HOW TO SHAPE VERTICAL SURFACES

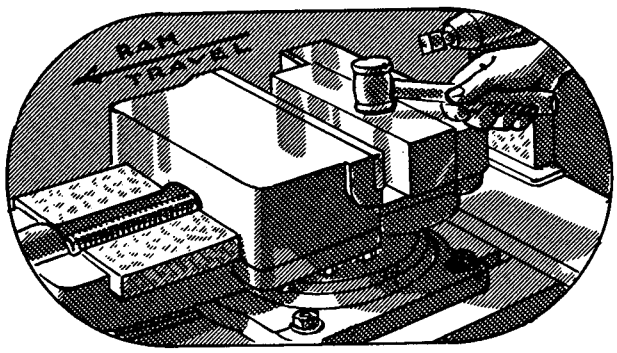
PROCEDURE

HOW TO MOUNT THE WORK IN THE VISE FOR A VERTICAL CUT

1. Bolt the vise to the table, if it is not already mounted on the machine, selecting from the several methods given in How to Mount the Shaper Vise on page 119, the one which is appropriate for mounting a vise having this kind of base.

2. Swivel the vise on its base, if necessary, so that the jaws are at right angles to the stroke or, as expressed in another way, so that the jaws are parallel with the face of the column.

3. Place the index line on the vise over the zero on the base as directed in How to Set the Jaws at 90° to the Stroke on page 124, and when a more accurate setting is desired, follow the directions given in How to Set the Vise at 90° to the Direction of the Stroke With an Indicator on page 133.



4. Place the work in the vise — on parallels if it must be raised — so that the end which is to be squared extends approximately one-half inch beyond the right side of the vise. At the same time, place a strip of paper under each end of the work if it rests on the vise or under each corner of the work if it rests on parallels.

5. Tap the work down in the vise with a lead mallet, pulling lightly on the paper strips underneath to ascertain whether or not it has been properly seated, for in order to have the ends planed square with its sides, the work must be placed parallel with the table as well as at right angles to the stroke of the ram. (Refer to page 184.)

6. Bevel the edges of the work at the end of the cut, almost to the depth of the cut. (Refer to page 196.)

HOW TO MOUNT THE WORK ON THE TABLE FOR A VERTICAL CUT

1. Remove the vise from the table as directed in How to Dismount the Shaper Vise on pages 122 and 123.

CAUTION Its weight and its size make help imperative for lifting the vise from the machine table.

2. Thoroughly clean the table; then remove any burrs or high spots from its upper surface with a smooth file.

3. Clean the surfaces of the work, and, at the same time, inspect these surfaces for burrs which must be removed before placing the job on the machine table.

4. Place a single thickness of paper on the shaper table for the purpose of increasing the amount of friction between the work and the table and reducing the likelihood of the job shifting during the cut (Fig. 305).

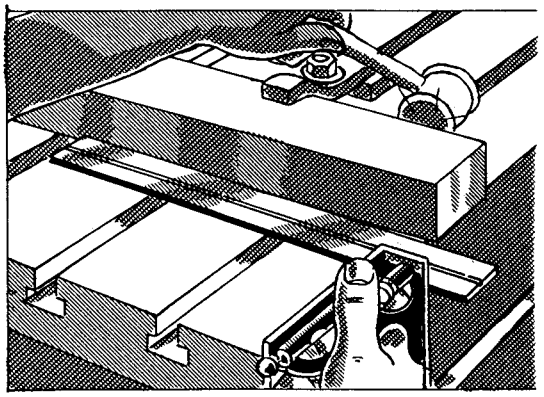


FIG.305

5. Place the work on the table with one of its sides as nearly parallel with the face of the column as it is possible to set it by eye. At the same time, allow one end to extend about one-half inch beyond the right side of the table.

6. Clamp the work to the table lightly, using straps and the shortest bolts possible which will still provide a full thread for the nut. If gooseneck clamps (page 107, Fig. 107) are available, use these, for their construction precludes the possibility of the bolt and the nut extending any further above the work than the clamp itself. This feature — that of having the top of the bolt no higher than the strap — is important, especially during the vertical cuts, inasmuch as any extension of the bolt above the work adds to the distance the tool slide must be extended from the head during the cut.

7. To make certain that there are no burrs on the side of the table which is to be used for squaring the work, rub a smooth file over this surface and wipe it with a cloth to remove the filings, for the surface against which the square is placed must be clean.

