HOW TO OPERATE AND CARE FOR THE SHAPER

Unit 1-P52(A) Part II Pages 55 to 74

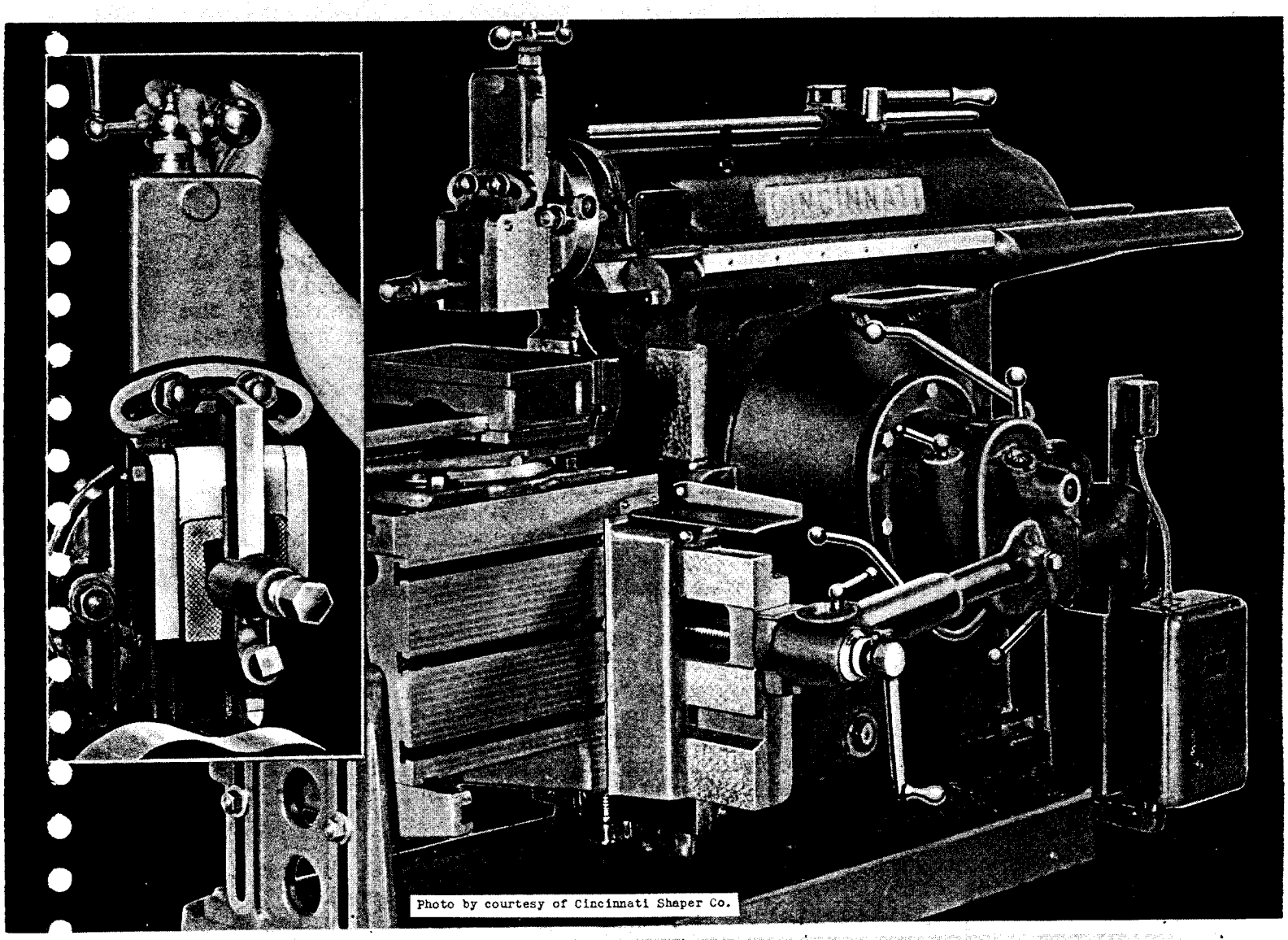


Photo by courtesy of Cincinnati Shaper Co.

UNIVERSITY OF THE STATE OF NEW YORK
STATE EDUCATION DEPARTMENT
BUREAU OF INDUSTRIAL AND TECHNICAL EDUCATION

HOW TO OPERATE and CARE for the SHAPER

OBJECTIVES OF UNIT

1. To become familiar with the operation points on the shaper.
2. To show how to use the controls on the shaper.
3. To show how to care for the shaper and its accessories.

INTRODUCTORY INFORMATION

Skillful operation of the shaper depends to a considerable extent upon the ability of the operator to control the movements of the various parts of the machine with certainty. Familiarity with the controls plays an important part in developing this ability. For this reason, and for the additional reason of safety, it is important for the operator to become familiar with both the hand and the automatic controls early in his experience so that he may know exactly what action of the mechanism will result when each button is pressed and when the various levers and handles are manipulated.

The operation points, located on the right side of the shaper where they are accessible to the operator without his moving from the usual operating position, include levers for starting and stopping the shaper, for changing the speed and the position of the ram, for controlling the direction of the feeds, and, on shapers provided with rapid power traverse, a lever or a push button for engaging this mechanism also.

Closely associated with the skillful operation of the shaper are its proper use and care. Experience proves that attention to these factors aids materially in extending the period during which the shaper retains its original accuracy and ease of operation. Procedures which will assure these results will be recommended in this section.

TOOLS AND EQUIPMENT

Crank or Hydraulic Shaper

PROCEDURE

HOW TO START AND STOP THE CRANK SHAPER

Several common types of drives are employed on the shaper, and, consequently, the particular type of drive determines the means used for starting and stopping the machine.

The cone-driven shaper, for example, usually receives its power from an overhead countershaft equipped with two identical pulleys. One is known as a tight pulley, since it is keyed to the countershaft and is used to drive the upper cone pulley; the other, known as a loose pulley, revolves without turning the countershaft and serves only to retain the belt when the shaper is not in operation.

