HYSTER

SERVICE MANUAL

FOR HYSTER DIRECT DRIVE AND POWER CONTROLLED WINCHES

D6C D6D

D7F D7H

D89A D89B

Form 599238

SAFETY PRECAUTIONS

Observe the following PRECAUTIONS to prevent injury to personnel and damage to equipment.

- Do not operate winch unless tractor is equipped with a rear screen for operator protection against cable breakage.

- Authorized operators only!

- Report damage or erratic operation of winch or pressure gauge immediately.

- Do not stand while operating the tractor or the winch.

- Make sure that instruments and controls are operative before working the unit.

- Do not use control levers or handles as machine mounting assists.

- Do not use control levers or handles as hangers for clothes, water bags, grease guns, lunch pails, etc.

- Do not permit personnel in the control area when working or making checks on the machine.

- Do not allow riders on the machine or load.

- Use extreme care when operating close to other machines.

- Avoid operating near anyone working or standing.

- Do not stand or permit others to stand in the bight (loop) of a cable.

- Do not stand or permit others to stand near the winch or cable when it is under tension.

- Do not work a damaged cable (broken wire or strands, or a decrease in the diameter of the cable, are warning signs).

- Do not leave the tractor while the winch line is under tension.

- Avoid pulling the hook over the drum and through the throat of the winch.

- Do not anchor a double or two-part line to the winch.

- When not operating the winch, always leave it in neutral with the brake on.

- Never attempt to clean, oil or adjust a machine while it is in motion.

- Use extreme care when removing cable and ferrule from the drum. When the ferrule is released the cable may spring out with force.

Winch Serial Number _____

Date put in service _____

SERVICE MANUAL

DIRECT DRIVE AND POWER CONTROLLED TOWING WINCHES

D6C & D, D7F & H, D89A & B

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REVISED
DEC. 1979

NOTE: This issue supersedes previously published manuals on this equipment. The following pages are changed:

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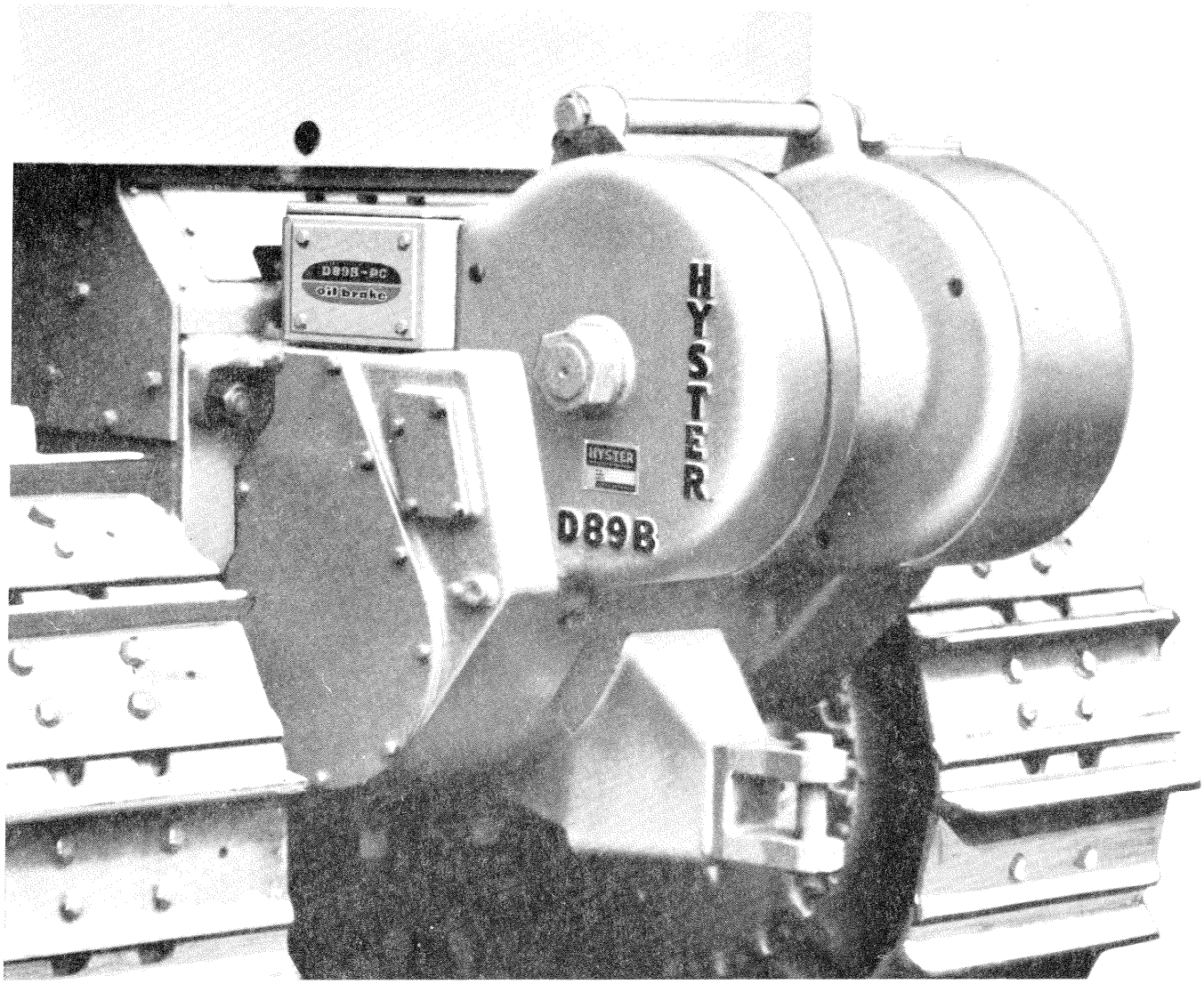

D89S-2C
oil brake
HYSTER
HYSTER
D89B

GENERAL

The service procedures and information given on the following pages cover the D6C, D7F, D89A, D89B and later winches.

Except for the D89B models, there are two types of winches, direct drive and power controlled. The D89B is power controlled only. Essentially the main differences between the types of winches is the handling gear and clutches.

Either type may be standard speed or lo-speed depending on the drum size and gear ratios. Regardless of speed the service procedures remain the same.

Of the two types of winches only the power controlled units can be mounted on either a powershift or direct drive tractor. The direct drive models are primarily for use on direct or torque converter drive tractors; however, this type of D6 or D7 winch can also be mounted on a powershift drive Traxcavator.

Regardless of model or type all winches consist of a transmission case, side frame and five shaft assemblies. The transmission case and side frame of the winches listed above and early D7H winches are two piece castings bolted together. The transmission cases and side frames of the D6D and later D7H winches are integral fabricated weldments. The five shaft assemblies are the PTO shaft, bevel gear shaft, brake shaft, intermediate shaft and the drum shaft. Fig. 1 locates the various shaft positions.

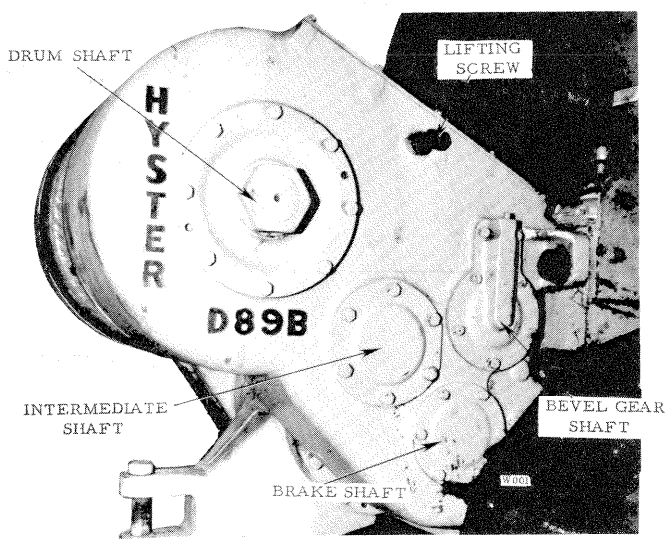


Figure 1

REMOVAL

NOTE: If the winch is to be disassembled and the drum can be removed without removing the winch, do so. Refer to DRUM this section for removal procedure.

1. Disconnect the power control hoses from the inlet block and control valve housing. Fig. 2.

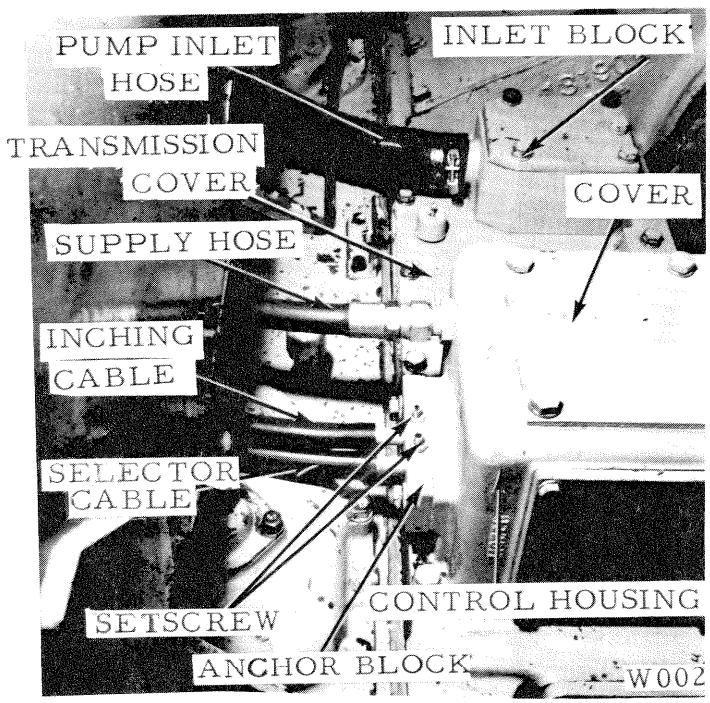


Figure 2

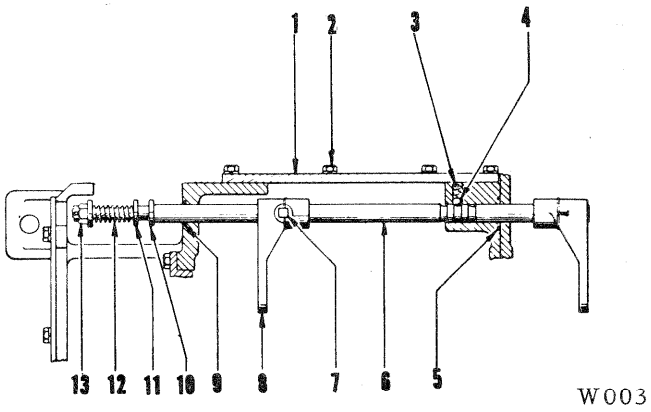
2. Remove: the transmission cover; the side frame cover, if the winch is to be disassembled; the top cover of the control housing on the power control winch, fig. 2, (the side cover of the control housing on the standard winch); the detent spring and ball, fig. 3, from the standard winch.

3. Disconnect the cables from the control housing and the brake and shifting mechanism, as follows:

a. Either unscrew the cable setscrews, fig. 2, or separate the cable anchor block from the control housing of the power control winch. Loosen the jam nut securing the cable and valve spool relationship. Using a short open end wrench, turn each valve clockwise until it is disconnected from the cable. Fig. 4.

b. Loosen the jam nuts securing the relation-

WINCH



1. Cover
2. Capscrew
   Lockwasher
3. Detent Spring
4. Detent Ball
5. O-Ring
6. Shift Shaft
7. Setscrew
8. Shift Fork
9. Seal
10. Washer
11. Washer
12. Spring
13. Nut

Figure 3

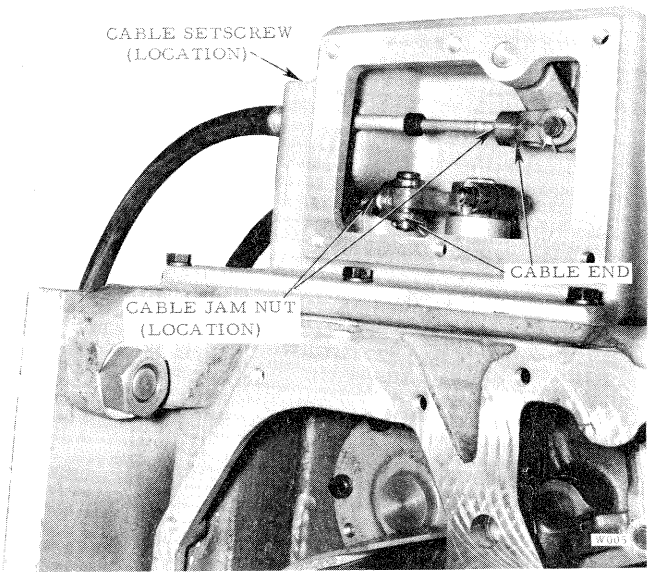


Figure 5

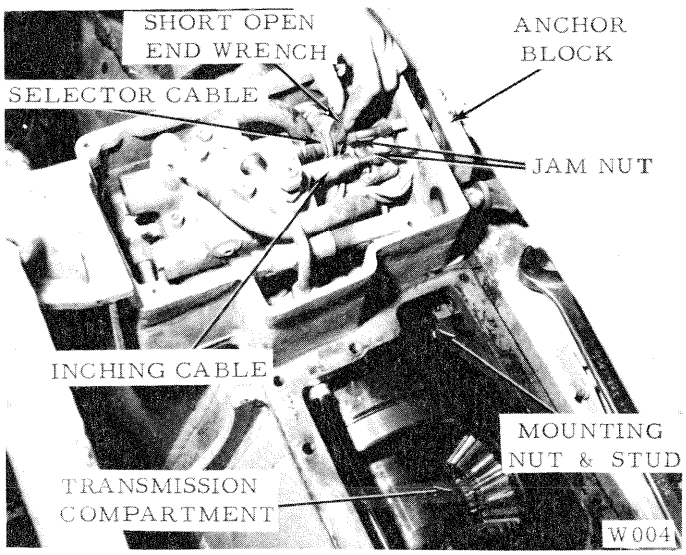


Figure 4

ship between the cables and cable ends on the standard winch. Separate the cable ends from the brake and selector cranks, by extracting the cotter pins and removing the connecting pins, fig. 5.

4. Attach a hoist and sling to each side of the winch, using two 7/8" UNF capscrews and the tapped holes provided for lifting. Remove the slack from the sling. Fig. 6. Place a drain pan under the winch and unscrew the three drain plugs, two on the bottom left side and one near the bottom on the right side, (D and C), fig. 7.

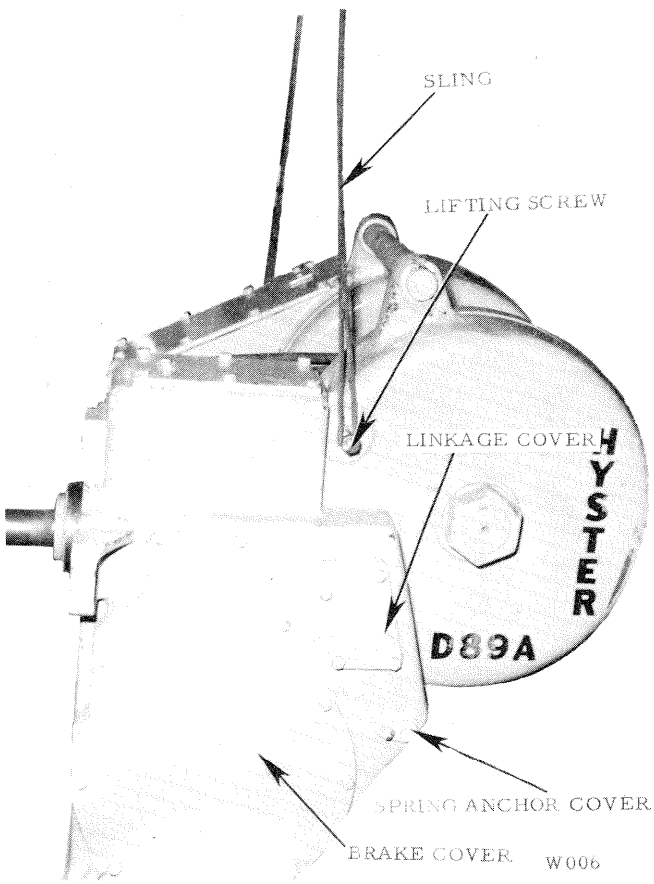


Figure 6

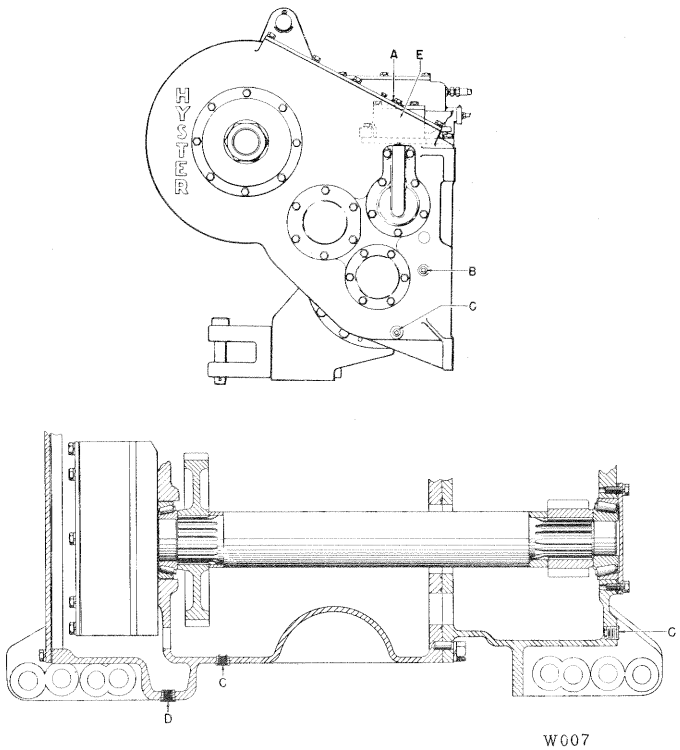


Figure 7

5. Unscrew all outside mounting nuts. Unscrew the mounting nut located in the transmission case, fig. 4, as far as possible. Pry the winch away from its mounting pad on the tractor. Fig. 8. Unscrew the inside nut some more.

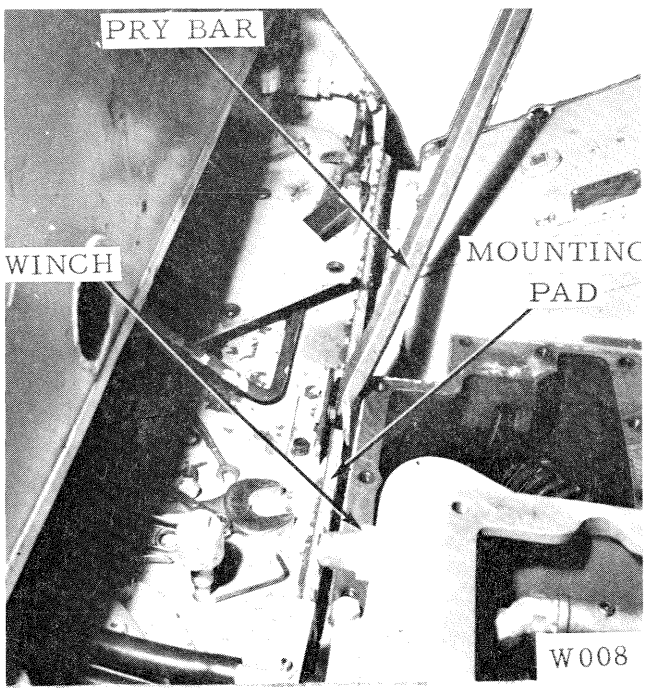


Figure 8

Pry the winch away from the mounting pad again, if necessary.

6. Pull the winch away from its mounting pad.

7. Plug the PTO shaft opening, the two cable openings, and stud hole in winch mounting face.

DISASSEMBLY

1. Check and record bevel gear back lash. Fig. 9. Unscrew the PTO shaft mounting screws.

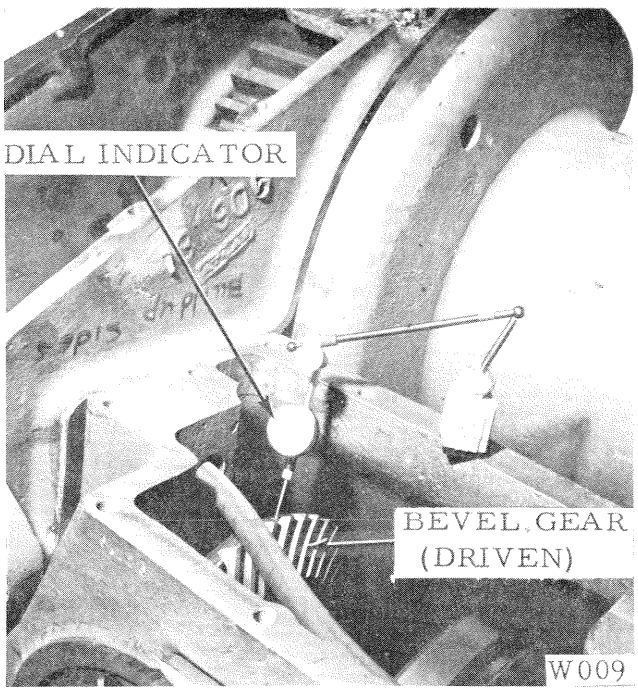


Figure 9

Pull the shaft assembly out of the winch. Remove the shim pack and note its thickness. Fig. 10. Disassemble the PTO shaft assembly.

2. Remove: the control housing; brake release mechanism; brake drum and band or oil brake assembly.

NOTE: Step 3 pertains to direct drive winches only.

3. Unscrew the nut from the left end of the shift shaft and remove the shift collar and spring shaft. Cut the lockwires retaining the shift forks. Unscrew the setscrews. Pull the shift shaft out, being careful not to drop the forks.

4. Disconnect the hydraulic line from the tapered bearing retainer on the left end of the

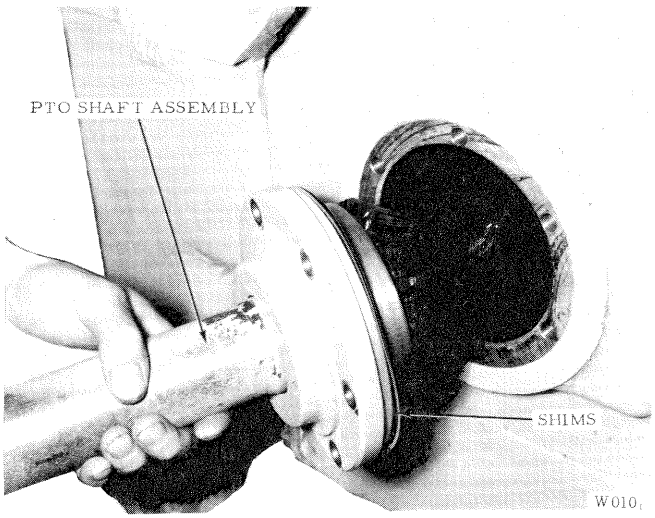


Figure 10

bevel gear shaft. Unscrew the capscrews securing the bearing retainer (1 and 15), fig. 11,

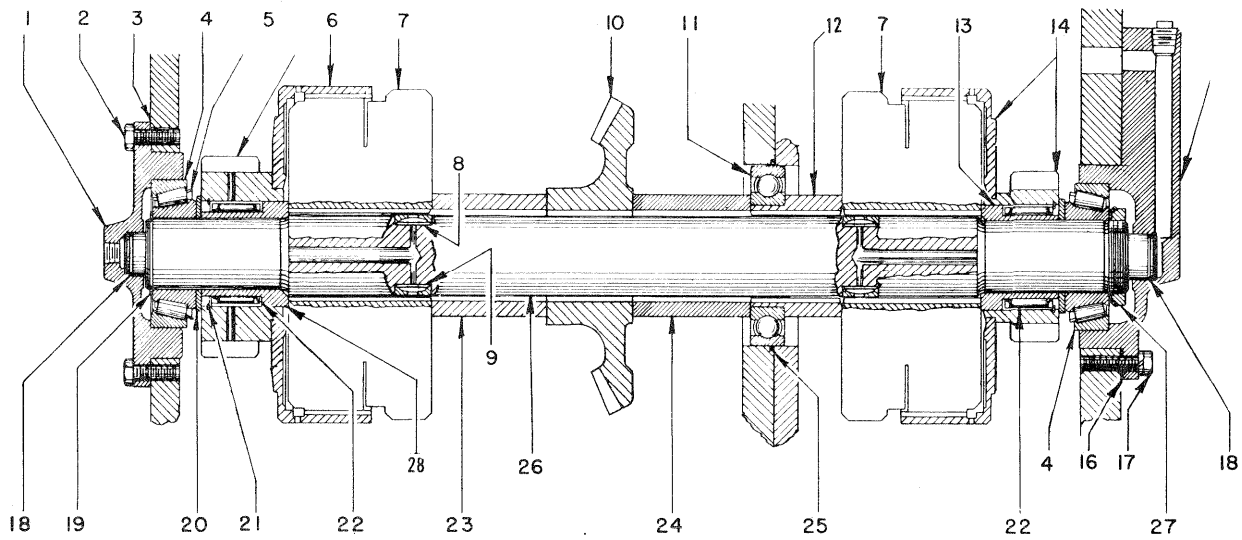
Remove the metal seal rings from each end of the shaft.

NOTE: Step 5 pertains to power controlled winches only.

5. Straighten the lockwasher tang securing the jam nut (27 on the right end of the bevel gear shaft. Unscrew the nut sufficiently to relieve the snap ring (21) retaining the tapered bearing on the left end. Remove the snap ring.

6. Re-install the retainers, temporarily.

7. Turn the winch on its left side. Block the assembly as level as possible. Disconnect hydraulic line from the right bevel gear shaft bearing retainer, if so equipped. Remove the bearing retainer. Fig. 12. Unscrew the jam nut. Fig. 13.



W011

BEVEL GEAR SHAFT

For Power Controlled Winch

1. Bearing Retainer
2. Capscrew Lockwasher
3. Shim
4. Bearing Cup
5. Bearing Cone
6. Second Reduction Spider
7. Clutch Assembly
8. Seal (three teeth)
9. Seal (two teeth)
10. Bevel Gear
11. Ball Bearing
12. Bearing Carrier
13. Bearing Carrier
14. Reverse Spider
15. Bearing Retainer
16. Shim
17. Capscrew-Lockwasher
18. Seal Ring
19. Snap Ring
20. Washer
21. Snap Ring
22. Roller Bearing
23. Spacer
24. Spacer
25. O-Ring
26. Clutch Shaft
27. Lockwasher Locknut
28. Bearing Carrier

Figure 11

at both ends of the bevel gear shaft. Separate the retainers from the case and side frame, using puller screws whenever tapped holes are provided. Note the thickness of the shim packs (3 and 16) and from which end each came.

8. Slide the tapered bearing and spacer washer off the bevel gear shaft. It may be necessary to start the bearing off by prying between the bearing and the reverse clutch gear, using two screwdrivers and working through the top of the

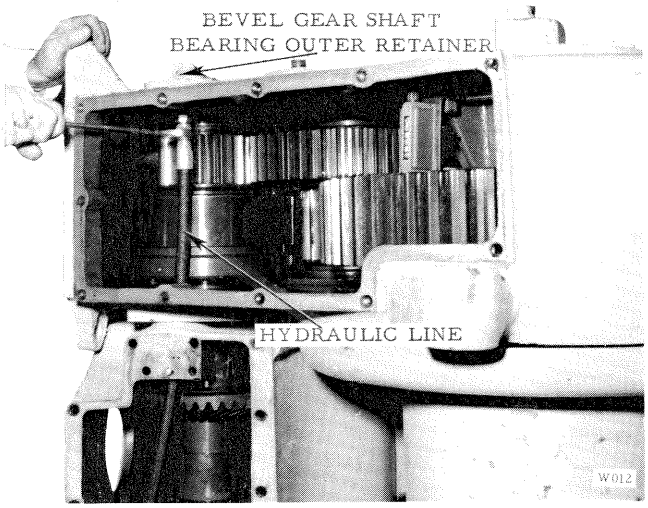


Figure 12

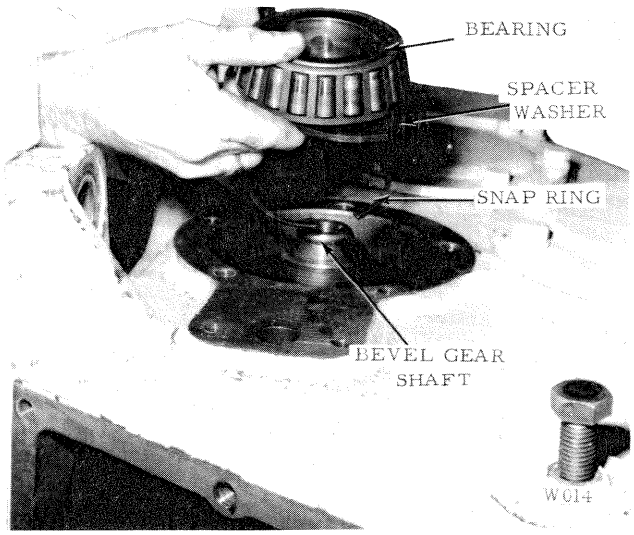


Figure 14

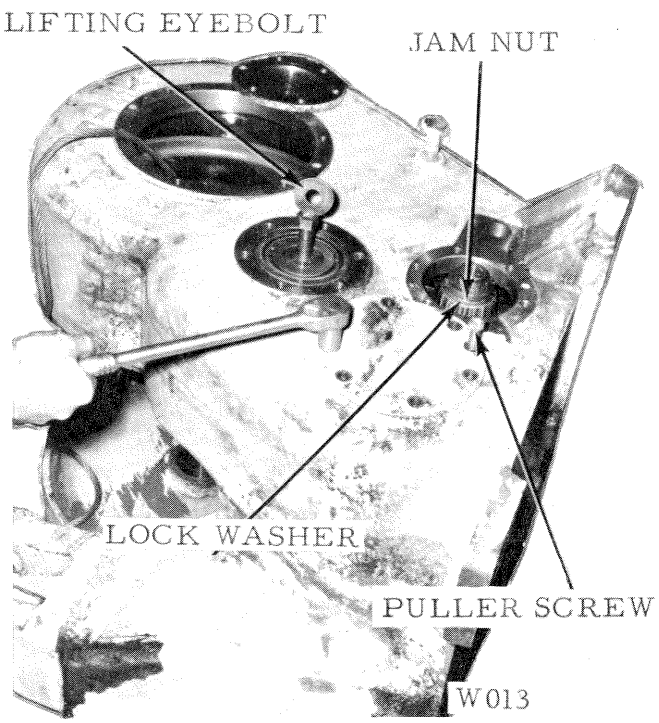


Figure 13

side frame. Remove the internal snap ring from the bore of the reverse clutch gear. Fig. 14.

9. Screw a 5/8" UNF eyebolt (bolt with a washer welded on it) into the thread in the bevel gear shaft. Attach a hoist to the eyebolt, making sure both are aligned. Note the location of the spacers positioning the bevel gear. Fig. 15. Pull the bevel gear shaft straight up,

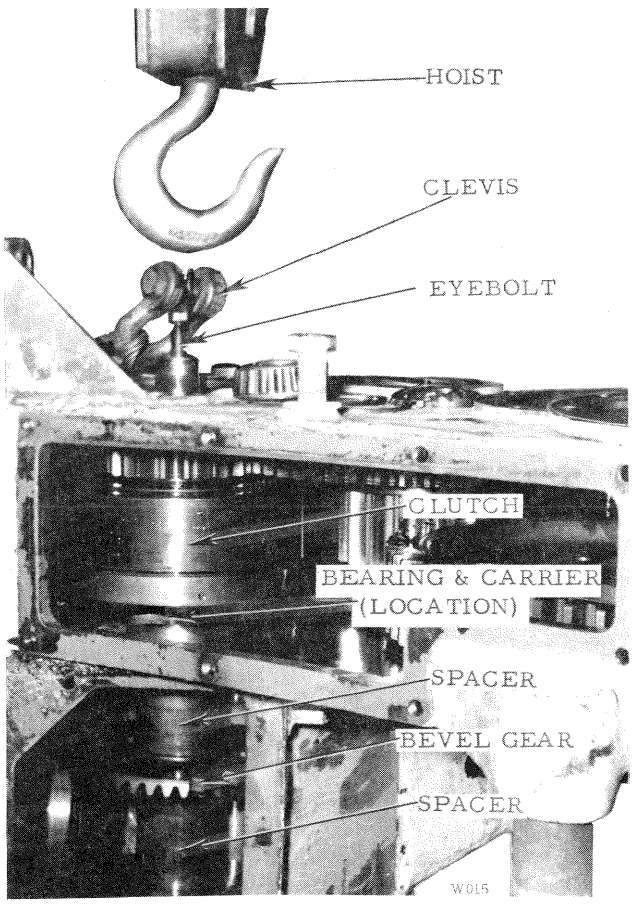


Figure 15

slowly and carefully, until it is free of the winch.

10. Remove the clutch assemblies, spacers, bevel gear and the tapered bearing from the case and side frame. Tap the ball bearing and carrier assembly out of its bore in the case and side frame. When removing the forward power control clutch, push it back into the case and place a block of wood (2 x 4) in front of it. Roll the clutch upon the block and pry it out of the case with a bar. Fig. 16.

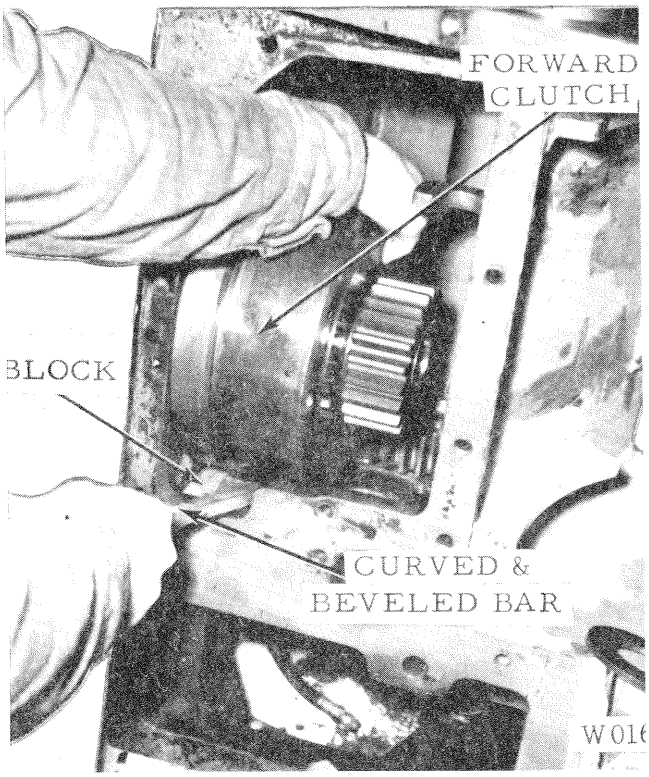


Figure 16

11. Disassemble the clutches, if necessary.

12. Unscrew the capscrews securing the intermediate shaft bearing retainer. Loosen the retainer by tapping it with a light hammer; then, lift it off. Pull the intermediate shaft, employing the method described in Step 9. Lift the two intermediate shaft gears out of the side frame. Fig. 17.

13. Remove the brake shaft bearing retainer.

a. If the bearing only is to be removed, pry the shaft up until the small gear is out of the side frame; then, block in this position. Fig. 18. Push the bearing off the shaft with the small gear, using a gear puller. Fig. 19.

b. To remove the brake shaft assembly pry

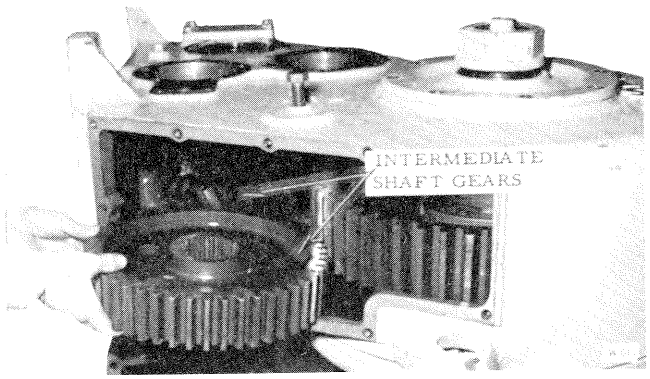


Figure 17

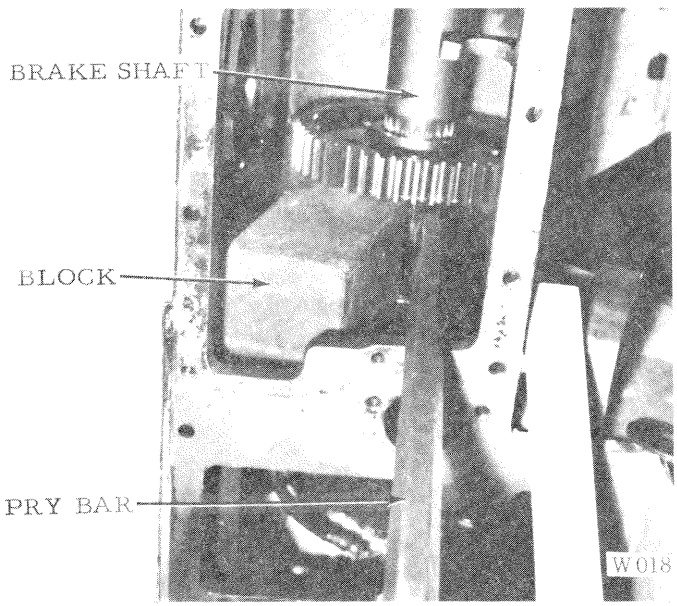


Figure 18

the shaft as in Step a., but do not block. Push the shaft to one side, hooking the gear over the side frame. Retain this position by wedging a piece of wood between the gear and bearing bore. Fig. 20. Tap the large gear off the shaft with a soft hammer. Fig. 21. Lift the shaft out of the case, using a hoist. Remove large gear.

14. Remove the tapered bearings remaining in the transmission case. Identify each bearing with its respective bore.

NOTE: While working a definite wear pattern is formed on the cup and cone of a tapered bearing assembly. The wear pattern is the equivalent of lapping the parts together. Consequently, longer bearing life will be experienced, if the original

SECTION A—WINCH

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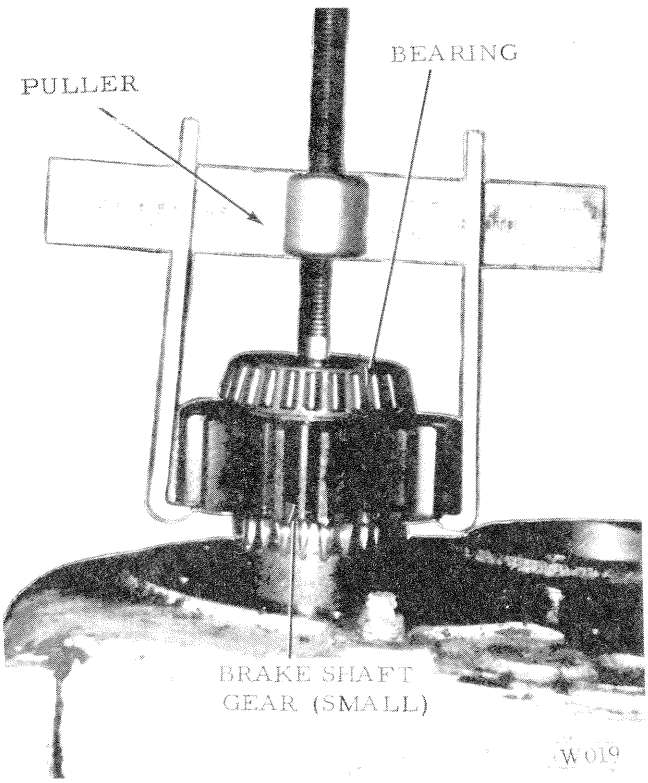


Figure 19

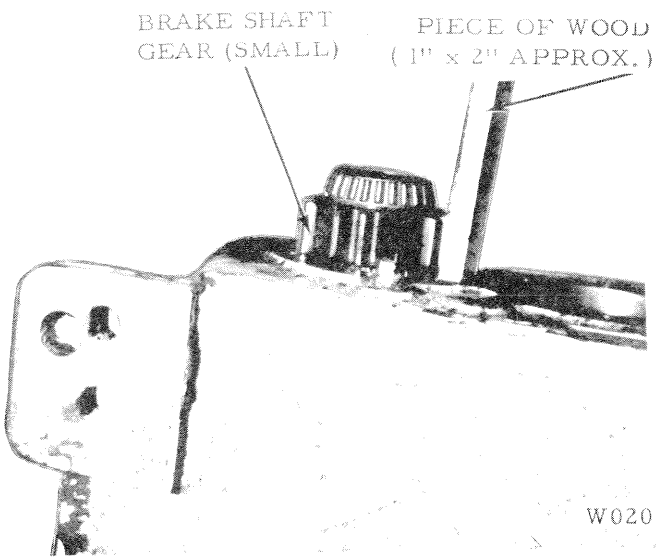


Figure 20

relationship is maintained between bearing parts.

15. Unscrew the drum shaft nut. Place a pan under the shaft to catch approximately two quarts of oil. Remove the bearing retainer from the side frame, by unscrewing the mounting capscrews and using puller screws. Note the shim pack thickness. Unscrew the place bolts securing the gear to the drum. Lift the inner bearing retainer and place bolts out. Fig. 22.

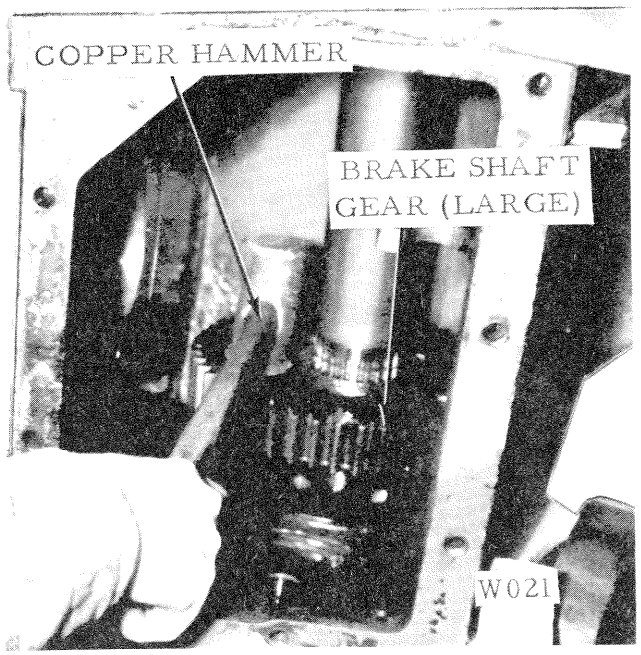


Figure 21

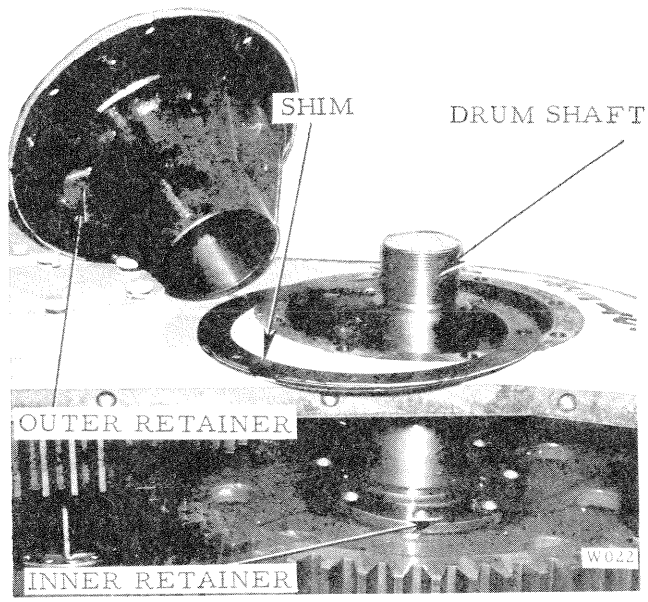


Figure 22

Turn a modified shaft nut onto the drum shaft and attach hoist to it. Pull the shaft straight up and out. Fig. 23.

NOTE: The running clearance of the drum shaft

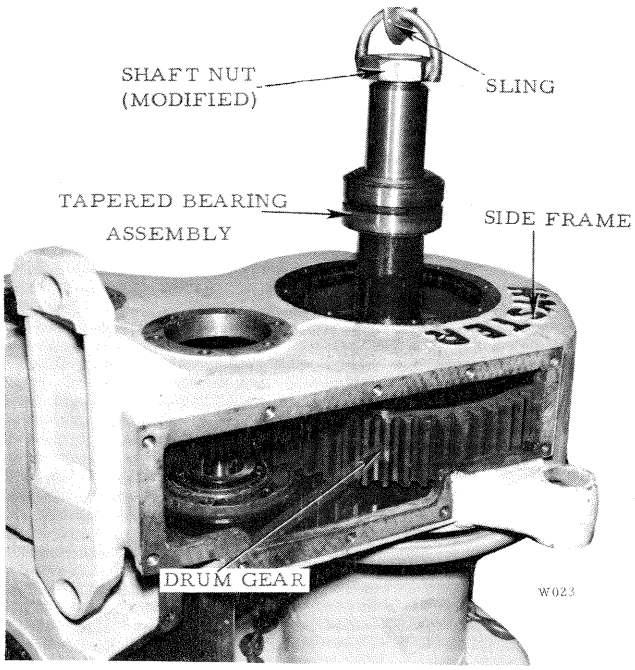


Figure 23

Figure 24

tapered bearings are pre-set, and cannot be changed. Each assembly is made of selected components which are not interchangeable with other similar components. Most generally the components in a given assembly have a common number will be etched on each of them. The number will be etched on the sides shown in fig. 24.

16. Work the drum gear, fig. 23, out of the side frame far enough to attach a hoist to it. Attach a hoist to the gear, remove the slack from the slinging, and pull the gear out.

17. If the transmission case and side frame are separate castings, unscrew the bolts holding them together. Fig. 25. Attach a hoist and sling to the side frame and lift it off the transmission case. Fig. 26.

18. Providing the drum has not already been removed, attach a sling and hoist to it and lift it off the transmission case.

