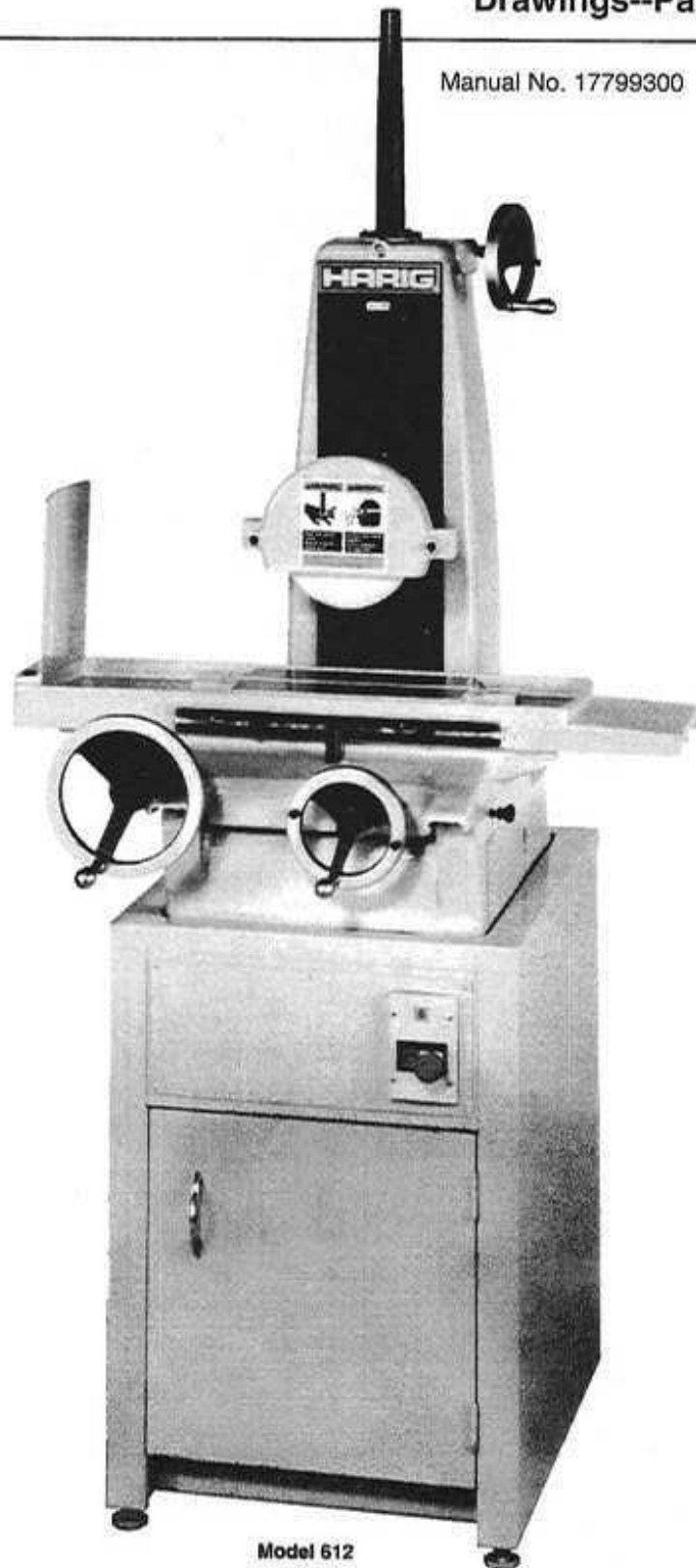

HARIG®

Nomenclature
Installation & Set Up
Operation
Maintenance
Troubleshooting
Drawings--Part Numbers

612 & 618 HAND FEED

Manual No. 17799300



Model 612

C-9300

OPERATION

Safety First

We, like most manufacturers, go to great lengths to make our products as safe as possible. But operators still can get hurt. In virtually every case, the injury is the result of:

- Not knowing how to operate the machine properly.
- Not following proper operating and safety procedures.
- Carelessness or inattentiveness. Trying to "take a short cut".
Poor maintenance.

For your personal safety, and to get maximum efficiency out of this precision machine, read and follow operation instructions carefully.

Standard Safety Precautions for operating the HARIG® Surface Grinder.

- NEVER operate machine without safety glasses.
- NEVER operate machine without wheel guard in place.
- DO NOT wear tie, scarf, ID bracelet, neck chain or other object that could become entangled in the machine or workpiece.
- ALWAYS wait for wheel to STOP before bringing your hands to table or workpiece.
- MAKE CERTAIN workpiece is SECURELY held in place.
- NEVER attempt to hand hold or hand feed a workpiece.
- NEVER exceed machine's capacity.
- Use proper grade grinding wheels and keep them dressed.
- Stop the machine and correct any malfunction IMMEDIATELY. (See troubleshooting section).
- Inspect and maintain machine by schedule—not by chance.
- Keep hands (and clothing) away from table when operating.
- If you're not a qualified electrician, do NOT tamper with electrical connections or wiring. Report any suspected electrical malfunction immediately.

612 & 618 HAND FEED SURFACE GRINDER

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Bridgeport Machines Inc.
1875 Big Timber Rd.
P.O. Box 538
Elgin, IL 60120-0538
708 695-1000

TROUBLESHOOTING

Uneven Down Feeding Response

The exceptional rigidity of the Harig grinder is obtained by an extremely close fit on the column ways. Since there is only a few tenths clearance between the spindle housing and column, any dirt or grit, or a very small warping of the back plate, could cause spindle housing to "hang up" in the ways.

Check for this condition by mounting an indicator on the wheel guard or spindle housing to touch a block on the grinder table. Turn down feed handwheel and note response on the indicator. The 100 lb. combined weight of the motor, spindle and housing, and guard assembly should keep the bevel gear carrying the elevating screw firmly seated in the thrust ball bearing in the column cap. (See Fig. 21) The only slack that should be seen as column is raised and lowered with the handwheel should be the small amount between the bevel gear and pinion on the handwheel shaft. If the response between handwheel readings and the indicator show a slack of several thousandths rather than the normal half thousandth slack between the pinion and bevel gear, the spindle housing assembly is probably "hanging up" in the column ways until the bevel gear is backed up to the pinion and forces the elevating screw down.

To inspect column ways, first remove the grinding wheel from the spindle. Then remove the wheel guard by loosening its clamping screw and sliding it off the end of the spindle. Loosen the five 5/16 set screws holding the spindle cartridge in the housing approximately 1/8". The spindle cartridge and motor assembly can now be removed from the back of the machine. Take out the six Phillips head screws holding the back dust guard retainer in place and remove the dust slides and retainer. Crank the saddle away

from the column and remove the six Phillips head screws holding the front dust slides. Now alternately crank the spindle housing to the top and then to the bottom of the travel, wipe off the ways with a clean cloth and inspect. Clean any dirt or grit. Check to see if a piece of grit has scored the ways. If so, they should be dressed with a fine stone to remove any ridges.

If the column way surfaces are clean and smooth and the spindle assembly is still sticking, either the spindle slide back plate has warped or the column uprights have moved closer together by a few tenths. If the spindle housing is tight in only a small area, scrape the back ways of the column to remove the high spot. The high areas of the way can be found by applying a thin layer of red lead to the ways and running the housing assembly up and down.

If the assembly is tight over the entire column, remove back plate from the spindle housing by taking out the six 5/16 screws holding it in place. Crank spindle housing to the bottom position and push the housing just far enough away from the column to inspect the 45° ways. If there is no evidence of scoring or a piece of grit lodged in the casting, grind .0003" off the two surfaces of the back plate that ride on the back column ways. Accurately check the step between the way surface of the back plate and the center part that is screwed to the spindle housing before grinding the way surface, so the entire back plate can be reground if found to be warped. Reassemble the back plate to the spindle housings. If still too tight, remove an additional .0003" from the way surface.

If the 45° way of the spindle housing is scored, remove housing from the column as follows: Mark elevating

screw (Fig. 20) at the point where it enters the spindle housing so that it can be turned to the same point when the grinder is reassembled. Loosen the 1/4-20 by 1" cap screw that holds the elevating screw in place. (See Fig. 20) Unscrew elevating screw from the housing and run it up to clear by holding screw with one hand and turning elevating handwheel with the other. Spindle housing can then be removed from the column and any score marks stoned off smooth.

D. Spindle housing too loose.

If error in down feed response is less than .001", spindle housing assembly may be too loose in the column ways. Remove motor spindle assembly and dust guards as outlined in previous paragraph. Determine amount of looseness by placing an indicator on grinder table to read against the part of the spindle housing projecting to the front of the grinder. With the column ways wiped clean of oil, alternately twist the spindle housing from one side to the other. The difference of the indicator reading when the twisting pressure is released should be less than a half a thousandth. Make this check at both the top and bottom positions of the spindle housing, as well as in the middle, and use the lowest reading. Remove the back plate from the spindle housing. Then remove 3/4 of the difference between the at-rest indicator readings from the center area of the back plate that is clamped against the spindle housing. For example, if .0012" slack is found, remove .0009" from the center area of the plate.

E. Spindle assembly creeps down.

Because of the exceptionally smooth action of the down feed mechanism, it would be possible for the spindle assembly to creep down or "unwind" itself if a frictional drag

TROUBLESHOOTING

Uneven Down Feeding Response Improper Longitudinal Feed Cross Feed Malfunction

were not used. This creep is most likely to occur if a vibration caused by an off balance wheel is occurring. The wave spring No. 17748702 adds a drag to the system by pressing the nylon washer No. 16213102 against the moving thrust bearing inner race and the second washer No. 16213128 against the stationary top column bridge. (See Fig. 20)

If extra drag is wanted for an out of the ordinary problem where the wheel balance cannot be corrected, order a 'C' spring No. 16213088 and install by removing the three screws that hold the elevating screw guard in place and lifting the guard off. Drop the open end of the C spring under the bevel gear. Push the back end of the C spring down with a screwdriver until the spring is horizontal, and move the spring sideways to snap across the high point of the gear and fit in the angular space between the bearing race and the bevel gear.

7. IMPROPER LONGITUDINAL FEED

A. Improper longitudinal feed (cable drive machines only). If table does not move when handwheel is turned, tighten cable. Loosen cable hook locknut (see Fig. 23) and tighten the adjusting nut to pull the cable tighter. Do not overtighten, as this may cause cable to break prematurely, or wear a flat surface into the nylon cable covering. Tighten only enough to pull the table without slip.

B. 612 Cable broken or worn. To replace cable, run table to the right and loosen the nut on the back of the hook until the cable loop can be slipped off. Remove the loop from the post under the left end of the table. Slip the two coils of cable off the roll of the handwheel shaft and pull the cable out.

