

**NORTON**  
**6" x 18"**  
**Surface Grinder**

**Instruction and Parts Manual**

**Manufactured in the USA by:**  
**Chas. G. Allen Co., Inc.**  
**25 Williamsville Road**  
**Barre, MA 01005**

**Telephone: (978) 355-2911    Fax: (978) 355-2917**

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**CHAS. G. ALLEN CO.**  
INCORPORATED

INSTRUCTION AND PARTS MANUAL

**ALLEN SURFACE GRINDER**

FORMERLY MANUFACTURED BY  
NORTON CO.

WARNER AND SWASEY CO.  
GRINDING MACHINE DIVISION  
WORCESTER SURFACE GRINDERS INC.

**6" × 18"**  
**TYPE S-3**  
**HYDRAULIC**  
**SURFACE GRINDING**  
**MACHINE**

**MANUFACTURED IN U.S.A.**

## SAFETY RULES FOR INSTALLATION

### USE ALSO WHEN MACHINE IS BEING MOVED, REWIRED OR REPAIRED

1. ABIDE BY YOUR COMPANY'S SAFETY REGULATIONS

2. KNOW THE WEIGHT OF THE MACHINE

Select lift trucks, cranes, slings, chains, and ropes of ample strength to lift this weight.

3. USE THE LIFTING POINTS DESIGNATED

Slings attached to small brackets, metal cabinets, control members or sheet metal guards may break away and drop the machine.

4. NEVER PLACE FINGERS, TOES OR ANY PART OF YOUR BODY UNDER A RAISED MACHINE

Always act as though the machine might drop. Stay clear of it.

5. LOCATE THE MACHINE SO THAT SIMPLE ACCESS IS GIVEN TO ELECTRICAL COMPARTMENTS, COOLANT TANKS, OIL RESERVOIRS, AND CHIP PANS

Safety of service and maintenance men is involved. These men should have unobstructed access to the units on which they work.

6. LOCATE FOR 24" CLEARANCE

To avoid squeezing people working near a machine, the extreme table or slide position of the machine should be 24" from the extreme position of any adjacent machine slide. A similar clearance should be maintained between slides and walls or partitions.

7. CHECK OPEN POSITION OF DOORS

Hinged doors and covers should have full swing. Restrictions may force work in cramped quarters. An off-balance operator with an awkward reach into a half-seen area is unsafe.

8. CHECK DIRECTION OF ROTATION OF MOTORS & SPINDLES

Test motors and spindles. Wrong direction may backoff threaded fastenings, stifle the exhaust system, make sparks fly in unexpected directions, or even allow the wheel to come off the spindle.

9. SELECT LOWEST WHEEL SPINDLE SPEED

If machine offers more than one wheel spindle speed, mount the belt, assemble the pulleys or set the speed selector for the lowest wheel speed. This will force the operator who mounts the grinding wheel to make the decision on what speed should be used with the grinding wheel he has selected.

10. CHECK DIRECTION OF SLIDE MOVEMENTS

Jog slides to check direction of movement. Move to end positions to check limit or safety switches. Switches may be ineffective with reversed direction of motor rotation.

11. PURGE HYDRAULIC SYSTEMS OF AIR

Large volumes of air in the hydraulic system may give a bouncy action and slides may leap forward unexpectedly as controls are operated.

12. GROUND THE MACHINE

This will make sure the machine will never be a "hot wire," a source of electrical potential.

**GENERAL SAFETY RULES  
APPLICABLE TO ALL GRINDING MACHINES**

**1. ABIDE BY YOUR COMPANY'S SAFETY REGULATIONS**

**2. READ INSTRUCTIONS IN THE OPERATION MANUAL**

Know your machine. Have an experienced operator or the machine tool builder's representative demonstrate the machine and explain its controls.

**3. LOOK FOR ALL "WARNING" PLATES ON THE MACHINE**

Understand these warnings and follow their directions as you operate the machine.

**4. MAINTAIN A SAFE WORKING AREA**

Your working area should be clean and uncluttered. Give yourself room for a firm, well-balanced stance.

**5. BE HARD TO CATCH**

Don't wear dangling neckties, beads, medallions, loose sleeves, or shoulder-length hair. These can catch on moving members and cause serious injury.

**6. DO NOT WEAR RINGS OR BRACELETS**

Finger and arm jewelry may snag on moving machine members and pull your hand into a danger zone.

**7. CHECK: ARE ALL GUARDS IN POSITION AND SECURELY FASTENED?**

Be sure all guards are in position before operating the machine. Do not operate a machine with missing guards. Be sure that all fasteners are being used and that all are firmly tightened.

**8. WEAR A FACE SHIELD OR SAFETY GLASSES**

Vigorous dressing or unexpected, heavy grinding may give a shower of abrasive. Protect your eyes.

**9. REMOVE WRENCHES, LOOSE TOOLS AND ALL LOOSE OBJECTS FROM THE MACHINE**

Free objects may walk toward the wheel or other rotating members and cause unexpected interferences.

**10. WHEN STARTING THE MACHINE STAND TO ONE SIDE OF THE WHEEL**

If a wheel has been damaged, it is most likely to fail the first time it is brought up to speed. Let the wheel run a few minutes before dressing or grinding.

11. DON'T LEAN AGAINST THE MACHINE OR IDLY REST YOUR HANDS OR FEET ON IT

You may be surprised or injured as a slide reverses direction and moves at fast travel rate. Don't let talking companions lean on your machine while it is running; they, too, might be surprised and injured.

12. ADJUST TRIP DOG POSITION WHEN THE TABLE IS STATIONARY

Stop the table, make the desired setting, clamp properly, and do not take a chance on pinched fingers.

13. STOP THE GRINDING WHEEL BEFORE ADJUSTING WHEEL DRESSERS, EXHAUST HOODS, WHEEL GUARDS AND COOLANT NOZZLES

All these members touch or come close to the grinding wheel and with wheel motion there is a chance of getting nicked, burned, or more seriously injured.

14. BE CERTAIN THAT THE WORKPIECE IS MOUNTED SECURELY AND THE DRIVER IS IN PLACE AND SECURE

If the workpiece breaks away and moves with the wheel, it may become a dangerous high-speed projectile.

15. DO NOT TOUCH A MOVING GRINDING WHEEL WITH YOUR FINGER

Even if you are an expert, judge a rough wheel by the work finish, not by the scratches on your thumb. The sense of feeling may be permanently impaired in the touching finger.

16. NEVER TRY TO STOP A COASTING GRINDING WHEEL WITH YOUR HAND OR A HAND HELD OBJECT

The wheel has been made to cut steel - never forget it. Let the wheel coast to rest.

17. STOP COOLANT FLOW BEFORE STOPPING WHEEL. DON'T RUN COOLANT ON A STATIONARY WHEEL

Gravity works on a stationary wheel saturated with coolant. The coolant drains to the low segment of the wheel and if the wheel is operated in this condition it will be seriously out of balance. To avoid unbalance, run the wheel for a few minutes after shutting off coolant and let centrifugal force remove coolant or dry the wheel.

18. USE GRINDING MACHINE IN WELL-PLANNED OR WELL-TESTED WAYS.  
DON'T IMPROVISE

Never use a grinding machine and its grinding wheel for any purposes other than those for which they were designed. Unplanned uses often cause unexpected accidents.

19. ACCEPT MACHINE LIMITS FOR WHEEL SPEED

Don't "soup-up" the spindle drive to get higher wheel speeds. Don't use special pulleys, higher speed motors or speed control devices which have been altered or made inactive.

20. USE STANDARD WHEEL DRESSERS

Don't use "make-shift" arrangements for dressing wheels and don't hold the diamond by hand as you would the tool in a wood turning lathe. A dresser must be well supported and securely clamped.

GRINDING WHEELS

There is an excellent standard B7.1-1970, issued by the American National Standards Institute, titled "Safety Code for the Use, Care, and Protection of Abrasive Wheels." Get a copy (ANSI 1430 Broadway, New York, N.Y. 10018). Some of the following rules are suggested by the B7.1 Standard:

21. DISCONNECT POWER TO SPINDLE BEFORE CHANGING WHEEL

Throw the main Disconnect Switch or press the wheel spindle stop switch to cut power. These switches give good wheel changing protection and insure a dead spindle which cannot be accidentally started by pressing the cycle start control. Wait until wheel stops rotating before attempting to change it.

22. INSPECT A NEW GRINDING WHEEL BEFORE MOUNTING IT ON THE MACHINE

Look for cracks, nicks, or signs of damage. If you see these or have any doubt about the soundness of the wheel, don't use it. Tap the wheel with a wooden hammer. A sound wheel may ring - a cracked one won't.

23. INSPECT WHEEL SLEEVE

Before mounting a wheel check the wheel sleeve to be sure the wheel can be clamped evenly. Remove high spots due to bruises or burrs. Clean the sleeve. Check flanges for



23 cont'd.

flatness and for proper undercuts where the flanges join the cylindrical, hole supporting hub of the wheel sleeve. Fillets must not exist and the sleeve flanges must not exert intense pressures on the corners of the wheel hole.

24. USE LIGHT PRESSURE WHEN MOUNTING A WHEEL

Don't force a wheel on a wheel sleeve; use a new blotter to distribute clamping pressure and tighten fasteners to give a firm pressure, but not a crushing pressure. Also, refer to your operators manual for the proper tightening of the fasteners.

25. WHEELS ARE RATED AND MARKED FOR A MAXIMUM OPERATING SPEED

Check to see that you have the right wheel and that the machine spindle speed is proper for the wheel.

26. STORE WHEELS IN A RACK AND HANDLE CAREFULLY

Abrasive wheels were not meant to bend and they may be damaged if dropped, rolled around, or parked on the floor.

SPECIFIC SAFETY RULES FOR  
SURFACE GRINDING MACHINES

1. WHEN LOADING WORK MOVE THE GRINDING WHEEL TO THE END AND  
BACK OF THE CHUCK

Don't remove or mount work with your hand near or under a live wheel.

2. CLEAN THE CHUCK SURFACE

Dirt or grit will keep the work from seating and will weaken the magnetic grip on the workpiece.

3. DON'T WIPE UNDER THE WHEEL

Never wrap a towel around your hand and wipe the chuck under a moving wheel.

4. BE SURE THE WORKPIECE SEATS

Watch for burrs and nicks in the workpieces. These may prevent a good bearing on the chuck and lessen holding power.

5. USE A BLOCKING STRIP

The tendency of small pieces to slide along the chuck can be checked by a large area strip of steel against which the pieces can butt.

6. CHECK - IS THE CHUCK TURNED ON?

When the chuck is loaded check to be certain the magnetism is on. Do this before starting to grind.

7. FINISH GRIND, THEN UP AND OFF

At the end of finish grinding, raise the wheel from the work by enough to clear or be above the next load of rough work. Do this wheel raising as you finish a chuck load of work. Don't trust memory and assume that you will do this just before grinding the next load of rough workpieces. Failure to reset the wheel may cause violent grinding as the wheel tries to rip off in one pass all the stock left for grinding.

THE PURPOSE OF THIS MANUAL IS TO ACQUAINT THE USER WITH THE  
FUNDAMENTAL FUNCTIONS AND ADJUSTMENTS OF THE 6 x 18 S-3 SURFACE GRINDER  
MACHINE.

IN ORDER TO INSURE CORRECT IDENTIFICATION OF REPLACEMENT PARTS, IT IS  
ESSENTIAL THAT EACH REPAIR PARTS PURCHASE ORDER CONTAIN THE MACHINE  
SERIAL NUMBER OF THE INDIVIDUAL MACHINE WHICH IS TO RECEIVE THESE PARTS.

