TECHNICAL MANUAL
OPERATORS, ORGANIZATIONAL, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL, INCLUDING REPAIR PARTS LIST

FOR
GRINDING MACHINE, CRANKSHAFT
MODEL 15A (G)

4910-00-540-6103
STORM VULCAN

HEADQUARTERS, DEPARTMENT OF THE ARMY
AUGUST 1981

Technical Manual

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HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, Dc, 12 August 1981

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FOR

GRINDING MACHINE, CRANKSHAFT MODEL 1 5A(G) (NSN 4910-00-540-6103)

REPORTING OF ERRORS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (recommended Changes to Publications and Blank Forms), or DA Form 2028-2, located in the back of this manual direct to: Commander, US Army Armament Material Readiness Command. ATTN: DRSAR-MAS, Rock Island, IL 61299. A reply will be furnished directly to you.

NOTE

This manual is published for the purpose of identifying an authorized commercial manual for the use of the personnel to whom this equipment is issued.

Manufactured by: Storm Vulcan
2225 Burbank Street
Dallas, TX 75235

Procured under Contract No. DAAA09-77-D-6003

This technical manual is an authentication of the manufacturers' commercial literature and does not conform with the format and content specified in AR 310-3, Military Publications. This technical manual does, however, contain information that is essential to the operation and maintenance of the equipment.

INSTRUCTIONS FOR REQUISITIONED PARTS
NOT IDENTIFIED BY NSN

When requisitioning parts not identified by National Stock Number, it is mandatory that the following information be furnished the supply officer.

1 - Manufacturer's Federal Supply Code Number. 83658
2 - Manufacturer's Part Number exactly as listed herein.
3 - Nomenclature exactly as listed herein, including dimensions, if necessary.
4 - Manufacturer's Model Number. 15A(G)
5 - Manufacturer's Serial Number (End Item).
6 - Any other information such as Type, Frame Number, and Electrical Characteristics, if applicable.
7 - If DD Form 1348 is used, fill in all blocks except 4, 5, 6, and Remarks field in accordance with AR 725-50.

Complete Form as Follows:

(a) In blocks 4, 5, 6, list manufacturer's Federal Supply Code Number - 83658 followed by a colon and manufacturer's Part Number for the repair part.

(b) Complete Remarks field as follows:
Noun: (nomenclature of repair part)
For: NSN: 4910-00-540-6103
Manufacturer: Storm Vulcan
2225 Burbank Street
Model: 15A(G) Dallas, TX 75235
Serial: (of end item)
Any other pertinent information such as Frame Number, Type, Dimensions, etc.

15A (G) GRINDING MACHINE

SECTION I. INSTALLATION

A. *Packing List*

Packing list is sent with machine. Carefully check if everything has been received in good order. Claims for shortages should be made immediately.

B. *Positioning*

Model 15.A (G) is 54" (1371mm) high, 42" (1066mm) wide and 114" (2895mm) long and requires 147" (3734mm) for front table travel. Allow at least 36" (914mm) at rear of machine for changing grinding wheels, cleaning, etc. When positioning grinder, select location that gives operator complete freedom of movement. Provide space it front of machine for table to hold tools required with grinder.

1. Place machine on solid concrete floor.
2. Carefully remove machine from skids and place in position on 4 mounting pads and plates. (Steel mounting plates go on top of mounting pads.) These mounting pads absorb vibration from other machines in shop and from outside sources that might cause poor grinding finish.
3. Wipe off all anti-rust compound with mineral spirits or equivalent.

C. *Lighting*

Large fluorescent lighting fixture should be placed over grinder. On high precision work, good lighting for entire working area will lessen operator fatigue and speed production.

D. *Preparation*

1. Remove hold-down straps from back table, front table, and rear of wheel slide base.
2. Place table traverse handwheel in place and lock securely with set screw.
3. Place grinding wheel infeed handwheel in place and lock securely with set screw.
4. Remove grinding wheel guard cover and carefully place grinding wheel on spindle. (See Sections J to L on handling of grinding wheel.) Tighten securely on spindle taper. When installing or removing grinding wheel, be careful not to mar taper or threads on spindle or wheel mount.
5. Install journal sizing gauge on grinding wheel guard with bolts furnished. All necessary information for installation, use and maintenance of gauge is furnished in carton in which it was delivered.
6. When shipping crankshaft grinder, headstock and tallstock are locked to table with manual lock nuts. These lock nuts should be loosened enough so head and tailstocks will move freely.

E. *Power Supply*

1. Direct disconnect switch should be placed neat machine. Bring wires from disconnect switch through holes in side of electrical compartment and attach magnetic starters. Be sure to connect ground wires to ground.

2 *3 Phase Circuit*

Machines equipped with 3 phase motors were wired at factory so all motors rotate properly -all rotate clockwise when looking into shaft. Should motors rotate backward, reverse 2 leads only at disconnect switch.

F. *Motors and Relays*

Machine is equipped with 3 motors:

½ HP workdrive motor
1/10 HP coolant pump motor
7 1/2 HP grinding spindle motor

Switch on *right* operates grinding spindle and coolant pump motors. Electrical compartment at right rear of machine houses magnetic starter (for 7 1/2 HP motor) and 2 overload relays: 1 for workdrive motor and 1 for coolant pump motor. Magnetic starter and overload relays have heater coils with amperage ratings corresponding to amperage rating of motors. Always maintain rating when replacing heater coils.

G. *Portable Coolant Tank*

Coolant tank should be located at the rear. To clean tank, remove coolant pump and disconnect coolant return hose. Tank can then be rolled to convenient area for cleaning. Tank capacity is 30 gallons (113.6 lit). Liquid grinding compound sent with grinder should be mixed with 40 parts water to 1 part compound. This liquid grinding compound is available in 3 1/2 gallon (13.24 lit) containers. A good grade of soluble oil may, however, be used; mix 1 part soluble oil to 40 parts water or to supplier specifications.

H. *Oil Reservoirs*

All oil reservoirs and wells are filled before leaving plant. Be sure to check them all before operating machine. Specific information is found in Section IV, B. Lubrication.

I. *Leveling*

Machine should be exactly level to insure proper operation and lubrication. Using machinist's level, move head- and tailstocks flush with end of table and place level on flat portion of v-ways between scribed lines. Then level machine lengthwise by placing level lengthwise on flat way of top table.

Machine must be level crosswise and lengthwise.

After leveling, bolt back table way guards in place.

J. *Mounting Grinding Wheel*

Grinding wheel is mounted on sleeve type mount. Mount consists of 2 parts: sleeve and flange, Sides of sleeve and flange grip sides of grinding wheel by tension effect of screws and hold them together. Always use new, clean blotters between mount and wheel. All dirt and small particles *must* be removed from sides and hole of wheel and also from mount. Screws and threaded holes must be cleaned and oiled before assembly of flange and sleeve. Numbers 1 through 8 are stamped on flange beside screw holes. These numbers represent tightening sequence that *must* be followed. This forms crisscross stress pattern to prevent damage to grinding wheel which would endanger operator.

When mounting grinding wheel:

1. Clean parts as stated above.
2. Place new clean blotter on both sides of wheel.
3. Place wheel on sleeve.
4. Place flange on and install screws with fingers.
5. With hexagon key wrench furnished, tighten No. 1 screw lightly.
6. Tighten the remaining screws, in order, lightly.
7. Retighten each screw, in order, a little more.
8. Using torque wrench, tighten each screw, in order, to 15 foot-pounds (.14 cm/kg) torque.

CAUTION

When inserting screws never tighten 1 screw up to full 15 foot-pounds (.14 cm/kg) and go to next screw. This procedure will damage wheel because flange will not be drawn evenly against wheel. Excessive tightening pressure must also be avoided, as this will distort flange and sleeve. After 8 to 16 hours of grinding, screws should be checked for looseness caused by compression of blotter. Screws will probably have to be retightened to maintain 15 foot-pound (.14 cm/kg) torque.

K. *Balancing Grinding Wheel*

Notice 2 bronze counterweights mounted in groove in wheel mount flange. Counterweights are locked in position by means of screw located in their centers. Counterweights may be moved in their groove to compensate for imbalance of grinding wheels. New grinding wheels should be balanced before and after truing on machine with grinding wheel dresser because a balanced grinding wheel is essential to good grinding.

To use spirit level horizontal balancer:'

1. Place balancing head gently onto base.
2. Check air bubble; it must be exactly centered in black circle on glass. If not, adjust by loosening or tightening small screws on side of chrome plated head.
3. Place mounted wheel onto balancing head.
4. Loosen nuts on counterweights and remove counterweights from flange.
5. Note position of bubble and scribe with chalk exactly in line with far side of bubble.
6. Place counterweights close together on each side of scribe line.
7. Move counterweights as necessary equidistant from line until bubble is exactly centered in black circle. Lock counterweights in position with lock nuts.
8. Recheck as needed. This method of balancing will assure properly balanced wheel.

L. *Removing Grinding Wheel*

When removing wheel, turn spindle nut 2 turns, then tap wheel with hand to break mount loose from spindle taper. Then, remove nut and wheel. Do not hit wheel or spindle with hammer.

SECTION II. HOW IT WORKS

A. *Table Traverse and Taper Adjustment*

Front table and back table move in opposite directions when traverse handwheel is rotated. Front table, however, moves 3 1/2" (88.9mm) before back table begins to move. This allows crankshaft journal to be moved across face of grinding wheel while grinding wheel is stationary. Top table is pivoted at center for taper adjustment. Taper adjustment screw moves top table. If any taper is encountered during grinding, loosen 2 cap screws underneath and at ends of sub-table and turn taper adjustment screw slightly to eliminate taper.

Example:

If large end of taper is toward right end of machine, taper adjustment screw should be turned clockwise.

B. *Coolant*

Good grinding is almost impossible without good coolant and proper use of it. Be sure to have proper coolant and keep It clean by changing as It becomes dirty. Use plenty of coolant when grinding and while dressing grinding wheel. One of the most common causes of poor grinding is improper use of wrong type of coolant. Coolant must flow between work and grinding wheel, not on top of work or on face of wheel.

C. *Headstock and Headstock Workhead*

Workhead has step pullies to adjust RPM. Clutch lever starts and stops rotation of workhead.

Lock shafts lock workhead In vertical position.

Elevating screw raises and lowers elevating head.

Dial is calibrated to 0.001" (.025mm).

Scale is used in conjunction with dial.

Locknut anchors headstock assembly to front table.

Dial and scale are direct reading. For example, when dial is rotated one complete turn, dial and scale will indicate movement of elevating head 0.125" (3.17mm). In reality, elevating head has moved only half that amount, or 0.0625" (1.59 mm). This eliminates necessity for operator to divide stroke by 2 to obtain setting. Cross-slide is adjusted with nut and is used for truing crankshaft when grinding main journals only.

NOTE

When truing and grinding rod bearing journals, cross-slide must be in neutral position at center.

D. *Tailstock and Tailstock Workhead*

Operation of tailstock workhead elevating screw, lock nut and cross-slide are all identical to headstock and are always used in conjunction with these corresponding parts.

E. *Headstock and Tailstock Degree Head*

When lock levers are up, degree head is locked in position.

F. *Wear Strips*

Both headstock and tailstock are equipped with precision ground alloy steel strips placed between housings and table surface.

G. *Wheelhead*

Wheelhead consists of:

1. Feed-up dial and mechanism.
2. Spindle assembly.
3. Drive-belt cover.
4. Wheel slide.
5. Wheel slide base.
6. Grinding wheel and guard.

Grinding wheel mount has internal taper on spindle. When mounting or removing grinding wheels, extreme care must be used to prevent damage to taper on spindle or in mount. Complete stock of grinding wheels is carried at factory available for Immediate shipment. Wheel guard cover is removed by removing 3 knurled nuts. Grinding wheel splash guard is fully adjustable for any width or diameter grinding wheel and should be kept as close as possible to grinding wheel to prevent excessive splashing of coolant.

Two locking screws and one expanding screw are provided on coolant pipe clamp bracket, permitting coolant nozzle to be adjusted to any convenient position. To adjust, loosen two lock screws and tighten center screw. Position coolant pipe and reverse screw procedure.

Spindle is mounted on three super precision spindle bearings inside housing. Bearings have been preloaded to Insure absolute rigidity. No further attention to spindle or bearings is necessary so long as care Is exercised with its use, because entire assembly has been permanently lubricated for life of bearings.

Feed-up dial is calibrated in 0.001" (.025mm). This dial is direct reading. When dial is turned to 0.020" (.5lmn), the grinding wheel will remove 0.020" (.51mm) stock from diameter of work. However, this dial is meant for roughing only. A dial indicator should be used to insure accuracy.

H. *Steady Rest*

Steady rest eliminates whipping and vibration while grinding. Steady rest is clamped to front table with lever. If lever falls to clamp steady rest securely, adjust screw underneath lever block to engage lower law and push knob fully in and turn to right 1/4 turn. Screw knobs are used to adjust steady rest jaw. When using the steady rest, be sure jaws are always In contact with journal when grinding. Use pressure necessary to grind round. Steady rest shoes are made of babbitt and are removable. Upper shoe is attached with cap screw. Lower shoe has two bronze screws cast into it which fit two holes in lower jaw. Two bronze nuts are used to secure shoe in place. Shoes are always available for immediate shipment, but a supply of these shoes should be kept on hand. The steady rest shoe should be filed flat, straight and smooth at regular intervals. Never allow shoe tips to have burrs or marks on them. Bevel sides of steady rest shoes to approximately 1/2 width of shoe. Three screws are used to adjust upper jaw gib. Gib should be kept snug against upper law so excessive play is eliminated. Keep screw threads and clamping mechanisms lightly covered with oil to prevent rust and corrosion and to provide smooth operation.

