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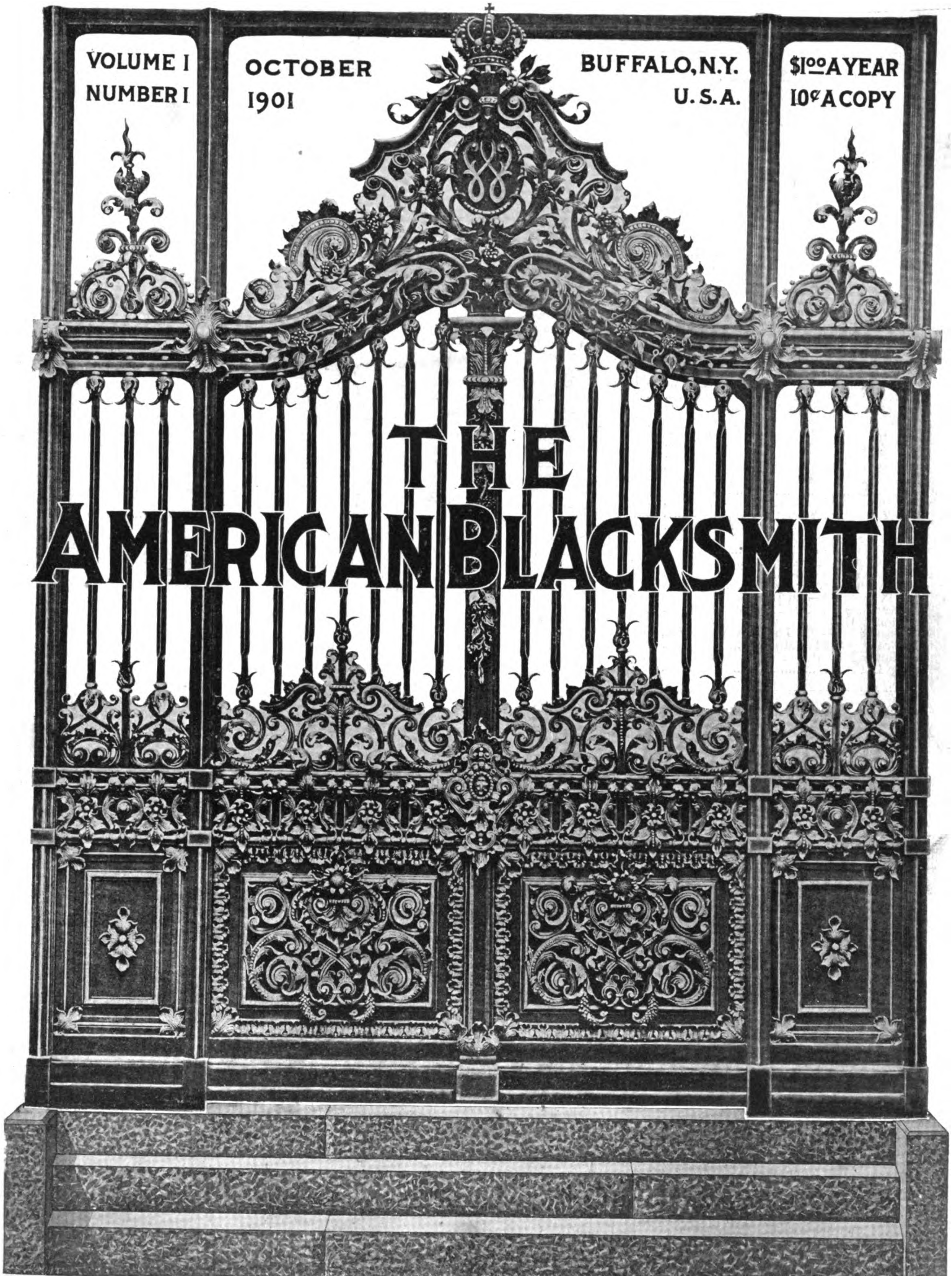
THE AMERICAN BLACKSMITH



CONTENTS.

The American Blacksmith

A MONTHLY JOURNAL FOR SMITHS OF ALL CLASSES

Prospectus. In the United States of America and Canada there are upwards of three hundred thousand men whose daily vocation is blacksmithing. This grand total may be roughly divided into two classes: First, the general blacksmith of city, town, village and country; and second, the industrial works blacksmith. The shops of the former are a familiar feature of every neighborhood, while in the case of the latter, with its numerous and diversified interests, the total number of smiths is far in excess of the usual estimate.

The American Blacksmith, founded in the first year of a new century, proposes to stand as the representative journal among this class of artisans, whose interests technical journalism has thus far done but little towards advancing. In other words, each monthly issue will be an enterprising and trustworthy exponent of the craftsmen engaged in blacksmithing or its allied trades. The promoters of the paper are men of influence and capital, who will spare no expense or pains to maintain it on the highest level of trade publications. The constant endeavor will be to keep it fresh, bright, and up-to-date, and as an earnest of this the paper, typography and binding, together with other details of arrangement and appearance will in The American Blacksmith represent the best efforts of the modern printer. Each issue, published in time for mailing on the first of the month, will contain 20 to 24 pages of reading matter, and not less than 32 pages, including advertisements. In other words, subscribers will be guaranteed a definite amount of pure reading matter in every number. No machine or article of manufacture will be described in the regular reading pages, unless possessing new features of real interest to our readers. The size of page is to be 9 by 12 inches. The subscription price will be one dollar per year, payable in advance, and subscriptions may begin at any time. A reduced rate is given to clubs of five or more new subscribers.

The General Blacksmith Will ever find his interests well cared for within the pages of this journal, and the articles will always be selected for their interest or value to the craft. Blacksmithing, carriage and wagon building, horseshoeing in its various phases, and the repairing of farm implements will be treated in detail, with the idea always foremost of presenting that which will be of practical value to the blacksmith or his brother artisan in their daily work. The department of veterinary surgery will also be well cared for. In all of this matter it shall be our endeavor to avoid theoretical ideas as far as possible, and to present the opinions and views of men whose practical experience enable them to be quoted as authorities. Complete illustrations will be presented in every practicable case.

The Industrial Works Blacksmith Is an indispensable adjunct to every concern which employs iron as a manufacturing basis. Naturally a wide variety of subjects will come up for illustration and treatment in this portion of the paper. The work of blacksmiths in railway repair shops, in the foremost carriage and wagon works of America, in agricultural implement factories, as well as in various other industrial shops, will be portrayed by competent writers. For instance, the experience of blacksmith shop foremen and workmen will be brought to bear upon problems of interest, with illustrations and descriptions of the steps of various processes in construction and repair work. The variation in ideas and practice upon various subjects is always a matter of interest and help to co-workers, and hence we shall endeavor to encourage the contribution of articles of this nature from the every-day workman.

Among other things we shall endeavor to present timely articles upon the principles governing the treatment of iron and steel, as well as upon the different structural changes which the metal undergoes. The metallurgy of iron is a most important subject to everyone who has to do with the shaping or treatment in any way of this all-important element. Only that portion directly affecting the blacksmith, however, will be considered.

A special department which has been arranged is that of questions and answers. Subscribers will be privileged to take advantage of the opportunity thus offered for an explanation of any of the problems which may have arisen in the course of their daily work, and it is hoped to make this feature a most valuable and interesting one, not only to those directly concerned in the questions, but to all others who may have to deal with the same subjects. We confidently expect that this department alone will make the journal worth many times its cost to the reader.

We take this opportunity also of pledging ourselves that all advertisers in The American Blacksmith will be strictly reliable firms, and that our subscribers will be able to rely upon them as such. No business will be accepted from houses whose integrity in dealing with our patrons could be questioned. We shall often be in a position to impart valuable information as to where good openings occur for local blacksmiths. This will always be used for the benefit of our readers.

In brief, the idea is to make The American Blacksmith, beginning as it does with a new century so full of bright prospects, representative of the very best practice, and fully up-to-date in every respect. The constant outlook will always be in the direction of aiding the blacksmith and improving his condition, as far as our efforts in this direction may be of avail, and to encourage that healthy enthusiasm and wider field of information, which has so much to do with the success of his career.

THE AMERICAN BLACKSMITH COMPANY

BUFFALO, NEW YORK.

HONEST DEALINGS.

Before an advertisement is accepted, careful inquiry is made concerning the standing of the house signing it. Our readers are our friends and their interests will be protected. As a constant example of our good faith in American Blacksmith advertisers, we will make good to subscribers loss sustained from any who prove deliberate swindlers. We must be notified within a month of the transaction giving rise to complaint. This does not mean that we will concern ourselves with the settlement of petty misunderstandings between subscribers and advertisers, nor will we be responsible for the losses of honorable bankrupts.

THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

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Subscribers should notify us at once of non-receipt of paper or change of address. In latter case give both old and new address.

Correspondence on all blacksmithing subjects solicited. Invariably give name and address, which will be omitted in publishing if desired. Address all business communications to the "American Blacksmith Company." Matter for reading columns may be addressed to the Editor. Send all mail to P. O. Drawer 974.

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Editorial Foreword.

As the name suggests, THE AMERICAN BLACKSMITH has been founded to furnish a standard or representative journal for the great army of blacksmiths, farriers, wheelwrights and carriage builders. The term "blacksmith" is here used in its broadest sense to include blacksmiths of every kind and class, the general smith, for instance, the carriage smith, the tool smith, the ship smith, the drop-forge smith and the machine blacksmith. Succeeding numbers of this journal will speak with much greater emphasis than any words at this point as to how well these important interests are to be served. One thing will be said, however, THE AMERICAN BLACKSMITH will never be a conglomerated product of the paste pot and shears, but will for the greater part consist of original contributions from men possessing the authority of experience.

In these days, as never before, it is essential that the successful craftsman keep abreast of the times in all that pertains to his work. He should always be fully informed as to what advances co-workers and specialists in allied processes are making. Since experience born of contact with the problems of daily work is of prime importance to the craft, contributions of articles from practical men will be a feature of these columns. Readers are urgently requested to send for publication methods of shop work which they find of advantage in their daily practice. Sketches or descriptions of improved tools, new devices or time-saving processes are especially solicited. THE AMERICAN BLACKSMITH would be glad also to receive questions or topics for discussion and will encourage a lively handling of all such.

Tools put upon the market by manufacturers will be described only when strictly new and of interest to readers. To be eligible such devices must possess novel and interesting features. It is not necessary that the manufacturers advertise in these columns, nor on the other hand will the ordinary trade write-up be printed for advertisers.

In putting forth the first number of this journal, the Editors have been guided in the choice of matter largely by the responses from an extensive correspondence with blacksmiths of all classes. As this issue will reach a much larger number than was possible by direct communication, it will be esteemed a favor if all will feel free to suggest the subjects they would like to see taken up, and also how THE AMERICAN BLACKSMITH may be of still greater service and value in subject matter and treatment.

A Typical Master Blacksmith.

A. L. WOODWORTH.

A blacksmith shop, by reason of the nature of the work and the manner in which the men are distributed, is entirely different from that of any other branch of mechanics. For instance, in nearly all other departments connected with manufacturing establishments, especially those where locomotives and cars are constructed, the men are distributed into gangs, each having its leader who is responsible for the particular part of the work assigned to his gang. In a blacksmith shop no such system can be inaugurated. The men are directly under the foreman, who is personally responsible for their conduct as well as for the quality and quantity of the output of his shop. The foreman must possess such executive ability as to enable him to make all employees under him feel their responsibility as well as that they are to a certain extent responsible for the success of the shop. In order to succeed fully, the foreman must have certain well-defined principles, sobriety, firmness and fairness; these, together with a thorough knowledge of the work, will gain for him the good will and respect of the men under his charge.

When starting in as a foreman, either as a beginner or in a new shop, make up your mind that you will have trouble unless you observe the truth in your dealings with the men. The neglect of veracity will lead to innumerable complications, and make you a failure quicker than any other fault. It is a bad habit to swear. Men who use violent language are not respected as much by the men as they would be otherwise. Don't "know it all"; you will find men under you who know more about some things than you do. The fact that you are the executive head of the shop does not imply that you have the most knowledge. You were put there because it was supposed that you understood the handling of men and possessed some executive ability. As a matter of fact, you should be intelligent and able to fill your position well. You should be studious and always reaching out after knowledge that will enable you to lessen the cost of your production, and to advance the company's interests. You should have a knack for readily mastering difficulties and getting promptly out of close places. Be quick to make up your mind, with a discrimination to put the right man at the right work. You should strive at all times to keep the men peaceable among themselves, and feeling as kindly as possible toward the company. This should not be lost sight of, for I believe a great deal of trouble could be averted in this way; besides, when the men feel that they are being well treated and properly paid, it requires but little effort on the part of the foreman to get good service out of them. Practice economy and teach your men to do it also, for it should be remembered that we handle the most expensive material and highest priced labor that enters into the construction and repairs of railway rolling stock. Keep an eye on the scrap pile and see that material is not sold as scrap which might be utilized to advantage.

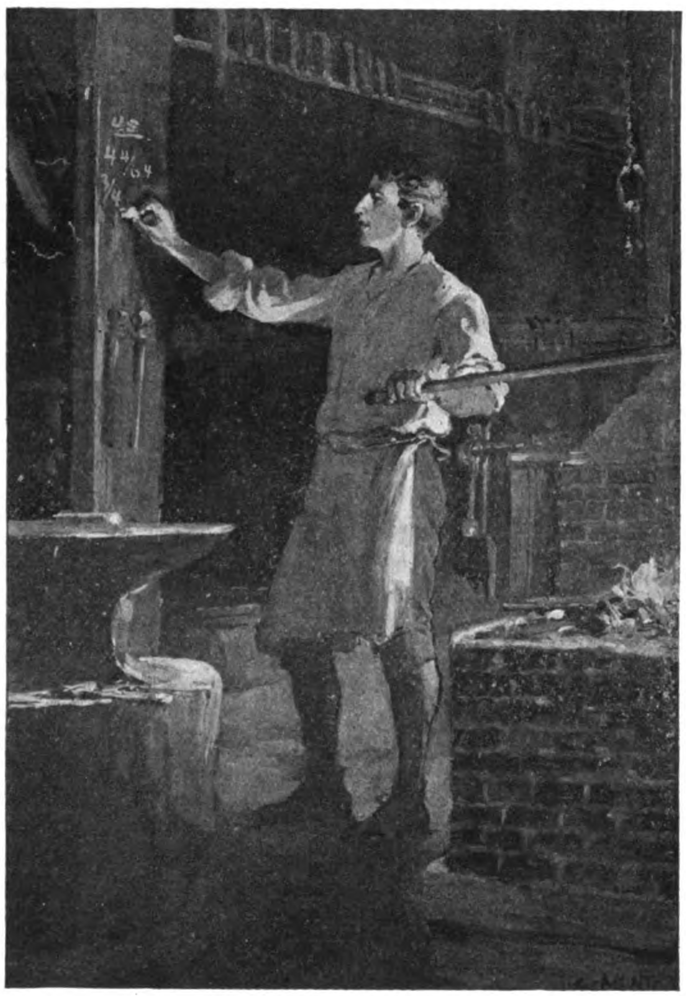
How the "Learned Blacksmith" Found Time.

At no time in the history of the world has the opportunity been as favorable as now to acquire an adequate knowledge of technical or other subjects. Our engineering colleges and technical schools with their corps of trained mechanical instructors are recognized as equal, if not superior, to those of almost any country. They afford to nearly every young man the chance of becoming an engineer and within his own means, even if dependent upon the results of his own labor to put himself through college. The various correspondence schools also make it possible for mechanics and students of all ages to become more proficient, and this during their spare time, so that none need lack the opportunity of obtaining knowledge. The progress will be rapid in proportion to the number of hours available for study.

The lack of sufficient appreciation of the value of an hour is an attribute of mankind but too common the world over. This is so well brought out in a reference to the career of Elihu Burritt, well known as the "Learned Blacksmith," which recently appeared in "Success," that we here take pleasure in reproducing it:

"'The loss of an hour,' says the philosopher, Leibnitz, 'is the loss of a part of life,' a truth that has been appreciated by most men who have risen to distinction—who have been world benefactors. The lives of those great moral heroes put to shame the laggard youth of to-day, who so often grumbles, 'I have no time. If I didn't have to work all day, I could accomplish something. I could read and educate myself. But if a fellow has to grub away ten or twelve hours out of the twenty-four, what time is left to do anything for oneself?'

"How much spare time had Elihu Burritt, 'the youngest of many brethren,' as he himself quaintly puts it, born in a humble home in New Britain, Connecticut, reared amid toil and poverty? Yet, during his father's long illness, and after his death, when Elihu was but a lad in his teens, with the family partially dependent upon the work of his hands, he found time—if only a few moments—at the end of a fourteen-hour day of labor, for his books.



ELIHU BURRITT, THE "LEARNED BLACKSMITH."

"While working at his trade, as a blacksmith, he solved problems in arithmetic and algebra while his irons were heating. Over the forge also appeared a Latin grammar and a Greek lexicon; and while with sturdy blows the ambitious youth of sixteen shaped the iron on the anvil, he fixed in his mind conjugations and declensions.

"How did this man, born nearly a century ago, possessing none of the advantages within reach of the poorest and humblest boy of to-day, become one of the brightest ornaments in the world of letters, a leader in the reform movements of his generation?

"Apparently no more talented than his nine brothers and sisters, by improving every opportunity he could wring from a youth of unremitting toil, his love for knowledge grew with what it fed upon, and carried him to undreamed-of heights, of palaces and council halls, where the words of the 'Learned Blacksmith' were listened to with the closest attention and deference.

"Read the life of Elihu Burritt, and be ashamed to grumble that you have no time—no chance for self-improvement. You need not deprive yourself of proper rest and recreation, for the building up of a sound, healthy body is as essential to well-being as the cultivation of the mind, but you may seize the moments, the half hours, the hours that you now spend idly, perhaps harmfully, in reading unwholesome literature, card-playing, or the like, and occupy them all, to the uttermost, with the culture of hand and heart and brain."

Hints on Bicycle Repair.

BY SCALE.

In nearly all towns of considerable size the bicycle repair shop has a permanent place, but in the smaller country towns, as a rule, the blacksmith is called upon to take the place of the bicycle repairer, and to such a few hints may be of value.

The stock of supplies need not be at all large or costly, as a blacksmith has most of the tools needed for the ordinary class of work. A few dozen balls of assorted sizes, spokes, nuts, and a few links of bicycle chain are enough to begin with. If you make a success, other articles will suggest themselves to you. Repairing tires is rather out of the line of blacksmith work, but trueing up a wheel, putting in spokes, replacing lost nuts, ball bearings, etc., are not at all difficult.

Brazing is easily done, too, if care is taken. Spelter is supplied in two forms, granulated and wire. It is well to have some of both kinds on hand. In starting out to do a job of brazing, if it is of considerable size, be sure to have plenty of well-coked coal, as green coal will smoke and cause trouble. The best flux is borax. For small work it may be mixed with water, and the parts to be brazed slightly heated and dipped in the mixture. The parts must be held by means of clamps, wire or other means in the shape they are to be when finished. For large work, dry powdered borax will do, but it is somewhat inconvenient. Have a clear bright fire, place your piece to be brazed in it and blow slowly, taking care that the piece be uniformly heated. Don't try to hurry or you will probably spoil the job. As soon as the right heat is reached, the spelter may be seen to run like water, and the blast should be instantly stopped. When the piece is cooled to a dark red, most of the borax may be scraped off with an old file, but care should be taken not to give the joint a hard blow until it is cold. If you happen to be out of spelter, brass springwire may be used, but it is not so good. If you have never done any brazing, it would be a good plan to experiment on some odd job, as for instance stopping a crack in a piece of pipe, before trying on a bicycle.

The Scientific Principles of Horse Shoeing.—1.

E. W. Perrin, Graduate of the British Army Veterinary School.

This article is intended as an introduction to a comprehensive discussion of the science of horseshoeing.

In the subsequent installments of the series appearing in The American Blacksmith, each article fully illustrated by the author, the following subjects will be treated of: Elementary Anatomy and Pathology of the Foot, Preparation of the Hoof for the Shoe, Fitting the Shoe to the Hoof versus the Hoof to the Shoe, Care of the Colts' Feet and Its Relation to Deformed Limbs, Frog and Sole Pressure, Interfering Front, Interfering Hind, Cross Firing, Stumbling, Forging or Clicking, Balancing Roadsters, Hot and Cold Fitting, The Use of Rubber Pads; Pathological Shoeing for Corns, Fracture of the Hoof, Toe or Quarter Crack; also Laminitic Pumiced or Drop Sole Foot, Contraction of the Hoof, Thrush, Ossified Cartilages or Sidebones, and Navicular Disease.

In taking up the science of horseshoeing with the readers of The American Blacksmith, I am encouraged by the prospect of reaching, not only the scientific horseshoer, but also that class of readers who are scattered over that wide and varied field of usefulness expressed in the term general blacksmith. I allude especially to the country blacksmith, the man with a shop on the cross roads, that man of many trades who is expected to repair a mowing machine

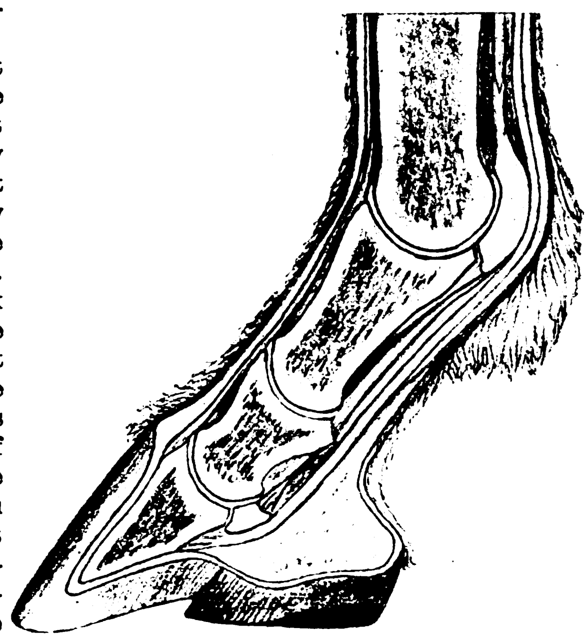


Fig. 1. VERTICAL SECTION OF HORSE'S FOOT.

or plow, fix a buggy, put a spoke in a wheel, and also to shoe horses and mules. The veterinary profession, together with the Master Horseshoers' National Protective Association, have accomplished wonders during the last few years by conducting schools for the purpose of instructing pupils in the science of horseshoeing, but the village blacksmith is isolated from the large cities where these seats of learning are located, and one of the objects of this series of articles is to place him in close touch with the schools by giving him in a concise form the very latest and most approved principles of horseshoeing.

The subject of scientific horseshoeing is of such magnitude that it needs a good sized volume to do it justice; hence the plan of dividing it into a series of articles was adopted, and if the reader will preserve these papers and have them bound he will possess a concise but complete treatise on the subject of horseshoeing.

Horseshoeing is indeed an intricate science. It has taken ages to reach its present stage of development, and the principal reason it has not kept abreast of other sciences is because the poor dumb animal is not able to tell—except by those mute signs which are understood only by the most accurate observers—of the pain and discomfort he suffers when improperly shod. If the patient horse was gifted with a somewhat greater degree of intelligence he would positively refuse to enter a shop wherein his feet had been hurt at a previous shoeing. That a great many horses are rendered prematurely old and useless on account of being used up on their feet, emphasizes the truism "No Foot, No horse." This condition is too often produced by a lack of that scientific instruction so absolutely necessary to the art of horseshoeing. True, most of the operations in shoeing are mechanical, but there is this substantial difference between it and other trades—other mechanics work on inanimate material, while the horseshoer handles a vascular highly organized structure, a living animate object. If a carpenter cuts a piece of wood one inch too small he has spoilt a piece of wood. If a blacksmith burns a bolt he has merely spoilt a piece of iron. If a horseshoer, however, cuts a horse's hoof ¼ inch too short he can't put it back; he has lamed the horse. If he drives a nail 1-16 inch too close, discovering his error he may withdraw the nail, but the mischief is done, the horse is lame. Having no knowledge of anatomy, he may trim the hoof in such a manner as to interfere with the equilibrium, with the natural bearings of the limb, thus throwing a strain on every articulation from the foot to the knee. Thus an unlevel hoof, an improperly fitted shoe, or a badly driven nail will lame and impair the usefulness of a horse, and sometimes altogether ruin him. Owing to the complicated structure of the horse's foot, therefore, a knowledge of its anatomy is absolutely indispensable to the art of horseshoeing.

The wonderful development in speed in the high-bred trotter and pacer, has opened up a comparatively new field in the science of horseshoeing, viz:—

Balancing or regulating the gait of fast harness horses. This branch of the farrier's art involves a thorough study of conformation, especially of the limbs, without which any attempt to remedy defective gait is the merest haphazard guess work. Only careful study and the application of scientific principles to practical experience will be awarded with success.

Before entering upon the subject under discussion, I wish to acknowledge my debt of gratitude to those eminent writers of this and preceding days, all of whose ideas upon this important subject I have carefully weighed. To the information gained by reading and studying I have added the results of 25 years of observation and practical experience. Preserving the good and eliminating the obsolete, I trust that articles to follow will contain much of profit and pleasure for my readers.

Blacksmithing at Sibley College, Cornell University.

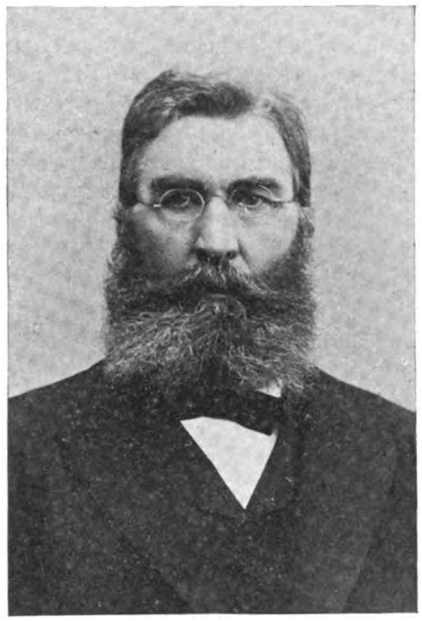
ROBERT H. THURSTON, LL.D., DR. ENG.,
Director of Sibley College, Cornell University.

Sibley College, at Ithaca, N. Y., is the "College of Mechanical Engineering and of the Mechanic Arts" of Cornell University, and Cornell University is the "Land-Grant College" of the State of New York.

In the year 1862, during the hottest strife of the Civil War, New York, among other states, received from Congress a grant of government lands amounting to nearly 1,000,000 acres, to be made the source of endowment of colleges, in which should be taught "such branches of learning as are related to agriculture and the mechanic arts." In the handling of this land the magnificent generosity and business ability of Ezra Cornell, then a wealthy senator from Ithaca, N. Y., evidenced itself. The profit accruing from this source constitutes the Cornell Endowment Fund and amounts to about $4,000,000; making Cornell's gift to his great cause total over four and a half millions of dollars.

Among the trustees selected to aid Cornell in the organization of the University was Hiram Sibley, another great and well-made though self-made man. He had been a poor boy, a working mechanic and an ambitious, agressive man. He had accumulated a fortune by organizing the Western Union Telegraph Company and by the successful prosecution of a large lumber business, among others of his various enterprises. He assumed the burden of founding the mechanic arts division of the University as his part of the work, and built a modern structure which was named for him.

One essential department of the college, both as complying with the demands of the law and the terms of the contract of the State of New York with the General Government, was that of mechanic arts or shop work. This was organized and systematized by Mr. John L. Morris, who still remains in charge of all its divisions as Professor of Mechanic Arts. He was a graduate of Union College, a very expert practical mechanic, and an experienced locomotive engineer of the New York Central, thus combining in a rare manner the scientific and practical knowledge essential in such a position.



JAMES WHEAT GRANGER, Foreman of Smith Shop at Sibley College.

It was seen by the founders of Cornell University that no mechanic could be entirely at home in his vocation without a knowledge of mathematics and of the physical sciences which underlie the work which he is to perform. It was also seen just as clearly that no school of engineering could do justice to its students without giving them some familiarity with the mechanic arts upon which their success must inevitably largely depend. The designing engineer must be familiar, not only with the science of his profession, but with the arts employed in the building of his design. Perhaps a still more important consideration, justifying the establishment of systematic instruction in the mechanic arts at Cornell, may be found in the fact that no man can appreciate the value and importance of the work or the dignity and intelligence of the worker who has not practically familiarized himself with the business and its methods, its capabilities and its difficulties. The young man who has been compelled as a part of his professional training to go into the blacksmith shop and learn the best methods of building a fire, of heating good and bad irons and the tool steels, and to form a chain-hook or to make and temper a lathe or a planer tool, will ever after feel the greatest respect for the mechanic who can do such work well and with facility. In his dealings with the men who are to afterward construct the machinery which he is to plan, he will not only feel that they are entitled to respect and to thoughtful consideration, to consultation and to deference in deciding between alternative designs, but he will usually know what forms are practicable and what are impracticable, undesirable or costly, and will avoid sending into the shop the "fool-drawings" which too often confront the most expert and well-meaning but absolutely confounded smith. He will know when to inquire whether a design for the foundry will "draw" if the pattern is made on his plan, and whether a proposed forging will be easy to make, inexpensive and safe. It will help him discover that every man in the shop finds a comfort and a pleasure in working with young designers who have learned that the trade is one demanding all high qualities no less than the "profession," and that talent, ingenuity and patience, and in fact all the manly virtues, find ample play in the pattern shop, the foundry, the forge shop and the machine shop.

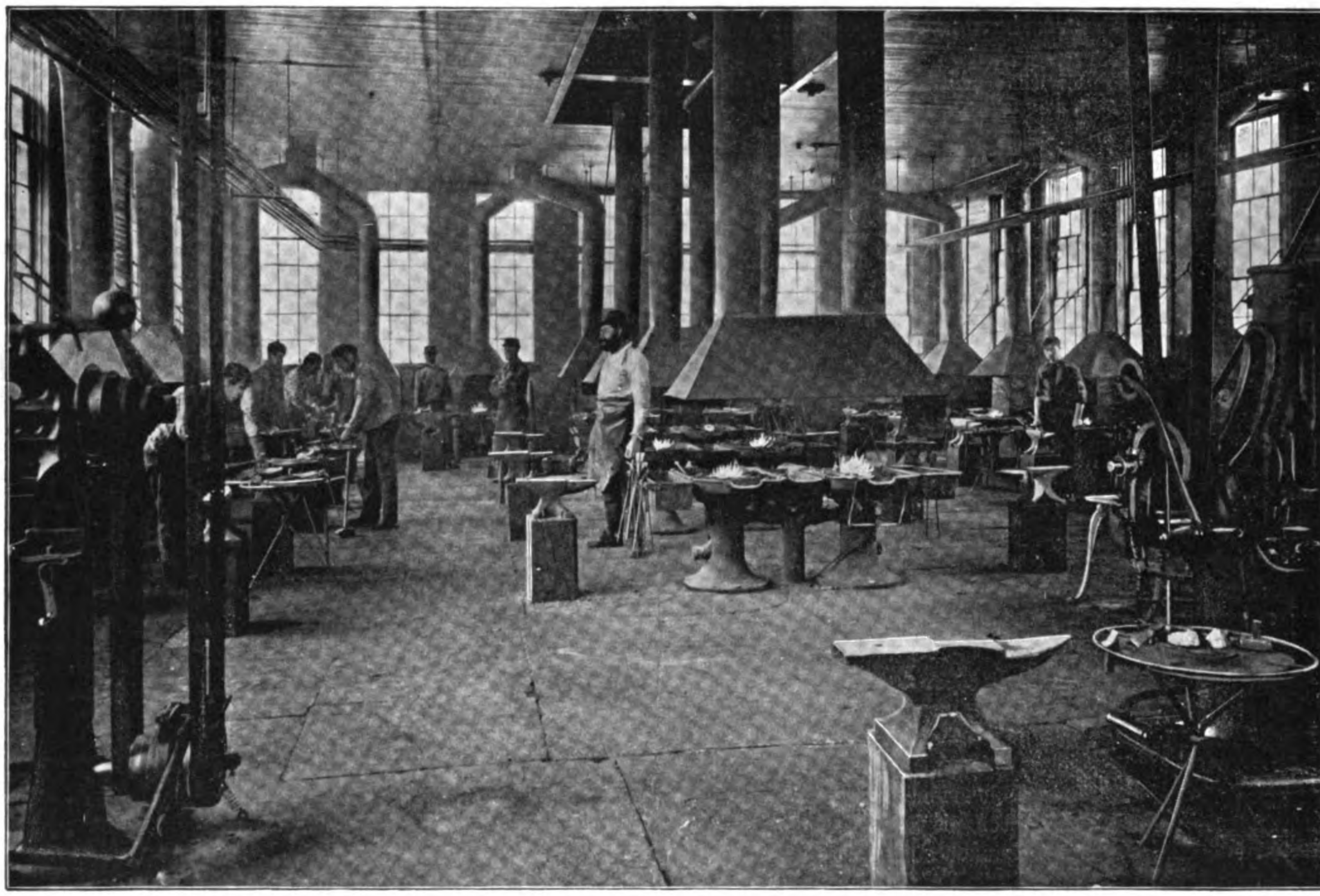
The blacksmith shop at Cornell is crowded with such young men, and no one can secure his degree as "Mechanical Engineer" without having performed every prescribed task in this shop, as well as in the others. Its foreman is Mr. James Wheat Granger, one of the most experienced and most expert smiths in the United States. He has spent a now tolerably long business life in the trade, has worked at every line of forging from horseshoeing to tool-dressing and machine work, and can weld short irons, or soft copper, make a chain or a side-tool or a cutting-off tool, and can temper large or small work with almost any man in the trade. He is fond of his "boys" and they of him, and he enjoys teaching as much as any pedagogue in the schools. The Director has been greatly and most pleasantly disappointed in the institution of this shop. He has expected that the young men coming to study the sciences and the college mathematics required in engineering might not take kindly to such trying and hand-soiling work; but the contrary has proved to be the case, and, under Mr. Granger's inspiring leadership, no course in the university is more enthusiastically pursued.

The equipment of forges and accessories are sufficient to permit the handling of classes of large size in sections of about twenty-five each, and Mr. Granger, with his scarcely less expert assistant, Mr. W. F. Head, finds ample occupation inducting the young mechanic into the mysteries of fires, materials and form.

The work here, as in all the Sibley College shops, begins with systematic exercises of the simplest kind, intended to give the student familiarity with his tools, one after another, each succeeded by an exercise or with a tool demanding a little more skill, and thus through a series of graded exercises, reaching at the last the most difficult of processes and the most exacting of tools and operations. It is said to be quite wonderful to see the rapidity with which these bright and well-trained boys, accustomed from the beginning to use head and hand together in their tasks, acquire skill and intelligent knowledge of any such manual art. Their later experiences, when sent into business where they must, as designing engineers, make use of their attainments in uniting the scientific and the practical, prove, it is found, that this wise provision for an insight into the trades subsidiary to their engineering work is one of the most important of all the divisions of their course. Even if it gave no other advantage than a power of appreciation of the work done for them by the pattern-maker, the moulder, the machinist or the blacksmith or the tool-dresser, it would amply repay all the time and labor expended in its acquirement. As also giving them power to anticipate and to provide against difficulties of working out their designs in the blacksmith shop or other department of the works, it is still more useful as well as most comforting to the responsible smith or moulder or pattern maker or machinist with whom they must co-operate in the work.

Beginning with ordinary tasks in shaping, welding and fitting, they soon become able to work to drawing and fit. When proficient, they attack steel, and finally, after brief instruction and practice, acquire the art of both forming and tempering their cutting tools. Every graduate of the shop finally carries into the college machine-shop with him a set of tools, a dozen or more, which he has himself made and which, whether good or bad, he must use in his new work. Under these circumstances, it rarely happens that the job of making these tools is not a good one. In fact, old mechanics often inspect these products of a boy's skill with envious eyes, and declare that they would be glad to have as good tools from their own tool dressers.

The students taking these courses are largely sons of mechanics, often of very successful mechanics, and they go out into the world more perfectly equipped than did their fathers, far better, in fact, than even the sons of



INTERIOR VIEW OF SIBLEY COLLEGE FORGE SHOP, CORNELL UNIVERSITY.

that distinguished royal family who are always expected to make themselves practically familiar with two trades. These young men have made a fair beginning and can earn a living, if necessary, after a little practical experience subsequent to graduation, in any kind of wood or metal working, and have beside these four or five vocations thus open to them that of the draughtsman and that of the professional engineer as well.

The world has never yet seen, in this or any other country, such opportunities offered to the sons of the average citizen as to-day, and here. That union of scientific knowledge with practical skill for which this country has always been more famous than other nations has in the modern technical school, open as it is to the son of every citizen who has a mechanic's talent and a fine mind, its highest and noblest illustration. No body of men can do as much for the country as this coming army of scientifically trained mechanics and engineers. The nineteenth century has been a century of development of mechanical engineering; the twentieth is to be one of as marvelous extension and refinement in all the mechanic arts, and our boys are to have opportunities such as the world never offered before even to the skillful, trained, educated and learned mechanic and engineer. Elihu Burritt, the "learned blacksmith," could he have lived to see it, would have envied while he rejoiced over the opportunities of the young mechanics and engineers of the twentieth century. We wish them all a very happy and prosperous new century.

Some Useful Hints on Repair Work.

F. H. BUMP.

I always save short pieces of two-inch sleigh shoe steel to make heading tools, and some of the thicker pieces make fine ones. I like them better than any other. When I had a bolt to head, I took a piece 18 inches long to begin with, and drilled a hole the size I wanted two inches from the end. Then when I wanted another size, I drilled another hole 3 inches from the first. I kept on as I wanted them, placing the holes about three inches apart. For convenience, I often marked the diameter in thirty-seconds of an inch near the hole. For a square shoulder I cut the hole square almost through the steel, and for the differently shaped heads, I cut dies of the required shape into the steel. Some of the bars are 30 inches long, but beyond this length they are unhandy, and I cut them in two. Now I seldom have a bolt called for but what I have a die. This is very convenient when doing a large business in repairing farm implements, where the bolts are odd sizes with odd shaped heads and shoulders.

Today I had a case of this kind. A man complained that his cutter bar worked loose in the shoe. I took it apart, swaged the bar until it filled the shoe and then tried the bolts. They fitted, as the owner remarked, "Like a needle in a gun barrel." The holes were 21-32 of an inch and the bolts 9-16, a difference of 3-32. The holes were drilled and not much worn. I looked over the bars and found a die to make that shaped head on a 21-32 bolt. Made the bolts, drove them in with a hammer, screwed down the nuts tight and had a good solid job. Makers of machinery of this class are apt to get such fits. I have seen 7-16-inch bolts in $\frac{5}{8}$-inch punched holes and cast holes of unknown size and shape. Many of them, which are apparently useless, when repaired by putting in bolts that fit, work as well as new. Sometimes a bolt has to be oval to fit worn holes. Again, on certain makes of mowers the push bar is fastened with a $\frac{1}{2}$-inch bolt at each end, and the holes get shaped about like a horse's head. I put in rivets to fit the holes, putting them in hot and swaging them in, and then giving them a final upset when cold. In some cases the rivet has to be 9-16x$\frac{7}{8}$.

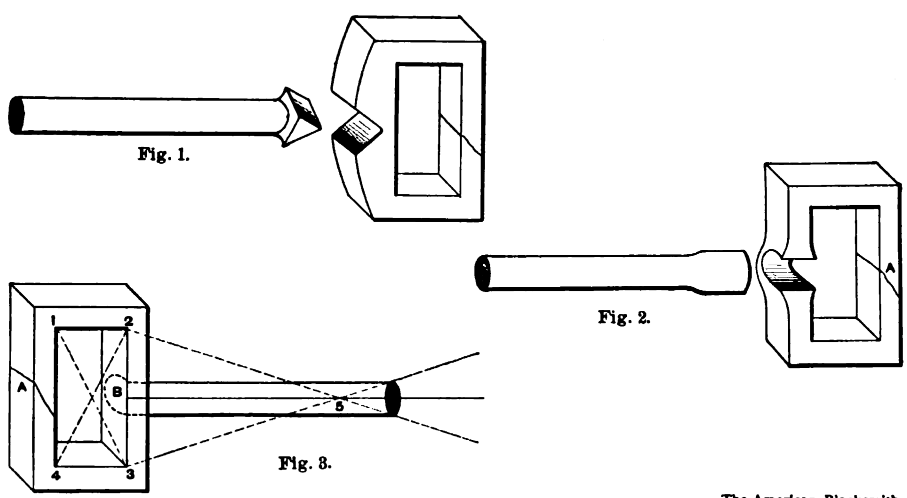
There is another job which we all do in our own way, i. e., upsetting pitman ends. Some upset to size, and leave it short. Some split the end and weld in a wedge. Some punch a hole and weld in a slug. I drill a 3-16 inch hole through and enlarge by driving a taper punch through it. This can be done over again several times and then a pin can be welded in. Some pitmans are made now with a hole through the end. This is a great convenience.

I have reboxed the dividing shoe roller of a mower where it was badly worn. I took a piece of 7-8 inch iron, brought it to a welding heat, put it in the hole and had the striker upset it with the sledge. When it was cold, a couple of blows with the sledge upset the shrinkage. Then we drilled a 17-32 inch hole and put in a $\frac{1}{2}$-inch bolt and it ran three seasons.

I incline to the belief there is nothing so good for a difficult weld as to put on drill chips and cover with borax, Cherry Heat or some other good compound. Try it and be convinced.

An Improvement in Locomotive Valve Yoke Construction.

W. T. JAMES.



The American Blacksmith.

AN IMPROVEMENT IN VALVE YOKE CONSTRUCTION.

The valve is of such importance in the steam engine that it is sometimes called the heart of the engine. It is therefore essential that every detail in its construction receive the most careful attention.

The old way of welding the stem to the yoke did not give entire satisfaction, instances occurring on the road of the stem falling off the yoke. The valve stem was attached in the following manner. The yoke forging, after being bent and welded, appears as shown in Fig. 1. The stem is also shown in position to be jumped on. As will be perceived, the blow is delivered on the end of the stem, which is at least 26 inches from the weld. Then again in turning up the stem it often happens that the scarf is cut away, making simply a butt weld.

Both these defects are overcome by the new method employed at the Elizabethport Shops of the Central Railroad of New Jersey, where the welding is accomplished as follows: The yoke and stem are prepared for welding as shown by Fig. 2. It will be noticed that the stem runs across the yoke and the blow is administered to the stem directly over the weld, thereby insuring a solid weld. When the stem is turned up the weld is not weakened because it extends across the side of the yoke. The lathe hand can now turn a square shoulder, leave no fillet in the neck and the stem will be as strong as ever, because it goes clear through the yoke.

The yoke may be squared up by means of intersecting lines drawn from the points 1-3 and 2-4, and from 2-5 and 3-5, shown in Fig. 3. If upon measurement these are found respectively equal, the valve yoke is square. New stems welded to old yokes in this manner at the shops mentioned have given perfect satisfaction.

The Artistic in Iron and Steel.

Iron is commonly regarded as a material almost solely to be wrought or shaped for utilitarian ends, to afford strength, hardness or immobility. Scant attention is paid to beauty in the finished product; the lines are stiff and the effects harsh. Iron too often seems foreign to art, in other words.

The day is approaching, however, when the aesthetic will be a consideration of the designer, and not the last at that. Our steel bridges will no longer obtrude long skeletons of stiff framework, while the ugly lines of much of our machinery will give way to graceful but unobstructive ornamentation. The eye will demand to be satisfied here as in other domains, and beautification and adornment will take its proper place in determining the completed form in most products of iron and steel. The parabolic truss and the graceful steel arch of modern bridges is a step in this direction.

The American people are often accused of being strict materialists, to whom all things are measurable by the standard of the "almighty" dollar. However true this estimate of national character may be, it is a fact that the development in the use of iron as a medium for purely artistic expression has reached a greater advancement in foreign countries, and especially in Germany, than it has on this side of the water. It may be remarked, however, that in numerous instances outside of this sphere, where iron is employed to serve its usual ends, American machinery and other products are far in advance of European types—as far as beauty goes. The American locomotive may be cited as a typical instance of this fact.

The art of creating in wrought iron that which is intended essentially for decorative purposes is one capable of wide extension. Marked by a beauty and charm peculiarly its own, such wrought metal work possesses also the attractiveness lent by novelty. Considering that wrought-iron sculpture necessitates the execution of the artistic conception with the metal at or above a red heat, it may readily be understood why more of this work is not done. Some very remarkable specimens have been produced, however, one of the most striking and beautiful of which is illustrated on a following page. It is the Eagle-Dragon group, a purely decorative piece made by Armbruster Brothers, the celebrated German iron workers at Frankfort-on-the-Main.

The engraving on the front cover of THE AMERICAN BLACKSMITH is taken from a photograph of an exceptionally beautiful gate of wrought iron, also made by Armbruster Brothers, to whom acknowledgment is here made for permission to reproduce the design in this manner. The gate is one of several on the pleasure garden side of the Royal Palace at Berlin, Germany, and stands approximately nineteen feet high by fifteen and one-half feet wide. As a handsome and imposing specimen of this kind of work, both decorative and useful, it is a fine example.

Art metal work of varying elaborateness will be illustrated in THE AMERICAN BLACKSMITH from time to time as samples of what is being done in this line. A series of articles upon the elements of such work is being arranged for, as the interest and importance of the subject is of no small degree.

An Appeal for Improvement.

J. G. HOLMSTROM.

The news which comes to me of the founding of a new blacksmiths' paper creates the greatest interest for many reasons. I am interested in the success of THE AMERICAN BLACKSMITH, because its success means the gospel of new and higher ideas preached to its readers. Its success means, if I am not mistaken in the intentions of the publishers, the raising of the standard of the smith to a higher level by an acquaintance with improved methods. Its success means co-operation, and a free interchange of ideas. It means a chance to get acquainted with each other. It means the dollar earned with less pounding, because of better tools and a better understanding of smiths one with another.

The blacksmith is the father of all mechanics, but it is a fact that of all mechanics and trades the blacksmith is of less influence than any of the rest. What is the cause? Simply indifference. No communication with each other, no trade journals edited by men directly interested in the trade, no cultivation of the influences which tend to uplift and improve. How many of us do not feel the need of a strong friendly co-operation to advance our interests and to secure what is due us?

Our records as mechanics date back to Cain, the son of Adam. The smith was a prominent person through all ages, and so important was he that when this trade was lost, as it was during the reign of Saul (I Sam. 13:19), there were neither spears nor swords in the army of the Israelites, and the lamentation was great, for how could Israel go to war without the smith to make the spears and the swords, iron the wagons and make the shields? How could Israel prosper in time of peace without the smith to make the plow, the hoe, and the axe? The people had all kinds of mechanics except the smith. They had lawyers and priests; they had merchants and mariners, but, alas, they had no smith. This shows that it requires skill that can not be attained by everybody to become a blacksmith. At that time the smith was a factor in the land. Is it so now? The smith of that time was a smith of all metals. Now we have different kinds of smiths: coppersmiths, silversmiths and goldsmiths. We have whitesmiths and blacksmiths. The whitesmith is a smith working in tin, silver or white metals, while the blacksmith works in the black metal.

When Solomon built the temple, according to the wish of Jehovah, he started on a tour of inspection one day. He was very much pleased with the work done by the masons and examined their tools slowly. "But" said he, "who made these tools?" "The blacksmith" was the answer. He then examined in turn the work of the woodworkers or carpenters, the gold and coppersmiths, and the weavers of carpets and draperies, asking of each "Who made your tools?" The answer was always the same: "The blacksmith." Turning to the architect he questioned "Who is the blacksmith, and where is he?" The architect took the king by the arm and led him behind the building into a little dirty shanty, where at the anvil stood the smith pounding hot iron, from which the sparks flew into the face of the king. With reverence the king bowed to the smith and knighted him: "Father of all mechanics, and king of all men."

Thus the blacksmith can point back to Cain, son of Adam, as the first man of his trade, and the originator of the same. No other mechanic has such a record. We have had plenty of time and opportunity to get to the front as mechanics. But have we done it? The poets of all ages have delighted to sing of the brawny smith and his sturdy craft. Have we lived up to the standard? What do we do, or what do you do to attain to a position of influence and importance in your community? What do you read and what company do you keep? Remember also that no man will ever be a millionaire that is content to sell cigars and candy in a little store in the lane. Neither will the smith prosper that is content to sit down in a little shanty in a village waiting for a man to come in and have a horse shod once in a while. No man will ever amount to anything unless he is posted on everything belonging to his trade or profession. Many smiths would pay hundreds of dollars for luxuries, but not a penny for books or papers. "They know it all." But this is the claim of the ignorant everywhere. I have never yet had an apprentice—and I have had many—that I did not learn some point of. But, if you "know it all," let us hear from you through our journals. There are thousands like me that know only a little, and we want to learn more. Tell us how you do the work. Yes, tell us how you collect your bills, and if the dead beats are allowed to fleece you and every smith in your town for lack of a better understanding and more co-operation. Tell us what you have done in your State to have an apprentice law placed on the statute books to prevent a botch from starting in our business, and running down prices and the standing of the smith.

I don't believe the smith has degenerated, but believe he has not kept pace with modern means to success as he ought to. Let us, therefore, go to work "hammer and tongs" to get it. Let us talk it over through the columns of THE AMERICAN BLACKSMITH. A friendly discussion of things belonging to our trade, as well as theories, will help to bring out the best means and methods.

On the Construction of Locomotive Side Frames.

*THOMAS PRENTICE.

The process of building locomotive side frames is one presenting a nice opportunity for the skill of the locomotive smith to display itself. It is also a very interesting one, and will bear describing here.

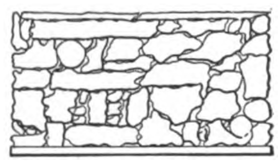


Fig. 1.

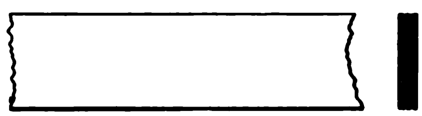


Fig. 2.

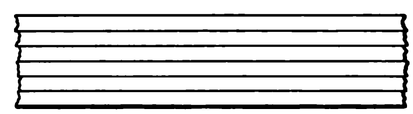
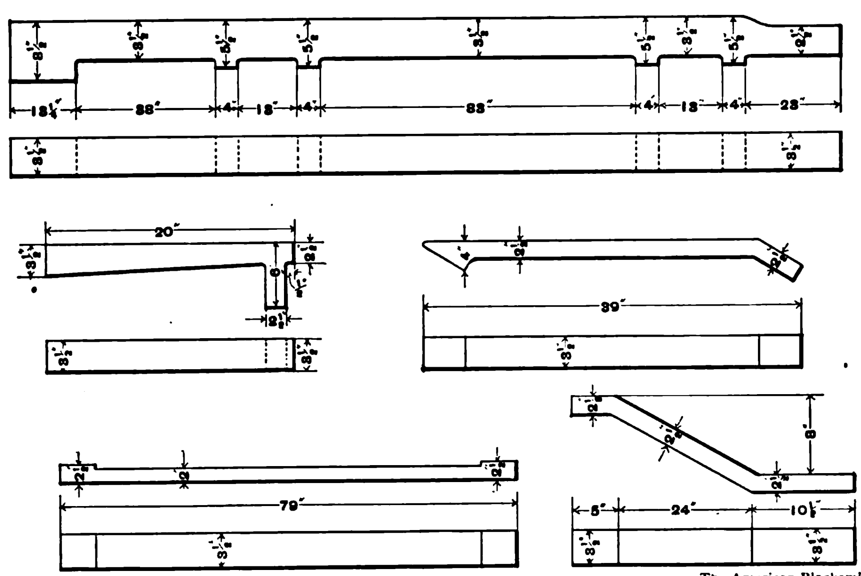


Fig. 3.



The American Blacksmith.

Fig. 4. THE CONSTRUCTION OF LOCOMOTIVE SIDE FRAMES.

Imagine to start with that we have before us a blue print calling for a number of sets of four-wheel passenger engine frames. The first thing we must look after is enough scrap iron of good quality free from dirt or scrap steel. To ensure the former quality we put the scrap through a tumbler to make it clean, as you would castings, after which it is put up in piles ranging in weight from 275 pounds to 400 pounds, according to the size and weight of the slab required. The scrap is piled on a hemlock board as shown in Fig. 1. This is then put in the heating furnace and shingled into a slab, which would come out something in the shape indicated by Fig. 2. These are then piled up five or six high, according to the weights required, when they are again put in the furnace. The hammersmith makes from these slabs the frame back, pedestals and braces, shown in Fig. 4. Referring also to Figures 7 and 8, A is the frame back, B the pedestals, C the end brace, D the front brace, and E the welding wedge.

After the hammersmith gets through with his part of the work, these pieces are taken to the blacksmith shop, where the building of the frame proper begins. This is usually done with a gang of five or six men. In some large shops this work is divided, one gang welding on the pedestal and another gang welding in the braces; in other shops, the gang that begins the job completes it, and this in my opinion is the most satisfactory way to have this work done. In putting the frame together, too much care cannot be given to the heating of both the frame back and pedestal. They are put on under a steam hammer. This should be done in one heat, as it is

*NOTE.—The author of the accompanying article, Mr. Thomas Prentice, holds the responsible position of foreman of the forge shop of the General Electric Company at Schenectady, N. Y. His breadth of experience makes him a valuable contributor to our columns.—*The Editors.*

almost impossible to take a second heat after the pedestal and back are once together. There are different methods of putting these together, but in my judgment the male and female scarf is the safest and consequently the best. The old method of welding, still followed in some shops, was that of cutting a piece out of the hub on the back, swaging the pedestal to correspond (see Fig. 5), driving the one into the other and then welding a binder across the flat of the frame where the weld was made. This has been discarded with one or two exceptions, and the welds are made in the manner indicated in Fig. 6, which is a section through

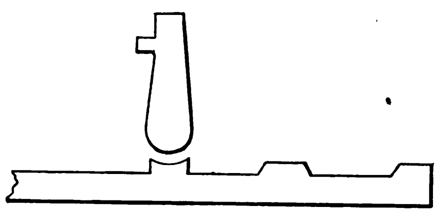


Fig. 5.

Fig. 6.

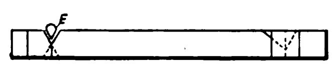
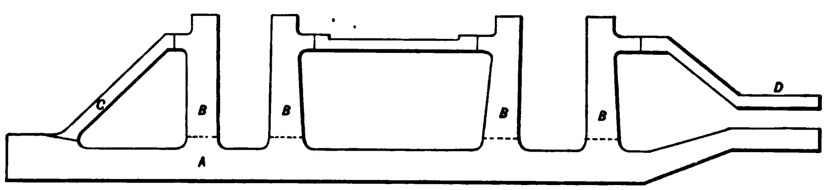


Fig. 7.



The American Blacksmith.

Fig. 8. THE CONSTRUCTION OF LOCOMOTIVE SIDE FRAMES.

the frame at A, Fig. 8. This method has the advantage of getting the center of both frame back and pedestal welded with the first two blows from the hammer. With the frame flat on the hammer anvil the scarfs are welded. After welding a gauge can be used to cut out the surplus stock, and a few blows from the sledges on a round nosed set completes the job.

After welding on all four pedestals proceed to the braces. Taking first the end brace, this piece and frame are suitably scarfed. In putting together it is advisable to use a wedge of wood between the pedestal lug and brace, leaving an opening so that the brace can either be thrown up or down as may be required. When putting in the center braces place them in position, using blocks the proper height and bolting firmly with clamps. Cut out a V-shaped piece from the brace and also from the pedestal lug, and making a wedge of hammered iron, weld it in between the brace and pedestal lug. Turn your frame over and repeat on the opposite side. Figure 7 suggests the manner of making the weld, while in Figure 8 is shown the nearly completed frame with center braces bolted into position for welding. Men who have spent considerable time at this business become expert and can produce a locomotive frame which gives no trouble to the machine shop.

Carriage Repainting.—1.

M. C. HILLICK.

Carriage repainting or, to make a wider application, vehicle painting, to be made profitable, must be conducted along business lines.

Vehicle painting has been described as being the same now that it was years ago, only different. As a business it possesses an individual character that has always remained the same despite the revolutions of time, but notwithstanding this fact, modern improvements have so touched the trade at many points that a pronounced difference in degree, if not in kind, clearly exists. Today the business of vehicle painting is more distinctively recognized *as a business* than ever before, and strictly applied business methods are now needful to make the paint shop a paying institution.

To the painter about to open a shop for vehicle painting we would say:—Contrive in the shortest possible time to let the greatest possible number of people know of your existence, and know you in a way that they may respect your skill as a mechanic and your ability as a business man. To be well advertised is as essential as having a place of business. With certain modifications the rules of business which apply to selling dry goods, drugs or dairy products, apply to the paint shop. The more up-to-date the painter is in his business methods, other things being equal, the larger will be his percentage of profits.

But it is not the mission of this article to offer the painter suggestions from the stand-point of a business man. Hence we leave this phase of the subject to be enlarged upon as each individual reader may personally apprehend its importance, merely adding, by way of emphasis, that such importance cannot be well overestimated.

In opening shop for repainting the painter will need as a minimum supply of tools, stock and shop conveniences the following:

Two spoke brushes.
Two oval chiseled sash tools.
Three painter's dusters.
One 3½-inch flat duster.
Three 3-0 oval chiseled varnish brushes.
Three 2-inch chiseled bristle flowing varnish brushes.
Six No. 3 oval bristle lead brushes.
Six 2-inch camel's hair brushes.
Six 1½-inch camel's hair brushes.
Six 1½-inch badger hair flowing varnish brushes.
Two sets of varnish brushes for body surfaces, each set consisting of:—
One 2-inch half elastic bristle brush.
One 2½-inch half elastic bristle brush.
One 3-inch half elastic bristle brush.
One 1½-inch badger flowing varnish brush.

Then there will be needed a good assortment of sword striping pencils varying in size from a hair line to the so-called handy line or round line.

Also:
One 2-inch blade putty knife.
One bevelled narrow putty knife.
One square point narrow putty knife.
One palette knife.
One hand torch or lamp for burning paint.
One piece of marble slab, 15x18 inches, for paint bench work.
One paint mill (a mill is indispensable).
Six varnish cups (1 pint capacity).
Three water pails.
Six sponges (No. 1 quality).
Three chamois skins (bar sheep pelts).

For unhanging and hanging off work:
One hammer.
One wagon jack.
Six "S" wrenches.
One monkey wrench (medium size).
One hand saw.
One pair of bolt clippers.
One brace and bits, punch, etc.

One pair of shaft couplers.

Six axle wrenches, size ¾ inch to 1½ inch.

Paints and Varnishes:

One 25-lb. keg white lead in oil.

Five lbs. lampblack, dry.

Ten lbs. ivory coach black, in Japan.

Five lbs. Indian red, in Japan.

Five lbs. wine color, medium shade, in Japan.

Five lbs. coach painters' red, in Japan.

Two lbs. English vermilion, deep shade.

One lb. English vermilion, light shade.

Two lbs. maroon, in Japan.

Five lbs. Brewster green, in Japan.

Two lbs. Quaker green, in Japan.

Two lbs. olive green, in Japan.

These greens to be in medium shade.

One lb. Prussian blue, in Japan.

Two lbs. ultramarine blue, light shade, in Japan.

One lb. ultramarine blue, medium shade, in Japan.

One lb. burnt sienna, in Japan.

One lb. burnt umber, in Japan.

One lb. Van Dyke brown, in Japan.

Two lbs. chrome yellow, medium shade, in Japan.

Two lbs. chrome yellow, deep orange, in Japan.

One-half lb. Naples yellow, pale, in Japan.

One-half lb. Naples yellow, deep, in Japan.

No. 40 carmine and the brilliant lakes used for developing special effects had best be bought in 4 oz. tubes, as the waste will be less, and the colors are always ready for use.

Oils and Varnishes:

One gallon coach Japan.

Three gallons raw linseed oil.

Two gallons turpentine.

One gallon rubbing body varnish.

One gallon quick rubbing varnish.

Two gallons black rubbing varnish.

One gallon pale elastic body varnish.

One gallon medium drying body varnish.

One gallon pale durable carriage varnish.

One gallon hard drying carriage varnish.

The two last named are for running parts.

Two gallons one coat carriage varnish for cheap, quick work.

One gallon top dressing bought ready for use or shop prepared.

For surfacing purposes, if the painter elects to mix his roughstuff, will be needed, say, 25 pounds of some reliable filler, dry; also 10 pounds of yellow ochre (French preferred) dry.

Local conditions and circumstances enter so largely into the question of shop mixing of the roughstuff supply, against buying the supply mixed ready for use, that each individual painter can best decide the matter for himself; hence the writer offers no suggestions for or against.

Shop Labor-Saving Devices:

Two revolving wheel jacks.

One revolving gear trestle.

One revolving body trestle.

Two cup stands for striper's and varnisher's use.

Boxes for holding tools, etc.

The above list is not extensive, and it may appear altogether too meagre to the actively aspiring painter, but it is a practical working basis, founded upon a modest outlay of money, and from it the painter of small estate may safely undertake the carriage repainting business. The workman of longer purse can proportion his stock in trade to meet the desired measure of finances.

The shop being the painter's place of business it should be made as business-like as possible. Perhaps it may be but a small affair, and its location may not be desirable, and it may be handicapped in other ways. But pass all this by. If the selection is the best that can be made for the time being, be content therewith, and endeavor to make the shop something more than a mere stopping place. Make it cozy and convenient to the extent of your means, remembering this, that even a little money rightly applied, when united with a resourceful mechanical ingenuity, will accomplish wonders in making the appointments of the shop more labor saving and better adapted to the peculiar needs of the painting business.

Aim first to make the shop furnish every available inch of space proportionate to its size. However small it may be, make it large in its capacity for holding work. In other words, make every inch of space count to the full extent of its measure. There are many ways of doing this. Utilize wall spaces, and spaces ordinarily devoted to retaining apparatus not strictly belonging to your business in a way to gain practical advantages therefrom. Ingenuity counts immensely in fitting up a shop in a manner to economize space. The invention of floor and wall devices for handling and holding work adds greatly to the shop's capacity for housing vehicles, and affording at the same time a profit earning working space. This accomplished, attention should be directed to making the shop tight and dust proof. Clean work cannot be done in uncleanly surroundings. Bar out to the utmost limit dust and dirt and smoke from the smith shop, the latter being a warring enemy to varnish lustre. A tight, close shop is easier to keep warm and more economical in this respect.

Light is another element urgently demanding the painter's attention. Some one has said that the well lighted shop is the well paying one. To a very large degree this is true. Good light is highly essential. It enables the workman to do more and better work than he otherwise would. It hastens the drying of paint and varnish, and insures more uniform paint-shop results. Chemists have demonstrated the great value of light in the drying of varnish. It is therefore advised that the paint shop be made as light as the resources of the painter will permit. Outfit all windows with blinds or shades, or, at any rate, provide some way of shutting out the sun's fierce glare when necessary. Locate the mixing bench where good light may be had. Strong light is a primary aid to the quick matching of colors. Aim to secure a generous and handy water supply, and if possible bring this directly into the paint shop—better still, pipe it to the floor upon which the washing and rubbing is to be performed. A plentiful supply of water flowing full into the shop is a 20 per cent. advantage to the painter. The varnish room—the paint shop's inner temple—what of that? Make this proportionately the largest room in the shop and the cleanest and lightest.

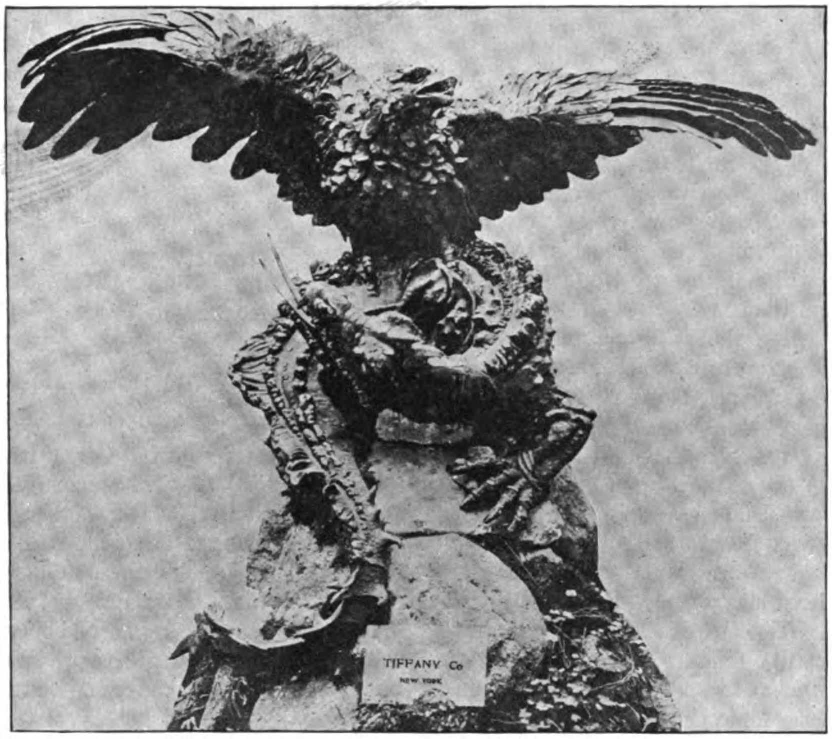
But space forbids mention of all the appointments which should comprise the sum total of the paint shop's equipment. In directing attention to a few of the most important, it is hoped that the reader may be encouraged to take note of the many other features of shop equipment which belong to the preparatory work of founding a carriage painting business in a fashion to make it pay a just measure of reward.

(To be continued.)

Ball Bearings. Recent experiments seem to indicate that the only practical use for ball bearings is with light loads. Where any material departure from sphericity of the balls, or any deteriorlation of the surfaces from which they roll occurs, such bearings cannot be satisfactory.

The Eagle-Dragon Group.

This notable and unique group, ordered by Emperor William II. to crown the centre of the Court of Honor of the German Section at the Paris Exposition of 1900, represents a magnificent eagle of heroic size, with outspread wings, struggling with a gigantic dragon which it holds down by its talons.



THE CELEBRATED EAGLE-DRAGON GROUP.

The group symbolizes the contest of liberty and truth with oppression and superstition—the eagle standing as the emblem of freedom; and its purchase from the German Government by Tiffany & Co., of New York City, has now made it an American eagle. The design, which was the conception of Prof. Fritz Hausman, was executed by Armbruster Brothers, the celebrated German iron workers. The work itself is a sculpture in forged iron, with no other tools than the hammer and chisel, held free in the hand, and no use of drills or machinery of any kind. The entire group was worked when heated to redness, and so heavy was the mass that great cranes were required to raise it to the mouth of the furnace for the repeated heatings.

The eagle measures twelve feet from tip to tip of the outstretched wings, and six feet six inches from the beak to the end of the tail. Its weight is 4,200 pounds. The dragon measures 22½ feet in length, though much folded and coiled, and weighs 6,000 pounds. The total weight of both pieces together is, therefore, five tons and two hundredweight, or 10,200 pounds. This does not include the iron base and rock mound on which it rests; their weight is fifteen tons. When mounted the group is sixteen feet three inches high.

This was the most important group in forged iron shown at the Paris Exposition, and is of great artistic merit as well as a wonderful piece of mechanical technique and ingenuity. In size, it far surpasses any similar work before executed. The eagle and dragon are beautifully wrought in artistic detail. That is, although they are wonderfully realistic and exhibit a great freedom of execution, each feather is distinct. The modelling is wonderfully strong, and each individual feather possesses all the variety of form and size as would an eagle's feather, but the painful detail so often present in work of this character is pleasingly absent. In other words, it is a happy combination of idealism and realism, none of the strength of the latter being lost in the blending with the former.

The Japanese iron eagle at the Columbian Exposition of 1893 measured 26 inches across the outspread wings, while the famous iron eagle in the Science Art Department of the South Kensington Museum measured 28 inches across the wings. The German eagle group here described, and the Japanese iron tiger cat, hammered out of a cube of iron ten inches square into a tiger over two feet in height and also bought by Tiffany & Co., were acknowledged to be two of the most remarkable objects at the Paris Exposition.

The Eagle-Dragon group was on view for a short time in Tiffany's Exhibition room, Union Square, New York City. It has since been purchased by Mr. George J. Gould to be used as an adornment for his place at Lakewood.

Shop Talks on Wheels and Axles.—1.

BY D. W. M.

The dish of a wheel bears a relation to the set of the axle because the weight of the load to be carried is best sustained by a perpendicular spoke. The bottom line of the axle arm should therefore lie horizontally.

A line drawn through the center of the axle arm should pass through the center of the wheel, perpendicular to the plane of the rim. Under these conditions an axle having no taper, but with both sides parallel, would not require a wheel with any dish, nor would the axle require to be set under. For that reason wire wheels on bike buggies are set perpendicularly on horizontal axles, as shown in Fig. 1. If the axle arm is tapered, the shoulder is thicker than the point, and the line drawn through the center of the arm will be deflected from a horizontal position. The plane of the rim of the wheel would as a consequence be inclined outwardly at the top. This may be seen by a reference to Fig. 2.

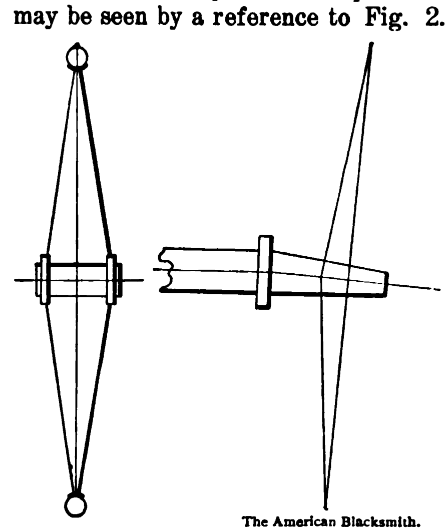


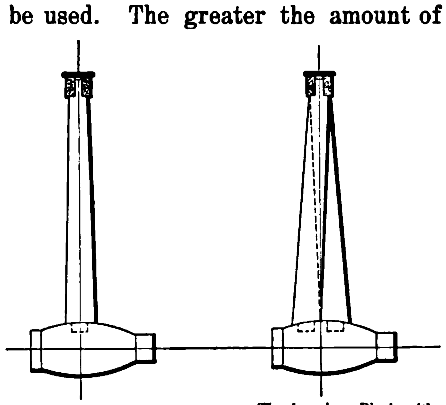
Fig. 1. Fig 2.

OUTLINES OF WHEELS WITH AND WITHOUT DISH.

This is the theory. In practice it has been found advisable to give a little more under-set to the axle, so that there will be a slightly greater pressure against the back collar, in order to avoid pressure against the nut, and a trifle more dish is given the wheel to sustain side thrust. Not all carriage builders, however, endorse this, and some think the spoke should stand a little under the perpendicular line. The wheelmaker, however, may avoid the difficulty by placing the center line of the spokes nearer the butt of the hub than the point, causing the center of the bearing to be nearer the shoulder than the point of the arm, or axle nut. The greater the taper of the axle arm, the greater the dish of the wheel required.

There are other considerations, however, which sometimes affect the dish, *i. e.*, the track and width of body of the vehicle. To secure the room needed in the vehicle it is necessary to slant the wheels outwardly at the top, to secure which an excessive dish is given, frequently as much as eight inches. In this case the hubs are made large, the spokes very broad and the back collars of the axles wide.

To provide strength for side thrust resistance and secure lightness of construction, the staggered spoke came to be used. The greater the amount of



The American Blacksmith.
Fig. 3.
NO STAGGER AND FULL STAGGER ON WHEELS.

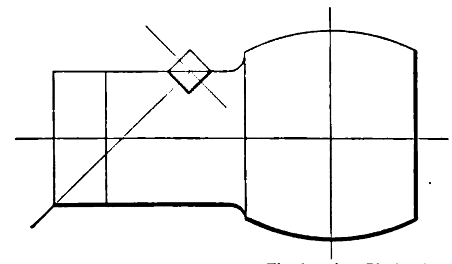
stagger the greater the base of the spoke bearings. The amount of dish is calculated from a line drawn from the center of the rim to the center of the total width of spoke bearing at the hub. With a full staggered spoke the face of the rear spoke is placed flush with the back of the front spoke. Fig. 3 shows spokes with no stagger and full stagger. Very light wheels are often made with even more than full stagger, allowing one-eighth of an inch or more between the front of one spoke and the back of the other. One well known builder of light work places a vertical steel band between the two rows of spokes to provide additional resistance. It makes an excellent wheel. The Sarven patent wheel is based on the idea that an even pressure by the compression of the tire is only to be obtained by placing the spokes in one row, known as the French fashion, and then sustaining the wheel against side thrust by means of two flanges riveted together, one on each side of the spoke. As is well known the Sarven wheel is a very strong one, but though light in appearance it is heavier than the same size wooden hub wheels.

In theory, a wheel should run perfectly parallel with every other wheel on the vehicle. In practice it has been found that the various obstructions offered by the ordinary roadway tend to spring the axles. To overcome this, they are slightly gathered to the front, so that when the wheels are on the rims will measure a little farther apart behind than in front. The gather will vary with the different conditions of roads and the character of the loads to be carried. If the roads are muddy and the wheels sink in, there is an added pressure brought to bear to strain the axles offered by the dish of the wheels.

A wheel set to rolling on the ground will take a circular track if it inclines the least bit from a perpendicular position. The dished wheel being inclined outwardly tends to run away from the vehicle and press against the nut. This tendency having been overcome by methods previously stated, there remains still the gather of the axles as an additional preventive, and in case of the mud and sand of roads, acting as a wedge between the front of the wheels to still further force them apart, additional gather must be provided. If the obstructions are of a more solid character such as stones or deep ruts, and if the loads are heavy, still more gather is required. A hard and fast rule cannot be set for all vehicles. Experience alone teaches what is needed. For light work over smooth roads, such as a bike runabout on asphalt pavements, no gather at all is required. But a heavy farm wagon on rough roads might require from 1½ inches to 2 inches. It is not many years since one inch gather was considered the regulation thing for ordinary top buggies, but with the advent of good roads that idea is modified. A light buggy with dished wheels may have but one-fourth inch gather, measuring in front of the wheels.

The amount of track required is not now determined so much by the ruts of roadways as in former years. The farm wagon made the ruts and all others had to follow. The South and West being less developed than the East and North the wagon track of 5 feet 2 inches had to be conformed to, even for light work. In those sections where hard roads prevailed tracks more suitable for light work could be used.

The Carriage Builders' National Association tried to regulate the matter at one time by adopting 4 feet 8 inches as the regulation track, and requesting wagon makers to adopt it and thereby assist in the effect for a uniform track. This had but little



The American Blacksmith.
Fig. 4.
DETERMINATON OF THE TRACK.

effect. But where the general movement for good roads has born fruit the question of track seems to be left entirely to the taste of the carriage builder. For the ordinary buggy, phaeton or light carriage, 4 feet 8 inches is the regular thing, and is being rapidly adopted, even in the South. But for runabouts and that class of light buggy, 4 feet 6 inches, 4 feet 4 inches, and even 4 feet, are generally used, depending on the width of body and the height of wheels.

If the body is 24 inches wide and the wheels 34 and 36 inches high, a track of 4 feet 4 inches will permit of a sufficiently short turn. The longer the axle or distance between wheels, the heavier it should be to carry the same weight and avoid springing. Therefore, leaving the ruts in roads out of the question, the width of track will be determined by the width of the body and the height of the wheels with a view to securing a reasonably short turn and the lightest construction of gear.

With some bodies the projection of the seat is such that the wheels, especially if high, would touch the handle of the seat or the side of the body, if a phaeton. In such cases rub irons or other stops, sometimes on the fifth wheel, must be arranged to prevent so far a turn, and the track must be determined accordingly. By means of a draft or some calculation it must be ascertained at what point on the wheel the body or rub iron will strike. With this as the end of a radius from the king bolt, the track may be calculated as indicated in Fig. 4, or if the track is determined first, the height of the wheels or of the body may be ascertained. These are not usually subjects for very accurate figuring, except in the case of cutunder jobs or full platform work, in which case a draft is necessary.

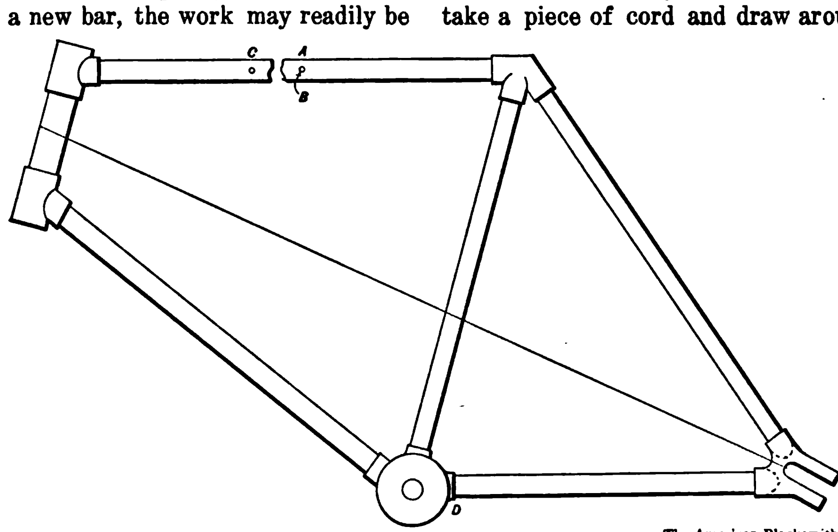
The front gear of a brougham, for example, is frequently narrower than the hind gear, sometimes 4 feet in front and 5 feet back. The object is to secure as short a coupled carriage as possible. As there is only a certain amount of room for the wheels to pass under the neck of the carriage, the track of the front gear is governed thereby. Some room is gained by placing the king bolt from 3 to 6 inches in front of the axle, the effect of which is to shorten the apparent length of the carriage.

(To be continued.)

The Repair of a Broken Bicycle Frame.

JAMES MOORE.

To repair a broken bicycle frame when not wishing to go to the expense of a new bar, the work may readily be done as follows: First take a piece of tubing, about three inches long, that will fit snugly into the broken bar. If you have none that will fit snugly, take a larger piece and cut a slot out lengthways, closing and rounding in vice until the right size is obtained. Next spring one end of the broken bar aside, and slip this bushing into the end A for a distance of one inch and a half, drilling a small hole and inserting a pin at the point B. Next place the foot against the upright bar and pull on the head, springing the other end of the bushing into the end C of the broken bar, after which press both ends together tightly, drill and pin the same as was done at the end A.



The American Blacksmith.

THE REPAIR OF A BROKEN BICYCLE FRAME.

If you have no blow pipe, get your forge to a good clean heat so that it does not smoke. Next place the broken bar on the fire at the break, turning from side to side to get an even heat all around. As soon as it begins to redden, apply the flux, using borax or saponine. Then take the spelter and flow it on the crack freely and it will draw itself into the broken part for the full length of the bushing.

Having taken the frame from the fire, let it stand till black, and then while still slightly warm dip it into water. This will shell off the burnt flux, which if left on is apt to spoil the file. When filing, barely clean the spelter off, taking care to file the tubing as little as possible.

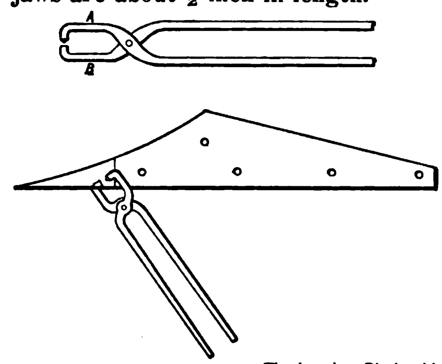
In all probability the frame will need lining up after springing it. Put the frame in the vice, clamping edgeways of the bracket at the point D. Sighting across the head and upright bar, if they are not parallel one with the other put a bar of iron through head and twist until they are true. Next take a piece of cord and draw around the head, back on each side to the slot where the rear wheel is carried as indicated in the illustration. Fasten the ends of the cord together, and then, measuring from the cord to the central upright bar, bend the rear forks until cord is an equal distance from the upright bar on either side. Now put the wheel together and it is ready to ride.

Tongs of Useful Type for Plow Work.

G. W. LYMAN.

I enclose herein a rough sketch of a pair of tongs, which I use for marking the hole in a land side point when making new plow lays.

One jaw, represented by the letter A in the accompanying illustration, is made of tool steel and is filed to a sharp point for prick punching. The jaw B is made to fit the ⅜-inch hole in a plow land side. The points of the jaws are about ½ inch in length.



The American Blacksmith.

USEFUL TONGS FOR PLOW WORK.

I weld my land side point to the lay, and fit to the plow. Then with the tongs, as shown in the sketch, I find where the hole wants to be and strike the jaw a sharp blow with a hammer. This makes a dent opposite the hole in the plow land side or frog. I then drill, countersink and cut key-seats, and the lay is ready to put on without stretching or upsetting the land side point. The method of using this tool is indicated by the engraving. If any brother smith doesn't understand this, and will write me, I will try to explain more clearly, as I am always ready to help the craft in any way I can.

Pointed Paragraphs for Beginners.

J. G. MARCY.

Having had about twenty-six years experience in the manufacture and repairing of carriages and sleighs, yet realizing that what I don't know or ever will know is more than a little, nevertheless I would like to say a few words to those about to start in business.

Seek at the outset a locality of well-to-do men. Own your shop, if possible. Better buy a shop, and what you would pay in rent pay towards it, if the proper shop can be bought on time.

Be a hustler. Never let your customers see you sitting down waiting for work; always be doing something. Do your work well and charge a fair price. I believe a man that works for a little or nothing has no confidence in his work, and the business done at a loss is worse than no business.

Be truthful. Do exactly as you agree. Be careful in making your promises, and then keep them. Be clean. Give tobacco and rum a wide berth. Let the shop always have an orderly air. Tools in their place, all litter swept up and scraps gathered at one point. Do everything possible to accommodate your customers. If you have one or more old wagons for them to use while you are repairing theirs, you will often find this a drawing card for securing a job which your competitor might otherwise get. Always give a certain discount for spot cash. Your customers will learn to pay on the spot and save the discount. Never be afraid to hold your job for the pay if the same is doubtful, unless you have agreed to wait.

Do not let customers go to your shop time after time and find you away fishing or hunting or off on a pleasure trip, unless you have a snug bank account. There is nothing that customers like better than to find a shop open, so they can give directions as to how they want their work done and also when they can have it.

Never be afraid to work more than ten hours. Often an hour or two will complete a job that would accommodate your customer a great deal by having it to use early in the morning.

Be up with the lark. An hour in the morning before customers are around is often worth more than two hours at any other time in the day.

Use good stock.

Take a good paper devoted to carriage work. It costs but a dollar or two and is a great help.

Correspond with large dealers in carriage supplies, and get their prices, so as to be posted.

Do not go by the rule "First come, first served." If you get the work out when you agree, that is enough. Rather use the rule, "I work for those that pay me best, and when I get time I'll serve the rest."

A Simple Welding Compound.

W. Z. SMITH.

Here is the receipe of a simple but excellent welding compound. Take yellow clay free from grit and dirt, pulverize it to a powder, then to four parts clay, add one part fine table salt and mix thoroughly. It is to be used the same as borax. It can be used to weld anything in the steel line, except spring steel. Should you get a piece of steel too hot, and burn it, plunge it immediately at full heat into water. After it becomes cold, heat and weld up with the above preparation and it will be as good as ever. This preparation is excellent to dress heads of chisels, flatters, swages, and tools which have been battered up.

Horseshoeing, Repair Work, and Carriage Building.

PRIZE ARTICLE CONTESTS.

What Do You Know That Will Interest Our Readers?

In order to stimulate interest among the great number of blacksmiths, wheelwrights, and other artisans, whose experience and practical knowledge of many special points connected with their trade will enable them to contribute to our columns articles of no small value to their brother craftsmen, we have decided to offer a series of prizes for articles upon three different subjects as suggested below.

The prizes will be nine in number, distributed for articles upon three different subjects.

These will be "Blacksmith Repair Work," "Horseshoeing," and "Carriage or Wagon Building." For the first, second and third best contributions under each head we will award prizes of $15, $10, and $5 respectively. We have made the first of the three topics purposely broad, so as to admit blacksmiths of all classes without reference to the character of their work. In order to enter for these prizes, articles must not be less, we have decided, than two hundred and fifty words in length. They may deal with any phase of their subject and will be judged solely upon their merits, the principal factor determining the choice of the best article being its value to our readers. Wherever practicable, articles should be illustrated by photographs, blue prints, or rough pencil sketches, so as to render the reading matter clearer and more interesting.

This prize contest will be subject to certain conditions as follows:

First. No person will be awarded more than one prize, though he may increase his chance of success by making as many contributions as desired, in any or all of the classes mentioned above.

Second. Contestants for these prizes must be subscribers to THE AMERICAN BLACKSMITH.

Third. We reserve the right to publish any articles thus submitted, awarding honorable mention to such of those contributors who may fail to secure a cash prize.

Contestants for any one of these prizes should bear in mind the essential point of making their matter interesting to the craft. This is best accomplished by relying upon personal experience, selecting as a subject some novel or valuable point which has come under their own observation. Write clearly upon one side of the paper only, and mark all articles in competition, "Prize Contest—Repair Work," "Prize Contest—Horseshoeing," "Prize Contest—Carriage Building," as the case may be. In order to insure impartial treatment at the hands of the judges, the article should be accompanied by a sealed envelope containing within the name and address of the contributor, and bearing on the outside some fictitious name, which is likewise to be signed to the article itself.

Our friends should remember that competition for these prizes does not require any practice or special faculty for writing, but that an article will be judged more by the real value of the matter which it contains than the language in which it is presented. Hence, if one has some good point to describe, he should feel no hesitation in writing about it, for it is our part of the work to put such matter into shape for publishing. The very best articles are those by the every-day smith or artisan, who tells of something that he has seen or done right in his own shop. Address all communications to the editor, THE AMERICAN BLACKSMITH, Drawer 974, Buffalo, N. Y.

Prize Contest—Horseshoeing—1.

Shoeing For Stumbling.

Stumbling is a common thing and many cases come into our shops in a week. First, we must observe the angle of the feet. Some horses stumble with too long a toe, while others have corns, sore tendons, or hard and contracted feet. This is generally found to be the fault. It is a common occurrence to hear a man say, "My horse stumbles so that he sometimes falls down, breaking a shaft or doing some other damage." One must be a close observer. First, find where the fault is. If the horse has corns, a bar shoe with the toe well rolled off and a heel calk, say from one-half to five-eighths of an inch high in my experience is the best, but if the feet are hard and contracted the first thing is to soften them. The best thing is a tar and oakum pad, as this resembles nature's remedy.

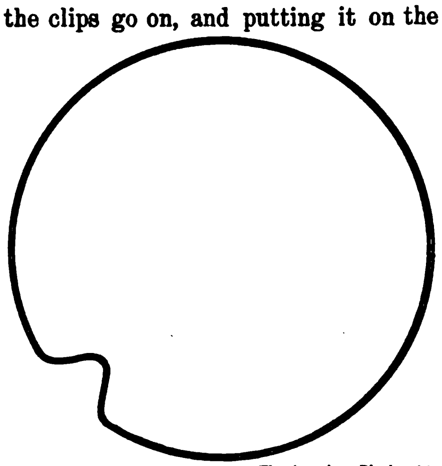
Of course these faults differ. One must observe closely and see whether the horse has splint, side bones, or other things of this nature. A fair knowledge of anatomy is one of the essential things in shoeing. The foot should be kept level above all things, so that the joints and tendons articulate in their proper manner.

A healthy foot depends on its frog coming in contact with the ground. All horses cannot be blessed with such, especially on the pavement where calks are necessary. Bar shoes or rubber pads are the best things our noble animals can be shod with.

Prize Contest.—Carriage Building—2.

A Quick Method of Tire Setting.

The following description will give you an idea as to how I set all kinds of wagon tires. In the first place I take the tire from the wheel and see that the spokes are all tight in the rim, as well as that the rim is the right length for the wheel, because some wheels will need sawing out a little to get the right dish. I then heat the tire quite hot a little ways from the joint where the clips go on, and putting it on the



The American Blacksmith.
A QUICK METHOD OF TIRE SETTING.

middle of the anvil, strike it two or three blows with the pane end of the hammer so as to bend the tire in the shape indicated by the illustration. Then I strike the tire on top of the crook, and just before it comes together, I strike the tire on the side nearest to me and that straightens it out so as not to make any bad place in the tire. I have set a great many hundred that way and I never have had any come back in something over nine years. Neither have I known of any ever breaking where I upset them in this way.

One man brought a tire that was very loose, and I upset it in three places, as described above, before putting it on, and it was just right. I have put on something over one hundred old tires this year and have not put a tire wheel on one, unless it is where I put in new rims, or new tires. Then, of course, I have to measure the wheel and tire. Any common carriage or wagon tire, however, no matter how loose, I can set and it will come right and with the proper dish every time. I have become accustomed to this way and I can tell with every blow of the hammer how much I shorten the tire. In this way, with a very loose tire, I get the holes in the tire and rim to match, so that the bolts will go back in the same holes. I upset the tire each side of the double bolt holes, and when I have to upset it three or four times I turn the tire round and upset it on the opposite side, and in that way the holes in the rim will come in the proper place. When anyone becomes accustomed to upsetting tires this way it can be done very quickly, nor is any time lost by stopping to measure the wheel and tire. I stopped measuring wheels and tires about four years ago. Before, when I did measure them, I would have to knock off one in about every ten, for I always want the tire just right before it leaves the shop. Then the customers will come again with another job, but if you should set the tire and not do it right, the fact would go all over town very quickly.

Now I have my way for welding new steel tires and I can weld one hundred and not lose two welds out of the lot; that is, I have done it and believe I can again. Before, when using borax, I have worked on some tires from one to two hours to get a weld and nearly given up, as the tire would not stick. Now I cut my new tire just the size of the wheel and scarf the end down the same as every one does, but instead of using borax, I use Muncie's Compound (that I get of the Muncie Wheel and Jobbing Co., Muncie, Ind.) I raise the tire after it is fitted, take a pinch of the welding compound and sprinkle on the tire. I then place the other tire on top of it, seeing that the welding compound is in between the two pieces of steel. I heat the tire at a good fire and it will weld every time. If you wish to do a very fine job, you can narrow up the weld on the corner of the anvil, sprinkle on a little borax, heat up good and hot, and then hammer the weld down to the same thickness as the rest of the tire. This gives a nice solid weld.

The way I weld a wagon spring is as follows: I heat up the end of the spring and upset it so as to have it good and thick, say about a third thicker than the rest of the spring. Then I scarf the ends down, not very long, and sprinkle on a little borax, so as to make the steel sticky. After that I sprinkle on the Muncie Compound, so that it will not slip around after getting the heat, as it will with borax alone. After I get the compound on the steel I put the pieces in the fire with the compound side down and take a good heat. When I take them out I turn them half over, so that the compound will come together, and strike the front end first very quickly with the pane end of the hammer. As soon as stuck, I hammer it right out and take another weld or so. When it is drawn out to the right size you cannot see a single mark of the weld. When split and riveted together there are always left more or less marks or bad places, and then the spring will surely break.

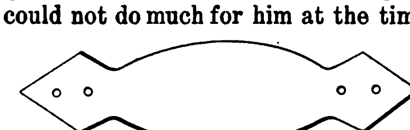
Prize Contest.—Horseshoeing—3.

Shoeing Defective Feet.

Having made horseshoeing a study, and having had experience with all kinds of horses and all kinds of feet, I will try to write a few words upon the subject.

To begin, I shall mention the treatment of a split hoof, in which the split ran from the hair to the toe. The first thing I did was to pare the foot level on the bottom. I then made a shoe to fit the bottom of the foot perfectly, with the outside coming up on the horny crest about three-eighths of an inch high all around. Then I sprung the shoe open to get the foot in it, and put it on with three nails to the side. I let the shoe stay on for two months, and then took it off, and re-set it the same as any other shoe. I employed a liniment and treated the foot all the time, but never had the horse used. In about eleven months the split had grown out, and the foot was sound. I have had the point argued that a split in the hoof from the hair to the toe could not be cured. This is a mistake. If any brother smith has a foot of this kind to deal with let him treat it in this way, and I will guarantee a sound foot in twelve months.

I once had a mustang pony with a quarter crack brought to my shop. I could not do much for him at the time,



The American Blacksmith.
HOOF PLATE FOR QUARTER CRACK.

because the foot was too sore, but in about a week he was brought back. I then made a small plate, as shown in the figure, and after pressing the foot close together, fastened it to the horny crest by means of four small screws. I let him wear this and a shoe, still applying liniment and in this way grew a sound foot.

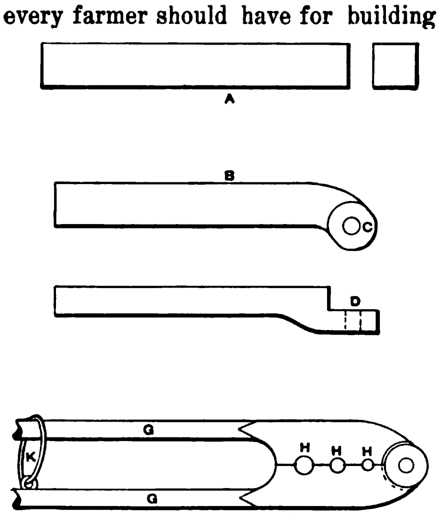
In starting out to cure corns on the feet of horses, I first pare the foot down level and set the shoe to fit. Applying my rasp just where the corn is, I cut the horny crest away for about one-eighth of an inch. I then take my knife and dig the corn out. No matter how shallow or how deep, I take it out just the same. Then I fill the holes with liniment, and let it soak into the foot. After that I shoe the foot, and then fill the holes with cotton, packing it under the shoe and soaking with the liniment. I use the liniment every other day for about ten days, and then place the horse in pasture for about a month. I then pull the shoes off, dig out the corns again, and re-set the shoes. I also re-fill the holes with cotton and liniment. Put the horse back to work, and the corns are all right.

I had a horse with corns so bad that he walked like a bare-foot boy on briers. I cured him in this way. Should any brother smith have a better way for treating a diseased foot, I shall be very glad if he will write up a few points. I believe a man should be learning something new all the time. I will wait patiently for a reply from one of the craft.

A Tool Useful in Building Wire Fences.

RAY BOSZOR.

The following is a brief description of a method of making a tool which every farmer should have for building



The American Blacksmith.

HANDY TOOL-STEPS IN ITS CONSTRUCTION.

wire fences. It is called a connector and is used for splicing wires.

First take a piece of tool steel one-half inch square, as at A. Stave one end over, leaving it the shape shown at B. Make two such pieces and drill ½-inch holes in the ends which were shaped, having center of hole in line with the inside edge of the bar, as shown at C. Then take a facing bar for facing off such articles, and face the ends down, in the manner indicated at D, until they will fit together nicely. Now draw the other end out, rivet together and drill holes of the different sizes desired, as at H. Put on a link, and file up to a smooth finish, when it will be ready for market.

A Few Practical Hints on Tempering Steel.

W. Z. SMITH.

In the practice of the every day work of the modern blacksmith there is a point which is not discussed to any great extent by most papers of a mechanical nature, at least not so much as it ought to be, namely, the art of tempering. This art should be thoroughly understood by all steel workers of whatever nature, for by knowing how to do this work a successful tool is insured. A man may be able to make a certain tool perfectly, yet if he is not able to temper it properly all his labor is lost and sometimes his reputation.

I have made a study of the art of tempering steel for the past ten years. This has demanded of me a great deal of time, patience and labor, but I have found a plan which I think second to none, in so far as small tools are concerned. It is ofttimes the fault of the steel as well as the workman if the tool is not good. I give below a few practical hints which I hope will be appreciated by some brother blacksmiths in this country, and I assure them that if these hints are faithfullv carried out they will be delighted with the results.

In making a tool the workman should know the kind of steel best adapted to the special work to be done by the tool.

In a trade journal, not long ago, I read an article by a man who desired to know how to temper a hammer made out of machine steel. Well that man may have meant well, but he was far from knowing the business, for his time and labor would be lost entirely. A hammer made from machine steel may be case hardened, but that is as much as you can do with it. Even then you will not have a tool worth the work put upon it, because it will be defective in one way or another. My plan is for tools, use the best tool steel procurable, and for articles intended to be made of machine steel, use that. For all edge tools I use any of the following brands, but prefer the first named: American Special Cast, Black Diamond, Hows Tool E. and Jessops. All of these brands are excellent and good results can be obtained by their use.

The next point to be considered is the heating and working of the steel. Some smiths claim that tool steel should not be heated above a bright cherry red. Let me ask them how about axles, hatchets, wood chisels and most all other wood tools which require welding? I do not think that their theory holds in these cases. I claim that steel can be worked at a good orange heat without injuring it. It should in fact be worked at that heat as nearly as possible; that is, it should be worked at an even heat, and should not be hammered after getting below a cherry heat. This will prevent the presence of more than one grade of steel in the same piece. Work the article to be made at this temperature, and then close the grain by water-hammering it at a dull red heat two or three times, until it appears to be very firm.

After having done this, relieve the strain by heating to a dull red, and then allow it to cool in the air until redness is no longer apparent when held in a dark place. Then dip into pure linseed oil. Do this about three times, wipe off all the oil, and let the piece get cold. This will prevent cracking and springing and remove all hard spots, making the steel very soft. After this it may be filed or smoothed off and then it will be ready for hardening. Heat the tool to an orange heat, or to the same heat at which it was worked and plunge into hot linseed oil. Let it come to the temperature of the oil, when it is to be taken out, wiped off and allowed to get perfectly cold. Now polish off on the grindstone or in any other possible way, taking care, however, not to draw the temper in polishing. If the article hardened should be sprung out of shape or bent after taking it out of the oil, simply bend it back into shape before it gets cold. This can easily be done and without injuring the steel. Although the steel is hard enough to cut glass it can be bent into a crescent without breaking.

Of course this alludes to knives, springs, etc.

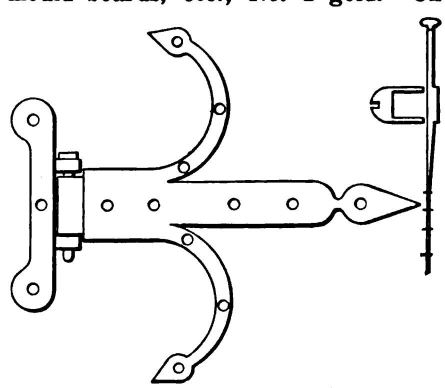
The next point is the most important, and consists in getting the right degree of hardness. The workmen should know for what use the tool is intended, because different classes of tools require different tempering. In order that a workman may become thoroughly acquainted with the various colors, I would suggest that he polish a piece of steel just as bright as possible, and then lay on a red hot iron and watch the colors as they come and go, being careful not to let them run too fast. He will then find that they come in the following order: The starting color is white or No. 1 silver, and following it No. 1 gold, No. 1 bronze, No. 1 red, No. 1 peacock blue, No. 1 dark blue, No. 1 pale blue, No. 2 silver, No. 2 red, No. 2 green, No. 2 blue, and so on. The way to draw the color is as follows: Get a piece of iron large enough to hold the heat a sufficient length of time, and heat nearly to a welding heat. Then lay the article to be tempered on the iron, moving it back and forth so as to draw the temper evenly, until the right color comes. Then lay it aside, and when it is cooled entirely polish and it will be ready for use. A tool treated in the above manner will be found to be all right. For drawing tools like bits, augers, etc., I take a piece of iron, say ½ x 2 inches and bend one end around, leaving it large enough to admit the bit. Other tools, too large to be drawn in the above manner I draw in a small closed furnace built for the purpose and heated by charcoal or coke.

It is necessary then that the workman knows what color the tool he is making should have, for without the proper temper the tool is useless, no matter how neat or good it may be otherwise. Below I give a short list of different tools and what I have found to be the color best adapted to each.

For edge tools of all kinds, such as woodworking tools, wood chisels, plane bits, draw knives, wood lathe tools, wood carving tools, spoke shaves, broad axes, hatchets, axes, hedge knives, pruning hooks, hay knives, pocket knives, No. 1 gold, No. 1 red, and No. 1 peacock should show (in spots). For blacksmith hammers, nippers, gun tools, cleavers, saw sets, belt punches, bits for iron, bolt cutters, chisels, etc., use No. 1 peacock. For ordinary cold chisels, awls, harness needles, case knives, forks, pitch-forks, grubbing hoes, tri-squares, trowels, calipers or dividers, screw-drivers, and tools of this nature which do not require much temper, draw to No. 1 blue, then cool in oil and draw to No. 1 red.

For marble cutters' tools, paper knives, paper shears, dehorning shears, hair clippers, edge tools for harness-makers, No. 1 bronze or copper color. For plug and feather drills, tools for rock quarries, picks, drills and stone hammers, No. 1 blue. In the case of stone cutters' tools, such as points or tooth chisels for lime or other soft stone, first find out the kind of stone, and then temper accordingly. Often No. 1 blue is sufficient, but frequently it is necessary to draw this color two or three times. I always mark these tools with a center punch; thus, a chisel which has had the temper drawn once, I mark once, and the next twice, and so on. In this manner I soon find the right temper.

For taps, dies, reamers, razors, shears for cutting iron or steel, tinners' shears, forceps for cutting horses teeth, can openers, sausage machine knives, drill bits for boring plow mould boards, etc., No. 1 gold. On boring tools for castings, glass cutters, files, floats for horse files, butcher's steels, toe calks, vise jaws, anvil faces, pipe tongs, ball bearings, use No. 1 silver. For physicians' and surgeons' knives, probes, manicuring tools and tools of this class, No. 1 bright red. For butcher knives, farriers' knives, shoe knives, sheep shears, scythes, sickles, etc., No. 1 blue with a little red. For the purpose of case hardening, set screws, land sides, mould boards, cultivator shovels, etc., use prussiate of potash in water. In case of flint glass cutters, mill picks for cutting English mill stone, or tools which require to be harder than fire and water can make them, use cyanide of potassium in water.



The American Blacksmith.
Fig. 1.—DESIGN OF GATE HINGE WITH SPRING AND CATCH.

In tempering springs by the quick process for cars, buggies, guns, machines, end gates, traps, and others too numerous to mention, first harden, hold over the fire and let all the oil burn off, and then lay aside and allow to cool. The slow process is only used on springs which require a very fine temper, such as clock springs and those used in artificial limbs, etc. Harden and draw to No. 2 green, being very careful to watch the colors and not let them run too fast. I always try to find the strain to which a spring is subjected, and temper accordingly. Thus, a spring which is calculated to bend one inch in twelve, I give No. 1 blue; for six inches, No. 2 silver, and for any degree above eight inches No. 2 green. To determine the degree of a spring take a board, say 12x12 inches, and locate a center on one corner, then draw an arc with a compass on the other end of the board and divide up into one-inch spaces. Lay the spring on the base and bend upward. If it is necessary that the spring should work at a tension above the eighth degree mark use No. 2 green. If the above rules are followed, there is no reason why an article so treated should not give satisfaction. Some may say that this process is too slow for the average every day workman. I admit that it is slow, but it is very sure, and is used by some of the foremost mechanics in this country.

How the Boys Used to Do It.

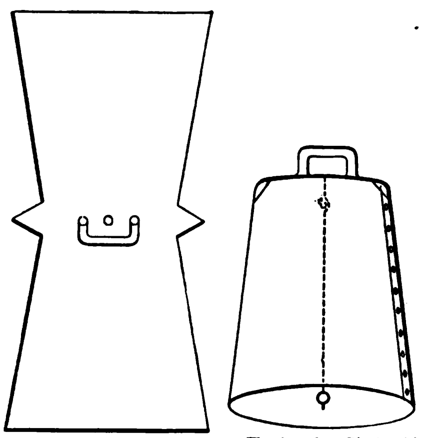
J. L. PAINTER.

The prospectus which I received of the AMERICAN BLACKSMITH suggests to me a few thoughts concerning blacksmithing in the olden days. I may say that I have worked at the blacksmith trade for thirty-three years, and don't pretend to know it all yet.

There is a great deal of work that is getting to be a lost art to the younger blacksmiths who are learning the trade now. When I first started, the blacksmiths made their own horseshoes and horse nails mostly out of old wagon tires split up and forged to proper size. They made all the rivets, bolts, nuts, washers and all forgings that belonged to a wagon by hand. There used to be considerable pride taken in forging a fine fitting wagon brake, and making double twist breast and stay chains for wagons. In fact, the boxing in the wheels was made by hand, the wagon axle skeins were all forged, steel layed plates formed to the circle of the boxing, riveted and banded on the axle and the wheel held to its place with a linch pin. Such articles as halter chains with spring snaps, cow chains, trace chains, log chains, open links, middle rings, swivels, door hinges for barns, door fastenings, gate hinges, together with all nails and bolts used to fasten them, were forged by hand.

Fig. 1 illustrates one of many designs that were used for fancy fence gate hinges, together with the irons to hold the gate closed, all hand forged.

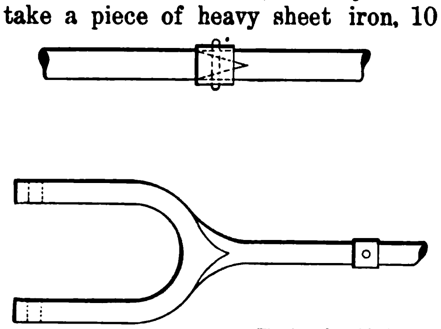
These are only a few things the making of which is getting to be a lost art, due to the fact that there is no need of hand forging, as the hardware stores supply everything in that line.



The American Blacksmith.

Fig. 2. FASHIONING A HAND-MADE COW-BELL.

I fashioned a hand-made cow bell the other day to show the boys what used to be made by the old blacksmiths. It is a good one and rings loudly. We take a piece of heavy sheet iron, 10 inches long and 4 inches wide, and cut out a piece as shown by the drawing. In this shape, we rivet in the strap staple and also the clapper staple. After this is done, we bend it into shape and rivet the joints together. In order to get the bell to sound, it must be brazed. To do this heat it, lay a good sized piece of old hub band brass in the bell and sprinkle all over with borax. Then melt the brass and heat the bell all around so as to have the brass run into every crack and joint; in fact all over the bell. When cleaned up, it is a good old hand-made cow bell.



The American Blacksmith.

Fig. 3.—REPAIRING A HARVESTER PITMAN.

I resort to brazing a good deal in machine repairing. The other day I had a job of brazing an end on a harvester pitman that had a cast head. (See Fig. 3). I took a piece of iron, doubled it and bent it over the end of the broken part. Then I put a rivet through the pieces and brazed the whole together. The same method of fixing castings for a customer in a hurry, where the repair parts cannot be obtained, will apply to many a job in these days of machinery.

The Veterinarian and the Farrier.—1.

E. MAYHEW MICHENER, V. M. D.

In conducting the veterinary features of THE AMERICAN BLACKSMITH the writer hopes to render some service to the busy horseshoer as well as the younger men who are about to take up horseshoeing as an occupation. No apology is deemed necessary for the attempt.

Between the occupations of horseshoer and veterinarian a relation has existed from very early times. On account of the undeveloped condition of the knowledge of both occupations, caused by the lack of opportunity for acquiring knowledge upon those subjects, the shoer and the veterinarian were frequently found combined in one individual. On account of his close relation to the care and welfare of the horse, the shoer was at the time the best one in most instances from which to ask advice. Since the establishment of veterinary colleges in America many men have devoted their time and energies to the study of the domestic animals in both health and disease, with the result that to-day all large cities and towns and very many country districts are supplied with graduate veterinarians. This does not mean that the shoer and the veterinarian are no longer related, but it does mean that according to the well known and ever acting law of the division of labor the two individuals now perform the work formerly attempted by one, and very much better, too, for all concerned.

The practice of medicine and surgery, both human and veterinary, has only within comparatively recent times merited the name of a science. Any occupation becomes a science in so far alone as knowledge in its particular line becomes perfected. The rapidity with which advances are made in a given line of work directly depends upon the individual effort and acquirement, as well as upon the diffusion of knowledge by the various ways by which we learn of the triumphs and also the mistakes of the worker.

Of all the ways which lead to the acquirement of knowledge the oldest and still the most valuable is by means of the powers of observation. Men have become expert within a single life time with no other tutor than their own experience; more have become expert by the additional assistance of the experience of others, acquired by imitation or imparted by word, spoken or written. The written records of a subject constitute its literature. By the study of the literature of an occupation we can determine what advances, if any, have been made in the given line. To literature the world owes much indeed for its condition of advancement.

Another manner by which knowledge is imparted and received is by means of the lecture or discourse, the common way in schools and colleges. Lecture courses in the art of shoeing have been successfully carried out at some of the veterinary colleges and are already productive of much good. While it is generally advisable for the shoer to attend such lectures if possible, yet a comparatively small proportion are so situated as to be able to do so. To these then is left the opportunity for self-improvement by means of close observation, and by the reading of standard books upon such subjects as pertain to the different matters of concern. Another method of acquiring education, which is destined to become popular, is through the reading of journals devoted to the interests of the shoer. In America to-day the development of journalism devoted to the various trades and occupations is of greater value to the busy worker than are the ponderous volumes within the library walls.

It is proposed, if the plan meet the approval of the readers of THE AMERICAN BLACKSMITH, to give in this department outline studies of the anatomy of the horse, with especial reference to that of the foot. This will comprise the study of the exterior of the animal as well as descriptive articles upon the interior anatomy. The defects in conformation will be considered in relation to the causation of disease and lameness. As the defects in conformation may be either congenital (the result of breeding) or acquired (the result of mismanagement or abuse), the proper classification will be studied with special reference to the part which shoeing may play in originating an undesirable condition, or in aggravating a condition already undesirable, as well as in respect to the rational treatment for the purpose of aiding relief or recovery. The causes and resulting alterations of various diseased conditions of the feet will also receive attention, and the principles of treatment described both preventive and curative.

While it will scarcely be denied that the treatment of diseased conditions of animals is in general best entrusted to a competent veterinarian, yet as lameness is so often caused by some of the various abnormal conditions of the foot, and as shoeing also plays a very important part in the correct treatment and at times in the causation of lameness, it becomes clear of the highest importance that the shoer be familiar with the parts with which he is obliged to deal.

Shoeing to Correct Forging.

T. M. HAMILTON.

In response to your invitation I send you by this mail a sketch of two shoes used for preventing forging, or striking the front foot with the hind foot. This method is probably familiar to the older members of the craft, but may interest the beginners.

The idea involved is to aid the horse in picking up his front foot, and at the same time to make it more difficult for him to pick up his hind foot.

The first object is accomplished by the curved front of the shoe, as shown in the accompanying Fig. 1. The foot rolls or turns on a shorter lever than when a common shoe is used and can be handled quicker.

The hind shoe should be made long in front with heavy calk, so as to make the leverage greater than with a common shoe. This also protects the hoof and allows it to grow to its original or natural form. The hind hoof is usually worn off from the contact with the front one, and if the shoe is fitted to the hoof it continually shortens the hoof and aggravates the trouble.

I have used this method for several years with satisfaction, and hope those of my readers who have not used it will give it a trial.

NOTE.—Mr. Hamilton is the instructor in blacksmithing at the Agricultural and Mechanical College of Greensboro, N. C. The above illustrates a phase of horseshoeing as dealt with in Mr. Hamilton's class courses. We hope to be able to print further contributions from the same source in later issues.—*The Editors.*

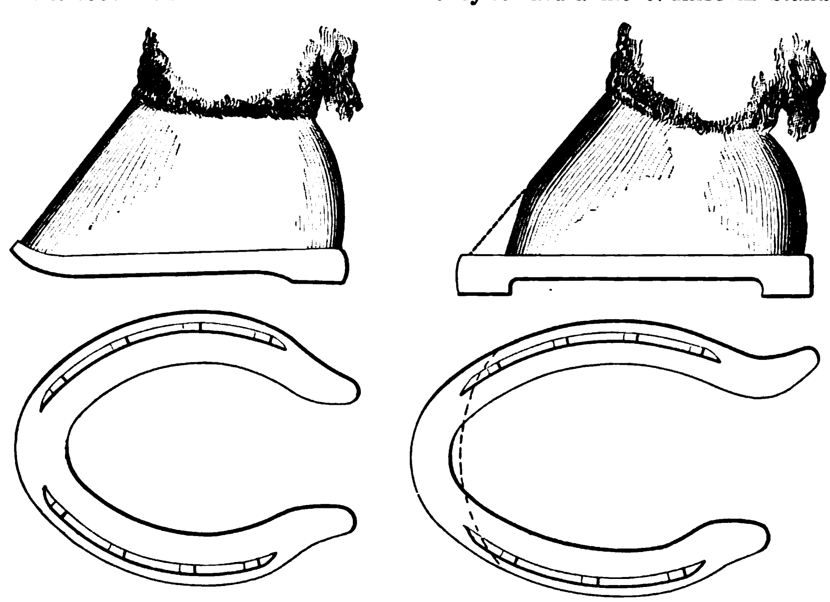

The American Blacksmith.

Fig. 1.—Front Hoof. Fig. 2.—Hind Hoof.

SHOEING TO CORRECT FORGING.

Prices for General Blacksmith Work.

Under the above heading we will publish from time to time, as they may be sent in by our readers, the prevailing schedules of current prices at various points for general blacksmith and repair work of all kinds. This will be of interest in influencing a tendency toward a more uniform standard of rates based upon the cost of materials and labor in the different sections.

It perhaps may be said that in Great Britain the local blacksmith fraternity, through their associations, has taken the initiative in fixing a list of rates for work of all classes coming to their shops. In this way criticisms in the matter of too low prices on the part of one shop or too high prices on the other are readily discussed and adjusted. This journal will ever maintain the stand that the competent smith should receive a proper figure in his right sphere among mechanics for his work. Associations in different cities and towns established for the purpose of discussing methods of improving work and for friendly business intercourse are of material value and can be made of great help. But such associations to reach the highest degree of usefulness must fix their standard of purpose high, and always see that it is maintained.

Some Ohio Prices.

Editor AMERICAN BLACKSMITH:

I can accommodate you with a few of our prices down in this vicinity, but the list will be far from complete:

Horseshoeing common.	
Four new shoes, . . .	\$ 1.20
Four shoes, old set, . .	.60
Bar shoes, per pair, . .	1.00
Side weights, each, . .	.40
Toe weights, each, . .	.40
Screw calk shoes, each, .	.40
Screw calk, changed, four feet, all around, . .	.75
Four New tires.	
$\frac{7}{8}$ in. x 3-16in. or $\frac{1}{4}$ in., .	\$ 4.00
1 in. x $\frac{1}{4}$ in., ...	4.25
$1\frac{1}{4}$ in. x 5-16 in., . . .	4.50
$1\frac{1}{2}$ in. x $\frac{3}{8}$ in., ...	5.00
$1\frac{3}{4}$ in. x $\frac{3}{8}$ in. or $\frac{1}{2}$ in., .	6.00
2 in. x $\frac{1}{2}$ in., or $\frac{5}{8}$ in., .	8.00
$2\frac{1}{4}$ in. x $\frac{1}{2}$ in. or $\frac{5}{8}$ in., .	8.50
$2\frac{1}{2}$ in. x $\frac{1}{2}$ in. or $\frac{5}{8}$ in., .	10.00
3 in. x $\frac{5}{8}$ in. or $\frac{3}{4}$ in., .	12.00
Setting four buggy or spring wagon tires, .	1.20
Setting four wagon tires up to $2\frac{1}{4}$ in., . . .	1.60
Setting four wagon tires up to $3\frac{1}{2}$ in., . . .	2.00
Rims, $\frac{3}{4}$ in., $\frac{7}{8}$ in. and 1 in., four, ...	3.00
Rims, $1\frac{1}{4}$ in, $1\frac{1}{2}$ in. and $1\frac{3}{4}$ in., four, ...	4.00
Rims, 2 in., $2\frac{1}{4}$ in. and $2\frac{1}{2}$ in., four, ...	6.00
Spokes, any size, \$0.10 to	.15
Bolsters, front and rear, ... \$2.00 or	2.50
Tongues without hounds,	1.50
Hounds, per pair, . . .	2.00
Axles, according to size, ... \$2.00 to	3.00
Neck yokes, long or short,	1.00
Singletrees, plow or wagon, each. . . .	.60
Shafts, buggy, per pair,	1.50
Crossbar, buggy, each, .	.50
Wheels, new, prices according to grade.	

Coal Miners' Tools.

New welded eye picks, according to weight . . . . . $0.75 to	$1.00
New needle, 6 feet long,	1.00
New scraper, 6 feet long,	.25
New screw, 2½ feet of thread with box, . .	3.00
Pick, re-steeled both ends,	.25
Wedges, . . $0.25 to	.45
Sledges, hand made, per pound, ...	.15

Yours truly,
G. W. LETT.

Queries, Answers, Notes.

This department has been arranged to afford subscribers the opportunity of obtaining an explanation of any of the problems which may arise in the course of their daily work. It is a feature that may be made most valuable and interesting, not only to those directly concerned in the questions, but all others who may have to deal with similar subjects. Those desiring an expression of opinion, therefore, should not hesitate to write.

A lively discussion of all topics is desired, and readers are invited to send in their views upon any of the subjects.

Plans Wanted. In the near future I expect to build and move into a new shop, and also to remodel my equipment. Will THE AMERICAN BLACKSMITH kindly publish some sketches of modern, up-to-date, 3-fire shops of its readers, with list of their equipment?—J. T. QUINTE.

When Do Steam Hammers Pay? Will some readers of THE AMERICAN BLACKSMITH kindly state their experience with steam hammers? Our conditions are as follows: There are several manufacturers here without blacksmith shops who bring a good deal of heavy work to us, and the time for handling it interferes with smaller customers' wants. We wish to learn if it will pay to put in a steam hammer. We are running from two to four fires constantly.—A. SARTWELL & SON.

Who Uses Electricity? My shop is not equipped with power. So much business is coming in that I am working under great disadvantages and will be compelled to enlarge. At what rate from the power companies is electricity cheaper than gas or steam engines? Is it reliable and are necessary repairs within the ability of a fair mechanic?—LUCIEN HAYWOOD.

Gas Engines for Power My shop is being fitted up for five fires and I expect to use a gas engine. What size would it be advisable to install with a view to some possible future increase? Will want to run two emery wheels, one drill and a grindstone.—HARRY SHELDON.

Does It Pay to Make Horse Shoes? I have been running a blacksmith shop for 28 years and in these later days have often felt it paid to buy horse shoes instead of making them. What is the experience of other smiths in small towns or villages? If it is cheaper to buy than to make, what suggestions can be offered for profitable work in spare time?—J. T. PETERSON.

Bad Debts. For the last three years I have been living in a town of about three thousand inhabitants and have some bad debts on my books. I am not very well acquainted with the standing of the people and I have taken some work that the other smiths would no doubt have turned away. I find difficulty with a number of outstanding accounts. What is the best method to proceed, as I need the money badly? I do not wish to lose any trade and would be glad if some brother smiths would state their method of drumming up old accounts, also of handling questionable ones.—ANXIOUS

Tempering Mill Picks. Will some brother smith tell me the best way to temper mill picks?—B. O. C.

Future Numbers and Contributors.

As demanded by the varied nature of the field to which THE AMERICAN BLACKSMITH appeals, the subject matter presented will necessarily be of a somewhat diverse character. The principle of the greatest interest to the greatest number, however, will always be adhered to in the selection of topics discussed.

Readers should bear in mind that no one number can gauge the exact value of the paper to any particular branch of the craft, for some of necessity contain more and others less upon any given subject. However, it will be found that twelve consecutive issues of THE AMERICAN BLACKSMITH furnish a greater volume of pertinent matter than can be had for a like expenditure in any other way. A word concerning contributors and the several branches of the art in this and succeeding issues:

Along the lines of general blacksmith work will always be found many articles of varying length, written by men in the daily harness, descriptive of various tools and devices they find convenient and useful. Shop experience is a valuable teacher, and many a time-saving or labor-saving hint may here be picked up. Mr. J. G. Holmstrom, a practical blacksmith-author, sends a timely communication, and promises for future issues matter of special interest on general blacksmith shop work.

In the department of machine blacksmithing appear several well known names: Mr. Thomas Prentice, foreman of the Forge Shop of the General Electric Company at Schenectady, N. Y., Mr. A. L. Woodworth, secretary and treasurer of the National Railroad Master Blacksmiths' Association, and Mr. W. T. James, who has had much experience as foreman of the Elizabethport forge shops of the Central Railroad of New Jersey.

On the subject of carriage work, this issue contains articles from two authorities. That on Wheels and Axles, modestly signed "D. W. M.," is from the pen of an expert, being the first of a series which will prove very attractive to the carriage man. Mr. M. C. Hillick, well known as a writer upon carriage painting, sends a contribution which deals with the problem of outfitting carriage shops and which is to be followed by several others later.

A leading article of this number is from the pen of Prof. R. H. Thurston, Director of Sibley College of Mechanical Engineering at Cornell University. Inasmuch as the influence of our technical schools is being felt in an ever-increasing degree, not only in this country but likewise in foreign lands, by the wide-spread introduction of American tools and American methods, it is believed that the outlines of blacksmithing work in leading schools of this kind will excite much interest. In a future number, the work done in the Cornell University forge shop will be described somewhat more in detail, and from the view point of the student himself.

In the department of horseshoeing is presented the first article of a series, treating of the anatomy and pathology of the horse's foot, written by Mr. E. W. Perrin, a graduate of the British Army Veterinary School. The complete series will form a concise, scientific discussion on horseshoeing in all its phases, which must needs be of interest to readers of the horseshoeing craft. As Veterinary Editor, THE AMERICAN BLACKSMITH counts itself fortunate in securing Dr. E. Mayhew Michener, a recognized authority in this domain, and feels that under his control this department will be of exceeding interest and value to farriers.

Mr. W. Z. Smith writes for this issue an extremely interesting article on practical tool tempering. Much information of value is afforded, and more matter in this line by practical men is to follow.

The names which precede will be found, it is thought, a sufficient guarantee of the character which it is proposed to maintain at all times in the columns of THE AMERICAN BLACKSMITH.

An Epoch-Marking Speech.

The speech of President McKinley, delivered September 5, 1901, at the Pan-American Exposition, the speech which proved to be his last, is in many ways a most remarkable one. Not only was it the last utterance of a truly great man to a loving people, a benediction as it were at the end of a life long devoted to the service of his country, but it is what may be termed an epoch-making, or rather, an epoch-marking speech.

McKinley's triumphs were those of peace, his laurels the fruits of statesmanship. This last address of his merits the deepest thought in that it outlines the progress and shadows forth the policy of a nation which under his guidance had leaped into supremacy in the world race. In the future history of this day the name of William McKinley will shine forth with undimmed lustre, the man, the husband, the soldier, the statesman, the president, the martyr.

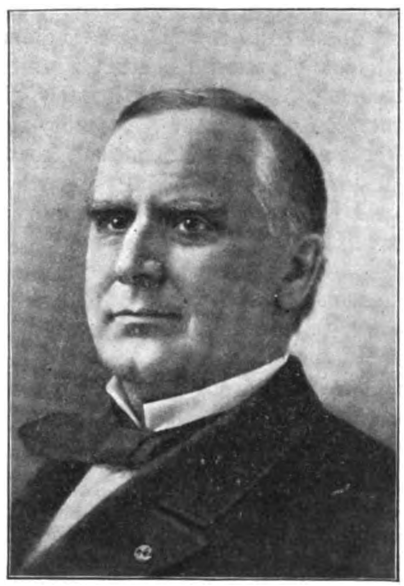
The Last Speech of President McKinley.

Expositions are the timekeepers of progress. They record the world's advancement. They stimulate the energy, enterprise and intellect of the people, and quicken human genius. They go into the home. They broaden and brighten the daily life of the people. They open mighty storehouses of information to the student. Every exposition, great or small, has helped to some onward step.

Comparison of ideas is always educational, and, as such, instructs the brain and hand of man. Friendly rivalry follows, which is the spur to industrial improvement, the inspiration to useful invention and to high endeavor in all departments of human activity. It exacts a study of the wants, comforts, and even the whims of the people, and recognizes the efficacy of high quality and low prices to win their favor. The quest for trade is an incentive to men of business to devise, invent, improve and economize in the cost of production. Business life, whether among ourselves, or with other people, is ever a sharp struggle for success. It will be none the less in the future.

My fellow citizens, trade statistics indicate that this country is in a state of unexampled prosperity. The figures are almost appalling. They show that we are utilizing our fields and forests and mines, and that we are furnishing profitable employment to the millions of workingmen throughout the United States, bringing comfort and happiness to their homes, and making it possible to lay by savings for old age and disability. That all the people are participating in this great prosperity is seen in every American community, and shown by the enormous and unprecedented deposits in our savings banks. Our duty in the care and security of these deposits and their safe investment demands the highest integrity and the best business capacity of those in charge of these depositaries of the people's earnings.

We have a vast and intricate business, built up through years of toil and struggle, in which every part of the country has its stake, which will not permit of either neglect or of undue selfishness. No narrow, sordid policy will subserve it. The greatest skill and wisdom on the part of manufacturers and producers will be required to hold and increase it. Our industrial enterprises, which have grown to such



WILLIAM McKINLEY
PRESIDENT OF THE UNITED STATES
BORN, JANUARY 29, 1843
DIED, SEPTEMBER 14, 1901.

great proportions, affect the homes and occupations of the people and the welfare of the country. Our capacity to produce has developed so enormously and our products have so multiplied that the problem of more markets requires our urgent and immediate attention. Only a broad and enlightened policy will keep what we have. No other policy will get more. In these times of marvelous business energy and gain we ought to be looking to the future, strengthening the weak places in our industrial and commercial systems, that we may be ready for any storm or strain.

By sensible trade arrangements which will not interrupt our home production we shall extend the outlets for our increasing surplus. A system which provides a mutual exchange of commodities is manifestly essential to the continued and healthful growth of our export trade. We must not repose in fancied security that we can forever sell everything and buy little or nothing. If such a thing were possible it would not be best for us or for those with whom we deal. We should take from our customers such of their products as we can use without harm to our industries and labor. Reciprocity is the natural outgrowth of our wonderful industrial development under the domestic policy now firmly established.

What we produce beyond our domestic consumption must have a vent abroad. The excess must be relieved through a foreign outlet, and we should sell everywhere we can and buy wherever the buying will enlarge our sales and productions, and thereby make a greater demand for home labor.

The period of exclusiveness is past. The expansion of our trade and commerce is the pressing problem. Commercial wars are unprofitable. A policy of good will and friendly trade relations will prevent reprisals. Reciprocity treaties are in harmony with the spirit of the times; measures of retaliation are not. If, perchance, some of our tariffs are no longer needed for revenue or to encourage and protect our industries at home, why should they not be employed to extend and promote our markets abroad? Then, too, we have inadequate steamship service. New lines of steamships have already been put in commission between the Pacific Coast ports of the United States and those on the western coasts of Mexico and Central and South America. These should be followed up with direct steamship lines between the western coast of the United States and South American ports. One of the needs of the times is direct commercial lines from our vast fields of production to the fields of consumption that we have but barely touched. Next in advantage to having the thing to sell is to have the conveyance to carry it to the buyer. We must encourage our merchant marine. We must have more ships. They must be under the American flag, built and manned and owned by Americans. These will not only be profitable in a commercial sense; they will be messengers of peace and amity wherever they go.

We must build the Isthmian Canal, which will unite the two oceans and give a straight line of water communication with the western coasts of Central and South America and Mexico.

The construction of a Pacific cable cannot be longer postponed. In the furtherance of these objects of national interest and concern you are performing an important part. This exposition would have touched the heart of that American statesman whose mind was ever alert and thought ever constant for a larger commerce and a truer fraternity of the republics of the New World. His broad American spirit is felt and manifested here. He needs no identification to an assemblage of Americans anywhere, for the name of Blaine is inseparably associated with the Pan-American movement which finds here practical and substantial expression, and which we all hope will be firmly advanced by the Pan-American Congress that assembles this autumn in the capital of Mexico. The good work will go on. It cannot be stopped. These buildings will disappear; this creation of art and beauty and industry will perish from sight, but their influence will remain to "make it live beyond its too short living with praises and thanksgiving." Who can tell the new thoughts that have been awakened, the ambitions fired and the high achievements that will be wrought through this exposition?

Gentlemen, let us ever remember that our interest is in concord, not conflict: and that our real eminence rests in the victories of peace, not those of war. We hope that all who are represented here may be moved to higher and nobler effort for their own and the world's good, and that out of this city may come not only greater commerce and trade for us all, but, more essential than these, relations of mutual respect, confidence and friendship which will deepen and endure. Our earnest prayer is that God will graciously vouchsafe prosperity, happiness and peace to all our neighbors, and like blessings to all the peoples and powers of earth.

The Blacksmith—An Artist's Sentiments.

A well-marked feature of human character is the desire we all have to know what other people may think of us. It is indeed a strong man who can unmoved bear the open scorn of his brother men, and all of us are human enough to feel a glow of pleasure when words of praise sound in our ears.

Hence our gratification at being able to reproduce below, as we do, a portion of a letter recently received from an eminent artist of this country, to whom we had written in reference to furnishing a design for the front cover of our new journal. His remarks refer to a design, which he submitted, showing the figure of a smith standing beside his forge in the attitude of just pausing in his labor of working the bellows. We think our blacksmith readers may find his words of interest as showing the light in which the craft is regarded by a representative of a highly intellectual and esthetic profession, if such it may be termed. The object of the artist, as will be seen, was to express by the drawing, as far as possible, his ideal conception of the character of the blacksmith.

"It has seemed to me in working out an idea for your magazine cover, that first of all to be considered is the true and ideally splendid character of the blacksmith, or, more particularly, the American blacksmith. A mighty man of brawn and sinew; steadfast, honest and industrious; 'looking the whole world in the face.' Drawing on such acquaintance as I have had among the men of this trade, my conception of his inner character is that of delightful simplicity, and as true and firm to his purposes as the iron he shapes on his anvil. Therefore, for the purpose of displaying these qualities to the best effect and for the sake of good design, I have placed the blacksmith in the foreground in nearly heroic proportions. This figure is to be sculptured almost in the 'round,' making it stand free from its background, and using all legitimate artifice to make this principal part of the design as imposing as possible. The interior of the shop, with forge, anvil, etc., to be done in a low relief, yet taking its proper place in the picture.

"The blacksmith being a man not given to gewgaws, I have, to keep the whole subject in harmony, made the architectural and decorative parts of the design somewhat after the type of the ancient Egyptian, since, as you are aware in the history of design, this style represents the utmost simplicity, combined with a sense of splendid strength and grandeur.

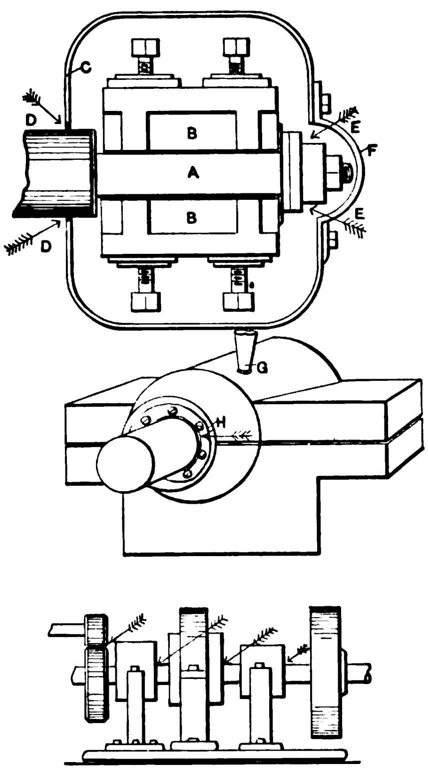
"The blacksmith has been posed as plying his bellows for the reason that we are thus allowed *to see the man.* This part of the work gives him the opportunity to look you in the eye for the moment without interrupting his business, such as is scarcely afforded by any other important duty in the range of his occupation."

Concerning Wheels of Motor Carriages.

BY "MACHINIST."

Owing to the extensive use of the horseless carriages and wagons, the wheelwright of today is interested in the wheels of motor vehicles to a considerable extent. The accompanying illustrations of wheels, hubs and parts of the gearing and bearings for the wheels of motor conveyances may be useful to the blacksmith and the wheelwright in explaining certain points that present themselves in every-day practice.

In Fig. 1 is shown a sectional view of a type of motor shaft with hub bearing and protecting shell of metal, the latter intended for keeping foreign matter, such as dust and fine particles



The American Blacksmith.

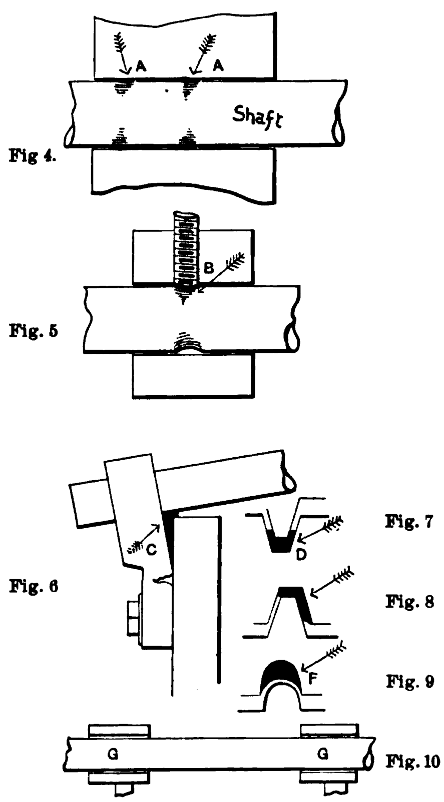
FIGS. 1, 2 AND 3. CONCERNING WHEELS OF MOTOR CARRIAGES.

of earthy matter, out of the parts. The shaft itself fits into the side of the case C, but usually there is a little margin left at D, through which the dust of the road can work itself to the journal A. Sometimes the wheelwright tries to avoid this trouble by adjusting a leather or thin metal washer between the wheel hub on the shaft and the case. Again, I have seen devices like rings put in at this point to prevent the dust from collecting. A good remedy is found by setting a collar on the shaft between the wheel hub and the edge of the case. As this collar will fill the void and fit closely to the case, foreign matter cannot enter. The portion of the bearing inside the case C is attached to the frame of the vehicle through the section of the case where divided, and can be reached through the cap F, which can be removed by loosening the set screws. The nut E can then be reached. Sometimes the bearings B bind on the shaft A, owing to some irregularity. This can be rectified by examining the parts for uneven places, and if any are found grinding them down. Heating of the parts may be due to these uneven places. If the linings of the bearings are badly scored, a good way to cast new ones is to make a mandrel and mold like that shown in Fig. 2. The ends of the box can be choked tight with sheet metal rings H, and after all is ready and the proper adjustment made, the babbitt metal previously melted can be poured through the funnel G. The sleeves thus made can be worked down to proper sizes for the bearings for the shaft and cut as required.

In motor carriages in which there are numerous journals for carrying shafts, there is always more or less trouble with the oiling of the same. Fig. 3 is a view of one form of wheel shaft which I saw in a motor carriage. There were bearings at all of the points indicated by the arrows and these parts were constantly running dry and heating. A coarse grade of hard grease was used, and this grease seemed to harden about the edges of the bearings and gather black dust. It was also found that the shaft was slightly sprung, causing it to bind in one of the end boxes. The trouble was overcome by removing the shaft and straightening it in a lathe, after which the bearings were thoroughly washed out with lye water and a proper grade of light oil used.

In the motor vehicle one finds various forms of plain bearings which he would never find in the bearings of the ordinary type of wagon or carriage. A plain shaft is shown in Fig. 4, and one of these which I lately examined to find out why it heated was seen to be grooved seriously, as at A A, caused by the presence of gummed and hardened foreign matter between the interior of the bearing and the shaft. These grooves of course create trouble by collecting gummed deposits from the oils and grease, and unless repaired will cause trouble in the running of the vehicle. The bearings ought to be carefully examined for indications of wear of this nature, and wherever it is found, it should be remedied at once.

If badly scored, the bearing can be restored to order by turning down the shaft until the part is smooth, and then, after the sleeves are also cut down, a new lining can be put in to make up for the portion removed. I have seen some very good bearings for motor carriage wheels ruined by using set screws as in Fig. 5. The set screw is adjusted, but in course of time it loosens a little and is pulled around the shaft, very soon resulting in the formation of a groove, as at B. The groove



FIGS. 4, 5, 6, 7, 8, 9 AND 10. CONCERNING WHEELS OF MOTOR CARRIAGES.

may be avoided if a new portion of the shaft can be used. If badly grooved and if the end of the set screw persists in turning, start a deeper hole with a boring tool and tighten the end of the set screw firmly into this.

By examining a motor vehicle from almost any point as it stands in the repair shop, various defects about the wheels and bearings may be located. In one instance I saw a machinist tighten up a cast iron bearing on a frame of a machine and heard the metal snap as the bearing broke, as shown in Fig. 6, as a result of a clog of hard oily matter at C. This stiff, black grease resulting from dust and grindings is a serious matter to deal with, and should be wiped, scraped or washed off whenever seen. In Fig. 7 is shown how the blackened, hardened grease often gets into the cogs of wheels as at D, and causes the teeth to run at a disadvantage. The cogs are lifted out from the mesh and may be caused to ride and perhaps to strip off. The gears should be gone over at intervals and the black dust scraped out with a tool prepared for the purpose. In Fig. 8 is also indicated how the foreign matter may get into the sides of the cogs and throw the gearings out of true. In one machine which I had occasion to inspect, I observed that a round pointed form of gearing was used and that foreign matter had accumulated in the cogs, as at F, Fig. 9, to such extent that the cogs slipped. This trouble was remedied in a few minutes by scraping out the cogs.

It is also a wise plan to examine the mechanism and gearing of automobiles and kindred carriages for sprung shafts. Often it will be found that the line between the points G G, Fig. 10, is not in perfect rotation with the center of the shaft. In some cases it may be necessary not only to straighten sprung shafts, but to put in a central bearing so as to prevent the wabbling of the shaft. I have often seen this done to advantage.

National Railroad Master Blacksmiths' Association. Denver Convention.

The 9th Annual Convention of the National Railroad Master Blacksmiths' Association was held at Denver, August 20th, 21st and 22d, F. C. Lace, Baltimore and Ohio Railroad, presiding. More than 150 members were present, and the convention was a most successful and satisfactory one in every way. Chicago, August 19th to 21st, was chosen as the place and date of the next annual convention, with the following officers for the ensuing year: President, W. P. Savage, Palestine, Texas; 1st Vice-president, John McNally, Chicago; 2d Vice-president, George Lindsey, Evansville, Ind.; Secretary and Treasurer, A. L. Woodworth, Lima, Ohio; Chemist, G. H. Williams, Boston; Chairman Executive Committee, R. A. Mould, Omaha, Neb.

The delegates were addressed by Governor Orman, of Colorado, Mayor Wright, of Denver, and President Jeffery of The Denver and Rio Grande Railroad. The speech of Mr. Jeffery was extremely interesting, and it is thought that a portion of it will bear repetition here:

"It was kind and complimentary for your committee to invite me to say a few words to you today, and it is still kinder for you to give me a few minutes of your attention. We are workers, all of us, in the nation's vineyards, figuratively speaking, either in one section or another of the broad domain, and all equally intent on advancing the general welfare by intelligent industry, well directed efforts and good citizenship. But pride of profession on your part very naturally stimulates effort in behalf of that trade to which you belong, and to which my own trade is near of kin. The blacksmith, the machinist and the mechanical engineer stand side by side in our advanced generation, and with their indispensable arts and ingenuity make possible the commercial and industrial wonders of this dawning century. Nor is it any reflection upon the workers in other useful arts when I say this, nor does it detract in the least from their importance as members of the vast industrial army. A brief line of thought will lead all classes to the conclusion that the forger and the fitter of iron and its products are the factors upon whose skill and success the destinies of all depend in the main. To you who are master forgers this is a suggestive thought, and I venture to ask that in your reflective moods you try to draw a mental picture of what our world would be today had there never been a blacksmith; that is, a forger and worker of iron. All honor to the blacksmiths through all the centuries behind us for what they have done, and all honor to those of today for what they have in hand to help mankind along in the broadening paths of industry and peace.

"To all of us gathered here the locomotive engine is as familiar as the street car, and our work has been closely identified with it nearly all our lives, but it may not occur to you that this piece of mechanism on which the civilized world absolutely depends, and without which its affairs could not be conducted, was the production, in three succeeding stages, of a blacksmith, a philosophical and thoughtful scientific instrument maker, and of an engineer in a coal mine.

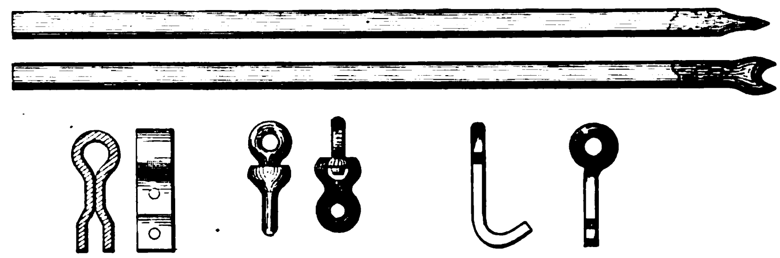
"It was my good fortune to come in personal contact with certain blacksmiths in my younger days whose influence I have felt to the present time. There was Robert Collyer, the blacksmith from Yorkshire, the eloquent divine, the charming lecturer, the refined and scholarly man. How I enjoyed his discourses, was impressed by his earnestness and moved by his sincerity and purity of character."

A partial list of the papers and reports presented at this convention is appended. Lack of space, it is regretted, makes it impossible to reproduce here any of these papers, but in the next issue of this journal will be printed a number of them, either in full or in part. Device for Bending Coal Car Hinges, A. L. Woodworth; Report of committee on Tools and Formers, D. Fitzgerald, Chairman; Manipulation of Tool Steel, Geo. Lindsey; Locomotive Frame Construction, R. Laizure and J. Newbury; Crank Pins and Piston Rods, William Young; Report on Flue Welding, J. H. Hughes.

Device for Bolt Holding.

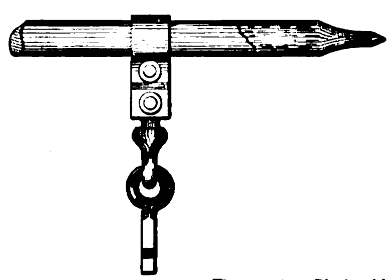
J. J. RATHBUN.

The accompanying engravings show a special kind of bolt holder which I have found very useful for holding the bolts of plows. The various parts composing the device are also shown. To make the main rod of the holder, I take a piece of iron ¾ inch round and about 2 feet long, and upon one end weld a piece of tool steel. This I draw down to the shape of a chisel, leaving the edge hollow in the center, however, so as to form two separate points to engage the head of the bolt. I next make an adjusting piece out of iron, ½ by 1 inch flat, and about 10 inches long, bending in centre, and forming an eye. The eye should be just large enough to pass smoothly yet snugly on the rod. I then drill a ½-inch hole close to the eye and rivet together. This done, I drill through the flat parts near the end, spread them, and rivet in place the end of a small swivel link, shown in the illustration. It should be sufficiently loose, however, to work to and fro. Then I make a hook of ½-inch square tool steel, forming an eye at the end to engage the free end of the swivel. I then have a good tool at a very small cost.



The American Blacksmith

DETAILS OF BOLT HOLDING DEVICE.



The American Blacksmith

BOLT HOLDING DEVICE.

A Handy Pair of Heading Tongs.

L. VAN DORIN.

The following description refers to a pair of heading or bolt tongs which I consider a very handy tool, and which perhaps will be new to many of my readers, as I have never seen the same kind of tongs in any shop except where the idea came from.

While the appended drawings explain the device sufficiently for an apt smith, I will say that these tongs are made much the same as ordinary ones, except that the jaws should be seven-eighths or one inch square. The upper or face side is laid with tool steel, and a rabbet formed with a sharp chisel in the bottom outside corner of each jaw (while hot), as shown by dotted lines in Fig. 1, and also by the end view of the jaws in Fig. 2. When the pieces are completed, rivet them together, and put a ring on the jaws to hold them firmly while drilling the holes. These must be in the center of the opening in the jaws, and the holes just the proper size for the iron to be used. When the iron is hot and placed in tongs and the tongs clamped in a vise, the iron will not slip in heading. Fig. 1 is a view of the face side of the finished tongs.

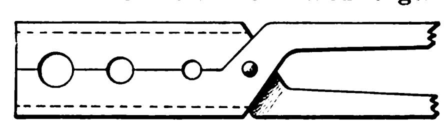


Fig. 1.

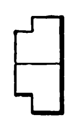


Fig. 2

The American Blacksmith

HEADING TONGS.

It will be understood that the rabbet in the tongs is for the vise jaws to fit in when using the tongs, and prevents them from slipping in the vise while heading a bolt. I have used mine to form countersunkheads, and can make countersunkheads of carriage bolts very quickly. I also find them handy for many other purposes. To form bolt heads with this tool requires no upsetting of the iron.

Shop Leaks.

Stop the leaks, not in the roof, but at the scrap heap. It is certainly surprising to what an extent shop costs may be reduced and profits increased by a little attention to this detail. The larger the shop and the more hands employed, the more apt are such leaks to escape attention. Leaks in the pay roll oftentimes exist, but are generally much more difficult of detection.

Opportunities for New Shops.

In connection with the business correspondence of THE AMERICAN BLACKSMITH office a number of desirable openings for new blacksmith shops at different points have presented themselves and are referred to below. As additional ones may arise from time to time, they will be mentioned in these columns. In many instances there are sections of rapidly developing country, especially in the South and West, where no shops are to be found within a convenient distance. The need of a competent general 'smith is ofttimes so great, that in addition to a desirable field, a bonus is offered him by a combination of parties who seek his services and would constantly utilize them. The inducement may be presented in the form of a free site, homestead land, equipment or a shop.

A good general blacksmith shop is wanted at Aslishers, Wilkes County, N. C. Correspond with W. D. Woodruff for full details.

The town of Bangor, Walworth County, S. D., is looking forward to having a new blacksmith shop in the near future. Write to Mr. M. A. Burns for particulars.

Mr. A. S. Hudgins, at Willow, Gates County, N. C., writes that there are no blacksmith shops at this point, and that one is very much needed. He will be pleased to furnish further information.

Spokane, Custer County, S. D., is a mining camp, at which the works have been shut down. They expect to resume shortly, and a 'smith will be required. J. O. Tyler will advise when. This field has afforded an excellent opportunity heretofore.

At Naples, Clark County, S. D., a movement is on foot to induce a blacksmith to locate. Communicate with J. P. Conway.

A general blacksmith is wanted to open a shop at Kurfees, Davie County, N. C. Correspond with J. Lee Kurfees.

Trade Literature and Notes.

The following catalogues and other trade literature have been received at this office:

Indiana Foundry Co., Ltd., Indiana, Pa. Illustrated catalogue of tuyere, swage blocks, and other blacksmith supplies, foundry hardware, stoves and plumbers' castings.

Cleveland Twist Drill Co., Cleveland, O. Illustrated catalogue of their line of twist drills, taps, reamers, etc.

The Schubert Bros. Gear Company, of Oneida, N. Y., inform us that they now have ready a new catalogue, illustrating their full line of buggies, road wagons, surries, white wagons, and also their line of gears for bike buggies, surries and business wagons. The catalogue is well worth obtaining, and may be had on receipt of request.

S. W. Mackey, 26th St. and York Road, Baltimore, Md. Descriptive catalogue of Mackey's Hoof Expanders, clamps and spring plates.

The Geo. Burnham Co., Worcester, Mass. An illustrated catalogue of hand and power upright drills, clamp drills and planer chucks.

Chas. W. Percy, 200 Summer St., Boston, Mass. Catalogue of Shipman Automatic steam engines, one to eight horsepower, and using kerosene for fuel.

The E. D. Clapp Mfg. Co., Auburn, N. Y. Illustrated catalogue and price list of the extensive line of carriage forgings made by this company.

Canedy-Otto Mfg. Co, Chicago Heights, Ill. Well illustrated catalogue of forges, blowers, drills, screw plates, etc.

P. H. & F. M. Roots Co, Connersville, Ind. Illustrated catalogues of their rotary positive pressure blowers and pumps.

Priestman & Co, 530 Bourse Bldg., Philadelphia, Pa. Catalogue of the Priestman Safety Oil Engine.

HONEST DEALINGS.

Before an advertisement is accepted, careful inquiry is made concerning the standing of the house signing it. Our readers are our friends and their interests will be protected. As a constant example of our good faith in American Blacksmith advertisers, we will make good to subscribers loss sustained from any who prove deliberate swindlers. We must be notified within a month of the transaction giving rise to complaint. This does not mean that we will concern ourselves with the settlement of petty misunderstandings between subscribers and advertisers, nor will we be responsible for the losses of honorable bankrupts.

WANTED AND FOR SALE.

Under this head will be inserted want and for sale advertisements, situations and help wanted, articles for sale, new or second-hand, and business opportunities. The uniform rate for this service is twenty-five cents a line. No insertions of less than two lines accepted. For sums less than One Dollar stamps will be taken, but amounts of One Dollar or over should be sent by P. O. Money Order or Express Order. All answers to advertisements received at this office will be carefully forwarded to their proper destination.

THE FARRIER'S FORGE.

Reproduction of a Famous Painting.

THE FARRIER'S FORGE.

AT large expense we have prepared especially for American Blacksmith patrons a handsome reproduction of Mr. George Morland's masterpiece, "The Farrier's Forge." The original is a famous oil painting, and our plates are made directly from an artist's proof engraving by Mr. Thomas G. Appleton. The size we furnish is 9 x 12 inches, and the printing is done on 100 lb. superior quality of paper, suitable for framing.

The original of this famous oil painting has been exhibited in the principal salons and art galleries of Europe and America, everywhere creating wide attention and appreciation. It stands very high among art critics, many of whom have pronounced it to be this painter's best work. A copy of our reproduction, of the size above stated, carefully and substantially rolled to protect it from damage, will be sent free to any person sending us one new yearly subscriber to The American Blacksmith. Remit by P. O. Money order, Express order, or New York Draft.

If you will send us a list of the names of blacksmiths whose subscription you intend trying to obtain, we will mail them in advance a sample copy of the paper for their examination. Let us have your assistance in extending the influence of The American Blacksmith. You can do your fellow craftsmen a real service by affording them the opportunity of becoming acquainted with the journal.

Another offer. If you will take the trouble to prepare carefully a complete list of the smiths, the wheelwrights and the carriage builders in your town, with their addresses, we will likewise send you a copy of the engraving as above. We want the name of everyone of these craftsmen which it is possible to get, no matter whether in business for themselves or employed in other shops, large or small. In other words, we want them all, the general blacksmith, the horseshoer, the machine blacksmith, the wheelwright and the ship smith.

The picture which you can thus obtain will be found a most artistic sample of the engraver's art, and one well worth possessing.

ADDRESS

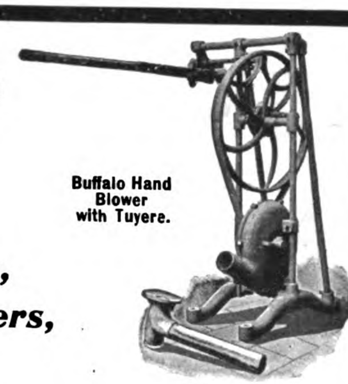
AMERICAN BLACKSMITH COMPANY,

P. O. DRAWER 974, BUFFALO, N. Y.

Buffalo Punch Shear and Bar Cutter.

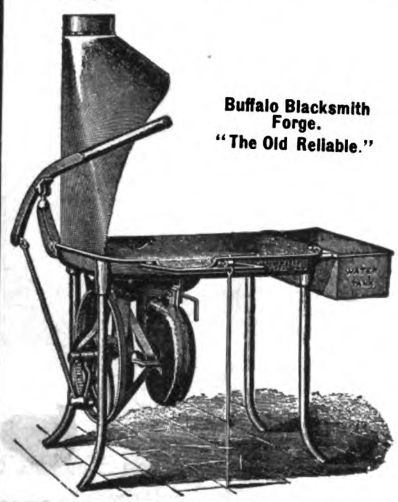
Buffalo Blacksmith Tools

"The World's Standard."



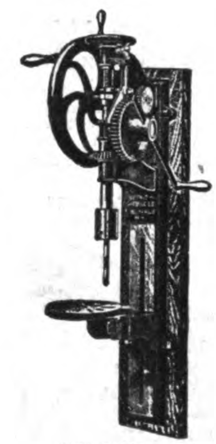
Buffalo Hand Blower with Tuyere.

Buffalo Portable Forges,
Buffalo Stationary Forges,
Buffalo Hand Blowers,
Buffalo Power Blowers,
Buffalo Blacksmith Drills,
Buffalo Punches, Shears and Bar Cutters.



Buffalo Blacksmith Forge. "The Old Reliable."

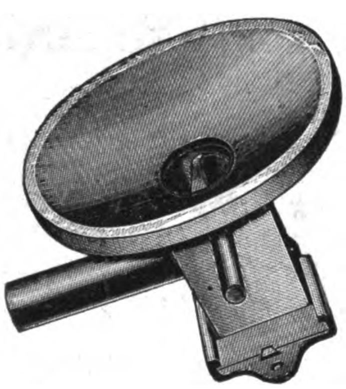
BUFFALO PORTABLE FORGES ARE KNOWN THE WORLD OVER.



Buffalo Drill with Automatic Feed.

Buffalo Forge Company

BUFFALO, N. Y.



Sutton Tuyere

This Tuyere is made of the best Dunbar pig metal, and has the fire bowl cast with it. The fire cannot spread and keeps clean and bright. It will pay for itself in the

SAVING OF COAL.

Send for descriptive circular and price.

ADDRESS

INDIANA FOUNDRY CO., Ltd., INDIANA, PA.

SAVES TIME, HORSE AND MONEY.

The Council Self-Cleaning, Perfect Lubricating Axle.

Manufactured in Pittsburg, Pa.

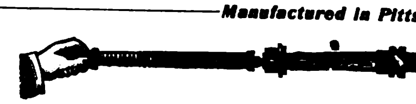


Illustration shows method of oiling axle. Takes but half a minute to grease four spindles, and you never have to remove wheel or nut. A child can do it. Makes oiling a pleasure and saves your spindles. Vehicles sell faster when equipped with this axle.
We want first-class agents in every county and state.

FOR PRICES AND INFORMATION, ADDRESS

B. F. KEITH CO., WILMINGTON, N. C.

WEIGHTS FROM 10 TO 800 LBS.

FIRST MADE IN AMERICA.

PATTERNS

Regular Blacksmith
Farriers'
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Plow Makers'
Double Horn
Saw Makers'
Instrument Makers'
Chain and Axe Makers'
Etc. Etc. Etc.

WE Make To Order ANVILS of any Special Dimensions or Shape.

Received Gold Medal, Highest Award for Anvils at Omaha Exposition, 1898.

THE CELEBRATED

HAY-BUDDEN Solid Wrought ANVILS

Every Genuine "Hay-Budden" Anvil is made of the best ***American Wrought Iron*** and faced with best ***Crucible Cast Steel.*** Every Genuine "Hay-Budden" Anvil is made by the latest improved methods.

FULLY WARRANTED.—We warrant all "Hay-Budden" Anvils to be sound, to be free from flaws, and to have faces hard and true, and will replace without extra cost, any that prove otherwise.

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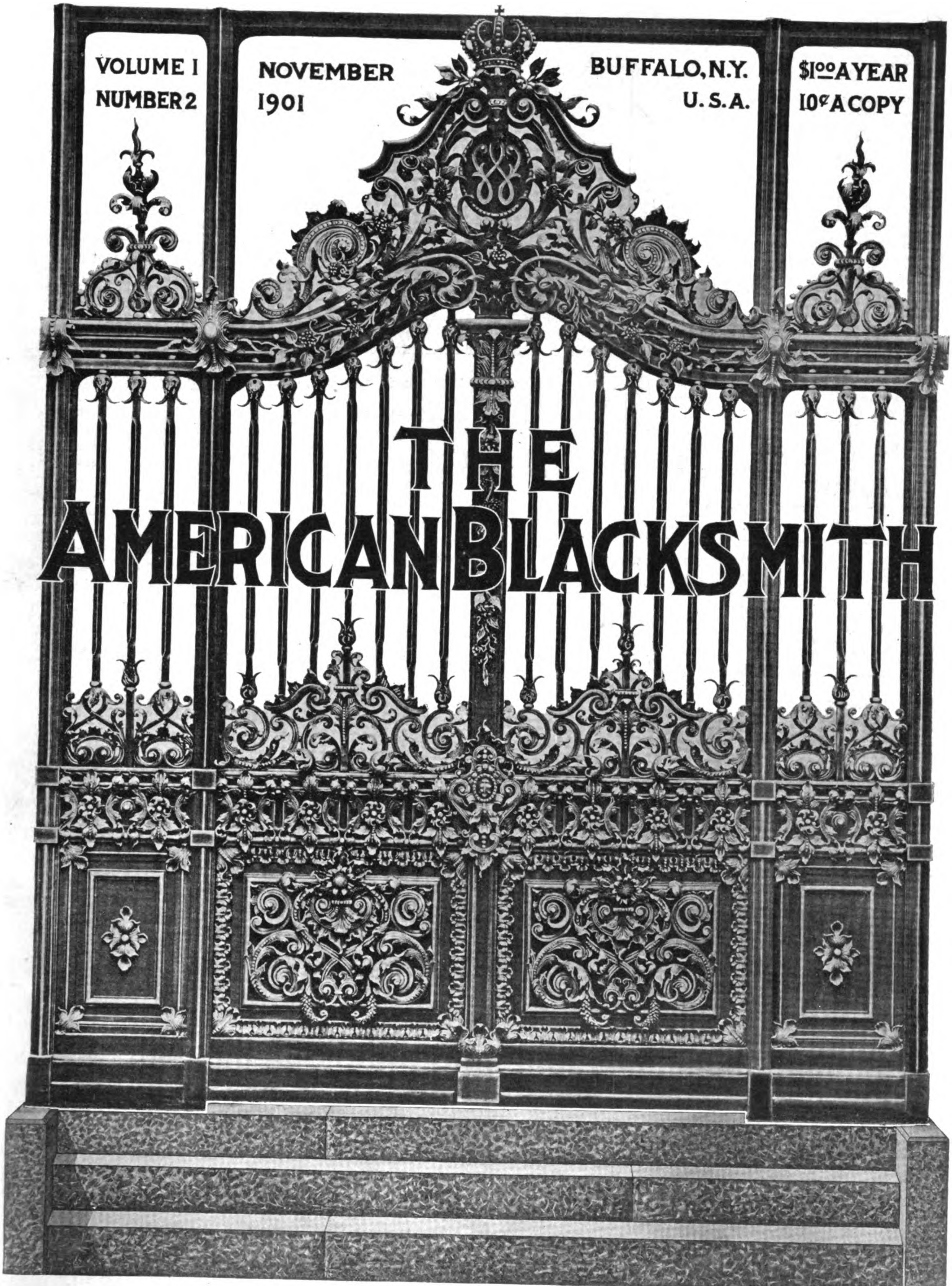
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NOVEMBER
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$1.00 A YEAR
10¢ A COPY
THE
AMERICAN BLACKSMITH

CONTENTS.

Horseshoeing, Repair Work, and Carriage Building.

PRIZE ARTICLE CONTESTS.

What Do You Know That Will Interest Our Readers?

IN order to stimulate interest among the great number of blacksmiths, wheelwrights and other artisans, whose experience and practical knowledge of many special points connected with their trade will enable them to contribute to our columns articles of no small value to their brother craftsmen, we have decided to offer a series of prizes for articles upon three different subjects as suggested below.

The prizes will be nine in number, distributed for articles upon three different subjects.

These will be "Blacksmith Repair Work," "Horseshoeing," and "Carriage or Wagon Building." For the first, second and third best contributions under each head we will award prizes of $15, $10, and $5 respectively. We have made the first of the three topics purposely broad, so as to admit blacksmiths of all classes without reference to the character of their work. In order to enter for these prizes, articles must not be less, we have decided, than two hundred and fifty words in length. They may deal with any phase of their subject and will be judged solely upon their merits, the principal factor determining the choice of the best article being its value to our readers. Wherever practicable, articles should be illustrated by photographs, blue prints, or rough pencil sketches, so as to render the reading matter clearer and more interesting.

The prize contest will be subject to certain conditions, as follows:

First. No person will be awarded more than one prize, though he may increase his chance of success by making as many contributions as desired, in any or all of the classes mentioned above.

Second. Contestants for these prizes must be subscribers to THE AMERICAN BLACKSMITH.

Third. We reserve the right to publish any articles thus submitted, awarding honorable mention to such of those contributors who may fail to secure a cash prize.

Contestants for any one of these prizes should bear in mind the essential point of making their matter interesting to the craft. This is best accomplished by relying upon personal experience, selecting as a subject some novel or valuable point which has come under their own observation. Write clearly upon one side of the paper only, and mark all articles in competition, "Prize Contest—Repair Work," "Prize Contest—Horseshoeing," "Prize Contest—Carriage Building," as the case may be. In order to insure impartial treatment at the hands of the judges, the article should be accompanied by a sealed envelope containing within the name and address of the contributor, and bearing on the outside some fictitious name, which is likewise to be signed to the article itself.

Our friends should remember that competition for these prizes does not require any practice or special faculty for writing, but that an article will be judged more by the real value of the matter which it contains than the language in which it is presented. Hence, if one has some good point to describe, he should feel no hesitation in writing about it, for it is our part of the work to put such matter into shape for publishing. The very best articles are those by the every-day smith or artisan, who tells of something that he has seen or done right in his own shop.

Address all communications to the Editor.

The American Blacksmith,

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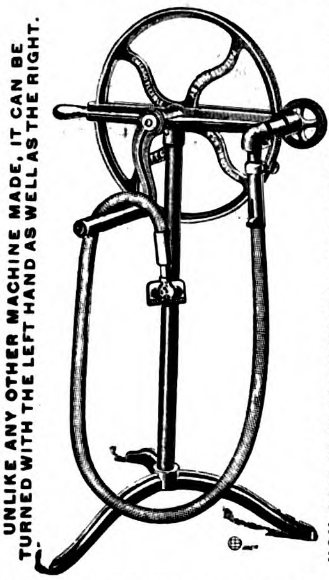

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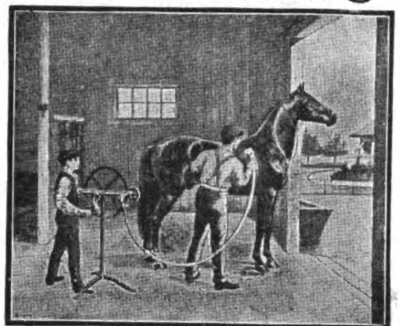

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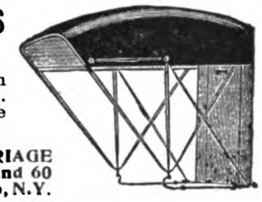

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BLACKSMITH WORK.

CUNNINGHAM, KAN., Sept. 13, 1901.

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HOMESTEAD, Iowa, June 24, 1901.

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CLAUS OTTE.

LADROA, IOWA, Oct. 22, 1901.

Gentlemen:—Your 2½ H. P. Engine is pulling an emery and buffer, a short jointer and a 12-inch rip saw, and it seems to have plenty of power to pull them all.

H. H. YORK.

AUBURN, MAINE, Oct. 16, 1901.

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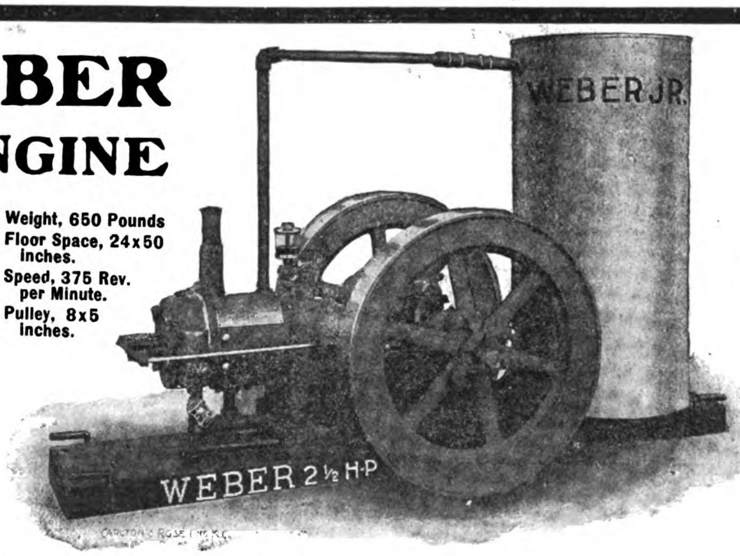

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THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

VOLUME 1 NOVEMBER, 1901 NUMBER 2

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Correspondence on all blacksmithing subjects solicited. Invariably give name and address, which will be omitted in publishing if desired. Address all business communications to the "American Blacksmith Company." Matter for reading columns may be addressed to the Editor. Send all mail to P. O. Drawer 974.

*Cable address, "*Blacksmith*," Buffalo. Lieber's Code used.*

A Great Exposition in Retrospect.

By the time this number reaches its readers, the Pan-American Exposition, of 1901, at Buffalo, N. Y., will have closed its gates, and taken its place among the records of the dawning century.

To attempt a comprehensive review of the Exposition, as has been aptly said, would mean to consider the history of the world in general and the development of this country in particular. All countries, all climes, all ages contributed to this transitory hoard, but as might be expected the achievements of this country in the last decade stood out most prominently. The great lesson of progress in science, industry and commerce was here easily to be learned, while to him who would contemplate art or humanity, the Exposition was not without its charms.

In many respects, it is to be regretted, the "Pan-American" was unfortunate. Weather was scarcely ever more unpropitious. The crowds, by every right expected, were destined never to be entertained, and financial stricture was inevitable. Finally came the lamentable tragedy, not only to mock and mar the very being of the City of Light in the midst of its homage to the Nation's Chief, but to overspread the whole land with deepest mourning.

In itself the "Pan-American" was a great fair in small compass. In scope and in general arrangement it was all and more than could be desired. Regarded as an exposition of Western Hemisphere civilization, the enterprise must be pronounced a great success. A few weak points might have been detected in the general scheme, it is true, where the "All-American" idea would seem to have been in a measure overlooked, but to the credit of all exhibitors it will undoubtedly redound. Almost every line of American industry was strongly represented, effective in quality of representation if not numerically.

"Expositions are the timekeepers of progress" said our late President. Since the pinnacles of the "White City" rose and fell, science has given us the Roentgen Ray and wireless telegraphy. Trans-oceanic telephony has but recently been made possible, and it would seem now as if the perfected long-distance telephone will before many years displace as a cumbersome mode of communication the once famed "lightning" telegraph. At the Buffalo Exposition was to be seen the first display of the new electric light, the Nernst lamp, doubly as efficient and superior in many other ways to the present incandescent lamp. A catalogue of the other though lesser wonders exhibited cannot be attempted here.

From the standpoint of art and architecture, the beautiful and the sublime, the Exposition was pre-eminently and grandly a success. Adornment played a prominent part in the scheme. Sculpture in profusion, gushing waters, picturesque bits of green, the harmony of coloring everywhere, the charming vistas here and grand ensembles there, these forbid adequate portrayal and require to be seen to be appreciated. And how frequently was voiced the regret that this fairy creation of mingled beauty and grandeur should be of so fleeting a nature! When in the deepening twilight of a summer's evening myriads of tiny sparks outlining every wall and tower gradually and mysteriously grew in brightness till the marvelous "City of Light" burst forth in all its soft brilliancy, then did inspiration stand close by our side. And what an object lesson when we recall that Niagara's mighty cataract a score or more miles away was impressed by man to furnish this surpassing radiance and under such complete control as to wax and wane at his command. Though conceived and executed upon a scale never before attempted in the history of electric lighting, the illumination was not the only attraction of the evening hours. The Exposition was an indulgent host, and few there were who could not at all times find something of fascination, be their temperament what it might. Many will be the pleasant recollections carried away, to outlast by far the scenes which gave them rise.

As to the ultimate result of the Pan-American Exposition, or of any Exposition for that matter, it would be hard to say. A bent toward closer commercial relations among all American nations, a broader knowledge on the part of the individuals, uplifted ideas for a few and much enjoyment for many, and its mission is accomplished.

Announcement of Special Contributions on New Topics.

Beginning with the initial number of The American Blacksmith, October, and continuing in the present issue, are four series of articles by eminent authorities upon subjects of trade interest. The second paper of Mr. E. C. Perrin's treatise on "Horseshoeing" here appears and future numbers will contain further installments of this comprehensive series. Mr. M. C. Hillick continues his treatment

ment of the subject of "Carriage Repainting" and succeeding issues will contain further topics of interest from the pen of this well-known contributor. The talks on "Wheels and Axles" written under the initials "D. W. M.' will continue in several numbers to come, and must continue to prove of more than passing interest to the trade, judging from our readers' comments. The veterinary column will continue to be ably cared for by Dr. E. M. Michener, V. M. D.