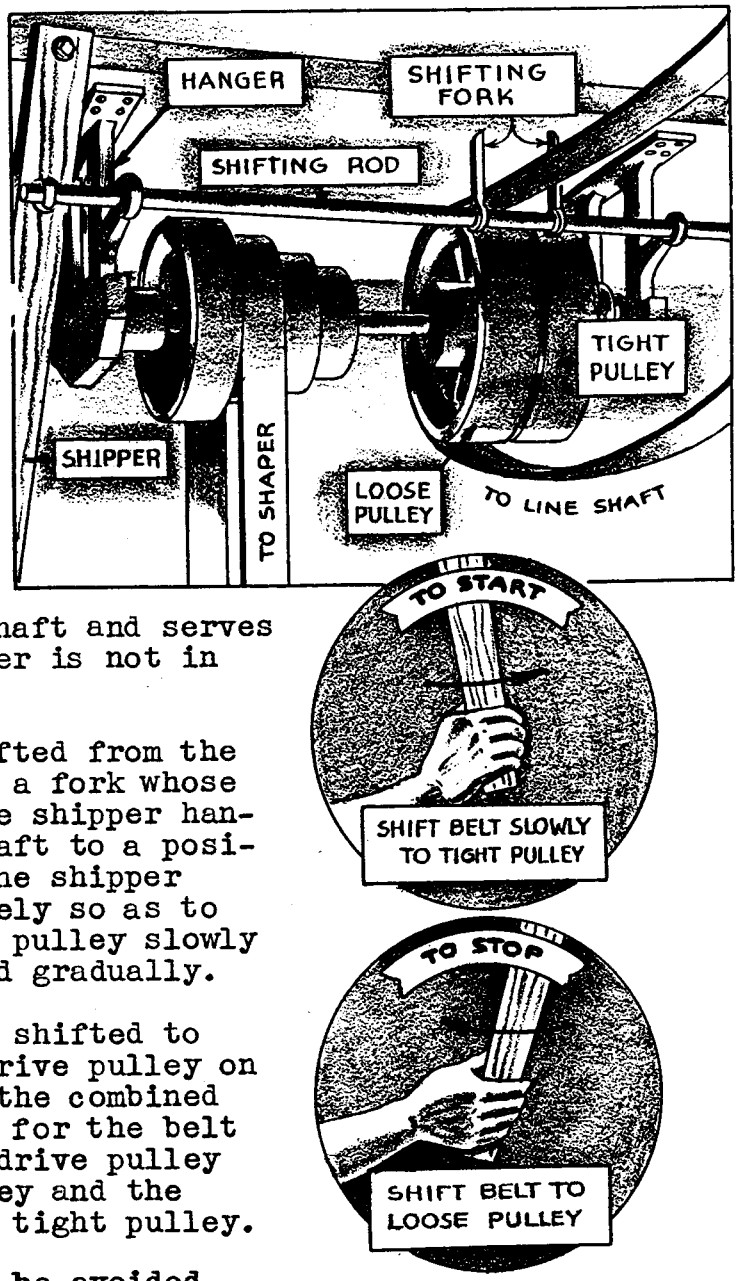


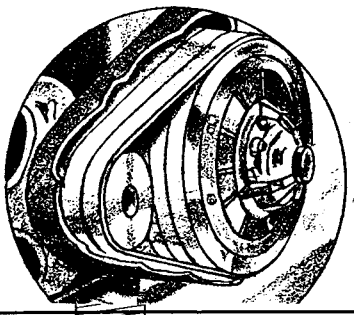
FIG.56

To start the machine, the belt is shifted from the loose pulley onto the tight pulley by a fork whose movement is controlled by means of the shipper handle extending down from the countershaft to a position within reach of the operator. The shipper handle should be moved over deliberately so as to allow the belt to move onto the tight pulley slowly and thus bring the machine up to speed gradually.

To stop the shaper, the belt is again shifted to the loose pulley. The width of the drive pulley on the line shaft must be equivalent to the combined width of the tight and loose pulleys, for the belt utilizes one side of the face on the drive pulley when it is guided onto the loose pulley and the other side when it is guided onto the tight pulley.

Hurried starting of the shaper should be avoided, for it produces two undesirable results: belt slippage and the noise which invariably accompanies it. Both can be avoided by starting the shaper without undue haste.

Such deliberation in shifting, however, is unnecessary when the machine is being stopped, since at this time the belt is simply guided onto the loose pulley; in contrast, when the machine is being started, parts having considerable weight must be set in motion, and this cannot be done instantly.



Instead of a cone pulley, some shapers employ a single step pulley for driving the machine. This single pulley may be driven from a line shaft, or from a countershaft directly above the shaper; or, in an arrangement known as direct drive, by a constant-speed electric motor which is usually located at the rear of the shaper and frequently on an extension of the base casting.

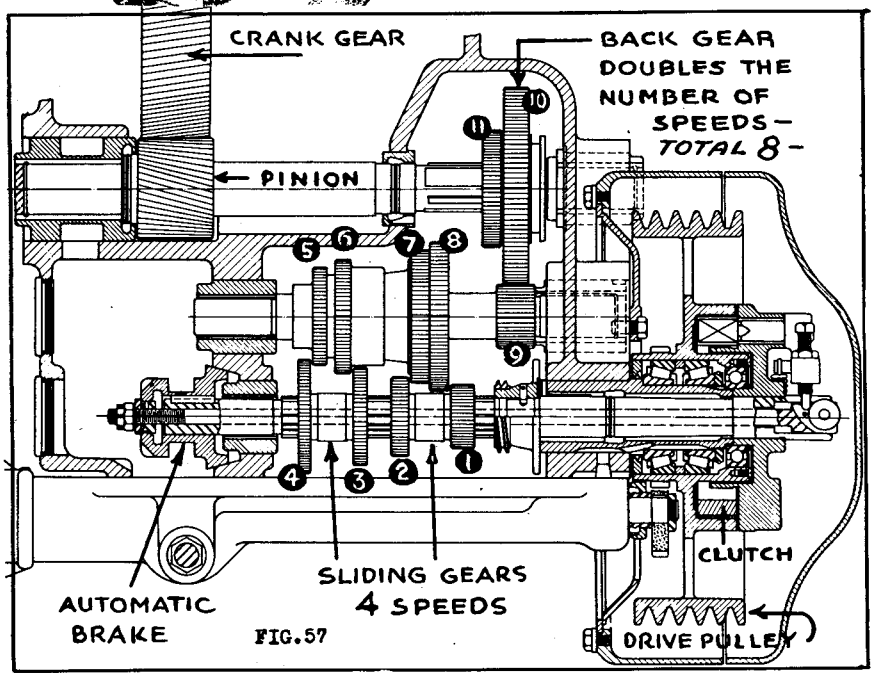


FIG. 57

Motion is transmitted from the single pulley to the mechanism which actuates the ram by a series of gears. The number of different combinations in which these gears can be arranged within the gear box by means of an external lever, determines the number of speed changes possible for the series.

A clutch on the main drive shaft permits starting and stopping the shaper independently of the motor. This is accomplished by a short movement of a lever which extends from the clutch to a place easily accessible from the operator's usual position. Shifting the clutch lever in one direction engages the clutch and starts the shaper; shifting it in the opposite direction disengages the clutch and stops the ram at any part of its stroke. (Refer to Fig. 57.)

Most shapers using a single-pulley drive are provided with a brake, also located on the main drive shaft and on the end opposite the clutch, to permit almost instantaneous stopping.

On some shapers, application of the brake is automatic, occurring coincidentally with the disengagement of the clutch; on others, the brake is applied by a slight pull on the clutch lever after the clutch has been disengaged.

HOW TO START AND STOP THE HYDRAULIC SHAPER

A single lever is mounted on the right side of the column for controlling both the starting and the stopping of the shaper. Another lever, which is interconnected with the one on the right side, per-

mits control of the machine from the left side when this is necessary. Before either of these levers can function for starting, however, it is necessary to start the electric motor which operates the pump for the hydraulic system.

