INSTRUCTION and PARTS MANUAL

MODELS 15 & 15A CRANKSHAFT GRINDERS

$20.000
800 LBS

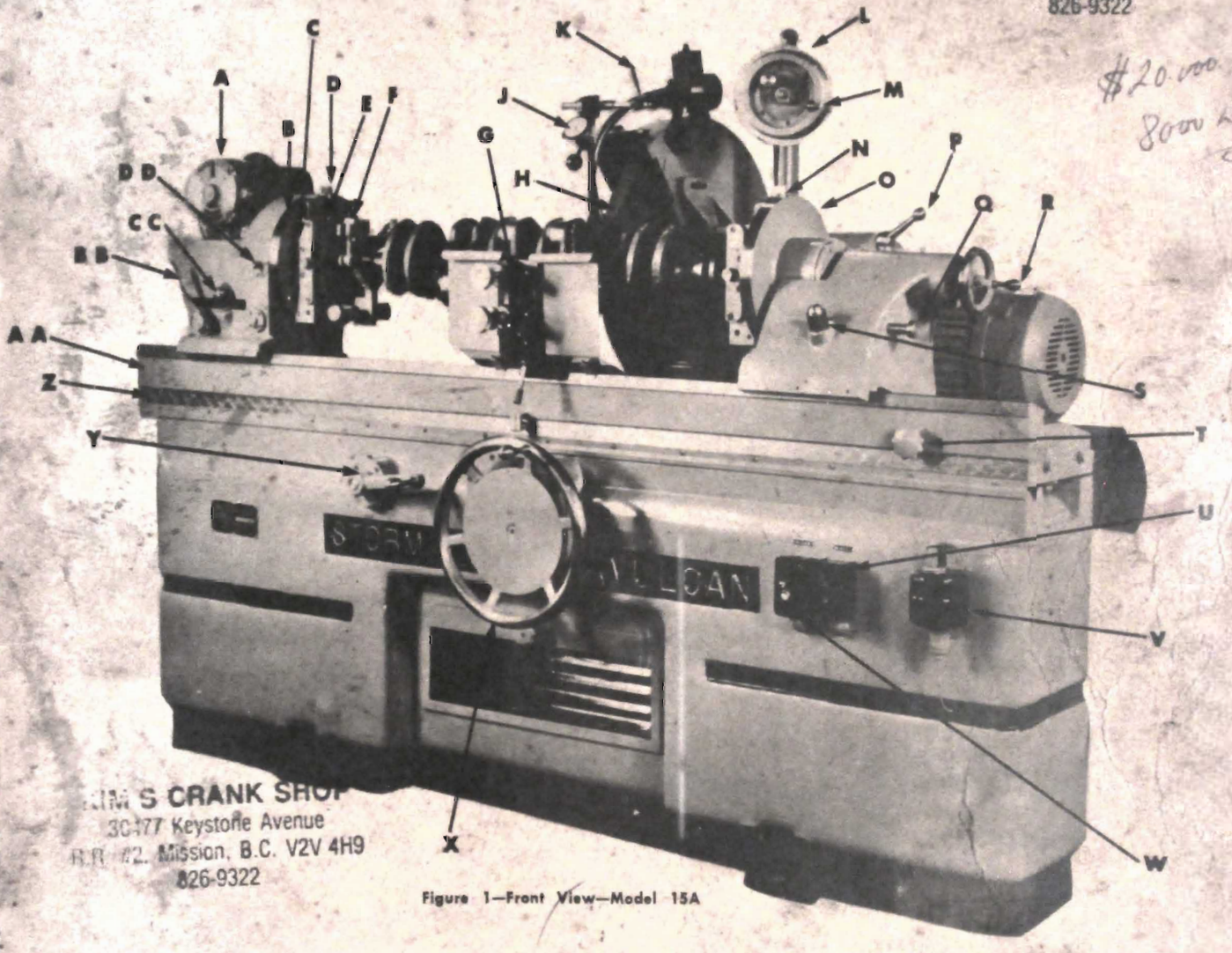


Figure 1—Front View—Model 15A

A. HEADSTOCK MOTOR
B. HEADSTOCK WORK HEAD
C. THROW SCALE
D. ELEVATING SCREW
E. CROSS SLIDE ADJUSTING SCREW
F. Y-DRIVER
G. STEADY REST
H. GRINDING WHEEL
J. ARNOLD GAUGE
K. COOLANT VALVE
L. FEED-UP DIAL
M. FEED-UP HAND WHEEL
N. ELEVATING HEAD
O. TAILSTOCK WORK HEAD
P. TAILSTOCK SPINDLE LOCK HANDLE
Q. TAILSTOCK WORK HEAD LOCK SHAFT
R. TAILSTOCK HAND WHEEL
S. TAILSTOCK LOCK NUT
T. TAPER ADJUSTMENT KNOB
U. GRINDING MOTOR SWITCH
V. BIJUR ONE SHOT OILER
W. HEADSTOCK & COOLANT MOTOR SWITCH
X. TABLE TRAVERSE HAND WHEEL
Y. WHEEL RETRACTION LEVER
Z. BOTTOM TABLE
AA. TOP TABLE
BB. HEADSTOCK CLUTCH LEVER
CC. HEADSTOCK LOCK NUT
DD. WORK HEAD LOCK SHAFT

Storm-Vulcan, Inc.
2225 BURBANK STREET · MElrose 7-1430 · DALLAS, TEXAS 75235

GENERAL INFORMATION

Storm-Vulcan presents this Operation and Maintenance Manual to enable you to get long, satisfactory service and the most profitable production possible from Models 15 and 15A Crankshaft Grinders. Feel free to write the company if there is any question not answered in this manual. Storm-Vulcan's interest in a machine and its purchaser does not end with the sale — the counsel of our engineering department is yours to command.

INDEX TO MANUAL

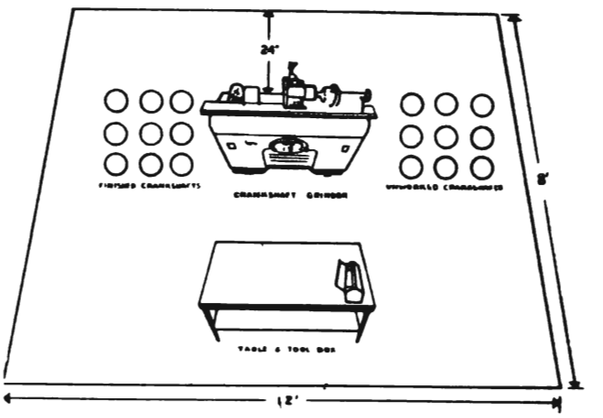
300 - BEFORE ASSEMBLY

301—SPACE REQUIRED

The Model 15 measures 50″ high, 40″ wide and 72″ long and requires 93″ for front table travel.

The Model 15A measures 54″ high, 42″ wide and 88″ long and requires 147″ for front table travel.

When positioning the machine, select a site that will give the operator complete freedom of movement and space in front of the machine for a table on which he may keep the necessary tools required with the grinder. The floor plan sketch at the right has been found to be very effective. Note that a minimum space of 24″ is allowed at the rear of the machine for easy accessibility for cleaning and oiling.



302—CAPACITIES

The capacities of both grinders are given in the following table:

	Between Centers	Swing	Stroke	Grinding Wheel
Model 15	48″	15″	6″	18″
Model 15A	60″	18″	7″	22″

303—LIGHTING

It is suggested that a large fluorescent lighting fixture be placed over the machine . . . its exact placement should be left up to the individual operator. On high precision work, good lighting for the entire working area will lessen operator fatigue and speed up production.

304—CHECK LIST OF EQUIPMENT

A packing list is sent with the machine. Carefully check and see that everything is received in good order. Claims for shortages should be made immediately. If anything is damaged in transit, file claim with carrier and notify STORM-VULCAN, Dallas, Texas.

400 - INSTALLATION

401—POSITIONING

First, carefully remove machine from skids and place in position on four mounting pads and plates (steel mounting plates go on TOP of mounting pads)—plates and pads are furnished as extra equipment. These mounting pads absorb vibration from other machines in the shop or outside sources that might cause a poor grinding finish. The machine should be placed on a solid concrete floor. Next, wipe off all anti-rust grease with clean rags.

402—ASSEMBLY

Remove back table hold-downs straps and bolt back table end way-guards in place. Remove front table hold-down straps. Place table traverse handwheel in position and lock tight with set-screw furnished. Remove the grinding wheel guard cover and carefully place grinding wheel on spindle and draw up tight on the spindle taper. Be careful not to scar or mar the taper on the spindle or in the grinding wheel mount when mounting or removing the grinding wheel.

Install Arnold Gauge on grinding wheel guard with bolt furnished. All necessary information for installation, use and maintenance of the Arnold Gauge is furnished in the crate in which it was delivered to you.

403—LEVELING

The machine should be perfectly level to insure proper operation and lubrication. Use a precision type carpenter's or machinist's spirit level. Extend the tables to the end and place the level on the flat portion of the Vee ways. The machine must be level, length-wise and cross-wise.

404—ELECTRICAL—MODEL 15

The Model 15 is equipped with three motors: the 1/3 H.P. work drive motor, the 1/10 H.P. coolant pump motor, and the 5 H.P. wheel head motor. According to customer specifications, these motors are furnished single or three phase and to the specified voltage. The switch at the right front operates the wheel head motor, and the switch at the left front operates the work head and coolant pump motors simultaneously.

The magnetic starter at the right rear is wired to the wheel head motor, and to the switch at the right front. This magnetic starter has heater coils for motor overload protection. These heater coils and the magnetic holding coil are matched with customer electrical specifications.

The switch at the left front is wired through the junction box at the left rear and thence to the headstock and coolant pump motors. This switch is of the manual type that has heater coils for motor overload protection.

A direct disconnect switch that cuts the power from the entire machine should be placed nearby. The wires are then brought from the disconnect switch to the junction box

404A– ELECTRICAL—MODEL 15A

The No. 15A is equipped with three motors: the ½ H.P. work drive motor; the 5 H.P. wheel head motor; and the 1/10 H. P. coolant pump motor. According to customer specifications, these motors are furnished single or three phase

The magnetic starter and overload relays have heater coils in them whose amperage rating corresponds with the amperage rating of their respective motors. Be sure to always maintain this rating when purchasing new heater coils.

The electrical compartment at the right rear of the machine houses a magnetic starter for the 5 H.P. motor and two overload relays, one for the ½ H. P. motor and one for the 1/10 H.P. motor. The compartment cover has a wiring diagram on the rear of it. Use this wiring diagram when tracing wires or servicing electrical equipment. Additional copies of this wiring diagram will be sent upon request.

Wiring Machine to Power Source

The entire electrical system was completely wired at the factory so that the only remaining connection to be made is to the electrical compartment. To connect, remove the compartment cover, bring the outside wires into the compartment through the hole in the bottom of it. Attach the wires to the terminal board at the bottom. One of the terminals is attached to the compartment for ground. Be sure to always bring a ground wire into this compartment and attach it to the ground terminal of the terminal board. Attach the remaining wires to the terminal board. A direct disconnect switch that cuts the power from the entire machine should be placed nearby.

Three Phase Circuit

Machines equipped with 3 phase motors were wired at the factory so that all motors were "in-phase," that is, they all ran in their proper direction when connected to one common 3 phase power source. Should the motors revolve backward after connecting the power source to the terminal board, reverse the leads at the terminal board.

501—HEADSTOCK AND HEADSTOCK WORK HEAD (Fig. 3)

The lock nut (J, Fig. 3) anchors the entire headstock assembly to the front table.

The elevating screw dial (B, Fig. 3), is calibrated to .001". This screw raises or lowers the elevating head (C, Fig. 3). The scale (L, Fig. 3) is used in conjunction with dial (B, Fig. 3).

The dial and the scale are direct reading, for example, when the dial is revolved one complete turn, the dial and scale will read that they have moved the elevating head .100" for the Model 15 and .125" for the Model 15A. In reality, the elevating head has moved only half that amount, .050" for the Model 15 and .0625" for the Model 15A. This eliminates the necessity of the operator dividing the stroke by two to obtain the setting.

The cross slide is adjusted with the nut (H, Fig. 3) and is used for trueing the crankshaft when grinding main bearing journals only.

NOTE: When trueing and grinding rod bearing journals, the cross slide must be in the neutral position at center.

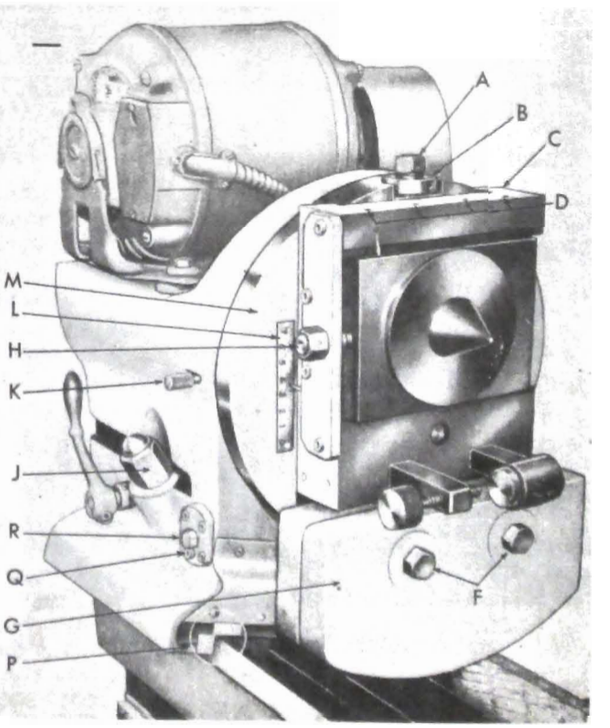


Figure 3—Headstock Work Head

502—TAILSTOCK AND TAILSTOCK WORK HEAD (Figure 4)

The operation of the tailstock work head (B), elevating screw (A), head lock shaft (E), lock nut (G), and cross slide (F), are all identical with the headstock, and are always used in conjunction with these corresponding parts.

The tailstock spindle is spring loaded to prevent excessive side pressure on the crankshaft when mounting.

The hand wheel (D, Fig. 4) moves the spindle and work head assembly to the right or left.

The spindle lock (C, Fig. 4) locks the spindle to the housing.

Wear Strips: (P. Fig. 3) (J, Fig. 4) Both the headstock and tailstock are equipped with precision ground alloy steel strips placed between the housings and the table surface. If realignment of headstock and tailstock becomes necessary, it is easily done by shimming between the housings and these steel wear strips.

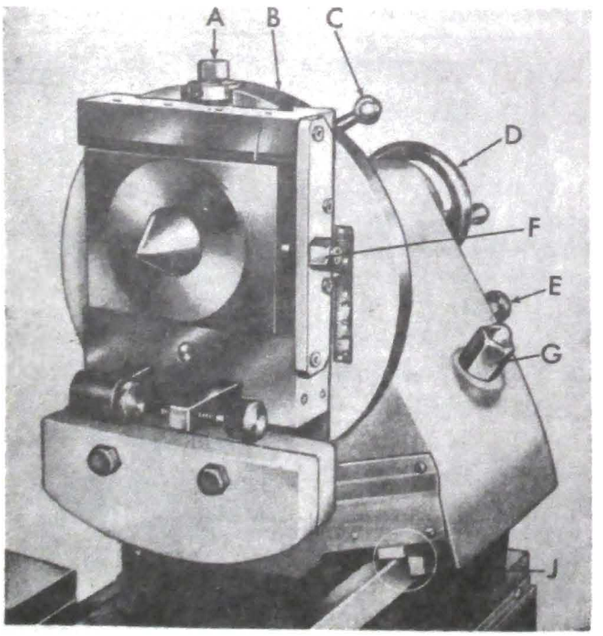


Figure 4—Tailstock

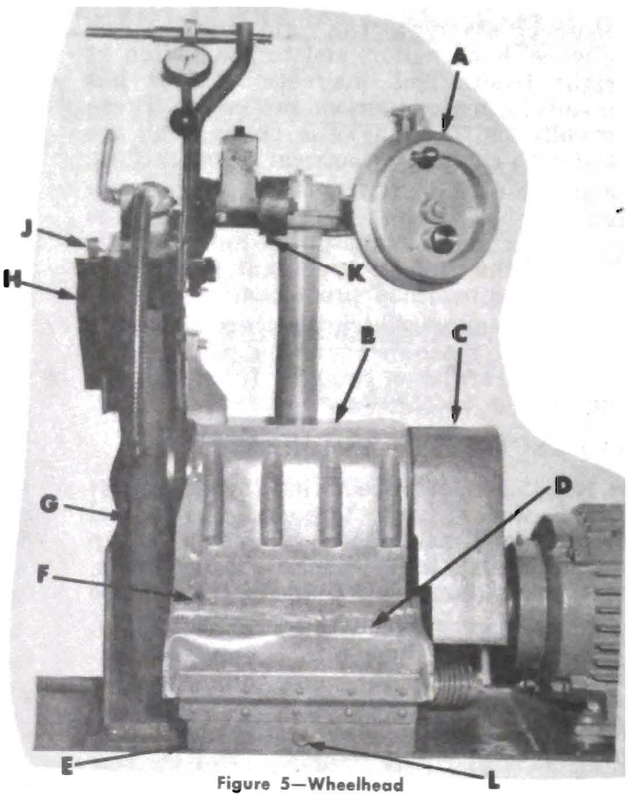


Figure 5—Wheelhead

503—WHEEL HEAD (Figure 5)

The wheel head consists of:

(A), the feed-up dial and mechanism.
(B), the spindle assembly.
(D), the wheel slide.
(E), The wheel slide base.
(G), the grinding wheel and guard.

The grinding wheel mount has an internal taper on the spindle. When mounting or removing grinding wheels, extreme care MUST be used to prevent damage to the taper on the spindle or in the mount.

A complete stock of grinding wheels is carried at the factory, available for immediate shipment.

The Model 15 wheel guard cover is removed by loosening the small set-screw located near the coolant pipe clamp at the top of the guard. The Model 15A wheel guard cover is removed by removing the three knurled nuts (J, Fig. 5). The grinding wheel splash guard (H, Fig. 5) is fully adjustable for any width or diameter grinding wheel and should be kept as close as possible to the grinding wheel to prevent excessive splashing of the coolant.

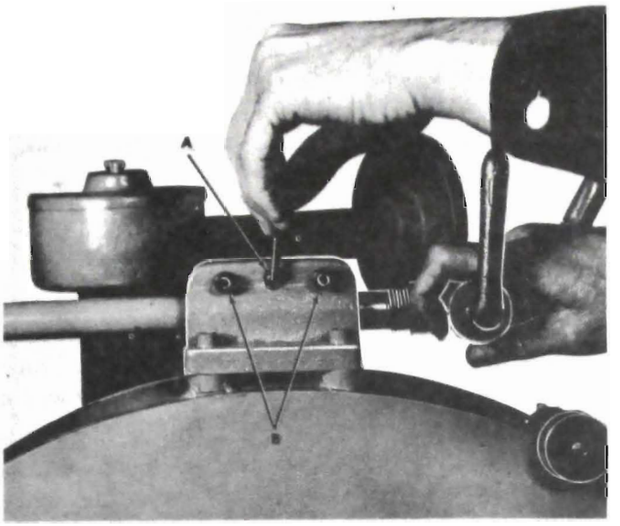


Figure 6—Adjusting Coolant Pipe (Model 15A)

The Model 15A grinding wheel guard can be moved back or forth after the two screws (one in front and one in rear) (E, Fig. 5) have been loosened. The guard is mounted in a dovetail groove for this purpose.

Two locking screws and one expanding screw are provided on the coolant pipe clamp bracket as shown in Figure 6, permitting the coolant nozzle to be adjusted to any convenient position. To adjust, loosen the two screws (B, Fig. 6), and tighten the center screw (A, Fig. 6). Position the coolant pipe and loosen the center screw. Then tighten the two lock screws.

The spindle is mounted on two pairs of super-precision spindle bearings inside the housing (B, Fig. 5).

These bearings have been preloaded to insure absolute rigidity. No further attention to the spindle or bearings is necessary so long as care is exercised with its use. The entire assembly also has been permanently lubricated for the life of the bearings. It is recommended that the factory be contacted whenever spindle trouble occurs.

Unless the operator is thoroughly familiar with this type bearing, he should never attempt to disassemble the spindle.

The factory maintains a complete spindle replacement service at a moderate price. When this service is needed, please write the factory for full details.

The feed-up dial (A, Fig. 5) is calibrated in .001". This dial is direct reading, that is, when the dial is turned .020", the grinding wheel will remove .020" stock from the diameter of the work.

MOUNTING THE GRINDING WHEEL

The grinding wheel is mounted on a sleeve-type mount. This mount consists of two parts, the sleeve and the flange. The sides of the sleeve and flange grip the sides of the grinding wheel by the gripping effect of the screws that hold them together. Always use new clean blotters between the mount and the wheel. Always be sure that all dirt and small particles are removed from sides and hole of the wheel and also from the mount. Always be sure that the screws and their threaded holes are clean and oiled before assembly of the flange and sleeve.

NOTE: Special instructions are necessary for the tightening of the eight screws that hold the flange and sleeve together.

Notice the numbers from one through five for Model 15, and one through eight for Model 15A, stamped on the flange beside the screw holes. These numbers represent the tightening order that must be followed. The tightening order is 1-2-3-4-5 for Model 15 and 1-2-3-4-5-6-7-8 for Model 15A. Notice that this forms a criss-cross pattern. This tightening order must be followed to prevent damage to the grinding wheel which would endanger the operator.

When mounting a grinding wheel, proceed as follows: Clean the parts as stated above. Place a new clean blotter on both sides of the wheel and place it on the sleeve. Then place the flange on and screw the screws in place with the fingers. With the hexagon wrench furnished, tighten No. 1 screw **lightly.** Then tighten the remaining screws in proper order lightly. Then go back and tighten each screw in proper order a little more. Then (using a torque wrench if available) tighten each screw in proper order to 15 foot pounds torque.

