

STYLE 50

EX-CELL-O PRECISION THREAD GRINDERS

INSTALLATION
OPERATION and MAINTENANCE

DEPT 524



EX-CELL-O CORPORATION

Manufacturers of Precision Machine Tools, Cutting Tools, Precision Production Parts,
Pure-Pak Dairy Equipment

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EX-CELL-O
PRECISION THREAD GRINDER
STYLE 50

Installation, Operation and Maintenance

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FOREWORD

In order that this precision thread grinder may give continuous, satisfactory service it is necessary that it be properly installed, operated and maintained. This manual is printed with this in view. It should be placed in the hands of the proper supervisor in the plant, and the information it contains should be studied carefully.

This thread grinder was designed and manufactured to conform to Ex-Cell-O's high standard of machine tool performance. It was built to rigid specifications by specially trained workmen, under competent supervision. It was inspected at various stages of construction, and has been tested in actual operation.

Some details of the machine furnished may differ from the description in this book. The reason for such difference is constant improvement in design, equipment and materials, as well as changes necessary to fill individual orders.

INDEX

	SECTION
General Description	100
Specifications	103
Installation	200
Lubrication	300
Operating Instructions	400
Operating Controls	401
Lead Control	401
Hydraulic Work Spindle Drive	403
Work Speed Chart	403
Work Spindle Speeds	404
Tailstock	404
Lead Change Gears	404
Backlash Compensator	409
Work Positioning Device	409
Helix Angle Setting	409
Grinding Wheel Feed Control	410
Dresser Feed	411
Grinding Wheel Spindle	411
Changing Wheel Pulleys	411
Grinding Wheels	411
Mounting Grinding Wheels	412
Work Speed and Thread Grinding Practice	412
General Grinding Suggestions	413
Correcting Unsatisfactory Grinding	413
Summarized Instructions for Setting Style 50 Thread Grinder to a New Work Piece	414
Maintenance	500
Cleaning the Coolant Tank	501
Hydraulic Oil	501
Grinding Spindle Service	501
Care of Grinding Wheels	501
Electrical Maintenance	501
Wheel Dressers and Machine Attachments	600
Three Way 60° and 29° Form Dresser	601
Three Way Plate-Type 10° to 90° Form Dresser	601
Three Way Cradle-Type 10° to 90° Form Dresser	602
Universal Cam-Type Dresser	603
Internal Grinding Attachment	605
Internal Grinding Wheel Dressers	606
Internal Straight Line Dresser	606
Internal Pantograph-Type Dresser	607
Refrigeration Type Oil Cooling Unit	610

INDEX (Cont'd)

	SECTION
Wheel Dressers and Machine Attachments (Cont'd)	
Suction Hood	610
Cam Grinder for Universal Dresser	612
Grinding Wheel Balancing Stand	612
Work Table Extension	613
Extra Standard Equipment	613
Ex-Cell-O Universal Cam-Type Dresser	700
Grinding Wheel Recommendations	800
Replacement Parts	900

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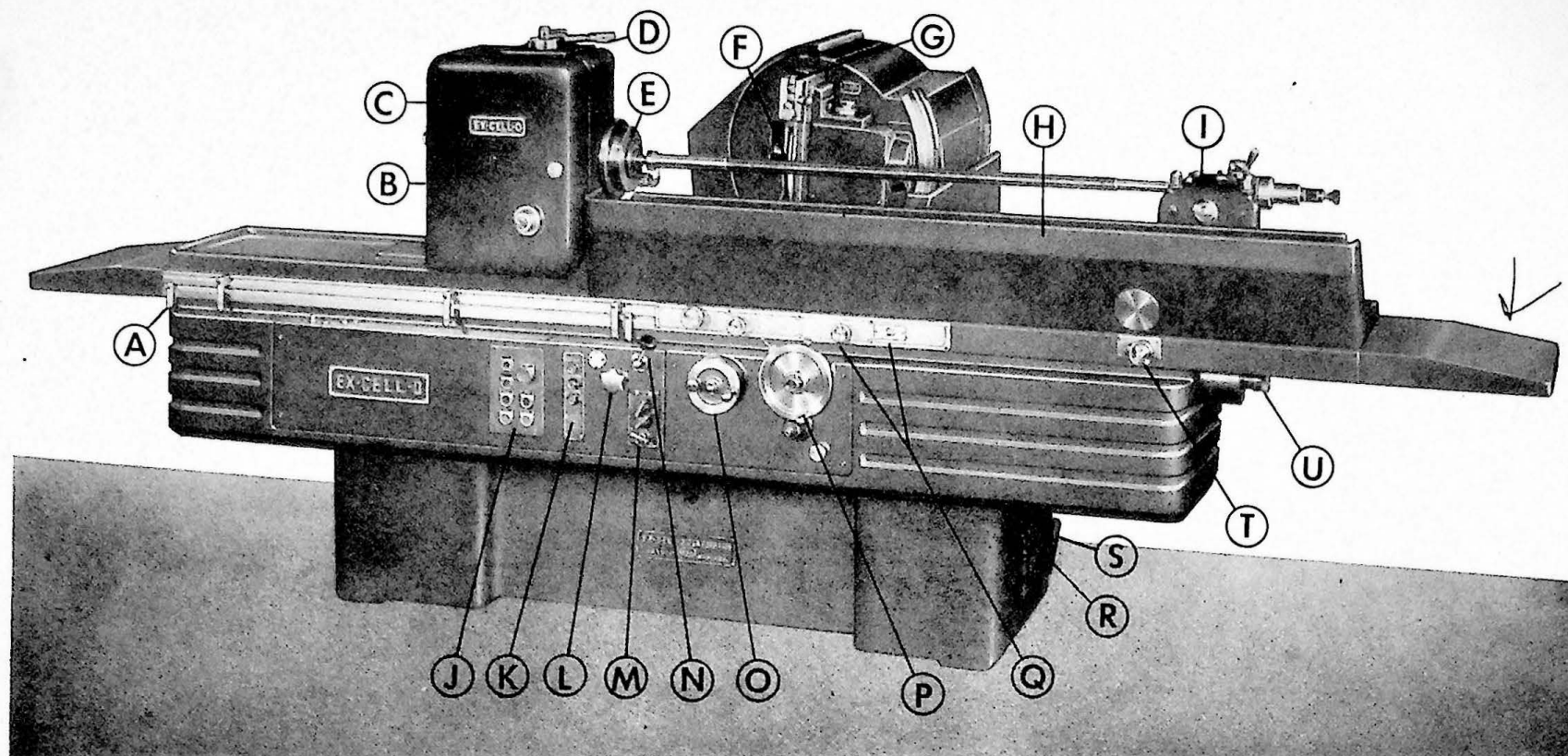
GENERAL DESCRIPTION

EX-CELL-O

PRECISION THREAD GRINDER

STYLE 50





EX-CELL-O STYLE 50 PRECISION THREAD GRINDER
Front View

- A. Table control dogs.
- B. Lead change gear housing.
- C. Hydraulic work spindle drive compartment.
- D. Rapid traverse speed control.
- E. Work spindle.
- F. Grinding wheel.
- G. Coolant valve.
- H. Work table.
- I. Tailstock.
- J. Electric control buttons and switches.
- K. Work spindle direction control.

- L. Table direction manual control knob.
- M. Work speed valve controls.
- N. Table control-start, stop.
- O. Dresser feed control.
- P. Grinding wheel feed control.
- Q. Lead control.
- R. Automatic lubricating compartment.
- S. Hydraulic oil filler.
- T. Work positioning device.
- U. Backlash compensator.

GENERAL DESCRIPTION

The machine table carries the work spindle and the adjustable tailstock. It is moved longitudinally on the machine bed on anti-friction ground and lapped rollers by a lead screw mounted with the nut underneath the table. The lead screw is driven by a train of gears from the work spindle.

The work spindle is worm-driven through a "V" belt and two three-step pulleys from a variable speed hydraulic motor mounted in the top of the work head housing. This provides an unusually wide range of work speeds, all controlled from the front of the machine.

The grinding wheel is driven by a 3 H.P. electric motor through a "V" belt and two-step interchangeable pulleys. The motor and wheel are mounted in a cradle through which the grinding wheel may be tilted to the helix angle of the work. The helix angle adjusting wheel with a graduated dial is used for this purpose.

A hydraulic backlash compensator which operates in conjunction with the lead screw permits grinding in both directions and automatic reversal at the end of the stroke with the wheel in the cut. It is not necessary to have an undercut at the end of the thread or to run the grinding wheel off the work before reversing.

By means of the work position knob the wheel may be matched to the thread of work that has been previously rough threaded. Filtered lubricant is pumped to the table and cross slide ways from the automatic lubricating compartment, which is provided with a sight gage.

For grinding odd pitches or for obtaining accurate overall lead dimensions on long work pieces, the lead setting obtained with the change gears may be varied and locked in the adjusted position. A graduation indicates the amount the standard lead is lengthened or shortened.

Style 50 Thread Grinder will grind to a predetermined size setting and then stop automatically, or it may be set to stop at either end of its table travel. The cross feed hand wheel with ratchet pawl for automatically controlling the cross feed provides hand or automatic cross feed as desired. The adjustable table dogs contact valve plungers controlling the direction of table travel, work speeds in either direction and, during single or two-pass grinding, the automatic stop.

The table cycle is started with a hand lever. Three hydraulic orifice handles control the rate of the work speed and the table travel. A manual table reversing knob is also provided. The operator may stop the entire machine by means of the master stop button. There are push button switches for starting and stopping the grinding wheel and coolant pump motors, the hydraulic pump motor, and the grinding wheel dresser motor.

The grinding wheel may be dressed at the operator's convenience. The dresser is fed toward the grinding wheel by shifting a hand lever. It is started by depressing the start dressing cycle button.

The hydraulic oil reservoir is located at the front of the machine base. It is accessible for filling from the right side. Pressure for the hydraulic power and control system is supplied by an electric motor-driven pump. A safety valve prevents excessive operating pressures. The oil is passed through a filter to remove impurities.

The wheel motor is mounted at the rear of the wheel cradle. The mounting is adjustable to maintain proper belt tension. The cradle may be adjusted with a hand wheel at the right side of the machine to the required helix angle. This adjustment is facilitated by graduations on the cradle and on the setting hand wheel.

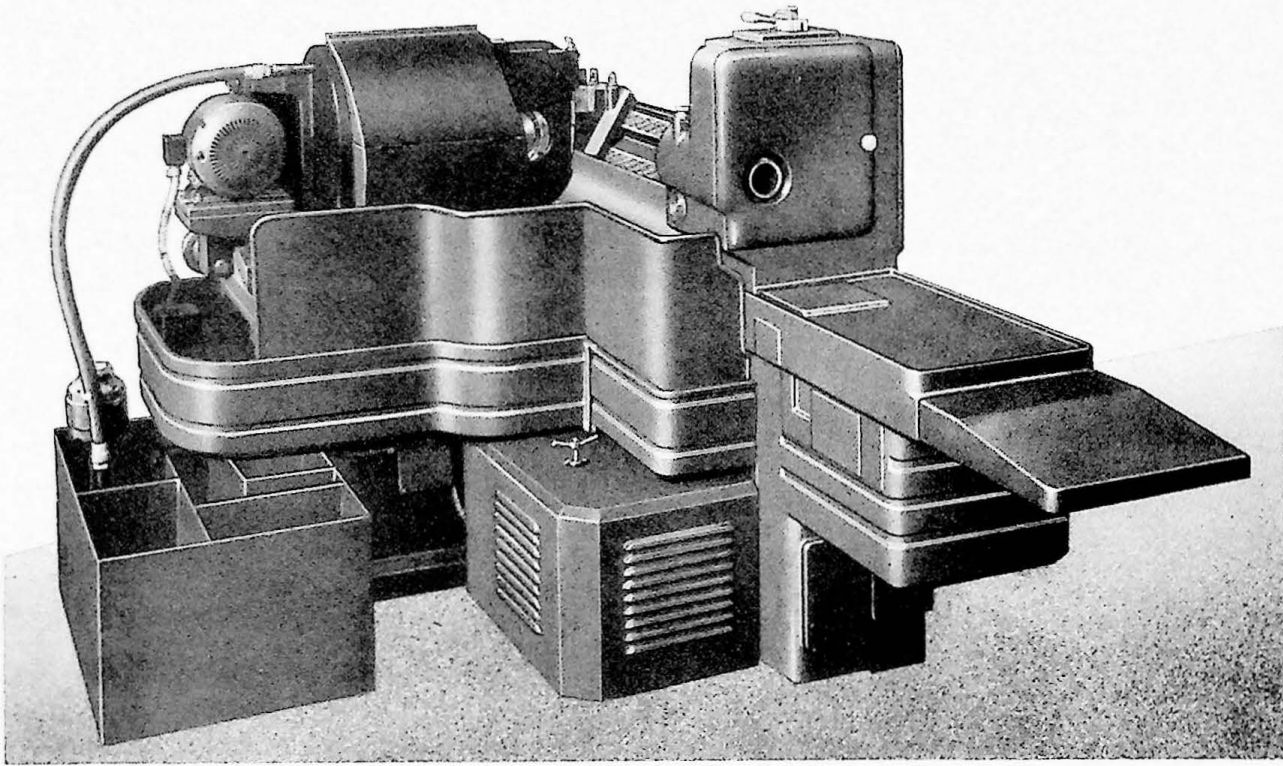
The coolant is directed to the grinding wheel through the coolant control valve. Coolant oil is pumped from a welded steel tank (placed outside of the machine base to make it easily accessible for cleaning) by an integral motor-driven pump. The coolant is directed to the grinding wheel through the coolant control valve.

Various pitches are produced by change gears.

Four types of dressers are available with this machine: Three Way 60° and 29° Form Dresser, Three Way Plate-type 10° to 90° Form Dresser, Three Way Cradle-type 10° to 90° Form Dresser, and Universal Cam-type Dresser. These are described in detail in Sections 600 and 700.

The dressers are mounted directly behind the grinding wheel and are driven by an electric motor through "V" drive step pulleys and a flexible drive shaft. The power-operated dresser feed may be disconnected by a lever at the side and

GENERAL DESCRIPTION



STYLE 50 THREAD GRINDER--Rear View

the dresser slide operated manually by the feed wheel. For operation while the dresser is being set to a new grinding wheel, an electric start push button is provided at the rear of the machine. After momentary starting, the dresser will complete one dressing cycle and stop automatically. Lights indicate when the dresser is in operation.

The machine may be supplied with either Metric or English master lead screw. One set of gears for the following pitches is included in the price of the machine equipped with the English lead screw: 2, 2-1/4, 2-1/2, 2-3/4, 3, 3-1/4, 3-1/2, 4, 4-1/2, 5, 5-1/2, 6, 7, 8, 9, 10, 11, 11-1/2, 12, 13, 14, 16,

18, 20, 21, 22, 24, 26, 27, and 28. On a machine equipped with a Metric lead screw one set of gears is supplied to grind the following leads: .75, .8, 1.0, 1.25, 1.5, 1.75, 2.0, 2.25, 2.5, 2.75, 3.0, 3.5, 4.0, 4.5, 5.0, and 6.0. For pitches other than those listed, additional change gears may be purchased.

When any standard thread form is ground, whether fine threads from solid hardened blanks, or previously roughed and heat treated coarse threads, a tolerance of plus or minus .0002" can be held on the pitch diameter. Lead can be held within plus or minus .0002 per inch.

GENERAL DESCRIPTION

SPECIFICATIONS

EXTERNAL THREADS

Maximum diameter of work ground (with 18" wheel)	8"
Maximum diameter of work ground (with 14" wheel)	12"
Maximum diameter swing over Table	24"
Maximum diameter work inserted through Work Spindle	3"
Maximum work length between centers	68"
Maximum Threaded Portion of Work (from Headstock center)	50"
Minimum Diameter Grinding Wheel	13"
Grinding Wheel Size	18" dia. with 9" dia. hole 3/8" and 1/2" thick
Grinding Wheel Speeds	
Standard	1485, 1575, 1670, 1780, 1910, 2040, 2150, 2290, 2450, 2640, r.p.m.
Optional	900, 1050, 1160, and 1350 r.p.m.

INTERNAL THREADS

Maximum inside diameter of work ground	8"
Maximum length of Internal Thread	3"
Minimum inside diameter of work ground	1"
Maximum length of Internal Thread on minimum (1") diameter	1"

GENERAL SPECIFICATIONS

Work Spindle speeds - grinding	1 - 80 r.p.m.
Work Spindle speeds - rapid traverse	10 - 135 r.p.m.
Maximum Helix Angle Setting of Wheel	45° left hand threads 20° right hand threads
Coolant Tank Capacity	50 gals.
Coolant Pump Capacity	18 g.p.m.
Grinding Wheel Motor	3 h.p. 1800 r.p.m.
Main Driving Motor	3 h.p. 1200 r.p.m.
Coolant Motor	1/2 h.p. 1800 r.p.m.
Hydraulic Reservoir Capacity	22 gals.
Overall Height	59"
Overall Height (with Suction Hood)	72"
Floor space required	224" wide x 89" deep
Net Weight of Machine (including Hydraulic Oil)	(approx.) 14,000 lbs.
Weight of Machine Crated for Domestic Shipment	(approx.) 16,250 lbs.
Weight of Machine Boxed for Foreign Shipment	(approx.) 17,500 lbs.
Size of Box for Foreign Shipment	(approx.) 550 cu. ft.

INSTALLATION
EX-CELL-O
PRECISION THREAD GRINDER
STYLE 50



INSTALLATION

When the machine is uncrated no loose boxes or packages should be thrown away as they contain parts for the machine. To make sure that the complete shipment is received, all parts should be checked against the shipping list.

As soon as the machine has been uncrated, it should be inspected very thoroughly to ascertain that no part has been damaged or rearranged during shipment. All the paper wrappings that have been used to prevent dust and dirt from getting into the machine should be removed. The wooden skids should be left on the machine until it is placed in position.

Style 50 Thread Grinder with the coolant tank requires floor space 224" wide x 89" deep. In the desired location, sufficient room should be provided to allow efficient operation of the machine and cleaning of the coolant tank. A clearance of four or five feet should be provided. If a crane is used to lift the machine into position, the lifting rope or cable must not bind any part or mechanism of the machine where it might cause damage. Caution must be exercised especially during the installation of the machine not to exert any force or impart any hammer blows to any of the spindles; otherwise the finely lapped and closely fitted precision ball bearing races may be damaged.

The sludge and grease should be cleaned from the machine with kerosene and a clean rag. Waste should not be used since it leaves lint on the machine. A brush with stiff bristles can be used for getting the corners clean. Dirt should not be blown away with an air hose since it may drive grit into the bearing surfaces.

FOUNDATION: For satisfactory machine performance, it is important that the thread grinder have a solid, level foundation. Concrete is best, but a firm wooden floor, free from vibration, may be used. When the machine is placed on an upper floor or balcony, it should be placed as close as possible to a pillar or column, of the building.

LEVELING: Three foundation rest pads and bolt holes are provided on the machine base. This three-point bearing allows the machine to set solid and facilitates leveling. The machine should be leveled both crosswise and lengthwise with a good machinist's level placed on the table ways. The bubble in the level should be given sufficient

time to come to rest. Only steel wedges should be used under the rest pads. The base should be grouted in with either concrete or sulphur.

BASE ASSEMBLY: The machine has been shipped partially disassembled into three major units consisting of the main base, the wheel head slide and the work table slide. These units and accessories are contained in three separate cases marked No. 1, No. 2 and No. 3 respectively.

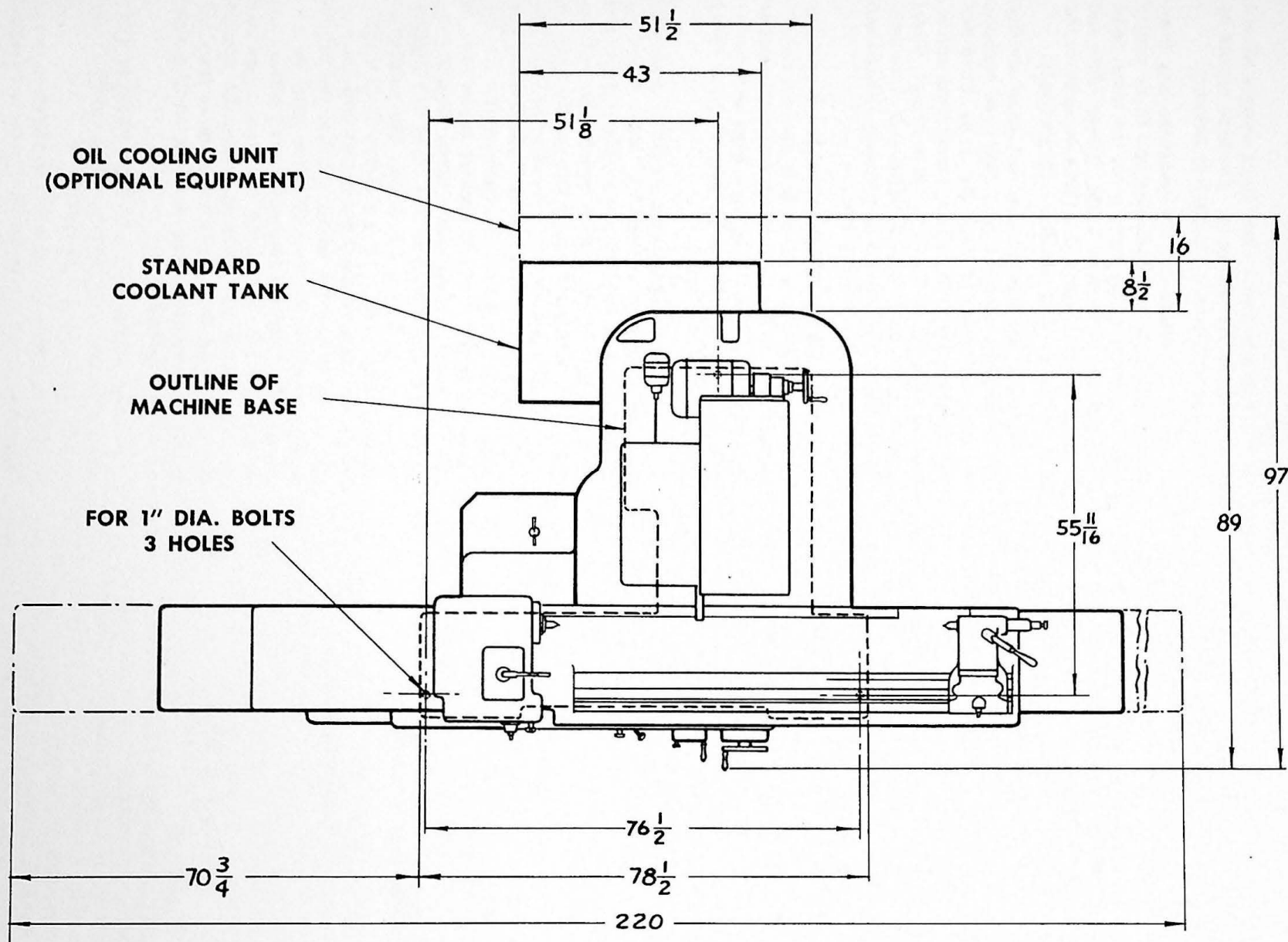
When the Machine is uncrated, case marked No. 1 should be opened first. This case contains the machine base and case No. 1-A. Case No. 1-A contains the lead screw, cross feed screw, dresser feed spline shaft, thrust bearings, wheel spindle, nuts, key, gears, belts and wrenches. The machine base should be properly cleaned and placed in the desired location.

WHEEL HEAD SLIDE: Case No. 2 contains the wheel head cross slide, belt guards, accessories, and case No. 2-A which contains the roller bearing cages. When these parts have been cleaned in the same manner as the base, they are ready to be mounted in place.

The roller bearing cages should be placed on the cross slide flat way and "V" way. When the slide is lifted on to the machine, the lifting ropes must be clear of the bottom bearing so that the slide may be placed lightly into position on the base casting. The several hydraulic oil lines between the base casting and the wheel slide are connected underneath. It is necessary for the fitter to enter the cored opening in the rear of the base to make these connections. No difficulty should be experienced as the lines are clearly marked 1 to 1, 2 to 2, 3 to 3, etc. The number of these fittings will vary according to the extra equipment and accessories supplied with the machine. To install the wheel spindle, the cradle face plate at the front of the slide must be removed. This exposes four set screws which must be loosened and the spindle adjusting screw and nut which must be removed. Then the spindle can be slipped into position and the screws and face plate replaced. The belt and wheel guards should now be installed.

CROSS FEED AND DRESSER FEED SHAFT: From case No. 1-A the cross feed screw is removed and cleaned with care.

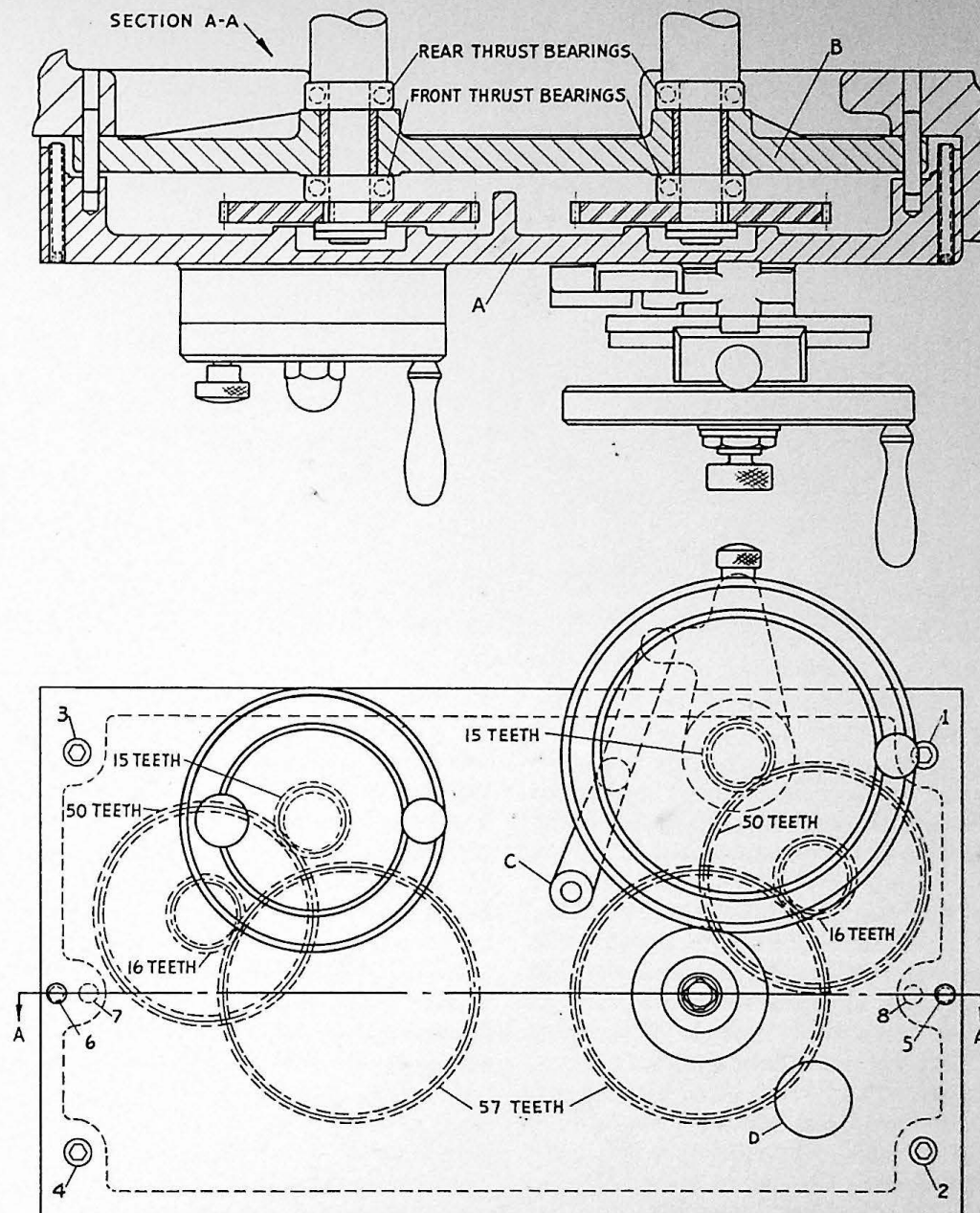
The outer control panel A, as shown in drawing, in the front of the machine base is removed



INSTALLATION

STYLE 50 THREAD GRINDER--FLOOR PLAN

INSTALLATION

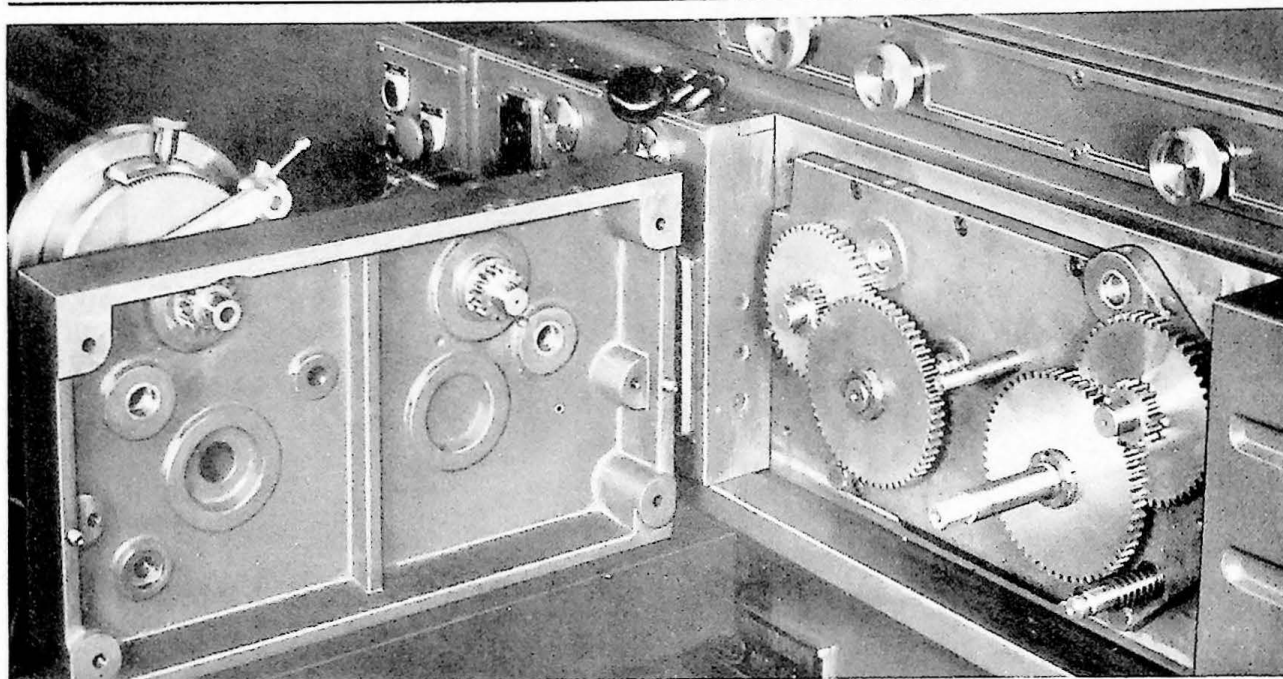


FEED SHAFTS AND THRUST BEARINGS

by loosening the four screws 1, 2, 3, and 4. Removal of the panel may be facilitated by tightening the draw screws 5 and 6. A shaft at C is removed with the panel and a spring at D. The inner panel B is now exposed and must be removed. This panel is positioned by two dowels 7 and 8. The cross feed screw may now be slipped through the clearance hole in the base and screwed into the bronze nut mounted on the cross slide. Likewise, the dresser feed shaft may be slipped into the opening in the base and engaged with the spline. Next, the rear thrust bearings must be installed

on the feed screw and dresser feed shaft. The inner panel may now be replaced and the front thrust bearings slipped on the shafts. The large driven gears are placed toward the thrust bearings and the check nuts screwed to retain the gears. Care must be used in tightening the check nuts only sufficiently to remove any end play. The studs carrying the compound idler gears between the handwheel gears and the large driven gears may now be assembled. The photo on page 204 shows gears assembled correctly. The draw screws visible at either side of the outer panel, must be

INSTALLATION



CROSS FEED SHAFTS, GEARS

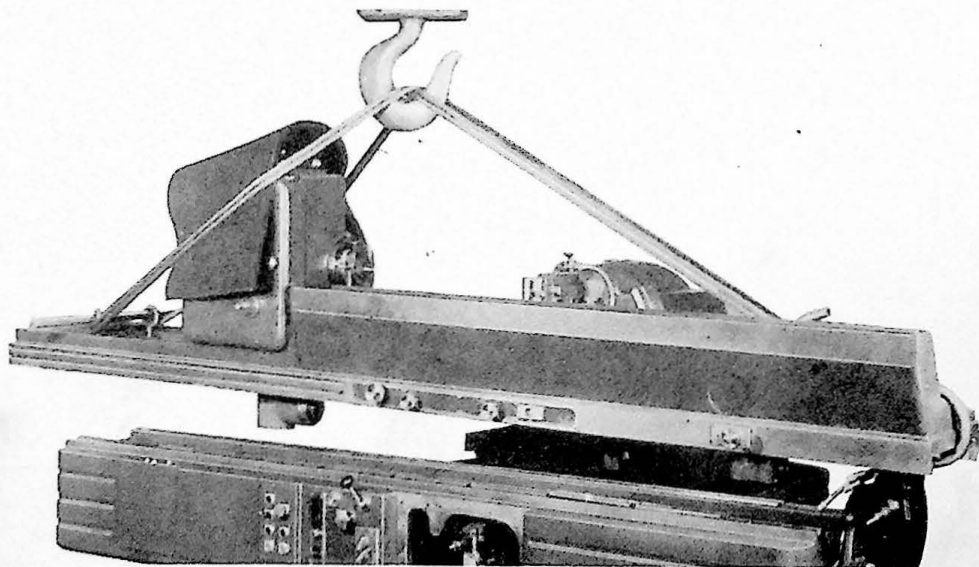
backed off. The outer panel may now be replaced, lining up the shaft at C and taking care that the spring at D is in place. At this time, the crossfeed and the dresser feed should be checked for free action without any binding. This completes the mounting of the cross slide.

