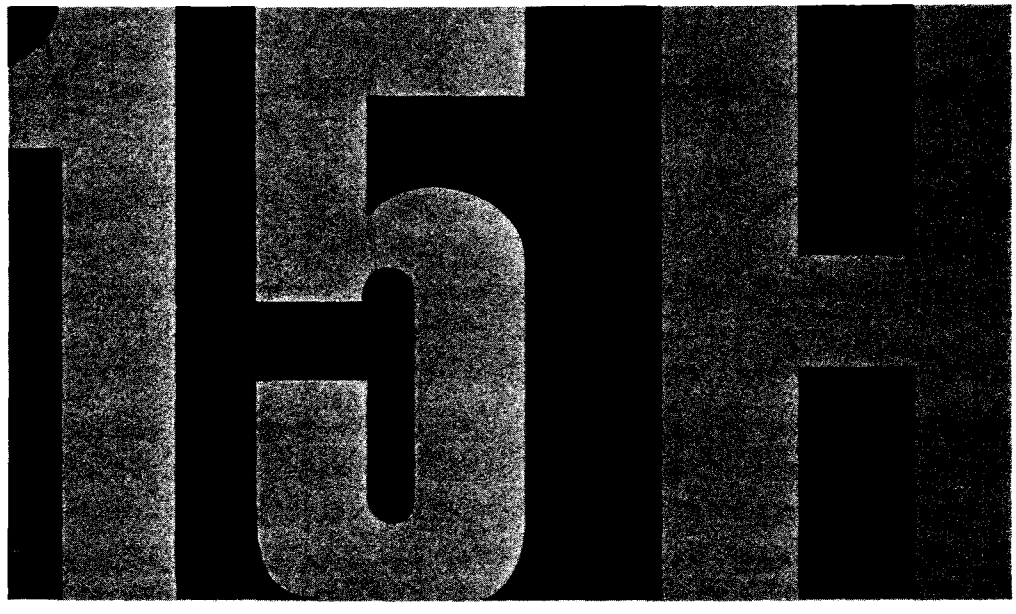
# SERVICE MANUAL

MODEL 15H SINGLE AND TANDEM
OIL HYDRAULIC PUMPS—MOTORS




COMMERCIAL SHEARING, INC.

# foreword . . .

This descriptive guidebook will familiarize you with COMMERCIAL Model 15H single and tandem pumps and motors — their component parts — relative position of each part — proper methods for assembly or disassembly of units — care and use of these oil hydraulic units so that better performance and greater life expectancy will result for your benefit.

A photographic presentation with explanatory notes covers the steps that should be closely followed when servicing the elements that comprise these units. Before any work is done in the repair of these units, it is suggested that all of the steps used in tearing down the assembled unit and all of the steps used in building up the unit be read. Such a digest will familiarize you with the general procedure of the work to be done and give you the feel of the specific operations involved.

# general instructions . . .

Here you have a gear type fixed displacement oil hydraulic pump or motor which has been built to very high standards and a new design. The result is the Model 15H pump and motor having operating characteristics far superior to other pumps and motors of its type. Close fits and small running tolerances were originally built in to insure peak performance and highest operating efficiency.

Slippage is a factor which has considerable bearing on the performance. As the amount of slippage is reduced, the higher the operating efficiency. Best results develop when a close fit is made between the gears and all surfaces they come in contact with. Allowance of a minimum running clearance is, of course, necessary.

Inspection of all COMMERCIAL pumps and motors will disclose gears in matched pairs—all are original equipment, made by COMMERCIAL on specially built machines which produce surfaces within limits much closer than is standard practice.

Seldom should you find it necessary to service the Model 15H oil hydraulic pump or motor during its life expectancy, but should a noticeable drop in performance occur it is advisable to make an inspection and replace such part or components which, due to some unusual condition, may have become worn. Should you find it advisable to replace the gears, insist that they be in matched pairs and the product of the original manufacturer. Matched gears are the very vitals of the gear type pump or motor. Expendable parts such as "O" ring shaft seals, pocket seals, single and double-lip oil seals and back-up rings should never be re-used even though inspection may show these items as being serviceable for future use. Such parts for replacement are available at a cost which is insignificant in view of your investment and when you consider the vital function of these items is to prevent leakage. All replacement parts should be given your final inspection to insure that no damage has resulted after final factory inspection was made.

# lubrication . . .

All parts of the units with the exception of the outboard bearing are lubricated by the hydraulic oil in the circuit. Particular attention must be paid to keep the oil in the circuit system clean. Whenever there is a pump or motor failure and there is reason to feel that metal particles may be in the system, the oil must be drained, the entire system flushed clean, and any filter screens thoroughly cleaned. New oil should be supplied for the entire system. Oil suitable and recommended for use in circuits involving Model 15H pumps and motors should meet the following specifications:

Hydraulic oils should have a viscosity index of 90 or higher and a viscosity SUS 150 to 200 at 100°F. Aniline point should be 165 or higher. Oil operating temperatures should not exceed 200°F.

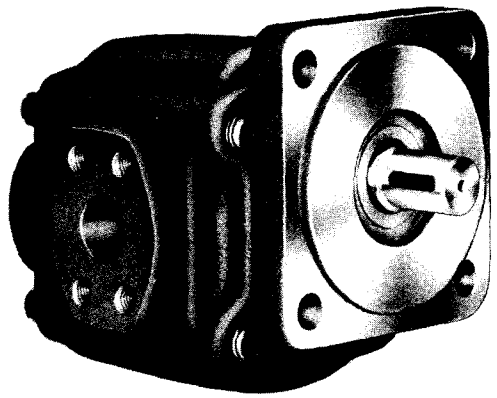
Oil should have anti-foam and anti-oxidation additives.

Do not use low viscosity naphtha base oils, aircraft hydraulic fluid, or hydraulic brake fluid.

Oil with a low pour point should be used when operation is to be in cold, low temperature climates.

At regular intervals the outboard bearing should be lubricated. You are cautioned that not all lubricants are satisfactory for proper lubrication of the outboard bearing. Results from tests and field operation indicate that a lubricant such as Texaco Starfak #2 is satisfactory.

## single COMMERCIAL Model "15H" Oil Hydraulic Heavy Duty Pump - Motor

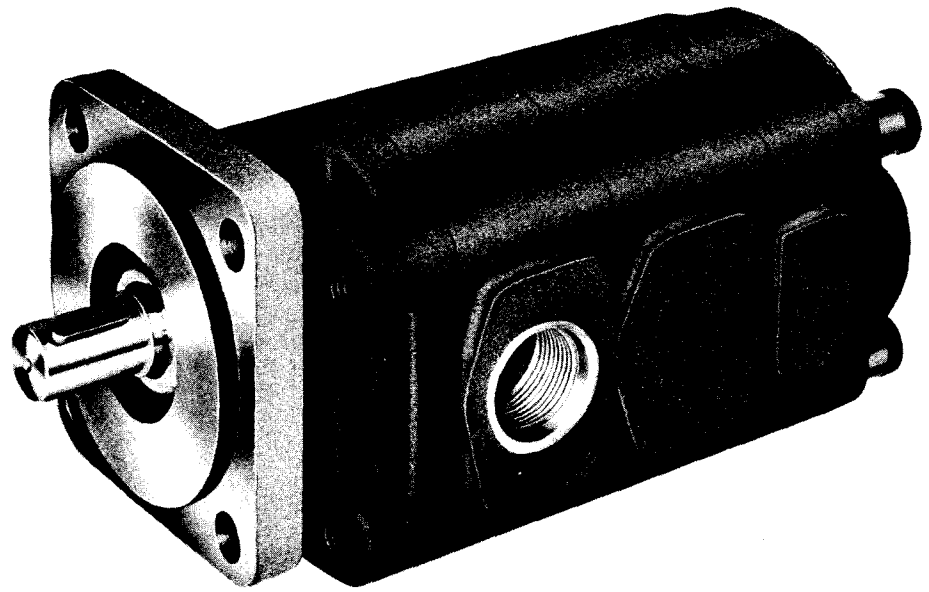


Exploded view, showing all parts and their nomenclature which are used in the Model 15H single pump or motor, is shown on page 4.

Complete instructions are given on page 5 covering the disassembly by subassemblies of the single pump or motor.

Instructions to assemble all parts into subassemblies and to complete the assembly of the Model 15H single pump or motor, are outlined in detail on pages 6, 7, 8 and 9.

## tandem COMMERCIAL Model "15H" Oil Hydraulic Heavy Duty Pump - Motor



Exploded view, showing all parts and their nomenclature which are used in the Model 15H tandem pump or motor, is shown on page 10.

Complete instructions are given on page 11 covering the disassembly by subassemblies of the tandem pump or motor.

Instructions to assemble all parts into subassemblies and to complete the assembly of the Model 15H tandem pump or motor are outlined in detail on pages 12, 13, 14 and 15.

