Technical Manual

check gusset connections and points where thin and heavy metals join. The good crew watches for loose bolts, nuts, cap screws, lock washers and other locking devices. Rod bolts are important too. Signs of scuffed paint, worn or bright spots next to any part indicate movement and becomes second nature to most personnel. Retighten ALL bolts shortly after initial start up. Grease and oil stains often indicate problems. Perhaps just poor housekeeping, but at least something is wrong.

Replacement and maintenance schedules may conform to planned shutdowns. Lack of proper lube, poor adjustments and abuse cause and speed up wear. These facts show up as the MAIN reasons for breakdown. If any part shows wear or distortion beyond expected normal wear, order replacement and quickly install. The cost of parts is nothing when compared to breakdown cost and loss of man hours and production.

Production machines operating 24 hours, 7 days every week deserve an 8 hour inspection and cleaning every 10 days. Cleaning before inspection eliminates dirt and dust falling into machinery parts when inspection plates and covers are removed.

On the upper works, a solvent makes removal of the accumulation of grease around bearings, gears, motors and the like easier. The dirt shield under the drag drum and the trough under the open gears may require a number 3 coal shovel to get the job done.

Start up the machine and dig enough to warm up machinery, open the inspection cover over gears and pinions. Look at gear teeth as machinery slowly goes thru its paces of hoist-lowering and drag-in pay-out. Broken teeth are easy to spot, but splayed or an unusual wear pattern takes a closer look.

For a quick check, run a piece of soft wire thru the gear mesh at each side of the pinion. Measure thickness of the two adjacent loops with micrometer. The sum of the two loops indicates backlash. Comparing them gives an indication of misalignment. If excessive backlash is suspected, measure with a dial indicator. There just isn't enough room between the gear guard and the pinion to use a feeler gauge.

Slowly rotate the upper works several times in each direction. Look at condition of roller circle, rail, gear and swing pinion. Sound here may indicate a flat or chipped roller or even suggest burrs or damaged teeth on the rotating pinion.

While hoist operates, check condition of point sheaves groove and bearings. Test hold down bolts on boom point end plate. While operating drag, check fairlead sheaves, grooves and bearings. Look at fairlead swivel, Test ALL hold down bolts with impact wrench. Check rope guides for wear. Look at hoist and drag ropes for broken wires. While on boom point and gantry, may as well check auto-lube system for loose, broken or damaged fittings or lines. Note condition of injector. Properly lube ALL points, it's important.

RUNNING CLEARANCE FOR BRONZE BUSHINGS

Shaft Nom. Diam.	Shaft O.D.	Running Clearance	Shaft Nom. Diam.	Shaft O.D.	Running Clearance
1	1.000 .999	.006 .010	5	5.000 4.998	.011 .020
1-1/4	1.250 1.249	.005 .010	5-1/4	5.250 5.248	.011 .020
1-1/2	1.500 1.499	.008 .013	5-1/2	5.500 5.498	.012 .020
1-3/4	1.750 1.749	.008 .013	5-3/4	5.750 5.748	.012 .021
2	2.000 1.999	.007 .012	6	6.000 5.998	.012 .021
2-1/4	2.250 2.248	.006 .013	6-1/4	6.250 6.248	.012 .021
2-1/2	2.500 2.498	.006 .013	6-1/2	6.500 6.498	.012 .021
2-3/4	2.750 2.748	.008 .015	6-3/4	6.750 6.748	.013 .022
3	3.000 2.998	.008 .015	7	7.000 6.998	.013 .022
3-1/4	3.250 3.248	.008 .015	7-1/4	7.250 7.248	.013 .022
3-1/2	3.500 3.498	.008 .015	7-1/2	7.500 7.498	.014 .022
3-3/4	3.750 3.748	.011 .019	7-3/4	7.750 7.748	.016 .024
4	4.000 3.998	.011 .011	8	8.000 7.998	.015 .024
4-1/4	4.250 4.248	.010 .019	8-1/4	8.250 8.248	.015 .024
4-1/2	4.500 4.498	.010 .019	8-1/2	8.500 8.498	.016 .025
4-3/4	4.750 4.748	.014 .022	8-3/4	8.750 8.748	.016 .025

Once insuring a clean bore, quickly locate pinion in the SAME angular position on shaft as before when cold readings were taken. Just as pinion nearly engages with taper fit, but not in actual contact, SNAP pinion into place with a quick, forceful PUSH. This is important. The HOT pinion must be snapped into position rapidly, before it COOLS. Otherwise, the pinion SEIZES on the shaft and stops any further adjustment.

