OUR GENERAL DEPARTMENT

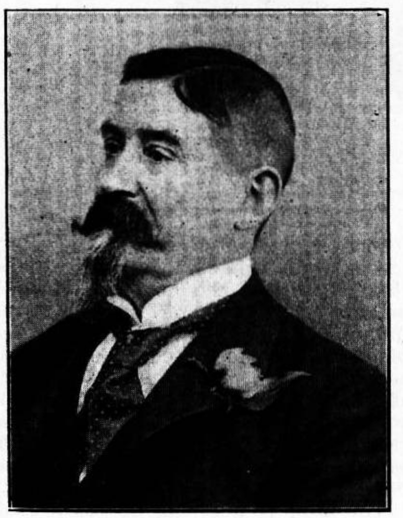
FORGING

This department is edited by Prof. Chas. P. Crowe, instructor of forging in the Ohio State University, for the special benefit of those who are engaged and consequently interested in this line of work. Prof. Crowe respectfully invites the reader to submit questions relative to the subject of forging. Indeed, it is his urgent request that readers will show that quality of interest in the papers presented as to continue asking him questions on any kind of forging for his explanation.

FOREWORD— GENERAL FORGING.

Anvils are sometimes transported by water, and make good ballast for a boat, but are somewhat difficult for the average roustabout to carry from wharf to ship across the gang plank. On one occasion a lot of anvils were being carried one at a time by each man as he walked cautiously over the narrow plank extended from the ship's side to the platform on which several hundred more were lying, and the captain was impatient to be off, when a strong-handed laborer appeared and asked for work. "Hurry," said the captain, "help get those anvils aboard.". The laborer seized an anvil in each hand and started across the plank. The extra weight was too much, it broke and down he went feet first to the bottom of deep water; it closed over him and he was out of sight for some time. Finally his head came above the surface, spitting and spluttering he yelled, "Get me quick or I'll drop these anvils."

Now, reader, don't drop this book until you have thought out just how you would make an anvil. Not a 150-pound one, necessarily, for your forge may not be large enough or the blast pressure in your fire strong enough if you want to kick or find fault tell us what for, may be it would do us good. Give us something to write about anyhow, and if you are interested other blacksmiths will be, too.



THOMAS WILLIAMS.

Thomas Williams was born in Dudley, England, August 17, 1846. He began work in the anvil shops of that city when he was 7 years of age. Later he went to Birmingham, a city at that time known as the toy shop of the world, and worked at anvil and vise making.

At Birmingham he became known as the most skillful workman in the business, and received large sums as royalities. His time was bid for, and premiums offered to keep him from working in competing shops. He is a rapid worker, and so expert that an anvil built up by him of fourteen pieces welded together is as smooth and perfect as though forged from a solid ingot. And he can do it in an hour, his record is a 150 pound anvil built of fourteen pieces, finished in an hour. One of these was exhibited at the world's fair in Chicago, and later sent to Mexico.

Mr. Williams has crossed the Atlantic five times, making this country his home since 1888, when he brought his family over. The first of this year, 1908, he was in deep sorrow over the death of his wife, and lost some time from his work, but is now recovering his cheerful manner and love for good company. He was never a hard drinker, though not a teetotaler, and the good fellows with whom he loves to associate have cost him the fortune he might have saved, for although always sober himself, his money has gone freely in entertainment of others.

Mr. Williams is also an excellent blacksmith and has no difficulty with the other fine work of the craft. When a soft bottom die with a hardened steel top is required, he is the man best qualified to make it, and he can make good in any department of the trade, but his specialty is anvils and vises. The former he loves to work with, to sketch their lines in his leisure, to file and polish models in brass two inches or so in height is his recreation. He thinks and talks of them by day, and dreams of them at night. The king of anvil makers in England, he is the chieftain in America.

How Anvils Are Made.

Making anvils is nice work. There is no finer example of a heavy forging than a wrought anvil.