I. *Truing Fixture*

Truing fixture is used for truing crankshaft journal with center line of headstock and tailstock spindles before grinding.

Indicator is shipped in separate box to prevent damage.

To assemble:

1. Remove taper from truing fixture shank and remove small brass plug from tape.
2. Place indicator into hole at knurled end of shank.
3. Remove small set screw at knurled diameter and place brass plug in tapped hole.
4. Replace set screw and position indicator so its needle moves only a few marks.
5. 5.Tighten set screw. Truing fixture is now ready for use

Shank is adjustable to any position when thumb screw is loosened. Truing fixture base is machined to fit contour front table and is so balanced; it requires no clamping. Be sure fixture fits securely against front table for accurate reading. Protect indicator from damage. Plunger assembly should be removed and cleaned every two weeks

To remove:

1. Loosen thumb screw and pull entire shank and plunger assembly from fixture)base.
2. Retain small brass plug under thumb screw which protects .shank from damage.
3. Loosen small set screw at knurled diameter of shank and remove indicator. Set screw also has small brass plug under it that should be replaced when reassembling
4. Unscrew knurled brass nut at end of shank
5. Remove plunger.
6. Clean all parts and apply light coat of oil and reassemble.

NOTE

Never oil indicator as this will damage It. Excessive oil on plunger and mating parts should be avoided so oil does not work into Indicator.

Indicator should be positioned in shank so Its plunger just contacts shank plunger for maximum travel of indicator for truing.

Truing indicator mounted on steady rest permits faster setup as it is not necessary to remove indicator while grinding. Note top steady rest shoe is spring loaded and should be brought into journal with very slight pressure to allow for indicator reading. When mating journals are aligned, both truing indicators may be used simultaneously.

K. *Dressing Grinding Wheel Face*

1. Installing Fixture

Wheel dressing fixture is clamped to front table in same manner as steady rest. Clamp adjustment is also similar. Diamond shank is held securely with set screw. Diamond must be securely anchored to fixture and fixture securely anchored to table with locking lever. Failure to do this will result in improper surface and patterns on face of the grinding wheel which will cause imperfect grinding.

Never allow the point of the diamond to protrude more than 5/8" (15.9mm) past fixture. Rotate diamond shank slightly after 3 or 4 dressings to maintain good cutting edge on diamond.

2. *Procedure*
   a. Clamp dressing fixture to front table
   b. Turn both switches on.
   c. Turn coolant on.
   d. Bring grinding wheel very slightly into contact with diamond.
   e. Move front table from side to side very slowly while feeding grinding wheel forward approximately 0.003" (.076mm) as indicated on feed-up wheel with each pass.
   f. The finished pass should be approximately 0.0015" (.38mm) on feed-up wheel.

CAUTION

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

New operators will find it best to dress grinding wheel before regrinding each crankshaft. After gaining experience, it will be necessary to dress wheel only when wheel has become glazed or rough. When dressing grinding wheel face with crankshaft removed, always use standard wheel dressing fixture.

L. *Dressing Grinding Wheel Sides*

1. *Installing Fixture*

Wheel side dressing fixture used for truing sides of grinding wheel with base and sizing width. Place fixture between chucks on headstock and tailstock. Threaded shank of the cluster diamond permits movementof diamond toward grinding wheel. Two flat surfaces on pilot diameter are provided so diamond will point slightly downward when set screw is tightened. When dressing opposite side of grinding wheel, loosen set screw and turn diamond toward grinding wheel. Tighten set screw which points diamond slightly downward. Be sure fixture is on center.

2. *Procedure*
   a. Turn wheel motor on.
   b. Move coolant hose into position at side of grinding wheel and turn coolant on.
   c. Bring diamond lightly into contact with grinding wheel at bottom and move diamond up toward center of grinding wheel.
   d. Move diamond back down toward bottom of grinding wheel.

Important:

Always use coolant on diamond when dressing grinding wheel. Be sure diamond Is locked tightly into position so diamond points slightly downward. Always bring diamond from bottom upward into grinding wheel. Always dress both sides of grinding wheel.

M. *Dressing Grinding Wheel Radii*

1. *Installing Figure*
   a. Install dresser on table; tighten clamp. Be sure clamp holds dresser tight.
   b. Loosen cap screws on top of diamond mount.
   c. Install diamond stop in front of diamond barely in contact with diamond.
   d. Read stamped number on plate (zero radius). Plate is on tailstock side of fixture.
   e. *Subtract* desired radius from stamped number. This is micrometer setting.

   Example:

Plate Number	3.250	(82.55 mm)
Desired Radius	.125	(3.18 mm)
Micrometer Setting	3, 125	(79.37 mm)

   Set and lock micrometer on desired number.
   f. Place micrometer over diamond mount bracket and diamond stop. Move diamond mount (and stop) until stop is against micrometer. Lock diamond mount with cap screws.
   g. Remove diamond stop and insert in back of bracket (DO NOT store with loose tools .....diamond stop is precision calibrating device and must not be damaged.)

2. *Procedure*
   a. Dress wheel face with standard dresser. DO NOT USE RADIUS DRESSER for face dressing diamond wear will change radius adjustment.)
   b. Swing stop pin limits arc of dresser. Place in left hole for radius on left side of wheel face. Use right hole for right radius.
   c. With wheel DEAD and retracted, install radius dresser in approximate center of table. Be sure clamp holds dresser TIGHT.

d. Place diamond bracket In left or right position (depending on which corner of wheel face is to be dressed.) Diamond mount will be parallel to wheel face.
e. Advance w-heel until diamond Is behind wheel face.
f. Traverse until wheel side is slightly In contact with diamond (Check by rotating wheel with fingers and adjusting traverse until light scratch is obtained.)
g. Retract wheel and swing bracket against stop. Diamond mount will be perpendicular to wheel face.
h. With wheel DEAD, advance until wheel face is lightly in contact with diamond. (Check as In Step f.) Record micro-infeed. Retract wheel approximately twice value of radius.

Example:	Radius	0 125"	(3.18 mm)
	Wheel Retraction	0.250"	(6.35 mm)

i. Place radius bracket at approximately 45 degrees (half way between stops. Start wheelhead motor. Open coolant valve wide for good stream, on wheel.
j. Slowly advance wheel (DO NOT TRAVERSE) until in contact with diamond.
k. Sweep dresser in full arc (between stops.) while continuing to advance wheel slowly until micro-infeed reading corresponds to recording from Step h. Stop wheelhead motor.
l. Repeat steps d through k on opposite corner.
m. Remove radius dresser. Redress wheel face with standard dresser. This cut must be very fine or radii will be altered. Wheel is now ready to grind.

NOTE

While grinding, use Radius gauge periodically to insure correct radius.

SECTION III. HOW TO OPERATE

A. *Preparing Crankshaft for Grinding*
   1. Clean crankshaft thoroughly.
   2. Check crankshaft for cracks, excessive bends and warpage.
   3. Straighten if necessary.

B. *Installing Crankshaft.*
   1. Lock headstock to table with nut..
   2. Place crankshaft in machine with flywheel end in tailstock.
   3. Lock tailstock.

C. *Grinding Crankshaft*

After crankshaft has been trued, all rod journals should be measured with micrometer to determine worst journal. If worst journal requires 0.020" (.51mm) stock removal from its diameter for clean up, then all other journals should also be ground 0.020" (.51mm) undersized. Repeat above procedures for determining correct undersize to grind main bearing journals. The journal-sizing gauge should be placed on journal immediately and set at 0 after 0.010" (.254mm) has been removed. This 0 setting is used for grinding all remaining journals to size. The journal-sizing gauge insures quick, accurate work. Journal-sizing gauge will also indicate a journal that is out of round.

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

NOTE

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

D. *Grinding Main Bearing Journal*
   1. Flywheel flange of crankshafts must be toward tailstock for this operation. Screw workhead vertical slides down to 0. Disengage counterweights. Turn tailstock 180 degrees from headstock and tighten chucks. This assures perfect balance of head and tailstock for grinding plain bearing journals.
   2. Place truing fixture on front table so indicator rod touches rear seal location. Rotate crankshaft by hand. Correct alignment by adjusting vertical or cross-side or both. Move truing fixture to timing gear location or unworn portion of front main bearing and correct for misalignment.
   3. When rear seal and timing gear location run true, shaft is ready for grinding.

NOTE

Maximum runout of flywheel flange timing gear location should never exceed 0.001".

E. *Use of Steady Rest When Grinding Main Bearing Journal*

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

F. *Grinding Rod Bearing Journal*
   1. Make sure cross-slide is in neutral position.
   2. Engage headstock and tallstock locking pins. Loosen chucks and loosen set screws on gibs. Move slide to proper stroke on scale by turning elevating screw.
   3. Position head and tailstock approximately equidistant from table center and slightly farther apart than length of shaft to be ground.
   4. Lock headstock to table with nut.
   5 Lock tailstock to table with nut.
   6. With spindle lock released, place crankshaft timing gear end on headstock chuck.
   7. Hold flywheel end in line with tailstock chuck and depress foot valve to actuate tailstock spindle.
   8. Tighten chucks and gibs securely.

Adjust counterweights:

1. Engage counterweight lock at back of workhead face. Rotate counterweights by hand to be sure locking pin is engaged to rotate weights.
2. Release weight locking nut with wrench. Both head and tailstock nuts are released by moving wrench clockwise when looking into spindle.
3. After loosening lock nuts, adjust counterweights with wrench.

4. Use same procedure as above for tailstock end.
5. Rotate weights up or down whichever is required to achieve proper balance of crankshaft. Headstock and tailstock weights should be approximately in same position.
6. After balance is obtained, be sure to tighten lock nut.

NOTE

DO NOT adjustweights without loosening lock nut....counterweight adjusting screws " ill be stripped.

G. *Truing Crankshaft With Mating Journals*

1. Rotate crankshaft so two end mating journals are approximately centered, that is, when they are at bottom dead center with respect to centers or centered about the headstock and tallstock spindle. Tighten chuck.
2. Place truing fixture on front table at one of end journals. Loosen screw and move indicator shank until plunger touches journal and moves indicator pointer approximately 0.050" (1.37 mm).Tighten screw. (When using steady rest truing indicator, before positioning indicator shank, bring top steady rest shoe against journal using only light pressure to allow for indicator movement.)
3. Disengage locking pins and revolve crankshaft by hand. Indicator will indicate amount of runout.
4. If indicator indicates runout of stroke, elevating screw nut nearest indicator needs adjusting.
5. Revolve micrometer dial 1/2 indicated runout, adjust locking plate adjustment screws. If screws fall to completely correct side runout, engage workhead lock pins, loosen chucks and slightly revolve crankshaft Into position. Tighten again and proceed as before.
6. Move truing indicator to opposing mating journal. True this journal as Instructed above. When both mating journals run true, they are ready for grinding.
7. After truing these journals 0 dial on indicator for locating next journals to be ground.
8. After grinding first pair of journals, engage locking pins on woorkheads.
9. Move steady rest to position for next journal
10. Loosen locks on chucks and rotate shaft until journal contacts upper steady rest shoe.
11. Tighten chuck locks and proceed as directed above.

H. *Truing Crankshaft Without Mating Journals*

Some crankshafts for 4, 6, and V8 cylinder engines do not have mating journals. Special instructions should be followed in truing these crankshafts

1. Place crankshaft in machine and set stroke as described in the previous section.
2. Be sure both headstock and tailstock vertical slides are at same relative position when reading micrometer dial. Be sure main bearing journals are exactly parallel to head and tailstock spindle.
3. Revolve crankshaft so one end of journal is in grinding position and lock both chucks. Place truing fixture at this journal, release head lock pins and revolve crankshaft. If Indicator shows stroke runout, adjust elevating screw nuts of both heads of runout amount. If side runout is indicated, adjust both locking plate adjustment screws the same amount.
4. 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 parallelism of the main and rod journals.

SECTION IV. MAINTENANCE

A. *General Maintenance*

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

Keep all screws and moving parts cleaned and oiled to prevent gumming and corrosion. Operator should make a habit of cleaning grinder at end of each days work to prevent damage from corrosion.

A grinding machine is constantly subjected to a cloud of grinding dust and coolant that will, in time wear moving parts. Thoughtfulness concerning lubrication and cleaning will greatly increase life of machine.

B. *Lubrication*

1. *Bed and Table Ways*
   With table traverse handwheel, move tables maximum distance and remove guards at table ends. This will uncover oil wells in bed ways. Keep well filled with SAE 140 extreme pressure lubricant or equivalent. Move tables maximum distance in opposite direction and move guards to find 4 remaining wells. Wells should be thoroughly cleaned and refilled with fresh oil at least once every 300 to 400 hours to prevent grinding dust and coolant from wearing and corroding ways. Fill oil cup in center of front table with lubricant daily. The one shot oiling system lubricates table and wheel slide. Jeep filled with SAE 140 lubricant or equivalent. Pull plunger four times daily.
2. *Variable Work Speed Gear Box*
   Gear box is located behind clutch. Remove oil level plug on back of gear box and check level every two months. Use STP or equivalent oil. Workhead spindle bearings are permanently lubricated and should require no further attention.
3. T*ailstock*
   Fill oil cups on top of tailstock housing with SAE 30 oil or equivalent once every week. Tailstock workhead spindle bearings are permanently lubricated and should require no further attention.
4. *Wheelhead*
   Grinding wheelhead spindle is permanently lubricated and should require no further attention. Add small amount of SAE 90 or equivalent to feed up worm gear through oil cup or by removing cover once every week.
5. *Table Traverse Gears*
   There are 5 oil cups at rear of base and 1 oil cup at front of base. Add SAE 140 or equivalent to oil cups every week. Put small amount of oil on gear shaft and gears at rear of base once every week.