Check this hot or Shrunk-On pinion position using the micrometer depth gauge as before.

The ACTUAL advance is the DIFFERENCE of depth gauge readings in HOT and COLD positions. To control pinion stresses, this advance MUST fall within the limits specified in the table herein. If this advance is NOT within the given limits, PULL and REMOUNT the pinion.

Assemble the lockwasher and nut AFTER proper pinion installation.

DO NOT permit the shoulder on nut to bottom BEFORE the main part of this nut tightens on locking plate. If this happens, REMOVE the nut and grind or turn so the needed clearance is available.

Now, certain the nut secures tightly against locking plate and pinion, turn up the locking plate on at least TWO faces of the nut.

Keep in mind that this pinion fit and key fit are the important points in the job of holding the pinion on the shaft. The locking plate just serves to hold the nut on the shaft. A CORRECT pinion, shaft fit places no LOAD on this nut and locking plate.

PINION REMOVAL from armature requires the use of a suitable pinion puller. This avoids causing damage to motor frame, bearings, armature shaft or pinion.

Please do NOT heat the pinion before pulling.

Please do NOT use wedges between the pinion and bearing cap.

Please do NOT use sledge hammer on the puller. This damages the anti-friction bearings, besides you might miss and hurt yourself.

(NOTE: This information obtained from Engineering Standard 790-1 and CI-772; MPS)

METHOD OF CHECKING SPACING AT SPLITS OF SPLIT RING GEARS (without hubs). After mounting on flange and tightening alignment and clearance bolts; place a cylindrical pin between gear teeth, several teeth away from the split. Set up a dial indicator and zero to maximum-plus reading as gear (with pin in teeth) rotates past the indicator stem. Remove the pin without disturbing indicator setting and place in the adjacent space toward the split. Rotate gear again (pass the pin under the indicator stem). Record the maximum-plus reading. Repeat this procedure for three spaces on EACH SIDE of the split, as well as, for the space AT each split. An indicator reading AT a split varying by .005" or more in the negative direction from other readings indicates the split is OPEN. This open split is caused by interference between gear bore and a mounting flange surface; bolting pads burred or foreign material between their surfaces; or the gear mounted elliptical, (egg-shaped) with large diameter at splits preventing tightening there. The gear egg-shaped mounting can be determined by making a radial runout check as described in a following paragraph. Take steps to correct this open split condition: Remove the interference between gear bore and flange register by clearing bolting pads of dirt or burrs. REMOUNT gear, if needed, to eliminate the elliptical shape. If this gear operates with open splits, bumping will occur every time a split passes thru mesh point with pinion.

METHOD OF ROD BOLTING GEAR TO DRUM END CASTING. All gear rod bolts are tightened by the turn of the nut method. In each case the cotter pin and slotted nut is considered to be the bolt head, while the plain nut is advanced for tightening.

It is possible to have all bolts tight and still have a gap between gear rim and drum end casting. This gap could increase from 0 at top most center to maximum gap at bottom center. As drum turns the gap will change position and inturn each bolt will become loose. Additional stress load and possible stress concentration in bolts that could cause failure.

Rotate drum so that bolt being tightened is always at top center. Proceed tightening to diagonally rod bolt, each time turning drum 180 degrees until all bolts are snug tight, i.e., (hand tool tight or until ratchet start on impact wrench).

