

CONVENTIONAL
PUMPING UNITS

OPERATOR'S MANUAL

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PREFACE

The purpose of this manual is to provide a word and picture description for the erection, operation and maintenance of an American pumping unit. Following the directions provided herein can result in procedures free from personal injury or equipment damage. It is recognized that the methods outlined herein are not necessarily the only workable ones under all circumstances, however, it is recommended that all persons involved with the erection, moving or servicing of pumping units employ the methods and procedures outlined, as personal safety should always be the primary concern.



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I INTRODUCTION

American International Manufacturing Corporation has been designing and producing oil field equipment since 1924 and has grown steadily with the petroleum industry through the years. New products and innovative design of energy producing equipment have consistently satisfied our customers the world over.

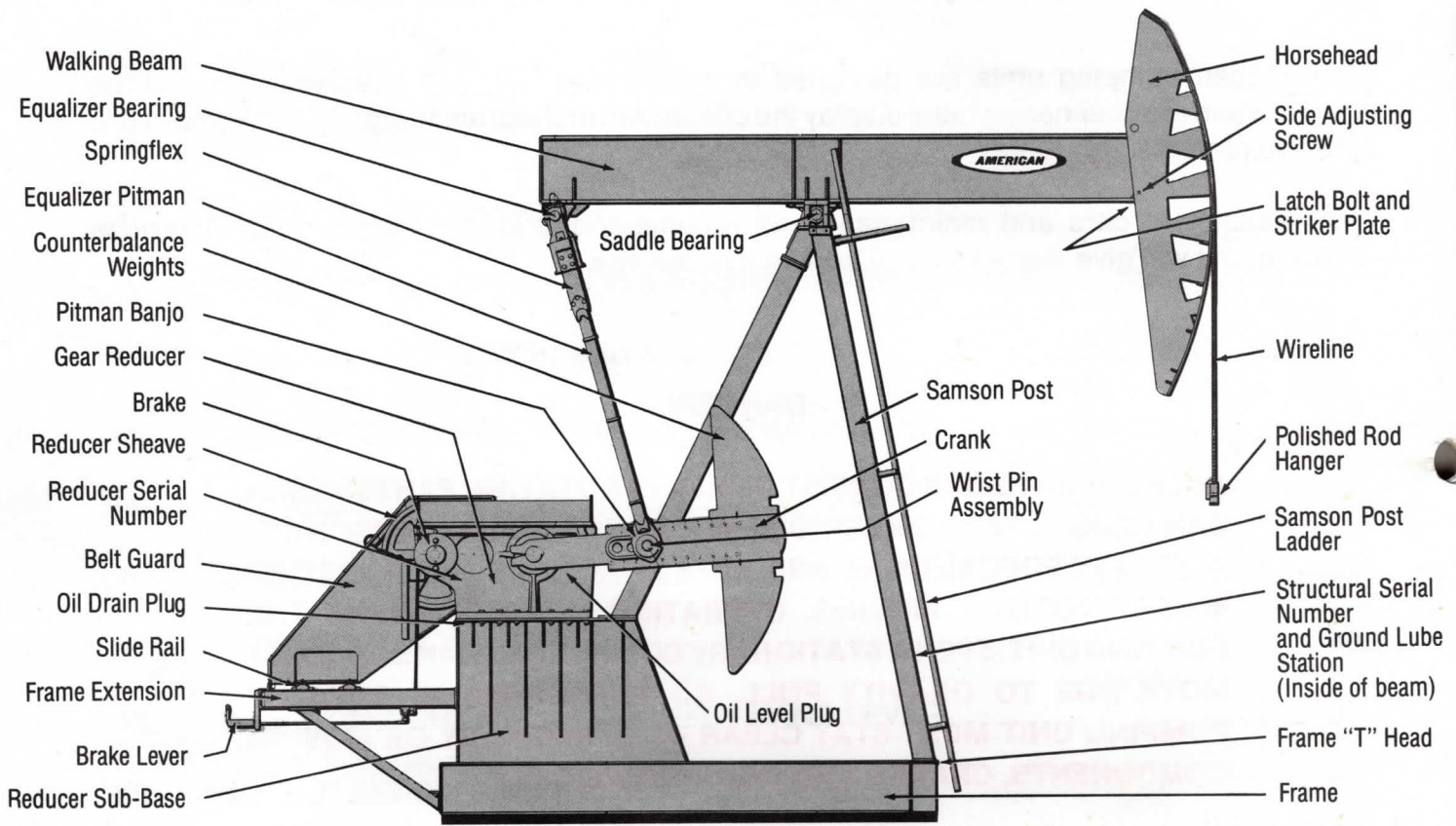
American pumping units are built by skilled craftsmen in our manufacturing facility in Fort Worth, Texas using the most accurate and up-to-date machine tools available and are shipped pre-assembled, within the limits of the transportation mode used, resulting in minimum erection time.

All American pumping units are designed in compliance with API specifications and the structure and reducer nameplates display the official API monogram to signify conformance to API requirements.

With reasonable care and maintenance as recommended in this manual your American pumping unit will give many years of trouble free service.

DANGER!

ALL PUMPING UNITS CONSIST OF HEAVY ROTATING PARTS WHICH CAN CAUSE DEATH OR SERIOUS INJURY TO UNWARY PERSONNEL IF SAFETY PRECAUTIONS AND SAFE PRACTICES ARE NOT USED WHEN ERECTING, MOVING, OPERATING OR MAINTAINING THE PUMPING UNIT. EVEN A STATIONARY COMPONENT CAN SUDDENLY MOVE DUE TO GRAVITY PULL, SO PERSONNEL IN AREA OF PUMPING UNIT MUST STAY CLEAR OF STATIONARY OR MOVING COMPONENTS, CRANKS AND COUNTERWEIGHTS.





II SAFE PERSONNEL PRACTICES

Maintenance of a pumping unit requires that personnel be familiar with all requirements governing the particular unit on which they have been summoned to work. The owner/operator should provide to all maintenance personnel a copy of this operator's manual. Maintenance personnel must acquire, read and understand this operator's manual prior to performing any task. Personal safety is of prime importance since the pumping unit and components thereof can cause death or serious injury if safe practices are not followed. Damage to the unit, loss of life or permanent injury can be caused by careless actions.

Careful performance of maintenance at the required intervals specified in the operator's manual will benefit maintenance people and the producer by assuring maximum production with minimum downtime and without disabling injuries due to unsafe work practices.

MAINTENANCE PEOPLE FOR THEIR OWN PROTECTION SHOULD:

Read and follow all danger, warning and caution signs displayed on the pumping unit and/or prime mover and those instructions given in this operator's manual.

Apply brake slowly several times before shutting down prime mover and prior to starting any maintenance work to be sure brake is functioning properly. Adjust if required.

Wear hard hats, safety shoes, safety belts, eye protection and respirators when necessary to protect life, limbs, lungs and eyes.

Wear no loose clothing, watches, rings, necklaces or ties when working on or around moving machinery.

Have no loose long hair. If long, keep tucked under the hard hat to prevent being scalped by moving machinery.

Wear eye protection when handling fuel, solvents or batteries, also when grinding, drilling, hammering metal or using an impact wrench.

Keep tools and equipment free of slick substances so slippage will not occur at an inopportune time. Do not throw or drop tools.

Make use of hoisting equipment instead of trying to manhandle heavy components. Lower parts to ground slowly. Support suspended parts by blocking or cribbing prior to working on, under or between them.



Know the nearest medical service location in case serious injury occurs.

Have fire extinguisher at hand and know how to use it.

WHILE SERVICING THE PUMPING UNIT, OBSERVE THE FOLLOWING INSTRUCTIONS TO PREVENT DAMAGE TO UNIT OR INJURY TO OTHER PERSONNEL OR TO ONE'S SELF.

Keep unit clean. Remove all oil, grease, dirt, mud, ice, etc. from ladder or other stepping areas before using them.

Make sure that other personnel are in the clear before hoisting or moving parts.

Use nonflammable cleaning solvents to clean parts. Do not use gasoline or diesel fuel.

Dispose of oily rags in approved fireproof container.

Store dangerous fluid such as starting fluid, gasoline or other flammable liquids in safe metal containers in a suitable storage area. Never use glass containers for flammable liquids.

To prevent accidental start-up of electric prime mover while performing maintenance, make sure that master switch is locked out before starting work on pumping unit.

BEFORE STARTING PRIME MOVER, CHECK FOR THE FOLLOWING WHILE WALKING AROUND UNIT:

Personnel on or near unit.

Any dangerous conditions such as missing shields or guards, loose equipment or tools on unit, blocks, chains or cribbing not removed, or any previously noted problem not corrected during shut-down.

Loose or missing bolts in unit, prime mover, frame or sub-base.

Do not operate any unit which is felt to be unsafe.

Immediately notify supervisor of any unsafe condition.



III FOUNDATION

The foundation plan, supplied with the pumping unit, shows the location of hold down clamps, bolt sizes required for foundation use and dimensions from pumping unit "T" head to center line of well. Below grade foundation design is the responsibility of the installation contractor based on his knowledge of local well site soil characteristics. Foundation may be any one of three types as follows:

POURED-IN-PLACE

Centerline foundation per foundation plan

PORTABLE CONCRETE BLOCK centerline foundation

This type of foundation must be set on a properly prepared soil base suitable, in judgment of the installation contractor, for the existing soil conditions. Its structural strength is the responsibility of its manufacturer.

TIMBER PAD SETTING for wide frame type pumping unit

1. Base orientation is commonly dictated by the prevailing wind. The unit is placed so that the prevailing wind will blow well leakage away from unit and prime mover. With engine prime mover, placement should provide maximum cooling for the engine radiator. Consideration must also be given to drainage at the well site. The foundation location should utilize natural drainage to drain water away from the foundation. When the natural gradient is incorrect or nonexistent, the site should be graded to provide drainage away from foundation.
2. Selected site should be graded level. An elevated mound of compacted earth, caliche or coarse gravel should be built having outside dimensions, at the top, at least 2 ft. greater on each side than the outside base beams. Slope of the mound sidewall should be less than the natural slump of the material used. The height of this compacted mound should be a minimum of 6 ft. in firm soil. In soil having poor bearing qualities or if the location will have poor drainage, the thickness of this compacted pad should be increased. A 4 in. thick coarse gravel fill topped by a 2 in. thick sand fill should be placed uniformly on this pad. This fill should be carefully levelled in both directions.
3. Following the certified installation drawing, a mat of boards should be carefully placed on the sand fill and the level again checked in both directions. These boards should be placed at right angles to the direction of walking beam. Timbers 3 in. × 12 in. are commonly used. In damp areas the use of creosoted boards is advisable. The timbers should be long enough to extend 12 in. beyond sides of unit base beams. For maximum support, a solid mat should be employed, leaving 2 in. gaps between adjacent boards.

Prior to laying out foundation, check wellhead to be sure that it is vertical and that polished rod is straight. A good foundation is essential for a trouble free unit operation.

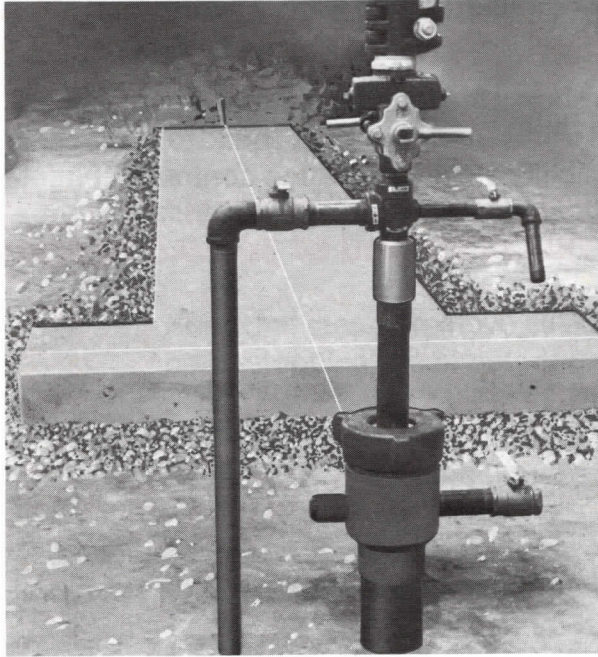


Fig. 1

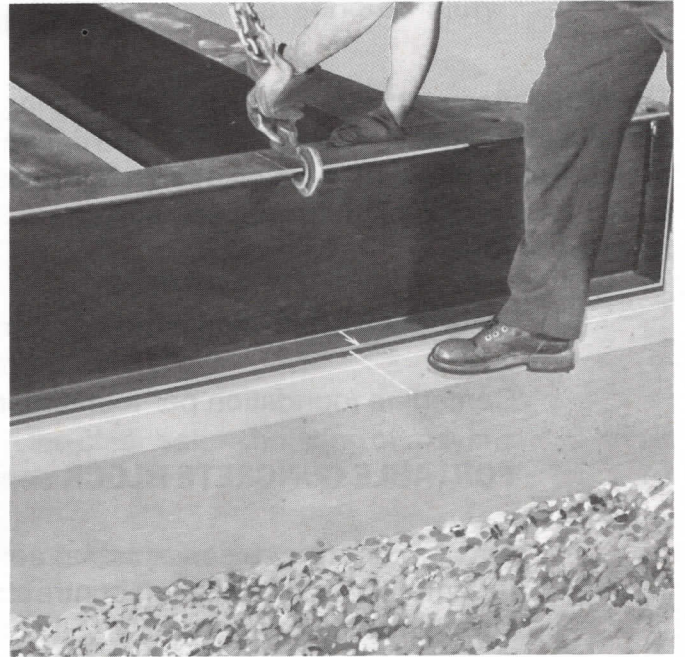


Fig. 2

IV PUMPING UNIT ERECTION

Erection of the unit at the well site requires hoisting equipment capable of lifting various combinations of components. The individual weights and heights to which they must be lifted are shown on page 13. To erect the unit proceed as follows:

1. Stretch a chalk line from centerline of wellhead to center of foundation rear end and mark centerline on foundation as well as location of "T" head as shown on foundation plan, Fig. 1. Find and mark centerline of frame "T" head and frame rear cross member on the unit frame.

CAUTION! POURED-IN-PLACE CONCRETE FOUNDATION MUST SET AT LEAST 48 HOURS BEFORE SETTING UNIT FRAME. FRAME HOLD DOWN CLAMP BOLTS MUST NOT BE TIGHTENED UNTIL CONCRETE IS COMPLETELY SET.

2. Set frame on foundation aligning frame centerline with that on foundation, Fig. 2.

DANGER! DO NOT WALK OR STAND UNDER SUSPENDED LOAD.

3. Position and install prime mover frame extension (if provided).

In most cases a pumping unit set directly on the block will be found to be reasonably level and plumb. If this is not the case due to unavoidable mill tolerances on the height and squareness of the base beams or imperfections in the top surface of foundation, then it will

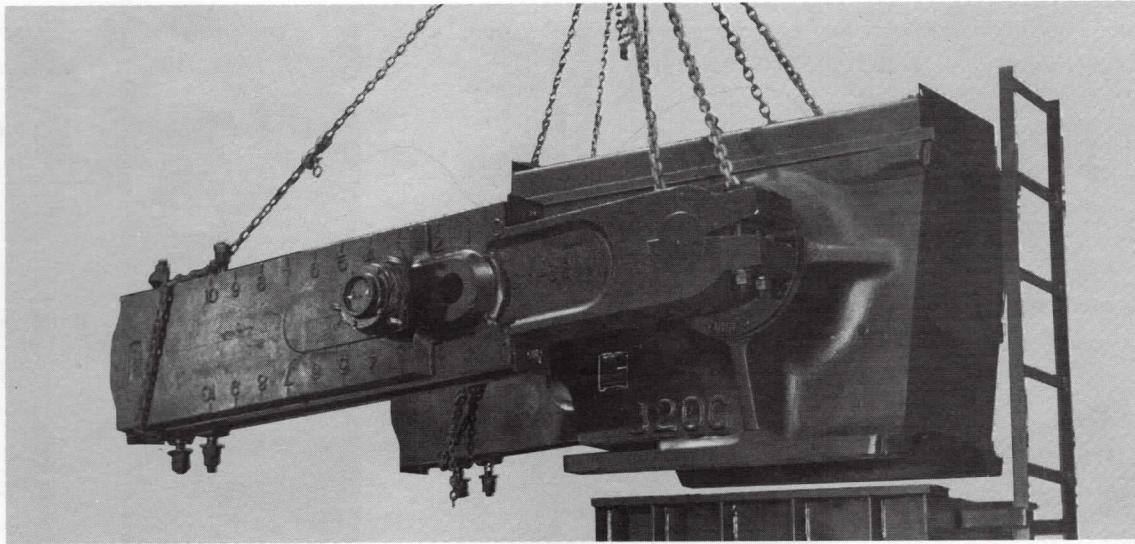


Fig. 3

be necessary to grout or shim under the frame at the samson post feet, reducer sub-base, and tiedown locations according to AIMCO foundation drawing. Shims may be welded together and to the base beam to make certain that they stay in place. Refer to the API RP11G for further information on pumping unit installation and maintenance. At this time secure frame to foundation with centerline clamps in order to prevent breathing between frame and concrete.

4. Set reducer and crank assembly on reducer sub-base (320 or larger units) using factory set alignment stops, Fig. 3.

Attach chain to each low speed shaft extension of reducer. Attach one chain to reducer belt guard bracket to hold reducer level. Attach chain around each crank in a manner to prevent slipping. All 5 chains to attach to one master link for hoisting hook. Take precautions to avoid marking of shafts with chains. Install and hammer tighten reducer to sub-base bolts.

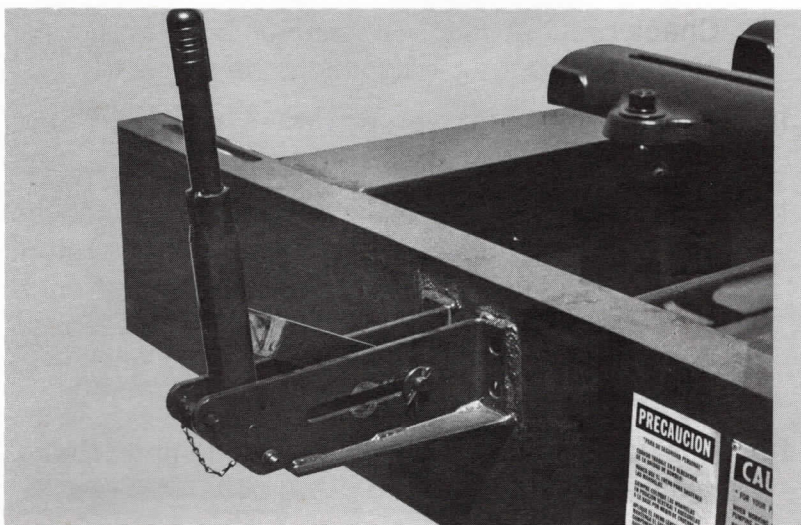


Fig. 4

5. Install brake handle and rods, Fig. 25, page 32.
6. Adjust and apply brake with CRANKS DOWN. Refer to Section VIII for procedures.

