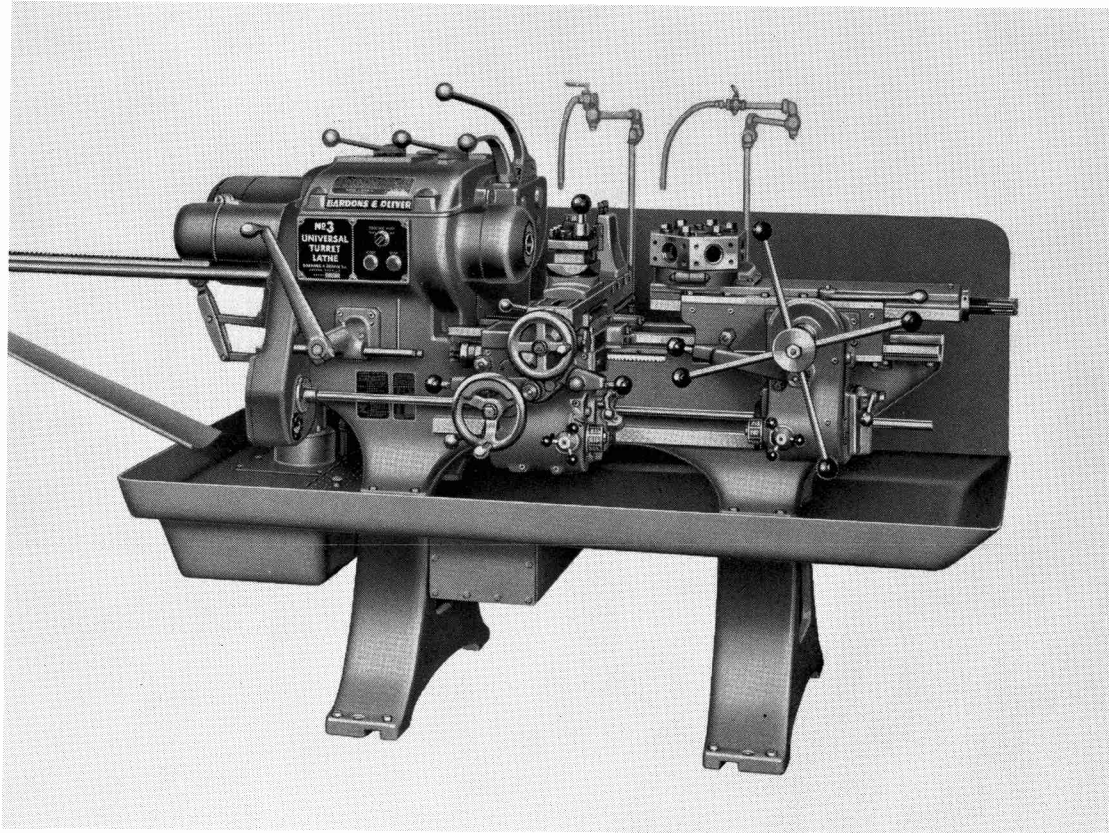


BARDONS & OLIVER

No. 3

UNIVERSAL TURRET LATHE



INSTRUCTION MANUAL

NO. 3 UNIVERSAL TURRET LATHE

The Bardons & Oliver No. 3 Universal Turret Lathe was designed and built to produce accurate work over a long period under conditions of hard usage. In order that the inherent accuracy be retained, extreme care must be given to the installation of the machine. Thorough inspection of the machine should be made at regular intervals, the frequency depending on the type of work handled and the accuracy desired.

Do not attempt to run the machine until all of the following instructions for Unpacking, Installing, Lubrication, Electrical Connections, and Leveling have been carefully and completely followed in the order listed.

UNPACKING

Turret Lathes for domestic customers are shipped in individual crates: those for foreign customers are shipped in individual boxes. While the machine is being unpacked, particular care should be taken not to mar the finish or damage the working parts.

Whenever possible, tools, chucks, and fixtures are attached directly to the machine. Wrenches and other items which cannot be attached, together with a data envelope, will be found in a separate box fastened to the platform or skids.

Contained in the data envelope are the instruction manual, electrical diagram, parts catalogue, and packing list. Be sure this data is preserved and delivered to the proper departments.

Check and account for each item on the packing list before disposing of any crating or boxing material.

INSTALLING

The machine is mounted on heavy wooden skids to prevent bed warpage in shipping. Locate the machine approximately in its final position before removing the skids. In removing the skids care must be taken to prevent undue twisting which might cause permanent distortion of the bed.

If possible, the legs should rest on a concrete foundation. A wooden floor lacks rigidity and its surface swells or shrinks according to climatic conditions.

To maintain accuracy, place steel bearing plates under each leg, as shown on the outline drawing of the machine. These plates should be grouted in concrete flush with the floor. If it is impossible to set these plates in or on concrete, they may be bolted down to a wooden floor. Here it is advisable to use plates affording a much larger bearing area on the floor. Drill and tap for the hold down screws after the bearing plates are firmly fastened to the floor.

On machines equipped with the hydraulic collet chuck and bar feed unit, assemble the bar feed unit according to the construction drawing in the back of the manual and place the unit in its approximate position with respect to the machine. The bar feed unit should be located on bearing plates the same thickness as used under the machine.

LUBRICATION

The headstock is fully enclosed and spray lubricated. The headstock oil reservoir is located beneath the chip pan as indicated on the lubrication chart. The head end bracket gear train is splash lubricated and has a separate oil reservoir.

The aprons are splash lubricated. The plunger pumps on the aprons lubricate the bearing surfaces of the turret slide, the cross slide, carriage, feed screw, and nut, as well as bearing surfaces in each apron not reached by the splash system. Since the plunger pumps take oil from the aprons, it may be necessary to add oil to the aprons more often than to the headstock.

The apron oil reservoirs are filled to the proper level before shipment. Fill the headstock and check the aprons. Make sure that the oil level in each reservoir is at approximately the center of the gage glass. Check the oil levels before starting the machine, as the level drops somewhat after the machine is started. Raising the oil level above the center line on the gage will cause oil leakage at various points and excessive oxidation or gumming of the oil.

On machines equipped with the hydraulic collet chuck and bar feed unit, connect the two hydraulic lines to the collet chuck cylinder underneath the end of the spindle. Each hose and fitting are suitably marked. Fill the oil reservoir in the hydraulic unit to the center line on the gage.

The instructions on the lubrication chart must be followed. If the machine is operated on a multi shift basis, the headstock and aprons should be drained, flushed and refilled two or three times as often as called for on the chart.

ELECTRICAL CONNECTIONS

The machine is shipped from the factory with all electrical equipment wired. It is only necessary to connect the main power lines to the terminals on the disconnect switch in the upper right hand corner of the electric control cabinet. When the headstock oil reservoir is filled as outlined in the "LUBRICATION" instruction, close the disconnect switch and press the "START" button located on the push button control

panel. If the power lines have been connected to give the correct rotation of the motors, the main spindle motor will revolve in the direction indicated by the arrow located on the motor. If the rotation of the motor is opposite to the arrow indication, press the "STOP" button and reverse two of the incoming leads.