8. Place the head of a combination square against the side of the table just cleaned, and extend its blade so that it comes alongside of the work (Figs. 305 and 306).

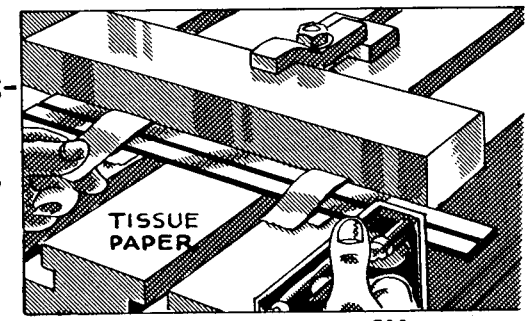


FIG.306

9. Press the head of the square firmly against the side of the table and carefully slide it toward the work, noting which end of the blade comes in contact with the work.

10. Tap the end of the work which does not touch the blade toward the square until the opening between the work and the square disappears and the

work is parallel with the blade, an indication that the work is now at right angles to the ram.

11. To check the alignment of the work more closely and positively with the square, place a piece of tissue paper between the work and each end of the blade. Then, if necessary, tap the work as before, until the same amount of "drag" is felt on both pieces of paper when they are withdrawn from between the blade of the square and the work (Fig. 306).

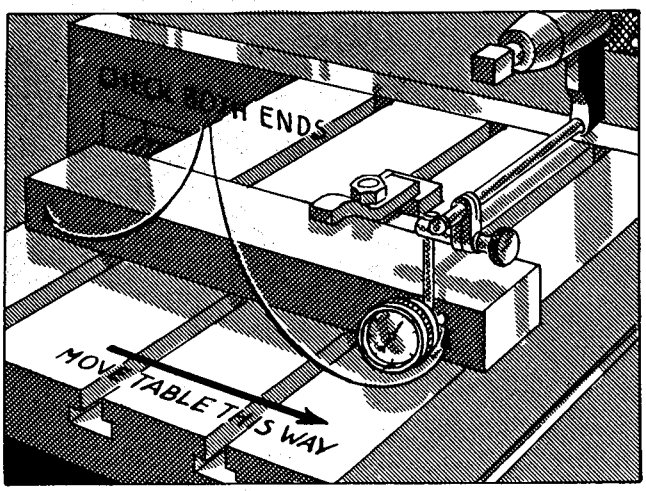


FIG.307

12. To align the work very accurately, use a dial indicator instead of a square. Clamp it in the tool post (page 134, Fig. 163) with its contact point against the front face of the work. Then move the work crosswise by means of the cross-feed screw to determine the amount of misalignment, and subsequently adjust the work in the same manner as before, until the indicator hand remains stationary during movement of the work from side to side (Fig. 307).

13. Tighten the work securely, and, as a precaution, check its alignment again to ascertain whether or not its position changed when the bolts were drawn down tightly.

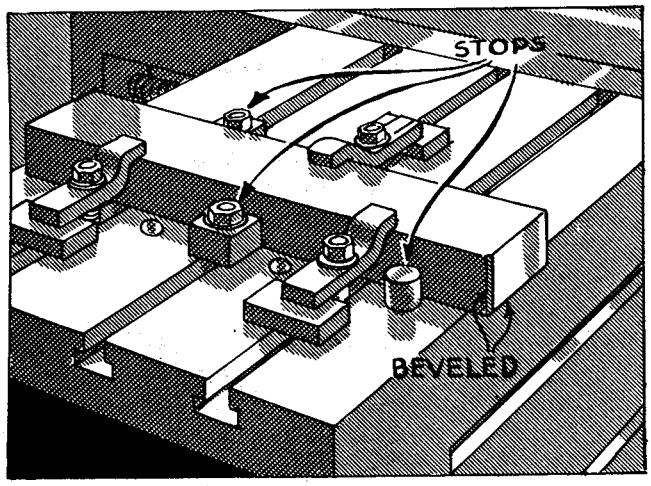


FIG.308

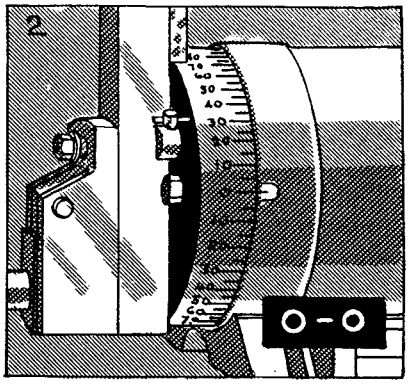
14. Place a suitable stop in front of the work at the right and another in the rear of the work at the left (Fig. 308) as an additional precaution against shifting of the work during the cut. Refer to How to Use Stops on page 139.