WORK TABLE SLIDE: Case No. 3 contains the machine table and accessories, hydraulic tubes, and case No. 3-A which contains the roller bearing cages. These roller bearing cages should be placed on the flat and "V" ways of the machine base. The ways must be well oiled.

The friction brake tube, located in front of, and below, the flat way on the machine base, must be removed. This is done by removing a screw that holds the tube in a bracket at the left end. The tube may then be drawn out.

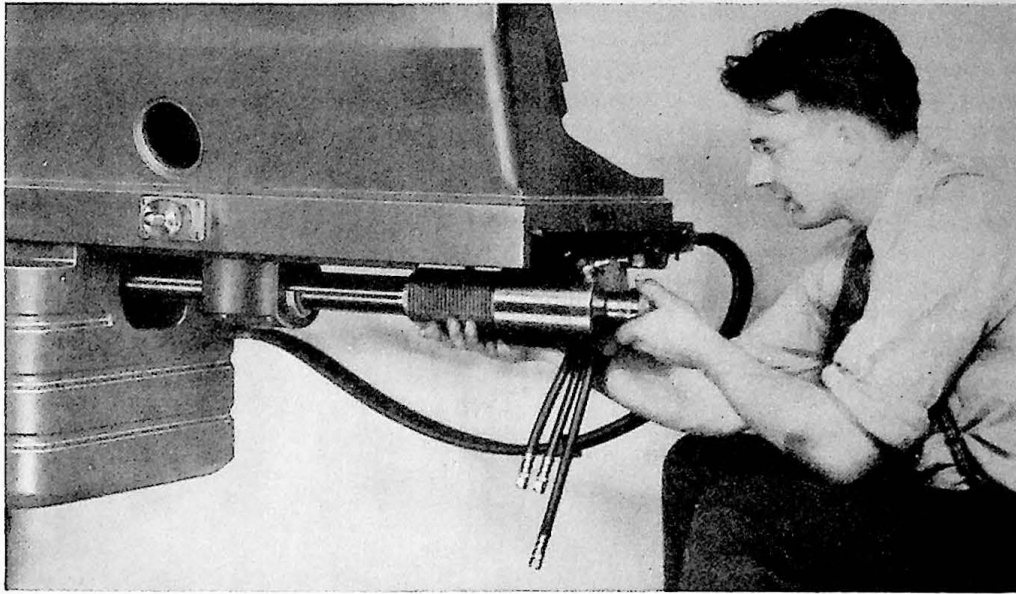
When the machine is shipped, the bronze lead nut is in position on the under side of the table. To avoid damage, this nut must be removed until the table slide is placed on the machine base.

RECOMMENDED WAY TO LIFT WORK TABLE: Three tapped holes for 1" eye bolts are provided as a safe way to lift the table. Two holes are near the left end and one at the right. They



RECOMMENDED WAY TO LIFT WORK TABLE

INSTALLATION



INSTALLING LEAD SCREW

are accessible by removing the three screws now in position at these points. It is suggested that a bar be inserted through two eye bolts at the left end of the table, and at the right end an S-hook be inserted through the eye bolt and under the edge of the table as shown in the photograph. The table weighs approximately 3000 pounds. When it is lifted into position, care must be used to be sure that the ropes or cables are sufficiently strong. The table should be lowered gently on the ways. The bronze lead nut may now be replaced. The friction brake tube may be slipped back into its bracket on the machine base, through the bracket on the table, and into the second bracket inside the base. Then the screw is replaced in the end of the tube. This brake may be adjusted by regulating the tension applied on it by the table bracket. To do this, the table may be moved by hand toward the left until the bracket is accessible from the opening at the left end of the base. A cover plate on the back of the base may be removed to facilitate adjustment. The arm on the table bracket should be tightened only enough to remove any play. The table slide should be moved by hand to be sure that the friction brake is not too tight.

The hydraulic lines must also be connected. These lines supply the necessary pressure fluid for actuating the hydraulic work drive motor and the backlash compensating cylinder at the right end of the machine table. The ends of the flexible hose connections, as well as the connecting fittings are numbered with individual marking tags. When

the hoses are connected they permit flexing in one plane. If, however, a hose is twisted, the operating life will be reduced.

INSTALLING LEAD SCREW

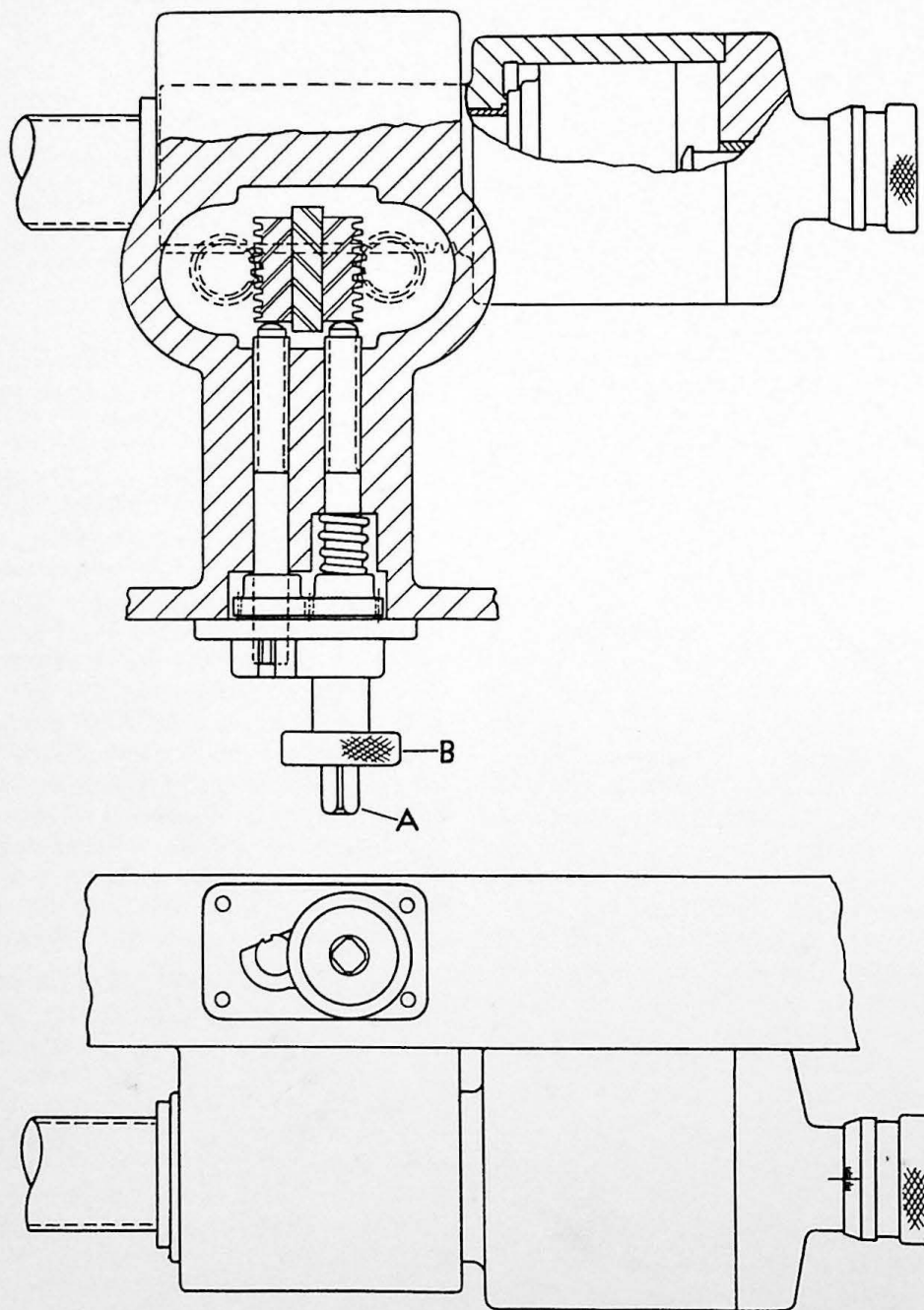
The lead screw should be removed from box No. 1-A, cleaned and dried thoroughly and then covered with a thin film of light oil. By approaching the machine from the right end (as shown in the above photograph) the screw can be slipped through the supporting bracket on the under side of the table until it enters the threaded nut. The wooden half bearing is placed in the bracket. This bearing is provided to assist in assembling the screw and can be discarded after assembly. The lead screw should be screwed into position by hand as far as possible, then the table should be pushed lightly to the left until the splined end of the lead screw engages in the driving member.

The drawing on page 206 of the Backlash Compensator and positioning device shows two pinions and racks. The pinions engage the rack on the compensator cylinder shown in the above photograph. The two racks in the positioning device may be removed by taking off the small cover plate at the right front of the table, and the plate inside that covers machined surfaces for the assembly of the pinion gears and racks. This will permit the pinions to rotate independently of each other and permit the lead screw and backlash compensator cylinder to enter the bracket freely.

INSTALLATION

There should be about $5/16$ " clearance between the back lash compensator cylinder and the table bracket when it is assembled. The racks can be replaced in the same relative position as shown. The knurled knob B is pushed toward the table disengaging the front gears so that the two racks work independently. In this position the knob is tightened by hand until the play in the racks is eliminated. Then the knob is released

and the front gears are re-engaged. The hand crank is then placed on the square A and turned, the two pinions turned against each other thereby wedging the mechanism in position. The hand crank should be turned only until the gears are snug. The cover plate is replaced and the rubber hose connections attached to the fittings on the table which are correspondingly numbered 1, 2, and 3.



BACKLASH COMPENSATOR DEVICE

INSTALLATION

CONNECTING THE COOLANT TANK: The coolant tank with the motor-driven pump should be placed at the rear of the machine. There are two hose connections, one at the grinding wheel guard and the other at the pump.

The coolant drains from the table into the flanged machine base and returns to the tank through a spout at the rear. The coolant is cleaned by a system of baffles in the tank which aid in settling the grit from the oil.

FILLING THE COOLANT TANK: The capacity of the coolant tank is 50 gallons. This fills the tank to the top of the highest baffle with the pump idle. This level should be maintained at all times. It should be checked daily and additional oil added to bring it up to the proper level.

A good grade of thread grinding oil should always be used, as the nature of the coolant has a decided influence on wheel life and the results obtained by the machine. It is advisable to consult those supplying the thread grinding coolant oil regarding specific problems.

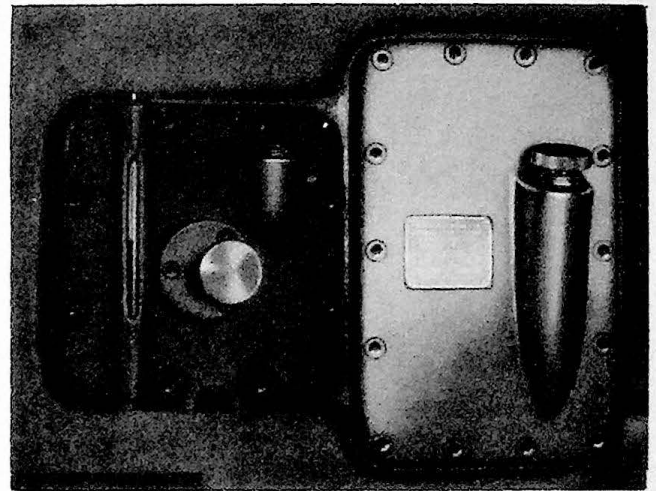
MOTOR CONNECTIONS: (Wiring diagram is furnished with the machine). There are four motors: one for the wheel head, another for the coolant pump, a third on the dresser drive and a fourth on the power feed. All the wiring for the motors and controls is in the machine base and only the outside power line connection to the machine is necessary. After the power line connection is made, the wheel spindle motor should be tested for correct rotation. The wheel spindle at the point nearest the operator should rotate downward. If it does not, it will be necessary to reverse the power line connections to the machine.

All the wiring and motors are properly connected to the control panel and tested before the machine is shipped. If the above instructions are followed, it will not be necessary to check the other motors for correct rotation or make any other changes in the wiring of the machine. The plug connection at the rear of the machine is for the coolant pump motor.

HYDRAULIC PUMP UNIT AND HYDRAULIC OIL: The hydraulic pump unit is mounted on a separate base with three-point suspension, and is

provided with rubber cushions to dampen vibration. The unit should be placed close to the machine, but not touching it, and the necessary hose connections made.

The filler opening for the hydraulic oil is located at the right hand end of the base near the front, just above the floor. (See photograph). The reservoir must be filled to about 1 inch below the filler opening. This will take about 20 gallons.



HYDRAULIC OIL FILLER

STARTING THE HYDRAULIC SYSTEM: After the hydraulic reservoir is filled to the proper level with hydraulic oil, the hydraulic motor should be run for about 15 minutes to be sure that the entire system is completely filled and all air expelled. All visible connections should be checked for leaks.

The two dogs operating the extreme right and left plungers (table reversing plungers) should be inside of the two stop screws in the lower table tee slot. The table control lever should be moved to "start" position and the table allowed to reverse itself rapidly for about 10 minutes. When the table movement operates smoothly, all air has been expelled.

If the hydraulic pump is noisy and sufficient oil is in the hydraulic reservoir, the intake hose assembly should be checked for air leaks.

LUBRICATION
EX-CELL-O
PRECISION THREAD GRINDER
STYLE 50



LUBRICATION

THE THREE MOTORS: need lubrication with a good grade of No. 203 non-fluid ball bearing grease at regular intervals, depending on the extent the machine is used.

The electric motors that drive the wheel head and the hydraulic motor for the work spindle, have two oiling points each, one at each bearing. The coolant pump motor has an oiler at the side and another at the top plate of the motor. This upper bearing is a ball bearing with sealed-in lubrication and should require only a few drops of oil once a year.

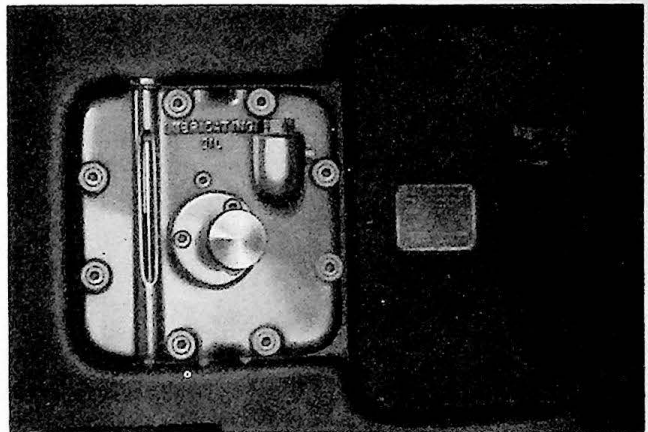
Any further instructions that appear on any plates or tags attached to the motors should be followed.

BEFORE THE MACHINE IS STARTED: attention should be given to all visible oilers. There are three important places which must have this attention: the work spindle, the wheel spindle and the main lubricating oil reservoir in the base on the right hand side (photo below). This reservoir holds about a quart of machine oil. It is provided with a pump and a sighting glass to show the oil level. This oil pump is connected to lines which radiate out to all inaccessible parts of the machine, such as the cross slide ways, table ways, lead screw and many other places. The reservoir should be filled as often as necessary.

The pump is automatically operated at each table reversal. Therefore, if short work pieces are being ground it may be desirable to limit the flow of oil. When long work is being ground there is a longer interval of time between table reversals, resulting in fewer pumping strokes, so that a greater flow of oil is desirable. The pumping volume may be increased by turning the knurled knob on the reservoir panel counter-clockwise, or the volume may be decreased by turning the knob clockwise. This adjustment, even when fully closed, does not stop, but merely limits the flow of oil.

THE WHEEL HEAD SPINDLE: is lubricated by removing the hexagonal cap on top of the wheel head housing. Spiral grooves on the spindle carry the oil to the bearings. A high grade spindle oil must be used. Socony-Vacuum spindle oil or its equivalent is recommended. (See spindle oil specifications).

When the machine is first operated, or after it has been idle for some time, this reservoir



LUBRICATING OIL FILLER

should be filled to make certain that the bearings have been thoroughly oiled. When the machine is used continuously, this reservoir should be filled about every four hours.

THE WORK HEAD SPINDLE BEARINGS: are lubricated by removing the hexagonal oiling cap at the top of the work drive housing. A reservoir oils the two precision bearings of the work spindle. A high grade spindle oil must be used.

THE WHEEL HEAD CROSS FEED MECHANISM: is lubricated by five oilers located immediately back of the cross feed handwheel. A good grade of machine oil should be used daily.

THE WORK HEAD SPINDLE WORM DRIVE: lubricating plug is located at the rear of the work head housing. The reservoir should be filled to the level of the plug with a good grade of machine oil. This is only necessary when first putting the machine in operation. No further attention is necessary.

THE WORK HEAD GEAR TRAIN: is spray-lubricated by a plunger pump, operated by a cam from the work drive shaft. The oil is taken from the oil sump which is fed by the oil from the work drive and spindle bearings.

THE IDLER PULLEY: for maintaining the belt tension, located in the front of the work head housing should be oiled daily through the oiler.

DRESSER LUBRICATION

THE THREE WAY, 60° AND 29° FORM DRESSER: has four oil cups. The one on the drive cable housing requires 600-W oil once a month. The worm slide should be lubricated daily with

LUBRICATION

machine oil through the oil cup on top of the slide. The ways and rollers require daily lubrication with spindle oil through the oil cup on the left side of the dresser base. The center diamond cam should be lubricated daily with spindle oil through the oil cup on the left side of the arm.

THE THREE WAY, PLATE-TYPE 10° TO 90° FORM DRESSER: has two oil cups. The one on the drive cable housing requires 600-W oil once a month. The worm slide should be lubricated daily with machine oil through the oil cup on top of the slide.

THE THREE WAY, CRADLE-TYPE 10° TO 90° FORM DRESSER: has three oil cups. The one on the drive cable housing requires 600-W oil once a month. The worm slide should be lubricated daily with machine oil through the oil cup on top of the slide. The ways require daily lubrication with spindle oil through the oil cup on the left side of the dresser base.

THE UNIVERSAL, CAM-TYPE DRESSER: requires 600-W oil in the drive housing once a month. This is lubricated through a screw-plugged oiler in the top of the housing. The driving mechanism in the carriage should have 600-W oil every other day. The oil cup for this mechanism is accessible after the dresser cover is removed.

The swivel bracket bosses have screw-plugged oilers that require spindle oil once a week. The dresser ways are lubricated daily with spindle oil through an oil cup on the left side of the dresser base. The faces of the cams should be kept greased.

SPINDLE OIL SPECIFICATIONS

The following specifications are recommended for the oil used in the spindle bearings of this machine:

Specific Gravity	.845
Beaume Gravity	35 Min.
Minimum Flash	310° F.
Minimum Fire	345° F.
Saybolt Viscosity	58-60 Seconds at 100°
Saybolt Viscosity	46.4 Seconds at 130°
Saybolt Viscosity	35-36 Seconds at 210°
Color Viscosity	75 Lovibond or No. 1 A.S.T.M.

This oil is a highly refined paraffin base oil--it should readily separate from water when agitated with water and allowed to stand.

These specifications are met by Socony-Vacuum "Gargoyle Velocite E" oil or its equivalent.

OPERATING INSTRUCTIONS

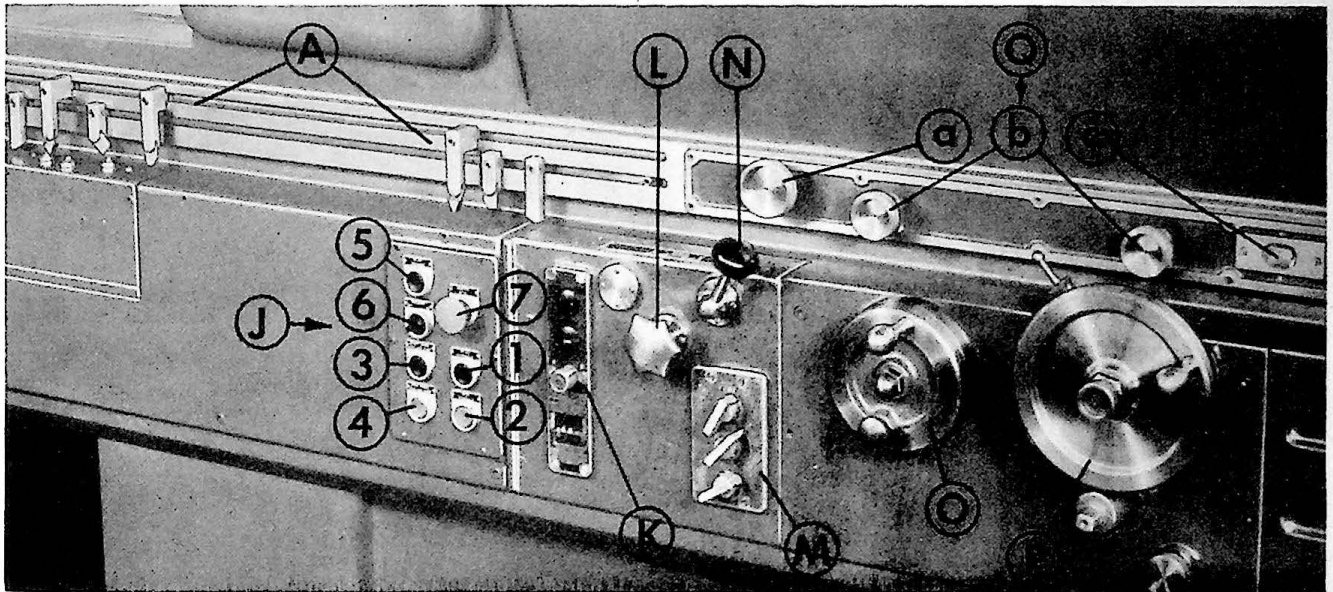
EX-CELL-O

PRECISION THREAD GRINDER

STYLE 50



OPERATING INSTRUCTIONS



OPERATING CONTROLS

- A. Table control dogs.
J. Electric Control buttons and switches.

1. Start hydraulic pump.
2. Stop hydraulic pump.
3. Start wheel and coolant pump.
4. Stop wheel and coolant pump.
5. Start dresser.
6. Dresser off-on.
7. Master stop.

- K. Work spindle direction control.
L. Manual table direction control.
M. Work speed control valves.
N. Table control start-stop.
O. Dresser feed control.
P. Wheel feed control.
Q. Lead control.
 a. Actuating knob.
 b. Locking knobs.
 c. Sight hole.

All controls are at the front of the machine within easy reach of the operator.

The position of the adjustable dogs A on the control bar determines the length of the table stroke, the approach and grinding movements. The direction of table movement may be reversed by the manual control knob L at any time during its travel. The table is started and stopped by Lever N.

The lead control device Q makes it possible to grind odd leads and hold accurate overall lead dimensions. The lead may be lengthened or shortened up to .020" per foot.

The buttons and switches 1, 2, 3, 4, 5, 6 and 7 on the panel J control the electric motors. A duplicate set of dresser control switches is provided at the left side of the machine for the operator's convenience when a new wheel is being installed.

The valve K must be set to conform to the right or left thread setting obtained with the change gears. The valve is locked in the adjusted position by a clamp screw. The plungers in the hydraulic panel must be in the correct relation to the valve K as explained on the plate.

A group of three valves M controls the work drive motor speed. The upper valve controls the grinding movement of the table toward the left, the lower valve controls the grinding movement to the right, and the center valve controls the speed of the hydraulic motor while the table is in rapid traverse.

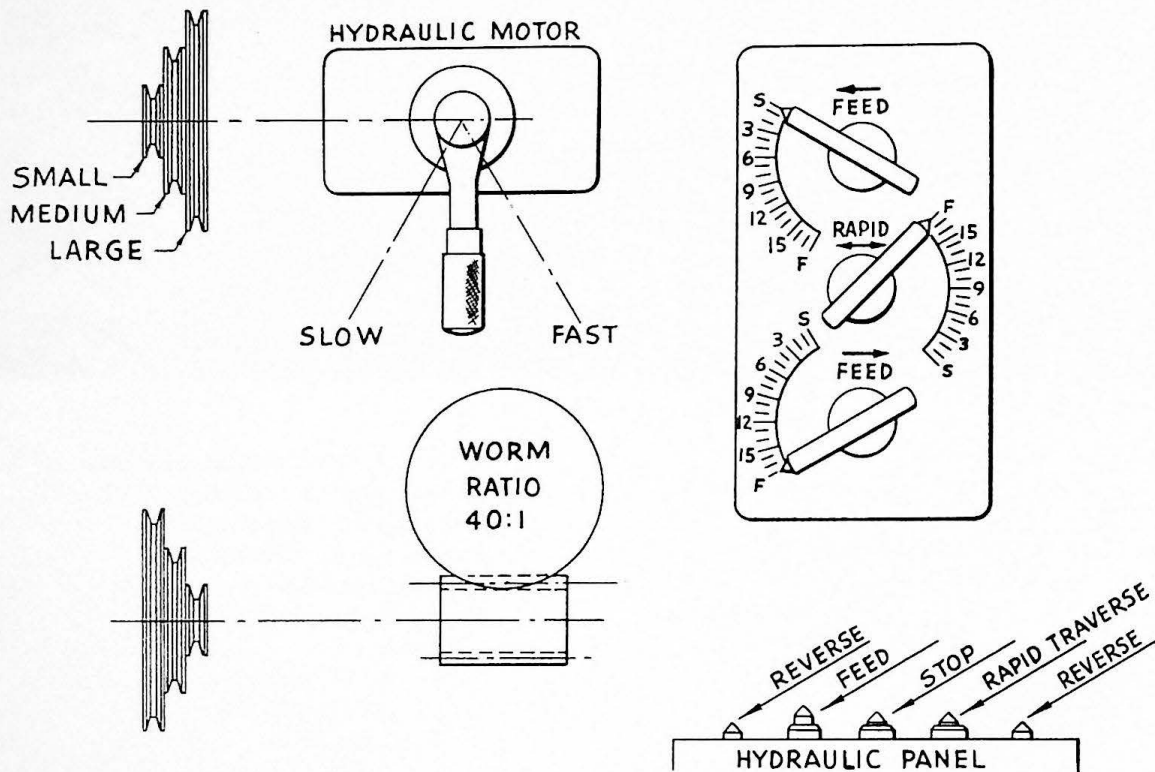
The hand wheel O, with its locking knob controls the dresser feed. The hand wheel assembly P controls the grinding wheel feed.

LEAD CONTROL: In the assembly Q, there is a sight hole c with a reference line inscribed

OPERATING INSTRUCTIONS

WORK SPEEDS

EX-CELL-O STYLE 50 PRECISION THREAD GRINDER
SERIAL NO. _____



RAPID TRAVERSE USING CONTROL HANDLE ON TOP OF MOTOR. CENTER DIAL TO BE SET AT FAST POSITION.			FEED USING UPPER AND LOWER DIALS						
	SLOW	FAST	S	3	6	9	12	15	F
LARGE	80	135							
MEDIUM	30	50							
SMALL	10	17							
HYD. MOTOR RPM	1200	2000	1050 TO 100						

NOTE: MAXIMUM RAPID TRAVERSE SPEEDS ARE OBTAINABLE ONLY IF THE SAFETY VALVE IS SET TO AT LEAST 1200 LBS. RELIEF PRESSURE.

OPERATING INSTRUCTIONS

on the beveled edge. Behind the sight hole is a sliding bar graduated in increments of .001 inches per foot and reading from 0 to plus or minus .020. To grind a thread of correct lead, the zero mark on the sliding bar should be placed in line with the reference line on the sight hole frame. The sliding bar is actuated by the knurled knob a. To adjust the graduated bar it is necessary to loosen knobs b. If the lead is to be shortened, for example .005 in one foot of thread length, the sliding bar must be moved to the right until the .005 graduation is aligned with the reference line. The knobs b must then be tightened.

WORK SPEED CHART

On the work speed chart, the upper left hand drawing represents the hydraulic motor used to drive the work spindle. This motor is of the variable displacement type. The displacement is changed by moving the handle shown.

When the rapid traverse control plunger in the hydraulic panel on the front of the machine is depressed, the hydraulic motor is shifted into rapid speed and the handle on the top of the hydraulic motor becomes effective. Moving this handle from slow to fast will cause the motor to run at speeds varying approximately from 1200 r.p.m. to 2000 r.p.m., depending upon the position in which the handle is placed (the handle is held by a twist of the knurled end).

For high workhead speeds, such as are used when returning idle to the start of the cut, the handle should be moved to the "fast" position, the center dial turned to F and the rapid traverse plunger in the hydraulic panel depressed.

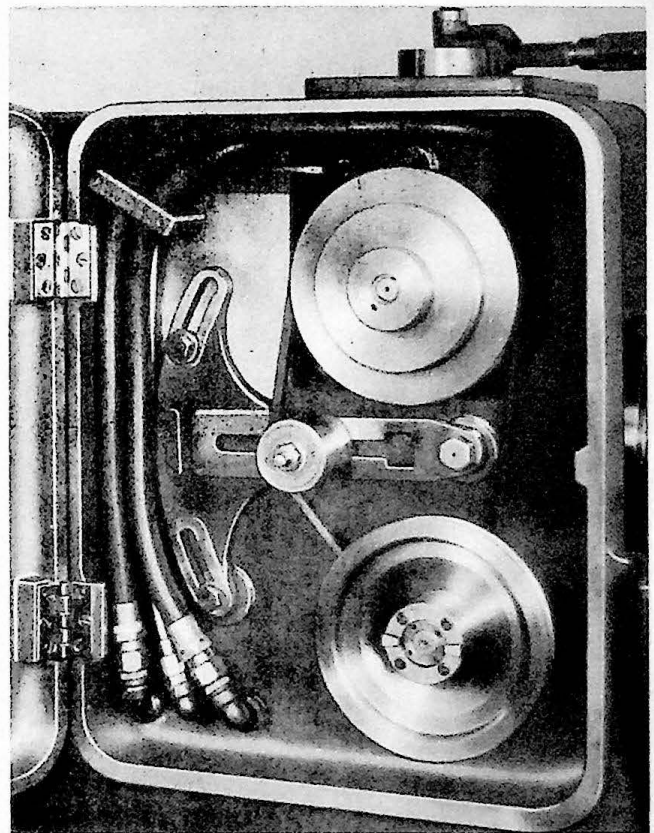
In this position, the hydraulic motor will run at approximately 2000 r.p.m. If the motor belt is on the small motor pulley and the large spindle pulley, the work spindle will run at approximately 17 r.p.m. If the belt is on the center pulleys, the work spindle will run at approximately 50 r.p.m. If the belt is on the large motor pulley and the small spindle pulley, the work spindle will run at approximately 135 r.p.m.

If these speeds are found to be too high, the handle may be moved toward the "slow" direction until a suitable speed is found. At the extreme slow position, the motor speed will be 1200 r.p.m. and the workhead speeds 10 r.p.m. to 30 r.p.m., or 81 r.p.m., depending on the location of the motor belt. If lower rapid traverse speeds are needed, the rapid traverse orifice at the center of the dial can be adjusted.

NOTE: It is not advisable to attempt to grind with the rapid traverse plunger depressed. This is to be used for rapid traverse only when approaching or leaving the work. When grinding, the FEED plunger should be depressed. The work spindle speed is regulated by the upper dial when the table is traveling in one direction, and by the lower dial when traveling in the opposite direction.

Infinitely variable speed adjustments can be obtained from the slowest to the fastest speeds by adjusting the respective orifice between "S" and "F". The drive belt may be changed to the large or small pulleys to change the speed range.

The reverse plungers in the hydraulic panel are used for reversing the motor and returning the work table at the end of the cut.



