

How to do ANGULAR DRILLING

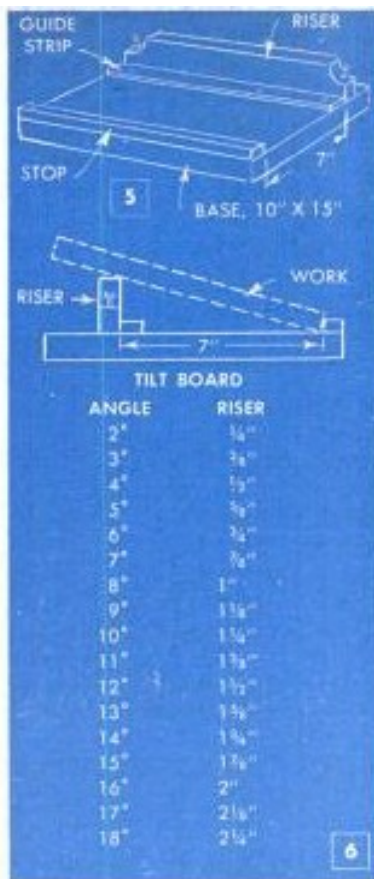
By Sam Brown

IF YOU PLAN to build furniture, likely you will run into a job where holes must be drilled at an angle. Although angular drilling may seem complicated, it actually is quite simple.

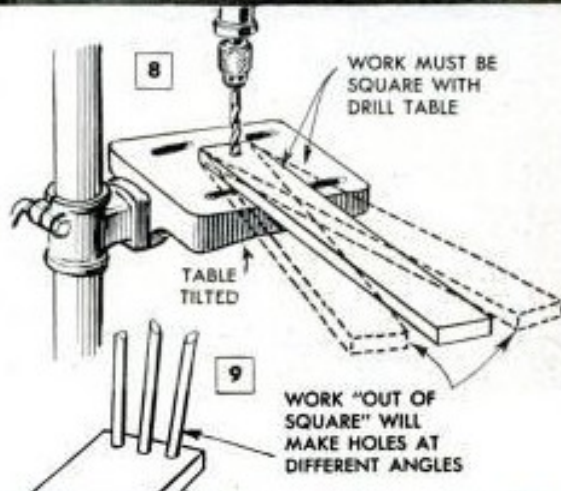
Kinds of angles: There are three main kinds of angles as shown in Figs. 1, 2 and 3. All three types are required in construction of the magazine rack pictured in Fig. 4. The simple angle involves a one-way tilt only. Most used is the equal compound angle, Fig. 2, which involves a tilt of the same magnitude as viewed from the front and end of the work. The unequal compound angle, Fig. 3, is likewise a two-way tilt, but with one angle greater than the other.

The simple angle: A basic rule in drilling at a simple angle is that the work must be square with the table, Fig. 8. It will be apparent that if the work is off to one side, the hole will show a similar error as in Fig. 9. However, positioning of the work is not too critical at low angles so that placement of the work by eye alone usually is sufficiently accurate. Examples of the simple angle are shown in sketches A, B, and C above. Note that when one turning joins another turning, the angle is always a simple angle—a one-way tilt. Radial work, sketch B, is always a one-way tilt and requires only that a radial line from the center of the work to the drilled hole must be square with the drill table.

Work requiring a simple angle usually is specified at so many degrees of tilt. The simplest way to set the tilt is to use a circular-saw miter gauge set at the needed



angle, and sight the bar to the drill column while adjusting the table as in Fig. 10. Use of a T-bevel, as shown in Fig. 11, is obvious. Also, instead of tilting the drill table, you can leave the table level and make the tilt with a tilt board as indicated in Figs. 7 and 12. If the tilt board is made exactly 7 in. between stop and riser, Figs. 5 and 6, height of the riser needed for any specified angle up to 20 deg. will be 1/8 in. per degree. This is tabulated in handy form in Fig. 6. Over 20 deg., the progression of 1/8 in. per degree will show a constantly increasing



