Engineering, Civil & Mechanical.

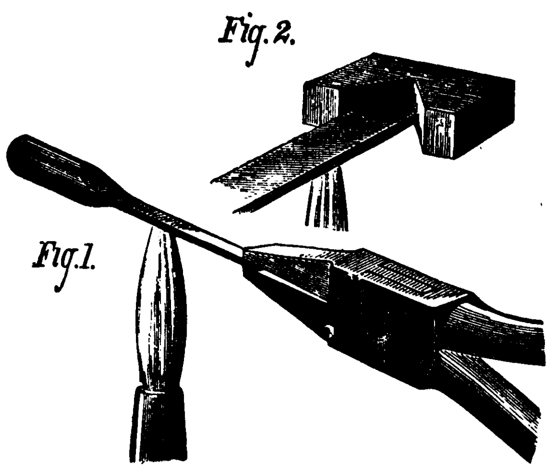
DRILLS AND DRILLING.

An ordinary flat drill for most purposes will answer nearly, if not quite, as well as a twist drill. It is not a difficult matter to make them, since we have such reliable material as Stubs' steel wire of every size. The best form of flat drill for general purposes is shown in Figs. 1, 3, and 4. It is made by milling or filing the opposite sides of the wire, so as to form a bit or blade having a thickness equal to about one fourth of the diameter of the wire. The angle of the point should be 90°, and the angle of its cutting edge about 45°, for most uses. For a drill of very hard substances, these angles may be more obtuse.

Having formed the drill, it should be hardened by heating it to a low red and plunging it straight down into cool (not cold) water. In case of a very small drill, it may be held in the flame of a gas burner or lamp in a pair of spring nippers over a vessel of water. When it attains the required degree of heat it may be dropped into the water.

To temper for most cases, the drill, after being brightened on an emery wheel or piece of emery paper, is heated; if it is a small one, in an alcohol or gas flame, until its color at the point runs down to a brownish yellow verging on a purple. If the drill is very large it may be heated over a forge fire, or over a heavy piece of red hot iron. If the drill is a very small one, it may be hardened and tempered at one operation by heating to a low red heat and plunging it immediately into a piece of bees-wax.

If it is desired to have the point of the drill very hard, without being liable to breakage, its temper may be drawn by holding its point in pliers, as shown in Fig. 1, while the main portion is held over a gas flame. The cool jaws of the pliers prevent the point from becoming heated.

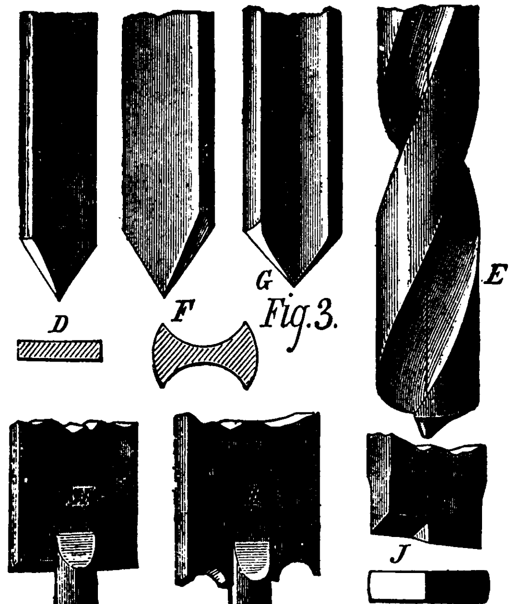


TEMPERING.

Another method, applicable to larger drills, is to employ a notched block of lead, as shown in Fig. 2. The drill in this case is driven a short distance into the lead before it is hardened; then as it is tempered, it is replaced in the lead to preserve the hardness of the cutting edges while the temper is drawn in the other portions.

When a drill is hardened by immersing its point in mercury instead of water, it acquires a diamond-like hardness. The point of the drill just described is shown in perspective and in section D in Fig. 3. The drill F is similar to the drill D, the point of difference being a half round groove along each face adjacent to the cutting edge. This device gives the cutting edge a more acute angle, which is desirable for some kinds of work. G is a straight drill having concave or fluted sides, and E is the well-known twist drill. The drills, G E, are shown in cross section in the central figure. Twist drills of recent manufacture have a central longitudinal line, which locates the point in grinding.

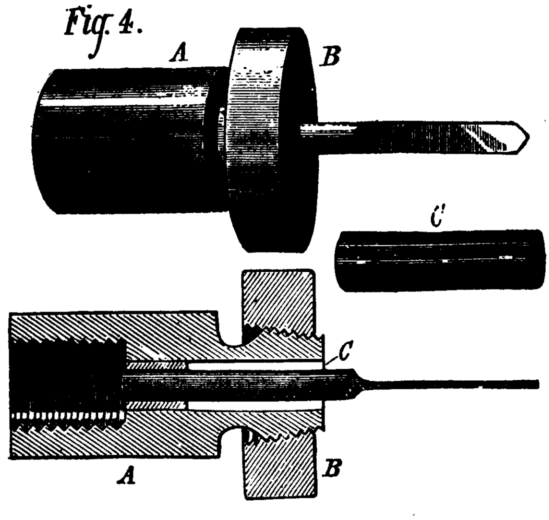
The best rule for grinding twist drills is to preserve, as nearly as possible, the original form. The ordinary pin drill H is used for counterboring, a hole being first drilled to receive the pin. The drill I is employed to give an ornamental appearance to plates in which pivots or small shafts are journaled, as in clock work. The bottoming drill, J, has three cutting edges, one upon each side, and a central transverse one connecting the other two. This drill, as its name indicates, is designed to make a flat bottom in a drill hole.



FORMS OF DRILLS.

The pin drill, K, which is shown in side and end views in Fig. 6, is first carefully turned and afterward milled with the rose bit L, producing the cutting points or lips which are afterwards beveled with a file. This drill is used for boring large holes in sheet metal, a small hole being drilled first to receive the pin. M is an expansion drill for the same purpose; its construction will be readily understood from the engraving. The spindle is mortised to receive the tool carrying arm, which is secured in the mortise by a key. The lower end of the spindle is bored to receive the drill, which also forms the pin for guiding the cutter.

While universal chucks are recommended for holding drills, another form of chuck, shown in Fig. 4, may be used with equal advantage. It consists of a main portion, A, which screws on the lathe spindle, and has a tapering threaded end for receiving the milled nut, B. The threaded end is split to admit of its contraction as the nut, B, is screwed on. The part A is bored longitudinally to receive sections, C, of iron or steel rod. To prepare this chuck for holding drills, the pieces, C, are inserted in the chuck, centered with a pointed tool, and are drilled with



DRILL CHUCK.