C. *Adjusting Rapid Retraction Lock*

Two adjustments are provided for rapid retraction lock. Tension adjusting screw located at bottom front of wheelhead base determines amount of pressure necessary to lock rapid retraction. Screw should be kept in a position that will require a slight pressure when turning retraction handle to forward locking position. Stop adjusting screw at rear of machine stops retraction lever. Screw should allow retraction lever to move slightly past center when rapid retraction is locked. Be sure to hold screw in position while locking jam nut.

D. *Elevating Head and Cross-Slid Gib*

Vertical slides and cross-slides have gibs that are adjustable to hold proper tension on dovetail. Each gib has four screws for adjustment. Never allow gibs any slack.

E. *Adjusting Workhead Clutch*

Detailed instructions for adjusting clutch are found on plate attached to rear of headstock housing.

F. *Adjusting Wheelhead Belt Tension*

Grinding spindle is driven by six v-belts located inside belt guard. Tension is constantly applied to belts by torsion spring. If belts require adjustment, proceed as follows:

1. Bring wheelhead to forward grinding position and remove belt guard. Guard is removed by lifting up at back and out at bottom, then upward.
2. Hold pulley idler arm toward spindle and slip belt from idler pulley.
3. Rest idler arm against top of back table and loosen set screw, located in outer edge of spring collar.
4. Revolve spring collar toward rear of machine and tighten set screw.
5. Lift idler arm close to spindle and reinstall belt.
6. Replace belt guard.

SECTION V. TROUBLESHOOTING

TROUBLE	CAUSE	CORRECTION
A. 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 checkboard pattern.	Wheel out of balance.	Balance wheel on wheel mount, repeat after truing. 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 checker-board pattern.	Faulty dresser.	Replace worn-out diamond. Tighten set-screw holding diamond.
	Diamond cracked or loose.	Replace or reset diamond.
	Dresser not rigidly clamped to table.	Adjust cam clamp.
General		DressingUse sharp diamond rigidly held close to wheel.

NOTE

Out-of-balance wheel can cause different patterns of chatter depending upon the amount of out-of-balance. Wheel should be balanced as accurately as possible.

B. 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 on wheel face	Oil spots or glazed areas Avoid getting oil on face of wheel.	Balance and true 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; reset diamond; use slower traverse speed; revolve diamond slightly every fifth dressing; tighten set screw on diamond Dress with less infeed; 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.
	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.

TROUBLE	CAUSE	CORRECTION
	Coarse grits of 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 fishtail.	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 infeed and slower traverse while dressing.
	Improper procedure.	Allow wheel to spark-out when finishing.
C. 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 infeed 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 infeed wheel pressure; dress wheel with slow traverse and less cut, change coolant.
D. 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
E. 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 1/4 turn every fifth dressing, use faster traverse and deeper penetration.
	Faulty operation.	Use more infeed.
	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.
F. 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.

NOTE

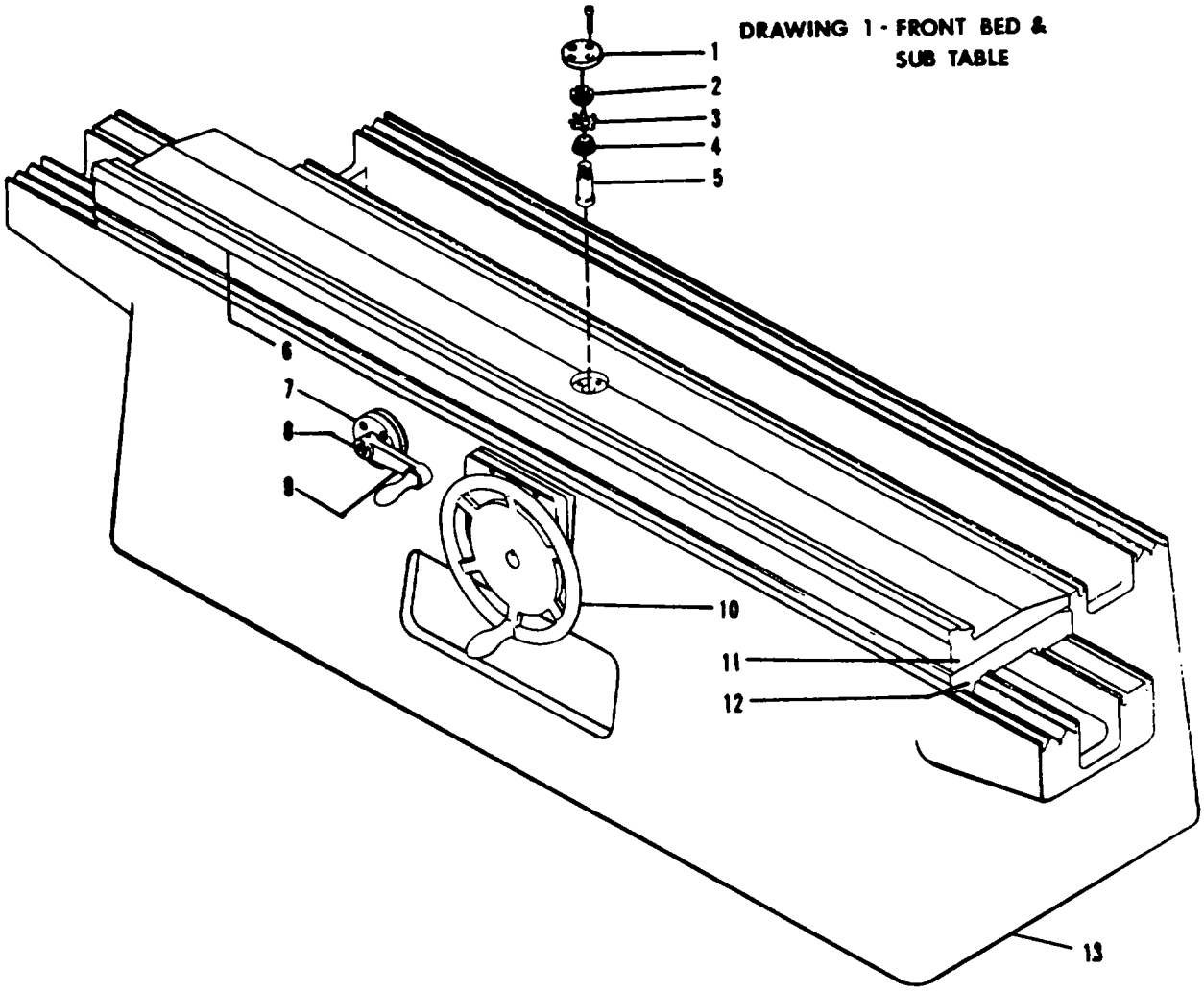
Machine MUST be level in all directions to insure accurate work.

TROUBLE	CAUSE	CORRECTION
G. 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.
H. BURNING OF WORK		
Work shows discoloration.	Improper wheel.	Use softer wheel, prevent glazing and loading, use more coolant; prevent chatter.
I. 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.
Radial break, two pieces.	Flange too tight.	Avoid excessive strains on sides of wheel. Tighten flange as explained under Wheel Mounting.

15A (G) GOVERNMENT GRINDING MACHINE

PARTS LIST

INDEX

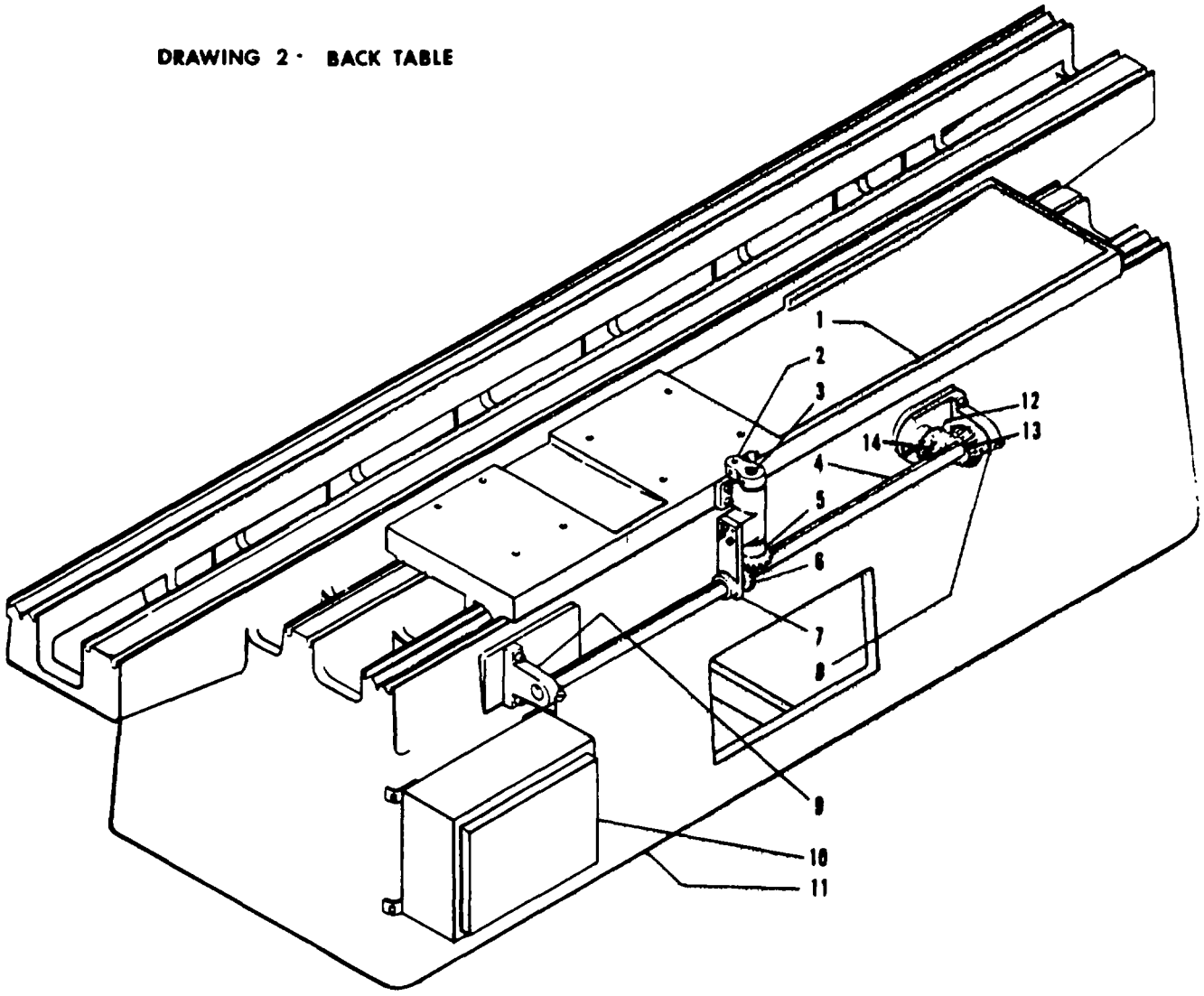


DRAWING 1 - FRONT BED & SUB TABLE

DRAWING 1 - FRONT BED & SUB TABLE

No.	Part No.	Description	No. Required
1	15A-10-9A	Pivot Pin Cover	1
2	N-05	Nut	1
3	W-05	Washer	1
4	07100	Timken Cone Bearing W/07196 Cup	1
5	15A-10-8	Pivot Pin	1
6	15C-20-9	Rack	2
7	15A-100-10	Bearing	1
8	15A-100-1C3	Retraction Shaft	1
9	15A-101-1	Retraction Handle Arm W/H3308 Handle	1
10	15A-20-1	Handwheel	1
11	15A-10-29	Top Table	1
12	15A-10-28C1	Sub Table	1
13	15C-10-1	Bed	1
	NOT SHOWN		
	15A-10-18	V-Oiler	4
	15A-10-19	Flat Oiler	4
	1410-10	Spring Retainer	4
	1410-11	Spring Retainer	4
	50CA3DE	Furnas Push Button Station	2