WORK SPINDLE DRIVE

HYDRAULIC WORK SPINDLE DRIVE: Hydraulic oil under pressure for the hydraulic motor is supplied by an electric motor-driven pump unit at the rear left of the machine base. The hydraulic motor, located inside the top of the work head housing, drives the work spindle through a worm gear drive. Three-step pulleys on both the hydraulic motor and the work spindle worm

OPERATING INSTRUCTIONS

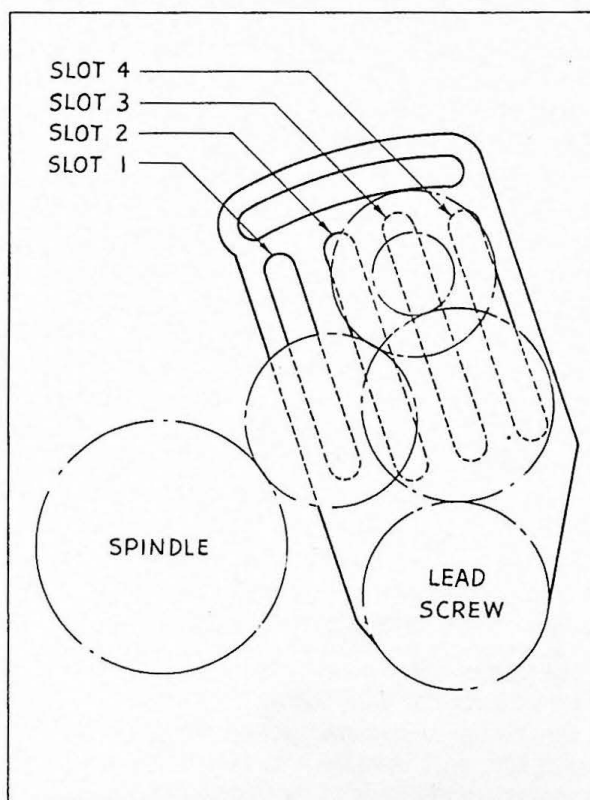
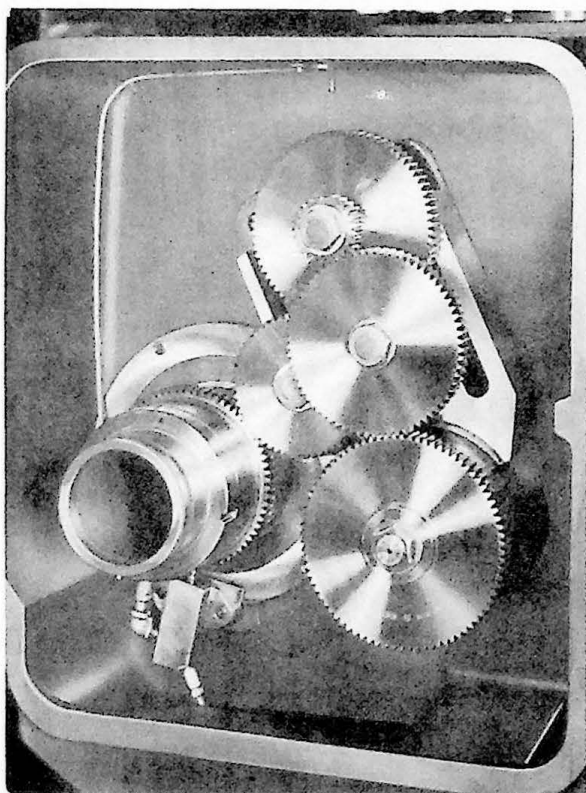
drive, gives an unusually wide range of work speeds. An idler is provided to maintain proper belt tension. The grinding speed of the motor is selected with an orifice control handle at the front of the machine.

WORK SPINDLE SPEEDS

Hydraulic Motor			
Pulley	Small	Center	Large
Work Drive			
Spindle	Large	Center	Small
Work Speed Range			
R.P.M.	7/8 to 10	3 to 30	7 to 80

TAILSTOCK: The tailstock center quill is spring operated. A lever on top of the tailstock withdraws the center from the work and a knurled knob on top is used to lock the quill, if desired. The large knurled nut at the right end of the tailstock adjusts the spring tension on the center and the smaller knurled nut acts as a stop. It should be adjusted so that the center will not hit the wheel when changing work.

At the front of the tailstock is an adjusting screw with a graduated dial for aligning the work head and tailstock. Turning the adjusting screw clockwise moves the tailstock toward the grinding wheel.



LEAD CHANGE GEARS

LEAD CHANGE GEARS: The change gears are alloy steel, heat-treated and finished with a tooth "shaving" process that removes all irregularities and produces the highest precision gear available within commercial means.

The teeth are 14 pitch, 20° pressure angle, with 3/4" wide face. They are kept constantly

lubricated by an oil spray furnished by a pump mounted beneath the work spindle. There are four slots in the gear quadrant, designated as Slot 1, Slot 2, Slot 3, and Slot 4. The diagrams furnished with the machine show how to mount the gears. In assembling the change gears, there must be about .003" "backlash" between all mating gears.

OPERATING INSTRUCTIONS

CHANGE GEAR CHART

Ex-Cell-O Style 50 Precision Thread Grinder
R. H. PITCHES with Standard 6 Pitch Lead Screw using
standard gears furnished with machine.

PITCH	SPINDLE	SLOT 1	SLOT 2	SLOT 3	SLOT 4	SCREW
2	84	63	28/56	70		56
2-1/4	84	56	28/56	63		63
2-1/2	84	56	28/56	63		70
2-3/4	84	63	28/56	56		77
3	84	63	28/56	56		84
3-1/4	84	56	28/56		70	91
3-1/2	72	63	28/56	56		84
4	84		70			56
4-1/2	84		70			63
5	84		70			70
5-1/2	84		70			77
6	84		70			84
7	72		70			84
8	84	56		56/28-70		56
9	84	56		56/28-63		63
10	84	56		56/28-63		70
11	84	56		56/28-63		77
11-1/2	72	56/28		56	70	69
12	84	56		56/28-63		84
13	84	56		56/28	67	91
14	72	56		56/28	70	84
16	84	56		56/28	63	112
18	84	56			75/25-70	84
20	72	56		75/25-70		80
21	72	48		75/25	70	84
22	72	48		75/25	70	88
24	84	48		75/25	67	112
26	72	48		75/25	67	104
27	72	48		75/25	67	108
28	72	56		75/25	67	112

OPERATING INSTRUCTIONS

CHANGE GEAR CHART

Ex-Cell-O Style 50 Precision Thread Grinder
L. H. PITCHES with Standard 6 Pitch Lead Screw using
standard gears furnished with machine.

PITCH	SPINDLE	SLOT 1	SLOT 2	SLOT 3	SLOT 4	SCREW
2	84	70		28/56		56
2-1/4	84	70		28/56		63
2-1/2	84	70		28/56		70
2-3/4	84	56		28/56		77
3	84	56		28/56		84
3-1/4	84	56		28/56		91
3-1/2	72	56		28/56		84
4	84	48		56		56
4-1/2	84	48		56		63
5	84	48		56		70
5-1/2	84	48		56		77
6	84	48		56		84
7	72	48		56		84
8	84	56/28		70		56
9	84	56/28		63		63
10	84	56/28		63		70
11	84	56/28		63		77
11-1/2	72	56/28		70		69
12	84	56/28		63		84
13	84	56/28		63		91
14	72	56/28		63		84
16	84	56/28		63		112
18	84	75/25		70		84
20	72	75/25		70		80
21	72	75/25		70		84
22	72	75/25		70		88
24	84	75/25		70		112
26	72	75/25		70		104
27	72	75/25		70		108
28	72	75/25		70		112

OPERATING INSTRUCTIONS

CHANGE GEAR CHART

Ex-Cell-O Style 50 Precision Thread Grinder
R. H. METRIC LEADS with Standard 6 Pitch Lead Screw

*Extra standard gears for metric leads listed.

M.M. LEAD	SPINDLE	SLOT 1	SLOT 2	SLOT 3	SLOT 4	SCREW
.75	70*	84/27*		70	36*	127*
.8	64*	72/27*		70	36*	127*
.9	72	72/27*		70	36*	127*
1.0	80*	72/27*		70	36*	127*
1.25	100*	72/27*		70	36*	127*
1.5	120*	72/27*		70	36*	127*
1.75	70*	56/42*				127*
2.0	80*	56/42*				127*
2.25	90*	56/42*				127*
2.5	100*		56/42*			127*
2.75	110*		56/42*			127*
3.0	120*		56/42*			127*
3.5	70*	56		28/42*	36*	127*
4.0	80*	56		28/42*	36*	127*
4.5	90*	56		28/42*	36*	127*
5.0	100*	56		28/42*		127*
6.0	120*	56		28/42*	36*	127*

OPERATING INSTRUCTIONS

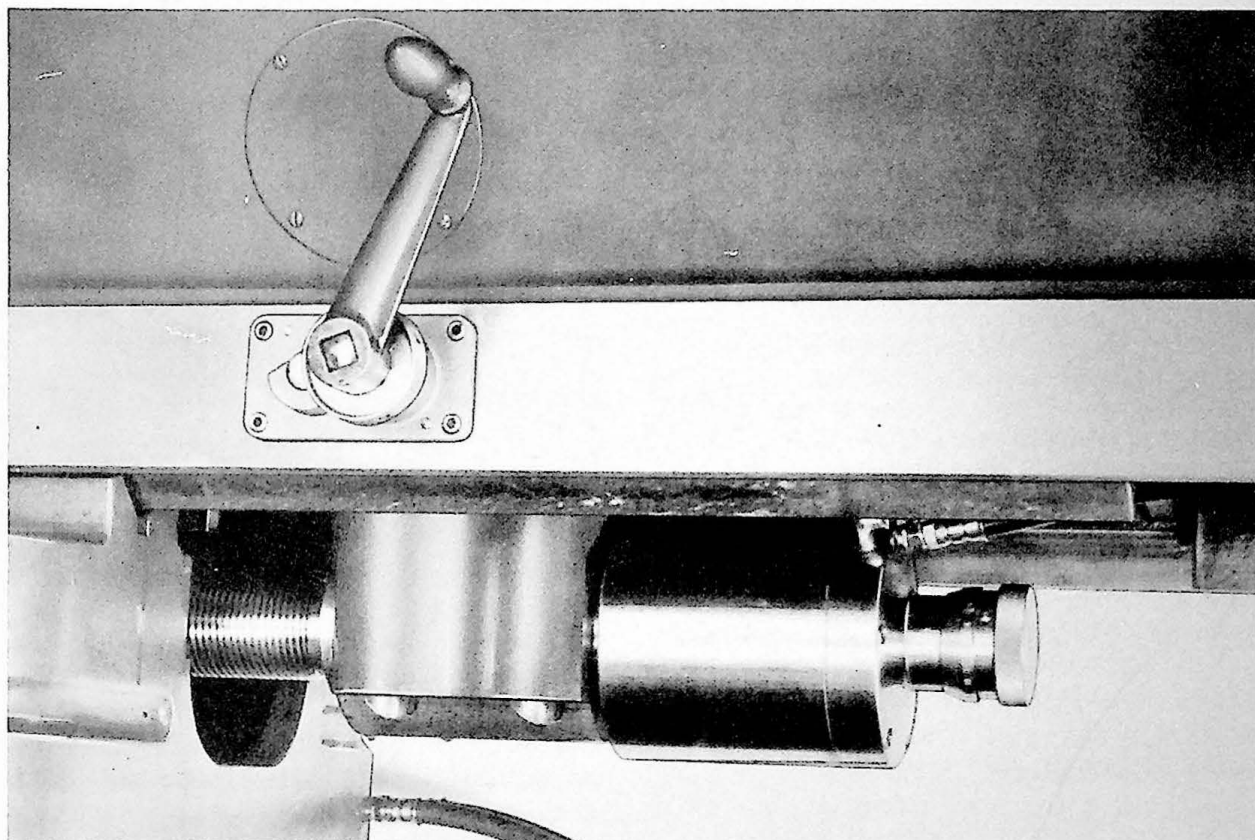
CHANGE GEAR CHART

Ex-Cell-O Style 50 Precision Thread Grinder
L. H. METRIC LEADS with Standard 6 Pitch Lead Screw

*Extra standard gears for metric leads listed.

M.M. LEAD	SPINDLE	SLOT 1	SLOT 2	SLOT 3	SLOT 4	SCREW
.75	70*		84/27*		70	127*
.8	64*	72/27*		70		127*
.9	72	72/27*		70		127*
1.0	80*	72/27*		70		127*
1.25	100*	72/27*		70		127*
1.5	120*	56			72/27*	127*
1.75	70*	56/42*		56		127*
2.0	80*	56/42*		56		127*
2.25	90*	56/42*		56		127*
2.5	100*	56/42*		56		127*
2.75	110*	56/42*		56		127*
3.0	120*	36*		56/42*		127*
3.5	70*	70		28/42*		127*
4.0	80*	70		28/42*		127*
4.5	90*	70		28/42*		127*
5.0	100*	70		28/42*		127*
6.0	120*	70		28/42*		127*

OPERATING INSTRUCTIONS



BACKLASH COMPENSATOR

BACKLASH COMPENSATOR: The backlash compensator is operated hydraulically. It automatically moves the table the amount necessary to compensate for the backlash of the gears and lead screw. Thus it is possible to grind in either or both directions of table travel. The direction of the work can be reversed while the wheel is in the cut. It is not necessary to provide an undercut in the work for wheel clearance.

A hand knob with graduations is under the right end of the work table. Each graduation represents .00025 table movement.

The backlash compensator must be adjusted after each alteration of the change gears.

To find the correct position of the hand knob a grinding cut is taken in one direction. Then without feeding the wheel into the work and with the coolant valve on the wheel guard shut off, the table movement is reversed. The compensator is then adjusted so that a minimum of sparking is visible. This indicates that the grinding wheel is returning in exactly the same path it travelled on the forward stroke.

WORK POSITIONING DEVICE: A knurled hand knob located at the front of the work table moves the table integrally so that pre-cut threads or threads that have been previously rough ground can be matched.

Torsional resistance is provided to prevent turning at any time except when the operator desires it. This desired rotational resistance is adjustable by pushing the knob by hand to the inward position and rotating it to the right to increase and to the left to decrease the resistance. When the knob is released to the outward position two pinions are engaged. By rotating the knob with the hand lever furnished as shown in the above illustration, the desired adjustments can be made.

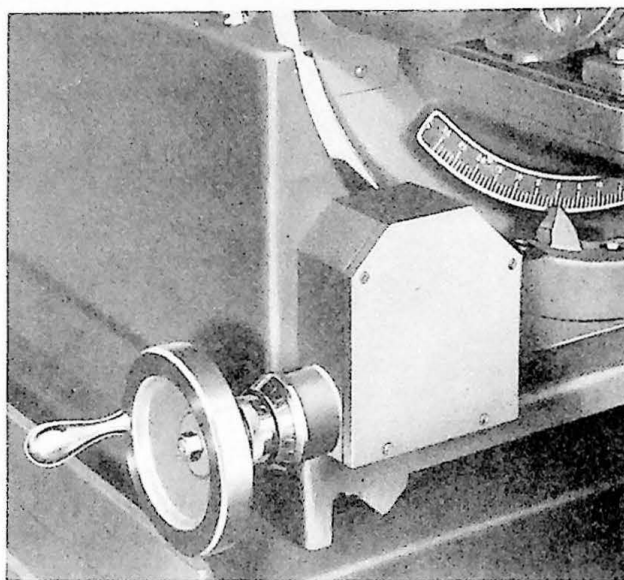
HELIX ANGLE SETTING: For setting the wheel head to the proper helix angle, the cradle with the wheel head slide is rotated by the hand wheel at the right rear of the machine. Before rotating the hand wheel, the two set screws near the pointer and the three on the segment strip at the front of the cradle, must be loosened. The hand wheel is rotated until the proper helix angle, as indicated by the coarse graduations on the

OPERATING INSTRUCTIONS

strip and the fine graduates on the hand wheel, is reached. Before grinding is started, all five screws must be securely tightened.

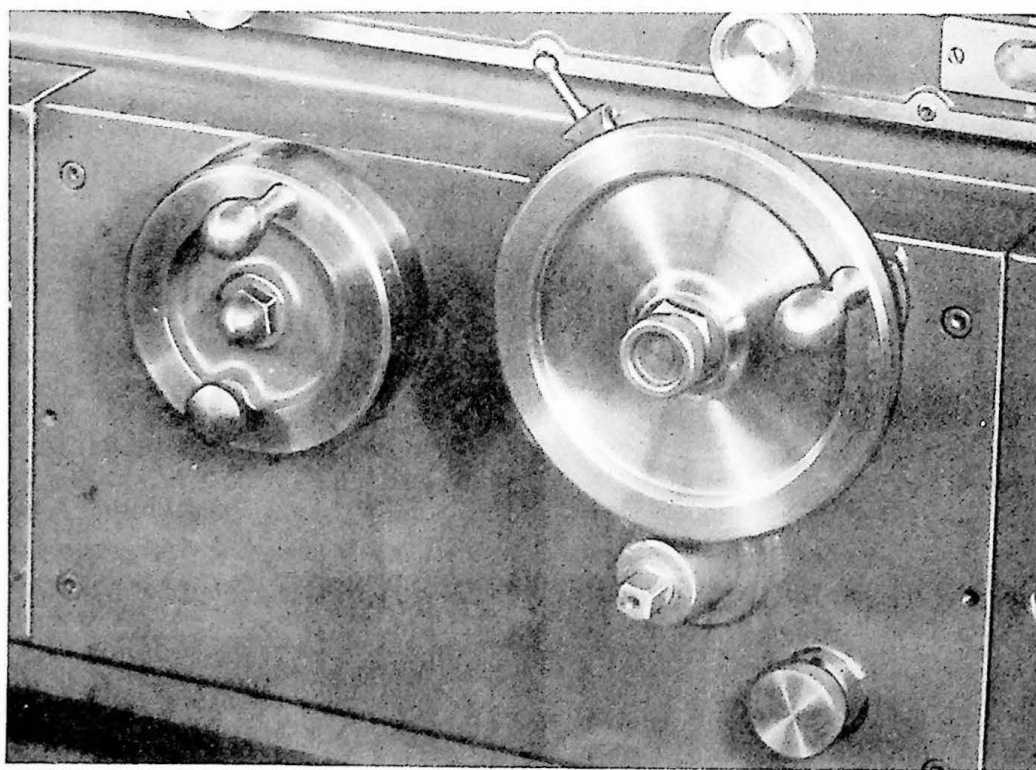
GRINDING WHEEL FEED CONTROL: The hand wheel assembly at the right in the photo below controls the grinding wheel feed. The knurled knob at the hub of the hand wheel locks it in position. The square rapid traverse shaft just under the hand wheel provides for quickly setting the grinding wheel to a new work piece. It is turned by a hand crank furnished with the machine. The shaft is engaged by pulling out and turning the knob at the lower right corner of the panel. A flange on the back of the hand wheel is graduated and numbered from zero to twenty-seven. One revolution of the hand wheel moves the grinding wheel .028". Each graduation represents .0002" on the pitch diameter of the work. These graduations are noted in relation to a zero line on a stationary shield at the back of the control assembly. A marker on the rim of the hand wheel may be turned to any position and locked with the knurled screw.

When a series of cuts is necessary the wheel feed may be set to operate automatically at every table reversal. For this purpose a lever is po-



HELIX ANGLE SETTING

sitioned in the slotted stroke adjustment arm at the left and behind the hand wheel. This adjustment provides for .0002" to .0016" feed at each table stroke. The automatic feed is put into operation by throwing the ratchet pawl into engagement with the notches on the hand wheel flange. The



GRINDING WHEEL FEED CONTROL

OPERATING INSTRUCTIONS

marker at the rim of the hand wheel may be set to throw the pawl out of engagement when the desired size is reached.

DRESSER FEED: The hand wheel at the left in the preceding photo moves the dresser toward or away from the grinding wheel. This hand wheel is graduated and numbered exactly the same as the cross feed control. A knurled screw on the rim of the hand wheel locks it in the selected position.

The dresser feed and grinding wheel feed controls are geared together in such a way that as the wheel is dressed it is automatically fed into the work enough to compensate for the amount removed during the dressing operation.

GRINDING WHEEL SPINDLE: A constant speed electric motor with a two-step pulley drives the wheel spindle. One set of three two-step pulleys, for wheel speeds of either 7000 or 9000 surface feet per minute, are furnished with the machine. Purchaser has the option as to which set is furnished with the grinder.

The table below gives the pulleys used to maintain the proper wheel speed for wheels from 18" diameter down to 13" diameter.

Wheel Diam.	PULLEY MARKINGS R.P.M. OF WHEEL SPINDLE	
	For 9,000 Ft./Min.	For 7,000 Ft./Min.
18	1910	1485
17	2040	1575
16	2150	1670
15	2290	1780
14	2450	1910
13	2640	2040

CHANGING WHEEL PULLEYS: Before the pulley is disassembled the drive belt must be removed. The pulley may be taken off the spindle shaft by forcing it from the taper seat. This is done by turning the hexagon head shoulder screw, which has a left hand thread. This shoulder screw is furnished with the machine, with the head protruding through the pulley bore. After the pulley is freed, the threaded collar that retains the shoulder screw is removed with a spanner wrench. The threaded collar has a right hand thread. After the threaded collar is disassembled the shoulder

screw is removed and the pulley may be slipped off the shaft.

The shoulder screw is inserted into the counterbored hole of the new spindle pulley; the threaded collar is screwed tight into place and the new pulley may be assembled and locked with the shoulder screw. Care must be taken that the drive key is in place while placing the pulley on the spindle shaft.

The spindle is supported on precision ball bearings. To avoid injuring these finely lapped spindle bearings, extra caution must be taken while mounting either pulleys or grinding wheels. No hammer should be used and no great force applied that might cause injury. By following the instructions as described in the previous two paragraphs on removing and reassembling the drive pulleys, no harm will be done.

As the wheel spindle is very sensitive, the drive belt should be properly tensioned. A belt that is too tight will affect its smooth running and will shorten the service life. Likewise, a belt that is too loose will overheat the spindle by slipping on the pulley.

GRINDING WHEELS: It is important that the proper type, grade and size of grinding wheel be selected for the work to be done. Grinding wheels as used for thread grinding are generally of two types: Resinoid and Vitrified. Both types of wheels can be used to advantage in grinding the standard threads usually encountered.

The Resinoid wheel, because of the bonding material used in its manufacture, is somewhat tougher and will stand more abuse than a Vitrified wheel.

The Vitrified wheel, because of its stiffer structure, is nearly always used for grinding threads that have been previously rough ground or cut, as it has less tendency to deflect and follow any lead error than a Resinoid wheel. Vitrified wheels are nearly always used to grind Acme or 29 degree threads.

A wheel speed of approximately 9000 surface feet per minute is recommended for grinding all threads that are ground from the solid, using Vitrified or Resinoid wheels. This speed is somewhat in excess of the usual safety code recommendation. However, because of the extremely hard and dense structure of wheels made especially for thread grinding, operation at this high surface speed is permissible. Wheel manu-

OPERATING INSTRUCTIONS

facturers are fully aware of the conditions under which thread grinding wheels operate and have arranged to test the wheels at sufficiently high speeds to run at 9000 feet per minute with safety.

In grinding 29 degree and Acme threads that have been previously rough ground or cut, it is desirable to operate at a much lower surface speed, and have an entirely different grade of wheel than that used for grinding threads from the solid piece. For this work, a surface speed of 7000 surface feet per minute is recommended.

The test tag attached to each wheel by the manufacturer, showing the testing speed and safe operating speed, should be consulted in each case before the wheel is mounted on the machine. The safe operating speed must never be exceeded. In purchasing wheels from new sources, it is necessary to make sure that the manufacturer of the wheels fully understands the conditions under which the wheel is to operate, in accordance with the above speed recommendations, for ordinary grinding wheels cannot be used successfully to grind threads and operate at these higher speeds.

The Ex-Cell-O Precision Thread Grinder is carefully constructed to a design adopted after many years of experience in grinding precision threads. It must be remembered, however, that the machine must have the proper wheel to do the work intended and to secure the very best results from the machine. If there is already some other thread grinding equipment in the plant, it will undoubtedly be found, because of the difference in the machine and especially in the wheel spindles, that a wheel will act entirely different when used on the Ex-Cell-O machine as compared to the same wheel operating on some other machine.

The wheel should be checked for cracks before it is mounted on the machine spindle. It may be checked by looking it over carefully to see if any cracks are visible, and it may be further checked by holding the wheel by one hand, resting the inside diameter on one finger and tapping it lightly with a screw driver handle. If there is some question regarding the soundness of the wheel, a comparison can be made with another wheel of the same type in order to be certain. This will require some practice and experience, since wheels of different kinds do not sound the same. It is generally safe to assume that a wheel that sounds dead or one that has no ring, may be cracked.

MOUNTING GRINDING WHEELS: The cover at the side of the wheel guard should be removed. The large flange of the wheel adaptor can be removed by removing the eight screws: the wheel can then be placed on the spindle. The parts should all be wiped clean. The 1/64" Vellumoid gaskets must be in place, one on each side of the grinding wheel.

When the wheel is mounted, the identification marks on the wheel should be toward the operator. Mounting the wheel the same way each time will save unnecessary dressing.

After the wheel has been mounted, the adaptor flange should be replaced and one of the cap screws tightened slightly. The opposite cap screw should be replaced and tightened with the same pressure as the first screw. The cap screw next to the first screw should be replaced and slightly tightened, the one opposite it, etc. By working around the flange several times in this manner, all the cap screws can be drawn up uniformly tight and snug. They must never be hammered or forced.

The coolant nozzle should be adjusted so that it clears the wheel when the wheel is turned over by hand. The wheel should revolve freely and not bind or touch the nozzle or wheel guard. The wheel guard can be adjusted backward and forward by the two clamping bolts at the side of the wheel guard. Other adjustments on the wheel guard can be made with the caps screws that hold the wheel guard support.

WORK SPEED AND THREAD GRINDING PRACTICE: For proper surface speed of the work, it is impossible to have a set of fixed rules that will cover a complete range of all work. However, from information gathered from actual jobs over a period of years approximate figures have been established which can be used as a starting point.

Thread grinding has, in general, been divided into two established methods: many light cuts at high surface work speeds of from 240 to 300 inches per minute, or fewer heavier cuts at low surface work speeds of from 18 to 96 inches per minute. High work speeds can be used for light cuts, while slower work speeds must be used on the heavier cuts to avoid excessive wheel wear.

The approximate depth of an ordinary rough cut is from .020" to .040". The machine is capable of removing that depth of cut without burning the work on most materials, when proper

OPERATING INSTRUCTIONS

wheels are used, at the correct wheel speed, together with the correct work speed. The number of roughing and finishing cuts that are necessary depends upon the material, and the nature and precision requirements of the job.

It is usually advantageous to grind threads not exceeding three inches in length productively from solid unthreaded blanks as coarse as:

- 10 pitch, up to 7/8" diameter
- 12 pitch, up to 1" diameter
- 13 pitch, up to 2" diameter
- 16 pitch, up to 3-1/2" diameter

Threads coarser than the above listed pitches can usually be more economically produced when the blanks are rough threaded previous to hardening.

On most of the work pieces, a cut of .020" to .040" deep (on a side) can be taken in one pass. On threads having a greater depth, more than one cut will be necessary.

In some cases, two or even more cuts are advisable, even on the shallow threads, where extreme accuracy in lead, diameter, and finish are required.

When two or more cuts are used, it is generally advisable to take for the last finish cut only from .004" to .010" on commercial work or .0015" to .004" depth on precision work. The roughing cuts may be from .020" to .040" deep.

When grinding to finish size in one cut, for example, a 20 pitch thread having a depth of .032", a work surface speed from 18" to 24" can usually be used.

In grinding threads having a depth over .040", where more than one cut is nearly always advisable, the roughing cuts (from .020" to .040" deep) can usually be taken at a work surface speed of from 36" to 48" per minute, while the finish cut (from .0015" to .004" deep) can usually be taken with a work surface speed of from 72" to 96" per minute.

GENERAL GRINDING SUGGESTIONS

The grinding wheel must not be used after it has worn down to less than 13" diameter.

As little heat as possible should be generated by the wheel. Only a few sparks should be visible in the coolant stream when grinding.

The proper wheel should be selected for the work in accordance with the wheel manufacturer's recommendations.

The wheel should operate at the correct speed to suit the wheel diameter.

The proper work speed should be selected.

The coolant tank should be filled to the top of the highest baffle with the proper coolant.

Grinding cuts of the recommended depth should be taken.

One of the first signs of a dull diamond is a whistling sound as the diamond passes over the wheel. A dull or cracked diamond will glaze the wheel. The diamonds should be checked as soon as they whistle or start to glaze the wheel. A broken or loose diamond must be replaced. A worn diamond can be rotated in the holder to bring a new cutting surface in contact with the grinding wheel.

CORRECTING UNSATISFACTORY GRINDING

When the wheel is burning the work:

The stream of coolant oil must hit the wheel at the point where it is grinding the work and the coolant should flow in sufficient volume. An excessive amount of coolant is never harmful but insufficient and incorrectly applied coolant is frequently the cause of trouble.

In rough grinding, much burning can be eliminated by using a coarser dressing feed or a somewhat heavier dressing cut to open the pores of the wheel and to make it cut more freely.

The diamonds must be sharp and in good condition. A dull diamond will produce a dull cutting surface on the wheel. Frequent turning of the diamond nib will help distribute wear and make it last longer. Sharp diamonds cut very quietly - dull diamonds produce a high pitched tone.

If the wheel is working just above its normal capacity, reduction of the work speed may eliminate burning but under certain conditions burning may be increased. If this happens, the work speeds should again be increased.

Using a lighter cut will always reduce burning but, of course, at the expense of production because more passes are required. If a lighter cut is used, it should be done as a temporary expedient until a more suitable wheel can be procured.

When the grinding finish is unsatisfactory:

The diamonds should be checked to make sure that the points are in good condition and not

OPERATING INSTRUCTIONS

loose in their settings. The shank must be secure in the holder. Too rapid traverse of the diamond feed will tend to produce a roughened surface on the wheel, resulting in poor finish.

The best finish cannot be produced if too much stock is left for the finish cut. A different ratio of roughing and finishing feeds should be tried.

The grinding wheel should be balanced.

If the drive belt is worn unevenly, it should be replaced. It should not be too tight and should run smoothly.

The wheel recommendations should be checked and a finer grain wheel tried.

When the wheel crumbles or wears too rapidly:

The wheel may be too soft, the work speed too fast, or the coolant at the point of wheel and work contact may be insufficient.

SUMMARIZED INSTRUCTIONS FOR SETTING STYLE 50 THREAD GRINDER TO A NEW WORK PIECE

1. The machine should be lubricated according to the instructions in the section on "Lubrication."
2. The grinding wheel spindle must be set up to the required helix angle.
3. When the helix angle setting of the grinding wheel spindle is to be changed, as, for ex-

ample, when worms are to be ground, the setting of the cradle-type or universal grinding wheel dresser must be changed to correspond to the spindle helix setting.

4. The change gears must be mounted to secure the required pitch. From .003" to .008" backlash must be allowed between the change gears.
5. The centers must be clean and the workhead center must run true.
6. The hydraulic control valve must be set for either right or left hand thread to conform to the mounting of the change gears.
7. The table dogs must be set for the correct stroke.
8. The proper grinding wheel should be selected (see "Grinding Wheel Recommendations").
9. The grinding wheel must be checked for cracks and correctly mounted.
10. The proper work speed and wheel speed should be selected.
11. The first work piece should be ground with manual infeed. It is always advisable to keep the size near the high limit of the work piece, for, as the diamonds wear and become dull, the grinding wheel will have a tendency to grind the work undersize.
12. The thread form of the first piece should be inspected and any necessary dresser adjustments made.
13. The automatic feed and automatic dressing should be adjusted as described on page 410.

MAINTENANCE
EX-CELL-O
PRECISION THREAD GRINDER
STYLE 50



MAINTENANCE

The Ex-Cell-O Style 50 Precision Thread Grinder is built so that it requires a minimum of maintenance care at regular intervals. Such care includes lubrication as explained in section 300, maintaining the proper levels of the fluids in the hydraulic reservoir and the coolant tank, and the removal of grinding sludge from the tank.

CLEANING THE COOLANT TANK: When the machine is used in continuous production the coolant tank should be thoroughly cleaned once a week. On tool room work the tank should be cleaned once a month. However, the length of time before the tank should be cleaned will vary with the type of work being done.

HYDRAULIC OIL: One of the most important units for the satisfactory operation of the machine is the hydraulic system. This system will operate without any noticeable wear as long as clean hydraulic oil is used. When the reservoir is filled, care must be taken that the receptacles and funnels used are clean. This will prevent possible contamination with other fluids or the entrance of dirt or grit into the system. The hydraulic oil used as a fluid medium should be extra light of Saybolt viscosity 120 seconds at 100° F. The reservoir must be kept filled.

GRINDING SPINDLE SERVICE: It is recommended that when a grinding spindle needs service, the work be done in the Ex-Cell-O Service Department. In this department are the special tools, inspection equipment, and experienced mechanics necessary to give the work the extraordinary care required of a precision spindle. A spindle thus serviced is given the same guarantee as a new one.