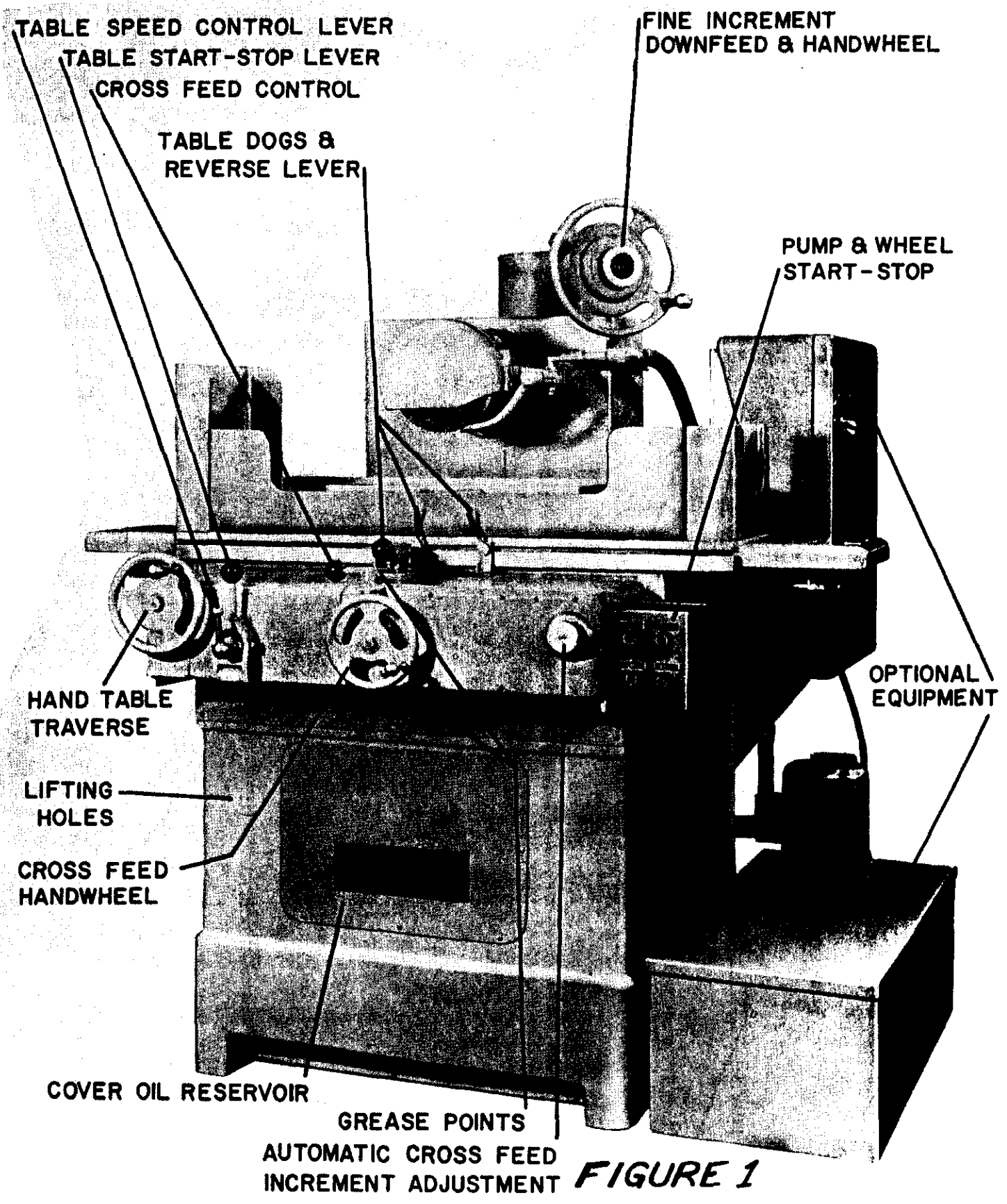
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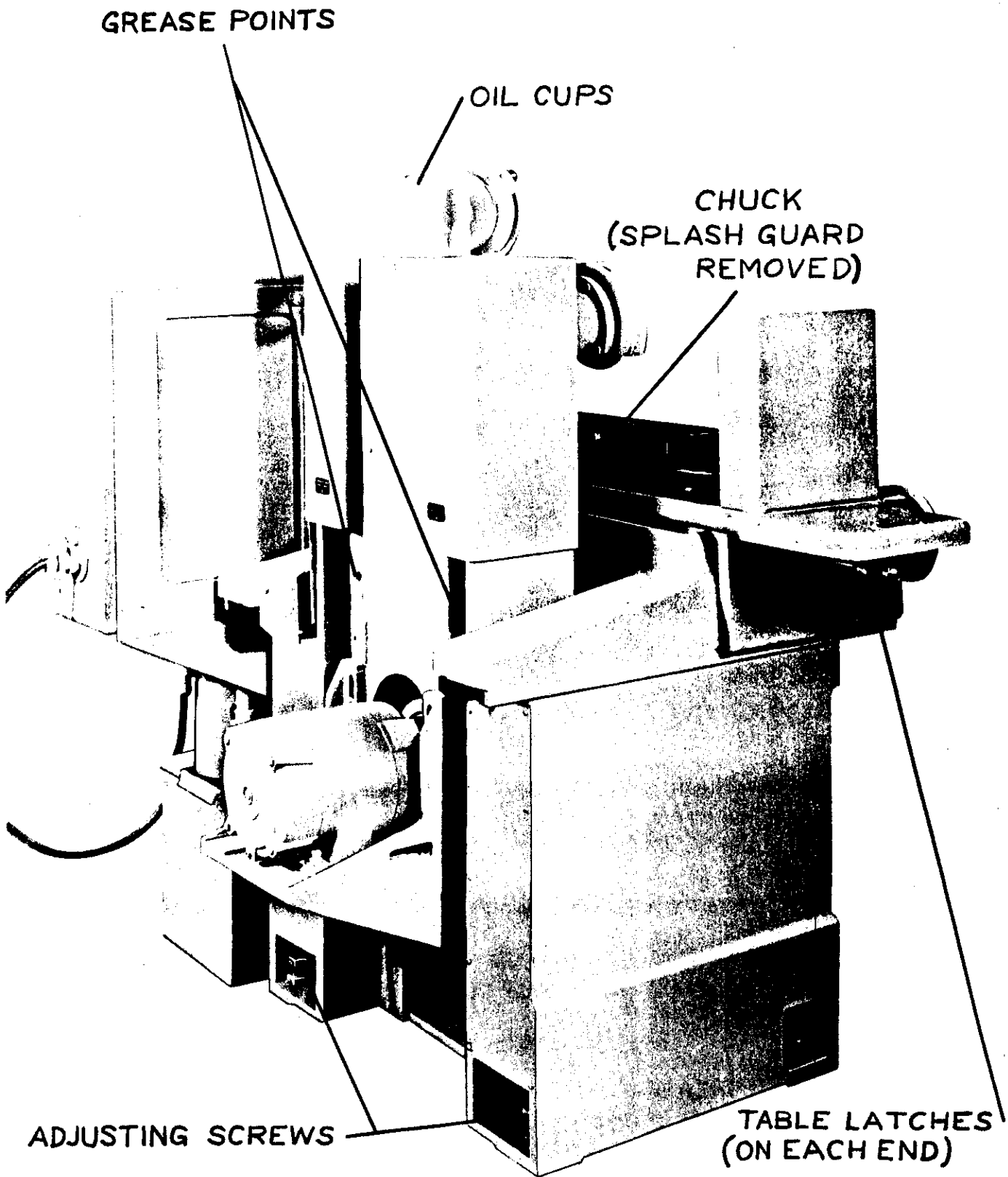
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*FIGURE 2*

TABLE OF CONTENTS  
UNCRATING AND HANDLING

iv

	Page
UNCRATING	1
LIFTING	1
LEVELLING	2
<u>PREPARING MACHINE FOR OPERATION</u>	
REASSEMBLY	2
Hose Connections	2
Hand Wheels	2
ELECTRICAL	3
MOUNTING WHEEL	3
GUARD	3
LUBRICATION	4
HYDRAULIC OIL	4
<u>OPERATING S-3</u>	
VERTICAL SLIDE	5
CROSS SLIDE	5
Cross Feed Setting	5
Cross Feed Direction Control	6
TABLE TRAVERSE	6
Table Speed Setting	6
Table Direction Control	6
Table Dog Setting	6
FAMILIARIZATION	7
TRUING	7
GRINDING THE WORK	8
ATTACHMENTS	9
Wet and Dry	9
Coolant through Wheel	9
High Speed	9
Radius and Tangent Angle Wheel Dresser	9
Power Wheelhead Positioner	9
<u>CONSTRUCTION AND SERVICING</u>	
HYDRAULIC SYSTEM	9
Pressure Adjustment	10
Removal of Pump Motor	10
TABLE CONTROL VALVE	10
HAND TABLE TRAVERSE AND TABLE	11
CROSS FEED	11
VERTICAL SLIDE	12
Gib Adjustment	12
WHEEL SPINDLE	12
WHEEL DRIVE BELTS	13
CENTER GUIDE ROLLS	17
PROCEDURE FOR GRINDING MAGNETIC CHUCKS	18
AUTOMATIC PICKER DOWN FEED	19
WHEEL HEAD MOUNTED TRUING DEVICE	19

PARTS SECTION

## UNCRATING AND HANDLING

### UNCRATING

Your new 6 x 18" Type S-3 Hydraulic Surface Grinding Machine has been packed for shipment to provide the maximum protection during transit. The machine is ruggedly designed and carefully constructed to produce work of high quality, and therefore, should receive the treatment of a precision tool.

Many of the small components have been removed from the machine for shipment and have been packed separately. Check the entire shipment against the packing list. Report any discrepancies immediately.

### LIFTING

There are four two-inch diameter cored holes in the front and back of the base through which bars may be extended for lifting the machine. Light sheet metal covers may be clipped into these holes when your machine arrives. These can be easily removed, and they should be replaced when the machine has been set up in order to keep contaminating elements from entering the hydraulic reservoir in the base. Please exercise caution when sliding lifting rods through the holes to avoid damage to the interior hydraulic and lubricating piping.

Slings rigged to the lifting bars should be spread, or blocks placed between the slings and the machine so that the machine will not be damaged during the lifting.

The machine weighs approximately 2,600 pounds uncrated. Lifting bars and wire or hemp ropes of sufficient capacity to handle this weight should be selected.

## LEVELLING

The Type S-3 Surface Grinder has sufficient stability built into it so that it may operate successfully on any substantial shop floor.

When setting the machine in place, slide a steel plate approximately 6 x 6 x 1/2" under each corner. Now level the machine by using a sensitive spirit level on the flat sliding table top. Level the machine from front to back and from side to side by the four adjusting screws in the base.

Once the level has been established it should last indefinitely, but it is a good practice to check the level periodically. Checking becomes more important when the machine has been set on a wooden floor which may have a tendency to settle. If the machine is on a concrete floor, be sure the machine is not attached to the floor.

## PREPARING THE MACHINE FOR OPERATION

### REASSEMBLY

There is very little reassembling to do upon receipt of a Type S-3 Surface Grinder. On export shipments to some countries, customs requirements make it necessary to ship motors and other electrical equipment separately. In this case, of course, these units must be mounted after the machine has been received. In the majority of cases, however, the motors and magnetic chucks are shipped mounted on the machine.

Remove the protective slushing compound from the bright surfaces with an organic solvent.

After the machine has been placed, remove the three rods anchoring the pump unit within the base. These pump motor anchor rods prevent the spring-mounted unit from swinging during transit. With their removal, the unit should swing freely inside the base. Be sure to remove the tie down rods which hold the sliding table to the base during shipment once the machine is in place.

### Hose Connections

Be sure that all interior hose and pipe connections are tight. Each hose is equipped at one end with a simple fitting and a union at the other end. Loosen the union before tightening the fitting, otherwise, the hose will take a twist which may ruin it. Be sure, also, in tightening the union, that the hose does not twist. Hydraulic pulsations in a twisted hose will cause it to break quickly.

### Hand Wheels

The hand wheels are easily mounted; refer to the figure 1 in this manual.



### ELECTRICAL CONNECTIONS

A qualified electrician should make the electrical connection between the plant power line and the control box on the machine. A wiring diagram is included with each machine to assist in making this connection and also to show the electricals found on your particular machine.

### MOUNTING THE GRINDING WHEEL

The equipment grinding wheels are packed separately in the box containing small parts. Before the grinding wheel is mounted on the sleeve or collet, tap the wheel lightly with a mallet. A clear tone indicates the wheel is sound; a dull tone means that the wheel may be cracked and unsafe to use. Slip one of the blotters packed with the wheels over the sleeve and then mount the wheel. The wheel slips on easily but without any play. Do not force the wheel onto the sleeve since internal strains and stresses will be set up in the wheel which may cause it to fail when grinding. With the wheel in place, slip on another blotter, then the sheet metal washer which is keyed to the sleeve, and finally, the flange. Use the spanner wrench supplied with the machine to tighten the flange. The flange should be brought up only tight enough to hold the wheel securely. Tightening too much also will cause dangerous stresses in the wheel.

The assembled wheel and sleeve fit on the spindle nose. Slide the sleeve firmly into place and secure with the retaining nut. A special wrench is provided for tightening the retaining nut. The nut has left-hand threads.

If a variety of work is to be ground, requiring several wheels and frequent wheel changes, a separate sleeve for each wheel is desirable so that the wheel will be permanently mounted until it is discarded.

### WHEEL GUARD

The wheel guard is made in two sections. The back section is held on the end of the wheel spindle housing by three bolts entering from the housing. The holes for these bolts are elongated so that guard may be swiveled by loosening the nuts. The front section of the guard hooks over the three studs on the back section rim. It locks into place by means of a latch on the right hand side.

The back section of the guard may be adjusted to tilt the guard in a counterclockwise direction in order to reduce the spray when a wet grinding attachment is used and when form truing.

**DO NOT RUN GRINDING WHEEL WITHOUT MOUNTING THE FRONT SECTION OF THE WHEEL GUARD IN PLACE.**

## LUBRICATION

The machine was thoroughly lubricated before shipment. It is recommended, though, to check all lubrication points before running the machine. (Figures 1 and 2)

There are four grease fittings on the machine; one on each of the vertical ways at the back of the machine, one at the base of the table reverse lever, and one for the cross feed half nut below the cross feed saddle on the front of the machine. Use a calcium soap base grease, or equivalent, of medium consistency and smooth texture intended for general purpose greasing. Grease once a week.

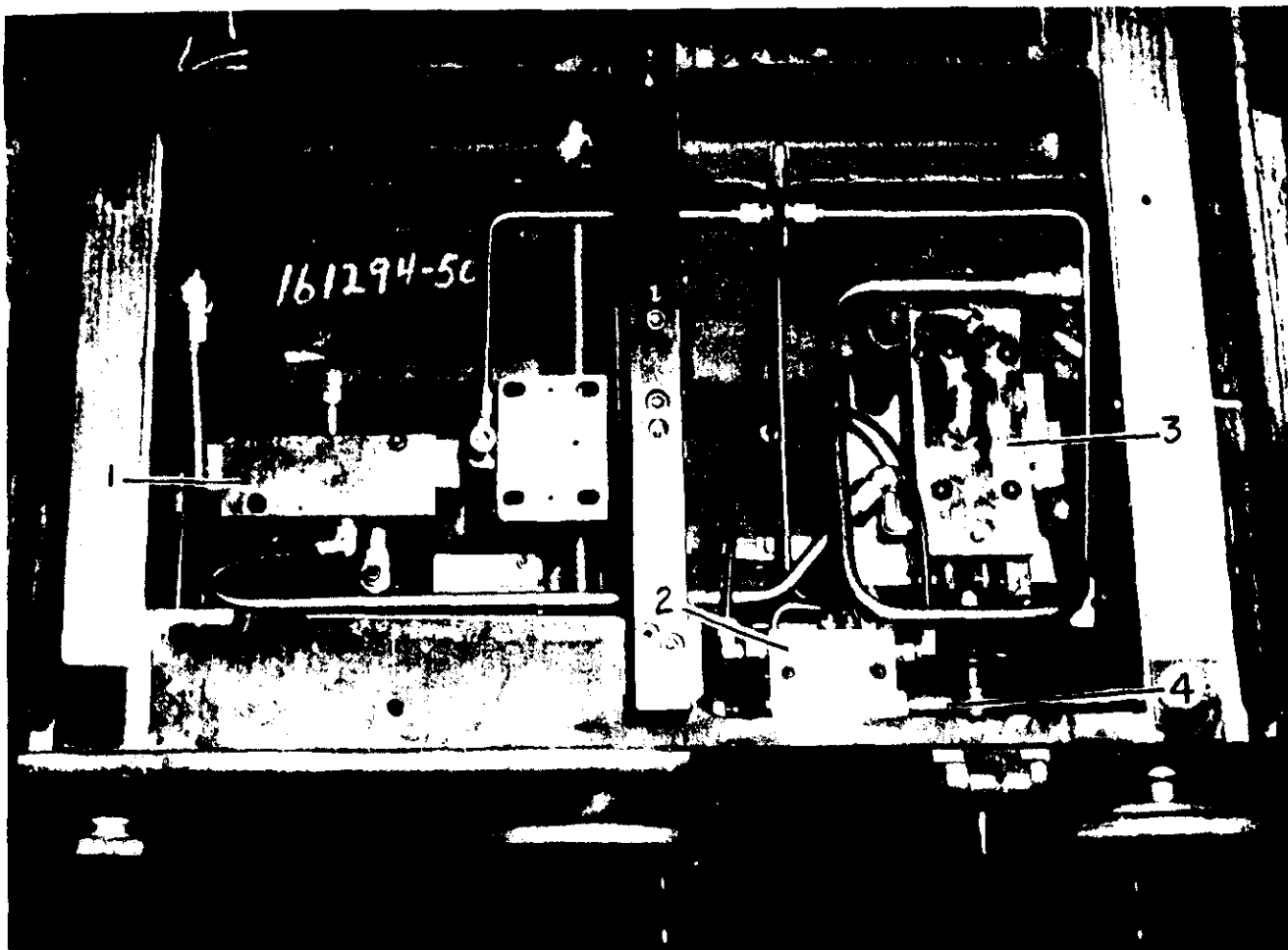
There is an oil cup on the top of the vertical feed housing which should be filled weekly with a high quality machine oil, 275 to 375 S.U.V.