Mark each nut position on bolt with chalk, paint, etc. Hold slotted nut and advance plain nut three fourths of a turn. Preceed to opposite bolt until all rod bolts are tight. DO NOT USE SPRING LOCK WASHERS.

NOTE: Check all rod bolts after the first week of operation, thereafter, every 500 hours.

Broken wires.

Corroded wires.

Marks indicating mechanical abuse, distortion or crushing.

Inspect rope sheaves often. Check sheaves and drums for proper alignment. Use no reeving that requires reverse bends unless provided with sufficient space between the bends for adequate rope recovery.

DO NOT ALLOW WEAR AT ROPE SHEAVE GROOVE. An old rope wears a groove to a reduced radius. This groove crushes or deforms a newly installed rope.

Avoid sheave groove or drum lagging from assuming rope lay shape. Alternate right and left hand lays, if needed. Keep sheaves and drum free of rough spots, nicks and burrs. Never use cracked or chipped sheave.

Maximum rope life and the best service evolves from extreme care in handling and installation. This is important. Working a new rope at reduced loads gives the rope lay time to acquire a permanent set. Slow acceleration and deceleration of load and eliminating sudden actions are good habits to develop. Never overstress a rope by jerking or catching a heavy, falling load.

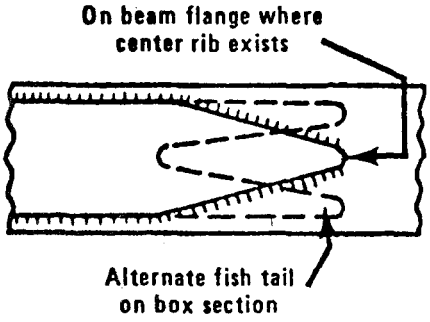
Lubrication remains the most important item in rope care. All rope is lubed when manufactured. Generally thin and filmy, this lube eases the manufacture rather than preserve the rope. This film drys rapidly or dissipates thru surrounding conditions.

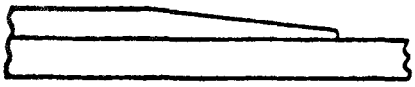
Lubricate every rope at installation and keep coated thru continued service. Lubricant serves to reduce internal friction wear and the outer wire wear against sheave or drum. Lube protects rope from weather and corrosive air, too.

Marion recommends a light, penetrating type lubricant (WRL) containing anti-rust and corrosion agents and anti-wear additives. This lube saturates rope interior thus reducing internal friction while providing a protective outer coating.

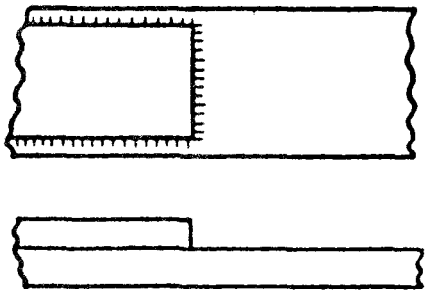
The rope lubricant selected may be an asphaltic type containing volatile solvent or diluent which allows strand and core penetration. This lube type works well for operations in highly abrasive material or water submersion.

One method of rope lubrication utilizes an automatic system that provides a drip fixture above sheaves on boom point, gantry, and fairlead. This system is generally timer controlled with manual override for severe conditions.





Reinforcing Plate Taper End
recommended



Reinforcing Plate Square End,
not recommended

REINFORCING REQUIRES EXTREME CAUTION in weld repairs. Faulty reinforcing has caused many repeat failures. The weld alone, if PROPERLY made, is sufficient to make the part as strong as it was originally. However, in cases where reinforcing seems needed, apply the following. Patch plates of NOT greater than three fourths the thickness of the part being reinforced to EXTEND beyond the critical areas. TAPER and ROUND the ends of these plates. EXTEND the weld completely around the ends and SMOOTH OUT gradually to the original structure. TAKE every care to eliminate stress concentration, such as: square ends; sharp break offs; exposed and rough, flame-cut edges; etc. (See sketches).