On machines equipped with the hydraulic collet chuck and bar feed unit, insert the plug attached to the end of the cable on the bar feed stand into the receptacle on the right hand side of the electric control cabinet on the machine. The hydraulic pump, located in the bar feed stand, will not operate unless the main motor is running. With the main motor running, the pump is started by turning the selector switch to "COLLET".

LEVELING

The accuracy originally built into the machine will be lost unless the machine is properly leveled. To maintain this accuracy the level of the machine should be checked at least twice a year.

Before leveling, allow the machine to reach normal operating temperature. To level, raise the machine by turning the leveling screws so that a 1/8 inch thickness gage may be slipped between the bottom of each leg and the bearing plate. Use a precision level about fifteen inches long. Starting at the head end, place the level lengthwise on the bed ways, and level by turning the adjusting screws. Then place the level across the bed ways and level. Repeat the two operations at the tail end of the machine. After leveling at each end, repeat the leveling process until all readings are equal. After proper alignment, bolt down the legs and recheck the level.

If extremely accurate work is to be done on the machine, the leveling can be further checked by chucking a round bar and taking a turning cut with the carriage or hexagon turret. Any remaining misalignment will be indicated by the amount of taper in the turned diameter. This can be corrected by slight adjustment of the leveling screws.

On machines equipped with the hydraulic collet chuck and bar feed unit, this unit should be bolted to the floor only after it is leveled and aligned with the spindle. To level and align the unit (Figure 1), do as follows: Place the unit in approximately the proper position with respect to the machine, and make necessary electrical and hydraulic connections. Insert a test bar (equal to the maximum capacity of the collet) through the revolving scroll chuck and just through the collet. The bar should be straight, of a uniform diameter and about 12 feet long. Close the collet. Place a parallel between the support bars and the test bar. Using a 1-1/4 inch parallel, raise the second stand until the test bar is level. Check alignment of support bars by placing level lengthwise on top of the bars and then crosswise on the bars adjacent to the parallel. Adjust by leveling the second stand. Level the first stand lengthwise and at right angle to the support bars. Using the test bar as a guide, align the stands with the center line of the spindle. Recheck level of test bar and support bars. As a check of alignment, the test bar should be concentric with the hole in the abutment sleeve. Recheck the levels throughout the bar feed unit.

To insure proper installation of the bar feed unit, tighten the chuck until it grips the test bar. Loosen the chuck just enough so that it can be moved back and forth over the test bar. It must slide freely over the whole length. After lining up and leveling the bar feed stands, bolt them securely to the floor.

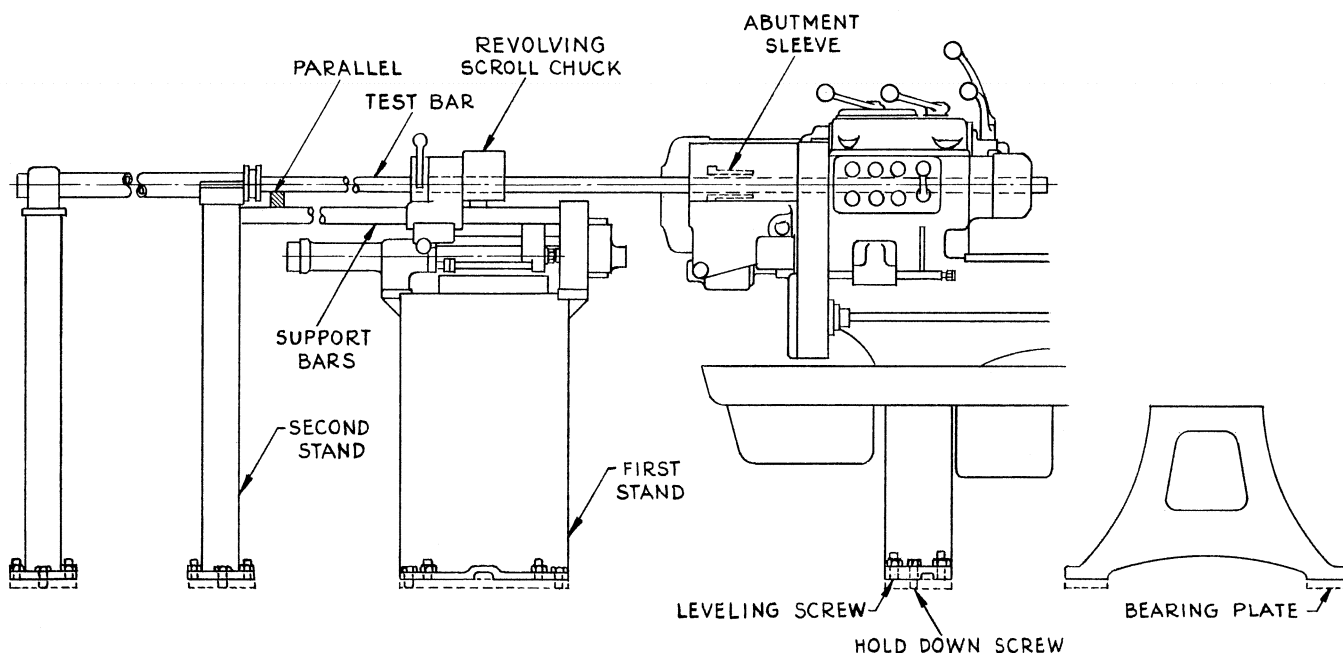


FIG. 1

INSTRUCTIONS

- | | | |
|-----------------|----|--|
| Before Starting | -- | Fill all oil reservoirs to the center line on the gages. Fill oil cups. Depress apron pump handles 3 or 4 times. |
| Every 4 hours | -- | Fill oil cups. Depress apron pump handles 3 or 4 times. |
| Every week | -- | Grease where indicated. |
| Every 3 months | -- | Drain apron oil reservoirs. Flush with solvent type flushing oil. Refill reservoirs. |
| Every 6 months | -- | Drain headstock, head end bracket and bar feed oil reservoirs. Flush thoroughly with solvent type flushing oil. Clean oil filters on inside of headstock and bar feed reservoir covers. Refill reservoirs. |

OIL SPECIFICATIONS

- | | | |
|--|----|---|
| Headstock, Head End Bracket and Bar Feed | -- | High grade mineral oil, with a viscosity of 145 - 155 seconds at 100°F. |
| Aprons | -- | High grade extreme pressure lead naphthanate type oil having a viscosity of 300 - 325 seconds at 100°F. |
| Oil Cups | -- | High grade oil of about S.A.E. 10 viscosity. |
| Grease Fittings | -- | No. 2 consistency grease. |