A generation ago all anvils used in this country were imported. The English anvil was known everywhere among blacksmiths, for the Dudley makers were the largest manufacturers, and employed the most skillful workmen in the world. Their methods of doing the work were not like the ways adopted here. Early after the industry was begun in this country the Old Country practice of building up anvils of many small pieces welded together was abandoned for what may be termed the American way of forging larger pieces into correct shapes and uniting them into an anvil with fewer welds, as may be seen from the accompanying illustrations.

The ingot of 15 point carbon steel shown in Fig. 1 is of the following dimensions: 7"x7"x7". A billet 4"x7"x-12¼" might be used to better advantage, as it is to be forged to the shape shown in Fig. 2, this is done with a 1,200 pound steam hammer.

The lump of metal left on the end of this piece ready to be drawn out for the tongs with which it is held while putting on the steel for the face of the anvil.

Welding the Face On.

The face plate is shown on top of the forging in Fig. 2 as it lies in position ready for heating to weld. This plate for a 100 pound anvil is ⅝ of an inch thick, 3¾ inches wide, and 16 inches long. It is 70 to 80 point carbon, crucible steel, a grade that is mild enough to weld gently, and will be maximum hard if cooled suddenly from the proper temperature. It is slid into a furnace after being well covered with the flux or welding compound, some of the compound is also put on top of the forging before the steel plate is laid on, so that any oxide forming in the joint may be made fluid enough to be expelled by the concussion of the steam hammer blows that weld it down after it is heated to a soft yellow. This part of anvil making requires great care and skill, for unless the plate of crucible cast tool steel is welded solid all over it will crack, break or chip out when it is hardened.

Forging the Horn.

Now the lump which was left on one end in shape for the tongs to grip firmly, is heated in a forge fire, and drawn to a tapered round shape under the steam hammer, the taper is straightened and set to the proper pitch in a pair of dies made to fit, and used like ordinary top and bottom swages. The heavy scale is removed from the horn while it is still red hot, by the use of a huge file with a handle on both ends, whinch is drawn back and forth by two men while the third workman revolves the forging. The holes are drilled after the piece has cooled slowly in a covering of lime to soften the cast steel, a large hole for the hardie and a small one for the pritchel in position shown in Fig. 3.

Shutting.

The anvil top Fig. 3 is now ready to weld to its base Fig 4. The top and the base is seven, the top of the base and the bottom of upper part of the anvil as shown in our ilustrations, are of the same dimensions 3¾"x5". These parts are heated in seperate forge fires of coal and coke. They are then carried to the steam hammer where the base piece being placed on the bottom die, the upper piece is placed in position directly on top of it, and a few blows of the steam hammer shuts or welds it solidly provided the heat was right and the surfaces free from scale or other impurities when they were placed in contact. This is a butt weld, and regarded as somewhat difficult to make when the material of which it is composed is considered, one precaution that must always be taken in welding, is to have the parts high in the middle so that that portion of the welded joint is formed before the outer edges weld and seal oxide, scale or flux into the joint where it cannot be expelled and will remain as a permanent defect in the work.

in selection of material or appliances Steel, fuel, flux and arrangement of the shop largely control those things, but the individual workman who has pride in his trade must make plane surfaces free from hammer marks, corner lines straight, shoulders square to the bottom, and the curves even and regular, or he will not stamp his private mark on it.

Hardening.

Finally the face of the anvil is heated to an even red all over and is lowered on an iron rack into a vat of water until it is submerged, then a heavy stream of cold water is directed onto the face until it is cold. This hardens the ⅝" plate of crucible steel which is at least .07 per cent carbon, while the body and horn being only .015 per cent carbon will not harden by quenching in water. Now the anvil is ground and polished with stone or emery, and painted or oiled to keep it from rusting and it is ready for sale or use.

61 years of age. His son, Thomas Williams, Jr., is the only one of the three Williams boys who learned his father's trade, and today they work in the same shop with skill and industry, making anvils for the horseshoers and blacksmiths who need them.

Not Well Built.

