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INSTRUCTIONS

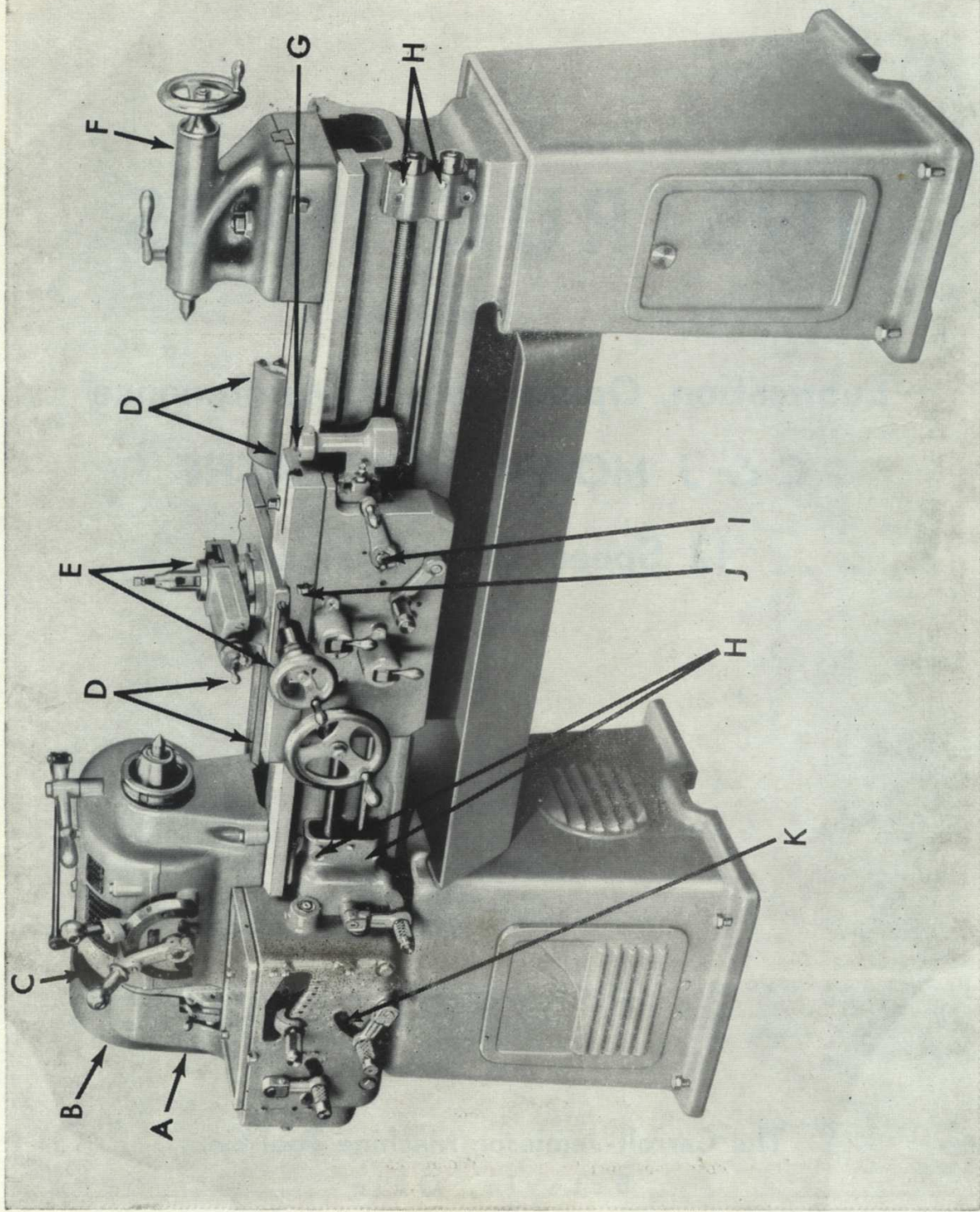
For

Lubrication, Operation and Maintenance

C & J MODEL "GH" LATHE

12 Speed Geared Head

The Carroll-Jamieson Machine Tool Co.
Batavia, Ohio



LUBRICATION

Refer to Points indicated on opposite page for oil application. These lubrication points should receive oil daily unless otherwise indicated.

A — Tumbler Gears and End Gears (Remove end gear guard cover for access)

Reverse quadrant stud oiler located on head.

B — Clutch Pulley (oil once per week)

C — Drive Shaft and Center Shaft Bearings

D — Carriage Vee Wipers

E — Cross Feed Screw Bushing also oil hole at cap screw located behind swivel on Cross Slide

F — Tailstock Screw

G — Thread Indicator

H — Lead Screw and Feed Rod Bearings

I — Lead Screw Nut Lever

J — Apron Mechanism Oilers (located on front of carriage). Also oilers on control housings.

K — Gear Box Shaft Bearings

Heavy Grease should occasionally be applied to gear box gears.

Remove Tool Tray for access.

NOTE — IMPORTANT: Headstock should be supplied with oil to depth of about one (1) inch. Headstock should be drained occasionally and old oil replaced with fresh. Oil recommended SAE **30**

Directions For Erecting, Operating and Maintenance Of C & J Model "GH" Lathe

ERECTION

Bed vees must be level at all points and legs of lathe equally supported to assure freedom from vibration when operating. Floor should be solid and as free from vibration as possible.

OPERATION

Feed and spindle speeds are governed by class of work being machined. The capacity of the cutting tool determines the spindle speed while the geared head will, in general, provide ample power for use of any reasonable feed required for finish of the work.

Screw Cutting—Set "Handle" on Gear Box to number position indicated by index plate for thread desired. Set "Levers" in letter positions indicated by index.

Note: Feed Reverse Lever on apron must be in neutral position before the lead screw can be operated.

For engaging the lead screw nut, push the nut lever *down*.

To Use the Thread Indicator: For cutting EVEN number of threads, thread can be caught either on a long or short graduation, that is, when either graduation is in conjunction with starting point as marked on top of indicator.

For cutting ODD number of threads, threads must be caught on either long or short graduations, that is, if operator starts with long mark he must continue catching thread on any long graduation coming even with starting point, and if starting with short graduation he must continue catching thread on short graduation coming even with the starting point.

When chasing threads the compound rest screw can be used for the feed, and cross feed screw for backing out the tool.

MAINTENANCE

Adjustment of the Vee Belt Clutch Drive Pulley:

When clutch is out of engagement loosen screw on split side of friction finger nut and turn to the right. This automatically adjusts both fingers with the same tension. Then start the clutch and if it slips with proper load then proceed over again and turn friction finger nut to the right. When correct adjustment is attained tighten the screw on split side of nut just enough to lock nut in position.

~~Never tighten screw on the solid side of nut. This screw should never be drawn down tight.~~

Clutch Pulleys are oiled from screw in hub of spider. This spider has an oil chamber that holds a liberal supply of oil which is fed to the pulley bearing with felt wicks.

It is not necessary to adjust the clutch too tightly to obtain maximum pull. The operating cone should never have to be jabbed in. This only causes undue wear on the cone. The clutch should be adjusted so that the operating cone goes into engagement with just a few pounds pressure.

CAUTION

It is advisable to use care in shifting from one high spindle speed to another. In this case the clutch should be disengaged and gears shifted in by jiggling the clutch lever. This also applies to shifting gears in the gear box which should not be shifted when under a heavy feed or high speed.

Adjustment of Timken Bearings: Remove screws in nut on rear end of spindle. Turn nut until proper adjustment is attained. Turn nut only slightly at one time and try adjustment. Tighten screws in nut when adjustment is complete.

Timken Tapered Roller Bearings are used on C-J lathes. The large or front bearing is pressed on the spindle. The rear bearing or small bearing

can be moved on the spindle. The adjustment is made by drawing the small or rear bearing toward the front bearing. This is accomplished by tightening the threaded collar or nut on rear end of spindle.

To ascertain spindle adjustment, disengage all gears on spindle. Loosen set screws in nut or collar on rear end of spindle. Turn this spindle nut slightly and try for adjustment by wrapping a cord around nose of spindle and pulling spindle over with a small spring scale attached to cord. Approximately 30 to 32 lbs. pull on the scale required to turn the spindle shows a good adjustment. Care should be taken to not get adjustment too tight.

Should this occur bearings can be loosened by placing a block of wood against end of spindle and tapping with a hammer.

Make sure set screws are tightened in the spindle nut before operating the machine.

Adjustment should be made when bearings are warm, as the oil will run free and not hold the bearings from turning easily.

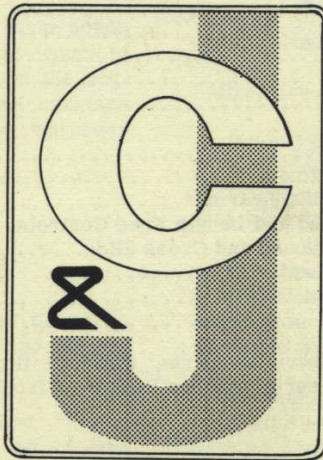
These bearings are properly adjusted before lathe is shipped from factory and should be checked for adjustment at regular intervals.

Cross Feed and Length Feed Control Adjustment: Remove control housing from apron.

Loosen set screw in adjustment nut (insert a set screw wrench through spring coils.) Turn nut slightly and check position of thrust bearing against cam when housing is in position. **IMPORTANT:** Tighten set screw in nut before operating lathe.

CAUTION: When necessary to remove adjustment nut from stud, care should be exercised when unscrewing the nut as heavy coil spring is held under tension by the nut.

Operation and Maintenance Manual



**C&J MASTER MODEL
GH
ENGINE LATHE**

THE CARROLL-JAMIESON MACHINE TOOL CO.

BATAVIA , OHIO

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NOTE: For ordering replacement parts, refer to illustrated parts list for this model lathe. Give lathe serial number located on front bedways at tailstock end.

These instructions do not attempt to cover all details, nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance of this equipment. Should particular problems arise which are not covered sufficiently for user's purposes, machinery dealer or factory should be contacted.

General Information

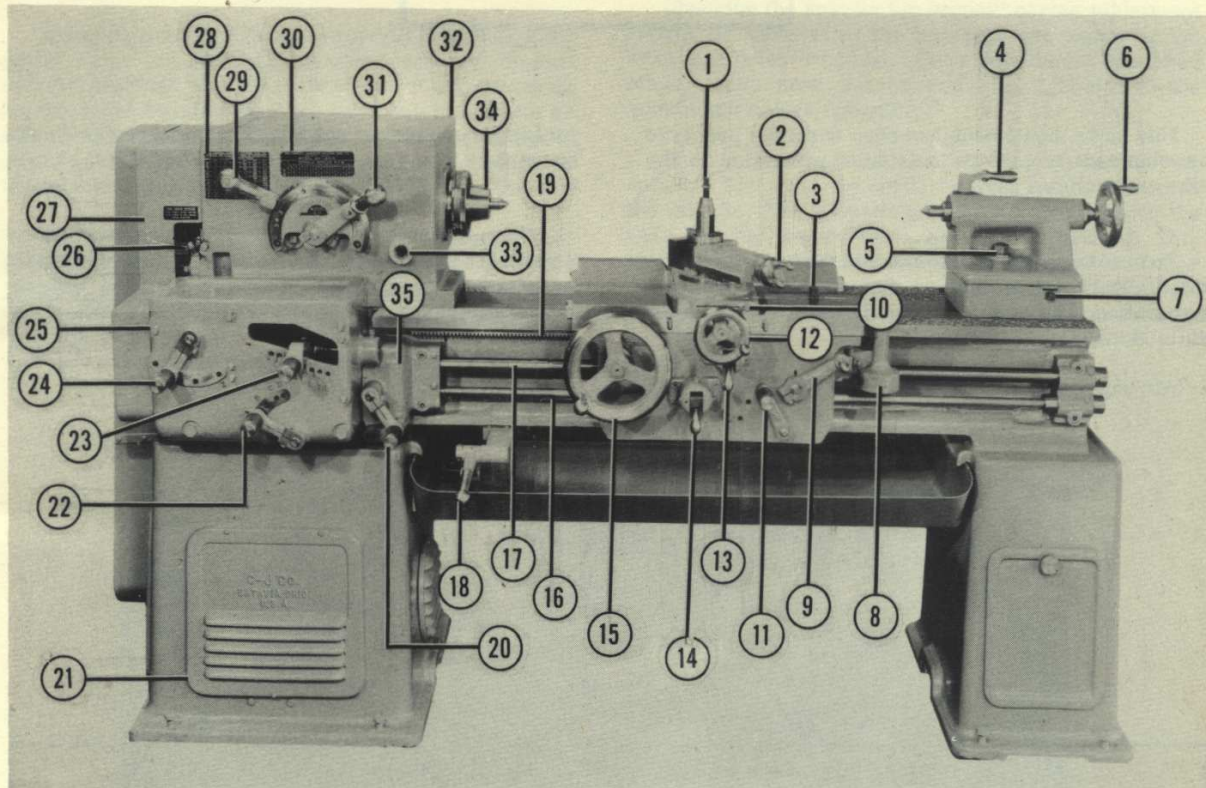


Figure 1. The C & J Master Model "GH" Engine Lathe

- | | |
|--------------------------------------|---------------------------------|
| 1. Tool Post | 19. Bed Rack |
| 2. Compound Rest Handle | 20. Clutch Box Handle |
| 3. Carriage Tightener Bolt | 21. Head Cabinet Leg Door |
| 4. Tailstock Binder Lever | 22. ABCD Handle |
| 5. Tailstock Bolt | 23. Sliding Arm Handle |
| 6. Tailstock Handwheel | 24. XYZ Handle |
| 7. Tailstock Side Screws | 25. Gear Box |
| 8. Thread Indicator | 26. Lead Screw Reverse Quadrant |
| 9. Lead Screw Half Nut Lever | 27. Guard |
| 10. Gib Adjusting Screw | 28. Thread and Feed Plate |
| 11. Feed Reverse Lever | 29. B Handle |
| 12. Cross Feed Handwheel | 30. Spindle Speed Plate |
| 13. Cross Feed Control Handle | 31. A Handle |
| 14. Length Feed Control Handle | 32. Headstock |
| 15. Apron Handwheel | 33. Window Indicator |
| 16. Feed Rod | 34. Spindle |
| 17. Lead Screw | 35. Clutch Box |
| 18. Main Drive Clutch Control Handle | |