CAUTION If stops having screws are selected, be careful not to force the screws against the job so hard that the work is again misaligned.

15. Bevel the edge at the front of the work with a file, almost to the depth of the cut.

Oil the shaper as directed in How to Oil the Shaper, beginning on page 47.

HOW TO ADJUST THE CUTTING TOOL AND THE TOOL HEAD



1. Read the description of the vertical cut beginning on page 184.

2. Set the tool head at right angles to the machine table by placing opposite the index line on the ram whichever of the graduations — zero or 90° — will cause the head to be placed square with the table. Then tighten the clamping bolts just enough to hold the head in this position. Refer to How to Adjust the Tool Head on page 91.

3. Check the accuracy of this setting with a square. Hold the head of the square down firmly against the finished surface (on the table or on the vise); then carefully slide the square to the side of the tool slide and note whether or not it is parallel with the blade of the square.

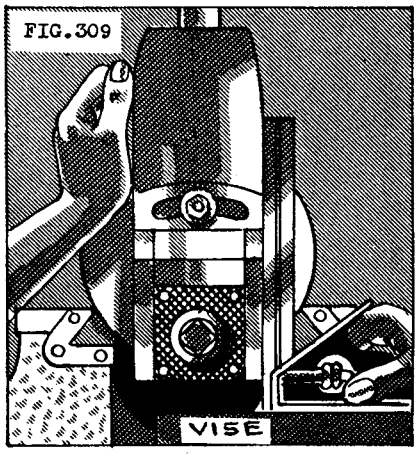
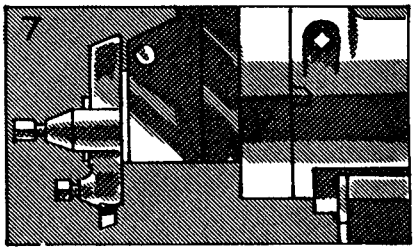


FIG.309

4. Tap the head in one direction or the other with the palm of the hand or with a soft hammer, if an opening is visible between the square and either end of the tool slide, for this condition is an indication that the head is not square with the table (Fig. 309).

5. Tighten the clamping bolts on the head securely when the head is square.

6. Loosen the binder bolt on the clapper box and swivel its upper end to the right to the limit of the slot; then tighten the bolt again. Refer to Functioning of the Clapper Box on page 186.



7. Note the height of the vertical surface which is to be planed. Run the tool slide up far enough at the start of the cut so that when the cut has been completed and the tool has reached the lower end of the vertical surface (Fig. 310), the slide will not extend much below the swivel block.

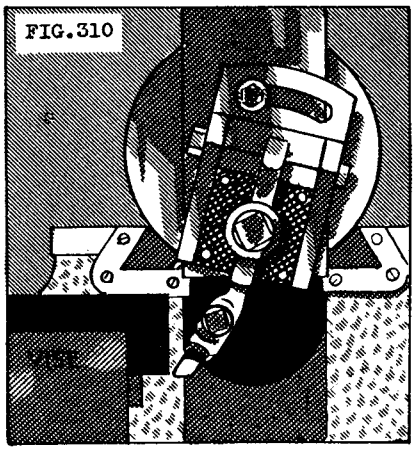


FIG.310

8. Measure the opening in the tool post so that either a forged tool or a tool holder of the correct size may be selected.

9. Determine whether a straight or an offset tool holder can be used to better advantage on this cut. Then select a tool bit that has been ground especially for taking a vertical cut on

the right-hand end of the job and for cutting the kind of material in the work. If a forged tool is selected instead of a tool holder and a tool bit, its selection too should be based on the type of cut (vertical) which is to be made. Refer to page 166 for the selection of the cutting tool.

10. Clamp the tool holder in the tool post in such a position that the vertical cut can be made without interference between the holder and the job. Furthermore, extend the tool holder beyond the tool block the shortest distance possible for making the cut. In no instance, however, should this distance be less than the height of the vertical cut, if rubbing of the tool slide on the work is to be avoided (Fig. 310).