Setting the simple angle



... BY SIGHTING WITH MITER GAUGE



... WITH SET BEVEL



... WITH TILT BOARD

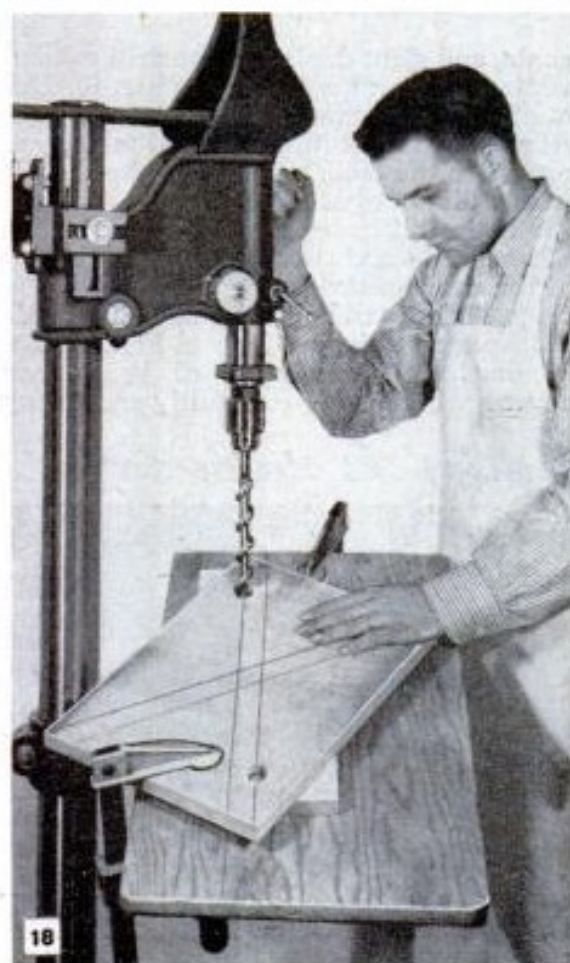
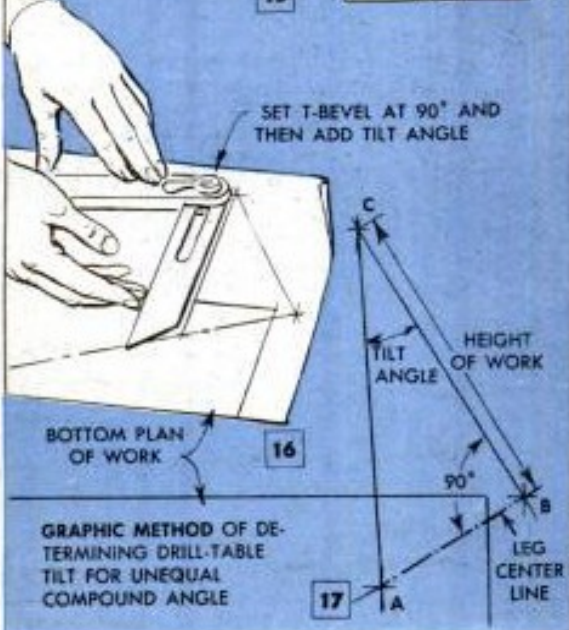
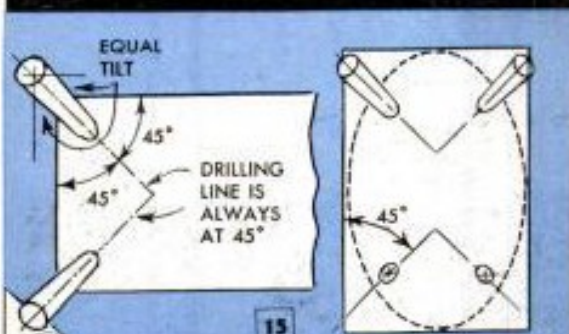


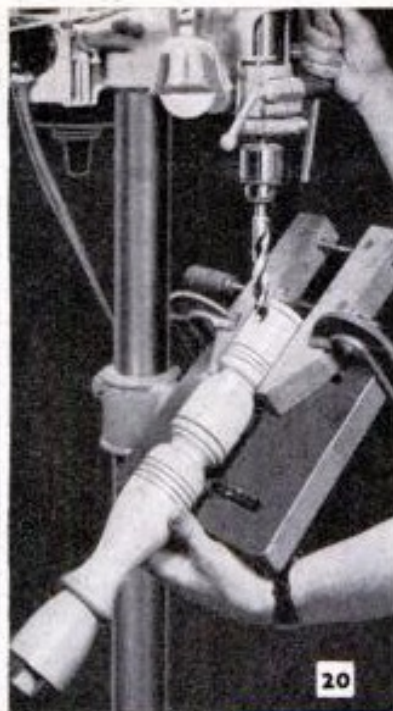
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 EQUAL COMPOUND ANGLES CAN BE CONVERTED TO SIMPLE ANGLES BY USING THE TABLE SHOWN AT THE TOP OF THE PAGE. NOTE THAT THE DRILLING LINE IS ALWAYS 45° TO THE EDGES OF THE WORK SURFACE

