

Better Boring

By Sam Brown



DIRECT MOUNTING IN TOOL POST



SQUARE BAR IN OPEN-SIDE HOLDER



BAR MOUNTED IN MILLING ATTACHMENT

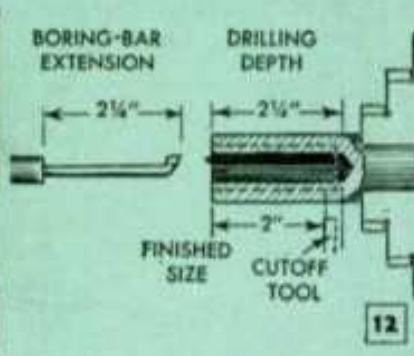
ONE SECRET of good boring practice in the metal lathe is in the selection of the right bar for the job. The first rule is to use the largest bar that will fit inside the work, particularly in bores that are longer than their diameter. The large bar is rigid and resists springing on a long overhang. If the bar is too light for the job, it will spring away from the work and you are likely to finish with an undersize hole or one that is slightly tapered. Most lathe operators have at least several of the complete assortment of boring bars shown in Fig. 4. The solid bars are the least expensive, are easy to mount and usually are selected for light work. The bars with inserted cutters are the only choice for boring the larger diameters. These come in the plain type with the cutter held by a setscrew and also in the sleeve type on which the inserted cutter is held by a sleeve and screw, Fig. 1. Note that the drawing shows the hole for the cutter broached 90 deg. but there also is a hole broached 45 deg. in the same setscrew for bottom work. The sleeve-type bar is somewhat more rigid but otherwise it has no particular advantage over the plain bar broached 90 deg. at one end and 45 deg. at the other. The 90-deg. cutter position is always somewhat the stronger and is used for nearly all through boring such as that in rough bushings and in cored holes. However, it will not bore to a corner, Fig. 2. This must be done



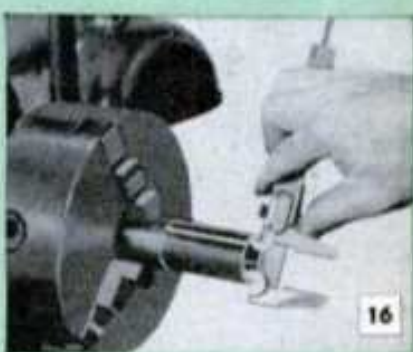
Simple Job Shows Standard Procedure



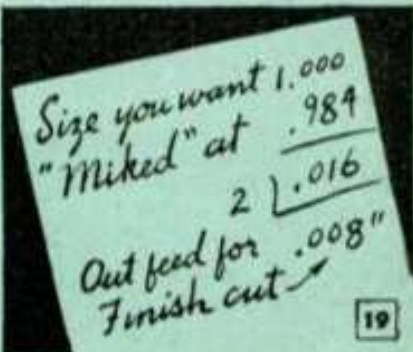
In making a bushing from solid stock, the first step is to spot the end of the work with a center drill so that the drill bit will center accurately. When drilling in the lathe, always maintain a uniform pressure