HOW TO ADJUST THE SHAPER PRIOR TO TAKING A VERTICAL CUT

1. Adjust the position of the cross rail on the column up or down so that a space of approximately one inch is apparent between the ram and the top of the work, or between the ram and the straps and bolts, whichever is higher. Refer to How to Adjust the Cross Rail on page 77.

CAUTION Before raising or lowering the table, loosen the bolts for clamping the cross rail and those for clamping the table support, but tighten them again immediately after the rail has been moved to its new position on the column.

2. Measure the length of the surface which is to be planed; add approximately one inch to this dimension in order to provide for clearance of the work by the cutting tool at both ends of the stroke. (Refer to page 79.)

3. Adjust the ram stroke for a length equivalent to that derived in step No. 2. For adjusting the crank shaper, refer to How to Adjust the Stroke on pages 79 and 80; for the hydraulic shaper, refer to How to Adjust the Stroke and the Position of the Ram on page 92.

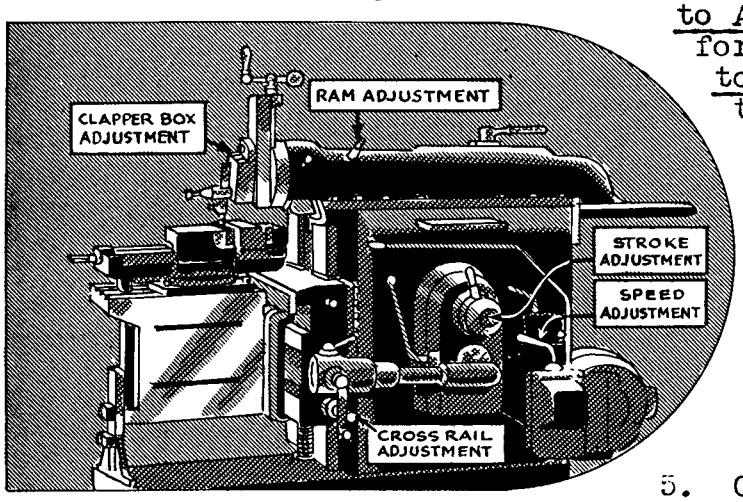


FIG.311

4. Adjust the position of the stroke so that the tool covers the entire surface which is to be planed. When using a crank shaper, refer to How to Adjust the Position of the Ram on page 81; when using a hydraulic shaper, use the reference given in step No. 3.

5. Consult the table, Allowable Cutting

Speeds — Feet Per Minute on page 308. From this table, determine the cutting speed in feet per minute which is to be used. Base the decision on the kind of material to be planed, and on the type of cut, whether roughing or finishing, which is to be made with a High-Speed Steel cutting tool.

NOTE: Most cone-driven shapers are unprovided with charts such as appear on the direct-driven shapers. For this reason step No. 5 may be omitted when a cone-driven shaper is used, inasmuch as the cutting speed in feet per minute cannot be determined when the number of ram strokes per minute is unknown. (Refer instead to pages 83 and 84.)

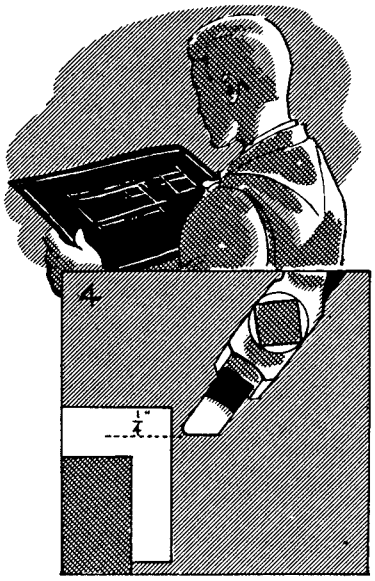
6. Determine the number of strokes per minute which will result in a cutting speed in feet per minute approximately the same as that decided upon in step No. 5. (Refer to page 295.)

7. Read page 82; then select from the procedures given for setting the speed on various types of shapers, the one which is appropriate for the shaper being used, and adjust the shaper for the number of strokes per minute decided upon in step No. 6. For setting the speed on a crank shaper, refer to How to Adjust the Speed of the Ram on pages 83 to 85; for setting the speed on a hydraulic shaper, refer to How to Adjust the Speed of the Ram on a Hydraulic Shaper on page 94.

CAUTION Do not attempt to shift gears while the shaper is in operation.

8. To determine whether or not the cut can be made without any part of the ram striking the work, feed the tool down for the length of the cut with the ram stationary; then carefully move the ram through one complete stroke by hand.

