

# **Norton S-1 Surface Grinder**

**Instruction and Parts Manual  
Operators Manual**

**Chas. G. Allen Co., Inc.  
25 Williamsville Rd.  
Barre, MA 01005**

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

## GUIDE RULES FOR THE SAFE OPERATION OF GRINDING MACHINES

Many experienced operators, foremen, and safety engineers are sharing their experiences with you in these safety rules. Take advantage of this accumulated wisdom and be a safe grinding machine operator.

The list of guide rules is a partial list. It is not complete. As a good operator you will be able to add to the list, building on your experience and the know-how of those working with you. Make your contribution as did the operator who added the rule:

### GIRL WATCHING

Step back from your machine as you admire the pretty girl walking by.

## 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?

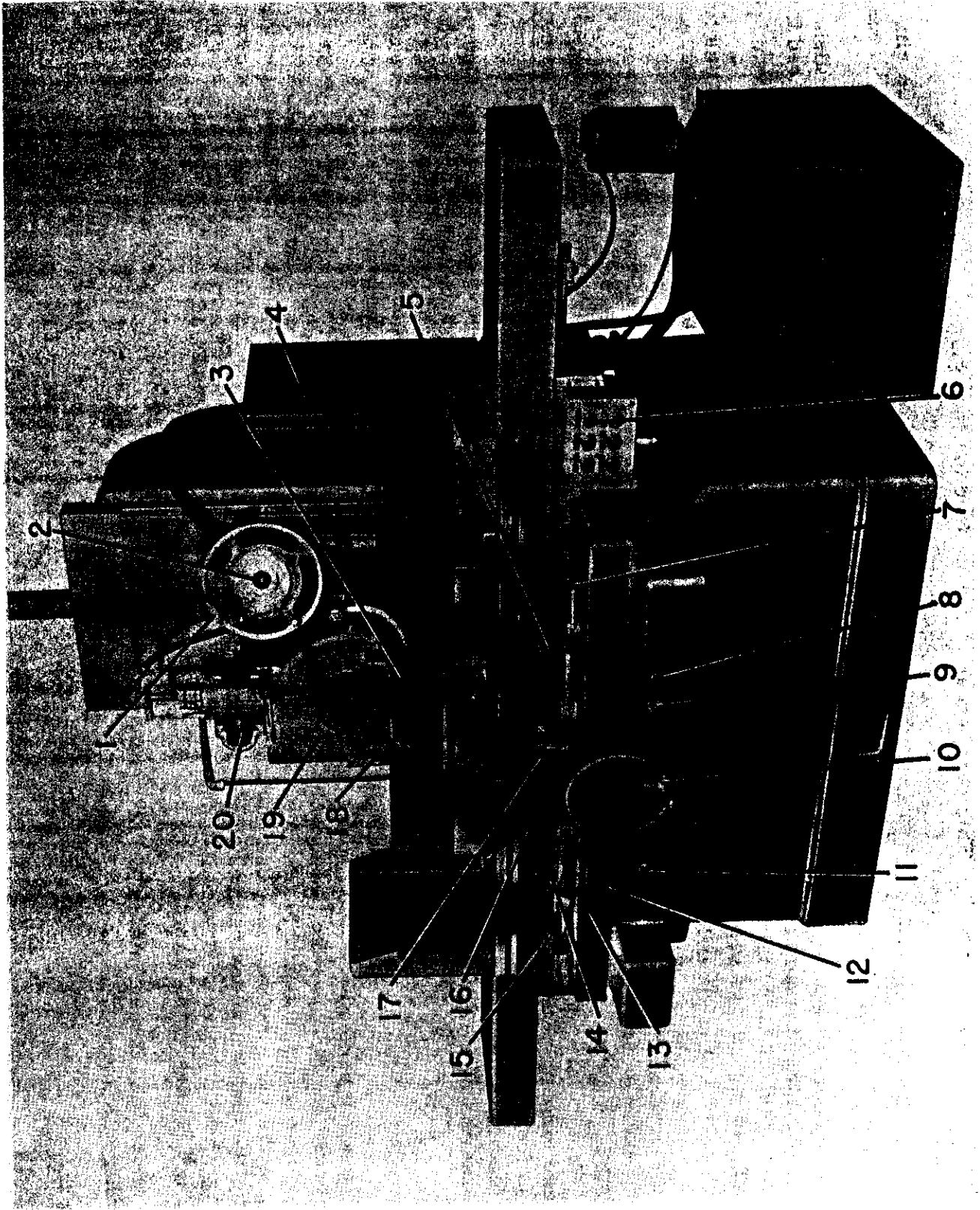
When the chuck is loaded check to be certain the magnetism is on. Do this before starting to grind.

### 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.

## TABLE OF CONTENTS

	<u>Page</u>
Front View of Machine . . . . .	3
Identification of Controls . . . . .	4
Rear View of Machine . . . . .	5
Nomenclature - Rear View of Machine . . . . .	6
 <b>ON RECEIPT OF MACHINE</b>	
Uncrating . . . . .	7
Lifting. . . . .	7
Placing and Leveling . . . . .	8
Rechecking Level. . . . .	8
Electrical Connections . . . . .	9
Mounting the Grinding Wheel. . . . .	9
Balancing the Wheel . . . . .	9
Wheel Guard . . . . .	10
 <b>LUBRICATION</b>	
Filling Reservoirs . . . . .	10
Hydraulic Oil Reservoir. . . . .	10
Ways Lubrication Reservoir . . . . .	11
Wheel Head Column and Feed Nut. . . . .	11
Oil Pressures . . . . .	11
 <b>OPERATION</b>	
Wheel Feed . . . . .	12
Fine-Increment Feeding. . . . .	12
Cross Feed . . . . .	12
Hydraulic Power Cross Feed . . . . .	12
Setting Power Cross Feed . . . . .	13
Control of Cross Feed . . . . .	13
Table Traverse . . . . .	13
Table Traverse Speed Setting . . . . .	14
Table Direction Control . . . . .	14
Table Dog Setting. . . . .	14
Truing the Grinding Wheel. . . . .	15
Setting Table Dogs . . . . .	15
Cross Positioning Work to Wheel. . . . .	15
Proceeding to Grind. . . . .	16
Stopping Table with Work in Machine . . . . .	17
Changing Wheel Speed. . . . .	17
Automatic Cross Traverse Reversal Mechanism . . . . .	18
 <b>PARTS DRAWINGS . . . . .</b>	 <b>.BEGINS 21</b>