19. Work the left bearing out of the drum, if it was pulled off during drum shaft removal.

POWER TAKE-OFF SHAFT (PTO)

A. General

The power take off shaft is commonly called

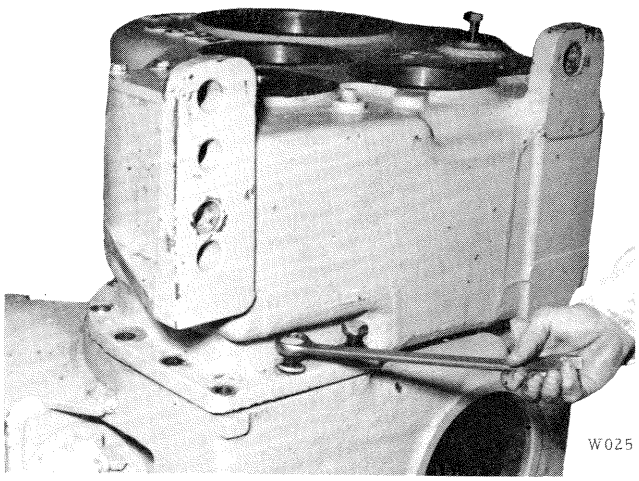


Figure 25

"PTO" and shall be referred to as such. It's purpose is to transfer torque from its source to the bevel gear shaft.

A long coupling, input shaft, pin and a lock ring are the components in the basic PTO shaft assembly. These will, however, vary between the standard speed and lo-speed units. Fig. 27. The bevel gear in the standard speed winch is splined to the input shaft, and held in position by a snap ring; on these, the bevel gear can be

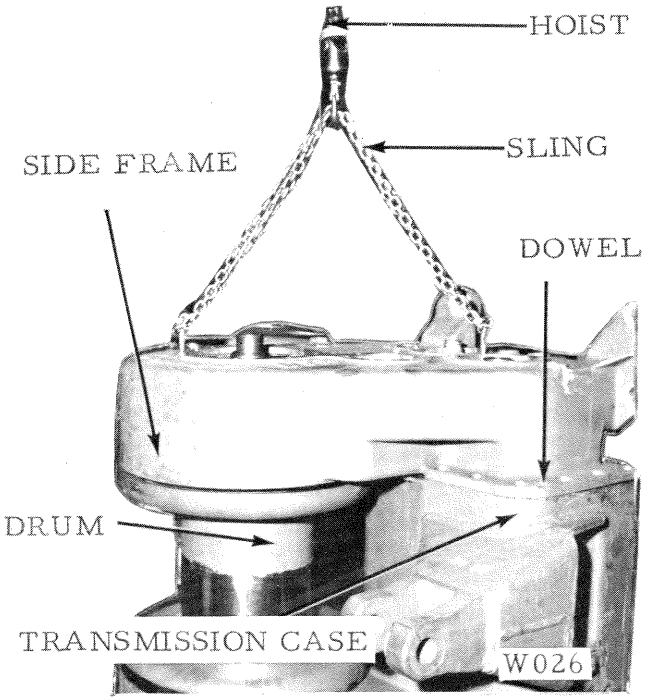


Figure 26

removed without removing the winch providing the bevel gear shaft is removed. In the lo-speed winch the bevel gear and input shaft are integral and held in position by spacer, lockwasher and locknut. The couplings differ between winches, depending upon the tractor on which the winch is installed.

On models other than the D6 winch the PTO shaft is supported by a double row ball bearing, and the gear depth is shim adjusted. The shims mission case. An O-ring on the carrier flange and a lip type seal pressed into the carrier bore, prevent leakage in these areas. The D6 PTO shaft is supported by a single row ball bearing.

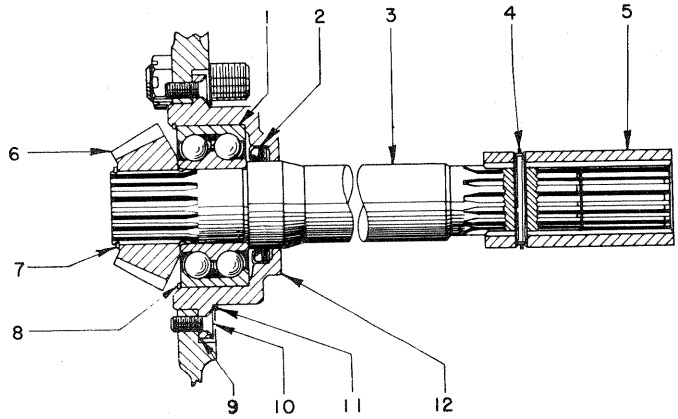
The bevel gears in the D6 and D7 winches are straight bevel. Spiral bevel gears are installed in the D89 models.

B. Removal

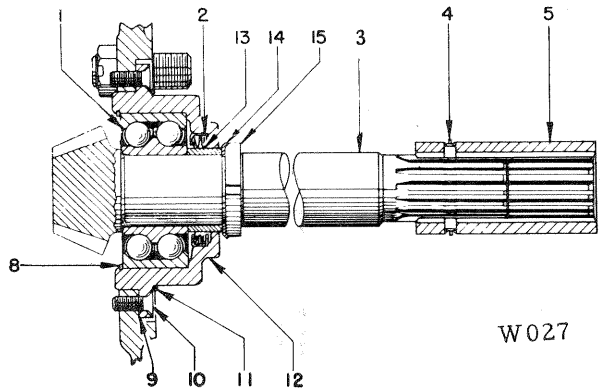
1. Remove the winch.

2. Check and record bevel gear back lash. Fig. 9. Unscrew the PTO shaft mounting cap-screws. Pull the shaft assembly out of the winch. Remove the shim pack and note its thickness. Fig. 10.

C. Disassembly



Power Take-Off Assembly
Standard Speed Winch



Power Take-Off Assembly
Lo-Speed Winch

1. Bearing
2. Oil Seal
3. Input Shaft
4. Pin and Lockring
5. Coupling
6. Bevel Gear
7. Snap Ring
8. Snap Ring
9. Shim Set
10. Flathead Capscrew Countersunk Lockwasher
11. O-Ring
12. Bearing Carrier
13. Spacer
14. Lockwasher
15. Locknut

Figure 27

1. Move the lockring out of position on the PTO shaft coupling. Fig. 27. Push the coupling retaining pin out. Pull the coupling off the input shaft.

2. Disassemble the remainder of the assembly, as follows:

a. Remove the snap ring holding the bevel gear on the standard speed input shaft. Pull the gear off the shaft. Remove the internal snap

ring retaining the bearing. Press the shaft, and bearing out the back of the bearing carrier, by applying pressure to the coupling end of the shaft. Remove the spacer. Press the shaft out of the bearing or the bearing out of the carrier, whichever the case may be. Extract the carrier seal. Fig. 27.

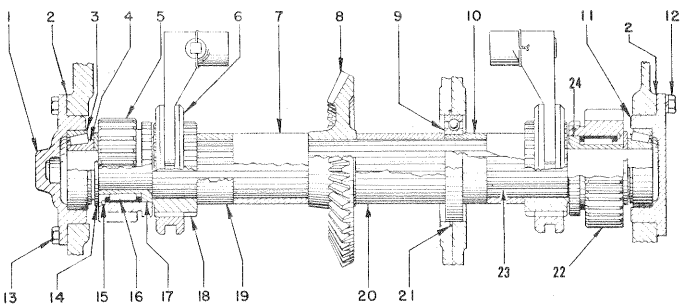
D. Assembly and Installation

Reverse "Disassembly" and "Removal".

BEVEL GEAR SHAFT AND CLUTCHES

A. General

Two tapered bearings and one single row ball bearing support the bevel gear shaft (clutch shaft). Figs. 11 and 28. Assembled on the shaft is a bevel gear, spacers and two clutch assemblies. Other components are also assembled on the shaft, depending on whether the winch is direct drive or power controlled. The endplay of the assembly is shim adjusted. The shims are located between the transmission case and both tapered bearing carriers. The only seal in this assembly is an O-ring located in a recess in the case ball bearing boss. Full length external splines on the shaft mate with internal splines on the shaft mate with internal splines in the clutch assemblies and bevel gear.



W028

BEVEL GEAR SHAFT
For Direct Drive Winch

1. Bearing Carrier
2. Shim
3. Bearing Cup
4. Bearing Cone
5. Gear
6. Dental Clutch
7. Spacer
8. Gear
9. Bearing
10. Bearing Carrier
11. Bearing Retainer
12. Capscrew-Lockwasher
13. Capscrew-Lockwasher
14. Washer
15. Snap Ring
16. Roller Bearing
17. Bearing Carrier
18. Dental Clutch Hub
19. Spacer
20. Spacer
21. O-Ring
22. Gear
23. Shaft
24. Bearing Carrier

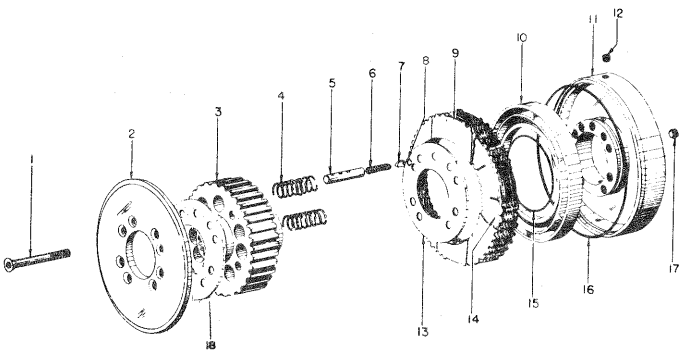
Figure 28

When the bevel gear shaft assembly is installed, the gear and shaft relationship is assured by the splines, spacers, ball bearing carrier and the clutch assemblies. The number of spacers will vary between winch models and types. Changing the drum rotation from "overwind" to "underwind" or vice versa is possible by changing the gear position. The D6 and D7 gear and hub are integral. Place bolts secure the gear to the D89 hub.

A collar with internal splines and an external groove is the dental clutch proper, however a hub and pinion gear may be considered as part of the dental clutch assembly. The hub is splined to the bevel gear shaft and has external splines which match those in the collar. The pinion gear in the left assembly is the drive gear of the second reduction gear set. In the right assembly it is the reverse gear. In either case, when the clutch is engaged the collar is moved toward the pinion gear until the splines of both components are meshed.

A shifting mechanism is used to shift the dental clutches. Fig. 3. This is an assembly of two shift forks, a shift rail, nut, washer, two springs of different sizes and a detent ball. Each shift fork is engaged with a dental clutch and attached to the shift rail. Although three adjacent detents are machined in all shift rails, the location of the group varies between models. Also, for several inches from the left end of the shift rail the diameter is smaller and partially threaded. Assembled on this end of the shaft is the larger spring, a shift collar assembly, washer and nut. The shift collar assembly consists of two washers and a spacer. A bell crank in the handling gear actuates the shift lever through the collar. The smaller spring, detent ball and the three detents hold the transmission in forward, neutral or reverse, whichever is selected. An internal snap ring in each pinion gear bore prevents gear moving toward the clutch hub. A large washer between each pinion gear and the nearest tapered bearing, prevents gear moving toward the bearing.

All multiple disc clutch assemblies are similar in construction and the parts are shown in fig. 29. Forward drum rotation is obtained by applying the forward (left) clutch and releasing the brake. Included in each assembly is a piston



W029

CLUTCH ASSEMBLY

1. Special Capscrew
2. Pressure Plate
3. Clutch Hub
4. Spring
5. Valve Body
6. Spring
7. Plunger
8. Snap Ring
9. Friction Disc
10. Clutch Piston
11. Housing
12. Pipe Plug
13. Spring Retainer
14. Separator Plate
15. O-Ring
16. O-Ring
17. Setscrew
18. Shim

Figure 29

and housing assembly, separator plates, friction discs, hub and release springs. These are secured as an assembly by a retainer plate and socket head through bolts. In turn each bolt is locked with a socket head set screw. A cooling valve assembly, spring retainer and shims are also parts in the clutch assembly.

The hub is drilled to allow the release springs, cooling valve and clutch apply oil to pass through it. Internal and external splines lock the hub to the shaft and separator plates. The separator plates are made of steel, have internal lugs and dished. Friction material is bonded to both sides of the friction discs, which have external lugs. Separator plates and friction discs alternately placed on the hub to provide maximum friction area. Also, the clearance of these is shim adjusted by shimming between the hub and retainer plate.

Torque is transferred through the multiple disc clutch when it is applied (plates and discs are squeezed together). This is done hydraulically through piston and housing assembly.

The piston housing is recessed to receive the piston and has a passage which allows oil to enter a cavity behind the piston. O-rings, also in the housing, prevent leakage between the piston and housing, during clutch application.

Clutch over heating is prevented by the cooling valve. This assembly consists of a body, spring and plunger. The body is tubular, closed on one end (threaded on the other), and has three holes. Near the open end is an internal snap ring which retains the spring and plunger. The assembly is screwed into the piston housing where it is in communication with the piston apply oil.

The through bolts go through all of the release springs but the one that surrounds the cooling valve. One end of each spring presses against the retainer plate and the other end holds the spring retainer against the piston, thus pushing the piston into the piston housing.

A manually operated hydraulic valve controls the clutch apply oil. Each bearing carrier supporting the bevel gear shaft is connected to the valve by hydraulic hose. The right end of the shaft is hydraulically connected to its respective hose through a drilled passage in the right bearing carrier. The hose to the left end of shaft is screwed directly into the carrier putting it in direct communication with the shaft end. Each end of the shaft has a drilled passage to the clutch hubs. Seal inserts between the clutch hub and shaft prevent leakage between the splines of the two components. Leakage between the shaft and bearing carriers is prevented by a seal ring on each shaft end.

The pinion gears driven by the multiple disc clutches are integral with a spider. In this case the spider is basically a pinion gear attached to a larger ring gear having internal splines (teeth). The ring gear fits over the separator plates and clutch discs and is driven by the friction disc lugs when the clutch is applied. Spider end movement is controlled by an internal snap ring and washer, in same manner as the pinions in the dental clutch assemblies.

Forward drum rotation is obtained by applying the forward (left) multiple disc clutch and releasing the brake. In neutral both clutches are released. In reverse the reverse multiple disc clutch is applied and brake released. Under no circumstances are both clutches applied at the same time. The brake is released when either clutch is applied.

B. Removal

1. Position the right track pad so the growsers are not in line with the clutch shaft during removal. Drain the oil from the winch.

2. Remove the brake assembly, including the band if so equipped. Disconnect hydraulic lines and remove any hydraulic equipment that would interfere with the removal of the left bearing retainer of the power controlled winch.

3. Remove the transmission and side frame cover. Remove the shifter mechanism from the direct drive winch, as follows:

a. Lift the detent ball and spring out. Fig. 3. Remove the side cover from the control housing. Disconnect the shifter cable from the crank. Fig. 5.

NOTE: The detent ball and spring is located under the transmission cover near the right end of the D6 and D89 shift rails and near the left end of the D7 shift rails. Use a magnetic pick-up to lift the ball out of the hole.

b. Unscrew the nut retaining the shift collar and spring. Remove these parts from the end of the shaft. Fig. 30.

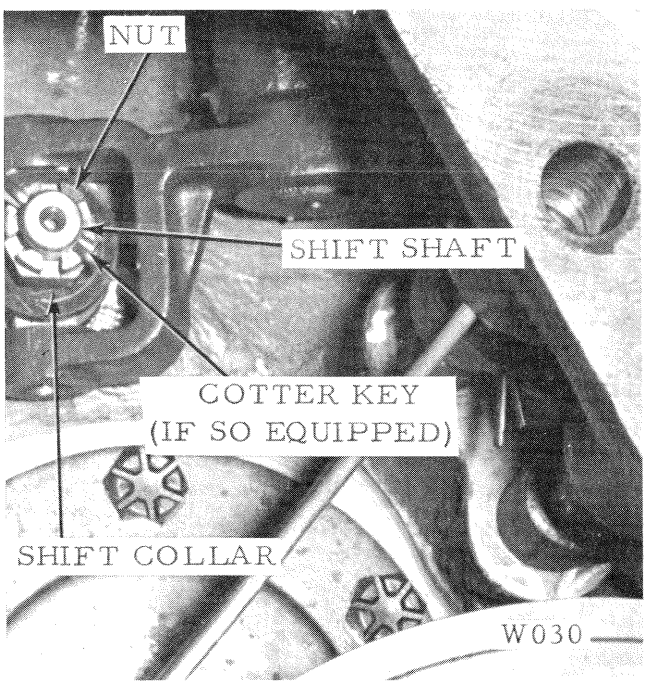


Figure 30

c. Cut the lockwires securing the shift fork setscrews. Fig. 3. Unscrew the setscrews.

d. Pull the shift rail out of the case, slowly. Lift the forks out as the rail is pulled out of them.

4. Check and record bevel gear shaft endplay and gear lash. Fig. 9. Unscrew the bolts securing the left and the right bearing retainer using puller screws whenever tapped holes are provided. Note and record the thickness of the shim packs. Remove the seal rings from the end of power controlled shafts.

CAUTION: Do not mix shims of the individual packs; otherwise the gear lash may be altered. Endplay is affected by adding or subtracting shims.

NOTE: Step 5 pertains to power controlled winches only.

5. Remove the seal ring (18), fig. 11, from each end of the shaft. Straighten the washer tang locking the nut to the right end of the shaft. Unscrew the nut (27). Remove the tang washer (27) and snap ring (19).

6. Remove the internal snap ring from the right pinion gear.

7. Pull the shaft out of the right side of winch utilizing the tapped puller holes as necessary. Lift the shaft components out of the winch as the shaft is withdrawn.

NOTE: A sling attached to the power controlled clutches will aid in the removal of these assemblies.

C. Clutch Disassembly

1. Lift the spider gear off the clutch assembly Fig. 31. Use an impact driver to remove the socket head setscrews locking the assembly capscrews Fig. 32.

NOTE: When removing the setscrews the assembly may be held stationary as described in Step 2.

2. Unscrew the socket head assembly cap-

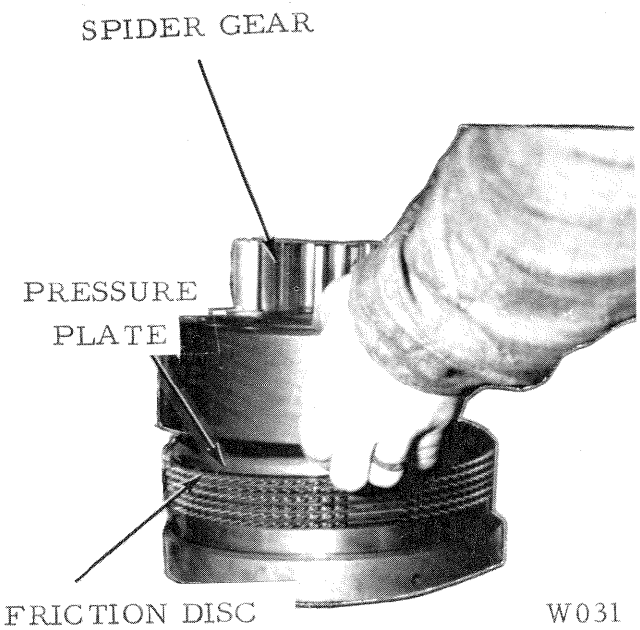


Figure 31

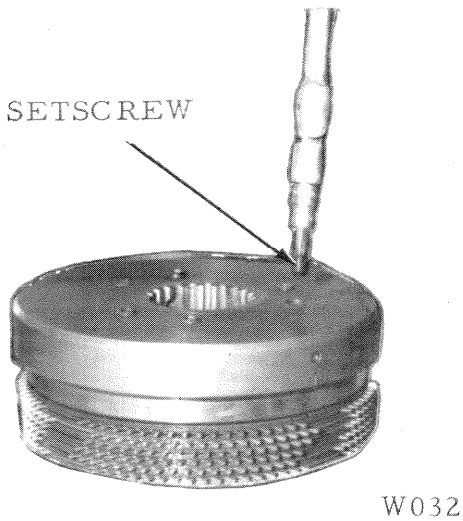


Figure 32

2. Use an impact driver to remove the socket head assembly capscrews. Unusually tight capscrews will have to have the capscrew head drilled off it. Use a Visegrip to remove remaining capscrew. The assembly should be clamped in a vise, or in a press as shown in Fig. 33.

3. Lift the pressure plate and shim off. Remove the release springs. Fig. 34. Note the relationship between the hub, cooling valve, friction discs and separator plates. Fig. 35. Lift the friction discs and separator plates off the hub. Remove the hub.

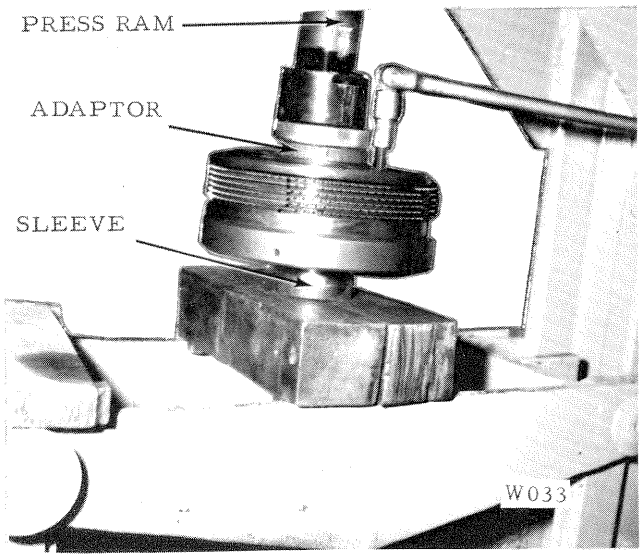


Figure 33

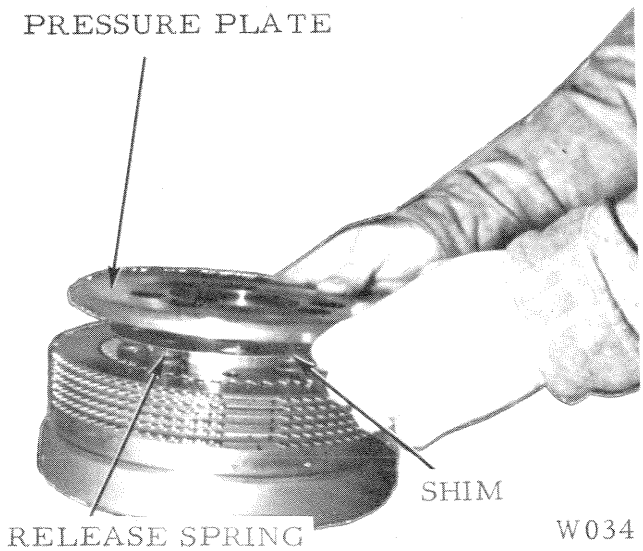


Figure 34

4. Lift the spring retainer out of the piston. Unscrew the cooling valve; remove its internal snap ring, valve and spring. Fig. 36.

5. Remove the piston from the piston housing. Remove the two O-rings from the bore of the housing. Fig. 37.

D. Clutch Assembly

Lubricate and assemble parts in the reverse order

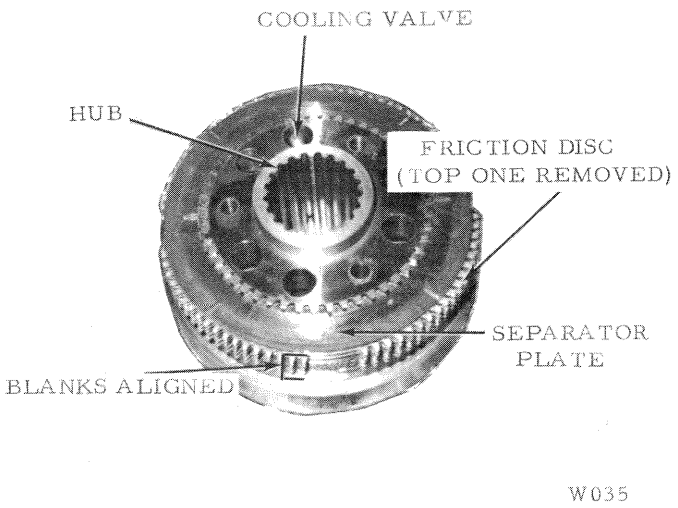


Figure 35

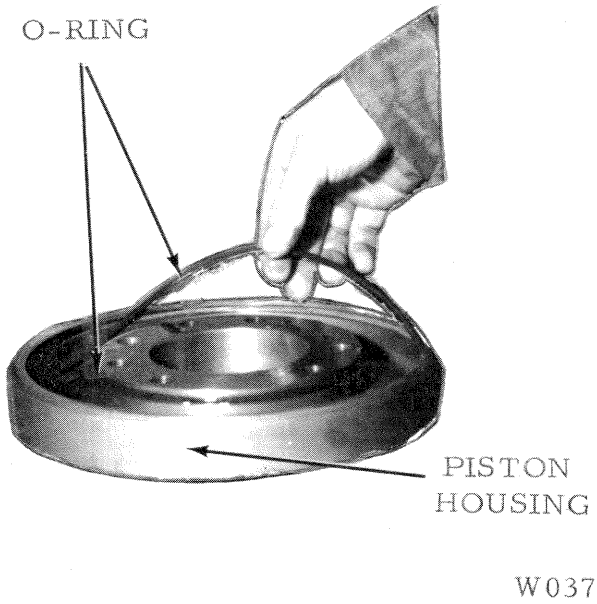


Figure 37

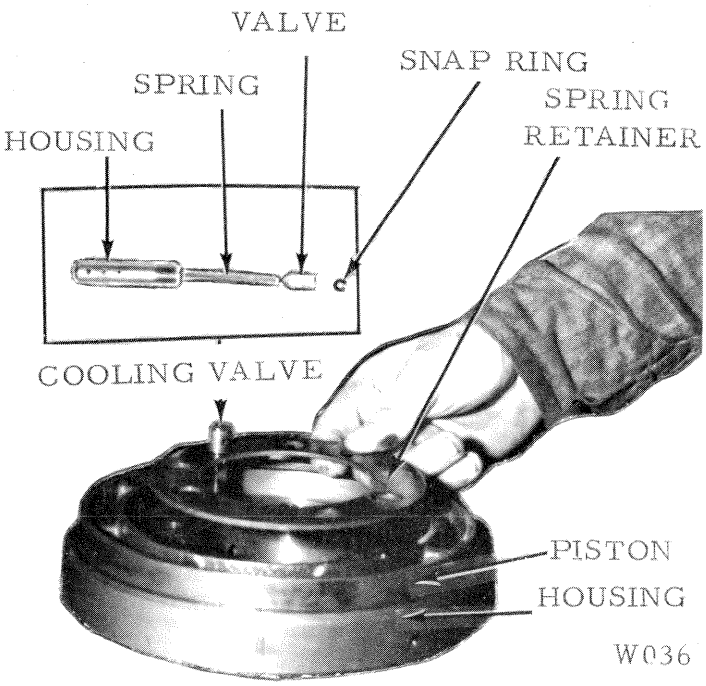


Figure 36

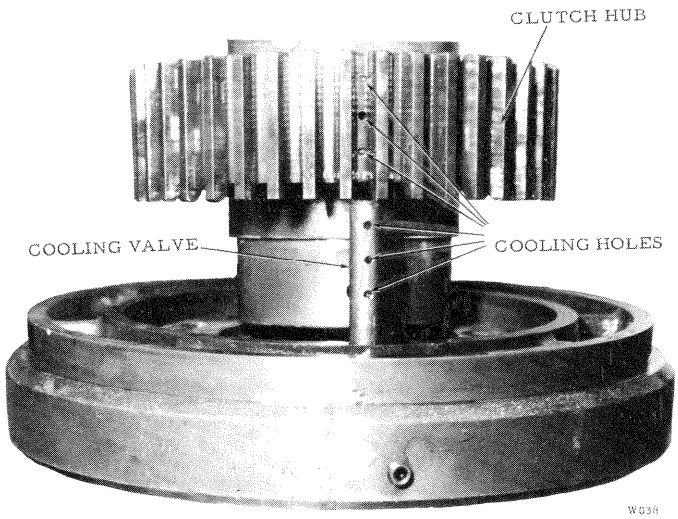


Figure 38

of disassembly. Assemble the separator plates with the dish of each facing the same direction. A separator plate should contact the piston. If necessary, stretch the large piston housing O-ring so it will stay in its groove long enough to push the piston into its housing. The cooling holes in the clutch hub must align with the holes in the cooling valve. Fig. 38. The blanked out teeth of the friction discs must be in line.

Fig. 35. Add or delete shims as required to obtain .085" to .125" clearance between the pressure plate and the top friction. Measure the air gap in two places 180° apart. Torque the assembly capscrews to 70 ft./lbs. and the setscrews to 40 ft./lbs.

E. Installation

NOTE: Lubricate all parts during assembly.

1. Assemble the parts on the shaft while push-

ing it through the right side of the winch and through the case. Assemble the shaft in the reverse order in which they were removed.

2. Secure the left bearing retainers and shims. Check and adjust the shim pack thickness as follows:

a. Temporarily install the bearing retainer, without shims and the capscrews tightened snugly and evenly.

b. With feeler gauges, measure the gap between the retainer and side frame. Measure the gap in several places around the retainer, and determine the average measurement.

c. The shim pack thickness should equal the average measurement for zero endplay. Delete shims to produce .000 to .004 in. preload.

NOTE: It may be necessary to make a shim for under the bearing cup in the retainer to obtain clearance between the retainer and winch case. Never install the retainer without shims.

d. Remove the bearing retainer. Place the shim pack in position and attach the retainer. Tighten the capscrews to the correct torque.

NOTE: When adjusting shaft end play, try to obtain the lower specification.

3. Apply a film of white lead to several gear teeth; turn the gears to obtain a pattern and compare the pattern with figs. 39 through 44. Check pattern on the drive side of the gears.

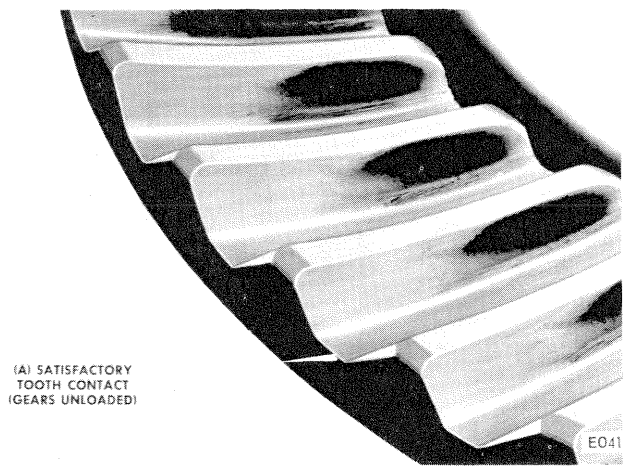


Figure 39

NOTE: Adjust shim pack under PTO bearing carrier to produce .006 to .014 in. gear clearance.

NOTE: The patterns illustrated are for spiral bevel gears. However, they can be used as a guide in obtaining the correct mesh of the straight bevel gears.

a. Figs. 39 and 40 show correct tooth contact.

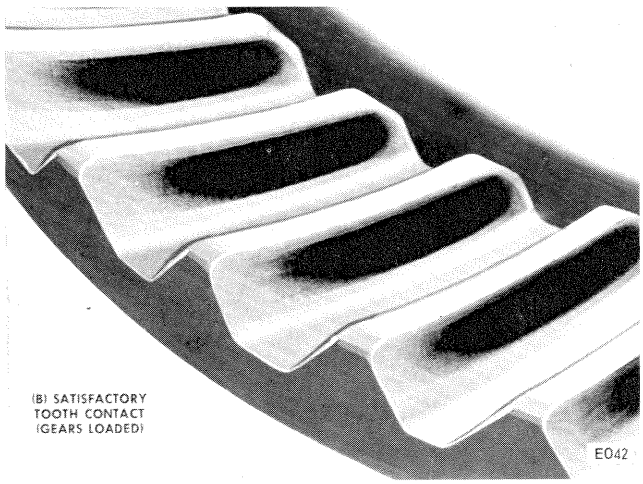


Figure 40

b. Fig. 41 shows short contact at heel, To correct, move gear toward pinion. Then move pinion away from gear to again obtain correct backlash.

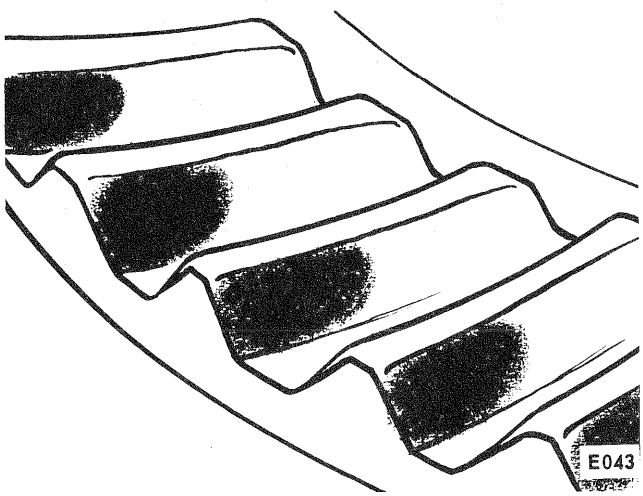


Figure 41

c. Fig. 42 shows short contact at toe. To correct, move gear away from pinion. Then move pinion toward gear to again secure correct backlash.

d. Fig. 43 shows heavy contact on flank or lower portion of tooth. To correct, move pinion away from gear until contact comes to full

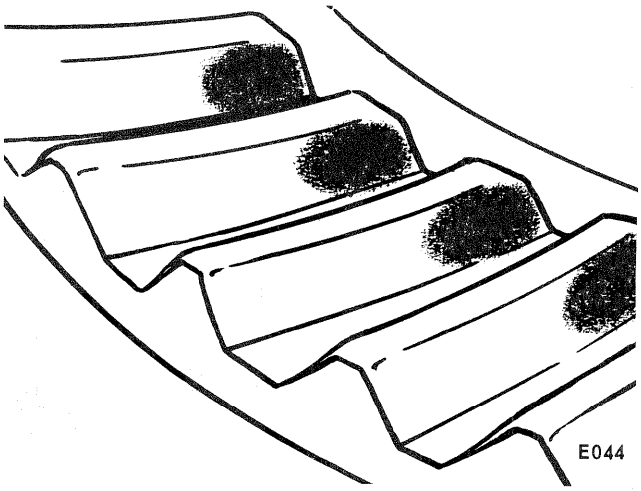


Figure 42

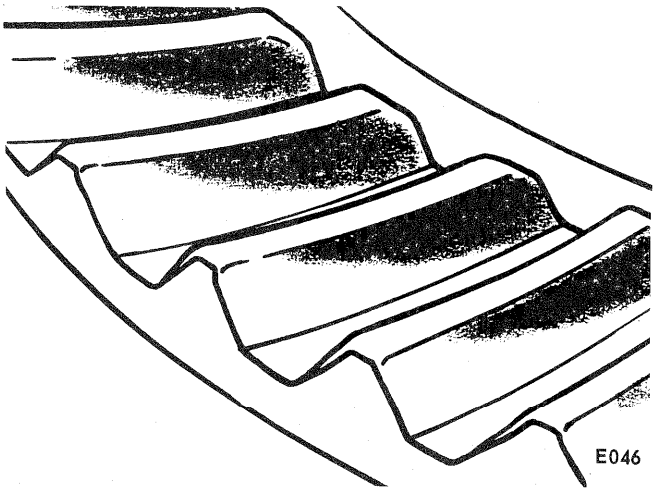


Figure 44

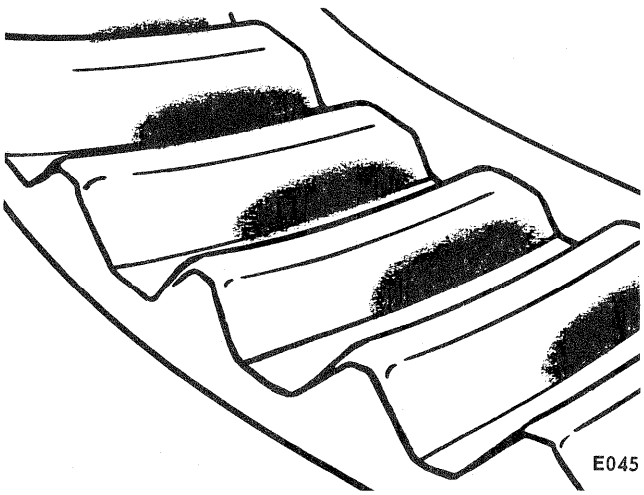


Figure 43

working depth of tooth without breaking contact at flank. Then move gear toward pinion to secure correct backlash.

e. Fig. 44 shows heavy contact on face of upper portion of tooth. To correct, move pinion toward gear until contact covers flank of tooth without breaking contact at face. Then move gear away from pinion to secure correct backlash.

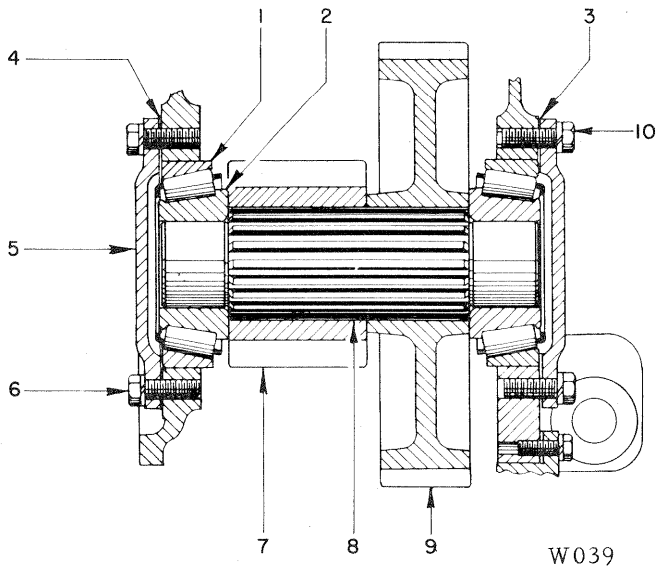
4. Install the brake, linkage hydraulic equipment and remaining parts in the reverse order in which they were removed. Adjust the control cables and brake band, if so equipped.

5. Fill the power control winch with 10 weight oil and the direct drive winch with 90 weight gear oil.

INTERMEDIATE SHAFT

A. General

Two tapered bearings supporting a short shaft that is splined to two gears are the components in the intermediate shaft assembly. Fig. 45.



INTERMEDIATE GEAR

1. Bearing Cup
2. Bearing Cone
3. Shim
4. Gasket
5. Retainer
6. Place Bolt
7. Drum pinion Gear
8. Shaft
9. Gear
10. Capscrew
11. Lockwasher

Figure 45

The intermediate gear and is meshed with the pinion on the brake shaft. It is also in mesh with the reverse pinion on the bevel gear shaft. The smaller gear is the drum drive pinion. Assembly endplay is shim adjusted. The shims are located between the right bearing retainer and frame. Shaft should have .007 in. endplay.

B. Removal

1. Unscrew the bolts securing the outer bearing retainer. Remove the retainer and note the shim pack thickness.

2. Pull the shaft out of the side frame, utilizing the shaft puller hole as necessary.

3. To remove the gears, remove the cover from the side frame, outer drum shaft retainer and sometimes the inner drum shaft retainer; then, lift the gears out.

C. Installation

1. Reverse the "Removal" procedure.

2. To find the shim pack thickness, attach the right bearing retainer snugly, find the average gap measurement between retainer and side frame, and add the specified shaft end play to the average measurement.

BRAKE SHAFT

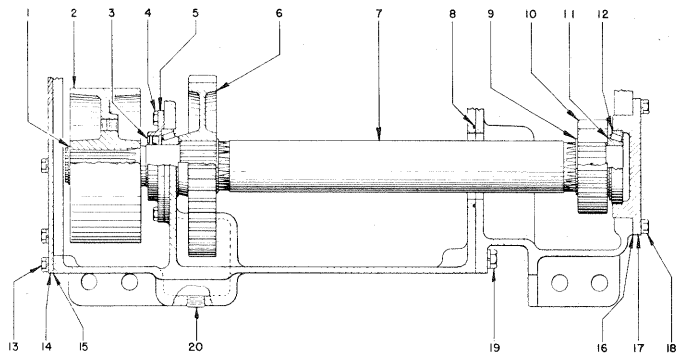
A. General

Splined to the left end of the brake shaft is a gear and a brake drum or a multiple disc oil brake assembly. Fig. 46. The gear is the driven gear in the second reduction set when drum is rotating forward. A gear splined to the right end of the shaft is the pinion of the intermediate gear set. In the D6 and D7 winches a snap ring is installed on the shaft behind the gears to prevent these from sliding further onto the splines. Spacers are used for this purpose in the D89 winches. A snap ring secures the brake to the shaft, regardless of type. The shaft assembly is supported by two tapered bearings, one of which is located between the brake and gear. The retainer of this bearing is equipped with a lip type oil seal, that prevents leakage in this area. Shaft preload is shim adjusted. The shims are located between the right bearing retainer or carrier, whichever the case may be.

B. Removal

1. Break the right track, at the rear of the tractor, so the shaft will clear it when removed.

2. Drain the lubricant. Remove the large cover from the left side of the winch.



BRAKE SHAFT W040

1. Snap Ring
2. Brake Wheel
3. Oil Seal
4. Capscrew
5. Oil Seal Retainer Gasket
6. Gear
7. Brake Shaft
8. O-Ring
9. Snap Ring
10. Gear
11. Bearing Cone
12. Bearing Cup
13. Capscrew Lockwasher
14. Cover Plate
15. Gasket
16. Shim
17. Bearing Carrier
18. Capscrew Lockwasher
19. Capscrew Lockwasher-Dowel
20. Pipe Plug

Figure 46

3. Remove the oil brake, mechanical brake or automatic brake, whichever the case may be. Remove the inner snap ring.

4. Remove the left and right bearing retainer, using puller screws whenever possible. Note and record the shim pack thickness.

5. Pull the shaft out the right side of the winch, using the puller hole in the shaft whenever possible. Prevent dropping the left bearing into the case, hold a wooden dowel firmly against the left end of the shaft as the shaft is pulled out.

6. When the shaft is pulled out of the bearing, carefully pull the dowel out of the case while guiding the bearing through the bearing retainer hole.

7. Remove the large gear by removing the bevel gear shaft removal; then, lift the gear out of the case.

C. Installation

1. Lay the gear in the bottom of the case, with longest side of the hub toward the brake.

2. Insert the brake shaft through its hole in the right side of the winch and into the bore of the large gear.

3. Push the shaft toward the left side of the winch. When possible, start the bearing onto the left end of the shaft.

4. With the shaft protruding beyond the left

side of the winch, push the left bearing retainer over the end of the shaft and against the case. With brake shaft horizontal, attach the left bearing retainer; be careful not to damage the seals.

5. Push the shaft to the left as far as possible. Tap the right bearing cup into the case firmly against the mating bearing. Attach the right bearing retainer with the attaching bolts equally tightened to slightly more than finger tight.

6. Measure the gap between the right bearing retainer and the case in several places. Average the gap. Make a shim pack equal to the average gap. Remove shims to produce .000 to —.004 in. preload.

7. Install the corrected shim pack between the right bearing retainer and side frame. Tighten the attaching bolts.

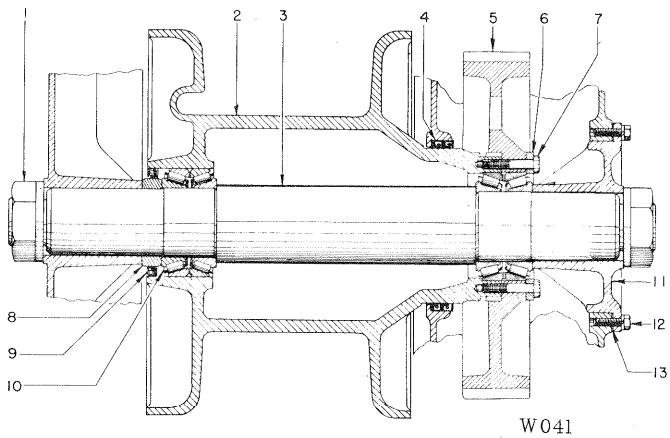
8. Install: the brake; bevel gear shaft; both top covers; left cover. Fill the winch to the proper level with lubricant. Connect the tractor track.

DRUM AND DRUM SHAFT

A. General

The drum shaft supports the drum through two pairs of tapered bearings, one pair in each end of the drum. Fig. 47. A nut screwed onto each end of it secures the shaft. A spacer on the shaft, between the left bearing and transmission case, maintains bearing-to-shaft relationship. Also in this area and pressed into the drum hub is a lip type seal. The lip contacts the space to prevent foreign particles entering the drum in this area.

Attached to the right side of the D6C, D7F, D89A, D89B, and early D7H drums is a gear and retainer plate. Fig. 47. Internal splines in the gear are constantly engaged with external splines on the drum hub. The retainer plate and the bottom of the bearing counterbore in the drum restricts axial drum movement. The gear is in constant mesh with its drive pinion on the intermediate shaft. A lip type seal pressed into the frame contacts the drum hub to prevent contamination in this area. The drums in the D6C winches and later D7H winches are bolted to a drive flange which is splined to the drive gear; these drums are distinguished by a circle of holes on the right flange, and can be removed without removing the winch.



DRUM ASSEMBLY

1. Nut
2. Drum
3. Shaft
4. Oil Seal
5. Drum Gear
6. Inner Retainer
7. Place Bolt
8. Spacer
9. Oil Seal
10. Bearing
11. Outer Retainer
12. Capscrew Lockwasher
13. Shim Set

Figure 47

B. Removal

1. Unscrew the driving bolts securing the drum to the drive flange. Attach a hoist to the drum using a bar and sling. Remove the slack from slinging. Fig. 48.

2. Unscrew the drum shaft nuts and the bolts securing the outer retainer to the side frame. With the aid of puller screws, separate the outer retainer from the side frame; then pull the retainer out of the side frame. Fig. 49. Note the shim pack thickness.

3. Unscrew the bolts securing the inner retainer. Lift the retainer out of the side frame. Fig. 50. Attach the drum gear to the drive flange with two bolts placed 180° apart. Place a drain pan under the drum to catch approximately two quarts of oil.

4. Using a soft drift and hammer, tap the drum shaft toward the right side until the bearings are out of their bores. Pull the shaft out. Fig. 51.

NOTE: In Step 4, it may be necessary to raise or lower the drum to relieve any pressure that may be preventing shaft removal.