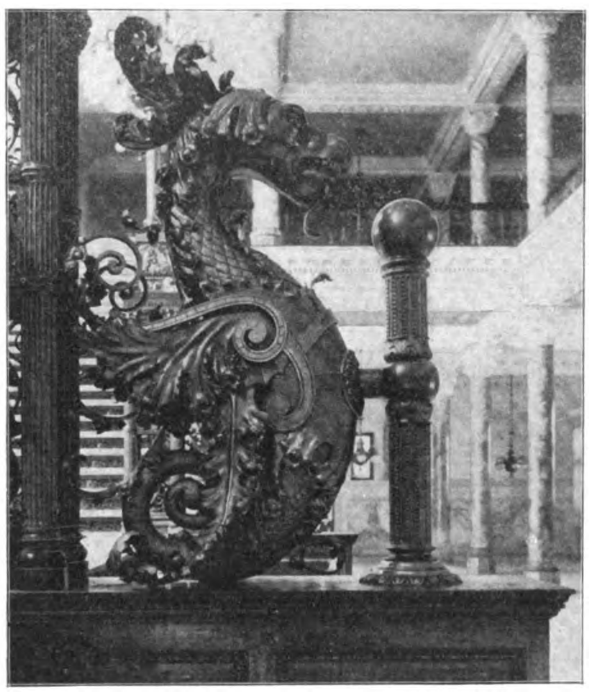
The Editors beg here to make announcement of two further series of articles which will undoubtedly be of absorbing interest to smiths of all kinds. The first, conducted by Mr. John L. Bacon, Instructor in Forge Practice at Lewis Institute, Chicago, is to consist, in the first place, of a series of monthly articles upon the fundamental principles of forging, the whys and wherefores of the blacksmith shop. As an indication of the scope of this series, it may be said that it will treat of such topics as the care and kinds of smith fires, hints on heating, calculation of stock, drawing, upsetting, forming, scarfing, welding, treatment of steels, the fundamentals of hardening and tempering, or in other words a detailed consideration of the various operations of the smith shop. As an additional feature, readers will be encouraged to ask questions upon any obscure points, and these questions with answers by the author will be printed if possible in the issue following the article giving rise to the question. Such a course should proove a novel and valuable addition to these columns.

The second series of articles, as mentioned, is to be written for The American Blacksmith by Mr. William C. Stimpson, Instructor in Forging at the Pratt Institute, of Brooklyn, N.Y. It will take up the subject of the elements of decorative design in forge work, and will lead from a consideration of the underlying principles of such work to examples of forging complete pieces of ornamental iron work. Illustrations showing the various steps will be presented. The subject of artistic wrought metal work is a broad and important one, and such a series as outlined above would be a valuable contribution to the literature of the trade, coming as it does from an expert in that line. A knowledge of the elements of such work is of value to every smith, almost without exception.

These two series are promised to start with the December issue.

Ornaments in Hammered Iron.

There is in this country a large and ever-growing field for ornamental iron work of diverse character. Many firms are making a specialty of hammered leaf and art iron work of all descriptions, including, among other things, elevator cages and enclosures, fences, balusters, gates, office railings, rood screens and decorative work for architectural uses. There is seemingly no limit to the uses for which work of this character may be appropriately put, subserving at once the artistic, architectural and constructional ends in view.



GROTESQUE ANIMAL IN HAMMERED IRON.

Engravings of some specimens of this class of work are shown herewith. The first figure is one of a pair of grotesque animals erected on the parapets of the grand staircase in the City and Municipal Buildings, Toronto, Canada. The body of the figure is of cast iron, and the balance executed in hammered iron. They were made by the ornamental iron department of the Canada Foundry Company, Limited, Toronto, Ontario, to whom we are indebted for the illustrations, and were from the designs of Architect E. J. Lennox, also the designer of the Municipal buildings themselves.

The larger engraving illustrates a grand stairway which is duplicated throughout these same buildings eighteen times. The structural work is of steel, and perforated risers support the marble treads, leading to landings finished in mosaic. The hand railing, about 700 feet in length in all, is made in hammered leaf work.

A Veteran's Views.

Editor of the American Blacksmith:

I am glad to see that our trade is to be better represented by the press. Now in order to make such an undertaking really useful to the class whose interests it represents, it will need the hearty co-operation of its patrons.

The trade today is not what it was twenty-five or thirty years ago, in many respects, that is. The blacksmiths of today are called on to do work which was unknown at that time and is of a nature that too often severely tests the ingenuity of the general blacksmith. The many different jobs brought to him require a variety of modern tools, the use of which enables the workman to turn out his work with greater neatness and accuracy. It also enables him to undertake work that could not be done with the old-fashioned tools. I will just mention a few indispensable tools, and to them can be added a great many more, though not every one is in a position to get them all at once. Every smith should have a good tire upsetter capable of upsetting wide tires, a set of solid die screw plates, a hack saw, a set of fluted reamers, an assortment of twist brace drills, a hand vise, an assortment of monkey and other wrenches, different files, a fair stock of bolts and rivets, several sizes of stove bolts, etcetera. In horseshoeing he will need a foot rest, a pair of hoof shears and a clincher. With these tools, in addition to the usual tools found in the blacksmith shop, many difficult jobs can be undertaken.

Right here let me say, never refuse to undertake a job if it can possibly be done. Your customer will not always believe you if you say this or that can't be done. He may take it to some rival smith who by making a special effort will soon gain the reputation of being the better mechanic. After an experience of forty years in the trade I think I know whereof I speak.

You should also try to learn to work and temper steel and to have some knowledge of brazing. That will serve you many times where welding is impracticable. Even a soldering iron and a knowledge of how to use it will be of much benefit in many cases.

The last point which I wish to bring out is that when you have done some difficult job, make it known through the columns of THE AMERICAN BLACKSMITH, and tell the way, you did it. It may be that some one knows a better way. You will find that there are some things to learn for all of us, and all will be benefited and enabled to do many things that would have otherwise proved puzzling.

VETERAN.

Elihu Burritt, "The Learned Blacksmith."

C. A. BLESSING.

Elihu Burritt, the youngest child in a family numbering ten children, was born on December 8th, 1810, in the old-fashioned village of New Britain, Connecticut. His father was a New England farmer-mechanic who, during the winter months and on rainy days, used the shoemaker's awl and hammer, and in summer with plow, hoe and sickle tilled the soil.

Little is known of the history of Elihu's early school days beyond the fact that they were few in numbers. As was the custom in those days, Elihu was brought up to know the trade of his father, and it was by this means that he was able to help support the family when his father died in 1828. When he was sixteen years old, he apprenticed himself to the village blacksmith of New Britain. He applied himself diligently and happily, and soon received a compensation of sixteen dollars per month and board. Here he labored for the next five years, saving most of the money he received, so that at the age of twenty-one he was able to attend the boarding school of his brother to repair the loss of a winter's schooling, lost in his sixteenth year because of the illness of his father. He was an apt pupil. with an earnest desire for learning, sharpened by the thought that the loss of a day at the anvil was the loss of a dollar. Mathematics was his favorite study. He was well prepared for the work he had undertaken, because he had used his time while blowing the bellows in solving problems in mental arithmetic. These problems, though simple at first, gradually became more difficult until he could solve the hardest problems while heating the iron in his massive old forge. Not allowing himself to make a mark with charcoal or chalk, he carried the results home to his brother to be verified. It was no doubt his success at this that induced him to give up three months' work at the age of twenty-one, to devote his time almost entirely to mathematics.

At the close of the term, he returned to the blacksmith shop, and struggled to do double labor, in order to make up the time lost in study. He now found it more convenient to pursue the study of different languages, for he was able to get a small Greek grammar in his hat when at work. His earnest manner soon caused his neighbor smiths to respect him and not laugh, as no doubt they did at first, when Elihu with his big, black, honest hand took the book from his hat while with the other he tugged at the bellows.

The work accomplished during this period of his life was very remarkable. He not only found time to do his work better, but he kept his forge and tools neater and in better order than the other men of the shop. A portion of each night he spent in study. His love for the languages gradually increased, until he resolved to risk another three months in study. He therefore went to New Haven, believing the very atmosphere around Yale College would assist him. The winter was spent in studying the languages, and he then returned to his old place at the forge.

HAMMERED IRON WORK, GRAND STAIRWAY, MUNICIPCAL BUILDING, TORONTO.

The change to close application to study from hard manual labor was followed by bad health, and at the wish of his relatives he decided to start in a new business in his native village. Unfortunately he set up a grocery and provision store just before the great commercial crisis of 1837, which swept the whole country. Burritt was involved in the general failure. I say this was unfortunate, and it was. Yet without this, the name of Elihu Burritt would not be known to history. He walked to Boston where he hoped to find employment at the forge. He failed. He then turned his steps to Worchester, where his every wish was gratified. He found employment at the forge and access to the large library of the Antiquarian Society. He now divided his time between the forge and library, but when business was slack at the forge he spent the greater part of the day at the library. The zeal with which he worked and pursued his studies while here can best be shown by his private diary. Let us see how he spent his time in 1837.

Monday, June 18th. Headache; 40 pages Eulbries Theory of the Earth; 64 pages French. 11 hours forging.

June 19th. 60 lines Hebrew; 30 pages French; 10 pages Eulbries Theory of the Earth; 8 lines of Syriac; 10 lines Danish; 10 of Bohemian; 9 lines Polish; 15 Names of Stars. 10 hours forging.

June 20th. 25 lines Hebrew; 8 of Syriac; 11 hours forging.

June 21st. 55 lines Hebrew; 8 of Syriac; 11 hours forging.

June 22d. Un-well; 12 hours forging.

June 23d. Lesson for Bible Class.

About this time people began to speak of him as "The Learned Blacksmith," and during the winter months of 1841 he was often invited to appear before the public to lecture. His lecture, "Application and Genius," urged that there was no such thing as genius, but that all attainments were the result of persistent will and application. The arguments he used were all from his own experience. He delivered his lectures about sixty times during this lecture season, and the next, and each summer returned to labor at the forge. Here he found time during the summer of 1842 to write a new lecture for the following winter. He was invited by the Babtist Society of Boston, to deliver an address in the famous Tremont Theatre, where the learned blacksmith made his first appearance on the stage of a theatre with a new lecture "Peace." Among those present in the large attendance were Worchester and Ladd. At the close of the lecture they expressed much satisfaction with the views presented and were glad to welcome a new and unexpected co-worker to their ranks. Burritt devoted himself to the cause of peace for the next thirty years, during which time he lectured throughout the United States and England. He was a member of the "Peace Congresses" that met at Brussels in Sept., 1848; at Paris in 1849; at Frankfort in Oct., 1850, and at Manchester in 1852.

After hearing one of his lectures, Nathaniel P. Rogers wrote thus: "He stood and delivered himself in a simplicity and earnestness of attitude and gesture belonging to his manly and now honored and distinguished trade. I admired the touch of rusticity in his accent, amid his truly splendid diction, which betokened, as well as the vein of solid sense that ran entirely through his speech, that he had not been educated at the college. I thought of plowman Burns, as I listened to blacksmith Burritt. Oh! what a dignity and beauty labor imparts to learning."

Many people thought Mr. Burritt endowed with special gifts, but he thus wrote of himself: "All that I have accomplished or expect or hope to accomplish has been, and will be, by that plodding, patient, persevering process of accretion which builds the ant-heap, particle by particle, thought by thought, fact by fact. If I was ever actuated by ambition its brightest, highest and warmest aspirations reached no further than the hope to set before the young men of my country an example in employing those invaluable fragments of time called 'Odd Moments.'"

An Enterprising Smith and a Curious Customer.

Editor American Blacksmith:

I have not much to say in regard to horseshoeing, but I have some very curious customers. One in particular does not agree with my theory of shoeing. He wanted me to shoe his horse, and pare the foot so that the frog would project below the shoe, and touch the ground. He claimed the horse should travel on the frog of the foot, as that was where the spring of the foot was, and he would not have a bar shoe on, either. He said the frog should touch the ground, but I would not shoe the horse that way for him, and so he left me for good, saying I did not know anything about shoeing. I have taken it for granted because he said so, and I will not say anything about shoeing.

I do not run a shoeing shop altogether. I do all kinds of repairing, and new work as well. I have an engine in my shop and with it run a band saw, a buzz-planer, a turning lathe and an emery wheel, a drill and a grindstone. I intend to put in more machinery in a short time. It is a good thing for any blacksmith to have a small engine in his shop. I would not be without it since I have found the value of it; it takes a great deal of the hard work off a man.

I am very glad to hear that you have started to publish another book for the good of the blacksmiths, for I think it a grand thing. I will take a dozen such journals if I can get them, for they are the finest thing ever printed in the interest of blacksmiths and wheelwrights.

W. D. Oliver.

This letter from a correspondent is interesting in that it displays a spirit on several points greatly to be commended. In the first place, we have here a smith who prefers to lose trade rather than shoe a horse in a way which he deems improper. Much suffering of horses from ill-shod feet could be avoided if shoers would refuse to allow the ideas of those unskilled in the art to prevail against their own better judgment as to how a shoe should be fitted. This fact Mr. Oliver evidently appreciated.

The next point of interest in the letter is the progressive spirit shown by this subscriber in fitting up his shop with power, and his intention "to put in more machinery in a short time." This example is well worth pondering upon.

Finally the correspondent takes a very broad view of the subject of blacksmithing literature, and it is needless to add that The American Blacksmith entirely coincides with his opinion. It is an encouraging sign of better conditions among the craft to hear such expressions. The journals for the smith cannot be too numerous, or rather, they cannot be too good. Few are the ways open for most mechanics to learn and increase their store of useful knowledge. A man may see new devices or improved processes, or a man may be told of them, but how seldom does the opportunity come for the general blacksmith in his daily routine, to go out of the narrow confines of his own shop or to converse with men of new ideas or advanced knowledge. How else then is he to enlarge his fund of information but by reading? In what easier way can one keep abreast of the times than by devoting his spare moments to reading from the live scientific and trade papers of the day? Such journals acquaint the progressive artisan with the best thoughts of the times, and enable him to profit by the interchange of opinions among men of ideas throughout his craft world, and that too without moving outside his own doors. He can in this way visit other shops, as it were, watch various ways of doing work, and even converse with other workmen, for The American Blacksmith will always encourage questions from readers upon any points in its columns.

The Editors.

Forge Shop Work at the Ohio State University.

CHAS. P. CROWE,
Of the Industrial Arts Department.

"The Cultured Mind."
"The Skillful Hand."

This motto is engraved over the door of Hayes Hall, on the university campus at Columbus.

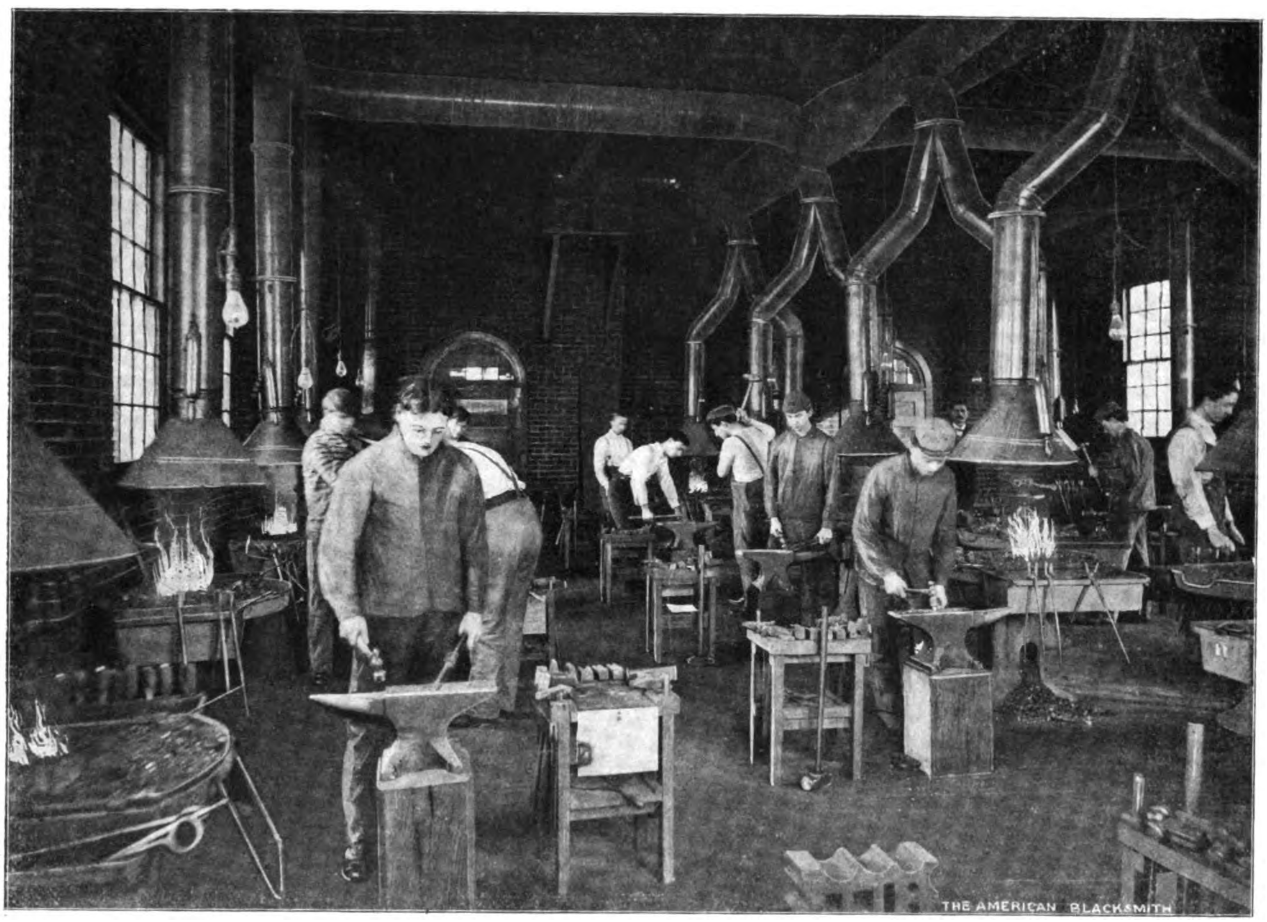
The building fronts the south, and bears the name of that honored Ohio statesman, Rutherford B. Hayes, who gave the last years of his life to the cause of education, and was one of the American pioneers in the cause of manual training and among the first to recognize its value to science and the industrial world.

In the forge room, a partial view of which is shown in the first engraving, and which occupies the northwest wing of the building, the young men in the engineering college of the Ohio State University spend three hours per day on stated days at the forge fires, teaching their hands to do what their brains direct, and as their skill increases under the instruction of a master, trained by experience in the trade which he has learned, the qualities of mind giving decision to the character are developed by the prompt action necessary to produce good work with hot metal. The accurate movements of mind and body required to make a good forging or successful weld, must aid in the training needed for good engineers.

The course of work, or number of pieces required is not such as would be given in a trade school, no attempt being made to make blacksmiths of the students, and though many secrets of the art are revealed, they are those pertaining to heating, bending, forging, hardening and tempering, without applying the articles produced to service, but with the aim of learning the fundamental laws and principles of industrial art.

The first lesson in the forge room is an examination of the forge; its parts are shown and their use explained to the student. He is then taught how to prepare and select the fuel, build and keep the fire in the way that will produce the best results. This is followed by general instructions on the use and care of the set of tools with which each forge is provided. The details and particular instruction concerning each tool being given when the work to be done requires its use.

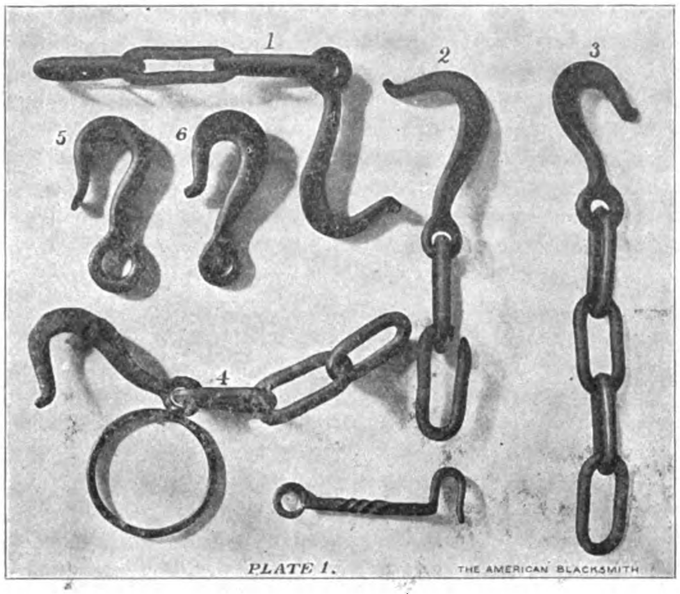
After several weeks spent on light and simple exercises, in which cutting, bending, breaking, up-setting and drawing, are practiced with the view to bring the stubborn metal to a form shown on a blue print, the student has formed original ideas as to the treatment necessary to bring the various grades of iron into shape, and has acquired sufficient skill with the hammer, that king of tools without which no form of industrial art could be begun, to undertake forging and turning the hook shown in Plate 1, No. 6.



FORGE SHOP INTERIOR, OHIO STATE UNIVERSITY.

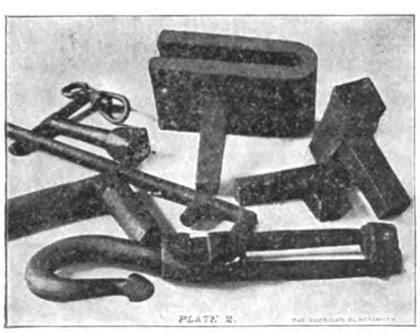
This is made of Norway iron ½ by ⅜, by 5 inches. The finished hook is 3½ inches long, from the centre of eye to the inside of bend; diameter of eye, ½ inch. Experienced men will see that when given a piece of iron the size mentioned, to be forged to the shape and dimensions given on the blue print, the learner has a problem to work for himself, even after seeing it done by the instructor.

Next, welding is learned by several practice pieces, and in this, shop-trained men are surprised at the quickness with which good results are obtained by the student, having his chemistry to teach him that the com-



FORGE SHOP WORK AT THE OHIO STATE UNIVERSITY.

bustion elements must unite in proper proportion to get the right heat, as well as having the teacher to tell him that the iron must be kept several inches above the tuyere with burning coal over it and under it. In this college interest is added by having each student test his hook and chain in the laboratory when studying the strength of materials. The results shown in Plate 1 were taken from the class work of the second term last year. No. 1 is a beautiful specimen, as the links were bent by the pull from a width



FORGE SHOP WORK AT THE OHIO STATE UNIVERSITY.

of $\frac{7}{8}$ inch between the sides to $\frac{5}{16}$ inch in the center, and so close a contact at the ends that their weight is supported horizontally, as shown by the attachment of the end link only. Plain signs of fracture may be seen at each end of every link. The rupture is at the end in the hook eye, and occurred with a load of 9,325 pounds. The hook straightened from the form shown at 6, to that which is represented with a load of 3,650 pounds. The No. 2 hook straightened at 5,300 pounds, the first link broke at 9,975 pounds, and the second at 10,050 pounds. No. 3 hook started to bend at 4,000 pounds, and a link broke at 4,300 pounds; with No. 4 the hook broke at a maximum load of 4,000 pounds, and the link with 5,200 pounds. It may be well to explain that in each case after the hooks started or were pulled to the forms represented the load was relaxed, and another attachment made to break the links, which are of $\frac{5}{8}$-inch round, common iron.

The breaking point of this iron, from an average of six $\frac{5}{8}$-inch test bars, was found to be 6,265 pounds, or about 62,000 pounds per square inch; the elongation was 22.9 per cent., elastic limit, 5,000 pounds.

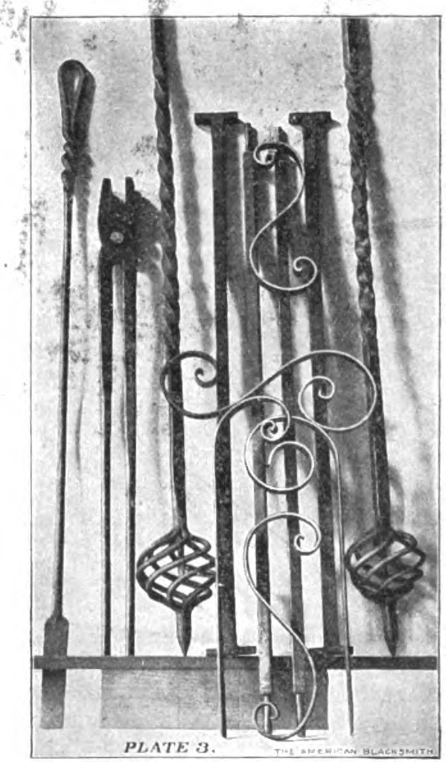
All students do not attempt such work as is shown in Plates 2 and 3, but are shown how it is done. Particular attention is called to the different ways of forging the two similar pieces on the right in Plate 2, the one beneath being of steel, split and drawn down to shape, while the one above it is built up of iron, welded to make the "T." The upper piece in this plate is of $\frac{3}{4}$ x 4 inches iron, with a 1-inch stem piece welded on.

It was made by three students, one of whom used the sledge, while another held the iron. The third brought the smaller piece from a second fire where the heat was taken, because the two pieces could not be simultaneously heated in one forge, and held the fuller, set hammer or flatter in position, or struck with the sledge, as was needed. Those who have accomplished such a job, can best understand the feelings of the boy when he has succeeded with this problem.

The work in Plate 3 was made by advanced students. The baskets and scrolls are handed down to the next class, and when enough of it is done, other classes will fit the pieces together in the form of screens, etc. This work is done from sketches without patterns, and is given to train the hand and eye to free-hand work.

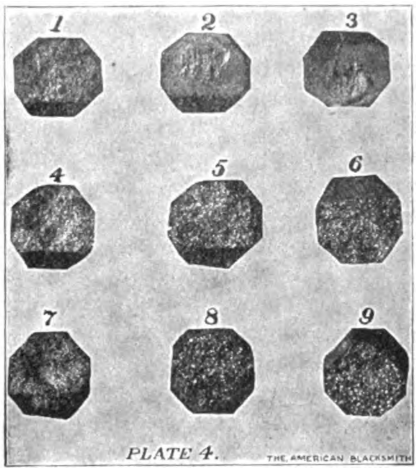
Plate 4 is a study on steel fractures; the camera has plainly reproduced the difference in the fineness of the grain caused by heat, but the appearance of the fractures with their fresh metallic lustre is much more impressive.

Each piece in the engraving is $\frac{5}{8}$-inch octagon steel, $\frac{3}{4}$ inch long. No. 1 was quenched when the other end of it first showed red in heating. No. 2 was low red. No. 3, clear red. No. 4, bright red. No. 5 was yellow, and the other end of No. 6 was scintillating at white heat, when the bar, which had been previously nicked, was plunged into cold water. The coarse grain, large crystals and brilliant lustre seen in Nos. 5 and 6, is not entirely absent in No. 4, but the fine strong grain and beautiful grey color of Nos. 2 and 3, is produced by slight difference in heat, which is scarcely apparent to the



FORGE SHOP WORK AT THE OHIO STATE UNIVERSITY.

unpracticed eye. No. 1 has a dark color and rather coarse grain, but lacks the large crystals and brilliancy of No. 4, which it resembles somewhat in the engraving. There is great difference too in the strength of the pieces, No. 6 being so weak that it is broken by a light blow, while No. 2 is stronger than No. 1. These changes are caused by such slight variations in temperature that the experienced man may sometimes be mistaken, and of course the heat required varies with the quality of the steel, being less in



FORGE SHOP WORK AT THE OHIO STATE UNIVERSITY.

high grade and more in low carbon steel.

Plate 4, Nos. 7, 8 and 9, show that time in heating affects the result. These pieces were heated quickly to a high heat, and quenched in cold water, and were consequently much stronger at the fracture than Nos. 5 and 6, and show a finer grain with less brilliant lustre in the centre.

These experiments with other illustrations and instructions prepare the young men for forging, hardening and tempering the set of lathe tools and chisels shown in Plate 5. These are made with blue prints to show the shape and kind of tools. Greater care is taken to give the class an understanding of the subject than to produce the temper required for a particular kind of tool. Those who understand it can get the proper temper at will, either by the color test or in a bath, or furnace maintained at the right temperature. Members of the craft will recognize a good piece of work at the top of this engraving. This heading tool, forged of iron, has a steel top laid on after taking the welding heat. The hole is drilled $\frac{19}{32}$ inch for making $\frac{9}{16}$-inch bolts, and the top is hardened. Beneath this in the picture are three rock drills, the bits, which are steel, welded into iron by the common practice of a V, or split iron, inserted steel, a borax heat and weld.

Such work is only given a class in the second term. After they have done the whole seventy-two hours work required in the first term in studying only first principles, and have reviewed them by further practice in the second term's work, they are able to "leave the first principles and go on unto perfection." If I may be allowed to adapt the language of Paul to the Hebrews, to this subject, "Be not carried about with divers and strange doctrines." There is no short cut to knowledge, and the nostrums and recipes for treating metals are useful only to those who know how to do good work.

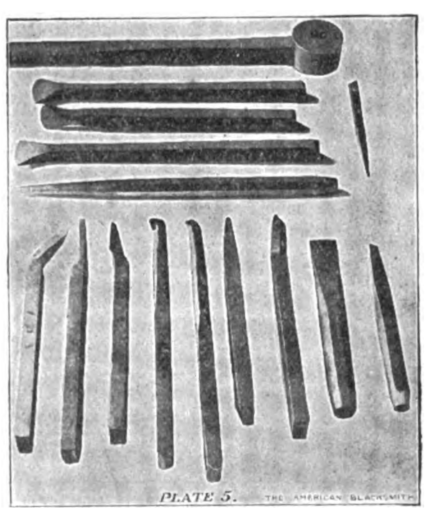
It has been said that the mastery of iron and steel working implies the ability to master the working of all metallurgical products. Therefore, men trained in schools like this may be relied on to meet the wants of the future.

The "Blacksmith"—Some Necessary Qualifications.

THOMAS PRENTICE.

It is a source of great pleasure to me personally, and I have no doubt will be to the craft generally to know that a new monthly journal is to be published, devoted to the interests of the American Blacksmith.

The term "Blacksmith" is wide in its range of meaning, and in order to afford a base upon which to build, we will divide the trade into five branches, as follows: First, the House Smith; second, the Horseshoer; third, the Ship Smith; fourth, the Locomotive Smith; and fifth, the General Smith. The



FORGE SHOP WORK AT THE OHIO STATE UNIVERSITY.

term House Smith, it may be well to state, takes in that class of men whose specialty is ornamental iron railings, fire escapes, and general iron work used in the building trade. It is true that each of the above are separate and distinct in themselves, and it is a fact that a first class horseshoer would make a very poor locomotive smith, and a first class ship smith would make a very poor house smith.

Some of the qualifications indispensable to a good blacksmith to-day are a general knowledge of metals, and a knowledge of blue prints, coupled with a fair amount of common sense and sound judgment. The knowledge of metals enables a blacksmith to determine at a glance whether he has a bar of iron, machinery steel, crucible steel, or self-hardening steel. I have come across men in my experience who could not tell the difference until it had gone through the fire, and in some cases have seen a blacksmith stand aghast to find that he had a bar of self-hardening steel in his fire, instead of crucible steel, wondering why it flew to pieces with a heat that crucible steel can be worked at. Such experiences are not only exasperating to the man, but annoying to his foreman. Men of that stamp require careful watching, not because they cannot do a good job, but because of their lack of the general knowledge referred to.

The age of templates and patterns for blacksmiths has long since passed away, and now in all branches of the business (with the exception of the horseshoer) blue prints or drawings are used. Hence the absolute necessity for men following this line of business is to acquaint themselves with this subject, a matter of the utmost importance to themselves and their employers.

It is true that blacksmiths are born not made, and I have found in all my experience the best men you could get or can get at the present time, are the men you train for your special work. There are men going around posing as blacksmiths who would not make an ordinarily good helper, and there are men who are employed as helpers, who, with a little encouragement, would make first-class blacksmiths. In locomotive work is this particularly true.

Shrinking Bands Without Cutting.

J. B. PATTERSON.

This is one of the things that has caused me no little trouble in my experience in the common repair smith shop, especially in banding hubs or any kind of work where small bands are required. Take for instance, the banding of a hub six inches in diameter. The first thing we do is to measure the exact amount of material necessary to make the band. Then we proceed to bend and weld; a good mechanic seldom misses. This generally leaves it small enough so that we can stretch it to the desired size after welding, but in case we get it too large, the only thing is to cut it and re-weld, as we can not upset it in the tire upsetter, on account of the band being too small for the machine. That would naturally be our conclusion, and I have done it many times. But that is not at all necessary, for there is a very quick and easy way to make the band smaller.

I went to work in a shop once, and after working a few days, the foreman of the shop started to line up some small cams. All went well for a while, but he stretched one a little too much, and it was too large. The material was machine steel about the same as steel tire, and about 8 or 10 inches in diameter by $1\frac{5}{16}$ inches in thickness. He had a good weld, and hence did not like to cut it and re-weld. He looked awhile at the band and then at me, and asked if I could make that band smaller without cutting it. I replied that it could be made smaller very easily without cutting. The foreman said he could not see how, because upsetting it would knock it out of shape, so that it would require some time to shape it again. I told him it was not necessary to hit it with the hammer or knock it out of shape in the least, and that surprised him all the more. I then told him how to do it as follows: Heat the band all around if not too large in diameter, or in case it is heat only eight or ten inches. (In the case referred to, the band was heated all around, for as remarked it was but 8 or 10 inches in diameter.) Take it to the water, and holding with a pair of tongs, dip into the water edgeways, just to the center of the band. Hold it there until the part out of the water is cold, as well as that in the water. Then take to the fire again, catching the band on the other side this time with the tongs, as it will be drawn crooked now. Heat and dip half way in the water a second time, and the band will be at least $\frac{1}{8}$ inch smaller, and drawn very little out of shape. My explanation is this: When the hot band is put into the water, the edge in the water cools off quickly and shrinks, drawing the other half with it, so that when the side or edge out of the water gets cold, the one side is smaller than the other. The operation must be performed the second time to get the other side small.

In this operation it should be noticed that you cannot put a band or piece of iron in the water without shrinking it a trifle. A band simply plunged in water will come out smaller than when it went in, as iron or steel plunged in water cools from the outside, shrinking the center in with it at the same time. I have shrunk collars and bushings this way, by simply plunging them in water when the diameter needed to be decreased just a little. This may seem like an idle tale to some smiths, but it is based upon natural laws, and is a fact that we cannot get away from. Give it a fair trial and you will be convinced, and when you make your next band too large, it will be no burden for you to make it smaller.

Locomotive Repair Work.

An Appliance for Handling Frames.

W. T. JAMES.

A foreman blacksmith in a locomotive repair shop is often confronted with

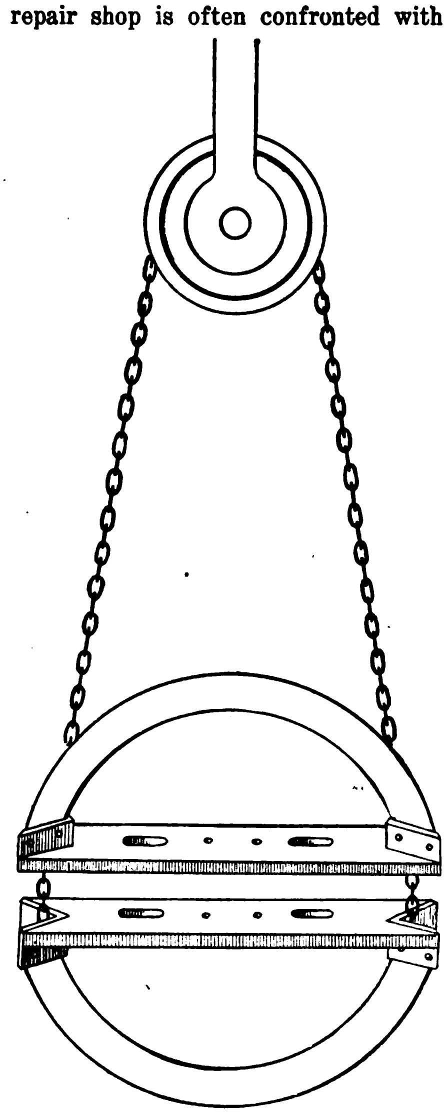


Fig. 1. APPLIANCE FOR HANDLING LOCOMOTIVE FRAMES.

the task of repairing broken frames. As these are quite unwieldy, his first thought will be how the broken frame may be most easily handled.

A very good device for this purpose is made of 3-inch angle iron, bent on its back so as to use the "V" of the angle iron as a guide for the chain of the crane, which is to support the weight of the frame. By this arrangement the chain will not slip off when the frame is turned upside down. We will suppose, to start with, that a wheel 36 inches in diameter will be large enough for any frame on the road. Always make the wheel large enough so that only one will be necessary. Cut two pieces, 3 by $\frac{3}{8}$-inch angle iron about 4 feet 6 inches long, and bend on the back to a radius of 18 inches, making both alike. Then take two bars of flat iron 1 inch by $3\frac{1}{2}$ inches, cut out a V-shaped piece at each end to match with the angle iron.

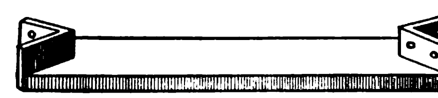


Fig. 2. PART OF LOCOMOTIVE FRAME APPLIANCE.

Four pieces of flat iron $\frac{5}{8}$ inch by $3\frac{1}{2}$ inches each, about 6 inches long, should next be bent in the middle to the proper angle, to fit the pieces just mentioned. Taking separate welding heats, attach one of the small plates to each end of the flat plates, when we will have two pieces such as shown in Fig. 2. Lay out two slot holes for 1-inch bolts, each slot to be $1\frac{1}{16}$ inch wide by $3\frac{1}{2}$ or 4 inches long, so that the wheel can be shifted to the heavy side of the frame to balance it when necessary.

The next step is to fit the curved angle iron to each bar, fastening it by four $\frac{1}{2}$-inch rivets. The angle iron is to be countersunk on the inside to receive these, so as to prevent the chain from getting caught. The thickness of the frame should be deducted from the diameter of the wheel so that when the latter is bolted to the frame, it will have the form of a perfect circle. Attention to this point will cause the device to work much easier. The completed form of this device is shown in Fig. 1.

These wheels have been made and used successfully at the Elizabethport Shops of the Central Railroad of New Jersey for fifteen years, and have been approved of by all blacksmiths who have used them.

An Instance of Equine Intelligence.

F. H. BUMP.

Some horses possess a degree of intelligence that is remarkable. A strange incident happened here recently, which causes me to make the above statement.

A horse which I have been shoeing for a number of years got a stone under one of his shoes, also a nail which had been driven into one of his hind hoofs projected so that the opposite ankle became cut and bruised.

The horse, upon being turned out in the pasture, came directly to our shop, took his place and held up his foot. I set the shoe but he would not leave until I had pulled out the offending nail. Then he trotted home apparently satisfied.

The Scientific Principles of Horseshoeing.—2.

Elementary Anatomy and Physiology of the Horse's Foot.

E. W. PERRIN.

In dealing with this subject, I would remind the reader that only elementary anatomy is necessary to the art of horseshoeing, and this article is written with a view to interest and instruct the average reader. Therefore those deeper studies involved in the subject together with those long, hard names so uninteresting, except to the veterinary surgeon, are left out. For the student who is sufficiently interested

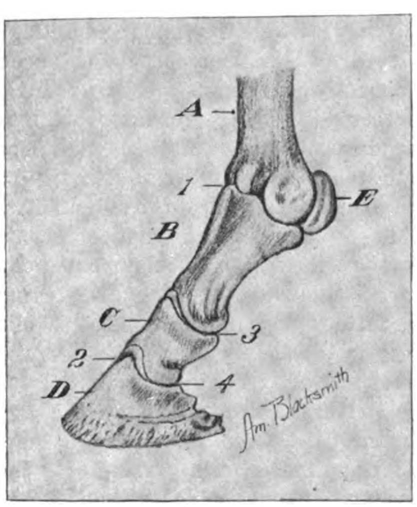


Fig. 2. BONES OF THE FOOT AND FETLOCK.

to delve deeper, the standard works of European and American authors are recommended.

We will first consider the bones as the frame-work, after which we will discuss the super-structure, consisting of ligaments and tendons, then the circulatory system, which supplies it with nutrition, then the nervous system which imparts to the whole animation and the power of motion, and finally the skin and hoof.

Fig. 2 shows the bones of the foot and fetlock, seven in number, the navicular bone, hidden in this cut, but shown in Fig. 3. In Fig. 2, A is the great metacarpal or cannon bone, the upper end of which unites with the knee joint, the lower end having two condyle surfaces, separated by a median ridge. B is the os suffraginis or long pastern bone, the upper articulatory surface of which has two glenoid cavities separated by a median groove, corresponding in shape to the lower end of the cannon bone. This it fits, to form with the two sesamoid bones E the articulation known as the fetlock joint, which is a true hinge joint. C, Fig. 2, is the os coronae or short pastern bone, the upper end of which has two glenoid cavities, corresponding in shape to the two condyles on the lower end of the os suffraginis. Into this it fits, forming the articulation, known as the pastern joint 3, which is also a true hinge. D is the os pedis, pedal, or coffin bone, the anterior and inferior portions of which are the same shape as the hoof and fit exactly into it. The eminence on its anterior superior aspect is known as the pyramidal process 2, to which is attached the tendon extensor pedis.

The articulatory surface of the os pedis together with the navicular bone, which is attached to it by osseous ligament, forms two glenoid cavities, into which the condyles on the lower end of the os coronae fit, forming the articulation known as the coffin or foot joint 4, Fig. 2, which is an imperfect hinge admitting of a little lateral movement. The bones are covered on the outside with a tough elastic membrane—the periosteum. The articulatory surfaces are covered with layers of elastic cartilage, which is smooth and glistening, and beautifully adapted to diminish concussion and prevent articular friction. Each articulation is enveloped by a capsular ligament, which is lined with a synovial membrane. This membrane secretes an oily fluid (synovia), which keeps the joints thoroughly lubricated, just as do the oil cups of machinery. The os pedis is very remarkable for its hardness, strength and porosity; it is filled with innumerable little holes which carry the numerous ramifications of arteries, veins and nerves.

The navicular bone F, Fig. 3, though very small, plays an important part in the economy of the foot. It serves as a pulley over which the great perforans tendon glides. From its deep-seated position, this little bone is almost inaccessible to treatment. It is of special interest, because prone to a

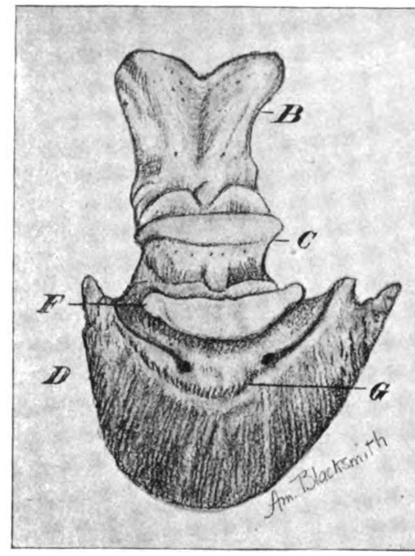


Fig. 3. POSTERIOR VIEW OF BONES OF FOOT.

disease which has baffled the skill of veterinarians for ages.

Ligaments may be defined as fibrous cords, or bands of various shape and size according to the location they occupy, and the functions they perform. Some are cord-like, some wide and flat, and so thin as to be semi-transparent. They possess great strength and some degree of elasticity. They are the stays and braces which bind the bony frame-work together. In Fig. 4, A is the superior sesamoideal, formerly known as the suspensory ligament of the fetlock, but it does not suspend or support the fetlock, except to a limited degree, as has been proved by that joint maintaining its normal position after this ligament was cut through. This ligament originates at the head of the cannon bone, between the two splint-bones, decending thence to the point Y, Fig. 6, where it bifurcates; descending further the branches are attached one to each sesamoid bone at the fetlock, from which point its branches extend obliquely downward and forward, inserting their ends in the os coronae and os suffraginis, and also mingling with the fibers of the extensor pedis.

There are three inferior sesamoid ligaments. D, Fig. 4, the median, the longest and strongest of the three, is attached at its upper end to the base of the sesamoid bones, and the lower e.. .s inserted in the fibro-cartilage on the posterior superior, or upper rear surface of the os coronae. The two lateral inferior sesamoid ligaments, E,

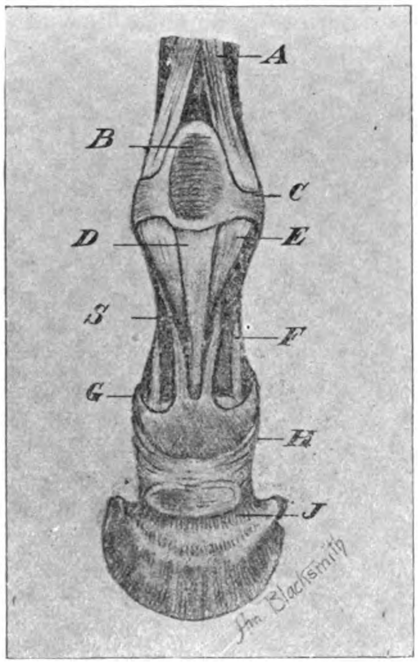


Fig. 4. POSTERIOR VIEW. TENDONS AND PLANTER CUSHION REMOVED.

Fig. 4, are attached to the base of the sesamoid bones at their upper end, their lower end being attached to the posterior inferior, or lower rear portion of the os suffraginis. There are also two deep inferior sesamoid ligaments located beneath the three just described, and attached also to the base of the sesamoids. They are about one and three-quarters inches long, crossing each other obliquely, and are inserted in the posterior superior portion of the os suffraginis, and serve to brace the sesamoids in position.

The lateral sesamoid ligament C, Fig. 4, is a broad, flat band, inserted into the edges of the fibro-cartilage on the surface of the sesamoids, whence it runs round the joint like a bandage, its fibers mingling with the extensor pedis on the front of the fetlock.

The intersesamoid ligament B, Fig. 4, is a mass of fibro-cartilage, which binds the two bones solidly together, presenting the smooth glistening surface upon which the flexor tendons glide. There are three pairs of coronary ligaments, the superior ligaments S, Fig. 4, the median ligaments F, and the inferior coronary ligaments G, all of them attached to the os coronae at their lower end, and to the os suffraginis at the other. They serve to brace and strengthen the pastern joint.

The lateral pedal ligament H, Fig. 4, is a thin flat band which is attached to the edges of the navicular bone, its fibers are lost on the lateral surface of the os coronae. The lateral ligaments of the fetlock are short and flat, one on each side of the joint. The upper end is attached to the metacarpal, and the lower to the os suffraginis (See L, Fig. 5). The lateral coronary ligaments are located one on each side, attaching the os coronae to the os pedis (See M, Fig. 5). The fibers of this ligament are also attached to the lateral cartilage which lays over it.

The suspensory ligament of the navicular bone, is attached to it on its upper border, thence it ascends obliquely running round the os coronae, having its ends inserted in the anterior inferior, or lower front surface of the os suffraginis.

The tendons will next be considered. There are no muscles beneath the knee and hock in the horse. Each tendon is attached to the bone it moves at the one end, and to its muscle at the other. What are tendons? They are white, cord-like sinews of great strength, and possessing great power of expansion and contraction, but though elastic, they cannot be stretched beyond their normal capacity without resulting in an accident, "a sprained tendon." Tendons vary in shape and

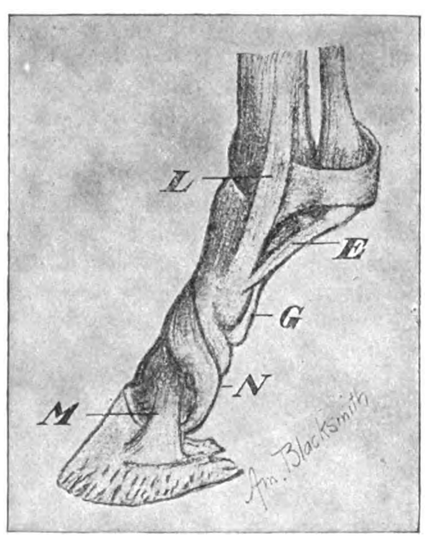


Fig. 5. SIDE VIEW, SHOWING INFERIOR LIGAMENTS.

length, according to their location and the functions they perform. They are composed of a multitude of fibers, bound together so as to form a strong rope, and when cut through at right angles to the direction of the fibers it greatly resembles a cable of fine wires.

There are two sets of tendons, flexors

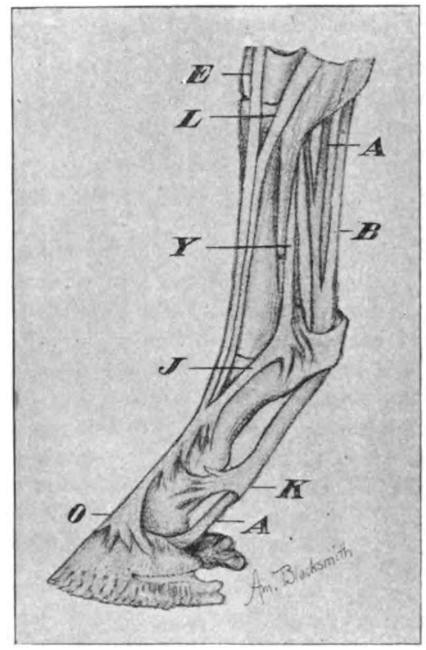


Fig. 6. SIDE VIEW SHOWING FLEXOR AND EXTENSOR TENDONS.

and extensors. The flexors, by far the most powerful, are situated behind the limb; their function is to flex or bend it. The extensors are located on the front and outside front of the leg, and as their name implies, they serve to extend it.

There are two flexor tendons, the perforans, A, Fig. 6, and the perforatus B. The flexor perforans, at its upper end, is attached to its muscle just above the knee, thence it decends, lying close to the perforatus, and about half way between the knee and fetlock it receives the metacarpal or check ligament which blends with it. A little further down the perforans drops into the sheath of the perforatus, and here both tendons begin to widen, till at the fetlock they are broad and flat, lying on the smooth surface formed by the inter-sesamoid ligament upon the sesamoid bones, B, Fig. 4. From the fetlock both tendons descend, one lying in the sheath of the other, to the lower end of the os suffraginis. Here the perforans drops through the perforatus, and from this point become wider and flatter, till, passing over the navicular, it is as wide as that bone is long, and passing over its smooth surface, it is finally inserted in the width of the semi luna crescent, G, Fig. 3. The perforatus is attached at its upper end to its muscle just above the knee, thence it decends the back of the leg, lying just beneath the skin, and passing over the fetlock, follows the outline of the leg to the point K, Fig. 6, where it terminates in two branches which attach themselves laterally to the long and short pastern bones. These flexor tendons, commonly known as the back sinews, are very prone to injury. When they are sound, the form and outline can be clearly seen through the skin.

There are two extensor tendons. The extensor pedis E, Fig. 6, is attached to its muscle above the knee. It is flat and thin, and descends the front of the leg; receiving on its way the fibers of the superior sesamoideal, and some of the inferior ligaments which blend with it. It is finally inserted in the pyramidal process O, Fig. 6. The extensor suffraginis L, Fig. 6, sometimes called the lateral extensor of the foot, is thin and flat. It runs over the outside front of the knee, and descending the leg its fibers blend with the extensor pedis, and is finally inserted in the anterior inferior surface of the os suffraginis.

(To be continued).

On Clicking or Over-Reaching.

J. W. LARSEN.

Probably one of the most annoying faults of a trotting horse is clicking. I had a horse come into my shop last week that had gone the rounds of all the shops. Every shoer had a little different idea about shoeing the horse, but instead of making the horse better he was getting worse.

When he was brought to me, he was shod with high heel calks and no toe calks in front, while on the hind feet he had a high toe calk and no heels. What was the result? In the first place, when the horse stood on the level floor, his legs were not in a line with the shoulders, but were drawn up under him. The last smith who shod him said he wanted to break his gait, and hence he was going to shorten his steps. I cured that horse at the first shoeing by simply putting a good heavy toe calk and low heels on the front shoes. On the hind feet, I put a very low toe calk, placing it back about half an inch on the shoe, and I also put a pretty good heel on. I fitted all the shoes out to a perfect line with the hoof and let the heel project out half an inch. The horse was started in a trot from the shop, was driven ten miles home, and never touched once.

My object in using a heavy toe calk in front was to put more weight on the toe, which produces a tendency to throw the foot more forward and lengthen the steps in front to get them away from the hind ones. Placing a low toe calk on the hind feet, set back from the edge, gives the foot a shorter motion than if it breaks over a long toe, and of course shortens the step of that foot.

By following this principle, I have had no difficulty with any horse. In very bad cases, I turn the toe calk on the hind shoe so as to carry the hind foot outside of the front, but I only do that on horses that are to be driven on the track, and are put to their best speed. Otherwise, I like to have them travel square.

Some Fundamental Shoeing Considerations.

J. W. LARSEN.

The first duty of a smith when a horse enters his shop to be shod, is to see how he stands on his feet. If he stands level and has carried his feet well without striking, it is an easy matter to shoe him again so he will go as well as before.

Have the helper remove the old shoes, then take your knife and clean out the hoof, cutting away all decayed matter from the sole of the foot so that it leaves a clean surface. Do not go in too deep, for in dry seasons this will dry up the foot too much, and it will crack. In wet weather it will make the foot so soft and tender that the horse can not travel without flinching when it strikes a rough or gravelly place. Hence only the dead tissues are to be cut away.

Next take your hoof shears and start at the inside heel and follow the sole with the shears, going just far enough down to get into sound horn. Be careful not to go too deep. At the quarter take the toe down as much as the heel, and then take your rasp and level the foot, keeping as nearly true to nature as you can. Next get your shoe ready, and here good judgment in selection is to be exercised. You must use a shoe that is able to support the horse without springing, for if a shoe gives on the foot it will cause lameness, and in weak quarters it will start a crack by pressing too hard on the heel.

In making the shoe, do not leave it too long; about three quarters of an inch beyond the heel is ample. Be sure you have your shoe perfectly level, fit it to the foot cold, then take a light heat on it and touch the foot with it, just enough to brown the hoof a little. Cool your shoe and in nailing on, start at the toe and work towards the heel. If the foot is a little contracted, start the nail close to the inside of the hole, and you can spread the hoof a quarter to half an inch at each shoeing, which is as much as any foot can stand. When you have the shoe nailed on, it should stick out about a thirty-second of an inch all around to give good protection. In driving the nails do not twist them off with the hammer, but bend them down and you will never have a torn apron or sore hand.

After driving all your nails, take your nail nippers and hold them under the bent nail, striking the head enough to tighten. With your nippers cut the nails close to the hoof. Using a fine rasp, remove a very little of the horn so as to make about a sixteenth of an inch of clinch with a good pair of clinchers.

A horse shod in this way will never go lame. No man can set a certain rule for shoeing, but my rule is to follow nature as nearly as possible, and I have had very good success. Every smith must use his own judgment in difficult cases, for what will cure one may injure another, especially when dealing with interfering. In most cases this can be cured with a level bearing by rasping off the part of the wall or hoof that strikes, but in bad cases the outside will sometimes have to be lowered. A horse that stands on a true level will hardly ever interfere. Set the hoof calk so that the horse will have a tendency to throw his foot out, and this will stop many cases of interfering.

Shoeing a Vicious Horse.

CHARLES RAPP.

Some time ago a man brought a large gray horse into my shop, which he had just bought, and said that he wanted it shod. It was a big, raw-boned, ugly horse, and weighed between fourteen and fifteen hundred pounds.

I put one of the men at work on him right away, and no trouble was had with the front feet. He had no sooner than got one of the hind feet off the floor, however, when the old horse drew his leg up, and then straightened it out with so much force that it sent the man half way across the shop. Thinking that by putting a twitch on his nose he would stand, I did so, but no sooner did the man get the foot up than he took another journey across the shop. I asked him to change places with me and hold the twitch, as I thought that he was afraid of the horse and so did not stick to him as well as he might. I used to think that I could hold any horse that ever lived if I only had a fair chance at him, but this one took that notion all out of me. I had just got his foot up nicely, when I got a lift that made my head spin. Well, I finally got up and looked at the horse and decided that we would not shoe him that way.

I have in my shop, a device called a side line for shoeing such horses. It consists of a half-inch rope about twenty-five feet long, and a strap one and a half inches wide and about nine or ten inches long, with a buckle and ring sewed to it. I take the end of the rope, put it around the neck of the horse and tie a knot that will not slip, having it so that the knot comes on the shoulder. The strap I buckle around the leg between the hoof and fetlock joint, so that the ring is in front. The other end of the rope I put through the ring, and then through the loop that is formed by the rope around the neck. You see by this that it makes a sort of a block and tackle between the horse's neck and hind leg.

That is the way I rigged this horse up. Then I put an inch rope around his neck and tied it so it would not slip, fastening it to a ring in the wall, which had an eye-bolt that went through the wall with a nut and washer on the outside. You can imagine that I thought I had him all safe, so I tightened up on the side line. When he felt his foot coming up from the floor and found that he could not kick, he did not take kindly to it at all, and the way he threw his fifteen hundred pounds on the rope that was around his neck was enough to scare anyone. I thought at first he would pull his neck off, then all at once the ring and eye-bolt pulled through the wall and made a hole about one foot by four inches. To say that he fell down does not express it at all; he simply tumbled in a heap. When he fell I slacked up on the side line and let him lay for a minute; then I touched him with the whip and made him get up.

He shook himself and looked as if he'd had most enough of it. I took the rope and put it through the hole in the wall where the eye-bolt pulled out, and tied a stout bar to it and then tightened up on the side line again. He gave just one good pull and then quit. We shod that foot and then put the rope on the other leg, and shod that one.

The next time he came in to be shod, I tried to do it without the side line, but it was of no use. Just about the time you would get hold of the foot, you would go on a journey across the shop, so I put on the side line and at the first pull he gave up, and we shod him without any trouble. He came a dozen or more times after that and all we would have to do was to put on the rope, and he would stand still as if he knew there was no use to kick against it.

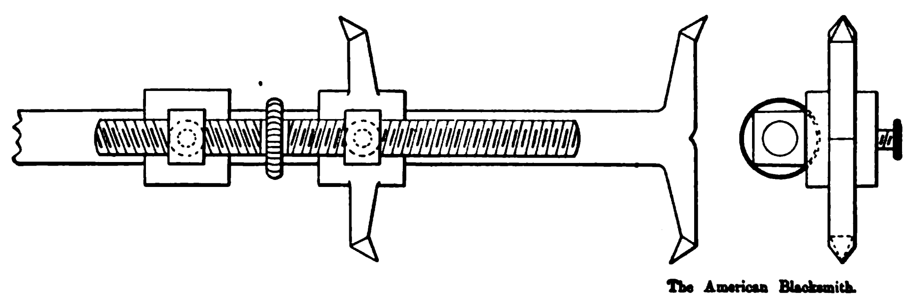
This side line is a very simple and inexpensive thing, and I do not think any horseshoer can afford to be without it.

Shop-Made Tools.

F. H. BUMP.

Blacksmith tools are now manufactured so extensively, that in many instances it is cheaper to buy them from the local hardware store, a large supply house or the manufacturer direct, than to make the tools by hand. But often a smith needs a peculiar kind of tool which he cannot get, either because it is too expensive or is not in stock. His only recourse then is to make it. Some smiths when they find themselves in this position, will say, "I can't." Every time a man says that, he takes a step backward and downward from the standard of manhood. Go to work and make something that will do the work even if it isn't a thing of beauty.

One day I wanted a pair of beam calipers and I made a very serviceable pair. I took a piece of $\frac{5}{8}$ by $\frac{5}{16}$-inch toe calk steel and forged a "T" on one end, one arm of the "T" having its outer side and the other its inner side practically at right angles to the bar, as shown by the illustration. Next I forged a movable jaw to correspond, which slides on the bar and is held in place by a thumb screw. This enables the device to be used as inside or outside calipers. The bar can be of any length, but be sure to make it plenty long enough. In order to make the tool complete, forge a projection on the side of the moving jaw $\frac{5}{8}$ by $\frac{5}{8}$, by $\frac{3}{8}$ inches. Now forge a second moving jaw without the arms, but with a similar projection on the side. Drill a $\frac{5}{16}$-inch hole through the middle of each projection parallel with the center of the bar, and tap one right and one left-handed with $\frac{3}{8}$-inch taps. Next put in a screw, threaded one half right-hand and one half left-hand with a knurl in the middle. This gives a quick adjustment and is fairly accurate. Trammel points can be bought in almost any style, and any odd-shaped points can be screwed in when made.



SHOP-MADE BEAM CALIPERS.—SIDE AND END VIEWS.

Wrenches of all shapes and sizes are an absolute necessity; ours are kept on a board in a convenient place, and range from a 24-inch monkey to a single ended wrench for $\frac{3}{16}$-inch tire bolts. Many of our single and double ended wrenches are made to fit the odd-sized nuts on various farm implements. For taking apart old wagons and sleighs and in fact all ancient relics, we invariably use the alligator as it fits everything and does not slip off like the monkey wrench and bark your knuckles. This accident is quite likely to happen with guard bolts. To remedy this we forged a double ended wrench 20 inches long and fitted it with teeth similar to an alligator, but more diagonally across, much smaller and cut in both jaws. This stays on the nut every time. On one make of machine is a $\frac{3}{4}$-inch bolt which must be drawn very tight, and which can only be accomplished from one direction, and with an 8-inch wrench. We forged a very heavy, single-ended wrench out of tool steel and drove it around with the sledge.

We find a 24-inch monkey wrench indispensable in the shop, especially in cases where many bolts are rusted tight, as there is purchase enough to start the nut or twist the bolt off, which is often just as well. We also have one with plain jaws on one side and pipe jaws on the other, which gives good satisfaction, as it is very heavy and has a long sleeve nut. The ordinary light monkey wrench, however, has no place in the shop.

One of the handiest tools in the shop is the jimmy. It is made of one-inch octagon steel, 3 feet long, one end drawn to a cold chisel and the other to a pair of claws like a nail hammer, but heavier. This will pull wire nails, spikes and bolts, even tire bolts which are driven through too small a hole and then upset on the end.

Where it is desired to pull anything together there is nothing handier than a one-inch turn-buckle with double grab hooks on each end, and two pieces of cable chain to fit the grab hooks. Where there is movement enough to require it, a chain hoist can be used to better advantage, but in many cases the turn-buckle is preferable.

The National Railroad Master Blacksmiths' Association.

Papers Read in Convention.

The Annual Convention of the National Railroad Master Blacksmiths held in Denver, August 20th to 23d, proved to be, as noted in our previous number, a very successful and enjoyable one. We regret that we are unable to publish all of the interesting papers and reports which were presented on that occasion, but take pleasure in reproducing below a number of them, as indicating the line of thought and investigation which is being pursued by that body.

Crank Pins and Piston Rods.

WILLIAM YOUNG,
Foreman Blacksmith, Wabash Railroad.

In making up crank pins, we have a separate bin for keeping our refined scrap iron, such as old main and side rods, rod straps, engine and crown bar bolts, etc. Anything that requires cleaning we throw in the rattler and clean it off. We put up our piles from 175 to 200 pounds, weld and draw into slabs, then cut and pile the second time. We put up piles of slab weighing from 1100 to 1200 each, take a welding heat, and weld piles with plain dies. In this way any impurities that may get in between the slabs are forced out. Rough down one-half of pile, take a welding heat on the other half, and rough down in same manner, then place back in furnace, put in rough swages, take a welding heat, and swage down to about three-quarters of an inch larger than forge size of collar. Heat and draw the other half the same way, take out the round swages, put in crank pin dies, take a light welding heat on end of bar, swage down until dies meet, cut off to length of wheel seat, and then it is ready for the lathe.

Our dies are bored out ½ inch larger than the finished size of the body of the pin, and forging them in dies of this kind keeps the forging nice and straight. By hammering down until the dies meet, it is not necessary to use callipers to know when they are down to proper size.

To have bars work free and easy in dies, have good fillets in journals and collars. Avoid all sharp edges and corners. In that way a very nice pin can be produced. We have been using nickel steel crank pins for several years, and they have given excellent satisfaction. They come to us forged and rough turned.

We make piston rods out of the very best hammered charcoal iron, which is ordered considerably larger than the forged size of the rod. We take a good welding heat, and draw down to proper size.

Have been using quite a number of steel piston rods lately, and they are giving good service. They also come to us ready forged and rough turned.

Contribution to Report on Manipulation of Tool Steel.

GEORGE LINDSEY.

Tool steel, or high carbon steel, should not be mistreated in any way. A great deal has been both said and written as to the best method of treatment in order to obtain ideal results, and in connection with this, some steel workers lay considerable stress on the color, which is merely nothing more than a film of oxide and bears in a measure no relation to the temper, for the reason that the various colors can be produced regardless of temper. I have not for years regarded the color test, but rather give special attention to the forging and quenching heats. If these two essential factors are lost sight of, all the fancies of mind and color go for naught. I want the best steel and very high in carbon. I want a slow regular heat, and when on the anvil it should be worked, not patted and pointed at. The steel should be evenly and properly heated throughout the mass. We all know this, but how many practice it? Knowing how it should be done and doing it as it should be done, are two different things. There is at all times that personal factor, "The man behind the gun." There is nothing infallible in this world but natural laws, which are God's laws; but if we follow the natural laws governing the principles of steel we will get good results. Man is only human and very prone to err in all human endeavors, and is constantly stubbing his toes against natural laws, and with results which cause disappointment in working steel as well as other things. As regards the color test, providing all other conditions are right, would recommend the following, taken from Hasewell:

430 degrees—very faint yellow.
450 degrees—pale straw.
470 degrees—full straw.
490 degrees—brown color.
510 degrees—brown with purple.
530 degrees—purple.
550 degrees—dark-blue.
560 degrees—full blue.
600 degrees—greyish blue varying on black.

Report of Committee on Flue Welding.

SUBMITTED BY J. H. HUGHES. APPROVED BY GEORGE JORDAN, CHAIRMAN

The substantial and economical welding of flues is one of the most important subjects connected with a railway shop, and deserves the most careful attention by all Master Blacksmiths, or those who are placed in charge of this class of work. I believe, as one of our members has previously stated that considerable money can be saved or thrown away for a railway company by the proper or improper management of this class of work, as the case may be; therefore, the subject under consideration may not receive too much care and attention from those concerned.

This subject was first brought before this convention at Chicago at its meeting of 1896, at which time the same was thoroughly discussed; more particularly the relative merits of the two classes of welding then most in use, viz: "butt welding" and "lap welding." The discussion was continued to the next meeting held in Chicago in 1897, where specimens of the butt and lap weld were introduced and a comprehensive paper read from the committee on flues. It was conclusively shown that practical tests proved the superior efficiency of the lap-welded flue, as compared with the butt weld. Since, therefore, it has been decided that the lap weld gives the most satisfactory and substantial results, I believe it is the aim and business of this committee here assembled to thoroughly discuss the modes and methods of this class of flue welding, and to ascertain or recommend the best and most economical manner of handling the flues through the several stages necessarily connected with this class of work, it being apparent that the cost of actually welding the flue is insignificant when compared with the preparatory process.

The different processes referred to may be separated under the several heads, viz:—cleaning, cutting, swaging, testing, the final cutting to proper lengths, and the annealing. At many places the foreman in charge is considerably handicapped for the necessary and convenient space for the purpose of getting the plant in as compact a shape as possible, at all times keeping in view the expense of unnecessarily handling the flues from one machine to the other. If the necessary space is not at hand and he finds himself compelled to set up a machine here and there, or at just any available place, it is apparent that the expense entering by reason of the unnecessary handling will be enlarged to a considerable item, as well as resulting in slow work. It is absolutely necessary that a flue welding plant be condensed as much as possible, if the cost is to be reduced to a minimum. For instance if the flues are cleaned by a rattler, a runaway should be made to the cutting off machine, which should be in close proximity to the welder. If a roller cleaner is used the same should be in such a position that when flues pass through the cleaner they could be immediately stored convenient to the cutting-off machine, so that they can be quickly placed at the command of the welder without unnecessary handling. The flue could also be swaged with the same heat, as when welded, and set back opposite the cutting-off machine, to be cut to the proper length and then placed convenient to the testing machine. The idea that I wish to convey is that the different machines and storage racks for flues should be so placed that they are always ready for the next process to which they are to be treated. When this particular item of the expense of flue welding is given due and proper consideration and at all times kept in sight, the expense of welding the flue proper will become secondary, and the results and amount of work thus obtained will be most gratifying. Thus it is clearly shown that the number of flues welded in a given length of time depends entirely on the facilities at hand, both as regards machinery and the relative position of each machine to the other.

With the construction of a proper heating furnace, the fuel for same could be either coke, gas or oil, in order that a number of flues may be undergoing the process of heating at one and the same time. Several patterns of welding machines are now in use, some of them welding by the process of rolling, while others use the trip hammer, either of which will do good work. However, I personally prefer and would recommend the rolling machine, since it is practically noiseless and has an attachment for scarfing. At the same time, however, the end of the flue may be scarfed by the cutting-off machine, where the trip hammer is used for welding.

Alloyed Tool Steel.

H. W. RUSHMER.

Man's achievements have been great, but still he is nothing but an imitator; how much he is indebted to nature no one knows; she will always continue to be the greatest of teachers, and of the many lessons she has taught us this is one.

Dr. Ohly has said, "The fact remains quite remarkable that the knowledge of the peculiar properties of an alloy of iron and nickel was first obtained by the study of meteorites. Their chemical composition and extraordinary hardness having been observed, the idea of imitating the product of nature lay near." This finally led to the process of alloying steel with many of the rarer metals.

These metals like chromium, nickel, vanadium, molybdenum, etc., which have nearly the same specific gravity and atomic weight as iron, have proved to give the most satisfactory results for most purposes. One exception to this rule is tungsten, which has a specific gravity and atomic weight that is more than double that of iron. Nearly all the alloyed tool steel contains a greater or less per cent. of it. In a test at the Watertown Arsenal a special tungsten steel to be used for small arms and containing 1.94 per cent. of tungsten, and .72 per cent. carbon, developed the following physical properties:—elastic limit 101,000 pounds per square inch, tensile strength 125,500 pounds per square inch, elongation 19 per cent., contraction of area 34 per cent. It is claimed that the steel commonly called Mushet steel contains about nine per cent. tungsten. It is the hardest and most difficult to work of all the alloyed steels. To-day we have tool steel alloyed in many proportions, which gives us many degrees of hardness, from the hardest, which no doubt is Mushet, down to the mildest, which is as easily worked as high carbon steel.

Mr. Metcalf claims that manganese is the metal that gives these steels their self-hardening properties, and that tungsten is a mordant that holds the carbon in solution and enables the steel to retain its hardness at comparatively high temperatures, and he proves it as follows:—"When a piece of carbon steel is pressed against a rapidly running emery wheel there is given off a shower of brilliant sparks which flash out in innumerable white, tiny stars of great beauty; it is accepted that this brilliancy is due to the explosive combustion of particles of carbon. When a steel containing as much as three per cent. of tungsten is pressed against the emery wheel the entire absence of these brilliant flashes is at once noticeable, and if there be an occasional little flash, it only serves to emphasize the absence of the myriads. Instead there is an emission of a comparatively small number of dull particles, and there is clinging to the wheel, closely, a heavy band of deep rich red color. This red streak is distinctive of the presence of tungsten." These operations are not only captivating to the eye, but they have a distinctive value as a guide to the tool dresser, for with every decrement of tungsten the width of the band is diminished until as little as 1 per cent. tungsten will show a fine red line intermingled with many white sparks. If the tool dresser has a new steel or a tool unmarked, brought to him he can tell to a nicety about what treatment to give it by this test.

These tool steels when fractured, show the finest grain that can be produced in steel, and are darker or grayer than high grade carbon steel.

A very large per cent. of the alloyed tool steel used in the past was an alloy of iron, carbon, tungsten and manganese, but recently some of the other metals are used with good results. One notable instance is the so-called Taylor-White steel, with patent specifications calling for a steel with the following percentages: Carbon, 1.85; Chromium, 2; Tungsten, 2.5; Manganese, .15; Silicon, .15; Phosphorus, .025; Sulphur, .03. At times Molybdenum is used instead of Tungsten, or both may be used.

The tools are given a high heat treatment, the temperature ranging from 1,725 to 2,000 degrees F. The tools are then cooled rapidly or slowly according to the hardness of the metal to be machined, or they are placed in a lead bath and when they have fallen to the same temperature as the bath they are taken out and are chilled quickly or slowly as desired. After this treatment the structure of the steel gives a non-silky appearance and is coarse grained, frequently interspersed with sparkling grains.

It is frequently remarked that it requires intelligence and skill to work high carbon tool steel, and some of those that work it with success fail to understand the principles of working the alloyed steels. When asked to dress tools made from this steel the atmosphere soon becomes burdened with their imprecations. The tool dresser should devote this time to studying the nature of his steel and the materials to be cut, so if one grade of steel is alloyed too high, and proves too hard, crumbling when put in service, let him try a grade that is a little milder, and with proper treatment his troubles will become less. The tool-dresser is not alone, for the steel-maker has his many trials in making these steels, which are hard to overcome; porosity, segregations, rents, ruptures, seams, and a tendency to split when drawn into bars, these as well as the difficulty of securing large quantities with the same degree of hardness or temper in each bar, are some instances. In some places the abuse of this steel is remarkable and if the steel-maker abused the steel in the same manner, he would not produce a perfect bar in a life time. He takes ample time to heat uniformly and thoroughly, and does not attempt to forge these ingots down to the finished bar in a couple of heatings as he would the carbon steel. So let us profit by his experience and use the blast sparingly, and heat uniformly and thoroughly, bearing in mind that quick and uneven heating is productive of strains. Heat the steel until it is perfectly plastic and malleable, and do all the forging between the range of a bright orange and orange color. It will be noticed that one of the peculiar properties of this steel is that it chills down much quicker than carbon steel.

In working the steel on the anvil it should be turned quite often, in fact whenever possible, for if it remains too long on one side it becomes chilled on that side, and if forged in this condition it will have a tendency to crack. If these conditions are carried on a little further, such as one part in a perfectly plastic condition and the other non-plastic, that part which is non-plastic will not draw as fast as the plastic part, and at the junction of these two conditions the particles or grains will slide over or cut past each other until the tension becomes sufficient to rupture.

The old-style diamond point tools are made by first drawing the points out nearly square, then they are placed on the corners and forged into a diamond shape. This is very bad practice with a steel of this kind, for they will almost invariably be split or worthless. Instead of this make the half diamond points, which can easily be done by drawing the points out square and then cutting the outside corners off with a sharp chisel, thereby leaving a stronger and better tool. When tools fail to hold their cutting edges, either by crumbling or breaking down, it would be well that we recall the past treatment, for possibly we have injured the quality of the steel by soaking it too long at a higher temperature than permissible, or by working it too cold, which would have a tendency to crush or shatter the steel, or perhaps it was spoiled by trimming too close with a dull chisel.

It is claimed by some that these steels can be heated to a high temperature and still retain their quality, but the reverse has been my experience, and even with careful treatment it will deteriorate rapidly, especially the higher tempers. A good hammering will partially restore the quality, for some of the best tools we ever had were forged out of old, worn out tools.

One of the difficulties for the steel makers to overcome is the tendency of the steel to split or rent after it has been forged a few times. Probably these little strains and rents take place in casting the ingot or in drawing it down into bars. These defects cannot be detected for a while, but will frequently make their appearance after the tools have been dressed a few times. Heating a few inches higher up than is required with the carbon steel, and holding it perfectly level on the anvil so as to reduce vibrations to a minimum, will, to some extent, prevent these strains from opening up. Again, for instance, we take the hardest steel and have a long tool; it is heated to the proper forging heat on the end, and near the center probably the temperature will be about 570 F., or as termed by some "the fatal blue;" it is placed unlevel on the anvil; a blow is struck with the sledge; a sudden vibration takes place which, if severe, will cause the tool to break instantly in that part which was heated to the blue. Upsetting the tool should be avoided by all means, and if persisted in will only result in failure. A marked improvement can be noticed in these tools where it is possible to give them a good hammer refining, providing the grain is not raised again in heating for hardening.

It is a false economy to use coal or coke that contains an excess of sulphur, for it is well known that iron or steel has an affinity for this deleterious element, and when steel is heated in this kind of fuel, the sulphur deposits itself between the molecules, which will prevent proper cohesion, resulting in weakness, and, at times, surface cracks. If the tool dresser is compelled to use sulphurous coal it can be counteracted a little by turning on the blast rather strong, and when the coal is all coked and fairly glowing, the blast can be turned off and a piece of iron laid in the fire, which will collect most of the sulphur, showing as a coat of white or yellow on the piece of iron. If necessary, repeat this operation until the fire is reasonably free from the deleterious element.

All alloyed steels can be annealed by packing in air-tight boxes or muffles, and then placing them in the furnace and maintaining an even temperature, of say about 1,200 F. for 24 hours, then permitting it to cool down slowly. One exception to this rule that I would make would be high manganese steel. Charcoal or any of the carbonaceous substances will answer for the packing material. Sometimes each individual piece of steel is wrapped up in asbestos and is packed in the box with layers of charcoal between them. After being annealed they show a much finer and velvety texture.

It is difficult to lay down any fixed rules for tempering these steels, as they vary so much in composition and temper. What would give the best results with one certain treatment would be a failure with the others. For instance, a very hard steel would give the desired hardness by being quenched in the blast, where a much milder steel would be soft and would have to be quenched in oil and water.

The very hardest steel, if not hard enough to cut the material, can be heated to a good orange color and quenched in the blast, and in the absence of this, oil can be used for the quenching. On those steels which are medium hard, the blast, oil, hot tin or lead can be employed. The tin or lead is just brought to the melting point and the tools are partly chilled in this and then taken out and placed in the oil or blast. The mildest steel cannot be quenched in the blast, and must be tempered in the oil and water. When tempered in the water they are heated carefully, the cutting points are dipped in the water, drawn to the straw color and then placed in the oil so as to prevent the temper from running. A good annealing will relieve many strains, and in some steels a good annealing will place the steel in such a condition that it can be tempered in water, which gives it great endurance.

Tire Setting.

J. G. HOLMSTROM.

Tire setting is one of the most important parts of the general blacksmith's business. First, because it is a class of work that requires care, and secondly, because a good part of the blacksmith's income is derived from this kind of work. I am not going to tell how tires are set by large manufacturers using modern machinery, but shall only give a few points to blacksmiths who are running repair shops.

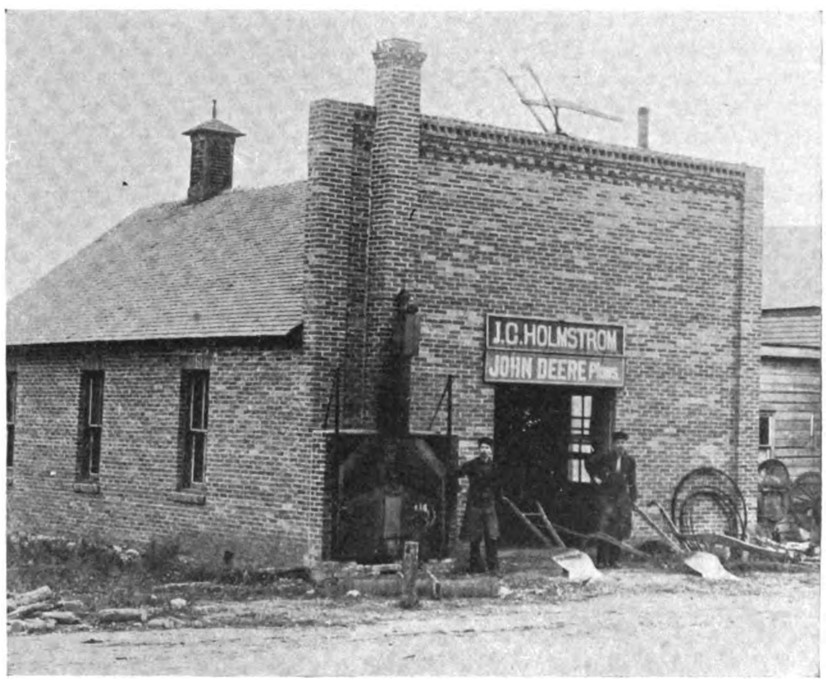


Fig. 1. SMITH SHOP WITH OUTSIDE TIRE HEATER.

In the first case, we will suppose that the old tires are worn out and new tires must be put on. First, remove the old tires and look the wheels over carefully to find out if the tenons are loose, or if the wheel is felloe-bound. If the tenons are loose, wedge them with short wooden wedges. If the wedges are short they will not run down through the felloe and split the spoke, as is the case when they are too long. When wedging be sure to fit the felloes snug against the shoulder of the tenon. In doing this you will notice that if the wheel is felloe-bound, the felloe cannot be fitted down on the shoulder until the felloes are cut off. The right opening between the ends of the felloes depends on the dish of the wheel; if the wheel has much dish the opening should be less than in a straight wheel.

Next place the wheel upon a plug inserted in the square hole of the anvil. This plug can be made of an old axle stub, and it will hold the wheel tight. Now measure the wheel with the gauge. Right here let me say something about gauges. Don't use a tire gauge with hands on it, because the hands will often be moved in placing the gauge among other tools, or you may drop it. You know one-sixteenth of an inch too much draw is enough to spoil a wheel. In measuring buggy wheels, run the wheel twice with the gauge; if the result is the same, enough, but if it differs run it again, so as to make no mistake. This precaution will pay. Now straighten the tire, bend in the bender, and place it in the tire holder, if you have one. It is essential that the tire should be held fast while measuring it, because different results are obtained in running a tire that is held solid and running a tire placed loose on the anvil. To obtain the correct measure the wheel and the tire should be held fast so that both can be run with the gauge at the same pressure.

The next operation is to cut the tire exactly the same size as the wheel and proceed to weld. Many smiths will scarf the ends of the tire and then rivet them together to hold them in position while welding. This is not necessary. Scarf the ends down and let them swell out as wide as they want. Then bend the tire so that the end placed on top will have a tendency to press down, after which fit the top end down snug, and hammer the swelled sides around over the edges of the under end, and they will hold together while being welded. When ready to weld, rest the tire over the edge of the anvil with the under end raised a little above the anvil. Let the tire down and strike the first blow above the under end. If this is not done, the under edge of the scarf will cool off before it is welded. When finished round the edges off. The draw in a buggy tire should be an eighth of an inch from the size of the wheel. Buggy tires can be heated in the blacksmith's fire before putting them on the wheels, but if you have many at a time and have no tire heater, a fire outside for that purpose is better.

Tire heaters are made in many styles, one of which is shown in the accompanying illustration, Fig. 1. This heater is made of brick, six feet square, with chimney above the building to insure a draft. The sliding door is easily raised by means of a chain, block and box full of scrap iron as a counterbalance. In the large door is a smaller door used to give easy access to the fire or to see if the tire is hot. Don't put a tire heater inside the shop, because the heat and smoke will smother you.

Wagon tires should be set the same as buggy tires, that is, the wheels should be looked over and set right, and the tire and wheel marked so that the tire will be returned to its original position. The draw should be from one-quarter to five-eighths of an inch, according to dish and size of wheel. In putting heavy wagon tires on, it is sometimes a little difficult to get the tire out of the fire and on the wheel. Therefore I insert a few hints on tools for this purpose. Fig. 2 shows a tool for taking the tire out of the fire. It can be made of an old buggy stub $1\frac{1}{8}$ inch square, and fastened to a wooden handle six feet long. The hand grip is made of $\frac{7}{8}$-inch half oval iron and bolted on. In lifting the tire out of the fire this grip will be a help to prevent the tire from tipping over. Next is a tool for stretching the tire out over the wheel. There are many kinds used, hence I will describe only two forms. The best consists of a wooden handle with a piece of flat iron bolted to it as shown, Fig. 3. Considerable power can be derived by making the handle 30 inches long. The hook will swing and make it fit any size. Smiths will easily understand the philosophy of the device from the cut. Another consists of a wooden handle $1\frac{3}{4}$ by $1\frac{3}{4}$ inches, having a piece of $\frac{5}{8}$-inch round iron, bent at right angles and bolted to it, as shown in Fig. 4. This tool can also be made entirely of iron by splitting off a piece of iron 2 by $\frac{3}{4}$ inches, and welding a rod of $\frac{7}{8}$-inch round iron to it for a handle.

In setting old buggy tires they should be shrunk equally on both sides. If they are not, the holes will not meet in the felloe and tire. Some smiths will take a centre punch and mark the tire, then measure the distance between the marks and shrink the tire. This is not the best way, however, because too much time is consumed in doing this on both sides of the tire, and if it is not done, new holes will have to be bored in the felloes. Besides, one measure will be on top of the other, and you may be one-sixteenth of an inch out of the way in each and spoil the job. The proper way to do this is to put the tire in the holder and run it with the gauge. I once had a man working for me who had been running a shop for himself for forty years. In

Fig. 2.

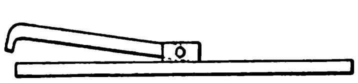


Fig. 3.

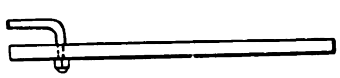


Fig. 4.

SIMPLE TOOLS FOR HANDLING TIRES.

setting the tire he would mark the tire with the centre punch, and proceeding on the supposition that the tire and the wheel were of the same size, would never measure the wheel. A tire of course may be the same size as the wheel, or it may be anything.

There are many kinds of tire coolers; with some it is necessary to immerse the whole wheel. I don't like the idea of soaking the wheel in water, and it is not necessary. A good tire cooler can be made as follows. Make a box five and one-half feet long, fourteen inches wide and twelve inches deep. Bolt a piece two by six inches by two and a half feet long on each side, with notches in it. After putting the tire on the wheel, run a rod through

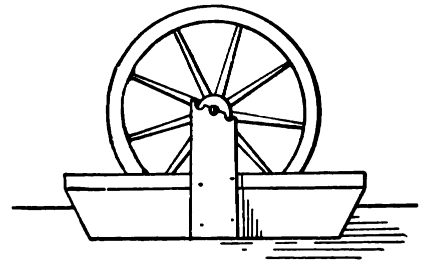


Fig. 5.

A CONVENIENT TIRE COOLER.

the hub and support the wheel on this rod as shown in the illustration, Fig. 5. By revolving the wheel swiftly, the water will cling to the tire all around.

In setting heavy wagon tires, it will often be necessary to drive the tire even with the felloes in cooling, because the felloes may be crooked. In such a case the tire cannot be evened up before it begins to cool off, and it is not well to wait until the tire is entirely cold, for it will then stick to the felloes so tightly that the same will split in mounting. This is especially true if the tire is worn to a wire edge. All this can be done while the wheel is on the hangers over the cooler. With this cooler as shown, I have set 600 tires in ten hours, having four helpers and three fires, with twelve tires in each fire.

A common tire will expand from two to three inches, or three-sixteenths of an inch to a foot. Steel tires will not expand quite as much. Thus it will be understood that light tires can be set with only a few heats in the forge. Heavy tires require a more uniform heat all around so that they will expand sufficiently, as they are very stiff and difficult to fit to the wheel.

N. R. M. B. A.—The official report of the ninth annual convention of the National Railroad Master Blacksmith's Association shows a total enrollment of 225 members, 201 of them active.

Shop Talks on Wheels and Axles.—2.

D. W. M.

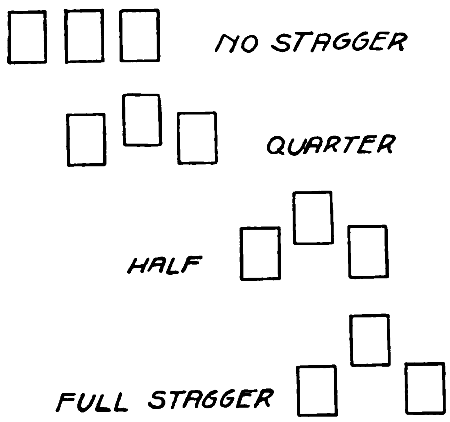
In full stagger for spokes, as explained in the preceding talk, the distance between the face of one spoke and the face of the next one to it, as set in the hub, is equal to the full width of the spoke. In half stagger there is only half that distance, and in quarter stagger one quarter that distance between the faces of adjacent spokes, as shown in Fig. 5. The half-stagger is now commonly used on wood hub wheels for light vehicles.

A wheel of one-inch tread, $1\frac{1}{8}$-inch spoke, half stagger and straight on the face, would have a real dish of $\frac{11}{32}$ inch. One half of the tread is $\frac{16}{32}$ inch, and one half of the total base bearing of the stagger at the hub is $\frac{9}{16} + \frac{9}{32} - \frac{27}{32}$ inch. Deducting $\frac{16}{32}$ inch leaves $\frac{11}{32}$ inch as the real amount of dish, as will be perceived from an examination of Fig. 6. The amount of dish should vary with the height of the wheel in order to have the front and hind wheels track. The real question involved is how to obtain a perpendicular line of support. Therefore, if the same dish were given to a high wheel as a low wheel, the plane of the face of the wheel being perpendicular to the center line of the axle, it would make it impossible for both wheels to have a perpendicular line for the bottom spoke. One of them would be wrong if the other were right. Suppose the wheel on which we have already calculated the dish to be 4 feet high; then a wheel 3 feet high, made to match it in every other way, and to be used as a front wheel, should have only three-fourths the amount of dish given the hind wheel. This can be very easily demonstrated by geometry and will not be discussed further here.

Having wheels made with the correct dish in them, the axles may be made the same length front and back, measuring between the shoulders, if the length of the arms are the same. But in some vehicles the front axles are not so heavy as the hind axles, and the hubs not so large in diameter, and in order to maintain an agreeable proportion, the front hub is shorter than that in the rear wheel, and so is the axle arm. In such a case calculation must be made from the center of the tread, or the perpendicular line of support.

We are aware that in many shops the front and rear wheels are made with the same dish, and the front axle is shortened enough to make them track, but this is faulty work and not scientifically correct.

Again, we are aware that many axle arms have no taper, and the dish of the wheels is an arbitrary matter in common practice, so that when the



The American Blacksmith.

Fig. 5. SPOKE ARRANGEMENTS FOR DIFFERING STAGGER.

vehicles run there is more wear against the collar than otherwise. Such axles, however, are made with broad collar bearings and but small bearing on the axle arm. This seems to be the prevailing method at present, limiting the amount of frictional surface to a small bearing at the front and back and at the collar. In this case the bottom of the axle arm does not lie horizontally but dips at the point. The great majority of wholesale work is produced without anything more than guess work to get it "about right"—yet having established gauges and conscientious workmen and inspectors, there is no reason why it should not be accurate.

We have often seen wagon skeins put on so that the wheels crowded against the axle nuts. A little mechanical knowledge would have prevented that and made an easy running wagon. It is a common thing also to see the skein on an old wagon worn on the top at the back end, and on the bottom at the front or point end. This is because a perpendicular line of support for the spokes was not obtained. The great amount of taper on wagon skeins makes it difficult to get sufficient dish on the wheels to accomplish that end, and they are frequently set with the face of the spokes plumb, not the center of the spoke bearing. To correct this in a measure, as stated in the preceding paper, the wheelmaker sets the spokes back of the center the distance between shoulder and nut. But this does not correct the fault.

There is a freedom of lateral motion required on heavy work, as farm wagons, busses, trucks and coaches, so that a close fitting taper axle is not preferable. If the wheels are held too rigidly they are not permitted to adjust themselves to ruts or small impediments and are unduly strained. Hence on such work some latitude must be allowed.

On the Collinge axle, the sides of the arm of which are parallel, this lateral motion is permitted and yet a close fitting axle can be used. To further facilitate its use and maintain a high degree of perfection, spiral spring washers have been inserted at both ends of the box, which by their spring allow a limited amount of lateral motion sufficient for practical purposes on coaches and fine heavy work, but we are not aware that anything of the kind has ever been used on the rougher sorts of vehicles, such as farm wagons, etc. It is apparent, however, that in order to maintain this freedom of lateral motion, the bottoms of the axle arms should lie horizontally. Yet by various devices many manufacturers avoid this and think they have minimized the difficulty and obtained an easy running vehicle.

(To be continued.)

Carriage Repainting.—2.

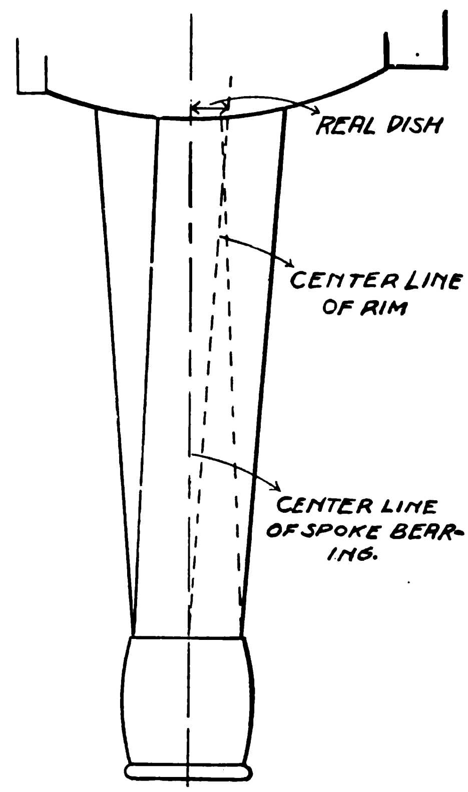
The Burned-Off Job.

M. C. HILLICK.

Of the various classes of repainting, none is perhaps more satisfactory from a purely mechanical point of view than that of burning off the old paint and beginning at the wood. From this beginning the painter knows just where he is. He becomes familiar with the composition of the paint structure from first to last. He goes forward with greater confidence, and is able to speak with more assurance to the owner of the vehicle. In a word, he speaks from a knowledge acquired behind the scenes.

A chief necessity in burning off a paint surface is a burning torch or lamp that is safe, simple in construction, easily handled, and capable of emitting a powerful burning heat. There are numerous makes of such lamps, and the painter engaged in business cannot well do without one. The rapid methods of carriage painting practiced nowadays necessitates a large proportion of burning off, as compared to the amount of painting performed, and this brings the burner into active use.

As regards care of the burning lamp, the latter should be kept clean in all its parts. The flues and mechanism must, to insure proper working of the lamp, be kept clear of all gummy substances. This will necessitate emptying the reservoir of the lamp at the time of turning off the flame. The unused fluid emits a vapor that will presently deposit in the flues a sticky, resinous film, fatal to good results. The clogged-up lamp has, in some instances, proved fatal to human life also. A number of accidents with the burning lamp have come under the direct personal knowledge of the writer, and, without an exception, they have been due to neglect of the simplest rules of prudence. Keep the lamp in a clean apartment, maintain it bright and clear, inside and out, and immunity from danger is assured. In addition to the burning lamp the equipment should comprise a narrow and a broad putty knife, and a common harvesting mitten, with a wrist and half-arm attachment. A leather apron



The American Blacksmith.

Fig. 6. OUTLINE ILLUSTRATING DISH OF WHEELS.

extending from the knees well up to the workman's chest belongs to the burning-off kit.

To a certain extent the term "burning off" is misleading. The actual and literal burning off of the paint would mean more or less scorching and charring of the wood, a condition that is to be avoided. In paint burning, simply direct the flame upon the surface long enough to soften up the old paint. Hold the knife in the right hand, and as the paint softens push it firmly and carefully under the soft pigment. Begin burning at the right-hand side of the panel, and as the knife becomes loaded with the soft pigment, it can be emptied to the right and across the unburned surface. Thus the hot mass of paint is kept free from the bare wood surface. The job burned properly is in a fair way to be painted properly. Bear in mind that the chief danger to the wood in burning off comes from too much burning. If the surface during the process of burning gets charred, and in sandpapering these charred places are only partially cleaned away, there remains a spongy surface to plague the painter. The aim of the workman, then, should be to remove the old paint without in any wise disturbing the texture of the wood.

Second only to the actual operation of burning off the paint belongs the work of sandpapering and cleaning up the burned-off surface, to receive the lead coat. All charred places require scraping out until the live wood, full of vitality, is reached. Every vestige of the old paint should come off. The clean live wood is needed as a foot-hold for the paint coats. When the surface is vital in every part it amounts practically to new stock all over, and when this condition is present an old surface will hold and bear out the paint structure fully as well as a new surface.

Surfaces that, when new, were coated with liquid primers need more sandpapering as a rule than surfaces coated with the time-honored oil and lead mixture. Liquid primers and wood fillers strike in the pores of the wood and dry very hard. It requires extra labor in sandpapering to strip a surface of this kind to the grain and pores of the wood sufficiently to insure a hard and fast clinch of the surfacing coats. If possible, sandpaper across the grain of the wood. The paper cuts faster, and the pores of the wood are more fully opened and made receptive to the lead coats. It has been questioned whether it is possible in burning off a badly cracked and fissured surface to so obliterate the imprint of the fissures, so that when coated up and newly finished these tracings may not reappear.

Railway car painters complain of the return, in tracery and outline, of the old checks and fissures which belonged to the burned off paint surface, the inference being that tracings are seared into the wood fabric from the old fissures, and when the new paint and varnish structure is completed, the fissure outlines reassert themselves. The close, hard sandpapering that gets down to the wood full and strong will remedy this difficulty. It will strip away the wood fabric and the old fissure scars effectually. When this is accomplished, the new surface may be depended upon to portray no earmarks of the old surface disfigurements. The sandpapering having been completed, the next step is to apply the primer, or, as most painters term it, the first lead coat.

Time was when an excess of oil was fairly deemed an impossibility in vehicle painting. To-day, under the conditions which prevail, a minimum of oil is preferred. The conclusions of the best trade practice affirm in favor of the coat that dries quick and hard rather than the one that dries slower, with an elasticity that, under the abbreviated allotment of time, is to a considerable degree uncertain. A coat of pigment may be made elastic with oil to a dangerous extent, without revealing the danger element in drying. To all appearances the coat has passed to a perfectly dry state, and in this condition it is recoated. The imperfectly dried percentage of oil remains passive, like the slumbering volcano, until the vehicle comes under the intense heat of the sun, when lo! blisters break forth and the surface is ruined. This so-called deviltry, often ascribed to the varnish coats, is comparatively common, and more often than not has its origin in these oil-deluged under-coats. The lead coat to use over the burned-off surface had best be mixed, for the ordinary run of work, in the proportion of one-fourth pure, raw linseed oil to three-fourths turpentine, with one-half a gill of good coach japan to one quart of the mixture. Use a first-class white keg lead and sadden out to a light slate color with lamp-black. Beat the lamp-black well into the lead before thinning up to a brushing consistency. This prevents the black from lumping up. For work that has an unusually extended time in which to be finished, three-eighths oil to five-eighths turpentine can be used. Apply this lead with an oval bristle brush, and brush out smooth and uniform. For a strictly high-class job, a second lead coat is next in order, after giving the first due time to dry. Mix this lead with only sufficient oil to constitute a reliable binder for the pigment. This will be one-half a gill of oil to one quart of turpentine, with coach japan in half quantity to the oil, lead and lamp-black as before. Make this coat, like the first one, to brush out free from brush marks and to flatten down nicely.

When this coat has dried adequately, which it should do in forty-eight hours, under good drying conditions, puttying is in order. Mix putty of dry white lead and enough drop black to give it a lead color, with equal parts of medium-drying rubbing varnish and coach japan as the liquid ingredients. This is only one of many formulas which might be given, but this is the putty of our forefathers, and it remains good enough for us and for those who are to follow. It dries quickly and hard, and gives satisfactory surface results.

We have now brought the work up to a point in the process of painting where it may properly be carried forward in company with the other classes of vehicle body painting. Extended space has been devoted to the burning off and cleaning up of the surface, the writer deeming this branch of work of the highest importance in the repainting business. "Burning off" has become an extensive practice. Hence the need of knowing how to do this work properly, safely and economically. The surface skillfully burned off, and cleaned up, and leaded, has a splendid start toward a finish that should please the populace. A subsequent chapter will describe how that finish may be accomplished.

An Axle-Setting Kink.

E. C. JOHNSON.

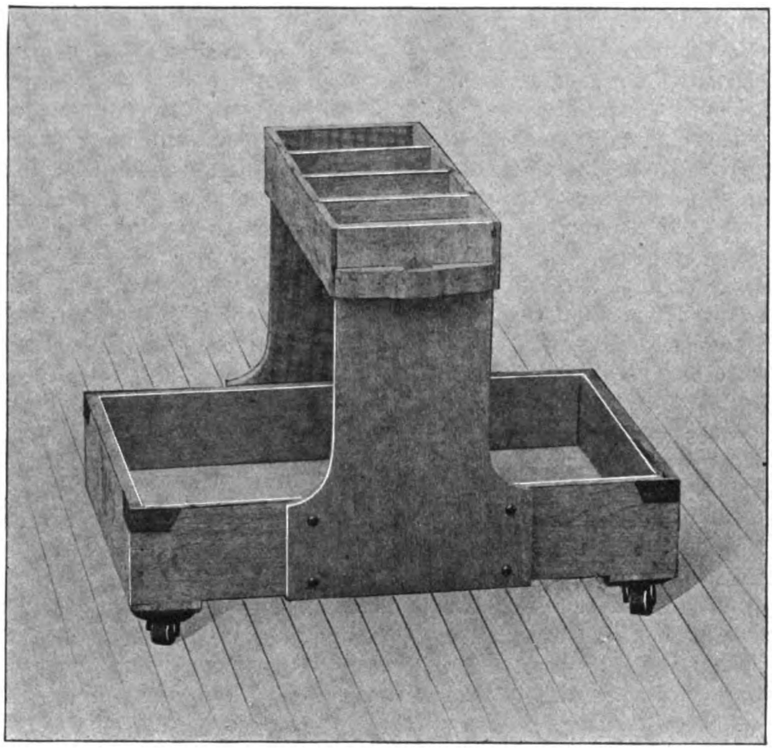
Axle setting is something which in many cases causes no little trouble to smiths. I have a great many axles to set, and some, where the wagon has tipped over and bent the axle right in the shoulder, would make difficult jobs for a man who is not used to setting. When I have an an axle bent in the shoulder, I heat the axle in the bend and place it in the wheel hot. It will be seen at once that by taking hold of the wheel and axle it can be straightened very quickly, and without pounding the axle one bit. I do not know how many smiths use that little trick, but before I learned it I used to spend considerable time trying to get axles back into shape by hammering them.

An Improved Shoeing Box.

JULIUS S. DUQUETTE.

The engraving presented herewith shows what I term a perfect shoeing box, and I think that its good qualities will be appreciated by any who may use such a box.

It is built of oak, with the base and bottom of the nail box of soft wood, combining strength with lightness. The soft wood may be of ½-inch stock, while the balance of the box is ½ or ⅝-inch and sometimes ¾-inch wood as desired. At the base the size of the box is 11¾ by 18 inches, 3½ inches high. The side supports or risers are 12½ inches high, and 8 and 5 inches wide at the base and top respectively. Four good size nail boxes are included on the top. The box should be tightly screwed together and braced, with four casters at the corners to complete it. If any of my readers are unable to construct the box from this description, I should be glad to have them write to me about it.



AN IMPROVED SHOEING BOX.

Conformation.

E. MAYHEW MICHENER, V. M. D.

Congenital variations from the normal conformation are those originating before birth and due to the effects of heredity. Defects of the conformation of one or both parents are alike transmissable. The results are not always noticeable in the first generation, but are never lost and may appear after a long time, so while it does not invariably follow that a defective sire or dam will produce offspring with same faulty construction, yet it is of such ordinary result that the fact has become well recognized by breeders of all live stock. While an animal of defective conformation may and frequently does perform well the work of the class to which he belongs, and has even in some instances excelled, it is also true that an animal of marked imperfection of conformation is of less value than one more nearly perfect.

In order to intelligently study the conformation of a part it is first necessary to have in mind the ideal or perfect condition.

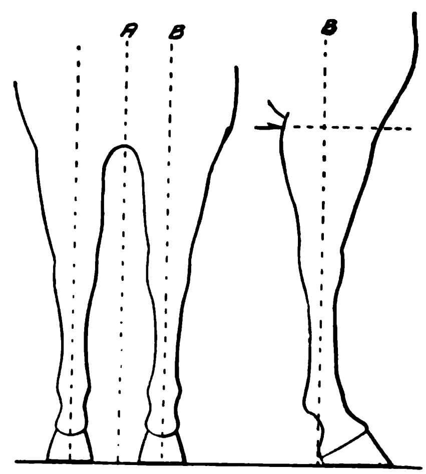
In studying the front limbs, have the animal stand upon a level surface and view the limbs from two positions, first from directly in front of the animal, and second, from the side of the animal. The two diagrams will give an idea of the lines to be observed in order to determine if the limb be properly balanced so as to receive the weight of the animal, and evenly distributed to the bones, joints and muscles which form the limb. Viewing the fore-leg from directly in front, the following deviation from the normal may be observed.

First, the condition known as base-wide. In this condition the interspace between the fore-legs is wider below than above, or roughly the shape of a triangle with base on the ground, and the apex just below the breast bone. This is due either to the fact that the shoulders are too close together, or the feet too far apart or to both conditions. As a guide in judging the condition, it may be said that the interspace between the feet at the ground surface should be such that another foot of the same size might be placed between.

Second, the condition known as base-narrow is the opposite to the one just described. The interspace between the fore-legs resembles that of a triangle with base uppermost and apex at the ground surface between the feet. This condition is more common than the base-wide condition, and is also more objectionable. Both outward and inward deflections of the leg may be seen starting at the knee or even at the fetlock joints, while from these points upward the limb may be normal.

Third, the bowed leg. In this condition the leg has an outward bend, thus placing the knees too far from the median line. The same animal may show both bow-leg and base-narrow condition.

Fourth, knock-kneed. This is the opposite condition of the bowed leg,



CONFORMATION OF THE ANTERIOR LIMBS.
A—Median Line
BB—Normal Line.

and the knees are too near the median line. It is found at times in the base-wide animal.

Viewing the limb from the side, the following deviations from the normal may be detected:

First, both fore feet in advance of the normal line, thus throwing undue weight and strain upon the hind portion of the limb. Second, both fore feet placed behind the normal line. Third, knees in front of normal line, a common condition, giving the leg a decided bow-like outline. Fourth, knees behind the normal line, the reverse of the preceding condition, and known as calf-kneed. Fifth, fetlocks too angular, bringing the heel of the foot in advance of the normal line, and thus throwing undue weight upon the back tendons and the navicular joint. Sixth, fetlocks too straight, throwing the heel back of the normal line, causing undue jarring of the body while traveling, and exposing the surfaces of the joints to injury from concussion.

A Shoeing Discourse.

F. H. BUMP.

We of the craft very often have to shoe perfectly sound feet, which are of such shape that the ordinary shoe, though it seems to fit, really is a misfit.

One type of foot in particular, shown in Fig. 1, may be mentioned. As

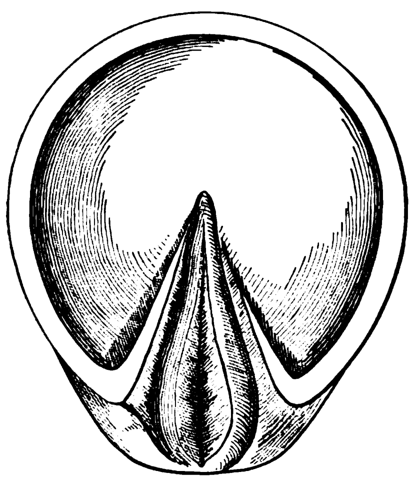
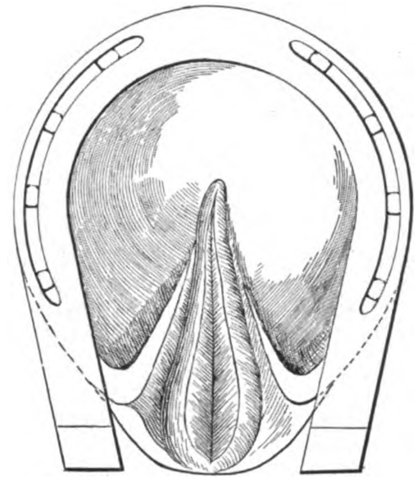
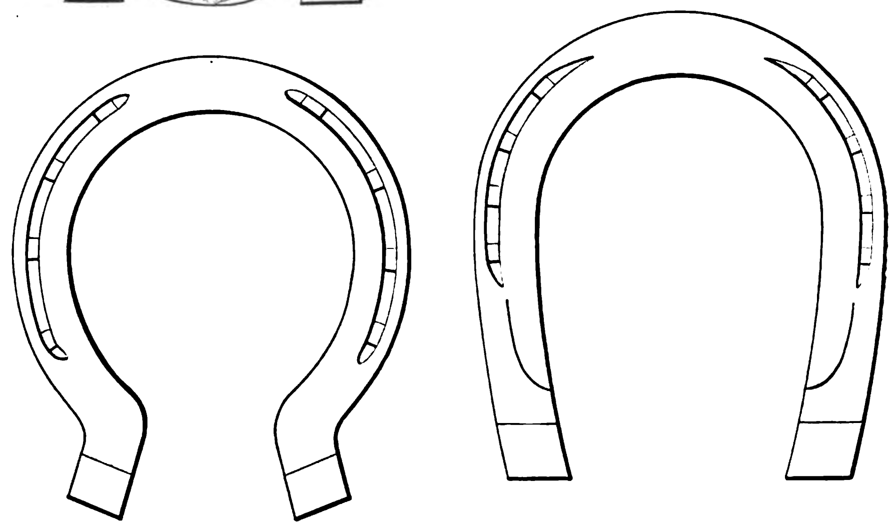


Fig. 1. A SHOEING DISCOURSE.

usually shod, see Fig. 2, the heels do not touch the shoe, and the latter cuts into the soft quarters. This leads to corns, bruised quarters and many other evils. Sometimes the shoe is turned in at the heels, but if turned in far enough to accomplish its purpose of providing a bearing under the whole heel, the heels will be too close together, and the foot has such a narrow base to stand on that strained and swollen ankles will follow. To remedy this, some smiths turn out the extreme heel, making a shoe like that shown in Fig. 3. This gives a base combined with a bearing, but is far from perfect when the foot grows out.

To get a perfect shoe for such a foot I take a steel shoe (I use no other) and, after calking and filing, cut the ground surface as indicated in Fig. 4, cutting half way through. I then take the pane and draw the points to the shape of Fig. 5. This gives a shoe that looks well, fits well, and furnishes both base and bearing. Where one side of the foot grows very fast and the other side is a failure, shoe that side the same way and try to throw more weight on



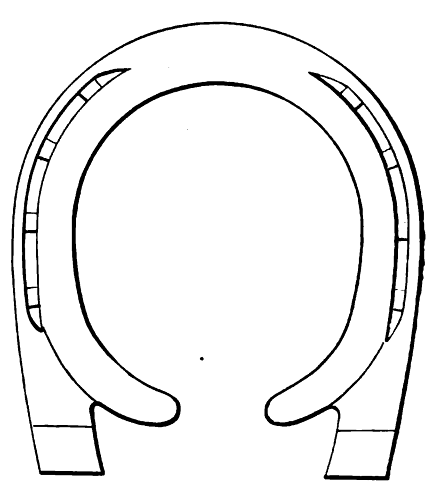


Figs. 2 and 3. A SHOEING DISCOURSE.

the faster growing side. This is a decided success in cases of contracted feet and narrow heels, and in bad cases of contraction the ends may be turned up to act as a spreader. In this way it will be found very useful, but care must be taken in using them, for if the hoof is spread too much at a time it is worse than before.

There is one other thing I always find, and that is you must enlarge the base a foot stands on in proportion as you raise it above the ground. When shoeing with plates, you can have the plate about as short as the foot itself, as in the cavalry service. When you raise the foot up on calks, you must make the heels longer in proportion, or there will be undue strain on the tendons. In shoeing the hind foot, I like to have the inside heel follow the foot closely and be short. Then I like to make the outside long and turn it out a little. (See Fig. 6). There are three reasons for this. First, the short inside heel is not in danger of cutting the opposite ankle or of being stepped on. Secondly, the long outside heel gives support when the horse is drawing and thus removes some of the strain on the ankle. Thirdly, almost all horses wear the outside of the shoe first, having a tendency to run the foot over to that side, and the long outside heel turned out prevents this.

I have very little trouble with interfering where this shoe is used. When this does not stop the trouble, I find just what part of the foot he strikes with. Then I turn a shoe which is very light except on the outside. Here, opposite the spot he strikes with, I leave about two inches very heavy, and put the toe calk its length farther in.



Figs. 4 and 5. A SHOEING DISCOURSE.

For extreme cases, I have allowed this extra width to project beyond the hoof and let the toe calk cover the inside toe nail hole. This makes the horse toe in, and as he turns his toe in he turns his ankle out and gets it out of the way of the other foot.

Today I shod a team to draw loads on plank. The owner had them shod with blunt heel calks and sharp toe calks. Has any brother smith tried this or seen it tried and knows how it works?

Pointers About Wheel Making.

J. E. SHUFORD.

In building a new wheel the first thing to consider is the hub. We wheelwrights of the cross-roads persuasion prefer a fast oak, but it should be solid, free from cracks, and in proportion to the size of the wagon to be built. I have known good workmen to use a 1½-horse hub for a two-horse wagon, but this is a mistake. In the first place, the spokes will not have sufficient hold for the work the wheel is expected to do; in the second, with a two-horse rim and tire the wheel is not in proportion and the job does not look well; and lastly the thimbles will be too light for two-horse work.

The spokes should be of first class white oak, and well seasoned. As hand-made spokes are not much used now and most men buy their spokes, we have no way of knowing if the wood is thoroughly seasoned, and it is best to put the spokes in a dry place until such is surely the case.

Hubs as they come from the factory are not always mortised as they should be. Run a square through the mortises and test them. The mortise should be ¼ inch longer on the outside of the hub than at the box, $\frac{1}{16}$ at the front and $\frac{3}{16}$ at the back. This, if the spokes are made right, will give the wheel the proper dish. The dish should always be built in the wheel and never drawn in with the tire. The end of the tenon should fit the mortise so that it will be ⅛ to $\frac{3}{16}$ inch larger at the shoulder the wide way and the same size as the mortise in thickness. The spoke should not be shouldered square but with $\frac{1}{16}$-inch bevel to the front. See that the tenon will start in the mortise and we are ready to drive the spokes. Have the hub properly boarded and screwed down solid on the wheel bench. Then dip the tenon in thin glue, warm water or a little white lead. Use a two-pound hammer with a flat face and a handle that will spring a little for driving large spokes, and a lighter hammer for light work. If the mortise and tenons are right the wheel will have ¼ to ⅜ inch dish, which, if the tire is properly put on, will give the wheel ½ inch dish. When driving spokes use a gauge and drive each spoke with the same dish. In repair work cut out the mortise with a sharp chisel enough to remove all bruised wood, caused by the first spokes, dip the tenon in glue and then in fine sand and drive them.

The rim or felloes used can be sawed or bent, except for very light wheels

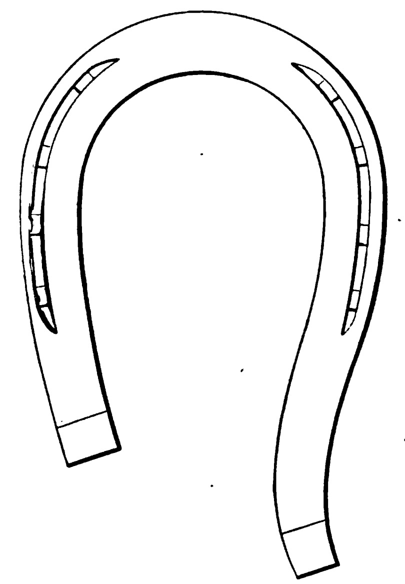


Fig 6. A SHOEING DISCOURSE.

and for these the bent rim is best. I like the sawed rim for heavy wheels, unless a wide tire is used. Then the bent rim is all right, as it does not have to be so deep and the width gives sufficient strength to keep it from bending down between spokes and causing flat places in the wheel when the tire wears thin. When putting on the rim see that every end joint fits and that the felloes fit down on the spoke. If sawed felloes are used put a dowel pin in every joint. If everything fits up well leave one joint ⅛ inch open, when your wheel is ready for the tire.

The tire should be in proportion to the wheel, neither too wide nor too heavy. All cross-roads smiths have customers who come with a light well-worn wheel and ask to have a new tire put on the wheel that has enough iron in it for two such wheels, and who invariably blame the smith when the wheel is strained.

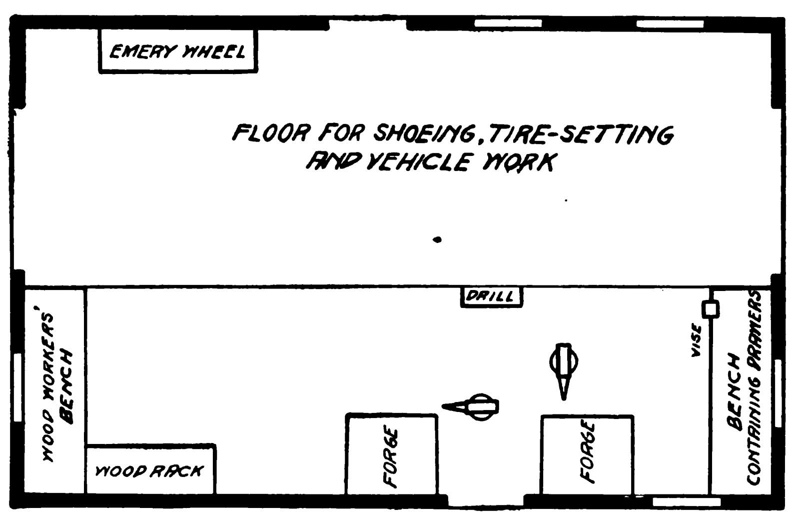
When doing a general line of work, refilling buggy wheels is a job that sometimes has to be done. If it is a patent hub, remove the rivets and drive every other spoke. Have the spokes the right size, which can be secured by stepping the flange with a compass. After driving half the spokes, start again, driving the remainder. Dip the tenons in good glue, and when all the spokes are driven put the wheel away until the glue has set. Then bore rivet holes and re-rivet, and you will have as good a wheel as ever.

In this country we still build the old fashioned wedge spoke wheel, which when built properly stands the heavy work and rough roads better than the shouldered spoke wheel, but as they are somewhat out of date in many places I will not give a description of them, unless some brother wishes it. In that case I shall be happy to tell how to build them the right way.

A Conveniently Arranged Blacksmith Shop.

C. C. HENDERSON.

A blacksmith must at all times look out for his interests in every possible



A CONVENIENTLY ARRANGED BLACKSMITH SHOP.

way, and this is true as regards the arrangement of his shop and tools. As nice a shop as I ever worked in had only two fires with anvils set at right angles to the forges. A drill was placed near and equidistant from the forges, and beyond in front was a large floor convenient not only for shoeing but tire setting and vehicle work. The accompanying sketch will serve to explain more clearly the arrangement referred to.

Carriage Builders' National Association.

The twenty-ninth annual Convention of the Carriage Builders' National Association of the United States was held at Cincinnati, Ohio, October 22d, 23d and 24th. The carriage building and accessory trades were fully represented in the line of exhibits shown, and this with the large attendance served to make the Convention a most successful one. It is hoped to present in the next issue some Convention notes of interest to the trade.

Master Horseshoers' Convention.

The tenth annual Convention of the Master Horseshoers' National Protective Association of America was held October 14th–18th at the Carrollton Hotel, Baltimore, Md. Local No. 9 of Baltimore provided an excellent program of entertainment for the delegates, of whom there were about 110, and was presented with a testimonial in appreciation of their efforts. Many important subjects were discussed, and steps were taken to encourage the establishment of schools of anatomy of the horse throughout the country.

Lawrence J. Fagan, of New York City, was elected President for the ensuing year; Patrick H. Rooney, Albany, N. Y., Secretary, and James G. Ray, of Columbus, Ohio, Treasurer.

American Blacksmith Prize Contests.

Have You Written An Article Yet?

On another page will be found details of the prize contest now being held for AMERICAN BLACKSMITH readers. Nine prizes aggregating Ninety Dollars ($90.00) will be distributed to the successful competitors, and you might be one if you try.

There are three subjects from which to choose, and three prizes will be awarded under each heading: Fifteen Dollars ($15.00) the highest, Ten Dollars ($10.00) the next, and Five Dollars ($5.00) the lowest. "Horseshoeing," "Carriage or Wagon Building," "Blacksmith Repair Work." Pick out your subject, and write your article. Do this at once before it is too late.

Remember. it is not fine hand-writing or good spelling that will win prizes. Ideas plainly put. new methods clearly explained, shop hints, handy tools, the lessons of long experience, these are wanted. Long-winded articles will not necessarily win—two hundred and fifty words only are required.

A number of articles have already been submitted, and the contest bids fair to be a vigorous one. If you have anything to write about, and most mechanics have when they stop to think, do not delay, but send in your best effort now. It is only required that you be a subscriber to THE AMERICAN BLACKSMITH. If you are not, look this copy over carefully, and ask yourself, leaving the matter of entering the Prize Contest entirely out of the question, if a year's subscripiton is not worth One Dollar to you.

Address all communications to the Editor, THE AMERICAN BLACKSMITH, P. O. Drawer 974, Buffalo, N. Y.

Two Methods of Forming Sockets for Wire Rope.

W. T. JAMES.

For the purpose of constructing wrought-iron sockets for wire rope, two methods are here described. The one first described necessitates the making of four welds, while by the second method only three are required, so that the latter method is to be preferred both as regards facility of construction, and strength of the finished socket.

The first method consists essentially in shaping a piece of good 5/8-inch flat iron substantially in the shape shown in Fig. 1. Calculate the dimensions necessary to form the proper circumferences, allowing also for the weld. This piece is then turned and welded on a mandrel, such as shown in Fig. 4. Next fashion two side pieces, welding them on the side of socket. Two views of one of these pieces are shown in Fig. 2. The ends are then turned and welded.

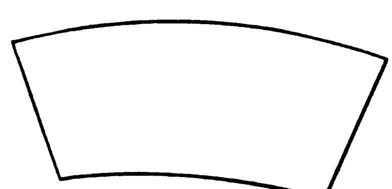


Fig. 1.

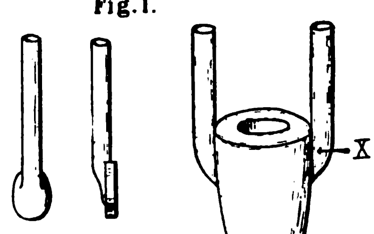


Fig. 2.

FIRST METHOD OF FORMING SOCKET.

Thus it will be seen that four welds are necessary to complete the operation, added to which is the danger of a poor weld at the point marked X, as has often been found in practice.

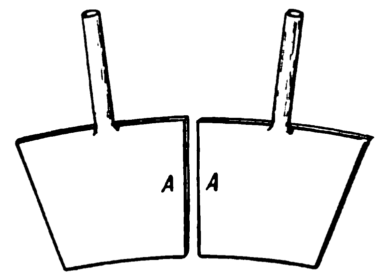


Fig. 3.

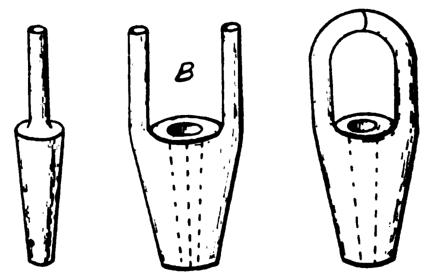


Fig. 4.

SECOND METHOD OF FORMING SOCKET.

The second or improved method necessitates the forging of two pieces as shown in Fig. 3, and in this case also the proper dimensions for the circumferences are to be figured out, allowing for the welds. Both edges of each piece are scarfed and the pieces themselves curved in the bottom swage, after which separate heats on each are to be taken. The weld at AA is first made on the horn of the anvil, after which scarfs on the other side are closed in, and the welds made, finishing on the mandrel shown in Fig. 4. After this operation the job will appear as shown at B, Fig. 4.

The next step is to scarf the round ends, bending them over and welding to complete the job. The result will be a solid socket which will stand the strain without danger of a weld giving out.

An Interesting Scotch Price Schedule.

We have pleasure in printing below an interesting notice coming to us from Scotland, showing the amount and regulation of blacksmith charges in that country.

At a meeting of master blacksmiths in the districts surrounding Spey, Avon and Fiddichside, held at Craigellachie, it was decided to fix prices on blacksmith work as below. It was left open from any point of view one elected to regard it

As a native Ithacan and an old friend of Cornell University, I was especially pleased with the article on "Blacksmithing at Sibley College." I believe THE AMERICAN BLACKSMITH will succeed because it deserves success.

Yours sincerely,
M. C. HILLICK,
Ithaca, N. Y.

American Blacksmith Company:

I to-day received the initial number of THE AMERICAN BLACKSMITH. It was more than pleasant to read over the first copy of your journal. In fact, this noon it was passed around for inspection among several of our instructors here, and the comments were *all* decidedly favorable; all of them were very much pleased with it and predicted its success.

I enclose the names of a few men who I think might be interested in receiving a copy of THE AMERICAN BLACKSMITH.

Yours truly, JOHN L. BACON,
Lewis Institute, Chicago, Ill.

American Blacksmith Company:

I think I will like your paper. Please find enclosed one dollar ($1.00) for one year's subscription. Yours truly,
H. F. BRESSIEN,
Chesaning, Mich.

American Blacksmith Company:

I receive THE AMERICAN BLACKSMITH to-day, and while looking through and reading it came to the conclusion that the paper would be useful to one in any line of blacksmithing. Enclosed find one dollar ($1.00) for one year's subscription.

Yours respectfully,
JOHN BEAVER,
Bay Port, Mich.

American Blacksmith Company:

Having received a copy of your journal on the 10th of this month, I think it is just what I want. Will you kindly put my name on your subscription list?

I remain, M. McINTYRE,
Allan's Corners, Que.

American Blacksmith Company:

Find enclosed my subscription for your paper, as I think it will prove a book of valuable information to me.

Yours respectfully,
RICHARD REID,
Caledonia, N. Y.

American Blacksmith Company;

I received a copy of "THE AMERICAN BLACKSMITH" yesterday and was so well pleased with the contents that I think I will try a year's subscription.

Yours truly, F. L. ADAMS,
Cumberland Centre, Me.

American Blacksmith Company:

Enclosed herewith please find our check for $1.00, being subscription to THE AMERICAN BLACKSMITH for one year.

From the appearance of the first number of your paper, we would say that it is just what is needed. We wish you success in your undertaking. Yours very truly,
WM. HARRIS & SON,
Pittsburg, Pa.

American Blacksmith Company:

Enclosed find postoffice order for one dollar ($1.00), for your book for one year.

We will be looking for the next issue of your valuable paper and hope it will be a success, as every shop should have one.

Yours respectfully.
J. G. BLOCHER & SON.,
Clinton, Ill.

SUBSCRIPTION CLUBS.

A gratifying feature attending the introduction of the first number of THE AMERICAN BLACKSMITH to the craft was the voluntary formation of numerous subscription clubs by those who received a copy. It is desired to encourage this club raising as much as possible. A special subscription rate has been made for such clubs, to be had on application. Send in the names of those who you think would subscribe, and a sample copy will be sent them. You can render your friends a good service, and the men around or under you in the shop, also, by bringing the paper to their notice and starting a club. Let us hear from you

American Blacksmith Company,
BOX 974, BUFFALO, N. Y.

THE FARRIER'S FORGE.

Reproduction of a Famous Painting.

THE FARRIER'S FORGE.

AT large expense we have prepared especially for American Blacksmith patrons a handsome reproduction of Mr. George Morland's masterpiece, "The Farrier's Forge." The original is a famous oil painting, and our plates are made directly from an artist's proof engraving by Mr. Thomas G. Appleton. The size we furnish is 9 x 12 inches, and the printing is done on 100 lb. superior quality of paper, suitable for framing.

The original of this famous oil painting has been exhibited in the principal salons and art galleries of Europe and America, everywhere creating wide attention and appreciation. It stands very high among art critics, many of whom have pronounced it to be this painter's best work. A copy of our reproduction, of the size above stated, carefully and substantially rolled to protect it from damage, will be sent free to any person sending us one new yearly subscriber to The American Blacksmith. Remit by P. O. Money order, Express order, or New York Draft.

If you will send us a list of the names of blacksmiths whose subscription you intend trying to obtain, we will mail them in advance a sample copy of the paper for their examination. Let us have your assistance in extending the influence of The American Blacksmith. You can do your fellow craftsmen a real service by affording them the opportunity of becoming acquainted with the journal.

Another offer. If you will take the trouble to prepare carefully a complete list of the smiths, the wheelwrights and the carriage builders in your town, with their addresses, we will likewise send you a copy of the engraving as above. We want the name of everyone of these craftsmen which it is possible to get, no matter whether in business for themselves or employed in other shops, large or small. In other words, we want them all, the general blacksmith, the horseshoer, the machine blacksmith, the wheelwright and the ship smith. Those sending in names under this offer must be subscribers to THE AMERICAN BLACKSMITH.

The picture which you can thus obtain will be found a most artistic sample of the engraver's art, and one well worth possessing.

ADDRESS

AMERICAN BLACKSMITH COMPANY,

P. O. DRAWER 974, BUFFALO, N. Y.

Pan-American Awards.

The list of awards announced by the juries at the Pan-American Exposition at Buffalo, for excellence of products exhibited, contains among others the names of many firms manufacturing for the blacksmith and carriage fields. These are given below, together with the particular machine or article on which award was made.

GOLD MEDALS.

J. L. Alberger & Son, Buffalo, N. Y., 125 H. P. tandem gas engine.

American Steel and Wire Company, Chicago, Ill.. diamond dies for drawing wire.

American Tool Works Company, Cincinnati, Ohio, radial drills.

Bement, Miles & Co., Philadelphia, Pa., steam hammers.

Buffalo Forge Company, Buffalo, N. Y., high-speed steam engines.

Buffalo Forge Company, Buffalo, fan system of heating, ventilating and drying.

Cincinnati Machine Tool Company, Cincinnati, Ohio, upright drills.

Cleveland Twist Drill Company, Cleveland, Ohio, twist drills.

Hay-Budden Mfg. Co., Brooklyn, N.Y., anvils

Landis Tool Company, Waynesboro, Pa., universal grinder.

Lazier Gas Engine Company, Buffalo, N. Y., gas and gasoline engines.

August Meitz, New York City, N. Y., kerosene engine.

Morse Twist Drill and Machine Co., New Bedford, Mass., machine tools.

National Meter Company, New York City, N. Y., gas engines.

Otto Gas Engine Works, Philadelphia, Pa., gas engines.

Pittsburg Meter Co., Pittsburg, Pa., gas and gasoline engines.

Struthers, Wells & Co., Warren, Pa., gas engines.

The O. C. White Co., Worcester, Mass., appliances for shop lighting.

Wilmarth & Norman Co., Grand Rapids, Mich., drill-grinding machines.

SILVER MEDALS.

Ames Iron Works, Oswego, N. Y., automatic steam engines.

Bement, Miles & Co., Philadelphia, Pa., vertical milling machine

Bessemer Gas Engine Co., Globe City, Pa., double-cylinder two-cycle gas engine

Buffalo Forge Company, Buffalo, N. Y., mechanical draft apparatus, forges, punches, shears and blacksmith drills.

Buffalo Gasoline Motor Works, Buffalo, N. Y., gasoline motor.

Foos Mfg. Co., Springfield, Ohio, gas and gasoline engines.

Gisholt Machine Co., Madison, Wis., tool grinders.

Rogers & Co., Samuel C., Buffalo, N.Y., grinding machinery.

Standard Tool Co., Cleveland, Ohio, twist drills, reamers, milling cutters and taps.

Weber Gas Engine Co., Kansas City, Mo., gas and hoisting engines.

BRONZE MEDALS.

Howard Iron Works, Buffalo, N. Y., vices.

Norton Emery Wheel Co., Worcester, Mass., Walker Universal tool and cutter grinder.

HONORABLE MENTION.

Buffalo Emery Wheel Co., Buffalo, N. Y., emery wheel foot power grinder.

VOLUME I
NUMBER 3

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1901

BUFFALO, N.Y.
U.S.A.

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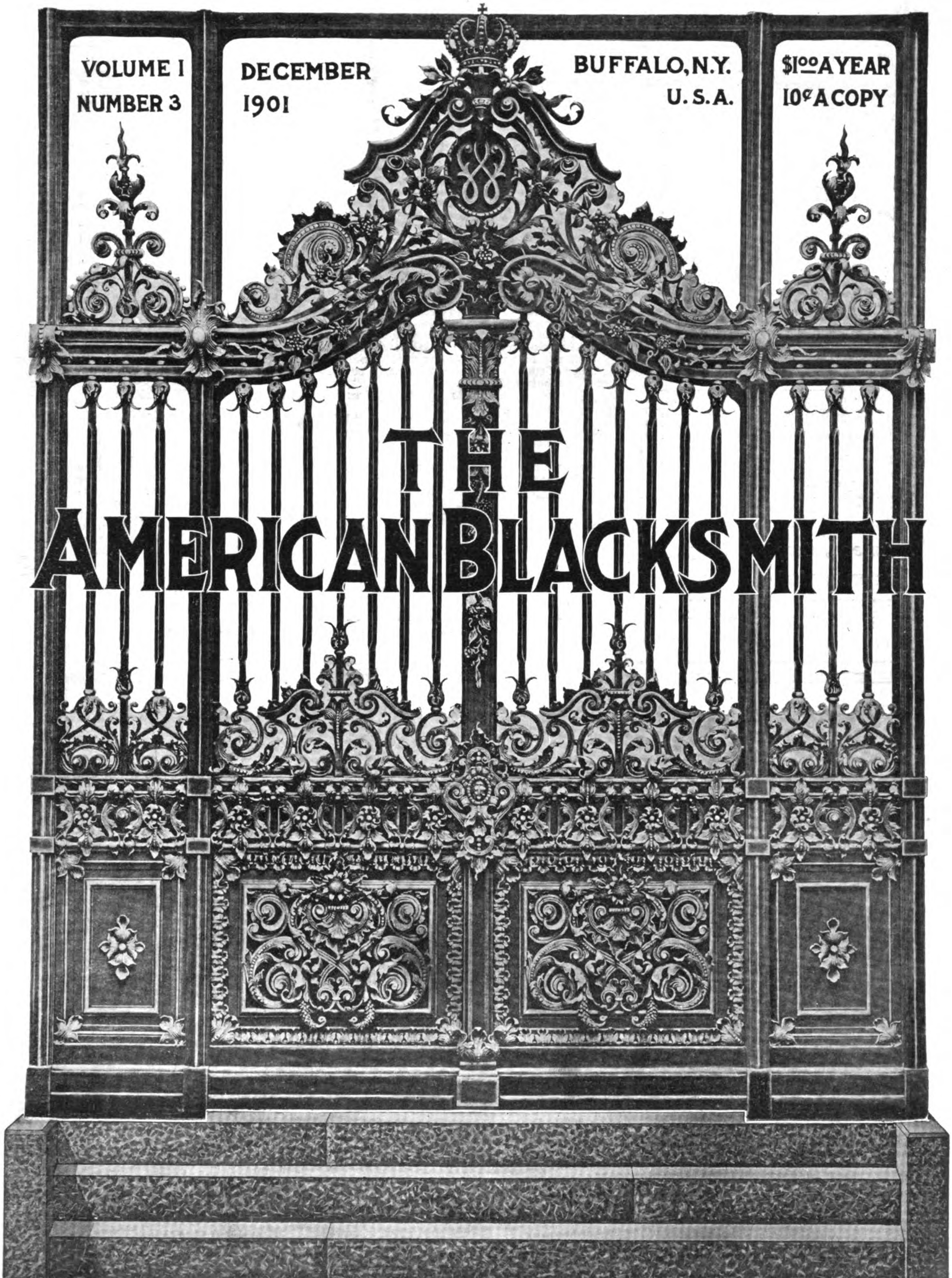
THE AMERICAN BLACKSMITH



CONTENTS.

HORSESHOEING, REPAIR WORK and CARRIAGE BUILDING

PRIZE ARTICLE CONTESTS.

What Do You Know That Will Interest Our Readers?

IN order to stimulate interest among the great number of blacksmiths, wheelwrights and other artisans, we have decided to offer a series of prizes for articles upon three different subjects as suggested below. The prizes will be nine in number, distributed for articles upon three different subjects.

These will be "Blacksmith Repair Work," "Horseshoeing," and "Carriage or Wagon Building." For the first, second and third best contributions under each head we will award prizes of $15, $10, and $5 respectively. We have made the first of the three topics purposely broad, so as to admit blacksmiths of all classes without reference to the character of their work. In order to enter for these prizes, articles must not be less, we have decided, than two hundred and fifty words in length. They may deal with any phase of their subject and will be judged solely upon their merits, the principal factor determining the choice of the best article being its value to our readers. Wherever practicable, articles should be illustrated by photographs, blue prints, or rough pencil sketches, so as to render the reading matter clearer and more interesting.

The prize contest will be subject to certain conditions, as follows:

First. No person will be awarded more than one prize, though he may increase his chance of success by making as many contributions as desired, in any or all of the classes mentioned above.

Second. Contestants for these prizes must be subscribers to THE AMERICAN BLACKSMITH.

Third. We reserve the right to publish any articles thus submitted, awarding honorable mention to such of those contributors who may fail to secure a cash prize.

Write clearly upon one side of the paper only, and mark all articles in competition, "Prize Contest—Repair Work," "Prize Contest—Horseshoeing," "Prize Contest—Carriage Building," as the case may be. In order to insure impartial treatment at the hands of the judges, the article should be accompanied by a sealed envelope containing within the name and address of the contributor, and bearing on the outside some fictitious name, which is likewise to be signed to the article itself.

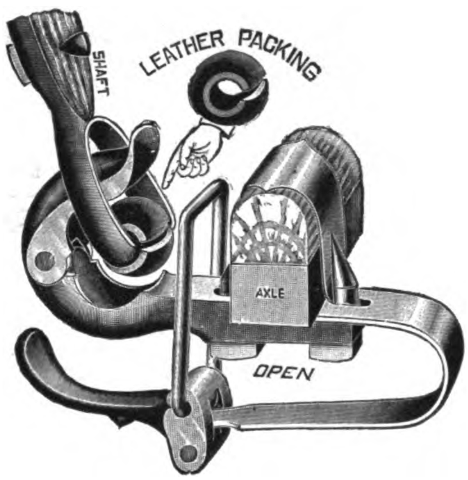
Competition for these prizes does not require any special faculty for writing, for an article will be judged more by the real value of the matter which it contains than the language in which it is presented. Hence, if one has some good point to describe, he should feel no hesitation in writing about it, for it is our part of the work to put such matter into shape for publishing. The very best articles are those by the every-day smith or artisan, who tells of something he has seen or done right in his own shop.

Address all communications to the Editor.

THE AMERICAN BLACKSMITH,

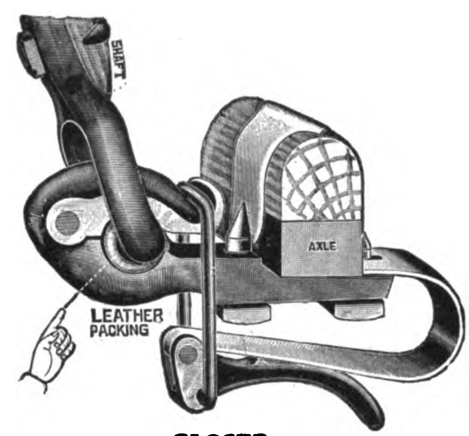
DRAWER 974, BUFFALO, N. Y.

THE BRADLEY SHAFT COUPLING



OPEN.

ALL STEEL



CLOSED.

AUTOMATICALLY TAKES UP ITS OWN WEAR.

(Can you afford to overlook this most important point?)

IT IS BALL-BEARING, which absolutely prevents side rattle. (There is nothing in a straight bearing coupling, such as the common bolt and nut coupling, to prevent side rattle.)

IT IS SELF-LUBRICATING. (A feature not contained in any other coupling.)

LOOK OUT for any Coupling that depends upon rubber for its anti-rattling qualities. (Rubber soon wrings and twists itself to death, requiring frequent renewal.)

THE BRADLEY Shaft Coupling depends upon **THE BEST STEEL SPRING** THAT MONEY CAN BUY for its anti-rattling qualities. It is absolutely noiseless, and with it shafts and pole may be exchanged in 10 Seconds without the use of tools of any kind.

One carriage concern has found it profitable to use 25,000 PAIRS of The Bradley Couplings within Five Years. Dealers, INSIST upon having all the carriages you buy equipped with these Couplings. You can get them if you insist, and at no advance in price. "Carriages with The Bradley Shaft Couplings on them are more than half sold." Compare the advantages of other Couplings with The Bradley. A little higher in price perhaps, but advantages considered, The Bradley Couplings are the cheapest on the market.

CORRESPONDENCE SOLICITED.

OUR 20-PAGE BOOKLET IS YOURS UPON REQUEST.

C. C. BRADLEY & SON

SYRACUSE, N. Y.

THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

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BUFFALO, N. Y., U. S. A.

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A Few Notes Concerning the Carriage Builders' Convention.

Some additional items concerning the twenty-ninth annual Convention of the Carriage Builders' National Association at Cincinnati, Ohio, which were crowded out of the November issue of this paper, may be of interest. The Grand Hotel was headquarters for the Convention, at which place the business meetings were held during the week. Equal interest, however, was centered in the exhibit at the Music Hall, of materials entering into carriage construction. Every inch of space was occupied by exhibitors from all parts of the country and the display of accessories and supplies used in the manufacture of vehicles was bewildering to the uninitiated. Many unique improvements in carriage construction were here first shown.

The attendance for the week was unusually large and well-deserved. At the registry office the names of approximately one thousand various representatives of the carriage and wagon trade were entered. The election of officers resulted in the choice of Mr. Henry C. Staver, of Chicago, as President, though Mr. W. H. McIntyre, of Auburn, Indiana, had been prominently mentioned preceding the election, in connection with this office. Considerable wire pulling for the next annual meeting was a lively feature of the week. Buffalo played strongly for first honors, but was defeated by Detroit supporters after a close contest.

The annual dinner of the Association was held in the Cincinnati Armory, and was a complete success. Some seven hundred were in attendance, making it in fact the largest banquet ever given by the Association. THE AMERICAN BLACKSMITH was represented here, as it was at the Music Hall Exhibit.

The Carriage Builders' National Association is progressing most successfully, and at each annual convention a long list of new members is always added. May its shadow never grow less.

Continued Articles of Special Interest.

To make good the promise on the part of the publishers to increase the value of the paper to readers in every possible way, THE AMERICAN BLACKSMITH begs leave to briefly call attention to the initial papers of two new series of continued articles, each of which are thought to be of special interest.

The two series thus referred to are written, one by Mr. William C. Stimpson, of Pratt Institute, Brooklyn, and the other by Mr. John L. Bacon, of Lewis Institute, Chicago. Both gentlemen are in charge of the forge shop departments of their respective schools, and are eminently qualified to write upon the topics in hand. Mr. Stimpson's articles will take up in detail and with full illustrations, the elementary principles of decorative iron work, a subject in which every progressive smith is, or should be, interested, as the opportunities for applying knowledge along these lines to advantage are almost without end. The series will comprise a full and comprehensive discussion of the subject. The second of the two series, the first number appearing in this issue, is that conducted by Mr. Bacon, embracing a thorough treatment of the various underlying principles and operations of forge shop work. The intended scope is outlined in the author's introduction on another page, and to this attention is directed for further details. As mentioned there also, a special feature will consist in the encouragement of questions from readers, with a department of answers, conducted by the author, the end in view being to make the articles of the greatest possible value to all. Both these series will continue from month to month.

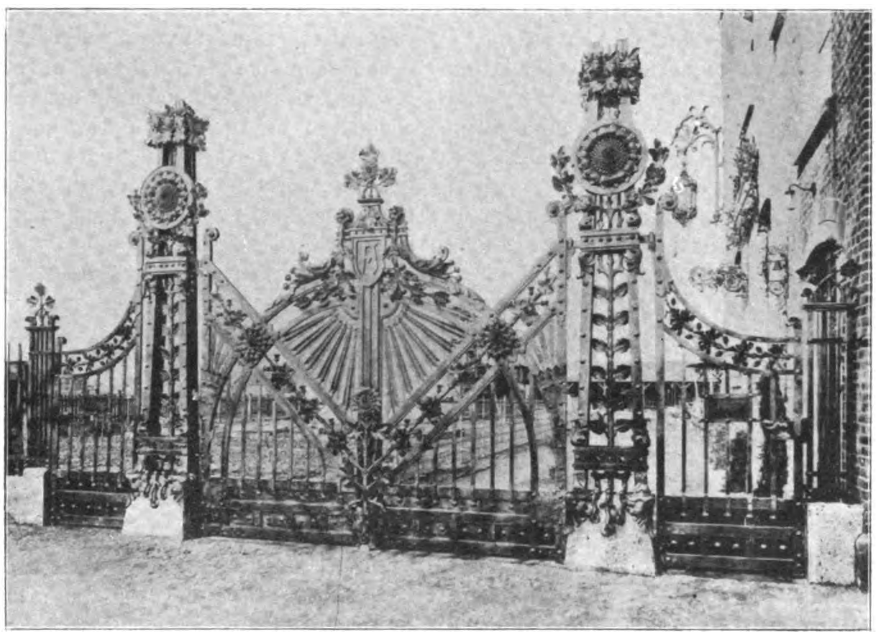
Among other regular AMERICAN BLACKSMITH contributors may be mentioned Mr. E. C. Perrin, a graduate veterinarian, writing an extended treatise on Scientific Horseshoeing, Mr. M. C. Hillick, well known in the carriage painting world, and Mr. E. M. Michener, V. M. D., conducting the veterinary department and writing upon general subjects of interest to the farrier and horse owner. Also must be mentioned the monthly contributions by Mr. J. G. Holmstrom, the blacksmith author, as also those written under the initials "D. W. M." by a gentleman, prominent in the carriage field.

Brief notices of the above nature are inserted in these columns at the present time, for the reason that this journal each month goes into the hands of a large number who are as yet unacquainted with it, and hence a few words as to contents are warranted. These names are cited as an evidence of what THE AMERICAN BLACKSMITH is endeavoring to do for its readers. The publishers hope it will always be possible to put the reading columns in as good hands.

An Illustration of Some German Ornamental Iron Work.

Specimens of special pieces of ornamental iron work are always of interest. The design illustrated by the accompanying engraving is especially so on account of its very unique character. It is a gate of German design and execution, and is now located at the works of the makers, the celebrated German firm of iron workers, Armbruster Brothers, at Frankfort-on-the-Main. The front cover design of THE AMERICAN BLACKSMITH was taken from a photograph of a magnificent gate made by the same company.

In this connection, the editors wish to say that numerous letters of favorable comment have been received regarding such few examples of this kind of work as have been illustrated in these columns. There exists, it seems, a widespread interest in work of this nature. THE AMERICAN BLACKSMITH will always gladly reproduce for its readers as many specimens as possible of decorative iron work, possessing features out of the ordinary, and any illustrations and descriptions along this line will always be gladly received.



AN EXAMPLE OF SOME GERMAN IRON WORK.

Blacksmith Work in Sibley College.

R. B. PUTNAM, M. E.

The founders and promoters of the "Sibley College of Mechanical Engineering" of Cornell University at Ithaca, New York, recognized from the beginning of the institution the importance of supplementing the purely technical work of the college with a course of practical instruction in shop work or the mechanic arts. Accordingly shops were built and equipped with the necessary tools and machines for instruction in carpentry work, wood turning, pattern making, foundry and blacksmith work, and machine shop work. Of these we are for the present only concerned with the blacksmith work.

The amount of work required of all students of Sibley College in the shop is two hundred actual hours, credit being given at the rate of one university hour per week for each three hours actually worked in the shop; that is, three hours of shop work is considered as equal to one hour of lecture or recitation work, plus two hours study. There are two instructors in the blacksmith shop, each of whom is a practical blacksmith. The day is divided into three sections of three hours each, as follows: First section, 8—11, second section 11—2, and third section 2—5 o'clock.

The men work in the sections to which they are assigned on alternate days, so that each man works nine hours per week in the shop; it requires about six months to complete the two hundred hours work which must be done before one is allowed to enter the machine shop. Provision is of course made for men who have had the work or its equivalent elsewhere to take examinations and pass it up.

The shop is 40 x 60 feet and contains 23 forges operated by blowers, and at each forge is an anvil. The students are required to furnish their own hammers, the regulation hammer being a 2½-pound blacksmith hammer, and no other is allowed in the shop, the foreman insisting that his blacksmith shop is "no place for tack-hammers." When a man reports to the shop he is first told to clean out his forge (any one which happens to be vacant at the time), and build his fire. This being done to the satisfaction of the instructor in charge, he is given some verbal instruction as to how he must use his hammer, and to heat his iron and get it hot enough to work without burning it. The instructor then gets a piece of ⅜ round stock about eighteen inches or two feet long, heats it in the middle and shows the student how to make it square Now some may think it no trick at all to hammer a piece of round iron out into a square piece; it looks wonderfully easy, but when one tries to do it for the first time, the thing seems to twist about in one's hand like a thing of life, and determined to take every shape on record except, of course, the desired square. Finally by the time the first three hours are done and the man's hands are fairly well blistered, he begins to find out that there is no necessity for holding on to the hammer or the material with a death grip.

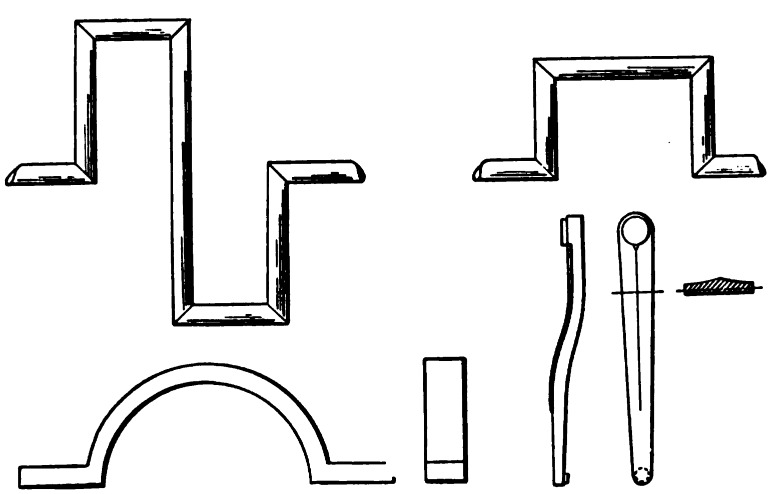
The time it takes a man to learn to make a piece of iron square varies from three to nine or twelve hours, depending on the man. Having succeeded in getting this much done, the student is now told to start in the middle and forge part of one end into the octagon shape, leaving the other part of that end square, and rounding up the whole of the other end. When this is done the instructor shows him how to put a sharp point on the iron, this point is then cut off and kept as a model, and our novice does not get through with that first piece until he has put a good square point on one end and a coned point on the other. The points are best made with the iron at welding heat; this prevents the splitting which is sure to be the result of trying to work the iron too cold. In making the points, a man learns what a welding heat should be, as well as how to handle his hammer.

The next step is to learn how to weld. The instructor takes a couple of pieces of ⅝-inch round iron, scarfs the ends, and calls the student's attention to the way in which this is done. When he has learned to properly upset and scarf his pieces the instructor shows him how to heat up his iron and how to handle it on the anvil, in fact makes a weld for him, after which the student proceeds to make his own weld. All blacksmiths know how apt the pieces are not to stick for a man the first time, and how, perhaps, when the first blow is struck, the bottom piece sometimes goes off on an independent tour of investigation around the shop. The Sibley men know how it goes; they also know what it is to take an apparently perfect weld to the foreman and see it fail when struck a sudden sharp blow across the edge of an anvil. They are kept on this weld until they acquire skill enough to make and finish a weld on 5/8 stock in one heat.

Then comes the making of a chain out of 3/8-inch stock, with a ring on one end and a hook on the other; there are 42 links in the chain, each link about 2½ inches long. First, 22 single links are made, which, by the way, have to stand whatever test the instructor thinks best to put them through. Having made these independent links, he proceeds to join them up, two links being put together with a third, making triplets; next these triplets are joined together with a seventh link, and so on, until finally the chain is completed. Then the ring is put on and the hook forged. For the hook, the student is given a set of patterns which show plainly the different steps in the process of forging; he is then given his stock and left to work it out for himself; of course he receives any instruction he may find it necessary to ask for, but he is encouraged to get along by himself as much as possible.

most difficult of the whole course. After this comes instruction in doing full-cornered work in both flat and round stocks, and the forging of cranks and pieces with off-sets. The accompanying sketches show what is done in the line of the full-cornered work. The trueness of all the angles are tested, and unless satisfactory they must be done over.

After this work is done the student makes three pairs of smith-tongs, all different sizes and after different patterns. In all this work he is furnished with patterns showing the different steps in the process; the jaws are made separate and the handles are welded on. Having completed this he begins to make iron and steel welds. In this work he takes a piece of iron stock of the proper size for a rock-drill and welds a piece of tool-steel in each end; he then forges one end into a rock-drill. He makes a chisel for iron with a steel head and steel point, the stock being iron. He also makes a long, flat wood-chisel, such as is used in wood turning; this of course has a steel end, the steel extending one-third the length of the chisel. He is taught to temper all tools himself. He gets still more practice in welding iron and steel when he comes to make his machine tools, and is given short pieces of stock and told to weld iron handles on instead of



OUTLINES OF SOME SIBLEY COLLEGE FORGINGS.

Having finished the chain, he next does some welding with flat and square stocks; he makes a flat ring, and then another by bending the iron edgeways. Having learned by this time to make a good weld with flat or round stock, he is taught how to make an angle, or L-weld, where one piece is welded to another at right angles; then a T-weld in both flat and round iron. This is his most difficult piece; many find it the

using tongs; the object being to work in as much practice in welding iron and steel as is possible.

After this he makes two sets of machine tools out of wrought iron; this is for the purpose of teaching him the forms. Then comes the steel-work proper. He makes a set of fifteen tools which he has to use in the machine shop. This set contains two flat chisels; one cape-chisel; right and left diamond points; one round-nose tool, right and left side-tool; one straight threading tool; two bent threading tools, one right and one left; two boring tools; three cut-off tools, one straight and two bent, one right, one left; scriber and center-punch. By the time one has completed this set of tools, the two hundred hours are all in.

However, many men learn the work rapidly and finish before their time is completed. They are then put on extra pieces, such as twist-drills, etc., or any work that might need to be done in the way of repairs for other shops. There is a power-hammer in the shop which all men use on some of the heavier forgings. The men are encouraged to do extra pieces of any kind they may desire. It is not claimed that a man who finishes his 200 hours of blacksmith-work is an expert blacksmith by any means; it is not the object of the course to turn out experts, but to teach the men by actual practice what difficulties may be met with or expected in forgings, and to teach practically what can be forged and what cannot. There are many cases of emergency on record, however, where Sibley men who had no other blacksmith work than that in college found it necessary and possible to do work in forging and welding, where much depended on the work being done, and well done. We cannot say with how much fear and trembling such work was undertaken, but we know that in the end they were successful.

At present, there is no die work in Sibley College; but we look forward to the time when some one interested in the promotion of the practical sides of technical education will make donations which will enable the equipment of the shops for instruction of this kind of work to be effected.

A Comparison of the Bulldozer and Steam Hammer.

D. B. MILLER.

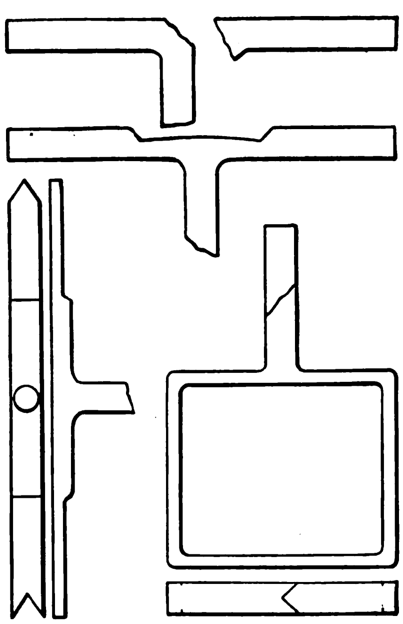
I have for some time been watching very closely the operating of a steam drop hammer and a bulldozer run by belt to determine which is the best machine for shaping forgings, and I find that the bulldozer will do very good work on light forgings, and also on heavy forgings where it does not require any acute angles or sharp corners. It is also possible to make more difficult shapes on the bulldozer than the drop hammer. The forgings can also be more readily adjusted to the bulldozer. The action is so much slower however, that the advantage gained is more than offset by the quick action of the drop hammer. In shaping forgings which require great force in making, and which must be done quickly to avoid reheating, I find the drop hammer very much superior to the bulldozer. However I do not wish to be partial to the drop hammer, but am of the opinion that if the bulldozer was properly equipped with either air or steam, much better results could be obtained. Air and electricity are beginning to play a very important part as a motor in the manufacture of railroad materials, and in order to keep abreast with the times it is very necessary to use the best modern machinery.

Valve Yoke Construction.

D. R. MILLER.

The accompanying illustration shows the steps in the construction of a valve yoke as made in the Norfolk and Western Railway Shop at Roanoke, Va.

The first view shows two square pieces of iron scarfed for welding. One piece is forged round, about six inches at one end, and bent as shown for the stem. Both pieces are welded together under a steam hammer, as shown by the second view. The ends are



METHOD OF FORGING A LOCOMOTIVE VALVE YOKE.

then forged as indicated. The yoke is next bent and welded in the back with a "V" scarf, after which the stem is welded on. You then have a yoke with the fiber of the iron circling the entire yoke and extending into the stem. Yokes made in this way give good service, and they very seldom break.

Hot versus Cold Fitting.

The following account of French experiments with hot-fitting and cold-fitting, as published by an English contemporary, The Blacksmith, may be of interest to readers of THE AMERICAN BLACKSMITH.

In the year 1840 it was decided by the French Minister of War to make a practical series of experiments extending over three years, to determine the advantages of the two methods. The horses in the cavalry school of Saumur were divided into two groups, one being shod hot and the other cold. About 22,580 shoes were fitted cold, and of these 386 were lost, detached or broken, while out of the same number fitted hot, only 123 were lost. A later experiment with cold fitting in a cavalry regiment with 650 horses showed a loss of from fifty-five to sixty shoes lost each month during marches and manoeuvres. The adoption of the hot-fitting system brought the loss down to one shoe on an eighty-mile march.

The Elements of Blacksmithing.

JOHN L. BACON,
Instructor in Forge Practice, Lewis Institute, Chicago.

In commencing this series of articles a few words of explanation as to its general nature and the ground to be covered are advisable.

First, as to scope. In these several treatises, necessarily limited as to length, it is hoped to cover the fundamental operations of the smithy and to touch upon most of the essential principles governing forge shop practice. A general idea of this may be had from the following rough outline, which will be followed in the main, though as the course develops the interest of readers may render deviations advisable.

The Fire—Materials—Cutting Tools and Cutting—Drawings:
- Coal—Building and maintaining the fire—Kinds of Fire.
- Wrought iron—Machine steel—Tool steel.
- Chisels — Hardies — Cutting — The hammer and anvil.
- Drawings—Allowance for finish.

Welding:
- Theory of welding.
- Scarfing.
- Kinds of welds.
- Oxidation in welding—Use of fluxes.
- Welding iron and steel.

Drawing, Upsetting, Twisting, Punching, Bending:
- Proper way of drawing—Splitting by bad forging.
- Upsetting with hand hammer—Ramming—Effect of light blows.
- Twisting bar iron—Gate hooks.
- Punching—The right and the wrong way.
- Bending—Links, Rings, Hooks.

Forming and Splitting—Bolts:
- Forging angle pieces with square corners.
- Avoiding cold shuts.
- Forming by splitting and expanding—Precautions.
- Chain stops, grab hooks, knuckles, cranks, tongs, ladles.
- Bolts—General proportions—Cupping tool.

Calculations for Stock and Weight of Forgings:
- Stock required for angles, links, rings, scrolls, etc.
- Measuring—With wheel, with string, or from drawings.
- Calculation of stock for discs, shafts, cranks.
- Calculation for weights of forgings.

Brazing and Pipe Bending:
- Brazing—Kind of brass—Wire—Spelter—Fluxes.
- Theory of pipe bending—What to avoid.
- Bending thin copper tubing.
- Bending long heavy pipe.

Tool Steel Work:
- Heating and overheating steel.
- Grain of steel — Effect of heat upon it.
- Hardening and tempering.
- Proper hardening heat—How determined.
- Tempering by "color"—Meaning of "color."
- Burned Steel.
- Tempering in water—oil—baths.
- Straightening long thin work.
- Forming cold and cape chisels—Other tools.
- Hardening and tempering springs—"Blazing."

Simple Jigs—Special Tools:
- When it pays to use them.
- Advantages for duplicating work.
- Simple jigs—Examples.
- Jigs for bending thin iron.
- Pipe bending jigs.

As to the general scheme of this series, it is proposed to make them as valuable as possible to beginners and apprentices, to those interested in manual training school work, and to smiths of an inquiring turn of mind who may be benefited by an explanation of methods pursued in leading industrial schools. To accomplish this, queries upon any obscure points are solicited. Readers of THE AMERICAN BLACKSMITH will be privileged and encouraged to ask questions upon any portions of the articles which may not be clear to them. These questions, with answers by the author, will be published from month to month. It is hoped that all will feel free to obtain an explanation of any troubling questions pertaining to forge work. The aim is to make the series as complete and intelligible as possible.

The Fire—Materials—Cutting and Cutting Tools—Drawings.

The coal used for forge work should be the very *best* soft coal and as free from impurities as possible. One of the common impurities in coal is sulphur, and this must be particularly avoided, as it affects the iron and makes it difficult to work, especially when welding. Coal which contains slate or earthy impurities must be also avoided, as this coal forms cinder which is always bad in the fire.

To test coal, take a lump and break it. It should break easily and appear glossy black all the way through. Poor coal will look streaky; that is, there will be a bright streak and then a dull one, and coal of this kind does not break as easily as good coal. Good coal should "coke" easily; that is, it should cake up and form coke in the fire when burned. Coal which will not do this makes a "dirty" fire. Coal should always be thoroughly wet before being put on the fire. When building a small fire, the cinder, ashes, etc., are first cleaned out down to the tuyere. Shavings, or some easily lighted material, are then put over the tuyere and set on fire, and over this is laid the coke (more or less of which is always left over from the last fire). As soon as the coke is burning well, the "green coal" (dampened coal) can be spread around and on top of it, keeping it up in a sort of mound shape. The green coal may be packed down around the sides of the fire, but should be put over the top loosely, to prevent it from spreading out too much, as it will, if there is no place for the blast to get through. As soon as the fire burns up brightly, and the coal on top has been turned to coke, it is ready for heating the iron. As the center of the fire burns out, the coke which has been forming around the sides should be pushed into the middle, and more green coal added around the oustide. to form coke. After starting, no green coal should ever be put directly into the fire, but it should be added around the outside in order that it may be coked before reaching the part of the fire where the iron is heating. In this way the fire is kept clean. We might say the fire is made up of three parts—the center, where the coke is burning and the iron heating, a ring around and next to the center where the coke is forming, and outside of this a ring of green coal.

This is the ordinary method of making a small fire. Larger fires are sometimes made as follows: Enough coke is first made to last for several hours, by mounding up green coal on top of the newly started fire. This coke is then shoveled to one side and the fire again started in the following way: A large block the size of the intended fire is placed on top of the tuyere, and green coal is packed down hard on each side of it, forming two mounds of closely packed coal. The block is taken out and fire is started in the hole between these two mounds, coke being added as necessary. Fig. 1 shows a fire of this kind. When a large furnace is used the coke is bought ready made.

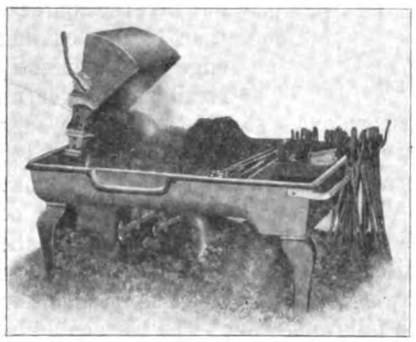


Fig. 1. METHOD OF BUILDING FIRES.

The fire should always be watched and kept burning brightly, and should be changed often enough to keep it from getting dirty. *Coke* and not *coal* should be burned in the part of the fire where the heating is going on. When heating, do not turn on too much blast. If this is done, some of the air is blown through the fire without having all the oxygen burned out, and this oxygen will cause heavy scale to form on the iron, which should always be avoided, particularly when welding. This sort of fire is known as an "oxidizing" fire. On the other hand, if there is just enough air blown into the fire to have all of its oxygen burned out, you will have a hot, bright fire, which looks white inside, and will heat the metal very quickly. This is the proper sort of a fire for welding. If there is less air admitted, the fire will be a "reducing" fire and there will be very little tendency to scale.

Large pieces of work should be heated much more slowly than small ones, or the outside will become hot while the metal in the center is comparatively cold. It takes some time for the heat to reach the center of a large bar, and allowance must be made for this when heating, otherwise the outside of the work will be overheated long before the center is hot enough to work.

The materials which the smith ordinarily works with are wrought iron, machine steel, and tool steel.

Wrought iron and machine steel (soft steel and machinery steel are other names for the same material) are chemically about alike, and will stand about the same treatment. Wrought iron is almost pure iron, but contains a little carbon. Some wrought iron and some machine steel contain the same amount of carbon, about 0.2 per cent., but the best iron contains less carbon. The principal difference between the two materials is this:—When the wrought iron comes from the puddling furnace where it is made, it has scattered through the mass of iron drops of slag, and as the iron is rolled out into bars these small particles of slag are lengthened out and form little streaks running all along through the bar, giving the iron a fiber something like that of wood. Machine steel comes from the furnace in a molten state and does not have these slag streaks running through it, but has instead a granular structure which makes the broken end of a bar of steel look as though it were made up of little grains like sand. The presence of slag in the wrought iron makes it much easier to weld, and for this reason wrought iron should be used when there is much welding to be done. Machine steel makes a good weld but a little more care must be used in heating it. Machine steel is much less liable to split when being forged than wrought iron, and a good quality of machine steel is much easier to get than a good quality of wrought iron. For these reasons it is generally better to use machine steel unless, as stated before, there are a great many welds to be made, and even taking this into consideration there is very little in favor of the iron.

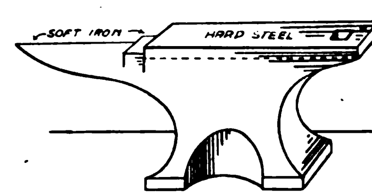


Fig. 2. THE ANVIL AND ITS PARTS.

Tool steel contains more carbon than machine steel (from 0.3 per cent. to 1 per cent. ordinarily), and it is this carbon which causes it to harden when heated red hot and suddenly cooled; this, however, will be taken up later on. With this very brief description of the material, we will next consider some of the tools used.

The anvil is made with a wrought or cast iron base and a hardened tool steel face. This hard steel face does not extend over all the anvil, the horn, and small cutting block next the horn, being made of soft iron. This is shown in Fig. 2. The anvil should be so placed that as you stand in front of it at work, the horn should be at your left hand. At the right hand end of the anvil a square hole is cut for holding hardies and other anvil tools.

The most convenient hand hammer for all around forging is the ball pene hammer of about a pound and a half in weight. When working with the hammer, the handle should be held firmly in the hand with the thumb extending along the top. By holding the hammer this way the blows can be directed much better than if the thumb is closed around the handle in the same way as the fingers.

For cutting off iron and steel two chisels are made: One for cutting the metal cold is shaped like Fig. 3a, and is called a "cold" chisel. A "hot"

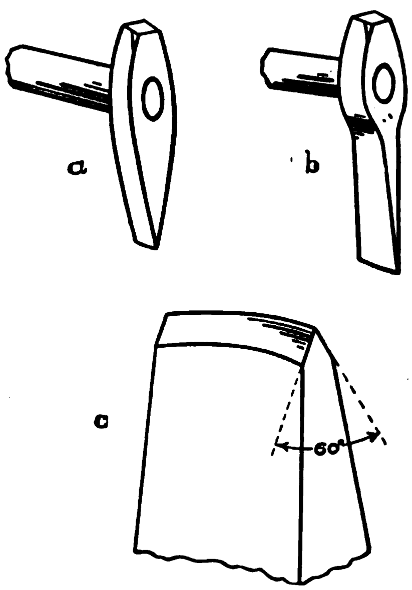


Fig. 3. HOT AND COLD CHISELS.

chisel for cutting hot metal is shown at Fig. 3b. These chisels are both made of tool steel, as is also the hardie which is shown in Fig. 4. The square shank of the hardie fits into the hardie hole on the right hand end of the anvil. The hardie is very convenient for cutting small pieces of metal, but is generally only used when there is no helper at hand. All three of the tools mentioned above should be hardened and tempered. Although the hot chisel may soon lose its temper by contact with the hot metal, it is always better to have it tempered at first, as the steel is then left in better condition. Care should be used in grinding the cold chisel to have the cutting edge slightly rounding, as shown at c, in Fig. 3. The ground faces should make an angle of about 60 degrees with each other. The chisel, if ground as shown above, is much less liable to break out at the corners than if the cutting edge is perfectly straight. Under no circumstances should the cutting edge curve inward and be concave, for the corners are almost certain to crack off.

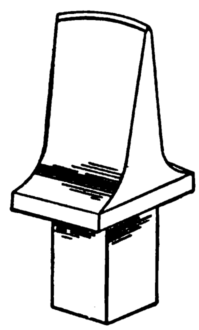


Fig. 4. THE HARDIE.

