

TECHNICAL MANUAL

**OPERATOR'S, ORGANIZATIONAL, DIRECT SUPPORT
AND GENERAL SUPPORT MAINTENANCE MANUAL
INCLUDING REPAIR PARTS LIST**

FOR

**BORING MACHINE, ENGINE CYLINDER
(MODEL FN)
(KWIK-WAY MFG. CO.)
(NSN 4910-00-473-6361)**

HEADQUARTERS, DEPARTMENT OF THE ARMY

MAY 1980

Technical Manual }
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HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 5 May 1980

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REPORTING OF ERRORS

You can improve this manual. If you find any mistakes or know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual direct to: Commander, US Army Armament Materiel Readiness Command, ATTN: DRSAR-MAS, Rock Island, IL 61299. A reply will be furnished direct to you.

NOTE

This manual is published for the purpose of identifying an authorized commercial manual for the use of the personnel to whom this boring machine is issued.

Manufactured by: KWIK-WAY MANUFACTURING COMPANY
MARION, IA 52302

Procured under Contract No. DAAA09-76-C-6595

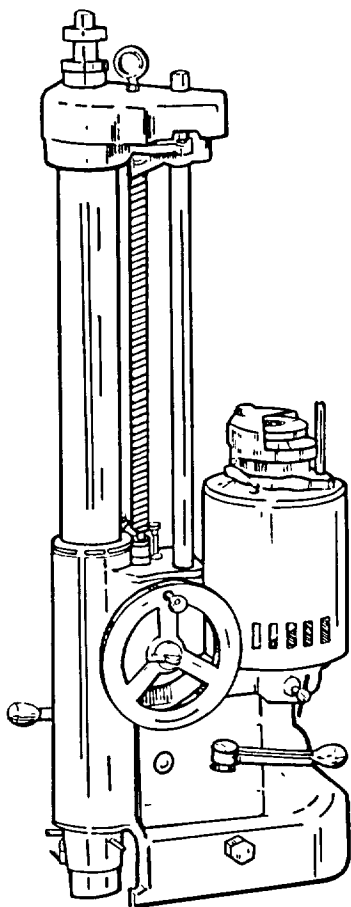
This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain available information that is essential to the operation and maintenance of the equipment.

INSTRUCTIONS FOR REQUISITIONING PARTS
NOT IDENTIFIED BY NSN

When requisitioning parts not identified by National Stock Number, it is mandatory that the following information be furnished the supply officer.

- 1- Manufacturer's Federal Supply Code Number - 11140
- 2- Manufacturer's Part Number exactly as listed herein.
- 3- Nomenclature exactly as listed herein, including dimensions, if necessary.
- 4- Manufacturer's Model Number "FN"
- 5- Manufacturer's Serial Number (End Item)
- 6- Any other information such as Type, Frame Number, and Electrical Characteristics, if applicable.
- 7- If DD Form 1348 is used, fill in all blocks except 4, 5, 6, and Remarks field in accordance with AR 725-50.
 - (a) In blocks 4, 5, 6, list manufacturer's Federal Supply Code Number 11140 followed by a colon and manufacturer's Part Number for the repair part.
 - (b) Complete Remarks field as follows:

Noun: (nomenclature of repair part)
For: NSN: 4910-00-473-6361
Manufacturer: Kwik-Way Manufacturing Company
Model: "FN"
Serial: (of end item)
Any other pertinent information such as Frame Number, Type, Dimensions, etc.



BORING MACHINE, ENGINE CYLINDER

INSTRUCTIONS & PARTS LIST FOR OPERATING
MODEL FN BORING MACHINE, ENGINE CYLINDER

CLEAN MACHINE

Clean the machine thoroughly, removing all dust and grit collected in transit. The rust preventative used on the machine and all parts may be quickly removed with a cloth dampened in solvent. Clean bottom of machine base in like manner.

LUBRICATION

TRANSMISSION - A certain amount of oil is left in the transmission after testing. CHECK THE OIL LEVEL BEFORE OPERATING THE MACHINE. Remove the slot head pipe plug immediately under the shift lever on the handwheel side of the machine. There should be sufficient oil in the transmission to flow from this hole. If the oil level is not high enough to flow from this hole, then remove the pipe plug immediately under the front edge of the motor and pour SAE #30 oil in the upper hole until it runs out of the lower one; then replace both plugs. MAINTAIN THE OIL LEVEL PROVIDED BY THE PLUG IN THE COVER IMMEDIATELY UNDER THE SHIFT LEVER ON THE HANDWHEEL SIDE OF THE MACHINE DO NOT EXCEED IT.

MOTOR BEARING AND DRIVE SHAFT PULLEY BEARINGS - This machine is equipped with sealed ball bearings on the motor shaft which will not need additional lubrication and the drive shaft pulley assembly is, also, equipped with sealed ball bearings so no lubrication is necessary. Wipe the drive shaft with thin layer of oil to provide lubrication for the sliding action of the pulley moving up and down the shaft.

OILERS - There are snap lid oilers immediately behind the handwheel and under the front edge of the motor. The snap lid oilers should be lubricated regularly.

FEEDSCREW - Lubricate the feedscrew occasionally by squirting the oil directly on the threads of the screw. Filling the ring at the base of the screw will lubricate the thrust bearing.

BORING SPINDLE - The boring spindle is mounted on a pre-packed bearing and a sealed ball bearing so additional lubrication is not necessary.

MOTOR CURRENT

Be sure the motor is of the proper voltage and cycle for the current available. The motor nameplate will give this information.

OPERATION OF MACHINE

Before inserting the plug on the motor cord into the outlet, be sure the motor switch is in OFF position. Before turning the motor on, be sure both levers are in the center or neutral position.

The operating levers on this machine are removable and can be positioned to meet the operator's ease of handling. The following instructions are written covering the movement of the levers when mounted with the lever on the handwheel side pointing back towards the motor end of the machine. The lever on the side opposite the handwheel vertical in neutral position.

THE LEVER ON THE HANDWHEEL SIDE OF THE MACHINE IS THE GEAR SHIFT. Maximum downward feed and spindle R. P. M. are obtained with the lever in the raised position, slow feed and R. P. M. are obtained with the lever in the lower position. The gear shift is in neutral or disengaged with the lever in the center position.

THE LEVER ON THE SIDE OF THE MACHINE OPPOSITE THE HANDWHEEL IS THE FEED CONTROL. When moved to the back position, it arranges the machine to feed downward. When moved to its forward position, it arranges the machine to retract or raise the sleeve. In center or neutral position, the feed is disengaged. Lever cannot be pulled to retraction position without depressing Retraction Release Plunger. See diagram on Page - 4 -

THE FEED SELECTOR KNOB IS LOCATED ON TOP OF MAIN BASE CASTING. See table of speeds and feeds on Page - 5 -

THE TOGGLE LOCATED AT THE CENTER OF THE HANDWHEEL ENGAGES AND DISENGAGES THE AUTOMATIC FEED. Raising the toggle disengages the clutch on the handwheel shaft and allows the operator to feed the machine by hand for such operations as counterboring and chamfering. The machine can be hand cranked manually at any time when the feed lever is in neutral position.

To start downward feed, set the Feed Selector Knob UP for slow feed, DOWN for fast feed, move the feed control lever to the back position and shift the gear shift lever either up for high speed or down for low speed. It will be necessary for the handwheel to rotate the feed shaft for a partial turn before the feed selector key will drop into gear and start feeding.

If it is necessary to stop the boring held at any time before the tool has passed completely through the cylinder, extend the toggle in the center of the handwheel to straight-out position. If it is then necessary to retract the sleeve, press the Retraction Release Plunger and move the feed lever to the FORWARD position.

CAUTION

HANDWHEEL WILL SPIN ON AUTOMATIC RETRACTION.

When the tool has passed through the cylinder, the rotation of the spindle and the downward feed will stop, if the automatic stop has been set. To raise the sleeve out of the cylinder, press the Retraction Release Plunger; lever will return to neutral position when the sleeve reaches the upper end of travel.

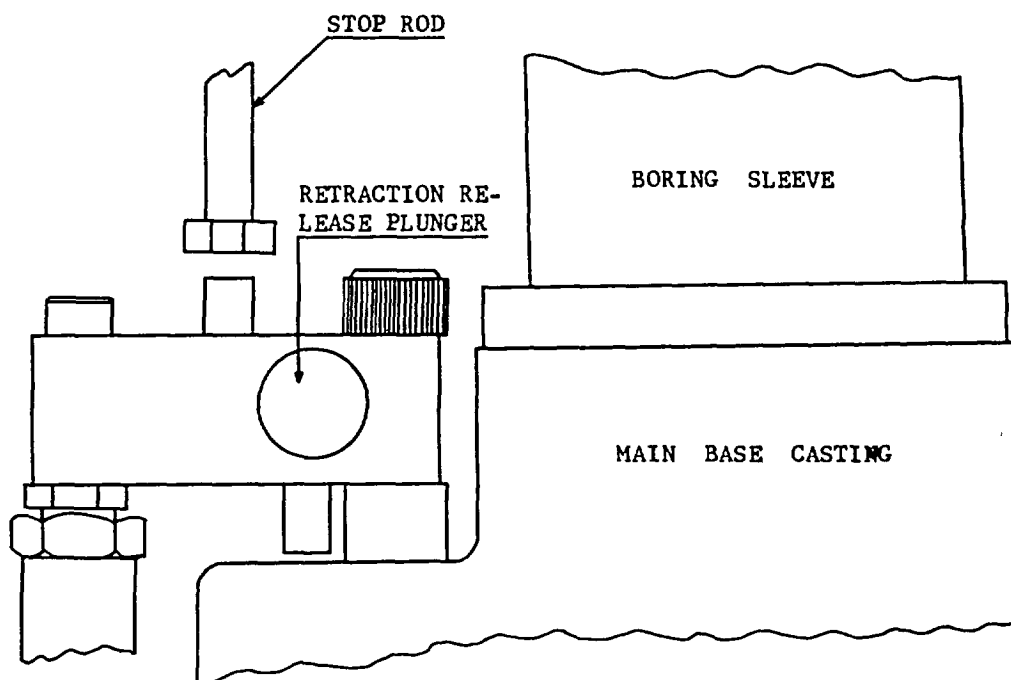
HAND CRANKING - If at any time you desire to crank the machine manually, it is necessary that you have the feed lever in the neutral position or the toggle in the center of the handwheel raised so it will disengage the clutch on the handwheel.

CHANGING SPEEDS - The machine can be shifted from high to low speed or vice versa at any time as long as the feed lever is in the BACK or feed position. The gear shift lever cannot be moved unless the feed lever is in the BACK or feed position. The feed selector knob cannot be reset unless feed lever is in NEUTRAL position or toggle, in center of handwheel, is in extended or straight-out position.

IMPORTANT

DO NOT ATTEMPT TO BORE WITH MACHINE WITHOUT FIRST CHECKING THE MICROMETER SETTING BY BORING IN A SCRAP CYLINDER. REFER TO INSTRUCTIONS ON SETTING AND ADJUSTING THE MICROMETER. DO ALL TEST BORING ON A SCRAP BLOCK UNTIL YOU ARE SATISFIED WITH RESULTS OBTAINED.

RETRACTION SAFETY LOCK



This machine is equipped with a special retracting lock assembly that will prevent the operator from accidentally engaging the retracting mechanism.

The above diagram is for reference only, and the operation will be very easily followed when you check it out on the machine. If the stop rod is set to disengage the feed and stop the rotation of the boring head after it clears the bottom end of the cylinder being bored, it will spring load the retracting mechanism so the bar will automatically retract from the cylinder when the Retraction Release Plunger is pressed.

If you wish to retract the bar at any time, when it has not been disengaged by the stop rod, it will be necessary for you to press the retraction release plunger and pull forward on the feed lever.

The Retraction Release Plunger is merely a locking mechanism which will allow the bar to come into neutral, but not go into retraction.

CAUTION

READ COMPLETELY BEFORE ATTEMPTING TO OPERATE MACHINE SPEED AND FEED COMBINATION

SELECTOR KNOB POSITION	GEAR SHIFT POSITION	HEAD R.P.M.	FEED IN/MIN
UP	UP	490	2.70
UP	DOWN	263	1.47
DOWN	UP	490	3.79
DOWN	DOWN	263	2.04

- 1 - Selector Knob is located on top of main base casting.
- 2 - Gear Shift Lever on handwheel side of machine.
- 3 - Feed Control Lever on side of machine opposite handwheel.
- 4 - Toggle Located In Center Of Handwheel engages or disengages the automatic feed. Drop the toggle for engaging feed. Pull up to straight out or extended position to disengage feed.
- 5 - When Selector Knob is in UP position, feeds and speeds are similar to previous Model F or Model FT Cylinder Boring Machines.
- 6 - Selector Knob is used in DOWN position for rough boring with fast feed. See Number 10.
- 7 - Feed Control Lever must be in Neutral to toggle, in center of handwheel, in extended position before feed selector can be moved.
- 8 - Allow time for feed selector to engage. If the feedscrew does not start turning, after one revolution of the handwheel, move selector knob slightly up or down to allow the key to engage.
- 9 - NOTE Stay clear of handwheel when raising feed control lever for retraction. Handwheel spins.
- 10 - CAUTION - DO NOT ATTEMPT TO TAKE CUTS OF MORE THAN 0.030" WITH THE FEED PLUNGER IN THE DOWN OR FAST FEED POSITION. This may damage the handwheel cross shaft by overloading. This Fast Feed is for light fast rough cuts and is not a heavy stock removal feed.

PROCEDURE

CYLINDER BLOCK PREPARATION

Remove all studs.
 Clean carbon and oil from surface. File top of block to remove burrs.
 Mike all cylinders for largest worn diameter.

SPECIAL ANCHOR BOLTS

Two special short anchor bolts are furnished with the machine and additional sizes are available. These can be turned into the head bolt holes in the block. Turn bolt down on anchor gage to set height.