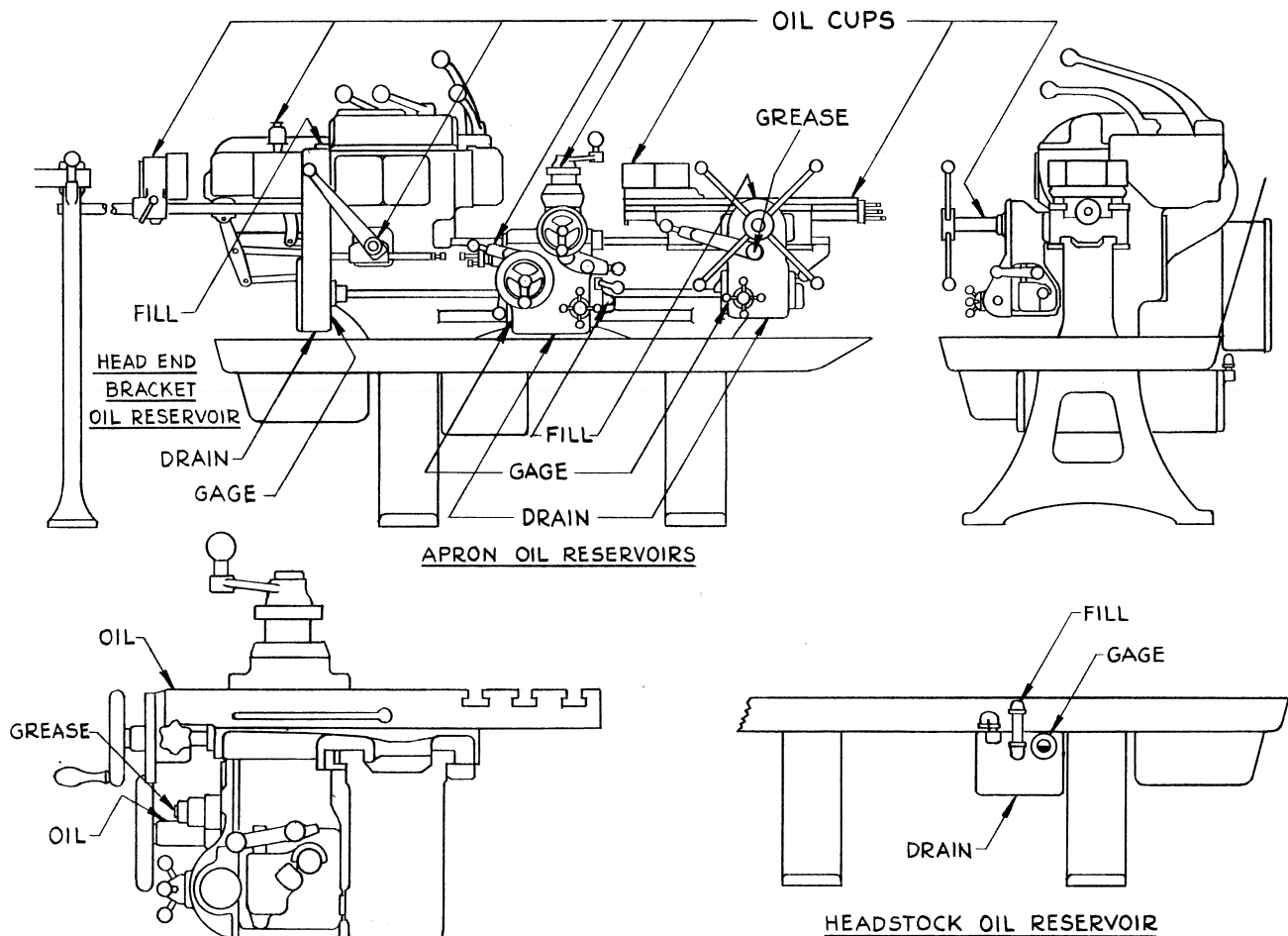


FIG. 2

HEADSTOCK

The No. 3 Universal Turret Lathe has a 12 speed headstock. Speeds are easily selected by positioning three levers as indicated on the chart attached to the front of the headstock (Figure 3).

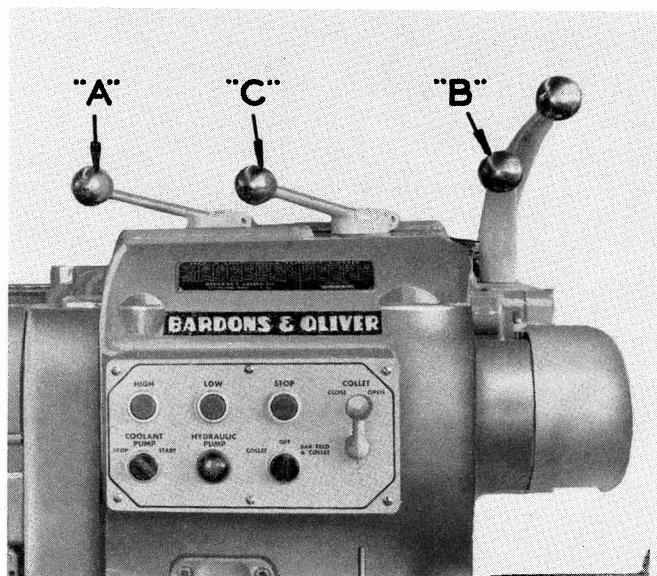


FIG. 3

The high-low lever "B" allows spindle speed changes without slowing the spindle. When the position of levers "A" or "C" is changed, the forward reverse clutch must be disengaged, and the spindle must be allowed to slow almost to a stop. The forward reverse lever when in the neutral position automatically applies the spindle brake. Between the forward and neutral positions there is a coasting zone which greatly facilitates gear shifting. An automatic lever lock prevents unintentional starting of the machine.

HEADSTOCK ADJUSTMENTS

1. There are two double multiple disc clutches, one to obtain forward and reverse spindle rotation and one to provide quick high-low speed changes (Figure 4).

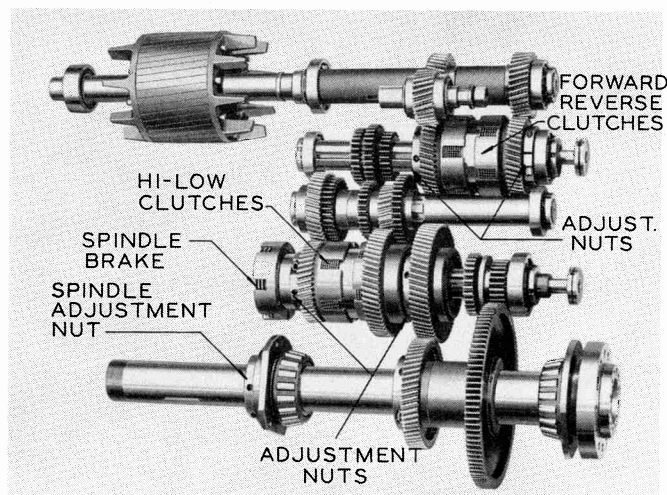


FIG. 4

The clutches have split adjusting nuts at each end which may be easily reached by removing the small covers on the top of the headstock. These clutches should not require adjustment more often than once or twice a year. When adjusting the clutches, keep trying the clutch levers in each direction while turning each nut a little at a time. After the right "feel" has been obtained in each clutch, be sure to tighten the locking screws in the split nuts before replacing the covers.