POSTHEAT TREATMENT: When employing this or in cold weather, SLOWLY COOL the welding area at a rate of 50 degrees F. or 27 degrees C. per hour to the normal temperature of 150 degrees F. (65.5 degrees C.) This is important. This usually means additional general heating AFTER completing the weld. Smooth up ALL rough edges and welds. Clean and repaint the repair areas.

ADDITIONAL INFORMATION or material on welding for a particular repair job may be obtained by sending ALL details to the Service Department of Marion Power Shovel Co., Inc. at Marion, Ohio 43302.

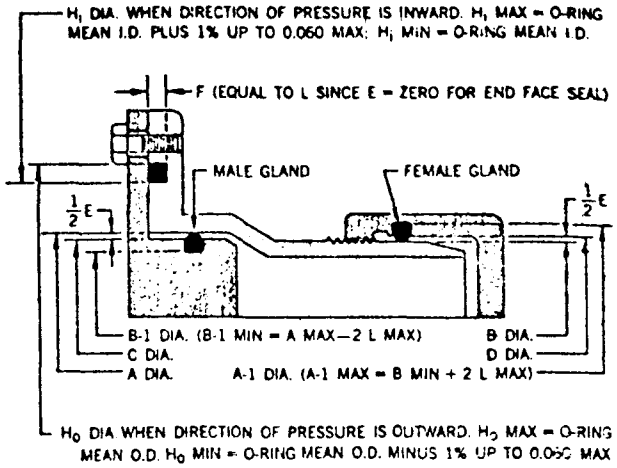
MATERIAL IDENTIFICATION

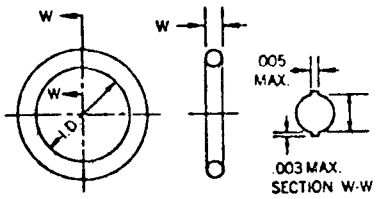
MARION MATERIAL SYMBOLS and

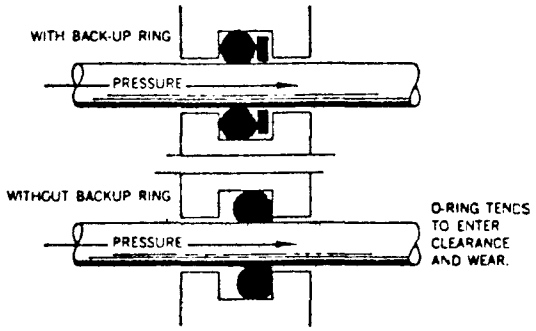
MAJOR COMPONENT PARTS

The following information contains the various materials used in major parts. Refer to the identification plate or material symbol on casting for specifics. Pre 1959 machines have no material identification on identification plate.

NOTE 1: Use E-6010 or E-6012 for nonstructural parts ONLY. For example; sheet metal, guard rails, catwalks, house coverings and stiffners.







Static seal use is generally simple. Three common types are shown at left.

When pressure exceeds 1500 psi, the backup ring is used. In static face seals, backup rings may not be needed.

MOST O-RING PROBLEMS return to three factors:

1. Size: Using incorrect size causes ineffective or totally destroyed function.

2. Compatibility: O-ring material must be compatible with the chemical, thermal and mechanical surroundings.

3. Installation: Improper handling during assembly causes a great deal of grief.

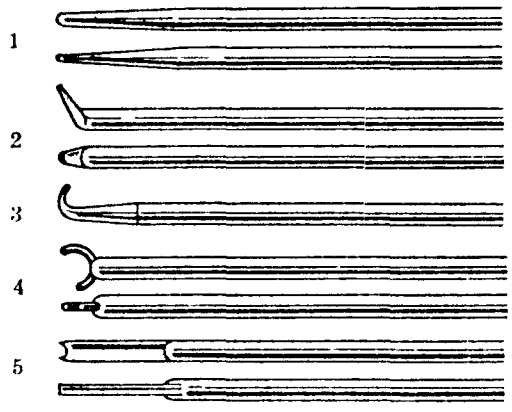
Size cannot be picked out by color code. Exact replacements are found ONLY by part number. DO NOT ATTEMPT matching size by feeling and comparing the new with the old. One other detail here: Do not open package until O-ring is needed for installation. This prevents mixing, rolling on floor, dropping in sewer; among other disasters.

