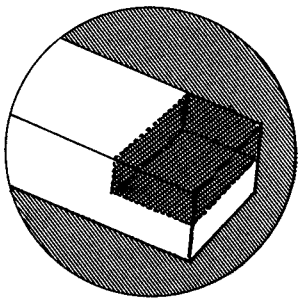
HOW TO SHAPE COMBINED HORIZONTAL and VERTICAL SURFACES



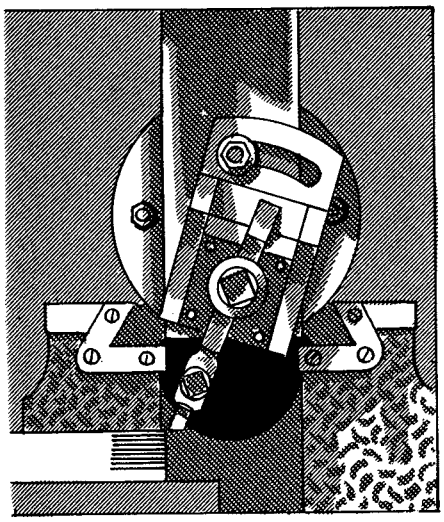


FIG.315

PROCEDURE

1. Read the description of the combined horizontal and vertical cuts beginning on page 187.

   NOTE: Squaring of a shoulder is usually preceded by horizontal and vertical cuts, and, as a rule, the shoulder is squared immediately after these cuts have been made and before the work is removed from the shaper. Therefore, directions for mounting the work will not be given at this time. However, when the job has been removed from the machine and it must be replaced for squaring the shoulder, then either directions given on page 210 or those given on pages 211 and 212, whichever are most appropriate, may be used.

2. Set the tool head at right angles to the table, and swivel the clapper box to the right as for a vertical cut. Refer to steps Nos. 1 through 8 on page 213.

3. Select a round-nosed roughing tool suitably ground for taking a horizontal cut on the material in the job, a tool with its cutting edge on the left side and with a relatively small radius on the corner (page 166).

4. Mount the tool holder in the tool post, allowing it to extend just far enough for the tool to reach the lower horizontal surface without having the tool slide strike the job. At the same time, place the tool holder in a position (slightly angular) which will enable the tool to cut to the corner without having its holder rub on the vertical surface (Fig. 315).

5. Make certain that the length of the stroke, its position relative to the cut, and also the speed of the shaper have been adjusted to suit the job. Refer to How to Adjust the Shaper Prior to Taking a Vertical Cut on page 214.

   CAUTION Carefully move the ram through one complete stroke to make certain that the above adjustments have been made correctly.

6. Take a series of horizontal cuts and rough out the work to within 1/64" of the final dimensions on both the horizontal and the vertical surfaces.

7. Remove the roughing tool and replace it with one ground especially for squaring the corner. Surfaces A and B on this tool, Fig. 316, form an angle slightly less than 90°.

8. Adjust this tool to the work so that a slight opening is still apparent at B when the point just barely touches a horizontal surface and so that a similar opening is apparent at A when the point touches a vertical surface, such as the end of a scale placed against the side of the tool as shown in Fig. 316.

NOTE: Although it is intended primarily for squaring right-angle corners, a tool ground like the one shown in Fig. 316 functions equally well as a finishing tool for both the horizontal and the vertical surfaces which form a shoulder. The procedure for its use in this manner has been explained here, and the procedure which is to be followed when a tool of this kind is used only for squaring the shoulder has been explained on page 223.

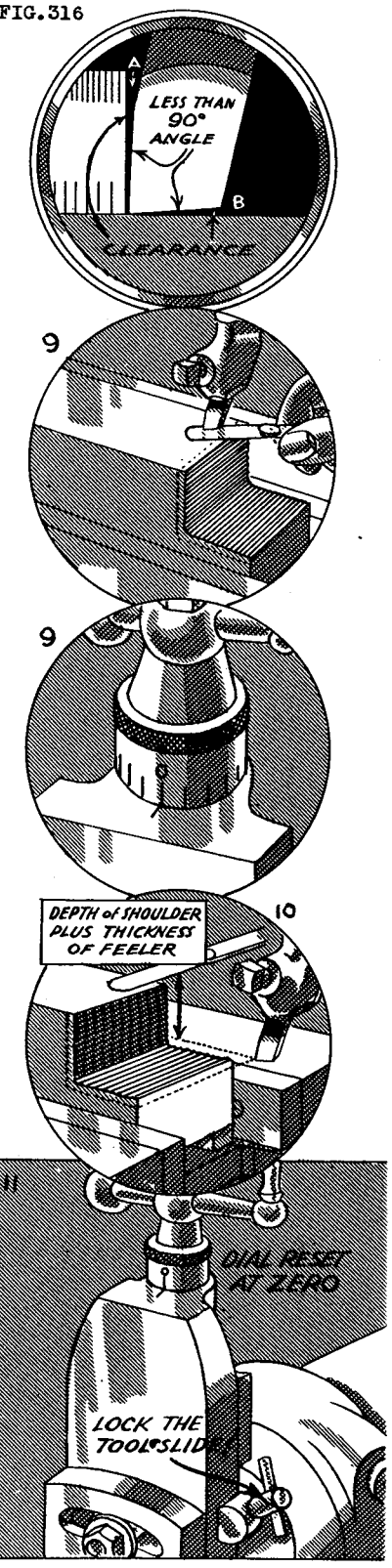
9. When the height of the shoulder must be accurately maintained, set the tool so that it just barely touches a feeler placed on the upper surface of the work; then set the micrometer collar on the down-feed screw to zero.