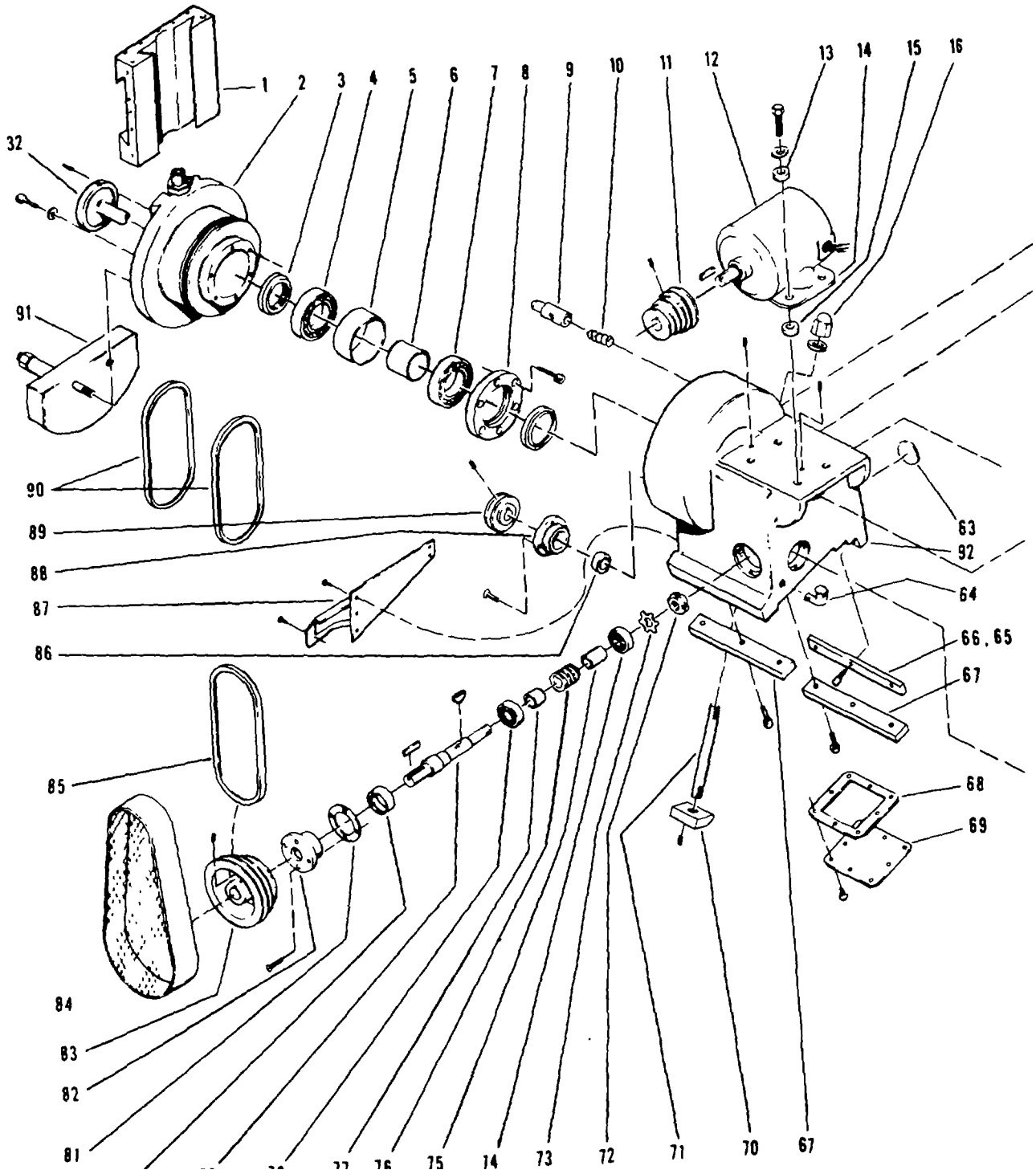
DRAWING 2 · BACK TABLE

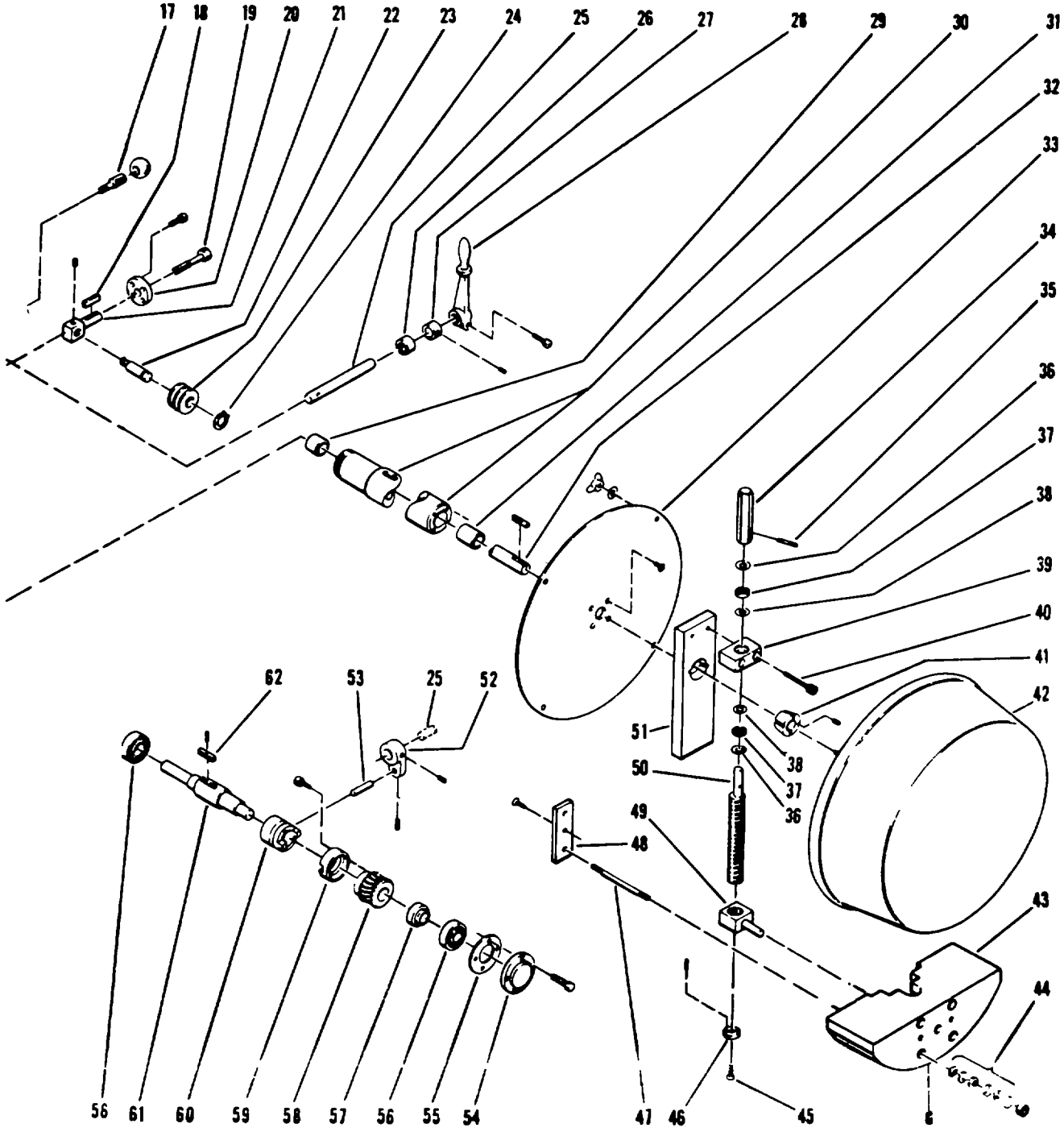


DRAWING 2 - BACK TABLE & RAPID RETRACTION

No.	Part No.	Description	No. Required
1	15A-10-4C2	Back Table	1
2	15A-102-3C1	Arm	1
3	15A-102-2	Shaft W/2 Ea. #11 Woodruff Keys	1
4	15A-100-11	Sliding Gear Shaft	1
5	15A-102-4	Gear	1
6	1510-26	Sliding Gear	1
7	15A-102-5C1	Bracket Mounted on 15A-102-1 Bracket	1
8	1510-8	Bracket	1
9	1510-12	Bracket	1
10	15A-191	Electrical Box	1
	Consists of:		
	P-2-107	Electrical Panel	1
	S-26-176	2 M Starter 1/2 HP	1
	S-26-172	1 M Starter 7 HP	1
	R-7-119	Relay	1
	K-3-105	Reset Kit	1
	H-41	Heater Coil for 1 M Starter	3
	H-21	Heater Coil for 2 M Starter	3
11	15C-10-1	Bed	1
12	1510-10	Gear	1
13	1510-9	Gear	1
14	15A-100-1C3	Retraction Shaft W11510-26 Key	1
	NOT SHOWN.		
	15A-12-1	Coolant Hose	1
	15A-12-2	Coolant Pipe	1
	15A-12-3	Coolant Clamp Bracket	1
	15A-12-4	Coolant Flex Tubing	1
	15A-11-3	Hose	1

DRAWING 3- HEADSTOCK 15A-130 (1 of 2)

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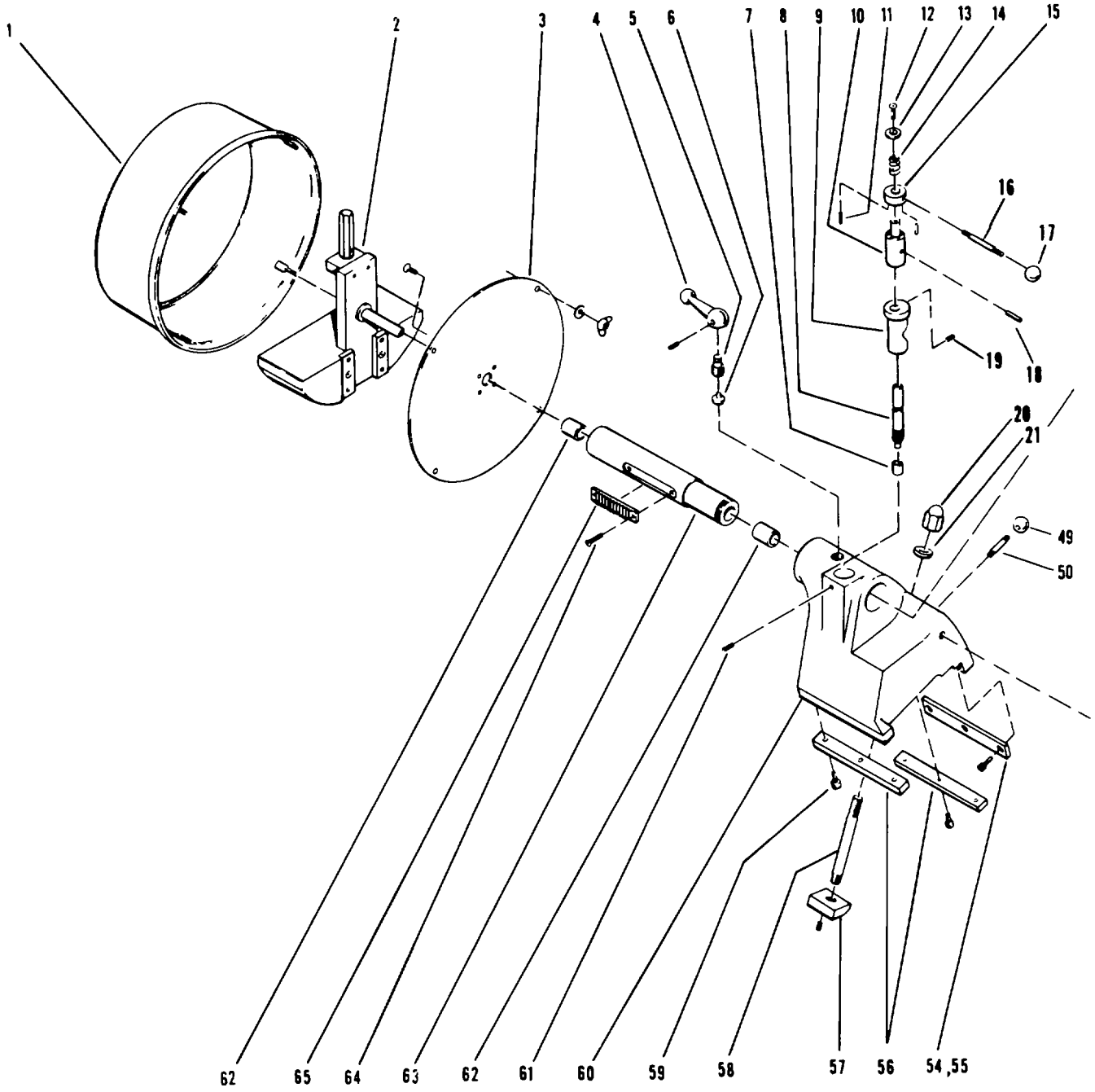
DRAWING 3 - HEADSTOCK 15A-130