2. The spindle is mounted in two single row precision tapered roller bearings. A split adjustment nut, located on the rear end of the spindle outside the headstock, may be easily reached with a pin wrench after removing the small plate on the top of the head end bracket. In adjusting, all end play should be eliminated but no preloading should be introduced.

3. The headstock hydraulic system provides oil to operate the spindle brake and to spray lubricate all moving parts in the headstock. The hydraulic pump is located in the clutch lever bracket directly in back of the spindle and supplies 50 to 60 lbs pressure to operate the spindle brake (Figure 5).

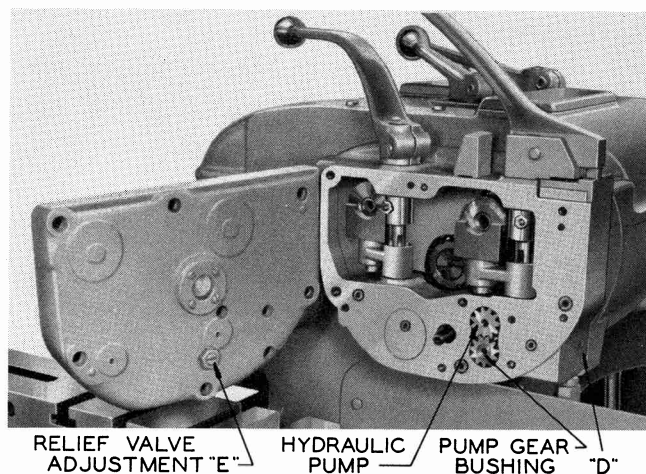


FIG. 5

If the breaking action is slow, insert a pressure gage in place of the pipe plug fitting "D" on the back of the clutch lever bracket. The brake will not operate properly at a pressure below 50 lbs.

The pressure may be regulated by adjusting the relief valve at point "E". If oil pressure is still too low, check for the following conditions.

1. Not enough oil in the headstock oil reservoir.
2. Clogged oil filter, located on the inside of the headstock oil reservoir cover.
3. Worn pump gear bushing which allows air to enter the hydraulic system.

If the pressure is correct and the breaking action is still slow, the brake should be disassembled, cleaned, and wire brushed. However, it should not be necessary to do this until the machine has been in use several years.

CARRIAGE AND SADDLE APRONS

The aprons provide six feed changes in geometrical progression for the cross and longitudinal travel of the cross slide and for the hexagon turret slide. The standard feeds may be halved by substituting an optional set of change gears in the head end bracket.

Feed changes in each apron are made by means of a single lever and are easily read on large rotating dials.

CARRIAGE AND SADDLE APRON ADJUSTMENT

1. Friction clutches in each apron engage the power feeds. These clutches must be kept in proper adjustment, since slippage will cause undue wear and result in failure of the clutches to release properly. A split adjusting nut is provided on the end of each feed lever shaft. To adjust the clutches, loosen the split nut locking screw and turn the nut. The lever should be worked up and down as the nut is turned. The clutches should be adjusted so that the feed lever plunger just reaches the point of engagement.

If a feed clutch becomes frozen due to slippage and will not release, it will be necessary to take off the apron cover and dismantle and thoroughly clean the clutching surfaces.

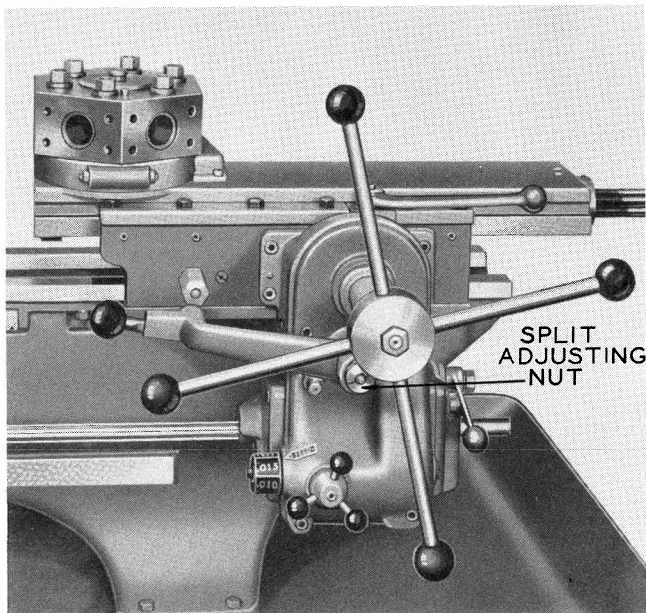


FIG. 6

TURRET, SLIDE AND SADDLE

The hexagon turret revolves on and is located centrally by a large diameter tapered roller bearing. A double bevel circumference clamp ring tightens the turret against the slide and preloads the bearing for accurate centering and vertical alignment. (Figure 7)

The turret slide travels on hardened and ground replaceable alloy steel ways in the saddle. It is guided between double, hardened, ground and lapped alloy steel gibs on each side, and held by sturdy hardened and ground steel top caps.

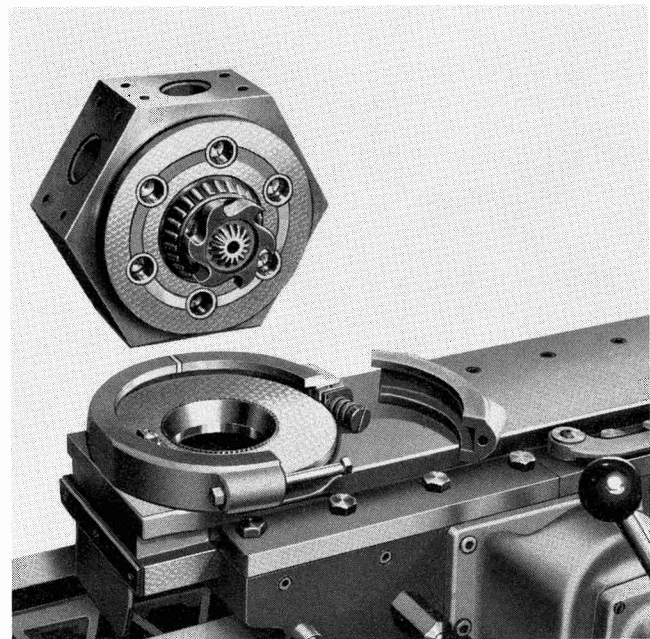


FIG. 7

To move the saddle on the bedways, loosen the eight screws beneath the lower saddle caps. Do not loosen the adjustment screws on the back side of the saddle. A latch is provided for attaching to the cross slide carriage for easy movement of the saddle along the bedways.

A neoprene apron is attached to the front end of the slide just below the turret to keep chips and dirt out of the indexing mechanism. However, the slide should be occasionally removed so that the saddle may be thoroughly cleaned. To remove the slide, place a board across the bedways beneath the front of the slide, remove the saddle caps and raise the rear end of the slide until the front end rests on the board.

The front top cap consists of three separate pieces, the middle portion serving as a slide clamp. The binder handle has a serrated hole for easy positioning.