Fig 5 shows the bottom and horn of an anvil that was not made in this country, the square hole in the bottom

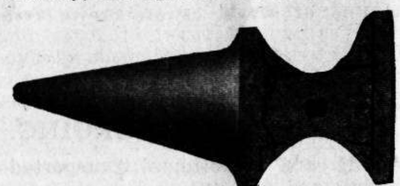


Fig. 5.

is for holding the end of a long bar of iron, which serves as a handle to hold and turn the anvil with while it is being forged. Notice the crack along the welded joints where the slabs were laid on the rectangular block which

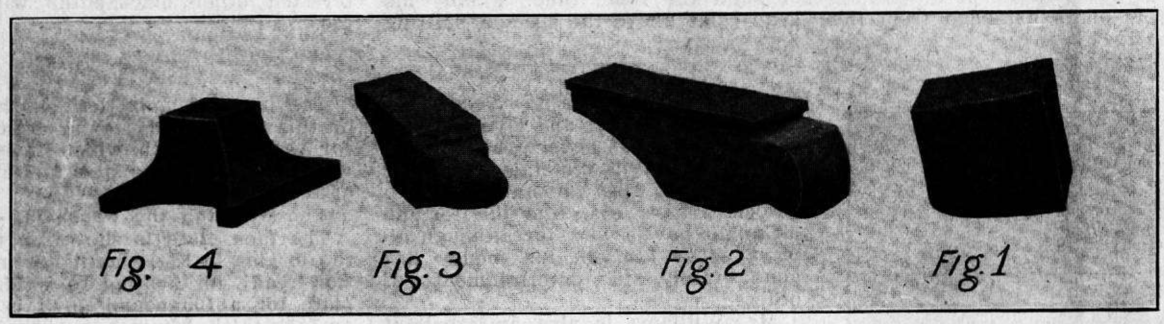


Fig. 4 Fig. 3 Fig. 2 Fig. 1

As the top part of the anvil is forged of Bessemer steel because this is a cheap and convenient material, the base must be made of something that this will unite with at a welding heat, or else some other quality of material having an affinity for both must be interposed between the top and base while all three are welding hot.

The bases are sometimes made out of steel ingots of the same quality as the tops, they can be forged quite readily under a powerful steam hammer, and the solid forged bases may be nicely finished in a die, which is nothing more than a block of steel or cast iron with a hole into which this base, bottom side up, will fit. But a favorite way is to make them from fluid steel poured into molds, and as the forged tops can be welded to these steel castings, it is a convenient method of manufacture.

After the top is welded to the base, the anvil is carried to a bed of punchings (small pieces of steel scrap) contained in a heavy open top cast iron box, where three or four helpers with sledges gather around and strike rapidly to close the edges of the weld, trim off the surplus material, if any, smooth down the plane surfaces with a flatter, and round out the curves with large fullers. Great care is taken to keep the corners of the face true, and to work out nice corners between the table and face and horn.

Then the hardie hole is drifted out with a square punch and the pritchel hole straightened with a round one. An expert anvil maker takes great pride in these latter points, if an anvil breaks at the welds or fails else-

Cast Iron Anvils.

There are other ways in which anvils may be made, but none better than the methods already described, though a body and horn of cast iron with a cast steel face laid on, looks pretty good to some people. But it has no "ring to it," which means that it is dead, no resilence, the hammers do not rebound, and so in the effort required to lift them the workman's labor is increased.

The steel faces of these anvils can be made hard and true, as they are thoroughly united by being fused or burned on, this is sometimes called **welding** steel to cast iron, but as no pressure except the weight of the material, and no hammering is done, it is not properly welding, but might be designated **freezing** pieces together.

Where Does the Product Go?

The making of anvils is practically limited to two places in this country, one of them in Columbus, Ohio, the other is New York.

Two thousand tons are made annually by these firms, this equals 100 carloads, and is 4,000,000 pounds. If the anvils average 100 pounds apiece, it is 40,000 anvils made annually in the United States. As the importation is quite large, it looks as though the anvils consumed were considerable in this country.