INSTALLING ANCHOR BOLT ASSEMBLY

Select proper length clamp and centering screws. See Page - 7 -
 Build up anchor bolt to proper length, using combination of bushings and extension as necessary. See Page 10

CENTERING AND CLAMPING

Wipe base of machine clean.
 Place machine in position over anchor bolt.
 Remove anchor gage.
 Select proper centering fingers, then PUT POINTED END of each into the boring head and push all the way in.
 Lower sleeve to desired position for centering - using handwheel.
 Tighten centering handwheel, at extreme top of bar, until all three fingers are tight against cylinder wall.
 Clamp machine to cylinder block, using hex head screw on side of the base.
 USE WRENCH FURNISHED - A LONGER WRENCH WILL CLAMP TOO TIGHTLY - See Page - 8 -
 Loosen centering handwheel all the way and raise sleeve back to top position.

ROUGH BORE

Lap roughing R tool. See Page - 12 -
 Set Micrometer. See Page - 15 -
 Set Plunger. See Page - 15 - Figure - 9 -
 Insert R tool holder in head.
 Set tool with micrometer and lock in place. See Page - 16 -
 Lower sleeve carefully until tool is 1/16" above top of block.
 Set stop rod according to bore length and engage feed.
 Lap finishing F tool while rough boring. See Page - 13 -
 When machine stops, rotate head until the index line, below the centering handwheel is forward. Rotating the head and tool to this position will eliminate any marking of the cylinder by the tool when retracting.
 Press retraction release plunger to retract sleeve from cylinder.

FINISH BORE

Remove roughing tool and install finishing F tool.
 Set micrometer to desired finished size and proceed as before.
 When bore is complete, turn boring head, by grasping vertical drive shaft, until the index line, below the centering handwheel, is to the front of the machine and raise sleeve from bore.
 Unclamp machine and move to next cylinder; then proceed in same manner.

CAUTION

ALWAYS CLOSE MICROMETER COVER AFTER SETTING TOOL. CLEAN MICROMETER HOLE IN BORING HEAD WITH BRUSH BEFORE INSTALLING MICROMETER.

ANCHORING DEVICE

Furnished with the anchoring device are different lengths of clamps, centering screws and anchor bolts. The capacities of these different parts are as follows:

ANCHOR CLAMP ASSEMBLIES

055-0461-23	Anchor Clamp Assembly #1	Capacity	2-5/8" to 3-1/4" Diam.
055-0462-20	Anchor Clamp Assembly #2	Capacity	3-1/4" to 3-7/8" Diam.
055-0463-28	Anchor Clamp Assembly #3	Capacity	3-7/8" to 4-1/2" Diam.
055-0464-25	Anchor Clamp Assembly #4	Capacity	4-1/2" to 5-1/4" Diam.

CENTERING SCREWS

065-0456-05	Centering Screw - Short	Capacity	Up to 3-13/16" Diam.
055-0457-47	Centering Screw - Medium	Capacity	3-13/16" to 4-5/16" Diam.
062-0457-01	Centering Screw - Long	Capacity	4-5/16" Diam. and Up

EXTENSION RODS

055-0471-46	Short Extension Rod	4-5/8" Long	Capacity	4-1/2" to 7"
055-0472-43	Medium Extension Rod	6-5/8" Long	Capacity	6-1/2" to 10"
055-0473-40	Long Extension Rod	8-5/8" Long	Capacity	8-1/2" to 12"

INSTALLATION OF ANCHORING DEVICE

The anchoring device is to be fastened into the cylinder next to the one to be bored. In the case of a four cylinder block, only two settings of the anchoring device are required, as Number 1 and Number 3 cylinders can be bored with anchoring device in Number 2 cylinder, and Number 2 and Number 4 can be bored with the anchoring device in Number 3 cylinder. A six or eight cylinder block requires four settings of the anchoring device.

To install the anchoring device, proceed as follows:

Select the longest length of clamp which will freely enter the bore when in the inverted position shown in Figure 3. Then, if the shoulders A-A allow more than 1/16" endwise movement of the clamp, loosen the two adjusting screws (each one the same amount as nearly as possible by eye) until the endwise movement is between 1/32" and 1/16". Then fasten this clamp to the anchor body by means of the clamp pivot pin, in the position indicated in Figure 2.

Turn the centering screws in if necessary (keeping each one/as nearly central with the centering spider as possible by eye) until it will freely enter the cylinder and yet have little side play in any direction. Select the proper combination of extension rods and coupling with the anchor clamp and body. Screw the assembly in or out until the approximate length is obtained.

The device is now ready to be put in place, but before inserting it, first examine the bottom of the cylinder bore to determine the best position on which to clamp. Whenever possible, we advise setting the clamp crosswise of the cylinder block, but if ribs or sloping walls interfere, use the nearest to a crosswise location which provides sufficient flat surface on which to hook the clamp

CAUTION

THE CLAMP MUST NEVER BE HOOKED LENGTHWISE OF THE BLOCK IF THE CYLINDERS ARE SO CLOSE TOGETHER THAT ONE END OF THE CLAMP WOULD PROJECT BEYOND THE WALL OF THE CYLINDER TO BE BORED. In other words, the MOST IMPORTANT CAUTION to be observed in positioning the clamp is NEVER ALLOW THE CLAMP TO PROJECT TO A POSITION WHERE THE BORING TOOL COULD STRIKE IT. Second in importance is selecting as flat a place as possible at the bottom of the cylinder on which to hook the clamp.

Now, tilt the clamp on its pivot pin until the anchor will enter the cylinder and rotate to such a position as determined by examination described in the above two paragraphs. Then lower until the upper tilted end can be hooked against one side wall and pull up until the clamp engages both sides, as shown in Figure 4. Pull up on the clamp nut and shake the clamp back and forth to make sure both shoulders (or adjusting screws) of the clamp are inside the cylinder. Continue to pull up on the clamp nut and at the same time, adjust length until the U-shaped anchor gage (Figure 1) can be slipped into place. Then, turn the clamp nut down almost tight against the gage. See Figure 4. The device will now be in position, as shown by Figure 2 or Figure 4, and is ready for the machine to be slid over it. Turning one of the centering screws slightly will lock the assembly in the cylinder.

Push the machine over the open end of the anchor gage first, as this allows removal of the gage after the clamp nut engages the T-slot in the machine.

CAUTION IN CLAMPING

IN CLAMPING THE MACHINE TO THE BLOCK, ALWAYS USE THE SPECIAL WRENCH FURNISHED FOR THIS PURPOSE. THE CLAMPING DEVICE INSIDE THE BASE OF THE MACHINE HAS A POWERFUL LEVERAGE, AND ONLY A MEDIUM PULL ON THIS WRENCH IS NECESSARY TO POSITIVELY CLAMP THE BAR. A HEAVY PULL ON THIS WRENCH WILL CLAMP THE BAR TOO TIGHTLY AND CONSEQUENTLY DISTORT THE CYLINDER BLOCK, RESULTING IN OUT-OF-ROUND HOLES AFTER THE MACHINE HAS BEEN UNCLAMPED. OVER-CLAMPING WILL, ALSO, FORCE THE CLAMP NUT, FORMING DEPRESSIONS IN THE T-SLOT OF THE ANCHOR CLAMP. THIS WILL EVENTUALLY CAUSE CENTERING TROUBLE AS THE CLAMP NUT WILL SLIP INTO THE DEPRESSIONS WHILE CLAMPING, MOVING THE MACHINE OFF CENTER AS FORCE IS APPLIED TO THE CLAMP.

CAPACITY OF CENTERING FINGERS

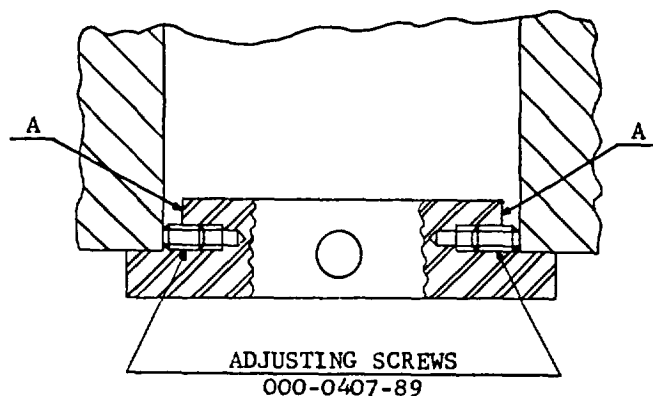
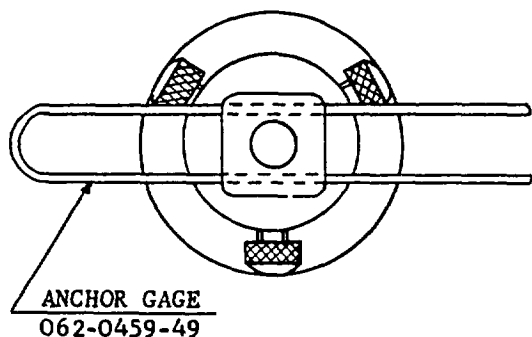
The range of cylinder sizes covered by each set of centering fingers is as follows:

062-0361-33	Centering Finger #1	(Set of 3)	2-21/32" to 3-1/8"
062-0362-30	Centering Finger #2	(Set of 3)	3-9/64" to 3-9/16"
062-0363-38	Centering Finger #3	(Set of 3)	3-35/64" to 4"
062-0364-35	Centering Finger #4	(Set of 3)	3-63/64" to 4-7/16"
062-0365-24	Centering Finger #5	(Set of 3)	4-27/64" to 4-7/8"
062-0366-30	Centering Finger #6	(Set of 3)	4-55/64" to 5-21/64"

NOTE

Capacity may be increased by added special equipment.

FIGURE 1



- 065-0456-05 CENTERING SCREWS - SHORT
- 055-0457-47 CENTERING SCREWS - MEDIUM
- 062-0457-01 CENTERING SCREWS - LONG

FIGURE 3

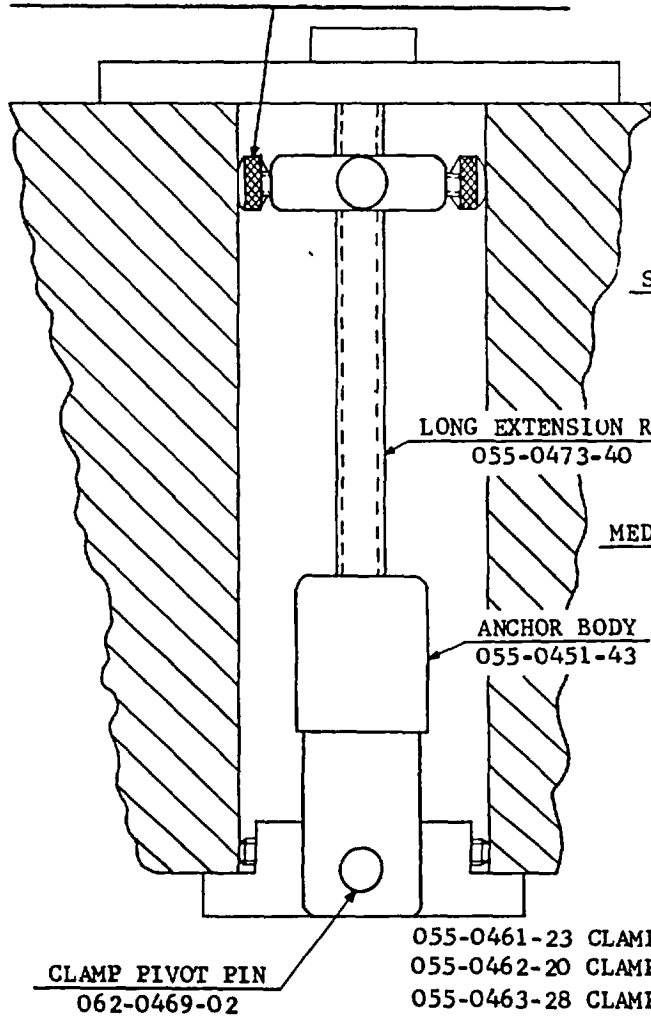


FIGURE 2

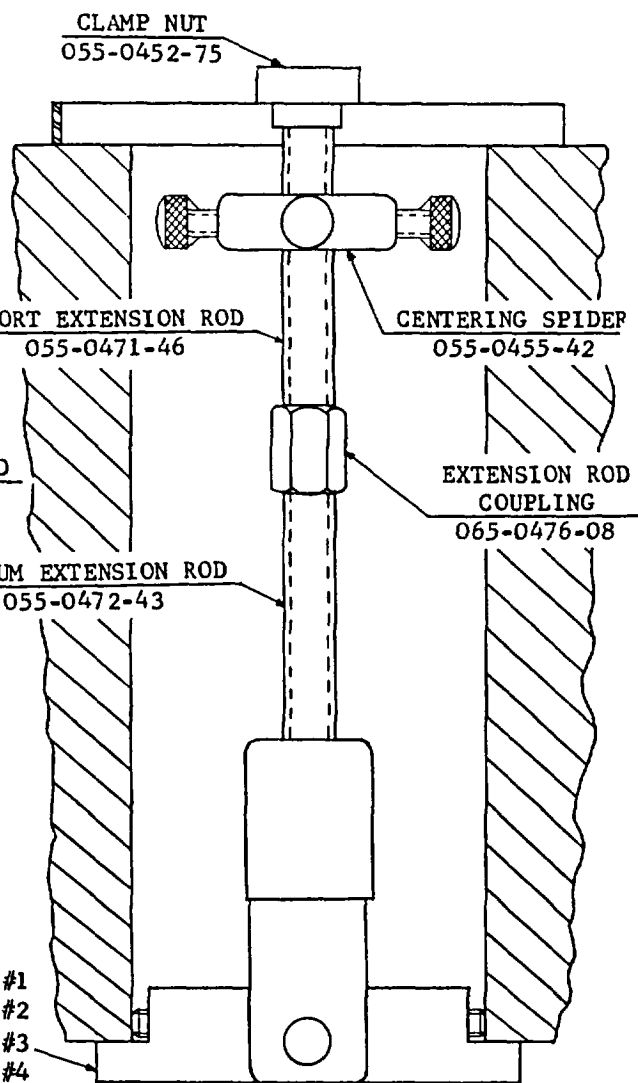


FIGURE 4

The tool bits used are tipped with Tungsten Carbide. TUNGSTEN CARBIDE IS AN EXTREMELY HARD AND BRITTLE SUBSTANCE AND MUST, THEREFORE, BE HANDLED WITH GREAT CARE AT ALL TIMES.

