HOW TO MOUNT WORK-HOLDING DEVICES

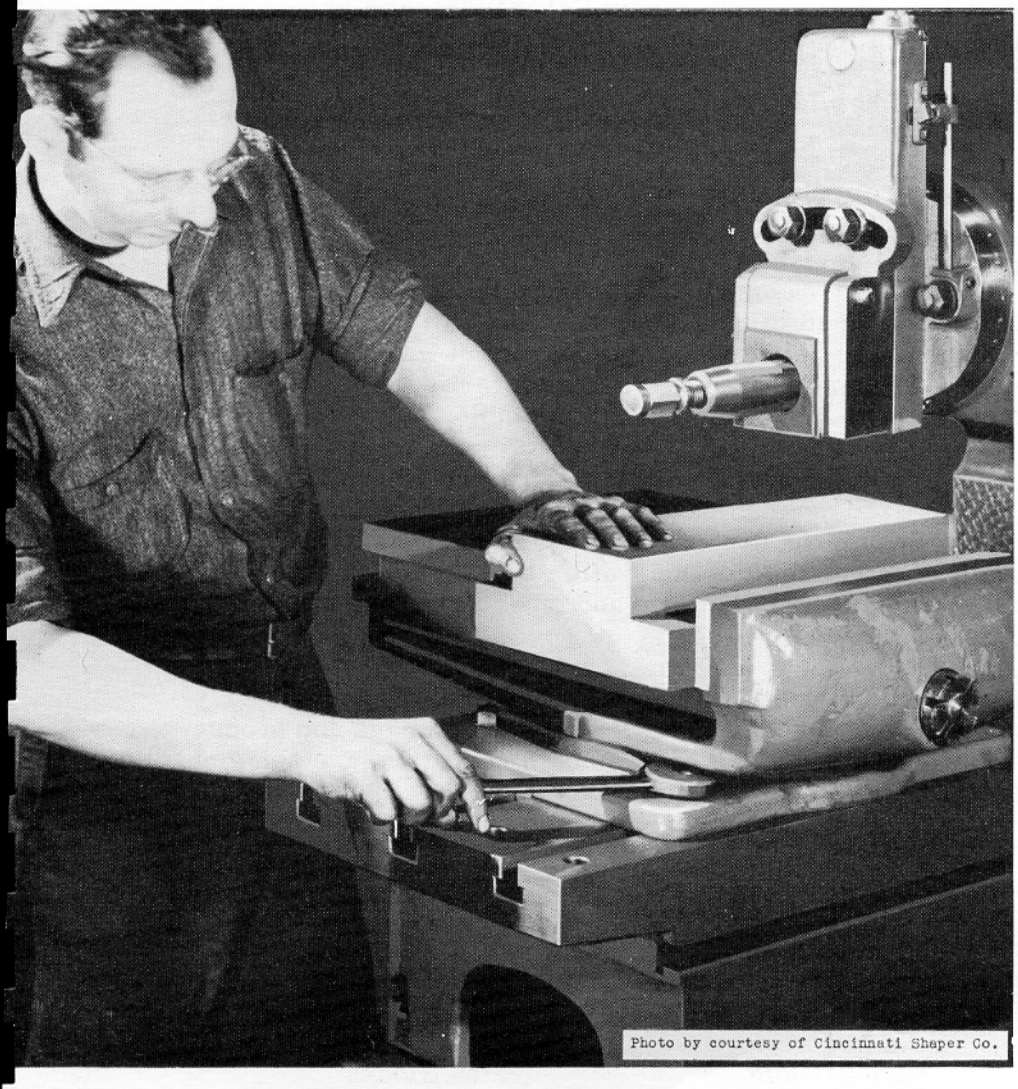
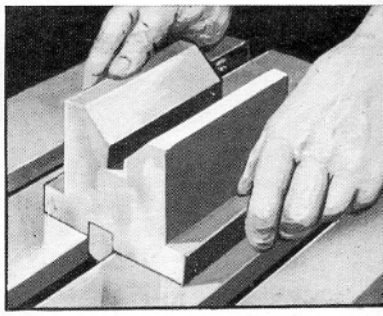
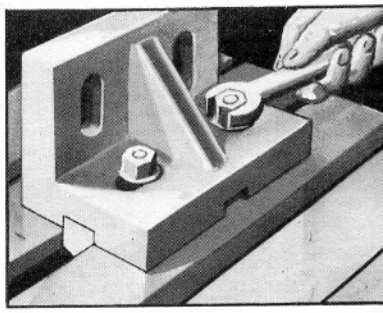


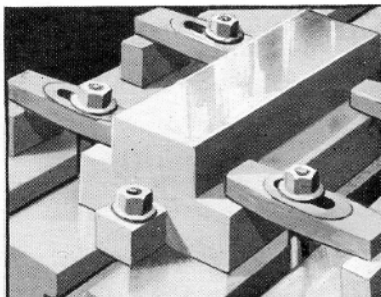
Photo by courtesy of Cincinnati Shaper Co.



MOUNTING V-BLOC



MOUNTING ANGLE-PLA



MOUNTING WORK ON TAB

UNIT P 52 (B)

Part III Pages 117 - 150

HOW TO MOUNT WORK-HOLDING DEVICES

OBJECTIVES OF UNIT

1. To show how to mount and dismount the shaper vise.
2. To tell how to set the vise parallel, at 90°, and at an angle with the direction of the stroke.
3. To illustrate how to use other work-holding devices.

INTRODUCTORY INFORMATION

Of all the work-holding devices, the vise is the most extensively used. It is heavy and awkward to handle and for this reason it should not be taken off the table unless some other method is to be used to hold the work. If more than one shaper is available, and if the shapers are being used for a variety of work, it is sometimes convenient to keep one shaper for vise work. This practice saves the time and labor required to mount and dismount the vise on the table.

In addition to vises, there are many types of holding devices ranging from the simple clamp to more specialized devices designed to meet the requirements of a special piece of work. Although the devices illustrated in this section are of standard design, the experienced operator may often be able to suggest slight modifications which would save considerable time and labor when the job is being set up.

Finally, it is important that all work-holding devices be carefully and properly stored when not in use. Proper storage of the parts to prevent damage and proper cleaning and oiling to prevent rust and to insure smooth operation, are some of the essential routine duties of the good mechanic.

TOOLS AND EQUIPMENT

Shaper
Parallels
C-clamps
Stops
Toe Dogs
Hold-downs
V-blocks
Jack
Fixtures
Brush
Necessary Wrenches
Slot Cleaner
Lead Mallet
Cleaning Cloth
T-head Bolts
Magnifying Glass
Shaper Vise
Assorted Clamps
Machinist's Clamps
Aligning Strips
Angle Plate
Mill File
Packing Strips
Step Blocks
Wedge and Shims
Special Vise Jaws
Square and Protractor
Tissue Paper
Indicator
Oil Can

HOW TO MOUNT A SHAPER VISE WITH A DETACHED BASE ON THE SHAPER TABLE

PROCEDURE

1. Reread the description of the vise with detachable base. Note that the base is separate from the vise body and three bolts are used to hold the vise and the base to the shaper table.

2. Clean the table.

3. Draw the slot cleaner (Fig. 122) through the entire length of the table so that all dirt and chips are removed.

FIG. 122

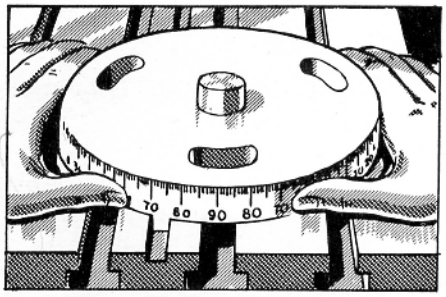
4. Brush off the chips from the table top before and after cleaning the chips from the slots (Fig. 122).

5. Wipe the table top clean with a cloth or wiping rag.

6. Inspect the surface of the table for burrs. If burrs are present, remove them with a file. Use care when burrs are being removed so that the table is not damaged by excessive filing or scraping the surface.

7. Clean thoroughly the base of the vise. Be sure that all chips are removed from the slots to prevent them from getting between the underside of the base and the table top (Fig. 123).

FIG. 123



8. Place the base on the table with the graduations toward the front (Fig. 123).

9. Align the key attached to the base with the key slot in the table and lower the case.

10. Clean thoroughly the body and the base of the vise (Fig. 124).

NOTE: If preferred, a bar can be tightly held between the vise jaws so that this end of the vise can be held securely when it is being lowered onto the base.

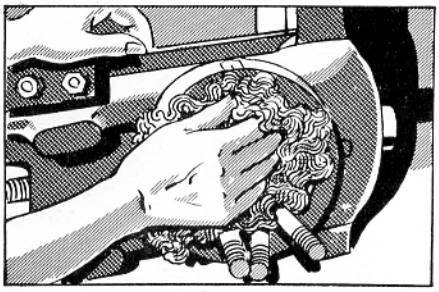


FIG. 124

CAUTION Two or three persons may be needed to mount the vise on the base to prevent personal injury through strain and also to avoid damage to the vise.

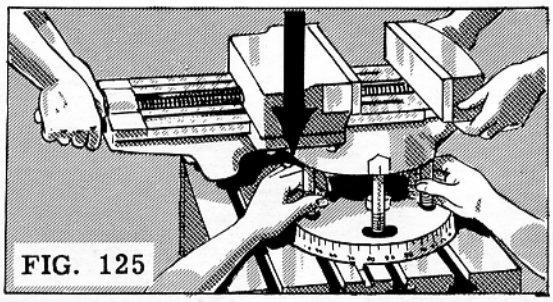


FIG. 125

11. Hold the body of the vise above the base and place the bolts around the T-slot so that they are aligned with the slots in the base (Fig. 125).

12. Lower the vise carefully to the base. Be sure that the pilot upon which the vise swings enters the recess in the vise body.

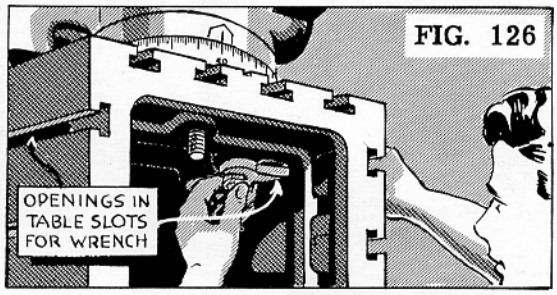


FIG. 126

CAUTION Arrange the bolts approximately in position before lowering the vise. The final adjustments must then be made with a rod. Under no circumstances must the fingers be placed between the vise and the base at this time.

13. Place a washer and a nut on each of the three bolts as they protrude through the table. Screw the nuts on just far enough to hold the vise and the base to the table (Fig. 126).

14. Rotate the vise until the zero mark on the vise coincides with the desired graduation on the base, and tighten the nuts securely.

HOW TO MOUNT A SHAPER VISE WITH A CLAMP-RING BASE

1. Reread the description of the shaper vise with a clamp-ring base illustrated on page 100, Fig. 91. Note that the base acts as a clamping ring. In the illustration, the base is shown separated from the vise in order to make clear the construction and method of clamping. However, the base is not removed when the vise is mounted on or taken off the table.

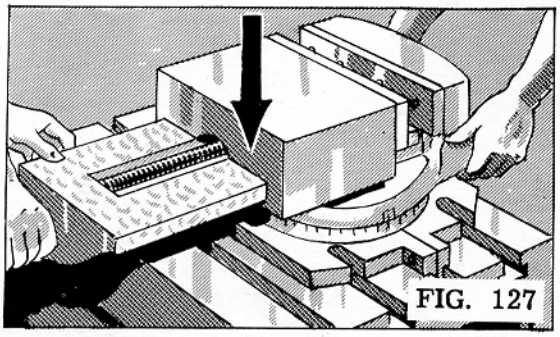


FIG. 127

2. Clean the table and the base of the vise. Remove burrs.

3. Place the vise, with base attached, on the table with the graduations toward the front (Fig. 127).

4. Align the key attached to the base with the selected T-slot. Then lower the base and the vise to the table.

5. Place a bolt in each end of the two table slots which correspond to the bolt slots in the base of the vise (Fig. 128). Be sure that the two back bolts can be placed in the table slots after the base is placed on the table.

6. Move the bolts along to enter the slots in the vise base.

7. Place a washer and a nut on each of the bolts and screw them on just far enough to hold the vise in place (Fig. 128).

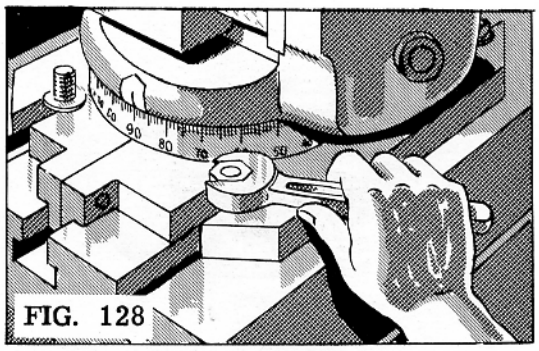


FIG. 128

8. Move the vise around to the desired position and tighten the four bolts. The vise and the base will then be secured to the table and will not shift under the heaviness of cuts.