The table ways are lubricated continuously with the exhaust oil supplied from the main control valve. The rate of flow of oil to each table way is controlled by the two needle valves that are under the cross feed saddle. These valves are exposed when the saddle is in the forward position. The cross feed ways are gravity fed. Remember to run the hydraulic pump each day in order to lubricate the ways, even though you intend to grind your work using hand table traverse. The flow of oil is critical. Too much oil will make the table and saddle "float," resulting in erratic grinding actions. Too little oil will cause excessive wear on the ways. MAKE SURE ON INITIAL START-UP THAT NEEDLE VALVES FOR TABLE WAY LUBRICATION ARE OPEN BEFORE OPERATING TABLE OR DAMAGE WILL RESULT.

## HYDRAULIC OIL

The hydraulic oil reservoir is in the base. It has a capacity of approximately 15 US or 12½ Imperial gallons. The correct oil level is just below the pump coupling. The reservoir is filled by removing the metal cover from the front of the base and pouring the oil through this opening. Caution should be used to avoid allowing contaminating elements from entering the reservoir when adding oil. Always replace the cover.

The recommended hydraulic oil is a high quality combination hydraulic and lubricating oil with inhibitors for rust, oxidation, and foaming and with additives for oiliness. An oil with 145 to 175 S.U.V. at 100F is recommended. The oil should be changed and the reservoir cleaned at least every six months, or more often if conditions warrant. A suction type cleaning machine is the most effective.



1. Cross Feed Hydraulic Control Valve
2. TRABON Way Lube Valve
3. Table Feed Hydraulic Control Valve
4. TRABON Adjusting Screw

The above photo is of the underneath side of the saddle. Shown are the control valves for the table feed and cross feed in addition to the TRABON system valve.

S-3, 6 x 18" hydraulic surface grinders, beginning with serial number H-7181 are equipped with Trabon lubrication to the table ways. At each reversal of the table, a measured amount of oil is alternately fed to the flat and vee ways.

While the amount of measured lubrication is set at the factory, we suggest you check this at start-up to assure proper lubrication to the ways. There is an adjusting screw at (4) which can be adjusted by using a screw driver. Bring the saddle full forward and the valve and adjusting screw can be easily seen.

## OPERATING THE S-3

### VERTICAL SLIDE

To raise or lower the grinding wheel, turn the handwheel extending from the top of the vertical column. The motion of turning the handwheel is transmitted through a set of beveled gears to the vertical feed screw. The feed screw turns in a full nut which is attached to the base. By turning the handwheel counterclockwise, the wheel is lowered; conversely, clockwise turning raises the wheel. The knurled knob in the center of the handwheel is used for making fine adjustments. The feed rate of the hub is  $1/5$  the rate of the handwheel.

Each complete turn of the vertical feed handwheel will move the vertical slide .050". One turn of inner knob moves the slide .010". The handwheel is graduated in .0005". The vernier on the pointer is graduated in .0001".

The maximum vertical distance, table top to bottom of standard 8" diameter wheel, is 15". The maximum vertical movement of the wheelhead is 16".

### CROSS SLIDE

Traversing the Cross Feed Saddle may be done either manually or hydraulically. The handwheel in the middle of the front apron is used for manual cross-feed. The handwheel is graduated in increments of 0.001". Turning the handwheel clockwise will move the saddle toward the grinding wheel; counter-clockwise, away from the wheel.

### Cross-Feed Setting

When the table is operated hydraulically, the saddle will feed automatically at each table reversal. This automatic cross-feed is adjustable from zero to approximately .100" per reversal. The spring loaded knurled knob on the right hand side of the front apron is pulled out and turned for the desired amount of cross-feed at each reversal, as noted on the graduated cross-feed hand wheel.

### Cross Feed Direction Control

A handle on top of the saddle, so marked, controls the direction of cross-feed. There are three positions for the handle; pushing the handle away from the operator, the saddle will cross-feed automatically at each table reversal toward the wheel; set at mid-point, the saddle may be moved in either direction by means of the handwheel; pulling the handle toward the operator, the saddle will cross-feed automatically away from the grinding wheel. The direction of the cross-feed is reversed manually.

### TABLE TRAVERSE

The table can be traversed manually or hydraulically. For manual movement, the table traverse handwheel on the extreme left hand end of the saddle must be engaged by pushing towards the saddle. The table will move in the same direction as the handwheel is turned. Before the table can be traversed hydraulically, the handwheel must be disengaged from the table rack by pulling it out away from the saddle. This safety interlock feature keeps the table handwheel from spinning as the table is traversed hydraulically. Then, the hydraulic table traverse can be started by pulling the table Start-Stop lever out. This lever is to the right of the table traverse handwheel.

### Table Speed Setting

The speed of the table traverse is controlled by the knob directly below the Start-Stop lever and may be varied up to 150 feet per minute. The table speed will increase when the knob is turned counter-clockwise. Once the desired speed has been found, it will not be affected by starting and stopping the table if the Start-Stop lever is used.

### Table Direction Control

The direction of hydraulic table traverse is controlled by the lever on the top of the saddle, the handle of which points toward the operator. The table will move in the same direction to that in which the handle is moved. Table direction can be changed either manually by moving the lever or by means of the table dogs which will trip the lever as they pass.

### Table Dog Setting

The table dogs on this machine can be set with finger pressure. Hammering is not necessary to keep the dogs in place.

To realize fully the maximum grinding time savings, set the table dogs  $2\frac{1}{2}$ " to 3" in from the ends of the workpiece when grinding at 150 f. p. m. table speed. This will compensate for the "overtravel"

7

of the table dogs beyond the reverse lever. The overtravel is a design feature permitting smooth reversals at high table speeds. The table dogs may have to be reset when the table speed is changed.

### FAMILIARIZATION

Having read the previous sections, set the machine up and try the controls. Push the Table Traverse Handwheel in so it engages the table rack. Push the Table Start-Stop lever "in" and turn the table Speed Control knob clockwise as far as it will go. Move the Cross Feed Direction lever to the middle or "neutral" position and turn the Cross Feed Increment Knob counter-clockwise to zero. Turn the Wheel Feed Handwheel clockwise to raise the wheel enough to clear any work that is on the table. Traverse the table by hand so it is at the mid-point along the ways. Clamp each table dog about four inches on either side of the table reversing lever.

Now, push the Wheel Drive Start Button. Next, push the Pump Drive Start Button. If each of the previous steps has been taken, there should be no movement of any components.

Start the table traversing by pulling the Start-Stop lever outward as far as it will go. (Did you disengage the table handwheel?) Turn the Speed control knob counterclockwise to bring the table up to full speed. Stop the machine, now, by "pushing in" the Start-Stop lever and move the table dogs out to the end of the work table. Start the table traversing again. While the table is moving, set the Cross-Feed Dial to produce desired cross-feed, as noted on the graduated cross-feed handwheel, and move the Cross-Feed Direction lever in the direction you want the table to move. The cross-feed will stop at the end of the saddle traverse and must be reversed manually.

During this preliminary period, experiment with the controls and familiarize yourself with their function.

### TRUING THE GRINDING WHEEL

If a magnetic chuck is used, the diamond holder can be held on the face of the chuck. If no chuck is used, the diamond holder can be clamped to the table surface by means of a bolt in the tee slot of the table. It is good grinding practice to locate the diamond holder on the left portion of the table. Move the table until the diamond is under the center of the wheel spindle. Then lower the grinding wheel until it touches the diamond lightly. Cross feed the saddle by hand until the diamond passes beyond the edge of the wheel and then feed down about 0.0005" and feed the diamond back across the wheel until it clears the opposite edge. Repeat this procedure with appropriate down feeding until, by the sound of the wheel in contact with the diamond, it is certain that the entire face of the wheel has been dressed to the condition required.

If a roughing operation is to be performed, a comparatively fast traverse of the diamond across the wheel face is used. A fine finish requires a slower traverse. For a finer finish, the diamond should be moved slowly across the wheel face without any downfeed of the wheel during the last several passes.

### GRINDING THE WORK

Before beginning to grind, set the table dogs for a given table speed so that the table will reverse at least  $3/4$ " beyond each end of the work. Refer to Table Dog Setting on page 6.

With the cross feed Start-Stop lever in neutral and the wheel clearing the work, move the table and allow the edge of the work to pass beneath the revolving wheel. With one edge of the work under the wheel, feed down until sparks show. Then move work away from wheel. Set appropriate vertical and cross feeds. Turn on the coolant (if the machine is arranged for wet grinding) and throw the cross feed lever in or out to feed the work across the wheel and pull out the table Start-Stop lever to start the operation.

After the full width of the piece has passed under and clear of the wheel, feed the wheel down. Continue feeding the wheel in this manner and reversing the direction of cross feed until the work has been ground to size.

To stop the table ALWAYS allow the wheel to pass off the work, and then push in the table Start-Stop lever.

The table can be stopped rapidly with the table start-stop lever. To prevent table coasting at high speeds, stop the table directly after a reversal is initiated. Oil in the table cylinder will then cause a quick stop.

Some operators will like to control table Start-Stopping with the speed control knob. This is not as fast in most cases, but will not hurt the machine.

It may be necessary to have the table dog pass beyond the table reverse lever. This is done by firmly holding the table reverse lever handle in the direction the table is moving and allowing the table dog to deflect the spring actuated tip of the table reverse lever. Stop table before it reaches end of stroke.

## ATTACHMENTS

### Wet and Dry Grinding

If the S-3 is equipped for wet grinding, a coolant tank is furnished which holds approximately 20 US or 17 Imperial gallons. We make no recommendations for any particular coolant but one free from soda should be used. Follow the suppliers instructions for mixing and if an undesirable foaming action occurs, the addition of a little kerosene will usually correct the problem. If the machine is equipped for dry grinding, attach the dust hood to the wheel guard and connect the hood of either the central or individual exhaust system.

### Coolant through Grinding Wheel

A special coolant tank is mounted on top of the vertical slide. A sight glass in the tank shows the coolant level. There are two valves on the coolant line leading from the tank to the front cover of the wheel guard. The electrically controlled valve permits fluid to flow ONLY when the wheel motor is running; otherwise, fluid could enter the wheel when stopped and cause a dangerous unbalance when the wheel is started. A second valve, with sight glass, is for manual metering of the coolant by the operator.

The coolant passes through a special sleeve and special adapter to the wheel. A WHEEL MUST BE USED WHICH DOES NOT HAVE A METAL OR PLASTIC BUSHING.

### Power Wheelhead Positioning Mechanism

Fast, fatigue-free wheel head movement is obtained by a 1/4 h.p. A.C. motor mounted on the vertical wheel slide. The motor turns the vertical feed screw by means of chain driven bevel gears. This arrangement may be applied easily to machines in the field as well as to new machines. The operating lever for rapid power positioning of the wheel is located on the wheel feed housing. The wheelhead will move upwards when the lever is held up; down, when the lever is pressed down. The speed is nine inches per minute. NEVER use the power-vertical feed to bring the wheel against the work.

## CONSTRUCTION AND SERVICING

### HYDRAULIC SYSTEM

A diagram of the hydraulic system is shown in figure 3. The pump, direct driven by its own electric motor through a flexible coupling, draws oil from the reservoir in the base, which has a capacity of about 15 gallons (US) or 12½ Imperial. Oil is poured directly into the base through the front. The proper oil level is just below the pump coupling.



We recommend that highly refined oil (S. U. V. 145 to 175 at 100°F.) be used in the hydraulic system, and that this oil have oily additives for ways lubrication and inhibitors for rust, foam, and oxidation.

The pump and motor unit is mounted in the base on a spring suspension frame. The pressure line from the pump enters the left end of the manifold block, located below the entrance to the reservoir. Two pressure lines go from the back of the manifold; the left hand one to the table control valve, the right hand one to the cross-feed control valve.

### Pressure Adjustment

Pressure adjustment is made by setting the relief valve: Remove the cap and loosen the check nut on the bronze screw; screw "in" the bronze screw to increase pressure, screw "out" to decrease pressure. The proper hydraulic pressure is 150 psi. A pressure gage may be inserted on the manifold by removing the set screw on top of the manifold.

Each hose is fitted with a union, accessible from the front of the machine. Each union is to be disconnected when the motor-pump unit is removed from the machine.

### Removal of Pump Motor

The motor may then be pulled forward and out as the suspending springs are disengaged. On replacing the unit, extreme care should be taken that the hoses are refastened without taking a twist. The hose fitting should be tightened in place first, after which the union should be tightened. In setting up the union, be sure that the hose does not twist, as this will either loosen the joint or cause the hose to break under the pulsation of the hydraulic pump. Both halves of the flexible coupling between the pump and motor should be kept tight on their respective shafts and pressed tightly together. Looseness of these flanges will cause rapid destruction of the coupling disc.

### TABLE CONTROL VALVE

The table control valve consists of the table start-stop and speed control valve and the table reversing valve.

The table start-stop and speed control valve consists of a single spool which, when pushed inward, stops the table by blocking the table exhaust and allowing the oil under pressure to pass directly to the reservoir. When the spool is pulled outward, pressure is directed to the reversing valve and the table exhaust is unblocked. The table speed is controlled by turning this spool, thereby changing the size of the aperture through which the table exhaust passes.

The table reversing valve has two spools. One is a pilot spool which is connected to the table reversing lever and provides pilot pressure to either end of the reversing spool (and to the spool in the cross-feed control valve). The reversing spool directs the pressure to and exhaust from the table cylinder, and its movement is relatively slow to provide smooth table reversals.

### HAND TABLE TRAVERSE AND TABLE

The hand table traverse unit consists of a shaft mounted in ball bearings and on which is a pinion meshing with a rack under the table. This unit is made so an outward pull disengages the handwheel, allowing it to remain at rest while the table is traversed by power.