Figures 5 and 8 show the tool bit (greatly enlarged) in the roughing and finishing operations of boring as seen when looking directly toward the tool face.

Both these figures show the three different angles which are lapped on the end of the tool bit. These are numbers 1, 2 and 3.

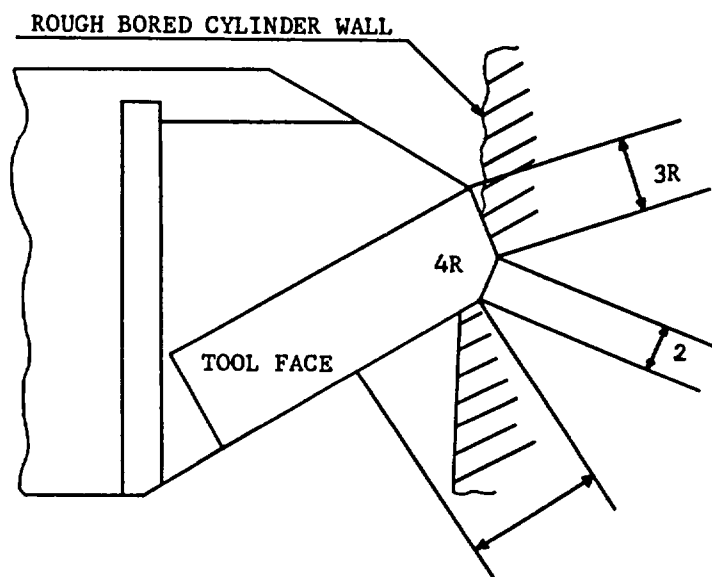


FIGURE 5
ROUGH BORING TOOL BIT
IN CUTTING POSITION

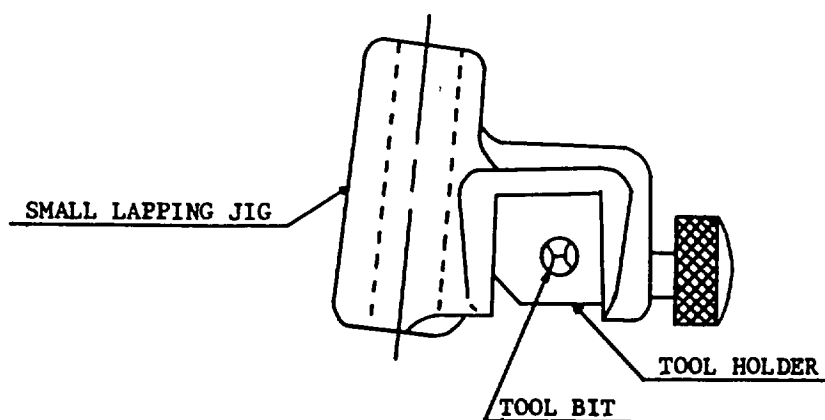


FIGURE 6
LAPPING JIG FOR LAPPING ROUGH BORING
TOOL BIT IN POSITION 4R

LAPPING THE ROUGHING TOOL

On the roughing tool, Figure - 5 -, a part of portion 1 and all of portion 2 remove the metal in boring and are, therefore, the parts of the tool that wear and must be reconditioned. The lapping operations will be as follows:

- 1- The first operation is to lap the tool face, Figure - 5 -, by using the small lapping jig shown in Figure - 6 -. Lap only until you have removed all built-up material from the face of the tool.
- 2- Then place the tool holder in the large lapping jig as shown in Figure 7 and set the swivel casting that holds the tool to position 1 as illustrated. Lap in this position until portion 1, Figure - 5 -, is smooth.
- 3- Shift swivel casting to position 2, Figure - 7 -, and lap portion 2, Figure - 5 - until portion 2 is in good condition.
- 4- Shift to position 3R, Figure - 7 -, and lap portion 3R, Figure - 5 -, until 2 has the proper width. For roughing tool, this width should be eight thousandths for the average size bore.

Under ordinary conditions, the roughing tool will bore six cylinders without relapping. There are exceptions, however, when the tool should be lapped more often, due to hard material or large and long bores. Examine the tool after each hole to check its condition. A sharp free-cutting tool requires less power and maintains consistent hole size so time spent in touching up the tool will improve results.

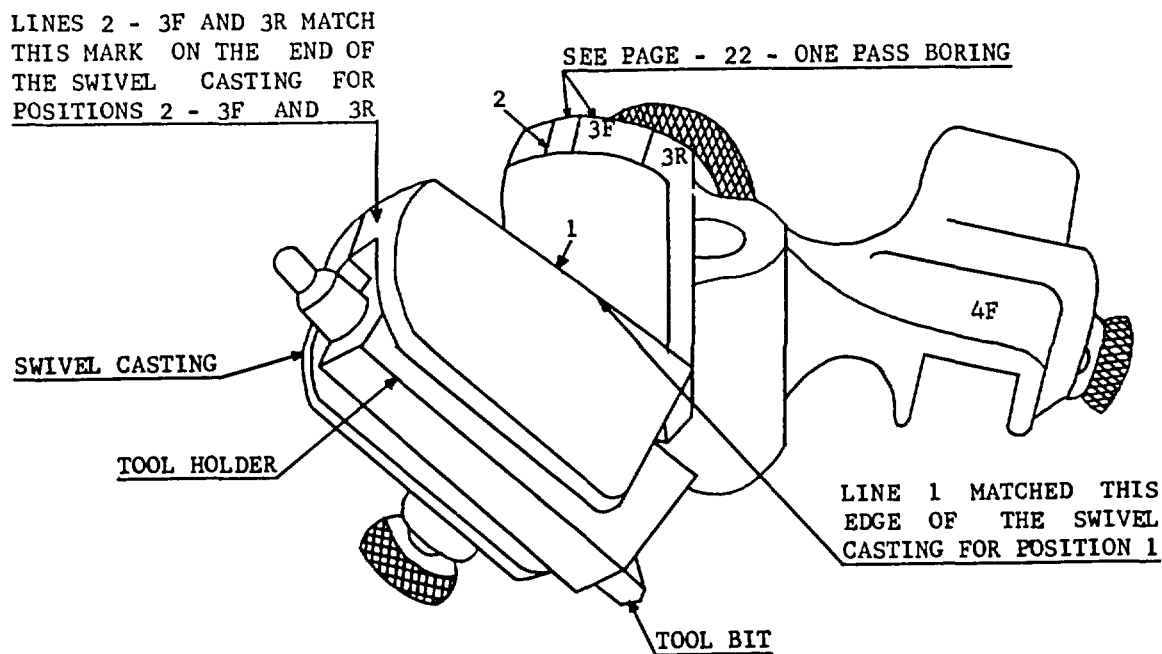


FIGURE 7
LARGE LAPPING JIG SHOWING THE DIFFERENT
POSITIONS FOR LAPPING THE TOOL

LAPPING THE FINISHING TOOL

On the finishing tool, Figure - 8 -, portion 2 is the part that produces the finish cut. The condition of portion 2, therefore, determines the final finish. The finishing tool bit is lapped only in the large jig and in positions 4F, 1, 2, and 3F.

- 1- The first operation is to lap the tool face, Figure - 8 -, with the tool in position 4F of the large lapping jig. Lap only until you have removed all built up material from the face of the tool.
- 2- Then place the tool holder in the large lapping jig as shown in Figure - 7 - and set the swivel casting which holds the tool to position 1 as illustrated. Lap in this position until portion 1, Figure - 8 - is smooth.
- 3- Shift the swivel casting to position 2 and lap portion 2 until it is smooth.
- 4- Then shift to position 3F and lap portion 3F until 2 has the proper width. This should be from 0.020" to 0.050", depending on the bore size, as explained on Page 14 under "Most Important Part Of The Tool".
- 5- Lap the finishing tool as outlined above, AFTER EVERY HOLE.

To fully understand the purpose of each lapping operation, carefully study the enlarged views of the tool, at the same time holding one of the tools in your hand in position shown in these views.

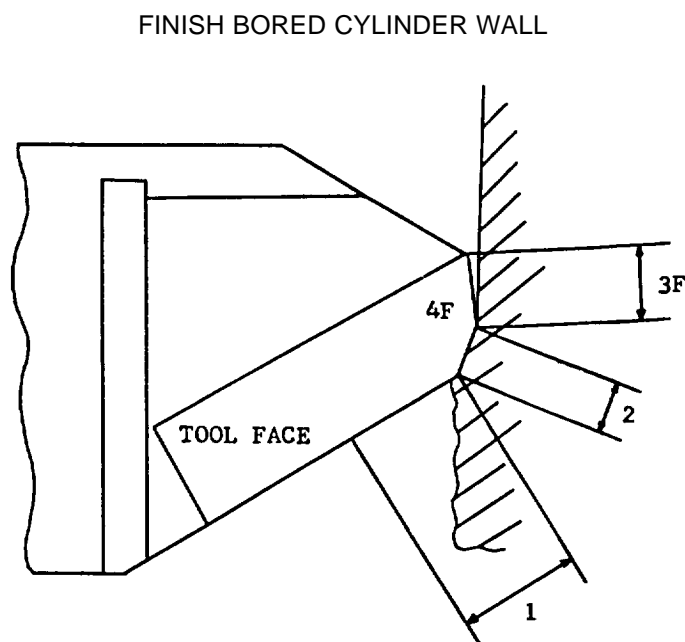


FIGURE 8
FINISH BORING TOOL BIT IN
CUTTING POSITION

MOST IMPORTANT PART OF THE TOOL

The portion 2 is by far the most important part of the tool and its width and condition will determine absolutely the quality of cylinder wall finish left by the tool in boring. The following rules apply to this part of the tool and, if observed, will provide the best results possible.

- 1- Portion 2 is widened by lapping operation number 2 and narrowed by either 1 or 3 (F or R) preferably 3, because it is faster.
- 2- Widening portion 2 improves the finish but at the same time, increases the tendency of the tool to chatter. The width of portion 2 **MUST, THEREFORE, BE WATCHED CAREFULLY.**
- 3- The correct width of portion 2 depends on the diameter of cylinder to be bored. For holes up to 3-1/4", the width on F tool should be about 0.040". For holes larger than 3-1/4" (and longer than 9") it will be necessary to reduce this width somewhat, the amount depending on the tendency to chatter at the bottom of the hole. For the largest holes, the width should be about 0.020".

Careful examination of the tool before lapping will show a gray line along portion 2. This is the wear that takes place on this keen edge after it has bored a hole. In lapping, you must remove this gray line in order to restore the **KEEN CUTTING EDGE** which is of vital importance in getting a good finish. The keenness of the edge of portion 2 is especially important.

MISCELLANEOUS SUGGESTIONS ON LAPPING

In all lapping operations, lower the jig very carefully to the lapping disc. **IF THE TOOL IS DROPPED ON THE DISC, BOTH TOOL AND DISC ARE SUBJECT TO DAMAGE.**

To get the best results in lapping, oscillate the tool with a short, quick movement. Never lap any more than is necessary. To facilitate lapping operations, keep the steel filed away from the Tungsten Carbide, similar to a new tool.

The lapping at positions 2 and 3 should be done toward the center of the disc. The lapping at positions 1 and 4 should be toward the edge.

CARE OF THE DISC:

KEEP THE FELT WICK IN THE LAPPING DISC GUARD SATURATED WITH A GOOD GRADE OF LIGHT MOTOR OIL (OR SPECIAL LAPPING DISC OIL). IF THE DISC IS USED DRY, THE TUNGSTEN CARBIDE PULLS THE DIAMOND POWDER OUT OF THE DISC AND WILL SHORTEN ITS LIFE. THE FREE USE OF OIL ON THE DISC WILL NOT ONLY IMPROVE THE RESULTS, BUT GREATLY PROLONGS DISC LIFE. OCCASIONALLY THE LAPPING DISC WILL BECOME GUMMED UP AND APPEAR DULL . CLEANING WITH SOLVENT WILL IMPROVE ITS CUTTING QUALITY. DO NOT PRESS FELT WICK DOWN TIGHT AGAINST THE LAPPING DISC AS TOO MUCH PRESSURE WILL SERVE AS A BRAKE AND REDUCE THE USABLE POWER OF THE MOTOR.

SETTING THE TOOL IN THE BORING HEAD

Determine the size to bore and set the micrometer. Each graduation of the micrometer body, or one revolution of the thimble, represents fifty thousandths.

For the roughing cut, the micrometer should be set two thousandths smaller than the desired finished size. Two thousandths is the proper amount for the finish cut. After setting the micrometer, lock it with the micrometer lockscrew. Loosen the plunger lockscrew and place the R tool holder along side the micrometer spindle as shown in Figure 9. Move the plunger until the overall length of the tool, tip of tool to tip of plunger, is approximately 1/2 inch longer than the extended length of the micrometer stem.