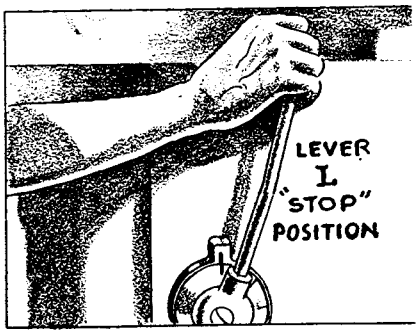


FIG.58

In addition to "Stop" which appears at the index line when the machine is at rest, the words "Low" and "High" also appear on the hub of the starting lever. They refer to the series of low speeds and the series of high speeds indicated on the speed-index plate (page 94) which are made available when the lever has been shifted to one of the positions designated on its hub. (Refer to Fig. 49.)

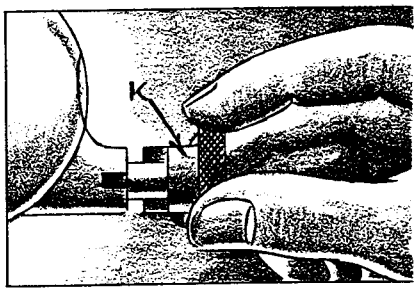


FIG.59

Moving lever L to the left so that it assumes an approximately vertical position, places the word "Low" adjacent to the reference line and starts the ram moving in the low-speed range.

Movement of the lever beyond this point is limited by a spring pin attached to knob K and engaged in a slot under the hub of the lever. A light pull on knob K, however, together with a turn of approximately 180°, withholds the spring pin from the slot which limits its movement. Consequently, the starting lever can now be moved farther to the left and the word "High" placed adjacent to the reference mark. This puts the ram into the high-speed range of movement. To stop the ram, this lever is shifted toward the rear of the machine to a position where "Stop" appears opposite the reference mark. To stop the electric motor which drives the hydraulic pump, it is necessary merely to push its control button. (Refer to Fig. 54.)

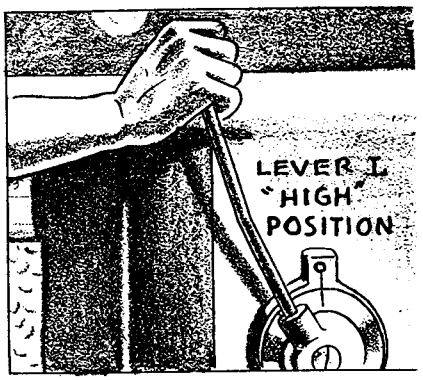
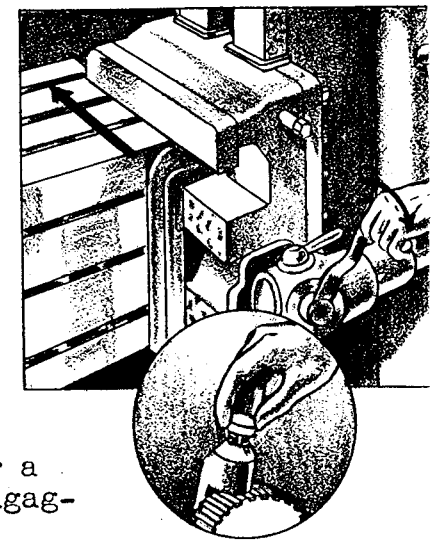


FIG.60

HOW TO CONTROL MOVEMENT OF THE TABLE ON THE CRANK SHAPER



Crosswise movement (horizontal) of the table in either direction over the cross rail is obtained by turning the hand crank on the end of the cross-feed screw in one direction or another. Clockwise rotation of the crank, which is furnished with the machine, moves the table away from the operator, and, conversely, counterclockwise rotation moves the table toward the operator.

Automatic movement of the table (automatic feed) in a crosswise direction is controlled by a lever or a knob located on the cross-rail unit. The feed is engag-

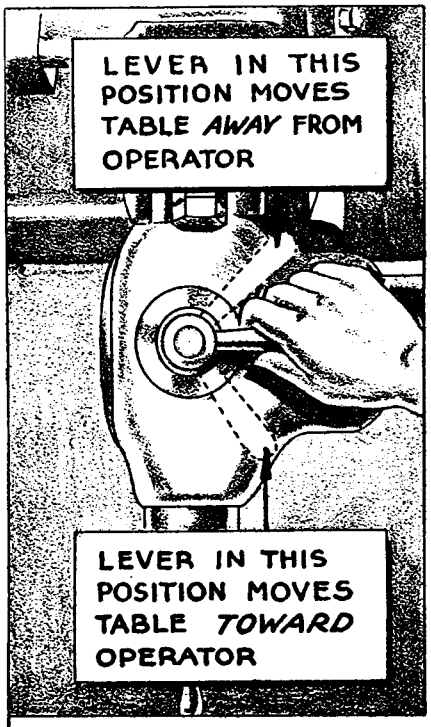


FIG.61

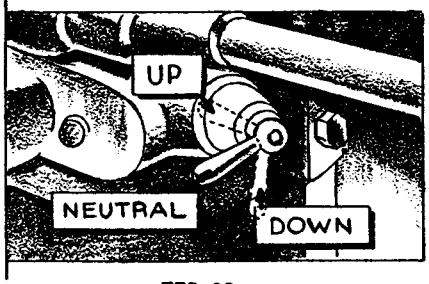


FIG.62

ed, disengaged, and reversed by changing the position of the knob or lever. The manner in which this is accomplished on the cone-driven shaper has been fully explained on pages 23 to 27.

On the modern shaper which uses a bevel-gear reverse mechanism similar to the one shown on page 28, the table moves in the direction in which the feed lever has been moved. Setting this lever away from the machine, feeds the table toward the operator. Setting the lever in the opposite direction, feeds the table away from the operator. The feed is disengaged by setting the lever in the midway position. The shaper is said to have directional control when the table feeds in the direction in which the feed lever has been moved.

The amount of feed per stroke or, in other words, the distance the table moves over for each stroke of the ram, may be regulated on all shapers, but in various ways, several of which have been explained on pages 23 to 28. The location of the mechanism used for regulating the amount of feed is approximately that of the one shown in Fig. 26.

Vertical movement of the table (up or down) on the face of the column is secured by turning the elevating shaft in one direction or another by means of a hand crank placed on its end. The elevating shaft protrudes from one side or the other of the cross rail, just below the cross-feed screw. The detailed instructions on page 77 should be followed when the table must be moved vertically.

HOW TO CONTROL MOVEMENT OF THE TABLE ON THE HYDRAULIC SHAPER

The table on the hydraulic shaper, like the one on the crank shaper, may be fed by hand in either horizontal direction by turning the hand crank on the end of the cross-feed screw in one direction or the other.

The cross rail, too, may be moved by hand in either vertical direction, to raise or lower the table, by placing the handcrank on the elevating shaft and turning it in whichever direction will produce the desired vertical movement of the cross rail on the column.

A somewhat different method, however, is employed for engaging the automatic cross feed on the hydraulic shaper shown on page 33, from those methods used for this purpose on any of the crank shapers whose feeding mechanisms have been described on pages 23 to 28.

The location of the feed levers on the hydraulic shaper and their placement for engaging and disengaging the cross feed, have been indicated in the illustration on page 46. Detailed instructions for applying the feed and for regulating the amount of feed per stroke, accompany the illustrations on pages 95 and 96.