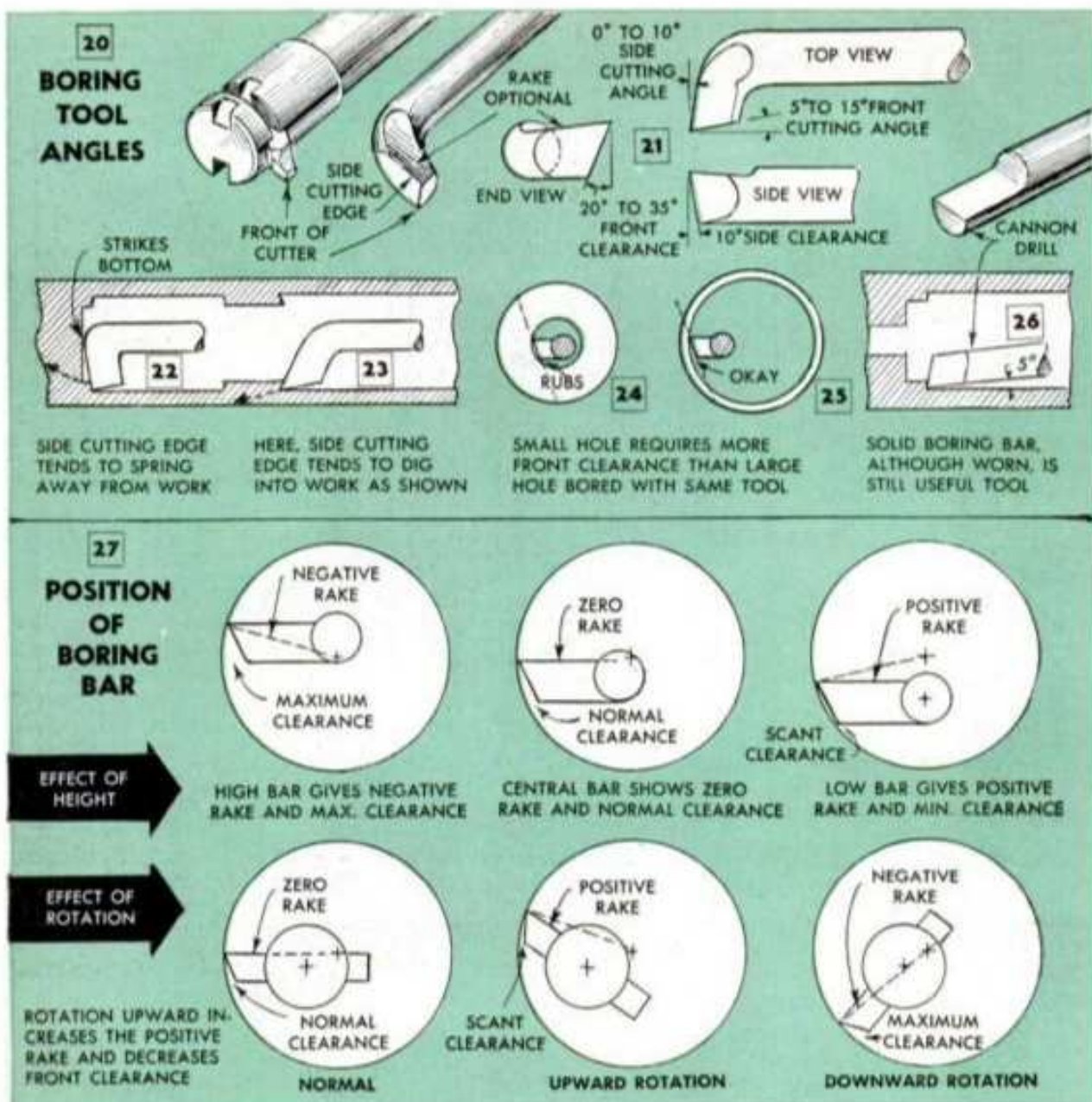
Next, the boring tool is run through in successive passes until the work is near the required finish dimension. Note that allowance is made in the setup for cutting the work to length and for clearance for the bar



When the boring cuts are started, a push-button switch wired into the motor circuit is located on the lathe bed so that it stops the machine when the tool reaches the required depth on each successive pass through work



As the inside diameter of the work nears the finish dimension, careful measurements are taken and the required outfeed setting of the crossfeed sleeve for the finish cut is then calculated from these measurements



with the 45-deg. cutter as shown in Fig. 3.

Boring a hole: A typical boring operation is pictured in Figs. 8 to 19 inclusive. Key points in the procedure are the 1/4-in. allowance for the boring-bar extension, Fig. 12, the use of an electrical stop switch and use of accurate measuring tools combined with a calculated outfeed measured on the micrometer crossfeed screw of the lathe carriage. The stop switch, Figs. 14 and 15, is a big help as it turns off the motor at the precise instant that the tool reaches the required depth on each successive cut. With the mechanical stop, it is necessary to throw out the power feed just before the tool reaches full depth and finish the cut by running the carriage up to the stop by hand. This procedure can result in an inaccuracy when critical work is near the required finish dimension. Use the cross-feed micrometer sleeve to determine the depth of cut. It's easy and fast. It also is

regular practice to reverse the power feed and back the tool out after running in the final cut. This trues the bore and brings the hole to exact size with a finish practically equal to that produced by reaming.