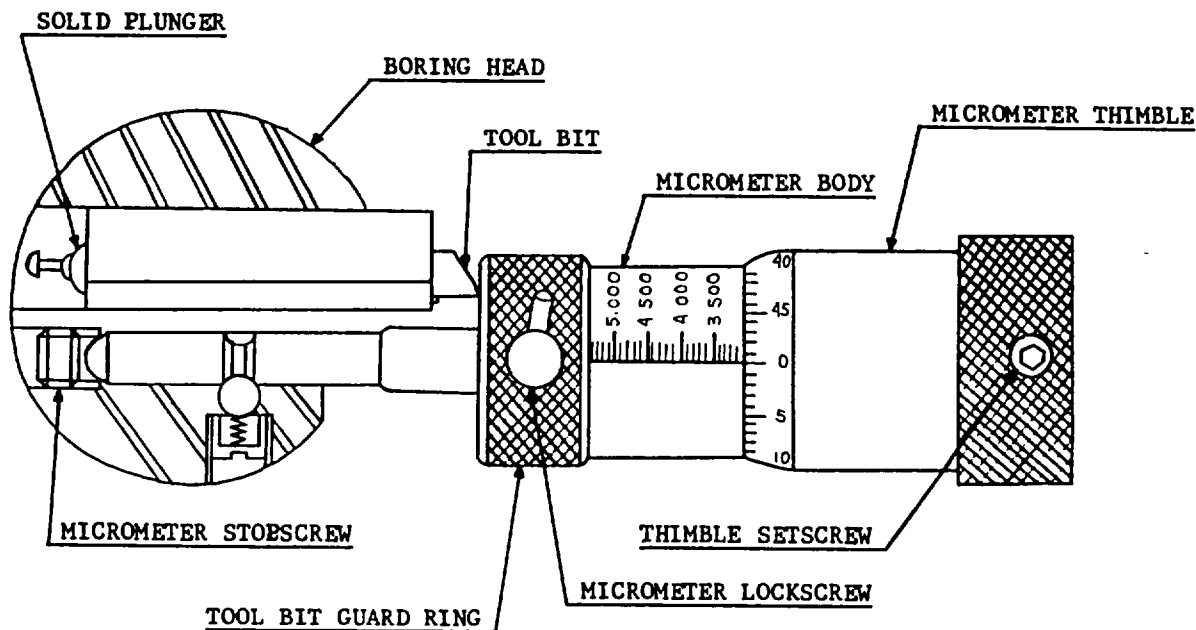


FIGURE 9

SETTING THE TOOL IN THE BORING HEAD

CAUTION

UNLESS THE PLUNGER IS PROPERLY SET, IT WILL BE IMPOSSIBLE TO MAINTAIN UNIFORMITY OF BORE SIZES.

Figure 9 shows the tool holder in the boring head ready to be locked in position. The small spring plunger is partly compressed, thus pushing the tool holder and tool bit out against the face of the micrometer body with a light spring pressure.

- 1- Before inserting micrometer spindle in boring head, clean hole with bristle brush furnished.
- 2- Insert the tool holder in the boring head. Turn guard ring on micrometer to the left (to protect tool bit and micrometer), insert the micrometer spindle in boring head and push it in until it clicks into place.
- 3- Turn the tool bit guard ring back to the right, allowing the tool bit point to gently contact the micrometer face. DO NOT rotate micrometer while tool is in contact with the face; scratches will affect setting size.
- 4- Lock the tool holder in place, remove micrometer.

NOTE

For best uniformity of tool setting, use the same part of the mike face in contact with the tool bit for all settings. This is easily done by keeping the micrometer lock screw in the same position each time.

CAUTION

When removing the tool holder from the boring head, have one hand on the tool to prevent its flying out.

The finishing tool is set in the boring head in exactly the same way, after resetting the micrometer for the desired finished size.

IMPORTANT:

Be sure the setting of the boring machine micrometer corresponds with the inside micrometer used in measuring the cylinders. If necessary to reset the tool setting micrometer, proceed in the following manner:

First, set the boring tool with the tool setting micrometer to take a light cut and lock the knurled thumbscrew to retain the micrometer setting. Bore about an inch down, then measure the hole with the inside micrometer.

Second, loosen the setscrew in the hub of the thimble of the tool setting mike, turn the thimble to correspond with the measured size of the hole, and lock the setscrew.

Third, after thus adjusting the micrometer thimble, set the micrometer to a size 5 or 10 thousandths larger, bore again and recheck.

If further adjustment is necessary, reset the thimble and check again. Repeat until the two micrometers read alike.

MICROMETER SPINDLE LOCK ADJUSTMENT

In setting the boring tool for size, the micrometer is automatically held against a stop in the boring head by spring pressure on a ball which enters a groove in the micrometer spindle. The spring pressure on the ball is adjustable by means of a setscrew in the side of the boring head. See Figure 9.

In setting the tool holder in the boring head, the spring pressure on the ball must overcome the spring pressure of the plunger in the tool holder so as to hold the tool holder in the proper position while being locked in the boring head. The spring pressure in the tool holder will vary according to the position of the plunger in the tool holder.

If the setscrew for adjusting the pressure on the ball is backed out too far, it is possible the end of the micrometer spindle will not be held against the stop in the back of the head. This will cause the machine to bore oversize at times and make it impossible to secure uniformity of bore sizes.

Whenever difficulty is encountered in sizes or uniformity of bore sizes, this adjustment should be checked. The setscrew should be screwed in until it stops, and should then be backed out one-half turn. There should be a distinct click when the ball enters the groove of the micrometer spindle and thrusts the end of the spindle against the stop in the boring head.

This machine is equipped with a special adjustable micrometer stopscrew in the back of the boring head. See Page -15 - Figure 9. This stopscrew should not be moved to correct micrometer setting and adjusting as moving it in any way will require a readjustment of the micrometer as discussed in a preceding paragraph. Page - 16 - Under Heading IMPORTANT .

The preceding paragraph explained the principle of the ball and spring pressure applied to the groove in the micrometer stem. This special stopscrew is adjusted so the ball that applies pressure to the groove in the micrometer stem just breaks over the edge of the groove and holds the micrometer tight against this stopscrew. If at any time it is necessary to change micrometers or if the mike screw develops end play in the boring head, this screw can be reset to position the ball properly at the edge of the groove on the stem so the micrometer will snap into the boring head and be held firmly without end play. Whenever a readjustment of this screw is necessary, it is extremely important that the bar be set up on a scrap block and the micrometer again be reset as explained in the paragraph under the heading IMPORTANT Page - 16 -.

ADJUSTING THE BORING SLEEVE MAIN BEARING

An improper adjustment of the main sleeve bearing on the Cylinder Boring Machine may cause trouble in the operation of the machine. This adjustment should be checked frequently. The adjusting of the sleeve bearing is a delicate operation and too much stress cannot be laid upon it. The most important thing to keep in mind in making this adjustment is that in order to maintain the maximum bearing area on the sleeve, you must have a good fit on the adjustable bearing at the extreme top and extreme bottom of the bearing area. If you have a good adjustment on the two center screws of the split bearing and the top and bottom screws are not clamping the bearing down against the sleeve, the sleeve will not be properly stabilized in the bearing and chatter, size variation and out-of-round trouble will develop in the bore.

The Cylinder Boring Machine sleeve bearings are properly adjusted when they leave the factory, but due to vibration and handling in shipment, you have no assurance that the sleeve will be properly adjusted when the machine is uncrated. Due to the importance of this adjustment, the machine should be readjusted before being put in service.

Four sets of adjusting screws are provided for this bearing, four large clamping screws and four smaller locking screws.

The adjustment is made by setting each set of screws separately beginning with the upper and lower adjusting screws and then the two center screws.

First loosen all four setscrews. Tighten the bottom clamping screw while moving the handwheel back and forth until a considerable drag is felt on the handwheel. Tighten the lockscrew of this set until it leaves a slight drag on the handwheel as the sleeve is moved up and down. Should this adjustment leave no drag or too great a drag after tightening the lockscrew, loosen the lockscrew and reset the clamp screw. Over tightening of the lockscrews will distort the bearing and cause uneven wear.

THE ADJUSTMENT AT THE BOTTOM OF THE BEARING AND THE ADJUSTMENT AT THE TOP OF THE BEARING IS MOST IMPORTANT AND SHOULD BE MADE PROPERLY BEFORE PROCEEDING WITH THE CENTER ADJUSTMENT SCREWS.

Adjust the top set of screws in the same manner. The drag on the handwheel should be slightly increased after locking these screws. Now that both the top and the bottom sets of screws have been adjusted, the center sets of screws should be adjusted in a similar manner and after all adjustments have been made, there should be a very definite drag on the handwheel as the sleeve is raised or lowered manually by cranking.

It is extremely important that the sleeve bearing adjustment be properly made when the bar is new and it is necessary that you have this additional amount of drag on the sleeve during the break-in period. If this adjustment is carefully made, and maintained during the first few months of operation, it will be possible to then maintain hole size, eliminate chatter and out-of-roundness for long periods of time without sleeve adjustment.

PROTECT THE BASE OF THE MACHINE Upon its accuracy depends the accuracy of the boring operation. Do not set the machine on a rough or hard surface. Always set the machine on a soft piece of wood or cardboard.

TROUBLESHOOTING AND SERVICE TIPS

THE BORING TOOL

The tool bits used in this machine are tungsten carbide and are extremely hard and brittle. The tool should never be lowered until it strikes the top of the cylinder to be bored and it should never be allowed to snap up against the face of the micrometer. Rough handling in this manner may not show evidence of cracking at the time, but as soon as the tool is put in service, a chip will fall out due to this rough handling.

If the belts on the machine become worn or oil soaked and have a tendency to slip, you will, also, find that tool bit breakage is a problem. The feedscrew in the machine is gear driven direct from the motor and if the belt slips under heavy cut, the feedscrew will continue to feed the tool. This extreme pressure will snap off the end of the carbide.

Extreme overloading of the machine will, also, break the carbide tip because, if the cut is so heavy that the machine stalls while cutting, the spring back caused by shutting off the motor or taking the machine out of gear will snap the end from the carbide tip.

CHATTER

Chatter trouble may develop during the boring operation due to several different causes and a listing might possibly help you to locate the cause should this trouble occur.

- 1 - Sleeve bearing adjustment too loose.
- 2 - Boring tool needs lapping or sharpening.
- 3 - Width of Number 2 face on boring tool too wide.
- 4 - Tool bit not locked securely in tool holder.
- 5 - Top of engine block not smooth, giving a poor clamping surface for the base of the machine.

OUT-OF-ROUND CYLINDERS

You may find that after boring a cylinder, removing the boring bar and checking the cylinder with an inside micrometer, the bore does not check round. If this out-of-roundness shows up through the whole length of the bore, it probably is due to overclamping of the Cylinder Boring Machine, which has distorted the block. When the Cylinder Boring Machine clamp is released, the cylinder will return to its original position giving an out-of-round bore.

If the out-of-round condition in the bore checks excessively at the bottom and is not apparent in the top of the bore, this trouble is caused by an improper sleeve bearing adjustment which allows the tool to bore out-of-round when it is boring at a position with the sleeve farthest extended from the base. It is sometimes difficult to determine if this variation is all out-of-roundness or part taper and part out-of-roundness.

When this condition exists at the bottom of a hole, it is important that you first check the sleeve bearing adjustment to eliminate the possibility of any out-of-roundness.

VARIATIONS IN BORE SIZE

A variation in size from one cylinder to the next can quite often be the fault of the operator, although he is not conscious of causing this effect. Due to the fact that the tool holder of the machine is spring loaded and the micrometer is held against the stop plug in the boring head with spring pressure, it is very important that the operator remove his hand from the micrometer while setting the tool. Force applied to the micrometer in any way while the tool is being set and locked in place will affect bore size.

Another cause of variations in bore size may be due to using a roughing tool that has worn down until there is very little carbide left; then using a new finishing tool to make the finish cut. The great variation in position of the boring point from a worn out roughing tool to a new finishing tool will change the centerline of the cutting face sufficiently to give a variation in bore size. Because of this, it is advisable to use both roughing and finishing tools with a comparable carbide in each tool.

Variation in bore size can, also, be caused by a loose thread in the micrometer. The end play on the micrometer stem between the thread and the thimble can be adjusted to remove this condition. Please refer to Adjustment of the Micrometer on Page - 24 -.

Variation in bore size can, also, be caused by the micrometer spindle not being held firmly against the backstop with the ball in the micrometer's stem groove. The tension on this ball can be readjusted and you should check to see that the stopscrew is locked securely in place. Please refer to Micrometer Spindle Lock Adjustment on Page - 17 -.

Variation in bore size will, also, be quite evident if the operator has scratched the face of the micrometer by rotating it while the tool was in contact with this face. If such a condition does exist, and does cause trouble, it is recommended that the micrometer be returned to the factory for relapping of the micrometer face.

As mentioned in a previous paragraph, it is advisable to insert the micrometer with the thumb lockscrew up each time that the tool is set. Although the face of the micrometer is checked very carefully and extreme accuracy is maintained between the micrometer stem and the micrometer face, you will find that more accurate settings will be made if the micrometer is inserted with the thumbscrew up each time the tool is set. The tool being set will be in contact with the same portion of the micrometer face.

THE COUNTERBORING

The special counterboring tool bit, due to the small amount of cutting done by it, will require much less lapping than the regular boring tool bit. A special counterboring lapping jig is available and is recommended, but if very little counterboring is done, the tool may be lapped freehand on the lapping disc. When lapping freehand, it is important that you maintain the relief angles that were originally ground on the tool, but this is not too difficult if care is exercised in placing the tool on the disc and holding the tool steady during the lapping operation.

When lapping the tool in the special counterboring lapping jig, the jig and tool should be positioned and checked on the lapping disc before the motor is turned on. It is extremely important that you lap the tool so you will retain the relief behind the cutting edge. The counterboring lapping jig can be used for lapping the face of the tool that is down in the counterbore and, also, the front or lead face of the tool. You might find, however, that you prefer putting the tool holder in the 4F position of the large swivel head lapping Jig and lapping the lead edge with a slight negative angle. The negative angle on the lead edge will keep the tool from digging in while you are hand feeding for a counterbore and enable the operator to feed the bar more smoothly by hand. See Page - 24- for counterboring depth boring gage.

In ordering a counterboring tool for this machine specify:
062-1074-05 Counterboring Tool Bit

In ordering special counterboring lapping jig specify:
062-0581-53 Lapping Jig For Counterboring Tool Assembly

BORING CLOSED CYLINDERS

There are many applications where the operator finds it necessary to bore to the bottom of the closed cylinder. In this type of boring, it is necessary that an offset boring tool be used so that it will extend below the bottom of the boring head. This tool must be used in special offset tool holder.

In an emergency, standard tool bits can be lapped in the offset tool holder in such a way that they can be used for offset boring, but it is advisable to order special offset boring tools that have been ground for that particular purpose.

When putting an offset tool or standard boring tool in the offset tool holder, you will find it necessary to file the shank of the tool so it will conform with the angles on the tool holder.