TURRET, SLIDE AND SADDLE ADJUSTMENTS

1. The clamping action of the turret clamp ring is supplied by two heavy springs which may be adjusted. (Figure 8) To adjust, remove the turret clamp guard, remove the cotter pin from the castellated nut, and

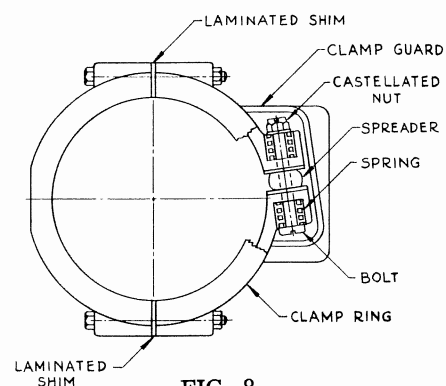


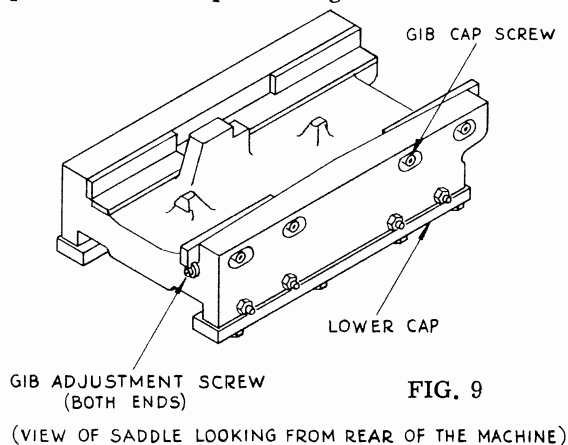
FIG. 8

holding the nut, turn the bolt. If all adjustment has already been taken up, the clamp ring must be removed. Laminated shims are located between the front and the back sections of the clamp ring. Peel off one lamination from each shim. Reassemble the clamp ring, taking care that each shim and all parts are put back exactly as they were originally. If wear has been excessive and the clamping action is still not sufficient, take another lamination from each shim as outlined. To check the clamping action, index the turret half way and then bring the slide forward. In this position the clamp ring is closed but the lock bolt is not engaged in the turret. Raise two of the turret binder bolts about two inches above the top of the turret. Place a bar between them and try to turn the turret.

2. If, after adjusting the clamp ring, the turret is still inaccurate, proceed as follows: move the slide to the rear, thus indexing the turret and opening the clamp ring. Bring the slide forward about half an inch. Insert a 1-1/2 inch bar in one of the turret holes. While applying pressure to the bar back and forth with one hand, place one finger of the other hand against the turret and on top of the clamp ring over the clamp spreader. If movement is felt at this point between the turret and clamp ring, the outer race of the tapered bearing is set too low in the slide. Then place finger against the turret and turret clamp on side opposite the clamp spreader and apply pressure as above. If movement is felt at the front of the turret the lock bolt and lock bolt bushings are worn.

Bring the slide forward until the leading edge protrudes about one inch from the saddle. Locate an indicator on the top surface of the turret. Tap the front of the clamp ring. If the indicator reading drops, either the outer race of the tapered bearing is set too high in the slide, or the flat bearing between turret and slide has become excessively worn.

The conditions outlined here should not occur for several years, even under hard usage. Correcting these troubles will entail one or more of the following operations: - relocating the tapered bearing outer race, rescraping the bearing surfaces of the turret and slide, replacing the lock bolt sleeve and bushings, and rescraping the clamp ring. Because of the skill and experience necessary to properly perform these operations, we suggest that you contact the factory Service Department before proceeding.



3. After the machine has been in operation a few months it may be necessary to adjust the slide gibs. (Figure 9) The front gibs are not adjustable. There are two rear adjustable gibs. Loosen the cap screws for each gib on the back face of the saddle. The gib adjustment screws are set into each end of the saddle.

CROSS SLIDE AND CARRIAGE

Adjustable tapered gibs are provided at the outside of the front bedway, the bottom of the rear bedway and the lower or third bedway. One long tapered gib provides adjustment for the cross slide.

The cross feed screw is mounted in two opposed radial thrust ball bearings which are slightly preloaded and do not require adjustment. An adjustable double bronze nut, located in the front face of the carriage, is provided so that backlash can be eliminated from the feed screw.

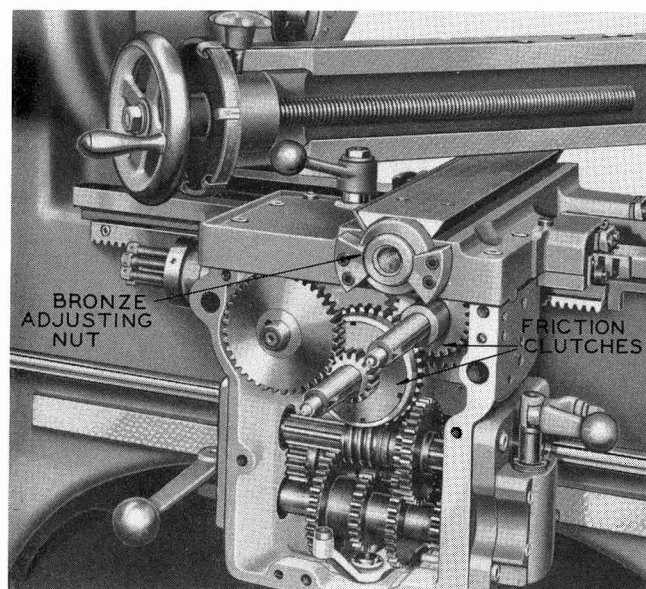


FIG. 10

CROSS SLIDE AND CARRIAGE ADJUSTMENTS

1. After the machine has been run for a few weeks check the adjustment of the gibs. Check these adjustments about twice a year thereafter. To adjust, back off the gib between the apron and lower bedway. Tighten the gib between the carriage and the front bedway until the carriage just begins to bind when the hand-wheel is turned. Then, back the gib off slightly. After releasing the set screws on the back face of the carriage, adjust the rear gibs in the same manner as indicated for the front gib. Adjust the gib between the apron and lower front way last. Tighten the cross slide gib until the slide just begins to bind. Then, back the gib off slightly. Make sure all gibs are held securely in the adjusted positions.

2. To eliminate backlash between the cross slide screw and nut, loosen the locking screws holding the bronze adjustment nut. (Figure 10) Turn the adjustment nut until the backlash is eliminated, and then retighten the locking screws.