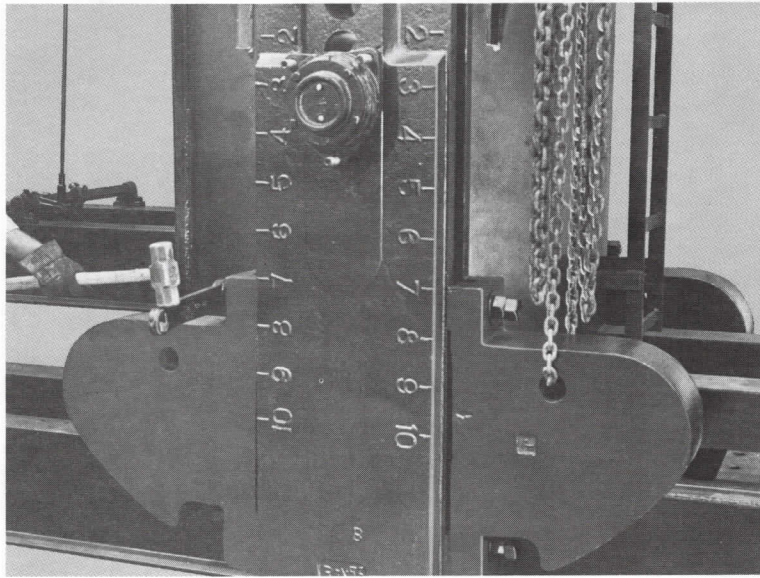


Fig. 5

7. Install counterweights on cranks. Holes through weights are provided to aid in their handling during assembly, Fig. 5. Cranks are furnished with two counterweight adapters, an adjusting screw lug and bolts for attaching and adjusting each weight.

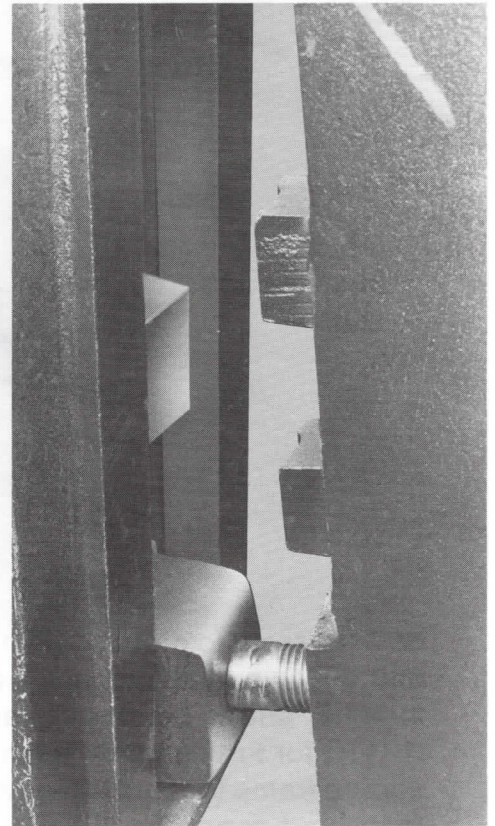


Fig. 6

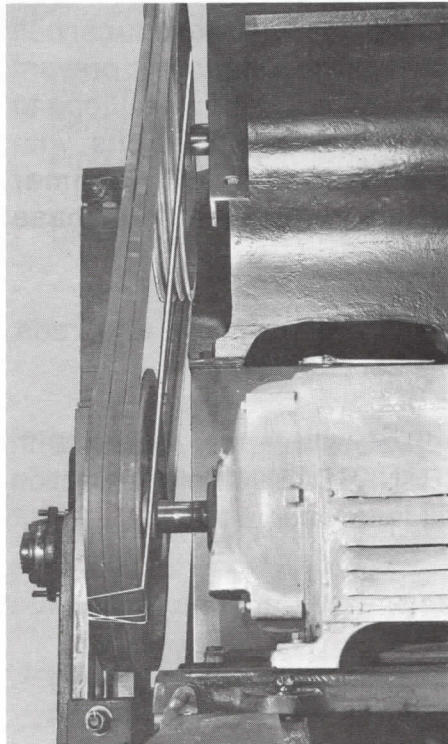


Fig. 7

8. Remove nuts from weight attaching bolts and lower weight into position over bolts making sure that screw adjusting lug is positioned between "ears" on weight, Fig. 6. Replace nuts and lockwashers and hammer tighten nuts.
9. Check reducer "QD" sheave hub bolts and make sure that all bolts are tightened the same.
10. Position prime mover on frame extension and install hold down bolts finger tight.
11. Install V-belts on reducer and prime mover sheaves and check alignment with a string line or straight edge. Align prime mover until string touches each side of reducer and prime mover sheaves. These four points of contact should be in a straight line to insure proper alignment, Fig. 7.
12. After installation, alignment and tightening of belts, tighten prime mover hold down bolts.
13. Install belt guard assembly and tighten mounting bolts.

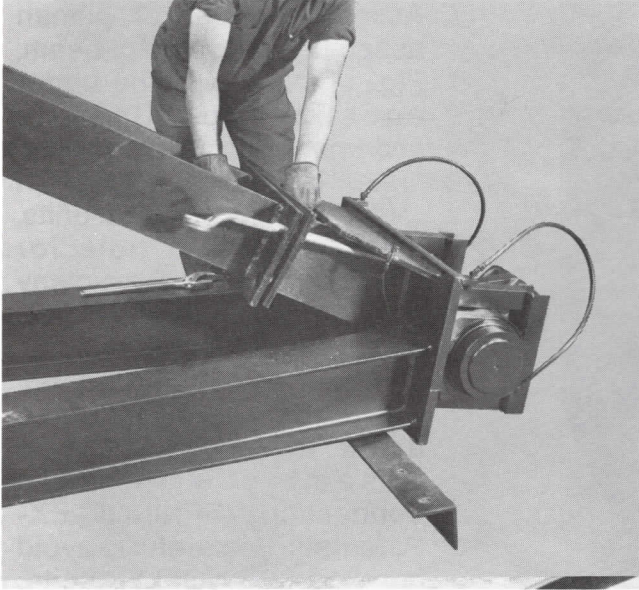


Fig. 8

14. Loosely bolt samson post rear leg to forward section of samson post, Fig. 8.



Fig. 9



Fig. 10

15. Install top ladder brace on samson post. Raise top of samson post enough to permit loosely bolting top of ladder to samson post top with one bolt allowing lower end of ladder to swing out from under samson post legs, Fig. 9.
16. Position hoisting sling between legs at samson post top. Hoist samson post with ladder attached onto frame. Install and tighten all samson post rear leg joint and foot bolts, as well as ladder mounting bolts, Fig. 10. Do not lift samson post by saddle bearing.

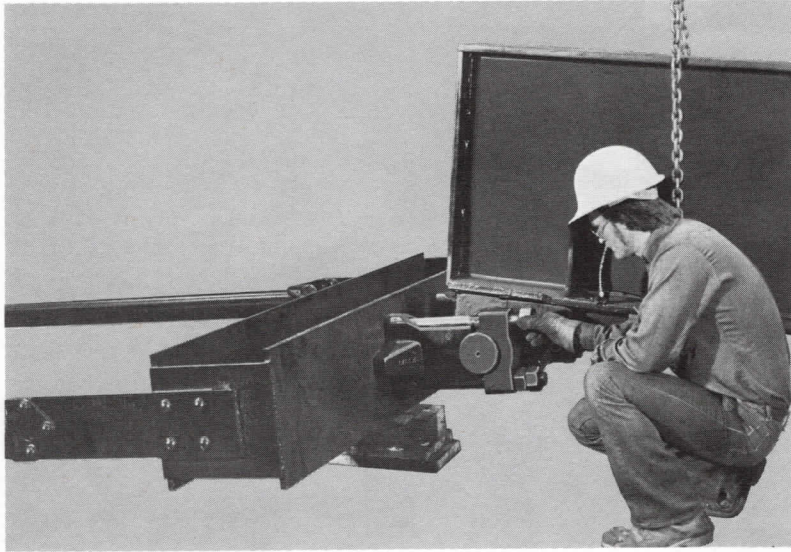


Fig. 11

17. Assemble equalizer pitman assembly to walking beam, Fig. 11. Note cribbing under equalizer to allow its alignment with walking beam. Install bolts finger tight. On D114-143-64 and larger units, be sure tapped hole for lubrication hose is midway between equalizer bolts. Install grease hose with "L" fitting on beam turned up. The equalizer and pitman arms are a one piece assembly with rigid connections (SPRINGFLEX-Patented). Be careful to avoid bending SPRINGFLEX units.

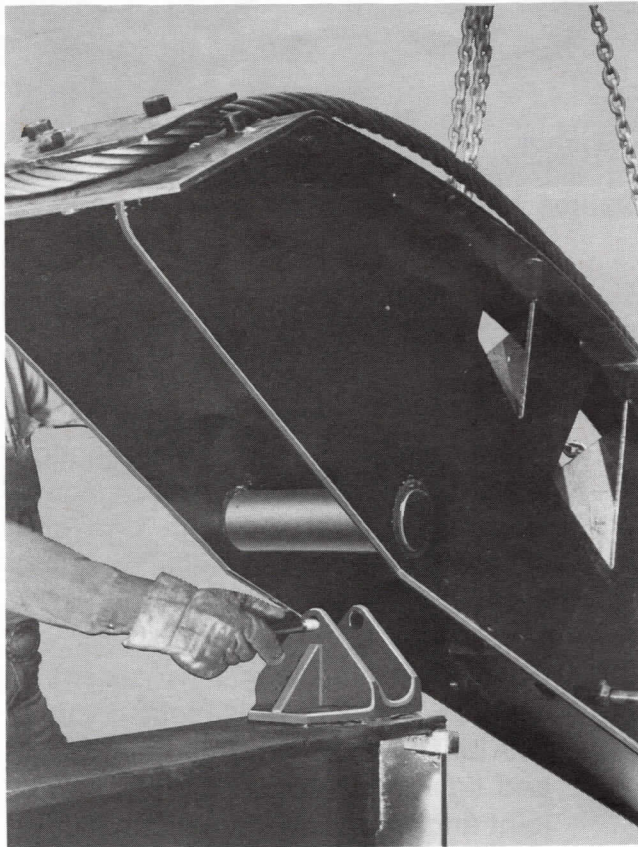


Fig. 12

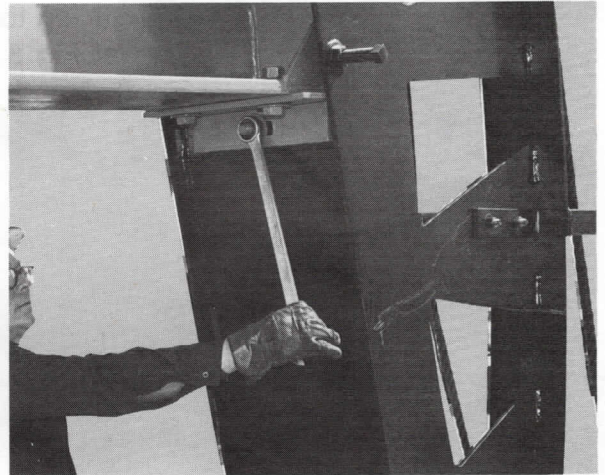


Fig. 13

18. Install horsehead on front of walking beam, Fig. 12. Attach wireline to horsehead and divide with carrier bar as equally as possible. Horsehead and pitman assembly can be erected with walking beam.
19. Loosen side adjusting screws until their ends are flush with inside of horsehead. Hoist walking beam enough to install latch bolt, striker plate and plate bolts. Do not tighten bolts until horsehead has been aligned. See Fig. 13.



Fig. 14

20. Find balance point on walking beam and hoist walking beam assembly to top of samson post and install all bolts finger tight, Figs. 14 & 15.

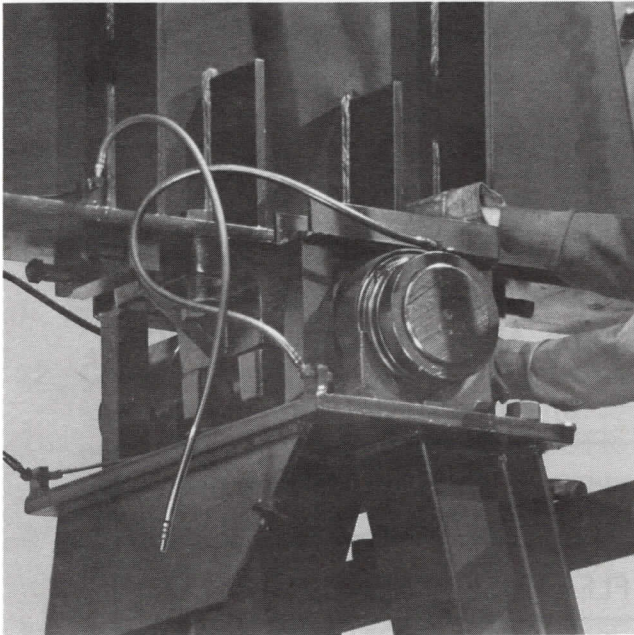


Fig. 15

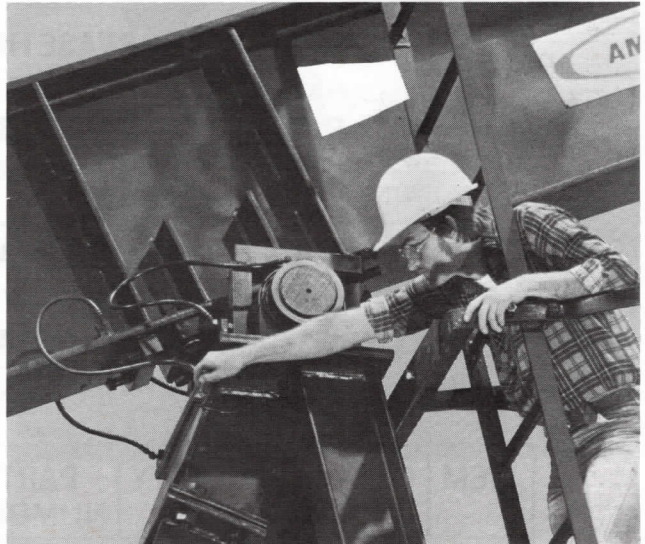
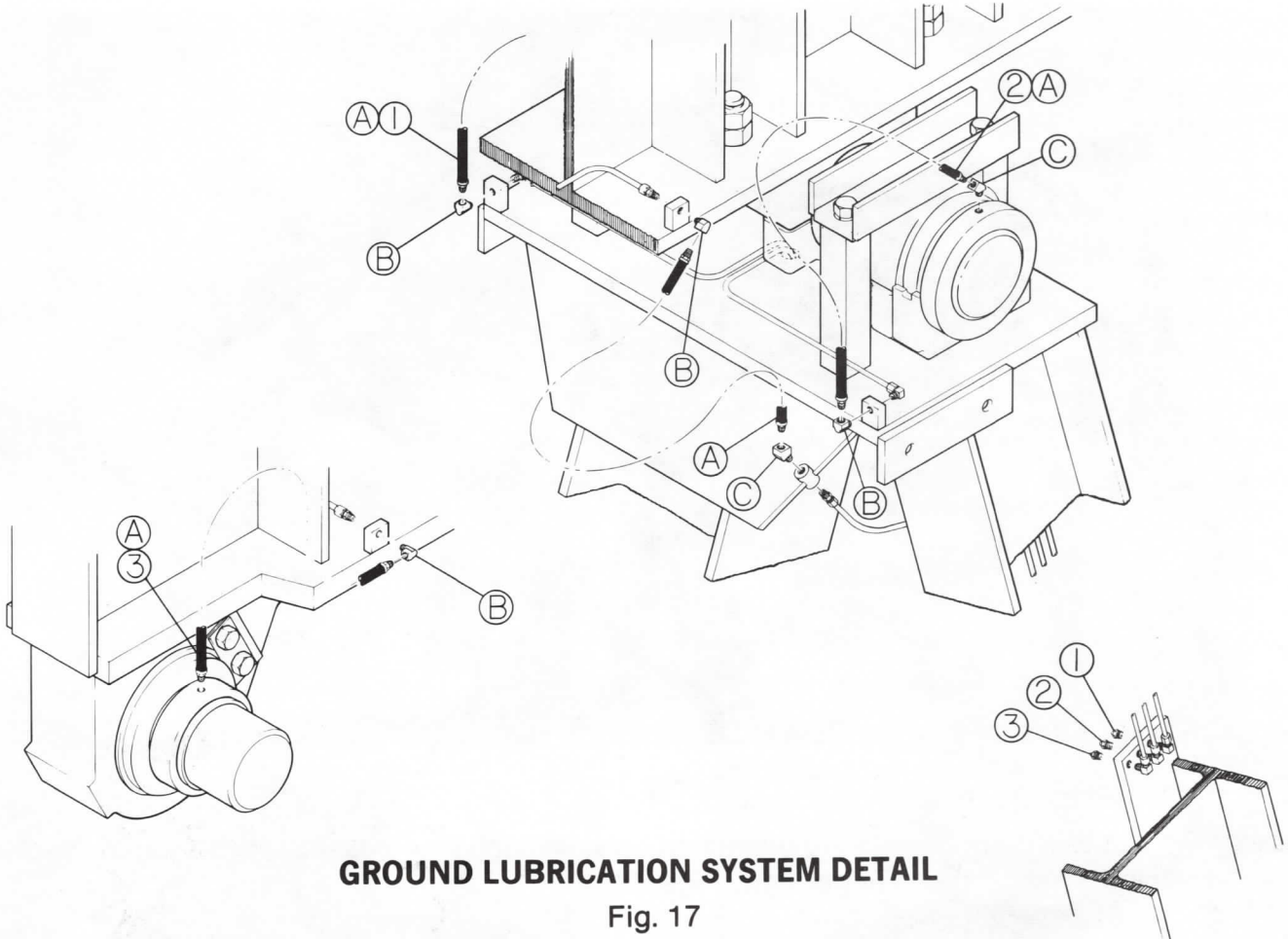


Fig. 16

21. Connect ground lubrication lines from bearings to samson post, Figs. 16 & 17.



GROUND LUBRICATION SYSTEM DETAIL

Fig. 17

CAUTION! MAKE SURE GREASE HOSES, 45° FITTINGS AND 90° FITTINGS ARE PROPERLY INSTALLED. GREASE HOSE FROM WALKING BEAM TO EQUALIZER BEARING 3A, SHOULD BE POINTING UP MIDWAY BETWEEN EQUALIZER BOLTS WHEN EQUALIZER ASSEMBLY IS INSTALLED. GREASE HOSE FROM SAMSON POST TO WALKING BEAM, SHOULD POINT DOWN AND TO THE BACK OF UNIT AT 45°. REMEMBER GREASE LINE DAMAGE MAY OCCUR IF GREASE LINES AND FITTINGS ARE NOT PROPERLY INSTALLED.