It is usually better to remove this metal before dressing the tool so the upper end of the tool will not interfere with the setting of the tool holder in the boring head.

LAPPING THE OFFSET BORING TOOL: #1, #2 and #3 faces on the tool bit are lapped with the large swivel lapping jig that is used for lapping standard boring tools. Set the number one position the same for both roughing and finishing.

The #3F position is set for lapping the finishing tool on the same line indicated on the swivel head jig, but in lapping the roughing tool, you will find it is not possible to go back as far as the #3R position without removing a good bit of the soft metal. Move the swivel head jig around about half way between the 3F and 3R position and then check the tool on the disc so you can maintain the original angle that was ground on the tool. This position normally will come about half between the 3F and 3R position. The #2 position is then lapped on the line indicated on the swivel head jig and the width of the #2 on a roughing tool should be held to a fine line, approximately 0.005 to 0.008 while the width of the #2 on the finishing tool can be increased to 0.030 to 0.40 in width.

Since the purpose of using the offset boring tool is to bore to the very bottom of a closed cylinder, it is important that you no more than just touch the end of the tool to the disc when you are lapping the #1 face. Should this #1 face become too wide, it will leave a fillet in the bottom of the counterbore. If you want to narrow the #1 face or want the tool so it will cut a counterbore with sharp corners, move the swivel head jig around until the tool holder is parallel with the top of the jig, check the tool on the disc to see it is flat, then lap this face until the #1 position has been removed or narrowed down satisfactorily for your particular boring operation.

The #4 face on the roughing tool is lapped with the special jig for offset boring tools. When using this jig, it is important to check to see that you have a positive relief on this face of the offset boring tool so that as the roughing tool, it will peel the metal off rather than scrape or plow it off. The #4 face on the finishing tool can be lapped in the #4F position on the large swivel head lapping jig.

When ordering offset boring tools for this machine specify:

062-1258-02 Offset Tool Bit

The offset boring tool does require special tool holders and when ordering specify:

062-1030-00 Offset Tool Holder - Short

OR

062-1031-08 Offset Tool Holder - Long

When ordering lapping jig for offset tools specify:

051-0455-13 Lapping Jig Assembly - Offset

CHAMFERING

The knife edge, at the top of the cylinder or sleeve, should be chamfered and this can be accomplished by using the standard boring tool, but the special 45 degree chamfering tool bit is recommended. No special lapping instructions will be necessary for the 45 degree chamfering tool and no special jig is required because the tool can be lapped using the swivel head jig or free hand to maintain the original angle ground on the tool. The chamfering is done by hand feeding the machine. Care should be taken in setting the tool to be sure the tool is set properly in the boring head so only the carbide on the tool will touch the knife edge on the cylinder wall.

The tool should be lowered to the top of the cylinder so it is positioned ready to cut and the gear shift lever on the machine should be set for hand feeding. Turn the handwheel very slowly till the tool starts cutting because jamming the tool into the top of the cylinder wall will break the tool or produce a rough chamfer.

When ordering the 45 degree chamfering-tool bit specify:
062-1075-02 45 Degree Chamfering Tool

ONE PASS BORING

Many operators prefer to dress a tool in such a way they can produce a desirable finish while taking out 0.030 to 0.040. You will find you can produce a very excellent finish on a cut as heavy as this if the tool is properly dressed for one-pass boring. The following dressing procedure is recommended.

It is best to start with a roughing tool if you want to lap a one-pass tool because the one-pass tool should have the #4R position lapped on the front of the tool. The #1 position is lapped as indicated on the swivel head lapping jig, the #3F position lapped as indicated on the jig and the #2 position lapped as indicated on the jig, but about the same width as you normally would lap the #2 position on a finishing tool. What you actually have then is a combination between the roughing tool and the finishing tool. On larger bores or long bores where chatter is a problem, it is recommended that you lap the #2 position about 1/16 inch toward the #3F mark and #3F position about 1/16 inch toward the #3R. Lapping the tool in this way will move the #2 and the #3F position back slightly so the tool will be freer cutting and, therefore, will not have as much tendency to chatter. Lapping the #2 and #3F with this 1/16 inch relief will enable you to make the #2 considerably wider. See Figure 7, Page - 12 -.

The above lapping procedure, also, is a definite advantage when boring the extremely hard sleeves because the #3F position will give the cutting edge more support as the tool wears and will cut down on a tendency to lose size as the tool wears.

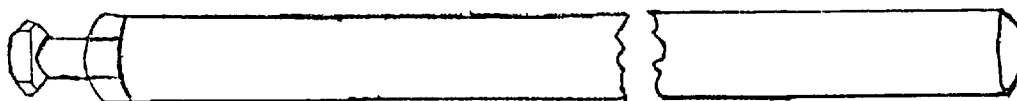
ADJUSTMENT OF THE MICROMETER

In setting the micrometer to the desired size, it is not necessary to depend on the sense of feel for accuracy; consequently, the adjustment should be such that there is a noticeable drag when the thimble is turned as contrasted with the conventional outside mike. The drag is adjustable by means of a hex nut which is accessible by removing the thimble.

In several instances, the difficulty as to bore sizes has been traced to a loosely adjusted micrometer. Any end play between the screw and body of the micrometer can affect the size of the bore. If the screw, or spindle, is worn to the extent that a nice adjustment as to drag cannot be had over the complete range, the micrometer should be returned to the factory for repair.

After making any adjustment on the micrometer, it should be checked before the machine is used to bore a good block. Take a light cut, about 1 inch down in a scrapped or demonstrating block, and measure the bore with an inside micrometer. If the setting of the boring machine micrometer does not compare with the inside mike, loosen the setscrew in the hub of the thimble of the boring machine mike, turn the thimble to correspond with the measured size of the hole and lock the setscrew in the thimble.

DEPTH BORING GAGE



A depth boring gage (roughly sketched above), for use in counterboring, is available for use with Cylinder Boring Machines. Once adjusted, any number of counterbores of exactly the same depth may be produced. Since the depth boring gages for the various models of machines are different, it is essential that orders specify with which machine the depth boring gage is to be used.

The depth boring gage is held in the keyway of the boring sleeve and the sleeve is fed downward manually. The lower end of the gage contacts the top of the boring machine and the downward travel is stopped when the cast iron pulley bracket, at the top of the machine, contacts the top of the gage. It is obvious that the depth boring gage must be adjusted according to the thickness of the flange of the sleeve being installed.

To adjust depth for the sleeve to be installed, first carefully measure thickness of flange at top of sleeve. Select feeler gages whose total thickness will equal this dimension. With boring sleeve lowered so counterboring tool just touches top of block, hold depth boring gage in keyway of boring sleeve and insert feeler gages between top of machine and lower end of gage. Then adjust screw until depth boring gage is tight between feeler gage and casting at top of sleeve. Lock adjustment with locknut. If a depth micrometer is available, the adjustment may be made by the cut-and-try method, measuring the depth of the counterbore after each cut, until the correct depth is obtained.

PLATE I

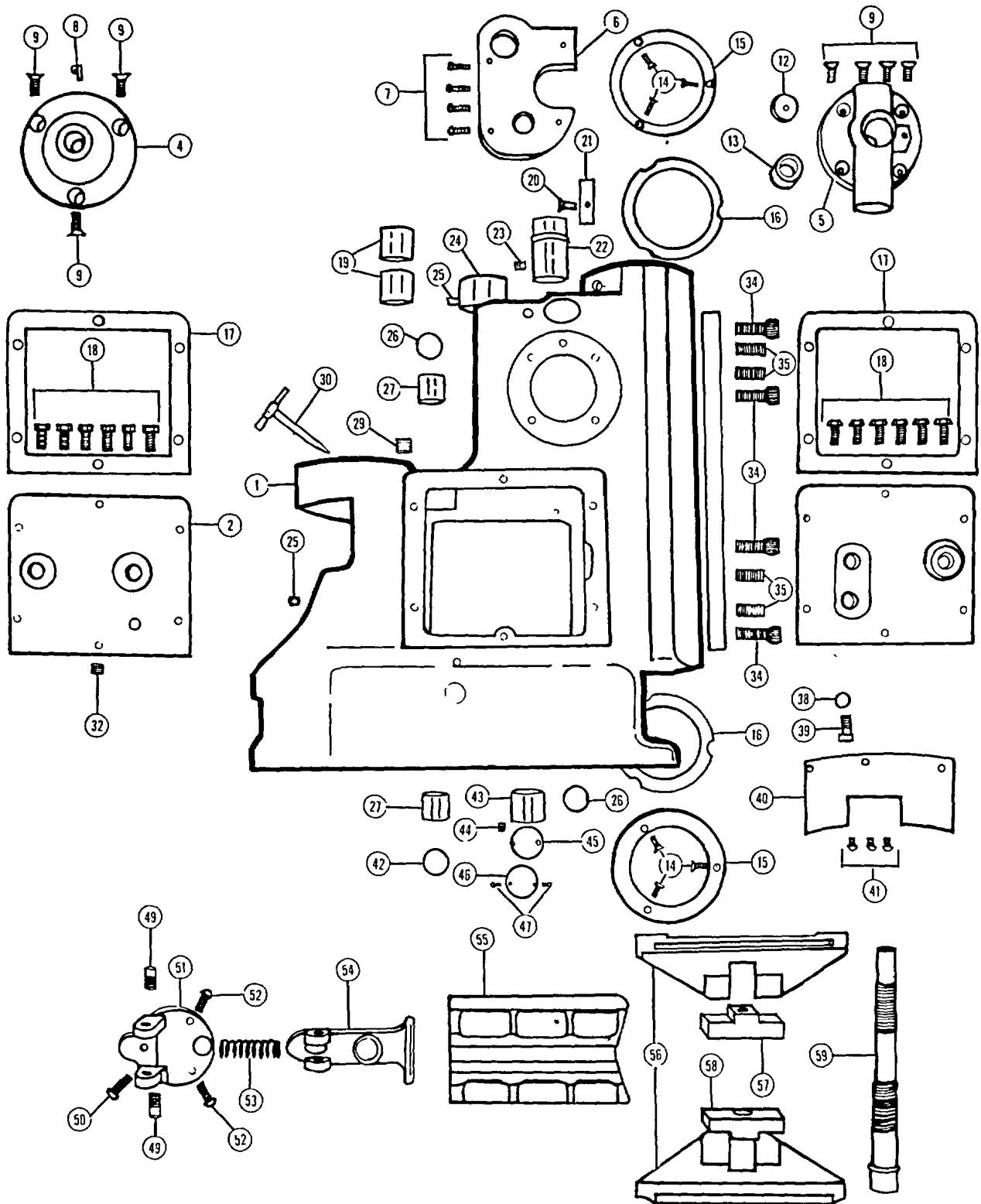


PLATE I

1	055-0101-02	Base	1	-	Req'd.
2	055-0146-04	Gear Case Cover - Front	1	-	Req'd.
3	055-0150-07	Gear Case Cover - Rear	1	-	Req'd.
4	062-0201-64	Worm Gear Shaft Bearing - Front	1	-	Req'd.
5	055-0202-48	Worm Gear Shaft Bearing - Rear	1	-	Req'd.
6	055-0162-08	Top Cover	1	-	Req'd.
7	000-0345-17	8 - 32 x 5/8 Round Head Machine Screw N. P.	4	-	Req'd.
8	000-1900-12	1/4 Snap Lid Oiler	1	-	Req'd.
9	000-0230-27	1/4 - 20 x 5/8 Flat Head Machine Screw	7	-	Req'd.
12	062-0203-69	Oil Plug	1	-	Req'd.
13	000-9203-39	Oilite Bushing	1	-	Req'd.
14	000-0222-76	8 - 32 x 1/2 Flat Head Machine Screw	6	-	Req'd.
15	055-0168-01	Felt Retainer - Lower	2	-	Req'd.
16	000-1702-32	3-1/4 x 2-5/8 x 1/4 Felt Washer	2	-	Req'd.
17	000-2000-69	Gear Case Cover Gasket	2	-	Req'd.
18	000-0100-22	1/4 - 20 x 5/8 Hex Head Capscrew	12	-	Req'd.
19	062-0165-82	Drive Shaft Center Bushing	2	-	Req'd.
20	000-0227-64	12 - 24 x 1/2 Flat Head Machine Screw	1	-	Req'd.
21	055-0181-46	Boring Sleeve Key	1	-	Req'd.
22	062-0248-60	Feed Screw Bearing	1	-	Req'd.
23	000-0590-56	Setscrew	1	-	Req'd.
24	055-0160-46	Return Shaft Upper Bushing	1	-	Req'd.
25	000-0487-63	5/16 - 18 x 5/16 Socket Cup Point Setscrew	2	-	Req'd.
26	000-1543-18	7/8 x 21/64 16 Gage Cup Expansion Plug	2	-	Req'd.
27	000-9203-39	Oilite Bushing	2	-	Req'd.
29	063-0162-92	Filler Plug	1	-	Req'd.
30	055-0103-15	Motor Thumbscrew Assembly	1	-	Req'd.
32	000-1542-45	1/8 Socket Pipe Plug	1	-	Req'd.
33	000-1740-09	1/16 x 1/2 x 12-1/4 Felt Strip	1	-	Req'd.
34	000-0170-78	3/8 - 24 x 1 Socket Head Capscrew	4	-	Req'd.
35	000-0505-39	3/8 - 24 x 7/8 Socket Flat Point Setscrew	4	-	Req'd.
38	000-2300-49	'O Ring	4	-	Req'd.
39	057-0149-46	Plunger Holder Assembly	1	-	Req'd.
40	055-0186-26	Dust Guard	1	-	Req'd.
41	000-0405-17	1/4 - 20 x 1/4 Cup Point Headless Setscrew	3	-	Req'd.
42	000-1541-64	7/8 x 14 Gage Expansion Plug	1	-	Req'd.
43	062-0133-03	Drive Shaft Lower Bushing	1	-	Req'd.
44	000-0405-17	1/4 - 20 x 1/4 Headless Cup Poin Setscrew	1	-	Req'd.