The service received from a spindle depends almost entirely on the care, cleanliness and skill of the mechanic who installs or replaces the precision ball bearings. For this reason the Ex-Cell-O Corporation assumes no responsibility for the performance of bearings not installed in its own service department. However, for plants that maintain their own spindle service departments, the following information is offered:

Ex-Cell-O Precision Ball Bearings are interchangeable as a unit, but the individual parts are not. Because the inner and outer races are developed in sets, they must be assembled in the spindle in the position indicated by the markings on the parts. The inner race and both of the outer

races have the bearing serial number and arrows etched in a prominent position so that, in assembly, these numbers will be opposite each other, and read in the same direction, facing the operator.

When new bearings are ordered, the serial number of the old bearings must be specified so they can be duplicated exactly, and have the same running characteristics.

CARE OF GRINDING WHEELS: Wheels not in use should be carefully stored flat. They should be wiped clean and stacked not more than twelve high on a smooth, flat surface. If wheels are stored vertically the coolant oil which saturates the wheel when in use, will work down and disturb the balance.

ELECTRICAL MAINTENANCE

SERVICE: Electrical equipment of the highest quality has been used in this machine. When trouble is experienced the Ex-Cell-O Service Department, or the nearest service department of the supplier of electrical equipment should be called. (Most of the electrical equipment on this machine is supplied by the Square D. Company.) This equipment requires the attention of trained men.

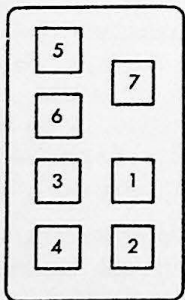
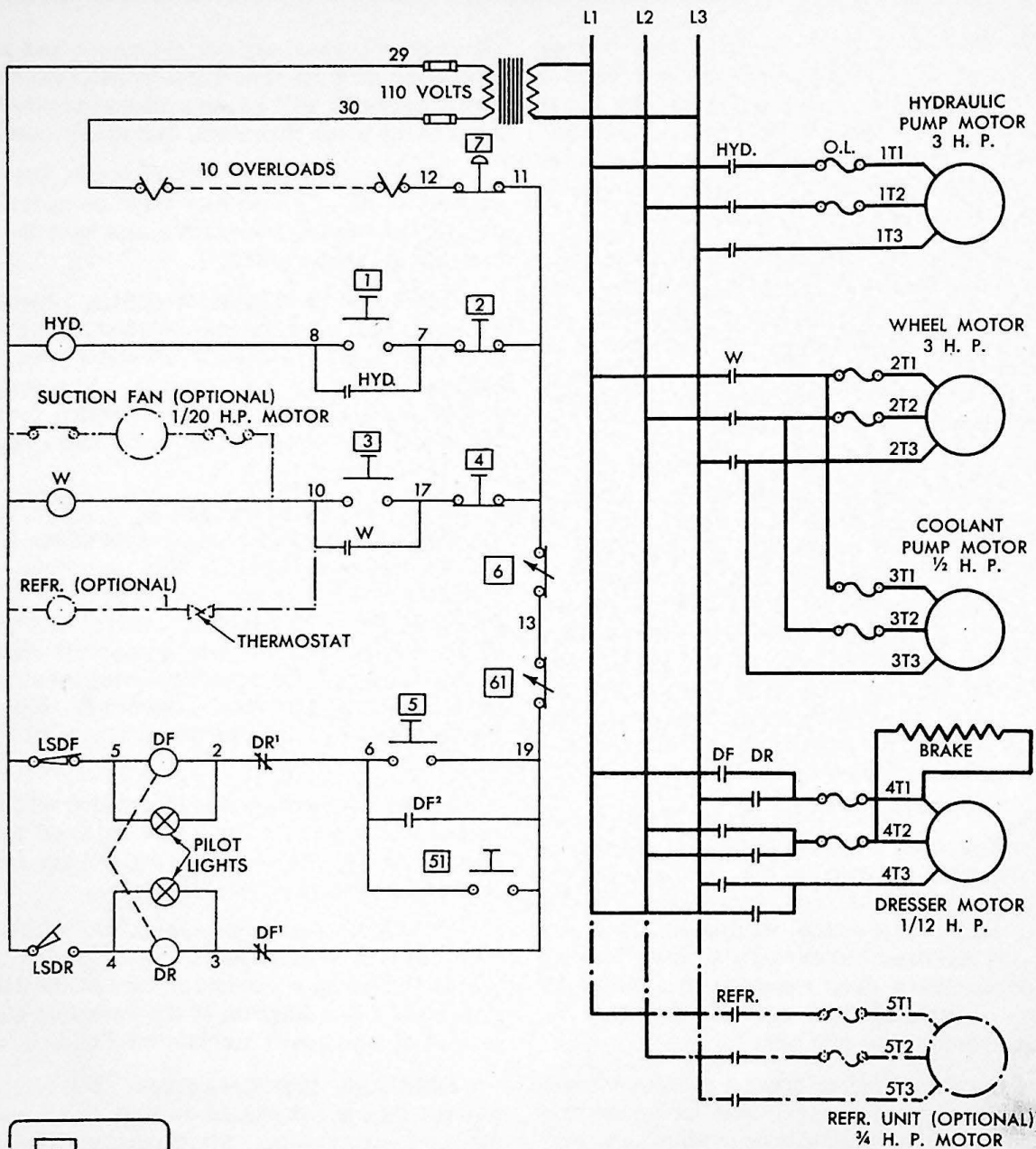
Under no condition should a millwright or un-instructed plant electrician be allowed to work on this machine as the resulting damage may far exceed the ordinary service costs.

For plants having the specialists available to take care of such repairs, the following information including a marked picture of the electric panel and a line diagram of the complete electric circuit of a standard machine will be helpful.

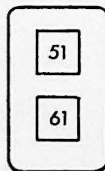
GENERAL INFORMATION: The electrical control equipment should be kept clean and dry. No part needs oiling; all contactors operate in free-fitted slides. Contacts are silver and are not harmed by discoloration or slight pitting. The contacts should never be filed. This merely wastes the contact material. Replacement is necessary only when the silver has worn thin.

The thermal unit does not deteriorate from operation. Continued overcurrent through the heating element raises its temperature, finally melting the alloy and permitting the ratchet wheel to rotate. The latch engaging the ratchet wheel is then released, allowing the overload relay contact to open, thus disconnecting all lines to the

MAINTENANCE



PUSHBUTTON
PANEL



DRESSER
STATION

CONTROL BUTTONS AND SWITCHES ON FRONT OF MACHINE

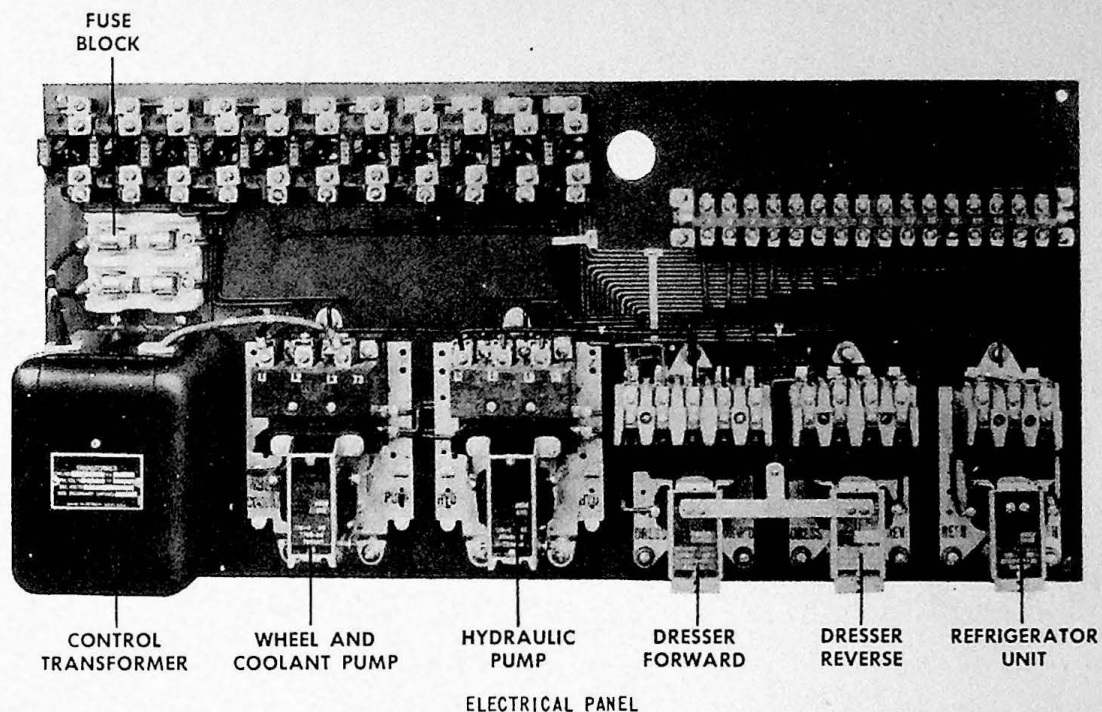
1. Start hydraulic pump
2. Stop hydraulic pump
3. Start wheel and coolant pump
4. Stop wheel and coolant pump
5. Start dresser
6. Dresser OFF-ON
7. Master stop

CONTROL BUTTONS AND SWITCHES ON LEFT SIDE OF MACHINE

51. Start Dresser
61. Dresser OFF-ON

ELECTRICAL DIAGRAM--STYLE 50

MAINTENANCE



motors. A few moments have to be allowed for the melted alloy to solidify before the relay is reset.

MOTORS: Four motors are furnished with the standard machine: the hydraulic pump motor, grinding wheel motor, coolant pump motor and dresser motor. In addition, a motor for the suction hood fan, and one for the refrigeration-type coolant unit are supplied when these accessories are ordered.

THE HYDRAULIC PUMP MOTOR: is mounted on a separate base at the left of the machine. It is started by pressing button 1 and runs continuously until it is stopped by pressing button 2 or the master stop.

THE WHEEL MOTOR: is mounted on the cross slide. This motor and the coolant pump motor are started by pressing button 3. Both of these motors run until they are stopped by pressing button 4 or the master stop.

THE COOLANT PUMP MOTOR: is mounted on the coolant tank. It is started and stopped with the wheel motor. Connection is made with an attachment plug and receptacle.

THE DRESSER MOTOR: is mounted on the top of the machine base at the left rear. When the start button 5 is pressed, and the selector

switch 6 is at the "on" position, the dresser will complete one cycle and stop.

REFRIGERATION UNIT MOTOR (Optional equipment): This motor is mounted with the cooling unit in the coolant tank. Connection is made with an attachment plug and receptacle. The starter for this motor is operated by pushbuttons 3 and 4. The motor is controlled by a thermostat after the wheel is started.

SUCTION HOOD MOTOR (Optional equipment): This motor is started at the same time as the wheel motor. It is connected to the 110 volt control circuit.

Note: If the overload for this motor operates it will not stop the machine.

An attachment plug and receptacle is provided for connecting the suction hood. To prevent overloading and burning out the control transformer it is very important that no other devices be attached to this receptacle.

A SOLENOID: operates the brake on the dresser motor.

LIMIT SWITCHES L S D F and L S D R are the contacts of switches mounted on the dresser. On the Universal Cam-type Dresser there are two microswitches. On the other dressers there is one switch with two circuits.

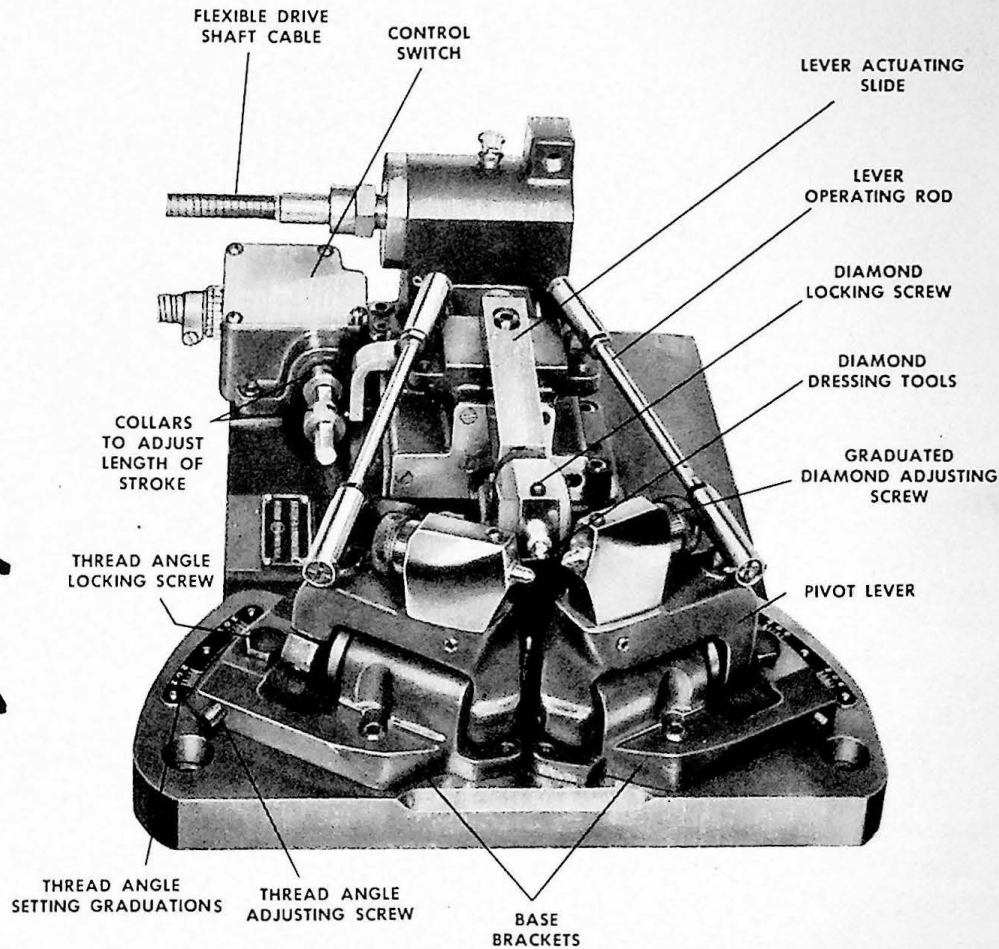
**WHEEL DRESSERS
AND
MACHINE ATTACHMENTS
EX-CELL-O
PRECISION THREAD GRINDER
STYLE 50**



WHEEL DRESSERS AND MACHINE ATTACHMENTS

The electrically driven wheel dresser is mounted directly behind the grinding wheel on a slide which is controlled by a graduated hand wheel at the front of the machine. The dresser is driven through a flexible shaft from a reversible

electric motor. After the dresser is started it automatically completes its cycle and stops. A duplicate set of controls at the side of the machine facilitates setting up.



THREE WAY 60° AND 29° FORM DRESSER

THREE WAY 60° AND 29° FORM DRESSER: This Dresser is adjustable for straight line thread forms such as American National, 60° Sharp "V" and 29° Acme. The dresser supports the dressing diamonds in individual pivoting levers. Each lever is provided with diamond locking and graduated diamond adjusting screws. The three levers are actuated from a common slide. The levers are supported by the base brackets. The two side brackets are adjustable for either 29° or 60° Form Threads.

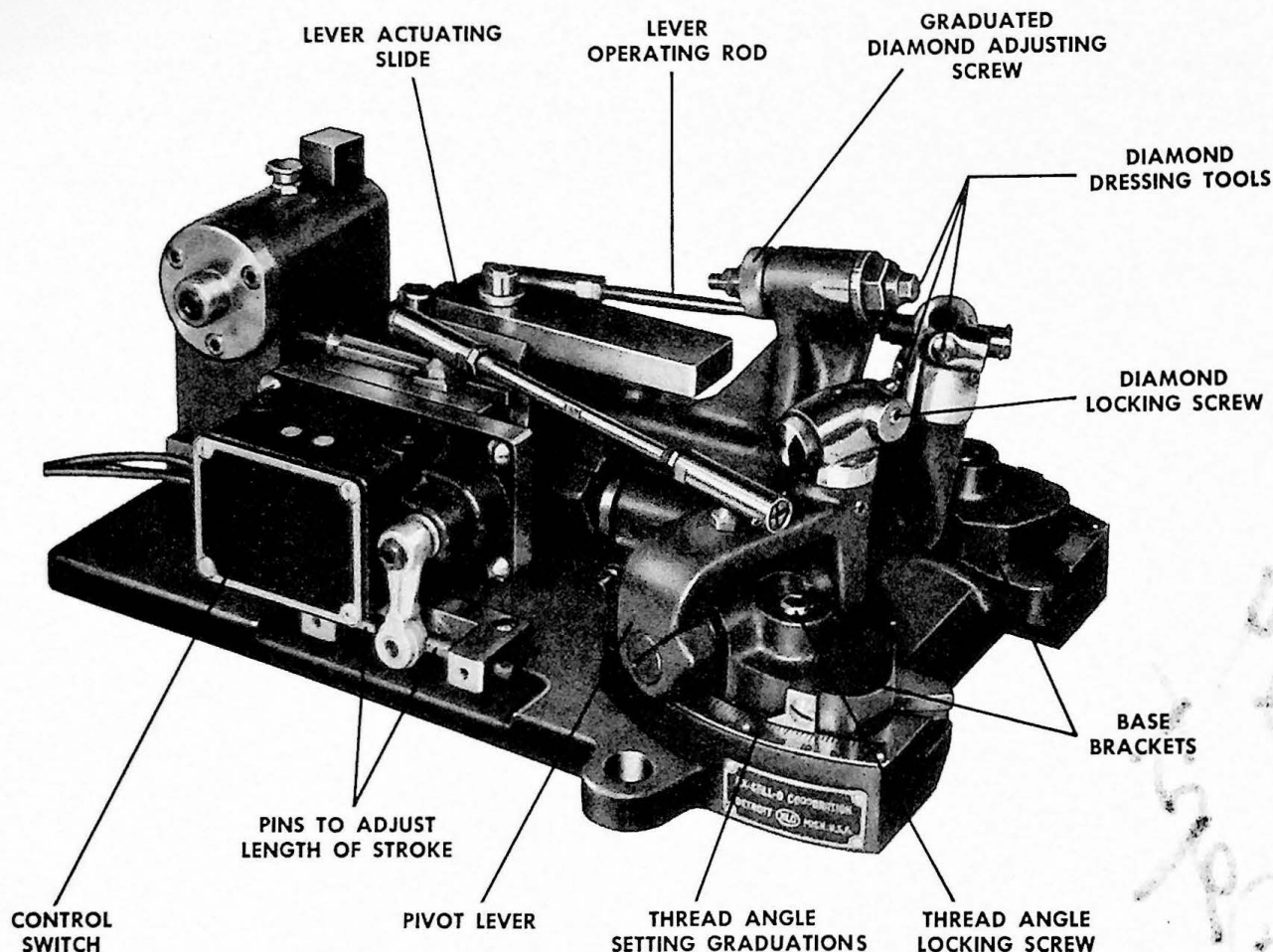
To prevent any loss of time during the dressing operation, the reversal and the stop position are adjustable to the required thread form by

means of two collars, which are locked to the rod operating the electric control switch.

THREE WAY, PLATE-TYPE 10° to 90° FORM DRESSER: This dresser is adjustable for straight line thread forms such as American National, 60° Sharp "V", 29° Acme, Modified Butress and variations of these forms.

The dressing diamonds are supported in individual pivoting levers. Each lever is provided with diamond-locking and graduated diamond-adjusting screws. The three levers are actuated from a common slide. The levers are supported

WHEEL DRESSERS AND MACHINE ATTACHMENTS



THREE WAY PLATE-TYPE 10° TO 90° FORM DRESSER

by the base brackets. The two side brackets are adjustable between 5 and 45 degrees.

For efficiency during the dressing operation the reversal and stop positions may be adjusted to the minimum movement necessary for the required thread form. This adjustment is made by positioning two pins which actuate the control switch.

THREE WAY CRADLE-TYPE 10° to 90° FORM DRESSER: This Dresser is adjustable for straight line thread forms such as American National, 60° Sharp "V", 29° Acme, and Modified Buttress threads. (Illustration on page 603.)

The dresser supports three diamonds in individual pivoting levers. Each lever is provided with diamond adjusting and locking screws. To facilitate the accurate adjustment of the width of the thread form, the diamond in the center lever

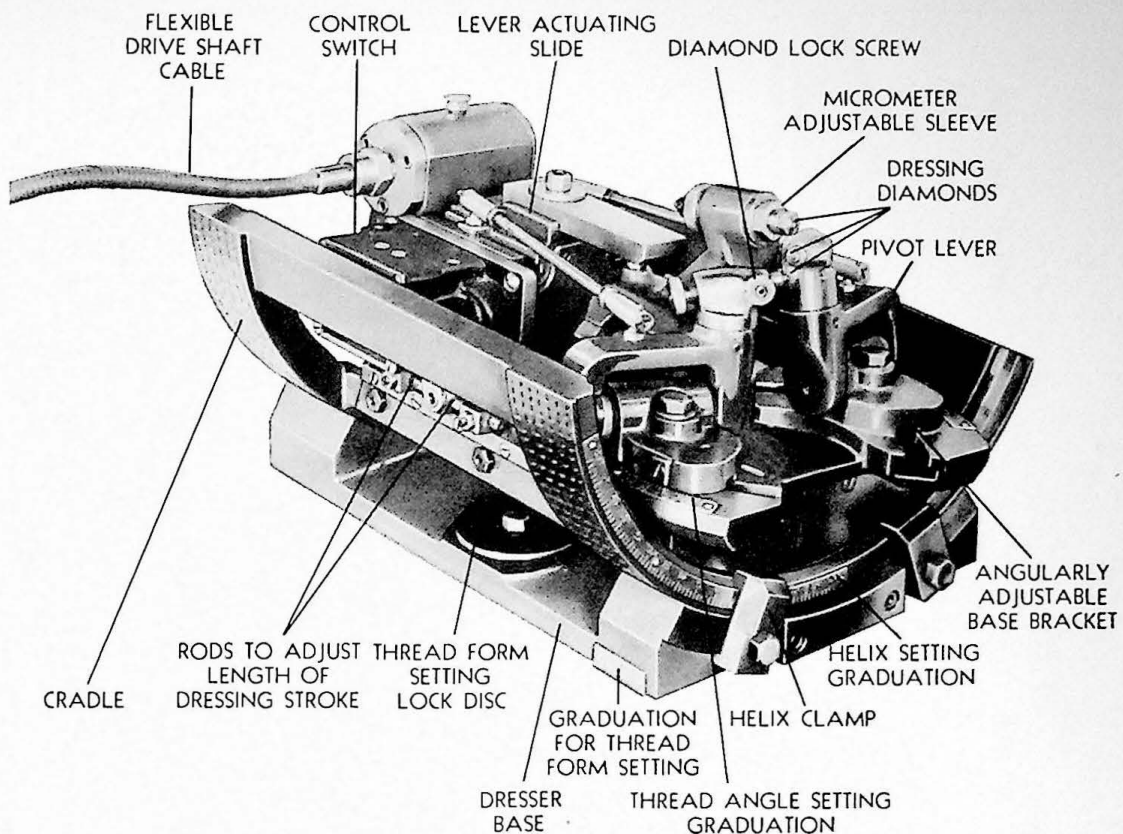
is carried in a micrometer adjustable sleeve. Low price natural stone diamonds are used.

The brackets supporting the pivot levers at both sides are adjustable, allowing a dressing path anywhere within 0 and 45 degrees toward the sides of the grinding wheel.

The dresser is adjustable for the position of the thread form. This adjustment is required on some machines to correct the taper setting. A suitable graduation, coinciding with the angle of the taper on one side, is provided. There are also graduations to simplify the angular and the helix settings.

To prevent loss of time during the dressing operation, the reversal and the stop positions are adjustable to the required thread form. This is accomplished by means of two adjustable pins actuating the control switch.

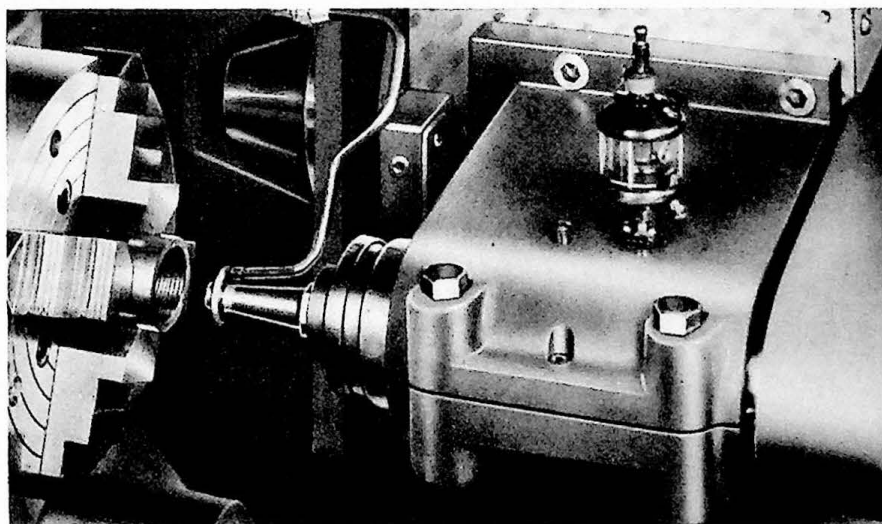
WHEEL DRESSERS AND MACHINE ATTACHMENTS



THREE WAY CRADLE-TYPE 10° TO 90° FORM DRESSER

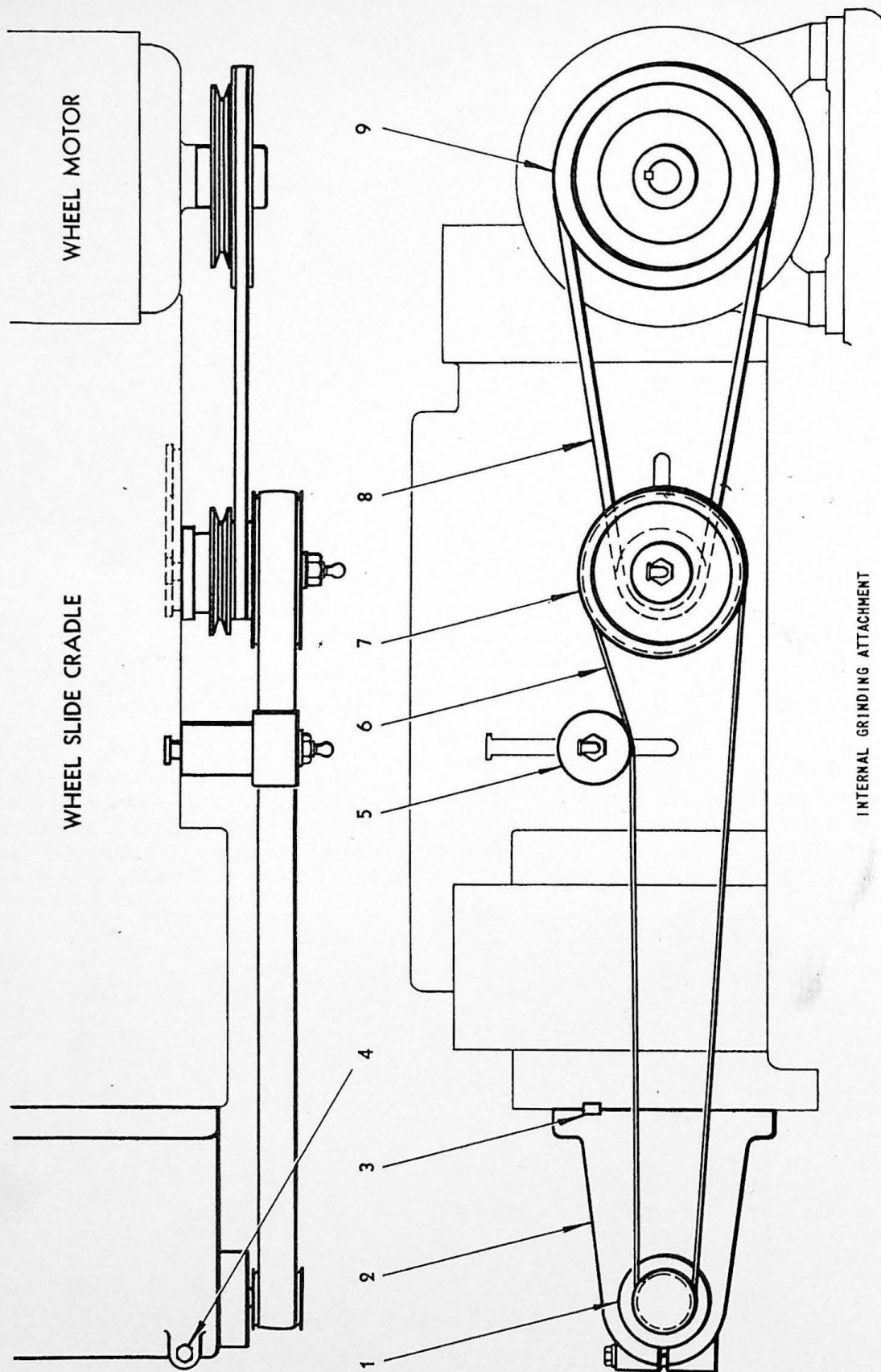
UNIVERSAL CAM-TYPE DRESSER: This dresser is adjustable for straight as well as radius form threads, such as American National, 60° Sharp "V", 29° Acme, Whitworth, Modified Buttress, and special forms. (See page 605.)

The various forms are obtained by the use of interchangeable cams. One set of two 60° cams is used for all the common American National Form and 60° Sharp "V" threads. Another set of two 29° cams is required if Acme threads are

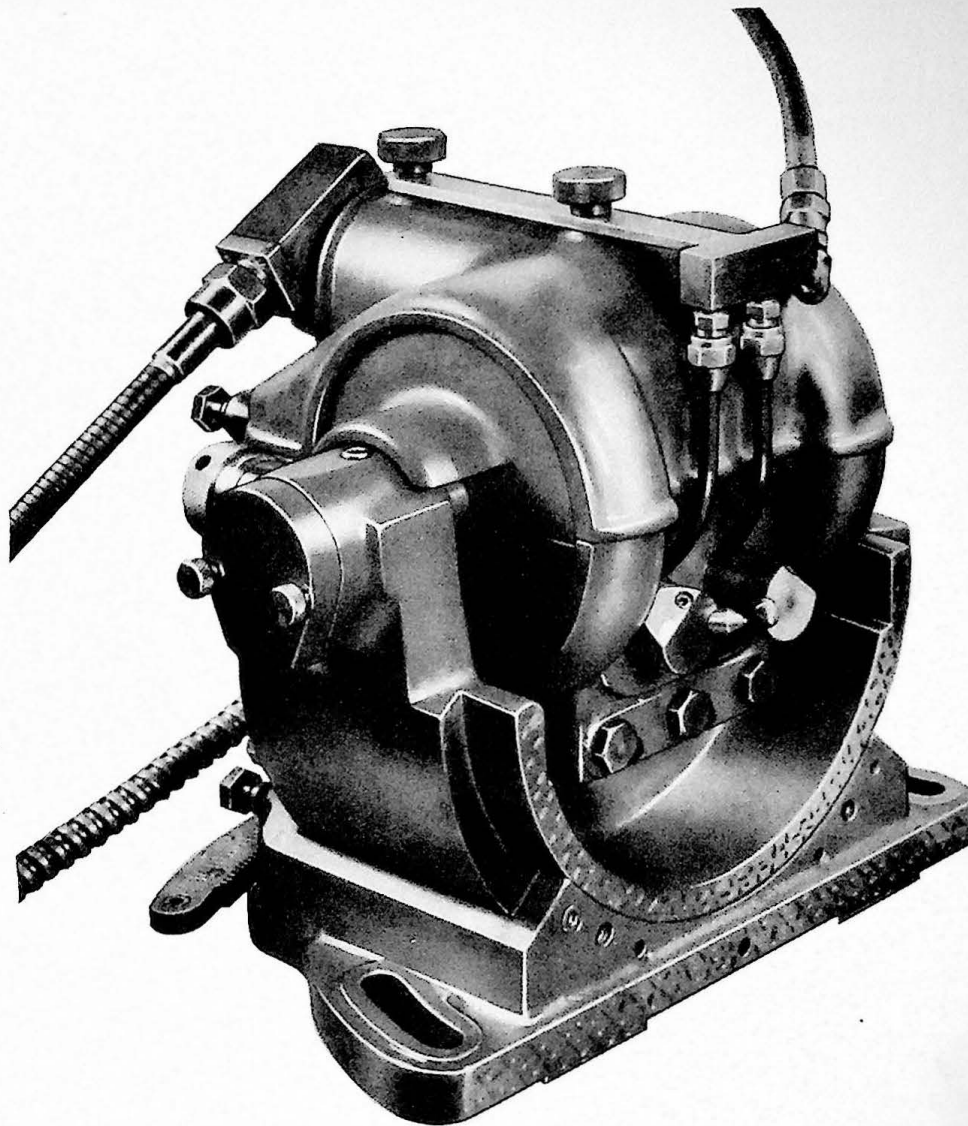


INTERNAL GRINDING ATTACHMENT

WHEEL DRESSERS AND MACHINE ATTACHMENTS



WHEEL DRESSERS AND MACHINE ATTACHMENTS



UNIVERSAL CAM-TYPE DRESSER

to be ground. For Whitworth or other radius forms, it is necessary to have a different set of cams for each particular form desired. Cams can be supplied to grind threads of any symmetrical form that is not less than $14\frac{1}{2}^\circ$ on the side. Modified Buttress and unsymmetrical special forms can be dressed with less than $14\frac{1}{2}^\circ$ on one side. Cams for standard form threads will be furnished as ordered. A set of cams may be interchanged on the machine in about twenty minutes' time.