10. Move the work to the left so that it is no longer under the tool; then use the micrometer dial and feed the tool down a distance equivalent to the height of the shoulder and the thickness of the feeler.

11. Lock the tool head in place, reset the micrometer dial at zero and start the shaper.

12. Adjust a rate of feed which will produce the kind of surface finish desired, engage the automatic feed, and then take a finish cut on the horizontal surface.

FIG. 316



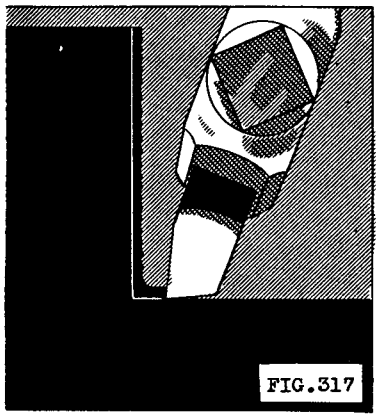


FIG.317

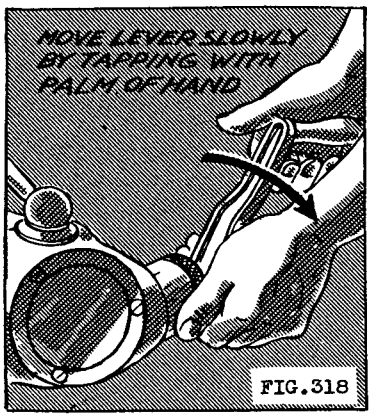


FIG.318

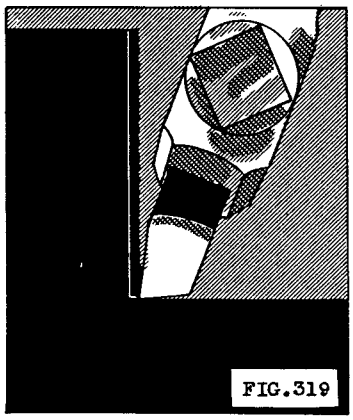


FIG.319

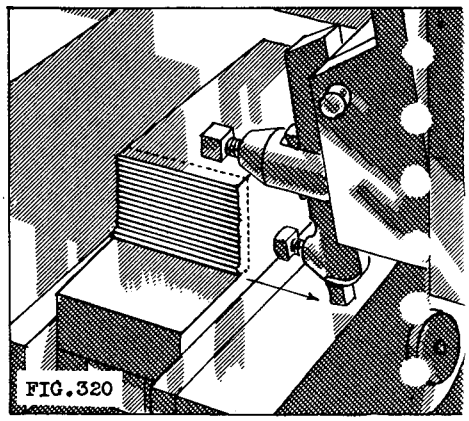


FIG.320

13. Disengage the automatic feed just before the tool reaches the fillet (Fig. 317). From this place use the hand feed and move the work toward the tool more slowly, tapping lightly on the handcrank with the palm of the hand to control to best advantage the amount of feed per stroke (Fig. 318).

14. Continue the hand feeding until the metal left in the corner by the round end on the roughing tool has been removed and until the tool has cut almost to the layout line indicating the location of the shoulder (Fig. 319). Then stop the shaper in its rearmost position (Fig. 320).