CAUTION: When inserting screws, never tighten one screw up to the full 15 foot pounds and then go to the next screw and tighten it up to 15 foot pounds. This procedure is likely to damage the wheel because the flange will not be drawn down evenly against the wheel. Excessive tightening pressure must also be avoided, as this will distort and warp the flange and sleeve.

After a period of 8-16 hours' grinding, the screws should be checked for looseness caused by the compression of the blotters. The screws will probably have to be retightened to maintain the 15 foot pounds torque. Be sure to follow the proper tightening order.

Use extreme care when mounting or removing the wheel from the spindle. If the taper in the wheel mount or on the spindle is damaged, the wheel will not run true. If the wheel is dropped on the spindle, the precision ball bearings will be damaged. When removing the wheel, turn the spindle nut two turns, then tap the wheel with the hand to break the mount loose from the spindle taper. Then remove the nut and the wheel. DO NOT hit the wheel or the spindle with a hammer.

BALANCING THE GRINDING WHEEL
(Figure 7)

Notice that two bronze counterweights (A. Fig. 7) are mounted in a groove in the wheel mount flange.

These counterweights are locked in position by means of a screw (B, Fig. 7) located in the middle of them. These counter weights may be moved in their groove to compensate for the unbalance in grinding wheels. New grinding wheels should be balanced before and after trueing them on the machine with the diamond wheel dresser. A balanced grinding wheel is essential to good grinding. Much patience and care must be used when balancing in order to insure the highest quality grinding.

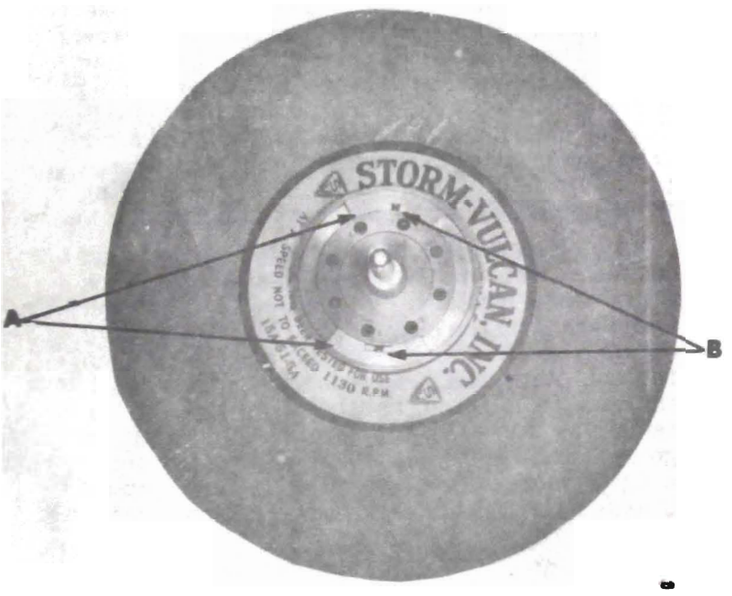


Figure 7—Balancing Grinding Wheel

Spirit Level: When using the spirit level horizontal balancer, obtain a clean table and place the balancer base on it. Then place the balancing head gently onto its base. Check the air bubble to be sure that it is exactly centered about the black circle on the glass. If not, adjust by loosening or tightening the small screws in the side of the chrome-plated head. Then place the mounted wheel onto the balancing head. Loosen the counterweights and note direction of unbalance by the position of the air bubble. Move the counterweights until the bubble is exactly centered about the black circle. Then lock the counterweights in position.

504—RAPID RETRACTION MECHANISM

The rapid retraction mechanism enables the operator to move the entire grinding wheel and spindle assembly away from the crankshaft without moving the feed-up dial. Fig. 2 shows this retraction mechanism.

505—TABLE TRAVERSE AND TAPER ADJUSTMENT

The front table and the back table move in opposite directions when the traverse hand wheel is rotated. The front table, however, moves 3½" before the back table begins to move. This allows the crankshaft journal to be moved across the face of the grinding wheel while the grinding wheel is stationary. The front table is built in two sections. The top section (CC, Fig. 1) is pivoted at center for taper adjustment. The taper adjustment knob (V, Fig. 1) moves the top table. If any taper is encountered during grinding, loosen the two capscrews underneath and at the ends of the sub table (BB, Fig. 1) and turn the taper adjustment knob a slight amount to eliminate this taper. Example: If large end of taper is towards right end of machine, taper adjustment knob should be turned to the right, or clockwise.

506— PORTABLE COOLANT TANK

Figure 2 illustrates proper position and connection of the Portable Coolant Tank. To clean tank remove coolant pump, and disconnect coolant return hose. Tank can then be rolled to convenient area for cleaning. The portable coolant tank capacity is 30 gallons.

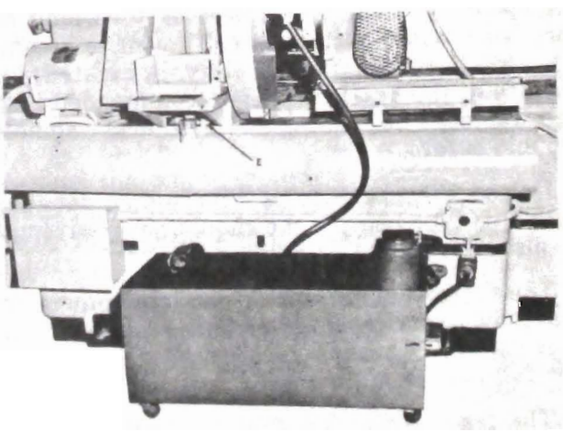


Figure 2 — Portable Coolant Tank

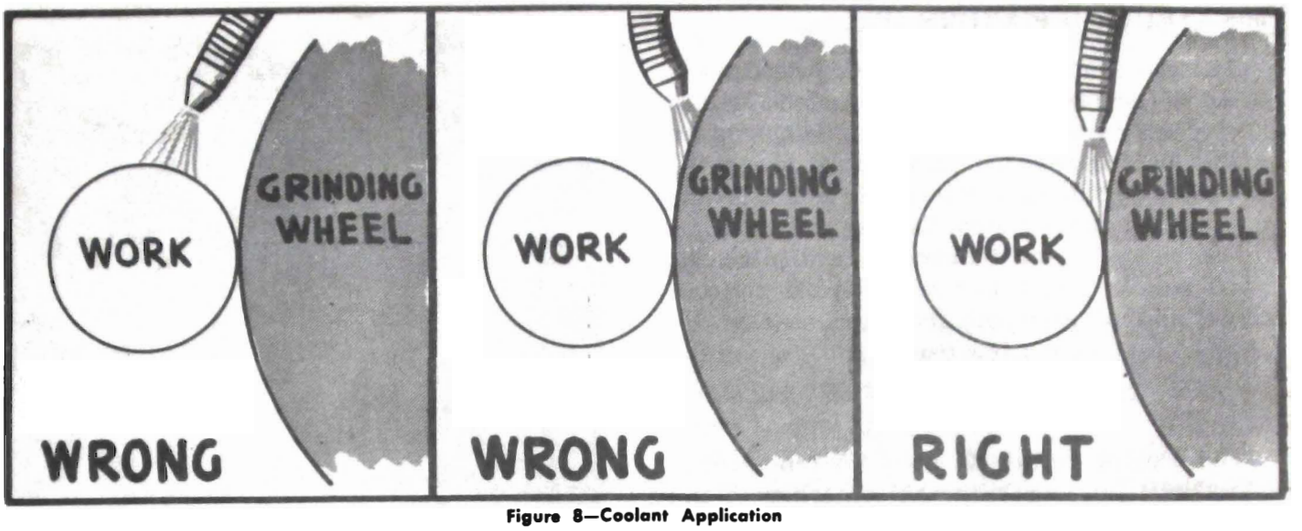


Figure 8—Coolant Application

Use of Coolant: Good grinding is almost impossible without a good coolant and the proper use of it. Be sure to have the proper coolant and keep it clean by filtering or changing as it becomes dirty. Use plenty of coolant when grinding and while dressing the grinding wheel. One of the most common causes of poor grinding is due to the improper use or the wrong type of coolant. The coolant MUST flow BETWEEN the work and the grinding wheel, not on top of the work or on the face of the wheel. (Fig. 8.)

507—STEADY REST (Figure 9)

The purpose of the steady rest is to hold the crankshaft steady and to eliminate whipping and vibration while grinding. The steady rest is clamped to the front table with lever (D, Fig. 9). If the lever fails to clamp the steady rest securely, adjust the screw underneath the lever block. To engage lower jaw (A), push knob (C) fully in and turn to the right one-fourth turn. The screw knobs (B) are used to adjust the steady rest jaws.

When using the steady rest, be sure that the jaws are always in contact with the journal when grinding . . . **never** put an excessive amount of pressure on the jaws. Any excessive pressure of the jaws against the crankshaft journal may tend to distort the chankshaft which will result in the journal being ground tapered or out-of-round.

The Model 15 steady rest jaws are tipped with good grade babbitt metal that is cast in place. The shoes may be retipped by placing the jaw in a vise and melting babbitt into place and then filing to shape or the jaws may be returned to the factory.

The Model 15A steady rest shoes are removable. These shoes are made of a good grade babbitt metal. The upper shoe is attached with a capscrew and the lower shoe has two bronze screws cast into it. These screws fit two holes in the lower jaw. Two bronze nuts are used to secure this shoe in place. These shoes are always available from stock for immediate shipment. It is recommended that a supply of these shoes be kept on hand.

The steady rest shoes should be filed flat, straight and smooth at regular intervals. Never allow the shoe tips to have burrs or marks on them.

The three screws (E, Fig. 9) on the 15A steady rest are used to adjust the upper jaw gib. This gib should be kept snug against the upper jaw so that excessive play is eliminated. The screw lock nuts are used to lock the screws in position after adjusting.

Always keep the screw threads and clamping mechanism slightly covered with oil to prevent rust and corrosion and to provide smooth operation.

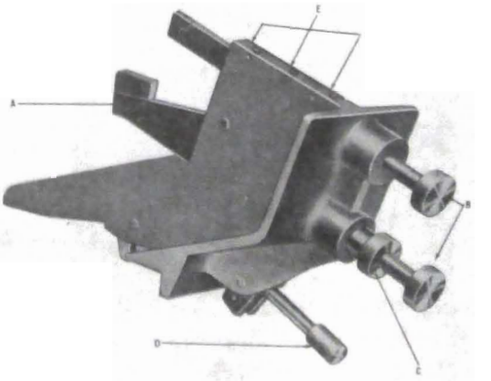


Figure 9—Steady Rest

508—TRUEING FIXTURE (Fig. 10)

The indicator (C, Fig. 10) is shipped in a separate box to prevent damage. Assemble as follows: Remove the tape from the trueing fixture shank and remove the small brass plug from the tape. Place the indicator into the hole at the knurled end of the shank. Remove the small set screw at the knurled diameter and place the brass plug in the tapped hole. Replace the set-screw and position the indicator so that its needle moves only a few marks and tighten the set-screw. The trueing fixture is now ready for use.

The trueing fixture is used for trueing the crankshaft journals with the centerline of the headstock and tailstock spindles before grinding.

The shank (A, Fig. 10) is adjustable to any position when the thumb screw (B) is loosened. The trueing fixture base is machined to fit the contour of the front table and is so balanced that it requires no clamping. Always be sure that the fixture fits securely against the front table for accurate readings. Protect the indicator from damage.

The plunger assembly should be removed and cleaned every two weeks. To remove, loosen the thumb screw and pull the entire shank and plunger assembly from the fixture base. Be sure not to lose the small brass plug that is under the thumb screw and protects the shank from damage. Loosen the small set-screw at the knurled diameter of the shank and remove the indicator. This set-screw also has a small brass plug under it that should be replaced when reassembling. Screw the knurled brass nut at the end of the shank out and the plunger may be pulled out. Clean all parts and apply a light coat of oil and reassemble. The indicator should be positioned in the shank so that its plunger just contacts the shank plunger so that the maximum travel of the indicator can be had for trueing.

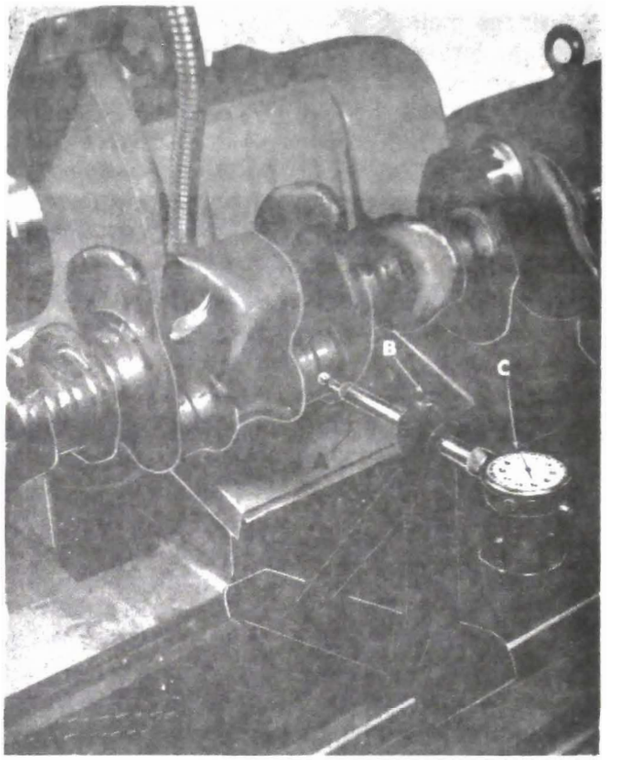


Figure 10—Trueing Fixture

NOTE: Never oil the indicator as this will damage it. Excessive oil on the plunger and mating parts should be avoided so that the oil does not work into the indicator.

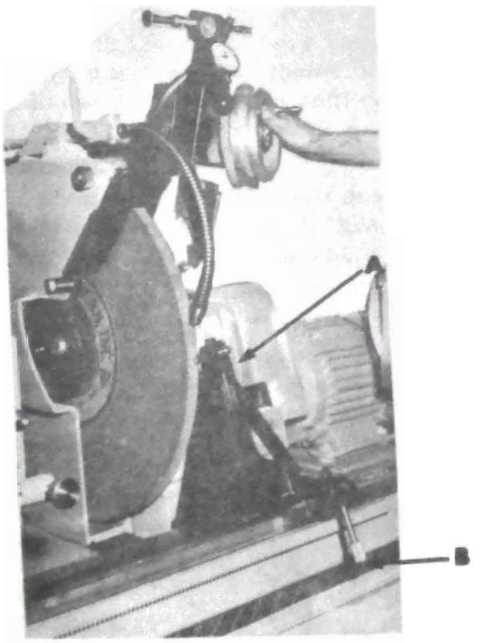


Figure 11—Wheel Dressing Fixture

509—WHEEL DRESSING FIXTURE (Fig. 11)

The wheel dressing fixture is clamped to the front table in the same manner as the steady rest. The clamp adjustment is also the same. The diamond shank (A) is held securely with a set-screw. Always be sure that the diamond is securely anchored to the fixture and that the fixture is securely anchored to the table with the locking lever (B). Failure to do this will result in an untrue surface and patterns on the

face of the grinding wheel which will cause imperfect grinding. Never allow the point of the diamond to protrude more than 5/8" past the fixture. Revolve the diamond shank slightly every few dressings to maintain a good cutting edge on the diamond.

510—DRESSING GRINDING WHEEL FACE (Fig. 11)

First, clamp the dressing fixture to the front table. Then, proceed as follows: Turn both switches on. Turn the coolant on. Bring the grinding wheel very lightly into contact with the diamond. Move the front table from side to side very slowly while feeding the grinding wheel forward no more than .001" each pass. Make four or five passes and "finish" with a .0005" cut.

CAUTION: Never dress the grinding wheel without using coolant on diamond. Never allow the back table to move while dressing the grinding wheel.

New operators will find it best to dress the grinding wheel before regrinding each crankshaft. After gaining experience, it will be necessary only when the wheel has become glazed or rough.

511—WHEEL SIDE DRESSING FIXTURE

The wheel side dressing fixture is furnished as extra equipment and is used for trueing the sides of the grinding wheel with the face and sizing the width. The same diamond that is used in the wheel dressing fixture may be used in this fixture, however, an extra diamond should be kept on hand for this purpose. The nose, (B, Fig. 12), is held to the frame of the fixture with the set-screw (A, Fig. 12). Two flat surfaces on the pilot diameter of the nose are provided so that the diamond will point slightly downward when the set-screw is tightened.

512—DRESSING GRINDING WHEEL SIDES

Clamp the wheel side dressing fixture in the chucks as shown in Fig. 12. Release work head lock shafts. Move coolant hose into position at the side of the grinding wheel and turn coolant on. Turn both motor switches on. Bring the diamond slightly into contact with the grinding wheel at the bottom and move the diamond up toward the center of the grinding wheel. Move diamond back down to the bottom of grinding wheel. Move the top table very slightly and take another cut.

IMPORTANT: Always use coolant on diamond when dressing grinding wheel. Always be sure that the diamond is locked tightly in position so that the diamond points slightly downward. Always bring the diamond from the bottom upward into the grinding wheel. Always dress both sides of grinding wheel.

513—ARNOLD GAUGE

All necessary information concerning mounting, use and maintenance of the Arnold Gauge is furnished in the carton in which it came.

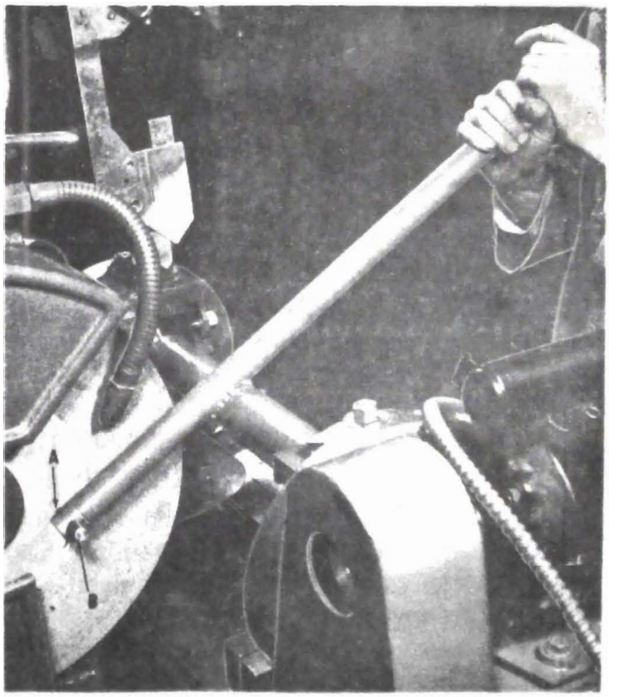


Figure 12—Wheel Side Dressing Fixture

600 - OPERATING INSTRUCTION

601—PREPARING CRANKSHAFT FOR GRINDING

First, clean the crankshaft thoroughly to remove all oil, sludge, carbon or other dirt and wipe dry. Be sure to clean all oil holes thoroughly before and after grinding.

Next, check the crankshaft for cracks, excessive bends and warpage . . . straighten if necessary . . . and be sure that the crankshaft centers are free from excessive burrs and rough spots.

NOTE: If the main bearing journals are to be ground on dead centers, the centers must be checked to be sure that they are true with the flywheel flange and the timing gear location. To check, place the chankshaft in the machine on dead centers and use the trueing fixture to determine the amount of run-out. If the run-out exceeds .002" at the flywheel flange, the centers must be re-cut. However, this is unnecessary if the mains are to be ground when using the cross-slide heads.

602—PLACING CRANKSHAFT IN MACHINE

Find the "stroke" of the crankshaft to be ground (listed in most bearing catalogs).

Engage the lockshafts into the work heads. Move the work head vertical slides to the proper setting according to the "stroke" of the crankshaft. Be sure that the cross slides are in the neutral position.

Place the timing gear end of the crankshaft on the headstock center and slide the tailstock housing along the table until its center is in contact with the flywheel flange center. Then, tighten the tailstock housing lock nut.

Screw the tailstock spindle handwheel until the spindle spring is compressed, that is, when the handwheel can no longer be turned. Then, turn the handwheel two turns in reverse. This assures spring tension against the spindle. Now, tighten the spindle lock handle.

Install the "Y" drivers on the crankshaft as shown in (D, Fig. 13), but do not clamp tight.

Four studs (F, Fig. 3) are furnished for holding the counterweights (G, Fig. 3) to the headstock and tailstock heads, two for each head. Place these studs into their holes located at the bottom of each head. These studs are removed when grinding main bearing journals.

Various sizes of counterweights are furnished as standard equipment, some made of cast iron and some of lead. The large weights must be used at the headstock as they will not clear the grinding spindle housing when used at the tailstock. Always use at least twice as much weight at the headstock as is used at the tailstock. Two lengths of spacers are furnished for placing on the counterweight studs when only a few counterweights are used.

603—TRUEING CRANKSHAFTS WITH MATING JOURNALS

Revolve the crankshaft so that the two end mating journals are approximately centered, that is, when they are at bottom dead center with respect to the centers or centered about the headstock and tailstock spindles. Tighten the "Y" drivers and place enough counterweights on their studs to balance the shaft when it is revolved.

Place the trueing fixture on the front table at one end of the end journals. Loosen the screw (A, Fig. 13) and move the indicator shank until the plunger ball touches the journal and moves the indicator pointer approximately .050". Then tighten the screw. Disengage the head lock shafts and revolve the crankshaft by hand. The indicator will indicate the amount of run-out. If the indicator indicates run-out of the "stroke," the elevating screw nut (A, Fig. 3 and A, Fig. 4) nearest the indicator needs adjusting as shown in Fig. 13. Revolve the micrometer dial one-half the indicated run-out. If the indicator shows side run-out, adjust the "Y" driver screws. Then move the indicator to the opposing mating journal at the opposite end. True

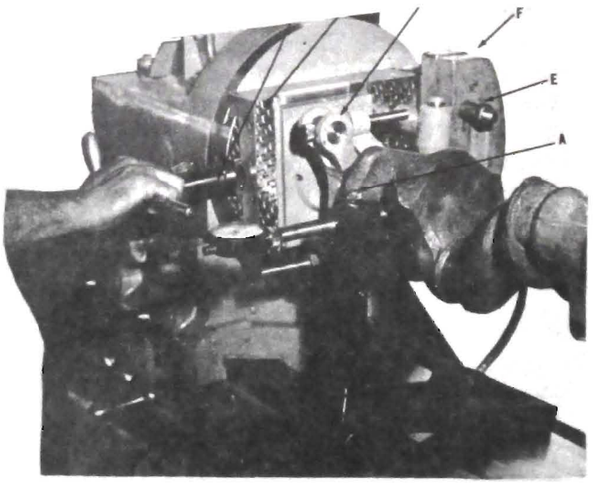


Figure 13—Adjusting Vertical Slide for Stroke Run-out

this journal the same as instructed above. When both mating journals run true they are ready for grinding.