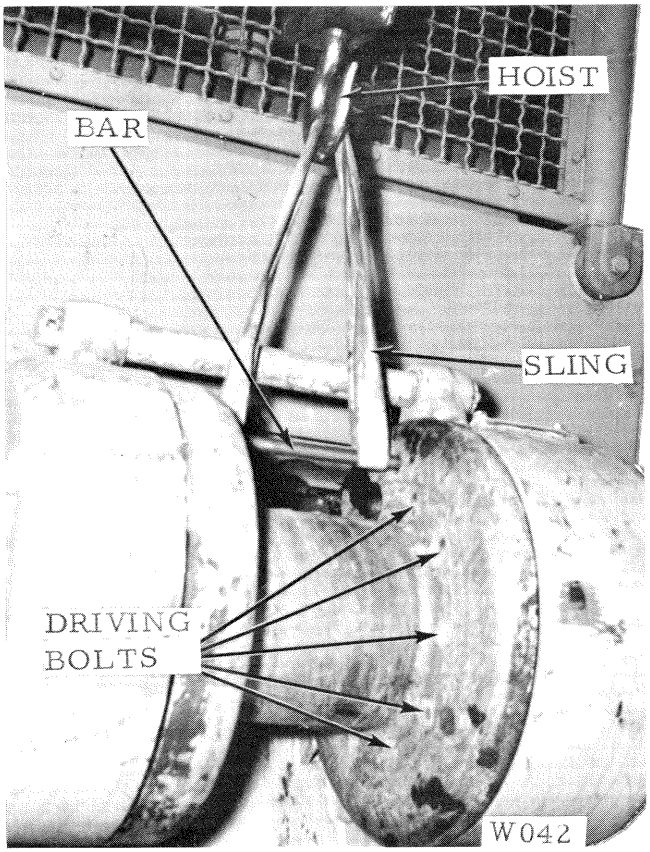


Figure 48

5. If the drive flange was not forced off the drum during shaft removal, insert a long piece of wood through the right side of the winch, through the drum and against the hub of the driving flange. Rap the end of the wood with a hammer until the flange is driven out of its counterbore in the drum. Fig. 52.

6. Pull the drum out of the winch, being careful not to spill the oil that is inside of it. Drain the oil from the drum. Remove the left shaft bearing asembly from the center of the drum, if it was pulled off during shaft removal.

7. Unscrew the two bolts securing the drum gear to the drive flange. Carefully pull the driving flange, fig. 53, out of the drum drive gear and side frame. Pull on one side of the flange and then the other until the flange is free of the gear.

NOTE: To support the flange during its removal, attach a hoist to it, utilizing a drive bolt hole.

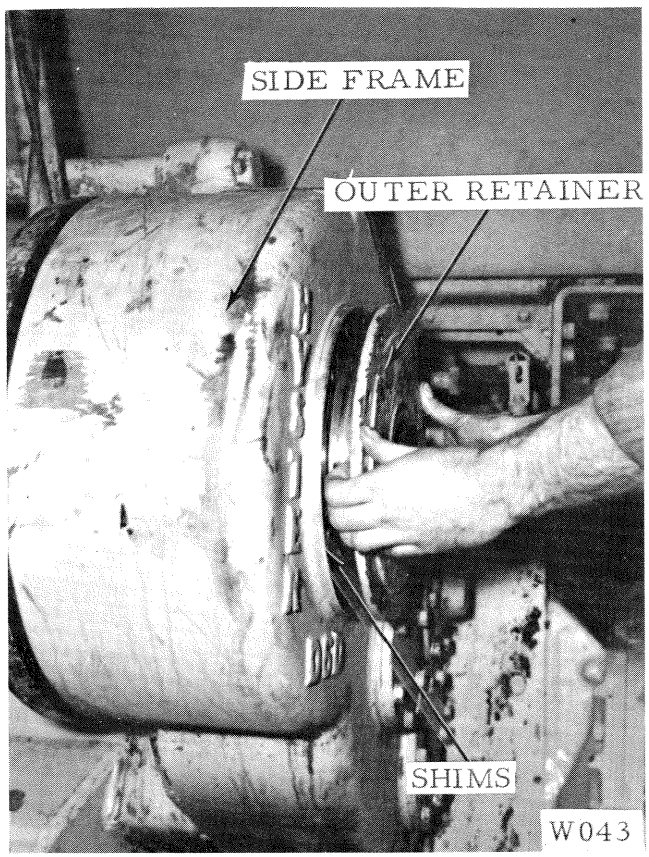


Figure 49

8. Pull the shaft bearings off the shaft only if necessary.

NOTE: The running clearances of the drum shaft tapered bearings are pre-set, and cannot be changed. Each assembly is made of selected components which are not interchangeable with others that are similar. Most generally the components in a given assembly have a common number etched on each of them. The number will be etched on the sides shown in fig. 24.

C. Cleaning and Inspection

1. Clean all parts with solvent.

2. Check the bearings. The assembly should be replaced, if any part is defective.

3. Remove nicks and burrs from machined surfaces.

4. Replace the seal in the right end of the drum bore and the seal in the side frame, if they were leaking before drum removal. Check the mating surfaces of these; smooth out minor scratches and defects with fine sandpaper.

WINCH

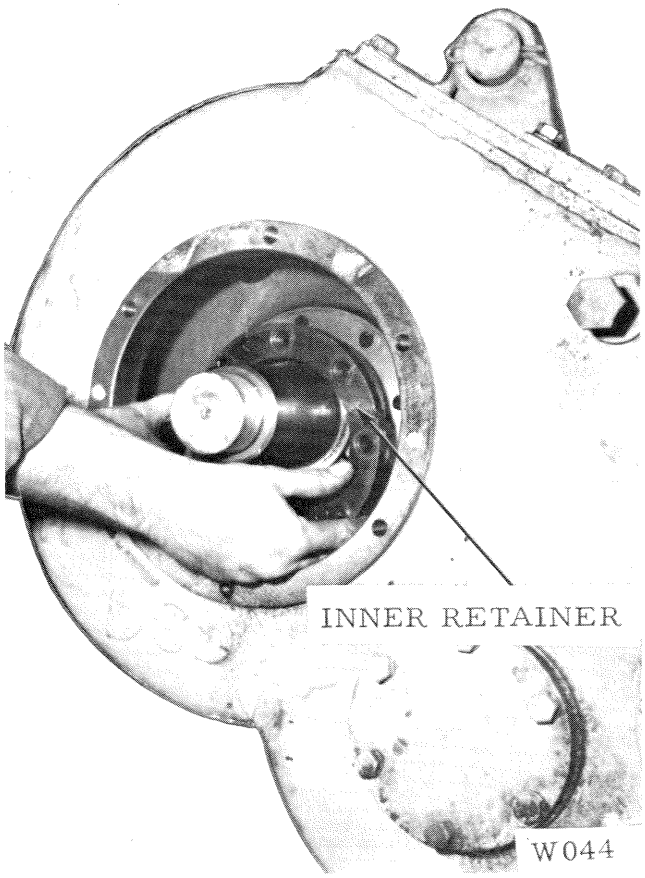


Figure 50

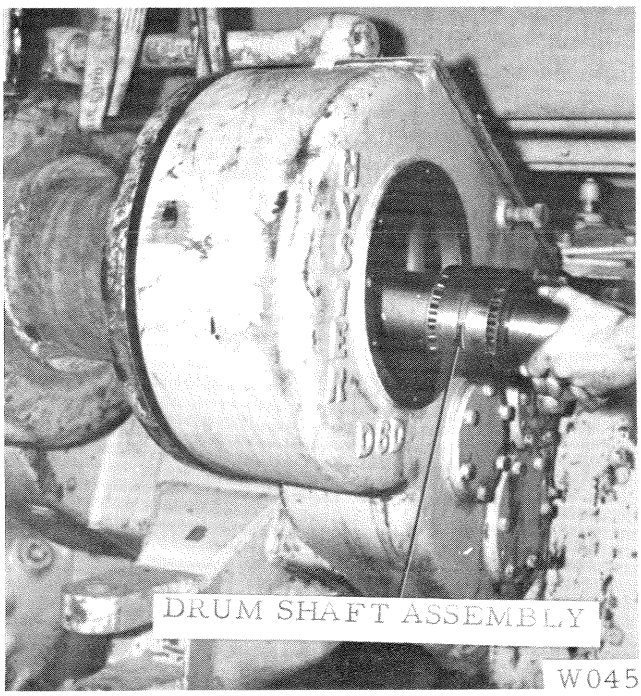


Figure 51

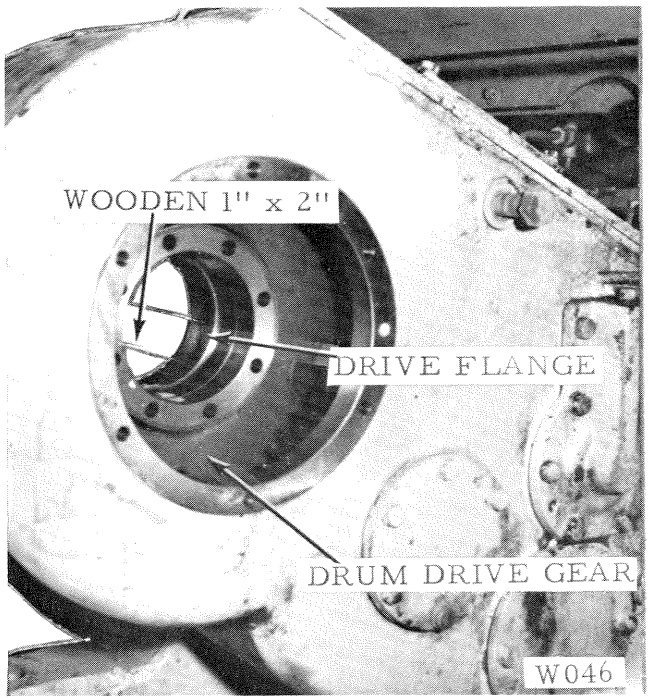


Figure 52

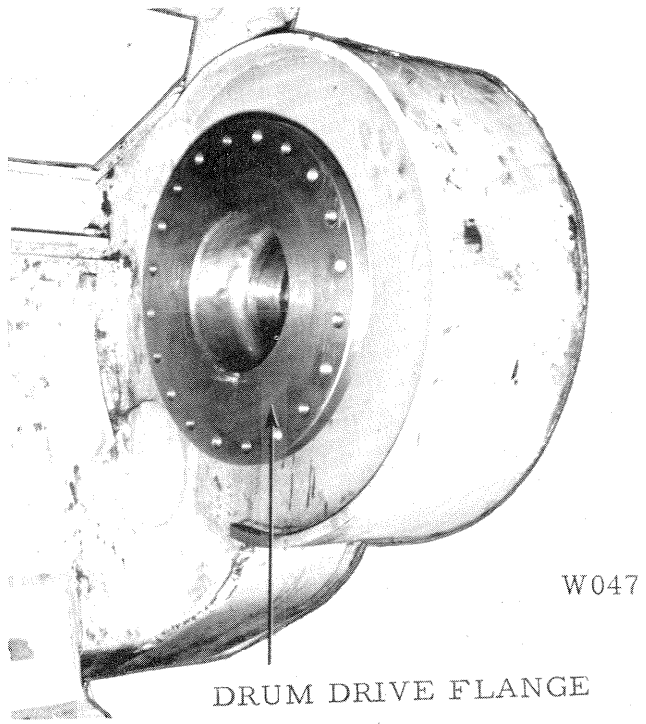


Figure 53

5. Grooves in the drum barrel should be filled by welding or metalizing and machined flat, especially if grooves are deep and a new cable is to be installed.

D. Installation

1. Install the side frame seal with seal lip toward the drum gear.

2. Lubricate the sealing surface of the drive flange. Carefully insert the splined end through the side frame seal and into the drum gear. Fig. 53.

3. Press the left hand bearing assembly into the drum bore far enough to make room for the seal. Press the seal into the drum bore, flush with the end of the drum and with the lip away from the bearing. Lubricate the spacer and position it in the seal, next to the bearing.

4. Affix a sling and hoist to the drum. Raise drum to winch height. Pour approximately two quarts of winch lubricant into the drum bore.

5. Place an O-ring in the drive flange counterbore, fig. 54, with the drive flange, fig. 53. Work the drum to the right until the flange is seated in the counterbore, making sure the bolt holes in the drum and flange are aligned.

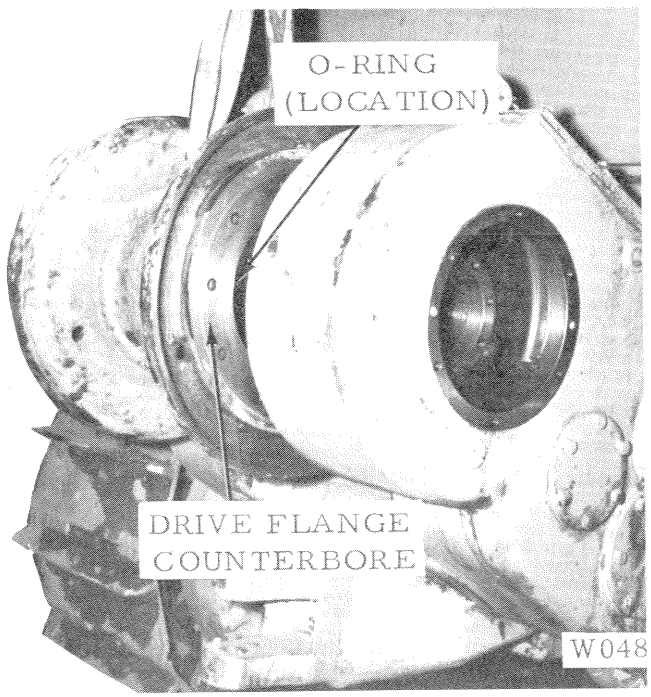


Figure 54

6. Push the tapered dowels on the drive bolts. Insert the drive bolt through the bolt holes in the drum and screw them into the driving flange.

7. Push the drum drive gear completely onto the drive flange splines. Slide the drum shaft through drum gear, drum, left drum bearing and left side frame. Fig. 51. Tighten the shaft nut against the left side frame. Secure the inner retainer, fig. 50, to the drum gear with the attachin

8. Tighten the drum drive bolts to specified torque. Fig. 55. Screw the left nut onto the drum shaft, and tighten it securely.

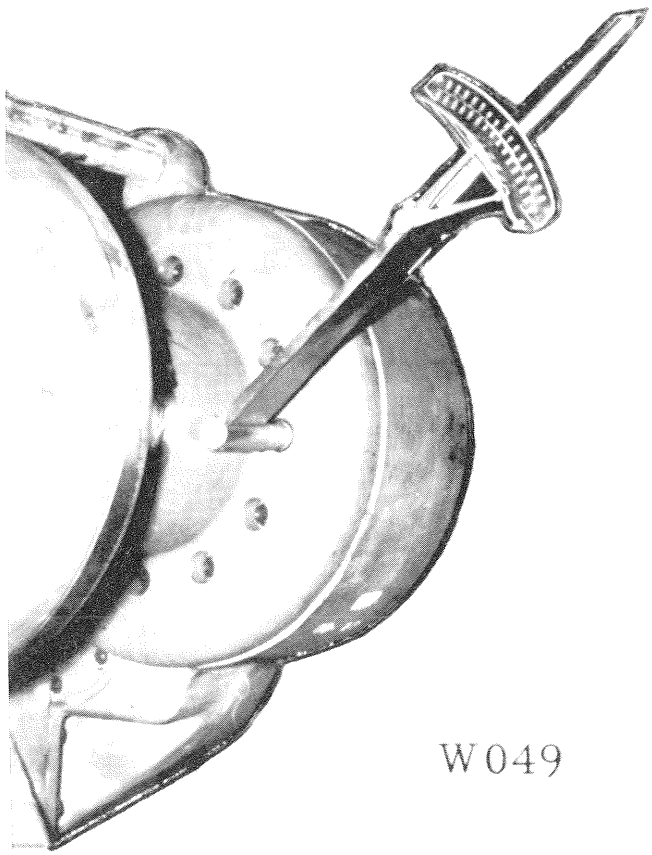


Figure 55

9. Slide the outer retainer onto the drum shaft and against the shaft bearing. Fig. 49. Screw the right shaft nut onto the shaft and tighten it securely.

10. Measure the gap between the outer retainer and the right side frame. Adjust the shim pack

thickness to the measurement obtained. Remove the outer retainer; then re-install it with the adjusted shim pack between it and the side frame. Secure the retainer with its mounting bolts and lockwashers, and with the shaft nut.

NOTE: In Step 10, the original shim pack should be correct; however, it should be checked especially if any shaft parts were replaced. If the exact shim pack thickness cannot be obtained it is better to have it slightly thicker than thinner.

11. Attach the cable to the drum and spool it onto the drum evenly.

OVERWIND AND UNDERWIND

A. General

When the cable passes over the top of the drum during forward rotation (haul-in) the drum is said to be overwinding. The drum is underwinding when the cable is pulled under it during forward rotation.

Unless otherwise specified the winch is set to overwind at the factory. However, the winch can be modified to underwind or vice versa.

B. Wind Modification - Direct Drive

1. Pull the bevel gear shaft out of the right side of the case far enough to enable switching places with the bevel gear (X) and spacer (Y). Fig. 56. Push the shaft into place and secure it after the switch is made.

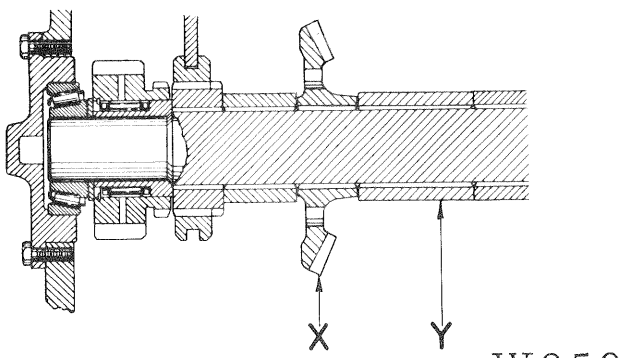


Figure 56

NOTE: In Step 1, the driven gear is moved from one side of the driving gear to the other. This operation may affect the gear lash, but it should not affect the shaft endplay. However, both should be checked and adjusted if necessary.

2. Change the anchoring end of the brake band, by changing the positions of pins (A) and (B), fig. 57.

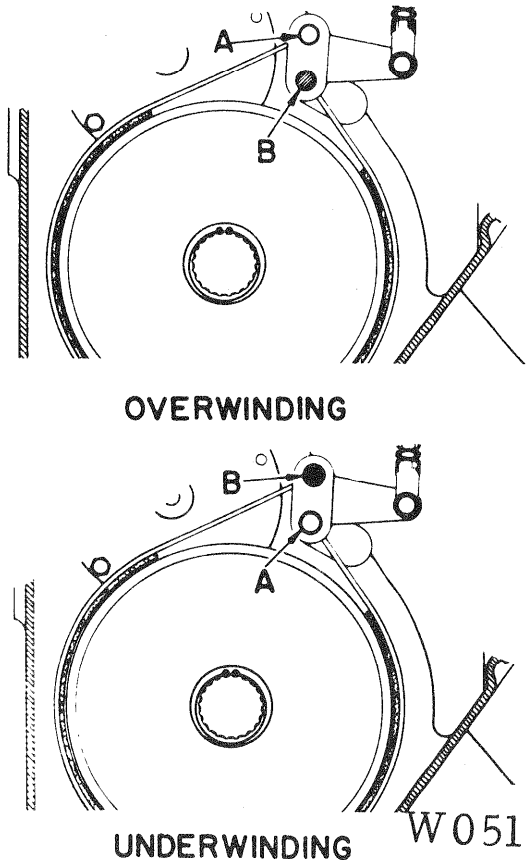


Figure 57

NOTE: Pin (A), fig. 57, connects the moveable end of the band to the crank; this pin is 4-5/8 inches long and has cotter pin hole in the center. Pin (B) is 6-3/8 inches long, has a tapped hole in the end, anchors the band and provides a pivot for the crank.

3. Change the automatic brake from overwind to underwind, by removing the assembly and replacing it with word "UNDERWINDING" to the outside. Fig. 58. The word "OVERWINDING" should be to the outside, if the change from underwind to overwind is made.

4. Change the drum from overwinding to

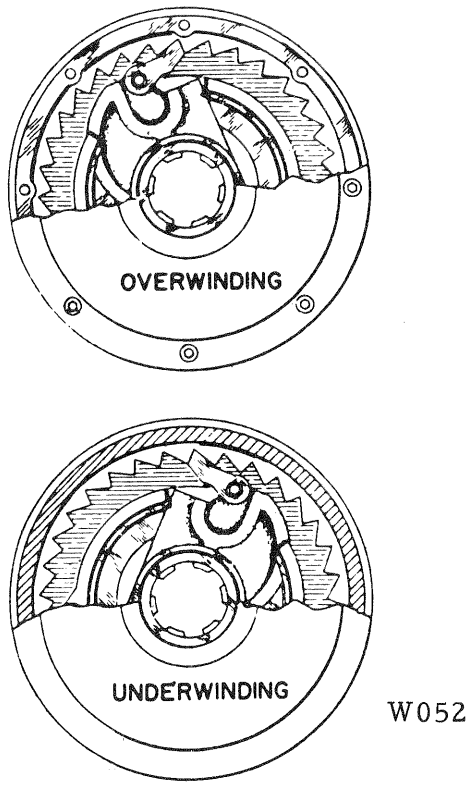


Figure 58

underwinding. Refer to Step a. for D6 and D89 winches and D7 winches equipped with lo-speed drums. Refer to Step b. for D7 winches equipped with standard drums.

a. Unwind the cable. Unscrew capscrew (4). Fig. 59. Remove ferrule lock (3) and ferrule (2). Break or cut the tack welds securing the filler (1). Smooth the ragged edges of filler and groove by grinding. Tack weld the filler in the underwind position. Lock ferrule (2) in underwind position with ferrule lock (3) and capscrew (4).

b. Unwind the cable. Unscrew capscrew (3), fig. 60. Remove ferrule lock (5) and ferrule (4). Change the position of the filler (2), from overwind to underwind. Place ferrule (4) in underwind position and secure it with ferrule lock (6) and capscrew (3).

NOTE: The ferrule lock for a D7 overwinding winch is different than that of an underwinding winch; for this reason numbers (5) and (6) were used in Step b.

NOTE: To change the winch from underwind to overwind, follow the procedure outlined in Step

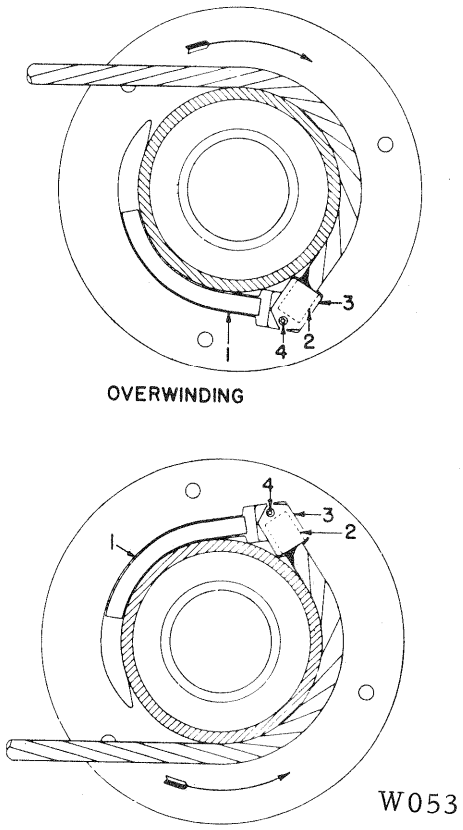


Figure 59

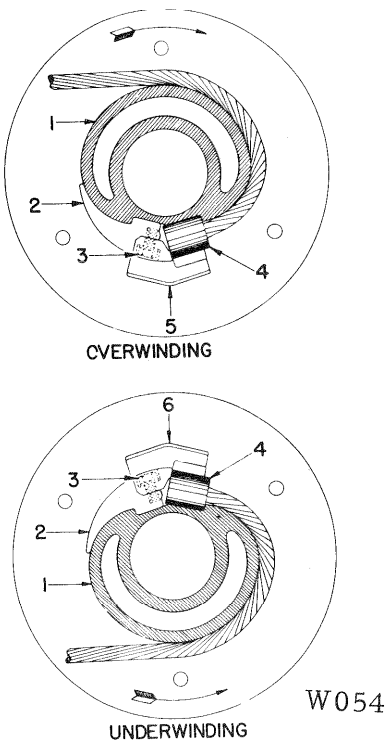


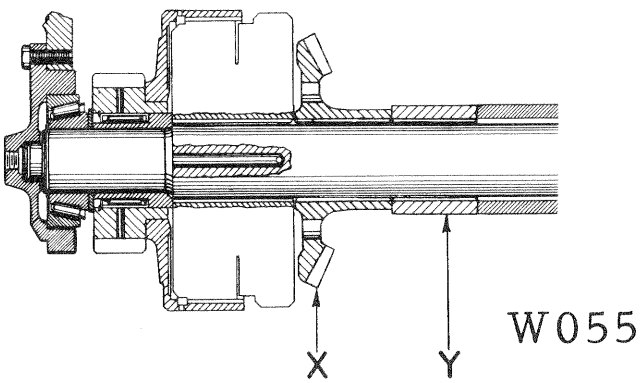
Figure 60

4 and transpose the words "overwind" and "underwind".

5. Wind the cable on thedrum, making sure it spools evenly.

C. Wind Modification - Power Controlled

1. Pull the bevel gear shaft out of the right side of the case far enough to enable switching places with the bevel gear (X) and (Y). Fig. 61. Push the shaft into place and secure it after the switch is made.



Power Controlled

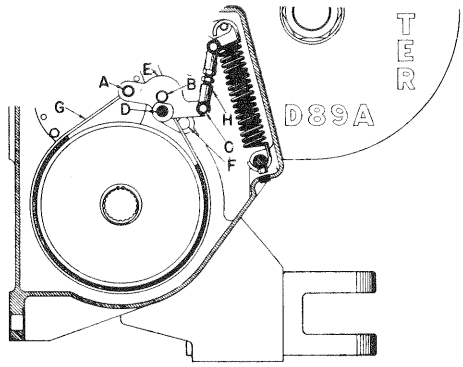
Figure 61

NOTE: In Step 1. the driven gear is moved from one side of the driving gear to the other. This operation may affect the gear lash, but it should not affect the shaft end play. However, both should be checked and adjusted, if necessary.

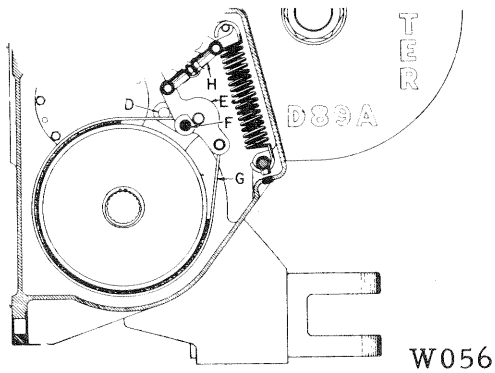
2. Remove pins (C) and (D). Fig. 62. Turn crank (E) and brake band (G) over. Replace pin (D) in new location, which is (F) when changing from overwind to underwind.

NOTE: When changing from overwind to underwind the pins, band and crank will be repositioned as shown in the illustration "UNDERWINDING", fig. 62. The illustration "OVERWINDING" shows the position of the pins, band and crank after the winch is changed from underwind to overwind.

3. Change the drum from overwinding to underwinding. Refer to Step a. for D6 and D89 winches and D7 winches equipped with lo-speed drums. Refer to Step b. for D7 winches equipped



OVERWINDING



UNDERWINDING

Figure 62

with standard drums.

a. Unwind the cable. Unscrew capscrew (4). Fig. 59. Remove ferrule lock (3) and ferrule (2). Break or cut the tack welds securing the filler (1). Smooth the ragged edges of filler and groove by grinding. Tack weld the filler in the underwind position. Lock ferrule (2) in underwind position with ferrule lock (3) and capscrew (4).

b. Unwind the cable. Unscrew capscrew (3), fig. 60. Remove ferrule lock (5) and ferrule (4). Change the position of the filler (2), from overwind to underwind. Place ferrule (4) in underwind position and secure it with ferrule lock (6) and capscrew (3).

NOTE: The ferrule lock for a D7 overwinding winch is different than that of an underwinding winch; for this reason numbers (5) and (6) were used in Step b.

NOTE: To change the winch from underwind to overwind, follow the procedure outlined in Step

4 and transpose the words "overwind" and "underwind".

4. Wind the cable on the drum, making sure it spools evenly.

CLEANING AND INSPECTION

1. All parts except bearings should be cleaned thoroughly with solvent, or by steam-cleaning. Do not use caustic soda solution for steam cleaning, unless they are rinsed with steam of clear water.

2. Parts should be dried with compressed air. Machined surfaces of steam-cleaned parts should be oiled immediately after drying.

3. Clean oil passages by working a piece of wire back and forth through the passages and flushing them with solvent. Dry the passages with compressed air.

4. Examine parts, especially oil passages, after cleaning, to make certain they are entirely clean. Reclean them if necessary.

5. Bearings that have been in service should be thoroughly washed in solvent. If the bearings are particularly dirty or filled with hardened grease, soak them in the solvent before trying to clean them. Before inspection oil the bearings with the same type of oil that will be used in the winch.

6. Dry bearings with compressed air. Do not spin bearings while they are not lubricated. Since the presence of dirt or grit in ball bearings is usually responsible for bearing failures, it is important to keep bearings clean during installation and removal. Observance of the following rules will do much to insure maximum bearing life.

a. Do not remove the wrapper from new bearings until ready to install them.

b. Do not remove the grease in which new bearings are packed.

c. Do not lay bearings on a dirty bench; place them on clean paper.

d. If assembly is not to be completed at once, wrap or cover the exposed bearings with clean paper or cloth to keep out dust.

7. Inspect bores for wear, grooves, scratches and dirt. Remove scratches and burrs with crocus cloth. Remove foreign matter. Replace parts that are deeply grooved or scratched.

8. Inspect mounting faces of the winch and tractor for burrs, paint, nicks, and foreign matter. Remove such defects.

9. Inspect threaded openings for damaged threads. Chase damaged threads with the correct size tap.

10. Replace parts that are cracked.

11. Inspect all machined surfaces for damage that could cause oil leakage or other malfunction of the part. Rework or replace the defective parts.

12. Inspect bearings for roughness of rotation. Replace a bearing if its rotation is still rough after cleaning and oiling.

13. Inspect bearings for scored, pitted, scratched, cracked, or chipped races, and for indication of excessive wear of rollers or balls. If any one of these defects is found, replace the bearing.

14. Inspect a defective bearing's bore and shaft for grooved, burred or galled conditions that would indicate that the bearing has been turning in its housing or on its shaft. If the damage cannot be repaired with crocus cloth, replace the defective part.

15. Inspect gear teeth for wear that may have destroyed the original tooth shape. If this condition is found, replace the gear.

16. Inspect gears for load pattern and signs of distress. Any distress indicates a possible future failure. Backlash cannot be used to establish critical gear wear, since production backlash tolerances are of such nature that a gear will pit, scuff, score or gall long before the gear wears sufficiently that such wear can be determined by backlash measurement.

17. Inspect splined parts for stripped, twisted, chipped, or burred splines. Remove burrs with a soft stone. Replace the part if other defects are found. Spline wear is not considered detrimental except where it affects tightness of fit of the splined parts. Here again, backlash cannot be used to establish critical spline wear since the parts affected must be centrally located in

respect to each other to determine a correct measurement.

18. Inspect parts for burred or damaged threads. Remove burrs with a soft stone or fine file. Replace damaged parts.

19. Inspect all snap rings for nicks, distortion, and excessive wear. Replace the part if one of these defects is found. The snap ring must snap tight in its groove for proper functioning.

20. Although not absolutely necessary, all O-rings and seals should be replaced. The O-rings must be free of flat surfaces, cuts, tears or any other form of deterioration. Discard if any of these exist. The seal lips should be sharp and smooth. Replace any that are not. Check the surface making contact with O-rings and seals. The surfaces should be smooth. In most cases, slight imperfections can be removed with fine sand paper. Replace any part if normal service life cannot be expected.

21. Check the seal rings on the end of the bevel shaft in the power controlled winch. Replace seal rings if machining marks are worn off, broken, or do not fit correctly in their grooves. Inspect the mating surfaces; these should be flat. Replace any part that has impaired sealing surfaces.

ASSEMBLY

NOTE: Steps 1 through 5 pertain to the two piece frame only.

1. Attach the bearing retainers and shims of the brake shaft and bevel gear shaft to the left side of the transmission case. Lay the transmission case on its left side and block it as level as possible. Place O-rings in the recesses around the shaft and bores. Make sure the aligning dowel is in place.

2. Press the left drum bearing assembly into the left bore of the drum, making sure the components are of the original assembly combination. Fig. 24. Press a seal into the bore until it is flush with the bore and with the lip away from the bearing. Push the spacer into the seal and against the bearing. Attach a hoist and sling to the drive end of the drum and lower the drum on its shaft bore in the transmission case.

3. If necessary, drive a new drum seal into the side frame, lip or lips toward the inside of the frame. Apply a film of grease to the sealing surface on the drum. Attach a hoist and sling to the side frame and lower it carefully into position on the transmission case, indexing the aligning dowel with its hole in the side frame. Fig. 26. Secure the assembly with lock washers and capscrews. Fig. 25.

4. Work the drum gear into the side frame and onto the drum splines, making sure the bolt holes are aligned. Attach a hoist and sling to the drum shaft and lower it carefully into the drum and into its left bearing. When the shaft is lowered completely the thread on the left end of the shaft will be exposed. Pour approximately two quarts of winch lubricating oil into the drum bore. Press the right bearing assembly on the drum shaft until it bottoms against the bottom of the drum counterbore. Secure the bearing and drum gear with the inner bearing retainer, fig. 22, and place bolts. Temporarily install the outer bearing retainer, shims and shaft nuts. Tighten the shaft nuts and capscrews snugly only.

5. Lubricate the tapered bearing that is to support the left end of the brake shaft. Place the bearing in the left brake shaft bearing cup. Attach the right bearing retainer and cup assembly and shims to side frame.

6. Check and adjust shim pack thickness as follows:

a. Temporarily install the bearing retainer, without shims and the capscrews tightened snugly and evenly.

b. With feeler gauges, measure the gap between the retainer and side frame. Measure the gap in several places around the retainer, and determine the average measurement.

c. The shaft will have zero endplay when the shim pack equals the average measurement. Subtract shims to produce .000 to —.003 in. preload.

d. Remove the bearing retainer. Place the shim pack in position and attach the retainer. Tighten the capscrews to the correct torque.

7. Secure the inner bearing retainer and cup assembly and gasket of the intermediate shaft to the transmission case. Tighten the capscrews to the specified torque. Place the inner tapered bearing in the cup, with the smaller intermediate shaft gear on top of it. Place the large gear on top of the small one.

8. Assemble the oil clutch, if so equipped.

9. Stack all bevel gear shaft parts, except for the left spacer washer, in the case in the assembled order.

NOTE: The assembled bevel gear shaft equipped with dental clutches is illustrated in fig. 28. Fig. 11 illustrates the bevel gear shaft equipped with multiple disc clutches.

10. Coat the splines of either bevel gear shaft with lubriplate. Also coat top and sides of the power control bevel shaft seals and insert them in the seal recesses. Slide the clutch bearing (bearings) over the right end of the shaft. Fig. 63. Sling the shaft and lower it through the stacked parts.

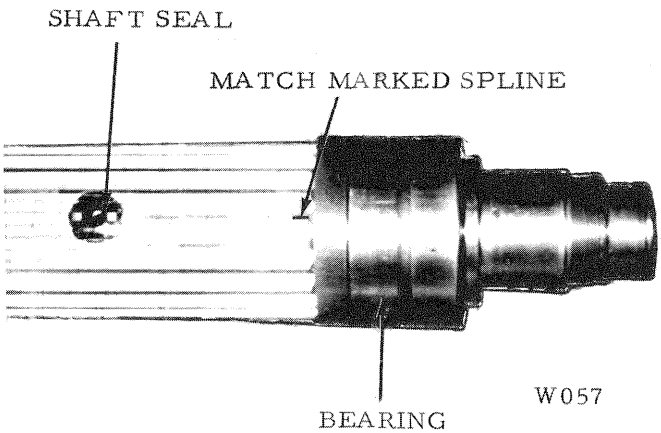


Figure 63

IMPORTANT: In Step 10, be certain that the match mark on the shaft of power controlled winches is in line with the pipe plugs on the clutches as the shaft passes through them. The seals and holes in the shaft will then be in line with oil holes in the clutch piston housings. On piston housing with two plugs, the plug to be interested in is in line with the root of the spline.

11. Install the snap ring in the end of the reverse clutch pinion, raise the clutch to get ring clearance. Place the spacer washer next to the clutch. Drive the tapered bearing onto the shaft, and place the tanged washer next to it. Fig. 14. Thread the jam nut onto the shaft and torque to 200 ft./lbs. Bend one of the washer tangs into a notch in the nut. Temporarily install the retainer.

NOTE: Fig. 64 illustrates one method of preventing the bevel gear shaft from turning while tightening the jam nut.

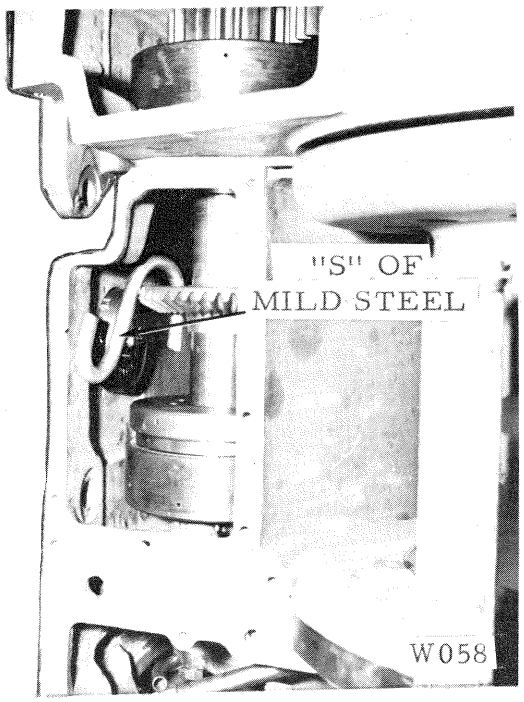


Figure 64

12. Turn the winch right side up. Remove the left bearing retainer, shims and bearing. Place the left spacer washer on the shaft. Drive the bearing onto the shaft and secure it with a snap ring. Affix the shims and bearing retainer.

13. Adjust the bevel gear shaft preload as outlined in Step 6.

NOTE: If original bevel gear shaft components are installed, the original shim packs should suffice, providing they are placed in their original positions. Any altering of the shim pack or changing its location will affect the mesh of the gears, and perhaps shaft preload.

14. Remove bearing retainers and install metal seal rings on ends of shafts. Be sure these seal rings are not broken or damaged when reinstalling bearing retainers.

15. Align the splines of the intermediate shaft gears. Press the intermediate shaft into the outer tapered bearing. Insert the inner end of the shaft into its bore, through the gears and into the inner bearing. Drive the remaining cup into its bore in the retainer, if removed. Determine the shim pack thickness as outlined in Step 6. Attach the outer bearing retainer and shims to the side frame. Tighten the capscrews to specified torque.

16. Assemble the brake, brake mechanism, shifting mechanism in the reverse order in which they were removed. Adjust the standard brake.

17. Assemble the PTO shaft and install it using the original shim pack. Check and adjust the backlash. Apply a film of white lead to several gear teeth; turn the gears to obtain a pattern and compare the pattern with figs. 46 through 51. Check pattern on the drive side of the gears.

IMPORTANT: When the original gears are installed, adjust them to the original backlash.

NOTE: The patterns illustrated are for spiral bevel gears. However, they can be used as a guide in obtaining the correct mesh of the straight bevel gears.

a. Figs. 39 and 40 show correct tooth contact.

b. Fig. 41 shows short contact at heel. To correct, move gear toward pinion. Then move pinion away from gear to again obtain correct backlash.

c. Fig. 42 shows short contact at toe. To correct, move gear away from pinion. Then move pinion toward gear to again secure correct backlash.

d. Fig. 43 shows heavy contact on flank or lower portion of tooth. To correct, move pinion away from gear until contact comes to full working depth of tooth without breaking contact at flank. Then move gear toward pinion to secure correct backlash.

e. Fig. 44 shows heavy contact on face or upper portion of tooth. To correct, move pinion toward gear until contact covers flank of tooth without breaking contact at face. Then move gear away from pinion to secure correct backlash.

18. Install the brake, linkage, control housing and remaining parts in the reverse order in which they were removed.

NOTE: If the winch is to be installed immediately, leave the transmission cover and control housing covers off.

INSTALLATION

1. Remove: the transmission cover; the plug in the PTO shaft opening; the two plugs from the cable openings in the control housing.

2. Check the PTO shaft coupling, make sure it is secured with the pin and lock ring.

NOTE: New winches are shipped with the PTO shaft removed. In this case it will be necessary to install the shaft.

3. Apply a liberal coat of heavy grease to the carrier O-ring. Slide the O-ring over the bearing carrier and into its groove.

4. Attach a sling and hoist to the winch utilizing two 7/8" UNF bolts and the tapped holes on each side of the winch. Fig. 13.

5. Clean the mounting surfaces of the winch and tractor. Be sure that the tractor PTO cover bolt holes are plugged tightly. Make sure the contacting surfaces are bare metal.

6. Remove control housing cover.

a. Side cover, direct drive winch.

b. Top cover, power controlled winch.

7. Hoist the winch and start the PTO shaft into its hole. Move the winch toward the tractor and line up the tractor power take-off splines with those in the PTO shaft coupling. Route the push-pull cable into their respective holes in the control housing.

8. When the winch is in place secure it with the nuts and lockwashers. Coat the stud inside the winch with a non-hardening sealer before threading the nut onto it. Be sure the cotter pin is installed inside of the winch.

SECTION B — HANDLING GEAR

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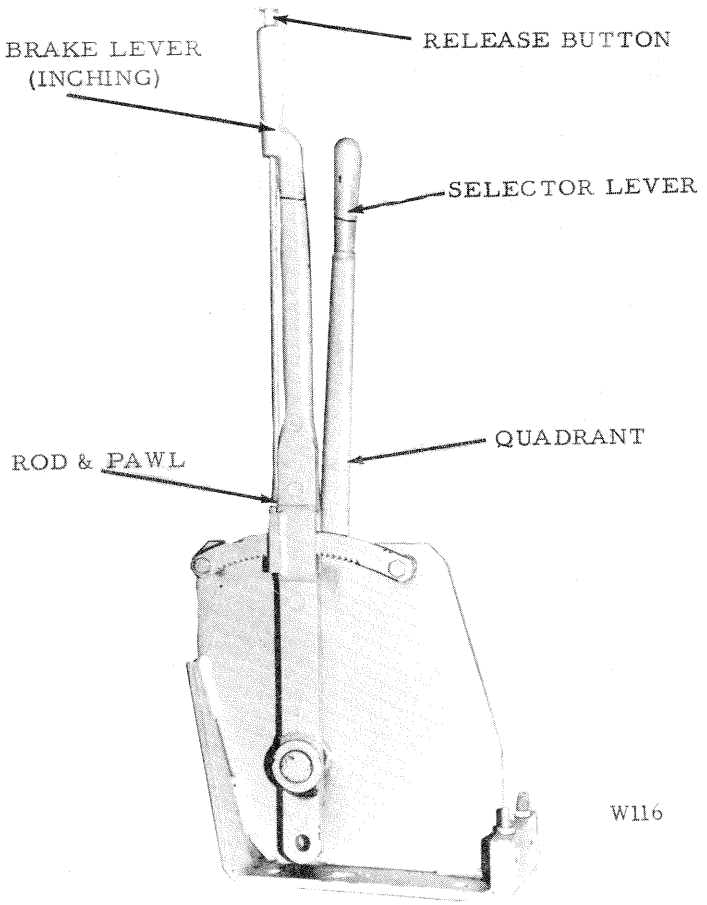
DIRECT DRIVE	2
POWER CONTROLLED	3

GENERAL

Three handling gear systems are considered in this sections:

a. Direct-drive winch with mechanical brake. Fig. 1.



DIRECT DRIVE WINCH WITH MECHANICAL BRAKE

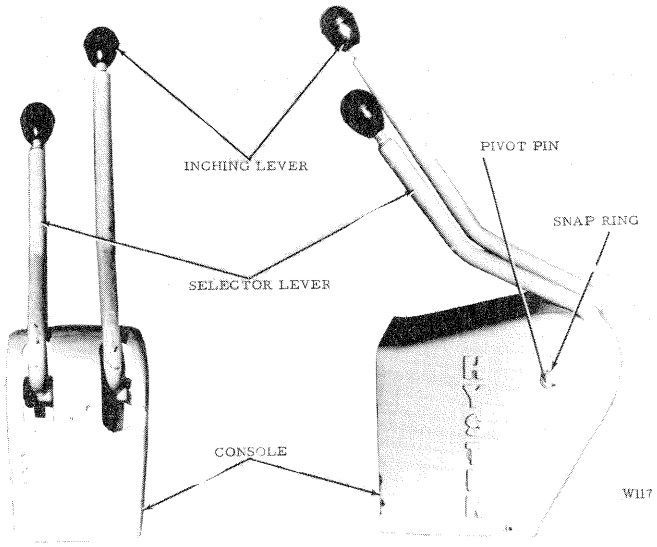
Figure 1

b. Power controlled winch with mechanical brake. Fig. 2.

c. Power controlled winch with oil brake. Fig. 3.

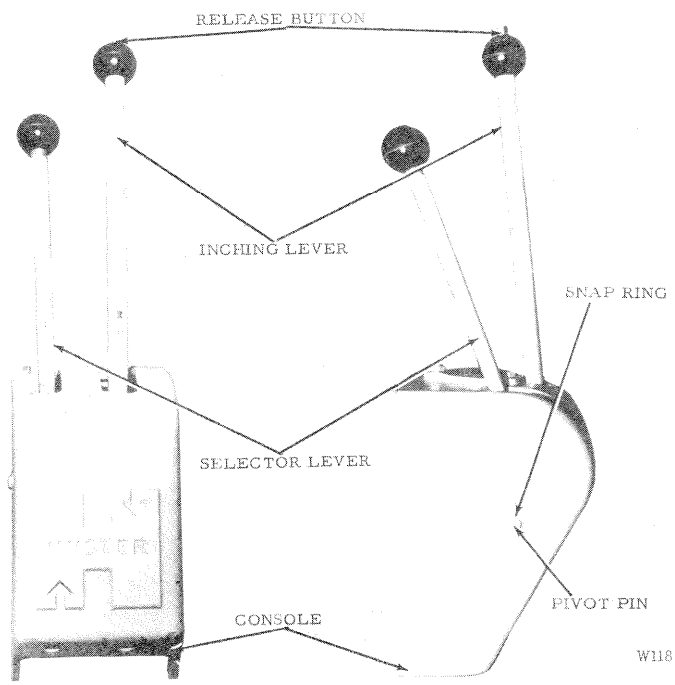
Although the components making up the handling gear will vary between winch models and types, all systems will contain a selector lever and an inching (brake) lever. Each is connected to a push-pull cable.