HOW TO MOUNT A SHAPER VISE WITH AN INDEPENDENT BASE

1. Reread the description of the shaper vise with independent base. Note that the base is clamped to the table independently of the vise. The base is not detached, though, when the vise is mounted on or taken off the table.

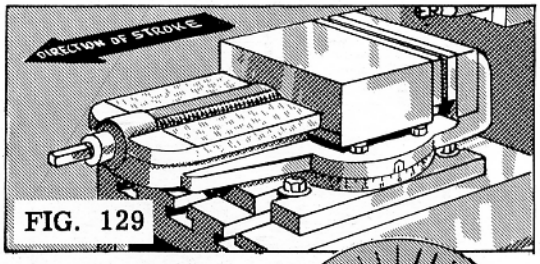
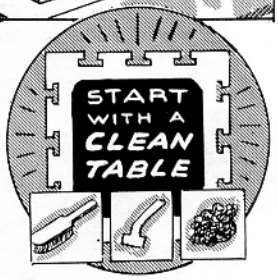


FIG. 129

2. Clean the table and vise base and remove burrs.



3. Place the bolts in the table slots before lowering the vise to the table, provided the base has bolt holes instead of slots. If the base has slots instead of bolt holes, the bolts may be moved into place later.

4. Allow the bolts to enter the bolt holes in the base. Then lower the vise and the base to the table.

5. Place a washer and a nut on each bolt and tighten the four nuts (Fig. 130). These will hold the base to the table.

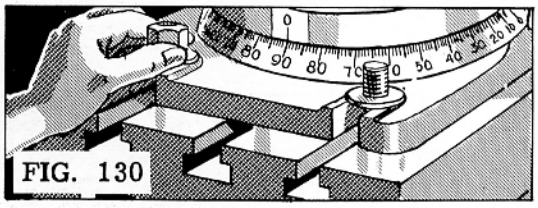


FIG. 130

6. Rotate the vise until the zero mark on the vise coincides with the desired graduation on the base (Fig. 131).

7. Tighten the four nuts on the vise. These will secure the vise in position on the base (Fig. 131).

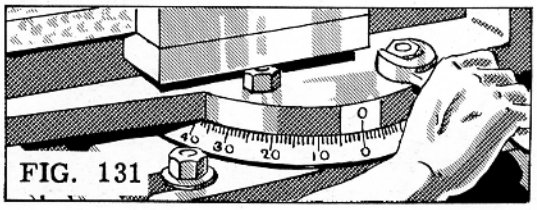


FIG. 131

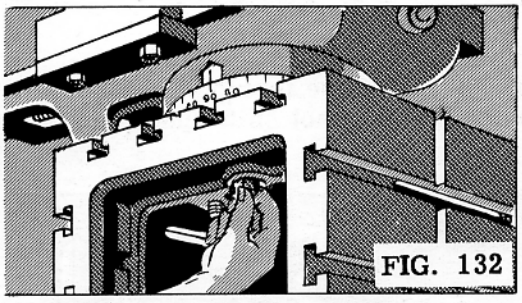


FIG. 132

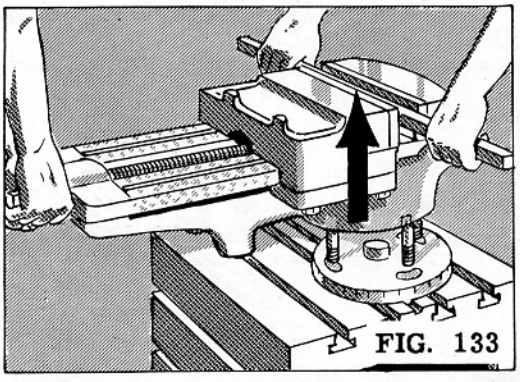


FIG. 133

HOW TO DISMOUNT A SHAPER VISE WITH A DETACHED BASE

1. Brush off all chips from the vise and the table.

2. Loosen and take off the three nuts and washers from the clamping bolts which pass through the table and project from the underside (Fig. 132).

   NOTE: A bar can be gripped between the vise jaws in order to provide handles for lifting the vise more conveniently (Fig. 133).

3. Lift the vise so that the bolts clear the base and place it on a bench or a suitable tool stand (Fig. 133).

4. Remove the base from the table (Fig. 134).

5. Clean around the vise screw and other parts that were inaccessible before the vise was taken off the table (Fig. 135).

6. Wipe the parts with an oily cloth to prevent rusting.

7. Assemble the vise and the base and put the nuts and washers on the bolts (Fig. 136).

8. Place the vise on a stand near the machine or store it in an appropriate and safe place to prevent damage or injury to the surface of the jaws or to other parts of the vise.

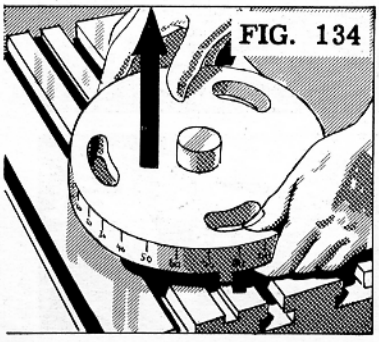


FIG. 134

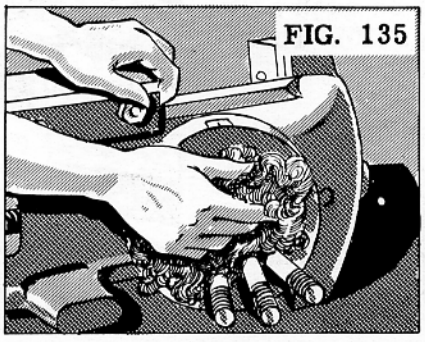


FIG. 135

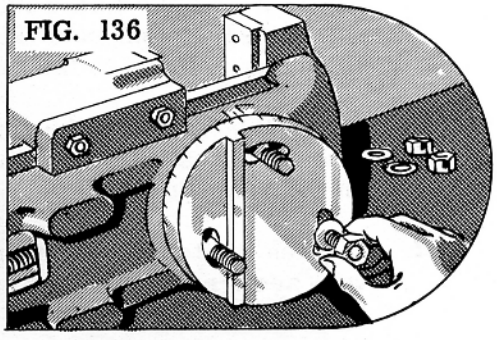
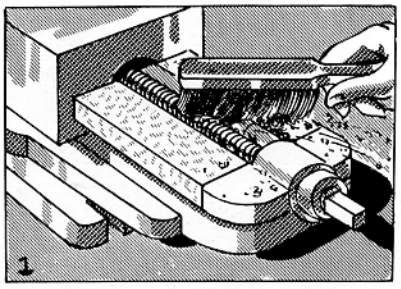


FIG. 136

HOW TO DISMOUNT A SHAPER VISE WITH AN ATTACHED BASE

Although some vises have detachable bases, other vises are attached to the base with a clamp ring or with four T-head bolts, which are held in a circular T-slot in the base (page 100). In each case, the vise is not removed from its base when it is being mounted on or taken off the shaper table.

1. Brush off all chips from the vise and table as shown in Illustration 1.



2. Wipe the vise with a cloth. If a coolant has been used, the vise should be dried with waste or rags.

3. Remove the four nuts which hold the base to the table (Fig. 137).

4. Lift the vise with the base attached. Remove it from the table and place it on a bench or a tool stand large enough to hold the vise (Fig. 138).

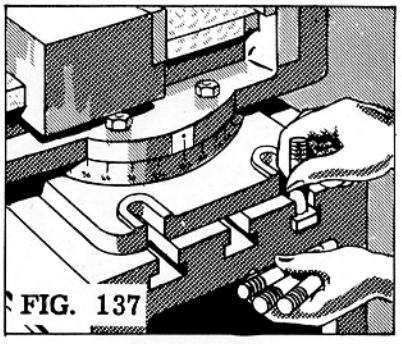


FIG. 137

5. Clean around the vise screw and other parts that were inaccessible before the vise was taken off the table.

6. Wipe the parts with an oily cloth to prevent rusting.

7. Place the vise on a stand near the machine, or store the vise in an appropriate and safe place to prevent injury to the surface of the jaws or to the other parts of the vise.

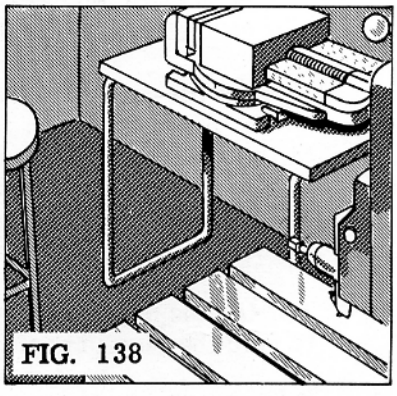
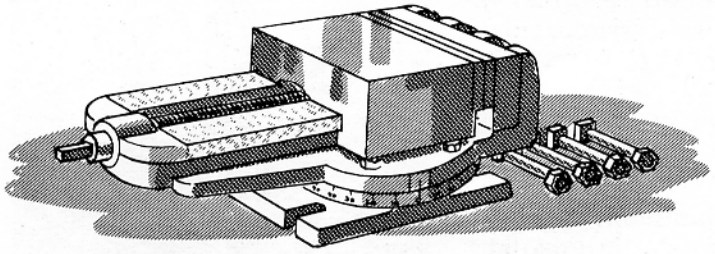


FIG. 138

8. Remove and clean the T-bolts and place them, with nuts and washers replaced, with the vise.



HOW TO SET THE SHAPER VISE WITH THE AID OF THE GRADUATIONS ON THE BASE

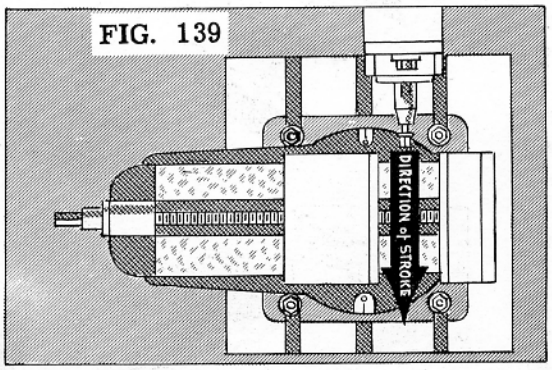


FIG. 139

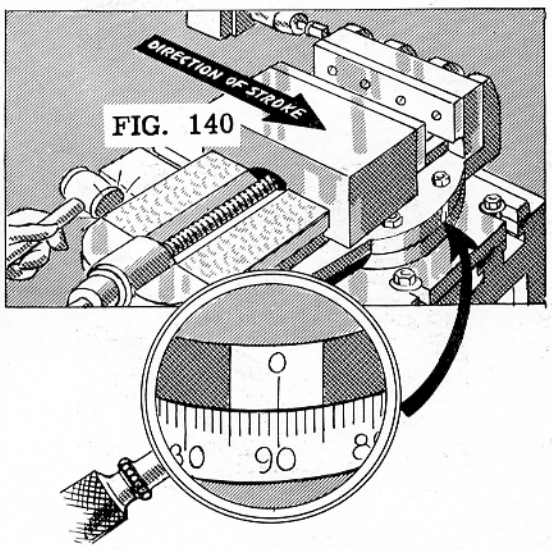


FIG. 140

A. PARALLEL WITH THE DIRECTION OF THE STROKE

1. Loosen the clamping nuts on the bolts just enough so that the vise will swivel on the base.
2. Note whether the bolts hold the vise independently to the base or whether the vise and the base are clamped to the table as a unit.
3. Set the zero mark on the vise with the 90^{o} graduation on the base (Fig. 140).
4. Tighten the nuts on the clamping bolts just enough to hold the vise in place.
5. Tap the vise lightly into position with a lead mallet if it is necessary to adjust the setting. Use a magnifying glass to magnify any slight variation in the position of the matching lines, thereby making it possible to adjust the markings more accurately (Fig. 140).
6. Tighten the clamping nuts securely after the vise has been finally checked and set.

B. AT RIGHT ANGLES (90^{o}) TO THE DIRECTION OF THE CUT

1. Loosen the clamping bolts.
2. Move the vise around until the handle of the vise is toward the front and the two zero marks on the vise coincide with the zero graduations on both sides of the base (Fig. 141).
3. Tighten the nuts on the clamping bolts just enough to hold the vise in position.
4. Examine the setting. If an adjustment must be made, tap the vise into position with a lead mallet.

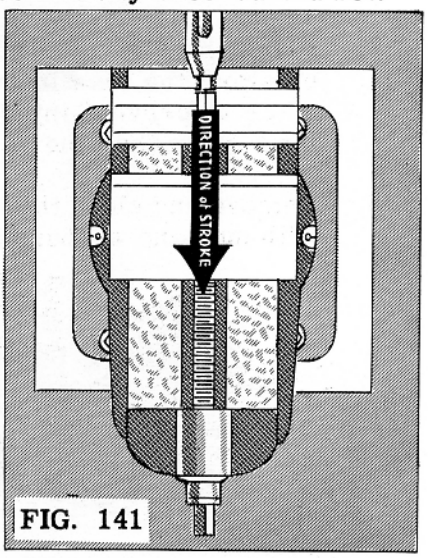


FIG. 141

5. Use a magnifying glass to accurately check the setting.

6. Tighten the clamping nuts securely after the vise has been finally checked and set.

C. AT AN ANGLE TO THE DIRECTION OF THE STROKE

1. Determine the angle at which the vise must be set.

2. Note that the zero position is the one in which the vise jaws are set 90° to the direction of the stroke (Fig. 142).

3. Loosen the clamping nuts and move the vise around from the zero position until the zero mark on the vise coincides with the desired degree on the base (Fig. 143).