PLATE I

45	000-2000-50	Gasket	1	-	Req'd.
46	055-0134-46	Lower Bushing End Plate	1	-	Req'd.
47	000-0240-15	6 - 32 x 1/4 Fillister Head Machine Screw	2	-	Req'd.
49	065-0428-43	Locating Arm Pivot	2	-	Req'd.
50	000-0213-00	1/4 - 20 x 3/4 Round Head Machine Screw	1	-	Req'd.
51	062-0116-02	Bearing Cap	1	-	Req'd.
52	000-0212-96	1/4 - 20 x 5/8 Round Head Machine Screw	2	-	Req'd.
53	000-1800-17	Compression Spring	1	-	Req'd.
54	062-0427-45	Clamp Locating Arm	1	-	Req'd.
55	062-0421-41	Main Clamp Casting	1	-	Req'd.
56	062-0422-06	Clamp Lever	2	-	Req'd.
57	062-0423-89	Clamp Nut - Rear	1	-	Req'd.
58	062-0423-03	Clamp Nut - Front	1	-	Req'd.
59	062-0424-00	Clamp Screw	1	-	Req'd.

PLATE II

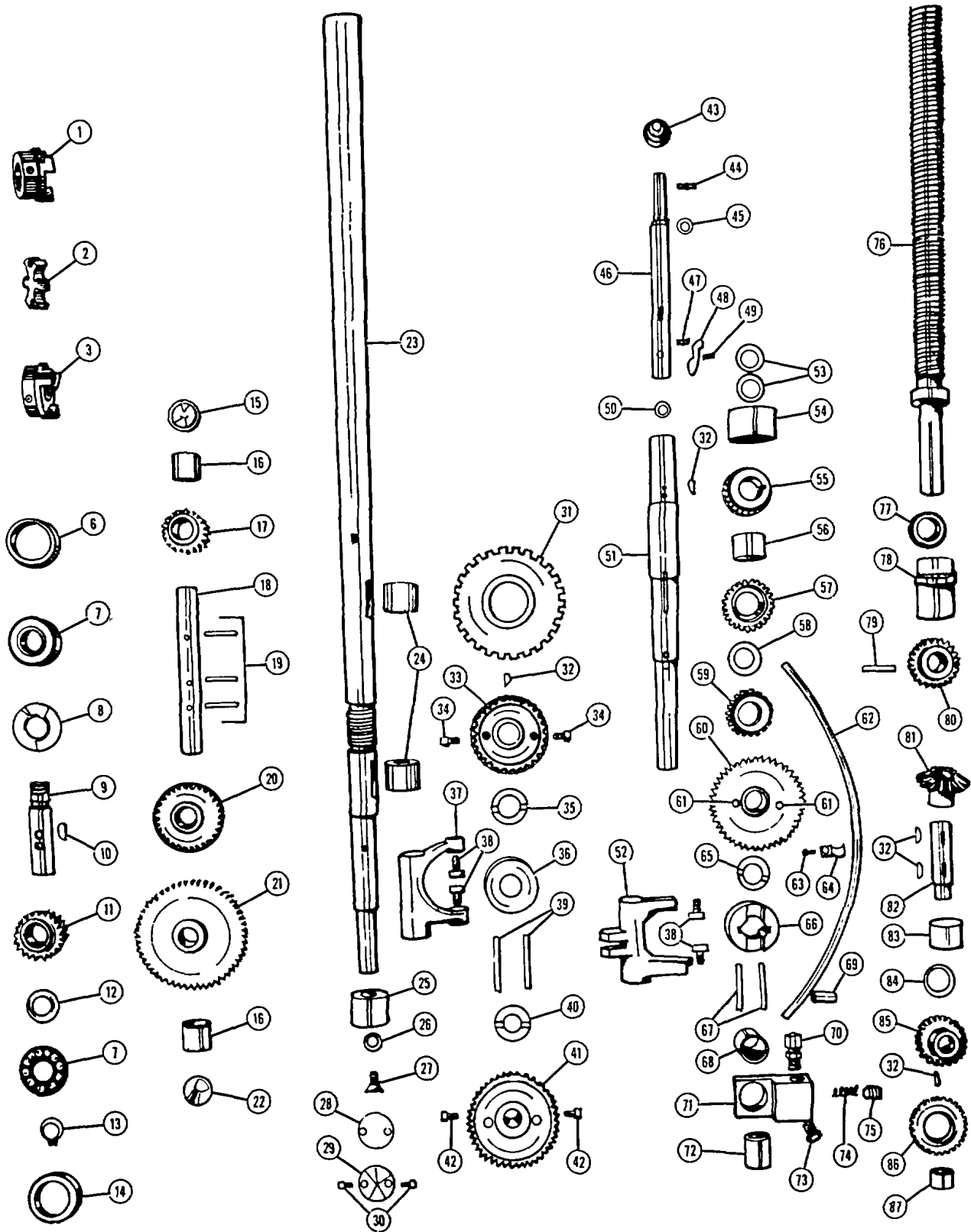


PLATE II

1	055-0110-44	Motor Driven Shaft Coupling	1	-	Req'd.
2	003-0050-97	Spider	1	-	Req'd.
3	055-0610-41	Motor Coupling	1	-	Req'd.
6	057-0115-05	Spacer	1	-	Req'd.
7	000-1603-77	Bearing	2	-	Req'd.
8	062-0112-89	Oil Slinger	1	-	Req'd.
9	055-0109-43	Motor Driven Shaft	1	-	Req'd.
10	000-7300-41	#5 Woodruff Key	1	-	Req'd.
11	062-0113-00	Motor Driven Gear	1	-	Req'd.
12	062-0112-03	Gear Spacer	1	-	Req'd.
13	000-1832-96	Snap Ring	2	-	Req'd.
14	055-0117-45	Bearing Spacer - Lower	1	-	Req'd.
15	000-1543-18	7/8 x 21/64 16 Gage Cup Expansion Plug	1	-	Req'd.
16	000-9203-39	Oilite Bushing	2	-	Req'd.
17	062-0125-01	Counter Shaft Small Gear	1	-	Req'd.
18	055-0121-05	Counter Shaft	1	-	Req'd.
19	000-7200-20	#2 x 1 Taper Pin	3	-	Req'd.
20	055-0124-07	Counter Shaft Medium Gear	1	-	Req'd.
21	055-0123-00	Counter Shaft Large Gear	1	-	Req'd.
22	000-1541-64	7/8 x 14 Gage Expansion Plug	1	-	Req'd.
23	062-0131-68	Drive Shaft	1	-	Req'd.
24	062-0165-82	Drive Shaft Center Bushing	2	-	Req'd.
25	062-0133-03	Drive Shaft Lower Bushing	1	-	Req'd.
26	062-0132-65	Drive Shaft End Washer	1	-	Req'd.
27	000-0235-07	5/16 - 18 x 5/8 Nyloc Socket Flat Head Capscrew	1	-	Req'd.
28	000-2000-50	Gasket	1	-	Req'd.
29	055-0134-46	Lower Bushing End Plate	1	-	Req'd.
30	000-0240-15	6 - 32 x 1/4 Fillister Head Machine Screw	2	-	Req'd.
31	055-0140-00	Drive Shaft Large Gear	1	-	Req'd.
32	000-7300-33	#3 Woodruff Key	1	-	Req'd.
33	055-0136-24	Drive Shaft Return Gear	1	-	Req'd.
34	062-0137-02	Clutch Pin	2	-	Req'd.
35	062-0139-07	Upper Thrust Washer	1	-	Req'd.
36	062-0141-05	Sliding Clutch	1	-	Req'd.
37	055-0143-02	Clutch Yoke	1	-	Req'd.
38	025-0221-06	Clutch Shifter Finger	4	-	Req'd.

PLATE II

39	062-0142-02	Clutch Key	2	-	Req'd.
40	062-0138-00	Lower Thrust Washer	1	-	Req'd.
41	062-0135-08	Drive Shaft Small Gear	1	-	Req'd.
42	062-0137-02	Clutch Pin	2	-	Req'd.
43	053-0293-02	Sliding Shaft Knob	1	-	Req'd.
44	000-7204-96	1/8 x 1/2 Roll Pin	1	-	Req'd.
45	000-2300-49	O Ring	1	-	Req'd.
46	055-0231-23	Sliding Shaft .1	1	-	Req'd.
47	000-7101-13	3/32 x 3/8 Roll Pin	1	-	Req'd.
48	071-0237-45	Sliding Key	1	-	Req'd.
49	000-1802-20	Compression Spring	1	-	Req'd.
50	000-1830-59	Spirolox Ring	1	-	Req'd.
51	055-0151-47	Return Gear Shaft	1	-	Req'd.
52	055-0127-09	Return Yoke	1	-	Req'd.
53	000-2300-81	O Ring	2	-	Req'd.
54	055-0160-46	Return Shaft Upper Bushing	1	-	Req'd.
55	055-0159-02	Return Shaft Drive Gear	1	-	Req'd.
56	055-0161-00	Return Shaft Bushing	1	-	Req'd.
57	055-0240-22	Return Shaft Feed Gear #2	1	-	Req'd.
58	003-0276-01	Feed Gear Spacer - Small	1	-	Req'd.
59	055-0239-21	Return Shaft Feed Gear #1	1	-	Req'd.
60	055-0157-32	Return Gear	1	-	Req'd.
61	057-0156-08	Return Clutch Pin	2	-	Req'd.
62	003-0002-49	Tubing Black 13" Long	1	-	Req'd.
63	000-0345-17	8 - 32 x 5/8 Round Head Machine Screw	1	-	Req'd.
64	000-1242-22	Hold Down Clip	1	-	Req'd.
65	057-0158-45	Return Gear Thrust Washer	1	-	Req'd.
66	055-0154-06	Return Clutch	1	-	Req'd.
67	055-0155-03	Return Clutch Key	2	-	Req'd.
68	055-0153-41	Pump Cam	1	-	Req'd.
69	000-7000-53	3/8 x 3/4 Dowel Pin	1	-	Req'd.
70	000-1561-75	Ball Check Valve	1	-	Req'd.
71	057-0152-41	Pump Body	1	-	Req'd.
72	000-9202-58	Oilless Bushing	1	-	Req'd.
73	057-0164-00	Check Valve	1	-	Req'd.
74	000-1802-38	Compression Spring	1	-	Req'd.
75	057-0169-06	Pump Spring Retaining Screw	1	-	Req'd.

PLATE II

76	055-0241-03	Feed Screw	1	-	Req'd.
77	000-1690-48	Thrust Bearing	1	-	Req'd.
78	062-0248-60	Feed Screw Bearing	1	-	Req'd.
79	000-7200-70	#3 x 1 Taper Pin	1	-	Req'd.
80	055-0247-07	Feed Screw Gear	1	-	Req'd.
81	055-0216-43	Bevel Gear	1	-	Req'd.
82	055-0235-06	Idler Shaft	1	-	Req'd.
83	055-0236-03	Bevel Gear Bearing	1	-	Req'd.
84	055-0101-88	Spacer	1	-	Req'd.
85	055-0237-00	Small Feed Idler Gear	1	-	Req'd.
86	055-0238-40	Large Feed Idler Gear	1	-	Req'd.
87	000-9200-45	Oilless Bushing	1	-	Req'd.