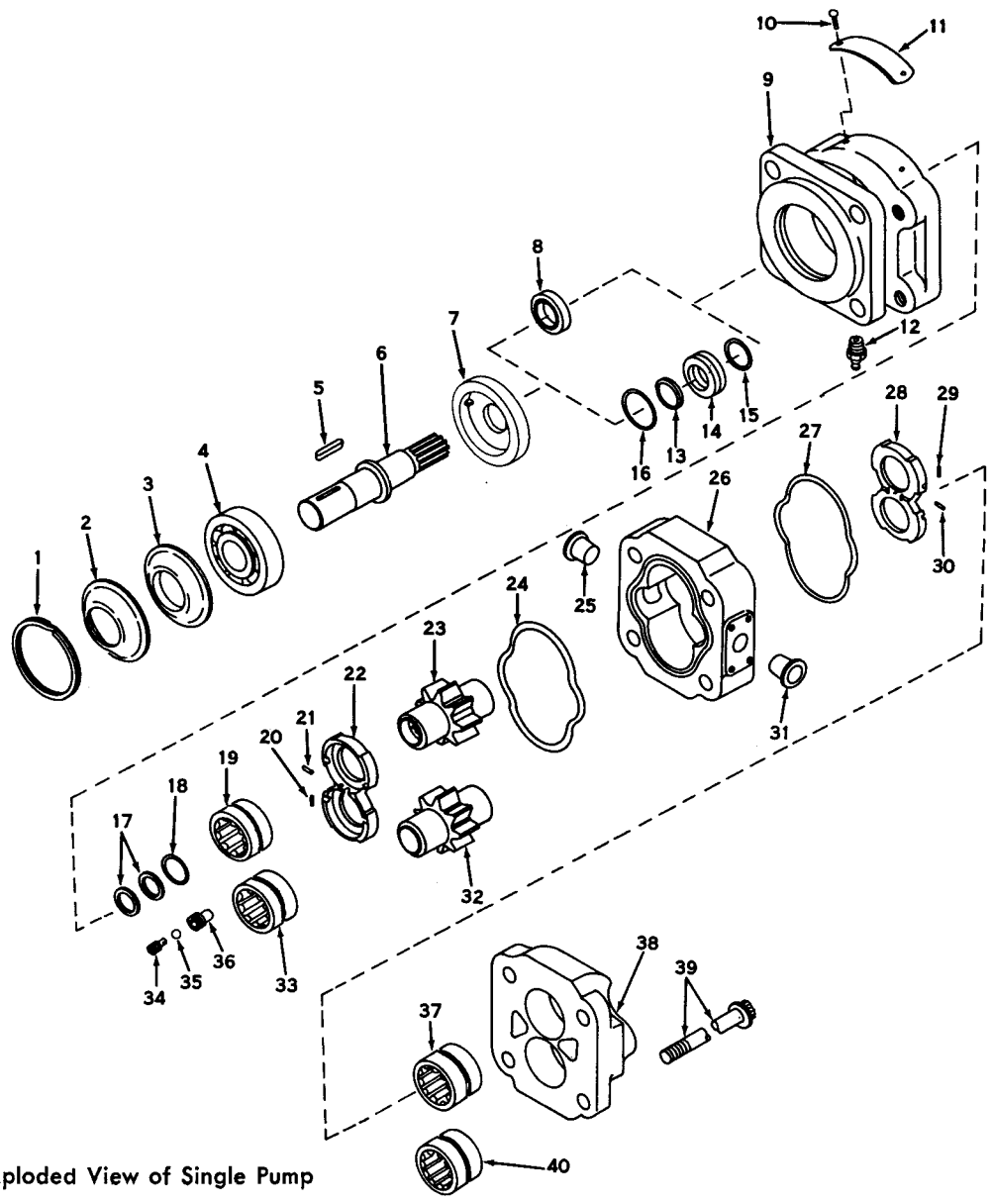



Fig. 1—Exploded View of Single Pump

| No. | Description |
|---|---|
| 1 | Spirolox Snap Ring |
| 2 | Bearing Shield |
| 3 | Bearing Seal |
| 4 | Shaft Ball Bearing |
| 5 | Key |
| 6 | Drive Shaft |
| 7 | Bearing Spacer |
| 8 | Oil Seal |
| 9 | Shaft End Cover |
| 10 | Drive Screws |
| 11 | Name Plate |
| 12 | Grease Fitting |
| 13 | Back-Up Ring |
| 14 | Bronze Insert |
| 15 | "O" Ring Shaft Seal |
| 16 | "O" Ring Gasket |
| 17 | Back-Up Rings |
| 18 | Shaft "O" Ring |
| 19 | Roller Bearing |
| 20 | Pocket Seals |
| 21 | Pocket Seals |
| 22 | Thrust Plate |
| 23 | Drive Gear |
| 24 | "O" Ring Gasket |
| 25 | Plastic Pipe Closure |
| 26 | Housing |
| 27 | "O" Ring Gasket |
| 28 | Thrust Plate |
| 29 | Pocket Seals |
| 30 | Pocket Seals |
| 31 | Plastic Pipe Closure |
| 32 | Driven Gear |
| 33 | Roller Bearing |
| 34 | Check Ball Retainer |
| 35 | Check Ball |
| 36 | Check Valve Seat |
| 37 | Roller Bearing |
| 38 | Port End Cover |
| 39 | Cap Screws |
| 40 | Roller Bearing |

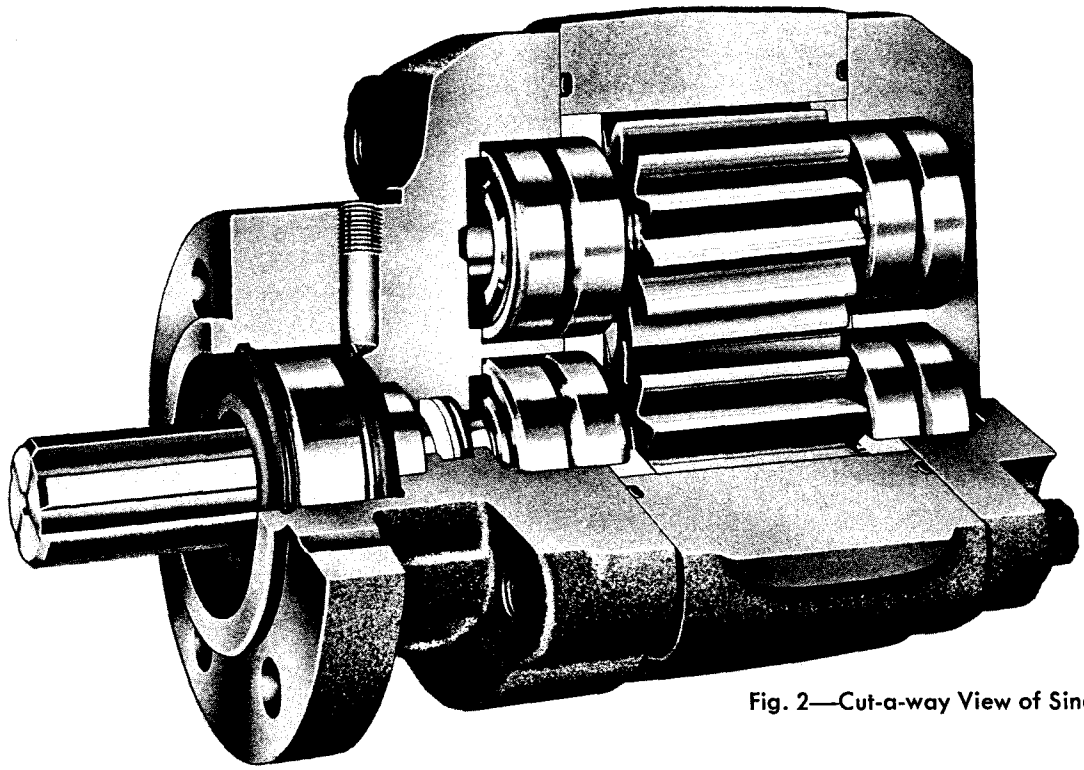


Fig. 2—Cut-a-way View of Single Pump

# single pump disassembly

### GENERAL NOTES

Remember dirt is the enemy of any hydraulic system. The best way to fight this enemy is to prevent its entry into the system. Make sure you disassemble and reassemble this pump in spotlessly clean surroundings. Apply a coating of grease (cup grease consistency) to surfaces of all "O" rings and oil seals to facilitate positive location as they are installed in a reassembly.

### DISASSEMBLY BY SUBASSEMBLY

1. Index mark the port end cover (38), gear housing (26) and shaft end cover (9) to facilitate reassembly.
2. Remove the four cap screws (39) from the port end cover (38).
3. Lift off port end cover (38); the thrust plate (28) with pocket seals and the roller bearings (37, 40) will also be removed in this operation.
4. Remove the driven gear (32).
5. Remove the gear housing (26) and drive gear (23) from the shaft end cover (9). Be sure to keep gears together as they are a matched set.

