

out hard hammering. There are hammers of various sizes and peculiar shapes, and other small instruments at hand; there are various notches, ridges, curves, and gauges on and about the anvils. When made into form, the files are then annealed or "lighted," in order to bring the steel to the state of softness fitted for the cutting of the teeth; next succeeds the process of grinding, by which a true and regular surface is given to the face of the intended file or blanks, as they are termed previous to the cutting of the teeth.

This is performed by a hammer and chisel; the hammers weigh from one to six pounds; the chisels are a little broader than the file, sharpened to an angle of about 20 degrees. The file is first laid upon the bare anvil, one end projecting over its front, and the other over its back; a leather strap now goes over each end of the file, and passes down upon each side of the block to the workman's feet, which being put into the strap on each side, like a stirrup, holds the file firmly upon the anvil as it is cut. The hammers employed have the handle placed in a remarkable manner with respect to the head, being adapted at such an angle that the cutler can, while making the blow, pull the hammer in some degree towards him, and thus give a peculiarity to the shape of the tooth. If the file is a flat one, the cutler places the small steel chisel with his left hand on it at a particular angle, and then with the hammer in his right, cuts an indentation; he then cuts another parallel to it, then another and another to the end of the file, shifting the file slightly in its fastening as he proceeds, and this he does with inconceivable rapidity. The double teeth are cut in a similar manner, one set of cuts crossing the other at an angle more or less acute. The cut is not a mere indentation made without reference to form; it is a triangular groove of particular shape, the production of which requires a discriminating tact in the management of both the hammer and cutting-tool, which can only be obtained by a long apprenticeship to the business; and which machinery, great as may be its powers, has hitherto failed to reveal. After the files have been cut, they are next hardened, and in this process three things are especially held in view—first, to prepare the file on the surface so as to prevent it from being oxidized by the atmosphere when the file is red-hot, which would take off the sharpness of the tooth—secondly, the requisite hardness has to be obtained—and lastly, the file has to be prevented from attaining the slightest bend or warping.

The first object is accomplished by laying a substance upon the file which, when it fuses, forms as it were a varnish on the surface, defending the metal from the oxygen of the air. This paste is composed of common salt, ale grounds, and bean flour. The file is now heated by being held by the tank with a pair of tongs into a coke fire; when it is uniformly heated from the tank to the point of a cherry-red colour, it is suddenly quenched in the coldest water, being at the same time kept in a perpendicular position. Half round files are an exception to this rule, being quenched in a horizontal direction. This management prevents the file from warping. After

the files are hardened, they are scrubbed clean with sand and water; and lastly, they pass into the hand of the fireman, who strikes the file gently on a piece of hard steel, and also rubs it from end to end; and from the sound he can tell at once, so great is his perception by long habit, whether it has the temper necessary to make a good file.

MANUFACTURE OF NEEDLES.—It is scarcely necessary to say that needles are made of steel, and that the steel is brought into the state of fine wire before it can assume the form of needles. The needle-makers do not make the wire, but purchase it. Having obtained the wire, which is bought in coils in weight about thirteen pounds, in length about a mile and a quarter; it is first put under the gauge to be tested as to its exact diameter; it is then carried to the cutting shop, where it is cut into pieces equal to the length of two of the needles about to be made. This operation is performed not by cutting them singly, but the workman takes about a hundred wires at once, grasps them between his hands, and then cuts them with a large pair of shears. These pieces have next to be straightened. This is effected by inclosing them within two iron rings, and placing them on a small furnace, where they are made red-hot; on being taken out in a glowing state, they are placed on an iron plate, and taking a long piece of iron or steel adapted for the purpose, the workman rubs the needles backwards and forwards, causing each needle to roll over on its axis, and also over and under those by which it is surrounded, till the action of one wire on another brings them all to a perfectly straight form.

Each of the pieces so manufactured is designed for two needles; the two ends constituting the points, and both points are made before the piece of wire is divided into two. The pointing immediately succeeds the rubbing, and consists in grinding down each end of the wire till it is perfectly sharp. They are ground on a small grindstone, and the needle-pointer takes fifty or a hundred of the needle pieces in his hand at once; he holds them in a very peculiar manner, and so nicely arranges his joints and fingers, that during the process of grinding every needle can be made to rotate on its own axis, by a slight movement of the hand, without any one needle being allowed to roll over the others. He grasps them so that the end of the wires (one end of each) projects a small distance beyond the edge of the hand and fingers, and these ends he applies to the grindstone, in the proper position for grinding them down to a point. The needle-grinders are the subjects of extreme pity. Their life is a living death. The particles of stone and steel pervading the air they breathe on every side, soon lays the foundation of disease on the lungs, called the "grinders' asthma;" it generally commences before they are five-and-twenty, and they linger out a miserable existence till about the age of thirty-five or forty, beyond that age very few dry-grinders are known to live. What a subject of reflection to those who seek to benefit the human race. It ought, however, to be remembered that the needle-grinders refuse to employ a mouth-