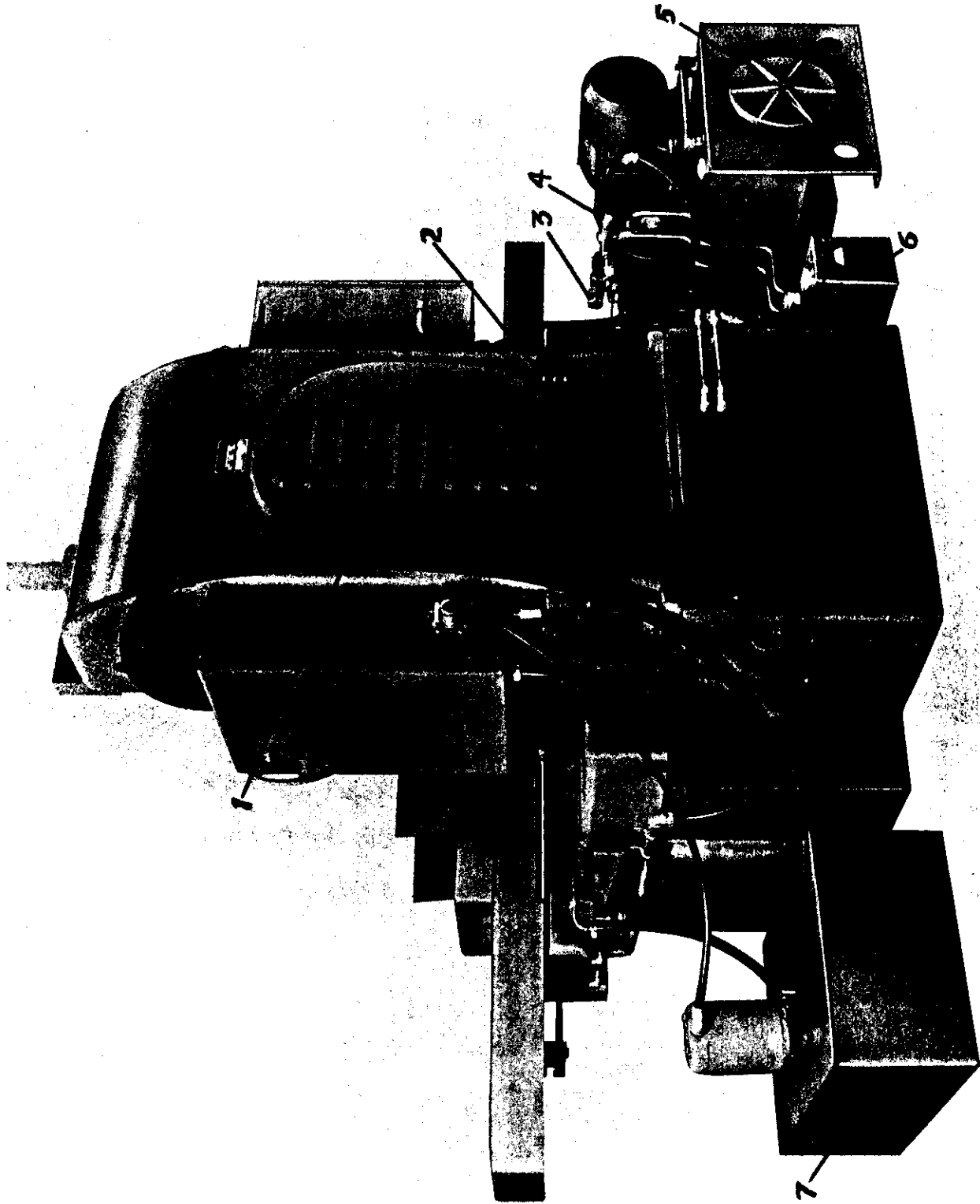


12 x 36" Type S-1 Hydraulic Surface Grinder

N 8913-B

## IDENTIFICATION OF MACHINE CONTROLS AND COMPONENTS

1. Wheel feed hand wheel. Divisions on rim of hand wheel indicate a feed of .0005". This hand wheel gives .050" down feed per turn.
2. Fine-increment feed knob. This is graduated .0001", and gives .010" down feed per full turn.
3. Two wheel spindle speeds are provided by belt change. With the standard 14" diameter wheel the lower speed of 1,760 is used. The higher speed (2,140 r. p. m.) is used when the wheel wears to approximately  $11\frac{1}{4}$ " diameter.
4. Elevated electrical enclosure (supplied at extra cost). Handle must be beyond "off" position to open door.
5. Cross feed direction control lever. Move this in to cross feed from front to back; move it out to cross feed forward. This lever must be moved to reverse the direction of cross feed.
6. Motor controls. Each button is labeled as to its function.
7. Power cross feed selector lever. There are three power cross feeds; a pick feed adjustable up to 1/2", a continuous, adjustable fine cross feed for truing, and a fast, continuous cross feed for bringing the chuck into desired position under the grinding wheel. Lever positions are marked "Pick", "Truing" and "Rapid."
8. "Pick" cross feed increments up to 1/2" are set by turning this knob.
9. Turning this knob sets the rate of continuous cross feed for truing.
10. Cross feed hand wheel. Graduations on rim equal .0005". One turn of wheel gives .100" cross feed.
11. Table speed control. Turn this to establish speed up to 125 feet per minute, that is desired for grinding.
12. Table positioning speed control. Turn this to obtain slow table speed for setting up.
13. Table speed control selector lever. Move this to obtain the fast table speed for grinding, or the slow speed for setting up. DO NOT change from fast to slow while table is moving. Stop the table, then change.
14. Table movement on-off control lever. Operating positions are marked.
15. Power wheel head positioning control lever. (Power wheel head positioning is supplied at extra cost).
16. Table control dogs.
17. Table reverse lever. Set the handle to the left to have table movement start to the right and vice versa.
18. Spray guard easily adjusts up or down.
19. Wheel guard cover. Always have this properly attached before running grinding wheel.
20. Wheel head mounted automatic truing device. This is optional at extra cost.



Rear View - 12 x 36" Type S-1 Hydraulic Surface Grinder N 9017-A

REAR VIEW OF MACHINE

1. Lubrication oil reservoir for the vertical feed screw gearing is reached by removing this sheet metal cover. This reservoir is identified by a 90° elbow fitted with a pipe plug.  
Fill reservoir through the elbow with a good grade of machine oil. Filling to the top of the elbow establishes the proper level in the reservoir.  
To drain reservoir, merely turn the elbow 180°.
2. These three fittings lubricate the wheel head column and the feed nut. Apply a good grade of medium grease weekly.\*
3. Hydraulic oil system pressure is regulated by this valve. Maintain pressure at approximately 400 pounds.
4. Ways lubrication system pressure is regulated by this valve. Maintain pressure in this system at approximately 5 pounds.

\* See page 10

5. Hydraulic oil reservoir. Fill this reservoir with approximately 40 gallons of high grade hydraulic oil of 145-170 S.U.V. at 100°F.\*

Change oil and clean this reservoir every six months, or when evidence of contamination exists.

6. Ways lubrication reservoir. Fill this with a high quality ways lubrication oil of 300-475 S.U.V. at 100 F.\*

This oil should have extreme pressure characteristics. Approximately 2½ gallons are required to fill.

7. Coolant tank. The Capacity of this tank is approximately 35 gallons.

\*Products conforming to these specifications are available from major suppliers.

Lubrication Bulletin #1968 gives brand names of a number of these, which though not specifically recommended by Warner & Swasey are represented as conforming to our specifications.

## ON RECEIPT OF THE MACHINE

### Uncrating

Your Warner & Swasey Type S-1 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.

For shipment, the machine has been set on a pallet and securely blocked in place. A Superstructure is built up around the machine and pallet to provide rigidity and to contain detached components. When unpacking the machine, leave it on the pallet until it has been moved to the location it will occupy. The pallet is strong enough to carry the machine or to be used as a skid. Be careful when removing the crating material that heavy blows do not strike the machine.

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 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, but should be replaced when the machine has been set up.

Exercise caution when sliding lifting rods through the holes to avoid damage to the interior 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.

S-1 Surface Grinders weigh approximately 8,500 to 10,500 pounds uncrated, depending upon size. Select lifting bars and wire rope of sufficient capacity to handle this weight.

### Placing and Leveling

The Type S-1 Surface Grinder has two 4 x 4" floor pads cast into the bottom of the front base, one at each end. The floor plan or erecting drawing print shipped for the machine will show these.

Set steel plates 1" thick and 6 x 6" minimum, under these two floor plates. Set a steel plate approximately 1" thick and 6 x 6" minimum, under the rear base pad at the center, with a portion of this plate protruding from the base pad to provide adequate support.

Now level the machine by using a sensitive spirit level on a flat surface of the table. Level the machine from end to end and from front to back by inserting steel shims between the steel floor plates and the machine base. When the machine has been made level, bring the jack screws, (shown on the plan view print shipped with the machine) into firm contact with relatively thin but adequate steel plates slipped under the base to take these screws. Do not disturb machine level in applying them. They are intended merely to maintain the level.

### Rechecking Level

It is good practice to check machine level periodically. Rechecking becomes more important if the machine has been set on a wooden floor. If the machine is put on a concrete floor, do not grout it in.

### ASSEMBLY OF THE NEW MACHINE

There is comparatively little assembly to be done on receipt of the new machine. In preparing to do what is necessary, it will be found helpful to review the front and rear illustrations included in these instructions, which show the machine in assembled form.

Disconnected hydraulic lines on the outside oil reservoirs, and their mating lines on the machine, are tagged to facilitate reconnection.

Remove protective slushing compound with a solvent. To preserve finished surfaces, it is desirable to apply a light coating of oil.



### Assembly of the New Machine (contd.)

During, or after assembly, it is desirable to make sure as a check on the unpacking procedure, that no tie-down or other equipment or material that will prevent or restrict machine operation, remains attached to it. This is to say that a final, careful check for encumbrances should be made before initial operation.

### 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 on the Wheel Sleeve

Generally, the grinding wheels are packed separately in the box containing small parts. The wheel sleeve will also be found in this box.

Before mounting the wheel on the sleeve, tap it lightly with a wooden mallet. A clear tone indicates the wheel is sound. A dull tone means that it may be cracked and unsuitable for use. Slip one of the blotters packed with the wheel over the sleeve, then mount the wheel. Do not force the wheel onto the sleeve as this will set up stress. With the wheel in place, slip on another blotter, and finally the wheel sleeve flange. Tighten the flange only enough to hold the wheel securely. Tightening it too much is not desirable.

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

### Balancing the Wheel

Proper balancing of the grinding wheel is important. Be sure to follow the instructions carefully. Position the two balancing weights in the sleeve 180 degrees apart and tighten in this position. Now true the grinding wheel.

After truing, remove the assembly from the spindle nose, and place in a balancing stand for determination of balance of the unit. Remove the two balancing weights. Allow the unit to come to rest and chalk mark the wheel on the heavy side (the bottom).

### Balancing the Wheel (contd.)

Reinsert the weights diametrically above center until the wheel will come to rest in any angular position. When the wheel is in static balance, tighten the weights, remount the unit in the machine and retrue the wheel.

### Wheel Guard

The wheel guard is made in two sections. The back section is held on the end of the wheel spindle housing. The front bolts onto the rear section. A vertical guard attached to the wheel guard may be adjusted to reduce spray when wet grinding or doing form grinding.

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

## LUBRICATION

### Filling Reservoirs

There are two reservoirs to be filled before operating the machine. These are for hydraulic oil and ways lubricant, and are discussed below.

### Hydraulic Oil Reservoir

The hydraulic oil reservoir is shown in the rear view illustration of the machine. As indicated previously, the disconnected lines and their mating connections on the machine are tagged to facilitate attachment.

Fill this reservoir with approximately 40 gallons of high grade hydraulic oil of 145-170 S.U.V. at 100°F. This oil should have inhibitors for rust, oxidation and foam. It should be changed and the reservoir cleaned at least every six months, or whenever evidence of contamination exists.

### Ways Lubrication Reservoir

The table ways are lubricated by direct delivery of filtered lubricant from an outside reservoir. This is shown in the rear view illustration of the machine. It is immediately to the right of the rear base.

Fill this with a high quality ways lubrication oil of 300-475 S. U. V. at 100°F. having extreme pressure characteristics. Approximately 2½ gallons are required. Keep this reservoir filled to the point indicated on the large sight-glass.