HOW TO OPERATE THE RAPID POWER TRAVERSE ON THE CRANK SHAPER

Rapid power traverse has been described on page 29. Its operation is controlled by a lever on the operator's side of the shaper when the rapid-power traverse unit is built-in and forms an integral part of the feed mechanism. When the rapid-traverse unit functions independently of the regular feed mechanism, however, it is usually operated by an individual electric motor and controlled by push buttons. (Refer to page 29, Fig. 36.)

On the built-in type, the same lever that engages and controls the direction of the table during feed, also controls the direction of the power rapid traverse.

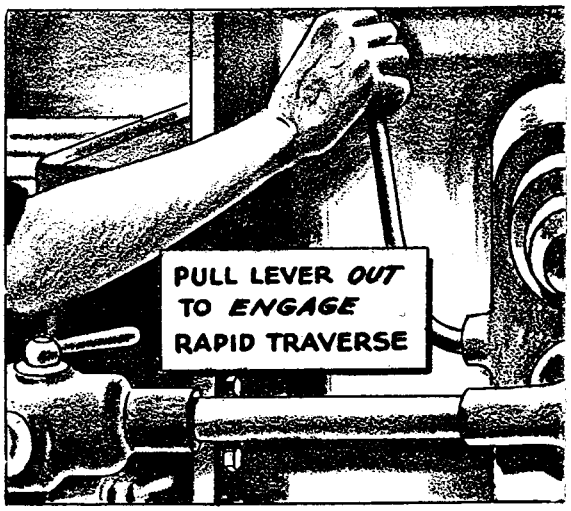


FIG.63

On some shapers the direction of the power rapid traverse is opposite to that of the feed set. When a unit which functions in this manner is engaged, it serves as a quick return, in that it moves the table over rapidly after a cut has been completed, and places the work in readiness for another cut.

On other shapers, however, instead of functioning as a quick return, the rapid power traverse functions in the same direction when engaged as does the feed — in the direction in which the feed lever has been moved. In both types, however, the direction is reversed by reversing the position of the feed lever.

To operate the built-in type of power rapid traverse, engage the cross feed by shifting the feed lever in the desired direction. Then pull out on the rapid traverse lever and hold it in this position while the table moves over the required distance. Release the lever to stop the rapid movement of the table. Release of the control lever automatically disconnects the rapid power traverse and reinstates the regular feed which becomes operative immediately (Fig. 63.

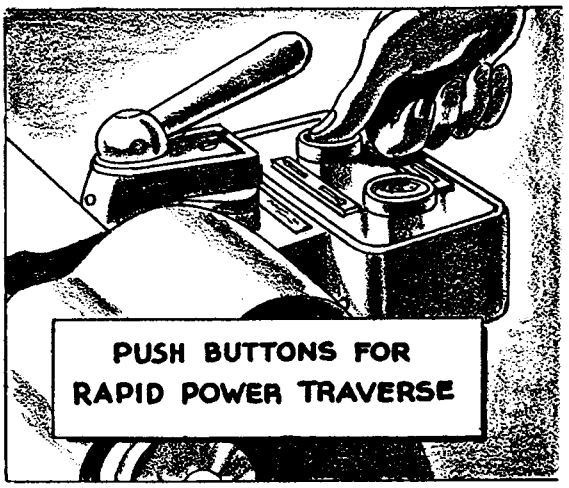


FIG.64

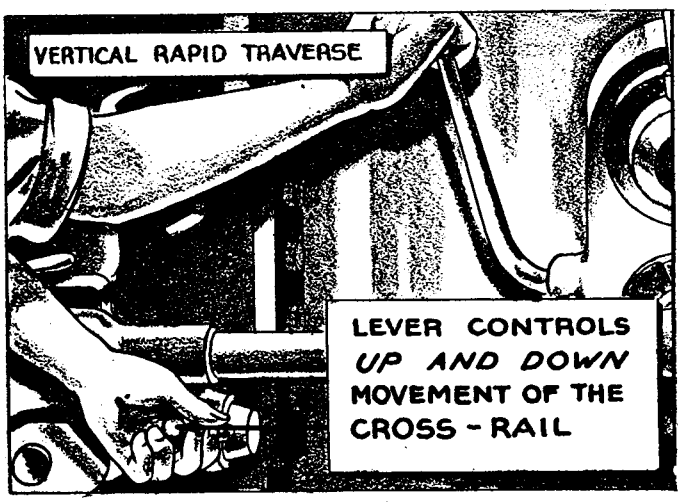


FIG.65

A somewhat different procedure is necessary when the shaper is equipped with an independent unit for the rapid power traverse. This unit is usually connected to the left-hand end of the cross-feed screw through a worm and worm wheel. Inasmuch as the direction of rotation of the driving motor may be reversed, movement of the table on the rail may be in either direction. (Refer to page 29.)

The control is through a "Forward" and a "Reverse" push button conveniently located at the operating end of the cross rail. The table may be traversed in either direction by simply pushing the button for the forward movement or the one for the reverse movement, as desired. This unit may be operated while the machine is at rest. (Refer to Fig. 64.)

In addition to horizontal power rapid traverse of the table, power rapid vertical traverse of the rail on the column is also available on some shapers to elevate or lower the work table rapidly.

The same single control lever used for the horizontal traverse is also used to engage the vertical traverse. The direction of the vertical traverse, whether up or down, however, is selected and indicated by another directional-control lever located at the rail (Fig. 65). A safety device is usually incorporated in the feed mechanism to prevent damage during operation of the rapid traverse.

CAUTION Before using power rapid <u>vertical</u> traverse on either the crank or the hydraulic shaper, read and follow directions No. 1 through No. 6 on page 77 pertaining to the adjustment of the cross rail. Then, after the rail has been adjusted, follow directions No. 9 and No. 10 on page 78.

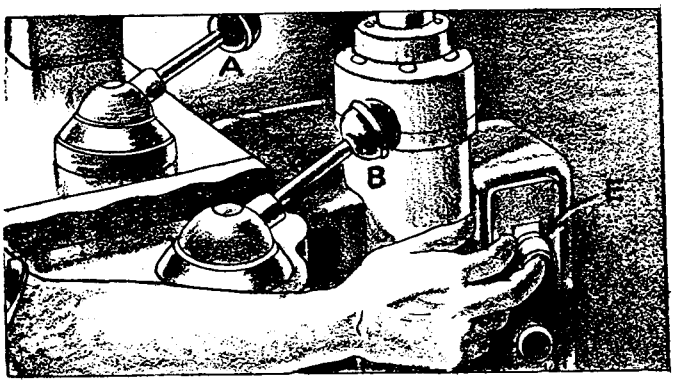


FIG.66

HOW TO OPERATE RAPID POWER TRAVERSE ON THE HYDRAULIC SHAPER

Rapid power traverse on the hydraulic shaper shown on page 33 is not actuated by pressure of the fluid in the hydraulic system, but instead by an electric motor mounted on the back of the cross rail on the operator's side of the shaper. The motor, and consequently the rapid traverse, operates under the control of push button <u>E</u> (Fig. 66).

