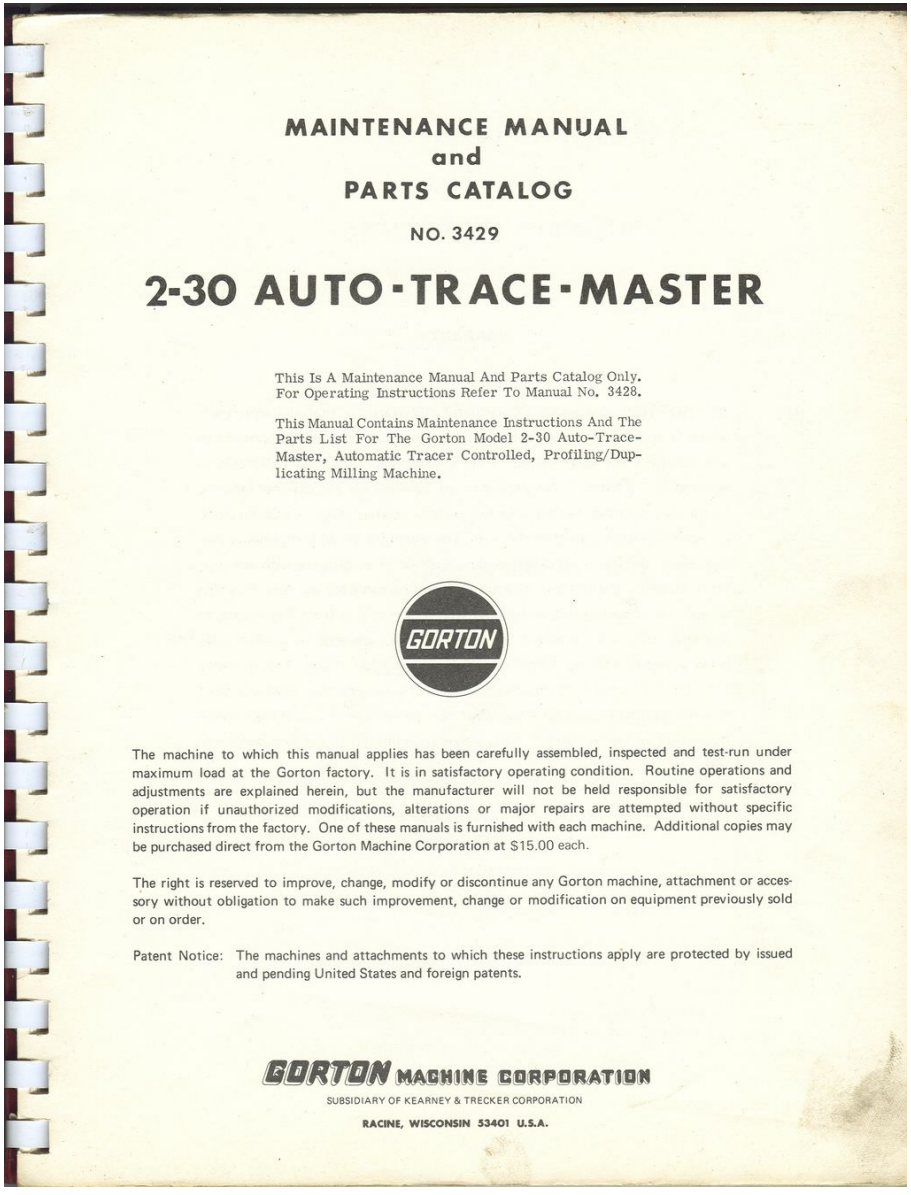
Photo 1


GORTON
2–30
AUTO–TRACE–MASTER
Maintenance Manual
and
Parts Catalog
3429

Photo 2



MAINTENANCE MANUAL
and
PARTS CATALOG

NO. 3429

2-30 AUTO-TRACE-MASTER

This Is A Maintenance Manual And Parts Catalog Only. For Operating Instructions Refer To Manual No. 3428.

This Manual Contains Maintenance Instructions And The Parts List For The Gorton Model 2-30 Auto-Trace-Master, Automatic Tracer Controlled, Profiling/Duplicating Milling Machine.

GORTON

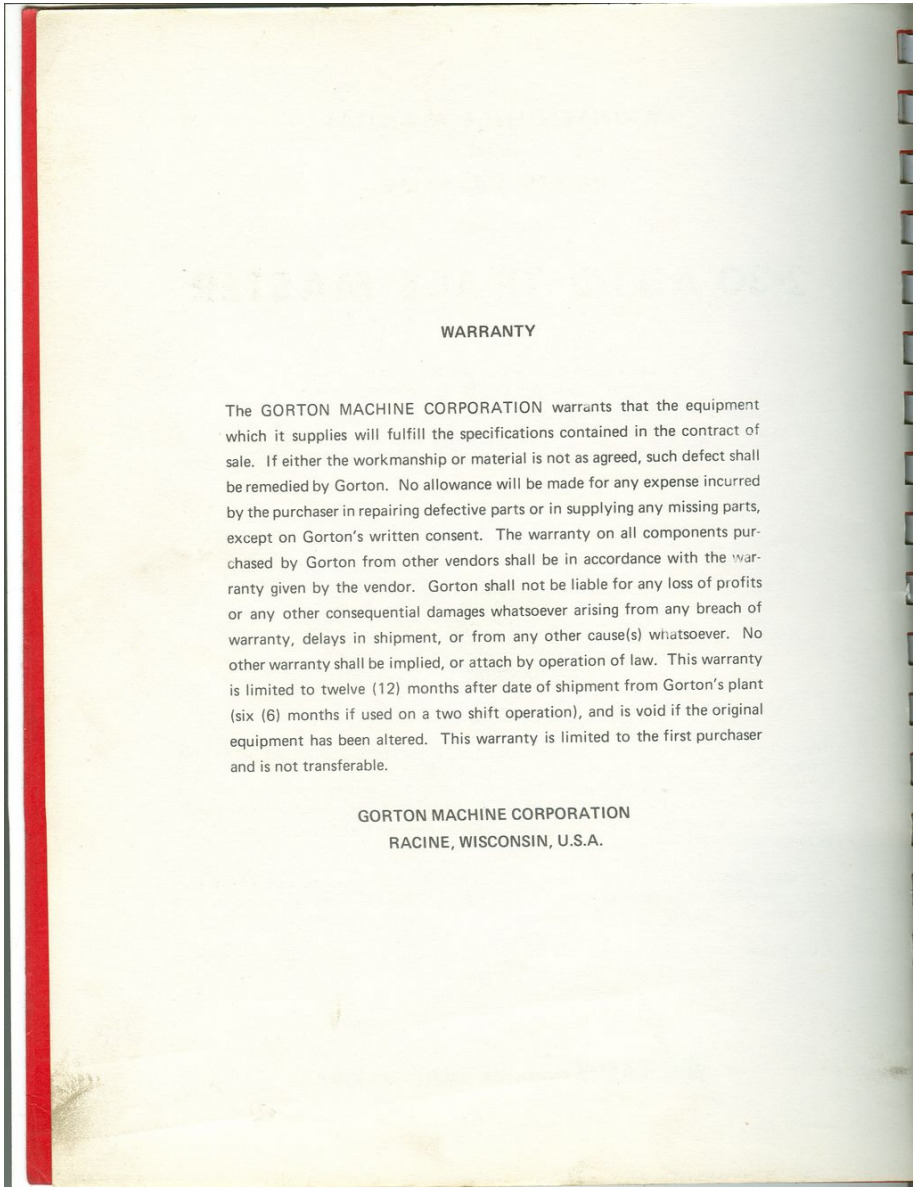
The machine to which this manual applies has been carefully assembled, inspected and test-run under maximum load at the Gorton factory. It is in satisfactory operating condition. Routine operations and adjustments are explained herein, but the manufacturer will not be held responsible for satisfactory operation if unauthorized modifications, alterations or major repairs are attempted without specific instructions from the factory. One of these manuals is furnished with each machine. Additional copies may be purchased direct from the Gorton Machine Corporation at $15.00 each.

The right is reserved to improve, change, modify or discontinue any Gorton machine, attachment or accessory without obligation to make such improvement, change or modification on equipment previously sold or on order.

Patent Notice: The machines and attachments to which these instructions apply are protected by issued and pending United States and foreign patents.

GORTON MACHINE CORPORATION
SUBSIDIARY OF KEARNEY & TRECKER CORPORATION
RACINE, WISCONSIN 53401 U.S.A.

Photo 3



WARRANTY

The GORTON MACHINE CORPORATION warrants that the equipment which it supplies will fulfill the specifications contained in the contract of sale. If either the workmanship or material is not as agreed, such defect shall be remedied by Gorton. No allowance will be made for any expense incurred by the purchaser in repairing defective parts or in supplying any missing parts, except on Gorton's written consent. The warranty on all components purchased by Gorton from other vendors shall be in accordance with the warranty given by the vendor. Gorton shall not be liable for any loss of profits or any other consequential damages whatsoever arising from any breach of warranty, delays in shipment, or from any other cause(s) whatsoever. No other warranty shall be implied, or attach by operation of law. This warranty is limited to twelve (12) months after date of shipment from Gorton's plant (six (6) months if used on a two shift operation), and is void if the original equipment has been altered. This warranty is limited to the first purchaser and is not transferable.

GORTON MACHINE CORPORATION
RACINE, WISCONSIN, U.S.A.

Photo 4

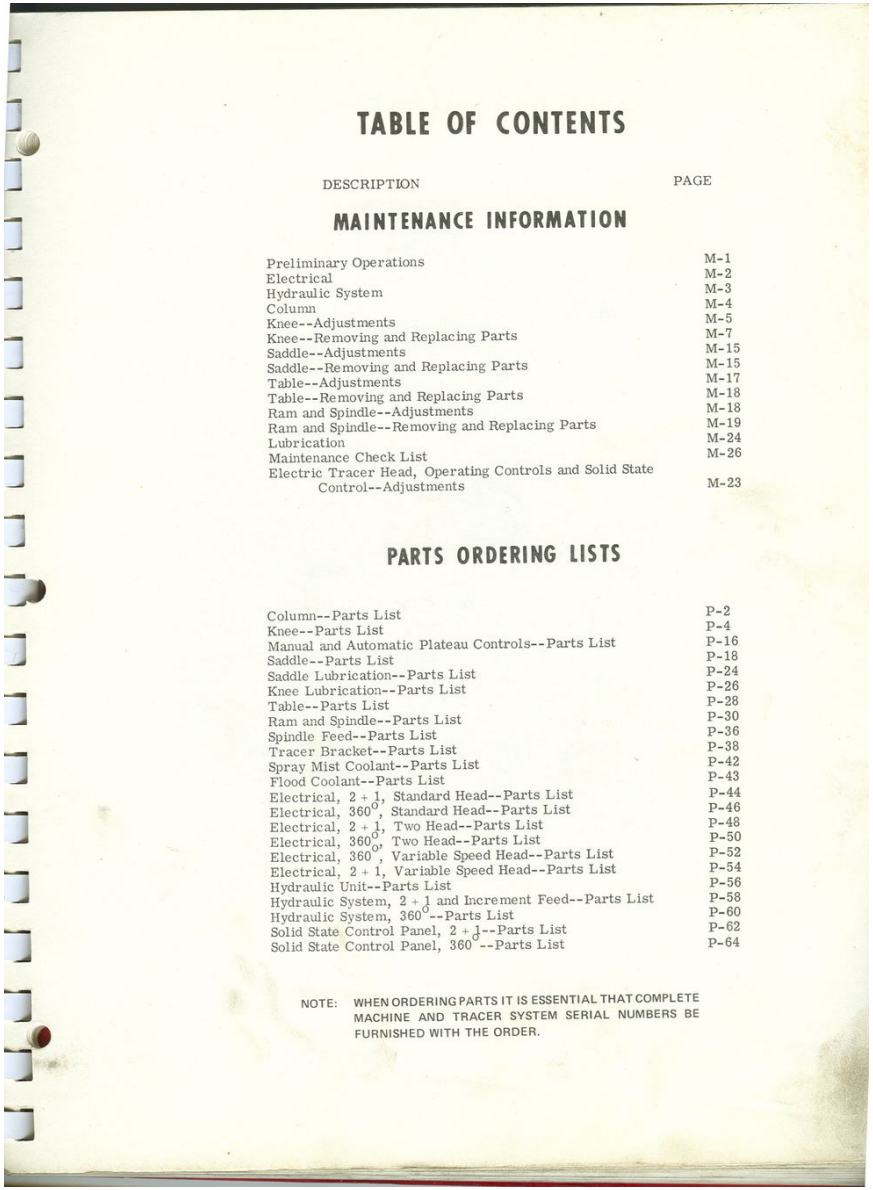


TABLE OF CONTENTS

NOTE: WHEN ORDERING PARTS IT IS ESSENTIAL THAT COMPLETE MACHINE AND TRACER SYSTEM SERIAL NUMBERS BE FURNISHED WITH THE ORDER.

Photo 5

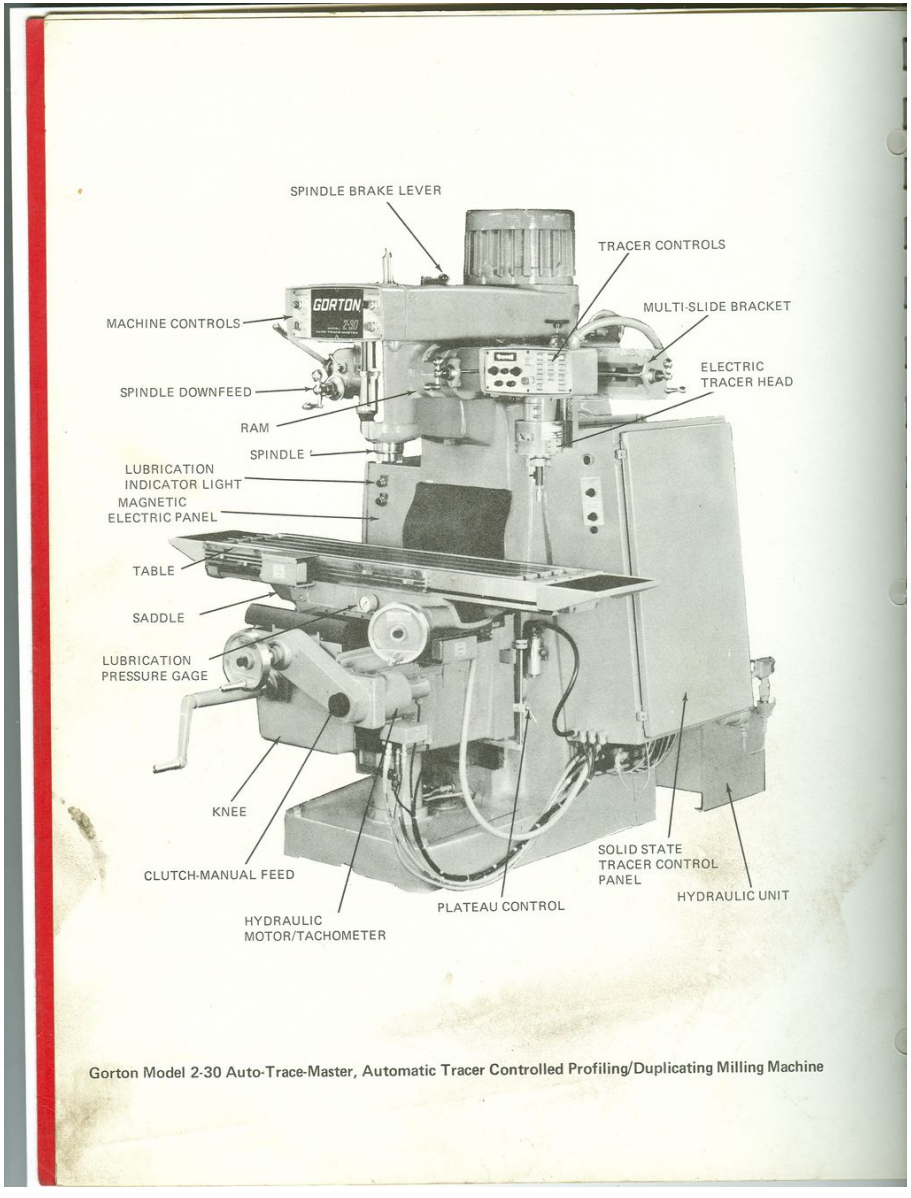

SPINDLE BRAKE LEVER
TRACER CONTROLS
MULTI-SLIDE BRACKET
MACHINE CONTROLS
ELECTRIC TRACER HEAD
SPINDLE DOWNFEED
RAM
SPINDLE
LUBRICATION INDICATOR LIGHT
MAGNETIC ELECTRIC PANEL
TABLE
SADDLE
LUBRICATION PRESSURE GAGE
KNEE
CLUTCH-MANUAL FEED
HYDRAULIC MOTOR/TACHOMETER
PLATEAU CONTROL
SOLID STATE TRACER CONTROL PANEL
HYDRAULIC UNIT
Gorton Model 2-30 Auto-Trace-Master, Automatic Tracer Controlled Profiling/Duplicating Milling Machine

Photo 6

PRELIMINARY OPERATIONS

1. UNCRATING

Remove crating with care so that machine and parts are not marred, scratched or damaged. Examine carefully for evidence of shipping damage. Report at once to transportation company and to Gorton representative any evidence of such damage. Check shipment carefully against itemized packing list for possible shortages.

2. FOUNDATION

Before moving the machine be sure the location has a solid footing and is level as possible. Have steel shims ready for leveling. Steel shims should be used because softer metals are not stable enough to maintain level of the machine.

The machine does not have to be bolted to the floor.

It is recommended that four heavy duty vibration dampening pads be used under the machine.

3. MOVING AND PLACEMENT OF HYDRAULIC UNIT

Remove the four bolts holding unit to skid. Use a lift truck to move the unit. Place the lift truck forks under the base of the unit and raise it. Locate the hydraulic tank so the long axis is parallel to the back of the machine or in a position that will not cause sharp bends in the hoses, which could set up turbulence or actually crimp the hoses.

The unit should be fairly level and shimmed to eliminate rocking action.

After the machine has been placed the hydraulic and electrical hook-up can be made.

4. MOVING THE MACHINE (figure 1)

Machines With Standard Head

This machine is easily moved by shop hoist or crane. Be sure that ram is in operating position and that ram is securely held by ram clamping nuts. Position the table with its center directly below the spindle.

Insert lifting hook into the eye bolt on top of ram and carefully move machine to desired location. If machine does not lift evenly, change position of spindle drive motor and the cross position of table. DO NOT USE CHAINS UNDER TABLE OR RAM. This could damage the bearing surfaces causing misalignment.

Machines With Variable Speed Head

Machines with a variable speed head should be moved with a lift truck as shown in the inset in Figure 1. Use wood spacers between the forks and bearing surfaces to prevent damage.

5. CLEANING

Do not operate any moving part of this machine until it is thoroughly clean and has been given a coating of oil. Remove shipping grease with clean olium spirits, or other grease solvent. Use lintless rags, not cotton waste. Never use an air hose. When machine is clean, give it a light coat of a good grade clean machine oil to prevent rust spots and other corrosion. For lubrication see LUBRICATION pages M-24 and M-25.

CAUTION

Make sure that head is securely clamped to column with front and rear ram clamping nuts (figure 1). Place lifting hook in eye bolt on top of ram and move machine to its permanent location.

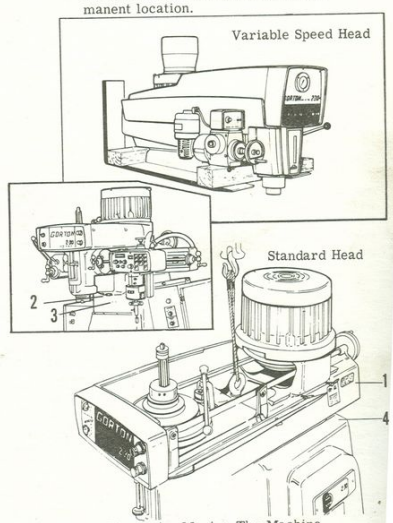


Figure 1. Moving The Machine

1. Ram
2. Clamping nut
3. Serial number
4. Clamping nut

6. LEVELING

After machine has been installed and cleane it must be carefully leveled. Make sure it is at roo temperature before beginning to level. Use a se sitive, graduated spirit level (10 seconds per gra uation) for best results. Level machine by placi spirit level first lengthwise, then crosswise on t table, and change the position of the table seve times during the process. Remember that this m chine must be re-leveled from time to time due floor settlement.

Photo 7

7. HYDRAULIC HOOK-UP (figure 2)

There are three lines (10, 9, and 16) marked R(return), P1(pressure), and D(drain). These lines are labeled and should be connected properly to make sure the hydraulic unit will operate properly.

NOTE

It is very important that all connections be free from dirt so hydraulic system will not become contaminated.

ELECTRICAL

8. HOOK-UP PROCEDURE

This machine and control equipment have been wired, phased, inspected and test run in our factory to insure correct performance in the customer's plant.

Spindle Motor

If machine was shipped with spindle motor dismounted, the motor must first be mounted and connected. To connect spindle motor, open terminal box cover and match color coded "tattle tail" lead wires of the motor to the same color wire of the power supply line. In some cases, wires are marked with letters and numbers. If motor leads are accidentally disarranged, consult motor specification plate for proper lead wire connection.

Hydraulic

The hydraulic unit is to be reconnected. Two flexible conduits lead from the unit. One contains three black wires, which are the motor power leads. The other conduit has six red wires which are the control wires for the solenoid and pressure switch. Wire nuts are shipped in a separate bag. All wires are numbered, and are to be connected to terminal block in control cabinet to like numbers.

Proceed to connect the power input line to the terminals marked L1, L2 and L3 on the terminal strip in the control cabinet. Make certain the correct voltage and phase is used.

9. MOTOR ROTATION

Proper connection should result in correct rotation of hydraulic motors. An arrow is provided on the hydraulic pump to check rotation.

Check spindle motor operating direction. The rotation direction of a standard machine is clockwise, when looking down at the spindle.

If any motor rotation is not correct, reverse two of the leadwires to that unit.

CAUTION

Entire machine should be checked before any individual electrical changes are made. It may be that the line wires into the cabinet are connected wrong, making entire machine function backwards.

Maximum efficiency requires full power. Check input voltage while machine is running and while all other electrical equipment on the same line is operating. The input voltage to the machine must be within plus or minus 8% of the voltage marked on the electrical cabinet nameplate to insure proper operation of controls.

10. SPINDLE DOWNFEED

Power to the spindle downfeed is supplied by a D. C. shunt wound motor. If the direction of rotation does not conform with the setting of the downfeed toggle switch the armature leads must be reversed at the motor.

The variable speed drive is a complete variable speed motor control system for operating a D. C. motor from an A. C. line. The function of the rectifier panel is to supply power to the armature and the field of the D. C. motor, and to so control the armature voltage that variable speed can be obtained up to the base speed rating of the motor at constant torque. Maximum horsepower is delivered at maximum speed. At speeds below the maximum, the rated torque is constant and the horsepower is directly proportional to the running speed.

11. DIAGRAMS

One of each of the following will be found in the pocket on the inner wall of the control cabinet door: elementary connection diagram, panel layout diagram, sequence of operations and instructions. Location of fuses, hook-up of actuators and controls is provided. This data should remain with the machine at all times for efficient service and maintenance.

Photo 8

12. GENERAL

If it is necessary to disconnect any motor, actuator or control, it is advisable to tag or mark the lead wires.

If for any reason the drawings have been misplaced, consult the nameplate on the control cabinet for EE and EP drawing numbers.

Only fuses of the same specification are to be used in the corresponding component. DO NOT USE SUBSTITUTE FUSES.

All electrical components are standard. In case of component fatigue or breakdown, the replacement should be of the same model and manufacture.

HYDRAULIC SYSTEM

13. HYDRAULIC PUMP (figure 2)

The hydraulic pump (4) is a vane type, variable volume, constant pressure type. It is preset at the factory to maintain 700 to 710 p. s. i. with no slide movement. Normal operating temperature will be in the 90° - 115° range.

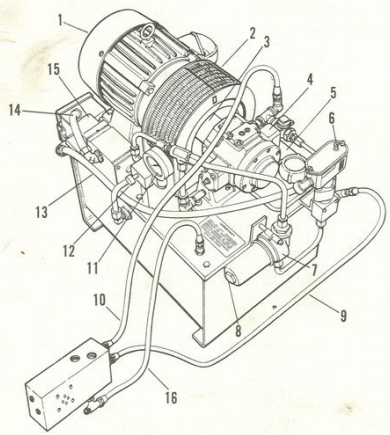
It is not recommended that this pump be dismantled in the field, nor tampered with in any way except by written instructions from the factory or by factory trained personnel.

14. REPLACING FILTER CARTRIDGE (figure 2)

A 10 micron spare filter cartridge is supplied with the machine. This cartridge should be used when "Change Filter" red indicator light lights up and stays on under normal operation.

NOTE

This red light works on a pressure differential (6) between the hydraulic pump pressure and pressure through the filter. Therefore, the red light will light up when the pump motor is stopped, the cross or longitudinal limit switches, or vertical limit switch on 2+1, are activated, or if the pressure differential adjustment screw is misadjusted (pressure difference is set at 100 lbs.). These are not true indications that filter should be changed.

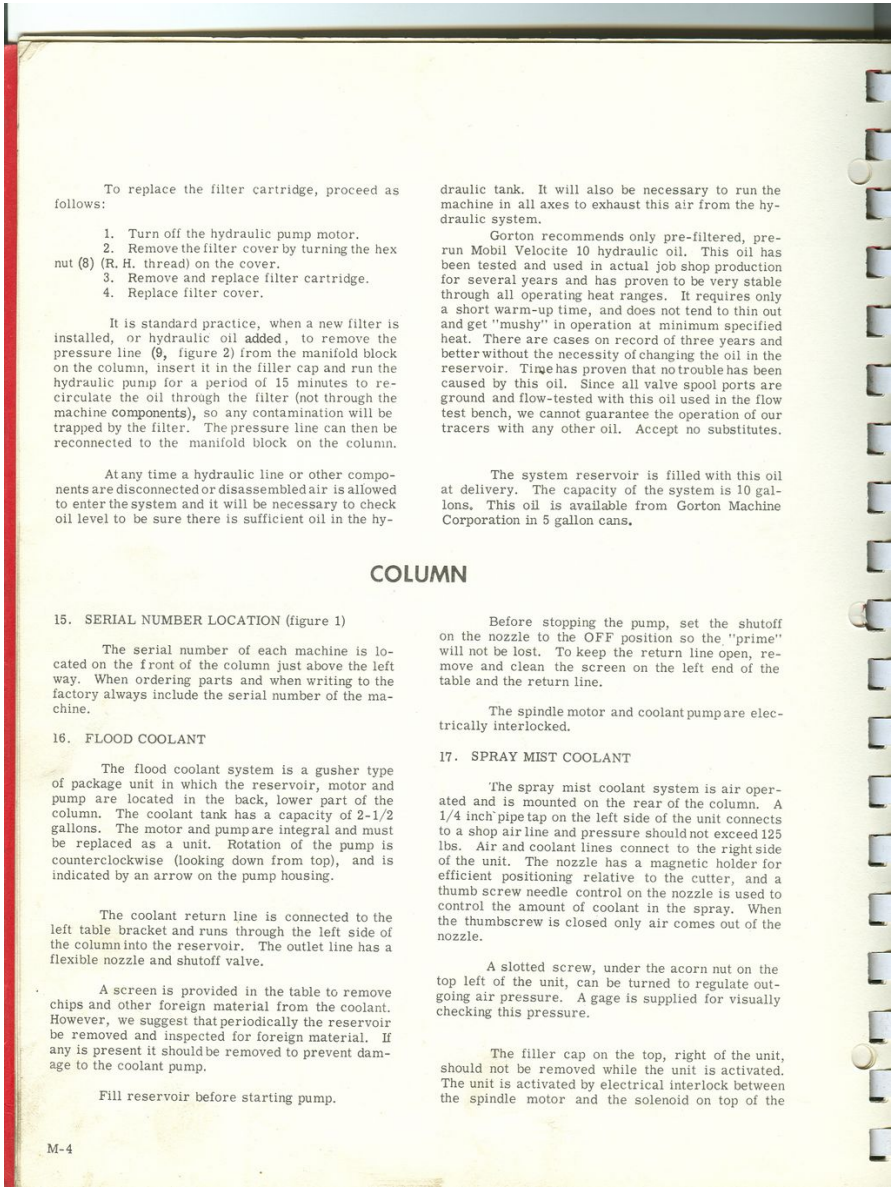


Legend-Figure 2

1. Pump motor
2. Air-oil cooler
3. Motor coupling
4. Hydraulic pump
5. Oil level gauge
6. Pressure diff. setting
7. Hydraulic filter
8. Hex nut (R. H. thread)
9. Pressure line
10. Return line
11. Pressure gauge
12. Gauge push valve
13. Flexible conduit
14. Flexible conduit
15. Solenoid valve
16. Drain line

Figure 2. Hydraulic Unit

Photo 9



To replace the filter cartridge, proceed as follows:

1. Turn off the hydraulic pump motor.
2. Remove the filter cover by turning the hex nut (8) (R. H. thread) on the cover.
3. Remove and replace filter cartridge.
4. Replace filter cover.

It is standard practice, when a new filter is installed, or hydraulic oil added, to remove the pressure line (9, figure 2) from the manifold block on the column, insert it in the filler cap and run the hydraulic pump for a period of 15 minutes to recirculate the oil through the filter (not through the machine components), so any contamination will be trapped by the filter. The pressure line can then be reconnected to the manifold block on the column.

At any time a hydraulic line or other components are disconnected or disassembled air is allowed to enter the system and it will be necessary to check oil level to be sure there is sufficient oil in the hydraulic tank. It will also be necessary to run the machine in all axes to exhaust this air from the hydraulic system.

Gorton recommends only pre-filtered, pre-run Mobil Velocite 10 hydraulic oil. This oil has been tested and used in actual job shop production for several years and has proven to be very stable through all operating heat ranges. It requires only a short warm-up time, and does not tend to thin out and get "mushy" in operation at minimum specified heat. There are cases on record of three years and better without the necessity of changing the oil in the reservoir. Time has proven that no trouble has been caused by this oil. Since all valve spool ports are ground and flow-tested with this oil used in the flow test bench, we cannot guarantee the operation of our tracers with any other oil. Accept no substitutes.

The system reservoir is filled with this oil at delivery. The capacity of the system is 10 gallons. This oil is available from Gorton Machine Corporation in 5 gallon cans.

COLUMN

15. SERIAL NUMBER LOCATION (figure 1)

The serial number of each machine is located on the front of the column just above the left way. When ordering parts and when writing to the factory always include the serial number of the machine.

16. FLOOD COOLANT

The flood coolant system is a gusher type of package unit in which the reservoir, motor and pump are located in the back, lower part of the column. The coolant tank has a capacity of 2-1/2 gallons. The motor and pump are integral and must be replaced as a unit. Rotation of the pump is counterclockwise (looking down from top), and is indicated by an arrow on the pump housing.

The coolant return line is connected to the left table bracket and runs through the left side of the column into the reservoir. The outlet line has a flexible nozzle and shutoff valve.

A screen is provided in the table to remove chips and other foreign material from the coolant. However, we suggest that periodically the reservoir be removed and inspected for foreign material. If any is present it should be removed to prevent damage to the coolant pump.

Fill reservoir before starting pump.

Before stopping the pump, set the shutoff on the nozzle to the OFF position so the "prime" will not be lost. To keep the return line open, remove and clean the screen on the left end of the table and the return line.

The spindle motor and coolant pump are electrically interlocked.

17. SPRAY MIST COOLANT

The spray mist coolant system is air operated and is mounted on the rear of the column. A 1/4 inch pipe tap on the left side of the unit connects to a shop air line and pressure should not exceed 125 lbs. Air and coolant lines connect to the right side of the unit. The nozzle has a magnetic holder for efficient positioning relative to the cutter, and a thumb screw needle control on the nozzle is used to control the amount of coolant in the spray. When the thumbscrew is closed only air comes out of the nozzle.

A slotted screw, under the acorn nut on the top left of the unit, can be turned to regulate outgoing air pressure. A gage is supplied for visually checking this pressure.

The filler cap on the top, right of the unit, should not be removed while the unit is activated. The unit is activated by electrical interlock between the spindle motor and the solenoid on top of the

Photo 10

spray mist unit. Coolant flow will start or stop with spindle motor control. Air flow will continue with coolant off.

A sight gage on the front of the unit provides a visual means of checking coolant level when filling the unit, and directly below the sight gage is the drain plug.

Water soluble oils are used in this unit and the mixture should be to manufacturer's specification and consistency to insure non rust and non clogging conditions. Multi nozzle manifold blocks are available so more than one nozzle can be used for greater cutting efficiency.

KNEE-ADJUSTMENTS

18. VERTICAL GIB (figure 3)

To adjust the vertical gibs they must be removed from the machine. Do so as follows:

1. Support the knee by holding up the table using hydraulic jacks or lift trucks at each end of the table or use a hoist with slings on both ends of the table.
2. Remove the five bolts (1) holding the vertical gibs (2) and spacers (3).
3. Take a micrometer measurement of the column ways (4) on both sides.
4. Machine the two spacers to the dimension of the column ways +.0004 inch.
5. Reassemble, being sure that left and right gibs are in proper locations.

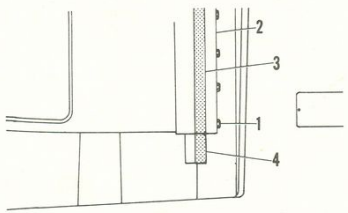


Figure 3. Adjusting Knee Vertical Gibs

1. Hex head bolts
2. Knee vertical gib
3. Spacer
4. Column Way

19. TAPERED GIB (figure6) (Knee)

Adjust the tapered gib on the knee as follows:

1. Remove the right vertical knee wiper (4) by removing screws.
2. Back off bottom gib screw (3) (small end of gib) and tighten top gib screw (1) to 30 inch pounds of torque with torque wrench.
3. Retighten bottom gib screw so gib cannot float.
4. Reassemble in reverse order.

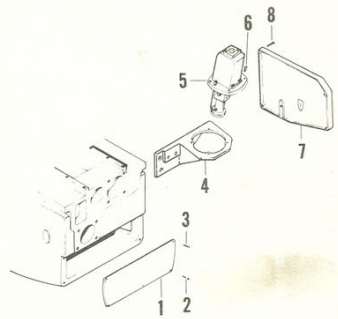


Figure 4. Lubrication Pump Removal
Legend - Figure 4

1. Front cover
2. Socket head screw
3. Socket head screw
4. Pump mounting bracket
5. Lubrication pump
6. Socket head screw
7. Right side cover
8. Socket head screw

20. REMOVING LUBRICATION PUMP (figure 4)

The solenoid operated pump is contained within the front knee cavity. To repair or adjust remove the lubrication pump from the knee as follows:

1. Disconnect the line voltage to the machine.
2. Place a large pan under the knee to catch oil from the knee reservoir, and remove the drain plug from the bottom of the knee.
3. Take out the capscrews (2 & 3) and remove the front cover (1). Take out the capscrews (8) and remove the right side cover (7).
4. Remove the three screws (6) holding the pump assembly. Tilt the assembly to gain access to the lubrication line to the pump and disconnect the line. Remove the pump assembly through the opening in the right side of the knee.

Photo 11

NOTE

There is adequate electric cable to allow removal or checking of components, including the float microswitch, solenoid and pump assembly.

The following checks are to be made to determine proper operation of electrical components and actuation of pump.

1. With main disconnect switch in "on" position and hydraulic unit operating, check operation of timer motor (located in main electrical control panel) by observing rotation of calibrated cam plate. Timer should operate through auxiliary contact M2 or N. O. contact of timer switch.

2. To determine correct operation of pump solenoid place test light across terminals 14 and 15. Timer cam plate rotating, test light should be "illuminated" and solenoid actuated as cam plate contacts switch. If solenoid does not operate check for burned out coil on solenoid.

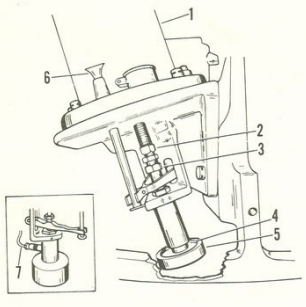


Figure 5. Lubrication Pump Adjustment
Legend - Figure 5

1. Lube pump
2. Upper hex nut
3. Lower hex nut
4. Retainer ring
5. Felt strainer
6. Plunger
7. Output line

4. Retainer ring

21. ADJUSTING STROKE OF LUBRICATION PUMP (figure 5)

The solenoid pump is contained within the front knee cavity. The pump is adjustable relative to the volume it displaces into the system.

The lower hex head (3) is an integral part of the solenoid activating plunger shaft and the upper hex nut (2) is a lock nut arrangement. By loosening the locknut and rotating the lower hex nut counterclockwise (facing unit), the shaft will be screwed into the solenoid, increasing its length of stroke and displacing (putting out) more volume.

The felt strainer (5) should be CHECKED PERIODICALLY and cleaned if necessary in solvent. The strainer (5) can be removed by snapping out the retainer ring (4).

A ball check in the pump housing is utilized so that prime of the system is not lost.

Check this by removing the ball check output line (7) extending from center of pump and operate plunger (6) manually. Oil should come out of ball check fitting.

NOTE

The way oil recommended will deposit a residue which may possibly cause the ball check to stick in the open position, which would result in dumping the oil into the reservoir and not into the lubrication system. If this occurs, the ball check must be removed and cleaned in solvent.

A float operated microswitch which is connected to the Tell Tale red light is used to show when oil level is low. It is necessary to refill the knee reservoir through the filler cap (right side) up to the sight gage so that the machine, through its electrical interlocks, does not become inoperative.

The red light is a "push to check" type. The bulb can be checked by pressing in on the red light cover.

Photo 12

KNEE-REMOVING AND REPLACING PARTS

22. SLIDING SHIELDS--FRONT (figure 6)

Remove the front sliding shields as follows:

1. Remove the front three screws (17) holding the retainer strips (16).
2. Remove the apron holder (19), apron (18) and saddle wiper (14) by removing screws (15 and 20).
3. Move the shields (13) forward and remove by sliding under the retainer strips.

23. SLIDING SHIELDS--REAR (figure 6)

Remove the rear sliding shields from the knee as follows:

1. Move the saddle forward.
2. Remove the rear knee wiper (9).
3. Take out the two cap screws (7) holding the rear shield.
4. Remove the two slide stops (10).
5. Remove the back three screws (17) holding one of the retainer strips (16).
6. Move the top shield back and the bottom shield forward a little. Shields can then be pulled out sideways from under retainer strip.

24. THRUST BEARINGS-ELEVATE FEED SCREW

To remove these bearings (10 & 12, figure 7) follow the procedure for removing the elevate feed screw. The bearings can then be removed from the elevate gear bracket.

25. HANDWHEEL AND CRANK ASSEMBLIES

The handwheel and crank assemblies are held to the shafts by setscrews. To remove the complete assemblies loosen the setscrew and slide off the handwheel.

When installing handwheel or crank be sure that setscrew enters the undercut on the shaft. The handwheel and crank are spring loaded and must turn freely when they are not engaged (pushed in).

CAUTION

If handwheel or crank is improperly installed, so it does not have spring loaded return, it becomes a safety hazard. It will also place a strain on the feed gear train.

NOTE:
HANDWHEELS ARE SUPPLIED WITH THUMB SCREWS WHICH, WHEN MACHINE IS BEING USED AUTOMATICALLY, CAN BE SCREWED IN SO HANDWHEELS CAN NOT BE ENGAGED.

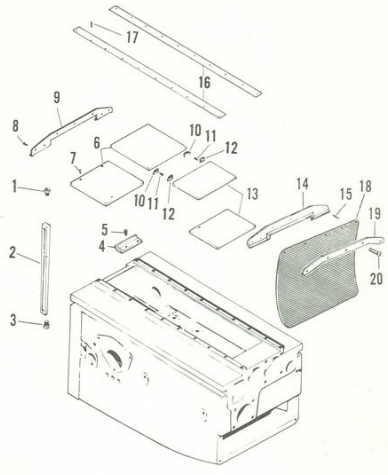


Figure 6. Knee Shields, Gib and Wipers
Legend - Figure 6.

1. Top gib screw	11. Slide stop screws
2. Tapered gib	12. Slide stops (front)
3. Bottom gib screw	13. Front shields
4. Right wiper	14. Front knee wiper
5. Wiper screw	15. Wiper screw
6. Rear shields	16. Retainer strips
7. Cap screws	17. Retainer strip screws
8. Wiper screw	18. Knee apron
9. Rear knee wiper	19. Apron holder
10. Slide stops (rear)	20. Saddle wiper screws

26. ELEVATE FEED SCREW 360° (figure 7)

Remove the elevate feed screw and elevate support as follows:

1. Elevate knee to uppermost position: Using a 4 x 4 or car jack, block up knee so it cannot move downward.
2. Loosen the setscrew in the cross feed crank and remove the crank.
3. Take out the four screws (16) holding the manual elevate assembly (15) and slide out the complete assembly .

Photo 13

4. Remove the three screws (1) holding the elevate gear bracket assembly (2) in knee. These screws can be reached through access hole in bottom of knee.

5. Rotate the elevate screw counterclockwise (looking down from top) by hand until elevate gear bracket (2) assembly approaches bottom surface of knee.

6. Remove the three screws (20) holding elevate support (19) to column. The elevate screw bracket assembly (2), support (19) and elevate nut (18) can then be swung to the side and pulled out of the knee.

7. To remove the elevate feed screw (14) from the elevate gear bracket (11) unscrew the Nylock lock nut (9) and tap out the feed screw.

8. Remove the feed screw (14) and elevate nut (18) from the elevate support (19) by removing the three screws (17) holding the nut to the support.

9. Reassemble in reverse order of disassembly. Do not tighten the three screws holding the elevate gear bracket until the manual elevate assembly is in assembled position. Use extreme care when attaching the elevate support to be sure vertical alignment of feed screw to column ways is maintained so no binding occurs.

27. ELEVATE FEED SCREW AND VERTICAL HYDRAULIC CYLINDER (INCREMENT FEED) (figure 7)

Remove the elevate feed screw and vertical hydraulic cylinder as follows:

1. Elevate the knee hydraulically. Then elevate it manually to gain access to the three screws (1). Using a 4 x 4 or car jack, block up knee so it cannot move downward.

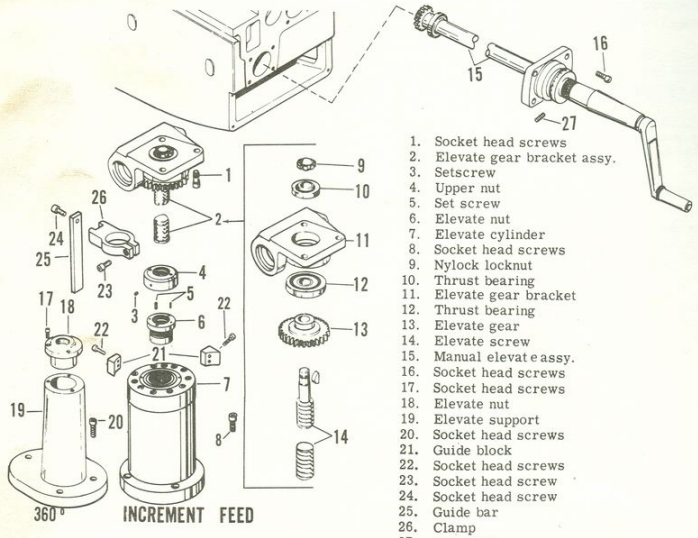
2. Loosen the setscrew in the cross feed crank and remove the crank.

3. Take out the four screws (16) holding the manual elevate assembly (15) and slide out the complete assembly.

4. Remove the three screws (1) holding the elevate gear bracket assembly (2) in knee. These screws can be reached through access hole in bottom of knee.

5. Rotate the elevate screw counterclockwise (looking down from top) by hand until elevate gear bracket (2) assembly approaches bottom surface of knee.

6. Disconnect the two hydraulic lines to the elevate cylinder. Remove the four screws (8) hold-



1. Socket head screws
2. Elevate gear bracket assy.
3. Setscrew
4. Upper nut
5. Set screw
6. Elevate nut
7. Elevate cylinder
8. Socket head screws
9. Nylock locknut
10. Thrust bearing
11. Elevate gear bracket
12. Thrust bearing
13. Elevate gear
14. Elevate screw
15. Manual elevat e assy.
16. Socket head screws
17. Socket head screws
18. Elevate nut
19. Elevate support
20. Socket head screws
21. Guide block
22. Socket head screws
23. Socket head screw
24. Socket head screw
25. Guide bar
26. Clamp
27. Setscrew

Figure 7. Knee Elevate Mechanism (360° And Increment Feed)

Photo 14

ing elevate cylinder (7) to column. The elevate screw, elevate cylinder and elevate nut can then be swung to the side and pulled out of the knee.

7. To remove the elevate feed screw (14) from the elevate gear bracket (11) unscrew the Nylock lock nut (9) and tap out the feed screw. Loosen the socket head screw (23) and remove the clamp (26) from the upper nut (4) to gain access to the setscrew (3)

8. Loosen the three setscrews (3) in the upper nut (4) and rotate the nut up the screw to get at the two dog point screws (5) and loosen the two screws. The nut (6) can then be unscrewed from the piston rod.

9. Reassemble in reverse order of disassembly. Do not tighten the three screws holding the elevate gear bracket until the manual elevate assembly is in assembled position. Use extreme care when attaching the elevate cylinder to be sure vertical alignment of feed screw to column ways is maintained so no binding occurs.

NOTE

If knee does not respond hydraulically, or if table does not return consistently to the same height, adjust upper nut (4) as follows: Loosen setscrews (3) and rotate upper nut (4)

NOTE (cont'd)

toward elevate nut (6) to pre-load nuts on screw. The pre-load of the nuts on the screw cannot be so great that the height of the table cannot be manually positioned by the hand crank.

28. ELEVATE FEED SCREW AND VERTICAL HYDRAULIC CYLINDER (2+1) (figure 8)

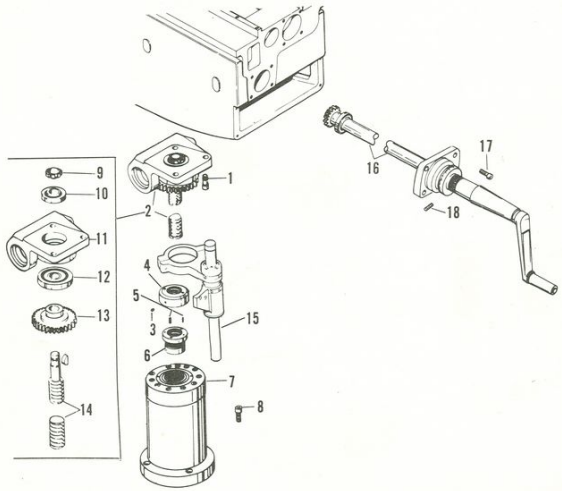
1. Elevate the knee hydraulically. Then elevate it manually to gain access to the three screws (1). Using a 4 x 4 or car jack, block up knee so it cannot move downward.

