TOWMOTORQUE SERVICE MANUAL

TOWMOTOR
THE ONE-MAN-GANG ®

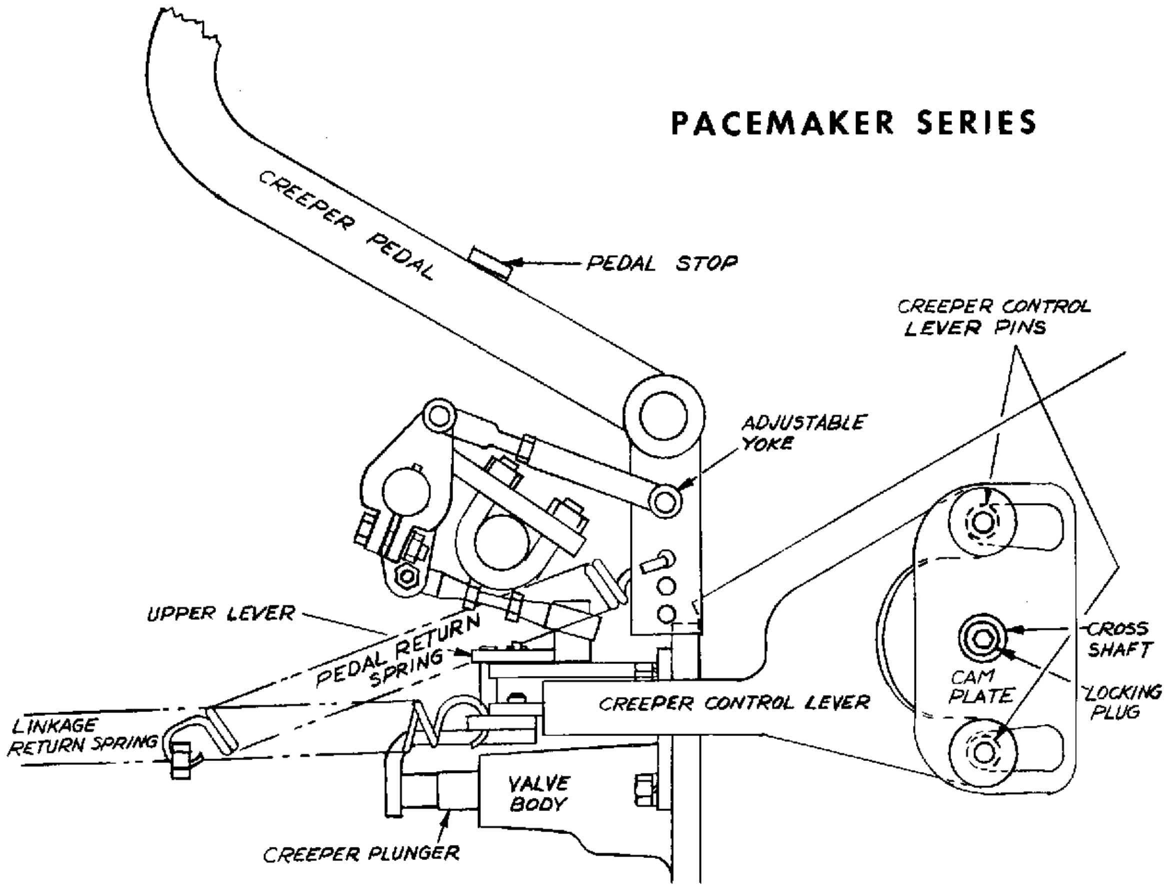
FORK LIFT TRUCKS *and* TRACTORS

MODELS 540, 600, 670 AND 680P ALSO APPLICABLE TO MODELS 392S, 422S, 462S, 501P, 502S, 502P, 600P AND 601P

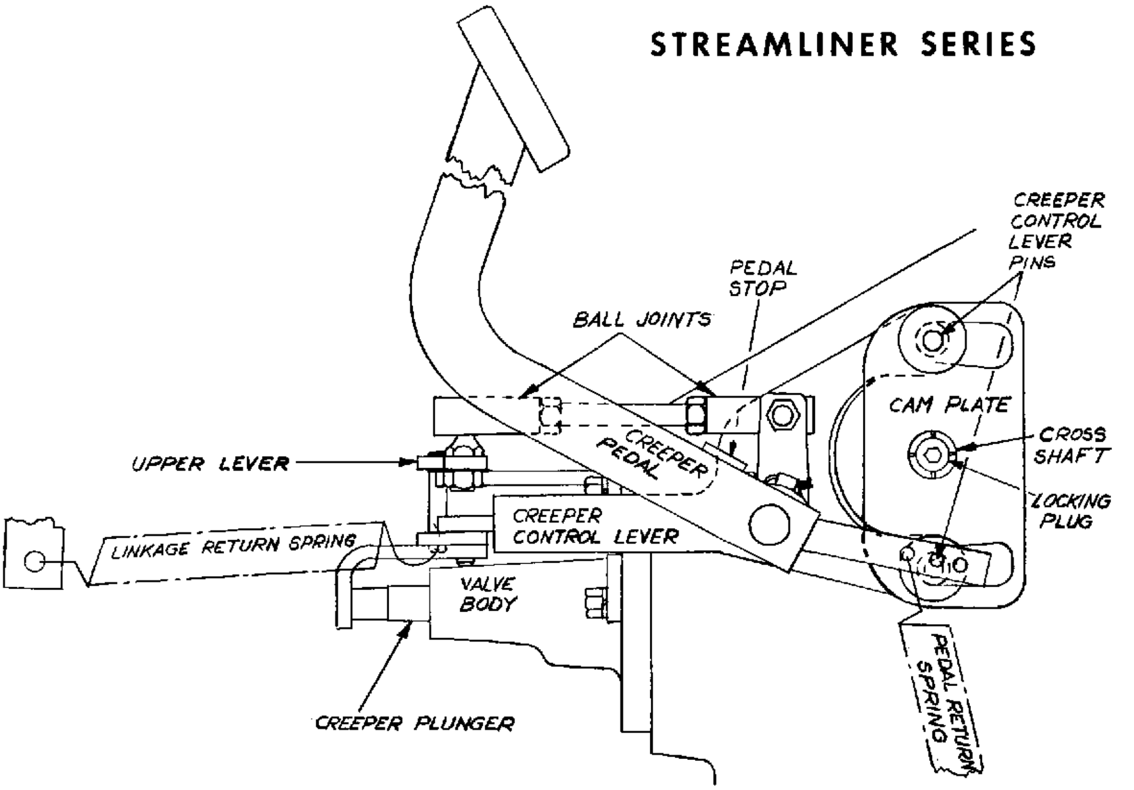
Price $1.00

TOWMOTOR CORPORATION
16100 EUCLID AVE. CLEVELAND 12, OHIO

PACEMAKER SERIES



STREAMLINER SERIES



SUPPLEMENTAL TOWMOTORQUE ADJUSTMENTS

CREEPER PEDAL ADJUSTMENT: (EARLY MODELS WITH ROUND CREEPER PEDAL) (See Page 1.)

Creeper pedal travel should be set so that the pedal contacts the stop bolt (1/32 inch additional travel after the valve plunger is all the way into the valve body). Adjust creeper pedal by lengthening or shortening the adjustable yoke at the valve.

CREEPER PEDAL ADJUSTMENT: (LATE MODELS WITH STANDARD CLUTCH CREEPER PEDAL)

To adjust this type of creeper pedal linkage proceed as follows: Disconnect the upper lever from the creeper lever support, mounted on the transmission, by removing the cotter pin and slipping the upper lever off the creeper lever support. Loosen the locking plug in the end of the cross shaft. The spring loaded lower control lever will then rotate the cam plate until both creeper control lever pins contact the left edge of the holes in the cam plate. Tighten the locking plug approximately 10 foot pounds of torque making sure the cross shaft does not rotate in the cam plate.

Move the creeper plunger to its fully extended position and place the creeper pedal against the pedal stop.

With the creeper plunger extended and the creeper pedal against the stop, reinstall the upper lever on the creeper lever support. The hole in the upper lever should be aligned with the pin in the lower lever. To make this alignment, loosen ball joint jam nuts, then turn ball joint and upper lever, as an assembly, in or out as necessary to align pin and hole. After adjustment is set, tighten ball joint jam nuts and install washers and cotter pins as necessary.

NOTE

On Models 540, 600, 670 and 680-P, follow the same adjustment procedure except when aligning the hole in the upper lever and the pin in the lower lever, disconnect the adjustable yoke at the brake pedal. Turn yoke and lever as an assembly in or out as necessary to align pin and hole.

After the initial linkage adjustments have been made, it may be necessary to make further adjustments to the linkage after the truck has been driven for the first time.