To install new cable, pass a stiff soft wire through the cable space from the right side of the machine. Bend over a loop or hook to attach the wire to a loop of the new cable and pull it back through the space. Form two coils in the cable and slip them over the cable roll. Put the loop over the post on the left and draw the cable loop onto the hook. Tighten the nut to put tension on the cable. Run the table back and forth and observe the cable on the roll. If it runs partly off the back end when the table is run to the left, grasp hook with a large adjustable wrench and turn the hook post to angle hook forward enough to make cable track properly.

C. 618 Cable broken or worn.

To replace cable, remove Table Safety Stop 16813012 (Fig. 22). Remove cable long feed eye bolt 16213053 (Fig. 23). Slip cable off cable post 16213039. Move table to extreme right and lift off table. Place table top down on a bench. Remove old cable. (Note direction of wind of the two loops of cable over cable roll 16213037. If cable is out of place, see Middle view of Fig. 23 for proper direction for assembly.) Tape an end of the new cable to the left underside of the carriage, near the front way. Bring the cable to the top of the cable roll and wind two clockwise turns onto the roll. Lead the cable on to the right and tape the end to the right underside of the carriage. Clean off the entire underside of the table so no grit will fall on the carriage, and place the table in position on the right side of the carriage. Remove the tape from the left end of the cable and, taking care to keep moderate tension on the cable (so it will not slip off the end of the cable roll), slip the cable over the cable post 16213039. Move the table to the left only enough to maintain tension on the cable.

Remove tape from right end of cable, hook it over the Longfeed Eyebolt, slip eyebolt through inner cable post 16213038 and tighten 1/4-20 nut to get moderate tension on the cable. (Light tension must be maintained on cable during the above so the cable does not slip off the end of cable roll.) Grasp cable under the left side of the table and pull to the front of the machine while cranking table back and forth until cable tracks evenly on cable roll when observed from under left side of the table. (It may be necessary to readjust tension.) Put no more tension on cable than is necessary, since this will cause a flat to wear on cable and can pull the table into a bow and cause inaccurate grinding. It should be possible to reposition the handwheel by running the table to an end stop and slip it to the new position with very little extra force. Tighten the locknut on the eyebolt, and replace the table safety hook.

8. CROSS FEED MALFUNCTION

A. Hand feed wheel turns hard. Be sure the cross feed lock thumb-screw has been loosened. (Right side of the base just under the saddle, A Fig. 9.)

Spindle On/Off Switch

PARTS LIST

REF NO.	QTY.	HARIG NO.	DESCRIPTION
FU1,2	2	17742121	Fuse Holder (L60030C-1PQ)
FU1,2	2	See Chart #1	
T1	1	See Chart #1	
M1	1	17747177	Contactora (Klockner Moeller #DILEM-10-24V)
E-Stop	1	17747179	Switch Assy, PB, E-Stop (Klockner Moeller #RPV/J01)
SW1	1	17747180	Switch Assy, Ily, Spindle, (Klockner Moeller #RLWKNWS)
OL1	1	See Chart #1	
FU3	1	17747911	Fuse, FLM 3A
FU3	1	17746838	Secondary Fuse Kit (Acme# PL-112602)
T2	1	See Chart #1	Transformer, 380V/460V Lube Pump Configuration

BACKSIDE OF FRONT PANEL
CIS and Heavy Duty Cabinet

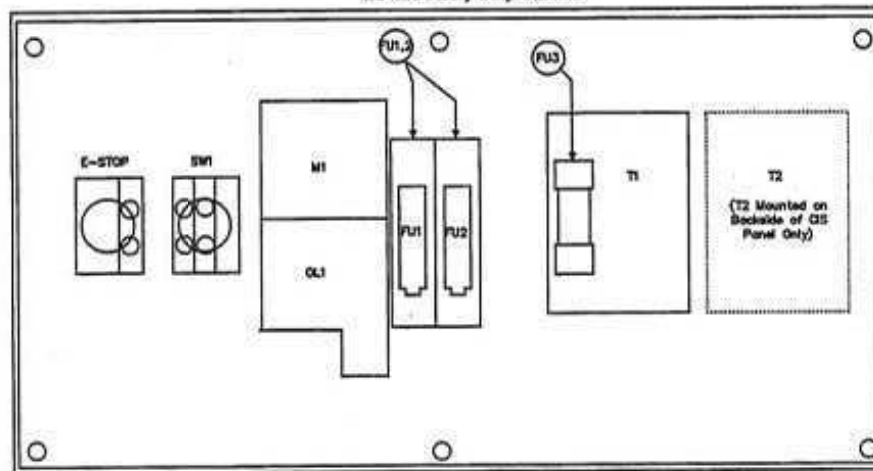
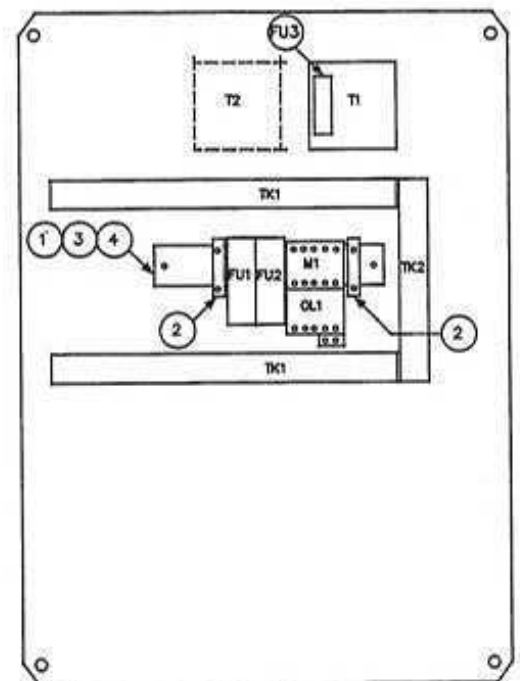


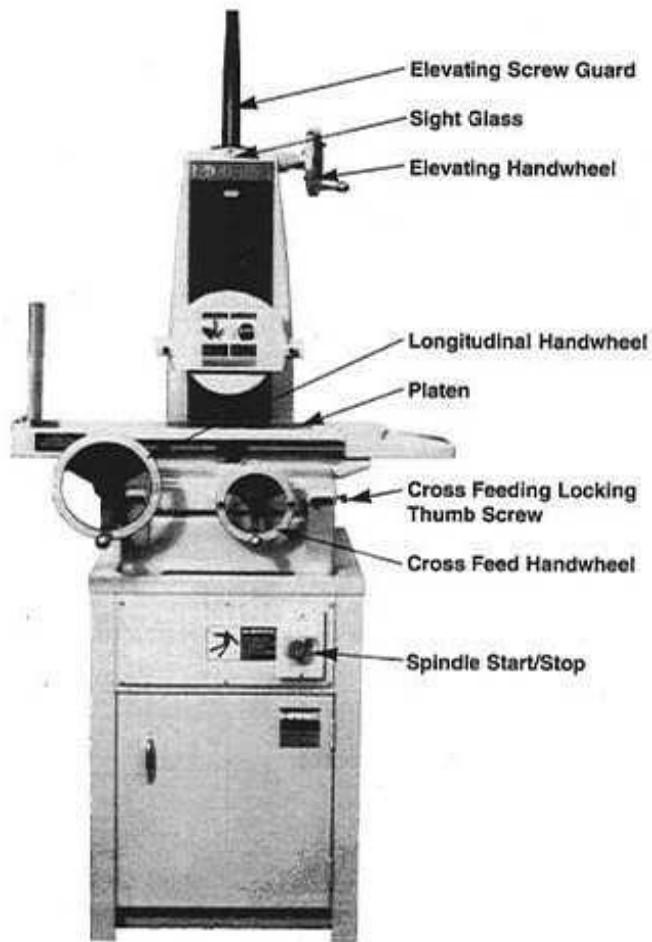
CHART #1: 612, 618 HANDFEED SPINDLE TYPES WITH FUSE AND OVERLOAD AMPERE VALUES AND PART NUMBERS

SPINDLE	LINE VOLTAGE				DEVICE
	208	230	380/50hz	460	
1.5 H.P.	.3A	.3A	.3A	.15A	FU1, 2
	17742137	17742137	17742137	17742124	
	4.6A	3.6A	2.4A	1.8A	OL1
	17747182	17747178	17747178	17747183	
	17746881	17746881	17746881	17746881	T1
	N/A	N/A	17746905	17746800	T2, W/ Heavy Duty Cabinet
	N/A	N/A	17746905	17746805	T2, W/ CIS or Console Cabinet
	16213507	16213507	16213506	16213506	LUBE PUMP
	17747019	17747019	17747019	17747019	Spindle
	2.5 H.P.	.3A	.3A	.3A	.15A
17742137		17742137	17742137	17742124	
6.1A		6.1A	3.0A	3.4A	OL1
17747184		17747184	17747178	17747178	
17746881		17746881	17746881	17746881	T1
N/A		N/A	17746905	17746800	T2, W/ Heavy Duty Cabinet
N/A		N/A	17746905	17746805	T2, W/ CIS or Console Cabinet
16213507		16213507	16213506	16213506	LUBE PUMP
17747052		17747052	17747052	17747052	Spindle