2. Loosen the setscrew (18) in the cross feed crank (16) and remove the crank.

3. Take out the four screws (17) holding the manual elevate assembly (16) and slide out the complete assembly.

4. Remove the ballscrew feedback assembly (15) (par. 32).

5. Follow steps 5 through 10 of paragraph 27.



Legend for figure 8

1. Socket head screws
2. Elevate gear bracket assy.
3. Setscrew
4. Upper nut
5. Setscrews
6. Elevate nut
7. Elevate cylinder
8. Socket head screws
9. Nylock locknut
10. Thrust bearing
11. Elevate gear bracket
12. Thrust bearing
13. Elevate gear
14. Elevate screw
15. Ballscrew feedback assy.
16. Manual elevate assy.
17. Socket head screws
18. Setscrew

Figure 8. Elevate Mechanism (2+1)

Photo 15

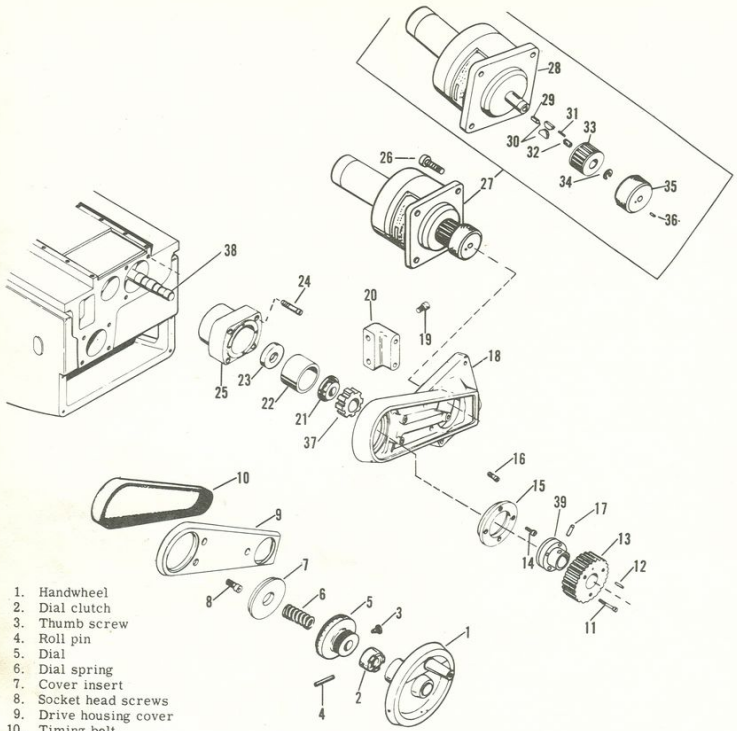


Figure 9. Knee Drive Mechanism

1. Handwheel
2. Dial clutch
3. Thumb screw
4. Roll pin
5. Dial
6. Dial spring
7. Cover insert
8. Socket head screws
9. Drive housing cover
10. Timing belt
11. Socket head screws
12. Dowel pin
13. Drive pulley
14. Socket head screws
15. Clamping ring
16. Socket head screws
17. Dowel pin
18. Transverse drive brkt.
19. Socket head screws
20. Transverse drive bracket
21. Bearing
22. Drive screw spacer
23. Bearing
24. Socket head screws
25. Transverse screw bearing bracket
26. Socket head screw
27. Hydraulic motor assy.
28. Hydraulic motor
29. Inner cone pin
30. Friction keys
31. Roll pin
32. Outer cone pin
33. Drive pulley
34. Snap ring
35. Knob
36. Set screw
37. Bear hug nut
38. Ball screw
39. Bearing nut (special)

29. REMOVING HYDRAULIC MOTOR, TACHOMETER AND CONE CLUTCH (Cross Feed) (figure 9)

To remove the fluid motor, tachometer and cone clutch as a unit proceed as follows:

1. Remove the four socket head screws (26).
2. Remove the setscrew (36) and knob (35).
3. Tilt the motor and disengage it from the timing belt.
4. Take off the snap ring (34) and pull off the drive pulley (33).
5. Remove the two cone pins (29 & 32) and the two keys (30).
6. Disconnect the three hydraulic lines from the motor.

Photo 16

30. REMOVING CROSS FEED DRIVE BELT (figure 9)

Remove the cross feed drive belt as follows:

1. Take off the handwheel (1) (see par. 27).
2. Take out the roll pin (4) and remove the dial clutch (2). Remove the dial (5) by loosening the thumb screw (3). Take out the three capscrews (8) and remove the drive housing cover (9).
3. Remove the three capscrews (11) and remove the drive pulley (13).
4. Take off the drive belt (10).

31. REMOVING BALLSCREW THRUST BEARINGS (figure 9)

Remove the ball screw thrust bearings as follows:

1. Remove the handwheel (1) (see par. 25).
2. Take out the roll pin (4) and remove the dial clutch (2). Remove the dial (5) by loosening the thumb screw (3). Take out the three capscrews (8) and remove the drive housing cover (9). Remove the three capscrews (11) holding the drive pulley (13) and remove the drive pulley. Take out the four capscrews (14) and remove the clamping ring (15). Remove dowel (17) and hub (39). Remove the socket capscrews (19).
3. Remove the two capscrews (16) and take off the transverse drive housing (18) with motor attached. Remove nut (37).
4. Remove four capscrews (24) and remove the transverse screw bearing bracket (25) with the bearings (21 & 23). Press the bearings out the front end of the bearing bracket.
5. Reassemble in reverse order of disassembly.

32. REMOVING BALLSCREW FEEDBACK (2+1) (figure 10)

To remove the complete ballscrew feedback assembly, proceed as follows:

1. Elevate knee to top position with hand crank and lower the knee hydraulically.
2. Using a 4 x 4 or car jack, block up knee so it cannot move downward.
3. Turn off hydraulics and electric power to machine.
4. Remove the two screws (1) from the nut housing (3). Note that this piece is also held by two dowel pins (2).
5. Remove the two screws (4) and remove the half of the mounting bracket (5) held by them. Keep shims (8) for use on reassembly.

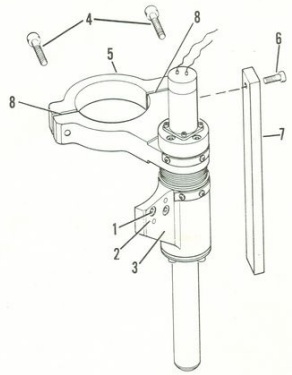


Figure 10. Removing Ballscrew Feedback

1. Socket Capscrews
2. Dowel Pins
3. Nut Housing
4. Socket Capscrews
5. Mounting Bracket (Half)
6. Socket Capscrew
7. Guide Bar
8. Shims

6. Remove the screw (6) and guide bar (7).
7. Disconnect and mark wires to tachometer.
8. The complete ballscrew feedback assembly can then be removed from bottom of the knee (See figure 8). Be careful when removing it to prevent damage to the threads on the screw. Set the assembly on a clean work bench.

33. CLEANING AND INSPECTING BALLSCREW FEEDBACK AND TACHOMETER (figure 11)

If the machine oscillates in the knee "Z" axis and no other malfunctions are apparent, the ballscrew and tachometer should be removed for inspecting and cleaning as follows:

1. Remove the complete ballscrew feedback assembly from the machine (paragraph 32).
2. Remove the four capscrews (6) and take off the shield (7), end cap (8) and shims (9).

Photo 17

3. Loosen the setscrew (10) which is accessible through a hole in the side of the tachometer mount (11).

4. Take out the four capscrews (12) and remove the tachometer (13).

5. Remove the four screws (14) holding the bottom shield (15). This releases the bottom of the accordion type cover (16) for access to the portion of the screw under the cover.

The screw or nut can be rotated to expose the screw surface for cleaning as follows:

6. Use a VERY CLEAN solvent and brush it onto the entire screw surface.

7. Rotate the screw through the nut to carry solvent into the nut. Repeat this procedure until the solvent which comes out of the nut is clean. Dry with a lintless cloth and lubricate with STP.

34. REPLACING TACHOMETER ON BALLSCREW FEEDBACK

To replace the tachometer on the ballscrew feedback, proceed as follows:

1. Remove the complete ballscrew feedback and tachometer assembly from the knee (paragraph 32). Electrical connections are long enough to pull the assembly out far enough for removal of the tachometer.

2. Rotate nut on ballscrew as necessary so setscrew (10) is accessible through hole in tachometer mount (11). Loosen the setscrew.

3. Remove the four screws (12) holding the tachometer (13) to the tachometer mount (11).

4. Take out the screws holding the end cover on the tachometer, disconnect the wires to the two terminals and remove the tachometer. Mark terminals so wires go to correct terminals on reassembly.

5. Replace the tachometer in reverse order of removal.

Legend - Figure 11

1. Socket Capscrew
2. Dowel Pin
3. Nut Housing
4. Socket Capscrew
5. Mounting Bracket
6. Socket Capscrew
7. Shield
8. End Cap
9. Shims
10. Setscrew
11. Tachometer Mount
12. Socket Capscrew
13. Tachometer
14. Shield Screws
15. Bottom Shield Clamp
16. Accordion Type Cover
17. Socket Capscrew
18. Guide Bar

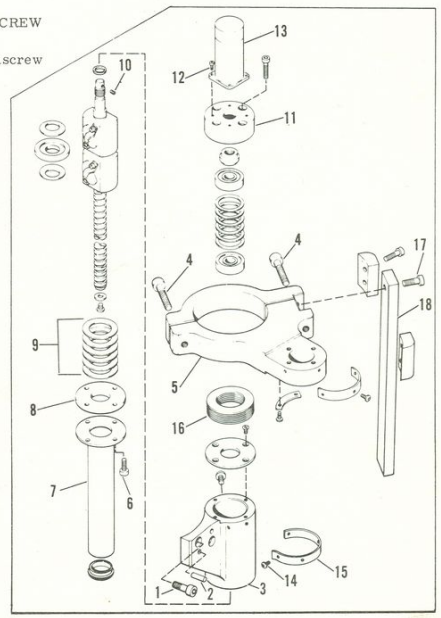


Figure 11. Ballscrew Feedback (Exploded view)

Photo 18

35. REPLACING TACHOMETER ON HYDRAULIC MOTORS (figure 12).

To replace the tachometers on the hydraulic motors, proceed as follows:

1. Turn off electrical and hydraulic power.

2. Remove the plug (4) in tachometer housing (5) and rotate the motor clutch so setscrew (6) in coupling can be reached through plug hole.

3. Remove the setscrew (6) from the coupling (7).

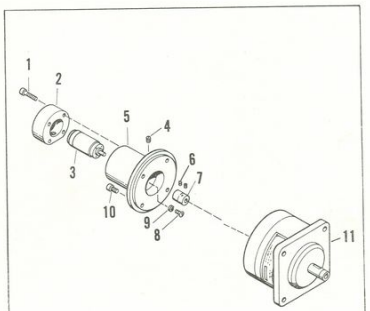
4. Take out the four capscrews (1) and remove the tachometer cover (2).

5. Take out the four capscrews (10) holding the tachometer housing (5) and remove the housing.

6. Remove the three screws (8) and lockwashers (9) holding the tachometer (3) and take out the tachometer.

7. Loosen the two screws holding the wires to the tachometer, disconnect the wires and remove the tachometer. Mark terminals so wires go to correct terminal on reassembly.

8. Replace tachometer in reverse order of removal.



1. Socket Capscrew
2. Tachometer cover
3. Tachometer
4. Socket Pipe Plug
5. Tachometer Housing
6. Socket Setscrew
7. Coupling
8. Screw
9. Lockwasher
10. Socket Capscrew
11. Hydraulic Motor

Figure 12. Replacing tachometer on hydraulic motors

36. CLEANING AND REPLACING TACHOMETER PARTS (figure 13)

To clean and/or replace parts in the tachometers, proceed as follows:

1. Remove the tachometer from the machine (see paragraphs 34 and 35).

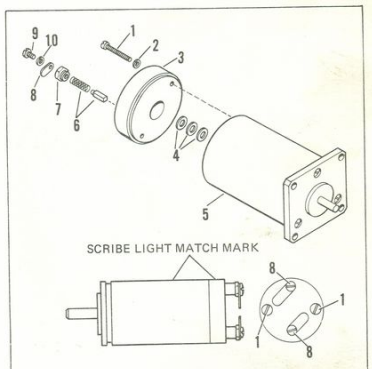
2. Make a light scribe mark (in the direction of the rotor shaft) across the main tachometer case and the brush holder disc. All other components removed from tachometer should be marked for realignment during assembly.

3. On tachometers for the hydraulic motors remove the tachometer cover by taking out the two screws.

4. Remove the screws (9) from the number 1 and 2 terminal posts.

5. Using a 3/16" wrench, remove the two terminal posts (7). These posts are also the brush holders.

6. Remove the two screws (1) and lockwashers (2) holding the cap (3) to the tachometer and remove it carefully because the brushes (6) and retaining washers (4) will come off with the cap.



1. Screw
2. Lockwasher
3. Cap
4. Retaining Washers
5. Tachometer case
6. Brush
7. Terminal post
8. Connector
9. Screw
10. Lockwasher

Figure 13. Cleaning and replacing tachometers

Photo 19

7. Clean the brushes with brightboy compound and clean the armature housing surface which the brushes contact.

8. With the edge of a piece of paper remove the fine particles between the slots in the commutator face. Blow the surface clean using dry air.

9. Square the brush faces using a fine stone. If the brushes are worn, break the four edges of each brush face approximately 45°.

10. Reassemble in reverse order of disassembly. Before replacing the rotor, align the magnet ring approximately 30° to the right of notch on main tachometer housing. Be sure to install brushes so the face with the groove is toward the O. D. of the tachometer.

37. CLEANING TRANSDUCER ON PLATEAU CONTROLS (2+1) (figure 14).

This procedure is to be performed only by qualified Gorton maintenance personnel.

1. Disconnect electrical power to the machine.

2. Loosen the thumbscrew (1) and remove the transducer (2).

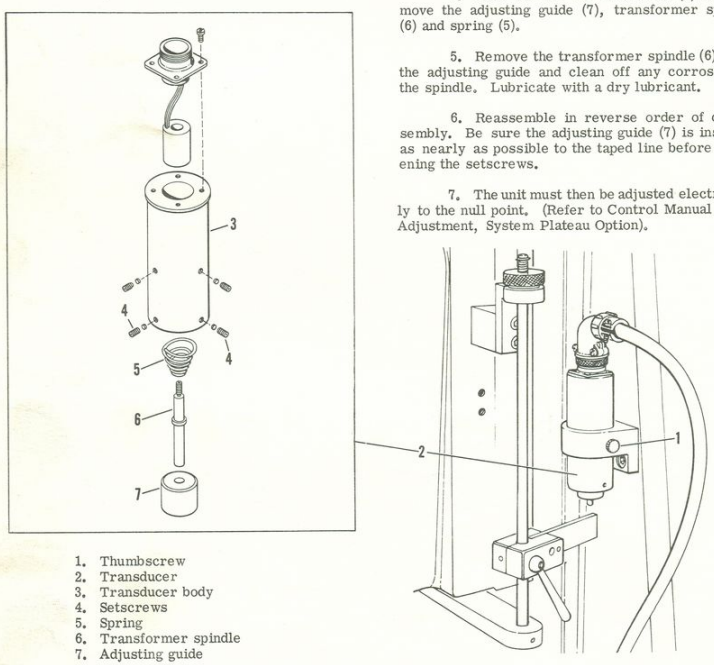
3. Tape the exposed area of the adjusting guide (7) right up to the point where it enters the transducer body so that on reassembly it can be inserted same distance. (Other methods of marking can be used but the surface of the housing must not be damaged).

4. Take out the two setscrews (4) and remove the adjusting guide (7), transformer spindle (6) and spring (5).

5. Remove the transformer spindle (6) from the adjusting guide and clean off any corrosion on the spindle. Lubricate with a dry lubricant.

6. Reassemble in reverse order of disassembly. Be sure the adjusting guide (7) is inserted as nearly as possible to the taped line before tightening the setscrews.

7. The unit must then be adjusted electrically to the null point. (Refer to Control Manual - "Z" Adjustment, System Plateau Option).



1. Thumbscrew
2. Transducer
3. Transducer body
4. Setscrews
5. Spring
6. Transformer spindle
7. Adjusting guide

Figure 14. Cleaning transducer on plateau controls

Photo 20

SADDLE-ADJUSTMENTS

38. FLAT GIB (figure 15)

To adjust the flat gibs they must be removed from the machine. Do so as follows:

1. Take out the four socket head screws holding the flat gib (3) and guide plate spacer (2) on each side of the saddle.
2. Carefully remove the two flat gibs and spacers.
3. Take a micrometer measurement of the two knee ways (1).
4. Machine the two spacers to the dimension of the knee ways +.0004 inch for oil space.
5. Reassemble, being sure that left and right gibs are in correct location.

39. TAPERED GIB (figure 16)

Adjust the tapered gib (18) as follows:

1. Remove the rear (14) and front (15) saddle wipers by removing the seven screws (13 & 16) holding each wiper.
2. Back off the rear gib screw (17) and take up on the front gib screw (19) to 25 inch pounds. Retighten rear gib screw so gib does not float.

NOTE

Special care should be taken to adjust the gibs. Because of the efficiency of the ball screws, the gibs can be easily over-tightened. Therefore, it is best to use a torque wrench and adjust to not more than 25" lbs. break away torque.

NOTE (cont'd)

If adjustment is too loose, loss of machine accuracy results. Too tight an adjustment squeezes out all lubricant and sliding ways are then subject to excessive wear and scoring.

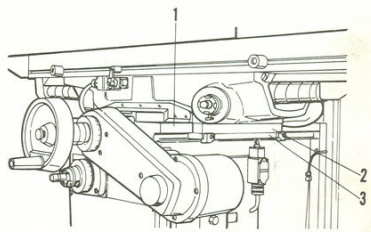


Figure 15. Adjusting Flat Saddle Gibs

1. Knee ways
2. Guide plate spacer
3. Flat gib

SADDLE-REMOVING AND REPLACING PARTS

40. ANGULAR HANDFEED SHAFT (figure 16).

Remove the angular handfeed shaft as follows:

1. Loosen the setscrew (11) and remove the handwheel assembly (12).
2. Take out the roll pin (9) and take off the dial clutch (10) and dial (8).
3. Take out the four capscrews (7) and pull out the complete angular shaft assembly (6). It may be necessary to rotate the shaft slightly to disengage the gear teeth.

41. ANGULAR HANDFEED HANDWHEEL

See paragraph 25 for servicing instructions.

42. REMOVING LONG. FEED DRIVE BELT (figures 16 & 17)

Remove the longitudinal feed drive belt as follows:

1. Remove the two table screw locknuts (4 & 10, figure 17). Loosen set screws (19, fig. 17).
2. Compress the ball screw shields (8, figure 17) and hold them compressed with a piece of wire.
3. Remove the stop dog (5, figure 16) and the left table end bracket (1, figure 17) by removing the four capscrews (2 & 3, figure 17).
4. Slide the table to the right to expose the nut on the ball screw assembly (5, figure 16). It is good practice to support the extended end of the table.

Photo 21

1. Button head screw
2. Screw shield cage
3. Timing belt
4. Drive pulley/shock absorber
5. Ball screw assy.
6. Angular shaft assy.
7. Socket head capscrew
8. Dial
9. Roll pin
10. Dial clutch
11. Set screw
12. Handwheel
13. Wiper screw
14. Rear saddle wiper
15. Front saddle wiper
16. Wiper screw
17. Rear gib screw
18. Tapered gib
19. Front gib screw
20. Gasket
21. Motor mtg. bracket
22. Motor pulley and feedback assy.
23. Socket head capscrew
24. Set screw
25. Knob
26. Snap ring
27. Outer cone pin
28. Drive pulley
29. Friction keys
30. Inner cone pin
31. Roll pin
32. Hydraulic motor and feedback
33. Spacers
34. Socket hd. cap screws

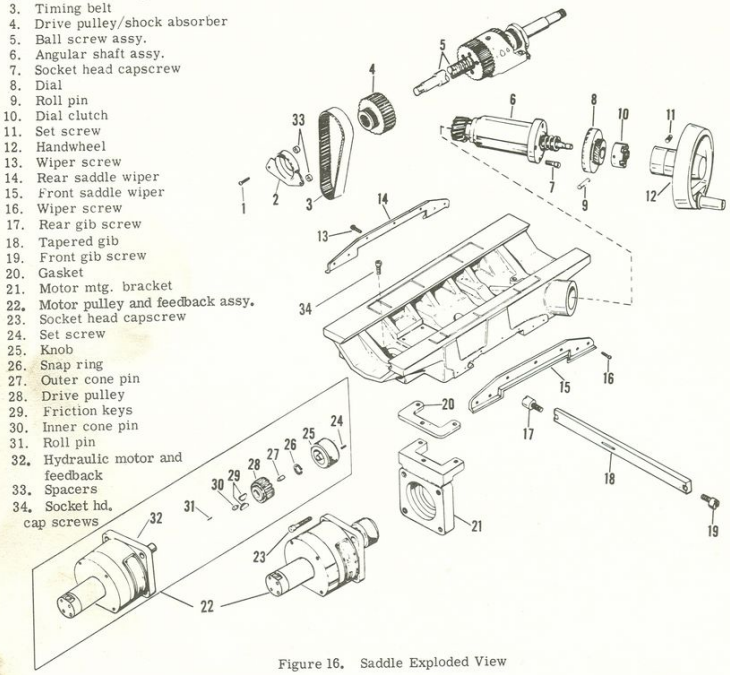


Figure 16. Saddle Exploded View

5. Remove the ball screw shield (8, figure 17) and the ball screw spacer (7, figure 17).

NOTE

All following reference numbers in this paragraph refer to figure 16.

6. Loosen the two socket screws (1) and remove the screw shield cage (2) and the two spacers (33).

7. Remove the fluid motor (see par. 43).

8. Slide off the timing belt (3).

9. Reassemble in reverse order. Be careful not to cut or damage belt in any way during reassembly.

43. REMOVING FLUID MOTOR AND CLUTCH (figure 16)

To remove the fluid motor and clutch proceed as follows:

1. Remove the setscrew (24) and the knob (25).

2. Remove the four socket head capscrews (23).

3. Tilt the motor and slide it out to disengage it from the timing belt.

Photo 22

4. Remove hydraulic hoses, marking before disconnection.

5. Take off the snap ring (26) and pull off the drive pulley (28).

6. Remove the two cone pins (27 &30) and the two keys (29).

44. CROSS AND LONGITUDINAL BALL SCREWS AND NUTS

The cross and longitudinal ball screws and nuts are critical assemblies and should be removed and replaced BY FACTORY PERSONNEL.

WARNING:

BALL SCREW AND NUT SHOULD NEVER BE DISENGAGED FROM EACH OTHER BY CUSTOMERS PERSONNEL. PERMANENT DAMAGE TO COMPONENTS WILL RESULT.

45. REPLACING TACHOMETER ON HYDRAULIC MOTOR

To replace tachometer on hydraulic motor follow instructions in paragraph 34.

TABLE-ADJUSTMENTS

46. GIB (figure 17)

Adjust the tapered table gib as follows:

1. Move the table to a point somewhere near center to gain access to the gib screws.

2. To tighten gib back off the gib screw (11) on the left end of the gib (12) and tighten gib screw (13) to 25 inch pounds. Retighten left gib screw so gib does not float.

NOTE

Special care should be taken to adjust the gibs. Because of the efficiency of the ball screws, the gibs can be easily over-tightened. Therefore, it is best to use a torque wrench and adjust to not more than 25" lbs. breakaway torque.

If adjustment is too loose, loss of machine accuracy results. Too tight an adjustment squeezes out all lubricant and sliding ways are then subject to excessive wear and scoring.

Legend - Figure 17

1. L. H. table bracket
2. Socket head screw
3. Socket head screw
4. Table screw locknut
5. Stop dog
6. Socket head screw
7. Ball screw spacer
8. Ball screw shield
9. Ball screw spacer
10. Table screw locknut
11. L. H. gib screw
12. Tapered gib
13. R. H. gib screw
14. R. H. table bracket
15. Socket head screw
16. Socket head screw
17. Switch dog plate
18. Socket head screw
19. Set screws
20. Socket hd. screw
21. Bracket
22. Socket hd. screw

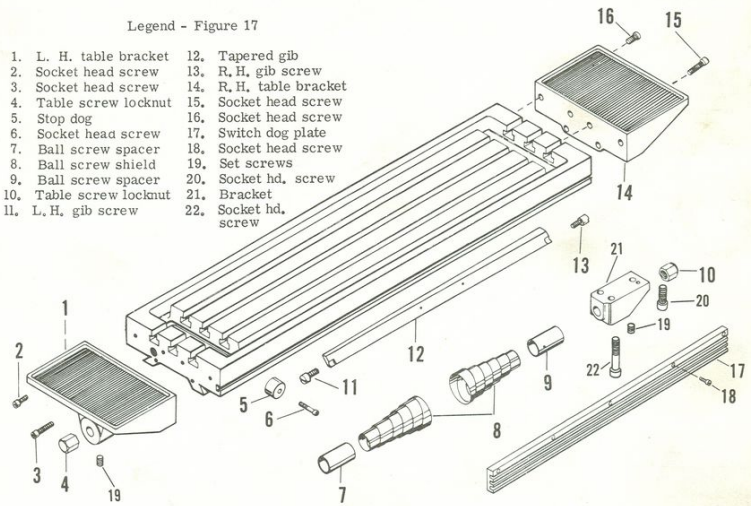


Figure 17. Removing Table

Photo 23

TABLE-REMOVING AND REPLACING PARTS

47. TABLE (figure 17)

Remove the table as follows:

1. Remove the two table screw locknuts (4 & 10) and loosen set screws (19).
2. Compress the two ball screw shields (8) and hold them compressed with a piece of wire.
3. Remove the stop dog (5) by taking out socket capscrew (6).
4. Remove the left table end bracket (1) by removing the six capscrews (2 & 3).
5. Rotate screw to disengage it from bracket (21). Remove the bracket (21) by removing the three capscrews (20 and 22).
6. Remove the two ball screw spacers (7 & 9) and the ball screw shield (8).
7. Remove the gib (12) by removing the right gib screw (13).
8. Remove the screws (17) holding the switch dog plate (18) to the table.
9. Slide table off the right side onto a support. Use a hoist to remove the table, or slide it out and onto "horses". Raise or lower the knee so table height matches height of the "horses".
10. Reassemble in reverse order.

RAM AND SPINDLE-ADJUSTMENTS

48. SPINDLE ANTI-BACKLASH (figure 18)

The spindle anti-backlash (5), is located directly above the spindle pulley, and provides a quick, positive means of controlling spindle backlash.

To adjust the anti-backlash proceed as follows:

1. Grasp the spindle (8) below the thrust collar (7) and sharply rotate it to left and right. The amount of backlash can be felt as you change from left to right rotation. As you rotate the spindle, pull it downward to determine freedom of vertical movement. A small amount of backlash is necessary so spindle vertical movement is not restricted.
2. If spindle binds during vertical movement or if backlash is excessive loosen the two locking setscrews (3).
3. Back off one adjusting setscrew (4) and tighten the other one. To reduce backlash, rotate the spindle dog (2) in the direction opposite to spindle rotation.
4. Lubricate the spindle splines several times a week, with Lubriplate (Fisk Refinery, N.J.)

49. ADJUSTING GUIDE RING (figure 22)

Adjust the guide ring so quill moves freely. Do so as follows:

1. When tightening the clamp ring adjusting screw (16), be sure that the guide ring (8) is all the way up in spindle nose.
2. With spindle feed hand lever, bring quill down 2 or 3 inches. Tighten screw (16) so that quill stays in place.
3. Now tap Allen wrench lightly until screw loosens just enough to permit quill to retract freely. If this clamp ring adjusting screw is too tight, the quill will bind. If too loose, heavy cutting will cause chatter and perhaps "cocking" of guide ring.

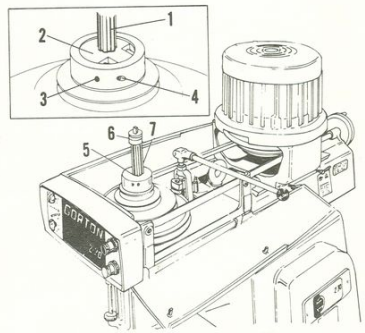


Figure 18. Spindle Anti-Backlash Adjustment

1. Spindle splines
2. Spindle dog
3. Locking setscrew
4. Adjusting setscrew
5. Spindle anti-backlash
6. Thrust collar
7. Spindle

Photo 24

50. SPINDLE DOWN FEED (figure 19)

If there is excessive float in the spindle hand feed lever, check and tighten the setscrew (6) in the housing below the hand feed shaft and the setscrew (5) in the collar behind the crank.

The torque output, using the power down feed should be sufficient to drill a 3/4 inch hole in cast iron. If this is not possible the overriding slip clutch may have lost its torque output due to lengthy usage. Replace the slip clutch (paragraph 53).

The direction selector toggle switch must be in the "OFF" position and the feed rate selector must be in "CLICK-OFF" position when the unit is not in use.

51. SPINDLE BRAKE (figure 19)

Adjust the spindle brake as follows:

1. Move the brake lever (3) as far as possible toward the front of machine (clamped position).
2. Loosen the socket cap screw (1) in the brake lever hub (2) and use a wedge to open the split in the hub so the brake lever can be moved.
3. Move the brake lever toward the rear (about to the center, between front and rear, of the machine) and retighten the cap screw.

52. ADJUSTING TRACER BRACKET GIBS (See pages P-40 and P-41)

These gibs must be adjusted by loosening the locking nuts and adjusting the socket setscrews equally to obtain a slight drag when the screw on that axis is rotated.

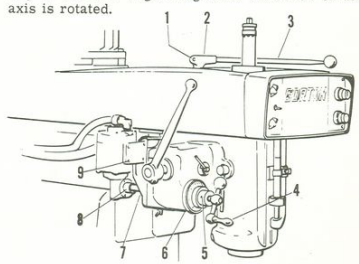


Figure 19. Spindle Feed and Brake Adjustment

1. Socket cap screw
2. Brake lever hub
3. Spindle brake lever
4. Spindle hand feed lever
5. Setscrew (collar)
6. Setscrew (housing)
7. Setscrew (shaft)
8. Setscrew (clutch)
9. Cap screws

RAM AND SPINDLE-REMOVING AND REPLACING PARTS

53. REPLACING SLIP CLUTCH (figure 19)

Replace the slip clutch as follows:

1. Back off the setscrew (7) on motor gear box shaft.
2. Remove the four cap screws (9) holding the motor to bracket.
3. Loosen setscrew (8) in slip clutch and remove the clutch.

CAUTION

In reassembly a few thousandths misalignment is permissible and will be compensated for by the slip clutch. Greater misalignment will load the motor so manual output torque will be diminished.

54. RAM

Remove ram head assembly as follows:

1. Move ram to mid position.
2. Remove the two clamping nuts (figure 1).
3. Follow same procedure as for moving the machine. (See par. 4). Move motor to balance ram. Lift straight up.
4. Place on a support protecting lower surface of ram. On reassembly be sure the pinion gear teeth engage properly with rack teeth on top of column.

55. REMOVING SPINDLE (figure 20 and 21)

The cutter spindle requires no adjustment. It requires no attention other than correct lubrication. If an irregular pattern develops during face milling, or if play should develop after a long period of service, the super-precision ball bearings which are fixed pre-load should be replaced by bearings of the same type from the Gorton Machine Corporation, which will put the spindle in "like new" condition.

NOTE

It is strongly recommended that spindles requiring service be returned to the factory for expert attention. However, if it is necessary to replace bearings in the field, do so as follows:

1. Bring spindle down approximately 2-1/2 inches and lock spindle in place with spindle locking lever (7).

Photo 25

2. Move the table to approximately four inches below spindle nose. Place wood block (5) on table to protect top.

3. Remove micrometer depth stop bracket assembly (1) by removing two socket head cap screws.

4. Remove depth stop attached to front of spindle behind the bracket.

5. At top of spindle pulley housing there is a round cover or plate. Remove four screws and take off this plate. Mark spline shaft and housing for correct mating during re-assembly.

6. Secure two wood blocks or parallels (3) of exactly the same height. Place one on each side of the extended spindle nose (4) and under the spindle sleeve bushing (2) which is under spring tension.

7. Raise the table until the two parallels are in contact with the lower edge of the spindle sleeve bushing. Put match marks on bottom edge of spindle sleeve bushing and lower edge of spindle housing for locating during re-assembly.

8. Remove the guide ring adjusting screw (8, figure 20) and drive a soft metal wedge in slot at rear of spindle housing thereby releasing the spindle sleeve bushing.

9. The spindle guide ring (2) and retaining spring (6) are now ready for removal by slowly lowering the table. Make sure the spindle guide ring follows down with the table. Continue lowering the table until guide ring bushing and spring are completely free.

10. Remove the blocks (3), spindle sleeve bushing (2) and spring (6).

11. Place another block (or blocks) of wood under the spindle nose (2, figure 21). Raise the table until block comes in contact with spindle nose.

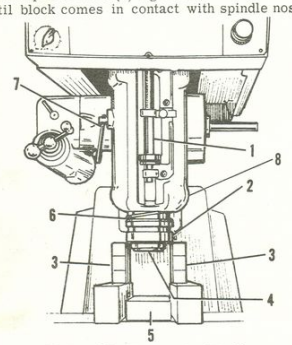


Figure 20. Removing Spindle

1. Micrometer depth stop assembly
2. Spindle sleeve bushing
3. Parallels
4. Spindle nose
5. Wood block
6. Retaining spring
7. Spindle locking lever
8. Guide ring adjusting screw.

12. Release spindle locking lever and again lower the table. As spindle sleeve (1) comes down, spindle feed levers will also come down. Note the approximate angle of the spindle feed levers when the spindle rack and pinion let go. (When reassembling spindle, the spindle feed levers should be held at the same approximate angle when reengaging the rack and pinion).

13. Continue lowering table until the spindle sleeve is completely free of housing.

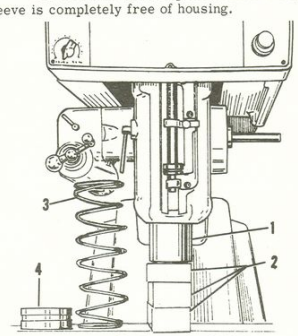


Figure 21. Removing Spindle

1. Spindle sleeve
2. Wood block(s)
3. Spring removed
4. Spindle guide ring

56. SPINDLE BEARINGS (figure 22)

Replace spindle ball bearings as follows:

1. Remove the spindle (paragraph 55).

2. Disengage the tang on lockwasher (11) from ball bearing thrust nut (10) and remove the nut (10) inside the top of spindle quill or barrel (14).

3. Remove the large slotted ring nut (5, L. H. thread) which is in the lower end of spindle sleeve.

IMPORTANT--Before removing or moving the spacer (13) which separates upper (12) and lower (15) bearings, be sure to inscribe match lines on both spacer end and spindle. When re-assembling, make doubly sure that these lines are rematched accurately.

4. Remove spindle (6) and press lower bearings (15) out from top and upper bearings out from bottom of quill using the spacer.

57. INSTALLING SPINDLE AND SPINDLE BEARINGS (figure 22)

Install spindle and spindle bearings as follows:

Photo 26

1. When installing new bearings, place the stamped thrust faces of the two outer races together. Also match the "balance" marks on both inner and outer races. Slide bearings (15) down spindle shaft (6) to nose. They should slide with a light "press" fit. When bearings are in place, tap spindle nose gently on wood to seat both bearings.

2. Insert spindle (6) in spindle barrel (14) and install spacer (13), being sure that match marks you made line up.

3. Install upper set of ball bearings (12) in the same manner as for those at spindle nose.

4. Install lockwasher (11) and bearing nut (10). Tighten this nut, then reverse position of spindle and sleeve, and re-install the large slotted ring nut (5, L. H. thread).

5. Lay spindle assembly on its side in a V-block. Check the runout on the O. D. of the spline shaft at its end with a dial indicator. This shaft must be concentric within .001" of total indicator reading.

6. If run-out is greater, find the low spot on the spline shaft and mark the exposed face of the nut in line with the low spot on the spline shaft.

7. Remove nut (10) and file or scrape at the spot marked, but on the opposite face of the nut until the spline shaft runs within the .001" tolerance. Be sure the tang of lockwasher is inserted in slot on the bearing nut. Tightness of the bearing nut does not affect bearing pre-load.

8. To install the spindle, reverse the procedure in paragraph 51. Make sure that the brass plug (3) at the end of the spindle locking screw (2) does not protrude into the spindle bore. Be sure to match mating marks on spline shaft and housing (paragraph 51, step 5). Also make sure that spindle feed levers are at approximately the same angle as described in paragraph 51, step 12.

9. Adjust guide ring (paragraph 46).

58. PULLEY HOUSING BEARINGS (figure 23)

To replace the pulley housing bearings proceed as follows:

1. Remove the V-belt (See Operator's Manual).

2. Remove brake assembly (paragraph 51).

3. Take out the four slotted head screws (1) from the retainer cover (2) and remove the cover.

4. Remove the four cap screws (3) holding the anti-backlash housing (4) to the spindle pulley (5) and remove housing.

5. Loosen the lockwasher (7) and locknut (6) holding pulley (5) to spline drive (8).

NOTE

Mark spindle spline and driving spline, so that the same splines will be mated during re-assembly.

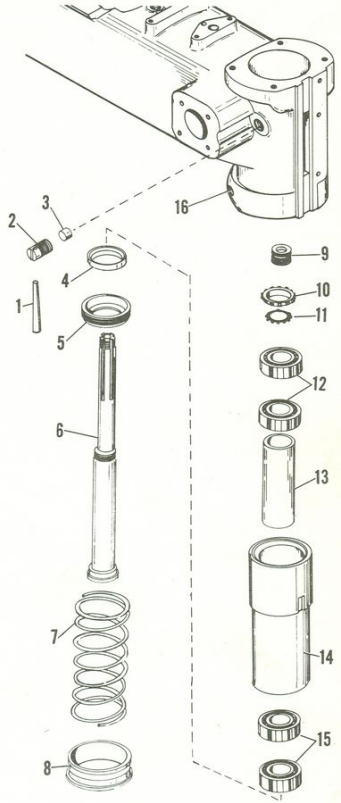


Figure 22. Spindle Assembly

1. Handle
2. Lock screw
3. Brass plug
4. Oil retainer
5. Ring nut (L. H. thd.)
6. Spindle
7. Spindle spring
8. Guide ring
9. Thrust collar
10. Ball bearing nut
11. Lockwasher
12. Upper spindle bearings
13. Spacer
14. Spindle barrel
15. Lower spindle bearings
16. Guide ring adj. screw

Photo 27

6. Lift pulley (5) up and out of machine.

7. Remove four cap screws (14) holding the bearing mount (16) to pulley shield. Remove four cap screws (15) holding bearing mount to top of the spindle bore and remove the mount with bearings inside.

8. Remove the nut (9, R. H. thread) holding the upper bearing (10) in place.

9. Invert the bearing mount and press or tap on the bottom bearing (now on top) to remove upper bearing (10), two spacers (11, 12), splined drive (8) and lower bearing (13).

10. Remove the splined drive from the bearings.

11. Install new bearings so that the thrust faces and match marks are together.

12. Re-assemble in reverse order of disassembly.

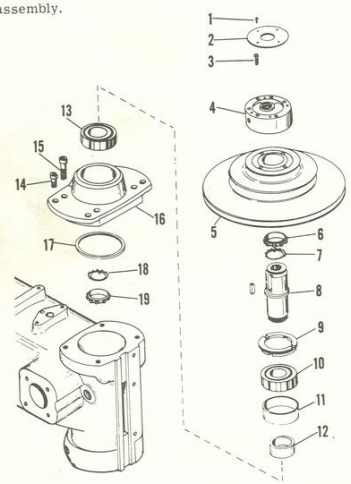


Figure 23. Replacing Pulley Housing Bearings

Legend - Figure 23

1. Cover screws
2. Retainer cover
3. Cap screws
4. Anti-backlash assy.
5. Pulley
6. Locknut
7. Lockwasher
8. Spline drive
9. Brg. nut (R. H. thd.)
10. Upper bearing
11. Brg. spacer (outer)
12. Brg. spacer (inner)
13. Lower bearing
14. Capscrew (pulley shld.)
15. Capscrew (spdle. bore)
16. Bearing mount
17. Bumper washer
18. Bearing lockwasher
19. Bearing locknut

NOTE

On re-assembly it may be necessary to move bearing mount (16) so pulley spline passes through driving spline with equal clearance in 360 degrees of rotation. This clearance can be easily checked by grasping splined shaft and, with rapid back and forth rotation, check backlash between the splines. Rotate the spindle 45 degrees and recheck. Do this until the complete circumference of the spindle has been checked.

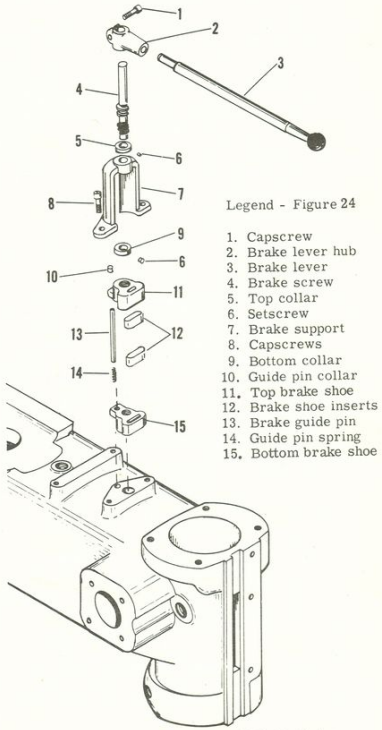


Figure 24. Replacing Spindle Brake

Legend - Figure 24

1. Capscrew
2. Brake lever hub
3. Brake lever
4. Brake screw
5. Top collar
6. Setscrew
7. Brake support
8. Capscrews
9. Bottom collar
10. Guide pin collar
11. Top brake shoe
12. Brake shoe inserts
13. Brake guide pin
14. Guide pin spring
15. Bottom brake shoe

Photo 28

59. BRAKE SHOES (figure 24)

To remove and replace the brake shoes proceed as follows:

1. Loosen the cap screw (1) holding the brake lever hub (2) and slide the assembled brake lever and hub up and off of the brake screw.
2. Loosen the setscrew (6) in the bottom brake screw collar (9) which is located above the top brake shoe (11).
3. Turn the brake screw (4) so the shoes are in the maximum open position.
4. Remove the two cap screws (8) holding the brake support (7).
5. Tilt the brake assembly forward and remove the complete assembly.
6. Loosen the setscrew (6) in the top brake screw collar (5) and remove the brake guide pin (13) and brake shoes (11, 15).
7. Re-assemble in reverse order of disassembly. When re-assembling, rotate brake guide pin to bring the new brake shoes together on the pulley and tighten setscrews in top and bottom collars (5, 9).

ELECTRIC TRACER HEAD, OPERATING CONTROLS AND SOLID STATE CONTROL - ADJUSTMENTS

For adjustment procedures on the electric tracer head, operating controls and solid state control see the Pegasus manual shipped with the machine.

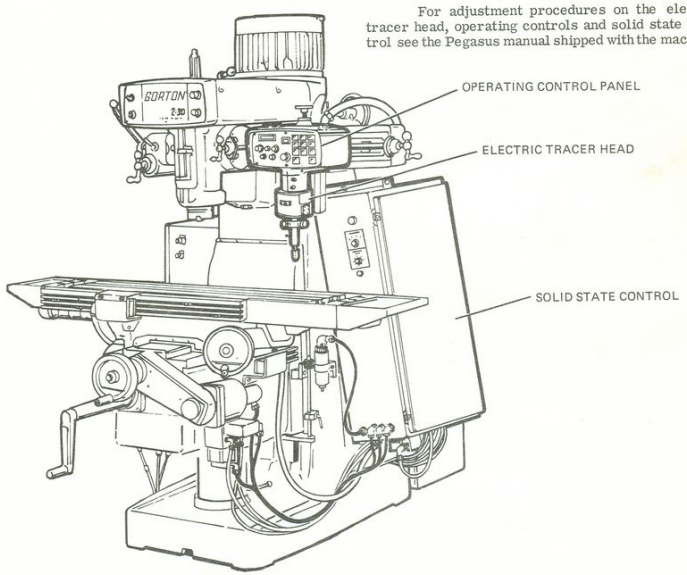
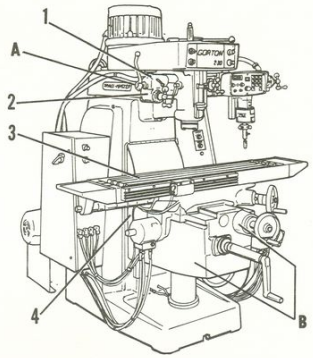


Figure 25. Electric Tracer Head, Operating Controls and Solid State Controls

Photo 29

LUBRICATION



A--SPINDLE DOWNFEED GEAR BOX

Spindle downfeed gear box lubricated at factory. If disassembled, repack with Pate Oil Andox M275 grease.

60. LUBRICATION

The 2-30 Auto-Trace-Master must be properly lubricated before placing in operation and during operation to insure continued trouble-free operation. The illustrations locate lubrication points on the machine and the lubrication plate. Due to the advanced design, a minimum number of units require daily attention. However, adherence to the lubrication schedule is of major importance in obtaining maximum performance and long life of the machine.

1. SPINDLE DOWNFEED MOTOR

Spindle downfeed motor bearings are lubricated at factory--for two (2) year period. When repacking use Socony BRB #4 or Sun Oil Prestige #42. Repeat at two (2) year intervals.

2. SPINDLE DOWNFEED GEAR CASE

Spindle downfeed gear case lubricated at factory--for two (2) year period. When re-packing use Socony Mobilplex EP-24 or Sun Oil Prestige 740 AEP. Repeat at two (2) year intervals.

3., 4. SADDLE/TABLE AND KNEE/COLUMN

The knee, saddle and table way surfaces are automatically lubricated from a solenoid operated pump reservoir system located in the front section of the knee. Operation is entirely automatic - controlled by a timer located in main electrical cabinet.

The system is actuated when hydraulic power unit is turned on.

A float operated microswitch which is connected to the Tell Tale red light is used to show when oil level is low. It is necessary to refill the knee reservoir through the filler cap (right side) up to the sight gage so that the machine, through its electrical interlocks, does not become inoperative.

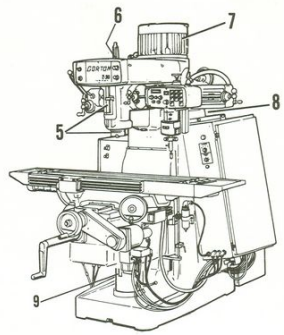
Fill reservoir with Socony Vactra #4 or Sun Oil SWL #90.

Photo 30

LUBRICATION

B--BEARINGS

Vertical elevate, cross feed and longitudinal feed screw thrust bearings. If disassembled, repack with Pate Oil Andox C grease.



5. SPINDLE BARREL AND DEPTH STOP

The spindle barrel and depth stop should be thoroughly cleaned and lightly oiled once a week. Use Socony Velocity #10 or Sun Oil Solnus #70.

NOTE: At same time lubricate spindle (6) with Fisk Refining Lubriplate.

6. CUTTER SPINDLE

The cutter spindle bearings are permanently grease packed and do not require replenishment or change.

7. SPINDLE DRIVE MOTOR

Spindle drive motor bearings are lubricated at factory. Requires no additional lubrication.

8. LUBRICATION PLATE

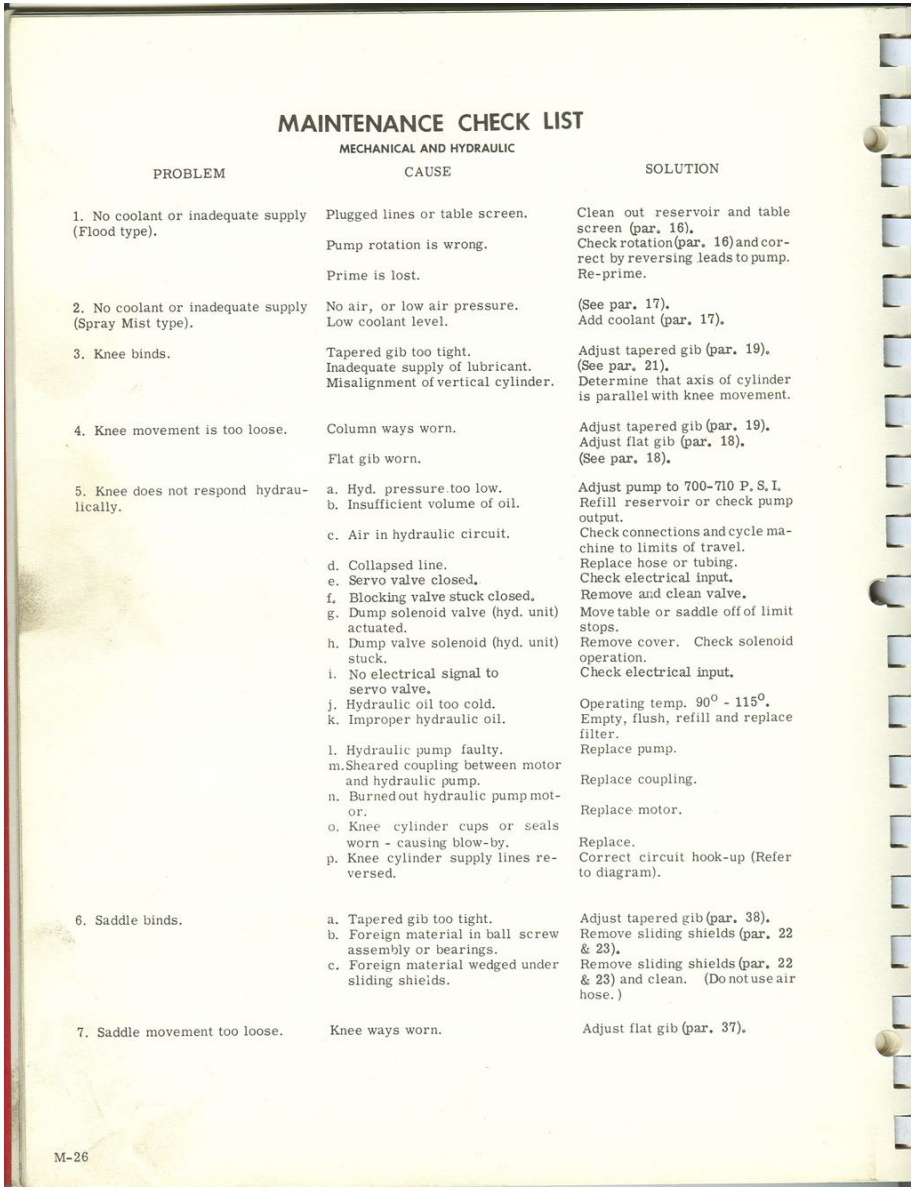
The lubrication plate which indicates type and frequency of lubrication as outlined above, is located on rear curved section of column.