Further information on the Universal Type Dresser will be found in section 700.

INTERNAL GRINDING ATTACHMENT: A separate unit that can be attached to the front of the wheel slide is available as special equipment for grinding internal threads. This unit is shown on page 603 and in the drawing on 604. It consists of the grinding spindle head (2), idler pulley (5), a counter pulley (7), a two-step pulley (9) for the motor, a "V" belt (8), and a flat belt (6).

The internal grinding head is attached to the front of the wheel cradle and held in place by four cap screws. The key (3) in the bottom of the head is used for alignment purposes. Before attaching the internal grinding spindle, the small piece of felt that covers the oil hole in the spindle during shipment must be removed.

WHEEL DRESSERS AND MACHINE ATTACHMENTS

In the top center of the spindle head is an Allen screw, used to position the spindle (1) lengthwise. When the spindle is placed in the head, the hole that is drilled in the top of the spindle must be brought into alignment with this screw. After the spindle is engaged with the alignment screw, the two screws (4) holding the spindle in the head must be locked. These screws must be tight enough to hold the spindle rigid. However any excessive pressure of these screws may damage the spindle bearings.

When the whole internal grinding assembly has been correctly installed, the center of the grinding wheel face will be inline with the center of rotation of the wheel cradle, thereby maintaining the wheel on the center of the work regardless of the helix angle setting of the wheel head.

After the spindle head has been locked in position, the motor pulley, the middle drive pulley and the idler should be attached. The middle belt should be slid back for tension on the flat belt and secured with the bolt. The belt tension can be adjusted with the idler pulley. The "V" belt tension can be adjusted by sliding the spindle driving motor lengthwise.

When the belts have been adjusted, the guard that fits over the wheel spindle pulley and the guard over the belt from the motor should be replaced. The motor belt guard is the same guard as used for external grinding.

In the table below is tabulated the length of thread that can be ground with the internal grinding attachment. The length indicated may be reduced on work pieces with excessive large helix angles because of the possibility of interference between the threaded hole in the work piece and the grinding quill.

THREAD DIAMETER	LENGTH OF THREAD
1" to 1-5/8"	2"
1-5/8" to 3"	2-1/2"
3" to 8"	3"

INTERNAL GRINDING WHEEL DRESSERS

Two types of dressers are available for the internal grinding attachment. With the Internal Straight Line Dresser all straight thread forms can be obtained, such as American National, 60° Sharp "V", 29° Acme.

With the Internal Pantograph-type Dresser straight and radius form threads can be obtained,

such as American National, 60° Sharp "V", 29° Acme, Whitworth, Modified Buttress and special forms.

INTERNAL STRAIGHT LINE DRESSER: This dresser together with the stop bracket (1) (see Illustration on next page) is mounted in place of the tailstock on the machine table.

The stop bracket, mounted between the dresser and the headstock, permits the dresser to be moved so that it is kept free of any interference with large chucks during the grinding operation, and allows the dresser to be positioned again for dressing.

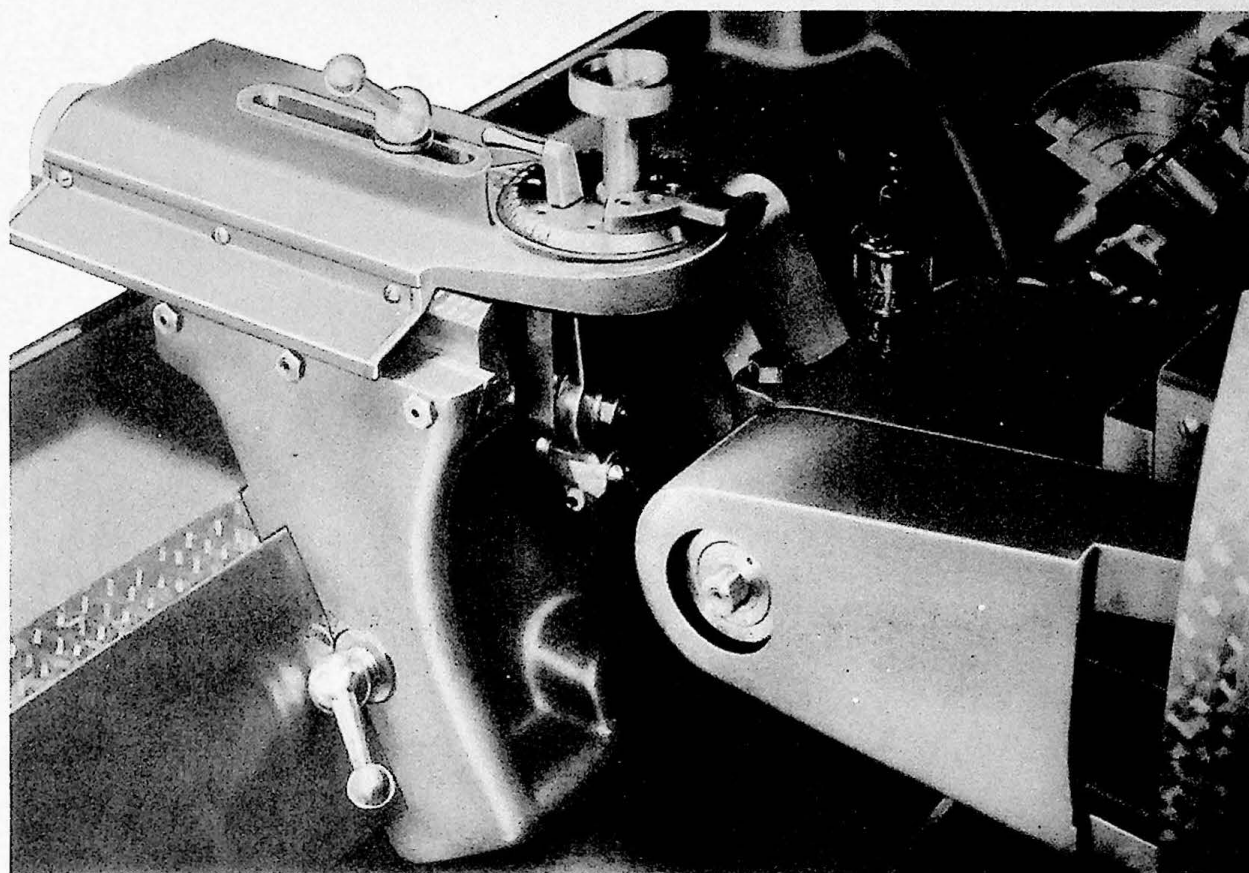
The dresser unit should be placed far enough to the right of the work to provide sufficient space for gaging between the work and the wheel. After it is positioned, it is clamped to the table with the handle (2).

After the dresser is mounted, it is aligned with the point on the grinding wheel. To re-position the machine table for subsequent dressings, the dog (3) at the extreme right of the table is adjusted so that it contacts the dial of the indicator (4) that is located at the right end of the machine base.

The wheel is dressed with one diamond that is swung to both sides of the wheel. Two stops (5) are provided for positioning the diamond bracket or holder to the proper form angle. For setting these stops, the knurled hand knob (6) is loosened and the graduated disc rotated until the desired angle for one side of the wheel is reached. The stop screw is adjusted and locked to that position, and the same adjustment for the thread angle setting is made on the other side. For setting the dresser to an angular position, it is necessary only to move the dresser bracket toward one of the stops and then lock it in that position.

To dress the wheel, the diamond is swiveled past the wheel by the handle (7). To get the correct width of flat at the top, it is necessary to have the diamond set correctly in the holder (8). To accomplish this, the wheel should be dressed at all three points, both sides and the flat. A piece of thin sheet brass or steel is fed by hand into the wheel to make a small template of the wheel shape. This template can be put into the comparator to check the width of the flat. If the width of the flat is too wide, the diamond should be fed toward the wheel a small amount by means

WHEEL DRESSERS AND MACHINE ATTACHMENTS



INTERNAL STRAIGHT LINE DRESSER

of the threaded screw (9). The wheel should be dressed again. The process should be repeated until the required wheel form is obtained. No further adjustment of the diamond is necessary until sufficient wear of the diamond has occurred to require a second setting.

After the correct wheel form has been obtained, the dresser may be set in relation to the work so that for further wheel dressing, it is necessary only to feed the cross slide and wheel into the diamond the amount that is to be dressed off the wheel. This method assures the correct work size.

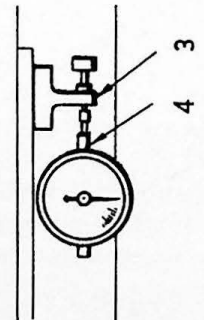
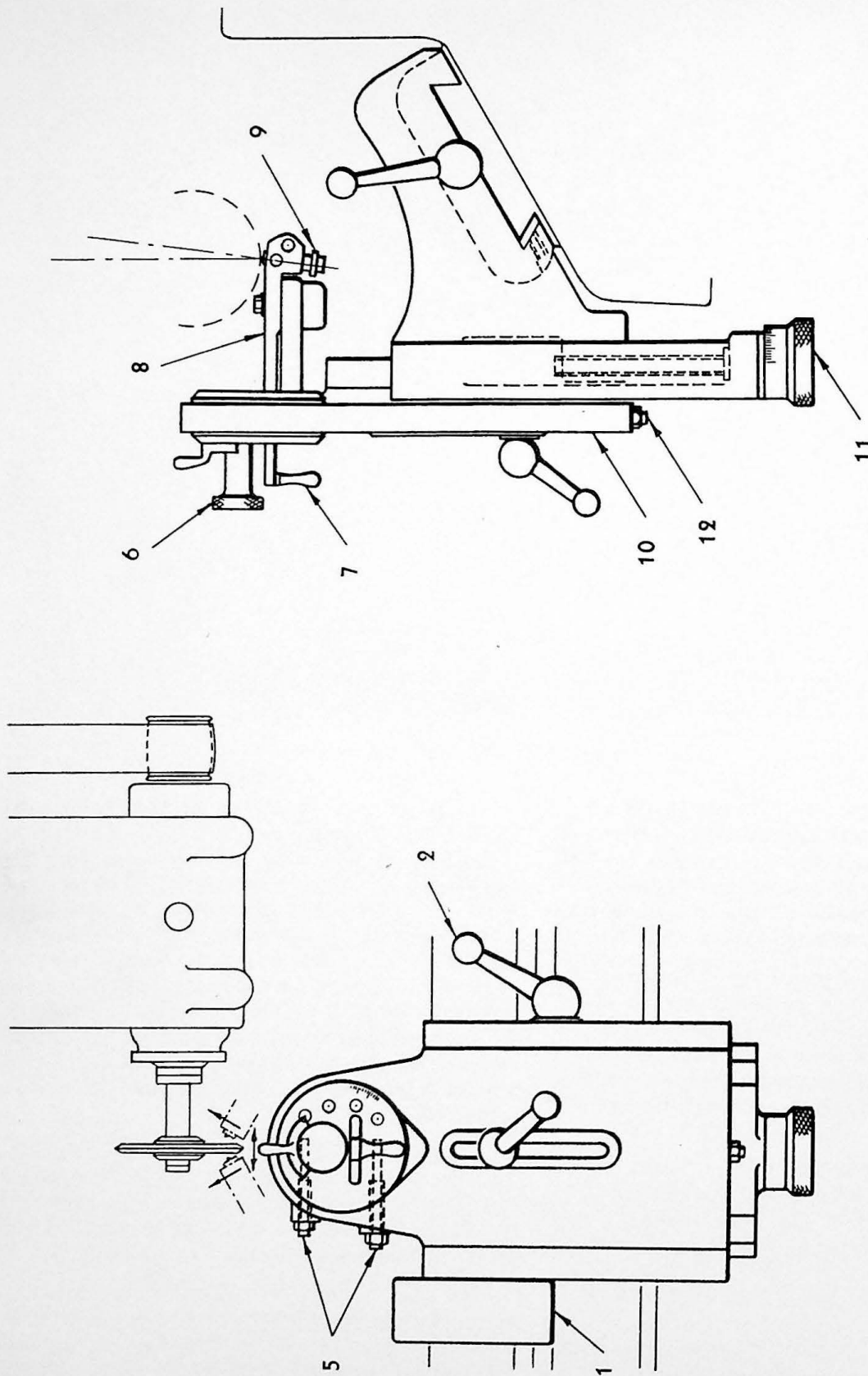
The size setting is obtained by setting the top slide (10) with the graduated knurled knob (11). Example: If the wheel has been dressed and a finish cut taken, and the hole is found to be .001" small, the dresser slide should be moved .0005" as shown on the graduated knob. The wheel is dressed after it has been fed into the diamond and then the work piece can be finish ground. This should produce the correct size.

While grinding to the same size setting, no further adjustments need to be made. If it is found necessary to remove the top slide (10) for any reason, the stop screw (12) should be adjusted against the permanent stop before removing the slide. When the slide is returned for wheel dressing and moved against this stop, it will be automatically located in the same position in relation to the wheel. If it is found necessary to remove the entire unit from the machine, the permanent stop (1) should be left on the dovetail slide to provide a locating point when the dressing unit is remounted.

INTERNAL PANTOGRAPH-TYPE DRESSER: This dresser is adjustable for straight as well as radius form threads, such as American National, 60° Sharp "V", 29° Acme, Whitworth, Modified Buttress and special forms.

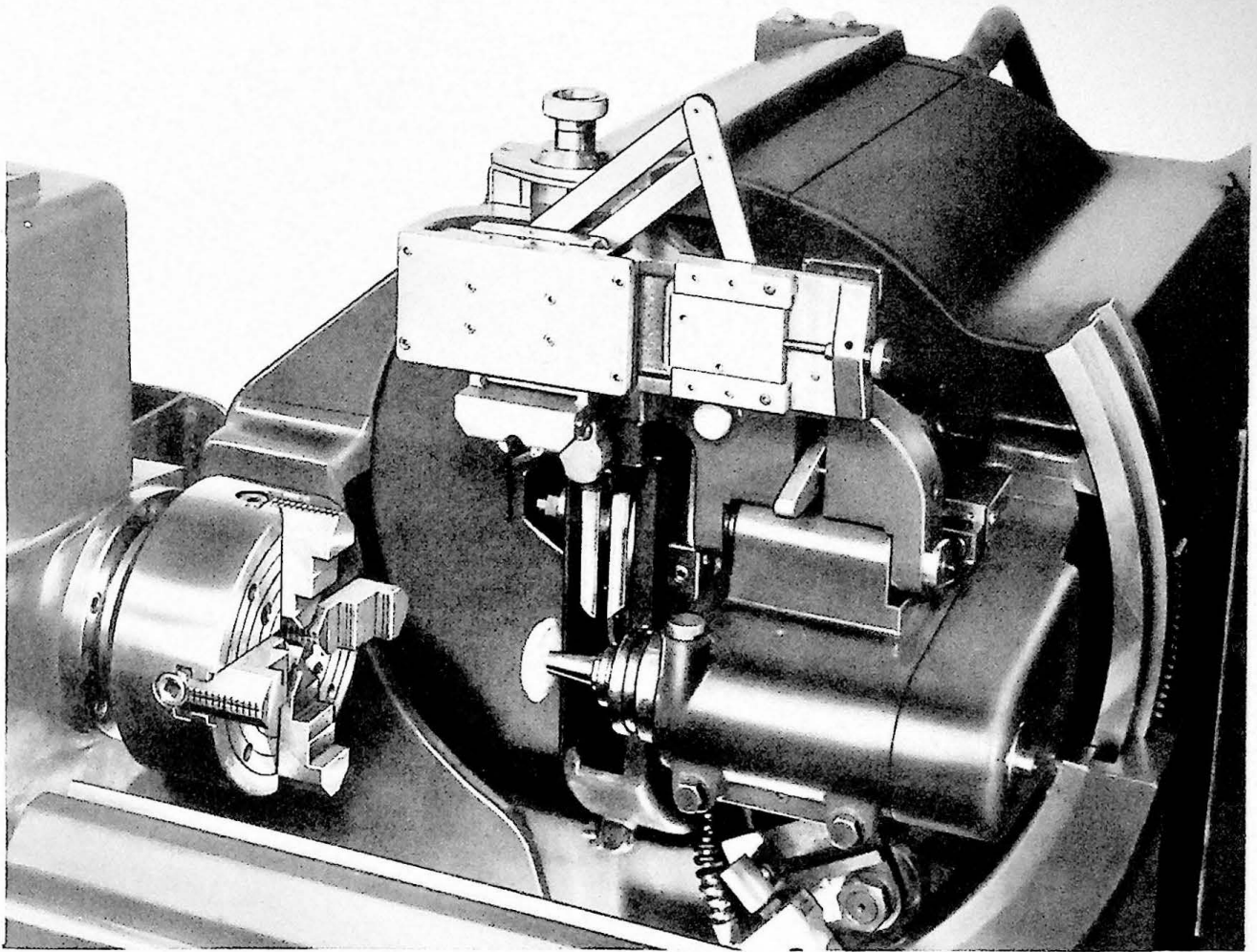
For generating the desired thread form, a set of two interchangeable cams is required. One set of 60° cams is used for the American National Form and 60° Sharp "V" threads, while another

WHEEL DRESSERS AND MACHINE ATTACHMENTS



INTERNAL STRAIGHT LINE DRESSER

WHEEL DRESSERS AND MACHINE ATTACHMENTS



INTERNAL PANTOGRAPH-TYPE DRESSER--IN GRINDING POSITION

set of cams is required if Acme threads are to be ground. For Whitworth or other radius forms, it is necessary to have a different set of cams for each thread form. Cams can be supplied to grind threads of any unsymmetrical form that is not less than 5° on the side. A set of cams can be changed on the machine in about five minutes.

Two select natural stone diamonds are used in the Internal Pantograph-type Dresser. The radius on the radius form threads does not depend on a special radius form lapped on the diamond but is generated by means of a point on the diamond. This point is "resharpened" while dressing, eliminating the possibility of a change in the thread form due to wear.

The dresser is hinged to the external grinding spindle. During grinding it is swung upward 90°

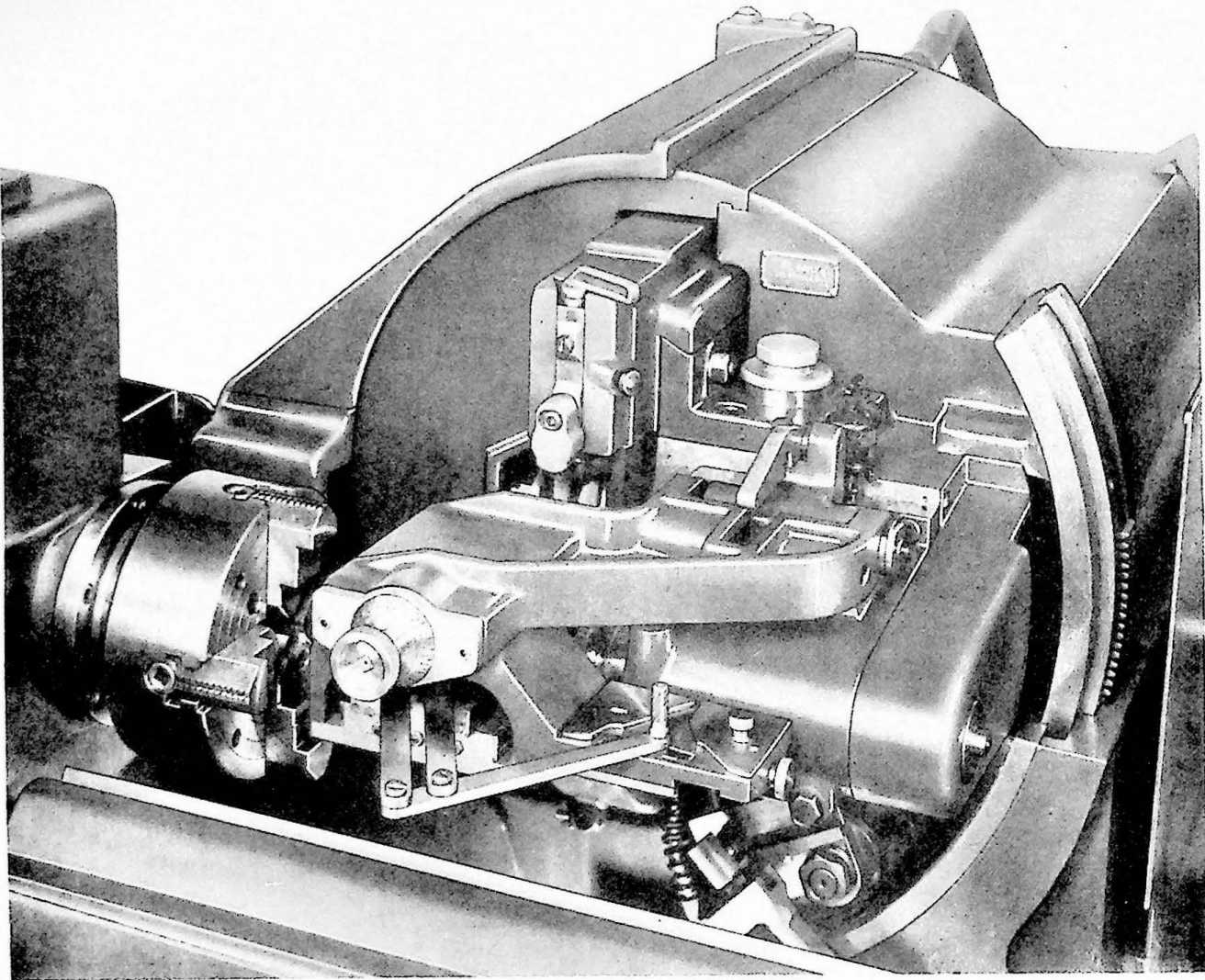
and locked in position out of the path of the work and workhead.

The diamonds are positioned by the adjusting screws and locked in place with two set screws. The diamond setting is facilitated by means of a step block. Because of the required alignment of the diamonds, setting is more important for radius thread forms than for straight line thread forms.

The use of an adjusting knob at the right of the dresser allows the adjustment of the desired width of thread form. The graduated knurled knob at the front of the dresser is for adjusting the depth of the dressing cut.

The movement of the diamonds is controlled with a manually operated pantograph mechanism. Straight line form cams are used. The desired

WHEEL DRESSERS AND MACHINE ATTACHMENTS



INTERNAL PANTOGRAPH-TYPE DRESSER--IN DRESSING POSITION

accuracy of thread form is readily obtained because of the large reduction between the cams and thread form.

REFRIGERATOR TYPE OIL COOLING UNIT: A refrigerator type coil cooling unit is available as extra standard equipment. It permits the maintaining of closer overall lead tolerances, especially on long workpieces. The unit is driven by a thermostatically controlled $3/4$ H.P. electric motor. Together with the coolant motor and coolant tank, it forms an independent unit placed outside the base of the threadgrinder. The electrical connections are obtained with plugs and receptacles. A large size flexible hose connects

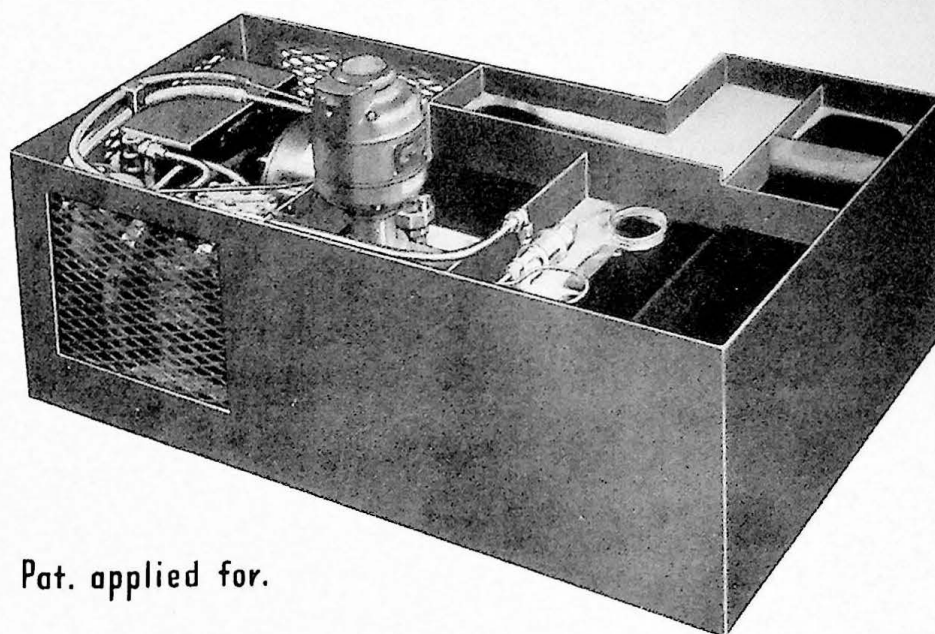
the supply line. The unit is furnished complete with thermometer.

SUCTION HOOD: To prevent the diffusement of coolant vapor, the Ex-Cell-O Thread Grinder may be equipped with a vapor hood.

The hood has an inbuilt motor-driven ventura fan and an oil reclaiming filter. It prevents vapor accumulations around the machine caused by the high operating speed of the grinding wheel.

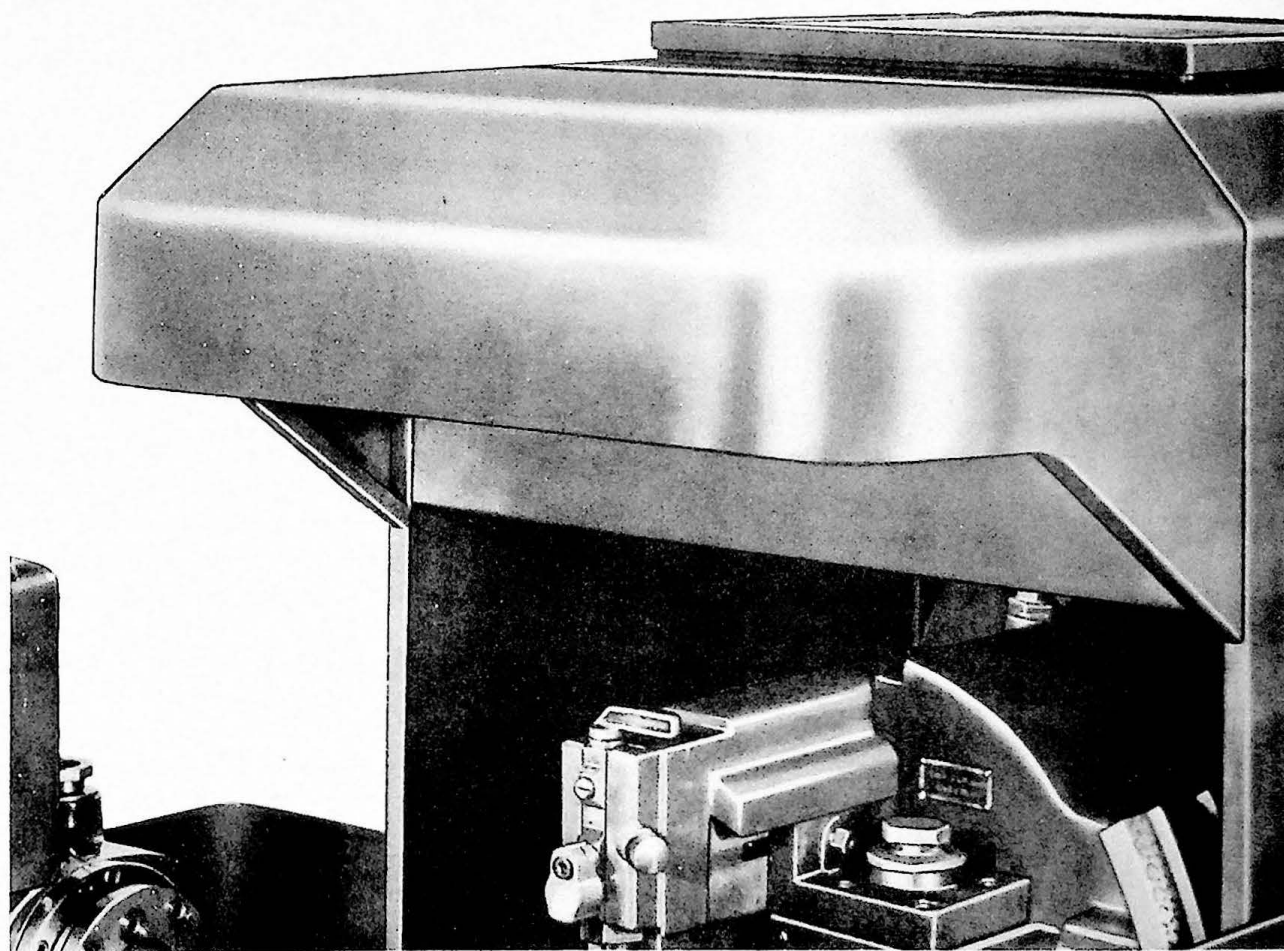
The fan is driven by a single phase $1/20$ H.P. 1725 R.P.M. electric motor. The hood is suspended on rollers operating on a trackway to facilitate the changing of the grinding wheel, setting of the dresser, and adjustment of diamonds.

WHEEL DRESSERS AND MACHINE ATTACHMENTS

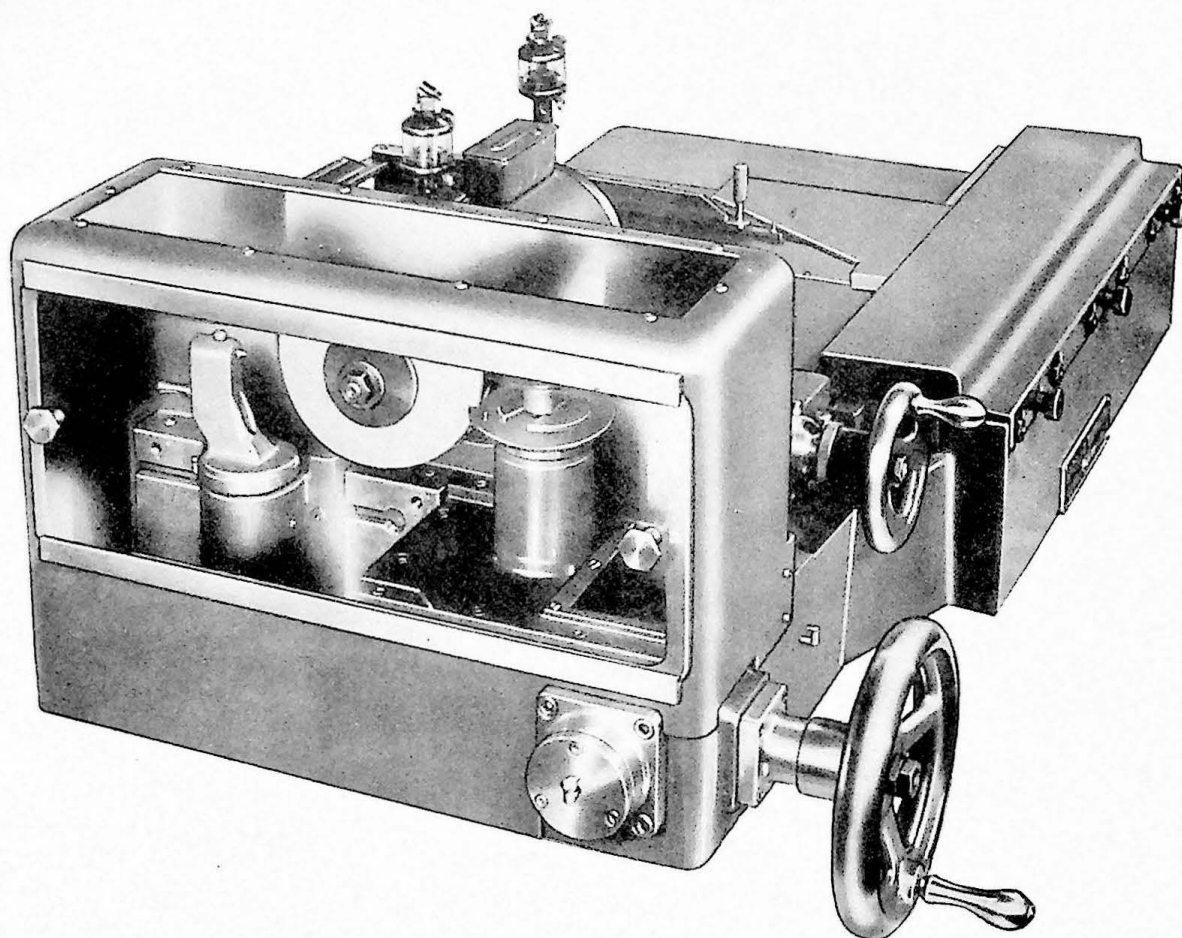


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REFRIGERATOR TYPE OIL COOLING UNIT

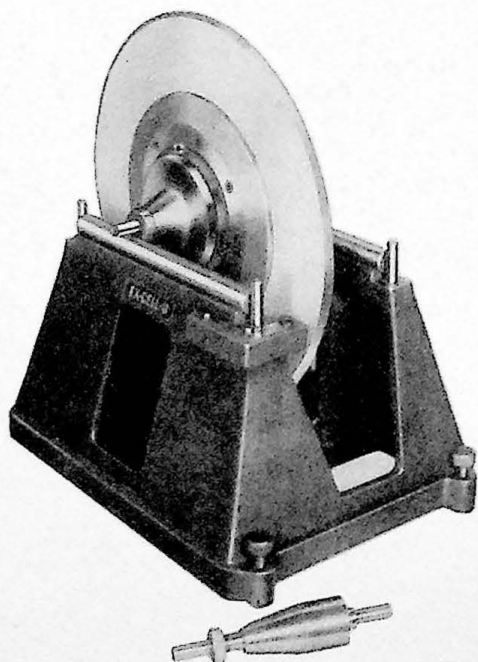


SUCTION HOOD



CAM GRINDER FOR UNIVERSAL DRESSER:

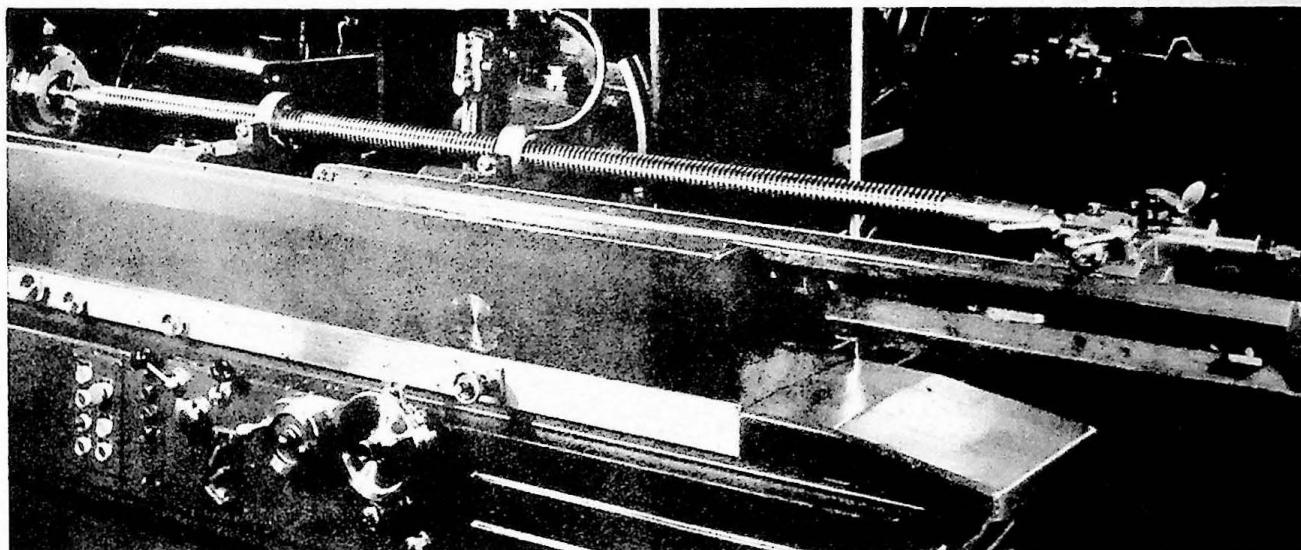
Although cams for the Universal Dresser are obtainable from Ex-Cell-O at any time, a Cam Grinder (above) is available for accurately producing all cams from large size, straight form templates in the customer's plant.