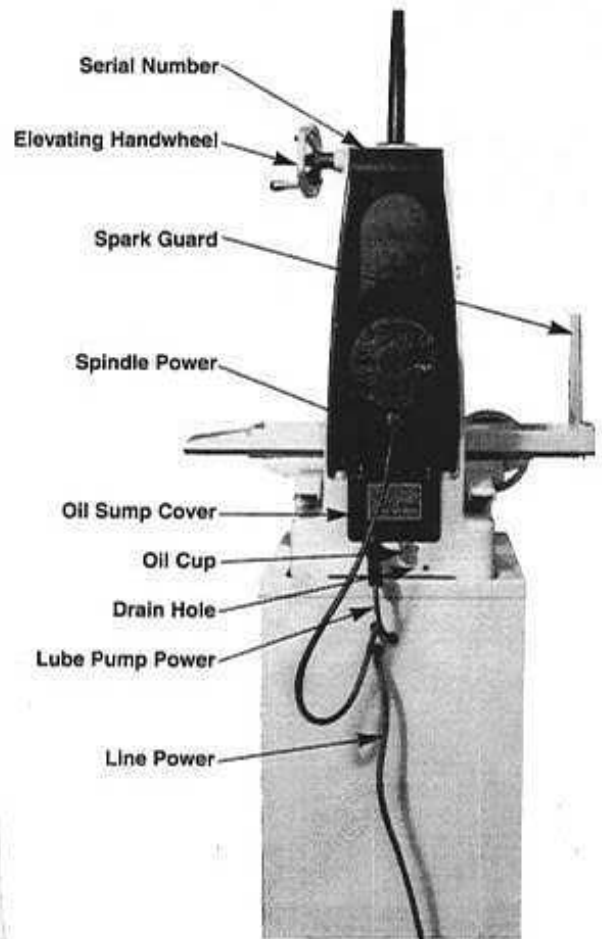


INNER PANEL
CONSOLE CABINET

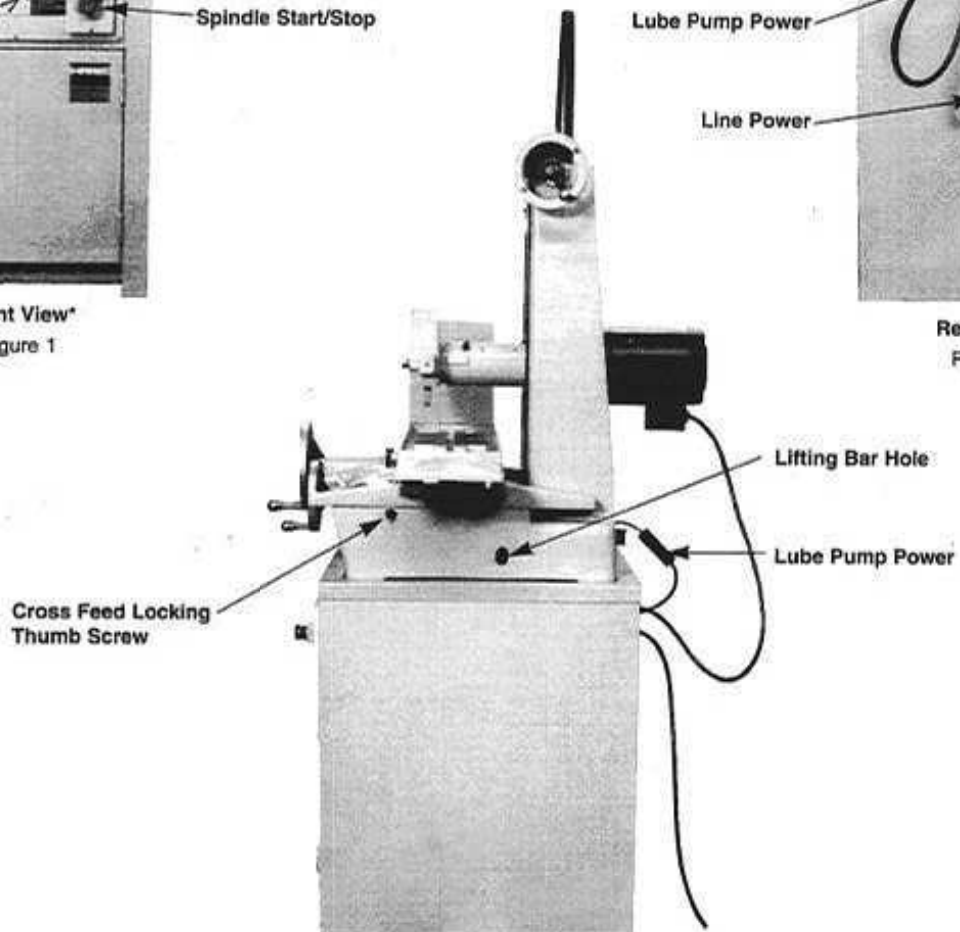
NOMENCLATURE



Front View*
Figure 1



Rear View*
Figure 2



Side View*
Figure 3

*Model 612 Hand Feed

INSTALLATION AND SETUP



Figure 4



Figure 5



Figure 6



Figure 7

Step 1. Do Not Remove Skid.

Do not remove skid until machine has been moved adjacent to its installation site.

Step 2. Lift Grinder From Skid and Position.

Before moving the elevating handwheel to remove the wood brace between the table and spindle housing, remove the plastic temporary dust cover from the top of the column and slowly pour 2 ounces ($1/4$ cup) of way oil (the gallon container in the "standard accessory box" found on the left rear corner of the machine skid) over the bevel gear.

2.1 Place $3/4$ " steel bar through holes near bottom of grinder base. (Fig. 3)

2.2 Attach 1800 lb. lifting strap to ends of bar and join near top of column. Strap to top of column. Pad machine adequately to prevent damage to finish. (Fig. 4)

2.3 Remove the four $1/2$ -20 hex head bolts holding the base cabinet to the skid. **Caution:** Do not lift by motor, spindle, table or saddle.

2.4 Lift slightly from skid. Loosen locking thumb screw. (A, Fig. 9, page 4) Balance machine

by turning cross feed handwheel. For safety, support the machine on two 4 ft. pieces of 4 x 4 while installing leveling legs.

2.5 Screw 4 leveling legs (located in "standard accessory box") into the holes in the base cabinet to project $5/8$ " below the bottom.

Step 3. Position Machine.

Position machine where desired. No special pad, floor reinforcement or drip pans are required.

Step 4. Clean Machine.

Remove grease from table, handwheels and exterior surfaces with clean rag. It is not necessary to disassemble anything as all interior surfaces are factory prepared. Do not use solvents or abrasives that may damage machine's finish.

Step 5. Level Machine.

5.1 Crank table all the way to the right and all the way toward the column.

5.2 Raise left front leveling leg $1/4$ " off the floor.

5.3 Place level on table platen and adjust the three remaining legs to level the table in both directions.

5.4 Lower left front leg to floor and give it an additional $1/8$ turn.

Step 6. Assembly.

Use three round head screws (furnished) to fasten Elevating Screw Guard to Column Cap. (Fig. 5)

Step 7. Wet Coolant.

If wet coolant attachment has been purchased with a 618, loosen the three $1/4$ turn coolant compartment screws (Fig. 6) and assemble as per instructions packed with the system. A wet coolant system purchased with a 612 is placed along side the machine.

Step 8. Lubrication.

8.1 Fill lube oil reservoir (cup at rear of machine). If needed, add way oil from the gallon furnished to bring level to up to nearly full. (Fig. 7)

8.2 Ways and feed screws are automatically lubricated.

8.3 Spindle and motor bearings are permanently lubricated.

8.4 If machine has a rack and pinion type longitudinal table travel, this assembly was greased at the factory. Add a small amount of grease to the rack each month.

SETUP OPERATION Power On Table Feeds

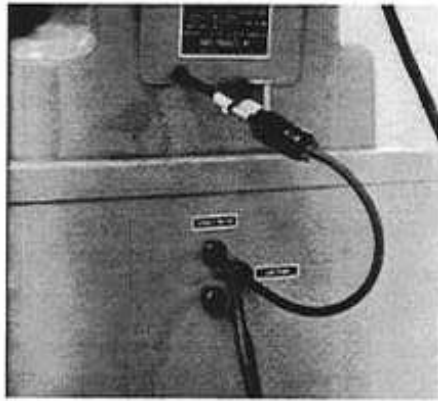


Figure 8

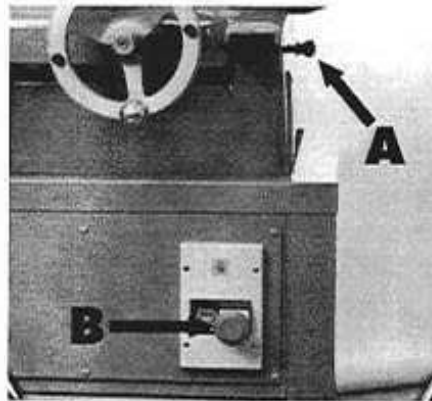


Figure 9

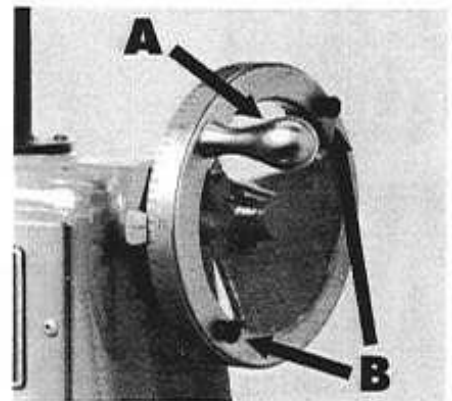


Figure 10

Step 9. Electrical Connections.
Caution: To preclude personal injury or extensive machine damage, all electrical work should be done by a qualified electrician.

9.1 Ground machine by connecting the green wire to a satisfactory ground. *Neither the building structure nor a hot water pipe is a satisfactory ground.* **Caution:** Do NOT ground the machine to a gas pipe. If a satisfactory ground is not available, drive an 8 foot copper ground rod into the ground and securely clamp the ground wire to it.

9.2 Compare rating label on the back of the spindle motor with house current to make certain they correspond.

Note: If it is not desired to use the line power cable furnished with the machine, access to the line connections is made by removing the two screws on the cover of the Spindle Start/Stop switch and removing the cover. The line connectors are the three screws at the top of the switch.

9.3 Connect three main line wires to house current system.

9.4 Remove wheel. Stand in front of machine. Turn Spindle Motor on. It should rotate CLOCK-

WISE. If not, switch any two of the three live wire connections.

Power On.

To turn the spindle motor on, depress "start" button located on front of cabinet. (B, Fig. 9) This also starts the lubricating system oil pump. After 1 minute, the oil level should rise to the midpoint of the sight glass on the column cap of the machine. This shows that the machine is ready for operation.

The 1.5 HP motor furnished as standard with this machine has enough power to take as heavy a cut as you will normally wish when cross feeding and grinding without coolant. When plunge grinding or grinding with coolant, it is relatively easy to overload the motor. The switch incorporates overload protection. If the overload switch trips, allow sufficient time for the overload to cool, then press the start button to restart the motor.

Longitudinal Feed.

Feed the table by operating the large handwheel. If your grinder has a cable drive (rather than a rack and pinion drive) you can readjust the position of the handle on the wheel by cranking the table to the end of its travel and continuing to turn the wheel (slipping the cable) to

the desired position.

It is a good practice to distribute oil evenly over entire length of the ways before using grinder. Simply turn on spindle and run table back and forth a few times. (Spindle switch activates oil pump.)

Cross Feed.

Achieve manual cross feed by loosening the cross feed travel locking thumb screw (A, Fig. 9) on the right side of the base under the table one turn, and operating the cross feed handwheel.

Elevating Mechanism.

Raise or lower grinding head assembly by turning handwheel (A, Fig. 10) on the right side of the top of the column.

To change zero setting, loosen two knurled screws (B, Fig. 10) projecting from face of wheel, slide calibrated slipring to desired position, and retighten screws.

To engage "fine feed" (optional equipment), tighten one large knurled screw. (A, Fig. 11) One revolution of the "fine feed" knob changes elevating screw setting by .001 inches. To disengage "fine feed", loosen knurled screw 1/2 turn.