For maximum efficiency and minimum downtime, always follow the directions as outlined. It is important to use fresh, clean lubricants at all times and to follow the specifications. Specific lubricants have been developed through extensive testing. Do not substitute unless equivalent product is available.

9. BALLSCREW FEEDBACK

Lubricate with STP every 6 months (See paragraph 33).

Photo 31

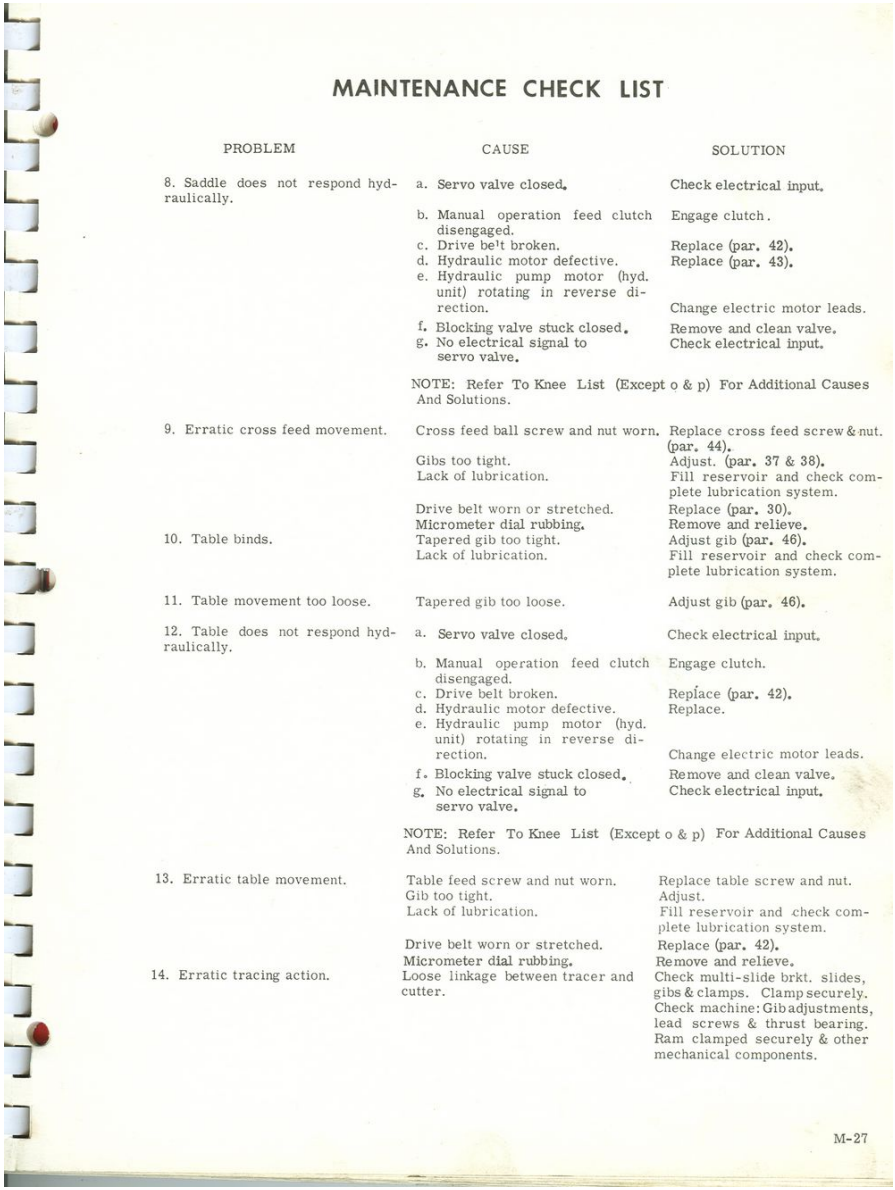


MAINTENANCE CHECK LIST

MECHANICAL AND HYDRAULIC

PROBLEM	CAUSE	SOLUTION
1. No coolant or inadequate supply (Flood type).	Plugged lines or table screen.	Clean out reservoir and table screen (par. 16).
	Pump rotation is wrong.	Check rotation (par. 16) and correct by reversing leads to pump.
	Prime is lost.	Re-prime.
2. No coolant or inadequate supply (Spray Mist type).	No air, or low air pressure.	(See par. 17).
	Low coolant level.	Add coolant (par. 17).
3. Knee binds.	Tapered gib too tight.	Adjust tapered gib (par. 19).
	Inadequate supply of lubricant.	(See par. 21).
	Misalignment of vertical cylinder.	Determine that axis of cylinder is parallel with knee movement.
4. Knee movement is too loose.	Column ways worn.	Adjust tapered gib (par. 19).
		Adjust flat gib (par. 18).
	Flat gib worn.	(See par. 18).
5. Knee does not respond hydraulically.	a. Hyd. pressure too low.	Adjust pump to 700-710 P. S. I.
	b. Insufficient volume of oil.	Refill reservoir or check pump output.
	c. Air in hydraulic circuit.	Check connections and cycle machine to limits of travel.
	d. Collapsed line.	Replace hose or tubing.
	e. Servo valve closed.	Check electrical input.
	f. Blocking valve stuck closed.	Remove and clean valve.
	g. Dump solenoid valve (hyd. unit) actuated.	Move table or saddle off of limit stops.
	h. Dump valve solenoid (hyd. unit) stuck.	Remove cover. Check solenoid operation.
	i. No electrical signal to servo valve.	Check electrical input.
	j. Hydraulic oil too cold.	Operating temp. 90^{o} - 115^{o}.
	k. Improper hydraulic oil.	Empty, flush, refill and replace filter.
	l. Hydraulic pump faulty.	Replace pump.
	m. Sheared coupling between motor and hydraulic pump.	Replace coupling.
	n. Burned out hydraulic pump motor.	Replace motor.
	o. Knee cylinder cups or seals worn - causing blow-by.	Replace.
	p. Knee cylinder supply lines reversed.	Correct circuit hook-up (Refer to diagram).
6. Saddle binds.	a. Tapered gib too tight.	Adjust tapered gib (par. 38).
	b. Foreign material in ball screw assembly or bearings.	Remove sliding shields (par. 22 & 23).
	c. Foreign material wedged under sliding shields.	Remove sliding shields (par. 22 & 23) and clean. (Do not use air hose.)
7. Saddle movement too loose.	Knee ways worn.	Adjust flat gib (par. 37).

Photo 32



MAINTENANCE CHECK LIST

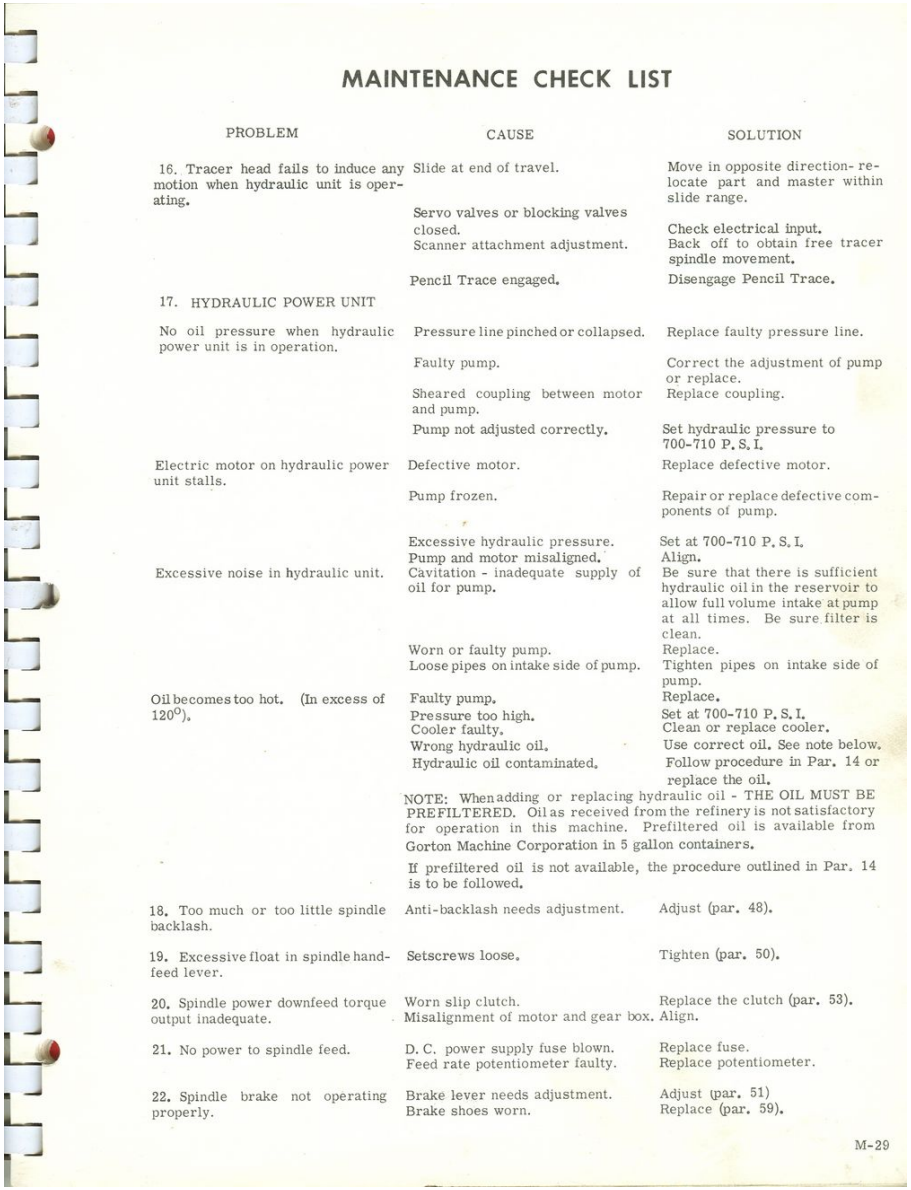
PROBLEM	CAUSE	SOLUTION
8. Saddle does not respond hydraulically.	a. Servo valve closed.	Check electrical input.
	b. Manual operation feed clutch disengaged.	Engage clutch.
	c. Drive belt broken.	Replace (par. 42).
	d. Hydraulic motor defective.	Replace (par. 43).
	e. Hydraulic pump motor (hyd. unit) rotating in reverse direction.	Change electric motor leads.
	f. Blocking valve stuck closed.	Remove and clean valve.
	g. No electrical signal to servo valve.	Check electrical input.
	NOTE: Refer To Knee List (Except o & p) For Additional Causes And Solutions.	
9. Erratic cross feed movement.	Cross feed ball screw and nut worn.	Replace cross feed screw & nut. (par. 44).
	Gibs too tight.	Adjust. (par. 37 & 38).
	Lack of lubrication.	Fill reservoir and check complete lubrication system.
	Drive belt worn or stretched.	Replace (par. 30).
	Micrometer dial rubbing.	Remove and relieve.
10. Table binds.	Tapered gib too tight.	Adjust gib (par. 46).
	Lack of lubrication.	Fill reservoir and check complete lubrication system.
11. Table movement too loose.	Tapered gib too loose.	Adjust gib (par. 46).
12. Table does not respond hydraulically.	a. Servo valve closed.	Check electrical input.
	b. Manual operation feed clutch disengaged.	Engage clutch.
	c. Drive belt broken.	Replace (par. 42).
	d. Hydraulic motor defective.	Replace.
	e. Hydraulic pump motor (hyd. unit) rotating in reverse direction.	Change electric motor leads.
	f. Blocking valve stuck closed.	Remove and clean valve.
	g. No electrical signal to servo valve.	Check electrical input.
	NOTE: Refer To Knee List (Except o & p) For Additional Causes And Solutions.	
13. Erratic table movement.	Table feed screw and nut worn.	Replace table screw and nut.
	Gib too tight.	Adjust.
	Lack of lubrication.	Fill reservoir and check complete lubrication system.
	Drive belt worn or stretched.	Replace (par. 42).
	Micrometer dial rubbing.	Remove and relieve.
14. Erratic tracing action.	Loose linkage between tracer and cutter.	Check multi-slide brkt. slides, gibs & clamps. Clamp securely. Check machine: Gib adjustments, lead screws & thrust bearing. Ram clamped securely & other mechanical components.

Photo 33

MAINTENANCE CHECK LIST

PROBLEM	CAUSE	SOLUTION
14. Erratic tracing action. (Cont'd).	Hydraulic pressure too high (pulsation).	Set at 700-710 P. S. I.
	Torque or flex between tracer and cutter.	Torque or flex between tracer & cutter increases as dimension between the two increases. Keep dimension to a minimum & be sure tracer is firmly clamped.
	Vibration in machine.	Machine vibration can induce a secondary vibration into the tracer spindle, thereby causing tracer shaft to oscillate. The use of lightweight tracing finger will minimize the tendency for a secondary vibration, and subsequent chatter. Eliminate vibration in machine.
	Loose tracing stylus in spindle of tracer.	Be certain that shank of stylus is seated firmly within tracer spindle.
15. Variations between template and machined parts.	Eccentric tracing stylus.	The spindle of the tracer is free to rotate, and any eccentricty in tracing stylus will be duplicated in the finished part, accordingly. Use only concentric tracing stylus.
	Bent tracer spindle or tracing stylus.	A bent spindle, free to rotate within the tracer, will induce the effect of eccentricity into the tracing stylus. Straighten or replace bent spindle and/or tracing stylus.
	Loose linkage between tracer and cutter.	Return to factory for replacement/repair.
	Cutter deflection.	This is generally recognized by oversize or tapered cut, and can be eliminated only by better cutting practice.
	Template or work-piece not securely held on holding surface.	Clamp template and work-piece securely.
	Inaccuracies in machine.	Inaccuracies in the machine, such as play in machine spindle, fish-tail of tracer-controlled member, etc. Precision duplicating can be accomplished only if the machine is properly adjusted.
	Method of tracing cavities.	When tracing cavities where extremely close precision is required, it is generally recommended that the tracer climb up a cavity wall, rather than to trace down a cavity wall.

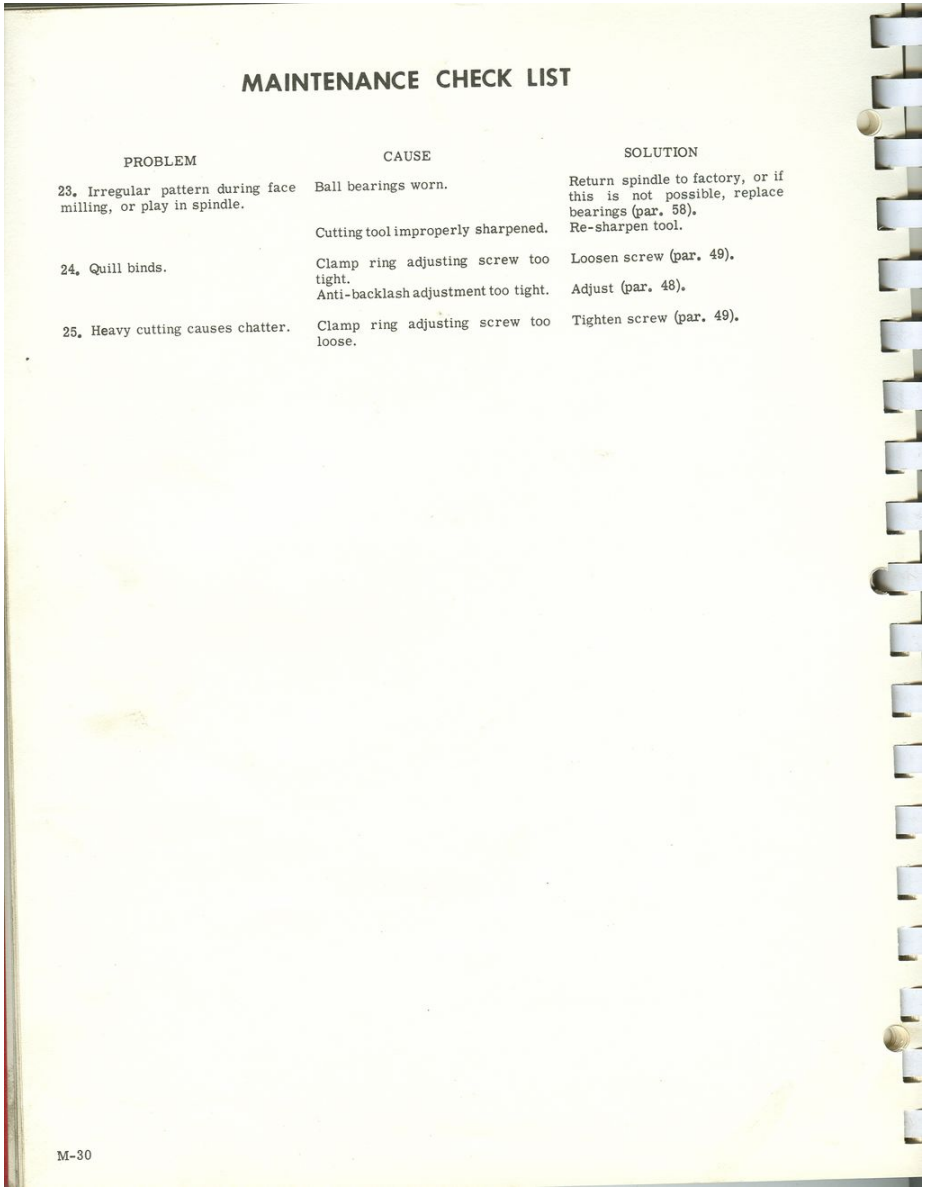
Photo 34



MAINTENANCE CHECK LIST

PROBLEM	CAUSE	SOLUTION
16. Tracer head fails to induce any motion when hydraulic unit is operating.	Slide at end of travel.	Move in opposite direction- relocate part and master within slide range.
	Servo valves or blocking valves closed.	Check electrical input.
	Scanner attachment adjustment.	Back off to obtain free tracer spindle movement.
	Pencil Trace engaged.	Disengage Pencil Trace.
17. HYDRAULIC POWER UNIT		
No oil pressure when hydraulic power unit is in operation.	Pressure line pinched or collapsed.	Replace faulty pressure line.
	Faulty pump.	Correct the adjustment of pump or replace.
	Sheared coupling between motor and pump.	Replace coupling.
	Pump not adjusted correctly.	Set hydraulic pressure to 700-710 P. S. I.
Electric motor on hydraulic power unit stalls.	Defective motor.	Replace defective motor.
	Pump frozen.	Repair or replace defective components of pump.
	Excessive hydraulic pressure.	Set at 700-710 P. S. I.
	Pump and motor misaligned.	Align.
Excessive noise in hydraulic unit.	Cavitation - inadequate supply of oil for pump.	Be sure that there is sufficient hydraulic oil in the reservoir to allow full volume intake at pump at all times. Be sure filter is clean.
	Worn or faulty pump.	Replace.
	Loose pipes on intake side of pump.	Tighten pipes on intake side of pump.
Oil becomes too hot. (In excess of 120^{0}).	Faulty pump.	Replace.
	Pressure too high.	Set at 700-710 P. S. I.
	Cooler faulty.	Clean or replace cooler.
	Wrong hydraulic oil.	Use correct oil. See note below.
	Hydraulic oil contaminated.	Follow procedure in Par. 14 or replace the oil.
	NOTE: When adding or replacing hydraulic oil - THE OIL MUST BE PREFILTERED. Oil as received from the refinery is not satisfactory for operation in this machine. Prefiltered oil is available from Gorton Machine Corporation in 5 gallon containers.	
	If prefiltered oil is not available, the procedure outlined in Par. 14 is to be followed.	
18. Too much or too little spindle backlash.	Anti-backlash needs adjustment.	Adjust (par. 48).
19. Excessive float in spindle hand-feed lever.	Setscrews loose.	Tighten (par. 50).
20. Spindle power downfeed torque output inadequate.	Worn slip clutch.	Replace the clutch (par. 53).
	Misalignment of motor and gear box.	Align.
21. No power to spindle feed.	D. C. power supply fuse blown.	Replace fuse.
	Feed rate potentiometer faulty.	Replace potentiometer.
22. Spindle brake not operating properly.	Brake lever needs adjustment.	Adjust (par. 51)
	Brake shoes worn.	Replace (par. 59).

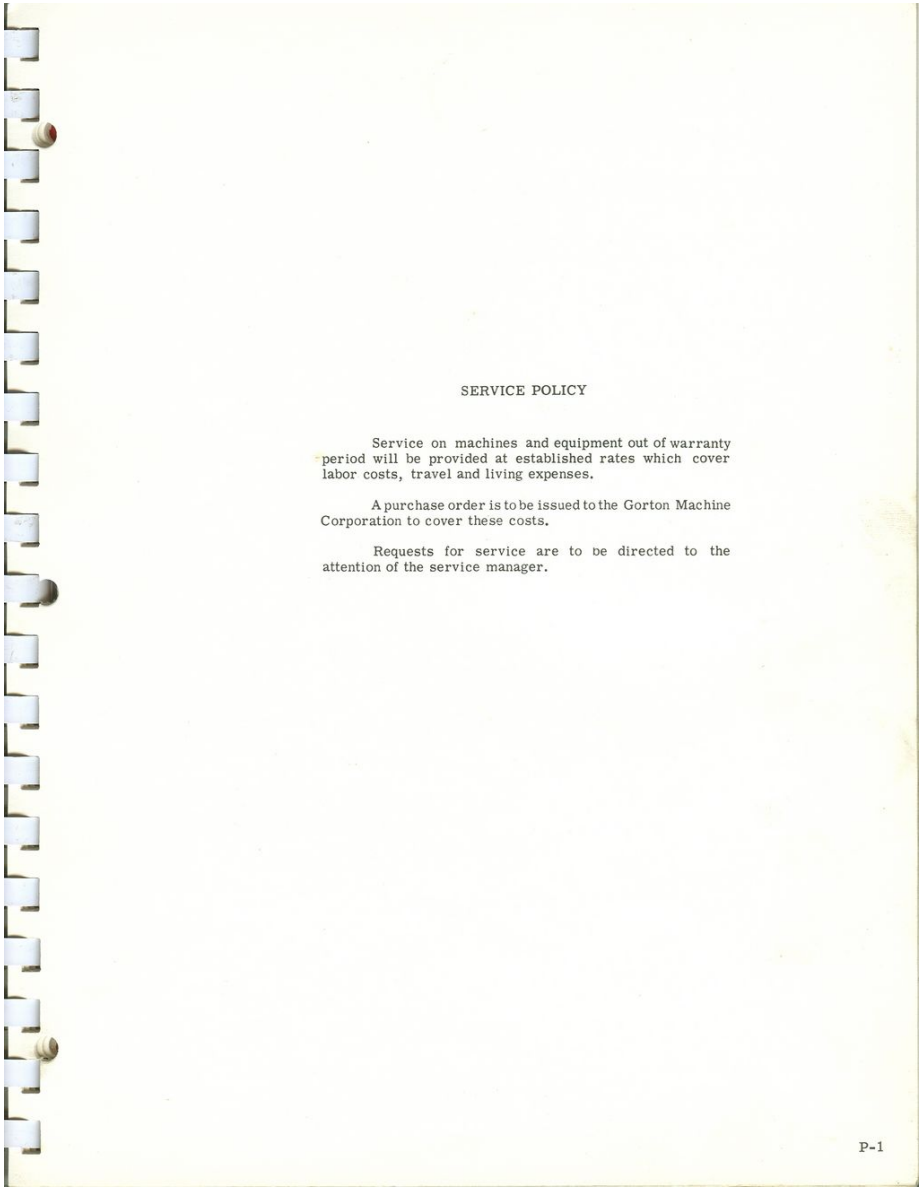
Photo 35



MAINTENANCE CHECK LIST

PROBLEM	CAUSE	SOLUTION
23. Irregular pattern during face milling, or play in spindle.	Ball bearings worn.	Return spindle to factory, or if this is not possible, replace bearings (par. 58).
	Cutting tool improperly sharpened.	Re-sharpen tool.
24. Quill binds.	Clamp ring adjusting screw too tight.	Loosen screw (par. 49).
	Anti-backlash adjustment too tight.	Adjust (par. 48).
25. Heavy cutting causes chatter.	Clamp ring adjusting screw too loose.	Tighten screw (par. 49).

Photo 36



SERVICE POLICY

Service on machines and equipment out of warranty period will be provided at established rates which cover labor costs, travel and living expenses.

A purchase order is to be issued to the Gorton Machine Corporation to cover these costs.

Requests for service are to be directed to the attention of the service manager.

P-1

Photo 37

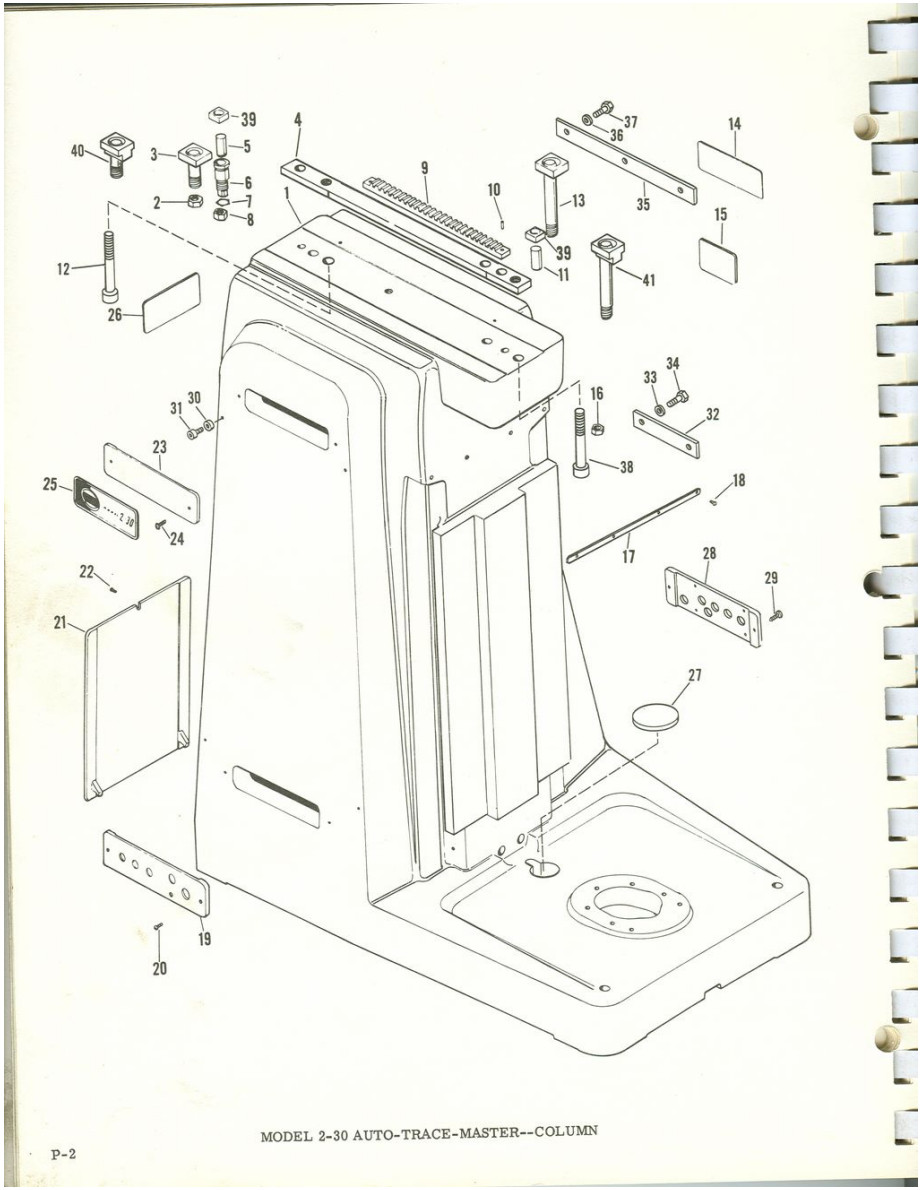
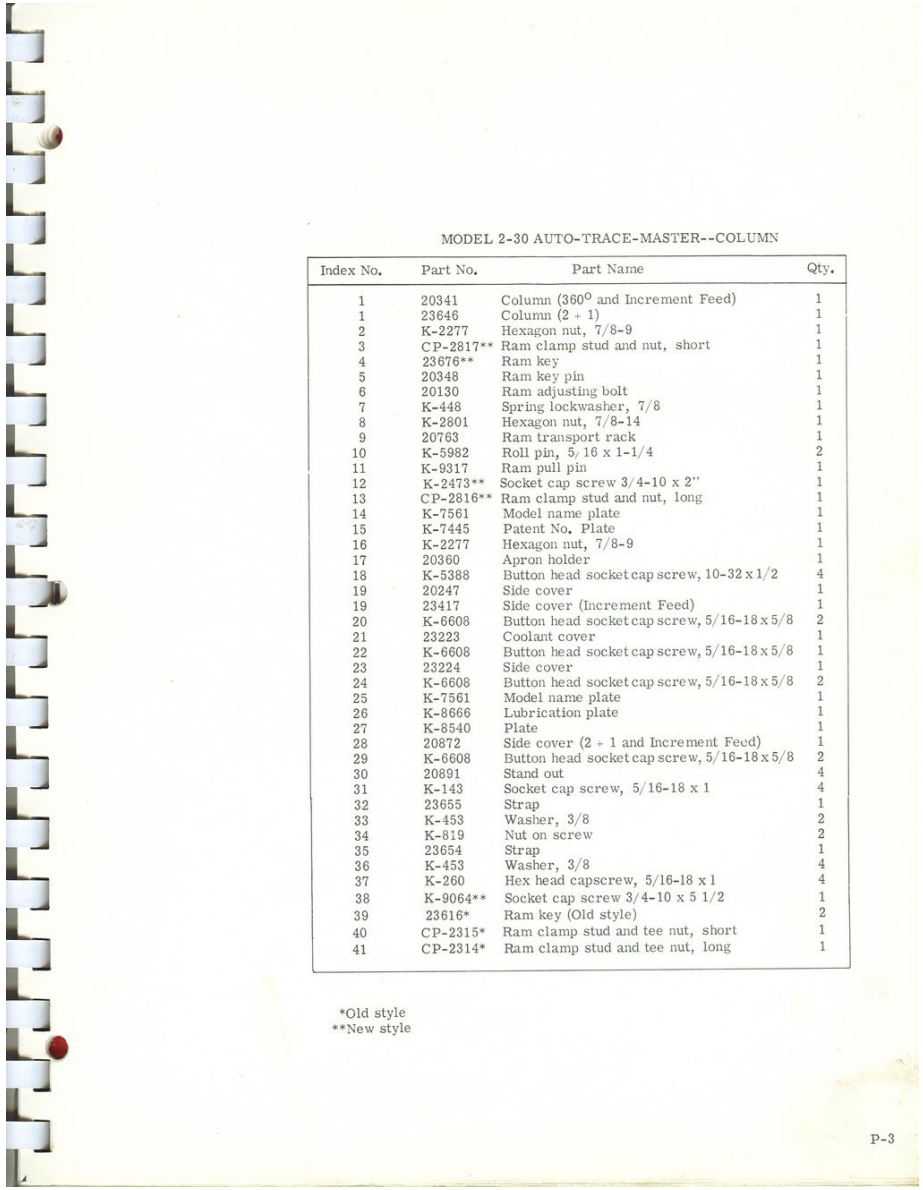


Photo 38

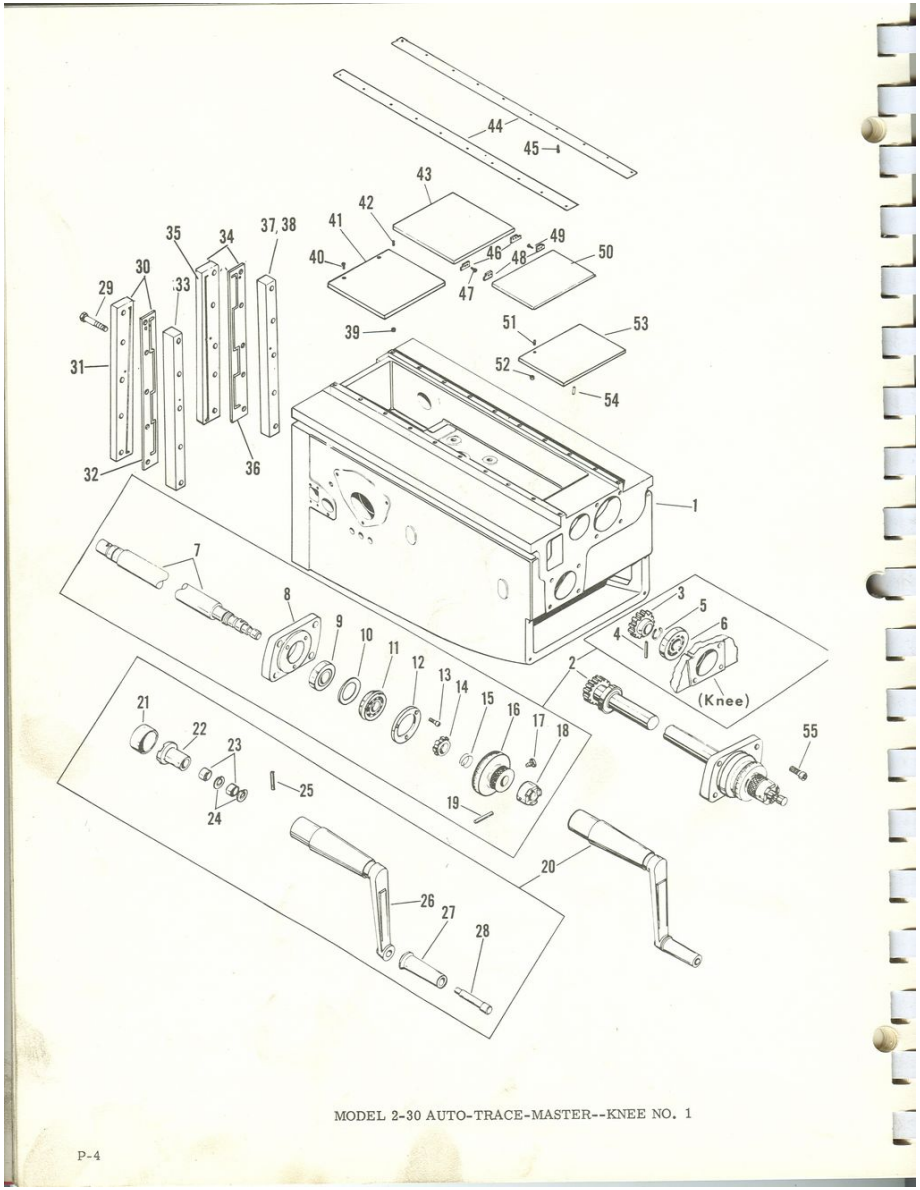


MODEL 2-30 AUTO-TRACE-MASTER--COLUMN

Index No.	Part No.	Part Name	Qty.
1	20341	Column (360° and Increment Feed)	1
1	23646	Column (2 + 1)	1
2	K-2277	Hexagon nut, 7/8-9	1
3	CP-2817**	Ram clamp stud and nut, short	1
4	23676**	Ram key	1
5	20348	Ram key pin	1
6	20130	Ram adjusting bolt	1
7	K-448	Spring lockwasher, 7/8	1
8	K-2801	Hexagon nut, 7/8-14	1
9	20763	Ram transport rack	1
10	K-5982	Roll pin, 5/16 x 1-1/4	2
11	K-9317	Ram pull pin	1
12	K-2473**	Socket cap screw 3/4-10 x 2"	1
13	CP-2816**	Ram clamp stud and nut, long	1
14	K-7561	Model name plate	1
15	K-7445	Patent No. Plate	1
16	K-2277	Hexagon nut, 7/8-9	1
17	20360	Apron holder	1
18	K-5388	Button head socket cap screw, 10-32 x 1/2	4
19	20247	Side cover	1
19	23417	Side cover (Increment Feed)	1
20	K-6608	Button head socket cap screw, 5/16-18 x 5/8	2
21	23223	Coolant cover	1
22	K-6608	Button head socket cap screw, 5/16-18 x 5/8	1
23	23224	Side cover	1
24	K-6608	Button head socket cap screw, 5/16-18 x 5/8	2
25	K-7561	Model name plate	1
26	K-8666	Lubrication plate	1
27	K-8540	Plate	1
28	20872	Side cover (2 + 1 and Increment Feed)	1
29	K-6608	Button head socket cap screw, 5/16-18 x 5/8	2
30	20891	Stand out	4
31	K-143	Socket cap screw, 5/16-18 x 1	4
32	23655	Strap	1
33	K-453	Washer, 3/8	2
34	K-819	Nut on screw	2
35	23654	Strap	1
36	K-453	Washer, 3/8	4
37	K-260	Hex head capscrew, 5/16-18 x 1	4
38	K-9064**	Socket cap screw 3/4-10 x 5 1/2	1
39	23616*	Ram key (Old style)	2
40	CP-2315*	Ram clamp stud and tee nut, short	1
41	CP-2314*	Ram clamp stud and tee nut, long	1

*Old style
**New style

Photo 39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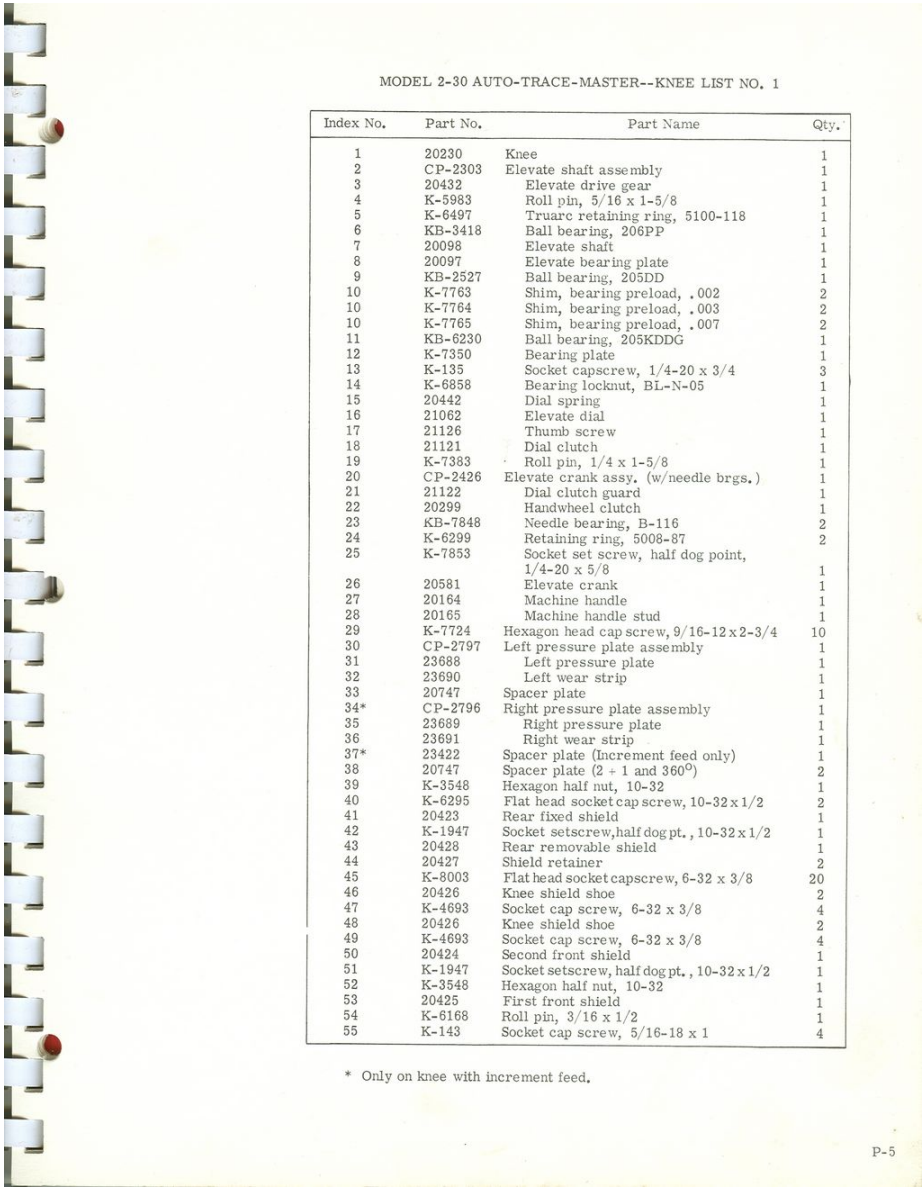
MODEL 2-30 AUTO-TRACE-MASTER--KNEE NO. 1
P-4

Photo 40



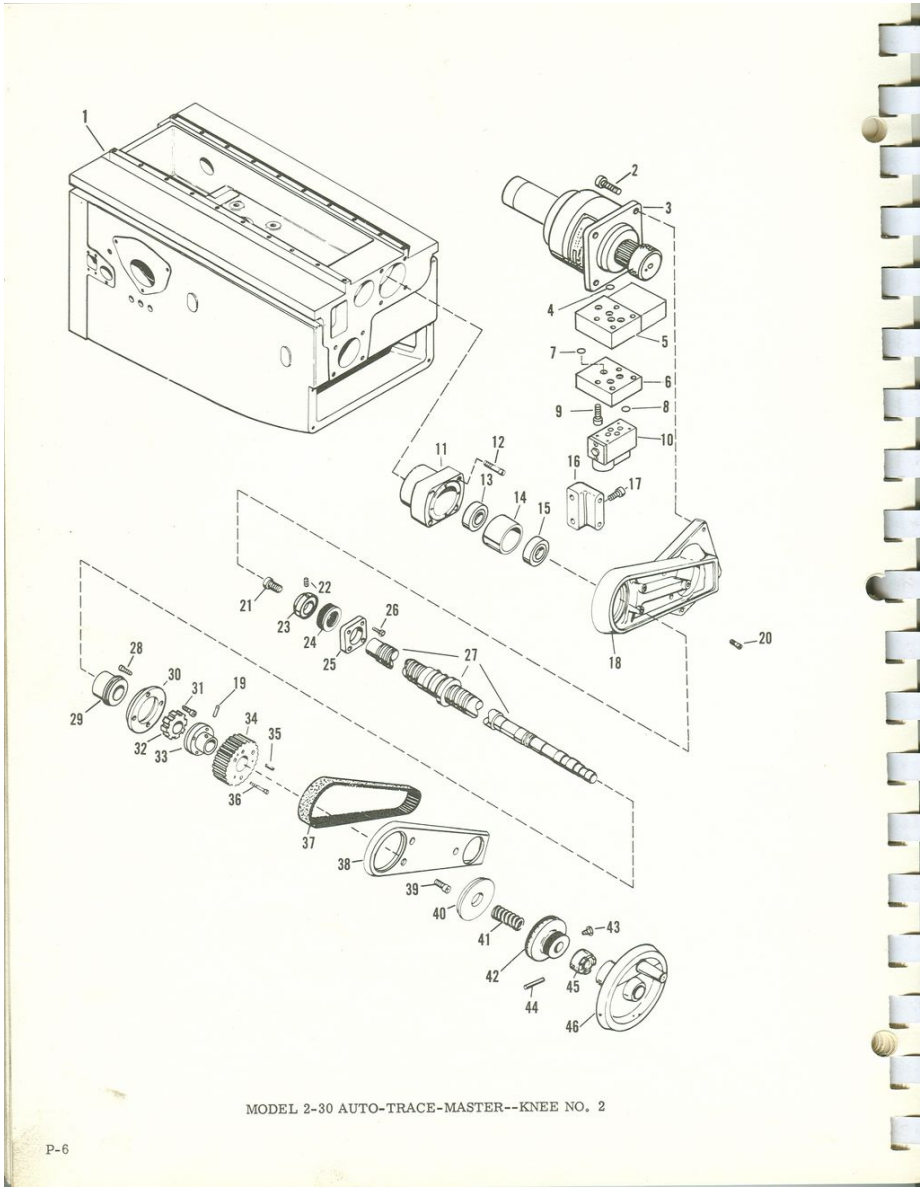
MODEL 2-30 AUTO-TRACE-MASTER--KNEE LIST NO. 1

Index No.	Part No.	Part Name	Qty.
1	20230	Knee	1
2	CP-2303	Elevate shaft assembly	1
3	20432	Elevate drive gear	1
4	K-5983	Roll pin, 5/16 x 1-5/8	1
5	K-6497	Truarc retaining ring, 5100-118	1
6	KB-3418	Ball bearing, 206PP	1
7	20098	Elevate shaft	1
8	20097	Elevate bearing plate	1
9	KB-2527	Ball bearing, 205DD	1
10	K-7763	Shim, bearing preload, .002	2
10	K-7764	Shim, bearing preload, .003	2
10	K-7765	Shim, bearing preload, .007	2
11	KB-6230	Ball bearing, 205KDDG	1
12	K-7350	Bearing plate	1
13	K-135	Socket capscrew, 1/4-20 x 3/4	3
14	K-6858	Bearing locknut, BL-N-05	1
15	20442	Dial spring	1
16	21062	Elevate dial	1
17	21126	Thumb screw	1
18	21121	Dial clutch	1
19	K-7383	Roll pin, 1/4 x 1-5/8	1
20	CP-2426	Elevate crank assy. (w/needle brgs.)	1
21	21122	Dial clutch guard	1
22	20299	Handwheel clutch	1
23	KB-7848	Needle bearing, B-116	2
24	K-6299	Retaining ring, 5008-87	2
25	K-7853	Socket set screw, half dog point, 1/4-20 x 5/8	1
26	20581	Elevate crank	1
27	20164	Machine handle	1
28	20165	Machine handle stud	1
29	K-7724	Hexagon head cap screw, 9/16-12 x 2-3/4	10
30	CP-2797	Left pressure plate assembly	1
31	23688	Left pressure plate	1
32	23690	Left wear strip	1
33	20747	Spacer plate	1
34*	CP-2796	Right pressure plate assembly	1
35	23689	Right pressure plate	1
36	23691	Right wear strip	1
37*	23422	Spacer plate (Increment feed only)	1
38	20747	Spacer plate (2 + 1 and 360°)	2
39	K-3548	Hexagon half nut, 10-32	1
40	K-6295	Flat head socket cap screw, 10-32 x 1/2	2
41	20423	Rear fixed shield	1
42	K-1947	Socket setscrew, half dog pt., 10-32 x 1/2	1
43	20428	Rear removable shield	1
44	20427	Shield retainer	2
45	K-8003	Flat head socket capscrew, 6-32 x 3/8	20
46	20426	Knee shield shoe	2
47	K-4693	Socket cap screw, 6-32 x 3/8	4
48	20426	Knee shield shoe	2
49	K-4693	Socket cap screw, 6-32 x 3/8	4
50	20424	Second front shield	1
51	K-1947	Socket setscrew, half dog pt., 10-32 x 1/2	1
52	K-3548	Hexagon half nut, 10-32	1
53	20425	First front shield	1
54	K-6168	Roll pin, 3/16 x 1/2	1
55	K-143	Socket cap screw, 5/16-18 x 1	4

* Only on knee with increment feed.