### SHAFT END COVER

1. Turn the shaft end cover (9) over so that the drive end of the shaft is facing up. With a screwdriver remove the snap ring (1) then remove the bearing shield (2) and bearing seal (3).
2. Pull the drive shaft (6) from the shaft end cover. The shaft ball bearing (4) will also be removed. Then lift out the bearing spacer (7).
3. Remove and discard the oil seal (8) from the shaft end cover.
4. Turn the cover over so that the thrust plate is up. Pry off thrust plate (22) carefully with a knife blade or thin screwdriver. Remove and discard the pocket seals (20), (21).
5. Pull the bearings (19, 33) with a bearing puller from the shaft end cover (9)—ONLY—if they are being replaced.
6. Remove the check valve assemblies (34, 35, 36).
7. Remove the shaft "O" ring (18) and the back-up rings (17) from shaft end cover (9).
8. Remove key (5) and press bearing (4) from shaft (6).

### HOUSING

1. Remove and discard "O" rings (24, 27) from grooves in housing (26).

### PORT END COVER

1. Pry off the thrust plate (28) with a knife blade or thin screwdriver. Remove and discard the pocket seals (29), (30).
2. Pull the bearings (37, 40) with a bearing puller from the port end cover (38)—ONLY—if they are being replaced.

# single pump assembly

## SHAFT END COVER SUBASSEMBLY

1. Install back-up rings (17) and shaft "O" ring (18) in gear side of shaft end cover (9).

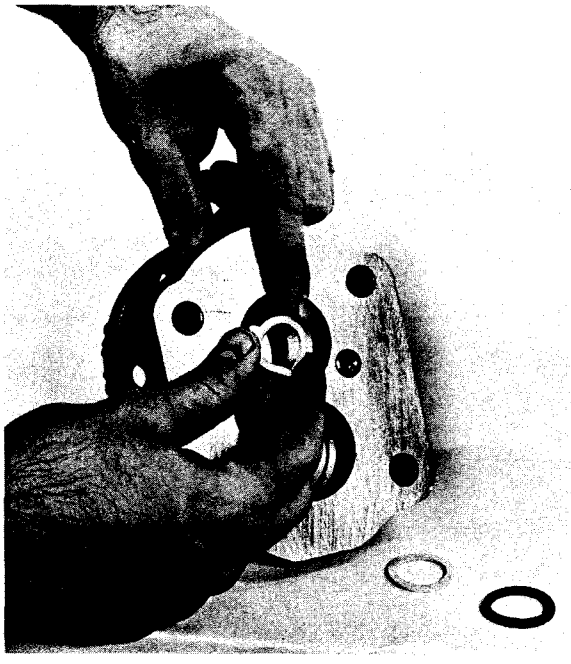


Fig. 3 Installing back-up ring

2. Install two new roller bearings (19, 33) in the bores of the cover—IF—the used ones were removed.

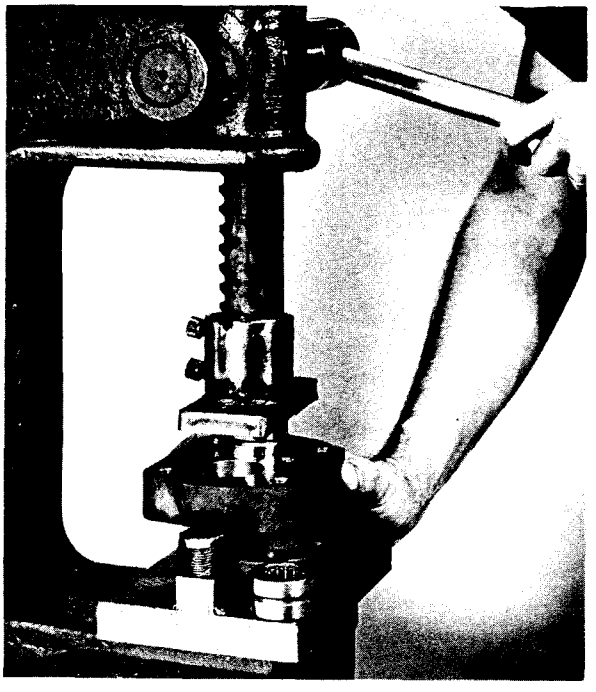


Fig. 4 Installing roller bearings

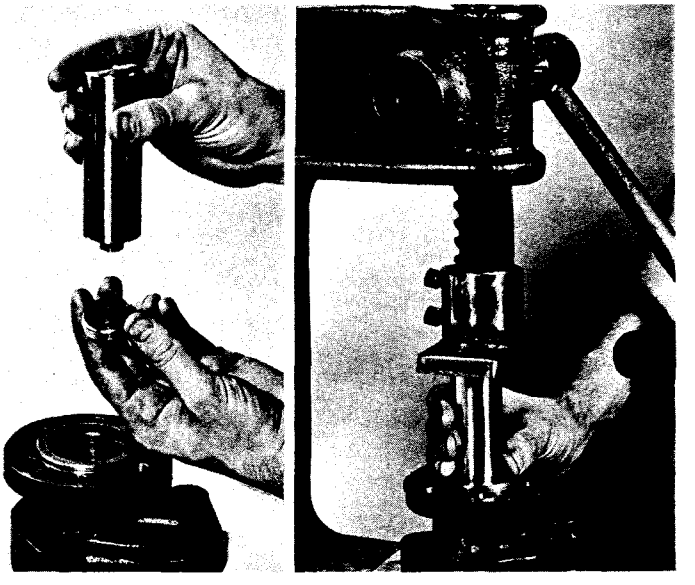
3. Place the shaft end cover (9) gear side up in a vise having soft jaws and reassemble the two check valves for double rotation by inserting the ball (35) into the check valve seat (36) and screwing the check ball retainer (34) flush into the check valve seat being sure the check ball is free to move. Screw the two check valve assemblies into their respective holes, approximately two threads below face of shaft end cover (9). Single rotation units do not require check assemblies. Instead, a plug is installed on the high-pressure side

Fig. 5 Peening over check valve seat

of pump with the low-pressure side left open. Peen over the check valve seat and ball retainer to prevent the valves from backing out.

4. Remove shaft end cover (9) from vise, turn over, place in arbor press and press in oil seal (8) with the open side down facing toward the bearing bore.

Fig. 6 Pressing in oil seal



5. Then install the bearing spacer (7) open side up. NOTE: For motors—use special bronze insert (14) with back-up ring (13) and shaft seal (15) in I.D. groove of insert and "O" ring gasket (16) in O.D. groove of insert.
6. Repack the shaft ball bearing (4) with a #2 consistency lithium base, high temperature, ball bearing grease. Press the bearing onto the drive shaft (6) being sure it is seated against the shaft shoulder.
7. Insert the assembled shaft into the shaft end cover (9).

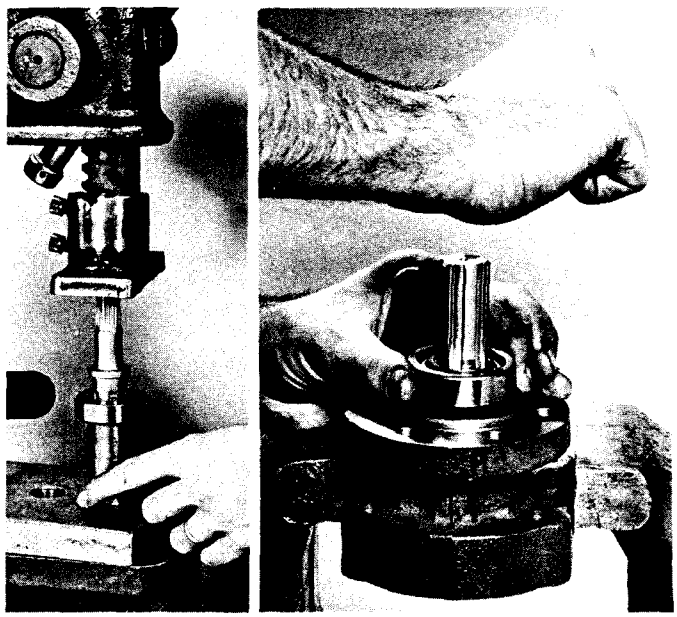


Fig. 7 Inserting assembled shaft

8. Place bearing seal (3) and bearing shield (2) on shaft.

Fig. 8 Installing bearing seal and shield

9. With ends of "Spirolox" snap ring (1) spread apart, insert one end of snap ring into groove. Then wind balance of the snap ring into the groove.

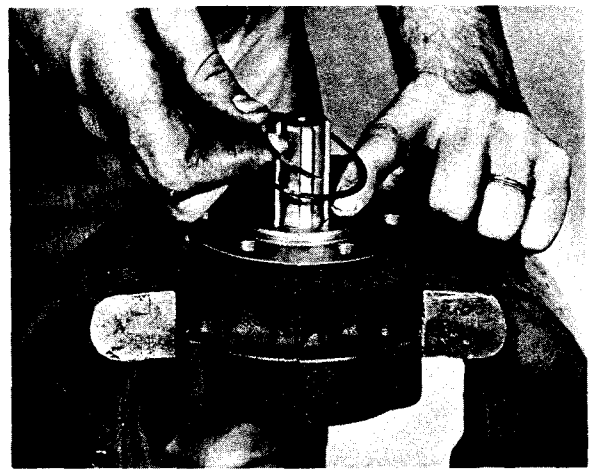


Fig. 9 Installing Spirolox snap ring

10. Turn shaft end cover over, place in vise with gear side up.
11. Lay the thrust plate (22) on the bench and cut four pocket seals (21) slightly (1/32" to 1/16") longer than the four outer slots in the thrust plate. Set them aside for a minute.
12. Place some heavy grease in the two middle slots of the thrust palte (22). Cut two pocket seals (20) 3/16" long. They may run 1/64" longer but if cut any shorter they must be discarded.