PLATE III

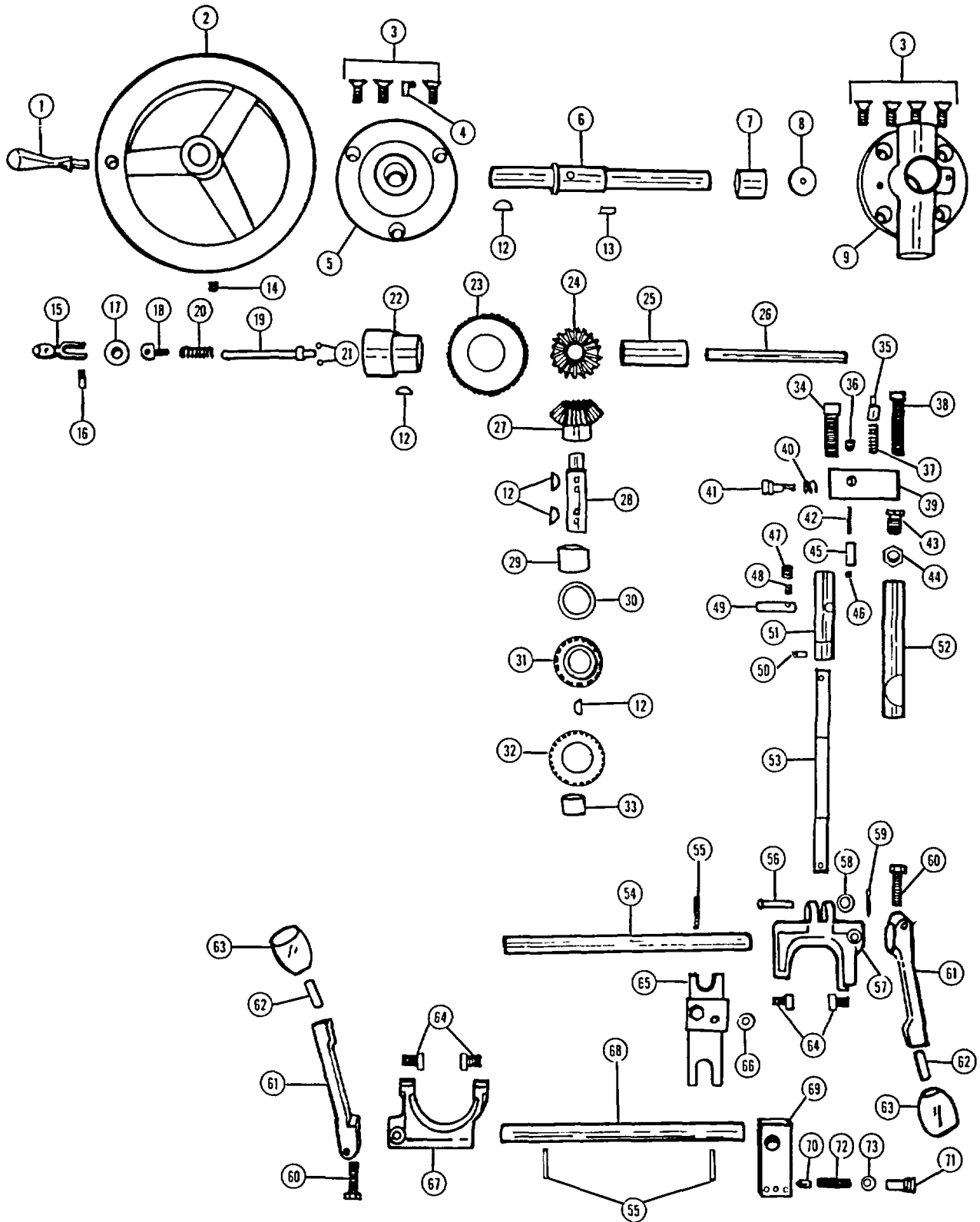


PLATE III

1	062-0245-00	Handwheel Handle	1	-	Req'd.
2	062-0208-65	Feed Handwheel	1	-	Req'd.
3	000-0230-27	1/4 - 20 x 5/8 Flat Head Machine Screw	7	-	Req'd.
4	000-1900-12	1/4 Snap Lid Oiler	1	-	Req'd.
5	062-0201-64	Worm Gear Shaft Bearing - Front	1	-	Req'd.
6	055-0206-20	Worm Gear Shaft	1	-	Req'd.
7	000-9203-39	Oilite Bushing	1	-	Req'd.
8	062-0203-69	Oil Plug	1	-	Req'd.
9	055-0202-48	Worm Gear Shaft Bearing - Rear	1	-	Req'd.
12	000-7300-41	#5 Woodruff Key	1	-	Req'd.
13	055-0249-01	Drive Key	1	-	Req'd.
14	000-0407-70	5/16 - 18 x 5/16 Headless Cup Point Setscrew	1	-	Req'd.
15	057-0219-26	Toggle	1	-	Req'd.
16	063-0219-89	Toggle Pivot	1	-	Req'd.
17	000-1180-52	Washer	1	-	Req'd.
18	062-0218-88	Toggle Link	1	-	Req'd.
19	057-0218-29	Feed Release Plunger	1	-	Req'd.
20	000-1800-68	Compression Spring	1	-	Req'd.
21	000-2100-64	1/4 Steel Ball	2	-	Req'd.
22	055-0210-23	Clutch Collar	1	-	Req'd.
23	057-0213-14	Worm Gear	1	-	Req'd.
24	055-0246-42	Bevel Gear	1	-	Req'd.
25	055-0215-03	Bevel Gear Spacer	1	-	Req'd.
26	055-0212-01	Feed Throwout Rod	1	-	Req'd.
27	055-0216-43	Bevel Gear	1	-	Req'd.
28	055-0235-06	Idler Shaft	1	-	Req'd.
29	055-0236-03	Bevel Gear Bearing	1	-	Req'd.
30	055-0101-88	Spacer	1	-	Req'd.
31	055-0237-00	Small Feed Idler Gear	1	-	Req'd.
32	055-0238-40	Large Feed Idler Gear	1	-	Req'd.
33	000-9200-45	Oilless Bushing	1	-	Req'd.
34	000-0170-35	3/8 - 16 x 1-1/4 Socket Head Capscrew	1	-	Req'd.
35	055-0228-28	Stop Plunger	1	-	Req'd.
36	000-0522-64	5/16 - 18 x 5/16 Half Dog Point Socket Setscrew	1	-	Req'd.
37	000-1802-46	Spring	1	-	Req'd.
38	000-0166-16	1/4 - 20 x 2 Socket Head Capscrew	1	-	Req'd.
39	055-0226-15	Plunger Arm	1	-	Req'd.
40	000-1806-02	Plunger Release Spring	1	-	Req'd.

PLATE III

41	055-0224-29	Plunger Arm Release	1	-	Req'd.
42	000-1800-33	Compression Spring	1	-	Req'd.
43	057-0229-22	Plunger Nut	1	-	Req'd.
44	000-1067-63	7/16 - 20 Hex Jam Nut	1	-	Req'd.
45	055-0229-84	Plunger Arm Stop	1	-	Req'd.
46	000-0591-02	10 - 24 x 5/16 Socket Cup Point Setscrew	1	-	Req'd.
47	000-0505-12	3/8 - 16 x 3/8 Flat Point Socket Setscrew	1	-	Req'd.
48	000-0485-18	1/4 - 20 x 1/4 Cup Point Socket Setscrew	1	-	Req'd.
49	055-0183-40	Stop Plunger Pin	1	-	Req'd.
50	057-0230-07	Stop Plunger Pin	1	-	Req'd.
51	055-0221-43	Return Stop Plunger	1	-	Req'd.
52	057-0225-31	Feed Control Plunger	1	-	Req'd.
53	055-0222-08	Return Rod	1	-	Req'd.
54	055-0126-01	Return Yoke Shaft	1	-	Req'd.
55	000-7200-20	#2 x 1 Taper Pin	1	-	Req'd.
56	057-0223-29	Clutch Yoke Pin	1	-	Req'd.
57	055-0121-05	Counter Shaft	1	-	Req'd.
58	000-1150-10	3/16 Wrought Iron Washer	1	-	Req'd.
59	000-0770-11	1/6 x 1/2 Cotter Pin	1	-	Req'd.
60	000-0100-57	1/4 - 20 x 1 Hex Head Capscrew	1	-	Req'd.
61	057-0147-09	Clutch Lever	2	-	Req'd.
62	000-0408-27	5/16 - 18 x 1 Headless Cup Point Setscrew	2	-	Req'd.
63	000-4500-22	Dimco Ball	2	-	Req'd.
64	025-0221-06	Clutch Shifter Finger	4	-	Req'd.
65	055-0129-46	Bar Carrier	1	-	Req'd.
66	057-0130-01	Bar Roller	1	-	Req'd.
67	055-0143-02	Clutch Yoke	1	-	Req'd.
68	055-0145-07	Clutch Yoke Shaft	1	-	Req'd.
69	057-0128-03	Clutch Saft Arm	1	-	Req'd.
70	000-2100-64	1/4 Steel Ball Included in 057-0149-46 .	1	-	Req'd.
71	057-0149-46	Plunger Holder Assembly	1	-	Req'd.
72	000-1800-92	Compression Spring Included in 057-0149-46	2	-	Req'd.
73	000-2300-49	O Ring Included in 057-0149-46	1	-	Req'd.

PLATE IV

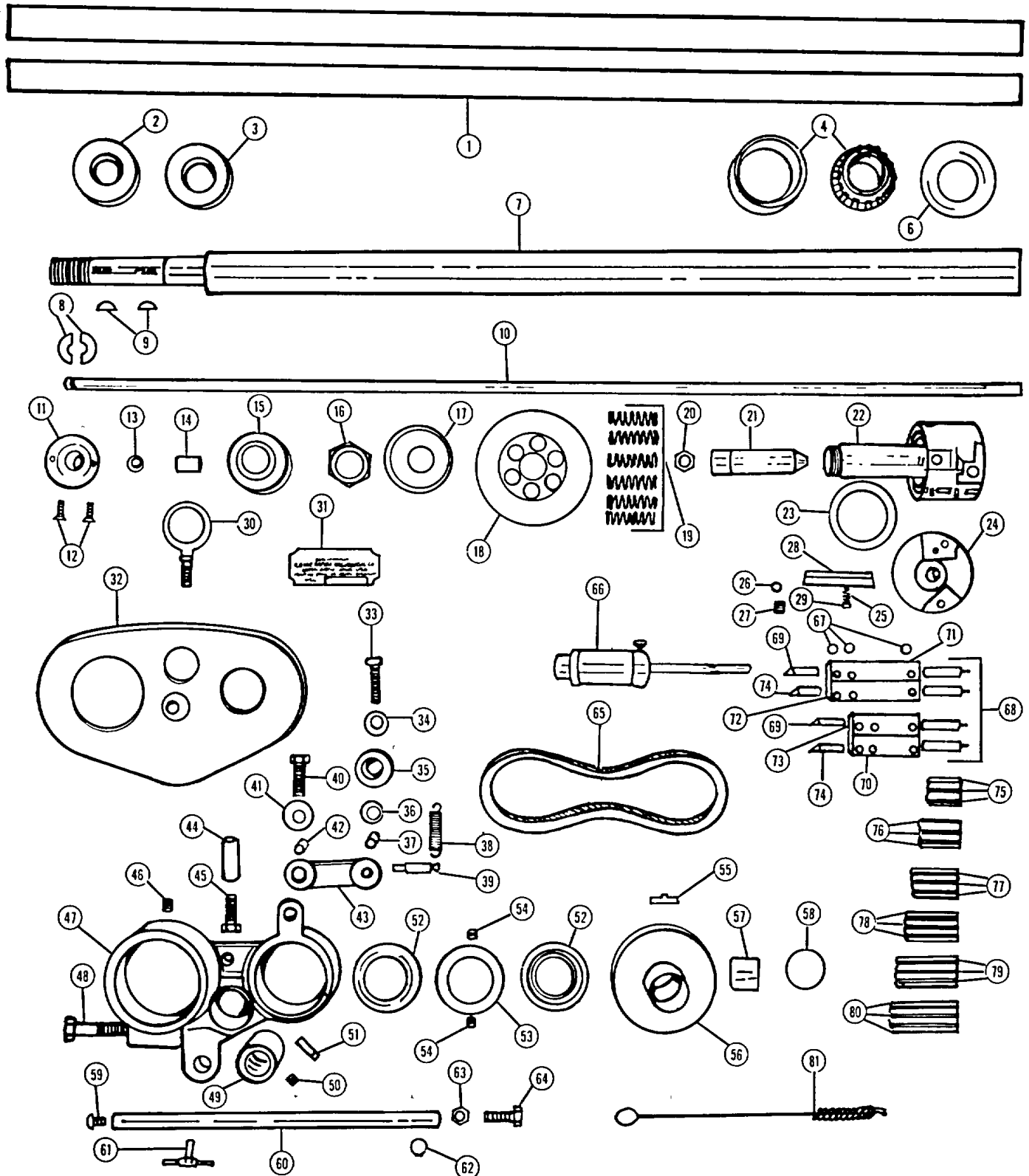


PLATE IV

1	055-0301-46	Boring Sleeve	1	-	Req'd.
2	062-0332-40	Spindle Pulley Spacer	1	-	Req'd.
3	000-1603-85	Ball Bearing	1	-	Req'd.
4	000-1640 11	Bearing	1	-	Req'd.
6	062-0302-67	Lower Sleeve Insert	1	-	Req'd.
7	062-0311-23	Boring Spindle	1	-	Req'd.
8	062-0358-46	Split Washer	2	-	Req'd.
9	000-7300-41	#5 Woodruff Key	2	-	Req'd.
10	062-0355-60	Centering Rod	1	-	Req'd.
11	062-0357-49	Handwheel Thrust Plate	1	-	Req'd.
12	000-0300-31	8 - 32 x 5/8 Flat Head Machine Screw	2	-	Req'd.
13	000-2300-57	O Ring	1	-	Req'd.
14	000-9200-96	Oilless Bushing	1	-	Req'd.
15	062-0356-09	Centering Handwheel	1	-	Req'd.
16	062-0334-44	Spindle Nut	1	-	Req'd.
17	062-0333-47	Spindle Handwheel	1	-	Req'd.
18	055-0331-02	Spindle Pulley - Below FN-876	1	-	Req'd.
18	055-0331-45	Spindle Pulley - FN-876 Up	1	-	Req'd.
19	000-1801-73	Compression Spring	6	-	Req'd.
20	062-0355-87	Jam Nut	1	-	Req'd.
21	062-0354-47	Centering Cone	1	-	Req'd.
22	055-0313-12	Boring Head Assembly	1	-	Req'd.
23	000-1701-78	2-1/8 x 1-5/8 x 1/8 Felt Washer	1	-	Req'd.
24	055-0312-15	Nozzle Plate Assembly	1	-	Req'd.
25	000-1802-38	Compression Spring	1	-	Req'd.
26	055-0328-40	Tool Lockscrew Plug	1	-	Req'd.
27	000-0505-12	3/8 - 16 x 3/8 Flat Point Socket Setscrew	1	-	Req'd.
28	062-0324-48	Tool Holder Gib	1	-	Req'd.
29	000-0245-38	10 - 24 x 3/4 Fillister Head Machine Screw	1	-	Req'd.
30	000-0700-17	3/8 x 1-1/4 Eye Bolt	1	-	Req'd.
31	000-6602-13	Nameplate	1	-	Req'd.
32	055-0337-49	Belt Guard	1	-	Req'd.
33	000-0252-91	5/16 - 18 x 1-1/4 Fillister Head Machine Screw	1	-	Req'd.
34	062-0375-63	Pulley Pivot Washer	1	-	Req'd.
35	062-0373-69	Idler Pulley	1	-	Req'd.
36	000-9201-69	Oilless Bushing	1	-	Req'd.
37	021-0223-06	Ferrule	1	-	Req'd.
38	000-1840-20	Tension Spring	1	-	Req'd.