General Information

GENERAL INFORMATION

This lathe equipment has been carefully prepared for shipment to provide maximum protection to the lathe and included parts.

In preparing the lathe for installation, the equipment should be moved on the skids to vicinity of installation. The lathe is normally more easily moved while skidded.

All unpainted machined surfaces are covered with

protective grease for shipping. These surfaces should be wiped clean with soft cloth and a light coat of lubricating oil should be spread on these surfaces.

The wooden box attached to the skids contains standard and extra equipment items. This box should be unpacked carefully and contents checked with included packing list. Since many small items are packed in this box such as centers, wrenches, screws, etc., the entire box should be checked to prevent any piece being overlooked.

ACCURACY TESTS

Each lathe is lined and tested to these tolerances to assure maximum performance:

TEST	STANDARD TOLERANCE
1. Spindle center runout	0 to .0005"
2. Spindle nose runout LO taper nose spindle	0 to .0005"
3. Headstock alignment - vertical	0 to .001" high at end of 12" test bar
4. Headstock alignment - horizontal	0 to .0005" to front end of 12" test bar
5. Tailstock spindle alignment - horizontal	0 to .0008" forward at end of spindle when fully extended
6. Tailstock spindle alignment - vertical	0 to .0008" high at end of spindle when fully extended
7. Vertical alignment of head and tail centers	0 to .001" high at tail stock
8. Cross slide alignment	0 to .001" hollow face in 12"
9. Spindle taper runout	0 to .0006" at end of 12" test bar

Lubrication

LUBRICATION (See Figures 2A and 2B.)

Oiling points that should receive daily oil application.

Points starred should be oiled every forty hours of operation.

The headstock and all oiling points except the gear box should be oiled with a fully inhibited turbine type oil, approximately 556SSU at 100°F., Standard Oil Company of Ohio SOHIVIS 65 or equivalent. A good grade of SAE 30 oil (non-detergent motor oil) could be used if changed often since SAE 30 oil would not have the oxidation life that the turbine oil would have.

The gear box should be lubricated with a multi-purpose lithium base grease, grade 2, Standard Oil of Ohio SOHITRAN 2, or equivalent.

1. Vee pulley bushing on drive shaft. (Remove set screw marked "oil".)
2. End gears, 22T and 25T directly under spindle (Oil holes in ends of stud shafts), 96T intermediate gear. (Oil hole in gear hub) Swing cover into open position for access.
3. Lead screw reverse quadrant. (Oiler adjacent to quadrant on headstock.)
4. Gear box. Direct oiling points and reservoir for shaft bearings. Heavy grease should occasionally be applied to gear box gears. (Eight oilers on

front and one oiler in shaft bearing on right side of box.)

5. *Sliding arm handle. (Slot on top of handle)
6. Clutch box. (Two oilers)
7. Carriage vee wipers. (Oil holes)
8. Carriage vee ways. (Remove set screws)
9. Cross feed nut cap screw. (Remove set screw.)
10. Compound rest bushing and dial. (Oil hole in front of handle)
11. Cross feed bushings and dial. (Oil holes on dial and on bushing between dial and carriage.)
12. Tailstock spindle, screw and hand wheel. (Oil direct to spindle, oil hole in bell in front of hand wheel, oil set screw by binder handle.)
13. *Thread indicator. (Oil hole in center of dial.)
14. Lead screw and feed rod bearings. (Oilers)
15. Reservoirs for apron mechanism. (Oilers on front side of carriage.)
16. Cross feed and length feed controls. (Oilers on cross feed and length feed control housing on front of apron.)
17. Lead screw nut lever. (Oil hole above lever hub.)
18. Maintain oil in lathe headstock at window indicator level. During operation oil will drop below this level. When necessary to add oil, remove plug in elbow fitting located on back side of headstock.

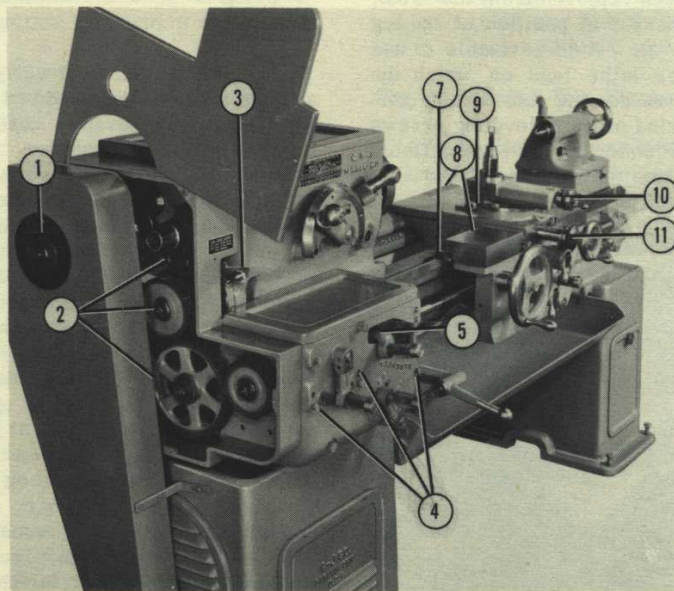


Figure 2A. Lubrication Points on the Lathe

Setting Up the Lathe

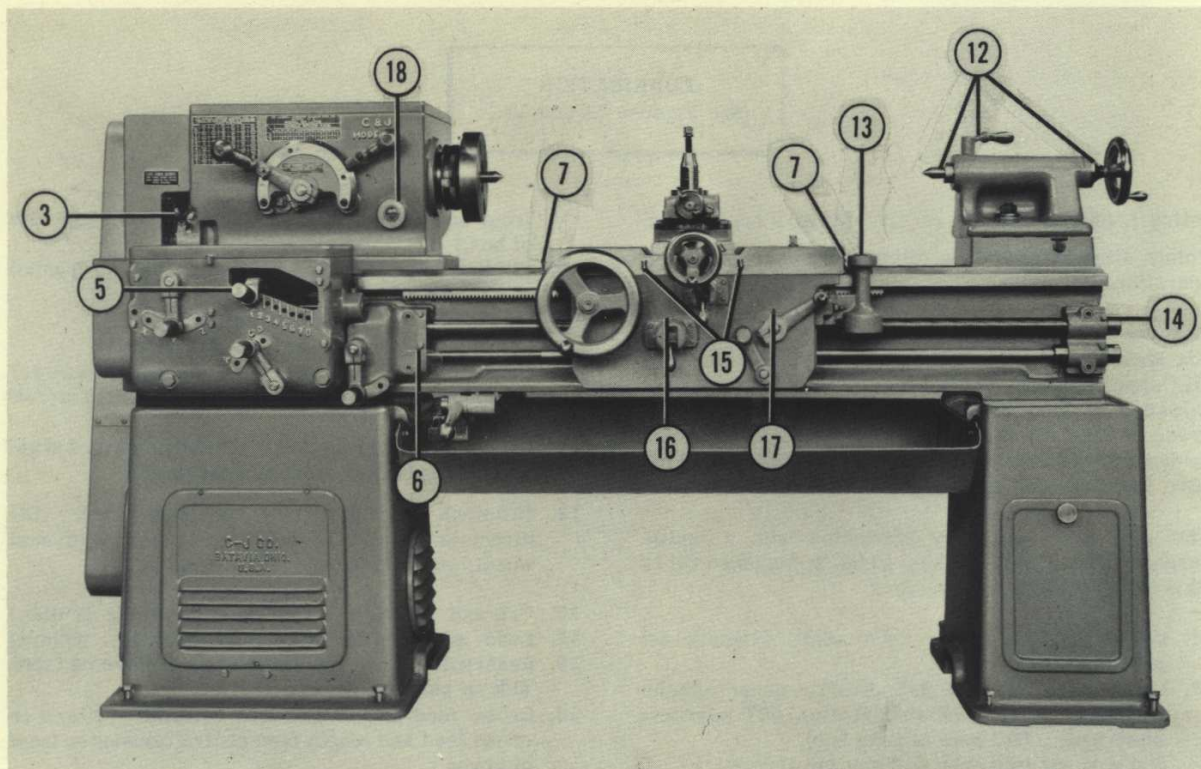


Figure 2B. Lubrication Points on the Lathe

SETTING UP THE LATHE

When the lathe has been removed from the skids, leveling screws should be put in position at the leg screw locations (Figure 3). It is advisable to use small metal plates under lathe legs on which the screws can set rather than coming into direct contact with floor. Over period of time, leveling screws would tend to dig in to concrete or wooden floor. User may desire to use shim plates alone under lathe legs rather than utilizing the screws.



Figure 3. Adjusting the Leveling Screws

Using a good machinists precision level, follow these steps in properly setting tool in place:

1. Place the level across surface of vee ways at right angle to length of bed at headstock end (Figure 4). Bring the level to zero reading or as close as practicable by adjustment of the leveling screws.

2. Move level to tailstock end of bed, approximately ten inches from end and repeat this procedure (Figure 5). The reading at this point must correspond to reading at headstock end. For a properly leveled lathe, these readings must be identical. Floor should be solid and as free from vibration as possible.

To provide a further check for proper leveling of the tool, once the lathe is operating, turn a test bar in a chuck. Bar should be at least 2" in diameter and extend 10 to 12 inches out of chuck. After bar is aligned take light test cut on length of bar. With lathe properly leveled, the bar, after test cut has been made, should indicate same micrometer reading at both ends or throughout length. A tapering cut will normally indicate that further leveling adjustment is necessary.

Setting Up the Lathe

High grade triple vee belts are provided and must be mounted by first removing belt guard on end of lathe. Lathes in which motors have been mounted at the factory are ready to receive the belts. The motor plate on which motor is mounted is adjustable. By removing head cabinet leg door (Figure 6), the adjusting screw is available. Motors mounted at factory are adjusted at proper height for proper belt tension. Belts should run with some slack and definitely should not operate "drum" tight.

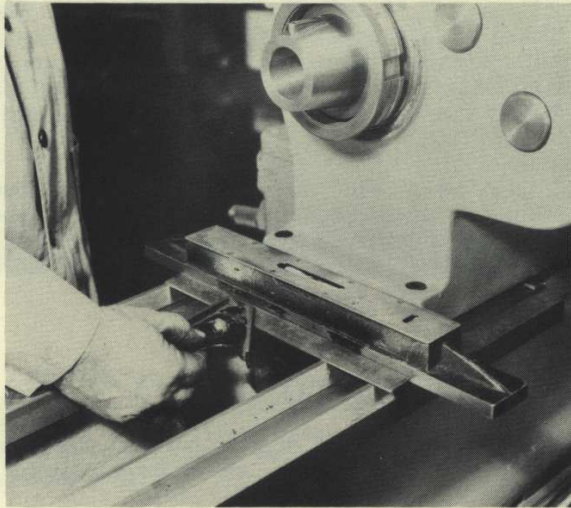


Figure 4. Leveling the Headstock End

Before operating the lathe, special attention should be given lubricating chart and all points should be oiled prior to running the tool.