EQUAL COMPOUND ANGLES			
WORK ANGLE	TABLE TILT	WORK ANGLE	TABLE TILT
2°	2¼°	12°	16¼°
3°	4¼°	13°	18¼°
4°	5½°	14°	19½°
5°	7°	15°	21°
6°	8¼°	17½°	24¼°
7°	9½°	20°	27°
8°	11°	22½°	30¼°
9°	12½°	25°	33°
10°	13¾°	27½°	36°
11°	15¼°	30°	39°

error, but within the limits of the table given is reasonably accurate.

The equal compound angle: On a drilling job like the one in Fig. 2, where the corner spindles tilt 8 deg. as viewed from the front, and 8 deg. when viewed from the end, you have an equal compound angle. Since the tilt is equal both ways, the drilling line is always at 45 deg. to the work, as in Fig. 15. Placement of the work is done easily by using a V-block. If the lower edge of the V-block is placed square with the table, the work and the drill will be in correct alignment. Tilt of the drill table itself, Fig. 14, is simplified by consulting the table in Fig. 13, which converts the equal compound angle to a simple angle. Thus, in the



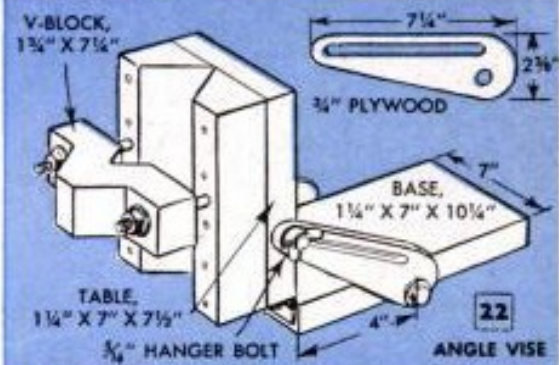


MOUNTING THE WORK CAN BE DONE BY ANY OF THE THREE METHODS SHOWN ABOVE. THE ANGLE VISE DETAILED AT THE RIGHT AND SHOWN IN USE IN THE LEFT-HAND PHOTO ABOVE, IS USEFUL FOR A VARIETY OF DIFFERENT JOBS

example previously mentioned, Fig. 2, a two-way tilt of 8 deg. is a one-way tilt of 11 deg., keeping the 45-deg. drilling line square with the table. Sketches D and E also picture the use of the equal compound angle.

The unequal compound angle: This is best worked by actually making the two tilts required. The example in Fig. 3 shows that all turnings for the side of the magazine rack have a uniform tilt of 8 deg. when viewed from the end, but vary in tilt as viewed from the front. Set the 8-deg. tilt needed with the use of the tilt board. As shown in Fig. 6, this will require a 1-in. riser. Then, with the work placed on the tilt board, Fig. 7, the center spindle hole can be drilled as a simple angle. The two spindles on either side of center require a tilt of 4 deg. In the same way, set the 6-deg. tilt, and then, since you have the setup made, the equal compound angle required for corner spindles is made similarly, with 8 deg. on the tilt board and 8 deg. on the drill table. The work has to be square with the drill table for both tilts.

A drawing-board method of determining the drilling line and tilt for an unequal compound angle is shown in Fig. 17. From drawings of the project it is easy to make a bottom plan view, locating on this the leg center line, as shown by line AB. From B erect a perpendicular, making it as long as the height of the project. Join C to A. The angle at C will be the required tilt of the drill table. To take off the angle, set a T-bevel at 90 deg. as in Fig. 16, and then add the angle.