OPERATION

Grinding Wheel Mounting Grinding Magnetic Chucks

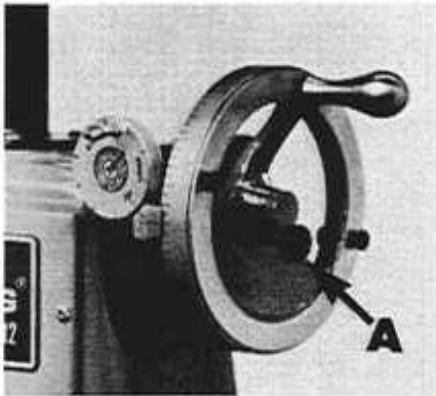


Figure 11

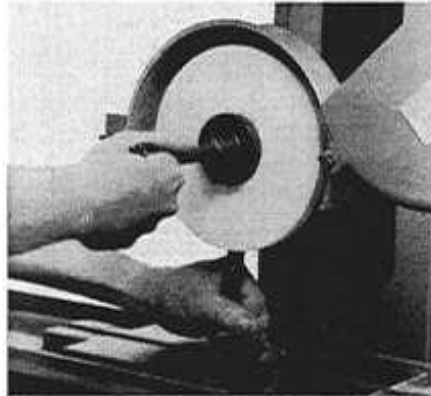


Figure 12

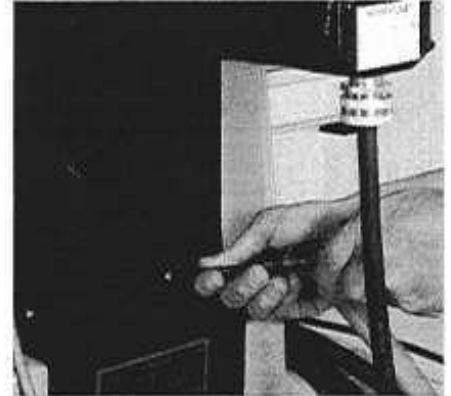


Figure 13

Grinding Wheel Mounting.

The grinding wheel furnished with your machine was chosen to satisfy average shop work requirements. It was dressed on both sides and bottom, and was balanced with the Harig wheel balancer 17794350. Before removing this wheel from the grinder, dress the bottom face and grind a piece of soft tool steel to check the machine setup and performance. Use only balanced wheels to ensure getting the maximum quality this precision machine is capable of producing. When specific problems regarding wheel selection are encountered, contact a grinding wheel manufacturer or his local representative for recommendations.

The spanner wrenches (*furnished*) fit the wheel nut which holds the grinding wheel on the adaptor, and the two holes in the back of the adaptor. Unless a right-hand thread has been specifically ordered, the wheel nut has a left-hand thread (*letters LH stamped on face of nut*) so that the wheel will tend to tighten under starting torque. When changing wheel, be sure adaptor is re-tightened. If left loose, wheel may shift and cause chatter marks.

The socket on one spanner wrench

fits the nut holding the adaptor on the spindle. To remove adaptor, unscrew nut completely (*left-hand thread*) and screw in the "puller" (*furnished*) until the center screw hits the spindle end. Tighten center screw until adaptor is free. (*Fig. 12*)

Grinding Magnetic Chucks.

A magnetic chuck with an untrue bottom can distort a surface grinder table to which it is clamped. For this reason, the bottom should be wiped dry, placed on a surface plate and checked for bow. If the chuck rocks or pivots rather than having an even drag, place it face down on the platen and grind the bottom flat. If a surface plate is not available, use the grinder's platen.

Caution: *Never* grind the platen, as this can impair accuracy.

Grinding the chuck surface requires special technique and great care. The "lead" filling between the magnetic poles tends to load the wheel and will cause the unsupported areas of the chuck over the magnet to move with any temperature difference created by grinding. Follow these instructions carefully:

1. Use a relatively coarse grit wheel of medium grade and open structure with a vitrified bond. The 9A-

46-H8-V52 wheel furnished with the machine works well if used with a mist or wet coolant and can be used dry if care is used to prevent heat buildup. If difficulty is experienced, use a still softer and more open wheel such as a 32A46-G12VBEP.

2. Dress wheel rather coarsely with a sharp diamond. Cross feed the diamond at a fairly rapid rate and do not pass under wheel unless dressed at least .0005 inches. Tighten screws holding chuck to table with minimum force needed to keep chuck in place. Overtightening may cause warping.

3. Chuck must be in "on" position while being ground.

4. Set depth of each cut to .0002".

5. Take a cross feed cut of at least .060 inch for each pass.

6. Dress wheel after each cut across chuck to remove any "lead."

7. A loaded wheel, whether caused by heavy cuts, improper dressing or the wrong type of wheel, can create heat buildup sufficient to warp center of chuck up into the wheel and seriously affect grinder accuracy.

MAINTENANCE

Cleaning

Lubrication

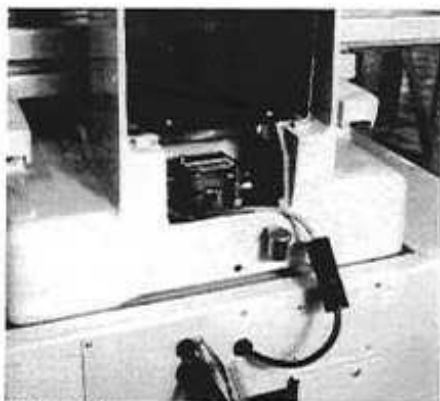


Figure 14

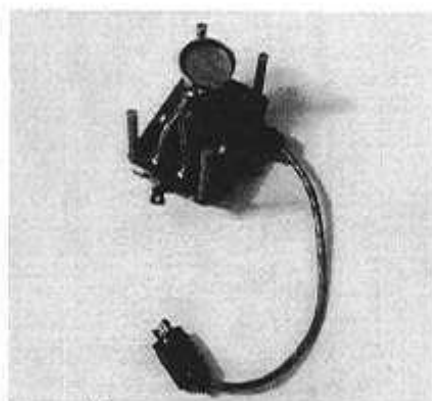


Figure 15

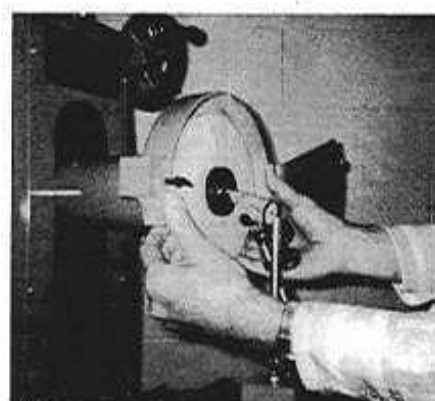


Figure 16

MAINTENANCE.

This precision surface grinder is equipped with an automatic "Flo-Clean" oil system. Unlike other grinders, this completely separate system circulates, filters and recirculates the cleaning/lubricating oil. All moving mechanical and wear surfaces are automatically and continuously flushed with filtered oil whenever the spindle is running.

Cleaning.

This machine requires only surface cleaning. All internal parts are cleaned automatically by the built-in system mentioned above. When cleaning the external surface:

1. Center table to prevent dirt and grit from being brushed onto ways.
2. *Never* use an air blast to clean machine. Use a vacuum and/or treated dusting cloth. *Removed dirt—don't just move it.*
3. Make certain that exhaust from vacuum or dust collector is not directed toward grinder and particularly not at underside of table.
4. If solvents must be used to clean surface, use caution not to drip on

ways. Do not use a lacquer base or other solvent which may damage machine's baked enamel finish.

Note: We recommend centering the table when machine is not in use to provide a dust cover for table ways.

Lubrication.

Since the motor and drive are permanently lubricated and sealed, the only lubrication maintenance required are the following periodic checks:

EVERY 100 HOURS OF OPERATION:

Check the large oil cup in the rear of the machine. If less than half full, add enough Harig Way Oil (*No. 16211245, furnished with machine*) to bring level nearly full. (*Fig. 7, page 3*) A standard 150 to 225 SUS viscosity oil may be used in place of Harig 16211245, but it will have 19% less "stick-slip" efficiency. If another way oil is used, check with the manufacturer to be sure the viscosity falls within the above range. The 325 SUS viscosity some manufacturers recommend may create an oil film thickness that could cause inaccurate grinding.

EVERY 1000 HOURS OF OPERATION:

Clean the oil pump filter. Unscrew dust guard retaining screws and remove guard. (*Fig. 13*). Remove pump from sump. With pump upside down remove the retaining clip (*Fig. 15*) from filter cup (*be careful not to puncture screen*) and remove first screen. Repeat operation for second screen. Clean pump, screens and sump, and reassemble and refill with new way oil.

In addition to the above instructions, check the oil run off bottle.

The bottle is located inside the front storage compartment.

Disconnect the hose, empty the waste oil, reconnect the hose, and return the empty bottle to its original position.

Note: Disposal procedure for all waste oil must be in accordance with local, state and federal regulations.

TROUBLESHOOTING

Adjustments Chatter

TROUBLESHOOTING

Adjustments.

Your Harig® surface grinder has been designed and manufactured to give a long life of accurate finish surface grinding. It has been thoroughly checked during manufacture and final assembly, has been run in, and has been given a performance test. A final inspection report showing the actual deviations found in six of the many checks performed on this machine is included with this manual.

The following section is set up to assist you in getting maximum performance from the machine. Each trouble or malfunction is listed, followed by possible causes, together with suggested adjustments or changes you can make.

Caution: Electrical tests with the current on should be made only by a qualified electrician.

Ordering Replacement Parts.

When repair parts are ordered, be sure to include the serial number of the machine as well as the part number shown in the following drawings. The machine serial number is stamped into the column cap casting next to the elevating handwheel.

1. CHATTER OR VIBRATION MARKS IN FINISH.

A. Wheel loose on sleeve. Put additional tension on wheel adaptor nut. Even if nut is not loose, motor starting torque may be causing wheel to shift slightly. Redress after adding tension to wheel nut.

B. Wheel out-of-balance.

All grinding wheels are out-of-balance. It is only a question of how much. (*One can verify this by holding the projecting part of the spindle housing while the grinder is running*

with the wheel, wheel nut and washer removed, and by comparing the vibration with the wheel mounted in place.) Balance the wheel with a Harig Wheel Balancer (No. 17794350) or comparable unit.

If the wheel has not been balanced, the chatter can be minimized by dressing the wheel at the grind point and taking a finishing cut that puts the same drag on the wheel as the dressing operation. The wheel is dressed out-of-round to compensate for the amount of vibration. If a heavier cut is taken, however, the chatter will occur because of the "hammering" of the out-of-round wheel at a different vibration rate.