A safety interlocking pin between the handwheel shaft and the table stop-start lever shaft makes it necessary to disengage the handwheel before the start-stop lever can be pulled out to start the machine.

The hand table traverse unit is removed by disconnecting the cap directly back of the handwheel and pulling out the shaft, pinion, and assembled ball bearings.

The table may be lifted from the machine by unclamping the latches at either end of the table which hold the ends of the table piston rods. The table may be disconnected from the piston rod, if desired, when hand operating the machine for a long period of time. However, this is not absolutely necessary since the resistance of the hydraulic oil, when the cross-feed handle is in the neutral position, is very slight.

### CROSS FEED

The impulse for the increment of cross-feed comes from the cross-feed piston and transmitted through the rack on the piston rod. At each table reversal, pilot pressure from the pilot spool of the table control valve moves the cross-feed spool. As this spool moves pressure is allowed to pass through to the cross-feed cylinder, moving the piston against a spring. When the cross-feed spool completes its travel, the pressure to the piston is blocked and exhaust takes place, and the piston is allowed to reposition through the action of the spring. A one-way clutch on the gear on the pinion shaft does not allow the repositioning of the piston and rack to move the cross-feed screw.

The direction of cross-feed is obtained by moving the cross-feed lever. The lever, in turn, moves a sliding gear keyed to the cross-feed shaft. In one position, the sliding gear engages the gear on a shaft to which is keyed the pinion for the rack on the cross-feed piston rod. In

a second position, the sliding gear is disengaged from any gear (neutral for hand movement). In a third position, the sliding gear engages an idler driven by the gear, on the pinion shaft, already mentioned, thereby turning the cross-feed screw in the opposite direction.

Amount of automatic cross-feed at table reversal is determined by the length of stroke of the cross-feed piston. The length of stroke is adjusted by a stop at the rear of the piston. This stop is adjusted by the cross feed knob on the right end of the front apron.

The cross-feed saddle rests on two flat ways of the cross slide. The movement of the saddle is guided by a hardened tool steel rail bolted to the underside of the cross slide at the center. The guide rail runs through antifriction bearing, hardened tool steel rollers that are bolted to the machine base. No oil clearance is allowed between the guide rail and rollers. The cross-feed of the saddle is controlled by the action of a feed screw and half nut for hand and hydraulic movement.

The roller alignment is critical since it affects the mating of the feed screw and half nut. A Chas. G. Allen Co. serviceman should be requested to make these adjustments. With normal grinding conditions and proper care, however, the alignment of the rollers as set at our factory will remain indefinitely.

#### VERTICAL SLIDE

The vertical slide has three gibs that can be used to compensate for wear, two holding gibs and one tracking gib. The adjusting screws are along the vertical ways and are accessible when the vertical slide is run up to its highest position.

#### Gib Adjustment

The gib is adjusted by backing off the retaining nuts and taking up on the set screws. Frequent adjustments are not necessary. We strongly recommend that you call for an experienced Warner & Swasey Serviceman to make adjustments when they are necessary because the take-up of the gibs must be "just right" to avoid binding.

#### WHEEL SPINDLE

The wheel spindle is an antifriction bearing type. It is sealed for protection from contaminating elements. It has been pre-lubricated to last the life of the spindle. It is built to operate at 2,750 r.p.m.

The spindle cartridge is secured in the spindle housing by two set screws in the underside of the housing. The lateral position is established by aligning the spindle pulley with the drive motor pulley.

To remove the spindle cartridge loosen the two set screws, remove the wheel sleeve, and draw the cartridge out of the spindle housing from the rear of the machine. Reverse the procedure when installing a new spindle. Be sure the flats in the cartridge case are at the bottom so the set screws will bear against them. When the pulleys are in line, tighten the set screws to hold the cartridge in position. Tighten these set screws carefully in order not to distort the spindle housing. Align the spindle drive pulley and the motor pulley by using a straight edge before tightening the set screws. Always use a wheel puller to remove the wheel mount and the drive from the spindle. Hammering them off will shorten the life of the bearings.

#### WHEEL DRIVE BELTS

The Type S-3 Surface Grinder is available with either flat belt or vee belt drive. Care should be exercised when installing a flat belt. The belt pulleys should be carefully aligned since any misalignment will cause the belt to stretch on one side, thereby reducing its life. Special attention should be paid to belt tension. With the belt in place, run the pulleys for a few minutes to distribute the tension evenly throughout the belt. The proper tension should be just enough so the belt will run without flapping. A belt properly aligned and under the correct tension will last almost indefinitely. The belt is elastic and resistant to the effects of lubricants. No belt dressing of any type should be used. The slightly tacky surface of the belt is the source of its driving ability.

While the installation of the vee type drive belt is not so critical as the flat belt, improper installation will materially reduce the life expectancy. Align the belt sheaves carefully. Always use a straight edge. Do not tighten the spindle cartridge in the housing until the sheaves are in line. The vee belt depends on the pinching action of the sheave on the belt for driving. For this reason, the belt should not be tight, but should have approximately 1/2" of slack at the mid-point between the sheaves.

### IN THE EVENT OF DIFFICULTY

Should any problem with this surface grinder arise, read this booklet carefully and in the majority of cases the remedy will be found herein. For instance, should the table refuse to start, the operator will first assure himself that the hydraulic pump motor is running. If it is not, trouble should be looked for in the motor itself, its wiring or starting switch. If the motor is running, trouble should be sought in the hydraulic line in the shape of a broken hose or loose connection.

Using this method of tracking down trouble, the average mechanic can run and maintain the surface grinder with perfect assurance. If, however, a difficulty arises that does not respond to this treatment, a letter, wire or phone call to the Company's home office will bring assistance. We request that the machine owner or operator give us full information such as the serial number of the machine, when it was purchased and full particulars on the nature of the trouble. Frequently, it is found that difficulties may be settled by correspondence or over the telephone if the machine man is explicit in his description of his problem.

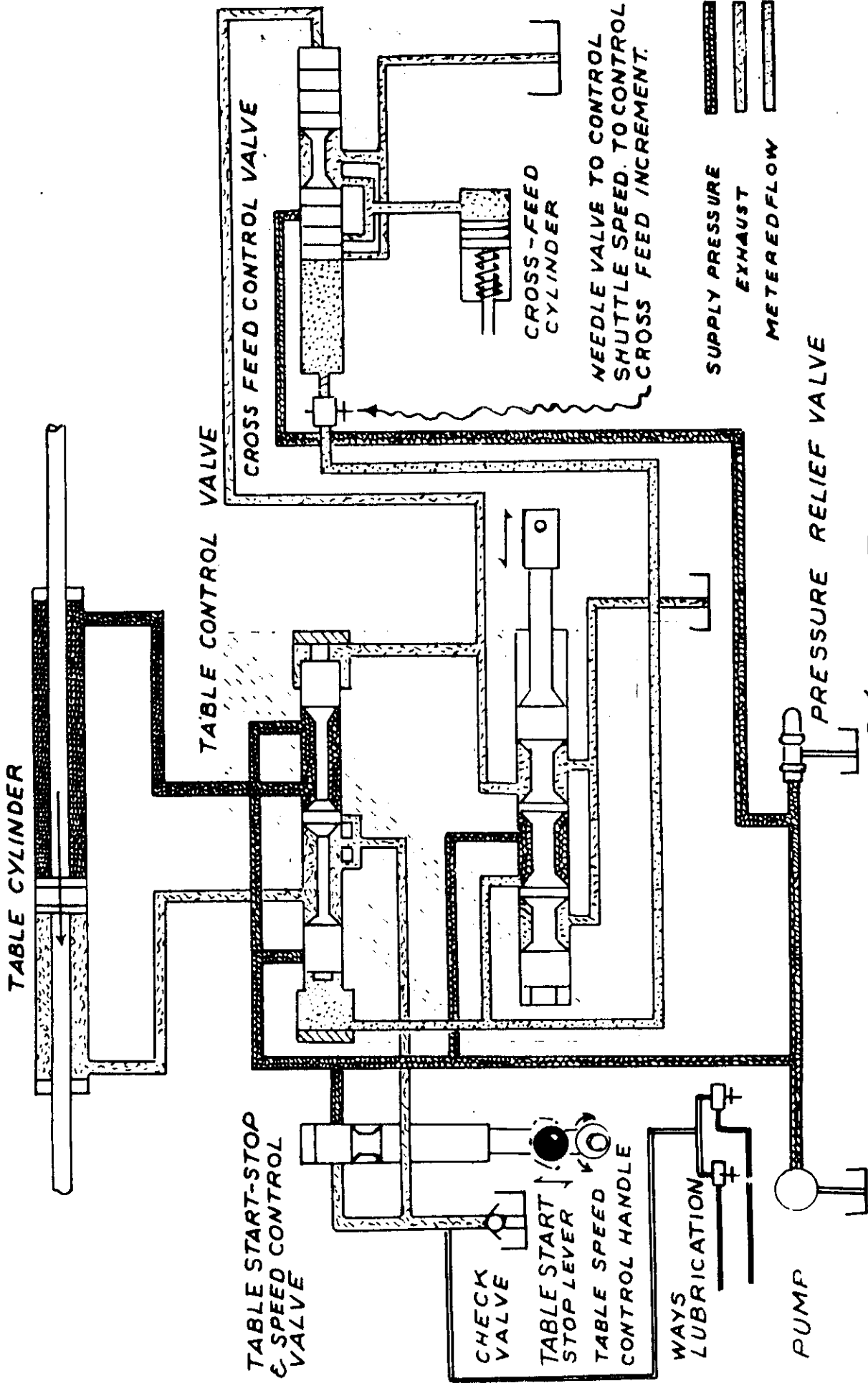
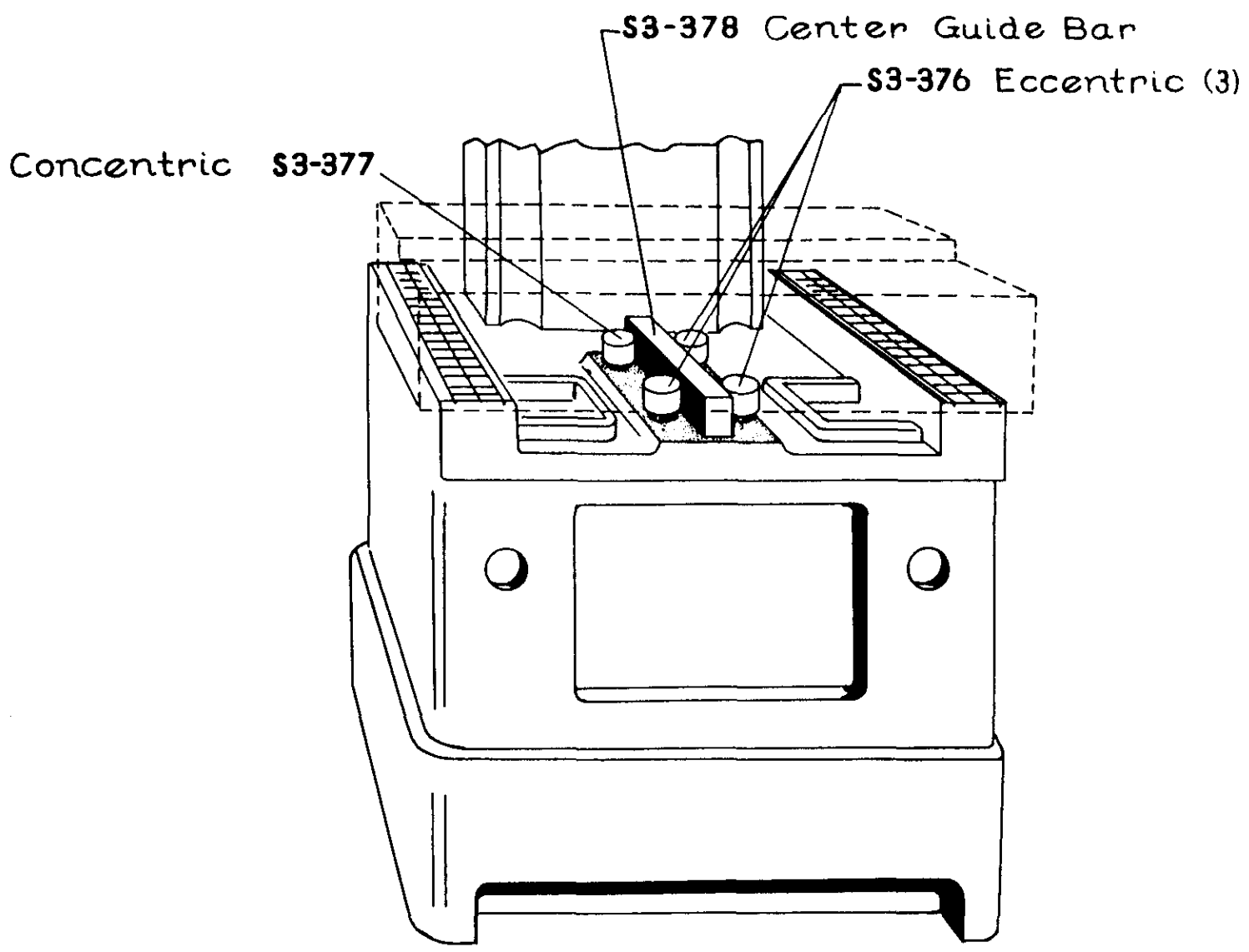


Figure 3  
6S3 HYDRAULIC SYSTEM



**CENTER GUIDE ROLLS**

SE-3433-B

## CENTER GUIDE ROLLS

This machine has a center guide bar attached to the underside of the saddle. This guide bar runs between four center guide rolls for maintaining accuracy of saddle motion. The construction is shown by the drawing on the adjacent page.

As is indicated by this drawing, one of these rolls is concentric or "fixed." This is the left rear roll, when facing the machine. The other three rolls are mounted on an eccentric as indicated by the marking on the drawing.

At factory assembly of the machine, the left front guide roll is carefully lined with the "fixed" guide roll. The saddle is placed on the machine with the guide bar firmly in contact with the left-hand rolls, then by manipulation of their eccentric mountings, the two right-hand rolls are brought into firm - but not binding contact - with the guide bar.

Saddle cross motion is then checked, and if necessary, is corrected by adjustment of the right-hand rolls. Examination of the machine will show that the adjusting studs for the two front guide rolls are very close to the base opening. The adjusting stud for the right rear (eccentrically mounted) guide roll can be felt farther back.

It will also be evident that the adjusting studs are locked by hex nuts. The adjusting studs are turned by a socket set screw.