ITEM	QTY	COMMODITY NUMBER	PART NUMBER	DESCRIPTION
A	4	061201	TF-451-3	FLEX HOSE ASSEMBLY - 30" LG.
B	4	026117	---	90° X 1/8" NPT STREET ELBOW
C	3	047666	---	45° X 1/8" NPT STREET ELBOW



WEIGHT AND HEIGHT DATA FOR ERECTION PURPOSES

UNIT SIZE	MINIMUM HOOK HEIGHT	APPROXIMATE WT. (LBS.) WIDE FRAME	REDUCER WEIGHT W/CRANKS (LBS.)
912G	30' - 0"	8,850	21,990
640G	30' - 0"	8,850	20,970
456G	30' - 0"	8,850	18,250
320G	25' - 3"	7,200	14,350
228G	25' - 3"	7,200	11,200
160G	21' - 8"	5,650	7,750
114G	19' - 10"	5,650	7,800

MINIMUM HOOK HEIGHT - Distance from bottom of frame to top of horsehead when walking beam is level.

NOTE: Normally 228G reducers and smaller are shipped mounted on frame. Add reducer weight w/cranks to wide frame to get total weight (lbs.).

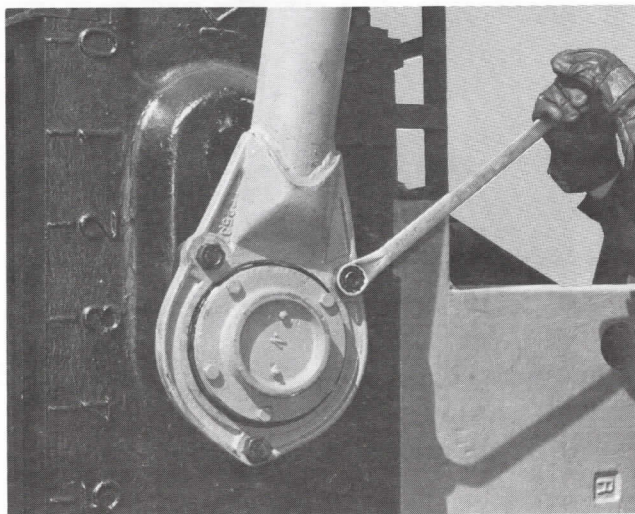


Fig. 18

22. Chain off light end of walking beam assembly, either horsehead end or equalizer end, to frame. Attach hoist to heavy end and raise or lower to move pitman banjos to align with crank wrist pin bearing housings.
23. Install pitman banjos on crank wrist pin bearing housings. Tighten bolts evenly leaving same space between banjo flange and bearing housing ears all around, Fig. 18.

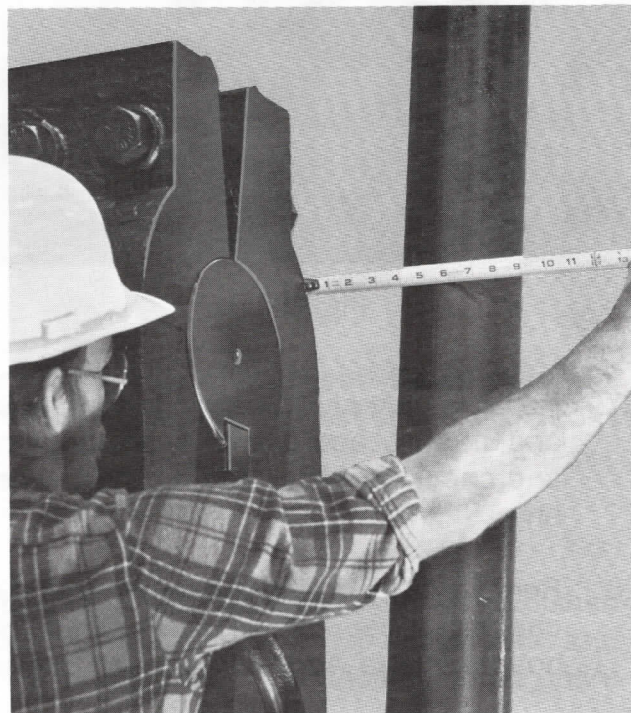


Fig. 19

24. Check clearance dimension between pitman pipe and crank face on each side of unit and adjust saddle bearing set screws to equalize, Fig. 19. Do not change this adjustment to align horsehead over well.



- 25. Remove cotter pins and check wrist pins for tightness. Replace and set cotter pins and install crank guards.
- 26. Inspect complete installation making sure that all bolts, nuts and hold down clamp bolts are tightened securely and that there are no tools or loose hardware laying on walking beam, horsehead, samson post, cranks or on other components.

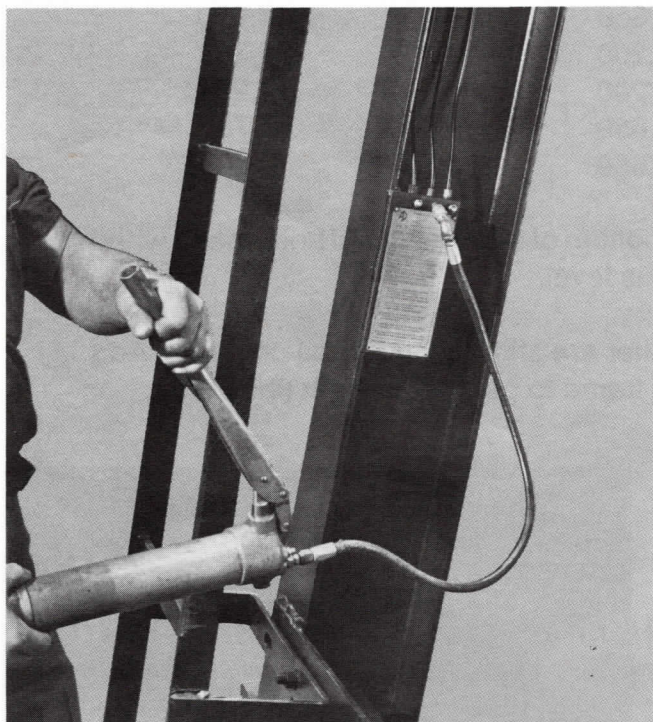


Fig. 20

- 27. Remove pipe plug from bottom of reducer and drain out approximately one quart of oil and check for water. Drain out all water, if any.
- 28. Remove oil level plug in side of reducer and check reducer oil level which should be at bottom of hole. Add oil if required, per page 27.
- 29. Lubricate saddle, equalizer and wrist pin bearings with AAR M-942 or Grade "0" lithium base grease. Pump grease slowly to avoid damage to grease seals. Use ground lubrication system to grease saddle and equalizer bearings, Fig. 20, for units with samson post over 72" tall.

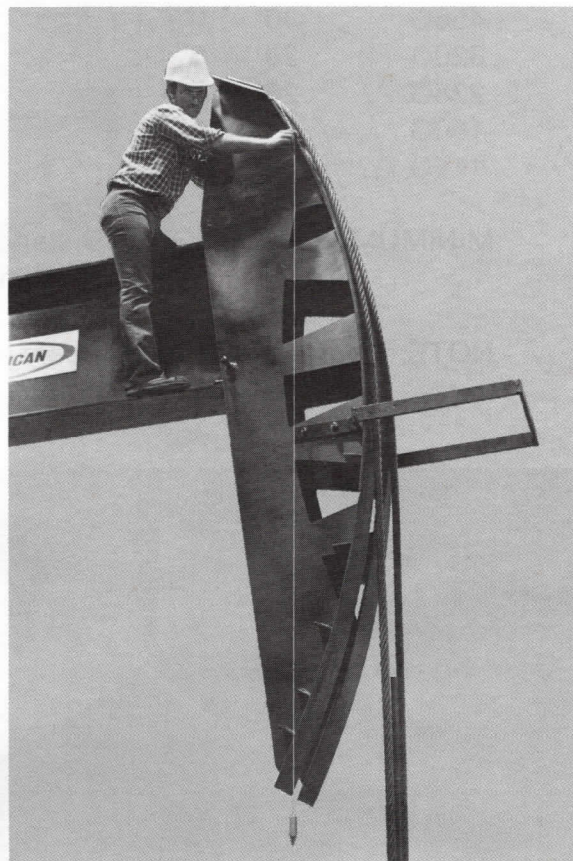


Fig. 21

- 30. Release brake, hoist cranks to safe height for installing polished rod. Apply brake firmly.
- 31. Insert polished rod into polished rod hanger and securely tighten polished rod clamp. Install gate and make sure latch falls into slot. Slowly release brake to allow cranks to rotate downward enough to draw wire line taut. Re-engage brake. Chain or block up cranks to prevent their movement.

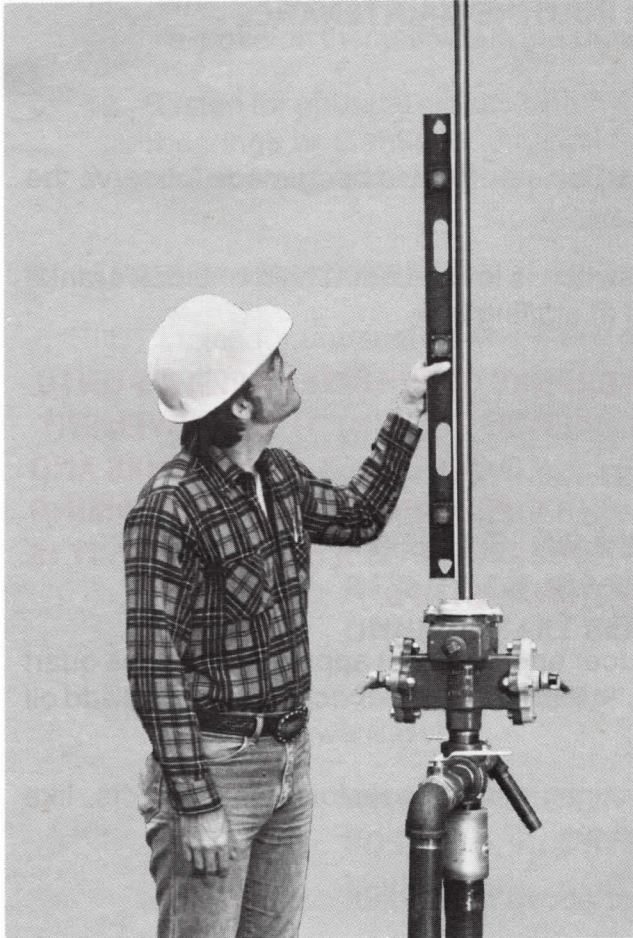


Fig. 22

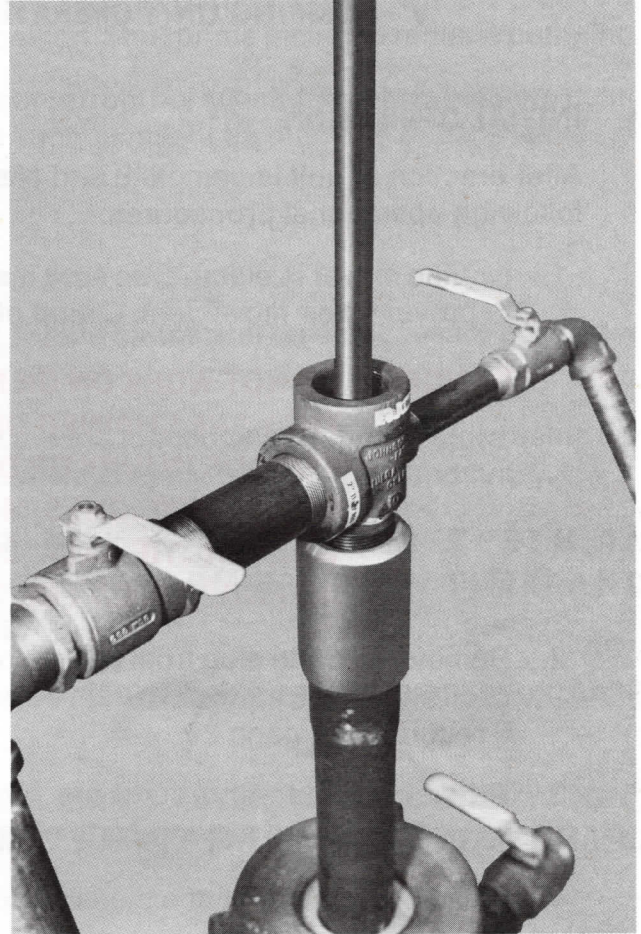


Fig. 23

32. Check to see if wire lines run down center of runners. Adjust horsehead if necessary, Fig. 21, using side adjusting screws to align horsehead vertically. Tighten striker plate bolts then loosen side adjusting screws.
33. Remove chains and blocking from cranks.
34. If stuffing box is under pressure, move horsehead to lowest position and check polished rod for vertical with an accurate level. Re-position horsehead at highest position and check polished rod for vertical, again. If a need for adjustment is indicated, move entire unit on foundation to correct, Fig. 22.
35. If stuffing box is not under pressure, remove gland and packing so that polished rod position can be observed in pumping tee bore. Stuffing box gland and packing may be fastened to polished rod carrier bar to keep it out of the way. Release brake, start prime mover and move horsehead to lowest position and set brake. Observe position of polished rod in pumping tee bore. Move horsehead to highest position and check position of polished rod in pumping tee bore. Polished rod should be as near center of bore as possible. If adjustment is required, move entire unit on foundation, Fig. 23.



V PUMPING UNIT OPERATION & ROUTINE MAINTENANCE

A. INITIAL OPERATION

After erection of unit is complete and after all adjustments have been made, observe the following operational procedures:

1. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

2. Remove oil drain plug from bottom of reducer and drain out approximately one quart of oil and check for water. Drain out all water, if any, then re-check oil level and add oil if required per page 27.
3. Be sure all nuts and bolts are properly tightened. Check for loose objects, like wrenches, left on moving parts of unit and remove them.
4. Avoid operating unit at excessive speed or above rated load.
5. Make sure proper counterbalance is maintained.
6. Follow recommended lubrication schedules, page 27.
7. Remove chains or blocking from cranks, remove wellhead clamp at stuffing box, release brake and start prime mover to commence pumping.
8. Apply brake slowly several times to be sure it is functioning properly before using it to position cranks. DO NOT JAM BRAKE. Always apply brake slowly and firmly.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

9. Stop prime mover and slowly apply brake to stop pumping unit with cranks horizontal, pointing toward well.

CAUTION! WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

10. If brake does not hold cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. Proceed to Section VIII before finishing this Section.



11. When brake holds crank without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. Start prime mover to resume pumping.
12. Listen for unusual noises which might come from horsehead, wireline, walking beam bearings or cranks, or unusual noises such as might be made by belts, sheaves or crank weights rubbing against belt guard.

B. AFTER 24 HRS. OPERATION

1. Listen for unusual noises. If any occur, locate cause and take necessary corrective action.
2. Apply brake slowly several times to be sure it is functioning properly before using it to position cranks. DO NOT JAM BRAKE. Always apply brake slowly and firmly.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

3. Stop prime mover and slowly apply brake to stop pumping unit with cranks horizontal, pointing toward well.

CAUTION! WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

4. If brake does not hold cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. Proceed to Section VIII before finishing this section.
5. When brake holds cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

6. Check all bolts including hold down clamp bolts for tightness.
7. Remove cotter pins and attempt to tighten wrist pin nuts. If any movement is accomplished, drive to next castellation and re-install cotter pins.
8. Re-tighten prime mover hold down bolts.



9. Re-check alignment to make sure that wire line tracks horsehead properly.
10. Remove chains or blocking from cranks, remove wellhead clamp at stuffing box, release brake and start prime mover to resume pumping.

C. AFTER FIRST TWO WEEKS OF OPERATION

1. Listen for unusual noises. If any occur, locate cause and take necessary corrective action.
2. Apply brake slowly several times to be sure it is functioning properly before using it to position cranks. DO NOT JAM BRAKE. Always apply brake slowly and firmly.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

3. Stop prime mover and slowly apply brake to stop pumping unit with cranks horizontal, pointing toward well.

CAUTION! WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

4. If brake does not hold cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. Proceed to Section VIII before finishing this Section.
5. When brake holds cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

6. Remove oil level plug and check reducer oil level. Service, if required, per page 27.
7. Lubricate saddle, equalizer and wrist pin bearings with AAR M-942 or Grade "0" lithium base grease. Pump grease slowly and observe relief fittings for proper operation.
8. Check all bolts, including hold down bolts and wrist pin nuts for tightness, as per B, 7 on page 17.
9. Remove chains or blocking from cranks, remove wellhead clamp at stuffing box, release brake, start prime mover and resume pumping.



D. AFTER SIX MONTHS AND EACH SIX MONTHS THEREAFTER

1. Listen for unusual noises. If any occur, locate cause and take necessary corrective action.
2. Apply brake slowly several times to be sure it is functioning properly before using it to position cranks. **DO NOT JAM BRAKE.** Always apply brake slowly and firmly.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

3. Stop prime mover and slowly apply brake to stop pumping unit with cranks horizontal, pointing toward well.

CAUTION! WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

4. If brake does not hold cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. Proceed to Section VIII before finishing this section.
5. When brake holds cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

6. Check reducer oil as per instruction A, 2, page 16.
7. Lubricate saddle, equalizer and wrist pin bearings with AAR M-942 or Grade "O" lithium base grease. Pump grease slowly and observe relief fittings for proper operation.
8. Check all bolts including hold down clamp bolts and wrist pin nuts for tightness, as per B, 7 on page 17.
9. Check unit alignment over stuffing box, page 15.
10. Remove chains or blocking from cranks, remove wellhead clamp at stuffing box, release brake and start prime mover to resume pumping.



VI REGULAR INSPECTION & ADJUSTMENT

To obtain extended unit life with efficient performance, regular inspection and adjustment with attention to the following conditions is advisable.

A. GENERAL INSPECTION

Unit should be checked at 6 month intervals. Inspection should include:

1. Listen for unusual noises. If any occur, locate cause and take necessary corrective action.
2. Listen for excessive gear reducer noise.
3. Listen for abnormal noises from wrist pin bearing areas on both sides of unit.
4. Listen for abnormal squeaks or grinding noises from saddle and equalizer bearing units.
5. Observe as to whether wireline tracks correctly, is not worn or rusted, and has no broken strands.
6. Apply brake firmly, several times. DO NOT JAM BRAKE. Always apply brake slowly and firmly.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

7. Stop prime mover and slowly apply brake to stop pumping unit with cranks horizontal, pointing toward well.

CAUTION! WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

8. If brake does not hold cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. Proceed to Section VIII before finishing this Inspection.
9. When brake holds cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.



DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

10. Check for looseness of bolts in connections of walking beam saddle and equalizer bearings.
11. Check for evidence of saddle or equalizer bearing leaks.
12. Check for loose wrist pins or wrist pin nuts and check for evidence of bearing seal leakage.
13. Check QD hub keys for looseness and observe belts for wear, looseness or being turned over in sheave grooves. Check sheave alignment per Fig. 7, page 8.
14. Check ground lubrication lines for damage. Make sure grease relief fittings are operative.
15. Check gear reducer for evidence of oil leaks at seals or gaskets. Check for evidence of dirt, water, sludge or metallic particles in reducer.
16. Check all bolts for rust around heads. Rusty heads usually signify looseness.
17. Check alignment of unit with wellhead per Figs. 22 or 23, page 15.
18. Check unit hold down bolts to see that they are tight.
19. After all problems have been corrected, remove chain or blocking from cranks and wellhead clamp at stuffing box. Release brake and start prime mover to resume pumping.

B. COUNTERBALANCE CHECK

Maintaining proper counterbalance on the unit is most important in order to operate at minimum cost for energy and to prolong life of the gears and bearings in the reducer.

Peak loads on the reducer occur during fluid lift and during counterbalance lift. If counterbalance is properly adjusted, these two load peaks will be equal thus minimizing reducer wear and energy consumption. Counterbalance condition can be checked by any one or more of the following methods:

1. **DYNAMOMETER CHECK** - Measure well loads at polished rod throughout cycle. Unit torque factors can then be used to calculate reducer torque and required counterbalance. See API Std. 11E.



2. **AMMETER CHECK** - Apply ammeter to any one of the three lead wires on electric prime mover. Readings must be equal on upstroke and downstroke. Higher reading on upstroke indicates need for more counterbalance. Higher reading on downstroke indicates need for less counterbalance.
3. **VACUUM GAUGE CHECK** - (Used on multi-cylinder engine prime movers) Gauge readings must be equal on upstroke and downstroke. Lower gauge reading on upstroke indicates need for more counterbalance. Lower gauge reading on downstroke indicates need for less counterbalance.

C. COUNTERBALANCE ADJUSTMENT

To adjust counterbalance, proceed as follows:

1. Shut down prime mover and slowly apply brake to stop cranks positioned slightly below horizontal if counterbalance is to be increased, and slightly above horizontal if it is to be decreased. The cranks should incline so that counterweight movement will be downhill Fig. 24.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE. WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

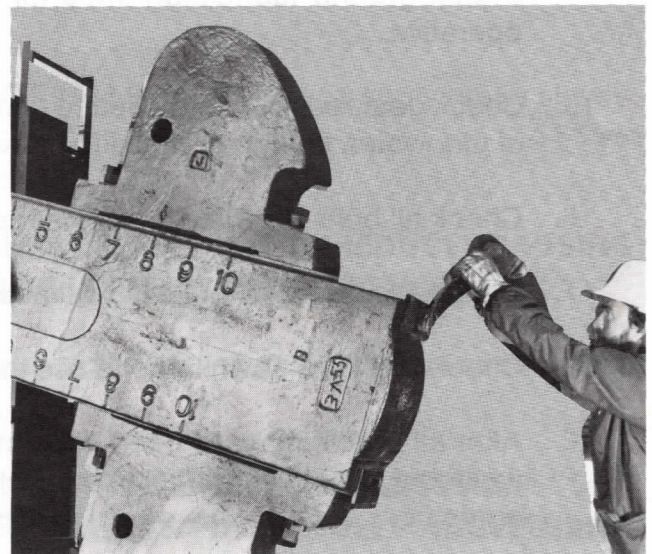


Fig. 24

2. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.



3. Loosen counterweight attaching bolt nuts, but do not remove them.
4. Move the weights to their new position by turning adjusting screw at the outer end of crank.
5. Hammer tighten nuts on counterweight attaching bolts.
6. Remove chain or blocking from cranks and wellhead clamp at stuffing box. Release brake and start prime mover to resume pumping.

D. ALIGNMENT

To check alignment, proceed as follows:

1. Shut down prime mover and slowly apply brake to stop cranks positioned DOWN.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE. WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

2. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

3. Measure distance between pitman pipes and cranks, Fig. 19, page 13. Dimensions should be the same on both sides of unit. If not, proceed to Number 4.
4. Loosen walking beam-to-trunnion bolts and set screws, then swing walking beam to equalize measurements.
5. Tighten walking beam-to-trunnion bolts and set screws.
6. Check horsehead alignment with stuffing box and realign, if necessary, by moving entire unit on foundation, Figs. 22 & 23, page 15.
7. Remove chain or blocking from cranks and wellhead clamp at stuffing box. Release brake and start prime mover to resume pumping.



E. CHANGING STROKE

If stroke change is required, wrist pins must be moved to other holes in cranks, as required, to lengthen or shorten the stroke using the following procedures:

1. Shut down prime mover and slowly apply brake with cranks positioned horizontally and pointing toward well.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE. WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

2. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box. Chain polished rod hanger bar to wellhead. Loosely chain equalizer to frame cross member.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

Note: Steps 3 through 15 apply to both cranks. Steps may be accomplished on each side alternately or in sequence on one side then the other.

3. Take bolts out and remove pitman banjo by prying between bearing housing and banjo flange with pinch bar. Do not hammer.
4. Remove cotter pin and wrist pin nut and install knocker on wrist pin.

THE TF-5086 NUT TIGHTENING ASSEMBLY CAN ALSO BE USED TO REMOVE THE WRIST PIN NUT. CONTACT YOUR AMERICAN DISTRIBUTOR FOR INFORMATION.

CAUTION! MAKE SURE THAT KNOCKER BOTTOMS ON PIN END TO PREVENT POSSIBLE THREAD DAMAGE.

WARNING! WEAR EYE PROTECTION WHEN HAMMERING METAL. FLYING METAL CHIPS CAN CAUSE PERMANENT EYE DAMAGE.

5. Using sledge hammer, drive wrist pin from crank hole, bottoming knocker on end of pin after each blow.



NOW AVAILABLE FROM AMERICAN, A PNEUMATIC WRIST PIN KNOCKER. TF-550 CONTACT YOUR AMERICAN DISTRIBUTOR FOR INFORMATION.

6. Inspect wrist pin and new wrist pin hole for fretted areas, burrs, deformities or damage which could prevent proper seating of pin and subsequent failure in operation
7. Clean wrist pin and new hole surfaces with non-flammable solvent and, if necessary, fine grit emery cloth.

CAUTION! WRIST PIN AND HOLE CONTACT SURFACES MUST BE IN SOLID CONTACT OVER 90 PERCENT OF THEIR COMBINED AREAS. IF CONTACT SURFACES OF HOLE AND PIN ARE FRETTED IN EXCESS OF 10 PERCENT OF SURFACE AREAS COMBINED, HOLE MUST BE SLEEVED AND NEW PIN INSTALLED.

8. Insert wrist pin (dry) into hole and seat snugly by hand pressure only. Cotter pin hole should be parallel with crank.
9. Lubricate threads and face of wrist pin nut with Texaco THREADTEX (or equivalent) and run nut on wrist pin by hand.
10. Apply tightening torque of 1000 ft.-lbs. to wrist pin nuts on CO33 and C46 cranks, 1500 ft.-lbs. on CO36 and C48 cranks, 3000 ft.-lbs. on C75 and K76 cranks and 5000 ft.-lbs. on K99 and KA117 cranks.
11. Further tighten nut to align castellation with cotter pin hole in wrist pin, insert and set cotter pin.

THE TF-5086 NUT TIGHTENING ASSEMBLY SHOULD BE USED TO CHECK TIGHTNESS ON NUTS ON ATF-585 AND ATF-485 WRIST PIN ASSEMBLIES IN THE FIELD. THIS IS A SURE WAY TO KNOW THE PIN HAS BEEN TIGHTENED TO 5000 FT.-LBS. CONTACT YOUR AMERICAN DISTRIBUTOR FOR INFORMATION.

CAUTION! DO NOT BACK OFF NUT TO ALIGN CASTELLATION WITH COTTER PIN HOLE. IF NUT IS UNINTENTIONALLY TURNED TOO FAR FOR COTTER PIN INSERTION, REMOVE WRIST PIN AND REPEAT INSTALLATION.

12. Check fit between pin and crank. If a .002" feeler gauge can be inserted between crank and pin, then the crank hole must be sleeved and a new wrist pin used.
13. Slightly raise or lower beam with hoist to align pitman banjo with wrist pin bearing housing.
14. Re-install banjo per instruction No. 23, page 13.
15. Apply rust preventive compound to open wrist pin holes.



16. Remove chain from equalizer and polished rod hanger bar. Remove wellhead clamp at stuffing box.
17. Release brake, use hoist to lift cranks slightly to permit removal of all safety chains and blocking from unit. Lower cranks to DOWN position.
18. Start prime mover and check for proper counterbalance with lengthened or shortened stroke.

F. WALKING BEAM ADJUSTMENT

Adjusting screws are provided on walking beam to move the horsehead to or from the well. The screws are located in front and in back of the saddle bearing trunnion. To adjust, proceed as follows:

1. Shut down prime mover and slowly apply brake to stop pumping unit with walking beam in horizontal position.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE. WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

2. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

3. Loosen bolts attaching saddle bearing trunnion to walking beam. Do not remove bolts or nuts.
4. Turn adjusting screws to move walking beam to new position.
5. Tighten bolts attaching saddle bearing trunnion to walking beam with hammer wrench.
6. Tighten adjusting screws.
7. Remove clamp from polished rod at stuffing box and chains or blocking from cranks. Check polished rod for vertical with accurate level, as per Section IV, No. 34 & 35, page 15.
8. Release brake and start prime mover to resume pumping.



VII LUBRICATION REQUIREMENTS

A. GENERAL INFORMATION

All structural bearing assemblies and the gear reducer are designed to provide years of trouble-free service if proper maintenance procedures at recommended intervals are observed by the unit operator. Many factors govern the lubrication requirements and maintenance practices, with some factors peculiar only to certain areas due to type of terrain, prevailing weather conditions and type of production. The information contained herein may not completely satisfy the necessary requirements of all pumping units, but if strictly observed as to lubrication points and types of lubricants, unit downtime will be minimal. American units (those with samson posts taller than 72 inches) are equipped with ground lubrication systems. Lubricants and time intervals specified are formulated on normal use of pumping units. If unit is used in extreme environmental conditions, with exceptionally heavy loads or at excessive speeds, time intervals between servicing may need to be adjusted. Lubricant types recommended may also require change to assure continued satisfactory operation.

B. STRUCTURAL BEARINGS

The wrist pin, equalizer and saddle bearings are provided with fittings so that lubricant may be applied with a standard grease gun. These bearings should be lubricated with AAR M-942 or Grade "0" lithium base grease at six month intervals, or more often, if required by operating conditions, temperature or oil seal condition.

CAUTION! DO NOT USE CUP GREASE OR HEAVY WHEEL BEARING GREASE IN BEARINGS.

Make sure that plungers in bearing pressure relief fittings are free so that pressure will not damage the seals. Tapered roller bearings in some saddle and equalizer assemblies have relief slots in lieu of fittings. Nylon saddle and equalizer bearings and all wrist pin bearings have pressure relief fittings. Always pump grease slowly and observe relief fittings and slots to see when bearings are full.

C. GEAR REDUCER

For prolonged life of pumping unit gear reducer, oil must be of suitable viscosity and be free of foreign materials, sludge and water. The method used to determine oil change intervals for reducers is left to each operator. The individual operator will decide on visual checks or sampling for laboratory analysis, which may include check of acidity and viscosity factors as well as determination of water, sludge and foreign material percentages in the oil. Oil change intervals can then be initiated when set limit for one or more of these factors is exceeded. Shut down prime mover and slowly apply brake to stop cranks positioned DOWN.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE. WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.



If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

Visual checks require removal of gear reducer cover for a look inside the reducer and a visual check of oil sample drained from bottom of case and allowed to settle. Oil change is made when inspection reveals sludge on interior surfaces, emulsification of oil, sludge in oil or oil contamination by sand or metal particles. Sludging/emulsification is usually caused by water accumulation in the reducer. Even small amounts of water, if observed, should be drawn off per instruction A, 2 on page 16, to prevent sufficient accumulation to cause sludging/emulsification.

Adverse operating conditions, which can cause more frequent change of gear reducer oil, include one or more of the following.

1. Intermittent operation of pumping unit.
2. Excessive sand or dust conditions.
3. Sulphur or sour gas fumes.
4. High humidity with high variation in daily temperature.

Under the most favorable conditions, a unit may operate as long as a year or more before an oil change is necessary.

D. REDUCER OIL CHANGE PROCEDURES

Each time the reducer oil is changed, perform the following:

1. After draining, flush reducer with automobile crank case flushing oil (or equivalent light oil).

CAUTION! KEROSENE OR GASOLINE IS NOT RECOMMENDED.

2. Drain flushing oil and check throughout reducer, including oil troughs to be sure of complete removal of all foreign matter.
3. Fill reducer to proper level with new oil. For temperatures down to 0°F., fill with AGMA 5EP (ISO VG 220). For temperatures to -30°F., use AGMA 4EP (ISO VG 150).

Note: Oils specified are premium mild extreme pressure lubricants with rust and oxidation inhibitors and with antifoam agent.



E. LUBRICANT PROBLEMS

Improper lubricant, lack of lubricant or operation under extreme environmental conditions may cause problems which should be recognized and corrected prior to causing greater problems and operational downtime. For lubricant problems probable causes and corrective actions, refer to chart below.

PROBLEM	PROBABLE CAUSE	CORRECTIVE ACTION
Lack of oil to gears for diversion to bearing oil channels	Oil too thin for high temps or too viscous for low temps	Add heavier or lighter oil (same grade) or drain and refill with proper viscosity oil
Unit hard to start in cold climate	Oil too heavy and viscous	Add lighter oil or drain and refill with lighter oil
Continuous severe pitting or scuffing of gears sufficient oil present	Gear overloaded at load peaks; oil of incorrect specifications, emulsified or contaminated	Reduce loading. Drain, flush and refill with proper lubricant
Gears wearing	Contaminated oil	Drain, flush and refill
Foam in gearbox or leaking from seals	Incorrect oil or overfilled (particularly at high speeds)	Drain, flush and refill with proper lubricant
Oil milky in appearance	Emulsified or incorrect oil combination with water	Drain, flush and refill with proper lubricant
Heavy soapy sludge in reducer	Incorrect lubricant or widely varying lubricants mixed	Drain, flush and refill with proper lubricant
Excessive rust or corrosion of gears or bearings	Intermittent operation in humid area. Water in case. Wrong lubricant or lubricant deteriorated.	Drain, flush and refill with proper lubricant
Sticky or insoluble deposits on gears or bearings	Oil operated too long or improper lubricant	Drain, flush and refill with proper lubricant



VIII BRAKES

BRAKE TYPES

The brake for American units in the field may be any one of four types, based on the model and size of the pumping unit. All four require periodic adjustment and maintenance to give trouble free operation. PUMPING UNIT BRAKES ARE INTENDED ONLY FOR USE AS AN OPERATIONAL STOP AND ARE NOT INTENDED FOR USE AS SAFETY STOPS DURING PUMPING UNIT MAINTENANCE. Brake and/or reducer damage could occur if the brake is used for anything other than shutdown. The four types of brakes and adjustment procedures for each are covered in the following sections.

IX SHOE IN SHEAVE BRAKE

Shut down prime mover and slowly apply brake to stop cranks positioned DOWN.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOP.

Adjustment of the shoe-in-sheave brake is accomplished by adjustment of clevises in the horizontal rod to be sure that shoe seats firmly in sheave when brake is actuated and clears sheave in "off" position.

X DIFFERENTIAL BAND BRAKE

Shut down prime mover and slowly apply brake to stop cranks positioned DOWN.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.



Adjust vertical rod so that it is at right angles to brake and toggle levers. Adjust horizontal rod so as to have several remaining teeth available on ratchet with brake firmly applied.

XI ADJUSTING LINKAGE AND ORSCHELN HAND LEVER

This adjustment is to be made at the time unit is assembled.

1. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

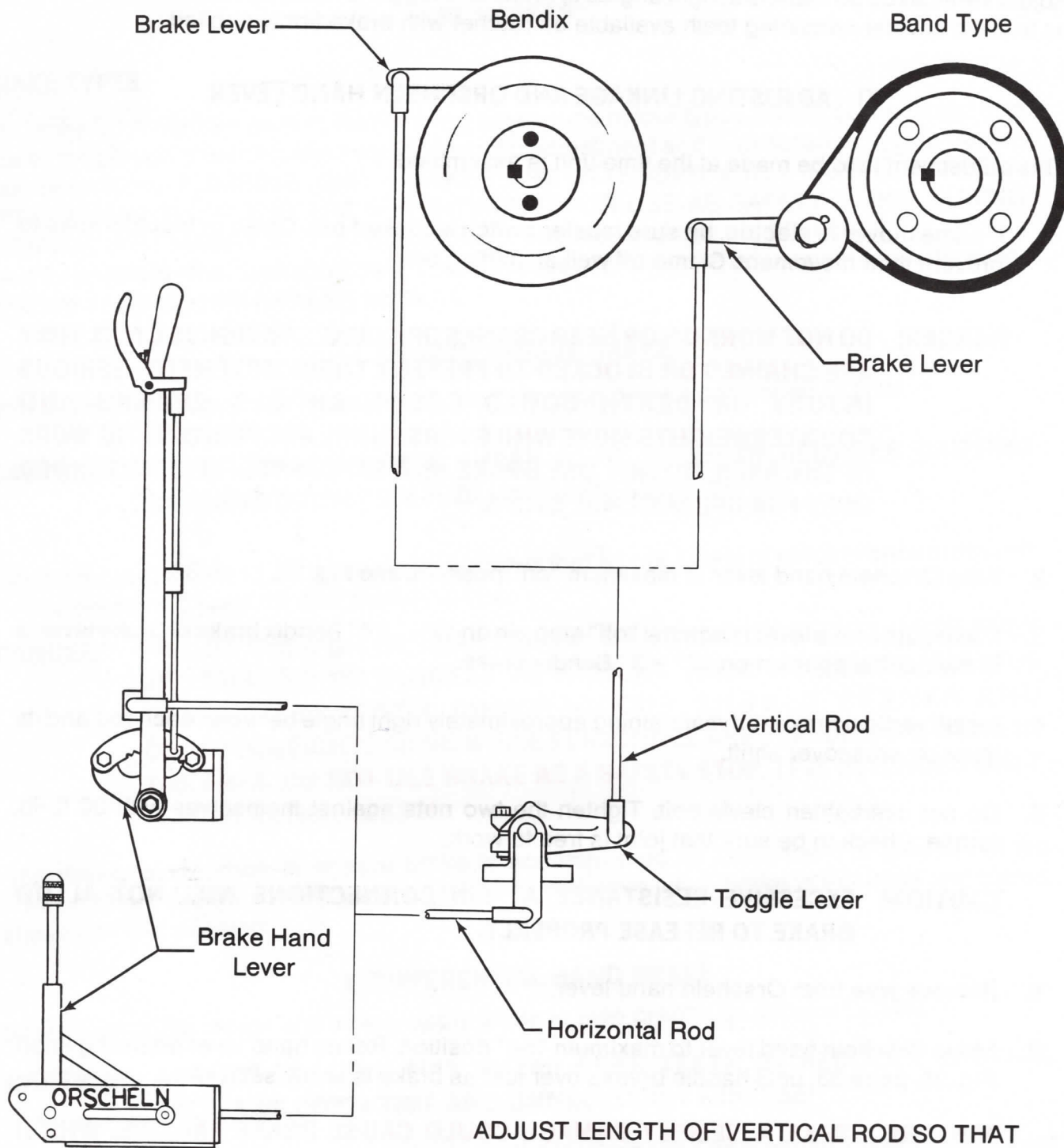
2. Wire Orscheln hand lever in maximum "off" position, see Fig. 26, page 33.
3. Make sure brake lever is against "off" stop pin on 17 $\frac{1}{4}$ " \times 4" Bendix brake or brake lever is in the neutral position on 12" \times 3" Bendix brake.
4. Install vertical brake rod maintaining approximately right angle between each rod and its lever on crossover shaft.
5. Do not overtighten clevis bolt. Tighten the two nuts against themselves with 30 ft.-lb. torque. Check to be sure that joint is free to work.