When cutting off wrought iron or machine steel cold, the bar should be cut on all sides about one-third of the way through and then snapped off in the following way: The bar should be laid with the cut resting on the outside corner of the anvil, the end to be broken off extending beyond the anvil, and this projecting end struck a sharp blow with the sledge. Flat stock need only be cut on two sides and simply nicked on the edges. No particular directions are necessary for cutting hot iron, excepting never, under any condition, to allow the chisel to be driven through the bar and onto the hard steel face of the anvil. When it is necessary to cut clear through a bar, a good way is to place the bar in such a position that when the chisel is driven through, it just clears the corner of the anvil, as shown in Fig. 5. The chisel may also be driven clear through the bar by cutting on the soft part of the anvil —either the horn or the soft iron block next the horn. Sometimes a thin flat piece of iron is laid across the face of the anvil and the cutting done on this. The ends of this piece of soft iron are bent down over the sides of the anvil to hold it in place.

One word about drawings. If a drawing is marked "*Rough*" the forging is to be left the size shown by the dimensions of the drawing. When finish is wanted on any part of a piece, that is, if any part, or piece, is to be afterward finished in the machine shop, or with a file, extra metal must be left on that part of the forging to make allowance for the finishing to be done. This finish is shown on the drawings in various ways—sometimes the surfaces, or parts, which require finish are marked simply "*f*," sometimes the word "*finish*" is used, or a red line may be drawn to indicate the place where the finish comes. When a drawing is marked "*finish all over*" extra metal must be left on all parts.

The amount of metal to leave for finishing varies. On small pieces which are to be filed up by hand, very little extra material should be left—$\frac{1}{32}$ inch being ample. On ordinary small work which is to be machined, from $\frac{1}{16}$ inch to $\frac{1}{8}$ inch may be left, while for larger work $\frac{1}{4}$ inch is the allowance sometimes made for finishing.

A forging when hot is expanded to some extent, and allowance must be made when measuring a hot piece of work for the contraction which takes place when cooling. For instance, a bar which measures two feet long when red hot will be about $\frac{1}{4}$ inch shorter when cold. This must always be taken into consideration. The proper allowance to make can only be learned by experience.

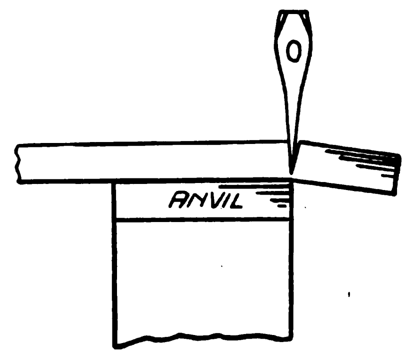


Fig. 5. PROPER CUTTING POSITION.

(To be continued.)

Burnt Tool Steel Restored.

J. B. PATTERSON.

It should be the duty of every one who expects to make a successful steel worker of himself to find out what the grain of steel looks like, and to examine it very closely before making an attempt to forge steel. Nearly every steel worker has different theories and ideas of working steel. Again if you take the steels of different manufacturers and compare the grain by breaking, you will notice a vast difference according to the grade of steel. Some will have a very fine grain, bright and velvety in appearance; others a very fine grain also, but much darker in appearance.

In taking up the question of burnt tool steel, it is well to know what this looks like. Take a small piece, lay it in the fire, blowing till it gets white hot—not so hot that it falls apart, but just hot enough to make the sparks fly a little. Take it from the fire, let it cool to a dark cherry red, and then quench in water, wipe dry or hold over the fire till dry, and break off a piece. Notice the difference now in the grain, very coarse and bright like pig iron and all full of little cracks. Now place the same piece in the fire, heat to a dark cherry red and lay aside to cool, this time without hardening. When cold break again and notice how dark it is in appearance, like rotten iron. This will give you an idea of what burnt steel looks like.

It would be well to find out how much heat the steel will stand before the grain is affected. This may be determined by heating in the fire to about an orange color, cooling and

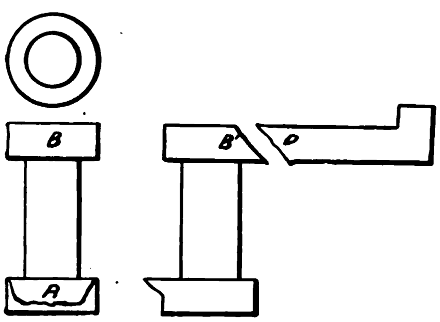
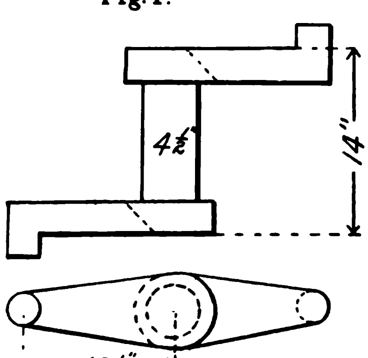


Fig. 1.



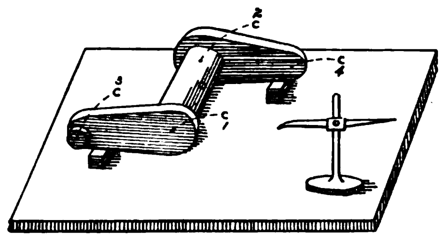
The American Blacksmith.

Fig. 2

FORGING A LOCOMOTIVE ROCKER.

breaking a little off the end. It will be seen that the grain is not affected at this heat, or at least it should not be. Then heat again till you find the degree of heat where the grain is changed and you will know just how hot to work this particular steel. This experiment will be worth to you ten times the value of the steel you burned and the time you wasted.

Next heat the piece of burned steel to a dark red. Take some bromide of potash, say about one half an ounce to a gallon of oil, pulverize and throw it in the oil and cool the steel off in this. Return it to the fire, heat slowly to a dark red and harden in water. Wipe dry, break off a piece and compare



The American Blacksmith.

Fig. 8 SQUARING UP THE ROCKER.

with the good piece, and to your surprise you will find the grain just as good or better than the piece that never was in the fire. Now make a chisel out of the same piece of steel, taking care this time not to over-heat it. Harden at a dark red and draw the color to a dark blue, and you have a chisel that will cut anything that a chisel is intended to cut.

By this method you may restore the carbon in any burned piece of steel and make it as good as ever, if it is not cracked up too much. These may be worked out if the steel is in such shape as will allow forging with a light heat with some good welding compound.

Forging a Locomotive Rocker.

W. T. JAMES

In forging a locomotive rocker, the barrel A B, Fig. 1, is forged in one solid piece, with the cylindrical surfaces as indicated. Two arms, D, are next forged, and scarfs formed at B and D, as shown in Fig. 1. When making the weld, stand the barrel on end, on the anvil as in a common weld, and after the weld is solidly stuck, turn upside down and put the fuller on the inside scarf, as there is good opportunity to get after heats on the outside scarf. The dotted lines in Fig. 2 show the welds after completion. This is a safe way of making a rocker, and further details are unnecessary, as any blacksmith can understand the process from the preceding explanation.

In order to square up the rocker before sending the same to a machine shop for turning, the following means may be employed. Place the rocker on a face plate with two parallel strips under it, as shown in Fig. 3. After striking the centers C^1, C^2, C^3 and C^4, take a surface gauge and adjust the position of the rocker so as to get the centers C^1, C^2 and C^3 in the same horizontal plane. The fourth center can then be tested, and if it shows out, as probably it will, the shaft is to be heated at O, and twisted until the four centers are brought to the same height from the surface plate.

It is not necessary to say any more as to lining up and taking twist out, as the blacksmith will run up against that naturally. These instructions hold also, in the case of repairing a rocker.

A Characteristic Blacksmith Shop in the Far Northwest.

WILLIAM LEGOE.

The photograph reproduced herewith, shows an interior view of my shop in New Whatcom, Washington. The view is not complete, as one fire and one vise bench, as well as the other side of the shop, could not be shown. As will be noticed, the fires are in the center of the shop, which is a great convenience for long rods. We do

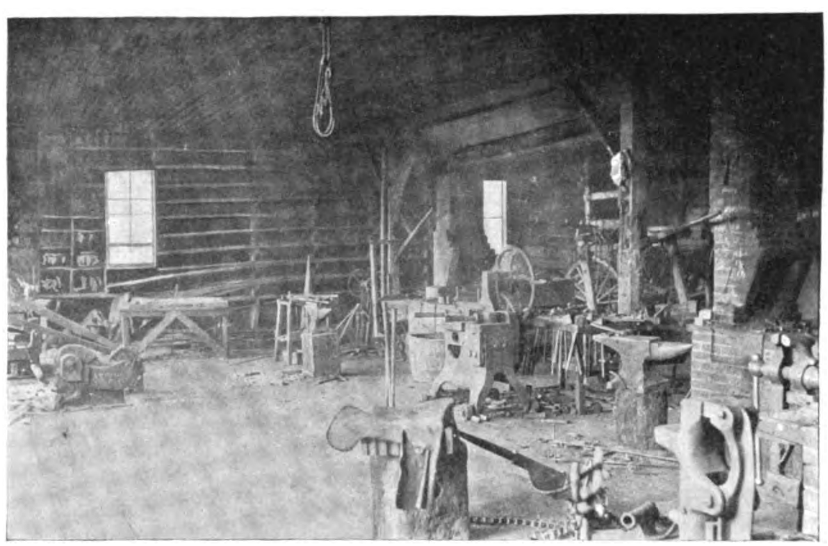


Fig. 1. INTERIOR VIEW OF THREE-FIRE BLACKSMITH SHOP.

horseshoeing and all kinds of repair work, and put up a wagon occasionally.

As for tools, we have the Green River Bolt Cutter No. 20, Wiley & Russell, Manufacturers; the W. W. Punch, No. 4, the Winner Shears, and the Champion Hot Tire Shrinker, large size, weighing 1,200 pounds, the West Hydraulic Cold Shrinker, smallest size, 1,300 pounds, and the Ziller Hand-Power Shrinker, manufactured in Portland, Oregon, weighing 16,000 pounds, and having a capacity of 1¼ by 4 inches cold. The West machine does fine work when the tire is not too thin and projects over the felloe a little, so that the wood does not take pressure off the tire. In the Ziller machine I have tried all kinds of wheels, large and small, with tires that could not be taken off a large wheel without cutting, and tires worn so thin that they bent around the felloes. If taken off these could not be expanded enough to get them back on a wide rim while hot, as they are much harder to get on than the narrow ones. With this machine you can do a fine job. We have also tried light tires on a light wheel, with some broken slivers bolted together, and have done a good job on them also.

Referring to the design of a chimney which will draw well, if any one will copy the first fire shown in the engrav-

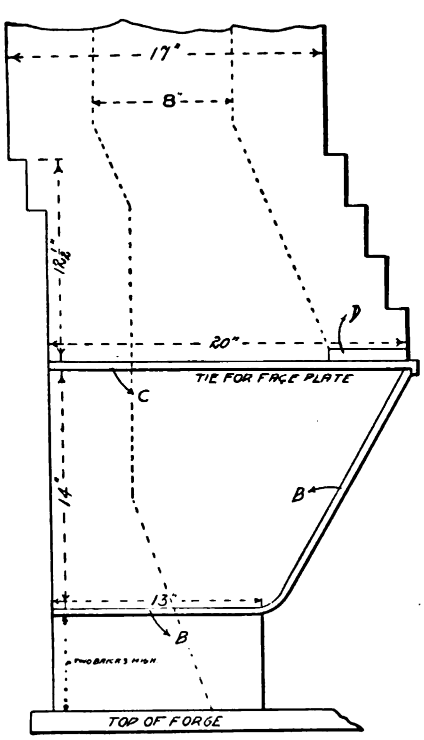


Fig. 2. SIDE ELEVATION OF CHIMNEY

ing, they will have the best I ever saw, and everyone that has used it says the same. Any bricklayer who does that kind of work can build it. In Fig. 2 is shown the shape and general plan of construction of this chimney. B B represent end supports 4 inches wide on the face, which run down on each side of the chimney front just above the fire, and bending, continue horizontally to the rear of the chimney at the level of the first two projecting bricks on the top of the forge. Two horizontal metal ties C hook over the upper ends of these face plates, and aid in sustaining it. Another metal plate, designated by the letter D, is likewise placed laterally across the chimney, at the top level of these two plates for sustaining the weight of the bricks above. The interior outline of the flue is indicated by the dotted

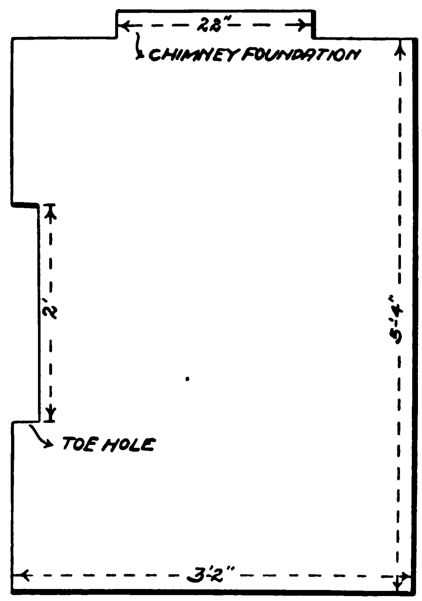


Fig. 3. GROUND PLAN OF FORGE.

lines on the sketch. The chimney above the offsets is 17 by 20 inches outside, while the dimensions of the flue within are 8 by 12 inches.

As for the forge itself, a convenient size is 5 feet 4 inches long, 3 feet 2 inches wide, and 2 feet 2 inches high. Fig. 3 shows the ground plan. For shoeing, a fire 4 inches higher is better. Around three of the top edges of the forge place a piece of wood 2 by 6 inches, either hard or soft, mortising the ends and nailing them together. Let the side pieces extend 2 or 3 inches beyond the forge on the chimney end, and by means of two ⅝-inch bolts with plates and washers fasten these ends firmly to the floor. This will give you a solid top when built in with mortar, when the forge is finished. This makes the height 2 feet 4 inches over all. In the center of the front side of the forge it is well to have a recess 2 feet in width, 4 inches deep and 2 inches high. I call this a toe hole, and have so designated it on the sketch. It is very handy and easier on your feet when working close

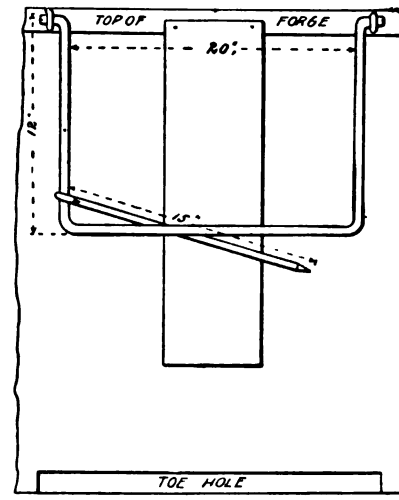


Fig. 4. DETAILS OF SIDE SUPPORT.

to the forge to have a recess of this nature.

For the purpose of forming a convenient side support, put two ½-inch bolts in the wooden corner piece of the forge. Then take a piece of ⅝-inch bar iron about 3 feet 10 inches long, bend over each end at right angles, and then about 10 or 12 inches from each end bend again in the reverse direction, so as to form the support shown on the side of the forge in Fig. 1, and also more in detail in Fig. 4. Then take a piece of 7/16-inch or ½-inch iron and form an eye at one end, large enough to turn round the corner of the support. Make this latter piece 15 inches long, sharpen the point and slip it on the support rod just described. By means of a piece of board nailed to the side of the forge, you will thus be able to support the rod at any elevation you may desire. Fig. 4 indicates the general outline of the device just described.

Another handy thing in the shop is an eye bolt in the ceiling, with a double and single block for raising a wagon up in front in repairing fifth-wheel or king bolt. Never build a shop with anything less than a twelve-foot ceiling, and then you can set a buggy pole up against the side. A ten-foot ceiling will always bother you.

I think that none of our sons should grow up wholly ignorant of studies which at once train the reason and fire the imagination, which fashion as well as forge, which can feed as well as fill the mind.—*Farrar.*

The Scientific Principles of Horseshoeing.—3.

Elementary Anatomy and Physiology of the Foot.

(Continued.)

E. W. PERRIN.

The lateral cartilages, sometimes called wings of the pedal bone, are thin plates of cartilage which are attached to the os pedis, one on each side, extending backwards partly within and partly above the hoof. The part above the hoof can be felt with the fingers. When in a normal condition they yield under pressure, but spring back as soon as the pressure is released, like a steel spring. These cartilages lie beneath the coronary cushion and are attached to the bone by ligaments. They are especially prone to disease, and will be fully dealt with in an article on "Sidebones, or Ossification of the Lateral Cartilages."

To prevent friction, all surfaces where there is movement are provided with a synovial bursa, sheath or membrane. The enlargements at the fetlocks-commonly called "wind galls," because it was erroneously supposed that they were inflated with air—are distentions of the synovial bursa of the fetlock. A superabundance of this lubricating fluid distends the sac, bulging it out on either side. This fluid resembles in appearance a high grade machine oil, the purposes of which it most adequately fulfills.

The nutrition of this complicated structure is maintained by the nervous and circulatory systems. The blood contains every element necessary for

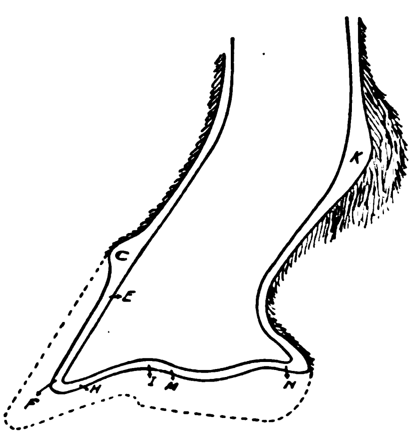


Fig. 7. SECTION OF THE SKIN.

the repair and nutrition of bone, sinew, nerve, tissue, skin, hair and hoof. It is carried to the foot by a system of arteries, the two main trunks of which are known as the digital arteries, which descend one on either side of the leg, following the course of the flexor tendons, lying between them and the superior sesamoideal. They give out numerous branches to the fetlock and pastern, but on reaching the coronet they divide into two main branches, which again divide and subdivide into innumerable branches. These terminate in minute ends, called capillaries, which are invisible to the naked eye, and which reach every portion of the foot. One of the main branches of this system, called plantar arteries, enters the os pedis on either side, passing in at the holes on the semi luna crescent, which are called the plantar foramen. From this point these branches pass through the bone, reappearing on the sides and running round in a little furrow in the bone. The blood is carried back to the heart, the pumping station, by a like system of capillaries, branches and main trunks called veins, a return circuit as it were.

A remarkable fact about the blood is that it not only rebuilds and repairs, but it also carries away the debris and waste. On its outgoing round it is bright red, laden with oxygen and all the materials necessary to nourish the body, but on the return circuit it is a blue purple, charged with carbonic acid gas and bearing away the effete products of the system. This venous blood is forced back to the heart, which organ pumps it to the lungs where it is purified and stocked with oxygen, returning to the heart to circulate anew.

The nerves convey that magic force which animates and imparts to muscles, tendons and ligaments the power of motion. They appear like fine white cords, and are classified as motor and sensory nerves, according to their function. Motor nerves are those which set in motion and control the muscles. The sensory nerves convey to the brain the sensation of touch or pain. There are two main trunks known as the digital nerves, one on each side of the leg; descending beside the digital arteries, they give out many branches to the fetlock and pastern, but on reaching the coronet they divide and subdivide into a multitude of branches, which in turn divide into innumerable filaments providing a complete circuit of nerve force. The ramifications of its network are so intricate as to set description at defiance.

The skin, though to a casual observer appearing as a simple covering, is a highly complicated organ, a minute description of which would occupy a volume. It is of special interest in the horse's foot, for the reason that the true skin of the leg continuing over the foot is transformed into secretory organs known as the pododerm which I shall attempt to briefly describe. The skin is composed of three layers. The

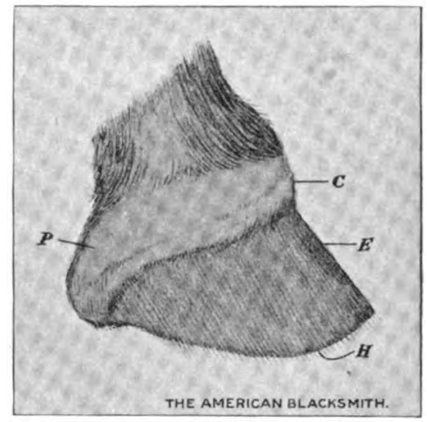


Fig. 8. THE FOOT DENUDED OF ITS HOOF.

first, the superficial layer or cuticle, is composed of a layer of flattened cells, "scales," which are constantly exfoliating as new cells are secreted by the true skin. The second layer, the cutis or true skin, sometimes called the leather skin, is provided with countless perspiratory pores, which form a system of surface drainage carrying off effete matter from the body. It is also provided with innumerable oil glands which lubricate the skin and impart that beautiful gloss to the hair of a well groomed horse. The cutis is also supplied with hair follicles, which provide the hairy covering for protection and warmth, possessing also the remarkable function of changing the coat each season, so that the animal is provided with a thin coat in summer and a thicker one in winter. The true skin varies greatly in thickness, especially in exposed parts; for instance on the front of the knees and points of the hocks it is very thick, while at the flank it is thin. The nerve and blood supply to the skin is a marvel in itself, for the capillary arteries are so numerous over the whole surface that you cannot prick the skin with a pin without wounding one of these capillaries, and the beautiful network of nerve filaments renders the skin so sensitive that a fly cannot alight on a hair without the horse feeling it. The third or inner layer is called the subcutaneous tissue. It is this layer that the butcher cuts through in stripping off the hide, it serves to connect the true skin to the body.

The pododerm or foot skin, though a continuation of the true skin of the leg, is divided into five different secretory organs. (See Figs. 7, 8, and 9). P, Fig. 8, is the perioplic band which commences just where the hair ceases to grow. It originates at the bulbs of the sensitive frog, blending with the velvety tissue which covers that organ, from whence it runs round the coronet from one heel to the other.

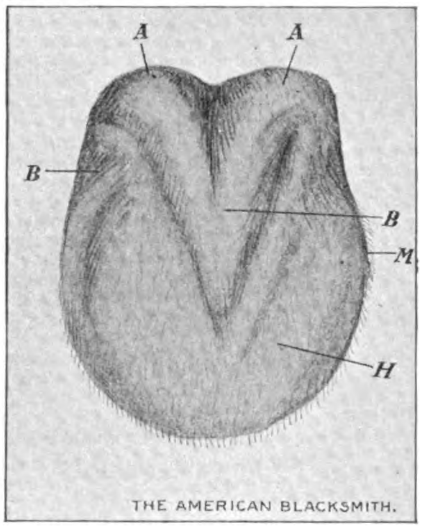


Fig. 9. PLANTAR SURFACE DENUDED OF HOOF.

Its function is to secrete the coronary frog band, a thin superficial layer of horn, which imparts the smooth gloss to the unshod hoof. The coronary cushion, C, Fig. 8, and C, Fig. 7, is a convex ridge, a ring running round the coronet from the bulbs of the sensitive frog. It fits into a concave groove on the inner superior border of the wall of the hoof. The coronary cushion is a highly organized structure; its surface covered with minute hair-like projections which fit into tiny holes in the horn, and its principal function is to secrete the wall of the hoof. E to F, Fig. 7, and E, Fig. 8, is the sensitive laminae, extending from each heel where it turns just under on the plantar surface to secrete the bars. Thence it runs round the foot from one heel to the other. It consists of a membrane thrown into a number of folds or leaves which run from the coronary cushion to the plantar surface. They dove-tail into an equal number, 500 or 600, of horny leaves on the inner side of the wall (L, Fig. 10). Its function is to secrete the horny laminae and inner layer of soft horn of the wall and bars. From H to I, Fig 7, and at H, Fig. 9, is the velvety tissue of the sole, which covers, with the exception of that part of the laminae which secretes the bars, the whole of the sole. It is covered with a great number of minute tubes called villi, which look to the naked eye much like hair on a fox terrier, though examination under a powerful glass reveals them as minute cone-shaped tubes tapering to hair-like points. Each tube contains a capillary artery and nerve filament which convey the materials for replenishing the growth of horny sole. The inner surface of the horny sole is filled with tiny holes, every one of which is a receptacle for one of these tubes or villi of the sensitive sole, and it is by these means that the horn cells and intertubular horn is secreted and pushed up from beneath. If in paring the sole in search of the cause of some lameness, you cut dangerously near the sensitive sole, you will slice off a number of the ends of these little tubes, villi, before you cut the sensitive sole itself, in which case a number of small blood spots will appear on the surface of the horn. To pare away another slice would cause profuse bleeding. This highly vascular organ is adequately protected by the horny sole of the hoof, but when the sole is pared too thin it is not only exposed to the shrinkage of a hard dry sole, but also to injuries from stones, nails, glass and other foreign bodies. Its function is to secrete the sole of the hoof. M, Fig. 9, is the velvety tissue of the frog, and like the rest of the pododerm it is a part of the true skin

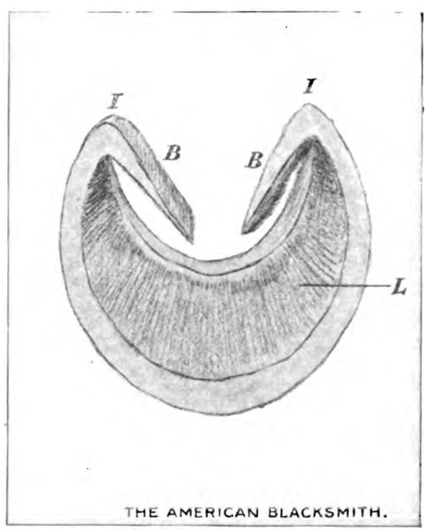


Fig. 10. THE WALL ALONE, VIEWED FROM THE GROUND SURFACE.

of the leg, though here it is transformed into a wonderful secretory organ which grows the horny frog. This tissue is covered with villi and extends over the plantar surface of the sensitive frog, blending on either side with the sensitive sole, H, Fig. 9, while at the bulbs, AA, Fig 9, it merges into the ends of the perioplic band. Its function is to secrete the horny frog. The sensitive or fatty frog is a wedge-shaped mass of fibrous and adipose tissue. On its plantar surface it

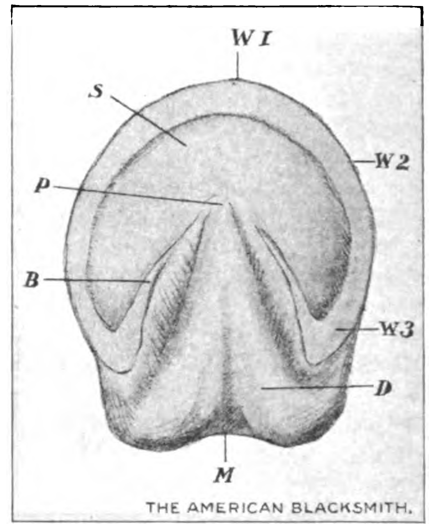


Fig. 11. GROUND SURFACE OF A FRONT HOOF.

is the duplicate in shape of the horny frog, M, Fig. 9, while on its superior surface it is almost flat from side to side, though concave from front to rear. It lays close up to the broad surface of the perforans and is suspended in position by a suspensory ligament, and a lateral ligament from the cartilage on either side. It is highly elastic and is aptly called the plantar cushion. It supports and diminishes concussion to the pedal articulation. Thus the whole of the pododerm comprising these five secretory organs grows every part of the horny box, the hoof.

The hoof which covers and protects the foot is remarkable for its great strength. It is tough and durable, and when in a healthy condition possesses some degree of elasticity. It is divided into three parts, sole, wall and frog. The wall, W1, W2, W3, Fig. 11, and Fig. 10, commences on either side of the frog near its point, running backward to the heels. These portions, BB, Fig. 10, are called the bars. At I I, Fig. 10, the wall inflects to form the heels or buttresses, and thence runs all around the foot. In front, W1, Fig. 11, it is called the toe, on either side, W2, the quarters, at W3, the heels. The wall is about the same thickness from coronet to ground surface, but thickest at the toe, somewhat thinner at the quarters, and thick at the buttresses or heels. Its greater bulk is composed of longitudinal fibres descending from the coronet to the plantar surface, which fibres are secreted by the coronary cushion and are solidly cemented together by a glutinous substance. The color of the hoof depends upon the pigment of the cutis, and hence the leg with a white pastern has a white hoof, except for the inner layer of soft horn, which is a whitish gray in all hoofs. The sole, S, Fig. 11, occupies the whole of the plantar surface within the margin of the wall and bars, and is secreted by the minute villi of the sensitive sole. It is different in texture from the horn of the wall, and is composed of tubular horn cells which become flattened into layers as they reach the ground surface. These layers exfoliate as the new horn is pushed up from beneath. It is concave on its ground surface and convex on its inner surface, fitting closely to the base of the os pedis which it supports, the sensitive sole interposing between the two. The frog, D, Fig. 11, and also Fig. 12,

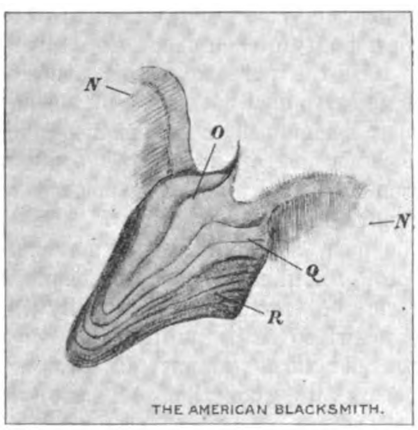


Fig. 12 THE HORNY FROG REMOVED FROM BARS AND SOLE

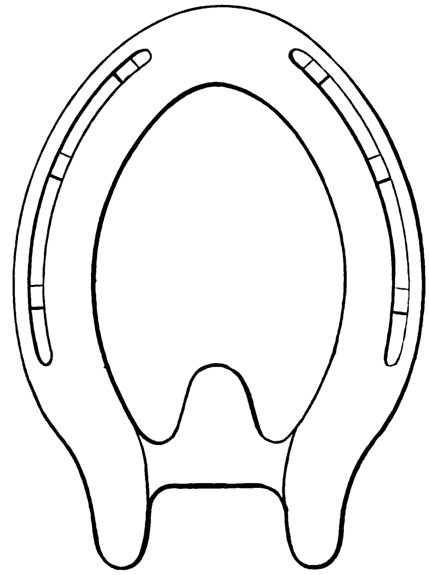
is located between the bars. It is wedged-shaped, with its apex to the sole, and widening toward the heels into two bulbs, with a depression between called the median lacuna or cleft of the frog, M, Fig. 11. The foot surface, Fig. 12, is covered with tiny holes, which receive the villi of the sensitive frog. The most interesting thing about the frog is its texture, which differs from any other part of the hoof. I never saw any substance which looks and feels so much like natural rubber. Its wonderful elasticity makes it beautifully adapted to diminish concussion to the foot and limb. Its function is to share with the other parts of the hoof the weight of the animal, and in a natural state it touches the ground with the heels. Like the sole it exfoliates naturally, generally in a complete layer covering the whole of its surface, provided it is not unduly pared in shoeing. The coronary frog band, N, Fig 12, is a thin band of horn secreted by the perioplic band. It originates in the bulbs of the frog and runs round the wall from each heel, and is readily seen in prolonged wet weather or after poulticing a foot, in which condition it is white and soft. It covers the wall with a glaze which protects its gluten from evaporation and imparts a gloss to the outer wall. As this superficial covering is so quickly destroyed by rasping the outside of the hoof, that practice is to be avoided as much as possible.

To the reader, I would say that horses' feet are cheap, and in order to profit by these studies you must do a little dissecting for yourself. Get a leg to the knee, skin it, then saw it into sections and observe the beautiful mechanism of the joints. To study the pododerm, soak a foot in water in which there is enough carbolic acid for disinfecting purposes, changing the water every three days. It takes about a month to separate a hoof from the foot and don't use force, because by so doing you destroy the villi. When the foot will come out with a little pull, wash clean and examine with a powerful glass, and you will be amply paid for your trouble.

A Successful Shoe for Contraction.

L. F. BENNETT.

Below is a sketch of a bar shoe which I have used with great success in cases of contraction. One case was a horse fourteen or fifteen years of age, whose left forward foot had become contracted by standing on hard floors. I commenced shoeing him in April. He was then so lame he would hardly touch his foot to the floor, and when standing would not bear any weight on it. His toe had been pared away as much as possible and the heels allowed to grow. (As these were naturally high, my readers can imagine how he stood). I found the frog as hard as the rest of the hoof and deep but narrow, the heels being contracted to such an extent that the frog looked pushed out of place. I cut away the heels, pared out the sole of the foot until it was very thin, but not soft. I also cut away the hoof on each side of the frog until I could spread the heels with my fingers. I used a hack saw for this, but it can be done with a knife. Then I fitted the shoe to the edges of the hoof, leaving the heels a little longer than used on most driving horses, and welded the bar in, according to the illustration. After this I packed the foot and nailed the shoe, using only three nails on a side and driving them



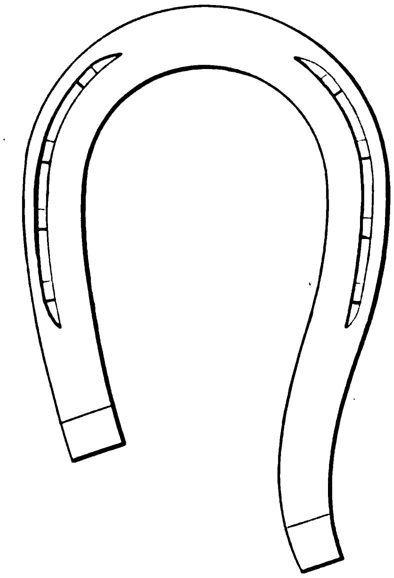
A BAR SHOE FOR CONTRACTION.

high. The horse began to improve rapidly, and within a week showed no lameness whatever. The hoof is now wider and the frog soft and in proper shape. The horse does not rest his foot when standing, and although I do not claim he is cured, I know it has helped him. The writer hopes this will prove of some benefit to those who may have a case of this kind to deal with.

Another Opinion on Interfering.

JOHN BUCHHEIT.

How can I stop that horse from interfering? This is a question that



A TRAILED SHOE FOR INTERFERING.

has been asked more, and has puzzled the average blacksmith more than any other thing. I have read volume after volume on the above subject, but I find that men recognized as authorities differ. After working and serving an apprenticeship in Germany of seven years, and twenty years in this country, I find that if you shoe your horse level you will stop nine-tenths of the interfering.

However, if I have a horse that will interfere after following the above rule, my next step is to shoe the horse higher on the inside, and lower on the outside. I have had cases when that would not work, and then I resort to the opposite method, high on the outside and the shorter calk on the inside. Trail the shoe, as indicated by the accompanying sketch. By so doing I have always been able to stop any case of interfering. You will find what makes one horse interfere will cure another. I have never had any success by side-weighting the horse.

Some Suggestions on Decorative Iron Work.—1.

WILLIAM C. STIMPSON,
Instructor in Forging, Pratt Institute, Brooklyn

In human nature there is an inborn love of beauty, although ideas as to what is beautiful differ with different peoples. The savage may express it in a carved war club, the Chinese in some cunningly executed piece of bronze, the Japanese in a smoothly enameled vase.

Looking backward over the history of civilized peoples we find that limited resources compelled the use of copper, bronze, potter's clay, wood or iron in different cases for fashioning their implements and utensils. Invariably,

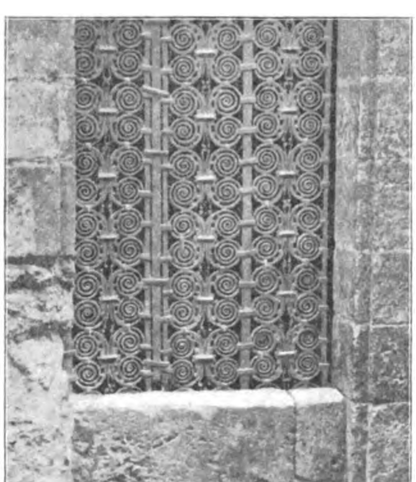


Fig. 1. WINDOW GRILL SUGGESTING STRENGTH AND RESISTANCE.

however, the art side showed itself. In the most highly civilized nations of the past, the great mass of the people seem to have appreciated the artistic in their trades, and we find many of the most common articles of daily use made with remarkable skill and with much beauty. Within the past twenty or thirty years a similar tendency has shown itself throughout the leading nations of our time, and in this country there is today a greater demand than

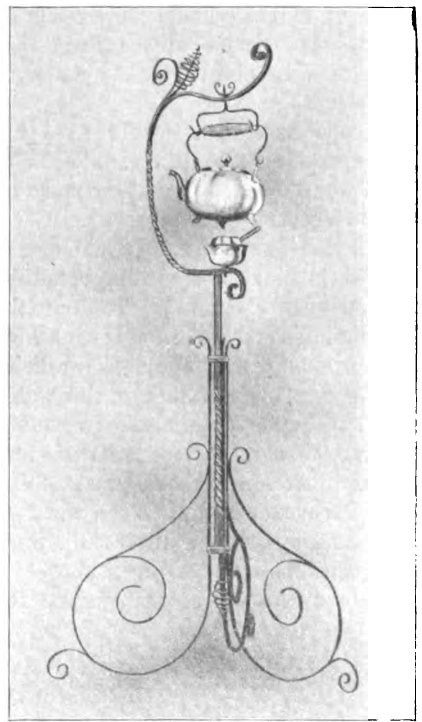


Fig. 2. IRON WORK SUGGESTING LIGHTNESS AND DELICACY.

ever for a simple beauty in house-furnishings and articles of daily use.

In a well designed article of any kind, the first requirement is that the material shall serve well its intended use; the next, that the article itself be constructed in accordance with the conditions imposed by the material. For decorative purposes wrought iron holds no mean place in the list of materials

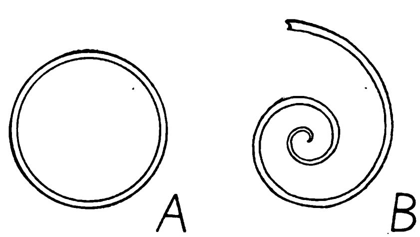


Fig. 3. THE CIRCLE AND THE VOLUTE SCROLL CONTRASTED.

thus employed, and few lend themselves more readily to the varying needs of the designer in making his decoration harmonize with its surroundings. For instance, with heavy stock, straight main lines, and closely coiled scrolls, it is possible to give an impression of great strength and resistance, suitable for the gate or window grill of some massive stone building (Fig. 1); while

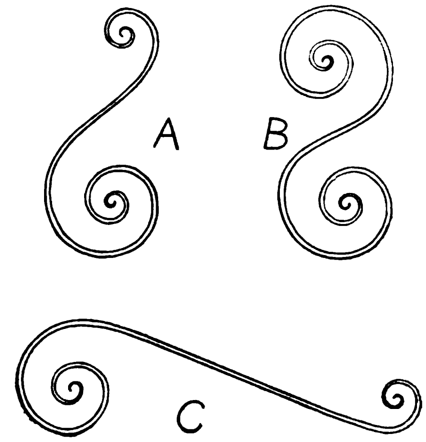


Fig. 4. PROPORTIONS OF S-SCROLL ENDS.

with small stock, sweeping lines and graceful curves, an air of lightness and delicacy may be produced suited to the most dainty interior decoration (Fig. 2).

It is the purpose of this series of articles to deal with some of the simpler elements, both in the design and construction of decorative wrought-iron work, and to show the methods for producing this class of work. One of the most characteristic forms is the scroll, for in no other material can this form be produced so readily and adjusted so easily as in iron. Let us consider three things: Its design in general, its production, and some typical endings.

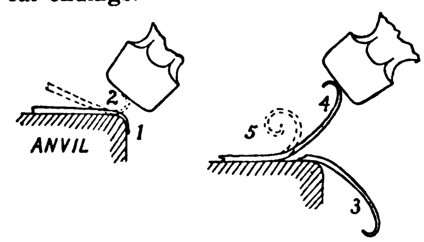


Fig 5. BENDING THE EYE OF SCROLL.

The subject of design is too large to be dealt with in much detail in an article of this character. I shall, therefore, state very briefly some of the points which the designer must consider when making his drawing. In the first place, his curved lines must have variety; that is, their sweep must change constantly. In a circle the curve is monotonous, as it has the same spring for its entire length; the volute scroll has variety, because the space between the lines gradually increases from the eye outward. (Contrast A and B, Fig. 3). This matter of variety in the curved line may be aided by the selection of stock. For example, take a scroll made from flat iron; looking full at the edge, you see simply the lines of the scroll; looking full at the flat, you see but parallel straight lines, except where the stock may be widened at the eye. In any other position you get a combination of these two, which

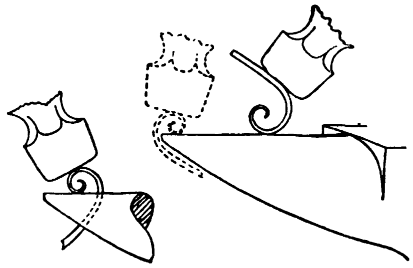


Fig. 6. CLOSING THE EYE ON THE HORN.

changes constantly with each point of view. In combining two or more of these scrolls the designer must have a good spring in the connecting line (A, Fig. 4), and not run it straight (C, Fig. 4). In these combinations he must regard the proportions of the adjacent scrolls, seeing that they balance well. Consider an "S" scroll, for instance. If the two ends are exactly the same size, the result will look clumsy and top-heavy (B, Fig. 4); while if one end is extremely small and the connecting line long, the result will look weak (C, Fig. 4). Still another point to be considered is the relative size of the scrolls compared with the size of the stock. Here the character of the work in hand will be the guide, as before stated—closely coiled scrolls suggesting strength, resistance; the more open curves suggesting lightness, grace. This whole matter of proportion—the relation between the apparent width of the iron and the enclosed spaces—lies at the very bottom of all

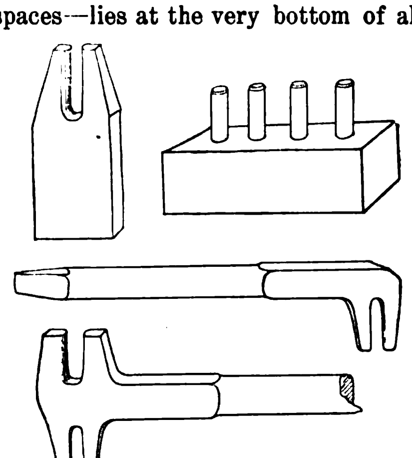


Fig. 7. BENDING BLOCKS AND WRENCHES.

good designs and can only be learned by constant study and practice.

To work out a scroll from a drawing, we must first get the length. Do this by measuring along the middle of the thickness of the stock with a piece of soft wire, or by stepping off with the dividers set to a convenient length, as ¼, ½, or 1 inch. Now cut the stock, making allowance for the change in length in shaping the ends (see Fig. 11); take heats, and draw down each end. For bending, we depend very much upon the variation in the heat of the stock. A good heat on the end of our blank, shading down to a low red, is the best condition for quickly bending the curves we wish. The sketches (Fig. 5) show clearly the different steps in forming the eye of a scroll. This part is all done by hammer blows,

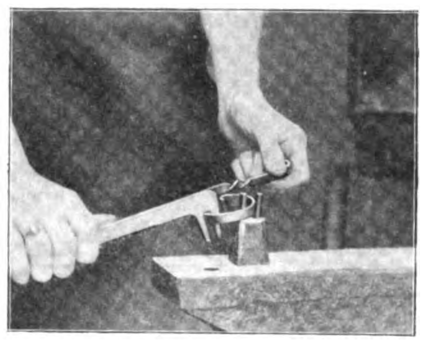


Fig. 8. THE BENDING BLOCK AND WRENCH IN USE.

coaxing the stock into the desired shape. With a little practice not only the eye, but some of the body of the scroll, can be bent up true and good in one heat. Should the eye be large when first formed, we can close it by striking on the back as we slowly roll it along the horn (Fig. 6). With light stock, the rest of the curve may be blocked out in this same heat with the aid of the bending block (Fig. 7). The

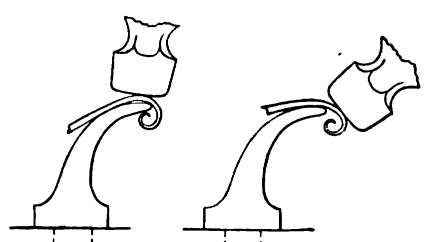


Fig. 9. TRUEING THE EYE ON BENDING FULLER.

bending block, or fork, and the wrench are the most useful tools for forming this class of work. I show two styles of blocks to be gripped in the vise, but either one could be made with shank to fit the square anvil hole. The forged block is better in the long run; the other, made by shrinking round steel pins into a soft steel block, can be made very quickly, but the pins are apt to bend. My readers are probably familiar with this style of tool in some form or other, and it will be readily seen (Fig 8), that with blocks and

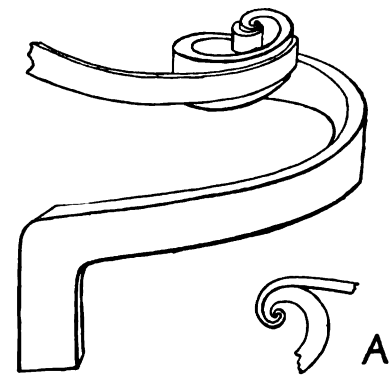


Fig. 10. A SCROLL FORMING DEVICE.

wrench any point in the scroll can be easily reached and the curve turned up. The wrench shown (Fig. 7) is of soft steel, case-hardened—the inside of the prongs being nicely rounded so as not to cut into the iron. A double-headed wrench, with one set of prongs a little closer together than the other, will be found very useful, especially where there is much taper on the scroll blanks. In either blocks or wrenches, the space between prongs or pins should be about one and one-half the thickness of the stock to be bent—length slightly greater than width of stock. What I term a bending fuller is very useful in forming and truing up the eye as shown in (Fig. 9). The overhang allows the stock to roll up well under the nose.

When many scrolls of exactly the same shape are to be made, a forming

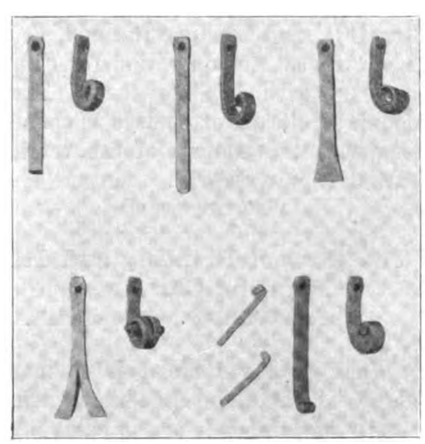


Fig. 11. SIMPLE FORGED SCROLL ENDINGS WITH BLANKS.

scroll is first bent with its eye thrown up—the other end bent at right angles so that it may be gripped in a vise, (Fig. 10). The scroll blank is heated and a very small eye formed on the end. This eye is caught in the eye of the former (A, Fig. 10), the stock wound

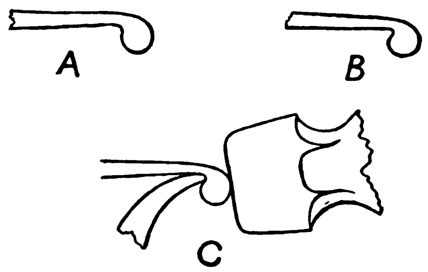


FIG. 12. FORMING A SOLID EYE.

around and then removed by a slight backward movement. It is then placed on the anvil or surface plate and set down. Figure 11 shows five typical forms of simple, forged, scroll endings. They were all made from the same size of stock, $\frac{1}{4}$ by $\frac{1}{2}$ by 5 inches, so that a comparison of the blanks and lengths can be easily made. Two methods are shown for welding up the eye of the last ending, and the same thing could be done by upsetting on the end before shouldering. The shoulder leaves the end, as at A, Fig. 12, and it requires more of an undercut, as at B, Fig. 12. On small stock this may be worked in very quickly with a half-round file, or it may be formed on a bending fuller, as shown at C, Fig. 12.

Sometimes a design calls for a double scroll, one inside of another. Two styles are suggested in Fig. 13, and the steps are clearly shown in each case. In A, after the double thickness is bent up, an even heat will allow the two ends to be sprung apart. In B, the short curve at the center of the eye is obtained by gripping the blanks in the vise, as indicated by the straight line C D, and bending the end, E, by hand; repeat the operation for F, and true up with bending tools. These double scrolls are often used in connection with the endings of the vertical bars of a gate or grill.

(To be continued.)

The Cost of Painting and Re-Painting Carriages.

Schedule of Labor and Materials.

M. C. HILLICK.

What good red blood is to man's physical being, a fair schedule of prices rigidly maintained is to the paint shop. In happiest phrase you may refer to the art side of vehicle painting, but the grace of the fashion of art perisheth quickly without a foundation of business methods sure and steadfast.

At no time in the history of the business of carriage and wagon painting have art and finances been more interdependent than in these early days of the new century. It has in times past been argued with insistence that an undeviating price schedule cannot be maintained in country villages and rural communities generally, but the pith of this contention is removed when it is recalled that today the practices of a prosperous rural community are substantially an accurate reflection of the practices flourishing in the large towns and cities. If it is feasible to adhere to a working schedule of prices in Buffalo, it is equally feasible to successfully cleave to a price schedule at a cross-roads settlement. As a matter of fact, the paint shop, regardless of location or previous condition of prosperity, is as dependent upon a price schedule for its success as the ocean liner is dependent upon its compass to point the course to a safe harbor. In years agone the paint shop proprietor has not seriously concerned himself

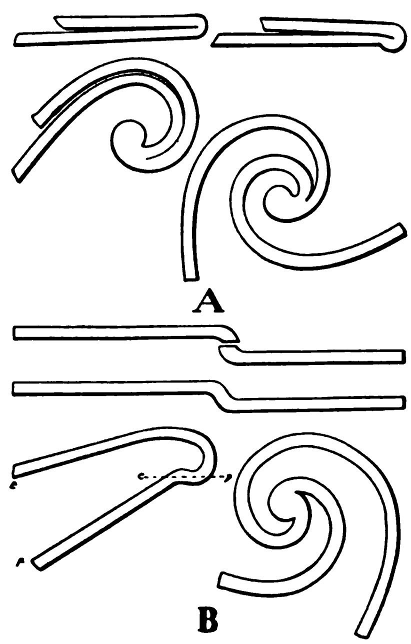


Fig. 13. THE FORMATION OF DOUBLE SCROLLS.

with a price schedule to be maintained to all alike. It has been policy from his view point to manipulate a sliding scale. Only in an indefinite, vague sort of way has a price schedule been fostered in a majority of provincial carriage paint shops. Perhaps to this cause, quite as much as to any other, must be attributed the more or less demoralized condition of the jobbing trade. Proportionately the country paint shop can be as healthy and robust as its city namesake. Proportionately, too, it can be made a profit-yielding institution. Neither can long survive any form of neglect, however.

In estimating upon special work not adapted to specific classification, or in estimating upon the necessary processes as applied to any given job, the carriage painter in the city or remote country village cannot afford to be other than painstakingly exact. Guess work in reaching a price for painting is always misleading. By their estimates ye shall know them. The painter who in cold figures works out a cost estimate to cover a certain piece of work, accurate down to minutest detail, is, other things being equal, in a position to make a reasonable profit from his investment of labor and material. In case of applying a guess estimate to cover the same work the coveted profits may vanish with merely a bare escape from loss to reward the guesser.

In working out a price schedule, it is essential to know the quantities of material — especially varnishes — required for the various classes of vehicles. It is possible to give in this connection only an approximate statement of quantities, because painters differ considerably in the quantity of material they apply per coat. Manifestly is this true in respect to varnish. The finisher in Buffalo may put on perhaps a fifth more varnish per job than his brother at any point of the compass fifty or 200 miles distant.

Paint and Varnish for Average Style Buggy.

Body (new work).

Priming, ...	1 pint
Lead, ...	$\frac{3}{4}$ "
Quick putty, ...	$\frac{1}{4}$ lb.
Roughstuff (4 coats), . . .	$1\frac{1}{2}$ pints
Stain coat, ...	$\frac{1}{4}$ pint
Color (thinned)	$\frac{1}{4}$ "
Black rubbing.	$\frac{1}{2}$ "
Clear rubbing (2 coats), .	1 "
Finishing varnish, ...	$\frac{3}{4}$ "

Running Parts (new).

Priming, ...	$1\frac{1}{4}$ pints
Rub lead, ...	$1\frac{1}{2}$ "
Putty, ...	$\frac{1}{4}$ lb.
Lead coat (if needed), . . .	$\frac{3}{4}$ pint
Color (thinned), ...	$\frac{1}{2}$ "
Black rubbing varnish, . .	1 "
Clear rubbing varnish, .	1 "
Finishing varnish, ...	$1\frac{1}{8}$ pints

Surreys, phaetons and cabriolets of the lighter build require nearly, if not quite, one quarter increase in quantity of all necessary material, over above table.

In the matter of heavy pleasure vehicles, such as five glass landaus for example, the quantities of paint and varnish would be as follows:

Five Glass Landau.

Body (new work).

Priming,	3	pints
Lead coat,	2	"
Putty,	½	lb.
Roughstuff (4 coats),	6	pints
Coat of stain,	1	pint
Color (thinned),	1	"
Black varnish (1 coat),	1½	pints
Color and varnish (1 coat),	1½	"
Clear rubbing varnish (1 coat),	2	"
Finishing varnish,	2⅛	"
Rubbing varnish, for mixing roughstuff, color, putty, etc.,	3½	"

Running parts (new).

Priming,	2¼	pints
Rub lead,	2½	"
Putty,	1	lb.
Lead coat (if desired),	1½	pints
Color (thinned),	2	"
Color and varnish,	1¾	"
Clear rubbing varnish,	2	"
Finishing varnish,	2¼	"

From the above the individual painter can quickly figure the cost of stock used upon the styles of vehicles in question. Local conditions, advantages in buying, etc., are large governing factors in determining the cost of paint and varnish materials.

The labor cost attached to painting the average buggy in the average jobbing paint shop is approximately as follows:

Painting Buggy—Labor Cost.

Body (including seat).

Priming, including sandpapering,	$ .20
Apply lead coat,	.15
Puttying,	.05
Apply roughstuffs (4 coats) and stain,	.30
Rub roughstuff,	.50
Moss off or lightly sand, and color, inside and out,	.20
Color and varnish, outside,	.10
Color and varnish, inside, and slush paint bottom of body,	.10
Rub down color and varnish,	.15
Apply clear rubbing varnish,	.10
Rub for finish, wash job, etc.,	.50
Finish inside (this to include lightly rubbing surface with pumice stone and water and washing up),	.30
Finish outside,	.20
Total,	$2.85

Running Parts (wheels and shafts included).

Sandpapering and priming,	$0.50
Putty and sandpaper,	.35
Rub lead,	.50
Apply second lead,	.25
Sandpaper and color,	.50
Apply color and varnish,	.25
Moss off and stripe,	.30
Rub with water and pumice stone and stripe (double line work),	1.00
Apply clear rubbing varnish,	.30
Rub varnish and wash for finish,	1.00
Apply finishing coat varnish,	.30
Blacking off top joints, dash feet, toe rails, steps, etc.,	.20
Total,	$5.45

Summary.

Painting and finishing body complete,	$2.85
Painting and finishing running parts,	5.45
Total,	$8.30

This statement is based upon active work, supplemented with shop equipment of labor-saving devices and a first-class working outfit of brushes, stock, etc. If but one or two jobs go through the shop at a time the cost items of labor would considerably increase over those herewith given. The cost of burning off a buggy body and running parts, added to the above would increase the total amount $3.50. If only the body was burned off, the running parts being surfaced over the old paint, the increase would amount to fifty cents.

The painter in the small town and village is often called upon to burn off and re-paint the coupe or other form of rockaway. From doing this work a well defined line may be had upon the cost of painting the heavier class of vehicles—Landaus and Berlin coaches, say.

Labor Cost of Painting a Four Passenger Rockaway.

Body—

Burning off,	$2.25
Sanding and leading,	.75
Puttying,	.40
Four coats roughstuff and guide coat,	1.50
Rub roughstuffs,	6.00
Moss off and apply two coats body color,	1.75
Paint and varnish roof,	1.00
Apply either color and varnish or rubbing varnish,	.50
Rub with water and pumice stone,	1.80
Stripe moldings, if required,	.50
Wash and apply second coat, rubbing varnish,	.65
Rub with water and pumice stone,	1.80
If a high grade job, wash and apply third coat rubbing varnish,	.65
Rub with water and pumice stone and wash for a finish,	$2.00
Apply finishing coat,	1.00
Total,	$22.55

Running Parts—

Unhanging and clean grease,	$ .50
Sanding and smoothing rough places,	.50
Apply lead coat,	.30
Putty,	.50
Sand and apply coat, "dead lead,"	.75
Look over with putty,	.15
Sand and apply coat color,	.75
Apply color and varnish,	.30
Lightly rub with water and pumice stone flour and touch with color,	1.00
Stripe, 3-line, and glaze,	1.50
Apply clear rubbing varnish,	.40
Rub with pumice stone flour and water and wash for finish,	1.75
To finish complete,	.50
Total,	$ 8.90

Summary.

Painting and finishing body,	$22.55
Painting and finishing running parts,	8.90
Polishing nickel, cleaning glass, etc.,	1.50
Hanging off, touching up and making ready for service,	1.50
Labor cost, total,	$34.45
Cost of paint and varnish materials for body,	$ 8.00
For running parts,	4.00
Material cost, total,	$12.00
Labor cost, total,	34.45
Grand total,	$46.45

As a working plan for readers of THE AMERICAN BLACKSMITH, located in the smaller towns and villages, is given the following:

Price Schedule for Repainting.

Touch up and varnish buggy,	$ 5.00
Touch up and varnish phaeton,	5.50
Rub bodies of above jobs, apply one coat color, stripe running parts and finish,	7.00
An extra coat of varnish to above,	2.00
Burning paint off buggy body, surfacing, running parts with lead and repainting job complete,	15.00
Same work to phaeton,	16.00
Touch up and varnish surrey,	7.00
Extra coat varnish for same,	3.00
Extra coat varnish for body,	1.75
Painting surrey, over old paint,	15.00
Burning paint off entire job and repainting,	20.00

Touch up and varnish cabriolet, 10.00
Extra coat varnish to same, . 4.00
Extra cost varnish to body, . 2.25
Painting cabriolet over old paint, 22.00
Burn paint off body, ... 2.00
Burn paint off entire job and repainting, ... 27.00
Touch up and varnish rockaway, 18.00
Extra coat varnish to same, . 8.00
Repainting over old paint surface, ... 48.00
Burn off body, surface running parts over old paint, and paint complete, ... 55.00
Touch up and varnish brougham or landau, ... 24.00
Paint over old surface, . . . 55.00
Burn off body, surface running parts over old paint, and paint throughout, ... 64.00
Touch up and varnish Berlin coach, ... 28.00
Surface and paint upon old paint, 60.00
Burn off body, surface running parts over old paint, and paint entire, ... 70.00
Platform wagon, paint upon old paint surface, ... 12.00
Color, and varnish, stripe and finish, above job, ... 10.00
Touch up and varnish light business wagon, ... 6.00
Paint light business wagon, without top, upon old paint, 11.00
Paint top (canvas) to same, . 2.00
Paint heavy business wagon, over old paint, without top, . . 15.00
Paint top (canvas) to same, . 3.00
Paint paneled top business wagon, over old paint, . . 28.00
Touch up and varnish hearse, . 20.00
Paint hearse, upon old paint, . 40.00
Burn paint off body, surface old paint on running parts, and paint throughout, ... 50.00
Burn body and running parts and painting throughout, . . . 60.00
Touch up and varnish cutter, . 3.00
Paint over old paint surface, . 6.50
Touch up and varnish pleasure sleigh, ... 6.00
Paint over old paint surface, same, ... 12.00
Burn paint off body, and paint throughout, ... 15.00
Clean up and apply dressing to buggy, phaeton or surrey top, per top, ... 1.00

Some of the New Ideas in Iron Work at the C. B. N. A. Exhibition.

BY D. W. M.

The latest shape in axles is the oval, for naked gear work, set on edge, or perpendicularly, to give greatest strength with lightness, the arch of the axle starting immediately at the back of the hub of the wheel. One maker used a forked axle to give a broader bearing for the fifth wheel, but this required a peculiar construction of the whole job, or was necessitated by it.

A new axle arm device had a hole drilled from the point through the center of the arm almost its entire length, and a slot cut from the top of the arm through to the hole. This slot was filled with felt. The center hole being filled with oil, and closed by a plug on the end of the axle arm screwed into the hole, was supposed to make an adequate reservoir for oil supply so as to feed the felt which absorbed the oil and distributed it to the inner surface of the box. The inventor stated that he had run an axle of this description about 4,000 miles with one oiling. The end of the axle had a nut to hold on the box in the usual way. The plug could be made to retain the box with a flange, and the exterior nut could be screwed on the box—making it oil tight. A screw plug at the rear collar closed the hole where the oil is injected. A new plan of oiling axles was shown. A hole being drilled through the axle nut and arm, and the arm perforated with a number of small holes, the oil is injected by means of a small pump without removing the wheel.

A new shaft coupling device doing away with leathers or rubbers, consisted of a ball on the end of the shaft set into a socket on the jack. A swinging loop made on the ball swings under the jack as soon as inserted, and a strong spring underneath catches this loop or is forced into it by a tool, holding the ball in the socket so tightly that rattle is said to be impossible. Offsets on the inner sides of the loop catch around the jack in such a way that when the loop drops into place, which it will do as soon as the shaft end is inserted in place, the shaft end cannot be pulled out without first raising the loop by hand, thereby making a safety device in case the spring should break. The whole device consists of four pieces only. Still another shaft coupler is made with a hook so that it can be inserted only by lowering the point of the shafts to the ground. When raised the shaft end tightens in place and a cam lever pushed back fixes the grip so strongly that rattle is said to be impossible. It can be applied to any old style jack.

A new style body loop was shown, so made as to be adjustable to any width of body. The appearance was of a short bar over the spring, the loop dropping under the body just outside the spring bearing. Under the body it curved outwardly to the side of the body or sill, and could be cut off if too long, and the outer hole drilled where wanted. As this device throws the weight of the job on the body bar instead of the sill it is open to an objection, for the bar is never made to sustain so severe a strain.

Fitting Sleigh Shoes.

J. G. HOLMSTROM.

A few years ago I was called upon to settle a dispute between a horseshoer and a farmer. The shoes of the farmer's bob were worn out, and he bought a set of cast shoes of the hardware dealer, bringing them to the horseshoer with the request that he put them on.

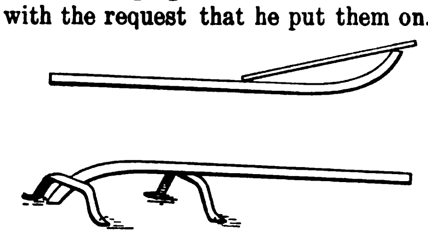


Fig. 1. STRAIGHTENING AND BENDING SLEIGH SHOES.

The shoes did not fit the runners, and the horseshoer began to whittle them down to the shape of the shoe. To this the farmer objected, as it would spoil the runner, but the horseshoer claimed that it was the only way to put them on, for the shoes could not be bent. The farmer, however, claimed they could, and the matter was referred to me.

It is possible that there are others who believe, as did this farrier, that bob shoes cannot be bent, and as this is a time of the year when such work must be done, I shall give them my experience in this work. It is easy to straighten or bend a cast shoe as the case may be, if we only know how to heat it. Here, as in many other instances, the whole secret is in the heating. When a bob shoe is to be bent to fit the runner, be sure to make the heat long enough. In heating, go slow and turn the shoe over in the fire so that it is not allowed to rest on one side for

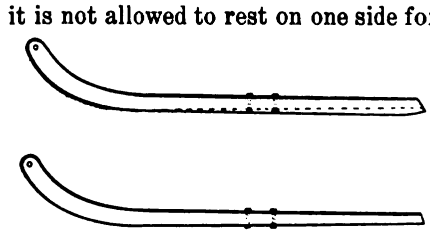


Fig. 2. REPAIRING A WORN RUNNER.

any length of time, for if you do the lower side will burn, while the upper side is cold. If you go too fast the outside may begin to melt while it is yet cold in the center. When the heat is of a dark red it is just what is wanted, and you may proceed to bend or straighten as the case may be.

If the shoe is to be straightened, take a piece of iron strong enough to stand the pressure, and place it over the shoe in the manner shown in Fig. 1. Then place it in the vise and turn the screw slowly, and if the heat is right the shoe can be straightened out entirely.

If the shoe must be bent, then prepare a place to bend it in. It can be bent by putting the shoe in the vise and pulling on the end of the shoe, but the best way is the way shown by the illustration. Make the staple-shaped pieces out of 1 by ½-inch iron, and fasten them to the floor with large screws.

Another way to bend the shoe is as follows: Place a piece of band iron on

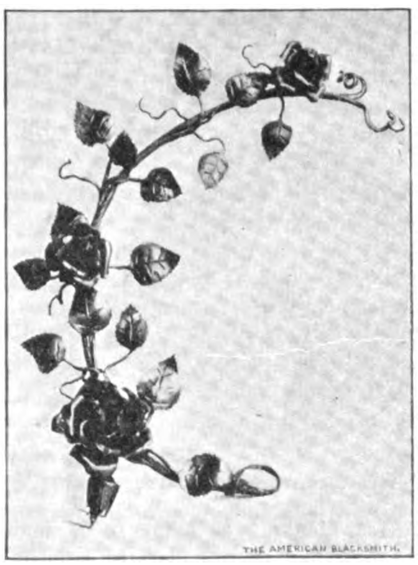


Fig. 1. A SPRAY OF IRON ROSES AND LEAVES.

the runner, and then when the shoe is hot put it on the runner, pressing it down with a couple of screw clamps to the position it should have. This may be done when the shoe is only a little out of shape, but when much out of shape it must be heated in several places. It will be found best to bend in the device described, or straighten in the vice, as it takes time to place the band iron on the runner and even then it will not bend snug to the runner.

If the runner should be worn out of shape, as they almost invariably are, you should not try to bolt on the shoe without first having repaired the runner. In the second illustration is shown a runner worn so that the bolts stick out through the runner. The same figure shows how this has been remedied by putting on the piece A.

If the shoe is too long and it must be cut, care should be taken that the jar from the blow in cutting will not break the shoe. Place the shoe over the hardie, and the cold chisel on the shoe exactly over the edge of the hardie; now take a solid grip with the left hand over the front end of the shoe to take up the jar from the blow. Let the helper strike a quick blow with an eight pound sledge. A heavy sledge will give a bump that is liable to jar the shoe so that it will break. The sledges used are too heavy in most cases, but I may explain that in some future article.

This done, the next things are the holes, and if the shoe is hard you will find it difficult to drill new holes. The shoe can be softened by the following process: Heat the shoe to a dark red, place a piece of brimstone, the size of a bean, just where you want the hole, and then let the shoe cool off slowly. If you want to know what the effect of the brimstone is on the shoe, just heat a rod of iron, say $\frac{5}{16}$ inch round to a white heat, put it against the brimstone and the iron will melt like lead. The spectacle is worth the trouble. In drilling hard shoes or any thing hard, don't use oil, as it will only prevent cutting; instead use water or turpentine. Also it is well to keep up a steady pressure on the drill, so that the chip once started will not be allowed to run out.

The Rose as an Element in Artistic Iron Work.

E. G. ZACHER.

That the fragrant, fragile and perishable rose, with its wonderful beauty of curve and contour, can be reproduced in so hard and inert a substance as iron may to many at first sight seem peculiar, but for the skilled hand it is a matter of comparative simplicity. In the finished product, indeed, it would seem as if only color and fragrance were needed to complete the illusion. Hard and unyielding as its prototype is soft and perishable, the iron rose possesses an additional interest to those who know its birth of fire.

The engravings accompanying this article show several handsome designs embodying the rose as an element of the design. Fig. 1 is a simple spray with roses and leaves. Fig. 2 shows a design for a photograph frame. Fig. 3 is of a single candlestick and Fig. 4 a triple candlestick, both employing the same general scheme of construction and using an adapted rose for supporting the candles. These engravings

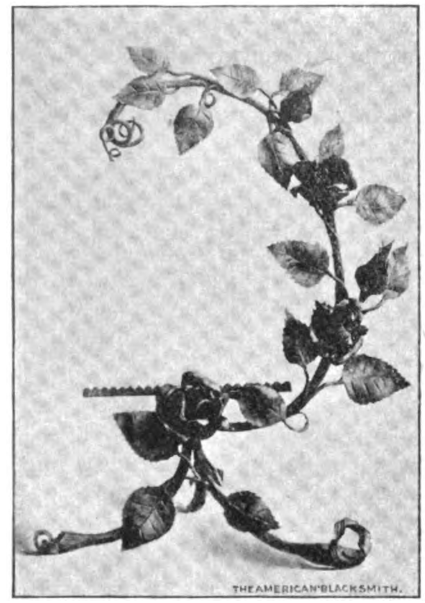


Fig. 2. A SIMPLE PHOTOGRAPH HOLDER.

are from samples of work done by an Austrian blacksmith, who learned his trade in some of the large forge shops of Germany, and who, during the past summer, has been engaged in producing a large variety of this class of work for sale to Pan-American visitors. This smith, with forge and helper, has been located very appropriately in the old German village "Alt Nürnberg" on the Midway of the Pan-American Exposition, and has been realizing a good margin of profit by the sale of

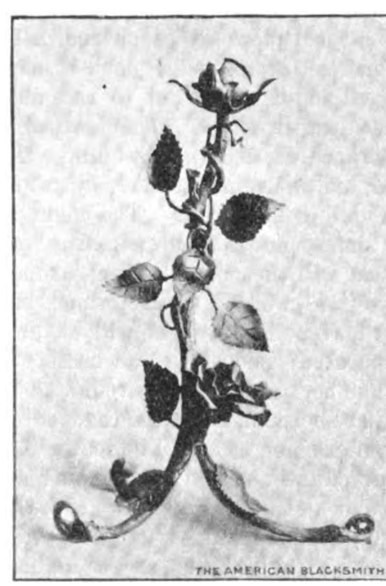


Fig. 3. A SINGLE ROSEBUD CANDLESTICK.

such pieces to visitors of aesthetic inclinations. The production of work of this nature by hand, without the aid of dies or moulds, requires of course no little skill in order that the resulting piece may possess artistic merit.

It cannot be said, however, that the work is extremely difficult, and hence for those who may desire to try their hand, a few hints regarding the candle

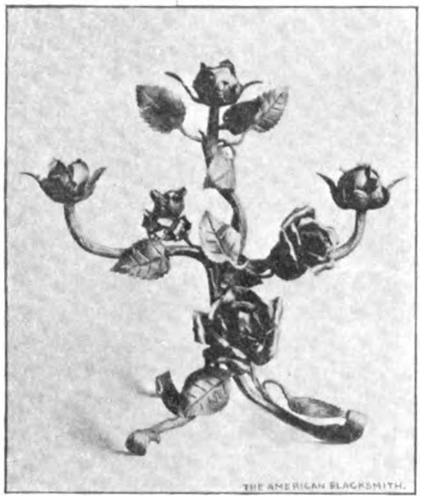


Fig. 4. AN ARTISTIC TRIPLE CANDLESTICK.

stick design, Fig. 4, will be given. A forge, a good grade of soft iron and a few ordinary tools are about the only requisites.

Take three pieces of $\frac{5}{8}$-inch bar iron, draw, weld together at one end and curve to form the upper part of the stem work. The lower part is formed in a similar way, and these two pieces welded together. To relieve the uniformity of surface, a cold chisel may be used to groove the stems. Having fashioned this, proceed to the leaves. Take a short piece of $\frac{3}{8}$-inch rod, heat one end to a white heat, place it upon an anvil and flatten it out to resemble a rose leaf in shape. The teeth-like appearance is secured by filing the edges, and the veins are made by means of a dull cold chisel. The stem is next drawn down to proper size, and the leaf will then have the appearance shown in Fig. 5. As a rose branch has many leaves this process will have to be repeated many times, according to the number of leaves desired, and it should be borne in mind also that leaves vary in size and shape. The leaves can be curved later with a pair of pincers.

The next thing to do is to make the rose. Much ingenuity is required here in order to give the rose a natural appearance, and yet shape it so as to allow a candle to fit in the center of it. The stem is first shaped by drawing down a short piece of $\frac{3}{8}$ths iron rod, and filing a square nose on the upper end, as indicated in Fig. 5. With a compass describe a circle (radius, one inch) upon a piece of sheet iron, and divide it according to the first diagram, Fig. 6, designating this piece by the letter A. Now describe another circle (same radius) and divide it so as to contain five petals, Fig. 6, second diagram, calling this B. Describe a slightly smaller circle, divide it similarly to B, but with only four petals, and label that C. Repeat this last operation, making the petals a trifle smaller and label this D. Then lay out a fifth piece, E, such as shown by the third diagram in Fig. 6, and of the same size as D. Cut out these pieces and punch a square hole in the center of each to correspond with the square head on the stem piece of Fig. 5. With a ball-headed hammer strike each piece so that it will assume a disk shape.

The next step is to weld the parts, stem and petals together. Take a careful welding heat on the stem end and the disks, and then quickly slip the latter on the stem in proper order, putting E on first, then D, C, B, and A last on top. Then fasten the stem in in a vise, and with one blow weld the disks to the stem, flattening out the square head. With a pair of pincers the petals may then be bent so as to

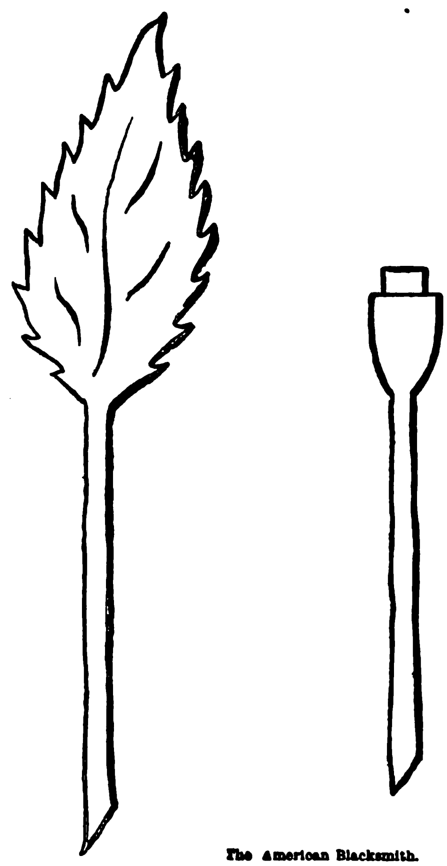


Fig. 5. OUTLINE OF ROSE STEM AND LEAF.

suit the taste of the maker, shaping them to form either a full blown rose or one sufficiently open at the center to accommodate a candle. To make a bud, take a low heat and close the petals together lightly. A nice effect may be given the roses by bending the petals of piece F down as though drooping.

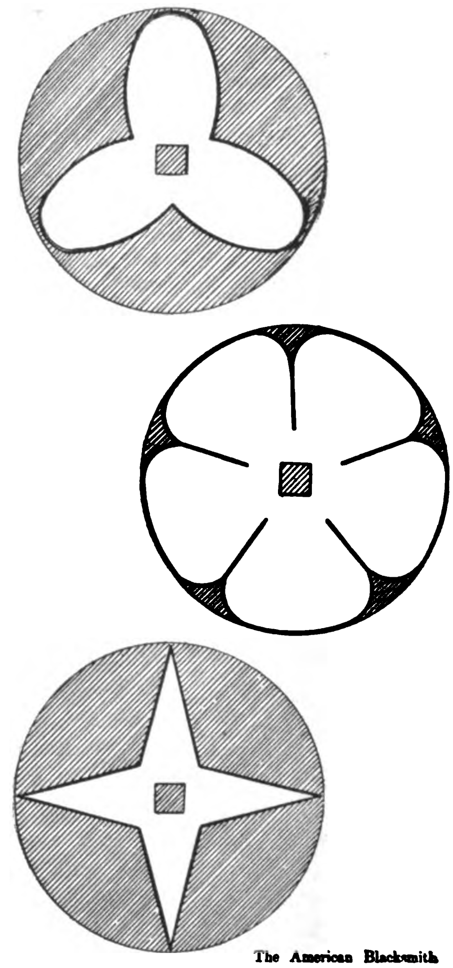


Fig. 6. BLANKS FOR MAKING THE ROSE.

After making as many roses, buds and leaves as may be desired to ornament the piece, they are joined by welding to the main stem at the proper places. The final touches are given by bending the various parts to assume the graceful lines desired in the finished product. To prevent it from rusting and also give it a better appearance, the candle-stick should be painted with a mixture of drop black and turpentine.

Many other ornaments embodying the rose have been made, such as picture frames, miniature hat racks, etc., but the candle-stick design has been found to be the most popular and pleasing, and, when well made, is a very handsome ornament.

A Blacksmith's Son. An interesting fact not generally known is that the father of Hall Caine, the celebrated novelist, was a blacksmith, at Ramsey, Isle-of-Man. This is but one instance where the sons of blacksmiths have become known to the world.

Replacing Broken Bicycle Spokes.

BY SCALE.

In a previous article I gave a few hints about brazing. In this article I shall attempt to describe the way to replace broken spokes in a bicycle wheel.

The tools needed are a nipple grip and a trueing stand. The first I have made by bending a piece of $\frac{5}{16}$ iron about $2\frac{1}{2}$ inches long into the shape of a "U," the point of the "U" being close together and the ends about $\frac{3}{16}$ of an inch apart. I think it best to buy a nipple grip, however, as they cost only a few cents. I also improvised a trueing stand by turning the wheel upside down and measuring from the sides of the forks to the rim.

We will suppose that a bicycler has had the misfortune to be run into by another, and has in consequence five or six spokes broken in the front wheel of his bicycle. He has come to us for repairs and wants his wheel as soon as possible. To begin with we will turn the wheel upside down. It will be necessary to crowd the tire off the rim for a space sufficient to get out the nipples belonging to the broken spokes. The new spokes must now be taken through the holes in the hub, to the proper holes in the rim. We screw down the nipples for a large part of the distance with a screw driver, using the slot cut in the top of the nipple for the purpose. After the spokes and nipples are in place we put a little rim cement—a can of which is handy—on the rim and crowd back the tire. The nipple is now used to tighten the spokes slightly. The nuts holding the axle are then loosened and we make sure the wheel is in the proper place, with axle tight against the forks as it should be with the weight of the rider on it. The nuts are then tightened, and the wheel turned slowly, we meanwhile watching the distance between the sides of the forks and the rim. Where the distance is unequal the spokes are tightened accordingly. We now go over the wheel with the hand, and any spoke that springs more than it should is tightened so as to equalize the tension of the spokes on the rim, as they are liable to break at the hub if not properly tightened. Our job is now done and the customer has his wheel in good shape again.

When crowding off the tire to remove old nipples, do not crowd off for a longer space than is absolutely necessary, especially if the wheel is to be used at once. If the wheel you are repairing is a rear wheel you may have to take off the sprocket to get the spokes to the hub. If you do be sure to turn the locknut that holds it the proper way, as some of the lock nuts for this purpose have left hand threads in them.

Shop Talks on Wheels and Axles.—3.

BY D. W. M.

From a theoretical standpoint it may be taken for granted that a high wheel requires less pulling power than a low one. The greater distance covered in a single revolution of a high wheel means that much less friction on the axle arm. A wheel four feet high would have a circumference roughly speaking of twelve feet, and a wheel three feet in diameter would have a circumference of about nine feet. Hence the three-foot wheel would have to turn $33\frac{1}{3}$ per cent. faster than the four-foot wheel in order to keep up with it on the road, and would require that much more power to overcome the friction. This calculation however does not take into account any accurate measurement of friction. There is friction of the axle and friction of the road bed, and still another element, i. e., the power required to mount an obstruction. The high wheel offers a long leverage, the low wheel a short leverage. In addition, owing to its shorter curve of rim, it would sink deeper into depressions in the road than the rim of a high wheel, and hence it is estimated that fifty per cent. is a nearer representative of the actual power lost by the low wheel.

There are other facts to consider, however. The high wheel involves greater weight. It is higher and wider, the tire and rim are longer, and the number of spokes required greater.

These offset the advantages over the low wheel. Sulkies for speeding purposes were formerly made with very high wheels of the toughest timber and lightest construction possible. To reduce axle friction various devices were put on the market until we have now the roller bearing and ball bearing axles. Ball bearing axles made it possible to save weight by reducing the size of the wheels.

The frictional resistance of roadways was reduced by the pneumatic tire. The resistance of the gather and set under of axles was eliminated by means of the wire wheel set perpendicularly and without gather. The question remained. How high should the wheels be? and only experience could determine the happy medium which provided the greatest amount of strength with the least weight and the smallest number of revolutions. Opinions still differ, according to the make of wheel and axle, the size varying from thirty-four to thirty-eight inches on wire wheels for a racing sulky.

On bike buggies there seems to be a disposition to make the wire wheels about two inches higher than last year, for the sake of appearances merely.

Careful experiments have been made to show the power required to draw a given load on a given roadway with various heights of wheels. But these are merely food for the curious and do not deal with conditions as they exist in real life. They establish the correctness of a principle which is evident enough without the experiments.

A high wheel offering longer leverage of resistance ascending an incline than a low one, offers less resistance on a level, all other things being equal. The direction of the pulling power is an element frequently neglected. A pull is more effective when it is parallel with the roadway. To pull downward is to make the load heavier and the friction greater. To pull upward is to lighten the load and reduce the friction, but at the expense of the power. But if transfer of weight, say to a horse or a locomotive, serves to give tractive or purchase power, then it may be so used to advantage.

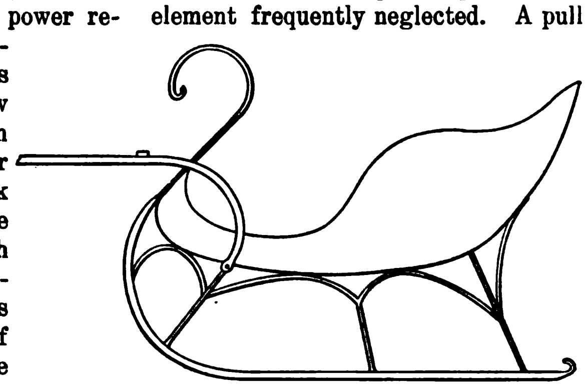


Fig. 7. COUPLING THE SHAFTS OF A SPEEDING SLEIGH.

A farm wagon with the reach dropping toward the front axle will pull a little harder than one with the reach horizontal, because it pulls down on the hind axle, provided the pulling was done by the reach. This is not the case, however, as the bed unites the gear, and therefore the position of the reach does not operate to affect the running of the wagon. The line of pull from the horses, however, is usually slightly upward and is such that the stronger the pull required the tighter the purchase power of the feet on the ground.

In a speeding sleigh it has been found advantageous to have the shafts coupled well back of the point where the runners leave the ground, to accommodate which a bar is frequently placed back of the dash board to which the shafts are coupled. If the point of the shafts is sustained by a strap on the saddle, a pull by the trace on the singletree would serve to elevate the heel of the shafts. To aid in this the points of the shafts are sometimes placed in a socket attached to the harness to prevent being pulled forward. A slight transfer of weight is thereby effected when an extra pull is required. This method is sometimes applied to speeders on wheels, and attempts have been made to apply the principle to heavier vehicles.

The placing of the load on a vehicle has much to do with its ease of running. If the load be mostly on the hind axles, an extra amount of friction is caused on axles and tread. It is better to distribute the load evenly over all the wheels if possible. Many vehicles are so constructed, however, that the hind wheels and axles must of necessity carry the greater part of the load. Some coal carts are so built, and some busses and wagonettes. In such cases the constructor should make ample provision in the way of adequate axle and wheel strength, not merely to carry the load, but to run easily.

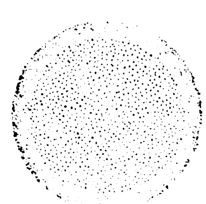
It is sometimes thought that the smaller the amount of surface presented for friction, the less the friction, but this is not always true. It depends on the character of the surface and not on the amount. If a piece of metal one foot wide and six inches thick and two feet long, each surface perfectly smooth and level, were laid on a perfectly smooth and level runway, it will be found by experiment that it will require the same power to move it when laid on its wide side as when laid on its narrow side. All other elements of friction being eliminated, save surface and weight, it is found that weight determines the amount of friction. A large axle causes no additional friction save by its own weight. A wide tire causes no additional friction save by its own weight. Over roads that are easily cut the wide tire will have an advantage over the narrow tire and move more easily. This is on the same principle as the snowshoe. Wide and thin tires for sand countries are better than the narrow ones. Narrow and thicker tires may be used only on hard smooth roads to advantage. Tires should be no thicker than necessary, as their weight comes on the wheels and helps to pound them to pieces. To save weight in tires is to save the wheels, save the load to be pulled, save power. But in this as in other things a happy medium is determined by experience. The tire must be thick enough to stiffen the rim against pounding on the road tending to flatten them between spokes, yet not so as to interfere with its resilience. The rim must be so proportioned that it will stand the continuous shocks and remain in shape. Formulas of proportion are published by various wheel factories for obtaining good results. Fashion sometimes decrees other proportions, however, without regard to science, experience or sense. Carriage building is not always scientific, more often it is not, and the thing called "style" is the master whose behests must be obeyed.

Case Hardening.

JOHN L. BACON.

The difference between wrought iron and tool steel resides practically in the amount of carbon which each contains. Tool steel can be hardened by heating to a red heat and cooling suddenly, because of the carbon which it contains, while wrought iron cannot be so hardened, on account of the lack of it. Wrought iron and machine steel are practically alike, in so far as chemical composition is concerned, since they will not harden to any great extent. This fact would prevent the use of either metal in many places where they would be the ideal materials, if they could only be given a hard surface.

It will, therefore, be seen that if by some means carbon can be added to the metal on the outside of an article made



SECTION OF CASE-HARDENED BAR.

of wrought iron or machine steel, the outside part will be practically converted into tool steel, and can be hardened in the ordinary manner, the inside metal remaining soft and unchanged. Wrought iron or machine steel if heated to a high heat in contact with charred leather, ground bone, or other material containing a great deal of carbon, will "take up," or absorb, carbon from that material, and the outside will be converted into a high carbon or tool steel. This process is known as case hardening, and is used for work which requires a hard wearing surface backed up by a softer and tougher material to resist shocks.

If a piece of wrought iron which has been case hardened be broken across, it will appear somewhat as shown in the illustration. The outside layer, or coating of hard steel, can be easily distinguished from the inner core of softer unchanged metal. The "depth of penetration" of the carbon, or in other words the depth to which the iron is changed into steel is determined by temperature to which the metal is heated, the length of time it is kept at that temperature, and the substance it is heated in contact with. The carbon penetrates faster at a high heat, but a high heat cannot always be used, particularly if that mottled appearance so often seen on case-hardened articles is wanted. Pieces which are to be mottled should not be heated much above a good red heat, as a higher heat destroys the color. The longer the work is kept at the proper heat the deeper the carbon penetrates, so that when the same heat and the same case-hardening mixture is used all the time, the depth of hardness on the pieces treated can be determined by the length of time the pieces are hot. In ordinary work, where it is not necessary to have the mottled coloring on the pieces, a good yellow heat should be used, about as high a heat as ordinary cast iron will stand without danger of going to pieces.

As stated before, a case-hardened piece of iron or machine steel is really made up of two distinct metals, the outside hard shell of high carbon steel, and the inside softer core of the original material. The outside coating can be treated just as you would ordinary tool steel, that is, it can be hardened and annealed. In fact when we suddenly cool a case-hardened article from a red heat, we perform exactly the same operation as hardening a piece of ordinary tool steel, with this difference, however, in hardening tool steel the piece is hardened clear through, and for ordinary purposes is so hard as to be almost useless, while with a piece of case-hardened machine steel, for instance, the outside only is hardened, while the inside is left tough and comparatively soft. In the case-hardened piece we have a tough inside core, which will stand shocks that would snap off a piece of hardened tool steel, and an outside coating of hardened tool steel. This gives a combination of hardness and toughness which is not possible with either machine steel or tool steel alone, and it is this fact which makes case-hardened articles so valuable for many purposes.

By taking certain precautions while heating and cooling, the surface of the case-hardened pieces may be given a mottled coloring of reds, blues, and greens, which when rightly done is sometimes very beautiful. Such coloring is often seen on gun locks, finished wrenches, etc.

Two of the commonest ways of case hardening are as follows:—

First. Small pieces, and pieces which need only a very thin shell of hard steel, are heated to a bright red heat, drawn from the fire and sprinkled over with cyanide of potassium, reheated for a very short time if small to give the carbon from the cyanide a chance to "soak in," drawn from the fire again, sprinkled with the cyanide, and cooled in cold water. This is an easy and quick way when it will answer the purpose. A small piece of iron case hardened in this way, when broken across, will barely show a very thin coating of steel around the outside, about one hundredth of an inch thick.

Second. This method is used when a deeper coating is needed. The pieces are first packed in an iron box in such a way that they are completely surrounded by ground bone, or some other material containing a great deal of animal carbon. The box is then sealed up air-tight with fine clay, heated in a furnace to the right heat, and kept at this heat for several hours. The deeper the coating desired, the longer the box is kept hot. When the box has been heated long enough it is withdrawn from the fire, the top taken off, and the pieces picked out while red hot and hardened in cold water. Or, as is often done, after taking off the top, the box is turned bottom side up over the tank and the whole contents, bone and all, dumped into the water. When case hardening this way it is necessary of course to protect the substance in which the pieces are heated from the action of the air, or it would burn to ash. For this reason it is very necessary to have the box sealed air tight with fire clay or something which will stand the heat. The boxes used are made of cast or wrought iron, but cast iron boxes are very satisfactory and easily replaced when worn out.

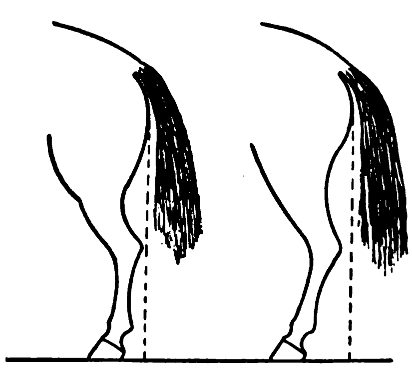
We have found by experiment that when wrought iron or machine steel pieces are heated in ground bone, the carbon will penetrate at the rate of about one one-hundredth of an inch per hour. Thus, if a box is charged with pieces which are to be case-hardened to a depth of three-hundredths of an inch, the box, after being brought to an even heat all the way through, should be kept at a full red heat for about three hours.

Conformation of the Posterior Limbs.

E. MAYHEW MICHENER, V. M. D.

Faulty conformation of the hind limbs is very common. In regard to the position of the limbs under the body or trunk, it has been said that a plumb line dropped from the most prominent and most posterior point of the rump should pass slightly behind the point of the hock, and continuing downward should pass behind the fetlock joint at a slightly greater distance than at the hock, and should strike the ground about twice as far from the back of the heel as it was from the fetlock joint. Refer to the left-hand outline in the illustration.

As in the case of the front extremities, the distance between the hind hoofs, while standing at rest, should be equal to the width of the hoof, that is, it should admit of a hoof of same size



CONFORMATION OF THE POSTERIOR LIMBS.

being placed between. If the distance is less, the condition is known as base narrow, as in the case of the front extremities, the lines of the limbs approaching each other as the ground is reached like the two lines of the letter "V." In the base-wide condition the lines are the reverse, diverging as they approach the ground and represented by the two lines of an inverted letter "V." Viewing the hind limbs from the rear of animal, the lines of the two legs should be nearly vertical and parallel.

In addition to the variations above noted, the hind limbs may be bowed either inwardly or outwardly. If the lines of the two limbs approach each other more closely at the hocks than at the fetlock joints the legs have an inward bow; the points of the hocks generally point inwardly and toward each other in this condition. The opposite condition to the one just described is when the points of the hocks point outwardly and the distance between the hocks is decidedly greater than the distance between the two legs at the level of the fetlock joints.

Viewing the hind legs from the side the condition known as sickle-leg may often be detected. In this condition the line of the leg in the part below the hock slopes away from and to the front of the more nearly perpendicular line of the perfect leg. The fetlock and also the hoof is thus placed too far in advance of the correct line, as seen in the right-hand diagram of the figure. The sickle hock is a very commonly observed fault in conformation, and predisposes the animal to curb and injuries of the flexor or back tendons of the leg, as an undue amount of strain is placed upon those parts. If the hoof is allowed to become long the condition is rendered still worse, as additional leverage is brought to bear upon the parts above mentioned. As has been noted the line of the perfect leg is slightly in advance of a perpendicular line. In limbs perfectly perpendicular from hock to fetlock, and in those in which the line of the leg is behind the perpendicular line, there is undoubtedly a predisposition to diseases of the hock joint, either of the bones or the ligaments and synovial membranes which compose it. In an abnormally straight hind leg the concussion is much greater than in one in which the force of impact in travel is distributed to the posterior tendons of the leg in proper amount. If, in addition to the abnormally straight condition, is added the hoof with high heel and short stubby toe, the condition is rendered worse.

The conformation of the part of the leg from fetlock joint to the ground surface of the hoof can for the great part be studied alike in both front and hind legs. Viewing this region from in front, the perpendicular line should divide the cannon, pastern, and hoof in two equal parts, meeting the ground at the middle

Spokes $2\frac{1}{4}$ x $2\frac{1}{2}$ inches,	$0.18
Carriage spokes,	.10
Cross bar,	.40
Carriage singletrees,	.40
Plow handles per pair,	1.00
Cultivator handles,	.75

J. M. BROWN.

A Price Schedule From Nebraska.

A short schedule of prices for general blacksmith work received from Mr. Edwin A. Stone, of Ong, Nebraska, is printed below:

Setting wagon and buggy tires, each,	$0.50
Sharpening plow lays, each,	.25
Sharpening cultivator shovels, per set,	.50
New 16-inch plow lays, each,	3.50
New 14-inch plow lays, each,	3.25

Congratulations.

THE AMERICAN BLACKSMITH craves the indulgence of its readers for a few minutes while it thus publicly shakes hands with itself, as it were. Never once did the highest expectations of its publishers look forward to the measure of success which has attended the dispatching of the first two issues of this periodical. The proverbial hot cake was simply not in the race. Copies have been in great demand, and friends made on sight everywhere. The large number of subscribers received, a grand total wholly unlooked for, together with much praise and many good wishes, has been almost overwhelming. This company is duly grateful for the tokens of appreciation thus unmistakably registered, and hopes always to merit the approval of its patrons.

Queries, Answers, Notes.

This column is intended for the especial benefit of AMERICAN BLACKSMITH readers. All should feel free to ask information upon any subject of craft interest. On the other hand it is hoped that those who have a good answer to any query thus made will not hesitate to submit it for the benefit of the questioner and others who may be dealing with the same problem. A brisk discussion of all such topics is desired. Comments upon the subject matter of preceding issues will also be given a place under this heading. It is especially desired that this department will be of value and benefit to readers.

Editor American Blacksmith:

Will some one with experience explain how to get old paint off of buggies, doors and furniture, so as to make a finished job? E. W. JONES.

Editor American Blacksmith:

Without encroaching on your time and space I would like to say a few words in regard to Mr. Smith's welding compound, described in your October number, for I don't quite agree with him as to its qualities. It is no doubt a good welding compound, but as to restoring burnt steel to its usual grade I question its ability. The compound has not yet been invented or made that will restore burnt steel. There is only one way to treat burnt or overheated steel, and that is to cut off the part so affected and put it in the scrap pile. D. R. MILLER.

Editor American Blacksmith:

I should be glad to see an article occasionally in your columns upon how to construct cheap power for blacksmith shops. I am very much interested in machinery. Though never having seen the working parts of a steam engine or the inside of a boiler, I have constructed one of each of my own design, and am running a 27-foot boat with them. I had no tools but a small post drill. I have designed a wind-power device and would be glad to give the details to any brother smith who might desire them. W. L. PAUL.

Editor American Blacksmith:

I expect to build and move into a new shop in the near future. Will The American Blacksmith kindly publish some sketches of up-to-date two-fire shops, in connection with a wood repair shop, all in same building, and a list of their equipment? Our line of work consists of horseshoeing and general blacksmithing and wood repairs. At times we build new work, such as wagons, carts and sledges, heavy and light.

I should also like to know what kind of liniment is used on corns, as mentioned in prize contest, Article No. 3 on horseshoeing in the October issue. Also should like to hear the experience of some smiths with weak heels on horses, and the treatment which they gave. JOHN A. MCKAY.

Editor American Blacksmith:

Replying to the question of "Anxious," in your October issue, I enclose copy of a form which I use for handling bad or doubtful accounts I have it printed at the bottom of my bill head, and supposing one Thomas Burke was the prospective debtor, it would read when filled out as follows:

"This certifies that I have this day sold and delivered to Henry Curtiss my two-horse wagon for the sum of three dollars ($3.00) paid to me in work. Said Curtiss agrees to lend me the use of same until the third day of December, 1901; he to take possession of same on that date unless the above mentioned sum is paid. I agree to take good care of, and be responsible for all damage to the same.

Witness my hand, this fifth day of October, 1901.

(signed) THOMAS BURKE."

The blank may be filled out with horse, wagon, buggy, plow, harrow or anything of the kind. The customer feels bound for the amount with a time limit. I submit this in hopes that it may be the means of saving brother blacksmiths many dollars. HENRY CURTISS.

Editor American Blacksmith:

The general blacksmith is in need of journals concerning the trade, in order to get more and better ideas about his work, to learn how to do better and quicker work with less labor and time, to bring the blacksmiths to a closer understanding, and to help them work with and not against each other. The blacksmith needs to keep posted in regard to his work, the prices and the best labor-saving tools. Blacksmithing can be made a success with good management, but one must keep up with the times

I would like to have better blacksmiths in our country than we have, more and better work, for we would have better prices. I would like to have better laws, so that we would surely get our pay for work when we give credit. Blacksmithing is a good trade if prices are not run down. There is plenty of work at a fair price, and indeed more good blacksmiths are needed.

I have steam power in my shop, by which I save a great deal of hard work. I can dress about as much lumber on my power planer in an hour as I could by hand in ten hours in the old way. The improved drill press and cold press punch is far ahead of heating the iron and punching holes. W. D. BOETTLER.

Editor American Blacksmith:

I want to know through your paper how to set spokes in a new wagon hub tight, and in the same plane. J. A. L.

Editor American Blacksmith:

Referring to the inquiry of Messrs. A. Sartwell & Son, in your October paper, would state that we most certainly do believe that in such a case a steam hammer would be of benefit. We advise this for the reason that we have for many years been solving these questions to the satisfaction of a great many firms in just exactly the same position.

Regarding the use of a steam hammer in a small shop, would state in the first place that it enlarges the capacity of the shop, and by vastly increasing the power to do work, will, in a short time, bring new work to the shop which was never thought of, and which was impossible to do without machinery to do it. By the use of a steam hammer under such conditions, we have found that many a shop was able to increase its buildings and business by such addition to its plant. We might instance a case of a man in the West who started a small blacksmith shop, doing all his forging by hand. He built up a good business this way, the town rapidly growing, and finally put in one of our No. 2 steam hammers, having 450 pounds falling weight. A month or so after setting up the hammer, we received a letter from him stating that he had the hammer running and was able to get so much work that it was going constantly, and that he would soon be able to put in further hammers. Last week we received an order from him by telegraph for a 1500-pound hammer to do his heavy work. This is only one instance. In addition to the above, the work turned out is done more cheaply and neatly and more to finished sizes than is possible by hand. GEORGE B. BELL,
Of the David Bell Engineering Works.

Editor American Blacksmith:

In answer to Mr. Lucien Haywood's query, would say that in my opinion electricity is more expensive than either a gas or a steam engine. Two years ago, when I built my shop, I put in electricity. My bills amounted to $22.00 per month. At the end of the second month I had the dynamo taken out and put in a gas engine. With this engine I operated my forges as well as heated the water for my shop and home, which is on the second floor, and my expense is but $3.00 monthly. As to the reliability of electricity, there is no question. Repairs are few, and can ordinarily be attended to by a fair mechanic. J. R. P.

Subscription Clubs.

It is an agreeably rare occurrence in the course of its correspondence that THE AMERICAN BLACKSMITH comes across a smith who is that narrow minded as to think only of his own advancement and who cares "not a whack" for the standing of his craft. The great majority, it is easily said, have the welfare of their trade as a whole, vitally at heart, and this is one of the brightest signs of the times.

THE AMERICAN BLACKSMITH has been founded in the interest of the craft, and it is felt they may be of mutual service. To increase the influence of the journal, its name must be spread in like degree. You can do your brother smith a real service by making him acquainted with THE AMERICAN BLACKSMITH. At the same time, you can benefit yourself and the journal as well. We will pay you for your time. Special inducements are offered for the formation of clubs of five or more subscribers, and these reduced rates will be cheerfully furnished on application. Let us hear from you. These special club rates are for the single purpose of inducing persons to become acquainted with the paper, and no renewals will be accepted at the end of a year from club subscribers, or anyone for that matter, for less than the regular subscription price, $1.00 per year It shall be the constant aim of the publishers to make the reading columns of the greatest possible value to the craft, giving double value and more for the subscription investment, so that once acquainted with THE AMERICAN BLACKSMITH, subscribers will be perfectly willing to renew at the regular rate.

Opportunities for New Shops.

In the course of extensive correspondence, covering the entire country, attention is called to a great many localities in which no blacksmith shop is at present located, and in some of which one is very urgently needed.

THE AMERICAN BLACKSMITH is glad to be able to make known these opportunities for the benefit of any of our readers who may be looking for something of the kind, and will continue to do so whenever the opportunity presents itself.

Mr. A. N. Longyear, of Bushnells Basin, Monroe County, N. Y., informs us that there is no blacksmith at that place, but that there is a good chance for some one to start a business. Mr. Longyear will furnish any further details if requested.

There is no blacksmith at the present time at Tilly Foster, Putnam County, N. Y., but Mr. Charles Erkson, of that place, owns a blacksmith shop which is unoccupied.

Leeds Point, N. J., has no blacksmith, and one could undoubtedly locate there with profit.

At Wayneport, Wayne County, N. Y., is offered a good opportunity for a man to work up a business. There is a good shop located at this place near a canal, but there is neither blacksmith nor wheelwright there. Address R A. McLeod for further information.

John Schneller of West Bethany, Genesee County, N. Y., writes that a good blacksmith is needed at his town. It is situated in a good farming section, and a shop here should pay between $800 and $900 a year. A blacksmith with a family is preferred. Mr. Schneller says that the locality would be a very good one for the right man, and offers to give any information regarding the locality which may be desired.

Deal Beach, N. J., has no blacksmith, as Mr. G. M. Parselle informs us.

There is no blacksmith at a nearer distance from Cedar Lake, Atlantic County, N J., than at Folsom, which is four miles away. For particulars as regards opening at this point address J. D. Woodford.

Bacons, Sussex County, Del., is only a small place, but has no blacksmith at the present time. For particulars address P. M. Culver.

Centerville, N. J., has not had a blacksmith in the last two or three years, and one is needed. Address C. B. Stout for further information.

Honest Dealings.

Before an advertisement is accepted for this journal, careful inquiry is made concerning the standing of the house signing it. Our readers are our friends and their interests will be protected. As a constant example of our good faith in American Blacksmith advertisers, we will make good to subscribers loss sustained from any who prove to be deliberate swindlers. We must be notified within a month of the transaction giving rise to complaint. This does not mean that we will concern ourselves with the settlement of petty misunderstandings between subscribers and advertisers, nor will we be responsible for losses of honorable bankrupts.

Trade Literature and Notes.

The following catalogues and other trade literature have been received at this office:

The Jas. Murdock, Jr., Company, Cincinnati, Ohio.
Illustrated catalogue of rails, bands, tips, name plates, and other carriage specialties.

Etna Mfg. Co, 40 John St., New York City.
Circulars of taps, dies, reamers, etc.

McKinnon Dash Company, Buffalo, N. Y.
A finely illustrated catalogue of all styles of wagon and carriage dashes.

Weyburn & Briggs Co., Rockford, Ill.
Illustrated circular describing their line of tuyere irons, tire shrinkers and benders.

The Parrot Varnish Co., Bridgeport, Conn.
Circulars descriptive of their make of varnishes.

The Hilbert-Freiberg Machine Co., Cincinnati, Ohio.
Circular explaining the application of their power post hammer.

The Fort Wayne Buggy Top Company, Fort Wayne, Ind.
Catalogue of buggy tops, cushions, full backs, carriage trimmings, etc.

Morgan & Wright, Chicago, Ill.
Price list of and directions for applying the Morgan & Wright solid rubber tires to wagon wheels.

VOLUME I

THE AMERICAN BLACKSMITH

NUMBER 4

BUFFALO, N.Y. U.S.A.

A PRACTICAL JOURNAL OF BLACKSMITHING.

JANUARY 1902

$1.00 A YEAR
10¢ A COPY

CONTENTS.

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THE ONLY TOOL REQUIRED.
TO OPERATE THE BRADLEY SHAFT COUPLING
ONLY ONE HAND IS REQUIRED TO OPERATE THIS COUPLING.
No wrenches, hammers, punches, patience or profanity, or anything but the one hand is required.
Ten seconds is all the time needed to change from shafts to pole.
Less than Ten Seconds if they are only to be removed.
THE PARTS of this Coupling cannot be lost, simply because there are no loose or separate parts. It is complete in itself.
The Bradley Shaft Coupling is made entirely of STEEL.
Beware of a Coupling that has malleable iron parts. It is not safe.
The Bradley is the only Coupling that will not rattle—see the Gap.
A Blacksmith can make a good profit by putting Bradley Couplings on old or new vehicles. They make a good Carriage better.
SHAFT
LEATHER PACKING
AXLE
OPEN
OPEN
SHAFT
AXLE
LEATHER PACKING
CLOSED
We make them in sizes to suit buggies, surreys, delivery and express wagons—four sizes in all—and all right, and all STEEL.
Dealers in carriage materials usually handle our Couplings.
If your dealer don't we will sell you direct.
We have printed matter describing our Couplings that you can have for the asking.
C. C. BRADLEY & SON, Syracuse, N. Y.

THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

VOLUME 1 JANUARY, 1902 NUMBER 4

BUFFALO, N. Y., U. S. A.

Published Monthly at 918 Mutual Life Building, 210 Pearl Street, Buffalo, N. Y., by the

American Blacksmith Company

Incorporated under New York State Laws.

Subscription Price:

$1.00 per year, postage prepaid to any post office in the United States, Canada or Mexico. Price to other foreign subscribers, $1.25. Reduced rates to clubs of five or more subscribers on application.

For sale by foremost newsdealers. Subscription agent for Great Britain and Ireland, Thomas Mattison, Floriana, Hillside Ave., Bitterne Park, Southampton, England. For Spain, J. F. Villalta, Puertaferrisa, 7-9, Barcelona, Spain.

Subscribers should notify us at once of non-receipt of paper or change of address. In latter case give both old and new address.

Correspondence on all blacksmithing subjects solicited. Invariably give name and address, which will be omitted in publishing if desired. Address all business communications to the "American Blacksmith Company." Matter for reading columns may be addressed to the Editor. Send all mail to P. O. Drawer 974.

Cable address, "BLACKSMITH," Buffalo. Lieber's Code used.

American Blacksmith Prize Contests.

Beginning with the October issue of this journal, a series of nine prizes was offered for the best nine articles submitted on three different subjects, three articles under each head. The contest bids fair to become even more lively than was anticipated, and hence it has been decided to leave the contest open a reasonable time so that any who contemplate writing may have ample time and opportunity for preparing an article.

It may be well to briefly enumerate here the conditions governing the contest. The three subjects are embraced under the following headings: Horseshoeing — Repair Work — Carriage Building, and are broad in scope, so as to cover all possible phases of the subjects. Three prizes of $5, $10 and $15 will be awarded under each heading, or a total of nine prizes in all. Those who compete must be subscribers to THE AMERICAN BLACKSMITH. The same person may offer as many articles as he pleases, but to no one will more than one prize be given. Articles in competition must be at least two hundred and fifty words in length, and should be clearly labeled "Prize Contest—Horseshoeing," "Prize Contest—Repair Work," "Prize Contest—Carriage Building," as the case may be.

Three articles which have been submitted were printed in connection with the October issue, and numbers of others have been received; but the opportunity still remains for those who wish it, to enter the contest. Articles are judged, not by whether they were sent in early, but by the value of the ideas contained in them. New tools, improved methods, short cuts and shop kinks, or descriptions of interesting and instructive processes, are desired.

The majority of the articles thus far received are upon horseshoeing, and hence a somewhat better opportunity remains open for those who intend writing upon one of the other two subjects, Repair Work or Carriage Building.

Do not delay, but pick out your subject and send in your article at once.

Your chance is as good as that of anyone, and all you need is simply to put your ideas on paper. Let us hear from you.

An Open Series of Blacksmithing Articles.

On a following page will be found the second article of a series on "The Elements of Blacksmithing." It is desired to call particular attention to this series, as it possesses a feature of some novelty. The articles, though complete in themselves, are intended as a whole to cover all the fundamental operations of the smith shop, but in order to make them of the greatest possible interest and value, readers will be welcome to submit questions freely upon any points which may not be clear. These questions and answers by the author will be published as soon as possible after their receipt, and in this way it is hoped that the maximum efficiency of such a course, so to speak, may be attained. All who may desire to obtain an explanation of any of the points covered, or of any allied topics, should feel no hesitancy in asking questions. The reading columns are intended primarily for the benefit of readers, and they should always so consider it.

The Oldest American Blacksmith.

It is our desire to obtain the name, address and a photograph of the oldest blacksmith in America who is yet following the trade. To this end will readers of THE AMERICAN BLACKSMITH kindly send in names and addresses of the oldest members of the craft of their acquaintance? The person sending the name of the oldest blacksmith will be presented with a handsomely framed copy of "The Farrier's Forge," described in our advertising columns. The frame will be as elegant a one suitable to the subject as we can buy in Buffalo, and the picture will be a handsome ornament to any home. Give full names, complete addresses and ages in each case. When the list of names are all in, this company will pay for a photograph of the oldest blacksmith of whom we may learn. It will then be published in our columns, together with anecdotes of his life, picture of shop, etc. Address, Editor AMERICAN BLACKSMITH, P. O. Drawer 974, Buffalo, N. Y.

The Perfect Weld.

The secret of a perfect weld lies in securing the proper temperature for a complete fusion of the metal. The blacksmith well knows that if the parts are in this state but little force is required in completing the union, whereas if the pieces have not been brought to the proper heat no amount of hammering will suffice to join them.

Comparative tests have shown that the strength of a weld depends upon the completeness and success with which it has been made. A good weld, as might be expected, is found to be quite as strong as the parts not welded. A poor weld is weak just in proportion as it is defective. A poor weld also may to all appearances be perfect, and it is this which leads the engineer or mechanic to distrust the weld in iron work. Since the ultimate strength of a weld then depends principally upon whether it is well or poorly made, there is but little difference in the strength of butt, lap and split welds, where each is perfect.

In practice it is found that the electric butt weld is superior to others, showing that strength results less from the kind of weld than from the perfect fusion of the iron. In this process the welding temperature is attained by the transformation of electrical energy of high current strength, and opportunity is easily afforded of watching the iron and determining when the proper degree of heat has been reached. When making a lap or split weld at the forge no such careful inspection is possible, and hence it is that these welds as a rule are more liable to be defective than the butt weld electrically made.

Ornamental Iron Work.

In previous issues, these columns have shown examples of various pieces of decorative iron work executed by foreign smiths. Germany is generally recognized as the home of the ornamental iron worker, but we venture the

Fig. 1. ORNAMENTAL IRON WORK.

assertion that this country will not always be the follower in this industry, for many indications show an awakening interest in work of this nature.

The few accompanying illustrations show some very handsome though simple pieces of work, the product of the forge of August Feine, Buffalo, N. Y. The scope of such ornamental work, from the simple to the elaborate, is almost infinite, and the variation of application equally wide. The present day seems to show evidences of an increased striving for the beautiful, for a combination of utility and art, and this is as it should be. That development is one-sided, in which the æsthetic has not its proper growth.

Examples of ornamental iron work of varying degrees of excellence are to be found on all sides, and the best are always interesting. This Journal would be glad to illustrate typical pieces of such art metal work, and hopes that its readers who may be interested will cooperate by aiding in securing photographs for reproduction. THE AMERICAN BLACKSMITH will defray the expenses incurred in secuing such views. Do you know of any handsome specimens?

Fig 2. ORNAMENTAL IRON WORK.

Valve Yoke Construction.

THOMAS PRENTICE,
Foreman of Forge Shop, General Electric Company, Schenectady, N. Y.

The articles which have appeared in this Journal in October, and again in December, on the making of a locomotive valve yoke, are intensely interesting, as they describe the different methods used for their construction in different shops, at the same time enabling readers to form their own opinions as to the methods employed. The first article from the pen of my esteemed co-laborer, Mr. W. T. James, sets forth the shop practice of repairing a broken or worn valve yoke, after a run has been made, and the locomotive has pulled into the round house for repairs. It is true that certain conditions prevail in the various shops which make it absolutely necessary for the blacksmith to use his own judgment to obtain the quickest and best results. In the article referred to, I presume such to be the case.

In these ever hustling times, however, when the heads of departments in our great railroad centers are at their wits' end to keep the wheels of transportation moving with unbroken regularity, it is the duty of the blacksmith, if he takes pride in the business of which he is an important factor, to use every means in his power, and every art known to his trade to delay as little as possible the work entrusted to him. By this I do not mean that a blacksmith should sacrifice the quality of his work for quantity. There is nothing more annoying, and I might add, more disgusting to the Master Mechanic, than to find that after the work has been completed, there is a bad weld, or a flaw, which has been pruned over, requiring the work to be duplicated. Such a condition of affairs is inexcusable to say the least, for there is not one case in a hundred when

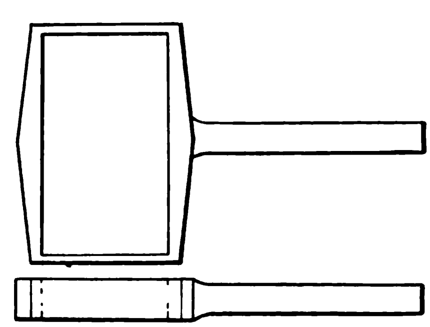


Fig. 1. VALVE YOKES—THE FINISHED FORGINGS.

the blacksmith does not know whether he has produced a first class job or an indifferent piece of work. Carefulness in obtaining good, clean welding heats, is one of the primary principles necessary to the successful blacksmith.

The article from the pen of Mr. D. R. Miller, in the December Journal, on valve yoke construction as employed in

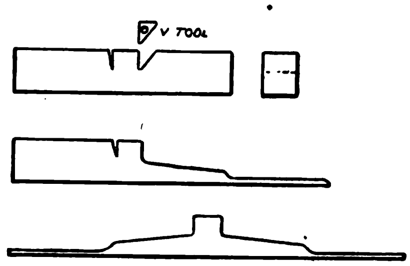


Fig. 2. THE PROCESS OF SHAPING THE YOKE.

the Norfolk & Western Railroad shops, at Roanoke, Va., is of interest, because it represents the making of a new valve yoke. The method of welding at the stem centre of the yoke does not appeal to me as the best way to begin. My practice has been to make as few welds in any piece of work as possible, and when welds must be made, to place these where the least possible chance is given for a break. I herewith submit a method of forging a valve yoke, which combines all that is claimed for the above article, and which can be made with equal ease to suit the blue prints of any Railroad Company, these differing according to the type of locomotive, or the fancy of the designing engineer.

Suppose we have an order for twenty locomotives. This would send into the smith shop an order for forty valve yokes, which we shall describe as being for four-wheel passenger engines. The finished forging ready for delivery to the machine shop will appear as shown in Fig. 1. For convenience we will proceed with this order in lots of ten, in the following manner: We take ten pieces of hammered or double refined iron, say $3\frac{1}{2}$ by $2\frac{1}{4}$ inches, and

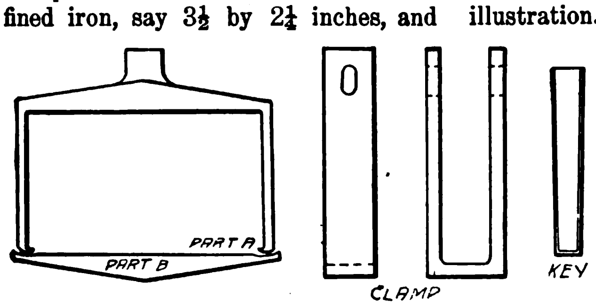


Fig. 3. WELDING THE YOKE AND BACK TOGETHER.

any length that may be required according to the size of the yoke. These we put in the fire near the centre, and having obtained the proper heat, we place them under the steam hammer, using a hack the exact depth we desire to cut. After cutting, proceed with a V-shaped tool as shown in the first illustration of Fig. 2. By using this tool we preserve the centre for the stem. Next proceed to draw out, using a $\frac{1}{2}$-inch rod to fuller where the bend comes. We then have a piece as shown in Fig. 2, second view. Reverse and proceed in same manner. This can be done with one heat for each end. After we have drawn out ten pieces, as shown by the last view of this figure, we proceed to bend, for which a long narrow fire will be required, enabling us to get a short heat. By placing four or five in the fire at one time the

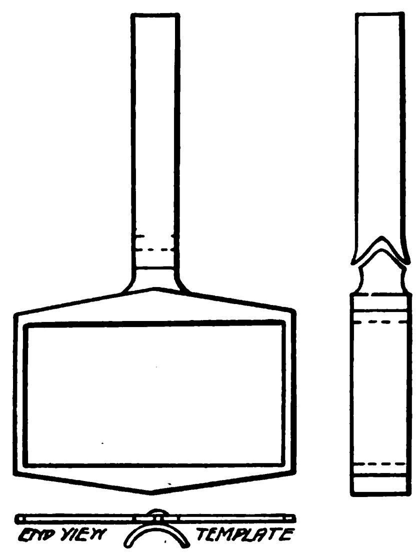


Fig. 4. METHOD OF WELDING THE STEM.

bending will be completed in a comparatively short time, and when completed the yoke will appear as in Fig. 3, the ends being cut and bent over the anvil as shown, thus forming the scarfs.

The back of the yoke is forged from a straight bar cut to length and fullered so that the scarfs on valve proper will fit into them, as shown by the same illustration. Having our ten yokes now ready for welding, we clamp yoke and back together with a common key strap, which is discarded after the first corner weld is made.

Our ten yokes now being welded, proceed to square same. This is most easily done by throwing all ten in a furnace, obtaining a good even heat all over, and squaring on a cast iron centre block, which has been planed to size. You will have no further trouble with this part of the job, as the contraction when cooling will be sufficient for the machine finish. We now have ten valve yokes finished minus the stem. This we proceed with in the following manner, using the male and female scarfs: Place the valve yoke hub end down in fire, for by doing so we get the heat just where it is needed. The stem should always be put on with female scarf; by so doing we avoid the possibility of coal or dirt getting in on the weld, as shown in Fig 4.

In centering the stem with the yoke side, a very easy and absolutely sure method is found in using a template the full size of the finished yoke, placing two guide strips under the stem of template, which fits over the yoke stem. We have now completed the first ten of our order, and have consumed not more than three days of the time of a fairly good mechanic.

Tools and Formers.

Report of Committee, N. R. M. B. A. Convention.

DANIEL FITZGERALD, CHAIRMAN.

A few years ago machines for doing forging were curiosities. Then a blacksmith who would get up a tool or former and attach it to his anvil for doing work was thought quite a genius; but now the blacksmith foreman who cannot devise and get in operation tools for various labor-saving machines is soon left behind.

To be a success, the foreman must be able to get up tools for different work on forging machines, also shapes and formers for his bulldozers. Then he must have dies and tools for shaping and welding different forgings on steam and Bradley hammers, punches and shears, etc., all of which must be kept busy and properly equipped with dies to do the different kinds of work. Then also tools and formers for the anvil must not be forgotten. A great deal of work can be done quickly and cheaply at the anvil, and at a great reduction in the cost of labor by a little expenditure in the way of hand tools. For instance, at the Milwaukee Roads shop at West Milwaukee, there is a tool for the anvil which was originally made to bend $\frac{5}{8}$-inch eye bolts, but which has been utilized for different classes of bending, until now we bend grab hooks of square iron, gate hinges, gate hooks, with eye on one end and hook on the other, and all kinds of round hooks as large as $3\frac{1}{2}$ inches round. In fact, we are continually finding something new for this tool, all of which goes to show that if you once get started with tools, they will keep on leading you into something new continually.

We do not want to convey the idea that we advocate hand tools when it is possible to use power, but we do say

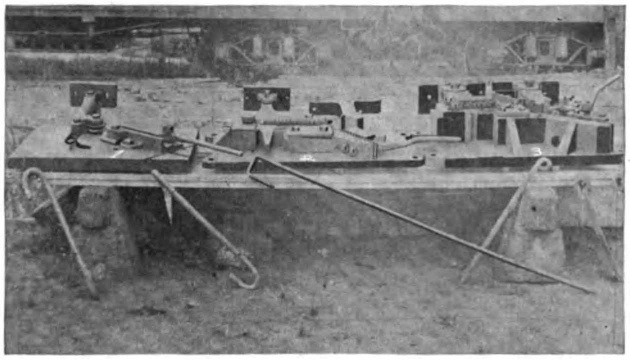


Fig. 1. BULLDOZER TOOLS FOR HANGERS, STRAPS AND HINGES.

that a blacksmith foreman should use all his skill and ingenuity in devising tools and formers to do this work with, thereby reducing the cost of production for his employer, and at the same time making it easier for his men. Now in regard to methods for getting out tools and formers for different kinds of work, I have always found it to be an advantage to have a full-sized pattern made of the forging desired. Then a man wants to know just how much room he has for his dies when the machine is closed, and how much metal he can get in when the machine is wide open. Very often you will get a tool ready and find out that the side motion will not close quick enough to allow enough stock to be gathered for your forging. Sometimes you can overcome this difficulty by doubling on your iron; sometimes by upsetting in a preparatory die. This upsetting can very often be done in the same die as the finishing is done; that is, have both shapes in the same block. Then again, if a forging is made of a stem with a head standing

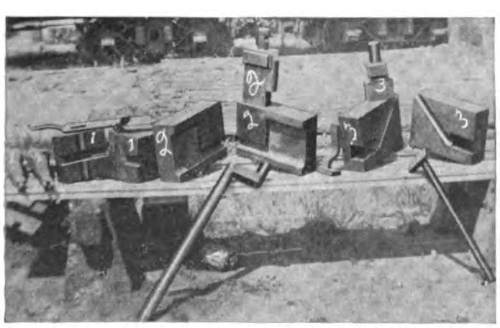


Fig. 2. DIES FOR AN AJAX FORGING MACHINE.

at right angles, this can be made and the right angle put in at one stroke of a forging machine, if you get your die the proper shape. This applies not only to forging machines but also to Bulldozers, steam hammers, Bradley hammers and all kinds of machines used in forming different kinds of forgings.

A more definite idea of tools for different machines may be had from the engravings shown herewith. Fig. 1 shows tools for a No. 3 Bulldozer. Tool No. 1 is for loop brake hangers, No. 2 for straps for side of coal car flats, and No. 3 is for strap hinges from 1 by $\frac{1}{2}$ inches to $4\frac{1}{2}$ by $\frac{3}{8}$ inches. All these tools finish the work in one revolution of the machine, so that a shop with proper heating facilities can accomplish a lot of this class of work.

Fig. 2 shows dies for an Ajax forging machine. Dies No. 1 are for forming refrigerator car door fasteners; dies No. 2 are for forming switch cranks, and dies No. 3 a coupler brace for pilots.

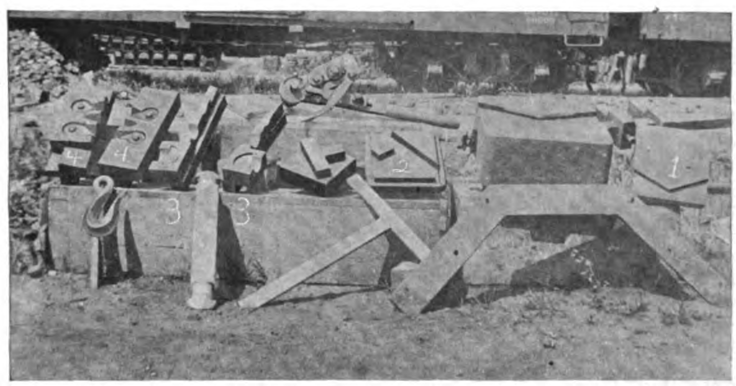


Fig. 3. SOME DIES FOR BRADLEY HAMMERS.

Fig. 3 shows some dies for Bradley hammers. Dies No. 1 are for welding a 4 by $\frac{1}{2}$-inch corner plate for stiffening corners of long furniture cars. These are welded at the proper angle without scarfing with a stop at each end. Dies No. 2 are for welding side door hangers or any "T" shaped forging; dies No. 3 are for forging the ends of spring plank axles; die No. 4 is for shaping both ends of switch hooks. The tool marked No. 5 is an anvil tool for eye bolts; this is the tool referred to before and is a very handy one. The tool shown in the illustration will bend eye bolts up to one inch and hooks up to $1\frac{1}{2}$ inches; also square hooks and eyes of flat iron up to 2 by $\frac{1}{2}$ inches.

These are very small items in the tools we have at West Milwaukee. Taken altogether, for different machines we have about 975 different dies, and we keep adding to them all the time.

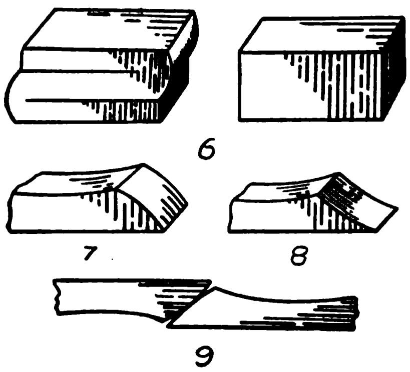
The Elements of Blacksmithing.—2

Welding.

JOHN L. BACON,
Instructor in Forge Practice, Lewis Institute, Chicago.

Some metals, when heated, grow gradually softer as the temperature is increased, until a heat is reached at which the metal is in such a condition, that if two separate pieces are brought together with slight pressure they will adhere and form one piece. All metals do not act this way when heated. Cast iron, for instance, does not become gradually softer as the heat is increased, but remains firm until a temperature is reached at which it suddenly becomes soft and goes to pieces. Any metal which becomes gradually softer when heated can be welded, while metals which act like cast iron when heated cannot. The temperature at which the two pieces of metal are in a condition to stick together is known as the welding heat.

The process of welding is briefly this: The two pieces of metal, properly shaped or scarfed, are brought to a welding heat, placed together, and hammered thoroughly or forced together with pressure in such a way as to bring the two pieces in contact with all parts of the weld. In all welding the greatest care must be taken to heat the pieces properly. A piece of wrought iron when heated to the welding heat looks almost white, and little explosive sparks will come from the surface. These sparks are small particles of iron which become separated from the bar and burn. Machine steel welds at a little lower heat, and tool steel at a still lower heat. The proper heat cannot be described satisfactorily, and the only way to determine it is by experiment. When two



Figs. 6, 7, 8, and 9. SCARFING AND WELDING.

pieces of iron are properly heated you can feel them stick the minute they touch each other. The fire *must* be clean and bright, or small particles of cinder, etc., will stick to the surface of the metal, and give a dirty, burned surface and spoil the weld. "A poor fire never made a good weld," is a maxim which should stand out in every man's mind who ever expects to have any success at welding. The fire should be of a "reducing" nature, as explained in the first paper, or, in other words, an excess of air must be guarded against. This sort of fire prevents the formation of heavy scale, and is not nearly as liable to burn the iron. Understand your fire thoroughly, know just how to keep it the way you want it, and welding will be a comparatively easy matter.

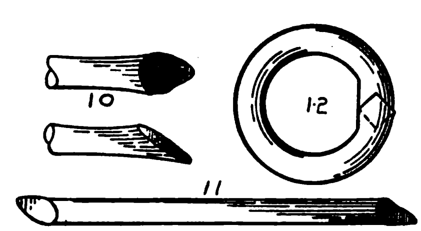
The simplest weld is the fagot or pile weld, where two or more pieces are laid together and welded their entire length. Such a weld is shown in Fig. 6, which shows the pieces before and after welding. When a large forging is to be made of wrought iron, small pieces of "scrap" (old horse shoes, bolts, nuts, etc.), are placed in a square pile on a board, bound together with wire, heated in a furnace to a welding heat, and then welded into a solid lump. The forging is then made from this, or, if very large, several of the lumps are hammered flat into "slabs," and these slabs welded together to form a still larger piece.

In the above weld the pieces were simply laid together and welded, but for most welding it is necessary to shape the ends of the pieces in such a way that they will fit each other when they come in contact, and make a smooth joint. This shaping is known as "scarfing," and the ends of the pieces so shaped are called the "scarfs."

The lap weld is the weld used for joining two bars of iron together by slightly over-lapping the ends. The scarf for such a weld is shown in Fig. 7. Care should be taken in making this scarf, as well as in all others, to so shape it that when the two pieces are laid together in welding they will first touch each other in the center of the weld. This gives a chance to force the melted oxide from between the two pieces. If the scarf was made hollow, like Fig. 8, the metal around the edge of the weld would come together first, leaving a hollow or pocket in the center where the melted scale would be held, making a weak weld, for wherever the oxide remains between the two pieces they will not stick to each other. This makes a dangerous weld, for the outside sticks together and gives the appearance of a good, sound weld, while through the center the metal is not welded at all.

Before scarfing for a weld, the end of the bar should first be thickened by "upsetting," and when scarfing, the blows of the hammer should be delivered in such a way as to tend to drive the metal back toward the body of the bar. This thickening of the bar is necessary to allow for the proper hammering of the weld, and for loss of metal due to scaling when heating.

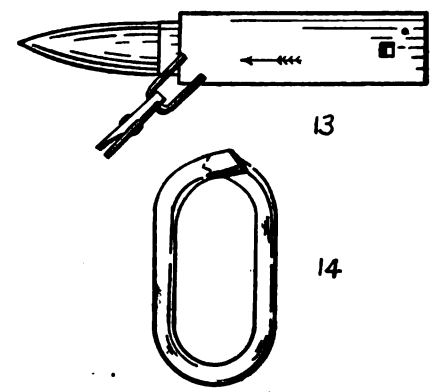
After the two pieces have been properly scarfed and heated to a welding heat, one piece should be taken from the fire by the helper, and laid on the anvil, scarf side up, and the other piece, held by the smith, placed upon this, scarf side down, in the position illustrated in Fig. 9. The two are then welded by hammering together. After sticking the pieces together with a few quick blows, the thin ends should be first welded as quickly as possible, as they lose their heat faster than the heavier parts of the scarfs. As soon as



Figs. 10, 11 and 12. ROUND LAP WELDING.

the thin tips are welded down, the body of the weld should be thoroughly hammered together as quickly as possible. Fig. 10 shows a method of scarfing for a round lap weld. Two views are shown, giving the top and side views of a properly shaped scarf used when two bars of round iron are to be welded end to end. This scarf should always be pointed, never chisel-shaped. The weld is made practically the same way as the flat lap weld described. The weld should first be hammered square and then rounded up.

In Figs. 11 and 12 is shown one method of making a ring weld. The stock is cut to the proper length and the ends scarfed like Fig. 11, and then bent into shape, as shown in Fig. 12,



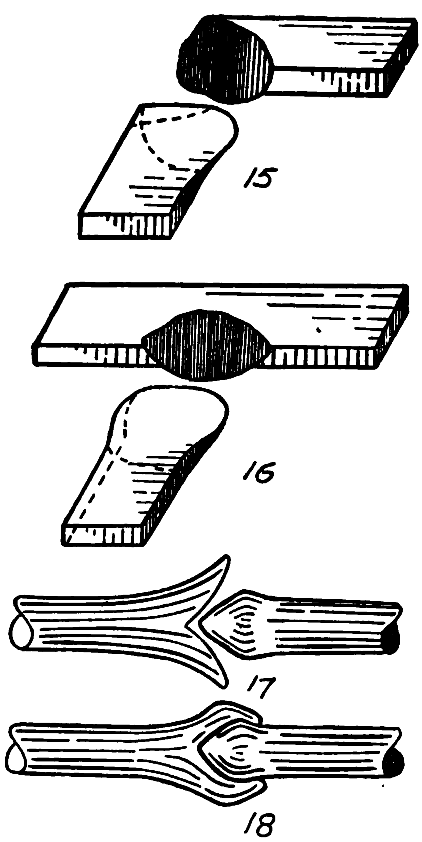
Figs. 13 and 14. CHAIN WELDING.

and welded. Rings are also made by first bending the stick into shape and afterwards scarfing, much the same as for a chain link.

In chain making, the iron for the link is first bent in a "U" shape, being careful to keep the legs of the "U" exactly even in length. The ends are then scarfed in the following way: One end is laid on the anvil in such a way that the edge of the anvil comes directly underneath the inside corner of the end and makes an angle of about 45 degrees with it. (Fig. 13). A blow of the hammer is struck directly down on top of the end, which is then moved slightly in the direction shown by the arrow, and another blow given. This is continued until the edge or extreme corner of the end is reached. Links made of $\frac{5}{16}$-inch iron require about three blows to form the scarf. This operation leaves a series of little steps on the end of the piece and gives it a more or less pointed shape. The "U" is then turned over and the other end scarfed in the same way. The ends are bent into the shape shown in Fig. 14, and welded. A second link can then be made, and a third, all except welding, which may be spread open and the first two put on it, closed up again, and welded.

One method of scarfing for an angle weld is shown in Fig. 15, and one for a

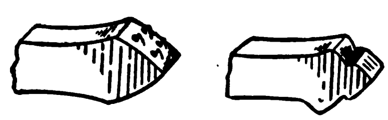
"T" weld in Fig. 16. The same precautions must be taken in scarfing and welding all these welds, as were used in making the lap weld. Fig. 17 shows a split weld, the pieces being in position to be hammered together, and Fig. 18 shows the same weld after the pieces are closed together ready for welding. This is a weld often used for welding iron to steel, the steel part being welded in the inside. The welding heat is often taken after the pieces are closed together. Sometimes in making this weld, as well as in the lap weld, the faces of the scarf are roughened by nicking with a hot chisel, as shown in Fig. 19, to prevent the pieces from slipping by each other while being welded. Welds in very thin stock may be made as illustrated in Fig. 20. Fig. 21 shows a washer weld. The stock is bent into shape without any previous scarfing, and the corners of the ends trimmed off as shown by the dotted lines. The ends are then scarfed

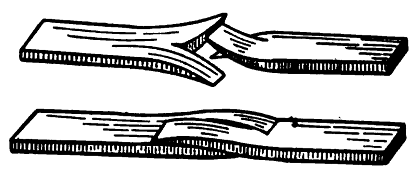


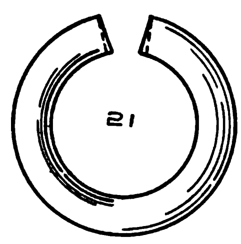
Figs. 15, 16, 17 and 18. ANGLE, "T" AND SPLIT WELDING.

with a fuller or pein end of the hammer, lapped over and welded.

Whenever a piece of iron or steel is heated for welding, under ordinary conditions, the outside is oxidized, that is, a thin film of iron oxide is formed. This oxide is the black scale which falls from heated iron, and is always formed when heated iron comes in contact with the air. This scale is not fluid except at a very high heat, and if allowed to stay on the iron will prevent a good weld. When welding without a "flux," the iron is heated to a high enough temperature to melt this scale, which is forced from between the welding pieces by the blows of the hammer. Each piece of metal is covered with this oxide, or scale, and we cannot bring the actual metal of the two pieces in contact until the oxide is liquified enough to be forced from between the pieces when they are brought together. A flux (for our purpose) is a substance which will combine with the scale, when heated in contact with it, and cause it to melt at a lower temperature than it would otherwise. The flux has a double action; it melts and flows over the piece, forming a protective covering which prevents further oxidation, and also causes the scale already formed to melt at a lower temperature. The flux







Figs. 19, 20 and 21. SPLIT AND WASHER WELDING.

does not in any way act as a cement, or glue, or cause the pieces to stick together except as noted above. When a flux is to be used, the piece should first be heated to about a yellow heat and the flux sprinkled on the parts to be welded. The heating is then continued until the metal is at the proper temperature to weld, when the weld is made as usual. Sand and borax are the most common fluxes. Sand melts the scale at a higher temperature than the borax, and for this reason borax is better than sand when a low welding heat is desired. A mixture of one part sal ammoniac and four parts borax makes an excellent flux, and cleans the iron better than borax alone. Borax and iron filings are sometimes mixed together and used for fluxing.

Tempering a Tap.

W. B. ALLEN.

As I have recently been obliged to harden and temper a great many taps and have found the method I employ a very successful one, I will briefly describe the way in which it is done for the benefit of any who may have had trouble in getting satisfactory results on work of this kind.

Taking the completed tap, it is first brought to a blood-red heat, using preferably a good charcoal fire for the purpose, turning the tap carefully so as to ensure a good even heating. In a bucket of clean cold water, in which about a handful of common salt has previously been dissolved, set the water to whirling by means of a stick, and then thrust the heated tap down vertically into the vortex of the whirlpool. By this means the tap is cooled quickly and evenly, so as to set up no unequal cooling strains in the metal.

The next step is in tempering. The tap is to be drawn to a straw color, but the exact state or depth of that color depends upon the kind of steel of which the tap is made, and also upon the nature of work to be done by it. This must be found by experience. For drawing the color, take a piece of cast iron tube two or three inches in diameter, heating it up to a dull red heat. The tap is then to be held in the center of the tube and carefully turned until the proper color is had. Quenching will then fix the temper and finish the tap.

A Tiny Anvil.

Reproduced herewith, Fig 1, is a photograph of what is undoubtedly the smallest perfect anvil in the world, and what renders it even more interesting is the attention paid to all the details of its construction, as careful as if it had been a full grown anvil. We are indebted to Mr. C. C. Henderson, of Lyons, Kansas, for the photograph and description of this minute anvil, a product of whose skill it is.

The anvil is a three-piece one, made like the Hay-Budden, and is welded, not brazed. It was forged on a Peter Wright Anvil. The steps in its construction are as follows, reference being made to Fig. 2. A small bar of iron was first taken and shaped, as at *a*, and to this was welded a steel face, resulting after forging in a piece such as shown at *b*. The foot was then

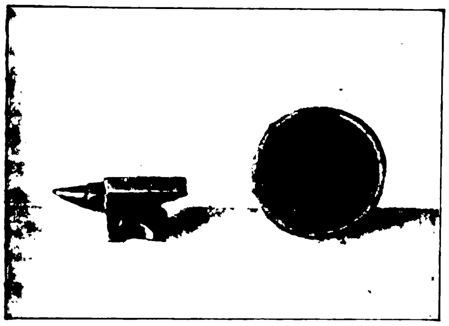


Fig. 1. ANVIL COMPARED WITH A DISC THE SIZE OF A TEN CENT PIECE.

shaped with the porter left on, as at *c*. The next step was the welding of the two, after which step the anvil appears as at *d*. After cutting off the porter which held the face, the horn was shaped and the hardy hole punched. The porter was then cut from the foot and the rough edges smoothed up.

An idea of the size of this tiny anvil can be had by comparing it with the disc in the above engraving. It is $\frac{5}{8}$ inch long from heel to top of horn and $\frac{5}{16}$ inch high. In addition it should be mentioned that the steel face was

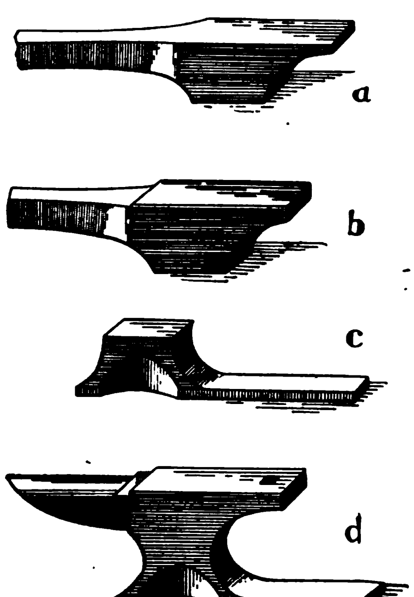


Fig. 2. PROCESS OF FORGING THE ANVIL.

tempered hard like the Hay-Budden anvil is tempered, with streams of water pouring on the face.

The reader can well imagine the care and patience which must necessarily have been exercised in forging and welding the different parts of this minute but complete reproduction of a blacksmith's anvil.

Railway Blacksmithing.

S. UREN,
Foreman Blacksmith, S. P. R. R.

There are five factors that must be strictly adhered to to insure forgings and maintain the strength of the iron manipulated.

First. The proper heat to produce the shape into which the iron is to be formed.

Secondly. The weight hammer used in producing the forging.

Thirdly. Working the iron at too low or too high a heat.

Fourthly. The fuel used to produce the required heat.

Fifthly. Sufficient area at the heated point to receive required lamination, to bring the disintegrated metal to its normal condition after being brought to a high heat.

The proper heat for shaping and forming in bending machines differ with the quality of the iron used, and should be brought to the proper heat at bending point only. But the demand for this class of forgings is so numerous that the above method has become obsolete. Long bars to be formed to shape required are placed in large quantities in the furnace, and in many cases brought to high heat their entire length. The molecular structure of the whole bar becomes disintegrated, and as no lamination can be performed on the heated bar, its structure is materially impaired. The different angles are formed in the machine as fast as possible. Then we make the vain boast how many pieces we have formed in an hour. There should be as much care taken in heating for forming as any other forging, and in no case should the bar be brought to a higher heat than is absolutely required to form the different angles. The forgings that have in many cases been brought to too high heat for forming, come back broken while in service. The broken section is examined and found to be of a coarse crystalline structure. The verdict is pronounced, a bad quality of iron.

The coarse crystalline structure in many cases is caused by bringing the metal to too high heat when no lamination can be performed on the same. I do not wish to be understood that all of these classes of forgings that do not resist the strains they are subject to is the fault of over-heating; in many cases it is an inferior grade of iron, and often-times contains sulphur and phosphorus in sufficient quantities to produce what is termed "red or cold short iron." But I do maintain much good iron is destroyed by improper heating for forming and the regard for quantity and not quality. The weight of hammer is an important factor in the production of large forgings. A light hammer will affect the outside of a large forging only, although the same dynamical force is attained. The weight of the hammer should be in proportion to the bulk of iron to be manipulated so as to produce perfect compression from surface to center of ingot or forging. From actual practice, I have come to the conclusion that a hammer of three or four thousand pounds will give best results for any forging from 36 to 50-inch area.

The quality of coal is an important factor in the production of re-worked scrap iron. If the coal contains an undue proportion of sulphur or other elements that have no affinity for iron, the semi-molten iron will absorb the impurities; the iron produced will be of an inferior quality, often-times red or cold short; in other words, it loses its ductility, hot as well as cold. It is claimed by many that the continual re-working of iron destroys its vitality. In my opinion, it is not the continual re-working that deteriorates the metal, but the impurities the metal absorbs in the manipulation. As before stated, fuel that contains elements that have no affinity for iron has much to do with the deterioration of iron worked over many times.

For the purpose of demonstrating this question, in 1898 I made a series of tests by working a pile of scrap under the hammer into billets four inches square, then re-heating and rolling into one-inch round bars, test pieces cut from the same, the remainder of the bars cut into short pieces, again piled similar to scrap, hammered as before and again rolled into one-inch bars, test pieces again cut from the same. This operation was continued seven times, the test from the last working, showing no material difference from the first.

Analysis of the coal used in heating:

Moisture, ...	1.00 per cent.
Volatile, ...	22.09 per cent.
Carbon, ...	63.68 per cent.
Sulphur, ...	.63 per cent.
Ash, ...	12.60 per cent.
Total.	100.00 per cent.

It will be observed from the above that the coal contained but .63 per cent. of the sulphur which is so injurious to iron.

Following are the tests made by Mr. Howard Stillman, engineer of tests.

Rollings	Tensile lbs.		Elongation		Reduction	
	Per sq. in	Per cent.	In 4 in.	Per Cent.	In Area	Per Cent.
1st from scrap	52786		29.5%		46.3%	
2d " above	52831	+ .08	29.3	— .67	43.8	+ .45
3d " "	53012	+ .43	28.0	— 5.08	44.7	+ 2.52
4th " "	53062	+ .52	28.7	— 2.71	44.0	+ .91
5th " "	52744	— .08	28.0	— 5.08	42.8	1.88
6th " "	53160	—1.16	26.4	—10.51	40.6	6.88
7th " "	52541	— .46	26.5	—10.17	38.6	11.47

Remarks on same: The above percentages of variation do not show material change up to and including the fifth rolling. On the sixth and seventh there is a marked tendency to decrease in ductility, though the tensile strength seems to have decreased at seventh rolling less than one-half of one per cent.

The question of economy regarding the different kinds of fuel depends in a measure on the price of each. The committee on fuel at the Master Blacksmith's convention of 1898, after careful consideration, came to the conclusion that oil was preferable to coal for furnace use, as there are not so many impurities in the heated gases for the semi-molten iron to absorb; consequently a cleaner heat and a better quality of iron is produced from scrap, and recommended the use of oil where the price justifies.

Lap Welding.

The different methods of preparing iron to be welded are governed by the conditions and shape of the forgings and appliances. Lap welding is the usual method adopted by smiths and whenever practicable, in my opinion, is the best. In many cases there is not sufficient care taken in preparing the parts. The scarfed portion of the end of bar should be as long as can be conveniently heated, but never more than at a 45-degree angle. The scarfed surfaces should be slightly convex or high in the center, so that when the two pieces are laid together for welding, after being brought to the proper heat, the center will take its bearing first, as it is absolutely necessary that the center of the welded section should form a perfect union first. Prior to making the scarfs, the metal should be re-inforced as far back as it will be exposed to intense heat, for the purpose of receiving lamination over the whole length of the heated surface, as it is imperative that the iron, which has been brought to near a welding heat, should be as perfectly hammered as the welded portion. After the preparation of the scarfing is completed, lay the two pieces carefully in a hollow fire, if practicable, and bring to the proper heat. Before laying the two pieces together be sure that no substance or element that has no affinity for iron has adhered to the scarfed surfaces. In laying the pieces together, the point of one scarf should just reach the heel of the other. The weight of hammer used to weld the pieces together must be governed by the size of the bar, as the blow should be sufficient to affect the metal from surface to center; with this precaution a good weld will be produced. I again call your attention to the proper treatment of the iron back of the weld, as I consider this of vital importance. In many cases, in testing welded sections by breaking transversely, I find good, fibrous iron in the welded section, and a coarse, crystalline structure each side of the weld. Break the same iron three inches back, where it has not been exposed to intense heat, and it will show a good fibrous structure. The cause of this is improper treatment of the iron back of the weld, or it was not properly re-inforced where it was brought to a high heat. The molecular structure of wrought iron becomes disintegrated in a measure when brought to a high heat; consequently, if there is not sufficient metal back of the welded portion to receive the necessary lamination to bring the disarranged atoms to their original position, the strength of the bar is greatly impaired.

I have made a series of tests in this regard in the manufacture of car axles.

The usual method of manufacturing car axles is to first rough the piles under the hammer after being brought to the proper heat, then finish each half at separate heats. For the purpose of impressing on the minds of the operators the importance of not heating the finished portion of the axle where no hammering is to be done on the same, I placed two finished portions of the axles in the furnace far enough to become white hot. As soon as the unfinished portion was brought to the proper heat, the axle was finished in the usual way, the finished parts that had been brought near a welding heat, lightly hammered over, with a little water to clean the scales off, making a perfect looking axle. We then made two axles from the same quality of material, leaving a piece about six inches long and one inch large near the center unfinished, for the purpose of not permitting the finished portion to come to more than a dark red heat. The unfinished portions of the axles were then placed between the hammer dies, when brought to the proper heat, and finished in the usual way. The axles were made from the same quality of material as the first two finished at a high heat in the center. The axles, when cold, under our drop testing hammer, broke as shown by the following table, the broken surfaces of Nos. 1 and 2 showing a coarse, crystalline structure, the broken surfaces of axles Nos. 3 and 4 showing a fine, fibrous structure.

Wrought iron when heated (without working to a welding heat or approaching that degree), causes the molecules

M. C. B. DROP TEST, HAMMER 1600 LBS.

Number of Test..		1	2	3	4
Diameter		4 1/4	4 1/4	4 3/8	4 5/16
BLOW	DROP	DEFLECTION OF AXLE			
1	12 feet	1 5/8 in.	1 5/8 in.	1 1/2 in.	1 1/4 in.
2	12 feet	1 3/4 in.	Broke	1 1/2 in.	1 1/4 in.
3	12 feet	1 1/2 in.		1 1/2 in.	1 1/8 in.
4	17 feet	Broke		1 5/8 in.	1 3/4 in.
5	17 feet			1 1/2 in.	1 1/2 in.
6	20 feet			2 in.	1 5/8 in.
7	20 feet			2 1/8 in.	1 5/8 in.
8	23 feet			2 3/4 in.	1 7/8 in.
9	23 feet			Broke	2 in.
10	23 feet				2 in
11	23 feet				2 1/8 in.
12	23 feet				2 1/4 in.
13	23 feet				Broke

to lose their adhesive qualities, and the metal will show a coarse, crystalline structure when broken.

"V" Welding.

This method consists of a combination of butt and cap welding. The scarfs are formed by fitting the pieces together in the center of the bar at an angle of about 60 degrees; if convenient a lesser angle is preferable. In preparing the scarfs, the throat of the inside angle should be left a little rounding, the apex of the made portion to correspond so as to make a perfect fit at the throat. The scarfed surfaces should be slightly convex across their surfaces, as in the lap weld, for the purpose of forming a perfect union in center of bar. In this class of welding the throat should be welded first by being driven together with a battering ram, or heavy sledge hammer, applied to the end of the bar when brought to the proper heat, before being taken out of the fire, if practicable. The same care must be taken back of the weld as in lap molding. A good weld can be secured in this manner if a clean heat is secured and the above method is carried out. I have seen many of this class of welds broken, and invariably find a defect in the throat of the welded section. The cause of this is in not bringing the iron to a proper heat at the throat of the section to be welded, or not properly ramming the pieces together before the side laps are welded. If the throat has not been welded before the side laps, when placed under the hammer the intersection of the two pieces at the throat are apt to draw apart and leave a defect in this section of the bar.

Butt Welding.

This method is simple, and the pieces are easily prepared for welding by upsetting the ends, leaving these a little convex. For insuring a perfect weld in center of bar the two pieces to be welded should be precisely of the same heat and the surfaces perfectly clean. When brought to the proper heats, the parts should be thoroughly forced together with heavy sledges. There are power machines in use for thoroughly compressing the metal together and reinforcing the iron at the welded section, to such an extent as to permit of severe lamination under the hammer to reduce the re-inforced portion to its proper dimensions and also bring the structure of the iron to its original condition, after the molecules have been disarranged, by being brought to a high heat. For general purposes, I do not approve of this method for welding small forgings. It is impractical, and I have seen many welds of this character separate at the welded point after being in service a short time.

In 1894, I had three of each style of welds made from 1½-inch round iron for the purpose of testing the same. Regarding the tensile strength and ductility of such welded section, in the following tests it may be observed that all butt welds showed crystalline structure due to upsetting of fiber of bar by nature of weld, and that there is less tensile strength. Area of test sections, 1.48 square inch.

Test No.	Tensile Str'gth per sq. in. lbs.	Elongation in 8 inches Per Ct.	Reduction of Area, Per Ct.	Remarks
				LAP WELDED
B 1	49,420	22.0	23.6	Broke in weld
2	49,175	26.0	46.0	Broke above weld
3	44,200	11.2	23.0	Broke in weld
Aver.	47,575	19.7	30.9	
				V WELDED
C 4	50,508	22.5	37.8	Broke above weld
5	49,122	21.5	38.0	Broke above weld
6	48,527	12.5	23 6	Broke above weld
Aver.	49,386	18.8	33.2	
				BUTT WELDED
D 7	48,115	11.5	18.9	Broke in weld
8	36,130	8 5	10.6	Bad weld
9	47,515	10.0	10.8	Broke in weld
Aver.	43,954	8.8	13.5	All show crystals

Taking the above averages with those previously determined as to quality of same iron unwelded, we have the following statement with comparative or relative values of the three methods of welding:

	Tensile Strength. Aver.	Relative Value.	Elongation in 8 inches. Aver.	Relative Value.	Reduced Area. Aver.	Relative Value.
	LBS.		PER C.		PER C.	
Unwelded....	52,078	1.00	22.2	1.00	31.5	1.00
Lap welded..	47,575	.91	19.7	.89	30.9	.98
V welded....	49 386	.94	18 8	.85	33.2	1.05
Butt welded.	43,954	.84	8.3	.37	13.5	.43

Welding by Laying in V or Angle Plates.

This method is adopted for large rings or framework of any description. In framework the different parts to be welded should be firmly bolted together, so as to retain the members in their proper position while the welding of the angle pieces is performed. This class of welding requires good judgment on the part of the smith. The two ends to be welded should form an angle of not less than 90 degrees when bolted together; the angle piece to be welded in the cavity should be about 5 degrees less than the opening of the two ends of the bars, for the purpose of insuring a perfect weld in the bottom of the recess, and must contain cubic inches sufficient to properly fill the opening. Care should be taken that the fibers in the V-shaped piece are in the same direction as the fibers in the bar to be welded. This is an important matter, and, as it is a little more convenient to make the V pieces on the end of a bar, it is often done; the consequence is, the actual tensile strength of the bar welded by this method is reduced one-half.

In the Sacramento shop, special iron from old horseshoes is made for this purpose. The piles are up-ended and worked every way to insure perfect welding in every direction. However, in all cases, no matter how the iron is worked, the fiber will flow in the direction in which the bar is elongated. It is advisable in all cases to make the V-shaped piece to be laid in the recess at right angles to the bar the piece is made from. The preliminaries being made, the parts to be welded are placed in the fire—the small angle-pieces usually in a separate fire. When brought to the proper heat, the bar is placed on the anvil and the small angle-piece forced in the cavity with heavy sledges, or the steam hammer, thoroughly welding the angle surfaces of the two ends of the bars. The same operation on the opposite side of the bar, makes a complete weld. In 1880 I adopted this method of welding on the pedestals of locomotive frames, instead of the old method of jumping them on the main bar. In my opinion there are three good reasons in favor of manufacturing locomotive frames by this method.

First, easier handling; second, better welding is produced; third, when the frame is completed the different members are left in their normal condition.

It is almost impossible to make a frame by the old method, jumping on the legs of the main bar and welding in the braces last, without leaving great strain on the different members, caused by the contraction from cooling after the welds in the braces have been made. Our method of making frames consists of forging the main bar or back of frame with projections four inches high in their proper position for the pedestals. This gives plenty of material for forming the angles for welding. The wedge bolt holes are punched in the edges with suitable dies under the steam hammer.

The braces are welded on to the legs, and V shapes formed on the ends of pedestals, also on the projection of the main bar. The different members are then bolted together with straps across the main bar and braces, forming a complete frame except the openings that are to receive the small angle pieces; the reel is then placed in position and swung in the crane, no balance weight being required, as the reel is placed in such a position that the neutral axis of the frame is in the center of reel. The frame is as easily handled as a straight bar of iron.

The smith commences at one end to weld in the angle pieces, continuing the operation until the center is reached, then reverses the frame and continues the same operation. It is evident that the contraction by the cooling after the welding will be in the direction of the length of the frame leg, and will have a tendency to spring the brake a little, leaving no strain on the braces or legs.

Some Suggestions On Decorative Iron Work.—2

WILLIAM C. STIMPSON,
Instructor in Forging, Pratt Institute, Brooklyn.

Next to the scroll, the twist is possibly the most characteristic detail of simple decorative work. It is used to relieve the plain effect of long parallel lines made by the edges of the stock, and gives life and variety to the whole design by introducing into it a number of short, subtile curves.

Flat stock shows this effect in the most pronounced way (see A, Fig. 14),

Fig. 14. TWISTS ON DIFFERING STOCKS.

and is useful where bold effects are wanted. On account of this, and the comparative ease of working, we find flat stock very largely used for decorative fire escapes, brackets, and fences in our larger cities. A glance at B, Fig. 14, shows at once the difference in effect of a twist in flat and square stock. In the former the lines of the narrow edge cause a variation in the spacing of the twist, while in the latter the spacing is uniform. A very pleasing effect for articles which, from their use, will be examined closely, is produced by twisting hexagonal stock; this gives almost the effect of a cylindrical surface with delicate raised lines worked about it (see the handle, C, Fig. 14). To gain this effect on round stock it must be hammered square, as in D, Fig. 14.

The lines of the twist will be long and flowing, or close together, accord-

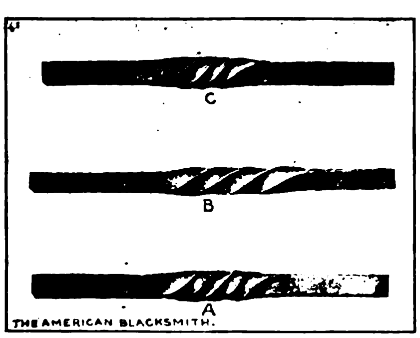
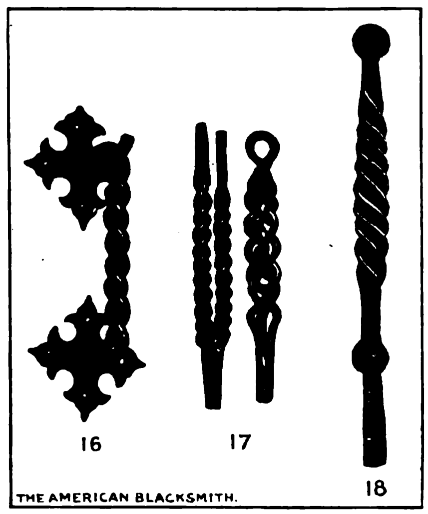


Fig. 15. HOT AND COLD TWISTS.

ing to the temperature of the bar and the length of the part twisted, as illustrated in Fig. 15; all the examples have the same length of twist; B was worked cold, and A at a yellow heat. The variety in the twist at C was obtained with a short fire—getting the piece quite hot in the middle and gradually cooling to punch marks. In working the metal hot, lay off the length to be twisted and heat carefully; then cool almost up to the punch marks, having the vise and the tongs grip well on the cold metal, or their jaws will mar the edges of the work. If, while twisting, one part gives more than another—thus making the work irregular—pour on a little water at the point which is twisting too much, holding the lip of the dipper close against the part to be cooled. Uneven work may be trued up in the same way; heat the part to be altered and cool either side by pouring on water. Then put in or take out twist as may



Figs. 16, 17 and 18. DOUBLE, BRAIDED AND SWELLED TWISTS.

be desired. To straighten twisted work use a wooden mallet, resting the iron on a wooden block.

For bending, grip a round bit of hard wood in the vise and use it as the horn, striking the work with a mallet. In combining a twist with a scroll, it is better to make the twist before bending.

A single strand of round stock will naturally show no change if twisted, but Fig. 16 shows two rounds combined to good effect in the form of a door handle. An effect of braided strands may be made with four pieces of round. Take two at a time—weld each end and twist up, twisting both pair in the same direction. Put these together, weld their ends, and twist the whole in the opposite direction (Fig. 17). In any of these examples where strands are used, if small square stock is employed in place of the round, the result will be far more handsome.

Another form of twisted handle is made from solid stock as shown in Fig. 18. Work out the blank, leaving the stock large and square in the middle and small at the ends. To twist, begin in the largest part, cooling

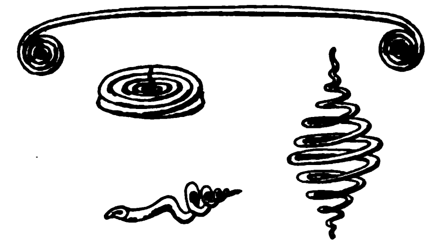


Fig. 19. METHOD OF FORMING SPIRALS.

evenly on each side, and leaving the stock hot for about one and a half times the thickness of the blank. Give this about a quarter turn, re-heat in the middle and cool, leaving a trifle more space hot. Give a little more twist, and so on until the whole piece is twisted. Fig. 19 shows a method of forming a spiral which may be used as a finial. Draw a long taper on the end of a small-sized round piece and turn ½ inch up at right angles; then roll the stock up like a coil of rope, sliding

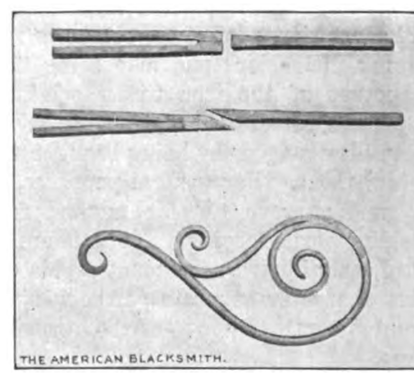


Fig. 20. WELDING BRANCH SCROLL.

one coil under the other when they come together. Now heat, and after cooling the half-inch ends pull the coils open. This same method is used in working out the tendrils required in some designs.

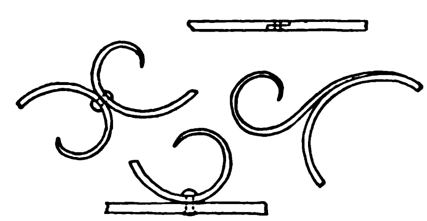


Fig. 21. RIVETTING SCROLL WORK TOGETHER.

In building any piece of decorative work, the most skilled workmen will weld all pieces to be joined. Sometimes, however, the job is not so difficult as it would seem at first glance.

An illustration of this may be noted where one member branches off from another, as shown in Fig. 20; here one may see how readily the piece can be

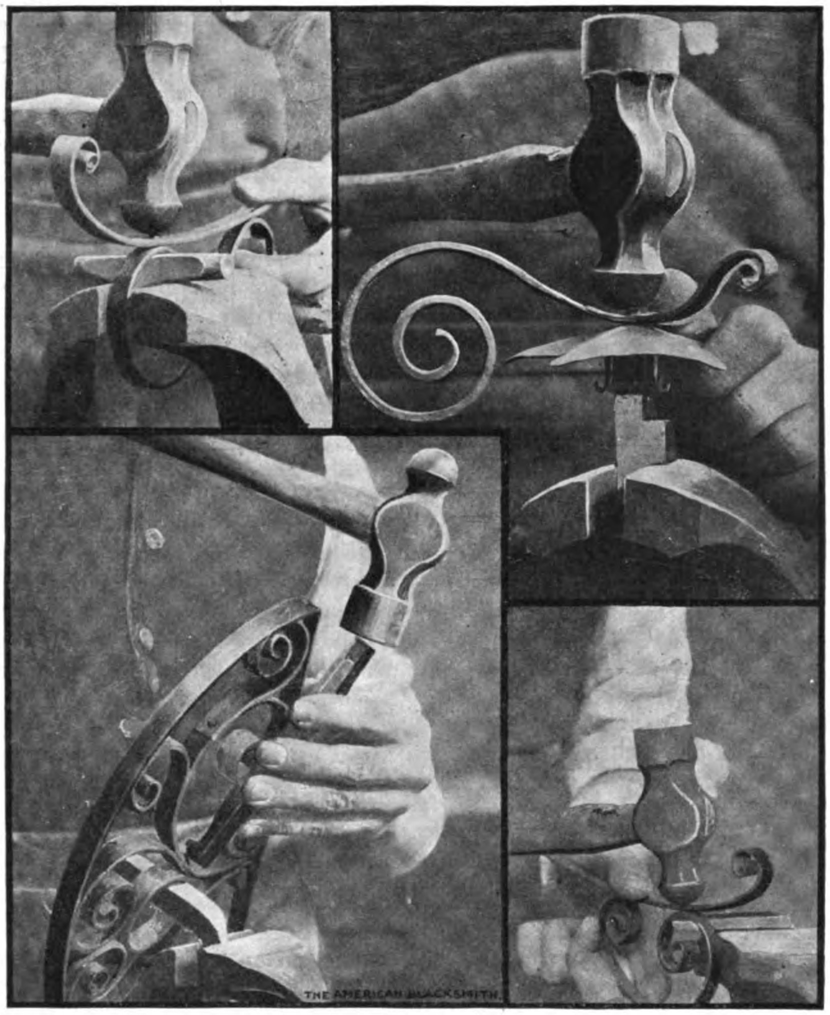


Fig. 22. TWO FORMS OF RIVET BLOCKS IN USE.

made and all scarfs easily hidden. The slight shoulders shown in the first example insure the stock welding firmly for that distance only, which is an advan-

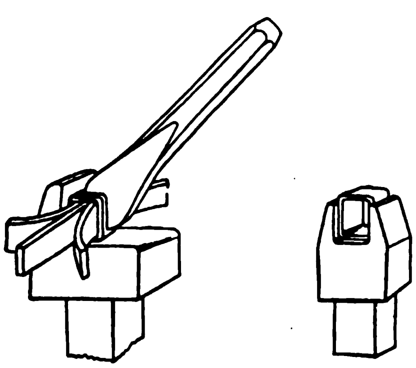


Fig. 23. BANDING STOCK TOGETHER.

tage when we come to form up the work. After the second weld is made, the whole is forged to a smooth taper, after which it is bent to form.

The use of rivets and of bands affords two methods of fastening scroll work together, which require less skill than that of welding. Fig. 21 shows several typical rivet joints, and two very convenient forms of rivet blocks in use are shown at Fig. 22. Often, where the eye of a scroll interferes with the riveting, it is bent out of the way temporarily with a bending wrench. Where this cannot be done, a foot is used, as shown in one of the engravings.

The simplest form of band is made from stock slightly smaller than the scroll work, and bent to a square U-shape over clip tongs, the jaws of which are the width of the stock to be clamped. The ends of the band should be just long enough to fold neatly over each other. Two devices for holding these bands while being clamped are shown in Fig. 23; the foot and clamping stick will accommodate more varied work, and the fork seat is very useful where many bands of the same size are to be clamped. Where it is very inconvenient or quite impossible to put a rivet, machine screws may be used to advantage in fastening. It is well to have the clearance hole for the

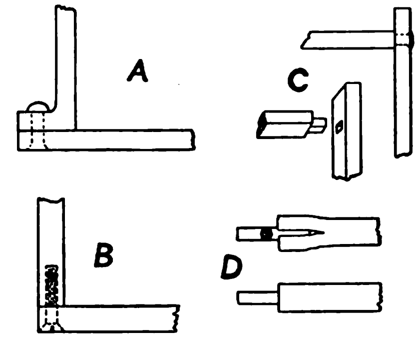


Fig. 24. METHODS OF BUILDING UP FRAME WORK.

screw full large to save trouble in getting the screw entered.

Fig. 24 illustrates the more common ways employed in building up the frame work of grills, brackets, etc. A represents a method used where considerable firmness is necessary in the corners of the frame; B, not very strong in itself, is used where the interior design is nearly self-supporting, and where the knee and rivet shown in A would interfere with the construction or design; C is a common form of

Fig. 25. FINISHED DESIGN FOR LAMP STAND.

tenon joint, in which the hole and pin may be either square or round—the square holds the bars more firmly and is generally used for main framework;

D shows a method for welding a round pin into the end of square stock, and is useful where there is not much strain on the pin.

Fig. 26 is the working drawing for the lamp shown in Fig. 25. This piece illustrates a number of points in regard to the assembling of work. On one scroll is shown the method of measuring lengths referred to in the previous paper. The basket may be varied to fit any small lamp font.

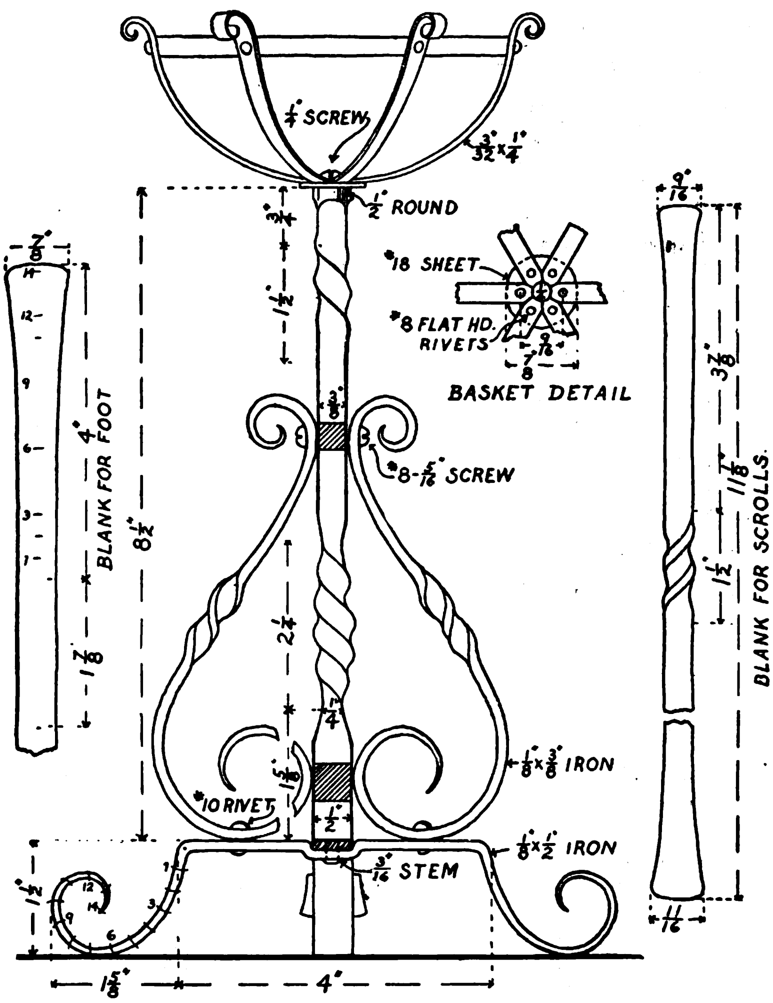


FIG. 26. WORKING DRAWING FOR LAMP STAND.