### Removing the Saddle

When it becomes necessary to remove the saddle for any reason, be sure to first back off the right-hand guide rolls. Do not touch the left front guide roll on receipt of the machine or when removing the table.

The two exceptions to this might be (1) when it is suspected that the adjustment of the left front stud has been disturbed during shipment; (2) if after a period of service the sliding table is known to be operating "out of square" with the center-line of the grinding wheel spindle.

In this case it may be found necessary to make adjustment of the two front guide rolls, but normally, it will be found that most required adjustment can be made with the two right-hand guide rolls only.



## PROCEDURE FOR GRINDING PERMANENT MAGNET OR ELECTRO-MAGNET TYPE CHUCKS

Prior to mounting a chuck on the sliding table of a surface grinder, we recommend the following steps be taken.

1. Place the chuck, face down, on the sliding table of the surface grinder.
2. Indicate the surface of the chuck lengthwise and crosswise and shim as necessary to level the surface to be ground.
3. Place blocks at each end of the chuck, and using hold down clamps bolted to the machine table, clamp the blocks snugly against the ends of the chuck so that it will not move while being ground.
4. Mount a 23A46-18VBE, or similar grinding wheel, on to the wheel sleeve furnished with the machine and mount the assembly on the spindle.
5. True wheel - "Open" - by moving diamond across wheel face rapidly with moderately heavy cut.
6. Grind chuck. The table should be operated at half speed and the maximum depth of cut should be .0002 to .0003". Use an adequate coolant flow, or if the machine is not equipped with a coolant arrangement, use any available spray mist attachment.

### DO NOT ATTEMPT TO GRIND CHUCK DRY

7. After the base has been ground, be sure it is free from burrs and mount on the table in the position it is to be used and clamp to table. Clamps should only be tightened sufficiently to prevent the chuck from moving on the table.
8. Put lever in "On" position, or if the chuck is an electric type, it should be energized.
9. Retrue wheel - "Open" - and grind top of chuck to "clean up." Follow instructions in "6" as to coolant and depth of cut.

Each time the chuck is ground, the wheel should be trued. There should be no effort to "spark out" on the top of the chuck after the last pass has been taken. A "commercial" grind finish will provide the best coefficient of friction for non-slip magnetic holding of work pieces on the chuck.

## AUTOMATIC PICKER DOWN FEED

The 6" S-3 can be arranged with automatic picker down feed at each table reversal or, as an optional arrangement, at each saddle reversal. See drawing in Parts Section. The mechanism is located on top of the wheel feed housing just behind the wheel feed handwheel (6S3-380). To operate, turn knob (6S3-410) to the left. The adjustment of this knob in or out determines the amount of down feed at each pick. The increment of picker feed is infinitely adjustable from zero to .003" and up to a total picker down feed of .040".

At the table reversal - or saddle reversal - oil pressure to the cylinder housing (6S3-399) forces the rack piston (6S3-391) to the left turning the overriding clutch (6S3-388) operating on the shaft (6S3-387) which in turn revolves the handwheel by means of the pinion gear (6S3-383). The amount of picker feed can be determined by checking the graduated handwheel as it moves past the pointer (6S3-395). As the oil exhausts, the rack piston is returned to its original position by the pressure of the spring (6S3-406).

## SETTING UP

Secure the workpiece on the table - or magnetic chuck - and CAREFULLY bring the wheel down until it barely sparks the workpiece. Determine the total amount of stock to be removed and move the adjustable dog (6S3-405) around the graduated handwheel clockwise the desired amount. When the total amount of downfeed has been reached, the adjustable dog will trip the latch (6S3-401). This will allow the mechanism contained in housing (6S3-392) to raise making the picker feed inoperative.

## WHEEL HEAD MOUNTED TRUING DEVICE

This device is mounted above the grinding wheel. It is manually operated and trues in a straight line only. The diamond shank (6S3-434) is lowered or raised by turning the nut (6S3-436) clockwise or counterclockwise respectively. The device is mounted so that the slide (6S3-443) is parallel with the wheel spindle and, therefore, dresses the wheel in the proper plane.

When it is necessary to true the wheel, CAREFULLY bring the diamond down and into light contact with the wheel. (The adjusting nut is graduated, each graduation being equal to .0005" downfeed). The truing operation can be observed by opening the small inspection door in the wheel guard cover (6S3-415). In truing, it is recommended that a minimum amount of abrasive be removed to "clean-up" the wheel. The diamond is moved across the grinding wheel by turning the handwheel (6S3-423). The truing coarseness or fineness will determine the speed of the diamond traverse across the wheel face.

20.

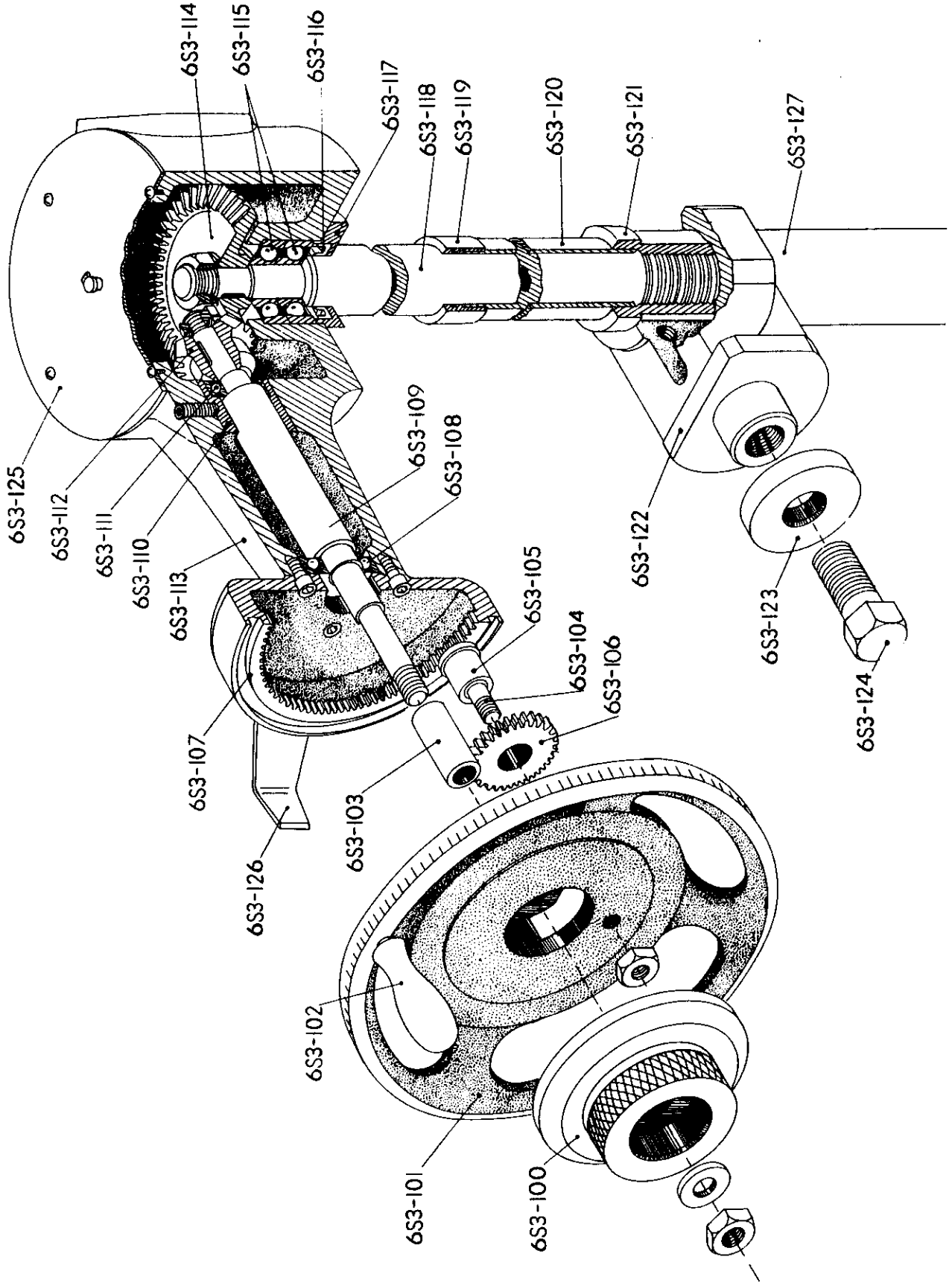
Notes for Machine Serial # \_\_\_\_\_

INDEX OF PARTS

Drawings for 6" S-3  
Surface Grinder

<u>Page</u>		<u>6S3 Catalogue Numbers</u>
22	Vertical Wheel Feed	Code 100-127
24	Table Reverse Lever	Code 130-162
24	Table Dogs	
24	Hand Table Traverse	
24	Reverse Lever Detent	Code 280-284
26	Automatic Cross Feed and Screw 1	Code 165-196
28	Automatic Cross Feed and Screw 2	Code 200-213
30	Table Cylinder	Code 215-222
31	Table Control Valve	Code 230-252
32	Wheel Spindle Antifriction	Code 255-260
33	Hydraulic Pump Parts & Cross Feed Shuttle Valve	Code 265-275
34	Wheel Guard Truing Device	Code 415-448
36	Picker Down Feed	Code 382-411

Please specify catalogue Part number and Name together with the machine Serial number on every inquiry or order.



VERTICAL WHEEL FEED

SE-3321-A  
SE-3322-A

Code 100-127

Vertical Wheel Feed

<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>
6S3-100	Down Feed Knob	6S3-116	Clipper Seal Type LA Style H1/25
6S3-101	Handwheel	6S3-117	Ball Bearing Retainer
6S3-102	Handle	6S3-118	Vertical Feed Screw
6S3-103	Bushing	6S3-119	Feed Screw Shield Cap
6S3-104	Idler Stud	6S3-120	Feed Screw Shield (upper)
6S3-105	Torrington B Ring	6S3-121	Elevating Nut
6S3-106	Idler Gear	6S3-122	Vertical Feed Nut Bracket
6S3-107	Sun Gear Housing	6S3-123	Washer
6S3-108	Ball Bearing	6S3-124	7/8 x 2½ Hex. cap. scr.
6S3-109	Handwheel Shaft	6S3-125	Housing cover
6S3-110	Bearing Sleeve	6S3-126	Pointer
6S3-111	Ball Bearing	6S3-127	Feed Screw Shield (lower)
6S3-112	Pinion		
6S3-113	Wheel Feed Housing		
6S3-114	Gear		
6S3-115	Ball Bearing		

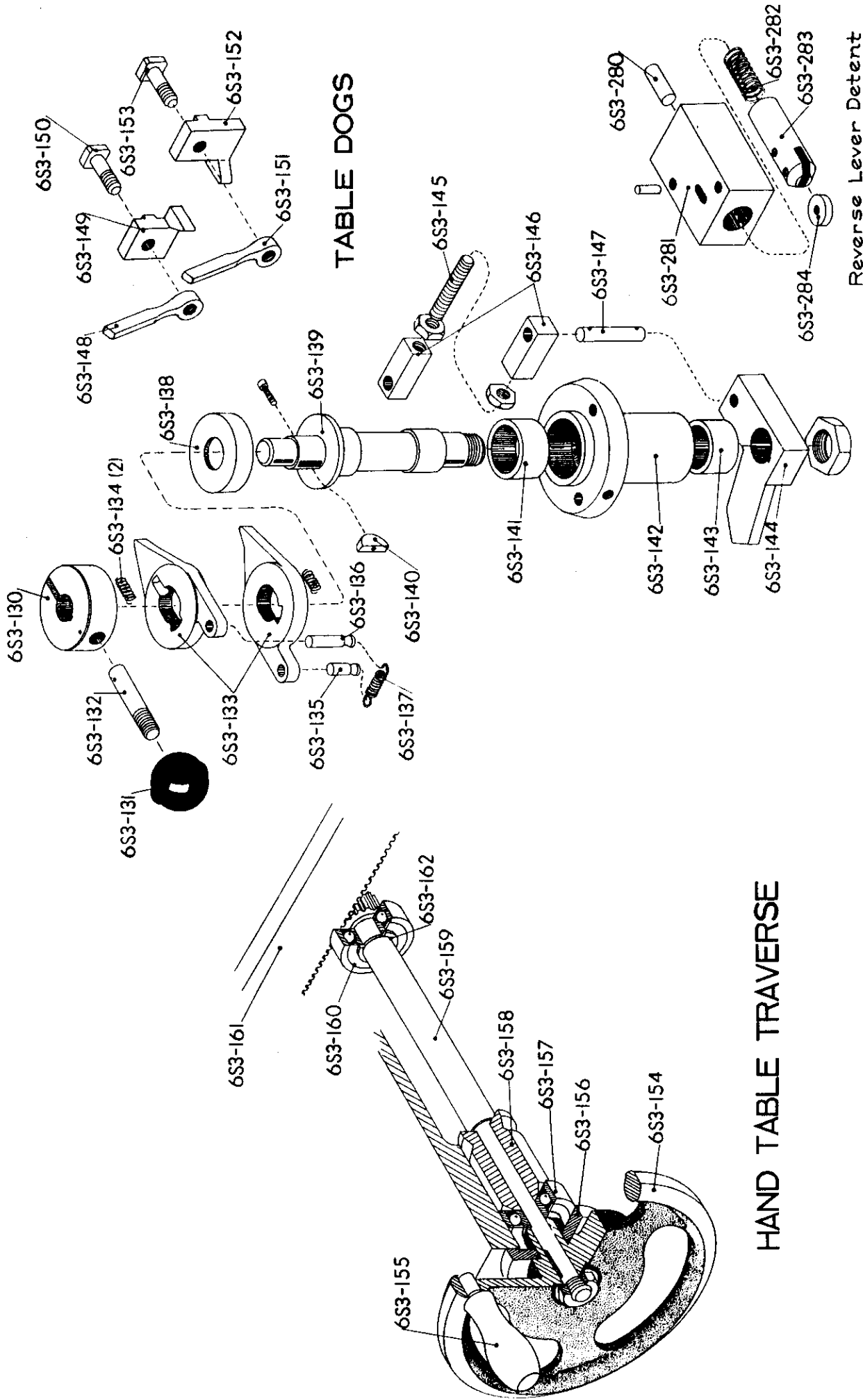


TABLE REVERSE LEVER

SE-3323-A  
SE-3324-A

Code 130-162

Table Reverse Lever

<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>
6S3-130	Collar	6S3-139	Shaft
6S3-131	Knob (Black)	6S3-140	Key
6S3-132	Knob Stud	6S3-141	Torrington Needle Bearing
6S3-133	Lever (2)	6S3-142	Housing
6S3-134	Spring (2)	6S3-143	Torrington Needle Bearing
6S3-135	Spring Pin (short)	6S3-144	Lever and Detent Cam
6S3-136	Spring Pin (long)	6S3-145	Soc. set Scr.
6S3-137	Spring	6S3-146	Link (2)
6S3-138	Hood	6S3-147	Pin