Except for the additional requirement — that of depressing button E — operation of rapid traversing in a horizontal direction is the same as the operation of the regular cross feed which has been explained on page 95.

In addition to the cross power traverse, vertical power traverse is also available on this shaper for raising and lowering the table. The operation of vertical traverse, too, is controlled by push button E, but its operation in this direction requires a change in the position of the selector lever B, and, in addition, may require a change in the position of the directional-control lever A also.

For vertical traverse, the selector lever B is moved in a counter-clockwise direction. Its movement in this direction brings the word "Vertical" on its hub to the reference line, and indicates that subsequent movement of the table will be either up or down.

The directional-control lever A is then moved in one direction or the other from its "Off" position so that the word "Up" on its hub is in registration with the reference mark if the table is to be raised, or so that the word "Down" is opposite this mark if the table is to be lowered.

CAUTION Before depressing the push button which controls the operation of the rapid vertical traverse, make certain that the clamps for holding the rail to the column, and also the clamps or bolts which hold the table support to the table, have been loosened.

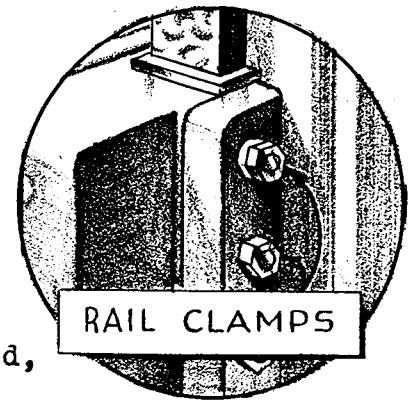


FIG.67

Follow directions No. 1 through No. 6 on page 77 pertaining to the adjustment of the cross rail.

After the rail has been raised or lowered as desired, follow directions No. 9 and No. 10 on page 78 for again clamping the rail and table support in position.

HOW TO CONTROL MOVEMENT OF THE RAM ON THE CRANK SHAPER

As is the case with all other controls indicated so far, those which have to do with the length of the ram stroke, the placement of the stroke with relation to the cut, and the speed of the ram, are also located on the right side of the shaper. This location makes them readily accessible from the operator's usual position.

For example, the stroke may be lengthened or shortened by placing a handcrank on the stroke-adjusting shaft (Fig. 68) and by turning it in one direction or the other, as required. A stroke-indicator dial, or a scale adjacent to the ram, indicates when this

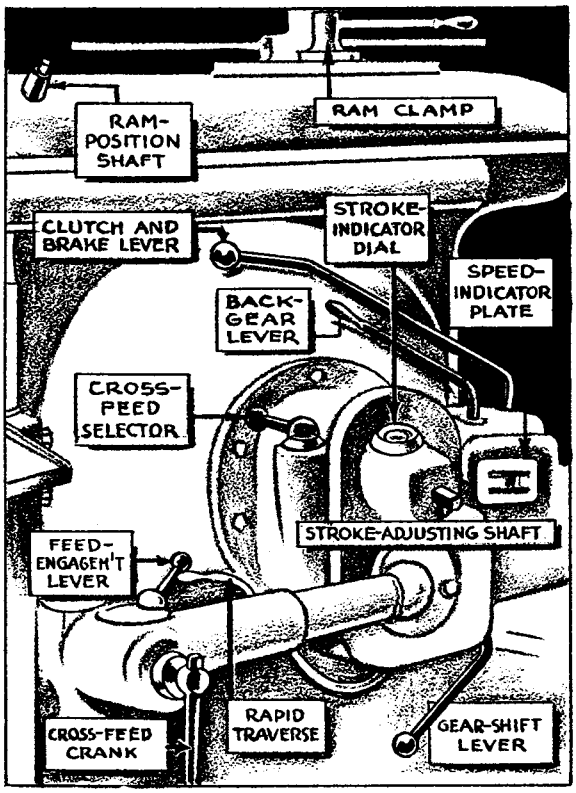
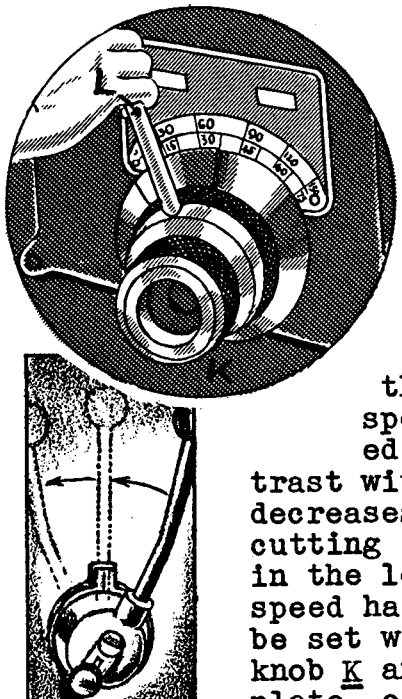


FIG.68

setting has been made correctly. Detailed instructions for making this adjustment have been given on pages 79 and 92.

After first loosening the ram clamp, the stroke may be located over the cut by turning the ram-positioning shaft by means of a handcrank. Obviously, the direction in which the shaft must be turned will be determined by the direction in which the ram must be moved, whether forward or backward from its present position. For detailed instructions for positioning the ram, refer to pages 81 and 92.

Any of the eight ram speeds indicated as strokes per minute on the speed-indicator plate are made available by locating the gear-shift lever and the back-gear lever in their designated positions. Four of these speeds are obtained by moving the gear-shift lever when the back-gear lever occupies one of its positions. Four different speeds are obtained by moving the back-gear lever to its alternate position. Step-by-step instructions for changing the speed of the shaper have been given in the section beginning on page 82.



HOW TO CONTROL MOVEMENT OF THE RAM ON THE HYDRAULIC SHAPER

The controls provided on the hydraulic shaper shown on page 33 for regulating the speed of the ram, the length of the ram stroke, and the position of the stroke with relation to the cut, differ considerably from the controls provided for regulating similar ram movements on the crank shaper.

Instead of being specified as strokes per minute, the speed of the ram has been indicated as the cutting speed in feet per minute on the speed-index plate attached to the flow-control valve (page 42). Also, in contrast with the crank shaper whose cutting speed increases or decreases whenever the stroke is made longer or shorter, the cutting speed of the hydraulic shaper is unaffected by changes in the length of the stroke. Therefore, once the cutting speed has been determined in feet per minute, this speed may be set without recourse to calculations, by simply loosening knob K and then moving lever L to any number on the speed plate, or to any intermediate position thereon.

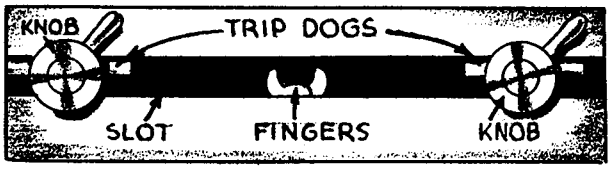


FIG.69

Furthermore, either the "High" or the "Low" series of speeds on the speed plate may be selected by shifting the starting lever to the position which brings either the word "High" or "Low" on its hub in registration with its reference mark. The functioning of the starting lever has been fully explained on page 42. Thus, instead of the usual eight speeds provided on a crank shaper, an infinite number of speeds within the limits prescribed on the speed plate become available on the hydraulic shaper.