Mounting a boring bar: The simplest method of mounting a boring bar is in the tool post as in Fig. 5. However, this mounting is suitable only for light work where the hole can be bored to the full depth with a minimum overhang of the tool bar. The three holding devices shown in Fig. 4 are now so universally used as to be classified as standard. A square-shank bar mounted in an open-side holder, Fig. 6, makes the most rigid setup. The lathe milling attachment also makes a good, rigid mounting for large bars and the jaw opening provides space for an additional support bar placed under the regular boring bar as in Fig. 7. This arrangement will help prevent chattering and springing when ex-

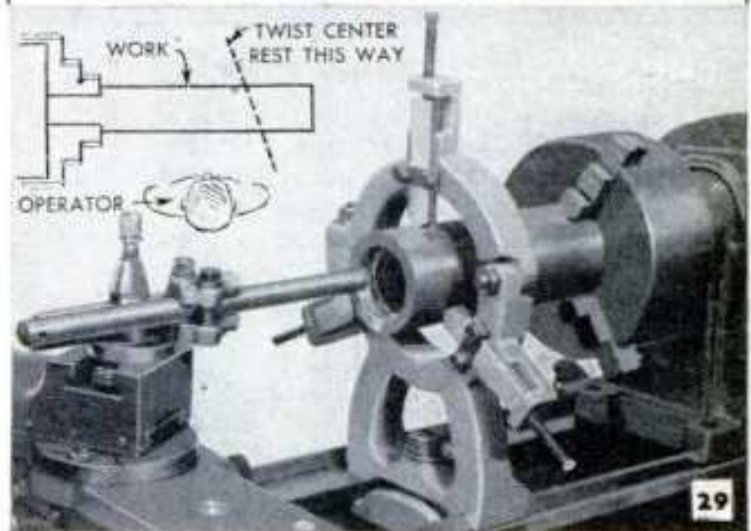
cessive tool overhang is necessary.

Boring-tool angles: Common clearance angles for boring tools are given in Figs. 20 to 26 inclusive. In grinding and honing the cutting edges, keep the side-cutting edge very nearly square to avoid undercutting and riding out, Figs. 22 and 23. The correct angles for most types of work are detailed in Fig. 21. The side clearance angle has a more or less fixed value for the common boring operations but it can vary from 0 deg. to 10 deg. The front clearance ranges from 20 to 35 deg., the sharper angle being required in small holes, Figs. 24 and 25. Some lathe operators run boring tools with a 0-deg. rake but a 5-deg. rake is common practice, especially when boring in ferrous metals. In general, the cutting angles are the same for all types of tools and also apply to solid boring bars worn down to the shank but still usable, Fig. 26. When ground as indicated, these bars are often called "cannon" drills.