### Wheel Head Column and Feed Nut Lubrication

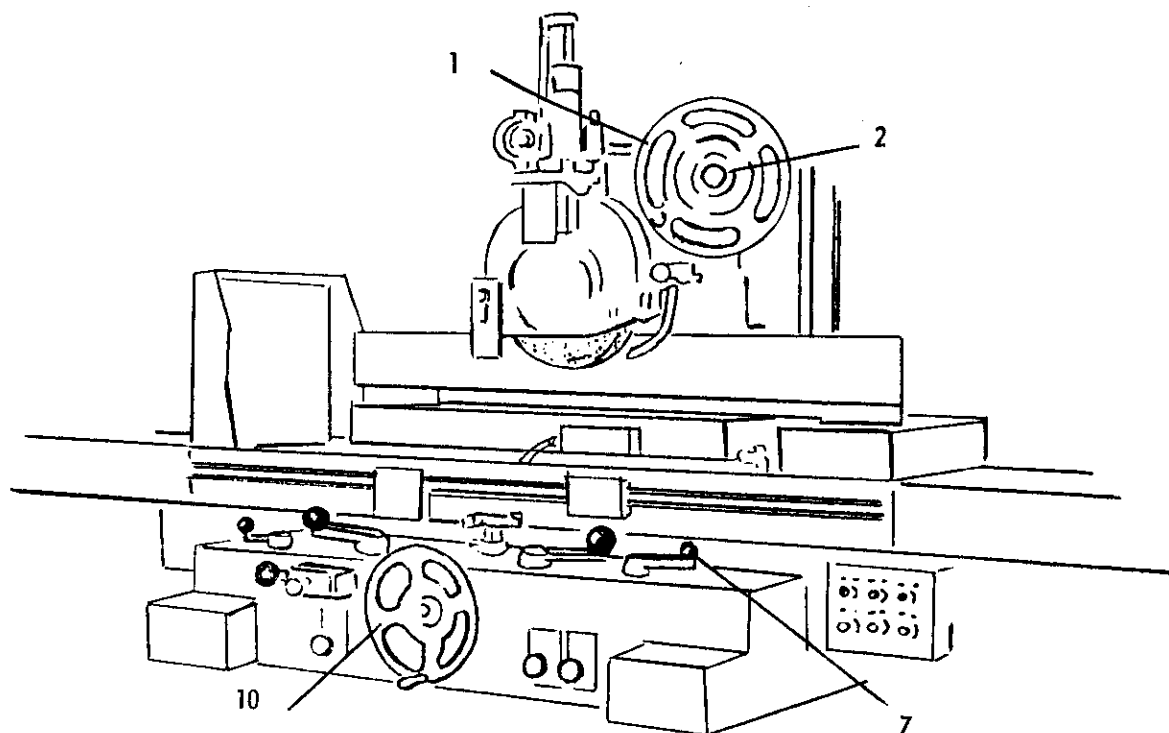
The wheel head column and feed nut are lubricated through three fittings on the lower right side of the column. These are shown as item #2 on page 6 of this manual.

The instruction tag immediately below these fittings contains the suggestion "Grease Weekly." Necessarily, this is based on assumptions having to do with maximum use of the machine. However, conditions vary, and when such use is not made of it, experience may show less need for maintaining this frequency. It is suggested that this be kept in mind.

Apply a medium grease to these fittings.

### Oil Pressures

Pressure in the hydraulic oil system should be maintained at approximately 400 pounds. Pressure in the ways lubrication system should be approximately 5 pounds.



### Wheel Feed

The grinding wheel is raised or lowered (fed) by hand wheel #1. Turn this counterclockwise to feed the wheel; turn it clockwise to raise it. Graduations on the rim of the hand wheel indicate  $.0005''$  of feed. One full turn of this wheel feeds or raises the grinding wheel  $.050''$ .

### Fine-Increment Feeding

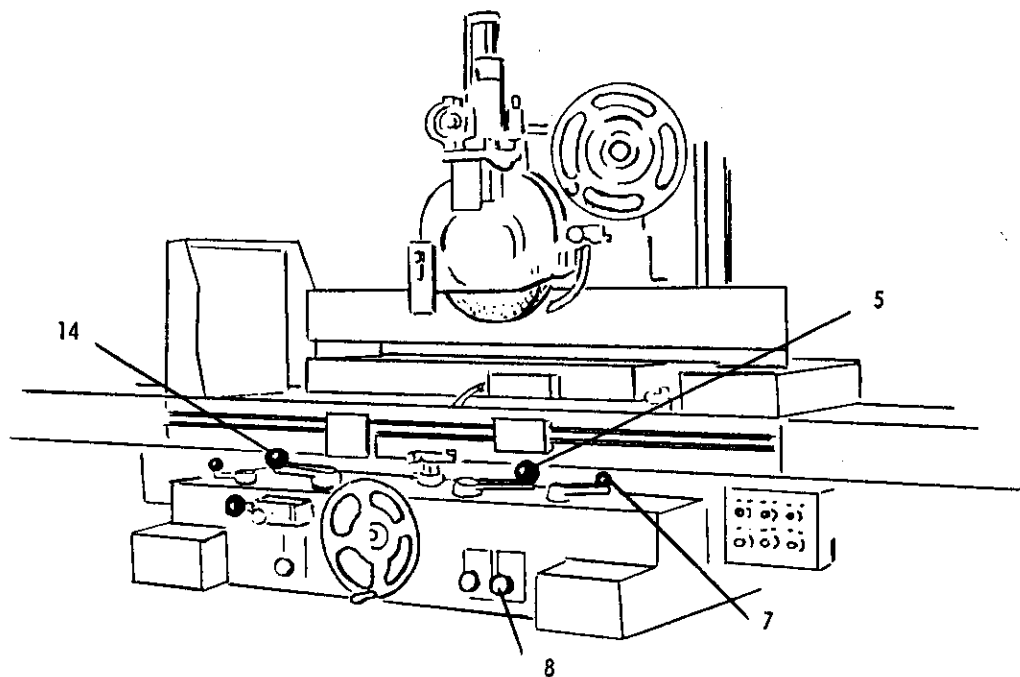
The Type S-1 Surface Grinder provides a convenient means of fine-increment feeding. This is done by operation of fine-feed knob #2. Turn this counterclockwise to feed the wheel. Graduations indicate  $.0001''$  feed. One full turn of this knob gives  $.010''$  feed.

### Cross Feed

The saddle is moved for cross-feed either manually or by hydraulic power. The cross-feed hand wheel #10 is graduated to show  $.0005''$  of cross feed. Revolving this hand wheel one full turn gives  $.100''$  of cross feed. Turning the hand wheel clockwise moves the saddle toward the grinding wheel. Turning it counterclockwise moves it toward the operator. The cross hand wheel is interlocked so that it does not revolve when using hydraulic power cross feed.

### Hydraulic Power Cross Feed

A power cross feed selector lever #7 permits selection of one of the three available power cross feeds. These are a pick feed with increments of pick adjustable up to  $1/2''$ ; a continuous, adjustable fine cross feed for wheel truing, and a fast, continuous cross feed for rapidly bringing the chuck into any desired position under the grinding wheel.



### Hydraulic Power Cross Feed (contd.)

This feature speeds setting up by making it unnecessary to move the saddle by hand unless the operator expressly desires to do so.

An instruction plate indicates the various operating positions of the cross feed selector lever.

### Setting Power Cross Feed

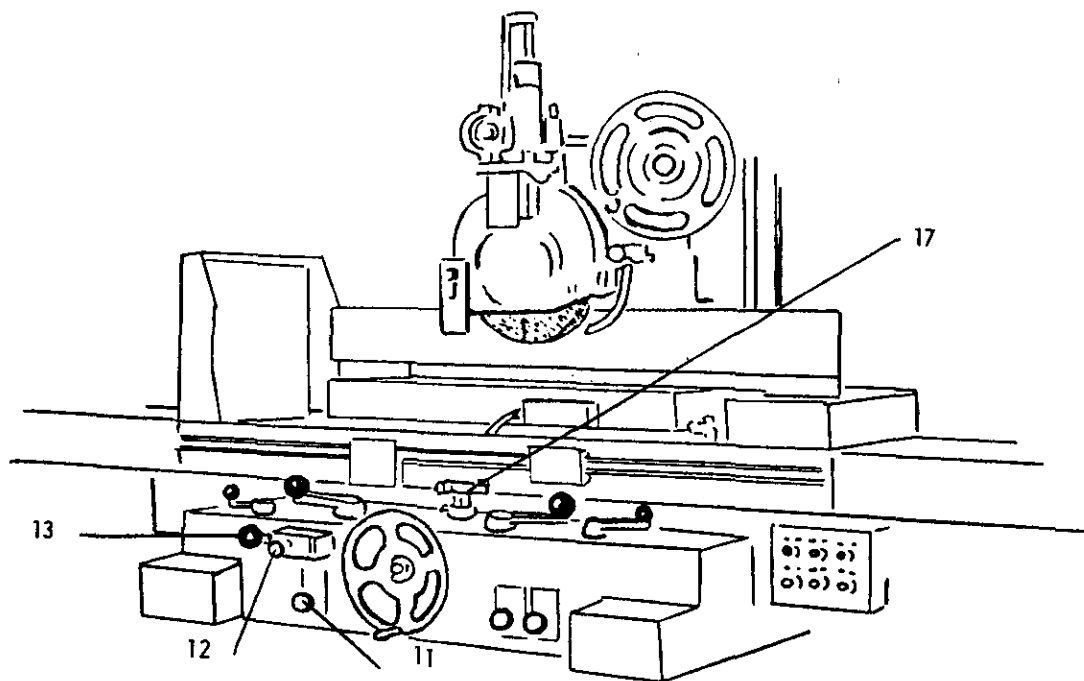
Increments of power cross feed are set by truing knob #8, and are adjustable up to a maximum of 1/2". With the desired setting made and the cross feed selector lever #7 set for the pick feed, this occurs at each table reversal.