P-5

Photo 41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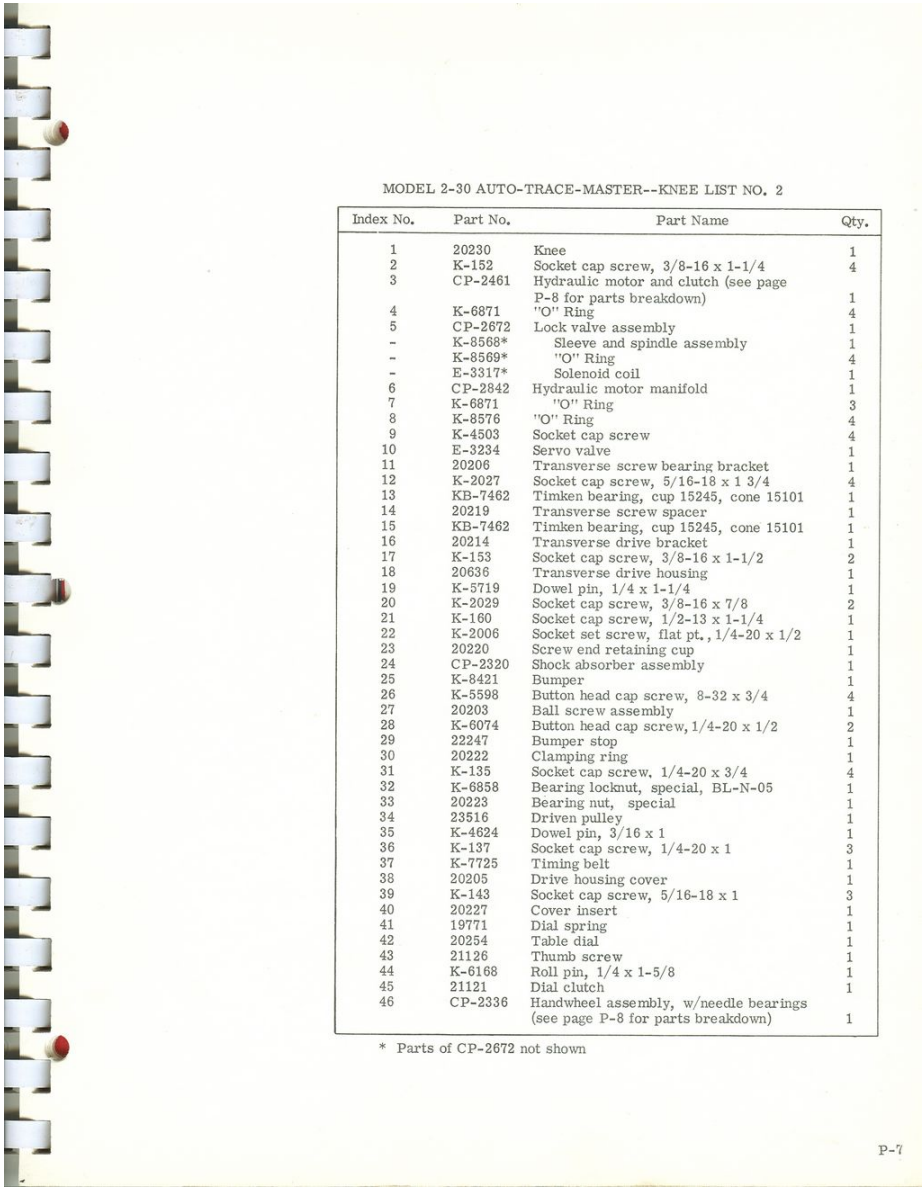
MODEL 2-30 AUTO-TRACE-MASTER--KNEE NO. 2
P-6

Photo 42



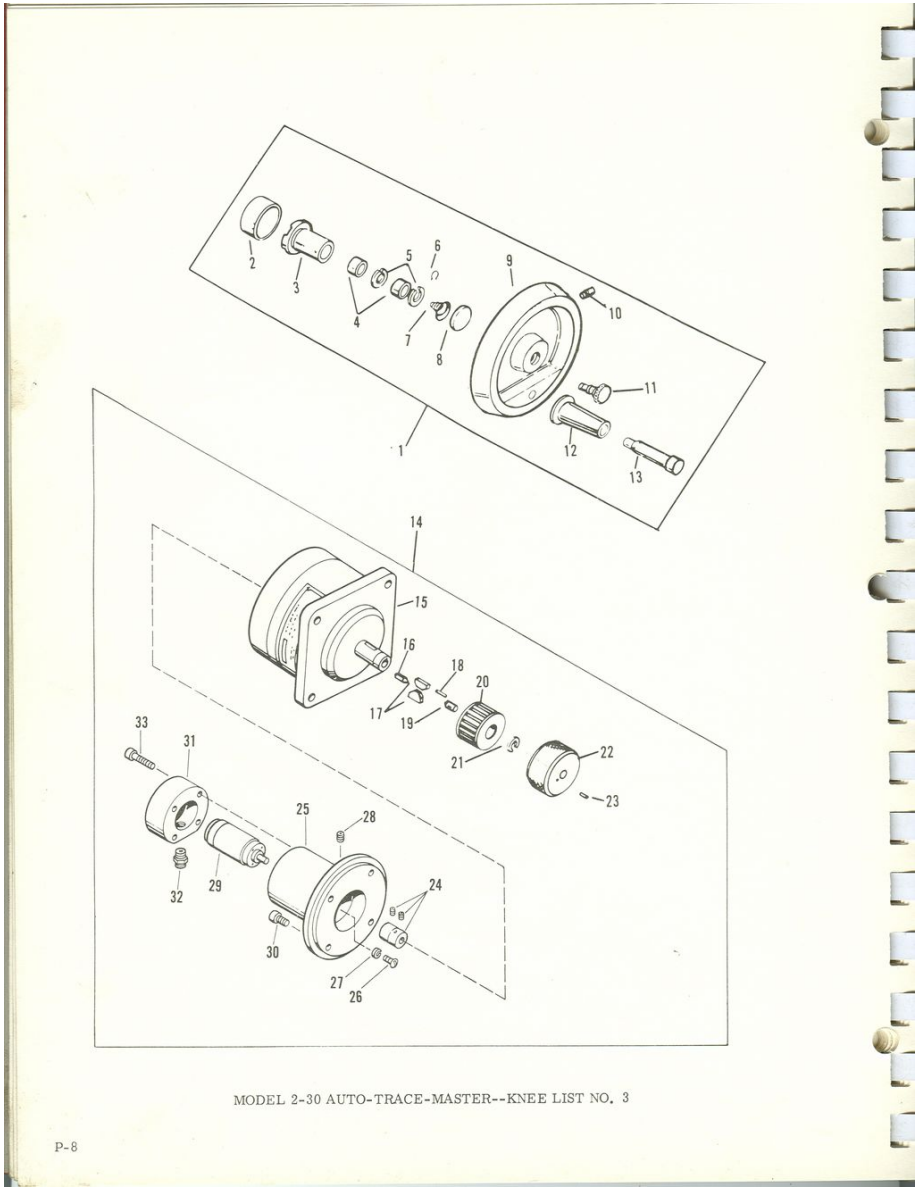
MODEL 2-30 AUTO-TRACE-MASTER--KNEE LIST NO. 2

Index No.	Part No.	Part Name	Qty.
1	20230	Knee	1
2	K-152	Socket cap screw, 3/8-16 x 1-1/4	4
3	CP-2461	Hydraulic motor and clutch (see page P-8 for parts breakdown)	1
4	K-6871	"O" Ring	4
5	CP-2672	Lock valve assembly	1
-	K-8568*	Sleeve and spindle assembly	1
-	K-8569*	"O" Ring	4
-	E-3317*	Solenoid coil	1
6	CP-2842	Hydraulic motor manifold	1
7	K-6871	"O" Ring	3
8	K-8576	"O" Ring	4
9	K-4503	Socket cap screw	4
10	E-3234	Servo valve	1
11	20206	Transverse screw bearing bracket	1
12	K-2027	Socket cap screw, 5/16-18 x 1 3/4	4
13	KB-7462	Timken bearing, cup 15245, cone 15101	1
14	20219	Transverse screw spacer	1
15	KB-7462	Timken bearing, cup 15245, cone 15101	1
16	20214	Transverse drive bracket	1
17	K-153	Socket cap screw, 3/8-16 x 1-1/2	2
18	20636	Transverse drive housing	1
19	K-5719	Dowel pin, 1/4 x 1-1/4	1
20	K-2029	Socket cap screw, 3/8-16 x 7/8	2
21	K-160	Socket cap screw, 1/2-13 x 1-1/4	1
22	K-2006	Socket set screw, flat pt., 1/4-20 x 1/2	1
23	20220	Screw end retaining cup	1
24	CP-2320	Shock absorber assembly	1
25	K-8421	Bumper	1
26	K-5598	Button head cap screw, 8-32 x 3/4	4
27	20203	Ball screw assembly	1
28	K-6074	Button head cap screw, 1/4-20 x 1/2	2
29	22247	Bumper stop	1
30	20222	Clamping ring	1
31	K-135	Socket cap screw, 1/4-20 x 3/4	4
32	K-6858	Bearing locknut, special, BL-N-05	1
33	20223	Bearing nut, special	1
34	23516	Driven pulley	1
35	K-4624	Dowel pin, 3/16 x 1	1
36	K-137	Socket cap screw, 1/4-20 x 1	3
37	K-7725	Timing belt	1
38	20205	Drive housing cover	1
39	K-143	Socket cap screw, 5/16-18 x 1	3
40	20227	Cover insert	1
41	19771	Dial spring	1
42	20254	Table dial	1
43	21126	Thumb screw	1
44	K-6168	Roll pin, 1/4 x 1-5/8	1
45	21121	Dial clutch	1
46	CP-2336	Handwheel assembly, w/needle bearings (see page P-8 for parts breakdown)	1

* Parts of CP-2672 not shown

P-7

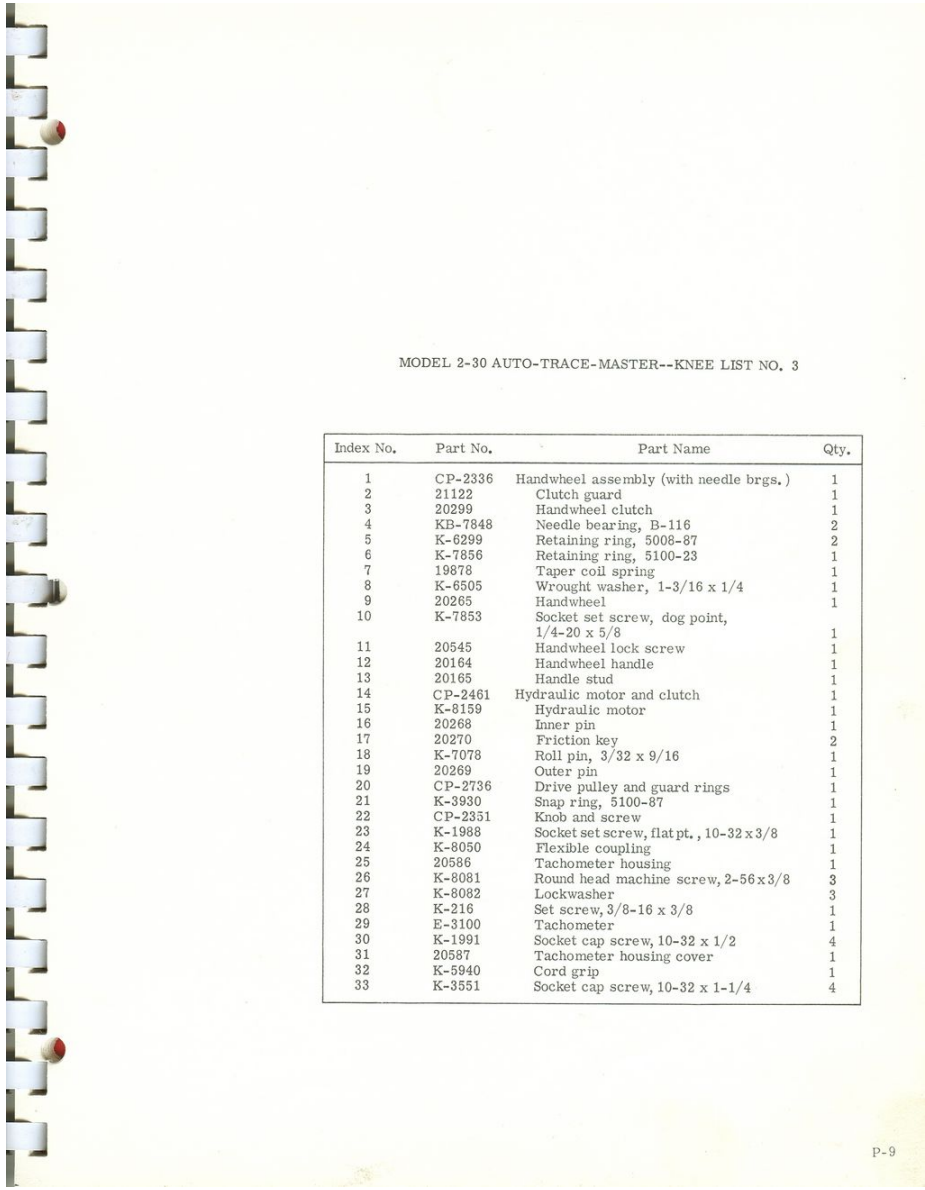
Photo 43



MODEL 2-30 AUTO-TRACE-MASTER--KNEE LIST NO. 3

P-8

Photo 44



MODEL 2-30 AUTO-TRACE-MASTER--KNEE LIST NO. 3

Index No.	Part No.	Part Name	Qty.
1	CP-2336	Handwheel assembly (with needle brgs.)	1
2	21122	Clutch guard	1
3	20299	Handwheel clutch	1
4	KB-7848	Needle bearing, B-116	2
5	K-6299	Retaining ring, 5008-87	2
6	K-7856	Retaining ring, 5100-23	1
7	19878	Taper coil spring	1
8	K-6505	Wrought washer, 1-3/16 x 1/4	1
9	20265	Handwheel	1
10	K-7853	Socket set screw, dog point, 1/4-20 x 5/8	1
11	20545	Handwheel lock screw	1
12	20164	Handwheel handle	1
13	20165	Handle stud	1
14	CP-2461	Hydraulic motor and clutch	1
15	K-8159	Hydraulic motor	1
16	20268	Inner pin	1
17	20270	Friction key	2
18	K-7078	Roll pin, 3/32 x 9/16	1
19	20269	Outer pin	1
20	CP-2736	Drive pulley and guard rings	1
21	K-3930	Snap ring, 5100-87	1
22	CP-2351	Knob and screw	1
23	K-1988	Socket set screw, flat pt., 10-32 x 3/8	1
24	K-8050	Flexible coupling	1
25	20586	Tachometer housing	1
26	K-8081	Round head machine screw, 2-56 x 3/8	3
27	K-8082	Lockwasher	3
28	K-216	Set screw, 3/8-16 x 3/8	1
29	E-3100	Tachometer	1
30	K-1991	Socket cap screw, 10-32 x 1/2	4
31	20587	Tachometer housing cover	1
32	K-5940	Cord grip	1
33	K-3551	Socket cap screw, 10-32 x 1-1/4	4

Photo 45

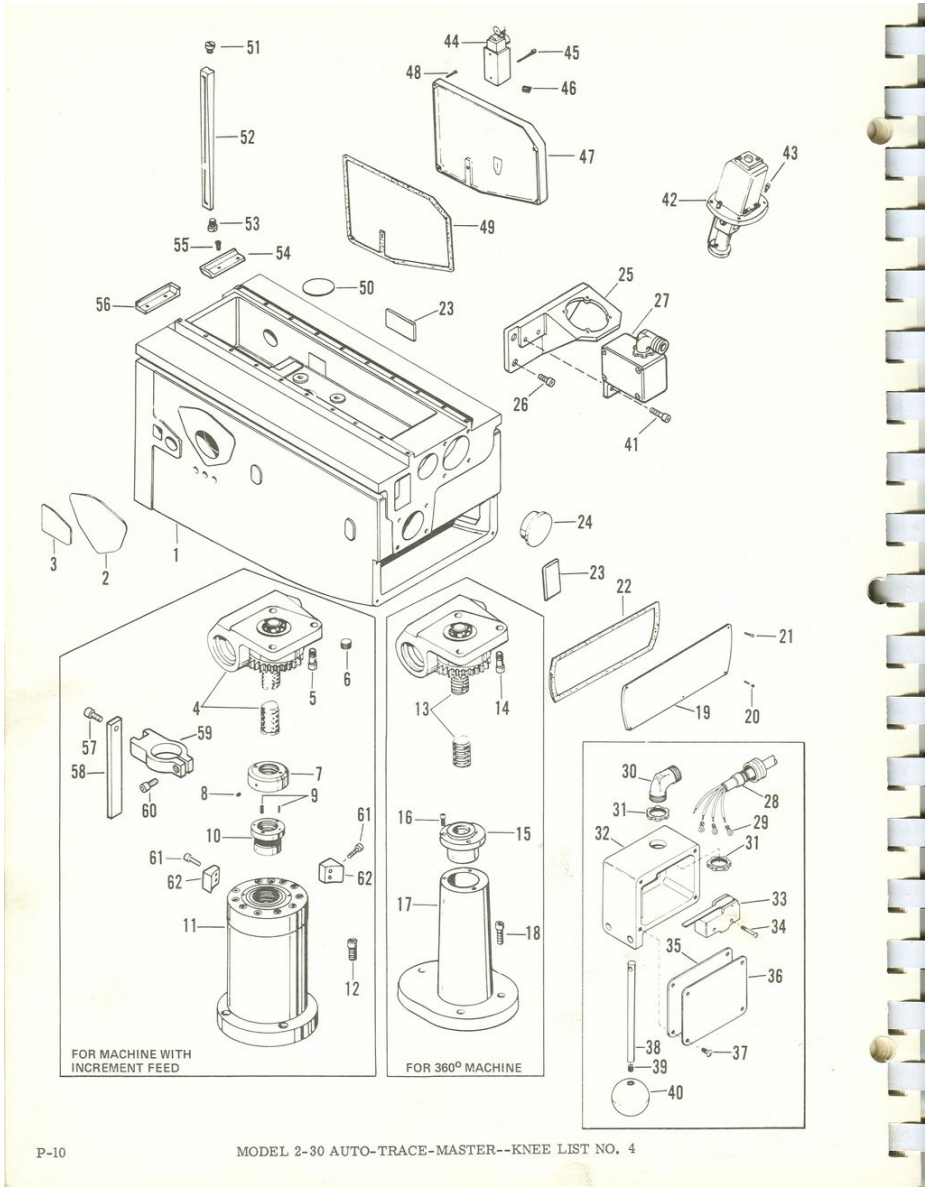
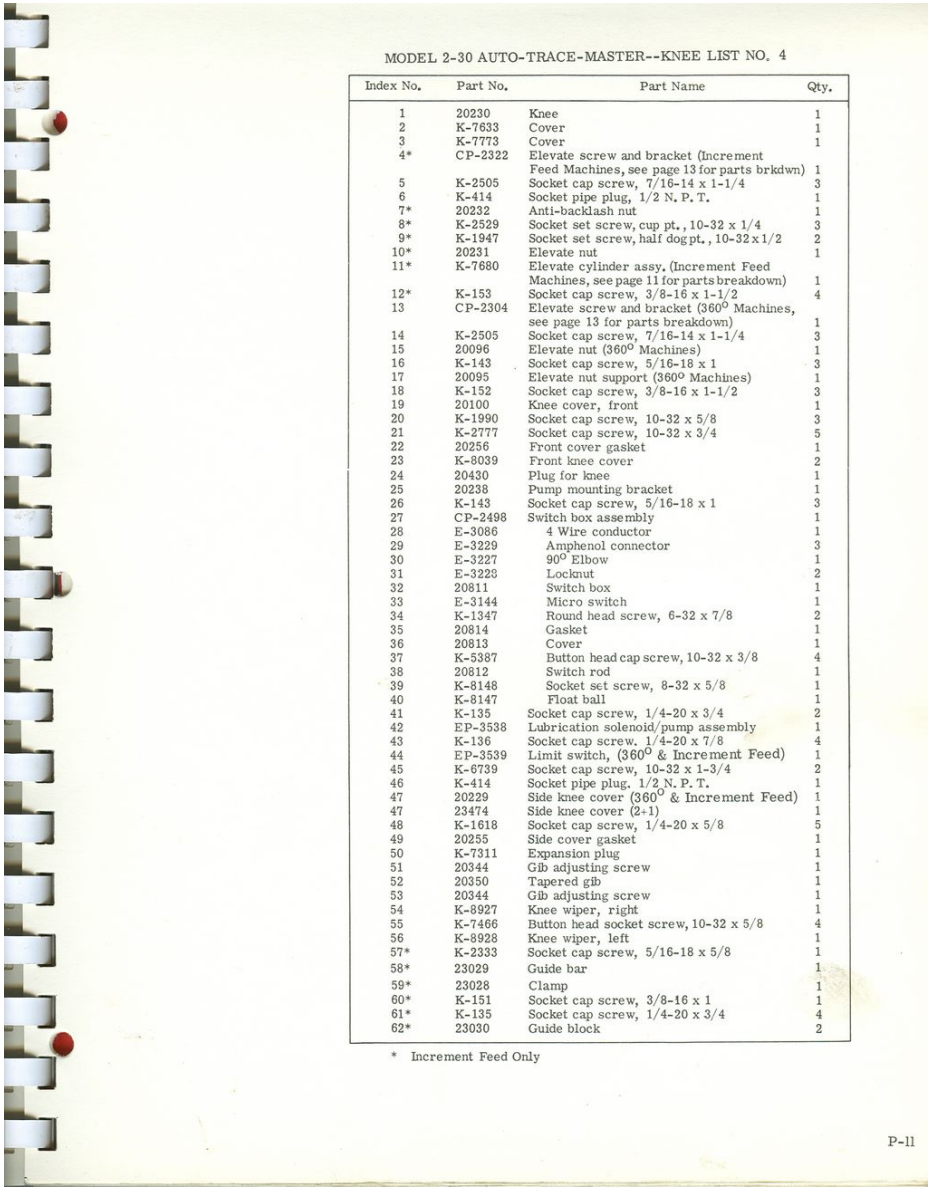

FOR MACHINE WITH INCREMENT FEED
FOR 360° MACHINE
P-10
MODEL 2-30 AUTO-TRACE-MASTER--KNEE LIST NO. 4

Photo 46



MODEL 2-30 AUTO-TRACE-MASTER--KNEE LIST NO. 4

Index No.	Part No.	Part Name	Qty.
1	20230	Knee	1
2	K-7633	Cover	1
3	K-7773	Cover	1
4*	CP-2322	Elevate screw and bracket (Increment Feed Machines, see page 13 for parts brkdwn)	1
5	K-2505	Socket cap screw, 7/16-14 x 1-1/4	3
6	K-414	Socket pipe plug, 1/2 N. P. T.	1
7*	20232	Anti-backlash nut	1
8*	K-2529	Socket set screw, cup pt., 10-32 x 1/4	3
9*	K-1947	Socket set screw, half dog pt., 10-32 x 1/2	2
10*	20231	Elevate nut	1
11*	K-7680	Elevate cylinder assy. (Increment Feed Machines, see page 11 for parts breakdown)	1
12*	K-153	Socket cap screw, 3/8-16 x 1-1/2	4
13	CP-2304	Elevate screw and bracket (360° Machines, see page 13 for parts breakdown)	1
14	K-2505	Socket cap screw, 7/16-14 x 1-1/4	3
15	20096	Elevate nut (360° Machines)	1
16	K-143	Socket cap screw, 5/16-18 x 1	3
17	20095	Elevate nut support (360° Machines)	1
18	K-152	Socket cap screw, 3/8-16 x 1-1/2	3
19	20100	Knee cover, front	1
20	K-1990	Socket cap screw, 10-32 x 5/8	3
21	K-2777	Socket cap screw, 10-32 x 3/4	5
22	20256	Front cover gasket	1
23	K-8039	Front knee cover	2
24	20430	Plug for knee	1
25	20238	Pump mounting bracket	1
26	K-143	Socket cap screw, 5/16-18 x 1	3
27	CP-2498	Switch box assembly	1
28	E-3086	4 Wire conductor	1
29	E-3229	Amphenol connector	3
30	E-3227	90° Elbow	1
31	E-3228	Locknut	2
32	20811	Switch box	1
33	E-3144	Micro switch	1
34	K-1347	Round head screw, 6-32 x 7/8	2
35	20814	Gasket	1
36	20813	Cover	1
37	K-5387	Button head cap screw, 10-32 x 3/8	4
38	20812	Switch rod	1
39	K-8148	Socket set screw, 8-32 x 5/8	1
40	K-8147	Float ball	1
41	K-135	Socket cap screw, 1/4-20 x 3/4	2
42	EP-3538	Lubrication solenoid/pump assembly	1
43	K-136	Socket cap screw, 1/4-20 x 7/8	4
44	EP-3539	Limit switch, (360° & Increment Feed)	1
45	K-6739	Socket cap screw, 10-32 x 1-3/4	2
46	K-414	Socket pipe plug, 1/2 N. P. T.	1
47	20229	Side knee cover (360° & Increment Feed)	1
47	23474	Side knee cover (2-1)	1
48	K-1618	Socket cap screw, 1/4-20 x 5/8	5
49	20255	Side cover gasket	1
50	K-7311	Expansion plug	1
51	20344	Gib adjusting screw	1
52	20350	Tapered gib	1
53	20344	Gib adjusting screw	1
54	K-8927	Knee wiper, right	1
55	K-7466	Button head socket screw, 10-32 x 5/8	4
56	K-8928	Knee wiper, left	1
57*	K-2333	Socket cap screw, 5/16-18 x 5/8	1
58*	23029	Guide bar	1
59*	23028	Clamp	1
60*	K-151	Socket cap screw, 3/8-16 x 1	1
61*	K-135	Socket cap screw, 1/4-20 x 3/4	4
62*	23030	Guide block	2

* Increment Feed Only

P-11

Photo 47

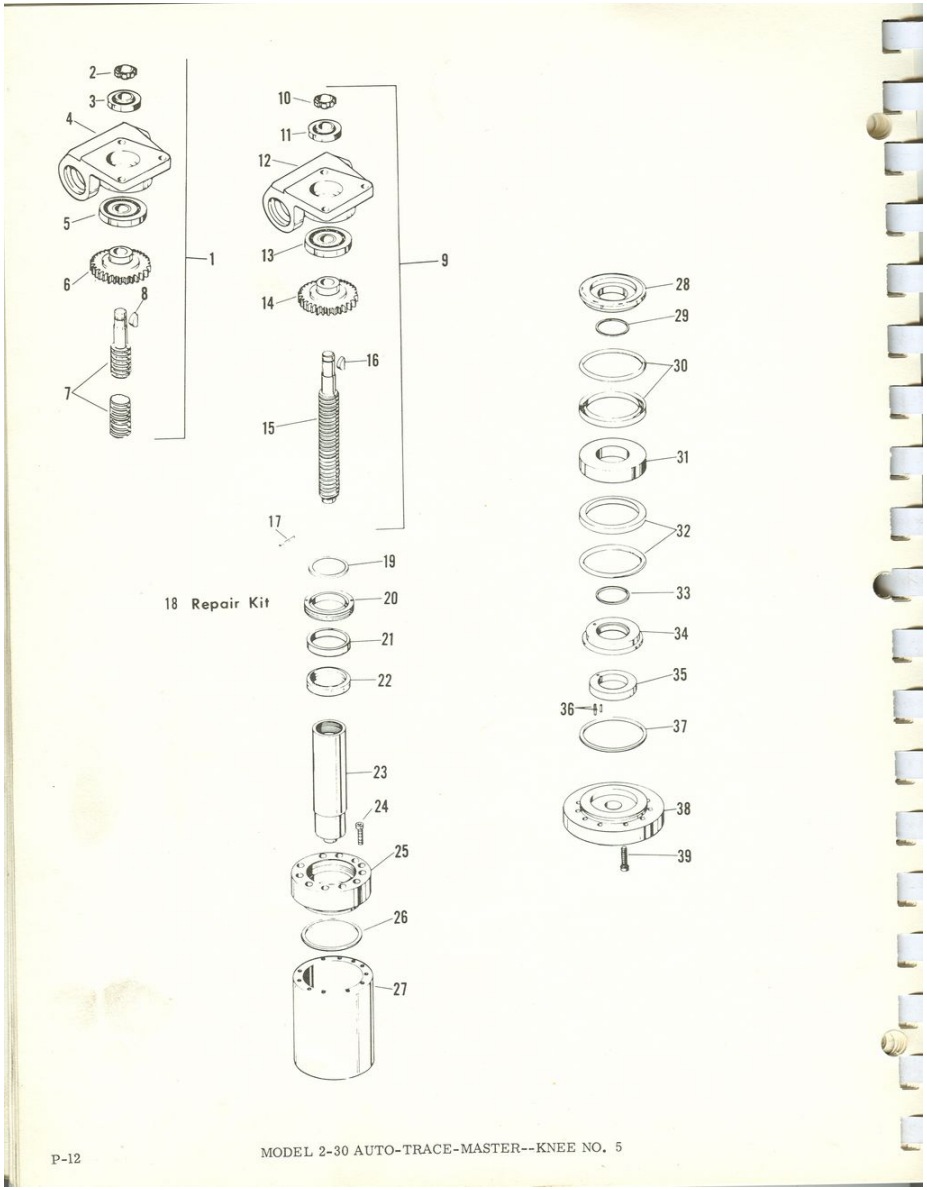

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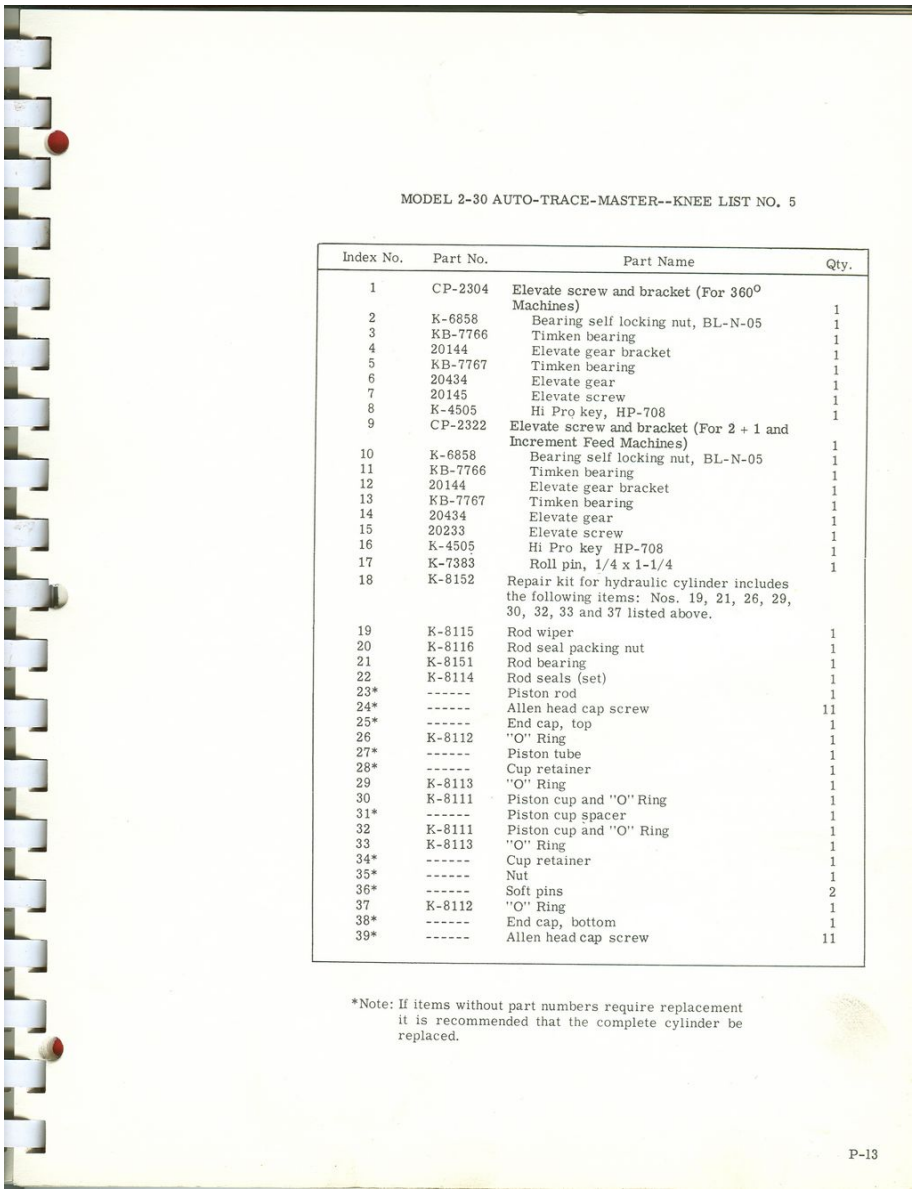
Photo 48



MODEL 2-30 AUTO-TRACE-MASTER--KNEE LIST NO. 5

Index No.	Part No.	Part Name	Qty.
1	CP-2304	**Elevate screw and bracket (For 360° Machines)**	1
2	K-6858	Bearing self locking nut, BL-N-05	1
3	KB-7766	Timken bearing	1
4	20144	Elevate gear bracket	1
5	KB-7767	Timken bearing	1
6	20434	Elevate gear	1
7	20145	Elevate screw	1
8	K-4505	Hi Pro key, HP-708	1
9	CP-2322	**Elevate screw and bracket (For 2 + 1 and Increment Feed Machines)**	1
10	K-6858	Bearing self locking nut, BL-N-05	1
11	KB-7766	Timken bearing	1
12	20144	Elevate gear bracket	1
13	KB-7767	Timken bearing	1
14	20434	Elevate gear	1
15	20233	Elevate screw	1
16	K-4505	Hi Pro key HP-708	1
17	K-7383	Roll pin, 1/4 x 1-1/4	1
18	K-8152	Repair kit for hydraulic cylinder includes the following items: Nos. 19, 21, 26, 29, 30, 32, 33 and 37 listed above.	
19	K-8115	Rod wiper	1
20	K-8116	Rod seal packing nut	1
21	K-8151	Rod bearing	1
22	K-8114	Rod seals (set)	1
23*	------	Piston rod	1
24*	------	Allen head cap screw	11
25*	------	End cap, top	1
26	K-8112	"O" Ring	1
27*	------	Piston tube	1
28*	------	Cup retainer	1
29	K-8113	"O" Ring	1
30	K-8111	Piston cup and "O" Ring	1
31*	------	Piston cup spacer	1
32	K-8111	Piston cup and "O" Ring	1
33	K-8113	"O" Ring	1
34*	------	Cup retainer	1
35*	------	Nut	1
36*	------	Soft pins	2
37	K-8112	"O" Ring	1
38*	------	End cap, bottom	1
39*	------	Allen head cap screw	11

*Note: If items without part numbers require replacement it is recommended that the complete cylinder be replaced.

P-13

Photo 49

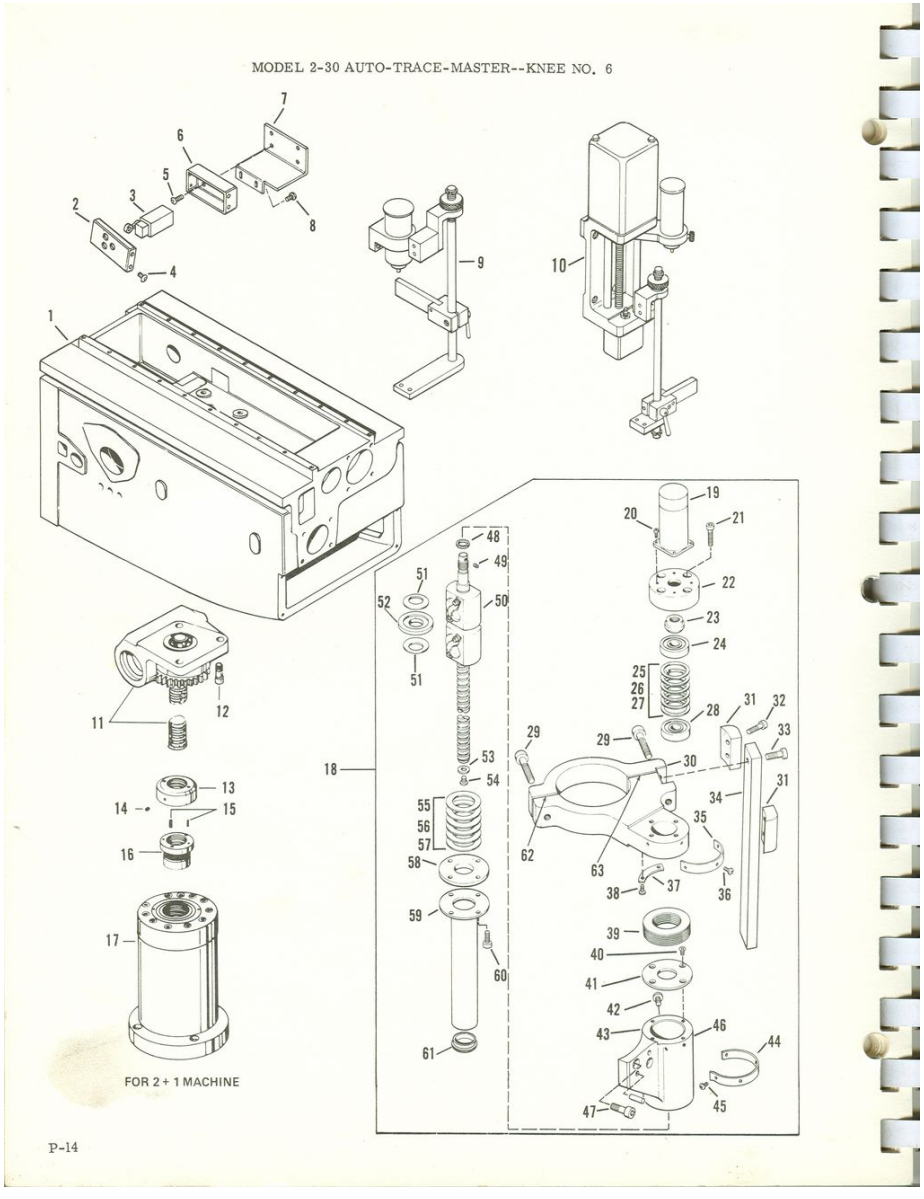


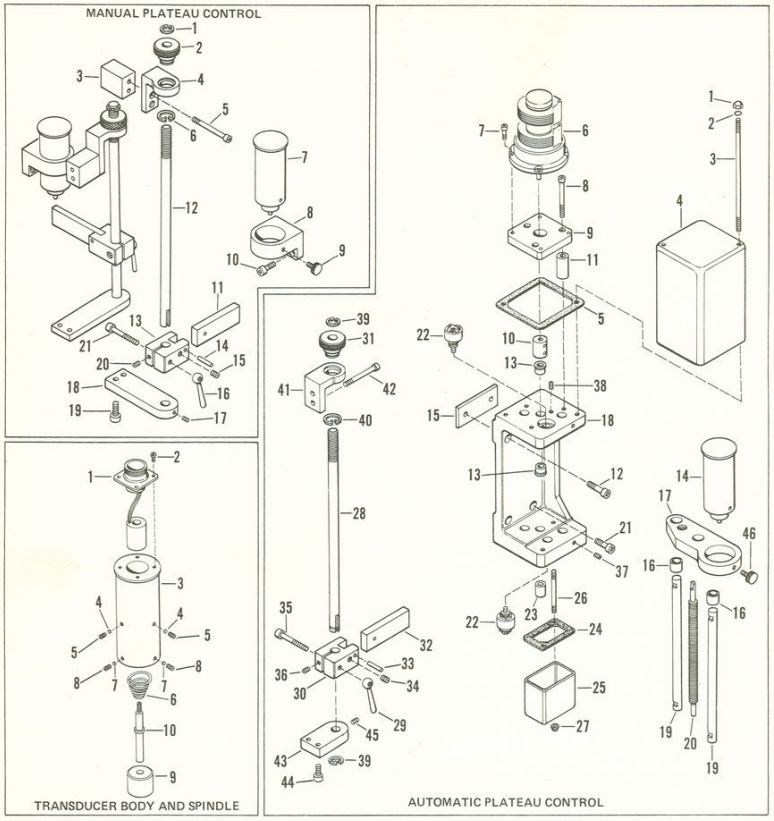
Photo 50

MODEL 2-30 AUTO-TRACE-MASTER KNEE LIST NO. 6

Index No.	Part No.	Part Name	Qty.
1	20230	Knee	1
2	23484	Cover	1
3	E-3221	Limit switch	3
4	K-6159	Round head, self-tapping screw, 6-32 x 1-1/4	4
5	K-7079	Button head, socket screw, 10-32 x 1/4	4
6	23483	Box enclosure	1
7	23478	Bracket	1
8	K-6075	Button head, socket capscrew, 1/4-20 x 3/4	2
9	G-1572-1	Manual plateau control (see page P-16 for parts breakdown)	1
10	G-1520-1	Automatic plateau control (see page P-16 for parts breakdown)	1
11	CP-2322	Elevate screw and bracket (2 + 1 mach.) (see page P-12 for parts breakdown)	1
12	K-2505	Socket cap screw, 7/16-14 x 1-1/4	3
13	20232	Anti-backlash nut	1
14	K-2529	Socket set screw, cup pt., 10-32 x 1/4	3
15	K-1947	Socket set screw, half dog pt., 10-32 x 1/2	2
16	20231	Elevate nut	1
17	K-7680	Elevate cylinder assy., (2 + 1 machines) (see page P-12 for parts breakdown)	1
18	CP-2746	Ball screw feedback	1
19	E-1228	Tachometer generator	1
20	K-6909	Socket cap screw, 4-40 x 3/8	4
21	K-2777	Socket cap screw, 10-32 x 3/4	4
22	23633	Tachometer mount	1
23	K-8800	Locknut	1
24	KB-8812	Ball bearing	1
25	K-8806	Shim	AR
26	K-8807	Shim	AR
27	K-8808	Shim	AR
28	KB-8812	Ball bearing	1
29	K-151	Socket cap screw, 3/8-16 x 1	2
30	23634	Mounting bracket	1
31	23030	Guide block	2
32	K-135	Socket cap screw, 1/4-20 x 3/4	4
33	K-2333	Socket cap screw, 5/16-18 x 5/8	1
34	23029	Guide bar	1
35	23627	Clamp	1
36	K-8319	Button head socket screw, 6-32 x 1/4	4
37	23629	Clamp	1
38	K-8319	Button head socket screw, 6-32 x 1/4	2
39	K-8802	Accordion cover	1
40	K-3529	Flat head mach. screw, 8-32 x 3/8	4
41	23636	End cap	1
42	K-8803	Button head socket screw, 1/4-28 x 1/2	1
43	23632	Nut housing	1
44	23628	Clamp	1
45	K-8319	Button head socket screw, 6-32 x 1/4	3
46	K-4545	Dowel pin, 1/4 x 3/4	2
47	K-141	Socket cap screw, 5/16-18 x 3/4	2
48	23635	Shoulder spacer	1
49	K-8801	Socket set screw, cup pt., 6-32 x 1/8	1
50	23630	Ball screw assembly	1
51	K-8804	Spring	2
52	23631	Spring spacer	
53	K-459	Washer	1
54	K-5388	Button head socket screw, 10-32 x 1/2	1
55	K-8809	Shim	AR
56	K-8810	Shim	AR
57	K-8811	Shim	AR
58	23637	Preload plate	1
59	23638	Shield	1
60	K-1990	Socket cap screw, 10-32 x 5/8	4
61	K-8805	Plug	1
62	24078	Shim, short	1
63	24079	Shim, long	1

Photo 51

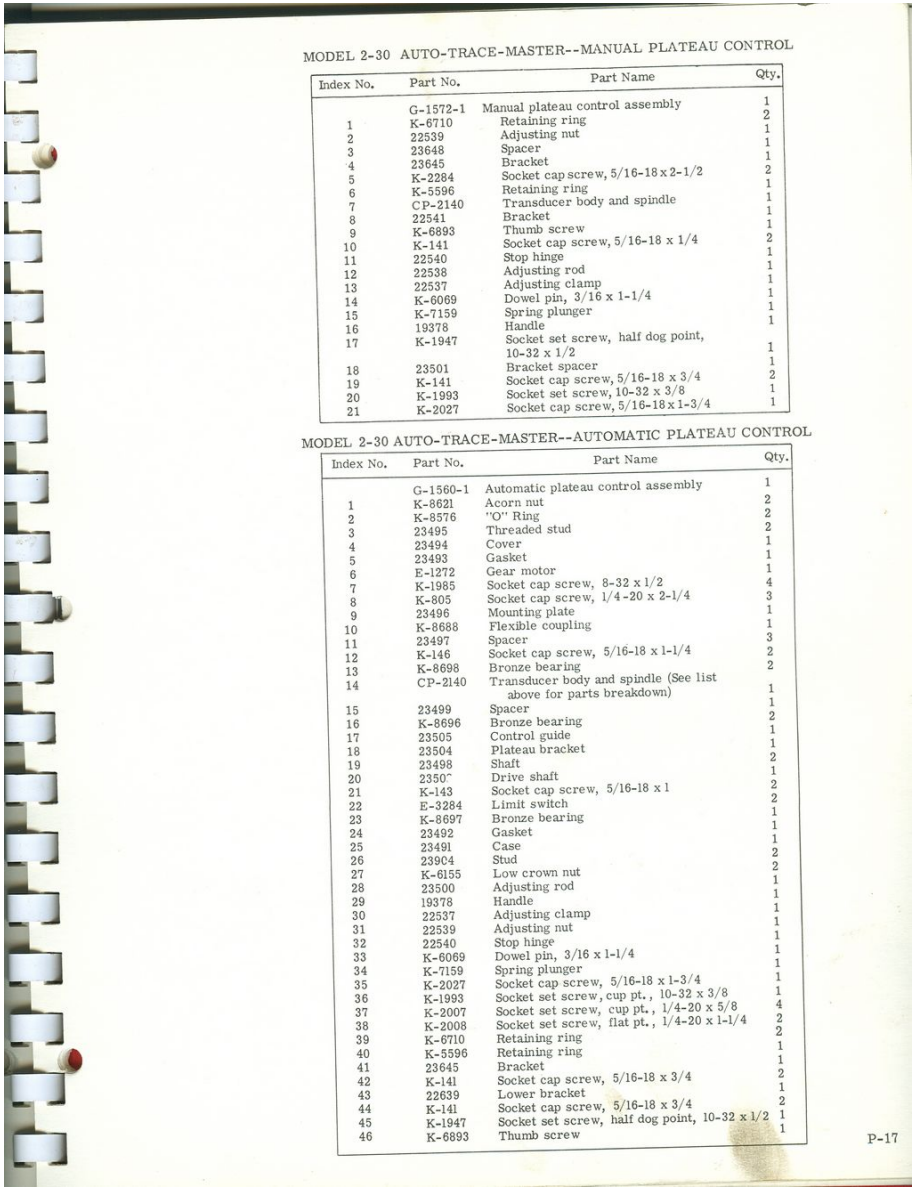
MODEL 2-30 AUTO-TRACE-MASTER PLATEAU CONTROLS AND TRANSDUCER



MODEL 2-30 AUTO-TRACE-MASTER TRANSDUCER BODY AND SPINDLE

Index No.	Part No.	Part Name	Qty.
1	EP-3166	Transducer and connector	1
2	K-6713	Fillister head cap screw, 4-40 x 1/4	4
3	22551	Transformer body	1
4	11994	Brass plug	2
5	K-1988	Socket set screw, flat pt., 10-32 x 3/8	2
6	22554	Transformer spindle spring	1
7	11994	Brass plug	2
8	K-1987	Socket set screw, flat pt., 10-32 x 5/16	2
9	22552	Adjusting guide	1
10	22553	Transformer spindle	1

Photo 52



MODEL 2-30 AUTO-TRACE-MASTER--MANUAL PLATEAU CONTROL

Index No.	Part No.	Part Name	Qty.
	G-1572-1	Manual plateau control assembly	1
1	K-6710	Retaining ring	2
2	22539	Adjusting nut	1
3	23648	Spacer	1
4	23645	Bracket	1
5	K-2284	Socket cap screw, 5/16-18 x 2-1/2	2
6	K-5596	Retaining ring	1
7	CP-2140	Transducer body and spindle	1
8	22541	Bracket	1
9	K-6893	Thumb screw	1
10	K-141	Socket cap screw, 5/16-18 x 1/4	2
11	22540	Stop hinge	1
12	22538	Adjusting rod	1
13	22537	Adjusting clamp	1
14	K-6069	Dowel pin, 3/16 x 1-1/4	1
15	K-7159	Spring plunger	1
16	19378	Handle	1
17	K-1947	Socket set screw, half dog point, 10-32 x 1/2	1
18	23501	Bracket spacer	1
19	K-141	Socket cap screw, 5/16-18 x 3/4	2
20	K-1993	Socket set screw, 10-32 x 3/8	1
21	K-2027	Socket cap screw, 5/16-18 x 1-3/4	1