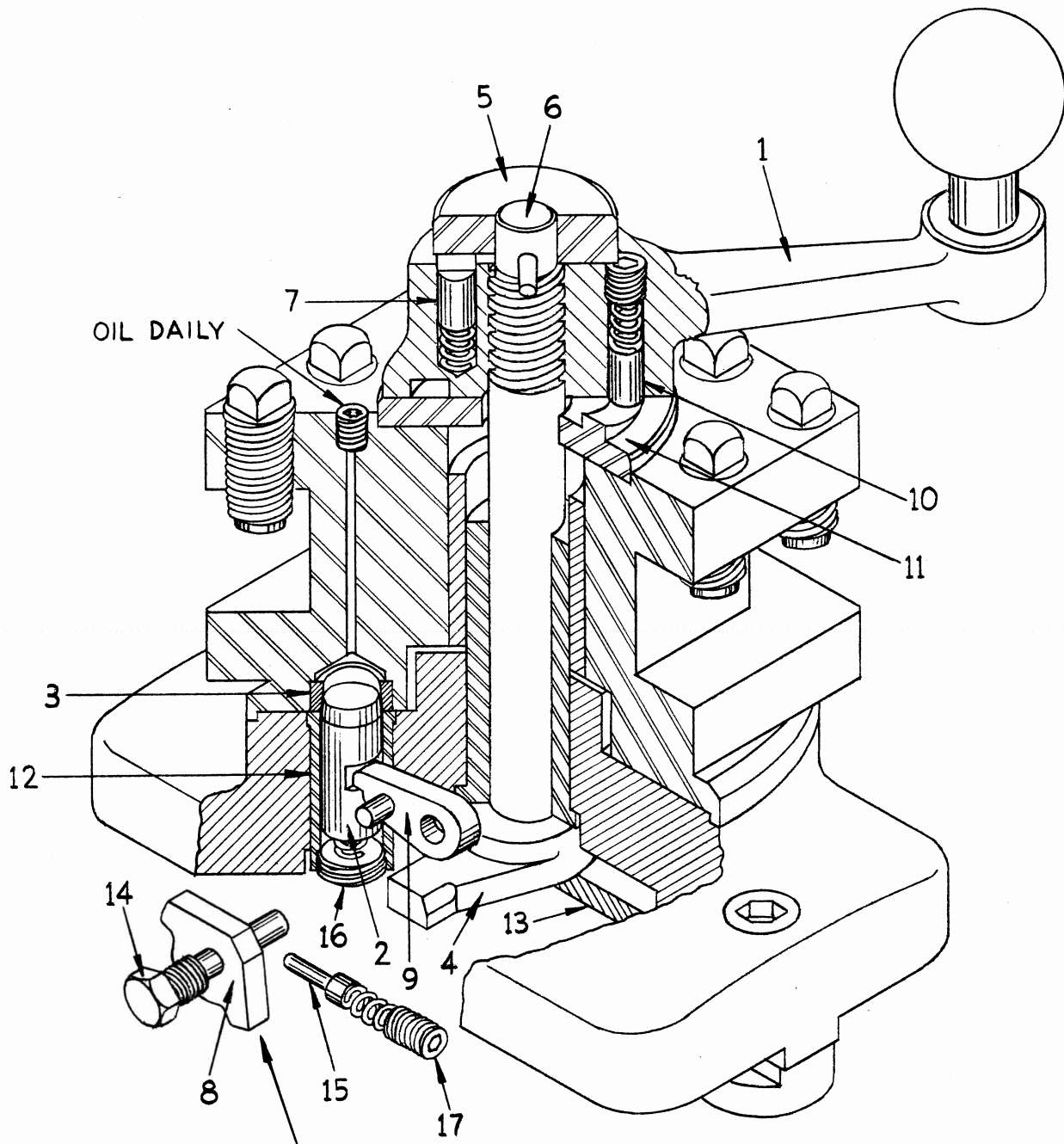
SQUARE TURRET

The Bardons & Oliver Square Turret features rugged construction and accuracy, assuring repetitive indexing within a few ten thousandths of an inch. A protective skirt around the bottom of the turret effectively keeps chips from the bearing surfaces. Daily maintenance of the square turret consists of oiling at the point indicated on the figure.

When the indexing lever (1) is in the extreme clockwise position as shown in the figure, the lockbolt (2) is seated in the turret bushing (3) and the turret is clamped to the base. Tapered pins position the lockbolt cam (4) and stud collar (5) on the center stud (6) in the proper timed relationship. The indexing sequence is as follows: - The indexing lever is moved counter-clockwise. The turret is unclamped. The hardened

pin (7) in the indexing lever engages the stud collar, causing the center stud to move with the indexing lever. The lockbolt cam engages the tumbler (8), depressing the lockbolt lever (9), which in turn disengages the lockbolt. The second hardened pin (10) in the indexing lever then engages the indexing plate (11) causing the turret to turn. The lockbolt rides on a recess in the turret until the next position is reached. Moving the indexing lever clockwise returns the lockbolt cam against the lockbolt sleeve (12). The indexing lever then disengages the stud collar and moves on the double acme threads causing the turret to be clamped to the base.

To properly maintain the square turret it should be completely disassembled and cleaned at least every six months. To completely disassemble, remove the bottom plate (13), stud collar (5), indexing lever (1),



LUG WITH RADIUS

turret, center stud (6), tumbler pivot screw (14), tumbler (8), lockbolt lever (9), tumbler plunger (15), screw plug (16), lockbolt spring, and lockbolt (3) in that order. Reassemble in the reverse order, taking care that each part is placed in its original position, particularly the tumbler and lockbolt lever. Double acme threads locate the indexing lever on the center stud. It is possible to assemble this unit with the lever 180 degrees from the proper position. If the tapered

pin which locates the stud collar on the center stud fits flush with both sides of the collar, the lever is properly positioned. If the pin goes in only half way, remove the indexing lever and reengage it opposite to the prior point of engagement. In adjusting the tumbler plunger the set screw should be tightened just enough to keep the tumbler in the proper indexing position. Tightening the set screw too much may cause the plunger to bind and shear.

DIAGNOSIS OF IMPROPER SQUARE TURRET OPERATION

The following chart lists difficulties which may be experienced with the square turret operation, and indicates the cause and remedy for each trouble.

TROUBLE	CAUSE	REMEDY
Turret remains stationary although indexing handle is turned one half revolution.	Indexing lever does not engage the indexing plate.	Remove the hardened pin in the indexing lever, clean, and on reassembly be sure the pin works freely.
Indexing lever moves only one quarter revolution and turret will not index.	Lockbolt does not dis-engage.	
	a) Set screw (17) holding tumbler plunger loosens.	Tighten set screw slowly until turret properly indexes.
	b) Tumbler plunger sticks.	Remove set screw, spring and plunger, clean, and be sure on reassembly that plunger works freely.
	c) Tumbler plunger broken.	Replace plunger. Plunger must work freely.
	d) Tumbler broken or excessively worn.	Replace tumbler.
	e) Lockbolt lever broken.	Replace lever.
Turret "Skips" or fails to stop at the next position on indexing.	Lockbolt spring worn.	Replace with about a quarter inch longer spring.
Repetitive indexing is inaccurate.	Lockbolt spring worn and lockbolt does not fully engage in turret.	Replace with about a one quarter inch longer spring.
	Lockbolt and lockbolt bushing excessively worn.	Recommend the square turret be sent back to the factory for rebuilding.
Turret drags or binds on indexing	Tools in the turret held too tightly.	Tighten tools only as much as possible with wrench provided. Do not use pipe on wrench handle.
	Bottom plate does not clear the cross slide.	Remove bottom plate, clean, and file nicks which may cause loss of clearance between the bottom plate and the base bottom.