4. Tighten the nuts on the clamping bolts just enough to prevent the vise from moving.

5. Check the setting. If it is necessary to make an adjustment, lightly tap the vise into position with a lead mallet. Use a magnifying glass when the setting is being checked accurately.

6. Tighten the clamping nuts securely after the vise has been finally checked and set.

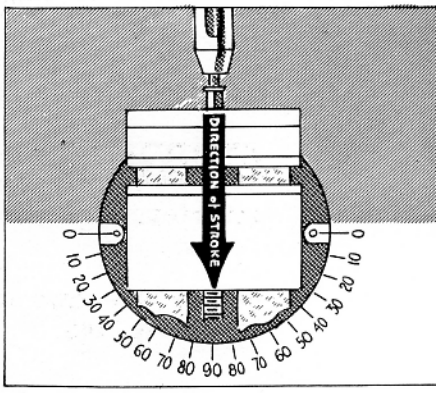


FIG. 142

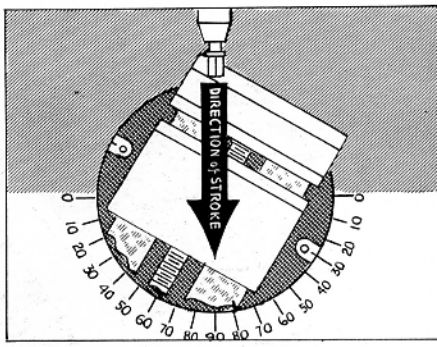


FIG. 143

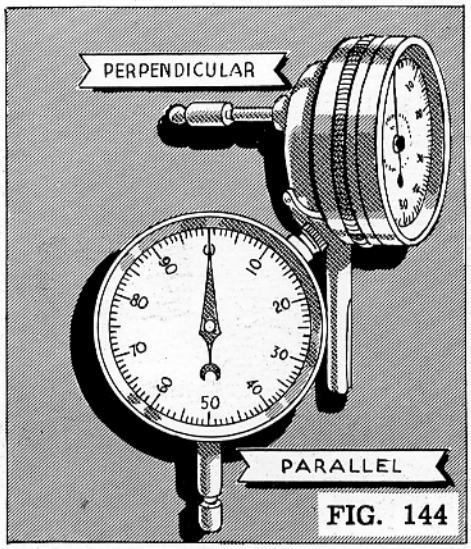


FIG. 144

HOW TO SET THE VISE WITH AN INDICATOR

NOTE: The setting of the vise with the graduations on the base is usually accurate enough for most purposes. When extreme accuracy is essential, other methods must be employed. A very simple and accurate gage for this purpose is the dial indicator, which should always be available in a well-equipped machine shop.

Dial indicators (Fig. 144) are graduated to read either to one-thousandth part of an inch (1/1000") or to one ten-thousandth part of an inch (1/10,000") with the operator estimating the value when the pointer is not exactly on the line representing the basic dimension. Four practices for setting the vise with an indicator are given.

HOW TO SET THE BOTTOM OF THE VISE PARALLEL WITH THE TABLE WITH AN INDICATOR

1. Follow the steps previously covered for mounting the vise.

CAUTION Be sure that dirt does not get between the vise and the table surfaces. A very small particle between the surfaces will interfere with the parallelism of the vise with the table.

2. Set the vise jaws approximately parallel with the direction of the stroke. Refer to Fig. 145.

3. Open the vise to its full capacity.

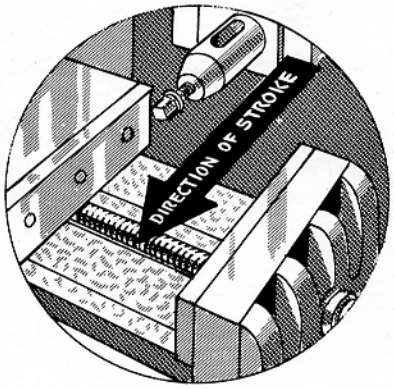


FIG. 145

4. Examine the work seat of the vise for burrs. Carefully remove any that may be present.

5. Clean the surface thoroughly.

6. Select two test parallels high enough to project above the top of the vise jaws and long enough to extend two or three inches beyond the width of the vise (Fig. 146).

NOTE: If parallels are not available, the indicated readings may be taken directly from the work seat of the vise.

7. Clean the parallels and lay them carefully on the work surface of the vise. Place one against each of the vise jaws.

FIG. 146

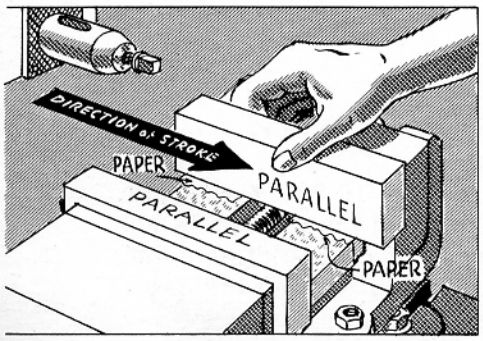


FIG. 147

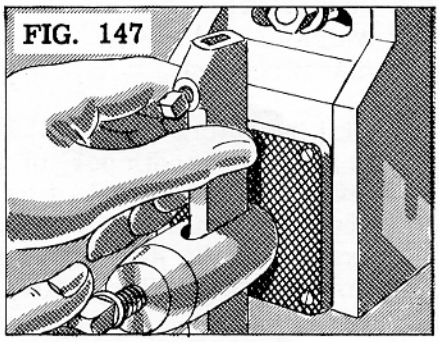
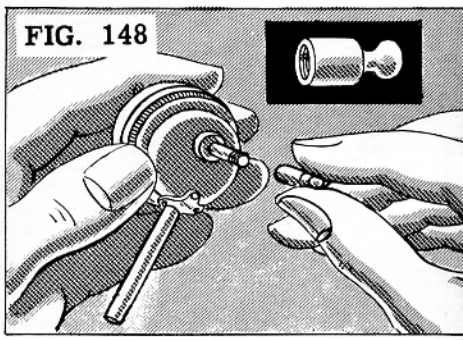


FIG. 148



8. Arrange the parallels against the face of the vise jaws so that they both project evenly beyond the sides of the vise. Some mechanics prefer to place a piece of tissue paper under the ends of each parallel to insure good contact and to prevent slipping (Fig. 146).

9. Select an indicator with the contact shaft perpendicular with the dial (Fig. 144). The dial faces upward and can be conveniently read from the operating position.

   NOTE: Dial indicators are made with two types of contact shafts, one parallel and the other perpendicular to the face of the dial. Figures 149 and 152 illustrate the arrangement for both types of indicators.

10. Reverse the position of the tool holder in the tool post (Fig. 147). This will provide a more convenient surface upon which to place the clamp because the tool end which contains the set screw and the tool has an irregular surface.

11. Attach a small, ball-type contact point to the end of the indicator contact spindle (Fig. 148). This point is simply screwed onto the end of the contact spindle. When necessary, the point can be removed quite easily.

12. Assemble the indicator, the gage-holding rod, the swivel or sleeve, and the clamp (Fig. 150).

13. Clamp the assembled unit to the end of the tool holder with the dial facing upward (Fig. 151).

14. Manipulate the down-feed crank and the cross-feed table control handle until the contact point is about one-half inch above one of the parallels.

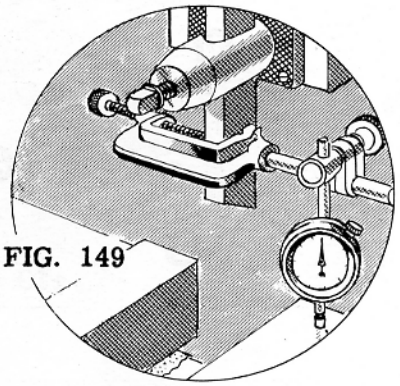


FIG. 149

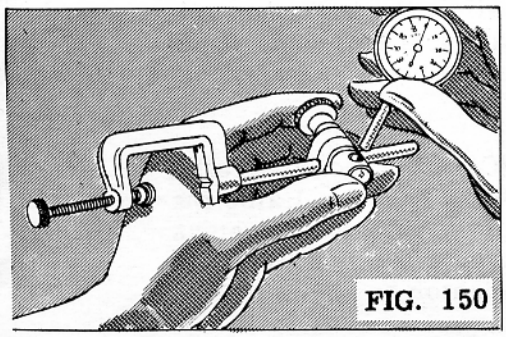


FIG. 150

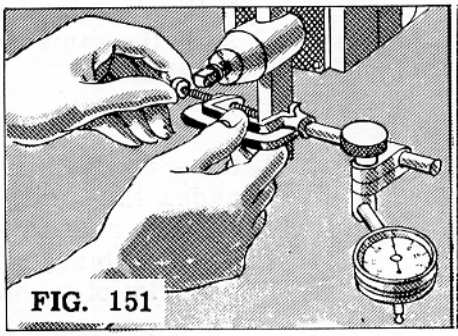


FIG. 151

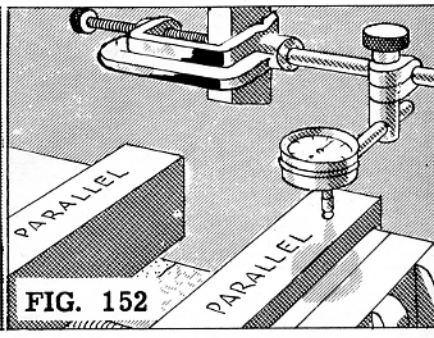


FIG. 152

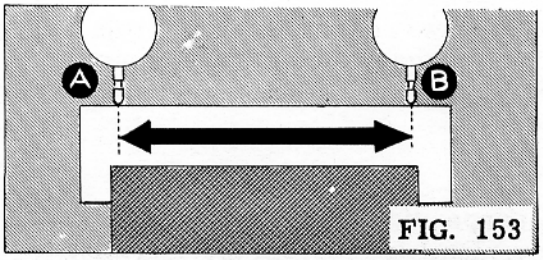


FIG. 153

15. Set the machine so that the length of the stroke is about one inch shorter than the length of the parallels (Fig. 153).

16. Position the ram so that the contact point travels within one-half inch of both ends of the parallels (Fig. 153).

CAUTION If the ram with the attached indicator cannot be operated by hand, use a slow speed to move the indicator back and forth over the parallel. Great care must be exercised that the point of the indicator is not allowed to travel beyond the surface of the parallel.

If this should happen, the point would drop below the level of the surface and would damage the indicator when the return stroke is made. This is also the reason for having both parallels project evenly beyond the sides of the vise. In other words, both parallels must be set in the same relation to the position of the stroke when the testing operation is in progress. Otherwise, there is the possibility of the indicator traveling beyond the surface of one of them.

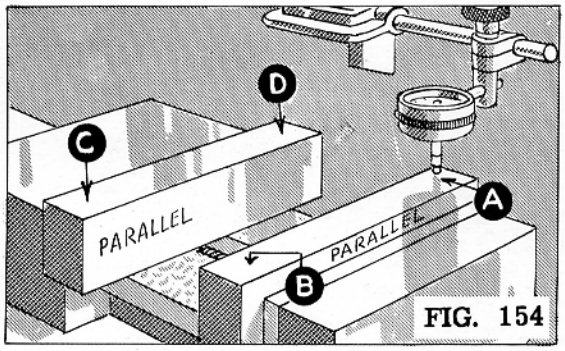


FIG. 154

17. Move the ram so that it is at the beginning of the stroke. Move the table so that one end of the parallel is under the contact point of the indicator as shown at (A) in Fig. 154.

18. Lower the indicator until the pointer registers about ten one-thousandths of an inch on the dial. This will show that the indicator point is making contact with the parallel.

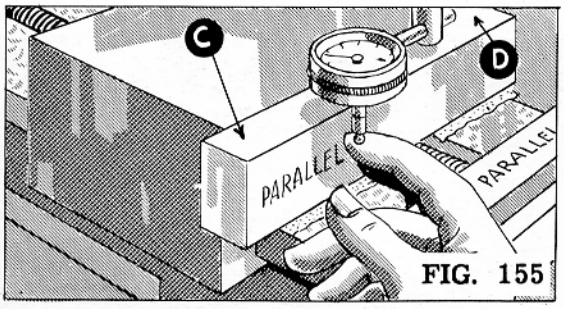


FIG. 155

19. Note the measurement on the dial. Then, move the ram to the forward position (B). If the vise is parallel, the indicator will show the same reading at both ends of the parallel.

20. Bring the surface (C) of the second parallel under the indicator. NOTE: Raise the contact shaft slightly with the finger as the parallel is moved directly underneath the point of the indicator as shown in Fig. 155.

21. Release the contact shaft and allow the contact point to rest on the parallel. The reading at (C) should be the same as the readings at (A) and (B).

22. Draw the ram again to the beginning of the stroke (Fig. 156). If the reading at (D) corresponds with all the others, the vise is parallel.

