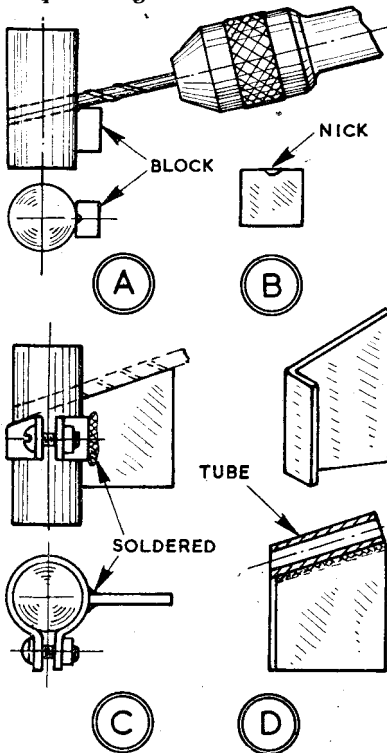


Oblique drilling

WHEN SOME EXPERIENCE in drilling and sharpening drills has been acquired, ordinary work with normal-size drills presents little difficulty. If a machine drill is available, work can be mounted on the table, in vee blocks, or in the machine vice. In drilling by hand care is essential, of course, to avoid breakage if the drill is small; and it is necessary to maintain reasonable squareness if the material is thick-which can usually be done by "sighting" the drill against the surface.

There are occasions, however, when it is necessary to drill obliquely or out-of-square-and difficulties may then be met, first in starting the drill on the sloping surface and, secondly, in guiding it at the required angle.

Various methods of guiding a drill for oblique drilling



To the first problem-starting the drill-there are several solutions. A fairly large and deep centre-punch dot can be made and the drill in a hand machine may then be started either- squarely or at a lesser angle than that required. When the full diameter of the drill is below the surface on the low side the drill, with no forward or in-feed, can be gradually brought round to the angle. Alternatively, a larger and shallow hole can be drilled squarely-and the required hole started in the bottom of it at an angle.

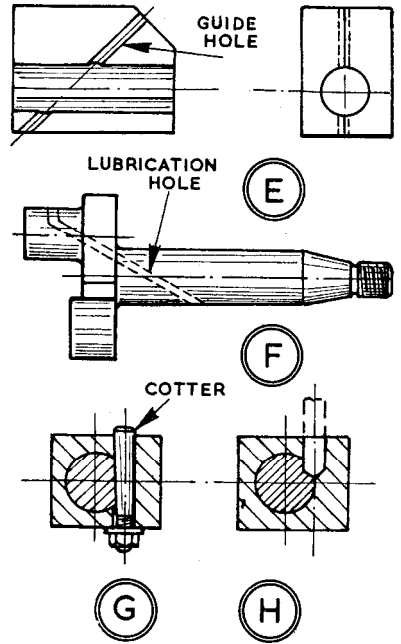
Again, two holes of the required size can be started squarely and close together for a little distance, with the drill brought round at the required angle. In some instances a short rotary file or mill can be presented to the surface at an angle to provide a surface on which the drill can be started; and on occasion such a surface can be filed or chiselled. At times, too, it is possible-or even desirable-to employ a simple jig as described. In most instances, with the hole started, the work can be completed by hand or transferred to a machine drill and carefully set up.

A drill, of course, slides off a sloping surface because it is unsupported on one side and a simple method of preventing this is to clamp a small block of the same material for the point to be retained at the required position, **A**. Such a block can be used on both flat and round material and provided with a shallow filed nick, **B**.

When the opposite side of the material is also sloping, care and a fine feed are essential when the drill is breaking through-otherwise breakage may occur; and in this connection it is helpful to clamp a small block over the position where the drill point will appear.

Angle guides

The second problem-guiding the drill at the required angle--can usually be overcome fairly easily. It may be enough to make an angle gauge from thin cardboard or sheet metal and hold it against the surface to get the line for the drill. The angle for the gauge can be marked with protractor and pencil on cardboard or with a scribe on metal.



Jigs for drilling round components

For a fix-on gauge for round stock, **C**, a simple clip is first produced, followed by the angle gauge which is held and soldered in place. Such a gauge can be fitted after the hole has been started to maintain the line while drilling. For flat stock the gauge can have the fixing edge turned at right angles for a clamp, **D**, and with both types a piece of tube can be soldered to the angled edge to guide the drill if required.

The best type of jig for round components of moderate size, both to make and for occasional use, is the halved or split type, **E**. To make it two blocks of metal are drilled down the joint line. Then using a protractor the line for the drill is scribed on each face, each line being deepened with a three-cornered file. Following this the blocks are reclamped and the vee-grooves drilled circular. This jig can be used for the big-end lubrication hole from the mainshaft of a small crankshaft, **F**.

Angle drilling of another variety is to cotter-secure a shaft, **G**. Without support it would be impossible to drill the cotter hole. But if the bore is plugged with tight-fitting material of the same sort, the hole can be easily drilled and reamed, **H**. □