HYDRAULIC COLLET CHUCK AND BAR FEED

The hydraulic collet chuck and bar feed are shown in Figure 11. Controls for the unit are located on the push-button control panel on the front of the headstock. The selector switch determines whether the collet operates separately or in conjunction with the bar feed. The operating lever controls the action of the collet separately, or controls the collet and bar feed together depending on the position of the selector switch.

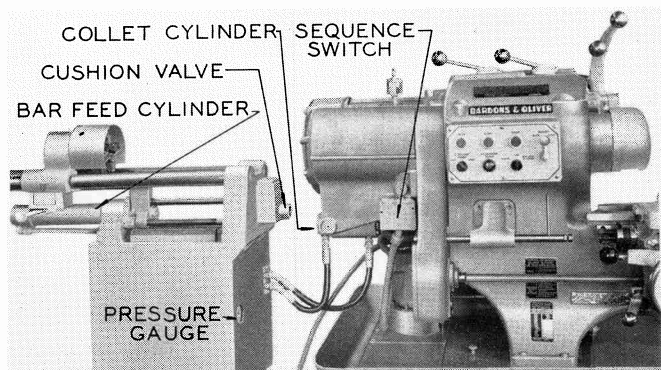


FIG. 11

The bar to be fed into the machine is held in a revolving scroll chuck. Two opposite jaws are equipped with eccentric drivers which grip on the forward stroke and release on the back stroke. The other two jaws are equipped with set screws to center the work.

The bar feed cylinder has an adjustable stroke with a maximum travel of 10 inches. An "easy to read" scale together with handy adjusting nuts, simplifies the setting of the bar feed stroke.

To insert a new bar and to regulate the grip of the scroll chuck, set the selector switch to "BAR FEED AND COLLET" and open the collet by moving the operating lever to "OPEN". Position the chuck about halfway between the bar stands by moving the lever at the bottom of the chuck head to the left. Swing the support tube forward and insert the bar. Pass the bar through the revolving chuck and just through the collet. Set the bar feed stroke for length. Close the collet. Close the chuck jaws until the drivers grip the bar securely when the chuck is moved forward, but release when the chuck is moved back. Then move the chuck all the way back.

As the collet is repeatedly opened and closed, the bar will feed forward by steps until the revolving chuck reaches the block at the front of the rack bar. After that the revolving chuck will feed the bar forward and then strip back until it passes over the end of the bar. Insert a new bar against the end of the old bar, and move the chuck head all the way back to starting position.

ADJUSTMENTS

HYDRAULIC COLLET CHUCK AND BAR FEED

Both chuck and bar feed are operated from a completely self-contained hydraulic power unit (Figure 12) located in the bar feed stand. The three solenoid valves direct the flow of oil to either the collet or the bar

feed cylinder, or directly back to the power unit sump. The relief valve has been set at the factory for 450 lbs. and should not require adjustment. The pressure may be checked by holding the operating lever in either the "OPEN" or "CLOSE" position. Do not increase the pressure over 450 lbs.

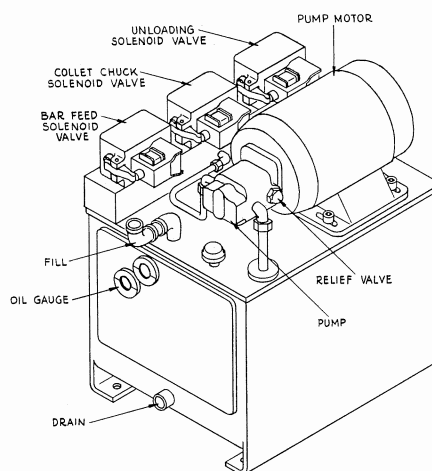


FIG. 12

Figure 13 is the hydraulic circuit diagram. The location of the various components in the diagram are shown in Figures 11 and 12. The cushion valve has two purposes. Through a cam operated valve it provides a cushion at the end of the forward stroke of the bar feed, and it also controls the speed of the return stroke.

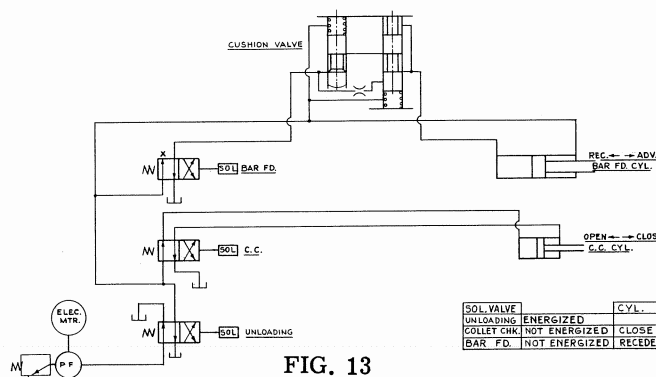


FIG. 13

Figure 14 is the electrical diagram for the bar feed and collet chuck unit. The sequence switch operates the bar feed solenoid. The bar feed brings the stock forward only after the collet has opened. When the collet is closed the switch allows the revolving head to be repositioned.

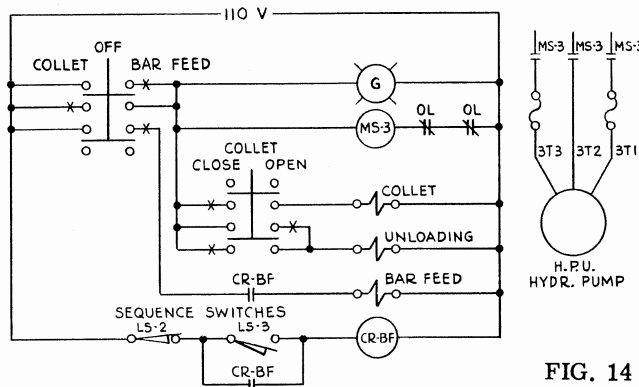


FIG. 14

HAND OPERATED COLLET CHUCK AND BAR FEED

The hand operated collet chuck and bar feed are shown in Figure 15. The bar to be fed into the machine is held in a two jaw revolving chuck located on the two rigid support bars.

A single lever, located at the front of the headstock, operates both the collet chuck and bar feed. Moving the lever away from the operator closes the collet. Moving the lever toward the operator opens the collet and actuates the bar feed through a ratchet mechanism.

When loading a bar, open the collet, swing the support tube forward, and insert the bar. Then, bring the bar forward through the revolving chuck and through the collet. Close the collet and move the revolving chuck back as far as possible. A lever located on the base of the revolving chuck releases the chuck from the ratchet mechanism and allows the chuck to slide on the support bars. Tighten the chuck jaws firmly on the bar.

As the collet is opened and closed the revolving chuck will travel forward until it reaches a stop near the end of the spindle. The chuck jaws must then be released, and the chuck must be moved to the far end of the support bars again.