### Control of Cross Feed

When power cross feed has brought the work under and clear of the grinding wheel, the cross feed action must be reversed by the operator. He does this by moving cross feed direction control lever #5. Move this lever in to cross feed from front to back; move it out to cross feed forward. In other words, this lever operates directionally. The center is the "off" position.

### Table Traverse

The table is traversed by hydraulic power. Table traverse is started and stopped by control lever #14. An instruction plate indicates the "on" and "off" positions.



### Table Traverse Speed Setting

Table traverse speeds are set by controls #11 and #12. Control #11 establishes the table traverse speed for grinding. This speed is adjustable up to 125 feet per minute.

Control #12 establishes a lower range of table speeds, suitable for table positioning during setting up. These speeds are also adjustable.

Lever #13 extending from the side of control #12 is used to select the fast (grinding) or slow speed range after initial settings have been made. Operating positions of this lever are shown by an instruction tag.

**CAUTION!** Do not CHANGE FROM FAST TO SLOW SPEED when the table is operating! Change to slow speed only when the table has been stopped!

### Table Direction Control

Table direction is controlled by positioning reverse lever #17 before the table is started. Turn the handle of this lever to the left when initial table movement to the right is desired, and vice versa.

### Table Dog Setting

The table dogs, which control length of table travers, are easily set in desired positions by loosening and tightening the screw through which they are held in the table tee slot.

To realize fully the maximum grinding time savings, set the table dogs in from the ends of the workpiece when grinding at top table speed. This will compensate for the "overtravel" 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.

### Truing the Grinding Wheel

If a magnetic chuck is used and a Wheel Head Mounted Automatic Truing Device is not furnished, a 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 spindle. Then lower the grinding wheel until it touches the diamond lightly. Cross-feed the saddle (with lever #7 in "Truing" position) 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 downfeeding 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, use a comparatively fast traverse of the diamond across the wheel face. A fine finish requires a slower traverse. For a finer finish, move the diamond slowly across the wheel face without any downfeed of the wheel during the last several passes.

### Setting Table Dogs

Set the table dogs for a given table speed so that the table will reverse a minimum distance of approximately 1" beyond each end of the work.

### Cross Positioning Work to Wheel

When it is desired to bring work into position with the wheel by cross-feed of the saddle (assuming the hydraulic pump is running and the table is stopped), proceed as follows:

Set cross-feed selector lever #7 in the "PICK" position. There should be no movement of the saddle because the table is not running.

Set cross-feed direction lever #5 to cause saddle movement in or out, as desired.

Now move cross-feed selector lever #7 to the "True" position. This should start the saddle moving slowly in the desired direction.

If it is necessary to speed this movement, move selector lever #7 to the "Rapid" position. The saddle should then move rapidly.

### Cross Positioning Work to Wheel (contd.)

Before the saddle reaches the desired position, move lever #7 back to the "True" position. This will decelerate cross slide movement for precise control.

When exact wheel-work positioning has been obtained, stop saddle motion by setting lever #7 back to the "Pick" position.

Now set cross feed direction control lever #5 into the "Off" position.

NOTE: A few of the early machines of this series can run full speed to the ends of in or out cross traverse, but it is inadvisable to let them do so. With later models, a mechanical shut-off prevents this by turning the cross traverse direction control to "Off" when the saddle is approximately 1/8" from the in or out limits. All models should be hand fed the last 1/8" or so, when it is necessary to send the saddle to its limits.

### Proceeding to Grind

If it has been necessary to cross feed the work into position with the wheel as described above, it is assumed the machine is "running." That is, the hydraulic pump motor is on. If not, turn it on and proceed as follows:

Put cross feed direction control lever #5 on "OFF."

Making sure the grinding wheel will clear the work (if not sure, raise the wheel by turning wheel feed hand wheel #1), start the wheel.

Now move one edge of the work under the wheel by manipulating table on-off control lever #14, and feed wheel down carefully until light sparks show. Then move the work away from the wheel.

Set cross feed increments as desired by turning knob #8.

Turn coolant on (if machine is arranged for wet grinding), throw cross feed lever #5 in or out as necessary to cross feed work under wheel, and move table on-off lever #14 to start table movement.



### Proceeding to Grind (contd.)

After the full width of the work has passed under and clear of the wheel, feed the wheel down appropriately. Continue feeding the wheel in this manner and reversing the direction of the cross feed when the full width of the work has been ground, until the workpiece on the full chuck load has been brought to desired size.

### Stopping Table with Work in Machine

To stop the table with work in the machine, ALWAYS ALLOW THE WHEEL TO PASS OFF the work, then use table on-off lever #14. To prevent table coasting when operating at top speeds, stop the table directly after a reversal is initiated. Oil in the table cylinder will then cause a quick stop.

### Changing Wheel Speed

When the grinding wheel has worn to the point indicated by the line on the wheel guard instruction plate which reads "Change Wheel Speed," proceed as follows:

- . Have the center of the wheel spindle at least 13" above the table.
- . Remove cover on back of the wheel head column, and locate the jack-bar held in the "up" position beneath the wheel drive motor bracket. Then release the jack-bar, permitting it to swing down.
- . Lower the wheel head until the jack-bar bottoms and supports the motor bracket, then just loosen the 4 screws that hold the motor bracket.
- . Lower wheel head again to provide slack in the two wheel drive belts. Then change belt positions from the step on the sheave marked 14" - 11 $\frac{1}{4}$ " to that marked 11 $\frac{1}{4}$ " - 9".
- . Now raise the wheel head to tighten the belts but be sure NOT TO OVERTIGHTEN. This will accelerate belt wear and will have an unfavorable effect upon the grinding finish. Belts should be just tight enough to drive properly.

### Changing Wheel Speed (contd.)

- . Now tighten motor base bracket screws (4), raise the wheel head, then lift the jack-bar and secure it in the "up" position.
- . Replace column cover.

### Automatic Cross Traverse Reversal Mechanism (at extra cost)

This feature which is available at extra cost, is designed to automatically reverse the direction of saddle cross traverse in the incremental at table reversals ("PICK"), or in the continuous cross feed ("TRUE"), with the table running.

#### Adjust Cross Feed Control Dogs

Adjustable dogs mounted on the right side of the machine base are set to cause automatic reversal of the cross traverse at the in and out points desired. A reversal valve mounted on the saddle (cross slide), has a finger that extends downward into the path of the dogs. Motion imparted to the finger by contact with the dogs, shifts the valve spool which caused hydraulic pressure to pass into a cylinder attached to the cross traverse control valve. This cylinder when moved by this pilot pressure causes the direction control spool to shift, directing line hydraulic pressure to the oil motor and shifting the direction control lever.

#### Control Handle

The control handle extending from the automatic reversal valve to the front of the machine is bi-directional. In the forward position, the saddle is caused to traverse out toward the operator, then rearward. In passing from "OUT" to "IN," the valve spool passes through a neutral position where hydraulic pressure on the cylinder is balanced.

At this position the control handle can be rotated approximately 40° into the "OFF" position. This rotation moves the reversal finger out of the path of the dogs and permits the saddle to travel beyond the dog setting. In either "NEUTRAL" or "OFF," cross traverse may be manually controlled. In automatic reversal operation ("OUT" or "IN"), the cross traverse direction control lever is moved and controlled by the automatic reversal valve. This means that the lever cannot be moved manually, but is used instead to indicate the direction of travel of the saddle.

### To Operate Automatic Cross Traverse Reversal

To operate the automatic cross traverse reversal, adjust the cross traverse limit dogs as mentioned above, to produce the amount of saddle cross traverse that is desired. The dogs are easily set by use of an Allen wrench in the two hex head screws which hold each dog.

When the desired setting of the dogs has been made, rotate the control handle 40° clockwise out of the "OFF" position, and push or pull the handle into the "OUT" or "IN" position as desired. Now select the type of cross traverse to be used ("PICK," "TRUE," or possibly "RAPID") by moving the power cross feed selector lever into the proper position.

After this has been done and the table is started, the cross traverse control handle will shift into "IN" or "OUT" as selected by the reversal control handle and the cycle will repeat. To disengage the automatic cross traverse reversal, push or pull the control handle into the center position, rotate it 40° counterclockwise, and stop the cross traverse using the direction control lever.

### Use Without Table Traverse

When used without table traverse (primarily in "TRUE" or "RAPID" cross feed), the automatic cross traverse reversal does not function. It stops the saddle, allowing time to downfeed the wheel for truing, or for engaging the cross feed hand wheel for final positioning. Placing the control lever in the opposite position causes cross traverse to resume.