Some Rules to be Observed in Setting Axles.

JOHN MILLIGAN, NEWCASTLE, ENGLAND.

The principal object to be attained in setting a carriage axle is a plumb or vertical spoke. That is, the front spokes of a "dodge-spoked" or staggered wheel (or any spoke in a wheel which has not "dodged" spokes) shall stand perpendicular and at right angles to the ground on the side, and shall also be perfectly square with the ground up both the front and back of the spoke, so that when the two wheels are screwed up on the axle arms, the distance between the backs of the "plumb" spokes of each should measure the same close between the felloes upon the ground or close up under the nave.

A pair of wheels three feet eight inches high, set true to the road, with a dish of ⅜ inch, will measure three inches wider between the tires at the top of the wheel than between the tires upon the ground. For an ordinary three-foot eight-inch Brougham or Landau wheel a dish of ⅜ inch should be given, and this will necessitate the axle arm being pitched ¼ inch in an arm 8½ inches long. The pitch of the axle must agree with the dish of the wheel, and in order to obtain a plumb spoke the axle arm must have the same inclination to the horizontal as the tire of the wheel has to the vertical.

There is no hard and fast rule as to the dish of carriage wheels; the very heavy cart wheels which have to stand heavy side strains have generally more dish than the light ones, but some limit should be regarded or else defects become very apparent. With regard to such limits, it has been found that the best results have been obtained by confining the dish of wheels to ¼ inch for every foot of the wheel's height.

In addition to pitching the axle arms we should set them with a little foregather, about ¼ inch or ⅜ inch at the most, depending on the height of wheel. That is, the arms, instead of lying in a straight line across on either side, are bent or twisted forward, and thus cause the wheels to be narrower across the front part than at the back, the reason being that by so doing the disadvantages arising from the use of conical wheels are counteracted; and also, that in using Mail axles, should the arm break in front of the solid collar, the "gather" of the arms will have the effect of causing the wheel to continue running much longer than it otherwise would do if straight arms were used. In the case of a Collinge axle where the wheel is secured to the arms by nuts, should the nuts work off while running, the "gather" would cause the wheel to keep running on the arm for some considerable time, and thus avoid accident. The "gather" also takes the strain off the nuts of both the Mail and Collinge axles. The only disadvantage in the "gather" of axle arms is, that it increases the amount of friction, and great care should be taken not to give too much.

In setting axles to the road, care should be taken that they are perfectly true. To ensure this the wheels are fitted on the axle to be tried, and its truth tested by measuring with a light iron rod as follows: BB—Fig. 1, to see that the track is to the gauge, which is usually about four feet six inches to centres of felloes. DD to see that the spokes are parallel. TC′ and T C or TB and T′B′ to see that the

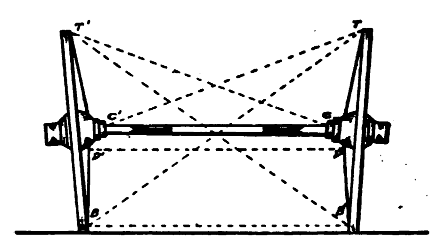


Fig. 1. SETTING AXLES TO THE ROAD.

two wheels correspond in their position upon the axle, and that therefore the two arms of the axle correspond with each other. After marking off the height of the center of the wheels on the edge of the tire, measure as shown in Fig. 2. EE′ and FF′ to see that the wheels are parallel, except for foregather, which, as mentioned before, should not be more than ⅜ inch on the full width. EF and E'F' or EC' and E'C to see that the wheels are at right angles to the axle.

All good makers of axles fagot the

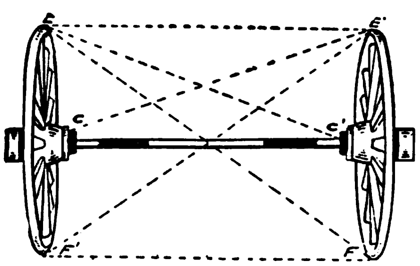


Fig. 2. SETTING AXLES TO THE ROAD.

iron for them, but this, if not well done, is often a cause of fracture, for sulphur, dirt and other impurities may get between the bars and prevent them being perfectly welded together. The chief cause of breakage is owing to the iron having been burned in forging; especially is this the case on the arm at either side of the axle collar and at the flap. Break almost any axle in this part and it will be found that the fracture is crystalline, however much care has been used in forging, while perhaps a piece broken off at one of the ends may show that the iron is of the best quality.

The other causes of breakage are various, such as a small faulty place in welding the flap on, or in welding the arms together. Another cause of breakage occurs now and then in cases where the loose flap or axle shoe has been kept in its place by a large rivet fixed into the under side of the axle. The sharp corner between the axle arm and the collar is the cause of many breakages, both because of the sudden change in size of the axle arm, and because the bending strain of the wheel has most effect here. To overcome this some axles are made with a round corner instead of a square sharp corner. Both axles and axle boxes if properly case-hardened wear for a very long time without requiring any attention. The boxes if carefully made rarely break; if they do, it is either a fault in boxing them, or a flaw in casting them.

Axle boxes are generally made of cast iron, those chilled cast are the lightest, but wrought-iron boxes are coming more into use owing to the demand for lightness, but they are not considered so durable. In shutting up Collinge axles great care has to be taken to prevent the screwed ends being shaken off, as this is easily done if the smith is not careful.

It is advisable before shutting up a Collinge axle to wind twine or fine cord round the screwed ends, as this lessens vibration and the chance of the screwed part being knocked off, and also preserves the thread of the screw from being damaged. The same thing is also done when the smith is setting an axle. If there is not an axle gauge in the shop the usual way is after warming with the tongs to strike the part which requires setting with the heavy hammer. This is not a good plan, as the axle end is very liable to drop off.

Another disadvantage of this method of setting axles is, that the wheels have to be tried on over and over again till the axle is set right.

In axle manufactories they have proper gauges to set them, and the wheels need not be tried on at all. The only thing the axle maker wishes to know is the amount of dish the wheels have, in order to get the exact hang of the axle arms. The most useful gauge is a bar tapered at the ends, and a screw-jack attached, such as is used in bending rails. Fig. 3 shows another useful gauge.

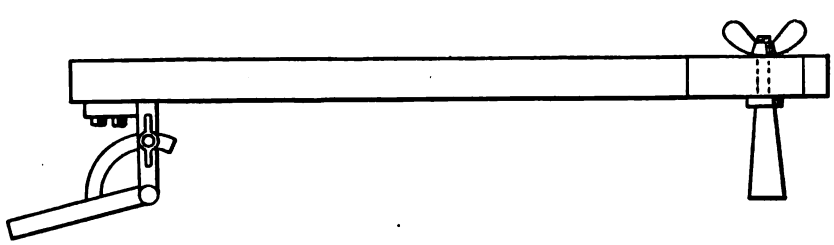


Fig. 3. A USEFUL GUAGE FOR SETTING AXLES.

Case hardening by heating in contact with bone dust, horn shavings, yellow prussiate of potash, or other substances rich in carbon, is generally applied to the axle arms, etc., after they are completely finished by the machine tools or by hand. The coating of steel produced by this process is hardened by cooling the article suddenly in water.

It will be understood, of course, that in the process of case hardening articles in this way, the carbonaceous substance must be protected from all contact with air to prevent its combustion.

Durability Of Colors.

Mixing and Applying to the Surface.

M. C. HILLICK.

The durability of coach colors depends quite as much upon the painter as upon the manufacturer. There must of necessity be a recognized partnership between the two if a reasonable measure of durability would be insured.

To-day, with the wealth of a royal family of colors at his call, the painter has in the title to this article a standard worth fighting for. At no former period in the history of the art of carriage painting have colors appeared in such endless array. The variations in a single family of colors cover a number anywhere from two to five dozen, this latter number having direct application to the family of reds.

Proportionately, this has increased the difficulty of making durability a uniform and sure result. The base of many of the handsomest colors are of a fleeting, flaking, actively perishing nature, and it is only by the use of strong counteracting agencies that reasonable permanence of color can be maintained. This infinite variety of colors, fairly bewildering in extent and glitter of shade, unstable and shifty of themselves alone, require supporting pigments of sufficient resources to supply the natural deficiencies of the topmost colors. In other words, it is essential that the foundation color be made strong and full and rich enough to hold out the final color in its finest estate, and to counteract its fading and flaking property. This accomplished, the painter has discharged his responsibility in the matter. The skill and science of the manufacturer must account for the rest.

The reds are said to be the least durable of all the colors used in carriage painting, considering them as a class. The aniline reds are, in the main, fugitive. So, too, those consisting of whiting as a base, or of some other equally unreliable extender. Yellows and such other colors as contain lead in their composition are durable. Browns having chiefly earthy constituents are usually permanent. Black and the dark greens are naturally brittle and disposed to chip and flake, and in addition they are strongly affected by the action of light, atmosphere and many prevalent gases. In blues, the ultramarine blue is classed by authorities as strictly permanent when exposed to ordinary conditions. Light and air have no effect upon it. Next to ultramarine blue. Prussian blue ranks as a durable color.

The disadvantages noted in connection with the use of many of the above colors may, fortunately, be largely overcome by skill in preparing them for application. In the matter of reds, for example: Many of the brightest and most widely sought reds depend for the complete development of their beauty upon the ground color over which they are applied, and the liquids in which they are reduced to a brushing consistency. These same agencies serve to furnish certain elements of durability which the colors, alone and unaided, do not possess. The ablest carriage painters of the country are as one man in their advocacy of foundations for those reds of questionable permanence, brought up in a full egg-shell gloss. Such foundations reflect more light than they absorb. The elasticity of their composition make them strong and keep them so, and in their strength they sustain and nourish the characteristically weak colors used above and next of kin to them. This maintenance of elasticity, almost to the point of gloss, for the foundation or ground color, applies with equal force to other colors of an unstable nature, and it would seem to be the most available method of counteracting the weak and shifty elements "holding the balance of power" in such pigments. Another link to be forged in the chain holding colors fast and sure against the exactions of service consists in using, so far as possible, such colors in the capacity of color-and-varnish. A great many of the popular reds, if used in sufficient varnish to reduce them to glazing colors, pure and simple, furnish wearing qualities of high value. Apply these same pigments as flat colors and deterioration of color and substance is immediate and pronounced. As a case in point, consider carmine. Use this glorious red as a flat color and there is no beauty in it. And durability—alas, it has none. But use carmine in a good flowing varnish in the proportion of $\frac{3}{4}$ oz. of pigment to a pint of varnish and, using a strong ground color to work over, you have a color radiant as the sunrise and durable as any in the noble order of reds. As a matter of fact, readers of THE AMERICAN BLACKSMITH engaged in using any of the fashionable reds will do well to employ them as glazing or color-and-varnish coats. Bring the foundation coats up perfectly and with enough gloss to hold the final color secure. Upon such a foundation most any of the reds, if kept adequately protected with varnish, will render a satisfactory service.

In the display of yellows there is a splendid variety ranging from primrose to twentieth century yellow. The more delicate yellows—in fact, you may take them as a class—are best brought up to a finish over a foundation of pure white. Bring this foundation up to a stout, fast white, properly puttied and sanded, and then over a flat coat of yellow, apply yellow color-and-varnish coats. The white base for yellow was for years passed along as simply a Frenchman's notion, but back of it there is a rational principle of science or chemistry—call it what you please—which controls the bleaching propensity of the yellow and holds it to its true purity of shade. All the more delicate yellows require expert manipulation under the brush, and clean, deft handling from first to final coat. Dirty brushes, dirty fingers, uncleanly conditions of every sort, mar and disfigure the yellow surface.

The browns in addition to being generally durable are easily applied to the surface. Vandyke brown, dignified by a famous name, yields a warm, fine brown with clearly a reddish cast, and over a single flat coat it can best be applied as color-and-varnish. Vienna brown is a rich, glowing brown, and is best used over a ground color of deep Indian red. One coat of Vinenna brown as flat color and one coat of color-and-varnish will suffice to give a brown of unusual beauty. Umbers and siennas, mellowed and softened into more refined shades and hues by the addition of appropriate pigments, or used alone, as individual preferences dictate, furnish durable colors when a customer seeks a study in brown.

Greens—how wide the range!—are aboundingly popular. As a rule they are handily applied. Nearly all greens are employed as solid colors and require no specially prepared grounds. But they do require very careful and complete breaking up in the cup. All the greens evince unusual power to assert the strength of some one or more of their color constituents independently of and to the detriment of the remaining ones. To overcome this tendency the color should be thoroughly mixed and frequently stirred during the time it is being used. Chief offenders along this line are Olive, Brewster, Quaker, Merrimac and sage green. In applying such greens to the surface—all greens, in a word—avoid cross brushing at the end of the panel. The practice of cross brushing produces two or more, often more, shades of the color. Apply the color with brush strokes carried out to the full length of the panel and leave cross brushing, or dressing up of the color as it is called, severely alone. The vehicle painted green should not be exposed, during its hours in the repository or carriage house, to strong sunlight or to extremes of heat or cold. Nor should ammonia fumes or gases have access to it. Barring exposure to the above conditions, and kept under a good gloss of varnish, the greens may go on record as durable. As to their adaptability for use upon nearly all classes of vehicles, address your query to the exclusively smart set of Newport or Bar Harbor, or to the gentlemen who create fashions from a three-legged stool in Broome Street, New York.

As previously stated, ultramarine blue is a permanent color. In its three shades, as furnished the carriage painter, it is for heavy pleasure vehicles the most generally used of all the blues. It should be used as a glaze color, never as a flat color. Its covering power is poor, and when used as a flat color it loses in brilliancy and depth of shade. For ultramarine, build up a dense, perfect ground, and use the ultramarine in an elastic varnish that has good flowing properties. Lamp-black makes a satisfactory ground color for ultramarine blue. Many painters use coach-black, and some of the handsomest medium shades of ultramarine are laid over a ground of Vandyke brown. The chief consideration is to have the ground practically faultless before applying the blue. It is useless to attempt to rectify a mistake of surfacing after the blue is once in place. Within recent years Cobalt blue has found a warm spot in the estimation of a very considerable number of carriage painters. The best samples of Cobalt blue are permanent under extraordinarily adverse conditions. From certain view points this blue reflects green and violet shades as well as pure blue. It is an elegant panel color for traps, park wagons and vehicles of this class. Formerly the high price at which it was quoted to consumers excluded it from the carriage painter's list of pigments, but to-day it is listed at only seventeen cents per pound. It requires a finely built up ground, over which it will yield lovely color effects.

Black is the most universally used color of all in pleasure vehicle painting. The ivory and bone blacks are, excepting lamp-black, the best known to carriage painters. In composition and general properties ivory and bone black are quite similar. They differ chiefly in hue. Bone black tends to a greyish-black hue, whereas ivory black of the best grade is a brilliant, intense black. Naturally, when ground in Japan, blacks, like the greens, are disposed to be brittle and flaky, and they are quickly susceptible to the action of light, moisture, impurities in the air, etc. Blacks are strictly solid colors and are used in this capacity. They should be broken up in turpentine, adding the fluid gradually, and the mixing should be thorough and complete. Apply with a camel's hair brush and carefully avoid brush marks. All blacks take on a greenish cast under successive coats of clear varnish. To prevent this the painter resorts to black color-and-varnish coats. The color-and-varnish should consist of plenty of varnish and but little pigment—simply a coating-up material to enrich the ground color. This gives the jet black of fine, soft, velvety texture. In the application of black to the surface, lay full, free coats, exempt from brush marks, and shun surface defects as you would a pestilence.

The Scientific Principles of Horseshoeing.—4.

Preparation of the Hoof for the Shoe.

E. W. PERRIN.

Preparing the hoof for the shoe is one of the most important operations in shoeing. The hoof grows much faster at the toe than at the heels, but this inequality of growth is equalized in a natural state by the greater wear at that part of the hoof; but in the domesticated state when the animal is kept on soft earth the hoof grows abnormally long, especially at the toe, and in the shod horse, even though the hoof be reduced to its normal size, as soon as the shoe is nailed on—the hoof being protected from wear—the abnormal condition commences and continues until the shoes are again removed. Then by preparing the hoof for the shoe is meant the reduction of the hoof to its normal dimensions, the cutting away of the surplus growth, or in other words the paring down of that

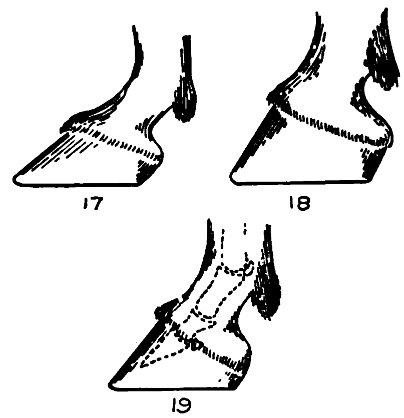
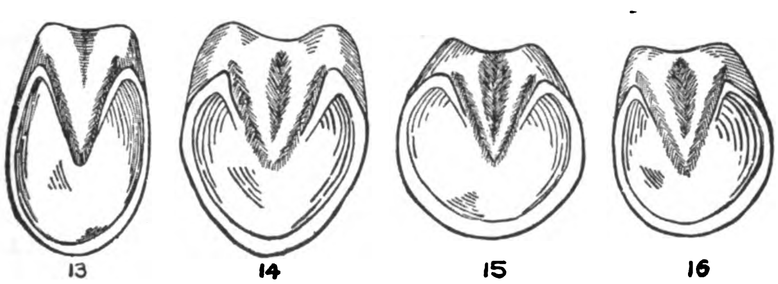


Fig. 17, 18 and 19. VARYING HOOF ANGLES AND THE NATURAL.

part of the hoof which would have worn away by contact with the ground in a natural state.

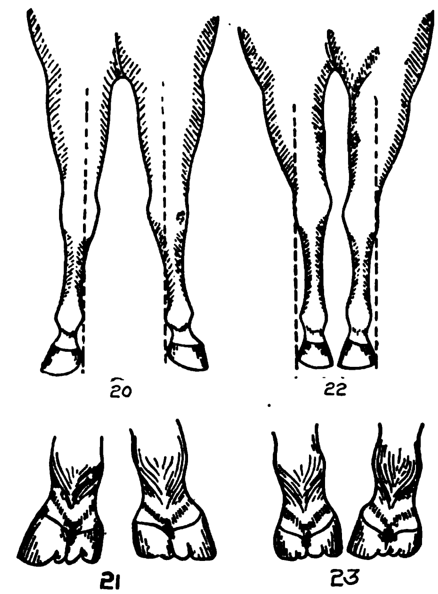
I suppose any mechanic could shorten a horse's hoof, but the problem requiring the farrier's art is, where to cut, and where not to cut, and it is here that a knowledge of anatomy and conformation is indispensable. Infinite diversity is a law of nature which is especially true of horses' feet and legs, and the variety of shapes of feet and conformation of limbs is so great that it is impossible to lay down with mathematical precision a given measurement to which horses' hoofs may be pared; hence greater skill and precise judgment is required than if the horseshoer had rule and compass to guide him, for each hoof must be pared to conform to the limb to which it belongs.

Horses' feet like men's may vary considerably in shape without being affected with disease; some are long from toe to heel (Fig. 13). Some wide at the quarters with a narrow toe (Fig. 14). Some almost circular (Fig. 15). Again, some are straight on the inside but wide and round on the outside (Fig. 16); but all of the above shapes are perfectly natural and should not be altered to conform to a standard pattern. Some feet also are highly concave on their ground surface, while others are somewhat flat.



Figs. 13, 14, 15 and 16. VARIATION IN THE SHAPE OF HORSES' FEET.

In the same way we cannot lay down a hard and fast rule for the angle to which a hoof should be dressed, because the natural angle differs in different conformation of limbs. For instance the long oblique pastern (Fig. 17), has a long oblique foot, low at the heels; on the other hand the upright pastern has an upright foot, somewhat high at the heels (Fig. 18). Hence it will be seen that the normal angles of Figures 17 and 18 are very different, yet both positions are perfectly natural; but to dress the hoof of Figure 18 to the dimensions of the hoof of Figure 17 would put too much tension on the



Figs. 20, 21, 22 and 23. VARYING CONFORMATION OF LEGS AND FEET.

flexor tendons, which would probably result in a sprain.

In considering leveling the hoof, it may be asked, what is leveling the hoof? As this is a point upon which some authorities are at variance, I desire to be very explicit upon it. Some prominent writers have attempted to prove that the only way to obtain a level hoof is to adjust it to the measurements of an instrument called a hoof leveler. Now if the locomotive apparatus of horses were all manufactured to measurement, then we might apply a mathematical instrument to the foot with beneficial result. If the legs of horses were perpendicular then a horizontal axis in the foot—i. e., both sides of the hoof the same height—would be correct, but look at the positions portrayed in Figures 20, 21, 22, and 23. You will observe that a plumb line dropped from the arm of Figure 20, the base wide position, falls inside the foot, while in Figure 22, the base narrow position, it falls outside the hoof. Hence in the former to make the hoof level, that is, to make the axis of the foot conform to the limb, we must leave the outside of the hoof a little higher than the inside, while in the latter, the base narrow, the natural position is with the inside of the hoof a little higher than the outside. But apart from the conformation of the limbs, the mode of action of individual animals may greatly modify the shape of the ground surface of the hoof; an examination of a pile of old shoes will prove how very few horses wear level. To a casual observer all horses' legs may look alike, but to the critic, the accurate observer, no two sets are alike. As further evidence in support of my position I invite the reader to observe carefully the shape of the hoofs in unshod horses. I have observed a batch of remounts when they first joined a regiment of cavalry before they were shod; I have seen them placed in line for an officer to inspect them, in which case I had a fine opportunity to compare their unshod hoofs; I have seen large numbers of unshod colts at horse fairs in England and Ireland, and I have seen them in stock yards and upon the prairies of America, and assert that in a large number of horses you will see every conceivable shape and form of hoof. Some are high at the heel and some low, some round, some straight, some are high on the outside, some on the inside, and again, owing to some peculiar mode of action, some are so rounded off at the toe that you can place your finger under the toe of the hoof while the foot is planted on the ground. Others are worn off—rounded up at the outside toe or quarter. Now it is conceded by all horsemen of experience, that as a general thing, the foot of the young unshod horse is sound. It is not until after he is shod and put to the severe test on hard roads that the foot troubles commence. Therefore I maintain that the foot is level when the horse places it level upon the ground in traveling, or, in other words, the hoof is level only when its ground surface is pared in conformity to the shape of the limb and mode of action of the individual animal to which it belongs, one side of the hoof higher than the other notwithstanding.

The problem of reducing the hoof to its proper dimensions will next be considered. First of all in shoeing a strange horse you will find it good practice to ask the owner if the animal is traveling satisfactorily, for it may be there is some fault to find which forms the reason for changing from one shop to another. If, however, the horse is traveling satisfactorily, then take particular notice how he is shod. Don't throw the old shoes on the pile before you have closely examined them, but take notice if there is anything special about the style, weight or manner in which they were fitted, because it will be quite safe to closely imitate that system of shoeing which has already proved to suit the animal, whereas to change the weight of shoe or dress the hoof to a different shape may cause the horse to interfere.

Having removed the shoe, pare away that part of the sole which is ready to flake off, but on no account pare the sole too thin. Bear in mind, it is better to have the sole $\frac{1}{2}$ inch too thick

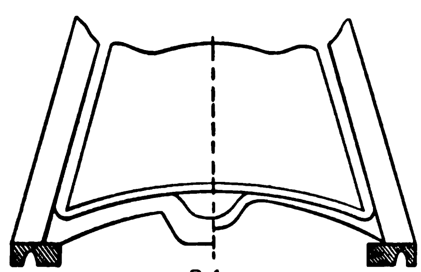


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Fig. 24. PREPARATION OF THE HOOF—THE RIGHT AND THE WRONG WAY.

than $\frac{1}{16}$ inch too thin. Then pare away all ragged or semi-detached horn from the frog, but don't thin it in an effort to make it conform to some standard shape. Next reduce the surplus growth of wall with the cutting nippers, and then level down with the rasp, leaving a wide bearing for the shoe to rest upon. Do not thin away the margin of the sole so as to leave a narrow rim of wall to carry the whole weight of the animal, for this erroneous system of preparing the hoof (see Figure 24), has been the direct cause of much foot lameness. It is natural for the margin of the sole to share with the wall and frog the weight of the animal, and the foot will be much benefited by allowing the margin of the sole to bear its natural share of weight, provided, of course, that it is not pared too thin, or worn thin by work without a shoe, in which case it may be necessary to protect it from weight until nature has grown back some of the horn so ruthlessly cut or worn away.

The thickness of the sole in unshod horses varies from $\frac{1}{2}$ to 1 inch and $\frac{5}{8}$ to $\frac{3}{4}$ inch is a common thickness in a healthy foot, in which condition it forms a substantial protection and support to the internal structures. There is no excuse for thinning the sole, except to search for some foreign body which may be the cause of lameness. In a natural state the immature horn cells are protected by the compact external layer, and as soon as the new growth is able to withstand the influences of atmospheric changes and wear, the outer layer is cast off—exfoliates. But undue paring exposes the immature soft horn to atmospheric changes and wear, which it is not able to stand and which causes it to form a hard, dry, contracting surface, the pressure of which acts as a foreign body on the sensitive sole, causing the animal to go sore and tender, sometimes accutely lame, for days after, proving not only this, but a thin horny sole also exposes the sensitive sole to wounds and bruises from stones, nails, glass, etc.

The bars form a brace to the heels and quarters. They should not be weakened by paring, but only to the extent of removing any loose horn. The buttresses should not be weakened by "opening up the heels," except in those cases where there is wasting—atrophy—of the frog; in such cases it may be necessary to "open up the heels," to prevent the buttresses from crowding in upon a weak frog, but it should not be practiced in healthy feet.

The toe of the coffin bone of the front foot is slightly rolled, and every front hoof of an unshod horse and every worn out front shoe, that I have seen in 27 years' experience, was more or less rolled at the toe. Therefore, in finishing the hoof roll the toe with the rasp. The amount of roll in different animals must be determined by the wear of the old shoes.

Having dressed both hoofs, the shoer should critically examine them in profile and from front to rear to see if they "pair." Great care must be taken that one hoof is not longer than its fellow and both must be at the same angle.

If the outer wall is growing down straight from coronet to ground surface, then there is no excuse for rasping it. Sometimes, however, the wall grows out shallow at the toe or on the quarters, "wingy," and in such cases enough of the wall may be rasped away as will make its profile describe a straight line from the coronet to the ground surface.

The above instructions are for guidance in the preparation of sound feet, certain modifications being necessary in cases of abnormal or diseased feet and limbs, which will be dealt with under pathological shoeing.

Interfering.—Its Cause and Cure.

C. P. TUCKER.

The proper care of horses' feet is of great importance, not only to owners and drivers, but to farriers as well. Interfering seems to be one of the most common themes of discussion, and hence a few remarks on the subject may not be out of place.

In my experience I have found that horses which toe out are most liable to interfere, as also those horses whose feet are unbalanced. By this I mean that one side, usually the outside, grows faster than the other. The outside grows down and tips the ankle in; as a result the horse in traveling strikes the most weight on the inside and seems to kill the growth at that part. Sometimes in a case of long standing the internal structure of the foot seems to be deranged and enough cannot be pared from the outside to level it. You may pare until the heels are of equal depth and yet when the horse stands his ankles tip in. In such cases the horse must be balanced by the shoe. If a calked shoe be used, make the inside calk enough higher to bring his ankles in a vertical line over his feet. His action will then be frictionless and he will travel clear. If a side weight be used, be sure to get a direct side weight and see that no weight extends further than the point of the frog, as shown in Fig. 1. All such weight deadens the effect of the weight outside. In making this shoe, I use my fuller at the toe, Fig. 1, draw out the inside as thin as I want it, and then the outside, after which I crease and punch.

Some shoers always turn the inside heel clear in under the foot, but this only tends to cripple the foot and tip the ankle in. Except in rare cases I leave the inside of the shoe quite straight.

The frog should always be in the center of the foot, with as much hoof on one side as on the other. Sometimes the outside shell will grow out into a wing-like projection, giving the foot the appearance of toeing out. This abnormal growth should be trimmed down, making a balanced foot, and then if the foot is properly leveled so that the weight of the horse bears equally on each side, in time the foot will grow to its normal state. Always level the foot and weld the toe calk at the center of the toe. Then in setting the shoe have the frog point directly at the center of the toe calk, and there will be fewer interfering horses.

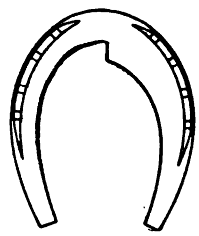


Fig. 1.
A SIDE WEIGHT SHOE.

A foot like that mentioned above in my opinion is caused by it not being properly leveled, throwing the weight of the horse on the inside of the foot and thereby retarding its growth.

Diseases of the Foot and their Treatment.—1.

E. MAYHEW MICHENER, V. M. D.

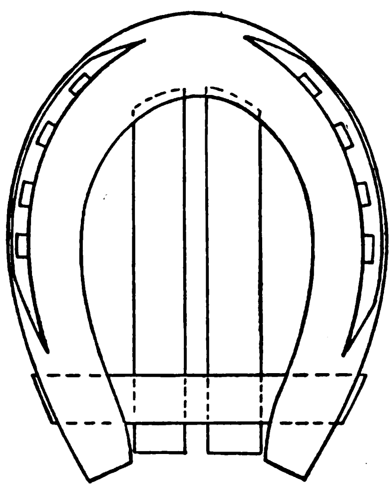
A knowledge of the various diseased conditions to which the foot of the horse is subject is of the highest importance to the shoer. Frequently the owner of an animal with diseased feet is unaware of the condition until the fact is brought to notice by the shoer. It is advisable that the shoer at once report to the owner any abnormal condition of the feet, so that proper treatment can be attempted. Not uncommonly the shoer has received the blame for conditions of the feet arising from causes not within his immediate control, and for his own protection, therefore, it is important that a close watch be kept upon all new animals coming to the shop as well as those belonging to old patrons. In this and in future articles it is proposed to go over the diseases and accidents of the foot, with reference to the cause, symptoms, treatment and results.

By the name thrush, is meant a common disease of the frog, characterized by a discharge of offensive matter from the sensitive living tissue, which has for its function the formation of the horn of the frog. The detection of this disease is not difficult, but the points of difference between thrush and the disease known as canker should be carefully considered, as the chances of speedy recovery under treatment is much less in the case of the latter disease. Thrush may also be confounded with decayed frog, resulting from injuries, as from nail punctures, so that a careful examination is always necessary before arriving at a positive conclusion. Lameness is not common in cases of thrush, and if present is generally due to the uneven condition of the road or to the presence of small particles of sand or other hard material in the cleft of the frog.

The most common cause of thrush is the presence of filth in a damp condition. It flourishes in dark, damp and badly kept stables. Lack of proper care of the feet is also an important factor; long feet with the consequent accumulation of an abnormal amount of horn upon the frog is a common cause. Lack of exercise greatly increases the liability of thrush. The disease is unknown in the horse in a state of liberty. It is a fact that certain animals are more liable to thrush than others under the same conditions, and this is especially marked in the case of thrush of the front feet. The heavy draft horse is more liable to the disease than the light-limbed animal, and recovery is generally much more prompt in the case of the latter.

The necessary treatment varies with the severity of the attack; in the mildest cases all that may be necessary is proper cleanliness, as daily cleansing of the hoofs with the hoof-pick and some dry oakum or a dry cloth. Water should not be used in cleansing, and the stables should be kept dry and clean. The shoe should not be left off, as a circulation of air is desirable and is aided by the elevation afforded the foot by the shoe. All horn which is decayed or has become loosened from the sensitive parts should be freely removed, as it only acts as an irritating foreign body, and serves to aid in the accumulation of the discharge in which the germs of decay find a favorable soil. If the case is one which requires the aid of medicinal remedies, the following drugs will be found good: Finely powdered sulphate of zinc in liberal amount generally effects a cure. Apply once daily after cleansing the parts by wiping out all fissures and the cleft of frog with a dry rag pushed well to the bottom by means of a dull blade or thin paddle. Dry calomel may be used in the same manner, and is good in cases in which the frog has become separated from the skin of the heel. Powdered iodoform is also a very excellent remedy where much of the tender parts become exposed upon removal of the decayed frog. What ever the remedy selected, it is important that it be applied to the very bottom of the clefts and fissures: small pledgets of oakum or absorbent cotton should be pushed into the cleft to hold the remedy in place and also to prevent the entrance of dirt. The frequency of the application of medicines must be governed by the severity of the case or the extent of the disease, once or at most, twice in severe cases, and less frequently in mild cases and as recovery progresses.

To ordinary observation canker resembles thrush with symptoms much intensified. This disease generally begins at the frog, but may begin in the sole, and in rarer instances even the bars or the outside wall of the hoof may be the point of attack. The course of this disease is more rapid than in the case of thrush; the horn is rapidly separated from the sensitive horn-forming structures beneath, and



METHOD OF RETAINING DRESSING.

the soft parts take on an unhealthy fungus-like growth which rapidly increases in size. Abundance of new horn cells are secreted by the soft parts, but the newly formed horn lacks stability and breaks down, mingling with the liquid discharge of the parts. The odor is characteristic and much more offensive than that of thrush.

The external causes which lead to canker are the same as named in the causation of thrush. In the case of canker, however, individual predisposition plays a more important part than in thrush. Coarsely made and heavy animals are more predisposed. Badly treated injuries of the foot sometimes result in canker.

The treatment of canker requires time and perseverence, with constant vigilance, and relapses are frequent even under good treatment. The following procedure is generally necessary: Complete removal of the whole of the horny covering to the utmost limits of the diseased soft parts beneath, the complete removal of the frog, and even the sole and at times the greater part of one or both quarters is required. This is done by cutting through the horn with a sharp toe knife, and by the aid of forceps the horn covering the diseased parts can be stripped off. The sensitive parts are next covered with a dressing, which is composed of small pledgets of oakum evenly applied, and retained with pressure by means of a leather boot, or by means of splints applied beneath the shoe, as shown in the diagram. Galvanized hoop iron is excellent material for splints, or splints may be made of straight-grained hickory or other tough wood. Apply enough oakum to get a decided pressure upon the sensitive parts. Allow the dressing to remain for two or three days, then immerse the foot for ten minutes in a bath of warm water containing one-half an ounce of creolin to the gallon, after which remove the dressing carefully, and if the soft parts are covered with a new horn layer of healthy appearance reapply the dressing as before. Generally, however, some spots of unhealthy growth are present, and these must be touched with some energetic caustic. For this purpose pure chromic acid is one of the best agents, and pure nitric acid is also used with good results. Use great care not to apply too much caustic. A camel's hair brush or small pad of absorbent cotton is used in making the applications; avoid allowing the caustic to come in contact with the hands or with the skin or healthy parts of the animal. Repeated applications of the caustic may be required, always scraping away the dead material resulting from previous applications. From two to four days is long enough to allow any one dressing to remain upon the foot. If the quarters are badly diseased the case may be incurable, and in the case of animals of little value it may be doubtful if even an ordinary case is worth the time and attention necessary to secure permanent recovery.

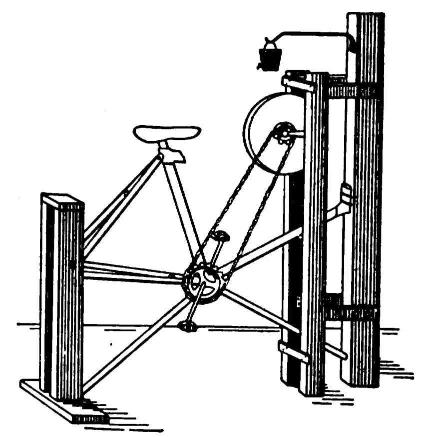
The two diseases of the foot discussed above, thrush and canker, are among those with which the farrier often comes in contact. They demand intelligent treatment for their abatement, and it is well that the shoer be familiar with them, and with their cause and cure.

A Novel Grindstone Arrangement.

JOHN ARROWOOD.

In the accompanying sketch is shown a novel grindstone. I had the frame of an old bicycle and utilized it in connection with the stone.

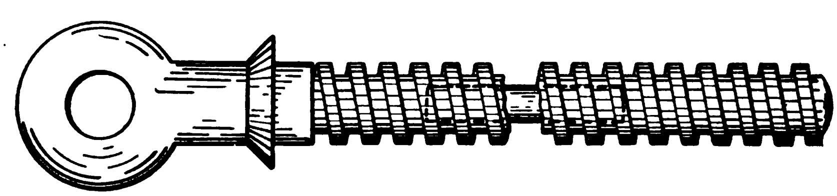
In rigging it up, I first cut out the middle brace of the bicycle and then with a 2 by 4 timber made the rear support. Next I stapled the front of the bicycle to a stout post and then



A NOVEL GRINDSTONE ARRANGEMENT.

made the frame for the grindstone. I braced the bicycle frame underneath as shown. By cutting the spokes out of the rear wheel I secured the small sprocket. Then I took a small piece of wood, fitted it snugly into the square hole of the grindstone, bored a hole in the wood the size of the sprocket axle, and fitted the axle to the stone. My next step was to take a piece of iron, cut notches for the axle to rest in and nail it to the frame, after finding the proper height for the stone. As the stone was quite high, it was necessary to obtain two chains and put them together.

This machine is now a handy ball-bearing grindstone, which runs at lightning speed and which costs but little to make.



REPAIRING A BOX VISE SCREW.

Repairing a Box Vice Screw.

W. D. BOETTLER.

The accompanying sketch shows a solid box vice screw that had become broken. I could not obtain another one to replace it without delaying my work too long, so I drilled a $\frac{3}{8}$-inch hole in each broken end about one inch deep. I then heated the ends and drove in a $\frac{7}{16}$ iron pin of the proper length to allow the two broken ends to come together. I put the screw in a clean fire and took a good welding heat on the broken parts and welded them together by striking light blows with a small hammer on the ends. Then with a small fuller in between the thread I welded in the pin. The thread did not waste away in the least. Since that time I have had no trouble with the screw whatever.

Price Schedule from California.

The following is a few of the prices charged for blacksmith and wheelwright work in this vicinity. We don't make much new work, as the factories ship in too cheap, and raw material is expensive.

Shoeing, ...	$1.50 to $2.00
Resetting, . . .	1.00
Tire setting, ordinary buggies, or wagons, per set, . . .	3.00 to 4.00
Heavy wagons, according to size, new tires, ...	8.00 up
Setting axles, . .	1.00 to 2.00
Plow shares, pointing inclusive, sharpening, ...	.50 to 1.00
Sharpening, each, .	.20
Sharpening weed cutters up to 13 feet,	.20 per foot.
Complete roller brake,	15.00 to 20.00

J. M. Fix.

Queries, Answers, Notes.

This column is intended for the especial benefit of AMERICAN BLACKSMITH readers. All should feel free to ask information upon any subject of craft interest. On the other hand it is hoped that those who have a good answer to any query thus made will not hesitate to submit it for the benefit of the questioner and others who may be dealing with the same problem. A brisk discussion of all such topics is desired. Comments upon the subject matter of preceding issues will also be given a place under this heading. It is especially desired that this department should be of value and benefit to readers.

Boring Cylinders and Turning up Cranks. In reply to Mr. A. Stone's inquiry in your November issue, would say that the best way to bore out the cylinder and crosshead guides of an engine which are cast in one piece, and secure perfect alignment at the same time, is to pass the boring bar through the stuffing box of the cylinder, and bore both the cylinder and guides at the same setting of the bar.

Regarding the question of turning up cranks, it is unnecessary to have a pair of jigs for each length of crank. Turn up a face plate with a collar upon one side of it to fit the diameter of the shafts you handle. Place a half-inch set-screw in the collar. Turn up the other side of the face plate and carefully mark the center. With the plate still in the lathe, turn light circles in its face at distances from the center equal to the throw of the different cranks. Now lightly cut a diameter upon the face of the plate, and lay off radii at angles of 90, 120 and 240 degrees. Whenever the circles are crossed by any one of the lines, sink holes in the plate to take the lathe centers, and you are ready to handle shafts with one, two or three cranks at 90, 180, or 120 degrees. Line up the shaft on the face plate of the lathe by means of parallel bars. C. A. B.

The Present-day Blacksmith. I can recall when I went in as an apprentice that forging machinery was a thing unheard of. At that time a man who could turn out a big day's work at the anvil was the man who was wanted. Nowadays it is different. What is wanted in the present age is a blacksmith, especially a foreman blacksmith, who can devise dies and tools for forging machines and hammers, thereby increasing the production at a greatly reduced cost for labor, and making it possible for the shop that employs him to compete with all other shops in the same line of business.

You will often hear it said that improved machinery for turning out work is a detriment to the mechanic. I don't think it is, but on the other hand, I think it is the means of opening up markets for the products of large shops. For instance, if farming implements had to be made by hand instead of by forging machinery, the majority of farmers would find the cost so much that they would be unable to buy them. Daniel Fitzgerald, Foreman Blacksmith, C., M. & St. P. Ry.

Shoeing a Knee-Sprung Horse. We should like to know through your columns the best way to shoe a knee-sprung horse that runs in a stage. Hughes and Kennedy.

Knee Sprung is a term by which we understand a relaxed condition of the knee joint, an inability to brace the limb when standing. The cause is a relaxed condition of the extensor tendons and capsular ligament of the knee joint, which is usually the result of severe work on hard roads.

The treatment consists in restoring the tone and strength of the affected parts. In confirmed cases of long standing there is no hope of a cure, but proper shoeing, even in chronic cases, will increase the usefulness of the animal by enabling him to travel in comfort. In young horses and those in which the disease is nipped in the incipient stage, get a veterinary surgeon to treat the joints. The feet must be shod high at the heels for a time, with a roller motion toe. A heavy thick-heeled rubber pad, "Dempsey" preferred, is far superior to any other shoe for this purpose. After a few months use of the rubber, you will probably notice a marked improvement, and as soon as your patient begins to wear lighter at the toe, which will be indicated by the wear of the shoe at that part, then begin to lower the heels a little at each shoeing until the natural angle of the foot is restored. I need hardly add that in young horses, in addition to the remedies here prescribed, a good rest is indicated.

In chronic cases, shoe with rubber or high heeled shoes with roller motion toe. Where the toe of the hoof has become very short and stumpy, in which case there is much danger of knuckling over on the fetlock, fit the shoe as much longer at the toe than the hoof as would make a line from the toe of the shoe to the coronet describe the normal angle of the foot when viewed in profile. Don't be in a hurry to lower the heels in the hope of bracing the knee, unless you are certain the animal can bear it without discomfort, for otherwise you will aggravate the trouble. E. W. Perrin.

Proportioning Pulleys. I should be pleased to answer the inquiry of Mr. M. I. Morgan in the November issue, but his statement of facts is rather too limited. I will therefore give a few facts that may help him.

An emery wheel five inches in diameter should run at 2,000 revolutions per minute, one twenty inches in diameter 1,000 revolutions per minute, and one which is thirty inches in diameter should make only 500 revolutions. A grindstone can be safely given a speed at the periphery, or outside edge, of 3,500 feet per minute, but a good speed to run them is 1,500 feet per minute. The number of revolutions of the stone per minute may be found by dividing the peripheral speed in feet per minute by the circumference of the stone in feet.

Run the line shaft the same speed as the engine. This requires the same size pulleys on engine and shaft. The diameter of shaft should be one and one half inches.

Proportion your driving pulleys by the following rule: The number of revolutions of two belted shafts varies inversely as the diameter of the two pulleys, or in other words, if the driving shaft pulley is twice as big as the driven shaft pulley, the driving shaft will only make one half as many revolutions as the driven shaft. For example we will suppose the emery wheel is five inches in diameter and must be run at 2,000, or $6\frac{2}{3}$ times as fast as the driving shaft. Hence the driving pulley must be $6\frac{2}{3}$ times the size of the emery wheel pulley. As the latter is three inches, the driven pulley will be twenty inches in diameter. Knowing, therefore, the speed of the driving or line shaft, together with the pulley diameter of the grind stone or other machine, you can find the size of the driving pulley to give the desired speed. C. A. B.

A Question About Old Wheels. I should like to hear from someone in regard to filling over a patent buggy hub (old or new) with new spokes, and as to whether it can be made to stand as well as from the factory, and how it is done. A. Bruton.

Mr. Smith Replies to His Critic. On page 48 of the November number of The American Blacksmith, I note the criticism of Mr. Chas. P. Crowe of an article in the October number of The American Blacksmith, entitled "A Few Practical Hints on Tempering Steel," written by myself.

I desire to say in behalf of myself, that the method given there is correct for the work and articles indicated. I also desire to say in behalf of Mr. Crowe, that by all appearances he has entirely misunderstood the parts which he claims are not practical. His criticism is also hasty and rather unjust. If he will kindly read the article over again, he will find that his remarks are misleading to a person who has not read the article, but who sees his criticisms alone. I have not asserted that "a knife or spring properly tempered" would cut glass. Such an assertion would be absolutely absurd. Also he has stated that a piece of steel so hard that it will cut glass, which can be bent into a crescent, would be a "useless freak." It is very amusing, but there are evidently some "freaks" which it would be well for him to get acquainted with.

He also stated that drawing the color two or three times has no effect and would only be a waste of time. If we were to believe this assertion, it would be conclusive to our minds that after drawing one color, it would be useless to draw the next color, because it would have "no effect and be a waste of time." "O, ye of little faith." In that part of the aforesaid article where it states that these colors are to be drawn two or three times, I claim that I am right. For instance, take a chisel and draw the first blue color; next, without reheating in the fire, and after being polished again, draw the first blue color again, and so on until the right temper is found. Anyone will see at a glance what I mean, and that it does have an effect.

Bending a hardened piece of steel into a half moon is easy and it is not a "useless freak," and anyone that claims that I am wrong, let him take a piece of steel, say for convenience a butcher knife properly forged and prepared, as indicated in my article, heat to an orange heat and immerse in hot linseed oil, and when at the same temperature as the oil, take it out, wipe off the oil and bend it. You can also have a sharp end or edge made previously to hardening, and after taking out of the oil it will cut glass. Bending while in this condition will not injure the steel; it will also leave the bend in it unless you take it out. Of course the bending part must be done before it has become cold, and immediately after wiping off the oil. The easiest way to find out whether I am right or wrong is to try it. I do not claim that it can be adopted as a universal law or method, but I do state that it is not a "chance or peculiar" method, but one in which the natural laws and elements of the material are considered, and one which can be used in the every day work of the ordinary blacksmith shop.

I would not, for anything, write an article that would have a tendency to mislead the craft at large, or on a subject that I did not know anything about; neither would I criticise a subject unless I had a clear meaning or knowledge of it. Before condemning a method, I would put it to practice, in order to determine its merits or disadvantages, or else say nothing. W. Z. SMITH.

A Country Blacksmith. I am a country blacksmith located two miles from the railroad and forty miles from any city of considerable size. I take two blacksmith journals, and try to keep up with the times. I am thirty years old, and have been following the trade for twelve years, eight of them for myself. My specialty is manufacturing and repairing farming implements. My shop is 24 by 60 feet, two stories and large additions. The tools which the same is equipped with consist of one 15-horsepower engine and boiler, one bolting saw, one shingle machine, one corn mill, one 36-inch band saw, one 12-inch planer, one double spindle shaver, one rip and cut-off saw, one wood-turning lathe, 24 inches swing, one emery wheel, one 36-inch emery stone, and one power drill, in addition to the usual complement of hand tools. I use the latest make of blacksmith tools and think that every blacksmith to keep up to the times should do so. I put power into my shop three years ago and could not do without it. If I had to run a shop without power, I would quit and work for a man that had it. A blacksmith who has never tried it does not know the benefit which it is to his trade.

Whatever you do, see that you do it well and charge what it is worth. Don't overheat your steel. Use the best of blacksmith coal and have a good fire to start with. Keep your shop clean and rub your tools up occasionally with a rag and oil. Make your shop as comfortable as possible and your business a pleasure. J. VESTAL.

Further Comments on a Recent Article. In your November issue Mr. Crowe has corrected some statements made in the October issue that were somewhat misleading. Kindly allow me to correct a statement or two which to me is at variance with good practice, and against the rules laid down by the highest authorities on tool steel.

On page 31, first column, he states that Nos. 7, 8 and 9 show that time in heating affects the result. These pieces were heated quickly to a high heat, and quenched in cold water, and consequently much stronger at the fracture than Nos. 5 and 6. Now, if I understand Mr. Crowe properly, he wishes to express the idea that a quick high heat is less injurious than a slow high heat. For my part, I cannot see where the difference will come in, for violent strains are set up in steel no matter how well it is heated and quenched. When heated quickly it is heated unevenly, and this will set up destructive internal strains, and if this treatment is continued the strains will become greater than the tenacity of the steel, and when quenched in water it will invariably crack. Mr. Crowe, in commenting on Mr. Smith's article, states that the forging heat is the wrong heat for hardening. This is very true when water is used as the quenching medium, but Mr. Smith plainly states that he is using oil as his quenching medium, and to harden steel in oil, the temperature of the steel will have to be much higher if you wish to secure a high degree of hardness.

The proper hardening heat is at the point of recalescence, and when heated above this point the grain is raised, or the crystals become enlarged, and this is the case when heated for oil hardening. This is one of the reasons why cutting tools hardened in oil are not as enduring as when tempered in water. Mr. Smith states that he heats to a dull red heat, and then water-hammers the piece two or three times, then heats it to the forging heat to be hardened. Now, if he has heated it again to the forging heat, he has raised the grain, and destroyed nearly all the virtue imparted to the piece by hammering it at a low red heat.

In regard to water-hammering, the steel maker is very chary about using water on his dies when drawing out his bar of steel, as he has good proof that it produces surface cracks. There is no doubt that water-hammering will cause this scale or oxide to fall off and cause the steel to harden a little quicker, but nevertheless I believe it is safer to follow the steel-maker's advice. In matters of this kind it is always best to learn what constitutes "good practice." H. W. RUSHMER.

Short Irons. Will someone please explain to me the meaning of "short irons," when one says he can weld short irons? H. N. POPE.

Concerning Power Hammers. I would like to say to Messrs. Sartwell & Son in answer to their query in the October number, that if they have any work to do with a hammer to get one by all means, as it will soon pay for itself in time and stock. If a steam hammer is not practicable, get a good sized Bradley Hammer, or an easy working drop hammer will do lots of work. I have seen it tried, as there has been a steam hammer placed in the shop where I am working. Many a short piece of stock that it would not pay to work up with the sledge is used up now. We have a good many dies from one foot long by ten inches wide, two inches thick, and some larger ones. Before when they split they were thrown into the scrap pile. Now I draw them out under the steam hammer and make smaller ones of them. HOMER N. POPE.

Tempering and Brazing. Will someone give me the best and surest way of tempering small springs, such as gun springs; also the proper way to solder or braze a thimble on a gun barrel. WM. P. GUDGELL.

Welding Compound. What is the best compound for welding Fish Egg Steel, Dry Steel and Mushett Steel? B. TODREA.

A Shoeing Question. A customer of mine has a mule that strikes his feet together at the edge of the hair at the top of the hoof. His feet are smaller at the top of the hoof than at the bottom, and he rubs the skin off at the top, not with the shoe, but with the other hoof. Will someone tell me how to fix him? I. W. VINES.

Some Shop Questions. I should like to know what a 6-horsepower gasoline engine would cost me, or power enough to drive a band saw, emery wheel, rip saw, cut-off saw, and a small planer. How much power will it take to run those machines?

I also wish to ask just how to temper the ordinary tools that a country blacksmith uses, such as mill picks, and cold chisels, the color for them, etc. G. P. BLANCHARD.

A Comment on Frog Pressure. Referring to the blacksmith who refused to shoe a horse with frog pressure, in the article on page 28 of the November number, the owner of the horse evidently had been reading horseshoeing, whereas the shoer had not, for frog pressure is proper. It is the natural function of the frog to come right on the ground and share the weight of the horse. E. W. PERRIN.

A Tire-Setting Criticism. I would beg leave to differ with Prize Contest Article No. 2 printed in the October number. The writer says he does not measure a wheel. His method may do when one is in a hurry or when the wheel will stand any amount of draught. I have upset a great many tires the way he tells of, but always measure the wheels, and believe it the only sure way. When machines for upsetting tires came out, I purchased the best I could get, and thought my money well invested. In setting a very light tire, the best way is to cool and then measure, for I do not believe anyone can rightly gauge the amount of shrinkage. H. N. POPE.

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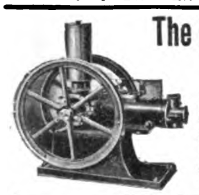

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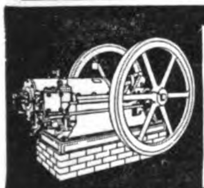

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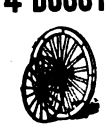

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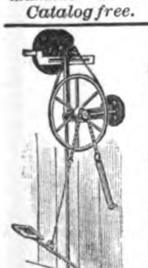

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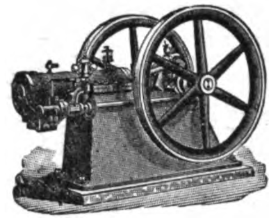

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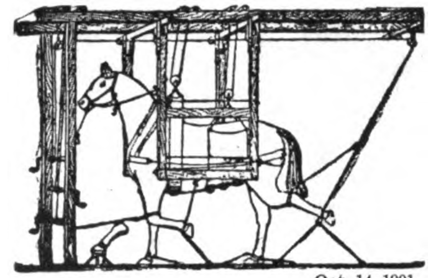

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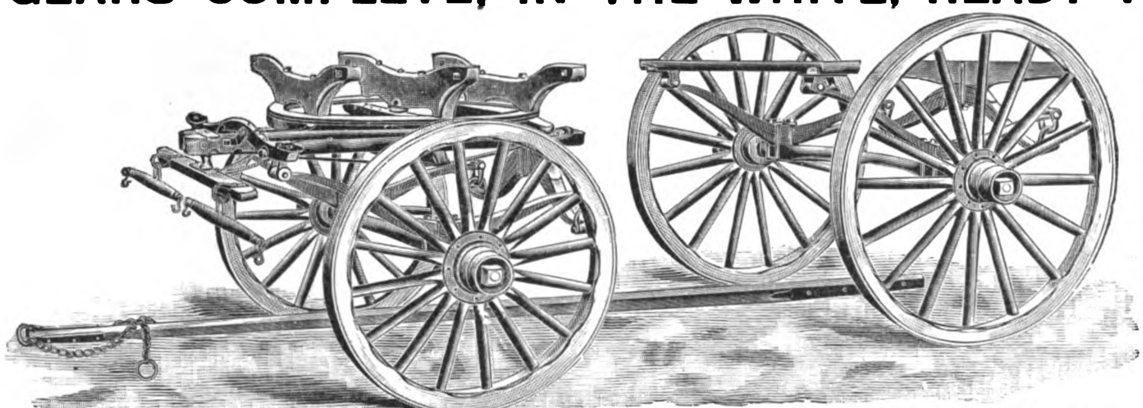

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VOLUME I THE NUMBER 6

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MARCH 1902 10¢ A COPY

CONTENTS.

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THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

VOLUME I **MARCH, 1902** **NUMBER 6**

BUFFALO, N. Y., U. S. A.

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Who Writes on Ship Smithing?

The general subject of ship smithing is one on which very little current literature exists. The railroad smith, the repair smith, the shoeing smith, and the general smith are all of them variously represented by the publications of today, but their brother of the shipyard would seem to be working on, unknown to fame.

His branch of the craft is an important one, and today with the shipbuilding interests of our immense coast line and lake shores and our navy looking up as they are, it is indeed time that the ship smith come to the fore. The responsibilities of his position are great, equal almost to those of the railroad blacksmith, for upon his thoroughness and fidelity does the safety of human lives depend.

THE AMERICAN BLACKSMITH desires that this branch of the craft be adequately represented in these columns, and would be glad to receive articles and notes bearing on the subject in question. A description of any tools, new devices, improvements, or interesting work relating to the shipsmith will be acceptable, and doubly so if accompanied by blue prints, drawings or rough pencil sketches to render the subject matter clearer. Some difficulty is experienced in finding those with both the ability and inclination to write. Our many readers among the shipsmiths will doubtless lend us their aid in this connection, which will be duly appreciated all around, as the smithy of the ship-yard is an interesting and important topic.

Shall we Have Registered Shoeing Smiths in America?

The question as to what shall be done to improve the conditions existing in many parts of this country injurious to the best interests of the shoeing craft, is a broad and vital one, and many are the complaints against incompetence and starvation prices. The country at large is now enjoying a wave of unparalleled prosperity, so that the smith and the farrier should by all rights be reaping the benefits which are to be expected from a greater volume of business and a freer circulation of money. In times such as these prices should be good, and if they are not he may well ask the reason why.

In order to remedy the wrongs of price cutting, mutual agreements have been attempted in various sections with varying success. As the skill and competence of all mechanics differs, it is of course incorrect in principle to say that all shall charge alike, but by fixing a minimum scale below which all parties to an agreement of this nature pledge themselves not to go, a very satisfactory arrangement is often effected, allowing the more competent to command a higher rate for their skill, and doing away with the bad effects of price cutting. To be thoroughly effective, such a schedule once adopted must be rigidly adhered to, and must embrace all craftsmen within its limits. If it does not it is often abortive by reason of such incompleteness.

Problems of this nature have long existed in England, and solutions attempted there are of interest to us. There is at present in England an association of shoeing smiths, whose object is the betterment of the craft standard, and membership in which necessitates the successful passing of a shoeing examination.

Such an examination of shoeing smiths was recently conducted under the auspices of the Worshipful Company of Farriers, at the forge of Mr. W. S. Turner, R. S. S., Quadling Street, Ipswich, and on this occasion also prizes were offered for superior excellence displayed. The examiners, who also acted as judges in the competitions, were Mr. Wm. Hunting, M. R. C., V. S., London, and Mr. R. Howard, M. R. C., V. S., Thetford, Norfolk. Candidates for the R. S. S. (Registered Shoeing Smiths) were required to make a fore and a hind shoe out of the iron provided, and to take off a fore shoe and fit and put a new one on. Candidates for the Doorman's Certificate were required to take off a fore and a hind shoe, prepare the feet, rasp and file up, and put on two new shoes.

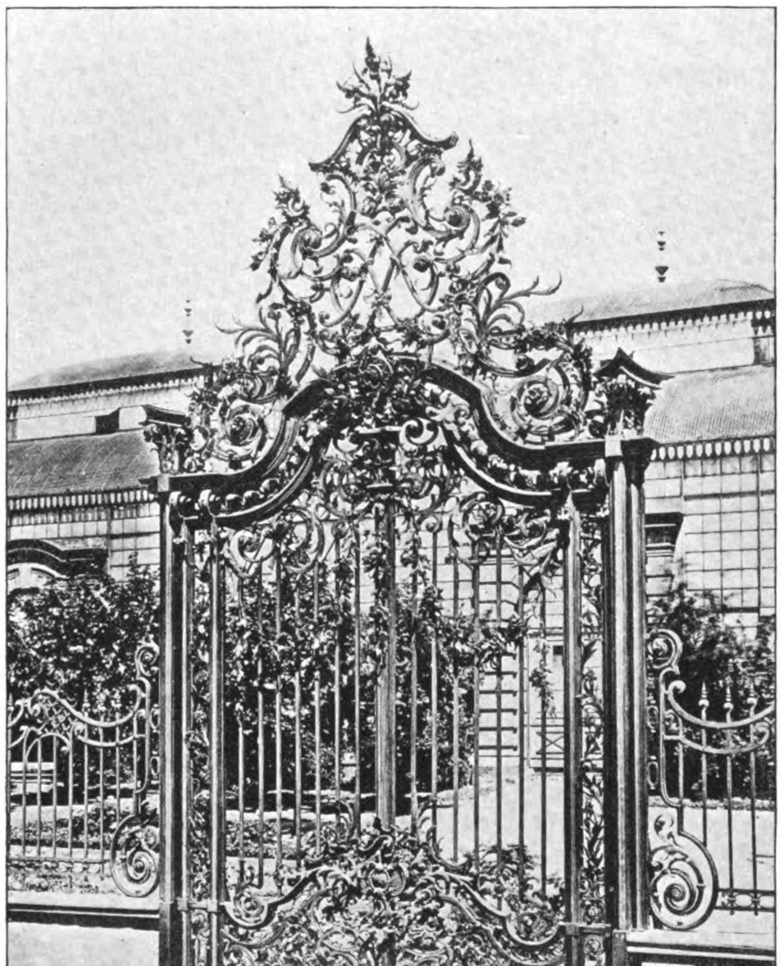
We are of the opinion that if such a society was formed in America, it would be of decided benefit to the craft in more ways than one. An improved standard would necessarily result. Examinations could be conducted perhaps four times a year, and certificates issued to those who passed them successfully. These certificates framed and hung in the shops of farriers would indicate to the public where competent work could be expected. A certificate then would be an incentive for the entire craft, something also for the apprentice to work for. Any movement of the above nature deserves not only the commendation, but the support of all blacksmiths who would be a credit to their craft. If the value and service of the medical profession has been brought to its present high standard by exacting requirements before a physician can practice, why should it not apply with equal force to other professions? Legislation having in view the limitation of craft abuse by incompetents, or prescribing qualifications necessary for practicing the trade, is a move in the same direction, and should have hearty support. As an adjunct of any such movements, the establishment of schools for instruction in the essentials of farriery should go far towards elevating the craft standard, and we note with pleasure the resolutions of a recent Horseshoers' Convention in this country recommending the establishment of schools of this kind.

Nothing that was worth having has ever been attained without struggling for it. An advanced, enlightened standing for blacksmith and farrier is worth striving for and can be attained if every individual having the interest of his trade at heart will contribute his effort toward advancement. Maintain a high standard of workmanship and there will be less worry about prices. Disseminate knowledge, combat ignorance and prejudice, give your support and influence, large or small as it may be, to craft betterment or beneficial legislation. If no other comes, the effort itself will be your reward.

We should be pleased to hear from those of the craft who have given thought to this subject. It must be admitted that some rather narrow views have been expressed during the course of the correspondence received at this office, but a most wholesome spirit looking to the best interests and welfare predominates. This journal will welcome communications upon these points, not for publication, but to enable an accurate estimate of the opinion of the craft as a whole to be formed. Let us hear from smiths in every section of the country where friction of this nature exists.

An Artistic Gate of Wrought Iron.

A very handsome specimen of German ornamental iron work is depicted by the accompanying engraving. The illustration in question is of a gate connected with the new palace of Emperor William, situated at Potsdam. It is admirably conceived, and the details worked out in a most pleasing manner.



SPECIMEN OF ORNAMENTAL IRON WORK BY ARMBRUSTER BROTHERS.

It is in all a typical example of the work of Armbruster Brothers, the celebrated German iron workers at Frankfort-on-the-Main, through whose courtesy we are able to show this illustration of artistic work.

THE AMERICAN BLACKSMITH will be glad at all times to receive from readers photographs and descriptions of typical pieces of art metal work of this and kindred natures.

The Study of Cast Steel in the Blacksmith Shop—1.*

GEORGE F. HINKENS,
Foreman Blacksmith, Westinghouse Air Brake Co.

Steel working is the most important branch of blacksmithing. There is not one smith in twenty who is fully competent in this particular branch, and not one in the twenty can train himself up to the art of treating steel. The trouble is that most smiths have notions that are at variance with the laws governing steel, and for the reason that they are not close observers of cause and effect lose sight of the importance, or the necessity, of working intelligently and planning wisely. Treating tool steel must now be regarded as a science demanding the highest order of thought. The toolsmith must understand the forces that play an important part in the treatment of the metal, and to the ignorant and indifferent man working steel is not consistent with his habits of thought, and never can be, for he has a way of his own that is inimical to steel.

The most important element in steel, so far as the tool user is concerned, is carbon. Cast steel is iron and combined carbon in the hardened state, and of iron and graphite carbon in the annealed state. Carbon in its combined state is akin to diamond, and in its uncombined form is akin to black lead.

I might evolve a nice little theory by saying that the higher the percentage of carbon in the combined state, the closer it approaches the diamond, when we remember that two per cent. carbon is very high and is seldom used. The tool-smith should know the carbon points of steel he is working. For example, if he has been in the habit of making milling cutters out

*Read before the North-West Railway Club.

of steel containing 125 points of carbon, he knows just what degree of heat is suitable for the right temper. If he should, perchance, receive a piece of steel with only 110 points of carbon, he would get the milling cutter too soft, yet he could in either case make a satisfactory tool if he knew the carbon points.

Purchasing agents should bear this in mind, and give the mechanical department what they call for, for it is both common sense and true economy to leave such matters to the judgment of the mechanical department. Find out what carbon points are suitable for the purpose required, and if you will change, notify the mechanical department, or else you will confuse the temper, for he cannot discern the difference by inspection.

I will give you the carbon points as were used in the St. Paul and Duluth shops with relation to the various purposes for which our tools are required. Remember a point in this case means one-hundredth of one per cent. of carbon, a very energetic element and a dominant factor indeed; hence a few words only are necessary to indicate the importance of carbon with its relation to steel.

One hundred and fifty carbon points, suitable for lathes, planers, boring car wheels, etc.; 135 carbon points, suitable for large lathe and planer tools, medium size dies, etc.; 125 carbon points, suitable for taps, reamers and drills; 115 carbon points, suitable for screw cutting dies, chisels, punches and milling cutters; 105 carbon points, suitable for cold chisels, punches, dies, large taps, milling cutters, small shear knives; 95 carbon points, suitable for large punches, shear blades, large dies and some blacksmith tools; 85 carbon points for stamping dies, hammers, cold sets, track chisels and smith tools; 75 carbon points for swages, flatters, cupping tools and blacksmith tools generally. In ordering steel, give the temper, or state the purpose for which the steel is to be used. Once in a while the steel worker will complain that the steel varies and the results are not always the same; the trouble was that he got hold of the wrong bar, or got the bars mixed by mistake.

The carbon points given are obtained from average results, but must not be adhered to strictly, as conditions may necessitate a deviation. Take a chipping chisel containing 125 points, such as we use in the tool room for fine and delicate work, and for comparison we will take a boiler maker's chipping chisel containing 105 carbon points; now, here are conditions that cause a large variation, a difference of 20 carbon points in the two chisels. Again, as to planer and lathe tools possessing different values as to carbon. For example: a lathe tool for turning hard tires, tool steel, or for hard roll turning, will require 150 carbon points, whereas a lathe tool for turning bolts or soft material will require from 125 to 135 carbon points. The speed of the machine and the nature of the material to be cut are factors in determining carbon points; so you see there are no hard and fast rules. I will also mention that carbon costs nothing, comparatively speaking. The difference in price between six cent and thirteen cent per pound steel is not due to the difference in carbon, but to material and skill. The iron for the finer grades of steel comes from Sweden, mostly from the Danemora mines, as this particular ore is almost free from sulphur and other substances so deleterious to steel.

Unless one is well-versed in the art of working, or treating steel, there are some difficulties in estimating exactly the value of carbon points, and it requires unusual attention, watchfulness, and thorough supervision on the part of the tool-smith and in the tool room. There are many factors to be considered in estimating the results of all of the many uses to which steel is put, as well as the treatment of the article itself.

Steel is not only the most useful of metals—in fact, indispensable—but it exhibits some of the most beautiful of physical phenomena, and if you think that it does not, I will ask you, "Why does steel harden?" Scientists cannot answer this satisfactorily.

Considering the fact that there are so many writers on steel today who are running after foibles, it would be ungracious in me to deprecate my fellow-craftsmen, but surely nothing is plainer than that more people are writing of steel than can make a good tool. There are also men who can not make a good tool, yet who can direct a blacksmith how it should be done in an intelligent and scientific manner. They lay no claim to being steel workers, yet they can give "pointers," and good ones, too.

I wish to say that the knowledge of the tool-smith, relative to steel, always has and always will depend on the disposition of the man. He must be exceedingly painstaking, and a close observer of the laws of cause and effect, for there will come into view more causes and more effects in manipulating steel (it is to be understood that this paper deals with crucible cast steel only), than in any other metal that the smith comes in contact with. Moreover, the results of every-day experience cannot be explained or tabulated so as to be understood by the man that is no adept, or schooled in the art of working steel. It is only the learned eye that can detect the full significance of the moods of steel, and it is only by coming in close contact with it every day that a man can learn to understand the principles governing it.

We know that the distance between the experienced and the inexperienced man is too great, and that modern industrial conditions are reaching out for the best. It no longer pays to have a misfit handling tool steel.

I have in a casual manner dwelt on the grades, carbon points and the purposes for which steel is required, the necessity of training the powers of observation, and the study, in a scientific and practical manner of facts relating to steel, in so far as they relate to the worker and users of steel. I will now endeavor to give a summary on heating, forging, annealing, hardening, tempering and soft centering.

Heating and Working.

In heating steel, as in everything else, science and common sense should be exercised. It is very discouraging to the steel maker who looks on his philosophy as being correct, to find that after all his care and expense, his product is abused in heating after it leaves the mill. Unequal heating will produce an inequality of the particles, and will cause their displacement in one direction or another when the steel is subjected to the forging process. Thus the different or varying state of heat appears to be of greater moment than is usually taken into consideration. In working a piece of steel with uneven heat, the particles are pushed out of their normal position and no amount of annealing can altogether replace them. The particles of steel will arrange themselves only in obedience to natural laws.

Forging steel at a black heat will crush the particles or bring about rapid crystallization. Some say that the word "crystallization" is not applicable, so I will say, "enlarge the crystals." Steel should be in a plastic state during the process of forging, and the heat should be as even as it is possible to have it; the force of the blow should also penetrate the whole mass so as prevent the drawing of the exterior surface away from the core or center. When the outside of the steel is worked more than the inside, the effect is telescopic, and the steel can only be rehabilitated by annealing, and then by no means will the temper be uniform. Hence, do not work steel at too low a heat, lest you strain it. Do not work it at an uneven or irregular heat, or the particles will be as variegated as the frost lines on a window glass. Too high heating will make the steel brittle and destroy its cohesive properties. The secret of successful tool-smithing is proper heating, and I will say that proper heating commences from the molten state at the mill.

Overheating has this effect on steel, as a writer on the subject puts it. "It changes the particles of pure steel to crystals of oxidized carburet of iron, and by cooling in water little diamond points of combined carbon and steel are fixed, but fixed so loosely in this crystalized framework that holds them that it breaks down and they crumble out."

I will call your attention to the matter of judging steel in the merchant bar by its structure or size of grain, and ask you to remember that this comes under the head of heats. I have in mind a lot of crucible steel for springs, which was rejected by the spring-maker on account of its coarse texture. I knew that the steel was all right, but I could not convince him. So I wrote to the manufacturer about the coarse grain in his steel. I knew I would receive in reply a corroboration of my views in the matter, which are that this particular lot of steel was finished or passed through the rolls as a final at a high heat, resulting in a very coarse texture. Had this same steel been reduced to a smaller size, which would have necessitated further rolling and a reduction in heat, the grain would have been finer in structure. Of course, this steel contained from 60 to 70 carbon points, and I think its structure was due more to temperature and the rolling than carbon.

Over-heating, under-heating, overworking and under-working will change the structure of steel, that is, down to 40 carbon points and below, as we have fully demonstrated in our shops.

Every degree of heat in any of its stages registers itself in a piece of steel as correctly as a thermometer will register every degree of heat in the atmosphere. The higher steel is in carbon the more mercurial; in other words, high carbon steel is more sensitive and yields to influence more readily than low carbon steel. The proper heat is learned only from experience. If the tool-smith, in forging a tool, were to reduce a piece of steel from 6 inches to 3 inches in diameter, he would use a higher heat than in reducing a piece of steel from 2 inches to $1\frac{7}{8}$ inches in diameter. In the first or larger piece he heats up to a coarse grain, but the sufficient amount of hammering in reduction of bulk refines the steel and no harm is done; if the second or smaller piece is heated up to the same high heat as the first piece, you start with the same coarse grain as in the large piece, and a reduction of only $\frac{1}{8}$ of an inch in diameter under the hammer is insufficient to hammer-refine the steel; besides the larger piece will hammer-refine and reduce in heat at the same time. Not so with the smaller piece; it will receive no hammer-refining and the high heat will leave its structure coarse.

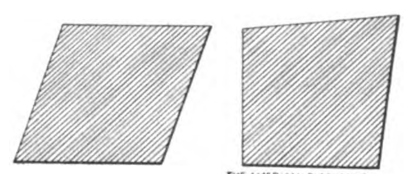


Fig. 32. SECTIONS THROUGH MISHAPED BARS.

Let us go a little further, so that the man, unfamiliar with the subject and not acquainted with the principles of the laws governing steel, can get an understanding of this important matter. In dressing a flat chipping-chisel, the tool-smith will reduce, or narrow up, the end slightly before the red leaves it, and on the final finish he will hammer on the flat side of the chisel until it becomes black, using judgment as to weight, number of blows and condition of heat, remembering the "fatal blue." Now, this is the right heat for this particular tool, and the heat method for making the chisel compact. But beware lest you destroy the chisel with just one blow of the hammer, and with the same heat as when striking the flat side. One blow struck on the edge will rupture the chisel. I will illustrate this by taking a book; you know that the book will stand considerable pressure when the force is applied to the flat surface, but the same pressure applied to the edge will distort every leaf in the book. This also applies to side tools, thread tools, or tools where the transverse section is thin. But do not mistake this for a forging heat, for we are not forging in this case, only giving a final finish, or hammer-refining—packing the steel, as it were, and this procedure is limited to only a few cases, and cannot be universally practiced.

Twenty-five years ago the importance of properly heating steel was ignored. The many and various degrees of heat were, as a rule, not brought into question. We know now that the higher degree of heat the more hammering or reduction in diameter the steel will stand. We also know that if we are to reduce the diameter of the piece only slightly, we should reduce the heat correspondingly, or we shall lose the desired compactness and fine grain. Of course, we can get a fine grain by annealing and hardening, but let us help that happy condition along throughout the whole course.

(To be continued.)

The Elements of Blacksmithing.—4.

Squaring Up—Bending—Hooks.

JOHN L. BACON,
Instructor in Forging, Lewis Institute, Chicago.

A common difficulty met with in all drawing out, or in fact in all work which must be hammered up square, is the liability of the bar to forge into a diamond shape, or to have one corner projecting out too far. If we should cut a section through a bar misshaped in this way at right angles to its length, instead of being a square or rectangle, the shape will appear something like Fig. 32. To remedy this and square up the bad corners, lay the bar across the anvil and strike upon the projecting corners, as shown in Fig. 33,

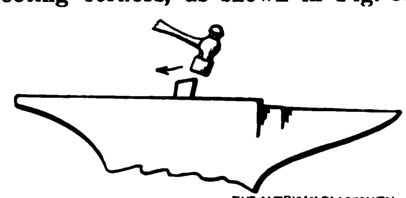


Fig. 33. METHOD OF STRAIGHTENING.

in such a way as to force the extra metal back into the body of the bar, gradually squaring it off. Just as the hammer strikes the metal it should be given a sort of a sliding motion, as indicated by the arrow. Do not try to square up a corner of this kind by simply striking squarely down upon the work. Thus far the methods and processes described are what might be called elementary principles, merely fragments of the work which goes to make a finished forging. Hereafter we will deal more with the complete pieces.

One thing must be remembered—there is, or should be, a reason for everything that is done, every operation that is followed. Forge work is a very exact science, and nothing should be left to guess work. Before undertaking any piece of work, form a clear idea of every step to be followed, do your thinking while your iron is in the fire, then, when the forging is on the anvil, work, and work rapidly. You should know exactly where every blow is to be struck before the metal leaves the fire, so that when it is on the anvil there will be no hesitating as to what to do next.

The following description of a gate hook answers, of course, not only for this particular piece, but for others of a like nature. We will suppose we have a hook like Fig. 34 to make. To start with, we must determine what length of stock, after it is forged to the proper size, will be required to bend up the ends. This can be calculated accurately mathematically, but for the present we will determine the amount in the following way: The amount, or length, of straight stock of the proper size, necessary to bend up the ends, should be measured through the center of the stock on the dotted lines in the figure. To do this, lay out the work full size and lay a string or thin piece of soft wire upon the lines to be measured. It is then a very easy matter to straighten out the wire, or string, and measure the exact length required. Later on a more exact method of calculating the amount of stock required to draw down to a certain size will be given, but for the present, the above will suffice. If the drawing is not made full size, an accurate sketch should be laid out on a board or other flat surface, and the length measured from this. The hook as above will require about 2⅞-inch length for stock.

Our first step would be as shown by

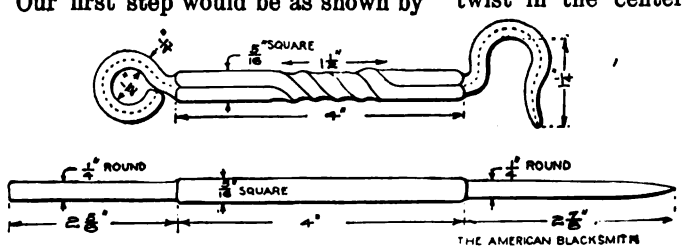
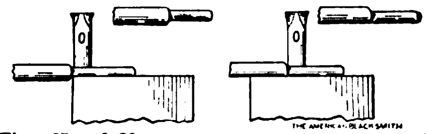


Fig. 34. GATE HOOK AND FIRST STEP IN ITS CONSTRUCTION.

the lower view of Fig. 34. After cutting the piece of $\frac{5}{16}$-inch square stock, start the forging by drawing out the end, starting from the end and working back into the stock until a piece is forged out 2⅝ inches long, and ½ inch in diameter. Now work in the shoulder with the set hammer in the following way: Place the piece on the anvil in such a position that the point where



Figs. 35 and 36. THE RIGHT AND THE WRONG WAY OF WORKING IN THE SHOULDER.

you wish the shoulder comes exactly on the edge of the anvil nearest you; place the set hammer on top of the piece in such a way that its edge comes directly in line with the edge of the anvil, Fig. 35. Do not place the piece like Fig. 36, or the result will be as shown—a shoulder on one side only.

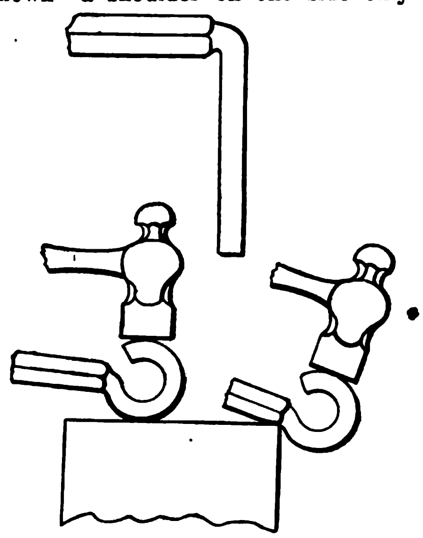


Fig. 37. BENDING THE EYE.

As you work in the shoulder, turn the piece continually, for the shoulder will work in faster on one side than on the other. Always be careful to keep the shoulder exactly even with the edge of the anvil.

When the piece is formed in the proper shape on one end, start the second shoulder 4 inches from the first and finish like Fig. 34. Bend the eye and then the hook, and lastly put the twist in the center. The eye should be bent in the following manner: Enough stock should first be bent down at right angles to the bar to form the eye, as shown in Fig. 37. Then start rounding at the extreme end of this bent-over piece. Start the bend at the end over the horn of the anvil and feed the stock across the horn, bending it down as you push it forward. Do not strike directly on top of the horn, but let the blows fall a little beyond the point

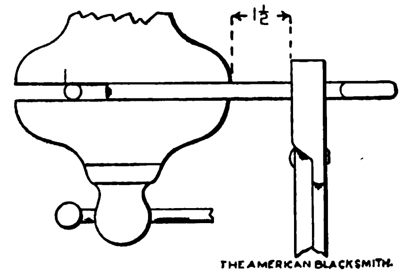


Fig. 38. MAKING THE TWIST.

where the iron is resting. By striking this way, the stock is bent and not knocked out of shape. If the eye is too small to be closed up over the horn of the anvil close it up as nearly as possible by bending in this way, and then completely close it over the corner, or on the face of the anvil, as shown. In forming the twist, first make a chalk mark on the jaws of the vise so that when the end of the hook is even with the mark, the edge of the vise will be where one end of the twist should come. Heat the part to be twisted to an even yellow heat (be sure that it is heated evenly), place it in the vise quickly,

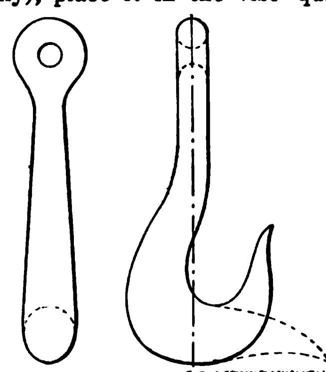


Fig. 39. EXAMPLE OF CHAIN HOOK.

with the end even with the mark; grasp the piece with the tongs, leaving the distance between the tongs and vise equal to the length of twist (Fig. 38), and twist it around one complete turn.

A "grab" hook is the name given to a hook such as is ordinarily used on the end of a chain. They are made in a variety of ways, one of which is given below in detail. We will take as an example the hook shown in Fig. 39. To forge this, use a bar of round iron large enough in section to form the heavy part of the hook. This bar should first be slightly upset, either by ramming or hammering, for a short distance from the end, and then flattened out. The next step is to round up the part for the eye, by forming it over the corner of the anvil, as indicated in Fig. 40. The eye should be forged as nearly round as possible and then punched. After punching, the inside corners of the hole are rounded off over the horn of the anvil in the manner shown in Fig. 41. This Figure also shows the appearance of a section of the eye as left by the punch, and as it appears when finished. It

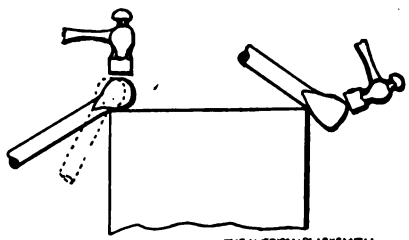


Fig. 40. SHAPING THE EYE ENDS.

should then be as though bent up from round iron, that is, all the square corners should be rounded off. When the eye is completed, the body of the hook should be drawn out straight, forged to size, and then bent into shape. Care should be taken to keep the hook thickest around the bottom of the bend.

The weakest point of almost any hook is in the bottom bend, and when

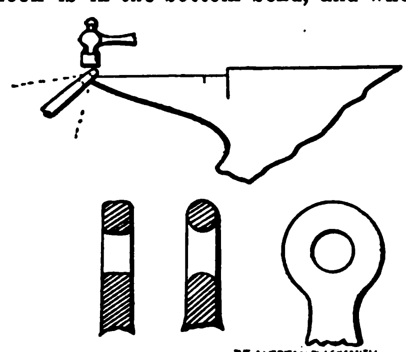


Fig. 41. PUNCHING AND ROUNDING THE EYE.

this hook is strained, there is a tendency to straighten out and take the shape shown by the dotted lines of Fig. 39. To avoid this we must keep the bottom of the hook as thick as possible along the line of strain which is shown by the line drawn through the eye. A good shape for this lower bend is shown in this figure, when it will be noticed that the bar has been hammered a little thinner in order to increase the thickness of the metal in the other direction, along the line of strain.

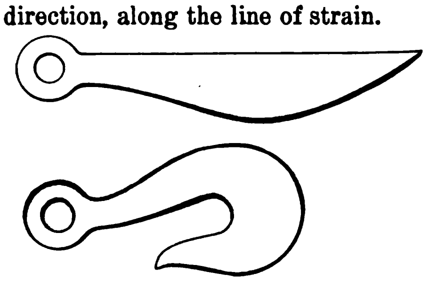


Fig. 42. GRAB HOOK FOR LOG CHAIN.

The proper designing of hooks, particularly crane hooks, has received a great deal of attention in the last few years. Another style of grab hook which is used on log chains and for like work is shown in Fig. 42, which illustrates it forged out and ready for bending, and also the finished hook. The forming will need no particular description. The hook shown is forged about $\frac{5}{8}$ inch thick, the outside edge around the curve being thinned out to about $\frac{1}{8}$ inch in order to give greater stiffness in the direction of the strain. Stock about $\frac{5}{8}$ inch by 1 inch should be used.

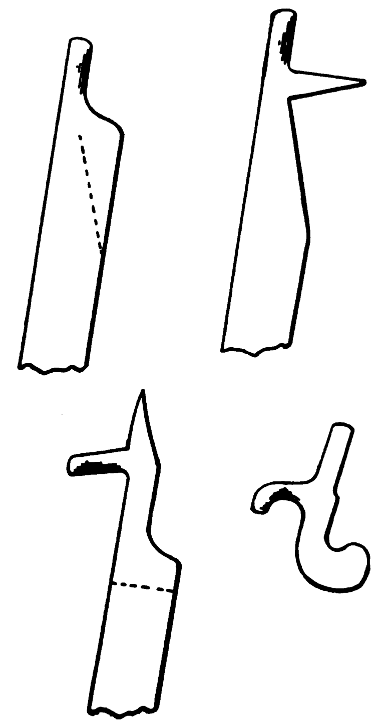
(To be continued.)

A Few Lines on Gun Smithing.

BY GUN DOCTOR.

To begin with, I will explain a method of forging an old style hammer for muzzle loading guns. First take a piece of $\frac{7}{8}$ by $\frac{1}{2}$ tire steel, and round one end down for about an inch and a quarter. Then split on the dotted line, turn the split part out at right angles as shown in the figure, draw down the shank, and cut off at the dotted line. Neatly round up the corners and work it down thinner from just under the round part. The top is to be set over to right or left, according to which side it is for. Then bend the bottom part upward and backward into its completed shape, as indicated. The next step is to file it up, drill the cup in the end, find where the hole for the tumbler post will come, drill it and square it up and put it on. I might add that it is about forty-five minutes work, for which I get fifty cents. Some other time I might take up the subject of hammers for breech loaders, which are much harder to make.

Now a word about springs. Almost any good blacksmith can forge and fit up a spring, but they cannot always temper them to stand. To begin with, the steel must be suitable, for you can't make a spring that will stand the extremes of temperature and the sudden jerks that a gun spring is subjected to, out of poor steel. Jessop's Firmer Chisel grade is my pet, though I have had success with other brands of high grade tool steel. Be very careful not to overheat; neither must it be worked too cold. Now we will suppose the spring is ready to temper. Fill a can with water and set it on the fire till it feels warm to your finger. Heat a pair of thin flat-nosed tongs red hot, take the spring by one end (if a main spring, the pin that goes in the lock plate is best), and hold in the fire till you get an even cherry red all over. Then drop in the warm water, take it out, hold over the fire till dry, and coat with tallow. When the tallow burns off, have ready a little fine, white pine sawdust and sprinkle a little of it on the spring, turning the spring over the fire constantly, and trying until the sawdust sparks as soon as it touches the steel. After this lay it by to cool, and you can warrant it as long as you want



FORGING AN OLD STYLE GUN HAMMER.

to, for if the steel is right and you temper by this method, it will never break or set. I find it preferable to make main springs considerably thinner and to give them more tension than the gun makers do, as by so doing they cock easier and fire more surely.

I saw in a trade journal some time ago an inquiry for a method of recutting the grooves in a breech loading rifle. Don't try it. The only remedy for a worn out breech loader is boring out to the next larger size and re-rifling. Some other time I will tell how to recut a muzzle loading rifle, something any good smith can do without any special tools, except such as are easily made.

Shop Talks on Wheels, Axles and Springs.—5.

The Suspension of Vehicle Bodies.

BY D. W. M.

The suspension or "hanging off" of the body on the gear and the proper adjustment of the gear to the load, together with due proportion of parts, is one of the most difficult problems in vehicle construction, and requires much experience as well as an educated eye. The height of the body of the vehicle from the ground is an important matter as concerning looks, as well as in practical mechanical points. It should be low enough to be easy of access, yet not so low as to appear squatty. Much depends upon the shape of the body and the style of gear used.

It was formerly thought that a short gear pulled more easily than a long one, but scientific experiments have disproved this, as a general principle. There are cases, however, where short gears have an advantage, and vice versa. A short gear strikes the gutter or hollow in the road more directly than a long gear, and is more difficult to draw out; but a long gear is more difficult to pull over the crown of a rise in the road. This supposes the road to be evenly distributed over front and back wheels. In the case of a wagonette with the greatest weight on the hind wheels, this might not be true.

In the majority of vehicles the weight is not evenly distributed, the rear spring and axle being made heavier than the front ones to carry safely the extra burden. In a buggy the body is usually hung higher at the rear end by one-half inch than at the front, and the rear spring has one more leaf than in front to enable the body to assume a level position when the passenger is seated. Frequently this precaution fails to secure the desired result. The difference between the front and rear springs on a phaeton should be still more marked than on a buggy, not only an additional leaf being required, but frequently two leaves, and some manufacturers use a wider spring with the axle made heavier in the center. On a rockaway there is a still greater difference. Sometimes two springs are used or a half platform system of springs. On a Brougham the difference is still greater, even the rear axles and wheels being made heavier, as on a coach. On a truck with cut-under front almost the entire weight is carried on the rear wheels, and consequently the wheels, axles and springs must be of a size sufficient to carry the estimated load successfully.

In making estimates of this kind, it is not customary to go by any tables of resistance compiled by scientific experimenters. Practical vehicle builders know that the quality of material cuts a large figure, but they also know that a large margin must be allowed for unforseen strains. Overloading of vehicles is a common practice. A two-ton wagon will often have to carry four tons. Sudden jolts, side wrenches or thrusts produce strains that must be allowed for and are expected every day; therefore the whole vehicle must be strong enough to stand abuse, and, even with this in view, experienced mechanics sometimes miss it.

A dead weight as against a live one is another factor to be reckoned with, four tons of people or resilient matter being far less severe on the vehicle than an equal amount of iron, stone or coal. In this connection, springs play an important part. They are not used ordinarily except to render the vehicle more comfortable to ride in, but they could be used to advantage in rendering a vehicle made for the handling of material easier of draught, and more durable. A farm wagon with bolster springs is better than one without.

For various reasons the hanging of a vehicle is not always designed to keep the body level. The greater part of the weight on a load is in the rear, yet it is commonly hung an inch or more higher in front. This is done to please the eye and also because the plunging into gutters or hollows has a tendency to settle the front gear. A truck is usually hung lower behind, for appearance and also for convenience. An ice wagon is frequently hung an inch or an inch and a half lower in front than in rear. This is not for appearance, but to keep the blocks of ice from sliding to the rear. As the wagon is unloaded from the rear, the greater load remains in front, accentuating the drop at that point. The gear for such a wagon should not be heavier in the rear than in front to carry the load, but the springs in the rear, the axles and the wheels are commonly made heavier than in front, though for no reason except that when the wagon is fully loaded there is a slight preponderance of load at the rear end.

In all perch jobs, there should be as much room between the body and the perch or the nearest point of contact, as between the upper and lower halves of the springs, if elliptic, say on a buggy seven and one-half inches. If it is desired to hang a buggy low, a drop axle or a low wheel is necessary.

On a phaeton the reach under the front part of the body is curved downward to clear the body in its down motion under a load. Yet, springs should be so proportioned that they will never come together except under extraordinary strain, as the bumping occasioned by weak springs is not only annoying, but adds the strain of a plunge shock to the axles. Where unavoidable, rubber bumpers are used. It is customary to set the front and rear springs on a buggy slanting back at the top about one-fourth of an inch, to counteract the forward plunge encountered on crossing gutters or hollows on road. The rear springs on three-spring vehicles, and all the side springs on platform jobs are set one-half inch to three-quarter inches higher at the front end of each spring than the rear end, for the same reason. Some makers attach a strap to the front end of side elliptics, fastened by a loop to the body. The cross springs on platform gears are also set leaning back, not only to overcome the forward thrust, but to accommodate the lengthening of the side springs, although shackles are provided for that purpose.

Tables of proportions between wheels, axles and springs have been published from time to time, but they vary with the decree of fashion, and would not apply equally to all parts of the country because of differing conditions of the road, as well as of taste. We will not attempt therefore to lay down any but general rules in our further remarks on the principles of suspension.

The setting of a brake is a part of the suspension. The brake block must be so placed that as the load bears the body down, the block will not pass the center of greatest diameter of the wheel, ordinarily being the point directly in front of the axle. To pass beyond this point is to relinquish the force of the brake. The axle must be secured from backward movement by the brake pressure, either by the manner in which the springs are hung or by a flexible rod attached to the body and clipped to the axle. Sometimes a chain is used. Generally the strain comes on the springs and they are set accordingly.

(To be continued.)

Shoeing a Wire Cut Foot.

R. W. CASSITY.

The following may be of interest as indicating a method of shoeing a horse with a wire cut foot, which makes him lame. Pare off the foot level and true, clean the sole of the foot of scales, but take care not to cut the frog at all. Trim the wall of the foot from the cut back one-eighth of an inch lower, so that the shoe can not touch. Next fit a shoe stout enough not to bend, and put it on, leaving the nails out where the sore part is. This takes the weight off of that part and gives it time and opportunity to heal.

Some Suggestions On Decorative Iron Work.—4.

WILLIAM C. STIMPSON,
Instructor in Forging, Pratt Institute, Brooklyn.

The main subject of this chapter—forming or shaping—is, next to welding, the most typical process of the smith's art; it is the ingenious combination of almost all of the forging processes. By forming is meant the working of the stock to such an extent that its original shape is almost, if not

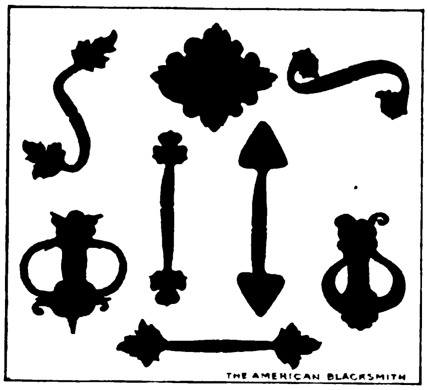


Fig. 43. EXAMPLES OF DECORATIVE HANDLES AND DOOR PULLS.

entirely, lost sight of. It is more difficult for a beginner to sketch out a good design when the work is to be shaped up, because the article will be viewed from all sides and not mainly from one side, as in hinges and scroll work. The piece, when made, will often look quite different from the flat drawing. About the only way to get a satisfactory result is to go ahead and work up a piece according to sketch; then, if there are parts which do not suit, they can be altered on the sketch

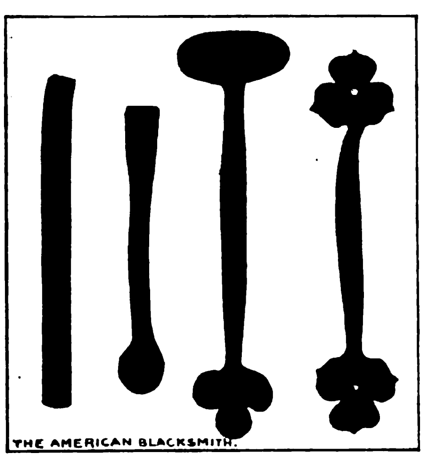


Fig. 44. PROCESS OF FORGING A DECORATIVE HANDLE.

and the piece itself changed or a new one made. Another method sometimes used in the art shops (to give a customer an idea of how his design would look made up without the expense of experimenting in the iron itself) is to model in clay the general proportions of handle, knocker, finial, or whatever the piece desired. This is a very simple operation and much cheaper than forging. When the bold, general proportions are made to harmonize with each other, the details may be easily worked out on paper.

To a large extent, the underlying principle in such designs is the matter of stress or strain. All parts which actually, or apparently, have to resist any strain, must satisfy the eye that they are strong enough to do so. If we enlarge a piece in the middle, and work on a head or ball for decorative effect, the parts each side of same must seem strong enough to support this weight. In the handles shown below, the leaf ends should be thick enough where they unite with the stem, to prevent their bending or breaking at this point with ordinary use.

In shaping work we have three general ways of working. We can use stock about the size of the largest sec-

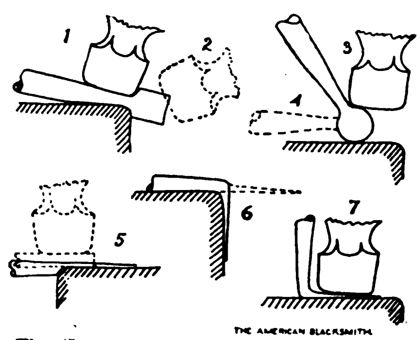


Fig. 45. DETAILED ILLUSTRATION OF HOW HANDLE END IS SHAPED.

tion and draw down for the smaller parts, as in a forged nail or drawn-out bolt; or we can take stock about the size of the smaller parts and upset for the larger section, as in the case of the bolt with upset head. Or again, we can weld up two pieces of stock in order to get the metal distributed where we want it; for example, the bolt with welded head. Now, in any job, the blacksmith is guided by his experience and good judgment in determining which of these ways he will use.

In all the operations of forming, the fibrous nature of the material must be kept in mind. The metal must be so worked, that these fibres are not unduly strained, for, if they are, flaws are apt to form and they may work in so deep as to break the piece. To illustrate some of the methods of forming, I will take up a few typical examples used frequently in decorative work.

First let us consider one of the simple handles shown in Fig. 43. This is formed up from ½-inch round stock and is a neat and very decorative little piece of work. Fig. 44 shows the steps taken. Notice that the forge work and bending are completed before the

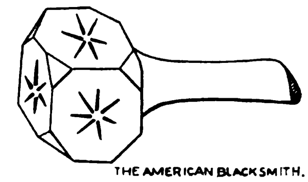


Fig. 46 OCTAGONAL END PIECE FOR ANDIRON OR POKER.

decorative leaf ends are cut out. Fig. 45 shows some of the positions in which the ends are held on the anvil to form them. The ends thus worked up are of a flat section. If square stock is substituted and the same process carried out, keeping the shank or stem central, we could work up a cube, and by hammering in the corners of the cube, we get an octagon on each face. This forms a very good finish for an andiron, poker, or any article where a

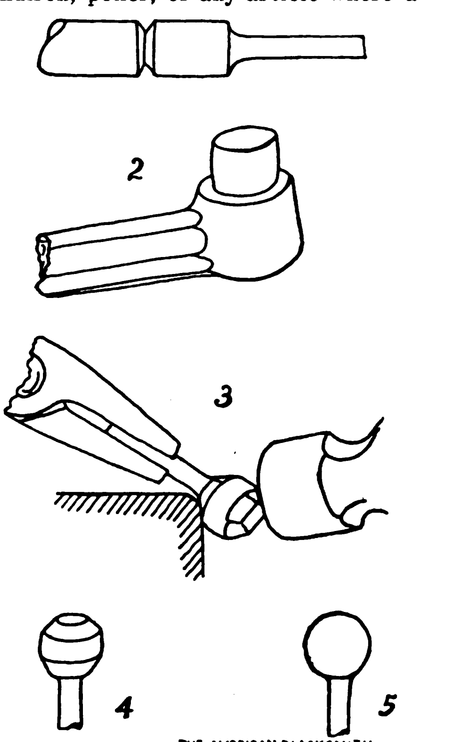


Fig. 47. PROCESS OF FORMING OCTAGONAL OR SPHERICAL ENDING.

knob is wanted (see Fig. 46). By continually working in the high corners, this form will quickly assume a ball shape, but round stock is the most convenient for shaping up a ball. As shown in Fig. 47, make a short cylindrical head first, using heading tool; then work off the top and bottom corners of this, hammering in on the squares first. The work must be put in the heading tool occasionally to keep down the cupping, which will form in working off the corners of the cylinder. The ball flattened in the direction of the stem, gives a nicely rounded eye bolt for a knocker or pull; flattened like a bolt head, it gives us a good strike button for same (see Fig. 43).

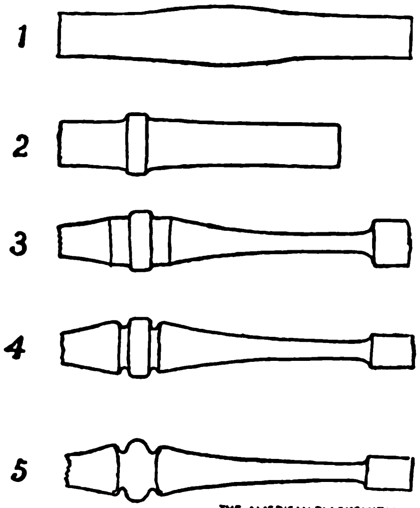


Fig. 48. PROCESS OF WORKING IN CENTRAL SWELL.

Sometimes a spindle is called for in a design, or a handle is to be forged of round stock with a swell in the middle. Fig. 48 shows the steps in working out the above. Number 1 shows the round stock upset a little larger than the diameter of the middle detail; No. 2 this middle bead blocked out; No. 3 shows the longer curves blocked out—first square, then nicely to an octagon, then round. This may be done with

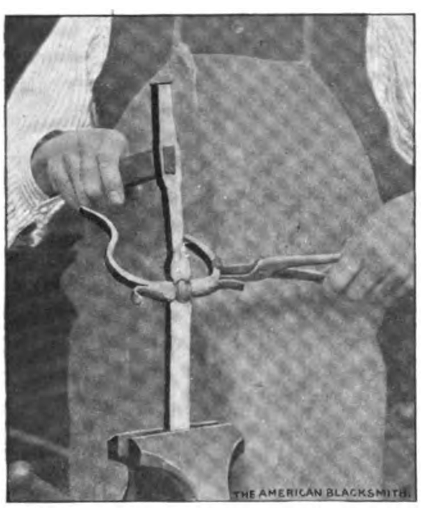


Fig. 49. FORMING SWAGES IN USE.

fullers whose curves are very slight, or worked over the horn with a hammer ground crowning. Number 4 shows narrow fuller marks run around each side of the head to guide the forming swages. Number 5 shows the piece swaged up. Fig. 49 shows a pair of forming swages in use. Light blows of a hand or backing hammer, with the work kept turning, will quickly smooth up a well-shaped head. The noses of these swages are made long to clear the ends of a knocker handle, which is not swaged until the lower curves are bent. The swages may be made very quickly of low carbon steel, or of soft steel, and case hardened. As they are comparatively narrow, it is a simple job to true them up with files.

Figure 50 is an example of a small spindle used in a lamp base—the font has been removed to show more clearly the finish of the spindle. Several examples of handles, having some decorative swaging in the middle are shown in Fig. 43.

To turn out such shapes in quantity, some form of drop forging is used, as is abundantly illustrated in almost every line of commercial work. With drop forgings, however, the skill shown is largely that of the die sinker, aided by accurate machines, and, while the product is smooth and each one absolutely exact, it cannot compare in artistic merit with a well-shaped piece of hand forging. The smith sometimes makes forging dies for himself by heating a pair of blank swages and setting them down over a master forging previously worked up out of steel.

In punching iron the blacksmith uses a punch with a flat end. This is driven nearly through the hot metal from one side. Then the piece is turned over and the thin stock at the bottom of the hole will cool enough to form a dark spot, and upon this spot the punch is placed and the burr driven out. This punching swells the metal at the sides of the hole, and right here is a point for the designer. If, in places where one member of a design pierces another, he can make this natural swelling of the metal a feature of his design, he is working in accordance with the nature of his material. When punching a hole, the punch should have the same general shape as the blank. If the blank is round, a round punch leaves the metal evenly distributed about the hole, while a round punch driven through a narrow bar leaves the stock weak at the sides. Where a bar must have a round or square hole punched through it, an oblong punch may be used and the hole swelled out to a round or square shape.

In grill work and similar designs, where some of the parts meet at right angles and cross each other, the bars

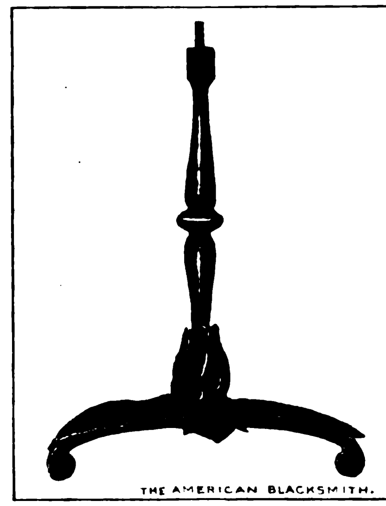


Fig. 50. SAMPLE OF SMALL SPINDLE.

are bent in and out, as in weaving. They are halved together, or a hole is punched in one bar and the other passed through it. Fig. 51 shows a gate in which the central portion of the design is treated in the latter way.

(To be continued.)

Fig. 51. ORNAMENTAL GATE WITH WOVEN TREATMENT.

A Few Shoeing Hints.

BY ANONYMOUS.

I should like to make a few remarks on shoeing. For shoeing a horse we must have the right kind of a shoe and must also have it prepared rightly. There is one point about punching shoes that I wish to bring out. Your holes should always be punched according to the slant of the foot. For front holes, a heavy slant, for instance.

Horseshoeing, Repair Work and Carriage Building.

PRIZE ARTICLE CONTESTS.

What Do You Know That Will Interest Our Readers?

In the following columns will be found printed a few of the numerous articles thus far received at this office in competition for the prizes offered for the nine best articles upon the above subjects. The numbers at the head of the various articles refer to the order in which they are received, and have no connection with the final award of prizes, the decision for which has not yet been made. The contest will be held open a short time longer to give everyone who may desire to write an opportunity to do so.

The greater number of articles received thus far have been upon the subject of Horseshoeing, and hence, the other two subjects, *i. e.*, Repair Work and Carriage Building, afford a better chance of winning a prize. Numbers of excellent articles have been received, but it is not yet too late to send in a prize winner.

The conditions of the contest are as follows:

First: No person will be awarded more than one prize, though he may submit any number of articles.

Second: Contestants for these prizes must be subscribers to THE AMERICAN BLACKSMITH.

Third: The right to publish any or all articles in competition is reserved.

These articles must not be less than 250 words in length, and must be plainly marked "Prize Contest—Repair Work," "Prize Contest—Horseshoeing," "Prize Contest—Carriage Building," as the case may be. It should also be remembered that the awards will be made upon the merit of the ideas or subject matter, and not upon the way it is expressed. Points from every-day experience make good subjects.

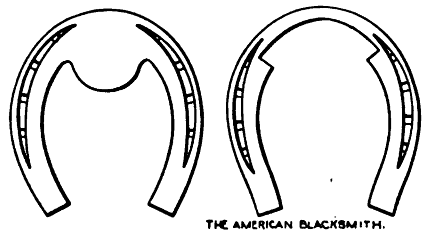
If you are contemplating competing for one of these prizes, do not delay, but send in your article at once, today if possible. Address all communications to the Editor AMERICAN BLACKSMITH, P. O. Drawer 974, Buffalo, N. Y.

The preceding outline is again printed for the reason that THE AMERICAN BLACKSMITH goes anew each month to a large number of artisans who are up till now unacquainted with the offer made therein.

Prize Contest—Horseshoeing.—6

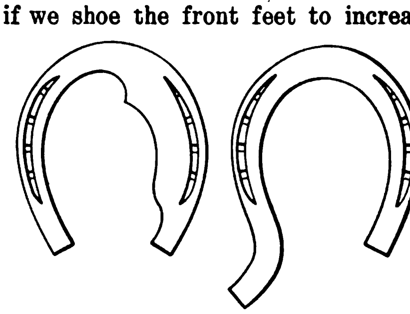
Forging and Interfering.

In this article I will take for my subject forging and interfering. One method of shoeing to prevent forging which many horsemen practice, is to shoe the front and hind feet with the same weight shoes, the front shoes fitted close and short, and the hind shoes left longer at the heels and the shoe set back from a quarter to one-half inch from toe to hoof. This projection of hoof is left and the sharp edge rasped off. This hoof projecting over the shoe is intended to deaden the clicking sound of forging.



Figs. 1 AND 2. A TOE WEIGHT AND A HEEL WEIGHT SHOE.

A much better way to shoe to prevent forging, one which I have used with success, is as follows: Shoe the front feet with rolled toe weight, such as shown by Fig. 1. The hoof must be properly pared and leveled, and the shoe fitted nicely to the foot, not the foot to the shoe, as is so often done by horseshoers. The object of shoeing the front feet with rolled toe weight shoes is to increase the action of the horse in front. The cause of forging is that the action of the horse in front is too slow for his hind feet, and therefore he strikes his front shoe with the toe of the hind shoe. It is understood by nearly all horseshoers that if a horse is weighted at the toe he will reach farther and quicker. Therefore, if we shoe the front feet to increase and quicken the action in front, we must shoe the hind feet to retard the action behind. The shoe I use to retard the action behind is a heel weight shoe, such as indicated by Fig. 2. The hoof must be properly pared and leveled, and the shoe fitted nicely all around.



FIGS. 3 AND 4. SHOES FOR INTERFERING.

Let the heel project well behind to get as much weight as possible at the heels. We now have the horse scientifically shod to prevent forging.

As to interfering, it should be said that very few horses interfere if the hoof is properly pared and leveled and the shoe fitted to the foot. The shoe I use in a bad case of interfering is a side weight shoe like Fig. 3. The weighted side of the shoe must come on the inside part of the foot when nailed on. The object of a side weight shoe is to widen the action in front.

I use a shoe like Fig. 4 for interfering behind. The inside part of the shoe must be short and fitted perfectly to the foot. As the horse's action in front and behind is not alike, it requires a different shoe to widen the action in front and behind.

Prize Contest—Repair Work—7.

Welding and Tempering Work.

"Good morning, Mr. Anvil."

"Good morning, Mr. Brown. Glad to see you. Where do you stay now?"

"Oh, I have bought a blacksmith shop in Tuppersville, and I am going to start for myself."

"How long have you been at that work?"

"Well, I served my apprenticeship of three years, and have worked almost a year as journeyman, and now I am going in to try how I can succeed as boss."

"What kind of work do you expect to do at Tuppersville?"

"General work. Horseshoeing, repairing of vehicles, farming machinery, and what may come along."

"In what kind of work have you had most experience?"

"In horseshoeing chiefly, and I came to you to give me, if you will be so kind, a few pointers on repair work."

"All right, my friend, what do you wish to ask about?"

"I would like to know how to weld a buggy or carriage springleaf so as to make it stand the strain again. Also, how to weld an axle broken at the shoulder. How to mend a broken piece of casting to make a good job. How to weld a broken horse-rake tooth to make it stand the strain; also, how to weld a pitchfork tine; how to temper a gun spring."

"Very well. As you had most experience in horseshoeing, I presume you can get along with that work all right, so let me give you my advice as to welding a springleaf. When you are called on to do that, don't simply weld the leaf as you would a piece of iron, but first scarf a piece of spring steel to a feather edge. Cut it off for about one and one-half inches. Lay that piece on one end of the broken leaf. Weld it carefully, then scarf the leaf as usual. Then take the other part and upset it a little. Then scarf and split both pieces in the center, fork them together and weld with borax or welding compound, being careful not to overheat. Then draw it out to the required length, rounding the edges with swage, and fit on under leaf, giving it some spring, and the leaf will be nearly as good as new."

"Thank you. I will try that, but how about an axle broken at the collar? How can I weld that to stand, too?"

"Well, my friend, you have me now, as I know of no way to make a good job by welding at the collar. If there is a way I would be glad to know it, but I will give you my way of repairing the break in such a case. I go to work and forge an arm to fit the box in the wheel and weld about three inches of the point of the old arm to it, which will leave the thread to fit the old nut. Then I weld the whole arm to the axle about eight inches behind the collar, and such a job has always given the best of satisfaction."

"I think your way is a good one, and I will try it, but what is to be done with a broken casting? Can that be welded?"

"In a general sense, no. Although castings can be heated to melt, and ends stuck together, in a practical sense that is of little use. Hence, when you have a broken casting to mend, do as the surgeons do; use a splint, or, in other words, fit as strong a plate as circumstances permit to the side of the casting, where it will not be in the way, fasten it on with rivets that fit the drilled holes well, giving it little drawbore, and in most cases the casting will be as good as ever. Of course, you must be careful in fastening the plate that you do not strike too hard while riveting or the casting will be broken worse than ever."

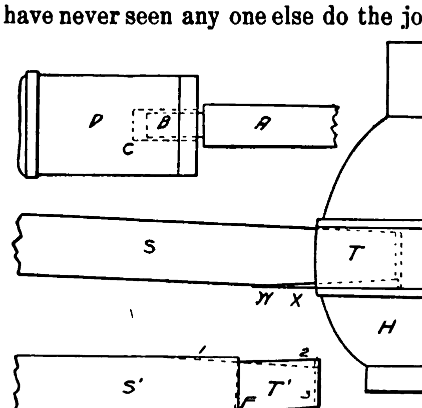
"Well, Mr. Anvil, tell me one thing. Can a horse-rake tooth be welded so as to stand reasonably well?"

"Well, Mr. Brown, my experience is that it can. It is only in the manner of fitting the broken parts. Horse-rake teeth are usually made of unrefined cast steel and great care must be taken in welding them, but I have no difficulty in making a satisfactory job. In fact, some of my customers say that they stand the strain better than some of the new ones. The way I do it is as follows: I scarf the broken parts about three inches in length, gradually tapering to a feather edge, place them together in a vertical line, and then hold them in position with a pair of tongs clamped on one end of the splice. I next take a light heat with borax at the other end, welding the point of lap there. Then I release the tongs and weld the rest of the splice, then shape the tooth, and that is all I do. A tooth thus welded will never break at the weld, and in fact is almost as good as new. Now, pitchforks I weld in the same manner, but I make the splice much shorter. As to tempering gun springs, I simply heat the spring evenly to a cherry red. When I say evenly, I mean as though the color was painted on. Then I drop the spring in lukewarm water. I then heat a piece of iron red hot and lay the spring on it, allowing it to heat sufficiently so that a piece of white ash wood when rubbed on it smokes freely. When it does so all over, I bury it in the coal ashes of the forge to finally cool off, when it is ready for use."

Prize Contest—Repair Work—8.

Repairing Old Wagon Wheels.

The repair of old wagon wheels is a job which should be well understood by every repair man who has this kind of work to do, and especially if the wheels are badly dished, but have sound wood in them. It cost me a good deal of thinking to learn how to do it, and I have never seen any one else do the job



REPAIRING OLD WAGON WHEELS.

in the same way, nor have I ever seen the job done any other way which would stand the test as well as this one.

Referring to the figure, S is the spoke which is shown driven into the mortise in the hub, H. The wedge, W, is inserted large end first into the mortise before the spoke is driven and when the job is done is cut off at X. The wedge is made of hard, tough wood, like hickory or ash, and should be twice as long as the mortise and of the same width. It should be from $\frac{1}{16}$ to $\frac{1}{4}$ inch at the back end and shaved to a point at the outer end as shown.

When the spokes are removed, they will have about the appearance shown by S' and T'. The parts 1, 2, 3 and 4, should be removed with a draw-knife to the dotted lines shown, or enough should be taken off the face to make it straight, and enough removed at 4 to let the spoke come down to the proper dish and also to facilitate driving, for if that part is not removed, it will strike against the outer end of the mortise and cause the spoke to rebound when the last blows are struck to send it home. The part 3 should be removed so as to insure against striking the boxing, but that is not always necessary. In badly dished wheels it is necessary to remove a little wood at F so as to make the shoulder bear evenly on the outer part of the hub, for when the dish is taken out and no wood removed from the back of shoulders, it is plainly to be seen that the bearing would be all at the back, thus tending to bend the spokes at the shoulders and force the dish back.

It is necessary to have a drive cap such as is shown at D. This should be of hard wood banded at both ends as shown, and should have a hole bored in one end as at C, which should be one size larger than the tenon B. A is the outer end of the spoke.

I always number my felloes and place corresponding numbers on the spokes, so as to be able to put the felloes all back where they came off. Then when the dowel pins are in place, the wheel will be back where it was before the work was commenced, excepting the dish will be out, and if the wood is sound it will be nearly as strong as a new wheel. Most repair men split the spoke about $\frac{1}{4}$ inch from the back and insert a short wedge in spoke before it is driven, but I don't think it is the proper way, for it does not tighten that part of the spoke next to the shoulder nearly as much as it does the back end, and it often starts a crack in the spoke that sometimes causes the spokes to split for several inches, besides letting in the water to rot the timber in the hub. With the wedge at the back, the whole length of the mortise is filled full and tight with good, solid wood, and the outer part can be made just as tight as the inner end. Here let me add that I have taken wheels that were dished the wrong way and by reversing the order, or placing the wedges at the front of the spoke, made them stay where I put them. One thing more. All hub bands should be tightened if loose, and if spokes are shrunk so they do not fill mortise tight sidewise, put a little strip of cloth over the part before you drive it, and also cover with white lead or glue.

The Economy of Pure Liquid Materials vs. the Adulterated.

Testing for Purity.

M. C. HILLICK.

The economy of pure liquid materials will be conceded by every intelligent carriage painter who has a reputation for honesty and fair dealing at stake. The adulterated and inferior turpentine, oil or japan, may for a brief season partake of the nature of a paying investment, but the spurious and expensive character of these materials is destined to be presently revealed. Such materials are dear at any price, and the painter working for permanent results, as far as paint and varnish can be made permanent, in addition to a fair measure of profits which he hopes to derive from his outlay of skill and labor is amply justified in rejecting the bogus products.

Turpentine is an article largely and daily used in the carriage paint shop, and into it, when prices run high as they have done for some time past, the sly and shifty adulterator loves to inject an extender of subtle and invisible presence. Formerly it was the practice to adulterate turpentine with from 25 to 45 per cent. of water-white kerosene oil, of 112 fire test. This latter oil shows by chemical analysis a composition practically as follows:—Heavy paraffine oil, $\frac{1}{3}$; kerosene oil, $\frac{1}{3}$; light oil, $\frac{1}{3}$. This adulterant has a gravity practically similar to pure turpentine, and it is therefore somewhat difficult to detect when testing from the point of gravity alone. Fortunately, however, the painter has at command a few simple, direct, and clearly convincing tests which should enable him to keep his turpentine supply fairly above suspicion. Pure turpentine has a sweet odor, not unlike that of the pine tree aroma, scarcely pungent, and not in any wise sour, and when freshly drawn the foam, if any, should rapidly subside. Naval authorities in testing turpentine, still adhere to the practice of dropping the suspected sample of turpentine on a piece of white paper in comparison with a standard sample. Turpentine containing a very slight percentage of kerosense oil will leave upon evaporation a greasy stain, whereas the pure article, not too quickly distilled, will leave no stain. A turpentine that has been too rapidly distilled will leave upon the paper a gummy, yellowish white stain, and this should not be confounded with the stain of the kerosene oil turpentine. Pure turpentine will usually evaporate from a piece of white paper in five minutes, and leave no stain. If more than seven minutes be required for the evaporation of the sample, it may be set aside as unfit to use in fine coach colors, or for mixing undercoatings of any kind. The sense of smell will sometimes expose the kerosene adulteration, but in these days of successfully deodorizing fluids, the olfactory organ cannot be depended upon as an infallible authority.

My esteemed friend, George B. Heckel, of *Drugs, Oils and Paints*, a recognized expert in all matters pertaining to the exposure of adulterants in paint shop supplies, advises the use of the hydrometer in testing for turpentine purity, and demands an insistance, on the part of painters, of 31° turpentine. Mr. Heckel some time ago publicly declared that if he were a painter, he would never accept a gallon of turpentine without sticking a hydrometer into it, and if it registered above $31\frac{1}{2}°$, or below $30\frac{1}{2}°$, he would not accept it from the United States Treasury. And in this position George Heckel is everlastingly right. However, in making a test of turpentine, the painter must study the characteristics of the fluid—its color, odor, drying property and freedom from greasy taints, etc. The benzine, naphtha, or petroleum refined spirit, infected turpentine will disclose its nature when used in thinning japan ground color. A color thinned with benzine, or naphtha of 88° will dry so quickly under the brush as to make the coating over of a large panel practically impossible. A color cannot be laid out free and clean from brush marks thinned with a benzine or naphtha adulteration. Moreover, a color so thinned will have a gritty, rough feeling to it which is a fatal defect in fine carriage surfacing. The kerosene-turpentine is an uncertain drier, and color or paint thinned with it will lack uniformity in drying. Some portions of the surface will dry perfectly, while others will show an exactly reverse condition. The carriage painter cannot well be overexacting in buying his turpentine supply. It is a business matter of the first importance that he should buy and use only the pure article.

In the use of raw linseed oil, he should likewise exercise his demand for a pure brand. There are a number of simple, easily conducted tests which should be learned and practised in determining the quality of the linseed oil stock. The painter in the small shop, who by reason of limited requirements does not buy direct from the reliable crushers, is more or less at the mercy of the unscrupulous manipulators of paint supplies, unless he provides himself with the means of detecting the deception. A cold pressed linseed oil, in raw state has a very light color, and a very little but peculiar taste and odor. As an oil grows in age it becomes paler in color and somewhat brighter. When spread in a thin film and exposed to pure dry air, raw linseed oil of prime quality will harden up quite solidly in, say, 72 hours. One of the chief advantages of pure, raw linseed oil, over all other oils, is its property of strongly combining with oxygen, and giving, by virtue of this combination, a very tough and highly elastic resinous film. Linseed oil ranks as a prompt and sure drying oil, and in this respect all its adulterants are failures.

The prominent adulterants are rosin, mineral and fish oil, the latter oil being probably the most generally used. Rosin oil in addition to being an unreliable drier, toughens the paint in which it is used, giving it a bad working property. Rosin oil in linseed oil may be easily detected by heating the suspected oil. If rosin oil be present, the strong rosin odor, despite the deodorizing process, will manifest itself. Fish oil, the product of the Menhaden fishing industry carried on along the Atlantic Coast, may in like manner be detected by heating, the fishy odor being fairly nauseating under the effect of strong heat. Fish oil has good body and it is said to dry decently enough, but it is deficient in the elements which contribute to the durability of raw linseed oil.

Mineral oils, on account of cheapness, have come into use as linseed oil adulterants. Mineral oil will retard the drying of paint, but does not materially affect its working or spreading property. Mineral oil paint dries poorly and lacks in permanence. A simple test which the carriage painter can successfully carry out, consists in putting a quantity of pure linseed oil in a test tube (procured at the local druggist's) and a like quantity of suspected oil in a second test tube, and then for a space of 15 minutes immersing the two tubes in warm water. Upon removal of the tubes from the water, pour the pure oil into the sample of suspected oil and note the result. In case of existing impurities, different colors will form in layers. Into four-ounce long, round bottles pour equal parts of linseed oil and nitric acid, of about 140° specific gravity. Shake sharply and stand aside for 20 minutes, then note the colors: If upper stratum, or oil stratum, be first a clear greenish yellow, gradually turning to cloudy yellow, and the lower stratum, or acid stratum, be practically colorless, then the oil may be adjudged pure. The presence of fish oil will color the upper stratum to a deep red brown of muddy hue, while the lower stratum will show a red or cherry color. In an eight-ounce bottle, shake a quantity of the linseed oil with a concentrated solution of soda, then add warm water and again shake contents. After standing aside for 30 minutes, examine, and if there is any percentage of petroleum it will separate from the soap.

Rubbing a few drops of linseed oil smartly between the palms of the hands will in case of a pure oil develop a pleasant odor, quite unlike that of any other oil. If rosin, or machine oil, a petroleum odor will promptly disclose the nature of the adulteration; and by the same token fish oil may be detected. As a matter of fact, this test is conclusive enough to unmistakably disclose adulteration by any of the oils above named, and this is what the painter is chiefly concerned with.

The proof that an oil is adulterated should be sufficient to condemn its use in carriage painting. The precise percentage of adulteration, as the chemist alone is able to determine, avails the painter but little in accepting or rejecting an oil of known impurity. The oil to any extent adulterated is to the full extent unfit for use in building up a carriage surface. The painter depends upon his lead and primary foundation coats for holding forth the matchless finish of his surfaces, and these foundation coats in turn depend upon the purity and stability of the materials composing them, of which raw linseed oil is a leader. Hence the importance of this oil being pure, and of established merit.

The japans which interest the carriage painter, chiefly come under the head of pale drying japan and coach japan. Pale drying japan belongs to the coach japan family and it should, when of prime quality, have the color of light amber. Pale drying japan is specially adapted for use in light colored pigments which are easily affected by dark hued liquid ingredients. This particular japan should dry fairly hard upon glass, in from two to three hours, and at the expiration of twenty-four hours it should not powder or break away under the friction of the finger. It should also assimilate and mix perfectly in from four to five times its volume of raw linseed oil, and such a mixture in a temperature varying from

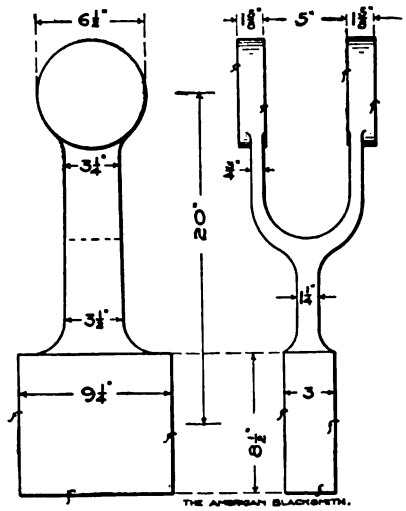


FIG. 1. DIMENSIONED VIEWS OF FINISHED CONNECTING ROD.

sixty-five to seventy-five degrees should dry free from tackiness in from eleven to fifteen hours. So, too, should coach japan, the carriage and wagon painter's standby, mix and assimilate with raw linseed oil without curdling the oil or separating from it. When mixed with four times its volume of raw linseed oil, good coach japan in a temperature of seventy degrees should dry free from tack, in from one to two hours, and after sixty hours it should so harden on the glass as to hold intact under sharp rubbing of the finger. If the japan curdles the oil or crawls away from it, or in conjunction with the oil fails to dry upon glass properly within the time and under the conditions above specified, the painter is justified in rejecting it as of inferior quality and a menace to durable work. Coach japan should have a true turpentine odor, and contain no appreciable sediment. To test a japan's quality for assimilating with linseed oil, pour equal quantities of the two liquids into a pint bottle and shake thoroughly. If the japan holds in suspension with the oil, becoming as one with the oil, and does not separate and drop to the bottom of the glass, it is of good merit in this respect. If this same mixture dries promptly, and as here described, it meets an important requirement in another respect. Really, this is a conclusive test of the worth of a coach japan, and by it practically all other japans may be tested. The use of a first class japan will relieve the painter of many troubles common to paint-shop experience.

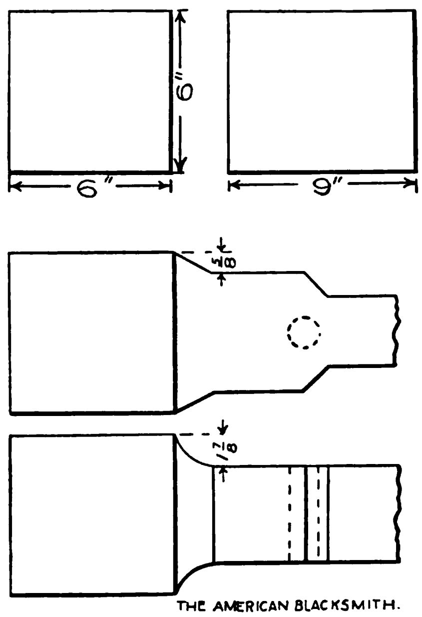
Forging a Connecting Rod.

THOMAS PRENTICE,
Foreman Blacksmith, General Electric Company.

To the average blacksmith, the greatest stumbling block in his way to success is the blue print. He has been educated to, or has educated himself to be entirely dependent on someone else to lay out his work for him, or he must have a template made from which to work. Discard this practice, and spend a couple of your evenings each week learning to read correctly the blue prints, which are likely to be handed to you to work from.

The accompanying sketches show a connecting rod, such as may be found on a fifty-kilowatt Marine Engine. The blacksmith receives his print and finds it does not give a forging sketch, but instead a finished rod with wrist pins, oil races and brasses all shown. Hence the necessity of great care in working from such a blue print. Figure 1 shows the rod as it should appear after the blacksmith has laid down his job and considers it complete. On this sketch it will be noticed that there is no machine work called for except where marked *f*, which at all times denotes that surfaces so marked are to be machine finished.

The first thing we must do is to get material sufficiently large to make the job, which as you will notice is 6½ inches across the hub. For that purpose we take a block of steel six inches square, if the material is hammered stock, or 6¼ inches square, if the material is rolled, the extra ¼ inch being necessary on account of the round edges of rolled bars. This we cut about nine inches long, as shown by Fig. 2, which gives us three inches from which to forge down the ends. This must be done carefully, for if we get it drawn too small, we require to begin again, and have made about ninety pounds scrap. Having drawn down the end to proper size and shape, as shown by Fig. 3, we proceed to punch a hole, as shown by the dotted lines. In punching, a piece of iron equal in thickness to the depth of the offset must be used, or we will not be able to keep up the size for the jaw of the rod. In cutting, use a short hack until you get down to where you can touch solid metal, finishing your cut with a hack long enough to cover the



Figs. 2 AND 3. SHAPING THE HEAD END OF ROD.

entire space from the end of your material to the hole. Your work will then appear as shown in Fig. 4. In opening, you must get your forging sufficiently hot to prevent tearing or undue strain, using a V-block loose on the hammer die, as shown in the same figure. This will open your piece enough to enable you to get it down on the hammer die, when a few light

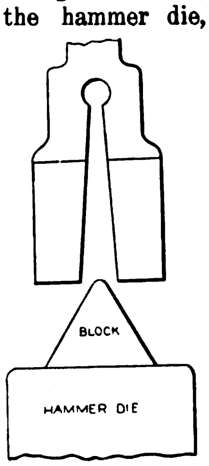


Fig. 4. OPENING UNDER HAMMER.

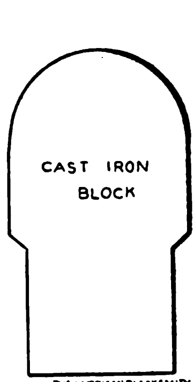


Fig. 6. BLOCK FOR BENDING.

blows will give you a forging as indicated by the upper sketch of Fig. 5.

You now proceed to flatten the ends to the desired thickness; this can generally be done in the same heat that you open with. You will notice that the centres are much shorter than you require when bending the jaws, and also that in bending, your stock has gathered or crowded itself against the stem. For the former, use a small rod, setting it in as shown by dotted lines, Fig. 5, and draw to required length, using a taper tool for that purpose. This will give you a forging, which, when bent will conform to your blue print. For the latter effect or the crowding, never attempt to work this over, as such a course will cause you endless trouble, and may spoil what otherwise might be a good job. This should be cut out with a gouge, as indicated by the dotted lines, Fig. 5, and if done neatly will give you the required radius, at the same time ensuring a perfectly solid piece of work. In rounding up the ends two methods may be employed. First, by working in the corners and rounding under the hammer, but this should not be done unless you are scarce for stock, and then carefully, as there is danger of the corner of the die sinking into the side of the rod. Second, by finding your exact center length, marking off with dividers and cutting under hammer with a hack; if this is done a very few blows of a sledge on a swage will give you a neat, good job, shown by Fig. 5, lower views. We are now ready for bending, and in doing so a short center heat is required. By keeping the ends cold you do not mark with hammer, and there is less danger of twist. In finishing your jaw end use a cast iron block, like that in Fig. 6. Take a short heat on the stem, draw down to size required for welding; cutting off the required length and

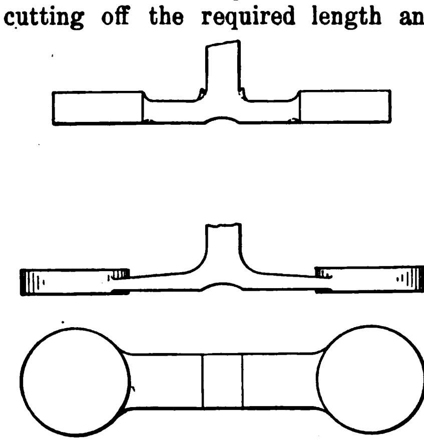


Fig. 5. DRAWING AND SHAPING THE HEAD END PIECES.

scarfing, you lay down the jaw end of your rod completed.

In making the tail or crank end, there is considerably less work. You take a block of steel, Fig. 7, with a short heat, using a hack for cutting, and draw with a V-tool, which keeps the inside corners square. This piece can be drawn under the hammer in one heat. A second heat and you can finish the inside, giving the proper radius with fullers. Cut and scarf, and your end will appear as shown by the lower view of Fig. 7. These are put together, Fig. 8, and welded. Great care must be exercised in welding, as it will be impossible to give the steel the same heat that iron will stand. Use no sand

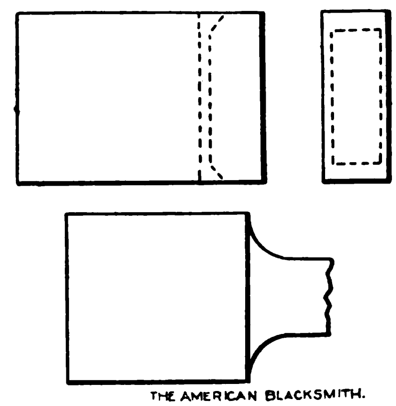


Fig. 7. SHAPING THE CRANK END OF ROD.

and as little borax or other welding compound as possible. It is of little use except to form a flux and exclude the air while taking from the fire to the anvil.

Having welded the rod satisfactorily, we are by no means finished. The forging must be squared up, and for this we place the rod on a surface table, using a parallel block and setting the surface gauge to take the centre of the jaw hub and centre of tail end. Place square on table and against jaw. If that is correct, place square across face of rod and measure distance to tail end. Reverse, and if distances are equal, your rod is ready for the machine shop. You have now finished your job and have consumed about twenty hours time with two helpers.

Diseases of the Foot and Their Treatment.—3.

E. MAYHEW MICHENER, V. M. D.

The disease known as corns is common and well known to all shoers. It is of more frequent occurrence in animals worked upon hard roads and city streets, yet is of not rare occurrence in the country horse. Corns are almost exclusively a disease of the front feet, although in rare instances the condition is found to exist in the hind feet. The part of the front foot usually the seat of corn is the triangular interspace situated between the wall of the quarter and the bar; the inner heel is the part most commonly diseased, but the outer heel is not infrequently the seat of trouble, and both heels are the seat of corns in many narrow and contracted feet.

The condition known as corns is always the result of some injury to the sole, the wall, or the bar, causing the outpouring of pure blood or in lesser injuries only the leakage of serum through the walls of the injured blood vessels. If the injury is slight and not repeated, the injury may be rapidly repaired by natural means without any external evidence of trouble becoming apparent, excepting a more or less stained condition of the young horn cells by the blood; as the formation of horn is constantly going on, the red stain becomes apparent on paring the surface after several weeks have elapsed from the date of injury. This explains the stained spots sometimes found in preparing the foot for the reception of the shoe. If, however, the laceration of the vessels is of such degree as to cause the outpouring of considerable blood or serum, and the injury be repeated at intervals, then the stained horn will be found to exist in layers separated by layers of normal horn of a thickness corresponding to the times between the repeated injury. The condition of the horn therefore is a faithful record of the frequency and

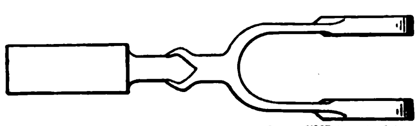


Fig. 8. WELDING THE TWO ENDS.

severity of the injury to the sensitive parts. A corn which is visible upon very slight paring of the horn may be set down as one of considerable age. If the amount of injury be sufficient to cause considerable loss of blood or serum so as to saturate the horn, the condition is spoken of as soft corn, and if, as not unfrequently happens, the parts become infected with pus-producing germs and pus is formed in greater or less amount, the condition is known as suppurating corn.

As above stated, the essential cause of corns is some injury to the small vessels of the sensitive parts of the sole, laminae, or the bars. The predisposing causes however are many. It is a fact, that feet that have never been shod are scarcely ever known to have corns. Thinning of the horn of the sole to an excessive degree may be named as a common predisposing cause.

The application of shoes of insufficient length is also a cause, as undue weight and shock is given to the short-shod foot in travelling. Low heels and toes of too great length alike impose upon the heels more than the proper amount of the animal's weight, and so become a cause of corns. Improper fitting, allowing weight to fall upon the interspace between the bars and wall is not uncommon; this condition is rendered more liable if the heel of the shoe is made narrow. Want of shoeing is a very frequent cause of corns, as by this neglect the heel of shoe is shifted off the wall and rests upon the seat of the corn and bruises the part. This latter condition is frequently seen in heavy draught horses whose shoeing is neglected. Mention should be made that the rasping away the wall to remove the bearing of the shoe in case of corns is not good treatment, as quarter-crack is likely to occur. If it is thought desirable to remove the pressure of the shoe upon the heel, it is best done by shoeing with three-quarter shoes or with tips only. If shoes of this description are used, they should be so applied as to present a level surface on the bottom or ground surface; this is accomplished by notching out the wall to receive the shoe and never by the application of a shoe which throws more than a normal proportion of the weight of the animal back of the center of the foot.

Conformation is an important predisposing factor in the causation of corns. Base wide animals are predisposed to corns of the inner heels and, conversely, base narrow conformation predisposes to corns of the outside heel or quarter. The reasons for this is plainly due to the uneven or unequal distribution of weight. The narrow or mule-shaped hoof is often the seat of corns, and the contracted heel is almost always the same. These conditions are rendered worse if the horn is allowed to become dry and unyielding, and the shoeing neglected or improperly done. In the contracted heel, the seat of the corn is commonly in the laminae of the wall or the bar. In the flat-footed animal the seat of the corn is generally the velvety tissue of the sole in the interspace between the bar and the wall. The nature of the road evidently has much to do in the causation of corns, as the trouble is of much more frequent occurrence in the city than in the country.

While corns may be the cause of severe and troublesome lameness, yet lameness is far from a constant symptom and of great importance is the fact that frequently corns are thought responsible for lameness due to some other disease, navicular arthritis, for example. The consideration of this fact is of great importance to the shoer. The detection of corn lameness is generally easy. It varies in intensity with the extent of the disease, the degree of hardness of the road and with the speed of the animal. Pressure upon the seat of the trouble applied by means of the pincers or hoof-testers will show undoubted tenderness. In suppurating corns a slight tap with the hammer upon the sole or wall will cause the animal to show pain. Corns may cause pointing and elevation of the heel, and if suppuration be present evidence of fever and loss of appetite may be present.

The treatment should, when possible, be directed toward prevention. The heels should be supported by shoes of sufficient thickness and width, and the toe of hoof kept short. If the contraction of the heel is pronounced, and the case will permit the shoeing with tips or three-quarter shoes, they should be so applied as to give the ground surface a level bearing, and this is well done by notching the wall sufficiently to admit the thickness of the shoe. If lameness be not pronounced, it is of doubtful good to pare the corn to any considerable extent, as it only thins the protecting horn over the tender spot and permits the entrance of dirt and pus-producing germs, and may in this way aggravate the trouble instead of helping it. If, however, the pain is great and increasing in severity, there is evidently pus formation going on, and the sooner an opening is made into the hoof the better. The opening should be made carefully by means of a small, sharp toeknife. Frequently a dark spot in the horn will serve as a guide in making the opening. Proceed carefully and do not cut into the living sensitive tissue so as to cause bleeding. If the pus cavity is found, enlarge the opening sufficiently to permit the syringing of the cavity with the disinfectant solution, and to permit drainage. For syringing, probably nothing is better than half creolin and half water. As an additional disinfection, soak the foot in clean, warm water containing one ounce of creolin to the gallon. Next pack the cavity with absorbent cotton saturated with pure creolin. Repeat the treatment once or twice daily and protect the opening from dirt by giving the animal a clean stall and the protection of burlap covering to the foot. In advanced cases there may be separation of the wall and an opening at the coronet discharging pus. In such cases clip the hair from the coronet, as well as any loose horn, and also make a counter opening in the bottom of the foot, as drainage cannot be complete from the opening in the coronet alone. The complications of corn are quittor and separation of greater or less extent of the horn of wall or sole. Tetanus or lock-jaw may also follow.

Practical Hints About Stubbing Axles.

J. G. HOLMSTROM.

No little skill is required to weld and set axles, so that when the work is done it is not only a good solid job, but the wheels have also the right pitch and gather. As this is the time of the year when such work is generally done, an article treating of this subject may not be out of place.

We will suppose that the vehicle to be stubbed has steel axles. First, be sure that the size of the stub is the

Fig. 1. METHOD OF PREPARING SCARF.

same as that of the old axle, and that the length of the spindle is right. Next, take the right measure of the whole length of the old axle, from the shouldered end where the tread begins —the latter part should not be included in the measure as it varies in different makes of axles and stubs. Now, place the spindle of the stub alongside of the spindle of the old axle so that the stub spindle reaches out ⅜ inch longer than the old spindle, mark at the inner end of the new stub, and cut off. This will allow enough stock for upsetting and welding. This done, heat the ends and upset before scarfing. I want to say in this connection, that most smiths overlook this point so essential to a good, strong weld, in all kinds of work. The ends should be upset far enough from the end so as to more than cover the scarfed part. If this is done there will be stock enough to work on, and when such a weld is finished, there will be no sign of a weld. The scarf should be prepared as shown in Fig. 1. It is often difficult to make the weld "stick" in a steel weld, because the heat cannot be so high as to soften the material as in iron. If the shape of the scarf is a little convex, the ends tend to slip off easily, though this may be overcome by a scarf prepared with a notch, as shown in Fig. 1. This method of preparing the scarf will work well in all kinds of steel welds, especially in high carbon steel. In making the weld the utmost care and attention must be paid to the fire to insure the best results.

After the axle has been welded and the right length attained, care should be taken so as to have the square or level parts at the ends stand level. This is important when the springs rest on the axle, for if this is not done, the springs will not be at the same angle in relation to the axle.

Next is the setting for the pitch and gather. In factories where the same dish and the same tapering in the spindles is generally used, the axle is set in forms or dies, but it is different in repair shops with all kinds of spindles and wheels of different dish, for it is then difficult to go by any gauge. Still, if a gauge is used, it should be one that can be set in proportion to the dish. I hold that the safest way to set axles, and do it right, is to measure the pitch by setting the wheel on the axle, and set the axle so as to get the plumb spoke, as shown in Fig 2. Here a case is presented, showing different dish in the wheels, both having been set to a "plumb spoke," which also will make the wheels track. No. 1 is a dished

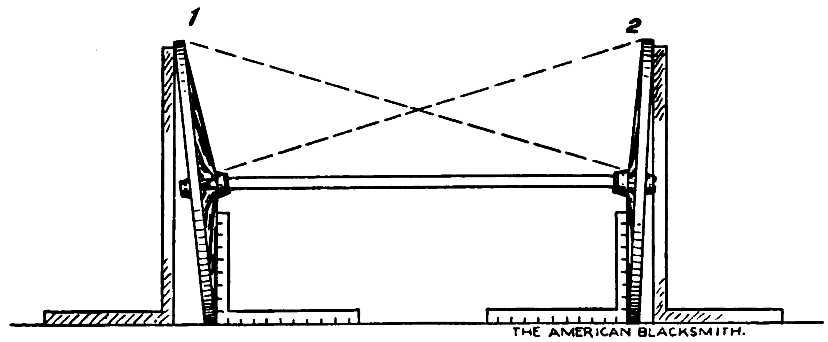


Fig. 2. ILLUSTRATION SHOWING WHEELS WITH PLUMB SPOKE BUT DIFFERENT DISH.

wheel, and No. 2 is a straight wheel. It will be seen from this that the surest way in a repair shop to set the axle is by the square, or when the wheels are of the same dish, measuring by rods, as indicated by the dotted lines. I am of the opinion that no carriage wheel should have more than ⅛ inch dish, and a wagon not more than ¼ inch, the difference in the size of the spokes at the hub and the rim being enough to give all the pitch needed. We sometimes see wagons twenty years old, of which the tires have never been reset. Upon examining the wheel we find it is straight. On the other hand, we see the tires come off from wheels of wagons almost new, and it will be noticed that such wheels generally have great dish. A wheel with much dish cannot be a strong wheel, nor can the tires be set tight on such a wheel, for that would draw the spokes over and dish it still more. Apropos of tire setting, let me say that the method practiced by the author of the prize contest article in the October issue for quick tire setting does not hold good even in chopping cord word, *i. e.*, setting on guess.

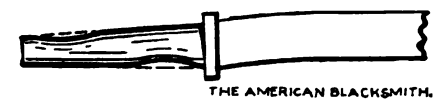


Fig. 3. WEAR ON AXLE WITH TOO MUCH PITCH.

How can a smith set a tire without measure where ⅛ inch too much dish on a tire twelve feet long will ruin the wheel, if it is a light buggy wheel. There is no guess work in mechanics—we must learn to use the ruler. The centre of gravity should follow the center of the spoke. This is not possible in a dished wheel, because the pitch will have to be out of proportion. It should be remembered in setting the axle, to allow a little for load; that is, the axle set to a plumb spoke is all right when the vehicle is empty, but when it is loaded, it is over the square and it is therefore best to set the wheel a little under the square, so that it will stand plumb when loaded.

The gather should be from ¼ to ⅜ inch. This is to prevent the wheel from running against the nut. It will easily be understood that if the gather is large it will cause friction, and make the vehicle run heavy. Too much pitch or too little will produce friction, wearing the axle as shown in Fig. 3. Too much gather will produce the same result on the sides of the spindle.

When the axle has been welded and set it is finished and no hardening should be attempted with the steel spindles used in this country. The boxes are made of cast iron and the spindle should be no harder than the box. Besides this the finish will be ruined in heating and the spindle probably broken at the first turn. In iron spindles made for special purposes case hardening is all right, but not with the patent steel axles which are now very generally used in the United States.

The axle finished, there is the setting of the boxes. Heat the old axle stubs and place them in the old boxes for half a minute or so. This will loosen the box, which will then easily be driven out. If there is oil in the hub it should be cleaned out well, and some fine cinders rubbed over the greased parts. This is not necessary where the hub has to be cut out. The box should be set so that the wheel will run true; if it is not, all the care taken in setting the axle will have been in vain, and there will be friction that will cause the spindle to wear quickly and the vehicle will run heavy. When an axle

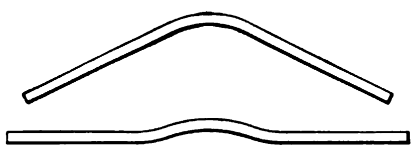


Fig. 4. EFFECT OF BENDING AN AXLE.

has been sprung out of shape it should be set in the same manner that the axle is set when stubbing. Heating a bent axle, placing it in the wheel and straightening by means of the wheel is not in line with practical blacksmithing experience. To illustrate, a bar of iron bent cold or hot, heated and bent back will be left in a shape such as shown in Fig. 4. It is our experience that a bent bar cannot be bent back to its original shape unless it is put in a bending device or hammered back. If the spindle is bent, bend it back in the bending device or with a maul.

The Scientific Principles of Horseshoeing.—6.

E. W. PERRIN.

Care of the Colt's Foot. Its Relation to Deformity of the Limbs.

As the twig is inclined so grows the tree, and as the hoof is inclined so grows the leg above it. If you would raise a straight tree, you must care for and cultivate when a sapling, and if you would raise a horse with straight legs, you must care for the feet in colthood. If the foundation of a house sink on one side, the house will lean to that side, and if the hoof—the foundation of the limb—sink to one side, then the limb will lean to that side, so that the foot and leg is very much what we make it. True, many horses grow straight legs in a wild state, but many do not, and besides the colt in a semi-artificial state needs more attention than those running wild, for the colt raised in limited pasture or paddock has less opportunity to wear down the surplus growth of hoof, which is a prolific cause of distortions and malformations of the pastern and fetlock.

If the average breeder and farmer understood the importance of caring for the colt's feet we would have less trouble with interfering horses, for much can be done to modify those malformations of the limbs which invariably cause it, if the remedy be applied in colthood, while the bones are soft. Generally no attention is paid to the colt's feet until he is old enough to work, then, we too often discover that the hoofs have grown all to one side, and as a result, the fetlocks are distorted—permanently deformed. It may be that he is a chronic ankle or knee hitter, see Fig. 28.

When the foal is a few days old the owner should critically examine its limbs and feet, and if there be any sign of malformation, the feet must be carefully watched and frequently reduced to normal dimensions. For instance, the legs of the base-wide position will have a hoof somewhat low on the inside, growing long and "wingy" on the outside. It is not claimed that care of the feet will widen the legs at the chest and bring them closer together at the base, but the hoof of this conformation will grow fast and wide on the outside, thus tilting the fetlock inward, and the bones and articulations being pliant will knit or conform to that position—a position which cannot be altered when the animal reaches maturity. In such cases the surplus growth on the outside must be kept well rasped down, and if the inside heel and quarter be low and weak, it may be necessary to protect it by nailing a very thin piece of steel along the weak part, while the other side is left exposed to wear. I have lately had to nail a thin tip on the outside toe of one fore foot of a colt. Owing to some weakness, this colt was wearing the outside toe of one foot through, while the heels had grown high and had turned under the foot, completely covering the frog, and as a result the knee was slightly bent, and the fetlock knuckled forward. It is needless to say that had this colt been neglected, the feltock and foot would have been permanently deformed, but by lowering the heels and protecting the toe, the fetlock was restored to its normal position, and the colt has grown up sound and strong.

The bones in the young colt are soft and pliant, and any deviation from the normal position in the foot will be followed in the limb of which it is the base. The first and most important step is to keep all surplus growth rasped down, and if the colt spends much time around a dirty barnyard, look out for "thrush" in the frogs, for thrush is the forerunner of contraction. After re-

Fig. 28. DEFORMITY ARISING IN COLTHOOD.

ducing the colt's foot leave the edges round and strong, because the wall will be less liable to chip in this condition. It is common to find a deep cavity in the wall of a colt's foot that has been neglected, and the cavity becomes packed with sand or gravel, often resulting in "sand crack"—fracture of the hoof. If the cavity is of any depth, the most effective treatment is to cut all the outer wall away to the depth of the hole, exposing the cavity to the light, in which case it cannot hold the packing which acts as a wedge, causing the cavity to become deeper and deeper. If the wall be tardy of growth apply some stimulating liniment, with friction to the coronet over the cavity once a week. This treatment will cause the wall to grow down solid. The little money spent in caring for the colt's feet will reimburse the owner ten-fold.

Frog and Sole Pressure.

Years ago it was erroneously supposed that the sole of the foot could not stand pressure. The oldtime shoer would not think of putting a front shoe flat on the foot, taking a bearing the full width of the web, and hence all front shoes were and are to this very day, "seated"—concave on their foot surface, so that it shall rest on the wall only. This pernicious system of making the wall instead of the sole, wall and frog carry the whole weight of the animal, has caused no end of foot lameness.

The frog is the natural buffer or cushion of the foot; its natural function is to share with the other parts of the foot the weight of the animal. Not only that, but its texture is so much like rubber that it is admirably adapted to diminish concussion, not only to the foot, but to the whole limb, but the ordinary method of shoeing deprives it of its natural function—puts it, so to speak, out of action.

It is a well known law of nature, that an organ deprived of its function deteriorates, dwindles and wastes away. This is precisely what happens in the frog when it is prevented from doing its share of weight bearing. Being deprived of the natural stimulus of work, which keeps the blood circulating in this organ—which life-giving fluid carries to it every element of repair—it wastes away, and cracks in the cleft. "Thrush" and ultimately atrophy sets in. But this is not all. The weight which the frog would bear, if allowed to, is thrown on the heels; this abnormal weight and concussion the heels and quarters cannot bear; thus corns, sidebones and contraction are superinduced.

I first saw sole pressure put to a practical test in the British Army years ago. We used "seated" shoes on the front feet, but an order came from Prof. Geo. Fleming, then principal veterinary surgeon of the British Army, to shoe all horses with fullered concave shoes—concave on the ground, but flat on their foot surface, the same as we call a snow shoe here; the knowing ones said every horse in the regiment would be lame in a month, but they didn't get lame, and they were still shoeing them that way when I left the army, and the feet improved by the change.

Here again nature is our guide, for in a natural state the outer margin of the sole bears equal weight with the wall, and all the sole will bear some weight. For instance in the field, the hoofs are stuffed with mud or clay, and the feet keep in excellent condition so long as the clay does not bake hard in the shoe, in which case it must be picked out or it will act as a foreign body on the sole, causing pain, but so long as it is wet and soft it is beneficial to the feet.

When the margin of the sole is deprived of its share of weight bearing, the weight which it would carry, if allowed to, is thrown upon the wall, thus causing severe concussion to the coronary cushion, a prolific cause of inflammation of the coronary band, also of brittle feet. Of course there are some feet with thin, flat soles, or others rendered too thin by paring, in shoeing, or from being worked without the shoe, and in such cases it may be necessary to seat out the shoe and protect the sole with leather until nature has grown back some of the horn so carelessly worn or cut away. Therefore, the shoe should take equal bearing on the wall and outer margin of the sole, and should be fitted so as to admit of frog pressure if possible.

(To be continued.)

Queries, Answers, Notes.

Questions upon blacksmithing, carriage building and allied subjects will be printed under this heading. Answers and comments are solicited from readers for reproducing here also.

Tempering Knives. Will some one please give me the best way for tempering knives so they will not spring?
GEORGE M. GOUDEY.

Shoeing Inquiry. Will some blacksmith kindly tell me how to prevent a horse from bumping his knee with side of foot when traveling? J. E. ELLIOTT.

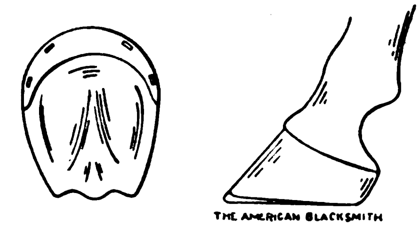
Soldering Gun Barrels. Will some one of the craft tell how to solder gun barrels, and also how to temper brass in making a spring? E. W. JONES.

Shop-Made Tools of Good Utility. One thing that is lacking in most shops is a portable drill. It seems as though any good workman could make it, and a hydraulic punch as well. I also have a saw gummer in my shop which brings me in about $50 a year, and it can be made in a few hours. I have a hoof knife which will cut down a hoof as much or as little as one likes in going once around, doing quicker and better work than any shears. I want to say that life is too short to fool it away with the tools our grandfathers used. I have made all my own tools except my anvil and screw plates, and if any of my brother craftsmen want to know any more about these tools or how to make them, I shall be pleased to give full directions. J. R. DOUD.

An Inquiry on Shoeing. Will someone tell me what kind of a shoe would be best for a horse whose joints are stiff just above the foot, so that he walks back on the heel with the toe turned up? J. M. SLOAN.

Method of Making a "Tip." In reply to a question as to the construction of a tip shoe described by Mr. John A. Green, in the December number, I would say that "Tip" is the name applied by Mr. Green to a short shoe covering and protecting the toe of a horse's hoof. The tip is made of steel to cover about one-third the horse's foot, the toe as wide as an ordinary light shoe, the ends drawn and narrower and thinner. Make the inner surface of the tip slightly concave, so as not to press on the sole. A tip may be turned, if desired, to come just over the front edge of the hoof. Secure the tip with four small nails, two on a side, with the holes well countersunk, not creased. A low sharp calk may be added in winter if necessary.

The success of the tip depends also upon the preparation of the horse's hoof. Do not cut the frog, unless some part of it hangs loosely, and nearly always let the



THE TIP SHOE.

bars and sole alone. Pare the wall sufficiently to leave a good, clean surface for the tip, doing very little to the heel, for if pared as much as the surface under the tip it offers too little resistance to the ground or pavement. As the tip wears away, nature will take care of the heel, and the foot will assume and maintain a normal and healthy condition. MISS S. E. GREEN.

Filling a Patent Hub. The question was asked in the January number how to spoke a patent hub. I have had good success in the following way: First, I remove every other rivet, and then remove the spokes, leaving four rivets in the hub. Commence to fill one section at a time. Cut a groove in the first spoke so as to set half way over the rivet. Then fit the spoke next to the other rivet the same as the first, and then drive the center spokes. Fill the other three sections in the same way. My object in leaving four rivets in is to keep the two flanges from spreading apart. Also in filling one section at a time the spokes will not run. Select spokes as near like the old ones as possible.
CHARLES L. EDICK.

Tempering Well Drills. Will someone inform me how to temper a well drill to give the best of results, as I have lots of trouble to get the drills to stand here, where there is a great deal of limestone?
WESLEY JOHNSON.

Hints on Tempering and Soldering. In answer to Mr. Gudgell's inquiry in the January number in reference to tempering and soldering, I would advise as follows:

First, clean off the parts to be soldered by scraping them until bright, and then apply a solution made of muriatic acid and zinc. Put about one ounce of the acid in a half-pint bottle and then add the zinc until the acid stops seething. Use a soldering iron for putting a thin coat of solder on each piece, first covering with the solution of acid and zinc. Place nipple where it is to be soldered, heat a rod and put through nipple, first covering over with the solution, then use solder and soldering iron until the solder melts freely. Then cool off with a wet sponge and remove the rod. I have not heard of any complaint of nipples put on in this way.

In reference to tempering springs, I first make and set the springs, being careful not to heat the steel too hot. Then I fasten a small copper wire to the spring, so as to have it heat uniformly, and placing it in the fire, heat to a bright cherry red. The spring is next plunged in water, taken out and placed in tip end of tongs so as to stand perpendicular. It is then held in the blaze of the fire with the blast on until you can detect the faintest heat, when the spring is to be set aside free from draught until cool. After it becomes cold, I cover with oil and it is ready for use. Springs tempered this way will stand. J. P. WINGARD.

Tempering Small Springs. I would say in reply to Mr. Wm. P. Gudgell that I have been in the business for sixteen years, and have found no surer way than the following for tempering small springs. Take a piece of good spring steel and shape your spring to fit. Then heat to a bright orange color and drop it in clear water. Of course it is then as hard as a piece of glass. Polish the small end of spring and get a very thin piece of hoop iron or something of this kind, lay the spring on it, put it in the fire and blow lightly, watch the small end, and as soon as its color changes to a gray take it off and let it all cool together. When cool, repeat the same thing until you have done it three times. Of course there are quicker ways, but I know of no better. I have made a great many, and when tempered with the above formula never have lost one yet. R. L. JONES.

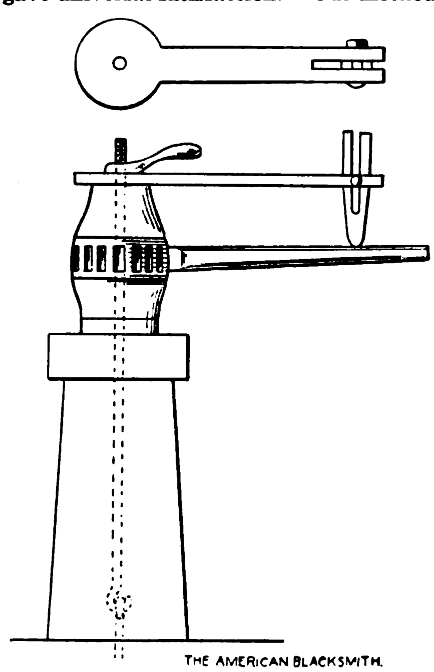
Spring Tempering. In tempering, I heat the spring as evenly as I can and cool it in lard or fish oil, though for very small springs boiled linseed oil is the best. Next I run a rod through the spring and hold it over the fire until the oil burns off. I then put it in the oil, place it over the fire a second and a third time and after the oil burns off the third time, lay it by to cool. Some springs will do all right with one or two burnings. A little practice will determine the right treatment. I have used the same treatment on gun springs. Often gunmakers, after hardening, draw their springs to a blue. In making springs I should use, if I could get it, a good grade of spring steel, though I often make them of cast steel when I can get no other. Springs for rat traps and tail boards for wagons, I hammer with water on the anvil until they have a little set in them, and they will do good work. H. N. POPE.

A Protest Against Cheap Work. I should like to hear from the smiths and horseshoers, especially from the State of Missouri, as to men pretending to shoe who have no broader idea about shoeing than to merely bend the heel and nail the shoe to the foot regardless of size or shape, and as a result are ruining thousands of horses every year. Being deficient in skill, these men offer their so-called low price as an inducement to patrons. They don't hurt the better class of workmen so much by the amount of trade they get as by the low prices they make. The really skilled mechanic will very seldom cut a price, as he knows too well what it means. A law making it compulsory for every man to pass a rigid examination on this one part of the trade, and get his diploma as a horseshoer, would be a good solution. Never say, let a man do his work good enough to freeze out these fellows, for there are a great many farmers who don't know a good job from a poor one, or, if they do, they want the skilled man's work and the cheap man's prices. A. G. STOUT.

Sinking Bar Welds. I noticed an article in the December number as to welding a piece of steel to a sinking bar. I have adopted this form of welding such pieces, as tool steel to iron, and steel to steel, and axle stubs, and all such welds which are difficult to handle in any other way. However, I first form my wedge, and chip or notch it and let it cool off while fixing the split end of the other piece. I put the wedge end in the split piece, while the latter is hot, screw them in the vise, then hammer the corners around the shoulder made on wedge piece by drawing it. Then I put in fire and proceed to weld. I welded a heavy well augur bar, two years ago, this way, which took four men to handle, and which is still holding good, although it has been fast in rock and has sections stripped off since made. I welded it with a ten-pound sledge on the anvil, after first taking a light hammer and tapping down tight in the forge while at a welding heat. I have lots of well augur work to do here, which I will write about some time in the future as it may be of interest to some brother blacksmiths. It is very difficult work to contend with. A. BRUTON.

How Should Tire Wires be Braced. Will some one please tell us in the next issue how to brace wires in rubber tires? G. W. HALL CARRIAGE WORKS.

Spoke Setting. In answer to inquiries of J. A. L. in the December number, will say that for years we have had the pleasure of knowing that our wheel building gave universal satisfaction. Our method



SPOKE DRIVING GAUGE.

of setting spokes is as follows: We always measure very carefully the mortise in the hub and make the spoke a little larger. If the mortise was $\frac{3}{4}$ by 2 inches, we make the spoke $\frac{7}{8}$ by $2\frac{1}{8}$ inches, with a slight taper on the back side. Then we dip the end in water and drive with short blows with a light hammer. For getting them in the same plane the accompanying illustration shows our driving gauge, which we found very accurate for hand work.

BICKNELL & EARLY.

Tempering Grub Hoes. Will you kindly inform me what kind of steel is generally used nowadays for grub hoes? Also, what oil or combinations of oils are used to temper such grub hoes in? I have a good many to repair and with the utmost care the most of them will crack or else be too soft or too hard when tempering in lukewarm water. OSCAR WOLF.

Question About Interfering. There is a question I would like to ask, and if some of the good brothers of the craft will answer, I should be greatly obliged. I have a horse that forges, and I have shod him every way that I know of, and still he overreaches. I have shod him light all round, and set the calk on the hind shoe back, and it is just the same. He will overreach without any shoes at all.

J. P. NELSON.

Comments on Previous Articles. Referring to the article on page 84 of the January issue, permit me to say that no attempt should be made to harden the steel spindles used in this country. With some special iron spindles case hardening is proper, but it is not so with the patent steel axles used in the United States. I make this remark because some smith might be led to think that our spindles must be hardened.

Neither do I agree with the author of "An Axle Setting Kink," on page 43, November issue. To bend an axle back to its original shape without a crook requires the use of a hammer maul or special bending device. J. G. HOLMSTROM.

Pointers on Pulleys and Shafting. I am well pleased with No. 4 of THE AMERICAN BLACKSMITH, and think the page devoted to blacksmith Queries, Answers and Notes interesting, and likely to prove profitable to readers.

The answers of C. A. B. to Mr. Morgan should be taken with considerable allowance. The rim of his emery wheels would approximately travel at 2,500, 5,000 and 3,750 feet per minute. Why should the surface speed of the 20-inch wheel be so much more than the others?

The statement that the line shaft should run at the same speed as the engine would do very well in Mr. Morgan's case, where the engine runs at 300 revolutions per minute, but is of course not intended as a general rule. Suppose, for instance, the engine should only run at 150 revolutions per minute, with possibly a 45-inch band wheel, a 45-inch pulley on the line shaft would require 24-inch hangers. Wood-working machinery generally requires high speeds, so that probably some of the pulleys would have to be over five feet, which would be out of the question. The proper way is to find out what machinery is to be installed, noting the power required, the speed, etc., and then speed the line shaft so as to get the best results.

About a year ago the buggy company here got a seven-horsepower gasoline engine. They were somewhat cramped for room, and we set up the outfit about as follows, and cannot yet see wherein it could be improved: The line-shaft is $1\frac{7}{16}$ inches in diameter and thirty feet long, with the engine close to the north wall. One hanger is just outside the 8-inch pulley that receives the belt from the engine, with a 16-inch pulley running at 260 revolutions per minute, which gives the line shaft 520 revolutions per minute. Next comes a 6-inch and then a 4-inch pulley operating a drop press to force boxes in wheels. Then a hanger, and close to that a 15-inch pulley to run hub borer, which bores out a hub ready to put in the box in a few seconds. Now another hanger, then a 6-inch pulley to run a tire drill. In short, there are seven 9-inch hangers in all; two more 12-inch pulleys to run cold tire setting machine, a 20-inch pulley to run a blower fastened between joists, a 7-inch pulley to run a general purpose drill and a 14-inch pulley to run a combined emery wheel and emery belt. The blower is belted directly without countershaft, and runs at about 2,200 revolutions per minute, making a strong blast for three fires. It would be amply powerful for another fire at the same speed, although the directions call for a speed of 3,600 revolutions per minute.

The particular point I wish to make is, if the line shaft were run at the engine speed of 260 revolutions per minute, it would necessitate a 40-inch pulley or a countershaft for blower, with about 18-inch hangers and all the other pulleys unnecessarily large. (There is no ceiling where the blower is located, or the hangers would have to be larger). We are proud of the emery belt. It runs very nicely, takes up very little room, and can be folded entirely out of the way in two seconds, when not needed.

I have several new wrinkles on setting upright boilers and repairing engines and boilers, leaky studs, cap screws, etc , things that country blacksmiths are often expected to do. Should any AMERICAN BLACKSMITH readers desire any information in my line I would be pleased to give them the best I can. B. FRANK MOHR.

A Painting Question. I am running a paint shop in connection with my carriage business on the percentage plan. I furnish all paints and varnishes, tools, shop utensils, shop, etc., solicit trade, collect bills, and become responsible for bad debts, etc. Painter furnishes light and fuel, takes apart and puts together work and hires all help and pays for same. What percentage of all receipts from the business should I receive? W. GALBREATH.

While the question is a debatable one, and dependent to some extent upon local conditions, we should decide that, approximately, the owner of the shop in this case should receive 40 per cent. and the painter 60 per cent. M. C. HILLICK.

A Gas Engine Enquiry. I would kindly ask what size engine I would need to run two fires, one drill press, one emery wheel, and one grindstone. I should like to put a gas engine in my shop for this purpose and would like to know which one is the best. Also, what size would be required to run a planer and saw in addition to the above. WM. J. ANGEMEER.

Power to Drive Various Machines. In reply to Mr. G. P. Blanchard's inquiry in the January issue, we beg to give the following power for running the different machines:

Band saw	¾ H. P.
Rip saw	2 or 3 H. P.
(depending on the thickness of stock.)	
Emery wheel	½ H. P.
Cut-off saw	1¾ H. P.
Pony planer	3 to 5 H. P.
(depending on the cut, feed and width of stock.)	

To figure this at the maximum, it would require 11 H. P. This would, of course, take care of the shafting, loose pulleys, etc. It will be safe, however, for Mr. Blanchard to use a six or seven horsepower engine, as all the machines will not be running at the same time.

We have repeatedly seen five horse-power engines running a planer, cut off and rip saw at the same time, working ten hours a day, month in and month out. A gasoline engine, if properly constructed and given some thought by the operator, will run considerably over its rated horse-power. We have also seen, in blacksmith shops, a three horse-power engine driving a circular saw, sawing two-inch oak, emery wheel, drill, and fan for blowing two fires. The cost of a six horse-power engine of modern make will be from $290 up to $350.

A. A. LAZIER, Vice-Pres't
Lazier Gas Engine Co.

The Cold Tire-Setting Machine. Is the cold tire-setting machine coming into general and practical use? From what I see and hear of it, there are some points in its favor and some against it. One of our brother blacksmiths here has one on trial, and I don't think he is very well pleased with it. In the first place, if your wheels are in good condition all well and good, but suppose your spokes are loose in the felloes, as you almost always find them in light work, to do a good job you will have to unbolt the tire, take it off and wedge the spokes; therefore, it is a small job to shrink and replace it the old way. It will be said, however, that you cannot govern the dish in wheels by the old way as well as with the machine. This is a mistaken idea, for a blacksmith that knows his business can give as little or as much dish as he pleases. Secondly, as to speed. In the heavier tires, ¾ by 1½ inches, with the machine they cut the tire somewhat longer and pull them on cold and then shrink them with the machine. Now, with a good helper, a blacksmith can put on as many or more tires in a day's run as a machine, because in making his weld he leaves the proper draw and can heat several sets at one heating. Again, it will be said that you will burn the felloes by heating in the old way, but with the latest cooling tub, such as we have, you will hardly char the wood As I said before, if your wheels are in good condition, I suppose the machines are all right, and I am not condemning them. I don't see, however, where we are saving much labor by using them. I may be very wrong, but should like to hear from some of the other smiths. WILLIAM L. GREEN.