HOW TO TAKE THE ROUGHING CUT (VERTICAL)

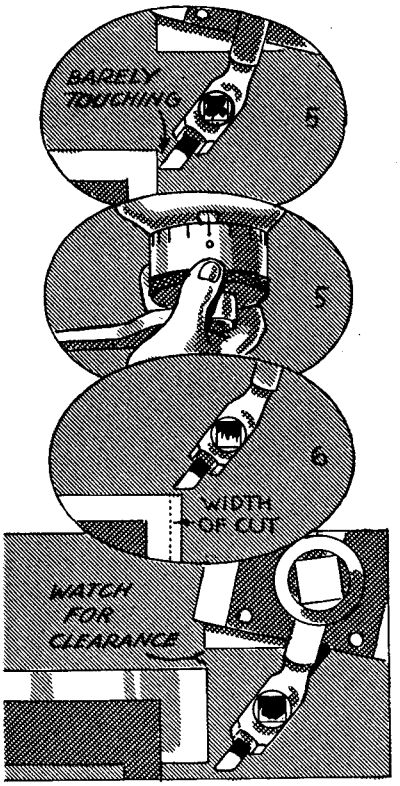


1. Consult the blueprint or the job layout for the purpose of determining how much material is to be removed by the tool.

2. When both ends must be squared and the job must be planed to a definite length at the same time, plan to remove approximately one half the excess material from each end. Refer to The Roughing Cut on page 181.

3. Bevel the vertical edges at the ends of the cut to prevent breakage of the corner below the finished surface.

4. To set the tool for a cut of the desired thick-



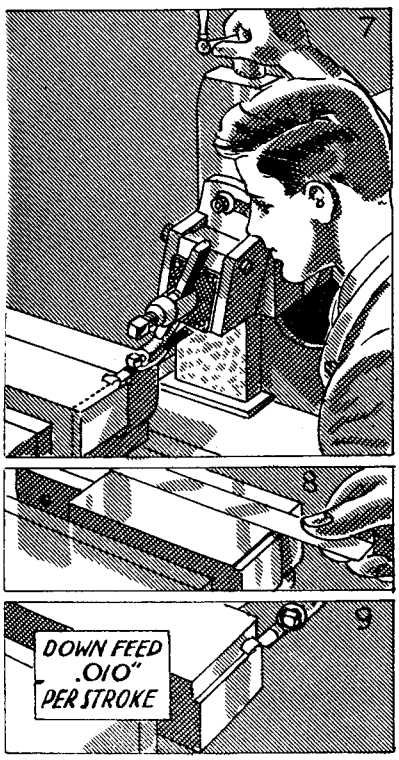
ness, move the work to the left of the tool; then, by means of the down-feed screw, move the tool down about 1/4" from the top of the vertical surface.

5. Now, by means of the cross-feed screw, move the work toward the tool carefully until they just barely touch; then set the micrometer dial on the cross-feed screw to zero.

6. Raise the tool so that it just clears the top of the job; then move the work to the tool for the desired cut, measuring its thickness by means of the graduations on the dial on the cross-feed screw.

NOTE: During the vertical cut, the tool is frequently extended somewhat farther from the tool post than usual so that the cut can be made to the bottom of the work without interference between the tool slide and the job. For this reason both the rate of feed and the width of the cut should be somewhat less than they are for horizontal planing.

HAVE ENTIRE SET-UP *CHECKED* BY YOUR INSTRUCTOR



OIL Oil the shaper as directed in How to Oil the Shaper, beginning on page 47.

7. Start the shaper; then feed the tool down carefully by hand until the cut has been started just far enough to make its width apparent.

CAUTION Keep the face and the eyes a safe distance from the work, or, better still, wear goggles as a protection from flying chips.

8. Stop the shaper for the purpose of measuring the work and making certain that the work in its present position will not be cut undersize because too heavy a cut is removed.

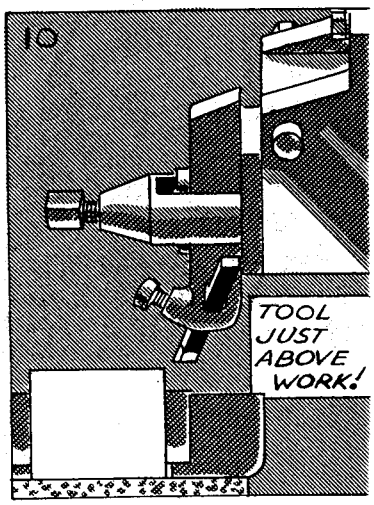
9. Start the shaper again; then feed the tool down about .010" at the end of each return stroke of the tool, continuing the feeding until the entire surface has been planed.