Lead in wiring should be brought to control box normally located on rear side of head cabinet leg. The control switch or station is usually positioned on front side directly below gear box readily accessible to operator (Figure 8).

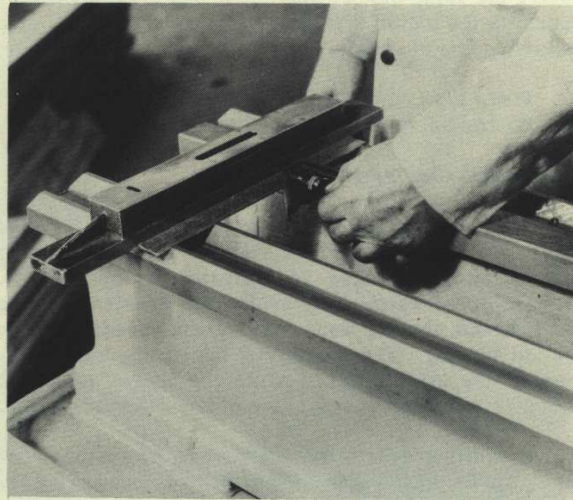


Figure 5. Leveling the Tailstock End

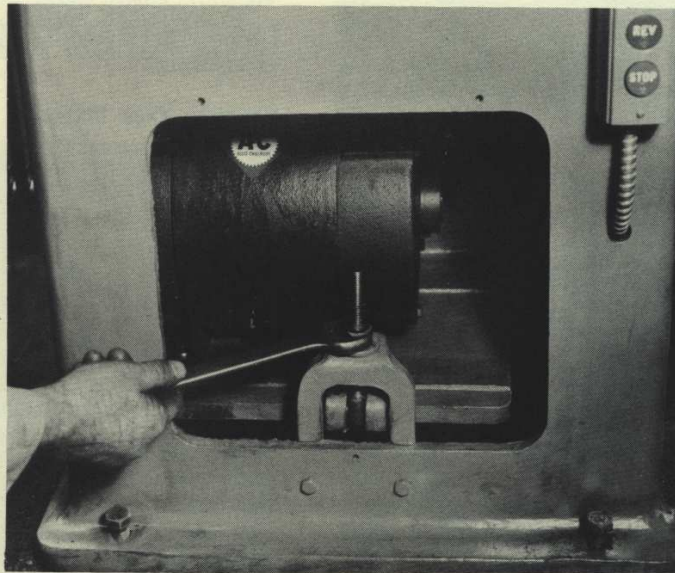


Figure 6. Adjusting the Motor Vee Belts

Operation

OPERATION

Starting the Lathe (See Figure 7.)

With clutch control handle in up or brake position start the lathe motor. The clutch and brake assembly permits the motor to be run continuously with starting and stopping of spindle controlled thru control handle.

Push down on the handle to engage the clutch. Pull up on handle to disengage clutch and engage brake.

Headstock (See Figure 7.)

The geared headstock is provided with twelve spindle speeds with speed changes made by shifting the A and B handles as indicated on speed plate. Lower speed range is provided for heaviest turning and thread chasing work with highest speed range for finish turning. The capacity of the cutting tool determines the spindle speed while the geared head will provide ample power for use of any reasonable feed.

In shifting gears, jog the gearing by pushing control handle up and down, engaging and disengaging the clutch while moving A or B handle to desired position. For this shifting operation the operator uses right hand to manipulate clutch control handle and left hand to shift the A and B handles.

Speed changes should not be made without slowing or jogging gearing.

In short time operator will become acquainted with speed handle positions to extent that he will seldom find it necessary to refer to speed chart.

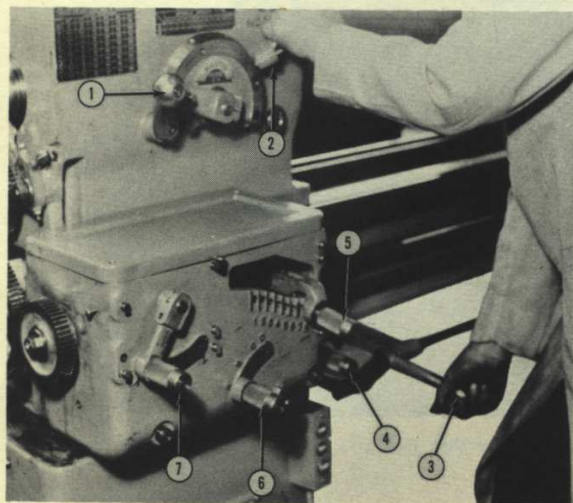


Figure 7. Disengaging the Main Drive Clutch

Gear Box (See Figure 8.)

Two shifter handles and sliding arm handle provide positions for 48 separate thread and feed changes. Handle at left has XYZ positions; handle at center ABCD positions. The sliding arm handle has positions 1 thru 8. Operator can check the gear box chart for desired longitudinal feed and set the handles accordingly.

In order to shift any of the handles from one position to another it is necessary for the lathe to be operating or for the gearing to be turning over. Shifting should not take place while gearing is under pressure of heavy cut.

Clutch Box (See Figure 8.)

At immediate right of gear box the clutch box handle can be placed in one of three positions:

1. To the right for engagement of the feed rod.
2. To the left for engagement of the lead screw.
3. Center position for neutral with both lead screw and feed rod disengaged.

In positioning handle, plunger pin should be fully seated in hole position to provide full clutch or gear engagement.

Mounting Face Plates or Chucks on LO Spindle (See Figure 9.)

Figure 7. Key

1. A Handle
2. B Handle
3. Main Drive Clutch Control Handle
4. Clutch Box Handle
5. Sliding Arm Handle
6. ABCD Handle
7. XYZ Handle

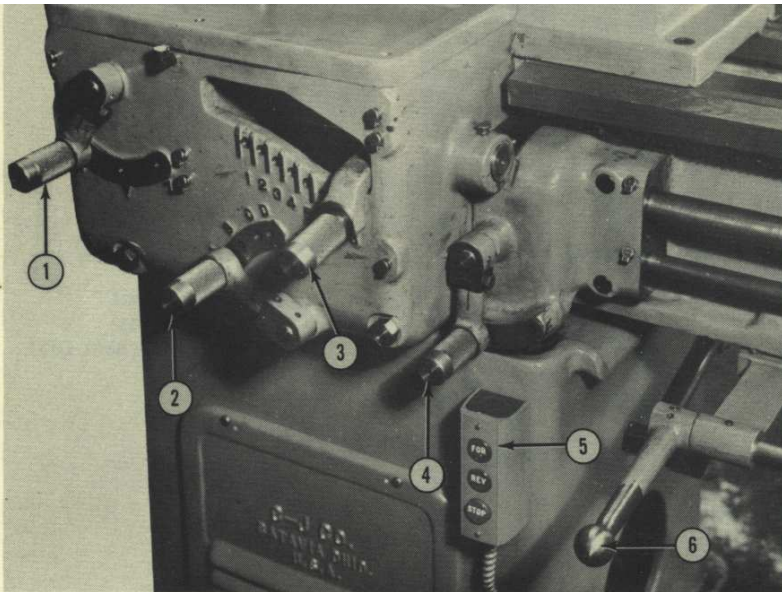


Figure 8. Key

1. XYZ Handle
2. ABCD Handle
3. Sliding Arm Handle
4. Clutch Box Handle
5. Control Box
6. Main Drive Clutch Control Handle

Figure 8. Gear Box and Clutch Box

Align the keyway in chuck or face plate with spindle nose key. Slide on spindle nose until engaged with draw nut threads. Tighten draw nut as much as possible by hand. Fully tighten by using LO spanner wrench.

Apron (See Figure 10.)

Individual length feed and cross feed controls are provided. Lever handles actuate positive type clutches -- upper handle for cross feed, lower handle for length feed. Instantaneous disengagement of automatic feed results when handle is pushed down from engaged position.

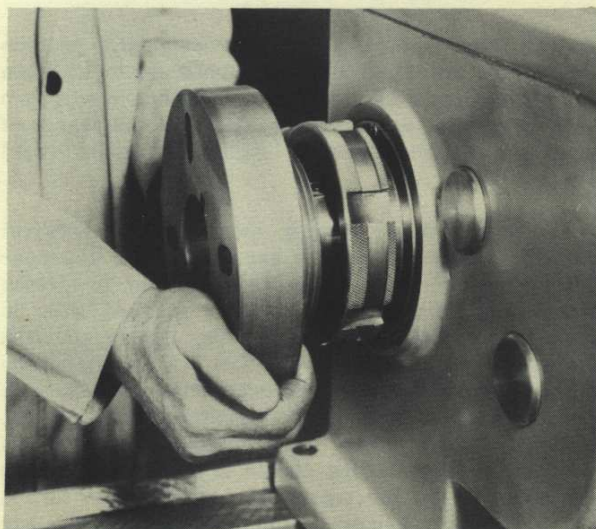


Figure 9. Mounting Face Plates or Chucks on LO Spindle

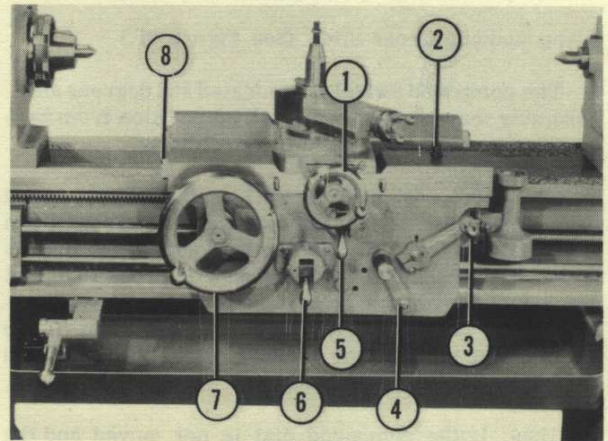


Figure 10. Apron

Figure 10. Key

1. Cross Feed Handwheel
2. Carriage Tightener Bolt
3. Lead Screw Half Nut Lever
4. Feed Reverse Lever
5. Cross Feed Control Handle
6. Length Feed Control Handle
7. Apron Handwheel
8. Shear Wipers

The feed reverse lever provides two directional length and cross feeds as well as neutral position. The lever must be in neutral position before the lead screw half nuts can be engaged for thread chasing.

Lead screw half nut lever is located at far right side of apron.

Operation

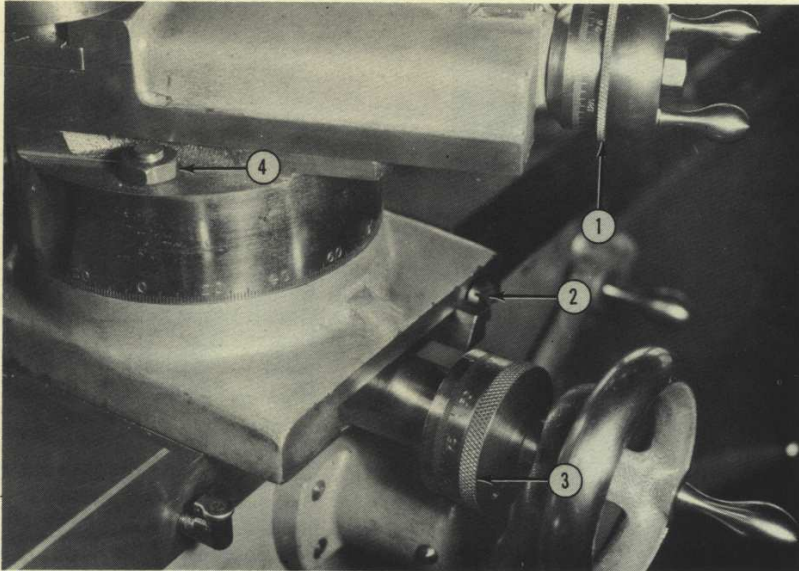


Figure 11. Compound and Cross Slide

Figure 11. Key

1. Compound Rest Dial
2. Gib Adjusting Screw
3. Cross Feed Handwheel Dial
4. Swivel Bolts

Compound and Cross Slide (See Figure 11.)

The compound swivel is graduated 360 degrees and assembly may be turned to desired position from zero marking by loosening the two swivel bolts.