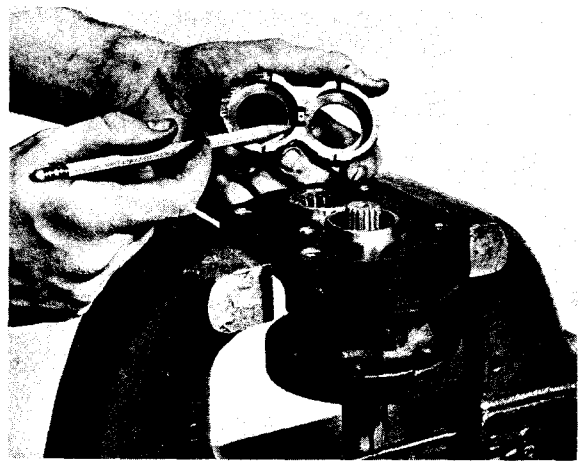


Fig. 10 Inserting pocket seals

NOTE: All pocket seals are cut from a strip obtainable as a service item. They must be cut with a razor blade as a pocket knife is not sharp enough.

Insert the seals in the slots.

# single pump assembly continued

13. Place the thrust plate (22) with the slots toward the face of the shaft end cover (9) over the bearings (19, 33). Check to see that the pocket seals in the center slots are still in place. Now tap the thrust plate into position until a clearance of approximately 1/32" is left between the thrust plate (22) and the shaft end cover (9).

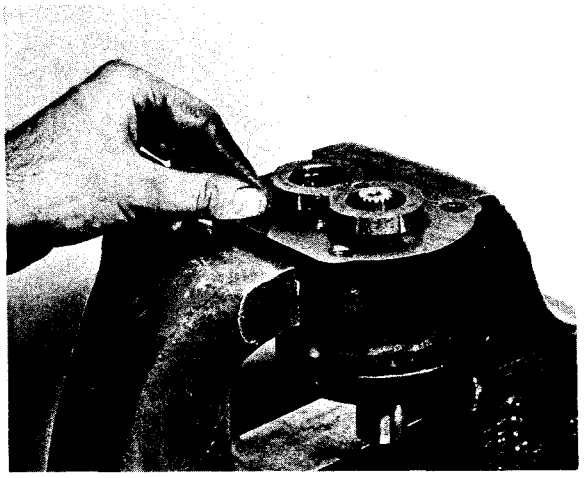


Fig. 11 Inserting pocket seal

14. Into each of the four slots in the thrust plate (22) insert one of the pocket seals (21) cut in Step 11. Be sure to push each seal all the way into the slot so that the hidden end is in contact with the roller bearing race. Then tap the assembled thrust plate until it rests against the shaft end cover.

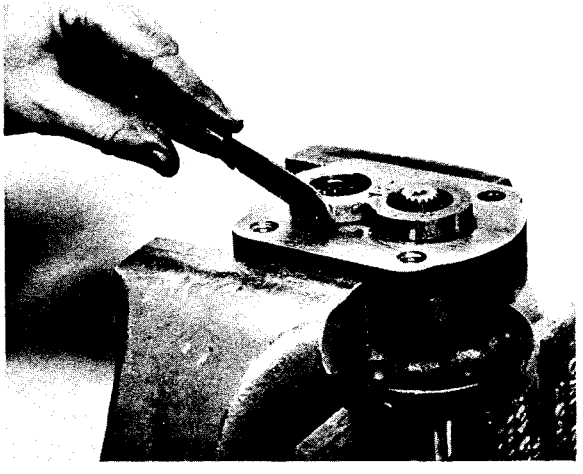


Fig. 12 Trimming pocket seal

15. Using a razor blade, trim away the excess from the exposed ends of the pocket seals (21) square and flush with the sides of the thrust plate.

## PORT END COVER SUBASSEMBLY

1. Install the new roller bearings (37, 40) into the bores of the port end cover (38)—IF—the used ones were removed.
2. Lay the thrust plate (28) on the bench and cut four pocket seals (30) slightly (1/32" to 1/16") longer than the four outer slots in the thrust plate. Set them aside for a minute.
3. Place some heavy grease in the two middle slots of the thrust plate (28). Cut two pocket seals (29) 3/16" long. They may run 1/64" longer but if cut any shorter they must be discarded.
   NOTE: All pocket seals are cut from a strip obtainable as a service item. They must be cut with a razor blade as a pocket knife is not sharp enough.
   Insert the seals in the slots.
4. Place the thrust plate (28) with the slots toward the face of the port end cover (38) over the bearings (37, 40). Check to see that the pocket seals in the center slots are still in place before tapping the thrust plates into position. Leave a clearance of approximately 1/32" between the thrust plate (28) and the port end cover (38).
5. Into each of the four slots in the thrust plate (28) insert a pocket seal (30) cut in Step 2. Push each seal all the way into the slot so that the hidden end is in contact with the bearing race. Tap the assembled thrust plate into position against the face of the port end cover.
6. Using a razor blade, trim away the excess from the exposed ends of the pocket seals (30) square and flush with the sides of the thrust plate.

## FINAL ASSEMBLY

1. Place the assembled shaft end cover in a vise, gear side up.
2. Pour a small amount of oil on face of thrust plate to provide lubrication of gears. Install the drive gear (23) on the shaft (6). Stone the gear ends before installation to remove any minute burrs.

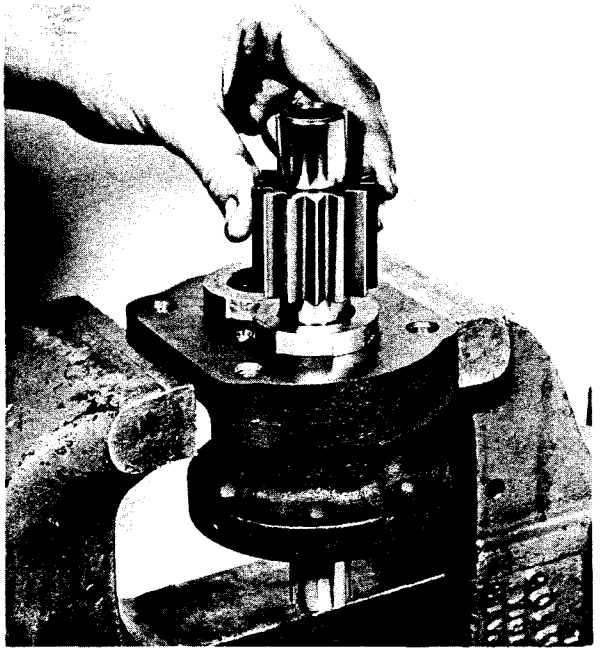


Fig. 13 Installing drive gear

3. Stone the faces of the gear housing (26) to remove any burrs that might have occurred in handling. Clean all surfaces (air blast or wipe). Install pre-greased "O" rings (24, 27) in the grooves in the faces of the housing (26).

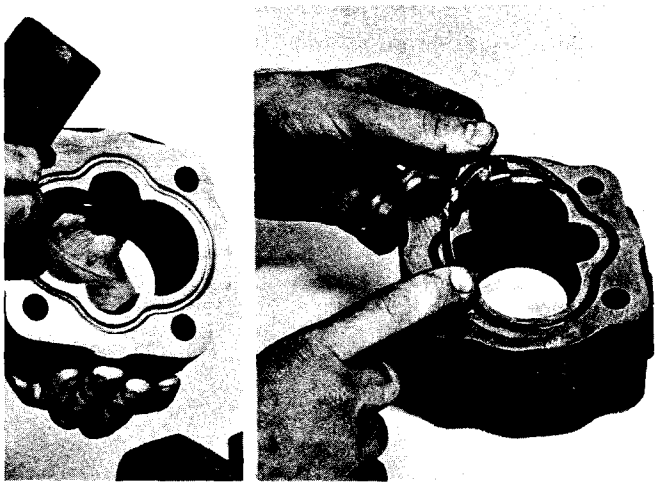
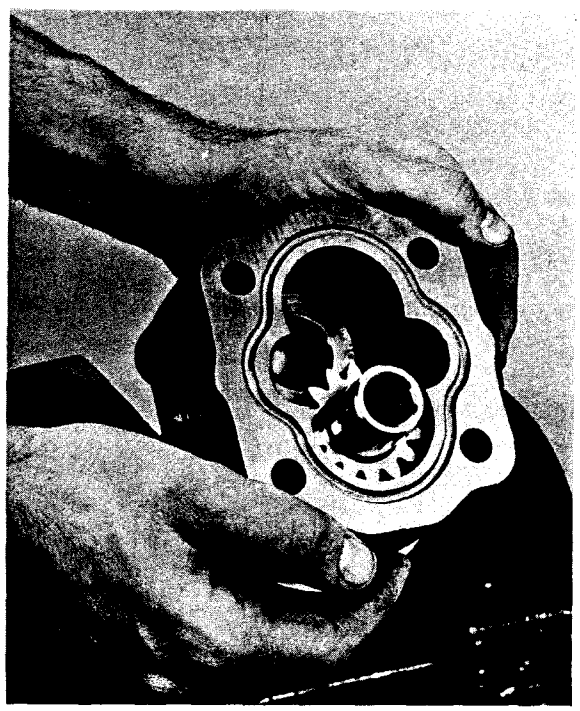


Fig. 14 Installing pre-greased "O" ring

4. Place the gear housing (26) over the drive gear (23) and tap into position with a soft hammer (plastic or leatherhead). Be careful not to pinch the "O" ring (24) when positioning the housing. Install the driven gear (32) into its respective bore. Pour a small amount of oil over the gears to provide initial lubrication when putting the pump back into service.