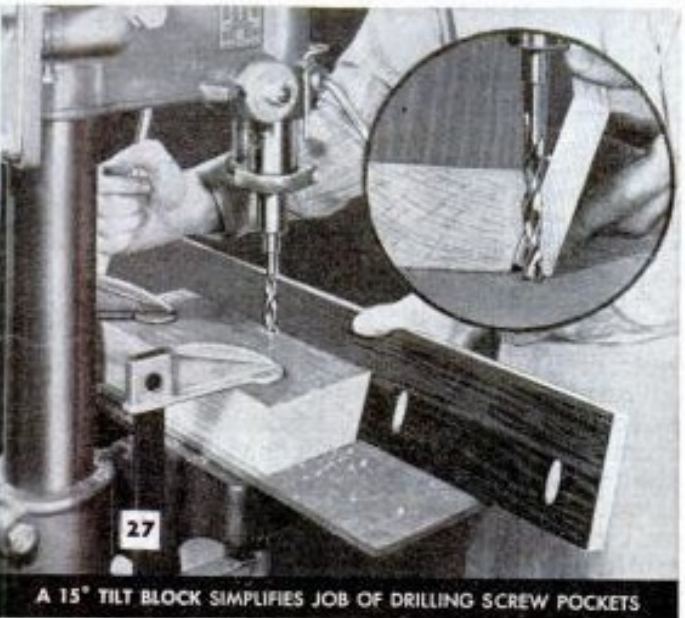
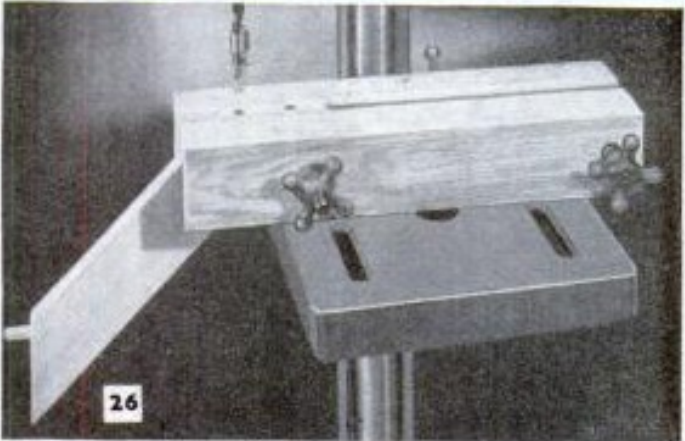
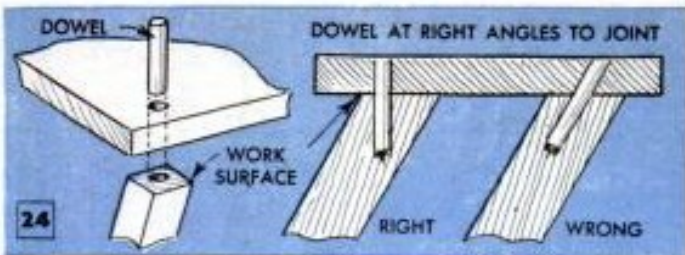


PENCIL LINES ON TABLE ARE USEFUL FOR WORK ALIGNMENT

ANGLES OF LESS THAN 10° NEED NO SPECIAL SET-UP—WORK IS MERELY HELD IN PLACE BY HAND



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DOWEL HOLES OFTEN REQUIRE ANGULAR POSITIONING OF WORK BUT THE HOLE ITSELF IS ALWAYS AT RIGHT ANGLES TO SURFACE OF JOINT



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A 15° TILT BLOCK SIMPLIFIES JOB OF DRILLING SCREW POCKETS

Use the T-bevel, set in this way, to set the drill table, as shown in Fig. 11. Fig. 18 shows the job being drilled.

Mounting the work: Besides knowing how to set the angle, there is the job of mounting the work. A useful gadget for spindle work is the angle vise, shown in Figs. 19 and 22. Fig. 20 shows a simple handscrew mounting. The fluting jig, Fig. 21, is a good mounting for spindles, especially if spacing around the circumference is required. If the tilt angle is not over 10 deg., then simple placement of the work on the drill table as in Fig. 23, will do the trick. Note the pencil lines drawn on the table to help align the work. Note also how square sections are left uncut on turning. In order to keep the square sections on the table when drilling various holes along the turning, the drill table can be swung right or left as desired. This does not affect the drilling angle.

Curved work: When angular or straight holes must be drilled in curved work like the handle in example E, saw a jig block to fit the curve, keeping the opposite end of the jig block true and square. With the curved member held in the jig, you will

have the equivalent of a square piece of work, and the tilt and positioning of work can be made accordingly.

Dowel holes: Angular drilling frequently is required in drilling dowel holes, but with the important difference that here you have a working surface. In Fig. 25, for example, a jig is made to hold the table leg in the required angular position, but the hole itself is no puzzle—it must be square with the work surface, Fig. 24. A similar case is the doweled miter joint, Fig. 26. Angular drilling for screw-pocket holes requires no calculation. A guide board with one edge cut at a 15-deg. bevel, Fig. 27, is clamped to the table so that the drill makes a hole at the extreme edge of the bevel.