Compound rest dial as well as larger cross feed hand wheel dial at front of carriage are graduated in half thousandths. By tightening, set screw dial is fixed to the shaft of the compound or cross feed and amount of movement from zero point can thus be determined. One complete clockwise revolution of the dial or 250 thousandths actually moves the compound or cross slide 125 thousandths or $1/8$ of an inch.

Thus, if the compound dial is not moved and the cross feed turned one revolution or 250 thousandths, the cutting tool is moved $1/8$ inch toward center providing for metal removal of $1/8$ inch on the side or 250 thousandths on diameter. In this manner, operator determines the amount he will remove from the diameter of work by the dial setting.

Care must be taken in assuring that screw backlash is taken up in determining dial setting.

Carriage (See Figure 10.)

For facing operations tightener bolt at right front is provided for holding carriage in position for this operation. Tool post wrench is used on this bolt. Be sure to loosen this bolt when resuming length feed operation.

Shear wipers on headstock and tailstock sides of carriage deter dirt and chips from working under vees of carriage.

Tailstock

The tailstock spindle or sleeve is moved in and out of housing by the turning of the handwheel. When in proper position, the spindle is locked by turning binder handle at top. Lathe center seated in the spindle may easily be removed by moving the spindle back into the housing. Tailstock screw striking end of center dislodges the center from tapered hole.

Set over screws on either side of tailstock base provide for swiveling tailstock to right or left of center for taper turning.

Taper Attachment (See Figures 12 and 13.)

The lathe taper attachment is designed to provide for turning any taper up to 4 inches per foot. When set for turning maximum taper, attachment will turn $15\frac{1}{2}$ " length at one setting. The less the degree of taper setting, the longer the length that may be turned at one setting.

To set for taper turning operation, loosen swivel bolts at either end of guide bar. Adjust bar to proper setting by turning adjusting screw handle. Headstock end of attachment (Figure 12) is marked with 35 graduations to right and left of zero. Each graduation indicates $1/8$ inch taper per foot. Thus, lining the mark on guide bar with 24th graduation would be setting for 3 inches taper per foot right or left of center. Naturally, taper setting as indicated is approximate and more exact setting should be derived following original cuts on the taper, checking the taper turned and making any required adjustment of the guide bar to give exact taper. Opposite end of guide bar is graduated in $\frac{1}{2}$ degree increments.

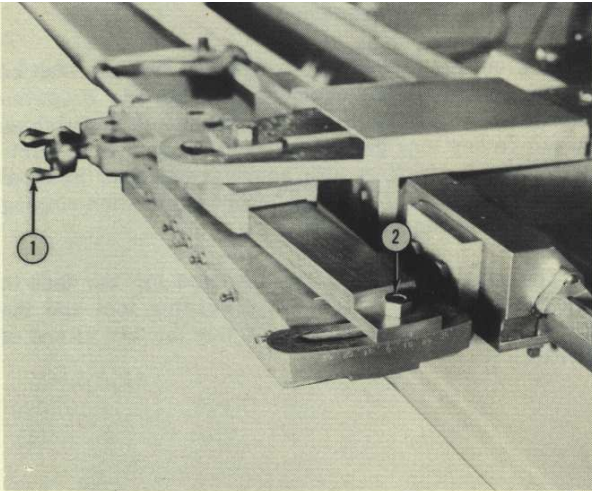


Figure 12. Taper Attachment , Headstock End

Figure 12. Key

1. Adjusting Screw Handle
2. Swivel Bolt

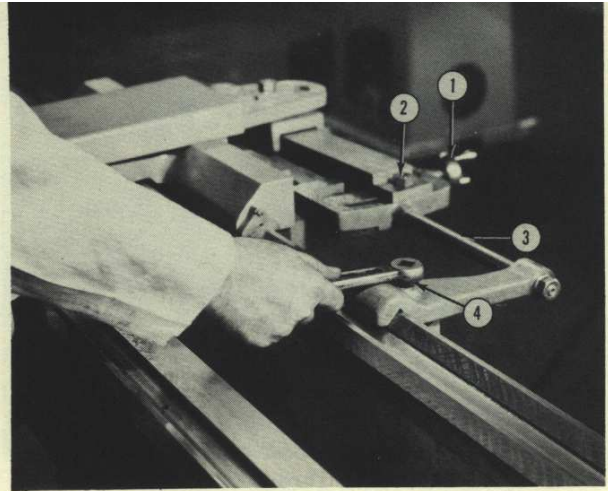


Figure 13. Taper Attachment , Tailstock End

Figure 13. Key

1. Adjusting Screw Handle
2. Swivel Bolt
3. Connecting Rod
4. Bed Dog Bolt

With guide bar in position, tighten the two swivel bolts. The connecting rod bed bracket at tailstock end of attachment should then be clamped to bed by tightening bed dog bolt (Figure 13).

With the bed bracket clamped in position, the cross slide movement is guided as carriage moves longitudinally. The cross slide moves in conformance with the movement of the guide bar shoe sliding on the stationary guide bar.

Lathes can be equipped with either the standard or the telescopic type taper attachment. With the standard taper attachment it is necessary to first disconnect the cross feed nut from the cross slide located at rear of cross slide. The cross slide is then free to follow the movement of shoe along guide bar.

The telescopic attachment does not require the disconnection of the cross feed nut to put it into operation as a telescoping type cross feed screw is employed. In using, the lost motion in the cross feed screw must be taken up to provide immediate response of the cross slide to the guide bar on engagement of the feed.

Additional points to check in using taper attachment:

1. Check dog on lathe bed vee to be sure it is not twisting or jamming the connecting bar or rod to guide bar. This dog should be tightened on bed before tightening nut at end of connecting bar.

2. Be sure dog is free of dirt where it contacts bed vee.

3. In setting top guide bar over to cut taper, bolts must be loose so as not to cause any drag on the bar as it is being adjusted to taper position, then drawn up tight.

4. Try taper attachment by hand to make sure guide bar and swivel slide will slide freely back and forth with bed dog loose.

Thread Chasing (See Figure 14.)

The thread indicator located on right side of apron is arranged to swivel to engage the lead screw. Lathe lead screw is 1-3/16" diameter, 6 TPI Acme right hand. Engage the thread indicator worm gear with the lead screw, place feed reverse handle in neutral position. Set up gear box handles in positions required for desired thread per index plate.

To engage the lead screw half nuts, push the lead screw nut lever down. Pull up for immediate disengagement.

Even number threads per inch -

In utilizing the thread indicator, when chasing an even number of threads, half nuts can be engaged on either long or short graduations, that is, when either graduation is in conjunction with starting point as marked on top of indicator.

Operation-Maintenance

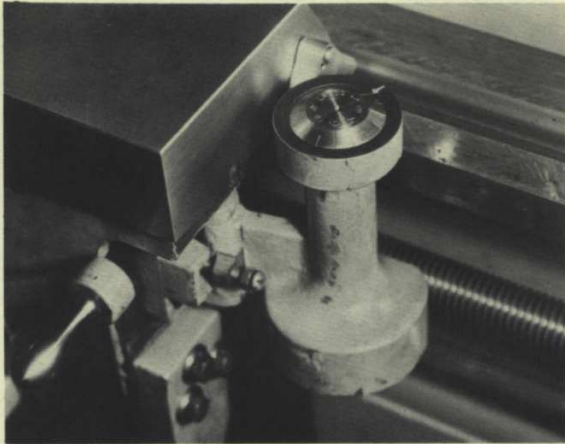


Figure 14. Thread Indicator

Odd number threads per inch -

For cutting odd number threads, threads must be caught on either long or short graduations. If operator starts with long mark he must continue catching thread on any long graduation coming even with starting point. If starting with short graduation, he must continue catching thread on short graduation coming even with the starting point.

The compound rest can be used for the feed in determining depth of cut for threading tool and the cross feed screw used to back out the tool at end of thread.

MAINTENANCE

Vee Pulley Clutch Adjustment (See Figure 15.)

To adjust the friction clutch for proper tension, place clutch in disengaged position. Release the locking pin located in yoke cover assembly by pulling out and either tighten or loosen clutch by turning the yoke cover assembly. Turn the assembly clockwise to tighten and counter clockwise to loosen.

It is not necessary to adjust clutch to extremely

tight position to obtain maximum pull. The operating cone should not have to be jabbed in. Proper adjustment will permit operating cone to go into engagement with few pounds of pressure.

Should drive shaft tend to creep or run with the vee pulley with the clutch disengaged, it is indication that vee pulley bushing at end of drive shaft is not sufficiently lubricated. Oil applied at this point will ordinarily correct this condition.

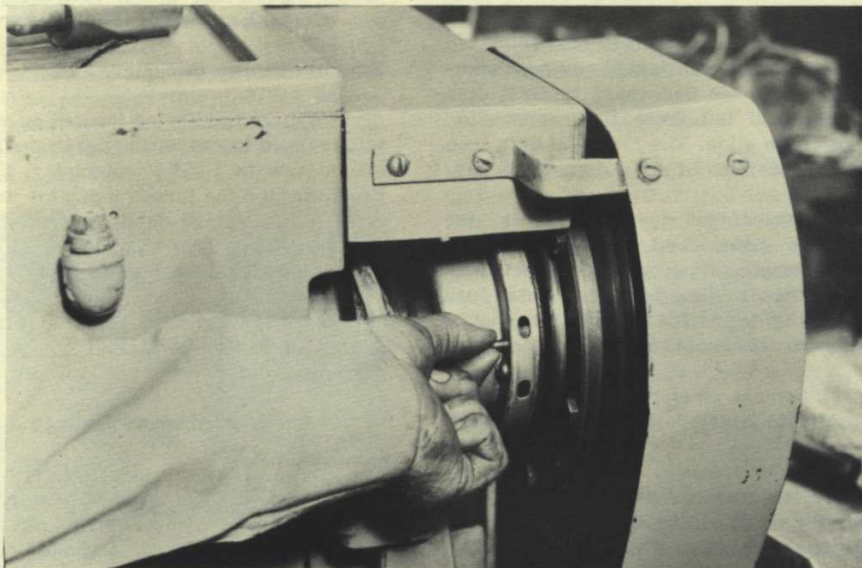


Figure 15. Vee Pulley Clutch Adjustment

Adjustment of Main Spindle Bearings (See Figure 16.)

The headstock spindle is mounted in precision Timken taper roller bearings which are properly adjusted before lathe is shipped from factory. After the lathe is placed in operation, a periodic check should be made to see that the proper adjustment is maintained.

When the headstock has been operating in the higher speed range for 30 to 60 minutes, properly adjusted spindle bearings will get quite warm. If the headstock at the front bearing location does not feel warm or even hot to the touch after about 60 minutes of higher speed operation, the bearing adjustment is indicated to be too loose.

To ascertain spindle adjustment, disengage all gears on spindle. Loosen set screws in nut or collar on rear end of spindle. Turn this spindle nut slightly and try for adjustment by wrapping a cord around nose

of spindle and pulling spindle over with a small spring scale attached to cord. Approximately 30 to 32 lbs. pull on the scale, required to turn the spindle, shows a good adjustment. Care should be taken not to get adjustment too tight. Should this occur, bearings can be loosened by placing a block of wood against end of spindle and tapping with a hammer.

Checking the spindle for proper bearing adjustment should be done when the bearings are warm or the head has been running. Once adjustment has been made, make sure set screws are tightened in the spindle nut before operating.

The large or front bearing is pressed on the spindle. The rear or small bearing can be moved on the spindle. The adjustment is made by drawing the rear bearing toward the large or front bearing. This is accomplished by tightening the threaded collar or nut on the rear end of the spindle as previously indicated.