If the "Y" driver screws fail to completely correct the "side" run-out, engage the work head lockshafts, loosen the "Y" driver clamps and slightly revolve the crankshaft into position. Tighten the "Y" driver clamps again and proceed as before.

After these mating journals are ground, the "Y" drivers are loosened and the crankshaft is revolved to bring the next pair of mating journals into position. These journals are then trued and ground as described above.

604—TRUEING CRANKSHAFT WITHOUT MATING JOURNALS

Some crankshafts for V-8, 4 cylinder and some 6 cylinder engines do not have mating journals. The following special instructions should be followed in trueing these crankshafts:

Place the crankshaft in the machine and set the "stroke" as described in section 603. Be sure that both the headstock and the tailstock vertical slides (B, Fig. 13) are at the same relative position when reading the micrometer dials; (C, Fig. 13). This is important to be sure that the main bearing journals are exactly parallel to the head and tailstock spindle.

Revolve the crankshaft so that one end journal is in grinding position and lock both "Y" drivers. Place the trueing fixture at this journal, release the head lock shafts and revolve the crankshaft. If the indicator shows "stroke" run-out, adjust the elevating screw nuts of BOTH heads half the amount of run-out. If side run-out is indicated adjust the "Y" driver screw.

Remember that when "stroke" adjustment is made on crankshafts that do not have mating journals, both vertical slides MUST be moved exactly the same amount to maintain parallelness of the main and rod journals.

605—MACHINE SET-UP FOR GRINDING MAIN BEARING JOURNALS

NOTE: The flywheel flange of the crankshaft must be at the tailstock for this operation. Remove the counterweights and the counterweight studs from both the headstock and tailstock

Screw the work head vertical slides down to "O".

Remove the "Y" driver and the "Y" driver posts from the tailstock.

Insert the special main bearing driver dog (A, Fig. 14) into the driver post hole in the vertical slide and bolt to the flywheel flange.

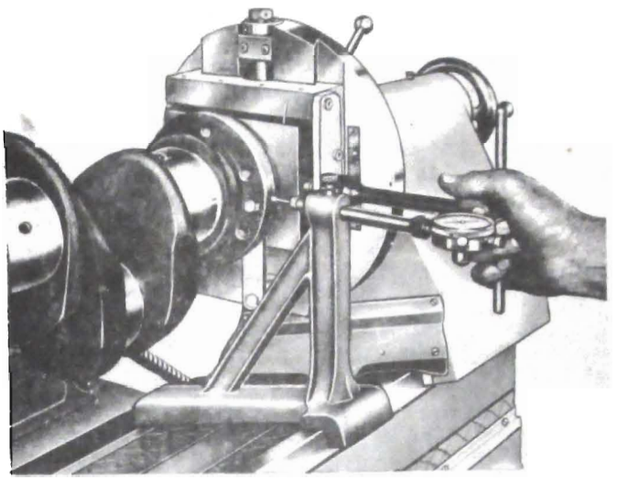


Figure 14—Set-up for Grinding Main Journals on Live Centers

CAUTION: Do not tighten the driver dog to vertical slide or flywheel flanges EXCEPT WITH THE FINGERS—this may leave a slight amount of play, but it will not affect the grinding.

Place the trueing fixture on the front table so that the indicator rod touches the flywheel flange. (See Fig. 14). Rotate the crankshaft by hand. Correct for misalignment by adjusting the vertical slide or the cross slide, or both.

Move the trueing fixture to the timing gear location or the unworn portion of the front main bearing and correct for misalignment.

When the flywheel flange and the timing gear location run true, the shaft is ready for grinding.

NOTE: Maximum run-out of the flywheel flange and timing gear location should never exceed .002".

606—MACHINE SET-UP FOR GRINDING MAIN BEARING JOURNALS ON DEAD CENTERS

The headstock and tailstock work head slides must be removed for dead center grinding. To remove, loosen the vertical slide gib screws and remove the two capscrews (C, Fig. 14). The entire elevating head may now be removed by lifting it off the work head.

Remove all counterweights. Remove the counterweight studs from the tailstock. Place the dead centers furnished into the taper of the headstock and tailstock spindles. This taper is a self-locking taper. The headstock center is removed by inserting a small rod into the hole

at the rear end of the spindle and tapping lightly until the center is released. The tailstock center is removed by turning the handwheel so that the spindle is retracted into the housing. When the spindle is completely retracted, its screw will push the center out.

Position the tailstock according to the length of the crankshaft and place the crankshaft in place on the centers. Apply spring tension against the tailstock spindle with its handwheel as explained before and lock the spindle with the lock handle. Place the "Y" driver in position at the headstock as shown in Fig. 14-A and clamp tight. The crankshaft is now ready for grinding.

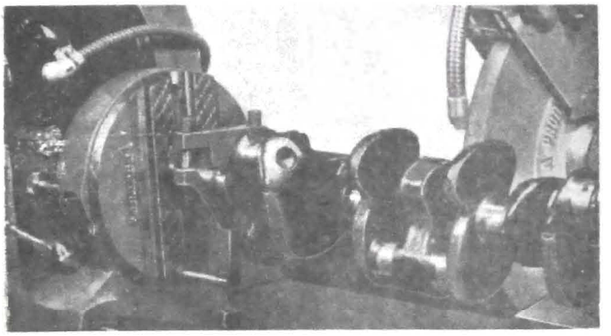


Figure 14A—Set-up for Grinding Mains on Dead Centers

Always use white lead or Dixon's lathe center graphite lubricant, which can be purchased from Storm-Vulcan or from machinery suppliers, on the dead centers as a lubricant to prevent scoring and marring the centers. However, a lubricant should never be applied to the tapered portion of the center as this would prevent it from seating properly in the spindle.

607—USE OF STEADY REST WHEN GRINDING MAIN BEARING JOURNALS

Place the steady rest at one of the center journals (preferably the one nearest the tailstock) and grind this journal to size. Leave the steady rest at this journal and grind the other main journals.

NOTE: Sometimes it may be necessary to use two steady rests, one at each center main. Only one steady rest is furnished as standard equipment with the grinder, however, these assemblies are carried in stock at the factory for immediate shipment for those who desire them.

608—GRINDING THE CRANKSHAFT

After the crankshaft has been trued, all of the rod journals should be measured with a micrometer to determine the worst journal. If the worst journal requires .020" stock removal from its diameter to clean up, then all of the other journals should be ground .020" undersize so that all journals are alike.

Repeat the above procedure for determining the correct undersize to grind main bearing journals.

After the first journal has been ground to size (as determined with a hand micrometer), the Arnold Gauge should be placed on the journal and set at "O". However, if it is known that for example .010" needs to be ground from the first journal, the Arnold Gauge can be placed in position on the journal immediately and then set at "O" after the .010" has been removed. This "O" setting is used for grinding all of the remaining journals to size. The Arnold gauge then insures quick accurate work. The Arnold gauge will also indicate a journal that is out-of-round.

Be sure to move the front table from side to side so that the entire length of the journal is ground to the same size if "plunge" grinding is not used. Also be sure to touch the fillets of the journal so that they will be square and true.

Plunge grinding is defined as follows: the grinding wheel is dressed to the exact width of the journal to be ground and has the proper fillet radius. The wheel is then aligned perfectly with the journal and is fed straight in until the journal is ground to the proper undersize. When plunge grinding is used, it is unnecessary to move the front table from side to side and is therefore faster.

The grinding wheel must be allowed to "spark-out" when finishing in order to obtain the highest quality finish. Otherwise, the journal would be marked and scratched.

NOTE: After the crankshaft has been ground, it should be cleaned all over and have applied to it a good grade rust inhibitor.

700 - REPAIR AND MAINTENANCE

701—LUBRICATION

Bed and Table Ways: With table traverse handwheel, move the tables their maximum distance and raise the guards at the table ends. This will uncover the oil wells in the bed ways. Keep these wells filled with No. 65 extreme pressure lubricant or equivalent. Move the tables their maximum distance in the opposite direction and fill the four remaining wells.

Also, keep the oil cup in the center of the front table filled with this lubricant.

The BIJUR ONE SHOT oiling system also lubricates the table ways and the wheel slide. Keep filled with APG 140 or equivalent. Pull plunger 4 times daily.

It is very important that only an extreme pressure lubricant be used for the lubrication of the table ways and the wheel slide ways.

These wells must be filled at least once a week. They should be thoroughly cleaned out and refilled with fresh oil at least once every two weeks to prevent grinding dust and coolant from wearing and corroding the ways.

Headstock: Check the headstock gear grease once every week by lifting the cover of the fitting at the left side of the headstock housing (DD, Fig. 1). Keep the grease filled to level. Use Texaco Meropa No. 3 or equivalent.

The work head spindle bearings are permanently lubricated and should require no further attention. If, however, the work head and spindle is disassembled, pack the bearing chamber one-half full with Texaco Regal Starfak No. 2 or equivalent.

Tailstock: Fill the oil cups on top of tailstock housing with Texaco Regal PE (R&O) or equivalent once every week. The tailstock work head spindle bearings are permanently lubricated and should require no further attention. If, however, the work head and spindle are disassembled, pack the bearing chamber one-half full with Texaco Regal Starfak No. 2 or equivalent.

Wheel Head: The grinding wheel spindle is permanently lubricated and should require no further attention. If, however, the spindle should be disassembled, pack the bearing chambers one-half full with Texaco Regal Starfak No. 2 or equivalent.

When the slide is full forward, fill the two oil cups back of the spindle housing with No. 65 extreme pressure lubricant or equivalent. Fill at least once every week.

Add a small amount of Texaco Regal PE (R&O) or equivalent to the feed-up worm gears through the oil cup or by removing the cover once every week. Also add a small amount of this oil to the oil cup once every week.

Rapid Retraction and Table Traverse Gears: There are five oil cups at the rear of the cabinet with one oil cup at the front of the cabinet. Add Texaco Regal PE (R&O) or equivalent to these oil cups every week. Also put a small amount of this oil on the gear shaft and gears at the rear of the cabinet once every week.

Miscellaneous Lubrication: Always keep an oil can filled with Texaco Regal PE (R&O) handy for miscellaneous lubrication.

Before sliding the headstock housing or the tailstock housing to a different position on the front table, be sure to wipe the table clean and apply a small amount of oil from the oil can to the table. This is very important to prevent excessive wearing of the mating surfaces which would prevent the spindle center-lines from lining up.

Always keep all screws and moving parts clean and oiled to prevent gumming and corrosion.

The operator should make a daily habit of cleaning the grinder at the end of each day's work to prevent damage from corrosion.

Be ever mindful that a grinding machine is constantly subjected to a cloud of grinding dust and coolant that will, in time, wear the moving parts. A little thoughtfulness on the part of the operator concerning lubrication and cleaning will greatly increase the life of the machine.

702—ADJUSTING RAPID RETRACTION—ADJUSTING LOCK

Two adjustments are provided for the rapid retraction lock. The tension adjusting screw located at the bottom front of the wheel head base just below the hinged splash guard (L, Fig. 5) determines the amount of pressure necessary to lock the rapid retraction. This screw should be kept in a position that will require a slight amount of pressure when turning the retraction handle to lock the rapid retraction.

The stop adjusting screw at the rear (E, Fig. 2) stops the retraction lever. This screw should be in a position that will allow the retraction lever to pass a slight amount past center when the rapid retraction is locked. Be sure to hold the screws in position while locking the nuts.

703—HEADSTOCK AND TAILSTOCK SPINDLE BEARINGS

The headstock and tailstock spindles are equipped with sealed ball bearings. These bearings are adjusted with the nuts at the end of the spindles. These nuts are accessible when the

work head vertical slides are removed. The headstock nut has left hand threads and the tailstock has right hand threads. These bearings should be adjusted until only a slight amount of drag is noticed when the driving heads are revolved by hand.

DO NOT adjust too tight as this will damage the bearings and impair the accuracy of the machine.

704—ELEVATING HEAD AND CROSS SLIDE GIBS

The vertical slides and the cross slides have gibs that are adjustable to hold the proper tension on the dovetails. Each gib has four screws for adjustment. These gibs must always be kept as tight as possible, yet still have face movement. Never allow the gibs to have any slack.

705—REPLACING HEADSTOCK DRIVING HEAD BELTS

The headstock work head is driven by two matched "V" belts. To replace these belts, remove the sheet metal guard located back of the work head. This guard is bolted to the housing with five machine screws.

Next, remove the motor and loosen the two set screws holding the spindle. Remove the idler pulley assembly by removing the small Allen head capscrew (Q, Fig. 3 and turn the adjusting screw (R, Fig. 3) counter-clockwise until the assembly is free to be removed. Then, loosen the set screw in the small pulley on the drive shaft. Pull the entire work head and spindle assembly away from the housing while also at the same time pulling the smaller pulley off the drive shaft. Replace the belts and reassemble.

Always be sure to purchase matched belts for this replacement.

706—ADJUSTING HEADSTOCK MOTOR PULLEY TENSION

This belt is adjusted by loosening the motor mounting screws and shifting the motor until the proper belt tension is reached. Tighten the motor mounting screws.

707—ADJUSTING HEADSTOCK DRIVING HEAD BELT TENSION —MODEL 15A ONLY

The headstock head is driven by two concealed "V" belts located just back of the head and inside the bell section of the headstock housing. The belts are adjusted for tension with the screw (R, Fig. 3). This screw moves an idler pulley which applies the belt tension. To adjust, remove the small Allen head capscrew (Q, Fig. 3) and turn the adjusting screw clockwise to apply tension or counter-clockwise to remove tension. After the adjustment has been completed, reinstall the Allen head capscrew. This capscrew keeps the adjusting screw from moving and relieving the belt tension. Care should be used in adjusting these belts, as excessive tension will wear the belts rapidly.

CAUTION: The headstock motor belt is a special balanced and tested "V" belt. DO NOT replace this belt with a standard belt. A standard belt will cause excessive vibration that will appear as chatter on the work. It is imperative that a balanced belt be used at the headstock motor.

708—ADJUSTING WHEEL HEAD BELT TENSION

The grinding spindle is driven by six "V" belts that are located inside the belt guard (C, Fig. 5). Tension is constantly applied to these belts by the torsion spring (B, Fig. 15). If the belts require adjustment, proceed as follows: Bring the wheel head to the forward grinding position and remove the belt guard. This guard is removed by lifting up at the back and out at the bottom and then upward. Hold the pulley idler arm in toward the spindle and slip the belts from the idler pulley. Rest the idler arm against the top of the back table and loosen the set-screw (A, Fig. 15) at the outer edge of the spring collar. Revolve the spring collar toward the rear of the machine and tighten the set-screw. Lift the idler arm up close to the spindle and reinstall the belts. Then, place the belt guard back into position.

CAUTION: The six matched "V" belts at the wheel head are special balanced and tested "V" belts. DO NOT replace these belts with standard belts. Standard belts will cause excessive vibration that appears as chatter on the work. It is imperative that six balanced belts, matched for length, be used at the wheel head.

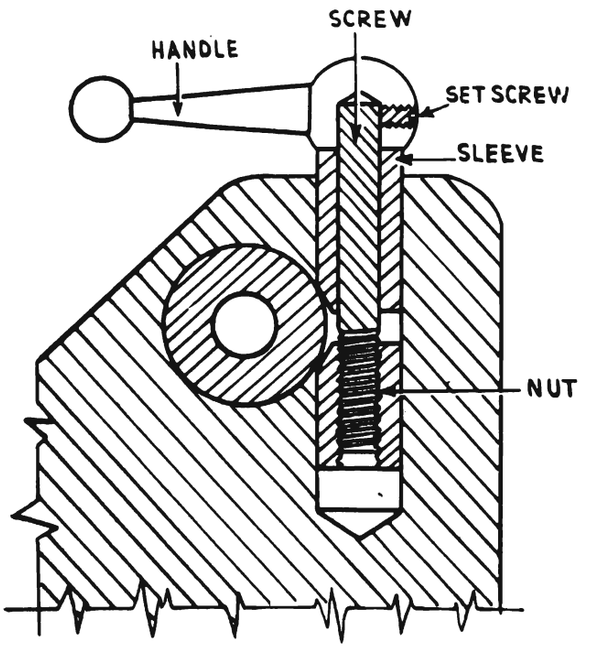


Figure 16—Tailstock Spindle Lock

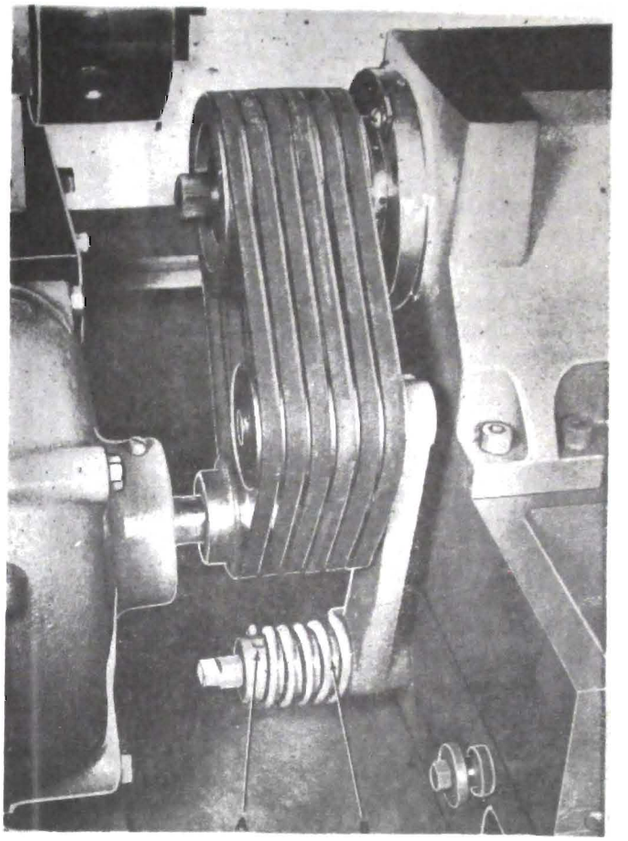


Figure 15—Adjustment for Wheelhead Belt Tension

709—ADJUSTING TAILSTOCK SPINDLE LOCK (Fig. 16)

The tailstock spindle lock consists of the handle, screw, sleeve and nut. When the handle is turned, the screw pulls the nut up and this action forces the sleeve down. This causes a wedging action which locks the spindle. Should the handle be out of position when the spindle is locked, it may be adjusted by loosening the set-screw on the side of the handle and placing the handle where desired and then retightening the set-screw. Be sure that the lock is tight against the spindle before adjusting.

TROUBLE	CAUSE	CORRECTION
Chatter Marks		
Regularly spaced marks.	General vibration.	Tighten motor mounting bolts. Check motor bearings and balance of motor.
	Loose spindle pulley.	Tighten pulley.
Regularly but widely spaced marks.	Bad driving belts.	Replace belts.
	Worn out idler pulley bearings.	Replace bearings.
Long, regularly spaced chatter marks that form a checkerboard pattern.	Wheel out of balance.	Balance wheel on wheel mount, repeat after trueing. If trouble persists, run wheel without coolant to throw off excess water and store on side to prevent water from settling at lower edge of wheel.
	Wheel out of round.	True before and after balancing. True sides to face.
Chatter marks have same frequency with building vibration.	Building vibration.	Install mounting pads or move machine to different location in building.
Chatter marks fairly long, wide and evenly spaced at wide intervals and discolored; wheel glazed or loaded.	Wheel too hard.	Use softer grade or coarser grit wheel (also see Wheel Glazing).
Irregular chatter marks when using dead centers.	Work centers not true.	Check fit of centers and lubricate point with white lead.
Chatter marks that form checkerboard pattern.	Faulty dresser.	Replace worn-out diamond. Tighten set-screw holding diamond.
	Diamond cracked or loose.	Replace or reseat diamond.
	Dresser not rigidly clamped to table.	Adjust cam clamp.
General	Dressing	Use sharp diamond rigidly held close to wheel.

NOTE: Out-of-balance wheels can cause different patterns of chatter depending upon the amount of out-of-balance. Wheels should be balanced as accurately as possible.