Liniment for Diseased Feet. In reply to Mr. John A. McKay's inquiry in the December number with regard to the liniment which I use, as mentioned in Prize Contest Article No. 3 in the October number, I would give the following:

Oil of Tar	4 ounces.
Oil of Origanum	1 ounce.
Linseed Oil.	6 ounces.
Alcohol	7 ounces.

Mix and apply once per day or more, if you think necessary. I have tried this in several cases and find it all right. H.

Shoeing for Weak Heels. In answer to John A. McKay's inquiry in December's issue, I will say, in my opinion, there is no such thing as corns in horses' feet. This may seem like a broad assertion. By dissecting a few feet you will be convinced, and will have little use for liniment or corn salve.

Now, in regard to weak heels on horses, in my experience there are no weak heels except on flat feet. There are two good methods to be used. First, pare the foot level. Shoe with a thin, broad shoe, generally the full size of the foot, although flat feet will bear some trimming. Do not put any calks on the shoes at all, and the shoe should be thin enough at the heel to let the frog come to the floor or the ground. The horse shod in this way will soon have a healthy foot. Second, if a horse is required to do a lot of heavy work and hard drawing and it is necessary to have calks, shoe with bar shoes and get a good pressure on the frog Do not let the shoe rest at all on the heel. A horse shod in this way will never be lame. The shoes should be reset as often as once in four weeks. In either case fit the shoes close to the foot. A great mistake is made by some in fitting the shoes too wide. G. W. KENYON.

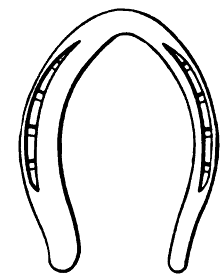
Filling Old Buggy Hubs. In reply to Mr. A. Bruton's inquiry in the January issue about filling old buggy hubs, I venture to say that if an old hub is not soaked full of grease, it can be filled satisfactorily. First, take the hub, clean it well, and get the correct measure of your spokes as to size in hub. Dress them all before driving. Be sure to have the small tenon fit snugly, and not to have the spokes too wide at the shoulder, so as to crowd out the others when driving. Get the best carriage glue and let it get good and hot. Also the spokes should be hot. Get the glue ready, dip your spokes and drive as quickly as possible, then lay your wheel away in a dry and warm place and let it stand for four days. Then put the rivets in the hub, put on the rim, set the tire, and paint it well, and I will guarantee that your wheel is as solid as a factory wheel. That has been my method of filling old hubs for the last fifteen years. C. W. METCALF.

A Query About Molding. As a great many smiths have commenced to make small castings of iron and brass to use in their business on account of the price being too high to be profitable to buy them, I would like to get some information about how to mix the clay and sand to make the molds, how to melt small lots of iron and brass, and how much more material to melt so as to be sure to have enough to fill the mold.

I should also like to know of a simple device for boring holes in gear wheels, so as to get them bored correctly.

WILLIAM DUFF.

Shoeing a Foot-striking Mule. In reply to Mr. I W. Vines' inquiry in the January issue with regard to shoeing the mule that strikes his feet together at the top of the hoof, I would say, take a plain horseshoe, and cut it out as shown. Put the



SHOE FOR FOOT-STRIKING.

weight on the outside. This shoe will control the action of the feet, throwing them wide apart. The heel calk can be turned, if desired, after cutting out the shoe. W. W. METTE.

Another Solution. In reply to Mr. I W. Vines' inquiry in regard to shoeing mules and horses that interfere, first fit the hoof, dressing it perfectly level, and then fit your shoe. Do not get the inside calk in too far, but make the toe calk and the inside heel calk about ⅝ of an inch long, and the outside heel calk square, and about 1¼ inches long, and rather slim. Turn it out well and leave your inside calk very blunt. The idea in having the outside calk longer is, that when they throw their feet in, the long calk will catch before they get the foot where they naturally set it down. In a short time they will get to traveling wider. I have practiced this for the last ten years and have found it to be the best way for that class of horses.

C. W. METCALF.

Tempering Mill Picks. In reply to an inquiry in the October number about tempering mill picks, I will give you the method I use and which I find very successful. First I will describe how to dress them. Be very careful in heating not to get them too hot. Heat slowly in a low fire, making them a low cherry red. Then proceed to forge. Take one pound of common salt and about ⅜ of a pound of soda to a gallon of soft water, stir up and allow to become still before using. Heat the picks to a scant red, then plunge them into the tempering solution, allowing them to cool therein. This solution may be used an unlimited time. H. R. FOX.

WANTED AND FOR SALE.

Want and for sale advertisements, situations and help wanted, articles new or second-hand, and business opportunities, will be inserted under this head. The rate is twenty-five cents a line. Send cash with order. No insertions of less than two lines accepted. All answers to advertisements received at this office will be forwarded to their proper destination.

X

FOR SALE.—Will sacrifice, for quick sale, one No.10 850-lb. Beaudry Champion Power Hammer, used four years. Serviceable as an auxiliary tool in a blacksmith shop.

Apply **J. H. WILLIAMS & CO., Drop Forgings, Brooklyn, N. Y.**

"A GOOD BUSINESS CHANCE." Z. H. Wannemaker, of Golden, Colo., having an established business of 15 years standing, wishes to sell his shop, tools, paint shop, house, stable, and stock in the blacksmith and wagon shop. Mr. Wannemaker is getting too old to continue the business. Some person can get a bargain. A limited number of photographs of the place will be mailed to parties wishing to locate in the healthiest city in Colorado. Golden is situated 15 miles west of Denver, and has a population of 2,000.

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Commercial Engraving

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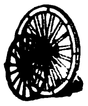
RUBBER TIRED WHEELS, fully guaranteed, per set. $15



I manufacture all sizes and grades, ¾ to 4-inch tread, with or without steel or rubber tire.

Buggy Gears with wheels and shafts, all ready for the body, $15.95. Spring Wagon Gears with wheels and shafts, $21.50. Buggy Tops, $5 65 and upwards. Buggy Bodies, $2.85; also finished top buggies for $28.75. Spring wagons, $35.00. Harness, $3 60.

Write to-day for Catalogue and net dealers' Price Lists on a full line of wheels, gears, carriage and wagon hardware—everything for the carriage shops. Address in full,

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ETNA MFG. CO., 44 JOHN STREET, NEW YORK.

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This Tuyere is made of the best Dunbar pig metal, and has the fire bowl cast with it. The fire cannot spread and keeps clean and bright. It will pay for itself in the SAVING OF COAL.

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P. O. DRAWER 974, BUFFALO, N. Y.

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BUFFALO, N. Y.

Founded 1888. **Every Friday $1.50 Per Year in advance.**

ALL THE NEWS. Reliable reports of Horse Market. Thousands of Horsemen believe this to be the best horse paper published.

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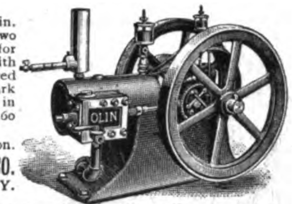

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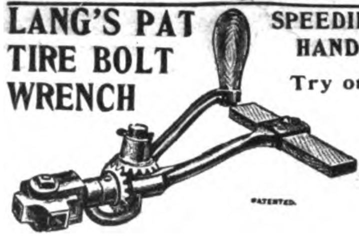
SPEEDIEST and HANDIEST.

Try one and you will use no other



WILL TAKE OFF OR PUT ON RAPIDLY 3/16, 1/4, 5/16 and 3/8 Tire Bolt Nuts, and is the most *Convenient* wrench made.

For sale by all heavy hardware dealers, or will be sent by Express, prepaid, upon receipt of $1.25.

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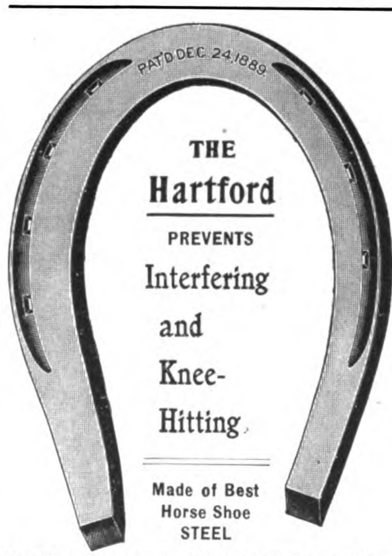

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Sample pair of either size or weight mailed, postpaid on receipt of 50 cents.
We make four sizes Nos. 1, 2, 3, 4. Three weights—Track, Medium, and Heavy.

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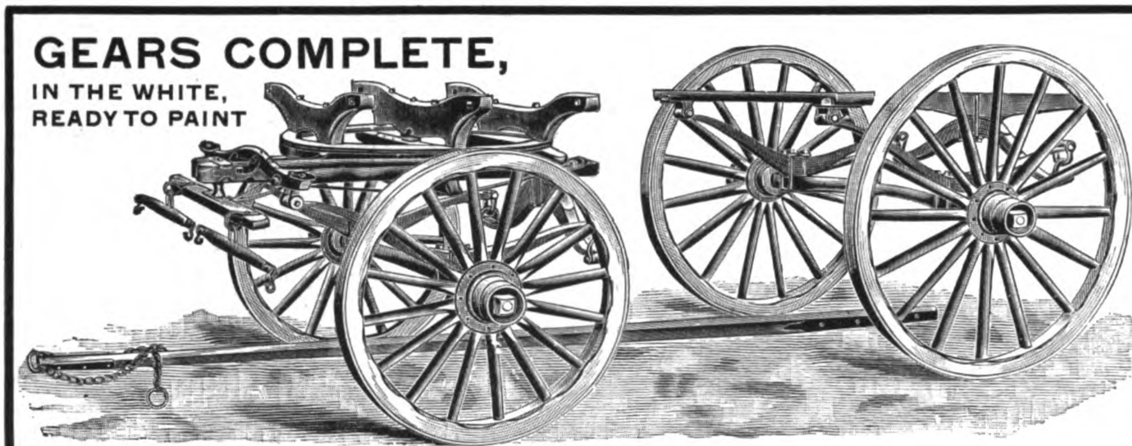
IN THE WHITE, READY TO PAINT



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ALSO FOR
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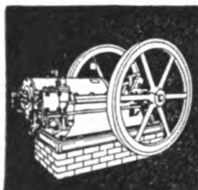

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We want your order. If you will trust us with it, we will ship you an engine that will please you. Try it. Get catalogue and prices free.

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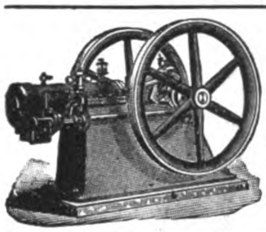

Columbus Gas and Gasoline Engines
5 to 60 H.P., Inclusive

The only cheap and convenient power for Blacksmiths.
Send for catalogue 33.

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ESTABLISHED 1824.

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Office Furniture
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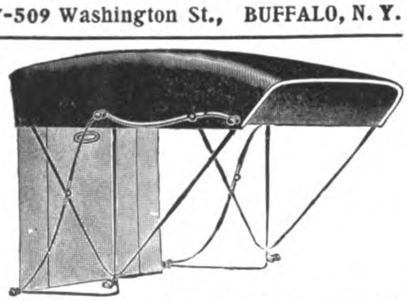

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CUSHIONS, BACKS, SEATS AND TRIMMINGS
FIRST CLASS WORK AT REASONABLE PRICES

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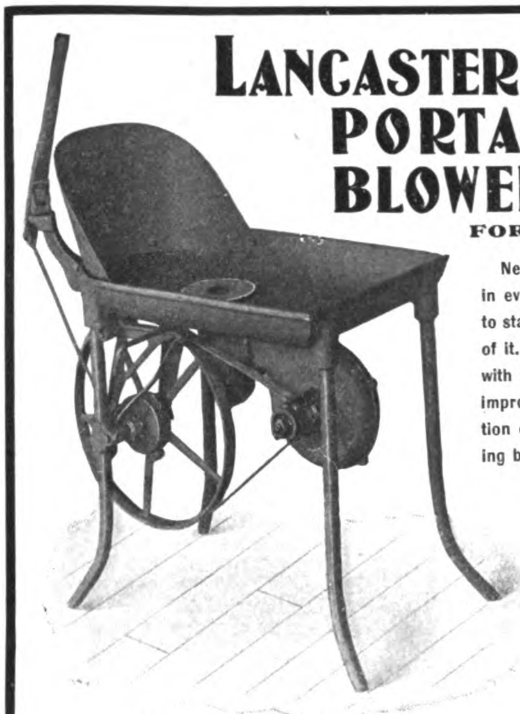
24 Cedar St. ONEIDA, N. Y.
Send for Catalogue.

LANCASTER and NIAGARA PORTABLE FORGES BLOWERS and DRILLS

FOR MODERN SMITHSHOPS.



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New and up-to-date in every respect. Built to stand service and lots of it. Forges furnished with our new ball tuyere improved fire pot, friction clutch and ring oiling bearings.

28-page, finely illustrated catalogue, yours for the asking.

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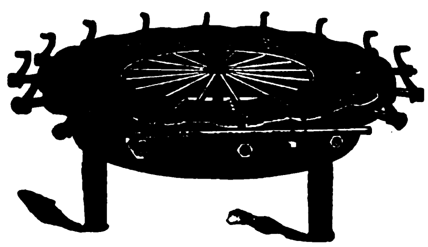
Sets Tires Cold

Without removing bolts. It keeps the dish of the wheel just right

IT IS THE GREATEST MONEY MAKER EVER OFFERED BLACKSMITHS



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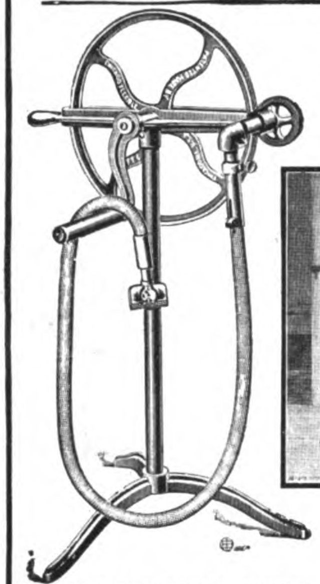
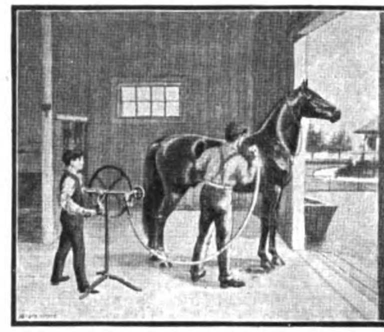
WITH THE CELEBRATED 1902 CHICAGO CLIPPER **Price, $10.75**



CLIPPED HORSES FEEL BETTER, LOOK BETTER, WORK BETTER AND ARE LESS LIABLE TO CATCH COLD. DON'T LET YOUR HORSES STAND IN THE BARN ALL NIGHT WITH A HEAVY DAMP COAT OF HAIR ON. IT WEAKENS THEM AND THEY LOSE FLESH.



No Horseshoeing Establishment is complete without the Celebrated 1902 Chicago Clipper, the greatest clipping machine ever invented. It is surprisingly simple, strong and durable, and requires no experience to operate. Has cut gearing throughout and will last a lifetime. Unlike any other made, the crank handle can be turned with the left as well as the right hand. A boy can turn it.

Blacksmiths everywhere are putting in this modern tool and are clipping horses as well as shoeing them. You can make more money clipping in the spring. Send to-day for beautifully illustrated catalog illustrating everything modern in this line, or send $3.00 and machine will be sent C. O. D. for balance. **Highest Award Pan-American Exposition.**

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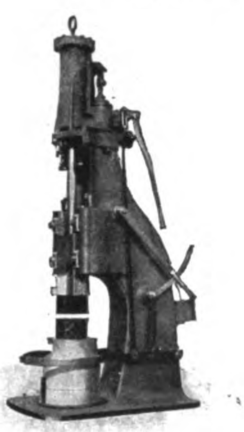
186 ONTARIO ST., CHICAGO, ILL. 97 CHAMBERS ST., NEW YORK.

We make more Clippers than all others combined.

STEAM HAMMERS

Single and Double Frame. Sizes from 100 lbs. to 5,000 lbs.



SINGLE FRAME HAMMER
Falling Weight, 400 lbs.

THE LATEST AND MOST IMPROVED DESIGN.

FOR OPERATION BY STEAM OR COMPRESSED AIR.

POST HAMMER
Falling Weight, 100 lbs.

AMERICAN ENGINEERING WORKS,

204 DEARBORN ST. CHICAGO, ILL.

VOLUME I

THE AMERICAN BLACKSMITH

NUMBER 7

BUFFALO, N.Y. U.S.A.

A PRACTICAL JOURNAL OF BLACKSMITHING.

APRIL 1902

$1.00 A YEAR
10¢ A COPY

CONTENTS.

Honest Dealings.

Before an advertisement is accepted for this journal, careful inquiry is made concerning the standing of the house signing it. Our readers are our friends and their interests will be protected. As a constant example of our good faith in American Blacksmith advertisers, we will make good to subscribers loss sustained from any who prove to be deliberate swindlers. We must be notified within a month of the transaction giving rise to complaint. This does not mean that we will concern ourselves with the settlement of petty misunderstandings between subscribers and advertisers, nor will we be responsible for losses of honorable bankrupts.

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IT MAKES PERFECT WELDS. IT UNITES READILY

IT does not have to be applied between the lap, like other compounds, but is used the same as borax.

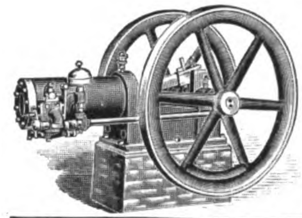
For Sale by Dealers in Blacksmiths' Supplies.

BORAX-ETTE FOR STEEL TRADE MARK A PERFECT WELDING FLUX.

PREPARED ESPECIALLY FOR WELDING
FAR SUPERIOR TO COMMON BORAX.

MANUFACTURED ONLY BY

CORTLAND WELDING COMPOUND COMPANY, CORTLAND, N. Y.



We make for the blacksmith a special 4hp. engine for drilling and blowing forges; looks like this cut, for $175.00.
We are booking orders nearly all the time for these Engines.
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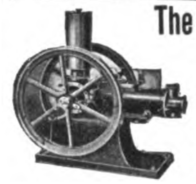

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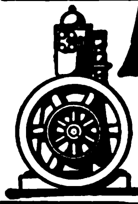

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The best engine for rugged stationary service. 2, 4, 6, 8, 10 H. P. sizes. *Get catalog free.*
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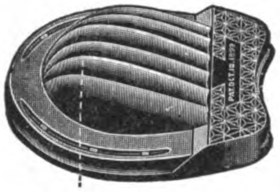

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"A. C." Pads cure all ordinary cases of Foot Lameness.

"TRY THEM."

No Slipping.
No Balling of Snow.

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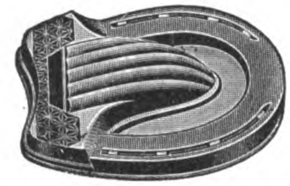

SEE THAT CUSHION?
It fills with air at each step.
That's what breaks concussion.
That's what prevents slipping.
That's what keeps the foot healthy.
That's what cures lameness.

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224 Distinct Forms

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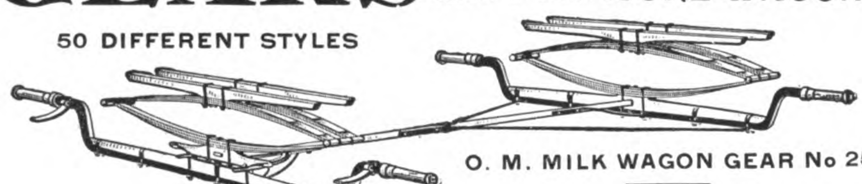

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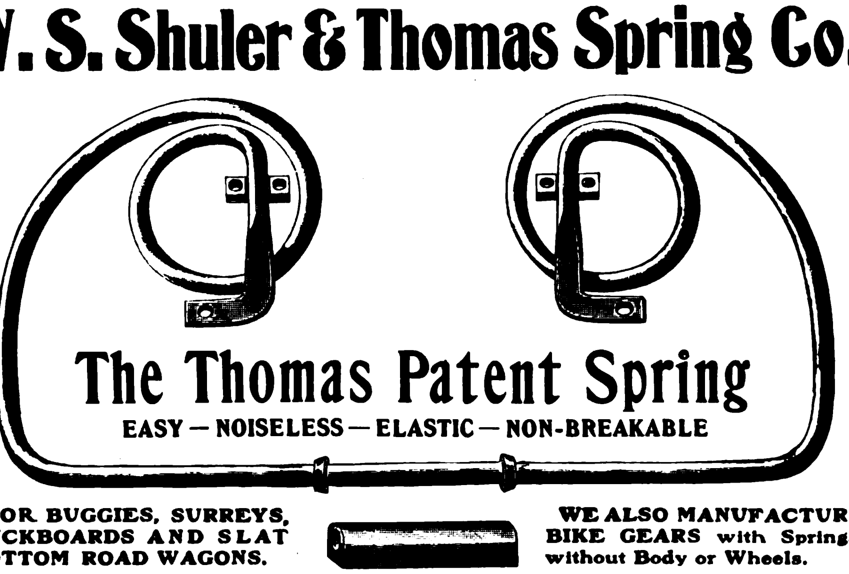
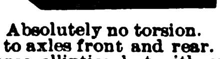
Made Especially for Blacksmithing and Carriage Work.

Positive, durable, strongest, self-cleaning, always works, quickest to change Drills, casts no shadow, will save its cost over other Chucks in saving of time. BUY THE BEST. Money refunded if not as represented. Ask your jobber for it, or send direct for prices or circular.
ONEIDA NATIONAL CHUCK CO., Oneida, N. Y., U. S. A.

W. S. Shuler & Thomas Spring Co.



FOR BUGGIES, SURREYS, BUCKBOARDS AND SLAT BOTTOM ROAD WAGONS.

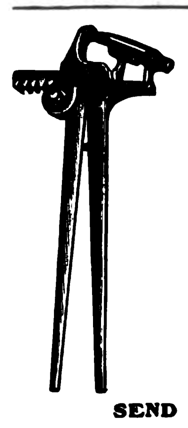


WE ALSO MANUFACTURE BIKE GEARS with Springs, without Body or Wheels.

Rides easy over rough roads. Absolutely no torsion. Keeps the body level. This spring has no end pitch and is hung close to axles front and rear. Simple to attach, no strain when attaching. Equal in length to three elliptics, but with only one thickness. A set of Buggy Springs with all connections weighs 15 pounds; Surrey Springs, 22 pounds.

W. S. SHULER & THOMAS SPRING CO.

Sole Manufacturers. Write for Catalogue and Prices. **AMSTERDAM, N. Y., U. S. A.**



The BLISS Hoof Cutter

IS MOST POWERFUL.

DOES THE BEST and largest range of work.

EASIEST kept in order.

MAKES EASIER WORK of Hoof Cutting than any other tool made.

SEND FOR PRICES.

Cut out this ad., and send it direct or through your dealer, and I will allow you 25 cents for it, if a cutter is bought. Only one ad. to be applied to a cutter; this offer good for 30 days only.

WILLIAM L. BLISS
South Egremont, Mass.

THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

VOLUME 1 — APRIL, 1902 — NUMBER 7

BUFFALO, N. Y., U. S. A.

Published Monthly at 918 Mutual Life Building, 210 Pearl Street, Buffalo, N. Y., by the

American Blacksmith Company

Incorporated under New York State Laws.

Subscription Price:

$1.00 per year, postage prepaid to any post office in the United States, Canada or Mexico. Price to other foreign subscribers, $1.25. Reduced rates to clubs of five or more subscribers on application. Single copies, 10 cents. For sale by foremost newsdealers.

Subscribers should notify us at once of non-receipt of paper or change of address. In latter case give both old and new address.

Correspondence on all blacksmithing subjects solicited. Invariably give name and address, which will be omitted in publishing if desired. Address all business communications to the "American Blacksmith Company." Matter for reading columns may be addressed to the Editor. Send all mail to P. O. Drawer 974.

Cable address, "BLACKSMITH," Buffalo. Lieber's Code used.

Entered February 12, 1902, as second class mail matter, post office at Buffalo, N. Y., act of Congress of March 3, 1879.

The National Railroad Master Blacksmiths' Association.

A neat little book has but recently come into our hands telling of the aims of the National Railroad Master Blacksmiths' Association. This organization is doing a splendid work, and is one of the most valuable assets possessed by the craft, so to speak. Too much cannot be said for what is being done by the Association, which more than deserves all the encouragement it has received from railroads and industrial concerns, and which merits the firm support of every blacksmith having the well-being of the craft at heart. The following is taken from the above-mentioned pamphlet:

"The chief aim of this booklet is to awaken an abiding interest among Master Blacksmiths of the United States, Canada and Mexico, and lead them to a truer realization of the responsibility of their positions and at the same time give a clear and comprehensive explanation as to the advantage gained by persistent study of metallurgy of iron and steel. In order to ascertain to what extent the work of the Association has become known and appreciated by our superiors, letters have been sent to several of the acknowledged leaders in railroads and manufacturing circles throughout the United States, and their prompt and courteous replies show conclusively that the efforts on our part to improve, increase and cheapen the cost of our work has been carefully watched and duly appreciated by those in authority over us, and we gratefully acknowledge the assistance they have given the Association, which has enabled us to accomplish far more than we could otherwise have done.

"This Association is composed in most part of foreman blacksmiths of railroad, car and locomotive shops, who expect by the employment of dies, formers and devices, created for that particular purpose, to reduce the cost of wrought iron and steel forgings which enter into the construction and maintenance of railroad rolling stock. The success of ten years abundantly proves that the Association has an undisputed place among the mechanical associations of the country. Hence, it is apparent that in no other branch of mechanics is there a greater need of an association of this kind than in ours. One of the strongest points in favor of this organization is that from the very first it has had the support of the heads of the mechanical departments of the various railroad and manufacturing concerns of the country, and in 1899, the American Railroad Master Mechanics' Association unanimously passed resolutions endorsing our work and pledging us their support.

"Our plan is to hold meetings at least once a year, at which time the principles governing the treatment of iron and steel, as well as the changes which the metal undergoes, are studied. At these meetings papers are read and discussed with the view of arriving at the best and most economical methods of doing work. We realize that men are not apt to improve with no other model than themselves to follow, but by coming together and exchanging ideas we learn from those more proficient in the art. The blackboard illustrations and the noon hour talks are exceedingly instructive and give rise to many new devices and methods, though they are never reported in our printed journal.

"Thus we have found that a systematic and persistent study of this branch of mechanics is not only necessary, but that it carries with it a certain amount of dignity and commercial value that no ambitious master blacksmith can afford to ignore."

The officers of the Association for 1901-02 are as follows: President, W. P. Savage, Palestine, Texas; first vice-president, John McNally, Chicago, Ill.; second vice-president, George Lindsay, Evansville, Ind.; secretary, and treasurer, A. L. Woodworth, Lima, Ohio.

In August, 1902, the Tenth Annual Convention will be called to order at Chicago, at which meeting the following subjects are arranged for consideration:

1. Uniform Methods, or Reducing Blacksmithing to an Exact Science.—S. Uren, chairman.
2. The Clean Shop; Does it Pay?—A. W. McCaslin, chairman.
3. Case Hardening.—Wm. Hodgetts, chairman.
4. Flue Welding.—W. W. McLellan, chairman.
5. Waste of Coal.—M. S. Clark, chairman.
6. Frogs and Crossings.—J. G. Jordan, chairman.
7. Track Tools.—J. H. Hughes, chairman.
8. Repairs of Frames.—W. C. Scofield, chairman.
9. Tools and Tool Steel.—Benj. Burgess, chairman.
10. Tools and Formers.—Geo. Tutbury, chairman.
11. Oil as Fuel.—Thos. McNeal, chairman.
12. Springs, Making and Repairing.—C. A. Miller, chairman.
13. The Oil Furnace, Best Form.—G. H. Judy, chairman.
14. Best Form of Forge for Using Oil.—T. Lace, chairman.
15. Repairing Broken Piston Rods; Is it a Good Practice?—William Young, chairman.

The Oldest Blacksmith.

In the January and February issues of this journal, the request was made for the name of the oldest American Blacksmith, and numerous responses were received. In our next issue will be presented the result of our inquiry, which we think will be a revelation to most of the craft.

The Apprentice, The Foundation of Blacksmithing.

D. R. MILLER.

Though taking a great interest in carriage work and horseshoeing, and being an ardent admirer of the horse, my experience is in railroad work, and hence my remarks will apply to railroad work only. I wish to point out a few facts which are of great importance to the trade, and which will affect its future very much, and as THE AMERICAN BLACKSMITH is founded in the first year of the new century, my remarks will be upon the foundation of blacksmithing, the apprentice.

The number of apprentices is becoming less and less each year. Blacksmithing does not seem to appeal to the boy of the present age. No doubt, this is due to the fact, that the work is hard, hot and sooty. Blacksmithing is all manual labor—no machine to do the work, while you sit by and read the paper.

The apprentices, in this section at least, do not appear to have the ambition necessary to make first class smiths. They appear to be content if they can place themselves on the same level with the average class, instead of striving to reach the top round of the ladder. This, no doubt, is the case in a great many instances, where a boy is apprenticed through necessity and not from choice. And when a boy is compelled to learn a trade, other than the one he wishes to learn, it frequently occurs that he worries through his time, not caring much whether he ever excels or not. Who is to blame? Naturally, the parents will be censured, for compelling a boy to learn a trade he dislikes. But the parents are not always the blame. They seek to place their son where he is by nature adapted, but find it impossible, as all professions are well crowded. The parents then look about for something else, and find the smith department the most accessible on account of so few voluntary applications for this trade.

Ofttimes the apprentices do not receive the proper encouragement, especially when they are dilatory. They should be given all the encouragement possible, and advanced as rapidly as deserving. The sooner the apprentice becomes master of his trade, the more benefit is derived from his labor by his employer.

There is also a class of smiths, which I term roving apprentices. They are employed as helpers to the smith, and after a number of years become quite handy. Often they are given light work at the forge, or else they go to other shops and get employment as smiths. Some of these young men make very good smiths, while others prove complete failures. This state of affairs is responsible for so many incompetent smiths traveling about the country. I understand the Blacksmiths' Union is endeavoring to break up this practice, which, if accomplished, will result in much good, as it will induce those who wish to learn the trade to become apprentices, so that finally the superior standard of Blacksmithing will dominate. I should like to hear from older craftsmen on this subject, for it seems to me to be a most important one and vitally affecting the craft. What is the experience of smiths in other sections than Virginia?

CALIFORNIA'S WOMAN BLACKSMITH, HER HUSBAND AND SHOP.

A Woman Blacksmith.

It will no doubt interest the readers of THE AMERICAN BLACKSMITH to know of all women who may be engaged in the trade. The town of Santa Rose, California, possesses two blacksmiths shown in the accompanying illustration, Mrs. Sarine Ann Faber and her husband, C. F. Faber. The woman, except for the short time while domestic duties claim her individual attention, labors from early morning till late in the afternoon helping her husband at the little smithy on First Street. Together they build wagons, set tires, make welds, and in fact the woman takes part in all work done at the shop. They are each about forty-nine years of age, strong and muscular, and with equal skill use the sledge, hammer, square or plane. Mr. Faber is an expert horseshoer, and there are but few who can beat him in treating bad feet.

His wife does not labor at the forge because of the increased profits, but because she enjoys the work, and would rather be helping her husband than be at home reading when all the housework is done. In fact, this woman prefers the heat of the forge to that of the oven, and finds more pleasure in working hot iron than in kneading bread.

Mrs. Faber cares nothing for the gossip a woman blacksmith naturally gives rise to, but takes pleasure in the distinction of being one of the few females interested in the forge. Many who come to the shop ask Mrs. Faber if she is going to shoe the horse, and she tells them she will when her husband cannot. "The best first," she says, or "the teacher before the scholar."

All honor to the smiths of Santa Rose. May they live long and prosper.

The Demand for Trained Workmen.

H. E. ZAPF.

Asst. Sec'y Amer. Corres. Schools.

It is hardly necessary at this day to present an elaborate argument that an increase in the efficiency of the workmen in an industry must, of necessity, prove of great value to that industry, and that anything which tends to increase the knowledge of the subordinates, from whose ranks future foremen and superintendents must be drawn, cannot fail but result to the advantage of the employer, in increased profits, due to the more intelligent and economical management of the plant.

While it must be admitted that during the past twenty-five years most gratifying progress has been made in American mechanical engineering and the education of mechanical engineers, yet it is evident to the managers of mechanical establishments that there is a great lack of competent mechanics below the grade of the mechanical engineer to take the increasing demands and responsibility of the work and properly carry it out.

The standard of the work of the machinist has rapidly moved forward in refinements and complications. He is called upon to read and understand intricate drawings, and to make quickly and with certainty very exact measurements and computations in the shop. He must deal with tempered steel for almost numberless uses and for the severest requirements. Hardened steel parts must be fitted to an extent and with a precision never thought of twenty-five years ago.

If the position of machinist is a hard one to fill, what is to be said of that of foreman? The opinion has been expressed that the most difficult position to fill is that of shop foreman. Is it not wise, economical shop management which is giving us the leading position in the machine markets at home and abroad? It is the shop which can build the best machinery at a less cost than others which is sure to be successful; and to secure this the management must depend upon no man more than the shop foreman. He must ascertain all possible legitimate ways and means for reducing shop costs, stopping leaks and losses without reducing the manliness of the men and the standard of the work. How many men of this kind do we get, and what opportunity is there to-day for training for such positions?

With this great and growing demand for the profession, and with the splendid opportunities open to young men who will fit themselves to be mechanics, and who in turn are demanding of the profession the chance to fit themselves, the question is forced to our attention: How can these needs be best met? By home study in a correspondence school.

Instruction by mail is not to be preferred to that gained by actual attendance at a good school, but when the latter is not possible or practicable, correspondence schools are a great blessing, and no one can deny that they have already gained a prominent position among the educational institutions of this country. They offer substantial aid to all classes, and while it should be remembered that there is no royal road to learning, no help should be despised.

The growth of correspondence schools during the past few years has been both rapid and wonderful.

The great impetus recently given to all technical trades and professions by the announcement of a new era of commercial prosperity in the United States has forcibly brought to the attention of the world the great value of technical education, acquired simultaneously with practical experience. The graduate of the ordinary technical school is obliged to accept a minor position in his profession, and trust to his education for rapid advancement. But the ambitious mechanic can make immediate application of his technical knowledge and secure, in the shortest possible time, a lucrative position.

The various engineering colleges are open to but few. Night schools are found only in the large cities. The correspondence system of instruction fully meets the requirements of the wage-earners by supplying the education for which employers are willing to pay, and pay well. It makes no difference where the student may be; whether in the same building with the school, or in another continent, wherever the mails go he can carry on his studies. This offers ambitious young men in foreign countries an opportunity for getting a technical education that has never been available before.

The Study of Cast Steel in the Blacksmith Shop.—2.

GEORGE F. HINKENS,
Foreman Blacksmith, Westinghouse Air Brake Co.

Annealing.

It is not necessary to go into much detail on the question of annealing steel. The object is two-fold, to remove any discrepancies due to forging, and to soften, so it can be worked into any desired shape. The restoration of the particles of steel to their normal state, that have been changed by forging, is brought about by annealing. Therefore, the answer to the question as to what degree of heat will cause the changes that will bring about uniformity in structure, is that when the steel is uniformly hot throughout the mass, it should be removed from the fire at once. If left in any longer, it will become "soaked" and will not temper as it should.

The annealing due to slow cooling will remove in a great measure all undue strains that were put in the steel by hammer, sledge or steam hammer. Annealing allows the particles of steel to arrange themselves in their right condition, but we must remember that bad strains can only be imperfectly eliminated by annealing, and it should be the inflexible purpose of the tool-smith to guard against working strains into the steel while forging. Steel that has been improperly worked, that is, that has had the grain crushed, cannot be rectified by annealing; there is a certain amount of brashness that no annealing can eliminate. The particles that, through bad or cold working have become crushed, telescoped and disintegrated, will not, like the lover, come back, but, like the shrew, are full of mischief and vexation. This point should always be borne in mind.

Hardening and Tempering.

The action of heat is closely related to the hardening process, and the value of the physical and carbon properties are certainly known to be dependent on the degree of heat in the steel article before immersion. The cohesion, adhesion, or whatever you may wish to call it, or the chemical affinity of carbon and iron, are without doubt influenced by too high or too low a heat.

In speaking of heat for hardening, we are governed by carbon points; the higher the carbon, the lower must be the heat which will register itself. When the tool is fractured, if it shows a sandy grain, it proves that the steel was overheated; if, on the other hand, the grain is fine and of clear appearance, it indicates a proper heat; if a variation in grain, it indicates uneven heating.

Cooling a piece of steel that is unevenly heated causes a complex arrangement of the particles, a separation in one place and a crowding in another, thus producing strains and water cracks. Hence, it behooves the hardener to so regulate the heat on the article to be hardened that the whole mass will be uniformly heated. It should be as uniform in color as possible. A piece of steel so heated, and immersed in water that is in motion, will give results that will gladden the hearts of all concerned. I said to keep the water in motion, and I will tell you why. If the article to be hardened is bulky, the heat radiating from it will repel the water, and envelop the article in a film of steam surrounded by hot water, and as steam and hot water are poor conductors of heat, they will prevent rapid cooling. Therefore, by keeping the water in motion, you keep the article to be hardened surrounded by cold water, thus causing more rapid cooling and an increase in hardness. The more instantaneous the cooling, the more harmonious the particles, coupled with uniformity of good hardness.

One of the great difficulties about heating steel for hardening is that of determining the time when the whole mass is uniformly hot. Mr. W. O. Johnson and myself experimented with two $\frac{3}{4}$-inch worn-out taps. We laid both taps in the fire and brought them up to a hardening heat; we then withdrew one from the fire and plunged it into cold water. The other tap we held in the fire for about seven minutes; during this longer period we were very careful about keeping the heat at a fixed state, and also at the same temperature as the first tap. After the expiration of seven minutes we plunged it in cold water. On examination we found that the tap that received the short period of heat did not arrive at the refining heat, and consequently showed a very coarse grain; whereas, the one that remained in the fire the longer period had attained the refining heat and showed, after breaking, a nice, refined grain.

Thinking that there might be a difference in the steel, we repeated the operation, only reversing the order of taps as to fire exposure, and got the same results. This experiment emphatically demonstrated that the relative difference between the coarse and fine grain was due to proper time exposure. The surface particles are heated first, and from the surface particles the heat is transmitted to the adjacent ones, and soon to the interior. The heat of the surface particles must lag, or wait for the adjacent particles, and so on through the mass. When all the particles in the mass have arrived at a corresponding heat, the article should then be taken from the fire and immersed. If you ask me how I know when the mass arrives at the ideal heat my answer is, I do not know. When in doubt, take the safer side, and keep the steel in the fire a little longer, as it is a question of judgment, and comparative at that. The time required to heat a piece of steel for hardening depends upon the size and shape of the article, —anywhere from a few seconds up to several hours. A milling cutter, 8 inches by 10 inches long, will require from three to four hours time.

I wish to call your attention to the utilization of old axle steel for blacksmith shop tools, when only the factor of battering and abrasion is to be taken into account, such as flatters, fullers, sledges and sets, and all tools that call for from 60 to 70 carbon points in crucible steel. Of course, we know that axle steel containing from 40 to 45 carbon points will not withstand battering, and, when left in its soft and graphitic state, will turn over like a "mushroom" bullet when under the influence of blows from the sledge. We have experimented, and with good success, in utilizing some of our old steel axles for the above mentioned tools. Our method is simply to harden the head, and on such tools as flatters and sets, to harden both the head and face. The process merely involves a determination of the proper degree of temperature which can be permitted for hardening in water, and I find that some degree of caution is necessary to obtain the desired heat. If the heat is too low, the temper in the tool will be too soft to withstand battering, and again, if the heat is too high, it will hasten the destruction of the tool by causing the head to break away, and for the reason of not knowing the exact carbon points, there is no means of absolutely determining the right heat, and therefore our only guide is to calculate from its action under the hammer.

Axle steel containing 45 carbon points should be drawn or tempered to a second blue. This will change the steel from a loose to a combined condition, thus making the working parts or the parts that receive the force, more compact. We have in use in our shop tools made from old axle steel that are just as serviceable for the purpose mentioned as any crucible steel of 60 or 70 carbon points.

Of course, I do not wish to be understood as recommending old axle steel to take the place of the regular tool steel, for flatters, fullers, sets, etc. Far from it. Old axles are too uncertain a quantity; they are too variable in carbon and other components, and therefore cannot be relied upon for the purposes in view. I give this merely as an experimental investigation, and it would seem that theory would condemn us. However that may be, strange facts often confront the theorist.

Soft Centers.

It is found by experience, that the time of immersion in cold water, for hardening the outside to a proper depth, can only be learned from observation, as the tool-smith must be guided entirely by the bulk of the article to be hardened and a hissing sound which the steel produces while cooling. This certain sound, and at times a tremor, indicates the effect to be produced. As soon as he discovers the effect by the above process, the steel should be taken out of the water and immersed in oil, which should be low in cooling value. The oil will prevent the outside from becoming soft, and retain a soft center. This, in a measure, applies to articles of small dimensions, large pieces being hardened only to a certain depth from the surface, and if properly heated, for the reason that the heat in the interior cannot be extracted quickly enough. In my opinion, the immersion in oil is beneficial for the reason that it will not shock the particles, giving them a longer time to arrange themselves than if cooled entirely in water. In order to substantiate this, let us take a thin, flat and irregularly shaped piece and cool in cold water, and we find that it will crack or warp. The same article cooled in oil will not crack and will warp only slightly. The reason is obvious. Oil is a slow conductor of heat, and allows the particles to act more slowly; hence the first operation in water will take care of the exterior of the steel. The second, in oil, takes care of the interior, thus preventing the steel from cracking by giving it time to cool slowly. The danger of cracking increases when the parts are unequally thick; by that I mean when they are irregular in their shape.

In order to obtain the right depth of hardness in a tap or reamer, a good way is to take a worn-out tap or reamer and use it as a trial piece, both as to heat and length of time for keeping in water. Break a piece off and you will see the effect on examination, and a few trials will put you in line. Hardening in oil, or combination of oil and water, has its limitations, however, and we must be governed entirely according to conditions. Of course, the object of a soft center in a tap or reamer is to increase the torsional strength. We felt a little proud of our success in hardening taps with a soft center from the fact that the Crescent Steel people placed some of our samples on exhibition at the World's Fair in 1893.

These samples had the soft center drilled out, making them hollow. The holes were drilled after sample pieces were hardened.

Recalescense.

Recalescense is a phenomenon that is attracting considerable attention. I will dwell on it only so far as to give you a slight idea of what it is.

A writer says: "The point of recalescense is that temperature, varying for each carbon percentage, at which cooling steel pauses awhile, gets hotter of itself, and again goes on cooling." When the steel gets hotter of itself it is at the refining point, or the point of recalescense, and at the right stage for cooling.

Mr. F. C. Law, who perhaps has given the subject more study than any investigator that I know of, says that "the point of recalescense is indicated by prominent waves playing over the bar, when the wave disappears it disappears from the center of the bar, which is an indication that the refining is completed, and the temperature of the bar is then uniform throughout, and if quenched under these conditions we obtain the ideal steel in the hardened state." The hope is justified that in the near future we shall learn to recognize that very exact point of recalescense, but for the time being the most of us will have to depend on the old methods.

When we consider the subject of steel in all its different phases, we cannot doubt its importance and it will be profitable for us to study the question in all its bearings.

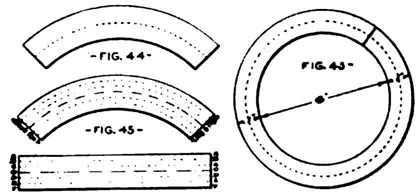
The Elements of Blacksmithing.—5.

Calculations for Amount of Stock Required.

JOHN L. BACON,
Instructor in Forging, Lewis Institute, Chicago.

Before continuing, it may be advisable to consider ways of estimating the amount or length of stock required for any particular forging. The simplest of these cases is where the stock is simply *bent* into shape, as in the many kinds of scroll work, bent hooks, cold shut rings, etc. One way of determining the length of straight stock required to bend up into some given shape was described in the preceding paper, where the lengths of the straight pieces necessary to bend the eye and the hook ends of the gate hook were determined by laying a string or piece of wire on top of the drawing, and then straightening it out and measuring the length from that.

Probably the simplest shapes we have to deal with are circles or rings. The stock required for bending such shapes can be either calculated or measured from the drawing. The one rule to follow in measuring all bent work is to *always measure the length of the material on an imaginary line running through the center of the stock.* To illustrate, we will suppose we have a ring like Fig. 43



FIGS. 43, 44 AND 45, CALCULATING LENGTHS OF CURVED SHAPES.

to calculate the exact length of the stock required. One way is to calculate the length mathematically, and in the majority of cases this is probably the easiest and most accurate method. This is done in the following way: The circumference, or distance around a circle, is equal to the diameter multiplied by $3\frac{1}{7}$ (or more accurately, 3.1416). We, of course, must measure the stock through the center of the bar, as shown by the dotted lines. To the inside diameter of the ring add one-half the thickness of the stock, which would give us in this case 7". Then $7'' \times 3\frac{1}{7}'' = 22''$, which gives the amount of straight stock we must cut to bend up the ring in question.

The reason for measuring the length

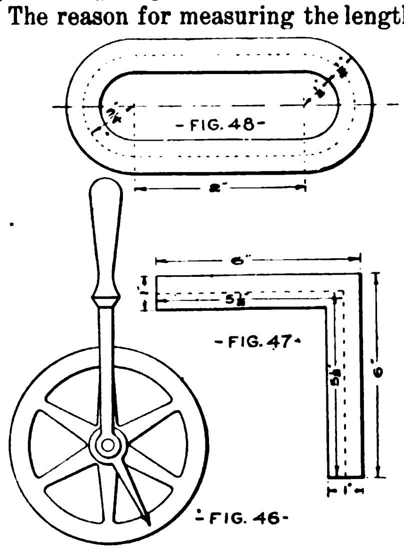


FIG. 46, MEASURING WHEEL. FIGS. 47 AND 48, LENGTHS FOR ANGLES AND LINKS.

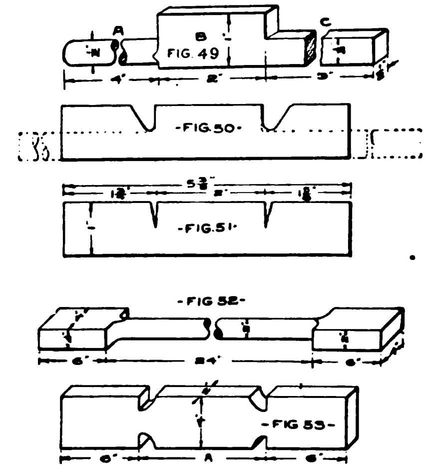
of stock through the center of the bar is this: Suppose we take a straight bar of iron with square ends and bend it into the shape shown in Fig. 44. If we measure the length of the bar on the inside edge of the bend and then on the outside, we will find the inside shorter than the original bar, the outside longer. The metal must, therefore, squeeze together or upset on the inside, and stretch or draw out on the outside. This being the case, there must be some part of the bar which neither squeezes together nor draws out, and this part of the bar lies almost exactly in the center, as shown by the dotted line. It is on this line of the bent bar that we must do our measuring in order to determine the original length of the straight stock. To make the explanation a little clearer, suppose we scratch lines upon the surface of a polished bar shown in the lower drawing of Fig. 45, and then bend this bar, as shown in the upper drawing. Comparing the measurement of each line with the length of the same line before bending, we would find the outside line A A had lengthened considerably; the line B B would be somewhat lengthened, but not as much as A A, and C C would be lengthened less than B B. The line O O through the center of the bar would measure almost exactly the same. The line D D we would find shorter than O O and E E shorter than D D, and F F shorter than any. Consequently to find out the length of stock to bend into any shape, measure on a line running through the center of the bent shape.

One method of measuring stock for scrolls, etc., has been well described by Mr. W. C. Stimpson in his article on Decorative Iron Work in this journal. That is, by stepping around a scroll with a pair of dividers and then laying off the same number of spaces in a straight line and measuring the length of that line. Still another way used for measuring around a wheel for the length of the tire, and sometimes for other work, is to use a light measuring wheel similar to the one shown in Fig. 46, mounted in some sort of a handle. This is a thin light wheel, generally with a circumference of 24 inches. The side of the rim is sometimes graduated in inches by eighths. To use it, the wheel is placed lightly in contact with the line or object which we wish to measure, with the zero mark on the wheel corresponding to the point we wish to start to measure from. The wheel is then pushed along the surface to be measured with just pressure enough to make it revolve. By counting the revolutions made and setting the pointer to correspond to the end of our line when we reach it, it is an easy matter to push the wheel over a straight line for the same number of revolutions, and part of a revolution, as shown by the pointer, and measure the length. If the wheel is graduated, the length run over can, of course, be read directly from the figures on the side of the wheel.

In Fig. 47 is a simple angle bend with a forged square corner. In calculating the length of stock for this we follow our settled rule and measure through the center of the stock on the dotted line. It would require $5\frac{1}{2}$ inches for each side, or a total of 11 inches. As another example, take the link shown in Fig. 48. We can divide this up into the two semicircles at the ends and the two straight sides; calculating as always through the center of the stock, we would have two straight sides 2 inches long, or 4 inches, and the two semicircular ends, or one complete circle for the two ends, the length required for these two ends would be $1\frac{1}{2}'' \times 3\frac{1}{7} = \frac{66}{14}'' = 4\frac{5}{7}''$, or nearly enough $4\frac{11}{16}''$. The total length of the stock then would be $4'' + 4\frac{11}{16}'' = 8\frac{11}{16}''$ to which must be added a slight amount for the weld.

When calculating the amount of stock required to make pieces in which the stock must be forged into another shape, there is also one rule which must be remembered. The finished forging contains the same amount, or volume of stock, no matter in what shape it may be, as the piece we start with (there is a slight loss from the scale, but this we will not consider at present.) The forging, Fig. 49, could be made in this manner: Take a piece of straight stock and make two cuts and widen them with a fuller in the manner shown in Fig. 50. The ends on either side of the cuts are then drawn down to size as shown by the dotted lines, the center being left the size of the original bar. We would use $\frac{1}{2} \times 1$-inch stock, as these are the dimensions of the largest parts of the forging. For convenience in calculating we will divide the forging into three parts: The round end A, the central rectangular block B, and the square end C. The block B will, of course, require just 2 inches of stock. The end C has a volume of $\frac{1}{2}'' \times \frac{1}{2}'' \times 3'' = \frac{3}{4}$ of a cubic inch. Our stock ($\frac{1}{2}'' \times 1''$) has a volume of $\frac{1}{2}'' \times 1'' \times 1'' = \frac{1}{2}$ of a cubic inch for each inch of length. To find the number of inches of stock required to make the end C, we must divide the volume of this end ($\frac{3}{4}$ cubic inch) by the volume of one inch of stock (or $\frac{1}{2}$ cubic inch). Thus, $\frac{3}{4} \div \frac{1}{2} = 1\frac{1}{2}$ inches. It will therefore require $1\frac{1}{2}$ inches of stock to make the end C.

The end A is really a round shaft, or cylinder, 4 inches long and $\frac{1}{2}$ inch in diameter. To find the volume of a cylinder we multiply the square of half the diameter by $3\frac{1}{7}$, and then multiply



FIGS. 49, 50, 51, 52 AND 53, ESTIMATING STOCK REQUIRED.

this result by the length of the cylinder. The volume of A would be $\frac{1}{4} \times \frac{1}{4} \times 3\frac{1}{7} \times 4 = \frac{11}{14}$. And the amount of stock required to make A would be $\frac{11}{14} \div \frac{1}{2} = 1\frac{4}{7}$ inches in length, which is practically equal to $1\frac{5}{8}$ inches. To the above amount of stock we must add a small amount to allow for scaling, allowing altogether about $1\frac{3}{4}$ inches. We need stock for the different parts of our forging as follows:

Round shaft A.................$1\frac{3}{4}''$
Block B ....2″
Square shaft C..................$1\frac{5}{8}''$
Total..............................$5\frac{3}{8}''$

First taking a piece of stock $\frac{1}{2}'' \times 1'' \times 5\frac{3}{8}''$ we would make the cuts for drawing out the ends as shown in Fig. 51. In such a case as the above, it is not always necessary to know the *exact* amount of stock to cut. We could have taken what we knew to be more than enough to make the forging, made our central block the proper dimensions, and worked down the extra metal into the ends and trimmed them off to the proper length. There are frequently times when we *must* calculate the amount of material required accurately, such as the following:

Take a case like the forging shown in Fig. 52. Here we have what amounts to two blocks, each $2'' \times 4'' \times 6''$, connected by a round shaft 2 inches in diameter. To make this we would use stock 2 inches thick and 4 inches wide, starting by making cuts as shown in Fig. 53, and drawing down the center to 2 inches round. It is, of course, necessary to know how far apart to make the cuts when starting to draw down the center. The volume of a cylinder 2 inches in diameter and 24 inches long would be $1'' \times 1'' \times 3\frac{1}{7} \times 24'' = 75\frac{3}{7}$, which we may take as $75\frac{1}{2}$ cubic inches. For each inch in length our stock would have a volume of $4'' \times 2'' \times 1'' = 8$ cubic inches. Therefore we would require $75\frac{1}{2} \div 8 = 9\frac{7}{16}$ inches of stock to form the central piece, consequently the distance between our cuts, shown as A in Fig. 53, would have to be $9\frac{7}{16}$ inches. Each end would require 6 inches of stock, so the total stock necessary would be $6 + 6 + 9\frac{7}{16} = 21\frac{7}{16}$ inches.

Any forging can generally be separated up into several simple parts of a uniform shape, as was done above, and in this form the calculation can be easily made, if it is always remembered that the *amount of metal* remains the same, and in forging we merely alter the shape and not the volume.

To find the weight of any wrought

WEIGHTS OF BAR STEEL PER LINEAL FOOT.

The weight given in the table is for a bar of steel 1 foot long and of the dimensions named.

Size in Inches.	Rounds, Weight in Lbs.	Squares, Weight in Lbs.	Width in Inches.	THICKNESS IN INCHES. $\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1
$\frac{3}{16}$	.094	.120	1	.21	.43	.638	.850	1.06	1.28	1.47	1.70	2.12	2.55	2.98	....
$\frac{1}{4}$	.167	.213	$1\frac{1}{8}$	.24	.48	.720	.955	1.20	1.43	1 68	1.92	2.39	2.87	3.35	3.83
$\frac{5}{16}$	.261	.332	$1\frac{1}{4}$	.27	.53	.797	1.06	1.33	1.59	1.86	2.12	2.65	3.19	3.72	4.25
$\frac{3}{8}$	.375	.478	$1\frac{3}{8}$	.30	.59	.875	1.17	1.46	1.76	2.05	2.34	2.92	3.51	4.09	4.68
$\frac{7}{16}$	.511	.651	$1\frac{1}{2}$	.32	.64	.957	1.28	1.59	1.92	2.23	2.55	3.19	3.83	4.47	5.10
$\frac{1}{2}$	.668	.851	$1\frac{5}{8}$	.35	.69	1.04	1.38	1.73	2.08	2.42	2.77	3.46	4.15	4.84	5.53
$\frac{9}{16}$	.845	1.076	$1\frac{3}{4}$	.38	.75	1.11	1.49	1.86	2.23	2 60	2.98	3.72	4.47	5.20	5.95
$\frac{5}{8}$	1.044	1.329	2	.43	.85	1.28	1.70	2.12	2.55	2.98	3.40	4.25	5.10	5.95	6.80
$\frac{3}{4}$	1.503	1.914	$2\frac{1}{4}$	.48	.96	1.44	1.91	2.39	2.87	3.35	3.83	4.78	5.75	6.69	7.65
$\frac{7}{8}$	2.046	2.605	$2\frac{1}{2}$	.53	1.06	1.59	2.12	2.65	3.19	3.72	4.25	5.31	6.38	7.44	8.50
1	2 672	3.402	$2\frac{3}{4}$	.59	1.17	1.75	2.34	2.92	3.51	4.09	4.67	5.84	7.02	8.18	9.35
$1\frac{1}{4}$	4.175	5.316	3	.64	1.28	1.91	2.55	3.19	3.83	4.46	5.10	6.38	7.65	8.93	10.20
$1\frac{1}{2}$	6.012	7.655	$3\frac{1}{4}$	.69	1.38	2.07	2.76	3.45	4.15	4.83	5.53	6.91	8.29	9.67	11.05
$1\frac{3}{4}$	8.183	10.419	$3\frac{1}{2}$	.75	1.49	2.23	2.98	3.72	4.47	5.20	5.95	7.44	8.93	10.41	11.90
2	10 69	13.61	$3\frac{3}{4}$	.80	1.60	2.39	3.19	3.99	4.78	5.58	6.38	7.97	9.57	11.16	12.75
$2\frac{1}{4}$	13.52	17.22	4	.85	1 70	2.55	3.40	4.25	5.10	5.95	6.80	8.50	10.20	11.90	13.60
$2\frac{1}{2}$	16.70	21.26	$4\frac{1}{2}$	.96	1.92	2.87	3.83	4.78	5.74	6.70	7.65	9.57	11.48	13.39	15.30
$2\frac{3}{4}$	20.21	25.73	5	1.07	2.13	3.19	4.25	5.31	6.38	7.44	8.50	10.63	12.75	14 87	17 00
3	24.05	30.62	$5\frac{1}{2}$	1.17	2.34	3.51	4.67	5.84	7.02	8.18	9.35	11.69	14.03	16.36	18.70
$3\frac{1}{2}$	32.74	41.68	6	1 28	2.55	3.83	5.10	6.38	7.65	8.93	10.20	12.75	15.30	17.85	20.40
4	42.77	54.45	7	1.49	2 98	4.46	5.95	7.44	8.93	10.41	11.90	14.87	17.85	20.83	23.80
5	66 82	85.08	8	1.70	3.40	5.10	6.80	8.50	10.20	11.90	13.60	17.00	20.40	23.80	27.20

iron forging, the volume should first be found in cubic inches, and this volume multiplied by 0.2779, the weight of wrought iron per cubic inch. (If the forging is made of steel, multipy by 0.2836 in place of 0.2779.) This will give the weight in pounds. Below is given the weight of both wrought and cast iron and steel, both in pounds per cubic inch and per cubic foot.

	Per Cubic Foot.	Per Cubic Inch.
Cast iron.........	450 pounds.	.2604 pounds
Wrought iron.	480 "	.2779 "
Steel	490 "	.2836 "

Suppose we wish to find the weight of the forging shown in Fig. 49. We had a volume in A of $\frac{1}{1}\frac{1}{4}$ cubic inches, in C of $\frac{3}{4}$ cubic inches, and in B of 1 cubic inch, making a total of $2\frac{1}{2}\frac{5}{8}$ cubic inches. If the forging was made of wrought iron it would weigh $2\frac{1}{2}\frac{5}{8}$ x 0.2779=0.7 of a pound. The forging shown in Fig. 52 has a volume in each end of 48 cubic inches and in the center of $75\frac{3}{7}$ cubic inches, making a total of $171\frac{3}{7}$ cubic inches, and would weigh, if made of wrought iron, 47.64 pounds.

A much quicker way to calculate weights is to use a table such as is given above. As steel is now commonly used for making forgings this table is figured for steel. The weight given in the table is for a bar of steel of the dimensions named and one foot long. Thus a bar 1 inch square weighs 3.402 pounds per foot, a bar $3\frac{1}{2}$" x 1" weighs 11.9 pounds per foot, etc.

To calculate the weight of the forging shown in Fig. 52, we would proceed as follows: Each end is 2" x 4" and 6" long, so as far as weight is concerned we have a bar 2" x 3" and 12" long. We find in our table that a bar 4" x 1" weighs 13.6 pounds for each foot in length; so a bar 4" x 2" being twice as thick would weigh twice as much, or 27.2 pounds, and as the combined length of the two ends of our forging is one foot this would be their weight. We find in the table that a bar 2" in diameter weighs 10.69 pounds for every foot in length; consequently the central part of our forging being 2 feet long would weigh 10.69 x 2, or 20.78 pounds. The total weight of the entire forging would be 47.98 pounds. This seems to show a difference between this weight and the weight as calculated before, but it must be remembered that before we calculated the weight for wrought iron while this calculation is made for steel.

(To be continued.)

The Blacksmith's Fire.

J. G. HOLMSTROM.

The aphorism: "A poor fire never makes a good weld" we all agree to, but it should be added, "A poor smith never makes a good fire." The fire must be made with regard to size of work and power of blast. No arbitrary rule can be laid down. The rule for a fire in a factory for heavy work with strong power blast does not hold good for the village smith with all kinds of work, and hand blowers or bellows.

In making a fire, it is essential everywhere that the fire pot should be cleaned out well so as to leave no fine cinders or dust. Next, take a small handful of shavings—not half a bushel—for that will make ashes detrimental to a fire for welding. Let the shavings burn almost down so as to make coal, then place some fresh dry coal on top and start the blast slowly. Coke should not be used to start the fire with. As the gases have been driven out, it is less combustible than fresh coal, and it takes a big pile of shavings to start it with. Next prepare the coke by breaking it in the size of a hen's egg, and place it in the center of the fire to a width ranging from three inches in diameter and more, according to the size of fire and the work to be done in it. The coke is to be put in a pillar shape from the bottom of the fire and up to the top, the coal being packed around,—packed, and not placed loosely in the fire. The coal should also be wet, and while packing the fire, care should be taken that the flame will follow the stream of coke in the center. There should be coal enough to raise the fire from the tuyere from four to ten inches, according to the work. If the fire is low, the iron to be worked will get too much wind on it and it will scale, making it difficult to weld. This fire, made at seven o'clock in the morning, should last till noon. In a factory with a dozen fires or more it is a great loss of time and coal to the owner to have the fires broken up and made over before the coal has had time to coke, and besides this it is a nuisance to have some one fire continually filling the shop with more or less smoke, which is impossible to avoid when making new fires, especially if the smith is not posted on making fires. The fires should be made at the same time, in the morning and right after dinner. The above rule is for a factory with power blast, and does not apply to the village smith doing all kinds of repairing and having only hand power for blast. In the first place, he cannot use wet coal very well, because the steam produced from the wet coal will force back into the bellows, causing an explosion as soon as the bellows stops. Neither can he use the fire for the same length of time, because it is not so large as the factory fire, and his blast is not sufficient to keep it going with advantage for five hours. As to placing fresh coal on the fire, the case often arises when it must be done. We often find an old fire useless for welding, which a little fresh coal will concentrate and give a bright sharp heat. This is often the case in the country shop when the smith has to change from other work to welding a plow lay or pointing a share.

There is a good deal of generalizing about the fire and welding. We often hear: "When the iron is of the proper heat it will fuse." This is not always so, for the iron may be at the proper heat and still not fuse. The best smith will have this experience, even when a good fire to all appearances has been made. There is another cause for a poor fire, beyond his control—sulphur in the coal. This cannot always be discovered when the fire is made,—it might be a lump in the lot, or the coal may contain a high percentage of sulphur all through. The experienced smith will discover it from the smell, and also from the color of the fire, which generally gives a yellow flame. The most common cause of failure is a dirty fire, in which case the heat will present a dull grayish color with small sizzling sparks. The cause in other words is an infinite number of cinders, too small to be seen by the naked eye, but in great numbers they will be noticed by the color and the sparks. When this is the case, the smith should clean out the fire pot at once if he has any welding to do, for it is impossible to make a good weld in such a fire, no matter at what heat.

Tool Dressing.

Self-Hardening Steel.

THOMAS PRENTICE,
Foreman Blacksmith, General Electric Company.

Twenty years ago a man who was a first class toolsmith, expert at forging and tempering all kinds of lathe and planer tools, was considered at the top of his profession, and commanded a scale of wages which put the ordinary blacksmith in the shade. The rapid strides made in science and chemistry have changed those conditions, for in all large manufacturing concerns where lathe and planer tools are used to any extent, the old high grade crucible steel has surrendered to the superior product of our steel mills, viz.: *Self-Hardening Steel.* When this steel was first introduced it was called *Mushet,* and to this day self-hardening steel in many sections still bears that name, which, however, is not correct, as

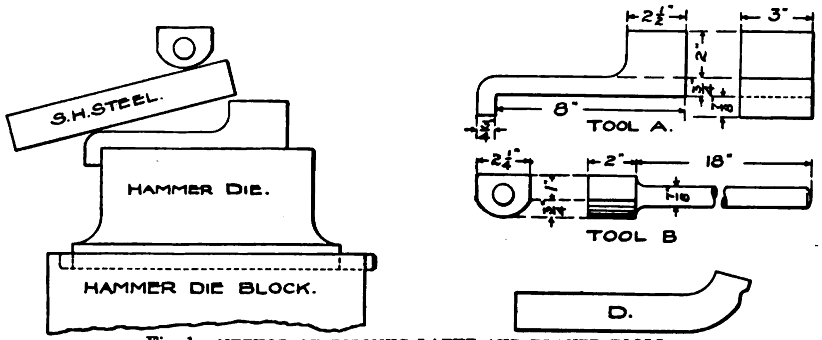


Fig. 1. METHOD OF FORMING LATHE AND PLANER TOOLS.

Mushet steel is only produced in Sheffield, England, and owing to the tariff the cost is very much greater than self-hardening steel produced in our own country, and there are several makers whose self-hardening steel will compare very favorably with Mushet; in fact, for general use, the balance of favor is with the home product.

Wherever self-hardening steel has been introduced it has had its friends and its enemies, and I regret to say the greatest enemy has often been the blacksmith. This was due to the fact that a slow heat was required, and only a very low heat could be taken, so that the effect of the sledges was not readily seen. Consequently a very small amount of production was obtained. This frequently led to petty quarrels between the smith and his superiors, the latter accusing the smith of wasting his time, while the former often stood on unfounded dignity, and could not or would not submit to any suggestions made by his superiors, nor try to find an easier and simpler method for himself and helper. While the blacksmith has been pounding the life out of himself and his helper, and sometimes the steel he was working, the chemist has not been idle, and as a result of the experiments in the laboratories we have self-hardening steel on the market today no harder to work than the ordinary tool steel of a quarter century ago. In fact, very few blows of the sledge are required to produce a tool of any shape or size. If the simple tools which I show in this article are used properly, the labor is reduced to a minimum, and production can be increased by 400 per cent.

There are a great many makes of self-hardening steel in the market today, every make having its friends. What will suit the requirements of one concern will not answer for another, so the user must be the judge of what he wants. I believe, however, it is expensive economy to use a cheap grade of tool steel, especially self-hardening, for lathe and planer work, as the labor cost in producing the tools forms a small part of the general expense. Take roughing tools as an example. If we have a shaft 12¼ inches in diameter, ten feet long, to be turned down 11⅝ inches in diameter, we can use a tool of high grade self-hardening steel, which will take a cut of $\frac{11}{32}$ inch at a speed of 45 feet per minute, and run constantly for ten hours without removing from the tool post for grinding. On the same size shaft a tool of lower quality which will only take a cut of $\frac{5}{32}$ inch at the rate of 35 feet per minute, will require to be taken out, say once every hour for grinding. You can readily see that with the first or high grade tool, you have cut in the ten hours 27,000 feet of metal $\frac{11}{32}$ inch deep. With the lower grade in the same time you have cut 21,000 feet of metal $\frac{5}{32}$ inch deep, less the time lost in grinding the tool. With the former we have travelled 6,000 feet further and cut over 50 per cent. more metal with less labor. Supposing the former steel to cost 45 to 50 cents per pound, and the lower grade 35 to 40 cents per pound, there is no question as to the quality of steel to be used, if results are what we are after, not merely the first cost of the steel. The principles to be observed in working self-hardening steel are carefulness and good judgment. When we realize we are working material which costs from 35 to 60 cents per pound, a careless man, no matter how small his daily wage, is an expensive man; on the other hand a careful man, though paid very much higher wages, will at the end of the month have proved to his employers that he is by far the less expensive man.

Let us suppose we receive an order from the tool room for fifty roughing tools, ¾ by ½ inch, twenty-five right-hand, twenty-five left-hand, fifty side tools, ¾ x 1½ inches, twenty-five right-hand, twenty-five left-hand, and fifty goose necks, all self-hardening. We proceed by getting the steel, setting a gauge to the required length, heating and nicking with a hot chisel (or, if you have a pair of shears, cutting under these). Do not attempt to cut off the pieces with the chisel after you have nicked the bars all round, but lay down, and when cold they will break very easily with the sledge, leaving the ends of your stock perfectly square. Having cut the material to the required length you proceed with your roughing tools by heating to a bright red. Take them to the steam hammer, and set with tools as shown in Fig. 1. A steam hammer of 800 or 1,000-pound blow will be most serviceable to you in this work, as they deliver a quick, firm blow. The tools A and B can be made in a very short time and require no machine work. In making tool A, be careful to get a good square corner on the inside, or you will have trouble with your steel slipping off and possibly resulting in injury to the smith. The square corner serves as a clamp, and the first blow of the hammer, which should be light, will cause the steel to sink on the tool, preventing the possibility of slipping. A couple of blows with the

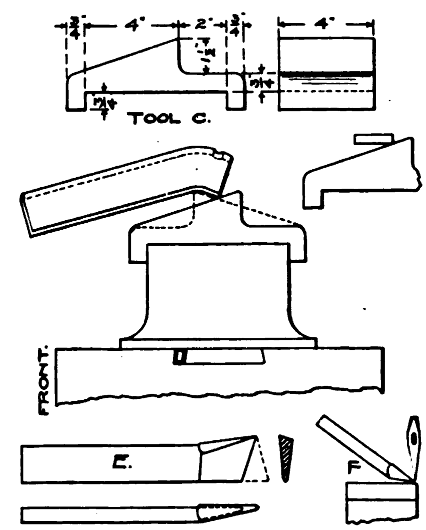


Fig. 2. SHAPING LATHE AND PLANER TOOLS.

hammer, using tool B for setting, will give you a piece as shown at D. Reheat the steel and place tool C across the hammer die, as shown in Fig. 2, holding the steel at an angle sufficient to ensure a good cutting edge. After this is done, reverse tool C as indicated, and place tool lengthwise, giving it a few good, quick blows to forge the taper on back of the tool, when you will have a forging as shown at E. Again heat and trim as per dotted lines at E, trimming the outer edges with a chisel on the anvil, as shown at F. Strike one blow under hammer to ensure a straight surface for tool post, and your job is completed. Right and left hand tools are made in the same manner and on the same tools, the only difference being, you hold the steel for the cutting edge at right or left angle as may be desired. Your tool when finished should look as shown at E. For the side tools, using the same size material, heat and lay across tool C, draw out and put offset in same with set hammer, trimming tail end and cutting edge with chisel.

Goose necks are forged in the same manner as roughing tools, except that they are drawn out on the point on tool C, instead of setting, as shown in Fig. 1. Clearance is obtained by working in the same manner as the roughing tools, the nose being thrown up over the horn of the anvil. For the roughing tools a good man will produce fifty in ten hours; of side tools and goose necks, the same man will produce sixty tools in a working day of ten hours.

As to tools made from tool steel, there are none, excepting diamond points or special tools for special jobs, that cannot be forged under the steam hammer by using the same tools as shown above for forging self-hardening steel. In making diamond points, do not attempt to cut the steel for them with a cold chisel, as is the practice in many shops even at this late date. A blacksmith in a couple of hours can forge a cutter, as shown in Fig. 3; this must be made from a first class grade of tool steel, and after grinding to a chisel point, care should be taken to temper it so that the cutting edge is hard; the bottom part which rests on the hammer anvil should be left soft. This you place across the hammer anvil, using a block which is a trifle higher than the edge of the cutter, say $\frac{1}{8}$ inch, to prevent damaging the face of the upper die, should you strike a blow heavier than is required to cut the steel. Place your bar of steel across this cutter, strike one blow, reverse the steel and a second blow will do the trick. In this way you can cut to length the material for fifty tools in twenty to thirty minutes, whereas if cut by hand power, you will consume three to four hours, and make hard work for the helper. In forging the diamond points, heat the steel to the ordinary working point, use tool as shown at Fig. 3, G, striking one blow, then turning alternately with each blow

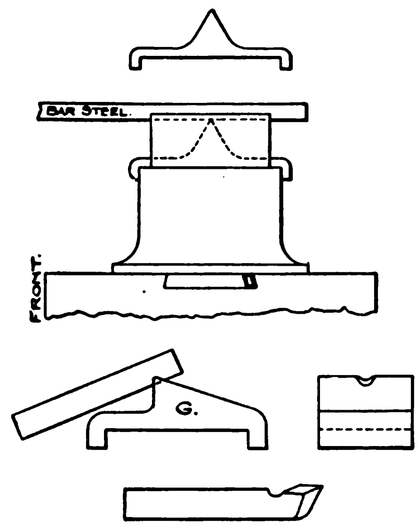


Fig. 3. CUTTING AND SHAPING TOOLS.

at right and left angle. This will form the diamond; reverse the tool and strike a few blows on the under side of the tool. This will give the desired clearance, and can be done in one heat. Reheat your steel, and with a hot chisel cut either right or left, according to the side you desire to be the cutting edge. In two heats you have forged a diamond point tool, and consumed not more than ten minutes in time. Some blacksmiths may question the time I give on these, but this time is attained in my practice every day.

Shop Talks on Wheels, Axles and Springs.—6.

Varieties of Suspension.

BY D. W. M.

From the two-wheeled dirt cart to the C-spring landau, there is a great variety in methods of suspension, each one adapted to its purpose. Among the springless vehicles, there is the ordinary street or farm cart for hauling dirt, the coal cart, four-wheeled and two-wheeled, the stone wagon, sand wagon, manure wagon, ordinary farm wagon, lumber wagon, truck, etc. In the two wheelers, the weight must be hung so as not to bear too heavily on the horse but enough to prevent its tipping backward. This is true whether with or without springs.

The writer has seen carts and hansom cabs so hung that they have tipped back when loaded and lifted the horse from the ground. If the pressure be against the belly-band of the horse's harness even a little, his purchase power is reduced. In this connection, grades of hills must be calculated on as altering the tilting point. Carts and various forms of two-wheelers, whether for business or pleasure, are often made so that the body can be adjusted to the incline of a hill by means of a lever and sliding rods on which the body moves by a motion of the hand or foot, applied directly or through a screw with wheel or crank handle. Most coal and dirt carts are made so that the body can be moved backward to the point of tilting, and being hung on a swivel can be tilted independently of the running part of the vehicle whether hung on two or four wheels; but this has nothing to do with the question of suspension, except that by the same apparatus, a load may be adjusted to the horse and to an incline with reference to the horse.

In four-wheeled vehicles it is desirable to distribute the load as evenly as possible over the front and hind wheels. In placing springs on a vehicle, the weight of the body as well as of the load to be carried must be calculated as nearly as can be done, in connection with the forward thrust, explained in the preceding article, to provide resistence.

In hanging a three-spring job, such as a surry, department wagon or phaeton, it is necessary to have more strength in the rear springs than the actual weight demands, because the vehicle is often tilted sideways and a large proportion of weight is thrown on one spring. Hence, three springs never ride as well as two springs. Suspension on four elliptic springs is seldom used now, except on survivals of old-fashioned vehicles; the unequal strain imposed on the springs laterally and the forward and backward thrust causes frequent breaking of the main leaves, resulting in a substitution of other forms of springs where practicable.

On all carriages without reaches the front is hung commonly on two elliptic springs, and the rear on half platform springs. The latter has a cross spring uniting the front ends of the lower half of each spring, the upper part of each spring being cut off at the pump handle, or a point forward of the axle and secured to the body or body loop or pump handle by bolts or clips. By this means the weight of the load is evenly distributed over both rear springs in whatever position the body may be placed, and consequently elasticity is gained. On business wagons, whether for light or heavy loads, the cross spring is usually placed in the rear and the top portion of the side spring is omitted, the front end being coupled directly to the body or a body bar. This form is also used on light and heavy passenger wagons, and is commonly used on both front and rear suspensions. It is adapted to a great variety of wagons, trucks, busses, vans, etc. A still stronger, though less elastic method is employed on very heavy vehicles, such as large busses, and cars, *i. e.*, omitting the cross springs, hanging on the lower half only of what would be an elliptic spring if complemented. The front ends are hung directly to a rigid fastening on the body and the rear end allowed to swing in a shackle to accommodate elongation.

There are various patented devices or arrangements of springs embodying the main principles of the methods described, all with merits of their own. In some the side springs are omitted and the cross springs alone used either singly or in pairs or triplets, the ends hung on hangers welded to the axles, dropping in some cases directly over the axle, in others on either side of the axle. In others the principle of the elliptic is used by reversing the two halves, joining them in the center, the ends being attached to the body and gear in various ways, sometimes in connection with side bars, sometimes placed crossways of the vehicle. We will not go into all methods of side-bar hanging and its substitutes, for they are too numerous. They are adapted to light driving rigs, one, two and four-passenger, two and four-wheeled. The object of a side bar is to secure a steady rein, preventing the body giving forward, as on elliptic springs, and the downward dip in front. In many cases, however, it has been used to gratify a mere fancy without any real utility. It was used on surreys quite extensively at one time, and was even adapted to phaetons, but all such applications are now discarded in favor of better and more sensible methods. But for the speeding wagon or gentleman's driving wagon, it is still one of the finest methods of suspension.

The introduction of the wire wheel and rubber tire has opened up other possibilities, and the new speeder hung without springs, or reach, the front and rear axles curved up to the body, truss fashion, braced to the body, the forward axle attached to a fifth wheel immediately under the body, is the latest development in that line, being an adaptation of the modern racing sulky with pneumatic-tired wire wheels, ball bearings, etc., to a four-wheeled speeder.

The two-wheeled pleasure cart has offered as great a variety of methods of suspension as any other vehicle. We might enumerate the old chaise with body hung on straps stretched between the front and rear bars; then the addition of a pair of rear springs standing upright, to which the rear ends of the straps or thoroughbraces were attached, then the addition of a cross spring in the rear, the front still hung on straps; then the advent of the C-spring, the body still hung on straps; then the use of elliptic and half platform springs. All these methods were used also on four-wheeled vehicles in front and rear suspension, such as fine carriages, coaches, victorias, and caleches. Many fine carriages hung on C-springs and straps are still running. It is a method requiring a very strong reach and the straps must be made so they can be shortened occasionally. The C-spring has also been used without a cross spring uniting the front ends, but is difficult to hang with a reach without unduly straining it. It is better without a reach, but has not proven entirely satisfactory and is seldom used now. However, a combination of "C" and elliptic or half platform spring is often used with excellent effect, by extending the rear end of the upper half of the spring in C-shape inverted, or downwards, to connect with the lower half, or extending the lower half in C-shape upwards to connect with the upper half. Of course, these are small C-springs in proportion to the full-sized C-spring, and are usually termed scroll springs. They are used to good advantage on rockaways, and sometimes on broughams and demicoaches.

As the greatest amount of strain comes on the longest or main leaf of a spring, that leaf should be heavier than the others, but frequently the leaf next to it is made the same thickness. The others are lighter, and on finely made springs often graduated in thickness, so that the shortest leaf will have equal resilience with the others.

The quality of the steel and temper have of course much to do with the elasticity of the spring and the manner in which it carries the load without letting down or losing its resilience; but granted that this is of finest quality, oil temper being tougher than water temper, a nicely graduated spring is superior to one not graduated. Just how thick to make the leaves depends on the width, length, number of leaves and load to be carried, and requires good judgment to determine. It is one of those fine accomplishments, possessed by but few carriage builders, which stamps a mechanic of the first quality when he does it. Excellent tables are published giving approximate dimensions. A general rule for an elliptic spring is to have the amount of open one-fourth the length, for ease and service.

Various devices have been patented to secure carrying capacity with resilience. In one the center of each leaf is ridged. In another a single leaf is used, thick in the center, tapering at the points. Extremely nice methods of tempering must be employed in manufacturing these springs and they have proved successful, but being difficult to repair are not in very common use. Carriage builders recognize in suspension one of the most important points in vehicular construction in its relation to the durability of all other parts and the satisfaction given to the user. Proportioning the parts for strength, beauty, and easy riding is involved. It is important to know how high to hang the body from the ground. This is governed to some extent by prevailing taste and requires not only an educated eye but one in touch with the times. The height of the wheels is also important, for tastes change in that respect, being related to the height of the vehicle, and an artistic temperament must be cultivated along mechanical lines. A first class carriage builder must be more than merely a worthy citizen; he requires high abilities of a composite type.

A Pensioned Blacksmith.

Mr. W. D. Martin, who has been connected with the shops of the Illinois Central Railroad in Jackson, Tenn., for the past twenty-one years, much of the time as Foreman Blacksmith, has recently been retired by that company and placed upon a pension, as he lately celebrated his seventieth birthday, marking the age limit fixed by the Illinois Central. Mr. Martin went to work at the age of nineteen, working during his time at all the branches of blacksmithing, and now despite his years, still possesses a remarkable activity and ability for work. In making mention of this veteran smith, it is an added pleasure to chronicle the case of a corporation who thus recognizes and rewards the deserving employee.

Horseshoeing, Repair Work and Carriage Building.

PRIZE ARTICLE CONTESTS.

What Do You Know That Will Interest Our Readers?

In the following columns will be found printed a few of the numerous articles thus far received at this office in competition for the prizes offered for the nine best articles upon the above subjects. The numbers at the head of the various articles refer to the order in which they are received, and have no connection with the final award of prizes, the decision for which has not yet been made. The contest will be held open a short time longer to give everyone who may desire to write an opportunity to do so.

The conditions of the contest are as follows:

First: No person will be awarded more than one prize, though he may submit any number of articles.

Second: Contestants for these prizes must be subscribers to THE AMERICAN BLACKSMITH.

Third: The right to publish any or all articles in competition is reserved.

These articles must not be less than 250 words in length, and must be plainly marked "Prize Contest—Repair Work," "Prize Contest—Horseshoeing," "Prize Contest—Carriage Building," as the case may be.

The prizes are $5, $10 and $15, three to be awarded under each heading. Let us hear from you.

The preceding outline is again printed for the reason that THE AMERICAN BLACKSMITH goes anew each month to a large number of artisans who are up till now unacquainted with the offer made therein.

Prize Contest—Horseshoeing.—9.

Spreading the Foot.

Is it possible to benefit a horse's foot by spreading it from the bottom?

Now I do not mean by this question, is it possible to relieve a horse for the time being, for we all know that a horse with badly contracted feet can be relieved for a time by spreading the feet from the bottom; but is it or can it be a lasting benefit to the foot? Now I am aware that I am going against a large majority of horseshoers, and good ones, too, but I am going to say it is an impossibility, it can not be done, and I think I can give good reasons why it can not be done. If the reasons are not convincing, will some brother be kind enough to tell me why?

I do not like springs in the feet, neither do I like the idea of spreading the feet by means of chamfering the shoe on the outside heel in order to force the heels apart, nor opening the heels by the means of spreaders. Now let us see why. In the first place, in order to get lasting benefit by spreading the foot, it must be spread, not from the bottom, but from the top, for there is where the hoof commences to grow. The blood vessels that feed the foot must have full play here, for it is obvious that if they are bound in around the coronary, they cannot supply a proper amount of blood to the feet. Now, can we spread the foot at the top by spreading it at the bottom? This is the question. It seems to me that we cannot. A horse's foot is smaller at the coronary or top than at the bottom, *i. e.*, it flares. Again it is soft and pliable at the coronary or top, and hard and firm at the bottom. Now, is it not easy to see if we spread it from the bottom we shut it together at the top?

A man, one of my customers now, came into the shop the other day and said, "Brown, have you any spreaders to open a horse's foot; my horse is lame and I want to open his feet." "No," said I, "I haven't such a thing in the shop, for I don't believe in that way of spreading the foot." "Why?" he asked. "I will tell you," I said. I put my two thumbs together, ends touching, the ends of my fingers dropping towards each other a little, representing the slant of the foot, the thumbs taking the place of the sole or bottom of the foot, the ends of the fingers the coronary or top. "Now," said I, "the top is soft and pliable, the bottom is hard and firm; if I pull my thumbs apart, the top at my finger ends not having anything to keep them must go in, in the same proportion that I pull my thumbs apart, and that is surely what you do not wish to do, is it not?" "Of course, I do not want to shut the foot together at the top and I guess you are right," said he. "But how will you open the foot?" he asked. "Simply by doing this," said I, putting my hands in the same position and pressing upwards with my thumbs, "the finger ends come open now." "A bar shoe," said he. "Right you are," said I. "Put on a bar shoe," said he. "All right," said I, and the horse is going all right.

Another man came into the shop a while ago. "Brown, will you shoe my horse just as I want you to?" said he. "Why, yes, of course I will," I said, "I will put the shoes on his ears if you want me to." "No, I don't want them on his ears, but I want you to weaken the shoe at the inside toe, then nail it on and take a pair of pincers or tongs and spread the shoe." I waited until he had finished, and then I asked him how much he wanted me to spread it open? "Oh, I don't know; about what you think is right." "Now look here," said I, "I don't know. Supposing I open the foot one hundredth of an inch, there is a space there somewhere one hundredth of an inch wide forced open, what is there to fill it up?" "I did not think of that," said he. "Now," I said, "I cannot tell when I get it open just one hundredth of an inch; my hand is not steady enough to open it just a hundredth, a sixteenth, or even a tenth of an inch, and what if I get it open too much? It will take nature some time to fill the hole we have made in there if we get a very large one." "Say, Brown, I guess we will not do it," said he. "I wouldn't do it if I were you," said I. I am shoeing the horse and he is doing nicely, and there is a good healthy growth at the coronary, showing that the feet are improving instead of going back on him.

A number of years ago, a well known horseman was in the part of the country where I was working, and his method of spreading the foot by the means of the spreaders became quite a fad. We all thought we had it down fine, but I tell you I lamed more horses than I should want any one to know, and as I look back, and as I think it over, I wonder that I did not lame more than I did. The foot of a horse is a very delicate affair. It is a wonderful piece of machinery, and supposing that it is possible to help the foot by tearing it open the least mite, a man must be well up in the business who knows exactly how far to go and stop. I am not.

Prize Contest—Repair Work.—10.

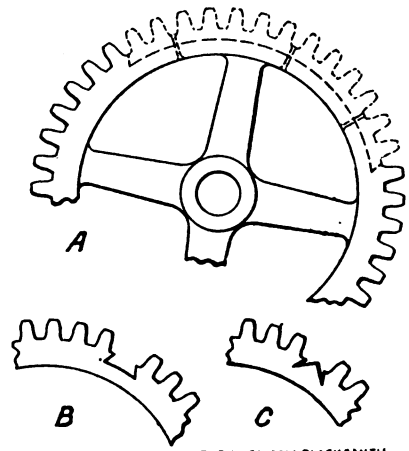
Repairing Broken Cogs.

It is often the lot of the general blacksmith to be called on to repair some break down in machinery, which sorely taxes his ingenuity to make the broken parts serviceable again. Now, the owners of the broken machinery are quite willing to pay any reasonable price to be helped out of a bad fix, for with them time is money, and to have their employees idle for several days until new parts can be provided is often very expensive. No machine shop being near, they see what the local smith can do.

In order to assist my fellowmen of the craft, I will endeavor to explain my method of repairing broken cog-wheels.

In former days when threshing was done with horse power, I was often called upon to mend all kinds of breaks and broken wheels. Sometimes only a cog, sometimes several side by side, which if not repaired rendered the wheel useless. In one case there was thirteen adjoining cogs broken and the owners thought the case hopeless, but I succeeded in repairing the break so well that they used it for years afterwards, and it was as good at the mended part as at any other place. I charged $12 for the job, and the owners cheerfully paid it, enabling them to resume their work with little interruption. Now it does not do to dovetail cogs when several are broken in the casting, side by side, as there is not metal enough left to hold them, so the only possible way is to make one continuous plate with the requisite number of cogs on it, and fit it in the body of the wheel by chiseling enough off the casting to allow a plate, in this case $\frac{1}{2}$ by 3 inches with thirteen cogs on it, to fit in the space thus made. I dovetailed the ends of plate and in addition put three rivets through the plate and flange, and that was all that was required to hold it there firmly. To make the plate and cogs I proceeded as follows. I took a plate of Norway Iron of the required length, forged the requisite number of cogs, punching a hole through each one and riveting them to the plate the proper distance apart. Then I took a welding heat on part of them and continued until all were welded on. I next shaped the plate to the curve of the wheel and fastened on as stated above. The figure will show the way the job was done.

In a break of only two cogs, dovetailing will be sufficient, but for three or more it is better to fasten with an additional rivet besides the dovetailing, making the whole of one piece. In the case of a single cog, when the rim is of sufficient thickness to stand a chiseled notch, a dovetailed cog inserted will be all that is required. In preparing a wheel for a cog to be inserted make the notch first. If the rim is heavy use sharp chisels and start as shown in the illustration. Then with a narrow chisel cut out the centre and dovetail on both sides, after which fit in the cog so that it will drive in reasonably tight, and if necessary clinch on top and bottom in the dovetailed part. In smaller cog wheels where the rim is too light to admit of chiseling, the file must be substituted to make the notch, and the cog after fastening slightly can be brazed on, but great care must be exercised or the wheel will be melted up before the spelter fuses.



THE AMERICAN BLACKSMITH.

METHOD OF REPAIRING BROKEN COG WHEELS.

In the case of bevel gearings, a broken cog is harder to insert on account of the thinness of rim not giving or leaving enough metal to admit of sufficient notching to hold the cog securely. In that case I first rivet a plate across the part where the cog is to be inserted on the under side parallel with the wheel, thereby strengthening the same, so that it will stand having a good dovetailed notch filed in it. I rivet the inserted cog on top and bottom after it is driven in place.

Sometimes the wheels are very greasy and in that case the burning of the greasy matter on the forge is first necessary before the article can be handled. In doing that, however, care must be taken that the wheel is heated all over in an even manner or a bursted rim will be the result.

Prize Contest–Horseshoeing.–11.

Interfering.

I note in the January issue an article on interfering, by C. P. Tucker. I agree with all that Mr. Tucker says as regards paring the hoof, but wish to give my experience with the different kinds of shoes. I have been in the blacksmith business fifteen years, and have used nearly all the different kinds of shoes I have ever heard recommended or seen for interfering, with more or less satisfaction. I have never yet found any kind or shape of shoe to answer as well in all cases as the one I am now using.

I take a shoe and cut both ends of an even length, or, if anything, cut the inside a trifle the shorter. Then I turn the inside of the shoe to form a heel calk, while on the outside I weld on a toe calk lengthways, setting the rear end of the calk in about $\frac{1}{4}$ or $\frac{3}{8}$ inch from the end of the shoe. The outside of the calk and the shoe comes flush. The toe calk I always weld in the center of the shoe, so that when the shoe is nailed on the toe calk sets on a line with the point of the frog. Make the shoe to fit the foot in all cases, except where it has a wing, which I always pare off as much as possible. Do not bend the inner heel calk in under the foot or the outside calk out, but set both heels of the shoe to fit perfectly under the wall of the hoof, except where the inside of the hoof is narrow, weak or low. In such cases I leave the shoe a little wider on the inside, and sometimes put leather under it to raise the inside of hoof, as the inside of the hoof should always be a little higher on interfering horses, to throw the ankle out. I have used this shoe on horses which interfered barefooted and with plates on both hind and front feet, and have never known it to fail, except after it was on the foot four or five weeks, which would allow the shoe to become moved from its original position by the growth of the hoof. After paring the hoof and resetting the shoe, they always went all right again. You can put this shoe on a horse that travels very close, and note that the shape and weight of the shoe will cause him to travel wide. I have often had a new customer say that the horse will kick his ankles with that shoe, and that you should put the long calk on the inside or turn the inside calk lengthways. I tell them if the horse strikes with that shoe to bring him back and I will give back the price of the shoeing. But I have never had one come back yet, and I have used it for three years on some very bad cases.

I never turn the inside calk or bend it under the foot where the inside of the hoof is low. It is a good thing to make the inside calk a trifle the longer, for, as I said before, the inside of the hoof should always be a trifle the higher on interfering horses.

I have never had much success with so-called side weight shoes. I have known them to prevent interfering in some cases where the foot needed balancing, and then again I have known them to make a horse worse. I also think it a bad practice to turn the outside heel of shoe out or the inside in under the hoof, for in most cases of interfering the inside of the hoof is weak or low, and to turn the shoe thus only makes matters worse by throwing the ankle in. You will note I say cut the heels of the shoe an even length. When you bend the inside to form a calk and weld a calk on outside, it will leave the outside of the shoe longer and heavier, according to the size of calk you weld on. This is as it should be. But don't make the shoe too long. Have it long enough to set well to toe of foot and have the inside at the back end set back over the foot from $\frac{3}{8}$ to $\frac{1}{2}$ inch. The outside of shoe being longer, it will extend over that much more. I think that if my brother smiths will try this shoe, being careful to have it fit the hoof, as I say, they will have no more trouble with interfering.

Some Suggestions on Decorative Ironwork.—5.

WILLIAM C. STIMPSON,
Instructor in Forging, Pratt Institute, Brooklyn.

In the third of this series of articles we described how simple, flat ornaments were forged and veined, and slight raised places, or modeling, worked upon them. We will now consider this work carried farther, and endeavor to show how the patterns for more complicated leaf work are made, and how the ribs and veins are raised and modeled in clear relief.

Almost the earliest use of leaves, as a decoration surrounding or growing out of a heavier bar, seems to have taken the form of blades of corn, an example of which is shown in the cresset holder, Fig. 52, made in the north of Italy in the fifteenth century. (Our drawing is taken from Gardner's "Iron Work"). The fully developed acanthus leaf modeling seems first to have been perfected in Germany during the sixteenth century (see illustration, Fig. 53), and in Germany and France, through the sixteenth and seventeenth centuries, many examples were produced, and these, to a large degree, have given the suggestion for much of the best work of the present time along this line. In earlier times the smith was obliged to hammer out his thin stock for leaf decoration from heavy bars, but today, sheet metal is almost universally used.

From their very nature leaves serve simply as decorations to the stronger lines in a design. They are used principally as rosettes, at the eye of a scroll or crossing of two bars, as husks out of which spring one or more heavier bars or scrolls, and as free endings, which of course have to withstand practically no strain. In Fig. 53 are shown several examples of leaves used as decorations in these three ways.

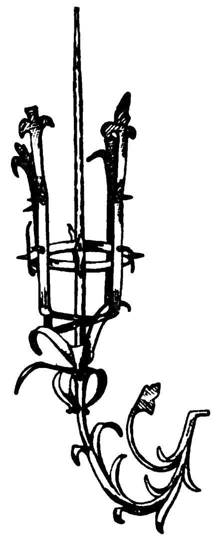


Fig. 52. EARLY FORM OF LEAF DECORATION.

With regard to designs in this class of work, the same precautions must be taken as those mentioned in the last article regarding handles, etc. Except in cases like the rosette, the design must be judged as to how it will look from all sides and the balance of the different parts carefully worked out. To work up the acanthus leaf ornament, considerable study of good examples is necessary. The modern tendency is away from this historic style and toward the invention of beautiful curves and spacing—basing the design more on natural plant forms.

Since leaf forms are to be worked up out of sheet metal, a pattern must first be made. It may be developed in a way similar to that used by the tinsmith in getting his patterns for elbows, pans, or other mechanical shapes. We use the same method as in finding the true length of a scroll, remembering there are many curved surfaces to measure. The following examples will serve, I think, to show how the developments are made. Fig. 54 is a conventional, five-pointed flower, which might be used to hold the socket for a candle, or as a center for a rosette. Here we have a side and a top view of the piece, and since the leaves are all alike the development of one leaf will answer for all. Draw the curve on the front view of the middle vein of one leaf so as to show its true length. Step this off in equal spaces—then step similar spaces on a straight line and

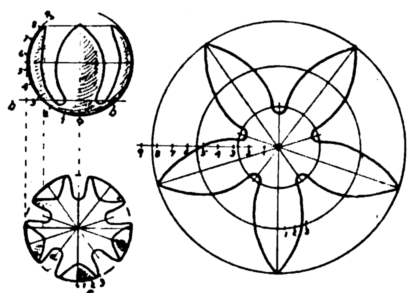


Fig. 54. DEVELOPMENT OF SIMPLE FLOWER FORM.

draw a circle having same radius as total length of leaf, that is $8\frac{1}{8}$ inches. Divide this circle into five equal parts, and the five points thus obtained form the tips of the leaves in the development. Next find positions of centers of the small circles connecting leaves at base. In the front view draw a line, b b, at right angles to vertical center line, and passing through the centers of these small circles. This line cuts the measured line about three-quarters of the way between 2 and 3. Strike the circle of development with $2\frac{3}{4}$ steps as radius. On this circle, half-way between middle lines of leaves, are the centers desired; strike five small circles—their diameters show full size on top view at *a*. Finally, strike circle on development which will pass through widest parts of leaves, *i. e.*, between points 5 and 6, and step off width of leaf obtained from top view at *c*.

Fig. 55 shows a conventional acanthus leaf. Here we have simply a front view and curves showing the general sweep of the section at three points—AB, CD, and EF. Step off the main curve of the leaf, and the smaller section curves, in conveniently sized spaces. Step off true length of main curve on a straight line. Now draw

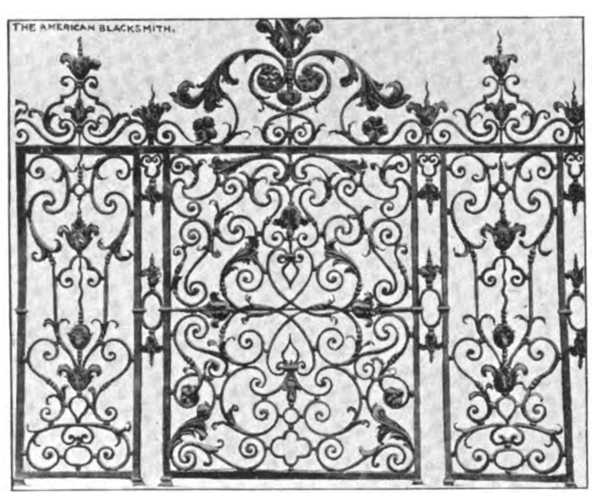


Fig. 53. HIGHLY DEVELOPED FORM OF LEAF DECORATION.

right-angle lines—b b, d d, f f—through this line at points corresponding to those on main curve which are cut by center lines of the section curves AB,

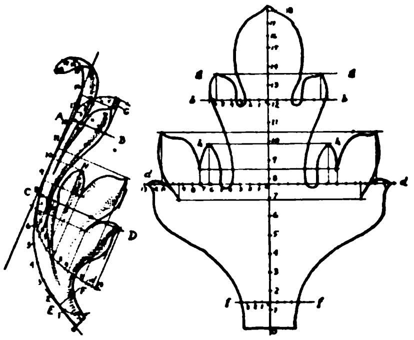


Fig. 55. DEVELOPMENT OF ACANTHUS LEAF.

CD, EF, and on these right lines step off equal spaces to those on section curves. To find the development of any point in the sketch, draw through it one line *parallel* to center line of section curve and note where this cuts the main curve; draw another line at *right angles* to center line of section and note where this line cuts the section curve. Reproduce these lines in their proper positions on the development and the point is determined. For instance, take points G and H on sketch. Their parallel lines cut the main curve between 13 and 14, and between 9 and 10; their right-angle lines cut the respective section curves between 5 and 6, and between 6 and 7. Draw the parallel g g at 13$\frac{3}{8}$ and h h at 9$\frac{7}{8}$ on development. Now at 5$\frac{3}{4}$ on b b and at 6$\frac{1}{4}$ on d d erect right lines. Where these right lines cross the parallels g g

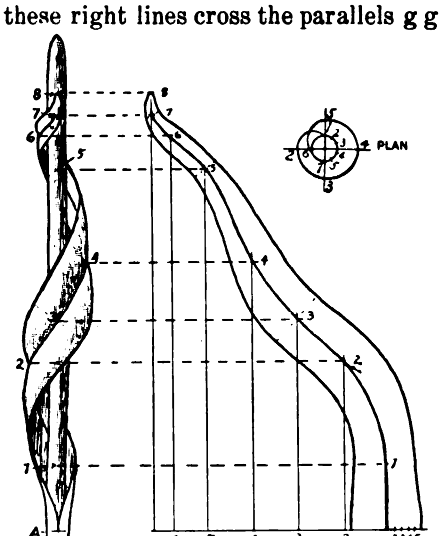


Fig. 56. DEVELOPMENT OF TWISTED BLADE.

and h h will be the development points of G and H. When all of the necessary points are determined in this way on the development, sketch in the outline of pattern.

In the third example, Fig. 56, a blade-like leaf twists about a central stem. Since the lower part of the leaf winds around the stem, if we unwrap the blade any point on the middle vein will remain on the same level; so, if we find how far each point moves horizontally, we can take its height directly from sketch. Draw the projection of the mid-vein of the blade directly under the sketch, and for convenience find development of the points which will be cut by right lines from front to back and from right to left. Get the true length of this projection curve, beginning at (a) on a horizontal line on the same level with A. Strike ver-

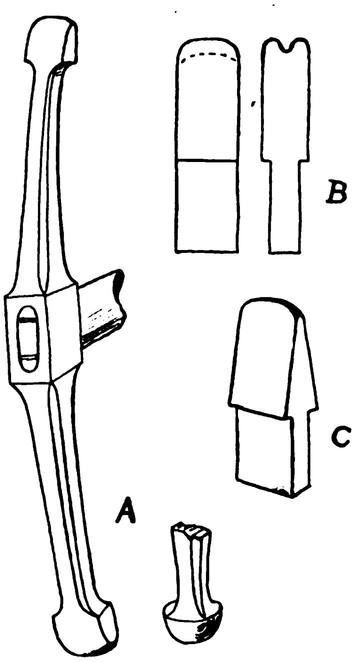


Fig. 57. MODELING HAMMER AND STAKES.

tical lines from the points 1, 2, 3, 4, etc., from this horizontal line—then where the horizontal lines drawn through 1, 2, 3, 4, etc., on the sketch cut their corresponding vertical lines we get points in the development of mid-vein. Since the vein runs straight along the stem from point 1 down, the line 1 to (a) will be a vertical line. From (a) step off each side half the circumference of the stem; this gives width of blade at the base. At the points 3, 5, and 7 we can get the true width of the blade direct from the sketch. With these points placed, sketch in the outline of pattern.

After the pattern is laid out on paper, it is best to cut a thin sheet metal pattern. This is held firmly on the metal to be worked up and the out line scribed around with a sharp scratch awl. The thickness of metal used in leaf work varies with the size of the work—from No. 24 to possibly No. 16 or heavier. No. 20 sheet is a good thickness for the general run of small work. This is thin enough to give little trouble in cutting out, yet heavy enough to keep its shape well in use. The work is cut out with straight and curved cold chisels made about 3$\frac{1}{2}$

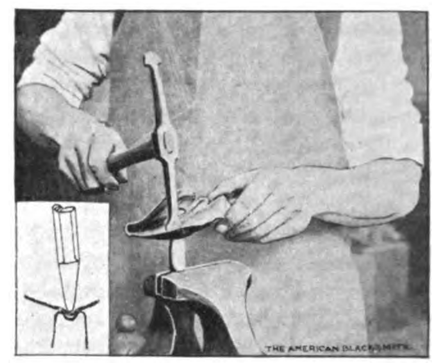


Fig. 58. FORMING A VEIN.

inches long. When there are many curves of the same sweep, gouge chisels will be found very convenient. After cutting, the edges should be smoothed off with a file or the sharp corners will work in and form a flaw.

The special tools used in modeling are shown in Fig. 57. They consist of long nosed hammers with various sized cross and ball piens—A, Fig. 57. The heads of these hammers are about 9 inches over all. Different sizes of grooving block, B, are used, as well as what might be termed chisel stakes—C. The working edge of all of these tools are nicely rounded.

The plan of working is to form up the general shape of the piece first, and do the raising on each lobe of the leaf, working from the inside and modeling into the end grain of wood, or when cold, into lead. Next block out the pipes and the veins between the lobes, using the grooving block with a narrow pien hammer—Fig. 58; then turn the

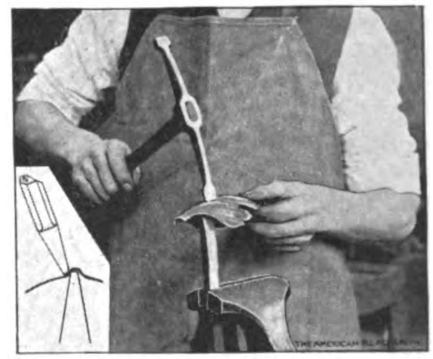


Fig 59. FINISHING UP DETAIL.

work, and by fitting the groove just formed over the chisel stake, sharpen up the detail by hammering from the face side of the piece—Fig. 59. All leaf work is modeled separately, then fastened to the bars it is to decorate. In fastening to these bars, welding is by far the best method. This, of course, requires considerable skill and care not to burn the thin stock in drawing the heat. A good welding compound is a great help here. Brazing is resorted

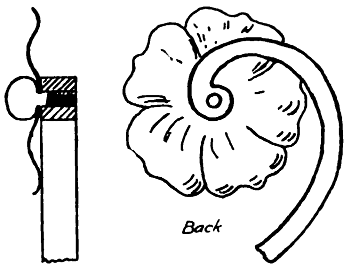


Fig. 60. METHOD OF FASTENING A ROSETTE.

to in some cases where it is not practicable to make a weld, and rivets can be used. For rosettes, of course, a rivet or a ball with a screw stem is the most practical method of fastening—Fig. 60.

In closing, let me remind my readers that you cannot learn to do practical work from talks or books. The most you can get in this way are ideas and suggestions. The only way to learn to do a thing is to go ahead and try it, and if you fail the first time, think hard, try to find out where you failed, and go at it again. Most of my readers in the shops can probably do a nice piece of machine forging or carriage work better than a piece of ornamental forging—Why? Simply because they have seen and done more of this class of work. If you want to try the ornamental side, study every bit of decorative work you can see or get hold of. For those who can do it—take a course of drawing at evening school. Then for those who have the advantage of a modern library, hunt up the good books on decoration and try to learn what is good and what is common-place in decorative work. The best results will come only when you have the power to picture the shapes in your mind, and the skill to work out your pictures in the iron with hammer and anvil.

Diseases of the Foot and Their Treatment.—4.

E. MAYHEW MICHENER, V. M. D.

By Laminitis, or Founder, is known a disease characterized by diffuse inflammation of the sensitive laminæ of the feet. It differs from local inflammation of the same tissue, as from injuries, in the fact that in laminitis the whole or greater part of the soft structures beneath the horn become suddenly affected. As with inflammation in general, the first stage of this disease is that of congestion or excessive blood supply to the parts. The blood vessels become enormously distended, and unless recovery begins at once, there is an outpouring of certain parts of the blood through the walls of the blood vessels, the horn-forming structures of the parts are stimulated to abnormal activity by the great amount of blood present, horn is secreted in excess of normal amount and is piled up rapidly. The horn formed, however, is friable and breaks down readily, the third phalanx is therefore loosened from the horn of the wall, and the pressure or pulling of the attachment of the perforans tendon rotates the bone downward and backward on its transverse axis, thus separating the laminæ of the soft tissues from those of the wall of the hoof. This separation is especially marked at the toe.

The symptoms of laminitis vary considerably, according to the severity and extent of the attack. Commonly the front feet is the point of attack, either of which may be worse than the other, and not uncommonly all four feet are affected, or in rare instances a front and hind foot are the worst. The attack is almost always sudden. Commonly the first symptoms are discovered on attempting to move the animal from its stall, when it is found to be more or less stiff and disinclined to move. If the fore feet are diseased the animal will be difficult to back, and in attempting to force the animal backward the fore feet will be extended in front of the animal, and the hind feet will be placed well forward beneath the body. On leading the animal forward the front feet are shifted rapidly and with evident pain, and the hind feet are placed well forward to take as much as possible of the body weight. Turning the animal to right or left causes pain, differing in amount as either side is worse than the other. When both front and hind feet are the seat of the disease, it is very difficult to induce the animal to walk at all, but the standing attitude may be less painful in appearance than is the case where only the fore feet are diseased. The affected feet are found to be very warm to the touch, the arteries of the fetlocks can be felt full and tense, and the throbbing of the pulse is readily felt at the fetlocks. Light taps with the hammer or slight pressure with the pincers will give the animal pain. The appetite is frequently impaired to greater or less extent, the bowels may be loose even amounting to a diarrhœa, the pulse is increased in force and frequency, and the body temperature is elevated at times as much as to 104 degrees F. Moving upon soft roads generally renders the movements of the animal less painful at the time, but the pain returns soon upon allowing the animal to stand.

Probably in the case of no other one disease have more causes been named. The popular idea among horse owners is that founder can arise from standing in cold air, overheating, watering while warm, feeding while warm, driving through water, and other causes. While admitting that the above causes may in rare instances induce founder, yet it can be said that the number of cases brought on by such causes is very small. Fully nine-tenths of founder is due to some indiscretion in the feeding of the animal. This may be in the amount of feed given, the kind of feed given, the frequency of feeding, or a change in amount or the kind. Hard driving or overwork is sometimes a factor in the production of founder, but it is generally accompanied with some mistake in the feeding of the animal. Animals known as "soft," or unaccustomed to severe work, are predisposed to the attack. Animals with badly shaped feet are more liable than those with good feet; a previous attack of founder certainly predisposes to later attacks upon less causes than in an animal which was never so diseased. Hard roads and bad shoeing may also be named as a predisposing cause. Continuous standing for a length of time sometimes is a cause of a certain kind of laminitis or founder. This is sometimes seen in cases of severe injury, where the animal is compelled to stand with most of the weight upon two or three feet. In severe injuries the use of slings to support the animal's weight somewhat is a good preventive measure.

The course of the disease depends upon the severity of the attack and also upon the time at which treatment is begun. If recovery is to be complete, improvement must begin within a short time, say five days or less, from the beginning of the attack. Should improvement not begin within that time, the alteration of structure within the hoof becomes so marked that it is impossible to have the parts regain their normal condition fully. Mild attacks or those which start to improve within a few hours may leave no permanent alterations excepting more or less ring of horn extending around the top of hoof. In cases where the alterations are more marked, the rings formed are more pronounced, and upon removal of the shoe the white line is seen to be altered to greater or less extent. This may amount to a simple increase in the thickness of the white line, or in more severe alterations the wall of the hoof is seen to be separated to greater or less extent around the white line. This condition when marked, is known as "seedy toe." In severe cases where recovery is delayed and the separation between the sensitive laminæ and the laminæ of the wall becomes marked, there is generally a deformity of the wall of the hoof, which becomes sunken in front, and later the toe has a decided turned-up appearance, the rings around the hoof are pronounced, and while they may be at some distance from each other at the front of the hoof, yet they all tend to come together at the quarters and heel. The alterations of the sole are pronounced in severe cases; the third phalanx, being tilted backward and downward, presents its sharp margin to the sole, which, receiving more than its due amount of the weight of the animal, is bulged downward and may even rupture, and the bone may protrude. In the latter condition the cases may be hopeless, and when there is marked deformity of the sole the animal never fully regains its usefulness for work upon hard roads. Very severe cases may, however, become useful for work upon soft roads or for farm purposes.

For reasons stated, treatment should be instituted early in the attack. Remove the shoes, and make immediate and constant cold applications to the affected feet. This is best done by standing the animal in a soaking tub, in the bottom of which several thicknesses of old carpet or other soft material has been placed to provide a soft resting place for the feet. Bleeding from the jugular vein is good treatment early in the attack only, and local bleeding from the toe or coronet is not advisable on account of the liability of infection by septic germs and resultant complications. Give the animal a roomy, loose stall if possible, and be sure that the floor is well littered with some soft, short bedding. Never allow the animal to stand long upon a hard floor. Allow it to go down to rest, and if it is disposed to remain down long it should be turned frequently and assisted to rise at least four times daily. While the animal is down, the cold applications must be continued to the feet by means of pads soaked in cold water or by several thicknesses of wollen cloth wrapped around the feet and kept constantly wet with cold water. Exercise upon soft ground is advisable for most cases from the beginning; the amount must be regulated according to the results obtained, and varies with the case.

Internally, at the beginning, the animal can be given a physic of one ounce of Barbadoes aloes in a ball, but if the bowels are decidedly loose the physic should not be given. Repeated doses of physic are not advisable. The tincture of aconite root is a valuable agent in the early stages of founder only, and can be given in doses of from fifteen to twenty drops at intervals of one or two hours during the first two days of the attack. Do not continue the aconite over a long period of time, and gradually decrease the amount and frequency of the dose. Instead of the aconite, many prefer the tincture of Veratrum viride in doses of not exceeding one dram at intervals of two hours. The nitrate of potash is of use in doses of one half ounce twice daily after the first two or three days have passed. After the first week has passed and the animal is not well advanced in recovery, the case may be called chronic, and the use of drugs by the mouth discontinued. Constant attention to the feet must, however, be faithfully kept up. If the appetite returns and the animal can be given a run to pasture each day, it should be done. If the sole has become ruptured the spot needs daily attention to keep it clean, and a disinfecting solution should be applied. At this time shoes may be applied with advantage to some cases. The kind of shoe that is best varies with the case somewhat, but in all should be of about double width, so as to protect as much of the sole as possible and be so applied as not to bear upon the sensitive sole. I prefer for most cases a wide-webbed shoe, thin at the heels and toe and thickest just in front of the quarters. In applying the shoe, rasp away the wall at the toe so it will not bear upon the shoe at all, as the pressure at the point only serves to increase the pain and to separate the wall to still greater extent. The shoes will need resetting at least every three weeks. It will be found that the heels grow fast and they will need lowering frequently. The sole should not be weakened by paring.

(To be continued.)

The Scientific Principles of Horseshoeing.—7.

Interfering-Hind.

E. W. PERRIN.

The prevention of interfering is one of the most difficult branches of the farriers art. Its causes are numerous, sometimes obvious and readily apparent, but sometimes equally obscure and difficult of solution, baffling the judgment of the most expert horseshoers. We know that certain reagents applied to certain chemical elements always produce the same definite results, and hence chemistry is reduced to a science, but the science of horseshoeing as applied to interfering is not so definite and certain in its results, for each animal has some individuality of its own, and although certain definite rules are laid down for our guidance in certain conformation of limbs, yet we occasionally meet with a case which upsets all our former calculations, and sets accepted theories at defiance.

The most important factor in the successful shoeing of interfering horses, is the keen intelligence and sound judgment—the ability of the shoer to diagnose the causes in each case. What, then, are the causes? Of course you have all heard the assertion that if there were no botch horseshoers, there would be no interfering horses. But this is too unfounded to waste space on. The most prolific cause of interfering is defective conformation of the limbs, weakness, unfit condition for work, improper hitching, careless riding or driving, corns, split hoof, sidebones, splints, sprains, or injuries to the foot, or any pain in the foot or limb which may prevent the animal from having proper control of the limb, and, finally, improper shoeing. The primary object in the treatment of interfering is to endeavor to ascertain the cause. With this object in view I recommend a thorough examination of the limbs and feet. Gather all the information possible from the owner, as to the history of the case. If it be a horse which you shoe regularly, and which is not in the habit of interfering, look about the feet and legs for signs of pain, have him trotted up to see if there be any sign of lameness, and look out for corns. Some time ago I was simply "cussed out," for making a horse interfere that never did so before. I humbly apologized, but on examination found a nail in the frog with pus behind it, which was the cause of the trouble, and the cause being removed the animal quit interfering. Last year an old customer of mine called me outside of my shop, and said he, "Whatever have you done to my horse? Ever since you put those last shoes on, he's been cutting his ankles badly, and this last day or so I can hardly get him along." I looked at his feet and I couldn't see anything wrong with the shoeing, but I noticed the animal hanging his head as if he had been driven forty miles. I said, "Have you been giving him more driving than usual? He looks mighty dull." But says he, "This interfering makes him a whole lot duller than he looks." I advised him to show the horse to a veterinary surgeon. Two days after I saw my complainant driving another horse, and on inquiry I learned that the veterinary surgeon told him to take the horse home, that it was sick, and on seeing the horse the next morning the veterinary surgeon pronounced it pneumonia, which of course, in the incipient stage was causing the interfering. In other words, the dullness was producing the inability to control the limbs—interfering—instead of the interfering producing the dullness, as asserted by the owner. And this is one of the many cases that shoeing cannot cure. I relate the above to remind you that in all horses that interfere as a result of incipient lameness, sickness, over-work, etc., the proper treatment is rest, good care, proper feed, and the advice of the veterinary surgeon.

The pain in a foot or limb resulting from a sprain, splint or ringbone, even though the cause may not be readily apparent, may cause the animal to lose control of the affected limb, hence the interfering. It follows, then, that unless you can discover the cause, the application of a remedy is the merest

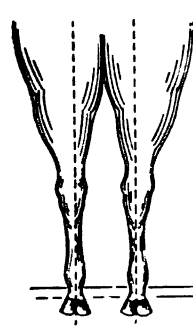


Fig. 29. POSTERIOR VIEW—REGULAR CONFORMATION.

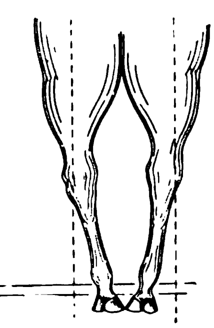


Fig. 30. THE HOCK-WIDE POSITION.

guess work, and hence the importance of a thorough examination in each case. Leg weariness is a common cause of interfering; it is common knowledge with all shoers that there is much more interfering in summer than in winter, on account of the prostrating effects of the hot sun.

The horse of regular conformation, Fig. 29, rarely interferes, except he be sick, leg weary or lame, but the horse of perfect conformation is the exception, not the rule, and this is the great-

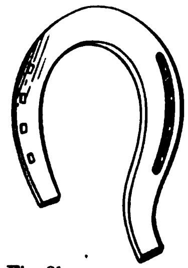


Fig. 31. OUTSIDE WEIGHT SHOE.

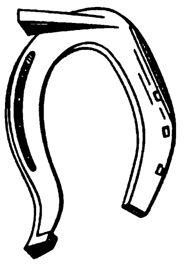


Fig. 32. OFF HIND ANTI-INTERFERING SHOE.

est trouble the horseshoer has to contend with. The hock-wide position, Fig. 30, with toes turned in, though common among draft horses, is comparatively rare in roadsters. The animal of this conformation, when he does hit, invariably strikes the fetlock or coronet with the inside toe of the opposite foot. If a roadster, I recommend shoe Fig. 31, a heavy outside weight fitted close at the striking point. If a draft horse, use the shoe in Fig. 32, with a toe calk welded on, projecting an inch over the outside toe of the shoe, and tapering down thin at the other end, the shoe fitted close at the striking point.

The conformations most prone to interfering are the variety of base-wide positions, or those with the legs perpendicular from the hock to the fetlock, yet with the points of the hocks close together, with the cannon bones set on at an angle, with toes turned out—toe-wide, Fig. 33. Most toe-wide horses, especially where the legs are set on at an angle to the body, will strike about the inside quarter, near the heel nail hole. Seventy per cent. of these will go clear, provided they are in condition for work, if you will only dress the ground surface of the hoofs to the shape they would wear them if unshod. The majority of such cases are outside wearers, for which I recommend shoe, Fig. 34. In preparing the hoof, rasp away a little of the wall at the striking point, A B, Fig. 35, leave the inside of the hoof a little higher than the out, as indicated by the wear of the old shoe, and roll both hoof and shoe at the outside toe and quarter, C D, Fig. 35. See Fig. 34, C D. If there is not sufficient hoof to admit of getting it high enough on the inside, then weld on a calk at the inside toe, Fig. 34, and fit full at that point—inside toe—but close between A B, Fig. 34, the striking point. Most animals of this conformation do not interfere until shod, and examination of their unshod hoofs after wear shows a long inside toe somewhat high on the inside and rolled to the outside quarter, which position allows the foot to break away to the outside and pass clear. So, whenever you meet with animals of this conformation that travel clear without the shoes, bend the shoes to the ground surface of the hoof, one side higher than the other, notwithstanding. Fig. 36 shows a high inside anti-interfering shoe, a great favorite in England and Ireland for horses that strike with the inside toe. I have frequently used it with eminent success.

As light a shoe as is compatible with reasonable duration of wear is indicated in all cases of interfering. Any extra weight is a burden to the muscles, and tired muscles are often enough of themesives to make a horse interfere. Don't experiment. You should have reasons obtained from definite deductions as to why you conclude to use this or that shoe. Always use boots until you are sure the horse goes clear, as a heavy blow with the edge of the shoe is equivalent to striking the joint with a hammer, and may, and often does cause serious complications in the fetlock joint.

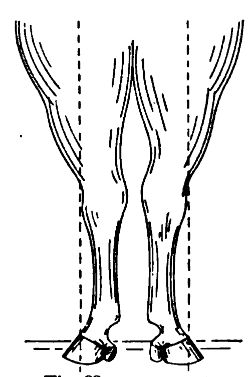
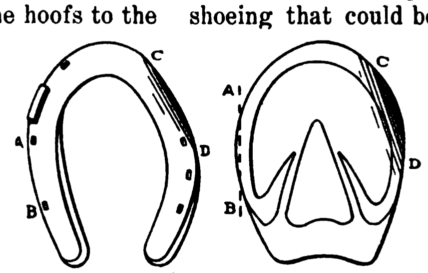


Fig. 33. TOE-WIDE CONFORMATION. POSTERIOR VIEW.

To lay down a specific principle of shoeing that could be successfully applied to all horses of a given conformation is impossible, because several horses of a given conformation may each have a peculiar movement—a mode of action of their own—which



Figs. 34 AND 35. NEAR HIND FOOT—GROUND SURFACE AND SHOE.

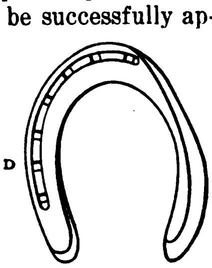


Fig. 36. HIND INSIDE SHOE.

may upset all our former calculations and set accepted theories at defiance. Therefore the foregoing paragraphs are offered as broad, general principles to which the shoer must apply the light of common sense and good, sound judgment to insure success.

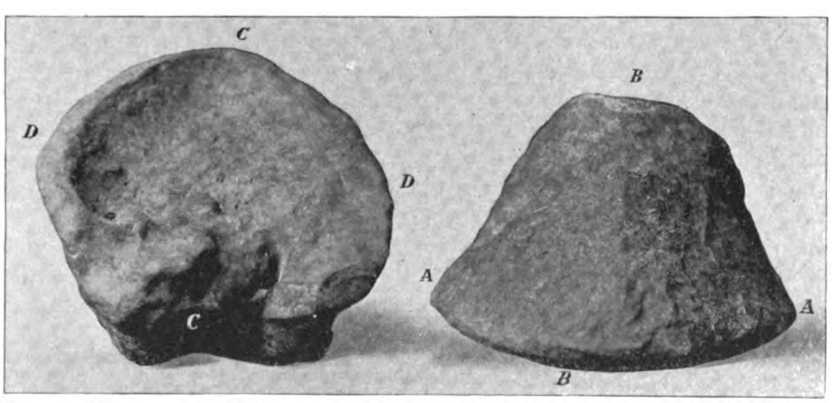
(*To be continued.*)

A Curious Stone Formation.

The accompanying illustration shows two views of what is apparently a large rock, closely resembling a petrified horse's foot. According to the natural formation it is the right hand hind foot, almost perfect at every point. The arc in the sole or bottom view is especially good.

In appearance, it looks like two bones grown together, the pedal bone and the lower pastern bone. On the top it resembles the glenoids where the upper pastern bone fits into it. Referring to the illustration, its dimensions are as follows: From D to D, 11½ inches; C to C, 12 inches; A to B, 13 inches. In height it is nine inches, and weighs eighty pounds.

This peculiar stone is the subject of no little speculation. As the progenitor of the modern horse is known to have been a small insignificant quadruped, the hoof in question could hardly represent a prehistoric horse of large proportions. Many who have seen the stone or petrification say it is a relic of some large animal, while others state with equal positiveness that it is simply a freak of nature. But whether of animal or mineral origin, it is certainly quite a curiosity. THE AMERICAN BLACKSMITH is indebted to Mr. M. S. Hewitt of Georgetown, Texas, for the photograph and description.



OF MINERAL OR ANIMAL ORIGIN—WHICH?

Tire Setting Kinks.

J. L. PAINTER.

I have a practical method of setting light buggy tires without changing materially the bolt hole places. Of course, years ago, before we had tire shrinkers, we used to cut and weld the tire enough smaller to set it tight again, and the cutting place generally was at the old weld, regardless of a system of cutting at such a place that would cause the holes to come right for the bolts again.

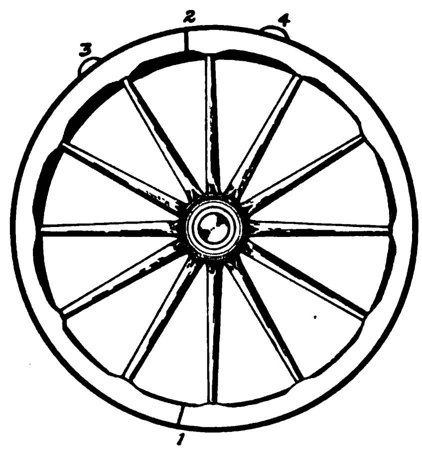


Fig. 1. TIRE SETTING KINKS.

The way I do it now with the aid of the tire shrinker is as follows: I first mark the tire and felloe at joint No. 1, Fig. 1, and then take the bolts out and the tire off. If the felloe needs sawing out, I saw at joint No. 2. After measuring the wheel with the traveler, I take the tire and upset it at 3, between the joint hole and the first bolt hole, and if the tire is very loose, I sometimes upset it again at 4 so as to bring the tire to the correct size of the wheel. Then I heat the tire, put it on the wheel and put the guide pin or the tire bolt in the holes at joint No. 1, leaving the upset parts at joint No. 2. That will bring the bolt holes nearly all to their place, except the holes at joint No. 2 which will be covered by the felloe plate, and would necessitate boring through the felloe anew.

In setting a light wheel a good deal of judgment must be used. If an old wheel has considerable dish, the tire should not have any draw whatever, while if the wheel is straight it will stand some drawing. Of course experience is the best teacher on the drawing of tires. At the time of year when it gets cold, we get a great many light broken tires to weld, and some of them are worn very thin. To weld them successfully, I cut the ends in the middle, turn one end up and one down, bring the halves together, as indicated in Fig. 2, and weld.

Another way of setting when the tire is off is as follows: I clean the felloe on its face and paint it with a mixture of varnish, oil, dryer and any paint, before putting the tire on. When I get the tire ready I warm it all around and put it on the wheel and let it cool on the paint without putting it in water. When the tire is cold and shrunken, it makes a water-proof job under the tire.

There are many good welding compounds, but for steel welding, I prefer pure pulverized borax. The main thing in welding steel is to keep the parts clean from dirt. If they are joined together, as when welding a spring or tire, or putting a piece of steel on a grub hoe, to get the parts to stay perfectly at their place when taking the heat is half the battle.

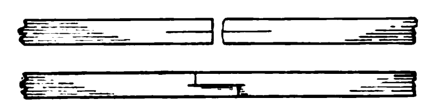


Fig 2. METHOD OF WELDING LIGHT TIRES.

I have a simple way of cutting off ends of steel tires, or any iron with the aid of a helper. I take a heavy three cornered file and break it up into two or three-inch lengths, and draw the temper, when they are ready for use. I lay the file on the anvil and place the tire on top and have the helper strike, after which I turn the tire, give it another blow and off it comes.

Corns; Causes and Cure.

W. S. GILDERSLEEVE.

Corns are caused in all cases by undue pressure of the horn against the sensitive structure of the foot. A foot that stands equally divided on either side of the center of the leg and is equally proportioned otherwise, is not frequently troubled with corns, but where the foot stands with the inside heel nearly in the center of the leg, with a deep perpendicular quarter and heel, we have a condition that is likely to produce corns or quarter cracks. The reason for this is the greater weight and concussion brought to bear upon the side nearest the center of the leg. Then if the horn is allowed to grow more rapidly on this side, which is very apt to occur, the foot is made more rigid, and is thus deprived of the elasticity which is so necessary for ease and comfort of movement.

This form of the foot is very frequently found among horses of all classes.

I find in treating a foot of this kind, whether the quarter has broken open or the interior parts are bruised from the pressure of the horn, the best thing to do is to lower the affected side of the foot from the heel to toe as much as possible, taking care to do it equally. Then cut out the bottom of the foot, especially on the affected side, as much as seems necessary, to allow the foot bone to descend readily when weight is put upon it. Now narrow and lower the other part to equalize the proportions of the foot, always bearing in mind that the inside should be kept as low or a trifle lower than the outside. A bar shoe, tar, oakum and leather will soon improve the foot.

There is no benefit derived from digging and burning out the corns. It is a dangerous method. The cause lies with the formation of the foot. There seek to remove it.

Queries, Answers, Notes.

Questions upon blacksmithing, carriage building and allied subjects will be printed under this heading. Answers and comments are solicited from readers for insertion here also.

Welding Plow Steel. Will someone tell me how to weld plow steel, and what is the best flux to use for the same?

WILSON TURNEY.

Tempering Drills. Will you kindly give me your best process of tempering axes, and also drills for miners?

W. F. SIZEMON.

The Cold Tire Setting Machine. Is the cold tire setting machine coming into general and practical use? From what I see and hear of it, there are some points in its favor and some against it. One of our brother blacksmiths here has one on trial, and I don't think he is very well pleased with it. In the first place, if your wheels are in good condition all well and good, but suppose your spokes are loose in the felloes as you almost always find them in light work, to do a good job you will have to unbolt the tire, take it off and wedge the spokes; therefore, it is a small job to shrink and replace it the old way. It will be said, however, that you cannot govern the dish in wheels by the old way as well as with the machine. This is a mistaken idea, for a blacksmith that knows his business can give as little or as much dish as he pleases. Secondly, as to speed. In the heavier tires, ¾ by 1½ inches, with the machine they cut the tire somewhat longer and pull them on cold and then shrink them with the machine. Now, with a good helper, a blacksmith can put on as many or more tires in a day's run as a machine, because in making his weld he leaves the proper draw and can heat several sets at one heating. Again, it will be said that you will burn the felloes by heating in the old way, but with the latest cooling tub, such as we have, you will hardly char the wood. As I said before, if your wheels are in good condition, I suppose the machines are all right, and I am not condemning them. I don't see however, where we are saving much labor by using them. I may be very wrong, but should like to hear from some of the other smiths.

WILLIAM L. GREEN.

Breaking of Flatters. As I am troubled considerably with flatters breaking or jumping off between face and eye for handles, would be pleased to get advice as to cause. The flatters are made of 1¾ inch square tool steel of good grade. Face is 3½ inches square, head 1¾ inches square. Flatters are not tempered. We do some hard hammering on them, but there ought to be some reason for this trouble. I also have some trouble with large top swages.

W. C. CALIF.

Welding Soft Steel. What is the best way to weld soft steel or machine. It is very difficult to take two pieces from the fire, put them on the anvil together and get them to weld. A fine weld can be obtained when they are brought together in the fire, but when taken out separately, I find it hard to weld.

J. W. E.

To the Editor:

In the February issue of THE AMERICAN BLACKSMITH appears an article from the pen of Prof. F. Paul Anderson, of the State College of Kentucky, to which in common with thousands of your readers, I desire through the columns of your magazine to take exception. In the last sentence in the first column of his article, Prof. Anderson states: "It is the belief of those in charge of blacksmithing at the State College that it is possible in a five months' course of two and one-half hours each day, to give young men a good working knowledge of the principles employed in blacksmith shops, etc." It is a fact too well known to admit any discussion, that the blacksmith is looked upon as a consolidation of brawn and muscle, with little or no brains, and that any one can be a blacksmith with a few months' work, but this is the first time I have ever seen such an opinion expressed in public print, and is all the more surprising coming from the pen of a gentleman of Prof Anderson's standing. A five months' course of two and a half hours per day, five days per week, would give 250 working hours as the maximum in the college term, or twenty-five days at ten hours per day. In such a time a young man would not become a first-class helper, no matter how bright or willing he might be. Imagine a young man graduating from Prof. Anderson's Training School and securing a job in one of our ship building concerns. The first job he gets is the building of a stern post or a rudder frame, or in locomotive work a reverse shaft or a set of links, or in an engine building concern he gets a connecting rod or an eccentric shaft. I am sure his five months' course would be of little use to him. The only method I have of forming an opinion of the statement is that Prof. Anderson received his information from an unreliable source, and so stated it without thinking, in which case it may be excusable, but if the statements were made with the consideration due to any article written for your paper, it certainly displays distressing ignorance of the true facts. To my mind an A 1 blacksmith is a peer in the mechanical world, and does not require to take a back seat for any other trade. I have been at this business for twenty-five years, and do not pretend to know it all yet.

THOMAS PRENTICE.

A Shoeing Inquiry. I would like to know how to shoe a horse who turns out his left hind foot, so that it keeps the shoe worn out. I have shod him with a trailer, but it doesn't work very well

G. E. COOK.

Hardening Plow Lays. Will some brother smith please tell me how to harden a lister lay after it has been sharpened, so that it will be as hard as it was when sent out from the factory? I wish to harden the entire lay from edge to mouldboard.

L. GORDON.

Plow Mouldboards. Will some one with experience explain how to soften a spot on a plow mouldboard, so it can be drilled without doing too much injury to the same?

EDWARDS.

Drilling Mouldboards. In answer to Mr. H. D. Heckendorf's question in the February issue, with regard to drilling mouldboards, would say, temper your bit in sealing wax, being careful not to get it too hard and ruin your bit.

S. M. PRICE.

A Cross-firing Horse. I have a pacer that cross-fires, and I would like to know the best way to put a stop to it.

E. A. GERARD.

How Shoe a Knee-Cutting Horse? I have found one horse in my shoeing experience that cuts his knees, and would ask some one to tell the proper way to shoe him to prevent it. I have tried shoeing him several ways, but have failed. I had another horse who cut his knees and shod him to perfection, but the same shoeing fails on this one.

C. D. ROBINSON.

Box Setting. I should like to hear from some one on box setting in wagon and buggy wheels.

WALTER WILLIAMS.

A Shoeing Question. I have a horse that has very peculiar feet in front, and I would like to have some brother blacksmith tell me how to shoe him, or what to do to make them grow right. The feet are wide apart, and toe out, so that the inside walls are much lower than the outside. The left foot is worse than the right.

GEO. W. McDOUGAL.

Books on Forging and Tempering. Will some one tell me where I can buy a book that treats mostly on forging and tempering lathe tools, and general blacksmithing?

ALSWORTH.

A Query on Sand-belts and Seasoning. Will some one tell me how to make a sand-belt and wheel to run by power? Please give kind of sand to be used.

Does the soaking or boiling of green wood in water for the purpose of seasoning impair its vitality, or make it more brittle? What effect does such as tallow, lard or neatsfoot oil have on wood? Will it not tend to make it brittle instead of toughening, as in the case of linseed oil?

C. W. F.

Soldering. In reply to Mr. John Case's inquiry in the February issue, for a soldering preparation, I would say that I use muriatic acid in which zinc has been dissolved. His trouble may not be in the

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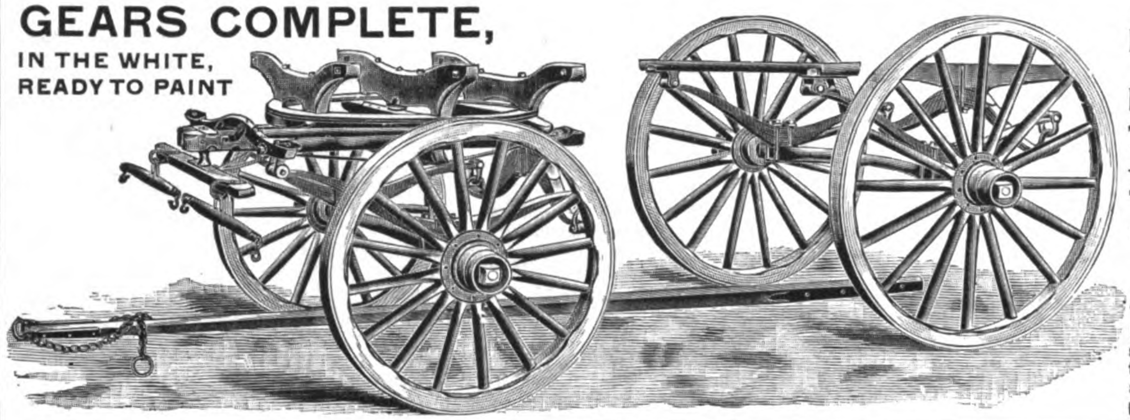

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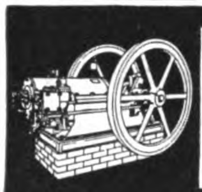

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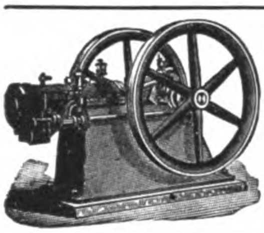

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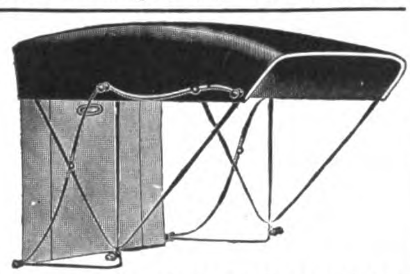

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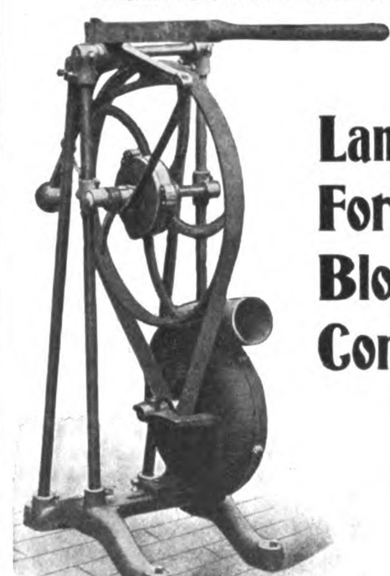

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VOLUME I

THE AMERICAN BLACKSMITH

NUMBER 8

BUFFALO, N.Y. U.S.A.

A PRACTICAL JOURNAL OF BLACKSMITHING.

MAY 1902

$1.00 A YEAR
10¢ A COPY

CONTENTS.

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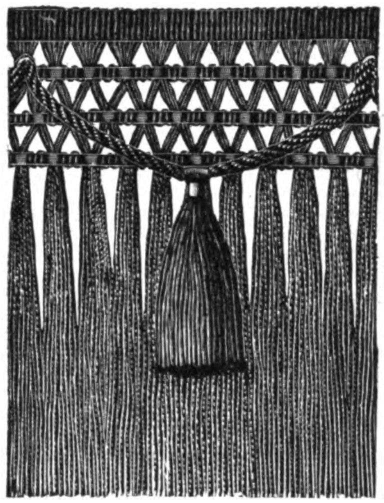

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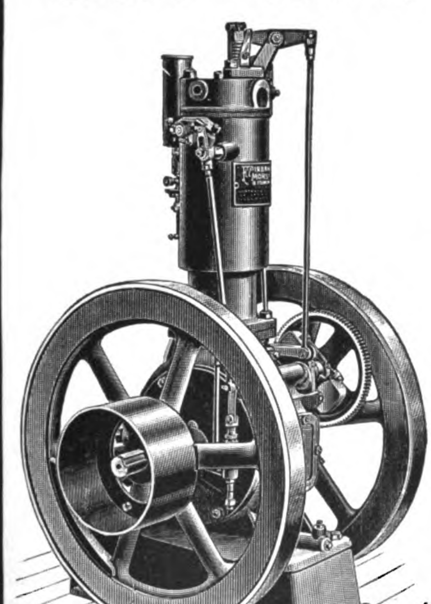

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THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

VOLUME 1 MAY, 1902 NUMBER 8

BUFFALO, N. Y., U. S. A.

Published Monthly at The Holland Building, 451-455 Washington Street, Buffalo, N. Y., by the

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Correspondence on all blacksmithing subjects solicited. Invariably give name and address, which will be omitted in publishing if desired. Address all business communications to the "American Blacksmith Company." Matter for reading columns may be addressed to the Editor. Send all mail to P. O. Drawer 974.

Cable address, "Blacksmith," Buffalo. Lieber's Code used.

Entered February 12, 1902, as second class mail matter, post office at Buffalo, N. Y., act of Congress of March 3, 1879.

Notice of Discontinuance.

Notice is hereby given that the services of Mr. Thomas Mattison, of Southampton, England, as subscription agent for this paper in England, have been and are now discontinued. We would therefore request readers and prospective subscribers to recognize no agent in England until further notice. Foreign subscriptions should be sent to us direct, price, $1.25, or five shillings per year, payable in advance.

Registered Shoeing Smiths.

The short article appearing in our March issue under the title, "Shall we have Registered Shoeing Smiths in America," aroused no small interest, as indeed it should, considering how vitally the question is connected with the welfare of the craft. We had the pleasure of receiving a great many interesting letters expressing earnest and logical views upon this question. We should like to see a lively discussion, and invite all readers who have given thought to the subject to express their opinions freely. What is your idea of elevating the standard of the shoeing craft, how may prices best be maintained and the evils of rate cutting abolished, and what are the best steps to take to prevent persons from engaging in shoeing who lack the necessary knowledge and experience? A free discussion is one of the best methods of getting down to facts, and by such means the best plans of securing the desired end can be discovered. Let us have your thoughts on this subject.

A Change of Office Location.

We wish to announce a change on May 1st of the office address of The American Blacksmith from the previous location, 210 Pearl street, to new, lighter and more commodious quarters at The Holland Building, 451-455 Washington street, Buffalo, N. Y., where we should be pleased to have any of our friends call when in the city. This move was made as a result of a necessity for increased space to accommodate our growing demands, our previous quarters admitting of no enlargement. Settled in our new quarters with three times the floor space, we feel sure that we can attend more promptly and in better fashion to the wants of our friends, and we have reason to congratulate ourselves upon the change.

Your Neighbor Craftsman.

The unvarying tone of all correspondence received at this office fully convinces the publishers of The American Blacksmith that their efforts to produce and sell a high grade journal at a low subscription price is thoroughly appreciated by the craft. The paper is meeting with unbounded success and a flattering reception everywhere. The following letter from Mr. Matt Schroeder, of Armor, New York, under date of March 7th, is only one of many similar communications reaching us in every mail:

"You will find enclosed one dollar for The American Blacksmith. It has proven to be all that you claim for it and more too. I congratulate you in making the journal what it is. I could not get along without it, if it cost twice the amount it does. One issue is worth more than the subscription price for one year alone. Please to notify me when my subscription expires, so that I can renew immediately."

Naturally we want the good work to continue. We don't want to stop until every smith having his own interest and the advancement of the craft truly at heart is with us. But whether you lend your support or not, no effort will be spared to make the paper suited to the needs of the craft and its individual members.

You are a regular reader, we will say, and think the paper good. Will you not aid us in making it better? You can do this indirectly by bringing it to the attention of your neighbor craftsman. We will appreciate anything you may do in this way. Further, we give a year's subscription free of charge to anyone sending us four new yearly subscribers at one dollar each. Let us hear from you. It is worth your while.

Tool Steel and Hardening.

The great secret of successfully hardening steel dies, cutters and other tools lies in securing a perfectly uniform heat through the whole piece. Cracking when hardening can almost without exception always be laid at the door of uneven cooling. To secure the best results the heat should be taken slowly and carefully, and ample time allowed for the hardening heat to thoroughly penetrate and ensure the same heat uniformly through the steel.

Another point well worth the attention of the toolsmith is the necessity of giving as great a cross section of metal near the cutting edge as possible. The amount of cutting which a given tool will do depends largely upon how effectually the temperature of the cutting edge is kept down, or, in other words, how rapidly the heat due to the cutting is conducted away. The metal conducts heat, roughly speaking, one hundred and fifty times as fast as air. Also the amount of heat conducted is proportional to the cross section, so that a bar of double the sectional area will transmit double the amount of heat in a given time under the same conditions. Hence it can be readily seen how the efficiency of a tool may be increased by giving it as large a section as possible near the cutting edge, so as to aid in removing the heat generated by the cutting.

How We Make the Best Frames in This Country.

RILEY LAISURE AND J. NEWBERY.
Richmond Locomotive Works.

We first select No. 1 long scrap, and have it thoroughly cleaned and made into piles weighing 300 pounds each. Then the next thing to be done is to have the furnace in proper condition, having the bridge plenty high. We then work these piles into slabs about 44 inches long, 12 inches wide and two inches thick. We work these only once, making what we called single worked slabs. We then take eight of these slabs and put them together, and make half a frame back. And we consider when this is properly worked that it will make a much better frame than was formerly made by taking twelve slabs, which were double worked, or worked twice, and making the frame back in one piece or without a weld. We consider the last mentioned way impracticable for many reasons. First, it was too much iron to be properly handled and worked down to the size for frame backs. Secondly, the iron being double worked became crystallized and brittle by using twelve slabs. Thirdly, while all locomotive builders would say a frame made

AN ORNAMENTAL IRON CHAPLET.

in this way was made in one piece, it really had from two to three welds, or what a hammer-smith would term lay-ons, which in our opinion are inferior to the same number of welds. For example, you may weld up a lay-on, and not be able to see where it is welded, and at the same time it will be weaker than an ordinary weld.

When we make our frame backs out of single-worked slabs, eight in a pile, the iron is not worked too much, nor is

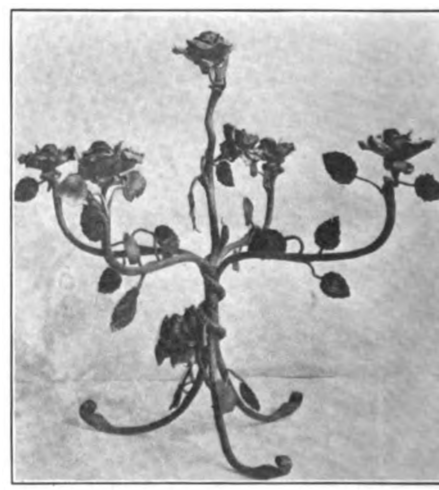
ARTISTIC IRON-WORK DESIGN FOR LAMP STAND.

it worked too cold. The frame is therefore more flexible, not having its virtue worked out of it. We then make our weld in the center of the back. Our iron is selected, and piled in the same way for our frame legs. The only difference is that it is double worked into short billets suitable for staff work. Our legs are bent, having a long toe for the brace weld, in order to prevent the hole for the bolt, which holds the pedestal cap, from coming in the weld of the brace. This leg we make in one heat suitable to be welded on the frame. Some of them weigh from 200 to 255 pounds. We make an average of 35 of these a day. Our tools for this work are very simple.

There are a great many ways to make iron driving axles. Our way differing in some respects from the many reports we have read on this subject, we think it might be of some service to state the best way that we know. After having made them in every conceivable way, we have adopted the way which we here mention. We first select our scrap as we do for all other work. We then have the furnace in good condition. The next thing is good coal. We use single worked slabs, instead of double worked. Our iron is carefully cleaned off before it is put into the furnace, and while heating the piles we never allow the fire to be poked up with the blast on hard enough to blow coal in the furnace, as we find this causes bad work. While poking the fire up with the blast on full with an inferior quality of coal, we find it drives the fine coal in between the slabs, which causes it not to weld and makes a bad axle. Another thing to guard against is to not get the iron too hot on one side before turning, as we find it seldom happens that an axle is bad only on the first end roughed down, and the side of the pile which is next to the bridge when it is first put in the furnace. Since we have adopted this method we very seldom lose more than three or four axles out of a hundred.

Wanted—Photographs.

It has been well said that for illustrating the modern journal, the camera has taken the place of the pen wherever the former could go, and naturally, for no more accurate, handsome and lifelike means of illustrating exists than



IRON CANDELABRUM FOR FIVE CANDLES.

the combined photograph and half tone process of today. Photographs of interesting subjects are therefore always in order, and we ask that wherever possible, readers will send us pictures of any subjects calculated to interest the craft. Photographs of blacksmith shops, interior or exterior views, novel or ingenious machines, handsome or unique specimens of ornamental iron work, will always be gladly received. A photograph of an intricate or skillful job of forging will often tell the story of its creation better than any number of words. We repeat, therefore, our invitation for views of these, and would be glad to have any of our friends respond.

The half tone engravings on this page show some very good specimens of artistic iron work. The variety of uses to which such work may be put is very large and is increasing. Perhaps some of our friends know of some such examples?

Styles of Painting Carriages for the Season of 1902.

M. C. HILLICK.

A very large number of AMERICAN BLACKSMITH readers located in country towns and villages are directly or indirectly connected with the business of vehicle painting, and to all such the prevailing styles of painting carriages are of especial importance. The average country vehicle user is becoming more and more critical in the matter of color and striping novelties, and whatever style is popular along city boulevards and in fashionable repositories is quite sure to create among provincial carriage users a desire for the same thing. One of the best forms of advertising at the command of the country and village painter is to be had through the medium of color and striping novelties.

In the middle West for this season the general purpose top buggy, with piano box, is being painted with black body, and gear Brewster green or carmine. The seat riser and body panels are striped with single and double fine lines of carmine, primrose, yellow, or white. Deft little fine line ornaments are thrown in at the corners of the panels, and in center of seat riser. Often the body panels are painted very dark green, not infrequently olive green, or medium ultramarine blue. A border of 1½ or 2 inches of black is run around the outer edge of the panels, and at the point of intersection of the two colors a stripe is run. This adds an attractive feature to the painting of the popular grade buggy. In speeding wagons, of which nearly every community has a few, there is a decided call for sprightly color effects. As for example: Paint body black, gear coaching red, striped with two hair lines of black ⅛ inch apart. Or paint body black, gear medium green, striped with two fine lines of canary yellow ¼ inch apart. Or paint body black, and gear primrose yellow, striped with hair lines of black ⅛ inch apart.

In the East, the style of striping buggy bodies is not popular. As a rule, piano bodies are painted plain black, gears Brewster or bronze green, or No. 40 carmine. The green is usually striped with two fine lines of carmine, while the carmine is striped, two fine lines of black or gold bronze of best quality. In the East, too, the gentleman's driving, or speeding rig, is often found painted, body black, gear English vermilion, striped with a single $\frac{1}{16}$-inch line of black, the spokes of wheels being striped from hub to felloe. The hub bands, steps and shanks, clips and stays are painted black. Throughout New England and in the vicinity of New York and Philadelphia, the speeding wagon with black body and primrose yellow gear, striped in double and single lines of black, is a favorite style. The popular Chicago road wagon with three parallel panels running full length of body is painted upper and lower panels black, center panel olive green, gear olive green, striped with two fine lines of back ¼ inch apart. This is varied by painting center panel maroon, and gear carmine, striping the gear with a single ⅛-inch line of black. What is known as the Beverly wagon, a strictly high class gentleman's driving wagon, is this season being painted, body panels maroon, moldings black, gear light carmine or New York red, striped with hair lines of black $\frac{3}{16}$ inch apart.

The handy and useful Concord wagon, almost infinite in variety and style, and fairly indispensable to a farming community, is painted, body black, olive or dark rich green, the striping being fine line, cut up work. The gear is painted London smoke, sulphur yellow, Brewster green, bronze green, twentieth century red, carmine, or Indian red, the striping being selected to harmonize with the color scheme chosen for body and gear, the double fine line stripe leading in favor.

The runabout wagon, popular among the best class road drivers of both town and country, is being variously painted. A pretty effect is shown by painting body black, seat pea green, gear pea green, striped with two hair lines of black or carmine ⅜ inch apart. Or paint body black, seat medium shade ultramarine blue, gear ultramarine blue, same shade as seat and striped with two fine lines of gold ¼ inch apart. For particularly gay effects paint body black, seat light carmine, gear light carmine, striped with two fine lines of black or gold bronze ¼ inch apart. Drivers who admire quiet but rich color effects prefer black body and seat, gear Brewster or twentieth century green or No. 40 carmine, striped with two fine lines of black ⅜ inch apart.

Stanhopes, ranging from the jaunty boulevard Stanhope to the closed top physician's Stanhope and thence along through many styles to the elegant Belmont Stanhope, with its roomy dimensions and stick seat and general look of easy elegance, are this season being painted, body black, gear dark rich green or carmine. Or the body black, side quarters deep green, moldings striped light green, gear deep green, striped with two lines of black or light green ¼ inch apart. Or in place of the green substitute maroon, or deep blue.

Phaetons of every style and kind are being painted, as a rule, in dark rich colors. In the middle West, and still westward, the big, roomy phaeton is often painted with body in two colors and striped, and gear cherry red or carmine, striped to harmonize with body colors. A standard style for the present season, however, is body panels deep green, blue or maroon, moldings and rockers black, the moldings being striped in whatever panel color is selected, gear green, blue or maroon, striped in fine lines of lighter shades of these colors. Many of the most aristocratic users are selecting phaetons painted, body black, gear Brewster green, striped with two fine lines of carmine ⅜ inch apart. In the painting of cabriolets, from the daintiest to the wide sweeping lines of the Princess and similar styles, the colors chosen are black, dark rich greens, maroon and blue. The striping is not lavish, but is noticeably fine and clean drawn. Victorias are painted in dark rich colors, striped usually with two fine lines drawn the full length of the spoke. Dark rich greens hold their own as favorites for panel colors upon this class of vehicles.

The surrey, an increasingly popular vehicle with the farming community, is being painted, body and seats black, moldings olive green, gear bronze or Brewster green, striped fine lines of carmine. Or paint gear New York red and striped with single ⅛-inch line of black. A popular middle West style consists of body and seats black, striped with carmine line on moldings; gear bronze green, with two fine lines of carmine ⅜ inch apart. Elegant color effects are had by painting body black, seats deep onyx green or Quaker green, gear lighter shade of these greens, striped two fine lines of carmine ¼ inch apart. Or paint body black, seat panels coach painter's blue or twentieth century blue, gear lighter shades of these colors, striped with three lines of black, or a ¼-inch line of black, edged on both sides with hair line of gold bronze. Black body, with gear painted coach red, carriage part lake or carmine, striped with two and three lines of carmine and gold, furnish handsome color effects.

Heavy pleasure vehicles, broughams, landaus, rockaways, coupe-rockaways, have main panels painted dark rich maroon, or cherry red, or olive green, or deep green; foot moldings and other parts of body black, the moldings being striped with the main panel color, gear to be painted in lighter shade of whatever color is used upon main panels. A fine style of striping landau and brougham gears consists of two ⅛-inch lines drawn ⅜ inch apart. The carmine stripe is a favorite for green gears, both single and double lines being used. Black lines show effectively upon red gears, as do also lines of lighter shade of whatever color may be selected for the gear.

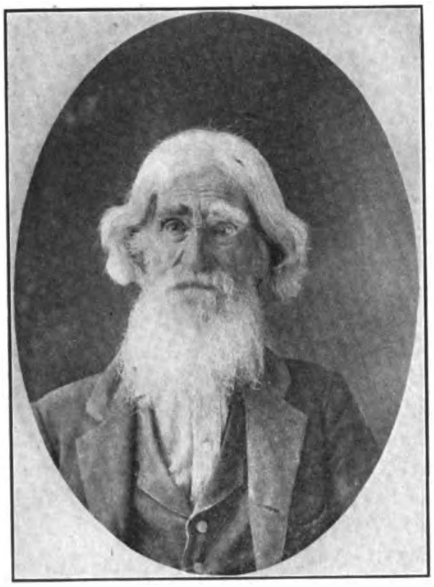
Hearses, ambulances, etc., hold to the sombre black. Carved work on hearses is now being done in a dead finish, so-called, which finish, however, has a dull, silky effect. This is the latest style in hearse finish, and is obtained by grinding ivory black in varnish and flatting out with turpentine to the desired silky effect. As a final word, it may be added that among the leaders of fine carriage work for the year 1902, and on into future years, a high quality of finish is to be maintained.

The Oldest American Blacksmith.

In response to the request made by THE AMERICAN BLACKSMITH for the name of the oldest blacksmith in America, a large number of names of aged and very interesting smiths was received. The result was surely most astonishing, for in the brief space during which the offer remained open we have been sent the names of three smiths over ninety years of age, twenty-two over eighty, and a baker's fifty more than seventy years of age, all still working at the anvil. This showing is a most gratifying one, as it seems to say most unmistakably that the grand old craft in its individual members is hale, hearty and healthful as of old.

Answers came from every part of the country, so that we believe we have obtained the name of the oldest smith in America. The honor of being America's oldest blacksmith belongs therefore to Mr. Samuel Brock, of Falmouth, Grant County, Kentucky, ninety-four years of age, whose photograph is reproduced on this page for the benefit of our readers. The name was sent in by Mr. W. D. Lemmon, of Falmouth, Kentucky. The following taken from the Williamstown (Ky.), Courier is of interest:

"S. Brock has been putting on horseshoes for seventy-six years. He will be ninety-five years old on the 26th day of October next. He was born in



MR. SAMUEL BROCK, FALMOUTH, KY., AGE 94.

Virginia, October 26th, 1807, and migrated to Kentucky, August 26th, 1840. Mr. Brock has been married three times, and has raised a family of sixteen children, eight of whom are dead. He is a Democrat in politics. His father died at the extreme old age of 113 years, and his mother died at almost as great an age, 106. Mr. Brock is a blacksmith by trade, and is yet able, as he says, to put a shoe on a mule. He lives seventeen miles from town and rides or drives to town alone. He is a conspicuous figure in Grant County history on account of his extreme old age."

Mr. Joe Bragg Turner, of Warsaw, N. Y., and Mr. Hyatt of Lake Charles, Iowa, are each ninety-two years old, but not knowing the months of birth, we are unable to say which is older. In addition to a few notes regarding these two smiths, we show a most interesting photograph of Joe Bragg, well bearing out the description of the old gentleman. Following the mention of these two smiths are given brief details of all we have heard from, who have journeyed along life's pathway for more than three-quarters of a century.

MR. JAMES KANE, OSKOSH, WIS., AGE 78.

MR. WILLIAM TUBBS, NORWICH, CT., AGE 85.

Joe (Bragg) Turner was born in 1810, being now ninety-two years of age. At an early age he was bound out to a blacksmith to learn the trade, which in those days meant a seven-years apprenticeship. His aptitude for the business made him a good workman, and for seventy years he has worked at his trade, sixty-five of which have been in the county of Wyoming, and forty in the village of Warsaw. He is better known in this section as "Joe Bragg," than by his legitimate cognomen, from the fact that he is always bragging of his work, and claims that he is the best steel worker in the county, if not in Western New York. He is to-day as agile as a man of sixty, and performs his daily duties regularly. He claims to be the oldest working blacksmith in the State, and up to this time his claim has not been disputed. The photograph is by Salisbury, and we are indebted to Richards and Sullivan of Warsaw, N. Y., for the details.

"Mr. Hyatt was in town Monday. He has resigned his position as blacksmith for the Industrial Lumber Company. Mr. Hyatt is ninety-two years old and his occupation, that of blacksmith, is an indication of his physical condition, says the Vinton Herald. He does not use glasses even to read, and is certainly the strongest and brightest specimen of manhood nearing the century mark with whom the Vinton folks have ever come in contact."

Thomas Downs, Patesville, Ky., born June 16th, 1814, is almost eighty-eight years old. He still works at his trade and runs a grist mill two days each week. The mill is one and one-half miles from his residence. He has lived in the same place fifty-eight years, and is prominent in church matters.

William Tubbs, 271 Washington Street, Norwich, Conn., aged eighty-five, was born in Lisbon, Conn., September 10th, 1816. He has been sixty-nine years at the trade and is still working at the anvil. His specialty is iron work for large buildings, and a cushioned axle hand freight truck of his own patent. His name was received from E. A. Spaulding, one of the forty who learned their trade from him.

W. H. Richards, Monongahela, Pa., eight-five years old, was born October 8th, 1816, and is still working at his trade and is very active for his age.

Walter Stickney, Meriden, Conn., will be eighty-five years old on the 16th of November, 1902. He has worked at blacksmithing for years, and is actively working at the forge and anvil to this day.

John Staley was born at Millbrook, on May 10th, 1817. At the age of fifteen he went to Blairstown as an apprentice in the shop of Robert Bonnell, coming to Stillwater township six years later, in which township he still resides, and has worked at the anvil continuously ever since. He has never been sick, nor has he worn glasses at any time. His early life being spent where the log schoolhouse seemed to be all that was required, and obliged to support himself at an early age, his education was therefore necessarily limited, in consequence of which the memory became more acute, and his work to be put on account was therefore stored in memory for days at a time, or until some kind friends would do the charging, and it was a rare thing when the smallest of items was forgotten.

Albert Avery, Hartwick, Otsego Co., N. Y., eighty-four years old, is still working at his trade of shoeing horses. He commenced at the age of nineteen and has always lived at Hartwick.

Daniel Gorman, Lima, Ohio, eighty-four years of age, was born in Ireland, coming to this country in 1859. He is always at his place in the blacksmith shop of the Cincinnati, Hamilton and Dayton Railway Company, and has not lost thirty days time on account of ill health in the past ten years, all told. Mr. Gorman may not be the oldest man in the craft now in active service, but is getting along in years.

Daniel Bidwell, Cute, Tenn., born September 5th, 1818, is eighty-three years of age. He went through the Civil War, going to the front with his company, and doing blacksmithing in the army at times when there was no fighting going on.

John S. Edwards, Leeds, Greene County, N. Y., eighty-two years old, is still working in his shop and doing a good business.

Nathan Moseley, Limestone, Tenn., born at Huntsville, Ala., May 7th, 1821, is eighty-two years old and still works at the anvil to this day.

Frank Miller, Potosi, Mo., eighty-one years old, works at the forge every day.

Stephen H. Ables, Esperence, N. Y., eighty years old, is working every day at his trade.

L. D. Krum, Krums Corners, N. Y., is eighty years old and has run a shop at one place for fifty-three years. He started at the age of nineteen. Mr. Krum has in his shop a foot power trip hammer, which has always been quite a curiosity, and many a student of Cornell has stopped to see the old gentleman work with his feet, as well as with his hands. Now for fifty-seven years his hammer and anvil have rung out their work notes every morning, but his work with them will soon be over.

MR. JOB BRAGG TURNER, WARSAW, N. Y., AGE 92.

S. D. Bolander, Allentown, Ohio, is eighty years of age.

Thomas Davey, 23rd and Callowhill Streets, Philadelphia, Pa., is eighty years old and still working hard at the anvil.

G. W. M. Drake, Monticello, Minn., is eighty years old, and one of the best blacksmiths in the State of Minnesota.

H. W. Dodge, Stromness, Ontario, Canada, eighty years old, can shoe horses as well as he could twenty years ago.

James E. Marcum, Troy, Kansas, is eighty years old. He works at his trade every day at most all kinds of work, and has ever since the first part of 1836. He was born April 10, 1822, and was in the Mexican War, fifty-five years ago. Still an active smith.

John S. Baichtal, Sac City, Iowa, was born July 18th, 1822, and is seventy-nine years old.

Charles Johnson, West Point, Pa., seventy-nine years of age, is working at horseshoeing at the present time.

Robert McKell, Spanish Fork, Utah, seventy-nine years of age, still works at the blacksmith trade.

John Brocht, Mastersonville, Pa., seventy-eight years old, is still working at the forge.

William Crater, Glen Gardner, N. J., was born February 9th, 1824, is seventy-eight years old.

James Kane of Oshkosh, Wis., seventy-eight years old, whose portrait is given above, is a blacksmith with a record of sixty-three years continuous service at the anvil. He was born in Inniskerry, Ireland, February 14th, 1824. At the age of fifteen he began work with the village smithy, serving seven years as an apprentice, and four as a journeyman. His work was horseshoeing and general blacksmithing. After eleven years in his native town, he removed to Boston, Mass., and then to Oshkosh in 1856. Here he established himself to remain, and for forty-six years has worked at his chosen trade. Endowed with a strong constitution and temperate in his habits, his sterling integrity and native honesty has made him comfortably wealthy and won for him good friends. Still he continues to work at his anvil, and attributes his excellent health at the age of seventy to hard work and plenty of sleep. While his earlier working years were confined to horseshoeing, at which he is a master, and which still forms the greater part of his business, his work of late years has been somewhat diversified, and general repairing is carried on. Mr. Kane says to-day that he feels good for ten years more of active work.

William Higgins, Salisbury Mills, N. Y., seventy-eight years old, has worked in one place forty-five years.

Isaac Schohe, Mastersonville, Pa., seventy-eight years of age, is still working at the forge.

Lawrence M. Vanbuskirk, Grimsby, Ontario, Canada, seventy-eight years old, still works at the forge in the shop where he has worked forty years.

Adam Barboe, Burnt Prairie, Ill., is seventy-seven years old.

Stephen Miller, Wallbridge, Ontario, Canada, seventy-six years old, has worked at the trade for sixty years.

Melchior Smith, Reading, Pa., seventy-six years old, is employed by the Greth Machine Works in Reading.

W. W. Bryant, Petersburg, Ill., was born on March 4th, 1827.

Charles Waugh, Hillsdale, Ontario, Canada, is seventy-five years old.

"My name is Tobias Zophee. I was born in City Spwander, Court DeGlaris, Switzerland, May 17th, 1827. Began my trade at thirteen years old, and struck for my father when I had to stand on a box to reach the anvil. I came to Courtland, Ala., in 1869. I worked at my trade for General Joseph Wheeler in 1870. I am five feet, six inches high, and weigh one hundred and forty-three pounds. I am seventy-five years old, and have not a gray hair in my head. I am active, work at my trade every day, and can do any work that any other blacksmith can. I am the father of fourteen children, am now a widower and in search of a handsome rich widow. If THE BLACKSMITH would aid me in finding this one desire of my heart you would very greatly oblige. TOBIAS ZOPHEE."

An Anvil Tire Holding Device.

J. G. HOLMSTROM.

The accompanying illustration shows a very useful device for holding tires. It is simple in its construction, does its work well, and can be instantly adjusted to fit any width of tire. It is of great service in holding tires in a convenient horizontal position to permit their being accurately measured.

The device consists of three parts, the frame, the back-plate and the cam. The frame has a leg made to fit the anvil hardy hole, and is provided with teeth on the back to engage in corresponding teeth on the back plate. For a portion of its height the back plate projects through the slot in the frame. The cam and handle are movably bolted to the back plate, and is set off center, as shown on the drawing.

When not in use the cam and handle is supported at its uppermost position by hanging upon the peg springing from the upper left hand corner of the frame. In using the device, the tire is placed with its face against the vertical side of the frame, and the back-plate and handle lowered until it rests upon the tire. By then turning the handle to the right the offset cam, or eccentric, tightens up and holds the tire, the teeth on the back stop holding the same and preventing its lifting.

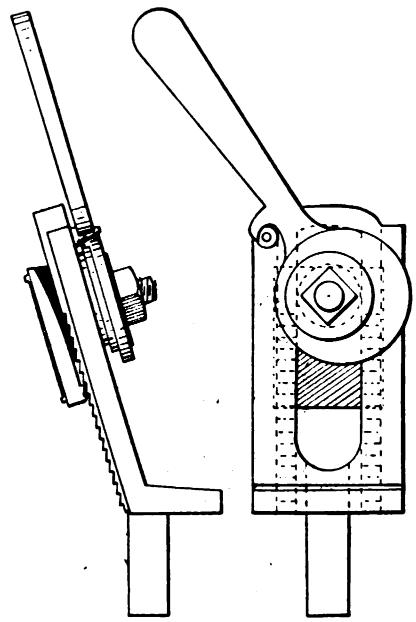
The Japanese Horseshoe.

It is said that in Japan straw is employed for making horseshoes. Ordinary rice straw is used, braided very tight and firm, and half an inch thick. They cost only about a cent a pair, and when worn out are thrown away.

Points on Heat Treatment of Tool Steel.

CHARLES P. CROWE,
Ohio State University, Columbus, Ohio

The surface of metals is liable to oxidation even at a low temperature. Iron surfaces that are polished become blue when exposed to the atmosphere at a temperature considerably below a red heat. If the heat is applied slowly while the surface can be watched it may be seen to change, first to a light yellowish color which becomes



A TIRE HOLDING DEVICE.

gradually darker as the surface is made hotter. This action of the air upon the polished surface of steel is useful to a temperer, as it furnishes him a guide for reducing the brittleness of hardened steel, but retaining the other properties of the hardened piece with its structure unchanged, unless the piece is heated higher than 700° Fahr., below which the blue oxide has been formed, but is driven off at the temperature, and will show itself again and quickly disappear if the surface is rubbed with a piece of sandstone.

The color of oxidation is not a function of the tempered condition of hardened steel, but an indication of the heat between temperatures of about 400 to 700° Fahr. If a temperer polishes off a color that appears at say 580° and then reheats the piece to a higher temperature, say 620°, indicated by a different shade of color, the effect would be the same as though he had taken the higher temperature without polishing the second time, and it would make no difference except in the time taken to do the work, whether the steel was cooled or not before reheating.

All the colors that have been proven and accepted as guides to the temperer, appear to chase each other from the polished surface and show themselves at known temperatures; therefore the method of repolishing and reheating several times may be a suitable way sometimes, but could not be adopted in common practice. In the table given below, I have named the most reliable and certain colors in their order, with the temperature at which the same condition would be caused without oxidation if the steel was heated uniformly away from an oxidizing atmosphere. It should also be remembered that many combinations of these colors may be observed on surfaces variously polished, or when the heat is checked at points between the given temperatures. This is especially true of the violet which causes red spots on the blue if the piece is quenched between 550° and 580°. There is also a mixed color known as peacock, which appears if the conditions are right, between 500° and 550°; but to those familiar with this process, it is well known that closer graduation by the color test is of little value except for special work on known grades of steel.