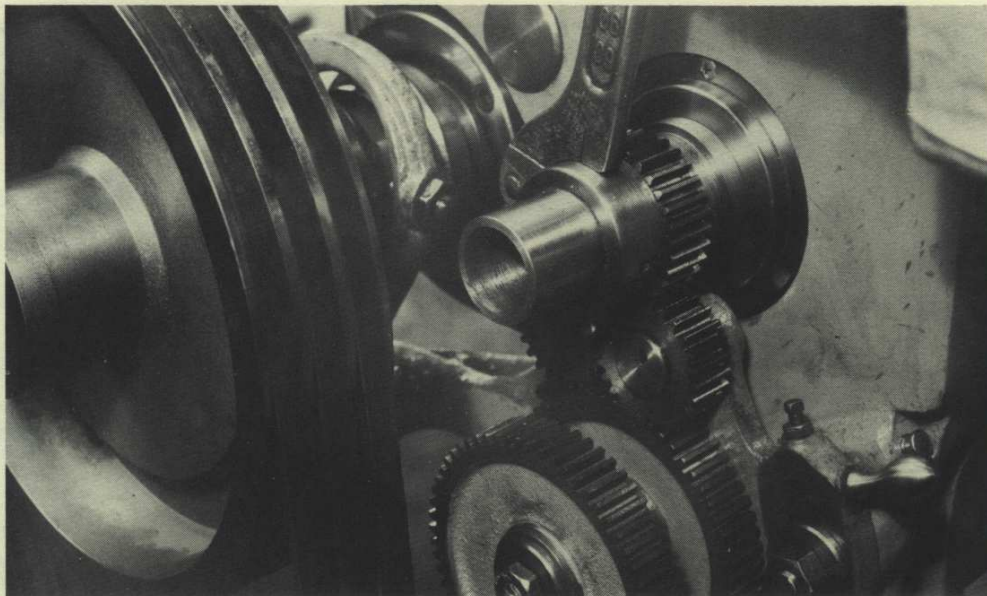


Figure 16. Adjustment of Main Spindle Bearings

Maintenance

Adjustment of Cross Feed and Length Feed Controls (See Figure 17.)

Remove control housing from apron. Loosen set screw in adjustment nut by inserting setscrew wrench through spring coils. Turn nut slightly and check position of thrust bearing against cam when housing is in position. Tighten set screw and nut before operating lathe.

CAUTION

When necessary to remove adjustment nut from stud, care should be exercised when unscrewing the nut as heavy coil spring is held under tension by the nut.

Gib Adjustment for Compound and Cross Slide (See Figure 11.)

Both the compound rest and the cross slide have

gib adjustment screws at front and rear. Tapered gibs provide for proper sliding fit along the dove tail on both the compound and cross slide.

Proper adjustment provides for smooth feeding of these assemblies on bearing surfaces with no play to affect tool under pressure of heavy cut. The compound and the cross slide are properly adjusted at the factory.

After approximately three months of normal lathe operation, it is advisable to check both assemblies for sliding fit. If any play is noticeable in either assembly, slight adjustment of gib screws will snug slide to dove tail bearing.

Gib adjustment screws are located at front and rear of each assembly. To tighten slide adjustment, loosen rear gib screw and tighten front screw. This forces tapered gib to rear along dove tail, thus tightening the sliding assembly. Very slight adjustment is normally required, $1/8$ to $1/4$ turn of adjusting screw usually being all that is required.

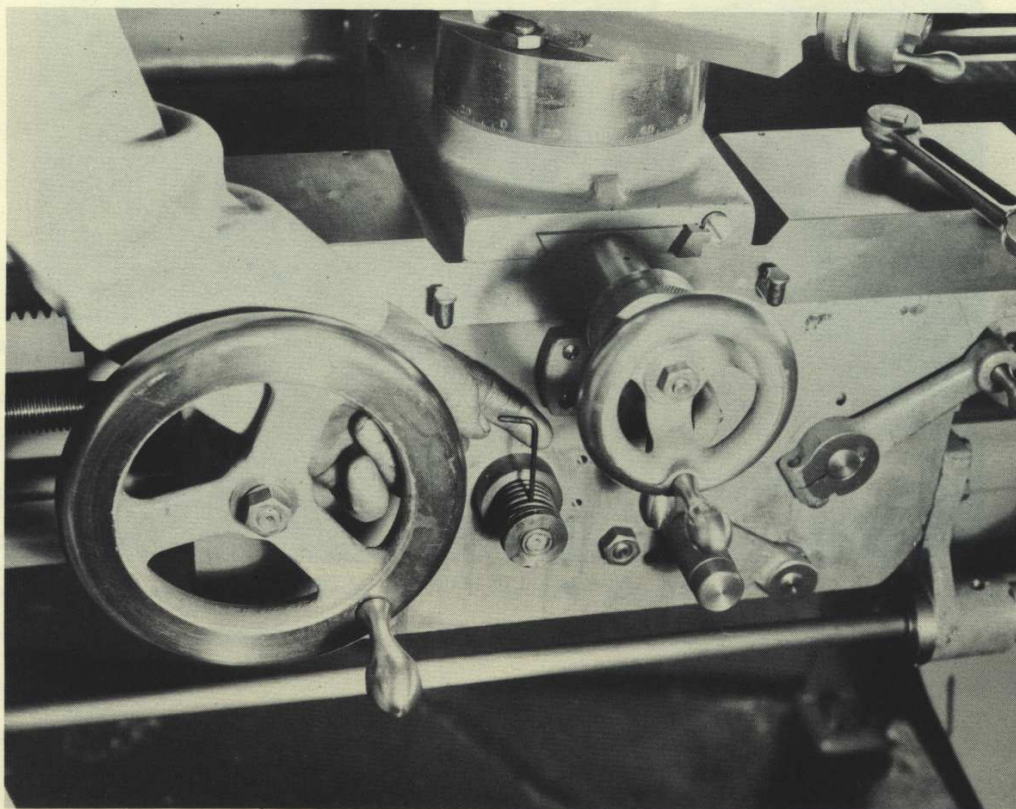


Figure 17. Adjustment of Cross Feed and Length Feed Controls

Adjustment can be made too tight causing cross feed hand wheel or compound rest handle to turn with some difficulty. With proper adjustment the slides will be snug yet handwheels will turn freely or with no drag. Gib screw at rear should be tightened against end of tapered gib to hold it snug in position.

Following initial checking and adjustment, normally an annual check for adjustment of the slides is all that is necessary to maintain lathe in good operating condition for precision turning.

Carriage Clamp Adjustment

Clamps under the rear side of the carriage and under the left front corner of the carriage can be tightened or loosened by adjustment of the set screws and jam nuts on the rear clamps and the one bolt under the left front corner. Periodically the carriage should be checked by applying pressure to underside of carriage and lifting to check for play between carriage and bed ways.

In tightening the clamps care must be taken not to draw clamps so tight to the bed that drag occurs in longitudinal movement of the carriage on the bed. Properly adjusted clamps allow for free carriage movement with carriage held firmly to bed even under pressure of heaviest turning operations.

Apron Assembly Removal

Should it become necessary to remove the apron for adjustment or replacement of parts in the assembly, this procedure should be followed:

1. Position carriage near center of bed.
2. Remove collar and nuts from end of lead screw and feed rod, remove two screws from journal or bearing block at same end.
3. Throw clutch box handle to extreme right position and remove screws from clutch box.

4. Engage half nuts in lead screw and move carriage toward tailstock until clutch box slides off and clears bed key.
5. Slide clutch box toward apron until lead screw clutch and feed rod gear are clear. Knock out pins holding lead screw clutch and feed rod collar (Figure 18). Remove clutch and gears and slide off clutch box.
6. Disengage half nuts and pull lead screw and feed rod clear of apron.
7. Remove two screws at each end of apron on underside to free it from carriage. It is advisable to block up under apron to prevent assembly from dropping.

In assembly, after clutch and gears are in place on lead screw and feed rod, replace tapered pins in clutch and collar. Throw clutch box handle to extreme left engaging lead screw clutch. Line up keyed shaft in gear box with keyway in clutch gear. Slide clutch box into position.

Check lead screw after end nuts are in place. With clutch and half nuts disengaged, the screw should turn over by hand to indicate no drag due to nuts being drawn to tight.

Lathe Care

Your C & J Master Model GH lathe is designed and built to give lasting precision performance. However, as in the case with any fine tool, it must be treated with care to give the long service life expected of it.

The most important factor in keeping your lathe in first class operating condition is following a proper lubrication procedure. Refer to LUBRICATION, page 5 of this manual.

Cleanliness is also important. This is particularly true with regard to the bed ways. Keep the ways as free as possible of dirt and chips and keep them well oiled. Do not lay tools directly on the ways. When grinding or polishing with emery cloth, protect the ways from abrasive dust by covering with cloth or paper.

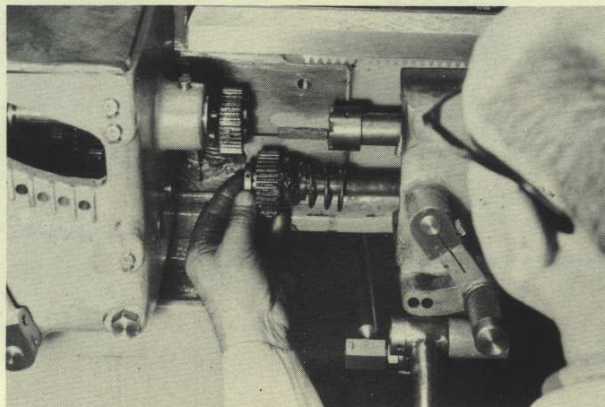
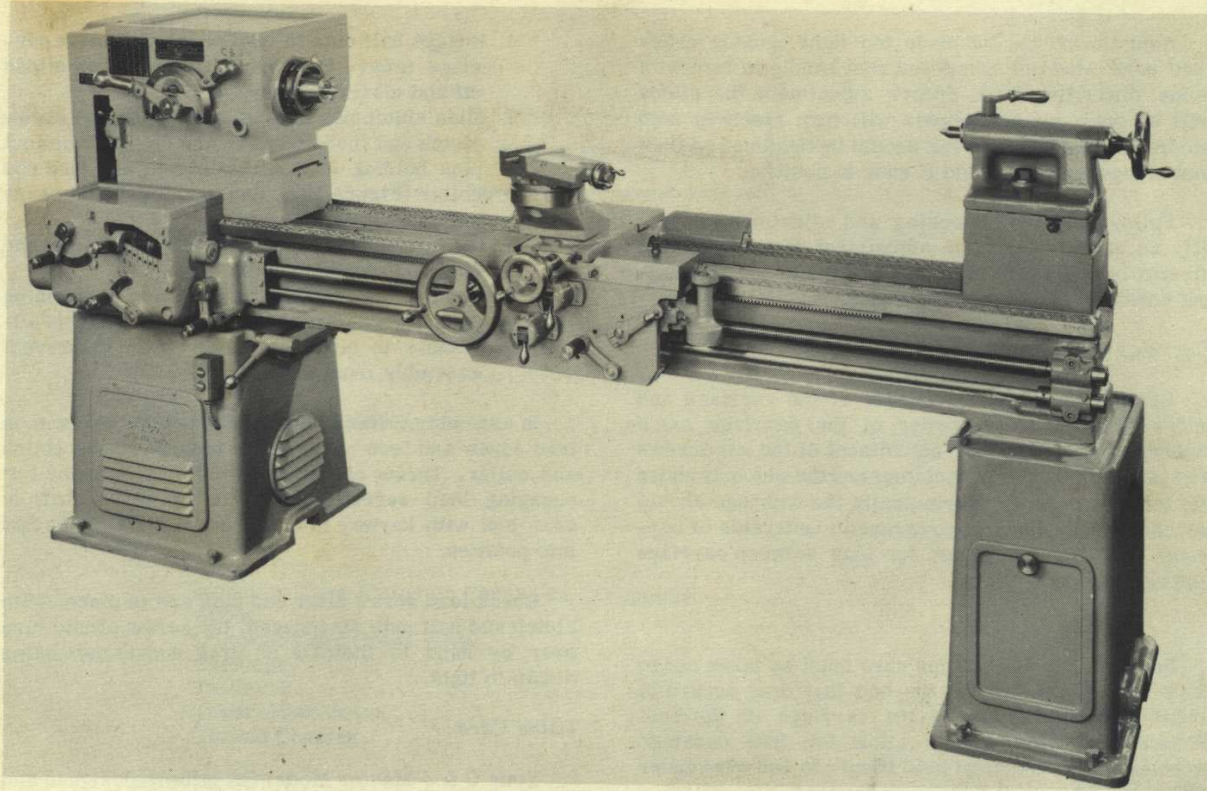
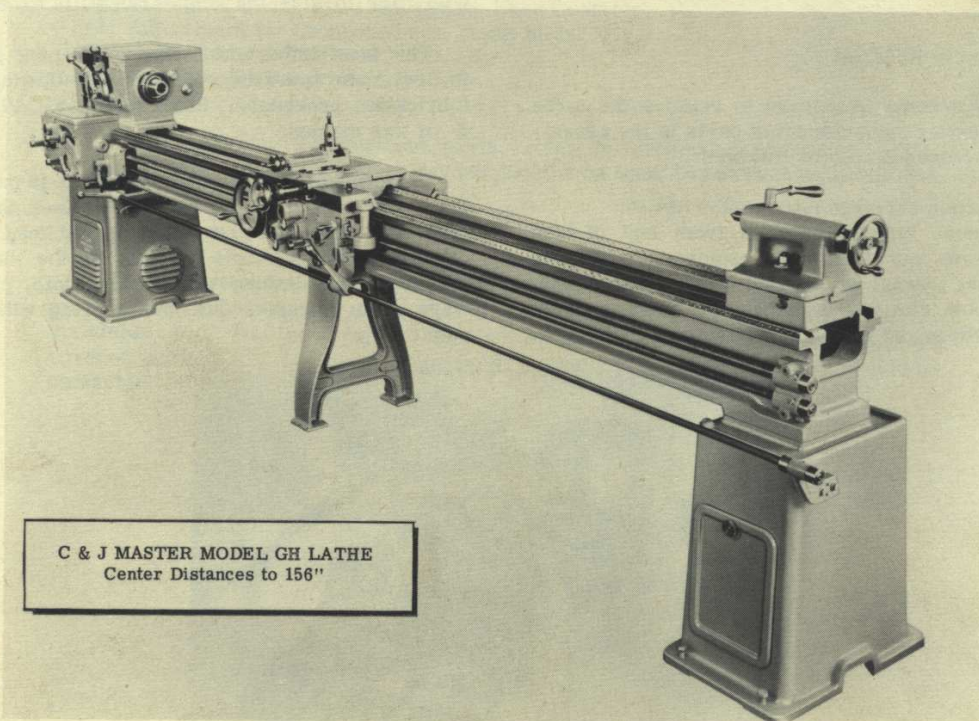