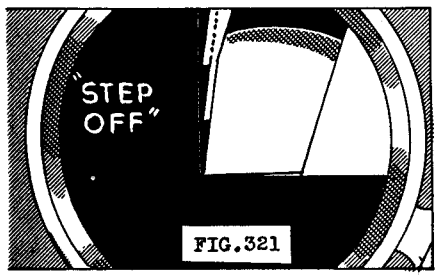
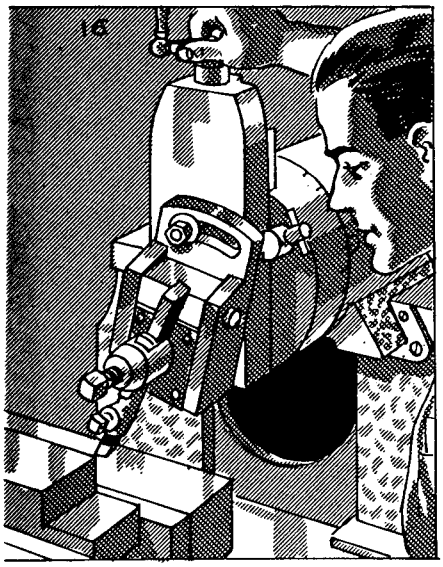


FIG.321

NOTE: If a large fillet has been left in the corner, it may be necessary to "step it off"; that is, it may be desirable to remove the fillet by taking several light cuts rather than by taking a single heavy one (Fig. 321).

15. Raise the tool to a position slightly above the vertical surface; then adjust the work to the tool preparatory to taking the vertical cut.



16. Start the shaper and then feed the tool down carefully until the cut is just started. Make further adjustments of the work, if necessary, so that the final setting will result in a cut which splits the vertically scribed line.

17. Whenever the dimension from the end of the work to the shoulder must be maintained accurately, this distance can be measured by using the graduations on the micrometer collar on the cross-feed screw. Move the end of the work against the left side of the tool (Fig. 322), using a feeler between, and set the micrometer collar to zero (Fig. 323). Then raise the tool above the vertical surface

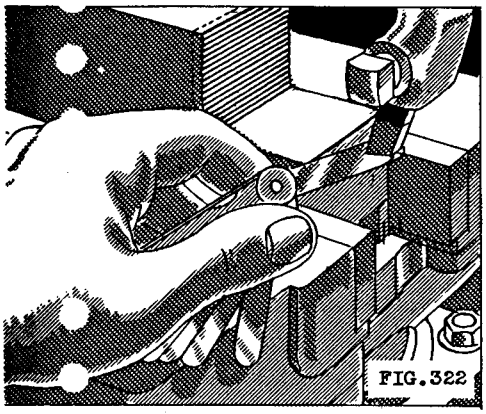


FIG.322

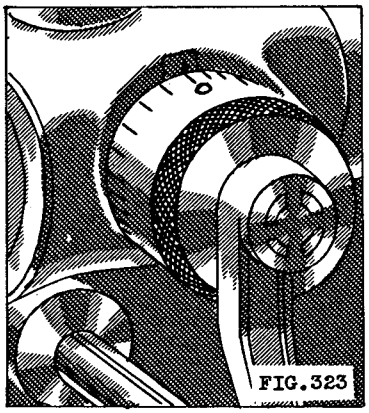


FIG.323

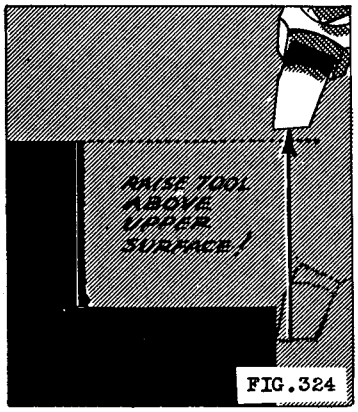


FIG.324

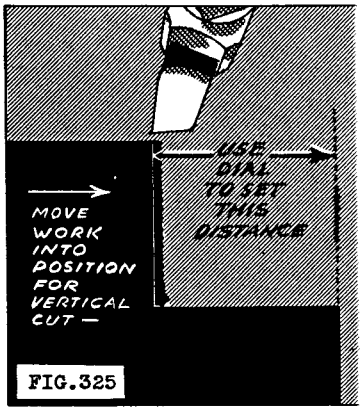


FIG.325

(Fig 324) and move the work over the number of thousandths required to locate it in position for taking the finishing cut on the vertical surface (Fig. 325), not forgetting to include the thickness of the feeler.

18. Decide upon the rate of feed to be used, and then feed the tool down this distance at the end of each return stroke.

19. Continue to feed the tool down steadily until it reaches the horizontal surface and the zero on the graduated dial on the down-feed screw is again opposite the index line. In other words, the tool should be fed down until it is again in the identical vertical position it occupied when the finishing cut was made on the horizontal surface. (Refer to step No. 11 above.)