Table Dogs

6S3-148	Lever (LH)	6S3-151	Lever (RH)
6S3-149	Dog (LH)	6S3-152	Dog (RH)
6S3-150	Tee Bolt (LH)	6S3-153	Tee Bolt (RH)

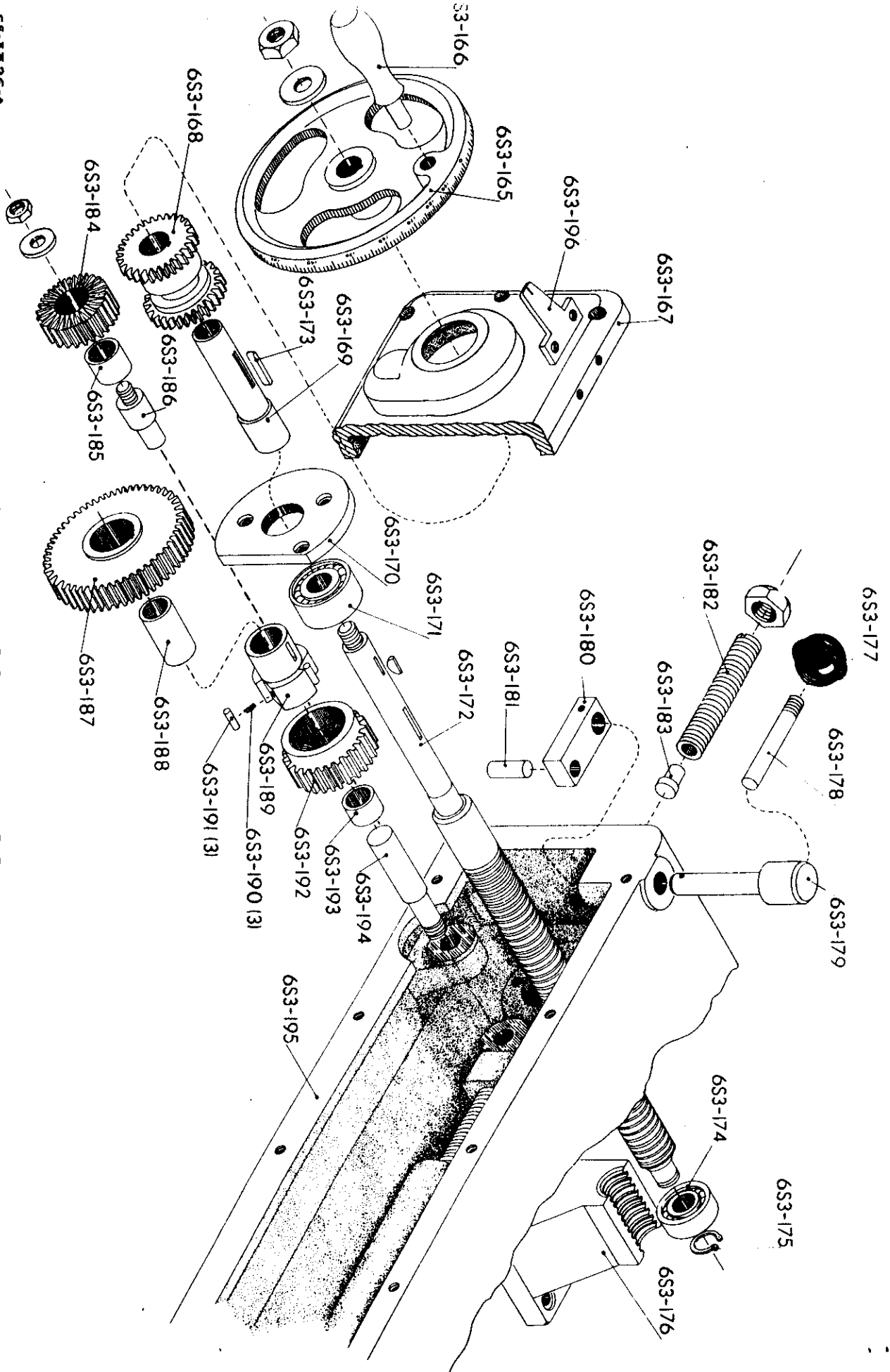
Hand Table Traverse

6S3-154	Handwheel	6S3-159	Rack Pinion Shaft
6S3-155	3QA Handle	6S3-160	Ball Bearing
6S3-156	Bearing Cap	6S3-161	Table Rack
6S3-157	Ball Bearing	6S3-162	Tru-Arc Snap Ring
6S3-158	Interlock Collar		

Reverse Lever Detent

6S3-280	Pin	6S3-283	Detent Plunger
6S3-281	Detent Block	6S3-284	Roll
6S3-282	Spring		





**AUTOMATIC CROSS FEED & SCREW 1**

SE-3326-A  
SE-3327-A

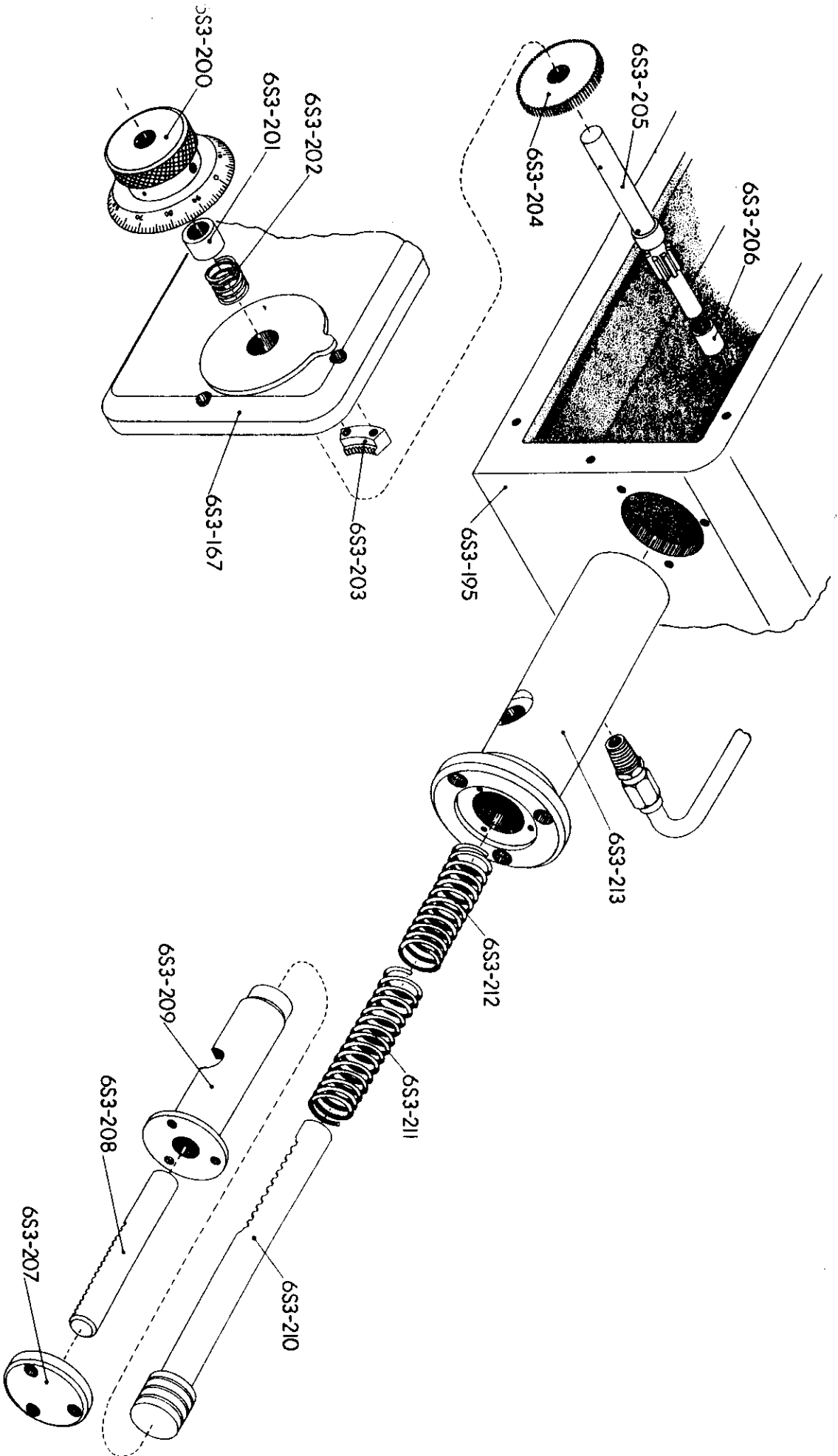
RAND

SE-3326-A  
SE-3327-A

Code 165-196

Automatic Cross Feed  
and Screw (I)

<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>
6S3-165	Handwheel	6S3-181	Pin
6S3-166	QA. Handle	6S3-182	Stop Screw
6S3-167	Cover	6S3-183	Stop Button
6S3-168	Sliding Gear	6S3-184	Idler Gear
6S3-169	Feed Screw Sleeve	6S3-185	Bushing
6S3-170	Bearing Cap	6S3-186	Idler Gear Stud
6S3-171	Ball Bearing	6S3-187	Gear
6S3-172	Screw	6S3-188	Oilite Bushing
6S3-173	Feed Screw Key	6S3-189	Clutch Sleeve
6S3-174	Ball Bearing	6S3-190	Spring (3)
6S3-175	Truarc Snap	6S3-191	Torrington Roller (3)
6S3-176	Half Nut	6S3-192	Rack Pinion
6S3-177	Ball	6S3-193	Oilite Bushing
6S3-178	Knob Stud	6S3-194	Clutch Stud
6S3-179	Reverse Lever Shaft	6S3-195	Cross Slide
6S3-180	Shift Lever	6S3-196	Pointer



SE-3328-A  
SE-3329-A

AUTOMATIC CROSS FEED & SCREW 2

RAND

SE-3328-A  
SE-3329-A

Code 200-213

Automatic Cross Feed  
and Screw (II)  
6" S-3

<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>
6S3-200	Knob	6S3-207	Sleeve Cap
6S3-201	Oilite Bushing	6S3-208	Adjustment Rack
6S3-202	Spring	6S3-209	Adjustment Sleeve
6S3-203	Locking Segment	6S3-210	Piston
6S3-204	Locking Gear	6S3-211	Spring
6S3-205	Pinion Shaft	6S3-212	Spring
6S3-206	Oilite Bushing	6S3-213	Hydraulic Cylinder