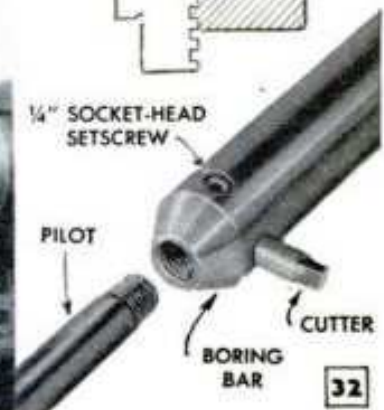
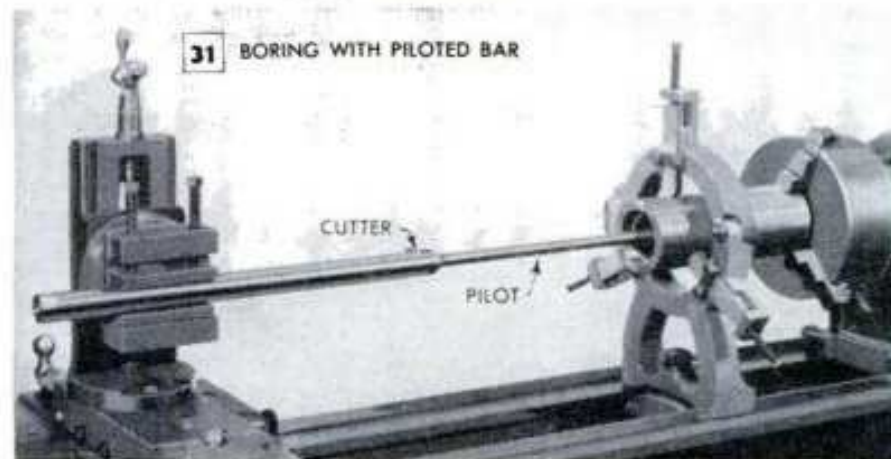
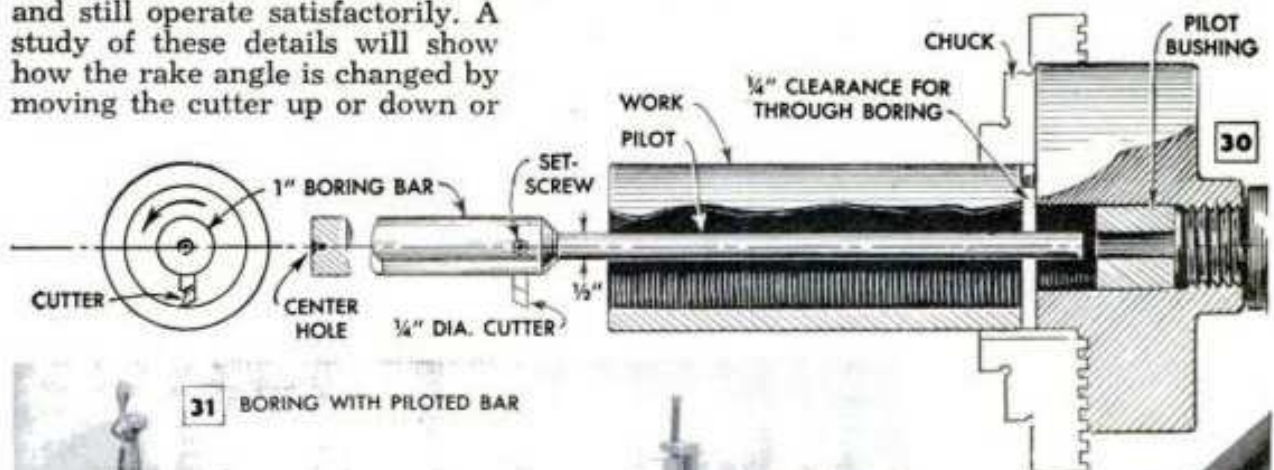
Position of boring tool: Although the boring tool can contact the work at any point, it is regular practice to run it directly on the horizontal center line of the work. This position gives the best visibility and the greatest accuracy of measurement on the crossfeed micrometer sleeve. Fig. 27 pictures the positions a boring bar can take and still operate satisfactorily. A study of these details will show how the rake angle is changed by moving the cutter up or down or