MODEL 2-30 AUTO-TRACE-MASTER--AUTOMATIC PLATEAU CONTROL

Index No.	Part No.	Part Name	Qty.
	G-1560-1	Automatic plateau control assembly	1
1	K-8621	Acorn nut	2
2	K-8576	"O" Ring	2
3	23495	Threaded stud	2
4	23494	Cover	1
5	23493	Gasket	1
6	E-1272	Gear motor	1
7	K-1985	Socket cap screw, 8-32 x 1/2	4
8	K-805	Socket cap screw, 1/4-20 x 2-1/4	3
9	23496	Mounting plate	1
10	K-8688	Flexible coupling	1
11	23497	Spacer	3
12	K-146	Socket cap screw, 5/16-18 x 1-1/4	2
13	K-8698	Bronze bearing	2
14	CP-2140	Transducer body and spindle (See list above for parts breakdown)	1
15	23499	Spacer	1
16	K-8696	Bronze bearing	2
17	23505	Control guide	1
18	23504	Plateau bracket	1
19	23498	Shaft	2
20	2350^	Drive shaft	1
21	K-143	Socket cap screw, 5/16-18 x 1	2
22	E-3284	Limit switch	2
23	K-8697	Bronze bearing	1
24	23492	Gasket	1
25	23491	Case	1
26	23904	Stud	2
27	K-6155	Low crown nut	2
28	23500	Adjusting rod	1
29	19378	Handle	1
30	22537	Adjusting clamp	1
31	22539	Adjusting nut	1
32	22540	Stop hinge	1
33	K-6069	Dowel pin, 3/16 x 1-1/4	1
34	K-7159	Spring plunger	1
35	K-2027	Socket cap screw, 5/16-18 x 1-3/4	1
36	K-1993	Socket set screw, cup pt., 10-32 x 3/8	1
37	K-2007	Socket set screw, cup pt., 1/4-20 x 5/8	4
38	K-2008	Socket set screw, flat pt., 1/4-20 x 1-1/4	2
39	K-6710	Retaining ring	2
40	K-5596	Retaining ring	1
41	23645	Bracket	1
42	K-141	Socket cap screw, 5/16-18 x 3/4	2
43	22639	Lower bracket	1
44	K-141	Socket cap screw, 5/16-18 x 3/4	2
45	K-1947	Socket set screw, half dog point, 10-32 x 1/2	1
46	K-6893	Thumb screw	1

Photo 53

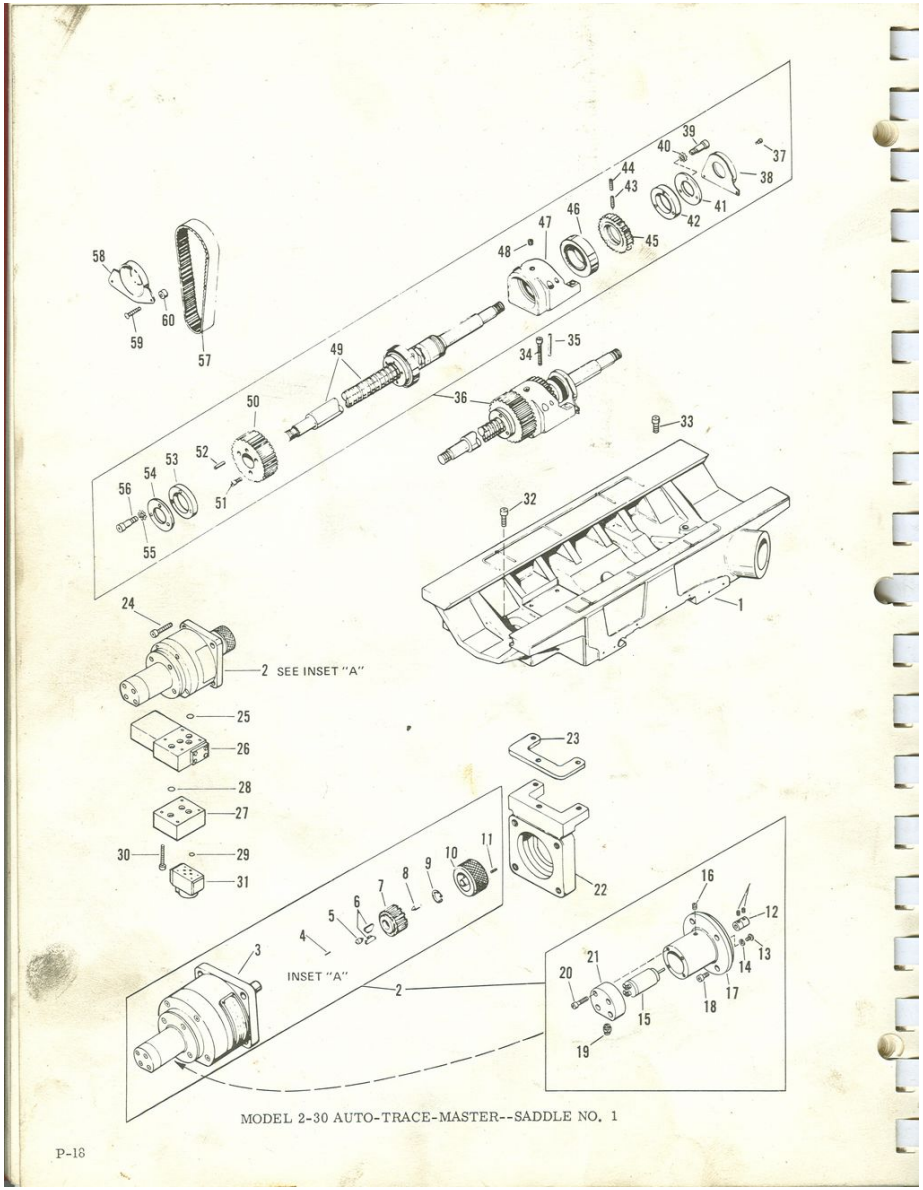
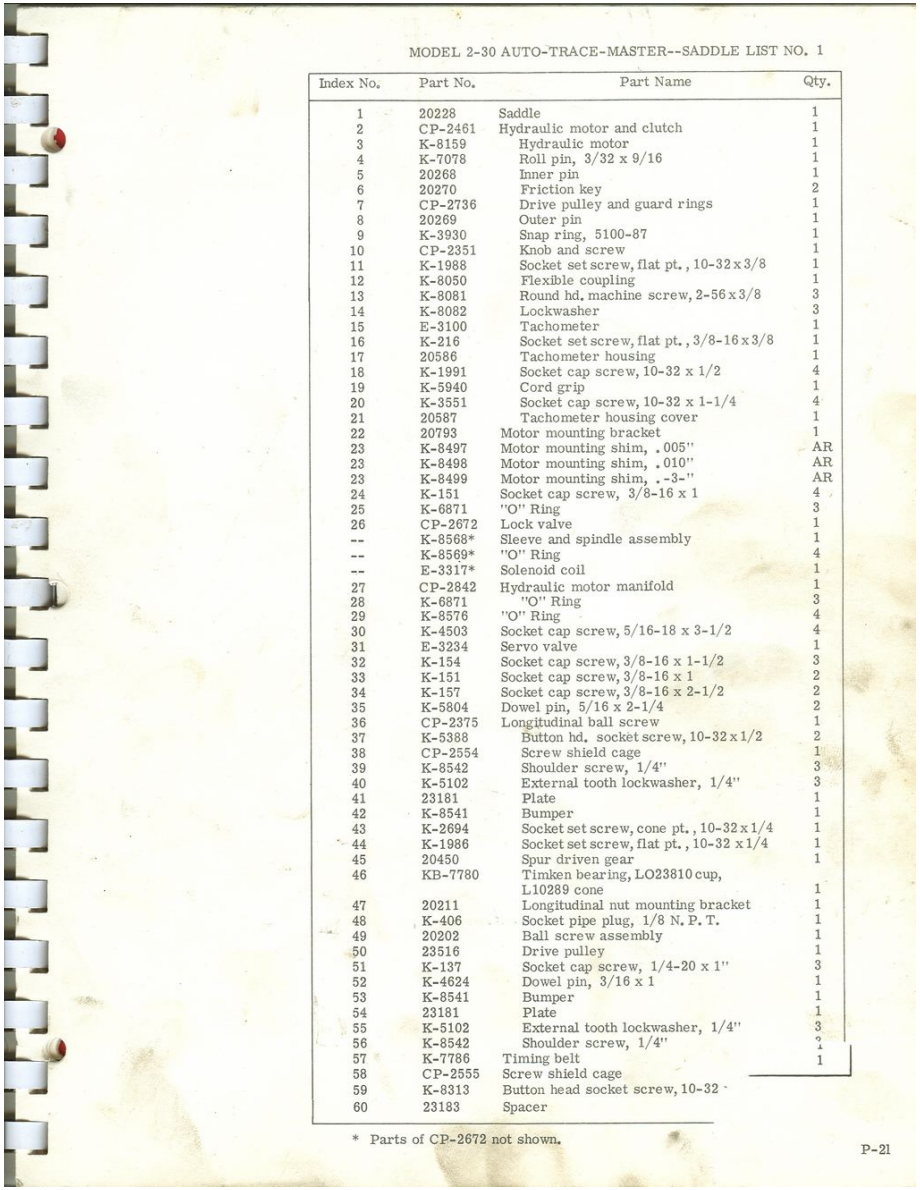

SEE INSET "A"
INSET "A"
MODEL 2-30 AUTO-TRACE-MASTER--SADDLE NO. 1
P-18

Photo 54



MODEL 2-30 AUTO-TRACE-MASTER--SADDLE LIST NO. 1

Index No.	Part No.	Part Name	Qty.
1	20228	Saddle	1
2	CP-2461	Hydraulic motor and clutch	1
3	K-8159	Hydraulic motor	1
4	K-7078	Roll pin, 3/32 x 9/16	1
5	20268	Inner pin	1
6	20270	Friction key	2
7	CP-2736	Drive pulley and guard rings	1
8	20269	Outer pin	1
9	K-3930	Snap ring, 5100-87	1
10	CP-2351	Knob and screw	1
11	K-1988	Socket set screw, flat pt., 10-32 x 3/8	1
12	K-8050	Flexible coupling	1
13	K-8081	Round hd. machine screw, 2-56 x 3/8	3
14	K-8082	Lockwasher	3
15	E-3100	Tachometer	1
16	K-216	Socket set screw, flat pt., 3/8-16 x 3/8	1
17	20586	Tachometer housing	1
18	K-1991	Socket cap screw, 10-32 x 1/2	4
19	K-5940	Cord grip	1
20	K-3551	Socket cap screw, 10-32 x 1-1/4	4
21	20587	Tachometer housing cover	1
22	20793	Motor mounting bracket	1
23	K-8497	Motor mounting shim, .005"	AR
23	K-8498	Motor mounting shim, .010"	AR
23	K-8499	Motor mounting shim, .-3-"	AR
24	K-151	Socket cap screw, 3/8-16 x 1	4
25	K-6871	"O" Ring	3
26	CP-2672	Lock valve	1
--	K-8568*	Sleeve and spindle assembly	1
--	K-8569*	"O" Ring	4
--	E-3317*	Solenoid coil	1
27	CP-2842	Hydraulic motor manifold	1
28	K-6871	"O" Ring	3
29	K-8576	"O" Ring	4
30	K-4503	Socket cap screw, 5/16-18 x 3-1/2	4
31	E-3234	Servo valve	1
32	K-154	Socket cap screw, 3/8-16 x 1-1/2	3
33	K-151	Socket cap screw, 3/8-16 x 1	2
34	K-157	Socket cap screw, 3/8-16 x 2-1/2	2
35	K-5804	Dowel pin, 5/16 x 2-1/4	2
36	CP-2375	Longitudinal ball screw	1
37	K-5388	Button hd. socket screw, 10-32 x 1/2	2
38	CP-2554	Screw shield cage	1
39	K-8542	Shoulder screw, 1/4"	3
40	K-5102	External tooth lockwasher, 1/4"	3
41	23181	Plate	1
42	K-8541	Bumper	1
43	K-2694	Socket set screw, cone pt., 10-32 x 1/4	1
44	K-1986	Socket set screw, flat pt., 10-32 x 1/4	1
45	20450	Spur driven gear	1
46	KB-7780	Timken bearing, LO23810 cup, L10289 cone	1
47	20211	Longitudinal nut mounting bracket	1
48	K-406	Socket pipe plug, 1/8 N. P. T.	1
49	20202	Ball screw assembly	1
50	23516	Drive pulley	1
51	K-137	Socket cap screw, 1/4-20 x 1"	3
52	K-4624	Dowel pin, 3/16 x 1	1
53	K-8541	Bumper	1
54	23181	Plate	1
55	K-5102	External tooth lockwasher, 1/4"	3
56	K-8542	Shoulder screw, 1/4"	3
57	K-7786	Timing belt	1
58	CP-2555	Screw shield cage	
59	K-8313	Button head socket screw, 10-32	
60	23183	Spacer	

* Parts of CP-2672 not shown.

P-21

Photo 55

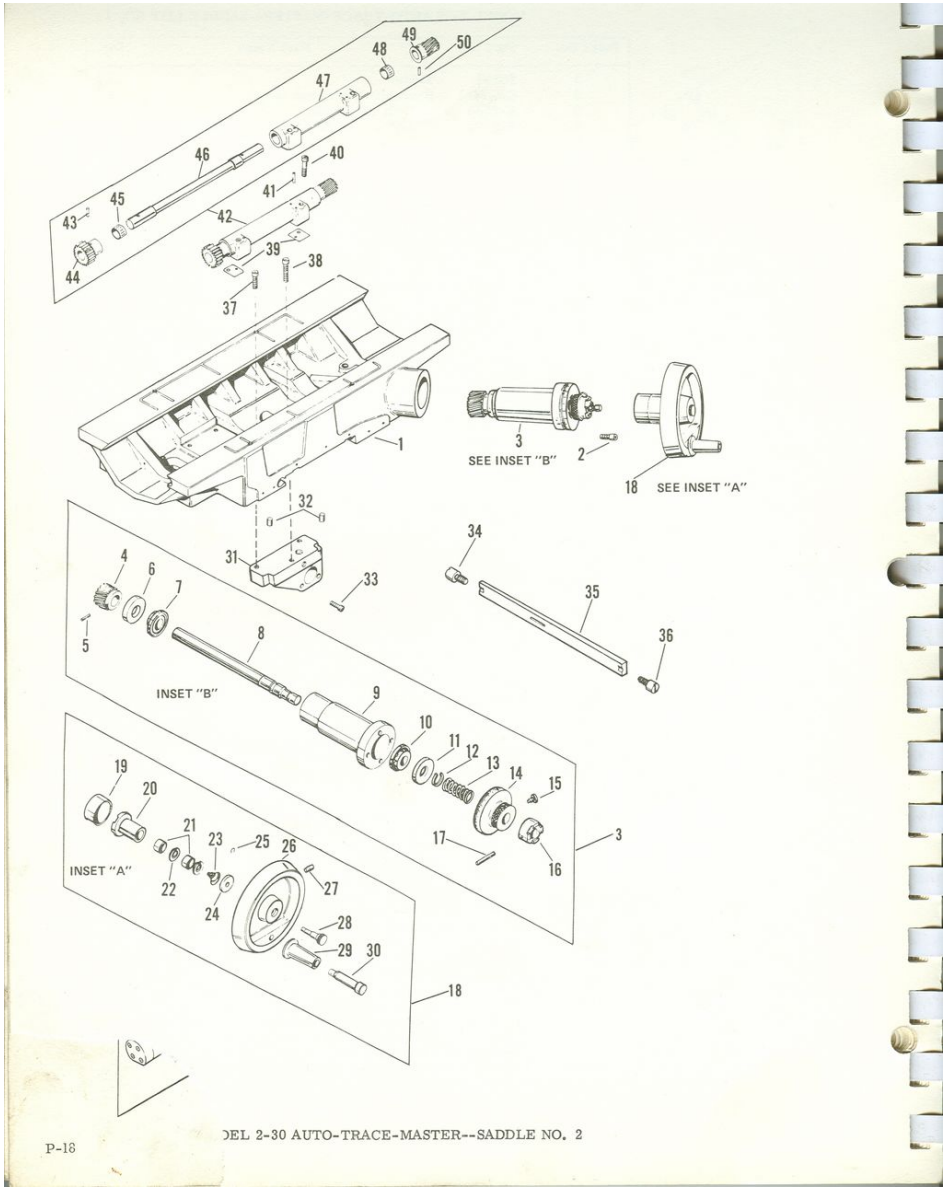
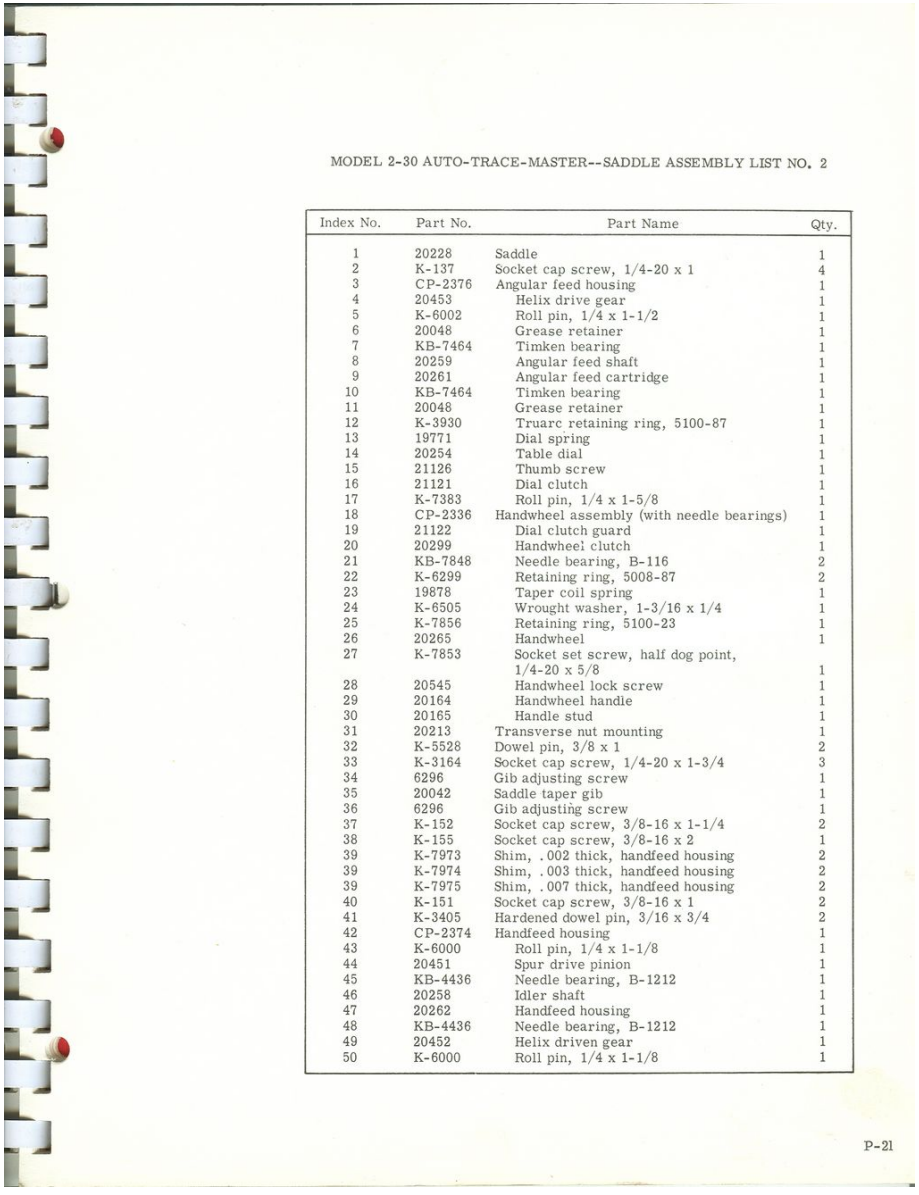

INSET "B"
INSET "A"
SEE INSET "B"
SEE INSET "A"
P-18
DEL 2-30 AUTO-TRACE-MASTER--SADDLE NO. 2

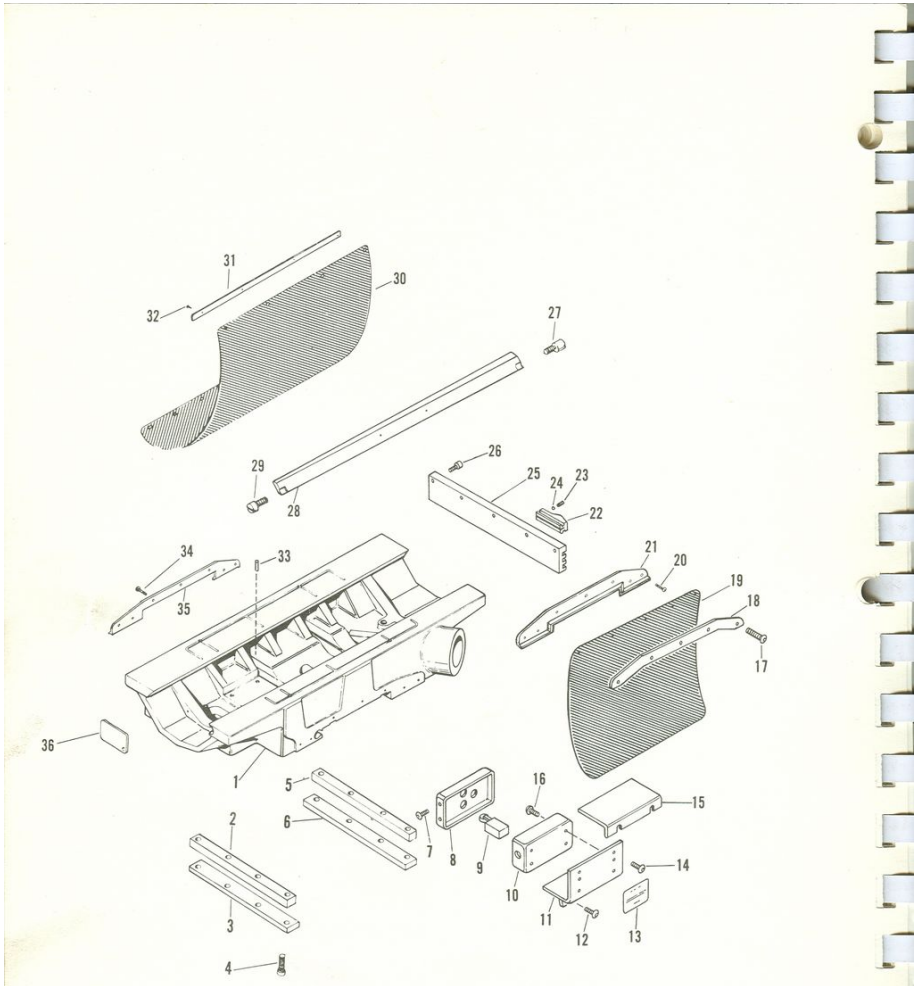
Photo 56



MODEL 2-30 AUTO-TRACE-MASTER--SADDLE ASSEMBLY LIST NO. 2

Index No.	Part No.	Part Name	Qty.
1	20228	Saddle	1
2	K-137	Socket cap screw, 1/4-20 x 1	4
3	CP-2376	Angular feed housing	1
4	20453	Helix drive gear	1
5	K-6002	Roll pin, 1/4 x 1-1/2	1
6	20048	Grease retainer	1
7	KB-7464	Timken bearing	1
8	20259	Angular feed shaft	1
9	20261	Angular feed cartridge	1
10	KB-7464	Timken bearing	1
11	20048	Grease retainer	1
12	K-3930	Truarc retaining ring, 5100-87	1
13	19771	Dial spring	1
14	20254	Table dial	1
15	21126	Thumb screw	1
16	21121	Dial clutch	1
17	K-7383	Roll pin, 1/4 x 1-5/8	1
18	CP-2336	Handwheel assembly (with needle bearings)	1
19	21122	Dial clutch guard	1
20	20299	Handwheel clutch	1
21	KB-7848	Needle bearing, B-116	2
22	K-6299	Retaining ring, 5008-87	2
23	19878	Taper coil spring	1
24	K-6505	Wrought washer, 1-3/16 x 1/4	1
25	K-7856	Retaining ring, 5100-23	1
26	20265	Handwheel	1
27	K-7853	Socket set screw, half dog point, 1/4-20 x 5/8	1
28	20545	Handwheel lock screw	1
29	20164	Handwheel handle	1
30	20165	Handle stud	1
31	20213	Transverse nut mounting	1
32	K-5528	Dowel pin, 3/8 x 1	2
33	K-3164	Socket cap screw, 1/4-20 x 1-3/4	3
34	6296	Gib adjusting screw	1
35	20042	Saddle taper gib	1
36	6296	Gib adjusting screw	1
37	K-152	Socket cap screw, 3/8-16 x 1-1/4	2
38	K-155	Socket cap screw, 3/8-16 x 2	1
39	K-7973	Shim, .002 thick, handfeed housing	2
39	K-7974	Shim, .003 thick, handfeed housing	2
39	K-7975	Shim, .007 thick, handfeed housing	2
40	K-151	Socket cap screw, 3/8-16 x 1	2
41	K-3405	Hardened dowel pin, 3/16 x 3/4	2
42	CP-2374	Handfeed housing	1
43	K-6000	Roll pin, 1/4 x 1-1/8	1
44	20451	Spur drive pinion	1
45	KB-4436	Needle bearing, B-1212	1
46	20258	Idler shaft	1
47	20262	Handfeed housing	1
48	KB-4436	Needle bearing, B-1212	1
49	20452	Helix driven gear	1
50	K-6000	Roll pin, 1/4 x 1-1/8	1

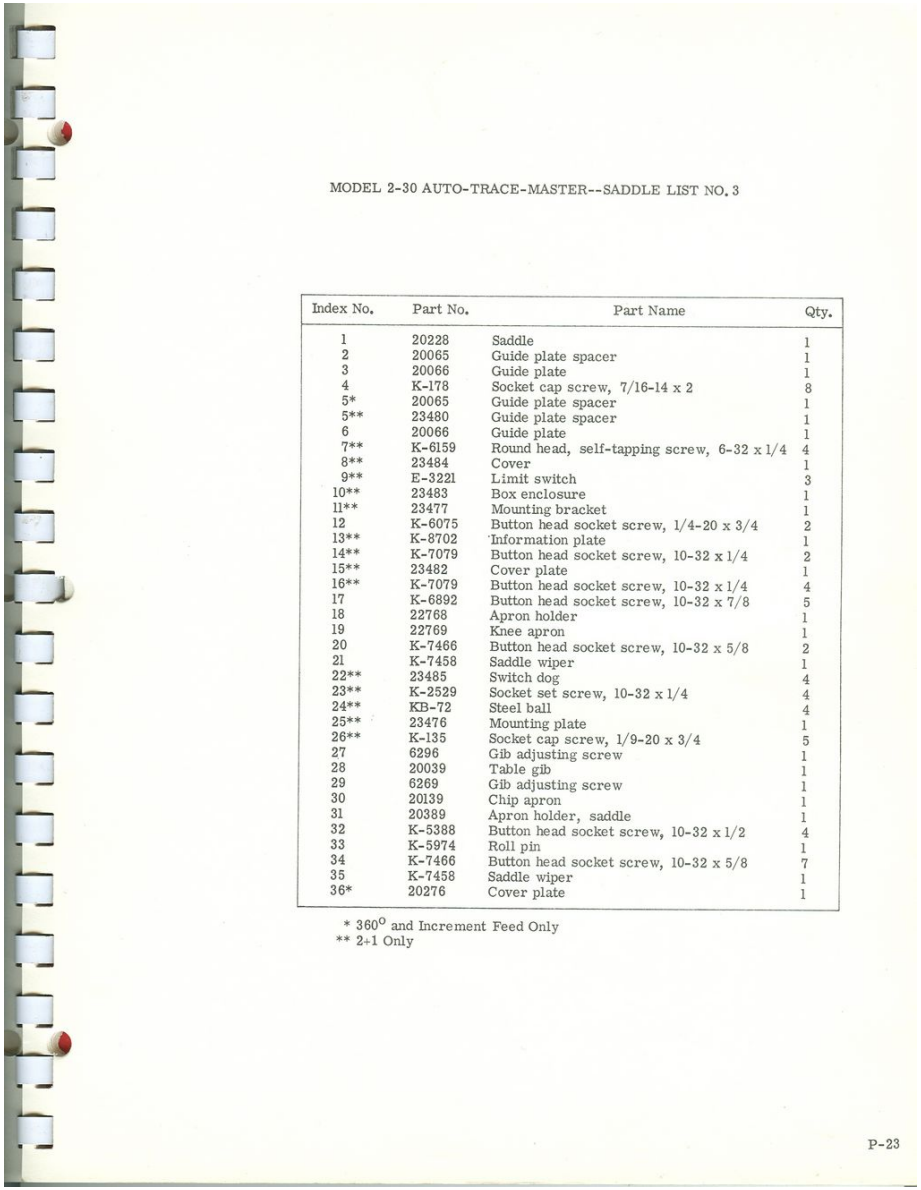
Photo 57



MODEL 2-30 AUTO-TRACE-MASTER--SADDLE NO. 3

P-22

Photo 58



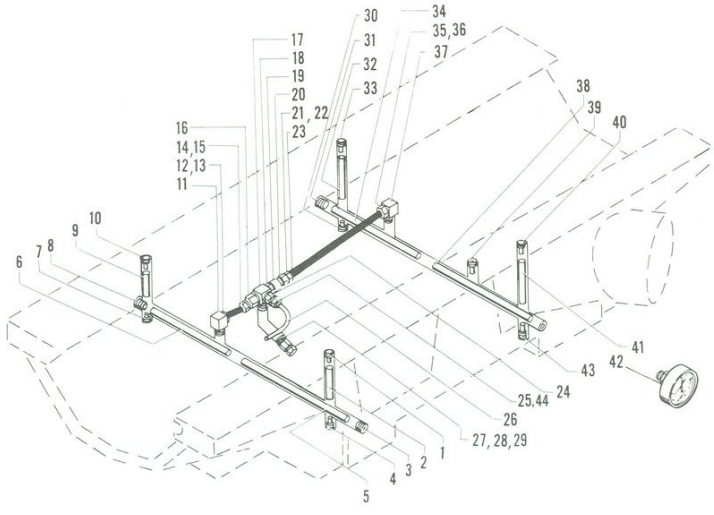
MODEL 2-30 AUTO-TRACE-MASTER--SADDLE LIST NO. 3

Index No.	Part No.	Part Name	Qty.
1	20228	Saddle	1
2	20065	Guide plate spacer	1
3	20066	Guide plate	1
4	K-178	Socket cap screw, 7/16-14 x 2	8
5*	20065	Guide plate spacer	1
5**	23480	Guide plate spacer	1
6	20066	Guide plate	1
7**	K-6159	Round head, self-tapping screw, 6-32 x 1/4	4
8**	23484	Cover	1
9**	E-3221	Limit switch	3
10**	23483	Box enclosure	1
11**	23477	Mounting bracket	1
12	K-6075	Button head socket screw, 1/4-20 x 3/4	2
13**	K-8702	Information plate	1
14**	K-7079	Button head socket screw, 10-32 x 1/4	2
15**	23482	Cover plate	1
16**	K-7079	Button head socket screw, 10-32 x 1/4	4
17	K-6892	Button head socket screw, 10-32 x 7/8	5
18	22768	Apron holder	1
19	22769	Knee apron	1
20	K-7466	Button head socket screw, 10-32 x 5/8	2
21	K-7458	Saddle wiper	1
22**	23485	Switch dog	4
23**	K-2529	Socket set screw, 10-32 x 1/4	4
24**	KB-72	Steel ball	4
25**	23476	Mounting plate	1
26**	K-135	Socket cap screw, 1/9-20 x 3/4	5
27	6296	Gib adjusting screw	1
28	20039	Table gib	1
29	6269	Gib adjusting screw	1
30	20139	Chip apron	1
31	20389	Apron holder, saddle	1
32	K-5388	Button head socket screw, 10-32 x 1/2	4
33	K-5974	Roll pin	1
34	K-7466	Button head socket screw, 10-32 x 5/8	7
35	K-7458	Saddle wiper	1
36*	20276	Cover plate	1

* 360^{o} and Increment Feed Only
** 2÷1 Only

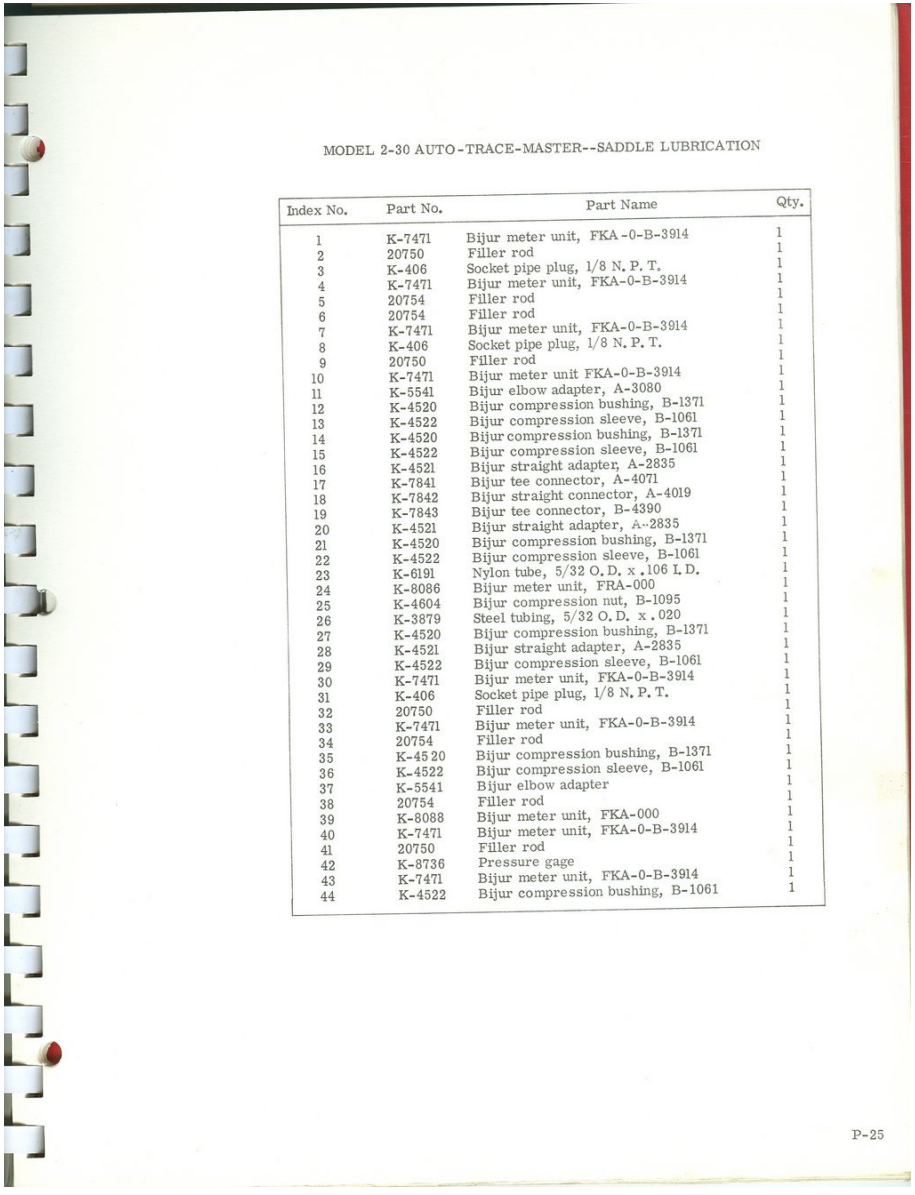
P-23

Photo 59



MODEL 2-30 AUTO-TRACE-MASTER--SADDLE LUBRICATION

Photo 60

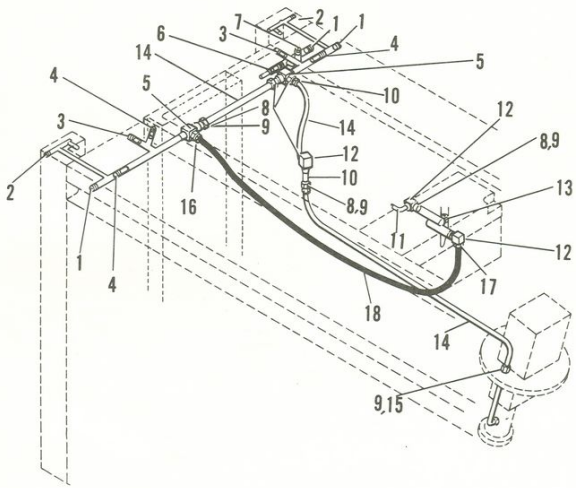


MODEL 2-30 AUTO-TRACE-MASTER--SADDLE LUBRICATION

Index No.	Part No.	Part Name	Qty.
1	K-7471	Bijur meter unit, FKA-0-B-3914	1
2	20750	Filler rod	1
3	K-406	Socket pipe plug, 1/8 N. P. T.	1
4	K-7471	Bijur meter unit, FKA-0-B-3914	1
5	20754	Filler rod	1
6	20754	Filler rod	1
7	K-7471	Bijur meter unit, FKA-0-B-3914	1
8	K-406	Socket pipe plug, 1/8 N. P. T.	1
9	20750	Filler rod	1
10	K-7471	Bijur meter unit FKA-0-B-3914	1
11	K-5541	Bijur elbow adapter, A-3080	1
12	K-4520	Bijur compression bushing, B-1371	1
13	K-4522	Bijur compression sleeve, B-1061	1
14	K-4520	Bijur compression bushing, B-1371	1
15	K-4522	Bijur compression sleeve, B-1061	1
16	K-4521	Bijur straight adapter, A-2835	1
17	K-7841	Bijur tee connector, A-4071	1
18	K-7842	Bijur straight connector, A-4019	1
19	K-7843	Bijur tee connector, B-4390	1
20	K-4521	Bijur straight adapter, A-2835	1
21	K-4520	Bijur compression bushing, B-1371	1
22	K-4522	Bijur compression sleeve, B-1061	1
23	K-6191	Nylon tube, 5/32 O. D. x .106 I. D.	1
24	K-8086	Bijur meter unit, FRA-000	1
25	K-4604	Bijur compression nut, B-1095	1
26	K-3879	Steel tubing, 5/32 O. D. x .020	1
27	K-4520	Bijur compression bushing, B-1371	1
28	K-4521	Bijur straight adapter, A-2835	1
29	K-4522	Bijur compression sleeve, B-1061	1
30	K-7471	Bijur meter unit, FKA-0-B-3914	1
31	K-406	Socket pipe plug, 1/8 N. P. T.	1
32	20750	Filler rod	1
33	K-7471	Bijur meter unit, FKA-0-B-3914	1
34	20754	Filler rod	1
35	K-4520	Bijur compression bushing, B-1371	1
36	K-4522	Bijur compression sleeve, B-1061	1
37	K-5541	Bijur elbow adapter	1
38	20754	Filler rod	1
39	K-8088	Bijur meter unit, FKA-000	1
40	K-7471	Bijur meter unit, FKA-0-B-3914	1
41	20750	Filler rod	1
42	K-8736	Pressure gage	1
43	K-7471	Bijur meter unit, FKA-0-B-3914	1
44	K-4522	Bijur compression bushing, B-1061	1

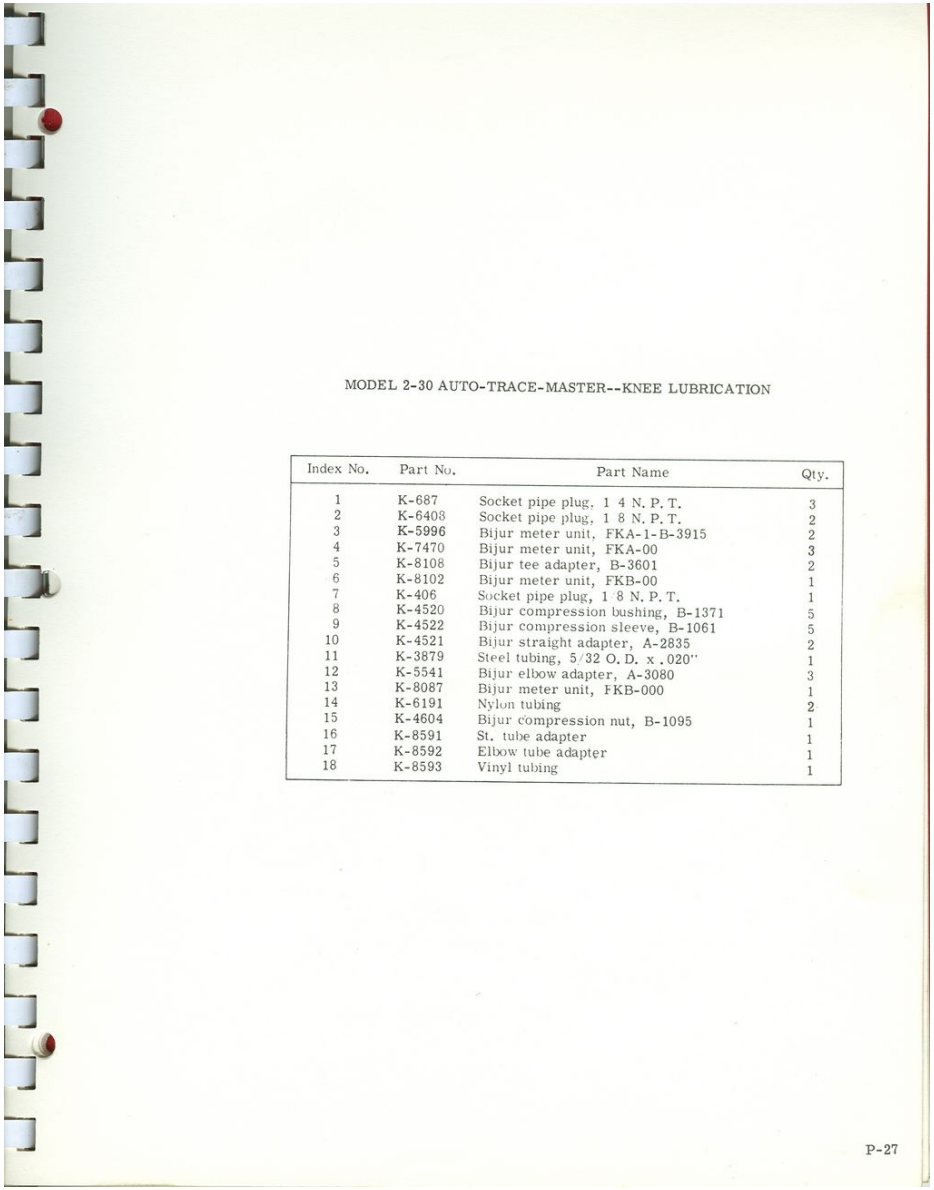
P-25

Photo 61



MODEL 2-30 AUTO-TRACE-MASTER--KNEE LUBRICATION

Photo 62

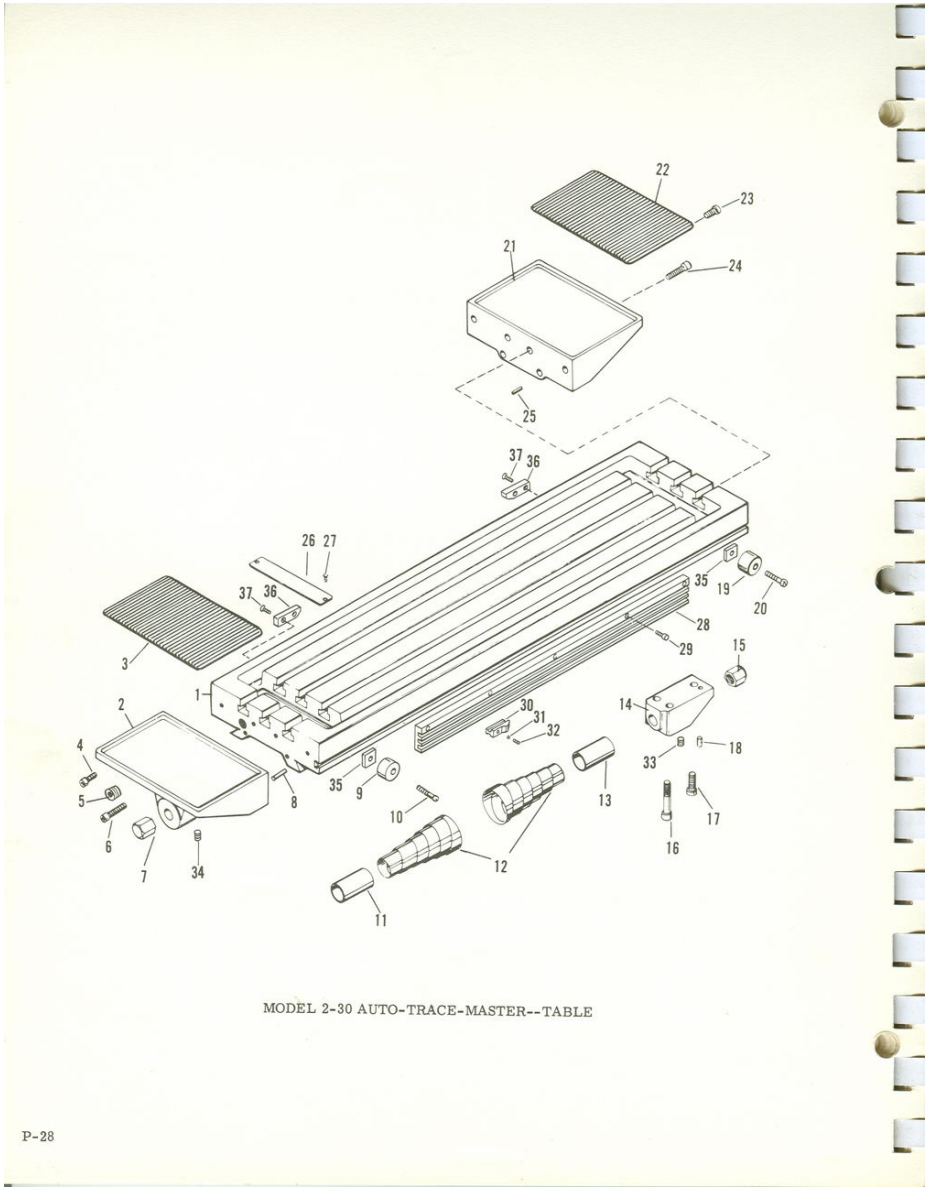


MODEL 2-30 AUTO-TRACE-MASTER--KNEE LUBRICATION

Index No.	Part No.	Part Name	Qty.
1	K-687	Socket pipe plug, 1 4 N. P. T.	3
2	K-6408	Socket pipe plug, 1 8 N. P. T.	2
3	K-5996	Bijur meter unit, FKA-1-B-3915	2
4	K-7470	Bijur meter unit, FKA-00	3
5	K-8108	Bijur tee adapter, B-3601	2
6	K-8102	Bijur meter unit, FKB-00	1
7	K-406	Socket pipe plug, 1 8 N. P. T.	1
8	K-4520	Bijur compression bushing, B-1371	5
9	K-4522	Bijur compression sleeve, B-1061	5
10	K-4521	Bijur straight adapter, A-2835	2
11	K-3879	Steel tubing, 5/32 O. D. x .020"	1
12	K-5541	Bijur elbow adapter, A-3080	3
13	K-8087	Bijur meter unit, FKB-000	1
14	K-6191	Nylon tubing	2
15	K-4604	Bijur compression nut, B-1095	1
16	K-8591	St. tube adapter	1
17	K-8592	Elbow tube adapter	1
18	K-8593	Vinyl tubing	1