GRINDING WHEEL BALANCING STAND: To get a good grinding finish it is necessary to have a balanced wheel. The stand shown (left) facilitates the balancing operation. It is furnished complete with two inbuilt liquid levels and the balancing arbor.

Before the grinding wheels are balanced it is necessary to level the stand by means of the adjusting screws. The balancing arbor is inserted into the wheel adaptor and the assembly is placed on the stand. Then the two balancing weights are moved in the adaptor groove until the static balance is obtained.

WHEEL DRESSERS AND MACHINE ATTACHMENTS



WORK TABLE EXTENSION: A work table extension and tailstock as shown above can be furnished to permit work piece up to 115" to be ground on the Style 50 Grinder. A steady rest is

usually required to support properly the long work accommodated. The Extension reduces the maximum swing to approximately 11". Information concerning shorter or longer extensions will be sent on request.

★ ★ ★

EXTRA STANDARD EQUIPMENT: In addition to the attachments illustrated and described on the previous pages, the following equipment can also be furnished:

- Wheel Thinning Attachment
- Dresser Diamonds
- Direct Current Wheel Drive
- Direct Current Motor Generator Set
- Table Extension and Tailstock
- Quick Clamp Type Index Head
- Face Plate
- Independent Four-Jaw Chuck
- Steady Rest
- Headstock Center Grinding Attachment
- Bench Type Lead Pick-Up Fixture
- Headstock Center
- Tailstock Center
- Wheel Adapter
- Work Driving Dog

Pulleys for obtaining low grinding wheel speeds of 1350, 1160, 1050, 900 R.P.M. extra pulleys, gears, spindles, grinding wheels, and other standard parts and assemblies.

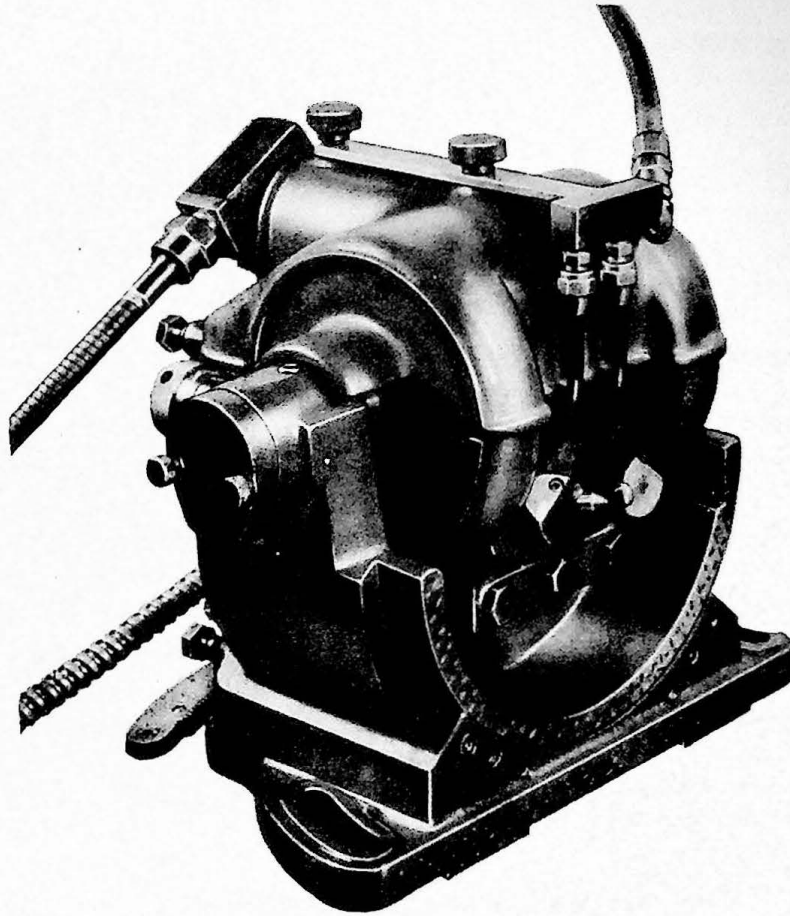
EX-CELL-O
UNIVERSAL CAM-TYPE DRESSER



INDEX

General Description	1
Lubrication	4
Changing Cams	5
Adjusting or Replacing Diamonds	6
Thread Form Corrections	7
Care of Diamonds	8
Diamond Specifications and Drawings	8
Setting Fixture for Universal Dresser Diamonds	10

UNIVERSAL CAM-TYPE DRESSER



UNIVERSAL CAM-TYPE DRESSER

GENERAL DESCRIPTION

THE UNIVERSAL CAM-TYPE DRESSER: may be used to obtain both straight and radius thread forms such as American National, 60° Sharp "V", 29° Acme, Whitworth, Modified Buttress and Special forms.

The various forms are obtained by the use of interchangeable cams. One set of two "60° cams" is used for all the common American National and 60° Sharp "V" threads. Another set of two "29° cams" is required if Acme threads are to be ground. For Whitworth or other radius forms, it is necessary to have a different set of cams for each particular form desired. Cams can be supplied to grind threads of any symmetrical form that is not less than 14-1/2° on the side. Modified Buttress and unsymmetrical special forms can be dressed with 7-1/2° on one side.

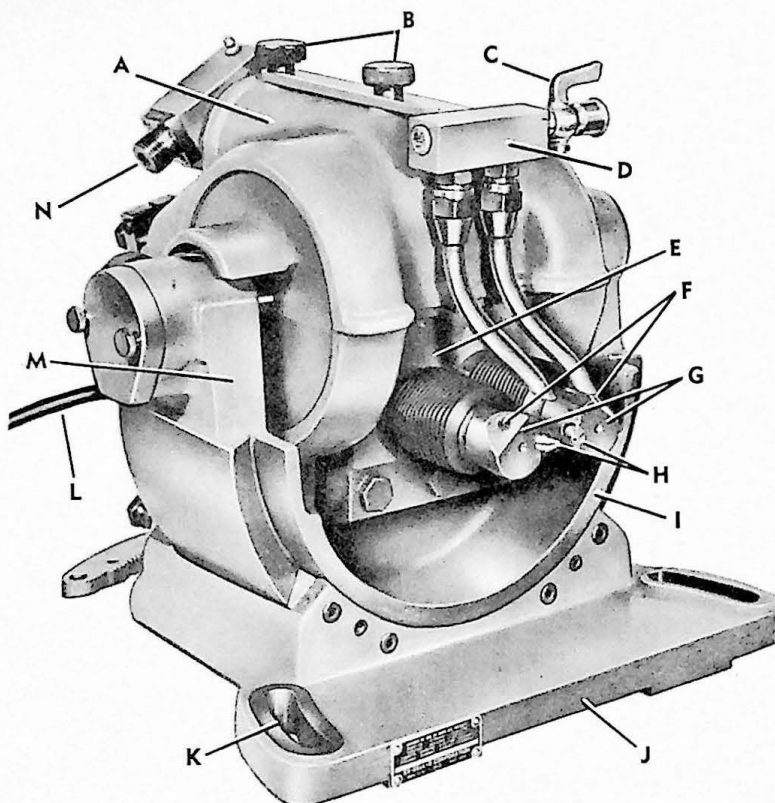
Cams for standard form threads will be furnished as ordered. A set of cams can be changed on the machine in about twenty minutes.

The above thread forms are obtained with two select natural stone diamonds, carried in the dresser. The thread form does not depend on a special radius form lapped on the diamond. The radius on the thread forms is generated by the point of the diamond. This point is constantly "resharpened" as it dresses the wheel, eliminating change of the thread form due to diamond wear.

The Universal Cam-type Dresser consists of the base bracket, the swivel bracket, the carriage and the removable cover. It is mounted on the dresser slide at the rear of the grinding wheel.

UNIVERSAL CAM-TYPE DRESSER

- A. Removable Cover
- B. Cover Hold Down Knobs
- C. Coolant Hose
- D. Coolant Manifold
- E. Carriage
- F. Diamond Tool Carriers
- G. Diamond Lock Screws
- H. Diamond Dressing Tools
- I. Swivel Bracket
- J. Base Bracket
- K. Bolt Slot
- L. Electric Power Line
- M. Half Round Shields
- N. Flexible Drive Shaft Cable



UNIVERSAL CAM-TYPE DRESSER, WHEEL SIDE

The base bracket supports the swivel bracket which is adjustable either normal to the axis or normal to the helix of the work. The setting is facilitated by the vertical angle adjustment graduation. After the desired setting is obtained the swivel bracket is locked by means of the swivel bracket lock screws. The non-rotating lead screw is supported at the upper ends of the swivel bracket.

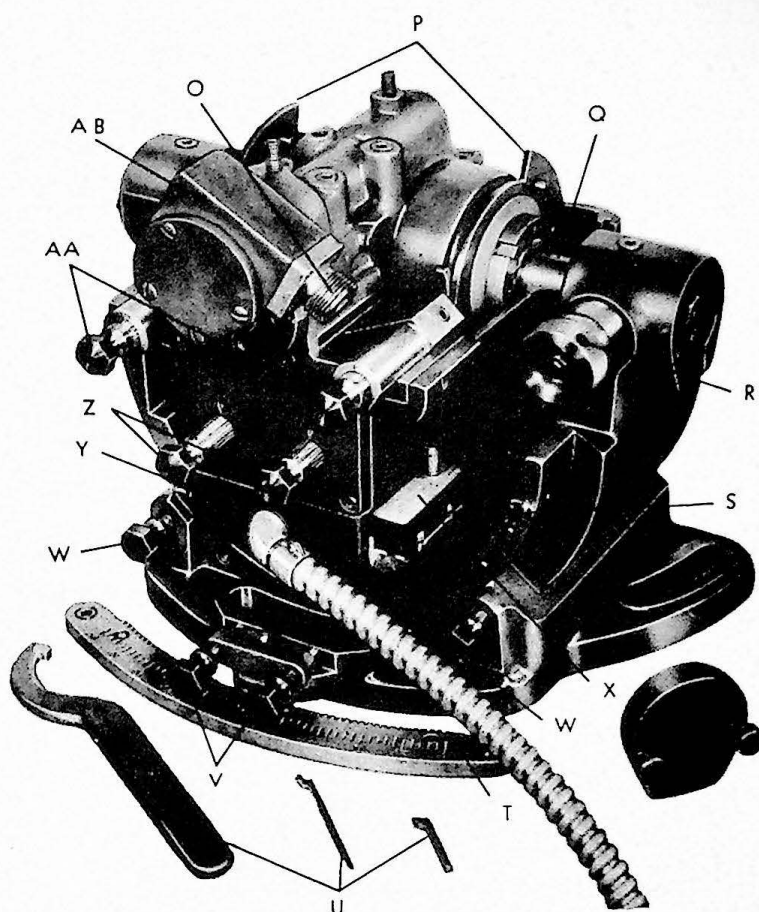
The lead screw support permits endwise movement during reversal of the rotation of the nut. This allows the dresser to be adjusted for various widths of thread form. This adjustment is made with a graduated thread width control knob on the swivel bracket. The base bracket is supported on the dresser slide. The thread form is positioned in relation to the axis of the work by swiveling the base bracket with the horizontal angle and adjustment screws. These screws actuate a pinion which engages the horizontal ad-

justment graduation plate. The base bracket is locked to the desired position by means of studs which extend through the bolt slots on the side of the base bracket, anchoring it to the dresser slide.

The dresser is motor driven through two Vee belt step pulleys and a flexible drive shaft which is enclosed in a metal hose to prevent wear due to dirt and lack of oil. The drive shaft is packed in grease. The motor is equipped with a solenoid brake to prevent coasting. It is indirectly controlled by the two limit switches which are mounted on the carriage. These limit switches are actuated by the cam cycle and control the stopping and reversing of the dresser drive motor through overload protected magnetic switches.

The flexible drive shaft is mounted to the power drive connection. The power drive may be readily disconnected by unscrewing the retaining nut as the power drive connection.

UNIVERSAL CAM-TYPE DRESSER



UNIVERSAL CAM-TYPE DRESSER, POWER DRIVE SIDE

- O. Power Drive Connection
- P. Dresser Cams
- Q. Non Rotating Lead Screw
- R. Graduated Knob to Control Width of Thread Form
- S. Vertical Angle Adjustment Graduation
- T. Horizontal Adjustment Graduation
- U. Spanner Wrenches for Cam Lock-Nuts and Switch Controls
- V. Horizontal Angle Adjustment Screws
- W. Swivel Bracket Lock Screws
- X. Reversing Switch
- Y. Stop Switch
- Z. Graduated Diamond Setting Screws
- AA. Graduated Cam Follower Adjusting Screws
- AB. Drive Bracket

The removable cover fits over the two dresser cams, the cam followers and the two diamond tool carriers. It is held on the carriage by means of two hold down knobs. The cover keeps out dust, dirt and undesirable oil. It also protects the cams and cam followers. The hold down knobs position the coolant manifold which is connected to the oil coolant system supplying oil for cleaning the two diamond tool carriers.

In the carriage are two half round shields which protect the side of the cams. They are located in slots from which they are easily removed by turning 180°, thus giving ample room for removing the cams.

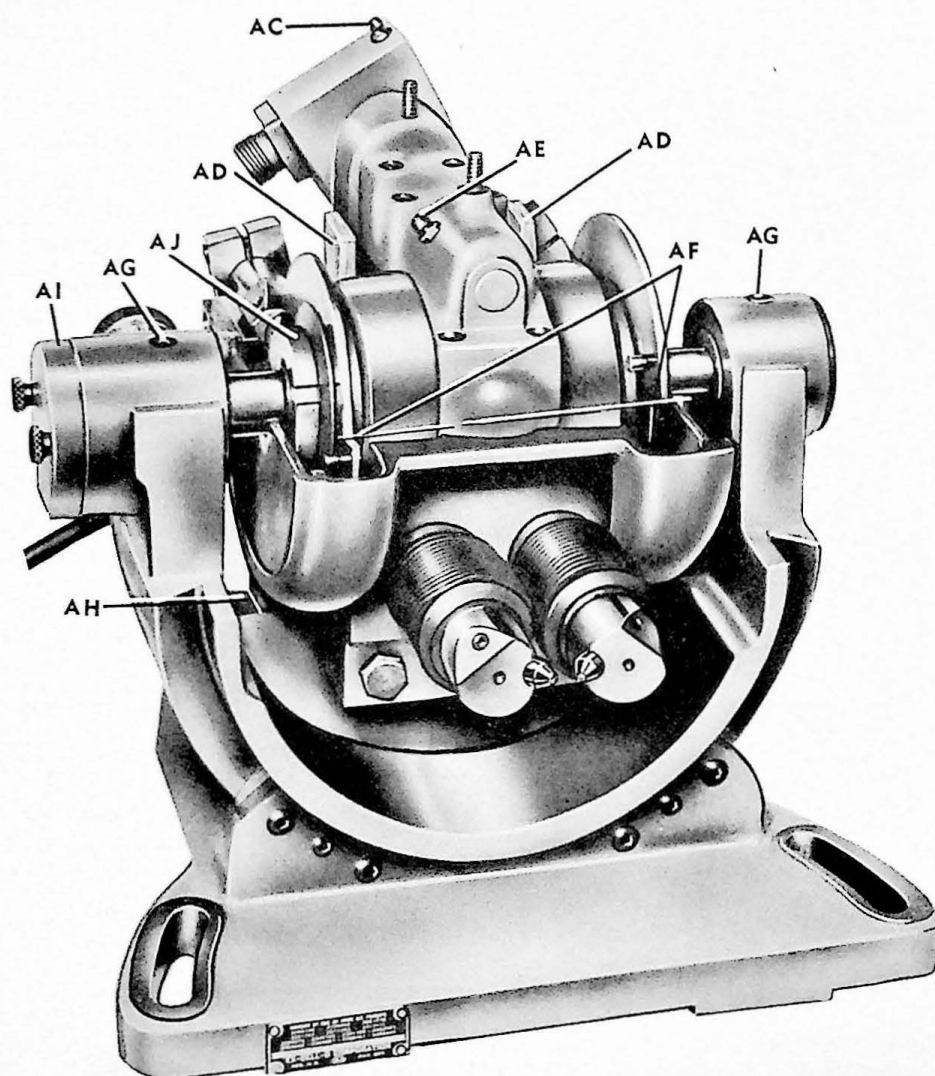
The carriage is retained on a non-rotating lead screw on the swivel bracket. The carriage supports the dresser drive mechanism and the two diamond dressing tools in the diamond tool carriers.

The grinding wheel is dressed by two movements of the diamonds. The first of these movements is perpendicular to the axis of the grinding wheel. The length of the second or crosswise movement is adjustable for controlling the width of the thread form.

When the diamond dressing tools are being installed, the "Diamond Setting" or the adjustment of the distance from the points of the diamonds to the front faces of the diamond tool carriers is facilitated by the graduated diamond setting screws. The diamonds are clamped in the adjusted position with the diamond lock screws.

The relation of the two diamonds is controlled with the graduated cam follower adjusting screws. The path of the diamonds may be adjusted for alignment at the front of the wheel as is necessary when the wheel is being dressed for radius thread forms.

UNIVERSAL CAM-TYPE DRESSER



UNIVERSAL CAM-TYPE DRESSER--Front

- | | |
|--|--|
| AC. Screw Plugged Oil Hole | AG. Screw Plugged Oil Holes |
| AD. Wedge Blocks | AH. Etched Line for centering carriage |
| AE. Oil Cup | AI. Dresser Bracket Cap |
| AF. Cam notches in line with carriage face | AJ. Cam Retaining Nuts |

LUBRICATION

There are four lubrication points on the Universal Cam-type Dresser.

The oil cup AE on the dresser carriage should be filled with 600W oil every other day. The screw plugged oil hole AC on the drive bracket should be filled monthly with 600W oil. On the

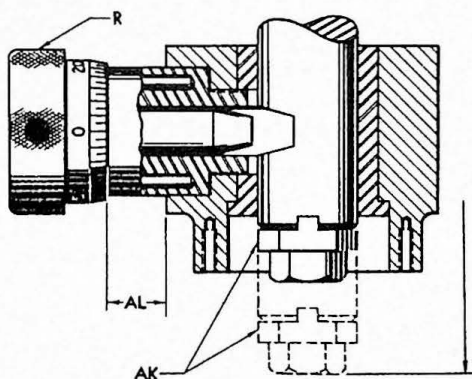
swivel bracket bosses are the screw plugged oil holes AG which should be filled with spindle oil once each week. The lead screw should be oiled with light machine oil whenever cams are changed and the cam faces should be kept well greased. The drive shaft cable is packed in grease and needs no attention.

UNIVERSAL CAM-TYPE DRESSER

CHANGING CAMS

(Refer to illustrations on pages 2, 4, 5.)

1. To change the cams on the Universal Dresser, the hold down knobs B and the coolant manifold D must be removed. The cover A should be lifted off and the two half round shields M removed. The dresser is jogged with the start and stop control until the notches in the faces of the cams are in line with the top of the carriage as shown at AF.
2. The diamond carriers must be pulled back to clear the cams. The wedge blocks AD are inserted.
3. Cam retaining nuts AJ are loosened with the spanner wrench which is furnished with the dresser.
4. Cap AI must be removed from the dresser bracket.
5. purities the lead screw is inserted into the support and checked for free movement.
11. The carriage is placed on the cradle. While it is supported with one hand the lead screw is inserted. If accurately shaped thread forms are to be produced it is of vital importance that no jerk movement is caused. Therefore the screw must slide freely at each operating position.
12. Thread width control knob R must be turned clockwise until it seats.
13. With lead screw and cams assembled, the dresser carriage should be centered between the lead screw bearings. To center the carriage the dresser is started with the electric control and run until the carriage reaches the



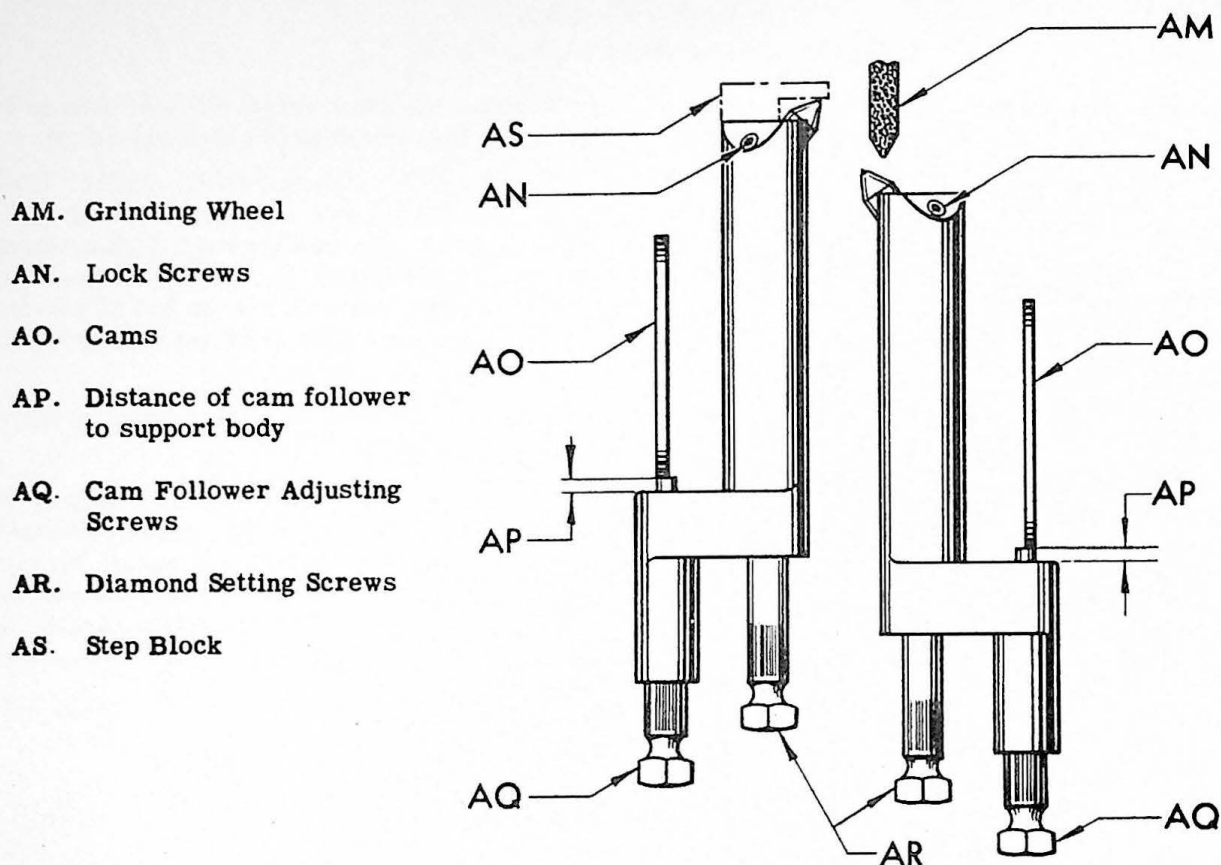
R. Thread Form Width
Control Knob

AK. Lead Screw Tail

AL. Dimension

5. Thread form width control knob R should be turned counter clockwise until dimension AL is one half inch or more.
6. The carriage must be moved so that lead screw tail AK is accessible at the outward position as indicated in the drawing.
7. Lead screw tail AK must be turned counter-clockwise to remove lead screw.
8. With the lead screw out, the cam retaining nuts AJ washers and cams should be removed.
9. The new cams must be assembled in the correct right and left positions, cam washers and nuts replaced but not tightened.
10. The lead screw support in the carriage must be thoroughly cleaned and greased with a good grade of vaseline. For ascertaining that no binding is caused by abrasives or other im-
- line AH while moving toward the left. If the carriage is already too far to the left, the dresser is run toward the right until it is beyond the center. Stopping and starting it again will reverse the carriage toward the left. The dresser may now be stopped as it reaches the line AH which marks the correct central position.
14. Cam notches should be set in line with the carriage face as shown at AF and cam retaining nuts tightened. (Caution: The cam retaining nuts must be tightened with a fair clamping pressure but no excessive force should be exerted.)
15. Cam faces should be greased, wedge blocks removed, half round shields and cover assembled. Cam followers should be let down gently by hand to avoid damaging the cams.

UNIVERSAL CAM-TYPE DRESSER



ADJUSTING OR REPLACING DIAMONDS

1. The dresser must be moved back to provide the necessary clearances from the wheel.
2. Lock screw AN must be loosened, the worn diamond removed and a new one inserted. The diamond must be adjusted to the required length with the diamond setting screws AR. The diamond setting may be simplified with a small step block (not furnished). The correct diamond setting is marked on the side of the cams. The diamonds may be set within .001" to .003" of their correct position by this method. A Diamond Tool Setting Fixture to facilitate diamond setting is described on page 10. It may be ordered as extra standard equipment.
3. The lock screw AN must be tight before the machine is started.
4. The thread form width control knob R must be turned clockwise .005" to .006" to increase the width of the form on the wheel. Each graduation on the dial of the knob represents .001" on the width of the wheel.
5. The cam follower adjusting screws AQ must be adjusted so that the distance AP from the front of the cam follower to the support body is about 1/4". The dresser should be returned slowly toward the wheel.
6. As the dresser approaches the wheel it should be run through its cycle. During the cycle, one of the diamonds will touch the wheel and the other will not. The diamond that touches should be moved back by turning its cam follower adjusting screw AQ clockwise until both diamonds touch the tip of the wheel during the cycle. The diamond setting screws AR should not be used as adjusting screws after the diamonds are set and locked with screws AN.
7. The thread form control knob R should be turned counterwise not more than .0003" per cycle of the dresser until the diamonds cut on the sides of the wheel.

UNIVERSAL CAM-TYPE DRESSER

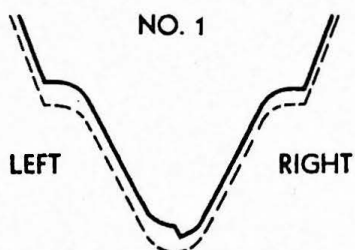
THREAD FORM CORRECTIONS

Angles and radii on thread forms are determined by the shape of the cams. The thread form may be positioned with relation to the work by swiveling the base bracket.

Note: After the dresser is set up and is in use for dressing the grinding wheel repeatedly,

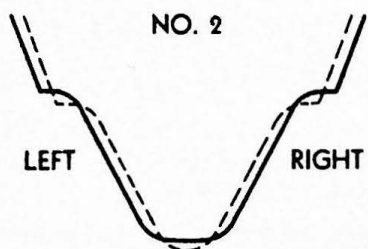
all the adjustments for alignment of the diamonds are made with the cam follower adjusting screws and not with the diamond setting screws.

The following illustrations show how thread forms may be corrected:



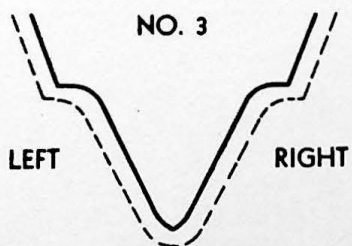
1. FORM OUT OF STEP.

This condition may be corrected by moving back the diamond which is too far ahead. The cam follower adjusting screw AQ on the side to be corrected must be turned in a clockwise direction.



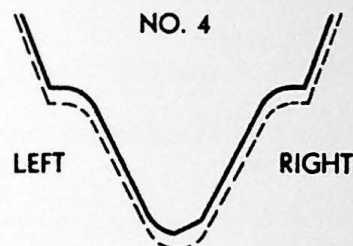
2. FORM TOO WIDE.

The thread form width may be decreased by turning thread form width control knob R counter-clockwise.



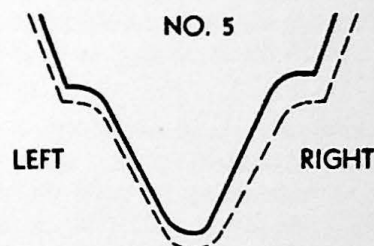
3. FORM TOO NARROW.

Thread form width may be increased by turning thread form width control knob R clockwise.



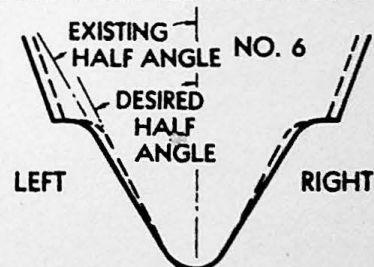
4. IRREGULAR RADIUS AT THE ROOT.

This is caused by chipped or worn diamonds. The damaged diamond must be replaced.



5. RADII OF FORM INCORRECT.

This is caused by a broken diamond or a diamond worn too much for sharpening on wheel to correct. A new diamond must be installed.

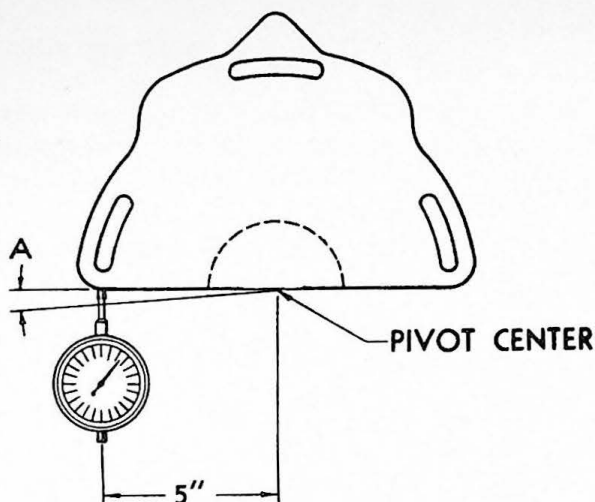
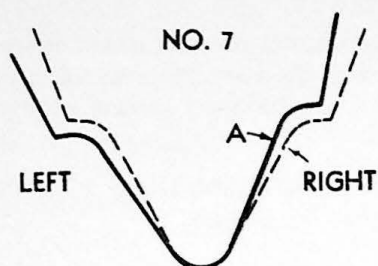


6. THREAD ANGLE TOO WIDE.

Small errors may be corrected by tipping the dresser in the circular way provided for helix angle setting. The correction angle can be found from the following formula:

$$\text{Cosine of Correction Angle} = \frac{\text{Tangent of Existing Half Angle}}{\text{Tangent of Desired Half Angle}}$$

UNIVERSAL CAM-TYPE DRESSER



7. THREAD ANGLE CORRECT BUT NOT CENTERED.

The dresser must be relocated around its pivot center as shown.