Guide for Tempering.

Tool steel after hardening and polishing may be tempered as desired by slowly heating it in the open air until the corresponding color appears. If not polished or if heated in a bath these colors do not appear.

TEMPER.	COLOR.	TEMPERATURE.
Very high.....	Yellowish white or Straw....................	400 F.
High	Dark Straw.............	450
	Orange or gold........	480
Medium........	Brown	500
	Purple	530
Mild..............	Violet.........................	550
	Light or sky blue....	580
Low	Deep or pigeon blue	600
Soft	Uncertain blue........	650
....	No temper remains. But grain is unchanged	700

The last temper named in this guide can be easily filed, and at 700° the fine or coarse grain that resulted from the hardening heat remains the same, but the temper required for cutting tools has been destroyed. The temper condition indicated by the color is fixed at the given temperature, and will remain so until it is heated higher, therefore quenching to prevent the surplus heat from a tool that has been hardened only on one end from supplying too much heat to the hardened portion, is necessary, but slow cooling is generally preferred when the danger of too much heat can be avoided in any other way.

Guide for Hardening.

Tool steel heated and quenched in water will be hardened and the grain changed or refined (small crystals), as indicated, according to heat used.

Resulting Hardness.	Color of Heat.	Appearance of Fracture.
Excessively hard and brittle	High yellow or cream white	Coarse grain with brilliant lustre.
Extra hard, will break easily.........	Yellow or orange	Grain open, but not so coarse or brilliant.
Too brittle, not strong.	High red or lemon	Grain not coarse, but with some bright lustre.
Very hard and strong	Clear red or brightcherry	Fine grain clear through, no bright lustre (small crystals).
Very strong and hard, except in middle	Low red or dark cherry.	Grain fine on the outside, but not in middle.
Stronger than bar, not hard enough......	Dark red or black heat...	Grain same as the bar.

The degree of heat required to cause the effect shown in the left and right hand columns varies with the carbon, but for any ordinary steel the color of heat shown above is sufficiently near the truth. If a piece is heated quickly the fifth effect will be more marked, and indicates clearly that time in heating should be carefully considered. This fact is frequently taken advantage of by the hardener, and can be practiced with safety on almost any section that is required to be made hard on the outside only. In the majority of cases, however, for ordinary tool work, it is the most common practice to allow sufficient time in heating for the piece to be evenly heated through before quenching, and I do not here advise any departure from that method, for the most work of the toolsmith.

The coarse grain in steel or iron is caused by a high heat and not by the chill; sudden cooling makes brilliant crystals of a fracture visible to the eye, and has led some men to believe the fallacy that coarse grains are formed in the cooling bath, but the bath only fixes them as they were when hot, therefore the proper hardening heat is at the same temperature whether mercury, cold lead, brine, beeswax, tar, oil, soap, or any other medium is used.

If it is desirable to make the steel more brittle, coarse grained [and presumably harder], a higher heat than the proper refining one must be used, and vice versa as to brittleness and hardness; but the grain is not always changed by such low heats as affect the other properties of the metal; if it is necessary to quench a piece at a heat so high as to make it coarse grained, in order to produce a required hardness, the bath or the steel must be wrong, or the requirements peculiar. The hardness resulting from a heat higher than that required to refine the grain may be greater or less than that produced from a lower heat, according to the bath used, and the hardness caused by cooling from the proper refining heat in the right kind of a bath may be the maximum hardness for that steel. Farther discussion of this question is unnecessary for our purpose here. A section that will refine and harden properly in water from a given heat may not do the same thing if cooled at that heat in oil, but of such a piece the steel maker says, "will not harden in oil." All steel makers agree on this point. I have made crucible steel in several mills, and have heard the complaint that "cutting tools hardened in oil are not as enduring as when *tempered* in water." This mistake is made only when an attempt is made to adapt a grade of steel to a purpose for which it was not intended.

Tool-smiths have always known that the heated condition is fixed by quenching, and in the investigations of science no better answer to the question "why does steel harden" has been found, though many interesting theories have been advanced; the only one undisputed agrees with us that the sudden quenching fixes the hot condition, making the metal in a cold state to show itself as it was when hot.

To determine the proper hardening heat, the phenomenon of recalescence peculiar to iron is of value. As this phenomenon is absent in other metals and has not been observed in so called self-hardening steels, but is clearly apparent during a shorter range of temperature as the carbon point is raised in iron, the period of recalescence has been mistaken for the hardening heat, but it is not, and steel quenched during this period will have streaks of unhardened metal. It is further known that this "point," which was but recently discovered to have an influence of value to steel workers, is indicated by its name; a piece of steel cooling from a bright red heat ceases momentarily to become cooler at about 1200° Fahr.; at this point the temperature actually rises; the steel "recalesces." This phenomenon is called "recalescence." It may be seen to glow distinctly brighter in a dark room, and the pyrometer marks a rise in temperature.

It is the "second red," the last bright glow peculiar to steel cooling in a dark place, an irregularity in the retardation of the cooling rate, that has been known to steel workers from time immemorial. It may be called the critical point through which steel must pass when being heated, and the temperature above this point to which steel can be heated without injury varies, as the point does with the carbon content, and may also be affected by other ingredients, as other metal alloys must be reduced to a liquid state to change the size and appearance of the crystals. Compounds of iron with other metals would be variously affected, but ordinary carbon tool steel is known to be changed structurally while passing through the recalescence point. Therefore, when the maximum hardness is desired it must be heated sufficiently above this temperature to form the grain and structural condition required before all of the iron goes into the hard condition to be fixed by the sudden cooling. Any hardness caused by quenching above the refining heat, which is just above the recalescence period, or from a heat lower than this, is irregular, and should not be called "proper hardening," though it might serve a good purpose in special cases.

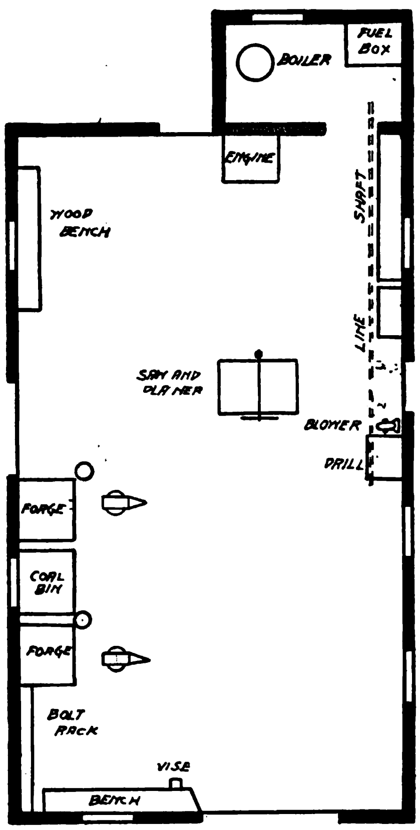
This subject will be more easily discussed when the science of metallography gets into more available books. It deals with the structure of metals, and has given us during the last twelve years the terms "cementite" and "pearlyte" to distinguish different formations in steel or iron, and "mastrusite" and "anstrusite" to indicate the structural formation due to hardening. By microscopic study of these formations man is able to discover the more exact effect of heat treatment, and this is leading to the complete answer of the questions, why steel hardens, and when and how the maximum hardness is obtained; we accept the phenomenon of hardened steel in its best condition as used by men of the longest and best experience, finding by experiment the proper hardening heat and quenching medium for each particular kind of tool and grade of steel, using the same heat (if it can be obtained by observation of the color of the heat radiated), for all tools of the same kind and grade, and always getting the heat that has been found to be correct, by the use of a pyrometer that ought to be at the service of every steel worker having much valuable stock to manipulate. Without a pyrometer the most careful man must often fail to distinguish the slight variations in temperature which cause the marked and dangerous changes which I have shown as an experiment that ought to be tried often by every toolsmith.

A Plan for a Blacksmith and Wagon Repair Shop.

W. D. BOETTLER.

The accompanying figure shows the ground plan of a very convenient blacksmith and wagon repair shop. I store my wood stock on the second floor and do all the painting on this floor also, as this gives me more room on the first floor for tools and for work. Where bellows are used, they should be overhead, as this arrangement gives more room and is much handier.

This plan is for a shop about twenty-five feet wide and about fifty or sixty



PLAN OF A TWO-FIRE SHOP.

feet long, suitable for most general repair work, but for a shop to do an extensive business in general repairing, shoeing and new work, I would prefer a shop forty feet wide and long in proportion to the amount of work to be done. I should prefer also to have the forges in a row in the center, using one side for shoeing and the other side for repairing old vehicles and ironing new ones. The wood shop should be separate.

The Elements of Blacksmithing.—6.

Split Work—Weldless Rings—Bolt Making.

JOHN L. BACON,

Instructor in Forging, Lewis Institute, Chicago.

There is a great variety of thin forgings, formed by splitting a bar and bending the split parts into shape. For convenience these can be called split forgings. Fig. 54 is a fair sample of this kind of work. This piece could be made by taking two flat strips and welding them across each other, but, particularly if the work is very thin, this is rather a difficult weld to make. An easier way is to take a flat piece of stock of the proper thickness and cut it with a hot chisel as shown in Fig. 54. The four ends formed by the splits are then bent at right angles to each other, as shown by the dotted lines, and hammered out, pointed as required.

If machine steel stock is used it is not generally necessary to take any particular precautions when splitting the bar, but if the material used is wrought iron, it is necessary to punch a small hole through the bar where the end of the cut comes to prevent the split from extending back too far. Fig. 55 shows several examples of this kind of work. The illustrations show in each case the finished piece, and also the method of cutting the bar. The shaded portions of the bar are cut away completely. Another forging of the same nature is the expanded eye in Fig. 56. To make this a flat bar is forged, rounding on the end, punched and split as shown. The split is widened out by driving a punch or other tapering tool into it, and the forging finished by working over the horn of the anvil as shown in Fig. 56. If the dimensions of the eye are to be very accurate it will be necessary to make a calculation for the length of our cut. This can be done as follows: We can suppose the forging, for the sake of convenience in calculating, to be made up of a ring 3 inches inside diameter, and sides $\frac{1}{2}$ inch wide, placed on the end of a bar $1\frac{1}{2}$ inch wide. The first thing is to determine the area of this ring. To do this, find the area of the outside circle and subtract from it the area of the inside circle.

Area of outside circle=12.57 sq. in.
Area of inside circle= 7.07 sq. in.
Area of ring = 5.50 sq. in.

Our stock being $1\frac{1}{2}$ inch wide has an area of $1\frac{1}{2}$ square inches for every inch in length and it will take $3\frac{3}{8}$ inches of this stock to form the ring, as we must have an amount of stock having the same area as the ring. This will be practically $3\frac{11}{16}$ inches. Our stock should be punched and split as shown in Fig. 54. It will be noticed that the punch holes are $\frac{5}{8}$ inch from the end while the stock is to be drawn to $\frac{1}{2}$ inch. The extra amount is given to allow for the hammering necessary to form the eye.

Weldless rings can be made in this manner, by splitting a piece of flat stock and expanding it into a ring, or they can be made as follows: The necessary volume of stock is first forged into a round, flat disc and a hole is punched through the center. The hole should be large enough to admit the end of the horn of the anvil. The forging is then

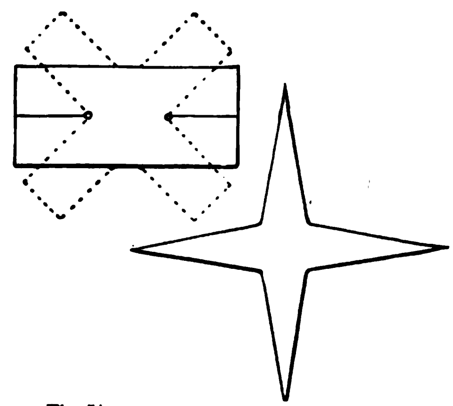


Fig. 54. EXAMPLE OF SPLIT FORGING.

placed on the horn and worked to the desired size in the manner indicated in Fig. 56. Fig. 57 shows the different steps in the process, the disc, the punched disc, and the finished ring. Rings of this sort can be made very rapidly under the steam hammer by a slight modification on this method. The discs are shaped and punched and then forged to size over a "mandrel." A U-shaped rest is placed on the anvil of the steam hammer, the mandrel is slipped through the hole in the disc and placed on the rest, as shown in Fig. 58. The blows come directly down upon the top side of the ring, it being turned between each two blows. The ring, of course, rests only upon the mandrel. As the hole

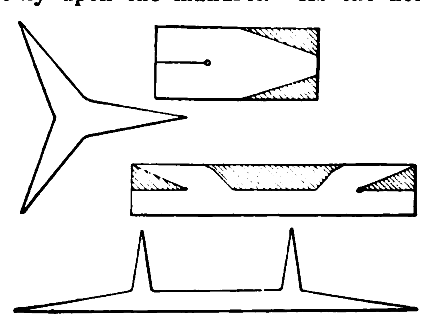


Fig. 55. SPLIT FORGINGS.

increases in size, larger and larger mandrels are used, keeping the mandrel as nearly as possible the same size as the hole.

For making bolts one special tool is required, the heading tool. This is commonly made something the shape of Fig. 59, although for a "hurry up" bolt sometimes any flat strip of iron, with a hole punched the proper size to admit the stem of the bolt, can be used. The heading tool should always be used flat side down. Bolts are made by either upsetting, or welding on, the head. For small bolts it is easier to upset the heads and it is generally easier to weld on the heads of larger ones. An upset head is stronger than a welded head, provided they are both properly made. An upset head is made as follows: The stock is first heated to a high heat for a *short* distance at the end and upset as shown at Fig. 60. The bolt is then dropped through the hole of the heading tool,

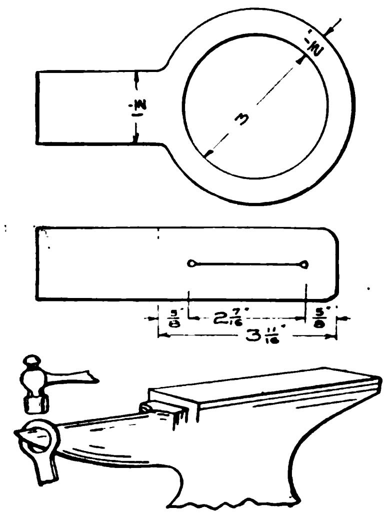


Fig. 56. FORMING WELDLESS RINGS BY SPLITTING.

the upset portion projecting above. This upset part is flattened down on the head, as shown at B, and forged square or hexagonal on the anvil. The hole in the heading tool should be large enough to allow the stock to slip through it easily up to the upset portion.

A welded head bolt is made by welding a ring of square iron around the shank to form the head, which is then shaped in a heading tool the same as an upset head. A piece of square iron of the proper size is bent into a ring, but not welded. This ring is just large enough, when the ends are slightly separated, to slip easily over the shank. The shank is heated to about a welding heat, the ring being slightly cooler, and the two put together as shown in Fig. 61. The head is heated and welded, and then shaped as described above. When welding on the head it should be hammered square the first thing, and *not* pounded round and round. It is much easier to make a sound weld by forging square. Care must be used

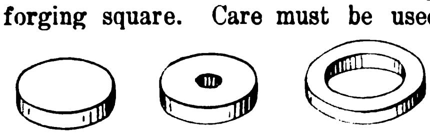


Fig. 57. RINGS FORMED BY PUNCHING.

when taking the welding heat to heat as slowly as possible, otherwise the outside of the ring will be burned before the shank is hot enough to stick.

Bolt sizes are always given as the diameter and length of the shank, or stem. Thus, a $\frac{1}{2}$-inch bolt, 6 inches long, means a bolt having a shank $\frac{1}{2}$ inch in diameter and 6 inches long from the under side of the head to the end. Dimensions of bolt heads are determined from the diameter of the shank, and should always be the same size for the same diameter, being independent of the length.

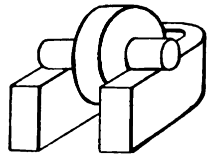


Fig. 58. FORGING ON A MANDREL.

The diameter and thickness of the head are measured as shown in Fig. 62.

The dimensions of both square and hexagonal heads are as follows:

D=Diameter of head, across the flats.
T=Thickness of head.
S=Diameter of shank of bolt.
$D=1\frac{1}{2}\times S+\frac{1}{8}$ inch.
T=S.

For a 2-inch bolt the dimensions would be calculated as follows:

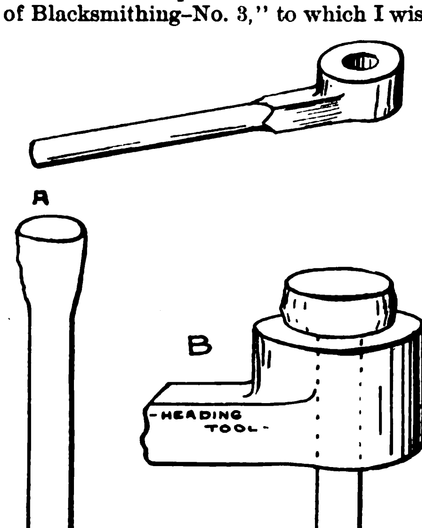
Diameter of head would equal $1\frac{1}{2}\times 2$ inches$+\frac{1}{8}$ inch$=3\frac{1}{8}$.

Thickness of head would be 2 inches.

Bolts generally have the top corners of the head rounded, or champfered off. (Fig. 62.) This can be done with a hand hammer or with a cupping tool (Fig. 63), which is simply a set hammer with the bottom face hollowed out into a bowl shape.

Comments on Preceding Chapters.

There are two points in "The Elements of Blacksmithing-No. 3," to which I wish



Figs. 59 and 60. HEADING TOOL AND ITS USE.

to call the attention of Mr. Bacon, as it seems to me that this most excellent series would be improved by a more liberal treatment. It is stated, page 99, "In drawing down iron from a rectangular bar there is very little danger of splitting, but when round iron is to be drawn to a smaller size * * * the bar is liable to be split." Then the proper instruction, which is a description of the usual way, follows, and we are told that round bars are liable to burst, but when forged square this danger is eliminated. I think the statement is entirely too strong, and that the splitting off and twisting of outside fibres or layers of metal around the piece, caused by rolling the bar slightly while the hammering is continued, is an evil as serious and as liable to occur as bursting in the centre of a round bar.

On page 100, we are told that hand punches should have "a much quicker taper at the extreme end * * * it acts more like a wedge." Now this wedge is more liable to split the iron, and will also bulge out the sides of the piece (unless it is quite wide); closing these bulged sides makes an oblong hole, etc. These evils are often greater than "drawing the metal

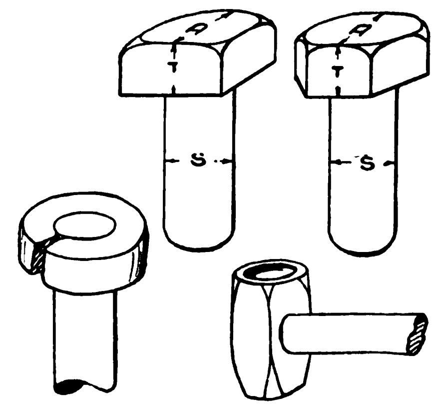


Fig. 61. A WELDED HEAD. Figs. 62 and 63. CHAMPFERED HEADS AND CUPPING TOOL.

in after it," and in fact I believe that smiths, who have a good deal of such work to do, use punches more generally than they do the one described in the article referred to. In my own work, I discarded that kind of a punch for one of uniform taper some years ago, and use the quicker taper at extreme end but seldom, mainly for drifting or when it is desirable to bulge the sides of the piece. CHAS. P. CROWE.

Author's Reply.

I thank Mr. Crowe for calling attention to the splitting and twisting off of the outside fibres of bars by improper forging.

Particular stress was laid on the internal bursting on account of the greater chances of its passing undetected, while the external splintering would be noticed and avoided. I think the internal rupture is the more common evil, although many times unnoticed. When working under the steam hammer particularly, an improperly forged bar shows by its action under the hammer that it has burst internally long before any cracks or splits appear on the surface.

I have in mind one instance when several crank shafts, turned out by a forge supposed to do first-class work, appeared perfectly sound, excepting a few almost imperceptible cracks in the ends of the shafts. On examination it was found that a fine wire could be pushed into these cracks for eight or ten inches, showing the centers of the shafts to be pretty well burst.

In regard to the punches, I have seen as good smiths using one kind as the other. For *wrought iron* the straighter the sides the less the liability of splitting, but soft steel is coming into much more general use than wrought iron, and is not so easily split. For work in tool-steel, particularly for punching eyes in hammers, etc., I think the taper point punch has much in its favor, as stated before. Of course the bulging here is of no disadvantage, as the eye can afterward be forged down over a drift.

Prize Contest Articles.

Horseshoeing, Repair Work and Carriage Building.

In the following columns will be found printed a few of the numerous articles thus far received at this office in competition for the prizes offered for the best articles upon the above subjects. The numbers at the head of the various articles refer to the order in which they are received, and have no connection with the final award of prizes, the decision for which has not yet been made. The contest will close with the June number, so that all who desire to enter articles in competition should not delay longer.

The conditions of the contest are as follows:

First: No person will be awarded more than one prize, though he may submit any number of articles.

Second: Contestants for these prizes must be subscribers to THE AMERICAN BLACKSMITH.

Third: The right to publish any or all articles in competition is reserved.

These articles must not be less than 250 words in length, and must be plainly marked "Prize Contest—Repair Work," "Prize Contest—Horseshoeing," etc.

The prizes are \$5, \$10 and \$15, three to be awarded under each heading. Let us hear from you.

The preceding outline is again printed for the reason that THE AMERICAN BLACKSMITH goes anew each month to a large number of artisans who are up till now unacquainted with the offer made therein.

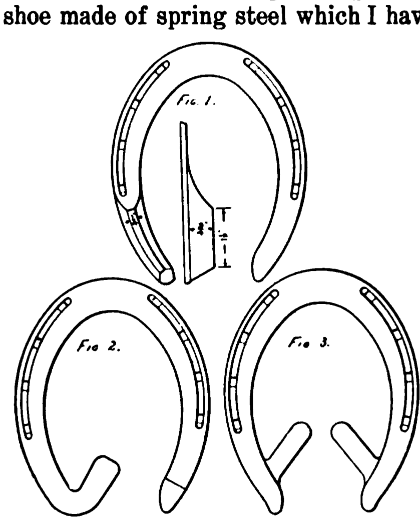
Prize Contest-Horseshoeing.-12.

Shoes for Interfering and Tender Feet.

From the earliest ages the noble horse has been the friend and companion of man, prized for his beauty, loved for his docility and valued for his strength. In the remotest ages, as far back as authentic history discloses anything of the life and pursuits of man, we find that the horse occupied a prominent position in his service. In those days shoes, doubtless made of rawhide, were tied on the feet, till some primitive anatomist conceived the idea of nailing shoes on.

Turning to the practical horseshoeing of today, I will give a few ideas, based on twenty-four years of every day practice. Take for instance an interfering horse, one that cannot be stopped, some will say: Dress his foot level and make a shoe like that shown in Fig. 1, and it will not fail in any case.

Fig 2 shows a half bar shoe which I use in cases where one side of the foot is contracted, or it can be made a double bar. As a rule, I only use six nails in this shoe, and take the bearing off of the quarters, thereby throwing the weight on the frog. This shoe I have found will relieve the horse in from two to four shoeings. Fig. 3 is a shoe made of spring steel which I have



SHOES FOR INTERFERING, CONTRACTION, AND TENDER FEET.

used on tender-footed horses, the bars being placed directly over the bars of the foot, thereby taking off the concussion as he steps, and protecting the foot from rocks and other like things.

Prize Contest-Horseshoeing.-13.

Knee-Knockers.

My first experience on shoeing horses that knocked their knees was when I first commenced to work for myself twenty years ago. I thought by getting the foot perfectly level and weighting the shoe on the inside it would have a tendency to drop the inside of the foot so it would pass the knee without hitting, but it did not work. The horse came back. I changed the shoes so the weight was on the outside, and he did not strike. That was my first experience. Since then I have paid more attention to knee-knockers.

Almost all horses that knock their knees, toe out, or the inside quarters are too low (a careful shoer will note the difference). My object is to straighten the leg, and this is accomplished, if he toes out, by lowering the inside of the toe and leaving the inside of the heel as high as possible. If the inside quarter is too low, lower the outside heel to level the foot, leveling the toe at the same time. Let the foot

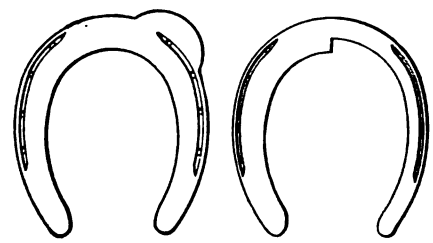


Fig. 2. OUTSIDE TOE-WEIGHT SHOE. Fig. 1. SIDE WEIGHT SHOE.

down on the floor occasionally and note the effect. Look at the foot from behind and look at it from in front. Step the horse around and note the way he stands. A careful shoer will note the difference in the way the horse stands, and the trouble he goes to will pay in the end.

Use a side-weight shoe, made by taking a front and hind shoe of same size, cutting them in two at the center and welding the light and heavy halves together. You will thus have a side-weight shoe made quickly and cheaply. (See Fig. 1.) Calk it if you wish, using inside heel calk with level toe. If this does not stop him from knocking, weld a piece on the outside of the toe on a common shoe as shown in Fig. 2, and the fault certainly will be corrected. My object in doing this is to keep the foot where he places it so as not to throw the knee in. Drive the nails as high as possible, so when the clinches raise (as they will when the foot grows down), they will not cut the knee.

In conclusion I will say to brother blacksmiths, be more thorough with your work; to horse owners, be more humane with your horses; give more oats, shorter drives, and more comfortable quarters, and we will have no more trouble with knee-knockers.

Prize Contest—Carriage Building.—14.

A Useful Forming Machine.

I find where one has not the room in the smith shop for a bulldozer as a bending machine, that a fine apparatus can be constructed out of a common hydraulic wheel press as follows: Take pale keepers on a farm wagon as a sample of work to be done. First make patterns out of any soft wood, as shown by Fig. 1, and send them to a foundry to have castings made from them. Fasten No. 1 on the head block over the wheel press by means of lag screws or bolts, and lay No. 2 so that the recess will come directly under the projections of No. 1 on the head block. Then take the band iron for making the pale keepers, cut off the right length and put a nest of them in the fire to heat. When you get a good bending heat, lay one on form No. 2 and spring the pumping valve and see how nicely and accurately your work will be bent. A good smith can do the work of ten men by this process.

Forms can be made for any kind of work that has to be bent, such as drain braces, circle irons, seat-hand holds, arch axles or setting axles. Care must be taken in making these patterns so as

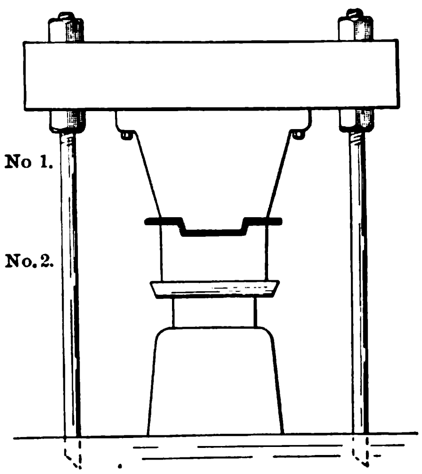


Fig. 1. A USEFUL FORMING MACHINE.

to have them to fit into each other with space enough all around for allowing the iron to be bent, as shown in the illustration.

Prize Contest—Repair Work—15.

Repair of Locomotive Frames.

The damaged and broken locomotive frame is a source of constant inconvenience and expense to the railway company, entailing, as it often does, the complete or partial stripping of an engine otherwise in good working order.

As to the causes of such frequent breakage, much has been said and written, still, locomotive frames do break, and the concern of those interested in their repair is, how to do the work in the best and most economical manner possible.

The extent and quality of the repairs effected will of course vary with the facilities at the disposal of the blacksmith. The "big shop" with a forge and other convenient appliances will more often substitute entirely new forgings for the fractured parts, while the smaller shops, less favorably equipped, will be satisfied with repairs of a more limited, though not necessarily of a less substantial and effective, character. In both instances, good judgment, experience and skill on the part of the blacksmith entrusted with this important class of repairs are the principal factors of efficiency and economy.

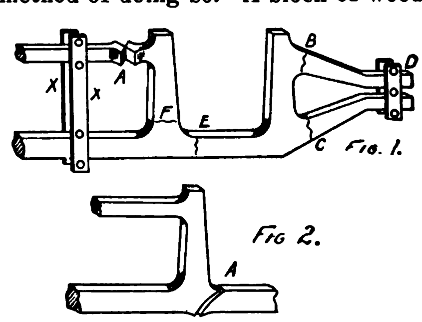
The straightening of bent and twisted front extension frames is now, except in cases of exceptional damage, easily accomplished without detaching them from main frame, by means of the improvised furnace of brick or asbestos, built around the damaged parts, with oil or coke for fuel, and air blast attachment. The welding of cracked and broken frames in place on the engine by the same means, and also by electricity, is being experimented with. Such a process, however, without the proper lamination or compression necessary to secure thorough consolidation of the fractured parts, amounting in fact to a sort of brazing process, cannot practically be considered as a weld in the proper sense of the term. The following in this relation will prove interesting. "At the west Oakland shops of the Southern Pacific Railway, a method is in use for welding cracked locomotive frames in place. A small furnace of fire brick is built around the frame at the crack, and an oil burner is then introduced and operated until the frame is brought to a welding heat. At the June (1901) meeting of the Pacific Coast Railway Club, Mr. McKellogg, foreman of these shops, stated that an engine was recently brought in off the road at 8.30 A. M. with the main frame broken under the rocker box. In twenty-two hours the engine was back on the road hauling its train."

The ever increasing weight and complexity of locomotive construction, evidenced in the magnificent specimens lately exhibited at the Pan-American Exposition, must convince the practical blacksmith of the necessity of some such methods of repairing frame breakage, other than by the delaying and expensive alternative now followed of dismantling a whole locomotive for this purpose, the more especially as the facilities in most repair shops for handling such frames do not keep pace with the ever increasing weight of same. Frames broken in one or more less vital parts may often be temporarily yet very substantially repaired by means of the "patch," in which the fractured parts are firmly bound together by screws, bolts or clamps. This method, we are aware, can only be regarded as a temporary expedient, and yet we believe it might with advantage be more largely resorted to as a means of keeping an engine in service until ultimately sent to the repair shop for general repairs. We have known patches of this kind of proper conformation and strength to hold fractured parts satisfactorily together for long periods.

The most common and frequent breaks occur at the front end of the frame, where the greatest strain is usually encountered. A variety of these breaks and methods of repairing them may be best described by the following sketches:

The broken brace at A, Fig. 1, shows the parts prepared for welding by the insertion of the angle or V-shaped plugs on both sides of brace. The brace is held firmly in position by iron straps, XX. The cavity formed by the junction of the two scarfs at A should form an angle of about ninety degrees. The plug should be somewhat smaller to ensure a perfect weld from bottom of cavity, and should be made of best hammered iron, in such a way as to have the fibre or reed of the iron running in the same direction as the pieces to be welded. Breaks of a similar kind occurring at B or C, Fig. 1, may be repaired in the same way by binding and holding the pieces in place, as at D.

A frame broken at base of pedestal, E, Fig. 1, is sometimes repaired by welding on a new piece as at A, Fig. 2, re-uniting the old end between the pedestals. This may be done by a lap scarf, male or female scarf, or by the angle or V-shaped plug. In the two latter instances the parts would have to be bound firmly together across the pedestals, as in Fig. 3, which shows the method of doing so. A block of wood,

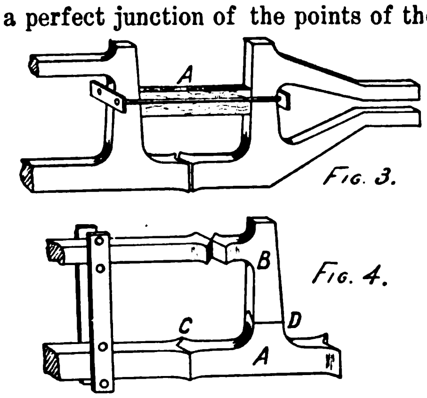


Figs. 1 and 2. REPAIRING LOCOMOTIVE FRAMES.

A, is placed between the pedestals, the proper distance apart. The parts are then held together by two screw bolts and plates at each end, as shown.

A fracture at the base of pedestal, as at F, Fig. 1, can be repaired by scarfing the part in same manner as shown at the brace A, Fig. 1, with straps, XX, in the same position. If the conformation of the break at A, Fig. 2, renders this method impracticable the repairs would be effected as shown in Fig. 4. A and B are newly forged parts. A is first welded at C, male and female scarf, or lap scarf if preferred. If the former, the pieces are driven together by a ram. The pedestal B is then welded at D, separate heats being taken. The old end is then scarfed and welded between the pedestals, as shown in Fig. 3. In both cases it is taken for granted that the old end of frame is to be utilized, as its retention when in sound condition is commendable as saving a large amount of expensive machine work. This implies much skill upon the part of the blacksmith in bringing the parts of frame to tram marks made before beginning operations. But it is commonly done. Whenever new parts are substituted, the stock should always, when possible, be augmented in the region of fillets, etc.

From $\frac{3}{8}$ to $\frac{1}{2}$ inch of surplus stock should be allowed for finish at machine. Smoothing or making a fine finish on work to be machined is unnecessary work on the part of the blacksmith, and is to be avoided. Solidity should be his chief concern. Avoid heavy blows by steam hammer upon welded parts of frame, as it loosens and pulls the welds apart. Straighten and adjust the frame as much as possible while hot upon the anvil. In welding male and female scarfs be sure to have a perfect junction of the points of the



Figs. 3 and 4. REPAIRING LOCOMOTIVE FRAMES.

scarfs. This can best be secured by leaving the cavity of the female and the apex of the male scarfs slightly rounded. If this is not attended to, a slight hollow cavity is the result, into which the oil will percolate, causing future fracture at the point of weld.

Such are only a few points in regard to frame repairing. The different classes and styles of locomotive frames present a wide diversity and character of breakage, but generally the principles of practice illustrated above will serve, with modifications, for all. The different forms and methods of scarfing are largely of relative value. Good or bad results in all cases depend very much upon the skillful and conscientious manipulation by the blacksmith engaged in this important class of work. The quality of the work depends equally upon good welding as upon good scarfing, and good welding is next to impossible in a fire composed of the cheap inferior kinds of coal usually supplied, indiscriminately, for use in the blacksmith shop. The use of small oil furnaces adapted to the welding of frames will, we believe, in the future become more common. By this means a cleaner and more uniform heat can be depended upon, and in consequence more perfect welding secured.

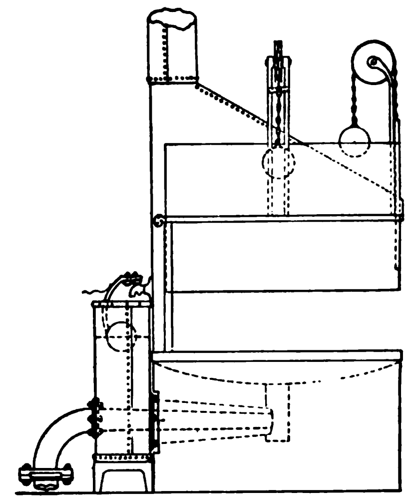
Side Versus Bottom Blast.

GEORGE HARNWELL.

The question in hand is whether blast from the bottom or from the side of fire is the best for general use. I know there is a lot of prejudice against the side blast by those smiths who have been accustomed to fires with blast coming in at the bottom, and there is much objection to bottom blast by those who have not been accustomed to that kind of fire. However, can work that requires the welding together of parts be done as solidly with the bottom as with the side blast? With the side blast the dross and dirt runs below the blast, and is not blown back upon the heat, and a cleaner heat is the result, but with the bottom blast, the fire has to be cleaned frequently, or else the heats will be yellow and dirty instead of white and clean.

The complaint of smiths who have been accustomed to bottom blast is that side blast heats all on one side, but I think that with a little practice they can overcome that, and be able to heat as uniformly as with bottom blast.

I have tried to show by the accompanying figure the simplest method of applying side blast to fires that I know of. Both the tuyere and tank are cast iron. The tank is cast with a large hole in one side and a small hole in the other, so that the small flange of the tuyere passes through and bolts on the inside of the tank while the large flange bolts to the outside of the large hole. A hole is cut in the back of the forge for the tuyere to pass through. The tanks can be all one size, but the tuyeres should be different lengths, so that the fire will be in the center of the forge. Forges for heavy work should be five feet by four or five feet where there is room, so that the tuyere would have to be two feet six inches from the large flange to the nozzle. Should the smith have to change from heavy to light work, he will find by inserting a



A WATER COOLED BLAST PIPE.

tapered bushing in the nozzle of tuyere that he can keep a small fire without trouble. I hope other blacksmiths will express their opinion on this subject.

Diseases of the Foot and Their Treatment.—5.

E. MAYHEW MICHENER, V. M. D.

Under the heading, Fissures of the Feet, are classed the conditions known as toe-cracks and quarter-cracks. The term sand-crack is also used by some in speaking of fissures. The location of the disease is designated by the terms "toe," or "quarter." True toe-crack occurs at the exact front of the hoof and quarter-cracks occur at any point between the middle of the toe and the heel. In rare instances fissure of the bars is met with.

Fissures may be superficial or deep, partial or complete. In the superficial crack the sensitive laminae are not involved. Superficial toe-cracks are not rare, and may exist for years without becoming deep. A complete crack is where the fissure runs from the coronet to the bottom of the foot. Toe-cracks are frequently complete and quarter-cracks are more rarely so. In toe-crack the fissure runs in the same direction as the horn fibres, and while this is frequently true of quarter-crack also, yet it is not rare to see the fissure of quarter-crack take a diagonal course across the direction of the horn fibres. This is especially liable in case the animal has deformed or badly shaped heels. Both quarter and toe-crack are most commonly found in the fore feet, but in the hind feet toe-crack is not rare, and quarter-crack very uncommonly found.

In studying the cause of fissures of the horn several factors require consideration. Predisposing causes are an undue brittleness of the horn and faulty conformation of the feet as in contracted heels. The direct or exciting cause may be hard roads, hard driving, wounds caused by treads and calk wounds. Continued bad shoeing, as in cases where the entire weight of the animal is allowed to fall upon the wall, and where the sole and bars are weakened by too much paring, is surely a common cause of quarter-crack. The heavy toe-clip, as often applied in the shoeing of the heavy draft horse, may be a cause of toe-crack if it is allowed to wedge into the wall at the toe. The use of nails of too great size seems to be a cause of fissures occasionally.

The beginning of the fissure is generally sudden and unless lameness be present the occurrence may escape the notice of the driver. Extension of the injury, however, generally causes lameness, and not infrequently some bleeding from the fissure is the first thing noticed. Lameness may not be present until the fissure has reached to considerable extent, and the degree of lameness varies much and in accordance with the amount of sensitive tissues involved in the injury. The entrance of dirt and septic germs serve to increase the inflammation, and the formation of matter is common. In cases where the fissure is considerable, the inflamed soft part may protrude between the edges of the fissure and the edges of the horn grasp the sensitive parts, thereby causing great pain and consequent lameness.

The complications of fissures are several: The inflammation may extend to the surrounding soft tissues of the foot, pus may burrow beneath the horny wall and sole, and the condition known as quittor may result. Tetanus or lockjaw may result from infection with the germs of that disease which abound in stables and in the soil. A complication rather common in toe-cracks is known by the name keraphyllocele, which means a tumor formed by an unnatural growth of the horny leaves which correspond to the laminae. This unnatural growth is caused by the continuous inflammation existing in the neighborhood of the fissure, and resulting from the over supply of nourishment furnished the parts, on account of the increased circulation of blood. The horn so formed is piled up on the inner surface of the wall, and in time compresses the sensitive parts greatly, and later may cause absorption of the part of the third phalynx beneath it. These cases can be told by the great amount of lameness seemingly out of proportion to the extent of the toe-crack, which may even have healed to all external appearance.

The treatment of cracks varies with the extent of the disease; if the crack be recent and incomplete and not involving the sensitive tissues to great extent it may recover with rest alone. In all cases, attention must be given that the condition of the horn be not allowed to remain dry and brittle; cleanliness is of great importance, and soaking the foot in clean, warm water containing some disinfectant, as creolin, is excellent practice in all cases. Moisture can also be conveniently applied by means of pads applied to the parts and kept wet with water. A good blister applied to the coronet at the location of the crack is good treatment, as it stimulates the growth of new horn at the coronet. At this point it may be mentioned that a fissure in the horn *even of the least extent never heals together again;* it is only by the formation of *new horn* above at the coronet, along with a small amount formed by the laminae, that the injury is repaired; so the course of repair is from the coronet and in a downward direction. If the crack is an old one, or if it extends more than an inch in length, it is generally best to remove a portion of the wall both in front of and behind the crack, or on either side if it be a toe-crack. (See Fig. 2). The part to be removed should be first marked out by the following lines: From two points at the coronet at a distance of not less than one inch from the top of the fissure draw lines that converge at the lowest point at which the fissure is visible, thus marking out a triangle with base uppermost at the line of the coronet. Next carefully remove the wall within the lines marked out. This is best done by means of a small sharp toe-knife; as the horn becomes quite thin, care is required to avoid wounding the sensitive parts by a slip of the knife, and the last parts to be removed should be accomplished by a kind of scraping. The thinner the horn is pared the better; the appearance of minute drops of blood is the sign that thinning has progressed far enough. The thinned horn now needs to be kept moist and pliable, and the occasional application of carbolized vaseline to the part will be found helpful. A blister at the coronet, as advised in mild cases, is also good treatment, after the above described operation. As the new horn is formed and pushed down from the coronet the foot should be examined from time to time to see that the least trace of the crack is lost in the newly formed horn, and should it be found that the new horn is fissured it must be removed back to a point at which the least trace of a fissure is lost. It is always best if the animal can be rested for a month or more until the new horn has become well started, but even if the animal cannot be rested the treatment is advisable. The blistering can be repeated at intervals of two weeks and is well done by a mixture of cerate of Cantharades, one ounce, to the Red Iodide of Mercury, one dram. Clip the hair closely before applying the blister, allow it to remain twenty-four hours, wash once daily thereafter until scab is all removed, when the part is ready for a second application.

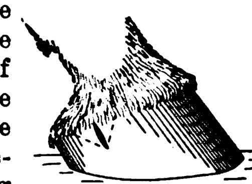


Fig. 2. QUARTER CRACK.

In the treatment of toe-cracks, various mechanical means have been employed and with quite good results; the most approved apparatus for mechanically closing toe-cracks consists of specially designed clasps. These are named from their inventor, the clasps of Vachette. Fig. 3 shows a cautery iron, a clasp or clamp, and a clasp closing forcep. These may be had of Hauseman & Dunn Co., 107 S. Clark Street, Chicago, Ill. In order to prepare the foot for the clasps, notches are burned into the wall on either side of the fissure, by means of a special instrument. The clasp is then inserted in the jaws of the forceps and the fissure is closed, and the clasp fastened by a firm pressure of the forceps. This method of treatment is generally efficient in toe-cracks, but is more difficult to apply in fissures of the quarter on account of the very common thinness of the wall at that point. Two or more clasps are applied to one fissure as the case demands. The precaution necessary in this treatment is in avoiding too deep burning with the cautery iron and in the thorough cleansing of the fissure before the operation. Correct shoeing is of the greatest importance in the treatment of fissures. In toe-cracks of heavy work animals the usual toe clip in such common use should be omitted. The toe should be allowed to remain rather longer than ordinary, and the heels lowered more than in ordinary shoeing. Heel calks should not be used in toe-cracks. In quarter-crack the reverse to the above holds good generally. Shorten the toe all it will bear. In certain well selected cases a bar shoe carefully applied so

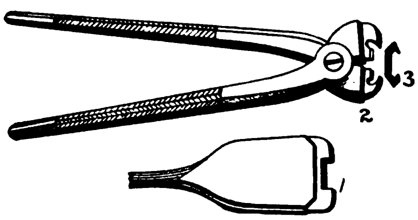


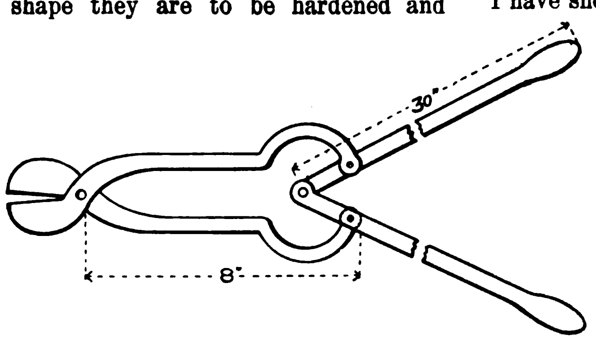
Fig. 8. CAUTERY IRON AND FORCEP.

the weight is well placed upon the frog is a great relief. In severe and neglected cases where the deep tissues of the foot have become involved it may be necessary to remove very much more horn, but as extensive surgery of this part requires an expert operator, the description of the work, so strictly of a surgical nature, is not thought necessary.

A Home-Made Bolt Clipper.

J. D. ARROWOOD.

In making this clipper I take two pieces of tool steel $\frac{3}{8}$ by $1\frac{1}{4}$ inches, forging them as shown in the sketch. The handles are to be formed from pieces $\frac{1}{2}$ by $1\frac{1}{4}$ inches in size, and for this common iron will do. They should be about 30 inches long, as indicated. Half-inch holes are then put in the blades and handles at the proper points as shown, using steel bolts or rivets for holding. After the steel jaws have been brought to the proper shape they are to be hardened and



A HOME-MADE BOLT CLIPPER.

drawn to a blue. In tempering, great care should be used, as only the cutting edge is to be tempered. The size which I have here described is suitable for $\frac{1}{2}$-inch bolts and under. Any blacksmith can get the idea from the sketch.

Practical Horseshoeing.

W. J. RAY.

The subject of horseshoeing is one which is receiving more thought and attention by the present craftsmen engaged in this line of work than it has at any time in the past. I maintain that a shoer must first understand the anatomy of the horse's foot before he can successfully do any shoeing. It is easily possible to ruin a good horse in a very short time through poor shoeing. Frequently lameness results which can be removed, and often diseases of the feet entirely cured, through proper shoeing.

No man can shoe a horse correctly who does not understand the complicated structure of the feet and legs. The shoer should know how many bones there are in the foot, their location and use. How many blacksmiths or horseshoers are sufficiently familiar with the foot of the horse to describe the location of the different bones and give their technical names? It is safe to predict that only a small percentage could accomplish this, simple as it is. We frequently hear of horseshoers claiming to understand the art in all its branches, yet could not even describe the shape of the coffin bone or tell where it is located. I do not propose to go into an extended explanation of the anatomy of the foot, as that is something which the horseshoer has to learn from experience. I have seen many horses ruined through poor shoeing, by men who do not understand their business, and who consequently should not be allowed to drive on a shoe. As the foregoing is all I care to say on general horseshoeing, I will invite your attention to a few particular points within my experience.

I have shod many kinds of horses, but am most interested in track shoeing. On September 7th last, I was called to Avon, Illinois, to shoe some running horses, as it was Fair week and many races were scheduled. One race horse in particular attracted my attention. She was a mile horse. I shod her several times up to July 1st. When I was called upon to shoe her on September 7th, I found her No. 3 foot was badly curled up. I encountered no difficulty in shoeing this mare's front feet, but the hind feet were so far gone they would hardly hold the nails necessary to secure the shoe. The hind feet were run down to such an extent that her fetlocks touched the ground when running at full speed. Her heels were also bruised. When I began to shoe her hind feet, the thought came to me to put on an extension bar shoe. Consequently I took a piece of B. and M. ribbed shoe steel and turned it. I then extended the steel back to the heel and completed the shoe by making the extension and bar as shown in Fig. 1. This shoe sets back one inch from the heel, and the bar runs back to the frog in the center. The shoe weighed five ounces.

There are many shoers who claim to be able to properly shoe running horses, but the point is to keep the foot per-

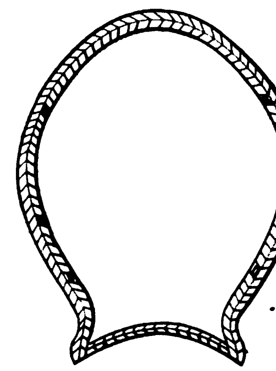


Fig. 1. RIBBED STEEL BAR SHOE.

fectly level, and to know how to make a light shoe stay on the feet, for it is hard on shoes going around the short turns of a half-mile track.

I wish next to call your attention to the plan I have adopted for shoeing over-reachers. First I pare the front feet until they are level, taking care not to pare any more from the heels than is necessary to level them. Next I rasp the toe all it will stand. The foot should then set at an angle of 53 degrees. I then fit on the shoe shown in Fig. 2. This shoe is made according to the size of the horse's foot. For a good sized horse, I take a piece of shoe steel $\frac{1}{2}$ inch by $\frac{5}{8}$ inch, cut it the required length and find the center. I then heat and forge in the center over

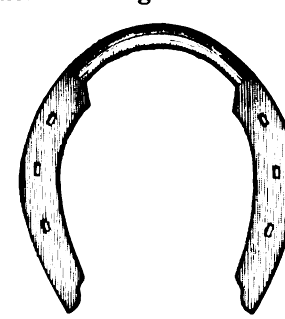


Fig. 2. A ROLLED TOE SHOE.

the horn of the anvil, on the inside of the shoe, making a scalloped section at the toe, as shown in the figure, thus securing a good heel weight shoe. The ground surface of this shoe at the toe should be round. Next I pare the hind feet the same as the front, leaving as much of the toe as possible, and at the same time paring the feet so they will stand at an angle of 50 degrees. Then I turn a light pair of side weight shoes, as shown in Fig. 3. Let the shoe ex-

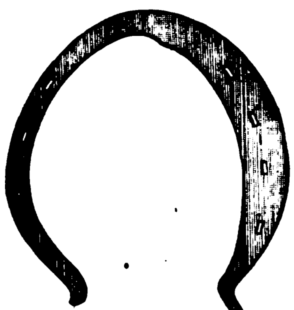


Fig. 3. A SIDE WEIGHT SHOE.

tend over the toe about ⅜ of an inch, and back with a good long outside heel.

Prices in Kansas City, Kansas.

We take pleasure in printing below a price schedule for blacksmithing and wood work, as adopted by a large number of blacksmiths and wheelwrights in Kansas City, Kansas.

PRICES FOR BLACKSMITHING.

Steel axles,	
One inch,	$ 6.50
1⅛ "	7.00
1¼ "	8.00
1⅜ "	9.00
1½ "	10.00
Axle boxes, . . . $0.50 and	1.25
Steel Skeins,	Per set.
3 inches,	$ 8.00
3¼ "	9.00
3½ "	10.00
Cast Skeins,	Each.
3 inches,	$ 1.40
3¼ "	1.60
3½ "	1.75
New tires per set,	
1 by ¼ inches,	6.00
1¼ by ⅜ "	7.50
1½ by ½ "	8.75
2 by ¾ "	14.00
Tire setting, per set,	2.50
Farm wagon tires per set,	2.00
Plow sheer,	
12 inches,	3.00
14 "	3.25
Sharpening plows, each, $0.25 to	.50
Pointing plows, each,	.75
Neck yokes,	
38 inches,	.50
48 "	1.00
Singletree clips,	
Center,	.25
End clips,	.25
King bolts to farm wagons,	.40
Shaft couplings, each, $0.40 to	.60

PRICES FOR WOOD WORK.

Hickory axle,	
3¼	$ 2.50
3½	2.75
3¾	3.00
Front bolsters,	1.50
Hind bolsters,	1.75
Sand boards,	1.50
Brake beams with block,	1.50
Doubletrees,	
4 inch,	.50
5 "	.75
Buggy doubletrees, $0.50 and	.75
Bent rims,	
1⅜ inches,	1.20
1⅝ "	1.50
2 "	1.75
Wagon tongue hounds, each,	.75
Hubs, per set,	1.50
Head block,	1.00
Plow beams, $1.50, $1.75 and	2.25
Poles to buggy and express wagons, . . . $2.00 and	2.50
Reaches to wagons, . . .75 and	.90
Shafts, ... 1.25 and	1.50
Cross bars,	.75
Singletrees, buggy and express, ... $0.50 and	.60
Farm wagon tongues,	2.00

Blacksmith Shop Tools.

H. R. LOOKER.

The appended drawing, Fig. 1, shows a face plate and movable press. The plate is from six to nine feet long, two feet or two feet nine inches wide, six inches thick, with a level surface on the top side. The press is made substantially as shown and of a size to fit the plate. We can truthfully say this is a most valuable device for any shop, large or small, though it is especially adapted for situations where there is no bulldozer or forging machine. Even in a shop of the latter description also, if work from a needle to an anchor comes in, it is almost indispensable. An air cylinder could take the place of the hand press, which would be more convenient.

The many uses this press can be put to are inconceivable. Formers of all descriptions may be placed on the face plate and forgings placed thereon and held in position by the press while being bent to shape. As much can be accomplished in one heat as in several on the anvil. Another advantage is that the work is not hammered to death, for by using suitably sized blocks for whatever work you wish to bend, everything can be brought with a few blows into the exact shape or size.

Fig. 2 shows a simple method of putting an offset into an engine draw bar, and also shows the iron block which goes between the cup on the bottom of the screw and the piece of rail or heavy bar with roller underneath. This keeps the bearing level as the offset is formed in the bar.

The device is also a great saver of time and material for straightening such pieces as side rods and straps, locomotive frames, motion plates, rocker arms, links, car or coach truck transoms and truck channel bars. In fact forgings of all descriptions, whether pertaining to a railroad or not can be straightened without being drawn or hammered out of shape or length.

Fig. 3 shows an arrangement for bending side rod straps on rollers, which is very easily accomplished. After bending, the strap is placed on a mandrel, under the steam hammer and a few blows put it into the shape required.

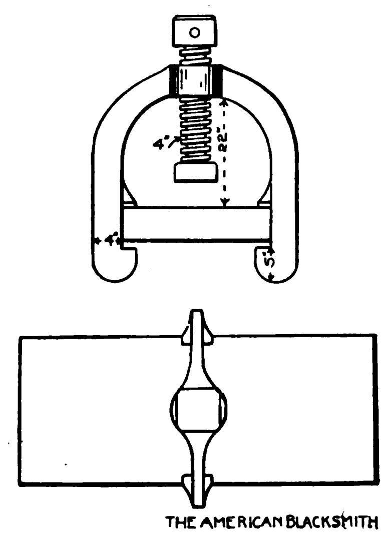


Fig. 1. FACE PLATE AND MOVABLE PRESS.

Most of us know this is work for the bulldozer, but there are many shops that are not equipped with the last-named machine, so it is the foreman's duty to do the next best thing.

Too much cannot be said in favor of tools. What a comfort and pleasure it is to work in a shop where there is a supply of the necessary tools kept in good order and to hand. Without tools the amount of work which can be done is lessened. Forgings made by hand hammer and sledge also are often fit only for the scrap bin. There are many men who would make better smiths if they would put the hand hammer away on the shelf, stop tinkering and learn to use tools. We must keep up with the age of improvements. A steam hammer is of very little use where all kinds of work comes into a shop, unless it be well supplied with tools. We are using a fifteen-ton Morgan hammer and think it one of the very best. It will run through nine-inch shafting like quicksilver, and we have enough tools to feed it with for the next five years. It is seldom we are able to remove the

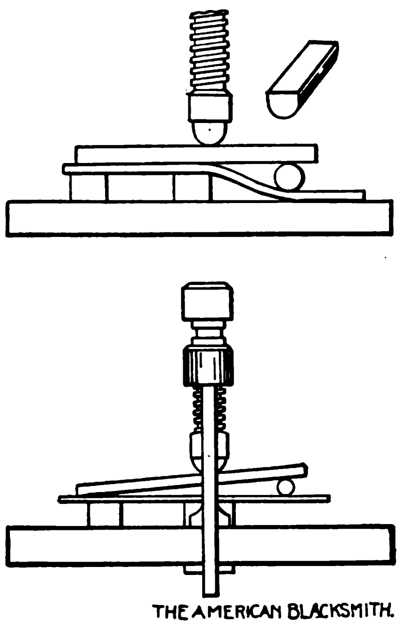


Fig. 2. OFFSETTING AN ENGINE DRAW BAR.

dies, as other fires need the hammer for different classes of work, and hence we find it necessary to make all tools so that they will go between the dies. First, a good set of swages from three-quarter, to six inches is indispensable. Also swages for shaping eye bolts and welding, and swages for putting links on coupler stems. Die punches, round, from one to four inches. These are time savers in making all sizes of wrenches. Slot punches, various sizes. All sizes of mandrels, round, square and flat. Ball dies, from $1\frac{1}{4}$ to five inches. Various sizes of cutters for cutting hot or cold iron. Bevel tools of many angles for making levers, keys, wedges and various other things. Fullers,

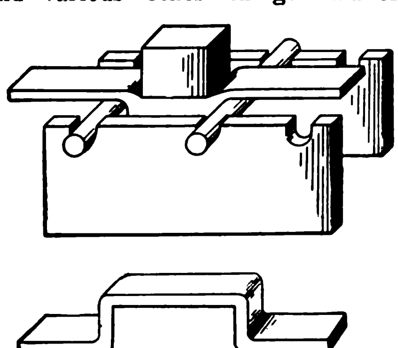


Fig. 3. BENDING SIDE STRAPS.

triangular and straight, round edge and sharp edge. Dies for putting a boss on both sides of levers. All sizes of heading tools, round and square. Punches for the same. These and many other tools too numerous to mention are the life of the shop. In conclusion I will say these tools mentioned are principally used in railroad shops, but they are useful everywhere. In large shops where they have from fifty to seventy fires and nearly as many furnaces we find work done on bulldozers, forging machines, bolt headers, and steam hammers of many sizes and patterns. Here also we find dies of every conceivable shape and form. When we inspect the many different ideas and modes of making the same article, we can well say that ingenuity has no bounds with the blacksmith, for surely he is a wonderful contriver.

American Blacksmith Prize Contests.

Have You Written An Article Yet?

On another page will be found details of the prize contest now being held for AMERICAN BLACKSMITH readers. Nine prizes aggregating Ninety Dollars ($90.00) will be distributed to the successful competitors, and you might be one if you try.

There are three subjects from which to choose, and three prizes will be awarded under each heading: Fifteen Dollars ($15.00) the highest, Ten Dollars ($10.00) the next, and Five Dollars ($5.00) the lowest. "Horseshoeing," "Carriage or Wagon Building," "Blacksmith Repair Work." Pick out your subject, and write your article. Do this at once before it is too late. the contest will close with the June issue.

Remember, it is not fine handwriting or good spelling that will win prizes. Ideas plainly put, new methods clearly explained, shop hints, handy tools, the lessons of long experience, these are wanted. Long-winded articles will not necessarily win—two hundred and fifty words only are required.

A goodly number of articles have already been submitted, and the contest is a very vigorous one. If you have anything to write about, and most mechanics have when they stop to think, do not delay, but send in your best effort now. It is only required that you be a subscriber to THE AMERICAN BLACKSMITH. If you are not, look this copy over carefully, and ask yourself, leaving the matter of entering the Prize Contest entirely out of the question, if a year's subscription is not worth One Dollar to you.

Address all communications to the Editor, THE AMERICAN BLACKSMITH, P. O. Drawer 974, Buffalo, N. Y.

A Unique Inkstand.

The accompanying engraving shows a handsome and unique inkstand constructed by Mr. M. S. Hewitt, of Georgetown, Texas, and recently presented by him to Gov. Sayers of Texas. It was made of a beautiful striped hoof, shod with a race plate, the top of the hoof covered with a brass plate. To hold the ink-well in place, the hoof was filled in with plaster of paris. The pen


A UNIQUE INKSTAND.

rack was made to represent a horse's front legs in motion extended. The brass mountings, hoof and shoe, were highly polished and handsomely engraved, and the whole is a credit to Mr. Hewitt's skilled workmanship.

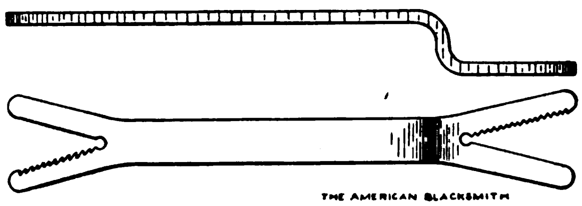
Some Handy Wrenches.

A. BRUTON.

Following is a description of some handy tools I use in my shop, which might be of use to some other smith: The first is an alligator "S" wrench of different size at each end, made from an old rasp. After forming and bending into an "S" shape, I take a heat, screw in vice just a little back of the fork at one end, and bend square over flatways, then heat and bend over horn of anvil, back of the first bend making an offset like as shown by the figure. This gives me a chance to get at a nut much better, and my hand is not so apt to be skinned in case of the wrench slipping. Where there are two nuts close together, as on buggy axles, etc., it can be made straight, with offset if desired. It should be tempered for use.

I also have a common "S" wrench made in the same way, which I use on plow bolts to a great advantage. I used to have trouble to unscrew and screw on nuts on buggy clips until I made these wrenches, as the common alligator or other wrench would catch on the other bolt while I unscrewed and screwed on nuts. Now I have no trouble as the handle part of wrench passes over one, while the other end fits square on the nut instead of slanting.

I also have a nail puller as I call it with a claw on one end like a hammer, though not so crooked, and flat at other end. It is made of octagon tool steel $\frac{3}{4}$ inch thick and about three feet long. I think this is one of the handiest tools I have in my shop to pull tire bolts, other common bolts, and spikes, and in fact anything I can get it onto or under. It is made with a slight S curve, and saves me much time and trouble.

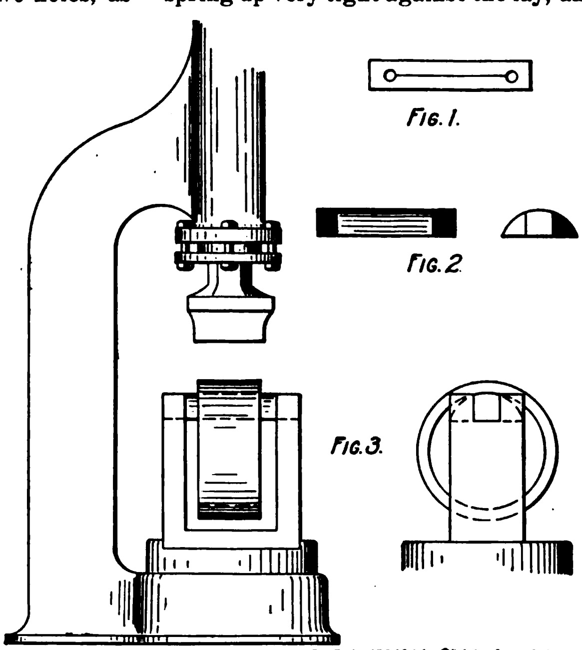


A HANDY OFFSET ALLIGATOR WRENCH.

Forming A Weldless Steel Ring.

JOHN W. CARSON.

The following description and illustration of an economical way of making a weldless steel ring, say from ten to fifteen inches in diameter and two to five inches wide, may be of interest to some: First draw the steel to the required size, then punch two holes, as shown at Fig. 1, and split between holes, cutting off all sharp corners so that it will not gall or cold shut. Be sure to have the required weight in the steel. Next open the piece sufficiently to place on the tool under the hammer, where it can be drawn to exact size in one heat. Fig. 2 shows a side and end view of the tool, the curve of which can be formed to any radius desired. Fig. 3 shows the tool in place under a small hammer.



FORMING A WELDLESS STEEL RING.

Your Neighbor.

Is he an AMERICAN BLACKSMITH subscriber? Or is he one of those mechanics who conducts his business without a trade paper, without keeping abreast of the times, without knowing what is going on in the world among the craft? If so, you can render that man a real service by urging him to try THE AMERICAN BLACKSMITH. After reading the paper regularly for one year, if his ideas fail to broaden in matters of this kind, his will indeed be an obstinate case. Every day letters are received at this office from new subscribers, the writers stating that a paper of the kind has never been taken before, but that they would hardly know how to do without THE AMERICAN BLACKSMITH. We feel sure your blacksmith neighbors will subscribe if they see the paper and are willing to take the chances that both of us will succeed if we try. Let's put forth the effort. We will pay you for your time. Send for our special club subscription rates.

Putting on New Plow Lays.

A. BRUTON.

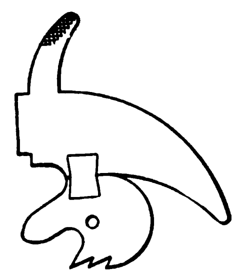
The following is a plan I have adopted for putting on new plow lays. I learned it from a practical blacksmith and wagon-maker, and have used it for five years, and it is without one single fault:

I first take my lay and put it on the plow, after taking off the old lay. Mark and drill holes, and then bolt fast. Then I take my quarter bar, or land side point, shape and fit it in place, mark and drill. Next bolt on under shin of lay to the plow, always being careful to spring up very tight against the lay, and leaving about $\frac{1}{4}$ of an inch lower on bottom edge than land side, for in welding it will always upset some. Now take mouldboard, handles and beam off, leaving lay and land-side point bolted fast to the bottom (or frog and braces). Then take a heat on the point, scarf, and turn under for welding. Proceed to weld up shin, keeping bolts tight. Sometimes I have welded clear up, but in most cases, I leave loose from bottom to take the last heat, on account of not being able to get to fire as well as when off of the plow. Now proceed to sharpen and level up the lay, and you have a fit without fitting after welding, and one that pleases every farmer. He can readily take off and put on the lay without anything but a wrench, as it does not have to be sprung anywhere to get bolts in, and fits like a factory lay. Now put plow back together, and the job is finished neatly and looks well. This takes a little time, but makes time in the end, and also makes a better customer for you.

Repairing a Rifle Hammer.

G. NABLO.

In the figure I show how I mended a flobert rifle hammer that was broken in



the middle. I filed a notch in each part and fitted a steel plug with a slight dovetail at each end and then brazed the whole together, making it stronger than ever it was. That manner of repairing broken articles can be used in many cases, especially in a broken malleable article and even in castings if one is careful not to overheat the cast iron.

Queries, Answers, Notes.

Questions upon blacksmithing, horseshoeing, carriage building and allied subjects will be printed under this heading. Answers and comments are solicited from readers for insertion here also. Questioners desiring answers by mail should enclose a stamp for reply.

Manual Training—Its Meaning.—On the letter head of a Western Trade School, devoting special attention to forge shop work, appears the following: "The Skillful Hand—The Cultured Mind." This is terse and to the point. We class it as one of the best definitions of the term Mechanical Technology which has come to our notice.

Die Forging. My experience, which has been for the last eight years as assistant foreman smith at one, if not the largest carriage and wagon works in the world, *i. e.*, The Midland Railway Works, Derby, England, entitles me to suggest the immense importance to the craft of that branch known as Die Forging. It is universal knowledge in the blacksmithing trade, that very intricate classes of work are done under steam hammers, and hydraulic presses, as well as on the anvil; for cheap, quick and good iron work, one of the former as well as the latter are absolutely necessary, and the time has come when a blacksmith can only consider himself an accomplished tradesman in proportion to his ability to make these useful tools serve his will. J. BRINDLEY.

Tempering and Soldering. In answer to Wm. P. Gudgell's inquiry the surest way to temper small springs, and one that can be depended on, is as follows: The material should be cast steel, and care should be taken not to get your spring too hot in forging. Take the finished spring and after heating it, quench in linseed oil. Now take a ladle or something that will contain your springs, put enough linseed oil in it to cover your springs, set over the fire until it comes to a blaze, and continue the blaze until you are certain every part of the springs are the temperature of blazing oil. Keep the vessel in motion to keep oil on springs. When the springs are done "cooking," blow out the blaze and lay aside to cool.

The way I solder a thimble on a gun barrel, is to first brighten the place where the thimble is to be placed, and tin it, and also the thimble. Muriatic acid and zinc with the addition of sal amoniac is the soldering liquid which I use. A gasoline paint burner is the best thing to use to heat the barrel, but heavy tongs will do, unless the barrels are very heavy, in which case use a soldering iron. After the parts are tinned, put enough solder on thimble for solid joint, put in place and fuse, being careful to keep the thimble in place until solder cools. U. E. CLARK.

Another Method. In reply to Mr. Gudgell's inquiry about how to temper small springs, such as gun springs, I wish to say that the way I usually temper them is as follows: First, give your spring the desired shape, then heat to cherry red and cool in water. I then place the spring in a ladle covered with grease or tallow and hold over fire until grease burns off, leaving a crust over the spring. Then cool in water. Your spring is complete.

Another good way to temper such springs is as follows: Heat the spring to cherry red, and cool in water. Take a good rich piece of pine and smoke spring until it is covered with a thick substance similar to lamp black, then cool in oil or tallow. W. S. SMITH.

Another Reply. In reply to B. F. Watson's inquiry in the February issue about upsetting and tempering old axes, I will tell how I do it. I heat just hot enough to work without splitting, and draw out with flatter as thin as desired. Heat to a light red and drive in moist ground. I have good success with this temper. A. T. WRIGHT.

Filling Patent Buggy Hubs. On page 91 of the January number of THE AMERICAN BLACKSMITH, I noted a question asked about filling patent buggy hubs, old or new. The following is my method of doing this work: If you have an old hub to refill, first cut off the heads of the rivets, being careful not to kink or bend the edges of the iron flanges. Then knock out the old rivets thin, and put the hub on your wheel block, and fasten the same as you would a wagon wheel to be filled. Remove all the old spokes. Usually they will come out, so that one of them can be used for a pattern. Cut all of the new spokes the size of the pattern, being careful to fill the space between the two flanges neatly. Before driving the spokes, prepare some of the best cabinetmakers glue, place the hub and spokes near the fire, allowing them to become warm so the glue will adhere to the wood, and then with a small brush, distribute some of the glue in one of the tenons of the hub. Now dip the end of the spoke to be driven in the glue and drive and repeat this operation until all the spokes are driven. Lay the wheel away for about eight or ten hours so as to allow the glue to set. Then bore the holes and replace all the rivets, after which you are ready to cut off the spokes to the proper size of the wheel wanted. Now make your tenons, put on the rim and finish in the usual manner.

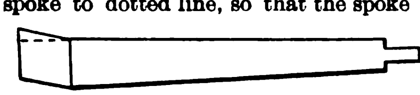
You are now ready to set the tire, which is one of the most important operations in making a good buggy wheel. In order to obtain good results, first measure the exact size of the wheel, then measure your tire, and if necessary, heat and shrink in the usual manner. After shrinking, cool your tire and measure. In this way you can get the proper draw without any guess work. If I am preparing a tire for a new wheel, I give the tire from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch draw, according to the size of the wheel. Put in your tire bolts and your wheel is ready for painting. The foregoing refers to filling hubs that are not decayed or rotten, as it is out of the question to fill a rotten hub satisfactorily. THOMAS POINSETT.

The Retort Courteous. Two of your contributors have done me the honor to comment on what I have said in your columns, and have made statements published on page 92 of your January issue, which call for a more extended answer than can be made here. No injustice was intended toward Mr. Smith in my recent comment, nor do I believe there was anything misleading, except in his manner of making the statements.

The good practice and high authority referred to by Mr. Rushmer must be an exclusive secret, for his assertions regarding the proper hardening heat and cooling bath are contrary to the best and most common practice from the Mississippi to the Eastern coast. For further consideration he is referred to the article already mentioned. He also says, "When heated quickly it is heated unevenly, ... and if this treatment is continued the strains will become greater than the tenacity of the steel, and when quenched in water it will invariably crack." This statement is worthy of more discussion than I shall give it, since chisel steel, 0.80% carbon, has been so treated five hundred and eighty times without sign of rupture. CHARLES P. CROWE.

Dish of Wheels. In answer to Mr. J. C. Roach's inquiry in the February issue, with regard to taking the dish out of wheels, I will give you my method, and if properly done it will make a strong wheel.

First draw all the spokes; you will find them shaped as in the cut. Dress off the spoke to dotted line, so that the spoke is



DRESSING SPOKES OF OLD WHEELS.

straight on face, and make some good hickory wedges that will just slip in the mortise in the hub. Make them a little longer than mortise, and just thick enough so that spoke will drive. In using, place wedge in bottom of mortise, thick end back and drive spokes with as much dish as wished. In putting on rim you may have to put in one felloe to fill out, as your wheel is a little larger than before. C. A. NICHOLS.

A Short Talk on Corns. Brother G. M. Beebe asks the cause of corns and their cure. Though new at the trade, having only worked at it since 1866, I wish to say a word or two. Corns are caused from pressure of the shoe at the heel, but sometimes it is caused by paring the heel too low, or leaving the shoe on until it comes in contact with the hoof at the heel. I never have been able to detect a sign of a corn in a horse that was never shod.

The best cure for corns is in the prevention. When I shoe a horse to cure corns, I commence at the quarters and pare the toe short. I touch the heels only in rare cases. This method will throw the pressure off the heel. Most shoers will cut the heel away to take off the pressure, when the fact is that it puts more on, and corns are the result, unless the horse has a remarkably good hoof. If a horse has corns, I do not try to dig them out root and branch, but cut out fairly well and fill the cavity with oil, tallow, lard, or something softening, and often press in some packing to hold the lard as long as possible, but never use anything to burn them out, as it only forms a hard crust over them and does not cure them. Keep the pressure off, and nature will cure them. If the hoof is in such shape that I cannot pare properly, I spring the shoe as far as the last nail hole from the hoof. To illustrate my notion, if you will take two boards, say six inches long, and lay them together, you will see they have an equal bearing. Now about two inches from the rear end of one, cut to the front of it say $\frac{3}{8}$ of an inch at the point, and a thin shaving at the beginning. This will illustrate the hoof. Then take the other board which represents the shoe, and nail them together as you nail on a shoe. What pressure have you on the heel where you have not cut the board?

This method is not only a safeguard against corns, but contraction also. Corns create fever, and a dryness of the hoof, which prevents the new growth from forcing the old growth outward. Therefore, the new growth is forced inward and held by the hard shell, causing a narrowness of the foot called hoof-bound. If this rule is followed, you will have no trouble with hoof-bound horses, although everything that will create a fever will cause contraction, such as founder, a nail in the foot, wire cuts, etc. CHARLES MCNAUGHT.

Chilled Mould Board. In answer to the inquiries of Messrs. Jones and Edwards, a good way to soften a chilled mould board is as follows: In the first place, lay your mould board on your fire level, take a piece of brimstone a little smaller than the hole you wish to drill, place it over the spot, heat until the brimstone melts and then let cool off. Now try to drill, and if still too hard, another application will be necessary, possibly a third. JOHN B. HARDACRE.

Drop Hammer Notes Wanted. I would like to hear from some good Drop Hammer men, as I am particularly interested in that line of work. D. C. GRANT.

Dressing of Wood-work. Will some one tell me how to dress wood-work, and the best material to use? I have been using a sand belt a great deal in finishing wood-work, but it does not give good satisfaction. A. L. COOPER.

F. F. Young, Sikeston, Maryland, is in need of a good all-around workman.

Tempering Springs. Will some one kindly tell me the best way of tempering springs, such as trap, gun, lock and spiral? JAMES REID.

Upsetting and Tempering Axes.—In answer to the inquiry of B. F. Watson with regard to upsetting and tempering axes would say, first upset the edge a little, heat to a cherry red, being careful not to heat higher when drawing. Do not hammer too cold. When you get the ax in good shape, get a bucket of clear water and heat about as hot as you can bear it with your hand for a minute. I would rather have it too hot than too cold. You can heat it with hot scrap iron. Now reset, put the ax in the fire, heat to a dull red all over, then hold in the water by the handle, half way, for ten seconds. Take it out and draw your temper. The first change in color is copper, then blue, and finally the blue is followed by a color the exact shade of copper. Now plunge the ax in the hot water and grind nicely, being sure not to get it too thin. I think this to be a very good recipe for this kind of work. GABRIEL DENNY.

Forging or Overreaching. In answer to J. P. Nelson in the March number on forging, or overreaching as it is commonly called, shoe in front with common, extra light steel plates with short sharp calks. If toe calks are needed, set them back $\frac{3}{16}$ inch from outside of shoe. Set shoe level and $\frac{1}{8}$ inch back from the edge of hoof. Run the rasp around the edge to take off the sharp edge of the shell. For the hind feet, take same grade of shoe, draw heels a little, and turn up slightly, welding short sharp calks lengthwise on each heel $\frac{3}{4}$ inch from the end of the shoe. Draw toe slightly with pein of hammer, weld the toe calks one size larger, then put on heels well forward and set the shoe well forward flush with or projecting a very little at the toe round the heels. I have used this shoe without failure to stop forging since 1895. R. A. WOODWARD.

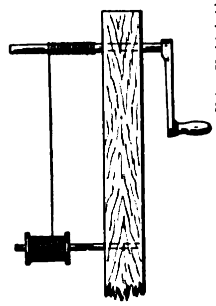
Interfering. In answer to the question about interfering, I will give my experience with forging horses to Mr. J. P. Nelson and others that may read it. I have a mare of my own that forged before she was shod, and I tried every way I could think of, but did no good, so I took a pair of Boss Toe Weight Shoes turned a very low heel and just enough toe to protect the shoe from wear, and fitted full to the foot, the same as on any horse. I then shod her behind, for shoeing forward alone will not stop it. I take a very light steel road shoe and turn a very low heel with no toe at all, but instead of a toe calk I took the round face of my hammer (I always use a double-faced turning hammer for fitting) and drew the toe of the shoe down thin, sloping to the hoof. This I also fitted to the foot, and the mare travels better than she ever did, and I never hear that click, click, any more. And again I had a four-year-old road mare to shoe that forged and also interfered behind, and she had been shod every way that could be thought of. When she was brought to me to shoe, she had great heavy shoes before and large side weights behind and still clicked. I shod her the same as No. 1, only I fitted the hind shoe very close behind on the inside, and threw the outside out somewhat more than No. 1, and it stopped her. A. KLINGINSMITH.

Vulcan Steel. I wish to know what vulcan steel and crown steel shot gun barrels are. What is the best steel to make razors of? HENRY WOEHNER.

A Good Blacksmith Wanted. I am about to purchase a blacksmith shop and I shall desire a good smith, one that is a good horseshoer and good on repair work also. J. H. TOWSLEY,
Gainsville, N. Y.

Soldering Gun Barrels. In reply to a recent inquiry, I first grind or file the barrels to make sure that they fit in line with each other. I then tin them, where the barrels and ribs fit together, with soft solder and clamp them all in place, ribs and barrels at each end. and then hammer the bridge and warm them up, so the solder will melt. I use soft solder in both soldering and tinning the ribs and heat with charcoal fire in a forge. Get your solder in strips or small flat pieces, and it will run right in and work from the bridge to the muzzle. Let the bridge cool as you work up the barrels. Do not heat too hot, for a low heat will melt solder. C. HALL, JR.

Hardening Brass and Making Springs. Brass can be hardened by hammering or running through rollers while cold. To make a coiled spring, say a $\frac{5}{16}$ spring, take a $\frac{1}{4}$-inch iron rod, put a crank on it or bend to shape of crank and let it run out at one end. Bore a hub in a block of wood, so the iron will fit tight, and run it through, fasten your wire on it, and wind it on by turning the crank, having your spool post so you can hold it tight enough to stretch the wire. C. HALL, JR.



MAKING BRASS SPRINGS.

Tempering Well Drills. In answer to Mr. Wesley Johnson's inquiry, would say, that in tempering well drills, take four gallons soft water, add twelve pounds common salt, two ounces Salamoniac, eight ounces Prussiate of Potash, two ounces of borax, and dissolve thoroughly. Heat the drill to bright orange and immerse until the heated portion is entirely under the liquid, then draw out slowly so as to have just heat enough to draw the temper back to a dark purple. With a little practice any smith can make a drill in this way that will give perfect satisfaction in all respects. R. A. WOODARD.

Tempering Well Drills. In reply to the question by Wesley Johnson would say, that if he would temper his drills just the same as he would a mill pick, they would stand. G. W. KENYON.

Length of Carriage Axles. Will some one kindly inform me if there is any difference in the length of carriage axles, forward and hind, and if so, how much.
T. T.

Tempering Knives. In reply to Mr. Goudey's inquiry on how to temper knives so they will not spring, would say that I have a way to temper them as follows: After you have your knife forged and are ready to temper, heat the knife to a cherry red evenly all over. Chalk the knife well on both sides all over, plunge it evenly in water, cutting edge first, and hold it there until it is the temperature of the water. Be sure and have the water lukewarm. Have a bar of iron hot, a piece of $2\frac{1}{4}$-inch wagon tire will do, wipe the chalk off and draw the knife slowly across the hot bar. Hold the back of the knife on the bar, and let it lean over a little as you see the blue coming in it, and be sure to keep it moving. Draw to a medium blue, then chalk again on both sides, and plunge into the water. I will guarantee you will have a good knife. Another way is to have some damp clay, heat the knife to cherry red and put in the clay, but you cannot always get the right temper. W. W. P.

Editor American Blacksmith:

I heartily endorse the thoughts of the writer of "Ear marks of a Thrifty Shop," and on that thought would say a word to the younger members of the craft, and to those about to choose a trade or profession which is worthy of most careful consideration. The mechanic chooses his trade, believing that he is better fitted for it physically, and his circumstances and surroundings make it look more favorable to him. We will imagine he chooses to become a blacksmith, and to him I want to say a word. Do not think for one minute that your trade is inferior. Some of the broadest minded and brightest intellects are engaged in the same trade, and the opportunities within your reach are as plentiful as with any student of the professions. The time has past when a man is barred from society, because he is a mechanic. All trades and professions in our country are equal, and the social position which a man enjoys, and the degree of respect which he is able to command depends not on his trade, but upon him and his individual character. Our modern mechanic has become one of the prime factors in the industrial problem of to-day, and is daily solving some of the most difficult problems that have baffled the mechanical skill of centuries. The time is no more in this country, when a mechanic is excluded from a position to which his intelligence and good name entitles him.

Supply yourself with some standard magazines and books, and as you commence to work, commence to read, and by so doing you will get the thoughts of the older members of the trade. I well remember way back in the fifties when we had no such help as you have; no horseshoers' conventions to read about; no veterinary colleges as plentiful as to-day, the results of which come to your hand monthly. I used to make a practice of securing feet from customers' horses that died to make a study of them. I have now in my old desk quite a collection of feet in different stages of deformity. I know a blacksmith, whom I hardly think is entitled to the name, who told me he had shod horses thirty-seven years and had never seen the inside of a horse's foot. What do you think of such a statement? Supply yourselves with some of the periodicals of the day. I would advise you to do so at once, and ask questions through this or any of the papers printed in the interest of your trade. You will find it a great help to you, as the older smiths, with hardly an exception, are as ready to give instructions as you are to receive them. There is much good comes from this interchange of opinions. Any questions you would like to ask, doubtless the editor of this paper would be pleased to have you do so, as that is one of its missions. The paper is for your benefit, and it will be what you help to make it. Later I will say something on anatomy and lameness, and diagnosis of diseased feet and shoulders, and offer some suggestions for the proper treatment of the same. Since I have come into the family of THE AMERICAN BLACKSMITH, I shall hope to hear from the boys, as it makes me feel like old times. H. M. SWIFT, V. H. S.

Welding Flux. I should like to obtain some information through the columns of THE AMERICAN BLACKSMITH as to what is the best welding compound or flux.
S. PRISE.

How Keep Shop Time. I would like very much to see some opinions in the columns of your valuable paper as to the best way of keeping shop time on different jobs in a blacksmith shop. It has been my custom to let every man keep a book and fill this in when a job was finished, and have the foreman of the shop make out a ticket (printed for the purpose), and turn it into the office. I find, however, that this system does not work well. It seems to me that it would be better to let every man and every helper fill out a ticket at the close of each day's work, and sign his name to same, and turn it into the office, each job being named or numbered as the case may be. I would be pleased to have some information on this subject.

BLACKSMITH.

An Exception Noted. I cannot just agree with the writer of Prize Contest, Article No. 6, "Forging and Interfering." While I think his method good for forging, I do not like his shoe for interfering, especially for the country roads, where there is a horse path. Where the outside heel is turned to such an extent, the horse path being lowest in the center will cause the horse to roll his ankles in and cause him to strike. I will give my method of shoeing for interfering in the near future.

G. M. GOUDEY.

Contraction of the Feet. I would like to know why contraction does not affect the hind foot of a horse as it does the front. W. A. DORSEY.

A Canadian Association. The blacksmiths of Eastern Ontario have at last succeeded in forming an association, which for the present embraces twenty-five shops in this district, including the blacksmiths of Almonte, Carleton Place, Carp, Pakenham, Clayton, Kinburn, and Marathon. Mr Givens, of Pakenham, is the president, Mr. Hanna, of Kinburn, vice-president, and Mr. E. G. Code, of Almonte, secretary-treasurer. A committee has been appointed to draw up a schedule of prices to govern the association and also to draft a constitution. It is understood the prices on work will be advanced between 15 and 20 per cent.

A Bunch of Queries. Does setting the shoe back and rasping off the hoof make a horse's foot shorter or not? Is it advisable to trim the fragments from the frog of a foot, where it is in the way, and does it injure the horse? When a horse has too much action in his knee, how can you fix the shoe to prevent it? Can you tell me the best way to cure thrush? Do you think a home-made steel shoe is the best for a farm horse or not? What causes a shoe to get loose on a horse's foot before it is worn out? ISAAC NEIGHBORS.

An Answer to Shoeing Inquiry. In answer to inquiry of Mr. J. M. Sloan, as to the best way to shoe a horse whose joints are stiff just above the foot, would say level the foot to a proper shape and put on a full rocker shoe. Let the heels of the shoe come back of the heels one inch. I have used this with success. E. S. HUFF.

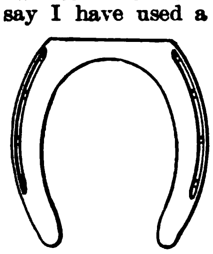
Answer to Shoeing Inquiry. In answer to J. M. Sloan in the March number, I would say that I have had a great deal of experience with horses whose joints are stiff above the foot, so that they walk back on the heel with the toe turned up. It is generally caused by founder or other injury to the foot, such as wire cut or puncture of nails. These cause contraction, and the heel will contract and sometimes roll under, while the toe thus left to carry all the weight will gradually turn up. Take an extra heavy draft shoe, turn one end for calks; then upset and round up until the calks are ½ to 9/16 inch long. Roll the shoe a little at the toe, and level about two inches of the shoe at the heel from inside toward the outside. Level the foot, then roll the toe and level the heels so the shoe will fit a little tight at heel, and the weight of the animal will tend to spread the heel. I have used this kind of shoe for the last five years and have found it a complete success. R. A. WOODARD.

Twist in Augers. I should like to have some information on how to put the twist in augers 1¼ inches or 1⅜ inches; the easiest and quickest way to have a perfect twist. H. H. MILLER.

Gun Work. As I have taken up gun work in connection with my blacksmith shop, and as it is difficult work, requiring lots of ingenuity and tools, I would like to have information through the columns of THE AMERICAN BLACKSMITH on the following subjects connected with this kind of work: Forging out the different pieces of a gun in the best manner; how to cut rifles in old barrels, and also new barrels; how to choke bore shot-gun barrels; something about stocking; also something about screw cutting and making screws, etc.; brazing and soldering; how to make boring tools to bore out barrels and other work; making springs, etc.; tempering and other kinks; wrinkles and receipts.

W. G. MUMMA.

To Shoe a Knee-Striking Horse. In answer to Mr. J. E. Elliott's inquiry, would say I have used a square-toed shoe for some years, and have never seen it fail yet. Horses that strike their knees are horses that toe out, and do not break over at the center of the toe. The square-toed shoe makes them break over in the center and they go clear. Will some brother shoer tell me how they shoe a horse that strikes his knees, cannon bone and ankle? G. M. GOUDEY.



SHOE FOR KNEE STRIKING.

Editor American Blacksmith:

I am receiving the paper all O. K., and I want to say I think it is just what the blacksmith needs in his business. The man that does not take a journal on his business is not up-to-date. I take three and wish I had more. I read everything in them, advertisements and all.

I cannot agree with Prize Contest Article No. 8, on Repairing Dished Wheels. First, he is making the wheel smaller than the mate, and besides it does not look right with wedges in it. In the time it takes to do that job, I could spoke a wheel with new spokes. I get a fair price for my time and give my customer a good job. Everything worth doing is worth doing right. Good work and fair prices is my motto.

I agree with brother B. F. Mohr on the shafting and pulley talk. I use power myself. I first put in a 6½ horse-power engine and found it too small, and then I put in 10 horse-power. I am, at this writing, putting in a 25-horse power steam engine to run a cotton gin, corn mill and all shop machines, and I want to say a man putting in power cannot get too much. If I had no power I would quit the business and work for a man that did have it.

J. VESTAL.

Shoeing a Horse. I should like to obtain some information as to how to shoe a horse that paddles when he trots; that is, he places one front foot directly in front of the other. JAMES BRUCE.

Hand-made Shoes. It is the opinion of the writer, answering the inquiry of Mr J. T. Peterson, that it does not pay a blacksmith to make his own horseshoes. The horseshoes found upon the market today are the best that it is possible to make and they are cheap, too. I believe any smith can find better employment for his spare time, but the nature of such employment must depend entirely upon the surroundings of the smith. A. B. C.

Car and Locomotive Springs. I would like to see something in THE AMERICAN BLACKSMITH about tempering car and locomotive springs. Also how to construct a small furnace to heat them, as it is impossible to get a uniform heat in ordinary smith's fire. OOM PAUL.

Corns. In answer to Mr. G. M. Beebe's question in the February number with regard to corns, I find the best way to treat corns is by using common brown sugar. Cut out the corn until it bleeds a little, then press the sugar in the place where it is cut out. Apply twice a day for one week and the corn will leave. If it does not, repeat in one month.

J. H. KLASSEN.

Tempering Grub Hoes. The question in the March issue, by Oscar Wolfwith, in regard to grub hoes, I will try to answer. In the first place, use blister steel, and when you have it ready to temper, just heat it to a cherry red, then plunge in water and let cool, but do not draw the temper at all. G. W. KENYON.

To Mold Iron and Brass. In reply to Mr. William Duff's inquiry in the March issue, would say that moulding sand can be made by mixing ten to fourteen per cent. of clay with ninety to eighty-six per cent. silica sand. The difficulty in mixing sand in this way is to get the silica sand fine enough. The sand should be fine enough to have a velvety feeling when a little is rubbed in the palm of the hand, and not feel hard and gritty.

Small quantities of iron or brass can be melted in a crucible in an ordinary forge. These crucibles should be kept covered to prevent the air from reacting on the melted metal. It is a good plan to throw charcoal on top of the metal when it melts if you are using brass. When making brass castings, melt the copper first and then add the necessary amount of zinc, etc. As zinc melts, and in fact burns at a lower temperature than copper melts, the zinc would be burned out of the mixture before the copper melted if the scraps of the different metals were merely mixed together and an attempt made to melt both down at the same time.

As to the amount of metal to be melted to make a certain casting, that is very uncertain, and depends upon the way the mould is made, the shape of the sprue hole, etc. The actual weight of metal in the casting can be determined as follows, from the weight of the pattern: If the pattern is made of white pine, well-seasoned, the weight of the casting will be sixteen times the weight of the pattern if the casting is made of cast iron, and nineteen times the weight of the pattern if made of brass. This will give the weight near enough for all ordinary purposes. To find the amount of metal to melt to make the casting, an allowance must be added to the weight, as found above, for waste in melting and for the metal which goes to fill up the sprue or pouring hole. This amount can, of course, only be determined by practice. JOHN L. BACON.

Prices Current—Blacksmith Supplies.

The following quotations are from dealers' stock, Buffalo, N. Y., April 23, 1902, and are subject to change. By comparison with last month's issue of The American Blacksmith, it will be seen that the predicted advance has materialized, there being an increase in price of $2.00 per ton on bars and about 10% on bolts. Dealers report good demands; mills turning out these commodities are well filled with orders. Further advances are rather to be expected.

All prices, except on the bolts and nuts, are per hundred pounds. On bars and flats prices are in bundle lots.

Bars—Common Iron and Soft Steel.

¼ in., round or square; Iron, $3.00; Steel, $2.80
⅜ in., " " " 2.60 " 2.60
½ in., " " " 2.40 " 2.80

Flats—Bar and Band.

¼ x 1 in., Iron............$2.40; Steel..............$2.80
¼ x 1½ in., " .... 2.80; " 2.80
3-16 x 1½ in., " .... 2.50; " 2.50

Norway and Swedish Iron.

¼ in., round or square............................. $4.90
⅜ in., " " 4.50
½ in., " " 4.80
¼ x 1 in... 4.80
¼ x 1½ in 4.20

Horseshoe Iron.

For No. 1 shoe, ⅜ x ½ in.............................. $3.40
For No. 2 shoe, ½ x ⅝ in.............................. 3.00
For No. 3 shoe, ⅝ x ¾ in.............................. 2.90
For No. 4 shoe, ⅝ x ⅞ in.............................. 2.90

Toe Calk Steel.

½ x ⅜ in. and larger..................................3½c lb

Spring Steel.

⅝ to 1½ in. Rounds, Op. Hearth $3.50; Crucible $6.00
1¼ to 6 in. by No. 4
guage to ½ in. Flats " 3.50 " 6.00

Carriage Bolts. (Net Price per Hundred).

¼ x 2 in...........	$0.54	⅜ x 2½ in...........	$0.82
¼ x 2½ in...........	.58	⅜ x 3½ in...........	.96
¼ x 3 in...........	.62	⅜ x 6 in...........	1.31
5-16 x 2 in...........	.65	½ x 4 in...........	1.70
5-16 x 3 in...........	.75	½ x 6 in...........	2.10

Tire Bolts. (Net Price per Hundred).

3-16 x 1½ in...........	$0.18	¼ x 1½ in...........	$0 28½
3-16 x 2 in...........	.21	¼ x 2 in...........	.31½
3-16 x 3 in...........	.27	¼ x 3 in...........	.37½

Hot Pressed Nuts. (Blanks).

¼, ⅜, 7-16, ½ in., 4c. per lb. net.

Note.—Base prices or most common sizes are listed above. Should subscribers desire net prices upon other sizes than those given, same will be published in following issues.

WANTED AND FOR SALE.

Want and for sale advertisements, situations and help wanted, articles new or second-hand, and business opportunities, will be inserted under this head. The rate is twenty-five cents a line. Send cash with order. No insertions of less than two lines accepted. All answers to advertisements received at this office will be forwarded to their proper destination.

TO LEASE. A blacksmith and wheelwright shop, good stock and good trade. Cause of retirement, sickness. A splendid opportunity for the right party. A. GENTSCH, Winona, Mass.

FOR SALE. A well-established carriage manufacturing business. For further information apply to H. HARRISON, Geneseo, N. Y.

Mr. Chas. W. Krause announces a change of address from Elmira, N. Y., to Adel, Iowa.

WANTED. A horseshoer in each county to take agency for Bliss Hoof Cutters. Liberal commission given. First application secures agency for your county.
W. L. BLISS, So. Egremont, Mass.

Trade Literature and Notes.

Of great advantage to the mechanic in any industry is a thorough knowledge of the most recent improvements in tools, machines and devices for the speedy accomplishment of work.

The catalogues issued by the various leading manufacturers clearly set forth the advantages and excellence of their tools and are a splendid aid for keeping up with the times. In the most prosperous shops are usually to be found the latest catalogues of all tools useful to those shops. The American Blacksmith requests all manufacturers of blacksmith and carriage building machinery to forward them, immediately upon issuance, the latest catalogues, price lists and other literature for acknowledgment in these columns. Readers would do well to send for such as would benefit them, and at the same time would do The American Blacksmith a service by mentioning its name in connection with the request.

The following literature has been received at this office:

George Henderson & Co., 122 Water street, Cleveland, Ohio.
Fully illustrated catalogue and net price list for 1902 of their complete and very representative assortment of tools and hardware for the blacksmith, the farrier and the carriage builders. Located in the great hardware center of Cleveland, this firm can furnish anything in the hardware line.

Studebaker Bros. Mfg. Co., South Bend, Indiana.
The South Bend Daily Times of April 17 contains an interesting description of this immense carriage and wagon building plant, with a statement of its origin and growth. These factories and yards cover 95 acres. The company's total pay roll carries over 3,000 names.

Paddock-Hawley Iron Co., St. Louis, Missouri.
Catalogue No. 44 of their line of portable forges, blowers, hardware, etc.

Wiley & Russell Mfg. Co., Greenfield, Mass.
Catalogue and price list of their "Patent Screw-Cutting" and other labor-saving machinery and tools.

C. C. Bradley & Son, Syracuse, N Y.
Small pamphlet telling of the well-known Bradley Shaft Coupling.

The Davis Coal and Coke Co., Chicago, Illinois.
Circulars advertising their coal and coke.

American Steel and Wire Co., Pittsburg, Pa.
Illustrated catalogue No. 2 of their line of Juniata horseshoes.

Lewis Tool Co., New York City.
Illustrated catalogue of self-adjusting jaw vises, wood-workers' vises, machinists' vises, etc.

Kalamazoo Tire Puller Co., Kalamazoo, Michigan.
Pamphlet describing Smith's giant tire puller.

Bauer Carriage Goods Co., Cincinnati, Ohio.
Catalogue and price list No. 10, of buggy tops, cushions and all styles of carriage trimmings.

Prentiss Vise Co., New York City.
Catalogue No. 47, describing all their styles of vises.

American Gas Furnace Co., New York City.
Descriptive pamphlets of gas blast furnaces and heating machines, melting furnaces, tempering furnaces, etc.

U. F. & John Barnes Co., Rockford, Ill.
Catalogue of their metal working machinery, disk drills, upright drills, lathes, circular saws, etc.

In the Morning's Mail.

The following letters were among the mail of a single morning. Such as these are continually coming in, and the American Blacksmith has a thousand if it has one. They show what is thought of the paper:

American Blacksmith Company:

I received the copy of your paper last night, and am very much pleased with it. If you can keep it up to what you have started, it cannot be beaten.
C. E. Arnold, Aberdeen, Wash.

American Blacksmith Company:

Enclosed you will find one dollar ($1.00) to pay for paper. I am pleased with sample copy. If you maintain the present standard the paper will be valuable.
John E. Smith, Fremontville, Cal.

American Blacksmith Company:

I wish to thank you for the copy of The American Blacksmith which I have just received. I like it very much, and feel that it will be of great help to me. I enclose herewith check for one dollar ($1.00) for one year's subscription.
E. A. Carder, Big Isaac, W. Va.

American Blacksmith Company:

Find enclosed $1.00, for which please send me The American Blacksmith for one year, beginning from date. I received a sample copy of your paper last week, and I take great pleasure in saying that it is the most practical paper for the members of our craft to read that I have ever examined. I speak, too, from an experience of over forty years.
Lauritz Smith, Draper, Utah.

American Blacksmith Company:

I like The Blacksmith, this number of it especially. I would not take 25 cents for this one copy.
C. D. Robinson, Burnt Prairie, Ill.

American Blacksmith Company:

Yesterday I received a copy of The American Blacksmith, and it is all O. K. It is a journal that will take very well among all classes of blacksmiths. I enclose $1 for a year's subscription.
Wm. Young, Springfield, Ill.

American Blacksmith Company:

Your paper just received, and I commenced looking at it from the back side, and did not look at but three leaves until my mind was made up to get it.

I am so far away I will not get the prize, but I think the paper is worth the money.
Z. M. Wesley, Beech Grove, Ky.

American Blacksmith Company:

Your letter of the 14th inst. received, also a sample copy of T. A. B., for which I am very thankful. I have read the contents and am delighted with the general tone. I wish you success. I feel it is the one thing needed, and hope you will get it to the home of the individual blacksmith. I feel it will help him to more fully understand his worth in the industrial world. It will help to lighten his daily toil more and more as he reads the contributions from those who like him have the same problems to deal with, viz.: "Is this the best way to do the work I am doing?" These are the thoughts that come to the man day after day. In the pages of the journal he can keep TAB on all those doubtful questions and find his answer in one or the other of the articles written. I feel there is a great future for it.
C. C. Sleffel,
Columbia University, N. Y. C.

ILLUSTRATIONS OF NEW MACHINES FOR THE TRADE.

OUR AIM is to inform readers about new machines of merit as soon as they are placed upon the market. We will publish illustrated descriptions of new apparatus, however, only when of interest to our readers.

OUR DESIRE is to be informed regarding new machines as soon as possible after they are brought out; especially those that have a bearing on modern blacksmith practice.

WE INVITE all manufacturers, irrespective of any past, present or future advertising affiliations with us, to send us complete descriptions, photos and blue prints, of new devices of interest to blacksmithing and allied crafts. Write to us before having new cuts made. Our facilities may be better than yours, and we may save you money on cuts.

WE PREFER complete data, photographs of the machine, blue prints showing its construction, and a description of its operation and main advantages over existing types. We must be sent this at least as soon as any similar publication. We do not publish old "write-ups." Also we must be the ones to judge of the availability, date of appearance and amount of space to be allotted such matters. The standard of AMERICAN BLACKSMITH reading columns will always be maintained.

AMERICAN BLACKSMITH COMPANY,

P. O. Drawer 974, - - BUFFALO, N. Y.

VOLUME I — THE — NUMBER 9

THE AMERICAN BLACKSMITH

BUFFALO, N.Y. U.S.A. — A PRACTICAL JOURNAL OF BLACKSMITHING. — $1.00 A YEAR 10¢ A COPY

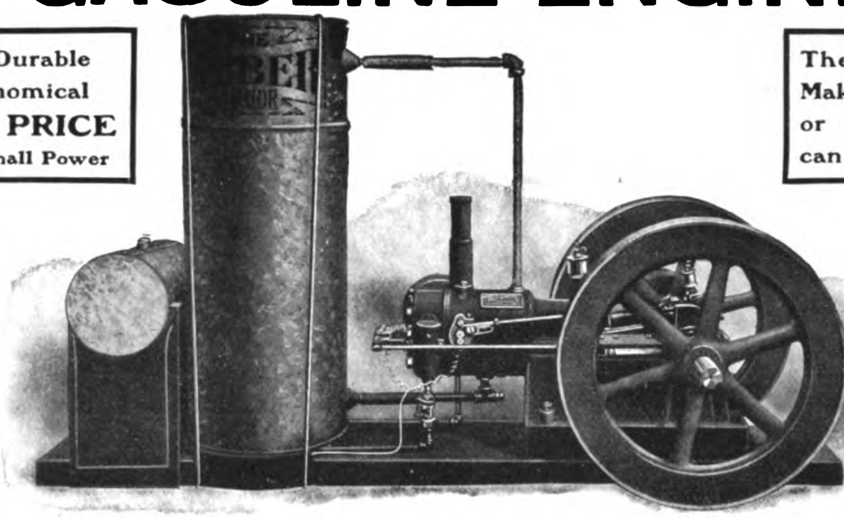
JUNE 1902

2½ H. P. WEBER, Jr.

GASOLINE ENGINE

Simple, Durable and Economical
LOW IN PRICE
The Ideal Small Power

The Greatest Money-Maker a Blacksmith or Carriage Builder can put in his shop



Weight, 650 Pounds.

Floor Space, 24 x 50 Inches.

Speed, 375 Rev. per Min.

Pulley, 8 x 5 Inches.

Other Sizes from 4 to 100 H. P.

The Name "WEBER" guarantees them.

THIS ENGINE shipped to user complete, mounted and crated, with all fixtures, as shown in cut. All adjustments are made, all pipes and fittings attached. Services of machinists not required to set up Engine. Only necessary to bolt down and set to work.

GUARANTEE.—We will replace, F. O. B. Factory, any part or parts unduly worn or defective, free of all charges, for a period of two years. We guarantee the engine to **fully develop 2½ Actual Horse Power.**
Your Money Back if it Fails to Meet our Guarantee.

Our best Advertisement is our host of well-pleased Customers. The following letters show what many thousands of blacksmiths think of the WEBER JUNIOR:

CUNNINGHAM, KAN., Sept. 18, 1901.

TO BLACKSMITHS:—If you are thinking of putting in power in your shop let me say to you, BUY A WEBER 2½ H.P. ENGINE! Don't be afraid about the power—it has all you want to run anything in a blacksmith shop, with power to spare. I had run my shop with a 4 H. P. steam engine for nine years, but I recently changed to the 2½ H.P. Weber, and find it has plenty of power. I run a power hammer, emery grinder, drill, bolt cutter, spoke tennoning machine, wood lathe, iron lathe, and expect to put in two saw machines, all up-to-date tools. I say again, DON'T BE AFRAID OF THE 2½ WEBER.

GEORGE G. SIMONSON.

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GENTLEMEN:—With your JUNIOR engine I am running a 20-foot 2-inch shaft, from which I belt to a 30-inch upright drill press, 24-inch iron lathe, 16-inch iron shaper, 18-inch fan, emery wheel, etc.

This little engine is satisfactory in every respect. There is no popping, snapping, jumping. As I have had 30 years' experience in the machine business, I can cheerfully recommend your little engine to anybody needing a small substantial power.

L. L. WATSON.

BRANFORD, CT.

GENTLEMEN:—I am the owner of the BEST and CHEAPEST gasoline engine built—the WEBER JUNIOR. I have never spent a penny for repairs. Can start or stop in five seconds. She is driving a drill press, emery grinder, blower, trip hammer and heavy punching press.

JOHN DONNELLY.

BATTENVILLE, N. Y.

GENTLEMEN:—The 2½ H. P. JUNIOR is no trouble to start and requires no attention. Also, it is very economical of gasoline, costing only about 5 cents an hour, and I am running a band saw, upright drill, wood lathe, grindstone, and am going to put in a circular saw and planer.

Anyone needing a good, small power will make no mistake in buying the WEBER JUNIOR, and will have all the power he wants.

W. R. CRUIKSHANK.

If You are Thinking of Putting in Power, Write Us, We can Save You Money.

Weber Gas and Gasoline Engine Co.

One-half per cent. discount, if you mention THE AMERICAN BLACKSMITH.

P. O. BOX V-1114, KANSAS CITY, MO.

THE AMERICAN BLACKSMITH

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A Robert Collyer Number.

The present issue of our journal might almost be termed a Robert Collyer number. Two articles from the pen of this eminent man appear, together with a short biographical sketch and a most modest one at that. One is a narrative blacksmith poem, and the other a chapter of early apprentice-day reminiscences. We are also fortunate in being able to reproduce a late photograph of Mr. Collyer. It is confidently thought that the words of this great orator and divine will be full of interest for our readers.

To the blacksmith, the name of Robert Collyer will always be associated with the names of those men to whom the craft can point with just pride. In a recent address before the National Railroad Master Blacksmiths' Association, President Jeffery, of the Denver and Rio Grande Railroad said: "It was my good fortune to come in personal contact with certain blacksmiths in my younger days, whose influence I have felt to the present time. There was Robert Collyer, the blacksmith from Yorkshire, the eloquent divine, the charming lecturer, the refined and scholarly man. How I enjoyed his discourses, was impressed by his earnestness and moved by his sincerity and purity of character." His life story is that of a man, who was not born great nor had greatness thrust upon him, but who made a name for himself by dint of an inborn love of knowledge and advancement, in spite of early handicaps and inferior advantages. It is the familiar instance of the strong character riding over obstacles which to weaker mortals would seem unsurmountable.

A State Board of Examiners.

We recently received notification from the capital of Ohio that the house had concurred in amendments to a bill establishing a State Board of Examiners of Horseshoers, the bill becoming a law. This is good news, though it now remains to be seen, of course, how the law will be executed and what its ultimate effect upon craft interests will be. Legislation of this nature is much needed. If a doctor is made to meet the requirements of a medical examination before being allowed to practice, is it not proper also for the farrier to prove his competence to carry on his work? We shall endeavor to secure further information for readers regarding this interesting bit of legislation. Again, it would give us pleasure to have any of the craft express their sentiments upon the subject in question, and to give the solution to the problem which they deem best.

Robert Collyer.

Robert Collyer was born in Keighley, Yorkshire, on the 8th of December, 1823. His father was a blacksmith, having learned his craft at the West House factory in Fewston, and when he was free of his time, found work in Hattersleys machine shop at Keighley, but returned to the factory when Robert, his eldest son, was a month old, and worked there until 1839, when the family moved to the great town of Leeds.

Robert went to a school in Fewston, kept by Willey Hardy, until he was rising eight years of age, when he went to work in the factory. He also went part of a year to night school under his old teacher, and this, together with one winter at night school, after he was bound an apprentice in Ilkley, was the extent of his learning in the schools, but from his earliest years, he was an earnest reader of all the books he could lay his hands on, loving especially Robinson Crusoe and the Pilgrim's Progress, and as he grew up, Shakespeare and Robert Burns. He read the Bible also, so that he still falls back on his early memories of chapter and verse, in the work he has to do as a minister.

In Ilkley, he found friends who loved books also, John Dobson, a wool comber, and Thomas Smith, a farmer's man. They formed a sort of reading club and held their books in common. He still holds one volume as a treasure in which the three names are written with the inscription "Liberty, Equality, Fraternity" on the fly leaf. John Dobson was the eldest by some years, and was the mentor, as well as the companion of the boys to the end of the chapter in Ilkley.

In April, 1850, he was married, the next morning starting for America, where he found work at a hammer factory at Shoemakertown,—now Ogontz, Pennsylvania, and made hammers there until February, 1859, when he was called to Chicago to take charge of a mission to the poor. In the same year, he was called to be the minister of Unity Church in that city, the Second Unitarian Church. He was a Methodist local preacher in England, and over in this country about eleven years all told, but when he was called to Chicago he had been suspended for heresy and silenced. He was minister of the Church there almost twenty-one years, and has been minister and associate minister of the Church of the Messiah in New York since September, 1879.

Information Wanted.

The Editor desires to take you, Reader, into his confidence, and ask you a few straightforward questions. As you have opened the leaves of this journal, you perhaps feel some interest in what is to be found herein. The question is, How can these pages be made more valuable, more applicable, more interesting to you? If you think of any subjects you would like discussed, if you have any questions to ask, or suggestions to make, let us hear from you. What topic connected with blacksmithing or carriage building or horseshoeing would you like to have treated of in these columns? We always wish to keep in touch with our readers and their wants. It is to our interests to see that THE AMERICAN BLACKSMITH is made of the greatest possible value to you personally. Let us hear from you on this subject.

An Ornamental Iron Bank Railing.

The J. E. Bolles Iron and Wire Works, Detroit, Mich., have recently executed a handsome design of ornamental iron railing for shipment to a customer in Mexico, a section of which is shown in the accompanying engraving. The scroll work is made of polished steel, ornamented with hammered leaf work, all oxydized copper finish. The base in this order was chipped plate glass with plain bevel edges, which gives a rich effect. A neatly ornamented steel plate panel instead of glass may be used when desired.

In addition to the above, the products of this firm illustrate some of the manifold uses to which ornamental iron work is now being put in these days. Their line includes, for instance, bank and office railings, elevator cabs and enclosures, brass and steel grille work, fire escapes, iron shutters, entrance and vault gates, iron and wire work, etc. This field is being continually extended, and if any of our readers know of any examples showing new uses of artistic iron work, we should be glad to have them send in a description and photograph of the same. This class of work is very interesting, and requires the combination of skill and artistic feeling to a high order, in order that the finished piece may not be devoid of all beauty and symmetry.

A HANDSOME ORNAMENTAL IRON RAILING.

Horseshoeing.—The Necessary Knowledge.

W. S. GILDERSLEEVE.

The subject of horseshoeing has been so often discussed and written about both by the practitioner and theorist, that it would seem to have been exhausted by this time, but there are many different ways of looking at it. Only practical experience in shoeing the varied forms of feet with their peculiarities and difficulties fits one to talk or write intelligently upon this very important subject, and in connection with it a thorough knowledge of the foot and its relation to the leg is necessitated.

A little explanation as to what constitutes a practical experience would be fitting at this time. I have found that knowledge obtained from a book written by a theorist on the subject is of little use, and often very misleading. Again, when listening to a lecture as to how the horse should be shod (unless by one who is a recognized authority) it is difficult to get much real information. Even watching the act performed will not fit one to do it. But the man with a true knowledge of the foot, who has been at the business long enough to have met with a number of difficult cases, who has prepared the feet of such, fitted shoes to them, nailed them on, watched for the improvements or changes in the horse's travel, and who lastly has profited by mistakes, this is the man who possesses practical experience of the best kind. The more he has of it the better authority will he be. A man may be able to make and fit a shoe in a very workman-like manner, and yet not be a good horseshoer in the true sense of the word, as he may have a very limited knowledge of the

DESIGN FOR ORNAMENTAL IRON GATE.

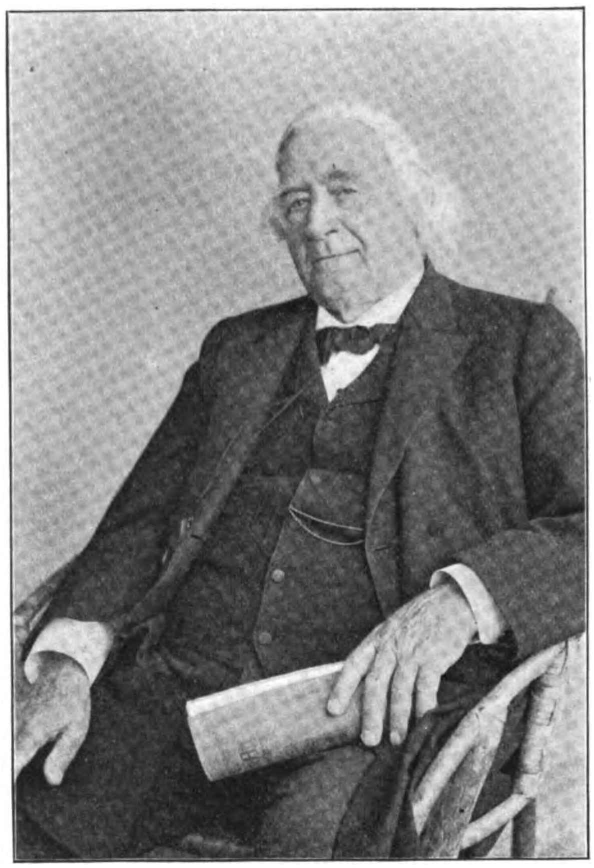
foot and its functions. There is too much thought and attention paid to the mechanical part of the business, which is of minor importance compared with the necessity of knowing when and how to cut the foot, and how to detect the differences in the forms of feet and their relation to the leg. These are some of the essential things that go to make a practical experience.

The experience a man acquires depends largely upon the locality in which he is practicing the art. In the country districts one will have less difficulty in keeping horses from going lame and interfering than he will have in the city, for one or two reasons. First, the roads are softer, thereby lessening the concussion of the foot, and allowing it to more easily adapt itself to the most natural position on the ground. Secondly, the frog and sole come in contact with the ground more, which tends to keep them in a more healthy condition. In the city there are opposite conditions to contend with. The hard unnatural roads make the foot liable to many troubles, which call for as many different treatments in order to keep it in condition for service. The hard, straining work in carts and trucks, as also the hurried, reckless driving in the delivery wagons, all go to form conditions from which the foot will suffer, many times directly. These are conditions which are not overdrawn or exaggerated; they have to be met with every day by the man who follows the business in the city. For this reason, the city farrier gets a broader experience from a greater variety of foot troubles. It is such experience which qualifies a man to cope with new and difficult cases that will surely come along, and which gives him the required knowledge for success. We need to know how to put a foot in the right shape when it is wrong. We should know how to locate lameness. We should be able to give a reasonable and intelligent explanation of the difficulty, and to tell how and why we treat it, if asked. This is all necessary. I don't think there is any business so generally followed, where there is so much ignorance and wrong ideas about it as there is in this business of horseshoeing, and the time has arrived for a better understanding of what we are doing.

Some Reminiscences by Robert Collyer, the Blacksmith Divine.

You ask me to tell you something about myself as a blacksmith and I must begin with the confession that I am a deserter from the ranks. I left the forge forty-three years ago this February, after twenty-one years at the anvil in England and America, when I was promoted from the anvil to the pulpit in 1859, and have only returned to the fine old craft for a part of one day to make one horseshoe. This was soon after the great fire in Chicago in 1871, when the students of the Cornell University offered me a thousand dollars if I would make them a horseshoe; so the shoe was duly made, the money paid promptly down on the nail, and I stood ready to make a hundred on the same terms.

I was bound apprentice to a blacksmith at Ilkley in Yorkshire in 1838, when I was somewhat over fourteen, to serve until I was twenty-one, and served my time to the day. The terms were my keep, with shirts and leather aprons, my people finding me in clothes. The craft was that of an old-fashioned country blacksmith. We made all the iron work for carts and wagons, shod the horses, together with a good many donkeys, fitted out the old-fashioned wooden ploughs, together with all the implements needed on the farms and in the house-holds in iron and steel; for all was fish that came to our net. I was looking over some pictures the other day of the work on a farm in the old Saxon times before the Norman Conquest, and noticed that with some slight improvement the things they used then were about the same we made in the forge from fifty to sixty years ago. The horses on the farms had big feet, as a rule, but one old horseshoe with half another made a new one, and the farmers liked these better than those we made from the new bars because they lasted longer; but it was tough work



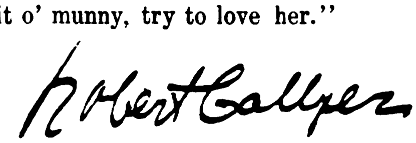
ROBERT COLLYER.

forging them out of the old iron, and now I look with envy into the windows on Broadway where the horseshoes are displayed that are made by these new processes so much nicer and more easily than we could make them in the old time, and if I must work at the anvil in any case wish that I could have come into the world, say seventy years later. While the price for four new shoes was two shillings all told, and as I said they had big feet, as a rule this left us a very scant profit. Your blacksmith of the old times must also be a veterinary surgeon and horse doctor in a rough and ready fashion. Looking after his teeth and his legs, also his feet, dressing out the corns, horning things into his stomach when he had what the old man called "belly work" and docking his tail with a sort of hand-made guillotine, and clapping on the stump a handful of aran webs (spider webs) to stop the bleeding—dear me how I did hate that job—and as I write, the memory comes back to me of the recipe for trouble in the poor creature's bowels duly imparted to me by the old man as a soveriegn remedy—an ounce of liquid laudanum, a dram of oil o' mint and a pint of castor oil mixed and then horned down.

The 'prentice lads lived well, as living went in those times. We always kept a cow, so we had plenty of skim milk for our oatmeal porridge morning and night, with oat cake to fill in. I like oat cake still, and always have some when I go back to the old home. He also fattened a pig for the winter, of a vast size that would turn the scale usually at 300 pounds, and grew so fond of each pig in its turn that when the butcher came to kill him it went to the old man's heart, so that he would run down cellar with his fingers in his ears to escape the screams of the creature when we hauled him to the cratch. We had four meals a day, and these included say two pints of ale for each 'prentice. We began work at seven and quit at seven, but worked longer if we were busy. I remember we worked once all night, and I came to the end of my time a big stalwart fellow equal to any task. I worked as a journeyman at the same forge, when my time was out, for seven shillings a week and found; this was a shilling more than my old shop mate Joe Mason had when he was free—dear old Joe, who was very good to me and died as the old year closed, in his 87th year, after working steadily for more than seventy years at the anvil.

I do not claim that I was a first rate hand at my craft. I never loved it as some do I have known, but there I was "in for life" as I supposed, and when the old man died I took charge of the forge on much better terms, but I saw no chance in England for getting on and working my way up. So I made up my mind to emigrate in 1850, and here I am calling up these old memories of the country blacksmith.

One little incident which befell me some years ago is very pleasant to remember, and helps me to believe I must have done better work perhaps than I was aware of. I called to see an old friend on one of my visits. I had done a good deal of work for him, and chatting with the good old man and his wife about those old times, the good wife said, "I have something I would like you to see in the parlor." It was a fire guard I had made, but did not remember, and a nice bit of work, though I say it. "Yes, you made it," she said, "to keep the children away from the fire, and when we had raised them all, I said I would keep the old fire guard nice and bright for his sake who made it," and there it was, shining like silver, though they had not dreamed I should ever come to see them. Then I asked the good man if he remembered the good advice he gave me one day. "Robert," he said, "thou will be wanting to get a wife one of these days, and I want to gi thee a bit o' good advice. Doant thee wed for munny—wed for love; but noo if thou sees a nice lass wi a bit o' munny, try to love her."



Workshop Recipes for Tempering, Annealing, Case-hardening and Drilling.

J. L. PAINTER.

To drill and file hard castings and iron, use turpentine on drill or file. You will be astonished at the result.

To anneal or soften steel for filing and drilling, heat to a low red, and bury in slack lime or in forge dust, and let it cool.

To temper mill picks, stone tools, etc., take a half pound of concentrated lye, dissolve in one gallon rain water. Heat steel to a cherry red and dip it in the solution one inch; draw to a straw color. If done properly the steel will stand the hardest stones.

To case-harden anvil tools made of iron, heat to a bright red; rub in prussiate of potash, or cyanide of potassium, and immediately cool in rain water.

To temper small springs, etc., heat to a cherry red and cool in rain water. Dip in lard oil; hold over fire until oil burns off. Repeat the oil dip twice more and then cool in oil. This is reliable if done properly.

To temper butcher knife blades of thin steel without warping, lay steel between two pieces of iron, bolt together, and heat to a cherry red. Cool in rain water, and draw temper by dipping the back of the blade in hot lead until you get a dark straw color on the edge.

To temper hand hammers, heat the face to a cherry red, cool in rain water, about one inch, then let temper draw to a dark straw color. Then put the hammer face in a cup of half an inch of lard oil, and let it cool in the oil, etc.

A good and reliable welding compound is made of two pounds of borax, ½ pound sal ammoniac; mix and melt them well together. When cold reduce them to fine powder. Use same as borax.

An every day welding compound is made of one quart of common dry clay, one pound of borax and one handful of salt. Grind together and it is ready for use. Very reliable and cheap for every day use.

Another good welding compound is made of one pound of borax, one ounce of muriate of ammonia; melt together. When cool grind fine and use the same as borax.

To weld a buggy spring, scarf each end, punch a hole half an inch from end; lay a thin piece of iron between; then rivet together and heat to a low red. Put iron scales on first; then use every-day welding compound. Heat slowly and you will get a good weld.

When working steel never be in a hurry; for edge tools, heat very slowly, and do not heat too hot. When you draw tool out, do all that you can at one heat, and finish with a wet hammer and anvil until almost cold. To temper lay the steel on top of a slow fire and heat very evenly before you temper.

Never upset a cold chisel, rather draw it out and cut the end off. The same with stone cutters' tools, etc.

To restore burnt steel, heat to a red; cool in water, and repeat two or three times. It will restore steel to a certain extent.

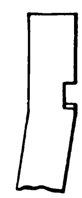
To weld low steel or iron to malleable castings, use one part sal ammoniac to ten parts borax, melted together, then grind fine. Heat slowly same as welding steel.

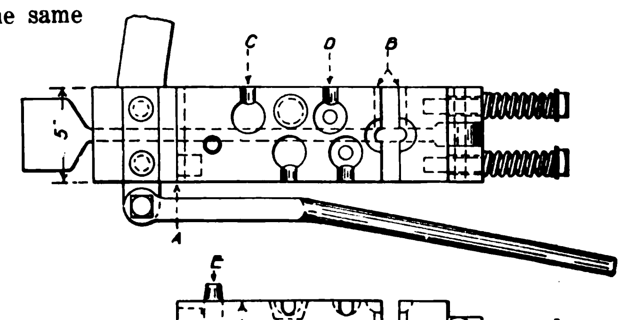
A Device for Making Freight Car Grab-Irons by Hand.

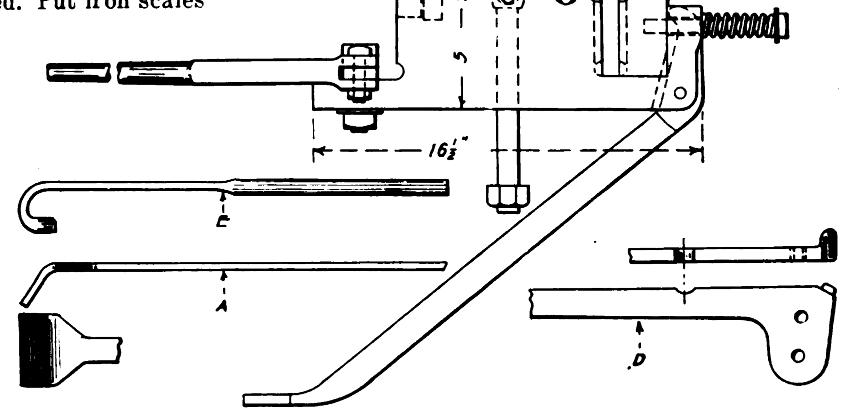
By the help of this device a man is able to turn out much more work than any other hand way of making grab-irons. By its aid, from 125 to 135 can be made in ten hours work, and it makes them all uniform.

Referring to the illustration, the first bend is made at A. In the same heat place the iron in B, put foot on lever, and upset; with cupping tool, make the round ball on the end. Next heat, place it in C, and form the end; with same heat place it in D, and punch hole, then place it on peg E, and bend end down. The lever A holds the iron in place at first bend; lever D is a gauge to punch hole, and lever E holds iron in place to bend end down.

This device was originated by Joseph Smith, Foreman Blacksmith of the Fort Worth and Denver Shops, at Fort Worth, Texas, and is one of the most unique and useful tools in the shop.







HAND TOOL FOR SHAPING GRAB IRONS.

The King And The Blacksmith.

ROBERT COLLYER.

It was long ago, and far away
In a summer palace, the legends say,
Where the fragrance of roses, and new mown hay
Was borne on the wind; while the plash and play
Of water from fountain, sweet and clear,
Rose and fell on the listening ear.
And the singing of birds, with the murmur of bees
Hidden away in the mulberry trees
Stole through a room, where one lay still,
The king of the land, on whose royal will
All men waited in fear and awe,
For the king was the fountain of life and law.

He had sat in his hall through the morning tide,
Where the folk had come, from far and wide
To the seat of justice, a wondrous throng,
That the king might judge between right and wrong
In each man's case and make due award,
While on right and left stood the royal guard,
Silent and stern, with bated breath,
To do his bidding for life or death.

But now he was tired and wanted a nap,
Just forty winks, so he donned his cap,
Silken and soft, in exchange for his crown,
Covered himself with a quilt of down,
Said "this feels nice" and shut his eyes,
Bade them close the lattice to keep out the flies,
And let none disturb him on peril of doom,
In the cool retreat of his darkened room.
But the king was to have no sleep that day
Tired as he was and falling away
To a slumber as sweet as labor can bring,
For right through the silence came the ring
Of many hammers struck on steel.
Many and mighty, peal on peal,
Of stalwart strokes from beyond the trees,
Drowning the murmur of water and bees,
And the singing of birds in the drowse of the day,
On the level space by the mountain gorge,
Where the master smith had built his forge.

Now this was the way the story ran,
That before the time the oldest man could remember
There had been a forge standing there by the mountain gorge.
And manned by the smiths, from father to son,
Steadily held and honestly won,
Workers in iron since the day
When the old bronze age had passed away,
Shoeing the horse, and forging the brand,
Strong and true for the soldier's hand,
Turning the share and tiring the wheel,
Master workmen in iron and steel.
There they had stood from the far old time,
Toiling and moiling in smoke and grime,
Upright and downright, steadfast and true,
Doing the work God gave them to do.

The land had been held by chartered right
Three hundred years, and maintained by might
Of the good right hand, from father to son,
Steadily held as honestly won,
So that clear as the right of the king to his crown
Was the right of the smith to have and to own
Homestead and smithy, garden and croft,
With all below and all aloft,
High as the stars and deep as the fires,
Full and free as the heart's desires,
So ran the charter, fair to see,
Dated ten hundred and ten, A. D.

But might makes right when kings grow white
With anger, and the lurid light
Burns in their eyes men fear to see,
Quailing before the majesty
Of one whose wrath is as the path of the lion, before which all things flee.
He tos't the cover away from his couch,
And some say he swore, but I will not vouch
For this—though we read, kings have been known
To swear in their wrath like the veriest clown.
I only know that he called the guard,
Whose place it was to keep watch and ward,
Bid them go forth and raze to the ground
The smithy, until no stone was found
To stand on another, and bring the smith
In to the royal presence forthwith
To hear his doom, who had dared to make
This clamor and keep a king awake.

Swiftly the guard went up to the glen
To bring the smith and his stalwart men
Into the presence of majesty.
And they said no word but quietly
Came forth of the smithy into the hall and ranged themselves against the wall.
With leathern apron and grimy face
Each man stood in his proper place,
While the folk flocked in from far and near,
High of courage or stricken with fear,
Crowding the hall to hear and see
How the smith would answer majesty.
And this was the way he answered the king,
"If right makes might then my anvil's ring
Must be heard all the same in this good free land.
Thy royal word cannot stay the hand
Of the smith in his forge, or thy royal might,
Hence anvil and hammer I stand on my right.
In the ancient time men made this rhyme
And carved it in runes on a stone
'By hammer and hand
All things do stand'
So I counsel thee let us alone.
And if thou wouldest sleep while we work all day,
Why move thy new palace out of the way.

"Who shoes the horse and forges the brand,
Strong and keen for the soldier's hand,
That thy foes may be met in battle array?
The master smith and his men alway.
Who forges the tools for mason and wright
To build the walls, whose massive might
Defies the foe and the tooth of time?
The men of my craft, in whose name, the rhyme
Was made, and carven on a stone,
The master smith and his men alone.
So the smith in his forge is also a king,
With crown and sceptre and all,
And when his anvil ceases to ring
Thy kingdom will go to the wall.
So I answer your majesty.
Now then, free men, what say ye?"
It was long ago and far away
To the east of sunrise, the legends say,
When this thing was done on a summer's day.
Then from that time forth, for ever and aye,
This law was made for great and small,
King or commoner, freeman or thrall,
That wherever the smith shall set his forge,
In town or vill or by mountain gorge,
Holding the same by lawful right
And steadily working with the might
Of his good right hand, then no matter what clamor
He may happen to make with his anvil and hammer,
He shall still be free to hold his own
And be proud of his cap, as the king of his crown,
Because, but for his making no thing can be made,
And so none shall molest him or make him afraid.

This law was made by the folk, wrote and then
It was signed and sealed with the great
AMEN.

Ring Forging in the Machine Blacksmith Shop.

THOMAS PRENTICE,
Foreman Blacksmith, General Electric Company.

The work which comes into the general machine blacksmith shop is so widely different in the range of size and the class of work, that it requires a man or a shop full of men who have passed the stage of being expert on only one branch of any particular class of forging. To be successful in such a shop the men must be quick to grasp the ideas of the prospective customer, and equally quick in putting these ideas into the work. The extent of your success depends largely on the amount of confidence your customers can place in you.

I have selected the forging of rings for this article, as they look so simple in themselves that I wonder why so many good blacksmiths make miserable failures on this class of work. It is a fact that in many cases a blacksmith will scarf one end of his iron and bend his ring before trusting himself to cut off for the lap scarf. This is all wrong, and I will say there is no excuse for a man doing such a thing, no matter what his training may have been. The old way of obtaining the length for a ring was three times the inside diameter plus three times the thickness of the material, with allowance for weld. No two men will get exactly the same results from this rule, as one blacksmith will allow two inches for the weld, while another only one and a half inches. Again we have the rule of three and one-seventh, which for practical shop use is close enough. Care must be taken, however, to use the centre of the ring stock; for example, if the ring is 20 inches inside diameter, 24 inches outside diameter, the centre of the ring stock would be 22 inches diameter.

Fig. 1 shows a finished ring 20 inches inside, 21 inches outside by 10 inches wide. After cutting off your stock, you can prepare by upsetting the ends and scarfing as shown. Then place in a furnace, or if you do not have one, use a long hollow fire. Bend the ends

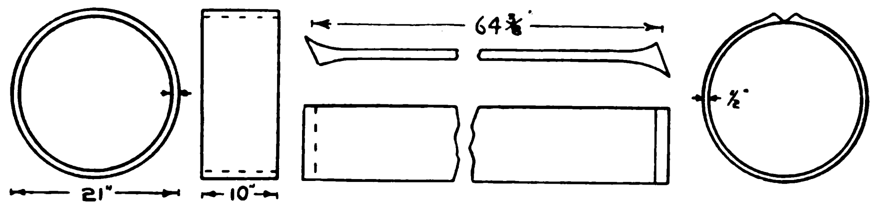


Fig. 1. FORGING A WIDE RING FROM THIN STOCK.

first, and place under the hammer and form with a block, finishing on an old pulley, if such a thing is handy. After bending close the scarf. Another method is to bend the ring, cutting out a "V" the entire width, as shown at the right, Fig. 1, welding a Norway bar iron in the "V." This, if proper heats are taken, will make an excellent job.

Fig. 2 shows a ring the same diameter inside made from 2 by 2 inch stock. This you cut, scarf as shown, and bend in rolls if you have them. If not, form a quarter circle, clamp this to a plate, bend around and you will get a ring free from flat spots. After bending the ring close in the outside scarf, as shown. This gives you a good stiff ring, which can be easily welded under a hammer.

Fig. 3 shows a ring, same inside diameter, made from 4 by 4 inch stock. The easiest method of forging a ring this size is to cut your stock at correct angle, so that the butt will be close when bent. Cut out and weld in a wedge-shaped piece as shown. Repeat on opposite side and you have a good job.

Fig. 4 shows a ring 48 inches inside diameter, 7-inch stock, 1¼ inches thick. This ring we make in two pieces, using the male and female scarf as shown. Place them together, using a clamp with turn buckle centre by means of which we draw them together while heating. This will prevent the sections from slip-

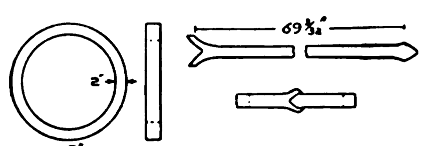


Fig. 2. RING FORGED FROM 2-INCH STOCK—24 INCHES OUTSIDE DIAMETER.

ping, and when welded we trim the outside and inside with good sharp chisels and secure the proper circle as shown in the same figure. For bending this ring use a cast iron block. This we bolt on a table of face plate with a loose pin, which can be removed at will, using a wedge to tighten the metal and prevent slipping. For a ring this size the best way is to punch it out of a plate, but where there are neither punch nor plate, and a job in a rush, the above method can be used to advantage.

A Cheap and Substantial Wrought-Iron Forge.

JOHN L. LEFLER.

As I see some of the other boys are telling what they are doing, I will describe how to make a good substantial wrought-iron forge at a minimum cost.

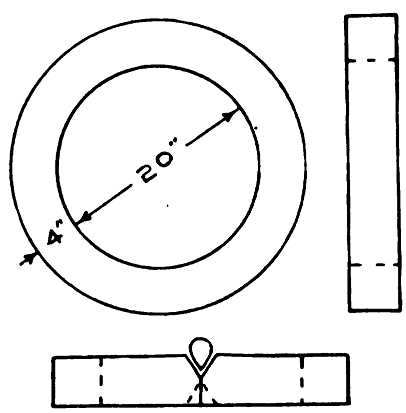


Fig. 3. WELDING WITH WEDGE-SHAPED PIECE.

Last fall I bought a blower from Montgomery, Ward & Co., of Chicago, Ill., which cost me $18.30 laid down at shop at Rosston, Texas. I got an old binder bull wheel, or drive wheel, of the old style with wooden rim and spokes, tore all the cleats off the tire and took out the rim. The rim was thirty-nine inches in diameter, which makes a good large hearth, $\frac{3}{16}$ of an inch thick and eight inches wide. To this I put four one-inch round iron legs of suitable length, with a nice curve at the bottom. I then made a shoulder five inches from the top of each leg for the edge of the tire to rest on. One and three inches from the shoulder I drilled two $\frac{5}{16}$-inch holes to bolt the legs to the tire. I then bent the remainder of the leg at right angles and drilled another $\frac{5}{16}$-inch hole. I used one of the old holes that was in the tire, where the cleats were fastened to bolt the legs on. I then drilled another in the tire to suit the hole in the legs, bolted them to the tire on the inside. Now my forge was sitting up on legs, just the right height. I next got two old wagon tires, and cut them long enough to reach across from one leg to the other, bolting to the legs on the under side of the right angle end of the leg, and cutting the pieces to fit snugly to the circle of the forge. (It was no longer to be called an old binder tire, but a wrought-iron forge). Across these two bars, I put two more running the other way, cutting them six inches longer, so as to bend down or at right angles three inches from each end with a $\frac{5}{16}$-inch bolt hole in each end to bolt to circle of forge, making them level with the top of the legs, as the first two were bolted under the angle ends of the legs. I also had them wide enough apart at the center of the forge to make a square just large enough to fit the tuyere iron snugly with the pipe connection under the bars. Now I put a ½-inch bolt where these bars cross each other, making the forge perfectly solid. Next I took a pair of tinner's shears and sheet iron. I began cutting out the lining for the forge or the bot-

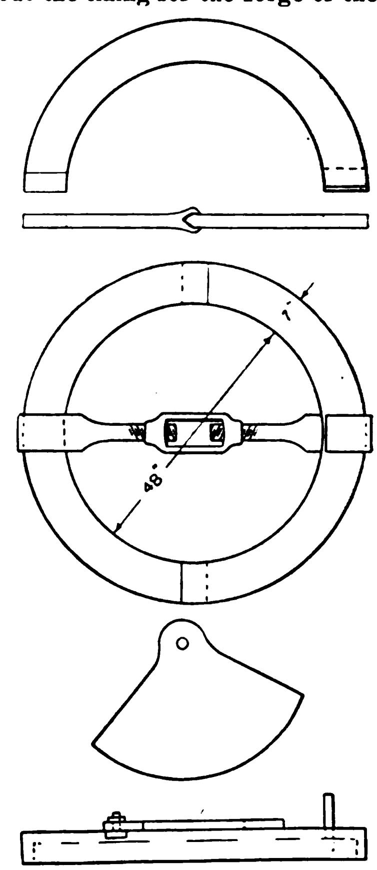


Fig. 4. METHOD OF BENDING AND WELDING A FLAT RING.

tom, having filled in on the bars with lighter old tire where it was necessary to keep the sheet iron from swaging. This bottom or lining, I cut to fit snugly up to the tuyere iron and the circle of the forge. After the first layer was down, I put on a heavy coat of coal tar, then cut the second layer and reversed the pieces, thus, crossing the seam of the first two and pressing them down on the coal tar, then another coat of tar, and then another layer of iron, then tar. Next was the fire pot. A cement was made of clean sand, lime and water. Pouring this in on the tar, and rounding in around the tuyere and fire pit, and leveling it off, the forge is ready for work when the hearth is dry. I still have two inches of iron above the hearth. Next I connect my blower. When this is done, I get some good green carriage paint and a brush, wash off all dirt from the new forge, and when dry, put on three coats of this paint as fast as it will dry. I then have a complete forge at a cost all told of five or six dollars, where it would have cost me eighteen or twenty dollars to have bought it. Now, if you want a forge, get some stock $\frac{3}{16}$ by 8 inches wide, bend it and make one. If you want a square one, lay off and bend the square to suit yourself. Lap the ends together, and rivet at the back side of forge. Put on flat legs if you want to and go ahead.

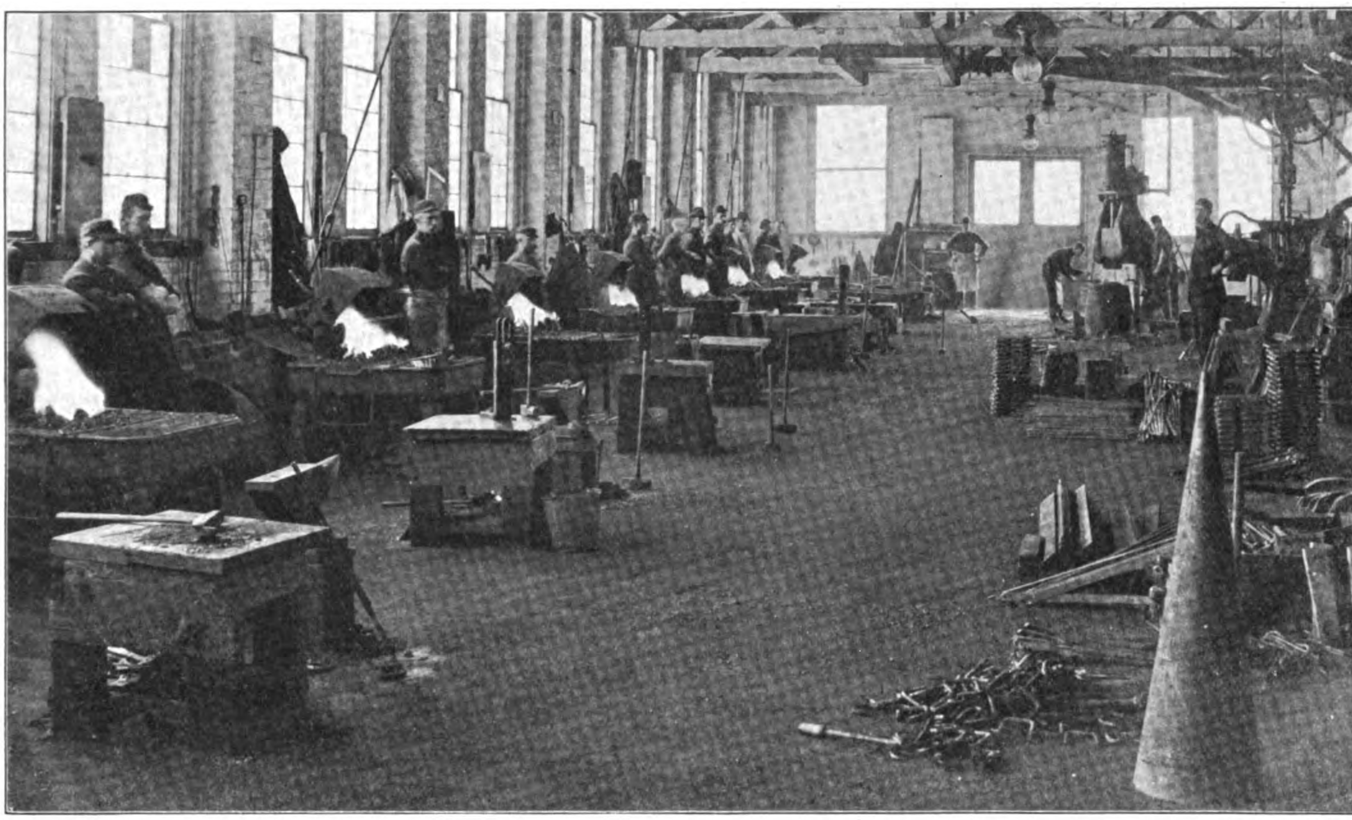
I also have a helper or a boy, that I will tell about sometime, that never complains of over-work, or of being tired, or wants to sleep, or presents any bills at the end of the month, and is always ready to help, and is agreeable also.

A Modernly-Equipped Forge Shop—Peckham Mfg. Co., Kingston, N. Y.

J. A. MURRAY, FOREMAN BLACKSMITH.

We are all familiar with the vast improvements that have been made and are being made in machinery, but we are not so familiar with the improved shop, and, to be more particular, the improved blacksmith shop. At the Peckham Manufacturing Company, Kingston, N. Y., we have a shop that gives evidence of the desire of the president, Mr. Peckham, to make the surroundings in the shop pleasant and agreeable for the workmen.

Fig. 1 shows the style of forges used and the system of carrying off the smoke and gases, and this from a sanitary standpoint is the most important feature of the shop equipment, as we find the shop always with a clear atmosphere. All blacksmiths will appreciate the importance of this feature. The forges are of the Buffalo Forge Company make, with down draft system attached. We have fifteen forges and eight furnaces, but the blower and exhauster are capable of taking care of twice this number, provisions being made for this when installing the system. The blower and exhaust fans are on a platform overhead, thus taking up no floor space. The hammer seen in this view is an eight-hundred pound Chambersburg, operated by compressed air, and we find it superior to steam in many ways. If the hammer remains idle any length of time it is not necessary to start it up a few minutes before the heat is ready to come out, as one has to do where steam is used, owing to water in the cylinder. Then again, where steam is used there is always some leakage around the piston, which means water dropping down the sides of the hammer head and getting on the iron when we do not want it and least expect it. Besides this hammer we have several Bradley hammers and also drop hammers that are not shown.

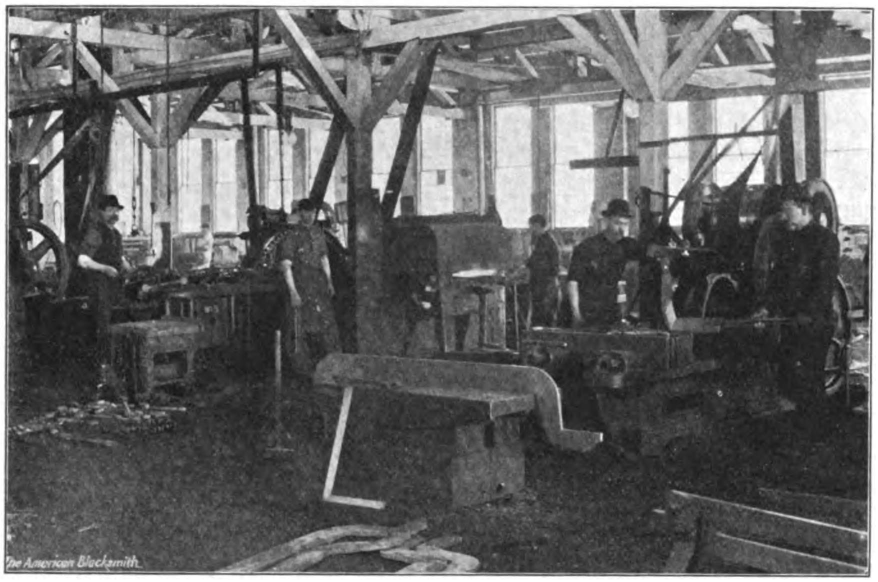


FORGE SHOP OF THE PECKHAM MANUFACTURING COMPANY, KINGSTON, N. Y.

Fig. 2 shows a Williams & White Bulldozer, also a No. 3 Ajax forging machine.

Fig. 3 shows a No. 7 Ajax Bulldozer, and in the background is seen a No. 00 double-ended Long & Allstatter shears. There is also in the shop a splitting shear and an Acme bolt header and forging machine.

The power is supplied by three Westinghouse motors. The shafting is in sections, so that in case of overtime just such sections are used that are required, or in case of accident to a motor, the clutch coupling is brought into play and the section run from the other motor. These motors will carry



VIEW OF FORGE SHOP, SHOWING BULLDOZER AND FORGING MACHINE.

an over-load of twenty per cent. of the rated horse power for a given time. We have several of the machines equipped with clutch pulleys, and I find myself a firm advocate of clutch pulleys, especially where the belts are large.

At each forge is a blackboard 18" x 30" with eraser and chalk attached. This is a small matter, but we find them convenient. Instead of marking up the hood of the forge or marking on the straightening table where it is so apt to be rubbed off, we make a free hand sketch of the job in hand, and there it is in plain view for the man to work from. This is in case of odd jobs. The main portion of the work is done from blue prints furnished from the drafting department. These blackboards may be seen in Fig. 1, between the forges.

The shop is well lighted and ventilated. There is a lavatory and toilet room for the blacksmith and forge department, hot and cold water being supplied.

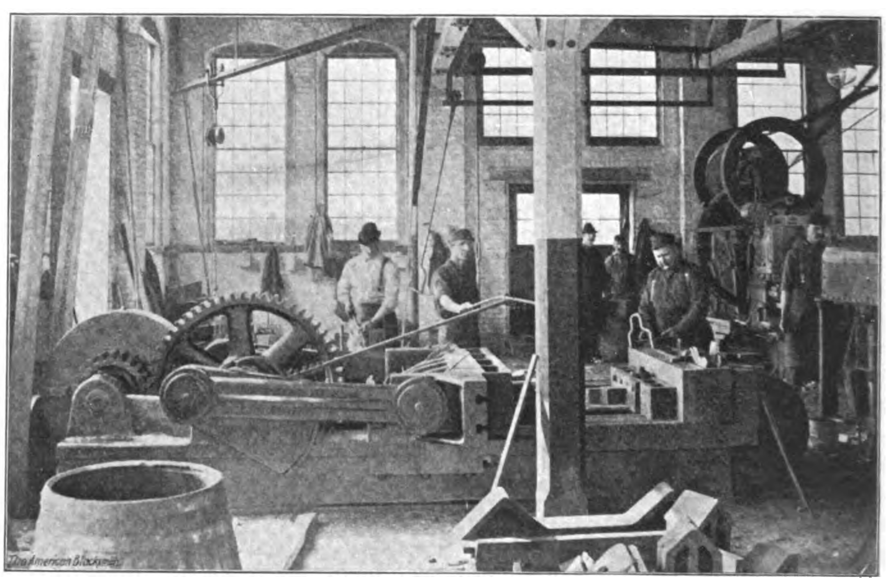
It has always been the writer's experience to find the forge and blacksmith shop away back in the yard, hemmed in by other buildings, shutting out both light and air and giving one the impression that any old place is good enough for the smith shop, but in our case we have a complete reversal of these conditions. We are in the front room so to speak, and instead of a dark, dingy, poorly lighted shop, we have a clean, well lighted, well ventilated shop. All this the writer thinks is evidence of the industrial betterment that seems to be the spirit of the times.

Shop Talks on Wheels, Axles and Springs.—7.

Methods of Ironing Gears.

BY D. W. M.

The principles governing the ironing of gears for vehicles are strength, lightness and elasticity. For lightness and elasticity, hickory timber is used wherever practicable, but for strength,



CORNER OF SHOP, WITH BULLDOZER AND SHEARS.

not only must the timber be of the best and toughest, but it must be so ironed as to be reinforced and braced in such a manner, as not to destroy the elasticity, nor weaken the wood parts. Modern methods have so reduced the use of wood that in some cases, as on the runabout buggy gear, there is none whatever, and tubular steel has produced a reasonably light construction.

In the ordinary buggy gear made for two eliptic springs, the axles are made with wooden caps or beds, clipped on. The jaws of the shaft shackles are usually made with a clip to be clipped on the axle. The king bolt is also frequently made with a clip for the same purpose; also the fifth wheel, made with two clips. This makes five clips for the front axle, but that is not considered sufficient, and one clip is commonly placed between the shaft shackle clip and the fifth wheel clip; in some cases two clips are used in each of those spaces, making nine clips. Owing to the oil from the spindle, or axle box, getting into the end of the wood-cap, and causing the shackle clip to slip and get loose, an additional clip, small size, is placed as near as possible to the end of the axle cap. A yoke on the bottom of the axle sometimes connects the two clips to prevent slipping.

The rear spring is often clipped to the axle with one centre clip for light work, but usually with two clips. The ends of the stays are clipped and an extra clip, small size, is placed outside at the ends of the wooden cap, for the same reason as on the front axle, and is sometimes yoked on the bottom in the same manner, but a better plan is to yoke the stay clip with the clip next to it towards the center. This is sometimes done by making a splice to the side of the stay heel and extending it either straight or in a curve to the next clip, and sometimes making a branch stay to take a clip midway between the spring clip and the outer stay clip.

We here give some of the usual forms of stays for single perch gears. These are sufficient to give a general idea of the points involved in ironing braces or stays for reaches. An endless variety may be designed, but the simple forms are far better than those with offsets or other fanciful designs. One of the beauties of iron work for vehicles is simplicity with high finish and perfect lines, ornateness being considered objectionable as gathering dirt, and vulgar because out of place, except on a state equipage or circus wagon.

For double perch (or reach) gears, a straight stay on either side is commonly all that is necessary, and even this is omitted on some methods of construction, particularly with tubular reaches with the heels forged solid on the axles. For such axles, especially the modern high arch, the side stay will be frequently curved to correspond. Many builders use a straight stay between the two reaches, connecting them, but others think it makes the gear too stiff, and omit it. Much depends on the material of which the reaches are made. If of good tough timber and plated on the bottom, they do not need a connecting stay. The heels of the reaches should be split to fit over the top and bottom of the wood for double reaches. For a single reach it is not so essential, and ordinarily the end of the reach is mortised in the axle bed, but for a drop reach, the heel plate extends straight under the axle, and along the top of the wooden reach, being bolted to it. It is customary with many builders to use a brace from the top of the lower half of the spring, but on low hung jobs this is in the way, and a corner iron is substituted, or nothing at all except the plate, as described. This plate is sometimes dropped from the axle to the reach to lower it. Of course drop irons must be arranged for the front to accommodate the fifth wheel and keep the reach level, whether a center king bolt, with or without clip, or a rear king bolt is used. The last is commonly used now.

A great deal of difficulty has been experienced in getting a fifth wheel adapted to the naked axle gears, *i. e.*, gears without axle caps of wood, which would not prove troublesome in use, and cause the reaches to break, such breakages occurring just back of the fifth wheel irons. Sometimes the fifth wheel irons themselves break, being made too frail. A return to the Brewster fifth wheel and wooden capped axles has been very general in consequence of this difficulty. Varieties of fifth wheels are very numerous, and even more so are the multitude of shaft shackle inventions. We will not try to describe them. They all have both merit and demerit. The perfect fifth wheel and perfect shaft shackle has not yet been found.

The method of ironing a buggy gear applies to a phaeton, except that the reaches on a phaeton are usually curved to drop to the front, so as to maintain a level at the fifth wheel bearings. The same method also applies to a surrey or light wagon; to a depot wagon and all two or three spring-work, varying in the size of irons used to the strength required for the size or weight of vehicle.

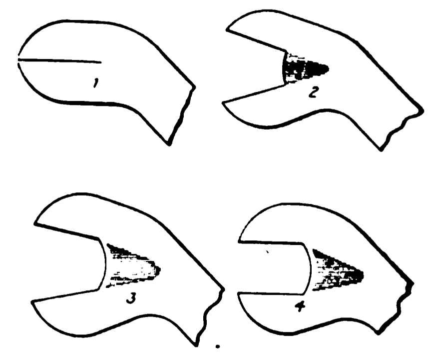
A gear must be so constructed that it will twist with the irregularities of the road way, so that one wheel will not be lifted if another goes over a stone, nor will any undue strain be manifested. It must also yield to an obstruction laterally and at once come back to correct position. The ironing of the reach must therefore be done so that nothing will be permanently bent out of shape under ordinary strains.

Single reaches are commonly plated on the bottom, and on both sides forward of the stays, a corner lug being made to take a bolt each side of the reach through the head block. Sometimes, especially for bent reaches, they are plated on the top as well as the bottom. Frequently this top iron extends from the rear end only to a point beyond the bend of the reach. To avoid cutting the wood more than necessary, rivets are often used, but bolts are usually preferred, as they are easier to tighten and repair.

A Quick Method of Forging a Wrench.

B. E. PEASE.

Oftentimes we are obliged to have an S-wrench and have it quickly to get at some special job, so I will give a quick and easy way to forge one. For convenience I will describe a $\frac{3}{4}$-inch wrench of medium weight. Take a piece of steel $\frac{1}{2}$ by $1\frac{1}{8}$ inches, bend to shape and round the corners; then split, as in Fig. 1, back $\frac{3}{4}$ of an inch. Next take $\frac{3}{8}$-inch fuller (if you do not have one at hand use a $\frac{3}{8}$-inch round iron) and fuller in a little to spread the jaws. Fuller on one side only. Then with a $\frac{3}{4}$-inch fuller spread the jaws wider, as in Fig. 2. Next drive the fuller in between the jaws until they are spread the right width, Fig. 3.



METHOD OF FORGING A WRENCH.

Then turn the jaws and forge the handle to suit the work required.

The Country Paint Shop.

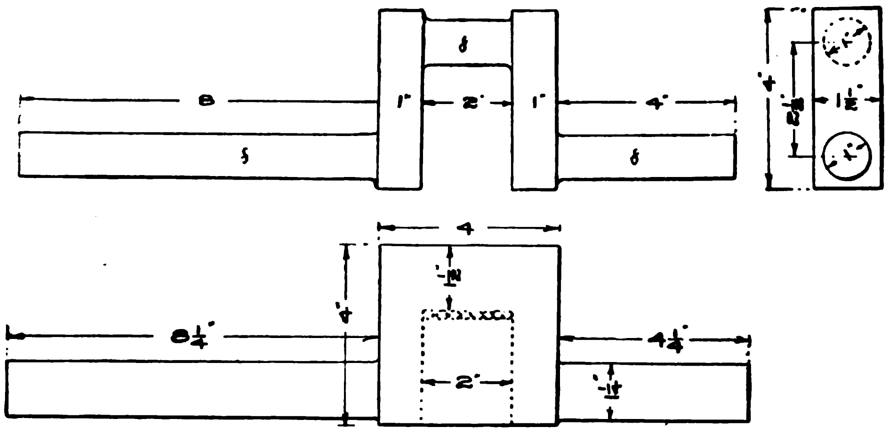
How to Make it Pay.

M. C. HILLICK.

Through the press and from the rostrum we are told that organization is the greatest recognized power of the Twentieth Century. This is the power with which the carriage painter is directly concerned. It is only by the organization and carrying forward of all the forces which he is able to command that the proprietor of the country and village paint shop can hope for business success.

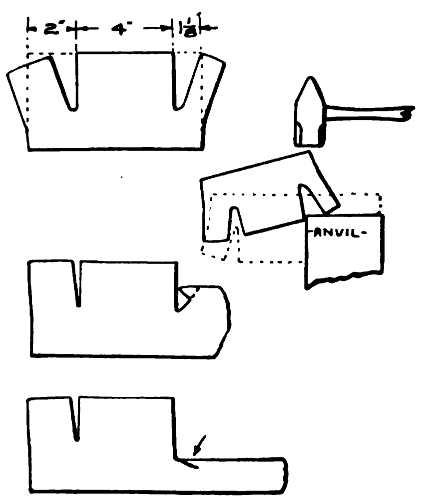
The changing standards of the changing years is leaving its impress upon the business of carriage painting quite to the same extent that other industries are being affected. This change, by the old-time painter, is spoken of as a hard condition, but when viewed from a strictly business standpoint, and in the spirit which accepts a sharp divergence from established practices as simply the manifestation of a natural law, the harsh lines are softened, and the problem assumes an easier aspect. Within the limits of a single article, space denies allusion to both the mechanical and business factors immediately contributing to the success of the country paint shop; hence, assuming that in respect to its mechanical equipment, its location, etc., the shop is upon a paying basis, we venture to devote attention to certain features of business directly associated with creating profits for the paint shop.

From an experience of ten years in what may practically be termed a country paint shop, the writer views advertising as the main support of the painting business to-day. Advertising means enlightenment. It is the pacemaker for business—*vide* John Wanamaker, the Ivory Soap man, Quaker in the machine shop. The throat can be formed by chopping out the surplus metal with a hot chisel, but on small cranks, such as here shown, it is generally cheaper in a well equipped shop to use the first method.



Figs. 72 and 73. A SIMPLE CRANK SHAFT AND ITS CONSTRUCTION.

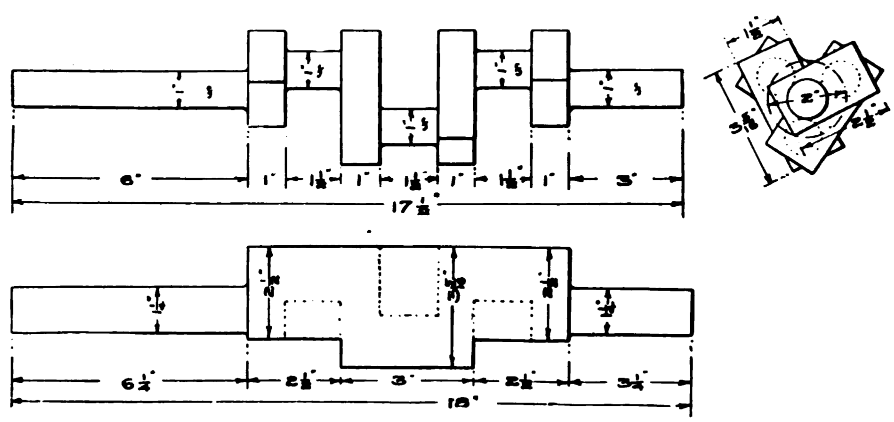
The first step is to calculate the amount of stock required. Stock 1½ by 4 inches should be used. The ends A and B should be left 1¼ inches in diameter to allow for finishing. The end A contains 10.13 cubic inches. Each inch of stock contains 6 cubic inches.



Figs. 74, 75, 76 and 77. SHAPING A CRANK SHAFT.

It would therefore require 1.7 inches of stock to form this end, provided there were no waste from scale in heating. This waste takes place, however, and must be allowed for, so we will take about 2 inches of stock for this end. B contains 5.22 cubic inches, and would require 0.87 inch of stock without allowance for scale. We would allow about 1⅛ inches. Our stock should then be 7⅛ inches long. The first step is to make cuts 1⅛ inches from one end and 2 inches from the other, and widen out these cuts with a fuller, as shown in Fig. 74. These ends are then forged out round in the manner illustrated in Fig. 75. The forging should be placed over the corner of the anvil in the position shown, the blows striking upon the corner of the piece as indicated. As the end gradually straightens out, the other end of the piece is slowly raised into the position shown by the dotted lines, and the shaft hammered down round and finished up between swages.

Care must be taken to spread the cuts properly before drawing down the ends, otherwise a bad cold shut will be formed. If the cuts are left without spreading, the metal will act somewhat after the manner shown in Fig. 76. The top part of the bar as it is worked down will gradually fold over, leaving, when hammered down to size, a bad cold shut, or crack, such as illustrated in Fig. 77. When the metal starts to act this way, as shown by the sketch Fig. 76, the fault may be remedied by trimming off the corner along the dotted line. This must always be done as soon as any tendency to double over is detected.



Figs. 78 and 79. A THREE-THROW CRANK AND ITS FORGING.

Fig. 78 shows what is known as a "three-throw" crank. The forging for this is shaped as shown by the solid lines in Fig. 79. The forging is drilled and sawed in the machine to the dotted lines, and pins rough turned, being left as large as possible. The forging is returned to the forge shop, heated, and bent into the shape of the finished crank. It is then sent to the machine shop and finished to size. Four-throw cranks are also made in this manner.

The slots are sometimes cut out in the forge with a hot chisel, but particularly on small work; it is generally more economical to have them sawed out in the machine shop.

(To be continued.)

Diseases of the Foot and Their Treatment.—6.

E. MAYHEW MICHENER, V. M. D.

Navicular disease is a disease characterized by inflammation, acute or chronic, of the lower portion of the sesamoid sheath of the perforans tendon, that portion of the tendon itself, and of the gliding surface of the navicular bone over which the perforans tendon plays. This disease is almost exclusively confined to the front feet of horses and mules, although rarely the disease has been found to exist in the hind feet, and in such cases is almost always traceable to some direct injury. Navicular disease is also known as navicular arthritis and coffin joint lameness. The disease may begin in any one or all of the above-named structures, and while the location of the lesion may be limited at first, the disease may be extended by inflammation to the neighboring structures. Navicular disease has existed from the earliest history of veterinary medicine, and has at all times been one of the most serious and common forms of lameness to which the horse is subject. The causes are numerous and at times obscure, and for the purpose of study may be divided into predisposing and exciting causes. It can be safely said that more than one half of all cases of lameness of the front extremities is due to navicular disease.

As to predisposing causes, domestication and work are certainly potent factors in the causation of navicular disease. In a state of nature, the horse is seldom found to suffer from this disease. In domestication the animal is subject to alternate periods of enforced rest and excessive activity, while in the wild or natural state this is not so. Under natural conditions also the wear of the hoof is commonly such as to maintain the proper balance of the foot. The unnatural conditions of the foot which are brought on by improper shoeing, or lack of shoeing, or bad stabling and hard roads, are also active in predisposing the animal to this disease. Heredity has been named as a cause of navicular disease, but there is no positive evidence that the disease itself is ever inherited. However, as vices of conformation are surely transmitted to a greater or less degree, and as conformation is to a degree a factor in the production of navicular disease, therefore heredity may be only responsible indirectly. Such conformation as tends to throw undue weight upon the perforans tendon and its sheath, as well as upon the navicular bone, as is the case in abnormally slanting fetlocks, predisposes the animal. Fetlocks that are too straight may be predisposed on account of the jar or concussion. If the hoof is hard, dry and inelastic, it predisposes to injury of the soft structures within it by reason of the weight of the animal. Hard, dry roads and stable floors predispose the animal to defective hoofs and secondarily to navicular disease. Long toes and toe calks tend to throw too much of the animal's weight upon the navicular region; neglected stable floors in cases where the front of the stall has become lower than the part where the hind feet rest, throw the weight of the animal too much forward, and may become a cause. Fast driving down hill tends to produce injury to the navicular region, by throwing a large amount of weight on the front feet.

A cause of navicular disease which is often overlooked is irregular work or lack of exercise. It is common to find the disease in animals which are used irregularly, and is especially liable to occur if the periods of absolute rest are alternated with periods of violent use, as in speeding the untrained animal. Such treatment of the animal subjects the parts to alternate periods of great and small blood supply, and this tends to lower the vitality of the parts by interfering with nutrition.

Direct or exciting causes of navicular disease are those due to direct violence to the parts, mis-steps, slips, severe bruises to the plantar cushion, or punctures of the feet by foreign bodies involving the perforans tendon, or its sheath, or the navicular bone itself, may terminate in navicular disease.

Excepting in the case of direct injuries as just stated, the first symptoms of navicular disease are commonly obscure and irregular, that is, of a number of cases the symptoms may vary within certain limits well defined. The first symptoms may be an irregular lameness so slight and fugitive in character that the driver is puzzled to account for it; the horse may be slightly lame all at once, and on watching closely it may fade away in a few steps and the animal go as well as ever; this lameness may re-appear during the same drive, or may not be noticed for a variable future time. Again, the attack may be sudden and so severe that the driver thinks at once that the animal has picked up a nail, and examines the foot to find nothing visible, and is puzzled. Again the animal may be put in stable apparently sound, and on being brought out may be found lame, the lameness may disappear on moving a short distance or may remain from few days to few weeks. Whatever may be the length of the attack, in most cases the frequency of their return becomes greater, until after a period varying greatly from few weeks to perhaps several years the lameness remains, varying only in intensity of symptoms. While the symptoms described above may seem confusing, yet in no other disease causing lameness is it easier for an experienced person to arrive at a correct conclusion, provided a straight history of the case can be obtained. Examination of the foot and the use of the hammer and pincers in determining the seat of the tenderness as a rule give negative results. The diseased foot may be warmer than its fellow, but this symptom is not constant by any means. Tenderness to the blows of the hammer, or to the compression of the pincers likewise, may give no positive results, although the lameness may be intense at the time. The animal may stand with the lame foot pointed forward and may elevate the heel, but these symptoms are also seen in other diseases and accidents to the feet, as in suppurating corns and in punctures of various kinds. Not rarely both feet of same animal have navicular disease, and if the pain be of like intensity in both feet at the same time it will cause the animal to move with a stiff, stubby gait and wear off the shoes at the toes. Stumbling in traveling is a common symptom of navicular disease, and frequently the animal becomes very lame directly upon stumbling or making a mis-step. An excellent rule in the examination for navicular disease is to make a thorough examination of all parts of the leg and foot to discover any other possible causes for the lameness, with particular care in regard to the foot, and failing to find sufficient cause for the trouble, and especially if the history is indicative of navicular trouble, the diagnosis can generally be made with accuracy. If other possible causes of lameness are discovered, as for example a splint of thickened tendon, it may be more difficult to arrive at a positive conclusion. In certain cases it may be necessary to make a hypodermic injection of one dram of a five-per cent. solution of cocaine along the digital nerve, in order to locate the trouble; by means of this injection the nerve trunk which supplies the navicular region is rendered insensitive for about a half hour, and should the lameness be below the point of injection the lameness will disappear for that time to return as the effects of the cocaine become lost. This is a thoroughly reliable and scientific method of confirming a diagnosis of navicular disease, and although it is not really required in a well marked case, it should be used if there is the least doubt.

Do not make the mistake of declaring the lameness to be in the shoulders as is so frequently done. Remember that shoulder lameness is very rare, and seldom exists at all unless from direct injury to the shoulders as from some violence, as a collision, or as the result of rheumatism, or the disease known as osteo-porosis or big-head, and further that shoulder lameness, when it does exist, does not present the symptoms as given above for navicular disease.

The course of navicular disease is almost always progressive; that is, it becomes more and more pronounced as time goes on. Some cases are more rapid than others and become permanently lame in a few weeks, but not uncommonly the intermittent attacks last many months or even several years before the lameness comes to remain permanently. A certain very small percentage of cases are said to recover if proper care be given early when first symptoms are noticed, but for practical another. Take horse No. 1 that overreaches, for instance; shoe him with toe weights in front and light shoes behind, and it may fix him so he travels all right. Horse No. 2 shod in the same way may not benefited at all, but take off the toe weights, pare down his front feet perfectly level, then take a pair of common shoes, fit them to the feet, giving the toes a little roll to help him break over a little quicker, and he gets his front feet out of the way before the hind ones hit them.

A horse was brought to my shop this winter which overreached very badly and interfered somewhat behind. The owner was told by the man who was shoeing him that he would always overreach. Without finding any fault with the other fellow, I shod the horse, first measuring both front and hind feet. His front toes were just ¾ of an inch longer than the hind ones, the latter having been knocked off. I pared down those front feet perfectly level and short as practicable, and put on common light shoes. The hind feet needed no paring, but the shoes I set out at the toe, making them the same length as the front ones. I rode behind that horse for half a mile and had the pleasure of seeing him travel without hitting, and he goes all right now shod the same way.