P-27

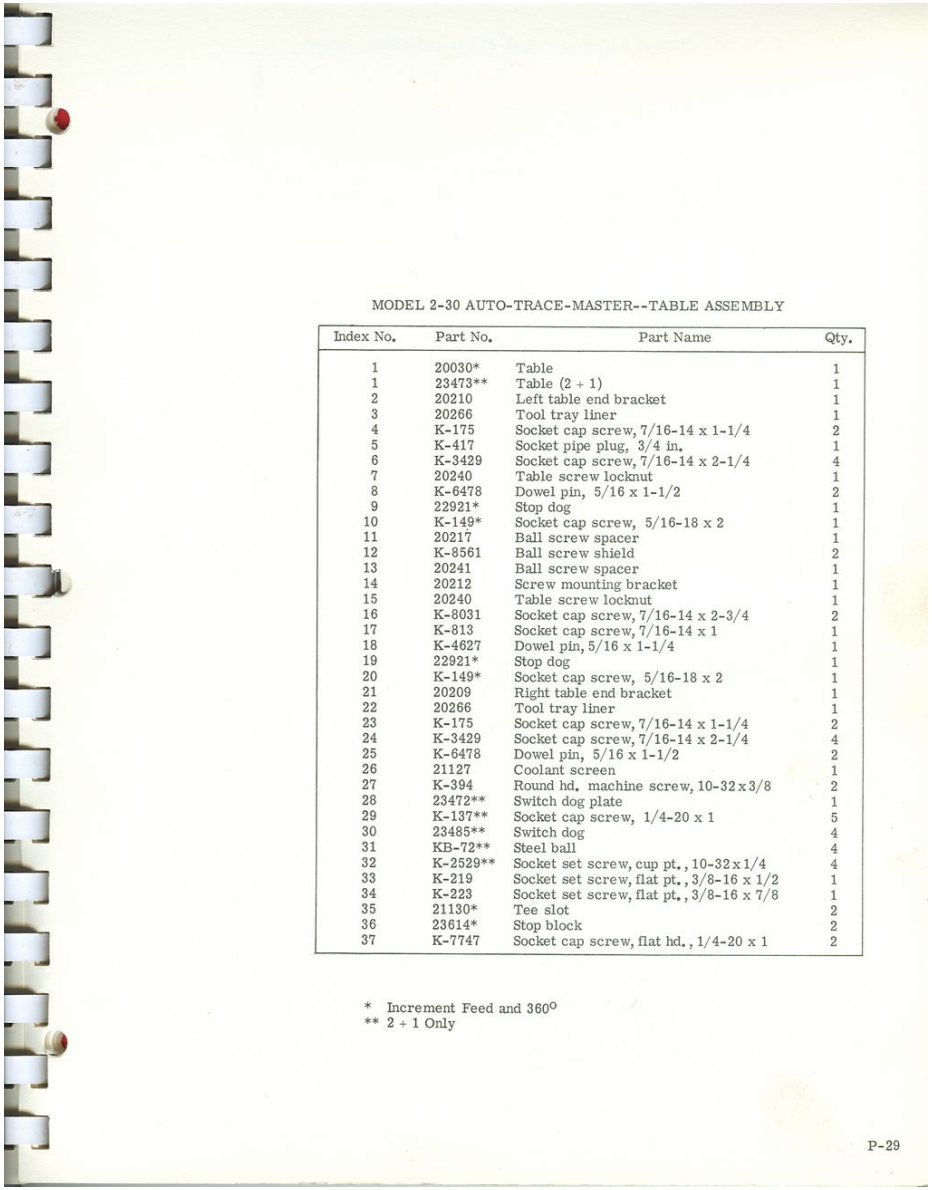
Photo 63



MODEL 2-30 AUTO-TRACE-MASTER--TABLE

P-28

Photo 64



MODEL 2-30 AUTO-TRACE-MASTER--TABLE ASSEMBLY

Index No.	Part No.	Part Name	Qty.
1	20030*	Table	1
1	23473**	Table (2 + 1)	1
2	20210	Left table end bracket	1
3	20266	Tool tray liner	1
4	K-175	Socket cap screw, 7/16-14 x 1-1/4	2
5	K-417	Socket pipe plug, 3/4 in.	1
6	K-3429	Socket cap screw, 7/16-14 x 2-1/4	4
7	20240	Table screw locknut	1
8	K-6478	Dowel pin, 5/16 x 1-1/2	2
9	22921*	Stop dog	1
10	K-149*	Socket cap screw, 5/16-18 x 2	1
11	20217	Ball screw spacer	1
12	K-8561	Ball screw shield	2
13	20241	Ball screw spacer	1
14	20212	Screw mounting bracket	1
15	20240	Table screw locknut	1
16	K-8031	Socket cap screw, 7/16-14 x 2-3/4	2
17	K-813	Socket cap screw, 7/16-14 x 1	1
18	K-4627	Dowel pin, 5/16 x 1-1/4	1
19	22921*	Stop dog	1
20	K-149*	Socket cap screw, 5/16-18 x 2	1
21	20209	Right table end bracket	1
22	20266	Tool tray liner	1
23	K-175	Socket cap screw, 7/16-14 x 1-1/4	2
24	K-3429	Socket cap screw, 7/16-14 x 2-1/4	4
25	K-6478	Dowel pin, 5/16 x 1-1/2	2
26	21127	Coolant screen	1
27	K-394	Round hd. machine screw, 10-32 x 3/8	2
28	23472**	Switch dog plate	1
29	K-137**	Socket cap screw, 1/4-20 x 1	5
30	23485**	Switch dog	4
31	KB-72**	Steel ball	4
32	K-2529**	Socket set screw, cup pt., 10-32 x 1/4	4
33	K-219	Socket set screw, flat pt., 3/8-16 x 1/2	1
34	K-223	Socket set screw, flat pt., 3/8-16 x 7/8	1
35	21130*	Tee slot	2
36	23614*	Stop block	2
37	K-7747	Socket cap screw, flat hd., 1/4-20 x 1	2

* Increment Feed and 360°
** 2 + 1 Only

Photo 65

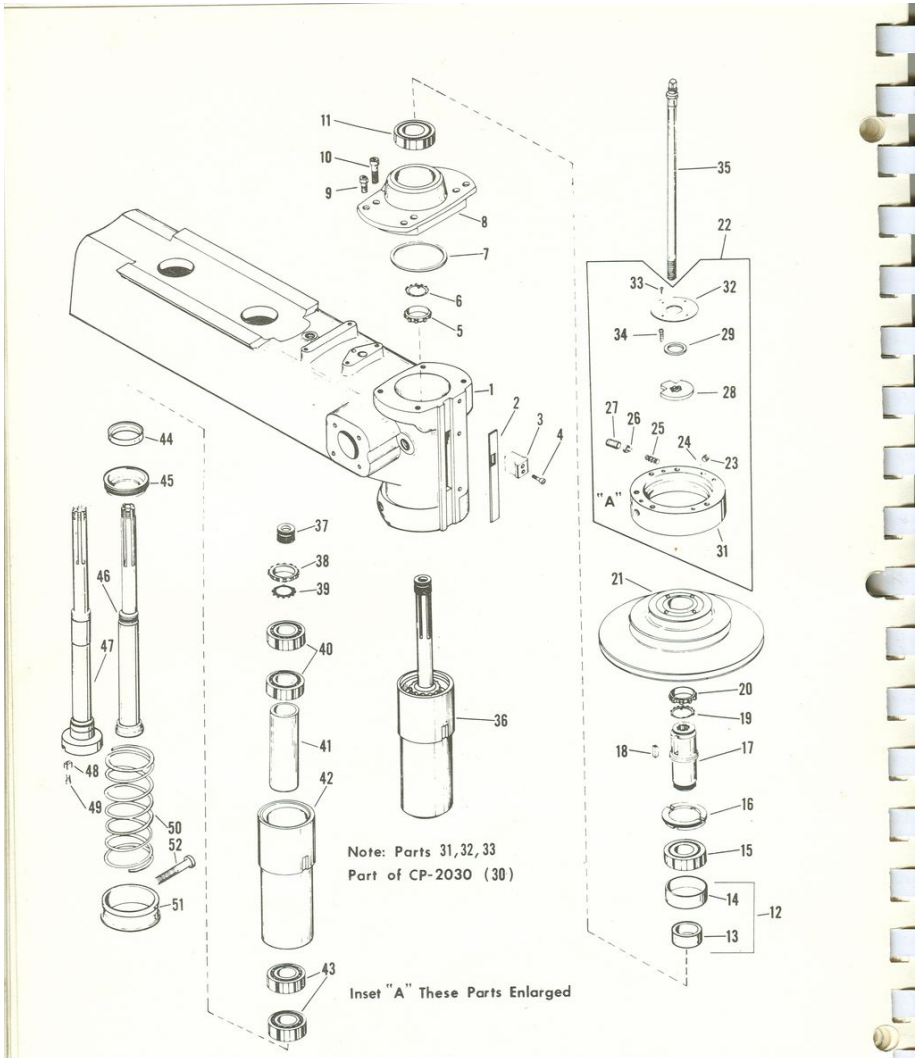
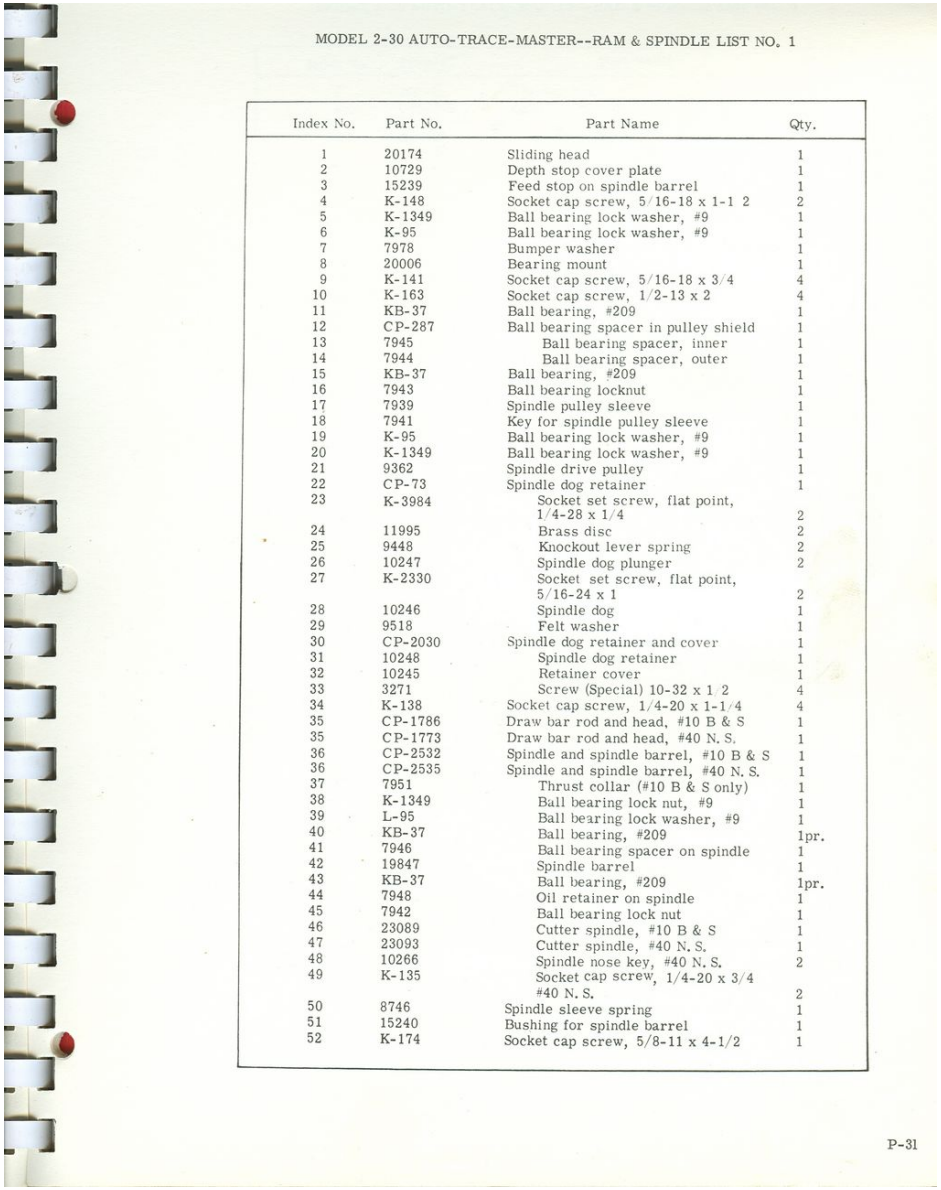

Note: Parts 31, 32, 33
Part of CP-2030 (30)
Inset "A" These Parts Enlarged
MODEL 2-30 AUTO-TRACE-MASTER--RAM & SPINDLE NO. 1
P-30

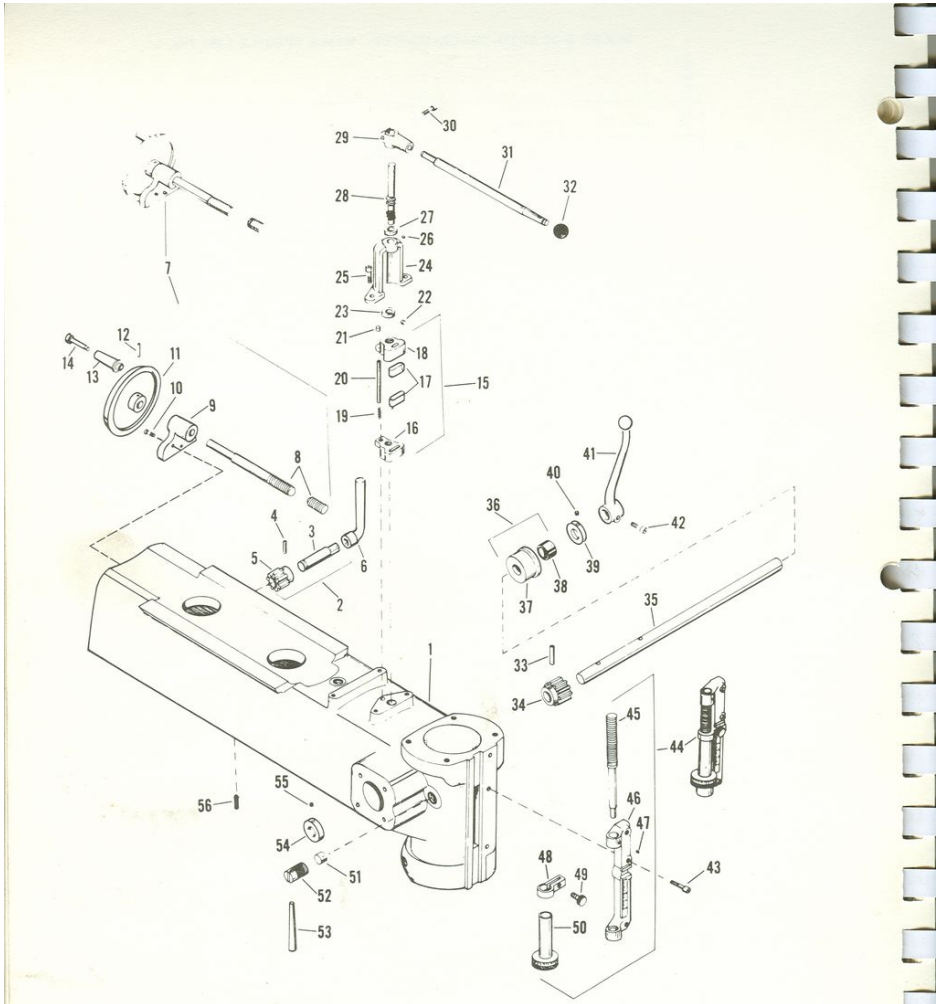
Photo 66



MODEL 2-30 AUTO-TRACE-MASTER--RAM & SPINDLE LIST NO. 1

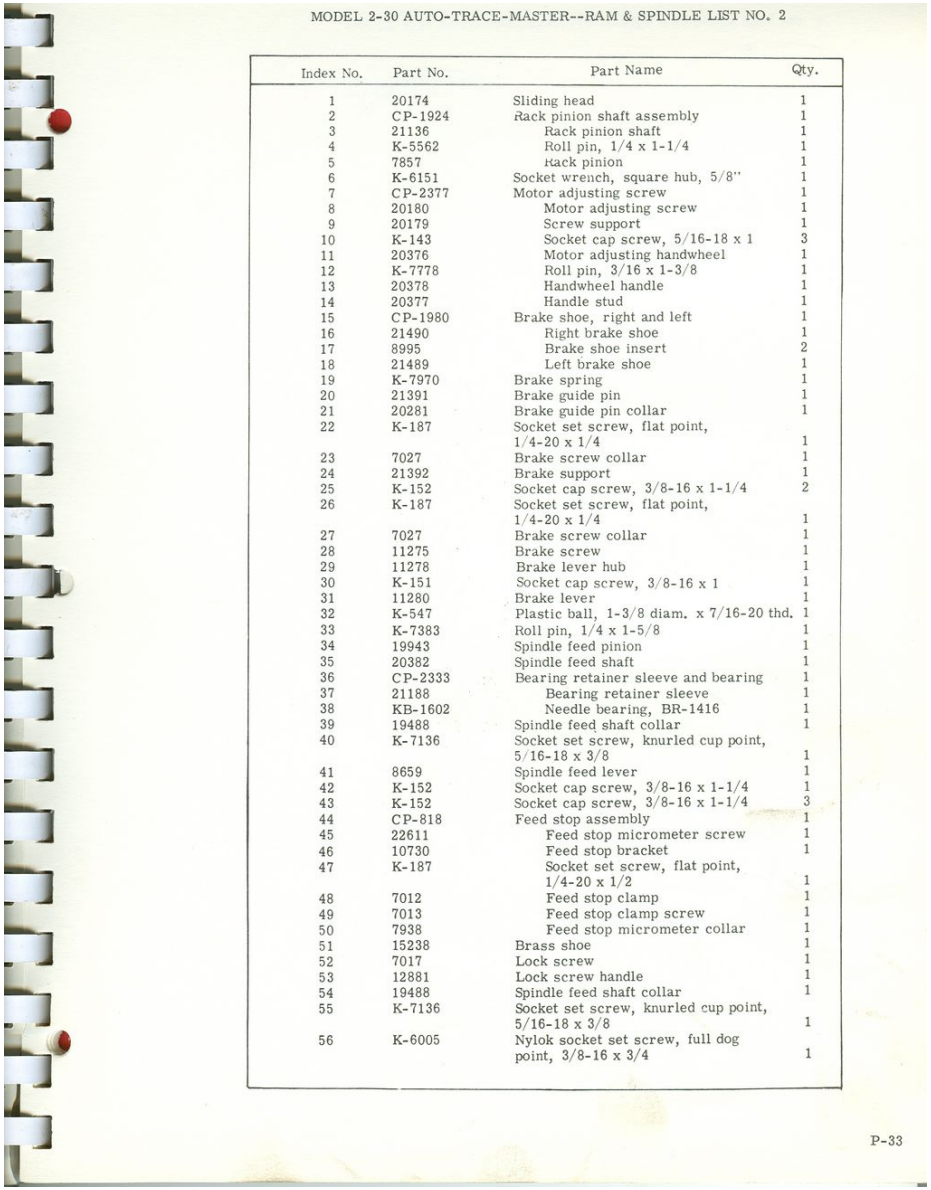
Index No.	Part No.	Part Name	Qty.
1	20174	Sliding head	1
2	10729	Depth stop cover plate	1
3	15239	Feed stop on spindle barrel	1
4	K-148	Socket cap screw, 5/16-18 x 1-1 2	2
5	K-1349	Ball bearing lock washer, #9	1
6	K-95	Ball bearing lock washer, #9	1
7	7978	Bumper washer	1
8	20006	Bearing mount	1
9	K-141	Socket cap screw, 5/16-18 x 3/4	4
10	K-163	Socket cap screw, 1/2-13 x 2	4
11	KB-37	Ball bearing, #209	1
12	CP-287	Ball bearing spacer in pulley shield	1
13	7945	Ball bearing spacer, inner	1
14	7944	Ball bearing spacer, outer	1
15	KB-37	Ball bearing, #209	1
16	7943	Ball bearing locknut	1
17	7939	Spindle pulley sleeve	1
18	7941	Key for spindle pulley sleeve	1
19	K-95	Ball bearing lock washer, #9	1
20	K-1349	Ball bearing lock washer, #9	1
21	9362	Spindle drive pulley	1
22	CP-73	Spindle dog retainer	1
23	K-3984	Socket set screw, flat point, 1/4-28 x 1/4	2
24	11995	Brass disc	2
25	9448	Knockout lever spring	2
26	10247	Spindle dog plunger	2
27	K-2330	Socket set screw, flat point, 5/16-24 x 1	2
28	10246	Spindle dog	1
29	9518	Felt washer	1
30	CP-2030	Spindle dog retainer and cover	1
31	10248	Spindle dog retainer	1
32	10245	Retainer cover	1
33	3271	Screw (Special) 10-32 x 1 2	4
34	K-138	Socket cap screw, 1/4-20 x 1-1/4	4
35	CP-1786	Draw bar rod and head, #10 B & S	1
35	CP-1773	Draw bar rod and head, #40 N. S.	1
36	CP-2532	Spindle and spindle barrel, #10 B & S	1
36	CP-2535	Spindle and spindle barrel, #40 N. S.	1
37	7951	Thrust collar (#10 B & S only)	1
38	K-1349	Ball bearing lock nut, #9	1
39	L-95	Ball bearing lock washer, #9	1
40	KB-37	Ball bearing, #209	1pr.
41	7946	Ball bearing spacer on spindle	1
42	19847	Spindle barrel	1
43	KB-37	Ball bearing, #209	1pr.
44	7948	Oil retainer on spindle	1
45	7942	Ball bearing lock nut	1
46	23089	Cutter spindle, #10 B & S	1
47	23093	Cutter spindle, #40 N. S.	1
48	10266	Spindle nose key, #40 N. S.	2
49	K-135	Socket cap screw, 1/4-20 x 3/4 #40 N. S.	2
50	8746	Spindle sleeve spring	1
51	15240	Bushing for spindle barrel	1
52	K-174	Socket cap screw, 5/8-11 x 4-1/2	1

Photo 67



MODEL 2-30 AUTO-TRACE-MASTER--RAM & SPINDLE NO. 2

Photo 68

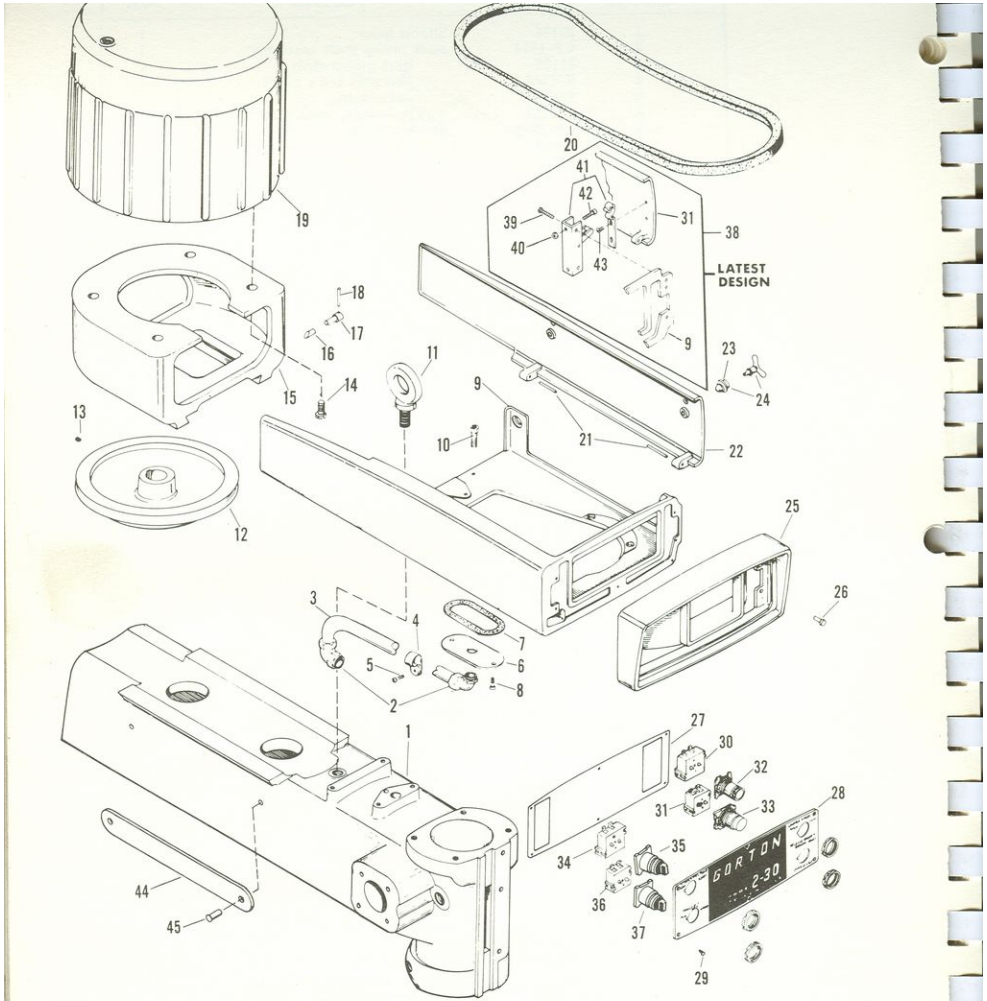


MODEL 2-30 AUTO-TRACE-MASTER--RAM & SPINDLE LIST NO. 2

Index No.	Part No.	Part Name	Qty.
1	20174	Sliding head	1
2	CP-1924	Rack pinion shaft assembly	1
3	21136	Rack pinion shaft	1
4	K-5562	Roll pin, 1/4 x 1-1/4	1
5	7857	Rack pinion	1
6	K-6151	Socket wrench, square hub, 5/8"	1
7	CP-2377	Motor adjusting screw	1
8	20180	Motor adjusting screw	1
9	20179	Screw support	1
10	K-143	Socket cap screw, 5/16-18 x 1	3
11	20376	Motor adjusting handwheel	1
12	K-7778	Roll pin, 3/16 x 1-3/8	1
13	20378	Handwheel handle	1
14	20377	Handle stud	1
15	CP-1980	Brake shoe, right and left	1
16	21490	Right brake shoe	1
17	8995	Brake shoe insert	2
18	21489	Left brake shoe	1
19	K-7970	Brake spring	1
20	21391	Brake guide pin	1
21	20281	Brake guide pin collar	1
22	K-187	Socket set screw, flat point, 1/4-20 x 1/4	1
23	7027	Brake screw collar	1
24	21392	Brake support	1
25	K-152	Socket cap screw, 3/8-16 x 1-1/4	2
26	K-187	Socket set screw, flat point, 1/4-20 x 1/4	1
27	7027	Brake screw collar	1
28	11275	Brake screw	1
29	11278	Brake lever hub	1
30	K-151	Socket cap screw, 3/8-16 x 1	1
31	11280	Brake lever	1
32	K-547	Plastic ball, 1-3/8 diam. x 7/16-20 thd.	1
33	K-7383	Roll pin, 1/4 x 1-5/8	1
34	19943	Spindle feed pinion	1
35	20382	Spindle feed shaft	1
36	CP-2333	Bearing retainer sleeve and bearing	1
37	21188	Bearing retainer sleeve	1
38	KB-1602	Needle bearing, BR-1416	1
39	19488	Spindle feed shaft collar	1
40	K-7136	Socket set screw, knurled cup point, 5/16-18 x 3/8	1
41	8659	Spindle feed lever	1
42	K-152	Socket cap screw, 3/8-16 x 1-1/4	1
43	K-152	Socket cap screw, 3/8-16 x 1-1/4	3
44	CP-818	Feed stop assembly	1
45	22611	Feed stop micrometer screw	1
46	10730	Feed stop bracket	1
47	K-187	Socket set screw, flat point, 1/4-20 x 1/2	1
48	7012	Feed stop clamp	1
49	7013	Feed stop clamp screw	1
50	7938	Feed stop micrometer collar	1
51	15238	Brass shoe	1
52	7017	Lock screw	1
53	12881	Lock screw handle	1
54	19488	Spindle feed shaft collar	1
55	K-7136	Socket set screw, knurled cup point, 5/16-18 x 3/8	1
56	K-6005	Nylok socket set screw, full dog point, 3/8-16 x 3/4	1

P-33

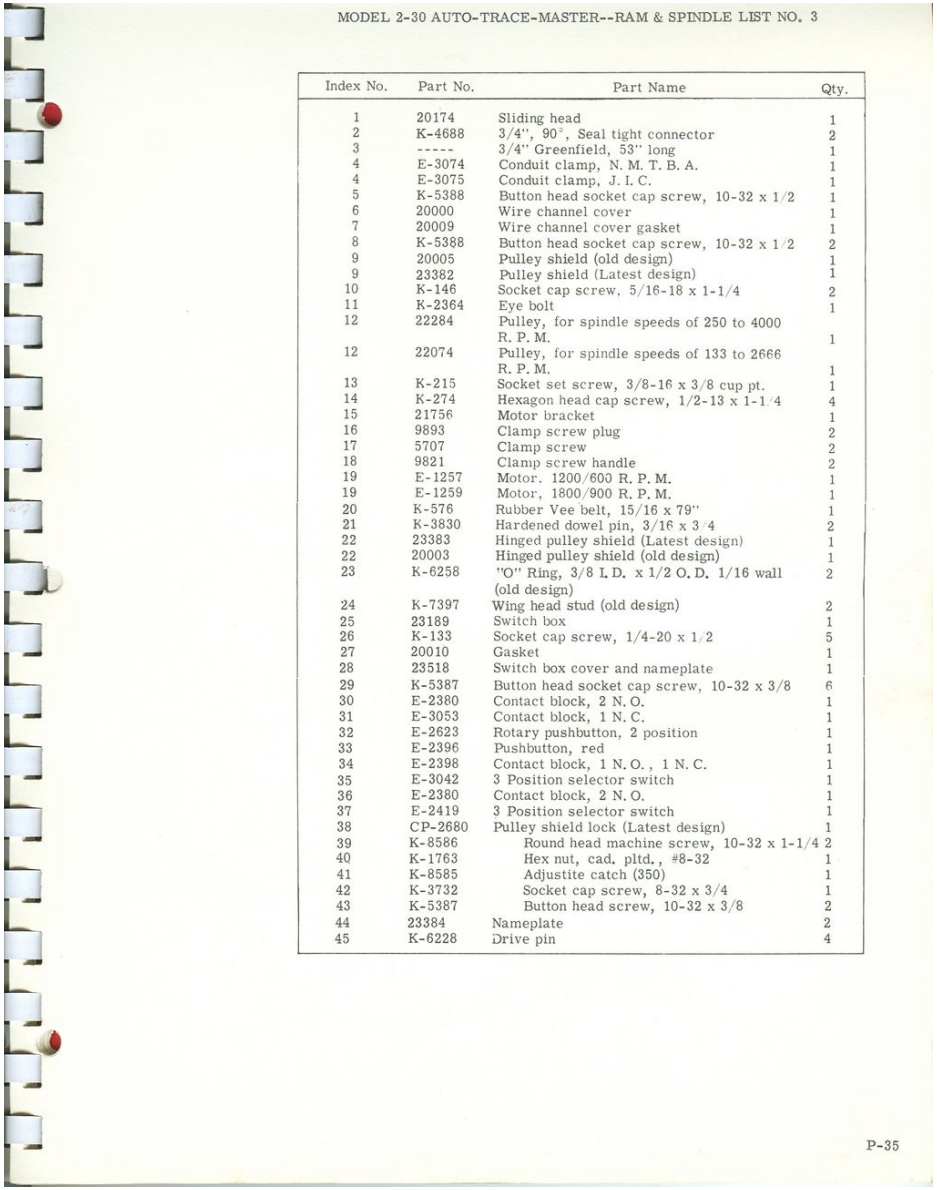
Photo 69



MODEL 2-30 AUTO-TRACE-MASTER--RAM & SPINDLE NO. 3

P-34

Photo 70

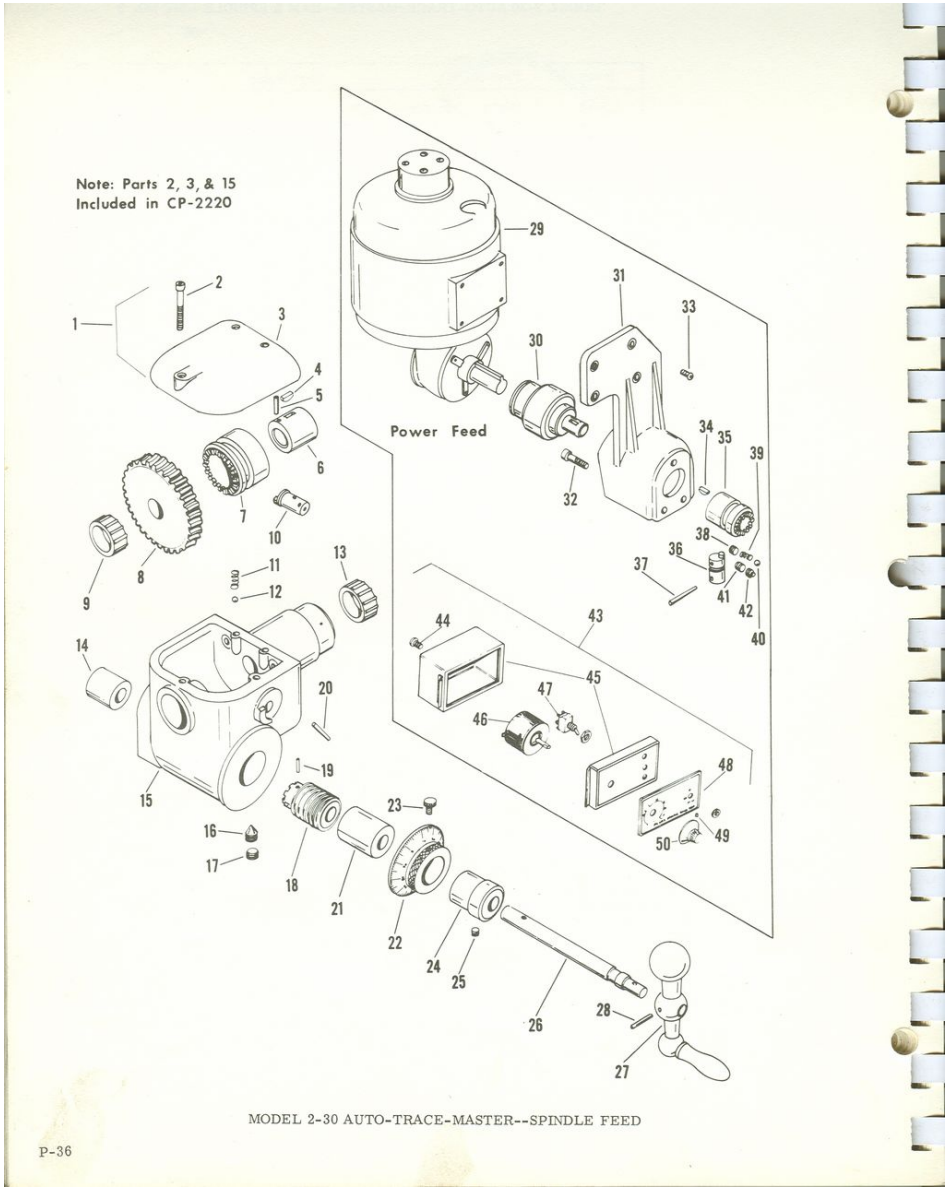


MODEL 2-30 AUTO-TRACE-MASTER--RAM & SPINDLE LIST NO. 3

Index No.	Part No.	Part Name	Qty.
1	20174	Sliding head	1
2	K-4688	3/4", 90°, Seal tight connector	2
3	-----	3/4" Greenfield, 53" long	1
4	E-3074	Conduit clamp, N. M. T. B. A.	1
4	E-3075	Conduit clamp, J. I. C.	1
5	K-5388	Button head socket cap screw, 10-32 x 1/2	1
6	20000	Wire channel cover	1
7	20009	Wire channel cover gasket	1
8	K-5388	Button head socket cap screw, 10-32 x 1/2	2
9	20005	Pulley shield (old design)	1
9	23382	Pulley shield (Latest design)	1
10	K-146	Socket cap screw, 5/16-18 x 1-1/4	2
11	K-2364	Eye bolt	1
12	22284	Pulley, for spindle speeds of 250 to 4000 R. P. M.	1
12	22074	Pulley, for spindle speeds of 133 to 2666 R. P. M.	1
13	K-215	Socket set screw, 3/8-16 x 3/8 cup pt.	1
14	K-274	Hexagon head cap screw, 1/2-13 x 1-1/4	4
15	21756	Motor bracket	1
16	9893	Clamp screw plug	2
17	5707	Clamp screw	2
18	9821	Clamp screw handle	2
19	E-1257	Motor, 1200/600 R. P. M.	1
19	E-1259	Motor, 1800/900 R. P. M.	1
20	K-576	Rubber Vee belt, 15/16 x 79"	1
21	K-3830	Hardened dowel pin, 3/16 x 3/4	2
22	23383	Hinged pulley shield (Latest design)	1
22	20003	Hinged pulley shield (old design)	1
23	K-6258	"O" Ring, 3/8 I. D. x 1/2 O. D. 1/16 wall (old design)	2
24	K-7397	Wing head stud (old design)	2
25	23189	Switch box	1
26	K-133	Socket cap screw, 1/4-20 x 1/2	5
27	20010	Gasket	1
28	23518	Switch box cover and nameplate	1
29	K-5387	Button head socket cap screw, 10-32 x 3/8	6
30	E-2380	Contact block, 2 N. O.	1
31	E-3053	Contact block, 1 N. C.	1
32	E-2623	Rotary pushbutton, 2 position	1
33	E-2396	Pushbutton, red	1
34	E-2398	Contact block, 1 N. O., 1 N. C.	1
35	E-3042	3 Position selector switch	1
36	E-2380	Contact block, 2 N. O.	1
37	E-2419	3 Position selector switch	1
38	CP-2680	Pulley shield lock (Latest design)	1
39	K-8586	Round head machine screw, 10-32 x 1-1/4	2
40	K-1763	Hex nut, cad. pltd., #8-32	1
41	K-8585	Adjustite catch (350)	1
42	K-3732	Socket cap screw, 8-32 x 3/4	1
43	K-5387	Button head screw, 10-32 x 3/8	2
44	23384	Nameplate	2
45	K-6228	Drive pin	4

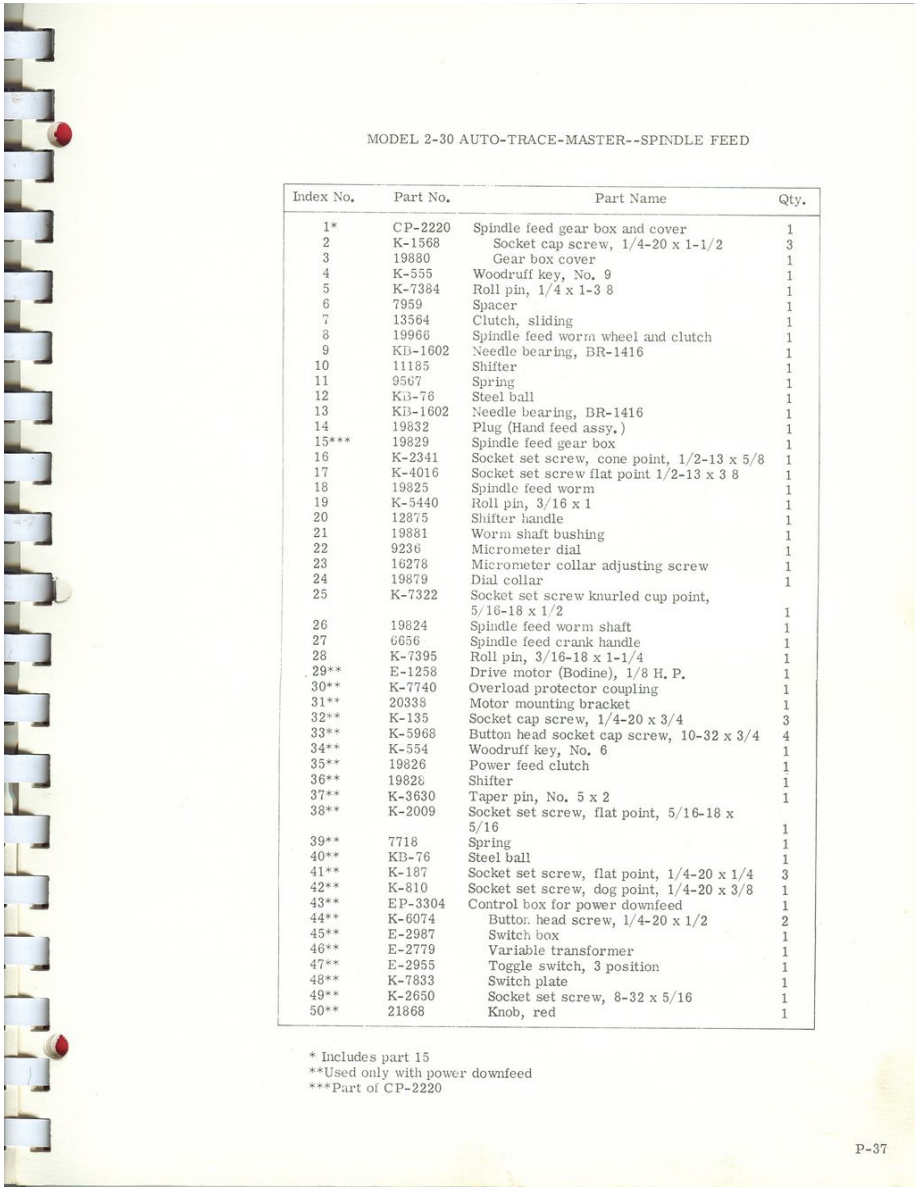
P-35

Photo 71



MODEL 2-30 AUTO-TRACE-MASTER--SPINDLE FEED

Photo 72



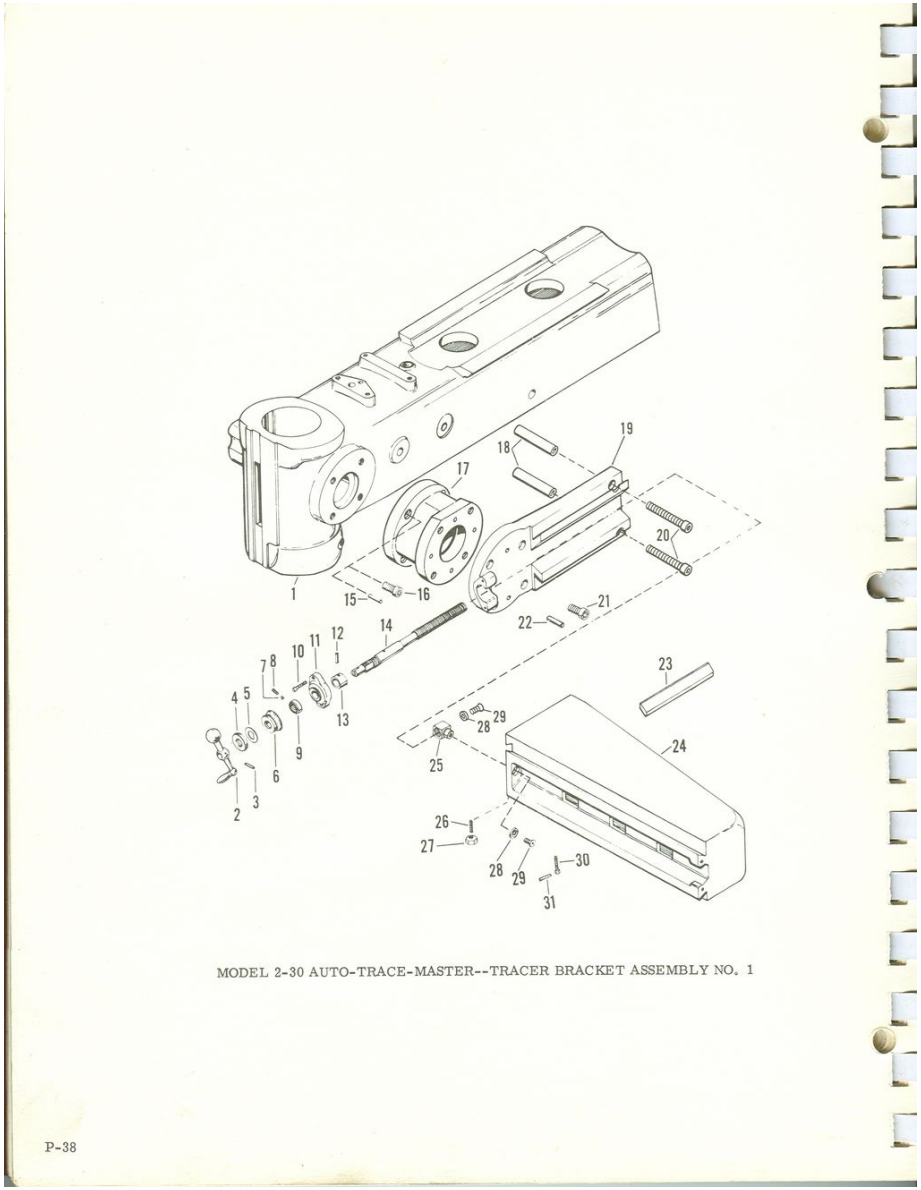
MODEL 2-30 AUTO-TRACE-MASTER--SPINDLE FEED

Index No.	Part No.	Part Name	Qty.
1*	CP-2220	Spindle feed gear box and cover	1
2	K-1568	Socket cap screw, 1/4-20 x 1-1/2	3
3	19880	Gear box cover	1
4	K-555	Woodruff key, No. 9	1
5	K-7384	Roll pin, 1/4 x 1-3 8	1
6	7959	Spacer	1
7	13564	Clutch, sliding	1
8	19966	Spindle feed worm wheel and clutch	1
9	KB-1602	Needle bearing, BR-1416	1
10	11185	Shifter	1
11	9567	Spring	1
12	KB-76	Steel ball	1
13	KB-1602	Needle bearing, BR-1416	1
14	19832	Plug (Hand feed assy.)	1
15***	19829	Spindle feed gear box	1
16	K-2341	Socket set screw, cone point, 1/2-13 x 5/8	1
17	K-4016	Socket set screw flat point 1/2-13 x 3 8	1
18	19825	Spindle feed worm	1
19	K-5440	Roll pin, 3/16 x 1	1
20	12875	Shifter handle	1
21	19881	Worm shaft bushing	1
22	9236	Micrometer dial	1
23	16278	Micrometer collar adjusting screw	1
24	19879	Dial collar	1
25	K-7322	Socket set screw knurled cup point, 5/16-18 x 1/2	1
26	19824	Spindle feed worm shaft	1
27	6656	Spindle feed crank handle	1
28	K-7395	Roll pin, 3/16-18 x 1-1/4	1
29**	E-1258	Drive motor (Bodine), 1/8 H. P.	1
30**	K-7740	Overload protector coupling	1
31**	20338	Motor mounting bracket	1
32**	K-135	Socket cap screw, 1/4-20 x 3/4	3
33**	K-5968	Button head socket cap screw, 10-32 x 3/4	4
34**	K-554	Woodruff key, No. 6	1
35**	19826	Power feed clutch	1
36**	19828	Shifter	1
37**	K-3630	Taper pin, No. 5 x 2	1
38**	K-2009	Socket set screw, flat point, 5/16-18 x 5/16	1
39**	7718	Spring	1
40**	KB-76	Steel ball	1
41**	K-187	Socket set screw, flat point, 1/4-20 x 1/4	3
42**	K-810	Socket set screw, dog point, 1/4-20 x 3/8	1
43**	EP-3304	Control box for power downfeed	1
44**	K-6074	Button head screw, 1/4-20 x 1/2	2
45**	E-2987	Switch box	1
46**	E-2779	Variable transformer	1
47**	E-2955	Toggle switch, 3 position	1
48**	K-7833	Switch plate	1
49**	K-2650	Socket set screw, 8-32 x 5/16	1
50**	21868	Knob, red	1