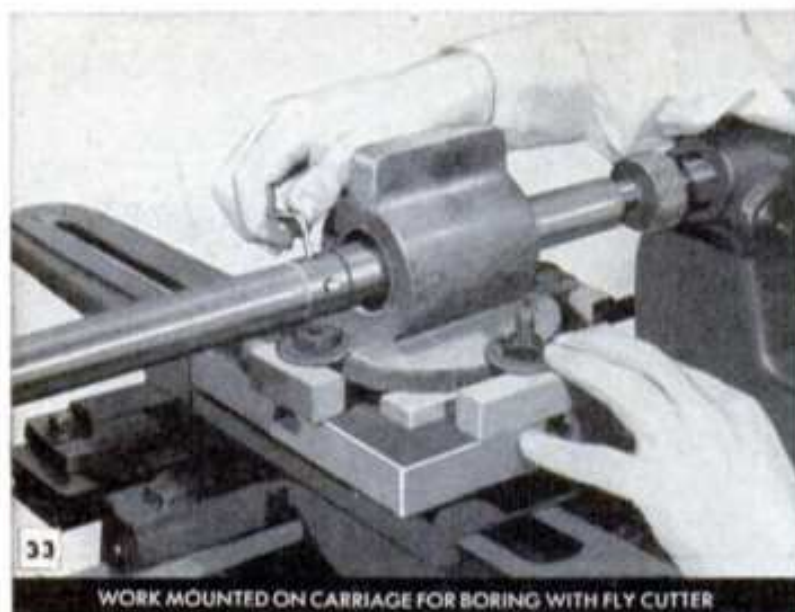


ACCURATE CENTERING IS NEEDED ON REBORING JOBS

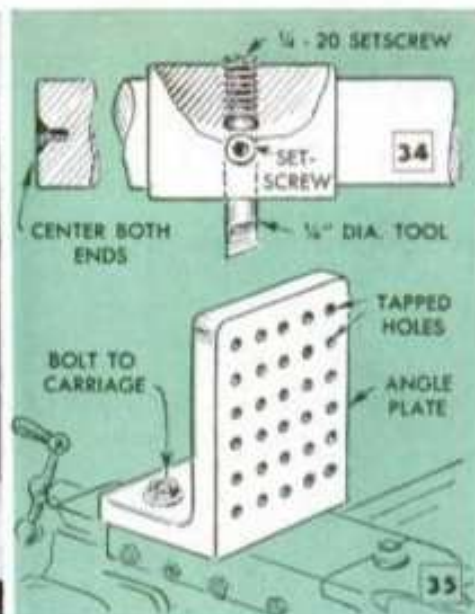


CENTER REST IS ESSENTIAL FOR LONG BORING JOBS





WORK MOUNTED ON CARRIAGE FOR BORING WITH FLY CUTTER



by rotating the bar. With the proper adjustment, one tool can be made to cut all the common materials. Ordinarily the tool is given a negative rake for such materials as plastics and brass, and positive for steel.

Reboring: A reboring job is one in which an existing hole is to be enlarged while its concentricity is maintained. A pulley hub, Fig. 28, is a typical example. Set up this job in a four-jaw chuck with the jaws gripping the outside of the hub. Use a piece of shafting of the same diameter as the hub bore to true the work. Set up a dial gauge and adjust the work in the chuck until the shaft runs dead true. Much the same setup can be followed for all reboring jobs—fit a shaft or a plug in the existing hole and use this to center the work.

Center-rest support: When making a long bore with the work held in a chuck, Fig. 29, it is essential to support the outer end of the work. That's where the lathe center rest comes in handy. One way of adjusting the rest is to place it close to the chuck after the work has been locked in the chuck jaws. After the rest has been adjusted to the diameter of the work, it is pushed along the lathe bed to a position near the outer end of the work. Another way is to true the work first, then carefully adjust the center-rest jaws with the rest in working position. The two lower jaws are brought up into direct contact with the work. The top jaw should be about .002 in. loose and this setting usually is made by slipping a sheet of paper under the jaw before it is locked in place. Place a few drops of oil on the work so that the jaws do not score it.

Boring with piloted bar: With any conventional mounting, a heavy boring bar will take light cuts in bores up to 5 in. long. However, in any bore over this length it will be necessary to use additional support. Often this is done by using a pilot working

through a bushing fitted inside the chuck or in the lathe spindle, Figs. 30, 31 and 32. Fig. 31 pictures the setup, and Fig. 30 sections both the work and the lathe chuck to show the position of the pilot bushing. A preliminary centering of the work is made by fitting the pilot in the bushing and supporting the outer end of the bar on the tailstock center. The milling attachment is then adjusted to clamp the bar and the setup is tested by running the lathe carriage back and forth. The pilot should slide freely through the pilot bushing without binding at any point. As the cutter passes centrally through the bore, it can be operated in any position without changing the cutting angles. The best position is shown in Fig. 30, as this puts the load at the point where the center rest gives the most rigid support.

Boring work on lathe carriage: Work of irregular shape often is fastened to the lathe carriage or to a boring table fitted to the carriage, Fig. 33. Sometimes a special angle plate, Fig. 35, is used. A boring bar is made up in the shop for the carriage jobs as in Fig. 34. The bar should be as large in diameter as the rough bore will permit and still allow clearance for the cutting tool. The length of the bar must be calculated from the length of the bore. The cutting tool, or fly cutter, as it is called, is held in place with a setscrew and adjusted for depth by means of a follower screw. In setting up, the work is carefully blocked and shimmed so that the boring bar is centered through the rough bore. When the setup is correctly made, this method produces very accurate work.

☞ To prevent smudging paper with a typewriter eraser, clean the eraser on an emery board before using. The board is kept handy by taping it to the typewriter.