Indicator reading = 5 x tangent A

CARE OF DIAMONDS

The cams used with Ex-Cell-O Universal Dresser for form thread grinding are designed to sharpen the diamonds and will maintain a uniform radius on the diamond tip if used with reasonable care.

To obtain maximum diamond life:

1. The amount dressed off the wheel should be as little as necessary to hold the form. On straight thread forms .001" on the wheel diameter is usually sufficient. On radius forms the amount removed must never exceed .0005" on the wheel diameter.
2. The wheel should never be dressed with the coolant pump disconnected. Coolant keeps the diamonds clean and prevents overheating which might cause diamonds to become loose in the holders.

DIAMOND SPECIFICATIONS

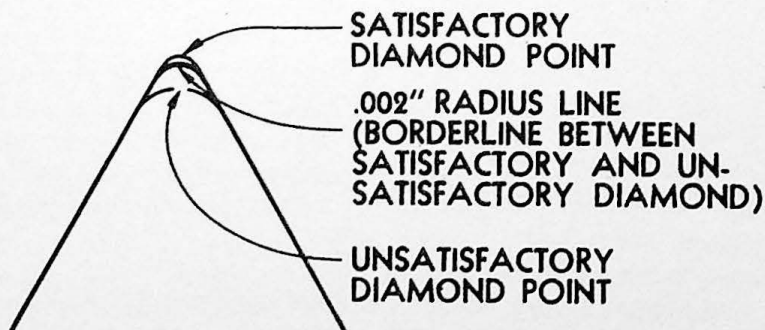
Suitable diamonds for the Universal Cam-type Dresser may be ordered from Ex-Cell-O Corporation. The diamond number should be specified.

Diamond No. 48-4105 ... For straight thread forms

Diamond No. 48-4128 For Whitworth and other radius form threads

For special forms, diamonds of the same specification or number as furnished originally should be ordered.

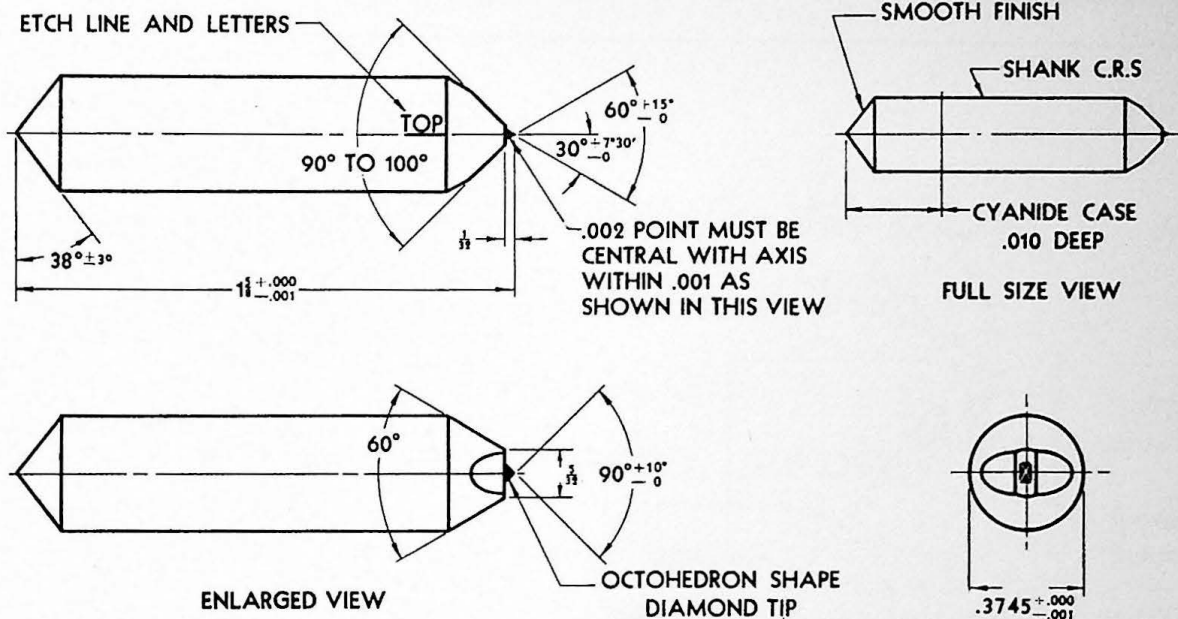
Diamonds for radius thread forms must have a sharp point. Diamonds purchased from other sources must be checked in the projector before they are mounted. If the point should be inside the .002" radius line the diamond must be rejected as unsuitable.



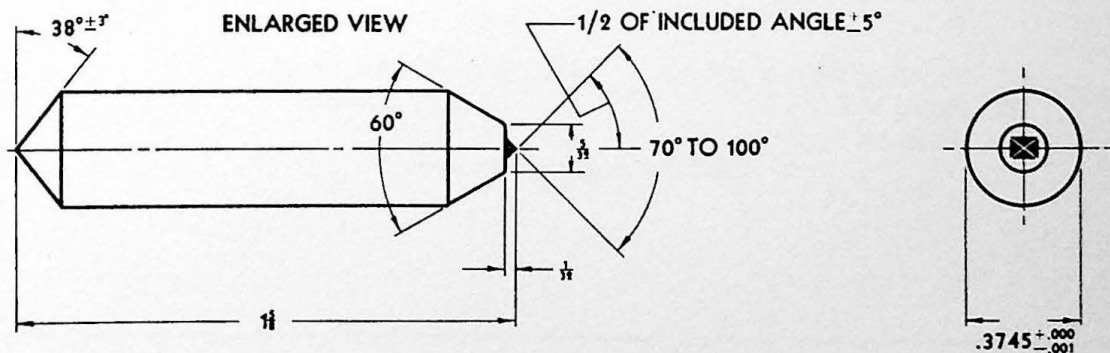
UNIVERSAL CAM-TYPE DRESSER

DIAMOND TOOLS FOR EX-CELL-O UNIVERSAL CAM-TYPE DRESSER

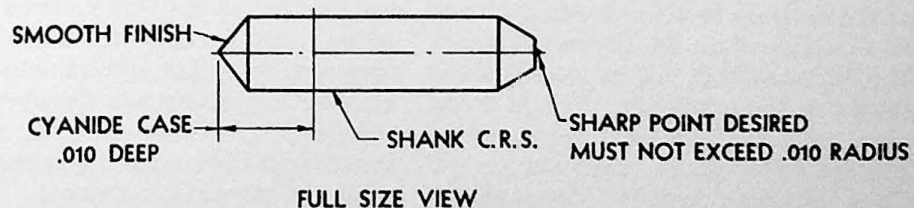
DIAMOND TOOLS FOR RADIUS FORM THREADS No. 48-4128



DIAMOND TOOLS FOR STRAIGHT LINE FORM THREADS No. 48-4105



OCTOHEDRON SHAPE DIAMOND POINT MUST BE CONCENTRIC WITH .3745 DIAMETER SHANK WITHIN .003

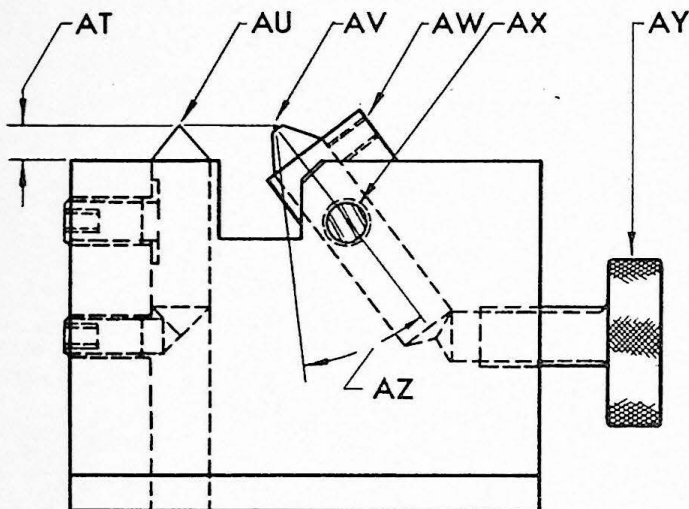


UNIVERSAL CAM-TYPE DRESSER

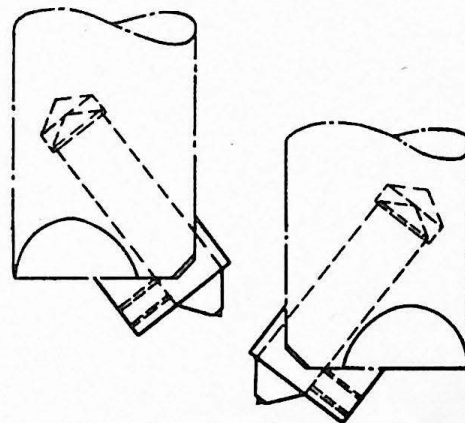
SETTING FIXTURE FOR UNIVERSAL DRESSER DIAMONDS

By the use of this Ex-Cell-O fixture new diamonds may be readily adjusted on the projector without touching the diamond point at any time.

This minimizes the possibility of the diamond point being chipped. The fixture may be purchased as extra standard equipment.



SETTING FIXTURE WITH SIZING PIN AND DIAMOND



DIAMONDS WITH COLLARS MOUNTED IN DIAMOND TOOL CARRIERS

AT. Required Setting Height
AU. Sizing Pin
AV. Diamond Tool

AW. Diamond Tool Collar
AX. Locking Screw
AY. Set Screw

AZ. Smallest Angle on Diamond

The Diamond is set in the following manner: The sizing pin AU is adjusted either with a height gage or with a sizing block. The height AT is adjusted so that it conforms to the desired diamond setting, which is stamped on the Universal Dresser Cam. The diamond tool AV is inserted and the fixture placed on the projector. The diamond is turned slowly until the smallest angle AZ is obtained. It is set to the same height as pin AU and screw AX is tightened slightly. The diamond

is adjusted exactly to the correct height with set screw AY and locked with screw AX. The collar AW is slipped over the diamond shank, fitted snugly against the fixture base and locked in position. The diamond AV and collar AW are then removed from the fixture and inserted into the arm on the Universal Dresser. Both diamonds are set in the same manner, assuring their location in proper relation to each other and to the center of the grinding wheel.

THREAD GRINDING WHEEL RECOMMENDATIONS

EX-CELL-O

PRECISION THREAD GRINDER

STYLE 50



GOOD THREAD GRINDING PERFORMANCE DEPENDS UPON:

1. The use of good diamonds and correct dressing practice.
2. The proper application of a suitable brand of thread grinding oil.
3. The correct wheel and work speed ratio.
4. A suitable grade of grinding wheel.

Instructions on the first three items are listed elsewhere in this book.

The wheel gradings collected on the following pages may be depended upon to give satisfaction on the classes of work for which they are recommended, provided the above conditions are observed.

Throughout the recommendations the bond of wheels used is indicated as follows:

(Res.) for Resinoid
(Vit.) for Vitrified

If increased production is required under special conditions, blueprint of part with complete information on the material used and its hardness should be submitted to the wheel manufacturer for suggestions.

EX-CELL-O CORPORATION

THREAD GRINDING AND GRINDING WHEELS

WHEELS FOR GRINDING EXTERNAL THREADS

AMERICAN NATIONAL FORM THREADS

TOOL AND HIGH SPEED STEELS, hardened

COMMERCIAL THREADS

Threads per Inch	Carborundum	Norton	Macklin
8 to 12	A100-T3-BT (Res.)	A100-S9-BH (Res.)	A100-W2-B7 (Res.)
13 to 20	A120-T3-BT (Res.)	A100-S9-BH (Res.)	A100-W2-B7 (Res.)
24 to 36	A150-T3-BT (Res.)	A150-T9-BH (Res.)	A150-W2-B7 (Res.)
40 to 60	A220-T3-BT (Res.)	A180-T9-BH (Res.)	A180-W2-B7 (Res.)
60 and finer	A220-T3-BT (Res.)	A220-T9-BH (Res.)	A220-W2-B7 (Res.)

PRECISION THREADS

8 to 12	AA100-K-VT (Vit.)	38A120-J7-VBE (Vit.)
13 to 20	AA120-K-VT (Vit.)	38A150-K8-VBE (Vit.)
24 to 36	AA150-K-VT (Vit.)	38A220-M10-VBE (Vit.)
40 and finer	AFA280-K-VT3 (Vit.)	A320-09-B (Res.)

ALLOY STEELS, heat treated and hardened.

COMMERCIAL THREADS

8 to 12	A120-T3-BT (Res.)	A100-S9-BH (Res.)	A100-W2-B7 (Res.)
13 to 20	A150-T3-BT (Res.)	A150-T9-BH (Res.)	A100-W2-B7 (Res.)
24 to 36	A220-T3-BT (Res.)	A180-T9-BH (Res.)	A150-W2-B7 (Res.)

ACME AND WORM THREADS

TOOL AND ALLOY STEELS, heat treated and hardened.

2 to 4	AA60-J-VT (Vit.)	38A80-I8-VBE (Vit.)
5 to 10	AA80-J-VT (Vit.)	38A120-J7-VBE (Vit.)
12 to 18	AA100-J-VT (Vit.)	38A150-K8-VBE (Vit.)

WHEELS FOR GRINDING TAPS

AMERICAN NATIONAL FORM THREADS

HIGH SPEED STEEL

COMMERCIAL THREADS

Threads per Inch	Carborundum	Norton	Macklin
4 to 7	A80-T3-BT (Res.)	A100-S9-BH (Res.)	A80-W2-B7 (Res.)
8 to 12	A100-T3-BT (Res.)	A100-S9-BH (Res.)	A100-W2-B7 (Res.)
13 to 20	A120-T3-BT (Res.)	A150-T9-BH (Res.)	A120-W2-B7 (Res.)
24 to 36	A180-T3-BT (Res.)	A180-T9-BH (Res.)	A180-W2-B7 (Res.)
40 and finer	A220-T3-BT (Res.)	A220-T9-BH (Res.)	A220-W2-B7 (Res.)

PRECISION THREADS

4 to 7	AA80-J-VT (Vit.)	38A120-J7-VBE (Vit.)	
8 to 12	AA100-K-VT (Vit.)	38A120-J7-VBE (Vit.)	
13 to 20	AA150-K-VT (Vit.)	38A150-K8-VBE (Vit.)	
24 to 36	AA220-K-VT (Vit.)	38A180-M10-VBE (Vit.)	
40 to 56	AFA280-K-VT3 (Vit.)	38A220-M10-VBE (Vit.)	
64 to 80	AFA280-K-VT3 (Vit.)	A320-09-B (Res.)	A220-W2-B7 (Res.)

THREAD GRINDING AND GRINDING WHEELS

WHEELS FOR GRINDING TAPS (Cont'd.)

AMERICAN NATIONAL PIPE THREADS HIGH SPEED STEEL

Threads per Inch	Carborundum	Norton	Macklin
8 to 11-1/2	A100-T3-BT (Res.) or AA150-K-VT (Vit.)	A100-S9-BH (Res.)	A100-W2-B7 (Res.)
14 to 18	A150-T3-BT (Res.) or AA220-K-VT (Vit.)	A100-S9-BH (Res.)	A120-W2-B7 (Res.)
27 and finer	A150-T3-BT (Res.) or AA220-K-VT (Vit.)	A150-T9-BH (Res.)	A150-W2-B7 (Res.)

ACME THREADS HIGH SPEED STEEL

2 to 4	AA60-J-VT (Vit.)	38A80-I8-VBE (Vit.)
5 to 10	AA80-J-VT (Vit.)	38A120-J7-VBE (Vit.)
12 to 16	AA100-J-VT (Vit.)	38A150-K8-VBE (Vit.)

WHEELS FOR GRINDING INTERNAL THREADS

AMERICAN NATIONAL FORM THREADS TOOL AND ALLOY STEELS For Grinding from solid

Threads per Inch	Carborundum	Norton	Macklin
6 to 16	A80-V3-BT5 (Res.)	A100-W9-BH (Res.)	*A100-W2-B7 (Res.)
16 to 24	A120-V3-BT5 (Res.)	A150-W9-BH (Res.)	*A150-W2-B7 (Res.)

For Grinding Pre-cut Threads

6 to 16	AA120-K-VT (Vit.)	*38A120-K8-VBE (Vit.)	A100-W2-B7 (Res.)
16 to 24	AA150-K-VT (Vit.)	*38A220-M10-VBE (Vit.)	A150-W2-B7 (Res.)

ACME THREADS TOOL AND ALLOY STEELS, hardened For Grinding Pre-cut Threads

2 to 8	*A80-I5-V10 (Vit.)	38A80-J8-VBE (Vit.)	A100-W2-B7 (Res.)
9 to 20	A120-I5-V10 (Vit.)	*38A120-J7-VBE (Vit.)	A150-W2-B7 (Res.)

*These wheels have performed especially well in their groups.

WHEELS FOR GRINDING NON-FERROUS METALS

Due to the large variation of the physical properties of these metals it is impossible to construct a table of wheel recommendations.

CARBORUNDUM

Some of these metals are best ground with Aloxite Resinoid while others require Carborundum Vitrified or AA Aloxite Vitrified. All such cases should be referred to the wheel manufacturer.

NORTON

Bronze, Brass and Aluminum are generally ground with 37C100-I-V, 37C180-I-V Crystalon Vitrified or finer for fine pitches. The Norton Representative should be consulted for recommendations.

WHEELS FOR GRINDING EXTERNAL THREADS AND TAPS

WHITWORTH FORM THREADS

For All Commercial and Precision Ground Threads

Threads Per Inch	Carborundum	Norton
8 to 16	120-P-T (Vit.)	38120-J7BE (Vit.)
18 to 24	150-P-T (Vit.)	38150-K8BE (Vit.)
24 to 40	220-P-T (Vit.)	38220-M10BE (Vit.)

WHEELS FOR GRINDING NON-FERROUS METALS

Due to the large variation of the physical properties of these metals it is impossible to construct a table of wheel recommendations.

Carborundum

Some of these metals are best ground with Aloxite Resinoid while others require Carborundum Vitri-fied or AA Aloxite Vitrified. All such cases should be referred to the wheel manufacturer.

Norton

Bronze, Brass and Aluminum are generally ground with 37100-1 37180-1 crystalon Vitrified or finer for fine pitches. The Norton Representative should be consulted for recommendations.

WHEELS FOR GRINDING INTERNAL THREADS

AMERICAN NATIONAL FORM THREADS

Tool and Alloy Steels Hardened

For Grinding from Solid

Threads Per Inch	Carborundum	Norton	Macklin
6 to 16	1003-A315 (Res.)	100-W9T-H (Res.)	100-10E20-2 (Res.)
16 to 24	1503-A315 (Res.)	150-W9T-H (Res.)	150-10E20-2 (Res.)

For Grinding Pre Cut Threads

6 to 16	120-N-T (Vit.)	38120-K8BE (Vit.)	100-10E20-2 (Res.)
16 to 24	150-N-T (Vit.)	38220-K9BE (Vit.)	150-10E20-2 (Res.)

ACME THREADS

Tool and Alloy Steels Hardened

For Grinding Pre Cut Threads

2 to 8	60-P-T (Vit.)	3880-J8BE (Vit.)	100-10E20-2 (Res.)
9 to 20	80-P-T (Vit.)	38120-J7BE (Vit.)	150-10E20-2 (Res.)

REPLACEMENT PARTS

EX-CELL-O PRECISION THREAD GRINDERS

STYLE 50

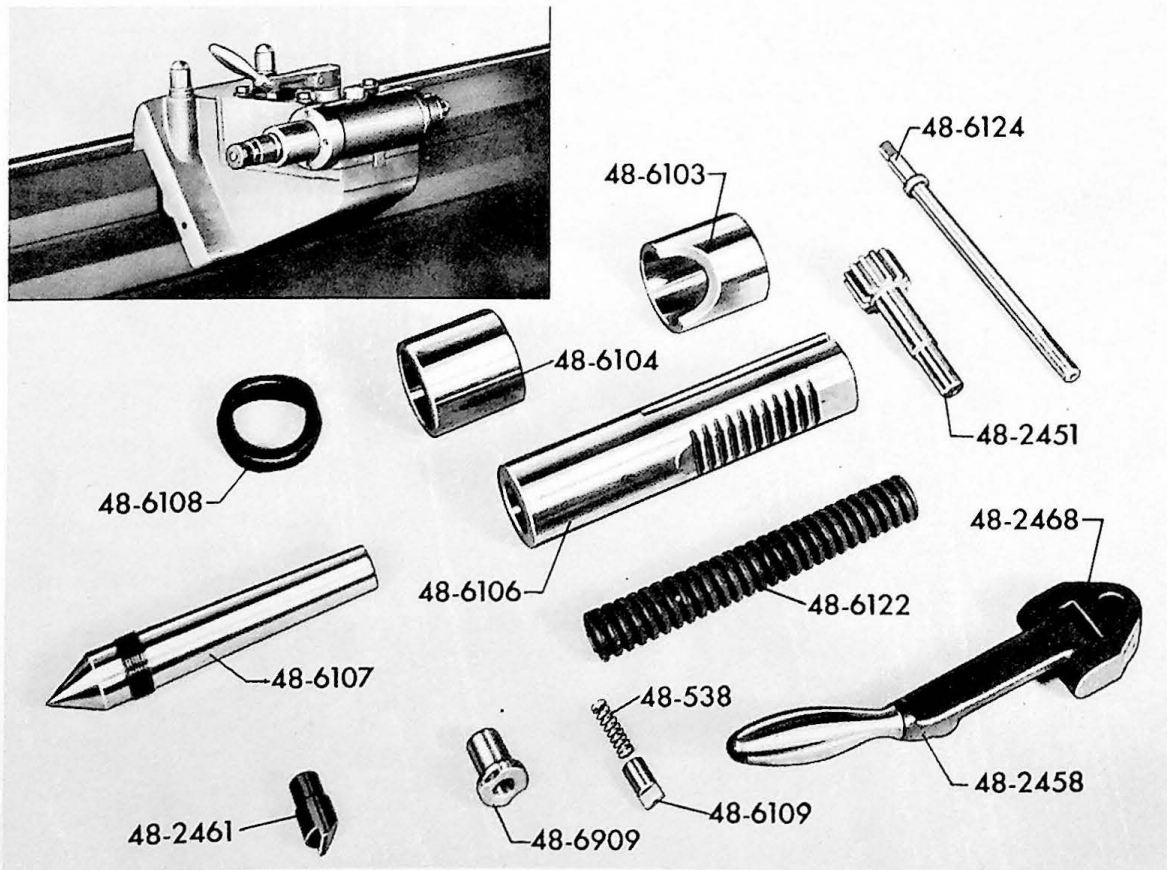
Only parts that may need replacement are in this list. The majority of machine parts last as long as the machine itself. If it should become necessary to replace a part that is not included in this list the order can be filled if the following information is forwarded: machine serial number, description of the part and, if necessary, a sketch.

Electrical equipment, V-belts and other standard items can be purchased at the nearest branch of the supplier.

To avoid errors and unnecessary delays when parts are ordered, the following information should be furnished:

1. Part number and name of item.
2. Quantity
3. Machine serial number

Part Number	Name of Part	Number Required
48-6100	TAILSTOCK ASSY.....	1
48-538	Plunger Spring	1
48-2461	Lever Stop Pin	1
48-2451	Pinion.....	1
48-2458	Lever.....	1
48-2468	Hinge Block	1
48-6103	Quill Bushing, R.H.	1
48-6104	Quill Bushing, L.H.	1
48-6106	Quill.....	1
48-6107	Center, High Speed Steel...	1
48-6108	Felt Seal	1
48-6109	Plunger.....	1
48-6122	Quill Spring	1
48-6124	Horizontal Alignment Adjusting Stud	1
48-6909	Bronze Nut	1

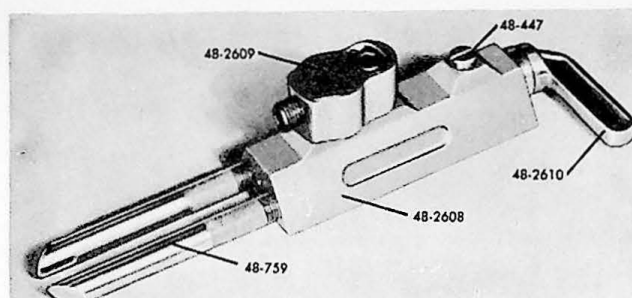


TAILSTOCK ASSEMBLY

REPLACEMENT PARTS

SPINDLE PULLEYS (not shown)

Part Number	O.D. Small Groove	O.D. Large Groove	For Spindle RPM
4-S-1180	4.260	4.390	2450-2640
4-S-1181	4.840	4.940	2150-2290
4-S-1182	5.360	5.500	1910-2040
4-S-1183	6.100	6.290	1670-1780
4-S-1184	6.840	6.960	1485-1575



COOLANT MANIFOLD ASSEMBLY

WHEEL DRIVE MOTOR PULLEYS (not shown)

Part Number	Current	O.D. Small Groove	O.D. Large Groove
48-577	60 Cycle	5.97	6.20
48-578	50 Cycle	7.11	7.39
48-719	D. C.	5.75	5.75
48-1432	60 Cycle	3.73	3.87
48-1433	50 Cycle	4.44	4.60
48-2418	D. C.	4.12	4.12

Part Number	Name of Part	Number Required
B-785-A	EXTERNAL WHEEL SPINDLE ASSEMBLY (not shown).....	1

WHEEL SLIDE ASSEMBLY (not shown)

48-410	Spindle Lock Screw, long...	2
48-411	Spindle Lock Screw, short.	2
48-3835	Ball Thrust Bearing for Feed Screw and Spline Shaft	4
	Ball Bearings, Fafnir or equivalent:	
	201 (K or W) A.B.E.C.-1 for Hand Wheel Shaft	1
	203 (K or W) A.B.E.C.-1 for Hand Wheel Shaft	1
	204 (K or W) A.B.E.C.-1 for Bevel Gear Shaft	2
	208 (K or W) A.B.E.C.-1 for Bevel Gear Sleeve.....	1
	210 (K or W) A.B.E.C.-1 for Bevel Gear Sleeve.....	1
	MM9508 for Feed Screw Nut	1
	MM9509 for Feed Screw Nut	1
	V-Belt, Gates or equivalent:	
	75-B	1
	81-B	1

HYDRAULIC CONTROL ASSEMBLY (not shown)

48-1557	Work Spindle Direction Valve	1
48-1561-A	Knob, Work Spindle Direction Valve	1

BASE ASSEMBLY (not shown)

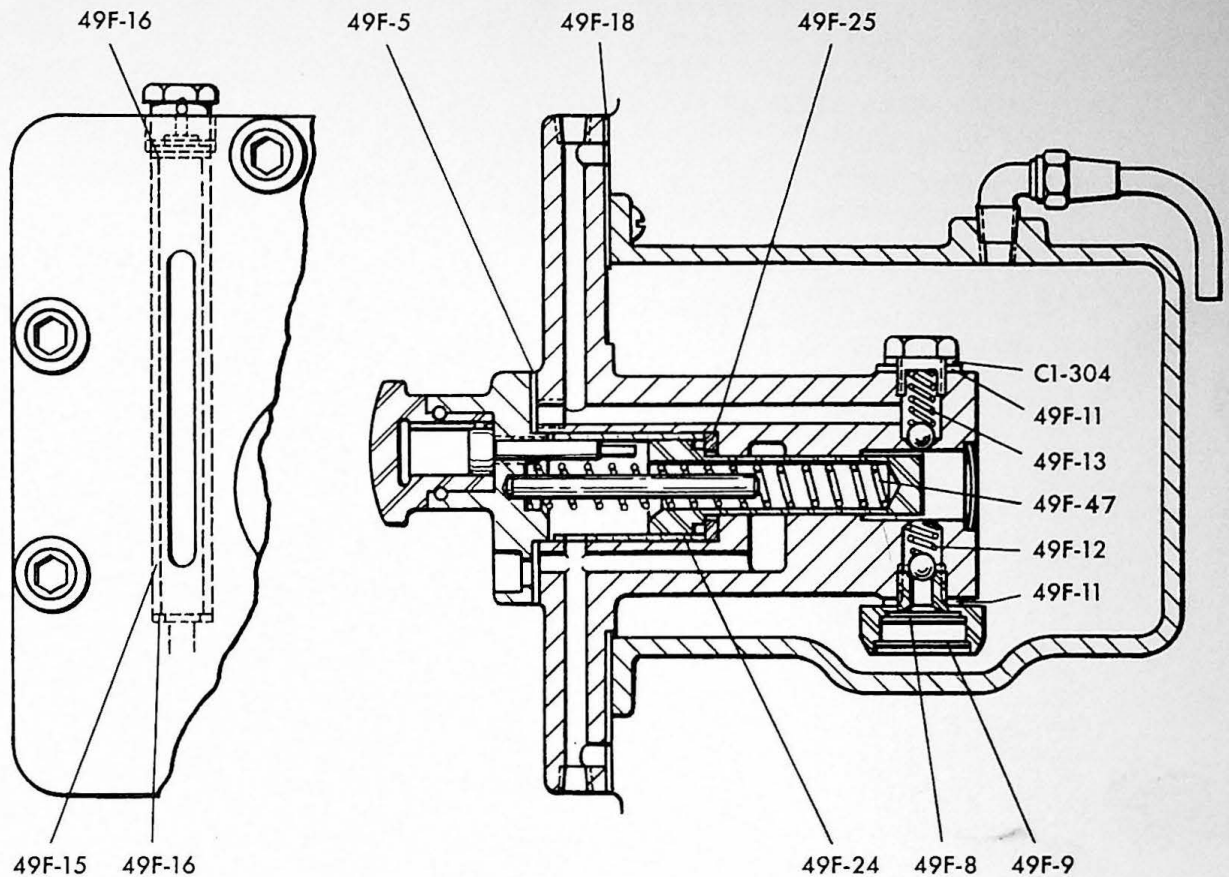
48-1578	Hydraulic Pump Tube	1
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Part Number	Name of Part	Number Required
48-8407	COOLANT MANIFOLD ASSEMBLY.....	1
48-447	Screw.....	1
48-759	Spout	2
48-2608	Manifold.....	1
48-2609	Manifold End	1
48-2610	Shutoff Valve	1

49F	LUBRICATING PUMP ASSEMBLY	1
49F-5	Cap Gasket	1
49F-8	Upper Strainer.....	1
49F-9	Lower Strainer	1
49F-11	Gasket, Intake and Exhaust	2
49F-12	Intake Spring	1
49F-13	Exhaust Spring.....	1
49F-15	Gage Glass.....	1
49F-16	Gasket	2
49F-18	Gasket	1
49F-24	Brass Bushing	1
49F-25	Washer.....	1
49F-47	Spring	1
C1-304	Copper Gasket	1
	15/16 Welch Plug	1
	15/16 Diameter Steel Ball	2

TABLE AND WORK SPINDLE ASSEMBLY

48-1824	Lead Pick-Up Pinion (not shown).....	2
48-1928	Plunger	1
48-1929	Spring	1
48-1991	Washer.....	4
48-2052	Nut (not shown)	2
48-2053	Nut	1
48-2056	Nut	1
48-2065	Idler Sleeve	1
48-2066	Sleeve	1
48-2067	Sleeve	2
48-2068	Bushing	1
48-2069	Bushing	1
48-2480	Stud	3
48-2481	Stud	1
48-6005	Worm Shaft	2
48-6028	Center (not shown).....	1
48-6031	Intermediate Pulley for Slow Work Speeds (not shown).....	1