NOTE: If (B) and (C) are low, adjust the table support and tighten the table gibs. This may be all that is necessary to bring these points into alignment.

NOTE: If (A), (B), (C), or (D) is low, loosen the clamping nuts and place a proper shim underneath the lowest point of the base.

CAUTION Make certain that there are no particles of dirt underneath the base of the vise.

23. Tighten the nuts and recheck the setting at all four points by following the same steps.

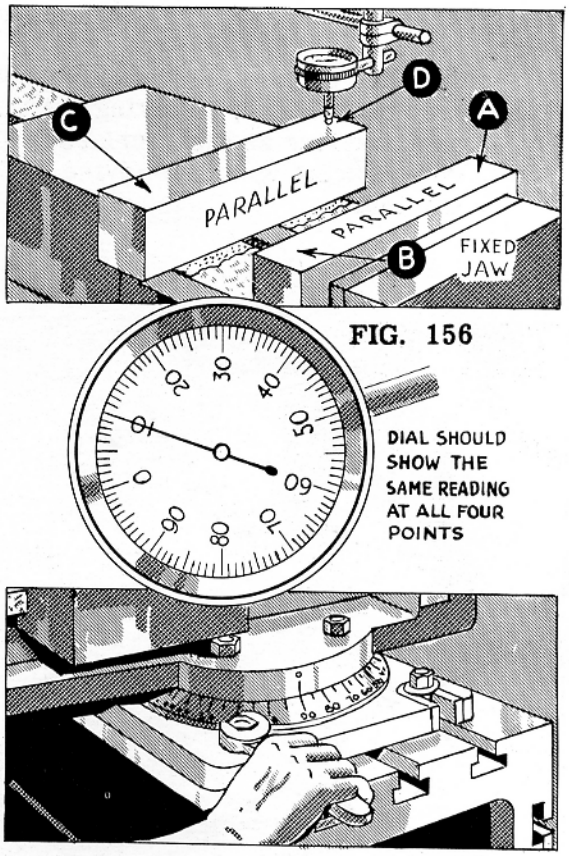


FIG. 156

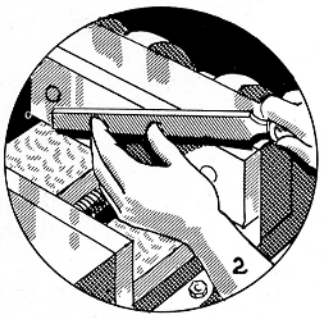
HOW TO TEST THE FIXED JAW FOR SQUARENESS WITH AN INDICATOR

1. Mount vise on table.

CAUTION Be sure that the undersurface of the base and the table surface are clean.

2. Examine the face of the fixed jaw. Carefully remove any burrs with a smooth or mill file or abrasive stone.

3. Clean the vise jaws thoroughly.



CAUTION Care should be exercised to see that chips do not get between the jaws of the vise and the work. They may cause injury to the jaws and the work when the vise is tightened. Furthermore, the jaws should be protected from rough work by a strip of soft metal or cardboard placed between the work and the faced surfaces. With proper

care the accuracy of the vise can be preserved for an indefinite period of time.

NOTE: Some vises have removable plates attached to the jaws. These plates may be removed by taking out the fillister head screws. They can then be placed on a machine and the surfaces refaced or reground. This, however, is not usually done, except upon the advise of the person responsible for the maintenance of the machine.

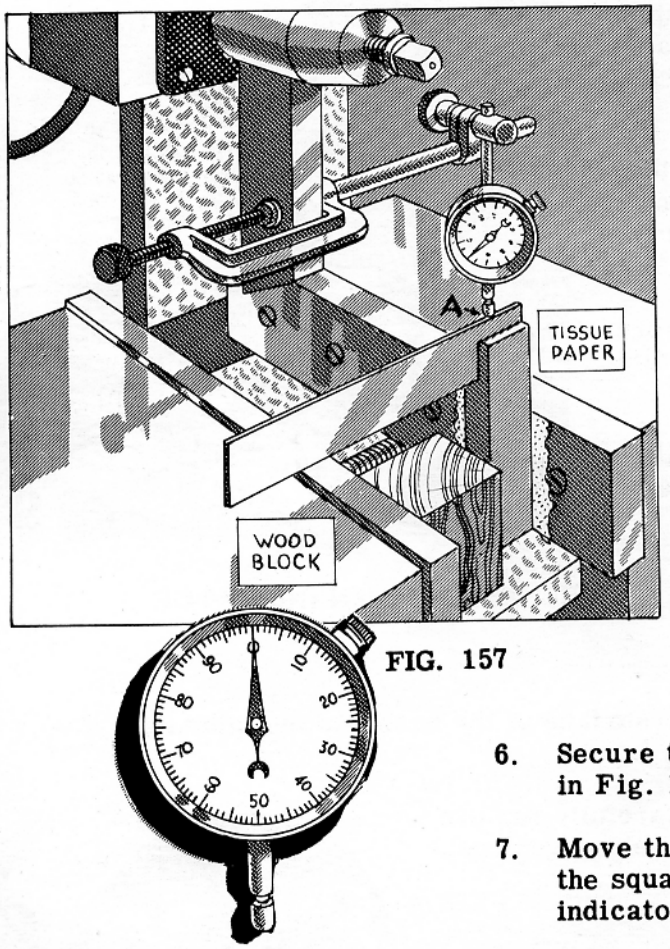


FIG. 157

4. Place a piece of paper against the fixed jaw of the vise. Next to the paper in a vertical position, place the beam of the square as illustrated in Fig. 157.

CAUTION The square is a precision tool and must be handled with great care if the accuracy is to be preserved. Every precaution should be taken against nicking the surface or the edges. Dropping a square may permanently destroy its accuracy, thereby rendering it useless. Squares should be kept in a box or case when not in use.

5. Place a block of clean wood between the beam of the square and the movable jaw (Fig. 157). Then, tighten the vise sufficiently to hold the square in this position.

6. Secure the indicator to the tool holder as shown in Fig. 157.

7. Move the ram and the table to bring the blade of the square directly under the contact point of the indicator as at (A) in Fig. 157.

8. Lower the indicator with the down-feed crank until the contact point of the indicator touches the edge of the blade.

9. Continue to lower the indicator until the finger of the dial registers about ten one-thousandths of an inch, assuming that the divisions on the dial are in terms of .001".

10. Observe the reading and move the table to the right in order to bring the blade of the square under the contact point as at (B), Fig. 158.

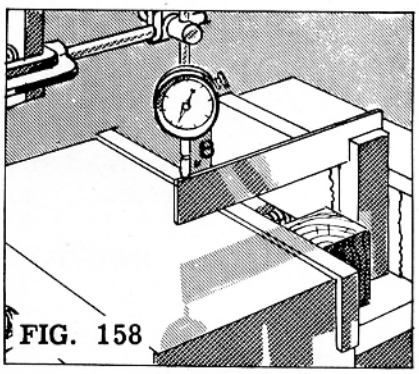
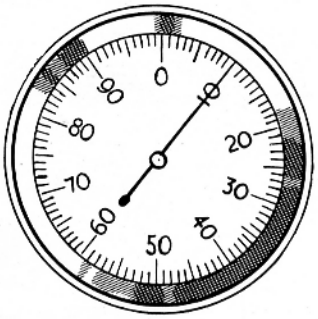


FIG. 158

11. Observe the position of the pointer. If the readings are the same at both ends of the blade, the face of the fixed jaw is square.

12. Test at each end of the jaw in the same manner.

NOTE: When the pointer does not register the same at both ends of the blade, it will be necessary to shim between the back of the plate and the machined surface of the vise. If the test shows that the face is more than a few thousandths out of square, the plate should be reground. Too much shimming may warp the plate when the screws which hold it to the vise are tightened.

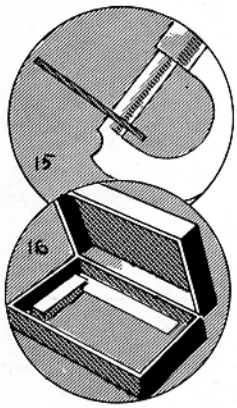


13. Observe the difference in the readings indicated at each end of the blade and determine the direction in which the blade must be shimmed to correct the inaccuracy.

14. Estimate the thickness of the shim.

NOTE: The thickness of the shim should be the same as the error noted on the indicator if the length of the blade and the height of the plate are the same.

NOTE: The thickness will be only half of the indicated error if the blade is twice as long as the height of the plate.



15. Measure the shim with a micrometer as shown in Illustration 15.

16. Remove the square from the vise and carefully place it in a safe place.

17. Take out the fillister-head screws. Remove the plate. Clean the machined surface of the vise and the back of the plate. If the reading indicated that the blade is high at (B), place the shim between the upper surfaces of the two faces. If it is low at (B), place the shim between the lower surfaces.

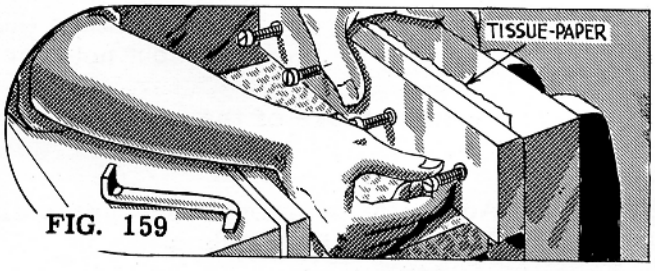


FIG. 159

18. Hold the plate and the shim in place with the hand and insert the fillister-head screws (Fig. 159).

19. Tighten the screws so that the plate is held securely.

20. Place the square in the vise and repeat the testing procedure until the face of the jaw is square.

21. Remove the indicator from the machine, the square from the vise, and carefully replace them in their boxes.

HOW TO SET THE VISE PARALLEL WITH THE DIRECTION OF THE STROKE WITH AN INDICATOR

1. Mount the vise on the shaper table if necessary.

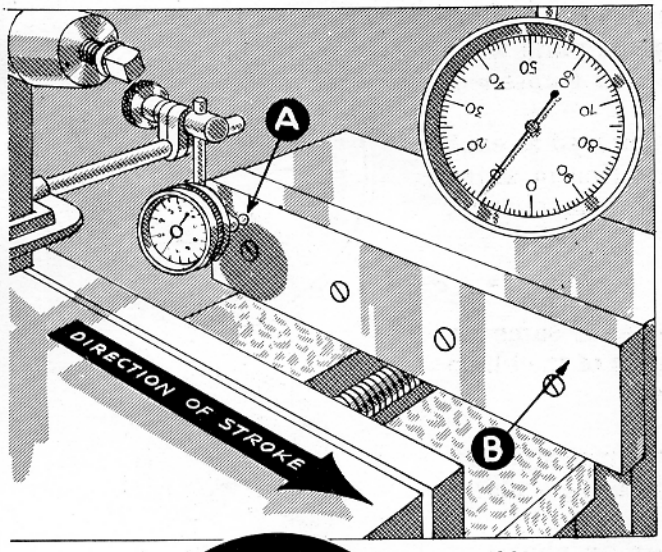


FIG. 160

2. Loosen the clamping nuts and set the vise so that the jaws are parallel with the direction of the cut. The vise handle should be on the left to facilitate operation of the shaper. The zero mark on the vise should coincide with the 90° graduation on the base.

3. Tighten the nuts on the clamping bolts lightly. The nuts should be tight enough to prevent the vise from swiveling, yet loose enough to allow the vise to be moved by a tap with the hand or a lead or composition mallet.

4. Clamp the assembled indicator in the tool post or to the shank of the tool holder (Fig. 160).

5. Observe that the indicator has a contact shaft perpendicular to the face of the dial. When a vertical surface is being tested, this style of indicator can be read more conveniently than an indicator with a contact shaft parallel with the face of the dial.

6. Arrange the indicator with the contact point toward, but not touching, the face of the fixed jaw (Fig. 160).

7. Set the stroke of the machine for one inch less than the length of the fixed jaw.

8. Adjust the position of the ram to allow the contact point to travel within one-half inch of both ends of the jaw.

9. Move the ram to the beginning of the stroke as illustrated at (A), Fig. 160.

10. Move the table until the face of the vise jaw presses against the contact point of the indicator. The finger of the indicator should register about ten one-thousandths of an inch to insure good contact between the face of the jaw and the contact point.

11. Note the measurement on the dial. Then move the ram to the forward position (B), Fig. 161.

12. Observe the readings on the dial when the indicator is at each end of the jaw. The difference, if any, between the dial settings should be divided by two. The result is the distance the vise must be swiveled.

13. Tap the vise lightly to move it the necessary distance in a direction away from the higher setting (Fig. 161).

14. Tighten the clamping nuts securely and recheck the setting. When the indicator reading is exactly the same at both ends of the jaw, the vise is set parallel with the stroke.