If a Harig Accu-Dresser or Presto-Dress™ is used to dress an unbalanced wheel, a chatter in the finish will result because the wheel is dressed round and will "hammer" by the amount of vibration. A balanced wheel will give you more pieces between dresses because of the elimination of this "hammering."

C. Wheel not dressed on sides.

If the wheel has not been dressed on the sides, a chatter or vibration pattern can result because of the side-to-side movement of the edges of the wheel, and because the surfaces of a wheel next to the mold are harder than the rest of the wheel.

D. Wheel in need of dressing.

If chatter appears after the wheel has been used for a time, it is probably due to the fact that most grinding wheels vary in hardness around the periphery. Since this chatter appearance is usually only a few millionths of an inch high, weigh the economics of more frequent wheel dressing against the slight loss of appearance.

E. Loss of preload.

Occasionally, due to a phenome-

non called fretting corrosion (*usually caused by out-of-balance wheels*), the rear bearing outer race will freeze in the spindle sleeve and the wave springs no longer hold the spindle shaft tightly back against the front bearings. To check for loss of preload, place an indicator against the spindle nose as shown in Figure 16. Push against wheel guard with thumbs, pulling wheel forward while watching indicator. When released, needle should instantly return to original position. If needle returns to original position only by rotating wheel by hand, return spindle to factory for repair. Be sure to state that there was loss of preload on this test.

F. Grade of wheel too hard.

Loading up or glazing of the wheel, particularly if grinding without coolant, can cause chatter. Replace wheel with one of a softer grade.

G. Taper of adaptor sleeve in error.

If the taper in the wheel adaptor sleeve is not the same as that on the spindle nose, or if a piece of dirt or grit has been assembled on the taper, chatter can appear on the work. To check the adaptor sleeve, put a thin film of Prussian blue inside the sleeve and press it on the spindle. The spindle taper should show contact all around the circumference on two separate rings.

H. Use of phase converter.

A phase converter used to run a three phase motor on a single phase supply will also affect finish and motor sound because of the unbalanced current a converter delivers. The type of converter that switches out of the circuit after starting the motor will cause a poorer finish than a single phase motor. The type of converter that stays connected and is rated to run the spindle motor, will give a better finish than a single phase motor.

TROUBLESHOOTING

Chatter

Longitudinal Lines

Inaccurate Grinding

I. Ball bearing failure.

The super precision bearings used in the Harig Spindle are sized to give an average life of many years of service. If a failure of either the spindle or motor bearings does occur, a chatter will appear on the work being ground, and a noise will be heard when the spindle is running. (*Wheel, wheel nut, and washer should be removed to make certain an unbalanced wheel is not causing the noise.*) Replacement of all bearings on the spindle assembly, or a new motor, is required. It is recommended that the spindle assembly be returned to the factory for this repair so that dynamic balance of the unit can be checked.

J. Unbalanced electric supply.

If the three phase current supplied to the machine is not reasonably uniform, a poor finish will result.

2. LONGITUDINAL LINES— SCRATCHY FINISH.

A. Wheel too soft for material being ground.

The grains in too soft a wheel will pull out before they have really dulled. The dressed surface will be lost too quickly and the few remaining pointed grains will give a scratchy appearance. Replace with a harder wheel.

B. Wheel dressed too finely, or wheel too hard.

If wheel is not cutting freely, longitudinal lines in the finish, sometimes discolored or burnt, will result. Replace with a softer grade wheel or pass the diamond across the wheel at a faster speed when dressing. Do not dress the wheel without a down feed before each pass.

C. "Hard-shell" sides on wheel.

Break the corners of the grinding wheel with an abrasive stick.

D. Grinding swarf in coolant.

Clean out coolant tank.

3. INACCURATE GRINDING.

A. Magnetic chuck clamped too tightly or too loosely.

A chuck or fixture clamped too tightly may warp the table, causing it to rock in the saddle ways rather than tracking smoothly. If chuck is not clamped tight enough, it could shift position and lift up and over dirt. Tighten one of the clamps firmly to hold the chuck in position when the table reverses. Then tighten the other clamp only enough to keep the chuck down on the table.

B. Wheel glazed; not cutting freely.

Redress wheel, or replace wheel with a softer grade.

C. Machine out-of-level.

Be sure that base cabinet was leveled according to installation instructions. Thickness of the four vibration isolation pads that support grinder on the base cabinet has been adjusted to support the grinder base so that the plane of the V-ways are exactly parallel with the plane of the flat ways. If grinder base is located on anything other than its own base cabinet and vibration isolation pads, check base ways for twist by laying a small surface plate on two 1.000 inch rolls in the V-ways and two .582 inch parallels on the flat ways of the base. If the two rolls are placed in the ends of the V-ways and one of the parallels put in the center of the flat way, the height of the pads should be adjusted until you get the same "feel" at either end of the flat way with the other parallel.

D. Magnetic chuck in need of dressing.

See "Grinding magnetic chucks" in the operating instructions in this manual on Page 5.

E. Grinding wheel shifted in adaptor.

If wheel is not tight enough on the adaptor, it can shift when grinder is turned on and off, or when a heavy cut is taken. This could cause grinder to cut an additional few thousandths, as well as giving a chatter appearance on the surface.

F. Down feed inaccurate.

See section "Uneven Down Feeding Response" on Page 9.

G. Side grinding not square.

If cartridge spindle has been replaced in the machine, it may be necessary to realign the spindle in its housing by adjusting tension on the five set screws that hold it in place. (*The five 5/16" diameter by 5/16" long set screws shown in Figure 20.*) To check squareness of the spindle to the longitudinal travel of the table, an angle plate can be indicated parallel to the table travel as shown in Fig. 5 of our Final Inspection Report, and an indicator fastened to the nose of the spindle can then be swung as shown. If indicator has a higher reading for the right-hand position shown in Fig. 5, slightly tighten the upper right and lower left set screws on top of the spindle housing to shift the spindle slightly. The angle plate can also be used to check spindle axis parallelism to the work table as shown in Fig. 3 of the final Inspection Report. Varying the tension applied by the bottom set screw, against the tension of the four top set screws, can change this indicator reading slightly.

H. Workpiece not parallel.

If machine does not grind parallel front-to-back, be sure cross feed lock screw (*A, Fig. 9*) is loosened enough so the pressure pin is not rubbing on the carriage locking strap.

TROUBLESHOOTING

Inaccurate Grinding

Motors Do Not Run, Oil Dripping

Uneven Down Feeding Response

I. Long spark out time.

If the grinder does not "spark out" after a reasonable number of passes, make sure that a way oil of less than 225 SUS viscosity is being used. The pressure oiling system floods the ways with so much oil that a higher viscosity lubricant can lift the table a few tenths when light cuts are taken.

4. MOTORS DO NOT RUN.

A. Fuses blown out.

If spindle motor will not run, or is running at a slow speed, one or more fuses may be blown. Check line leading to the machine to make sure plant circuit fuses are not blown.

Caution: All checks of the electrical system should be made by qualified personnel.

On rare occasions a fuse will blow under normal machine usage. If a fuse blows repeatedly, however, the cause must be found and corrected.

Note: A stalled motor can blow a fuse. Wiring to the motors should be inspected to make sure there are no loose connections. Check particularly in the connection box to the motor that insulation has not been worn through causing grounding out to the machine frame.

B. Overload relay tripped.

The spindle may stop because its overload relay is tripped. To restart the spindle, allow sufficient time for the overload to cool, then press the start button. If a special electric option has been chosen, either the spindle overload or the lube pump overload may cause the spindle to stop. To reset, press the reset button on the appropriate relay, unless they are set for automatic reset.

If the spindle motor overload is tripping regularly, chances are that too heavy a cut is being taken with the

grinding wheel, or that the wheel is loading up and putting extra strain on the motor. A 1.5 HP motor will have enough power to take as heavy a cut as the operator normally wishes if table is cross feeding and coolant is not being used. If coolant is used when cross feeding, or if plunge grinding is being done, it is easy to take a cut that will require more than 1.5 HP. Under these conditions, check the current consumption of the spindle motor to make certain it is not drawing more than the full load motor current before increasing current capacity. To readjust the trip point, remove the Start/Stop switch cover (Fig. 1) by removing two screws. Reset the red dial with a small screwdriver.

C. Motor burnt out.

All motors used on your grinder have a design life of many years. The motor most likely to fail is the oil pump motor because it depends on the oil level being maintained to keep it from overheating. A burnt out motor will usually draw an excess of current and trip the motor overloads, blow fuses, or overheat in one spot. It may, however, overheat an internal connection and cause a wire to break loose. Checking motor circuits with an ohmmeter should locate any internal breaks. An ammeter check on motor current on each of the three legs of a three-phase motor will show a shorted out section of winding by drawing more than the rated full load current.

Caution: All electrical checks should be made by qualified personnel.

The maximum temperature at which a motor can be safely operated depends on the class of insulation of its windings. A motor stamped Class A can reach a temperature of 203°F on its shell, and one stamped Class B can reach 239°F and still be within

the manufacturer's specifications.

5. OIL DRIPPING

A. Machine not level.

Oil dripping from underside of the table ways can be caused by machine improperly leveled. Recheck leveling and follow installation instructions if machine is not level.

B. Restricting valve opened too wide. Check setting of restricting valve (17778007 in Fig. 19). Remove dust guard (Part No. 16211072) by loosening the two screws and sliding guard up so screw heads will pass through the key hole slot in the guard. Reset valve by closing it down completely and then reopening 1/2 turn. If dripping from ways continues, close valve back to the point where it is opened approximately 1/3 of a turn.