On every installation the selector lever is a plain lever and knob assembly. This lever controls the dental clutches of the direct-drive winch through the cable and a crank assembly and



POWER CONTROLLED WINCH WITH MECHANICAL BRAKE

Figure 2



POWER CONTROLLED WINCH WITH OIL BRAKE

Figure 3

multiple disc clutches of the power control winch through a cable and a control valve assembly.

Regardless of winch model and type, the inch-

ing lever (brake lever) is always longer than the shift lever. However, only the inching lever of power control unit equipped with a mechanical brake is plain.

DIRECT DRIVE

A. General. Fig. 1

The handling gear of the direct-drive winch utilizes mechanical means of controlling the rotation of the drum and the brake. The brake on this winch is manually applied and released.

There are three positions into which the selector lever can be placed, forward, neutral and reverse. Once the lever is placed in a position it will remain there until manually re-positioned.

A spring loaded pawl, push rod and a push button are included in the brake lever assembly. The pawl engages teeth on a quadrant to hold the brake lever stationary. In this position the brake can be applied but not released. The brake will remain applied until the lever is pulled "in" and the push button is depressed, lifting the pawl out of the quadrant. As long as the button is depressed the brake lever can be pushed out, releasing the brake.

CAUTION: The brake must be released before operating the winch and the tractor clutch disengaged or winch in neutral before the brake is applied; otherwise, damage to the winch may result or tractor engine stalled.

B. Brake Lever Adjustment

1. Adjust the brake band.

2. Adjust cable to dimension "A", fig. 4, by loosening the jam nut and turning the rod end on or off the cable end as necessary. Tighten the jam nut.

3. With the brake completely released, adjust the rod end at the brake lever until dimension "B" is obtained.

Winch	A	B
D6	1-7/16	5-1/16
D7	1-1/8	4-3/4
D89	1-1/4	4-7/8

C. Shift Lever Adjustment

1. Place winch in "neutral".

2. Adjust rod ends as necessary to place the shift lever in the center of its travel. Make sure that forward, reverse and neutral can be selected by moving the selector lever to the corresponding positions.

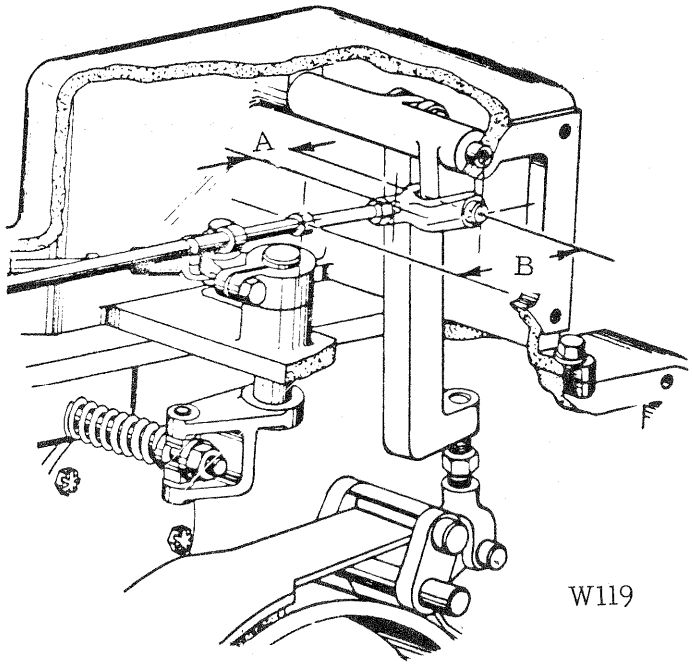


Figure 4

POWER CONTROLLED

A. General. Figs. 2 and 3

Regardless of whether the winch is equipped with a mechanical or oil brake, the handling gears of the power control units are a combination of mechanical and hydraulic devices. Springs apply the brake, and hydraulic pressure releases it.

The selector lever of the power control winch can be placed in four positions, forward, neutral-brake applied, neutral-brake released and reverse. Normally the lever is in neutral-brake applied position. Moving the lever out one detent releases the brake; two detents causes reverse clutch application. The lever must be manually removed from either the brake release or reverse positions.

Pulling the inching lever "in" actuates the inching spool in the control valve to release the brake. When the lever controlling a mechanical brake is released, it will return to the brake apply position.

NOTE: The terms "in" and "out" refer to the lever movement toward and away from the housing mounting surface, respectively.

The inching lever of the D7H and D89B controlling the oil brake is equipped with a locking mechanism, consisting of a spring loaded lock plate, locking rod, positioning lever and a rod.

The rod is located axially in the lever and protrudes out the top of the lever knob. The protrusion forms a push button. Normally the brake lever functions the same as the one controlling the mechanical brake on the power control winch. However, the brake can be set at any degree of release, by depressing the push button as inching lever is released in the desired position. This places the lock plate in locking position to prevent further outward movement of the released inching lever. A slight inward movement of the lever will release the locking mechanism allowing the inching lever to return to brake apply position.

B. Removal—Mechanical Brake Console

1. Unscrew the mounting bolts. Loosen the jam nuts securing the cables to the cable ends.

2. Disconnect the cables from levers, by extracting the cotter keys and pushing the pins out.

3. Note the amount of thread screwed into each rod end. Screw the ends off the cable.

4. Unscrew the set screws securing the cable to the console. Pull the cables out.

C. Disassembly—Mechanical Brake Console

1. Remove the snap ring from either side of the pivot pin. Fig. 2.

2. Push the pin out.

D. Removal—Oil Brake Console. Fig. 5.

1. Unscrew the mounting bolts. Loosen the jam nuts, securing the selector cable to the cable end and inching cable to the locking rod assembly.

2. Loosen the jam nuts and unscrew the setscrews holding the two cable assemblies in the console.

3. Remove the cotter key and pin connecting

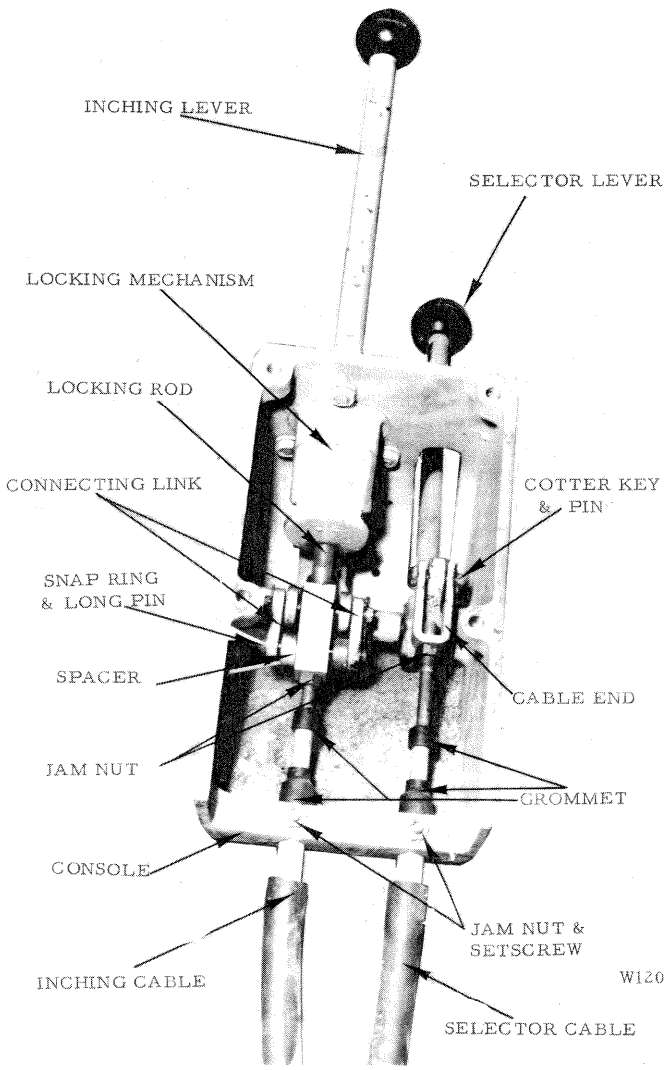


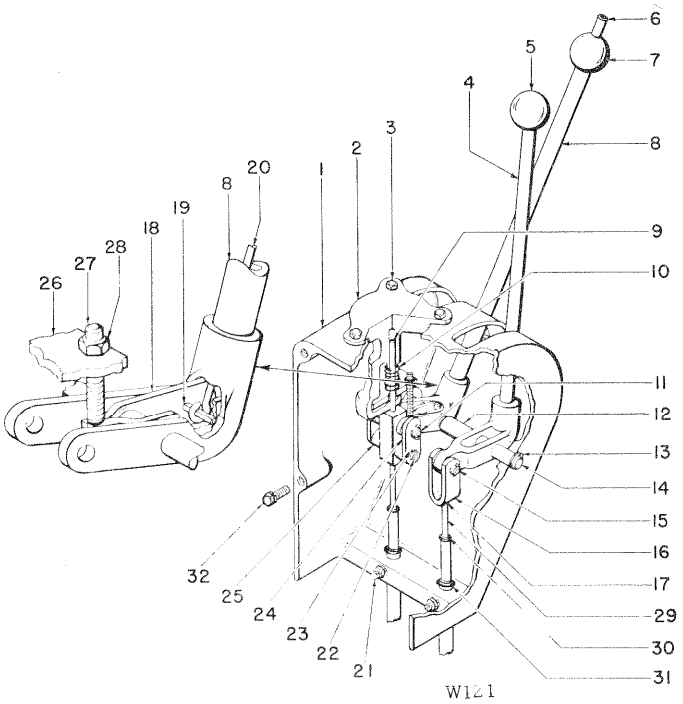
Figure 5

the cable end to the selector lever. Screw the cable end off the cable. Pull the cable assembly out of the console, being careful not to damage the large grommet.

4. Remove the snap ring from the outer end of the long pin connecting the locking rod to the connecting links. Pull the pin out, being careful not to lose the two spacers.

5. Pull the locking rod out of the locking mechanism, by pulling on the inching cable; be careful not to damage the large grommet. Screw the locking rod off the cable. Pull the cable out of the console.

HANDLING GEAR



1. Console
2. Guide Block
3. Nut, Bolt & Lockwasher
4. Selector Lever
5. Knob
6. Release Button
7. Knob
8. Inching Lever
9. Locking Rod
10. Spring
11. Pin & Cotter Key
12. Spacer
13. Snap Ring
14. Pivot Pin
15. Pin & Cotter Key
16. Cable End
17. Jam Nut
18. Release Lever
19. Roll Pin
20. Release Rod
21. Setscrew, Jam Nut & Lockwasher
22. Pin
23. Snap Ring
24. Connecting Link
25. Spacer
26. Lock Plate
27. Setscrew
28. Jam Nut
29. Push Pull Cable
30. Small Grommet
31. Large Grommet
32. Bolt & Lockwasher

Figure 6

E. Disassembly — Oil Brake Console. Fig. 6

1. Remove the snap ring (13) from the selector lever end of the lever pivot pin (14). Loosen the jam nut and setscrew securing the pivot pin. Pull the pivot pin out of the console until the selector lever (5) and spacer (12) are free.

2. Screw the knob off the inching lever. Pull the pivot pin completely out of the console. Remove the inching lever. Screw the nuts off the bolts retaining the locking mechanism; then, push the mechanism out of the console. Fig. 7.

3. Disassemble the selector lever as follows:

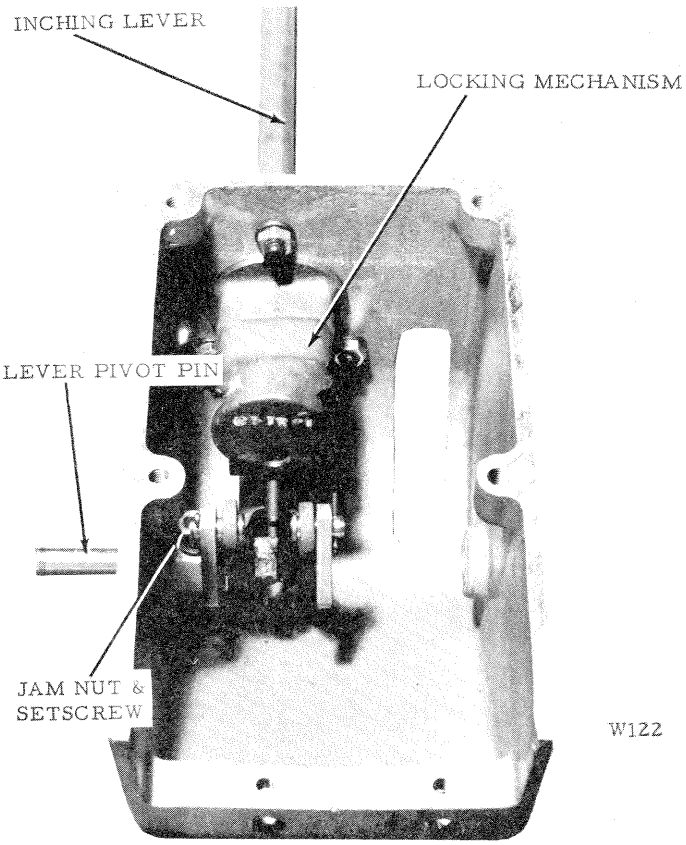


Figure 7

Figure 8

a. Unscrew the release button from the release rod. Fig. 8.

b. Lift the release rod and lever assembly out of the inching lever. Press the roll pin out of the release lever. Remove the cotter keys and pins retaining the connecting links. Fig. 9.

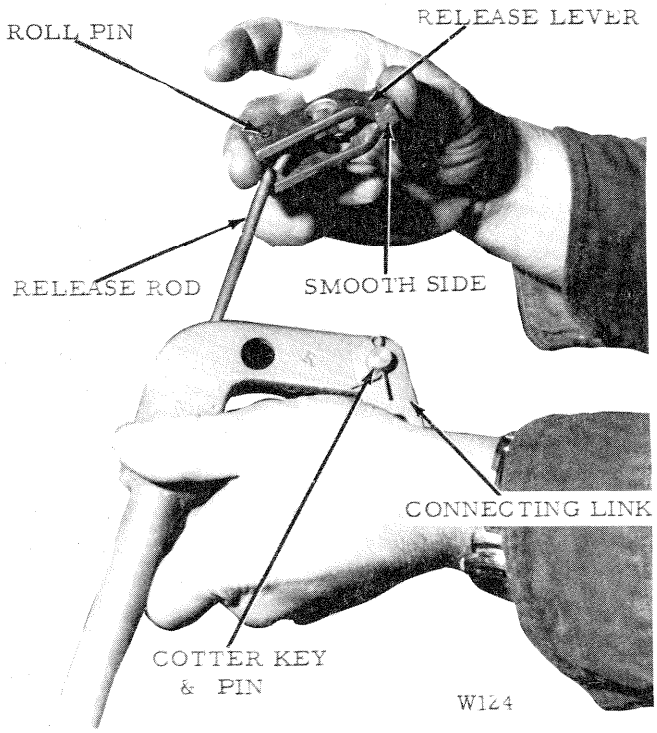


Figure 9

4. Disassemble the locking mechanism, fig. 10, as follows:

a. Pull the locking rod out of the guide, if not already removed.

b. Carefully push the spring and lock plate out of the guide.

c. Note how far the adjusting screw is turned into the lock plate. Loosen the jam nut and turn the screw out of the lock plate.

F. Assembly and Installation. Fig. 6.

NOTE: Assemble and install the console controlling the mechanical brake equipped winch in the reverse order in which it was disassembled and removed.

1. Connect the release lever to the release rod with the roll pin, making sure the smooth side of the lever is "up" and the slot in the roll pin "down". Fig. 9.

2. If the adjusting screw on the locking plate

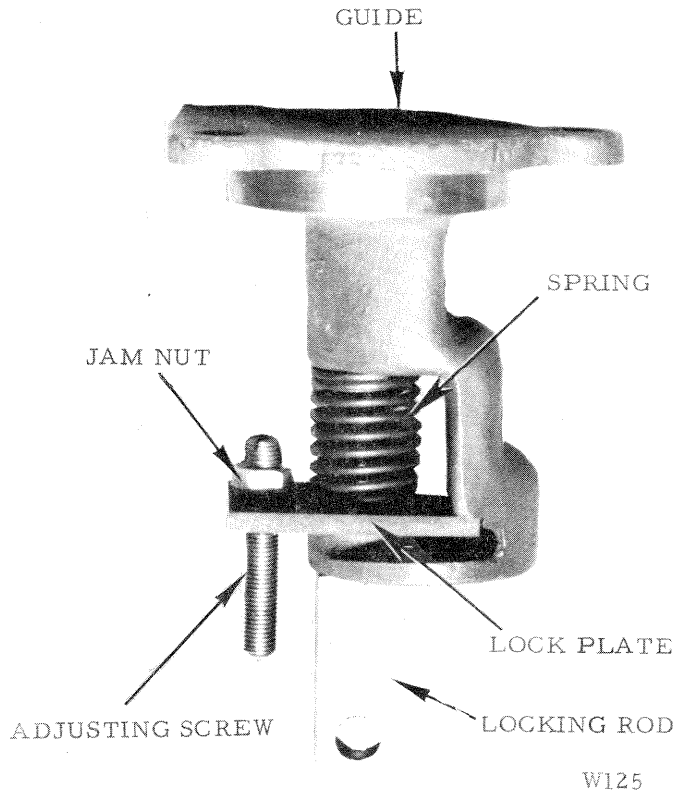


Figure 10

has been removed, screw it into the plate until it extends beyond the bottom of the plate 1-1/4 inches; then, lock it in place with the jam nut. Assemble the plate and spring in the guide, with the spring on top of the plate and the screw down. Fig. 11.

3. Attach the two connecting links to the inching lever with pins and cotter keys. Slide the release rod assembly into the lever and screw the knob onto the threaded end. Figs. 9 and 8.

4. Push the lever pivot pin through inching lever side of the console, through inching lever, spacer, the selector lever and out the opposite side of the console. Make sure that the setscrew detent in the pin is in line with the setscrew hole. Secure the pin with the setscrew and snap rings.

NOTE: When assembled the smooth side of the release lever is up.

5. Push the inching cable through its hole in the bottom of the console, and lock it in position

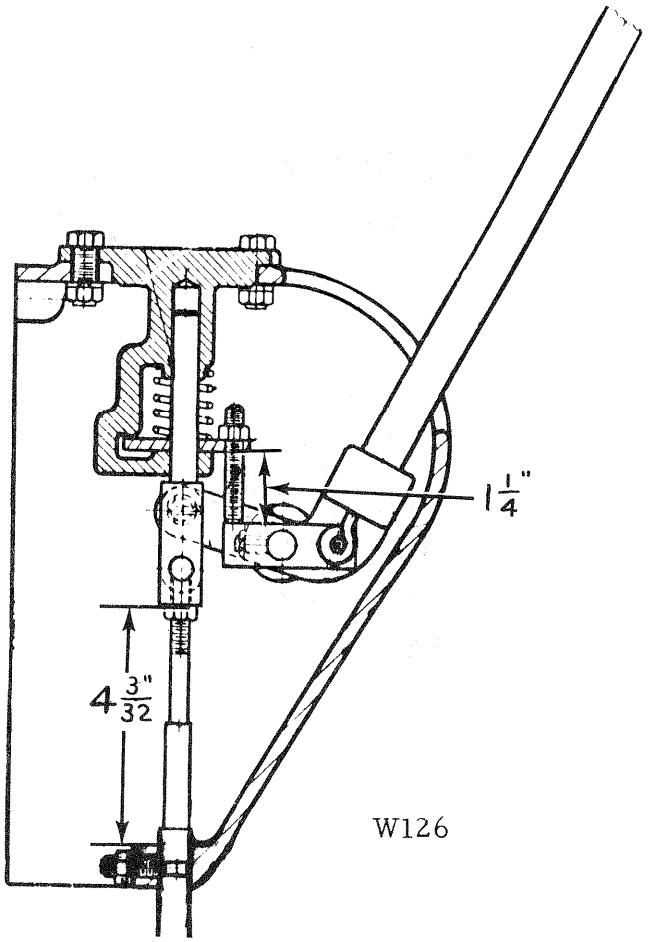


Figure 11

with the setscrew. Screw the locking rod on the inching cable until the bottom of the block is 4-3/32 inches from inside bottom surface. Fig. 11.

6. Place the block of the locking rod between the two connecting links on the inching lever, with a spacer on each side of it. Align the holes of the components and insert the connecting pin. Secure the pin with the snap ring.

7. Push the guide assembly into the top of console and over the locking pin, being careful not to knock the locking plate or spring out of alignment. Secure the guide with the three bolts, nuts and lockwashers.

8. Pull the inching lever back and push it forward several times. With the lever in its extreme forward position measure from the bottom of the locking rod block to the inside bottom surface. The measurement should remain 4-3/32 inches. If not, adjust the lock plate screw or reposition the block on the inching cable, whichever is necessary.

CAUTION: In Steps 5 and 8 do not screw the cable against the pin connecting the block to the links.

NOTE: When the inching lever is in its extreme forward position it should not touch the front of the console.

9. Place the selector spool in reverse position, by pulling the selector cable out of its housing as far as possible. Screw the cable end on the cable until its holes are in line with those on the selector lever when the selector lever is pushed forward. Screw the end onto the cable several turns and connect it to the selector lever.

10. Push the selector lever to its extreme forward position and pull it to its extreme backward position several times. In no instance should the lever contact the front or back of the slot in the console. Screw the cable end onto the cable, if the lever touches the front of the slot; turn it off the cable, if it touches the back of the slot.

NOTE: As a further check measure the distance from the end of the spools to front of the valve, with the spool in various positions. Fig. 12. In "reverse" the end of the selector spool should be 2-1/2 inches from the front of the valve; in "forward" it should be 1-19/32 inches. In brake on position the end of the inching spool should be 2-3/16 inches; in brake released position it should be 1-23/32 inches.

11. Attach the console to the tractor and recheck the control lever movement.

SECTION C — BRAKES

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GENERAL

Basically there are two types of brakes, mechanical and oil. The D7F, and D89B power control winches and all direct drive type winches have spring applied dry brake band type brakes.

Working in conjunction with the mechanical brake may be an automatic brake. This is an optional assembly which is installed on Direct Drive Winches only.

OIL BRAKE. Fig. 1

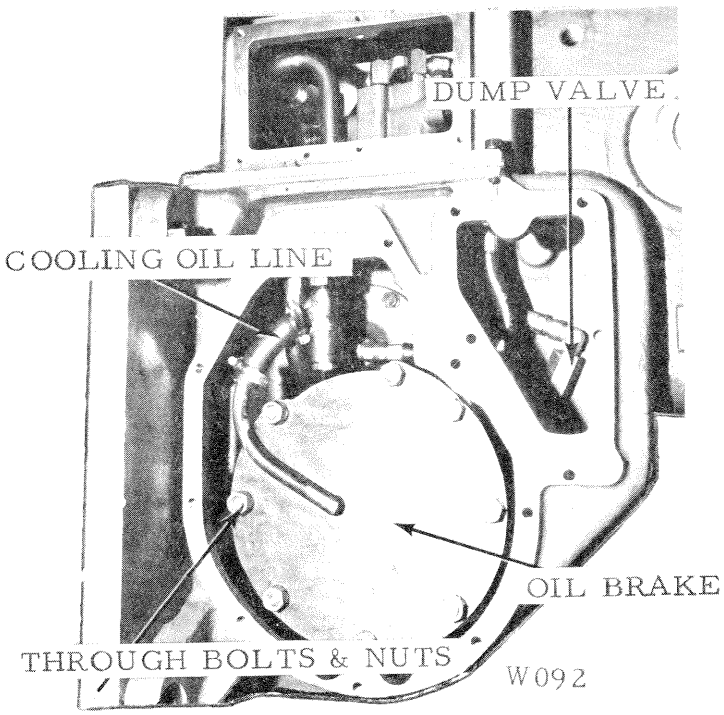


Figure 1

A. General

This is a multiple disc assembly having ten separator plates and eleven friction discs placed alternately on a hub. The separator plates are dished and have internal lugs that are indexed with external splines on the hub. External lugs on the friction discs are indexed with internal splines of a cage.

Besides being splined to the brake shaft the hub is also secured to the shaft by an external snap ring. The cage is located between the brake cover and a pressure plate. A piston housing is located on the other side of the pressure plate.

Pressure of two dished disc springs press against a steel ring. In turn the ring presses the separator plates and friction discs together, locking the brake shaft to the case.

Making up the release mechanism is a piston and eight push rods. The piston is located in the piston housing. The push rods are equally spaced in the cage and are located between the piston and ring.

The brake is released by directing pressurized oil into the cavity behind the piston, forcing the piston out of its housing. This movement is transferred through the push rods and ring to the springs, deflecting them; thus, releasing the brake by removing the pressure on the separator plates and friction discs. O-rings prevent leakage between the piston and housing.

When it is desired to again apply the brake the hydraulic pressure is discontinued and a quick release valve assures a fast evacuation of the oil which applies the brake.

Located between the cover and cage of early D89B assemblies are shims. These are used to adjust the brake pack clearance; the pack being the friction discs and separator plates. The pack clearance in later D89B and all D7H assemblies need no adjustment and shims have been omitted.

Basically the two assemblies differ from each other by the method of parts retention. Through bolts were originally used to hold the assemblies together. In such cases the assembly is secured to the winch by attaching the piston housing to the winch with studs and nuts.

Later the mounting studs were omitted. The through bolts were replaced by long studs that screw into the winch and protrude out of the assembly cover. In this case the assembly is held together and against the winch by nuts screwed on the ends of the protruding studs.

Cooling oil enters the cover port, flows between, over and around the brake components. The brake pack is partially submerged in sump oil for additional cooling.

B. Removal

1. Drain the oil from the winch. Remove the large cover from the left side of the winch.

2. Disconnect the cooling oil line from the

brake cover. Fig. 1. If through bolts secure the brake assembly replace two of them with two long slotted studs, fig. 2, replace 180° apart. Unscrew the remaining through bolts and remove the cover and shims. Otherwise, unscrew the nuts securing the cover and remove the cover. Fig. 1.

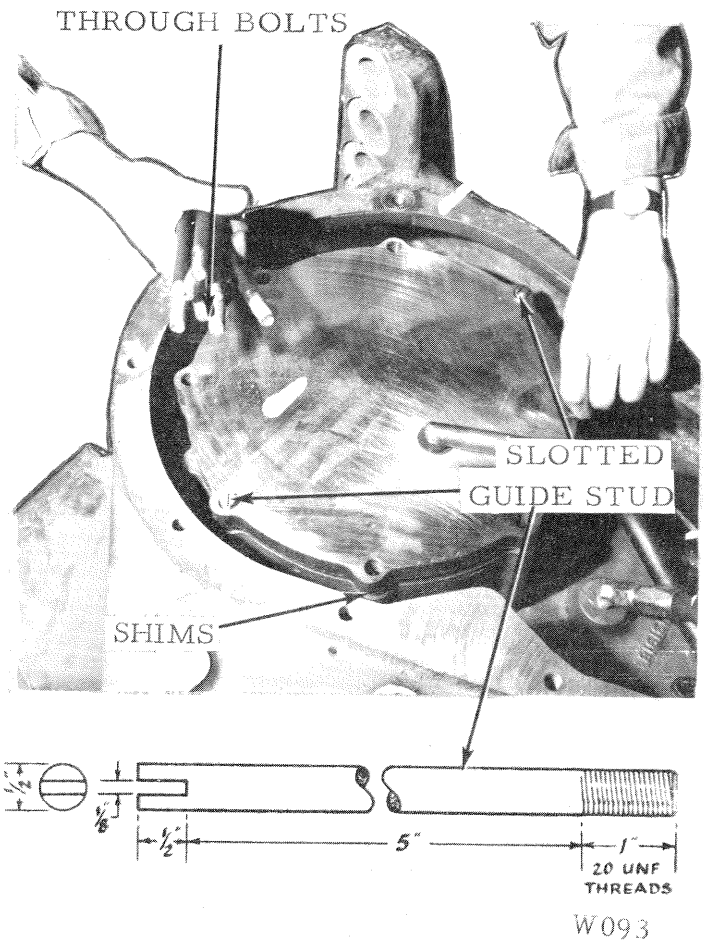


Figure 2

3. Remove the dished disc springs and steel ring. Fig. 3.

4. Tap the cage with a soft hammer to loosen it, if necessary; then, slide it off the studs. Pull the friction discs and separator plates off the hub, as an assembly. Fig. 4.

5. Remove the outer snap ring holding the hub on the brake shaft. Pull the hub off the shaft. Fig. 5.

6. Remove the inner snap ring. Slide the pressure plate off the shaft; tap it with a soft hammer to loosen it if necessary. Fig. 6.

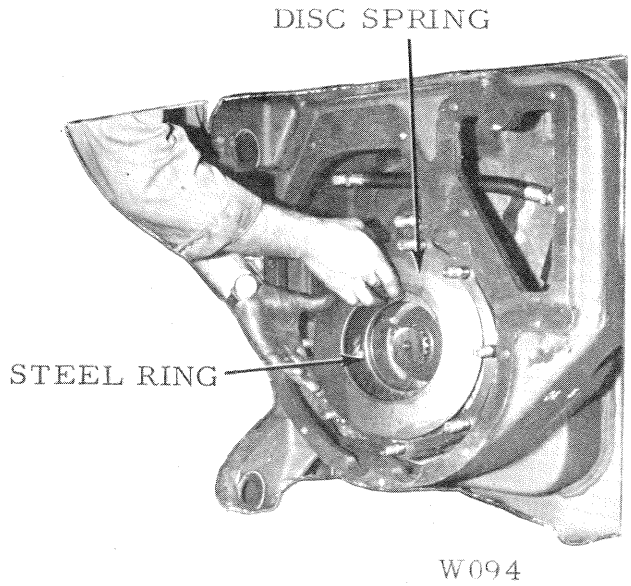


Figure 3

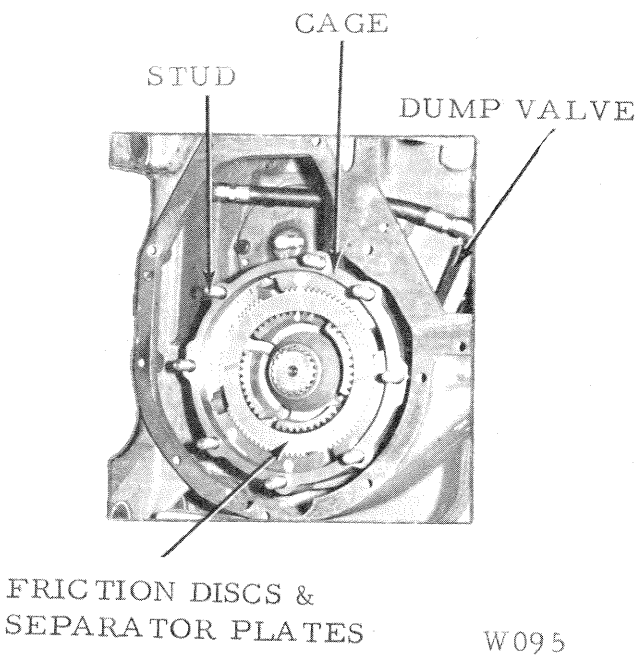


Figure 4

7. Remove the piston and housing. Refer to "a", if the brake assembly was held together with through bolts; to "b" if it was held together and attached to the winch with long stud.

a. Disconnect the hydraulic hose and quick dump valve from the piston housing. Remove the piston from the housing, by directing low pressure through one of the piston housing

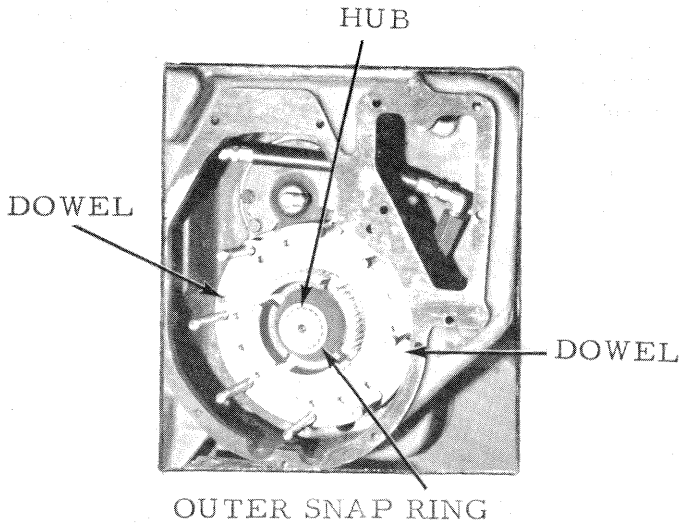


Figure 5

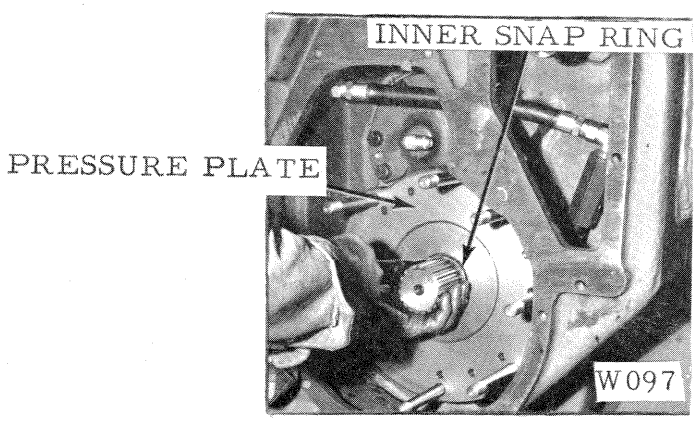


Figure 6

ports; if the housing has an inlet and an outlet port it may be necessary to plug one while utilizing the other. Unscrew the nuts from the studs. Fig. 7. Tap the piston housing with a soft hammer to loosen the tapered dowels; remove the dowels, and pull the housing away from the winch.

b. Disconnect the quick dump valve from the piston housing. Slide the piston and housing off the studs. Fig. 8. Remove the piston from the housing with low air pressure.

NOTE: Studs are installed with an interference fit. Do not remove them unless absolutely necessary.

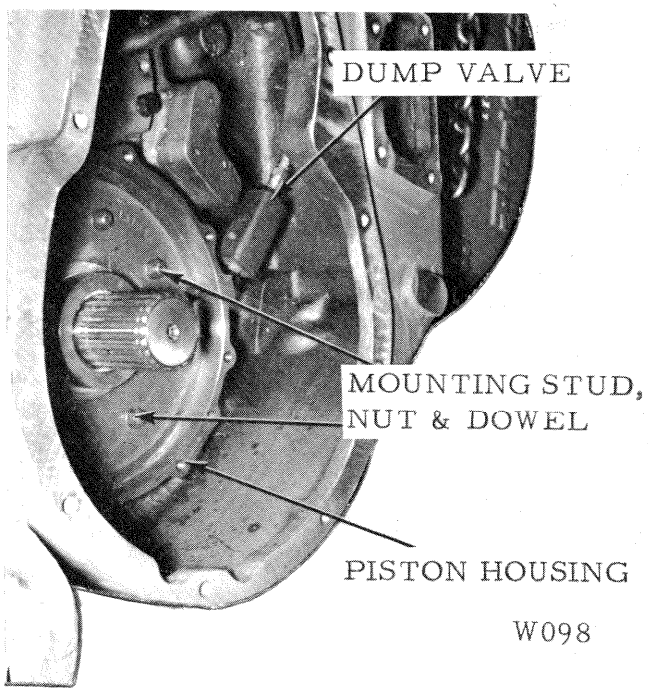


Figure 7

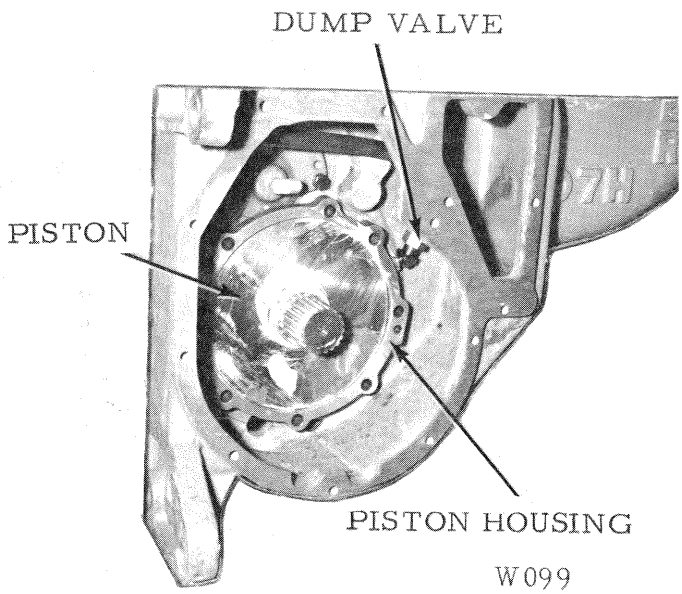


Figure 8

C. Installation

1. If new studs have been installed, check the stud height.

NOTE: The stud height of early D89B winches should be 7/8 inch plus or minus 1/32. Fig. 9. The studs on the D7H and later D89B winches

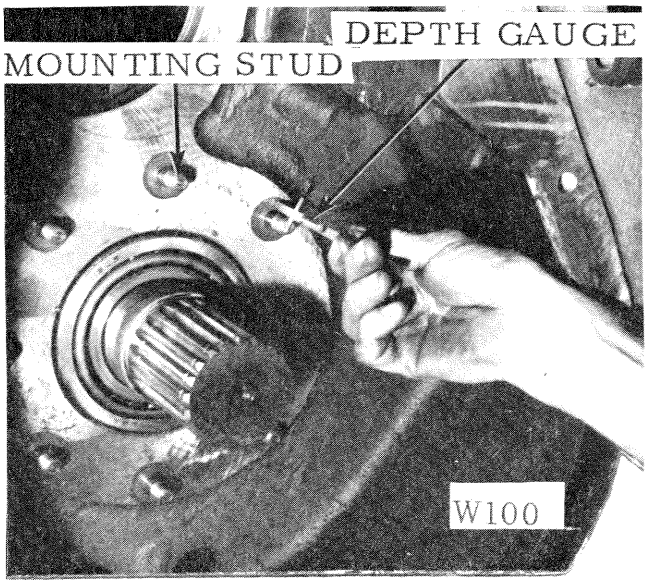


Figure 9

should not extend past the left gasket surface, and the end stamp "N" must be out. Fig. 10.

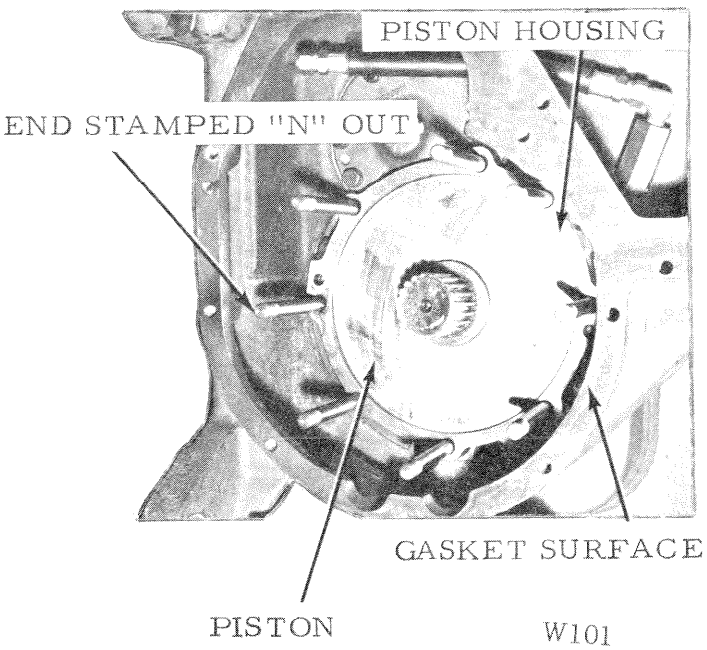


Figure 10

2. Install the piston and piston housing. Refer to Step a. for early D89B and Step b. for other winches.

a. Slide the piston housing over the short mounting studs. Push the tapered dowels over the protruding stud ends. Secure the assembly with lockwashers, dowels and nuts. Fig. 7. Tighten the nuts to specified torque. Lubricate the piston O-ring, its seal ring and the piston housing counterbore. Place the O-ring in its groove around the piston. With the recessed side of the piston, fig. 11, toward the mounting studs, carefully work the piston into the piston housing.

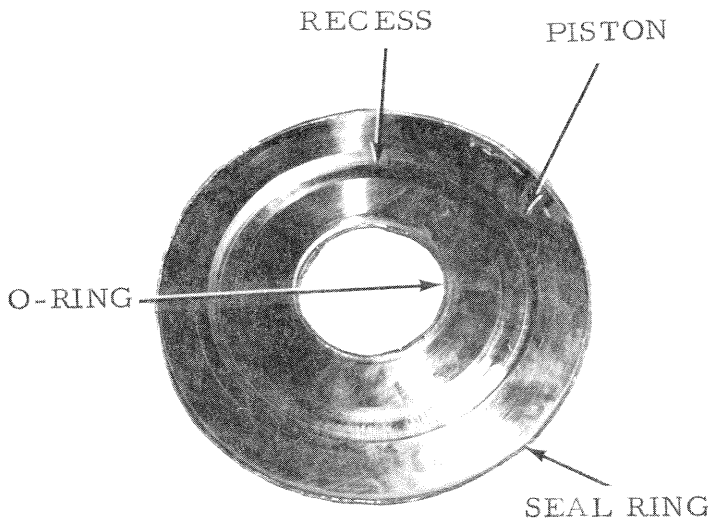


Figure 11

NOTE: It may be necessary to stretch the piston bore O-ring slightly so it will stay in place long enough to install the piston.

b. Lubricate the piston O-ring, seal ring and piston housing counterbore. Carefully work the piston into the piston housing counterbore. Slide the assembly over the mounting studs and against the winch. Fig. 10.

3. Attach the hydraulic hoses and dump valve. Fig. 4, 7 and 8. Push the two dowels into position in the piston housing. Fig. 5. Screw the two aligning studs into the cases of early D89B winches.

4. Slide the pressure plate over the studs and against the piston housing.

5. Position the inner snap ring in its groove around the brake shaft. Fig. 6. Slide the hub over the shaft, next to the inner snap ring. Secure the assembly with outer snap ring. Fig. 5.

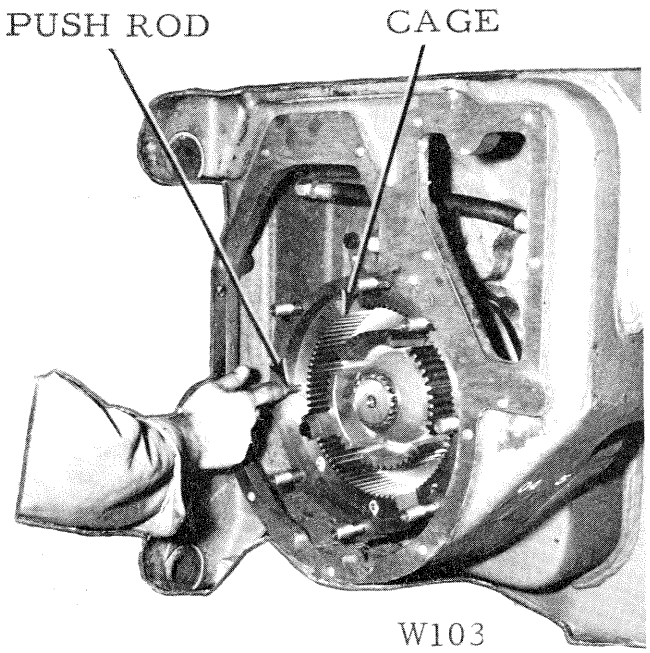


Figure 12

6. Place the cage next to the pressure plate. Lubricate the push rods and push them into the guide holes in the cage. Fig. 12.

7. Starting with a friction disc, fig. 13, alternately install the friction discs and separator plates. Install the separator plates with the dish in the same direction. Before installing the brake pack of brakes that are secured to the winch by short studs, fig. 7, it will be necessary to determine the needed shim pack, using the tool shown in fig. 14, and as follows:

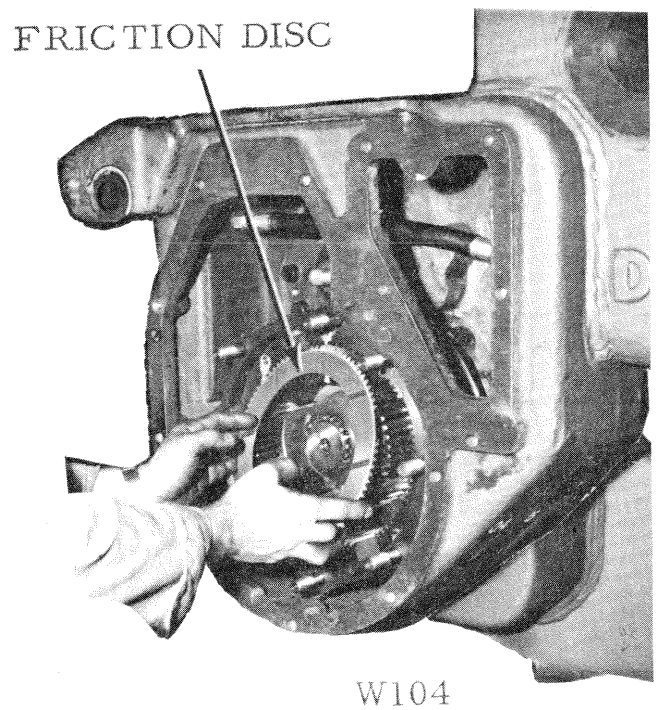


Figure 13

a. Assemble the friction discs and separator plates between the champing plates. Fig. 15.

b. Completely compress the discs and plates by tightening the 1/2 inch bolt to 12 lbs.-ft.

c. Measure between the plates to obtain the thickness of the pack.

(1) If thickness is less than 2.220 inches, subtract the difference between 2.220 and pack thickness, from .049 inches, which is the thickness of shim set.

(2) If pack thickness equals 2.220 inches, use all shims provided.

(3) If pack thickness exceeds 2.220 inches, select other friction discs and separator plates so that pack thickness will be less than or equal to 2.220 inches.

8. Place the ring in the cage next and the two dished springs next to it. Fig. 13.

9. Attach the cover and shims, Fig. 2 if so equipped. Tighten the assembly bolts or nuts 200 ft. lbs. use G-8 nuts and HT flat washers.