15. Remove the indicator from the machine and carefully replace the parts in its case or holder.

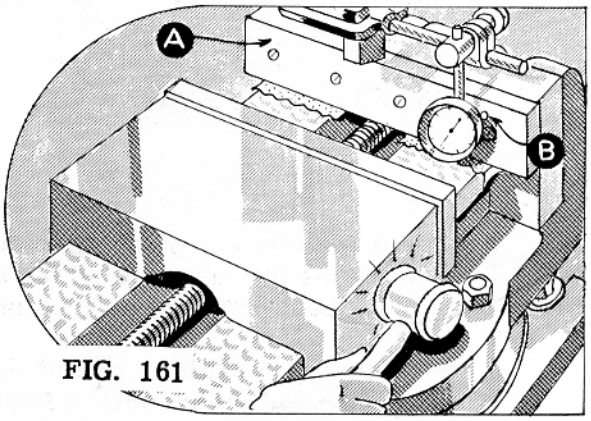


FIG. 161

HOW TO SET THE VISE AT 90° TO THE DIRECTION OF THE STROKE WITH AN INDICATOR

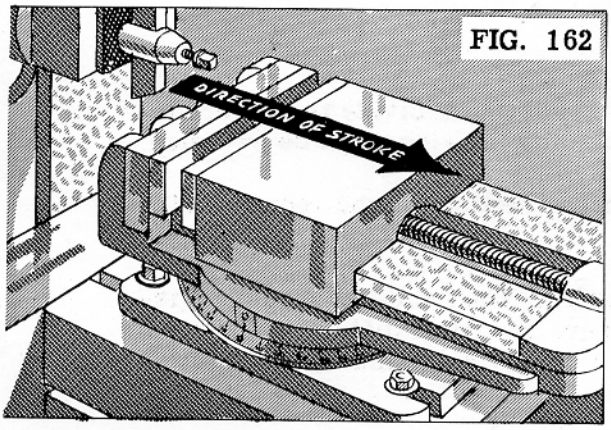


FIG. 162

1. Mount the vise on the table if it is necessary to do so.

2. Loosen the clamping nuts and set the jaws at 90° to the direction of the stroke (Fig. 162). The vise handle will then be toward the front and the zero marks on the vise will coincide with the zero marks on the base.

3. Tighten the nuts lightly on the clamping bolts. The nuts should be tight enough to prevent the vise from swiveling, yet loose enough to allow the vise to move by giving it a tap by hand or with a lead mallet.

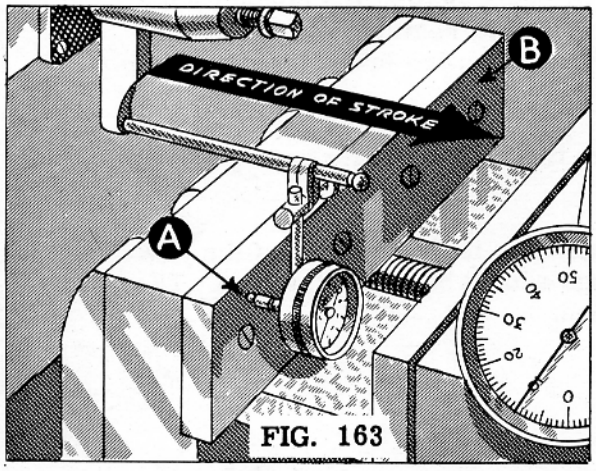


FIG. 163

4. Clamp the assembled indicator in the tool post (Fig. 163) or to the shank of the tool holder.

5. Observe that the indicator has a contact shaft perpendicular to the face of the dial. When a vertical surface is being tested, this style of indicator is more conveniently read than an indicator with a contact shaft parallel with the face of the dial.

6. Arrange the indicator near the end of the jaw with the contact point forward, but not touching, the face of the fixed jaw (Fig. 163).

   NOTE: The contact point is pressed against the face of the jaw either by moving the ram in slightly or by adjusting the clamp which holds the indicator to the tool holder.

7. Adjust the contact point against the face of the jaw by means of the clamp which holds the indicator to the tool holder. Have the pointer register about ten one-thousandths of an inch on the dial as shown at (A), Fig. 163.

   CAUTION This is one of the safest methods of adjusting the indicator to protect it from damage. The adjustment can be made by moving the ram. However, this should not be attempted unless the action of the ram can be controlled by hand.

8. Note the reading on the dial. With the table hand feed, move the vise so that the indicator is in position (B).

9. Observe the reading at (B).

10. Subtract the lower reading from the higher reading and divide the difference by two. The answer is the amount in thousandths the vise must be swiveled.

11. Tap the vise in a direction away from the higher setting for the required distance.

12. Tighten the clamping nuts and recheck the setting. The indicator should register the same at both ends of the jaw. If there is still a difference between the two readings, the clamping nuts should be loosened and the adjustment continued until the setting is correct.

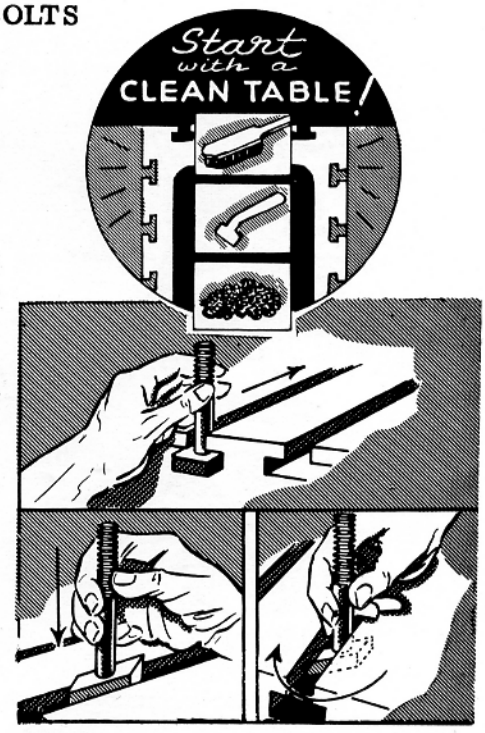
13. Remove the indicator from the machine. Carefully replace the indicator parts in the case.

HOW TO USE THE SHAPER BOLTS

1. Reread the descriptions of various types of shaper bolts.

2. Insert a T-slot cleaner in the end of the table slot near the apron and draw the cleaner outwards. Repeat this step a few times to clean out all the chips.

3. Brush off the chips that may accumulate around the top of the slots and the surface of the table as a result of cleaning out the slots.



THE SQUARE T-HEAD BOLT

Insert the T-head in the end of the table slot and push the bolt along to the required position.

THE CUTAWAY T-HEAD BOLT

Drop the head of the bolt into the table slot and turn the head.

THE TAPPED T-HEAD BOLT

1. Insert the tapped head into the end of the table slot and move it along into position.

2. Select a stud that will project far enough above the surface of the work to hold a clamp (if necessary), a washer, and a nut.

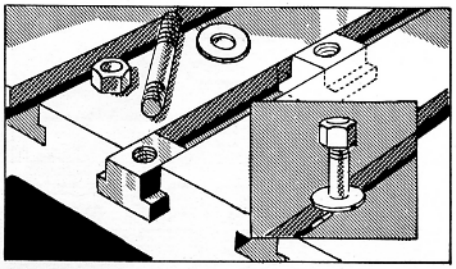
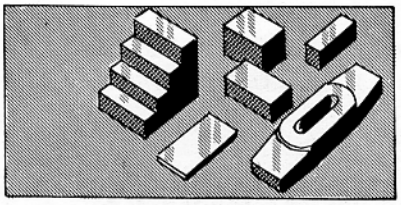


FIG. 164

HOW TO USE CLAMPS, PACKING BLOCKS AND STEP BLOCKS



1. Reread the different types of clamps, packing blocks, and step blocks.

2. Select a plain clamp and a block equal to the height of the surface to be clamped. If blocks of the exact height are not available, a strip should be placed between the top of the block and the underside of the clamp.

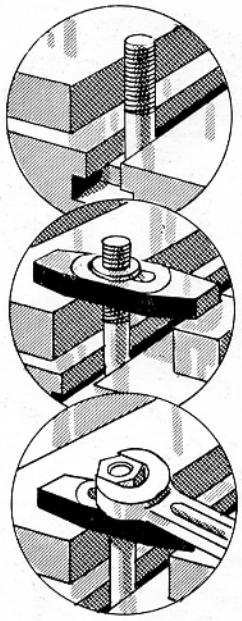


FIG. 165

3. Insert a square T-head bolt in the table slot.

4. Place the clamp over the bolt. Support one end of the clamp on the work and the other on the block. Check to see that the clamp is level and that the bolt is placed near the clamped surface. See Fig. 166 for the correct method of clamping.

   NOTE: Because of the location of the table slots and the size and shape of the work, it is not always possible to place the bolt in a position of maximum gripping power. The arrangement emphasized in Figure 166 should be duplicated whenever practicable.

5. Place a washer and a nut on the bolt and tighten the nut with a wrench.

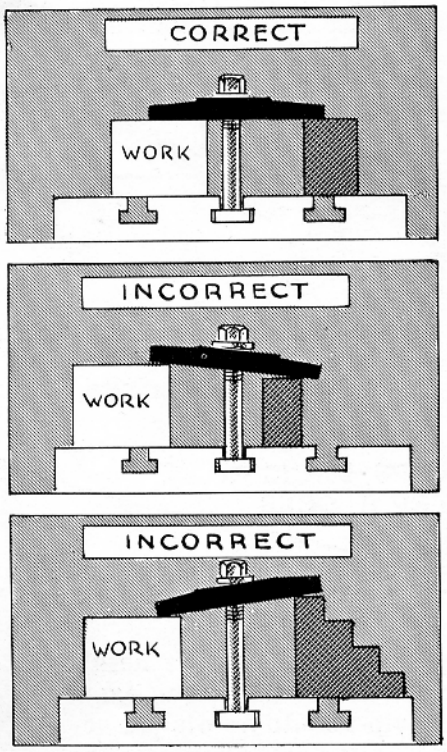


FIG. 166

CORRECT

1. Bolt near the work. Greatest pressure is exerted on the work.

2. Clamp level. Full area of the face of the clamp bearing on the work gives maximum gripping power.

INCORRECT

1. Bolt near the block. Greatest pressure is exerted on the block and not on the work. Corner of the work only is held, providing minimum gripping power.

2. Clamp not level. Clamp has tendency to tip the work. Tightening the nut has tendency to bend the bolt.

INCORRECT

1. Bolt midway between the work and the block. Pressure evenly distributed when greatest pressure needed on the work.

2. Clamp not level. Point of clamp only gripping the work. Tightening the nut has tendency to bend the bolt.

HOW TO USE ALIGNING STRIPS OR ALIGNING BARS

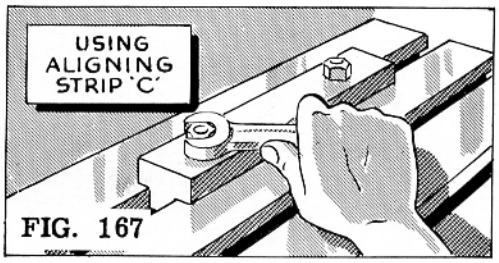


FIG. 167

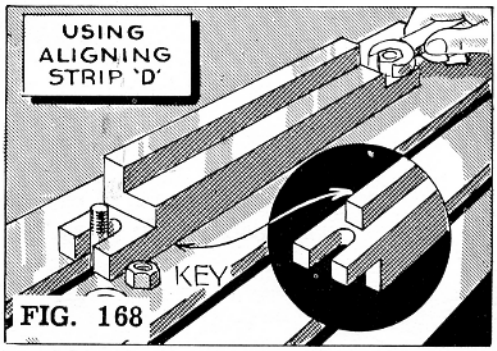


FIG. 168

A. EDGE OF THE STRIP PARALLEL WITH THE DIRECTION OF THE STROKE

1. Determine the types of aligning strips that may be required for the job on hand.

2. Clean the table and with a file or abrasive stone remove any burrs which may be on the table surface.

3. Select two strips similar to the ones illustrated in Figures 167 and 168. On the undersurface of each of these there is a tongue which, when placed in the table slot, aligns the strip with the direction of the stroke.

4. Place two T-head bolts in the table slot.

5. Clean the bottom surface of the strip and with a fine file remove any burrs which may be on the base or the sides. If the strip illustrated in Fig. 167 is used, take the nuts and washers off the bolts.

6. Place the strip over the bolts and onto the table with the tongues in the table slot. If the strip shown in Fig. 168 is used, it is placed directly on the table and aligned with the tongue in the same manner as the previous strip.

7. Place the washers and the nuts on the bolts. In the case of Fig. 168, move the bolts into the open lug slots, and tighten the nuts securely. The alignment of the strip can be tested with an indicator if this should be necessary.

B. EDGE OF THE STRIP 90° TO THE DIRECTION OF THE STROKE

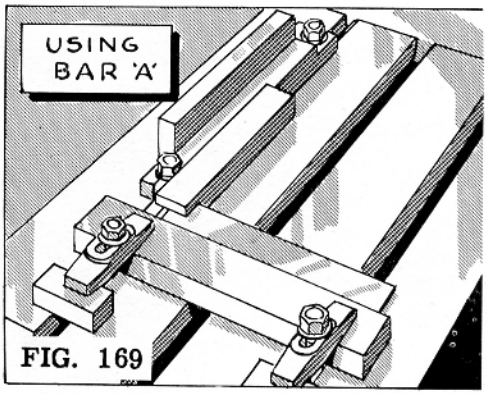


FIG. 169

NOTE: Either of the aligning bars, or strips, shown in Figures 169 and 170 may be used for this purpose. If the one at Fig. 169 is selected, it is held to the table with bolts which pass through the slot. The strip is secured to the table with clamps.