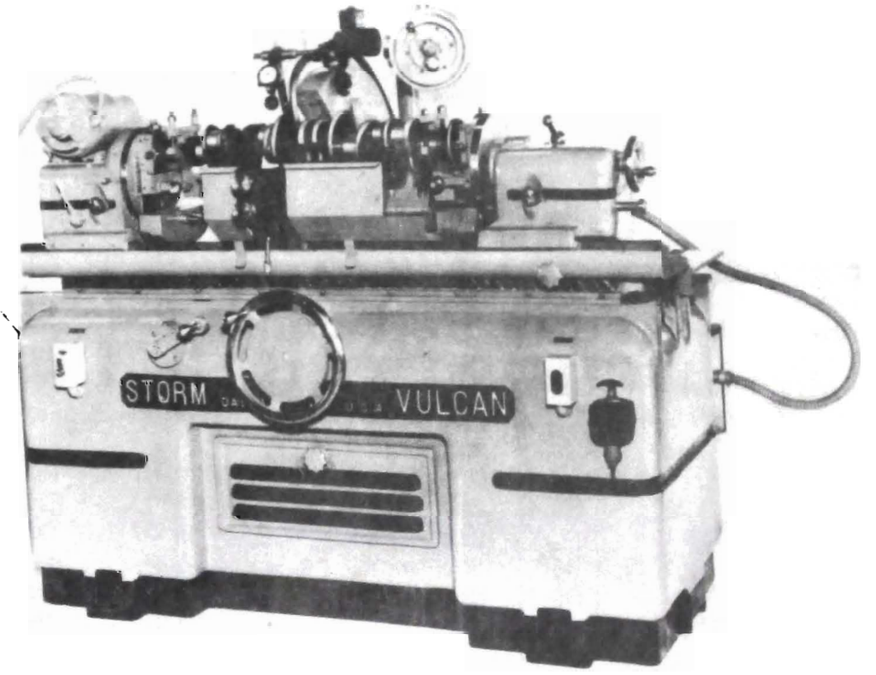
TROUBLE	CAUSE	CORRECTION
Scratching of Work		
Narrow and deep regular marks.	Wheel too coarse.	Use finer grit wheel.
Wide irregular marks of varying depth.	Wheel too soft.	Use harder grade wheel.
Widely spaced spots on work.	Oil spots or glazed areas on wheel face.	Balance and true wheel. Avoid getting oil on face of wheel.
Uneven marks on work.	Bad vee belts.	Replace spindle belts. Purchase set of six matched belts.
Fine spiral or thread on work.	Faulty wheel dresser.	Replace cracked diamond; reseat diamond; use slower traverse speed; revolve diamond slightly every fifth dressing; tighten set screw on diamond. Dress with less in-feed; do not allow diamond to stop while in contact with wheel; do not start dressing on wheel face. Move diamond evenly across face of wheel; round off edges of wheel.

TROUBLE	CAUSE	CORRECTION
	Sagging work.	Provide additional steady rests.
Wavy traverse lines.	Ragged wheel edges.	Round off wheel edges.
Occasional deep marks.	Faulty wheel dressing.	Replace worn out diamond; revolve diamond slightly; flush wheel with coolant after dressing.
	Coarse grits or foreign matter in face of wheel.	Dress wheel.
	Bond disintegrates, grit pulls out.	Coolant too alkaline for wheel bonding material; decrease soda content or change coolant.
Irregular marks.	Loose dirt settling on machine.	Keep air and shop clean. Clean machine daily.
Irregular marks of various lengths and widths; scratches usually fish-tail.	Dirty coolant.	Change coolant; clean coolant tanks, hose and wheel guard.
Deep irregular marks.	Loose wheel flanges.	Tighten flanges; use blotters between mount and wheel.
Grit marks.	Wheel too soft or too coarse.	Change Wheel.
	Dressing too coarse.	Finer in-feed and slower traverse while dressing.
	Improper procedure.	Allow wheel to "spark-out" when finishing.
Grinding Grade of Wheel		
Lack of cut; glazing, loading, burning of work; chatter.	Wheel acts too hard.	Open up wheel grit by sharper dressing; increase in-feed wheel pressure; discard gummy coolant; use coarser grit or softer grade wheel. Increase work speed.
Wheel marks on work; short wheel life; wheel not cutting properly.	Wheel acts too soft.	Decrease work speed and in-feed wheel pressure; dress wheel with slow traverse and less cut; change coolant.
Wheel Loading		
Metal particles lodged on abrasive grains or in wheel pores.	Incorrect wheel.	Use coarser grit or more open structure to provide chip clearance; use more coolant.
	Faulty dressing.	Replace worn-out diamond.
	Faulty coolant.	Coolant too thick or heavy; change dirty coolant.
Wheel Glazing		
Shiny appearance and slick feel.	Improper wheel.	Use coarser grit or softer grade wheel or manipulate wheel to get softer grinding effect.
	Improper dressing.	Use sharp diamond; turn diamond ¼ turn every fifth dressing; use faster traverse and deeper penetration.
	Faulty operation.	Use more in-feed.

TROUBLE	CAUSE	CORRECTION
	Faulty coolant.	Use less oily coolant; use more coolant; increase soda content if water is hard; don't use soluble oils in hard water. NEVER use straight oil coolants.
Inaccurate Work		
Work out of round.	Expansion of work.	Keep temperature of work down by using more coolant and lighter cuts.
	Work out-of-balance in machine.	Correct with counterweights.
	Faulty operation.	Use less steady rest pressure.
Tapered journals.	Faulty grinding machine.	Correct worn ways and alignment of tailstock and headstock; tighten headstock and tailstock spindle bearings; replace worn-out bearings; level machine.
	Improper dressing.	Check dressing fixture for rigidity; check diamond; move point of diamond closer to fixture.
	Improper operation.	Use harder wheel.
NOTE: Machine MUST be level in all directions to insure accurate work.		
Checking of Work		
Work has check marks.	Improper grinding.	Prevent wheel from acting too hard. Don't force wheel into work; use more even flow of coolant; adjust idler to prevent belt slippage.
Burning of Work		
Work shows discoloration.	Improper wheel	Use softer wheel; manipulate wheel to get softer effect; prevent glazing and loading; use more coolant; prevent chatter.
	Faulty operation.	Use less in-feed; eliminate belt and wheel slippage; prevent slippage of work.
Wheel Breakage		
Radial break, three or more pieces.	Improper mounting.	Use blotters between mount and wheel; correct uneven flange pressure; prevent dirt between mount and wheel.
	Faulty operation.	Prevent overheating due to lack of coolant or excessive wheel pressure on work.
	Faulty grinding wheel.	Sound wheel before mounting by tapping lightly to be sure that it was not damaged in transit or in handling.
Radial break, two pieces.	Flange too tight.	Avoid excessive strains on sides of wheel. Tighten flange as explained under Wheel Mounting.

ILLUSTRATED

PARTS CATALOG



Model 15

CRANKSHAFT GRINDER

STORM VULCAN

AUTOMOTIVE ENGINE REBUILDING EQUIPMENT • 2225 BURBANK STREET • DALLAS, TEXAS 75235 • 214/637-1430

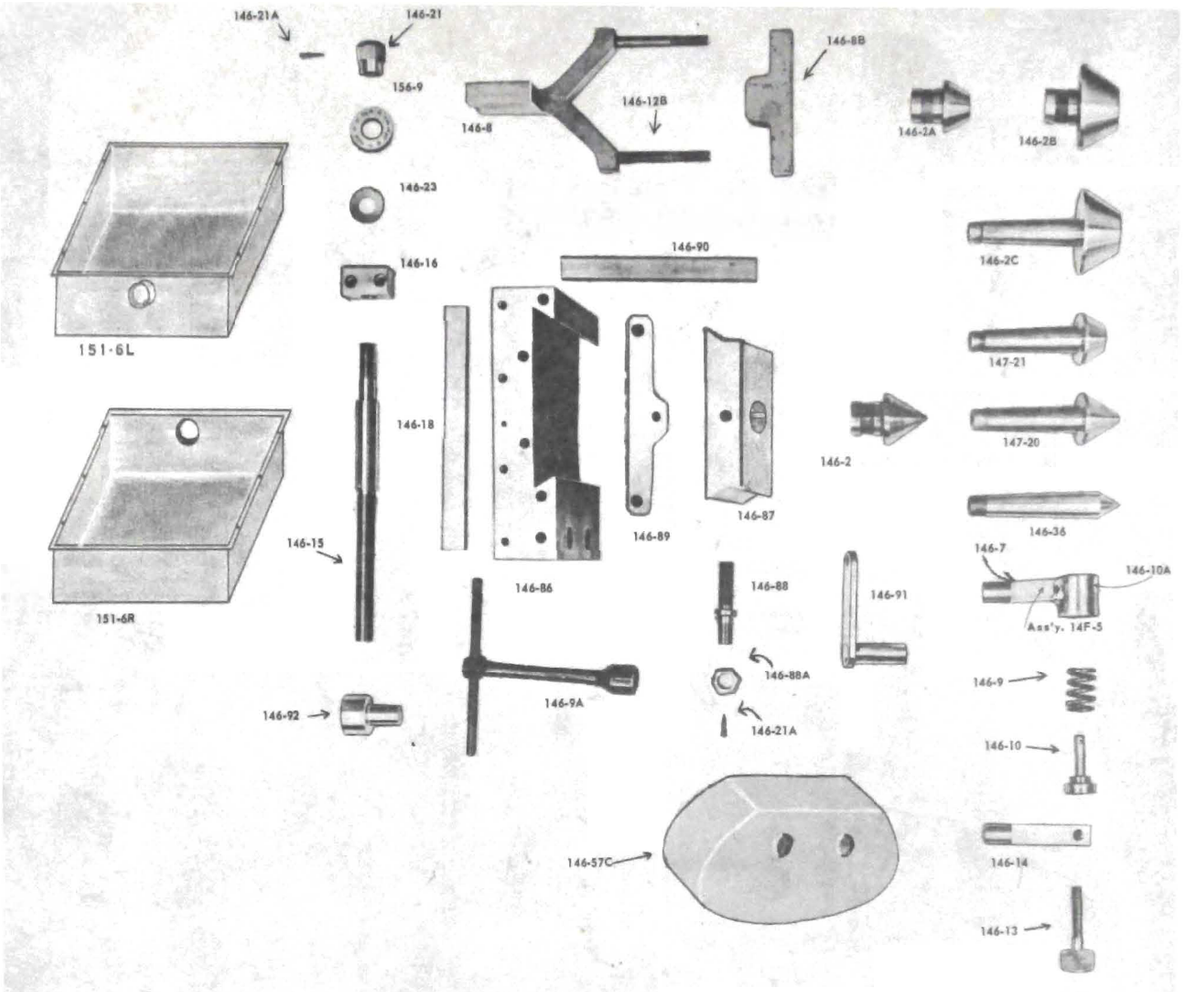
Be Sure to Give Number and Name of Part When Ordering

141–3	Knob (1 each, Front Door & Taper Adjustment)
141–6	Coolant Pump
143–2	Back Table & Retr. Shaft Bearing (2 Reqd.)
143–5	Bed "V" Oil Roller (4 Reqd. Not shown)
143–10	Table Traverse Gear (2 Reqd.)
143–11	Table Traverse Gear
143–16	Handwheel Handle
143–24	Bed Flat Oil Roller (4 Reqd. Not shown)
143–29	Intermediate Shaft Bushing
143–32	¾" Freeze Plug (2 Reqd.)
143–33B	Switch Box (Headstock & Pump)
143–33C	Push Button (Grind Wheel)
143–33D	Magnetic Switch (Grind. Wheel)
143–33E	Junction Box
143–33F	Junction Box Cover
143–38	½" Street Elbow (2 Reqd.)
144–7	Taper Adjustment Pin
144–8	Top Table Water Guard
144–8A	Top Table Water Guard Gasket
144–9	Sub Table Lock Washer (2 Reqd.)
145–3	Taper Adjustment Nut
145–4	Taper Adjustment Screw
145–5	Taper Adjustment Collar
145–6	Taper Adjustment Washer
146–2	Headstock Center, Pointed (2 Required)
146–2A	1-7/8" Center, Blunt
146–2B	3" Center, Blunt
146–2C	3" Center, Blunt #3 Morse Taper
146–2D	3" Center, Blunt, Extra Long, Optional, Not shown.
146–2E	1-7/8" Center, Pointed, Extra Long, Optional, Not shown.
146–2F	1-7/8" Center, Blunt, Extra Long Optional, Not shown.
146–7	Spring Drive Post (2 Reqd.)
146–8	"Y" Driver (2 Reqd.)
146–8B	"Y" Driver Clamp (2 Reqd.)
146–9	Driver Post Spring (2 Reqd.)
146–9A	Elevating Screw Wrench
146–10	Drive Post Plunger (2 Reqd.)
146–10A	Driver Post Plunger Housing (2 Reqd.)
14F–5	146–7 and 146–10A Welded Together (2 Reqd.)
146–12B	"Y" Driver Stud (4 Reqd.)
146–13	Driver Screw (2 Reqd.)
146–14	Front Drive Post (2 Reqd.)
146–15	Elevating Screw (2 Reqd.)
146–16	Elevating Screw Guide (2 Reqd.)
146–18	Throw Head Slide Gib (2 Reqd.)
146–21	Elevating Screw Adj. Nut (2 Reqd.)
146–23	Elevating Screw Dial Washer (2 Reqd.)
146–36	#3 Morse Dead Center
146–46	Head Drive Pulley
146–48	Worm Shaft Ball Bearing (2 Reqd.)
146–49	Worm Gear Shaft Ball Bearing (2 Reqd.)
146–51	Hold Down Nut (2 Reqd.)
146–56	Small Counterweight (Not shown)
146–57	Large Counterweight (Not shown)
146–57A	Counterweight Stud, Head (2 Reqd.) 5½"
146–57C	Medium Counterweight
146–57D	Counterweight Stud, Tail (2 Reqd.) 4"
146–57E	Medium Counterweight, Lead (Not shown)
146–57F	Large Counterweight, Lead (Not shown)
146–65	Head Drive Belt (2 Reqd.)
146–66	Motor Belt
146–75	Head and Tailstock Head Bearing Retaining Ring (4 Reqd.)
146–76	Counterweight Stud Spacer (4 Reqd.)
146–77	Work Driver Stud Spacer, (Tailstock – 4 Reqd.)
146–86	Headstock Throw Head
146–87	Head & Tailstock Center Cross Slide (2 Reqd.)
146–88	Center Cross Slide Screw (2 Reqd.)
146–88A	Nut, Cross Slide screw (2 Reqd.)
146–89	Center Cross Slide Plate (2 Reqd.)
146–90	Center Cross Slide Gib (2 Reqd.)
146–91	Driver Dog for Grinding Mains
146–92	Elevating Screw Nut (2 Reqd.)
146–93	Center Cross Slide Pointer (2 Reqd.)
147–4A	Tailstock Screw
147–5	Tailstock Screw Nut
147–6	Tailstock Screw Thrust Collar
147–7	Tailstock Screw Thrust Washer
147–9	Spring Retainer Plate
147–10	Tailstock Spindle Spring
147–13	Feed Up & Tailstock Hand Wheel (2 Reqd.)
147–20	Tailstock Spindle Center, Pointed with #3 Morse Taper
147–21	Tailstock Spindle Center, Blunt with #3 Morse Taper
147–32	Tailstock Throw Head Slide
148–2	Steady Rest Screw (2 Reqd.)
148–3	Upper Jaw
148–4	Lower Jaw
*148–5	Cam Rod
*148–6	Lock Cam
148–7	Rapid Release Nut
148–8	Lower Jaw Arm
148–9A	Steady Rest & Diamond Dresser Cam Pin (2 Reqd.)
148–10	Steady Rest & Diamond Dresser Cam Handle (2 Reqd.)
148–11	Lower Jaw Pivot
148–12	Steady Rest & Diamond Dresser Cam Rod Pin (2 Reqd.)
148–13	Rapid Release Pin
148–14	Steady Rest & Diamond Dresser Lock Foot Pin (2 Reqd.)
148–16	Steady Rest Cover Plate
148–20	Steady Rest Bushing
148–21	Steady Rest & Diamond Dresser Clamp Foot (2 Reqd.)
148–22	Steady Rest Base
149–2	Back Table End Way Guard (2 Reqd.)
1410–8	Wheel Slide Flat Oil Roller
1410–9	Wheel Slide "V" Oil Roller
1410–10	Flat Oil Roller Spring

IMPORTANT—Specify Model and Serial Number of Machine When Ordering Parts

* Steady Rest & Diamond Dresser.

Be Sure to Give Number and Name of Part When Ordering



1410–11 "V" Oil Roller Spring	1412–21K Grinding Wheel (2")	1416–6 Headstock Worm
1410–18 Pulley Idler Spring	1412–25 Neoprene Washer for Mounting Motor (8 Reqd.)	1416–7 Female Worm Gear Clutch
1410–20 Idler Pulley Ball Bearing (2 Reqd.)	1413–1A Grinding Wheel Guard Cover	1416–8 Male Worm Gear Clutch
1410–21 Idler Arm Shaft	1414–1A Trueing Fixture Base	1416–9 Worm Gear Shaft Key
1410–22 Spring Tightener Collar	1414–3 Spring	1416–10 1–3/4 Expansion Plug
1411–17 Retracting Slide Guard	1414–5 Rod Holder (2 Reqd.)	1416–11 Worm Gear Shaft Oil Seal Retainer
1411–18 Retracting Slide Guard Spring	1414–7 Indicator Bracket	1416–11A Gasket Seal Retainer (2 Reqd.)
1412–21 Grinding Wheel (1")	1414–8 Indicator Rod Button	1416–12 Oil Seal
1412–21E Grinding Wheel (1 1/8")	1414–9 Thumb Screw	1416–13 Worm Shaft Spacer
1412–21J Grinding Wheel (1 3/16")	1414–10 Indicator Rod	1416–14 Worm Shaft Oil Seal Retainer
1412–21B Grinding Wheel (1 1/4")	1414–11 Indicator Arm	1416–15 Clutch Engager Shaft Lever
1412–21F Grinding Wheel (1 3/8")	1420–2A Indicator For Trueing Fixture	1416–18 Clutch Engaging Arm
1412–21H Grinding Wheel (1 7/16")	1416–2 Worm Gear Shaft Bearing Cap	1416–19 Worm Shaft
1412–21C Grinding Wheel (1 1/2")	1416–3 Worm Gear Drive Shaft	1416–20 Headstock Oil Retaining Plate
1412–21D Grinding Wheel 1 11/16")	1416–4 Worm Gear Shaft Spacer	1416–20A Gasket, Retaining Plate
1412–21G Grinding Wheel (1 3/4")	1416–5 Headstock Worm Gear	

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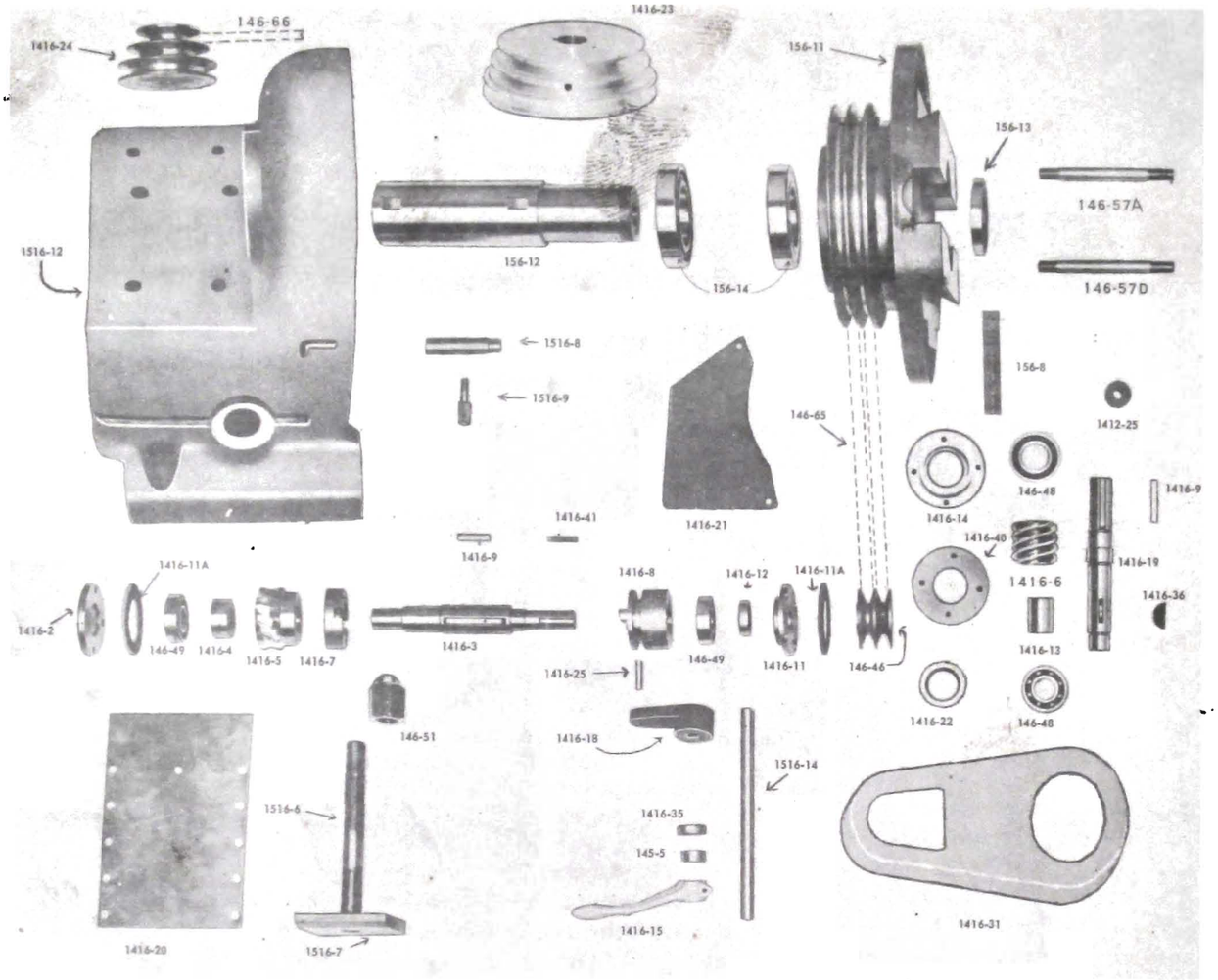

1416–21	Headstock Pulley Splash Guard	1420–3	Machine Leveling Pads (4 Reqd.)	151-1A	Bed
1416–22	Oil Seal	1420–4	Leveling Pad Plates (4 Reqd.)	151–2	Front Door
1416–23	Headstock Drive Pulley	1420–5	Diamond	151–3	Front Door Latch
1416–24	Headstock Motor Pulley	1420–6	Grinding Compound (25 lbs.)	151–4	Front Door Latch Stud
1416–25	Clutch Arm Pin	1420–6A	Grinding Compound (5 lbs.)	151–5	Rear Door
1416–31	Headstock Pulley Guard	1420–7	1-1/4 Box Wrench	151–6L	Coolant Pan
1416–32	Pulley Guard Stud	1420–8	Grinding wheel Slide Dresser Assembly	151–6R	Coolant Pan
1416–34	Headstock Motor (Not Shown)	1420–8A	Side Dresser Frame	151–7	Coolant Pan Hose
1416–35	Clutch Shaft Oil Seal CR5062	1420–8C	Side Dresser Diamond Holder	151–8	Coolant Pan Hose Clamp (2 Reqd.)
1416–36	#13 Woodruff Key	1420–8D	Side Dresser Diamond With Threaded Shank	153–1	Intermediate Shaft Bearing
1416–37	Neoprene Washer for Mounting Motor (8 Reqd.)	1420–10	Balancing Arbor (Optional)	153–2	Handwheel Shaft Bearing
1416–40	Bearing Cap Gasket	1420–10A	Wheel Balancer (Spirit Level Type, Optional)	153–3	Handwheel
1416–41	Worm Gear Shaft Pulley Key	1420–11	Special "Y" Driver, Use 15A–111 (Optional)	15C–5	Handwheel Assembly Complete
1420–1	Arnold Gage			153–6	Intermediate Shaft
1420–1C	Arnold Caliper 3" – 5"			153–7	Water Return Pipe
				153–8	1/2" Conduit Pipe (2 Reqd.)