* Includes part 15
**Used only with power downfeed
***Part of CP-2220

P-37

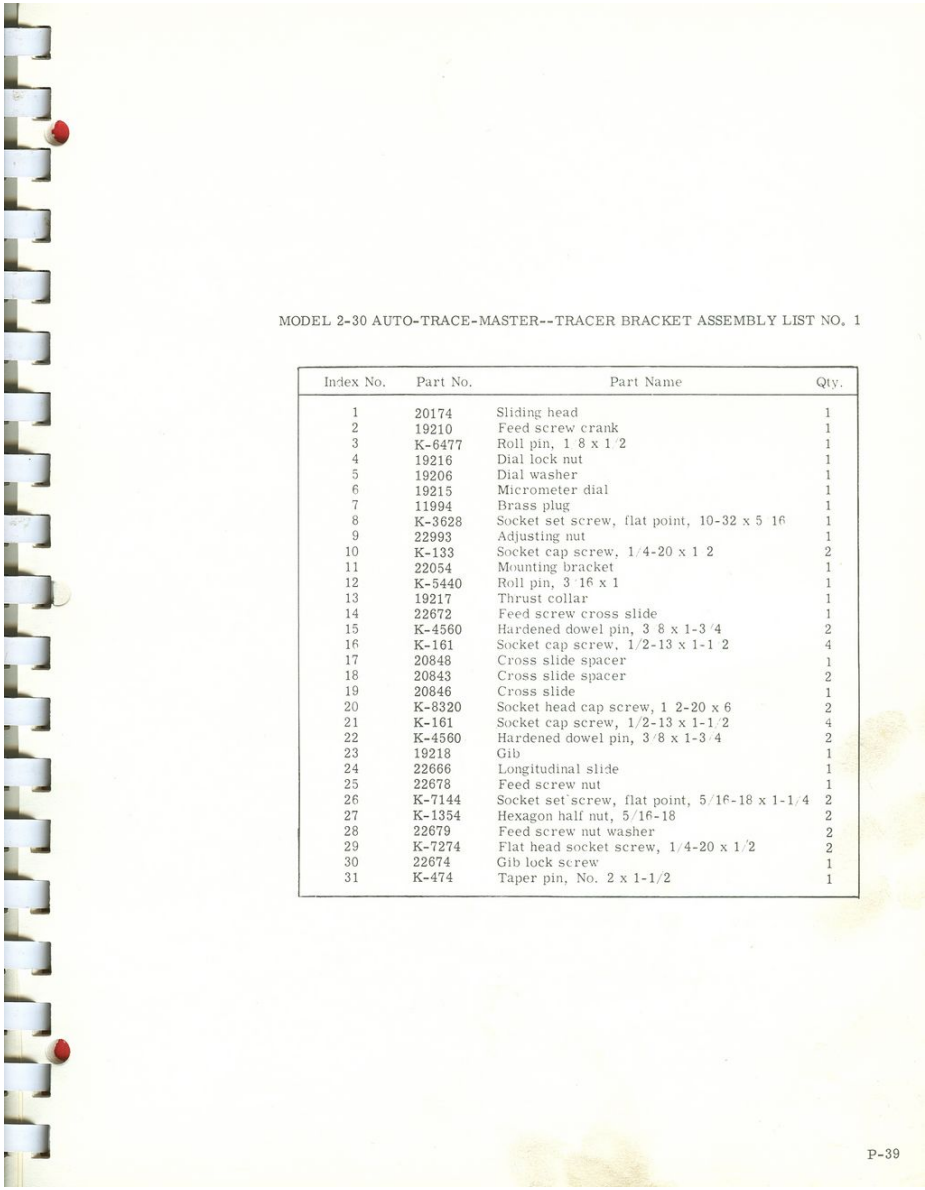
Photo 73



MODEL 2-30 AUTO-TRACE-MASTER--TRACER BRACKET ASSEMBLY NO. 1

P-38

Photo 74

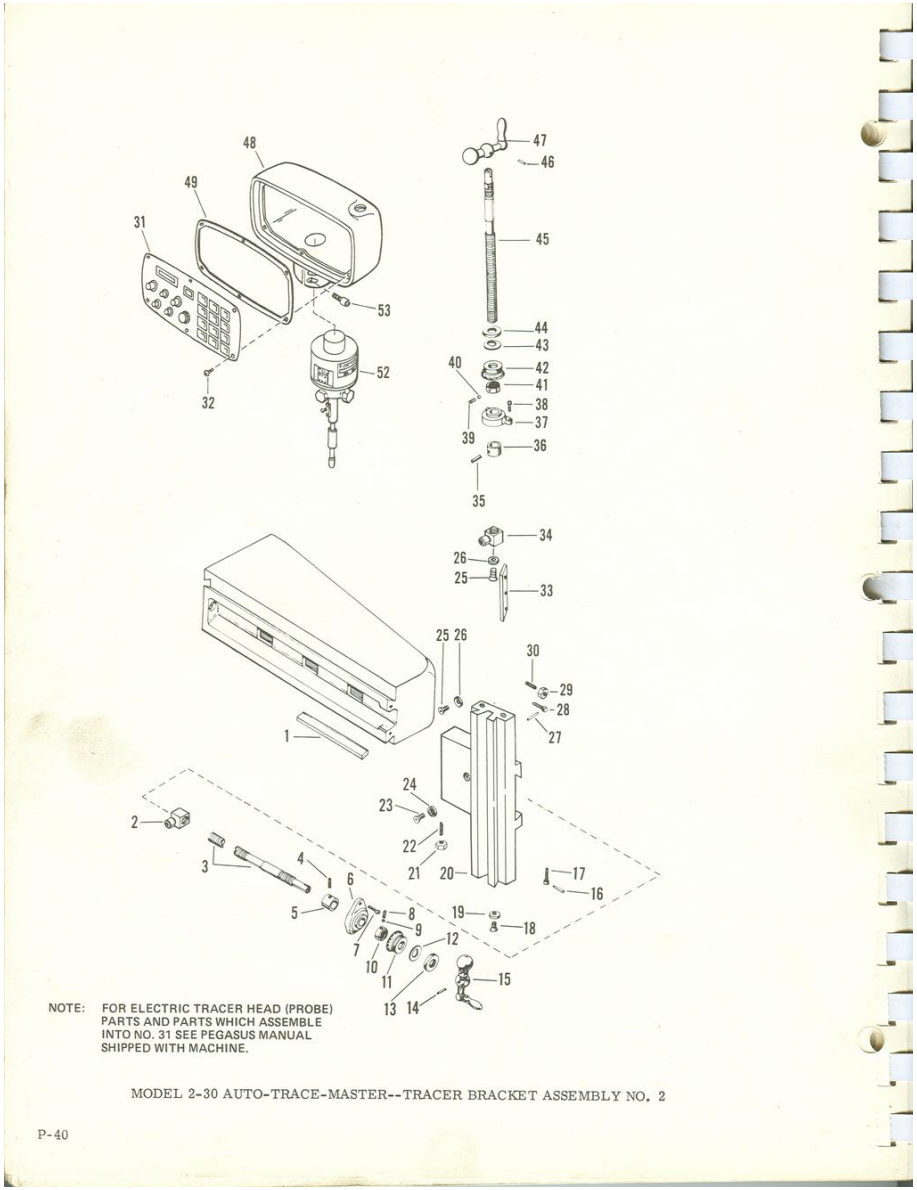


MODEL 2-30 AUTO-TRACE-MASTER--TRACER BRACKET ASSEMBLY LIST NO. 1

Index No.	Part No.	Part Name	Qty.
1	20174	Sliding head	1
2	19210	Feed screw crank	1
3	K-6477	Roll pin, 1/8 x 1/2	1
4	19216	Dial lock nut	1
5	19206	Dial washer	1
6	19215	Micrometer dial	1
7	11994	Brass plug	1
8	K-3628	Socket set screw, flat point, 10-32 x 5/16	1
9	22993	Adjusting nut	1
10	K-133	Socket cap screw, 1/4-20 x 1/2	2
11	22054	Mounting bracket	1
12	K-5440	Roll pin, 3/16 x 1	1
13	19217	Thrust collar	1
14	22672	Feed screw cross slide	1
15	K-4560	Hardened dowel pin, 3/8 x 1-3/4	2
16	K-161	Socket cap screw, 1/2-13 x 1-1/2	4
17	20848	Cross slide spacer	1
18	20843	Cross slide spacer	2
19	20846	Cross slide	1
20	K-8320	Socket head cap screw, 1/2-20 x 6	2
21	K-161	Socket cap screw, 1/2-13 x 1-1/2	4
22	K-4560	Hardened dowel pin, 3/8 x 1-3/4	2
23	19218	Gib	1
24	22666	Longitudinal slide	1
25	22678	Feed screw nut	1
26	K-7144	Socket set screw, flat point, 5/16-18 x 1-1/4	2
27	K-1354	Hexagon half nut, 5/16-18	2
28	22679	Feed screw nut washer	2
29	K-7274	Flat head socket screw, 1/4-20 x 1/2	2
30	22674	Gib lock screw	1
31	K-474	Taper pin, No. 2 x 1-1/2	1

P-39

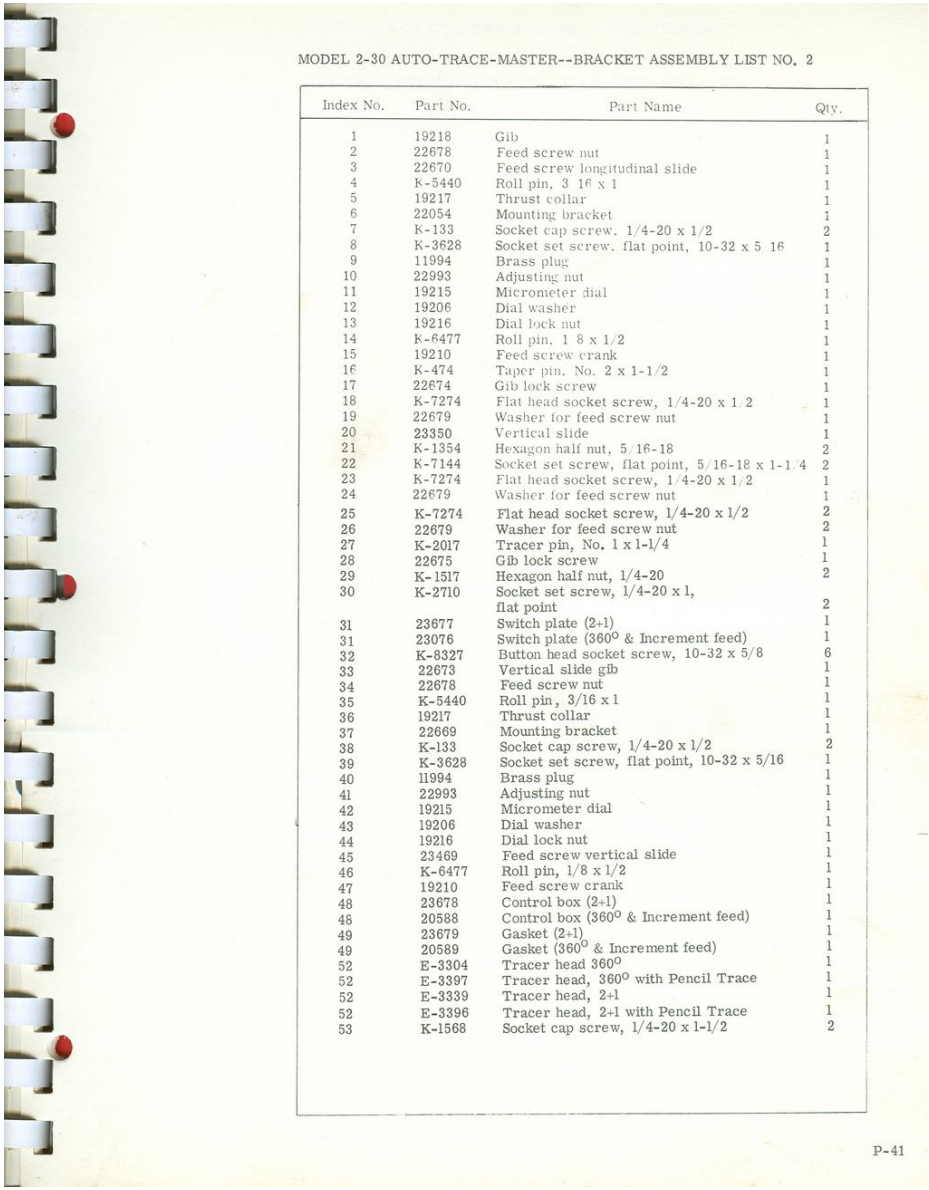
Photo 75



NOTE: FOR ELECTRIC TRACER HEAD (PROBE) PARTS AND PARTS WHICH ASSEMBLE INTO NO. 31 SEE PEGASUS MANUAL SHIPPED WITH MACHINE.

MODEL 2-30 AUTO-TRACE-MASTER--TRACER BRACKET ASSEMBLY NO. 2

Photo 76



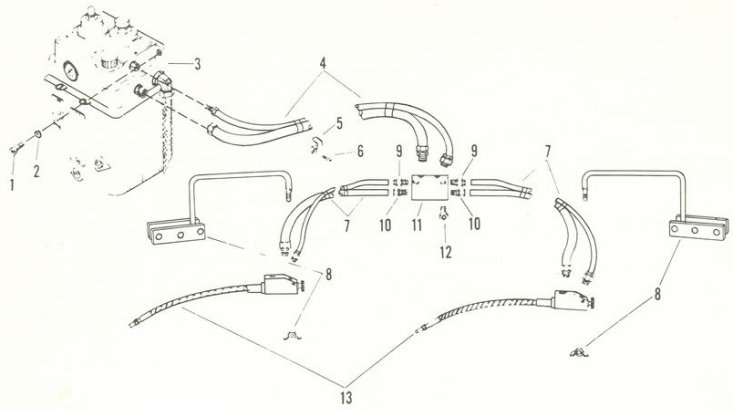
MODEL 2-30 AUTO-TRACE-MASTER--BRACKET ASSEMBLY LIST NO. 2

Index No.	Part No.	Part Name	Qty.
1	19218	Gib	1
2	22678	Feed screw nut	1
3	22670	Feed screw longitudinal slide	1
4	K-5440	Roll pin, 3 16 x 1	1
5	19217	Thrust collar	1
6	22054	Mounting bracket	1
7	K-133	Socket cap screw, 1/4-20 x 1/2	2
8	K-3628	Socket set screw, flat point, 10-32 x 5 16	1
9	11994	Brass plug	1
10	22993	Adjusting nut	1
11	19215	Micrometer dial	1
12	19206	Dial washer	1
13	19216	Dial lock nut	1
14	K-6477	Roll pin, 1 8 x 1/2	1
15	19210	Feed screw crank	1
16	K-474	Taper pin, No. 2 x 1-1/2	1
17	22674	Gib lock screw	1
18	K-7274	Flat head socket screw, 1/4-20 x 1 2	1
19	22679	Washer for feed screw nut	1
20	23350	Vertical slide	1
21	K-1354	Hexagon half nut, 5 16-18	2
22	K-7144	Socket set screw, flat point, 5/16-18 x 1-1/4	2
23	K-7274	Flat head socket screw, 1/4-20 x 1/2	1
24	22679	Washer for feed screw nut	1
25	K-7274	Flat head socket screw, 1/4-20 x 1/2	2
26	22679	Washer for feed screw nut	2
27	K-2017	Tracer pin, No. 1 x 1-1/4	1
28	22675	Gib lock screw	1
29	K-1517	Hexagon half nut, 1/4-20	2
30	K-2710	Socket set screw, 1/4-20 x 1, flat point	2
31	23677	Switch plate (2+1)	1
31	23076	Switch plate (360° & Increment feed)	1
32	K-8327	Button head socket screw, 10-32 x 5/8	6
33	22673	Vertical slide gib	1
34	22678	Feed screw nut	1
35	K-5440	Roll pin, 3/16 x 1	1
36	19217	Thrust collar	1
37	22669	Mounting bracket	1
38	K-133	Socket cap screw, 1/4-20 x 1/2	2
39	K-3628	Socket set screw, flat point, 10-32 x 5/16	1
40	11994	Brass plug	1
41	22993	Adjusting nut	1
42	19215	Micrometer dial	1
43	19206	Dial washer	1
44	19216	Dial lock nut	1
45	23469	Feed screw vertical slide	1
46	K-6477	Roll pin, 1/8 x 1/2	1
47	19210	Feed screw crank	1
48	23678	Control box (2+1)	1
48	20588	Control box (360° & Increment feed)	1
49	23679	Gasket (2+1)	1
49	20589	Gasket (360° & Increment feed)	1
52	E-3304	Tracer head 360°	1
52	E-3397	Tracer head, 360° with Pencil Trace	1
52	E-3339	Tracer head, 2+1	1
52	E-3396	Tracer head, 2+1 with Pencil Trace	1
53	K-1568	Socket cap screw, 1/4-20 x 1-1/2	2

P-41

Photo 77

MODEL 2-30 AUTO-TRACE-MASTER--SPRAY MIST COOLANT

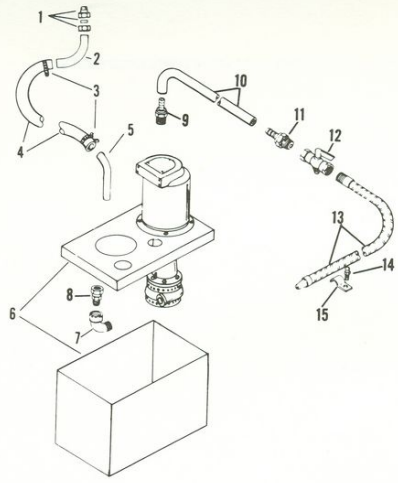


MODEL 2-30 AUTO-TRACE-MASTER--SPRAY MIST COOLANT

Index No.	Part No.	Part Name	Qty.
1	K-135	Socket cap screw, 1 4-20 x 3/4	2
2	K-440	Spring lockwasher, 1/4 in.	2
3	K-6510	Spray mist coolant unit UBA, Bijur No. D-107	1
4	K-6512	Dual hose assembly, 8 ft., Bijur No. B-156-8	1
5	K-6539	Parker hose clip	1
6	K-5387	Button head socket screw, 10-32 x 3 8	1
7	K-6775**	Dual hose assembler, 3 ft.	2
8	K-6513	Magnetic jet holder, Bijur No. B-133	2*
9	K-4521**	Straight adapter, No. A-2835	3
10	K-6776**	Hose connector, 5/16, No. B-150	3
11	K-6774**	3-Way dual tee block	1
12	K-1568	Socket cap screw, 1/4-20 x 1-1/2	2
13	K-6511	Flexible extension jet, Bijur No. B-101	2*

*Only one used in single nozzle system
**Used only on dual nozzle system

Photo 78



Index No.	Part No.	Part Name	Qty.
1	K-7851	Tube fitting, No. 12FBU-S	1
2	20399	Coolant return elbow	1
3	K-7850	Hose clamp	2
4	K-8009	Coolant return hose	1
5	20398	Coolant return tube	1
6	E-1084	Coolant pump, tank and motor	1
7	K-816	Street ell, 3 8	1
8	K-2050	Reducer, 1/2 to 3/8	1
9	K-8298	Push on coupling	1
10	K-8300	Push on hose	1
11	K-8299	Push on coupling	1
12	K-8301	Two-way shut-off valve	1
13	K-8302	Flexible spout	1
14	K-8304	Thumb screw	1
15	K-8303	Cable clamp	1

MODEL 2-30 AUTO-TRACE-MASTER--FLOOD COOLANT

Photo 79

MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

5/2—1/2 H. P. STANDARD HEAD (2 + 1)

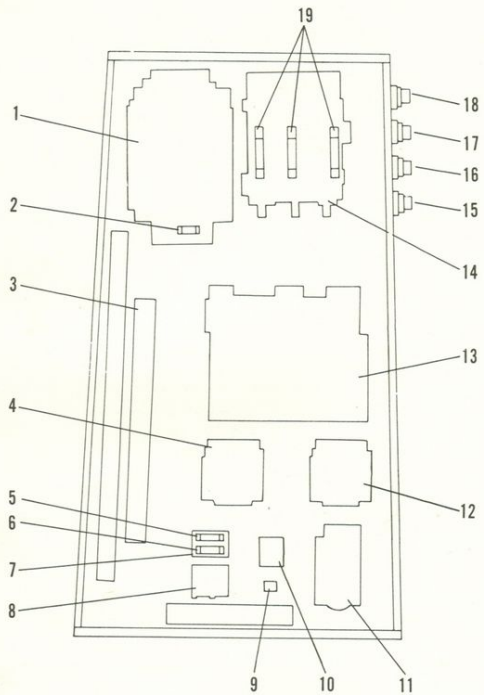
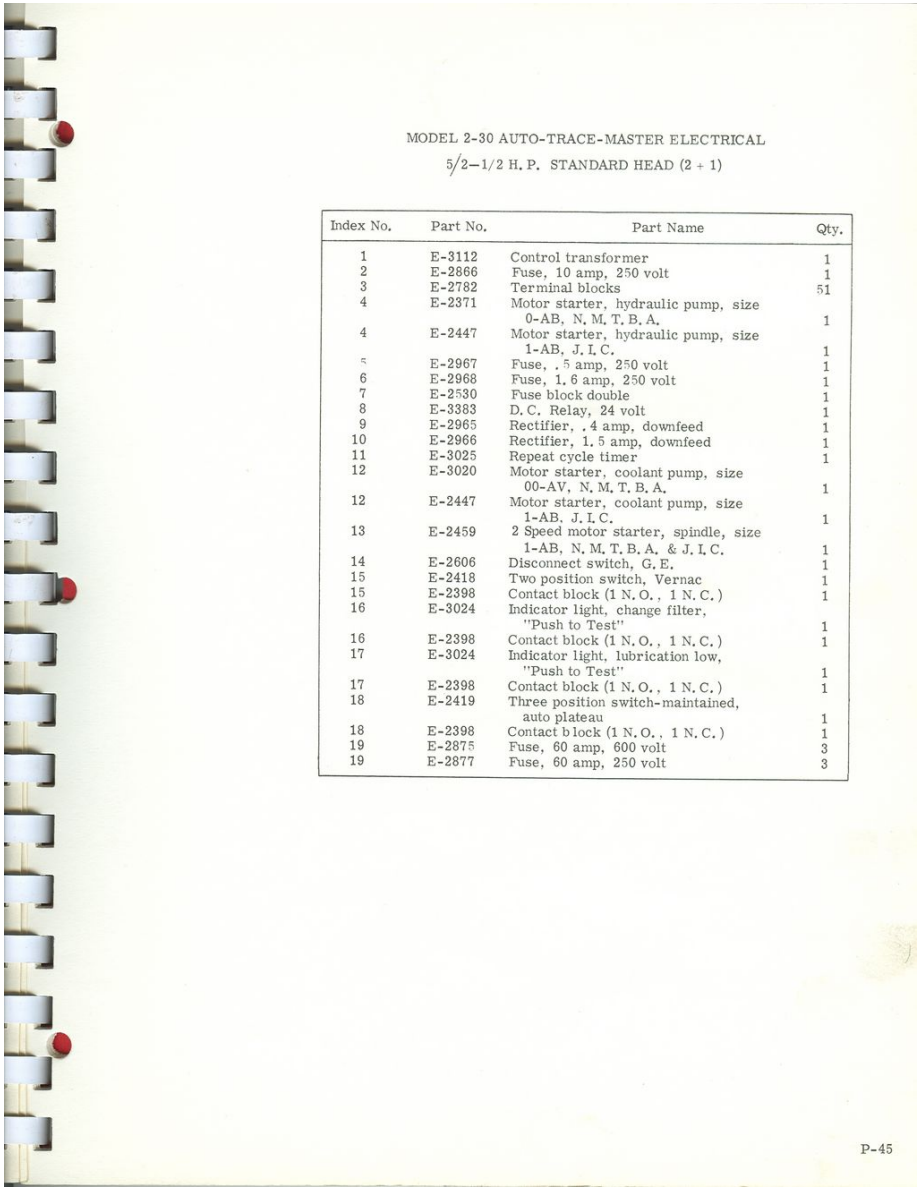


Photo 80



MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

5/2—1/2 H. P. STANDARD HEAD (2 + 1)

Index No.	Part No.	Part Name	Qty.
1	E-3112	Control transformer	1
2	E-2866	Fuse, 10 amp, 250 volt	1
3	E-2782	Terminal blocks	51
4	E-2371	Motor starter, hydraulic pump, size 0-AB, N. M. T. B. A.	1
4	E-2447	Motor starter, hydraulic pump, size 1-AB, J. I. C.	1
5	E-2967	Fuse, .5 amp, 250 volt	1
6	E-2968	Fuse, 1.6 amp, 250 volt	1
7	E-2530	Fuse block double	1
8	E-3383	D. C. Relay, 24 volt	1
9	E-2965	Rectifier, .4 amp, downfeed	1
10	E-2966	Rectifier, 1.5 amp, downfeed	1
11	E-3025	Repeat cycle timer	1
12	E-3020	Motor starter, coolant pump, size 00-AV, N. M. T. B. A.	1
12	E-2447	Motor starter, coolant pump, size 1-AB, J. I. C.	1
13	E-2459	2 Speed motor starter, spindle, size 1-AB, N. M. T. B. A. & J. I. C.	1
14	E-2606	Disconnect switch, G. E.	1
15	E-2418	Two position switch, Vernac	1
15	E-2398	Contact block (1 N. O., 1 N. C.)	1
16	E-3024	Indicator light, change filter, "Push to Test"	1
16	E-2398	Contact block (1 N. O., 1 N. C.)	1
17	E-3024	Indicator light, lubrication low, "Push to Test"	1
17	E-2398	Contact block (1 N. O., 1 N. C.)	1
18	E-2419	Three position switch-maintained, auto plateau	1
18	E-2398	Contact block (1 N. O., 1 N. C.)	1
19	E-2875	Fuse, 60 amp, 600 volt	3
19	E-2877	Fuse, 60 amp, 250 volt	3

Photo 81

MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

5/2—1/2 H. P. STANDARD HEAD (360°)

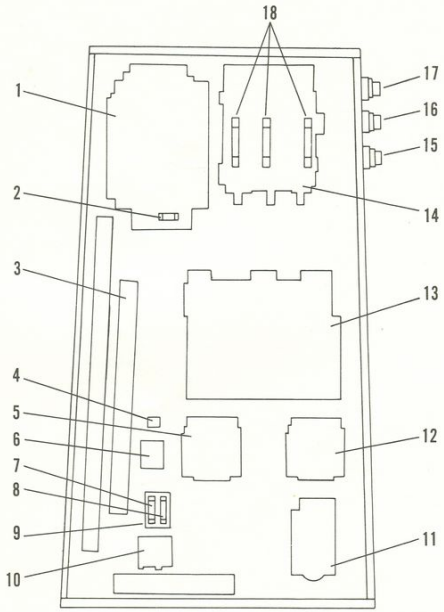
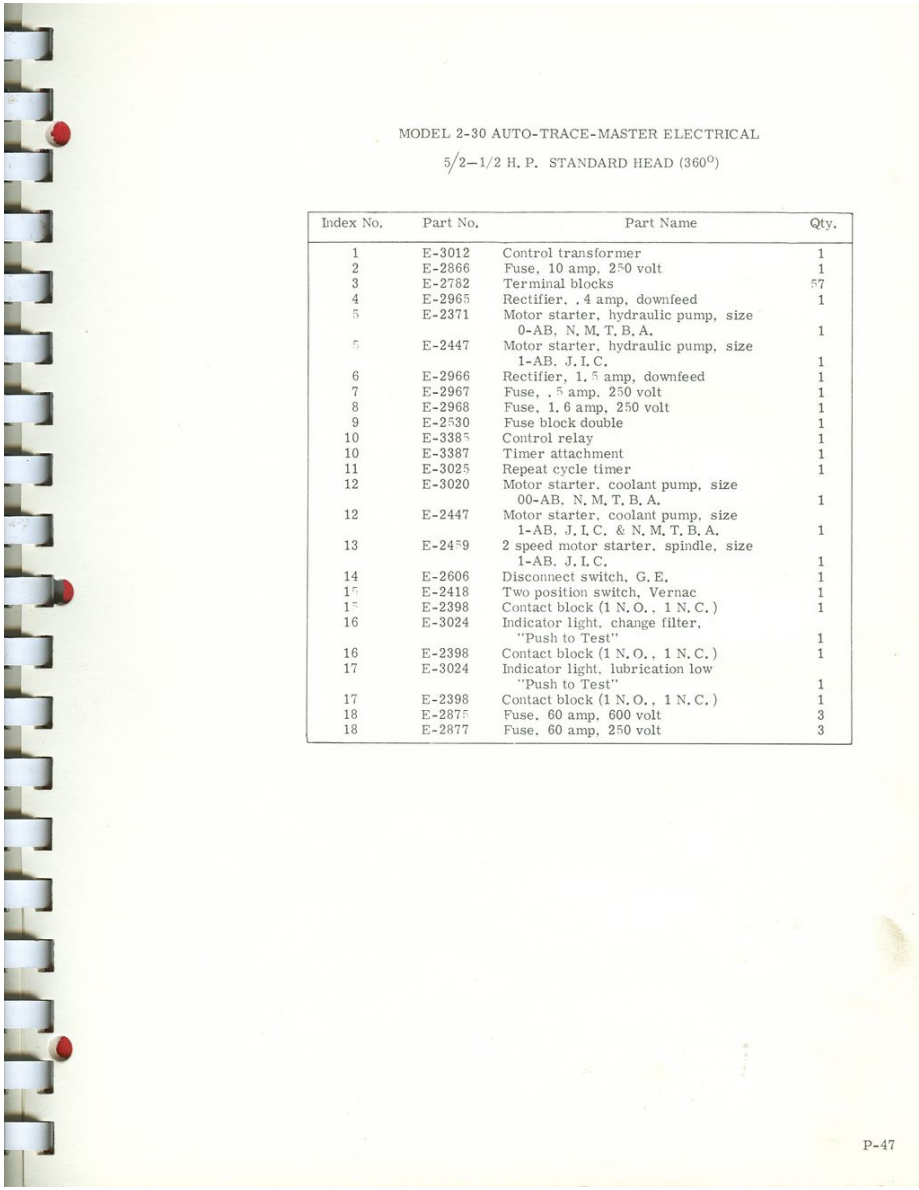


Photo 82



MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

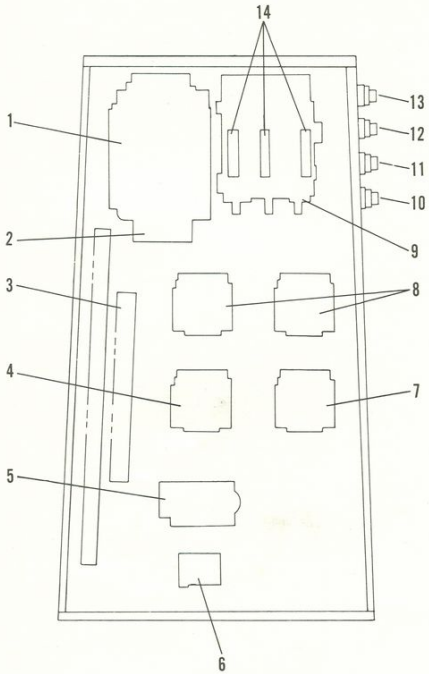
5/2—1/2 H. P. STANDARD HEAD (360°)

Index No.	Part No.	Part Name	Qty.
1	E-3012	Control transformer	1
2	E-2866	Fuse, 10 amp, 250 volt	1
3	E-2782	Terminal blocks	57
4	E-2965	Rectifier, .4 amp, downfeed	1
5	E-2371	Motor starter, hydraulic pump, size 0-AB, N. M. T. B. A.	1
5	E-2447	Motor starter, hydraulic pump, size 1-AB, J. I. C.	1
6	E-2966	Rectifier, 1.5 amp, downfeed	1
7	E-2967	Fuse, .5 amp, 250 volt	1
8	E-2968	Fuse, 1.6 amp, 250 volt	1
9	E-2530	Fuse block double	1
10	E-3385	Control relay	1
10	E-3387	Timer attachment	1
11	E-3025	Repeat cycle timer	1
12	E-3020	Motor starter, coolant pump, size 00-AB, N. M. T. B. A.	1
12	E-2447	Motor starter, coolant pump, size 1-AB, J. I. C. & N. M. T. B. A.	1
13	E-2459	2 speed motor starter, spindle, size 1-AB, J. I. C.	1
14	E-2606	Disconnect switch, G. E.	1
15	E-2418	Two position switch, Vernac	1
15	E-2398	Contact block (1 N. O., 1 N. C.)	1
16	E-3024	Indicator light, change filter, "Push to Test"	1
16	E-2398	Contact block (1 N. O., 1 N. C.)	1
17	E-3024	Indicator light, lubrication low "Push to Test"	1
17	E-2398	Contact block (1 N. O., 1 N. C.)	1
18	E-2875	Fuse, 60 amp, 600 volt	3
18	E-2877	Fuse, 60 amp, 250 volt	3

Photo 83

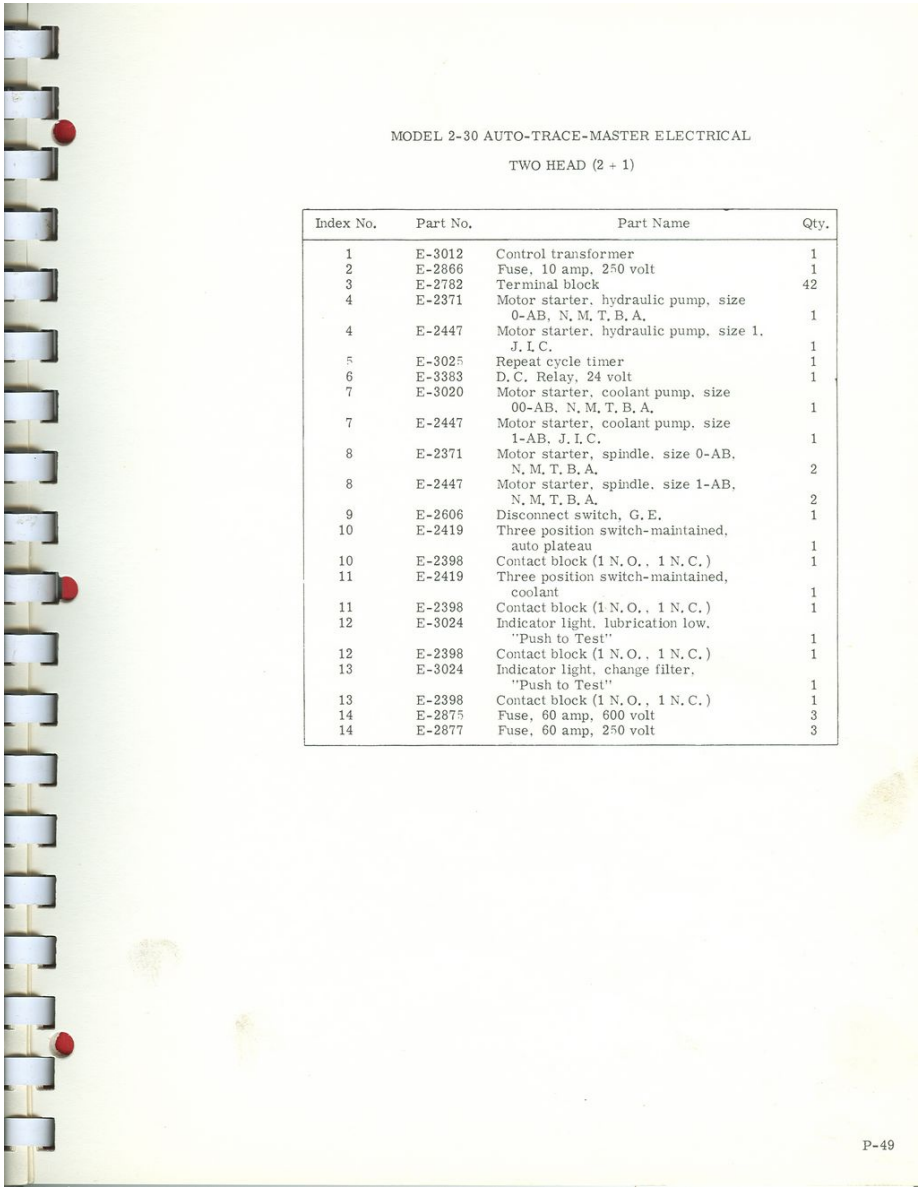
MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

TWO HEAD (2 + 1)



P-48

Photo 84



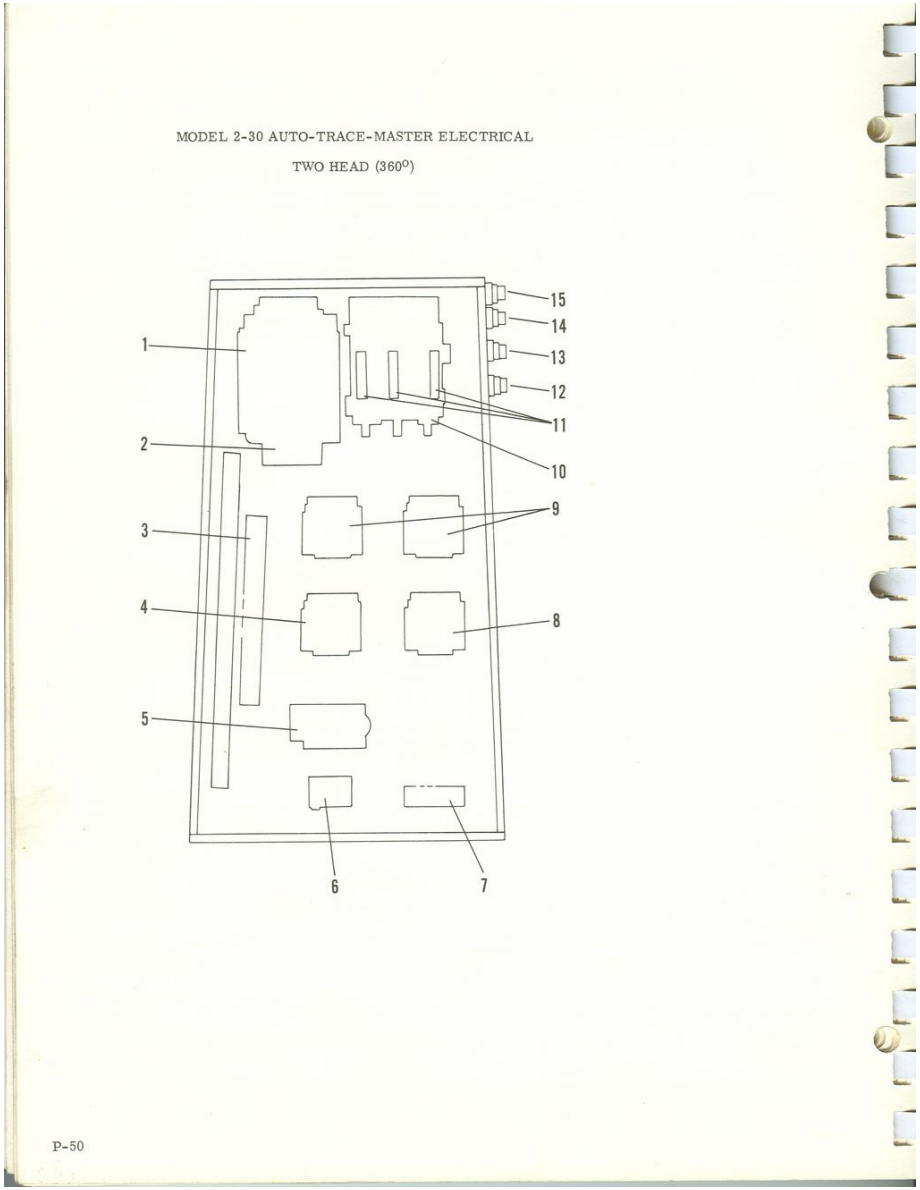
MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

TWO HEAD (2 + 1)

Index No.	Part No.	Part Name	Qty.
1	E-3012	Control transformer	1
2	E-2866	Fuse, 10 amp, 250 volt	1
3	E-2782	Terminal block	42
4	E-2371	Motor starter, hydraulic pump, size 0-AB, N. M. T. B. A.	1
4	E-2447	Motor starter, hydraulic pump, size 1, J. I. C.	1
5	E-3025	Repeat cycle timer	1
6	E-3383	D. C. Relay, 24 volt	1
7	E-3020	Motor starter, coolant pump, size 00-AB, N. M. T. B. A.	1
7	E-2447	Motor starter, coolant pump, size 1-AB, J. I. C.	1
8	E-2371	Motor starter, spindle, size 0-AB, N. M. T. B. A.	2
8	E-2447	Motor starter, spindle, size 1-AB, N. M. T. B. A.	2
9	E-2606	Disconnect switch, G. E.	1
10	E-2419	Three position switch-maintained, auto plateau	1
10	E-2398	Contact block (1 N. O., 1 N. C.)	1
11	E-2419	Three position switch-maintained, coolant	1
11	E-2398	Contact block (1 N. O., 1 N. C.)	1
12	E-3024	Indicator light, lubrication low, "Push to Test"	1
12	E-2398	Contact block (1 N. O., 1 N. C.)	1
13	E-3024	Indicator light, change filter, "Push to Test"	1
13	E-2398	Contact block (1 N. O., 1 N. C.)	1
14	E-2875	Fuse, 60 amp, 600 volt	3
14	E-2877	Fuse, 60 amp, 250 volt	3

P-49

Photo 85


MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL
TWO HEAD (360°)
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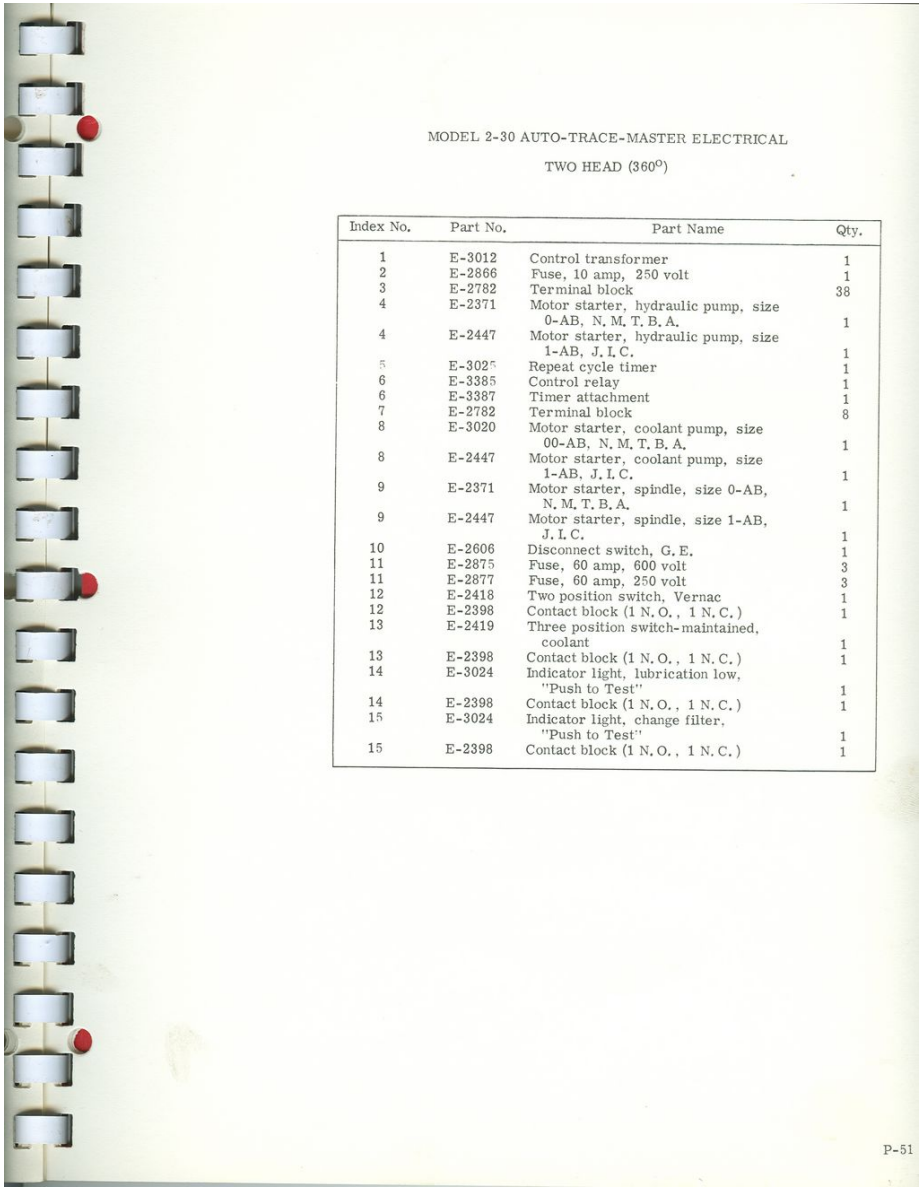
P-50

Photo 86



MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

TWO HEAD (360°)

Index No.	Part No.	Part Name	Qty.
1	E-3012	Control transformer	1
2	E-2866	Fuse, 10 amp, 250 volt	1
3	E-2782	Terminal block	38
4	E-2371	Motor starter, hydraulic pump, size 0-AB, N. M. T. B. A.	1
4	E-2447	Motor starter, hydraulic pump, size 1-AB, J. I. C.	1
5	E-3025	Repeat cycle timer	1
6	E-3385	Control relay	1
6	E-3387	Timer attachment	1
7	E-2782	Terminal block	8
8	E-3020	Motor starter, coolant pump, size 00-AB, N. M. T. B. A.	1
8	E-2447	Motor starter, coolant pump, size 1-AB, J. I. C.	1
9	E-2371	Motor starter, spindle, size 0-AB, N. M. T. B. A.	1
9	E-2447	Motor starter, spindle, size 1-AB, J. I. C.	1
10	E-2606	Disconnect switch, G. E.	1
11	E-2875	Fuse, 60 amp, 600 volt	3
11	E-2877	Fuse, 60 amp, 250 volt	3
12	E-2418	Two position switch, Vernac	1
12	E-2398	Contact block (1 N. O., 1 N. C.)	1
13	E-2419	Three position switch-maintained, coolant	1
13	E-2398	Contact block (1 N. O., 1 N. C.)	1
14	E-3024	Indicator light, lubrication low, "Push to Test"	1
14	E-2398	Contact block (1 N. O., 1 N. C.)	1
15	E-3024	Indicator light, change filter, "Push to Test"	1
15	E-2398	Contact block (1 N. O., 1 N. C.)	1

P-51

Photo 87

MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL
5 H. P. VARIABLE SPEED HEAD (360°)

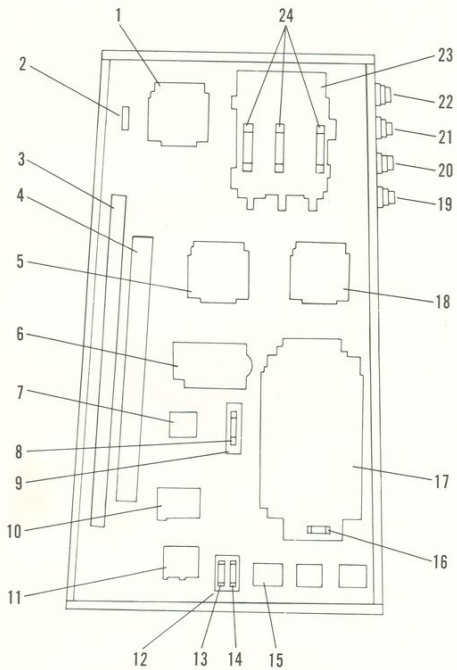
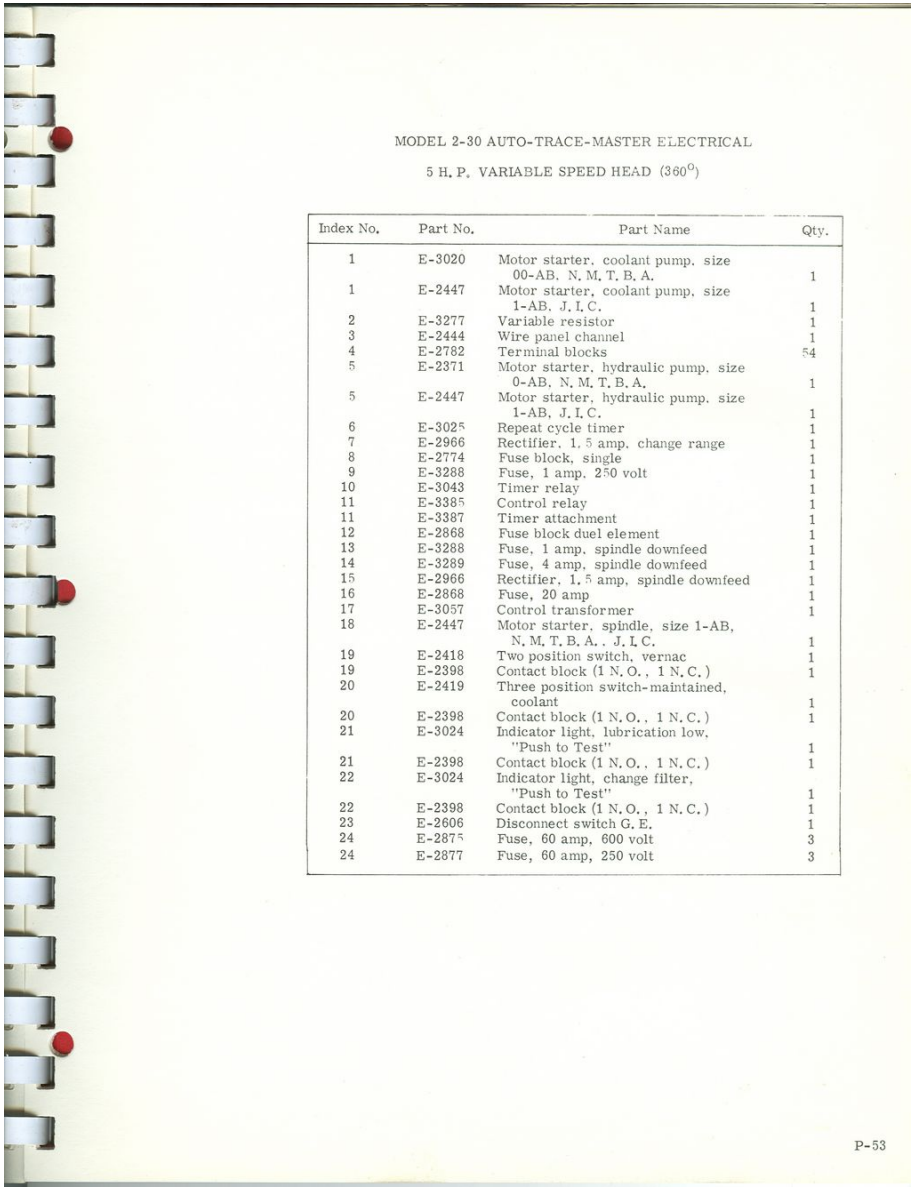