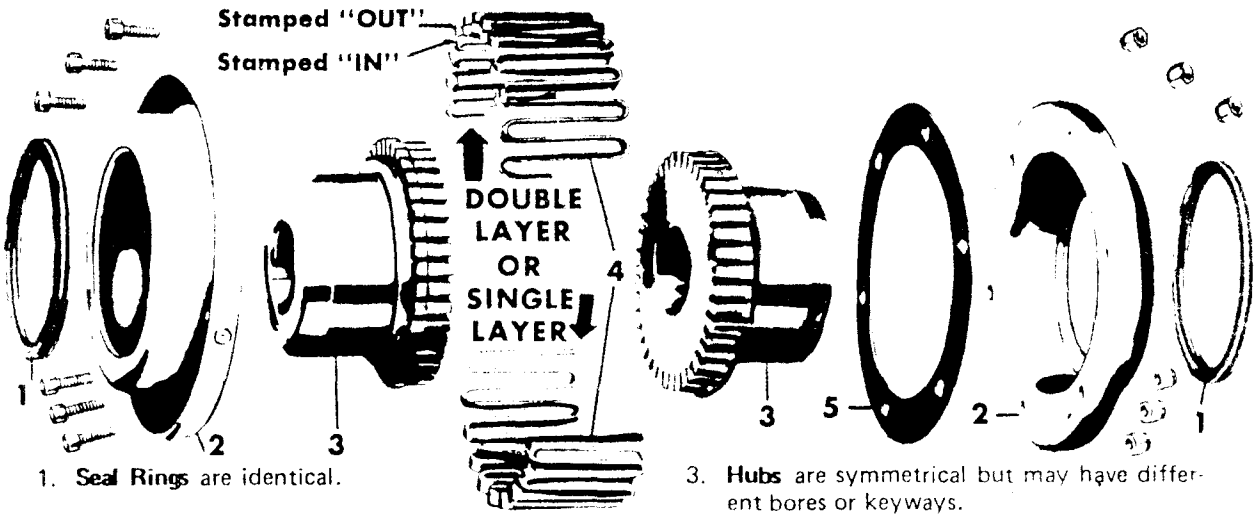
POOR INSTALLATION may begin with the removal of the old seal.

Some points on removal:

Removal involves parts with close tolerance surface finishes.

In critical surface areas; scratches, abrasions, dents, and other surface mars cause faulty seals. This results in component failure.



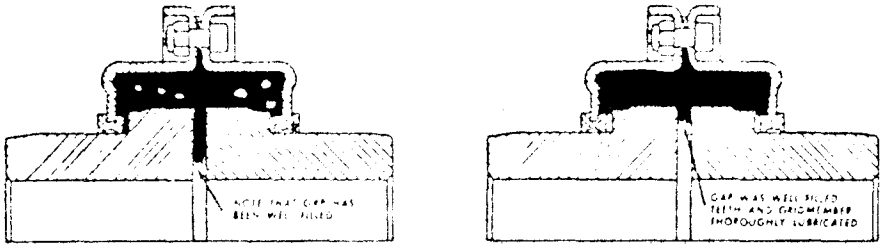


1. **Seal Rings** are identical.
2. **Cover Halves** are furnished with permanent lube fittings or, in some sizes, 1/8" or 3/8" NPT holes to receive your lube fittings. Cover halves are interchangeable and otherwise identical.
3. **Hubs** are symmetrical but may have different bores or keyways.
4. **Gridmember** for smaller sizes is in one piece. In larger sizes the gridmember is in several sections and layers.
5. **Gasket** fits between the covers and prevents grease leakage.