CAUTION! EXCESSIVE RESISTANCE AT PIN CONNECTIONS WILL NOT ALLOW BRAKE TO RELEASE PROPERLY.

6. Remove wire from Orscheln hand lever.
7. Move Orscheln hand lever to maximum "on" position. Rotate hand lever adjusting knob, Fig. 26, page 33, until handle breaks over just as brake is firmly set.

DANGER! BRAKE ASSEMBLY DAMAGE COULD CAUSE BRAKE FAILURE, WHICH COULD RESULT IN DEATH OR SERIOUS INJURY.

8. Remove chain or blocking from cranks.
9. Apply firmly several times to be sure of proper function.
10. No further adjustment of linkage or hand lever should be made. All further adjustments, if needed, must be made at brake when wear occurs.



ADJUST LENGTH OF VERTICAL ROD SO THAT BRAKE LEVER AND VERTICAL ROD ARE AT RIGHT ANGLES WHEN BRAKE IS APPLIED AND TOGGLE LEVER IS AT SAME ANGLE AS BRAKE LEVER.

Figure 25 LINKAGE ADJUSTMENT FOR BRAKES



XII 12" X 3" BENDIX BRAKE

A. ADJUSTING BRAKE

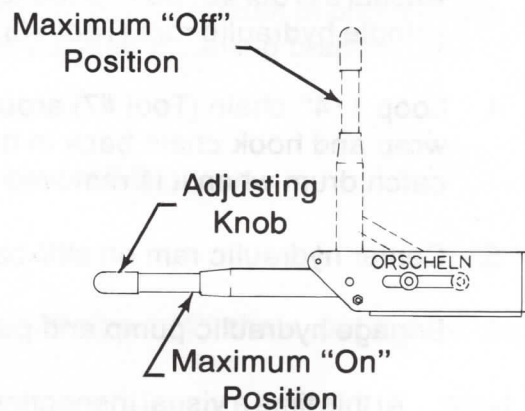
1. Shut down prime mover and slowly engage brake with cranks positioned DOWN. If prime mover is electric, be sure master switch is locked out. Clamp off well at stuffing box.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE. WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

2. Do not change linkage or hand lever set-up.
3. Release brake and disconnect vertical rod (Item #1) from brake lever (Item #2). Wire (Tool #1) Orscheln hand lever (Item #3) in maximum "off" position, (Fig. 26). Make sure brake lever goes to neutral position.
4. Using brake wrench (Tool #2), adjust brake shoes (Item #4) outward by turning star wheel pivot nut (Item #5) until shoes contact brake drum (Item #6). Then rotate star wheel pivot nut back one or two notches to allow clearance between shoes and drum.
5. Rotate drum while adjusting to check for drag.
6. Check brake linkage maintaining approximately right angle between each rod and its lever on crossover shaft.
7. Reconnect vertical rod to brake lever in neutral position. Do not overtighten clevis bolt (Item #7). Tighten the two nuts against themselves with 30 ft.-lb. torque. Check to be sure that joint is free to work.

CAUTION! EXCESSIVE RESISTANCE AT PIN CONNECTIONS WILL NOT ALLOW BRAKE TO RELEASE PROPERLY.

8. Remove wire from Orscheln hand lever.
9. Move Orscheln hand lever to maximum "on" position. Rotate hand lever adjusting knob, Fig. 26, until handle breaks over just as brake is firmly set.
10. Remove clamp from well at stuffing box.



Item #3

Fig. 26

11. Release brake, start prime mover and apply brake firmly, several times. **DO NOT JAM BRAKE.** Always apply brake slowly and firmly.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

12. Stop prime mover and apply brake to stop pumping unit with cranks horizontal, pointing toward well.

CAUTION! WHEN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

13. If brake does not hold cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. If prime mover is electric, be sure master switch is locked out. Clamp off well at stuffing box. Proceed to Step B.
14. When brake holds properly, no further adjustment of linkage or hand lever should be made. All further adjustments, if needed, must be made at brake when wear occurs.

B. REMOVING BRAKE DRUM

1. Rotate drum until tapped holes in hub are horizontal, Fig. 27.
2. Screw the two studs (Tool #3) into the tapped holes in brake drum hub to a depth of approximately 1".
3. Install stiff-back (Tool #4) with nuts and flat washers (Tool #5) positioned to seat on hollow spindle hydraulic ram (Tool #6).
4. Loop 1/4" chain (Tool #7) around the two studs with a double wrap and hook chain back in itself. Use hoisting equipment to catch drum when it is removed from high speed shaft (H.S.S.).
5. Center hydraulic ram on stiff-back and H.S.S.
6. Engage hydraulic pump and pull drum off of shaft.

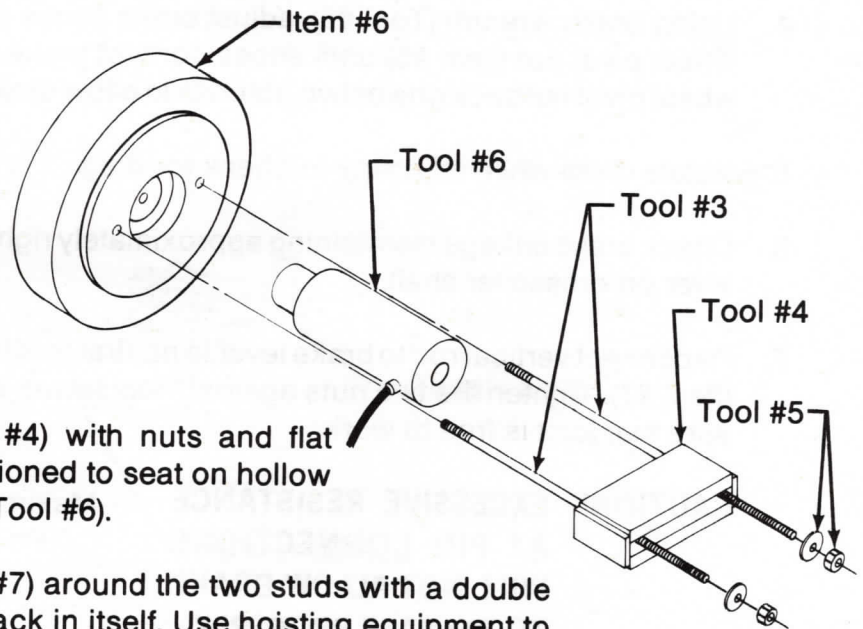


Fig. 27

Note: At this time a visual inspection can be made of the condition of brake shoes. If brake shoes are oily or severely worn, the shoes should be replaced. To remove old shoes, go to Step C. If it is desired to change whole brake assembly, go to Step D.

C. CHANGING BRAKE SHOES

If brake shoes are oily or severely worn, the shoes should be replaced. To remove old shoes, use the following procedure:

1. Take off the shoe return springs (Item #8), using brake spring pliers (Tool #8).
2. Remove adjusting screw spring (Item #9).
3. Remove star wheel pivot nut.
4. Remove anchor pin brace (Item #10).
5. Remove brake shoes and lining assembly.
6. Reverse procedure 1 thru 5 to install new brake shoes being careful to keep linings oil free.
7. Go to Step E.

D. CHANGING BRAKE ASSEMBLY

If it is desired to change the whole brake assembly, use the following procedure:

1. Remove the four 5/8" brake mounting bolts (Item #11).
2. Remove brake assembly.
3. Install new brake assembly.
4. Replace four 5/8" brake mounting bolts and torque to 185 ft.-lbs.
5. Go to Step E.

Note: Brake assembly has been pre-set at factory. Little, if any adjustment should be required. If adjustment is required, normally, adjusting bottom of brake shoes will take care of the problem. See Step A, page 33, after installing brake drum.

E. RE-INSTALLING BRAKE DRUM

1. Screw 3/4" end of stud into tapped hole in end of H.S.S.
2. Lubricate shaft with silicon spray (Tool #9).
3. Screw 1" stud into tapped puller hole in drum. Using a 1/4" chain, put a double half hitch on 1" stud and hoist drum into position.
4. Place square key (Item #12) in brake drum keyway.

Note: It may be necessary to rotate H.S.S. to line up keyways.



5. Be certain that drum keyway and shaft keyway are exactly lined up, and start hub onto shaft.
6. Slide hollow spindle ram over stud in H.S.S. with ram pointing outward, Fig. 28.
7. Install flat washer and nut.
8. Be certain that brake linings are positioned correctly to avoid being damaged when drum is pressed on.

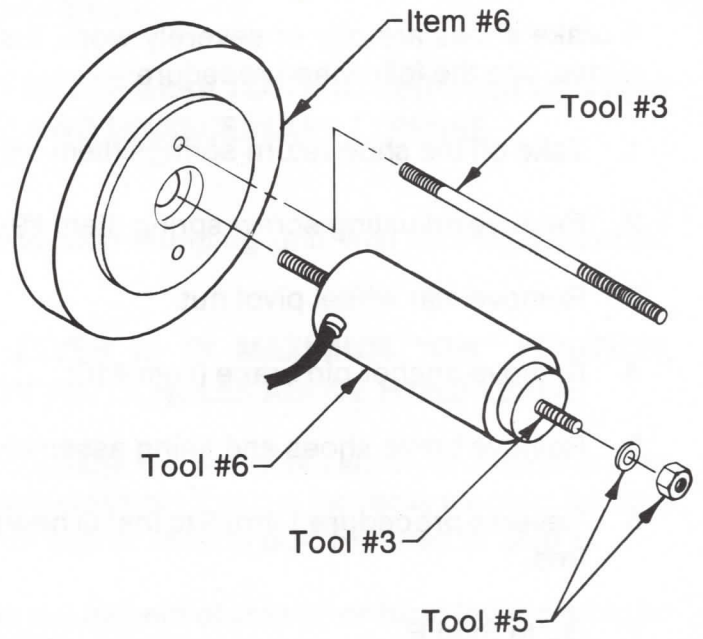


Fig. 28

CAUTION: BRAKE ASSEMBLY MAY BE DAMAGED IF BRAKE DRUM IS PRESSED ON TOO FAR.

9. Press drum on shaft until chamfer on inside of drum has cleared brake shoes. This should give shoes full contact on drum, Fig. 29.
10. Release hydraulic pressure and back nut off. Rotate drum to be sure that it does not drag.
11. Remove ram and studs.
12. At this time, if brake needs to be adjusted, go to Part A, page 33, and proceed as follows.

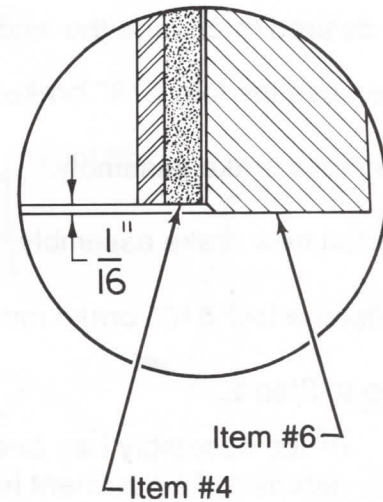


Fig. 29

TORQUE TABLE

ITEM	FT.-LBS.
CLEVIS BOLT (ITEM #7)	30
BRAKE MOUNTING BOLTS (ITEM #11)	185



12" x 3" ITEM LIST

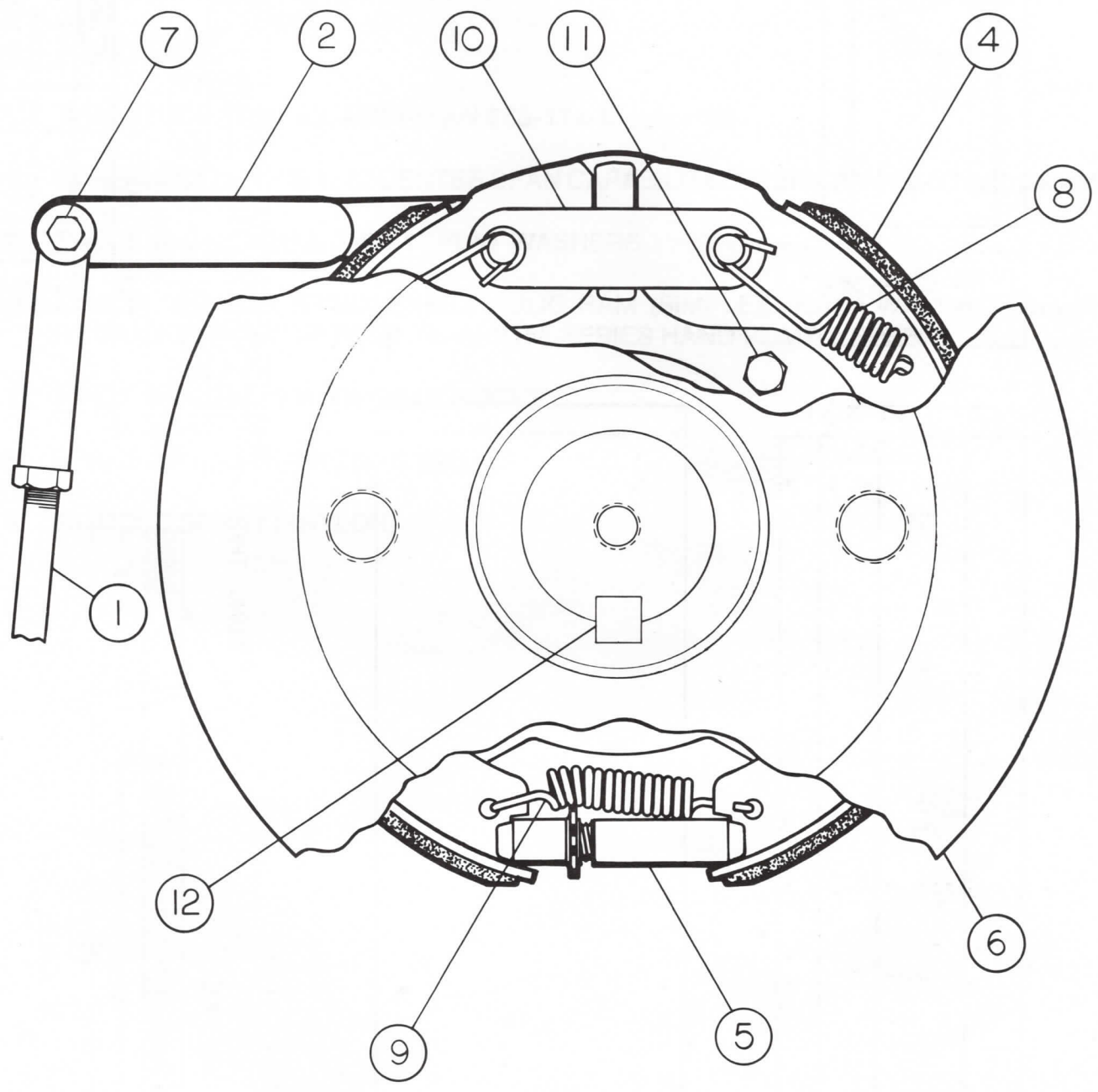
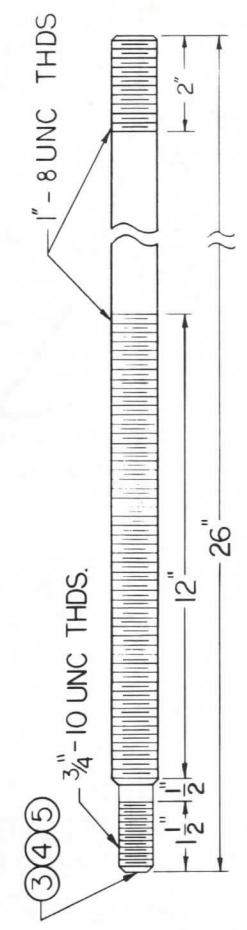
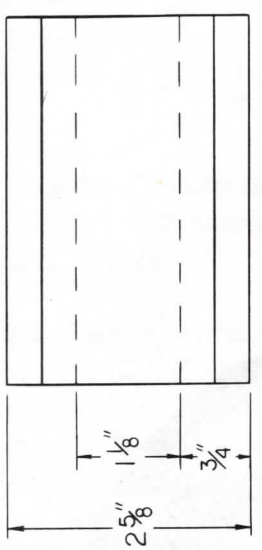
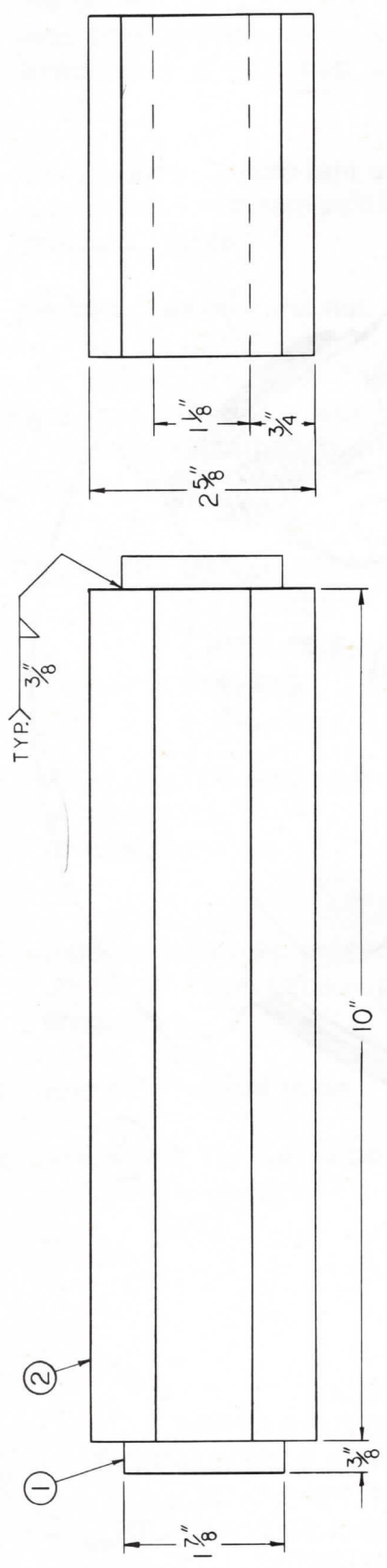