Figure 18. Apron Assembly Removal



C & J 16 - 25" MASTER MODEL GH LATHE, 20" Swing Over Cross Slide



C & J MASTER MODEL GH LATHE
Center Distances to 156"

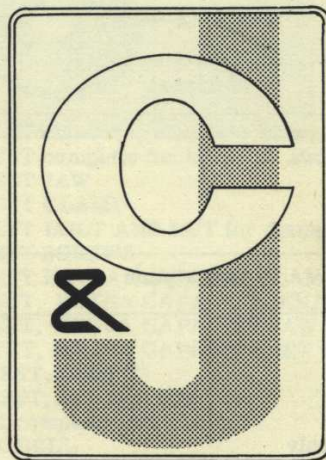
THE CARROLL-JAMIESON MACHINE TOOL CO., BATAVIA, OHIO

Parts List

C&J MASTER MODEL

GH

ENGINE LATHE



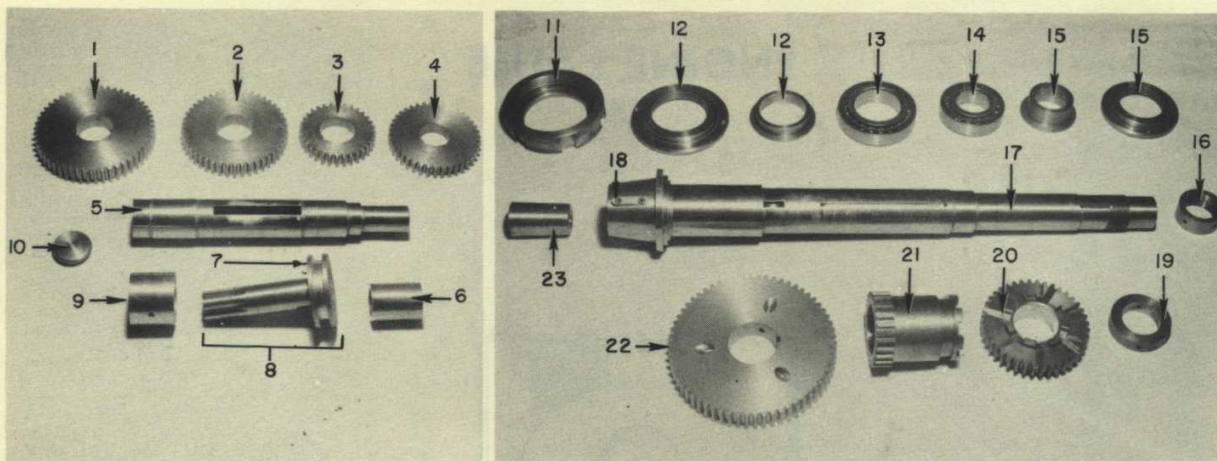
THE CARROLL-JAMIESON MACHINE TOOL CO.

BATAVIA , OHIO

Parts List

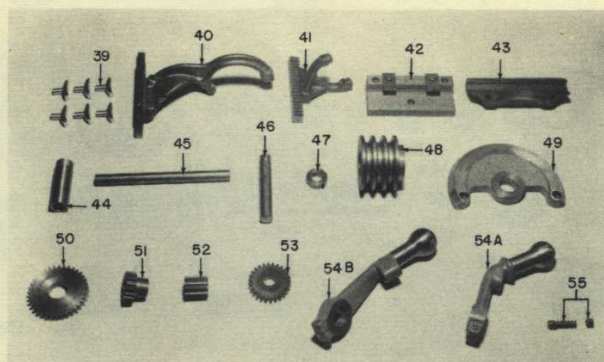
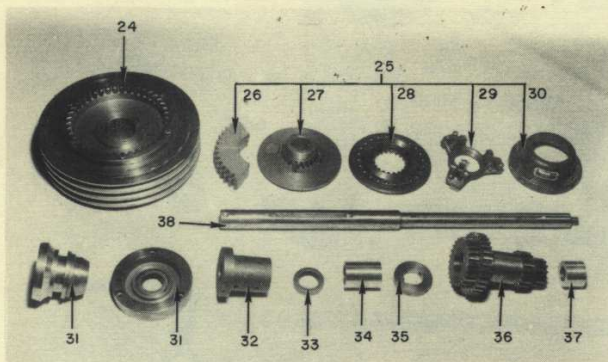
SECTION I - HEADSTOCK AND BED PARTS

NOTE: When ordering parts give the lathe serial number located on bed ways at tailstock end



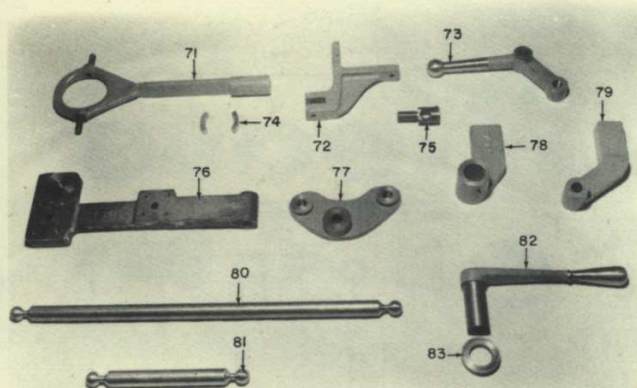
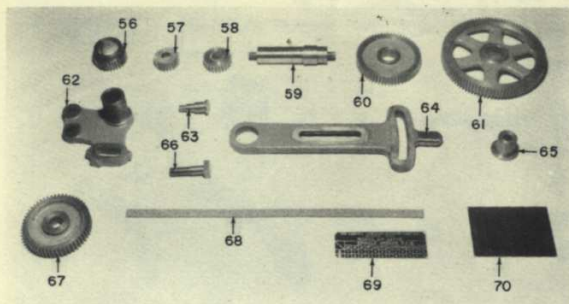
Index No.	Part No.	Description
1	MA101	50T GEAR
2	MA102	45T GEAR
3	MA103	32T GEAR
4	MA104	39T GEAR
5	MA117	CENTER SHAFT only
*	MA117A	CENTER SHAFT with gears assembled (Includes Items 1, 2, 3, 4, 5, 8)
6	MA118A	BRONZE BEARING, rear, for center shaft
7	MA137	PINION SLEEVE COLLAR
8	MA100	10T PINION with collar
9	MA118	BRONZE BEARING, front, for center shaft
10	MA140	BEARING CAP for drive shaft or center shaft
11	MA124B	DRAW NUT for LO spindle
12	MA121	OIL RETAINER with collar, front
13	MA131	TIMKEN BEARING, front
14	MA132	TIMKEN BEARING, rear
15	MA122	OIL RETAINER with collar, rear
16	MA125	SPINDLE NUT
17	MA124A	SPINDLE, LO taper nose type, with bushing
18	MA124C	KEY for LO spindle
19	MA139	SPINDLE THRUST COLLAR
20	MA107	40T GEAR
21	MA106	27T SLIDING CLUTCH GEAR
22	MA105	62T MAIN DRIVE GEAR
23	MA126	CENTER BUSHING
*	MA126A	SPECIAL CENTER BUSHING for #4 M. T. Shank
*	MA126B	SPANNER WRENCH for LO draw nut

SECTION I - HEADSTOCK AND BED PARTS



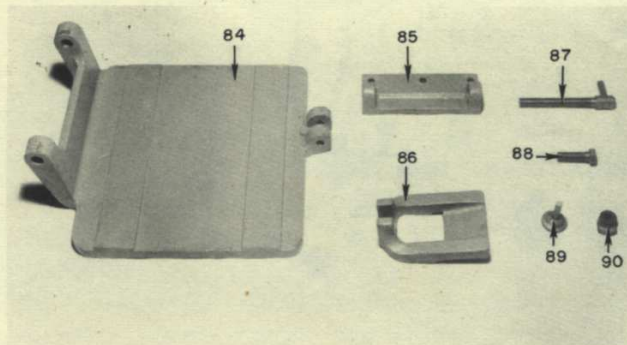
Index No.	Part No.	Description	
24	MA154	VEE BELT PULLEY for drive shaft (less clutch)	
*	MA156	VEE BELT, (matched sets of 3)	
25	MA147	CLUTCH complete for vee pulley	
26	MA149	CLUTCH DRIVING PLATE (3 segments)	
27	MA152	HUB AND BACK PLATE for clutch	
28	MA152A	FLOATING PLATE for clutch	
*	MA153	FELT WICKS for vee pulley bushing (8)	
29	MA148	CLUTCH ADJUSTING YOKE ASSEMBLY	
30	MA150	METAL COVER for clutch	
31	MA158	BRAKE ASSEMBLY (brake plate and shifter spool)	
32	MA151	BUSHING for vee pulley	
33	MA134	OIL SEAL for drive shaft	
34	MA119	BRONZE BEARING, front, for drive shaft	
35	MA133	THRUST COLLAR for drive shaft, rear	
36A	MA108	14T SLEEVE GEAR	These parts are not interchangeable - furnished complete
36B	MA109	19T SLEEVE GEAR	
36C	MA110	32T SLEEVE GEAR	
36D	MA111	25T SLEEVE GEAR	
37	MA119A	BRONZE BEARING, rear, for drive shaft	
38	MA116	DRIVE SHAFT for head	
39	MA123	SHIFTER SHOE, bronze, set of 6	
40	MA129	SHIFTER in head (large) with rack	
41	MA130	SHIFTER in head (small) with rack	
42	MA138	BACK SHIFTER GUIDE BLOCK	
43	MA142	SHIFTER CLAMP, large	
44	MA143	SHIFTER GEAR SLEEVE	
45	MA144	SHIFTER GEAR STUD	
46	MA145	SHIFTER GEAR SHAFT	
47	MA146	SHIFTER GEAR COLLAR	
48	MA157	VEE BELT PULLEY for motor	
49	MA186	"HALF MOON" PLATE for A and B handle	
50	MA114	36T GEAR	
51	MA112	17T GEAR	
52	MA113	12T GEAR	
53	MA115	26T GEAR	
54A	MA183	"A" SHIFTER HANDLE with plunger	
54B	MA184	"B" SHIFTER HANDLE with plunger	
55	MA185	PLUNGER complete for A or B handle	