NOTE: Inasmuch as both the size of the cut and the quality of the finish desired may vary considerably, it is impossible to specify a rate

of feed suitable for every combination of these factors. The recommended procedure, therefore, is to feed the tool to the work slowly at first, and then to increase the rate when the action of the tool makes it apparent this can be done with safety.

CAUTION Keep the fingers and hands away from the cutting tool while the shaper is in operation. It is extremely dangerous to place the hands directly behind the vise, or the work, at any time while the shaper is in operation.

10. When the cut has been completed, stop the ram in its rearmost position and raise the tool to the position for starting the cut, that is, to the top of the work.



11. File the burrs from the edges of the work preparatory to testing it with a square; then wipe the upper surface and the end in order to remove the filings and any other foreign material which may be present.

12. Test the work with a try square as shown in Fig. 312 to see if the end has been planed square (at right angles) to the upper surface.

NOTE: When the surface of the work is unusually rough and irregular before it is machined, this condition is very likely to be reflected to some extent on the finished surface as a result of spring in the tool. A second, light cut, made for the purpose of removing these irregularities, is advisable for correcting this condition. Then a true surface which indicates the actual position of the head in relation to the upper surface of the work will be available for testing with the square.

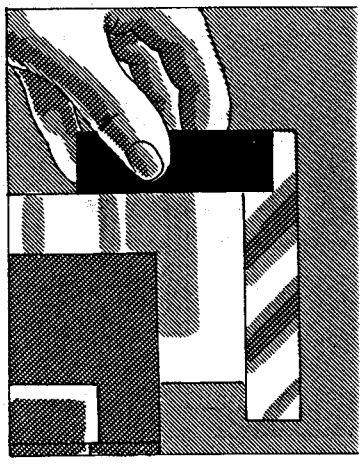


FIG.312

13. When testing the work with a square, press its beam down firmly against the upper surface of the work and carefully move the blade toward the end just planed. Then note whether or not the vertical surface is parallel with the blade.

NOTE: If the work and the tool head have been set up as directed, the end should be square with the top of the work when the cut has been completed. If this is the case, the blade of the square will touch the end from top to bottom and neither an opening nor light will be visible between the work and the blade of the square. Obviously then, the work is not square

when light is visible between the square and the end of the work. To correct this condition, the tool head must be swiveled slightly in one direction or the other depending upon whether the light is visible at the upper or the lower end of the blade.

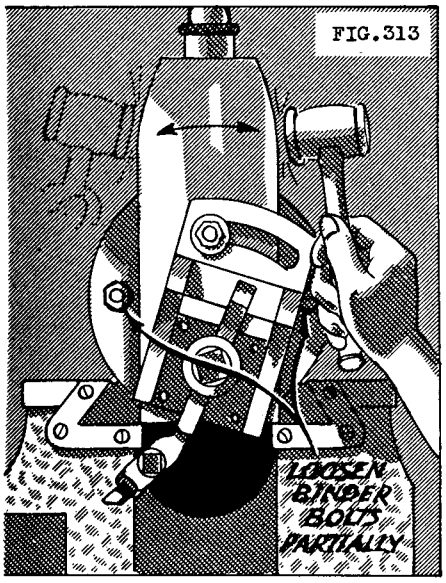


FIG.313

14. When the position of the tool head is to be changed only a small amount for correcting a slight inaccuracy in the cut, partially loosen the binder bolts holding the swivel block to the ram, and swivel the head in the direction desired by tapping it lightly with a block of wood or lead: to the left when the opening occurs at the lower end of the square and to the right when the opening occurs at the upper end (Fig. 313). The number of adjustments required to make the work square will depend upon the operator's ability to estimate the amount of swiveling needed on the head to produce the desired correction in the cut.

15. Reset the work to the tool after each adjustment of the head inasmuch as their relationship changes each time the head is swiveled. Then take another light cut and check the result with a square as before.

CAUTION When taking several trial cuts to square the work, be careful not to cut the work undersize.