Fig. 30

- | | |
|-----------------------------------------|---------------------------|
| 1. VERTICAL ROD | 7. CLEVIS BOLT |
| 2. BRAKE LEVER | 8. SHOE RETURN SPRING |
| 3. ORSCHELN HAND LEVER
(see page 33) | 9. ADJUSTING SCREW SPRING |
| 4. BRAKE SHOES | 10. ANCHOR PIN BRACE |
| 5. STAR WHEEL PIVOT NUT | 11. BRAKE MOUNTING BOLTS |
| 6. BRAKE DRUM | 12. SQUARE KEY |



NOTE: $\frac{3}{4}$ " -- 10 NC THDS. ON END OF STUD
 1/2 SCALE

5	2	1" x 3/16"	HEAVY FLAT WASHER	8UNC	"C" NO.
4	2	1" HEAVY	HEX NUT		
3	2	1" STUD	SAE GR-5	26" LONG	
2	2	3/4" HR FLAT STL.	GR-A36	4" x 10"	
1	2	3/8" HR FLAT STL.	GR-A36	1 1/2" x 4"	
Mk	Req		DESCRIPTION		

BILL OF MATERIAL

SUPERSEDED BY		DATE	
REVISIONS		DATE	
NO	DESCRIPTION	SCALE	DRN
1		FULL	RD
COMMODITY NO.		11 10 82	
AMERICAN		STIFF-BACK	
		BRAKE DRUM	
		PULLER	
DWG. NO.		REV. SIZE	
Z8-174		C	



12" x 3" TOOL LIST

1. 2' OF 16 GAGE WIRE
2. BRAKE WRENCH
3. TWO STUDS (ITEM #3, AMERICAN #Z8-174-C, page 38)
4. STIFF-BACK WITH 6-1/2" CENTER SPAN CAPABILITY (AMERICAN #Z8-174-C, page 38)
5. TWO 1"-8 UNC NUTS, TWO 1" FLAT WASHERS
6. 30 TON HOLLOW SPINDLE HYDRAULIC RAM (SIMPLEX R206P W/1" HOLE), WITH HYDRAULIC PUMP (POWER TEAM P158 SERIES HAND PUMP 2 SPEED)
7. 10' OF 1/4" CHAIN WITH GRAB HOOKS
8. BRAKE SPRING PLIERS (K-D 298)
9. SILICONE SPRAY (KRYLON)

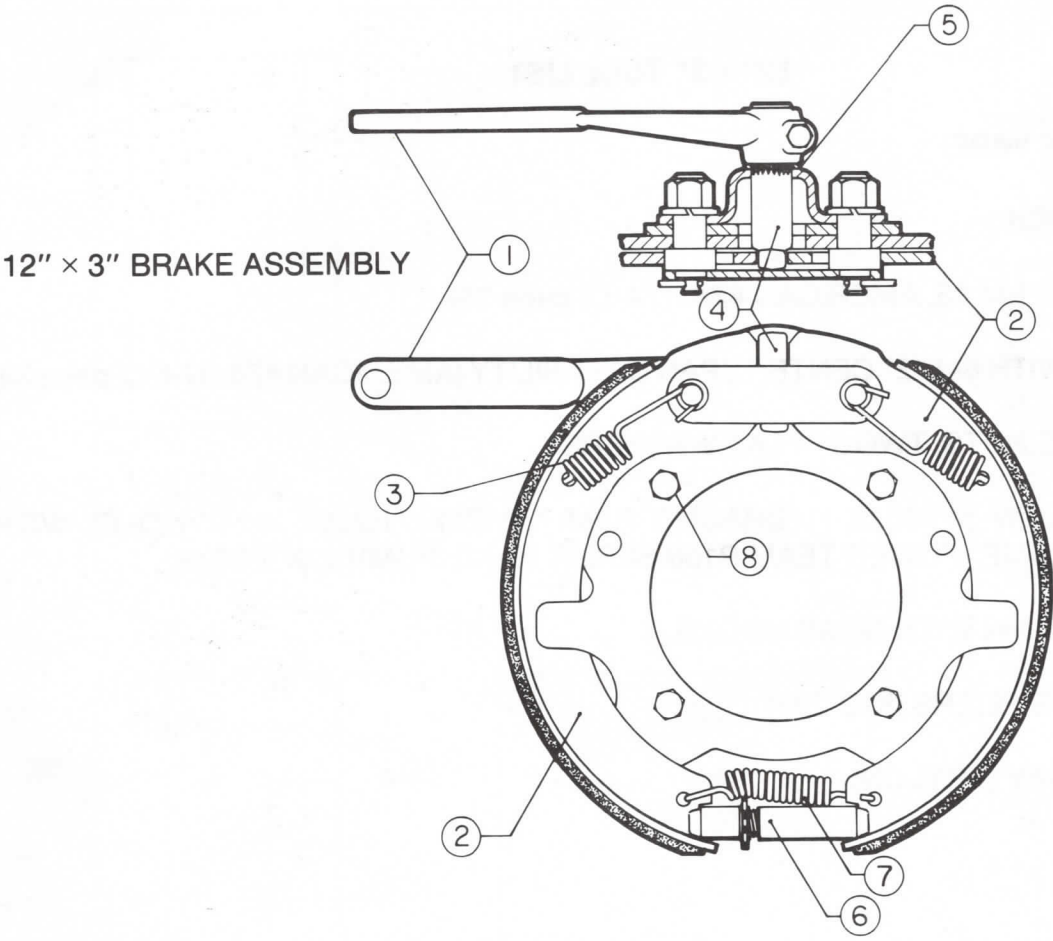


Fig. 31

ITEM	QTY	COMMODITY NUMBER	PART NUMBER	DESCRIPTION
--	--	2050677	3203471	12 x 3 BRAKE ASSEMBLY
1	1		309745	LEVER
2	2		310844	SHOE & LINING ASSEMBLY
3	2		309020	SHOE RETURN SPRING (50# BLACK)
4	1		309714	CAMSHAFT
5	1		310317	SPRING WASHER
6	1		3202973	ADJUSTING SCREW ASSY
7	1		47757	ADJUSTING SCREW SPRING (40# RED)
*8	4	2051075		BOLT-5/8" x 1-3/4" LG-GR 5 (TORQ 185 FT LB)

* THESE ITEMS MUST BE ORDERED SEPARATELY WHEN COMPLETE ASSEMBLY IS DESIRED.



XIII 17-1/4" x 4" BENDIX BRAKE

A. BASIC PREPARATION

Please read through procedure to determine main objectives and to become familiar with principal components before beginning work.

1. Shut down prime mover and slowly engage brake with cranks positioned DOWN. If prime mover is electric, be sure master switch is locked out. Clamp off well at stuffing box.

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE. WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

2. Do not change linkage or hand lever set-up.
3. Release brake and disconnect vertical rod (Item #1) from brake lever (Item #2). Wire (Tool #1) Orscheln hand lever (Item #3) in maximum "off" position, Fig. 32.

B. ADJUSTING BOTTOM OF BRAKE SHOES

Use this procedure first when brake needs adjustment.

1. Rotate brake drum (Item #4) until star adjusting wheel (Item #5) is visible through access hole.
2. Turn star wheel to expand brake shoes (Items #6 & #7) until they bear lightly against brake drum at their bottoms. Brake drum should rotate with moderate drag.
3. Back linings of shoes away from brake drum by turning star wheel the amount of 5 clicks or 1/4 turn for old brake drum; and 10 clicks or 1/2 turn for new brake drum.
4. Check brake linkage maintaining approximately right angle between each rod and its lever on crossover shaft.
5. Re-connect vertical brake rod and brake lever. Do not overtighten clevis bolt (Item #8) Tighten the two nuts against themselves with 30 ft.-lb. torque. Check to be sure that joint is free to work.

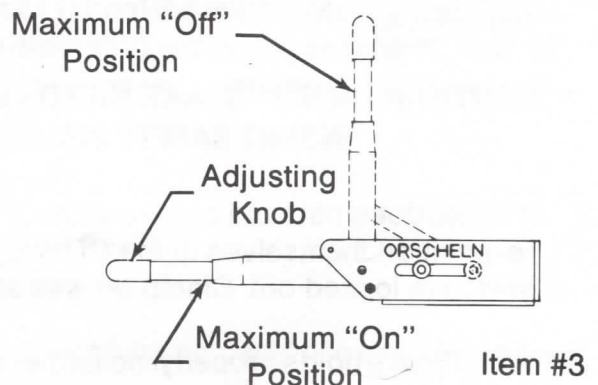


Fig. 32



CAUTION! EXCESSIVE RESISTANCE AT PIN CONNECTIONS WILL NOT ALLOW BRAKE TO RELEASE PROPERLY.

6. Remove wire from Orscheln hand lever.
7. Move Orscheln hand lever to maximum "on" position. Rotate hand lever adjusting knob, Fig. 32, page 41, until handle breaks over just as brake is firmly set.

CAUTION! IF BRAKE LEVER TRAVELS MORE THAN 5/8", THE ACTUATOR LINKS WILL FALL OUT OF THE NOTCHES IN BRAKE SHOES BACKBONE RESULTING IN BRAKE FAILURE.

8. Brake lever should move from 1/8" to 5/8" away from "off" stop pin, (Item #9) Fig. 33, when brake is applied. If brake lever moves more than 5/8", top actuator assembly should be adjusted. Go to Step C before proceeding with this adjustment. If brake travel tolerance is alright, go to next number.
9. Remove clamp from well at stuffing box.
10. Release brake, start prime mover and apply brake firmly, several times. **DO NOT JAM BRAKE.** Always apply brake slowly and firmly.

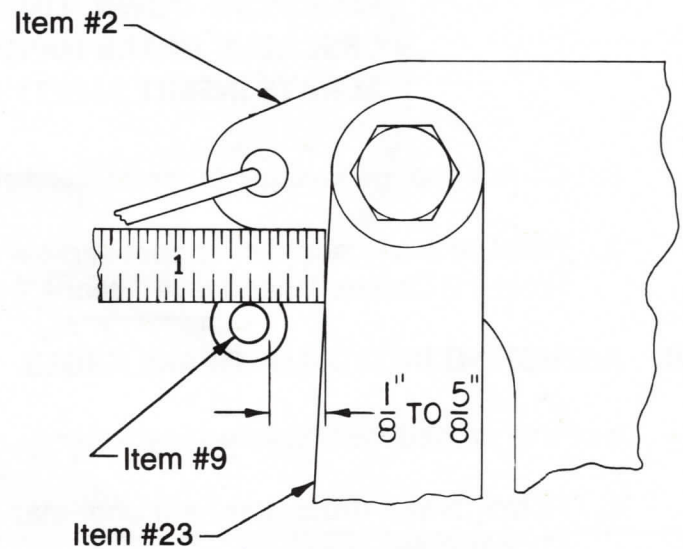


Fig. 33

CAUTION! ABRUPT BRAKING MAY SHEAR GEAR TEETH IN REDUCER CAUSING EXCESSIVE DOWN TIME AND UNNECESSARY EXPENSE.

11. Stop prime mover and apply brake to stop pumping unit with cranks horizontal, pointing toward well.

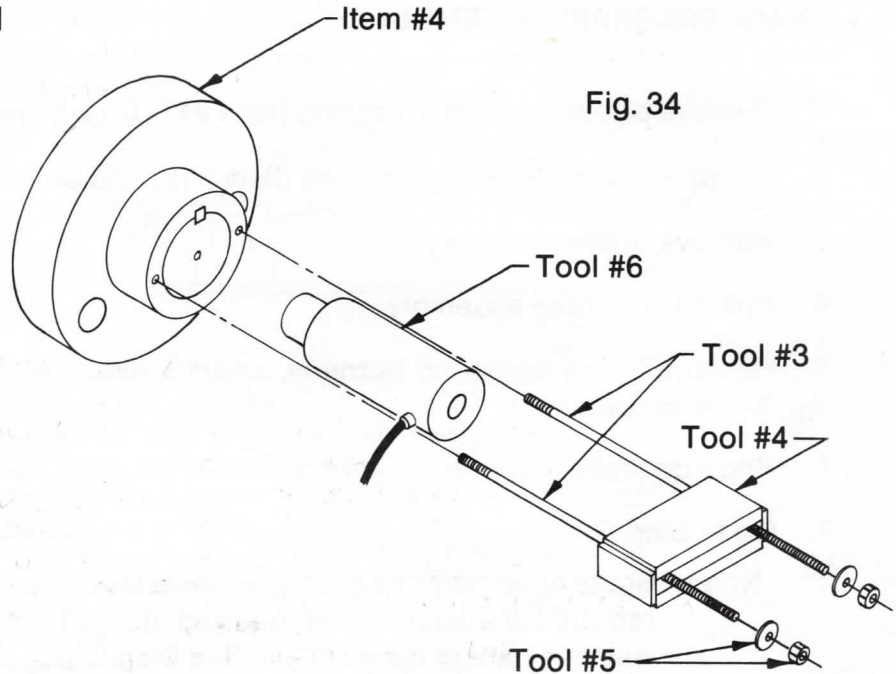
CAUTION! WHEN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

12. If brake does not hold cranks without slippage, release brake slowly and allow cranks to re-position themselves in the DOWN position. If prime mover is electric, be sure master switch is locked out. Clamp off well at stuffing box. Proceed to Step C.
13. When brake holds properly, no further adjustment of linkage or hand lever should be made. All further adjustments, if needed, must be made at brake when wear occurs.



C. REMOVING BRAKE DRUM

1. Rotate drum until tapped holes in hub are horizontal, Fig. 34.



2. Loop 1/4" chain (Tool #2) around brake drum hub with a double wrap and hook chain back in itself. Use hoisting equipment to catch drum when it is removed from high speed shaft (H.S.S.).

3. Screw the two 1" studs (Tool #3) into the tapped holes in brake drum hub to a depth of approximately 1-1/2".
4. Install stiff-back (Tool #4) with nuts and flat washers (Tool #5) positioned to seat on hollow spindle hydraulic ram (Tool #6).
5. Center hydraulic ram on stiff-back and H.S.S.
6. Engage hydraulic pump and pull drum off of shaft.

Note: At this time a visual inspection can be made of the condition of brake shoes. If brake shoes are oily or severely worn, the shoes should be replaced. To remove old shoes, go to Step D. If it is desired to change whole brake assembly, see Step E. If brake shoes are O.K., then proceed to Step F.

D. CHANGING BRAKE SHOES

1. Take off the shoe return springs (Item #10) using brake spring pliers (Tool #7).
2. Remove the two shoe hold down springs (Item #11) from the middle of brake backbone. This is done by grasping shoe hold down cup (Item #12) with standard pliers (Tool #8), holding shoe hold down spring pin (Item #13) in place from rear, compressing spring and turning shoe hold down cup 1/4 turn.
3. Remove shoes from backing plate, (Item #14).
4. Remove adjusting star wheel and adjusting link (Item #15).
5. Remove shoe-to-shoe spring (Item #16).
6. Reverse procedure 1 thru 5 to install new brake shoes being careful to keep linings oil free.
7. Go to Step F.



E. CHANGING BRAKE ASSEMBLY

1. Remove brake lever return spring (Item #17) from brake lever.
2. Remove brake centering harness (Item #18) and brake mounting bolts (Item #19).
3. Remove brake assembly.
4. Install new brake assembly.
5. Replace brake centering harness, and the nine 1/2" brake mounting bolts with 85 ft.-lbs. of torque.
6. Replace brake lever return spring.
7. Go to Step G.

Note: Brake assembly has been pre-set at factory. Little, if any adjustment should be required. If adjustment is required, normally, adjusting bottom of brake shoes will take care of the problem. See Step B, page 41, after installing brake drum.

F. ADJUSTING TOP ACTUATOR

1. Rotate adjusting star wheel until adjusting link has minimum length.
2. Try installing set-up drum (Tool #9). Bushing (Tool #10) is required on D456 reducer. If it can be installed, go to number 10. If it cannot be installed, go to next number.
3. Remove connecting links (Item #20) from the tops of brake shoes. This is done by inserting a screw driver (Tool #11) under brake shoe and prying tops of shoes radially outward, one at a time. When sufficient clearance is achieved, remove connecting link from slot.
4. Mark the top of actuator cam (Item #21), and do not invert during adjustment.
5. Lay straight edge (Tool #12) on right side of actuator cam and mark position on upper support casting (Item #22).
6. Remove actuator cam and connecting link assembly from splined cam shaft (Item #23) by removing 1/4" machine screw (Item #24) and lockwasher (Item #25) and tap end of actuator cam lightly to break loose any corrosion. Now slide actuator cam from shaft. Do not pull on cam connecting links. Avoid breaking roll pins (Item #26). If roll pins are broken, they must be replaced to insure proper brake operation.
7. Rotate actuator cam only one spline at a time. Direction of rotation can be determined by the distance between the set-up drum and brake shoe linings. Turn actuator cam counterclockwise if the set-up drum is too loose, and clockwise if the set-up drum is too tight. Use mark on upper support casting to insure actuator cam was only moved one spline.
8. Push actuator assembly back on splined cam shaft in new position and re-install

machine screw, lockwasher and actuator connecting links in top of shoes.

9. Install set-up drum. Bushing is required on D456 reducer.
10. Top edge of brake linings should bear lightly on set-up drum. The brake shoes' metal backbone should also fit up to the upper support casting's angle face (on both sides), points "A", Fig. 35. If all four points of contact are not achieved, remove set-up drum and do steps 3 thru 10.
11. Turn star wheel to expand brake shoes until they bear lightly against set-up drum at their bottoms. Set-up drum should rotate with moderate drag.
12. Back linings of shoes away from set-up drum by turning star wheel the amount of 5 clicks or 1/4 turn for old brake drum; and 10 clicks or 1/2 turn for new brake drum (set-up drum shown in position, Fig. 36).
13. When brake is applied, brake lever travel tolerance should be from 1/8" to 5/8" away from "off" stop pin, Fig. 33, page 42.