SECTION I - HEADSTOCK AND BED PARTS



Index No.	Part No.	Description
56	MA163	30T SPINDLE GEAR
57	MA164	22T HEAD REVERSE GEAR with bushing
*	MA164A	BUSHING only for 22T reverse gear
*	MA165	25T MICARTA HEAD REVERSE GEAR
58	MA165A	25T MICARTA/STEEL HEAD REVERSE GEAR
59	MA166	STUD for reverse quadrant for 60T gear
60	MA167	60T STUD GEAR
61	MA168	96T INTERMEDIATE GEAR
62	MA174	TUMBER QUADRANT only (reverse plate)
63	MA172	STUD for reverse gears (22T or 25T)
64	MA179	INTERMEDIATE QUADRANT (long)
65	MA169	BUSHING for 96T gear
66	MA169A	QUADRANT BOLT for 96T gear
67	MA170	54T LEAD SCREW GEAR
68	MA191	SET CORK GASKETS - 4
69	MA187	SPINDLE SPEED PLATE
70	MA188	GEAR BOX INDEX PLATE
*	MA189	MASTER PLATE - half moon
71	MA159	SHIFTER YOKE for clutch and brake
72	MA160	SHIFTER YOKE BRACKET
73	MA161B	CLUTCH CONTROL HANDLE
74	MA162	BRAKE OPERATING SHOES, set of 2
75	MA161C	KNUCKLE JOINT complete
76	MA161	BED BRACKET for operating handle
77	MA161A	BED BRACKET SHIFTER PLATE
78	MA161F	APRON CONTROL ROD APRON BRACKET
79	MA161G	APRON CONTROL ROD REAR CABINET BRACKET
80	MA161E	SHIFTER ROD - rear
81	MA161D	SHIFTER ROD - under bed
82	MA161H	APRON CONTROL ROD HANDLE - at apron
83	MA161I	COLLAR for handle

SECTION I - HEADSTOCK AND BED PARTS

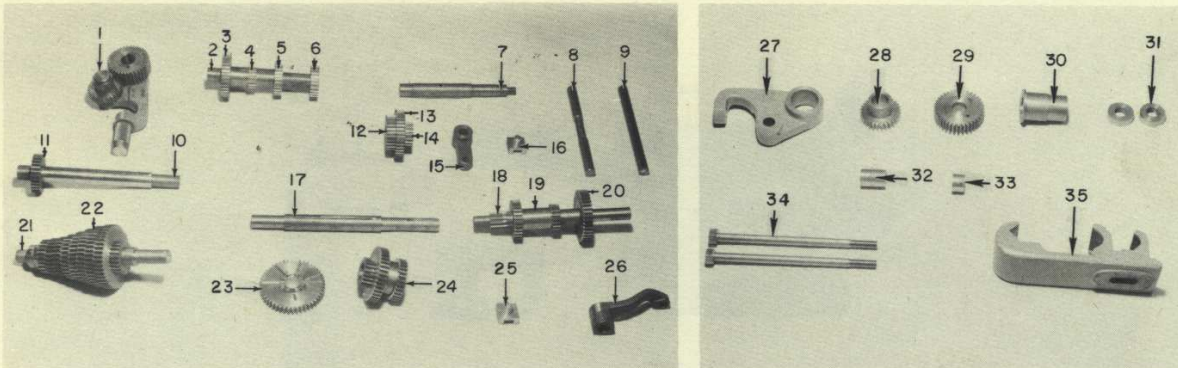


Index No.	Part No.	Description
84	MA196	ADJUSTABLE MOTOR PLATE
85	MA197	HINGE for motor plate
86	MA198	STIRRUP for motor plate
87	MA199	ADJUSTING SCREW for stirrup
88	MA207	LEVELING SCREWS for legs
89	MA203	DOOR KNOB
90	MA203A	DOOR KNOB CAM

* Non-illustrated parts

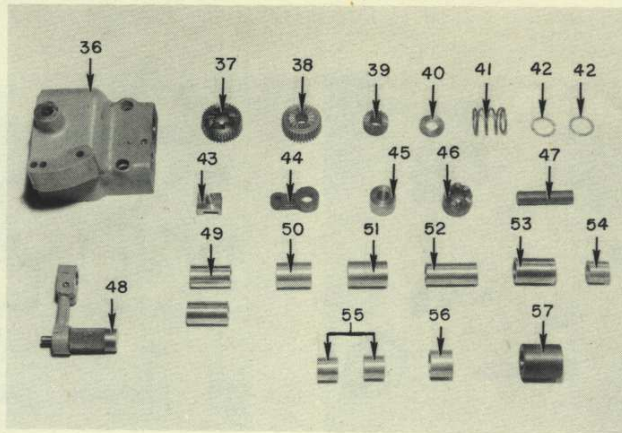
*	MA120	GEARED HEAD, completely assembled
*	MA120A	GEARED HEAD COVER
*	MA124	SPINDLE, threaded nose type, with bushing
*	MA127	DOG PLATE (small face plate) threaded
*	MA128	DOG PLATE for LO type spindle
*	MA136	PIPE PLUG for headstock drain
*	MA171	27T LEAD SCREW GEAR (to chase 1-1/2 TPI)
*	MA175	90T GEAR for cutting 2 TPI
*	MA176	57T GEAR for cutting 19 TPI
*	MA177	45T GEAR for cutting 30 TPI (or 7-1/2)
*	MA178	SET OF GEARS for cutting 27 TPI - 80T and 81T
*	MA180	FITTING with plug for head lubrication
*	MA181	WINDOW TYPE OIL LEVEL INDICATOR
*	MA182	OIL TROUGH for head
*	MA190	BED RACK
*	MA192	CABINET LEG FRONT less doors and motor base parts
*	MA193	DOOR for cabinet leg, left end
*	MA194	DOOR for cabinet leg, right end, round
*	MA195	DOOR for cabinet leg, front
*	MA200	VEE BELT GUARD
*	MA201	END GEAR GUARD, Aluminum
*	MA201A	COVER for end gear guard, aluminum
*	MA202	CABINET LEG, Rear
*	MA202A	DOOR for rear cabinet leg
*	MA202B	SHELF for rear cabinet leg
*	MA204	LEG, center, pan type for long beds
*	MA205	PAN BLOCK for pan type center leg
*	MA206	LEG, center, regular

SECTION II - GEAR BOX PARTS



Index No.	Part No.	Description	
*	B200	GEAR BOX complete with parts assembled	
*	B201	GEAR BOX machined less parts	
1	B204	SLIDING ARM HANDLE complete with gears	
*	B204A	KNURLED KNOB complete for sliding arm handle	
2	B207	COMPOUND SHAFT	
3	B210	40T COMPOUND GEAR	
4	B208	20T COMPOUND GEAR	
5	B209	30T COMPOUND GEAR	
6	B216A	30T DRIVE GEAR (compound shaft)	
7	B206	COMPOUND SHIFTER SHAFT (for 54T lead screw gear)	
8	B240	BACK LEVER SHAFT (ABCD)	
9	B214A	COMPOUND SHIFTER HANDLE SHAFT	
10	B217	SLIDING ARM HANDLE SHAFT	
11	B216	30T DRIVE GEAR (sliding arm shaft)	
12	B212	30T SHIFTING COMPOUND GEAR	
13	B213	40T SHIFTING COMPOUND GEAR	
14	B211	20T SHIFTING COMPOUND GEAR	
15	B214	COMPOUND SHIFTER	
16	B215	BRONZE SHIFTER SHOE	
17	B218	LEAD SCREW SHAFT	
18	B220	12T SHAFT	
19	B231	20/30 T. CLUSTER	
20	B232	40T GEAR	
21	B219	CONE GEAR SHAFT	
22A	B221	CONE GEAR 24T (2 required)	
22B	B222	CONE GEAR 26T	
22C	B223	CONE GEAR 28T	
22D	B224	CONE GEAR 32T	
22E	B225	CONE GEAR 36T	
22F	B226	CONE GEAR 40T	
22G	B227	CONE GEAR 44T	
22H	B228	CONE GEAR 46T	
23	B230	48T CLUTCH GEAR	
24	B229	20/30/40 T. CLUTCH CLUSTER	
25	B237	BRONZE SHOE for ABCD shifter	
26	B239	BACK LEVER	
27	B205A	SLIDING ARM HANDLE only (less knob and gears)	
28	B233	29T SLIDING ARM GEAR	
29	B234	36T SLIDING ARM GEAR	
30	B235	SLIDING ARM HANDLE BUSHING	
31	B263	LEAD SCREW LOCK NUTS (pr)	
32	B251	BUSHING for 29T tumbler gear	
33	B250	BUSHING for 48T drive shaft gear	
34	B236	GEAR BOX BOLT	
35	B264	LEAD SCREW SUPPORT	

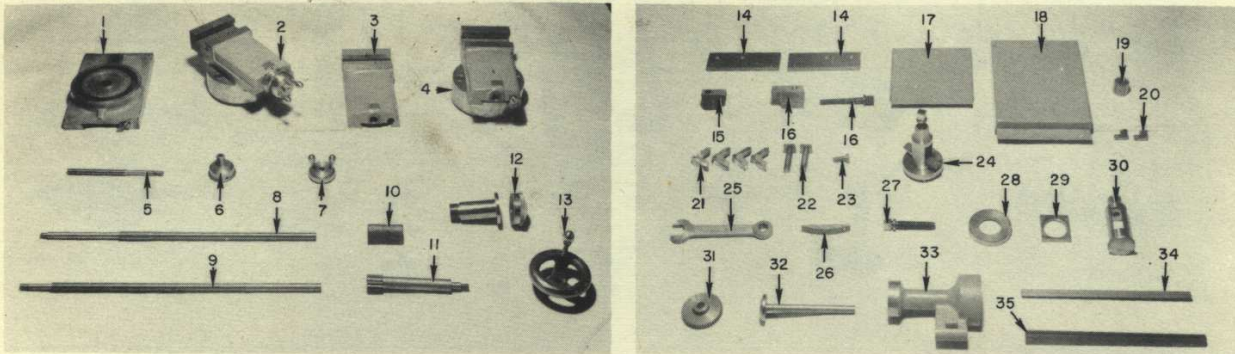
Any of Index 21 and 22 must be ordered separately.



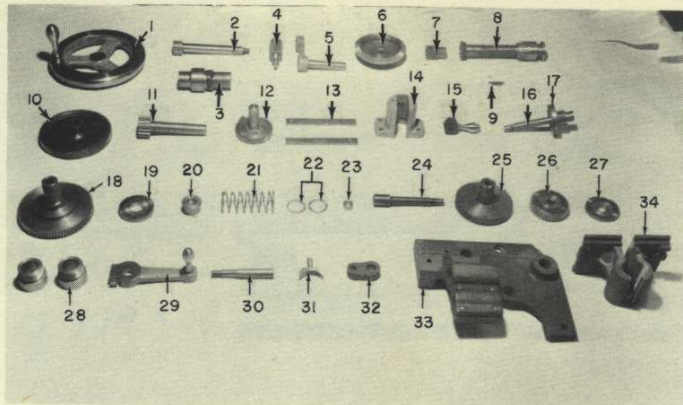
Index No.	Part No.	Description
36	B202	CLUTCH BOX machined less parts
*	B203	CLUTCH BOX with parts
37	B252	36T CLUTCH GEAR
38	B253A	36T FEED ROD SAFETY CLUTCH GEAR
39	B253B	SLIDING SAFETY CLUTCH
40	B253C	COLLAR for feed rod gear
41	B253D	SPRING for safety clutch
42	B253E	BRONZE WASHERS
43	B238	BRONZE SHOE for clutch box
44	B241	CLUTCH BOX DOG
45	B254A	COLLAR for feed rod, threaded
46	B255	LEAD SCREW CLUTCH
47	B262	CLUTCH BOX LEVER SHAFT
48A	B204B	SHIFTER HANDLE ABCD complete for gear box
48B	B205	SHIFTER HANDLE XYZ complete for gear box
49	B242	BUSHING 7/8 hole x 2-1/8 length (2) ea.
50	B243	BUSHING 7/8 hole x 1-7/8 length (1)
51	B244	BUSHING 1" hole x 2-1/16 length (1)
52	B245	BUSHING 7/8 hole x 2-3/4 length (1)
53	B246	BUSHING 1-1/16 hole x 2-1/16 length (1)
54	B247	BUSHING 3/4 hole x 1-1/16 length (1)
55	B248	BUSHING 7/8 hole x 1-1/16 length (2) each
56	B249	BUSHING 1-1/16 hole x 1-3/16 length (1)
57	B206A	COMPOUND SHIFTER SHAFT BUSH, cast iron
*	B256	FEED ROD 6 ft. bed
*	B257	FEED ROD 8 ft. bed
*	B258	FEED ROD 10 ft. bed
*	B259	FEED ROD 12 ft. bed
*	B260	FEED ROD 14 ft. bed
*	B260A	FEED ROD 16 ft. bed
*	B265	LEAD SCREW 6 ft. bed
*	B266	LEAD SCREW 8 ft. bed
*	B267	LEAD SCREW 19 ft. bed
*	B268	LEAD SCREW 12 ft. bed
*	B269	LEAD SCREW 14 ft. bed
*	B270	LEAD SCREW 16 ft. bed