Both the length of the stroke and its correct placement over the work are controlled by the two knobs located over the slot in the ram. These knobs are actually clamping nuts screwed onto the upper ends of threaded studs which extend downward and terminate in flat rectangular members under the ram slot (Fig. 69).

These rectangular members are, in effect, trip dogs placed at opposite ends of the ram stroke and clamped in the desired position by means of the knurled knobs. The trip dogs alternately engage with fingers located one above the other on the upper end of a vertical shaft connected with the pilot valve. Each time one of the rectangular members (trip dogs) engages a finger, the shaft attached to the finger makes a partial rotation and actuates the pilot valve, causing it to reverse the direction of the ram movement in the manner explained on page 45.

Inasmuch as the knobs, together with the rectangular members to which they are connected by means of studs, can be moved in the ram slot, they may be spaced and located to suit any job whose length is within the capacity of the shaper.

HOW TO CONTROL MOVEMENT OF THE TOOL SLIDE

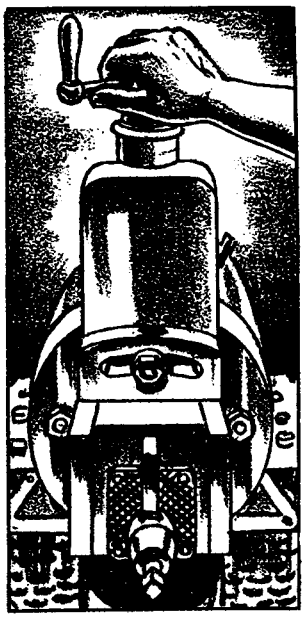


FIG.70

Movement of the tool slide, together with the cutting tool, is controlled by the handle attached to the down-feed screw located within the slide. The slide is lowered by rotating the handle in a clockwise direction, and raised by turning it in the opposite direction (Fig. 70).

The extent of its vertical and angular movement — about 7" on a 16-inch shaper — is limited by the length of the slide itself and by the length of the down-feed screw also. For convenience in making accurate adjustments of the slide and the tool, the feed screw has been fitted with a micrometer dial, graduated in thousandths of an inch. (Refer to page 91.)

A dial, similar in function, is also provided on the cross-feed screw and sometimes on the elevating shaft as well. Together they provide micrometer adjustment of both the tool and the work. When the dial is clamped in place, it

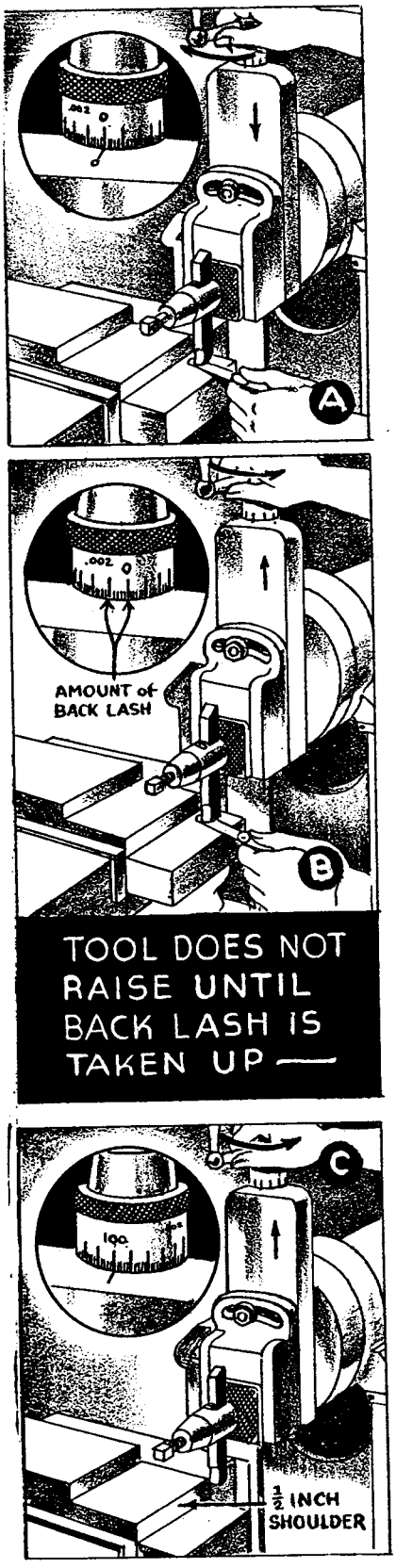


FIG. 71

becomes an integral part of the screw on which it is mounted and accurately measures movement of both the screw and the part of the machine which it is intended to move.

The number of graduations on the collar is directly related to the lead of the screw (the distance a screw advances in one revolution). For example, if the down-feed screw has five threads per inch, one revolution of the screw advances the tool slide 1/5 of an inch or .200". If the circumference of the graduated collar is divided into two hundred equal spaces, then the distance between lines on the collar represents 1/200 of a revolution or one one-thousandth of an inch (.001").

HOW TO TAKE UP BACK LASH

Whenever a graduated dial is used on the shaper for making accurate adjustments of the tool or the work, all "back lash" or "lost motion" must be taken out of the screw before the dial is set to a definite figure. Back lash in a screw is the lost motion existing between the threads of a screw and the threads in the nut through which the screw turns. Back lash is present in a small degree even in new machines, and to a greater extent in older machines as wear occurs.

For example, before using the micrometer dial for setting the tool for a certain cut, back lash must be taken out of the down-feed screw. One way to make certain that all back lash has been taken out is to give the handle about a half turn in a direction opposite the proposed adjustment before setting the tool to the surface from which the depth of cut is to be measured with the dial. (Refer to Fig. 71 A.)

For subsequent cuts in the same direction, back lash will be of no further consequence. When the movement of the tool is reversed, however, from a downward direction to an upward direction, the back lash must be taken up again, before the tool will move up when the screw is turned. (Refer to Fig. 71 B.)

The amount of back lash in the screw can be measured, also, when its direction is reversed, for at this time the screw makes a partial turn before the tool slide is moved in the opposite direction by the screw. This partial turn may be measured by noting the readings on the dial before reversing the screw, and again at the instant the tool slide moves in its reversed direction.

HOW TO CARE FOR THE SHAPER AND ITS ACCESSORIES

Care of the shaper and its accessories requires the performance of certain tasks before the machine is set in motion, and the performance of others of equal importance after the job has been completed. These tasks pertain largely to maintaining the shaper in good working condition.

In addition, care of the shaper and its accessories requires the observance of certain precautions during the setting up of the job and the tool. Finally, the operator must adhere to certain accepted procedures during performance of the job, and avoid other procedures which are prone to cause damage to the machine and may involve the safety of the operator and his fellow workers.

A tradesman's standing among his fellow workers and their appraisal of his ability are determined, to a large extent, by the treatment he accords machines and tools with which he works.