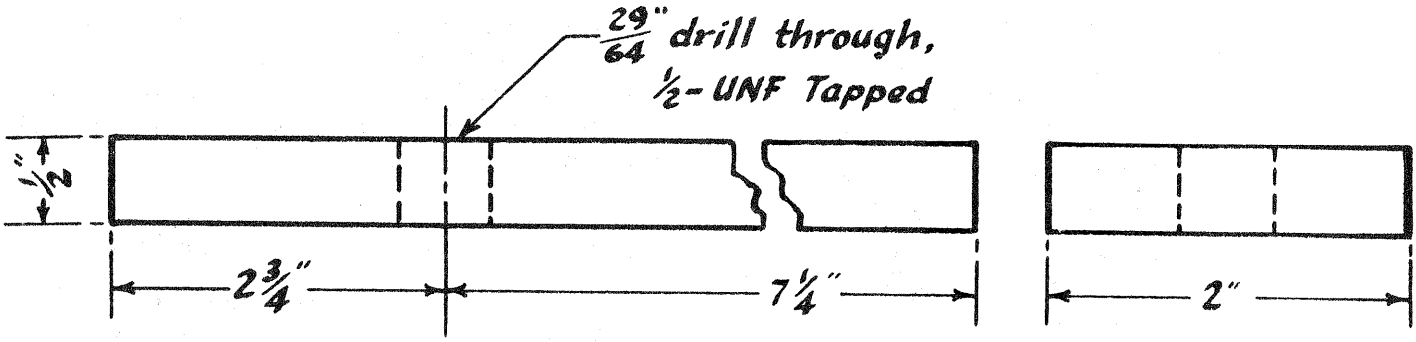
10. Attach the side cover and gasket, using aligning dowels. Fig. 16.

MECHANICAL BRAKE

A. General. Fig. 17

A cast iron brake drum, splined to the brake shaft and an external wrap around brake band are the major components in the mechanical brake system. Segmented lining is riveted to the band, and the drum is secured to the shaft by an external snap ring.

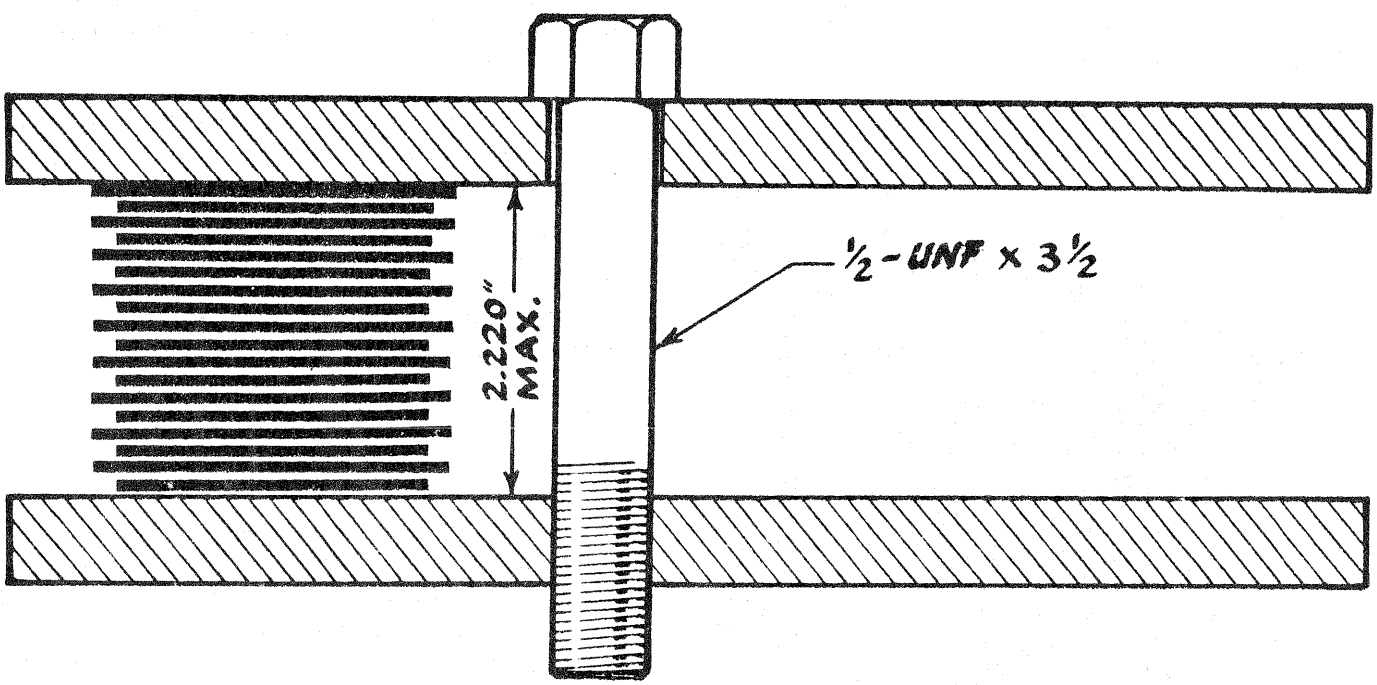
When installed on a direct-drive winch the mechanical brake is manually applied and released, through mechanical linkages. The brake on a power-controlled winch is applied by two tension springs and released by a hydraulic cylinder.



2 Pieces 1/2" x 10" x 2" Cold Formed
1 pc. Drilled and Tapped as Shown
2nd pc. Drill Hole to 9/16"

W105

Figure 14



W106

Figure 15

B. Removal

1. Remove the brake cover, linkage cover and the spring anchor cover from power controlled winches.

2. Remove the brake drum. If the winch is direct-drive refer to Step a. Refer to Step b., if it is power controlled.

a. Release the brake. Remove the snap ring

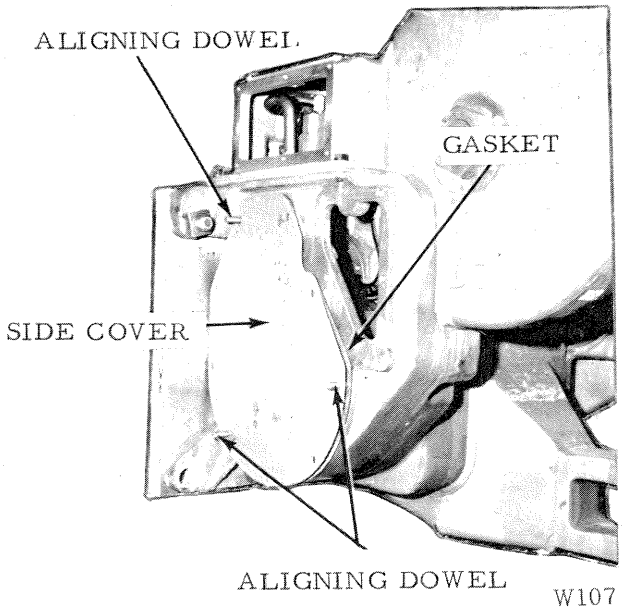


Figure 16

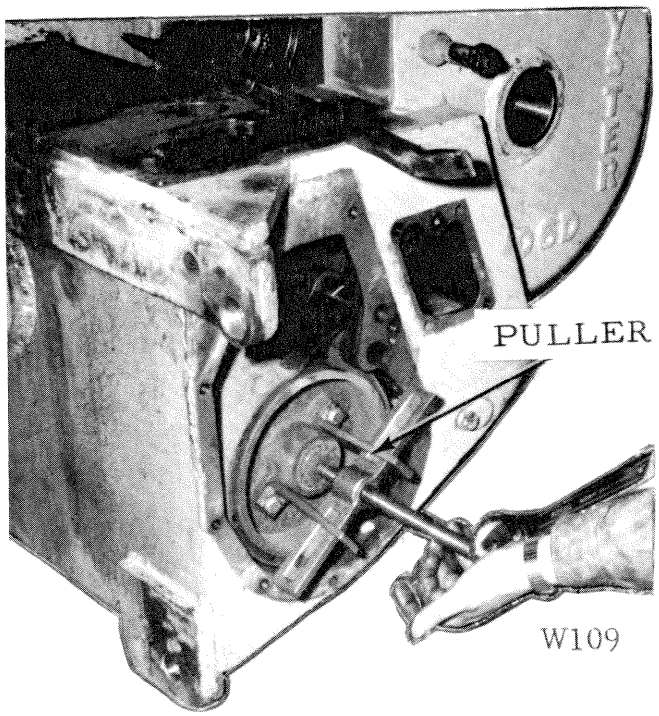


Figure 18

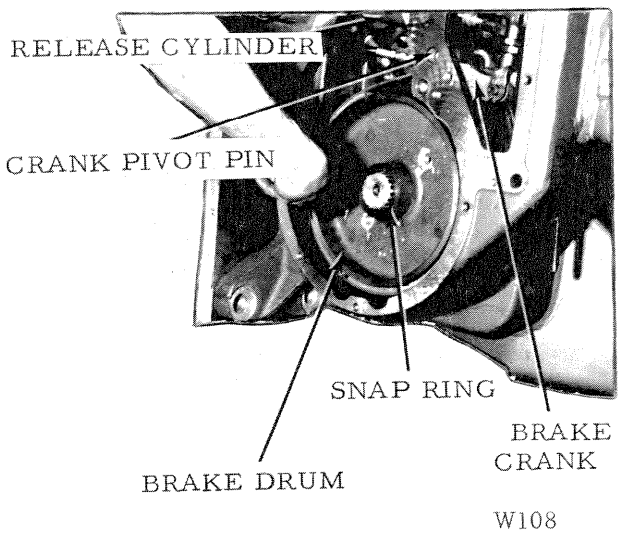


Figure 17

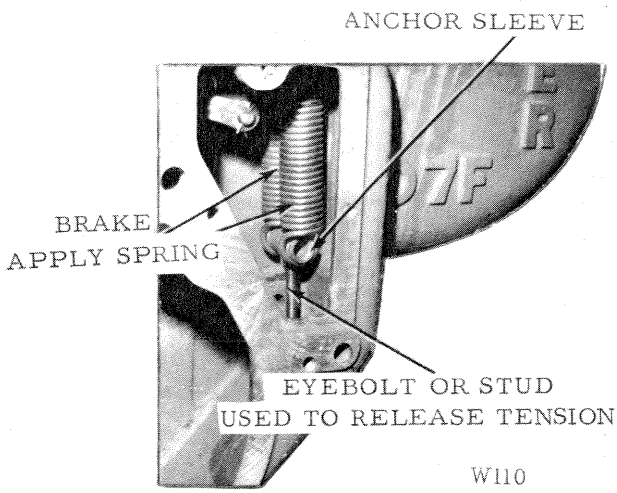


Figure 19

retaining the brake drum. Fig. 18. Pull the drum off the shaft; use a puller if necessary. Fig. 18.

b. Unscrew the plug directly below the spring anchor sleeve. Insert an eyebolt into the hole and screw it into the bottom of the anchor sleeve. Fig. 19. Push a prybar through the eyebolt and against the case. Push down on the pry bar, slowly. Remove the springs.

NOTE: The eyebolt can be made by welding a cut washer to 1/2" UNF x 4" capscrew. The

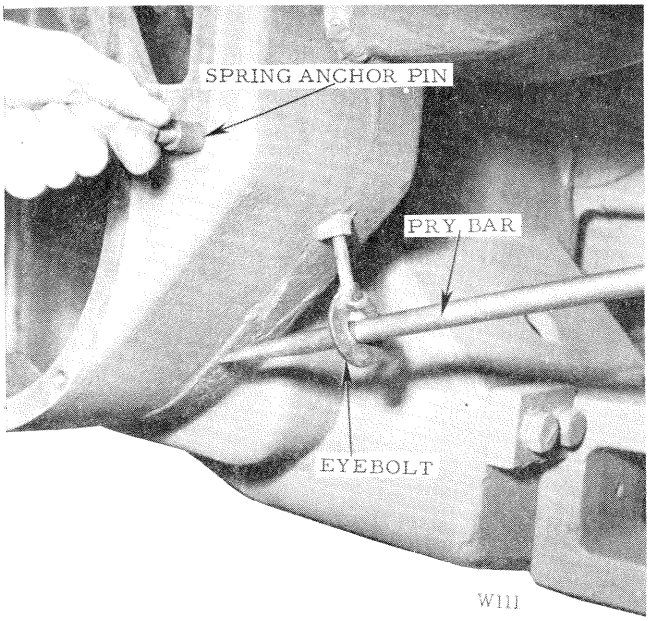


Figure 20

springs in fig. 19 are shown in the released position so the relationship between the anchor sleeve, springs and eyebolt may be seen clearly.

NOTE: As an alternate, a 1/2" x 7-1/2" UNF stud, nut, washer and deep socket may be used to relieve the spring pressure instead of the eyebolt and pry bar mentioned in Step b. The end of the stud is screwed into the anchor sleeve. Then the washer is placed over the stud and against the case. Spring pressure is relieved by screwing the nut onto the stud and snugly against the case. When the pin is extracted the nut is unscrewed. Fig. 21.

3. Disconnect the rod end from the brake crank or release cylinder. Pull the brake crank pivot pin out. Fig. 17. Lift the brake band out of the case. Fig. 22.

C. Installation

1. Install the brake band and drum in the reverse of "Removal".

2. Adjust the brake band. Refill power controlled.

D. Band Adjustment

1. Remove both covers from left side of the winch.

2. Release the brake by moving the direct-

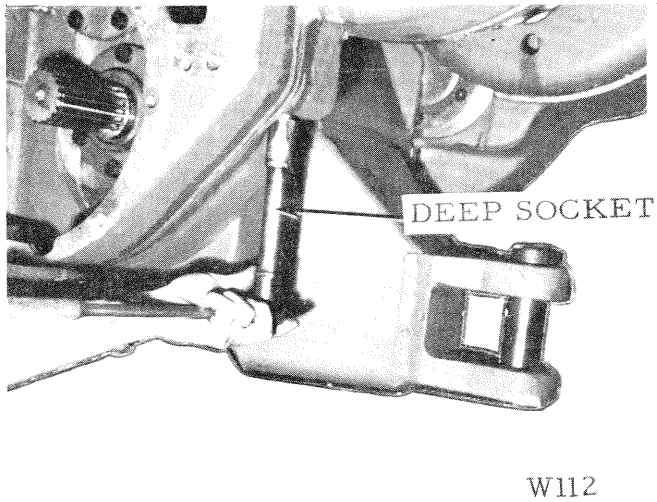


Figure 21

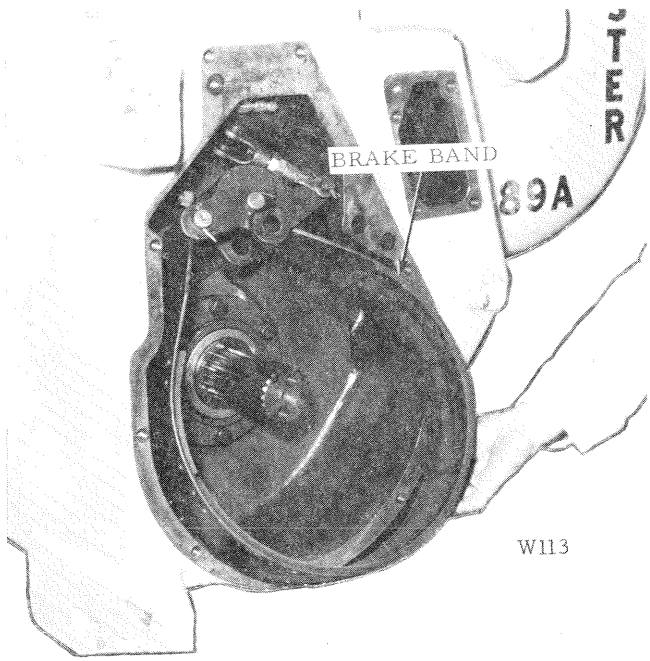


Figure 22

drive brake lever forward, or pushing the power-controlled lever into neutral-brake off position, with the tractor engine running.

3. Loosen the jam nut on the adjusting link. Fig. 23. Lengthen the link by turning it to the left until the band is wrapped snugly around the drum; then shorten it until the drum is free to turn without dragging. Tighten the jam nut. It

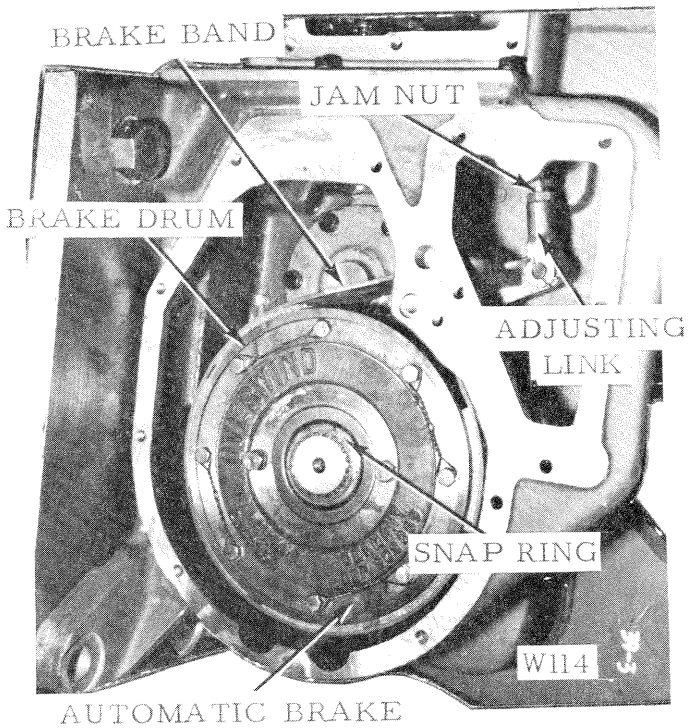


Figure 23

may be necessary to pry the band one way or the other to obtain equal clearance between drum and band.

NOTE: When adjusted the band should clear the drum approximately 1/32 inch.

4. Attach the covers and gaskets to the left side of the winch. Fig. 16.

AUTOMATIC BRAKE

A. General

This assembly mounts on the brake shaft and is held in position by an inner snap ring and an outer snap ring. Fig. 23.

In operation during haul-in the standard brake is applied. The pawl retracts during forward drum rotation.

NOTE: This assembly must be repositioned on the shaft when changing the winch drum from overwind to underwind or vice versa.

B. Removal

1. Remove the cover from the left side of the winch. Fig. 16.

2. Remove the outer snap ring. Fig. 23. Pull the brake assembly off the brake shaft.

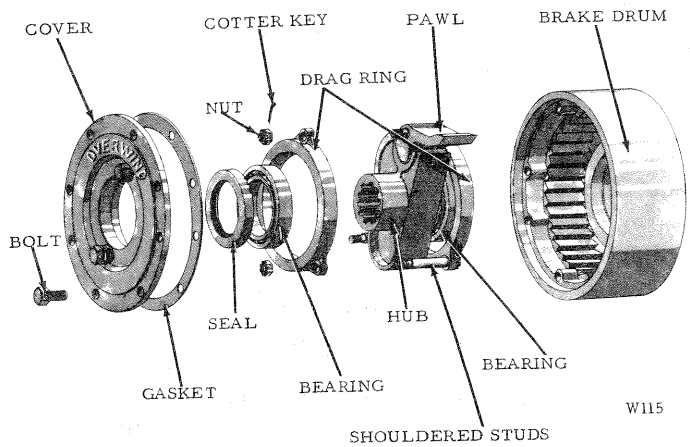


Figure 24

C. Disassembly. Fig. 24

1. Cut the lockwires securing the cover attaching bolts. Unscrew the bolts. Remove the cover and gasket by pushing on the side of the hub opposite the loosened cover.

2. Note which way the pawl is installed. Extract the cotter pins and unscrew the nuts securing the drag ring. Lift the drag ring off the shoulder studs.

3. Slide the pawl out of the hub. Pull the bearings off the hub or out of the covers, only if necessary.

4. Press the seals out of the covers, only if they are to be replaced.

D. Servicing

1. Clean all parts thoroughly with solvent and blow dry with compressed air.

2. Remove all old sealer from the gasket surfaces. Run a thread chaser through all tapped holes and buff the bolt threads with a wire brush.

3. Dress rough sealing surfaces with fine sandpaper. Press new seals into the covers with lips toward the center of the assembly.

4. Repack the bearings and brake, using one pound of high temperature bearing grease in the D6 and D7 brake assemblies and 1-1/2 pounds in the D89 assemblies. Make sure all wearing surfaces are lubricated.

E. Assembly. Fig. 24

1. Press the bearings into the covers. Smear grease on the seal lips.

2. Secure three shoulder studs in one of the drag rings. Place the assembly in the drum over the hub of the cover with the flat side to the right.

3. Set the hub between the three shoulder studs of the installed drag ring. Slide the pawl over one of the studs with the lug to the right.

4. Slide the other drag ring over the shoulder studs; secure it with the nuts and cotter pins.

5. Apply a film of non-hardening sealer to each side of the cover gasket and copper washers. Coat the bolt threads with non-hardening sealer.

6. Attach the cover and gaskets with the bolts, copper washers and lockwires.

F. Installation

1. Slide the brake assembly over the brake shaft and against the inner snap ring.

NOTE: If the winch overwinds, install the brake with the word "OVERWIND" to the outside. If the winch underwinds, install the brake with the word "UNDERWIND" to the outside.

2. Install the outer snap ring. Fig. 23. Adjust the brake band if necessary. Install the winch cover. Fig. 16.

NOTE: The brake band adjustment is made the same way as that of the standard mechanical brake.

SECTION D – HYDRAULIC

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FLOW DIVIDER	16
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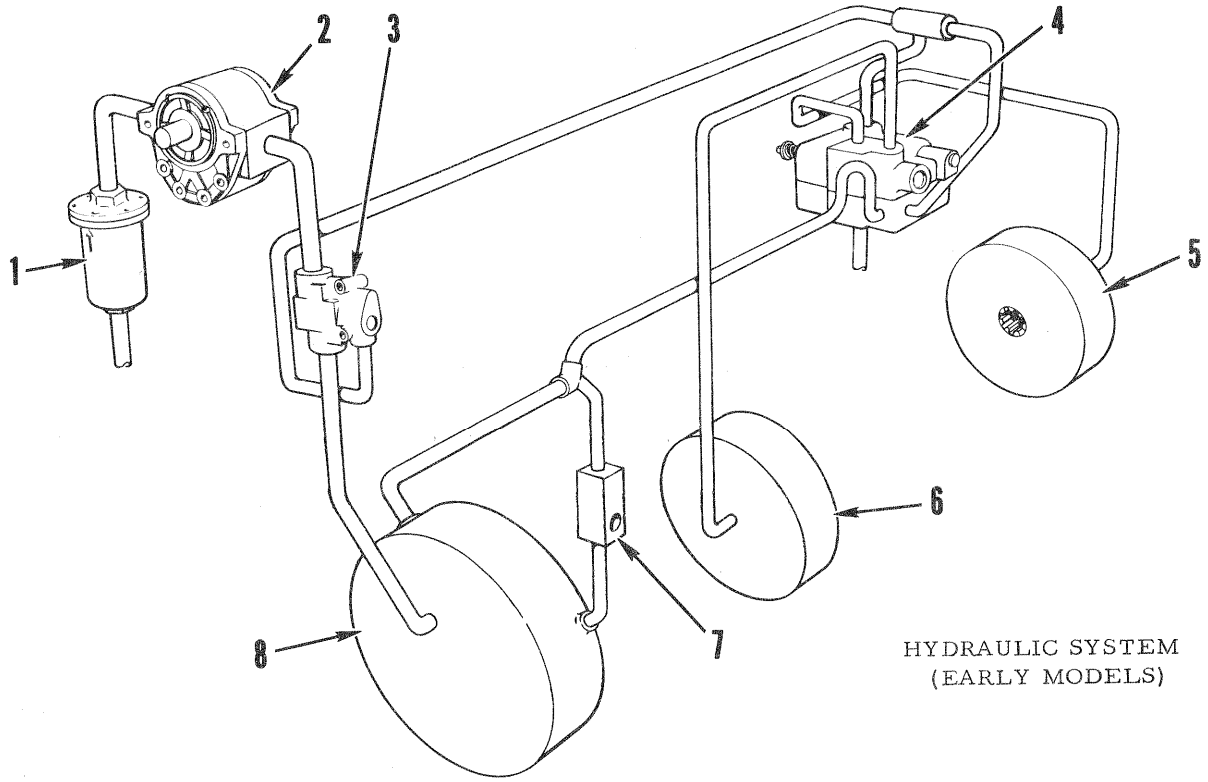
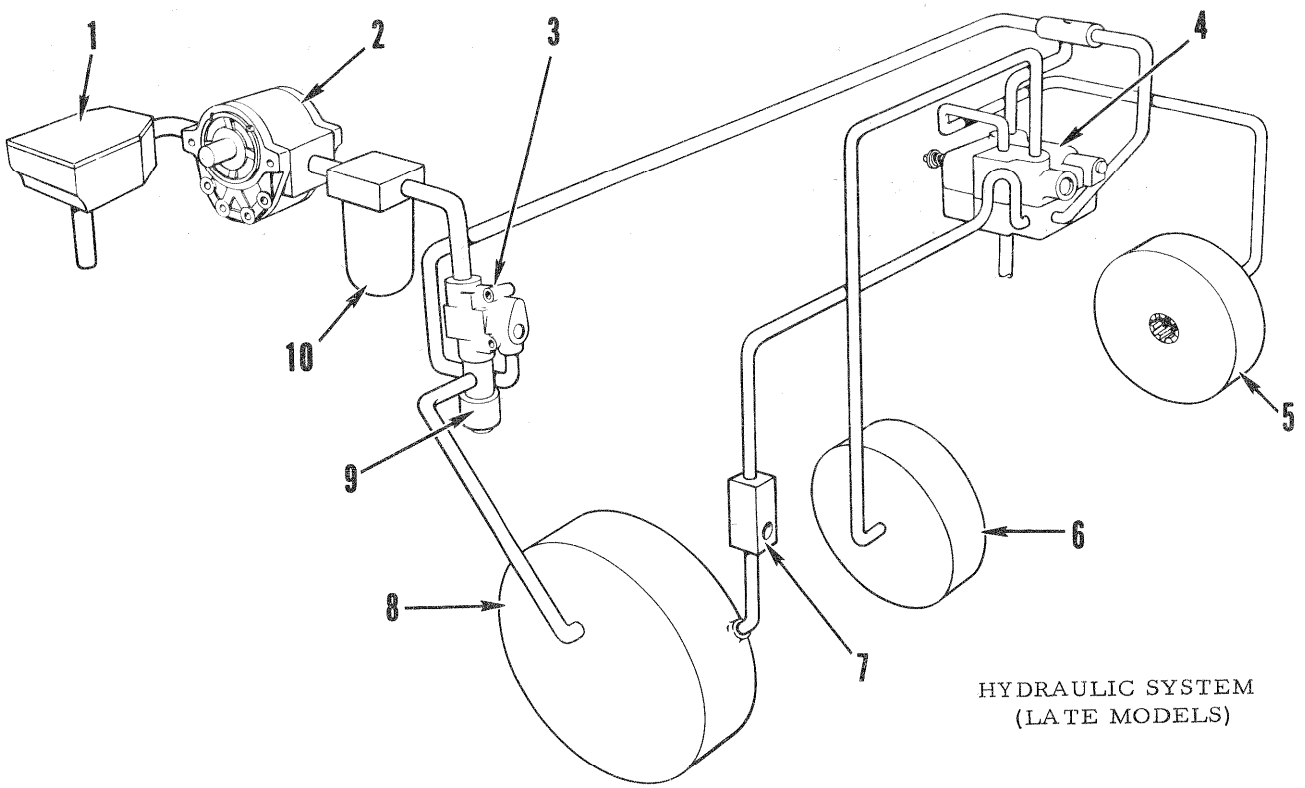
HYDRAULIC



HYDRAULIC SYSTEM
(EARLY MODELS)



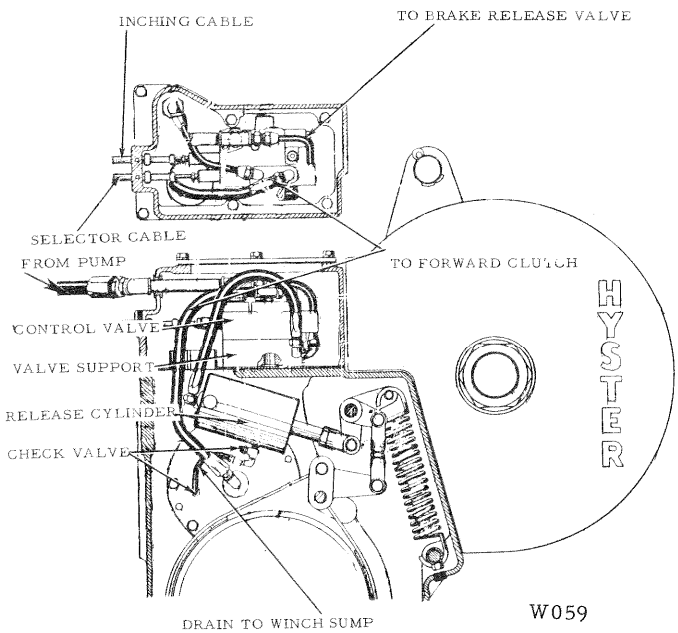
HYDRAULIC SYSTEM
(LATE MODELS)

1. Strainer
2. Pump
3. Flow Divider
4. Control Valve
5. Right Clutch
6. Left Clutch
7. Dump Valve
8. Brake
9. Relief Valve
10. Filter
    (If so equipped)

GENERAL

All power control winches depend upon hydraulic pressure to control the drum rotation and to release the brake. To supply and control this pressure a hydraulic system is required. There are two systems considered in this section: One for the winches equipped with a mechanical brake; One for winches equipped with an oil brake. There is a slight variation in the circuitry of some oil brake equipped winches.

A hydraulic pump, control valve, hydraulic cylinder, two multiple disc clutches and a strainer are the assemblies in the hydraulic system of a winch equipped with a mechanical brake. Fig. 1. Although hydraulically operated the clutches are part of the bevel gear shaft and are considered in the winch section.

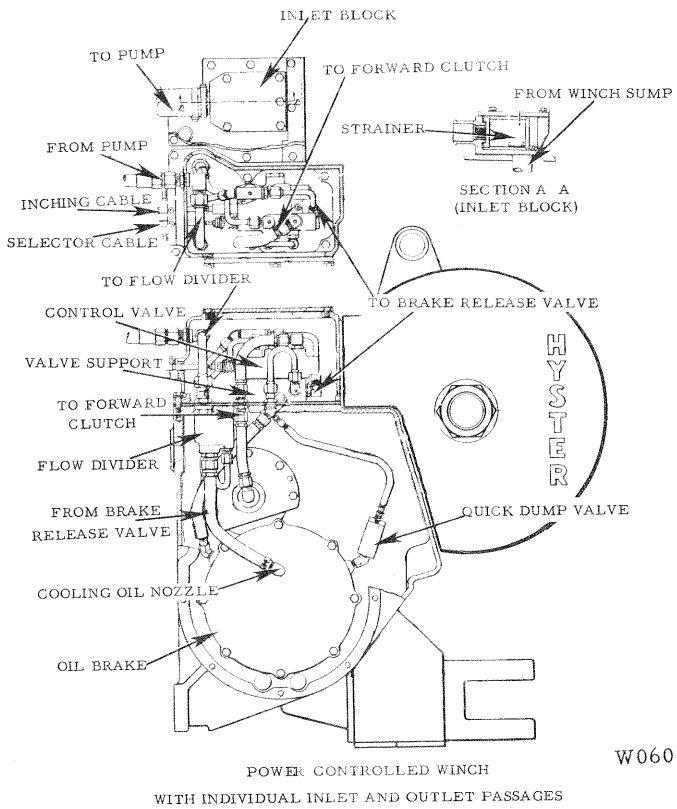


POWER CONTROLLED WINCH WITH MECHANICAL BRAKE

Figure 1

In operation: The hydraulic pump supplies the oil to the system; the control valve is actuated by the handling gear, receives the oil from the pump, then distributes and regulates it; the hydraulic cylinder releases the brake; the strainer removes contaminants from the oil.

The assemblies in the hydraulic system of a winch equipped with an oil brake are nearly the same as those mentioned above, except it does not have a hydraulic cylinder. A flow divider, a dump valve and on some winches brake cooling oil relief valve are also included in the oil brake system. Fig. 2 and 3. The oil brake proper is considered in the brake section.



POWER CONTROLLED WINCH
WITH INDIVIDUAL INLET AND OUTLET PASSAGES

Figure 2

Oil from the pump is divided and routed to two places by the flow divider. A metered amount of oil is routed to the control valve assuring a definite amount of oil here. Oil in excess of the metered amount is brake cooling oil.

Brake cooling oil is routed to the brake cover. Fig. 2. In some cases the oil is directed to a relief valve and then to the brake cover; in this case excess oil is dumped into winch sump. Fig. 3.

The dump valve is placed in the hydraulic system to assure fast evacuation of brake release oil, which is necessary for rapid brake application.

The temperature gauge should be discarded, and a one piece suction hose used.

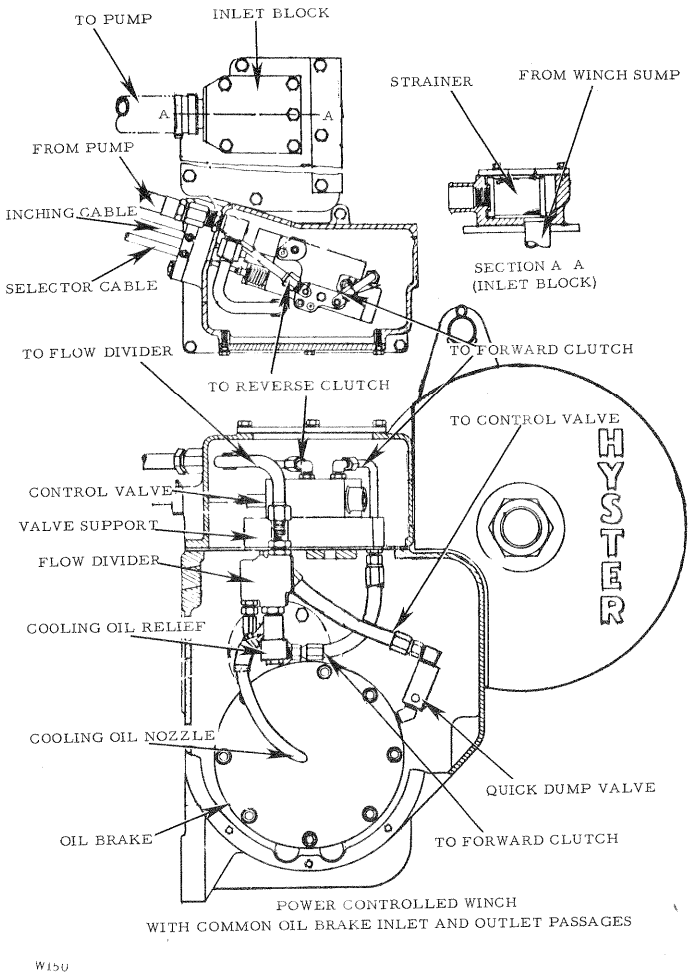


Figure 3

HYDRAULIC PUMP

A. General

Pumps installed in Caterpillar tractors are driven by an auxiliary PTO shaft. Early D7H and D89B units used a 2 gear speedup drive rated at 33 GPM. These have been replaced with inline pump drives. See Parts Service Gram AO-E-3R2 for change over kits. The D7F and D89A winches must use their small displacement pumps to prevent overheating. The side part and end part pump may be used for both models.

Belt driven pumps and pumps driven by external-internal gears rotate clockwise, when viewing the drive end. The Hyster P/N is stamped on the pump.

The direction in which the pump should rotate is indicated by arrows stamped on the body and both end covers.

NOTE: When servicing the pump, extreme care must be taken to prevent foreign matter from entering the unit and causing damage to the machined surfaces.

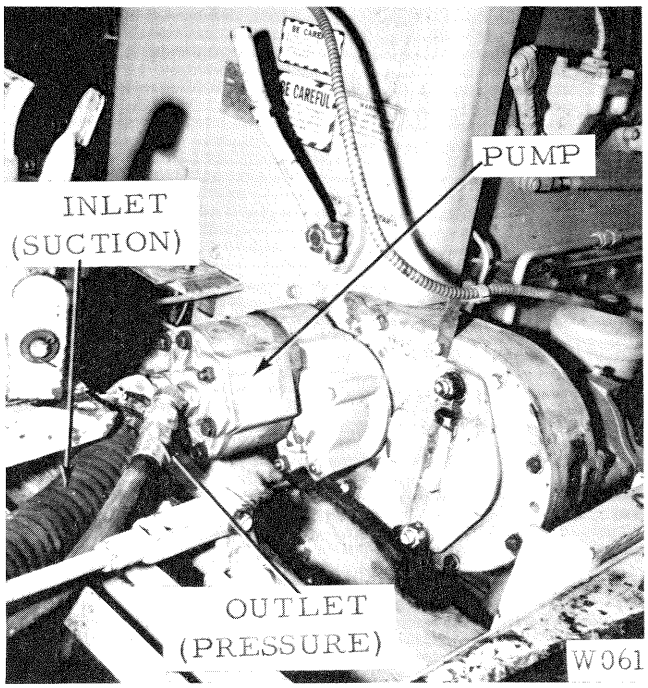


Figure 4

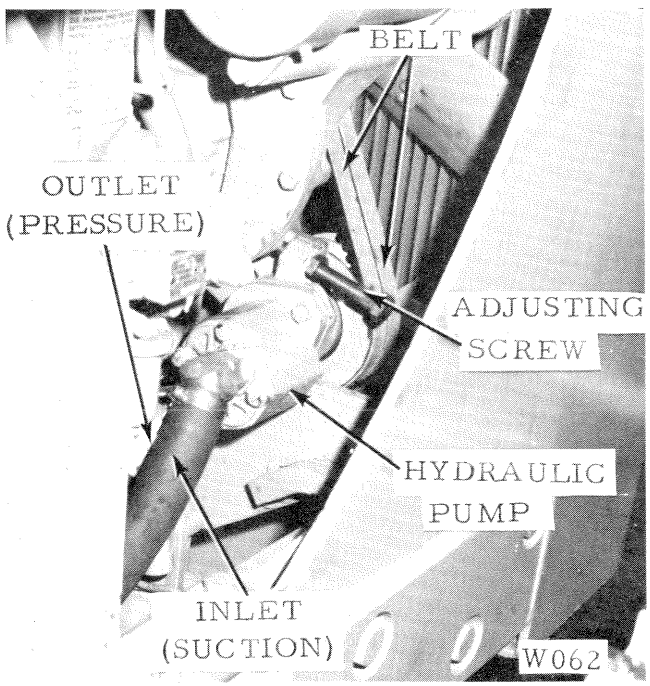
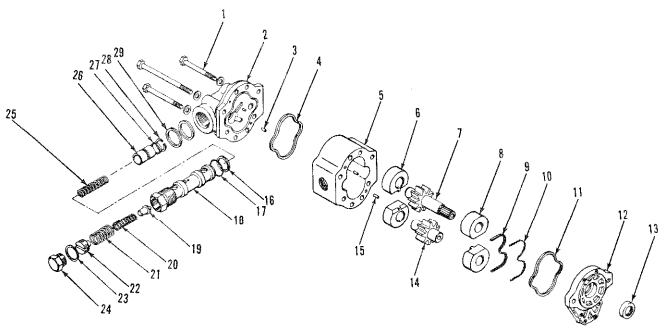


Figure 5

A housing, two gears, four bearings, a front and a rear cover are the components making up the pump assembly. Pressure loading the front bearings assures correct gear-to-bearing clearance during operation. During pump operation, pressurized oil is directed to an area between the front cover and bearings forcing them toward the gears. Pressure from the outlet side of the pump is against the opposite side of the bearings. When the two pressures are balanced, a thin film of oil exists between the gears and bearings, and actual gear-to-bearing contact is prohibited.

Oil is prevented from by-passing the body and end covers by neoprene gaskets between the components. A replaceable shaft seal is pressed into the front cover. Communication of the high pressure and low pressure oils between the bearings and front cover is prevented by a "W" shaped seal.

B. Disassembly. Fig. 6



G103

1. Cover
2. Capscrew-Lockwasher
3. Detent Spring
4. Detent Ball
5. O-Ring
6. Shift Shaft
7. Setscrew
8. Shift Fork
9. Seal
10. Spacer
11. Washer
12. Spring

Figure 6

1. Make sure that there are arrows, indicating pump rotation, stamped on the body and both covers. Fig. 7. If not, match mark the body with the two end covers. Remove the drive.

2. Unscrew the through bolts and remove the washers. Separate the front and rear covers from the body. Remove the seal from the front cover. Lift out the "W" shaped gasket seal and spacer. Drive out the shaft seal. Fig. 8.

3. Mark the relative position of the bearings

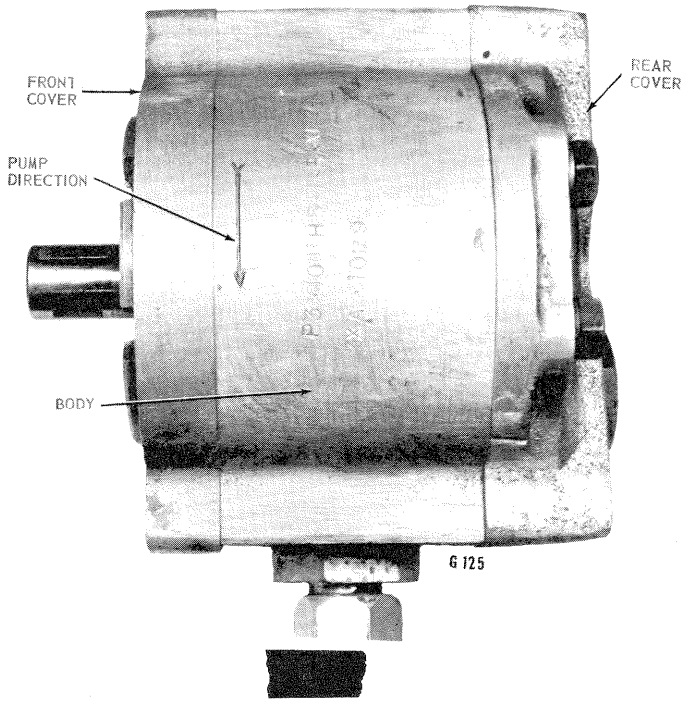


Figure 7

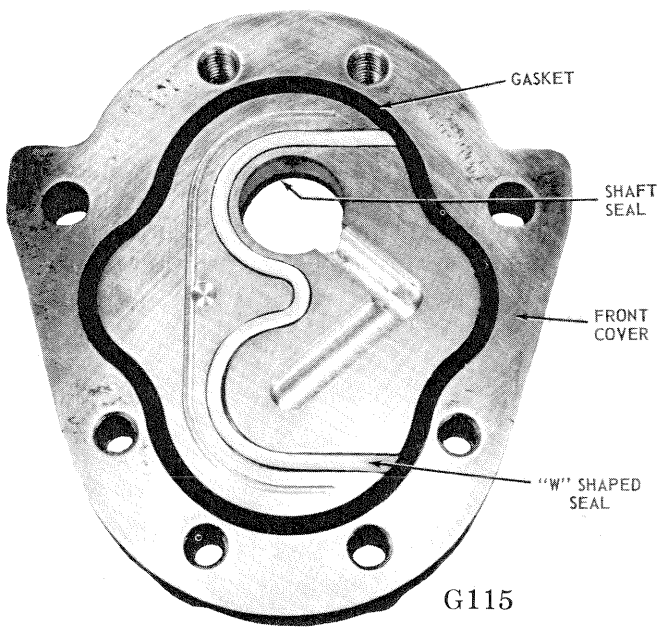
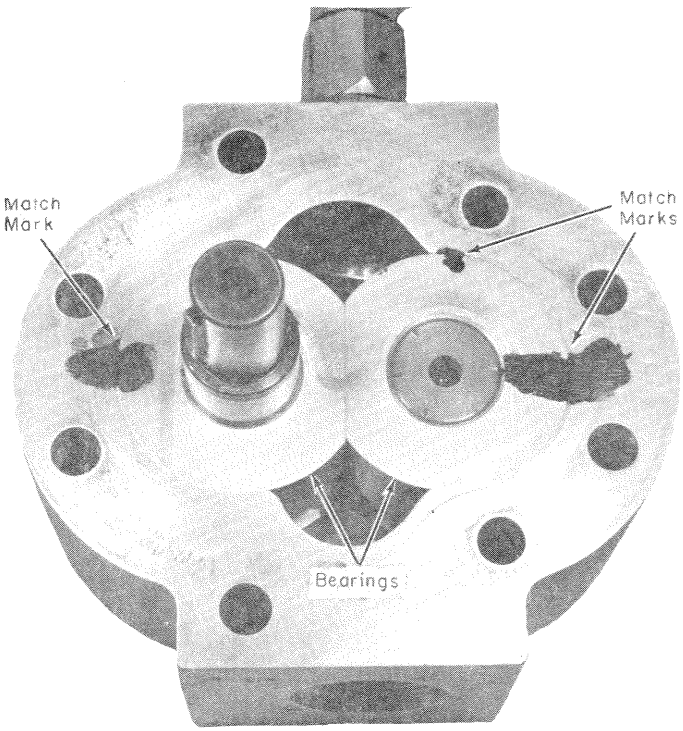


Figure 8

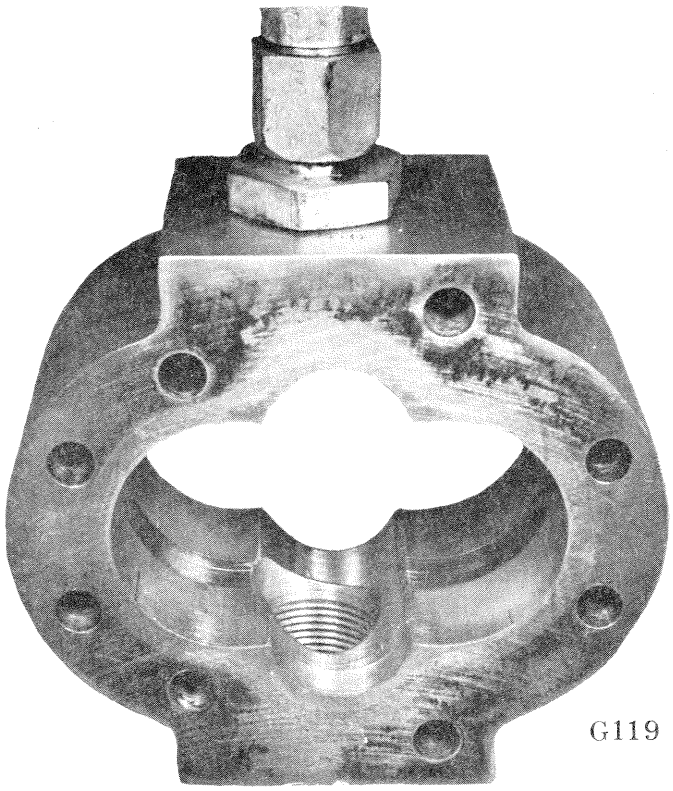
and body, front and rear. Do not scratch, use prussian blue. Fig. 9. Push on the rear bearings until the front bearings are free of the housing. Slide the bearings off the shafts.