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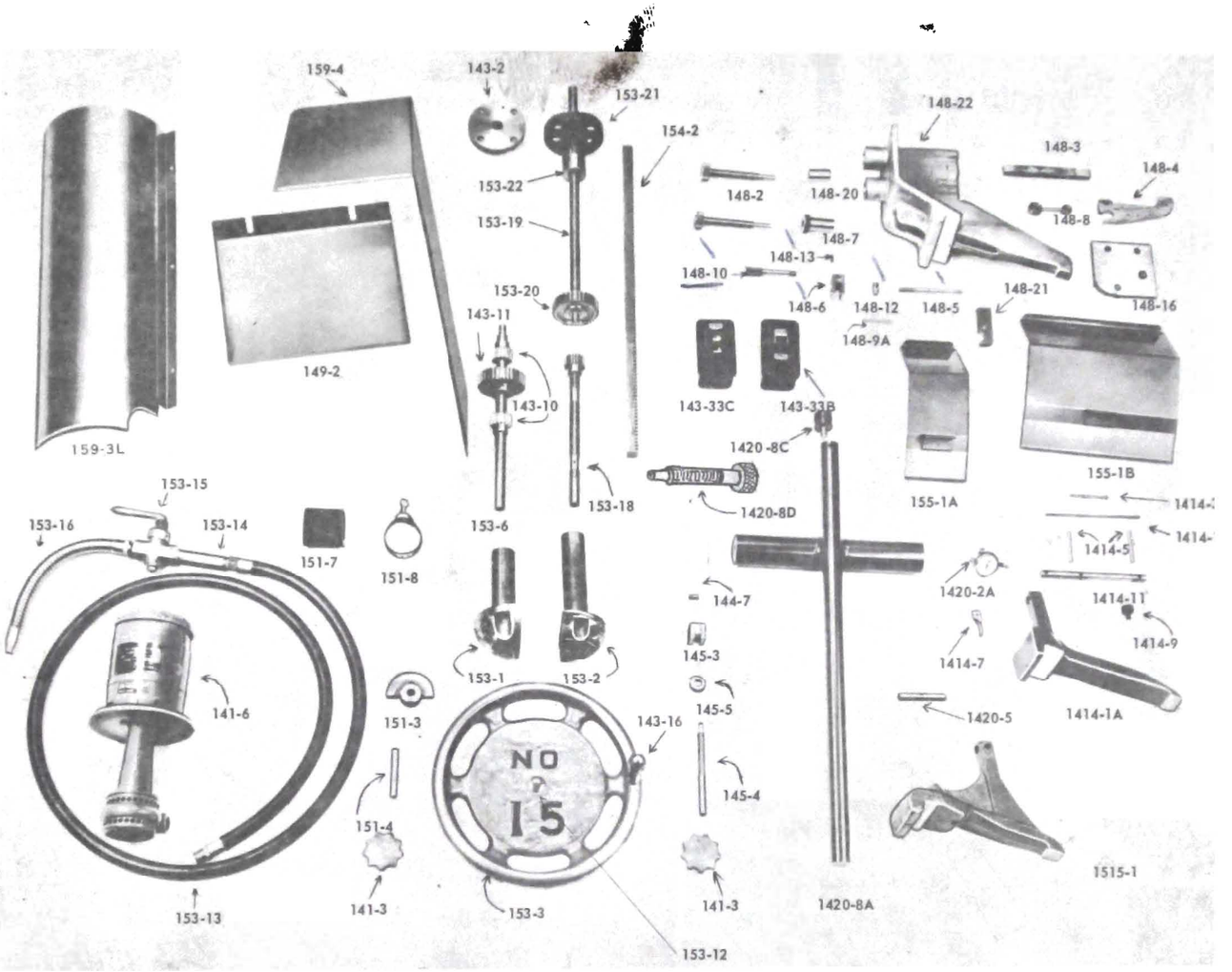

153–9	"V" Way Oiler Spring (4 Reqd.)	153–23	Handwheel Gear & Shaft Bearing	155–6	Table Pivot Shaft Lock Washer
153–10	Flat Way Oiler Spring (4 Reqd.)	153–24	Drive Shaft Gear Key	155–7	Table Pivot Cover Plate
153–12	Handwheel Expansion Plug	153–25	Back Table Drive Collar Key	155–8	Table Pivot Cover Plate Gasket
153–13	Collant Hose (84" Long)	153–26	Back Table Traverse Gear Collar	156–8	Headstock Head Scale
153–14	Coolant Pipe (1/2" x 4")	153–27	Back Table Traverse Gear Bushing	156–9	Elevating Screw Dial (2 Reqd.)
153–15	Coolant Valve (1/2" Water Cock)	154–1	Sub Table Front Water Guard	156–10	Elevating Screw Dial Holder (2 Reqd.)
153–16	Coolant Tubing (1/2" x 15" Flexible)	154–2	Sub Table Rack	156–11	Headstock Head
153–17	Handwheel Key	154–3	Sub Table	156–12	Headstock Spindle
153–18	Handwheel Gear & Shaft	155–1	Top Table	156–13	Headstock Spindle Bearing Nut
153–19	Back Table Drive Shaft	155–1A	Top Table Splash Guard (4")	156–14	Head & Tailstock Ball Bearings (4 Reqd.)
153–19A	1/2" x 1-1/2" Dowel Pin	155–1B	Top Table Splash Guard (10")	157–4	Tailstock Head Scale
153–20	Back Table Drive Shaft Gear	155–2	Table Pivot Shaft	157–8	Tailstock Head
153–21	Back Table Traverse Gear	155–3	Table Pivot Shaft Bearing	157–9	Tailstock Spindle
153–22	Back Table Drive Collar	155–5	Table Pivot Shaft Lock Nut		

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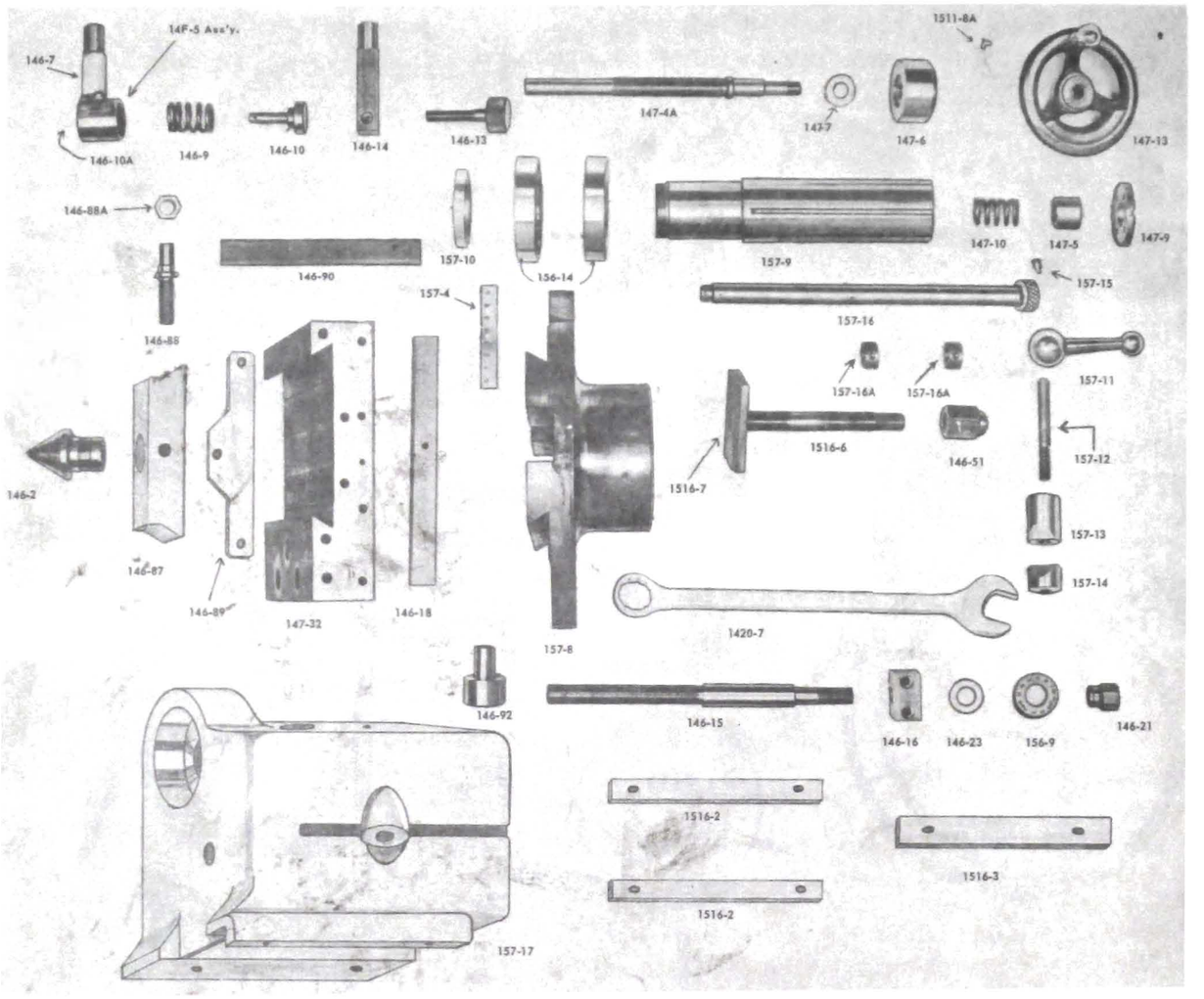

157–10	Tailstock Spindle Bearing Nut	159–3R	Retraction Shaft Splash Guard – Right	1510–10	Retraction Handle Shaft Gear
157–11	Tailstock Spindle Clamp Lever	159–4	Back Table Splash Guard, Top	1510–11	Retraction Handle Shaft
157–12	Tailstock Spindle Clamp Stud	159–5	Back Table Rack	1510–11A	Woodruff Key (2 Reqd.)
157–13	Tailstock Spindle Clamp Sleeve	1510–1	Wheel Slide Base	1510–12	Retraction Handle Shaft Bearing and Bracket
157–14	Tailstock Spindle Clamp Nut	1510–2	Rapid Retraction Table Bracket	1510–14	Retraction Lever Arm
157–15	Tailstock Spindle Key	1510–3	Table Bracket Shaft	1510–15	Lever Arm Handle
157–16	Tailstock Head Lock Shaft	1510–3A	Table Bracket Shaft Woodruff Key (2 Reqd.)	1510–16	Wheel Slide Gib
157–16A	Tailstock Lock Shaft Collar (2 Reqd.)	1510–4	Table Bracket Shaft Gear	1510–17	Wheel Slide Gib Eccentric
157–17	Tailstock Housing	1510–5	Sliding Retraction Gear	1510–19	Rapid Retraction Arm
159–1A	Back Table	1510–6	Sliding Gear Back Plate	1510–20	Rapid Retraction Connecting Arm
159–2	Back Table Front Water Guard	1510–7	Rapid Retraction Gear Shaft	1510–21	Connecting Arm Screw (2 Reqd.)
159–3L	Retraction Shaft Splash Guard – Left	1510–7A	Woodruff Key	1510–22	Table Bracket Oil Cup
		1510–8	Retraction Shaft Support Bracket	1510–23	Pulley Idler Arm
		1510–9	Gear Shaft Stationary Gear	1510–24	Retraction Compensating Spring

IMPORTANT—Specify Model and Serial Number of Machine When Ordering Parts

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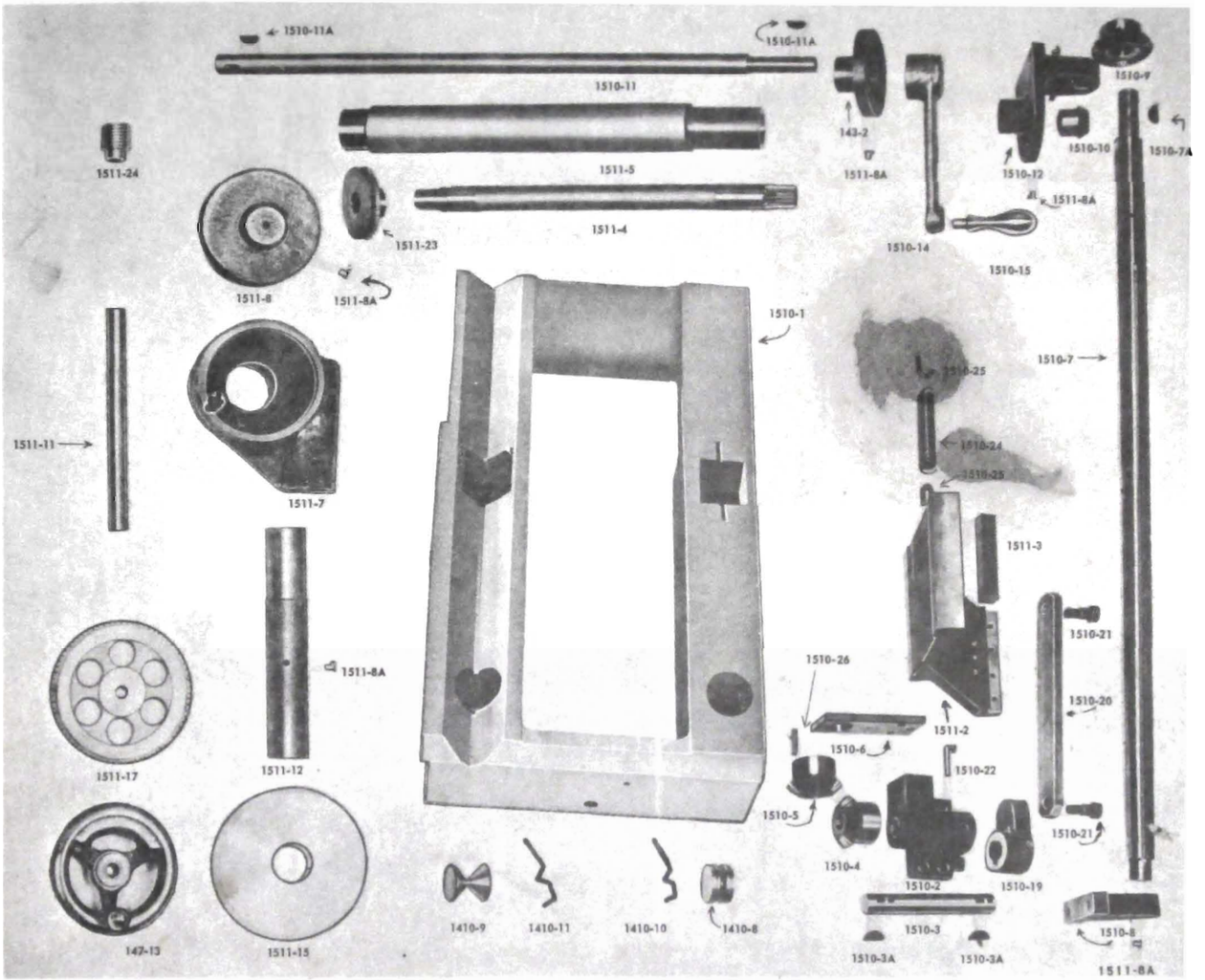
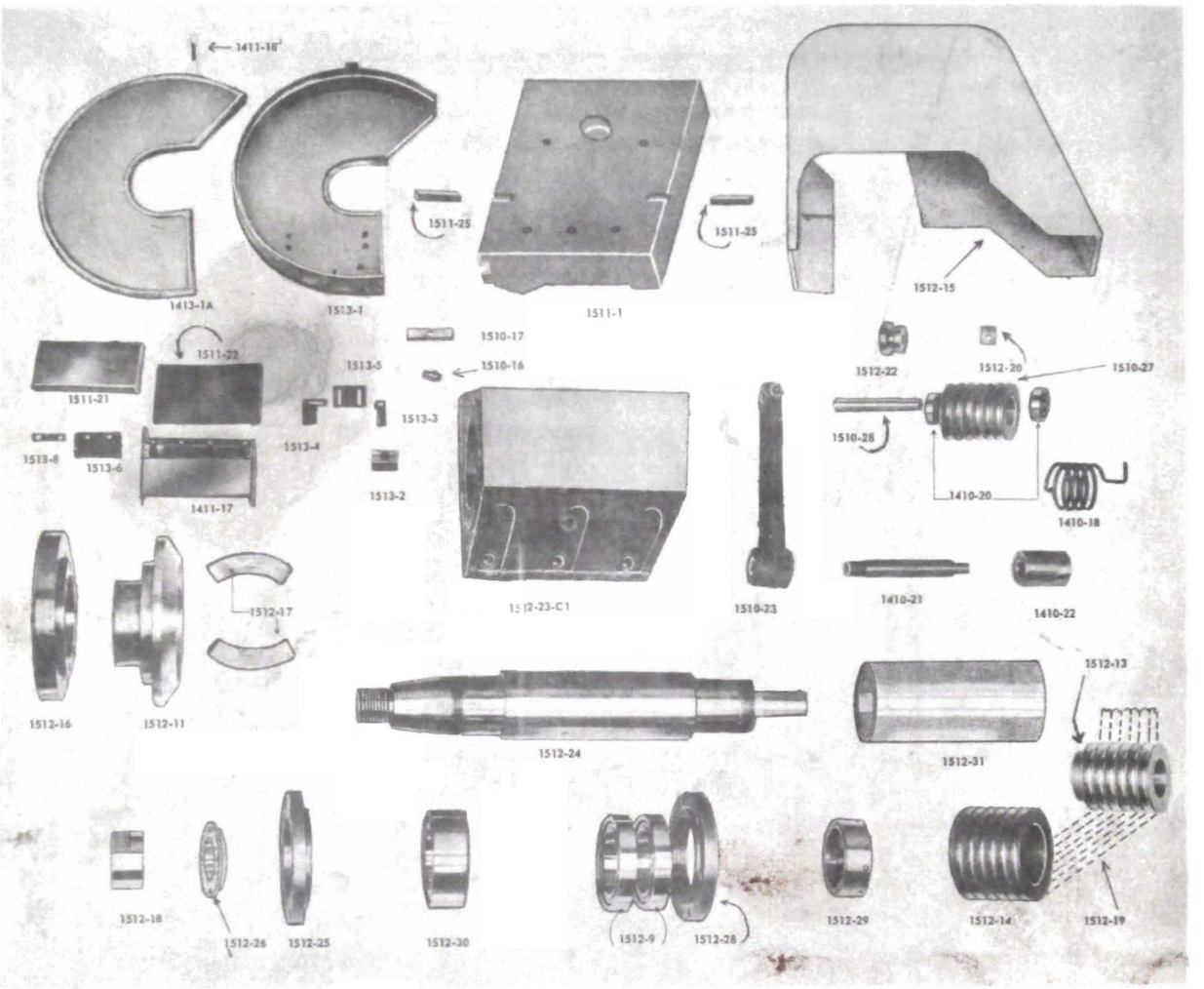


1510–25	Compensating Spring Eye Screw (2 Reqd.)	1511–12	Worm Shaft Housing (With Bushings)	1512–13	Grinding Spindle Motor Pulley, 60 Cycles
1510–26	Sliding Gear Key	1511–13	Worm Shaft Bearing, Long	1512–13S	Grinding Spindle Motor Pulley, 25 & 50 Cycles
1510–27	Grinding Spindle Idler Pulley	1511–14	Worm Shaft Bearings, Short	1512–14	Grinding Spindle Pulley
1510–28	Idler Pulley Shaft	1511–15	Feed Up Pointer Plate	1512–15	Grinding Spindle Pulley Guard
1510–29	Grinding Belt Guard Stud	1511–17	Feed Up Dial	1512–16	Grinding Wheel Mount Flange
1511–1	Wheel Slide	1511–18	Feed Up Rack Shims	1512–17	Wheel Flange Counterweight
1511–2	Feed Up Slide Plate	1511–20	Wheel Slide Oil Cup	1512–18	Grinding Spindle Nut
1511–3	Feed Up Rack	1511–21	Wheel Slide Guard, Rear	1512–19	Motor Belts (6 Reqd.) Set of Six "Matched"
1511–4	Feed Up Pinion Gear	1511–22	Retracting Slide Guard Apron	1512–20	Pulley Guard Holder
1511–5	Feed Up Pinion Housing	1511–23	Feed Up Worm Gear	1512–22	Pulley Guard Roller
1511–6	Feed Up Pinion Gear Bearing (2 Reqd.)	1511–24	Feed Up Worm	1512-23-C1	Grinding Spindle Housing
1511–7	Feed Up Worm Gear Housing	1511–25	Wheel Head Slide Key (2 Reqd.)	1512–24	Grinding Spindle
1511–8	Worm Gear Housing Cover	1512–9	Angular Contact Ball Bearing, Rear (2 Reqd.)	1512–25	Front Seal
1511–8A	Gitts Oilers #302 (7 Reqd.)	1512–11	Grinding Wheel Mount		
1511–11	Feed Up Worm Shaft				