1. Insert the necessary number of bolts in the table slots.

2. Thoroughly clean the aligning strip with a clean cloth and remove all burrs with a fine file or abrasive stone.

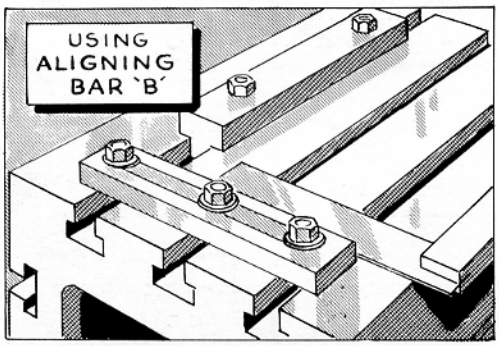


FIG. 170

3. Place the strip on the table in the required position. In the case of Fig. 169, clamps must be used.

4. Use either a solid square (Fig. 170), or a combination square to set the new aligning strip at 90° with the one previously located, or at 90° with the edge of the table.

CAUTION Provision must be made to protect the edges and surfaces of a square from damage by keeping the square in a case, or by laying it on a cloth in a safe place when it is not in use.

5. Place the beam of the square against the first aligning bar and adjust the second aligning strip parallel with and against the blade of the square (Fig. 169).

6. Tighten the nuts lightly to hold the strip in place.

7. Test again for squareness. First, lay two pieces of tissue paper over the strip. Then, with the beam of the square pressed against the first bar, move the square forward until the blade grips the two pieces of tissue paper.

8. Adjust the aligning strip by tapping it with a lead or composition mallet until the force required to withdraw the two pieces of paper is the same.

9. Tighten the nuts down securely when the proper adjustment has been made. The strip may be set also by placing the beam of the square against the edge of the table (Fig. 170) and aligning the strip parallel with the blade of the square. If a more accurate setting is required, an indicator can be used.

10. Clean and return all tools promptly when all necessary adjustments have been made.

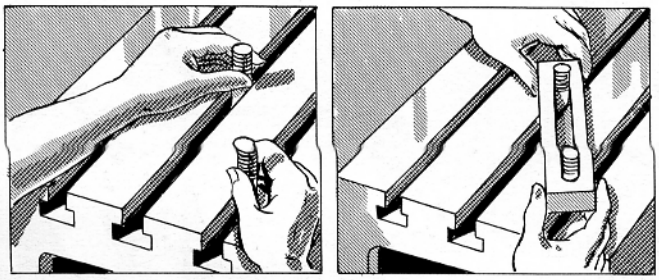


FIG. 171

C. EDGE OF THE STRIP AT AN ANGLE ON THE TABLE

1. Select one of the strips with an elongated slot. If the type strip shown in Fig. 171 is used, the slot through which the bolts pass may be utilized even when the strip is placed at an angle on the table.

2. Clean the top surface and the edge of the table. Remove any burrs which may be present.

3. Place the bolts in the table slots.

4. Clean the aligning strip and be sure that it is free of burrs.

5. Place the strip over the bolts and set it approximately at the desired angle.

6. Set the protractor to the correct angle.

7. Press the base of the protractor against the edge of the table (Fig. 172). With the blade extending over the top of the table, adjust the strip against and parallel with the blade of the protractor (Fig. 172).

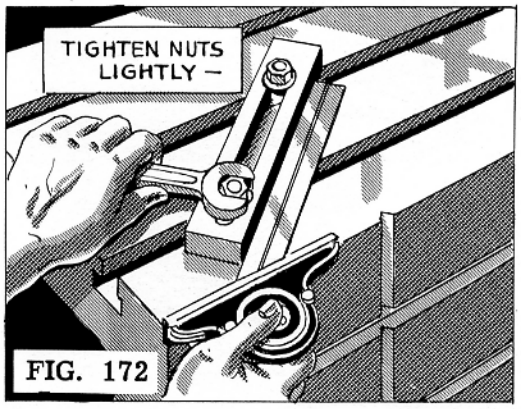


FIG. 172

8. Tighten the nuts just enough to hold the strip in position.

9. Place two pieces of tissue paper over the strip. Press the protractor against the edge of the table, and move it forward until the blade grips the two pieces of paper (Fig. 173).

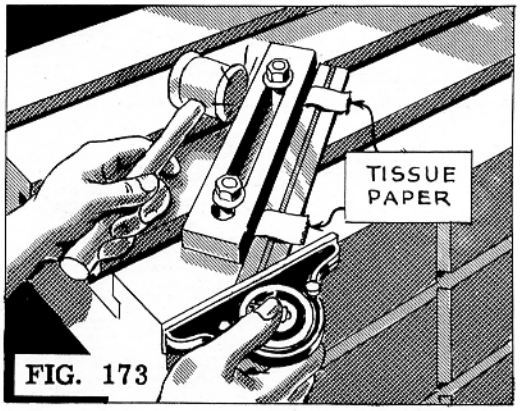


FIG. 173

10. Adjust the parallel, if necessary, by tapping it lightly with a lead mallet until the force required to withdraw the two pieces of tissue paper is the same.

11. Tighten the nuts down securely when the setting is correct.

NOTE: If an aligning strip already has been set parallel with the stroke, the second strip may be set at an angle with the one located on the table. In this case, the protractor is substituted for the square, and the strip is set at an angle.

HOW TO USE STOPS

1. Determine the type stop needed for the job on hand.

2. Clean out the table slots and brush the surface of the table.

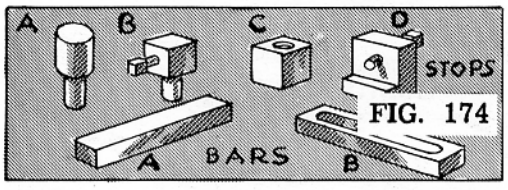


FIG. 174

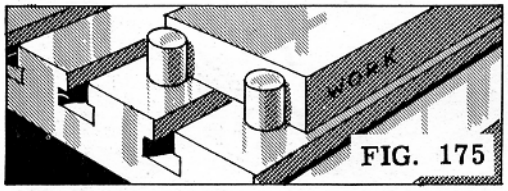


FIG. 175

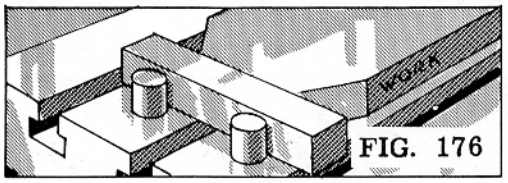


FIG. 176

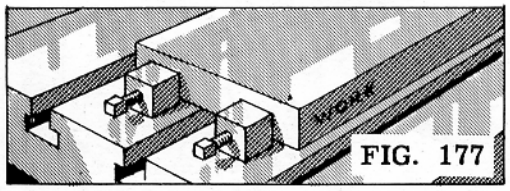


FIG. 177

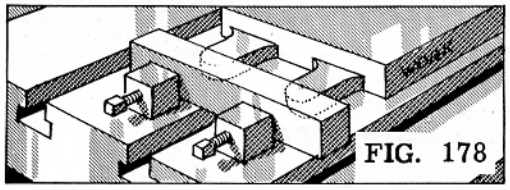


FIG. 178

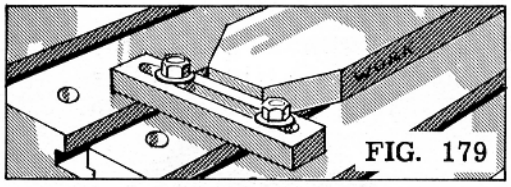


FIG. 179

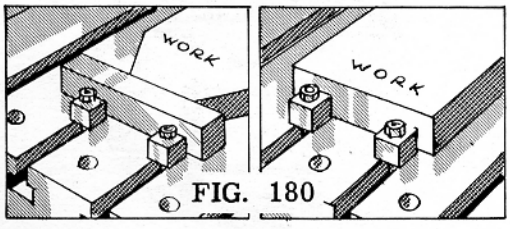


FIG. 180

3. Select two stops from each of the types illustrated in Figure 174 at (A), (B), (C), and (D); a bar A, and a bar B.

4. Clean the two stops (A), and place them in the round holes located near the front of the table (Fig. 175).

5. Locate the finished edge of the work against the two stops.

6. Insert a bar between the stops and the contacting surface of the work if the width of the work is too narrow to catch against the two stops (Fig. 176). For an unfinished or an uneven surface, the stops (B) (Fig. 174) are more practical because the screws can be adjusted.

7. Place the two stops, type (B), in the holes in the table (Fig. 177). Then, after the work has been located in relation to the stops, the screws can be adjusted to compensate for any unevenness of the edge.

   NOTE: Sometimes the unevenness of the contacting surface, especially in castings, takes the form of lugs or other projections. In this case, place a bar between the stops and the projections on the casting (Fig. 178), and adjust the screws to suit. When it is impractical to use the holes on the table to hold stops, the slots can be utilized for this purpose.

8. Put a T-bolt in each of the selected table slots and place the bar over the bolts (Fig. 179).

9. Provide a washer and a nut for each bolt. Adjust the stop to the work. Then, tighten the nuts securely. Individual stops (C) may also be used with or without a bar (Fig. 180).

   NOTE: Stops are often used to hold the work by the pressure of the screws. The screws may either force the work against an aligning strip or hold the piece between two sets of stops as described in the following steps.

a. Arrange the work, and aligning strip, on the table in their proper relation.

b. Select three stops with screws set at an angle. The slight angular set of the screws, which is between 5^{o} and 10^{o}, will force the work against the aligning strip and the work to the table (Fig. 181).

c. Insert the stops in the end of the table slots and move them along to the desired position.

d. Tighten the screws against the piece to be held. At the same time tap the work lightly with a lead mallet to seat the work on the table.

e. Note that the work can be held between individual stops or by those arranged in sets. The screws may be parallel with the surface of the table instead of set at an angle (Fig. 182). To compensate for different widths of work, strips of various widths can be used with any of the stops and slots.

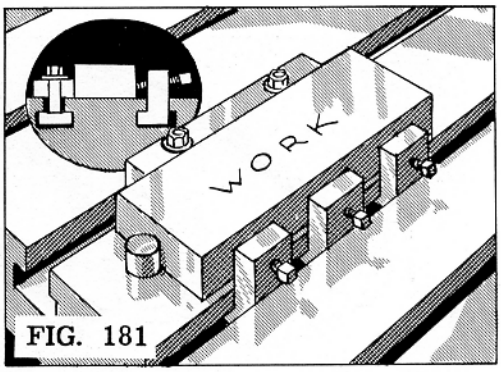


FIG. 181

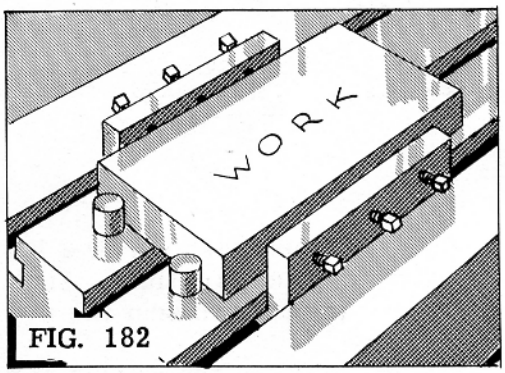


FIG. 182

HOW TO USE TOE DOGS

1. Read the description of toe dogs and stops.

2. Wipe the table surface and clean out the table slots.

3. Arrange the work on the table.

4. Put two round stops in the reamed holes at the front of the table (Fig. 183). This will prevent shifting caused by the cutting action of the tool.

5. Place two stops in each of the selected table slots (Fig. 183). The number of stops will depend upon the length of the piece. At least two sets should be used unless the piece is so short that there is room for only one set.

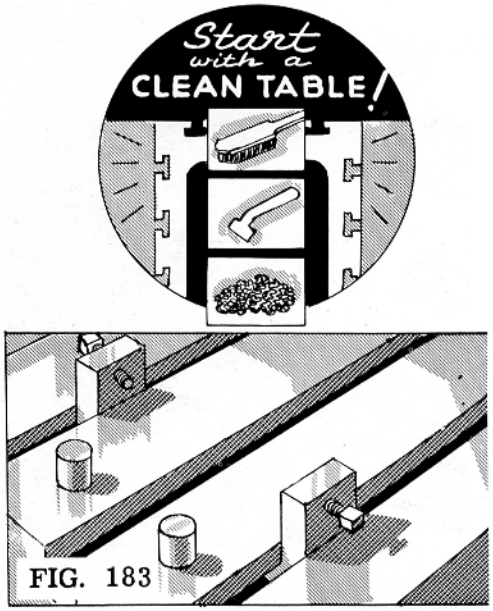


FIG. 183

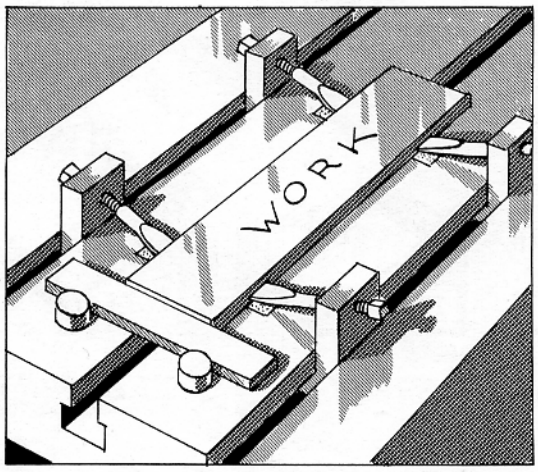


FIG. 184

6. Select four toe dogs with flat ends, two for each side of the work.

7. Place the toe dogs in turn against the sides of the work. Support the flat ends upon shims and the opposite ends against the screws of the stops (Fig. 184). Shims are not always used. When they are employed, the table surface is protected and the contact edges of the toe dogs are steadied.