5. Install the port end cover subassembly on the gear housing (26). Hubs of gears fit into the I.D. of the roller bearings (37, 40) and thrust plate (28) fits into the gear housing. Use a soft hammer to seat or position the port end cover assembly against the housing, making sure the "O" ring (27) on the face of the housing is not pinched.

Fig. 15 Installing gear housing



6. Thread the four cap screws (39) into the shaft end cover. Tighten the four cap screws alternately to 100 ft. lbs. of torque.
7. Rotate the shaft with a six inch wrench. Protect the shaft splines when using a wrench. The shaft should rotate easily.
8. Thread the grease fitting (12) into the shaft end cover (9)—IF—it was removed. Fill the cavity with a #2 consistency, lithium base, high temperature, ball bearing grease until a grease film appears around the shaft (6).
The pump is now ready for installation and run-in.

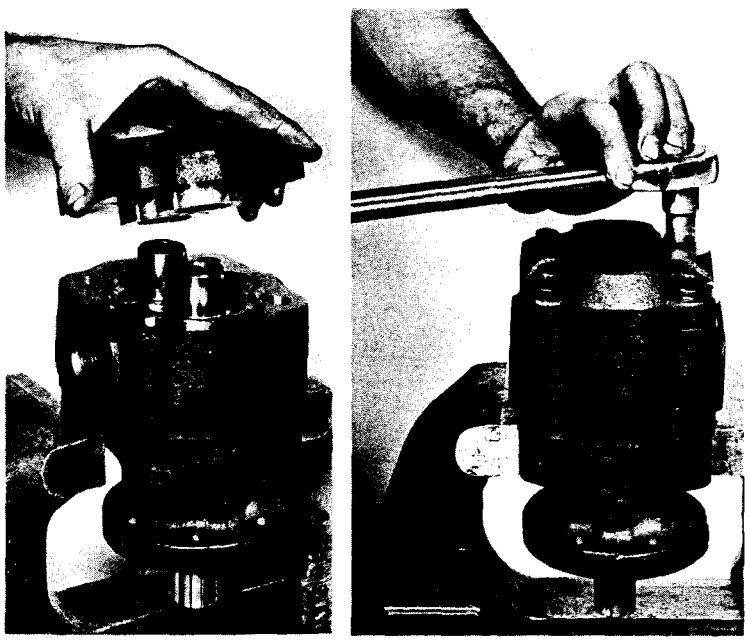


Fig. 16 Installing port end cover

## IMPORTANT PRECAUTION TO OBSERVE BEFORE OPERATING NEW OR REBUILT HYDRAULIC PUMPS AND MOTORS

To avoid possible damage to a new or rebuilt hydraulic pump or motor, back off the main relief valve adjusting screw (or remove adjusting shims or spacers) before operating unit. Then, AFTER UNIT HAS RUN-IN FOR ABOUT 5 MINUTES AT ZERO PRESSURE (with all control levers in neutral position) adjust relief valve pressure to proper and prescribed setting. Failure to observe this precaution can result in almost immediate failure of the hydraulic unit—if the relief valve pressure setting should be excessive.

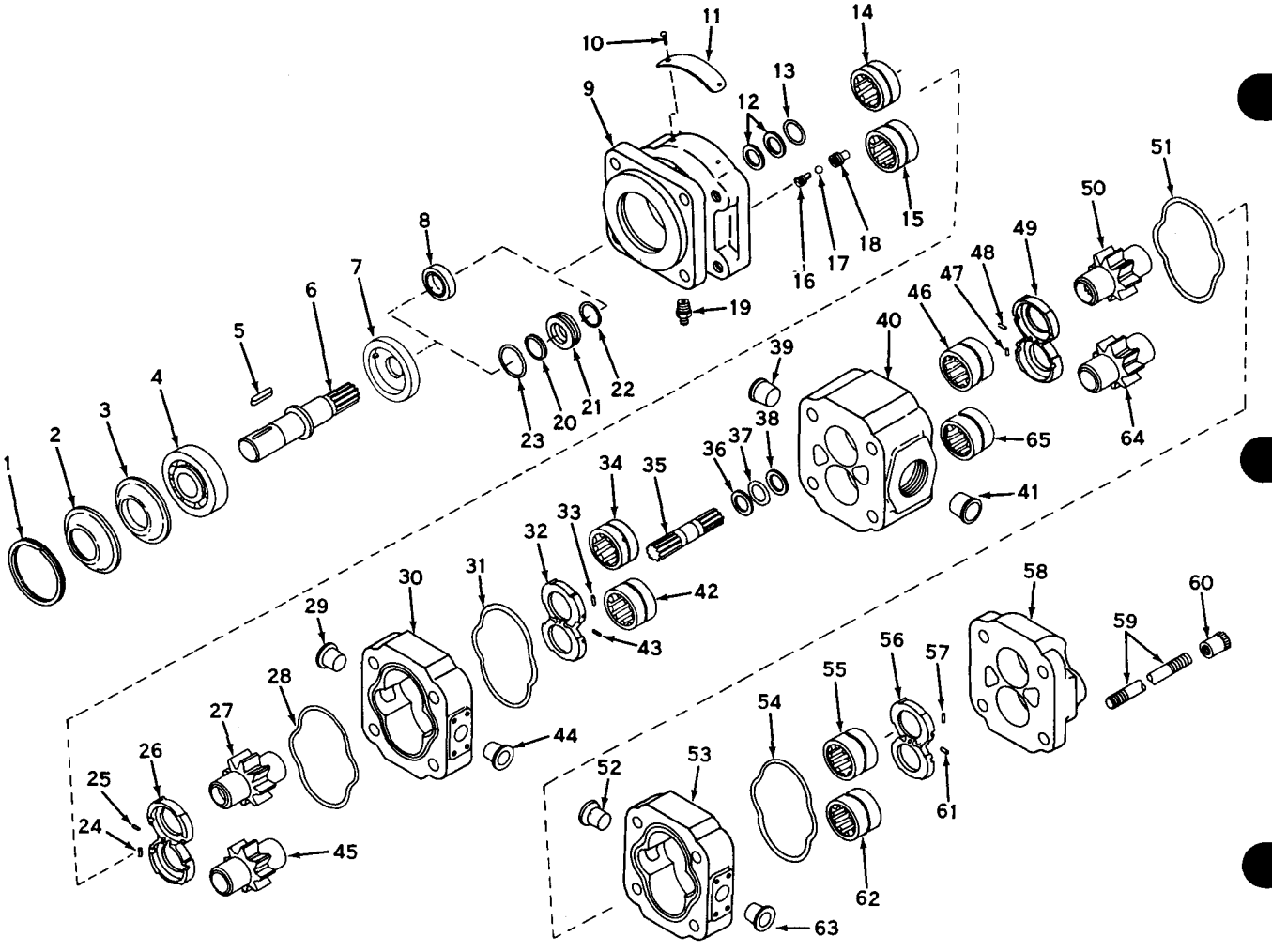


Fig. 17 Exploded View of Dual Tandem Pump

| No. | Description |
|---|---|
| 1 | Spirolox Snap Ring |
| 2 | Bearing Shield |
| 3 | Bearing Seal |
| 4 | Shaft Ball Bearing |
| 5 | Key |
| 6 | Drive Shaft |
| 7 | Bearing Spacer |
| 8 | Oil Seal |
| 9 | Shaft End Cover |
| 10 | Drive Screws |
| 11 | Name Plate |
| 12 | Back-Up Rings |
| 13 | Shaft "O" Ring |
| 14 | Roller Bearing |
| 15 | Roller Bearing |
| 16 | Check Ball Retainer |
| 17 | Check Ball |
| 18 | Check Valve Seat |
| 19 | Grease Fitting |
| 20 | Back-Up Ring |
| 21 | Bronze Insert |
| 22 | "O" Ring Shaft Seal |

| No. | Description |
|---|---|
| 23 | "O" Ring Gasket |
| 24 | Pocket Seals |
| 25 | Pocket Seals |
| 26 | Thrust Plate |
| 27 | Drive Gear |
| 28 | "O" Ring Gasket |
| 29 | Plastic Pipe Closure |
| 30 | Housing |
| 31 | "O" Ring Gasket |
| 32 | Thrust Plate |
| 33 | Pocket Seals |
| 34 | Roller Bearing |
| 35 | Connector Shaft |
| 36 | Back-up Ring |
| 37 | "O" Ring |
| 38 | Back-up Ring |
| 39 | Plastic Pipe Closure |
| 40 | Bearing Carrier |
| 41 | Plastic Pipe Closure |
| 42 | Roller Bearing |
| 43 | Pocket Seals |
| 44 | Plastic Pipe Closure |

| No. | Description |
|---|---|
| 45 | Driven Gear |
| 46 | Roller Bearing |
| 47 | Pocket Seals |
| 48 | Pocket Seals |
| 49 | Thrust Plate |
| 50 | Drive Gear |
| 51 | "O" Ring Gasket |
| 52 | Plastic Pipe Closure |
| 53 | Housing |
| 54 | "O" Ring Gasket |
| 55 | Roller Bearing |
| 56 | Thrust Plate |
| 57 | Pocket Seals |
| 58 | Port End Cover |
| 59 | Studs |
| 60 | Nuts |
| 61 | Pocket Seals |
| 62 | Roller Bearing |
| 63 | Plastic Pipe Closure |
| 64 | Driven Gear |
| 65 | Roller Bearing |

