man prefers to make his own drills, and from personal experience we have found no better drills than those thus made, to do which is a simple process. For example, a drill-chuck being fitted to the lathe, with a round hole one-fourth inch in diameter, and a fixing-screw; have always at hand a bar of round cast steel of the correct diameter, to fit the hole, and cut off a length as required. If the drill is to be made of a large diameter, it must be flattened out at the forge to the desired size, and then finished with a file. Most workman, nowadays, simply forge their drills and grind them into shape; this answers every purpose for work that does not require any finish, all that is necessary is that the tool should run pretty true in the lathe and cut well. In boring a hole in thin work it becomes necessary to make it flat at the bottom. To do this a small half-round bit placed in the same chuck answers the purpose. This is essential where the hole has to be topped, as it allows of one or two more threads being made by the top. If the drill is required to be smaller in diameter than the steel from which it is made, it is a simple matter to turn down the end and then file it flat on both sides, to the same shape as the larger previously mentioned. A great point with regard to drilling is the hardening of the drills. * * * In using all drills for boring a hole between the centres of the lathe, it is a most essential thing to let the work turn round occasionally in the hand. A certain way of boring a true hole of large diameter, say three-fourth to one inch, is to fix in the chuck a well-made cylinder-bit, and carefully fix the work on the saddle of a self-acting lathe, and place on the change-wheel used for a fine finishing cut. * * * For very small work the bow drill is a very useful tool. Bows are made in many ways, and from different materials. Those for sale are of steel, with a hook at the end, over which a thin catgut is looped, with another hook near the handle, and to alter the tension a small toothed wheel with a detent is used. * * The Archimedian drill is also used for many small pieces of work. This is made from pinion-wire carefully twisted into the form of a very quick screw; and to tap the nut for it a similar short piece must be made and the end tapered off to the bottom as if it were of the thread. This done a hole must be drilled in the pieces of metal that is to form the nut, and the tap, as we will call it, be driven through it. This will form a corresponding screw for the long one to work in. * * * To know how such a thread is put into a piece of metal may be of service for other purposes.—*Forge and Lathe.*

BLACKSMITHS' HAMMER SIGNALS.

When the blacksmith gives the anvil quick, light blows, it is a signal for the helper to use the sledge, or to strike quicker.

The force of the blows given by the blacksmith's hammer indicates the force of the blow it is required to give the sledge.

The blacksmith's helper is supposed to strike the work in the middle of the width of the anvil, and when this requires to be varied the blacksmith indicates where the sledge blows are to fall by touching the required spot with his hand hammer.

If the sledge is required to have a lateral motion while descending, the blacksmith indicates the same to the helper by delivering hand hammer blows in which the hand hammer moves in the direction required for the sledge to move.

If the blacksmith delivers a heavy blow upon the work and an intermediate light blow upon the anvil, it denotes that heavy sledge blows are required.

If there are two or more helpers, the blacksmith strikes a blow between each helper's sledge hammer blow, the object being to merely denote where the sledge blows are to fall.

When the blacksmith desires the sledge blows to cease, he lets the hand hammer head fall upon the anvil and continues its rebound upon the same until it ceases.

Thus the movements of the hand hammer constitute signals to the helper, and what appears desultory blows to the common observer constitute the method of communication between the blacksmith and his helper.