Accurate figures are not available at this office regarding the number of foreign made anvils sold yearly in America, but as there were none made here until just 20 years ago, the foreign article has not yet been supplanted. In fact, one of the best anvil makers of England—the man who brought the industry to this country—

forms the center of this anvil, seven pieces were welded together to make this base, then the heel was jumped on, but has broken off, the horn was jump or butt welded also to the center piece, and a steel face welded on in sections which cross the joint of heel and horn to center, strengthening them somewhat—but not enough in this case to prevent breakage—and always leaving soft places where the sections of the steel meet.

The horn or heel can not be broken on an anvil made according to the method described in the first part of this article, but the low price at which the foreign anvils could be sold here were it not for the high tariff on them, would cripple the industry in this country.

To Build a Solid Forge Cheap and Quick.

This sketch appeared in The Hub, one of the best of carriage papers, some time ago, and as it is something Journal readers are always interested in, we herewith reproduce it.

Replying to a western subscriber in relation to building a cheap and durable forge—one that can be made quickly—we present the following suggestion, which is fully illustrated and described. Recent developments in the building line and in the chemistry of building materials have demonstrated the fact that a mixture of good fair cement, good sand, and the new roofing material, viz., ground slate, about equal parts of each, make a very desirable and reliable building compound. Whether for buildings subject tion of interior structures, where heat is the greatest opposing force or element, this compound is desirable.

The writer some two years ago witnessed the construction of a tire-heating furnace built of such materials, which, although in constant use, has not shown any disposition to loss of strength occasioned by fierce fires of wood only.

The whole is done by simply mixing the material with water, so that it becomes of about the same consistency as mortar. Boxes are made of the proper dimensions and shape, of rough boards, the material put in the same and rammed in so that there are no gaps or other disagreeable holes or recesses. After the writer saw the result of the tire-heating furnace he con-concluded the same plan would apply very well to the building of forges. That, unlike brick, there would be no loose or broken bricks to keep up a constant annoyance and a rebuilding every two or three years.

Fig. 1 represents the forge complete, A the back of same, B the base upon which to rest the metallic smokestack, whether of sheet or galvanized iron; C the working side of the forge; D the outer end; EE represent the tops of the side walls; FF the top of end wall and the outer wall of the coal box; G the coal box; H is the tuyere pot; K the hole leading from outside to the tuyere for the rod of the tuyere valve; L is the ash pit; MM are the brackets for the water trough; NN are the supporting legs of the same bolted to MM; OO are angles two or more inches high, to hold the water box in

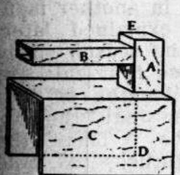


Fig 2

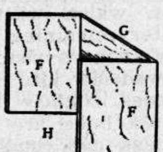


Fig 3

position; PP show where the brackets enter the forge walls. The dotted lines Q and R show inner and bottom lines of coal box; the holes in back A are means by which the bonnet and smokestack are to be secured to the back of the forge; the holes are formed by placing pieces of bound iron where wanted and removing the same when cement work is dry; S is an extra anchor-plate, upon which the center back part of the water box rests to prevent it from sagging at that point.

To begin, make a plain outer box, the inside of which will be of the outer dimensions of the forge, in which you cut out for L and K. This you secure to the floor when you want it. Do not forget to provide for part A. Next make an inner box of such size as to permit of four inches of space between the two boxes of cases; also cut out for K and L. Cut out both boxes at proper place for water-tank brackets and place them in position. Next place Fig. 2 in position to suit H, K and L, Fig. 1. Now, then, you may begin stuffing your box, and at the end of a week you may begin removing the casing and fill in the small holes and other defects, and when all is done make a wash of cement and slate, equal parts, mixed with water, and apply two coats with

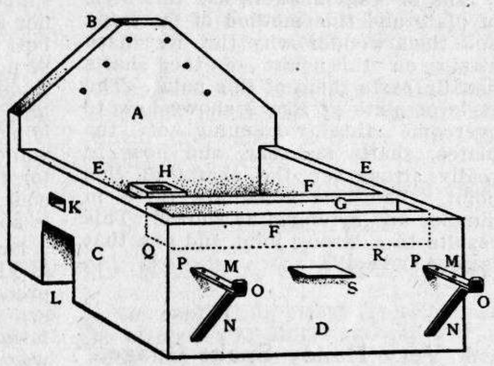


Fig 1

ordinary whitewash brush.