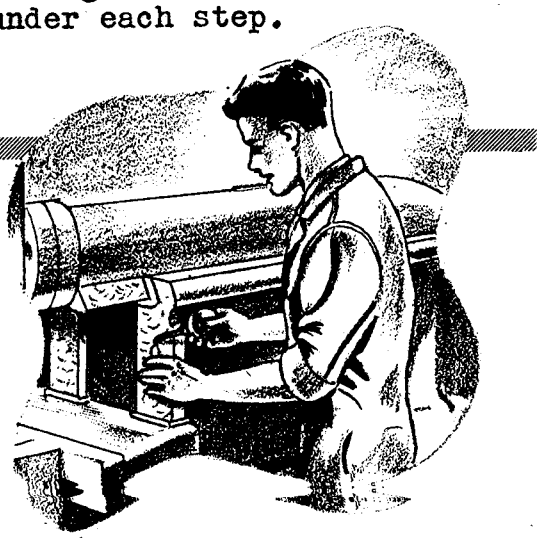
An efficient worker operates machines with care. He also handles tools in a manner which will continue their usefulness over a long period, and he returns them to their proper places when the job is completed. He knows accuracy is impossible with tools damaged by rough usage and haphazard piling about the machine.

He disposes of chips before they become a hindrance to his work, and he judiciously lubricates his machine in a routine manner at such regular intervals as dictated by the speed of the machine and the type of work performed.

He assumes that other workmen, like himself, prefer to start a job with a clean machine and, therefore, he makes certain that it is clean and in good working order when he leaves it.

Every setup of the job and the machine includes the numbered steps below. Procedures recognized by skilled tradesmen as being helpful in turning out good work and in reducing machine wear and damage to a minimum, are recommended under each step.

1 LUBRICATING THE SHAPER



a. Read the Description of the Oiling System beginning on page 29.

b. Follow the instructions given in the section, How to Oil the Shaper (page 47), which apply to the type shaper in use.

2 MOUNTING THE WORK-HOLDING DEVICE

a. Remove all burrs, chips, and dirt from the surface of the machine table in order to provide a flat, clean surface on which to place the work-holding device.

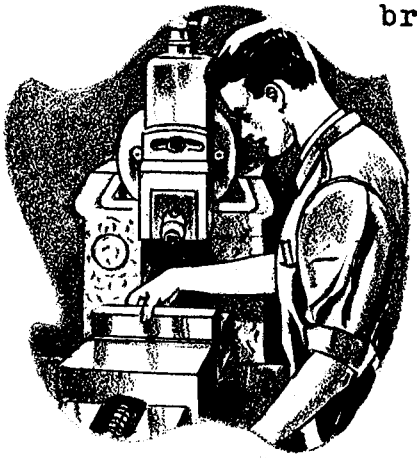
b. Thoroughly clean the bottom of the vise or other work-holding device before it is placed on the machine table. This precaution will prevent pitting and scarring of the table and the bottom of the vise, an undesirable condition resulting from the presence of chips between these surfaces.

c. Ask for help in lifting whenever it is necessary to place in position or to remove a heavy fixture or machine vise. Dropping it may damage both the machine and the holding device and, worse still, may cause personal injury.

d. Place a washer under each nut used for clamping a vise, a fixture, or the work itself to the machine table. Make certain, however, that the nut has not been drawn down to the end of the thread on the bolt, for if this occurs, the part which it is intended to clamp will still be free to move, although the force applied to the nut would indicate that the part has been clamped securely to the table.

3 MOUNTING THE WORK

a. Clamp all work in the shaper securely, using whichever method is most appropriate for holding the particular job. It is dangerous to have the work move even a small amount during the cut, but work which is forced out of the holding device by pressure of the cutting tool is almost certain to damage the shaper before the machine can be brought to a standstill.



b. Place a cardboard between the vise jaws and a rough casting and between the table and the casting if it is clamped to the table instead of in a vise or in a fixture. Cardboard will protect these machine surfaces from the irregularities which are usually present on unmachined castings.

CAUTION Refrain from using a hammer on the handle of the shaper vise as an aid in tightening the

vise on the work. The handle is usually of a length which will allow the application of enough pressure to hold the work without the aid of a hammer. Besides, hammering is likely to set up burrs which will injure the operator's hands.

c. Place all the work held in the vise as far down in the jaws as practicable without having the tool cut into the vise jaws. If a job is to be clamped to the machine table, keep it as low as possible. This procedure makes the setup rigid and reduces the vibration to a minimum during the cut.

d. Use the shortest bolts possible for clamping work so as to avoid interference between the ram and the bolts. This applies especially to the bolts nearest to the ram.

e. Avoid marring the machine table by using only wood, or metal blocking which has no burrs, for supporting the outer ends of clamps used to hold work to the table.

f. Use parallels, and store them also, in a manner which will preclude their becoming damaged through falling on hard material, for this will raise a burr, and their use in this condition will result in inaccurate work. When a parallel becomes burred despite all precautions having been taken to prevent this condition, remove the burr with a flat, smooth file if the parallel is soft, or, if the parallel has been hardened, use an oil stone for this purpose.

4 MOUNTING THE TOOL

a. Clamp the tool holder in the tool post with as little overhang as practicable. This eliminates the unnecessary strain which is placed on the tool head when a cut is made with the tool holder extending below the tool block farther than is required.

b. Place the tool holder in a vertical position so that if it should be forced over by the pressure of the cut, the tool will swing in an arc away from the work, instead of into the work as would be the case if the tool holder were set toward the cut.

c. Clamp the tool holder securely in the tool post to prevent its working loose during the cut.

d. Use only sharp cutting tools, for dull tools require considerable more power to remove a given amount of metal than do sharp tools. Furthermore, a dull tool creates much more heat than does a sharp

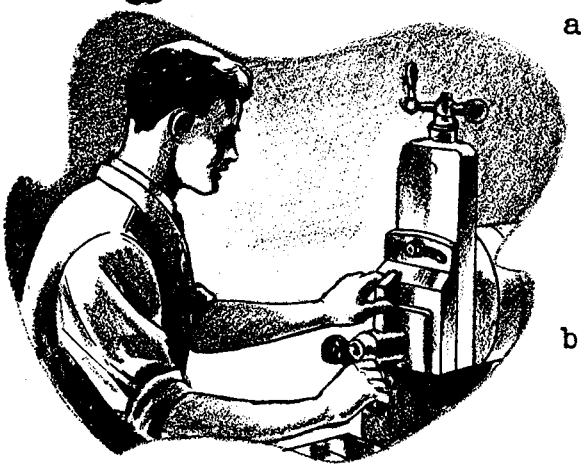
tool, and, moreover, produces an inferior finish on the work.

e. Clamp the cutting tool securely in its holder and as short as practicable. If applied, these two recommendations will prevent tool breakage and its attendant hazards to the operator and the machine. Furthermore, clamping the tool as suggested conforms to the practice of keeping the setup rigid.

f. Make certain that the clapper block is functioning correctly: (1) that it lifts slightly on the return stroke of the ram, and (2) that it assumes its position against the back of the clapper box immediately under pressure of the cut.

g. Adjust the tool holder and the tool only when the machine is at a standstill. These adjustments become extremely hazardous if made when the shaper is in motion.