8. Arrange the toe dogs so that they are set at about the same angle as that of the screws. If the toe dogs are inclined at too great an angle, the pressure of the screws will force the outer end of the dogs upward. When this happens, the pressure against the work will be released.

9. Adjust each screw a little at a time. Continue in order until all screws are sufficiently tight. At the same time, tap the work lightly with a lead mallet in order to seat the work onto the table.

NOTE: The amount of pressure to exert against the screws will depend upon the thickness and construction of the work (its resistance to distortion) and upon the holding power required to overcome the cutting action of the tool. This is largely a matter of experience and judgment.

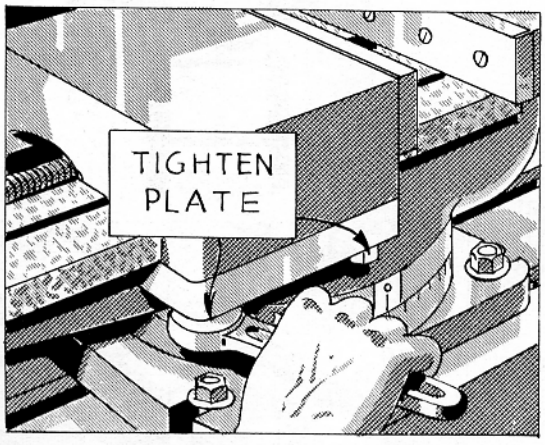


FIG. 185

HOW TO USE HOLD-DOWNS

1. Reread the description of hold-downs.

2. Note that the same principle will be employed to grip the work with hold-downs as was used with toe dogs. In this case, the work will be held between the vise jaws instead of on the table.

3. Mount the vise on the shaper table.

4. Tighten the plate underneath the movable jaw to prevent excessive lifting

of the jaw when the vise is tightened. This should be done only when necessary and when an adjustment is provided for this purpose (Fig. 185).

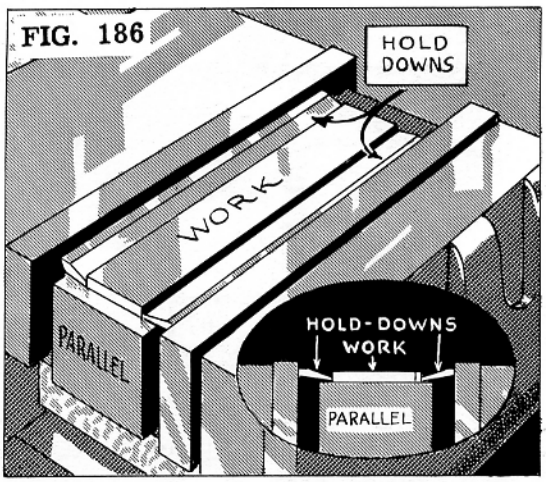


FIG. 186

5. Open the vise wide enough to place the work and the hold-downs between the two jaws (Fig. 186).

6. Select a parallel bar which will raise the work as high as possible in the vise and at the same time allow the hold-downs to be held between the jaws (Fig. 186).

7. Check the vise and all contacting surfaces to be sure they are clean. If the work has a finished surface, place four pieces of tissue paper on the parallel so that the four corners of the work will rest upon the tissue paper.

8. Place the work upon the parallel with one hold-down on each side (Fig. 186).

9. Tighten the vise jaws to grip the hold-downs lightly against the work.

CAUTION The amount of force that may be exerted against the work will depend upon the ability of the material to resist distortion. The cut must also be regulated accordingly. Otherwise, the cutting action of the tool will push the work forward and out of the vise.

10. Increase the pressure of the jaws against the hold-downs. At the same time, seat the work on the parallels by tapping lightly with a lead mallet.

CAUTION If a heavy blow is struck with the mallet, the work will rebound and will not seat on the parallel.

11. Test the work for being seated by trying to pull out the tissue paper. All four pieces of tissue paper will hold securely when the work is properly seated on the parallels.

HOW TO USE V-BLOCKS

A. 'V'-BLOCKS PARALLEL WITH THE DIRECTION OF THE STROKE

1. Reread the description of 'V'-blocks (page 110).

2. Wipe the table surface and clean out the table slots.

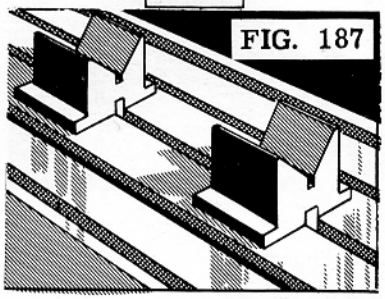


FIG. 187

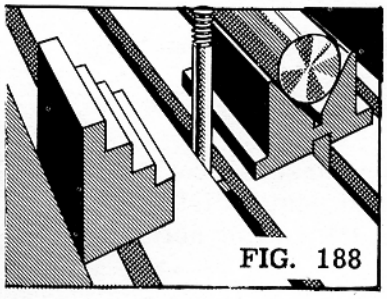


FIG. 188

3. Clean the bottom of the V-blocks with a file. Remove any burrs from the surface of the V-blocks and the table with a fine cut file or abrasive stone.

4. Place the V-blocks on the table with the tongues in the selected slot. The tongues will align the V-blocks with the table slot (Fig. 187).

5. Support the work in the V-blocks (Fig. 189).

6. Insert two T-bolts into the table slot and move them along into position.

7. Select two flat clamps and place them over the bolts.

8. Insert a piece of copper, cardboard, or soft metal strip between the finished surfaces of the work and the clamps (Fig. 189).

9. Check the clamp to be certain it is level and that the bolt is as near as possible to the clamped surface.

10. Tighten securely the nuts on the bolts.

11. Place a suitable stop against the forward edge of the V-block to take the thrust of the tool.

ALTERNATE METHOD

As an alternate method of holding the shaft, the V-blocks illustrated in Fig. 190 can be used. These V-blocks are essentially handy when a number of duplicate pieces have to be held.

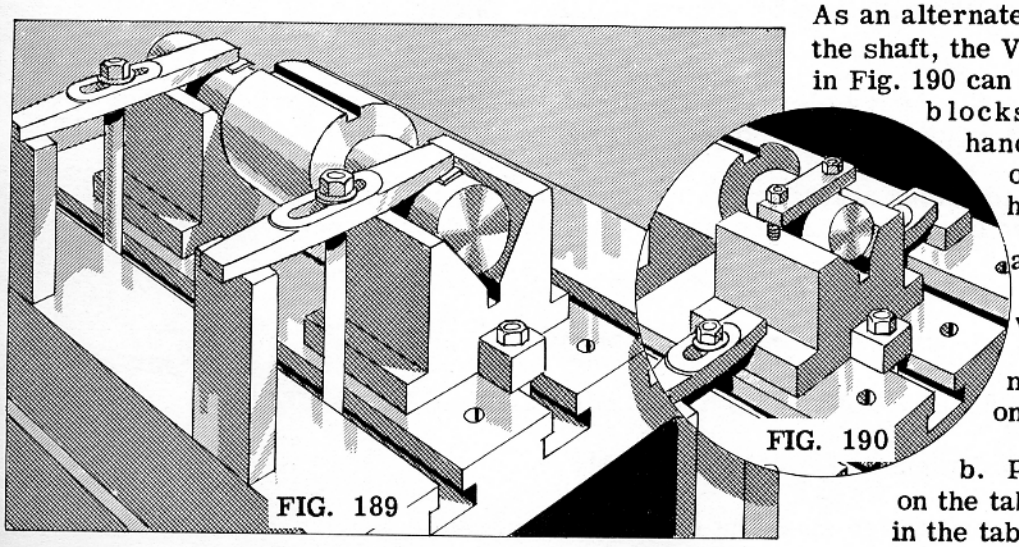


FIG. 189

FIG. 190

a. Use care in checking the table and work for burrs and cleanliness when mounting the blocks on the table.

b. Place the V-blocks on the table with the tongue in the table slot.

c. Strap the V-block to the table and fasten a stop forward and against the front of the block to receive the thrust of the tool (Fig. 190).

d. Place the work in the V-block; put the clamp over the bolts; and then put on the washers and the nuts. Be sure that a protecting strip of soft metal or cardboard is between the finished surface of the work and the clamp.

e. Hold the clamp level and turn the nuts to tighten the clamp with the fingers.

f. Alternately tighten each of the nuts with a wrench. Tighten a little at a time until enough pressure is applied to hold the work securely.

B. 'V'-BLOCKS 90° TO THE DIRECTION OF THE STROKE

1. Check the work table and V-blocks to see that they are clean and free of burrs.

2. Align the V-blocks with each other by placing the work or a test bar in the V-shaped openings.

3. Place a square on the table in a vertical position with the blade touching the shaft as shown in Fig. 191 at (A).

4. Hold a combination square so that the blade lies flat on the table surface and the head rests against the front edge of the table.

5. Adjust the combination square so that the end of the blade touches the edge of the first square (Fig. 191).

6. Arrange the squares in the same manner at the opposite end of the shaft as shown at (B) in Fig. 191.

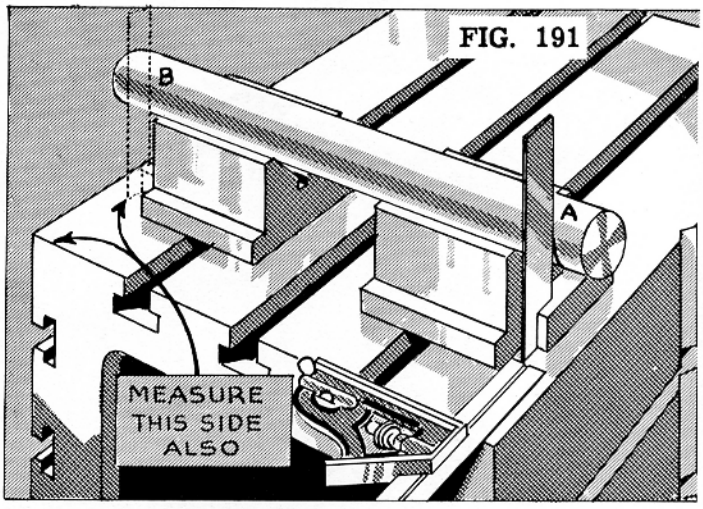


FIG. 191

7. Move or lightly tap the V-block until the edge of the first square is the same distance from the front edge of the table as it was when the square was in position A.

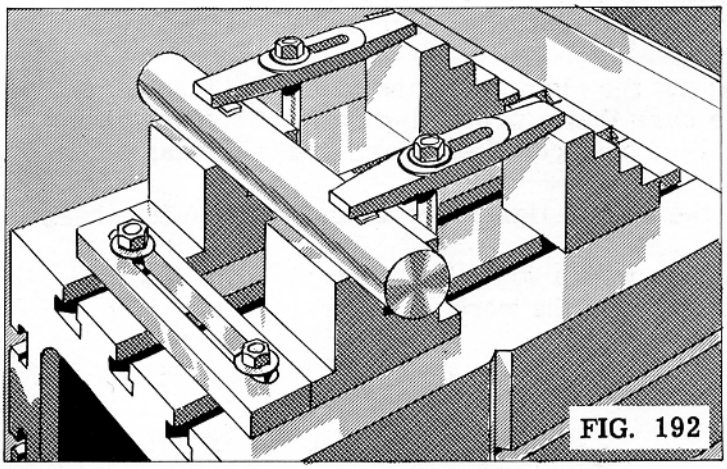


FIG. 192

8. Bolt a bar stop to the table and against the forward edges of the V-blocks (Fig. 192). This will hold the V-blocks in alignment and, in addition, will act as a stop to take the thrust of the tool.

9. Clamp the round portion of the work with two flat clamps. Use soft metal or cardboard shims between the finished surfaces of the work and the undersides of the clamps to protect the finished surfaces.

10. Recheck the alignment. Make any necessary adjustments. Then tighten the nuts down securely.

HOW TO USE ANGLE PLATES, C-CLAMPS AND JACKS

A. ANGLE PLATE AT 90° WITH DIRECTION OF STROKE

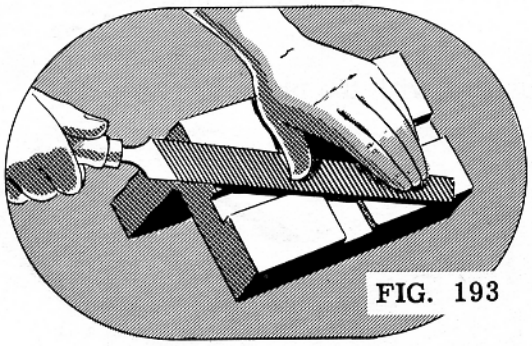


FIG. 193

1. Reread description of angle plates, pages 111 and 112.

2. Wipe the table surface and clean out the table slots.

3. Clean the angle plate. Remove with a fine file or flat abrasive stone any burrs on the faces of the angle plate and the surface of the table.