4. Mark the relative position of the gears. Pull the gears out of the housing. Push the rear bearings out of the housing.



G116

Figure 9



G119

Figure 10

C. Cleaning and Inspection

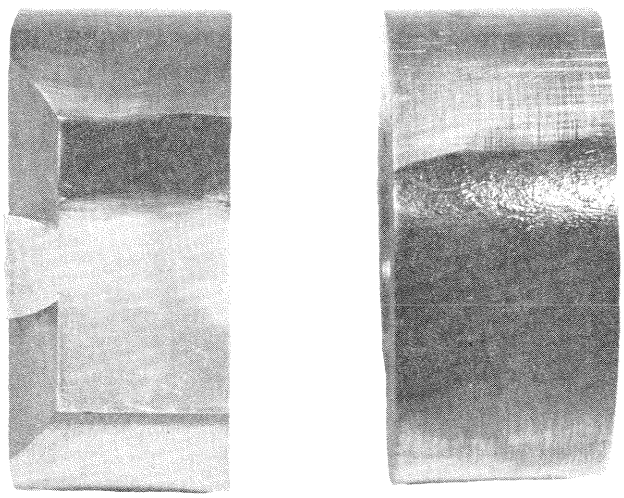
1. Clean all parts thoroughly in solvent.

2. Check gears and shafts for nicks, cracks or chipping. Discard component if any of these are present. Burrs and minor defects may be removed with fine sandpaper.

3. Examine gear chamber of body for evidence of contact between gears and body, especially the intake cavity of the body. Fig. 10. Although wear of more than 1/64 of an inch is abnormal, it is not critical if the bearings are not defective.

4. Inspect the body and bearing for irregularities of the bore caused by bearing attempting to turn or signs of working. Fig. 11.

5. Examine bearings and body for scratches and pitting. Use fine sandpaper on a surface plate to dress out any slight imperfections of bearings. Do not attempt to remove deep scratches or gouges. Fig. 12 illustrates method of dressing the bearing. Check bearing bores for concentricity or smearing. Fig. 13. Place bearings in their respective positions in the body and check clearance between bearing flats, which



G123

Figure 11

should be between .0002 and .001 inch.

6. Check milled seal and gasket recesses of the cover for any obstruction that would prevent normal seating. Make sure internal threads of front cover and threads on capscrews are in

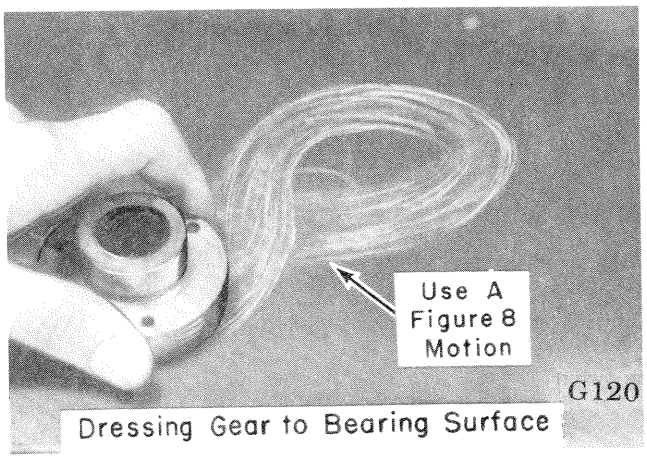


Figure 12

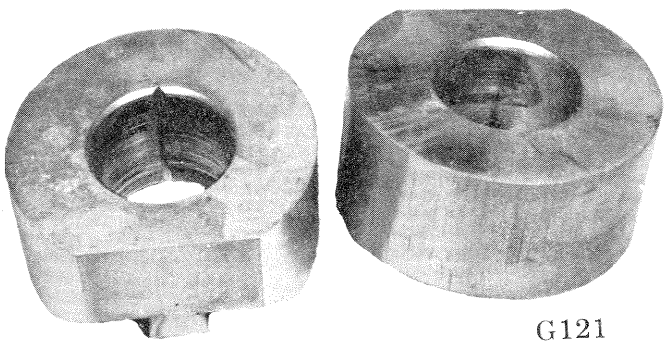


Figure 13

Figure 14

good condition.

D. Assembly. Fig. 6

1. Apply a light coat of non-hardening gasket cement to the bore in the front cover. Press new shaft seal into the bore and wipe off excess cement. Stake seal in three places.

NOTE: Generously lubricate all parts with SAE 10W oil during pump assembly.

2. Install front bearing, gears and rear bearings in their respective positions. Make sure all marks previously made during disassembly are aligned.

3. Position gasket, spacer and "W"-shaped gasket seal, fig. 14, in front cover recess. Fig. 8.

CAUTION: Do not distort or attempt to straighten a damaged "W" gasket seal, as it's sealing effect will be impaired.

4. Assemble front and rear cover to the body, being careful that the "W" gasket seal retains its position in the recess of the front cover. Tighten through bolts to specified torque.

5. Assemble the pump drive to the shaft. Turn pump by hand and check for binding.

6. Purge the pump by pouring oil into the intake port and turning the pump by hand.

E. Break-In Procedure

1. Break-in will be required for new pumps, rebuilt pumps, or those out of service for an extended time.

2. Prime pump: Fill inlet hose with correct hydraulic oil. Fig. 15. Due to position and/or location, complete filling of inlet hose may be impossible, so fill to permissible limit.

3. Start and run the engine at 1000 RPM with everything in neutral. Run for 10 minutes frequently checking the pump for abnormal hot spots. Stop the engine.

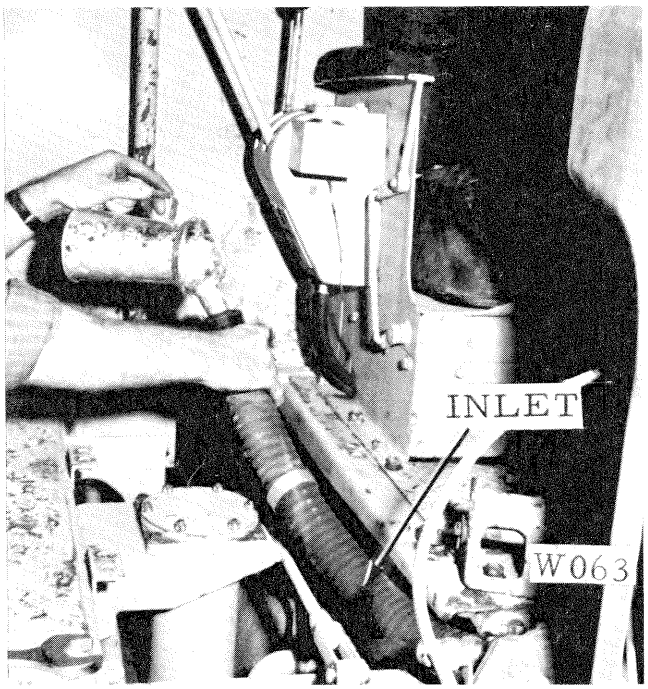


Figure 15

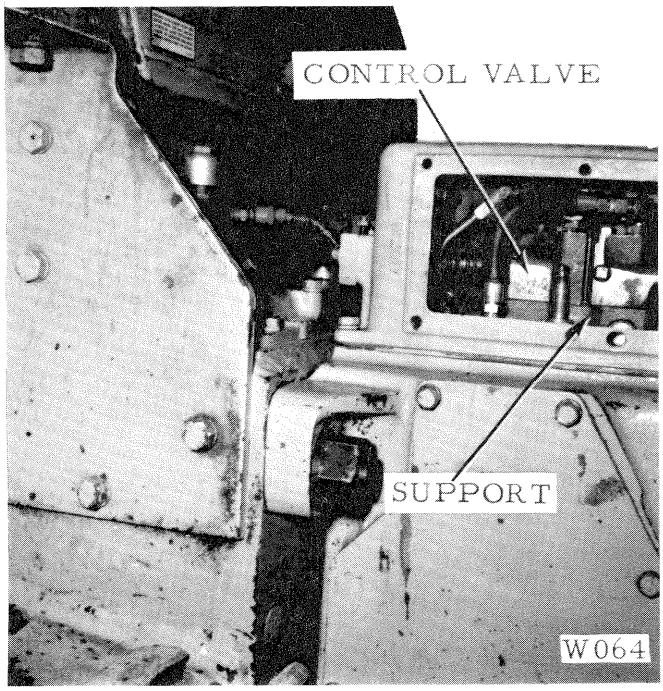


Figure 16

4. Install a pressure gauge between the pump and control valve. Adjust the relief valve setting.

5. Run the engine at 1000 RPM. Operate components slowly for one minute before placing winch into normal service.

CONTROL VALVE. Fig. 16

A. General

Clutch apply oil is routed by the control valve to the various assemblies. The control valve also controls two oil pressures, clutch and cooling.

Contained in the body is a selector spool, inching spool and regulating valve. Also in the body are springs, plugs and drilled passages necessary for proper valve function. The entire assembly is attached to the top of a support. All valves are equipped with a clutch cooling oil relief valve, except the ones on the D7H winches; a metered orifice in the valve support controls the clutch cooling oil on these. Fig. 17.

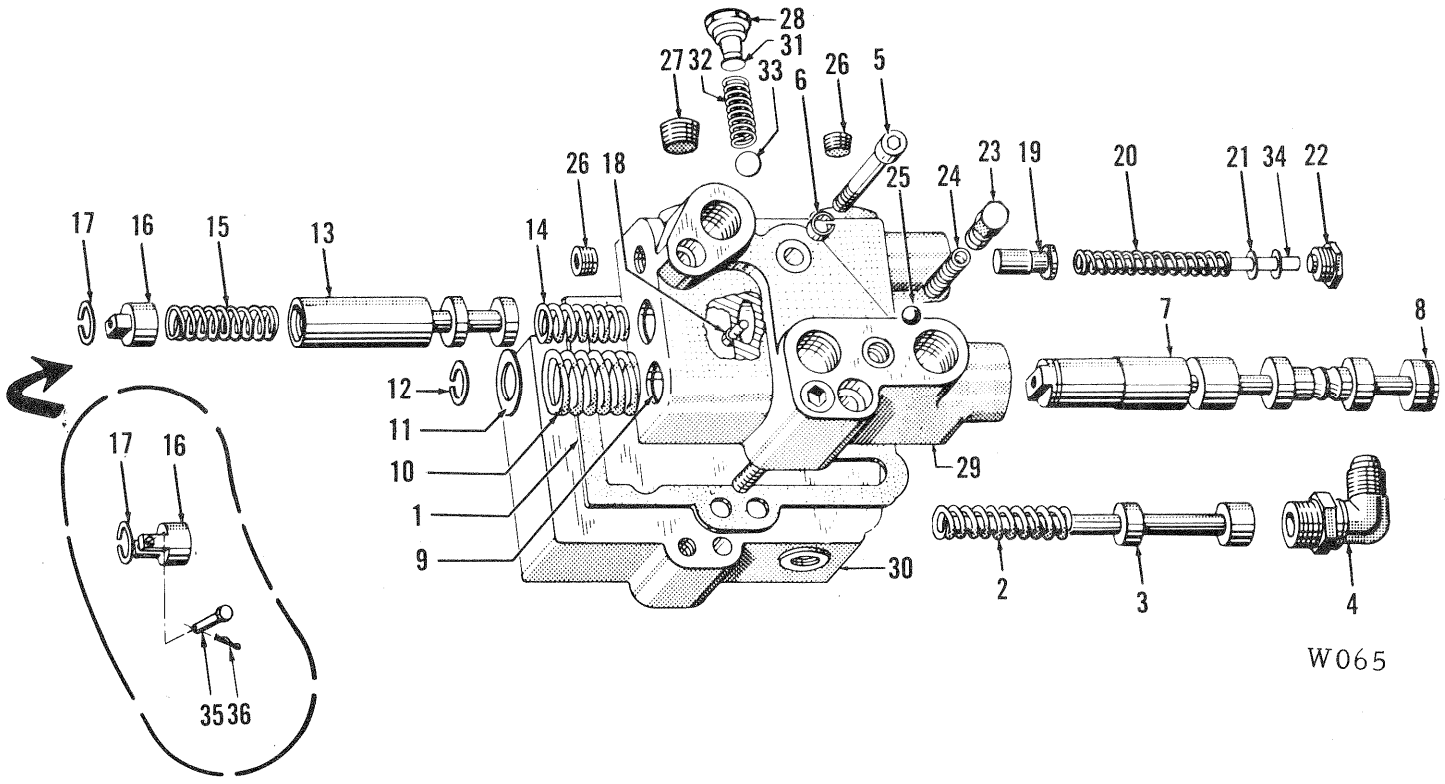
The support may house a brake release spool and spring. The spool bore is attached to the valve main pressure passage by a steel tube. A gasket prevents leakage between the valve body and support. A spring holds the spool in the brake release position. All supports contain a sump.

One end of the selector spool is attached to the selector lever and cable. The spool is spring loaded so that it will return to neutral-brake applied position, whenever the selector lever is released from forward position. Two detents and a spring loaded detent ball hold the valve in neutral or brake off. Although the valve is not held in reverse by the detent ball, it must be manually removed from this position

Assembled in the inching spool is a take-up spring and plug, secured by an internal snap ring. The assembly is spring loaded in the brake apply position, and secured by a cap-screw area to permit axial movement.

The relief spool is spring loaded and shim adjusted. Main line pressure is adjusted by varying the shim pack thickness.

Valve sump pressure is maintained by a relief ball which is spring loaded and shim adjusted. Oil seeping past the spool enters the sump through passage (12), fig. 18, connecting the spool bore with the sump. Part of the oil flowing out of the sump is used to cool the clutches; the excess is returned to the winch sump.



1. Gasket
2. Spring*
3. Brake Release Spool*
4. Fitting and O-Ring
5. Mounting Bolt
6. Lockwasher
7. Selector Spool
8. O-Ring
9. O-Ring
10. Centering Spool
11. Washer
12. Snap Ring
13. Inching Spool
14. Positioning Spring
15. Take-Up Spring
16. Plug
17. Snap Ring
18. Capscrew
19. Relief Spool
20. Relief Spring
21. Shims
22. Plug and Gasket
23. Plug and O-Ring
24. Detent Spring
25. Detent Ball
26. Plug
27. Plug
28. Fitting and O-Ring
29. Body
30. Support
31. Shims*
32. Spring*
33. Relief Ball*
34. Limiting Rod
35. Pin
36. Cotter

* If so equipped

Figure 17

In neutral-brake applied position oil enters the inlet port (1), into the main line passage. The passage routes the oil to the relief spool (2), and to two other passages.

One of the passages directs main line oil to the back (spring end) of the inching spool and to the third land (3) of the selector spool. Oil at the third land is static until the selector spool is shifted to apply a clutch; it then is released to flow to the clutch selected for application. This oil is called "apply oil".

Besides being routed through the apply oil passage part of the mainline oil becomes the clutch cooling oil. This oil is routed from the inlet port past the first land (4) of the inching spool to the first land (front) of the selector spool, where it enters passage (5) in the bottom of the selector spool bore to the valve sump (6).

In the sump the cooling oil is divided. Part of

HYDRAULIC

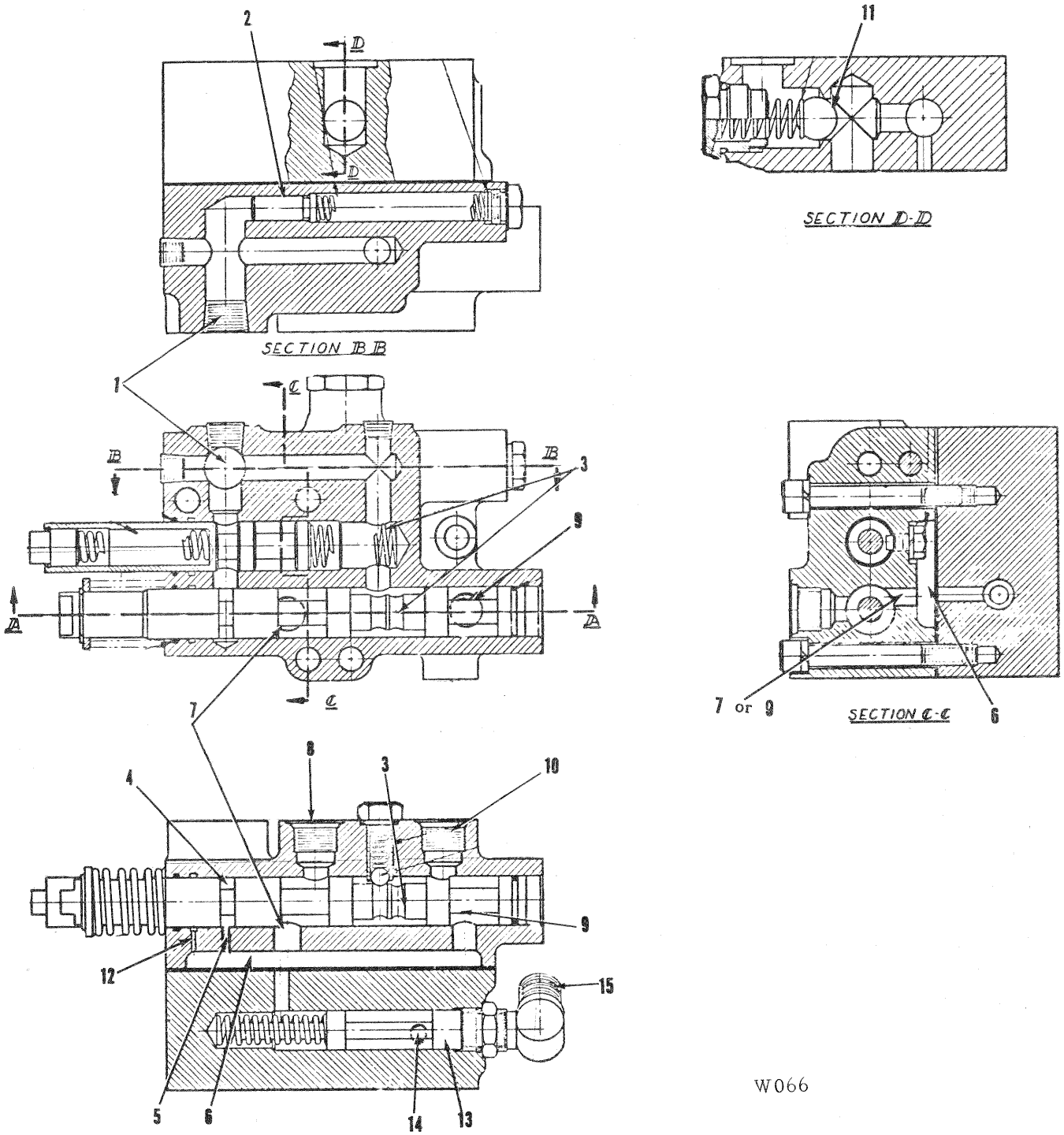


Figure 18

the oil is routed from the sump, through passage (7), past the second land of the selector spool and out the reverse clutch port (8) to the reverse clutch. The rest of the cooling oil is routed to the forward clutch in the same manner, except the oil passes the fourth land (9) and out the forward clutch port (10).

When the cooling oil pressure exceeds 7 P.S.I. the relief ball (11) is pushed off its seat, allowing the excess oil to return to the winch sump. Cooling oil also tends to act upon the main re-

lief spool, but does not affect it because of the low pressure.

Any oil leaking past the release spool is routed through a passage to the valve sump. The passage is on the spring side of the release valve, and similar to passage (12).

Pulling the selector lever in pushes the selector spool in, connecting the apply oil passage (3) to the forward clutch port (10), and closing the cooling oil ports. As the forward clutch is applied the apply oil pressure rises. When the pressure reaches approximately 40 P.S.I. the brake release spool (13) is moved against the spring to uncover the brake port (14). Oil flows through the port to the brake to release the brake. The brake port (14) and release spool (13) are externally connected to the inlet port (1) through fitting (15). Control valves on the D7H winches are not equipped with release spool (13).

Releasing the lever to return to neutral, stops the apply oil flow and the pressure drops, allowing the clutch to release and brake to apply.

When the selector lever is placed in the brake release position, the selector spool is pulled out one detent. In this position the cooling oil passage (5) to the sump is covered causing the oil pressure to rise. Since no clutch ports were opened full pressure is immediately applied to the brake release spool (13). The spool is moved to uncover the brake port (14) allowing the oil to flow to the brake. With the brake release and no clutches applied the drum can be manually rotated.

Placing the selector lever in the reverse position moves the selector spool out two detents. In this position the oil flow to apply the reverse clutch and release the brake is similar to that in the forward position, except the apply oil is directed to the reverse clutch port (10).

When the inching lever is pulled in the inching spool is pushed into its bore. The oil flow through the control valve is restricted raising the oil pressure in back of the inching spool, and at the brake release valve (13) and port (14) and ultimately at the brake release piston. The pressure (3) behind the inching spool tends to push the spool out. This tendency is felt by the operator and is known as "Operator feel". The degree of brake release depends upon how far the brake lever is pulled in; it can be anywhere from completely applied to completely released. The spring in the spool permits "feathering" of the brake and helps in providing "Operator feel". When "feathering" the inching lever is moved slowly in and out a short distance to obtain the precise brake release desired.

The relief valve being always acted upon by the main line pressure will by-pass excess oil when the pressure exceeds the specified setting.

B. Removal—D6 Winch

1. Disconnect the hydraulic line from the front of the valve housing. Cap the openings. Unscrew the capscrews securing the housing cover. Lift the cover off housing.

2. Unscrew the inlet pipe until it is free of the valve body and the capscrews securing the cable anchor block, (if preferable the cable set screws may be loosened instead). Loosen the jam nuts locking the cable position in the spools. Disconnect the cable from the inching spool, by turning the spool with short open end wrench. Fig. 19. Disconnect the cable from the selector spool, the same way.

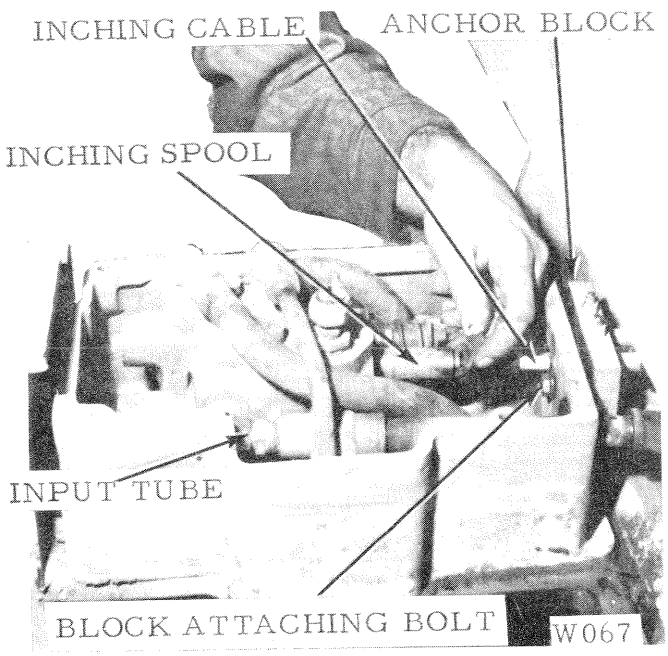


Figure 19

3. Disconnect the steel tube from the reverse port. Unscrew the socket head bolts securing the valve assembly to the winch. Disconnect the

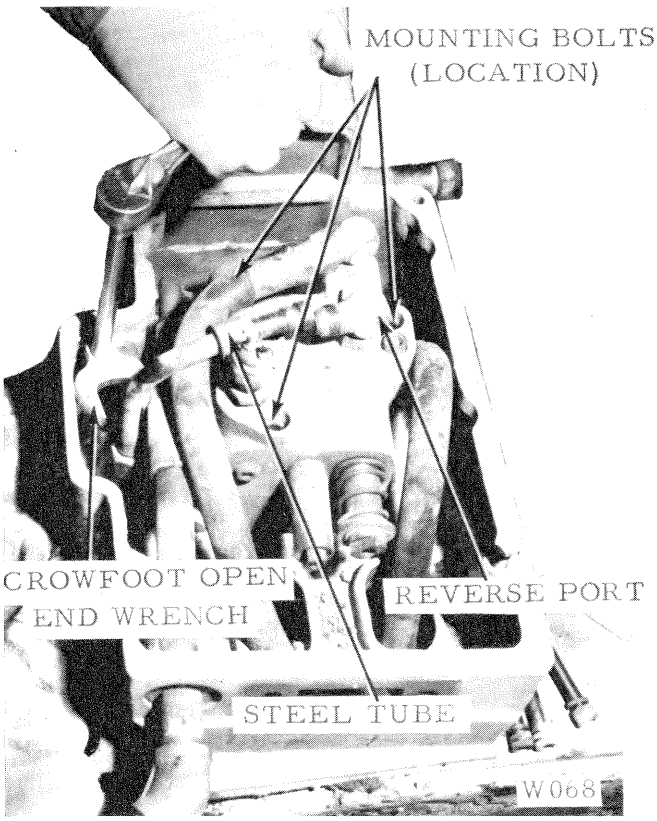


Figure 20

tube from the bottom of the housing. Fig. 20.

4. Lift the valve partially out of the housing. Disconnect the brake hose and the forward clutch hose from the valve. Fig. 21. Lift the valve out. Remove the O-ring from the winch or the bottom of the support.

C. Removal—D7, and D89 Winch

1. Unscrew the capscrews securing the top cover to the housing. Fig. 22. Tap the cover with a soft hammer to loosen it. Then, lift it off. Remove the side cover in the same manner.

2. Disconnect the inlet hose from the housing. Loosen the two setscrews anchoring the cables (if preferable the anchor block may be separated from the housing). Fig. 23.

3. Loosen the jam nuts locking the cables to the inching spool and selector spool. Disconnect the cable from the inching spool, by turning the valve, using a short open end wrench. Fig. 19. Separate the cable from the selector spool in the same manner. Pull the cables out of the housing.

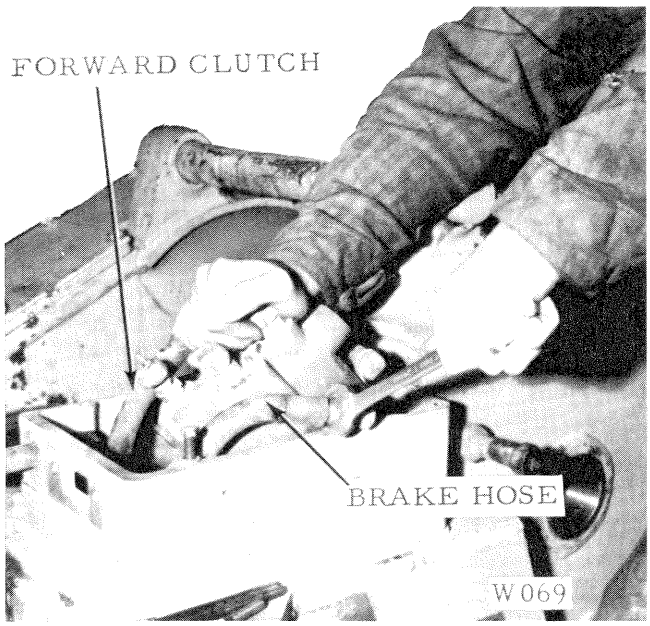


Figure 21

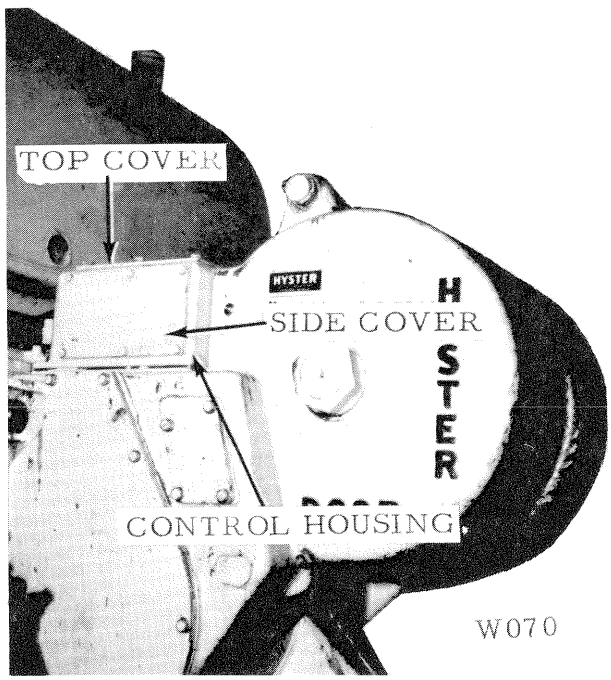


Figure 22

4. If the winch is equipped with a mechanical brake, unscrew the inlet pipe. Fig. 19.

5. If the winch is equipped with an oil brake, disconnect the steel inlet tube from the bottom of the control valve compartment. Loosen the

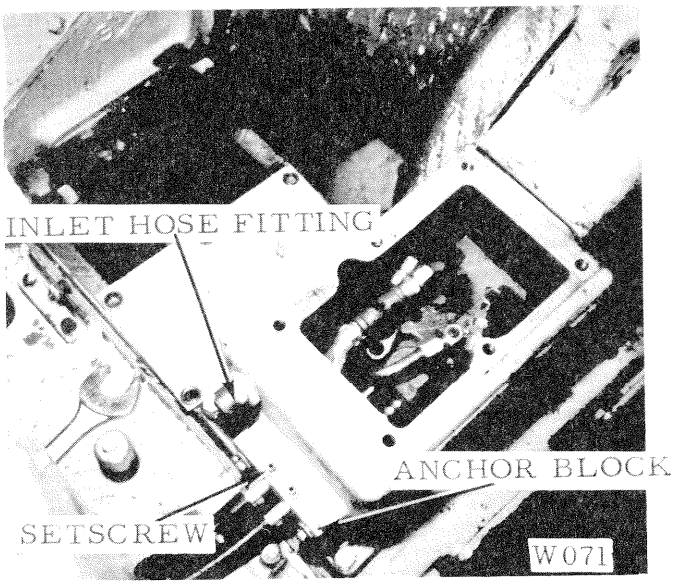


Figure 23

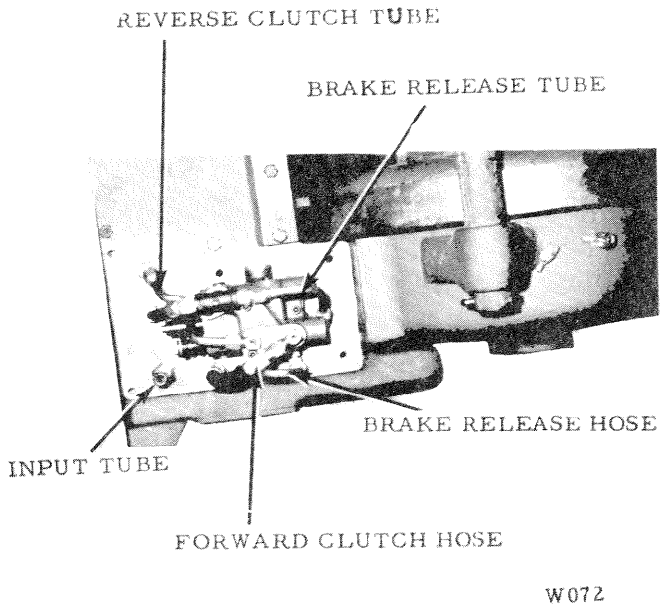


Figure 24

fitting connecting the tube to the front of the housing.

6. Unscrew the bolts securing the housing to the winch. Lift the housing off. It may be necessary to jar the housing to loosen it.

7. Disconnect from the valve: The steel input tube; the steel reverse clutch tube; the forward clutch hose; the brake release hose. If the valve body is to be separated from its support, loosen the connections of the steel brake release. Fig. 24.

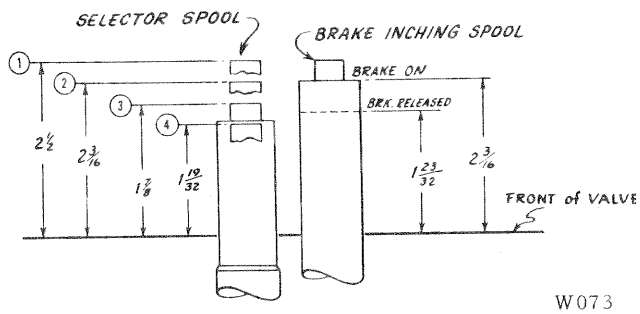
NOTE: Fig. 24 is of winches other than the D7H. Refer to fig. 25 when removing the D7H valve.

8. Unscrew the three socket head bolts securing the control valve assembly to the winch. Lift the assembly off. Remove and discard the O-ring from the winch or the bottom of the support, whichever the case may be.

D. Disassembly. Fig. 17

1. Remove the snap ring and washer securing the selector spool. Slide the centering spring off. Unscrew the plug retaining the detent ball and spring Remove the selector spool by pushing the spool on the end where the cable connects.

2. Push the plug in the inching spool in far



1 Reverse Clutch Engaged
2 Brake Release
3 Neutral
4 Forward Clutch Engaged

Figure 25

enough to relieve the pressure on the snap ring. Remove the snap ring. Release the pressure, slowly. Remove the plug and inching spool.

3. Separate the valve body from its support, by unscrewing the assembly bolts holding them together. Turn the bottom of the body up. Unscrew the capscrew retaining the inching spool while pushing on the spool. Pull the inching spool out. Remove the return spring.

4. Unscrew the main relief valve plug. Remove the shims. Note the shim pack thickness. Extract the spring and spool.

5. Unscrew the plug retaining the cooling oil relief ball, if so equipped. Remove the shims,

spring and ball. Note shim pack thickness.

NOTE: The cooling oil relief spring and the inching spool return spring are similar. Do not interchange them. The relief spring is the shorter of the two.

6. Remove the brake release spool by unscrewing the fitting in the valve support and extracting the spool and spring, if so equipped.

E. Cleaning and Inspection

1. Clean all parts with solvent, paying particular attention to the corners in the spool bores.

2. Inspect the spools and their mating surfaces for nicks, burrs and scratches. Replace any spool if it does not slide freely in its bore, or if it is nicked or scratched deeply. Burrs and slight defects can be removed with fine sandpaper.

NOTE: When re-working a spool with sandpaper, avoid breaking the sharp corners.

3. Remove all gasket material from the body and support. Discard all O-rings and gaskets.

F. Assembly. Fig. 17

1. Place O-rings in the grooves: on the cable end of the inching spool and selector spool bores; in the groove of the selector spool; on the relief ball fitting; brake spool fitting. Assemble a new gasket on the main relief spool plug.

2. Apply oil liberally to the spools and spool bores.

3. Assemble the control valve in the reverse order in which it was disassembled, using a new gasket between the body and the supoort.

NOTE: Do not pull on the selector spool to get the O-ring compressed into the spool bore. Tap end of spool to accomplish this, and to avoid over-travel, causing damage to the O-ring by the internal port lands.

G. Installation

1. Install the control valve in the reverse order in which it was removed, using a new O-ring between the valve support and winch.

2. Check the control cable adjustment, by measuring the spool positions at each position of the control levers.

NOTE: The spool positions must be equal to the dimensions shown in fig. 25.

3. Adjust the spool positions as necessary, by turning the spool on or off the cable end. Lock securely with the jam nut.

4. Check oil pressures and adjust if necessary.

H. Checking and Adjusting

1. Remove the covers from the control valve housing.

2. Unscrew the plugs covering the check ports. Install gauges in the ports. Fig. 26.

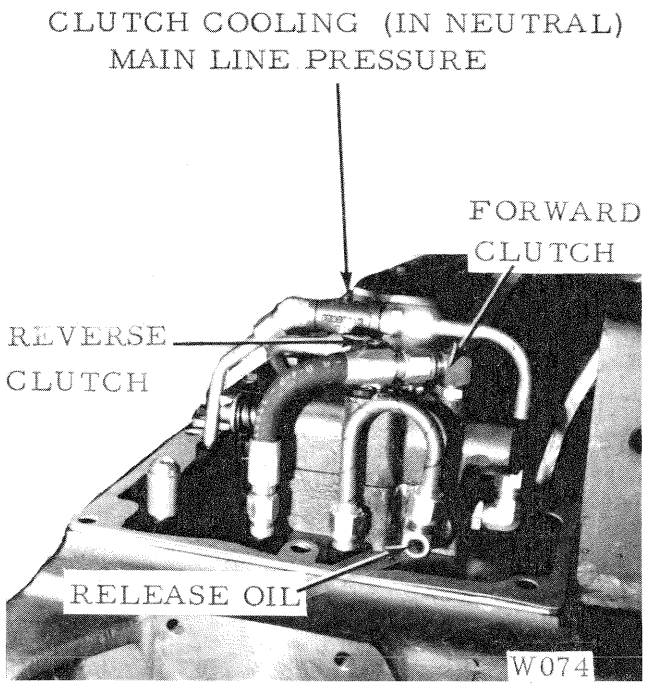


Figure 26

NOTE: When checking the oil pressure, oil temperature should be at least 70° F.

3. Start the engine and set its speed at 1000 RPM. Engage the forward clutch and note the pressures indicated at the forward and reverse ports.

a. The pressure at the forward clutch port should not be less than 210 P.S.I. or more than 230 P.S.I.

b. The pressure at the reverse clutch port should not be more than 7 P.S.I.

NOTE: The high pressure is clutch apply pressure and the low pressure is the cooling oil pressure. The valves on D7H winches are not equipped with the clutch cooling valve.

4. Apply the reverse clutch. The high pressure should now be at the reverse clutch port and the low pressure at the forward clutch port.

5. Adjust the pressures as necessary. In both cases (high and low pressure): remove shims from the respective relief to lower the pressure; add shims to raise the pressure.

NOTE: If the high pressure is lower than specified, re-check with the engine idling and at governed speed. The lack of supply oil is indicated if the pressure drops below 200 P.S.I. at idle and raises to specifications at governed speed.

NOTE: If the high pressure is satisfactory at one clutch port and low at the other, the hydraulic system relative to the port with the low pressure is defective.

6. Disconnect the steel tubing connecting the valve support to the brake. With engine idling, slowly move the inching lever to brake release position while observing the gauge. Oil should start dripping, from the open port of the support when 40 P.S.I. is indicated.

NOTE: If the brake valve releases too soon (with less than 40 P.S.I. applied) or too late, replace the spring and/or valve as necessary. The valves on D7H winches are not equipped with this valve.

7. The pressure indicated by the gauge connected to the valve support to brake release cylinder or oil brake should drop suddenly under any of the following conditions:

a. When releasing the inching lever from brake release position.

b. When releasing selector lever from forward clutch apply position.

c. Upon returning the selector lever from neutral-brake release position to neutral-brake applied position.

d. Upon returning the selector lever from reverse clutch position to neutral-brake applied position.

NOTE: A slow pressure drop may be caused by sluggish control valve operation. However, it can also be caused by defective dump valve.

STRAINER

A. General

This unit is located: under the floor plates of the tractors equipped with a D7F or D89 winch, fig. 27; on the top-right side of the D6C and D7F winches mounted on Traxcavators, and D6D, D7H and D89B winches, fig. 28.

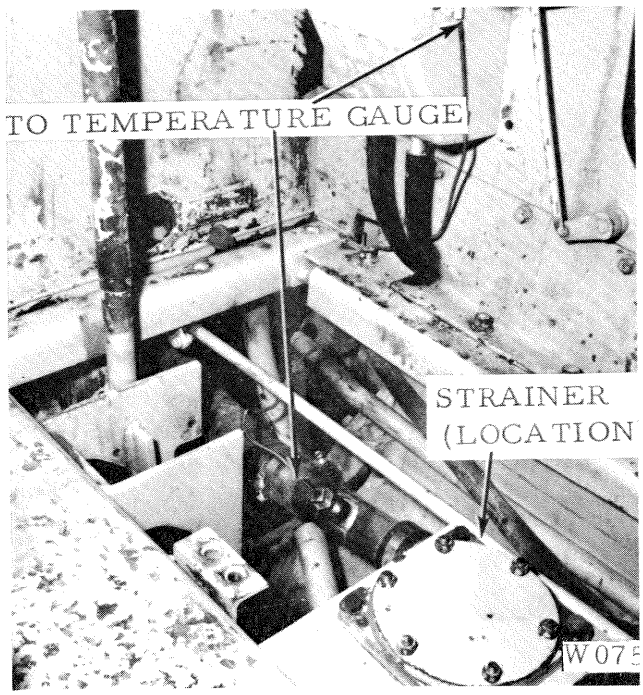


Figure 27

It is an in-line full flow type with a by-pass valve. The valve will open at 5 inches of mercury. The seven bar magnets are held on with a clip and may be removed for cleaning.

B. Removal and Service.

1. Removal:

a. If the strainer is located under the floor plates, remove the floor plates. Disconnect the strainer intake hose. Unscrew the housing mounting capscrews. Separate the housing from the head. Remove the strainer by turning it counterclockwise. Remove the O-ring from the head, and discard it.

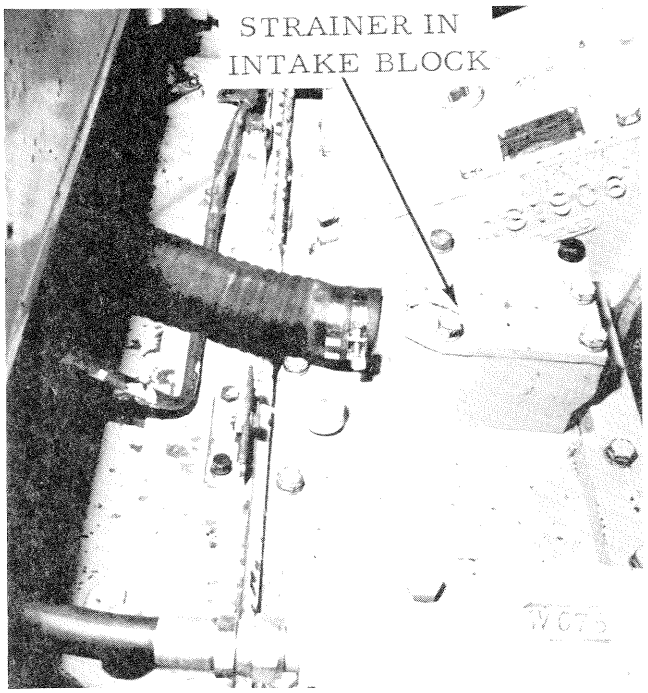


Figure 28

b. If the strainer is on top of the winch, unscrew the cover capscrews. Separate the cover from the intake block. Remove the strainer by turning it counterclockwise. Fig. 29.

2. Clean the strainer by running clean solvent into the open end of the strainer, allowing it to flow until the strainer screen is clean.

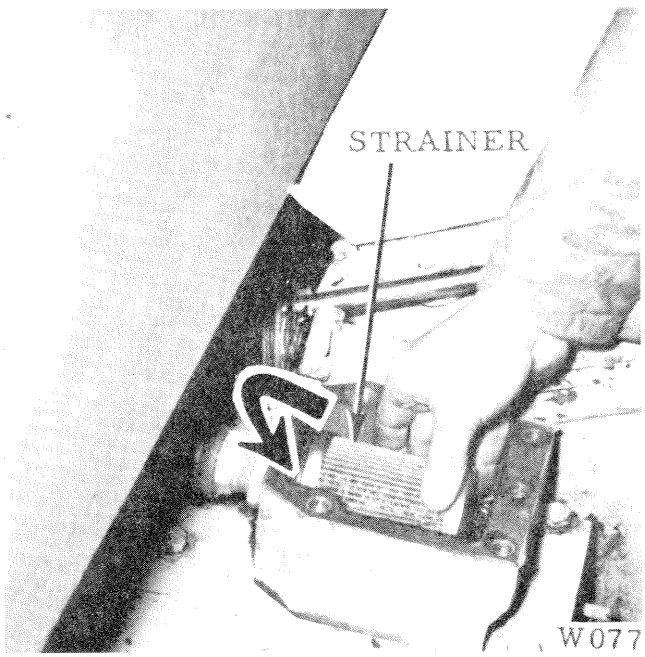


Figure 29

NOTE: If a solvent tank equipped with a centrifugal pump is available, the strainer may be connected directly to the pump through a strainer head and hose. The strainer may also be cleaned by agitating it in clean solvent.

HYDRAULIC CYLINDER

A. General

The mechanical brake on a power control winch is released by a single acting hydraulic cylinder. Fig. 30. A cylinder shell, piston and rod assembly, and a guide assembly are the components of the hydraulic cylinder.

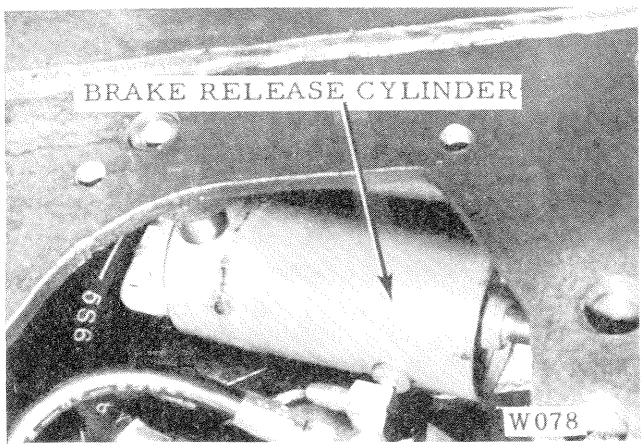


Figure 30

Pressurized oil entering the piston end of the cylinder extends the rod to release the brake, the rod is retracted by the brake springs when the pressure is released.

Any oil seeping past the piston is returned to the winch sump via a hose connecting the sump to a port on the rod side of the cylinder.

B. Removal

1. Remove both the covers from the left side of the winch. Disconnect the hose from the bottom of the cylinder. Plug the hydraulic openings.

2. Remove the cotter pin from the pin connecting the rod end to the brake mechanism. Fig. 31.

3. Extract the pin from the anchor end of the cylinder. Fig. 32. Disconnect the hose from the end of the cylinder. Plug the hydraulic openings. Work the cylinder out of the case.