IMPORTANT—Specify Model and Serial Number of Machine When Ordering Parts

Be Sure to Give Number and Name of Part When Ordering



1512–26	Front Nut	1515–1	Wheel Dresser Base		ASSEMBLIES
1512–28	Rear Seal		For Dresser Base Also Use	14A–1	"Y" Driver Assembly
1512–29	Rear Nut		148–5–6–9A–10–12–14 & 21	15A–111	Special "Y" Driver Assembly
1512–30	Cylindrical Roller Bearing, Front	1516–2	1" x 3/8" Head & Tailstock Wear Strip (4 Reqd.)		Use 15A–111
1512–31	Grinding Spindle Sleeve	1516–3	¾" x 3/8" Head & Tailstock Wear Strip (2 Reqd.)	15F–3	Headstock Hold Down Assembly
1513–1	Grinding Wheel Guard	1516–5	Worm Shaft Bearing Snap Ring	15H1–1	Wheel Mount Assembly
1513–2	Coolant Pipe Clamp Bracket	1516–6	Hold Down Stud (2 Reqd.)	15K	Wheel Dresser Assembly
1513–3	Grinding Wheel Splash Guard, Right	1516–7	Hold Down Foot (2 Reqd.)	14L	Steady Rest Assembly
1513–4	Grinding Wheel Splash Guard, Left	1516–8	Headstock Head Lock Shaft	15B1–2	Idler Arm Assembly
1513–5	Grinding Wheel Splash Guard, Top	1516–9	Head Lock Shaft Handle	15C–5	Retraction Handle Assembly
1513–6	Grinding Wheel Splash Guard, Bottom, Neoprene	1516–10	Headstock Housing Oil Cup	15G1	Complete Tailstock Assembly
1513–8	Grinding Wheel Splash Guard Clamp, Bottom	1516–11	Headstock Housing Breather Plug	15F1	Complete Headstock Assembly
		1516–12	Headstock Housing	15H2	Grinding Spindle Assembly
		1516–14	Clutch Engaging Shaft	14F5	Spring Drive Post Assembly
		1516–16	¼" x 2½" Oil Cup Nipple	14J	Indicator Assembly Less Indicator
				15	Elevating Screw Assembly

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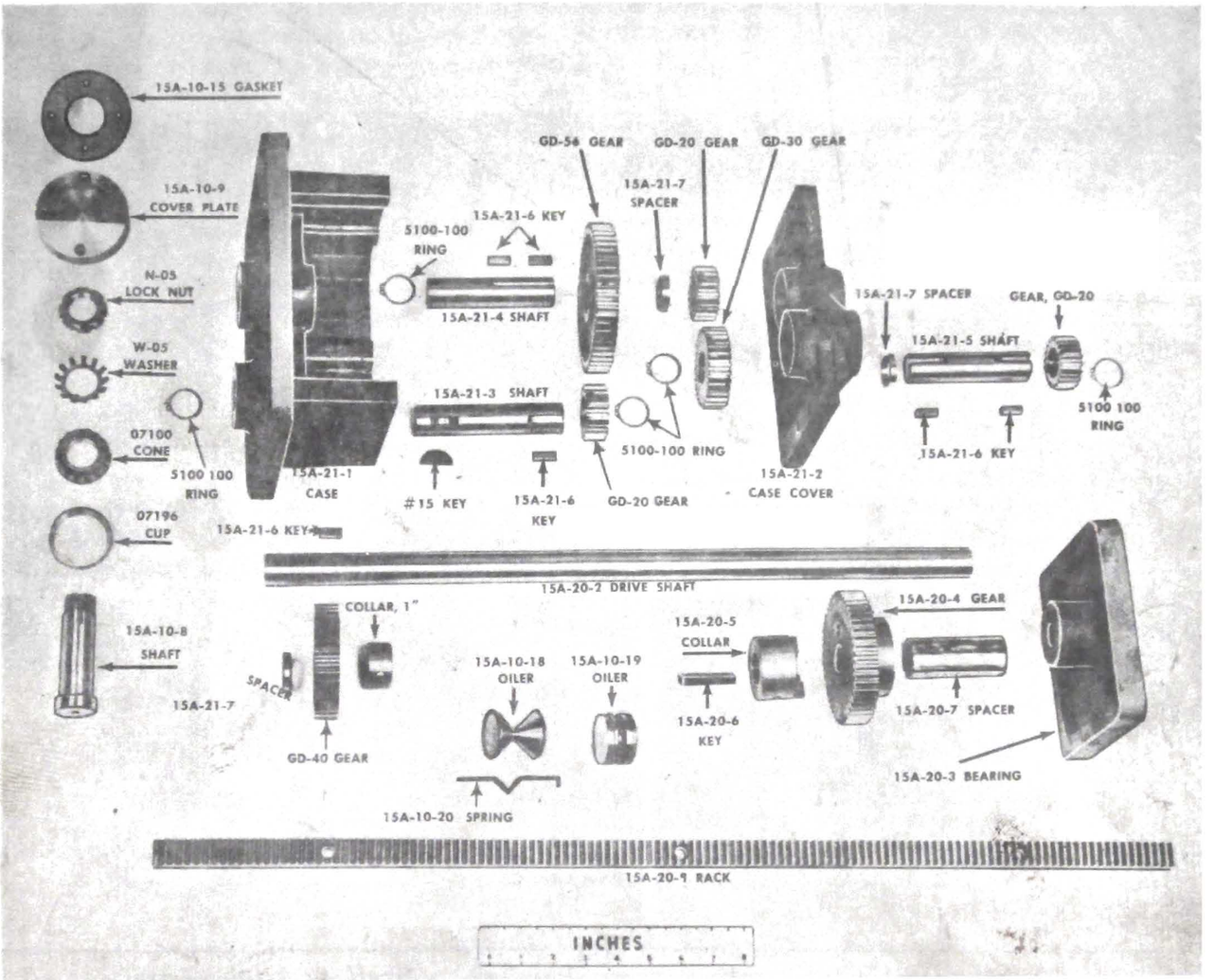

15A — Parts Illustration No. 1

15A-10 BED ASSEMBLY

15A-10-1	Bed
15A-10-28	Table, sub
15A-10-29	Table, top
15A-10-4	Table, back
15A-10-7	Guard, back table water
15A-10-8	Shaft, table pivot
15A-10-9	Cover plate, table pivot shaft
15A-10-15	Gasket, table pivot cover plate
15A-10-16	Guard, gear shaft splash, left
15A-10-17	Guard, gear shaft splash, right
15A-10-18	Oiler, "V" way (4 required)
15A-10-19	Oiler, flat way (4 required)
15A-10-20	Spring, "V" way oiler (8 required)
15A-10-22	Door, rear
15A-10-24	Lock washer, sub table (2 required)
15A-10-25	Guard, steady rest side—6"
15A-10-26	Guard, steady rest side—10"
15A-10-27	Guard, steady rest top
15A-10-30	Guard, back table top splash
15A-10-42	Guard, sub table water
15A-10-43	Guard, top table water
15A-10-44	Guard, sub table end way (2 required)
15A-10-45	Guard, back table end way (2 required)
07100	Cone, Timken
07196	Cup, Timken
N-05	Lock nut, ball bearing
W-05	Lock washer, ball bearing
804	Cup, oil
15A-11	Coolant pan assembly
15A-11-1	Coolant pan, left
15A-11-2	Coolant pan, right

IMPORTANT—Specify Model and Serial Number of Machine When Ordering Parts

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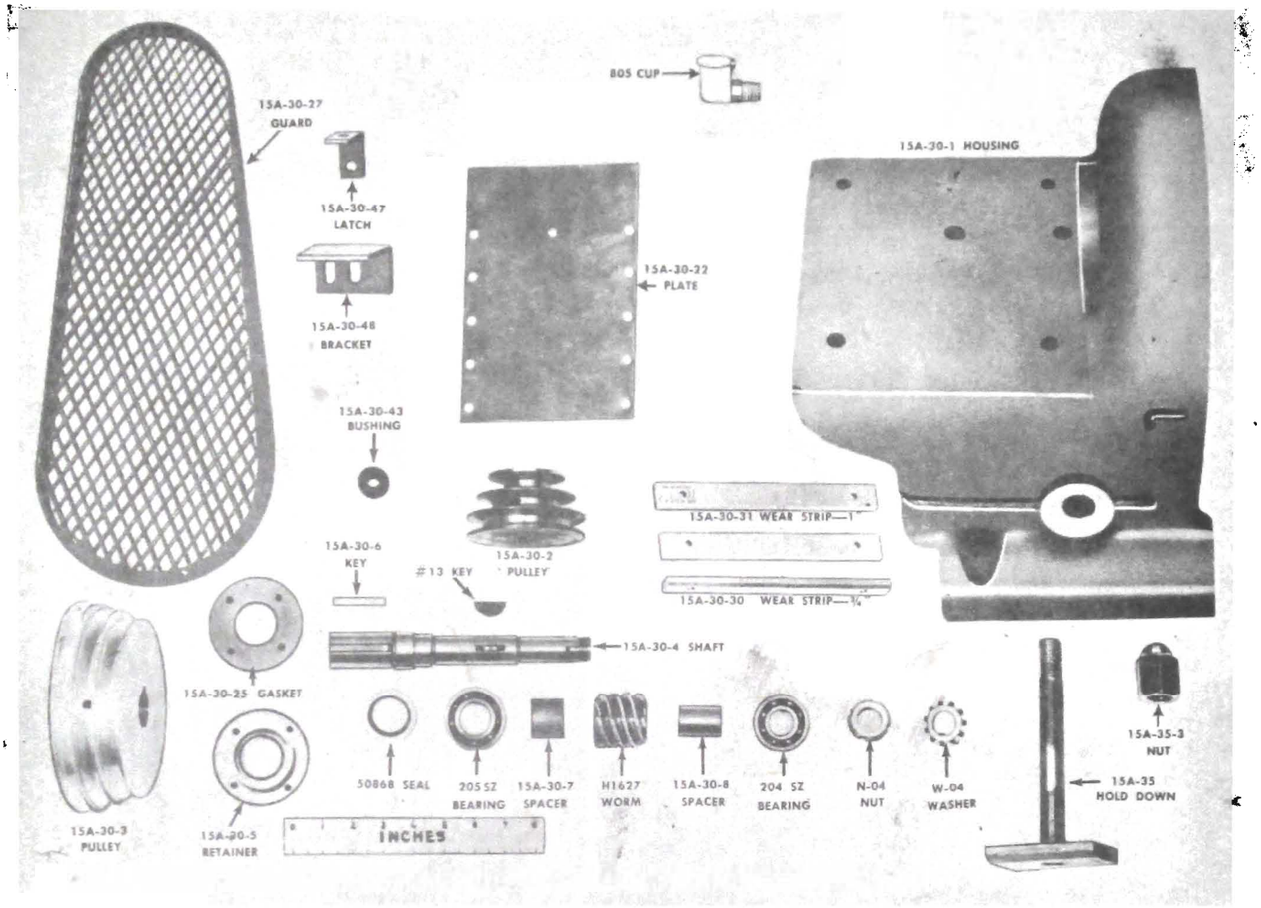


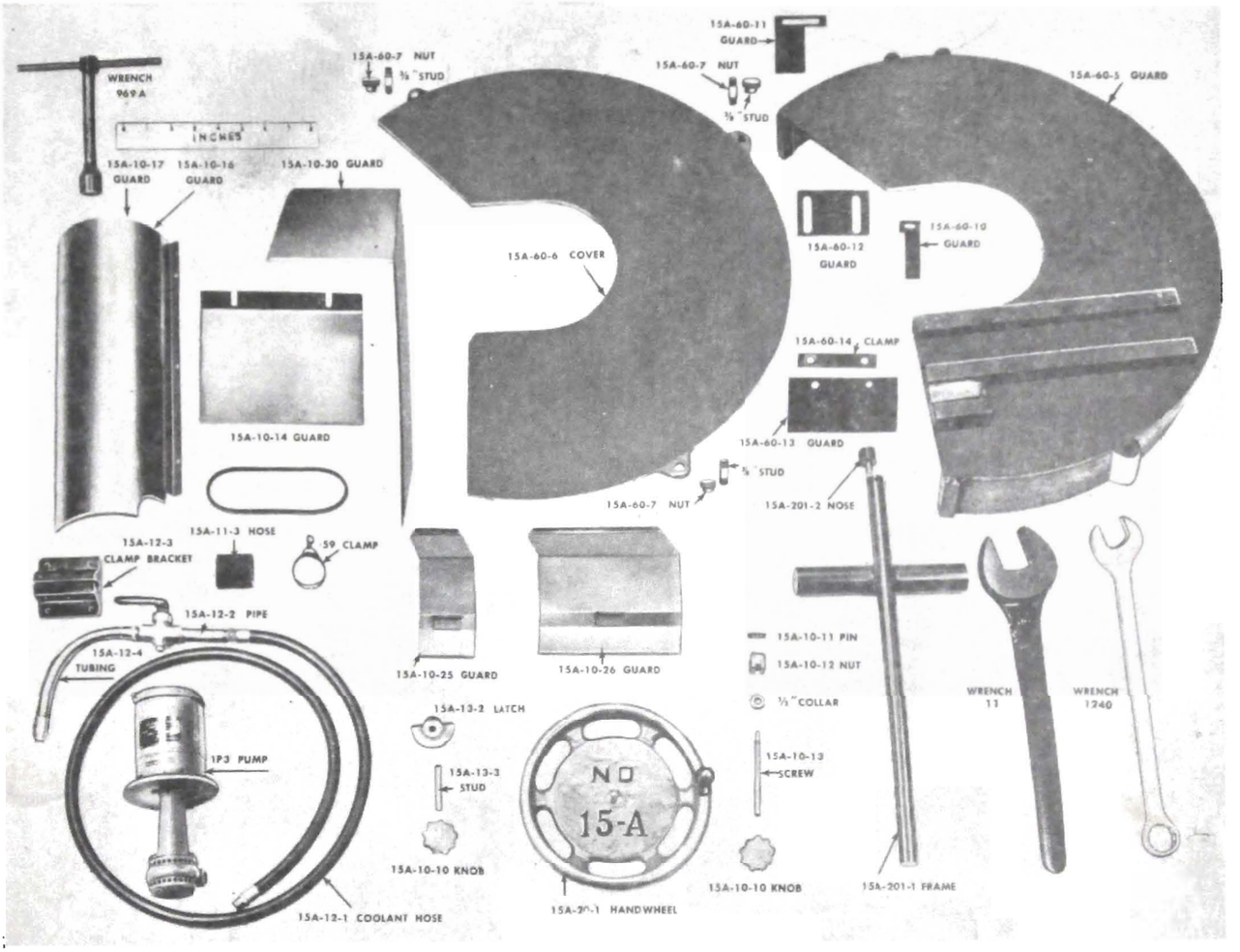
15A — Parts Illustration No. 2

15A-11-3	Hose, coolant pan connecting
1P3	Pump, coolant
59	Clamp, hose (2 required)
15A-12	Coolant hose assembly
15A-12-1	Hose, coolant
15A-12-2	Pipe, coolant
15A-12-3	Clamp bracket, coolant pipe
15A-12-4	Tubing, coolant (flexible)
½"	Water cock
15A-13	Front door assembly
15A-13-1	Door, front
15A-13-2	Latch, front door
15A-13-3	Stud, front door latch
15A-13-4	Knob, front door
15A-14	Taper adjustment assembly
15A-14-1	Screw, taper adjustment
15A-14-2	Nut, taper adjustment
15A-14-4	Pin, taper adjustment
15A-13-4	Knob, taper adjustment

15A-20 TABLE TRAVERSE GEAR ASSEMBLY

15A-20-1	Handwheel, table traverse
15A-20-2	Shaft, back table drive
15A-20-3	Bearing, back table shaft
15A-20-4	Gear, back table drive
15A-20-5	Collar, back table tarry drive
15A-20-6	Collar key, back table tarry drive
15A-20-7	Spacer, back table drive gear
15A-20-9	Rack, sub and back table (2 required)
15A-21-6	Key, table traverse gear
15A-21-7	Spacer, table traverse gear
GD-40	Gear, spur
	Collar, 1" set
H-3308	Handle, Balcrank
414	Cup, oil
B-1618-12	Bearing, bushing type
15A-21	Table traverse gear case assembly
15A-21-1	Case, table traverse gear
15A-21-2	Case cover, table traverse gear
15A-21-3	Shaft, table traverse handwheel
15A-21-4	Shaft, table traverse idler
15A-21-5	Shaft, front table drive
15A-21-6	Key, table traverse gear (5 req'd.)

Be Sure to Give Number and Name of Part When Ordering



15A — Parts Illustration No. 3

15A-21-7	Spacer, table traverse gear (2 required)
15A-21-8	Dust cover
5100-100	Ring, snap (6 required)
GD-20	Gear, spur (3 required)
GD-30	Gear, spur
GD-56	Gear, spur
	Pin, dowel (5/16 dia. x 1 1/4) (4 required)
	Key, #15 Woodruff

15A-30 HEADSTOCK ASSEMBLY

15A-30-1	Housing, headstock
15A-30-2	Pulley, headstock motor
15A-30-3	Pulley, headstock worm shaft
15A-30-4	Shaft, headstock worm
15A-30-5	Retainer, worm shaft oil seal
15A-30-6	Key, worm shaft pulley
15A-30-7	Spacer, worm shaft worm
15A-30-8	Spacer, worm shaft bearing
15A-30-9	Cap, worm gear shaft bearing
15A-30-10	Shaft, worm gear drive
15A-30-11	Spacer, worm gear drive shaft
15A-30-12	Gear, worm
15A-30-13	Clutch, female
15A-30-14	Clutch, male
15A-30-15	Retainer, worm gear shaft oil seal
15A-30-16	Pulley, worm gear shaft
15A-30-17	Key, worm gear shaft pulley
15A-30-18	Handle, clutch shaft
15A-30-19	Shaft, clutch
15A-30-20	Arm, clutch
15A-30-21	Pin, clutch arm
15A-30-22	Plate, headstock oil
15A-30-23	Gasket, headstock oil plate
15A-30-24	Guard, headstock pulley splash
15A-30-25	Gasket, worm shaft oil seal retainer
15A-30-26	Gasket, worm gear shaft oil seal retainer
15A-30-27	Guard, headstock belt

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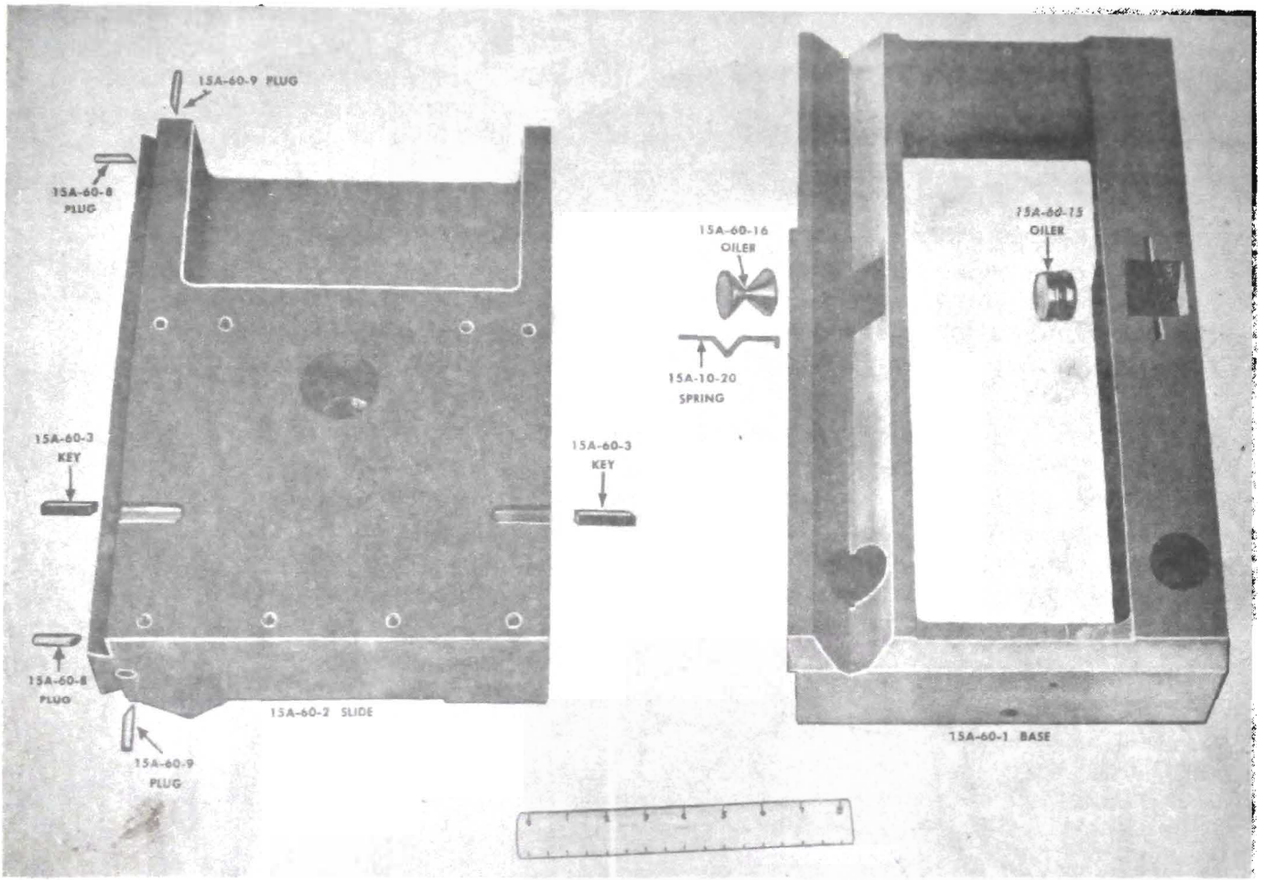