20. Slowly feed the shoulder away from the tool by hand so that the surface in the corner merges with the remainder of the horizontal surface. When the tool is fed down, the slight angle at which the lower surface of the tool has been set is duplicated on the horizontal surface in the corner (Fig. 326) and, consequently, point A is slightly higher than the remainder of the horizontal surface. It is for the purpose of removing this point that the work is fed away from the tool slowly after the tool has reached the horizontal surface (Fig. 327).

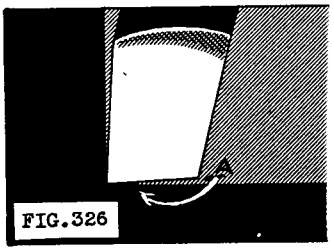


FIG.326

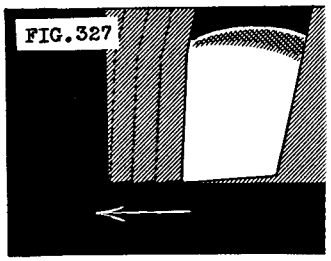
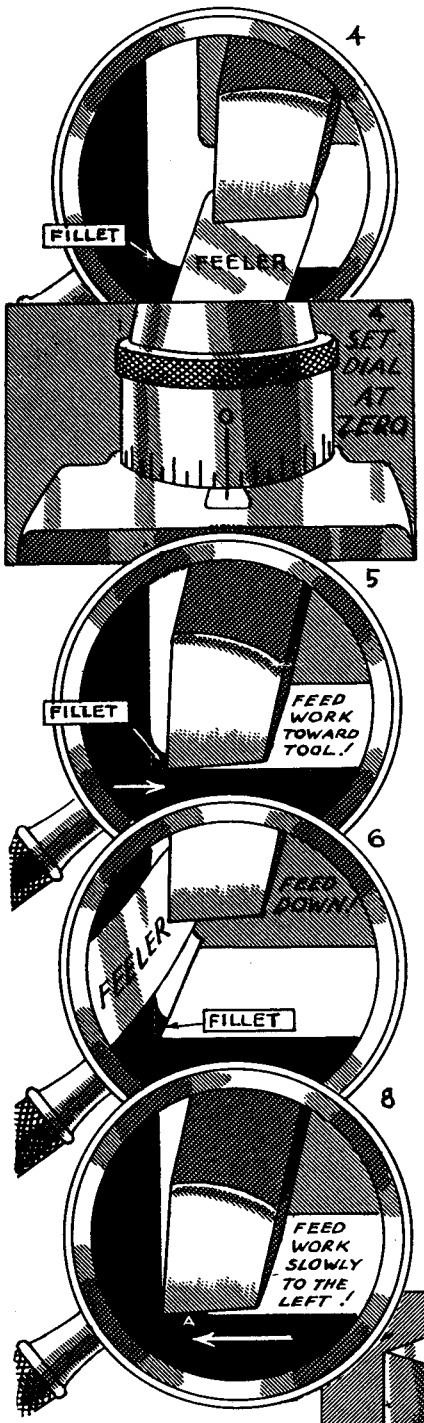


FIG.327

NOTE: When the finishing cuts have been made on both the vertical and the horizontal surfaces with a round-nosed tool, consequently leaving a fillet in the corner, the shoulder can be squared as follows:

1. Select a tool similar to the one recommended in step No. 7 above.

2. Set the tool in relation to the work as directed in step No. 8 above.



3. Make certain that the length of stroke, its position relative to the cut, and the speed of the shaper have been adjusted to suit the job.

4. Place a feeler of a known thickness (in thousandths of an inch) on the horizontal surface under the tool and then move the tool down carefully (with the ram stationary) until a slight drag is apparent when the feeler is withdrawn; now set the micrometer collar on the down-feed screw at zero.

5. Start the shaper and feed the work toward the tool by hand until the side of the tool is almost in line with the vertical surface.

6. Raise the tool so that its point is above the fillet; then carefully move the work toward the tool, tapping lightly on the crank on the cross-feed screw until the tool just barely scrapes the shoulder.

NOTE: This adjustment can also be made by placing a feeler between the work and the tool while the ram is stationary and then moving the work toward the tool a distance in thousandths equal to the thickness of the feeler. This distance can be measured by means of the micrometer dial on the cross-feed screw.

7. Feed the tool down carefully until it reaches the horizontal surface and until the zero on the micrometer dial on the down-feed screw has been turned beyond its index line a distance in thousandths equal to the thickness of the feeler used under the tool when it was adjusted to the horizontal surface in step No. 4.

8. Turn the handcrank on the cross-feed screw in a clockwise direction, feeding the work slowly to the left so that the tool will remove the slight projection at A and cause the surface in the corner to merge with the remainder of the horizontal surface. (Refer to Fig. 327.)