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

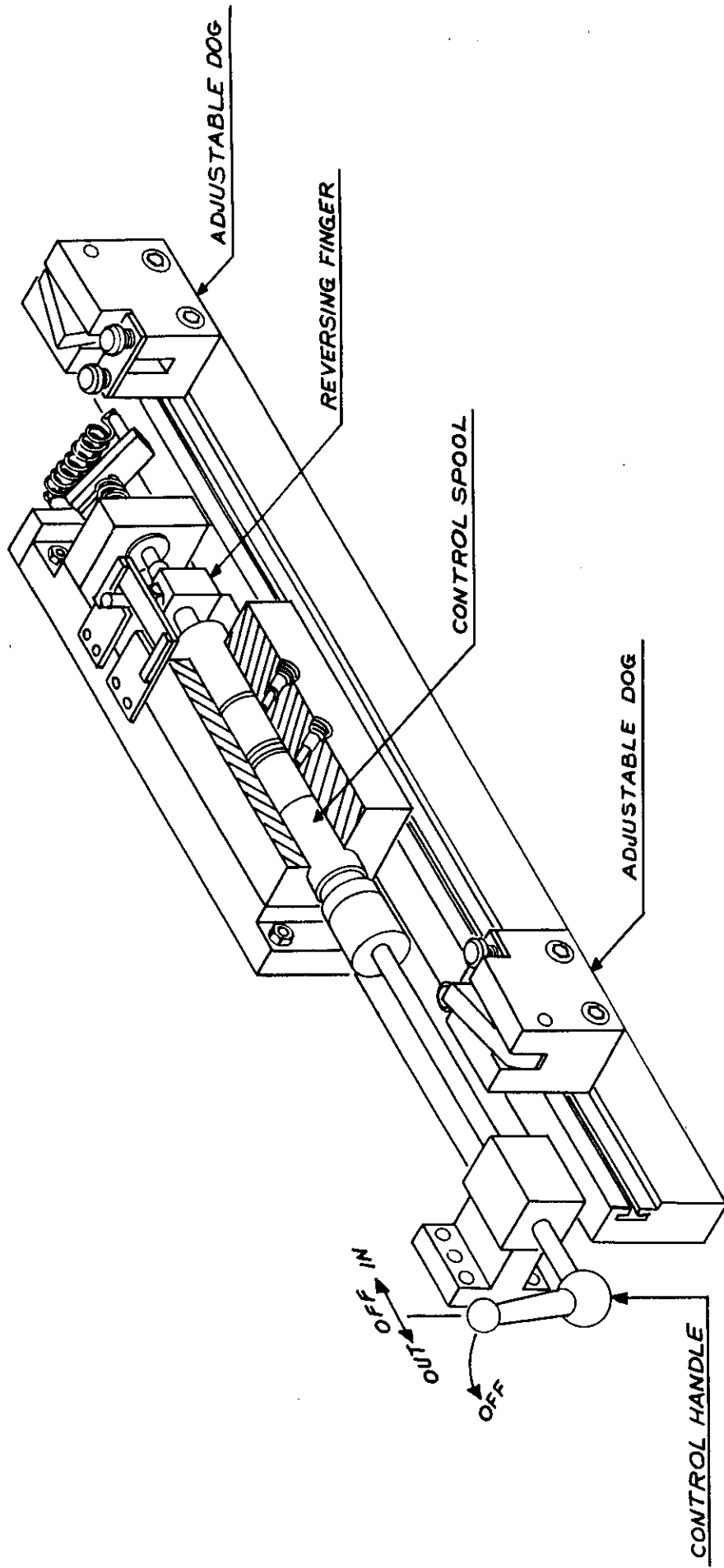
Prior to mounting a chuck on the sliding table of a surface grinder, we recommend the following steps be taken.

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-I8VBE, 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. Rettrue 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.

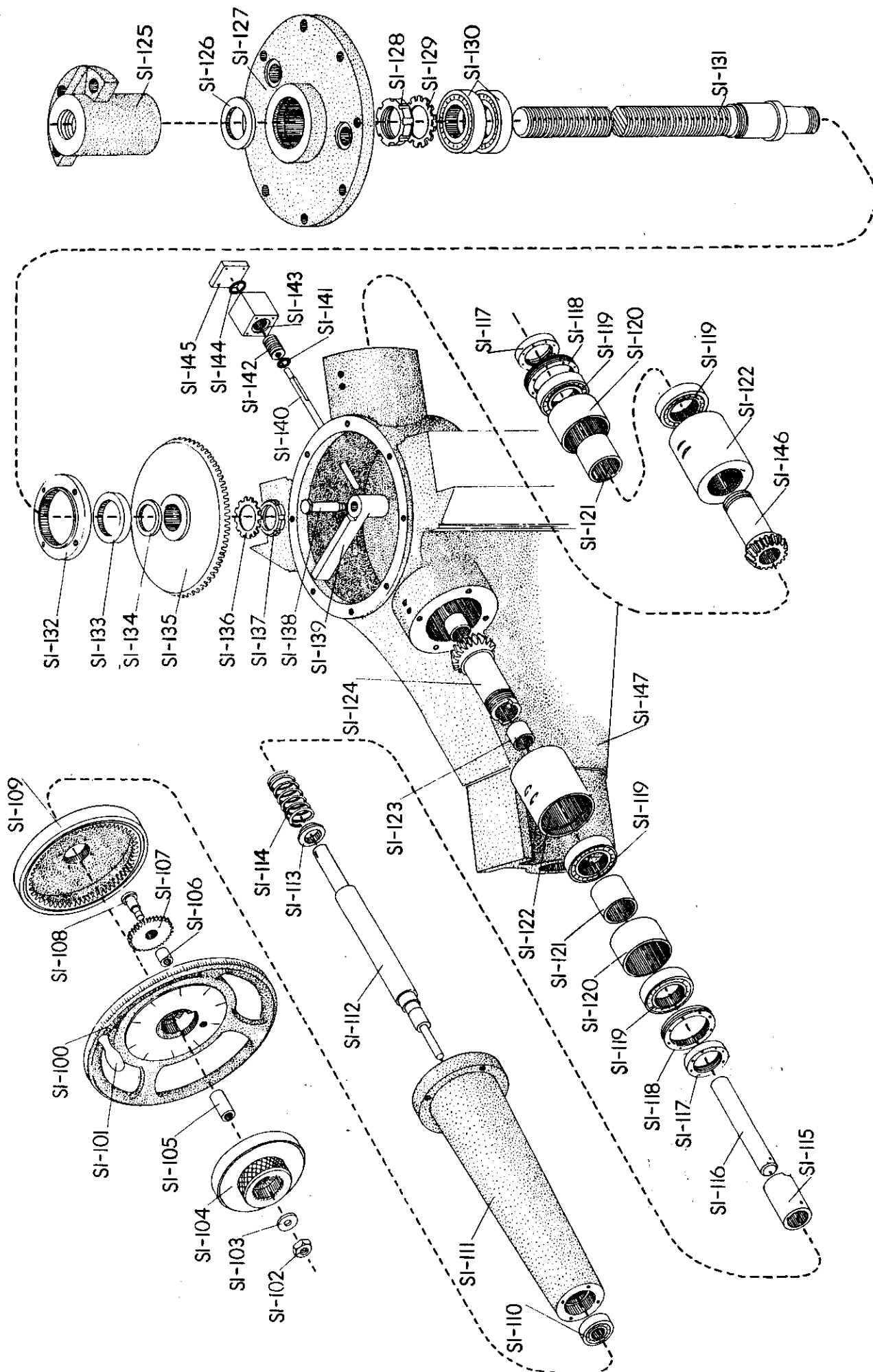


Automatic Cross Traverse Reversal Mechanism



TABLE AND SADDLE CONTROLS

Code No.	Part Name	Code No.	Part Name	Code No.	Part Name	Code No.	Part Name
S1-1	Handwheel	S1-25	Half Nut	S1-49	"O" Ring	S1-73	Lever
S1-2	Grease Fitting	S1-26	Nut Stop	S1-50	Needle Valve	S1-74	Cam Roller (8)
S1-3	Nut	S1-27	Oil Motor Gear	S1-51	Lever	S1-75	Spool
S1-4	Washer	S1-28	Oil Motor	S1-52	Shoulder Screw	S1-76	Reverse Lever
S1-5	Handle	S1-29	Pivot Stud	S1-53	Spool	S1-77	Roller Stud (2)
S1-6	Pointer	S1-30	Clutch Lever	S1-54	Bracket	S1-78	Dog Roller (2)
S1-7	Clutch	S1-31	Bracket	S1-55	Control Lever	S1-79	Pivot Shaft Housing
S1-8	Oilite Bushing	S1-32	Lever Hub	S1-56	Control Lever	S1-80	Pivot Shaft
S1-9	Disconnect Clutch	S1-33	Lever Extension	S1-57	Extension	S1-81	Ball Bearing
S1-10	Spur Gear	S1-34	Ball (2)	S1-58	Ball	S1-82	Nut
S1-11	Spring (4)	S1-35	Control Shaft	S1-59	Control Shaft	S1-83	Pivot Arm
S1-12	Rd. End Key	S1-36	Spacer	S1-60	Spacer	S1-84	Piston Drive Link
S1-13	Bushing (2)	S1-37	Positioner Cam	S1-61	Actuating Cam	S1-85	Nylon Bushing
S1-14	Oilite Washer	S1-38	Spacer	S1-62	Lever	S1-86	Shoulder Screw
S1-15	Handwheel Shaft	S1-39	Control Lever	S1-63	Spool	S1-87	Table Dog Body (L. H.)
S1-16	Bracket	S1-40	Tru Arc	S1-64	Bracket	S1-88	Dog Cam (2)
S1-17	Nut		Retaining Ring	S1-65	Lever Hub	S1-89	Table Dog Body (R. H.)
S1-18	Washer	S1-41	Cam	S1-66	Control Shaft	S1-90	Valve Body
S1-19	Gear	S1-42	Bracket (2)	S1-67	Spacer	S1-91	"O" Ring
S1-20	Ball Bearing (2)	S1-43	Link (3)	S1-68	Control Lever	S1-92	Piston
S1-21	Cross Feed Screw	S1-44	Lever	S1-69	Tru Arc	S1-93	End Cap
S1-22	Ball Bearing (2)	S1-45	Roller	S1-70	Cam	S1-94	Roller Housing
S1-23	Washer	S1-46	Knob	S1-71	Lever	S1-95	Roller
S1-24	Nut	S1-47	End Cap	S1-72	Link	S1-96	Roller Guide
		S1-48	Valve Stem		Roller		