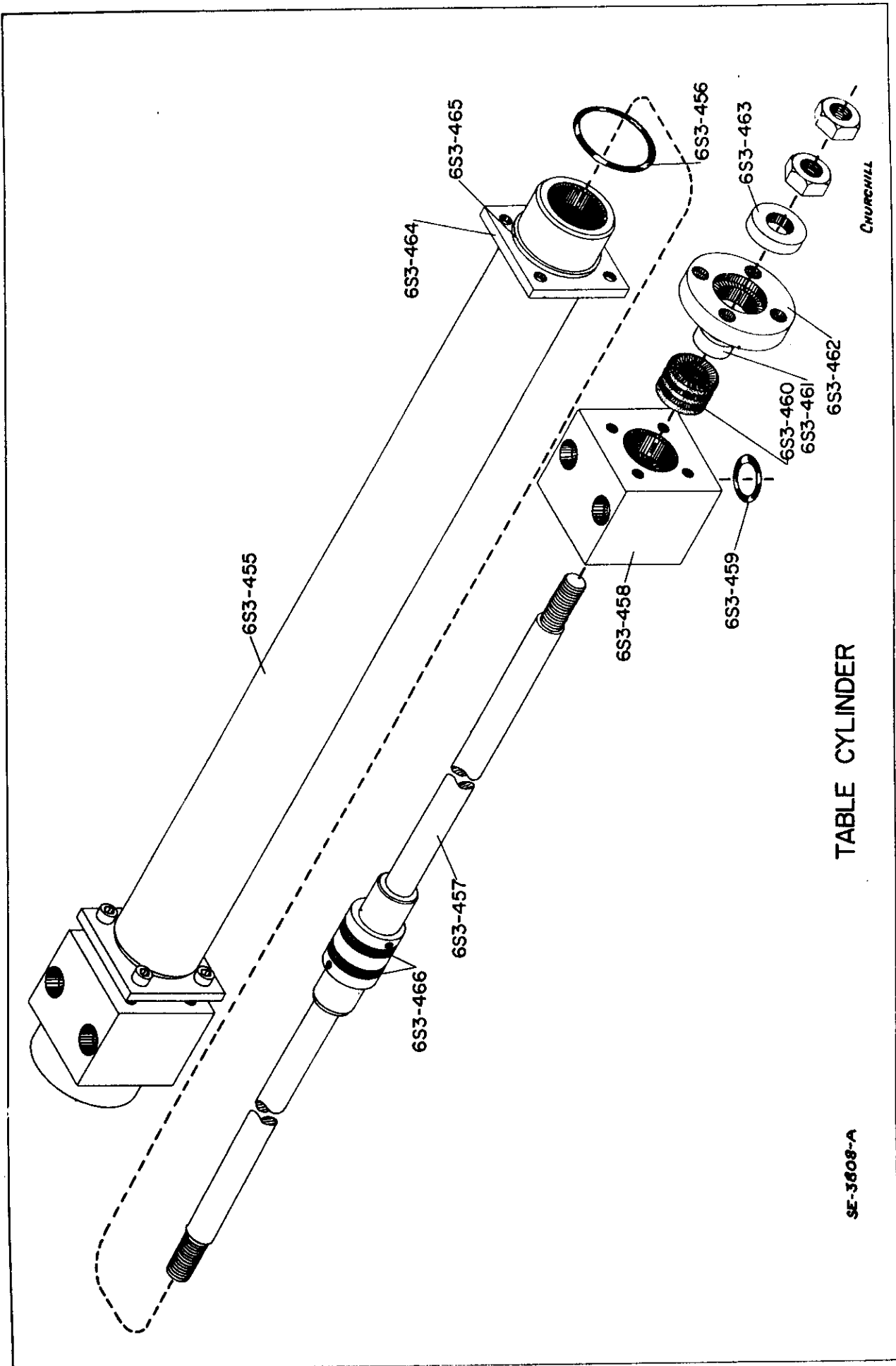


TABLE CYLINDER

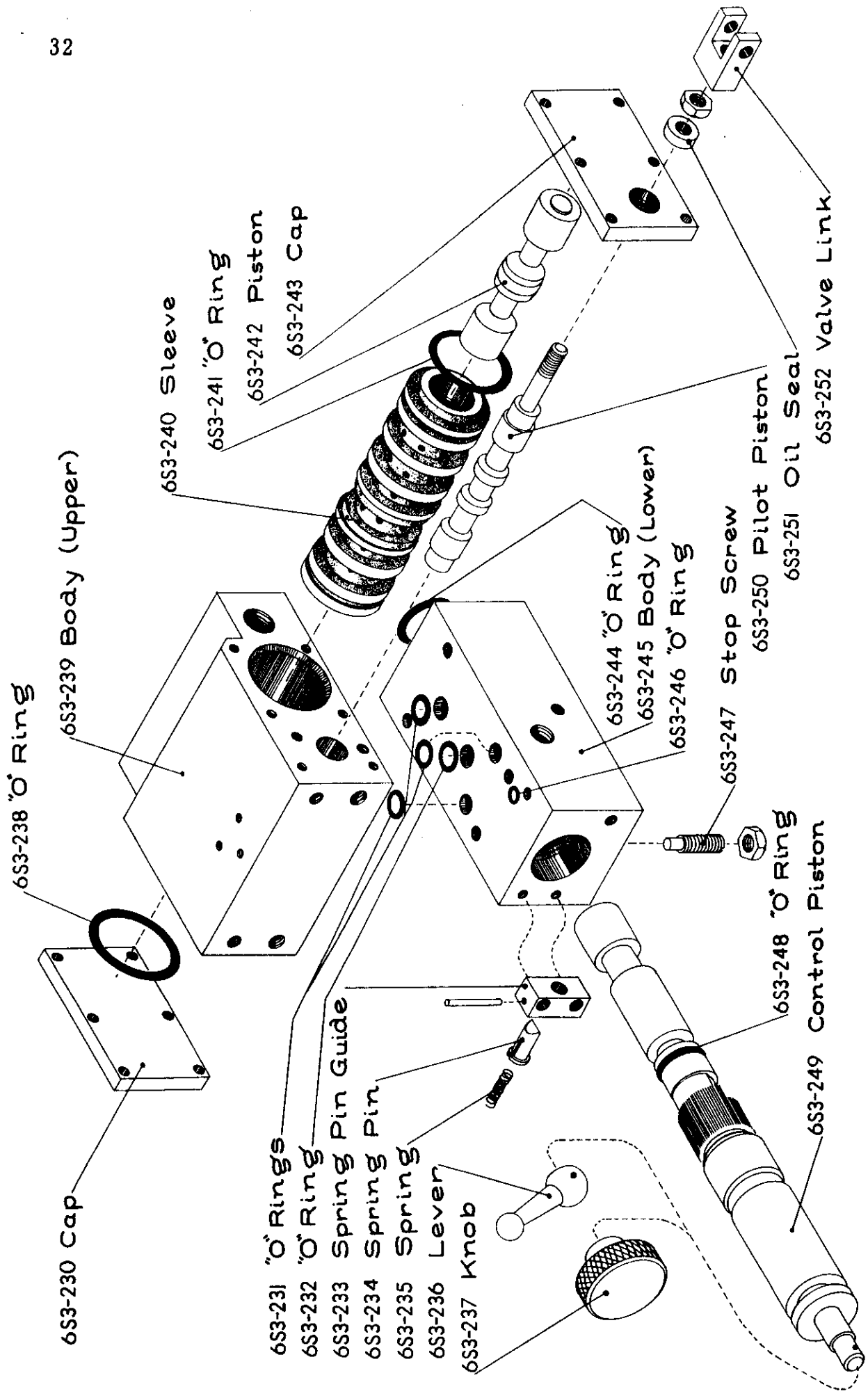
SE-3608-A

SE-3808-A

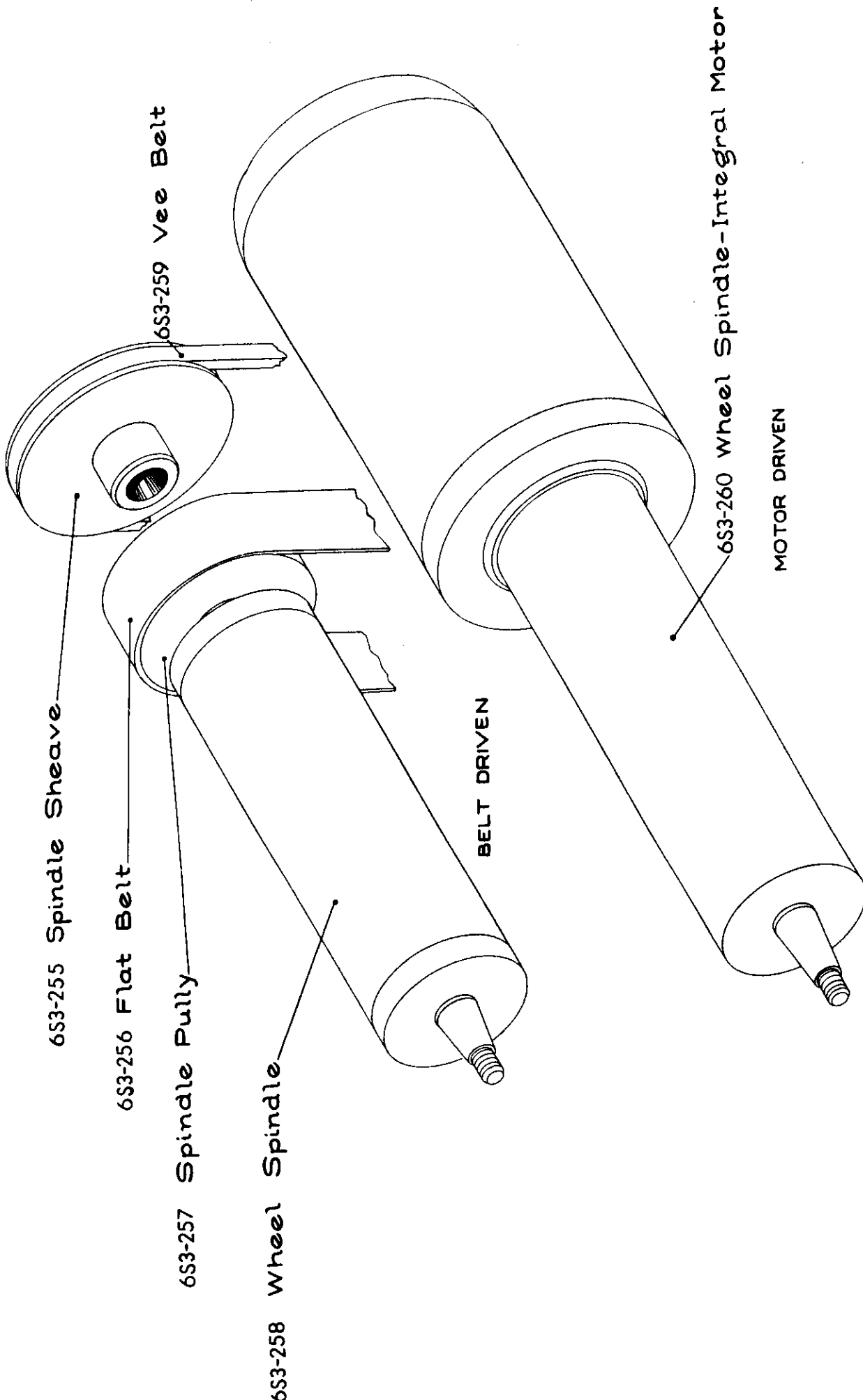
Codes 455 - 466

TABLE CYLINDER

<u>Code No.</u>	<u>Part Name</u>
6S3-455	Cylinder
6S3-456	"O" Ring (2)
6S3-457	Piston & Rod
6S3-458	Cylinder Head (2)
6S3-459	"O" Ring (2)
6S3-460	Unee-Pack (4)
6S3-461	Bushing (2)
6S3-462	Cap (2)
6S3-463	Seal (2)
6S3-464	Collar (2)
6S3-465	Tru-Arc Ring (2)
6S3-466	Unee-Pac (2)