* Non -illustrated parts

SECTION III - CARRIAGE PARTS

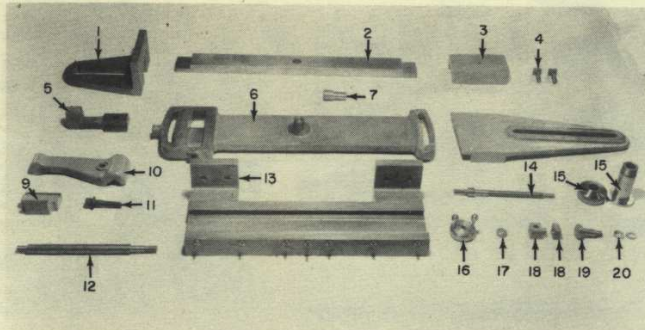


Index No.	Part No.	Description
*	C100	CARRIAGE planed and drilled
1	C101	CROSS OR BOTTOM SLIDE with gib
*	C102	COMPOUND REST TOP AND SWIVEL complete
2	C102A	COMPOUND REST TOP AND SWIVEL complete 18"
3	C102B	COMPOUND REST TOP only less screw parts
4	C103	COMPOUND REST AND SWIVEL less screw parts
5	C104	COMPOUND REST SCREW
6	C105A	COMPOUND DIAL AND BUSHING
7	C106	COMPOUND REST HANDLE
8	C110	CROSSFEED SCREW, standard type
9	C111	CROSSFEED SCREW, telescopic type
10	C112	CROSSFEED NUT, bronze
*	C112A	CROSSFEED NUT, cast iron
11	C113A	CROSSFEED PINION, telescopic type
12	C114A	CROSSFEED BUSHING AND DIAL
13	C115	CROSSFEED HAND WHEEL
14	C107	CARRIAGE CLAMP (rear)
15	C108	CARRIAGE CLAMP (left front)
16	C109	CARRIAGE CLAMP (right front, including bolt)
*	C117	TIGHT AND LOOSE BOLT
17	C118	DIRT GUARD, standard
18	C118A	DIRT GUARD, for lathe equipped with telescopic taper attachment
19	C113	CROSSFEED PINION
20	C133A	CARRIAGE OILER (1207)
21	C119	BRASS WIPERS (4)
22	C120	SWIVEL BOLTS (pair)
23	C122	GIB SCREWS
24	C123	TOOL POST COMPLETE
25	C124	TOOL POST WRENCH
26	C125	TOOL POST WEDGE
27	C126	TOOL POST SCREW
28	C127	TOOL POST RING
29	C128	TOOL POST WASHER (square)
30	C129	TOOL POST only (less parts)
*	C130	THREAD INDICATOR complete (includes items 31, 32, 33)
31	C131	THREAD INDICATOR WORM
32	C132	THREAD INDICATOR, dial and shaft
33	C133	THREAD INDICATOR BARREL OR SLEEVE
34	C134A	GIB for compound
35	C134	GIB for carriage slide



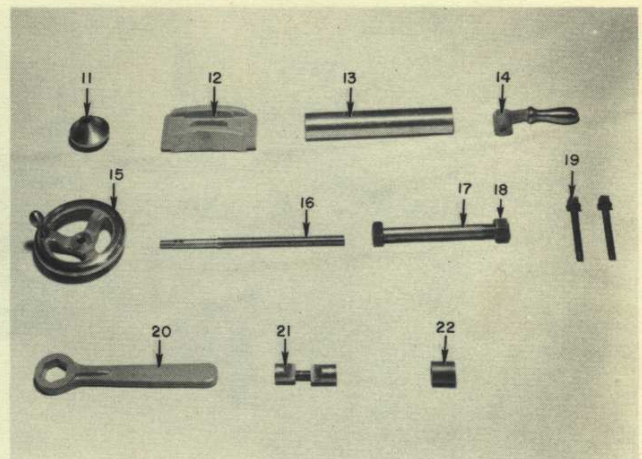
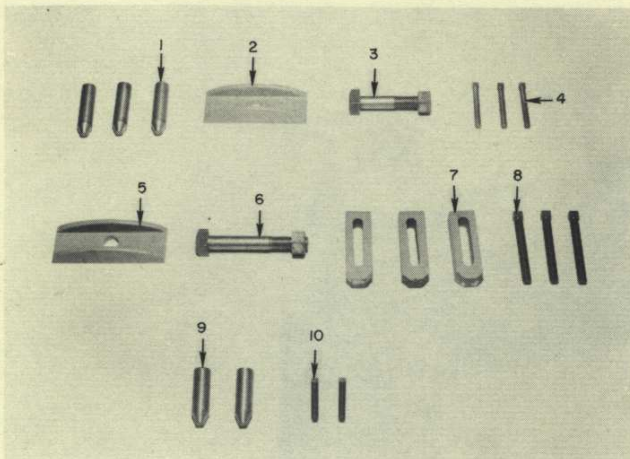
Index No.	Part No.	Description
*	D200	APRON complete
*	D201	APRON CASTING, machined and painted
1	D202	APRON HAND WHEEL
2	D203	HAND WHEEL PINION, first stud 17T
3	D206	HAND WHEEL BUSHING
4	D205	FEED REVERSE KNOB
5	D204	FEED REVERSE LEVER AND STUD
6	D207	BEVEL GEAR 56T less pinion
7	D208	BEVEL GEAR PINION 16T
8	D209	DOUBLE BEVEL PINION 19T
9	D210	KEY for double bevel pinion
10	D211	RACK GEAR 80T
11	D212	RACK PINION 16T
12	D213	NUT BOX CAM
13	D214	NUT BOX GIBS, pair
14	D215	HOUSING only for longfeed or crossfeed controls
15	D216	CAM LEVER for longfeed or crossfeed controls
*	D217	LONGFEED CLUTCH ASSEMBLY less housing, cam lever and thrust bearing
16	D218	LONGFEED GEAR STUD, 17T
17	D220	CLUTCH for longfeed gear stud
18	D219	76T LONGFEED GEAR less clutch
19	D221	CLUTCH for 76T longfeed gear
20	D222	ADJUSTING NUT for longfeed or crossfeed stud
21	D223	COIL SPRING for longfeed or crossfeed control
22	D224	BRONZE THRUST WASHERS
23	D225	THRUST BEARINGS
*	D226	CROSSFEED CLUTCH ASSEMBLY, less housing, cam lever and thrust bearing
24	D227	CROSSFEED CLUTCH STUD
25	D228	60T CROSSFEED GEAR less clutch
26	D229	40T CROSSFEED GEAR AND CLUTCH
27	D230	CLUTCH for crossfeed stud
28	D231	APRON BUSHING
29	D232	NUT LEVER AND HANDLE
30	D233	BEVEL GEAR STUD
31	D234	SHIFTER SHOE for bevel pinion
32	D235	SHIFTER DOG
33	D236	BACK WALL
34	D237	NUT BOX (pair half nuts)

SECTION V - TAPER ATTACHMENT PARTS



Index No.	Part No.	Description
1	E118	TELESCOPIC CROSSFEED SUPPORT
2	E100	TOP GUIDE BAR
3	E101	TOP GUIDE BAR SHOE
4	E105	BOLTS for swivel slide, pair
5	E117	TELESCOPIC CROSSFEED BRACKET
6	E103	SWIVEL SLIDE
7	E122	TAPER ATTACHMENT TOP GUIDE BAR STUD
8	E102	CONNECTING BAR
9	E114	COMPLETE LOCKING BRACKET BED DOG AND CLAMP
*	E115	TELESCOPIC CROSSFEED PINION
10	E112	LOCKING BRACKET BED DOG
11	E111	TIGHTENER BOLT TO CLAMP
12	E110	CONNECTING ROD TO CLAMP
13	E104	CARRIAGE BRACKET
14	E106	ADJUSTING SCREW
15	E119	TELESCOPIC CROSSFEED BUSHING AND DIAL
16	E108	ADJUSTING SCREW HANDLE
17	E107	ADJUSTING SCREW COLLAR
18	E109	ADJUSTING SCREW NUT
19	E120	TELESCOPIC TAPER ATTACHMENT TOP SHOE STUD
20	E121	TELESCOPIC TAPER ATTACHMENT THRUST WASHER

OPTIONAL ATTACHMENTS	
Part No.	Description
M100	MILLING ATTACHMENT vise with jaws and screws
M101	MILLING ATTACHMENT SCREW
M102	MILLING ATTACHMENT JAWS
M103	MILLING ATTACHMENT SLIDE
M104	MILLING ATTACHMENT SWIVEL
M105	MILLING ATTACHMENT SCREW only
M106	MILLING ATTACHMENT CRANK HANDLE
M107	MILLING ATTACHMENT DIAL AND BUSHING
M108	MILLING ATTACHMENT SWIVEL BOLTS

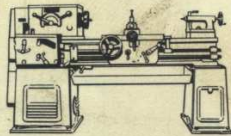
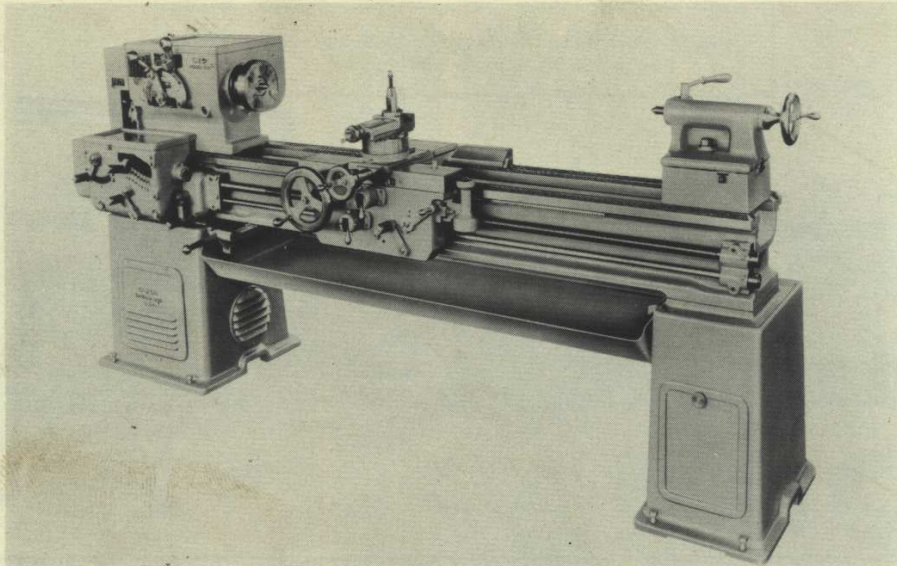


Index No.	Part No.	Description	
*	J100	STEADY REST Standard, complete with clamp for 16" lathe	
*	J101	STEADY REST complete for lathe 18" swing	
1	J102	STEADY REST JAW	
2	J103	STEADY REST CLAMP	
3	J104	STEADY REST BOLT AND NUT for clamp	
4	J105	STEADY REST SCREWS	
5	AM102	STEADY REST EXTRA CAPACITY CLAMP	
6	AM103	STEADY REST, EXTRA CAPACITY BOLT AND NUT	
7	AM104	STEADY REST, EXTRA CAPACITY JAW (3)	
8	AM105	STEADY REST, EXTRA CAPACITY SET SCREWS	
9	K101	FOLLOW REST, JAWS (3)	
10	K102	FOLLOW REST, SET SCREWS	
*	L100	TAILSTOCK complete with clamp	
11	L101	TAILSTOCK BELL	
12	L102	TAILSTOCK CLAMP	
13	L103	TAILSTOCK SLEEVE AND NUT	
14	L104	TAILSTOCK BINDER LEVER	
15	L105	TAILSTOCK HAND WHEEL	
16	L106	TAILSTOCK SCREW	
17	L107	TAILSTOCK BOLT AND NUT	
18	L108	TAILSTOCK NUT for bolt	
19	L109	TAILSTOCK SIDE SCREWS	
20	L110	TAILSTOCK WRENCH	
21	L111	TAILSTOCK BINDER BUSHING	
22	L112	TAILSTOCK SLEEVE NUT (roughed)	

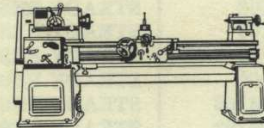
DRAW IN ATTACHMENT PARTS for LO Taper Key Drive Spindle

- DIA 5 DRAW IN ATTACHMENT, BUSHING
- DIA 6 DRAW IN ATTACHMENT, HANDWHEEL
- DIA 7 DRAW IN ATTACHMENT, EXTENSION TUBE
- DIA 8 DRAW IN ATTACHMENT, COLLET TUBE

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MASTER MODEL GH 16"



MASTER MODEL GH 18"

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