6. UNEVEN DOWN FEEDING RESPONSE.

A. Wheel too loose.

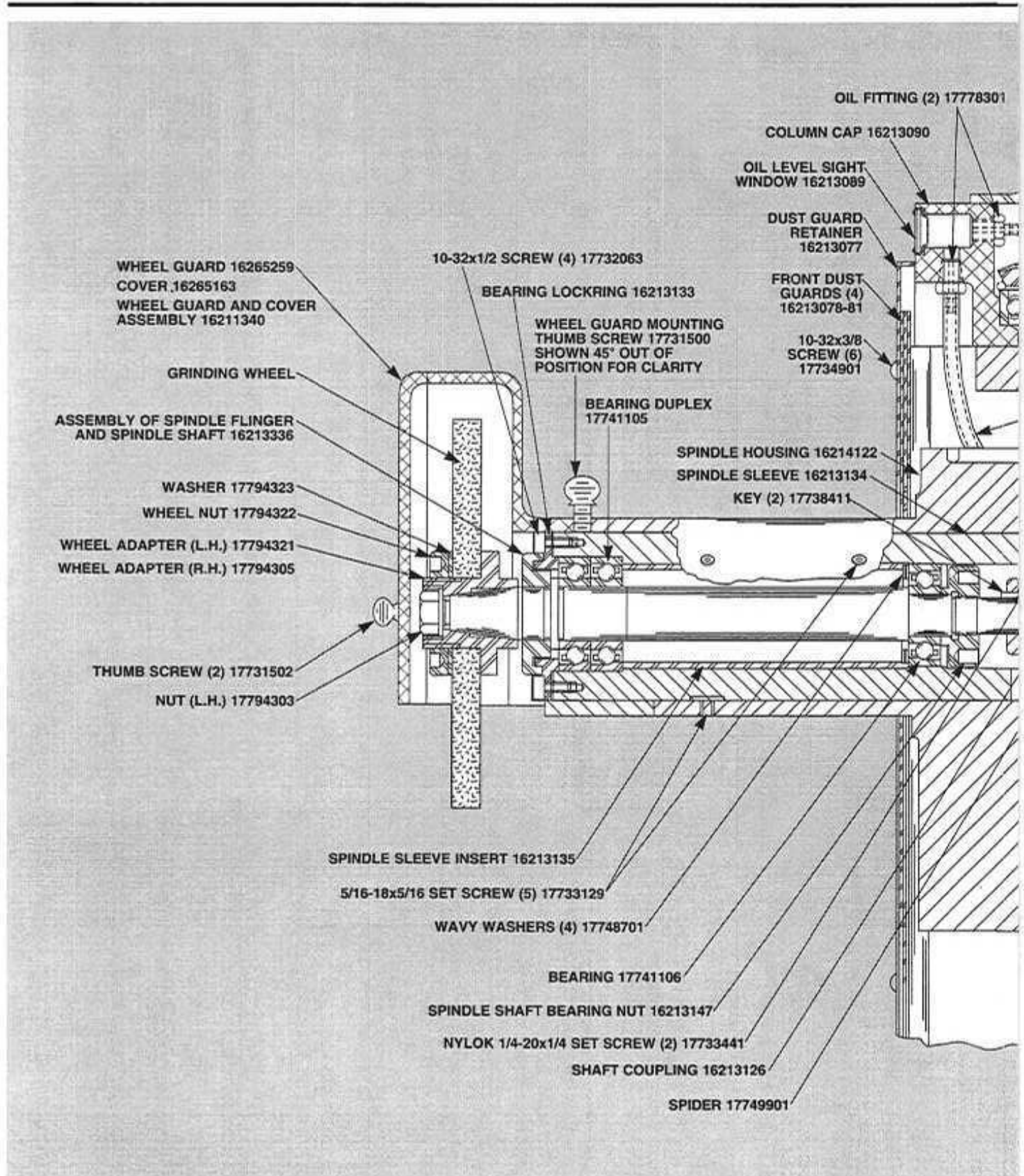
If grinder has been stopped and restarted with the wheel insufficiently tight, the wheel may have shifted slightly when the motor was restarted, cutting an additional amount because of being off center. Retighten grinding wheel.

B. No oil on column ways.

Check oil level in sight glass at the top of the column shortly after spindle motor is turned on. If oil does not appear, make sure that oil cup on the back of machine base is nearly filled. Add oil if necessary. If oil is at the proper level, see that pump is running and that filter screen is clean. (See *Lubrication under Maintenance.*) Check that oil lines are intact and on their proper fittings as shown in Fig. 19.

C. Spindle housing assembly sticking in column ways.

Spindle and Elevating Assemblies



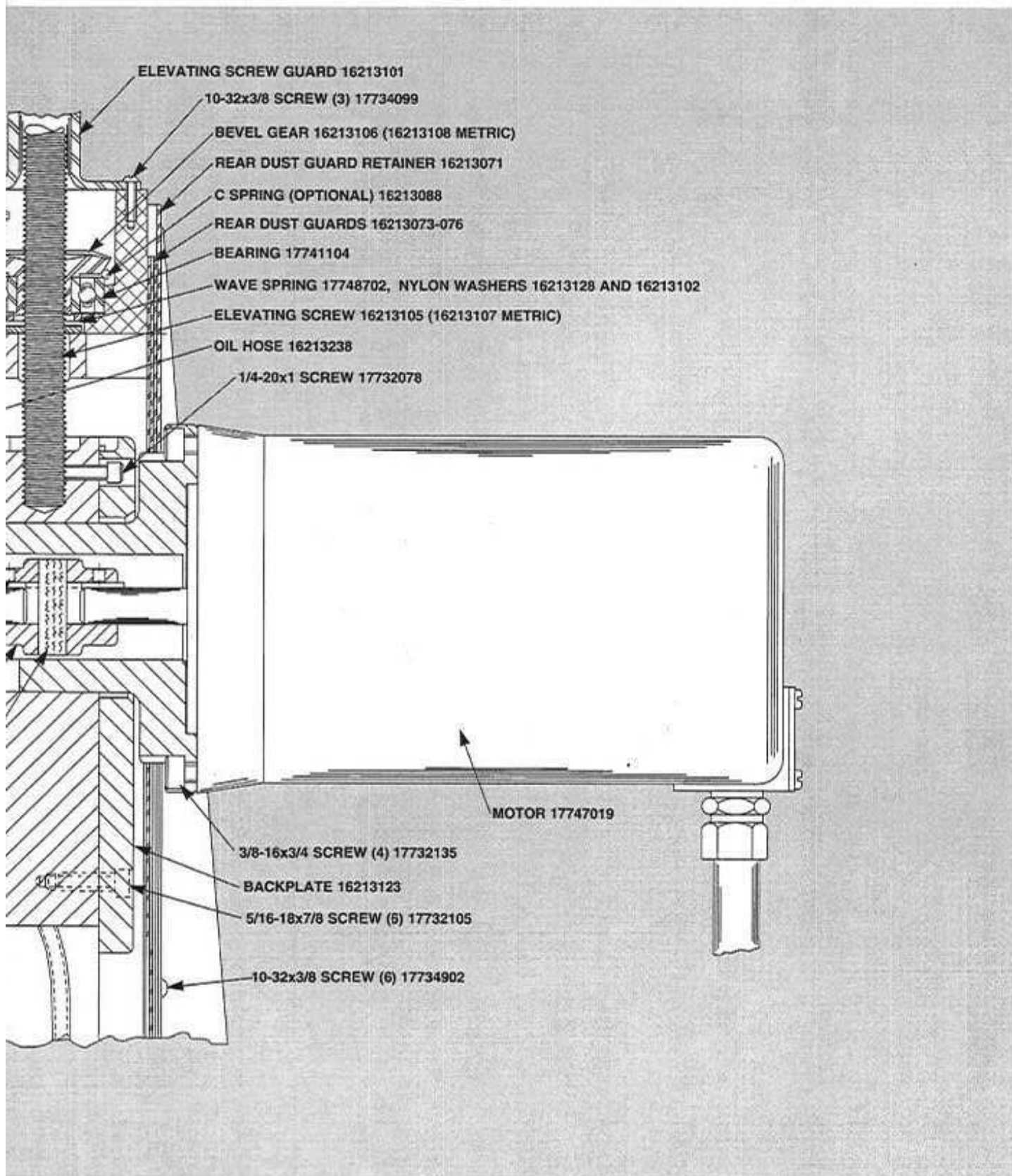
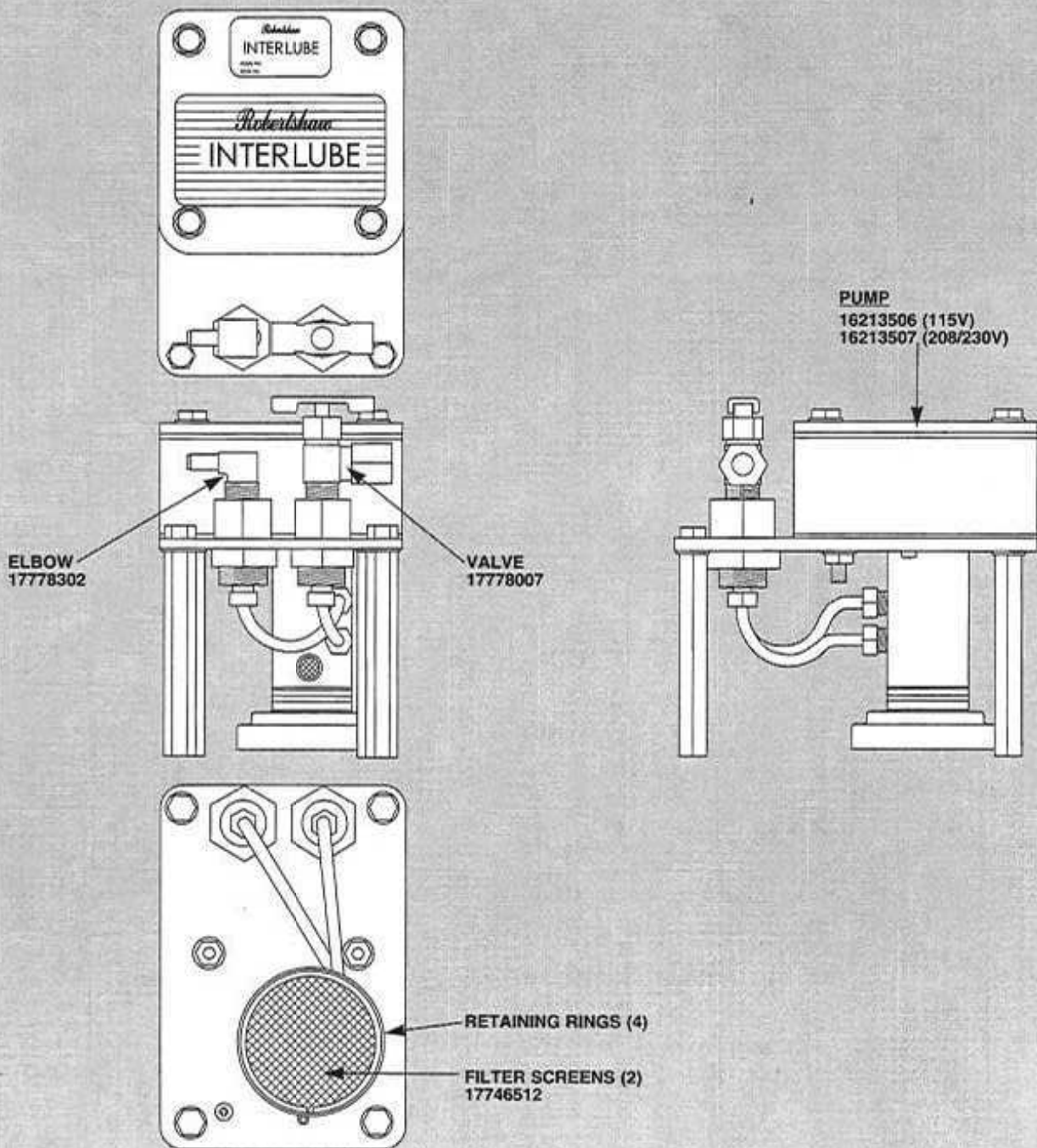