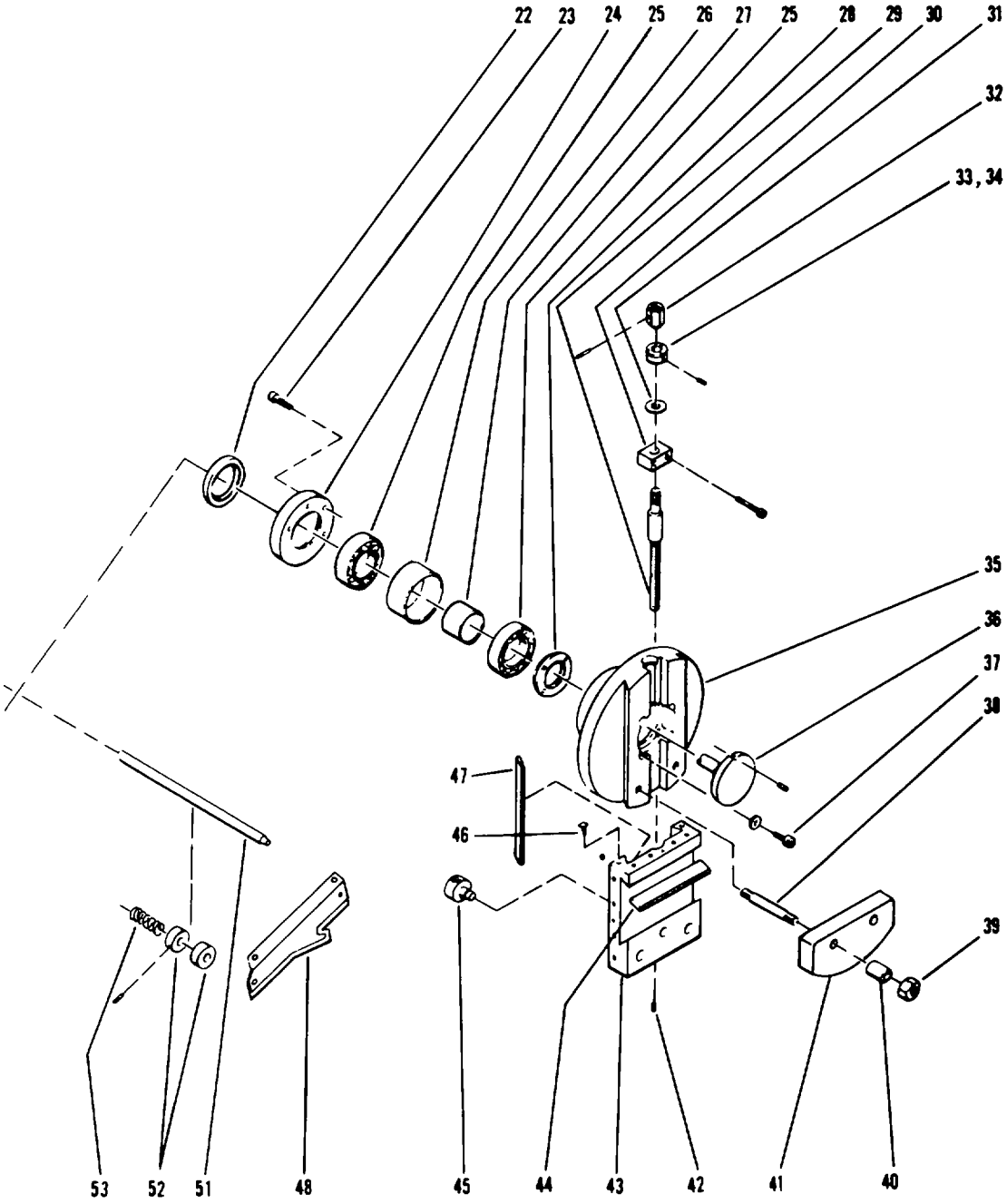
No.	*Part No.*	*Description*	*No. Required*
1	15A-32-1	Headstock Throw Head	1
2	15A-130-6	Headstock Head	1
3	15A-130-2	Spindle Bearing Nut	1
4	B-6-137	Bearing (Fafner MM211WI)	2
5	15A-31-9	Outer Bearing Spacer	1
6	15A-31-8	Inner Bearing Spacer	1
7	15A-31-6	Bearing Retainer	1
8	NA3656214	National Seal	1
9		Locking Pin	1
10		Locking Pin Spring	1
11	15A-30-2	Motor Pulley	1
12	M-4-122	Motor 1/2 H P 220 V	1
13	411-85	Rubber Bushings	4
14	1416-37	Rubber Motor Mount	1
15	15A-30-43A	Motor Mount Spacer Bushings	4
16	15A-35-3	Headstock Hold Down Nut	1
17	15A-30-29	Locking Pin	1
18	15A-36-4	Idler Key	4
19	15A-30-40	Idler Adjusting Screw	1
20	15A-30-39	Idler Screw Plate	1
21	15A-36-3	Idler Guide	1
22	15A-36-2	Idler Pulley Shaft	1
23	15A-36-1	Idler Pulley	1
24	5100-75	Snap Ring	1
25	15A-30-19	Clutch Shaft	1
26		Seal	1
27		1/2 Set Collar	1
28	1416-15B	Clutch Shaft Handle	1
29	16DU16	Garlock Bushing	1
30	15A-31-7	Shaft	1
31	16DU24	Garlock Bushing	1
32	15A-130-1	Shaft	1
33	15A-130-5	Back Plate	1
34	15A-140-11	Nut	1
35		¼ x 1 Roll Pin	1
36	TRA 1018	Thrust Race	2
37	NTA 1018	Needle Thrust Bearing	2
38	TRC 1018	Thrust Race	2
39	150-31-8	Elevating Screw Block	1
40		3/16 - 18 x 1 ¾ Socket Cap Screw	1
41	1210-1	Dodge Taper Lock Bushing	1
42	15A-140-19	Counterweight Cover	1
43	15A-130-4	Counterweight	1
44	BS-15-8.2-0.08	Belleville Disk Springs	48
45		5/16 - 18 x ¾ Socket Cap	1
46	15A-140-16	Retainer Washer	2
47	15A-140-13	Gib Stud	2
48	16A-140-15	Gib	1
49	150-32-6	Counterweight Nut	1
50	15A-140-12	Screw	1
51	15A-130-3	Counterweight Support	1
52	15A-30-20	Clutch Arm	1
53	15A-30-21	Clutch Arm Pin	1
54	1416-11	Oil Seal Retainer with 1416-2 Cap	1
55	15A-30-25	Gasket	1
56	6204 2RSJ	SKF Bearing	2
57	1416-4	Spacer	1
58	1416-5	Worm Gear	1
59	1416-7	Female Clutch	1
60	1416-8	Male Clutch	1

No.	*Part No.*	*Description*	*No. Required*
61	15A-30-53	Worm Gear Drive Shaft	1
62	1416-9	Male Clutch Key	1
63		2” Freeze Plug	1
64	1220	Gits Oiler	1
65	15A-30-32	Wear Strip Shims	1
66	15A, 30-54	Wear Strip	1
67	16A-30-55	Wear Strip	2
68	15A-30-23	Oil Plate Gasket	1
69	1A-.30566	Oil Plate	1
70	16Aa35-1	Headstock Hold Down Foot	1
71	16A-36-2	Headstock Hold Down Stud	1
72	N.04	Lock Nut	1
73	W-04	Lock Washer	1
74	6204-2RSJ	SKF Bearing	1
75	16A-30-8	Worm Shaft Bearing	1
76	1416-7	Worm	1
77	1SA-30-7	Worm Shaft Spacer	1
78	6205-2RSJ	SKF Bearing	1
79	16A-30-4	Headstock Worm Shaft	1
80	50868	Oil Seal National W/#13 Woodruff Key and 15A-30-6 Key	1
81	15A-30-25	Worm Shaft Gasket	1
82	15A-30-5	Oil Seal Retainer	1
83	15A-30-3	Worm Shaft Pulley	1
84	15A-30-27	Headstock Belt Guard	1
85	A35	Vee-Belt	1
86	50027	Oil Seal	1
87	15A-30-24	Headstock Pulley Splash Guard	1
88	1416-40	Oil Seal Retainer	1
89	1416-46	Pulley	1
90	4L320	Matched V-Belts	2
91	15A-30-37	Counterweight Assembly	1
92	15A-30-1AC1	Housing	1

DRAWING 4- TAILSTOCK 15A-140 (1 of 2)



DRAWING 4- TAILSTOCK ISA-140 (2 of 2)

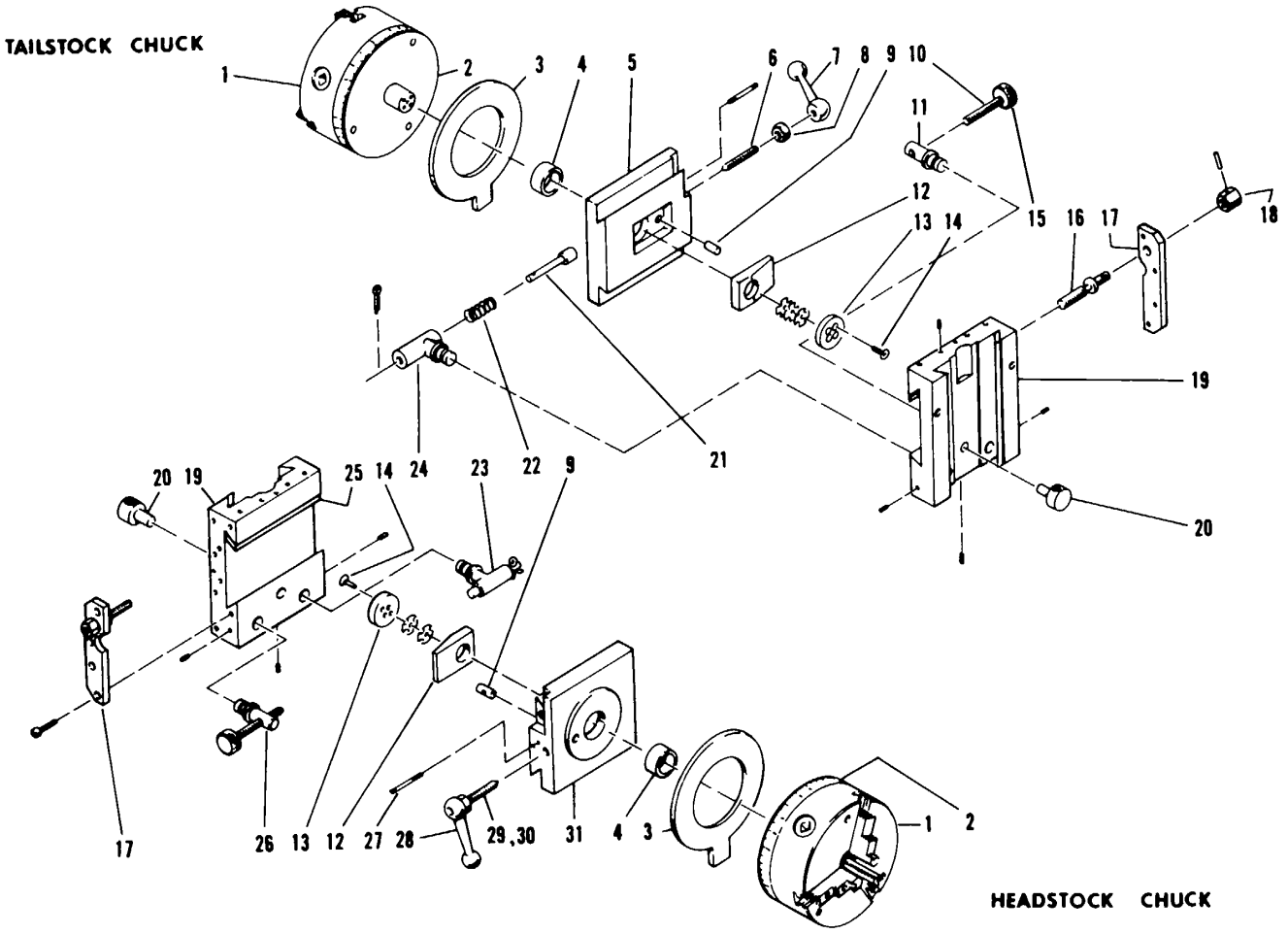


DRAWING 4 - TAILSTOCK 15A-140

No.	Part No.	Description	No. Required
1	15A-140-19	Counterweight Cover	1
2		Counterweight Assembly (See Headstock Drawing)	1
3	15A-130-5	Back Plate	1
4	15A-140-10	Lock Handle	1
5	15A-140-8	Spindle Lock	1
6	15A-140-9	Spindle Lock Pad	1
7	P52-8	Bunting Bushing	1
8	15A-142-5	Advance Pinion	1
9	15A-142-6	Housing	1
10	15A-142-4	Body	1
11		3/16 x ½ Roll Pin	2
12		¼ - 20 x ½ Flat Head Socket Cap	1
13	13A-142-1	Retainer	1
14	15A-142-2	Spring	1
15	15A-142-3	Drive Ring	1
16	4140	Reid Stud 2 - 13 x 5	1
17	K-4-103	Ball Handle	1
18		7/4 x 1¼ Roll Pin	1
19		5/16 x ½ Socket Set Screw	1
20	15A-35-3	Hold Down Nut	1
21		FW5 Reid Washer	1
22	363G214	National Seal	1
23		¼ - 20 x 3/4 Socket Cap Screw	1
24	15A-31-6	Bearing Retainer	1
25	7211CTC-C78G2	Ball Bearing SKF	2
26	15A-41S-9	Outer Spacer	1
27	15A-41S-8	Inner Spacer	1
28	15A-130-2	Spindle Bearing Nut	1
29	15A-33-1	Elevating Screw	1
30	150-31-8	Elevating Screw Block	1
31	HW 10-20-3	Washer	1
32	15A-33-4	Elevating Nut	1
33	15A-33S-1	Elevating Screw Dial	1
34	15A-33S-2	Elevating Screw Dial Holder	1
35	15A-140-18	Head	1
36	15A-30-10	Shaft	1
37		Sock Cap Screws	1
38	15A-30-45	Counterweight Stud	2
39		5/8 - 11 Hex Nut	1
40		Spacer	1
41	15A-30-35	Counterweight	As Required
42		5/8 - 18 x 3/4 Socket Set	1
43	15A-44-1	Tailstock Head	1
44	15A-32-4	Cross Slide Gib	1
46	15A-33-2	Elevating Screw Nut	1
46	302	Gits Oiler	2
47	15A-32-2	Gib	1
48	15A-30-24	Splash Guard	1
49	B4	Reid Knob	1
50	4140	Reid Stud 5/e - 18 x 4	1
51	15A-140-17	Lock Shaft	1
52	SC75	Set Collar	2

No.	Part No.	Description	No. Required
53	527	Ajax Spring	1
54	15A-30-32	Shims	As Required
55	15A-30-30	Wear Strip	1
56	15A-30-31	Wear Strip	2
57	15A-35-1	Hold Down Foot	1
58	15A-45-1	Hold Down Stud	1
59		1/4 - 20 x 5/8 Socket Cap	6
60	15A-40-1B	Housing	1
61		5/16 - 18 x ½ Socket Set	1
62	16 DU24	Garlock Bearing	2
63	15A-140-1	Shaft	1
64		8 - 32 x 3/8 Flat Head Socket Cap	2
65	15A-140-7	Spindle Rack	1