VERTICAL FEED

SE-3527-A  
SE-3528-A

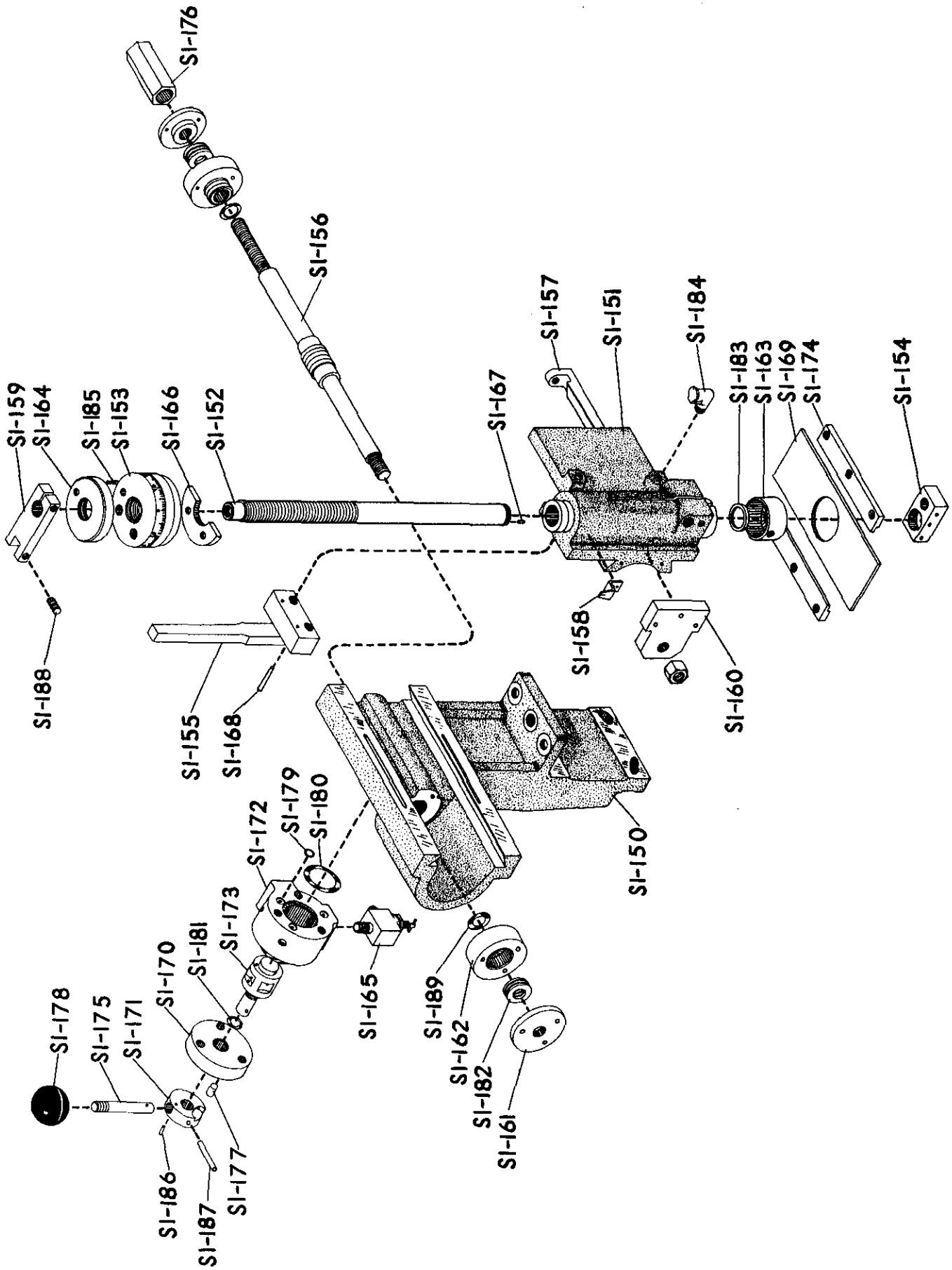


SE-3527-A  
SE-3528-A

VERTICAL FEED

Code 100-147

<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>
SI-100	Handwheel	SI-117	Nut (2)	SI-134	Spacer
SI-101	Handle	SI-118	Nut (2)	SI-135	Miter Gear
SI-102	Elastic Nut	SI-119	Ball Bearing (4)	SI-136	Washer
SI-103	Washer	SI-120	Spacer (2)	SI-137	Nut
SI-104	Feed Knob	SI-121	Spacer (2)	SI-138	Stud
SI-105	Bushing	SI-122	Retainer (2)	SI-139	Clutch Lever
SI-106	Bushing	SI-123	Bushing (2)	SI-140	Piston Rod
SI-107	Idler Gear	SI-124	Miter Gear	SI-141	"O" Ring
SI-108	Stud	SI-125	Full Nut	SI-142	Piston
SI-109	Sun Gear Housing	SI-126	Seal	SI-143	Cylinder
SI-110	Ball Bearing	SI-127	Gear Cover	SI-144	"O" Ring
SI-111	Bracket	SI-128	Nut	SI-145	Cap
SI-112	Handwheel Shaft	SI-129	Washer	SI-146	Miter Gear
SI-113	Spring Retainer	SI-130	Ball Bearing (2)	SI-147	Housing
SI-114	Spring	SI-131	Feed Screw		
SI-115	Clutch	SI-132	End Cap		
SI-116	Bevel Gear Shaft	SI-133	Seal		



# WHEEL HEAD TRUING DEVICE

(JOB NO. 5447)

SE-3700-A

Wheel Head Truing Device  
(Job 13-5447)

Code 150-189

<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>
S1-150	Body	S1-170	End Cap
S1-151	Horizontal Slide	S1-171	Handle Cap
S1-152	Dia. Nib Holder Shaft	S1-172	Valve Body
S1-153	Grad. Feed Knob	S1-173	Spool
S1-154	Diamond Nib Holder	S1-174	Guide (2)
S1-155	Steady Bracket	S1-175	Knob Stud
S1-156	Piston Rod	S1-176	Adj. Stop
S1-157	Horizontal Gib	S1-177	Pin
S1-158	Pointer	S1-178	Std. Black Knob
S1-159	Support Arm	S1-179	"O" Ring (2)
S1-160	Bracket	S1-180	"O" Ring (2)
S1-161	Gland (2)	S1-181	"O" Ring
S1-162	End Cap (2)	S1-182	Unee-Pac (2) (4)
S1-163	Cup Guard	S1-183	Seal
S1-164	Nut - centering	S1-184	Oiler (2)
S1-165	Needle Valve	S1-185	Spring (3)
S1-166	Stop Washer	S1-186	Roll Pin
S1-167	Pin	S1-187	Roll Pin
S1-168	Taper Pin (2)	S1-188	Ball Plunger
S1-169	Slide Plate	S1-189	"O" Ring (2)