WELDING CAST STEEL.—There are so many grades or tempers of cast steel now in use (from steel rails to surgical instruments) that there is a great difficulty in understanding what is meant by cast steel. The old system of steel-making was the converted or cemented process; the converted bars were welded once or twice, then called single or double sheer-steel, according to treatment received. In the Huntsman or crucible process, the converted bars were broken up into small pieces and charged into crucibles along with oxide of manganese, &c., and when melted, cast into ingots, hence the "term" cast, to distinguish from shear-steel. We have three methods by which cast steel is produced, *i.e.*, Bessemer, Siemens, and Huntsman (crucible) processes, and the various qualities and tempers manufactured by these are legion. Some of these steels will weld without any difficulty, and some with only the greatest difficulty; some kinds will harden very hard when plunged into water at a red heat, and others, when subject to the same treatment, will bend over and over without showing any signs of a fracture, the sudden cooling having made no perceptible difference; yet both are cast steel, and probably may have been made from the same process. Cast-steel rails are sold at about $9 per ton, cast steel for tools at from $60 to $140 per ton. This will show "Panourgia" at once that there is a great difference in cast steel; and if "Panourgia" will only specify the kind of steel he has a desire to weld; what purpose he bought it for; what class of steel it is, tool, Siemens', or Bessemer, I will advise him as to treatment of the same to accomplish his desire. Some kinds of cast steel will weld as easily as wrought iron, notwithstanding the assertions of "Hartlepoolian," who says "Steel may be stuck together, but, in my opinion, cannot be welded;" and quotes, in support of his theory, the rolling of tires in lieu of welding. In the manufacture of wrought-iron tires, they are first piled, fagotted, then built up, consequently this is a welding process from beginning to end. These tires are fast being replaced by steel ones; steel being considered a more suitable metal for tires, axles, &c., but no attempt has been made (that I am aware of) to weld cast-steel tires as yet. But steel axles are welded and built up in the same manner as iron ones. Steel cranks are made at the Mersey Iron and Steel Forge, Liverpool, by welding slabs or blooms of steel together, and when complete weighs several tons (see Mr. Ratcliffe's paper before the Iron and Steel Institute at Liverpool last autumn). Now, this steel is cast a certain temper for the purpose, and let me here inform "Hartlepoolian" that in the hands of a man who knows its requirements, this metal will weld as easily as either Leeds or Government iron, and is "stuck" together with as much certainty as ordinary wrought-iron.—*English Mechanic.*

WELDING CAST STEEL. "Panourgia" asks, can it be successfully welded? Yes, it can, as far as welding goes, but the success depends on the use it is put to after. For cutting tools or rods for machinery no use whatever. For welding into iron for bricklayers' chisels, digging forks, and similar tools it answers very well; I have had practical experience in each case, but remember nothing but practice will give the required results what the flux used. What I use is 10 parts of borax to 1 of sal-ammoniac fused together in a sheet-iron pan, and when cool crush fine and use as sand. Or 2 parts of borax to one of saltspernella with sand process as above. Now prepare to weld, having the anvil in a close and convenient position. 1st. Upset the ends to be welded, and have plenty of stuff to work upon and scarf a little longer than for iron; if more than one, prepare them all in this way first, as you can keep the colour of the heat better in your eye when welding close one after the other. 2nd. Blow up a nice, clear fire, free from sulphur as possible, and heat the pieces to a peculiar yellow, then dip in flux lightly and heat till you see it flow, and it becomes a light yellow without sparkling. 3rd. Take out and strike with a light sharp blow, and follow up with quick sharp blows (not heavy); if the scarves are buried pene over, take light heat, and work to proper size.—*English Mechanic.*

TO GALVANIZE SMALL ARTICLES OF IRON.—A correspondent of the *Manufacturer and Builder* describes, as follows, the difficulties he encountered in trying to galvanize some small iron hooks: "I could not make the zinc take to the iron. I used a pint of sulphuric acid, pint of muriatic acid, pint of sal-ammoniac, and zinc enough to cover the hooks. I first dissolved the zinc with muriatic acid, then I reduced the sulphuric acid with water. I then dissolved the sal-ammoniac, then I dipped the hooks into the sulphuric acid, then after washing it off I then dipped it into the muriatic acid; after taking it out and letting it stand for some time I then dipped it into sal-ammoniac; after taking it out and letting it stand some time I then dipped it into the zinc, but on taking it out the zinc would not stick to it. Can you tell me where the trouble is?" The editor answers his query as follows: Clean the metal by pickling in the dilute acid, and scouring (or tumbling) with moist sand, if necessary. Rinse quickly in pure water, pass through the chloride of zinc solution, and then transfer to the zinc pot. Keep the melted metal covered with dry sal-ammoniac. Moist iron rusts very quickly when exposed to the air, and unless the surface is perfectly freed from this oxide it will not take the zinc.