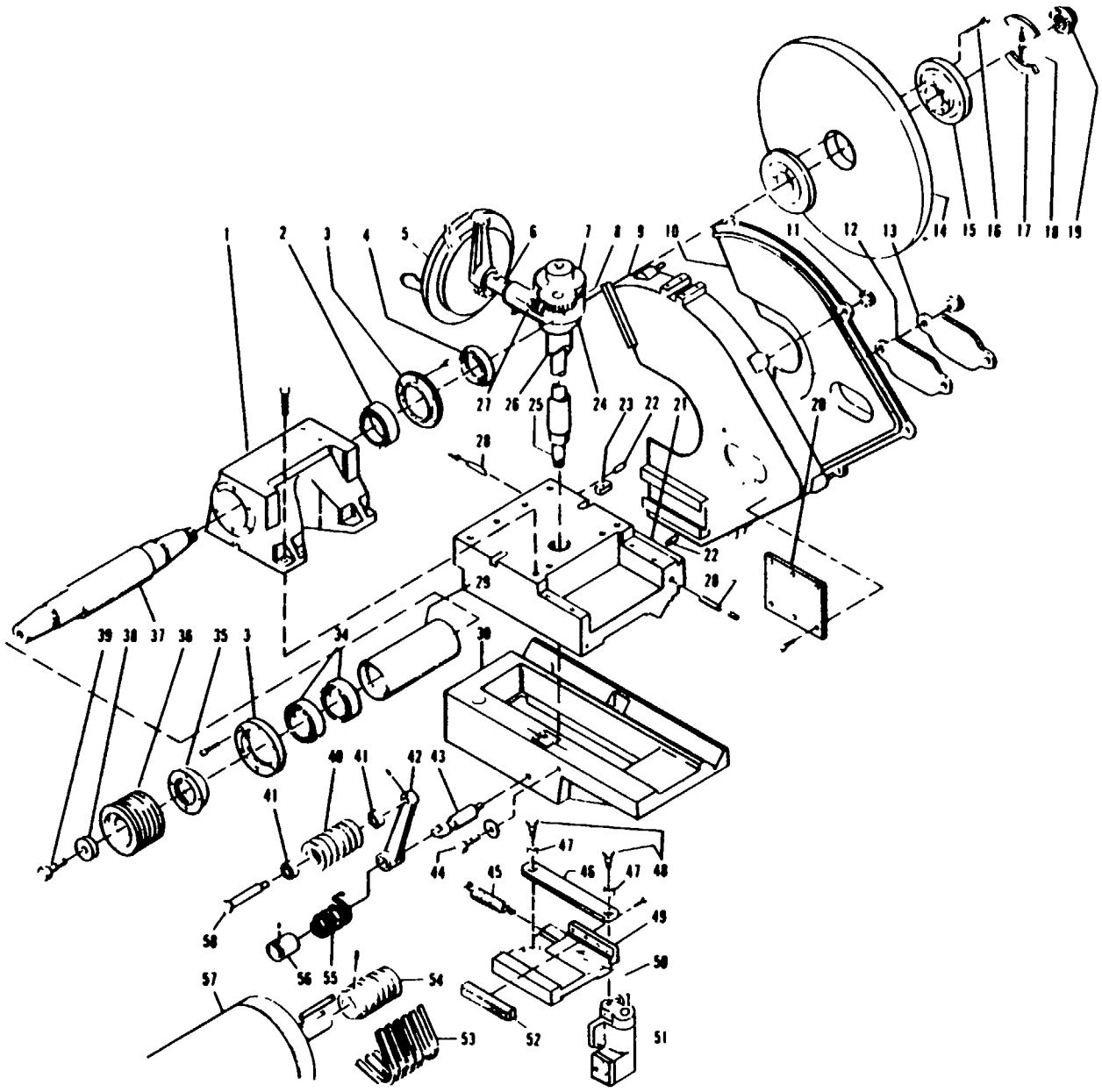
DRAWING 5 - DEGREED CHUCKS



DRAWING 5 - DEGREE CHUCKS

No.	Part No.	Description	No. Required
1	63014	Chuck	2
2	15A-132	Index Plate	2
3		Spring Drive Post Plate	1
4	GB2020	Bearing	2
5	15A-260-1	Tailstock Cross Slide	1
6	15A-250-17R	Gib Lock Stud	1
7	15A-250-16R	Gib Lock Handle	1
8		½ - 13 R.H Hex Nut	1
9	15A-250-5	Lock Pin	2
10	15A-250-18	Drive Post Screw	2
11	15A-250-15	Drive Post	2
12	15A-250-4	Lock Foot	2
13	15A-250-7	Back Plate	2
14		1/4 - 20 x 3/4 Flat Head Socket Cap Screw	8
15	15A-30-51B	Knob	2
16	15A-32-5	Cross Slide Screw	2
17	15A-250-8	Cross Slide Plate	2
18	146-88	Nut W/Lock Pin	2
19	15C-32-1	Throw Head	2
20	15A-33-2	Elevating Screw Nut	2
21	15A-250-13	Plunger	2
22	15A-250-14	Spring	2
23		Spring Drive Post Assembly	2
24	15A-250-10	Spring Drive Post Housing	2
25	15A-32-4	Gib	2
26		Drive Post Assembly	1
27	15A-250-21	Stop	2
28	15A-250-16L	L.H. Gib Lock Handle	1
29	15A-250-17L	L.H Gib Lock Stud	1
30		½ - 13 L.H. Hex Nut	1
31	15A-250-1	Headstock Cross Slide	1

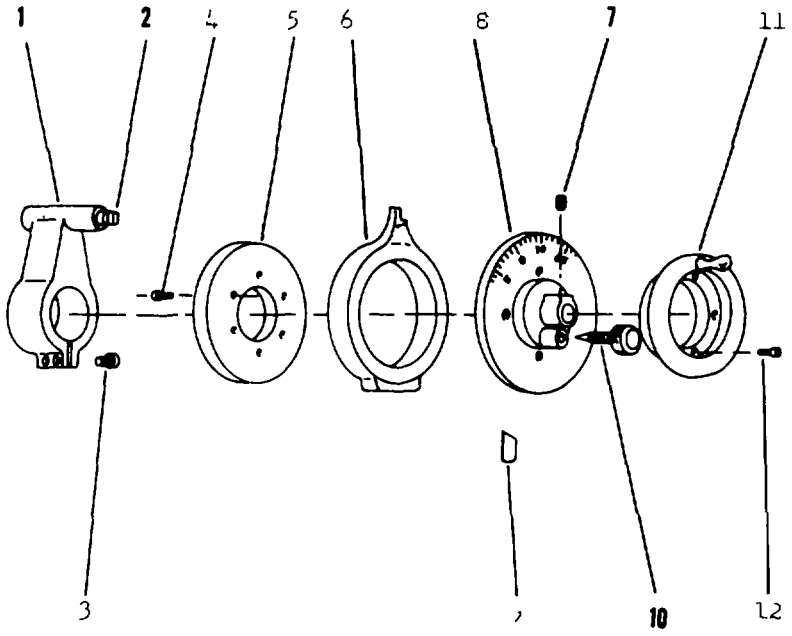
DRAWING 6 - GRINDER SPINDLE ASSY



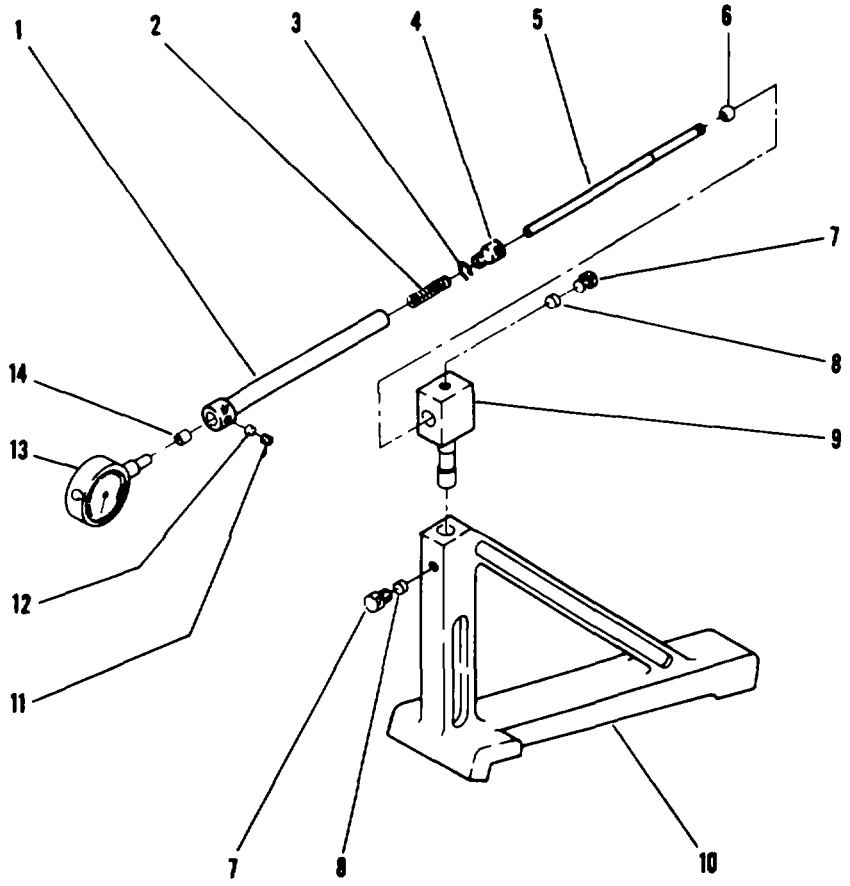
DRAWING 6 -- GRINDER SPINDLE ASSEMBLY

No.	Part No.	Description	No. Required
1	15A-50M2-1	Housing	1
2	NN3012K-C4817	Bearing	1
3	15A-50M1-21C1	Seal	2
4	15A-50M1-20	Front Spindle Nut	1
5		Infeed Assembly (See Drawing 7)	
6	15A-62-2	Worm Shaft W/15A-62- 3 Thrust Washer1 And 16A-62-4 Sleeve	
7	1511-8	Worm Gear Housing Cover W/C-31-107 Oiler	1
8	1511-23	Worm Gear	1
9	15A-506	Grinding Wheel Guard	1
10	15A-504C3	Grinding Wheel Cover	1
11	15A-60-7	Nut on 3/8" Stud	3
12		Gasket	1
13		Hand Hole Cover	1
14		24" Diameter x 1" Wide Grinding Wheel 24" Diameter x 1 1/2" Wide Grinding Wheel	
15	15A-14	Wheel Flange	1
16		5/8 - 18 x 2 Socket Cap Screws	8
17	15A-51-3	Counterweight	2
18	15A-51-4	Lock Screw	2
19	15A-50-3	Wheel Mount Retaining Nut	1
20		Cover Plate	1
21	15A-60-2C4	Wheel Slide	1
22	15A-60-8	Plug	2
23	15A-60-3	Key	2
24	1511-7	Worm Gear Housing	1
25	15A-61-2	Pinion	1
26	15A-61-1	Up Feed Column	1
27	1511-24	Worm	1
28	15A-60-9	Plug	2
29	15A-50M1-12C2	Spindle Sleeve	1
30	15A-60-1C3	Wheel Slide Base	1
31	15A-10-18	V-Oiler (Not Shown)	1
32	1410-10	Spring (Not Shown)	1
33	15A-10-19	Flat Oiler (Not Shown)	1
34	112HDM	Barden Bearing	2
35	15A-50M1-23C1	Rear Spindle Nut	1
36	15A-50-8	Pulley	1
37	15A-50M1-2C1	Spindle	1
38	15A-50-9	Washer	1
39		¾ - 16 x 1½ Hex Head Cap Screw	1
40	1510-27	Idler Pulley	1
41	6202-2RSJ	Bearing	2
42	15A-63-1	Idler Arm	1
43	15A-63-2	Idler Shaft	1
44		3/4 - 16 x 1½ Hex Head Cap Screw	1

No.	Part No.	Description	No. Required
45	1510-24	Spring	1
46	15A-100-3C2	Arm	1
47		5/8 x 7/8 x ½ Drill Bushing	2
48	15A-100-12	Shoulder Screw	2
49	15A-60-19	Up Feed Slide Plate	1
50	1510-25	Screw Eye	2
51		Rapid Retraction Arm Assembly (See Drawing 2)	1
52	15A-60-20C1	Rack	1
53	4L300	V-Belt	6
54	15A-150-10A	Motor Pulley	1
55	15A-63-3	Idler Spring	1
56	15A-63-4	Collar	1
57		7-½A HP Motor	1
58	15A-63-6	Shaft	1
	NOT SHOWN		
	150C-60-24C3	Vee-Belt Guard Cover	1