15A — Parts Illustration No. 4

15A-30-28	Shaft, head lock
15A-30-29	Handle, head lock shaft
15A-30-30	Wear strip—¾"
15A-30-31	Wear strip—1" (2 required)
15A-30-32	Shims, wear strip (.001, .002 and .005 thick)
15A-30-33	Key, male clutch
15A-30-34	Stud, counterweight, 8¼" (4 required)
15A-30-35	Counterweight, small (iron) (5 required)
15A-30-36	Counterweight large 1" thick (iron) (2 req'd.)
15A-30-37	Counterweight, large 1½" thick (iron) (2 required)
15A-30-38	Counterweight, large (lead) (2 req'd)
15A-30-39	Plate, idler screw
15A-30-40	Screw, idler adjusting
15A-30-41	Spacer, counterweight stud—1½" (4 required)
15A-30-42	Spacer, counterweight stud—2¼" (4 required)
15A-30-43	Bushing, motor mount (12 required)
15A-30-44	Guard, top table wiper
15A-30-45	Stud, counterweight—5½" (4 required)
15A-30-46	Spacer, counterweight stud—1" (4 required)
15A-30-47	Latch, belt guard
15A-30-48	Bracket, belt guard hinge
15A-30-49	Center, Morse taper (1⅞" pointed)
15A-30-49A	Center, Morse taper (1⅞" blunt)
15A-30-49B	Center, Morse taper (3" blunt)
15A-30-50	Post, front drive
15A-30-51	Screw, front drive post
205SZ	Bearing, ball
204SZ	Bearing, ball (3 required)
	Center, Morse taper (pointed)
N-04	Nut, ball bearing lock
W-04	Washer, ball bearing lock
	Motor, electric—½ h.p.—1750 r.p.m.
50027	Seal, oil
50868	Seal, oil
50005	Seal, oil
2"	Plug, expansion

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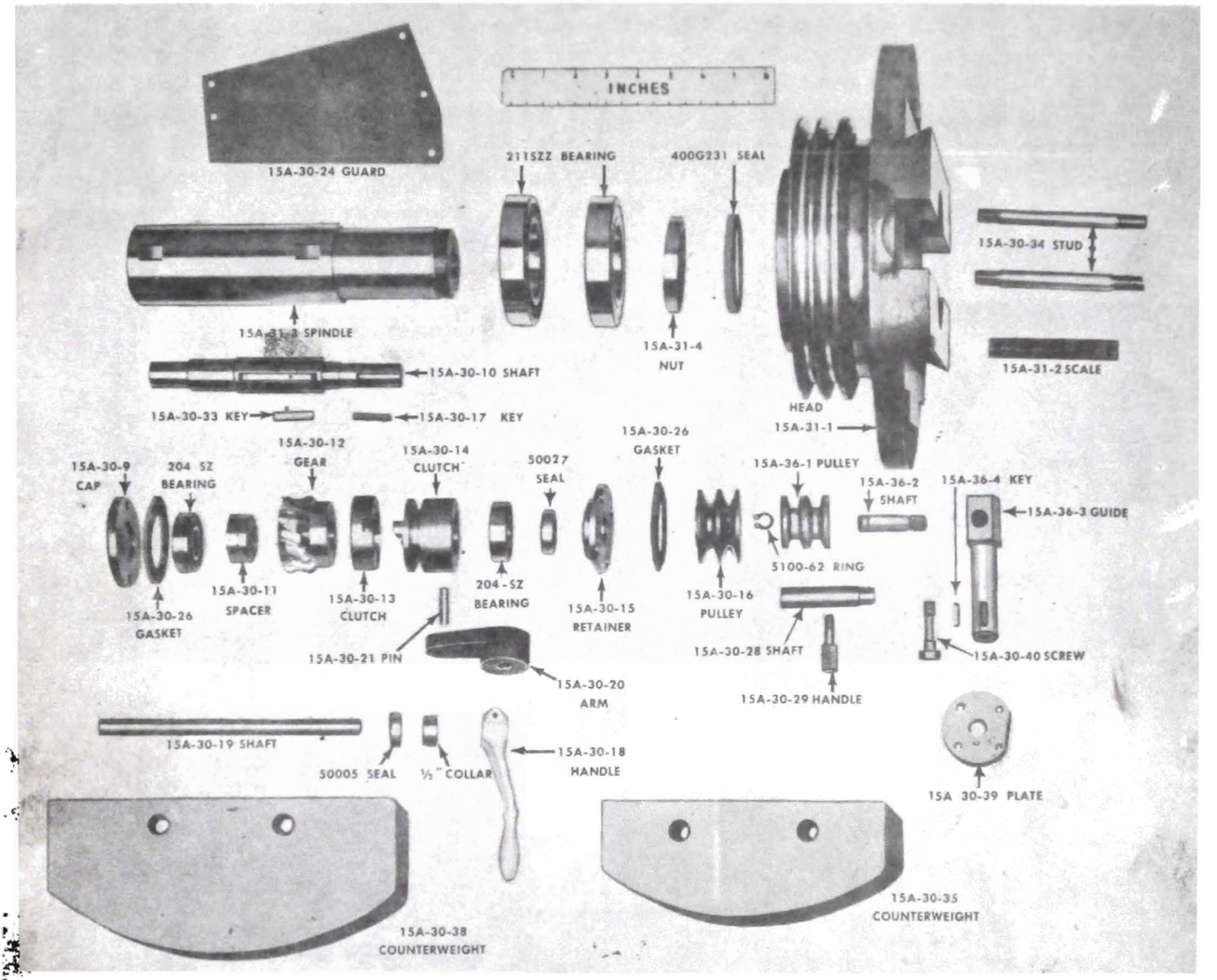
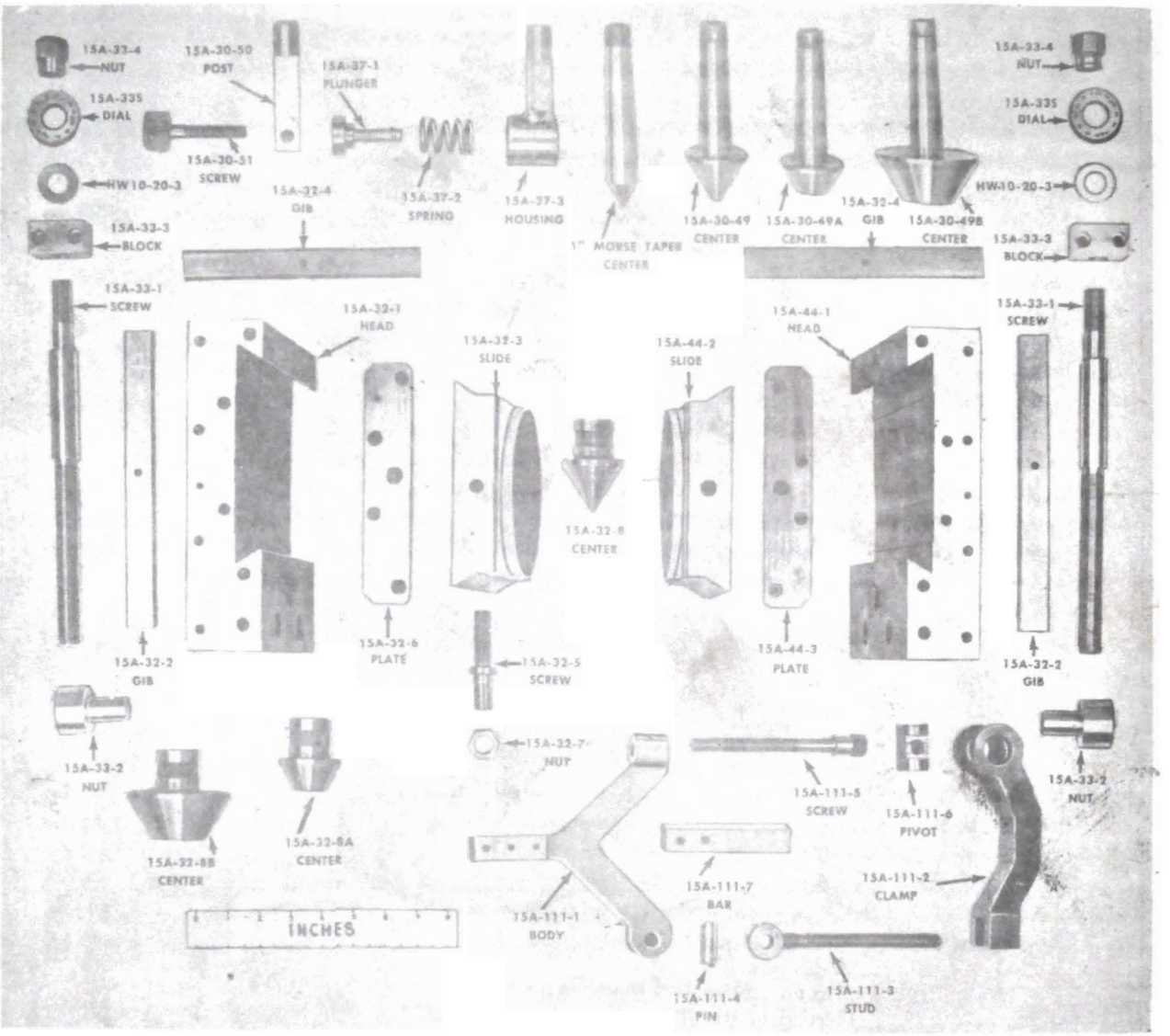


15A — Parts Illustration No. 5

H1627	Worm
1M032	Belt, "V" (2 matched)
1M038	Belt, "V"
	Key, #13 Woodruff
½"	Collar, set
804	Cup, oil
	2½" Hinge, square butt
15A-31	Headstock head assembly
15A-31-1	Head, headstock
15A-31-2	Scale, headstock throw
15A-31-3	Spindle, headstock
15A-31-4	Nut, headstock spindle bearing
211SZZ	Bearing, ball
400G231	Seal, oil
15A-32	Headstock elevating head assembly
15A-32-1	Head, headstock elevating
15A-32-2	Gib, headstock elevating head
15A-32-4	Gib, headstock cross slide
15A-32-5	Screw, headstock cross slide
15A-32-6	Plate, cross slide screw
15A-32-7	Nut, cross slide screw
15A-32-8	Center, cross slide (1⅞" pointed)
15A-32-8A	Center, cross slide (1⅞" blunt)
15A-32-8B	Center, cross slide (3" blunt)
15A-32-9	Cross-slide, elevating head
15A-33	Headstock elevating screw assembly
15A-33-1	Screw, headstock elevating
15A-33-2	Nut, headstock elevating screw
15A-33-3	Block, headstock elevating screw
15A-33-4	Nut, headstock elevating screw dial
HW10-20-3	Hardened washer
15A-33S	Headstock dial assembly

IMPORTANT—Specify Model and Serial Number of Machine When Ordering Parts

Be Sure to Give Number and Name of Part When Ordering



15A — Parts Illustration No. 6

15A-33S-1	Dial, headstock
15A-33S-2	Holder, headstock dial
15A-35	Headstock hold down assembly
15A-35-1	Foot, headstock hold down
15A-35-2	Stud, headstock hold down
15A-35-3	Nut, headstock hold down
15A-36	Headstock idler assembly
15A-36-1	Pulley, headstock idler
15A-36-2	Shaft, headstock idler pulley
15A-36-3	Guide, headstock belt
15A-36-4	Key, headstock idler
B-1012-10	Bearing, bushing type
5100-62	Ring, snap
15A-37	Spring drive post assembly
15A-37-1	Plunger, drive post
15A-37-2	Spring, drive post plunger
15A-37-3	Housing, drive post plunger
15-A-37-4	Post, spring drive

15A-40 TAILSTOCK ASSEMBLY

15A-40-1	Housing, tailstock
15A-40-2	Shaft, tailstock head lock
15A-40-3	Sleeve, spindle clamp
15A-40-4	Nut, spindle clamp
15A-40-5	Stud, spindle clamp
15A-40-6	Lever, spindle clamp
15A-40-7	Key, spindle
15A-30-30	Wear strip—¾"
15A-30-31	Wear strip—1" (2 required)
15A-30-32	Shims, wear strip (.001, .002 and .005 thick)

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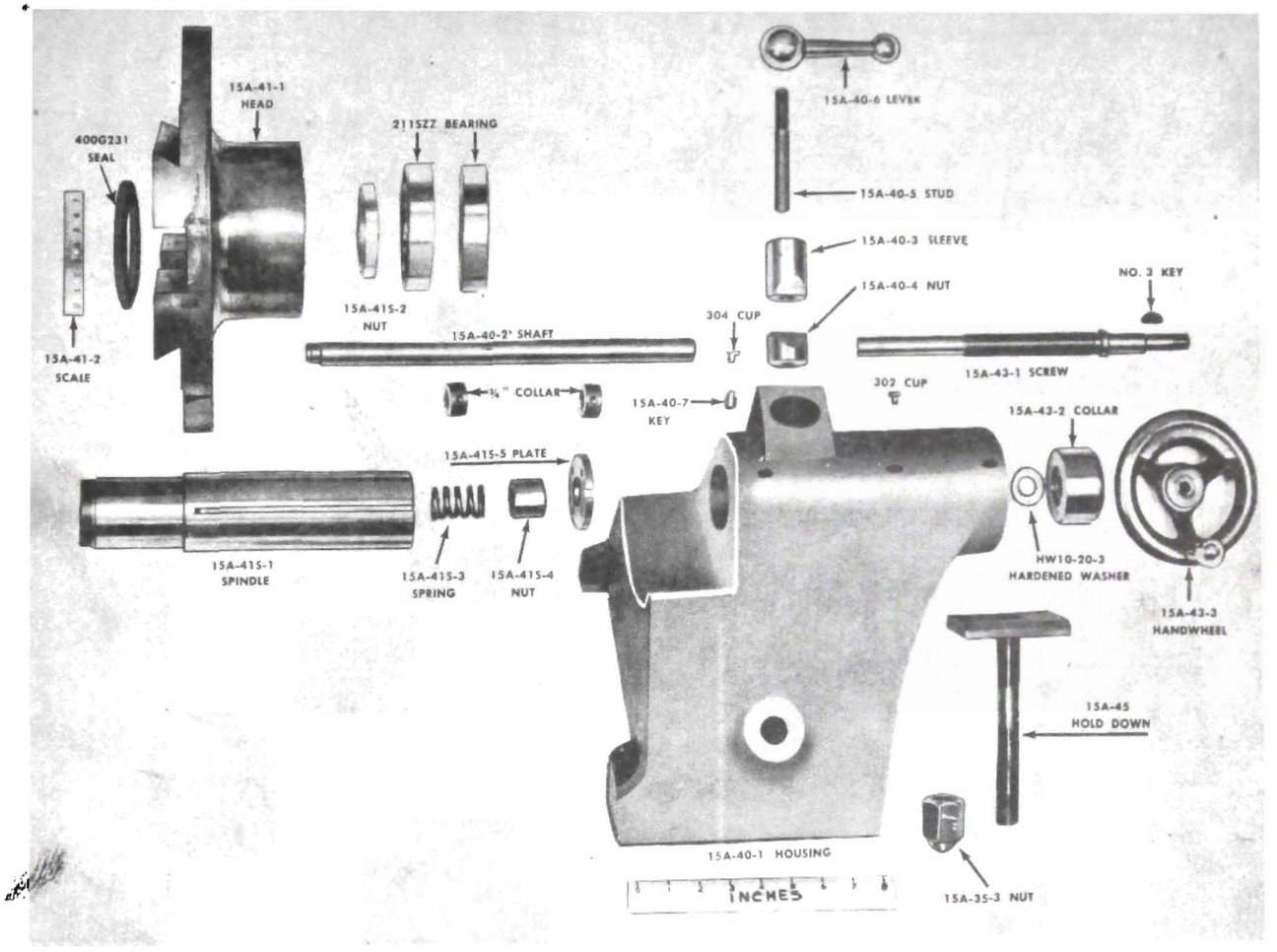

15A — Parts Illustration No. 7

15A-30-44	Guard, top table wiper
15A-30-50	Post, front drive
15A-30-51	Screw, front drive post
15A-37	Spring drive post assembly
¾"	Collar, set (2 required)
302	Cup, oil
304	Cup, oil
15A-41	Tailstock head assembly
15A-41-1	Head, tailstock
15A-41-2	Scale, tailstock head throw
211SZZ	Bearing, ball (2 required)
400G231	Seal, oil
15A-41S	Tailstock spindle assembly
15A-41S-1	Spindle, tailstock
15A-41S-2	Nut, tailstock spindle bearing
15A-41S-3	Spring, tailstock spindle
15A-41S-4	Nut, tailstock spindle screw
15A-41S-5	Plate, spring retainer
15A-41S-6	Screw, spindle nut (dog-point)
15A-43	Tailstock spindle screw assembly
15A-43-1	Screw, tailstock spindle
15A-43-2	Collar, tailstock spindle thrust
15A-43-3	Handwheel, tailstock
	Key, #3 Woodruff
HW10-20-3	Hardened washer
302	Cup, oil
15A-44	Tailstock elevating head assembly
15A-44-1	Head, tailstock elevating
15A-44-3	Plate, tailstock cross slide screw
15A-32-2	Gib, elevating head
15A-32-4	Gib, cross slide
15A-32-5	Screw, cross slide
15A-32-7	Nut, cross slide screw
15A-32-8	Center, cross slide, (1⅞" pointed)
15A-32-9	Cross-slide, elevating head
15A-33	Elevating screw assembly
15A-45	Tailstock hold down assembly
15A-45-1	Stud, hold down
15A-35-1	Foot, hold down
15A-35-3	Nut, hold down

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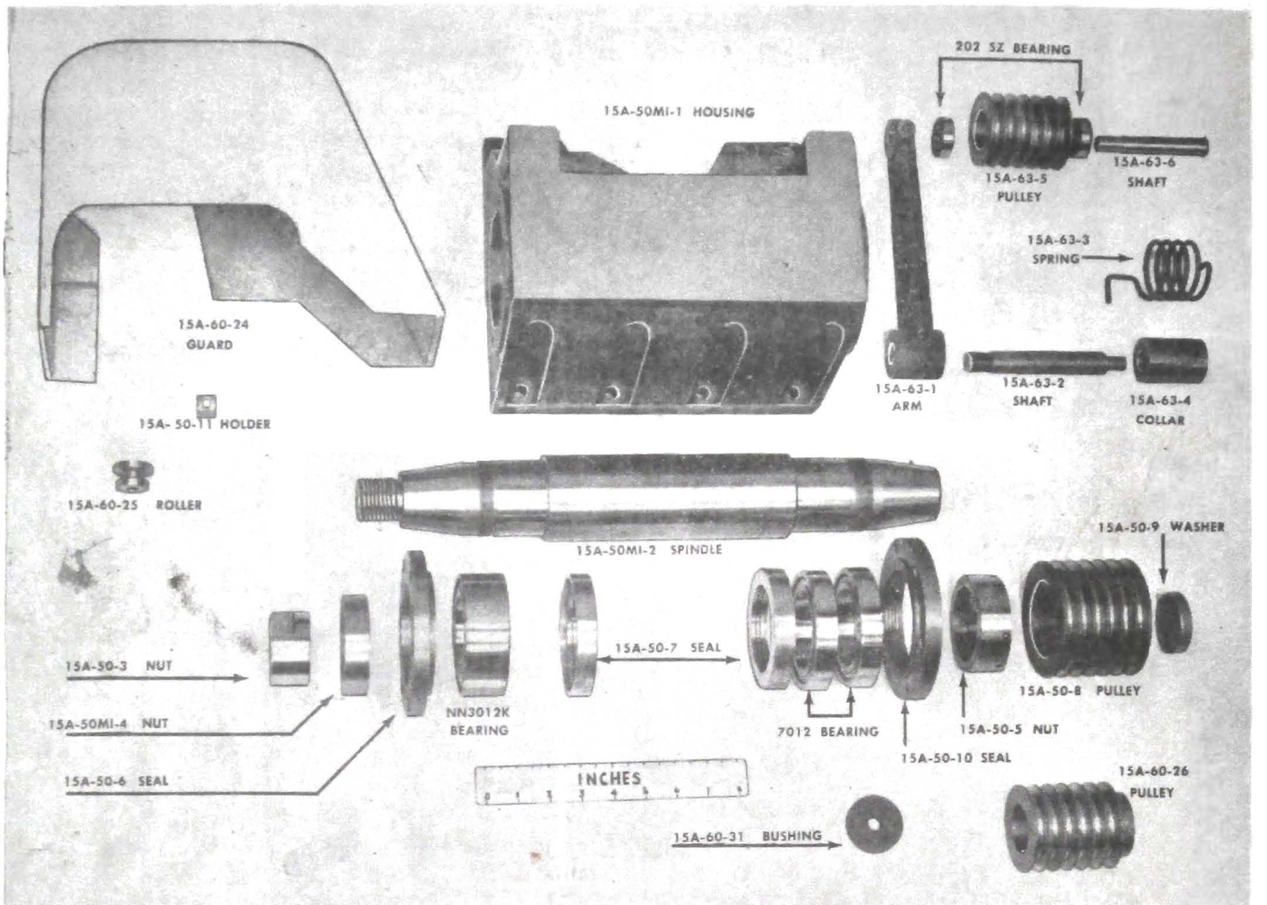


15A — Parts Illustration No. 8

15A-50MI GRINDING SPINDLE ASSEMBLY

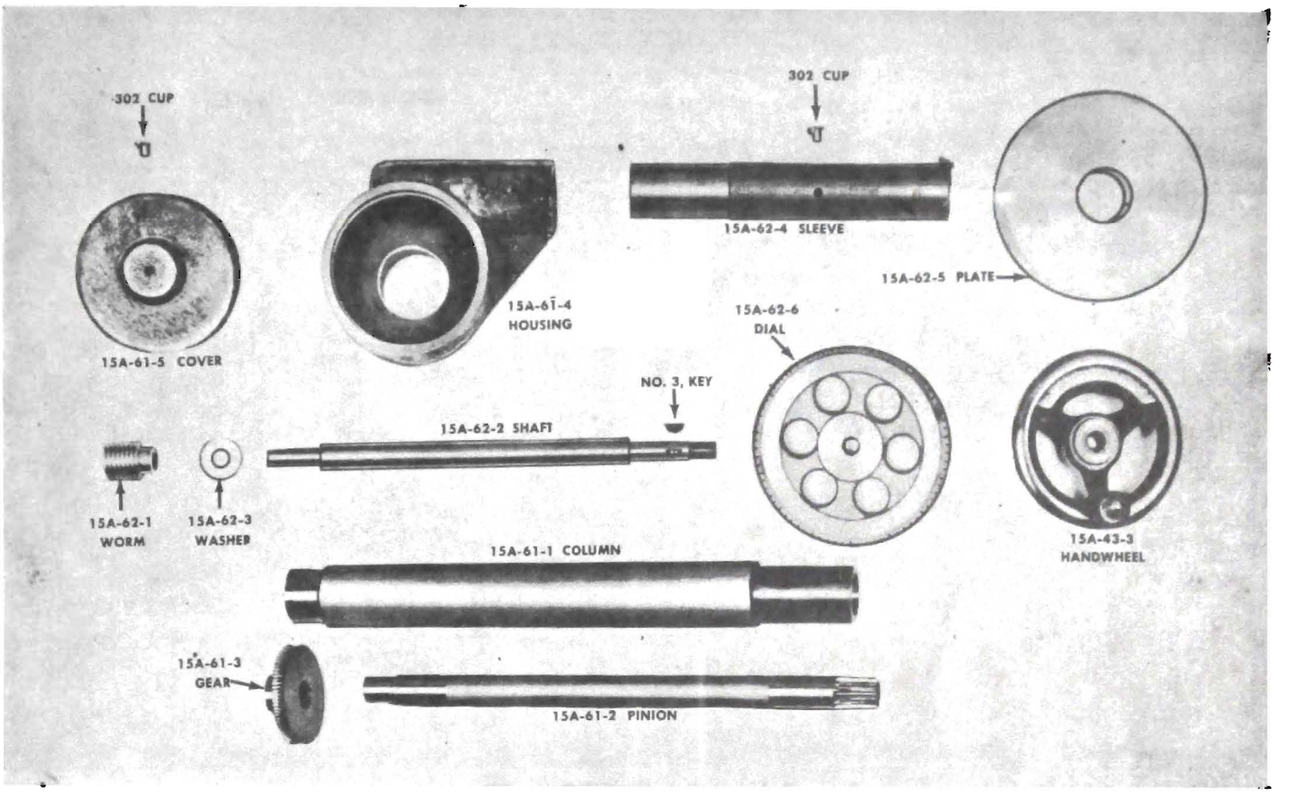
NOTE: When ordering or writing in reference to any part of grinding spindle assembly, be sure to give number stamped on top of the spindle housing.