Figure 20

Lubrication System



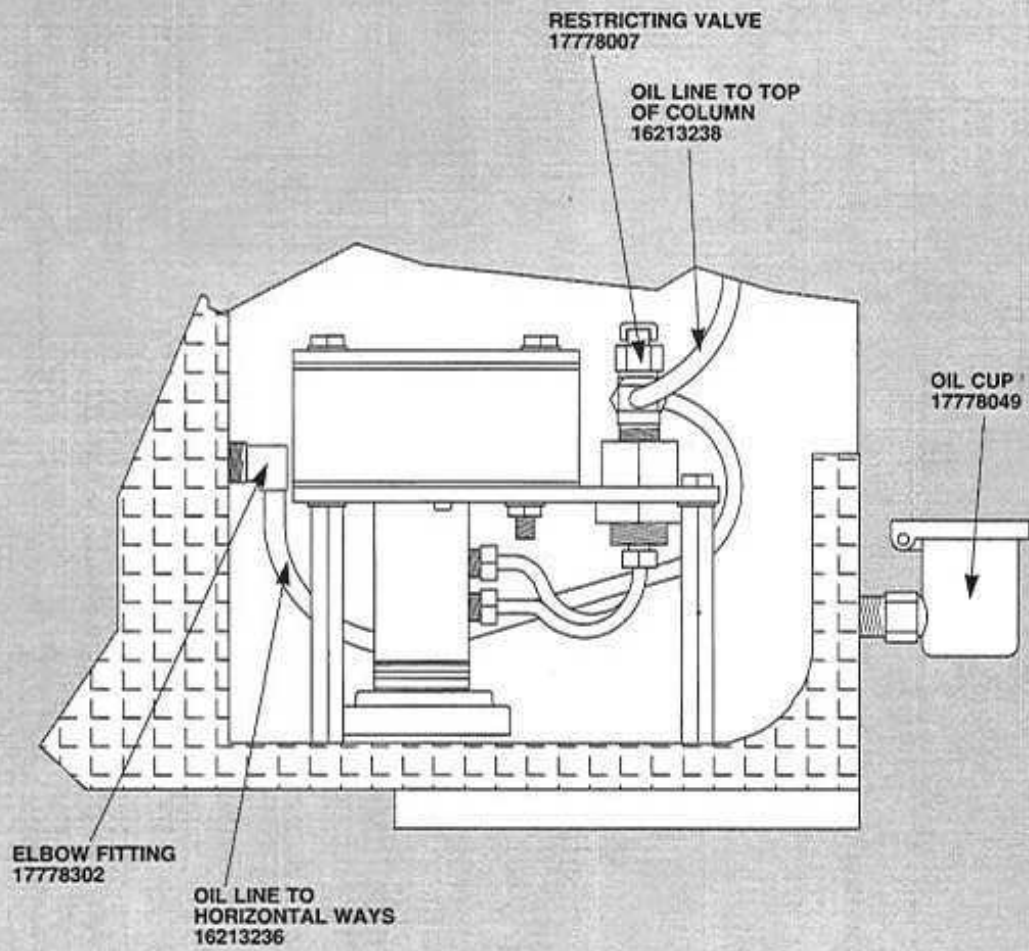
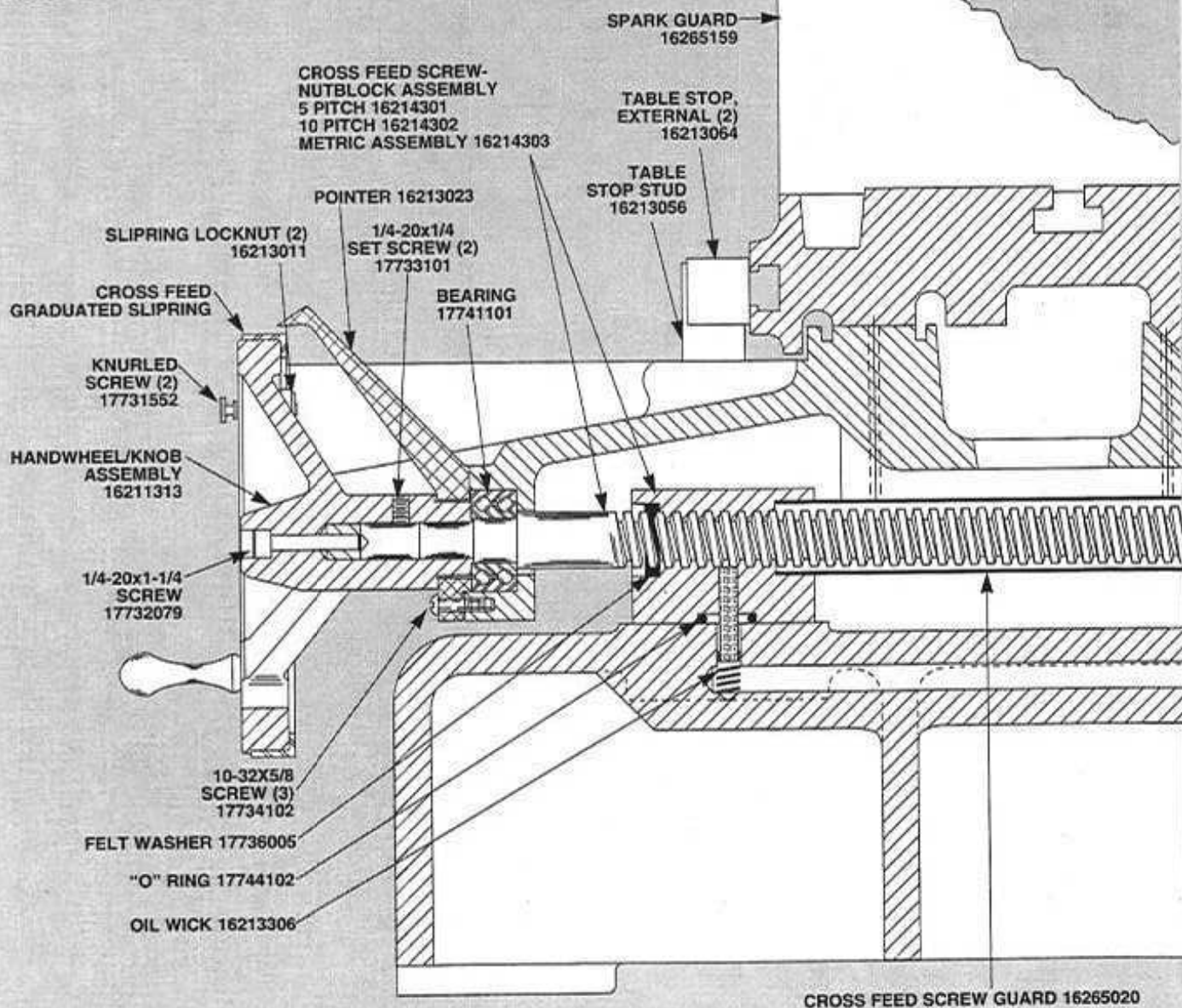


Figure 19

Cross Feed

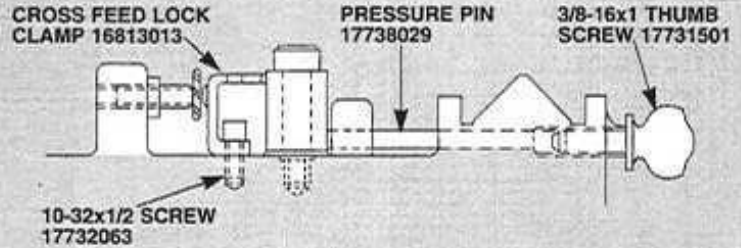
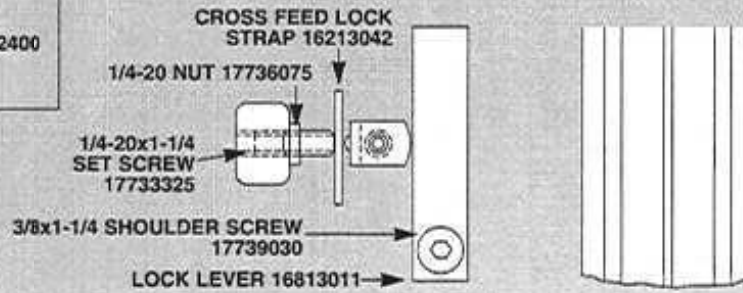
CROSS FEED SLIPRING
 .001" GRADUATION FOR 5 PITCH
 CROSS FEED 16213012
 .001" GRADUATION FOR 10 PITCH
 CROSS FEED 16213018
 .02 MM GRADUATION FOR METRIC
 CROSS FEED 16213043



612 CROSSFEED LOCK PARTS

- 3/8-16x1 THUMB SCREW 17731501
- 1/4 DIA. x 2-3/8 PRESSURE PIN 16213044
- CROSS FEED LOCK STRAP 16213042
- (2) 1/4 WASHERS 17736115
- (2) 1/4-20x1/2 HEX HEAD SCREWS 17732400
- 1/4-20x3/4 SET SCREW 17733107
- 1/4-20 NUT 17736075

**BOTTOM OF CARRIAGE
LOCK MECHANISM DETAIL (618)**



REAR VIEW OF LOCK MECHANISM (618)