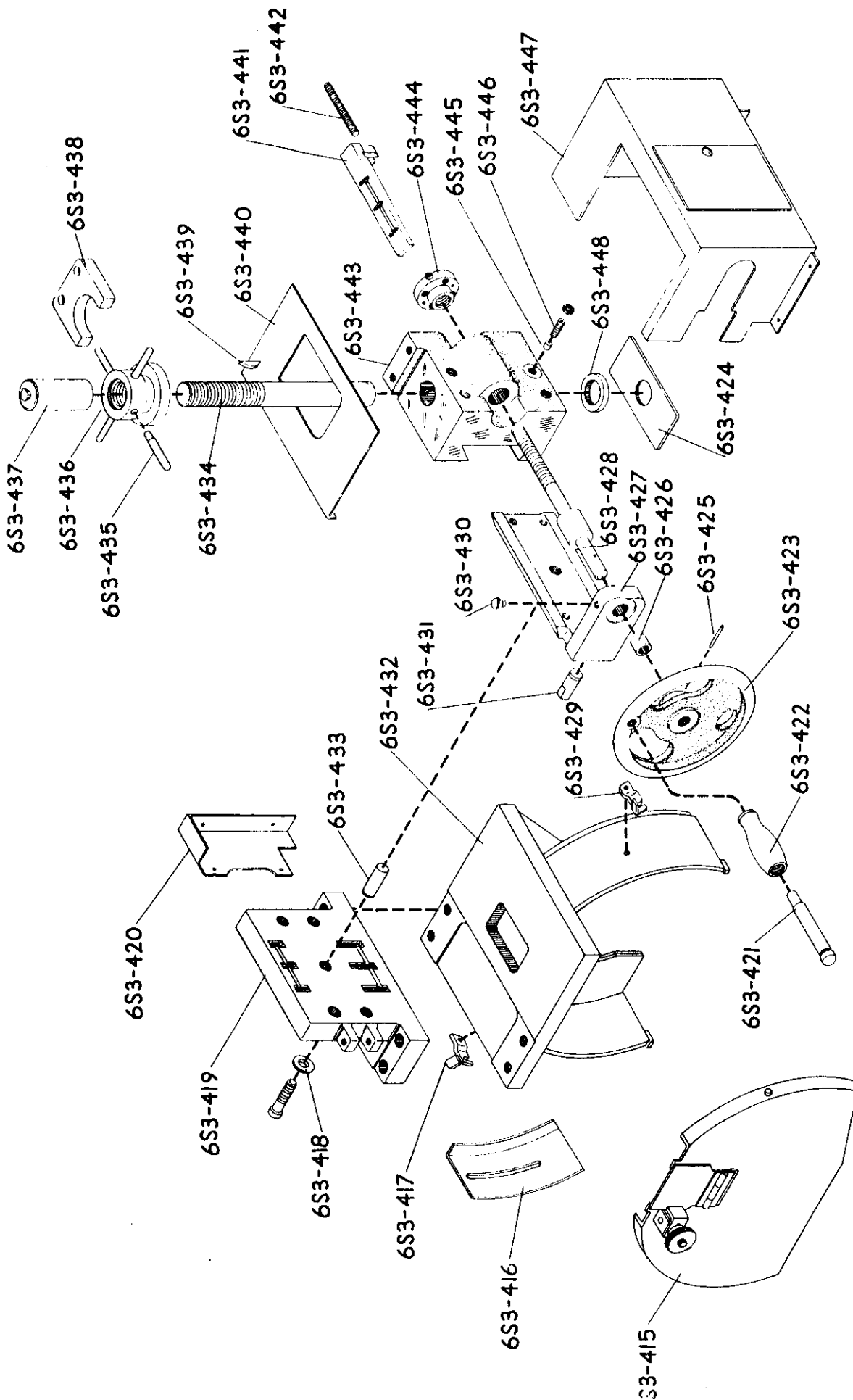


# TABLE CONTROL VALVE



**WHEEL SPINDLES**  
(ANTIFRICTION BEARINGS)





# WHEEL GUARD TRUING DEVICE

CHURCHILL

E-3715-A  
E-3718-A

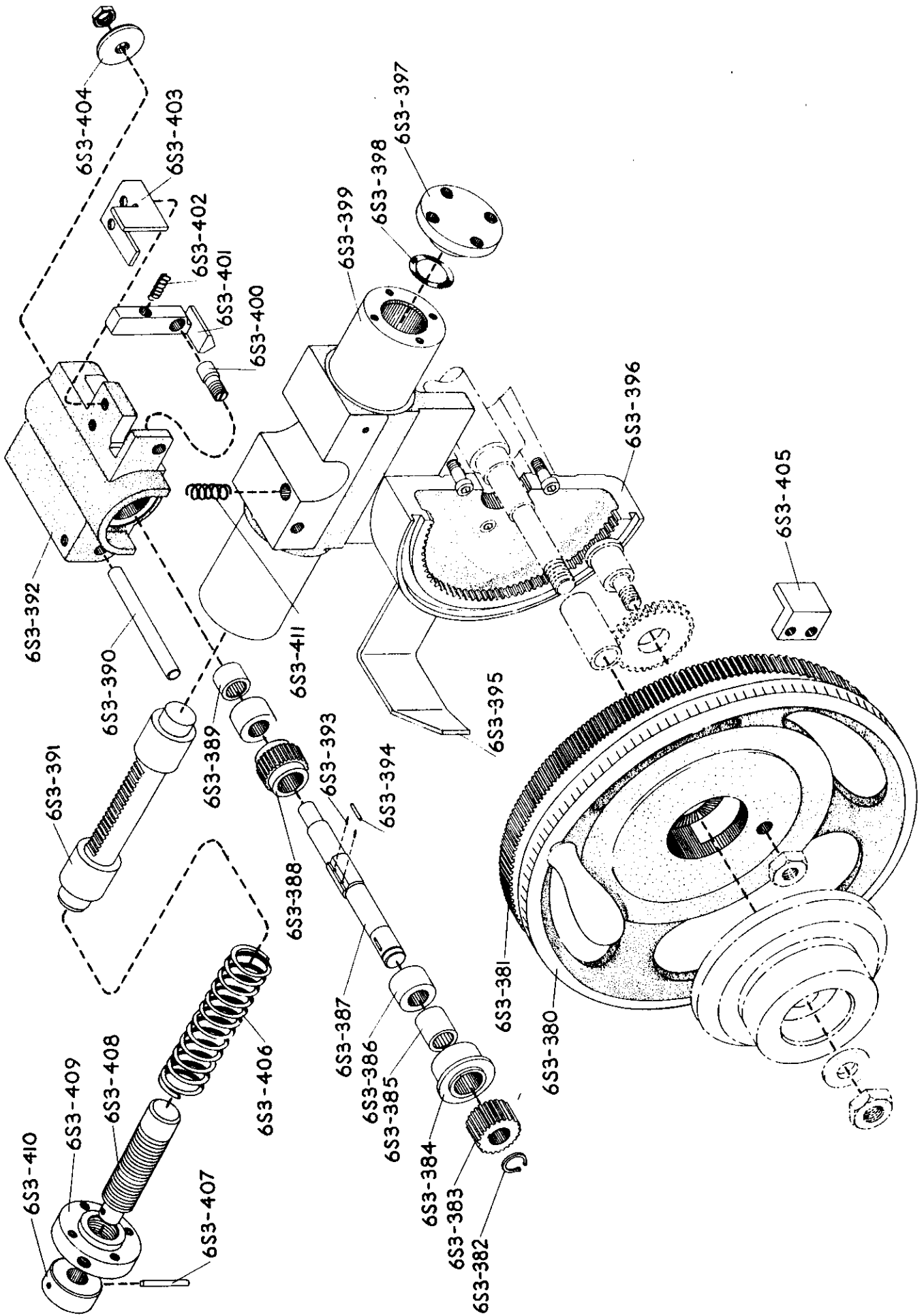
SE-3715-A  
SE-3718-A

Job #5379

Page 1 of 1  
Code 415 - 448  
6-21-68

Wheel Guard Truing Device

<u>Code No.</u>	<u>No. Req'd</u>	<u>Part Name</u>	<u>Code No.</u>	<u>No. Req'd</u>	<u>Part Name</u>
6S3-415	1	Wheel Guard Cover	6S3-432	1	Wheel Guard (8" Wheel)
6S3-416	1	Water Guard	6S3-433	1	Dowel Pin
6S3-417	1	Latch (R. H.)	6S3-434	1	Dia. Shank (8 & 10" Wheel)
6S3-418	4	Washer	6S3-435	1	Hand Pin
6S3-419	1	Base	6S3-436	1	Nut
6S3-420	1	Dust Guard	6S3-437	1	Guard
6S3-421	1	Handle Stem	6S3-438	1	Clamp
6S3-422	1	Handle Stem	6S3-439	1	Woodruff Key
6S3-423	1	Hand Wheel	6S3-440	1	Dust Guard Cover
6S3-424	1	Shield	6S3-441	1	Gib
6S3-425	1	Roll Pin	6S3-442	1	Stop Screw
6S3-426	1	Bushing	6S3-443	1	Slide
6S3-427	1	Dovetail	6S3-444	1	Nut Bushing
6S3-428	1	Trav. Screw	6S3-445	1	Shoe
6S3-429	1	Latch	6S3-446	1	Set Screw (Rd. Pt.)
6S3-430	3	Oil Cup	6S3-447	1	Dust Guard
6S3-431	1	Clamp Pin	6S3-448	1	Seal



CHURCHILL

# VERTICAL PICKER FEED

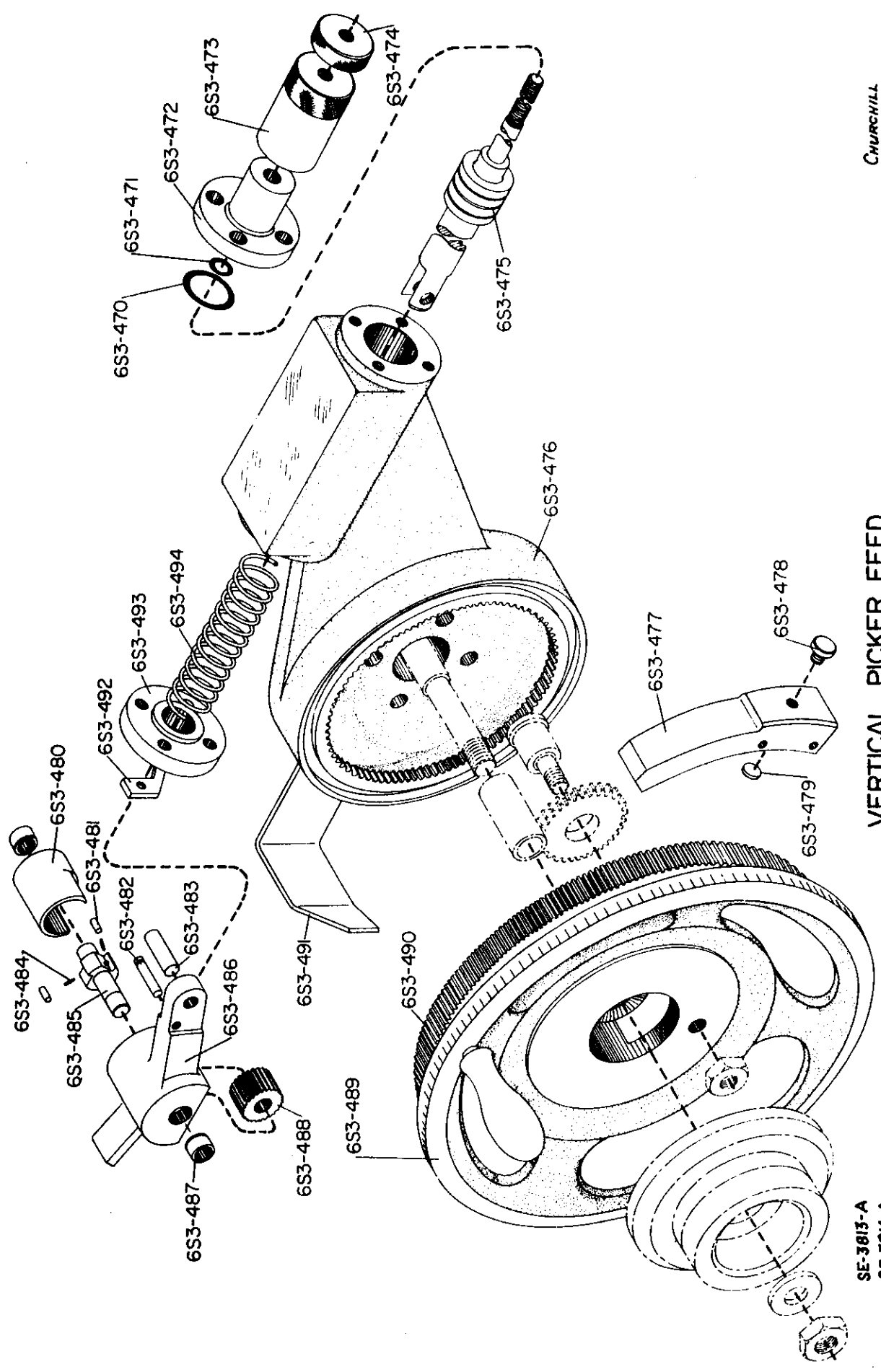
SE-3712-A  
SE-3717-A

SE-3712-A  
SE-3717-A

Page 1 of 1  
Code 380-411  
6-20-68

Vertical Picker Feed

<u>Code No.</u>	<u>No. Req'd</u>	<u>Part Name</u>	<u>Code No.</u>	<u>No. Req'd</u>	<u>Part Name</u>
6S3-380	1	Hand Wheel	6S3-396	1	Sun Gear Housing
6S3-381	1	Gear	6S3-397	1	End Cap R. H.
6S3-382	1	Snap Ring	6S3-398	1	"O" Ring
6S3-383	1	Gear	6S3-399	1	Cylinder Housing
6S3-384	1	Bushing	6S3-400	1	Eccentric Shaft
6S3-385	1	Needle Bearing	6S3-401	1	Latch
6S3-386	2	Spacer	6S3-402	1	Spring
6S3-387	1	Shaft	6S3-403	1	Latch Stop
6S3-388	1	Gear	6S3-404	1	Washer
6S3-389	1	Needle Bearing	6S3-405	1	Dog
6S3-390	1	Pin	6S3-406	1	Spring
6S3-391	1	Piston Rack	6S3-407	1	Roll Pin
6S3-392	1	Gear Housing	6S3-408	1	Adj. Screw
6S3-393	6	Springs	6S3-409	1	End Cap
6S3-394	3	Roller	6S3-410	1	Knob
6S3-395	1	Pointer	6S3-411	1	Spring



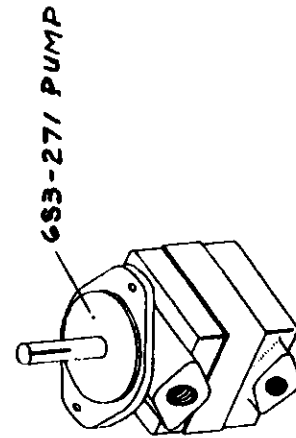
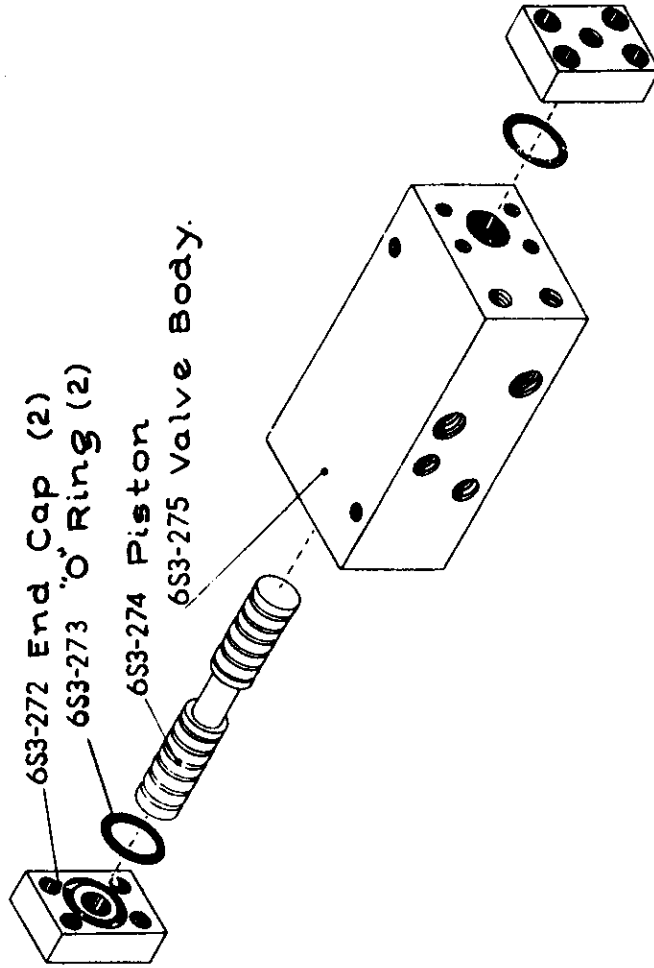
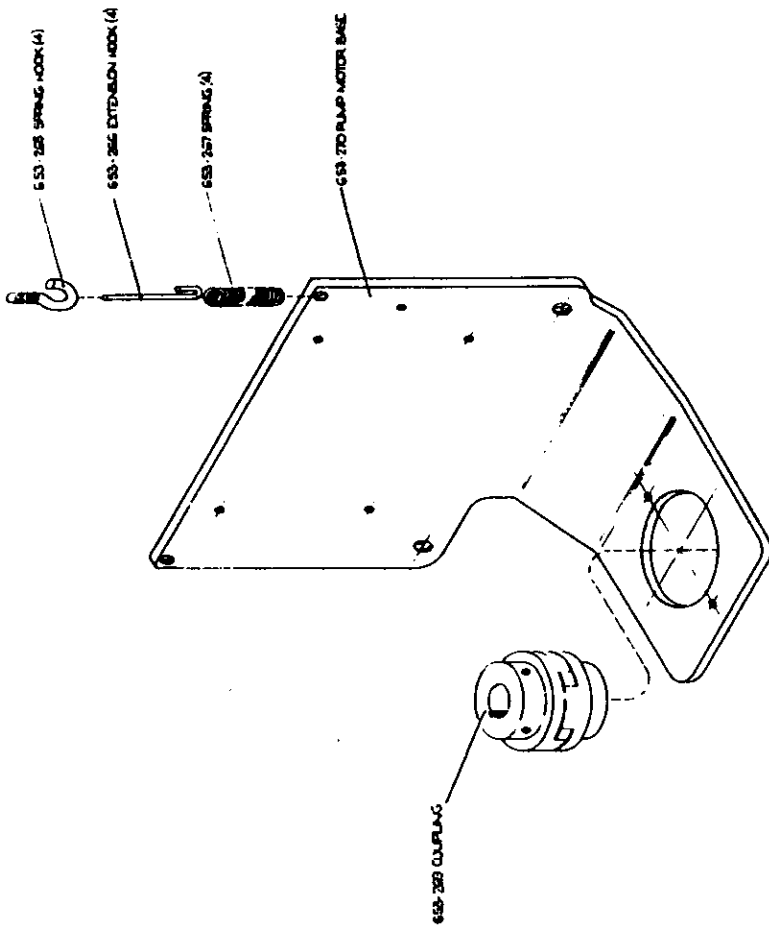
SE-3813-A  
SE-3814-A

VERTICAL PICKER FEED

CHURCHILL

VERTICAL PICKER FEED

<u>Code No.</u>	<u>No. Req'd</u>	<u>Part Name</u>
6S3 - 470	1	"O"-Ring
6S3 - 471	1	"O"-Ring
6S3 - 472	1	End Cap - R.H.
6S3 - 473	1	Adjusting Nut
6S3 - 474	1	Nut
6S3 - 475	1	Piston
6S3 - 476	1	Gear Housing & Cylinder
6S3 - 477	1	Pawl Latch
6S3 - 478	1	Thumb Screw
6S3 - 479	1	Shoe
6S3 - 480	1	Sleeve
6S3 - 481	3	Roller
6S3 - 482	1	Spring Pin
6S3 - 483	1	Pin
6S3 - 484	3	Spring
6S3 - 485	1	Pinion-Shaft
6S3 - 486	1	Pawl Arm
6S3 - 487	2	Bushing
6S3 - 488	1	Pinion
6S3 - 490	1	Handwheel
6S3 - 491	1	Pointer
6S3 - 492	1	Clip
6S3 - 493	1	End Cap* - L.H.
6S3 - 494	1	Spring



# CROSS FEED SHUTTLE VALVE

# HYDRAULIC PUMP PARTS