15A-50MI-1	Housing, grinding spindle
15A-50MI-2	Spindle, grinding
15A-50-3	Nut, grinding spindle wheel mount
15A-50MI-4	Nut, grinding spindle front
15A-50-5	Nut, grinding spindle rear
15A-50-6	Seal, grinding spindle front
15A-50-7	Seal, grinding spindle inner (2 required)
15A-50-8	Pulley, grinding spindle
15A-50-9	Washer, grinding spindle pulley
15A-50M1-10	Seal, grinding spindle rear (Shown on parts list illustration as 15A-50-10)
15A-50-11	Holder, belt guard
7012	Bearing, precision ball (2 required)
NN3012K	Bearing, precision roller
15A-51	Wheel mount assembly
15A-51-1	Sleeve, wheel mount
15A-51-2	Flange, wheel mount
15A-51-3	Counterweight, wheel mount (2 required)
15A-51-4	Screw, counterweight lock (2 required)
15A-51-5A	Wheel, grinding 1"
15A-51-5B	Wheel, grinding 1 3/16"
15A-51-5C	Wheel, grinding 1 1/4"
15A-51-5D	Wheel, grinding 1 3/8"
15A-51-5E	Wheel, grinding 1 7/16"
15A-51-5F	Wheel, grinding 1 1/2"
15A-51-5G	Wheel, grinding 1 11/16"
15A-51-5H	Wheel, grinding 1 3/4"

15A-60 WHEEL HEAD ASSEMBLY

15A-60-1	Base, wheel head slide
15A-60-2	Slide, wheel head
15A-60-3	Key, wheel head slide (2 required)
15A-60-5	Guard, grinding wheel
15A-60-6	Cover, grinding wheel guard
15A-60-7	Nut, grinding wheel guard cover (3 required)
15A-60-8	Plug, grinding wheel guard lock —short (2 required)
15A-60-9	Plug, grinding wheel guard lock— long (2 required)
15A-60-10	Guard, splash—right

Be Sure to Give Number and Name of Part When Ordering



15A — Parts Illustration No. 9

15A-60-11	Guard, splash—left
15A-60-12	Guard, splash—top
15A-60-13	Guard, splash—bottom
15A-60-14	Clamp, bottom splash guard
15A-60-15	Oiler, flat type
15A-60-16	Oiler, "V" type
15A-60-19	Plate, feed up slide
15A-60-20	Rack, feed up
15A-60-22	Spring, compensating
15A-60-23	Screw, compensating spring eye (2 required)
15A-60-24	Guard, belt
15A-60-25	Roller, belt guard
15A-60-26	Pulley, motor
15A-60-27	Guard, front splash
15A-60-28	Apron, front splash guard
15A-60-29	Guard, rear splash
15A-60-30	Bushing, motor mount (4 required)
15A-60-31	Spring, front splash guard
15A-10-20	Spring, oiler (2 required)
0M026	Belt, "V" (6 matched)
	Motor, electric, 3 h.p., 1750 rpm.
	Stud, 3/8" x 1 1/2" (3 required)
304	Cup, oil (2 required)
15A-61	Feed up column assembly
15A-61-1	Column, feed up
15A-61-2	Pinion, feed up
15A-61-3	Gear, feed up worm
15A-61-4	Housing, worm gear
15A-61-5	Cover, worm gear housing
A-1324	Bearing, bushing type (2 required)
302	Cup, oil
15A-62	Worm shaft sleeve assembly
15A-62-1	Worm, feed up
15A-62-2	Shaft, feed up worm
15A-62-3	Washer, worm shaft thrust
15A-62-4	Sleeve, worm shaft
15A-62-5	Plate, pointer
15A-62-6	Dial
15A-43-3	Handwheel
	Key, #3 Woodruff
302	Cup, oil
B-1220-8	Bearing, bushing type
B-1220-12	Bearing, bushing type
15A-63	Idler arm assembly
15A-63-1	Arm, idler
15A-63-2	Shaft, idler arm
15A-63-3	Spring, idler arm
15A-63-4	Collar, spring tightener
15A-63-5	Pulley, idler
15A-63-6	Shaft, idler pulley

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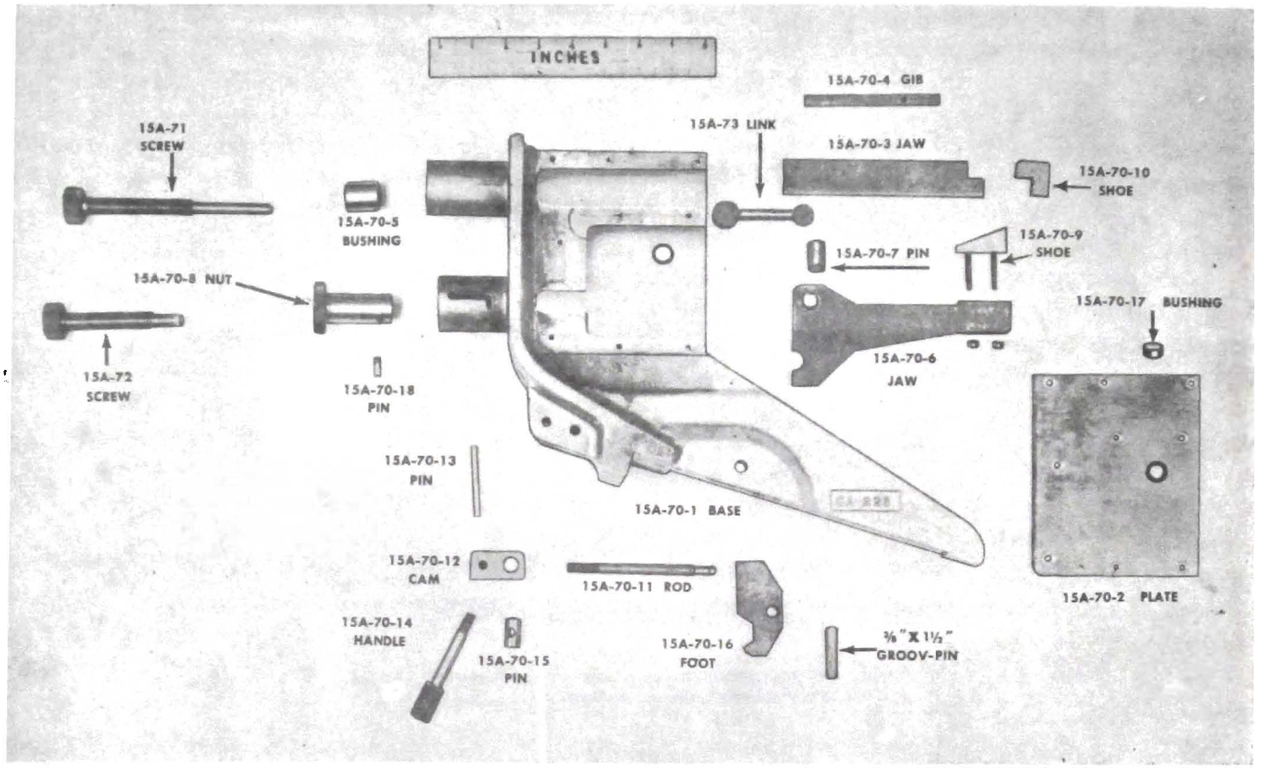

15A — Parts Illustration No. 10

202SZ	Bearing, ball (2 required)

15A-70 STEADY REST ASSEMBLY

15A-70-1	Base, steady rest
15A-70-2	Plate, steady rest cover
15A-70-3	Jaw, steady rest upper
15A-70-4	Gib, steady rest upper jaw
15A-70-5	Bushing, steady rest threaded
15A-70-6	Jaw, steady rest lower
15A-70-7	Pin, lower jaw pivot
15A-70-8	Nut, lower jaw rapid release
15A-70-9	Shoe, lower jaw
15A-70-10	Shoe, upper jaw
15A-70-11	Rod, cam
15A-70-12	Cam, lock
15A-70-13	Pin, cam
15A-70-14	Handle, cam
15A-70-15	Pin, cam rod
15A-70-16	Foot, clamp
15A-70-17	Bushing, lower jaw (2 required)
15A-70-18	Pin, rapid release nut
⅜" x 1½"	Groov-Pin
15A-71	Upper jaw screw assembly
15A-72	Lower jaw screw assembly
15A-73	Lower jaw link assembly

15A-80 TRUEING INDICATOR ASSEMBLY

15A-80-1	Base, trueing indicator
15A-80-2	Screw, thumb
15A-80-3	Plug, thumb screw
15A-80-4	Plug, shank screw
25C	Dial indicator
15A-81	Trueing indicator shank assembly
15A-81-1	Shank, trueing indicator
15A-81-2	Bearing, plunger front
15A-81-3	Spring, plunger
B-35-3	Bearing, bushing type
5133-15	Ring, snap
15A-82	Trueing indicator plunger assembly
15A-82-1	Plunger, trueing indicator
15A-82-2	Ball, trueing indicator plunger

15A-90 WHEEL DRESSER ASSEMBLY

15A-90-1	Base, wheel dresser
15A-90-2	Diamond
15A-70-11	Rod, cam
15A-70-12	Cam, lock
15A-70-13	Pin, cam
15A-70-14	Handle, cam
15A-70-15	Pin, cam rod
15A-70-16	Foot, clamp
⅜" x 1½"	Groov-Pin

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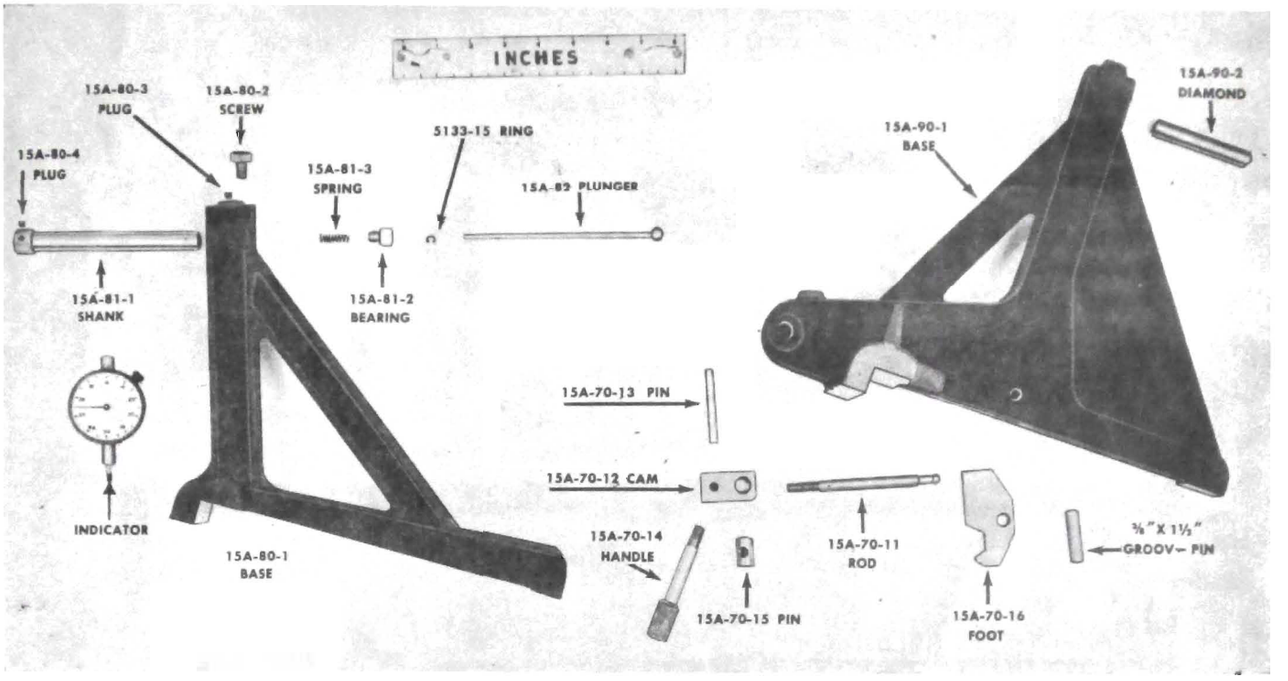

15A — Parts Illustration No. 11

15A-100 RAPID RETRACTION ASSEMBLY	
15A-100-1	Shaft, handle
15A-100-3	Arm, connecting
15A-100-4	Gear, sliding
15A-100-5	Bracket, gear shaft support
15A-100-6	Gear, gear shaft stationary
15A-100-7	Gear, handle shaft
15A-100-8	Bearing & bracket, handle shaft
15A-100-9	Key, sliding gear
15A-100-10	Bearing, handle shaft
15A-100-11	Shaft, sliding gear
SS-625-500	Screw, shoulder (2 required)
	Key, #11 Woodruff (3 required)
302	Cup, oil (4 required)
15A-101	Rapid retraction lever assembly
15A-101-1	Arm, rapid retraction handle
H-3308	Handle, Balcrank
15A-102	Retraction table bracket assembly
15A-102-1	Bracket, retraction table
15A-102-2	Shaft, retraction table bracket
15A-102-3	Arm, retraction
15A-102-4	Gear, table bracket shaft
15A-102-5	Plate, sliding gear back
	Key, "A" Woodruff (2 required)
1220	Cup, Oil
15A-111	"Y" Driver Assembly (2 required)
15A-111-1	Body, "Y" driver
15A-111-2	Clamp, "Y" driver
15A-111-3	Hinged stud, "Y" driver
15A-111-4	Pin, "Y" driver hinged stud
15A-111-5	Adjusting screw, "Y" driver
15A-111-6	Clamp pivot, "Y" driver
15A-111-7	Body bar, "Y" driver
15A-112	Short driver dog (for grinding mains)
15A-113	Long driver dog (for grinding mains)
ELECTRICAL 15A-190	
15A-190-1	Compartment, electric control
15A-190-2	Cover, control compartment
15A-190-3	Screw, captive (2 required)
15A-190-4	Nut, #8-32 special (4 required)
15A-190-5	Nut, #8-32 special (3 required)
15A-190-6	Strap, grinding motor grounding
15A-190-7	Strap, headstock motor grounding
15A-190-8	Conduit, ½" x 27" (2 required)
15A-190-9	Conduit, ¾" x 43"
15A-190-10	Conduit, flexible—½" x 52"
15A-190-11	Conduit, flexible—⅜" x 80"

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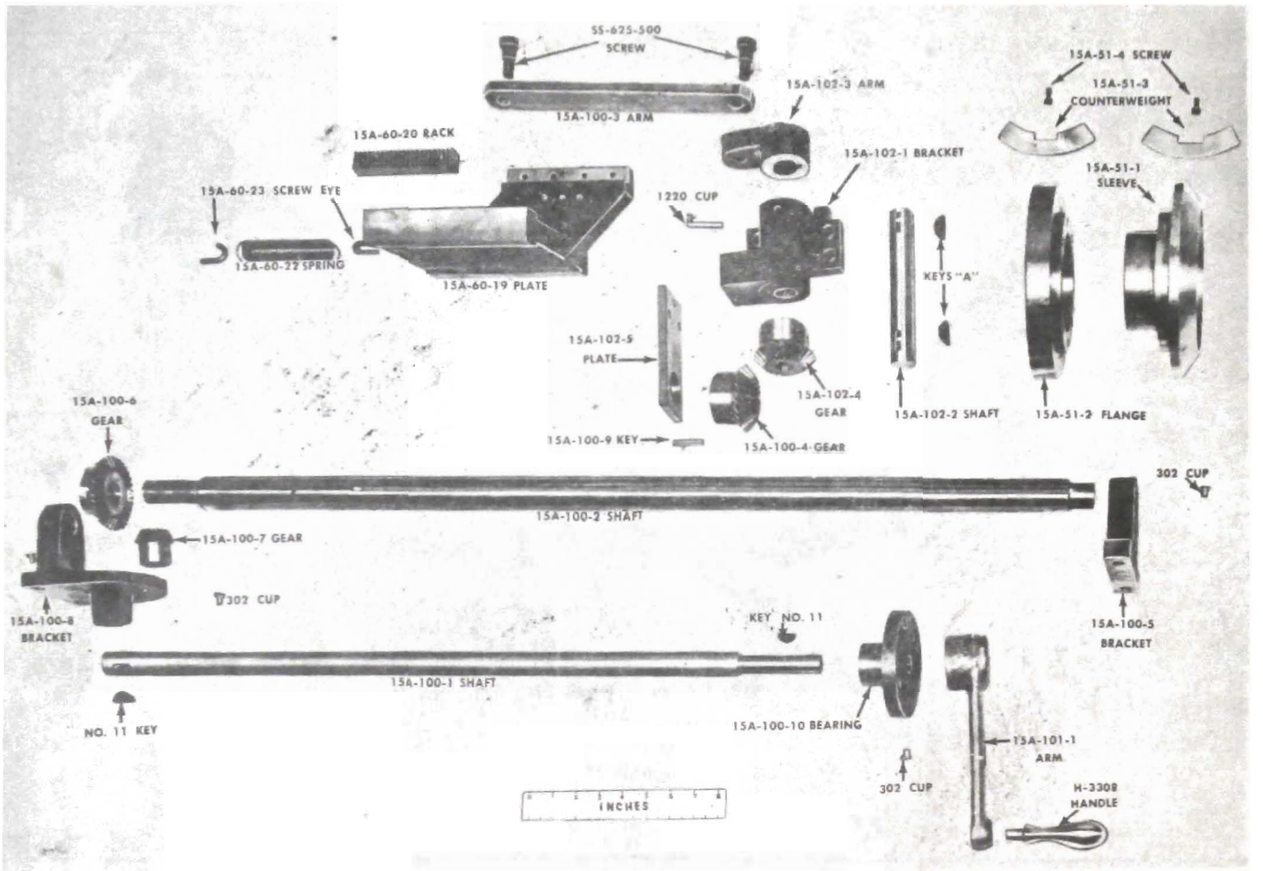

15A — Parts Illustration No. 12

15A-190-12	Wiring diagram
15A-190-13	Conduit street elbow
	#104 BEPCO terminal block
	9586 H 1760 magnetic starter
	H1369B Heater coil (3HP)
	10250 H56 Push button station
	9115 H 89 Manual starter
	10172 H 2 Overload relay (2 required)
	H148 Heater coil (½ HP)
	H1468A Heater coil (1/10 HP)
	#72171 Junction box
	#72-C-1 Junction box cover
	#802 Connector (2 required)
	#240 Connector
	#241 Connector (2 required)
	#8221 Connector (2 required)
	#266 90° Connector
	#123 Conduit bushing (2 required)
	#122 Conduit bushing (9 required)
	R2 Reducing washer
	R3 Reducing washer
	½" 45° Elbow
	½" Close nipple

15A-200 EXTRA EQUIPMENT

15A-200-1	Arbor, balancing
15A-200-2	Diamond, cluster
15A-200-3	Mounting pads (4 required)
15A-200-4	Mounting plates (4 required)
15A-201	Wheel side dresser assembly
15A-201-1	Frame, side dresser
15A-201-2	Nose, side dresser
15A-202	Coolant drain pump assembly
15A-203	Wheel balancer (spirit level type)
25 lb.	Lubricant, economy grinding
969A	Wrench, ⅞ "T" handle
11	Wrench, 1 13/16 open end
No. 00	Wrench, 5/16 open end
1240	Wrench, 1¼ open end
	Gauge, Arnold (with 3" to 5" caliper)