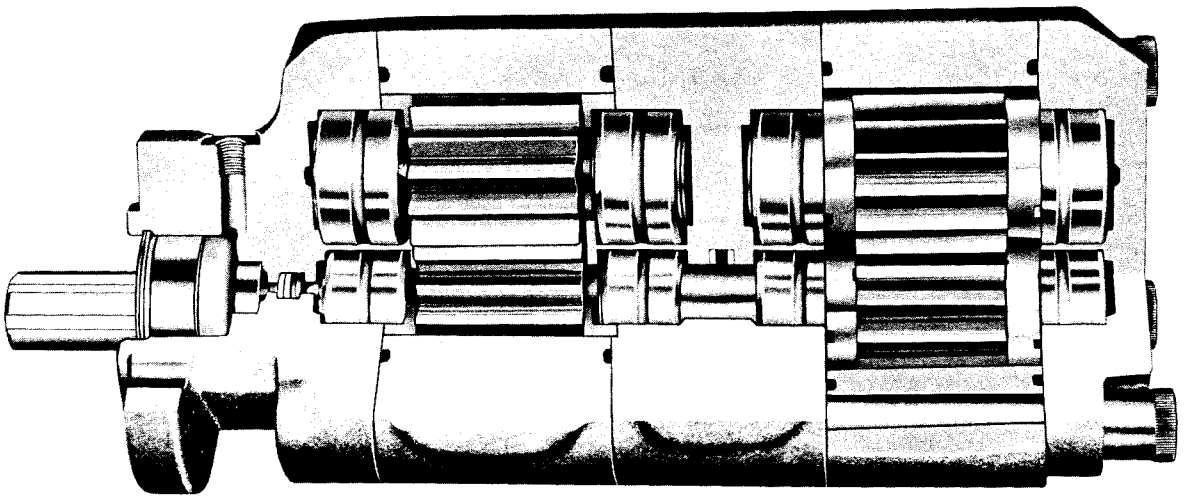


Fig. 18 Cut-a-way View of Dual Tandem Pump

# tandem pump disassembly

## GENERAL NOTES

Remember dirt is the enemy of any hydraulic system. The best way to fight this enemy is to prevent its entry into the system. Make sure you disassemble and reassemble this pump in spotlessly clean surroundings. During reassembly lubricate all "O" rings and oil seals with a sticky grease before installation.

## DISASSEMBLY BY SUBASSEMBLIES

1. Index mark the port end cover (58), gear housing (30) and (53), bearing carrier (40) and shaft end cover (9).
2. Remove the four allenhead nuts (60) from the studs (59).
3. Lift off port end cover (58), the thrust plate (56) with pocket seals (57, 61) and roller bearings (55, 62) will also be removed in this operation.
4. Remove the driven gear (64), drive gear (50) and gear housing (53) from the bearing carrier (40). Keep the gears together as they are a matched set.
5. Remove the bearing carrier (40) from the gear housing (30). The thrust plates (32, 49) with their pocket seals (33, 43, 47, 48), roller bearings (34, 42, 46, 65), back-up rings (36, 38), and "O" ring (37) and connector shaft (35) will also be removed. Then remove the four studs (59).
6. Remove the connector shaft (35) from the drive gear bore of bearing carrier (40).
7. Remove the driven gear (45), drive gear (27) and gear housing (30) from the shaft end cover (9). Keep the gears together as they are a matched set.

## SHAFT END COVER

1. Turn the shaft end cover (9) over so that the drive end of the shaft is facing up. With a screwdriver remove the snap ring (1) then remove the bearing shield (2) and bearing seal (3).
2. Pull the drive shaft (6) out of the shaft end cover. The shaft ball bearing (4) will also be removed. Then lift out the bearing spacer (7).
3. Remove and discard the oil seal (8) from the shaft end cover.
4. Turn the cover over so that the thrust plate is up. Pry off thrust plate (26) carefully with a knife blade or thin screwdriver. Remove and discard the pocket seals (24, 25).

## BEARING CARRIER

1. Pry off thrust plates (32, 49) with a knife or thin screwdriver. Remove and discard all the pocket seals (33, 43, 47, 48).
2. Pull the four bearings (34, 42, 46, 65) with a bearing puller from the bearing carrier (40)—ONLY—if they are being replaced.
3. From the connecting shaft bore, remove and discard the two back-up rings (36, 38) and "O" ring (37).

## HOUSING

1. Remove and discard "O" rings (28, 31, 51, 54) from grooves in housing (30, 53).

## PORT END COVER

1. Pry off the thrust plate (56) with a knife or thin screwdriver. Remove and discard the pocket seals (57, 61).
2. Pull the bearings (55, 62) with a bearing puller from the port end cover (58)—ONLY—if they are being replaced.

# tandem pump assembly

## SHAFT END COVER SUBASSEMBLIES

1. Place the shaft end cover (9) gear side up in a vise with soft jaws. Install back-up rings (12) and shaft "O" ring (13).