DRAWING 7 INFEED CONTROLS



DRAWING 8 TRUING INDICATOR 15A-80

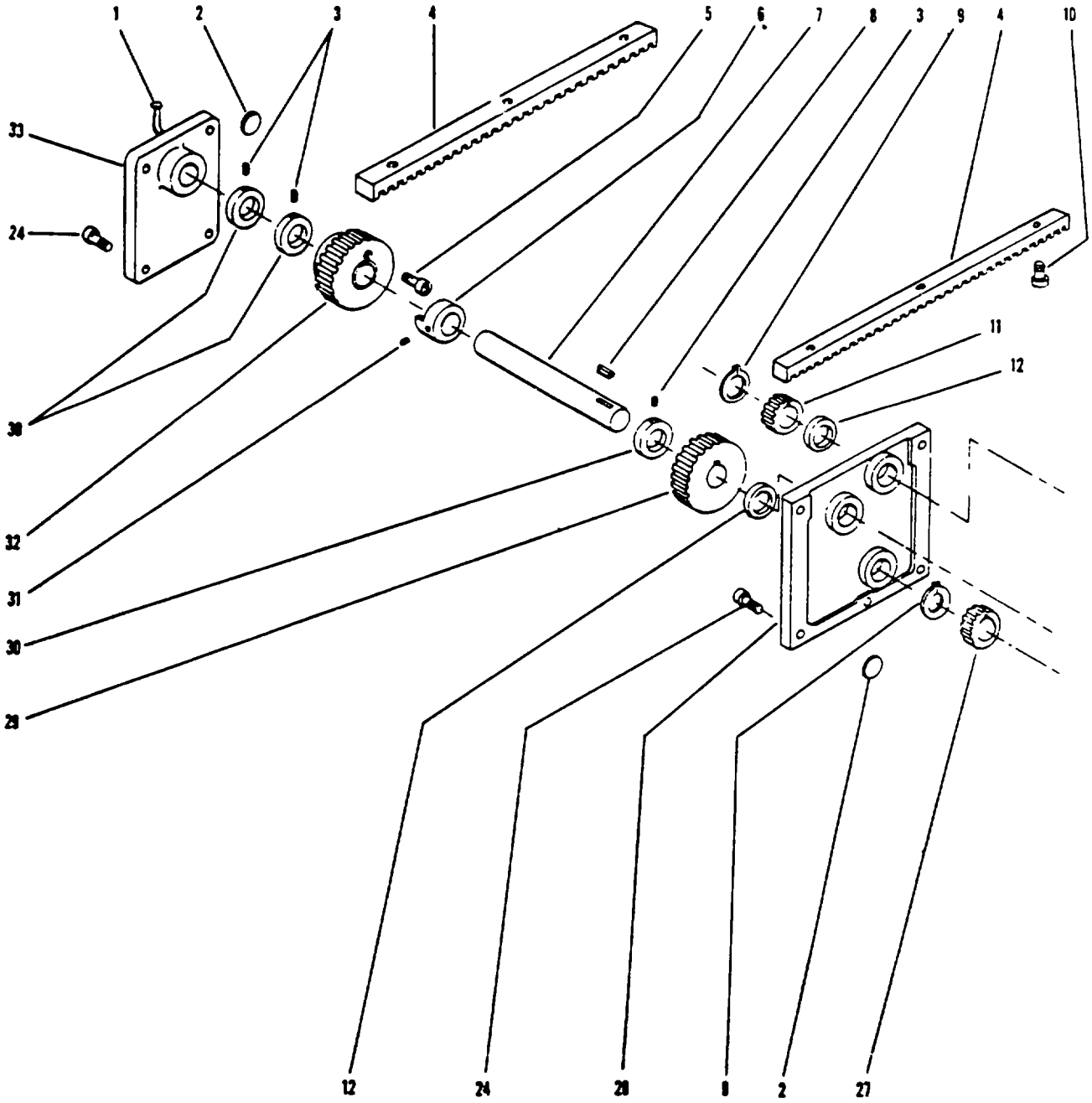
DRAWING 7 - INFEED

No.	Part No.	Description	No. Required
1	75-82-14	Infeed Handwheel Stop Bracket	1
2	75-82-17	Infeed Stop Plunger	1
	W/75-82-18	Infeed Stop Plunger Pin	1
3		5/l6 - 18 x 1 Socket Cap Screw	2
4		10 - 24 x ½ Socket Set Screw	6
5	75-82-13	Infeed Handwheel Back Plate	1
6	75-82-12	Infeed Handwheel Adjusting Stop	1
7		5/16 - 18 x 1/2 Socket Set Screw	1
8	75-82-11	Infeed Dial Wheel	1
9	75-82-16	Infeed Dial Wheel Lock Plunger	1
10	75-82-15	Infeed Adjusting Stop Lock Screw	1
11	75-82-10	Infeed Handwheel	1
12		10 - 24 x ½ Socket Set Screw	6

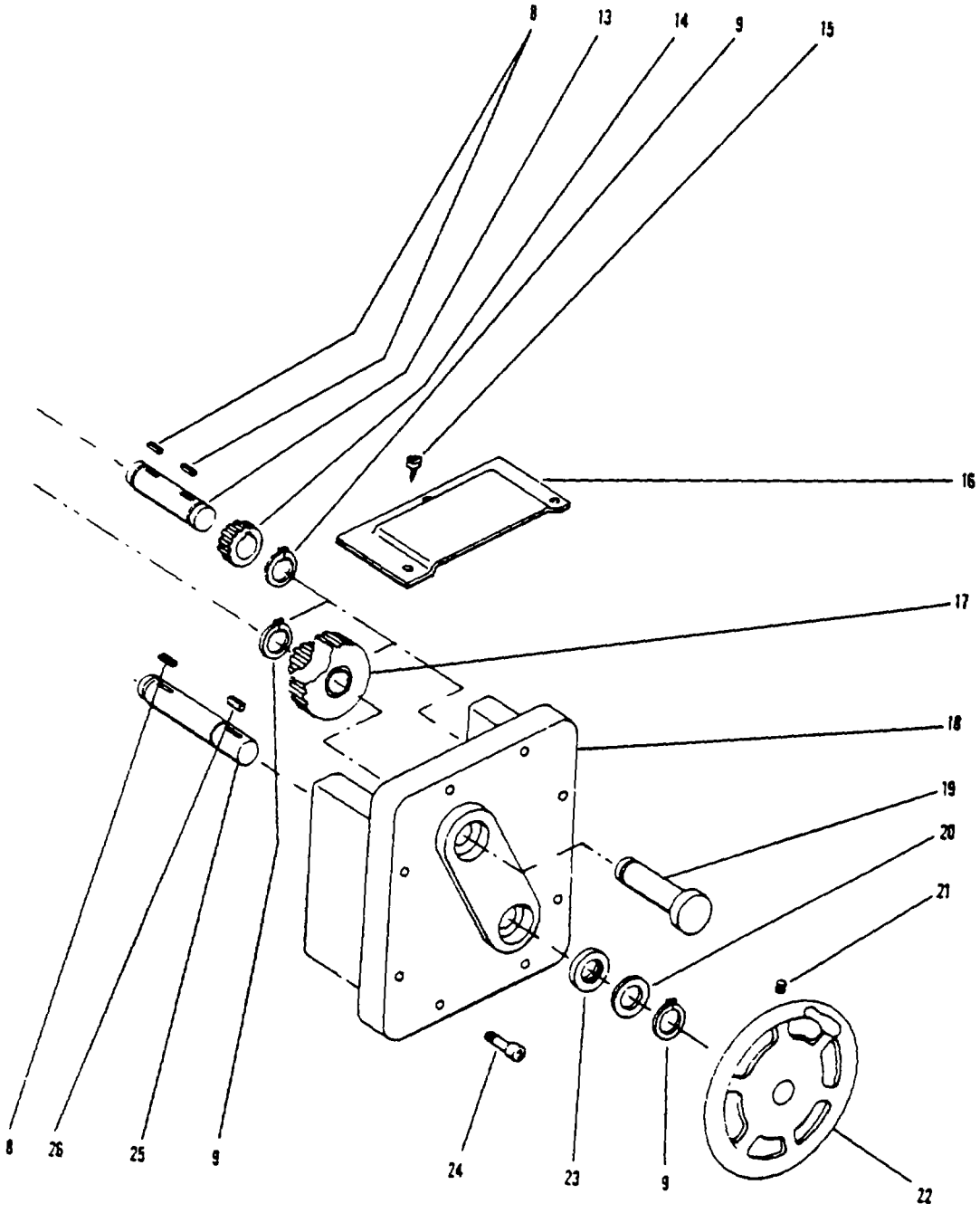
DRAWING 8 - TRUING INDICATOR 15A-80C1

No.	Part No.	Description	No. Required
1	15A-81-1C1	Shank	1
2	15A-81-3	Plunger Spring	1
3	5133-15	Tru-Arc Retaining Ring	1
4	15A-81-3	Front Bearing	1
5	15A-81-1	Plunger	1
6	15A-82-2	Plunger Ball	1
7	1419-9C1	Thumb Screw	2
8	15A-80-3	Plug	2
9	15A-80-5	Pivot Block	1
10	15A-80-1CI	Indicator Base	1
11		10 - 32 x 3/16 Socket Set Screw	1
12	15A-80-4	Shank Screw Plug	1
13	1-2-114	C81 Federal Indicator	1
14	B-35-3	Bronze Bushing	1

DRAWING 9- TRAVERSE ASSY (1. of 2)



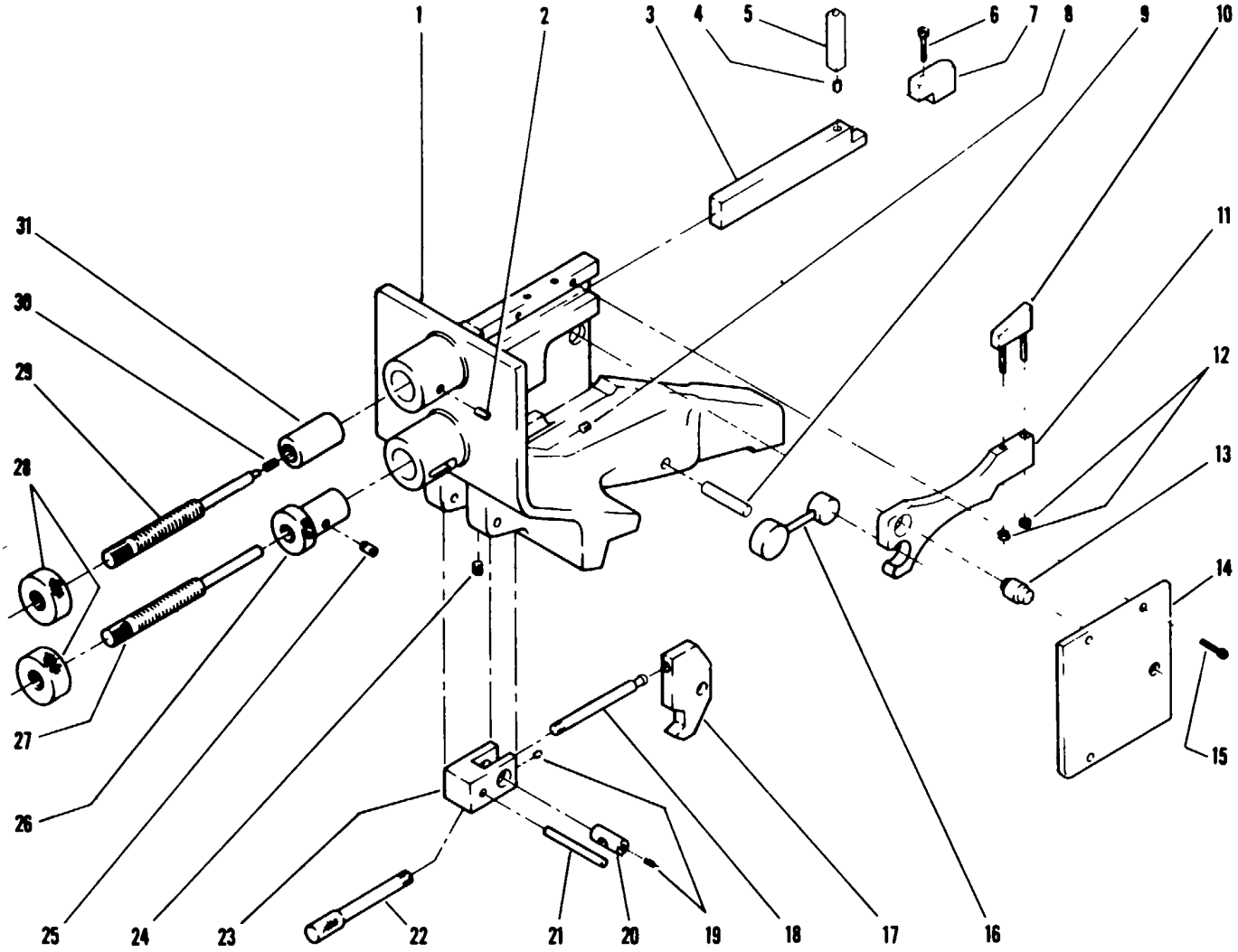
DRAWING 9- TRAVERSE ASSY (2 of 2)