Interfering, too, has many causes, and like overreaching, no fixed rule can be laid down, but I am convinced that if horses' feet are pared perfectly level, as they should be (by that I mean when the horse is standing on a level floor his feet will allow the bones of his legs to conform to each other as nature intended they should), cases of interfering in horses would be fewer than they are. I have good success in following this idea, but there are exceptions of course. For instance, one horse I shoe will interfere with any kind of shoe except a light side weight, the inside fitted the exact length of the foot and not any fuller. It must be perfectly smooth to the foot. Another horse has thoroughpins on both hind legs, and to travel without hitting he is shod with a side weight. The outside has to be fitted perfectly to the foot and no longer at the heel, while the inside is straight along the quarter, and the heel trailed out and extending back ¾ of an inch.

Stumbling, corns and contraction, very often are all found in the same horse, so that if corns are present, or the feet are contracted, relieve the horse from these and you cure the stumbling. If a horse has corns with low heels, I cut out very little if any, but pare down at the toes, put on a common shoe with side calk just in front of corn, thin the heel of the shoe over corn to take off pressure, or in very bad cases use a bar shoe, providing the frog is in condition to receive it. For contraction, if the frog is hard, and it generally is, I pare down the horn well, pack the feet with Excelsior Hoof Packing, and put on a common shoe with a leather pad until the foot is softened some. Then I use a good stiff bar shoe, and if properly fitted, I say from experience, they will cure almost any case of contraction or quartercrack without the aid of anything else but nature. Some horses stumble without having either corns or contraction. It may be because his toes are too long or he is knee-sprung or getting old. I have seen it so, and in such cases I shorten the toes up and give a slight roll, setting the toe calk well back on the shoe if any are used, and as a general thing they are. Much more could be said on the subject of horseshoeing, but I think I have touched upon the points the average shoers meet in daily practice. Judging by my own experience of over twenty years, in conclusion would say if we take nature for a guide, use sound judgment plentifully, and the knife very little, we will not be bothered with many lame horses.

The Scientific Principles of Horseshoeing.—8.

Interfering.—Front.

E. W. PERRIN.

Any impediment to clear locomotion in the fore extremity may be called interfering; ankle, shin and knee knocking is common, but the part most frequently hit is the fetlock, or ankle. The principal causes of interfering in front are much the same as behind, *i. e.*, defective conformation of the limbs, overwork, leg weariness, or pain in the feet or legs, and sometimes defective shoeing.

As the toe-wide position with twisted cannons is the one which causes the most interfering in front, I will devote the most time to that. You will observe that in the regular position, Fig. 37, the legs are set on square to the chest, and an imaginary line struck through the foot from toe to heel would point to the hind limb on the same side, but in the toe-wide position, Fig. 38, the foot and pastern, and frequently the whole limb from the elbow to the foot, is set on at an angle to the body. The knee is a true hinge joint, and therefore when the knee is flexed the foot is raised under and across the body, corresponding to the angle which the limb bears to the body. If the legs are considerably twisted, the foot raises up behind the opposite leg from which position it is very difficult to extend it without coming in contact with the opposite leg. If he travels near the ground he will strike the ankle, or a high stepper will hit just under the knee.

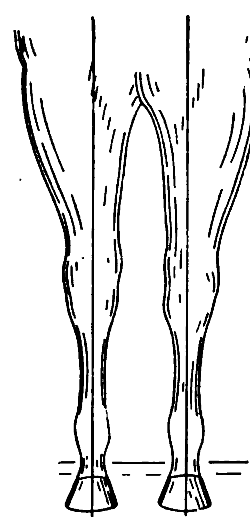


Fig. 37.
REGULAR CONFORMATION.

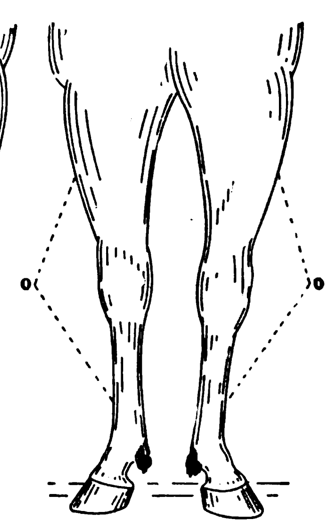


Fig. 38.
THE TOE-WIDE POSITION.

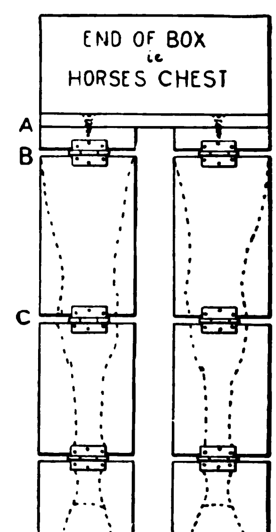


Fig. 39.
A LEG-ACTION MODEL.

The best way to illustrate the mechanics of the toe-wide position is to make a small model representing a horse's forelegs and chest, Fig. 39. The end of a 25-pound nail box, a few strips of wood and six hinges is all that is necessary. Burr up the pins in the hinges so that they will work stiff enough to hold the legs in any position you place them, and nail one end of the box to a wall over a bench or table so that the feet just touch the table. Now turn the legs at the point AA,

Fig. 39, square with the chest, to represent the regular position, then bend the knee, C, and the foot will point straight to the hind leg on the same side. Put the foot down again and turn both legs slightly outwards at the chest, AA, Fig. 39, to represent the toe-wide position. Then bend the knee again and the foot will point under and across the body as indicated by the dotted lines. Next bend the leg forward from the point B—the shoulder—as if to take a step, and you'll find the foot will hardly pass the other leg without striking it. Therefore the toe-wide position forms a mechanical impediment more or less severe, according to the acuteness of the angle at which the legs are set on to the body, and the distance they are apart.

Have a toe-wide horse trotted towards you; stand directly in front of him and fix your eyes on the movements of the feet, and you'll see each foot describe a semicircle inwards at each step, passing dangerously close to, or even striking, the opposite leg. Have him trotted towards you once more, and fix your eyes on the movement of the knees, and you'll find the knees describe positions occupied by the dotted lines O O, Fig. 38. In driving such a horse, sit right behind him and cast your eye over one shoulder, and you will see the knee bending outward and forward, but you can't see the foot unless you bend over, because it is lifted up under the body. On the other hand, in riding behind a horse of the toe-narrow position, Fig. 40, you see the bottom of the front foot at each step, but you can't see the knee, for in the toe-narrow—pigeon-toed—position, the feet are picked up to the outside of the body, to a position indicated by the dotted lines A A, Fig. 40. The toe-wide horse usually strikes with the inside quarter about the inside heel hole. If the legs are perpendicular, leave the inside of the hoof high, roll the outside toe and quarter, and rasp away a little of the wall at the point of contact. Use the shoe, Fig. 42, fitted close at the point of contact, A B, Fig. 42, but full at the inside toe. If the wall is low and thin at the inside toe, then fit full at that point; this will make the horse break away to the outside quarter; when you have grown a long, full inside toe, the calk can be left off.

For the base-wide position, Fig. 41, use shoe, Fig. 43, fitted close between A B. In preparing the hoof, dress the inside somewhat lower than the outside and rasp away a little of the wall at the inside toe.

The toe-narrow—pigeon-toed—position, Fig. 40, rarely interferes, but

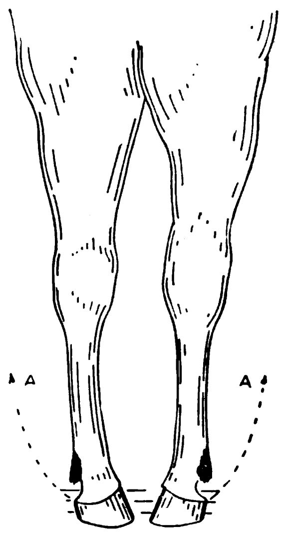


Fig. 40.
THE TOE-NARROW POSITION.

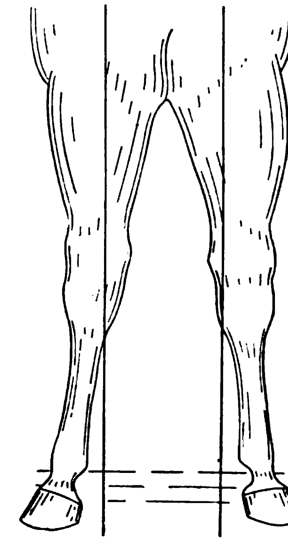


Fig. 41.
THE BASE-WIDE POSITION.

when they do, they can generally be prevented by the use of what is generally known as a paddling shoe, Fig. 44. This shoe is made with a very heavy outside, fullered near the inside web on the outside half, and fitted with all the surplus width of web flush of the foot on the outside, but close on the inside toe with a little of the wall rasped away at this point.

For the knee hitter of a base-wide position, use shoe, Fig. 45, an outside weight with toe welded on projecting an inch over the shoe to the outside and tapered down to nothing at the other end. Fit close at the point of contact and roll the inside toe of both hoof and shoe.

Now, we occasionally meet with a horse with one leg of a regular position

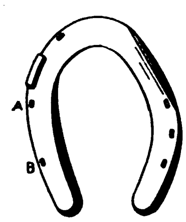


Fig. 42.

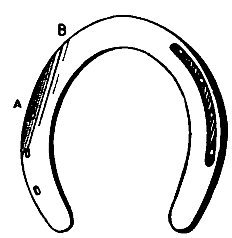


Fig. 43.

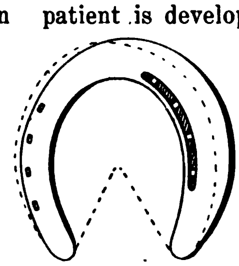


Fig. 44.


Fig. 45.

SHOES FOR VARIOUS FORMS OF INTERFERING.

and its fellow toe-wide, perhaps, hitting one ankle only, in which case a specific system of shoeing may be required for the one foot only.

Sometimes in very exceptional cases we meet with a horse with two odd legs. I have two such cases at present, with one leg toe-wide, and its fellow, calf-kneed and base-wide. On the toe-wide foot I am using shoe, Fig. 42, and on the base-wide foot shoe, Fig. 43. The base-wide foot is dressed high on the outside, while the toe-wide foot is dressed high on the inside. Both horses are going clear.

Now in conclusion let it be understood, that horses of these conformations in their acute forms are malformations. Such horses go clear only when perfectly shod and at their best, and since they go dangerously close all the time, it takes but little to make them interfere. Therefore look well over each case and endeavour to ascertain the cause. A horse with a perfect set of limbs will rarely interfere, even though run down with hard work. I once advised a butcher to rest a crooked-legged, over-worked pony, suggesting that the work was more than the pony could stand. "But," said he, "the pony I had last summer stood the work all right when we were busier than now, and he didn't cut his ankles." I replied, "That pony had a set of sound, well-built legs, while this one's are put on 'all round the corner.'" Many animals of defective conformation interfere in the hot weather only. One reason is they get tired sooner on account of the excessive heat, and they generally get twice as much driving in summer as in winter.

If you have a horse of defective conformation of limbs that is interfering and you find he has a corn, or thrush in the frog, or any pain in the foot, you must remove the cause first, or you'll scarcely succeed in the prevention of interfering. If you suspect your patient is developing a splint, a ring bone or side bone, recommend him to a veterinary surgeon.

A sound horse stands square and comfortable on his front feet. Any disposition to point with one foot, or to alternately rest the front feet, is indicative of discomfort and pain. Often the first indication of the ossification of a lateral cartilage—side bone—is the shoe being worn out entirely on one side; in endeavoring to save the side of the foot that hurts, the horse wears out the shoe on one side, and strikes the opposite ankle too. All such cases should have rest, and treatment by a competent veterinary surgeon. I am aware that many an owner will refuse to rest a horse unless he be acutely lame, but remember that in trying to prevent interfering—which in some cases is impossible, until some pain in the foot or limb is removed—you bring discredit upon yourself.

(To be continued)

Master Horseshoers' Convention.

Forty-two delegates, representing twenty-two New York State locals of the Master Horseshoers' Protective Association, answered to the roll call at their convention held in Buffalo, May 19th and 20th.

Most of the first day's session was devoted to routine business. According to the reports submitted it was shown that New York State possessed one-tenth of the total membership. The organization is 25,000 strong, of which 2,000 belong to New York State associations.

Discussion of matters of importance to the trade occupied the second day, and reports of committees were read.

At the evening session the following officers were elected: President, Thomas J. O'Brien, Albany; first vice-president, Thomas F. Benningham, Elmira; second vice-president, John M. Welsh, Rochester; third vice-president, Henry McCann, New York; secretary and treasurer, Charles J. McGinness, Brooklyn.

It was agreed to let the executive committee of the association decide where the next convention shall be held.

In a Shadow.

Do you know of a fellow who is standing in his own light? One of the kind that sticks to his old tools, knows not the meaning of the word "progressive," and procures no literature to stir him out of his ancient rut, and put him in touch with the hustling, up-to-date, money-making world of today? If you would do him a real service, call his attention to THE AMERICAN BLACKSMITH, show him a copy, tell him what you think of it.

If you will send us four paid subscriptions at $1.00 per year, we will give you a year's subscription yourself free of charge, or extend your time a year if you are already a subscriber.

Queries, Answers, Notes.

Questions upon blacksmithing, horseshoeing, carriage building and allied subjects will be printed under this heading. Answers and comments are solicited from readers for insertion here also. Questioners desiring answers by mail should enclose a stamp for reply.

Sharpening Plows. Will some brother blacksmith tell me which is the right way to sharpen plows, beginning at the bottom or top? A. K. STUART.

Tempering Axes. W. F. Sizeman will find a good way to temper an ax from the following: After drawing out, finish hammering with low red (not black) heat, and be sure to get the grain of steel well packed and set. Then just as the red leaves, cool the bit in linseed oil. Next raise the heat to dark red, after which cool as before. Repeat the same the third time. Then heat to cherry red and cool in warm oil. The first three times of dipping will warm the oil sufficiently, and this last dipping will harden the bit. Next brighten the bit by grinding, and hold it on a heavy piece of red hot iron until the first blue passes off and leaves it a green color. Be sure and draw the color even all along the bit. When you get the above color stop drawing and lay the ax down to cool, after grinding to edge. They will never crack. GEO. M. WELCH.

Editor American Blacksmith:

In closing his article on tool dressing, Mr. Thomas Prentice says, on page 141, "Some blacksmiths may question the time I give on these, but this time is attained in my practice every day."

This aroused my interest, and has lead me to carefully consider the methods described. and to question several men familiar with such work, on the advisability of doing it with a steam hammer. Mr. Reasoner, of the Kilbourne and Jacobs Co., said "the work can be done quicker on the anvil." Mr. Barnes, of the Columbus Forge and Iron Co., said: "The tools ought to be made at one heat if it is done on a steam hammer, but they would be better if made on the anvil with a greater number of lighter blows."

Now, as we understand Mr. Prentice, the stock used is ¾ x 1½ inches self hardening steel. of a grade which he says is "no harder to work than ordinary tool steel," and six tools an hour is considered fast work. It occurs to me that many readers ought to give serious thought to this very important part of the question concerning all forge work.

In my practice I have not considered 10 or 12 tools an hour fast work, with ½ x 1⅛ inch steel of 1.40% Carbon; 15 diamond point tools can be made, hardened and tempered, in one hour, out of this stock, on the anvil, without any special forging tools or training of the helper. But I do not mention it as very rapid work, as I believe more could be turned out without risk of injury to the tools produced or the workmen.

The self-hardening or air-hardening and special steels, of which we hear so much these days, are a different material requiring special treatment.

CHAS. P. CROWE, Forge Master,
Ohio State University, Columbus, O.

Editor American Blacksmith:

I am in receipt of your favor of the 15th inst., enclosing letter from Charles P. Crowe, Forge Master, O. S. U., giving the opinions of Mr. Reasoner of the Kilbourne & Jacobs Co., also Mr. Barnes of the Columbus Forge & Iron Co. The opinions of these gentlemen are certainly worth something, but I cannot agree with Mr. Reasoner that the work can be done quicker on the anvil than under a hammer. In this opinion I believe I have the endorsement of the trade. Mr. Barnes' opinion that they would be better if made on the anvil with a greater number of lighter blows is, to my mind, a good point, and for that reason I recommend a hammer giving a quick, light blow.

I am inclined to accept Mr. Crowe's statement with a pinch of salt, that he is producing at the anvil every day 10 to 12 tools per hour of steel, ½ x 1⅛ inches, and this is not fast work, he adds. A production of 100 tools to 120 tools per day, even of the size he mentions, would mean one tool every five minutes for the entire working time, and on diamond points he says 15 can be made, but does not say they *are* made. That amount would be at the rate of one tool made, hardened and tempered, every four minutes for the entire working time, and this is not considered fast work; perhaps not in the Ohio State College, but it would be in general practice in any large or small shop.

Mr. Crowe should read carefully my article before quoting. I said the self-hardening steel of today was no harder to work than the ordinary tool steel of a quarter century ago — perhaps in the experience of the gentleman there has been no change in the tool steels in the past 25 years. If so, his experience differs very much from my own, and thousands of my brethren in the trade.

The last part of the letter is an admission that self-hardening steel is an unknown quantity to him. It is not a question of hearing about it, but the actual practice with the major part of makes of S. H. steel that enables me to speak about it. The special treatment referred to is, no doubt, the Taylor-White process, which I will not discuss here, but if Mr. Crowe desires to hear more about this and will write me I shall be pleased to reply to any question he may ask. Discussions of this nature are of great benefit to the craft if taken right, and I am pleased to see the criticism contained in the enclosed letter, as it opens up the avenue of thought and the possibilities of making better the conditions of those men who have chosen blacksmithing for their trade.

THOMAS PRENTICE, Foreman Blacksmith,
General Electric Co., Schnectady, N. Y.

Tempering Moils. I would like to have some one tell me how to temper moils for moiling rock, so they would not break so badly. W. F.

Rubber Tires. Will some one tell me how to put on rubber tires and channels on buggy wheels, the probable cost of same, and what kind of tools are to be used?
J. E. BOB.

Welding Soft Steel. J. W. E. says soft steel is hard to weld and he is right. It is slippery, bothersome goods to handle, but get some good iron drill chips, burn the oil out of them, mix well with your borax and with a clean fire, I think good results will follow. H. N. POPE.

Welding Soft Steel. In answer to J. W. E. in the April issue as to welding soft steel, I will give my experience as follows: I upset and scarf as usual and use Cherry Heat Welding Compound. The use of this compound makes the welding of soft steel comparatively easy. Try it and be convinced. ALFRED CANUTESON.

Welding Soft Steel. In reply to Mr. J. W. E. in the April number as to how to weld soft steel, would say, I suppose he meant such steel as is used in making buggy axles, which is very difficult to weld. I will give my method of repairing them. Take the axle stub to be welded and lay it on the old axle, shoulders even, marking at the end of the stub. Then cut the old axle off three-quarters of an inch longer than the mark, so as to have plenty of steel to work on. Now upset the ends, slope them downward with a short bevel, take another heat and slope about half way from shoulders to point on the corner of anvil. Drive the point down, which will leave a shoulder near the middle of the bevel Fix both the same way. Be sure to have a clean fire, using a little clean sand, and you will have no trouble.

A. L. Cooper.

Welding Machine Steel. In reply to J. W. E. with regard to welding machine steel in separate heats, would say, first have a good clean fire and always upset ends before scarfing. Then sprinkle a little Climax Welding Compound on scarfs and put in the fire scarf side up, being careful not to brush off the compound. About five seconds before taking out of fire, turn the work over, scarf side down, then proceed to weld. If you need a second heat use borax. D. E. Carey.

An Answer on Shoeing. Geo. W. McDougal would like to know how to shoe a horse that toes out, for which I would give the following: I should pare down the outside of hoof as much as possible, leaving the inside and place toe calk round to the inside. Do not put it around too far the first time shoeing, but bring it around more each time until you have him toeing straight, and shoe often.

D. E. Carey.

Drilling Mouldboards. In answer to Mr. Edwards in the April issue on drilling mouldboards, heat as small a spot as you can to a bright red and drop a piece of brimstone the size of a pea where you wish to drill the hole, and let it burn off. Lay down and let cool. When cool it will drill with any ordinary drill bit.

R. A. Woodard.

Drilling Mouldboards. In answer to Mr. Edwards in the April number, take small singletree ferule, say one inch or less in diameter, place it on the mouldboard where you want to drill a hole. Fill it with brimstone and set on fire. It will burn out and draw the temper in a small place, so that it can be drilled with a common bit. Repeat if necessary, but one heat will generally suffice.

G. M. Welch.

A Number of Questions. Will some one tell me the best metal or substance of any kind that is practicable to use for a feeding device for feeding wire or tubing by rolls, about three inches in diameter—something that will not slip? I have tried fibre, cast-iron, lead, steel, etc., but they all wear or slip. The best that I have been able to find is rubber, because it is of a sticky nature and therefore takes hold, but the trouble is it wears too fast. Probably if I could get some very hard rubber, I would save a great deal of time and trouble adjusting I certainly would be thankful for suggestions on this subject.

I also would like to know if there is any way, or anything on the market for polishing wire and tubing better than rag wheels or emery wheels, that has not the tendency to heat up or dig in wherever there may be a seam or opening in said wire or tube, and still at the same time give a good polish very quickly?

Also if solder is injurious to nickel plating solutions, and what the effect is?

P. C. T.

Editor American Blacksmith:

In reply to inquiry from "Blacksmith" in May issue of the Journal requesting opinions on keeping shop time, I desire to say that cards, three by four inches, made up in block form as per accompanying illustration are the most satisfactory. I have

DAY WORKER'S Daily Time Card.

Pay Card No.............................100.....
Name...
Order No...
....
....
....
Commenced at......o'clock......M.............
Finished..............o'clock......M.............
Hrs...
Foreman.

used this form in giving a blacksmith a job. When the same is completed, a card is filled out, giving his check number, date, name, and the order number on which he has been working. It makes no difference what time it takes. For example: Should he work ten hours on one job, only one card would be required for him and his helper, or helpers if more than one. If, however, he has five different jobs covered by different shop orders in one day, five time cards shall be made out for each man working on the job, giving the exact time on each job. These cards are turned over to the foreman at the close of each day, whose duty it is to look over the time carefully, and if correct, approve by signing the same. They are then forwarded to the pay roll department. This method keeps a foreman thoroughly posted on what is going on in his department, and forms a complete record for the office.

Thomas Prentice,
General Electric Co.

Welding a Steel Axle. Will some one tell me how to weld a common steel axle successfully, and also the best welding compound, as we sometimes have difficulty with the same?

W. R. Waller & Son.

Answer to Shoeing Inquiry. In answer to the question of J. E. Elliott in the March issue about shoeing a horse that bumps his knee, would say, that in the first place, I make the foot as near level as possible, then I rasp all the wing off of the inside that is necessary to make it straight. I generally use just an ordinary light shoe. I take and weld a heavy piece of toe rod on from the heel as far front as I see the foot has been worn smooth by rubbing the knee, and for the other calk, I turn on the shoe the same as any other shoe, but fit it close in at the heel. I have found this plan to work very successfully on most horses, but, of course, there are exceptions.

G. H. Bowmer.

Drilling Mouldboards. If S. M. Price will put some muriatic acid on the spot to be drilled, I think he will have no trouble.

D. E. Carey.

Mending Drill Points. Will some one kindly tell me how to mend drill points?

J. M. Spiney.

Welding Large Bars of Steel. In answer to Mr. W. M. Bryant in the April issue as to welding large bars of steel or iron, heat the ends to be welded, round them, and then place in the fire with ends one-quarter inch apart until at welding heat. Then if convenient, have someone hold each piece and strike the ends on something solid, lean against anvil, placing the two ends together, striking top piece when thoroughly welded which will require from one to three heats, according to size of shafting. Then put under swage and draw down to size. I have never failed to get a good weld in this way.

R. A. Woodard.

Welding Large Bars of Iron. Mr. W. M. Bryant wished to know how to weld large bars of iron. I think he alluded to a butt weld. I will tell him how I welded one last week. First see that the fire is clear from cinders underneath, then get a three-sided box that will go across the fire with the top thicker than the sides, pile on the coal, wet it and tamp it good, and let the box burn out. This should leave a good clear hole through the fire. Put one end of bar in at one end of forge, and on the other side get them good and straight, so there will be no trouble in turning. Heat the end and back it up a little on the edge. This will allow the centers to meet first. I sling up a battering ram, so as to get a good fair blow on the end of the bar. Keep the fire well fed with coke and do not let the blast come in contact with the weld. I do not think he will have any trouble. The shaft I welded was three and one-quarter inches by ten feet long. Homer N. Pope.

Breaking of Flatters. Mr. Calif has trouble with his flatters. I have had the same trouble. My remedy was to anneal them once in a while and have had no trouble since. H. N. Pope.

Breaking of Flatters. In answer to W. C. Calif, as to the breaking of flatters would say, in the first place dispense with the eye and instead fuller it round with a seven-eighth or one-inch fuller. Then get a three-eighth round iron about eighteen inches long, bend in the middle, and lap in the groove made by the fuller. Weld the two ends together, turn up at right angles about two inches long. Now get a hazel stick about twelve inches long, the right thickness for handling, say about one and three-eighths inches in diameter, bore a hole through it three inches from the end, and burn it on to the pointed end you have turned up. Lap the point over and screw it down with a coupling of iron about one-half by one one-eighth of an inch, and you will have a flatter that will prove most highly satisfactory, with no jar on the hand. I have found them to stand, until there has been scarcely anything left but the face. T. Reay.

Another Method of Welding Iron Bars. The following is a method which I recently employed for welding a heavy bar for a power feed mill and which worked to perfect satisfaction: After heating the ends, where the bar is to be welded, I punched a one-half-inch hole in each piece endways for about one and one half inches. Then I took a one-half-inch rod, cut off a piece, and drove it in the end of the long piece of the bar, after which I drove the short piece to the pin until they fitted up tightly together. After taking a heat, I gave the article a few blows with a four-pound hammer, again heated it a little hotter, and with a sledge on the anvil upset until the parts were well united, and then drew it out to the original size. The bar being about sixteen feet long and two inches thick, it was not very light, so that the pin helped to hold it while heating, and gave it a solid center, and helped to make up for the lap in welding. I thought this might be useful to some one.

A. BRUTON.

Cutting Threads. Will some one tell me how to cut a left-hand thread with a right-hand die? C. C. WHEAT.

Damascus, March 16, 1902.

Editor American Blacksmith:

I beg to say that in connection with my Damascus Office, I opened an agency in Beirut also, just to facilitate the introduction of American articles in this country; all the correspondence must be thereafter addressed to my Beirut Office, where we have foreign Post Offices, and not to Damascus.

On this occasion I take pleasure to let you know for publishing in your paper that there is an opening for the sale of machine-made horseshoes in the market of this district, to which the attention of American Manufacturers might profitably be drawn. The horses, mules and donkeys of this region largely outnumber the population. In consequence, horseshoeing is an important occupation, and the consumption of horseshoes reaches a high figure. The type of shoe employed here is that common to the Orient — a plate fitted so as to cover the entire sole of the hoof with a perforation in the center. The weight of the average shoe is three-fourths of a pound. The native smiths have usually cut these plates from sheets of wrought iron and rudely shaped them for the purpose in view. Within a short time a Belgium manufacturing concern shipped to me four hundred shoes as samples for trial, machine made, laying them down at Beirut at a cost of about 3 cents per pound. These shoes have already reached the consumers and have been found very satisfactory. No doubt American Manufacturers could very well compete with Belgium in this article, and I will be very glad to receive, with your help, samples of American machine-made horseshoes, similar to my information, with lowest quotations, in which very large business could be done.

Kindly let us know through my Beirut office if you could help me in this matter, and awaiting your reply, I remain,

Yours truly, ANTOINE L. DOMMAR,
Damascus, Syria.

Refilling a Patent Hub. In reply to the inquiry of Mr. A. Bruton with regard to refilling a patent hub, I would like to give the following: I first remove all rivets from the flanges, take out the old spokes, and clean out the mortises perfectly. Then put small bolts in every second hole, screw down the nut tightly on flange, but not tight enough to press the flanges together. Now take one of the old spokes as a pattern, and trim eight new spokes to as near the exact size of the old one as possible, then drive two spokes opposite two spokes all round the wheel, between the places where the bolts were placed. Tie the ends of each pair of spokes together, so that they will not spread apart while taking a small bit and boring the rivet hole between each pair of spokes, and insert a small bolt, which is screwed down as tight as possible. Then take out the four first bolts and prepare eight more spokes, being very careful to get each pair the exact size to fill the space intended for them. Drive them two at a time, tapping each one alternately, so when the shoulders begin to tighten they will press the adjoining spokes firmly against the bolts and prevent them from jumping out. When I have all the spokes driven, I next put my rim on, then have a trestle to put my wheel on, and screw it down to proper dish, which holds the wheel firmly in place. I then put on the tire, and while it is cooling, I tap over each spoke with a hammer to firmly set all joints together. After the tire is through drawing, and the wheel set to proper dish, take off of trestle and put in the rivets. I have wheels here filled in this way which have been in constant use for two years, and have never shown any sign of working loose.

HENRY EDMONDSON.

Some Views on Tire Setting. In reply to Wm. L. Green in the April number regarding cold tire-setting, would say, that the gentleman seems prejudiced against improved modern methods. First, he alludes to spokes being loose in the hub; in reference to the same will say, that the only thing necessary in modern methods is to allow enough space in rim to drive spokes in hub, and if spokes do not rest on thimble, they will come to time and make many a wheel serviceable for some time, where, by the old process, the wheel would be entirely useless.

In regard to controlling dish of wheel with the cold process, the dish is entirely governed, provided the spokes do not rest on thimble in hub. I have a tire setter and have taken the dish out of wheels that would have been considered a total wreck, to be set by the old process. Mr. Green speaks about wedging spokes. My theory is that a wheelright that undertakes to wedge spokes is not up-to-date, and does not know his trade. In regard to governing the dish of a wheel by the old method, it is only guess work, as to measuring wheel and tire. As farmers don't usually have tires set until they lose them, it means a loose spoke in hub.

I have followed blacksmithing for eighteen years, and my experience has been, that setting tires in the old way was guesswork, and the pay had to come whether tires were set properly or not.

In regard to speed, I have set more tires by myself in the modern way than any two practical mechanics can the old way, and do a better job by one hundred per cent. Taking Mr. Green's theory, if he will reverse the same, it would be more appropriate, for a wheel in good condition can be set the old way, and a fair job done, but it takes the modern tire-setter to revive the life of a dilapidated wheel.

ALBERT SCHUETZ.

Tempering a Steel Drill. I would like to know the color for tempering a steel drill for drilling in flint rock. Will someone please answer in The American Blacksmith? M. G. LEWIS.

Recipe for Welding Compound. The following recipe for welding compound is the best I have ever used and I have tried several: one pound pulverized borax, two ounces carbonate of iron, and ½ ounce nitrate of potash. J. T. CURRY.

Tuyere Irons. What kind of tuyere iron is the best and the most durable for about a 38 or 40-inch bellows, and also what kind of cement or mortar is best to use for the same? WILLIAM STOFFEL.

Editor American Blacksmith:

I received several copies of your journal, and I am highly pleased in looking over the different articles written by brothers of my profession. What a valuable study is the horses' foot to those who follow that vocation. Every horseshoer should be a college in himself in studying the horse's foot. What a vast field is the subject of the anatomy of the horse's foot in all its natural formation, how to keep it in health, and when diseased, how to heal the same. To my brethren of the profession, I would simply say, go and procure specimens of horse's feet, get your saw, and saw them right through the center of the frog, when you will have a sectional view of what constitutes the bony and horny structure of the horse's foot. You will then see why nature has placed the plantar cushion, or frog, over the three bones that articulate or join under this plantar cushion. You will at once see the importance of the frog to the foot in its healthy condition. It breaks the jar to the internal structure, when coming in contact with the ground, and from the weight of the horse performs natural expansion to the lateral part of the foot. If the frog is mutilated, as I am sorry to say it is by a great many horseshoers, the os pedis, os navicular and the os corona, the three bones which articulate under the plantar cushion or frog, are exposed to the jar of every footfall of the horse, and the synovial oil that nature has placed there as a lubricant dries up, and the result that follows is navicular disease. What a grand study it is then to seek the key of practical knowledge, and learn the importance of the frog or plantar cushion.

The external sole of the horse's foot will be found on each side of the frog of a commissure nature, formed thus so as to give room as it were to the frog in performing its natural expansion in giving way under the weight of the horse. Underneath this structure is the flexor pedis tendon, which flexes the foot and passes over the navicular bone, which acts as a pulley or leverage, and as it ascends upwards and laterally the Sesamoid bones, which form the fetlock act as another leverage. But often through lack of knowledge of the same, the structure is destroyed by mutilation of the frog, scooping out of the sole, together with hot fitting and fitting the foot to the shoe.

Do you think that a horseshoer that will do this, is competent to shoe a horse? I say no. Hot fitting has the same effect on the fibrous substance of the horse's foot, and penetrates the internal structure of the same, as quickly as an electric shock would effect us. In all cases of interfering, or speedy cutting, the foot should be balanced or trued, otherwise cure cannot be accomplished.

The next important thing in connection with the shoe is the selection of a good nail, and this will be found in the Capewell horseshoe nail, from the smallest to the largest. By shoeing in accordance with the natural formation of the horse's foot, and the different work that he has to perform, you will be doing a benefit to the horse, and a credit to yourself. Improper shoing causes contraction, quartercrack, corns, weak and small frog, and ossification of the lateral cartilages, which are known as side bones. By the practical study of the anatomy of the horse's foot, we can prevent these diseases, which are otherwise bound to come.

JOHN KIERNAN,
Chief Farrier United States Army.

Welding Compound. Wilson Turney will find Boraxette or Watkins Welding Compound a splendid flux for welding plow steel. As some plow steel will not stand as high heat as others, it is well to test it at low heat first, and increase until you learn the grade of steel you are working. GEORGE M. WELCH.

Prices Current — Blacksmith Supplies.

The following quotations are from dealers' stock, Buffalo, N. Y., May 28, 1902, and are subject to change. Prices remain firm. Some dealers may quote 10c per 100 lbs. lower on Bars, but a fair average for small quantities is as follows:

All prices, except on the bolts and nuts, are per hundred pounds. On bars and flats prices are in bundle lots.

Bars—Common Iron and Soft Steel.

¼ in., round or square;	Iron, $3.10;	Steel, $2.90
⅜ in., " "	" 2.70	" 2.70
½ in., " "	" 2.50	" 2.40

Flats—Bar and Band.

¼ x 1 in.,	Iron............$2.50;	Steel..............$2.40
¼ x 1¼ in.,	" 2.40;	" 2.40
3-16 x 1½ in.,	" 2.60;	" 2.60

Norway and Swedish Iron.

¼ in., round or square................................	$4.90
⅜ in., " "	4.50
½ in., " "	4.30
¼ x 1 in..	4.30
¼ x 1½ in	4.20

Horseshoe Iron

For No. 1 shoe, ⅜ x ½ in........................	$3.40
For No. 2 shoe, ½ x ⅝ in........................	3.00
For No. 3 shoe, ⅝ x ¾ in........................	2.90
For No. 4 shoe, ⅝ x ⅞ in........................	2.90

Toe Calk Steel.

½ x ⅜ in. and larger................................	$3.50

Spring Steel.

⅝ to 1½ in. Rounds,	Op. Hearth $4.00,	Crucible $6.00
1¼ to 6 in. by No. 4 gauge to ½ in. Flats	" 4.00	" 6.00

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WANTED. By a blacksmith, good situation at shoeing and general work. Married, thirty, a good worker; references. **A. E. HALLAM, Bound Brook, N. J.**

FOR SALE. Attention! 12-inch swing back-geared Lathe, $40; 18-inch swing back-geared Lathe, $50; 14-inch Brown & Sharpe general purpose Lathe, $60; 18-inch x 8 ft. bed, back-geared Lathe, sc. cutting, $150; 20-inch Barnes Drill Press, chuck and drills, $50; 5h. Gasoline Engine, good as new, $100; 15h. Jewel Automatic Steam Engine, new, $115; 10h. Upright Steam Engine, used five months, $80; 8x16 Slide Valve Engine, complete, $120. **PARADOX MACHINERY CO., 181 E. Division St., Chicago, Ill.**

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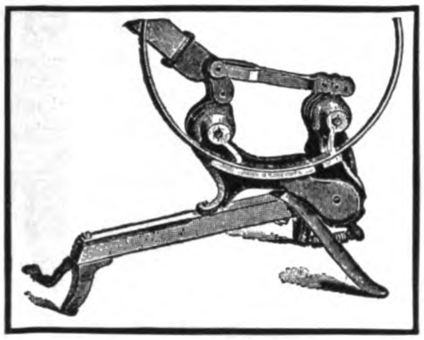

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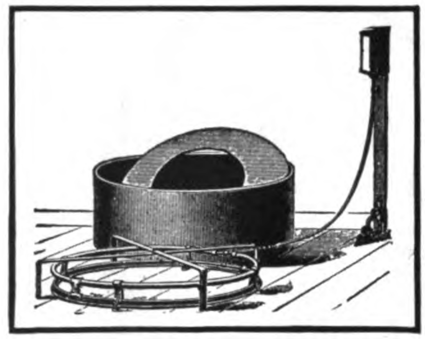

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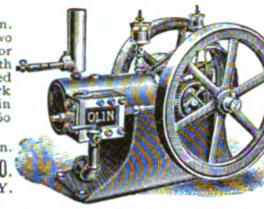

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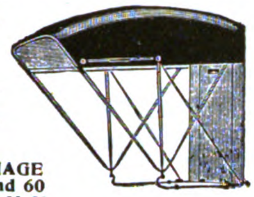

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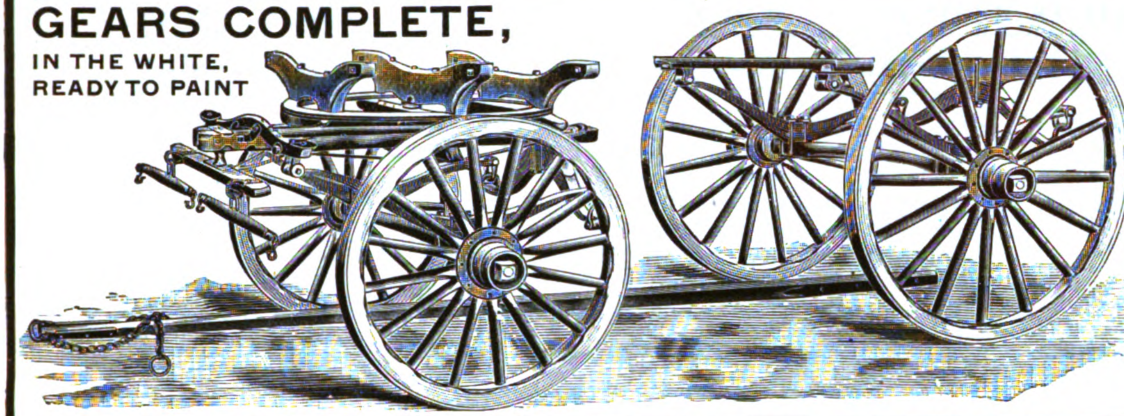

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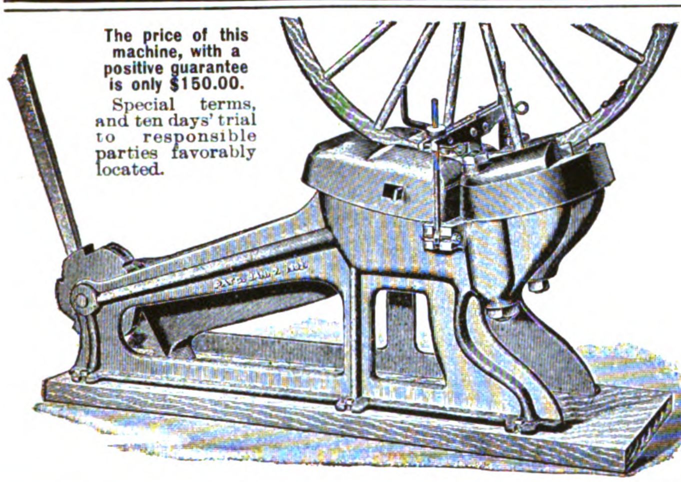

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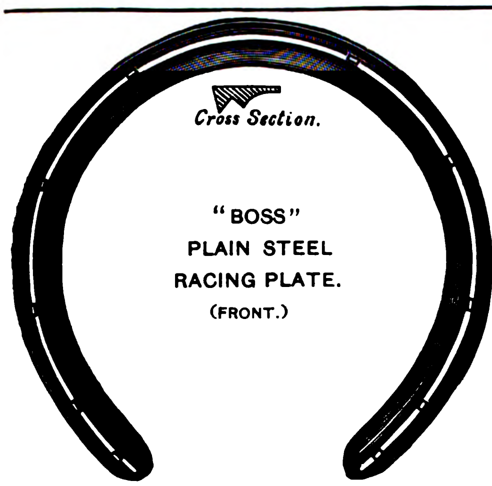

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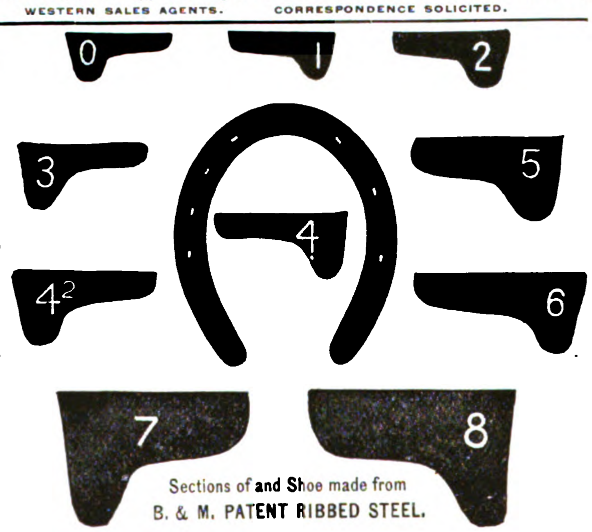

VOLUME I

THE AMERICAN BLACKSMITH

NUMBER 10

BUFFALO, N.Y. U.S.A.

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JULY 1902

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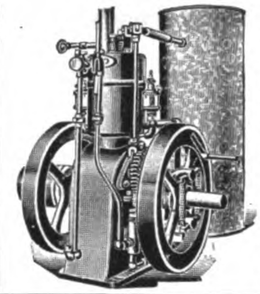

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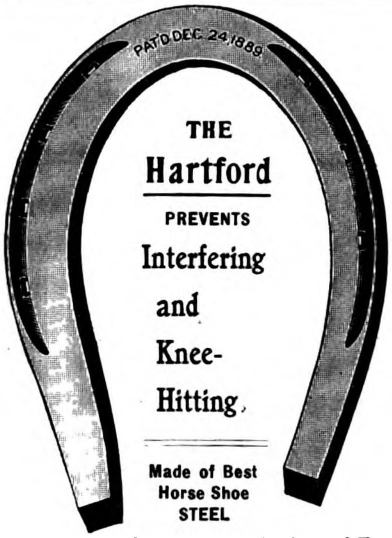

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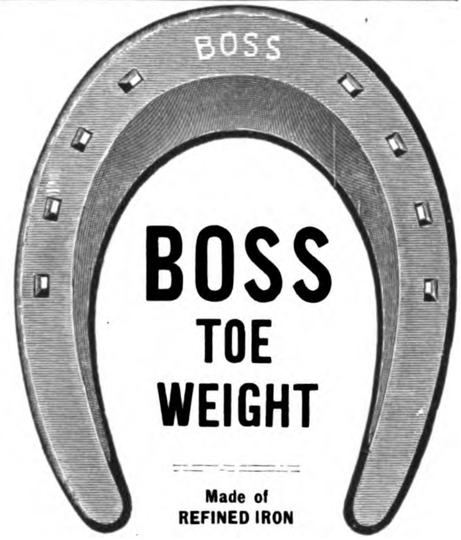

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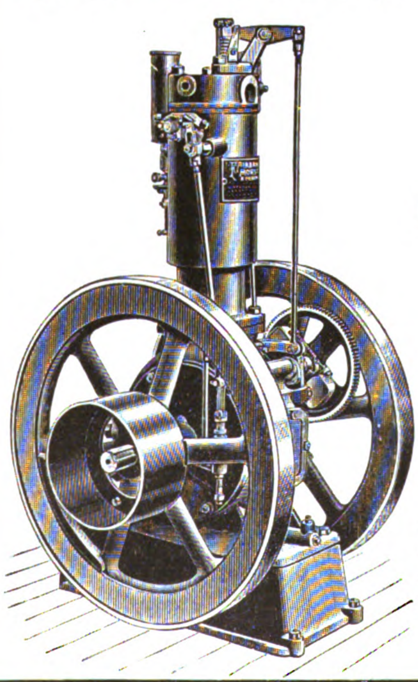

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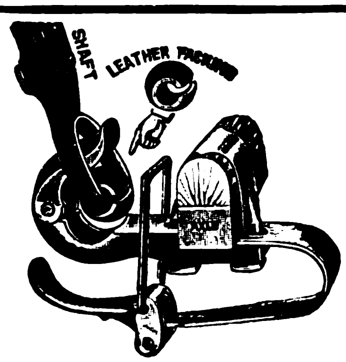

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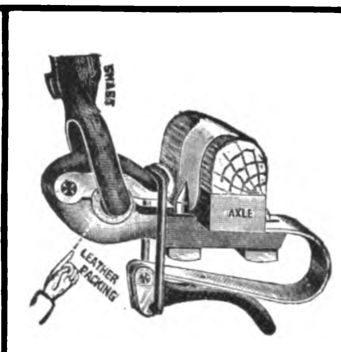

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THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

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The Evolution of the Hammer.

It would be an interesting study to seek out the origin of all our common tools and utensils and to trace in detail the various steps as they developed into their present-day forms. The first plow was undoubtedly a forked stick, drawn along the ground. The hoofs of oxen were used in early days in place of the threshing machine, and the primitive wheel was roughly hewn from a solid block of wood, probably a section of a tree trunk.

Our familiar hammer has been evolved through the ages by a similar process. Man must early have grasped the idea of holding a rock in his hand to lend weight to the blow and protect his own flesh. Then came the idea of fastening to a stick by a thong, or by piercing the stone to accommodate the handle. Such was, without doubt, the crude forerunner of our modern steel implement. Metal succeeded stone and requirements of weights caused growth in size, so that we next find the machine hammer, the trip, tilt or helve hammer. The application of steam to the hammer marks another stage, Nasmyth's upright hammer as perfected to-day, being the highest type. The limit to the weight of this hammer was reached in the last decade, at least for metal working, when it was found that the immense 100-ton machines did not yield as good results in working metals as did the slow-motion hydraulic press, by which they have been superseded. What direction the next development of the hammer, as we know it, will take would be hard to predict, but in this remarkable age of improvements few devices of this kind long remain unaltered.

The Shoeing Smiths Registration Question.

In the May number of this journal we invited discussion upon the above topic, as one vitally connected with craft welfare. The replies have been numerous if diverse in character, and we would be glad to hear from other smiths upon this subject. How can we best abolish the rate-cutting evil and improve the standard of the shoeing craft? We wish to direct attention to the article by Mr. E. W. Perrin on another page treating of this matter. It is such an excellent discussion of the problems involved that we have given it in full, and are confident it will be found of interest.

We invite further correspondence along the same line from others who have given thought to the question.

Letters from Practical Men.

The large numbers of letters received each day from the blacksmiths and wagon builders all over the country enables us to keep closely in touch with the craft and to know their wants. While this correspondence shows that our efforts to provide a standard, modern journal are fully appreciated, and that the various series of continued articles by writers of the highest repute guarantee the reader a paper of solid worth each month, still there have come numerous requests from subscribers for more short pieces from men who are rubbing up against troubles and difficulties in their everyday work, more articles from men who are ingeniously solving the problems which are presented to them in the course of their day's activity in the wagon shop, the repair shop, or the wayside shoeing shop. We therefore take this means of inviting letters from readers, telling about interesting items in their daily experience. Write out a brief description of that last repair job you did, illustrate it with rough pencil sketches if necessary, and send it in to us. Anything a little out of the ordinary run makes good reading. Our columns are always open to aid those who have any questions to ask, as we believe the true purpose of a journal such as this one, is to be of the greatest possible service to the craft and to the individuals thereof. One of the ways in which our readers can aid us is by sending in occasional descriptions of interesting work. The light of your experience thrown on workshop questions may greatly help others who are dealing with like work, and they in turn may have discovered a handy kink which you would find valuable. We therefore repeat our request for letters from the practical everyday craftsman.

A Subscription Plea.

Believing it to be to the interest of the craft as well as to our own to extend the influence and the number of readers of this journal, we are going to call on our subscribers for co-operation.

Those who know THE AMERICAN BLACKSMITH appreciate our efforts to provide them with the best journal possible, but they can help us make it better still by bringing it and any merits it possesses to the attention of their friends. We believe in the motto of the business man who said:—"If we please you, tell your friends; if we don't, tell us."

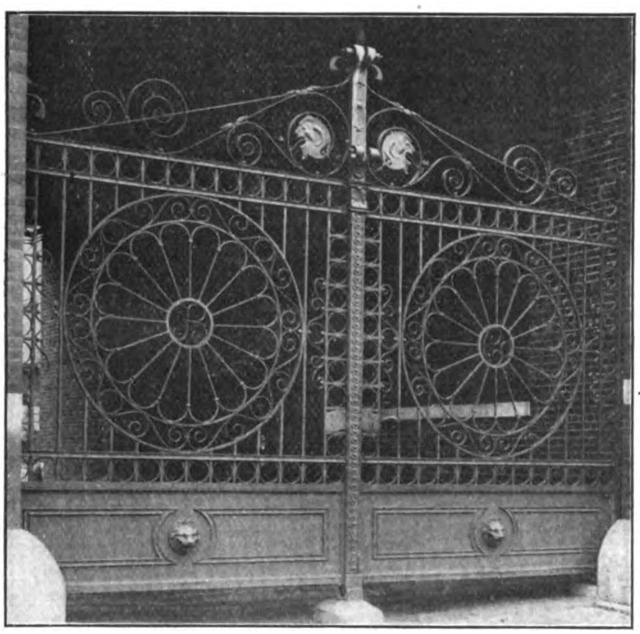
If therefore any of our friends are well pleased with the paper, we wish they would show it by sending in some new subscribers. We will furnish all the sample copies desired and the paper itself will do the talking. Further, we will pay a liberal commission for clubs raised in this way. Write to us for rates, blanks, and full information. Hundreds of smiths have taken advantage of our offer and are profiting by it. Summer is an especially good time for this work.

We do not offer a prize for the highest number of subscriptions obtained. By our scheme, everyone gets a cash commission in exact proportion to the number of new subscribers secured. Everyone gets something—no blanks, in other words. Will you not try to get your friends among the craft interested? Write us today.

A Method of Tempering Taps.

JOHN L. LEFLER.

For tempering taps and knives and small springs, get a steam pipe of sufficient size and length to accommodate the piece; heat one end and flatten on the anvil, and weld so it will not leak. Cut off sufficient length to take the tool to be tempered. Then fill with lead and set up in the fire, melt it and bring to a red heat. Immerse the tool as soon as the lead is melted and let it remain in the solution until red. Then dip in salt water all over. When cool take out.



ORNAMENTAL IRON WORK FROM FORGE OF AUGUST FEINE, BUFFALO.

Heat a large piece of iron to a red heat, grease the tool to be tempered with tallow, and take the hot iron, lay it on the anvil, and with a pair of nippers, hold the tap over the hot iron, turning until the desired color is obtained. Then drop it into linseed oil and you will have a good temper. This is the best way I have found to get a uniform heat, which is of much importance in tempering tools.

Country Paint Shop Problems.

Tops and Top Dressing.—Polishing Metal Parts.—Cleaning Glass.

M. C. HILLICK.

The rubber and leather top, considered in connection with the painting of a carriage, furnishes an important problem for the country painter to solve. As a rule, the rural vehicle owner or user is less careful of the leather or rubber furnishings of a vehicle than the city user. Consequently these parts of the vehicle reach the painter in a more or less sorry condition. To simply clean the leather or rubber equipment up and turn it into service without some sort of dressing over, the remaining part of the carriage going forth spotless in a new garment of paint and varnish, partakes very much of the untutored American's practice of fitting himself out in war paint and finery, and donning a battered hat of ancient vintage. Of necessity there must be a just balance of details in order to obtain a uniformity of finish.

The carriage top upon reaching the paint shop should be removed and dusted out thoroughly, and along with the side curtains, storm apron, dash, boot, carpet, etc., set away in a clean compartment or portion of the shop to await future treatment. All such parts —all parts of the vehicle, in fact— need to be plainly marked with owner's name. Top joints, shifting rail, etc., if chipped or worn considerably, require a coat of flat lead. When the job has in large part drawn towards a finish, it is time to take the top and its furnishings in hand. Sand up joints and rail; apply coat of quick drying drop black. Over this lay a coat of black color and varnish. Then wash the top with soft, tepid water and castile soap. Use water sparingly. Dry off carefully with chamois skin. If the top be a hand-buffed leather one we would rub it over with the following mixture:—Neat's foot oil, ¼ gallon; beef suet, ¼ pound. Warm oil and suet together, and add 1 gill of melted beeswax, shaking the ingredients thoroughly. Then to the mass add sufficient ivory drop black to darken it. The bees wax gives the leather coolness, the Neat's foot oil gives it softness and pliability, and the suet strengthens its moisture-shedding property, while the black assists in the retention of the desired newness of color.

Rub this mixture over the leather with soft cloths, and then dry up to a clean, sharp burnish with a woolen cloth.

This may also be used upon a machine-buffed leather top if the enamel holds in a good state of preservation.

A reliable dressing for either rubber or leather may be made of ½ gallon elastic finishing varnish, 2 ounces beeswax cut in turpentine, and sufficient ivory drop black to give the dressing the desired color property. Thin out to proper working consistency with turpentine.

To all paint shops, both great and small, there is sure to come during the busy season a drift of rubber tops with the enamel badly impaired, and much the worse for wear in other respects. For tops thus conditioned the following formula is specially adapted:

¼ gallon liquid asphaltum.
¼ " turpentine.
¼ " elastic finishing varnish.
⅛ " boiled linseed oil.
⅛ " coach japan.
⅜ pound drop black.

Put the ingredients into, say, a two-gallon can, cutting the black up with turpentine before adding it to the other ingredients. Shake contents of can until a perfect incorporation is secured. Then set aside to settle out before using. Apply sparingly with a brush (a 2½-inch flat bristle brush is preferable for this work) and furnish a clean, dry apartment for the dressed parts to dry in free from dust.

All leather or rubber dressings, of whatsoever name or nature, should be applied thinly and evenly. The best practice sanctions this method of application. The dash, shaft, leather or rubber side curtains, storm apron and boot are made all the better for cleaning up and dressing over thinly. As a matter of fact, all such parts demand treatment to the end, that when the job leaves the paint shop it may go out complete in the most insignificant detail.

A carriage top may very easily be permanently misshapen by bad storage in the paint shop. The top that is not regularly calashed during service should not be calashed during its retention in the paint shop. The aim of the painter should, first of all, be directed to furnishing the vehicle, in all its parts, to the owner in as perfect condition as possible.

The nickel or silver-washed or brass attachments of certain vehicles which from time to time invade the paint shop, are usually tarnished, and require cleaning up and polishing. A quick, fine polish for such fixtures can be made as follows:—

1 lb. tripoli.

½ part of an ordinary sperm candle.

1 gill of ammonia.

Put the candle in enough kerosene oil to dissolve the sperm. Then add the tripoli, following this with the addition of the ammonia, which should thicken the mass to a paste of proper consistency. Apply and clean up with soft cloths, and then rub to a polish with strip of woolen.

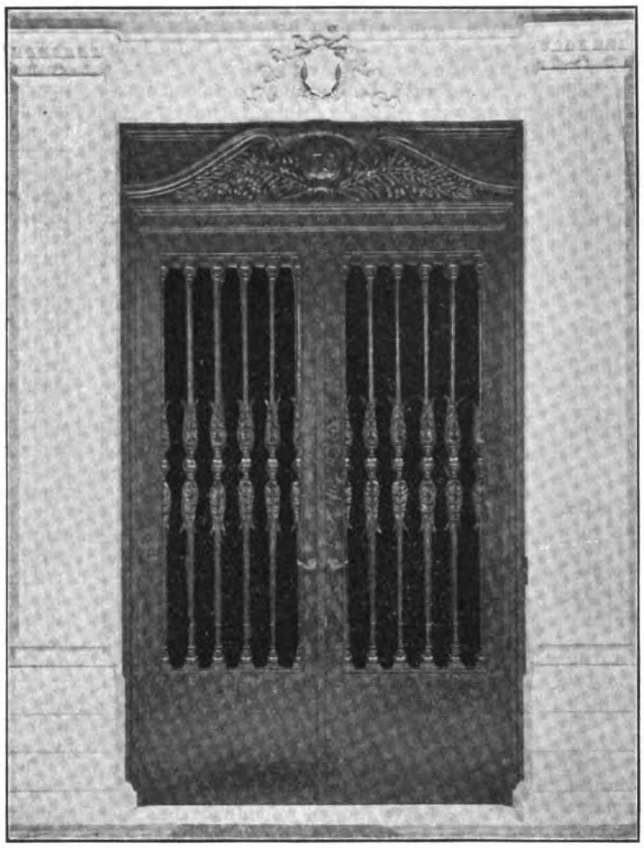
The cleaning of glass is another matter of importance to the painter when a landau, rock-a-way, or hearse is up for painting or varnishing. For this purpose moisten a soft velvet sponge with wood alcohol, or neutral solvent alcohol, and wet up the glass thoroughly. If the glass be badly smeared with paint or varnish accumulations, moisten with oxalic acid applied with a brush—a considerably worn one will suffice. Wipe dry with clean cotton fabric, free from lint, and with a second clean piece of the same material rub sharply to a bright burnish.

The Registration of Shoeing Smiths.

Editor American Blacksmith:

Under the above caption in the May issue of THE AMERICAN BLACKSMITH you invite discussion on what are the best means to elevate the standard of the craft, how may prices best be maintained, etc. I reply that education and organization are the two potent factors necessary to the elevation of the craft, without which there can be no genuine progress.

To register shoeing smiths is all right, but you have no right to ask a legislature for a law allowing you to practice your profession to the exclusion of others, unless you have some special qualifications—unless you can pass a critical examination—hence education is the primary object. The Master Horseshoers' National Protective Association of America have been working to this end for years, and recognizing, as they do, that education must precede legislation, they have established and conducted classes of



ORNAMENTAL IRON WORK FROM FORGE OF AUGUST FEINE, BUFFALO.

scientific instruction. But while considerable improvement is perceptible in large cities, little legislation has been enacted because the educational feature is not wide enough in its scope. These educational features of our craft must extend to, and embrace the horseshoers of every city in a state, else when you ask for protective legislation you have the opposition of a vast army of second, third and fourth-rate horseshoers, who, though shoeing horses for a life-time are fully conscious of their inability to pass an examination, and naturally do not want any legislation that would deprive them of the opportunity of earning a living, even though they do ruin horses' feet in pursuit of it.

When the majority of horseshoers have the ability to pass the necessary examination, they will have but little difficulty in obtaining the desired legislation; until then they are not justly entitled to it.

The best way—in my judgment—to accomplish the desired end is set out in the following address, before the Horseshoers' National Protective Association of America, October 15, 1900.

The Apprentice.

How to raise horseshoers of the first class is a problem that has taxed the brightest minds of the craft, for whatever ideas may have been conceived none that have been put to a practical test were of any real value, for admitting that some apprentices do attend the schools, the number is so small as not to represent 10 per cent. of the whole. Now tell me if only 10 per cent. of the growing crop of horseshoers receive scientific instruction, how long will it be before we deserve, much less obtain, that protection which we now seek from the legislature? What moral right have we to ask such protection if we cannot undergo that critical examination and successfully pass that ordeal which would entitle us to practice our profession to the exclusion of others who have not thus qualified?

Let me ask you upon what ground did the veterinary profession obtain protection from the quack horse doctor? Simply because they earned that protection by qualifying at a veterinary college and obtaining a diploma which protects not only the veterinary surgeon but the horse-owning public also from the impositions of the quack, and I predict that when the majority of the horseshoers thus qualify in this most essential branch of their profession that they will have but little difficulty in obtaining the protection you desire, but until then they are not justly entitled to it. And how long will it be before we reach this much desired goal of progress, if we continue to raise 90 per cent. of our apprentices without scientific instruction?

Fellow craftsmen, I have a remedy, but I want to reach that point of my subject in a round-about way, stopping occasionally on the road to point out the mistakes of the present system, because it is only by a careful study of the errors of the old that we can appreciate the value of the new.

Mistakes of The Present System.

1. Masters have been too careless in selecting the material for the embryo horseshoer. They have too often looked upon the apprentice as a sort of financial investment, and associated too much brawn with too little brains. If you would raise a perfect plant the matter of first importance is the selection of perfect seed; in like manner if you would raise a high mechanic you must select first class material to begin with. You cannot make a first-class horseshoer out of a boy who has only brains enough to shovel dirt. All attempts to weed the field is so much labor thrown away if you sow more weeds with the next crop, and from the same manner of reasoning, of what avail to teach the passing man unless we inculcate a higher education in the youth of the future?

2. The next great stumbling block is that at present scientific instruction is

altogether out of the reach of the majority of apprentices, and where the school is within reach the apprentice does not avail himself of its benefits because it is not compulsory. You know we all like to get through life with as little trouble as possible. As long as the apprentice knows that he can get a job at as good wages without that trouble and expense but few will go to school even though it be, so to speak, "under their noses." You know that most of us never would have gone to school as children if our parents had not compelled us so to do. But suppose that the apprentice knew that he would have to go to school to obtain his certificate, and that without that certificate he would stand but little chance of employment. Suppose we offer a substantial prize for the student that passes with the highest number of marks; don't you see what an incentive this would be? Such a high honor would be worth trying for.

How do I account for it that apprentices don't take advantage of the schools? First, because it is not compulsory; second, because many of them have not the mental capacity to study; third, because there is some expense that the apprentices' small wages will not cover except by the most exemplary economy; fourth, because there is no incentive to encourage us to this extra labor.

The Amendment.

Therefore, I suggest that we amend the law so as to make scientific education absolutely compulsory, and therefore I also suggest that the Association create a special educational board of directors whose duty it shall be to manage, direct and control the apprenticeship system, to which all correspondence connected with the work should be addressed. This board might comprise a principal or chairman, a secretary-treasurer and three or more managers to act as assistant instructors, who should be past masters in the art of horseshoeing, and whose duty it should be to instruct the class in the practical part—such as preparing hoofs, forging, pathological and anti-interfering shoes, the shoeing of interfering horses, balancing roadsters, etc. The board should secure the services of a veterinary professor or demonstrator of anatomy to teach anatomy and pathology of the foot and leg. It would be necessary to prepare a special course of lectures adapted to the need of horseshoers only.

I am in favor of establishing a veterinary school in a large city in a centrally located state, so that railway fare would be more equally divided for students, the same as other colleges do. There should be a lecture hall or theatre and a shoeing department, with sufficient forges to enable every student to be thoroughly finished in the practical as well as the scientific part of the profession.

Such a school properly conducted could run from two to four sessions each year, with a number of students to each session. Three months is long enough for one session, and if our masters would only take the interest in it that this branch of our profession deserves the school would be full all the time, and it is difficult to overestimate the immense good that would accrue to the whole craft by the adoption of such a plan.

How to Finance This Scheme of Education.

This has hitherto seemed a difficult problem. It was easy to propose a course of education at a college, but how a poor apprentice was to provide $200 to defray the expense of such education seemed an insurmountable object, but I have thought out a plan by means of which the necessary funds may be forthcoming, which I call my deferred pay system.

This system not only supplies the funds to defray the cost of education, but the money so held in trust by the Association forms a substantial security to the employer against breach of contract; for bear in mind that when the apprentice knows that he cannot ignore his contract with his employer without forfeiting the money held in trust for him by the Association, and with it his certificate and prospects as a horseshoer, we will hear less of the runaway apprentice.

Therefore, I recommend that the master having satisfied himself that he has the right material to make a first class mechanic, should communicate with the secretary of the educational department and make application for the necessary papers to register his apprentice, which papers should be sent in triplicate—one for the master, one for the apprentice, and one for the educational department for record. In addition to the regular cash pay the master should pay to the apprentice 75 cents or one dollar per week deferred pay, which deferred pay should be regularly forwarded by the master monthly to the educational department, the secretary of which will place the amount to the credit of said apprentice, and forthwith return to the apprentice coupons to the value of that amount.

This money is to be held in trust by the department for the purpose of defraying the expenses of educating the apprentice in a manner that will enable him to earn the highest wages attainable for horseshoeing. It will be the means of giving the young horseshoer a fair start in the field of labor.

The secretary of the department will know from his records when each apprentice is near fulfilling his indentures, and will lay plans for the number of students he can accommodate at each session. He should then warn both master and apprentice at least a month ahead, so that the apprentice may be prepared to attend the school when notified. At the proper time the secretary should forward a railway pass to the apprentice, and on his arrival at the school he should be taken care of in much the same way as a student at college.

At the expiration of the session, if he has fulfilled his contract with his employer, he should be given his certificate and whatever balance in money the department may have to his credit. If, on the other hand, he has some months to serve to complete his indentures, his certificate should be withheld, and he should be given a railway pass back to his employer. His certificate and any balance due him should be forwarded him on completion of his engagement.

If the apprentice be, owing to accident, disablement or death, unable to fulfill his contract, then all money held in trust for him by the department should, after satisfactory proof being furnished, be returned to the apprentice, his heirs or assigns.

If, however, the apprentice quit his employer or otherwise violates his contract, then all money held in trust for him by the educational department shall revert to his employer as a compensation for breach of contract. The indentures should contain the necessary legal contract to cover these grounds, and should be signed by both parties in the presence of witnesses before a Justice of the Peace.

To Strengthen This Law by Protective Legislation.

If you wish to further strengthen this law by state legislation, first of all get your city school in operation, and thereby prove to your legislature that you deserve the protection you ask, but you ought not to ask the legislature to deprive the apprentice of his right to learn his trade as he does now unless you have a better method to offer. But once your school is in operation and you are prepared to provide education for your apprentices, then I am in favor of a state law that would impose a heavy fine on any master employing an apprentice without indenturing him in accordance with law.

I have been asked, what would you do with the hundreds of apprentices now serving under the old law?

I would recommend that all apprentices who make application within six months from the date upon which the new law goes into effect, shall be allowed to re-register if they so desire under the new law, the time he has already served being counted as part of the term of four year service.

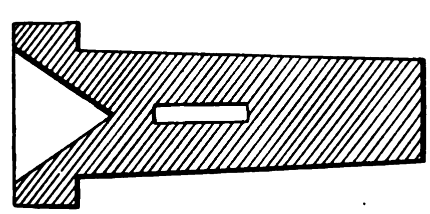
And from the date of such registration he shall be required to pay to the treasury of the Association not less than one dollar per week, but as much more as he desires, and his indentures shall be considered fulfilled when the four years so expire, but he shall not be allowed to attend the school until the full amount is standing to his credit on the books of the association.

This plan would give any apprentice now serving the advantage of attending the school as soon as he had saved the money to defray the expense of such education.

E. W. Perrin.

A Simple Tool For Upsetting.

Charles Lawrence.



A TOOL FOR UPSETTING.

On a small railroad there is plenty of work as to tools and formers. We had a number of old flat cars to rebuild this winter, which brought lots of bolts into the shop to be welded all the way from ⅝ to one inch. Now this had to be done in good shape, and consequently they had to be upset before welding. I started in in the old way, upset the ends, scarfed them off and welded. But with hundreds of welds before us, and also turn buckles to weld in the truck rods, this would never do, so I made a tool or hammer to fit in a 1¼-inch square hole in the swage block with a shoulder on it. In the end, I punched a square hole, tapering from about 1¼ inches to a point, put a hole in it for a handle, and it was complete. It is about the best tool of the kind I ever saw. For short work, I put it in the swage block, and for large work I use it with a handle, and let the sledge do the work. The accompanying figure will show how the tool looks. First, I draw the iron to a square point, then apply the tool in this way, get the iron upset in the right place, and with less work. After upsetting, a few strokes on the fuller hammer will give a good scarf.

Further Details of Machine Blacksmithing Practice.

THOS. PRENTICE,
Foreman Blacksmith, General Electric Company.

Continuing my article in the June issue on general machine shop blacksmithing, I find that the extent to which this may be carried is almost without limit, as a shop of this sort has no special piece which they make, and as a consequence must be ready to compete with other shops of the same class. To do this successfully, two things demand attention, first the cost of production; second, the quality of work produced. The first calls for the exercise of brain power, which, properly used, will do more to keep the place on a profitable basis than anything else. Second, the brawn of arm power to hustle the work along. Blacksmiths, remember that brain and brawn in our business are twin brothers, and cannot be separated without disastrous results.

The first job on our list is, if you please, an order for 500 pipe clamps as shown in Fig. 1. This looks very simple, and it is very simple if you go about it in the right way. The band proper is $2\frac{1}{2}''$ x $\frac{1}{2}''$, the ends are $\frac{3}{4}''$ diameter with threads for nuts on each end. We cut off our stock $2\frac{1}{2}''$ x $\frac{1}{2}''$, 14″ long, and draw the ends, making them appear as shown in the lower sketch. In doing this, care must be taken to spread the end more than to draw, as we require to gather the stock at the base of the thread stem for strength, which we obtain by the spreading, and could not get by simply drawing the material out. Our next move is to take the straps to the screw cutting

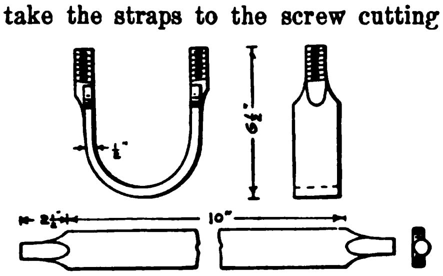


Fig. 1. COMPLETED PIPE CLAMP AND BLANK BEFORE BENDING.

machine and cut the threads the length desired. While this is being done we must look for some easy method to bend these correctly, and for that purpose we have prepared a block Fig. 2, A, which has been either planed or milled out to the sizes given. The $\frac{7}{8}$-inch hole in the ends of this block are to take two short bars for lifting the block on and off the hammer anvil. This will prevent the helper or blacksmith from getting his hands directly under the hammer, and prevent the loss of fingers or hand should the hammer for any cause drop suddenly.

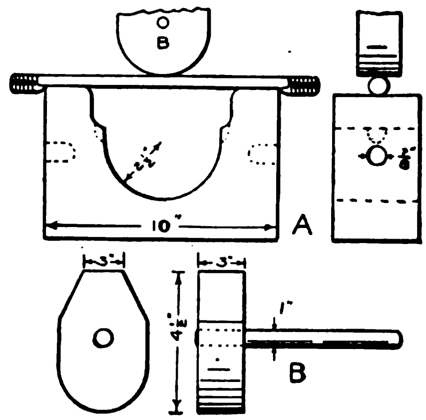


Fig. 2. METHOD OF BENDING WITH BLOCK AND TOOL.

The next tool, Fig. 2, B, we make without any machine work, and it will answer the purpose if forged smooth. The taper top as you will see later is very essential. Having prepared the bottom block or die, you will notice we have it exactly the length the strap is between the shoulders; this saves a good deal of time as no measurements require to be taken when bending. Lay the strap across the bottom die, placing block B on top and in the centre, press down with a full pressure of steam, and when you get it bent by this pressure, give a light blow which will prevent it springing after being taken from the block. After you have bent the strap, the ends will lie slightly at an angle, to straighten, use a rawhide mallet which will not mar the threads and you have a neat, quick job. These should be bent cold, using an oil swab for the bending forms.

(To be Continued.)

A Few Shoeing Don'ts.

BY CASTLEWOOD.

Do not burn the horse's hoof as it will in time destroy the foot. If you doubt, heat your thumb nail several times. You will not need to trim it for it will break off as fast as it grows.

Do not fit the shoe of the front foot tight on the heel back of the heel nail, which should never be back of the quarter where the hoof begins to draw in. If nails are back of this it stops the heel from expanding, and has a tendency to contract the foot.

Do not dish the shoe back of the quarter or heel nail for that also contracts the foot. My experience is that it is always best to level the hoof from toe to heel and side to side, so that the horse stands natural and easy.

Always commence at the toe and nail back to the heel, and from the heel back. Have the shoe free so that a thick piece of paper will pass between the hoof and shoe. The length of shoe must be governed by the shape of hoof and fetlock.

Filling Old Buggy Hubs.

BY W. H. K.

I have filled old Sarven buggy hubs successfully for many years. In filling a patent wheel, I take out about one half of the rivets contained in the hub, take out the spokes, and fit the new ones tight without putting any dish on the back of the spokes, or, in other words, leaving the spokes straight back and front. I then drive the spokes in tight and screw my hub plates up tight. These are made out of $\frac{1}{2}$ by $2\frac{1}{4}$-inch iron with an ear extending between every spoke trough. This ear has a screw which holds the lower plate in its place. These hub plates are made so that they can be used for small and large hubs. For the large hubs I have notches cut on the inside of the plates. Next drill a $\frac{1}{2}$-inch hole for every rivet. After having put in one half of the spokes, put in the rivets, take out the remaining rivets and fix the rest of the wheel the same way, and you will have a substantial wheel.

Another Opinion on Keeping the Foot Sound.

GEORGE W. KENYON.

I wish to state my opinion as to how to keep horses' feet sound. In so doing I will simply repeat Mr. John A. Green's statement in the December number to a letter. His ideas are correct. Mr. Green does not condemn a bar shoe, but he carries the thought that a tip is far ahead of the bar or anything else. I can say from many years of experience that I have had good results by using a bar shoe, and in many cases simply a side bar. In either case my object is to get a severe frog pressure. One great objection to either a bar or a side bar shoe, is they are not reset often enough. They should be reset as often as from two to five weeks, depending upon the foot. The smith should know about that. There are a great many horses that do not need any tips or shoes of any kind on their front feet all through the summer season, and yet if you tell some people that, they would not believe it. I have shod horses for farmers, lawyers, merchants and doctors, and they generally all want the toe cut well down, without touching the heel, a low toe and a high heel calk put on, the very thing that causes contraction, and then keep it on expecting to effect a cure. In speaking of corns and gravel, I maintain there is no such thing as a corn. Did you ever see a corn in the hind foot? Certainly not. This fact is worth a little study.

The Elements of Blacksmithing.—8.

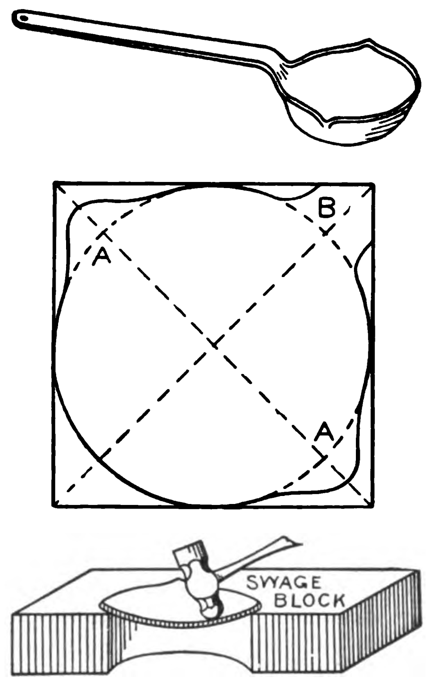
Ladle and Tong Making. Brazing.

JOHN L. BACON,
Instructor in Forging, Lewis Institute, Chicago.

Ladles are not very often forged now by hand, but it is very convenient at times to know how to go at this class of work. A ladle such as illustrated in Fig. 80 is made from two pieces, a thin strip for the handle welded at B to a second flat piece formed into a bowl. The bowl is made as follows: A square piece of stock of the proper thickness is cut and "laid out," like Fig. 81. The centre of the piece is first found by drawing the dotted diagonals. Taking the point where the diagonals cut each other as the center, a circle is drawn as large as possible, and the piece is cut out with a cold chisel to this circle, excepting at A and B, where projections are left to form the lips, and at B, where a piece is left for welding to the handle.

The bowl is easily formed from this piece by heating it carefully to an *even*, yellow heat and placing it over the round hole in the swage block or other object. Now, using the pene end of the hammer, pound the flat piece into a rounding shape by striking on the metal when it is not supported by the swage block. As the metal in the center is forced downward by the blows of the hammer, the swage block prevents the material at the sides from following, and it is gradually worked into a bowl shape. Fig. 82 shows the position of block and work and method of forging. The bowl being properly shaped, the lips should be formed. This may be done by holding the edge of the bowl where the lip is to come against one of the small grooves in the side of the swage block, and driving a small bar of round iron, or a thin fuller, against the side of the bowl from the inside, forcing the metal into the groove and forming the lip. The handle may be welded on either before or after forging the bowl. For a ladle with a bowl 3½" in diameter, the diameter of the circle in Fig. 81 should be about 4", as the edges of the piece draw in together somewhat. Stock for other sizes should be in about this proportion. Machine steel should be used for making the bowl; if ordinary wrought iron is used it is almost impossible to forge it without splitting.

There are many methods of making tongs but the following is given as about



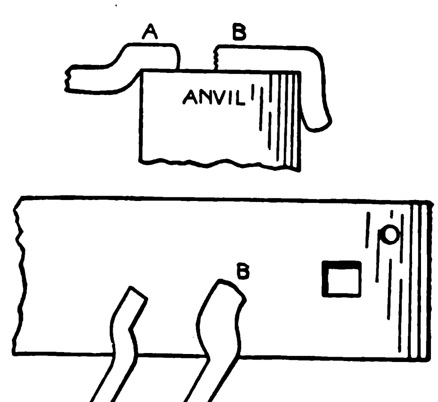
Figs. 80, 81 and 82. LADLE, BLANK AND METHOD OF SHAPING BOWL.

the easiest for the beginner to forge out entirely with a hand hammer. The tongs here described are light ones, forged from ⅝" square stock: The end of the bar is first bent at right angles over the farther side of the anvil, as shown at B, Fig. 83. A second bend is made, as at A, and then as shown at B, Fig. 84, the shoulder between the eye and the jaw formed. The bar is widened out one way, and thinned the other to form the eye. The stub after working down, see Fig. 85, is scarfed, and a ⅝" round bar welded on to form a handle. The formed piece is cut from the bar at A, Fig. 85, leaving enough to form the jaw, which is worked down to shape over the corner of the anvil. Another piece exactly like this one is made. When riveting, the parts should be placed together, the rivet heated red hot, thrust through the hole, and headed up. This will probably leave the tongs fastened tightly together, but they are easily loosened by heating red hot and opening and shutting a few times. It is common when there is a power hammer to draw out the whole length of the handle and have no weld. This is sometimes done when forging tongs by hand but takes longer. Tongs made in this way are stronger.

Brazing.

Brazing, we might say, is soldering with brass, the brass taking the place of solder. Briefly, the process is as follows: The surfaces of the pieces to be joined are cleaned thoroughly where they are to come in contact with each other. They are then fastened together in the proper shape by binding with wire, or holding with some sort of clamp. The joint is heated, a flux being added to prevent oxidation of the surfaces, and the "spelter" (prepared brass) sprinkled over the joint, the heat being raised until the brass melts and flows into the joint making a union between the pieces. Ordinarily it requires a good red or dull yellow heat to melt the brass properly. Almost any metal that will stand the heat can be brazed. Great care must be used when brazing cast iron to have the surfaces in contact properly cleaned to start with, and then properly protected from the oxidizing influences of the air and fire while being heated. Brass wire, brass filings, or small strips of rolled brass can be used in place of the spelter. Brass wire in particular is very convenient to use in some places, as it can be bent into shape and held in place.

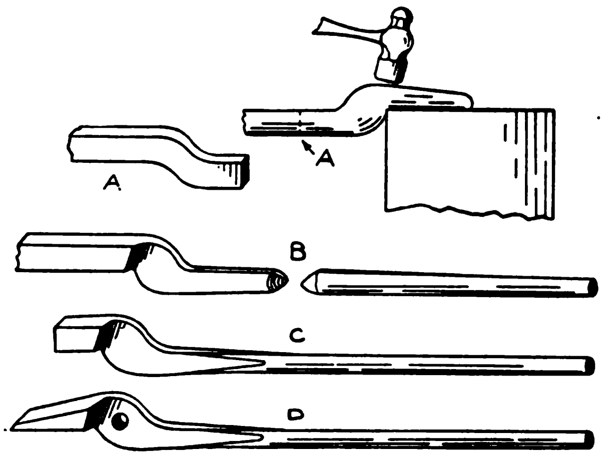
A simple brazed joint is illustrated in Fig. 87, which shows a flange (in this case a large washer) brazed around the end of a pipe. It is not necessary to use any clamps or wires to hold the work together, as the joint may be made tight enough to hold the pieces in place. The joint, however, should not be perfectly tight all around. It must be



Figs. 83 and 84. SHAPING END OF TONGS.

open enough to allow the melted brass to run between the two pieces. Where the pipe comes in contact with the flange the outside should be free from scale and filed bright, the inside of the flange being treated in the same way.

This must be done carefully, for brass will not stick when there is scale. When the pieces have been properly cleaned and forced together, a piece of brass wire should be bent around the pipe at the joint, as shown in Fig. 88,

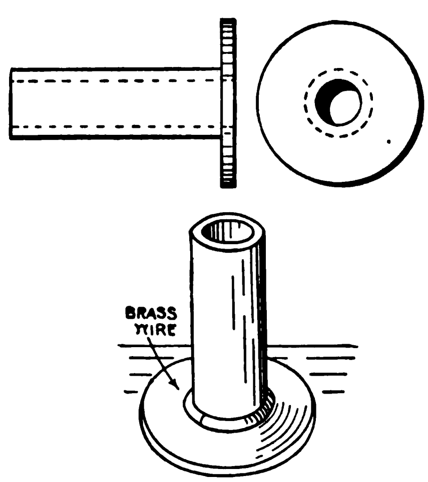


Figs. 85 and 86. TONG MAKING.

and the work laid on the fire in the same position as in the cut. The fire should be a clean, bright bed of coals. As soon as the work is in the fire the joint should be sprinkled with the flux, in fact it is a good plan to put on some of the flux *before* putting the work in the fire. Ordinary borax can be used as a flux, although a mixture of about three parts borax and one part sal ammoniac seems to give much better results. The heat should be gradually raised until the brass melts, and runs all around and into the joint, when the piece should be lifted from the fire.

The brazing could be done with spelter in place of the brass wire. If spelter were used the piece would be laid on the fire and the joint covered with the flux, as before. As soon as the flux starts to melt, the spelter, mixed with a large amount of flux, is spread around on the joint and melted down as the brass wire was before. For placing the spelter when brazing, it is convenient to have a sort of a long handled spoon. This is easily made by taking a strip of iron about $\frac{3}{4}$" x $\frac{1}{8}$", three or four feet long, and hollowing one end slightly with the pene end of the hammer. There are several grades of spelter which melt at different heats. Soft spelter melts at a lower heat than hard spelter, but does not make as strong a joint. Spelter is simply brass prepared for brazing in small flakes, and can be bought all ready for use. The following way has been recommended for the preparation of spelter: Soft brass is melted in a ladle and poured into a bucket filled with water having in it finely chopped straw, the water being given a swirling motion before pouring in the brass. The brass settles to the bottom in small particles. Care must be taken when melting the brass not to burn out the zinc. To avoid this, cover the metal in ladle with powdered charcoal or coal. When the zinc begins to burn it gives a brilliant flame, and dense white smoke, leaving a deposit of white oxide of zinc.

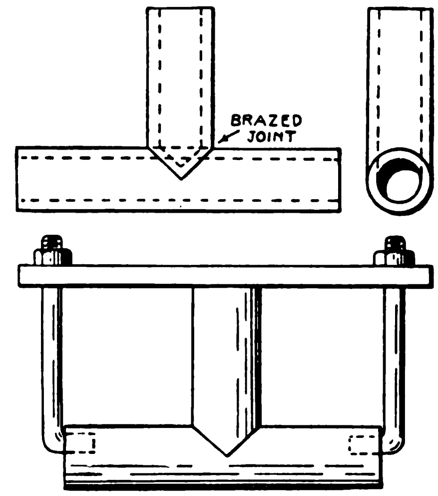
Another example of brazing is the "T" shown in Fig. 89. Here two pipes are to be brazed to each other in the form of a T. A clamp must be used to hold the pieces in proper position, while brazing, as one pipe is simply stuck on the outside of the other. A simple clamp is shown in Fig. 90, consisting of a piece of flat iron having one hole near each end to receive the two small bolts as illustrated. This strip lies across the end of the pipe, forming the short stem of the T, and the bent ends of the bolts hook into the ends of the bottom pipe. The whole is held together



Figs. 87 and 88. A SIMPLE BRAZED JOINT.

by tightening down on the nuts. The brazing needs no particular description as the spelter is laid on the joint and melted into place as before. A piece of this kind serves as a good illustration of the strength of a brazed joint. If a well-made joint is hammered apart the short limb will sometimes tear out, or pull off, a section of the longer pipe, showing the braze to be almost as strong as the pipe.

When using borax as a flux the scale should be cleaned from the piece before



Figs. 89 and 90. METHOD OF PIPE BRAZING.

it cools, as the borax when cold leaves a hard, glassy scale which can hardly be touched with a file.

(To be Continued.)

Shoeing for Lameness.

G. D. DENIO.

I often have horses brought to me lame, and the owner will say, "I had this horse shod only a few days ago, and still he is as lame as ever. Can you tell what ails him?" It is the same old trouble generally, shod too close or heavy on the heel. I take the shoe off and lay a straight edge across the side that sets to the foot, and it is generally perfectly flat, often hollowed from toe to heel. I then pare the foot with much care, and with the farrier's knife I examine the space between the quarter and outer wall of the foot. Here is where corns are found, and I find them on nearly every foot that is shod in the manner above mentioned. To cure this kind of lameness, I cut this space out from $\frac{1}{4}$ to $\frac{1}{2}$ inch deep, and if I find a corn there, I dig it out as much as possible, even to the point of bleeding. Then heat some pine tar and pour it in hot, fill in some cotton batting, fit the shoes, so that when the two top sides are placed together they will rock or leave a space from heel nail hole $\frac{3}{16}$ of an inch. When this shoe is set there should be $\frac{1}{16}$ of an inch of daylight under each heel, or between the shoe and heel. This plan will cure corns and stop the lameness. Young blacksmiths should remember this and save the patient horse much pain.

When you get a bill for the paper that is publishing everything that is for your best advantage and articles upon all subjects you request, treat that bill as you would like your customers to treat bills you render them and for work performed.

Tables for Useful Reference.

From time to time there will be printed in these columns various tables of useful facts, relations and figures which it is hoped will save the busy craftsman much time and trouble. It is always much easier to pick information from a table than to stop work, sit down and figure it out yourself. The table means that someone else has done the calculating for you.

The table appearing herewith arranges for ready reference the values of the circumferences and areas of circles for various diameters. The radius of a circle of course is one-half the diameter. The table can be used for any unit of measure, whether inches, feet, yards, or centimeters. If the diameter is in inches, for instance, the circumference will be in inches, and the area in square inches. If feet are taken as the unit, the result will be feet or square feet.

By reversing, we can use the table to find the diameter and area of a circle when the circumference is known, or the diameter and circumference when the area is known.

Shop Talks on Wheels, Axles and Springs.—8.

BY D. W. M.

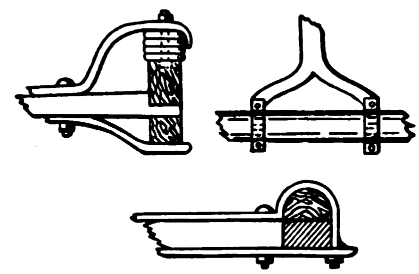
The modern naked axle gear is constructed on plans which involve the same principles of construction governing the wooden capped axle, except that the absence of clips makes it unnecessary to provide against their slipping. Elasticity must be retained, and the bracing must be done so as not to interfere with it.

In a single reach gear of the old style a strong brace is usually provided running from the reach to the top of the spring. In a double reach gear this is omitted, but the top plate of reach extends over the axle cap, frequently forming a half clip. In the single reach the rear end of reach plate is split on bottom to act as clip bars for the clips on spring. But a naked axle gear is usually constructed with the heel ends forged solid on the axle, obviating the necessity for clips and braces. In many cases the side braces for the reaches are omitted but we think unwisely. Reaches for naked axles are frequently made of wood, the ends inserted in the forged heels and bolted or clipped in place. Tubular reaches are better when filled with wood, less liable to kink, and holding bolts or rivets more solidly.

It must be borne in mind that much of the strength of the gear in sustaining forward and backward strain is reinforced by the method of attaching the body loops to the springs or spring bars. Unless this is done properly the reach ends will not of themselves be able to stand the strain put on them, neither would the reaches stand without breaking. But if the loops are firmly bolted and properly fitted to the springs, or spring-bars, a vast difference is made in the rigidity of the gear, yet without interfering with its elasticity.

It is always best to plate the reaches on the bottom. It does interfere slightly with the elasticity of the gear, yet so little as to be practically nothing, and as a preventive of accident in case of breakage from buckling is invaluable. There are many carriage builders who omit the bottom plate on double reach gears, depending on tough hickory alone, but any hickory will rot from rust at bolt holes in time, and sooner or later a bad accident happens, which a bottom plate would have avoided, by preventing the gear from pulling apart and letting the body fall to the ground.

We will not discuss the various



HEEL ENDS OF SINGLE AND DOUBLE REACHES.

methods of attaching fifth wheels and bracing the forward ends of the reaches. The principles governing are the same as for the rear end. Braces top and bottom are arranged to accommodate the form of fifth wheel used, whether for single or double reach. On naked axles the reach sockets are forged solid on the upper part of the fifth wheel, which has also the front spring head block forged with it.

A thoroughly satisfactory fifth wheel for naxed axle gear has not yet been found, and there has in consequence been a strong disposition to return to wood capped axles and Brewster fifth wheels, which have always proved strong enough to stand all the strains put on them, and are easily repaired if out of order. The question of repairing is always important. Vehicles must be made to run anywhere, and if they can not be repaired without sending to the maker for the parts, or without a machine and peculiar appliances and great expense, they cannot be used except in a limited area within reach of the original maker.

TABLE OF CIRCUMFERENCES AND AREAS OF CIRCLES.

DIAM.	CIRCUM.	AREA.	DIAM.	CIRCUM.	AREA.	DIAM.	CIRCUM.	AREA.	DIAM.	CIRCUM.	AREA.
1/16	.1963	.0030	5/8	5.105	2.073	1/8	12.959	13.364	5/8	20.813	34.472
1/8	.3927	.0122	3/4	5.497	2.405	1/4	13.352	14.186	3/4	21.206	35.785
3/16	.5890	.0276	7/8	5.890	2.761	3/8	13.744	15.033	7/8	21.598	37.122
1/4	.7854	.0490	2	6.283	3.141	1/2	14.137	15.904	7	21.991	38.485
5/16	.9817	.0767	1/8	6.675	3.546	5/8	14.530	16 800	1/8	22 384	39.871
3/8	1.1781	.1104	1/4	7.068	3.976	3/4	14 923	17.728	1/4	22.776	41.282
7/16	1.3744	.1503	3/8	7.461	4.430	7/8	15.315	18.665	3/8	23.169	42.718
1/2	1.5708	.1963	1/2	7.854	4.908	5	15.708	19 635	1/2	23.562	44.179
9/16	1.7671	.2485	5/8	8.246	5.411	1/8	16.101	20 629	5/8	23.955	45.664
5/8	1.9635	.3068	3/4	8.639	5.939	1/4	16.493	21.648	3/4	24 347	47.173
11/16	2 1598	.3712	7/8	9.032	6.491	3/8	16.886	22.691	7/8	24.740	48.707
3/4	2.3562	.4417	3	9.424	7.068	1/2	17.279	23.758	8	25.133	50.265
13/16	2.5525	.5184	1/8	9.817	7.669	5/8	17.671	24 850	1/4	25.918	53.456
7/8	2.7489	.6013	1/4	10.210	8.295	3/4	18.064	25.967	1/2	26.704	56.745
15/16	2.9452	.6902	3/8	10.603	8.946	7/8	18.457	27.109	3/4	27.489	60.135
1	3.1416	.7854	1/2	10.996	9 621	6	18.850	28.274	9	28 274	63.617
1/8	3.5343	.9940	5/8	11.388	10.321	1/8	19.242	29.465	1/4	29.060	67 201
1/4	3.9270	1.2272	3/4	11.781	11.045	1/4	19.635	30.680	1/2	29.845	70.882
3/8	4.3197	1.4849	7/8	12.174	11.793	3/8	20.028	31.998	3/4	30.631	74 662
1/2	4.7124	1.7671	4	12.566	12.566	1/2	20.420	33.183	10	31.416	78.540

We have gone over these fundamental principles of gear construction because many have become so interested in modern methods of construction that they have forgotten the essential points, and hence we have to-day many failures in the practical use of these novelties, which, although attractive in appearance, are built on wrong principles. One of the most expensive springs on the market proved to be a failure, because it could not be tightened up when it wore and began to rattle at the heads. One of the most finely made and expensive fifth wheels proved to be a failure because it was not properly braced and would break. I could name a long list of finely made goods used in various parts of the gear, highly lauded when put on the market, and sold to the finest builders, all of which proved failures because they were not properly reinforced to withstand strain, or could not be easily repaired, or did not allow of elasticity. Wherever one piece is joined to another it must be so done as to be firm, strong, elastic, and easily taken apart. Iron to iron, steel to steel, should have wood or leather between, if only a thin layer. Clips should be of Norway iron, because it is soft, of very great tensile strength, and its fibres do not easily break, yet it is yielding.

The wooden spring bar is fast coming into favor again because the forged, solid, or "Bailey type" of hanger has not the requisite elasticity.

Wood capped axles are coming into vogue again, partly for the same reason, viz., lack of elasticity in the naked axle although of steel, and partly because the combination of tough hickory and steel is lighter and stronger.

The old fashioned carriage maker was a man who knew the small details of his business from experience, and modern builders will always find such knowledge a useful and necessary groundwork, which it is not well to overlook.

Prize Contest Articles.

The articles following are among those submitted in contest for the prizes offered by this journal for the best contributions on various subjects. The numbers attached to each, refer simply to the order of their receipt.

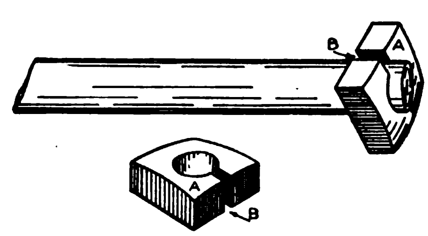
As announced in the preceding issue, this contest closed June 30th. It has been a vigorous and highly successful competition, and the uniformly high standard will make the choice of the best articles a somewhat difficult matter for the judges. As soon as the decision is reached it will be announced, we hope, in the August number. Lack of space will prevent publication of all the numerous articles received, but we will endeavor to give the best of those which have been sent in. We take this occasion to acknowledge receipt of those articles coming in under a nom de plume.

Prize Contest—Repair Work.—20.

Easily-Made Bolt Head.

An old nut or blank nut driven on to the end of a rod will not weld to a rod readily, as blacksmiths know. The idea conveyed in this device is a nut similar to the blank nut used for tapping out, only this one is intended to be welded on for a bolt head or rod head. The hole in the center is supposed to be made a shade smaller than the iron to be driven in. For example, the hole in the bolt head, to form a half-inch bolt, would be $\frac{7}{16}$ inch in diameter. These heads can also be made octagonal or hexagonal. The opening must be cut across the grain of the iron so that the opposite side will bend, and not split.

The advantage in this nut for blacksmiths is the convenience. The old way of bending a collar to put on for a head is slow and tedious, and if a person is not an expert at putting on a head in that way, it will be a poor job, and all on one side. Then again, this nut is much more convenient for welding on long rods that cannot be worked in a heading tool. For use around mines, small foundries, bridge work and black-



A CONVENIENTLY FORMED BOLT HEAD.

smith repair shops, I think they will be quite a convenience.

To try the advantage of this bolt head, take an ordinary blank nut and cut through the side (across the grain) with a hack-saw, then insert rod of iron and weld same. The figure represents the bolt-head on rod in the proper position to be welded, a little of the rod being allowed to stick through to round up the outside of head smoothly. It is a well known fact with blacksmiths that you cannot make a solid weld on a bolt-head without there being an opening in the piece to be put on; for instance, take a common nut and put it on the end of a rod for a head, and when you strike it on one side, when at a welding heat, that side stretches and the two opposite sides pull away from the rod. When you strike the opposite two sides, the first two break away. If you undertake to forge a head put on in this way, you will find that it has not been firmly welded, while with the bolt, which I have described in this article, can be welded on so as to be as solid as a machine made bolt head.

Prize Contest–Horseshoeing.–21.

A Few Hints on Shoeing.

A valuable horse with a poor hoof becomes almost worthless, so that the common saying—"No foot, no horse," is practically correct. For this reason the subject of horseshoeing is one which should receive much attention, as it is by poor shoeing that so many horses are rendered almost valueless for life.

The hoof in its natural state is adapted only to a grassy surface, so that when we wish to bring the horse into practical use upon our hard and stony roads, it becomes necessary to protect the hoof, by shoeing, from the unnatural wear and tear which it is subjected to. It is greatly to be regretted that so large a share of the men, who are permitted to do this very important work of shoeing the horse, do not know the nature and structure of the foot, and the principal rules which should guide them in doing this work. It is a great fault of nearly all shoeing smiths, that they cut and pare with the idea of improving the foot, when their aim should be mainly to let nature have her course as much as possible; or, in other words, imitate the natural condition of the foot, and only pare away such parts as have become useless.

In paring the foot, be very careful not to cut down the outside, so as to allow the entire weight to rest on the inside of the shoe upon the sole, but only take away the dead portion of horn on the sole, and cut down the wall from heel to toe until the bearing is natural, leaving it even and as near its natural state as possible. The frog should not be cut down, as is frequently practiced, nor should it be touched when healthy except for the purpose of cleansing. The frog should be allowed to come to the ground, which will prevent to a certain extent the concussion which would otherwise take place.

That part of the hoof which should not have pressure is the portion between the bar and the quarter, commonly known as the seat of the corn. Corns appear in the angle of the hoof near the heel. Upon cutting away the horn, there will be found a red spot, but if very bad, the color will be a dark purple and it will be deeper seated.

The shoe to be selected should depend upon the condition of the foot, and the condition of the road, etc. The flat shoe, when properly applied, leaves the foot nearest its natural shape by allowing the horse a good even foundation to stand upon, and is most likely to give satisfaction for all ordinary purposes. What I mean by the flat shoe is one flat upon its superior surface which comes in direct contact with the hoof. The shoe should always be fitted to the foot, and not the foot to the shoe, as is too often practiced; the greatest pressure should be around the outside of the hoof, from about half an inch to three quarters of an inch, according to the size of the foot.

The shoe should be as large as the foot, so as not to require any cutting down of the hoof to make it fit the shoe, and the heels of the shoes should not be permitted to project backward beyond the heels of the hoof more than one-fourth of an inch. The outward margin of the shoe should just correspond with the shape of the foot, except at the heels where the shoe should be a little wider from the quarter to heel and well boxed up, especially on the outside.

A red-hot shoe should not be allowed to be burned into the foot to fit it, but if the foot is properly prepared, and the shoe perfectly level on its bearing surface all round, it may be heated to a dull red heat and firmly applied to the hoof for a few seconds; but care should be taken in applying hot shoes to thin and diseased hoofs. Many persons are not aware of the thinness of the hoof, which makes it quite necessary that the nail holes in the shoes should be exactly opposite the white line, and it ought to be seen that they have the proper direction and quite well forward in the toe and quarters, so as to avoid driving the nails into the sensitive tissues, which would cause serious injury and lameness.

The nails should be driven straight through the wall at an angle, and not too high; the height at which the nails should come out of the surface of the wall depends mainly on the weight of the shoe and size of the hoof. A nail driven in the white line and coming out at a moderate height is much more satisfactory than one driven outside the white line and coming out very high in the wall. A nail for a horse's foot differs materially from every other kind of nail, not only in shape, but in the quality of iron from which it should be made. It is important that it should be made from the very best of iron, free from flaws, seams, and all sulphurous gases in the process of manufacture. They should be made solid, soft, ductile and bright, yet stiff enough to stand being driven without bending under the hammer. They are made in sizes to suit all feet, and should never be used larger than is absolutely necessary, as the smaller the nail the less injury it does to the hoof. The fewer the nail holes required in the shoe the better. See that the nails fill the holes, and the heads the fullering, leaving little if any to project beyond the ground surface when finished, thus preventing the clinch from rising when brought in contact with the ground, and saving the injuring of the fetlocks.

Prize Contest—Repair Work.—22.

Mower Knives.

In Fig. 1 is a sketch of a chisel for use on sections like No. 2, Fig 1. They are even with the mower knife bar, and cannot be struck with the hammer, as shown on No. 3. When a knife is filled out with sections, as No.

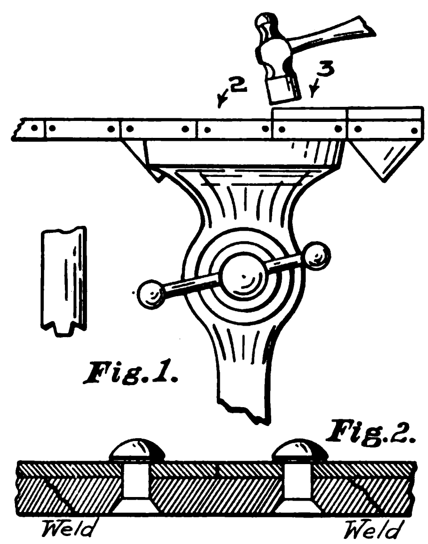


Fig.1.

Fig.2.

MOWER SECTION REPAIR WORK.

2, your helper must hold the knife. Always start from the head of the knife; it makes the best job. There are generally two sections in the head which you will have to punch out. Put the knife bar over a piece with a hole about $\frac{5}{16}$ of an inch, as you are less liable to bend the head and bar. Have a good heavy punch well tempered, and give the rivet a good blow the first two or three times to cut the hood which is at the top.

Fig. 2 shows my way of welding a knife bar. I always cut out enough of the bar to get my welds in the middle of a section. This of course makes two welds, but to weld in one of the holes is wrong. Welded in the above way your welds will never break. Always be sure you have plenty of iron in the piece you splice. You can easily rasp off some if there is too much.

Prize Contest—Repair Work.—23.

Farm Wagons and Buggies.

Mr. A, who brings his wagon to have the tire shrunk, has run it until you could slip a knife blade between the tire and the rim. He thinks shrinking the tire will put his wheels in first-class repair. To do this, I would either have to ruin his wheels with dish, or the first time he hauled a load they would be as bad as ever. The trouble is the spokes have worked in the hub, and to do myself justice, and please Mr. A, those spokes must be taken out, canvassed, glued and re-rivetted. Now it is worth $2.00 to do this extra work, but Mr. A is not willing to pay this, so I agree to do the extra work for $1.00, and I tell him just why I can afford to do it, for I have found out that a pleased customer is as good an advertisement as I can get. I knocked down the wheels, canvassed, glued and redrove them, and made a first-class job. Mr. A got his wagon and put it to hard service again. In less than sixty days, Mr. A had told his three friends, B, C and D, and they, every one, became permanent customers, and good paying ones, too.

Someone might want to know how this canvassing of spokes is done. If the spoke is very loose, take some drilling, cut a strip just as broad as the spoke is wide, then cut off a piece, put it over the end of the tenon and let it lack $\frac{1}{16}$ of an inch of coming to top of shoulder. Saturate it with glue, also glue the sides of the tenon, and lap the drilling over the end of the spoke. Next cut a strip just as wide as the spoke is thick, work it in same way, and the spoke is ready for the hub. This should also receive a coat of glue in the mortise. Take some fine emery sand and sprinkle a small quantity on the drilling over the tenon, and drive it home. To prevent spoiling the tenon that goes in the felloe, bore a hole $\frac{1}{16}$ of an inch larger than the tenon in the end of a piece of hard wood, and a little larger than the spoke, and eight inches long, using this in driving.

I will next describe some of the fruits of the $1.00 that I gave Mr. A. Mr. C brings his buggy to have new tires put on. I examine the wheels and I find the rim dented between every spoke, some of the tenons also being loose, so I suggest to him to have wheels cut down the thickness of rim and have new rims put on. I got the job, took special pains with the rims and tires, and when Mr. C. came after the buggy the result was a well pleased customer, so much so, that he gave me another job on the same buggy, and that was to repaint it. This I did by sanding down gear and wheels and giving two coats lead, smoothed off the gear, gave one coat of lamp black, rubbed that with a woolen cloth, and then gave two coats of drop black, rubbing them with a woolen cloth just enough to set them down. Then I came on with a coat of gear varnish and let the job stand forty-eight hours. I then dusted off, striped and transferred the job nicely, and let stand twelve hours. Next I gave it the final finish by flowing on a coat of heavy gear finishing varnish. On the body I spread a coat of body surface with a broad putty knife, and let it stand twelve hours; then sanded down with No. 2 sand paper, gave it three coats of rough stuff, and in twelve hours cut it down to a surface. Then I took No. 0 paper and passed over it lightly, just enough to take off the dust, and then came on with one coat of lamp black and two coats drop black, and leveled down with woolen cloth. I next gave it two coats quick drying rubbing varnish, and let it stand twenty-four hours, and put on my surface with felt and pumice stone. I then striped and flowered off, and flowed on a coat of elastic finishing varnish. You would not have known the job, for Mr. C did not when he came after his buggy. I had it sitting with three others, and he could not pick his own from among them. I venture to say for him, that he never spent $19.00 more willingly. I did not agree to stripe and transfer the old job, but I did it as an advertisement.

Don't be afraid to do a dollar's better job than you promised, if you want to get the highest prices.

Never cut a job because competitors agree to do it for so much. Speak well of your competitors, make them hustle to get ahead of you, charge a handsome profit on everything you do, and when you give a customer a $1.00 cut, tell him why you can afford it. Tell him the secret of a well pleased customer, show him your willingness to please him, and you will get in return ten-fold more customers.

Prize Contest—Horseshoeing.—24.

To Shoe a Horse for a Seedy Toe.

Before describing my method of shoeing a horse with seedy toe, it may be as well to inform the farrier or shoeing smith in what consists a seedy state of the horse's toe. The wall of the foot is composed of two layers. The outer one—the hardest, the darkest and the thinnest—is secreted by the coronet. The inner layer—the softest, thickest and most light in color—is derived from the sensitive laminæ. These different kinds of horn in a healthy state unite one with the other, so that the two apparently form one substance. The junction makes a thick, elastic and strong body, whereto an iron shoe can be safely nailed, and whereon the enormous bulk of the horse's frame may with safety rest. But when overwork or disease affects the natural functions of the body, the two kinds of horn do not unite, and if the shoe be removed there will be found a vacant space between the two layers of horn. Into this space a nail or a straw may be pushed to ascertain the depth of the lesion. After the separation has taken place, the disease is easily aggravated by dirt or gravel getting into the hollow so formed. Lameness is not usually present until the disease has run to a very considerable extent upwards.

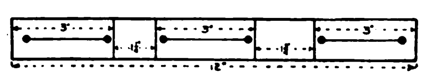


Fig. 1. BLANK LAID OUT FOR THREE LINKED SHOES.

In treatment, my first endeavor is to limit the extent of the disease, and secondly, to promote a more vigorous and healthier secretion of horn. I apply cold water bandages around the coronet to assist in keeping the horn moist and allaying fever and pain. In shoeing a foot affected with seedy toe, I pare the hoof level, and as low as possible, and get the hoof back as near to its natural shape as may be, but if there is any tenderness in the sole, it must be protected. I then make a plain, flat, broad-webbed shoe, concaved on the sole-bearing surface, the nail holes to be stamped where the foot is least affected, reset the shoe every three or four weeks, and the horse's foot will improve. I have found the scoop-toed rolling motion shoe beneficial for horses suffering from seedy toe, as it helps to take the weight off the diseased parts. In shoeing a very bad foot, the diseased portion of wall should always be relieved of weight. The cavity should be cleared out and filled with tar and tow, or, better still, with Venice turpentine and tow; then I apply a bar shoe (with leather sole), or a light steel plate in place of leather, with a view of relieving the anterior portion of the foot. The shoe must not have a clip at the toe. Horses that I have shod after the above named methods have been at work daily.

How to Make Three-Linked Shoes

LOUIS PETERSEN.

Take a piece of Norway iron $\frac{3}{4}$ by $1\frac{1}{2}$ inches and twelve inches long, and lay out as shown in Fig. 1. Punch holes and cut through the middle from hole to hole as indicated. The object of punching a round hole in a piece of work of this description is to prevent a separation of the iron beyond the hole, when spreading it apart. After having prepared the piece as shown, shape it to resemble three rings. Forge the bars of the two end shoes before separating. You then have two spaces to separate; one makes the bar of the middle shoe and the toe of the end shoe, the other space forming the two toes of the middle and the end shoes. The best way to separate them is by drilling and cold chiseling. Fig. 2 shows the work half done, while Fig. 3 is a complete job, the letters signifying the National Horse Shoers' Association. I may add that in making the three-link shoe, a good way to get a clear idea of the separating is to take

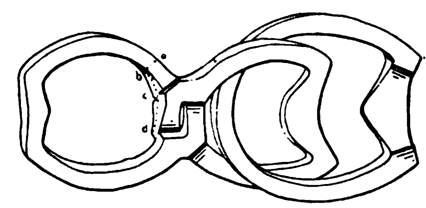


Fig. 2. SHOES PARTLY FORMED.

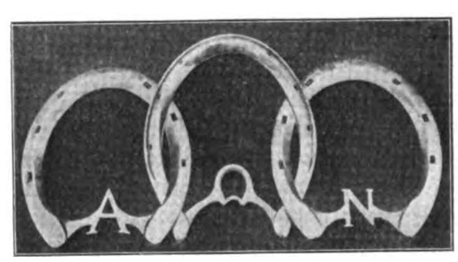


Fig. 3. THE COMPLETED SHOES.

two narrow web shoes and hinge the toes together, heat them, and pinch them together in a vise, as this will make a good pattern to work by.

Special Features of Horseshoeing.

W. Z. SMITH.

Nearly every horseshoer, I suppose, has been accused by some individual of ruining the feet of some horse. I do not believe that a horseshoer with any common sense would intentionally ruin the feet of any horse. The fault is more frequently with the owner than the shoer. The foot demands that certain laws of nature be observed, and if these laws are not complied with, there is bound to be some defect.

One fault is that too often the horse stands on a dry plank floor without any moisture whatever. I believe that this causes more contracted feet than any other thing. Contracted feet are inclined to quarter-cracks, sand-cracks, and corns. In fact, a foot in this condition is always feverish. The first thing to do is to get the fever out of the foot. In severe cases a good flaxseed poultice for two or three nights or more will be found to give great relief. Soaking the feet in cold salt water is also very beneficial, and common crude petroleum will soften and start the foot growing as quickly as anything that can be used. If the horse must be shod, a bar shoe should be used with plenty pressure on the frog. A piece of leather should be placed between the shoe and foot, covering the entire sole of the foot, and a sponge placed directly on the frog, which should be kept moist with oil or water all the time. In cutting the foot, the heel should be opened as far as possible so as to allow the frog to spread. The frog should not be cut at all except to remove loose particles, and the old frog when it sheds.

I desire to give a few cases of shoeing and foot surgery that have come under my personal observation. A customer had a road mare whose feet were very much contracted. When he brought her to the shop the first time, the heels of the front feet were nearly together, just about an inch between them (she wore a No. 3 shoe). I also noticed that the wall of the foot was full of small cracks. In examining the foot, I saw that I could not prevent both feet from having quarter-cracks. I started in with the method given above, but in spite of all that I could do both feet became cracked from the bottom to the hair. Their condition was due entirely to standing on a plank floor, and not from faulty shoeing. I had the owner apply a flaxseed poultice every night for a week until the fever had left. I then shod the mare with bar shoes and leather pad, placing a sponge between the pad and frog which was kept moist with water all the time. Across the top of the quarter-crack, I burned a crease with a hot iron, then cleaning out the cracks, put on a small band of iron with small screws on each one. About every three weeks, I took off the shoes to clean the foot. In about six months the mare had good feet and wore a No. 4 shoe.

An old farmer had a three-year-old filly, which had caught its foot on a barb wire and cut it so badly that the foot was divided nearly like a cow's foot. It had run in the pasture for a year in this condition, and in consequence the two parts became separated and healed to a certain extent, but occasionally would break and be very sore. I hesitated to take the job, but as I could not make the foot worse, and the horse not being of any service in that condition, I decided to undertake it and do the best I could. I started in by cleaning the foot thoroughly with warm water to which I had added a quantity of carbolic acid. I then filed the rough seams, which had formed about the cut, as thin as I could without drawing blood. The inner crevice of the wound I scraped with a sharp knife. After this I put the foot into a bucket of cold salt water, and tied it to the horse and tied him in a corner, so that he could not get out of it. I let him stand so for a day. At night I put on a flaxseed meal poultice to which I added carbolic acid and turpentine. In the morning the thin horn of the foot was nearly white from the action of the poultice. I now started to devise some arrangement to get the two parts together and to hold them so. I made a band out of iron one-eighth inch by one-half inch with a hinge at the toe, a bolt and nut on one end and a hole at the other. While fitting this I had the foot held together with a large pair of tongs in the hands of my helper. This band I fastened to the inside part of the foot with four small screws, so as not to let it work out of place. Next the bolt end was passed through the hole at the other end and at the outside heel. Before tightening the band, I scraped the inside of the crack until it bled freely, then drew the two parts together. I thought best to put a shoe on the foot in order to keep it level and to guard against the breaking of the band, so I put on a bar shoe with a heavy bar and wide web. In three weeks' time the wall of the foot seemed to be making some headway towards uniting. During this time the foot was kept clean and well oiled, and during the whole time that it took to heal it, there appeared not the least fever.

In six months the outside shell had grown together and seemed to be firm, so I took off the band entirely, but kept it shod. A new difficulty appeared in the shape of a hole in the sole of the foot next to where the cut had been, and from this issued a black fluid very offensive to smell. I thoroughly cleaned it twice a day with warm water and carbolic acid and syringe for three days, then took a strip of gauze to which I had applied some calomel, and stuffed it into the hole. This dried up the matter, after which it healed up entirely. After taking care of that foot for over a year, I had a pretty fair job and a better reputation, and the horse was able to do a fair day's work. In payment I received fifty dollars. I have frequently heard it said that if a horse's foot was split up through the hair it would never grow together again, but I must say that I disagree with those who say so.

A horse with a case of gravel was brought to the shop about eight months ago. A piece of stone of the shape and size of a small lima bean became imbedded under the toe. By looking at the foot there appeared to be nothing wrong, so the horse was shod and turned away again, but in a few days it was brought back very lame. The shoe was pulled off and a small hole appeared between the wall and sole, out of which some matter issued. The inside of the foot was found to be in a very bad shape, and very sore. We had great difficulty in treating this foot on account of the distress it caused the horse. The sole of the foot was pared as thin as could be with safety, but being unable to get to the stone from the underside of the foot, I had to cut a piece out of the toe in the shape of a wedge about an inch wide at the base and two and a half inches long. After this the stone was picked out, and the wound thoroughly cleansed with a weak solution of water and carbolic acid, and dried. I had the harness maker fashion a boot out of leather, so as to fit the foot and ankle. Before putting on the boot I filled the whole cut with softened tallow and sealed it over with the same, to prevent any air or dirt getting into the wound. In a few days the soreness left and the horse was able to walk on the foot again, and in three weeks I put on a shoe with a large toe clip to cover the whole cut. I also filled the cut with cotton, saturated with tar, and kept it filled until I was sure it had healed. After being shod the horse was put to work and kept at it, and seemed not to be inconvenienced at all. In time the foot grew out and was as good as ever.

I suppose throughout the country there are daily occurrences like those described, and yet a man may shoe horses a whole lifetime, and not be able to treat cases similar to these. I therefore say that to be a successful shoer, a fair amount of knowledge of the anatomy of the horse's feet and legs is absolutely necessary.

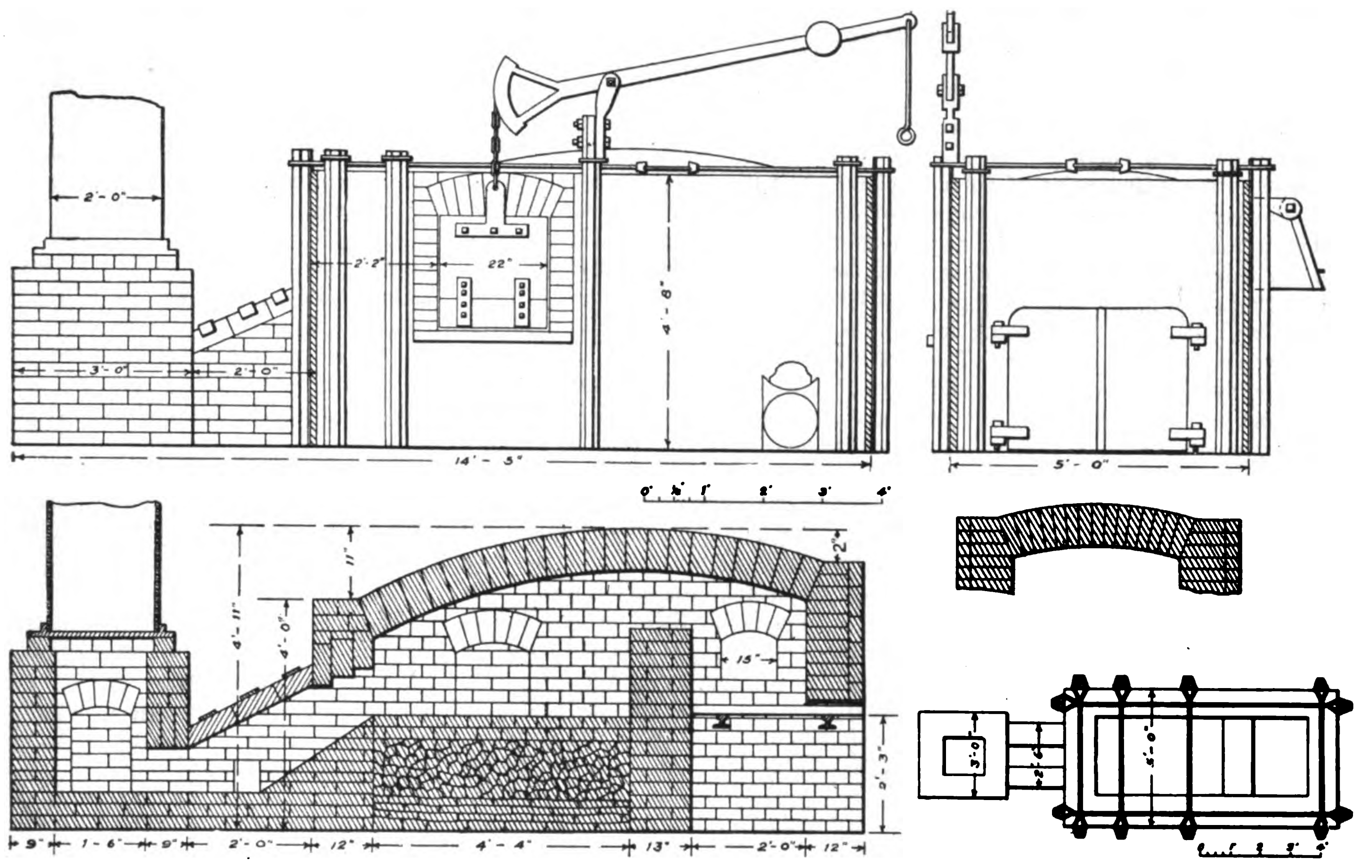
For stumbling I find that the best shoe is one with the toe well rolled up, short, heavy calk, but no toe calks, the shoe to be of good weight. A horse's gait my be altered by lowering the heels on front feet, and toes on hind feet, or vice versa. In forging or overreaching, this method will be found to be to some advantage in most cases. A heavy shoe in front, and a light one behind will also sometimes have the desired effect, or any means by which the front feet are caused to be picked up quicker than the hind feet. Interfering is best studied by seeing the horse travel and finding out what causes it to interfere. In most cases, interfering is a weakness of the animal, and in such cases it is very difficult to remedy, and more so to cure.

Details of a Heating Furnace.

Through the courtesy of Mr. John W. Carson, of the Titusville Forge Company, Titusville, Pa., we are enabled to present herewith detailed drawings and other information concerning a heating furnace, which is used in this particular case for ingots eight inches square, two such being charged at one time.

The drawings referred to show the general details of construction. The coal used is a good quality of bituminous, with an average thickness of ten or twelve inches on the grate bars, and is so fed as to be coked. The necessary draft is supplied by means of a centrifugal blower, 30 inches in diameter, running at approximately 600 revolutions per minute, while for carrying off the gases a stack 35 feet in height is employed. The heating space of the furnace is four feet square.

As to construction, the furnace is built entirely of fire brick, with cast iron plates on the outside to keep it from bulging. As thus built, the furnace may need a little repairing once in a while, such as fixing the bridge wall between the fire chamber and heating space, or repairing the jams at the door, but otherwise it will last eighteen months to two years on iron and two or three years on steel. In other words, it must be rebuilt in the neighborhood of every two years. The following estimate as to the cost of construction of this furnace will be of interest:



DETAILS OF A HEATING FURNACE. SIDE AND END ELEVATIONS, GROUND PLAN AND SECTIONS THROUGH FURNACE AND ARCH.

Fire Brick	$ 90.00
Fire Clay	10.00
Doors, Plates and Braces	60.00
Grate Bars	3.00
Chimney	20.00
Chimney Lining	40.00
Labor	50.00
Total	$273.00

Shoeing Cocked-Ankle Horses.

CHAS. L. EDICK.

My method in shoeing horses for cocked ankles is to relieve the strain on ankle. I use a shoe long enough to extend 1½ inches beyond the heel, cut the toe down all it will bear, and raise the heels of the shoe with a low toe calk. Rub the ankles with pure alcohol once or twice a day, and caution owner not to drive fast down hill.

Notes on the Manipulation of Iron and Steel in Blacksmithing Work.*—I.

GEO. F. HINKENS.

The paper assigned to me on blacksmithing, I understand, is from the popular standpoint, referring to the practical more than to the theoretical, in so far as its application to the structural and mechanical is concerned. By the structural, I mean the forgings, whether iron or steel, as applied to their various uses. By the mechanical, I mean the method of process of producing the forgings.

A close analysis of the theories and practice in reference to iron and steel, of many master mechanics and others, will reveal a vulnerable point of difference and conflict of opinion. One point must be admitted, and that is, iron and steel are indissolubly linked together. They both have a mission to perform, and go hand in hand, each doing its share correlated with the other. The trouble in many instances is a lack of understanding or disregard for the proper purposes for which each is best intended.

Steel, in my opinion, is used too often when iron would answer better and be far more reliable, from the very fact that steel will not give any warning before reaching the danger point, but will give and rend asunder without a moment's warning, thereby causing serious damage to property and often loss of life. Before I proceed further I will quote the following, entitled "Steel Fractures."

"Mysterious fractures of steel have been undergoing an examination in England, the result of which is likely to give considerable information to metallurgists as to the composition and behavior of steel. For some time there has been a growing distrust of steel as compared with wrought iron, which has of course not been dissipated by the frequent breakages of rails, axles, shafts and the like. Dr. Thomas Andrews has made some careful microscopical examinations of steel, which throw considerable light on the whole matter. The investigations were made with sections of rails and shafts which had failed mysteriously. A portion was machined from the rail or shaft; a microscopic section was prepared from it and then etched with acid to bring out its structure. The examination was made with a powerful microscope, magnifying 3,000 times or more. It was found in this way that in addition to minute blow holes and air cavities, a further very serious source of internal weakness was sulphide of iron. In steel castings this occurs generally as long thin veins running between the minute steel crystals. In large forgings which have been reheated or annealed, the sulphide often collects in little nodules, leaving fine fissures in the metal. Dr. Andrews believes that constant vibration gradually loosens the cohesion of the crystals of metal when such particles of sulphides occur, and a fracture once begun at such a microscopic flaw runs directly through the forging on the line of the least resistance, in a similar manner to the fracture of glass or ice. In a broken steel propeller shaft it was found, by means of the microscope, that there was scarcely any cohesion between a large portion of the crystals forming the physical structure of the shaft."

On the other hand, iron, with the ordinary care, can usually be detected in its course toward rupture or breakage by reason of its constitution, as I will endeavor to show. Before so doing, I will give attention to steel, as to its uses and abuses in machinery construction. Steel, in the sense as applied to machinery, is of a nature that requires more care and intelligence in its manipulation than iron. Steel is granular in its nature; the molecules and particles are differently constructed or differently situated. Now, as the molecules in steel, on account of their arrangement, affect the action of the body differently from the molecules in iron, it is of interest to investigate how far steel can, with our present knowledge, take the place of iron.

To commence with, let us remember that steel is more mercurial than iron and more sensitive with every varying degree of heat or cold; mark the word "cold." Cold often is as dangerous to steel as heat, and from this standpoint cold is, as a rule, more dangerous in steel than iron. I am referring to climatic conditions when speaking of cold in relation to steel or iron. Steel, as a rule, separates more easily its parts; and under transverse or torsional strains will divide into pieces when not treated in accordance to the principles of its formation. There are various processes in vogue for alleviating the constringency of the particles in steel, such as annealing, the Coffin toughening process, etc., which in a great measure answer their purpose. But suppose some of our engines or cars using their scientifically-treated steel should become wrecked, a contingency that is too liable to occur; in that event what will become of the annealing or Coffin process? After straightening, bending, drawing and upsetting the damaged parts in repairing, possibly some of you will subject it to the previous annealing process. Aye, but there is the rub; how are you going to do it? There is not a shop in the Northwest that is equipped for it. With our crude facilities it can only be done after a fashion. I am speaking of large irregular-shaped forgings or castings; small articles can easily be taken care of.

But let us go a little further and we will find other difficulties. Oftentimes an engine or a loaded car will be disabled on account of damage to steel forgings or castings, and it is imperative that said engine or car be immediately repaired and put into service. Under these conditions we must forego the reconstruction process in so far as annealing or the toughening process are concerned, thereby losing the essential benefits necessary to the original and, as a matter of course, necessary at all times. Here we find a case where we must conform to the method of working iron, with not any of the good resulting to iron and with much of the harm resulting to steel.

The chemical and physical constituents of steel are more easily changed than those of iron, under most conditions. Moreover, the vast varieties of steel make it more difficult to handle from the smith's standpoint. Axle steel, a grade of steel from which we might expect uniformity, is as diverse in structure as possible. Some axles, when drawn to a size that will yield in bending cold, the part drawn can be raised to a high red-heat, plunged in water, and when cold can be bent so as to form a close-laying fold. Other axles under like treatment will snap asunder like cast iron. Here we find peculiar variations in steel from which the same results are expected, steel intended for the same specific purpose—car and engine axles—yet so widely different in its physical and chemical properties. Now this phenomena is not so strange, considering that these results are from two different axles. We have demonstrated beyond a doubt in our shop that six pieces from the same axle can be changed by mechanical means to be very dissimilar in construction and appearance, and of the six pieces, only one is perfect—the piece that was properly heated, properly forged and properly cooled or annealed.

* Read before the North West Railway Club.

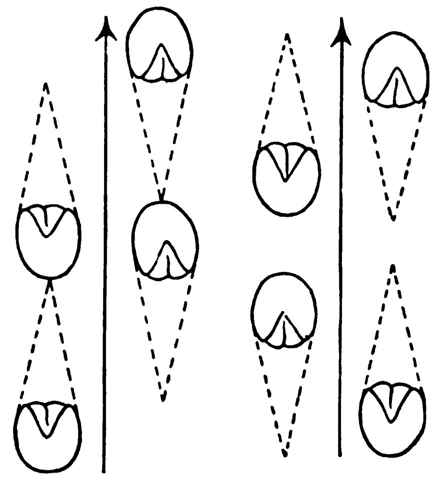
Iron, under the same conditions, will change in its chemical and physical construction far less, and therefore will be safer in proportion, the same cause showing considerably less effect on iron.

Every degree of heat, in any of its stages, registers itself for good or bad; and if we could note its changes under all of its different phases, we would find that all of its elements and composition bore an affinity more close than that of iron. Overheating, underheating, overworking and underworking, changes the structure of steel from its natural and proper position more so than in iron. We have proven this by the following results:

Six pieces were forged from the same axle. The first piece was properly heated, properly worked and properly cooled; the result was a perfect piece of steel with a nice texture. The second piece was properly worked but cooled slowly from a yellow heat; result, imperfect texture and a quality poorer. The third piece was heated at a white heat and cooled slowly from a white heat; result, a higher degree of imperfection and much coarser in texture. The fourth was burned in heating and partly restored in structure by hammering; result, a very high degree of imperfection and much coarser in texture. The fifth was burned in the fire; result, valueless for all purposes. Sixth, and last operation, was properly heated and overworked, or rather worked too cold; result, very brash, and broke very irregular, the cold hammering greatly impaired the steel and put it in a condition that blacksmiths usually term "rotten." Now these conditions will raise or lower the steel in tensile and transverse strength, and out of these six varying manipulations only one is fit to be put into service. This being so, is it not important to consider iron, versus steel, in all its bearing before putting into service?

Let us give just casual attention to what is termed the "fatal blue heat" in steel. Although our ideas may be vague and uncertain, nevertheless there seems to be some sensitive peculiar effect produced in what is called the "fatal blue heat" in wrought iron. Probably it is a movement of the particles striving to adjust themselves. Undoubtedly a partial separation of the crystals has taken place, thereby reaching the point of least cohesion due to a disturbance of the molecules.

In the magnetite or magnetic iron, such as smelted in the mines of Danemora, in Sweden, the ore is usually free from all impurities, and is almost always smelted with charcoal, which is free from sulphur. This is possibly one of the causes why it is not so dangerous at the "blue heat" as other irons containing more of the earthy impurities, commonly known as "clay ironstones," and as a consequence we find that the iron which is the purest and of high magnetic properties shows a higher average over other iron, as shown by the test pieces. The poorer the iron the more susceptible to the "blue heat," or, in other words, the poorer the iron the more dangerous to work at that heat. The danger to steel at the "fatal blue" is more pronounced than in iron, but it exists more or less in all grades of iron.



Figs. 44 and 45. GAIT DIAGRAMS OF TRUE PACERS AND LINE TROTTERS.

The peculiar feature about the "critical point" is that it occurs at a descending heat in a greater degree than at an ascending heat. This disorder should be recognized when working iron or steel, and the changing conditions noted by the workman, especially in flanging plates of mild steel and in forging steel rods and straps on account of the inside corners of angle, which part is the most vulnerable by reason that the inside corners are the points of least resistance, at least such has been my experience. In consideration of these facts it would be better not to expend any labor on steel at the "fatal blue heat."

In iron we find the danger in a lesser degree, therefore we do not consider it of so much importance as in steel. At any rate it would not be practical, in every day work, for the reason that we have no convenient means of registering the heat, only that of the eye, or by rubbing over with a wooden stick or an old tool handle.

I do not wish to go on record as an enemy to steel, but I do claim that steel should have more uniformity for its adoption for specific purposes. I also claim that there should be more diversified knowledge and experience in the treatment of steel. Our smiths must pursue an altogether different course than was ever required in working wrought iron. It is a question where they must adapt theory with practice. If this can be ascertained I shall recognize steel as more serviceable than I do at the present time.

(To be Continued.)

The Scientific Principles of Horseshoeing.—9.

Cross Firing.

E. W. PERRIN.

What is cross firing? It is a form of interfering peculiar to trotters, single footers and mixed-gaited horses. True pacers, Fig. 44, line trotters, Figs. 45 and 46, and passing-gaited trotters, Fig. 47, do not cross fire except when crowding a shaft or sometimes in being driven to a break. Cross firing consists in striking the inside heel or quarter of the front foot or shoe with the inside toe of the opposite hind foot, Fig. 48.

The causes are first, improper hitching and harnessing; second, carelessness and inexperience in riding or driving; third, some pain in the mouth resulting from an ill-fitting bridle or a bit that does not suit, or a decaying molar, causing the animal to carry the head to one side, thus throwing the locomotive apparatus out of balance; fourth, defective conformation

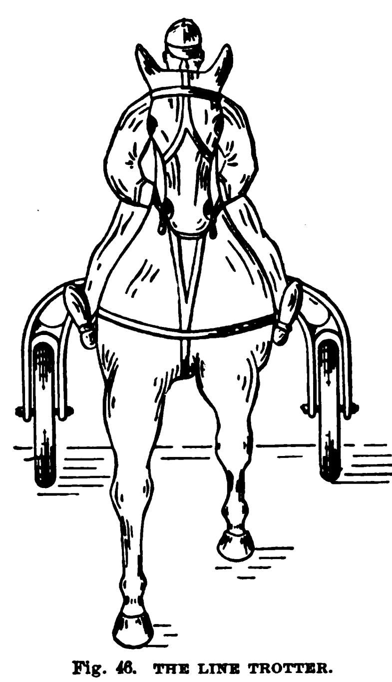


Fig. 46. THE LINE TROTTER.

of the limbs and faulty action, or an uneven stride; fifth, unbalanced feet and improper shoeing.

Under the heading of first cause, let it be understood that in order for the four limbs to move in unison the horse must go square in the harness. Anything about the harness that does not fit, or is unevenly hitched, may cause sufficient discomfort to make the animal crowd one shaft and go at a sort of "half passage." Under such circumstances the horse—especially of defective conformation—is very apt to cross fire. (See Fig. 48.)

With harness and saddle horses that only cross fire once in a while, the fault is usually to be blamed to the rider or driver; when the conformation is defective it doesn't take much to throw a horse off its balance. I have seen a trainer, who ought to have a little horse sense, push and urge a horse to speed, and then, because he breaks, give him a violent jag on the mouth. Such cruel treatment is very apt to make a horse cross fire. The reckless turning of corners at a high rate of speed is a good way to make a horse step on front foot. If, when driving or riding fast on a straight line, you suddenly turn a corner, the head and neck is pulled to one side, throwing the whole body on a curve, the power of the bridle suddenly changes the fore extremity into the new direction, but the hind quarters—not so easily controlled—continue for a stride in the old direction; such recklessness not only causes cross firing, but sometimes throws a horse entirely off his feet.

With single footers that are "coupled up short" on long legs, a little rough handling on the part of the rider will make them break, mix, cross fire, or overreach. For instance, some years back, I shod a fast single footer, and never had any trouble with him until the owner let his son ride the horse; after that I couldn't keep a shoe on his front feet. The reason was simple. Ridden at high speed in the city, to avoid collision with city traffic, the horse frequently had to come to a sudden stop. The motion in the fore legs was quickly arrested by the bridle, but the hind legs slid up under the body, causing the horse to cross fire or overreach. The only shoe I could keep on the front feet of this horse was a thin plate let into the hoof at the heels like a "Charlier" shoe, but this did not prevent the cross firing; in this case it was simply a question of horsemanship.

Therefore, in the application of a remedy for cross firing, in fact for any other trouble, the primary point is to ascertain the cause.

It may be your horse takes an uneven stride, in which case you must find out which limb takes the shortest stride. To measure the stride, select a piece of track or soft road, take a drag, harrow or garden rake and go over a piece about 300 yards long, and wide enough for the horse to travel on, and develop, on striking your prepared road, the speed at which he hits, driving once over it. Now take an inch tape and measure the foot-prints. Having discovered the limb which takes the short stride, examine it and try to ascertain the cause of the short stride.

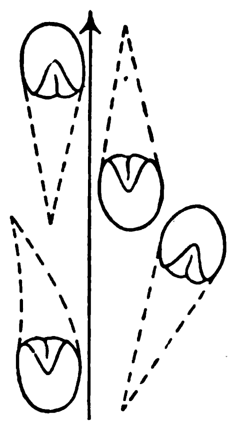


Fig. 47. DIAGRAM FROM THE PASSING-GAITED TROTTER.

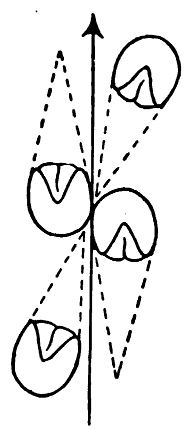


Fig. 48. DIAGRAM SHOWING CROSS-FIRING.

A trainer brought a horse to me cross-firing with one foot. He had measured the stride and found it short with the foot that was struck. He had tried weights, but to no purpose. On examination I found a quarter-crack on that foot. The fracture did not extend to the ground surface of the foot, and while there was no perceptible lameness, there was some tenderness on that side of the foot, which I concluded to be the cause of the short stride. I advised the owner to put the horse out of training, in order that the crack might be treated, which was done, and when the foot was made sound—the cause removed—the cross firing ceased.

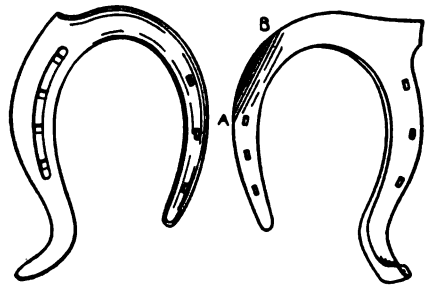
So I repeat, look well about the animal with a view to discovering the cause; don't try experiments on mere guess work; sometimes a bad case of thrush will shorten the stride in the affected limb, a corn, a cracked heel, a splint in its incipient stage or sore shins.

For instance, at the Clinton Park track about two years ago, it was a wet season, and the track was quite muddy. A large number of horses got sore heels that were difficult to heal in spite of all the care. Several horses that had sore heels in front only, began to scalp and all efforts in shoeing could not prevent it, but when the heels got well the scalping stopped. I was shoeing runners at the track that season, and I watched these cases closely, and I concluded that the sore heels materially shortened the stride of the front limbs and that was the cause of the trouble.

I need scarcely add that cross firing resulting from the above causes cannot be cured by shoeing; you must first remove the cause. Afterwards, in shaft crowding, rig a spring pole to the shaft the animal crowds, which will oblige him to travel straight.

A short stride may result from an uneven or improperly prepared hoof, want of muscular development in the particular limb or shoes that do not suit or are improperly fitted. If the stride of one limb be short, and the foot apparently sound, take particular notice how the old shoes are worn. If that shoe is worn thin on one side, or if the outside toe or quarter be rolled—worn off—that may be invariably accepted as an indication that the foot is not balanced, or that the animal wears heavy on one side, in order to save the other side that gives him some pain, and while the pain, obscure though it be, is not enough to cause lameness, yet may be sufficient to shorten the stride of that limb, enough to bring its foot in contact with a hind one. Shoe the short-stride foot with a toe-weight shoe, or screw a weight on to the hoof at the toe. Defective conformation of the hind limbs, however, may also have something to do with it. For horses of the base-wide position, use shoe Fig. 49 or 50. For the base-narrow position use shoe Fig. 51, an inside weight, thin on the outside and rolled to the outside quarter. A very light shoe with a low sharp heel calk for the secure foothold of the hind feet with a weight screwed on the outside of the hoofs, works like a charm on some horses.

In the preparation of the hoof the shoer must be guided by the individual case. The theory advanced by some, that all four toes must be of the same length and all eight heels of the same height, is erroneous. It would be just as consistent to say that all men six feet high must have feet of equal dimensions. Some horses have a blocky, upright pastern and high heels in front, and an oblique pastern with low heels behind; again some horses in a natural state carry much more hoof in front than behind. Correctly speaking the hoof is level only when the animal places the plantar surface of



Figs. 49 and 50. CROSS-FIRING SHOES FOR BASE-WIDE HORSES.

the foot flat on the ground in travelling. (See chapter on preparation of hoof in the January issue).

As to weights, it is acknowledged that weight lengthens the stride, but it also causes a horse to dwell on his stride, and in some cases of cross-firing this is to be avoided. Hence, while toe weights are a great benefit in some cases, they only aggravate the trouble in others. What is needed in some cases is to quicken the "pickup" in front, and this is best obtained with shoe, Fig. 52, heavy at the heels, light and thin and rolled up at the toe.

But since each animal has distinctive peculiarities of its own, we occasionally meet with one that upsets all accepted theories. If you have been given a fair trial, and have failed,

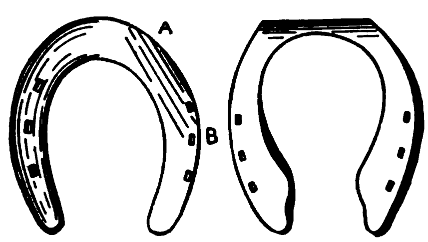


Fig. 51. CROSS-FIRING SHOE, BASE-NARROW HORSES.

Fig. 52. SHOE TO QUICKEN THE PICK-UP.

and you feel sure the case could be cured by shoeing, if you only knew how, then remove the shoes observing carefully how each old shoe is worn, and wherever the shoe is worn thin lower that part of the hoof with the rasp. If the front shoes are worn thin at the toe and scarcely any at the heels, then lower the toe of the hoof and roll it up also. Now work that horse slowly on smooth ground for a week or so without the shoes, rasp away sharp ragged edges of the wall occasionally, but on no account touch the bottom of the hoof, and take care not to work him till he is foot sore. When he has worn the ground surface of the hoofs to his natural level, take him to a track or speedway for a trial, put him to the speed and gait at which he cross-fires, and in nine cases out of ten he will go clear, provided. of course, there was enough hoof when the shoes were removed to admit of him wearing them to his own level before they become sore.

Now if your horse goes clear without shoes all you have to do is to protect the hoof by shoeing it with a very light shoe the same weight all round, and fit them accurately to the hoof, without any preparation of the hoof. If the front hoofs are long and the hind ones short, leave them so. If the hoof is rolled to the toe, outside toe or quarter bend the shoe carefully down to it. This treatment upsets the pet theory of mathematical measurements of feet, but then horses are not built to mathematical measurement like locomotives. The proof of the pudding is in the eating, and the plan of letting the horse wear his hoofs to his own level, will often prevent cross-firing when every other plan has failed.

(To be Continued.)

Queries, Answers, Notes.

Questions upon blacksmithing, horseshoeing, carriage building and allied subjects will be printed under this heading. Answers and comments are solicited from readers for insertion here also. Questioners desiring answers by mail should enclose a stamp for reply.

Dressing an Anvil. Will some one tell me the best way of dressing an anvil and tempering same? GEO. MERIDETH.

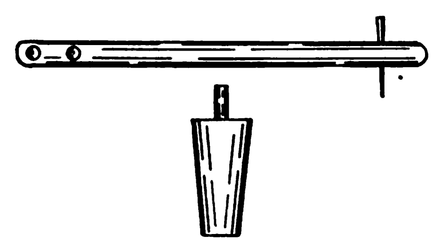
Melting Brass and Copper. I wish to know how to melt brass and copper in small quantities. Can it be done in a common forge for small journals, etc? Are there different grades of copper and brass, and if so, how can the difference be detected? Also what is the best for casting purposes? I frequently have small journals to make, but always use babbitt.
E. H. C.

In reply to the above, I would say that brass can be melted in a forge by using a graphite crucible and keeping it well covered while in the fire. The fire should be rather slow and come up well around the crucible. It is a good plan to cover the top of the melting brass with charcoal, as this will partly prevent the zinc from burning out.

There are about as many grades of brass as there are foundrys casting it, the mixture depending upon the use for which it is intended. A "red" brass contains a large amount of copper, while a yellow brass contains a larger amount of zinc and tin. The American Machinist sometime ago gave the following as about the composition of the brass used in foundrys for bearings for shafting:—32 pounds of copper, 4 pounds of zinc, 1 pound of tin and 1 pound of lead. When melting down this mixture, the copper should be melted first and the zinc, tin and lead added to the melted copper. As zinc burns when exposed to the air at a much lower temperature than copper melts, the surface of the melted copper should be well protected from the air by covering with charcoal.

A good quality of babbitt makes a most excellent bearing, and if the metal is to be melted in a forge the babbitt metal would seem preferable to the brass on account of its being much more easily handled. It is rather a difficult thing for one not used to it, to get a good brass casting.
JOHN L. BACON.

Points on Box Setting. In the April issue, Mr. Walter Williams states he would like to hear from some one as to box setting in wagon and buggy wheels. Box setting is a job often given to the helper or apprentice, but they should never be allowed to do it until the proprietor or foreman knows they can do it properly. Box setting should be done with care in order that a rig should run properly, and is just as important as the proper dish to a wheel. If in an old worn wheel, every particle of grease should be removed and sand or fine cinders put in the wheel to soak up the remaining grease. Cut pieces of burlap, or canvas, for buggy wheels, 1½ inches wide and three inches longer than the box. Put them evenly in the hub, and when enough to make the box tight, drive it in, and if not true with the wheel, true it up by wedging and cut-



ARRANGEMENT FOR TRUEING UP BOXES.

ting of the canvas or burlap that sticks out of either end. You then have a good solid job. The above rule applies to wagon boxes as well.

To true up a box, take a piece of hard wood and make it round, so it will fit the box, leaving the top end about eight inches long, and cutting it flat on one side so as to clamp on an arm. In the end of the arm bore several holes, so that you can drive a wood pin in and it will do for several sizes of wheels. By turning you can easily tell where the box is not true with the wheel. By wedging from the opposite side, your box can easily be trued up. This arrangement will be clearly understood from the figure. If the wheel is old and not true, get it on your horses and square the box with the four equal points of the wheel and you have it as good as can be.

Never use any cement, for a box can be set solidly without any cement, and there is no cement to rot the hub or get loose in time like most cement will do. McKay Bros. Co. ask what is the best cement, and my reply would be skilled labor; but if a person is bound to use cement—lime, ashes and salt mixed with water is the best. I have found best of all, however, is a clean hub, and a good job properly done by a confident man. M. SNIDER.

Contraction of the Feet. In answer to W. A. Dorsey in the May number where he asks why contraction does not affect the hind feet of a horse as it does the front, I have asked this question a great many times, and put it to good horseshoers and veterinary surgeons, but I have never got a true and satisfactory answer yet. The hind foot does not contract except in very rare cases. If it did contract then it would have the same effect as it does on the front foot, that is in proportion as the front and hind foot have a different work to do. Their contact with the earth is not the same by any means, perhaps, as near as can be correctly stated, two to three. If it is asked why the hind feet do not contract, I will explain that clearly later.

G. W. KENYON.

A Question on Sand Cracks. Will some brother horseshoer tell me how to shoe a horse that has a sand crack in front of foot? It is cracked from coronet to the bottom of hoof, so that I can press the crack almost together with my hands. I have tried a strip of iron across the crack with screws on both sides of crack with bar shoe, which helped it some.

J. W. VINES.

Mr. R. H. Sayers wants a partner who can paint and trim carriages. Address him at Elk Creek, Va.

Vulcanizing Bicycle Tires. Will some one kindly inform me in the next issue how to vulcanize rubber bicycle tires? I have tried it by melting rubber in a ladle and pouring it on hot, but when I poured it would not harden. I also tried it by melting and letting it drop on and that would not harden it. I next tried it with powdered sulphur, which hardened it but not enough.

JOHN R. THOMPSON.

In vulcanizing rubber it is necessary to have the rubber at a high enough temperature to melt the sulphur, viz., 240° Fahrenheit. Raise the heat to say 270° or 280°, add powdered sulphur, apply, and at the end of an hour complete vulcanization should take place.—[ED.]

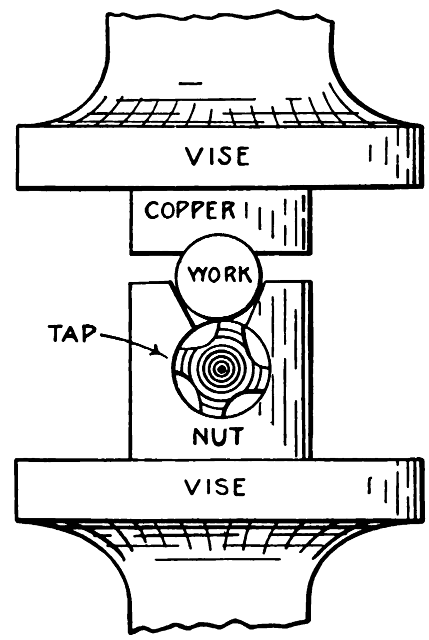
Tempering Drills. Will some one tell me how to temper drills so they will bore or cut chilled castings and what to use in tempering them?

G. R. YORK.

Spreading the Foot. I wish to say that I do not agree with Prize Contest Article No 9 on Spreading the Foot, in which it is claimed that the top of the foot being soft will go together when it is spread at the bottom. I have been a horseshoer for a great many years and I have never seen a contracted hoof which could not be cured by proper and regular shoeing I always work on the principle of spreading the foot. The way I shoe a horse's foot is by making my shoe too wide to be nailed on nicely. Beginning at the toe, I start driving the nails, and then raising the shoe on the opposite side, drive the nail until it starts to come out, and so on until all the nails are started. Now begin at the toe and drive the nails in firm, first on one side and then on the other until they are all in. This will spread the foot at the bottom, and being soft and pliable at the top, it will spread the bottom which relieves the coffin joint, which is the seat of all lameness in contracted feet. It must be understood, however, that some judgment must be used in paring the foot. Ordinarily a contracted foot is high on the heel. Pare the foot as much as it will allow, especially at the heel, put on the shoe without either toe or calk and let the frog of the foot be below the shoe, so that when he steps the pressure will be on the frog. In case the frog is gone, I then use a bar shoe This method of shoeing contracted feet, I have found to be effective in many cases.

H. G. MASON.

Cutting Left Hand Threads. Mr. C. C. Wheat asked in the June issue how to cut a left hand thread with a right hand tap. I will give my method. Take a right hand tap of the desired number of threads and run into a nut hard and fast. Then take it out of the nut, and cut a V in the nut so that one edge of the tap will stick into the V far enough to cut a full thread on the bolt The larger the bolt the larger must the V be cut. Put the tap back into the nut with edge projecting into the V and turn upside down in vise with a piece of copper or other soft metal against the other vise jaw with the work between. Turn the work toward the left and you will get your left hand thread. Care must be taken not to let edge of tap stick too deep into the V,



CUTTING A LEFT-HAND THREAD.

as in that case you would break a piece out of the tap. You must have copper or metal between vise and work, so that it will not spoil the thread or work.

H. H. SANDERS.

Power in the Shop. If a man travels through the country he finds a good many shops without power, but if we can look ten years ahead we will find the things changed, with power in nearly every shop and also modern machinery.

The first thing a smith wants to get is the power, and if he thinks two horsepower is enough, he should get about four-horse power, as there will be machinery added to it which he has no idea of at the time he buys the engine. Also his trade will increase at least one-third, because it is attractive, and some customers will come a long distance just to see the machinery, while orders will come on account of getting the work done quicker and better than it can possibly be done by hand. I am able to prove this by experience. Before I had the power I worked alone. When I had a plow to sharpen, I had the farmer hitch his team to the power and I polished his lay, then sat down and waited for the next, but today I am working two men and a boy besides myself and have all we are able to handle. I bought a four-horsepower steam engine five years ago, second-hand for $75.00. At first I only run the emery wheel, but this only lasted a short time. I kept adding machinery and am now running a lot of different machinery with my engine and soon will have to put in a larger engine. I am running emery wheel, blower, trip hammer, lathe drill, rip saw, disc sharpener, grindstone and other small machinery, also a feed grinder.

A drill is a tool that has to be in every shop, and I would advise everyone to buy a good one. Mine is a drill that will do the work for hand and power; also it has the quick return which will save the operator a great deal of time taking out drills from holes, especially when run from power. In a country where there is a great deal of plow work to be done the smith wants to put in a power hammer, as the sharpening of plow lays and cultivator shovels is hard labor, and generally comes in the hottest time of the season. With a good power hammer a smith is able to sharpen a 14-inch plow lay in from two to five heats, providing he has a good hammer. Not all power hammers will do this and I advise the brother smiths to ask W. J. Broatch Iron Company, Omaha, Neb., for information. The power hammer will save lots of other hard work. Therefore I would say, get power and put in machinery and save the hard labor.

H. FELHUS.

Hydraulic or Hand Punch. Will some one please tell the best way to make a good serviceable hydraulic or hand punch?

GEO. F. WILSON.

A Discussion on Plow Work. I will endeavor to give my idea of putting on new plow lays. First, I wish to offer a little amendment to the plan of Mr. A. Bruton in the May number. As Mr. Bruton begins with his lay first, I begin with my short landside. I first fit my landside by hammering to the proper shape and then file out notch for point of the moldboard, allowing from one-fourth to one-half inch of landside to drop below bar of plow to make it the same as it was when new. The next thing is to drill the hole with a little draw, so as to draw it tight to landside plate. Then I fit my lay to all braces and landside, drill holes and bolt on. If the bar will come loose easily from beam and moldboard, I take it off together. The point is all sharpened before I bolt on. Next proceed to weld as far back as frog of plow. Then take apart and weld heel or shin, after which take a light heat again on heel and your lays will never rip open any more than a factory lay.

If I cannot get bar of plow off from moldboard easily, I leave the part of lay up from short landside enough to insert tongue of an Ideal plow clamp. Then I unbolt lay and landside and weld heel first. By so doing there is no fitting to be done after the lay is welded. I think Mr. Bruton or any other brother smith will find this way safest and best.

I would like to ask a question in this connection. As I am in a locality where plows and all tilling tools must be very hard to scour, I bought a can of Dimond Hardening Compound some years ago, and I have been obliged to keep putting salt in to make it harden well. Now I would like to hear from some good plow man, whether or not soft water and salt alone would not be as well. I know of some smiths who use nothing else.

WILLIAM BALDWIN.

Toe Rolling. Will some brother of the craft explain all about toe rolling? Is the shoe level, or turned up a little at the toe, or what is meant by rolling?

G. G. E.

Using Wet Coal. In reply to Mr. Holmstrom's statement in the April issue on making fires with a hand power blast, that wet coal cannot be used very well on account of explosions, I will say that I use a 40-inch bellows. I have a box that holds one hundred pounds of coal which I fill up every morning, and pour water on until it is over the coal. I dip the coal out of the water with a scoop to make the fire, and when it begins to get dry I sprinkle well and keep packed down around the fire. I keep the coal and forge wet all the time, and I have never had a bellows explode yet. When I leave the fire for a few minutes I round up the coal and run a poker down under it to the bottom to open up a little, and there is no danger.

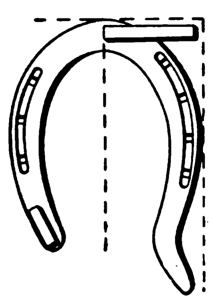
I have two forges in my shop. I am in a country town that has no railroad, but I get more work than I can do, and hope all the craft is fixed the same way.

A. T. WRIGHT.

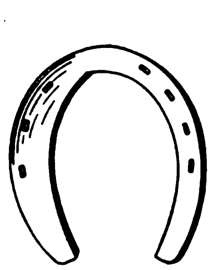
What is the Best Shoe. I have a horse weighing about 1300 pounds which is a first class horse, but his left front foot bothers him when he is driven on the road. He is lame in the coffin joint and he has been blistered three times, but after he is roaded a while he gets lame again.

Now I think if I were to get him a pair of rubber shoes he would be all right. Will some brother smiths give me their advice as to the best make of a shoe for this horse? E. H. DEAGLE.

Shoeing a Knee-Knocking Horse. In answer to G. M. Goudey in the May issue as to how to shoe a horse that strikes his knee, cannon bone and ankles, would say that the shoe, as per sketch herewith, has given me the greatest satisfaction, and I would recommend the same to every shoer for that trouble. In making this shoe, be sure and set the toe calk from the center of the toe of the shoe to the outside, and extend it well out. C. W. BRAUND.



SHOE FOR KNEE-KNOCKING (BRAUND.)



SHOE FOR KNEE-CUTTING (CAREY).

How to Shoe a Knee-Cutting Horse. The way I shoe ankle, shin or knee-hitting horses is to make shoes two-thirds heavier on the inside than on the outside. If he toes out, lower the outside of hoofs a little. I have never failed to stop interfering in front in this way.

D. E. CAREY.

A Reply on the Tire-Setting Question. Kindly allow me space to make some corrections in reply to Mr. Albert Schuetz's views on tire setting in the June issue. In the first place, I did not say in my letter, printed in the April issue, that the spokes were loose in the hub. I stated that they were loose in the felloe, and I would suggest that the gentleman put on his glasses and look again, when he will find that I never mentioned hub at all.

From what Mr. Schuetz says about tire-setting being all guesswork, it seems to me that he should have someone to help him out, for I have been setting tires for twenty years and don't think my trade would have lasted very long if I had been setting them by guess work all this time.

I wish to add that far from being prejudiced against modern methods, I keep in touch with all the latest ideas. I came to see Mr. Schuetz's article because I was reading THE AMERICAN BLACKSMITH.

The gentleman is not quite satisfied with the speed I spoke about, but I still contend that I can put on as many new wagon tires or more than he can with his machine, each of us having one helper.

W. L. GREEN.

Filling Patent Hubs. I wish to thank my brother craftsmen for the many answers to my question on filling patent buggy hubs. I will try some, if not all, and see which is best. I have tried to fill them and they seemed to be all right in every respect, but would not give good satisfaction. I know of old and tried workmen who do the same and with the same result. This is the reason I asked the question and it seems to be the best way of getting information of any kind.

I must say I do not know of any way of cutting a left hand thread with a right hand die, as asked by C. C. Wheat in the June number. If there is such a thing, I would like to know it myself, but I think he would have to cut it with his left hand and then it would be a right hand thread.

A. BRUTON.

A Question on Shoeing. Will some brother smith tell me how to shoe a three-year-old colt that drags it feet on the ground? I am breaking in a Hambletonian mare and when she trots she kicks up dust with her hind feet and wears off her feet. E. D. PASEK.

Setting Axles. Will some one give me the direct measure for setting Axles?

R. G. PARSON.

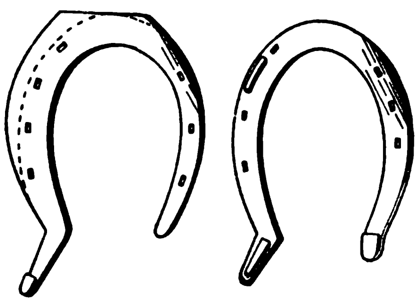
Mr. Kenyon Takes Exception. I must say that I am surprised when I read Charles McNaught's practice on shoeing, after working since 1866. I do not wish to say anything unkind, or use any harsh words, but his theory on shoeing is too old, his kind of treatment has been in practice for at least seventy-five years by a great many shoers. To-day the best shoers and the up-to-date veterinarians are giving it up. We cannot go back on medical science. Years ago the smith that could do the most shoeing got the most pay. To-day the shoer that can do the most scientific work can get the most pay.

Now in regard to corns, there are no corns. I will give any man $100 who will show me a corn in a horse's foot. We formerly heard people say "That horse is so lâme he is graveled." You won't hear a man who is up with the times say that now.

I saw where one brother uses brown sugar for corns. O, my friend, what an idea! But I think I understand that all right. I think that man belongs to the sugar trust. Did you read the article by John A. Green and one by L. F. Bennett in the December number? Then in the April number an article, Prize Contest, Horseshoeing—9. Then again what about E. W. Perrin's work? What are you going to do with all of this science, and successful shoeing? I will tell you, that a foot should be pared level. Cut the heel the same as the toe. Then the shoe should be put on to rest the same on the heel as the toe. The frog should come to the ground; nature says so, and so says science. A shoe should never have a calk on unless it is actually necessary. Furthermore a foot should never have a shoe on unless it is actually necessary. "Horseshoeing is a necessary evil," Robert Bonner has said. When a horse is shod and shod right it will be just as near barefooted as possible. Shoers are not to blame altogether for the lame horses in the country. They shoe too many times to the order of their customers, but there is no reason in this day and age of the world why we cannot understand the nature of the foot and the correct way they should be shod. Then we can advocate the right, even if we cannot always practice it.

G. W. KENYON.

Cross-Firing Horses. If I had to train a pacer that cross-fired, I would first lower the inside toes of his hind feet, and shoe him with a plain hind shoe with a light toe calk on the outside toe, and a little roll on the inside toe, turn out the outside heel as per sketch with calks welded on. A



SHOES FOR CROSS-FIRING HORSES.

chronic cross-firer almost always breaks over on the outside point of the hind toe, hence it will be seen that some obstacle must be placed there to cause him to break over in the center of his toe and carry a straight line of action. D. E. CAREY.

The Phenomenon of Hardening. As Mr. Crowe has brought the point of recalescence into question, and as he does not seem to understand it from the hardener's viewpoint, a few words in correction and also in my own defence will no doubt be timely. The authority whom I will cite for much that follows is Mr. Sau and to my knowledge his correctness on this subject has never been disputed.

Many of the mechanical papers have used the term recalescence in the same sense that I did, to represent the completing point of the hardening zone. It is recognized by all that it is a misapplication of the term, but it is used for the want of a better one. Calescence comes from the same root as caloric, meaning heat, and therefore recalescence signifies reheating. Speaking technically, there is no such thing as recalescence during the heating process, and it only occurs during the descending grade or in other words while cooling down. The hardener is not much concerned about this point, but it is of value to the steelmaker, for in casting ingots in solid moulds, particularly in large sizes, he has to count on stripping off his molds before the metal reaches the point of recalescence. At this particular stage in the process of cooling the steel will expand so much that the mold very often cannot be stripped without a great deal of trouble. In heating a piece of steel between the range of incipient red and a medium orange color, there are points where the rise of temperature is retarded or completely arrested, and it is claimed that expansion is checked and sometimes actually reversed; then after each retardation the regular rise of temperature is resumed. In high carbon steel there are three different points where the rise in temperature is retarded. These are called critical points, and their location in the range serves the purpose of dividing the range into zones. Each zone begins with a retardation and is completed with an evolution of heat. This evolution of heat causes the piece to increase very rapidly in temperature, and is then followed by another retardation The critical point which the hardener is interested in, is termed the hardening zone, and is the most prominent and constant point in the range. Various notations have been adopted to designate these critical points, viz.: Ac. 1, the completing point of the hardening zone; Ar. 1, the point of recalescence, the critical point in heating. Then again, others use W for the completing point of the hardening zone; V for recalescence or the cooling critical point; X for the melting point. In locating the proper hardening heat I believe Mr. Crowe has mistaken Ar. 1 for Ac. 1, for he is perfectly silent in regard to quenching from the ascending grade which is undisputably the proper hardening heat. It is true that nearly the same hardness can be obtained by quenching from either the descending or ascending heat, but the latter is conceded to be the better practice. The soft spots which Mr. Crowe mentions prove to the hardener that he has overrun the heat conducting power of the steel, or he has quenched before the completing point of the hardening zone, He can quickly detect these soft spots or streaks without even testing with a file, for the outline of the hardening curves are left on the surface. Poor steel will frequently harden in spots and steel with a glazed surface or a piece where the skin has not been entirely removed will act in the same manner.

I kindly thank Mr. Crowe for informing me of my secret process, for I was not aware of it, and if such is the fact, the credit rightfully belongs to a Pittsburg firm whom I served under. I am always willing to learn, and would like to practically test a few of Mr. Crowe's theories with him on such tools as end mills, angular and side milling cutters, boiler-maker's chisels, rivet sets, etc.

I am fully aware that steel has been hardened a large number of times, but how long would these pieces last if put into service? I venture to say that if used for a chisel it would break the first two or three blows. There has never been a time when tools were tested as they are today, and if any part of the tool is in a strain from poor treatment, we will soon have a worthless tool, so it will not do to risk too many hardenings.

Please favor us with the name of the firm who is making steel that would be suitable for large drop hammer dies, large mills, etc., that will give the requisite hardness when quenched in oil, for there has been nothing like it in the past.

H. W. RUSHMER.

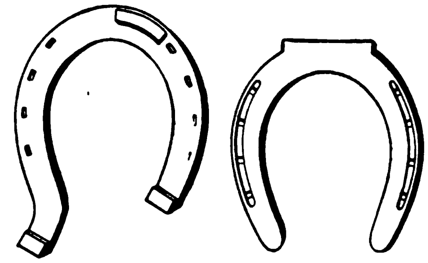
Editor American Blacksmith:

After sixty-four years of experience as a practical farrier, I assert that there is but one successful way for shoeing and curing contracted feet, which is to free the bottom and open the top, as a contracted hoof is bound up around the coronary band.

There can be no rule given for shoeing two speed horses alike, as there are scarcely any two formed or gaited alike. It is well known that no piece of machinery can last long unless it is plumb and well-balanced, and it is the same with a horse's foot and leg. They must set plumb and level or trouble will ensue. Balance the body and the feet and every joint will work properly. PROF. WM. RUSSELL.

Interfering Horses. As to interfering horses, I have tried almost every way that has been shown in THE AMERICAN BLACKSMITH and have found that what will prevent one will cause another to strike. However, I have a method that has accomplished the result all right in every case thus far. It is simply to make the shoe to fit the foot, as in any case of plain shoeing. Then level the hoof, turn the outside heel out a little and put your toe calk in at the first nail hole. The inside heel should only be flush. This will cause the horse to break over in a way that will throw the foot out. I should like to have some brother smiths try it, and let me know the result. The shoe is shown by the cut.

A. W. DUBOIS.



SHOE FOR INTERFERING (DUBOIS.) SHOE FOR KNEE-KNOCKING (NEIGHBORS.)

A Shoe to Prevent Knee-Knocking. The shoe which is shown here will, I think, keep any horse from knee-knocking, and anyone who tries it will be convinced. Make the shoe the size of the foot and weld a piece on the toe, as shown. The shoe is to be square in front, and the toe can be brought to correspond by proper paring, in several shoeings, if not the first time. It does not make the foot shorter to draw the shoe back and rasp off the hoof.

A shoe gets loose because the nails do not fit tight in the hole of the shoe, or in other words, the holes are made too long.

ISAAC NEIGHBORS.

Welding Steel Axles. In answer to W. R. Waller & Son about welding steel axles, I have a good many to weld and I use the split and wedge style. Split one end and shape the other like a wedge. Cut a few places with the pene of hammer on the wedge and let it cool while getting the split end ready. Of course I bevel the end of the split, then squeeze split over the wedge hot. The wedge being cold and the split end hot it mashes in the notches or lumps on the wedge. It is then easier to get an even heat on both pieces at once. I use common borax; it gives better results for me than anything I ever used. I take a light heat and force all together on anvil before using any borax at all, if I can avoid it. Then I take a second heat as hot as it will stand with borax and so on until finished. I never missed a good clean job in this way. A. BRUTON.

Repairing Sarven Wheels. I have read with interest the articles on filling and repairing wheels, and will endeavor to give some of my ideas.

In the first place it is just and also good business policy to work for your employers' or customers' interest, as well as your own. Consequently when any of my customers want a job of any kind done, and I think the expense will be more than the benefit they will derive from it, I tell them that it will be profitable for me but not for them to have it done that way. Now nine times out of ten if a patent wheel has to have more than three or four new spokes, the felloe and tire will be pretty poor too.

Our price here is 15 cents each for Sarven spokes, or 12 cents where quite a number are put in the same wheel. Sixteen spokes at 12 cents is $1.92, and setting the tire, 40 cents, making $2.32, or with new felloe, 80 cents more, and new tire the same; $3.92 for making a new wheel on an old hub. Now I will furnish a new wheel and set the box ready to put on the vehicle, seven-eighths-inch tire, for $1.75 to $2.75 according to quality. While I claim to do pretty good work, I don't think I can fill an old wheel and make it better than new. Consequently when the repair bill on an old Sarven wheel is more than $2.00 it rarely pays to fix it. Everyone knows that Sarven wheels of same size spoke look very near alike. I usually have a lot of old wheels, many of which will have every spoke sound clear to the tenon or felloe. About 50 cents worth of work, changing the box in the hub and cutting new tenons on the outer end of the spokes, will often make such a wheel as good as one or two dollars worth of new spokes in the old hub; also as your customer will see that you are trying to serve him, and not merely trying to get a big bill out of him, he will come again.

When a new spoke is put in a Sarven wheel, none but a careful mechanic will make it as good as before; and when a rivet and spoke is taken out and replaced by a new rivet and spoke for 15 cents, it is not profitable to fool around three quarters of an hour to heat up a glue pot to glue the spoke in. I find the most of wagon makers around here put them in without glue. I obviate that difficulty by using LePages liquid glue which is always ready. J. K. RIBLET.

Tempering Brass Springs. J. W. W. calls for a method of tempering brass springs. I do not think there is one. Brass can only be hardened by drawing, rolling or hammering. Coil springs are made in a lathe on a mandrel. There is a quality of metal called spring brass, which, for many purposes, make good springs.