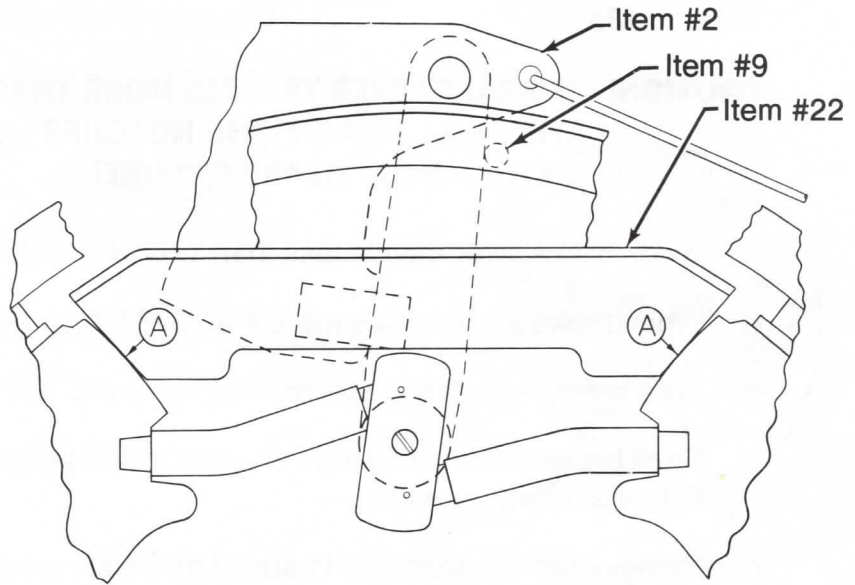


Fig. 35

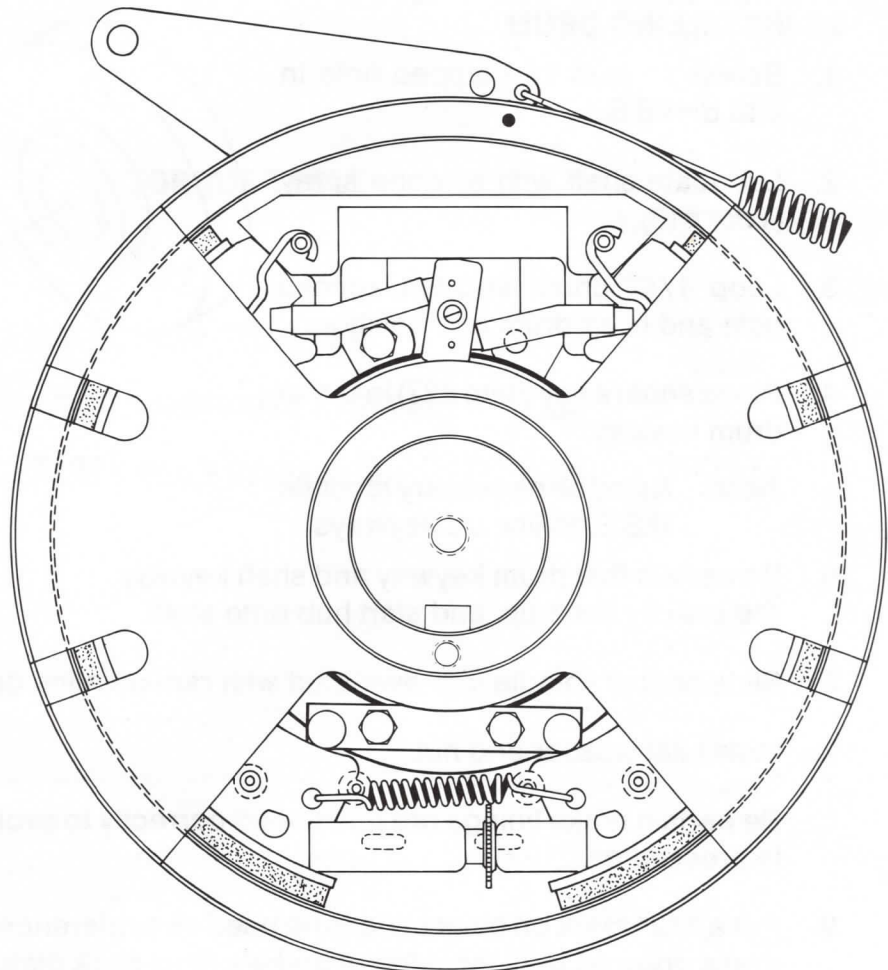


Fig. 36

When this condition is satisfied, proceed to Number 14. If not, follow instructions 13a through 13e.

CAUTION! IF BRAKE LEVER TRAVELS MORE THAN 5/8", THE ACTUATOR LINK WILL FALL OUT OF THE NOTCHES IN BRAKE SHOES' BACKBONE RESULTING IN BRAKE FAILURE!

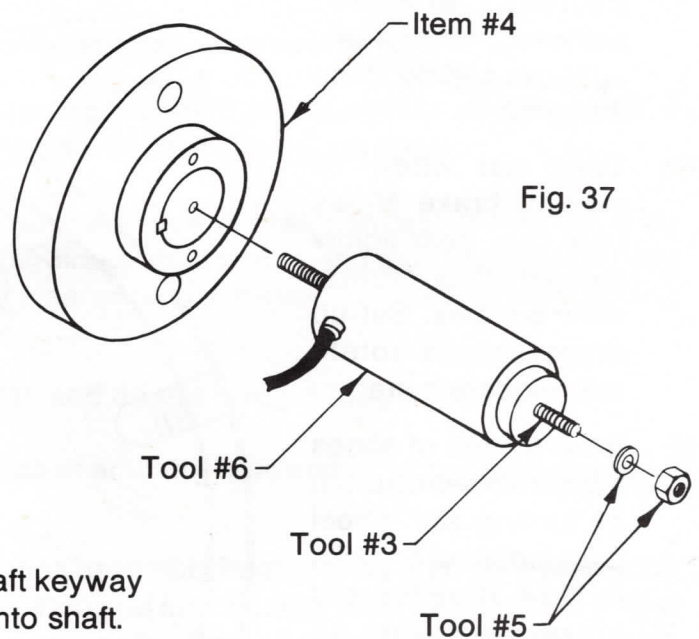
- a. When brake lever travels less than 1/8", the actuator cam is too tight.
 - b. When brake lever travels more than 5/8", the actuator cam is too loose.
 - c. Wire brake lever firmly against "off" stop pin.
 - d. Back brake shoes away from drum by rotating adjusting star wheel until adjusting link has minimum length.
 - e. Remove set-up drum. Go to step 3 and start procedure again.
14. Remove set-up drum using care to avoid bumping shoes out of position for entry into brake drum.

G. RE-INSTALLING DRUM

1. Screw 1" stud into tapped hole in end of H.S.S.
2. Lubricate shaft with silicone spray (Tool #13).
3. Loop 1/4" chain through access hole and hoist drum into position.
4. Place square key (Item #27) in brake drum keyway.

Note: It may be necessary to rotate H.S.S. to line up keyways.

5. Be certain that drum keyway and shaft keyway are exactly lined up, and start hub onto shaft.
6. Slide hollow spindle ram over stud with ram pointing outward, Fig. 37.
7. Install flat washer and nut.
8. Be certain brake linings are positioned correctly to avoid being damaged when drum is pressed on.
9. Put a 1/2" mark on back plate to be used as a reference point. Using hydraulic pump, press drum on until the edge of brake's steel back plate enters groove in brake drum 1/2", Fig. 38.





10. Release hydraulic pressure and back nut off. Rotate drum to be sure that it does not drag on back of plate.
11. Remove ram and stud.
12. Go to step B, number 1, and proceed to adjust bottom of brake shoes.

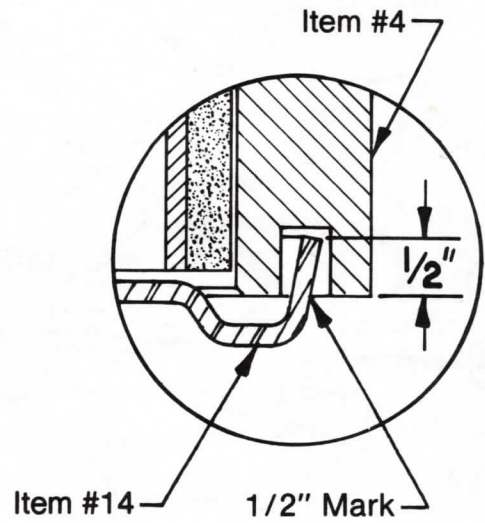


Fig. 38

TORQUE TABLE

ITEM	FT.-LBS.
1/4" MACHINE SCREW (ITEM #24)	5
1/2" CLEVIS BOLT AND NUTS (ITEM #8)	30
1/2" NC GRADE 5 BOLT (ITEM #19)	85

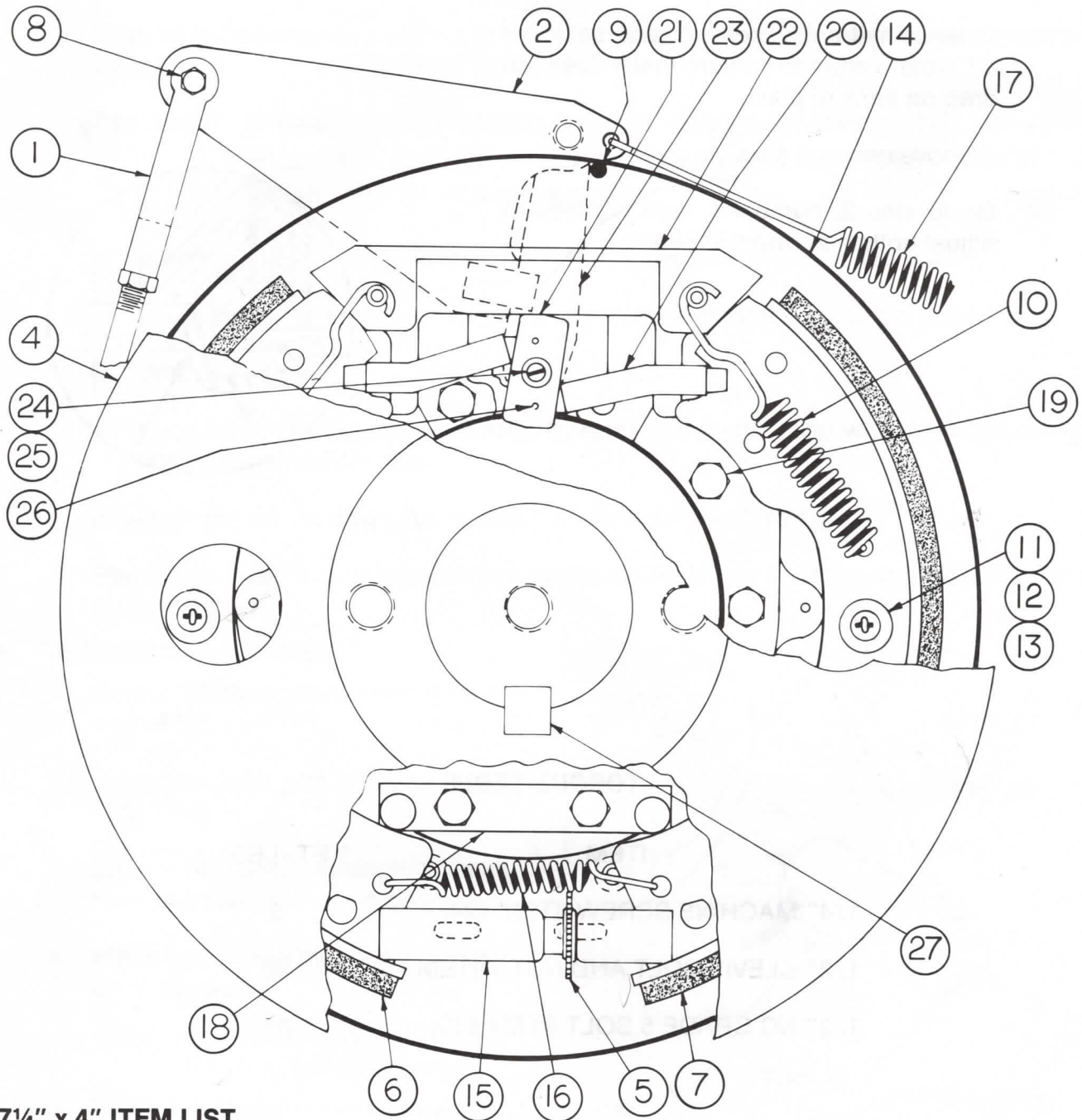
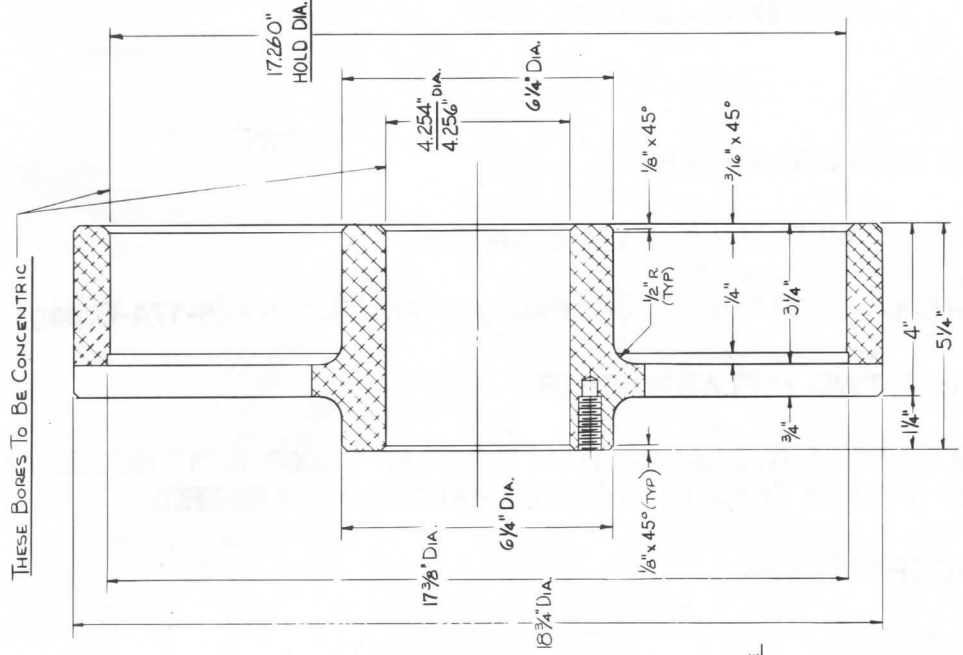


Fig. 39

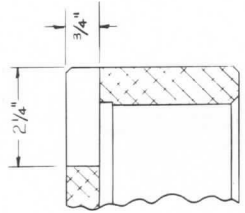
17¼" x 4" ITEM LIST

- | | | |
|--------------------------------|-------------------------------|---------------------------|
| 1. VERTICAL ROD | 11. SHOE HOLD DOWN SPRING | 19. BRAKE MOUNTING BOLTS |
| 2. BRAKE LEVER | 12. SHOE HOLD DOWN CUP | |
| 3. HAND LEVER
(see page 41) | 13. SHOE HOLD DOWN SPRING PIN | 20. CONNECTING LINK |
| 4. BRAKE DRUM | 14. BACKING PLATE | 21. ACTUATOR CAM |
| 5. ADJUSTING STAR WHEEL | 15. ADJUSTING LINK | 22. UPPER SUPPORT CASTING |
| 6. BRAKE SHOE L.H. | 16. SHOE-TO-SHOE SPRING | 23. SPLINED CAM SHAFT |
| 7. BRAKE SHOE R.H. | 17. BRAKE LEVER RETURN SPRING | 24. 1/4" MACHINE SCREW |
| 8. CLEVIS BOLT & NUTS | 18. BRAKE CENTERING HARNESS | 25. LOCK WASHER |
| 9. "OFF" STOP PIN | | 26. ROLL PIN |
| 10. SHOE RETURN SPRING | | 27. SQUARE KEY |

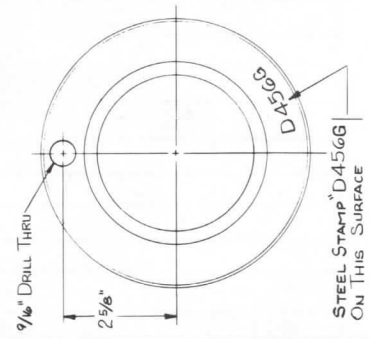
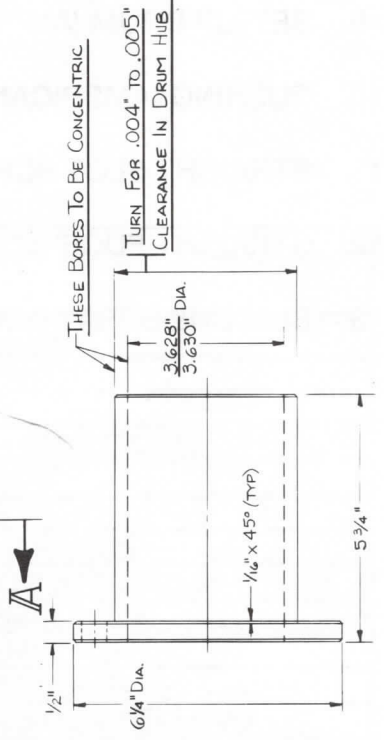
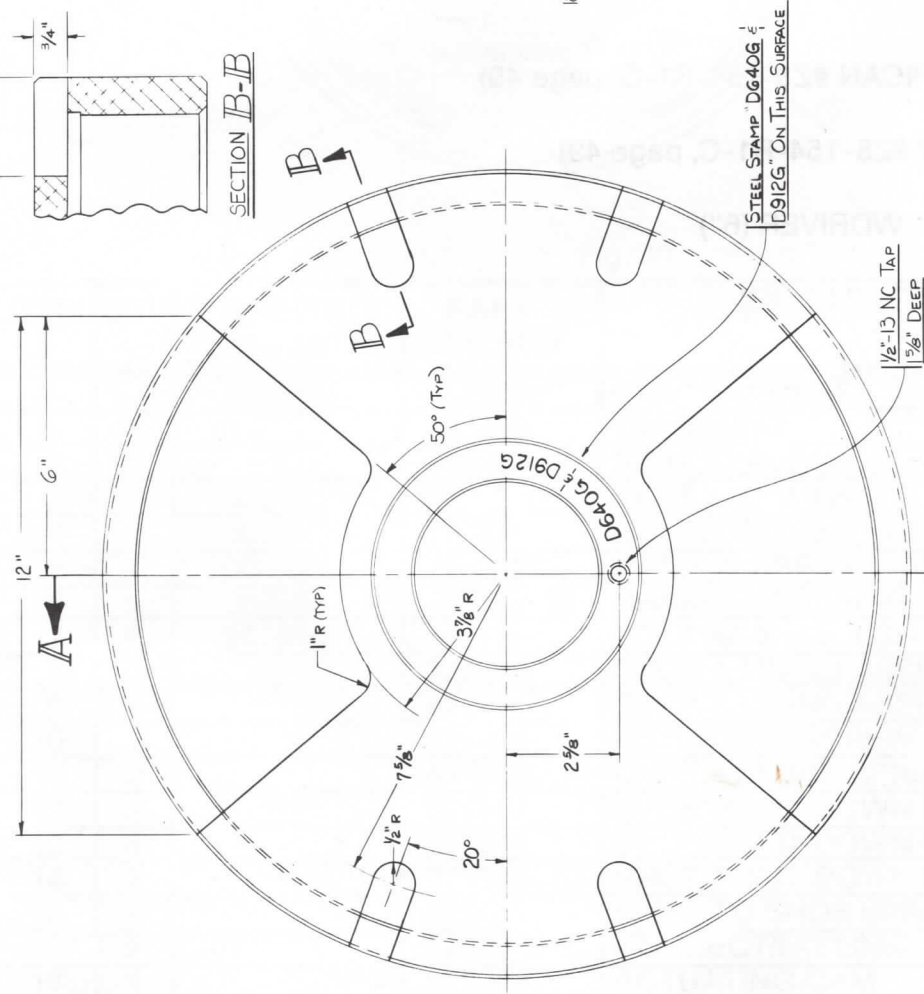


SECTION A-A

DRUM MATERIAL: STRESS RELIEVED ALUM.
 BSHG. MATERIAL: A.I.S.I. C1018 H.R.S.
 F.A.O BOTH P&S.