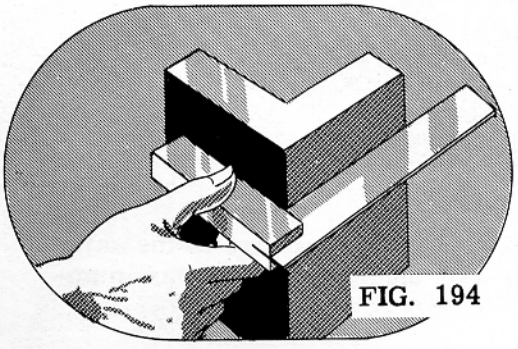


FIG. 194

4. Test the two sides of the angle plate for squareness with a precision square. It must be assumed that the square is kept in the tool room or some other safe place, and checked periodically for accuracy.

5. Place the angle plate on the table with the tongues aligned with the central slot of the table.

6. Place clamps on each side of base and secure the angle plate to the table (Fig. 195).

7. Bolt a stop to the table close against the forward edge of the angle plate (Fig. 195). This will prevent any movement due to the thrust of the tool.

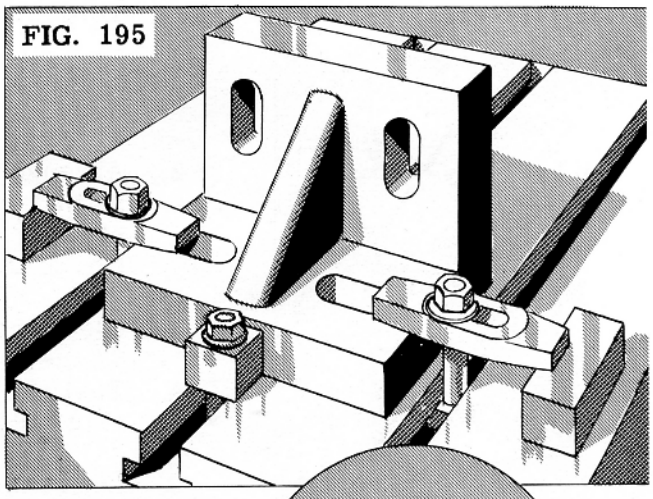


FIG. 195

NOTE: Aligning the plate by means of the tongues in the table slot will be accurate enough in most cases. The angle plate, however, may be tested with an indicator in a manner similar to that used for checking the accuracy of vise jaws. The plate may also be tested for squareness with the table by using a solid square (Fig. 196) as follows:

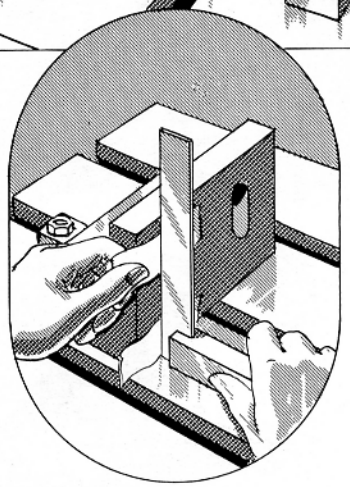


FIG. 196

a. Clean the surface of the table, the face of the angle plate, and the beam of the square.

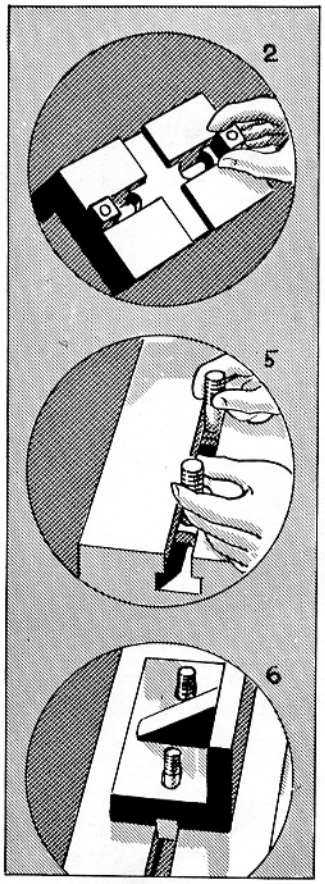
b. Place the beam of the square on the table and bring the blade against the face of the angle plate.

c. Test the face for squareness. Check whether or not the blade of the square is parallel with the face of the angle plate. A more positive method is to use tissue paper between the surfaces to be tested.

d. Insert two pieces of tissue paper between the angle plate and the blade of the square (Fig. 196).

e. Press the beam of the square downward on the table and forward against the angle plate.

f. Withdraw the two pieces of tissue paper. When the force required to remove them is the same, the angle plate will be square with the table. Otherwise, paper or thin metal shims must be placed under the lower side of the base to square the vertical surface of the angle plate with the table. The angle plate may also be removed and the faces reground. Whichever procedure is followed, the test should be repeated in squaring the angle plate with the table.



B. ANGLE PLATE PARALLEL WITH THE DIRECTION OF THE STROKE

1. Reread the description of clamps and jacks. (Refer to pages 112 and 114).

2. Arrange the tongues on the base of the angle plate so that when the tongues are aligned with the table slots, the angle plate will be parallel with the direction of the stroke. (See Illustration 2.)

3. Clean the table and angle plate and remove burrs.

4. Test the plate for squareness with a solid square (Fig. 194).

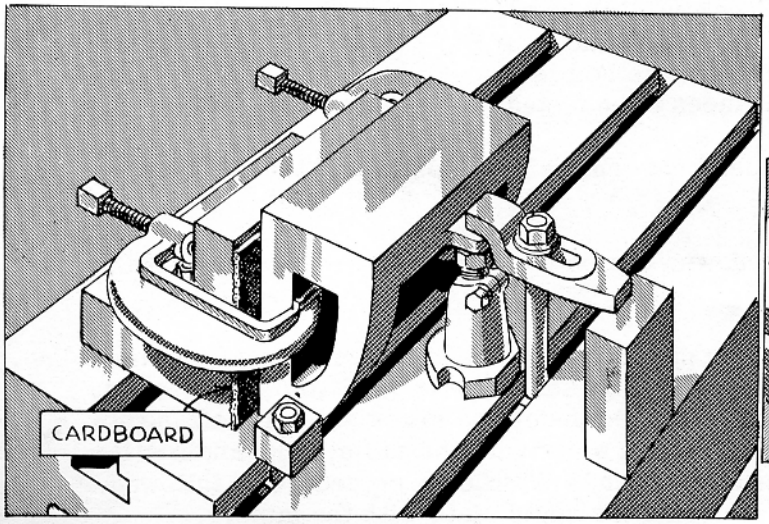
5. Insert two T-head bolts in the table slot. (Refer to Illustration 5.

6. Place the angle plate over the bolts and align the tongues with the table slot (Illustration 6).

7. Bolt the angle plate to the table (Illustration 7).

8. Clean the side of the work and the face of the angle plate. (Refer to drawing 8).

9. Place a piece of cardboard between the face of the angle plate and the surface of the work (Illustration 9), if the material being held has a rough surface. This will protect the finished face of the angle plate (Fig. 197).



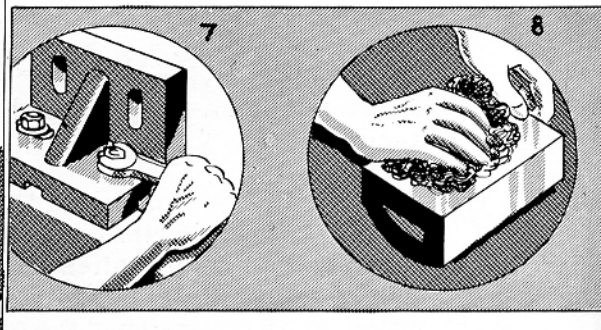


FIG. 197

10. Use two C-clamps to hold the work to the plate.

11. Place one piece of soft metal between the C-clamp screw and the work and another piece of soft metal between the pad of the C-clamp and the work. These soft metal pieces will protect the surfaces from being marred by the screw or the pad of the C-clamp. If the surfaces to be held are rough or will not be damaged by marks, the metal packing may be left out.

12. Tighten the C-clamp securely by turning the square-head of the clamping screw with a wrench.

13. Place a stop against the front edge of the angle plate to take the thrust of the tool (Fig. 197).

14. Select a jack of suitable size. The length of the threaded part of the screw that is held in the jack base should be at least equal to the diameter of the screw (see illustration at 14).

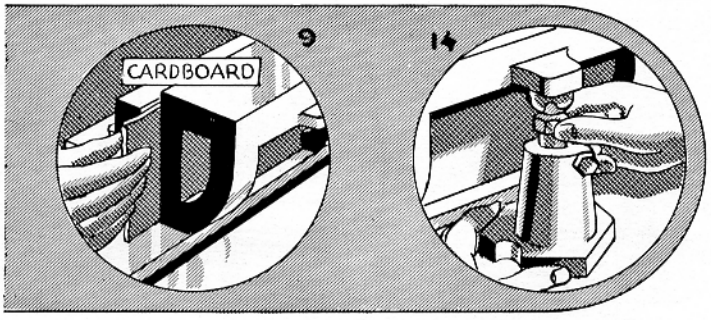
15. Clean the base of the jack.

16. Place the jack under the unsupported portion of the material. A piece of cardboard should be used under the base of the jack to prevent its slipping or marring the table surface.

17. Adjust the jack screw until the swivel top touches the material to be supported and there is a slight tension when the screw is turned.

18. Arrange a clamp so that the work will be clamped directly above the part supported by the jack.

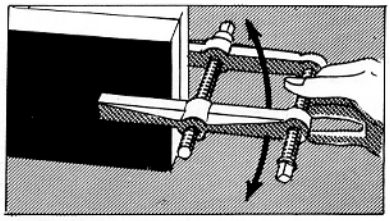
19. Place a piece of cardboard or soft metal under the clamp if it is necessary to protect the finished surface.

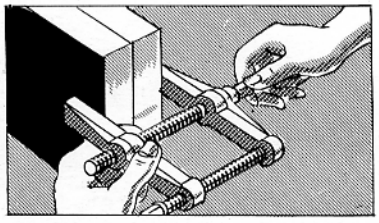


20. Tighten the nut on the T-head bolt.

NOTE: The angle plate should be tested for parallelism with the direction of the stroke and for squareness with the table.

HOW TO USE MACHINIST'S OR PARALLEL CLAMPS





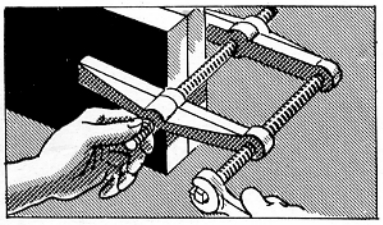


FIG. 198

1. Reread the description of machinist's clamps. Parallel clamps are often used instead of C-clamps to hold parts together. Parallel clamps are usually used in pairs.

2. Open the jaws of the clamp a distance equal to the combined thickness of the work.

3. Place the clamp over the work to be held. If protecting strips are necessary, cardboard or soft metal should be placed between the jaws of the clamp and the finished surfaces.

4. Tighten the front screw with the fingers until the clamp grips the work and the jaws of the clamp are parallel (Fig. 198).

5. Tighten the back screw securely by using a wrench or round rod which has been inserted into the head of the screw.

NOTE: If the clamp is holding firmly with maximum gripping power and both jaws are in contact along the entire surface that is being held, the clamp will not move. Figure 199 illustrates both correct and incorrect methods of adjusting the clamp.

CORRECT: Jaws are adjusted parallel with surface being clamped. This insures maximum holding power. Clamp will not move up and down.

INCORRECT: Jaws are not parallel with surface being clamped. Jaws are holding with minimum gripping power. Jaws open at the front or back and hold at one point only. Clamps move up and down.

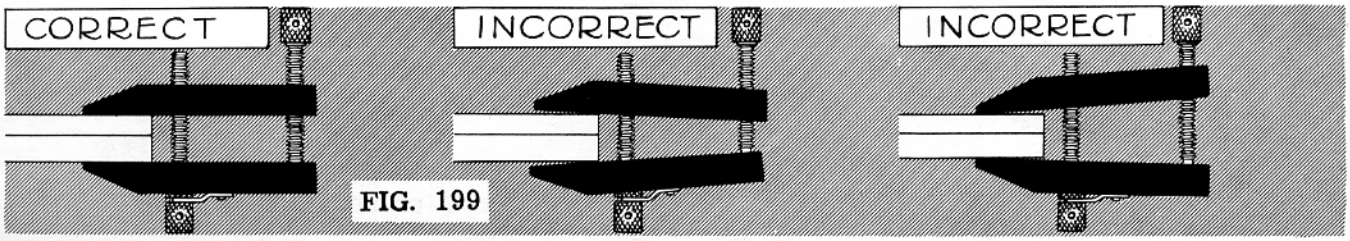


FIG. 199