H. N. POPE.

Corns and Their Treatment. From a close observation extending over fifty-one years of uninterrupted shoeing, I shall like to take exception to some statements in preceding issues. Corns are very seldom formed in a contracted hoof, but almost universally in feet with low heels. There are two kinds or stages—the red or bloody corn and the soft corns, the latter being less prevalent than the former. The cure that I have used for twenty years is the same, although it takes more time and care to heal up the soft corn. Pus occurs only in the soft corn; they are found only in very low heels and usually on the inside quarter of the front feet. The bloody corn is found in feet that are tender or thin in the heel; they are often found in feet that are rather hollow. The cure that I have discovered and used successfully for several years is this: If the foot is tender, I hunt for corns, and if found, I cut them or scrape them out clean the first time, then I use a heavy web shoe, rather broad at heel, so as to rest on the hoof and protect the bar, in both the soft and red corns. Then I put some castor oil in the cavity, and have the owner put some oil in two or three times for one week. Except in very bad cases, two shoeings and cleaning will make a perfect cure. I never had a horse leave my shop lame when I give this treatment. So far as the bar shoe is concerned, I never found any use for them. They are unnatural. JOHN HOVIS.

Prices Current — Blacksmith Supplies.

The following quotations are from dealers' stock, Buffalo, N. Y., June 28, 1902, and are subject to change. No change has occurred since last month's quotations which we repeat below.

All prices, except on the bolts and nuts, are per hundred pounds. On bars and flats prices are in bundle lots.

Bars—Common Iron and Soft Steel.

¼ in., round or square;	Iron,	$3.10;	Steel,	$2.90
⅜ in., " "	"	2.70	"	2.70
½ in., " "	"	2.50	"	2.40

Flats—Bar and Band.

¼ x 1 in.,	Iron	$2.50;	Steel	$2.40
¼ x 1½ in.,	"	2.40;	"	2.40
3-16 x 1½ in.,	"	2.60;	"	2.60

Norway and Swedish Iron.

¼ in., round or square	$4.90
⅜ in., " "	4.50
½ in., " "	4.30
¼ x 1 in.	4.30
¼ x 1½ in	4.20

Horseshoe Iron.

For No. 1 shoe, ⅜ x ½ in	$3.40
For No. 2 shoe, ½ x ⅝ in	3.00
For No. 3 shoe, ⅝ x ¾ in	2.90
For No. 4 shoe, ⅝ x ⅞ in	2.90

Toe Calk Steel.

½ x ⅜ in. and larger	$3.50

Spring Steel.

⅝ to 1½ in. Rounds,	Op. Hearth	$4.00,	Crucible	$6.00
1¼ to 6 in. by No. 4 gauge to ½ in. Flats	"	4.00	"	6.00

WANTED AND FOR SALE.

Want and for sale advertisements, situations and help wanted, articles new or second-hand, and business opportunities, will be inserted under this head. The rate is twenty-five cents a line. Send cash with order. No insertions of less than two lines accepted. All answers to advertisements received at this office will be forwarded to their proper destination.

FOR SALE—A good blacksmith shop. For further information, apply to **R. A. MEYER, Janesville, Wis.**

FOR SALE.—Blacksmith and wagon shop, house and lot. Good location, doing good cash business. **S. E. HARWOOD, Maquon, Ill.**

FOR SALE — CHEAP.—Two hand-colored tempering charts explaining plain and scientific tempering in oil, water or tallow. Tells what each color will stand. Also 40 new steel working receipts, including machine and plow work, with 5 fine steel welding compound receipts, enabling you to weld all the different kinds of steel made. Also tells how to work self-hardening and the new imported French steel. All for one dollar. Send for samples free. **W. M TOY, Sidney, Ohio.**

D. S. Quigley, C. C. C. & St. Louis Railway Company, Wabash, Indiana, is in need of a first-class railroad smith, rate twenty-seven cents per hour.

Samuel M. Nicholson, president and general manager of the Nicholson File Company, Providence, R. I., has been chosen a president of the American Screw Company.

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SPEEDIEST and HANDIEST.

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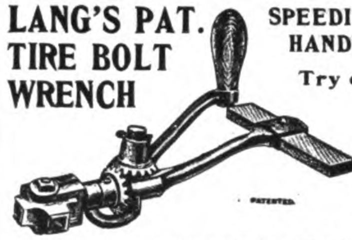

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For sale by all heavy hardware dealers, or will be sent by Express prepaid, upon receipt of $1.25.

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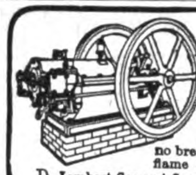

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FAR SUPERIOR TO COMMON BORAX.

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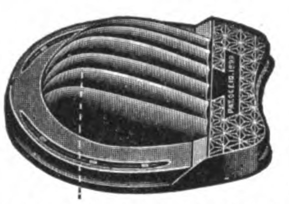

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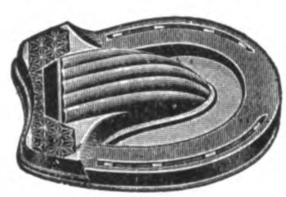

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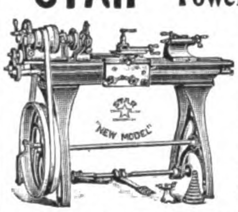

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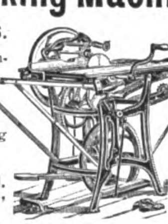

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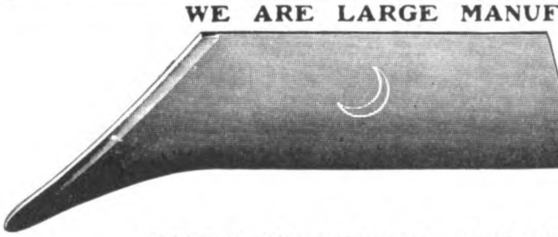

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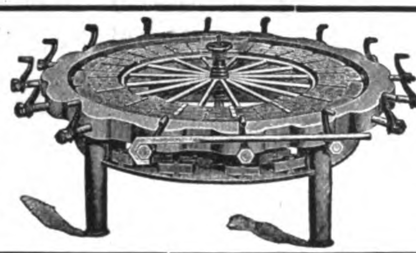

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READ A LETTER FROM THE OTHER SIDE OF THE WORLD.

BALAKLAVA, AUSTRALIA,
April 17, 1902.

MESSRS. NORMAN & Co.,
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The Henderson Hand Power Tire Setter that I purchased from you has given me great satisfaction in every way, as it does all that is claimed for it, and I would not be without it on any account. It has considerably increased my business and has brought me work, that without it, would have gone elsewhere. It not only sets the tires of wheels without dishing them but it takes the dish out of wheels tired by the old process. I have not had a single complaint, although I have, during the past season, tired some hundreds of wheels. It does the work in a fraction of time occupied by the old process and does it thoroughly. Yours truly,

W. H. GRIGGS.

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But WE say not and will prove it. You admit that you occasionally break a casting, a gear tooth, lever arm, or frame. You admit that when it is broken it is useless and you have to throw it away. You also admit that sometimes you have to wait weeks to get a new one.

But you don't admit that it can be mended and made as good as new by brazing the broken parts together. If you will send to us a broken casting of any kind or description, we will braze it and make it as good as new. We only charge shop rates of 75c per hour and will return your casting to you in a few hours if it is a "rush" job.

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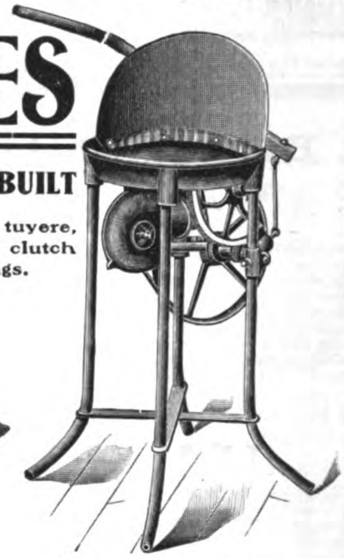

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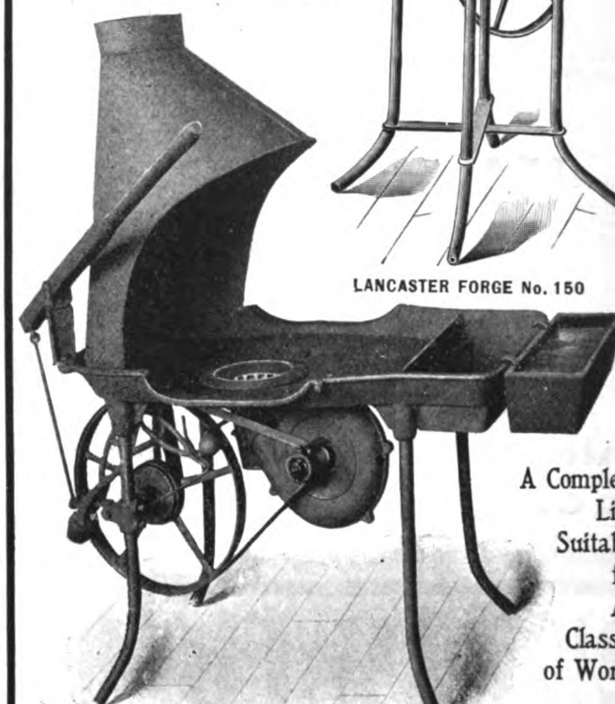

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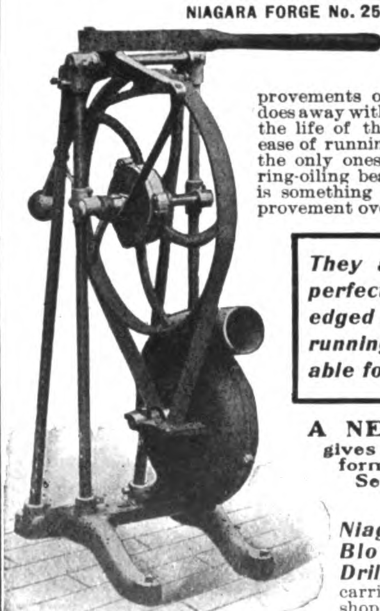

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Office, Buffalo, N. Y., U. S. A.
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Lathes and Drill Presses

Especially for Blacksmiths and Machinists, also Hand and Power Planers and Shapers and Machinists' Supplies.
Catalogue M.

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ESTABLISHED 1824.

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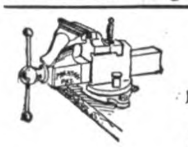

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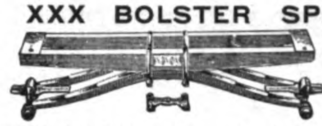

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CHEAP
Strong in every part

In 5 minutes changes a farm wagon into a spring wagon

BELLE CITY BOLSTER SPRING CO.
1601 RACINE ST., RACINE, WISCONSIN

ENGINES for BLACKSMITHS

Plain Vertical Engines, 3 to 50 H. P.
Plain Horizontal " 10 to 150 "
Simple, Strong, Efficient, Cheap.
Hoisting Engines, Machine Tools, Wood Working Machinery.
Write for Catalogue B.

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1233 Real Estate Trust Bldg.
PHILADELPHIA, PA.

MODERN BLACKSMITHING,

Rational Horseshoeing
AND
Wagon-Making.

With Rules, Tables and Recipes.

A necessity for blacksmiths, horse-shoers, wagon-makers, mechanics and apprentices.

$1.00 post-paid.

AMERICAN BLACKSMITH CO.
P. O. Drawer 974, Buffalo, N. Y.

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Blacksmiths' and Carriage Makers' Supplies.

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Every Drill guaranteed perfect.

ONE EACH $\frac{1}{16}$, $\frac{3}{32}$, $\frac{1}{8}$, $\frac{5}{32}$, $\frac{3}{16}$, $\frac{7}{32}$, $\frac{1}{4}$, $\frac{5}{16}$, $\frac{3}{8}$
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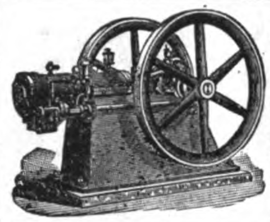

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5 to 60 H.P., Inclusive
The only cheap and convenient power for Blacksmiths.
Send for catalogue 33.
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$25.00 Daily Profit. Boy makes 25 Wagon Sleigh Bolsters a day. About $2.00 profit on each. Doubles the value and life of wagon and man. Adjusts to wide and narrow boxes. Every Wagon owner buys them. Wagon factories use them. For sale cheap by wholesale and retail hardware stores, blacksmiths, etc. Send for circulars, prices, samples.

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IN THE WHITE,
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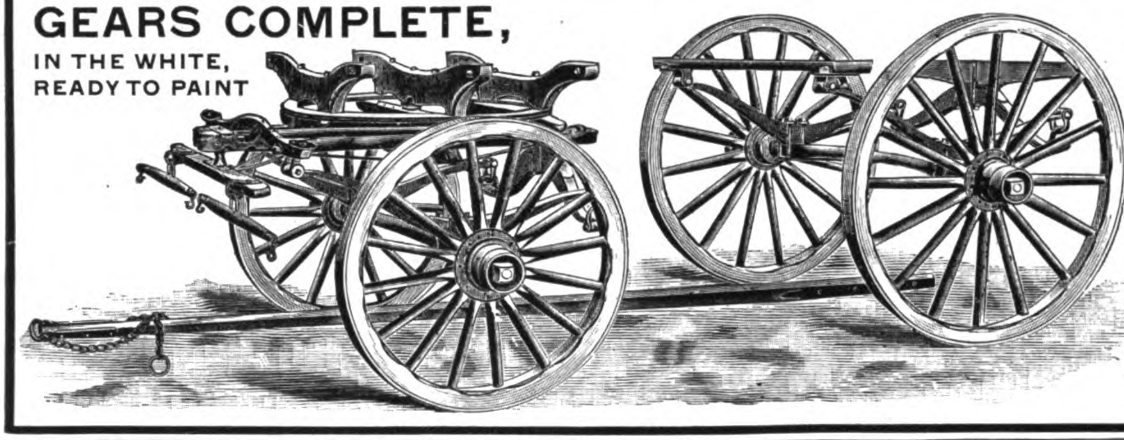

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Delivery Wagons
ALSO FOR
Ice, Brewery and Transfer Wagons

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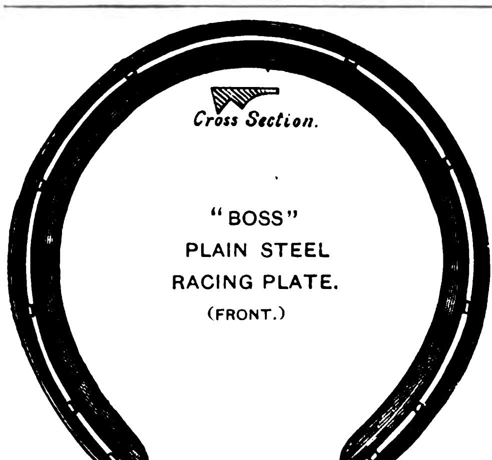
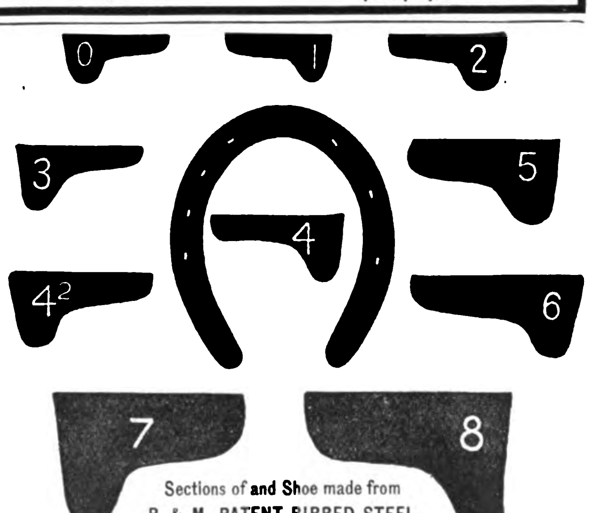
In writing for prices give full specifications and description of what is wanted, so as to enable us to make prompt quotations.



PRICE, PER SET, POSTPAID, 75 CENTS.

SPECIALTIES
of the
BRYDEN HORSE SHOE COMPANY
CATASAUQUA, PA.,
are
Racing, Training and Trotting Plates, Racing Plate Steel in the bar, and B. & M. Ribbed Steel.

Send for Latest Catalogue.



Sections of and Shoe made from
B. & M. PATENT RIBBED STEEL.

VOLUME I | NUMBER II

THE AMERICAN BLACKSMITH

BUFFALO, N.Y. U.S.A.

A PRACTICAL JOURNAL OF BLACKSMITHING.

AUGUST 1902

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HANCOCK 4 to 25 Horse Power
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The most practical and durable Trip Hammer ever offered to the trade. Useful for sharpening plow shares. Takes place of helper for all kinds of forging and striking on tools, as Flatters, Set-Hammers, Chisels, Punches, Swages. Also for sharpening Horseshoe Calks, etc. Cut shows Hammer ready for work, and also set back out of way.

ONE MAN DOES THE WORK OF TWO.

Write for price, descriptive circular and testimonials.

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To Owners of Gasoline Engines, Automobiles, Launches, Etc.

The Auto-Sparker

does away entirely with all starting and running batteries, their annoyance and expense. No belt—no switch—no batteries. Can be attached to any engine now using batteries. Fully guaranteed.

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Apple Economical Gas Engine Igniters

ARE POSITIVELY THE BEST BUILT FOR

STATIONARY, AUTOMOBILE AND MARINE **GAS ENGINES** EITHER TOUCH OR JUMP SPARK SYSTEM

We are the Leaders in the Manufacture of

IGNITING DYNAMOS, COILS AND PLUGS, MAGNETOS, GOVERNORS, ETC.

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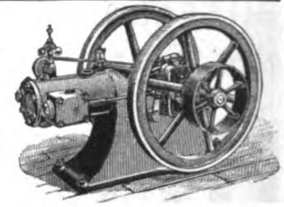
GAS AND GASOLINE ENGINES.



Our engines will bear comparison with the best in their class, and are well known for their durability, simplicity and ease of operation. A big feature is our MAGNETO GENERATOR, geared direct to the engine, doing away with batteries and hot tubes.

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Use "The Western" and Judgment, Saving Time and Money.

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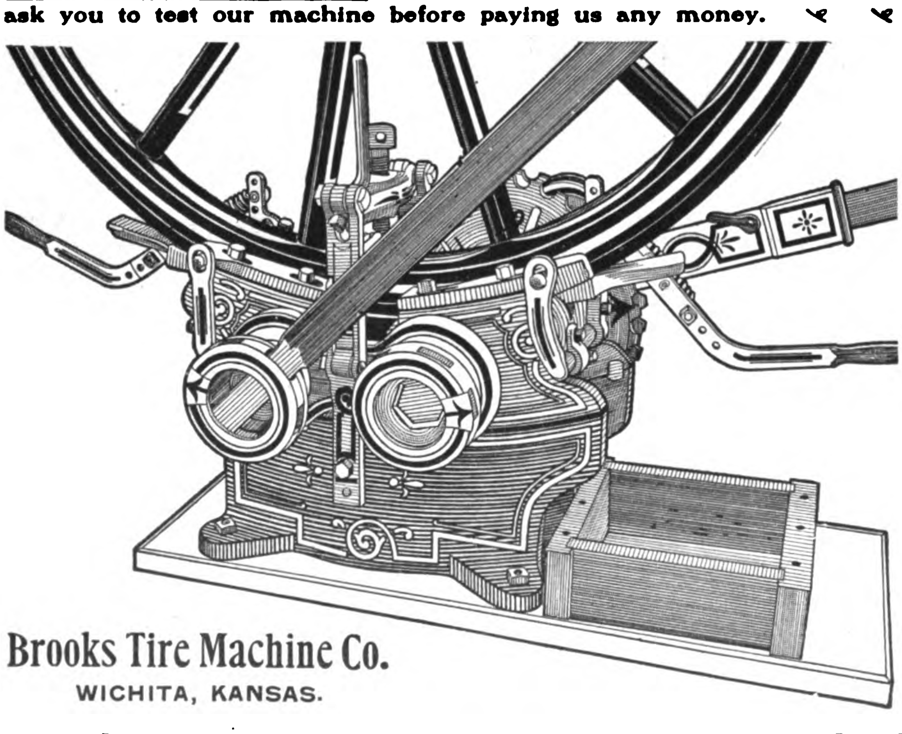
SHIPPED ON TRIAL

If not found to be satisfactory, this Machine can be returned to us at our expense.
Can anyone make you a broader offer? We think not, and we know there is not a better Cold Tire Setter made. This is why we ask you to test our machine before paying us any money.



Brooks Cold Tire Setter

The Latest and Best Up-to-Date Machine for Wagon and Carriage Repair Shops.

WITH it you can control the tire-setting business of your locality. A hand-power machine that sets heavy and light tires *cold*. It compresses the metal into shorter space without removing the tires or bolts from wheels. It is mostly made of a high grade of steel and drop forgings. It weighs only 500 pounds, and occupies a floor space of 2 x 3 feet. Room in any shop for one. It will set more tires in the same length of time, and do it with less labor, and the machine cost less than any other hand-power machine on the market. With it you do not have to over-dish or spring the wheel in order that it may spring back to overcome the reaction of the tire when it is released from pressure. This objectionable feature in cold tire setting is overcome with this machine. **It is the greatest money maker ever offered to wagon and repair shops.** It is sold on a positive guarantee to do just what we claim for it. Write us to-day for descriptive circular and price.

Brooks Tire Machine Co.
WICHITA, KANSAS.

YOU GET THE MACHINE AND THE MACHINE WILL GET THE BUSINESS.

SAVING TROUBLE

Save a man trouble and you do him a service he'll remember. The pleased customer has a pleasant way of coming again,—of sending his friends.

Save Trouble

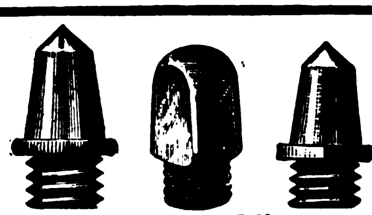
NEVERSLIP CALKS

Do Pleasant Work

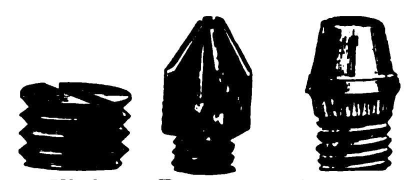
They Enable Horses to Stand in Slippery Places—Anywhere

Of course, they please owners, for horses wearing them can speed or do heavy work in safety and comfort. They are easily inserted, easily removed or renewed.

THEY SHARPEN THEMSELVES AS THEY WEAR



"On and Off



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Drilled Shoes too—all ready, in sizes corresponding to all standard makes, costing only four cents for the drilling

Save the Coupons WHICH ARE PACKED IN EVERY BOX OF CALKS AND GET A **Set of Tools Free**

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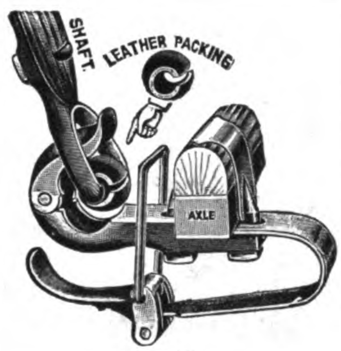
Branch: 242 Randolph Street, Chicago, Ill.

THE BRADLEY SHAFT COUPLING

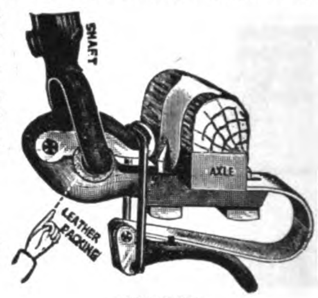
IS a thoroughly practical, quick shifting, ball bearing, and absolutely noiseless Carriage Shaft Coupling, complete in itself, with no loose parts or pieces, and always ready.

ONE HAND IS THE ONLY TOOL REQUIRED TO OPERATE IT.



OPEN.

It automatically takes up its own wear, and with it shafts and pole may be exchanged in 10 Seconds. It is made entirely of Steel, and will outwear any vehicle to which it is attached. It has been on the market 10 years, and there are over 500,000 Pairs of them in use. The best carriage-makers everywhere use them. Blacksmiths can make a good profit by attaching them to old or new vehicles. Sold by all jobbers in carriage goods. Printed matter free for the asking.



CLOSED.

C. C. Bradley & Son,

SYRACUSE, N. Y.

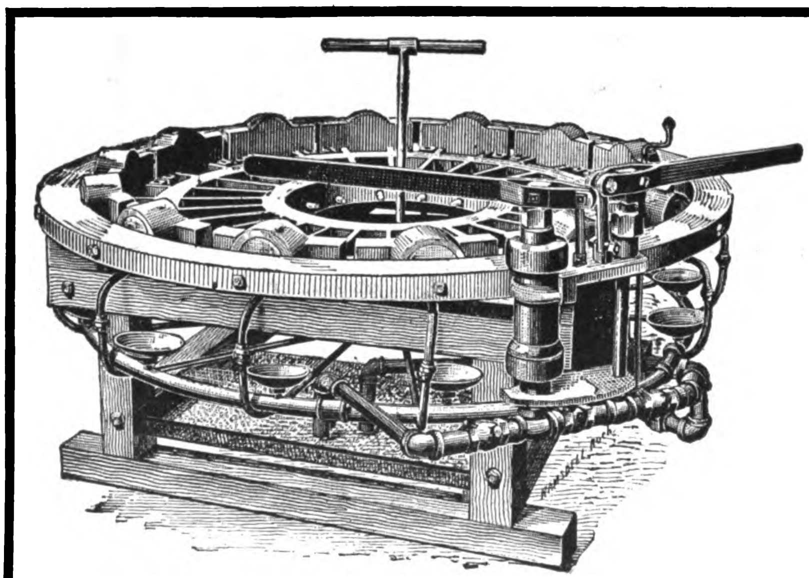
THE WEST "HYDRAULIC JUNIOR"

A New Hand Tire Setter for Repairers and Builders who have no Power or cannot afford one of our Large Machines

IT SETS THE TIRES COLD.

It is not necessary to take off old tires or remove bolts when resetting unless wheel needs repairing. Dish can be made just what is desired or necessary, and no more.

WILL PAY FOR ITSELF IN A SHORT TIME.



WILL RESET A TIRE IN ONE MINUTE.

Construction is similar in general principle (see cut) to our power machines which are so well and favorably known in nearly all parts of the world.

QUICKEST AND BEST HAND MACHINE MADE.

This is a First-Class Tire Setter, operated by Hand Pump, capable of giving 2,500 lbs. pressure per square inch, and will set tires ½ inch by 2½ inches and all lighter sizes on wheels 54 inches diameter down to 34 inches.

FOR PRICE AND TERMS, ADDRESS **The West Tire Setter Co.**

"JUNIOR" DEPARTMENT. ***ROCHESTER, N. Y.***

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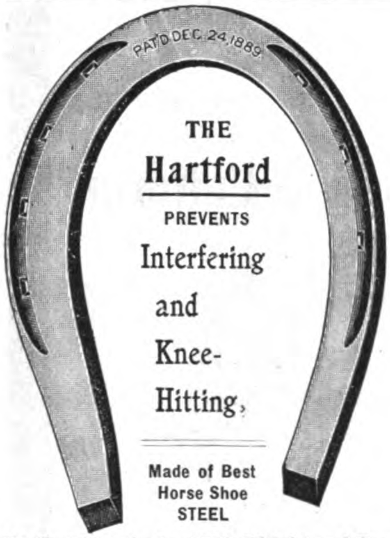
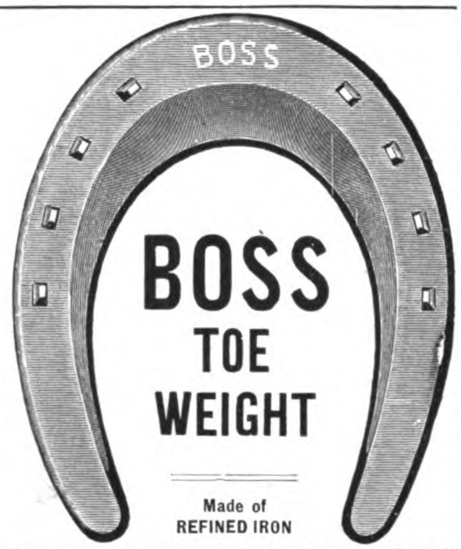
Before an advertisement is accepted for this journal, careful inquiry is made concerning the standing of the house signing it. Our readers are our friends and their interests will be protected. As a constant example of our good faith in AMERICAN BLACKSMITH advertisers, we will make good to subscribers loss sustained from any who prove to be deliberate swindlers. We must be notified within a month of the transaction giving rise to complaint. This does not mean that we will concern ourselves with the settlement of petty misunderstandings between subscribers and advertisers, nor will we be responsible for losses of honorable bankrupts.





Do You Use the best Side Weight and Toe Weight Shoe made in this country? **If Not, Why Not?** They cost you less labor and money and are superior to a hand made shoe. Carried by all leading jobbers Sample pair of either size or weight mailed, postpaid on receipt of 50 cents. We make four sizes Nos. 1, 2, 3, 4. Three weights—Track, Medium, and Heavy.

THE SIDE WEIGHT HORSE SHOE CO.
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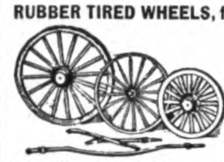
RUBBER TIRED WHEELS, fully guaranteed, per set, $15



I manufacture all sizes and grades, ¾ to 4-inch tread, with or without steel or rubber tire. Write to-day for Catalogue and net dealers' Price Lists on a full line of wheels, gears, carriage and wagon hardware—everything for the carriage shop. The prices will interest you. Address in full,

Wm. W. BOOB, 428 East 7th St., Cincinnati, O., U. S. A.

Sutton Tuyere

This Tuyere is made of the best Dunbar pig metal, and has the fire bowl cast with it. The fire cannot spread and keeps clean and bright. It will pay for itself in the **SAVING OF COAL.**

Send for descriptive circular and price.

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INDIANA, PA.

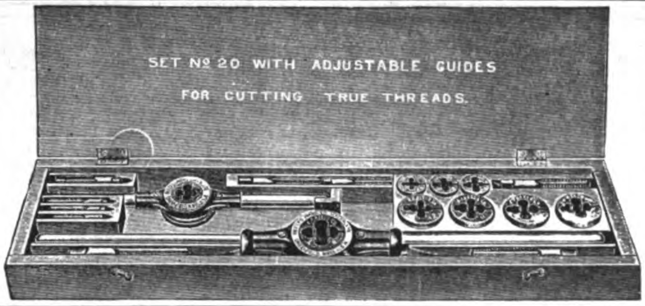
WHEELS WHEELS WHEELS

WHEELS in All Styles
WHEELS painted Any Color
WHEELS without Tire
WHEELS with Tire
WHEELS in All Grades

SEND FOR PRICE LIST. WE CAN SERVE YOU PROMPTLY.

Carriage Wheel Supply Co.

UNION CITY, INDIANA.



THE BEST PAYS BEST

That is true of anything—especially true of Screw Cutting Tools.

The name of Reece has long stood for everything that's best in Screw Cutting Tools—has stood for good materials, superior workmanship and reasonable prices, and stands for those qualities to-day, more than ever before. Send for catalogue.

Double Set, Nine Sizes, ¼ in. to 1 in. inclusive.

The E. F. REECE COMPANY, Greenfield, Mass., U.S.A.

ESTABLISHED 1874. INCORPORATED 1898.

THE MOST IMPROVED RUBBER PAD OF ITS KIND.

ORDER BY NAME "A. C." THROUGH YOUR SUPPLY HOUSE.

Consolidated Hoof Pad Co.

18 VESEY STREET, N. Y.

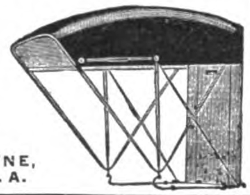
BLACKSMITHS and WAGON MAKERS

We call your attention to the LOW PRICES offered by

The Fort Wayne Iron Store Co.

and BLACKSMITH TOOLS, HORSE NAILS, HORSE SHOES, ANVILS, FORGES, also WAGON MAKERS' and CARRIAGE TRIMMERS' SUPPLIES, WHEELS, RIMS, SPOKES, SHAFTS and POLES, CARRIAGE CLOTHS, LEATHER, RUBBER, Etc., Etc. . . .

Send for our RED BOOK, the most UP-TO-DATE Catalogue, with lowest prices, yet published. Furnished FREE to any one in the trade.



Our Top and Cushion Department is running DAY and NIGHT to keep up with our orders. New Tops, Old Tops recovered.

SEE OUR PRICES. WORKMANSHIP GUARANTEED.

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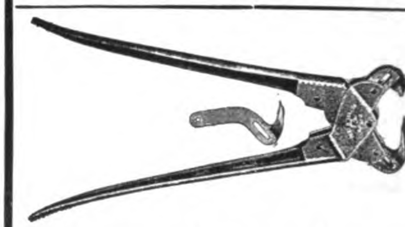
Electric Sharpening Hammer

Does not slip from work, hence saves 50 per cent of your strength.



The Giant Hoof Parer

Many points of superiority. Makes strictly a straight cut.

WRITE US FOR OUR CATALOGUE

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HIGH-CLASS TOOLS OF NEARLY EVERY MAKE

ARE SHOWN IN

"The Tool Catalogue"

JUST PUBLISHED

704 Pages, and a Discount Sheet, sent to any address for 25 Cents

This is the book to have if you want to buy Tools right and keep posted as "to what is doing"

MONTGOMERY & CO.

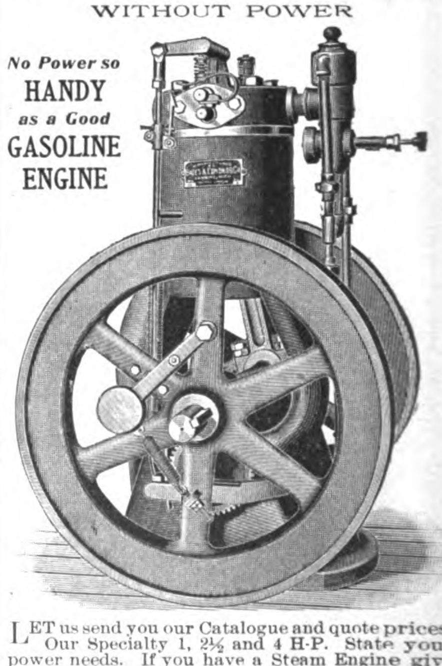
Makers and Venders of High Grade Tools and Supplies

103 FULTON STREET, - - - NEW YORK CITY

NO BLACKSMITH SHOP COMPLETE

WITHOUT POWER

No Power so **HANDY** *as a Good* **GASOLINE ENGINE**



LET us send you our Catalogue and quote prices. Our Specialty 1, 2½ and 4 H-P. State your power needs. If you have a Steam Engine give full description. **We sometimes make exchanges.**

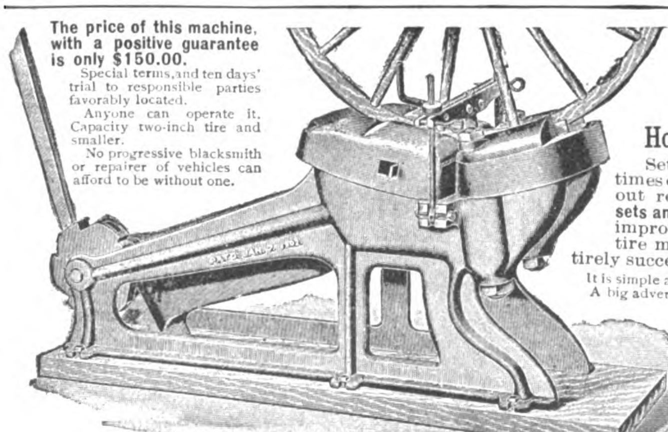
Bates & Edmonds Motor Co. LANSING MICH.

The price of this machine, with a positive guarantee is only $150.00.

Special terms, and ten days' trial to responsible parties favorably located.

Anyone can operate it. Capacity two-inch tire and smaller.

No progressive blacksmith or repairer of vehicles can afford to be without one.



FOUND AT LAST!

The tire-setting problem solved—the latest patent out.

House's Cold Tire Setter

Sets tires much better and ten times quicker cold than hot, without removing bolts or tires—**It sets any kind in five minutes.** An improvement on all other cold tire machines, and the only entirely successful one on the market.

It is simple and strong and will never wear out. A big advertisement for any blacksmith. Will rapidly increase his business and give him great advantage over his competitor. Why not lead in your trade and take the profits, instead of following and giving them to your rivals?

PADDOCK - HAWLEY IRON CO., - St. Louis. Mo.

Blacksmith Supplies, Wagon and Carriage Material, Tools and Machinery.

THE AMERICAN BLACKSMITH

A PRACTICAL JOURNAL OF BLACKSMITHING.

VOLUME 1 **SEPTEMBER, 1902** **NUMBER 12**

BUFFALO, N. Y., U. S. A.

Published Monthly at The Holland Building, 451-455 Washington Street, Buffalo, N. Y., by the

American Blacksmith Company

Incorporated under New York State Laws.

Subscription Price:

$1.00 per year, postage prepaid to any post office in the United States, Canada or Mexico. Price to other foreign subscribers, $1.25. Reduced rates to clubs of five or more subscribers on application. Single copies, 10 cents. For sale by foremost newsdealers.

Subscribers should notify us at once of non-receipt of paper or change of address. In latter case give both old and new address.

Correspondence on all blacksmithing subjects solicited. Invariably give name and address, which will be omitted in publishing if desired. Address all business communications to the "American Blacksmith Company." Matter for reading columns may be addressed to the Editor. Send all mail to P. O. Drawer 974.

Cable address, "BLACKSMITH," Buffalo. Lieber's Code used.

Entered February 12, 1902, as second class mail matter, post office at Buffalo, N. Y., act of Congress of March 3, 1879.

A Completed Volume.

With this, the September issue, the first volume of THE AMERICAN BLACKSMITH is completed. On looking over the ground covered in the past twelve months, it is clearly apparent that we have not been mistaken as to the need of a journal of this kind. The day has passed when anything in the way of a paper will do for the smith. Almost every other trade and profession has its journal, prepared and printed in a modern style, and it is this need which we are supplying for the blacksmiths of America. We set out with the idea in mind of making the paper so good that 10,000 regular subscribers would be obtained during the first year. We have so far exceeded our efforts, that we have set the mark for the second year's work at 30,000 subscribers.

It is our intention to improve the paper in every possible way and to enlarge it. We make a point of supplying what is wanted by readers, and will always appreciate suggestions as to how we can make the paper better suited to their individual needs, a true help, in other words. We want the craft to feel that it is their paper, a paper of which they can justly be proud. Our efforts along this line can be greatly aided by our friends. The more subscribers we obtain, the better can the paper be made. We can obtain more subscribers, if each reader will but put forth an effort to bring the paper to the attention of his friends among the craft. We would like to have each present subscriber send in the name of one other subscriber before the end of the year. Can you not influence some friend to subscribe? You are acquainted with the paper well enough to know that he will be glad to have you bring it to his attention. In this way it will be a comparatively easy matter to reach the 30,000 mark, and we hope we can count on the efforts of our friends in this way.

An Old Ohio Blacksmith.

One of the oldest blacksmiths who has come to our attention since publishing last May the names of numerous old craftsmen in various sections of the country, is Cooper Chidister, of Massilon, Ohio, who died recently at the age of 97. At the time of his death he was the oldest man in Massilon, and was remarkable also for his enormous strength. He frequently boasted that he would not retire from blacksmithing until he was 100 years old. Before his death he requested that the anvil he had used for over 80 years, and by ancestral blacksmiths before him, be used as a pulpit at his funeral. His request was complied with, and the clergyman stood upon the old anvil as he delivered the eulogy.

Are Gas Engines a Good Investment?

The question of putting in power is a vital one to blacksmiths now-a-days, and the experience of those who have already put in an engine is most valuable to others who are contemplating such a step. We would like to hear from those of our readers who have installed power in their shops in any form, as to what their experience has been with it. Does the gas engine give perfect satisfaction? Have you been able to accomplish more work, have the profits in your business increased, or in other words, do you consider the installation of a gas engine a profitable investment? In order to stimulate correspondence on this important topic, we will give a cash prize of $5.00 to the author of the best article received within the next two months, bringing out most clearly the advantages and arguments in favor of putting in power.

Some Words on Ship Smithing.

GEORGE HARNWELL.

Ship smithing today is somewhat different from that of thirty years ago. The steam hammer has come into more general use, mild steel has taken the place of iron to a considerable extent, and forgings are now made out of the solid metal with the aid of the steam hammer, tools and formers, that were once made in a manner quite different and generally requiring more welding. Of course there are still the small shops without even steam hammers, where work is done in the old style, but so much depends on what kind of a shop a smith is in that it almost seems there are no rules to be laid down, each man having to do the best he can with what is at hand.

There are some general rules that every foreman should impress on his apprentices. The first is always learn to do a good, solid and clean job, before you try to do it quickly. Then there are the rules regarding chain and hooks and their respective sizes. A hook should be always three times the size of chain and one inch in length for every $\frac{1}{8}$ inch in diameter, so that if we have a $\frac{1}{2}$-in chain, we require $1\frac{1}{2}$-inch stock to make a hook for it, unless otherwise ordered. Having formed the eye we cut it twelve inches long, which we find turns into a nicely-shaped hook. It should be attached to the chain by a $\frac{5}{8}$-inch link, one and a half times as long as the other links. Some cargo hooks are made by splitting the iron, drawing down and welding in the crown, as with a link. When a large eye is required, this is the best and quickest way. Sling or cargo hooks are always made with the points bent in, or following the hook round as it is called. I have seen smiths, where their blue print called for an elongated wire eye, punch with a long punch and work it in that shape, but in most cases it will be found better to punch with a round punch and work in a round shape, when with a few blows in the swages we have the required shape.

In forging hollow bit tongs, a great fault with young lads is in making them what I call cow mouthed, that is, having a lump at the back part where the clearance should be. I have tried to show what I mean in the figure. The arrows point to where the lump is generally left, and although the tongs may be made hot it is impossible to do away with that lump, unless the rivet is taken out and the jaws reformed. Especially is this the case with steel tongs, iron ones being much easier to alter.

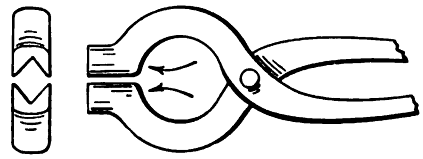
Estimating Costs in Carriage Shops.—2.

BY D. W. M.

As this paper reaches mainly a class of readers engaged in manufacturing on a small scale in comparison with a wholesale plant, I will endeavor to show how to get at cost estimates accurately in such a business.

It is not to be supposed that it is any less accurate because the business is small. The items of cost are practically the same as in a large plant. The system employed may be practically the same, but the division of labor is different. One man attends to several departments, or performs the work which is allotted to several in a larger shop. The proportionate cost of labor will be greater, but there will be a saving in some other direction. It is well, however, to have a system that is adaptable to a growing business and to recognize the possible division of labor, although yet in embryo, so far as its practical application goes. Thus the same man who makes the body may do the crating for shipment, yet the cost should be kept as though done by a separate man. The same man may tire the wheels, weld the axles and iron the gear, yet the cost should be separate, and the accounts so show. This involves some trouble. All accuracy involves trouble or effort. Correct accounts of any sort do not keep themselves. The building of one vehicle is never expected to be duplicated. An estimate on one vehicle is never good for another. All are made at a figure sure to be enough, and all jobs requiring close figures are declined. They get their business solely on their reputation for doing good work.

The cost of material will vary with the location of the shop and the quantity in which purchases are made, also the quality of work produced. The cost of labor will vary in the same way.



HANDY TONGS FOR THE SHIP SMITH.

To make a rigid system of estimating costs applicable to all is manifestly impossible. Some general rules may apply however. The writer has had experience in all the phases of the business, from shoeing horses, repairing plows and building farm wagons in a country town to running a largo wholesale plant employing four hundred men. My way may not be the best, but it is the result of experience, and I have never seen it improved upon as a means of knowing all the time what the business is doing.

We will suppose, therefore, a business in which horses are shod, plows mended, vehicles repaired, farm wagons built and occasionally a light wagon on springs; buggies and other vehicles are bought and sold and a wareroom for their display kept up. This is a fair sample of a country shop, and of many small city shops. The proprietor is manager, cashier, superintendent, foreman and clerk. The office expense is eliminated. There is no expense account for selling goods, as he is his own salesman.

Some one comes in and asks what he will charge to build a light three-spring wagon with two seats. How is he to know what price to fix? He knows he can buy one at wholesale for $65.00 and probably get $85.00 from his customer. But he wants a good job and is willing to pay $100. Can he build it for that and make a profit? He thinks he can and takes the risk. If he had a systemized schedule of costs he would know very close to the truth, and if he lost money on the first wagon, the record would be valuable in keeping him from loss the second time.

The proprietor of such a shop would probably buy the body from a body factory; the wheels, axles, springs, and forgings, if any, would be bought; also the pole or shafts in the wood only. He would iron the body, gear, shafts or pole, tire the wheels, and box them. He would buy the cushions, dash and any other trimmings needed, probably getting the cushions at the harness shop near by. He would paint the wagon, or get the painter who runs a paint shop in conjunction with him, either up stairs or next door, to do it. His task of figuring cost is comparatively simple. He refers to the list sent him by various manufacturers or jobbing houses and gets the prices on the parts he has to buy. His blacksmith can do his work in about such a time, and the painter will do the job for about so much, or he will do it himself. All the work will be done between repair jobs, and whatever he gets over and above cost of material is really clear gain. That is the way he decides the matter rapidly in his mind.

But if someone should come to him with a proposition for ten vehicles at one delivery, he would have to figure accurately and know whether he was going to make or lose money. With his farm wagons he sells at a price made by others. He has to do so or lose his custom. If he comes out even, he at least preserves his repair trade. He does not know whether he makes money or loses in building a farm wagon, but if others can sell them, he reasons that he can afford to do so also, or ought too, and he will find out at the end of the year whether he has made or lost money.

This is about the way the majority look at the matter. They also think that there are so many side issues involved which cannot be figured on with any accuracy, that a good general guess is about as valuable as close estimating. In fact they are afraid a close estimate will lead them to underbid. Nevertheless a good business man will want to know just where he stands, and why. The trouble with most manufacturers is, they stop at the labor cost. All their efforts at economy in production are directed toward cutting down labor; whereas the greater part of the cost is outside of labor, and in some cases it will be found in directions which they are unwilling to acknowledge.

It is evident that without a system nothing of real value can be done. The methods employed in wholesale shops, where a cent on one article means much because multiplied by thousands, are worth studying and adapting even to a small business. Price lists of goods must be kept handily indexed for ready reference. The actual cost of all materials, including waste, freight, handling, insurance, interest or investment, and any other items that affect cost should be kept in tabulated shape, so that the total cost of a set of wheels of any given size, or of a pair of shafts, or a pole, or a top, a cushion, an apron, a body of customary design, or other article manufactured, can be seen at a glance. The labor account should be tabulated in the same way.

To keep such a tabulated list up to date seems a waste of time in a small business, but if kept up it soon ceases to be irksome, and the profitableness of it soon gives it such an interest that nothing could persuade one who has tried it faithfully to give it up. It must not be forgotten that the time of the proprietor is just as worthy of being reckoned on the wage account as that of any workman. An old and successful carriage builder remarked to the writer that he considered his time worth as much as any two of his workmen. It makes no matter if the proprietor is superintendent, clerk, foreman, workman, etc., all the capacities in which he figures should be represented by something in his estimates of cost, otherwise he is not paying himself.

A cost schedule should show columns under the heads of wood work, smith work, painting, trimming, setting up, shipping, office, and general expenses. Each of these will be divided into labor and material. Under general expenses will appear, rent, insurance, interest, printing and advertising, repairs, selling cost, etc.

Separate estimates for the different parts of a vehicle will be kept as already stated. These estimates applied to the articles produced should total up at the end of a week with the shop cost of material and labor used, as appear on the weekly report. If a variation occurs it must be traced until found.

This system, if followed faithfully, will be found to be absolutely reliable, and one that will give accuracy to the practical working of any factory to which it is applied. It does not involve an undue or impracticable amount of clerical work and will be found a saver of labor, of material and of general expense, besides giving one the profound satisfaction of knowing all about the condition of the business. With its aid an account of stock may be taken once a month with little trouble. It is doing for the factory what the bookkeeper does for his accounts when he presents a trial balance sheet. It is a system applicable alike to a large or small shop with proper adaptation.

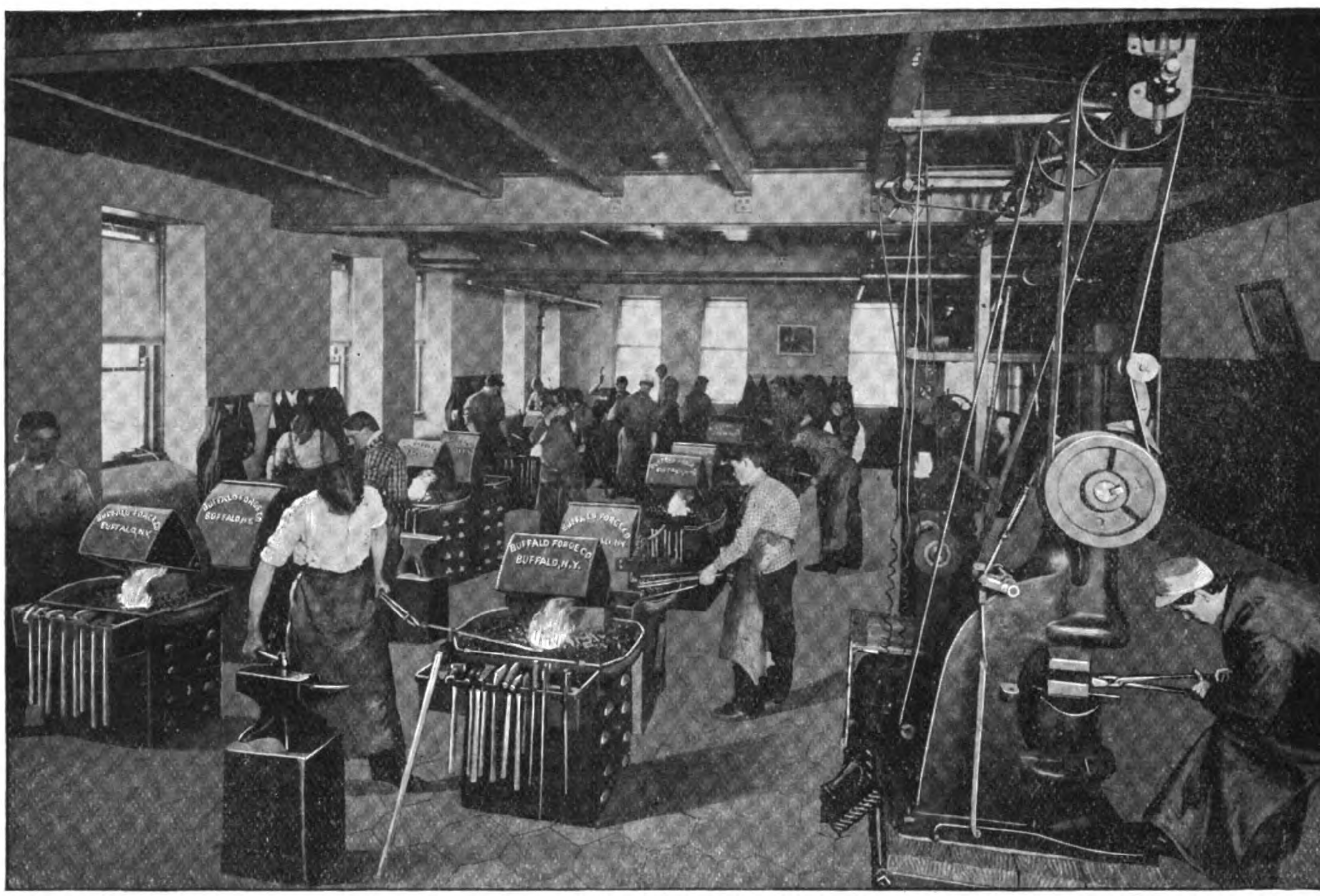
(To be Continued.)

Forging at the Kansas City Manual Training High School, Kansas City, Missouri.

FRANK CUSHMAN, JR.
Instructor in Forging and Mechanical Drawing.

Kansas City possesses one of the finest Manual Training High Schools in the country. The building is a handsome brick and stone structure, containing thirty-eight class rooms, and a large auditorium capable of seating sixteen hundred people. The school is, by far, the most popular one in Kansas City, over sixteen hundred students being enrolled. The hours are necessarily arranged so that all of the students are never in the building at the same time.

While the school bears the name "Manual Training", it should be understood that the usual academic studies, viz., English, history, mathematics, foreign languages, chemistry, physics, biology, botany, etc., are fully up to the standard of any high school in the



FORGE SHOP OF THE KANSAS CITY MANUAL TRAINING HIGH SCHOOL.

country. Instruction is also given in free hand and mechanical drawing, steam and electrical engineering, book-keeping, stenography and type-writing, physical training, etc. These studies are all correlated with the manual training work of the school. The studies perhaps most closely related to the manual training work are free hand and mechanical drawing, chemistry, physics, and engineering. The manual training

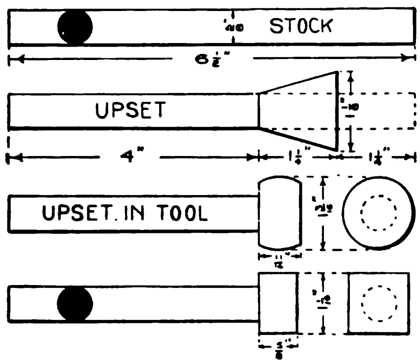


Fig. 2. FORMING A SQUARE-HEADED BOLT.

course for boys covers four years, and includes carpentry and joinery the first year, wood turning and pattern work the second, forging the third, and machine-tool work the fourth year. The boys are, from the first, taught to work from drawings, and the first year in the mechanical drawing rooms is spent largely on shop drawings.

The regular course in forging, which is placed in the third year, consists of a series of graded exercises, twenty-four in number. Fourteen of these exercises are in iron and ten in steel

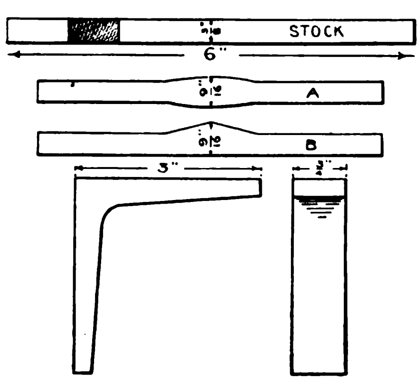


Fig. 3. BENDING UP AN ANGLE.

work. The work in steel includes a set of lathe tools for use in the machine shop the following year. The work in the shop is supplemented by lectures on the metallurgy of iron and steel, to give the students an idea of the chemical composition, physical and mechanical properties, and practical uses of all kinds of iron and the different steels. The object of these exercises in the shop is not to *construct* something for show purposes but to *instruct* the students in the fundamental principles of forging. The time allowed, only about ninety hours, incuding time for instruction, is so short, that it is found necessary to limit all ordinary students to the regular course of exercises. There are, of course, some boys who possess exceptional mechanical ability, and these are allowed to make some useful or ornamental article of wrought iron or steel from their own designs, applying the principles already learned. These projects include such pieces as fire sets, andirons, ornamental lamp stands, boat anchors, grappling irons, hammers, heading tools, tongs, etc.

It may seem to many practical men that a boy could learn very little of this mechanical art in nine working days of ten hours each. Our results prove, however, that with systematic instruction, and no waste of time, the average student obtains a very fair idea of the principles of forging, and the majority considerable manual skill as well.

The exercises in iron work include instruction and practice in drawing, forming, upsetting, and bending rectangular stock to sharp external corner, upsetting and bolt making, fagot welding, practice in scarf welding, round and flat stock, "L" and "T" scarf welding, and such pieces as a ring bolt and nut, three links of a chain with a hook, a pair of flat tongs, etc. The work in steel consists of a series of exercises in drawing and forming cast steel and instruction and practice in hardening and tempering. The tools which each student is required to forge, file to shape, harden, temper and grind for his own use are the following,—graver, prick punch, ¼-inch and ½-inch cape chisels, flat chipping chisel; round nose, side, diamond point, cutting off and boring tools for the lathe. Other exercises in steel include blacksmith's hand punch, ratchet drill, rivetting hammer, hardy, hot chisel, cold chisel and other blacksmith's tools.

The forge shop is equipped to accommodate classes of twenty. There are twenty Buffalo down draft forges, fully equipped, in the shop, one instructor's forge, somewhat larger, a 100-pound Beaudry power hammer, drill, emery wheels, etc. The fans are electrically driven and are located over head in one corner of the room. There is a separate motor furnishing power for the hammer and other tools. Fig. 1 is a general view of the forge shop. It is located on the ground floor, and well lighted by twelve large windows. Figs. 2 and 3 show reproductions from typical blue prints for student's use.

This year about seventy-five boys are taking forging at "Manual," and the majority display a lively interest in their work. It is an established fact that this sort of work correlated with other studies is an excellent thing for anyone. It educates the hand and eye as well as the mind, also the judgment, and helps to keep the student from becoming one-sided, and too theoretical. As a whole, the Kansas City Manual Training High School is doing a grand work. It is from such sources that we shall look for the best American citizens; practical men with their feet on the ground, who can *do* something as well as *talk*.

How One Horse was Cured of Interfering.

A. BRUTON.

I stopped a horse from interfering by cutting the outside of the shoe off, drawing it out to the right length, making it lighter than the inside of shoe, and then turning the heel of the inside part under and welding down smooth. This serves as a side weight when one is not obtainable. Of course I used as long a shoe as I could get, so as to have plenty to work on, thereby giving more side weight. This was a plate, but in case of calks, proceed in like manner, only make the inside calk thick after turning. Then fit inside close to foot all around and turn outside heel out a little on the plate or calked shoe.

A Home-Made Tuyere.

G. NABLO.

I have for several years used a simple contrivance for a tuyere in my forges and they have given every satisfaction. I simply take a piece of heavy gas pipe about 1½ inches in diameter, long enough to reach from one side of the forge to the other. One end I enlarge so as to receive the point of the bellows well, and the other end is brought even with the opposite side of the forge. Now whenever I want my fire, I drill a hole ⅝ inch in diameter. Then I imbed the whole tube at the usual depth in the forge, covering all parts (except fire-place) with brick or clay, or both, and leaving a sufficient space for the fire-place. Then I insert a wooden plug at end of tube. After using for two or three weeks, some cinders will get in the tube, and I then simply remove the wooden plug and using a rod with a small hook at the end, scrape it out clean. When good coal is used, such a tuyere will last for many years and stand quite heavy heats. Of course when burnt out, it will have to be replaced by a new tube. I have tried different kinds of tuyeres but like the above better than any I have used. The joint between bellows and tube I make air tight with putty.

The Elements of Blacksmithing.—10.

Hardening and Tempering.

JOHN L. BACON.

Instructor in Forging, Lewis Institute, Chicago.

In practice, tools may be divided for convenience in tempering, into two general classes:—

First, tools which have only a cutting edge tempered, such as most lathe tools, cold chisels, etc. Second, tools tempered to a uniform hardness throughout or for a considerable length, such as dies, reamers, taps, etc.

The method of tempering a cold chisel will serve as an example of the tempering of nearly all tools in the first class, the only difference being the temperature to which the tools are reheated as shown by the "temper colors." When the cold chisel has been forged into the proper shape, it should be laid to one side and allowed to cool down until it is black. Then heat the cutting end to the proper hardening heat, for about three or four inches, taking care not to heat the steel *above* the hardening heat. Dip the hot end into cold water for about two inches, and leave it there just long enough to cool off, keeping the tool moving in the water in the mean time to prevent too sharp a line between the hot and cold parts. As quickly as the end is cool take the chisel from the water and polish off the hardened part with a piece of emery cloth or old grindstone. The heat from the back of the chisel, which should be still red hot will reheat the cold part, and the scale will form on the polished surface showing the temper colors. First a faint tinge of yellow will appear, which will move down toward the point of the chisel, as it is gradually reheated, followed by brown, purple and then blue. As soon as the desired color (purple for cold chisels) shows on the cutting edge, the tool should again be cooled in the water. If we were tempering lathe tools, the process would be exactly the same, only the steel would be cooled the second time as soon as the edge showed a very pale yellow, instead of purple.

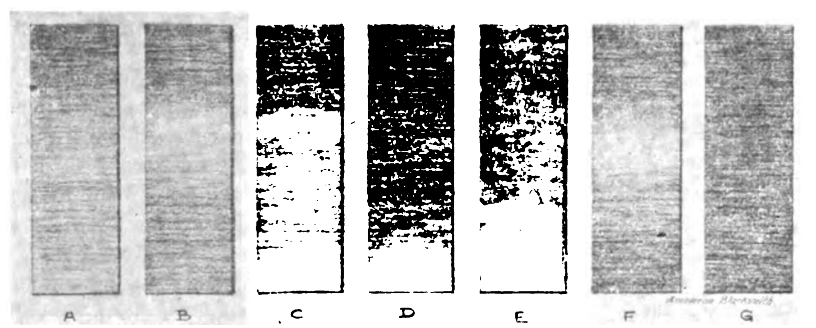
Tools of the second class, tools of uniform hardness all over, may be tempered as follows: The whole tool is first heated to a uniform hardening heat and cooled completely, thus hardening it throughout. The surface is polished bright and the temper then drawn by laying the tool on a piece of red-hot iron until the surface shows the desired color—generally light brown for this class of tools. When reheating on the iron the tool should be turned almost constantly, otherwise the parts in contact with the iron will be heated first and become overheated, and consequently two soft before the other parts are hot enough. Sometimes the reheating is done on a bath of melted lead or heated sand. Large pieces are sometimes "drawn" over a slow even fire, or on a sheet of iron laid over the fire.

There is one fact which after a little studying will help to determine the proper hardening temperature of a given piece of steel. If a piece of steel be heated to a good yellow heat and allowed to cool, it will cool gradually until it reaches a temperature at which it seems to get hotter again; that is, it grows darker in color, and then, when this critical temperature is reached, it becomes lighter for an instant, and then gradually cools down. The point at which this takes place indicates about the proper hardening heat of the steel.

This phenomena is known as "Recalescence." An attempt is made in Fig. 96 to illustrate the action of the heated bar of steel at the point of recalescence. A shows the heated bar as it comes from the fire, the hottest parts showing lightest. At B, the steel has cooled slightly and heat of recalescence begins to show at the light streak about the center of the bar. At C, the first streak has moved up a little, and the end begins apparently to reheat, this second streak gradually moving up, as illustrated in D, E, and F, until at G the bar has passed the critical temperature and cooled down in the ordinary way. This illustration is somewhat the same as that given by Howe in his Metallurgy of Steel, which gives an excellent explanation of this phenomenon.

The hardening heat of steel is often described as a "cherry" heat. This term is very misleading and means very little. As such an authority as Metcalf once remarked, "Cherries are all the way from very light yellow to almost black, and 'cherry' heat seems to mean almost any of these various colors."

It is a good plan when drawing the steel from the fire, to hold it for an instant in the shadow of the forge to see if you are getting the proper heat. The color of the heat will appear quite different here than it will in the sunlight, and you will be much more liable to get a uniform heat by judging in the shadow than in the open sunlight, which varies so much in intensity.



REPRESENTATION OF BAR IN SUCCESSIVE STAGES OF COOLING.

It was mentioned before that the *rate of cooling* partially determined the hardness of the tool—the faster we cool the steel the more brittle it will be, thus for springs which must be tough but *not* brittle, or very hard, the steel should be cooled somewhat slower than if we were, hardening an engraving tool. When steel is wanted *very* hard it can be cooled in salt water—files are hardened this way—or, in extreme cases, mercury is used, as this conducts the heat away very quickly. When the tool is wanted tougher but not so hard, oil may be used, or even water with a thin film of oil on top, for when anything is plunged into this the oily film sticks to the object and draws down into the water with it. As oil abstracts the heat more slowly than water the steel is left somewhat tougher and not so hard. The foregoing very general discussion of hardening and tempering will be followed in the next chapter by its application to specific pieces.

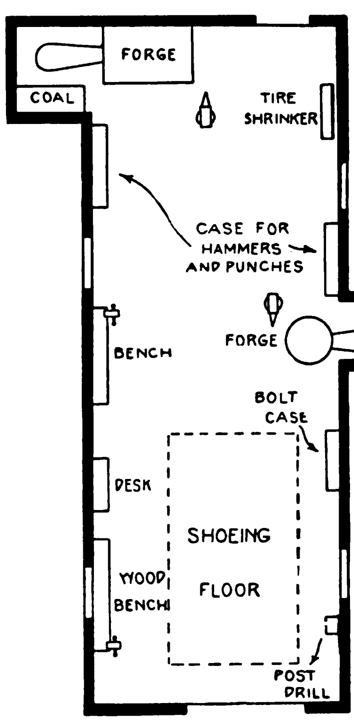
(To be continued.)

Details of a Two-Fire Shop.

A. BRUTON.

I noticed in the December number that Mr. John A. McKay asks about a plan for a two-fire shop. Accompanying is a rough sketch of mine. It is 14 by 38 feet inside, and faces the north. My south forge is of stone with a 40-inch bellows, the west forge of binder tire on legs for a frame, and a 30-inch bellows. The south anvil is 150 pounds, while the west anvil is 100 pounds. There is also a 75-pound iron vise, and a 190-pound tire shrinker made with anti-kinking device.

I have shelves inside up above a man's head for different material, besides on beams overhead, for iron, tongues, felloes, rims, etc. There are also nails in the walls over the benches for saws, squares, wrenches, etc. My punches are in a strap on the wall, each punch and cold chisel to itself, directly above my hammer box or shelves. I keep my planes and similar tools in a tool chest. I have another little box on the back end of my iron vice bench, where I keep my good files and other



PLAN OF A TWO-FIRE SHOP.

tools, which I do not wish everybody to use. This has a lid to close and keep out dirt. Of course with a larger shop, I could arrange a little more conveniently. My bellows rooms are a great saving of space, being shedded off of the main building with the coal box in one. I have my smoke stack of heavy galvanized sheet iron with ten-inch pipe above the hood.

A Neat Foot Scraper.

JAMES H. JENSEN.

Accompanying is a rough sketch of a foot scraper which is very neat and very easily made. I have made several pair for churches and schools. The base is made from a piece of $2\frac{1}{4} \times \frac{5}{16} \times 6$-inch stock with eight holes for screws. I bore three holes with a $\frac{5}{8}$ drill as shown in Fig. 1, A. I cut out the ends and then draw them out and turn as shown on finished piece, at B. Next I drive a square $\frac{3}{4}$-inch punch through the center hole to rivet the upright in. This piece is $\frac{7}{8} \times \frac{7}{8}$ at the bottom and $\frac{5}{8} \times \frac{5}{8}$ at the top. It is made $\frac{3}{4}$ inch square at the bottom for fastening into the base. I use a hack-saw to split the upright for welding the head on, though the upright can also be split with a thin chisel. The head is made from a piece $1 \times \frac{1}{4} \times 4\frac{1}{2}$, shaped as shown.

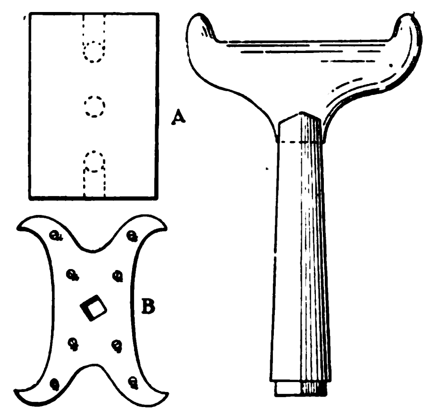
Painting the Tramp Buggy.

The Processes Involved and the Profits Derived Therefrom.

M. C. HILLICK.

It came to the asylum for unavailable vehicles through due processes of barter known unto all carriage dealers located in country towns, and from thence it was rescued to the transforming processes of the paint shop. It was a top buggy, piano box, Brewster gear, built on easy lines and had style sufficient to put it out of the class of so-called factory wagons. But, alas, it was in a sorry plight as to surface, and to put it into good selling condition at a minimum cost constituted the problem of exceptional moment. There were hub checks and felloe fissures, and cracks over running parts and body deep and plenty. And this is the way the painter proceeds to give it the best possible finish for the least money.

Remove top, clean thoroughly and set aside. Unhang, and mark the various parts. Sand body with No. $1\frac{1}{2}$ paper, cutting the surface into furrows which show coarse and bristling under the microscope. Then lay on a thin coat of lead containing just enough raw linseed oil to fasten the pigment securely to the surface. Then set aside over night to dry. Next morning apply a thin coat of rough stuff made of roughstuff filler and orange shellac. This first coat should be thin in order to penetrate well into the surface crevices. Apply with a bristle brush. On this coat putty all holes and bruises with a quick, hard drying putty. After 12 hours apply a second coat of the shellac roughstuff, using the roughstuff heavier in body than the first coat. In the afternoon of the same day apply a third coat of the same roughstuff. This material on account of quick setting properties must be worked very quick and sure. The following morning rub out with German rubbing stone, using raw linseed oil, instead of water, to dip the stone in. Stand aside, after rubbing and wiping dry with clean rags, until just before quitting time at night.



DETAILS OF A FOOT SCRAPER.

Then polish surface with a tuft of curled hair abstracted from the trim shop, dust off, and apply a coat of drop black, carrying a light varnish binder. The next morning sand and dust out inside of body and seat, apply a coat of color, and in due time, a coat of color-and-varnish. The outside of body flow with black color-and-varnish. In the meantime apply, after sanding thoroughly to roughen surface somewhat, a coat of flat lead to the wheels and running parts. Use, say one part raw linseed oil to twenty parts turpentine. The deep hub checks and splits in felloes should be puttied the day following with a putty made as follows: Keg lead, one part; whiting, two parts, mix in equal parts of hard-drying varnish and raw linseed oil. Mix to fairly thick paste and then thicken to right working consistency with dry white lead. Apply this putty smooth, as it cannot be sandpapered. It will neither chip nor flake. All ordinary cavities putty with the regulation, hard-drying putty. Outside surface of axles, side bars, etc., to be draw puttied—thin regular putty for this purpose. After 24 hours, sand running parts smooth, and apply a coat of Indian red mixed with enough varnish to insure the color against drying "dead." If this color is applied in the forenoon it can be coated upon with color-and-varnish in the late afternoon. For color-and-varnish, use a light shade of wine color, using only sufficient color in quick rubbing varnish to enrich the Indian red ground.

The morning following rub the running parts with a soft sponge dipped in pumice stone flour and water. Rub gently and just to the extent of erasing the gloss. Wash up cleanly all parts of the surface and then run a single ½-inch stripe of drop black around hubs, face of felloes, side bars, axles, springs, etc. When this stripe is dry, at each edge of stripe run a fine line of gold bronze. This style of striping yields a particularly rich effect, and also serves to conceal surface defects. The striping once dry, proceed to black hub bands, axle and side bar clips, the metal part of the axles, fifth wheels, etc. This increases the color effect and lightens the appearance of the vehicle. If the striping and blacking off is done in the morning, the running parts may be finished in the afternoon. Use a heavy, quick drying gear varnish and flow on all the parts will carry.

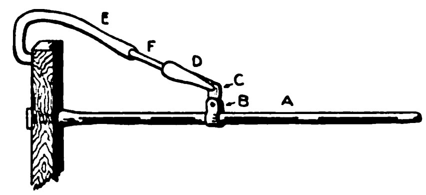
The body can now be gently rubbed with water and pumice stone flour and washed up. A uniform and clean rub over, sufficient to reduce gloss and remove motes and nibs of dirt is more to be desired than a close surfacing on this coat. Wash surface up thoroughly, and if corners or edges are flicked through, touch up lightly and then apply a full, heavy flow of hard drying finishing varnish. Dress the top and all the rubber furnishings with one of the dressings described in a former issue of THE AMERICAN BLACKSMITH. Bring the top joints, shifting rail, etc., up to a shapely finish, and when all parts are in condition to handle, hang-off, touch up, and behold!—the Brewster derelict in comely raiment.

Three days later the buggy changed owners, and for his profits, over and above cost of labor and material, the painter tucked a crisp $10 bill into the depths of a capacious pocket.

A Handy Bolt Holder.

A. T. WRIGHT.

The accompanying figure shows a bolt holder that I have made and am using, which is as handy a tool as a smith can have in a shop for bolts that turn when you tighten up the nut. A is the rod, ⅝ inch round, tipped with steel and one end checked or roughened. This end works on the head of the bolt. B is the clip that works round and up and down on the rod. C is a catch that works in clip, the inner end of the catch being toothed to take hold of the rod. Hook F and ring D makes a swivel. E is a hook that hooks under the wagon axle or felloe beam or any-



A USEFUL BOLT CLAMP.

thing that comes handy. This device also makes a good tire-bolt clamp.

Examples of Die Forgings.

BY RAM. ENG.

It is not necessary to say that the chief risk in ironwork is to be found in the welds. If you can get a perfect weld, it is quite as strong as the solid portion of the article, but who can guarantee that a weld is perfect until it is broken? I have seen many instances in which the article has been welded all round for the depth of ⅛ inch, and the remainder not welded. Until there are means of looking inside the iron, it will continue to be impossible to say for certain, from the appearance of the finished article, whether it is soundly welded or not. (I grant you there are many imperfect welds detectable, and much bad work can be prevented from getting into traffic, by the experienced

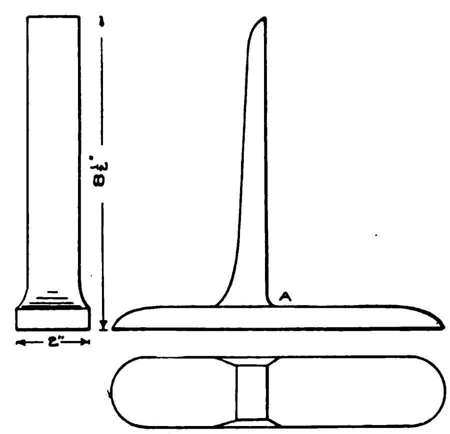


Fig. 1. A CARRIAGE STEP IRON.

foreman). Hence if an article can be produced from the solid, or without a weld, with its grain in the desired direction, it is much more reliable than the welded one. I am conscious of the fact, that it will often require costly blocks or dies and powerful machinery to effect this, and in cases where there are only a few articles to be forged it will not pay to incur the necessary expense, but where many of the same class of articles are required a large per cent. can be saved, much risk dispensed with, and the ironworker's life made more tolerable, and at the same time more remunerative.

I have chosen the following because the principle is capable of being applied in many cases where a T-shaped article is required. A carriage step iron (single) is perhaps one of the simplest articles as regards its shape, and most blacksmiths would answer the question, "How would you make it?" after only a few minutes' consideration, and say "Take the right size of iron for the plate and arm, taper one end of the latter, scarf the other, and then weld at A, Fig. 1." But if asked to make it without a weld, it would require much thinking before arriving at a means by which it could be produced, at as little, or less, cost. The former method has been the practice in most shops for years, but in spite of extreme care, both of the blacksmith and his foreman, they will occasionally be returned from traffic broken at the weld, sulphur, dirt or oxidized iron and silicon having become deposited between the surfaces. Thus the article was weakest at the point of greatest strain.

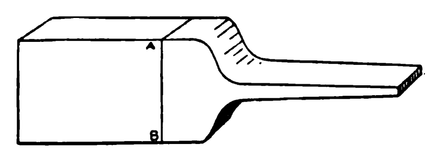


Fig. 2. DRAWING DOWN THE BLOCK.

I tried several methods of making this out of the solid, before arriving at the following: I take a piece of iron (hammered or rolled), 5 by 1¾ by 12 inches (this makes three), and place in the furnace or fire. I then place the plain blocks in the ten cwt. hammer, the bottom block having a hole through the center from the face downwards, ⅞ by 1⅝ inches, with ½ inch radius all round. When the piece is hot, I draw it down on the front of the blocks to the shape shown in Fig. 2, taking care to get it down as sharp as possible, and only as much as is necessary to draw the tapered part or arm. I then cut it through at AB and place the drawn portion in the hole in center of the block, (See Fig. 3), and hold a half-round tool (Fig. 3) over the top while the hammer beats it down, taking care to move it after each blow of the latter, thus causing it to draw out to the maximum, while only spreading the minimum. By lifting it out of the block, once or twice, and edging it under the hammer, it is easily brought to the T-shape at one heat, though rough. After making a quantity in this way, I again change the bottom hammer stock for one shaped the same as the article (Fig. 4). I then get the uses to a welding heat, taking care not to waste the arm or tapered part, and stamp. This makes a thin fin along each edge, which can either be sheared off when cold, or cut off while hot with the set, with very little

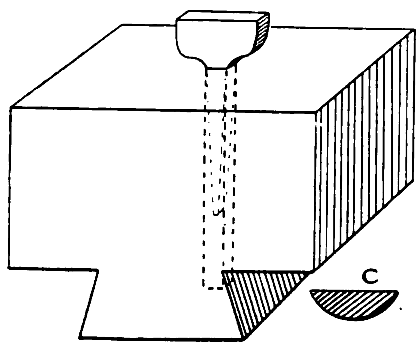


Fig. 3. METHOD OF SHAPING.

setting. The article is easily finished by the least qualified hand in the shop.

I make a head stock step iron (Fig. 5) in much the same way as the above, although it is somewhat different in shape, using the same size of iron, and the same roughing out blocks and tools. However when I have drawn it down to the T-shape, and it is about 1½ inches square, I hold it on the edge of the blocks and flatten it, taking care to keep the shank from under the hammer, until the plate is the required thickness, and then edge it by placing it in the hole in center of the block until it is the required width. (Care must also be taken to have this as near finished sizes as possible, allowing for re-heating) or it will cause the shoulder at E to be too long and weak when stamped.

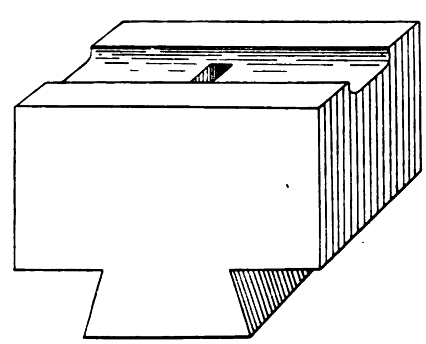


Fig. 4. BLOCK FOR FINISHING THE PIECE.

When stamping this article, it is held at F with a pair of tongs, the plate lying on the block, which is shaped exactly the same as the face of the vise. A thin fin is made all around this article the same as the previous one, and is treated in the same way. In both cases they are perfectly sound, and the total cost less than when welded. It is not necessary to explain its advantages over the welded article to a practical blacksmith.

Prize Contest Articles.

Announcement of Prize Winners.

We take pleasure in making the following announcement of prize winning articles in the contest recently held by this journal.

The articles on the topic of "Horseshoeing" and "Repair Work" were all of a very high standard of excellence, so that no little difficulty was experienced in choosing those articles which were to be awarded the first place of merit.

Under the head of "Horseshoeing" the first five contributions in order of merit are as follows:—

Article No. 4, published in the February issue, "Corns and their Cure," by Mr. T. F. Brown, Fairfield, Me., first prize, fifteen dollars. Article No. 5, February issue, "The Relief of Ailments and Deformities of the Foot," by Mr. Louis Peterson, Sheldon, Ia., second prize, ten dollars. Article No. 24, July issue, "To Shoe a Horse for a Seedy Toe," by Mr. W. F. Hayden, R. S. S., Banbury, Eng., third prize, five dollars. The two articles adjudged next best were those by Mr. H. H. Spier, Greenville, Pa., "Faulty Action and its Remedy," No. 34, published below, and by Mr. James W. Vaughn, Markham, Va., No. 6, "Forging and Interfering," March issue. A year's subscription to THE AMERICAN BLACKSMITH is awarded to each of these writers.

Under the topic "Repair Work," the first, second, and third prizes of fifteen, ten and five dollars are respectively awarded to Mr. Wm. B. Reid, 257 N. Ogden St., Buffalo, N. Y., No. 15, May issue, "Repair of Locomotive Frames;" Mr. G. A. Bishoff, Gainsville, Texas, No. 37, printed below, "Wheels, Axles, Springs," and Mr. T. H. Butcher, Blooming Grove, Texas, No. 33, "Refilling Sarven Patent Hubs," also printed below. Mr. J. A. Elder, Jennings, Kansas, "Repairing old Wagon Wheels," and Mr. George Nablo, Fisherville, Ont., Canada, "Welding and Tempering Work," articles Nos. 7 and 8, April issue, are given a year's subscription to THE AMERICAN BLACKSMITH. Under the heading "Wagon Building," Mr. F. T. Hunt, South Boston, Va., author of article No 14, "A Useful Forming Machine," May issue, and Mr. E. C. Johnson, Brattleboro, Vt., No. 2, "A Quick Method of Tire Setting," October issue, are each awarded a year's subscription.

We wish to acknowledge, also, our indebtedness to the judges, Mr. E. W. Perrin and Mr. J. G. Holmstrom for their careful and earnest endeavors to select the most meritorious articles from so many almost equally good.

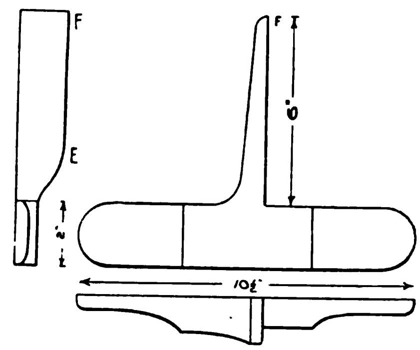


Fig. 5. HEAD STOCK STEP IRON.

It has been found possible thus far to print only a few of many articles received upon the subjects "Shoeing" and "Repair Work." Of those remaining the best will appear from time to time, in the regular reading columns.

Prize Contest—Repair Work.—33.

Refilling Sarven Patent Hubs.

T. H. BUTCHER.

Refilling a Sarven hub is a job that a great many wood-workmen fail on. In fact, some will tell their customer that a Sarven hub can not be refilled so as to give satisfaction. This is a great mistake, and if any wheelwright will follow my plan in regard to refilling a Sarven hub he will have no trouble.

I first remove all the rivets from the hub, for two reasons. First, if you will notice the flanges, you will find they have been closed in rivetting, standing closer together at the outside than at the mortise. To overcome this difficulty you are compelled to remove all the rivets. Then take your hammer, tap the flanges lightly until they stand $\frac{1}{16}$ of an inch wider at the outside than they do at the mortise. The second reason, I should add, why I remove all of the rivets, is because I cannot make as solid a job by grooving out the spoke so it will pass the rivet as I can to bore a hole through the solid spoke to fit the rivet. After this is done, I select the best spoke from the old hub for a pattern, and proceed to fit my spokes, one at a time, finishing it and driving it before I fit another. I proceed in this way until the sixteen spokes are driven. If some of the spokes are too large, and are inclined to force some of the other spokes out, I remove one and trim off just a little. I repeat this until I get my spokes to stay just where I drive them, making a solid bearing against the wooden part of the hub, as well as making a solid bearing one spoke against another. For upon a complete and solid fit depends your success. After I get a perfect fit on every spoke, I remove, glue, and then redrive, one spoke at a time. I next set the job aside until the glue dries. Then I put new rivets in the hub, cut them the desired length and rivet up reasonably tight, so as not to break the glue. I next rim and tire the wheel. After the tire has cooled off, I re-rivet the hub solidly. I have followed this plan for several years and have not had a single wheel sent back to me as yet.

Another job giving some blacksmiths a great deal of trouble is to get the holes in buggy tires to fit the old holes in the rim, when resetting the tire on a loose buggy wheel. I have seen some wheels that have had the tire reset, that have had new holes bored in the rim ½ inch from the old ones. This makes a job look very badly, especially when it is on a good wheel.

Before you take off the tire turn your wheel with the dish down, and mark your tire at the left-hand hole of the felloe plate, then take off the tire, and if your wheel is very badly rim bound (which is usually the case), wedge up the loose spokes until the rim becomes tight. Then turn your wheel with the dish down, as you did when you marked the tire, and saw out the rim at the joint where you marked the tire. In sawing, make your saw do all of its cutting on the right-hand rim, and never cut any off of the left-hand rim. You will thus cause the rim to fill up what has been cut from one side of the wheel. Next shrink the tire between the double holes and first bolt hole on the right-hand side of your mark. This will bring your tire around with the rim and all the holes in the tire will fit the holes in the rim, excepting the right-hand hole of the plate where you marked your tire. This hole will have to be rebored, but the felloe plate will cover up the old hole. When you are ready to fit the tire on the wheel, be careful to fit a bolt in the left-hand hole where your mark is. If you, through mistake, get the bolt in the right-hand hole, it would pull your tire too far to the left.

Prize Contest—Horseshoeing.—34.

Faulty Action and its Remedy.

H. H. SPIER.

Forging, interfering and knee-knocking are the three hardest problems to master. I have found by twenty-five years of practical experience and much study at road and turf shoeing, that there are many different kinds of shoes to be used, and while we are using a certain kind of shoe, the foot must be dressed correspondingly.

Knee-knocking is the least common, but oftentimes the hardest to successfully overcome. In the first place, we must notice particularly how the foot sets upon the ground, if toe points in or out, also how the leg bone sets in the foot. If the bone sets inside the center of the foot, and the toe points out, the foot standing low on inside, shoe the foot in the following manner and ninety per cent. will go right. Dress the foot level if possible, leaving the inside of foot full and strong. Weaken the outside by dropping outside wall with rasp. Also take outside off from edge of foot, from quarter to toe, and fit the following shoe. Weight the shoe on inside from heel to toe; make the outside of shoe light and much thinner, also leveling the outside of shoe at toe, thus giving the foot a chance to break over at this point. Should the foot turn in and the bone set in center of foot, which is commonly the case, dress the foot level, straighten the foot by taking off the inside rim of foot from inside quarter to point of toe. If shoeing with plate, make the shoe heavy on outside from heel to point of toe, fitting full to outside, making the inside of shoe thinner and lighter, fitting closely to foot as dressed. Should you wish a calked shoe, use an ordinary shoe of light weight by welding on toe calk extended well to outside, leaving inside toe calk and inside heel calk slightly the lower, which will enable the foot to break over square and go clear.

Forging is a very common fault among road horses. To overcome it, quicken his step in front, and shorten, widen or retard his step behind. If the horse strikes badly, drop the forward toe of the front foot as much as it will stand, leaving the heels well up. Use an extra light shoe of whatever size the horse may wear, raise a light heel calk, bevel towards the toe, and give the heel of the shoe a little spring, 1½ inches forward from the heels. Make a complete roller motion toe and fit the shoe to the foot. The horse will do the rest with the front end. To retard his hind step you must first notice in particular at what point the horse breaks over. This can be determined by the wear of the point of the toe. If you find that the break over is at the center, or very near that point, shoe the foot with an extended shoe at least four ounces lighter behind than in front. If a calked shoe is used, weld on a toe calk ⅜ to ½ of an inch high with a heel calk ¼ of an inch lower, dressing the foot level, and leaving the toe of the foot well extended. If the heels of the foot are naturally high, cut them well down, fit the shoe level and to the foot.

Should you observe upon examining the foot that the horse breaks over the outside of the toe of the hind foot, dress the foot as before mentioned, weld on a well extended toe calk to outside, inclined slightly forward leaving the heel calks of the shoe lower, throwing out side heel of shoe outward from the foot. This compels the foot to break square over the toe and retards the action behind.

You will find exceptions to this rule to prevent forging, and when you do, try the following: For shortening a horse's stride behind for the prevention of forging, shoe the horse in front with a rolling motion toe weight, if the break-over is at about the center. Shoe with little heel, and no toe, leaving toe of foot a good length, which will extend the forward action almost invariably. The hind feet should now be noticed very particularly as to how they or the shoes are worn. If the horse wears heavier on one side than the other, stand him square on his feet, but leave the heels of the foot well up and the toe of the foot of good length. In preparing the shoe for the foot, one should be used at least four ounces lighter than the ones used on the front feet, fitting it out well at toe, and giving a bevel or short roll at the toe without toe calk. Let the shoe extend well back of the heels with a short calk.

My theory for shoeing a horse to widen his stride behind is as follows: Before dressing the foot for the shoe, notice in particular how the horse has worn his shoe. Should you find they have been worn level, leave the inside a trifle the lower with a well extended toe. You must make a shoe for this foot, leaving heavy side-weight inside. Two-thirds the weight of the shoe should be left between the inside quarter, and the point of the toe at center. From this point, draw shoe down lightly to outside heel, also draw lightly the inside heel from inside quarter back, leaving inside heel ½ of an inch the longer and nail on. Should you find that your horse has worn his feet heavy on the outside, dress the feet level as possible, always leaving extended toe to outside if possible. Should the toe be worn off at this point, turn the shoe quite heavy on the inside from quarter to toe, leaving the shoe the same thickness all the way around. Welding on light toe calk, projecting over outside of shoe, running straight out from the foot. Raise a low heel on outside of shoe, throwing outside heel of shoe outward to a point in line with the extended toe calk, and leaving the inside heel without calk. Fit the shoe close at all points and nail it on.

In treating a horse that interferes, we should always remember that there are different causes. We occasionally find a case where the horse strikes that has never been shod, which is quite often a stubborn case to overcome. I have found that in this instance the foot almost invariably has been worn quite low on the outside, and well off at outside of toe. Dress the inside down all it will stand, to a level if possible. Shoe with outside weight shoe, extend toe calk to outside, inclining forward. Raise a low outside heel calk throwing heel of shoe outward from foot. Leave inside heel without calk, fit the shoe closely to inside of foot and nail it on. Should you find a horse that stands low on the inside of his feet from natural causes, you will observe that the leg bone sets inside from the center of foot, subjecting the inside of the foot to more than its share of the weight, consequently this foot will almost invariably stand low on inside. Where you find this kind of a foot, you will generally find an interferer. To shoe this horse, so that he will go clear, drop the outside of the foot by dressing, or by an inside heel, and toe calk welded well to inside of toe. If the horse toes out, fit the shoe quite straight on the inside, setting the toe of shoe well to inside, and allowing the shoe to run across point of toe up to outside quarter. Should there be danger of pricking at the two outside nails, leave them out and use but the two heel nails outside. This will line up the foot, keep the horse level and ordinarily stop the interfering.

Prize Contest—Repair Work—37.

The Repair of Wheels, Axles, Springs.

G. A. BISHOFF.

Of all classes, repair work is the greatest. With twenty-six years experience, covering a territory from Baltimore to San Francisco, and from Minneapolis to the Gulf, I will endeavor to treat briefly the different parts in their regular order.

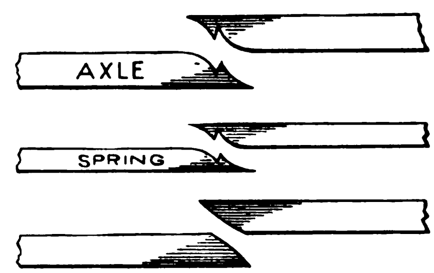
The buggy shaft irons are generally the first to be repaired. The best way to repair a shaft iron, broken at the crossbar, is to furnish a new piece of iron for the tee, or it can be made just as good by laying a piece on the old tee if the new iron is not convenient, but the danger in that is a misfit of the holes, which is very important, for it is absolutely necessary that the bolts should fill the hole to keep the iron from getting loose and causing a very disagreeable squeak. I am always careful to see that the shafts are square before fitting the iron. If this is neglected, the buggy will not track, and the shaft point will injure the horse's side. Again, the shaft iron sometimes breaks in the bend and the shaft is sure to straighten more or less. This must be corrected by bending the shaft, or by straightening the sound shaft. This can always be done without taking off the shaft iron, by nailing a block to a post about six inches from the floor, placing the shaft eye under the block and pulling until you have straightened the shaft to match the other shafts. By this means you can true your shafts and avoid a great deal of trouble to your customer, as well as yourself, with very little or no additional cost.

Setting axles is another important piece of work too often poorly done. My rule for this work is to set all axles on a plumb spoke from hub to floor, and half inch gather in front, provided the wheels have the proper dish. Otherwise be governed by circumstances. I find the cold axle-setter a very profitable tool, for with it more than half of the spring axles can be straightened in a very short time without removing them from the buggy, which also prevents breaking the paint on new buggies. This always pleases the customer and is a drawing card.

To straighten wheels that have too much dish and make them stand is a difficult thing with most shops. In this I have been successful. To straighten a wood hub wheel, I remove the tire, take out spokes and straighten the face of the spokes. I then make a wedge-shaped block large enough to fill the mortise in hub, so the spoke will drive in sufficiently tight, dip wedge and spoke in thin glue and then in fine sand, place wedge in the hub and drive in spoke. Treat each spoke in the same manner and let the glue harden before putting on tire.

To straighten a much-dished Sarven wheel, remove the tire, screw the wheel down well on frame or floor (face down), take a hand set or fuller and place on flange close to hub. Use a two-pound hammer on set to force the flange to its original place, and be certain the flange is the same all around the hub, or otherwise the wheel will wabble. In extreme cases it may be necessary to screw the hub down past straight and again use set on flange. When you have straightened, take up, put new rivets in hub if needed, and be careful to have enough head on your rivets to support the flange. Now set the tire. Fill the open space in rim, caused by straightening the wheel, with a piece of hard leather. Sarven wheels can be tightened at the hub the same as the wood hub wheel, but it is much less work to close the flange as just explained.

A few words about the cold tire setting machine. I have the McGovern and would not be without one. It will not do everything, but it will tighten tires if the wheels are sound and do it



A WELDING KINK.

quickly. I find by reversing the wheel in the machine I get a more perfect job. If a wheel is rim bound, I remove felloe plate and saw out enough to let rim down on spokes, replace the felloe plate and set tire in machine. If a few spokes are loose in rim, I take out enough bolts so that I can drive the tire partly off and wedge the spokes in rim, replace tire and bolts, then set in machine. But if all or nearly all the spokes are loose in rim I take tire off, wedge spokes, saw out rim and upset tire on two sides to make holes match. I never fail to use a wheel traveler when setting tires by hand. It does not pay to guess. Another thing worth noticing is that more than half of the tires are a little looser on one side than another. Then naturally, that side should be upset the most.

Old wheels run with a loose tire always have the rim bent in at the joints. To remedy this I soak the bent places in water for ten or fifteen minutes to soften the wood. After straightening the rim, the joint will not fit. I then saw out enough to fit ends of rim perfectly. If there is too much opening, I fill with good leather so as not to dish the wheel too much. If it should be necessary to saw out very much I then put leather in both joints to make the holes fit.

If a new or sound wheel has a broken spoke, I do not remove the tire in hurried jobs, but clean out the mortise in hub and $\frac{3}{8}$ inch in rim and fit both ends of spoke before driving. I am always careful that the tenons in rim will fill both ways. It is also well to make spoke $\frac{1}{16}$ inch longer than the others. I now drive spoke in hub and then use a prop and lever to force out rim and place spoke tenon in mortise, remove lever and strike the tire with a hammer to settle rim on spoke. If done with care it will last about as long as the old way and can be finished in a few minutes. A piece of board the length of the spoke placed on the hub for a prop, and any old buggy axle makes a good lever.

To weld buggy springs and make them stand is a different thing with most smiths. I weld a great many and guarantee every one of them. I have only had five to break in the past seven years. I consider the old way of dovetailing the spring to weld it a very bad way, because by lapping the spring you make it double thickness just where you want it to heat first. The result is that the spring is injured by getting too hot at each end of the lap, and rarely gives satisfaction. My method is to upset the ends well, scarf the same as you would a steel tire, then take a chisel and cut a groove about $\frac{1}{8}$ inch deep across the thick end of the scarf, finish both ends the same and see that both grooves fit each other nicely before welding. Now heat the ends separately, the same as you would any piece of iron and put your spring well in fire so you do not burn off the thin ends. The grooves will make it impossible for the scarf to slip and you will have no trouble in making a good weld. I always weld steel axles the same way. Each scarf and groove can be made in one heat so there is no lost time and will save much trouble. The scarfs on a spring should be somewhat longer than on an axle.

In conclusion, I will say a few words about rubber tires. I am sure some brother has been troubled with badly rusted tires, making it almost impossible to get the new wires through the rubber. Experience has taught me the best thing to do is to use a hard wire, two numbers smaller than the ones taken out. They can be put through the rusty rubber so much easier because it is much stiffer and smaller. I mention this because it is the most troublesome feature in the rubber-tire business.

Shoeing Knee-Sprung Horses.

CHAS. L. EDICK.

In shoeing horses that are knee sprung, we should try to relieve the strain on the cords and tendons. To do this, lower the toes as much as they will bear, and raise the heels of the shoe. Use some liniment to remove the soreness, and after shoeing once or twice, lower the heels gradually to the natural position. Young horses can be cured this way if the trouble is not of too long standing. Caution the driver or owner during treatment not to drive too fast down hill.

The Treatment of Toe-Cracks.

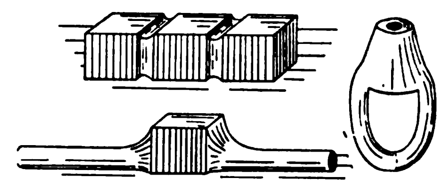
J. G. BLOCHER.

I will try to explain how to cure the worst toe-crack that can come to a blacksmith. If the foot is dry, first soak it in a tub for two or three hours, then make a bar shoe beveled out to spread the hoof. Weld two ears on the outside of shoe at the two last nail holes and punch $\frac{1}{4}$-inch holes in them. Draw clips at the outside toe and inside toe to keep the hoof from spreading beyond the shoe. Rasp off about $\frac{1}{16}$ inch at the toe between the toe nails to help close the crack. Next cut a piece of rubber three inches long and two inches wide, and $\frac{1}{2}$ inch thick and lay it on top over the crack. Make two bands to rivet on the ears long enough to come over the rubber, and turn the ends up $\frac{5}{8}$ inch, punching a $\frac{1}{4}$-inch hole for a stove bolt. Now draw the crack together, but not very tight. In a few days tighten it a little and cut the outside shell between the crack out. Then burn the coronary band above the crack. Keep the hoof damp or use a good hoof salve. The horse can be used at light work in ten days.

Forming Small Wire Rope Sockets with One Weld.

H. N. POPE.

In making such sockets, the size I used to make a great many of, I take $\frac{7}{8}$-inch square Norway Iron and fuller in on three sides in two places, as indicated by the illustration. This leaves one side or face straight with the center about one inch long. I then draw both the ends out to $\frac{3}{8}$ inch round, leaving them a little full at the end for the weld. I next turn the ends up and then punch the hole, using a narrow punch block. The body is next worked up on a mandrel to the desired size, and the ends brought together and welded. Those we generally used had a half-inch hole in the body, which was finished to $\frac{7}{8}$ inch with the loops $\frac{3}{8}$ inch in diameter.



FORMING A ONE-WELD SOCKET.

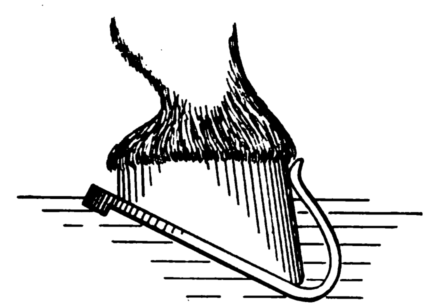
I think this method would work on larger sizes, unless one was wanted with a hole large enough to weld on the horn of the anvil. In that case it may be better to turn a body and weld on the loop.

Shoe for a Toe-Walker.

W. D. BOETTLER.

I enclose a rough sketch of a horseshoe that I made and put on the hind foot of a horse that walked on his toe. As a result the owner of the horse said that he walked better and that it improved him more than any shoe that he had ever put on before.

I turned a low square heel at the proper length, then drew out the toe of the shoe a little and welded the end of a piece of an old 16-inch rasp, about



SHOE FOR A TOE-WALKER.

four inches long. Then I drew out the other end and left it flat and bent it up to brace against the front of the foot, leaving a space of about one inch between the foot in front and where the bend comes up. I turned the upper end out a little bit so as not to injure the foot. The horse walks better than with a common plain-toed shoe.

Pointers on Shoeing.

R. A. PATTERSON.

In Texas a shoer has much to contend with. We get horses with cuts, bruises, narrow heels and every other conceivable thing. Cripples come to my shop nearly every day, but there is no one way to shoe them all, any more than there is one way to treat stumbling and interfering.

We will consider horses with sound feet, however; some have a round stumpy foot, some a flat foot and some have a foot nearly like a mule. There is no one rule to shoe them by, but the great principle which will work on all is to shoe the feet to leave them as near like nature made them as possible. I always advise my shoers to level the feet. I mean by that to trim their hoofs so the horses can stand level and pick their feet up level. Nearly all smiths trim the sole of the foot with the knife. When a horse's foot gets so it won't shed the bottom, the foot is not in a healthy condition and should be treated Trim your horse's foot down nearly to the sole. Take your knife and trim all the loose stuff from around the frog, being careful not to cut the sound part. The bars run from the heel down to frog. Start at the lower point next to the point of the frog and trim to the heel, being careful not to trim too much. Slope from heel to point. This gives a good brace and keeps your horse from having bruised places at the side of the frog. Take a proper shoe and make it fit the foot back to the last nail hole, and let the shoe extend out 1/16 of an inch on each side. If you have a calk, let it extend back so the point of the heel will be on the shoe. A calked shoe should be longer than a smooth shoe. Now level the shoe, so that it will not press more at one point than another. Take an old rasp and file the heel of the shoe up to the first nail hole perfectly level. Use a nail that will fit the shoe. Nail it on and draw the nails tight enough to make a good fit, though not too tight. Next take the rasp and cut the fragments from under the nail, but don't file a notch under it. Then take the hammer and clinch the nail, hammer the clinch into the hoof and your horse will travel like a new one.

Prices from Finleyville, Pa.

I give below some of the prices for work in this section, which may be of some interest.

Four New Shoes, toe or no toe, . $1.60
Four Shoes, reset, ...80
Bar Shoes, each 50
Hand Made Shoes for driving horse, each, ...50
Setting Tires on buggy, per set, 2.00
Setting tires on wagon, per set, 2.00
Setting Axle from 3/4 to one inch, .75
Setting axle from 1 1/4 to two inches, ... 1.25

W. J. ANGEMEER.

Two Attractive Shoeing Shops.

The accompanying illustrations show the two well-equipped shops of Mr. E. J. Delorey, a progressive smith of San Diego and Los Angeles, California. We print the following brief description of them in his own words:

The San Diego shop, Fig. 1, is located at 1227 Fifth Street, the principal street of San Diego. It is brick, 90 by 22 feet, and nicely furnished inside with a large office on the left of the entrance. There are two fires, and short bins for different sizes from No. 0 to No. 6, are between the two fires. The coal bin is just about fifteen feet past the last fire. A box stall, 12 by 14, is located in the back end of the shop. The forges are made of the same style as my Los Angeles fires, which you will see in Fig. 3—a style of my own. They are all closed in, except the opening to work at the fire. With this style of a forge, it is impossible for any dust or smoke to get in the shop, and the fire seems to heat faster than an open one. A great many horseshoers are putting these kind of forges in, since they have seen mine. All the fixtures are on the same side, which gives a 90-foot wall to tie horses to—room for twenty-five horses. The main door is wide enough to drive in a double team. I work three men and a boy here, and some days they shoe thirty horses. The two shops have shod sixty-two horses in one day, one-third of the shoes hand-turned.

The Los Angeles shop is located at 145-147 North Broadway, one of the principal streets of the city. It is seventy feet long; the first forty feet, twenty-nine feet wide; the next thirty feet, being fifty feet wide. The shop has two entrances, one a driveway, that comes in from the right side of the shop. On this floor, 30 by 50,

WEIGHTS OF SQUARE AND ROUND BARS OF WROUGHT IRON IN POUNDS PER LINEAL FOOT.

WROUGHT IRON WEIGHING 480 LBS. PER CUBIC FOOT. TO GET WEIGHT OF GIVEN BAR, MULTIPLY BY LENGTH IN FEET. FOR STEEL ADD TWO PER CENT.

Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long.	Weight of Round Bar One Foot Long.	Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long.	Weight of Round Bar One Foot Long.	Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long.	Weight of Round Bar One Foot Long.	Thickness or Diameter in Inches.	Weight of Square Bar One Foot Long.	Weight of Round Bar One Foot Long.
1/8	.05	.04	7/8	27.55	21. 64	5/8	105.5	82 83	3/8	232 7	183.7
1/4	.20	.16	3	30.00	23.56	3/4	110.2	86.56	1/2	240.8	189.2
3/8	.46	.36	1/8	32.55	25.57	7/8	115.1	90.36	5/8	248 0	194.8
1/2	.83	.65	1/4	35.21	27.65	6	120.0	94.25	3/4	255.2	200.4
5/8	1.30	1.02	3/8	37.97	29.82	1/8	125.1	98.22	7/8	262.9	206 2
3/4	1.87	1.47	1/2	40.83	32.07	1/4	130.2	102. 3	9	270 0	212 1
7/8	2 55	2.00	5/8	43.80	34.40	3/8	135.5	106. 4	1/8	277.6	218.0
1	3.33	2.61	3/4	46.88	36.82	1/2	140.8	110. 6	1/4	285.2	224.0
1/8	4 21	3.31	7/8	50.05	39.31	5/8	146.3	114. 9	3/8	292.5	230.1
1/4	5.20	4.09	4	53.33	41.89	3/4	151.9	119. 3	1/2	300.8	236.3
3/8	6 30	4.95	1/8	56.72	44.55	7/8	157.6	123. 7	5/8	308.8	242.6
1/2	7.50	5.89	1/4	60.21	47.29	7	163.3	128. 3	3/4	316 9	248.9
5/8	8.80	6.91	3/8	63.80	50.11	1/8	169 2	132. 9	7/8	325.1	255.3
3/4	10.21	8.60	1/2	67.50	53.01	1/4	175.2	137. 6	10	333 3	261.8
7/8	11.72	9.20	5/8	71.30	56.00	3/8	181.3	142. 4	1/4	350.2	275.1
2	13.33	10.47	3/4	75.21	59.07	1/2	187.5	147. 3	1/2	367.5	288.6
1/8	15.05	11.28	7/8	79.22	62.22	5/8	193.8	152. 2	3/4	385.2	302.5
1/4	16.88	13.25	5	83.33	65.45	3/4	200.2	157. 2	11	403 3	316.8
3/8	18.80	14.77	1/8	87.55	68.76	7/8	206.7	162 4	1/4	421.9	331.3
1/2	20.83	16.36	3/4	91.88	72 16	8	213.3	167. 6	1/2	440 8	346.2
5/8	22.97	18.04	3/8	96 30	75.64	1/8	220.1	172. 9	3/4	460 2	361.4
3/4	25.21	19.80	1/2	100. 8	79 19	1/4	226 9	178. 2	12	480 0	377

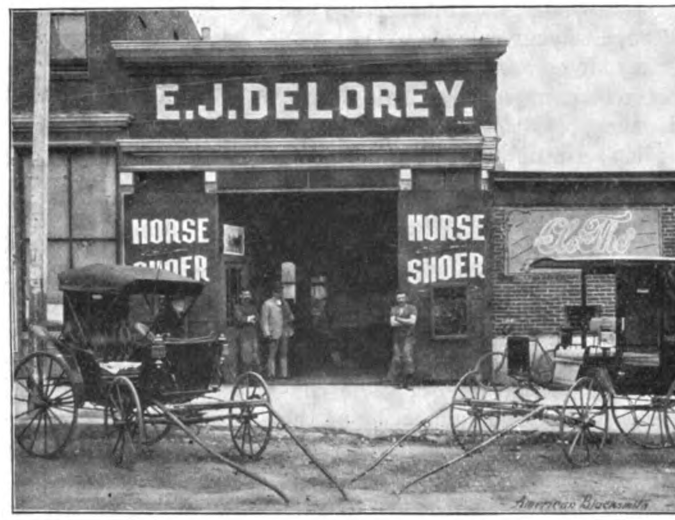
there is plenty of room to unhitch and leave the buggies while the horse is being shod, which is a great thing for a shop in a city, as it does away with hitching and unhitching on the street, and the buggies are out of any danger of runaways. This shop has two fires run by electric power, also an emery wheel to clean up the shoes, and do away with all the cold filing. I also have a box stall, 12 by 14, in this shop in the back end. This shop is L-shaped inside, with a 70-foot wall to tie to, and room for eighteen horses. I work four men in this shop, counting myself.

A Practical Method of Carriage Re-painting.

GEORGE T. PARKER.

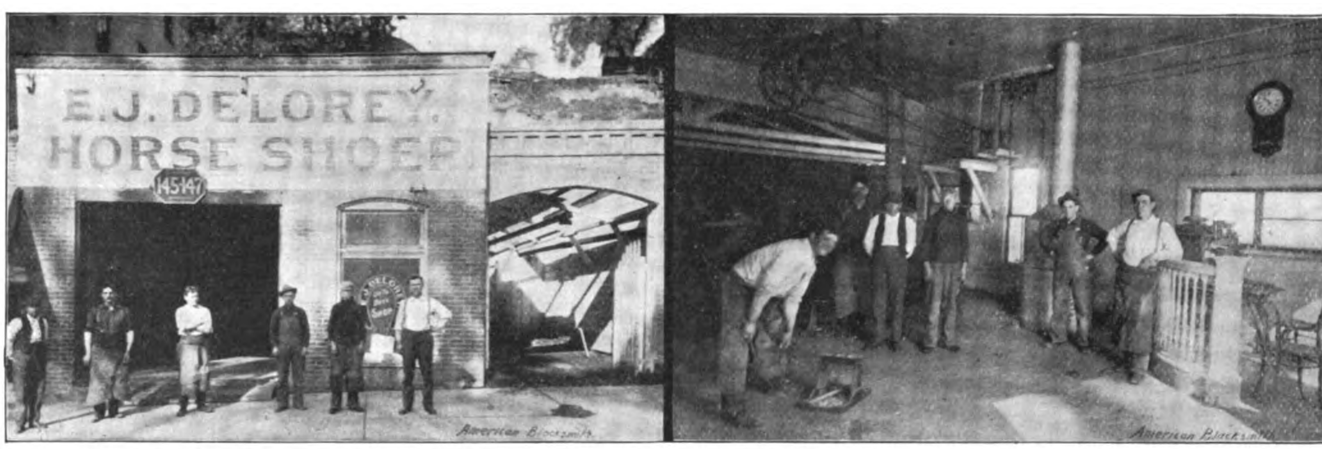
The subject matter of this description is intended principally to bring out some ideas upon a practical method of repainting buggies at a small cost, and turning out a neat and satisfactory job.

First clean the buggy thoroughly and sand-paper with No. 2 sand-paper. Take enough keg lead to do the work. Usually about one pound suffices for an ordinary buggy. Thin this so as to work well under a bristle brush with one-third raw linseed oil and two-thirds turpentine, adding about a tablespoon of extra coach Japan and a small quantity of lamp black, Venetian red or yellow ochre, according to the color in which you expect to finish the job. Give both body and gear a coat of this mixture. (It does not matter what color you use on the body at first). Let them stand until next day, when they will be read to putty. The putty should be made of dry white lead mixed with equal parts of extra coach Japan and quick rubbing varnish, and should be thin enough to work easily under the knife. Putty up all defects on body and gear, and if the holes and scars are not too deep, the job will be ready to sand-paper and give another coat on the following day. Putty made in this way dries very quickly and thoroughly hard, and will not crack or fall out. After sand-papering the gear, give a coat of lead mixed with about one-half teaspoonful of linseed oil and thinned with turpentine and about a teaspoonful of Japan. This coat should be thin enough to work well under a camel's hair brush and should be colored so as to match fairly well with the finishing color. If your room is kept at about 70 degrees F. with plenty of fresh air stirring through it, this coat will be dry and ready for the finishing color on the following day. Sand-paper smoothly with No. 1 sand-paper and proceed with your coloring. Take your color (I use Masurey's Color ground in Japan) from the can and stir thoroughly before adding any turpentine, until all lumps disappear. Then thin down by adding turpentine very slowly and stirring thoroughly, until the whole mass is thin enough to flow freely under a camel's hair brush. A few drops of rubbing varnish, about a teaspoonful to one pint of color, should next be added. Apply this to the gear with a 1½-inch camel's hair brush, being careful to avoid running on the spokes at the hubs. If this coat is applied in the morning, another can be applied in the afternoon of the same day. On the following day stripe up, and when this is dry (which will usually be in about 12 hours when properly mixed) finish with a coat of elastic gear varnish, applying it with 1½-inch bristle varnish brush, and if you take pains your gear will be all you can desire.



AN ATTRACTIVE SHOEING SHOP.

After second coat of lead and the body is thoroughly dry, proceed with the rough stuff. Make your rough stuff by taking Reno's Filling and mixing to a stiff paste with equal parts of quick rubbing varnish and extra coach Japan, adding a small lump of keg lead about the size of the end of the thumb to a half pint of the paste. After stirring and mixing thoroughly, reduce with turpentine to about the consistency of thin cream. Apply this rough stuff, two coats per day (one in morning and one in evening), for two days. On the following day rub off with hard or lump pumice stone and clear water. As the under coats of lead are of a different



EXTERIOR AND INTERIOR VIEWS OF A LOS ANGELES SHOP.

color than the rough stuff, they serve as a guide and keep you from rubbing through to the wood. After rubbing smooth, wash off nicely and let dry for an hour or more. Then sand-paper with No. 0 sand-paper, dust off carefully and proceed with your color.

Thin your color so that it will flow easily under a camel's hair brush. You can apply two coats of this the same day on which the body is rubbed down. This color should have a very few drops of rubbing varnish in it, so as to make it a little bit elastic.

On the following day, rub the body over with moss, or curled hair, and apply a clear coat of rubbing varnish. The body should be painted and varnished while setting on a barrel or some convenient stand. The application of the rubbing varnish is the most difficult part in the whole job of painting, as it is necessary to go over the panels quickly to keep from leaving too many brush marks, while it is also of vital importance that the varnish is perfectly level to keep it from sagging and running, as this spoils the looks of the whole job, no matter how well the balance is done. In all varnish coats on bodies, first put your varnish on lengthwise, go over the panel crosswise and finish lengthwise, drawing your brush the full length of the body, and being sure it goes through to the bottom of the varnish. Apply varnish with a stiff bristle brush. (I would advise that beginners set their bodies up on one side while putting on rubbing varnish).

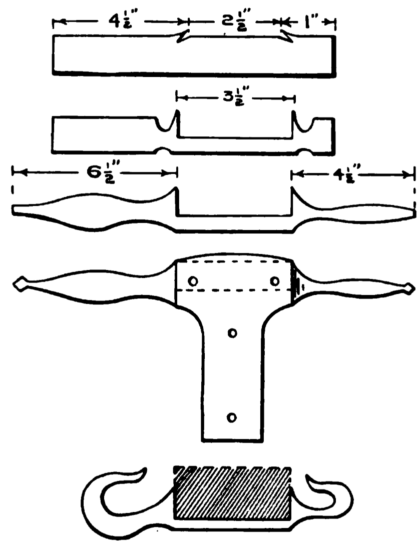
Give the rubbing varnish about 36 to 48 hours to dry, then rub down with pulverized pumice stone and clear water, using a piece of felt for the rubbing. After rubbing and washing off nicely put on the ornaments and proceed with the finishing coat of varnish, which should be a good quality of wearing body varnish. Your job is now complete, and when dry, hang off and there you are.

A curious custom survives in London regarding the payment of rent of a piece of ground in the parish of St. Clements. Way back in the thirteenth century, in the year 1234 to be more precise, a blacksmith rented a lot from the crown to build a shop on, paying as rent six horseshoes and the proper number of nails. Later the property came into the hands of the city corporation at the same rental, so that ever since then the Sheriff of London has annually paid to the city the six horseshoes and nails as rental.

Method of Fashioning Evener Hooks.

J. S. DUQUETTE.

The accompanying illustration shows roughly the method I employ in making evener hooks. I first nick hot a bar of best quality iron one inch square, and then fuller as indicated by the second figure. With a top and bottom swage



METHOD OF FASHIONING EVENER HOOKS.

I then draw out the two ends, after which I weld on a "T," resulting in such a piece as shown by the fourth view. The large hook may be of steel, if desired. The last step is to shape and bend the ends as indicated by the fifth view.

The Scientific Principles of Horseshoeing.—11.

E. W. PERRIN.

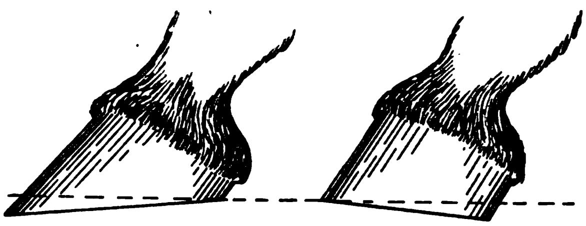
Stumbling. Its Causes and Cure.

Stumbling consists in the horse tripping in his step or stubbing his toe against some projection in the ground, causing him to blunder forward, and as a result he may fall to his knees, or he may fall headlong in a heap. The latter is much more probable if the rider or driver has not a firm hold of the reins, for once the horse loses control of the fore legs the velocity in his body and the vehicle behind him helps to throw him forcibly to the ground. Very serious accidents to both horse and man are common as a result of stumbling.

Considering causes, it will be observed that the habitual stumbler carries his feet too near the ground; hence the least projection in the surface of the road may catch the toe of the shoe. This want of knee action, this want of elasticity of step and freedom of movement may result from a variety of causes; therefore we must study the causes of each individual case, before we can scientifically apply the proper remedy.

While certain conformations of body and limb, such as upright shoulders and pasterns, a head and neck heavy in proportion to the size of the body, feet abnormally large or small, fore legs too far under the body, which make the horse heavy on the fore hand, too much weight on the fore legs, and those conformations of fore legs which predispose to interfering, also predispose to stumbling. Yet we hear little complaint about stumbling while the animal is feeling good—while he retains that spirit and metal—that elasticity of step and grace of movement which we so much admire in the young horse when he is first put to work. There is no stumbling here, even though the conformation be somewhat faulty. It is not until that elasticity of step is changed for a stiffer gait, a less elegant movement—in stable parlance called "groggy," that the stumbling commences, and if the horse could talk, he would soon tell a tale of hot, tender feet, sore joints, tired muscles and tendons. If you have ever had tender feet, especially in summer, then you know that when your feet are tired you feel tired all over. The urchin, used to bare feet, can walk and run on rough ground with an elasticity of step and freedom of movement that is truly surprising, but one who has crippled his feet by the use of tight shoes, gingerly picks his way—he hobbles along in fear of stubbing his toe; his tender feet makes his footing insecure. So with the horse. The pain and discomfort in the feet and legs destroys the elasticity of step and freedom of movement, causing the horse to carry his feet too near the ground. This is the most common cause of stumbling. Pain in the feet may result from a variety of causes. For instance it is common to see a street horse with feet so hard and dry that you can scarcely cut the sole. A casual observer sees nothing wrong in this, but the experienced shoer quickly detects a rise of temperature in such feet, perhaps some throbbing of the plantar arteries. The constant changing of position and alternate resting of the front feet is a symptom of pain quickly noted by an accurate observer, and the lameness often present in such cases—if equal in both feet—is not so readily apparent, and is therefore not called lameness, but he is lame enough to stumble.

A chronic stumbler is generally affected with some chronic ailment of foot or limb, such for instance, as side bone, ring bone, splint, contraction, corns, navicular disease, sore tendons, etc., and in such cases treatment can

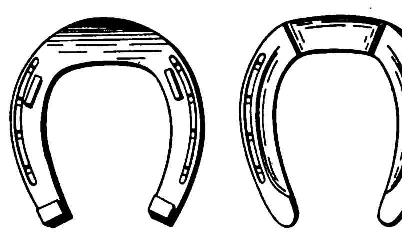


Figs. 68 and 69. LONG TOES AND HIGH HEELS. THE TRIMMING RECOMMENDED.

only be palliative, unless, of course, it be possible to remove the cause.

Some other causes of stumbling are interfering, improper shoeing, and abnormal growth of hoofs, which makes the horse clumsy on his feet. Fig. 68 shows the toe abnormally long, and Fig. 69 shows a hoof too high at the heels. The dotted line indicates in each case the amount of hoof to remove in order to restore the natural angle. The principal mistake in shoeing is the use of a shoe which is square at the toe, instead of turned up—rolled—as nature intended it should be.

The coffin bone—os pedis—of the front foot is slightly rolled at the toe, but the conformation of limbs and mode of action modifies the amount of roll of individual horses, the truth of which you can easily verify by observing the feet of a batch of young horses which have never been shod, or by an inspection of your shoe pile, which will reveal the fact that *all* your old front shoes are more or less rolled at the toe. Unlevel hoofs may cause stumbling. For information as to how to level the hoof, see article on "Preparation of the Hoof for the Shoe" in the January issue of this journal. The long oblique pastern is less liable to stumble, but don't lower the heels of the upright con-



Figs. 70 and 71. SPECIAL SHOES FOR STUMBLING.

formation in the hope of curing stumbling, for by so doing you may cause a sprain of a flexor tendon or ligament.

Having made up your mind as to the cause, the next thing in order is the application of the remedy. For hot, dry feet, apply poultices of warm wet bran. For after treatment, stop the feet every night with wet clay and wash out clean each morning. In shoeing, dress the hoofs to normal dimensions, and turn up the toe of the shoe to the degree to which the old shoe is worn.

If stumbling results from corns, contraction, split-hoof, interfering, etc., the cause must be removed if possible. The treatment for contraction, corns, etc., will be dealt with in subsequent articles. If you suspect that your patient is developing a ring bone, side bone, or splint, or if he has sore joints or tendons, recommend him to the Veterinary Surgeon. If a horse stumbles as a result of puffy joints and "gummy" tendons, commonly called "stove up," a rest is indicated, but the shoer often has to deal with a customer who says he can't afford to rest him—that he'll have to work as long as there's a dollar in him. This is a condition over which the shoer has no control, so he must do the best he can, and therefore in dealing with stumblers of the "plug class," elevate the heels so as to take the tension off of the sore tendons, and roll the toe of both hoof and shoe. Where there is an indication of navicular disease, use a Goodyear rubber shoe and roll the toe. Where calks are necessary use the shoe shown in Fig. 70. For light buggy work or saddlers, use the shoe of Fig 71. But bear in mind that treatment of the feet must go with the application of anti-stumbling shoes, for all the roller motion shoes in America will not cure a dry, tender foot, and, I repeat, pains and discomfort in the feet is the principal cause of stumbling.

(To be continued.)

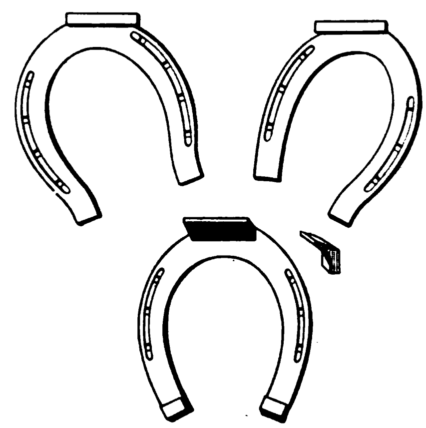
A Mutual Service.

One friend will do much for another. THE AMERICAN BLACKSMITH is your friend, and will do everything in its power to further your interests. It is giving you a live representative blacksmith paper for a nominal sum. It is securing articles for you from contributors of wide reputation among the craft. Any article or discussion which you may request upon blacksmithing subjects will be presented just as soon as it can be arranged for. You are a friend of the journal, and this is what it is doing for you. What are you doing for it? The dollar you pay scarcely covers the cost of publishing, but the more subscriptions received the better can the paper be made. So speak to all of your blacksmith friends about the paper, and urge them to subscribe for one year. At the end no one will have to ask them to renew. There is another way to look at this: In recommending the paper to them you are doing them, personally, a greater favor than you possibly appreciate.

Some Shoeing Suggestions.

HENSON GOOD.

The smith in beginning to shoe a horse should ask about his gait, and if he forges or interferes. In trimming off the rough fragments, care should be taken not to pare away any of the frog, as it is intended for a cushion. The sole should not be pared too thin. The rim or wall should be trimmed evenly with a hoof shears or nippers and rasped level.



Figs. 1, 2 and 3. SHOES FOR INTERFERING.

Next is the fitting of shoes, and the different kind to be used. I am not a lover of plates. I will admit that the plate is next to the real shape of the foot and the least alteration is made to the model foot, but the flat plate is not the elastic foot. The plate strikes the ground all around, making a solid jar, and on pikes they are liable to cause bruises and shoulder lameness.

Calks should not be too high. The calked shoe only strikes the ground at three places, and often misses stones. Roads are seldom so hard but that a calked shoe will cut in to some extent, giving less jar.

In fitting a shoe, I turn the calks first, then jump the toe on by using a toeing bar. In shoeing a perfect foot, the toe should be in the center of the front end of the frog. The shoe should be large enough to cover the foot without cutting away the outer shell or wall. The heels of the shoe should follow the curve of the heel by covering or extending properly over the wall around the quarter. Fig. 1 is a shoe for a pigeon-toed foot, with the toe set out of center of shoe. Fig. 2 shows shoes for a splay-footed or nigger-heeled horse; the toes should be set inside of the center of foot. In cock-ankled horses, the toe should extend as far in front and high as possible, with low calks, as in Fig. 3. For interfering, set the calk under as much as possible, the outside calk the same. Use only two or three nails on the inside next to the toe. For interfering with side of foot, level well, countersink and smooth the clinches. Always leave one or more nails out, just at the place they strike, as the clinch generally strikes first.

For corns, level the foot nicely, and trim out the corn, but not so deep as to cause tenderness. I recommend a well-made bar shoe, letting the bar rest on the frog, so that the heel of the shoe does not touch the wall by $\frac{1}{16}$ of an inch, or enough to run a case knife under the heel of the shoe. Do not draw the nails too tight. Put some turpentine on the corn, as it has a tendency to remove soreness. If the frog is hard and dry, use some good hoof ointment. I have found this to prove successful.

The proper way to shoe a horse that is knee-sprung is to put a shoe on with a rolling motion, or in other words, set the toe back and not very high. Make the calks fairly high. For a knee-sprung colt, use a high toe and low heels or calks. For a horse that cross-fires, a heavy side weight is preferred with long outside calks. For a pacing horse, the same, but not so heavy on the outside.

In conclusion, I would say, don't burn the foot, pare off the frog, or make the shoe too small. Don't get the shoe narrower than the foot at the heel, or rasp the outside of the wall, and do not try to see how high you can drive the nails without making the horse jump.

A Hint as to Filing.

P. C. ERSKINE.

The file attachment illustrated herewith is something which I find very useful, especially for heavy work, such as plow filing.

As is clearly shown, the device consists simply of a $\frac{1}{4}$-inch rod, one end of which is bent to hook over the end of the file, while the other end passes through a hole in the handle and is threaded to receive a nut. By placing a block under the rod and tightening up on the nut, the file may be given a slight bow downward. This opens the teeth and makes the file cut better. In my opinion, also, it will last longer.

AN ATTACHMENT FOR FILES.

The Origin of Nail Terms.

The terms "fourpenny," "tenpenny," etc, as applied to nails, refers to their weight by the thousand. Sixpenny nails are nails a thousand of which weigh six pounds; tenpenny nails weigh ten pounds to the thousand. It is an old English term, and meant at first "ten pound" nails (the "thousand" being understood), but the old English clipped it to "ten-pun," and from that it degenerated until "penny" was substituted for "pounds." When a thousand nails weigh less than one pound they are called tacks, brads, etc., and are reckoned by ounces.

A New Drill-Grinding Attachment.

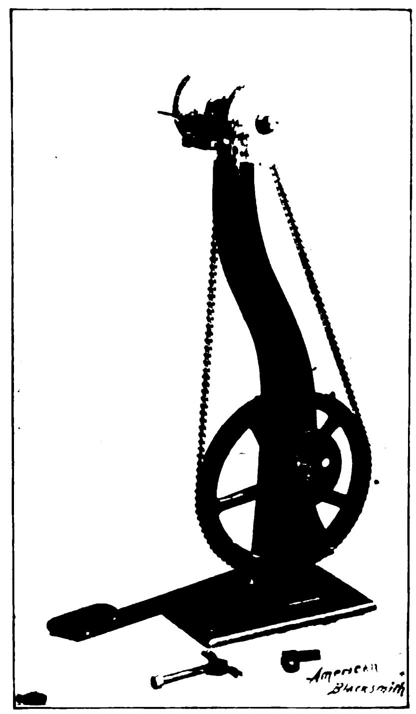
A novel attachment for grinding twist drills has recently come to our notice. By its use, the makers claim, twist drills from $\frac{1}{8}$ to one inch in diameter can be perfectly ground, the device being fitted with adjustments to secure any required angle. From the engravings it appears to be simple, easily attachable and readily adjustable. Both illustrations show it attached to a No. 10 Hero Emery grinder, the entire outfit being built by the Robertson Manufacturing Company, Buffalo, N. Y. This grinder is a foot-power machine standing 41 inches high, the spindle being driven by means of a treadle, heavy balance wheel and steel chain arrangement. The machine as thus made, with tool rests and grinding attachments, is very serviceable for blacksmith and repair shops. The gearing ratio is such as to give a good speed for the grinding required in such shops.

Diseases of the Foot and Their Treatment.—8.

E. MAYHEW MICHENER, V. M. D.

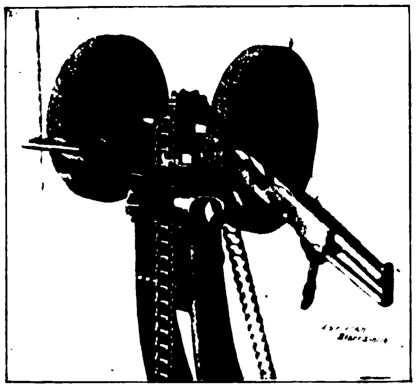
The condition commonly known as curb is the result of sprain or laceration of the fibres of the calcaneo-cuboid ligament, which has for its function the binding of the bones of the posterior line of the hock. The condition is at some time during its duration accompanied with enlargement of a firm character, situated four or five inches below the point of the hock and directly behind it. The enlargement changes the normal straight line from point of hock to fetlock to one of more or less curve at its superior part. The name curb is derived from the French word "courbe" meaning a curve. The deviation from the straight line is best observed by standing to one side and slightly behind the animal, and viewing the line from point of hock to fetlock. The amount of enlargement varies greatly in different cases from that which is very slight to that which is so decided as to be noticed at a distance. The size of the enlargement does not always bear a direct relation to the severity of the lameness or the obstinacy of the case.

As to the cause. The causes of curb may be classed as those predisposing and exciting. Curb is most common in young animals, because of the imperfect development of the bones and ligaments



HERO EMERY GRINDER WITH DRILL GRINDING ATTACHMENT.

of the immature animal. Conformation of the hind leg certainly plays a very important part in the causation of curb; this is so marked that certain animals with badly shaped legs can almost be depended upon to become curbed even under very moderate use. The temperament of the animal plays a certain part in the causation of curb, even when the legs are not predisposed. Animals which are of nervous temperament, quick at starting or disposed to rear if restrained, are liable to strain, causing



ADJUSTABLE ATTACHMENT FOR GRINDING TWIST DRILLS.

curb. Occasionally a curb is produced by a sudden stop. The character of the work may predispose to curb. For example, animals used in delivery wagons are subject to sudden starts and stops, or in the case of the saddle horse the hock is exposed to severe strain in jumping and abrupt turning. The draft horse is predisposed by reason of overloading. The condition of the road plays an important part in the causation of many cases of curb, a slippery condition of the surface or great roughness may cause severe strain of the back portion of the hock.

Turning to the symptoms, lameness may be and generally is the first symptom of curb; it varies greatly, from that only noticeable to an experienced eye, to that of such extent as to render the movement of the animal very difficult. In the more severe cases, the fetlock joint may be held flexed, or what is commonly known as "knuckled;" the heel is elevated and the toe of the hoof alone allowed to touch the ground. It is well to remember that in certain cases of spavin these symptoms are also shown, and also that in the case of puncture of the foot the animal may also take a similar position. Remember also that a punctured foot may come on the same leg as is also curbed, and do not neglect to examine the foot thoroughly in all cases of lameness no matter how clear the case appears to be. The lameness of curb frequently becomes worse on work. The enlargement may be seen and felt with the hand. If the lameness be severe, the heat and tenderness upon pressure is commonly well marked. Less severe cases may show very slight lameness or defect of gait, although the enlargement may be very pronounced. The lameness of curb is commonly the most severe during the formation of the enlargement, and very commonly the case is much improved by a rest of one or two weeks. By renewed hard pulling or exertion the lameness frequently returns and the enlargement may increase in size. Relapses of this kind should be avoided, and when work is seen to render the animal worse, the case should have absolute rest. In the determining of curb lameness, care should be exercised not to confound the case with that of sapvin, as curbs and spavins not uncommonly appear on the same leg; also do not fail to distinguish the difference between curb and that of strain of the perforans tendon and its reinforcing check ligament. Attention to the location alone is sufficient to differentiate these two conditions.

The prospects of recovery are good in the majority of cases, provided reasonable care and treatment are given. The most serious cases are those in which the lameness is intermittent in intensity, and which is found to be brought on by slight work after the ordinary rest and treatment has been allowed.

The enlargement frequently disappears after a variable time, but in certain cases and especially in those with badly shaped hind legs the enlargement may remain as a permanent blemish. An animal with a curb is strictly an unsound one, as such hocks cannot be in a normal condition, and are more or less liable to relapse, yet in general a curb on a leg, otherwise of good conformation and sound in other respects, does not offer a very serious objection. Animals with legs predisposed to curb on account of conformation are unsuitable for breeding. By long continued selection it is possible to eliminate the curby hock from the class of animals used for breeding purposes, and so vastly decrease the number of curbs which come as the result of faulty conformation. The vice of conformation known as the sickle leg is one which is almost invariably transmitted to the offspring whether it exists in the sire or the dam.

Concerning the treatment of curb, this depends upon the condition of the case. If it is a new one with lameness lately begun and with the enlargement painful to pressure, and hot to touch, the treatment should aim to reduce inflammation in the part. Absolute rest is essential where lameness is decided. Spraying with cold water for periods of twenty minutes or longer, three times or more daily, is good treatment. In the intervals between the spraying, good results are obtained by the frequent application of a liniment composed of tincture of opium and tincture of aconite root, four ounces of each with the addition of ordinary vinegar in quantity sufficient to make one pint. Apply to the enlargement at frequent intervals. A high-heeled shoe should be applied as soon as possible, and the toe of the foot should be shortened as much as possible without making the foot tender. After the acute inflammation has subsided, which usually requires from one to two weeks, the animal may require a blister over the enlargement. If lameness is entirely gone the blister may not be necessary, yet it is of some assistance in aiding the removal of the enlargement and in strengthening the parts and thereby in guarding against a relapse. The blister found to answer well in these cases is the same as advised for spavin, and consists of cantharides, one ounce, to which is added one dram of the red iodide of mercury, and well mixed. To apply, clip the hair closely over the enlargement and apply the blister ointment with a small paddle, rubbing it well and lastly applying a coating of the ointment over the enlargement. The tail must be tied up to prevent disturbance of the blister, and the animal's head must be kept securely tied up short for twenty-four hours to keep his nose away from the blister. After two days the parts should be washed well once daily with warm water and soap, and after drying well a small quantity of vaselene or good lard should be rubbed into the crust formed by the blister. The blister can be re-applied at intervals of twelve to sixteen days, if required. In cases where the lameness is obstinate it may be necessary to resort to the firing iron. The best treatment in firing is that done with a fine platinum point, as the resulting scar is scarcely noticeable.

The prevention of curb is a matter of great importance to the shoer. In addition to avoiding the exciting causes which have been mentioned, the toe of the foot should not be allowed to grow long from lack of proper paring, and the toe calk should find no place on the animal predisposed to curb. The shoeing should be done with the end in view of relieving strain upon the hind parts of the hock. For this purpose the wedge-shaped shoe, thick at the heel and thin at the toe, or in other cases the broad heel calk, is indicated. The shoes should be moved at least once in four weeks in order to shorten the toe.

(To be continued.)

Queries, Answers, Notes.

Questions upon blacksmithing, horseshoeing, carriage building and allied subjects will be printed under this heading. Answers and comments are solicited from readers for insertion here also. Questioners desiring answers by mail should enclose a stamp for reply

Heating Without Burning. Please inform us how to heat a large piece of wrought iron rapidly but without burning.
B. F. CARDIN,
Fernandina, Fla.

How to Shoe Unruly Horses—I should like to know the best way to prevent a horse or mule from kicking when shoeing.
E. A. DULANEY,
Ironton, Ohio.

How Build a Tire Heating Furnace? I should like to hear from some brother craftsman with regard to building a furnace to heat light and heavy carriage tires.
W. H. WINFIELD,
New Berne, N. C.

How Make an Emery Stand? Can some one of the readers of THE AMERICAN BLACKSMITH give me plans through the paper as to how to make an emery stand to run by horse power?
JNO. J MATHEY.
Robey, S. D.

Shoeing Question. I shod the front feet of a colt close and short the first time, while the hind feet were never shod. He pulls off the front shoes with his hind feet when he is turned out to pasture. He never overreaches when riding, the feet being perfectly straight and in good shape. I would like the opinions of some of the best shoers.
R. RINARD,
Masterton, Ohio.

To Temper a Knife Blade. I saw a notice of a blacksmith who wants to know how to temper a knife blade. To do this take a piece of rosin soap, heat the blade just to a red, and then put it in the bar of soap edge down. Do not melt the soap; simply cut the hot piece into it. When it is cool it will be hard enough for a razor. I have found this to be a very good method.
DAVID R. LILLY,
B. M. L. School, Md.

Editor American Blacksmith:

I am a carriage and wagon builder, and at the present time I weld a great many axles. I would like to know how to get the right length of the axle to weld without putting the axle stubs in the wheels and measuring it. In this part of the country all carriages and wagons have a five-foot track. I would like to get the best rule for welding axles without using the wheels.
MORRIS D. FRABLE,
Nazareth, Pa.

Editor American Blacksmith:

I have been doing a great deal of shoeing for a livery stable which has a number of defective drivers. One animal in particular there is that toes out behind and swings her heels so close that she steps them over each other. I weighted her on the inside and raised the shoe on the inside without any effect. Then I weighted her on the outside with an extension weight or trail to swing her off from the inside heel. This shoe stopped her except on the side for some time, but we have to take into consideration the hot weather.

There is another animal which is the worst forger that I have ever seen. What will stop others does her no good. I would like to know how to shoe this horse.
M. MINOR,
Metropolis, Ill.

How to Set Axles. Mr. Parson asks how to set axles. I suppose he refers to the track and swing. The swing is the distance the rims are further apart at the top than at the bottom when the wheels are on. For instance, if the wheel is plumb they have no swing at all. As a general rule, a wheel should have from one to three inches swing; buggies about one inch, and heavy wheels more, especially if much dished. In repairing one axle only, the wheels are made to stand to suit the other axle. As to the easiest way to set axles, they may be set with a machine or hammer, the main thing being to give the proper set. For this purpose I use a very simple device and with it you can set new axles exactly right at the first trial. This of course is of no interest to persons having a large shop with machinery, but is intended for the common blacksmith. The shape of the axles between the shoulders has nothing to do with the set.

They may be quite uneven as to shape. In practical work in common smith shops, it is not worth while to bother about that myth, the plumb spoke. Set the point of the axle down so that the wheels stand to suit you.

As to the length at which to cut axles, I would say that if the track is to be four feet eight inches, and the distance from the dish in front to the end of the base is four inches, the two wheels would make eight inches, so that the axles would need to be cut to four feet. One-half or three-quarters of an inch must be added to this to give the wheels the right swing in some cases, and an allowance must be made for welding.

To make the gauge, take a board three-fourths of an inch thick, long enough to reach from the shoulder of the axle on the under side to the other end of the axle. Cut a notch on the edge to fit to the collar so that the edge of the board will come up to the arm of the axle. Shave this part to a thin edge, so that when applied to the arm on the under side it is easily seen how the set corresponds to the gauge. If the axle is set down between the shoulder, the gauge must be shaved, so that when applied to the axle on the under side it will rest on the shoulder and arm of the axle. The two ends should be in range, and a little practice will enable the smith to set the axles down a point more or less as required. This is the handiest and simplest device that I have ever had in the shop.
S. PRISE,
South Bethany, Ind.

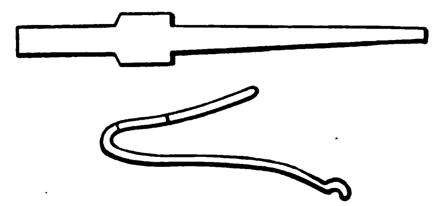
Gunlock Screws. Will some brother smith tell me how to forge gunlock screws, and the method of holding them while cutting the thread and slot? Also the correct way of forging gun springs? Also whether plaster of paris can be used instead of moulding sand for moulding brass, and how?
MINOR JACKSON,
Madison, Va.

To make small screws, forge out some pieces of old file ¼ by ½ inch and a few inches long. Drill holes the size of the screws wanted, and file about four or five "rip saw" teeth around the hole. Now ream the other side of plate so that the body of the screw will not wedge and twist. If the brace is not true, you will get a tapered screw body which would do for tumbler pins, but would not do for inside lock screws, cross or side screws.

When these miller bars are finished as above, grease the holes and teeth, take a piece of flat iron, about ¼ by 2 inches, and 1½ feet long, lay the miller on the bar, place it on top the fire in the forge and blow the fire slowly until it just becomes red hot. Then drop in oil until nearly cold, wipe off the oil and test with a sharp file. If too soft heat a little hotter and drop it in the oil again. Repeat until the file slips instead of cuts.

Now select a short piece of Norway iron or mild steel of the diameter that you want the head of the screw. Point the screw and square up the end that goes in the brace. Put the miller in the vise and proceed as in cutting tennons or spokes. Bear hard enough only to make the cut, keeping the cutting part well oiled. With care you can make these useful tools for about one-fourth what factory millers would cost.

Now when body of screw is milled far enough, saw off and place threads between two pieces of wood in a vise, file the head to the shape wanted and saw slot in the head. Now try the screw.



FORGING A MAIN SPRING.

If too tight, adjust your die and using a screw driver run the screw in and out of die, or if a thin plate, you can run taper pin farther through until screw fits.

To forge main springs, take a piece of double shear steel, and forge to the right thickness. For either side, cut to the shape shown in the illustration, heat again and bend. The offset is made to allow the filing of a pin to go through the lock plate. Be sure to bend in the right place or you may have to drill another hole in the lock plate or cut out some wood. The other offset is filed from the spring when you have it fitted, as the extra offset can be held in a vise when filing the edges of the spring. Next heat and open the end a quarter inch wider than it is to be when in place.
WILLIAM DUFF,
Coffeen, Ill.

Horse Stocks. Will some one tell me through the columns of THE AMERICAN BLACKSMITH a good plan for making cheap stocks for shoeing horses?
A. C. VORHES,
Pleasant Ridge, Ohio.

Editor American Blacksmith:

I would like to know what is good for an enlargement of the foot joint or ankle joint, as I have a horse that is affected in that way.
JOSEPH RESH,
Delabole, Pa.

Quarter-Crack Treatment. In answer to Mr. Whitney's question on quarter-crack would say that I usually forge out a piece of iron as for a cold chisel about 1¼ inches wide. Using the blunt edge of this I burn the hoof just above the crack in the hair, taking care to burn deep enough so that when the new hoof comes down there will be no crack left. This of course will make a sore spot, but if kept away from the mud and dirt will not amount to anything.

JAMES GALLT,
Jefferson, N. Y.

What is the Best Shoe for Sore Feet? We should like to know what is the best way to shoe a horse that has been driven barefooted on stone and hard roads until his feet were sore?

H. F. MEYER,
Big Rock, Mich.

Editor American Blacksmith :

Mr. Rushmer has a view point which I do not understand that he is correct in assuming and he states on page 211 that he is not much concerned about the (recalescent) point; I aimed to make the effect of that heat clear to toolsmiths, by using a column of your space on page 159. I will add here that three periods of recalescence have been observed by Albert Sauveur in steel of 50 point carbon, such as is used for rails. They multiply in high carbon steel. The highest one is the most easily observed, and as it is just below the proper hardening heat, it is the only one of value to the hardener who desires to get his steel in the best condition structurely, for in this heat the iron becomes all Beta, *i. e.*, it lacks magnetic permeability and goes into the hard state. Below this heat some of it is Alpha iron, *i. e.*, it lacks magnetic retentivity—is in a soft condition.

To my mind, this is better than the notation quoted on page 212, and should enable anyone of experience to choose whether his steel should be quenched at a rising or falling temperature.

The violent molecular disturbance which takes place during recalescence in cooling, occurs at a slightly higher temperature during heating. My statement on page 159 is, that for maximum hardening, steel should be heated sufficiently hot and suddenly quenched. Mr. Ede of the Woolwich arsenal recommends partial cooling in the air before quenching in water, but in my practice I have found no work requiring such treatment. I cannot understand this subject from the point of view taken by every hardener. The simple facts I have stated in your columns are from observations of the metal and the heat, by the aid of a microscope and pyrometer, which lend most certain assistance to an experienced steel worker who understands their use.

I should be pleased to join Mr. Rushmer in testing any of the theories which seem new to him, but am at a loss to know which of the plain facts I have stated he refers to. Every apprentice soon learns not to overheat steel, the efficient toolsmith knows it is equally important that it should be hot enough for any treatment it is to receive, or it will fail to give satisfactory results when put to practical use.

CHAS. P. CROWE,
Ohio State University.

Trueing Wagon Wheels. Will some brother wagon maker tell me the best and easiest device for facing and trueing a wagon wheel? Doing it by hand with a draw knife, 2½ and 3-inch threads are too hard to work.

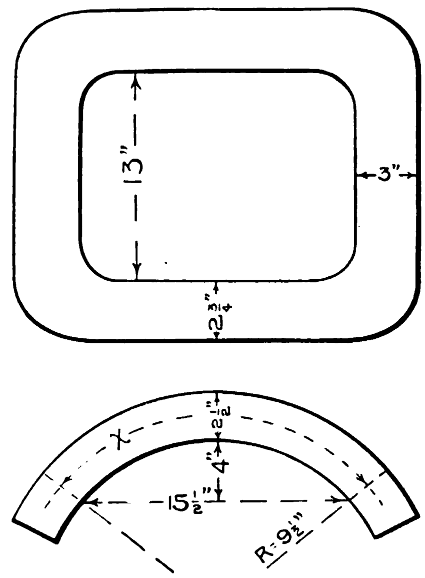
I. E. B.

Estimating Stock Required. How will I figure out the amount of material to make the door ring, to be of the dimensions shown in the accompanying sketch?

It is 15½ inches inside after it is bent. I make these rings without any trouble, but I have no exact way of figuring the amount of stock.

A. R. WYLIE,
Big Springs, Texas.

The amount of stock required on the above piece can be quickly figured out with the aid of trigonometry, and by applying this we find the theoretical length of stock required to be 6 feet 6½ inches, which is the length of the dotted



CALCULATING STOCK REQUIRED FOR A BENT DOOR RING.

line running through the center of the bent ring, as indicated. This is equal to 2 $(x+3+13+2\frac{3}{4}.)$ The value of x is about 20½ inches.

A simpler and more satisfactory way of determining the desired length is to find the length of wire which will bend into the shape of the line x, and having found this proceed as before to find the total length. The length thus obtained can then be corrected to allow for scaling and for scarfs if welded.

A. B. B.

A Good Opening in Pennsylvania. Mr. Henry Heimbach, Seisholtzville, Berks Co., Penn. woodworker, writes that there is a good opening for a first-class blacksmith at that place. There is no good smith nearer than two miles. There should be plenty of work for a good man, but he ought to be a horseshoer also. There is an empty shop within a quarter of a mile, with a railroad, coal yard and lumber yard also. Write to Mr. Heimbach for further information.

Hind Interfering. Will some brother shoer give me points on hind interfering? I used to imagine I could shoe anything without having interfering, but lately I have had some trouble and would like to know the experience of brother shoers in this regard.

W. H HOFFMAN,
McCutchenville, Ohio.

Warner Patent Wheels. Will some brother smith please inform me through the columns of THE AMERICAN BLACKSMITH a sure way to fix a Warner patent wheel, where the band is loose on the hub, the band which the spokes go through, that is? I have tried several ways to tighten the band but have failed. I think the reason is, that in this part of the country the salt water causes rust under the band, and in dry weather the band becomes loose, the spokes then working in the hub.

C. D. BRIDDELL,
Marumsco, Md.

A Good Horseshoer Wanted. If there is a good horseshoer in the craft who wants a job, I think I can give him one. He must be a steady man with good habits.

ROBERT L. TENNIS,
Hampton, Va.

Cold Tire Setting. I have noticed an article in the August number of THE AMERICAN BLACKSMITH in which Mr. C. W. Smith seems to criticise my article regarding cold tire setting in the June issue.

I will say that I have only made reply to Mr. W. L. Green's article in April number regarding cold tire setting, and had my say. I did not make a reply to Mr. Green's July article, as I think the columns of THE AMERICAN BLACKSMITH should not be used for controversies between brother blacksmiths. The columns are open to all for their opinions, but surely not for wordy battles.

Mr. Smith states in his article that cold tire setting will do very well on solid wheels, but fears the dishing of wheels. Now, I will repeat that with the cold process and the proper machinery it is impossible to wrongly dish a wheel if the smith understands his business. I hope some other brother smiths will give their experiences and opinions on cold tire setting.

ALBERT SCHEUTZ,
Wien, Mo.

Editor American Blacksmith:

I am much pleased with your paper, and think every blacksmith would be benefited by reading it.

I hope to see a large number of articles on machine and ship-building smithing. I wish some of the brother smiths around the country who have had experience in forging crank-shafts would tell me how they do it. I have forged several, but have never seen any one else forge one, and would like to know how their methods compare with mine.

I am foreman of the Blacksmith Department of the Lombard Iron Works, and we have a general run of work, consisting of steamboat, railroading, cotton gin, cotton factory, saw mill and electrical machinery and other work.

Our blacksmith shop equipment consists of one No. 3 Belle steam hammer, one Bradley hammer, shears for cutting round and flat iron, one bolt machine that we are about to replace with an Acme machine, and many other handy tools.

Our whole shop force consists of over two hundred men; in fact, it is the largest and best equipped job shop in the south.

Our boiler shop is one of the best equipped in the United States for the class of work that we do.

J. F. JELLICO,
Augusta, Ga.

Shoeing the Natural Foot. Having made horseshoeing a study, and being a manufacturer of hand-made horse shoes, I will say a few words on shoeing the natural foot.

First I level the foot on the surface, taking care not to trim lower than the crown. Trim the corners and inside of heel so as to give the "frog" room.

Then I make a shoe to fit the foot perfectly. I put the crease well in from the edges. Slant the nails diagonally to the wall. This prevents splitting the hoof.

I make the shoe as long as the foot so as to avoid using the rasp, for when you rasp the hoof to make the foot look neat you injure it.

I make the shoe uniform in thickness from heel to toe, and take great care in trimming the hoof, in order that the horse may rest level on the ground.

By following the above rules I have successfully treated many defective hoofs. S. A. SUANN, Thomasville, N. C.

Cutting Left-Hand Nut. In regard to the article in the June issue about how to cut a left-hand thread with a right-hand die, Mr. Sanders tells us how to cut a left-hand thread with a right-hand tap. Now will some brother tell me how to cut a left-hand nut to fit this thread without using a left-hand tap?

JOHN B. CAMPBELL, Klamath Falls, Ore.

A Shoeing Query. Will some brother smith tell me through the columns of THE AMERICAN BLACKSMITH the best way of shoeing a horse behind which is over on his ankles? E. H. WATROUS Pawlet, Vt.

Registered Smiths—Contracted Feet. Having read Mr. E. W. Perrin's article on "Shoeing Smith Registration," I may say I view the matter in a somewhat different light.

Suppose you were in a country where there were plenty of odd jobs of all kinds to be done, and also horseshoeing. Suppose also, there are no registered smiths, that your customers would not have any one shoe their horses but you. What would you do? Why, shoe their horses, of course, to the best of your ability.

I am not an expert horseshoer, but have lots of it to do and have no trouble or complaints.

Some of my customers use their horses until they can scarcely travel, before bringing them, for me to shoe.

What would you do with such as these?

Here is a circumstance I will relate that may be of value to some one. Not long ago a customer came to me with a herd pony, suffering from the worst case of contracted feet I have ever seen, and wanted to know if I could shoe the pony. I looked at her forefeet and asked if he didn't keep her shoes on too long. He replied that he never pulled them off until they wore off.

I took up one foot and dug out the dirt and started paring it. It had a very large bloody corn on each side of the frog. I cut out of each front foot all the bloody spots I could, then on each side of the frog, at the heel, I cut away all the hoof I could without cutting to the quick, leaving the toe as nearly level as possible. Next I put on a heavy shoe, with high heel calks and no toe. Of course, there was no pressure on the heels of the foot, but I nailed as far back as I could.

Then I took a pair of heavy tongs and spread the foot as far as I thought it would stand. This left a crack in the center of the heel of the frog in which you could lay a shoe nail. Next, I had the owner get cotton batting to stuff under the shoe where I had cut away the spots, and to keep it well soaked in a mixture of turpentine and skunk's oil, half and half, for a week. At the end of this time I again spread and continued in the same way until the shoes were on a month, when I took them off, and, as before, cut away all the hoof that I could.

I let the frog stand down for about two inches, as the pony had a very deep one and as hard as a rock. This threw all its weight on the frog. I had the pony stand in a bed of mud and manure every night and as much as possible in the day time, instructing that she be used moderately all the time. At the end of six or eight weeks I could spread and spring the feet with my hands. I pulled the old horney frog out with my fingers and the foot was straight. Not a bit of lameness and no bloodshot places.

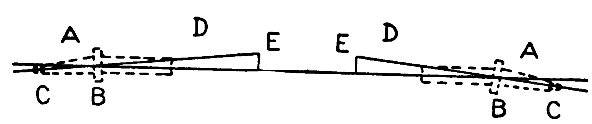
Another thing I wish to speak of, is M. J. K. Riblet's answer as to filling old buggy hubs.

I think he is more in the right than any other man I have read. Judging from experience in such work and of other kinds also, I find it pays to save your customer all the expense you can, and work to his advantage as well as your own. Then you have a customer who will stay by you. A. BRUTON, Hill City, Kan.

To Drill Chilled Cast Iron. In answer to the question of Mr. Wheeler in the August issue as to how to draw the chill from cast iron, our way is to lay the piece on the forge, sprinkle a good coat of sulphur on the spot to be drilled, blow the bellows slowly until the sulphur is burned off, and then proceed with the drilling.

O'DANIEL & PRICE, Western Grove, Ark.

To Set Axles. In reply to R. G. Parsons, I will give my way of setting axles I first draw a straight line on a board the length of my axle. Then I measure the length of spindle A and the diameter of spindle at both collar and end, as B and



METHOD OF LAYING OUT AXLES FOR SETTING.

C. Next I measure the height of wheel and lay off this distance from the collar. With the straight edge I measure the distance from the front spoke. This will give you the dish E, which is to be laid off as shown. Then draw a straight line from E through center of collar B, and that will give you the center of C, by which the axle can be set. W. L. POTTER, New Lisbon, N. Y.

An Ankle Hitter. I would like to know the best way to shoe a horse that bumps his ankles. VINCENT BEELS, Yale, Ill.

Horse Power Calculations—Contracted Feet. I am just now engaged in putting in some new machinery, and would like to have a rule for calculating the horse power of boilers and engines.

I have noticed several articles in THE AMERICAN BLACKSMITH on the cure of contracted feet and run-down heels. The mules in my country are badly afflicted with the outside heel turning under. When I shoe one in that condition I trim the inside of the foot a trifle lower than the outside and trim the toe as much as good judgment will allow. I then take the hoof knife and pare the inside or run-down side and fit the shoe a fraction smaller on that side. Next I twist the shoe from the first nail-hole to the calk, which is about one-half of the thickness of the shoe. By so doing, the weight of the mule presses the hoof out to its proper place. If both sides are contracted twist both sides of the shoe. I have been successful in this practice, having learned the same from a Canadian veterinary surgeon. E. W. JONES, English, Ark.

Calculating Horse Power of Boilers.—This is rather an indefinite thing, as the rating of a boiler is only nominal or approximate. The horse power which can be developed in a given boiler depends not only on the grate area and heating surface of the same, but also upon the kind and amount of coal burned on the grate, the draft, temperature of feed water and other details. The standard which has been adopted for a boiler horse power is the evaporation of $34\frac{1}{2}$ pounds of water from 212 degrees Fahrenheit into steam at the same temperature. As a rough-and-ready rule for getting the rating of a given fire-tube boiler, the horse power may be found by the formula $n \times L \times d \div 50$, where n is the number of tubes, L the length of the boiler in feet and the diameter of the tubes in inches.

The usual formula for the horse power of a steam engine is $2 \times P \times L \times A \times N \div 33{,}000$, where P is the mean effective cylinder pressure in pounds per square inch, L the length of the stroke in feet, A the area of the piston in square inches, and N the number of revolutions per minute. The value of P is found by means of a steam-engine indicator. This is the exact formula for the horse power which an engine may be developing at any given time An approximate rule for determining the horse power which an engine can develop is $\frac{1}{2}d^2$, or the square of the cylinder diameter in inches divided by two. Thus an engine with a ten-inch cylinder under ordinary conditions would develop somewhere in the neighborhood of fifty horse power.

Case Hardening. I would like to know if there are any chemicals that will harden common iron by heating, applying the chemicals and then cooling. Also if iron can be hardened to any considerable depth, say one-eighth of an inch, and with any degree of certainty of getting it hard every time. J. E. RUSSELL. Titonka, Iowa.

For hardening the surface of wrought iron in this way, case hardening, perhaps the two commonest chemicals are cyanide of potassium or a mixture of equal parts of prussiate of potash and sal-ammoniac. The former is the better though more expensive. Apply the hardening compound to the hot iron, give it time to soak in and then plunge the iron while still hot into salt water. To get the necessary hardness with prussiate of potassium, it may be necessary to heat and sprinkle a second time before quenching.

Another method when the pieces are large is to pack them in bone dust or other material high in carbon, inside of airtight boxes. They are then heated throughout for several hours, the length of time depending upon the thickness of the hard shell which is desired. To harden to a depth of one-eighth of an inch would require considerable time, a good many hours, as this is thick shell as case hardening goes.

The explanation of the hardening is that the carbon of the bone dust is absorbed slowly by the hot iron, forming a thin shell of steel. Upon being plunged into a cooling bath while hot, the steel thus formed is hardened. W. A. B.

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If you find a bill in this copy for next year's subscription, October, 1902 to October, 1903, it means that your subscription has expired.

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AMERICAN BLACKSMITH CO.,
P. O. D. 974, BUFFALO, N. Y., U. S. A.

Prices Current — Blacksmith Supplies.

The following quotations are from dealers' stock, Buffalo, N. Y., August 27, 1902, and are subject to change. No variations have occurred since last month's figures.

All prices, except on the bolts and nuts, are per hundred pounds. On bars and flats prices are in bundle lots.

Bars—Common Iron and Soft Steel

¼ in., round or square; Iron, \$3.10; Steel, \$2.90
⅜ in., " " " 2.70 " 2.70
½ in., " " " 2.50 " 2.40

Flats—Bar and Band.

¼ x 1 in., Iron............\$2.50; Steel...............\$2.40
¼ x 1½ in., " .... 2.40; " 2.40
3-16 x 1½ in., " .... 2.60; " 2.60

Norway and Swedish Iron

¼ in., round or square.................................. \$4.90
⅜ in., " " 4.50
½ in., " " 4.30
¼ x 1 in.. 4.30
¼ x 1½ in 4.20

Horseshoe Iron

For No. 1 shoe, ⅜ x ½ in.............................. \$3.40
For No. 2 shoe, ½ x ⅝ in.............................. 3.00
For No. 3 shoe, ⅝ x ¾ in.............................. 2.90
For No. 4 shoe, ⅝ x ⅞ in.............................. 2.90

Toe Calk Steel

½ x ⅜ in. and larger.................................... \$3.50

Spring Steel.

⅝ to 1½ in. Rounds. Op. Hearth \$4.00, Crucible \$6.00
1¼ to 6 in. by No. 4
gauge to ½ in. Flats " 4.00, " 6.00

Carriage Bolts. (Net Price per Hundred).

¼ x 2 in..........	\$0.54	⅜ x 2½ in..............	\$0.82
¼ x 2½ in..........	.58	⅜ x 3½ in..............	.96
¼ x 3 in..........	.62	⅜ x 6 in..............	1.31
5-16 x 2 in..........	.65	½ x 4 in..............	1.70
5-16 x 3 in..........	.75	½ x 6 in..............	2.10

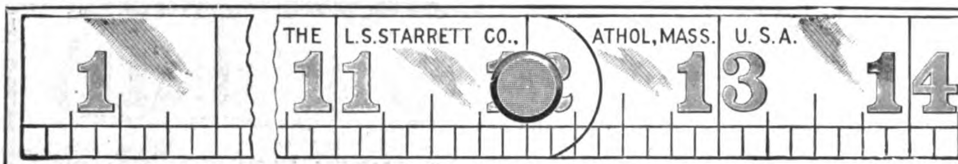
Tire Bolts (Net Price per Hundred).

3-16 x 1½ in..........	\$0.18	¼ x 1½ in..............	\$0.28½
3-16 x 2 in..........	.21	¼ x 2 in..............	.31½
3-16 x 3 in..........	.27	¼ x 3 in..............	.37½

Hot Pressed Nuts. (Blanks).

¼ in.. \$0.09 lbs. net
⅜ in.. .06 " "
7-16 in.. .05 " "
½ in.. .04 7-10 "

NOTE.—Base prices or most common sizes are listed above. Should subscribers desire net prices upon other sizes than those given, same will be published in following issues.



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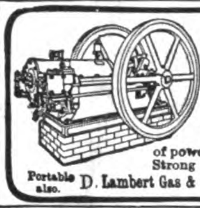

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Portable also. D. Lambert Gas & Gasoline Engine Co., Anderson, Ind.

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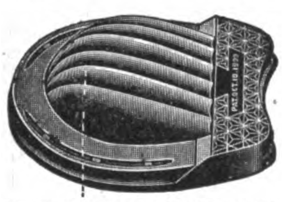

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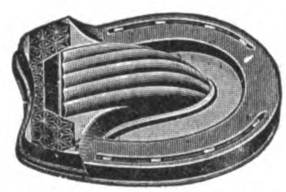

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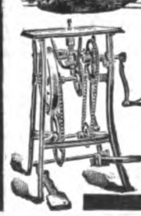

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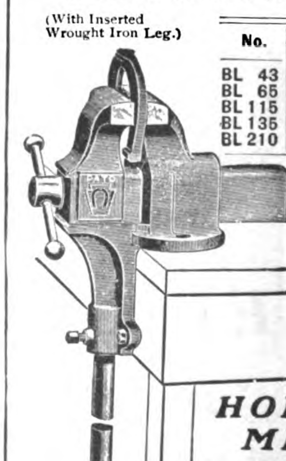
BL 43	4 in.	4 in.	$16.00
BL 65	5 in	5 in.	24.00
BL 115	6 in.	6 in.	37.00
BL 135	7 in.	7 in.	58.00
BL 210	8 in.	8 in.	90.00



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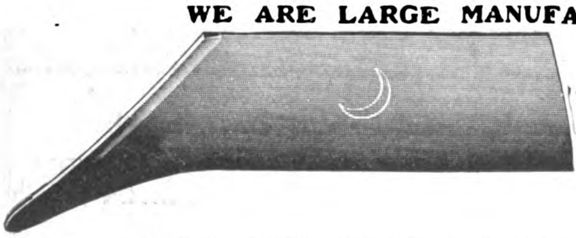

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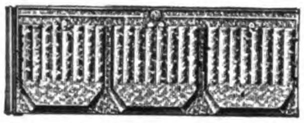

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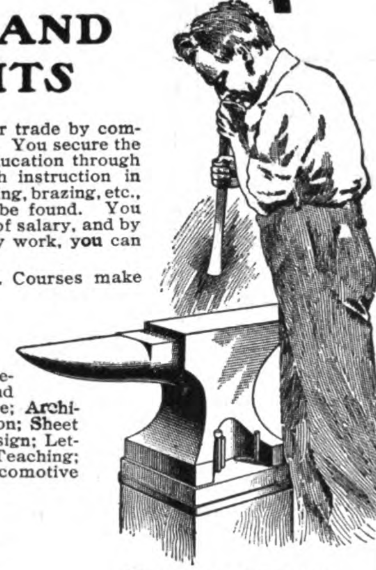

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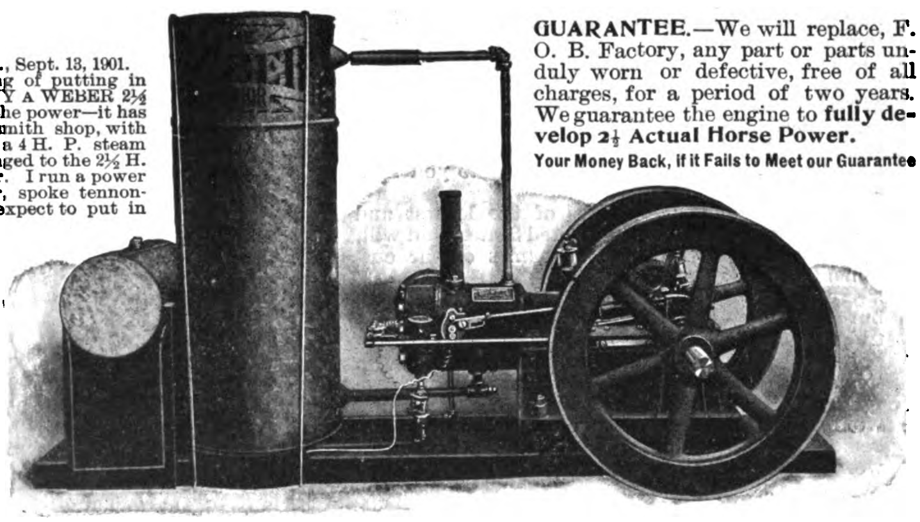

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LETTERS UPON P

MAKING IRREGULARLY SPACED REAMERS

Editor MACHINERY:

Following is a sketch and description of a method for makin fluted reamers with irregular spaces, which, whether the reame is straight or tapered, have the property of lessening the chatte and making smoother holes. The method for spacing the flute of such reamers is shown by Figs. 1 and 2 and is explained a follows: A list of divisions should be made out which will re quire an unequal number of turns of the index crank for eac indexing, but the sum of these turns must equal the total numbe of turns necessary to give the work one full rotation. For a ordinary dividing head which requires forty turns of the inde crank for one turn of the work, a list of divisions may be mad out as below which is for cutting six teeth. The turns of the in dex crank for the successive flutes are: $5\frac{1}{2} + 6\frac{1}{2} + 6 + 7\frac{1}{2} +$ $+ 7\frac{1}{2} = 40$. For dividing with a simple index plate a similar lis may be made out.

The cutter should be set so as to leave a proper thickness land as at E F in Fig. 1, and the relation of the mill to the wor should not be altered until the job is complete. The dividin should begin with the smallest number of turns in the list whic in this case is 5 1-2, and should be carried through with the di ferent numbers of turns as given in the list.

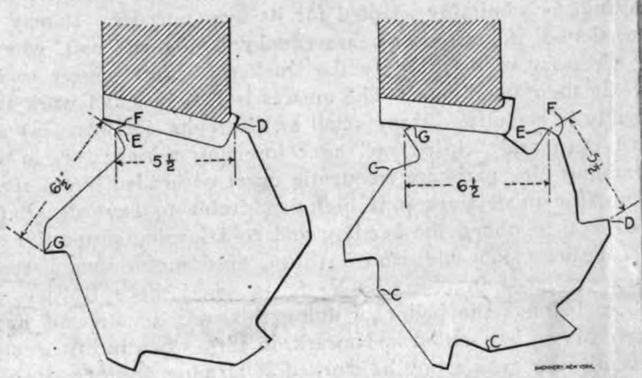

FIG. 1. FIG. 2.

Fig. 1 shows the result after going around the work once, th spaces being all of even width but some of the resulting teet are very thick. The last indexing on the list (7 1-2) will brin the cutter into the first space cut and by indexing in the sam order again the cutter would simply pass through each flu without cutting. If, however, after getting around the wor the first index is skipped and the cut is started with the inde of 6 1-2 turns and continued around the work in the order the list as given, the lands will all be milled to the same thicl ness as shown in Fig. 2. The reason for this is that in stead of indexing as at first from the face D to E ($5\frac{1}{2}$ turn Fig. 1, by skipping an indexing the work is indexed from poi F to G ($6\frac{1}{2}$ turns) Figs. 1 and 2, and so on around the reame The faces and backs of all the teeth are all at the same angl so that in grinding the reamer to size one tooth will not wid more than another. The slight lumps at C C C, Fig. 2, are rea ily removed on an emery wheel so that the resulting reamer scarcely noticeable from an evenly spaced one.

Meriden, Conn. JAMES P. HAYE

* * *

CHAMFERING CUP LEATHERS, ETC.

Editor MACHINERY:

I noticed in the July issue of MACHINERY an item about ma ing cup leathers which referred more particularly to chamferi the edges. A blue print is enclosed which shows the way have been doing it and which makes a beautifully formed cup. is a sleeve which is bored about 1-32" smaller than the cylind in which the cup is to work, B is the follower and C is the c former. The cup former is made of steel of the dimensions i dicated in the sketch with the edge R turned to an angle of abo 60° and case hardened. The sharp edge of the cup former C b ing such a close fit in the sleeve A the surplus leather is trimm off as neatly as if done with a sharp knife and the fillet under t edge leaves a handsome chamfer on the cup leather.

Did any reader ever melt babbitt in a blacksmith's forge a