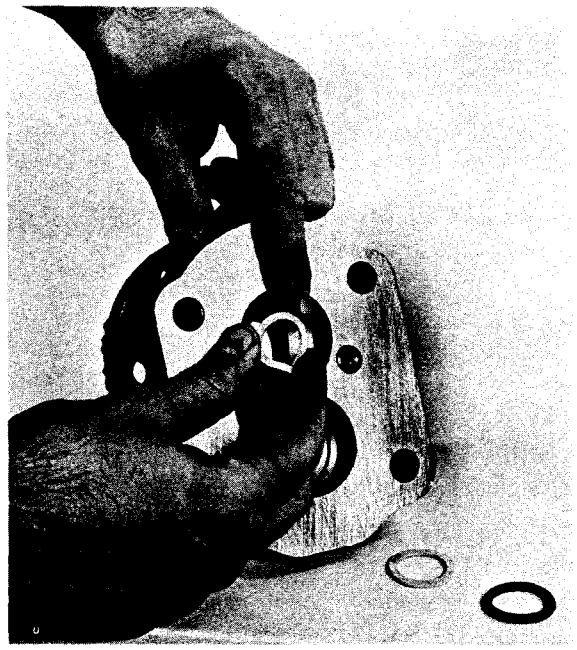


Fig. 19 Installing back-up ring

2. Install two new roller bearings (14, 15) in the bores of the cover—IF—the used ones were removed.

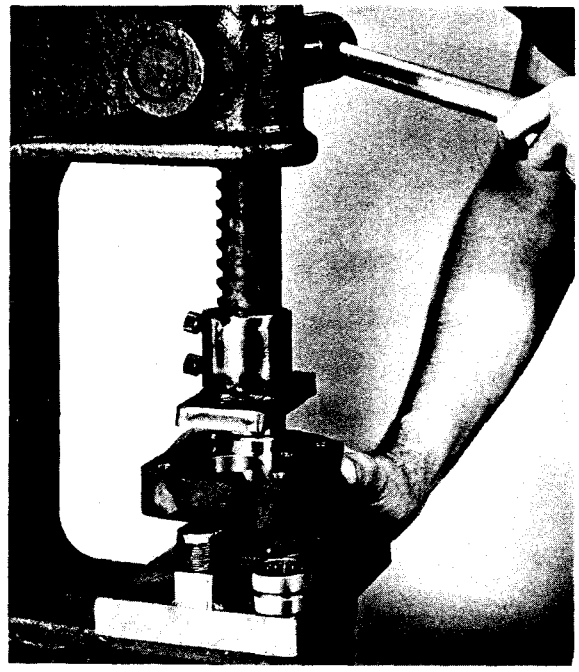


Fig. 20 Installing roller bearings

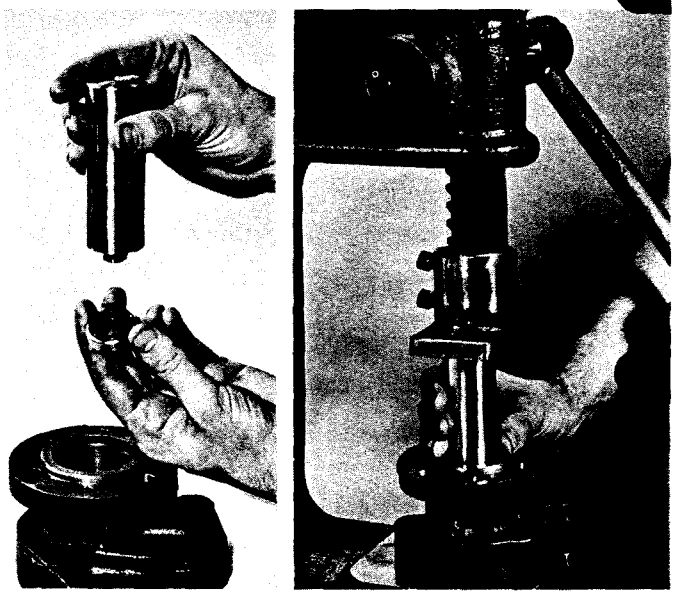
3. Reassemble the two check valves for double rotation by inserting the ball (17) into the check valve seat (18) and screwing the check ball retainer (16) flush into the check valve seat being sure the check ball is free to move. Screw the two check valve assemblies into their respective holes, approximately two threads below face of shaft end cover (9). Single rotation units do not require check assemblies. Instead, a plug is installed on the high-pressure side of pump

Fig. 21 Peening over check valve seat

with the low-pressure side left open. Peen over the check valve seat and ball retainer to prevent the valves from backing out.

4. Remove shaft end cover (9) from vise, turn over, place in arbor press and press in oil seal (8) with the open side down facing toward the bearing bore.

Fig. 22 Pressing in oil seal



5. Then install the bearing spacer (7) open side up. NOTE: For motors—use special bronze insert (21) with back-up ring (20) and shaft seal (22) in I.D. groove of insert and "O" ring gasket (23) in O.D. groove of insert.
6. Repack the shaft ball bearing (4) with a #2 consistency, lithium base, high temperature, ball bearing grease. Press the bearing onto the drive shaft (6) being sure it is seated against the shaft shoulder. Insert the assembled shaft into the shaft end cover (9).

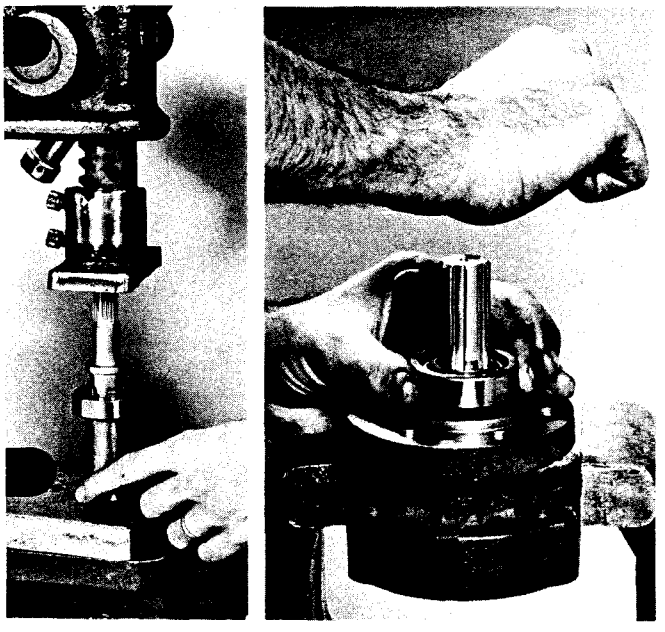


Fig. 23 Inserting assembled shaft

7. Place bearing seal (3) and bearing shield (2) on shaft.

Fig. 24 Installing bearing seal and shield

8. With ends of Spirolox snap ring (1) spread apart, insert one end of snap ring into groove. Then wind balance of the snap ring into the groove.

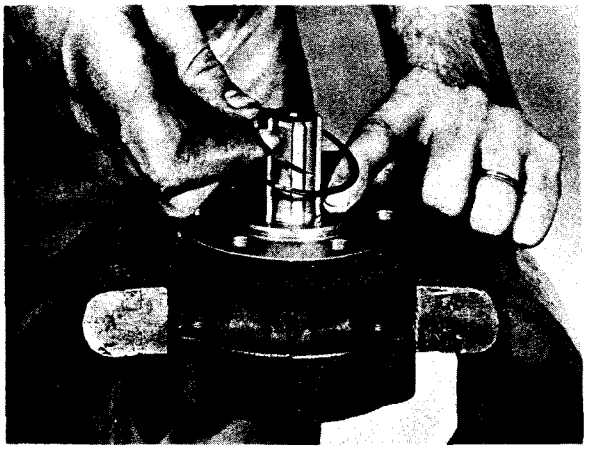


Fig. 25 Installing Spirolox snap ring

9. Turn shaft end cover over in vise with gear side up.
10. Lay the thrust plate (26) on the bench and cut four pocket seals (25) slightly (1/32" to 1/16") longer than the four outer slots in the thrust plate. Set them aside for a minute.
11. Place some heavy grease in the two middle slots of the thrust plate (26). Cut two pocket seals (24) 3/16" long. They may run 1/64" longer but if cut any shorter they must be discarded.

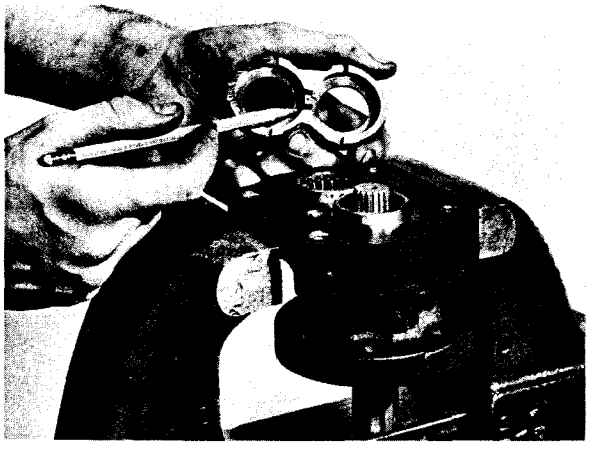


Fig. 26 Inserting pocket seals

NOTE: All pocket seals are cut from a strip obtainable as a service item. They must be cut with a razor blade as a pocket knife is not sharp enough.

Insert the seals in the slots.

12. Place the thrust plate (26) with the slots toward the face of the shaft end cover (9) over the bearings (14, 15). Check to see that the pocket seals in the center slots are still in place. Now tap the thrust plate into position until a clearance of

# tandem pump assembly continued

approximately 1/32" is left between the thrust plate (26) and the shaft end cover (9).

13. Into each of the four slots in the thrust plate (26)

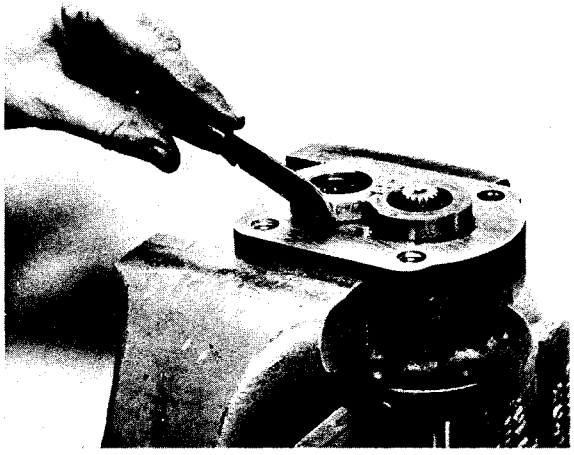


Fig. 27 Trimming pocket seal

insert one of the pocket seals (25) cut in Step 11. Be sure to push each seal all the way into the slot so that the hidden end is in contact with the roller bearing race. Then tap the assembled thrust plate until it rests against the shaft end cover.

14. Using a razor blade, trim away the excess from the exposed ends of the pocket seals (25) square and flush with the sides of the thrust plate.

## BEARING CARRIER SUBASSEMBLY

1. Install the back-up ring (36), "O" ring (37), and other back-up ring (38) into the groove in the O.D. of the bearing carrier (40). Be sure to have the "O" ring sandwiched between the back-up rings.
2. Install four new roller bearings (34, 42, 46, 65)—IF—the used ones were removed.
3. To each face of bearing carrier (40) install thrust plates (32, 49) over bearings in the manner described in steps 2, 3, and 4 for port end cover subassembly.