5 ADJUSTING THE WORK AND THE TOOL



a. Before turning a handcrank, shifting a lever, or pushing a control button, ascertain very definitely just what action will result when each control is manipulated. Manipulating any part of the shaper without knowing what motion will occur, in what direction and how fast, may result in serious damage to the machine.

b. Thoroughly clean, and then oil, the flat bearing surfaces on the cross rail used to guide the table horizontally. Give the same care to the bearing surfaces on the front of the column, used to guide the table vertically. This care should be accorded these surfaces each time the table is moved to any extent.

c. Remove all tools and accessories from the base of the machine to avoid jamming when the cross rail is lowered. Tools placed on other parts of the shaper and no longer needed for the job should also be removed. This is especially important if these tools are likely to become dislodged through vibration and thus interfere with the movement of the parts being fed automatically. Considerable damage to the feed mechanism usually results if movement of a part is forcibly stopped while the shaper is in operation and the automatic feed is still engaged.

d. Previous to making adjustments of such parts as the cross rail, loosen the clamps which lock these parts rigidly in place during the cut. It is equally important that these clamps be

tightened after the adjustment has been made and that all other parts not used to feed the work or the tool be clamped securely also.

e. To assure a more rigid machine setup, adjust the table vertically so that the space between the work and the bottom of the ram is no greater than the safety of the operator requires. A space of approximately two inches is considered sufficient for this purpose.

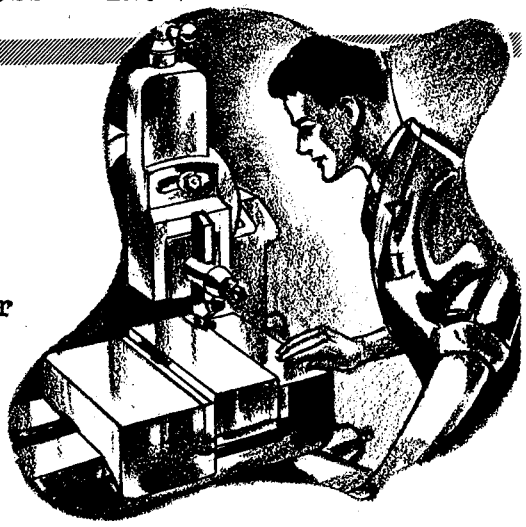
Whenever the distance between the ram and the work is increased appreciably, the tool slide must be extended beyond the tool head a correspondingly greater distance. In this extended position, the tool slide is not well supported, and, as a result of this lack of support, is likely to be broken if the tool should get caught in the cut or if the slide should strike the column at the end of the return stroke.

f. Avoid gear clashing when the speed is being set. Make all speed changes with the clutch disengaged.

g. Whenever the construction of the shaper permits, pull the belt or turn the hand wheel to give the ram one complete stroke by hand, before turning on the power. Since this is impossible on many shapers equipped with individual motor drive, the clutch should be engaged cautiously while the ram makes a complete stroke. This procedure is recommended to permit detection of any interference between the ram and the work.

h. Before engaging the rapid power traverse, make certain there will be no interference between the tool and the work. Also, in order to avoid jamming these parts, ascertain whether or not the table can be fed over the required distance before reaching the limit of its travel on the cross rail.

6 TAKING THE CUT



a. Set a cutting speed which is commensurate with the length of stroke and at the same time takes into consideration the material being cut and the cutting material in the tool.

b. Set the tool so that it clears (passes over without cutting) the highest part of the job before engaging the clutch. After the machine has been set in motion, feed the tool down toward the work carefully.

c. Lock the tool slide in place after the depth of cut has been established so as to keep it from moving during the cut.

d. Before engaging the automatic feed, ascertain the rate of feed for which the machine has been adjusted.

e. Whenever the automatic feed operates at the beginning of the cutting stroke, instead of preferably during the return stroke, adjust the length and the position of the stroke so that the tool will run beyond the back end of the work a somewhat greater distance than usual. This will allow the feeding of the table to be completed before the tool engages the cut. The feed mechanism should not be forced to feed the work after the tool begins to cut, for it was not designed to withstand the heavy pressure required to force the tool into the metal.

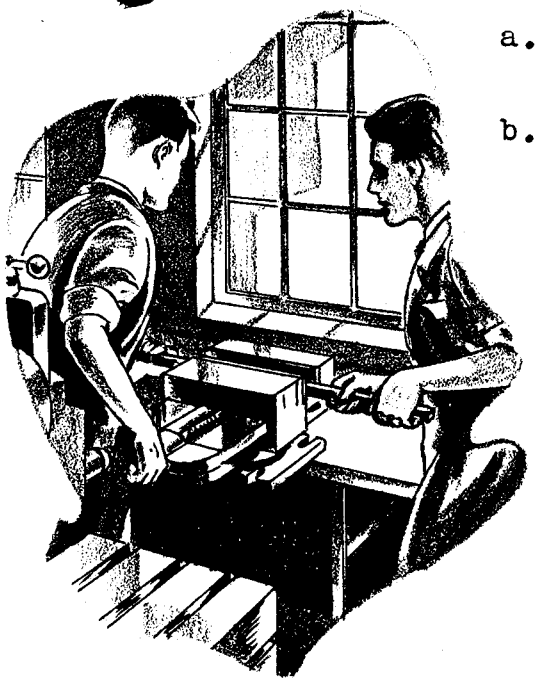
f. Feed the work to the tool slowly by hand, and then, if the cut is of the desired depth, engage the automatic feed.

g. Remain at the machine while the cut is in progress in order to maintain control thereof at all times.

h. Brush chips from the work in a direction which will prevent their entering the working parts of the shaper.

i. After completing angular shaping, set the tool head back to the vertical position and tighten it in place. This is a precautionary measure recommended to prevent the tool head from striking the column during the return stroke, a hazardous condition which develops when the stroke is lengthened and the head is left in the angular position.

7 DISASSEMBLING THE SETUP



a. Clean the work-holding device of all chips and oil.

b. Remove any special holding device or fixture from the machine and return it to its proper storage space.

NOTE: The vise is usually left on the machine table and bolted securely in place. Leaving the vise in place with the bolts loose may result in serious injury, for the vise is sure to move when work is tightened therein.

c. Return all tool holders not usually used on the shaper to the tool crib, or to the storage cabinet if one is provided.

d. Brush all chips from the machine;

then wipe it with waste.

e. Return all straps and bolts to their proper places in a clean condition. Assemble the bolts, the nuts, and the washers.

f. Carefully return parallels to their storage space to avoid burring.

8 MAINTAINING THE SHAPER IN A GOOD OPERATING CONDITION

Under this heading have been listed some of the measures which should be observed for the correct functioning of the shaper and its driving mechanism. Because of his daily association with the shaper, the operator should detect immediately conditions about the machine which contribute to inefficient operation and to inaccurate performance. Since the operator's regular duties usually do not include correction of these faulty conditions, it is his duty to report them to the individual responsible for maintaining the machine in proper adjustment and in good repair. The following are among such measures:

a. Adjust the tension on the belt when necessary in order to prevent excessive slippage on the pulley and thus assure maximum power when it is needed.

b. Make adjustments on the machine required because of wear, and necessary for the production of accurate work.

c. Give timely service to electric motors and their controls in order to forestall their breakdown.