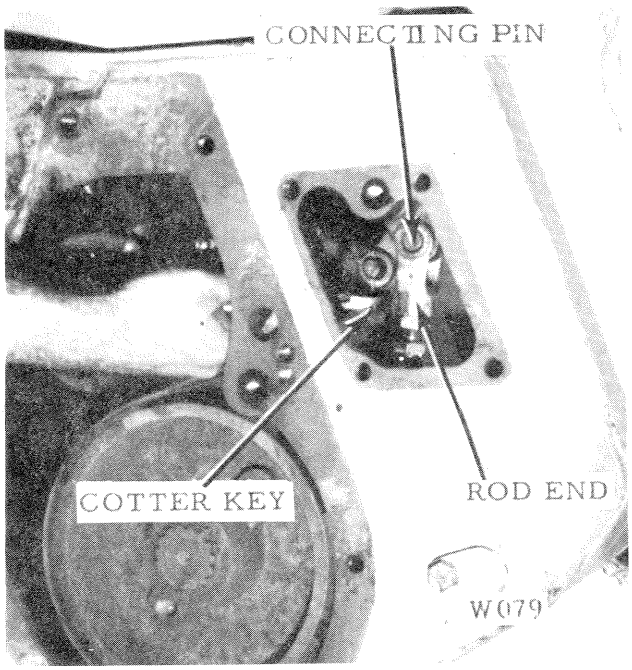


Figure 31

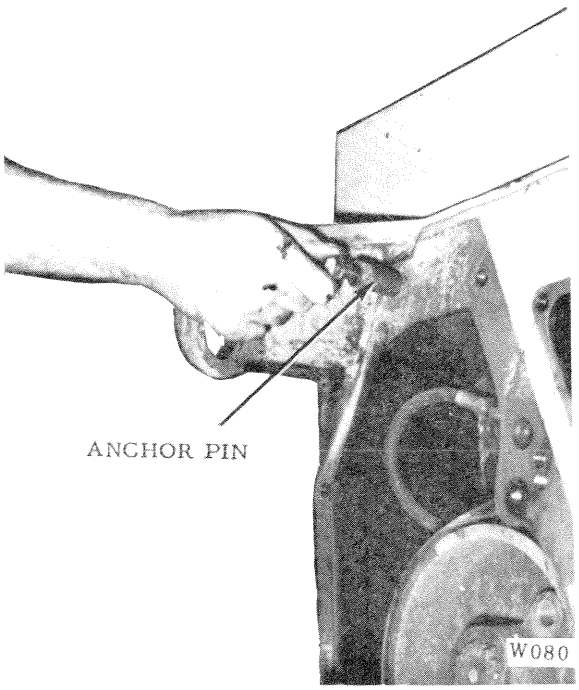
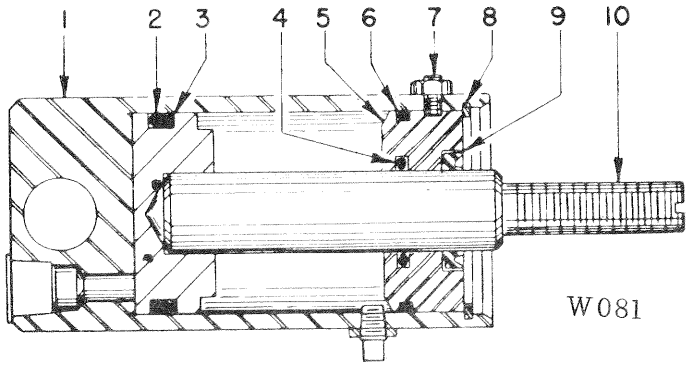


Figure 32

C. Disassembly. Fig. 33

1. Loosen the jam nut. Unscrew the set screw securing the head.

2. Push the head in. Remove the internal snap ring from the cylinder bore.



1. Housing
2. O-Ring
3. Back-Up Ring
4. O-Ring
5. Guide Assembly
6. Setscrew
7. Jam Nut
8. Snap Ring
9. Oil Seal
10. Piston and Rod

Figure 33

3. Remove the plugs from the ports, put there during removal. Pull the rod and piston assembly out of the cylinder. Slide the guide off the rod.

4. Remove: the O-ring and back-up ring from the piston; the outside O-ring and inside O-ring from the guide. Do not remove the oil seal from the guide unless necessary.

D. Cleaning and Inspection

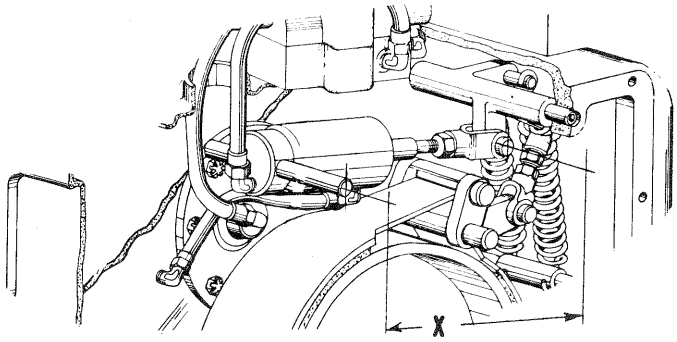
1. Clean all parts in solvent.

2. Inspect the piston and rod assembly and cylinder for nicks, burrs and scratches. Slight defects may be removed with fine sandpaper. Otherwise defective parts should be replaced.

E. Assembly and Installation

1. Assemble the cylinder in the reverse order in which it was disassembled, lubricating parts liberally with oil and using new O-rings.

2. Pull the rod out as far as possible. Measure from the center of the anchor pin hole to the center of the rod end pin hole, (X) fig. 34. Beginning with serial number A82L-1726, B77P-2020 and A68P-2222, the distance on the D6, D7 and D89 winches should be 10-7/8"; the distance on winches with prior serial numbers should be 10-5/8". Turn the rod end on or off the rod end as necessary to obtain the measurement, if the distance is not correct.



W149

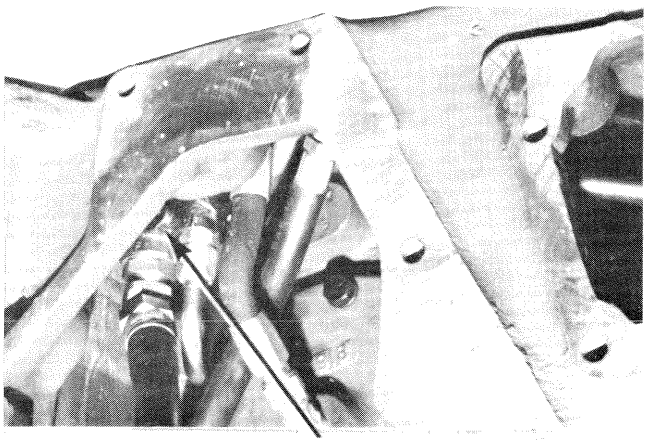
Figure 34

3. Install the cylinder using the reverse of the Removal procedure.

FLOW DIVIDER

A. General

The components of the flow divider are enclosed in a one piece body. Fig. 35. These are a control piston, orifice, spring, end cap and a retaining ring. An O-ring is assembled on the end cap to prevent leakage in this area.

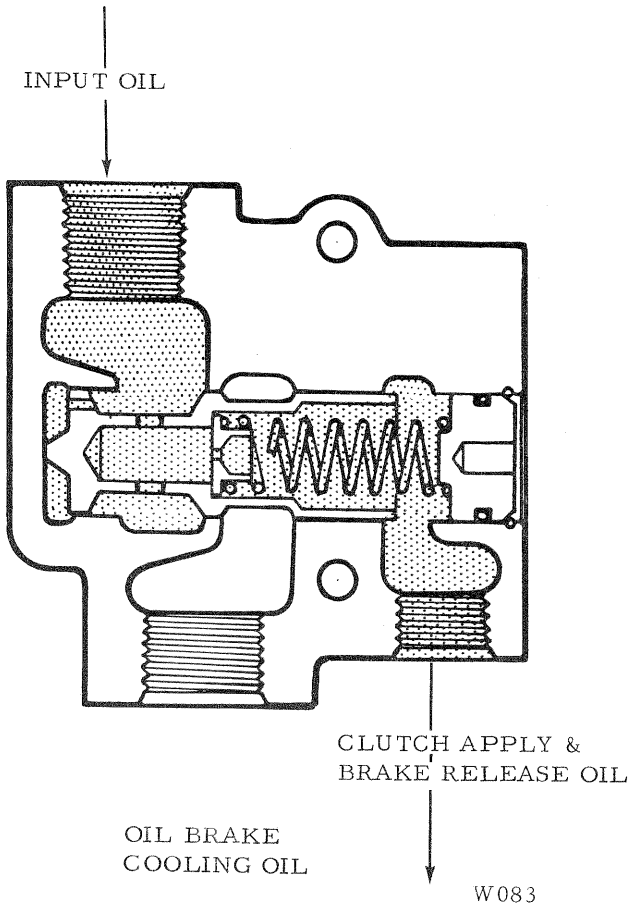


FLOW DIVIDER W082

Figure 35

The spring holds the orifice against a shoulder in the control piston bore.

When the input is equal to or less than the controlled GPM (8GPM) the oil flow through the divider is as shown in fig. 36. The oil flows into the input port around the control valve and through the holes to the valve bore. Oil then flows through the metered orifice and

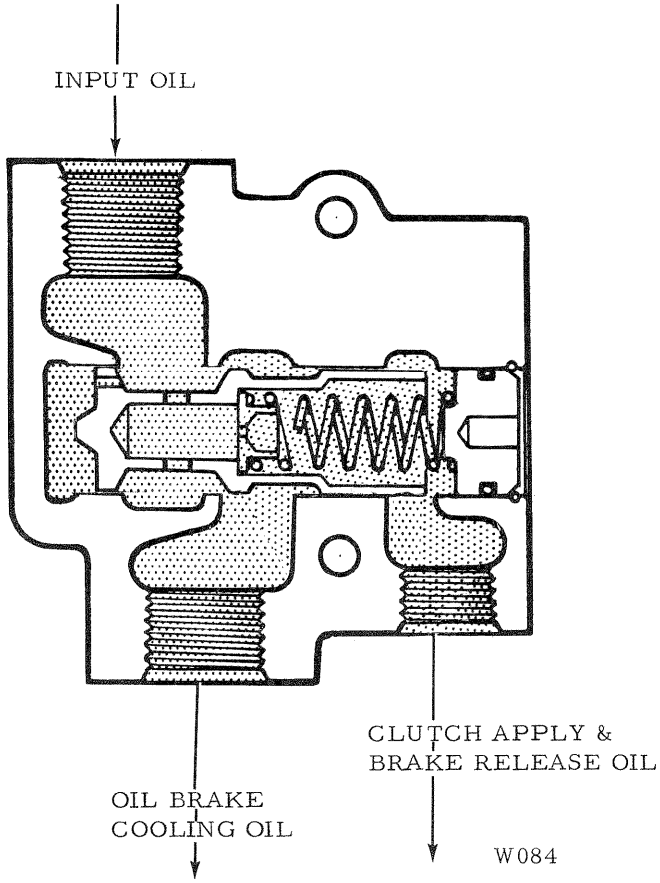


NO METERING - LOW INPUT VOLUME

Figure 36

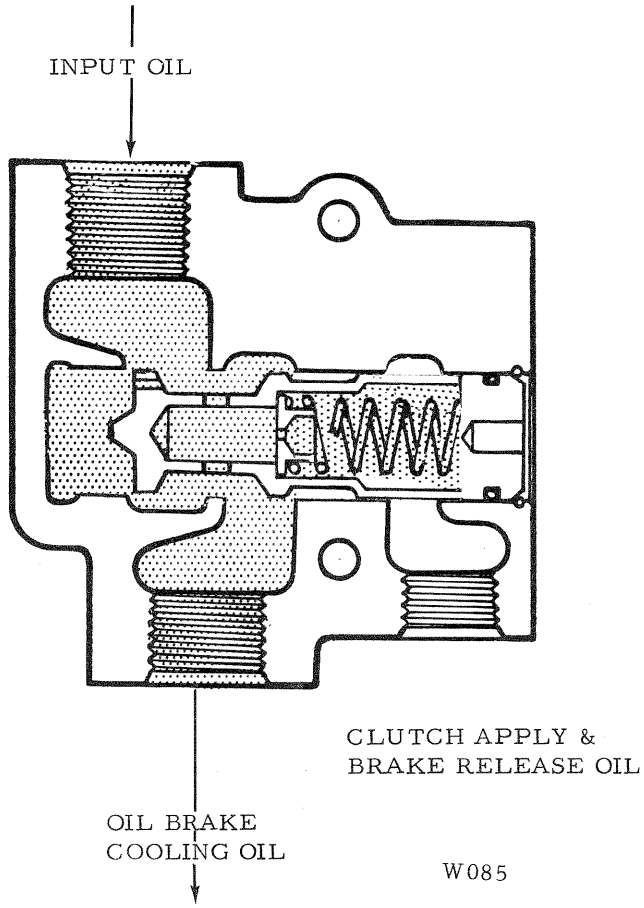
valve bore, out the port, then to the control valve. There is no movement in the flow divider because the oil flow is low enough to pass through the orifice without difficulty.

Since the orifice will allow only a given amount of oil to pass, oil pressure on the inlet side of the orifice will increase when the amount of input oil increases. When this happens the oil flow through the valve will be as shown in fig. 37. It will flow into the input port, through the valve holes, bore and orifice and eventually to the control valve. Pressurized oil on the input side of the orifice is routed through a passage to a cavity behind the control piston, forcing the piston to move against the spring pressure. This movement causes a land on the piston to move against the spring pressure. This movement also causes the piston to partially close



METERING - MEDIUM TO HIGH INPUT VOLUME

Figure 37



NO METERING - COLD OIL

Figure 38

the control valve port to help maintain the specified flow.

The oil to the brake and the restriction in the control valve port will vary whenever the volume of input oil varies.

In cold weather the oil cannot flow through the orifice, and the valve will be forced against the end cap. Fig. 38. In this position the port to the control valve is closed, except for a notch in the valve. The oil requirements of the clutches are fulfilled by the oil flowing through the notch. All the oil passes into the brake cooling system, and will continue to do so until the oil temperature begins to rise. As the temperature rises oil will begin to flow through the orifice instead of to the cooling system. The transition will take place until the oil is warm enough to flow easily, at which time the flow divider will meter the oil to the control valve.

B. Removal

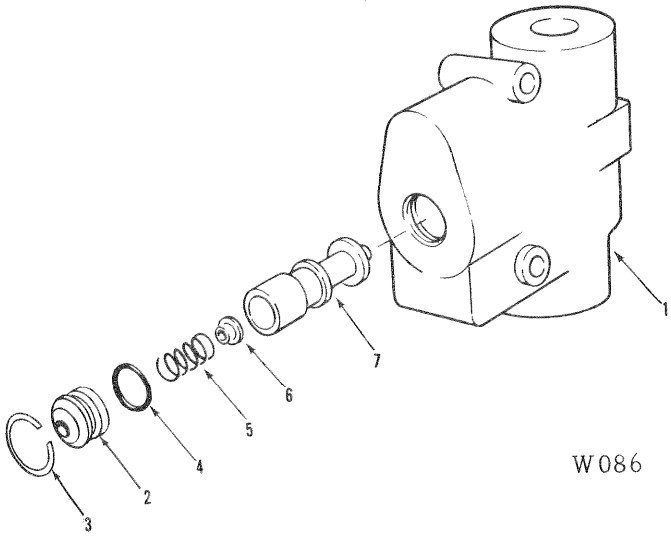
1. Remove both covers from the left side of the winch. Disconnect the hose and steel tube from the bottom of the flow divider or oil brake relief valve.

2. Remove the side cover from the control valve housing. Disconnect the supply line from the bulkhead fitting.

3. Unscrew the bulkhead fitting jam nut until the flow divider is free.

C. Disassembly and Inspection. Fig. 39

1. Push in on the end cap and remove the internal snap ring. Remove the spring, orifice and control valve.



1. Body
2. End Cap
3. Retainer Ring
4. O-Ring
5. Spring
6. Orifice
7. Control Piston

Figure 39

2. Wash all parts in solvent. Discard the O-ring and parts that are scored or nicked. Slight scratches can be removed with fine sandpaper.

NOTE: A feather edge around the internal snap ring groove will damage the O-ring during the installation of the end cap. Be sure to remove this sharp edge, if present.

3. Lubricate all parts with winch lubricant. Assemble in the reverse of Step 1. Apply "STP" "Power Punch" or like lubricant to the O-ring to help in preventing O-ring damage while installing the end cap.

DUMP VALVE

A. General. Fig. 40

The components of the dump valve depends whether the brake release oil is routed through the valve or through a separate hose. Either assembly will include a spring loaded by-pass valve located in the bore of a one piece body.

On units routing the release oil through a separate hose, fig. 27, the by-pass valve is a spool valve. Fig. 41. Both ends of the dump valve bore are connected to the brake piston cavity. One end of the bore is connected to the exhaust port of the cavity, through a fitting, that also supports the dump valve assembly. The

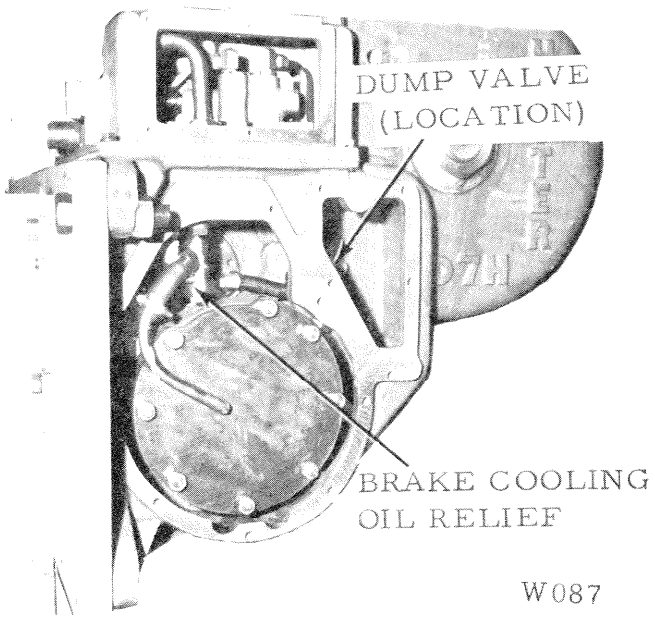
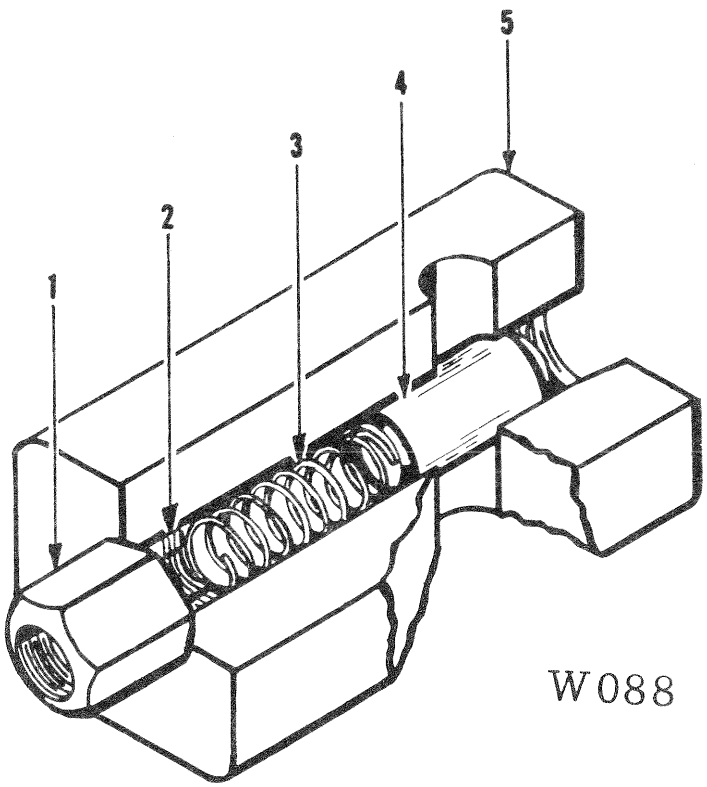


Figure 40



1. Fitting
2. Shim Pack
3. Spring
4. Spool
5. Body

Figure 41

spring nolds the spool near this end to close the dump ports. There are two such ports. The pressure at which the spool will open the port to release the brake oil is shim adjusted. The shims are located opposite the spool end of the body bore. An adaptor, hose and a "tee" fitting connect the shim end of the bore to the hose carrying the release oil to the piston cavity.

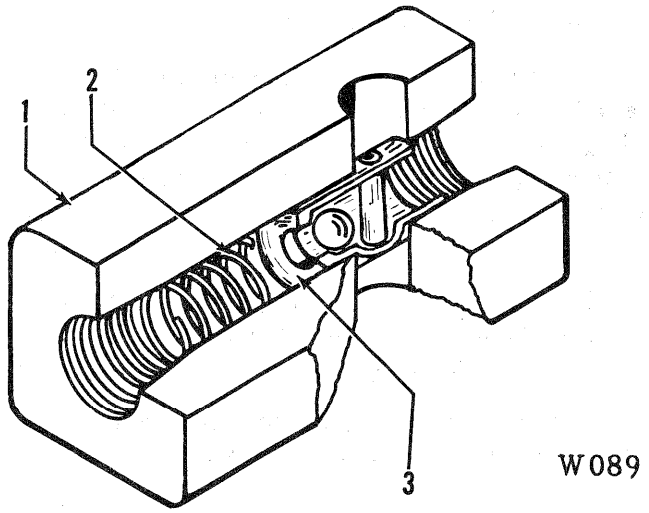
When the brake is released, pressurized oil is routed through the "tee" fitting to the shim and spring end of the spool, and to the release piston cavity, forcing the piston out. Release oil in the cavity is also in communication with spool end of the dump valve. Conditions within the dump valve remain unchanged, since only the spring continues to act on the spool. Oil pressing against the valve, it is equal on both ends.

During brake application springs force the piston into its cavity, and oil evacuation is accomplished through both ports in the piston housing. However, the evacuation out the inlet port through the hose and "tee" fitting, is sufficiently hindered to cause a pressure drop on the shim end of the spool. The higher pressure on the exhaust port side pushes the spool against the spring opening the dump ports, allowing a rapid evacuation of oil through the dump ports to winch sump.

Some units have only one port in the piston housing. Fig. 3. In such cases the release oil enters and evacuates through the dump valve which is attached to this port. The by-pass valve in this dump valve is an assembly of a counterbored sleeve, ball and roll pin. Fig. 42. The ball is free to move in the counterbore but prevented from falling out by the pin. The bottom of the counterbore is a seat for the ball, and is closer to the spring. The fitting supporting the dump valve, puts the larger bore in communication with the piston cavity.

Release oil enters the spring end of the dump valve around the ball and out of the dump valve. The oil is then routed to the piston cavity releasing the brake.

As soon as the application of release oil ceases, the pressure drops and the brake springs begin pushing the piston into its cavity. Oil displaced by the piston forces the ball on its seat in the by-pass valve, trapping the oil in the valve.



1. Body 2. Spring 3. Spool

Figure 42

This causes an instant drop in pressure on the inlet side of the dump valve. The trapped oil, still under pressure, pushes the by-pass valve assembly towards the inlet side of the dump valve, opening the dump ports. The displaced oil is evacuated to the sump through the open dump ports.

B. Service

1. To remove: Disconnect the hose from the top of the valve; unscrew the valve from the mounting fitting, being careful not to drop the spool and spring out of the bottom of the body.

2. Wash parts in solvent. Replace parts that are damaged. Slight defects on the spool and in the bore may be removed with fine sandpaper.

OIL BRAKE RELIEF VALVE

A. General

This assembly limits the oil brake cooling oil pressure so that the cooling oil will not hinder the brake operation; without it cooling oil would prevent the brake from releasing, especially at high pump output.

The inlet port of the relief valve is connected to the dump port of the flow divider. Fig. 40. Excess oil from the valve is dumped into the winch sump.

B. Removal and Disassembly

1. Drain the winch lubricant, or block the left side of the tractor approximately 18 inches higher than the right side so that the oil will not run out when large cover is removed. Remove the large cover from the left side of the winch.

NOTE: The relief valve can be disassembled without removal, by unscrewing the cap from the bottom of the assembly.

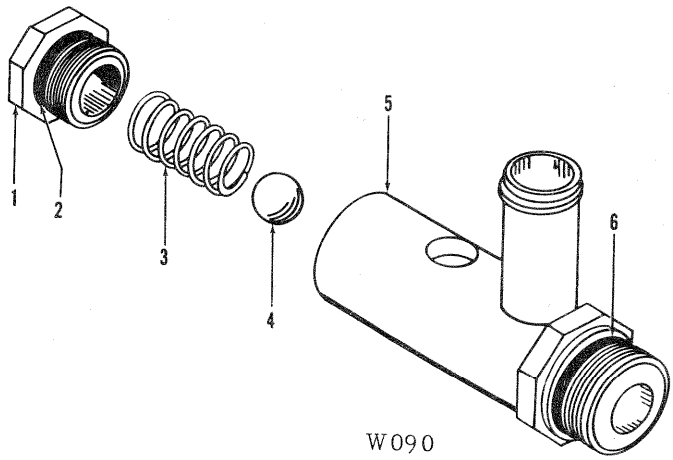
2. Disconnect the hydraulic lines from the relief valve. Plug all hydraulic openings.

3. Unscrew the relief valve from the bottom of the flow divider.

4. Unscrew the cap. Remove the spring and relief ball. Fig. 43.

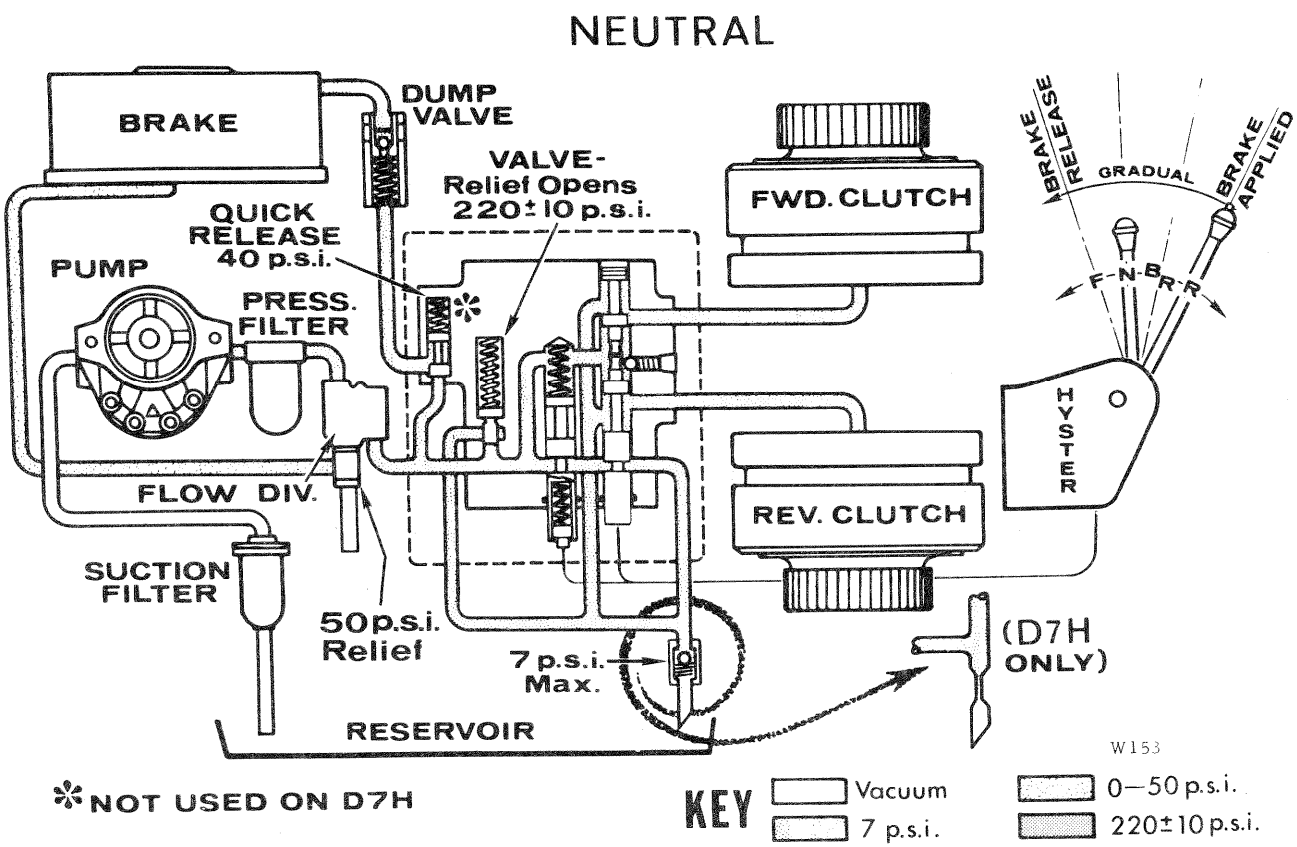
C. Assembly and Installation

Reverse the Removal and Disassembly.



1. End Plug
2. O-Ring
3. Spring
4. Relief Ball
5. Body
6. O-Ring

Figure 43

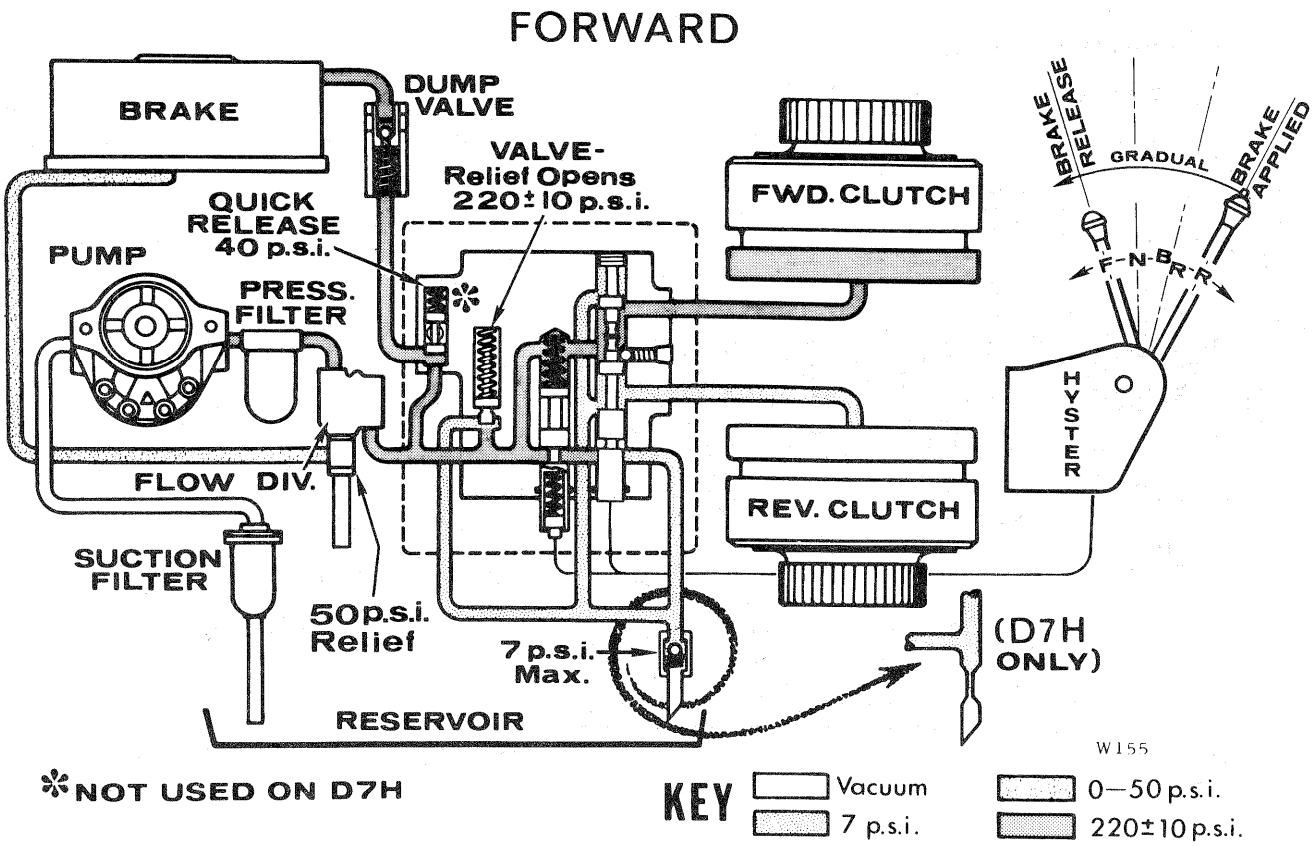


OPERATION: NEUTRAL

With the selector lever (short lever) in the neutral (vertical position) and the brake release lever (long lever) moved all the way away from the operator (brake apply position), both control spools in the control valve are open to dump. In this position, both clutches are released and the brake is spring applied.

Pump flow enters the flow divider and is divided into two flows: (1) controlled flow (8 G.P.M.), and (2) excess flow. The controlled flow is then directed to the control valve. Excess flow is routed via the 50 PSI relief valve to the brake for cooling.

Approximately 7 to 13 PSI system pressure is maintained in neutral. This pressure is developed through the system pressure drop across the control valve. This pressure is further regulated to 7 PSI by the low pressure relief valve to cool and lubricate both clutch packs as well as maintain a constant oil supply in all lines.



OPERATION: FORWARD

With the selector lever (short lever) pulled one position towards the operator from neutral (forward position) and the brake release lever (long lever) relaxed away from the operator (brake apply position), the selector spool in the control valve has been moved into the valve one position. The movement of this spool into the forward position does two things: (1) blocks the flow divider's controlled flow from passing directly to dump, causing an immediate pressure build up and (2) connects this high pressure build up to the forward clutch.

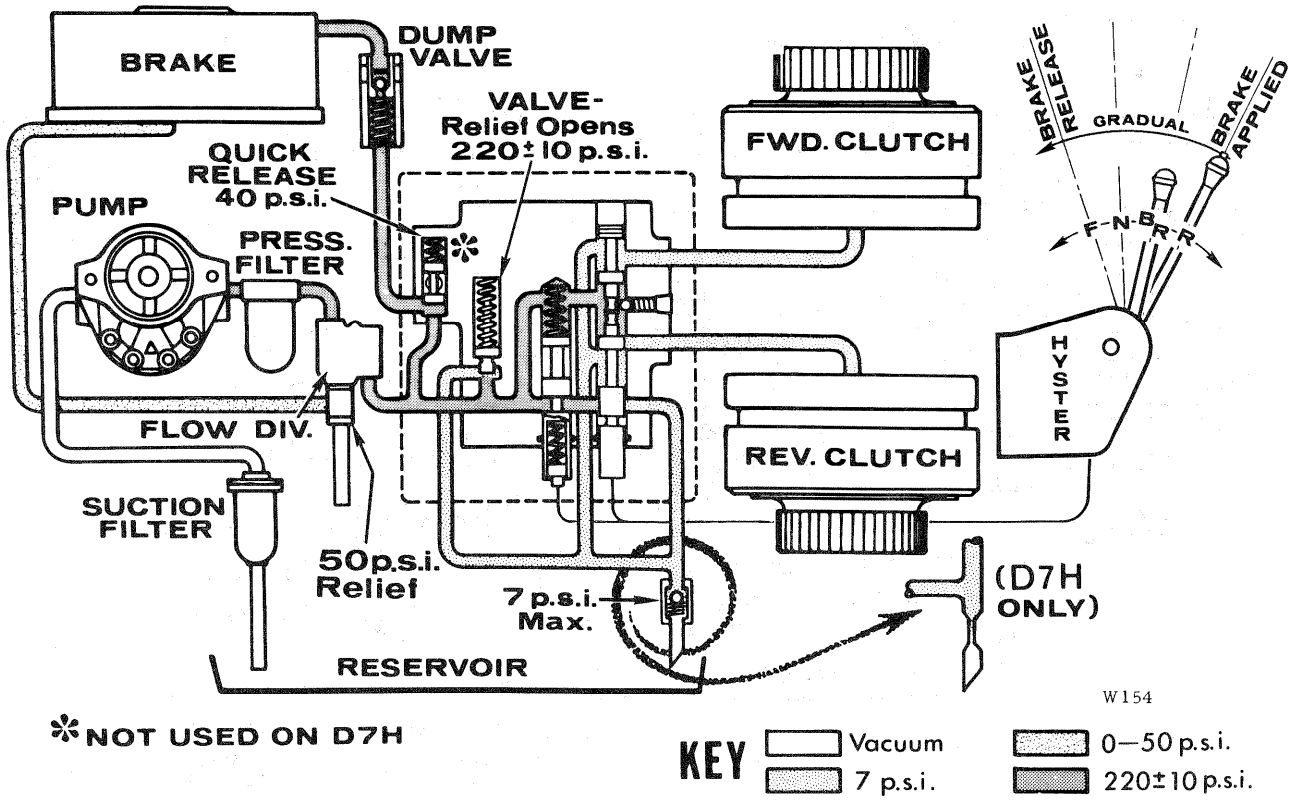
As this pressure builds the forward clutch locks up. A fraction of a second later the brake releases. The system pressure will continue to build until it relieves itself via the high pressure relief valve. This valve opens at 220 PSI supplying cooling and lubricating oil as well as maintaining a safe maximum operating pressure.

It should be noted that the high pressure oil routed to the forward clutch not only engages this clutch assembly, but pushes the cooling oil valve within the forward clutch pack into the "meter" position, allowing only a metered amount of cooling and lubricating oil to circulate through this clutch.

Low pressure oil for cooling the reverse clutch is being maintained by the low pressure (7 PSI) relief valve.

When the selector lever is moved to the neutral position, the system high pressure will be allowed to dump past the control spool. With the system pressure drop that follows the neutral shift, the spring within the brake will force the oil that is in the brake out to dump via the dump valve. As the brake locks up, the forward clutch releases.

BRAKE RELEASE



OPERATION: BRAKE - RELEASE

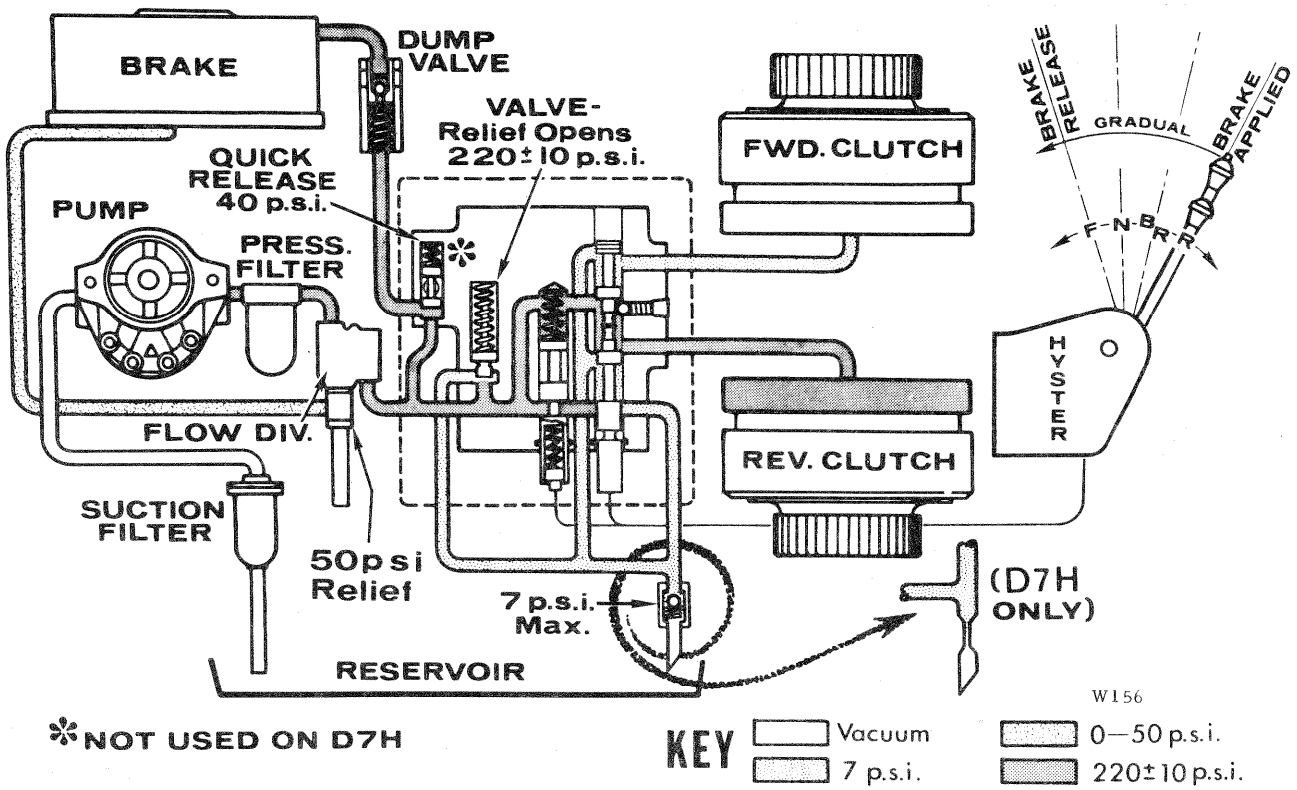
With the selector lever (short lever) pushed one position away from the operator from neutral (brake release position) and the brake release lever (long lever) relaxed away from the operator (brake apply position), the selector spool in the control valve has been moved out of the valve one position. The movement of this spool into the brake release position blocks the flow divider's controlled flow from passing directly to dump, causing an immediate pressure build up. It should be noted that this pressure build up is not routed to either the forward or the reverse clutch.

As the pressure builds the brake will release. The system pressure will continue to build until it relieves itself via the high pressure relief valve. This valve opens at 220 PSI supplying cooling and lubricating oil as well as maintaining a safe maximum operating pressure.

Low pressure oil for cooling the clutches is being maintained by the low pressure (7PSI) relief valve.

When the selector lever is moved to the neutral position, the system high pressure will be allowed to dump past the control spool. With the system pressure drop that follows the neutral shift, the spring within the brake will force the oil that is in the brake out to dump via the dump valve.

REVERSE



OPERATION: REVERSE

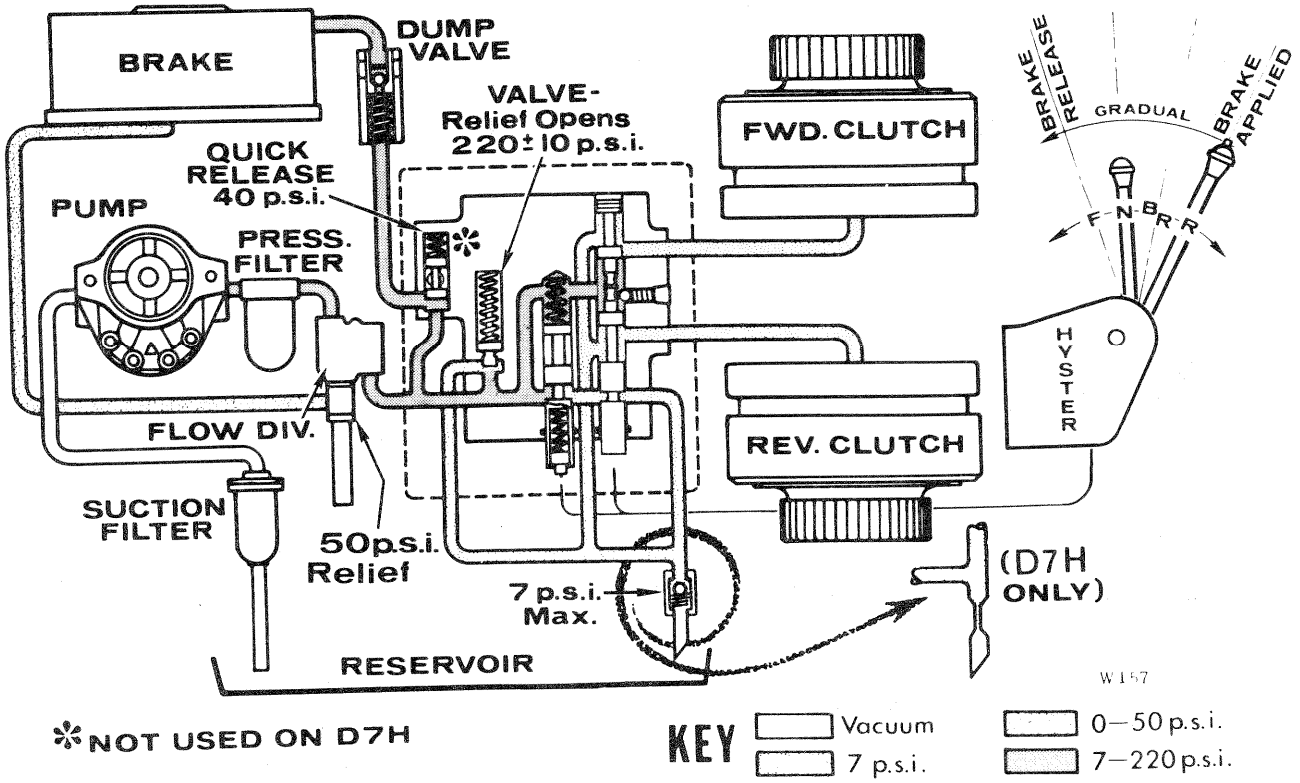
With the selector lever (short lever) pushed two positions away from the operator from neutral (reverse position) and the brake release lever (long lever) relaxed away from the operator (brake apply position), the selector spool in the control valve has been moved out of the valve two positions. The movement of this spool into the reverse position does two things: (1) blocks the flow divider's controlled flow from passing directly to dump, causing an immediate pressure build up and (2) connects this high pressure build up to the reverse clutch.

As this pressure builds the reverse clutch locks up. A fraction of a second later the brake releases. The system pressure will continue to build until it relieves itself via the high pressure relief valve. This valve opens at 220 PSI supplying cooling and lubricating oil as well as maintaining a safe maximum operating pressure.

It should be noted that the high pressure oil routed to the reverse clutch not only engages this clutch assembly, but pushes the cooling oil valve within the reverse clutch pack into the "meter" position, allowing only a metered amount of cooling and lubricating oil to circulate through this clutch.

Low pressure oil for cooling the forward clutch is being maintained by the low pressure (7PSI) relief valve.

GRADUAL BRAKE RELEASE



OPERATION: GRADUAL BRAKE RELEASE

With the selector lever (short lever) in the neutral (vertical position) and the brake release lever (long lever) all the way away from the operator (brake apply position), both control spools in the control valve are open to dump. In this position, both clutches are released and the brake is applied. This is the neutral position.