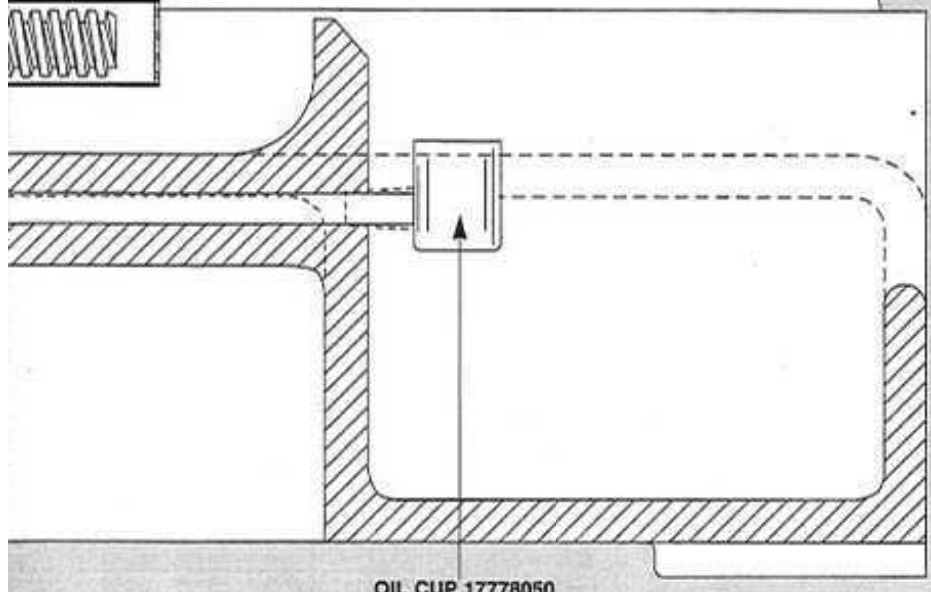
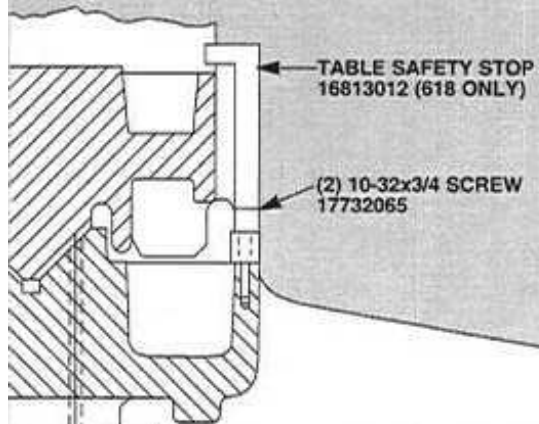
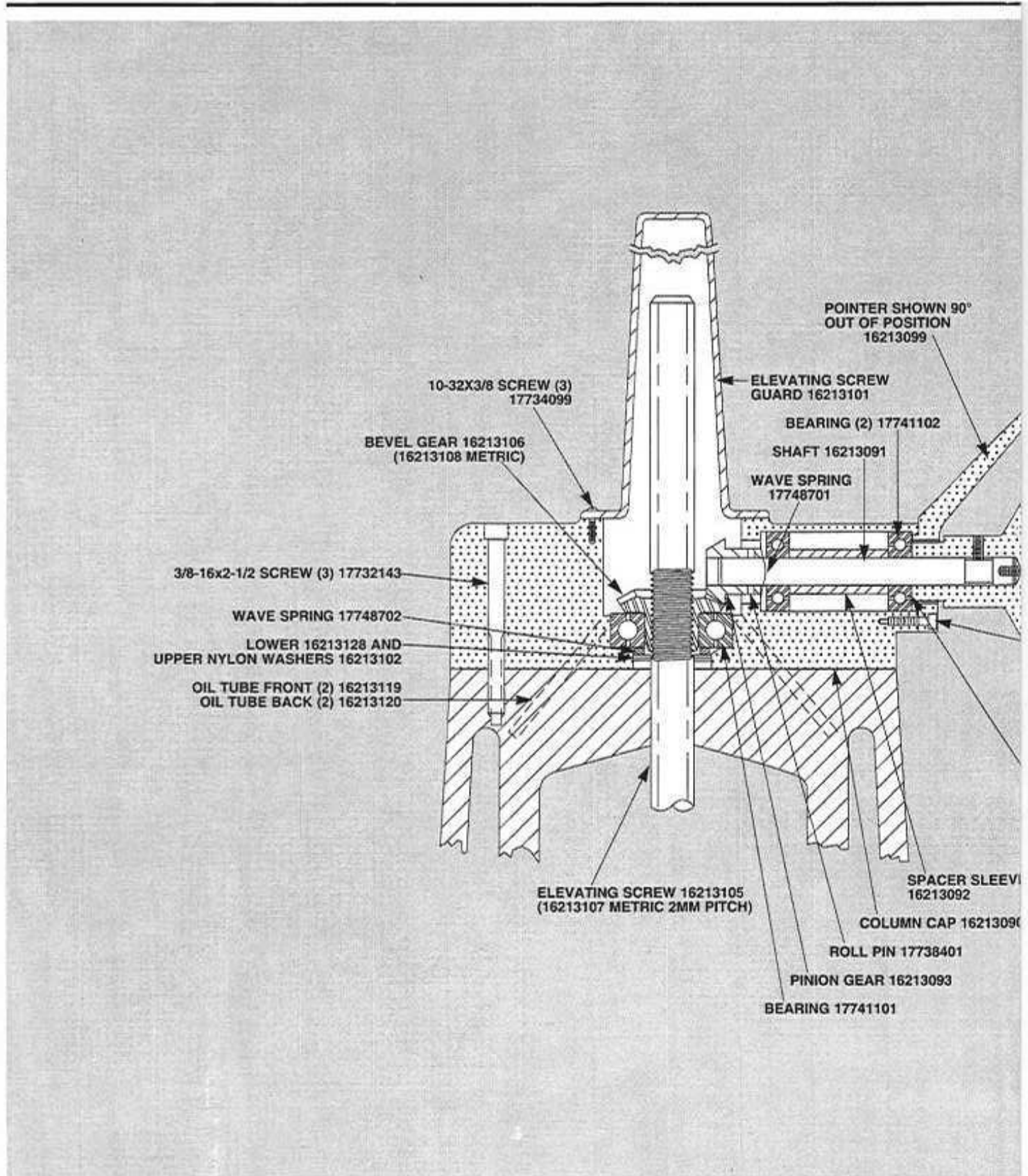


Figure 22

Elevating Screw and Handwheel Assembly



SLIP RING
.0005 GRADUATION 16213115
.0001 GRADUATION 16213118
.002MM (FOR METRIC SCREW 1MM PER REV) 16213111

ELEVATING HANDWHEEL/ KNOB
ASSEMBLY 16211313

1/4-20x1 SCREW 17732076

10-32x5/8 SCREW (3) 17734102

KNURLED SCREW (2) 17731552

LOCKNUT (2) 16213011

SHIM .005x7/8x1-3/8 17745153

SHIM .010x7/8x1-3/8 17745154

SHIM .015x7/8x1-3/8 17745155

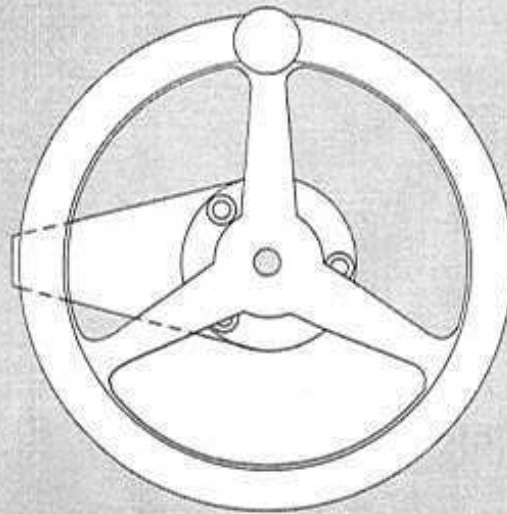
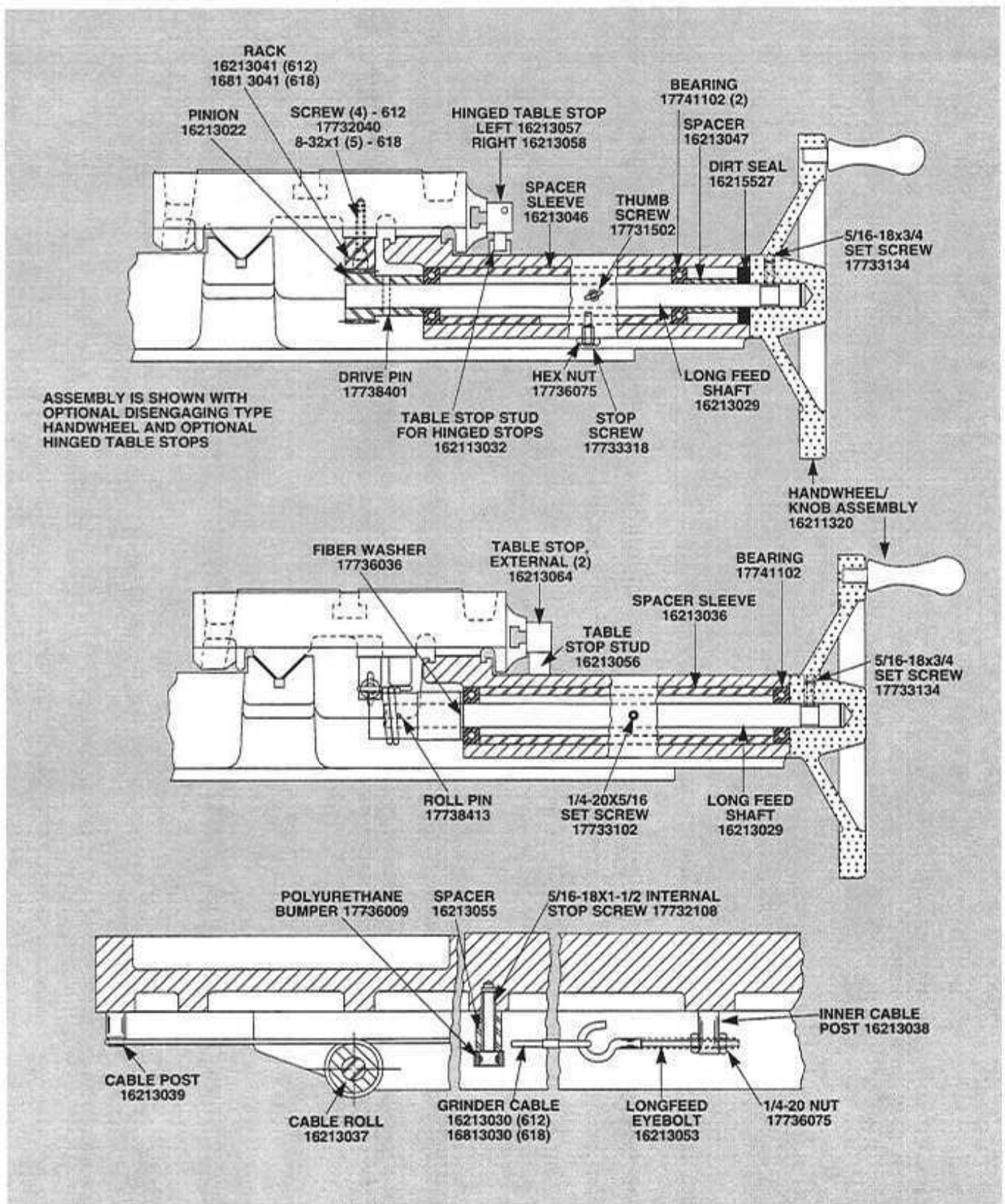


Figure 21

Longitudinal Feed



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