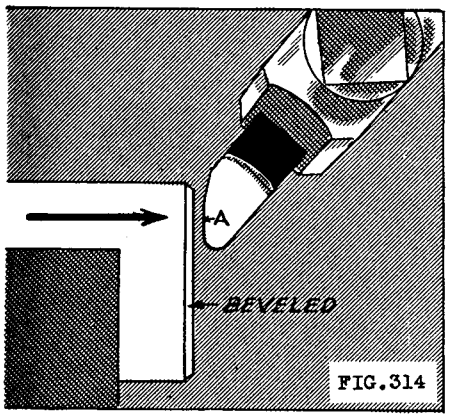


FIG.314

HOW TO TAKE THE FINISHING CUT (VERTICAL)

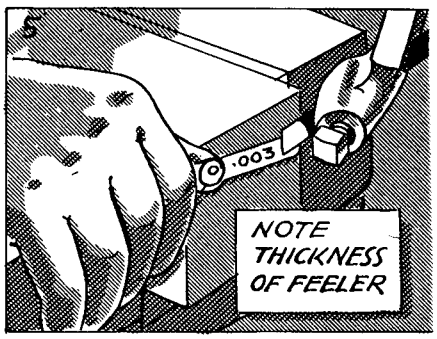
1. Replace the roughing tool with a left-side finishing tool suitably ground for cutting the kind of material in the job. Locate the tool in the tool post according to instructions given in steps Nos. 7 through 10 on pages 213 and 214. Refer to page 166 for the selection of the tool and to page 182 for a description of the finishing cut.

2. File a small bevel on the edges of castings to prevent the sand and scale on their surfaces from dulling the keen cutting edge of the finishing tool.

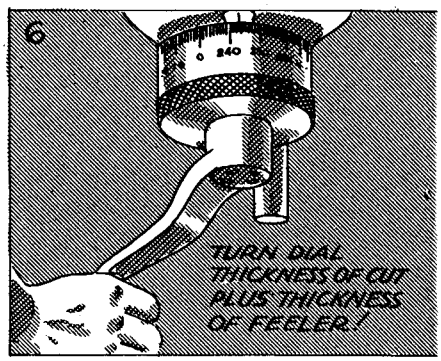
3. By means of the ram, place the tool opposite the vertical surface, and, by means of the down-feed screw, lower the tool so that it extends alongside this surface; then, using the cross-feed screw, move the work over until it almost touches the tool.

4. Adjust the tool in the tool post so that its cutting edge at A

is parallel with the vertical surface as shown in Fig. 314; then tighten the tool-post screw.



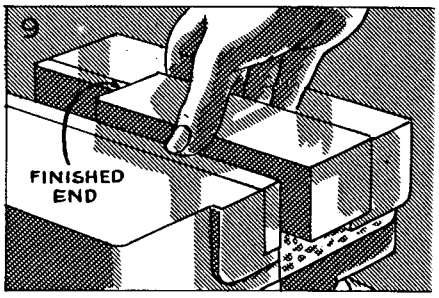
5. After placing a feeler against its end, continue to move the work carefully toward the tool until a slight "drag" is required to withdraw the feeler from between the work and the tool. Now set the graduated collar on the cross-feed screw to zero.



6. Raise the tool so that it clears the job; then move the work to the right a distance equivalent to the thickness of the cut (about .010") and the feeler, using the micrometer collar to measure the distance.

7. Start the shaper and feed the tool down at the end of each return stroke of the ram, using a fine feed when finishing steel and about a half turn of the down-feed screw when finishing cast iron.

8. File the burrs from the edges; wipe the surfaces clean; then test the work with a square. (Refer to page 217, Fig. 312.)



9. To square the opposite end of the work, reverse its position in the shaper, repeating steps Nos. 4 through 6 on page 210 for work held in the vise, or, repeating steps Nos. 2 through 15, beginning on page 211, for work clamped to the table.

10. Replace the finishing tool with the roughing tool, repeating steps Nos. 7 and 10 on pages 213 and 214.

11. Take the roughing cut as directed in How to Take the Roughing Cut (Vertical) on page 215, allowing .010" to .015" on the overall length of the work for the finishing cut.

12. Replace the roughing tool with the finishing tool used for the opposite end and proceed to take the cut as directed in steps Nos. 1 to 8 above.

13. Measure the overall length of the work, and, if the job is oversize, take additional cuts, using the micrometer dial on the cross-feed screw to control the amount of metal to be removed.

14. When the job is finished, brush all chips from the machine, and return the parallels and other accessories to their proper places in a clean condition.