Fig. 2 is the woodwork for forming K, L and H, Fig. 1; A, cavity for ashpit and tuyere case formation. This wall ought to be fully two inches thick, requiring two inches between inner and outer case, the same for B and C. For the top of C prop up a board in the recess and let it suffice for B at the same time.

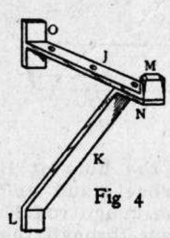


Fig 4

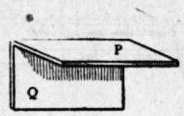


Fig 5

Dotted line D shows inner base of the ashpit; E is the upper part of the tuyere shaft, upon which the tuyere rests. Make the whole of this part so that it can be taken apart easily when cement is dry. Fig. 3 forms the outer box for the formation of Fig. 2; FF

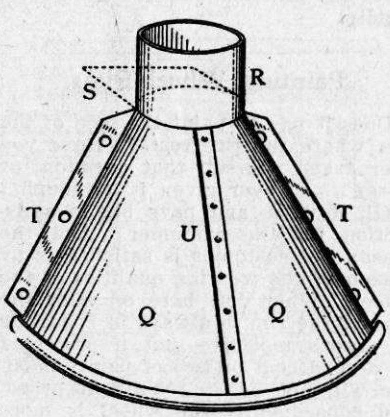


Fig 6

sides; G back; H recess. Fig 4 shows one of the water-box brackets; J box rest, with holes for securing with bolts; K bottom or under stay, with its foot, L; M is turned-up end, which confines the box; N is where the two are secured together by means of a bolt; O is the inner part, with two angles, which should be securely in the forge wall. Make the whole of 2x¾ iron. Fig. 5 is the center bracket iron for water box; P, that part upon which the box rests, is provided with a hole for securing bolt; Q the angle which turns down on the inside of the front wall; make P in length, over all, ten inches, and wide enough to give the bottom of the box not less than an eight-inch rest, securing with one or more bolts, such as illustrated in Fig. 8.

Fig. 6 shows a full view of bonnet and connecting pieces of pipe, forming the smokestack; QQ face of the bonnet, which, for best interest, we make semi-circular; R is the section made for the smokestack connection; dotted lines S show rest formed on R to set on top of back wall B Fig. 1; T shows

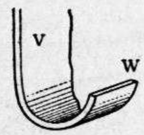


Fig 7

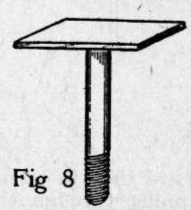


Fig 8

a flange on QQ, with holes by which it is secured to the back, A, Fig. 1; U is a piece of iron about 2x⅜ in., riveted to the front to prevent indentation by tires or similar irons. In securing put cement between flange and wall. Fig. 7 is a turn-up at the bottom of bonnet to arrest the dust, etc.; V, section of bonnet; W, dust arrester, which may be swept often. Fig. 8 is bolt for securing tank to bracket head, is 2x1 in., bolt ⅜ in. Put white lead under head when putting in place.

Davenport. The last meeting of No. 40, Davenport, Ia., was one of the most enjoyable and entertaining ever held. At the conclusion of business all of the members, together with a large delegation of No. 16, Moline and Rock Island, and accompanied by two prominent attorneys of the city repaired to the dining room of a hotel where an elaborate spread had been prepared by the committee selected for that purpose. It did not take long for the husky sons of Vulcan to dispose of the good things that were laid before them by mine host, after which a bountiful display of mirth, song and eloquence followed. Speeches were delivered by several members, but of course most prominence was given to the addresses of the attorneys, one of whom takes care of this city's legal business. Indeed, it was after these gentlemen had divested themselves of some of their thoughts that everyone present wanted to be heard. Not until a late hour was it decided that for a time at least we would have to separate, hoping for a renewal of such pleasant occasions.

The winter's horseshoeing business has been very poor in Davenport, Ia., and vicinity.

D. E. COPP.