DRAWING 9 - TRAVERSE ASSEMBLY

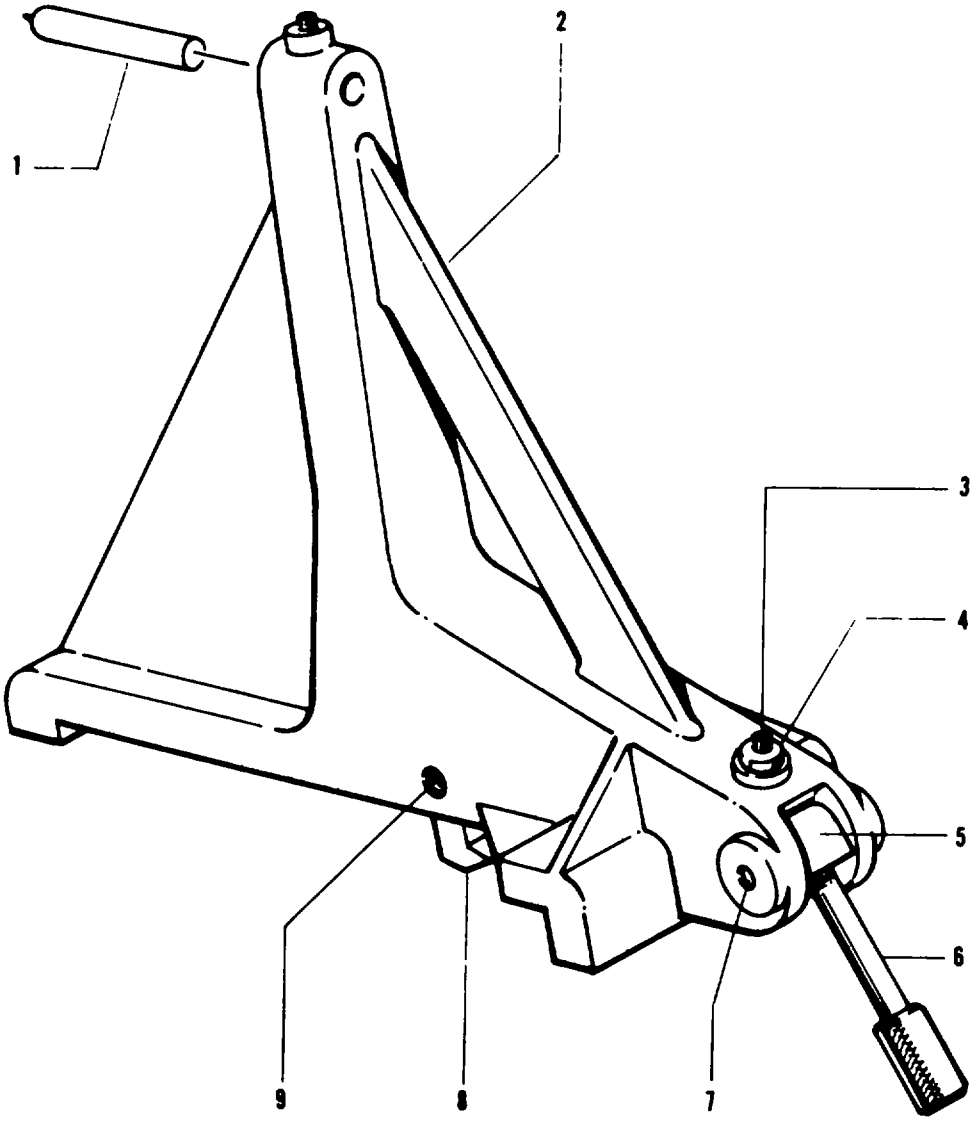
No.	Part No.	Description	No. Required
1	C-31-102	Oil Cup	1
2		1” Core Plug	2
3		5/16 - 18 x 3/8 Socket Set Screws	3
4	15C-20-9	Gear Rack	2
5		3/8 - 16 x ½ Socket Cap Screws	1
6	16A-20-5	Traverse Collar	1
7	16A-20-2	Drive Shaft	1
8	15A-21-6	Key	3
9	R-11-114	Snap Ring	4
10		5/16 - 18 x 1 Socket Cap Screw	5
11	G-3-106	Gear	1
12	15A-21-7	Thrust Spacer	2
13	15A-21-5	Pony Shaft	1
14	G-3-108	Gear	1
15		10 - 24 x ¼4 Machine Screw	5
16	15A-21-8	Gear Case Lid	1
17	15C-21-8	Gear Sub-Assembly	1
18	15A-21-11C2	Gear Case	1
19	15A-21-4C1	Stud Shaft	1
20	15A-21-10	Thrust Washer	1
21		3/8 16 x ½ Socket Set Screw	1
22	15A-20-1	Handwheel	1
23	S-2-113	Oil Seal	1
24		5/16 x 1 1/4 Socket Cap Screws	17
25	15A-21-13	Handwheel Shaft	1
26		#15 Woodruff Key	1
27	G-3-1-5	Gear	1
28	15A-21-2C1	Gear Case Cover, Rear	1
29	G-3-109	Gear	1
30		7/8” Set Collar	3
31		5/16 - 18 x 1 Socket Set Screw	1
32	153-21	Gear Sub-Assembly	1

DRAWING 10-STEADY REST 15A-70



DRAWING 10 - STEADY REST 15A-70

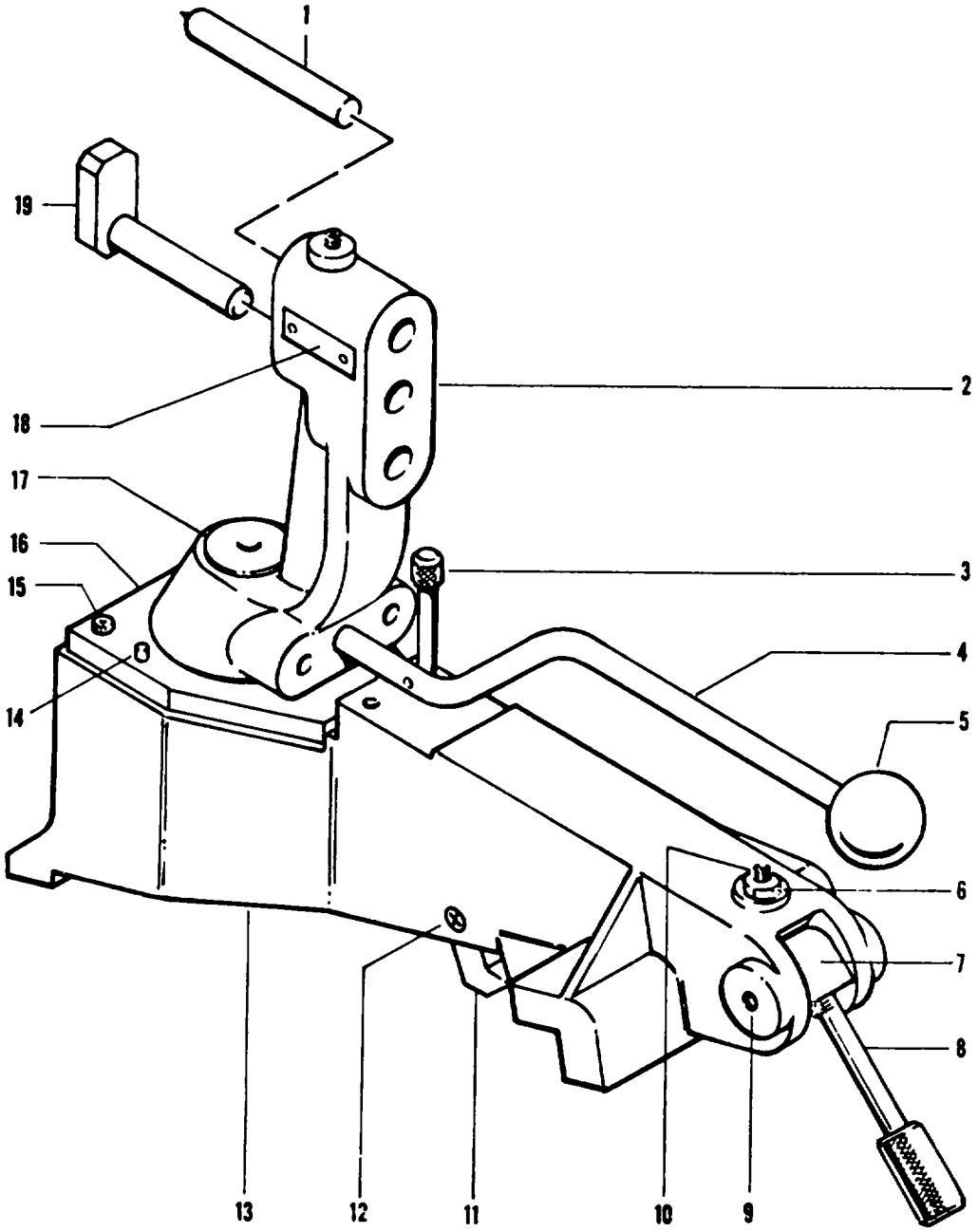
No.	Part No.	Description	No. Required
1	15A-70-1A	Steady Rest Base	1
2		1/4 - 20 x 3/8 Socket Set Screw	1
3	15A-70-3	Upper Jaw	1
	W/15A-70-4	Upper Jaw Gib	1
4		10 - 24 x ½ Socket Set Screw	1
5	15A-70-18	Post	1
6		10 - 32 x ¾ Flat Head Socket Cap Screw	1
7	15A-70-10	Upper Jaw Shoe	1
8		1/4 - 20 x 1/2 Socket Set Screw	1
9	P-4-101	¾ x 1½ TP II Groove Pin	1
10	15A-70-9	Lower Jaw Shoe	1
11	15A-70-6A	Lower Jaw	1
12		8-32 Hex Nut	2
13	15A-70-7	Lower Jaw Pivot Pin	1
	W/15A-70-17	Lower Jaw Bushing	2
14	15A-70-2	Cover Plate	1
15		10 - 24 x 3/4 Flat Head Socket Cap Screws	4
16	15A-73	Lower Jaw Link	1
	Consists of		
	15A-73-2A	Lower Jaw Button 4"	1
	15A-73-1A	Lower Jaw Link	1
	15A-73-3A	Lower Jaw Button 1"	1
17	148-21	Clamp Foot	1
18	148-5	Cam Rod	1
19		1/4 - 20 x 1/4 Socket Set Screw	1
20	148-12	Cam Rod Pin	1
21	148-9A	Cam Pin	1
22	148-10	Cam Handle	1
23	148-6	Lock Cam Plate	1
24		1/4 - 20 x 1 Socket Set Screw	1
25	148-13	Dowel Pin	1
26	15C-70-8	Lower Jaw Release Nut	1
27	15A-72-1A	Upper Jaw Screw	1
28	15A-71-2	Knob	2
29	15A-71-1AC1	Upper Jaw Screw	1
30	15A-70-21C1	Upper Jaw Spring	1
31	15C-70-5	Threaded Bushing	1



DRAWING 11- WHEEL DRESSER 15A-90

DRAWING 11 -- WHEEL DRESSER 15A-90

No.	*Part No.*	*Description*	*No. Required*
1		Diamond Dresser	1
2	15A-90-1	Wheel Dresser Base	1
3	N-3-112	Lock Nut	1
4	W-1-116	Lock Washer	1
5	148-6	Lock Cam	1
6	148-10	Cam Handle	1
7	148-9A	Cam Pin	1
8	148-21	Clamp Foot	1
9	P-4-101	3/8 x 1 ½ TP II Groove Pin	
	NOT SHOWN		
	148-5	Cam Rod	1



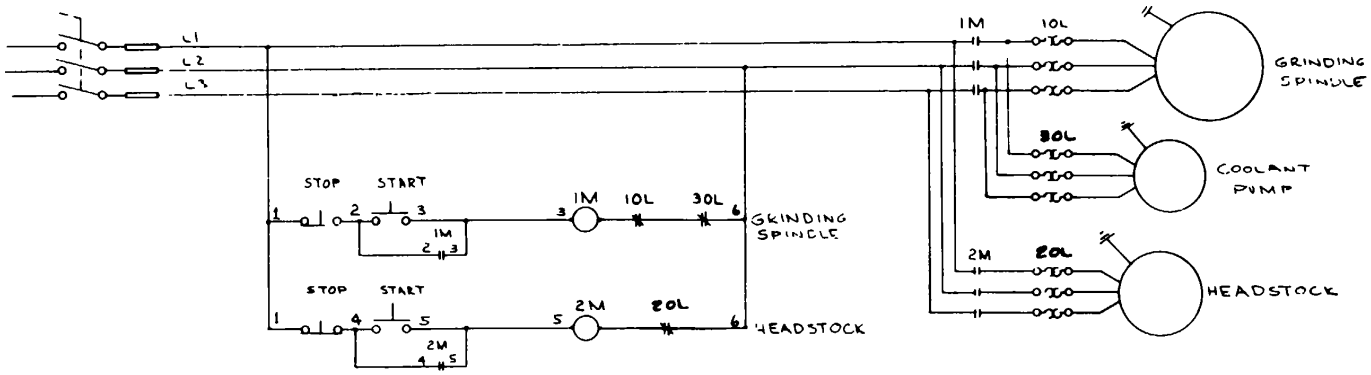
DRAWING 12 - RADIUS DRESSER 15A-120C1

DRAWING 12 - RADIUS DRESSER 15A-120C1

No.	*Part No.*	*Description*	*No. Required*
1	15A-120-12	Radius Dresser Diamond	1
2	15A-120-3	Swivel Post	1
3	15A-120-20	Index Pin	1
4	15A-120-21	Handle	1
5	K-4-103	Knob	1
6	W-1 116	Lock Washer	1
7	148-6	Lock Cam	1
8	148-10	Cam Handle	1
9	148-9A	Cam Lock Pin	1
10	N-3-112	Lock Nut	1
11	148-21	Clamp Foot	1
12	P-4-101	3/8 x 1½ TP II Groove Pin	1
13	15A-20-1C1	Base	1
14		¼ x 7/8 Dowel Pin	3
15			
16	1517-4	Plate	1
17	15A-120-5	Pivot Shaft	1
18		Reference Plate	1
19	15A-121	Diamond Stop	1
	NOT SHOWN		
	148-5	Cam Rod	1
	09067	Timken Cone Bearing	1
	09195	Timken Cap Bearing	1
	1517-6	Spacer	1

ACCESSORIES

Part No.	*Description*	*No. Required*
15 TA	Coolant Tank Assembly	1
15A-70	Steady Rest	1
15A-80	Truing Indicator	1
15A-90	Wheel Dresser	1
15A-201	Side Dresser	1
15A-200-1	Balancing Arbor	1
	Balancing Stand	1
869A	Wrench	1
11	Wrench	1
1240	Wrench	1
15A-10-30	Back Table Splash Guard	1
	24" Diameter x 1" Wide Grinding Wheel	1
	24" Diameter x 1I" Wide Grinding Wheel	1



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