LUBRICATION OF COUPLING DURING ASSEMBLY

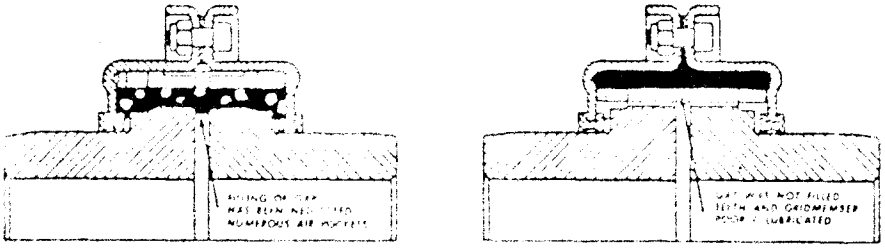
PROPERLY FILLED – Air pockets have been reduced to a minimum by careful packing and the gap between the hubs has been well filled.

The lubricant in the gap acts as a reservoir. Centrifugal force causes it to flow from the gap into the voids and completely lubricate the coupling.



IMPROPERLY FILLED – Note the large number of air pockets and the absence of lubricant in the gap and at the inside diameter of the cover.

Centrifugal force throws the grease outward leaving the rubbing surfaces unprotected, thus causing excessive wear.



COUPLING ALIGNMENT (REPRESENTATIVE READINGS)

(ALL READINGS IN MILS OR THOUSANDTHS OF AN INCH)

Feeler Position	Coupling Position			
	0 Right	0 Top	0 Left	0 Bottom
Right	12	14	13	14
Top	12	13	14	14
Left	13	14	13	15
Bottom	13	13	14	15

Coupling in line. Gradually changing readings indicate coupling is opening slightly with rotation.

Feeler Position	Coupling Position			
	0 Right	0 Top	0 Left	0 Bottom
Right	12*	14*	14*	16*
Top	15	17	17	19
Left	18*	21*	20	23*
Bottom	15	18	17	20

Coupling out of line sideways. Note that right and left readings* show constant difference of 6 to 7 thousandths; top and bottom readings all right.

Feeler Position	Coupling Position			
	0 Right	0 Top	0 Left	0 Bottom
Right	14	14	16	17
Top	10*	10*	11*	12*
Left	15	14	17	17
Bottom	19*	19*	22*	22*

Coupling out of line vertically. Note that top and bottom readings* show constant difference of 9 to 10 thousandths; left and right readings all right.

Feeler Position	Coupling Position			
	0 Right	0 Top	0 Left	0 Bottom
Right	14	11*	16	20*
Top	18*	15	11*	16
Left	14	19*	15	12*
Bottom	10*	16	20*	15

Bad coupling face indicated. Note how tight and loose spots* travel with rotation of coupling. Necessary to remove both rotors and true-up coupling faces.

CODE	NAME	DESCRIPTION
continued. . . .		
GL	Enclosed Gear Case	3. Inside machinery house, where oil is not pumped, use GL-200 except where freezing temperatures rarely or never occur, use GL-250. For large shovels and walking draglines: 1. For crawlers, use GL-140. 2. For gear cases inside machinery house: a. Use GL-200 where temperatures rarely go below freezing. b. Use GL-250 instead of GL-200 where temperatures rarely go below freezing. c. Use GL-140 with older type pumps. On new machines, oil should be drained after first 60 days of operation and replaced with new oil. Thereafter, change oil once a year, or when determined necessary by oil supplier. Oil should be checked for contamination every 30 days.
PO	Pneumatic Oil	Petroleum oil especially compounded for use in air line oilers or built in lubricators having the correct viscosity, low pour point, emulsifying ability, film strength and free of deposit forming tendencies. It should not cause swelling or deterioration of rubber or leather seals and gaskets.
EMG	Electric Motor Grease	Electric motor bearing grease meeting the requirements of G.E. Specification D6A2C5 or Westinghouse equivalent.