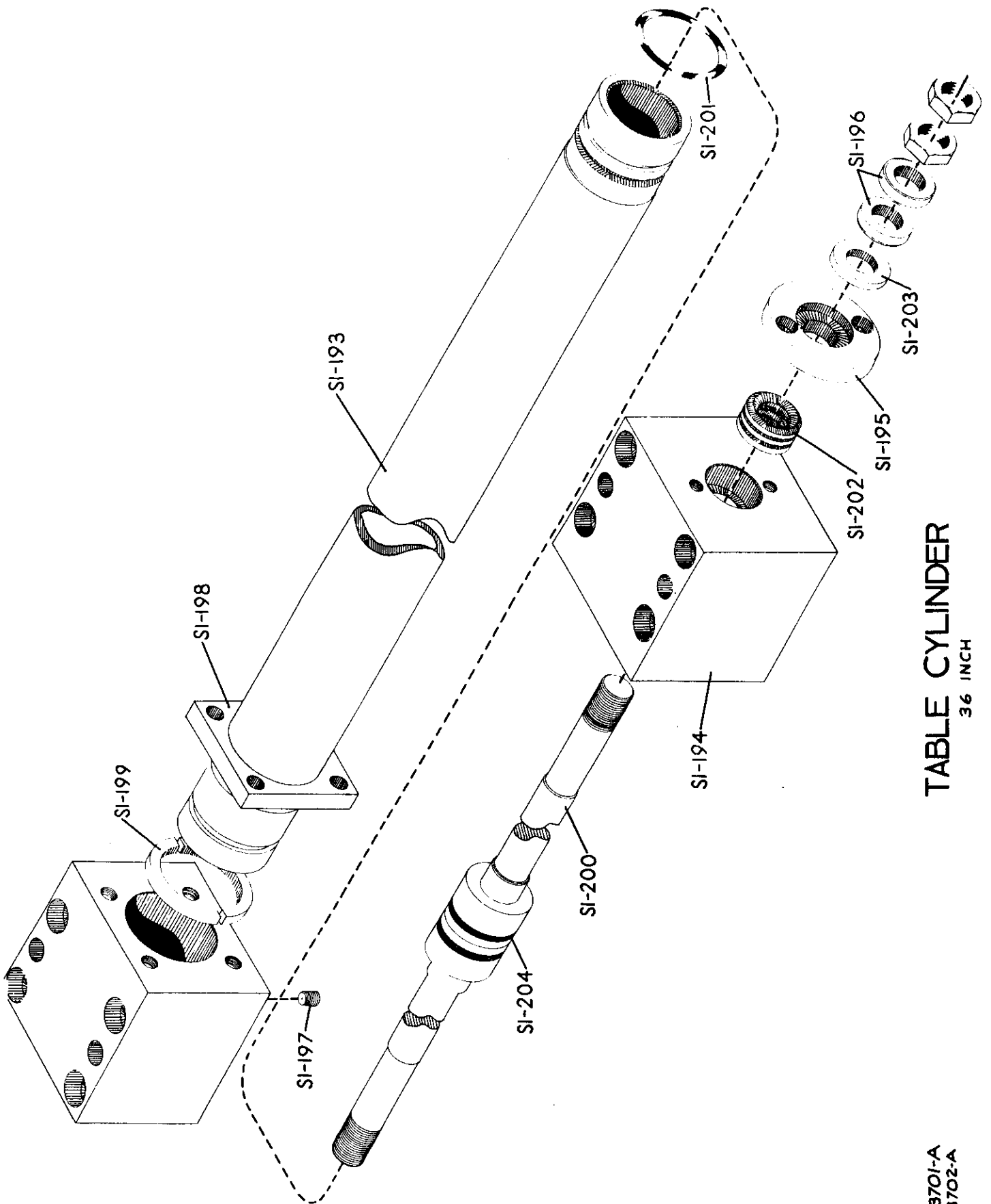


TABLE CYLINDER  
36 INCH

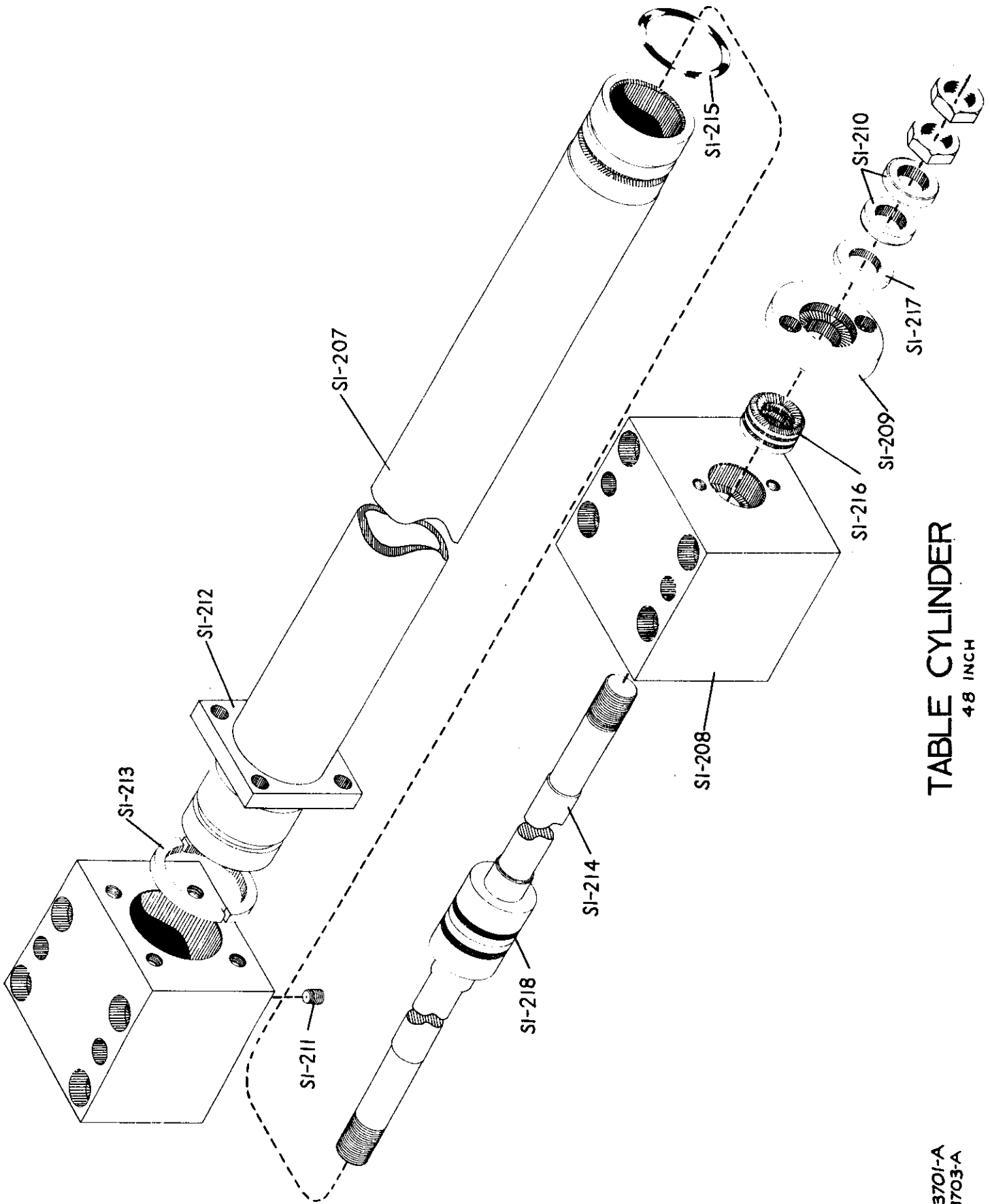
SE-3701-A  
SE-3702-A

SE-3701-A  
SE-3702-A

36" INCH TABLE CYLINDER

Code 193 - 204

<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>
SI-193	Cylinder	SI-199	Clamp Ring
SI-194	Cylinder Head (2)	SI-200	Piston Rod (4)
SI-195	Cap (2)	SI-201	"O" Ring (2)
SI-196	Washer (4)	SI-202	Unee-pac (8)
SI-197	Spec. Pipe Plug (2)	SI-203	Seal (2)
SI-198	Clamp Flange	SI-204	Seal (2)
			"O" Ring (2)



**TABLE CYLINDER**  
 48 INCH

SE-3701-A  
 SE-3703-A

SE-3701-A  
SE-3703-A

48" INCH TABLE CYLINDER

Code No.

Part Name

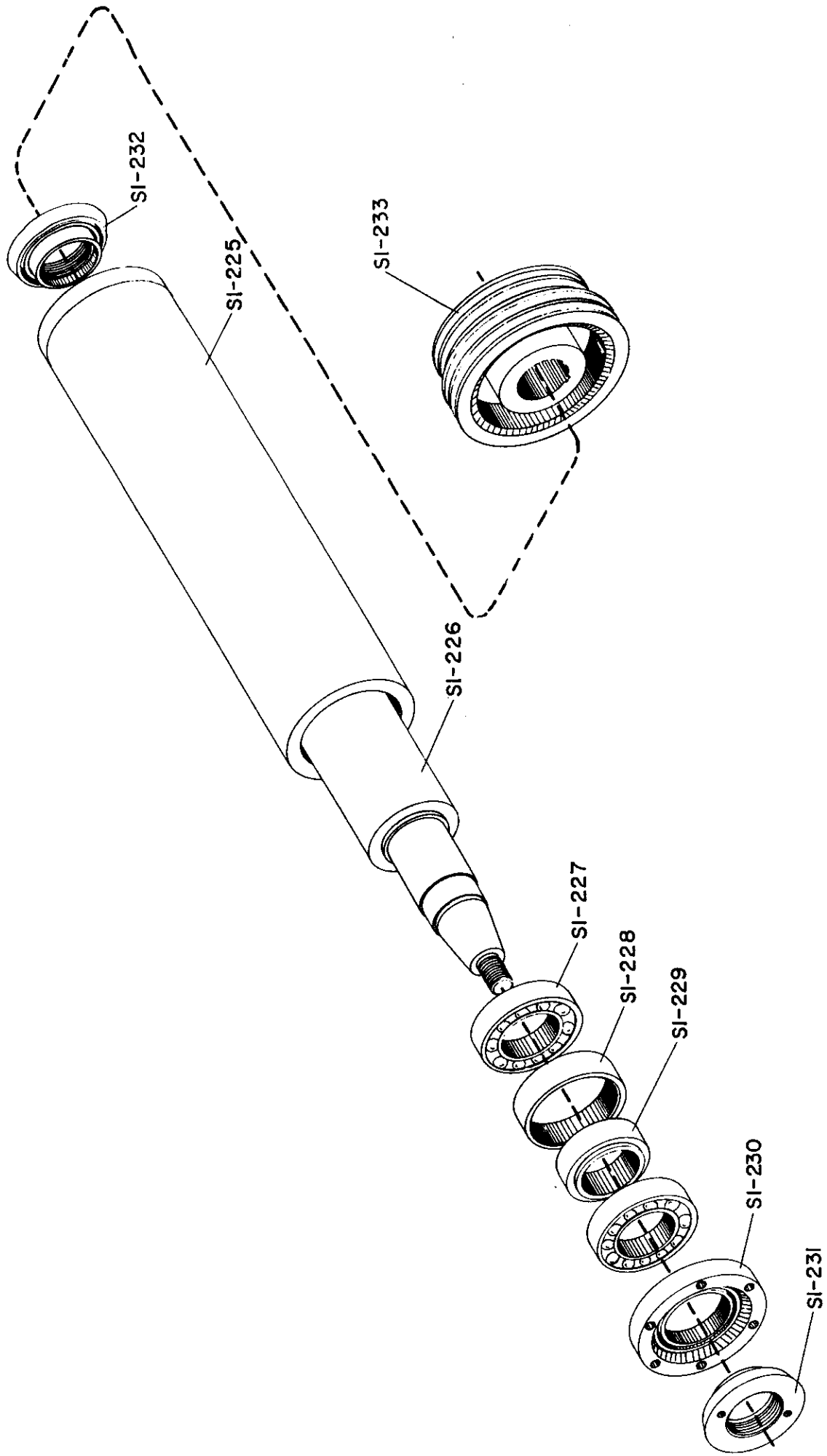
Code No.

Part Name

Code No.