Photo 88



MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

5 H. P. VARIABLE SPEED HEAD (360°)

Index No.	Part No.	Part Name	Qty.
1	E-3020	Motor starter, coolant pump, size 00-AB, N. M. T. B. A.	1
1	E-2447	Motor starter, coolant pump, size 1-AB, J. I. C.	1
2	E-3277	Variable resistor	1
3	E-2444	Wire panel channel	1
4	E-2782	Terminal blocks	54
5	E-2371	Motor starter, hydraulic pump, size 0-AB, N. M. T. B. A.	1
5	E-2447	Motor starter, hydraulic pump, size 1-AB, J. I. C.	1
6	E-3025	Repeat cycle timer	1
7	E-2966	Rectifier, 1.5 amp, change range	1
8	E-2774	Fuse block, single	1
9	E-3288	Fuse, 1 amp, 250 volt	1
10	E-3043	Timer relay	1
11	E-3385	Control relay	1
11	E-3387	Timer attachment	1
12	E-2868	Fuse block duel element	1
13	E-3288	Fuse, 1 amp, spindle downfeed	1
14	E-3289	Fuse, 4 amp, spindle downfeed	1
15	E-2966	Rectifier, 1.5 amp, spindle downfeed	1
16	E-2868	Fuse, 20 amp	1
17	E-3057	Control transformer	1
18	E-2447	Motor starter, spindle, size 1-AB, N. M. T. B. A. , J. I. C.	1
19	E-2418	Two position switch, vernac	1
19	E-2398	Contact block (1 N. O. , 1 N. C.)	1
20	E-2419	Three position switch-maintained, coolant	1
20	E-2398	Contact block (1 N. O. , 1 N. C.)	1
21	E-3024	Indicator light, lubrication low, "Push to Test"	1
21	E-2398	Contact block (1 N. O. , 1 N. C.)	1
22	E-3024	Indicator light, change filter, "Push to Test"	1
22	E-2398	Contact block (1 N. O. , 1 N. C.)	1
23	E-2606	Disconnect switch G. E.	1
24	E-2875	Fuse, 60 amp, 600 volt	3
24	E-2877	Fuse, 60 amp, 250 volt	3

P-53

Photo 89

MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL
5 H. P. VARIABLE SPEED HEAD (2 + 1)

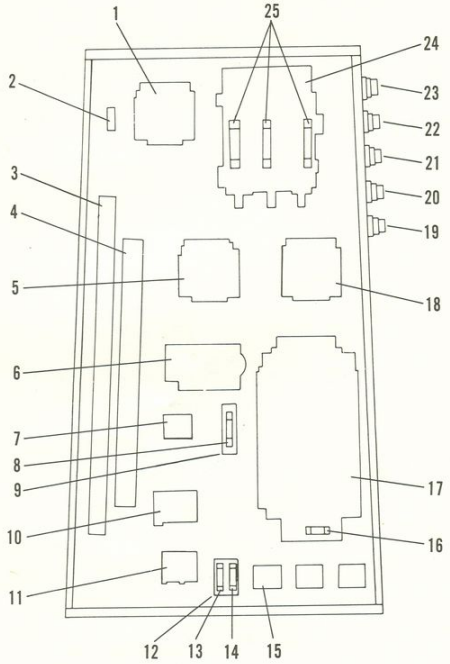
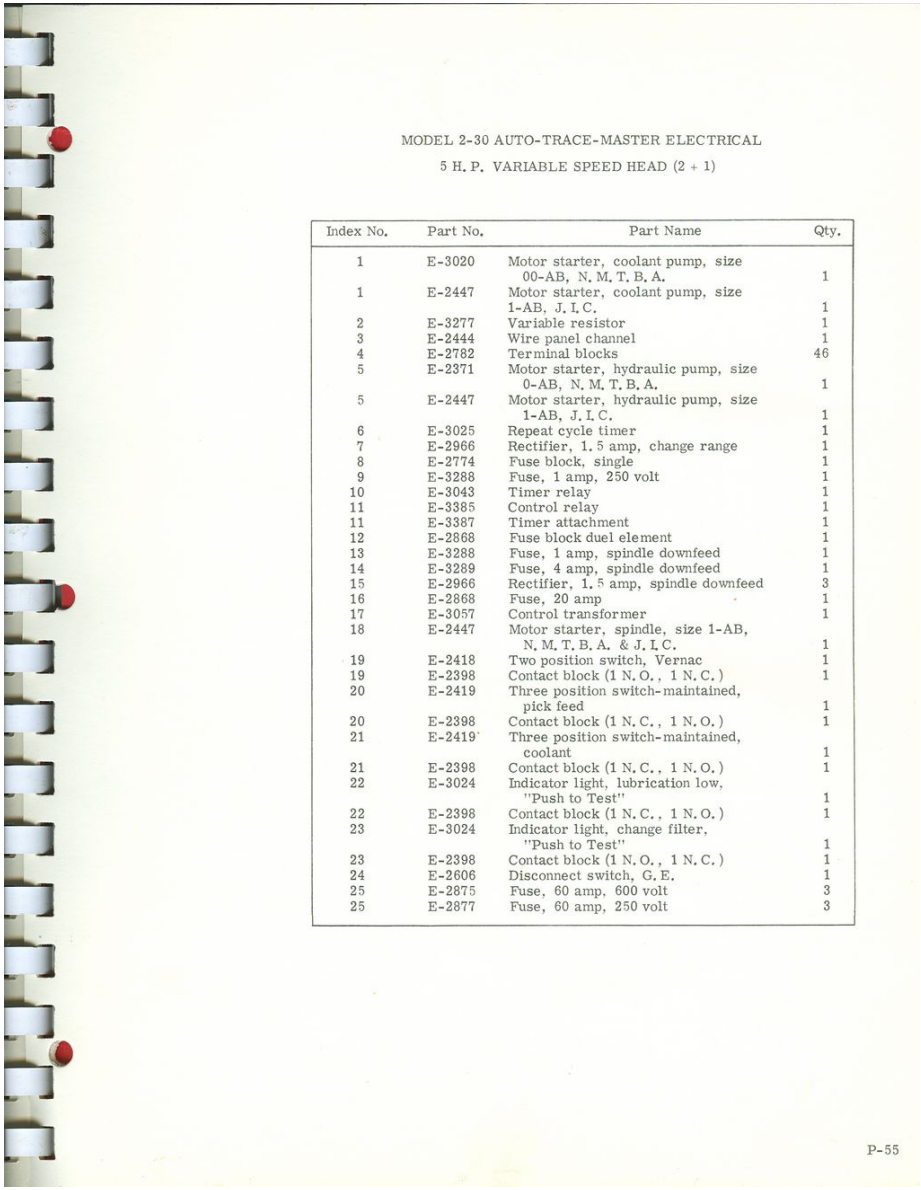


Photo 90

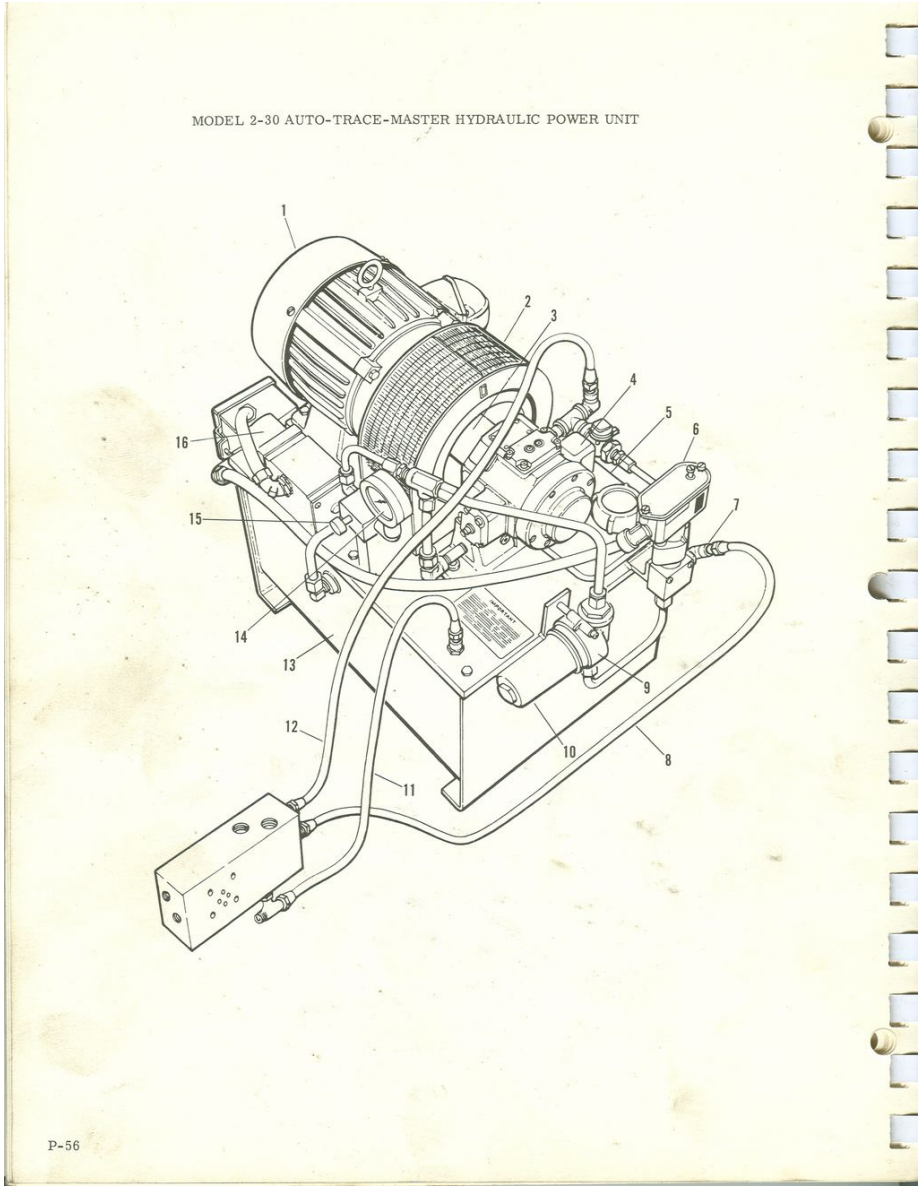


MODEL 2-30 AUTO-TRACE-MASTER ELECTRICAL

5 H. P. VARIABLE SPEED HEAD (2 + 1)

Index No.	Part No.	Part Name	Qty.
1	E-3020	Motor starter, coolant pump, size 00-AB, N. M. T. B. A.	1
1	E-2447	Motor starter, coolant pump, size 1-AB, J. I. C.	1
2	E-3277	Variable resistor	1
3	E-2444	Wire panel channel	1
4	E-2782	Terminal blocks	46
5	E-2371	Motor starter, hydraulic pump, size 0-AB, N. M. T. B. A.	1
5	E-2447	Motor starter, hydraulic pump, size 1-AB, J. I. C.	1
6	E-3025	Repeat cycle timer	1
7	E-2966	Rectifier, 1. 5 amp, change range	1
8	E-2774	Fuse block, single	1
9	E-3288	Fuse, 1 amp, 250 volt	1
10	E-3043	Timer relay	1
11	E-3385	Control relay	1
11	E-3387	Timer attachment	1
12	E-2868	Fuse block duel element	1
13	E-3288	Fuse, 1 amp, spindle downfeed	1
14	E-3289	Fuse, 4 amp, spindle downfeed	1
15	E-2966	Rectifier, 1. 5 amp, spindle downfeed	3
16	E-2868	Fuse, 20 amp	1
17	E-3057	Control transformer	1
18	E-2447	Motor starter, spindle, size 1-AB, N. M. T. B. A. & J. I. C.	1
19	E-2418	Two position switch, Vernac	1
19	E-2398	Contact block (1 N. O., 1 N. C.)	1
20	E-2419	Three position switch-maintained, pick feed	1
20	E-2398	Contact block (1 N. C., 1 N. O.)	1
21	E-2419	Three position switch-maintained, coolant	1
21	E-2398	Contact block (1 N. C., 1 N. O.)	1
22	E-3024	Indicator light, lubrication low, "Push to Test"	1
22	E-2398	Contact block (1 N. C., 1 N. O.)	1
23	E-3024	Indicator light, change filter, "Push to Test"	1
23	E-2398	Contact block (1 N. O., 1 N. C.)	1
24	E-2606	Disconnect switch, G. E.	1
25	E-2875	Fuse, 60 amp, 600 volt	3
25	E-2877	Fuse, 60 amp, 250 volt	3

Photo 91


MODEL 2-30 AUTO-TRACE-MASTER HYDRAULIC POWER UNIT
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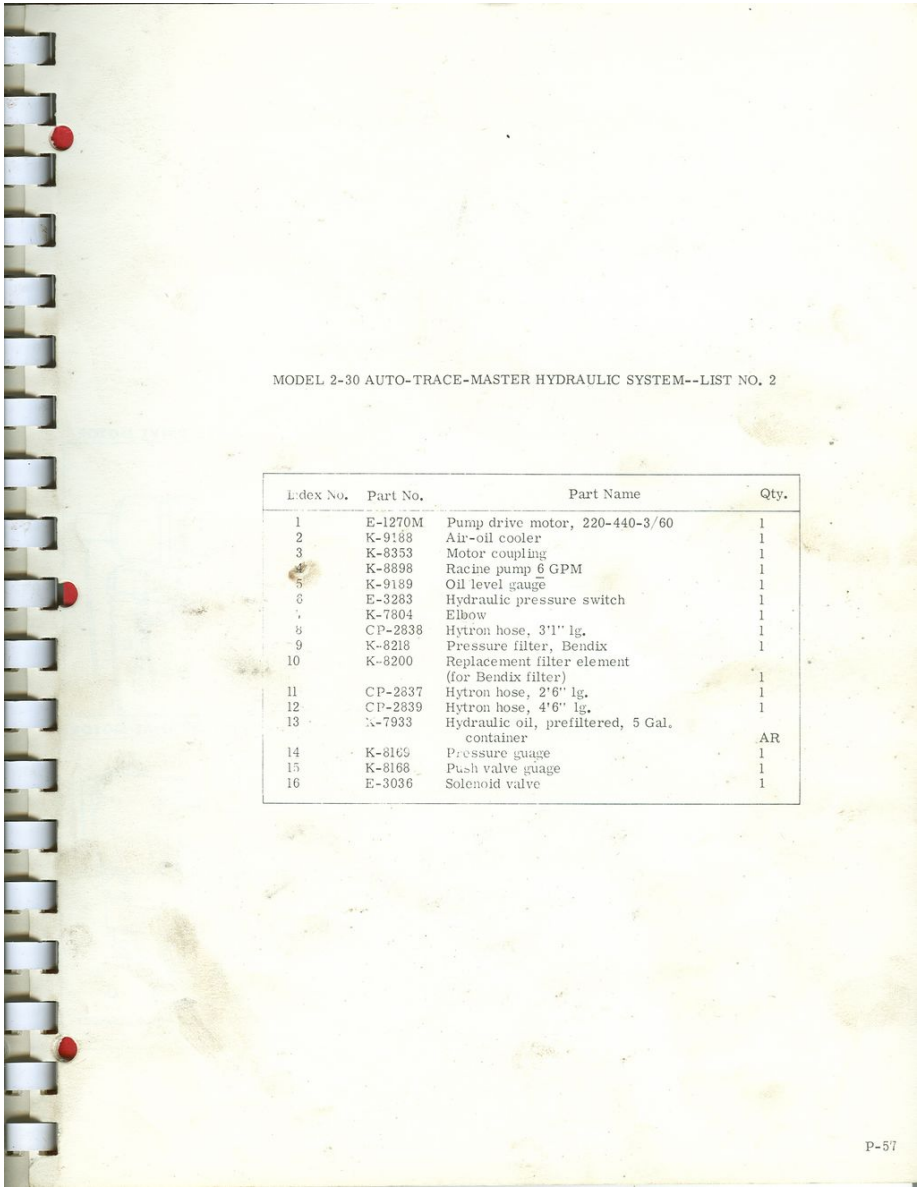
P-56

Photo 92

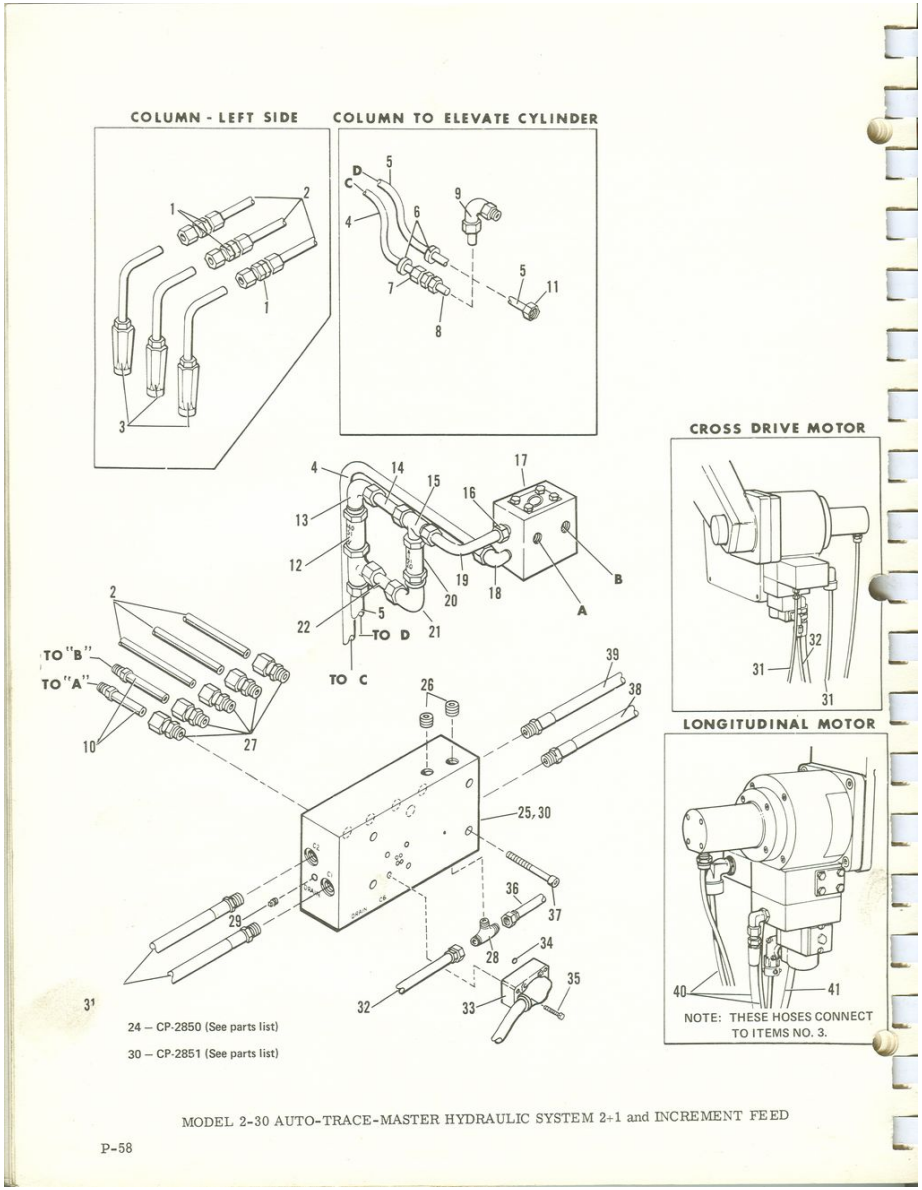


MODEL 2-30 AUTO-TRACE-MASTER HYDRAULIC SYSTEM--LIST NO. 2

Index No.	Part No.	Part Name	Qty.
1	E-1270M	Pump drive motor, 220-440-3/60	1
2	K-9188	Air-oil cooler	1
3	K-8353	Motor coupling	1
4	K-8898	Racine pump 6 GPM	1
5	K-9189	Oil level gauge	1
6	E-3283	Hydraulic pressure switch	1
7	K-7804	Elbow	1
8	CP-2838	Hytron hose, 3'1" lg.	1
9	K-8218	Pressure filter, Bendix	1
10	K-8200	Replacement filter element (for Bendix filter)	1
11	CP-2837	Hytron hose, 2'6" lg.	1
12	CP-2839	Hytron hose, 4'6" lg.	1
13	K-7933	Hydraulic oil, prefiltered, 5 Gal. container	AR
14	K-8169	Pressure guage	1
15	K-8168	Push valve guage	1
16	E-3036	Solenoid valve	1

P-57

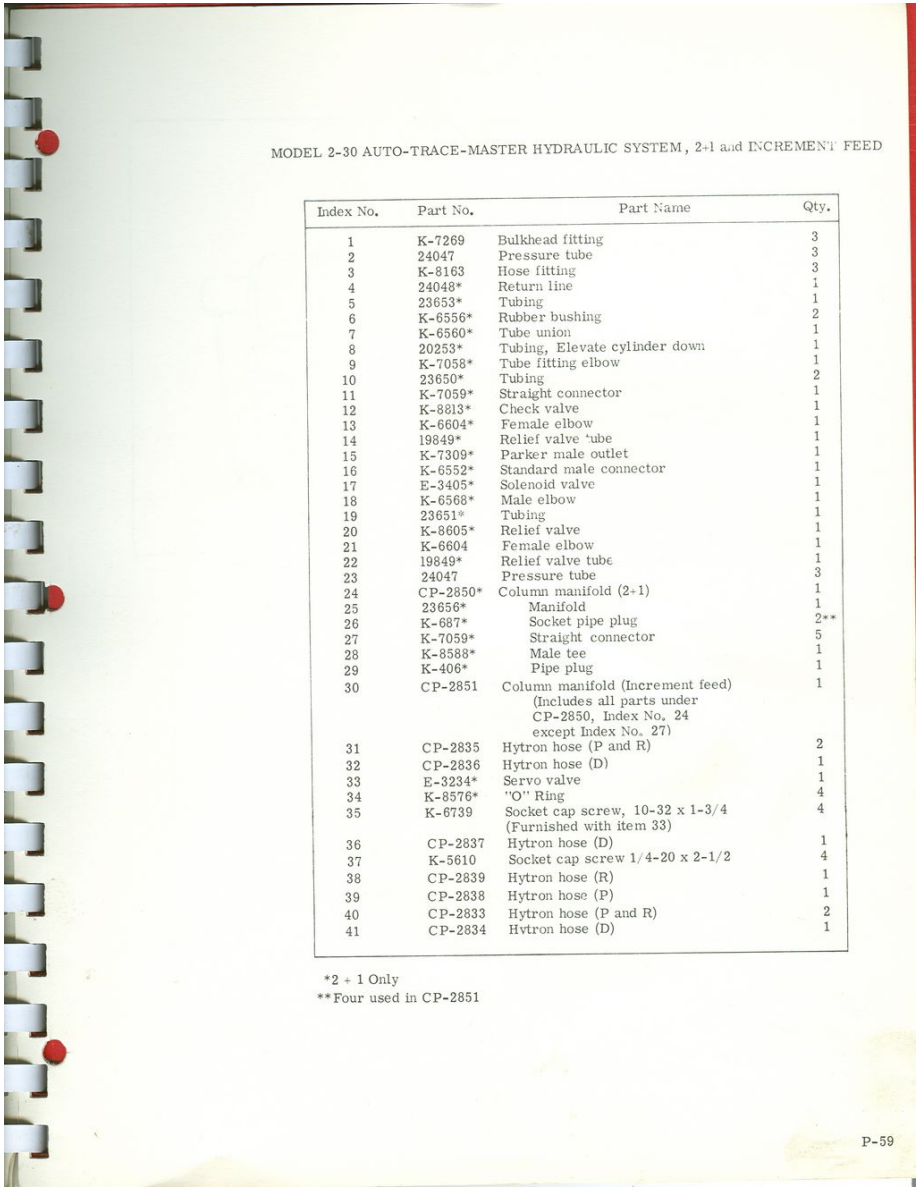
Photo 93



MODEL 2-30 AUTO-TRACE-MASTER HYDRAULIC SYSTEM 2÷1 and INCREMENT FEED

P-58

Photo 94



MODEL 2-30 AUTO-TRACE-MASTER HYDRAULIC SYSTEM, 2+1 and INCREMENT FEED

Index No.	Part No.	Part Name	Qty.
1	K-7269	Bulkhead fitting	3
2	24047	Pressure tube	3
3	K-8163	Hose fitting	3
4	24048*	Return line	1
5	23653*	Tubing	1
6	K-6556*	Rubber bushing	2
7	K-6560*	Tube union	1
8	20253*	Tubing, Elevate cylinder down	1
9	K-7058*	Tube fitting elbow	1
10	23650*	Tubing	2
11	K-7059*	Straight connector	1
12	K-8813*	Check valve	1
13	K-6604*	Female elbow	1
14	19849*	Relief valve tube	1
15	K-7309*	Parker male outlet	1
16	K-6552*	Standard male connector	1
17	E-3405*	Solenoid valve	1
18	K-6568*	Male elbow	1
19	23651*	Tubing	1
20	K-8605*	Relief valve	1
21	K-6604	Female elbow	1
22	19849*	Relief valve tube	1
23	24047	Pressure tube	3
24	CP-2850*	Column manifold (2+1)	1
25	23656*	Manifold	1
26	K-687*	Socket pipe plug	2**
27	K-7059*	Straight connector	5
28	K-8588*	Male tee	1
29	K-406*	Pipe plug	1
30	CP-2851	Column manifold (Increment feed) (Includes all parts under CP-2850, Index No. 24 except Index No. 27)	1
31	CP-2835	Hytron hose (P and R)	2
32	CP-2836	Hytron hose (D)	1
33	E-3234*	Servo valve	1
34	K-8576*	"O" Ring	4
35	K-6739	Socket cap screw, 10-32 x 1-3/4 (Furnished with item 33)	4
36	CP-2837	Hytron hose (D)	1
37	K-5610	Socket cap screw 1/4-20 x 2-1/2	4
38	CP-2839	Hytron hose (R)	1
39	CP-2838	Hytron hose (P)	1
40	CP-2833	Hytron hose (P and R)	2
41	CP-2834	Hytron hose (D)	1

*2 + 1 Only
**Four used in CP-2851

Photo 95

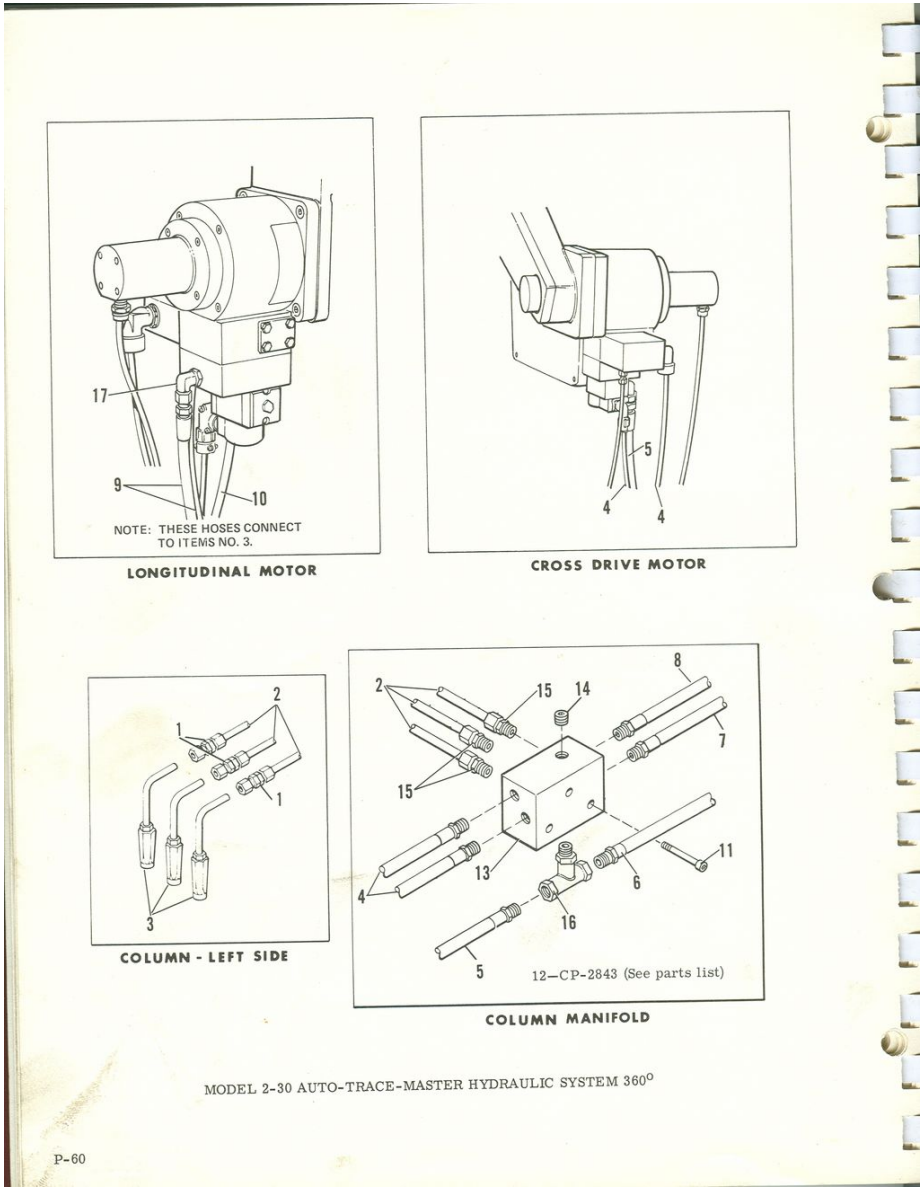
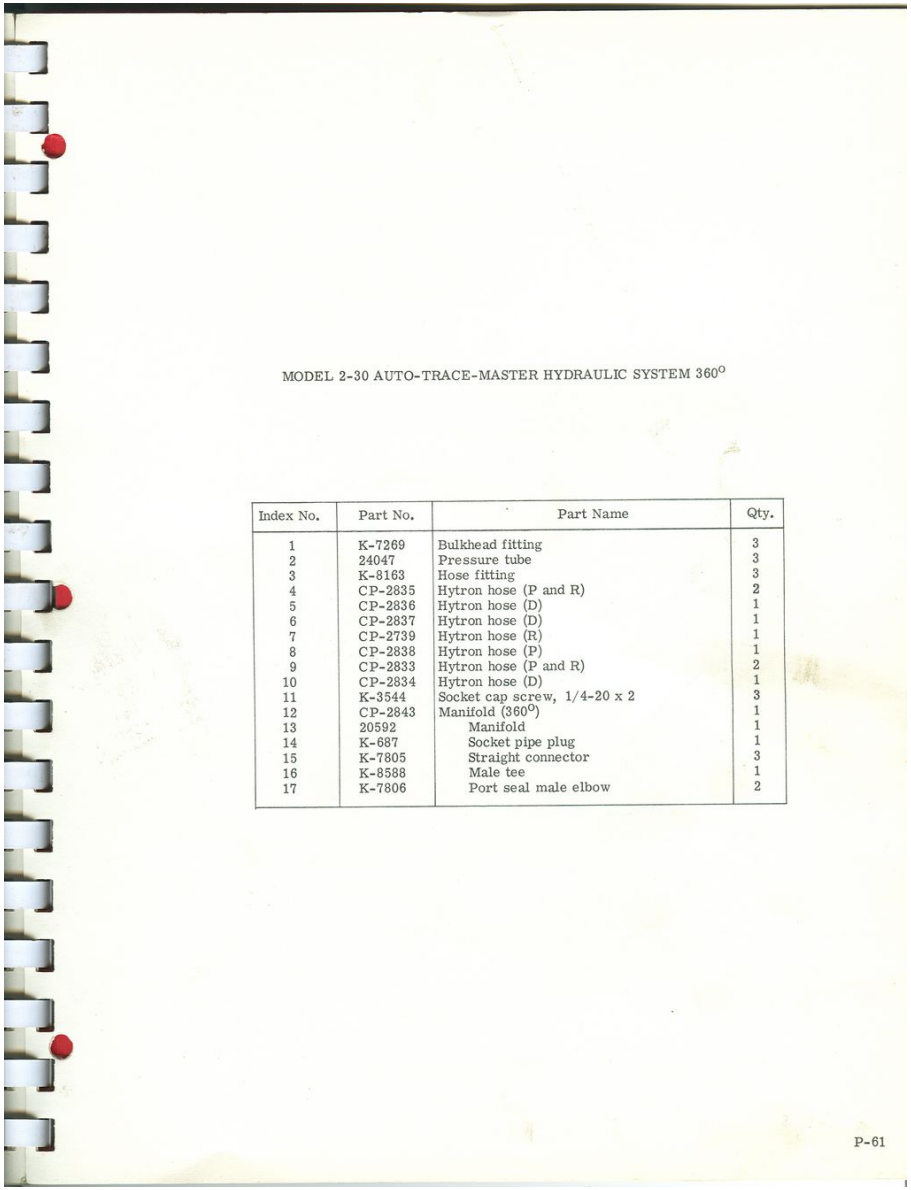

17
9
10
NOTE: THESE HOSES CONNECT TO ITEMS NO. 3.
LONGITUDINAL MOTOR
5
4
4
CROSS DRIVE MOTOR
2
1
1
3
COLUMN - LEFT SIDE
2
15
14
8
7
15
13
4
6
11
16
5
12—CP-2843 (See parts list)
COLUMN MANIFOLD
MODEL 2-30 AUTO-TRACE-MASTER HYDRAULIC SYSTEM 360°
P-60

Photo 96



MODEL 2-30 AUTO-TRACE-MASTER HYDRAULIC SYSTEM 360°

Index No.	Part No.	Part Name	Qty.
1	K-7269	Bulkhead fitting	3
2	24047	Pressure tube	3
3	K-8163	Hose fitting	3
4	CP-2835	Hytron hose (P and R)	2
5	CP-2836	Hytron hose (D)	1
6	CP-2837	Hytron hose (D)	1
7	CP-2739	Hytron hose (R)	1
8	CP-2838	Hytron hose (P)	1
9	CP-2833	Hytron hose (P and R)	2
10	CP-2834	Hytron hose (D)	1
11	K-3544	Socket cap screw, 1/4-20 x 2	3
12	CP-2843	Manifold (360°)	1
13	20592	Manifold	1
14	K-687	Socket pipe plug	1
15	K-7805	Straight connector	3
16	K-8588	Male tee	1
17	K-7806	Port seal male elbow	2

P-61

Photo 97

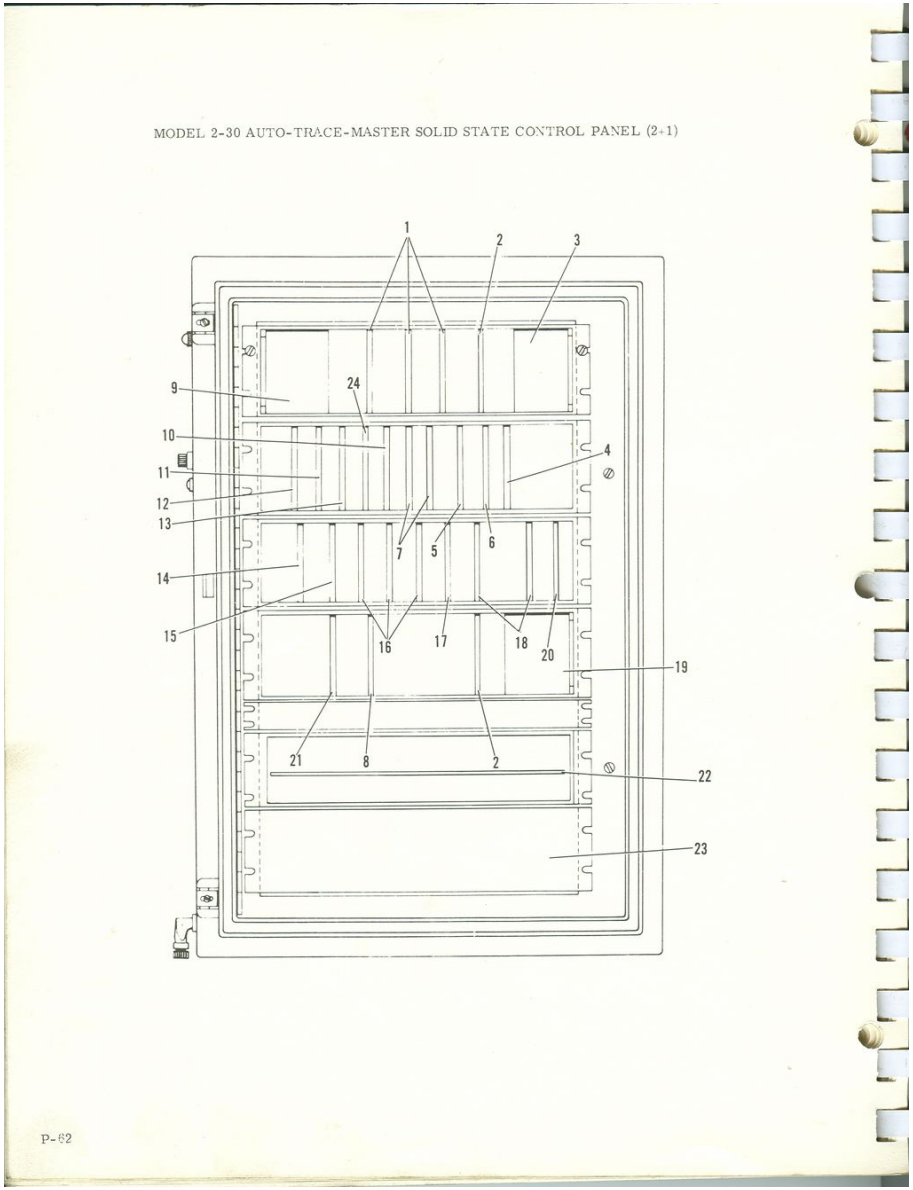
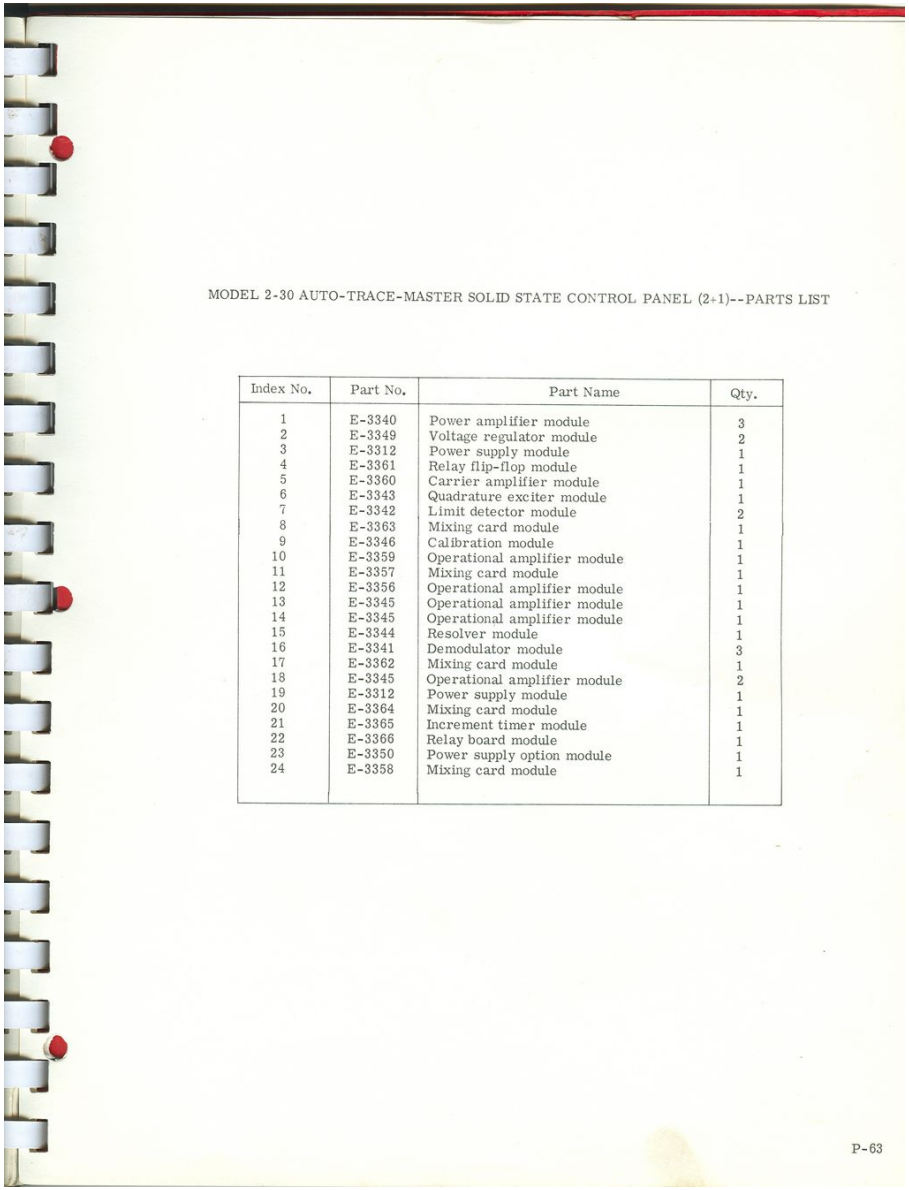

MODEL 2-30 AUTO-TRACE-MASTER SOLID STATE CONTROL PANEL (2+1)
1
2
3
9
24
10
4
11
12
13
7
5
6
14
15
16
17
18
20
19
21
8
2
22
23
P-62

Photo 98



MODEL 2-30 AUTO-TRACE-MASTER SOLID STATE CONTROL PANEL (2+1)--PARTS LIST

Index No.	Part No.	Part Name	Qty.
1	E-3340	Power amplifier module	3
2	E-3349	Voltage regulator module	2
3	E-3312	Power supply module	1
4	E-3361	Relay flip-flop module	1
5	E-3360	Carrier amplifier module	1
6	E-3343	Quadrature exciter module	1
7	E-3342	Limit detector module	2
8	E-3363	Mixing card module	1
9	E-3346	Calibration module	1
10	E-3359	Operational amplifier module	1
11	E-3357	Mixing card module	1
12	E-3356	Operational amplifier module	1
13	E-3345	Operational amplifier module	1
14	E-3345	Operational amplifier module	1
15	E-3344	Resolver module	1
16	E-3341	Demodulator module	3
17	E-3362	Mixing card module	1
18	E-3345	Operational amplifier module	2
19	E-3312	Power supply module	1
20	E-3364	Mixing card module	1
21	E-3365	Increment timer module	1
22	E-3366	Relay board module	1
23	E-3350	Power supply option module	1
24	E-3358	Mixing card module	1

P-63

Photo 99

MODEL 2-30 AUTO-TRACE-MASTER
SOLID STATE CONTROL PANEL (360°)

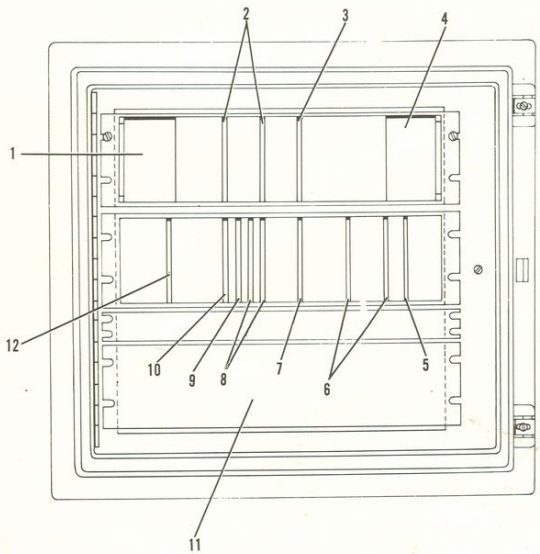
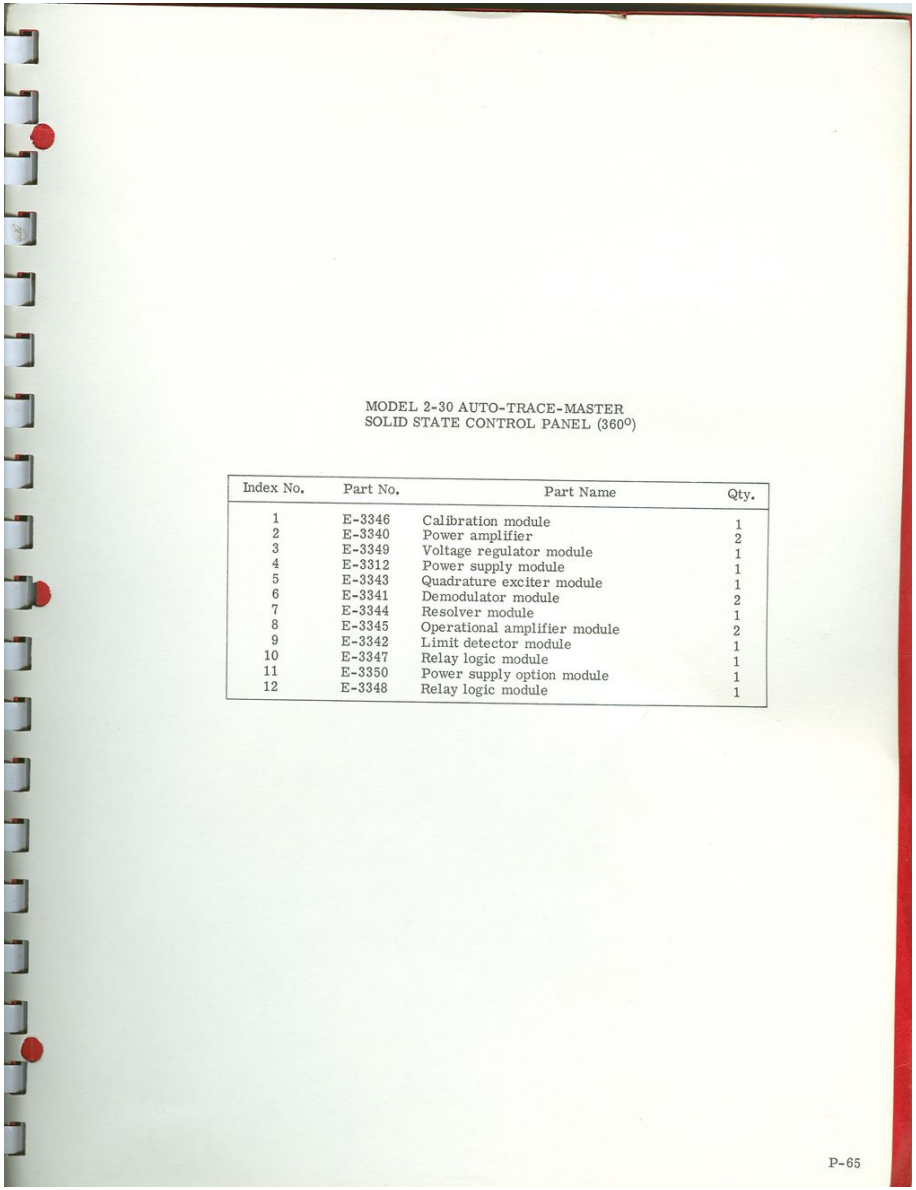


Photo 100



MODEL 2-30 AUTO-TRACE-MASTER
SOLID STATE CONTROL PANEL (360°)

Index No.	Part No.	Part Name	Qty.
1	E-3346	Calibration module	1
2	E-3340	Power amplifier	2
3	E-3349	Voltage regulator module	1
4	E-3312	Power supply module	1
5	E-3343	Quadrature exciter module	1
6	E-3341	Demodulator module	2
7	E-3344	Resolver module	1
8	E-3345	Operational amplifier module	2
9	E-3342	Limit detector module	1
10	E-3347	Relay logic module	1
11	E-3350	Power supply option module	1
12	E-3348	Relay logic module	1

P-65

Photo 101