In addition to the aforementioned products the following lubricants may also be required. No specification or standard for these products have as yet been prepared.

ropes pins at gantry head. This line only operates during the digging cycle. Line B pumping during walking cycle, supplies grease to the propel shaft in board and outboard bearing, the propel pinion inboard and outboard bearing, propel gears bearings walking arms, stabilizers and walking shoes. Line AB operating while in digging and walking cycle supplies the two swing shafts, center journal, center journal thrust washer. A hose heel, with gun, located left of drag drum is to be used for the hand lube points on deck so piped to line AB. Also from AB a hose with coupling, pressure gauge and switch plus an electric pushbutton to start lube cycle is located on outside of rotating frame and right of fairlead. This hose couples to any one of four coupling on roller circle lube line every 4 to 8 hours. The system cycles once every 15 minutes in digging cycle (inner pin circle on timer) and every 225 seconds (6 pin spaces on inner circle of propel timer) during walking cycle. The outer pins on both timers is set at 150 seconds (4 pin spaces) behind inner pins the alarm timer setting is 100 seconds. Air pressure is regulated at 70 psi and the pressure switch is set at 2,500 psi. The system uses a 400 pound drum of MPG grease.

OPEN GEAR LUBE:

OPERATION:

Line A to pump lube only when digging.
Line B to pump lube only when propelling.
Time cycle to be 15 minutes for dig cycle and 5 minutes for propel cycle. (Fast cycle timer).

LUBRICANT:

Use only OGL type H open gear lubricant with diluent.
See MPS Company lubrication specs.

CONTROL PANEL SETTING:

1. Time cycle – See Operation.
2. Alarm Timer – Set for 2 minutes (120 seconds).
3. Air pressure regulator – 80 psi.
4. Small air regulator – 90 psi.
5. Relief valve – 4,000 psi.
6. Set outside pins (on timer) 4 spaces behind inside pins (150 seconds).

OTHER SETTINGS:

Set end of line pressure switches at 2,500 psi (item 40).

Adjust brake while in set position. Back out piston rod stop screw A until shoe contacts brake housing. Loosen locknut B on set spring rod and adjust large nut until each spring measures 4-25/32 inches. Tighten locknut. The assembly automatically balances tension between the two springs.

Push cylinder piston ALL the way IN with piston against cylinder end. Turn stop screw A until screw is 1/8 inch from piston rod. Tighten locknuts and check that piston does NOT BOTTOM.

Release brake and loosen BOTH locknuts on support rod. Adjust threaded sleeve C until brake shoes space evenly around housing with 1/8 inch minimum clearance. Keep 1/4 inch clearance between stop plate D and guide block at support rod spring end. Tighten locknuts on support rod. Check that support rod spring and set spring do not bottom.

This assembly requires NO lubrication or additional adjustment to compensate for wear.

To replace friction material, disconnect air line and remove brake shoe assemblies from base plate and housing. Disassemble support rod and set spring rod assemblies and lift shoe from housing. Remove snap ring at pivot. Pull connection pin. Remove old lining and install new lining. Assemble brake on base plate and housing, then readjust.

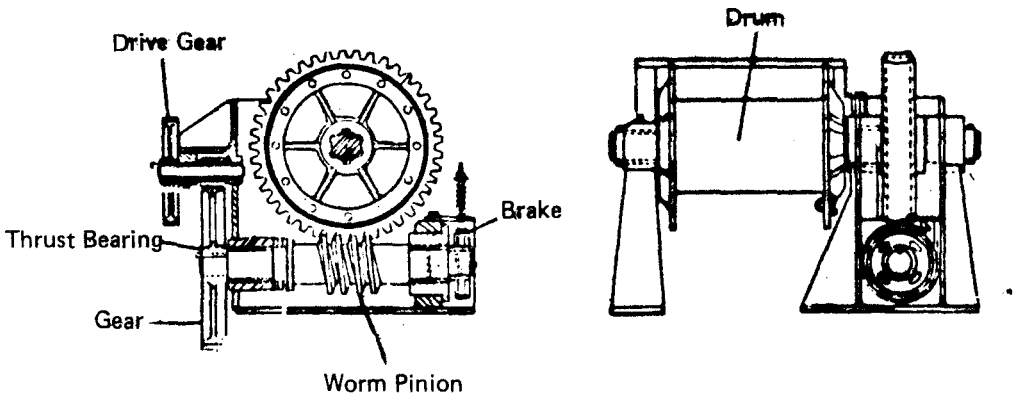
The **HOIST AND DRAG BRAKE** assemblies are similiar in construction and operation.