PLATE IV

39	057-0378-06	Spring Pin - Long	1	-	Req'd.
40	000-0105-53	3/8 - 16 x 1-1/4 Hex Head Capscrew	1	-	Req'd.
41	000-1180-60	Washer	1	-	Req'd.
42	062-0372-61	Idler Arm Pivot	1	-	Req'd.
43	062-0371-64	Idler Arm	1	-	Req'd.
44	055-0335-01	Pulley Bracket Spacer	1	-	Req'd.
45	000-0105-53	3/8 - 16 x 1-1/4 Hex Head Capscrew	1	-	Req'd.
46	000-0590-56	Setscrew	1	-	Req'd.
47	055-0336-09	Pulley Bracket	1	-	Req'd.
48	000-0105-70	3/8 - 16 x 1-3/4 Hex Head Capscrew	1	-	Req'd.
49	062-0346-61	Feed Nut	1	-	Req'd.
50	000-0487-63	5/16 - 18 x 5/16 Socket Cup Point Setscrew	3	-	Req'd.
51	081-0729-81	Spring Pin - Short	1	-	Req'd.
52	000-1601-21	Bearing	2	-	Req'd.
53	057-0343-00	Bearing Spacer	1	-	Req'd.
54	000-0407-70	5/16 - 18 x 5/16 Headless Cup Point Setscrew	3	-	Req'd.
55	062-0342-46	Pulley Drive Key	1	-	Req'd.
56	055-0341-17	Drive Shaft Pulley Assembly	1	-	Req'd.
57	055-0344-00	Flange Bearing - Nylon	1	-	Req'd.
58	000-1831-30	Spirolox Ring	1	-	Req'd.
59	000-0215-20	5/16 - 18 x 3/8 Round Head Machine Screw	1	-	Req'd.
60	062-0175-89	Stop Rod	1	-	Req'd.
61	057-0174-22	Lockscrew Assembly	1	-	Req'd.
62	000-1833-34	Ring	1	-	Req'd.
63	000-1042-64	5/16 - 18 Hex Finish Jam Nut	1	-	Req'd.
64	000-0103-08	5/16 - 18 x 1 Hex Head Capscrew	1	-	Req'd.
65	001-1902-45	#30-285 V Belt (Matched Set of 2)	2	-	Req'd.
66	055-0620-13	Micrometer Assembly - Standard	1	-	Req'd.
		or			
66	055-0620-30	Micrometer Assembly - Metric	1	-	Req'd.
67	000-0590-21	Tool Bit Screw	3	-	Req'd.
68	062-0317-19	Plunger Holder Assembly	1	-	Req'd.
69	062-1071-03	Boring Tool Bit - Roughing	2	-	Req'd.
70	062-1021-28	Tool Holder Short - Roughing	1	-	Req'd.
71	062-1025-27	Tool Holder Long - Roughing	1	-	Req'd.
72	062-1025-35	Tool Holder Long - Finishing	1	-	Req'd.
73	062-1021-36	Tool Holder Short - Finishing	1	-	Req'd.
74	062-1072-00	Boring Tool Bit - Finishing	2	-	Req'd.
75	062-0361-33	Centering Finger #1 (Set of 3)	1	-	Req'd.

PLATE IV

76	062-0362-30	Centering Finger #2 (Set of 3)	1 - Req'd.
77	062-0363-38	Centering Finger #3 (Set of 3)	1 - Req'd.
78	062-0364-35	Centering Finger #4 (Set of 3)	1 - Req'd.
79	062-0365-24	Centering Finger #5 (Set of 3)	1 - Req'd.
80	062-0366-30	Centering Finger #6 (Set of 3)	1 - Req'd.
81	000-8900-22	3/8 Bristle Brush	1 - Req'd.

PLATE V

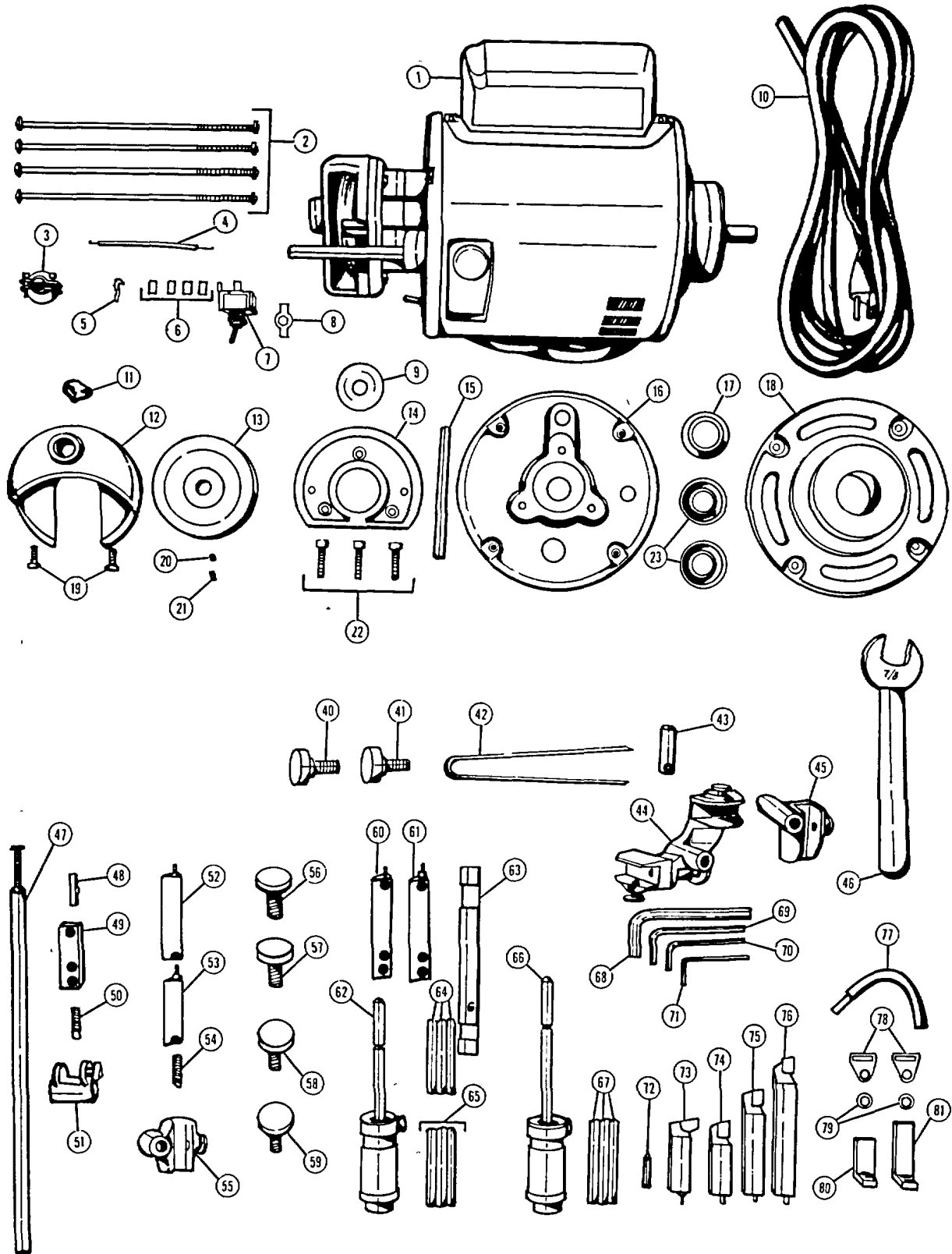


PLATE V

1	062-0600-18	Motor Unit Assembly 115 Volt - 60 Hertz - 1 Phase.....	1	-	Req'd.
		or			
1	055-0600-10	Motor Unit Assembly 230 Volt - 60 Hertz - 1 Phase.....	1	-	Req'd.
		or			
1	062-0600-34	Motor Unit Assembly 115 Volt - 50 Hertz - 1 Phase.....	1	-	Req'd.
		or			
1	055-0600-37	Motor Unit Assembly 230 Volt - 50 Hertz - 1 Phase.....	1	-	Req'd.
2	000-1440-37	7 - 11/16 Thru Bolt 115/230 Volt - 60 Hz - 1 Ph	4	-	Req'd.
		or			
2	000-1439-52	9 - 1/16 Thru Bolt 115/230 Volt - 50 Hz - 1 Ph	4	-	Req'd.
2	000-1097-62	10 - 32 Hex Machine Screw Nut	4	-	Req'd.
3	000-1243-03	Cable Connector 3/8	1	-	Req'd.
4	000-2410-08	#16 Jumper Wire 4" Long	1	-	Req'd.
5	000-1242-57	Hook Tongue Terminal	1	-	Req'd.
6	000-1242-49	Female Flag Terminal	4	-	Req'd.
7	000-1202-19	Switch	1	-	Req'd.
8	000-1204-30	Off-On Switch Plate	1	-	Req'd.
9	000-1701-00	1-1/2 x 1/2 x 1/4 Felt Washer	1	-	Req'd.
10	000-1260-71	14-3 SJO Cord Set -3 Prong Plug 8½' 115V 50/60Hz 1Ph	1	-	Req'd.
		or			
10	000-1261-28	16-3 SJO Cord Set -3 Prong Plug 8½' 230V 50/60Hz 1Ph	1	-	Req'd.
11	000-1732-66	5/8 x 5/8 Felt Wicking	1	-	Req'd.
12	062-0612-00	Lapping Disc Guard	1	-	Req'd.
13	062-0611-11	Lapping Disc Assembly	1	-	Req'd.
14	062-0605-81	Lapping Disc Guard Spacer	1	-	Req'd.
15	061-0115-01	Lapping Fixture Stud	1	-	Req'd.
16	062-0605-30	Upper Motor Endshield	1	-	Req'd.
17	000-1820-44	Pre-Load Spring.....	1	-	Req'd.
18	062-0601-40	Lower Motor Endshield	1	-	Req'd.
19	000-0100-22	1/4 - 20 x 5/8 Hex Head Capscrew	2	-	Req'd.
20	000-6400-18	Lockscrew Plug	1	-	Req'd.
21	000-0407-70	5/16 - 18 x 5/16 Headless Cup Point Setscrew	1	-	Req'd.
22	000-0250-38	1/4 - 20 x 1 Fillister Head Machine Screw	3	-	Req'd.
23	000-1604-58	Bearing	2	-	Req'd.
40	062-0452-64	1/2 - 13 Anchor Bolt	1	-	Req'd.
41	062-0452-48	7/16 - 14 Anchor Bolt	1	-	Req'd.
42	062-0459-49	Anchor Gage	1	-	Req'd.
43	062-0469-02	Anchor Clamp Pivot	1	-	Req'd.
44	062-0540-18	Lapping Fixture Assembly	1	-	Req'd.
45	062-0555-10	Lapping Fixture Assembly - Roughing	1	-	Req'd.
46	000-8800-19	#5 Engineers Wrench	1	-	Req'd.
47	062-0381-60	Bar Stop	1	-	Extra
48	062-0389-00	Friction Plunger / Counterboring	1	-	Extra
49					

PLATE V

** 50	062-1074-05	Counterboring Tool	1	-	Extra **
51	062-0581-53	Lapping Fixture Assembly For Counterboring Tool	1	-	Extra
52	062-1031-16	Offset Tool Holder - Long	1	-	Extra
53	062-1030-27	Offset Tool Holder - Short	1	-	Extra
54	062-1258-02	Special Offset One Pass Tool Bit	1	-	Extra
55	062-0551-11	Offset Lapping Jig	1	-	Extra
56	062-0452-72	1/2 - 20 Anchor Bolt	1	-	Extra
57	062-0452-56	7/16 - 20 Anchor Bolt	1	-	Extra
58	062-0452-21	3/8 - 16 Anchor Bolt	1	-	Extra
59	062-0452-30	3/8 - 24 Anchor Bolt	1	-	Extra
60	062-1041-20	Tool Holder 3-3/8 - Roughing	1	-	Extra
61	062-1042-28	Tool Holder 3-3/8 - Finishing	1	-	Extra
62	055-0620-13	Micrometer Assembly - Standard	1	-	Req'd.
or					
62	055-0620-30	Micrometer Assembly - Metric	1	-	Req'd.
63	053-0466-49	Anchor Clamp #6	1	-	Extra
64	062-0367-37	Centering Finger #7 (Set of 3)	1	-	Extra
65	062-0368-34	Centering Finger #8 (Set of 3)	1	-	Extra
66	055-0620-99	Micrometer Assembly (3.6 to 6.3)	1	-	Extra
67	062-0369-31	Centering Finger #9 (Set of 3)	1	-	Extra
68	000-0600-20	5/16 Across Flats Hex Wrench	1	-	Req'd.
69	000-0600-70	3/16 Across Flats Hex Wrench	1	-	Req'd.
70	000-0600-62	5/32 Across Flats Hex Wrench	1	-	Req'd.
71	000-0600-54	1/8 Across Flats Hex Wrench	1	-	Req'd.
72	062-1150-09	Boring Tool For Track Roller	1	-	Extra
73	062-1196-24	Offset Counterboring Tool 2-9/16"	1	-	Extra
74	062-1121-15	Heavy Duty Boring Tool 2-9/16" - Roughing	1	-	Extra
75	062-1131-11	Heavy Duty Boring Tool 3-5/8" - Roughing	1	-	Extra
76	053-1141-13	Heavy Duty Boring Tool 4-3/4" - Roughing	1	-	Extra
77	063-0359-80	Hose Elbow	1	-	Extra
78	000-2004-09	Nozzle Shield Gasket	2	-	Extra
79	000-2004-17	1/2 x 5/16 x 5/64 Rubber Washer	2	-	Extra
80	062-0327-15	Nozzle Assembly Short #1	1	-	Extra
81	062-0327-23	Nozzle Assembly Long #2	1	-	Extra

** FOR ROTUNDA "FN" CYLINDER BORING MACHINE, ITEM NUMBER 50 IS STANDARD

NOTES

DESCRIPTION

Description of the Model FN Cylinder Boring Machine is as follows:

Capacity 2-5/8 in. thru 5-1/4 in., length 12-1/2 in.
Size 1. Additional descriptive material will be found throughout the manual.

OPERATION

Detailed operation instructions covering the Model FN Cylinder Boring Machine will be found in the manual, pages 2 thru 24.

REPAIR

Normal maintenance procedure and detailed adjustment instructions are fully covered in the manual.

TROUBLESHOOTING

Detailed troubleshooting procedures are dealt with in the manual on pages 19 and 20.

PARTS LIST

A complete listing of replacement parts will be found on pages 25 thru 41 in the manual laid out in an assembly oriented manner for easy and positive identification.

By Order of the Secretary of the Army:

Official:

E. C. MEYER
General, United States Army
Chief of Staff

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

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Engine Cylinder Boring Machine
(Model FN)

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PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
52			
17	4		

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Callouts 55 and 56 are switched around Also, 12 and 28 are switched.

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TM 9-4910-579-14 & P BORING MACHINE, ENGINE CYLINDER, (MODEL FN)-1980

PIN: 045630-000