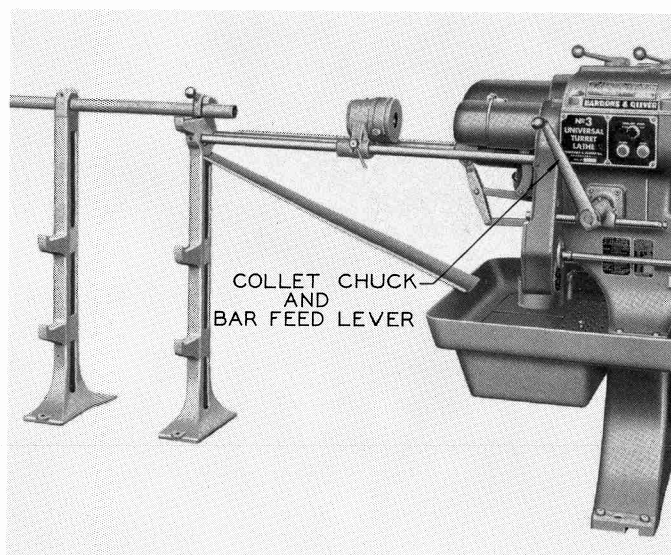


FIG. 15

COLLET CHUCK

To change collet pads remove the pad screws from the master collet. These can be reached through holes in the collet hood. (Figure 16) To avoid runout of stock, clean the master collet and pads carefully before putting in the new pads.

Dirt and fine chips working into the collet and spindle recess may cause the collet to stick and not release. To avoid this condition, remove the collet hood and clean the collet and spindle recess frequently.

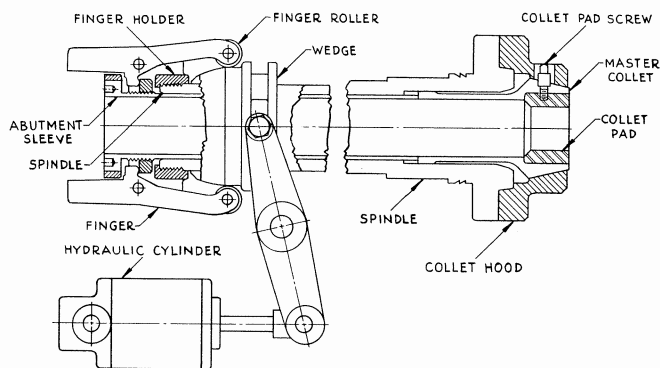


FIG. 16

COLLET CHUCK ADJUSTMENTS

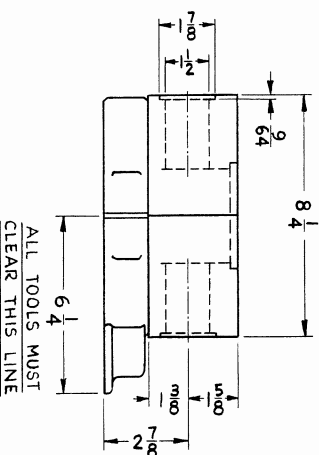
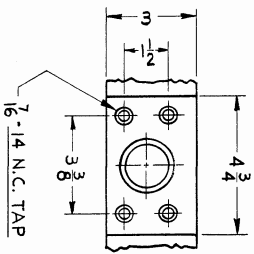
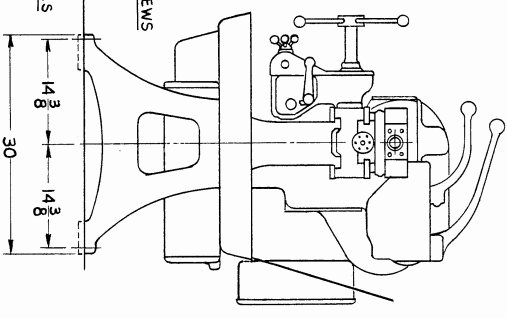
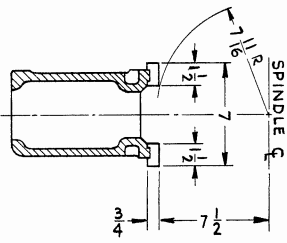
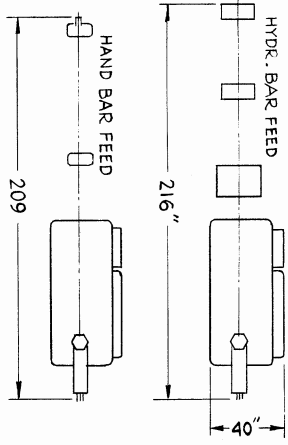
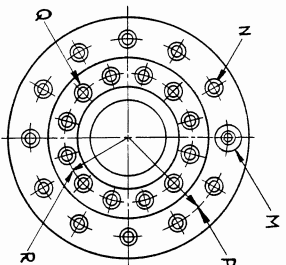
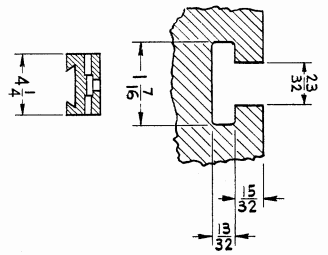
1. The grip of the collet is adjusted at the rear end of the spindle by use of the spanner wrench for which holes are provided in the end of the abutment sleeve.

(Figure 15) The finger holder should at all times abut tightly against the end of the spindle. The collet grip should be adjusted so that the finger rollers pass just beyond the top of the wedge incline when the collet is closed.

COOLANT SYSTEM

An impeller type pump with integral motor drive is mounted directly over the coolant sump, and is controlled by an independent push button switch mounted on the control panel at the front of the headstock.

The coolant sump, located at the head end of the machine, is divided into two compartments by a baffle. Metal particles settle in the first compartment, and thus the pump located in the second compartment is protected. The sump should be cleaned frequently.



	$1\frac{1}{2}$ " TM CAPACITY	2" TM CAPACITY
A	6 $\frac{1}{2}$	8 $\frac{1}{4}$
B	4 $\frac{3}{16}$	5 $\frac{1}{2}$
C	2 $\frac{3}{8}$	3 $\frac{1}{2}$
D	$\frac{3}{8}$	$\frac{11}{16}$
E	1	1 $\frac{1}{8}$
F	3 $\frac{7}{8}$	4
G	1 $\frac{13}{16}$	2 $\frac{5}{8}$
H	30 $\frac{3}{16}$	30 $\frac{1}{16}$
J	1 $\frac{7}{8}$	2 $\frac{3}{8}$
K	2 $\frac{1}{2}$ -12 PITCH	3" TM -12 PITCH
L	1 $\frac{1}{8}$	1 $\frac{3}{8}$
M	$\frac{3}{4}$ C BORE - $\frac{5}{16}$ DR. 1 $\frac{1}{2}$ -18 TAP - $\frac{9}{16}$ DP.	$\frac{13}{16}$ C BORE - $\frac{3}{8}$ DR. $\frac{3}{8}$ -16 TAP - $\frac{5}{8}$ DP.
N	2-13 N.C. TAP THRU ELEVEN HOLES	5-11 N.C. TAP - $\frac{1}{16}$ DR. ELEVEN HOLES
P	2 $\frac{3}{8}$	3 $\frac{3}{8}$
Q	2-13 N.C. TAP - $\frac{7}{16}$ DR. TWELVE HOLES	5-11 N.C. TAP - $\frac{1}{16}$ DR. TWELVE HOLES
R	1 $\frac{5}{8}$	2 $\frac{1}{8}$

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