LUBRICATING PUMP ASSEMBLY

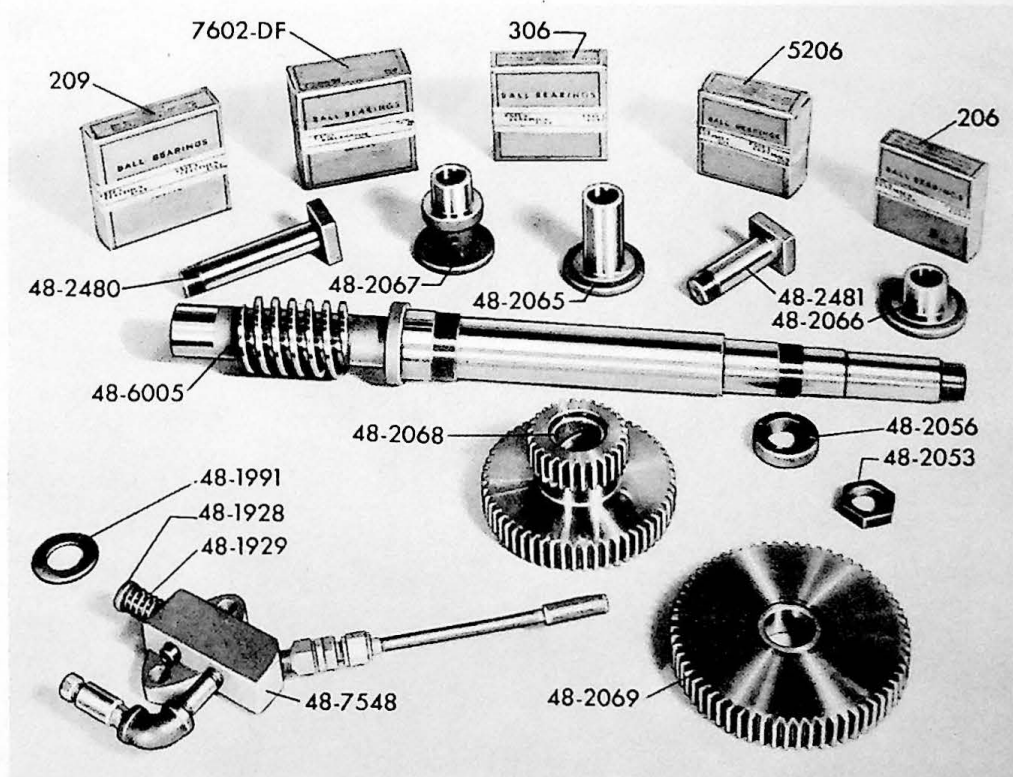


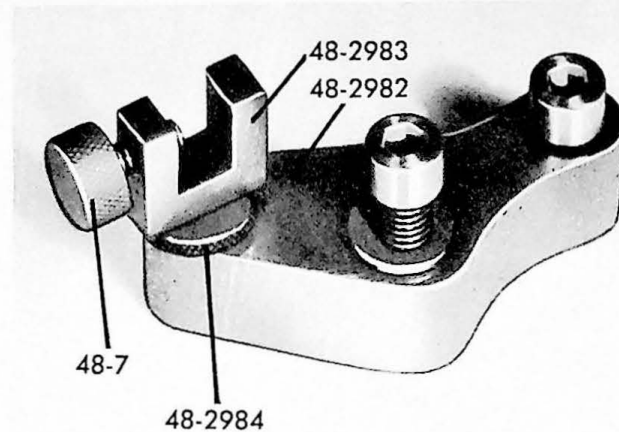
TABLE AND WORK SPINDLE ASSEMBLY

REPLACEMENT PARTS

Part Number	Name of Part	Number Required
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TABLE AND WORK SPINDLE ASSEMBLY (CONT'D)

48-7548	Pump Body	1
	Ball Bearings, Fafnir or equivalent:	
	206 (K or W) A.B.E.C.-3 for worm shaft, rear end	1
	206 (K or W) A.B.E.C.-5 for right end of horizontal gear shaft, and for upper end of vertical gear shaft	2
	209 (K or W) A.B.E.C.-5 for left end of lead screw drive sleeve	1
	306 (K or W) A.B.E.C.-5 for lower end of vertical gear shaft	1
	5206 A.B.E.C.-5 for left end of horizontal gear shaft	1
	5209 A.B.E.C.-5 for right end of lead screw drive shaft (not shown)	1
	7206DF A.B.E.C.-3 for front end of worm shaft ...	1
	MM9520 DF for left end of work spindle (not shown)	1
	MM9521 DB for right end of work spindle (not shown)	1
	Oil Seals, Perfect or equivalent (not shown):	
	18712 for front end of worm shaft	1
	30024 for right end of lead screw drive sleeve ...	1
	500330 for left end of work spindle	2
	575424 for right end of work spindle	1
	V-Belts for Work Drive, Gates or equivalent (not shown):	
	2320	2
	2400	1
	IDLER PULLEY ASSEMBLY for work spindle drive (not shown)	
	Ball Bearing, Fafnir or equivalent:	
	204 (K or W) A.B.E.C.-1 ...	2
48-2428	WORK DRIVE ASSEMBLY	1
48-7	Screw	1
48-2982	Plate	1
48-2983	Driver	1
48-2984	Lock Nut	1



WORK DRIVER ASSEMBLY

Part Number	Name of Part	Number Required
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ROLLER CAGE ASSEMBLIES (not shown)

48-6402	Angular Roller Cage Assembly for wheel slide	1
48-6405	Angular Roller Cage Assembly for work table..	2
48-6408	Flat Roller Cage Assembly for wheel slide	1
48-6411	Flat Roller Cage Assembly for work table..	2

VARIABLE SPEED HYDRAULIC MOTOR (not shown)

48-3540	Gasket	1
48-3907	Motor Fitting with 1" pipe thread	1
48-3908	Motor Fitting with 3/4" pipe thread	1
	Ball Bearing, N.D. or equivalent:	
	55505 A.B.E.C.-1	1
	Oil Seal, Victoprene 60237 or equivalent	1

WORK TABLE CONTROL DOG ASSEMBLIES (not shown)

48-1375	RIGHT HAND STOP DOG ASSEMBLY	1
48-1596	Base	1
48-1377	Lever	1
A6-1	Nut	1
	Socket Head Screw 5/16 - 18 x 2	1
	C-1110 - Q Bantam Roller	1
48-1376	LEFT HAND STOP DOG ASSEMBLY	1
48-1596	Base	1
48-1377	Lever	1
A6-1	Nut	1
	Socket Head Screw 5/16 - 18 x 2	1
	C-1110-Q Bantam Roller ...	1

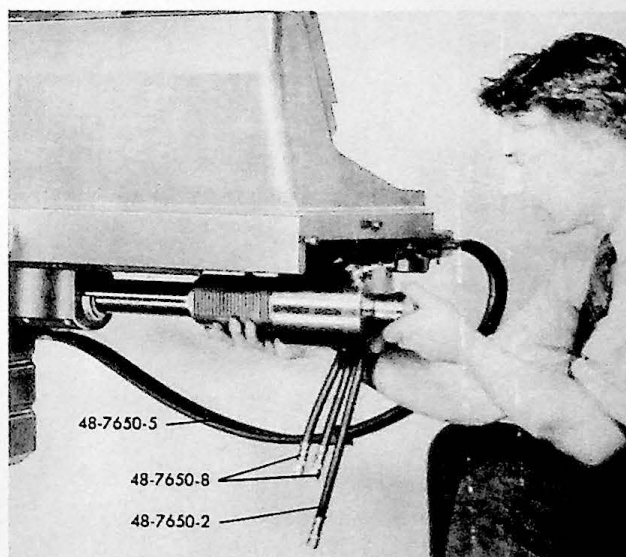
REPLACEMENT PARTS

Part Number	Name of Part	Number Required
WORK TABLE CONTROL DOG ASSEMBLIES (CONT'D)		
48-1579	RIGHT HAND SAFETY DOG	1
48-1584	LEFT HAND SAFETY DOG	1
48-1384	RIGHT HAND REVERSE DOG	1
A6-1	Nut	1
	Socket Head Screw 5/16 - 18 x 7/8	1
48-1385	LEFT HAND REVERSE DOG ASSEMBLY	1
48-1588	Left Hand Reverse Dog	1
A6-1	Nut	1
	Socket Head Screw 5/16 - 18 x 7/8	1
48-1580	FEED DOG ASSEMBLY	1
48-1581	Base.....	1
48-1582	Lever.....	1
	Socket Head Screw 5/16 - 18 x 1-1/2	1
	C1110-Q Bantam Roller....	1
48-1585	RAPID TRAVERSE DOG ASSEMBLY	1
48-1586	Base	1
48-1582	Lever	1
A6-1	Nut	1
	Socket Head Screw 5/16 - 18 x 1	1
	C-1110-Q Bantam Roller ..	1
48-1590	RAPID RETURN DOG ASSEMBLY	1
48-1586	Base	1
48-1592	Lever	1
A6-1	Nut	1

DRESSER DRIVE ASSEMBLY (not shown)

48-8867-3	Flexible Drive Shaft Assembly for Three Way 60° and 29° Form Dresser and Three Way Plate-Type 10° to 90° Form Dresser	1
48-8867-4	Flexible Drive Shaft Assembly for Three Way Cradle-Type 10° to 90°	

Part Number	Name of Part	Number Required
	Form Dresser and Universal Cam-Type Dresser	1
48-8855-3	Core for Flexible Drive Shaft Assembly 48-8867-3	1
48-8855-4	Core for Flexible Drive Shaft Assembly 48-8867-4	1
48-8946	Brake Belt	1
	1200 Gates V-Belt	1
INTERNAL GRINDING ATTACHMENT (not shown)		
B-630	Internal Grinding Spindle Assembly.....	1
12-S-626	Quill for 2-1/2" to 4" diameter Wheels	1
12-S-627	Quill for 1" to 2-1/2" diameter Wheels	1
	Ball Bearing, N.D. or equivalent:	
	3204 A.B.E.C.-1 for idler pulley	2
	3205 A.B.E.C.-1 for countershaft pulley	2
	V-Belt, motor to countershaft, Gates 2470 or equivalent	1
	Flat Belt, 1-1/2" wide x 63" long, Gates Speedflex Crosscord R-5-210-B or equivalent	1

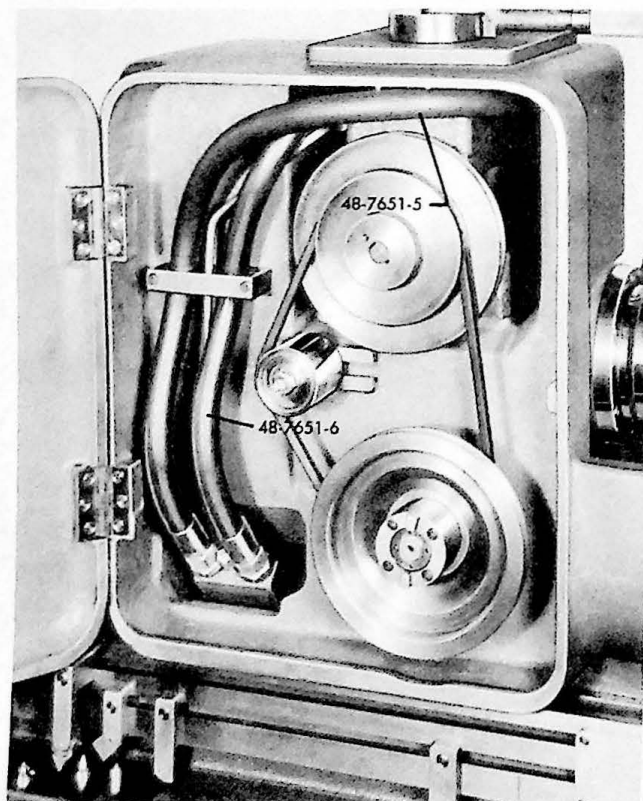


FLEXIBLE HOSE AT RIGHT END OF MACHINE

REPLACEMENT PARTS

FLEXIBLE HOSE

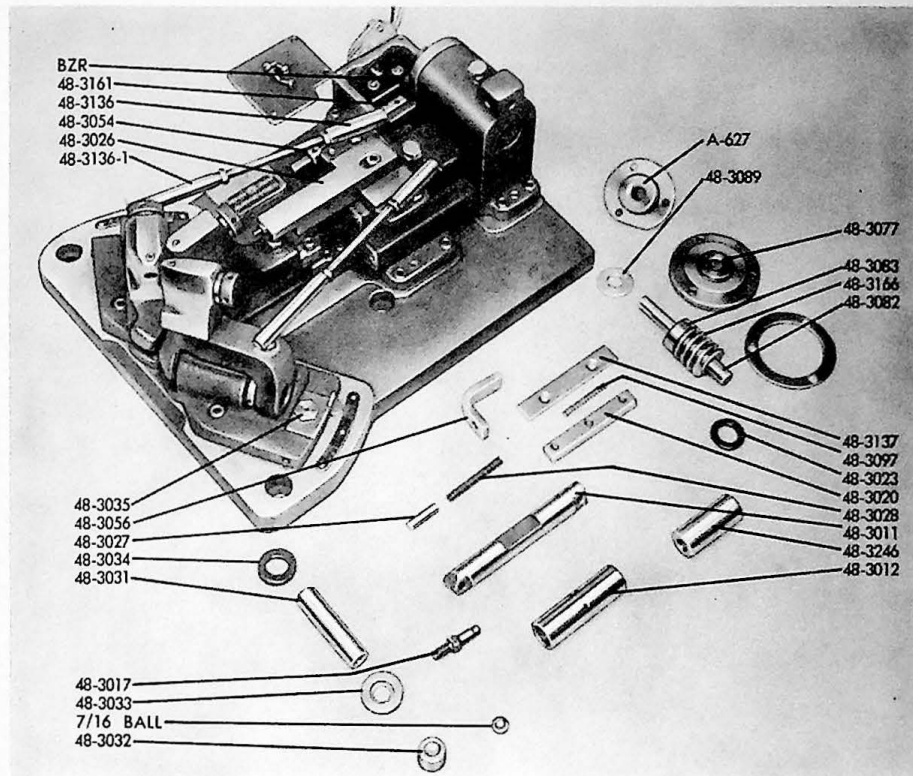
Part Number	Where Used	Overall Length	Number Required
Coolant hose:			
48-534-2	Coolant tank to wheel slide (not shown)	58-1/2"	1
48-7650-1	To dresser (not shown)	24"	1
Hydraulic hose:			
48-1640	Base to hydraulic pump intake (not shown)	15"	1
48-7650-1	Under wheel slide, base to wheel slide feed screw nut (not shown).....	24"	1
48-7650-2	Table to backlash compensator	22-5/8"	1
48-7650-5	Base to table, right end	48"	3
48-7650-6	Base to table, left end (not shown)	52"	1
48-7650-8	Table to backlash compensator	18-1/2"	2
48-7651-1	Hydraulic filter to base (not shown)	14"	1
48-7651-2	Base to table, left end (not shown)	52"	3
48-7651-5	Table to hydraulic motor	39-1/2"	1
48-7651-6	Table to hydraulic motor	30-1/2"	1
Hose Assembly, Bijur or Equivalent:			
	B-3508 under table, base to lead screw nut (not shown)...	24"	1



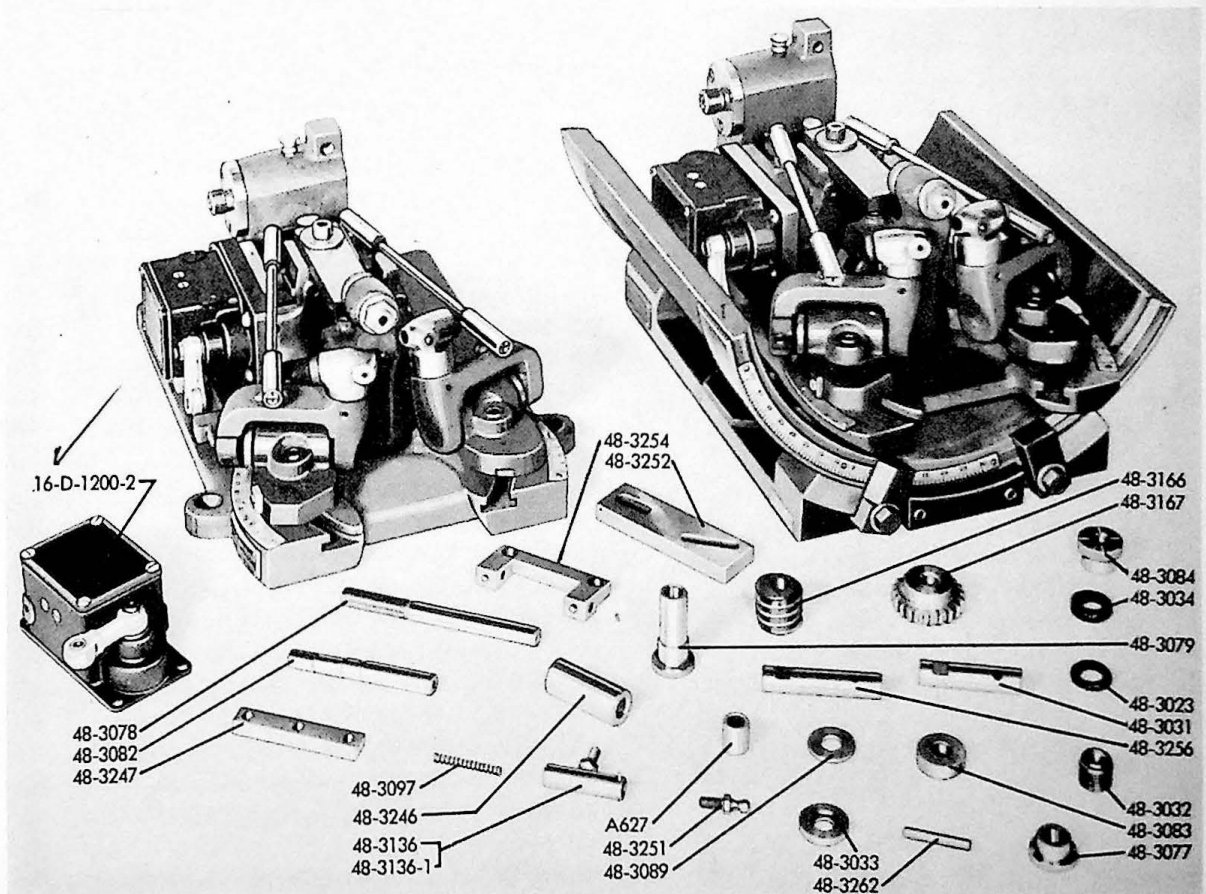
FLEXIBLE HOSE FROM TABLE TO HYDRAULIC MOTOR

Part Number	Name of Part	Number Required
THREE WAY 60° and 29° FORM DRESSER		
48-3011	Shaft	1
48-3012	Bushing	1
48-3017	Cam Stud	1
48-3020	Gib	1
48-3023	Felt Washer	1
48-3026	Cam Block	1
48-3027	Plunger	1
48-3028	Plunger Spring	1
48-3031	Shaft	2
48-3032	Shaft Bearing	2
48-3033	Seal Washer	2
48-3034	Felt Seal	4
48-3035	Stud	2
48-3054	Adjusting Collar	2
48-3056	Switch Trip Arm	1
48-3077	Bushing	1
48-3078	Lead Screw Shaft (not shown).....	1
48-3079	Lead Screw Shaft Bushing, Long (not shown).....	1
48-3082	Worm Shaft.....	1
48-3083	Drive Collar	1
48-3084	Worm Shaft Bushing (not shown)	1
48-3089	Bronze Washer.....	1

REPLACEMENT PARTS



THREE WAY 60° AND 29° FORM DRESSER

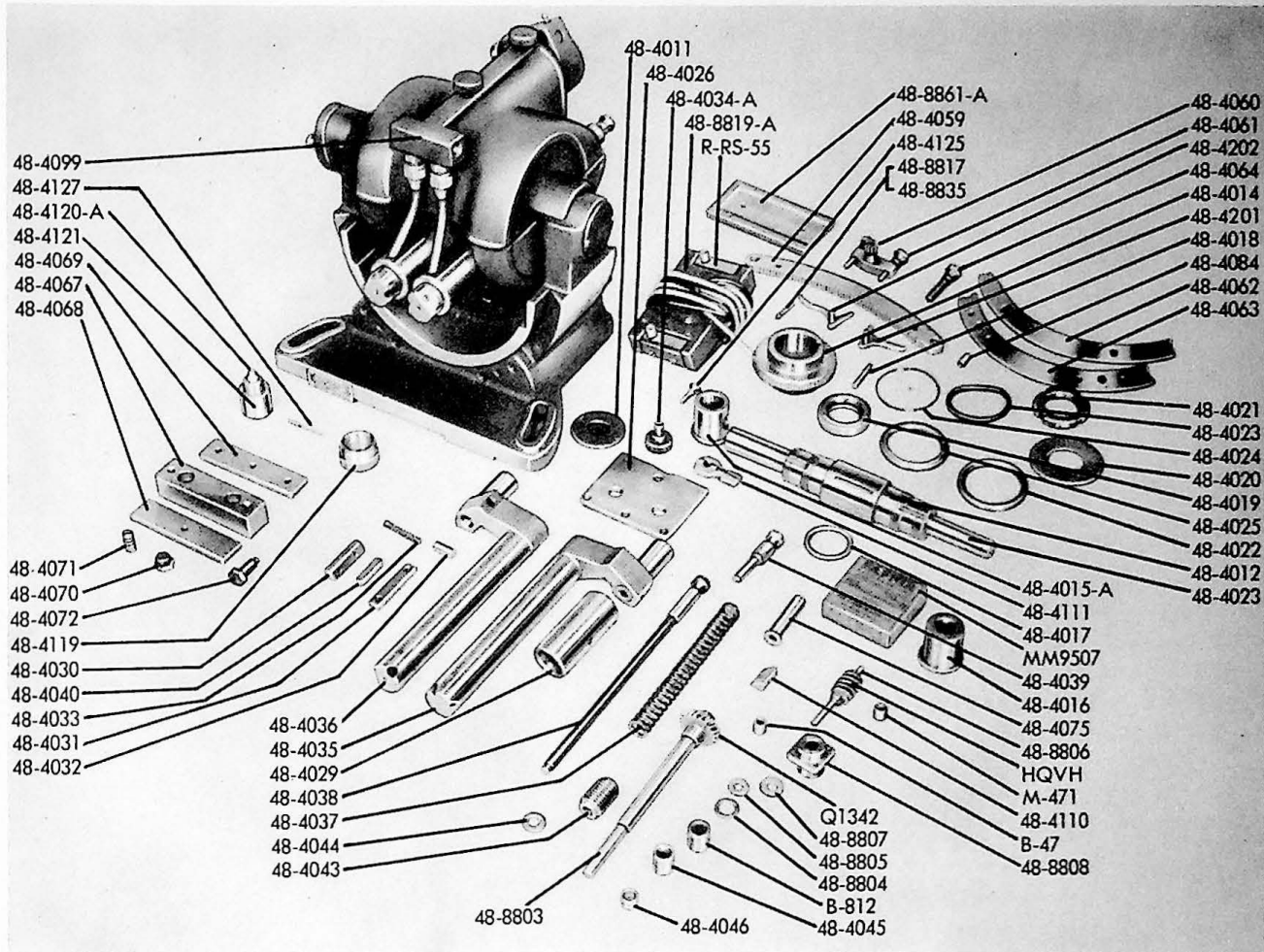


THREE WAY, PLATE TYPE 10° TO 90° FORM DRESSER AND THREE WAY, CRADLE-TYPE 10° TO 90° FORM DRESSER

REPLACEMENT PARTS

Part Number	Name of Part	Number Required	Part Number	Name of Part	Number Required
THREE WAY 60° and 29° FORM DRESSER (CONT'D)			UNIVERSAL CAM-TYPE DRESSER		
48-3097	Spring	1	48-4011	End Plate	1
48-3136	Ball Joint Assembly	2	48-4012	Cam Carrier	1
48-3137	Spring Plate.....	1	48-4014	Bronze Worm Wheel	1
48-3136-1	Ball Joint Assembly.....	2	48-4015-A	Bushing, R.H.	1
48-3161	Switch Cam	1	48-4016	Bushing, L.H;	1
48-3166	Worm	1	48-4017	Bushing Spacer	1
48-3167	Worm Gear (not shown)....	1	48-4018	Key	1
48-3246	Bronze Lead Screw Nut ...	1	48-4019	Bearing Nut	2
	A-627 Oilite Bushing	1	48-4020	Washer	2
	Oil Seal for switch shaft		48-4021	Cam Nut	2
	Perfect 10012 or		48-4022	Retainer for Felt Wiper ...	2
	equivalent.....	1	48-4023	Felt Wiper	2
	Micro-Switch BZR	1	48-4024	Bearing Equalizing Ring...	2
THREE WAY, PLATE-TYPE 10° to 90° FORM DRESSER AND THREE WAY, CRADLE-TYPE 10° to 90° FORM DRESSER			48-4025	Bearing Nut	2
48-3023	Felt Washer.....	1	48-4026	End Plate	1
48-3031	Shaft.....	2	48-4029	Bushing, Diamond Carrier	2
48-3032	Shaft Bearing	3	48-4030	Guide.....	1
48-3033	Washer	2	48-4031	Wear Plate	2
48-3034	Felt Seal.....	6	48-4032	Spring Plunger	2
48-3077	Bushing	1	48-4033	Spring	2
48-3078	Lead Screw Shaft	1	48-4034-A	Cover Screw	2
48-3079	Lead Screw Shaft Bushing		48-4035	Diamond Carrier, R.H. ...	1
	(Long)	1	48-4036	Diamond Carrier, L.H. ...	1
48-3082	Worm Shaft	1	48-4037	Spring, Diamond Adj.	
48-3083	Drive Collar	1		Screw.....	2
48-3084	Worm Shaft Bushing	1	48-4038	Diamond Adjusting	
48-3089	Bronze Washer.....	1		Screw.....	2
48-3097	Spring	3	48-4039	Cam Follower Adj. Screw	2
48-3136	Ball Joint Assembly, front	2	48-4040	Cam Follower	2
48-3136-1	Ball Joint Assembly, rear	2	48-4043	Drive Worm.....	1
48-3166	Worm	1	48-4044	Bronze Washer	2
48-3167	Worm Gear	1	48-4045	Bronze Bushing	1
48-3246	Bronze Lead Screw Nut....	1	48-4046	Bronze Bushing	1
48-3212	Diamond (not shown)	1	48-4059	Sector Gear	1
48-3247	Gib	1	48-4060	Pinion Gear	1
48-3251	Cam Stud.....	1	48-4061	Horizontal Angle Adj.	
48-3252	Cam Block	1		Screw.....	2
48-3254	Switch Trip Bracket	1	48-4062	Guide, Rear.....	1
48-3256	Center Arm Shaft.....	1	48-4063	Guide, Front	1
48-3262	Adjusting Pin	2	48-4064	Swivel Bracket Lock	
48-4105-1	Diamond (not shown)	2		Screw.....	2
	A-627 Oilite Bushing	1	48-4067	Guide, Block.....	1
	16-D-1200-2 Snap Lock		48-4068	Wear Plate, Front	1
	Switch.....	1	48-4069	Wear Plate, Rear	1
			48-4070	Screw.....	2
			48-4071	Spring	2
			48-4072	Shoulder Screw	1
			48-4075	Cam Follower Bushing....	2
			48-4099	Coolant Manifold	1
			48-4110	Guide	1

REPLACEMENT PARTS



UNIVERSAL CAM-TYPE DRESSER

Part Number	Name of Part	Number Required	Part Number	Name of Part	Number Required
UNIVERSAL CAM-TYPE DRESSER (CONT'D)			Ball Bearing, Fafnir MM9507 or equivalent		
48-4111	Key.....	1	Bearing, Torrington or equivalent:		2
48-4119	Knob	1	B-47 for drive end on		
48-4120-A	Stop Wedge	1	48-8806 shaft	1	
48-4121	Wedge Bushing	1	B-812 for 48-8803 shaft	1	
48-4123	Lead Screw (not shown) ...	1	M-471 for 48-8806 shaft ...	1	
48-4125	Screw	2	Boston Worm, HQVH	1	
48-4127	Wedge Bushing Plunger....	4	Boston Worm Wheel,		
48-4201	Switch Trip Arm, R.H.	1	Q1342	1	
48-4202	Switch Trip Arm, L.H.	1	Micro Switch, R-RS-55	2	
48-8803	Shaft	1	INTERNAL PANTOGRAPH-TYPE DRESSER		
48-8804	Washer	1	48-4105-1	Diamond for Straight Line Thread Forms (not shown)	2
48-8805	Washer	1	48-4128	Diamond for Radius Thread Forms (not shown)	2
48-8806	Worm Shaft	1			
48-8807	Washer	2			
48-8808	Needle Bearing Retainer ..	1			
48-8817	Plunger	2			
48-8819-A	Junction Box.....	1			
48-8835	Sleeve	2			
48-8861-A	Junction Box Cover.....	1			

REPLACEMENT PARTS

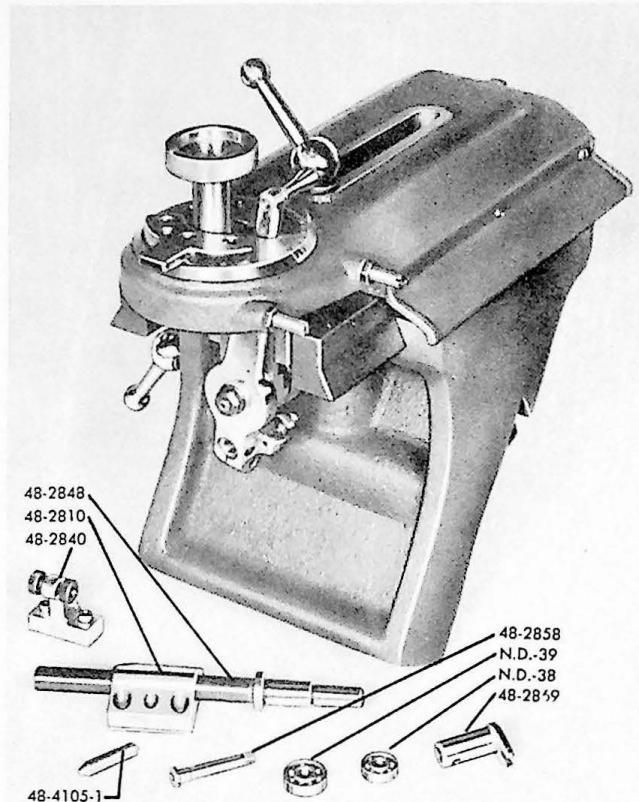
Part Number	Name of Part	Number Required
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INTERNAL PANTOGRAPH-TYPE DRESSER (CONT'D)

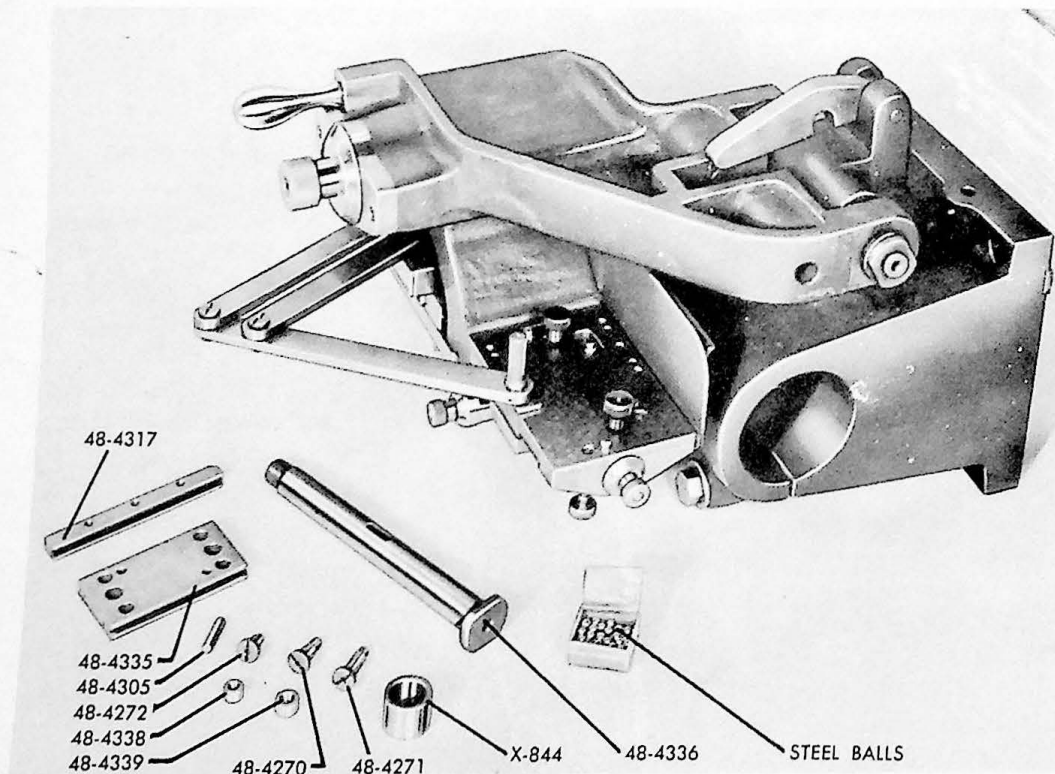
48-4270	Shoulder Screw	2
48-4271	Shoulder Screw	1
48-4272	Shoulder Screw	1
48-4305	Anchor Pin	1
48-4317	V-Rail	4
48-4335	V-Slide	2
48-4336	Hinge Pin	1
48-4338	Bushing	1
48-4339	Bushing	5
X-844	Bushing	2
	.1875 Dia. Steel Balls	60

INTERNAL STRAIGHT LINE DRESSER

48-2810	Bronze Feed Screw Nut	1
48-2840	Dog	1
48-2848	Feed Screw	1
48-2858	Pivot Screw	1
48-2869	Diamond Holder	1
48-4105-1	Diamond	1
	Ball Bearing, N.D. or equivalent:	
	38 A.B.E.C.-5	1
	39 A.B.E.C.-5	1



INTERNAL STRAIGHT LINE DRESSER



INTERNAL PANTOGRAPH - TYPE DRESSER