Code 207 - 218

S1-207	Cylinder	S1-213	Clamp Ring
S1-208	Cylinder Head (2)	S1-214	Piston Rod (2)
S1-209	Cap (2)	S1-215	"O" Ring (2)
S1-210	Washer (4)	S1-216	Uneepac (8)
S1-211	Spec. Pipe Plug (2)	S1-217	Seal (2)
S1-212	Clamp Flange	S1-218	Ring (2)
			"O" Ring (2)



# WHEEL SPINDLE

CHURCHILL

SE-3796-A

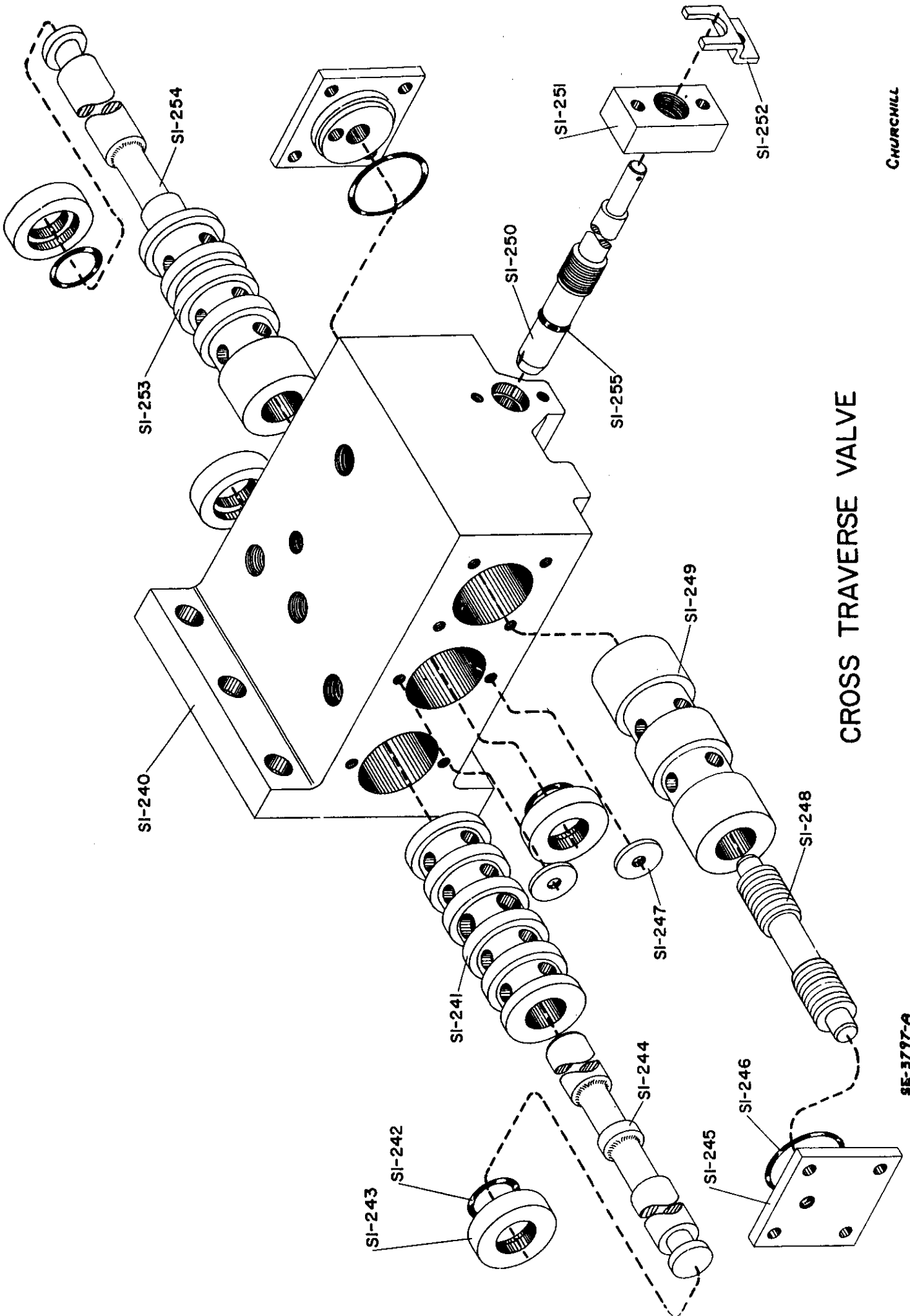


SE-3796-A

Code# 225-233

Wheel Spindle

<u>Code No.</u>	<u>Part Name</u>
S1-225	Spindle Cartarge
S1-226	Spindle
S1-227	Ball Bearing (2 pr.)
S1-228	Spacer B.B. (2)
S1-229	" " (2)
S1-230	B.B. Cap (2)
S1-231	B.B. Locknut
S1-232	B.B. "
S1-233	Spindle Sheave



CROSS TRAVERSE VALVE

SE-3797-A

CHURCHILL

Cross Traverse Valve

<u>Code No.</u>	<u>Part Name</u>
S1-240	Body
S1-241	Sleeve
S1-242	"O"-Ring (4)
S1-243	Retainer (4)
S1-244	Spool
S1-245	End Cap (2)
S1-246	"O"-Ring (2)
S1-247	Washer (8)
S1-248	Spool
S1-249	Sleeve
S1-250	Pick Feed Adj. Scr.
S1-251	Tapped Plate
S1-252	Valve Stop
S1-253	Sleeve
S1-254	Spool
S1-255	"O"-Ring

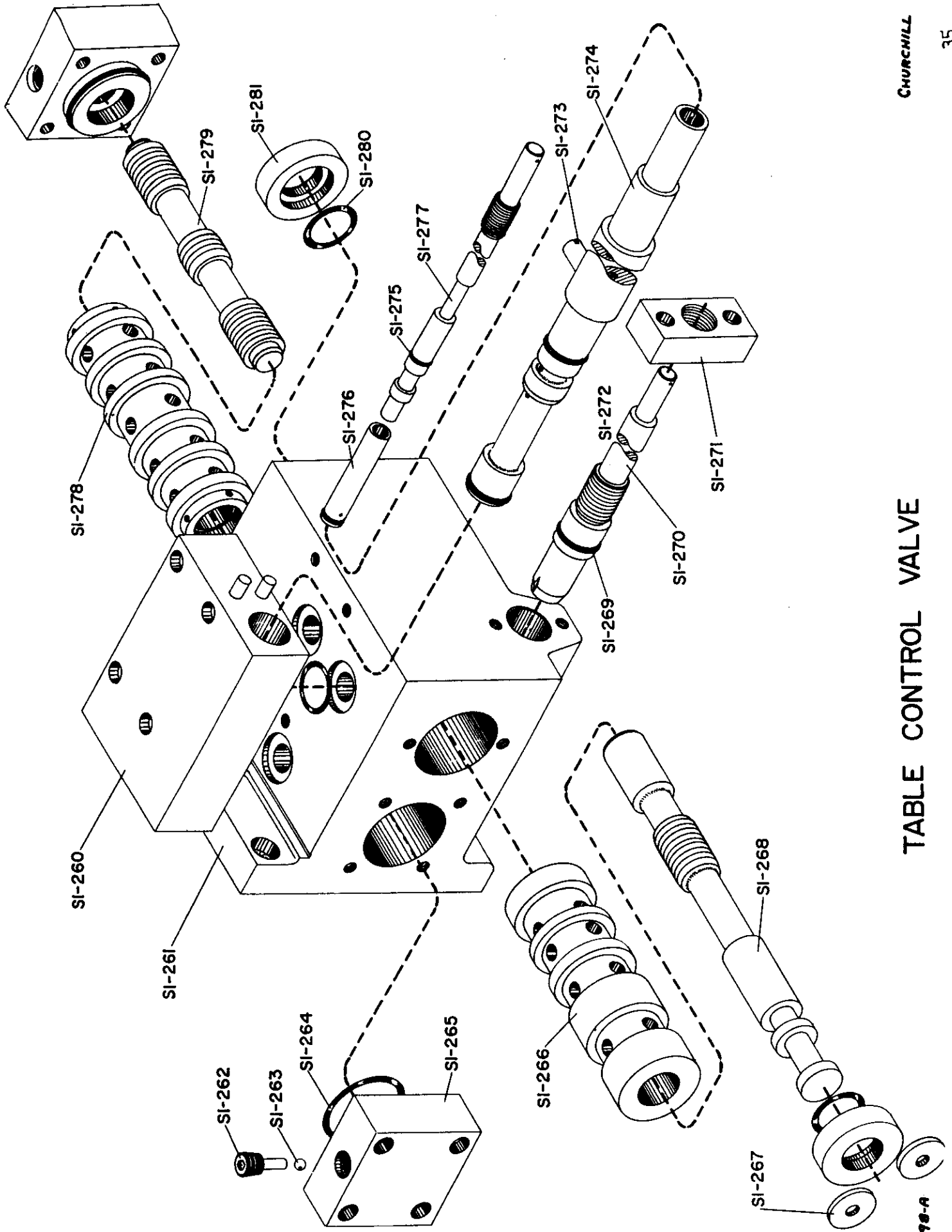


TABLE CONTROL VALVE

Code# S1-260-281

SE-3798-A

Table Control Valve

<u>Code No.</u>	<u>Part Name</u>	<u>Code No.</u>	<u>Part Name</u>
S1-260	Speed Control Body	S1-273	Stop Screw
S1-261	Body	S1-274	Spool
S1-262	Plug (2)	S1-275	"O"-Ring (2)
S1-263	Steel Ball (2)	S1-276	Needle Valve Ext.
S1-264	"O"-Ring (2)	S1-277	Needle Valve
S1-265	End Cap (2)	S1-278	Sleeve
S1-266	Sleeve	S1-279	Spool
S1-267	Washer (4)	S1-280	"O"-Ring (2)
S1-268	Spool	S1-281	Retainer (2)
S1-269	"O"-Ring		
S1-270	Exhaust Control Valve		
S1-271	Tapped Plate		
S1-272	Quad-Ring (2)		