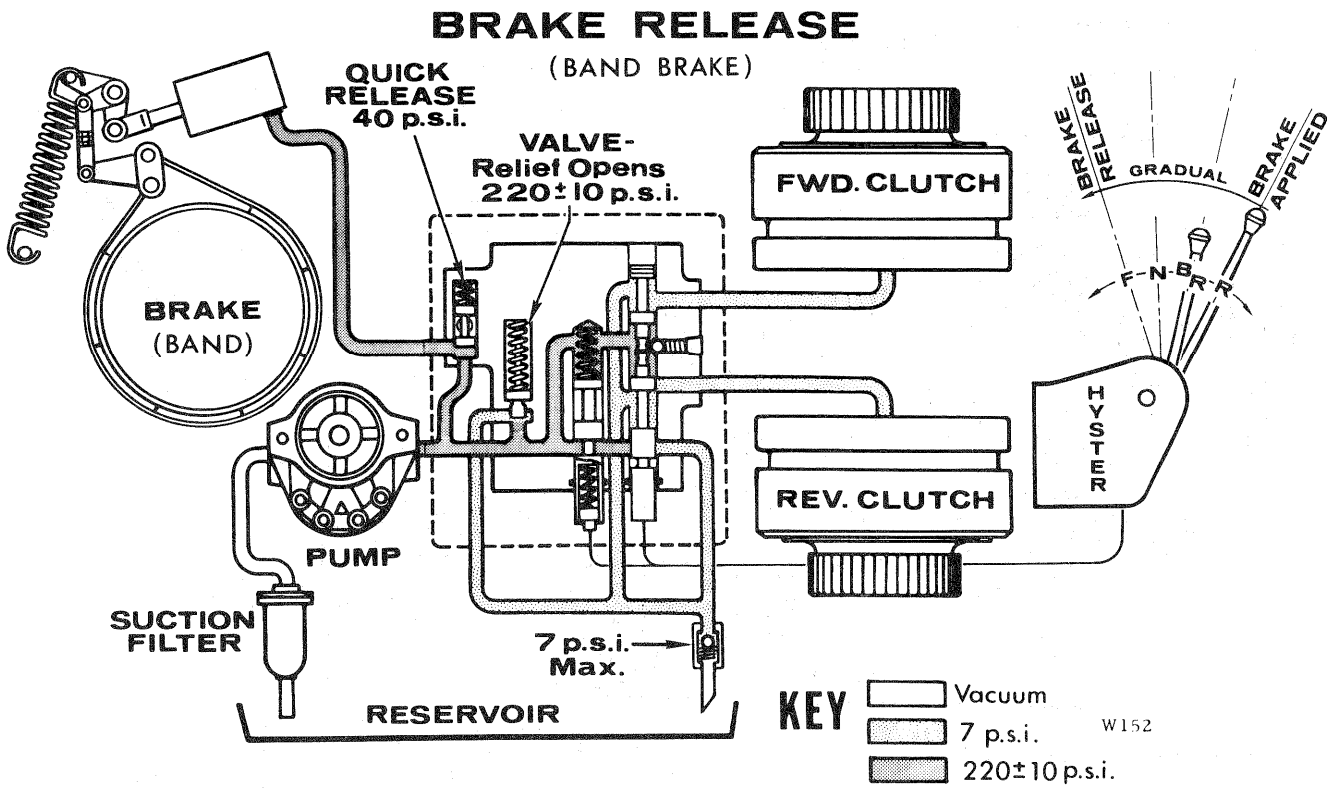
In the neutral position, the only position in which the brake is normally applied, it is possible to gradually release the brake by slowly pulling the brake release lever (long lever) towards the operator. As the brake release lever is pulled towards the operator, the brake release spool moves gradually into the control valve and partially blocks the flow divider's controlled flow through the control valve. This partial blocking causes a partial pressure build up upstream of the spool. This gradual pressure build up is felt at the quick release valve until it reaches 40 PSI. At 40 PSI the quick release valve opens and the pressure build up is felt at the brake itself.

Pressure to the brake, to gradually release it, can be regulated by the gradual movement of the spool connected to the brake release lever. By gradually releasing the brake it is possible to control the brake slippage and lower loads slowly with the winch.

It should be noted that the pressure build up is ported behind the brake release spool to give the operator a pressure feel at the brake release lever.

Low pressure oil for cooling the directional clutches is still being maintained by the low pressure (7 PSI) relief valve.

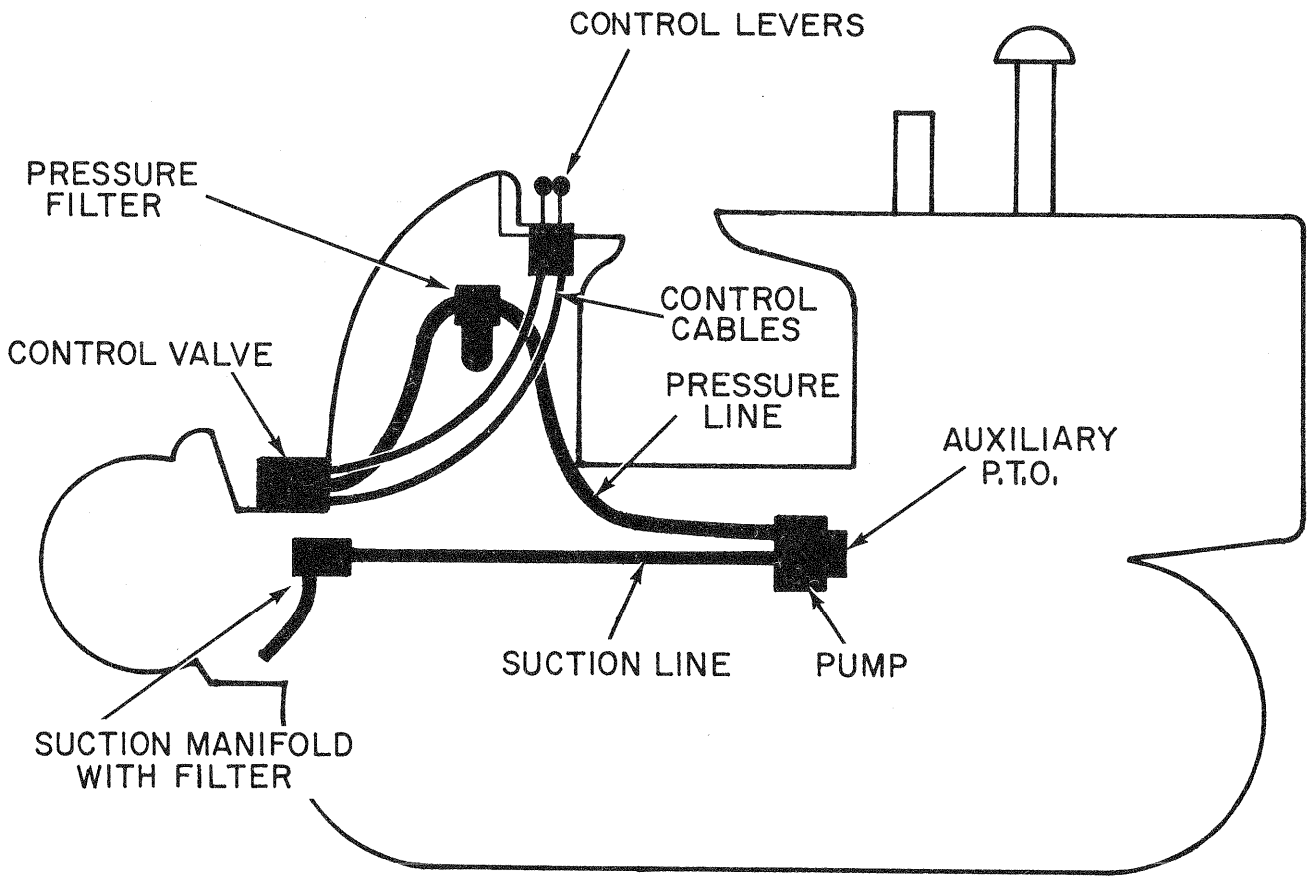
When the brake release lever is moved back to its relaxed position, the system pressure will be allowed to pass directly to dump past the brake release spool. With the system pressure drop that follows, the spring within the brake will force oil that is in the brake out to dump via the dump valve. The brake will lock up.



OPERATION: BRAKE RELEASE (BAND TYPE BRAKE)

Operation same as the brake release of the oil brake model, except the oil in the brake cylinder dumps through a dump port between the two lands of the quick release valve.

POWER CONTROL SYSTEM



SECTION E — TROUBLESHOOTING GUIDE

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TROUBLESHOOTING GUIDE

DIRECT DRIVE WINCH

Cause	Remedy
Brake Not Holding	
1. Water in the brake compartment	1. Drain water from the compartment every day, if necessary.
2. Brake lining saturated with oil	2. Replace the lining. Locate origin of oil leakage and repair leak.
3. Brake band out of adjustment	3. Adjust brake band and cable. Make sure linkage operates freely.
4. Brake cable out of adjustment	4. Adjust brake cable and band. Make sure linkage operates freely.
Hard Shifting	
1. Cables and linkage binding or rusted	1. Clean, straighten, repair or replace parts as necessary.
2. Shifting collar too tight on splines or splines rough	2. Remove shifting collar, and dress splines with fine stone. Replace parts as necessary.

POWER CONTROLLED WINCH

Winch Fails to Operate or Operates Sluggishly	
1. Plugged strainer or air leaks in inlet line	1. Clean strainer. Check all connections from the winch sump to the inlet port of the pump; repair or replace parts as necessary.
2. Low oil level	2. Add oil as necessary to raise to proper level.
3. Oil viscosity too high or cold oil	3. Drain oil and refill with specified lubricating oil. Allow oil to warm before operating the winch.
4. Low operating oil pressure	4. Refer to Low Operating Pressure.
5. Push-pull cables out of adjustment	5. Make sure the cables and handling gear operate freely. Check and adjust cables as necessary. Check for and replace sticking, broken or otherwise defective valve parts.
6. Tractor engine idling too slow	6. Adjust to correct idle RPM.
Low Operating Oil Pressure	
1. Defective or mal-adjusted relief spring	1. Replace the relief spring if broken, bent, worn or otherwise defective. Add shims as necessary to raise the oil pressure to specification.
2. Sticking relief valve	2. Clean the relief valve and bore; make sure the valve slides freely in its bore. Replace sticking valve. If dirt caused the valve to stick, check oil in winch sump; it should be clean, if not replace it.

TROUBLESHOOTING GUIDE

Cause	Remedy
3. Oil viscosity too high	3. Drain oil and refill with specified oil.
4. Low oil level	4. Add oil as necessary to raise to proper level.
5. Plugged strainer or air leaks	5. Clean strainer. Check all connections from the sump to the pump inlet port; repair and replace parts as necessary.
6. Internal slippage in pump	6. Check pump for gear wear, hammered bushings and defective "W" shaped seal. Replace parts or pump as necessary.
Oil Brake Not Holding Properly	
1. Loose or broken hose	1. Tighten fitting. Replace hose.
2. Inching spool sticking in the valve	2. Check and free-up the inching lever and cable; adjust as necessary. Check the inching spring, replace if defective.
3. Worn detent on selector spool valve	3. Replace the selector spool valve.
4. Overheated oil	4. Check cooling oil relief; replace parts as necessary to raise pressure to specification. Limit inching to the minimum until oil is within operating temperature.
5. Worn friction discs	5. Replace the friction discs, and if scored, the separator plates.
6. Notches worn in the clutch cage or hub by the discs and plates	6. Replace the cage and/or hub.
One Clutch Will Not Hold	
1. Improper selector cable adjustment	1. Make sure the handling gear and selector cable operate freely. Adjust the selector cable as necessary.
2. Broken seal ring on the bevel gear shaft	2. Replace the seal ring on the end of the shaft with the improperly operating clutch.
3. Damaged clutch piston O-ring or seal ring	3. Replace the O-ring or seal ring.

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SPECIFICATION LISTING

D6 WINCH

A. Gear Ratios

Standard Speed:	
Forward	45.1:1
Reverse	19.5:1
Slo-Speed:	
Forward	64.9:1
Reverse	28:1
Lo-Speed:	
Forward	81:1
Reverse	35:1

B. Number Of Teeth On Standard Speed Gears

PTO Shaft Bevel Gear	23
Bevel Gear Shaft:	
Bevel Gear	45
2nd Reduction Pinion - Forward	22
2nd Reduction Pinion - Reverse	20
Brake Shaft:	
2nd Reduction Driven Gear	51
Intermediate Pinion	20
Intermediate Shaft:	
Intermediate Drive Gear	49
Drum Pinion	16
Drum Gear	65

C. Number Of Teeth On Slo-Speed Gears

PTO Shaft Bevel Gear	16
Bevel Gear Shaft:	
Bevel Gear	45
2nd Reduction Pinion - Forward	22
2nd Reduction Pinion - Reverse	20
Brake Shaft:	
2nd Reduction Driven Gear	51
Intermediate Pinion	20
Intermediate Shaft:	
Intermediate Driven Gear	49
Drum Pinion	16
Drum Gear	65

D. Number Of Teeth On Lo-Speed Gear

PTO Shaft Bevel Gear	16
Bevel Gear Shaft:	
Bevel Gear	45
2nd Reduction Pinion - Forward	22
2nd Reduction Pinion - Reverse	17
Brake Shaft:	
2nd Reduction Driven Gear	51
Intermediate Pinion	17
Intermediate Shaft:	
Intermediate Driven Gear	52
Drum Pinion	16
Drum Gear	65

E. Drum

Barrel Dia.	
Standard and Slo-Speed	10 in.
Lo-Speed	7 in.
Flange Dia.	21 in.
Barrel Length	10-1/8 in.
Recommended Cable Size	3/4 in.
Capacity With 3/4 Inch Cable: *	
Standard and Slo-Speed	401 ft.
Lo-Speed	461 ft.
Capacity With 7/8 Inch Cable *	
Standard and Slo-Speed	295 ft.
Lo-Speed	339 ft.

* Allow for loose or unevenly spooled cable.

Ferrule Size:	
3/4 Inch Cable	J6
7/8 Inch Cable	J7
Seal Bore Dia.	5.624-5.628 in.
Bearing Bore Dia.	5.5135-5.5155 in.
Drive Flange Counterbore Dia.	14.000-14.003 in.
Drive Flange:	
Outside Dia.	13.995-13.998 in.
Bearing Counterbore Dia.	5.5135-5.5155 in.

F. Drum Shaft and Outer Retainer

Shaft:	
Bearing Journal Dia.	3.2495-3.2505 in.
Retainer Journal Dia.	3.1850-3.1870 in.
Gear Bore Dia.	5.5135-5.5155 in.
Outer Retainer:	
Bore Dia.	3.189-3.191 in.
Pilot Dia.	10.120-10.123 in.

G. PTO Shaft And Carrier

Shaft:	
Bearing Journal Dia.	1.9681-1.9688 in.
Seal Journal (Spacer) Dia.	2.370-2.380 in.
Carrier:	
Bearing Bore Dia.	4.3304-4.3318 in.
Seal Bore Dia.	3.498-3.502 in.
Pilot Dia.	5.185-5.187 in.

H. Bevel Gear Shaft And Bearing Retainers

Shaft:	
Seal Ring Groove Width	.125-.133 in.
Tapered Bearing Journal Dia.	1.8744-1.8749 in.
Endplay - Direct Drive	.006-.009 in.
Preload - Power Controlled	.000-.004 in.

SPECIFICATION LISTING

Direct Drive Spacer Length:	
Short (Ends within .0015 inch parallel)	1.687-1.689 in.
Medium (Ends within .003 inch parallel)	3.500-3.505 in.
Long (Ends within .0035 inch parallel)	4.250-4.255 in.
Power Controlled Spacer Length:	
Short (Ends within .003 inch parallel)	3.500-3.505 in.
Long (Ends within .0035 inch parallel)	4.250-4.255 in.
Spacer Washer Width	.190-.195 in.
Ball Bearing Carrier:	2.000-2.005 in.
Bearing Surface Dia.	3.1491-3.1500 in.
Width	
Bevel Gear Backlash	.006-.014 in.
Seal Ring:	
Type	Locked Joint
Width	.0925-.0935 in.
Side Clearance	.0205-.0215 in.
Left Bearing Retainer:	
Seal Ring Bore Dia.	1.500-1.505 in.
Bearing Cup Bore Dia.	3.6705-3.6718 in.
Pilot Dia.	4.997-4.999 in.
Right Bearing Retainer:	
Seal Ring Bore Dia.	1.500-1.505 in.
Bearing Cup Bore Dia.	3.6708-3.6718 in.
Pilot Dia.	4.997-4.999 in.

I. Brake Shaft And Bearing Retainers

Shaft:	
Bearing Journal Dia.	2.500-2.505 in.
Seal Journal Dia.	2.495-2.499 in.
Endplay - Direct Drive	.006-.009 in.
Preload - Power Controlled	.000-.004 in.
Left Bearing Retainer:	
Seal Bore Dia.	3.496-3.498 in.
Bearing Cup Bore Dia.	4.252-4.255 in.
Right Bearing Retainer:	
Bearing Cup Bore Dia.	4.249-4.250 in.
Pilot Dia.	5.997-6.000 in.
Brake Drum Dia.	9 in.

J. Intermediate Shaft

Bearing Journal Dia.	2.3750-2.3755 in.
Endplay	.004-.007 in.

K. Transmission Housing

Bore Diameters:	
PTO Shaft Bearing Retainer	5.188-5.190 in.
Bevel Gear Shaft Bearing Retainer	5.000-5.002 in.
Ball Bearing	4.9211-4.9225 in.
Brake Shaft Bearing Retainer	4.2515-4.2525 in.
Drum Shaft	3.189-3.191 in.

L. Side Frame

Bore Diameters:	
Bevel Gear Shaft Bearing Retainer	5.000-5.002 in.
Ball Bearing	4.9211-4.9225 in.
Drum shaft Outer Retainer	10.125-10.128 in.
Intermediate Shaft Bearing	4.8765-4.8780 in.
Brake Shaft Bearing Retainer	6.000-6.002 in.
Drum Seal	9.998-.0.002 in.

M. Direct Drive Clutch

Dental Clutch Groove Width	.510-.515 in.
Pinion Gear Bore Dia.	3.0000-3.0012 in.
Carrier Bearing Surface Dia.	

N. Power Controlled Clutch

Piston:	
Outside Dia.	8.496-8.498 in.
Inside Dia.	5.750-5.752 in.
Piston Housing:	
Piston Cavity Large Dia.	8.506-8.508 in.
Piston Cavity Small Dia.	5.486-5.491 in.
Inside Dia.	3.376-3.378 in.
Hub - Small Dia.	3.373-3.375 in.
Friction Disc:	
Overall Width	.122-.128 in.
Friction Material Thickness	.0275-.0365 in.
Separator Plate	
Width	.080-.084 in.
Dish	.012-.022 in.
Cooling Valve Spring:	
Free Length	2 in.
Pressure at 1-1/4 Inches	.863 lbs.
Cooling Valve Installed Height	1.875-1.906 in.
Release Spring:	
Free Length	2-5/16 in.
Pressure at Two Inches	31.88 lb.
Plate to Disc Clearance	.085 to .125 in.

SPECIFICATION LISTING

D7 WINCH

A. Gear Ratios

Standard Speed:	
Forward	40.6:1
Reverse	17.53:1
Slo-Speed:	
Forward	49.8:1
Reverse	21.5:1
Lo-Speed:	
Forward	71.6:1
Reverse	30.9:1

B. Number Of Teeth On Standard Speed Gears

PTO Shaft Bevel Gear	23
Bevel Gear Shaft:	
Bevel Gear	45
2nd Reduction Pinion - Forward	22
2nd Reduction Pinion - Reverse	22
Brake Shaft:	
2nd Reduction Driven Gear	51
Intermediate Pinion	22
Intermediate Shaft:	
Intermediate Driven Gear	51
Drum Pinion	15
Drum Gear	58

C. Number Of Teeth On Slo-Speed Gears

PTO Shaft Bevel Gear	23
Bevel Gear Shaft:	
Bevel Gear	45
2nd Reduction Pinion - Forward	22
2nd Reduction Pinion - Reverse	19
Brake Shaft:	
2nd Reduction Driven Gear	51
Intermediate Pinion	22
Intermediate Shaft:	
Intermediate Drive Gear	54
Drum Pinion	15
Drum Gear	58

D. Number Of Teeth On Lo-Speed Gears

PTO Shaft Bevel Gear	16
Bevel Gear Shaft:	
Bevel Gear	45
2nd Reduction Pinion - Forward	22
2nd Reduction Pinion - Reverse	19
Brake Shaft:	
2nd Reduction Driven Gear	51
Intermediate Pinion	19
Intermediate Shaft:	
Intermediate Driven Gear	54
Drum Pinion	15
Drum Gear	58

E. Drum

Barrel Dia.	
Standard and Slo-Speed	12 in.
Lo-Speed	8 in.
Flange Dia.	22-1/2 in.
Barrel Length	
Standard and Slo-Speed	12-3/8 in.
Lo-Speed	10-5/8 in.
Recommended Cable Size	7/8 in.
Capacity with 7/8 Inch Cable: *	
Standard and Slo-Speed	382 ft.
Lo-Speed	402 ft.
Capacity with One Inch Cable: *	
Standard and Slo-Speed	293 ft.
Lo-Speed	308 ft.

* Allow for loose or unevenly spooled cable.

Ferrule Size	
7/8 Inch Cable	J7
One Inch	J8
Seal Bore Dia.	6.002-6.003 in.
Bearing Bore Dia.	6.002-6.003 in.
Drive Flange Counterbore Dia.	15.997-16.006 in.
Drive Flange: Outside Dia.	15.995-15.998 in.

F. Drum Shaft And Outer Retainer

Shaft:	
Bearing Journal Dia.	3.999-4.000 in.
Retainer Journal Dia.	3.493-3.495 in.
Gear:	
Bearing Bore Dia.	6.377-6.379 in.
Pilot Dia.	7.842-7.844 in.
Outer Retainer:	
Bore Dia.	3.498-3.500 in.
Pilot Dia.	11.120-11.123 in.

G. PTO Shaft And Carrier

Shaft:	
Bearing Journal Dia.	1.9681-1.9688 in.
Seal Journal (Spacer) Dia.	2.370-2.380 in.
Carrier:	
Bearing Bore Dia.	4.3306-4.3318 in.
Seal Bore Dia.	3.498-3.502 in.
Pilot Dia.	5.185-5.187 in.

H. Bevel Gear Shaft And Bearing Retainers

Shaft:	
Seal Ring Groove Width	.125-.133 in.
Tapered Bearing Journal Dia.	1.8744-1.8749 in.
Endplay - Direct Drive	.006-.009 in.

SPECIFICATION LISTING

Preload - Power Controlled	.000-.004 in.
Direct Drive Spacer Length:	
Short (Ends within .0018 inch parallel)	2.187-2.192 in.
Medium (Ends within .003 inch parallel)	3.500-3.505 in.
Long (Ends within .0035 inch parallel)	4.250-4.255 in.
Power Controlled Spacer Length:	
Short (Ends within .003 inch parallel)	3.500-3.505 in.
Long (Ends within .0035 inch parallel)	4.250-4.255 in.
Spacer Washer Width	.190-.195 in.
Ball Bearing Carrier:	
Bearing Surface Dia.	3.1491-3.1500 in.
Width (Ends within .0013 inch parallel)	1.630-1.635 in.
Bevel Gear Backlash	.006-.014 in.
Seal Ring:	
Width	.0925-.0935 in.
Side Clearance	.0205-.0215 in.
Left Bearing Retainer:	
Seal Ring Bore Dia.	1.500-1.505 in.
Bearing Cup Bore Dia.	3.6708-3.6718 in.
Pilot Dia.	4.997-4.999 in.
Right Bearing Retainer:	
Seal Ring Bore Dia.	1.500-1.505 in.
Bearing Cup Bore Dia.	3.6708-3.6718 in.
Pilot Dia.	4.997-4.999 in.

I. Brake Shaft And Bearing Retainers

Shaft:	
Right Bearing Journal Dia.	2.375-2.376 in.
Left Bearing Journal Dia.	2.500-2.501 in.
Endplay - Direct Drive	.006-.009 in.
Preload - Power Control	.000-.004 in.
Left Bearing Retainer:	
Seal Bore Dia.	3.496-3.498 in.
Bearing Cup Bore Dia	4.452-4.455 in.
Right Bearing Retainer:	
Bearing Cup Bore Dia.	4.875-4.876 in.
Brake Drum Dia.	12 in.

J. Intermediate Shaft

Bearing Journal Dia.	2.5000-2.5005 in.
Endplay	.004-.007 in.

K. Transmission Housing

Bore Diameters:	
PTO Shaft Carrier	5.188-5.190 in.
Bevel Gear Shaft Bearing Retainer	5.000-5.002 in.
Ball Bearing	4.9211-4.9225 in.
Brake Shaft Bearing Retainer	4.2515-4.2525 in.

L. Side Frame

Bore Diameters:	
Bevel Gear Shaft Bearing Retainer	5.000-5.002 in.
Ball Bearing	4.9211-4.9225 in.
Drum Shaft Outer Retainer	11.125-11.128 in.
Intermediate Shaft Bearing Retainer	5.376-5.377 in.
Brake Shaft Bearing Retainer	6.250-6.252 in.
Drum Seal	10.998-11.002 in.

M. Direct Drive Clutch

2nd Reduction Gear Bore	3.0000-3.0012 in.
Dental Clutch Groove	.510-.515 in.
Bearing Carrier Dia.	2.2494-2.2500 in.

N. Power Controlled Clutch

Piston:	
Outside Dia.	8.496-8.498 in.
Inside Dia.	5.750-5.752 in.
Piston Housing:	
Piston Cavity — Large Dia.	8.506-8.508 in.
Piston Cavity — Small Dia.	5.740-5.742 in.
Inside Dia.	3.376-3.378 in.
Hub — Small Dia.	3.373-3.375 in.
Friction Disc:	
Overall Width	.122-.128 in.
Friction Material Thickness	.0275-.0365 in.
Separator Plate:	
Width	.080-.084 in.
Dish	.012-.022 in.
Cooling Valve Spring:	
Free Length	2-11/16 in.
Pressure At Two Inches	.6875 lb.
Cooling Valve Installed Height	1.875-1.906 in.
Release Spring:	
Free Length	2-31/32 in.
Pressure At Two Inches	45.42 in.
Plate To Disc Clearance	.085 to .125 in.

O. Oil Brake

Apply Spring:

Dish	.337-.347 in.
Pressure at 11/32 inch Deflection	11000-11900 lbs.
Piston:	
Outside Dia.	10.496-10.498 in.
Inside Dia.	3.499-3.502 in.
Piston Housing:	
Piston Cavity Large Dia.	10.503-10.506 in.
Piston Cavity Small Dia.	3.493-3.496 in.
Push Rod:	
Diameter	.373-.375 in.
Length	3.222-3.225 in.
Friction Disc:	
Overall Width	.122-.128 in.
Friction Material Thickness	.0275-.0365 in.
Separator Plate:	
Width	.080-.084 in.
Dish	.012-.022 in.

D89 WINCH

A. Gear Ratios

Standard Speed:	
Forward	46:1
Reverse	21.7:1
Lo-Speed:	
Forward	83.6:1
Reverse	28.4:1

B. Number Of Teeth On Standard Speed Gears

PTO Shaft Bevel Gear	21
Bevel Gear Shaft:	
Bevel Gear	41
2nd Reduction Pinion - Forward	24
2nd Reduction Pinion - Reverse	17
Brake Shaft:	
2nd Reduction Driven Gear	51
Intermediate Pinion	17
Intermediate Shaft:	
Intermediate Driven Gear	48
Drum Pinion	14
Drum Gear	55

C. Number Of Teeth On Lo-Speed Gears

PTO Shaft Bevel Gear	16
Bevel Gear Shaft:	
Bevel Gear	41
2nd Reduction Pinion - Forward	19
2nd Reduction Pinion - Reverse	17
Brake Shaft:	
2nd Reduction Driven Gear	56
Intermediate Pinion	17
Intermediate Shaft:	
Intermediate Driven Gear	48
Drum Pinion	14
Drum Gear	55

D. Drum

Barrel Diameter:	
Standard Speed	14 in.
Lo-Speed	9-1/4 in.
Flange Dia.	25 in.
Barrel Length	10-3/4 in.
Recommended Cable Size	1-1/8 in.
Capacity With 1-1/8 Inch Cable: *	
Standard Speed	239 ft.
Lo-Speed	300 ft.
Capacity With 1-1/4 Inch Cable: *	
Standard Speed	192 ft.
Lo-Speed	242 ft.

* Allow for loose or unevenly spooled cable.

Ferrule Size:	
1-1/8 Inch Cable	J9
1-1/4 Inch Cable	J10
Seal Bore Dia.	7.002-7.004 in.
Bearing Bore Dia.	7.002-7.004 in.
Pilot Dia.	9.573-9.583 in.

E. Drum Shaft And Outer Retainer

Shaft:	
Bearing Journal Dia.	4.4990-4.5005 in.
Retainer Journal Dia.	4.373-4.375 in.
Gear Bore Dia.	7.002-7.004 in.
Outer Retainer:	
Bore Dia.	4.377-4.380 in.
Pilot Dia.	11.061-11.063 in.

F. PTO Shaft And Carrier

Shaft:	
Bearing Journal Dia.	2.5586-2.5595 in.
Seal Journal (Spacer) Dia.	2.995-3.005 in.
Carrier:	
Bearing Bore Dia.	5.5116-5.5130 in.
Seal Bore Dia.	4.001-4.005 in.
Pilot Dia.	6.746-6.749 in.

G. Bevel Gear Shaft And Bearing Retainers

Shaft:	
Seal Ring Groove Width	.125-.133 in.
Tapered Bearing Journal Dia.	2.3746-2.3751 in.
Endplay - Direct Drive	.000-.004 in.
Direct Drive Spacer Length:	
Short	2.685-2.688 in.
Long	3.808-3.813 in.

SPECIFICATION LISTING

Preload - Power Controlled	.000-.004 in.
Power Controlled Spacer Length:	
Short	2.685-2.688 in.
Long	3.808-3.813 in.
Spacer Washer Width	.183-.185 in.
Carrier Ball Bearing Surface Dia.	3.3458-3.3469 in.
Bevel Gear:	
Hub Counterbore Dia.	6.624-6.626 in.
Hub Pilot Dia.	6.622-6.625 in.
Backlash	.006-.012 in.
Seal Ring:	
Type	Locked Joint
Width	.0925-.0936 in.
Side Clearance	.0205 .0215 in.
Left Bearing Retainer:	
Seal Ring Bore Dia.	1.500-1.505 in.
Bearing Cup Bore Dia.	4.875-4.876 in.
Pilot Dia.	6.747-6.749 in.
Right bearing Retainer:	
Seal Ring Bore Dia.	1.500-1.505 in.
Bearing Cup Bore Dia.	4.875-4.876 in.
Pilot Dia.	5.997-5.999 in.

H. Brake Shaft And Bearing Retainers

Shaft:	
Bearing Journal Dia. - Right	2.500-2.501 in.
Bearing Journal Dia - Left	3.005-3.0015 in.
Seal Journal Dia.	2.932-2.942 in.
Preload	.000-.004 in.
Left Bearing Retainer:	
Seal Bore Dia.	4.245-4.247 in.
Bearing Cup Bore Dia	5.513-5.516 in.
Brake Drum Dia.	14 in.

I. Intermediate Shaft

Bearing Journal Dia.	2.750-2.751 in.
Endplay	.004-.007 in.

J. Transmission Housing

Bore Diameters:	
PTO Shaft Bearing Retainer	7.000-7.002 in.
Bevel Gear Shaft Tapered Bearing Retainer	6.750-6.752 in.
Ball Bearing	5.9053-5.9067 in.
Brake Shaft Bearing Retainer	5.5130-5.5145 in.
Drum Shaft	4.377-4.380 in.

K. Side Frame

Bore Diameters:	
Bevel Gear Shaft Tapered Bearing Retainer	6.000-6.002 in.
Ball Bearing	5.9053-5.9067 in.
Drum Shaft Outer Retainer	11.065-11.070 in.
Intermediate Shaft Bearing	6.6260-6.6270 in.
Brake Shaft Bearing Retainer	5.9100-5.9110 in.
Drum Seal	10.998-11.002 in.

L. Direct Drive Clutch

2nd Reduction Gear Bore Dia.	3.4999-3.5013 in.
Dental Clutch Groove	.510-.515 in.
Carrier Bearing Surface Dia.	2.7494-2.7500 in.

M. Power Controlled Clutch

Piston:	
Outside Dia.	9.996-9.998 in.
Inside Dia.	6.000-6.002 in.
Piston Housing:	
Piston Bore Large Dia.	10.006-10.008 in.
Piston Bore Small Dia.	5.990-5.992 in.
Inside Dia.	3.626-3.628 in.
Hub - Small Dia.	3.623-3.625 in.
Friction Disc:	
Overall Width	.122-.128 in.
Friction Material Thickness	.0275-.0365 in.
Separator Plate:	
Width	.080-.084 in.
Dish	.020-.030 in.
Cooling Valve Spring:	
Free Length	2-11/16 in.
Pressure At Two Inches	.6875 lbs.
Disc To Plate Clearance	.085 to .125 in.

N. Oil Brake

Apply Spring:	
Dish	.325-.335 in.
Pressure At 1/4 Inch Deflection	8000-8750 lb.

Piston:	
Outside Dia.	12.246-12.248 in.
Inside Dia.	4.255-4.260 in.
Piston Housing:	
Piston Bore-Large Dia.	12.253-12.255 in.
Piston Bore-Small Dia.	4.243-4.246 in.
Inside Diameter	3.015-3.020 in.
Push Rod:	
Diameter	.373-.375 in.
Length	3.422-3.425 in.
Friction Disc:	
Overall Width	.122-.128 in.
Friction Material Thickness	.0275-.0365 in.
Separator Plate:	
Width	.080-.084 in.
Dish	.020-.030 in.

HYDRAULIC

A. Manual Control Valve

Relief Pressure at 8 G.P.M.:	
Main Line	215-235 P.S.I.
Clutch Cooling	6.5-7.0 P.S.I.
Detent Spring:	
Free Length	1-9/64 in.
Pressure At One Inch	19.74 lbs.
Clutch Cooling Oil Relief Spring:	
Free Length	1-29/32 in.
Pressure At 1-7/16 Inch	1.3 lbs.
Main Line Relief Spring	
Free Length	4 in.
Pressure At Three Inches	28 lb.
Take-Up Spring:	
Free Length	1-27/32 in.
Pressure At 1-3/4 Inch	2.89 lbs.
Centering Spring - Selector Valve	
Free Length	1-1/2 in.
Pressure At One Inch	48.75 lbs.

B. Flow Divider

Controlled Flow	8 G.P.M.

C. Quick Dump Valve

Relief Pressure	2-4 P.S.I.
Relief Spring:	
Free Length	1-15/32 in.
Pressure At 1-1/6 Inches	1.4 lbs.

D. Brake Cooling Oil Relief Valve

Relief Pressure	50 P.S.I.
Relief Spring:	
Free Length	2-1/8 in.
Pressure At 1-5/16 Inches	14.5 lbs.

Remove ball and spring from cooling oil valve if later high GPM pump used.

E. Pump Output

NOTE: The pump output is given at engine RPM.

#D6C — Power Controlled:

On D6 Tractor	
At 550 RPM	2.7 G.P.M.
At 1800 RPM	8.9 G.P.M.
On 977 Traxcavator	
At 600 RPM	4.9 G.P.M.
At 1950 RPM	13.8 G.P.M.

#D6D — Power Controlled:

On D6 Tractor	
At 550 RPM	(4.3 G.P.M.*)
At 1800 RPM	(14.0 G.P.M.*)
On 977 Traxcavator	
At 600 RPM	4.9 G.P.M.
At 1950 RPM	13.8 G.P.M.

#D7F — Power Controlled:

On D7 Tractor	
At 500 RPM	5 G.P.M.
At 1200 RPM	11 G.P.M.
On 977 Traxcavator	
At 600 RPM	4.9 G.P.M.
At 1950 RPM	13.8 G.P.M.

D7H — Power Controlled:

On D7 Tractor — Overdrive drive	
At 500 RPM	13 G.P.M.
At 1200 RPM	33 G.P.M.
On D7 Tractor — Inline Drive	
At 500 RPM	7 G.P.M.
At 1200 RPM	18 G.P.M.
On 977 Traxcavator	
At 600 RPM	4.9 G.P.M.
At 1950 RPM	13.8 G.P.M.

#D89A — Power Controlled:

On D8 Tractor	
At 500 RPM	4 G.P.M.
At 1200 RPM	11 G.P.M.
On D9 Tractor	
At 500 RPM	5 G.P.M.
At 1240 RPM	13 G.P.M.

D89B:

At D8 Tractor — Overdrive Drive	
At 500 RPM	13 G.P.M.
At 1200 RPM	33 G.P.M.
On D8 Tractor — Inline Drive	

*Optional on earlier models, Standard on later models.

At 500 RPM	7 G.P.M.
At 1200 RPM	18 G.P.M.
On D9 Tractor — Overdrive Drive	
At 500 RPM	12 G.P.M.
At 1280 RPM	30 G.P.M.
On D9 Tractor — Inline Drive	
At 500 RPM	8 G.P.M.
At 1280 RPM	19 G.P.M.

HANDLING GEAR

A. Direct Drive Winch

Dimension "A"

NOTE: Dimension "A" is the distance from the brake cable end to the center of the connecting pin, in the control housing.

D6	1-7/16 in.
D7	1-1/8 in.
D89	1-1/4 in.

Dimension "B"

NOTE: Dimension "B" is the distance from the brake cable housing to the center of the connecting pin, in the control housing.

D6	5-1/6 in.
D7	4-3/4 in.
D89	4-7/8 in.

B. Oil Brake Console

Distance from the bottom of the lockplate to the bottom of the adjusting screw	1-1/4 in.
Distance from the bottom of the cable end to the bottom of the inside console surface	4-3/32 in.

TORQUES

NOTE: All torques are given in lb.-ft. and with lubricated threads, unless otherwise indicated. Only critical torques are listed; use the "General Torque Tables" for torques of unlisted capscrews, bolts and nuts.

A. Specific Torques

Drum Shaft Inner Retainer Bolts:	
D6	75
D7 And D89	146
Drum To Flange Bolts	200
P. C. Clutch:	
Assembly Bolts	70
Setscrews	40
Bevel Gear Shaft:	
Left Bearing Retainer Bolt	75
Right Jam Nut — P. C. Only	200
Intermediate Shaft Left Bearing Retainer Bolt	146

B. General Torque Tables

NOTE: The following torque values are based on unlubricated threads. For lubricated threads reduce the values 30-40 per cent.

Carbon Steel Capscrews:

Size	UNC	UNF
1/4	11	13
5/16	21	23
3/8	38	40
7/16	55	60
1/2	85	95
9/16	125	140
5/8	175	210
3/4	300	330
7/8	450	490
1	680	715

Socket Head Capscrews:

Size	UNC	UNF
1/4	14	17
5/16	30	35
3/8	55	70
7/16	95	105
1/2	125	140
9/16	190	200
5/8	260	285
3/4	450	490
7/8	720	775
1	1090	1160
1-1/8	1500	1760
1-1/4	2150	2430

Hex Head Capscrews:

Size	UNC	UNF
1/4	6	7
5/16	13	14
3/8	23	26
7/16	37	41
1/2	57	64
9/16	82	91
5/8	111	128
3/4	200	223
7/8	375	400
1	560	600

SECTION G—MISCELLANEOUS

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MISCELLANEOUS

CONVERSION TABLES

FRACTIONAL INCH TO DECIMAL AND MILLIMETER

Fraction	Decimal	Millimeter
1/64	.0156	0.3969
1/32	.0312	0.7937
3/64	.0468	1.1906
1/16	.0625	1.5875
5/64	.0781	1.9844
3/32	.0937	2.3812
7/64	.1093	2.7781
1/8	.1250.	3.1750
9/64	.1406	3.519
5/32	.1562	3.9687
11/64	.1718	4.3656
3/16	.1875	4.7625
13/64	.2031	5.1594
7/32	.2187	5.5562
15/64	.2343	5.9531
1/4	.2500	6.3500
17/64	.2656	6.7469
9/32	.2812	7.7437
19/64	.2968	7.5406
5/16	.3125	7.9375
21/64	.3281	8.3344
11/32	.3437	8.7312
23/64	.3593	9.1281
3/8	.3750	9.5250
25/64	.3906	9.9219
13/32	.4062	10.3187
27/64	.4218	10.7156
7/16	.4375	11.1125
29/64	.4531	11.5094
15/32	.4687	11.9062
31/64	.4843	12.3031
1/2	.5000	12.7000
33/64	.5156	13.0969
17/32	.5312	13.4937
35/64	.5468	13.8906
9/16	.5625	14.2875
37/64	.5781	13.6844
19/32	.5937	15.0812
39/64	.6093	15.4781
5/8	.6250	15.8750
41/64	.6406	16.2719
21/32	.6562	16.6687
43/64	.6718	17.0656
11/16	.6875	17.4625
45/64	.7031	17.8594
23/32	.7187	18.2562
47/64	.7343	18.6531
3/4	.7500	19.0500
49/64	.7656	19.4469
25/32	.7812	19.8537
51/64	.7968	20.2406
13/16	.8125	20.6375
53/64	.8281	21.0344
27/32	.8437	21.4312
55/64	.8593	21.8281
7/8	.8750	22.2250
57/64	.8906	22.6219
29/32	.9062	23.0187
59/64	.9218	23.4156
15/16	.9375	23.8125
61/64	.9531	24.2094
31/32	.9687	24.6062
63/64	.9843	25.0031
1	1.0000	25.4001

THOUSANDTHS TO MILLIMETERS

Inch	Millimeters
.001	.025
.002	.051
.003	.076
.004	.102
.005	.127
.006	.152
.007	.178
.008	.203
.009	.229
.010	.254

1 micro-inch equals one millionth inch
1 micron equals one millionth meter

U.S. LIQUID MEASURES

2 pints equal one quart
4 quarts equal one gallon
1.2009 gallons equal one British Imperial gallon

U.S. GALLONS TO LITERS

(One U.S. gallon equals 3.785329 Liters)

Gallons	Liters	Gallons	Liters
0.1	0.38	6	22.71
0.2	0.76	7	26.50
0.3	1.14	8	30.28
0.4	1.51	9	34.07
0.5	1.89	10	37.85
0.6	2.27	20	75.71
0.7	2.67	30	113.56
0.8	3.03	40	151.51
0.9	3.41	50	189.27
1	3.79	60	227.12
2	7.57	70	264.97
3	11.36		
4	15.14		
5	18.93		

MISCELLANEOUS

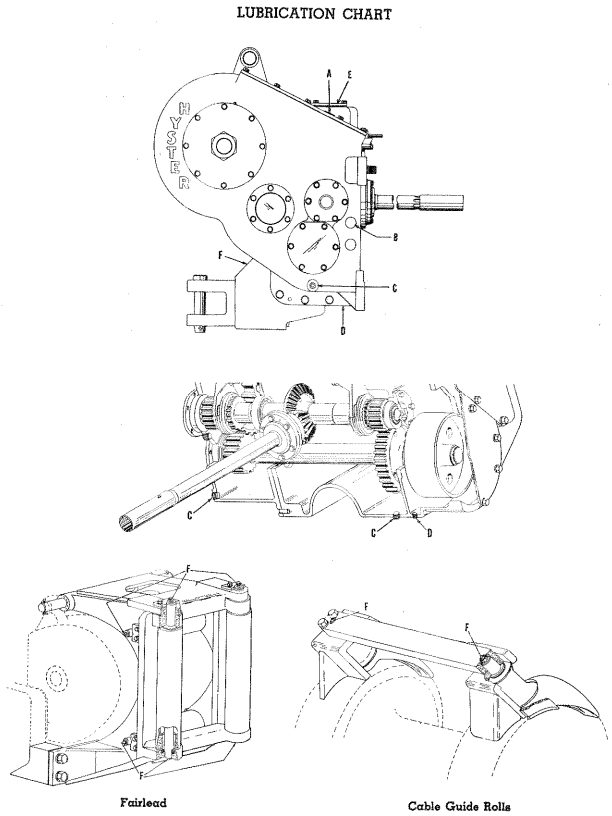

Figure 1

LUBRICATION INSTRUCTIONS

Every Eight Hours or Daily

Swiveling Drawbar, Fairlead and Cable Guide Rolls (optional):

Lubricate with pressure gun grease. (Fittings at "F").

Rod End Pins:

Rod end pins, shifter rods, lever fulcrums, pin connections and other moving parts should be lubricated with SAE 30 engine oil at the end of each shift.

Every 50 Hours or Weekly

Transmission:

Check oil level at plug "B"; add oil if necessary. If winch is new, drain, flush and refill

NOTE: When checking oil level in winches mounted on power shift tractors, stop tractor engine to obtain a correct reading. For winches mounted on direct drive tractors, disengage the tractor master clutch to obtain a correct reading.

Every 200 Hours or Four Weeks

Loosen plugs "C" and "D" and drain any accumulation of water in the transmission and brake compartment. Tighten plugs when oil appears, and check oil level.

Every 500 Hours or When Tractor Engine Oil Filter is Changed

Filter:

Remove cartridge "E", clean thoroughly and replace.

Every 1000 Hours or Six Months (Under Normal Conditions)

Transmission:

Drain, flush and refill with new oil. At the factory the winch is filled to proper level with specified oil. Drain through plugs "C" and "D". Refill through plug "A" up to level plug "B".

Automatic Brake:

Disassemble, clean repack with a high melting point grease; then reassemble.

CAUTION: Do not completely fill with grease, or attempt to grease the brake through the breather.

OIL CAPACITIES AND TYPES CHART

Winch	Capacity U.S. Gals	Liters	Type
D6C — D.D.	10	38	SAE 90 EP
D6C — P.C.	12	45	SAE 10 Series 3
D6D — D.D.	10	38	SAE 90 EP
D6D — P.C.	12	45	SAE 10 Series 3
D7F — D.D.	13	49	SAE 90 EP
D7F — P.C.	13	49	SAE 10 Series 3
D7H — D.D.	18	68	SAE 90 EP
D7H — P.C.	20	76	SAE 10 Series 3
D89A — D.D.	18	68	SAE 90 EP
D89A — P.C.	18	68	SAE 10 Series 3
D89B — P.C.	22	83	SAE 10 Series 3

AUTOMATIC BRAKE LUBRICANTS

Atlantic Richfield	Thermogrease
Mobil Oil	Mobiltemp Grease No. 1
Shell Oil	Darina Grease 1
Standard Oil	Chevron Indust. Grease
Texaco	Thermatex EP No. 1
Union Oil	Strona HT 1
Sun Oil	Sunaplex 991 EP
BP Australia	Energrease HTB2

"THE QUALITY KEEPERS"

HYSTER APPROVED PARTS

HYSTER COMPANY
TRACTOR ATTACHMENT OPERATIONS

500M 12/79 LL LITHO IN U.S.A.