These brakes are not intended to stop or slow down motor armature rotation, except if power is lost, but designed as holding brakes acting upon a de-energized motor.

The assembly contains two shoes to act on a friction housing keyed to the motor armature shaft. A compression spring sets the shoes and release is with an air cylinder.

ADJUST HOIST AND DRAG BRAKE assemblies when in release position, (pressure in air cylinder). Loosen set screws A and B. Turn nuts C on connecting rod D until clearance between brake shoe and housing is 1/8 inch. Balance clearance by adjusting set screw A at bottom of operating lever until clearance between shoes and housing is same on each side of housing. Position shoe by turning set screw B so heel of shoe does not drag on housing.

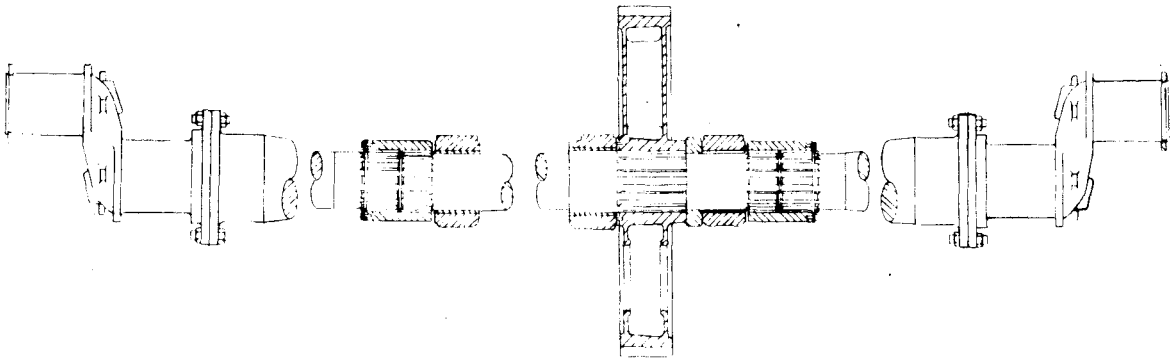
Next, with brake in set position, adjust set spring by turning nuts E on spring suspension until spring measures 17-7/32 inch Total Length, 5-9/32 inch Initial Deflection.



BOOM HOIST

DRAGLINE BOOM SUSPENSION support boom in working position using two, each side of boom, bridge strand ropes attached at boom point and anchored to gantry.

The bridge strands are galvanized, prestressed wire rope with two zinced, open end sockets and dampers. The bridge strand length is compatible with boom length and working angle. The rope is stripped. The bridge strand socket bores mount in line.



HOIST AND DRAG ROPES length and size varies according to boom length.

The hoist rope is 2 inches in diameter, WR-37, lang lay, IWRC, IPS.

The drag rope is 2-3/8 inches in diameter, WR-16, lang lay, IWRC, IPS.

Hoist and drag ropes are considered expendable items. The operator should develop a habit of watching ropes during machine operation for broken wires or frayed strands or for rope end brooming. A kink causes permenant damage, so promptly replace these kinked ropes.

Rope wear is greatest at or near bucket. If outside wires or strands show excessive wear, remove socket and cut off worn area. Then seize the rope end and resocket.

The **COLLECTOR RINGS** transmit incoming power from tub to rotating frame. ALWAYS DISCONNECT this incoming power at the source when servicing. This assembly consists of four rings stacked with ceramic insulators secured to tub center pin. Location is in space over center journal below deck of rotating frame. The brushes attach to the outside case. Clean and inspect every 30 days.