SECTION B-B



SUPERSEDED BY		DATE		REVISIONS		NO.		DESCRIPTION		DATE	
ZB-154 <td colspan="2">11-2-60 <td colspan="2">1 <td colspan="2">A <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td></td></td>		11-2-60 <td colspan="2">1 <td colspan="2">A <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td></td>		1 <td colspan="2">A <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td>		A <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td>		REVISION <td colspan="2">11-2-60 </td>		11-2-60	
ZB-154 <td colspan="2">11-2-60 <td colspan="2">2 <td colspan="2">B <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td></td></td>		11-2-60 <td colspan="2">2 <td colspan="2">B <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td></td>		2 <td colspan="2">B <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td>		B <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td>		REVISION <td colspan="2">11-2-60 </td>		11-2-60	
ZB-154 <td colspan="2">11-2-60 <td colspan="2">3 <td colspan="2">C <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td></td></td>		11-2-60 <td colspan="2">3 <td colspan="2">C <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td></td>		3 <td colspan="2">C <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td></td>		C <td colspan="2">REVISION <td colspan="2">11-2-60 </td></td>		REVISION <td colspan="2">11-2-60 </td>		11-2-60	

DATE	11-2-60	SCALE	HALF	DRN.	BTM	COMMODITY NO.	
DATE	11-2-60	SCALE	HALF	DRN.	BTM	COMMODITY NO.	
DATE	11-2-60	SCALE	HALF	DRN.	BTM	COMMODITY NO.	

DWG. NO.	ZB-154	REV.	R2	SIZE	C
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17¼" x 4" TOOL LIST

1. 2' OF 16 GAGE WIRE
2. 10' OF 1/4" CHAIN WITH GRAB HOOKS
3. TWO STUDS (ITEM #3, AMERICAN #Z8-174-C, page 38)
4. STIFF-BACK WITH 6-1/2" CENTER SPAN CAPABILITY (AMERICAN #Z8-174-C, page 38)
5. TWO 1"-8 UNC NUTS, TWO 1" FLAT WASHERS
6. 30 TON HOLLOW SPINDLE HYDRAULIC RAM (SIMPLEX R306P W/1" HOLE), WITH HYDRAULIC PUMP (POWER TEAM P158 SERIES HAND PUMP 2 SPEED)
7. BRAKE SPRING PLIERS (K-D 198)
8. STANDARD PLIERS
9. SET-UP DRUM (AMERICAN #Z8-154-R1-C, page 49)
10. BUSHING (AMERICAN #Z8-154-R1-C, page 49)
11. STRAIGHT SLOT SCREWDRIVER (6")
12. STRAIGHT EDGE (5" TO 6" LONG)
13. SILICONE SPRAY (KRYLON)

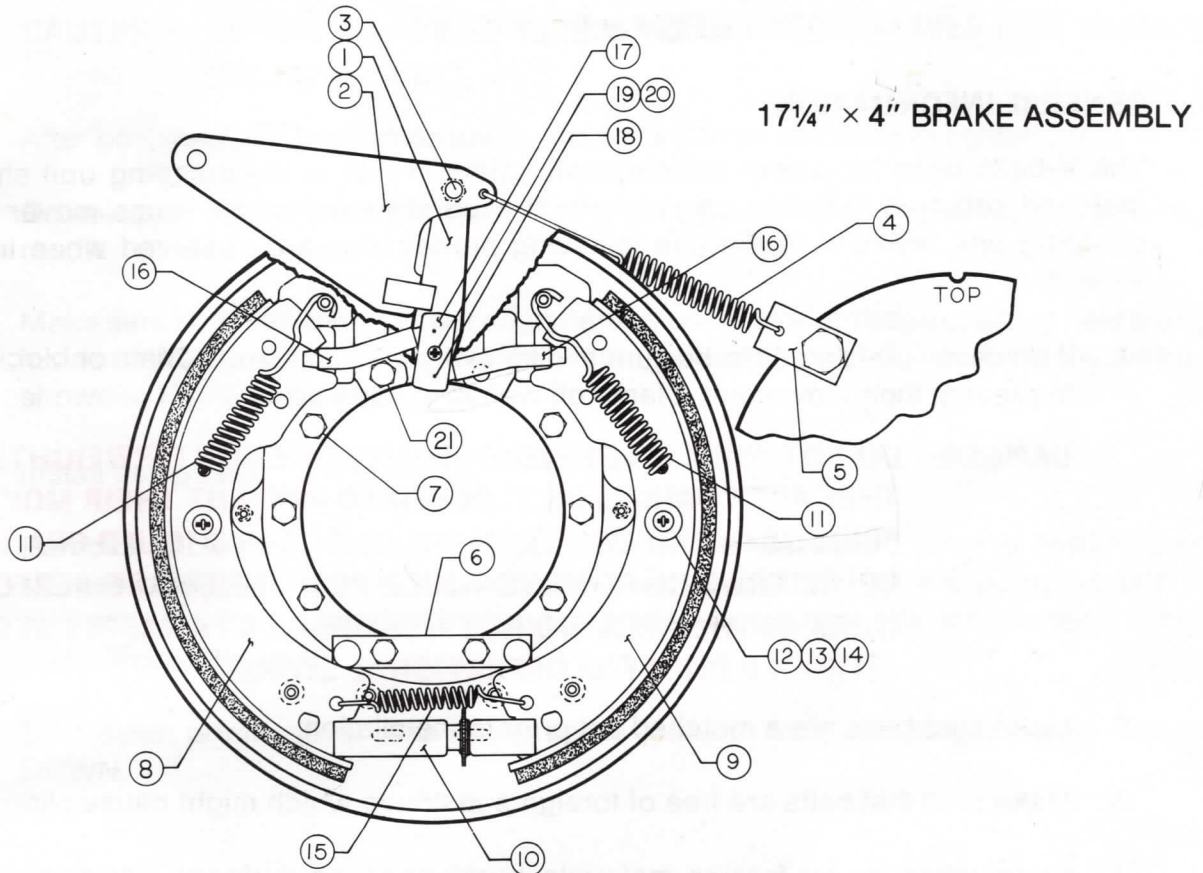


Fig. 40

ITEM	QTY	COMMODITY NUMBER	PART NUMBER	DESCRIPTION
--	--	2057840	4150090	17 1/4" X 4" BRAKE ASSEMBLY
1	1		323699	CAMSHAFT
2	1		D912G-47	BRAKE LEVER
3	1	058163		BOLT - 1/2" X 1 1/2" LG - GR 5 (TORQ. 50 FT LB)
4	1	0062998	TF-311	BRAKE RETURN SPRING
5	1	0063087	TF-312	RETURN SPRING TAB
6	1	062983	D912G-50	BRAKE CENTERING HARNESS
7	8	2058467		BOLT 1/2" X 2 1/4" LG - GR 5 (TORQ. 85 FT LB)
8	1		322790	SHOE & LINING ASSEMBLY L.H.
9	1		322791	SHOE & LINING ASSEMBLY R.H.
10	1		321436	ADJUSTING SCREW ASSEMBLY
11	2		4150092	SHOE RETURN SPRING (60# YELLOW)
12	2		314808	SHOE HOLD-DOWN SPRING (45# BLACK)
13	4		319815	SHOE HOLD-DOWN CUP
14	2		319816	SHOE HOLD-DOWN SPRING PIN
15	1		322999	SHOE TO SHOE SPRING (30# GREEN)
16	2		3200341	CONNECTING LINK
17	1		316305	ACTUATING CAM
18	2		909127	PIN
19	1		901004	LOCK WASHER
20	1		902379	SCREW (TORQ. 5 FT LB)
21	1	2058119		BOLT - 1/2" X 2" LG - GR 5 (TORQ. 85 FT LB)



XIV V-BELT DRIVE

A. GENERAL INFORMATION

The V-belts used for power transfer from prime mover to the pumping unit should be matched sets and installed on properly aligned sheaves on the prime mover and the pumping unit. Make sure that the following precautions are observed when installing V-belts.

1. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

2. Make sure belts are a matched set prior to installation.
3. Make sure that belts are free of foreign substance which might cause slippage.
4. Check sheaves for foreign materials, burrs or rough surfaces which might cause slippage or belt damage.
5. Check sheaves for wear. If worn, replacement may be necessary.

B. V-BELT INSTALLATION

1. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

2. Clean O.D. of "QD" hub and shaft. Clean bore of sheave and "QD" hub. Do this for both reducer and prime mover sheave assembly, if necessary. Mount "QD" hub on shaft. Align keyways and insert key. Mount sheave on "QD" hub. Make sure set screw is tight in "QD" hub.
3. Tighten sheave hub bolts uniformly and alternately to prevent sheave wobble.
4. Reduce center distance of drive to permit V-belt installation without prying or hard forcing.



CAUTION! PRYING OR FORCING OF V-BELTS OVER SHEAVES CAN DAMAGE BELTS SEVERELY.

5. After positioning V-belts in grooves, increase center distance to tighten belts.
6. Do not apply excessive tension. If belts are too tight, belt and/or bearing damage may result.
7. Make sure sheaves are in proper alignment by using straight edge or string held along inside of sheave edges. Straight edge or string should touch edges of both sheaves as shown in Fig. 7, page 8.
8. Install belt guard.
9. Remove chains or blocking from cranks, remove wellhead clamp at stuffing box, release brake and start prime mover to resume pumping. Allow pumping unit to operate for approximately 30 minutes while observing belts for slippage when operating under load.
10. Shut down prime mover and slowly apply brake to stop pumping unit with cranks DOWN.
11. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

12. Remove belt guard.
13. Recheck belts for tension and sheaves for alignment. Adjust tension and alignment as required.
14. Replace loose or mismatched belts and recheck as necessary.
15. Install belt guard.
16. Remove chains or blocking from cranks, remove wellhead clamp at stuffing box, release brake and start prime mover to resume pumping.



XV DIRECTION OF ROTATION

A. GENERAL

American pumping units will operate, due to geometry of units, in either direction. Gear life is extended, if rotation is reversed periodically, by presenting a different tooth profile to the load; thereby distributing the load and gear tooth wear.

B. REVERSING ROTATION

Be sure master switch is locked out. Reversing the rotation direction of pumping units using an electric motor for prime mover simply requires reversing two of the three electrical leads to the motor. This can be done on a yearly basis to extend useful service life of the pumping unit reducer.

XVI REPAIR PARTS

All records for American pumping units are filed by STRUCTURAL SERIAL NUMBER. When ordering parts, IT IS VERY IMPORTANT THAT YOU SPECIFY THE STRUCTURE SERIAL NUMBER OF THE PUMPING UNIT REQUIRING PARTS REPLACEMENT.

A. STRUCTURE SERIAL NUMBER LOCATIONS

Pumping unit STRUCTURE SERIAL NUMBERS are stamped on the following parts:

1. On nameplate on samson post, Fig. 20, page 14.
2. On the reducer sub-base, right side.
3. On walking beam bottom flange near the saddle bearing.
4. On the horsehead pin, right side.

B. REDUCER SERIAL NUMBER LOCATION

The reducer serial number is stamped on the nameplate which is located below and slightly forward of the brake drum, page 2.



XVII MOVING PUMPING UNIT

A. GENERAL INFORMATION

Extreme caution must be taken to prevent personal injury/death or pumping unit damage when dismantling for move. Heavy parts require crane or winch truck for disassembly, loading and erection at the new location. Hoisting equipment should have load and reach capacities as shown in the table on page 13.

B. DISASSEMBLY

Disassembly of the pumping unit for relocation may be accomplished by the following procedures:

WARNING! ALL COMPONENTS OF THE PUMPING UNIT ARE CONSTRUCTED OF VERY HEAVY MATERIALS. DO NOT ATTEMPT TO MANHANDLE ANY PART OF THE UNIT. MAKE USE OF EQUIPMENT DESIGNED FOR HANDLING HEAVY LOADS.

1. Stop prime mover and slowly apply brake to stop pumping unit with cranks horizontal, pointing toward well.

CAUTION! WHEN ORSCHELN BRAKE HAND LEVER IS IN MAXIMUM "ON" POSITION, ALWAYS INSERT SAFETY PIN IN HOLES ABOVE HAND LEVER.

2. If prime mover is electric, be sure master switch is locked out. Chain or block cranks to prevent their movement. Clamp off well at stuffing box.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

3. Remove polished rod clamp and hanger from polished rod.
4. Attach hoist near top of horsehead, remove latch bolt, loosen horsehead side adjusting screws to clear walking beam and remove bolt holding horsehead in walking beam pivot fitting; then carefully hoist horsehead clear of walking beam and deposit on truck or ground.

WARNING! STAY CLEAR OF POLISHED ROD HANGER AND SWINGING WIRELINE WHILE REMOVING HORSEHEAD FROM PUMPING UNIT.



5. Attach hoist to end of one crank. Release brake and lift crank up enough to remove chains or blocking from cranks. Lower cranks to the DOWN position. Set brake in MAXIMUM "ON" POSITION.
6. Disconnect and cap off ground lubrication lines for equalizer and saddle bearings on walking beam and samson post.

CAUTION! CAP ALL OPEN LINES TO PREVENT ENTRY OF DIRT, SAND OR OTHER FOREIGN MATERIAL WHICH COULD CAUSE BEARING DAMAGE.

7. Attach hoist to pitman end of walking beam. Remove equalizer pitman banjos from wrist pin bearing housings.

WARNING! EQUALIZER PITMAN BANJOS MAY COME OFF OF WRIST PIN BEARING HOUSINGS VERY ABRUPTLY IN EITHER AN UP, DOWN OR OUTWARD DIRECTION WHEN THEY ARE PRIED LOOSE. STAY CLEAR OF BANJOS TO AVOID SERIOUS INJURY.

8. Chain well end of walking beam to unit frame and lower hoist slowly. Find balance point on walking beam and securely attach hoist to walking beam.
9. Remove bolts attaching walking beam to saddle bearing trunnion then remove chain from well end of walking beam to unit frame.
10. Hoist walking beam and equalizer assembly clear of saddle bearing trunnion and deposit on truck or ground.
11. Remove equalizer pitman assembly from equalizer bearing.
12. Connect hoist to samson post top between front and rear legs; then remove bolts attaching samson post legs to frame.
13. Remove top inside bolt from ladder, leaving outside bolt to pivot ladder on while lowering samson post. Also, remove bolts from middle and bottom supports of ladder.



14. Hoist samson post clear of frame.
15. Pivot bottom of ladder out of the way while laying samson post on the ground, with rear leg up.
16. Remove ladder and lay samson post on ground.
17. Attach hoist to rear samson post leg, remove bolts and lay rear leg on truck or ground.
18. Remove belt guard from pumping unit; then adjust prime mover slide rails to loosen V-belts.
19. Remove prime mover hold down bolts and, if electric, disconnect wiring after making sure that master switch is locked out.

WARNING! MAKE SURE ELECTRICAL POWER IS LOCKED OUT PRIOR TO DISCONNECTING WIRING.

20. Attach hoist to prime mover and lift prime mover from frame extension and load on truck.
21. Remove counterbalance weights from cranks. Then raise cranks to a level position pointing away from well. Chain or block cranks to prevent their movement.

DANGER! DO NOT WORK ON OR NEAR CRANKS OR COUNTERWEIGHTS UNTIL THEY ARE CHAINED OR BLOCKED TO PREVENT THEIR MOVEMENT. SERIOUS INJURY OR DEATH COULD OCCUR SHOULD CRANKS AND COUNTERWEIGHTS MOVE WHILE PERSONNEL ARE PERFORMING WORK IN THE AREA. DO NOT USE BRAKE AS A SAFETY STOP. IT IS INTENDED ONLY FOR OPERATIONAL STOPS.

22. Attach chains to each low speed shaft extension of reducer. Attach one chain to reducer belt guard bracket. Attach chains around each crank in a manner to prevent slipping. All 5 chains attach to one master link for hoisting hook. Remove reducer hold down bolts. Disconnect vertical rod of brake linkage from brake lever.
23. Lift reducer assembly from frame and load on truck.
24. Remove hold down clamp bolts and hoist frame from foundation to truck. Secure frame to truck with chain or cable booms.
25. Secure all other parts on trucks with chain or cable booms to prevent load shifts while transporting to new well site.



CHECK LIST PRIOR TO UNIT OPERATION

BEFORE STARTING UNIT

- Oil in reducer?
- Grease in wrist pin bearings on both sides?
- Grease in saddle and equalizer bearings on walking beam?
- Brake linkage correctly installed and adjusted?
- Brake handlever correctly installed and adjusted?
- Brake adjusted for firm drum contact?
- Foundation bolts and hold downs tightened?
- Reducer bolts tightened?
- Prime mover bolts and hold downs tightened?
- Prime mover serviced as necessary for operation?
- Guards installed for sheaves, cranks, etc.?
- QD sheave hubs and V-belts tightened?
- Pumping unit correctly aligned with wellhead?
- Blocks, chains and cribbing removed from all areas?
- Tools removed from area of prime mover and pumping unit?
- Polished rod hanger clamp tightened?
- Stuffing box gland tightened?
- Oil on top of stuffing box packing?
- Flow line valve open?

Please fill out this information and keep on file.

Unit Identification Numbers:

Structure Serial Number _____

Reducer Serial Number _____

Lease Name _____

Well Number _____

Date Installed _____

AFTER STARTING UNIT

- Unit alignment OK?
- Wireline centered on horsehead tracks?
- Counterbalance adjustment OK?
- V-belts not loose, slapping or misaligned?
- No abnormal squeaks or noises from walking beam bearings?
- No abnormal squeaks or noises from wrist pin bearings?
- No evidence of oil leakage from gear reducer?
- No excessive vibration of reducer?
- No excessive vibration of prime mover?
- No excessive vibration of samson post?
- Polished rod correctly centered in stuffing box?
- Polished rod not heating?
- Make sure well pumps up.