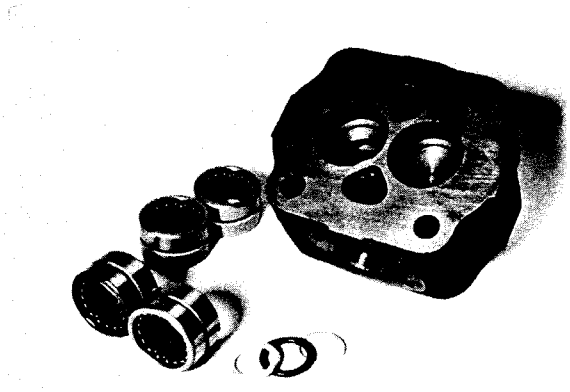


Fig. 28 Bearing carrier with component parts

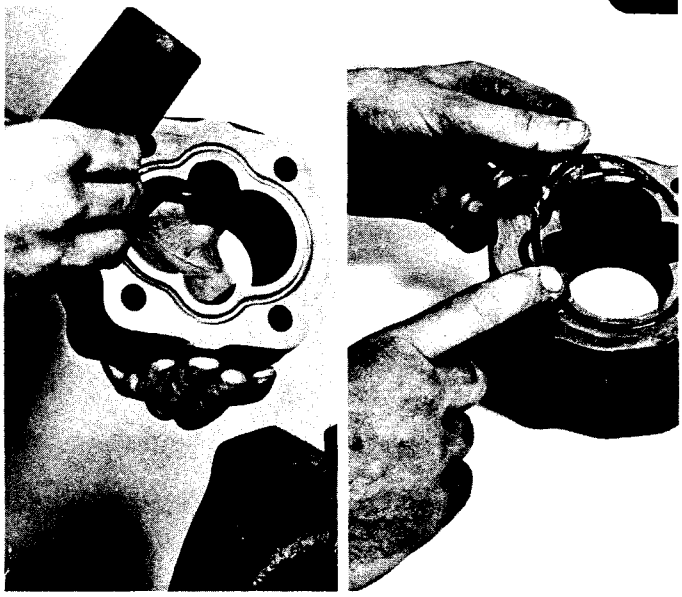
## PORT END COVER SUBASSEMBLY

1. Install the new roller bearings (55, 62) into the bores of the port end cover (58)—IF—the used ones were removed.
2. Lay the thrust plate (56) on the bench and cut four pocket seals (61) slightly (1/32" to 1/16") longer than the four outer slots in the thrust plate. Set them aside for a minute.
3. Place some heavy grease in the two middle slots of the thrust plate (56). Cut two pocket seals (57) 3/16" long. They may run 1/64" longer but if cut any shorter they must be discarded.
   NOTE: All pocket seals are cut from a strip obtainable as a service item. They must be cut with a razor blade as a pocket knife is not sharp enough.
   Insert the seals in the slots.
4. Place the thrust plate (56) with the slots toward the face of the port end cover (58) over the bearings (55, 62). Check to see that the pocket seals in the center slots are still in place before tapping the thrust plates into position. Leave a clearance of approximately 1/32" between the thrust plate (56) and the port end cover (58).
5. Into each of the four slots in the thrust plate (56) insert a pocket seal (61) cut in Step 2. Push each seal all the way into the slot so that the hidden end is in contact with the bearing race. Tap the assembled thrust plate into position against the face of the port end cover.
6. Using a razor blade, trim away the excess from the exposed ends of the pocket seals (61) square and flush with the sides of the thrust plate.

## FINAL ASSEMBLY

1. Place the assembled shaft end cover in a vise, gear side up.
2. Pour a small amount of oil on face of thrust plate to provide lubrication of gears. Install the drive gear (27) on the shaft (6). Stone the gear ends before installation to remove any minute burrs.
3. Stone the faces of the gear housing (30) to remove any burrs that might have occurred in handling. Blow or carefully wipe clean before installing pre-greased "O" rings (28, 31) in the grooves in the faces of the housing (30).

Fig. 29 Installing pre-greased "O" ring



4. Place the gear housing (30) over the drive gear (27) and tap into position with a soft hammer (plastic or leatherhead). Be careful not to pinch the "O" ring (28) when positioning the housing. Install the driven gear (45) into its respective bore. Pour a small amount of oil over the gears to provide initial lubrication when putting the pump back into service.

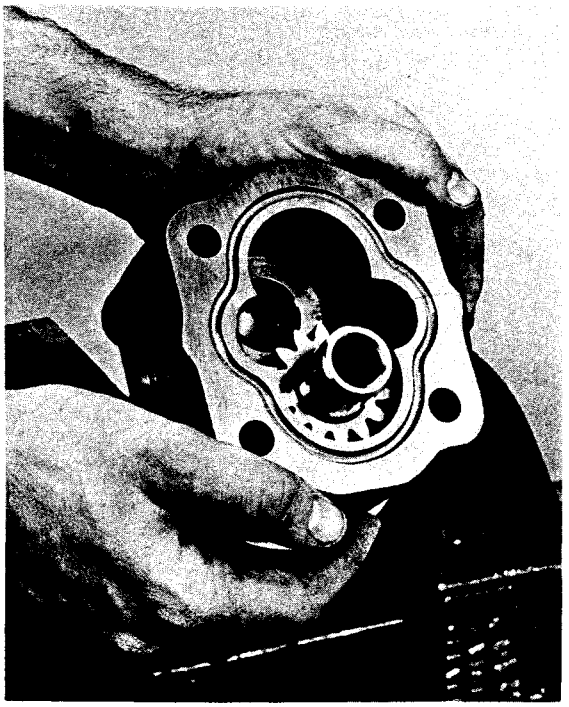


Fig. 30 Installing gear housing

5. Install the bearing carrier subassembly on the gear housing (30). Hubs of gears fit into the I.D. of the roller bearings (34, 42) and thrust plate (32) fits into the gear housing. Use a soft hammer to seat or position the port end cover assembly against the housing, making sure the "O" ring (31) on the face of the housing is not pinched.
6. Insert the connector shaft (35) into the bore of the drive gear.
7. Pour a small amount of oil on face of thrust plate to provide lubrication of gears. Install the drive gear (50) on the shaft (35). Stone the gear ends before installation to remove any minute burrs.
8. Stone the faces of the gear housing (53) to remove any burrs that might have occurred in handling. Blow or carefully wipe clean before installing pre-greased "O" rings (51, 54) in the grooves in the faces of the housing (53).
9. Place the gear housing (53) over the drive gear (50) and tap into position with a soft hammer (plastic or leatherhead). Be careful not to pinch the "O" ring (51) when positioning the housing. Install the driven gear (64) into its respective bore. Pour a small amount of oil over the gears to provide initial lubrication when putting the pump back into service.
10. Install the port end cover subassembly on the gear housing (53). Hubs of gears fit into the I.D. of the roller bearings (55, 62) and thrust plate (56) fits into the gear housing. Use a soft hammer to seat or position the port end cover assembly against the housing, making sure the "O" ring (54) on the face of the housing is not pinched.
11. Thread the four studs (59) with a stud driver into the shaft end cover (9) leaving enough thread protruding above the port end cover (58) to accommodate the allen head nuts (60). Tighten the four nuts alternately to 100 ft. lbs. of torque. Be sure the drive shaft is easily rotated after tightening the nuts.
12. Thread the grease fitting (19) into the shaft end cover (9)—IF—it was removed. Fill the cavity with a #2 consistency, lithium base, high temperature, ball bearing grease until a grease film appears around the shaft (6). The pump is now ready for installation and run-in.

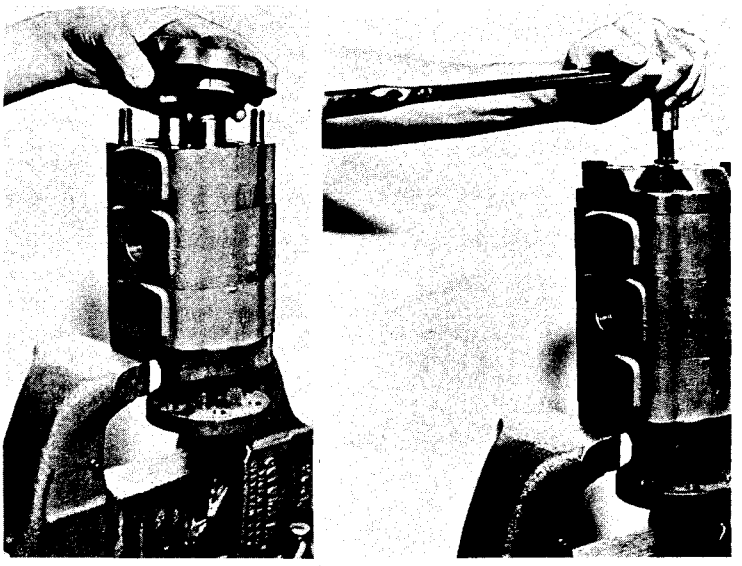


Fig. 31 Installing port end cover

## IMPORTANT PRECAUTION TO OBSERVE BEFORE OPERATING NEW OR REBUILT HYDRAULIC PUMPS AND MOTORS

To avoid possible damage to a new or rebuilt hydraulic pump or motor, back off the main relief valve adjusting screw (or remove adjusting shims or spacers) before operating unit. Then, AFTER UNIT HAS RUN-IN FOR ABOUT 5 MINUTES AT ZERO PRESSURE (with all control levers in neutral position) adjust relief valve pressure to proper and prescribed setting. Failure to observe this precaution can result in almost immediate failure of the hydraulic unit—if the relief valve pressure setting should be excessive.

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