1. If the clutch does not completely disengage with the creeper pedal positioned between one or two inches from the floor board, the ball joint or adjustable yoke may be adjusted to have the creeper plunger positioned somewhat into the valve body with the pedal fully released. The plunger should not be positioned into the valve body sufficiently as to cause an increase in the shift cycle time or the clutches to slip. The position of the plunger that would cause a change in the shift cycle time varies with each valve body due to the internal cored oil passages in the valve body.

2. If the pedal position for creeping the truck is not the same in forward and reverse gear, the cam plate may be rotated slightly on the cross shaft to compensate for the difference in travel of the clutch linkage. If the pedal position is lower in forward gear than in reverse, rotate the cam plate on the cross shaft in a clockwise direction (viewed from the left side of truck). If the pedal position is higher in forward gear than in reverse gear, rotate the cam plate on the cross shaft in a counterclockwise direction. This adjustment may be required with each rebuild of the transmission that affects the amount of travel of the clutch linkage.

It is necessary that the movement of the creeper plunger closely follow the movement of the creeper pedal due to the nature of this control mechanism. A binding or sticking condition in the linkage that results in an abrupt movement of the plunger in the valve body, causes the truck to lurch and gives difficulty in controlling the truck speed during creeping. The linkage should be lubricated with SAE 30 engine oil at each pivot joint during assembly and none of the linkage should be painted. The linkage return spring preloads the linkage to take up the initial clearances at each pivot point, and any increase in clearance due to wear.

CREEPER PEDAL AND LINKAGE (LATE MODELS)

The following information contained in these supplement pages refers to the adjustments of this "new style" creeper pedal linkage. Variations in operation between "early model" linkage and "late model" linkage is given under the title "How to Creep in Tight Spots".

This new style linkage is quite sensitive in its creeper pedal actions, therefore, accurate adjustments are required for best efficiency and operation of the truck during "creeping".

Identification between "early" and "late" model linkage can be distinguished as follows: Early models have a round button-type creeper pedal while the late models use a pedal similar to a standard transmission clutch pedal.

HOW TO "CREEP" IN "TIGHT SPOTS" (LATE MODELS)

Procedures for creeping in tight spots are essentially the same as those used in the "early models" except that extremely easier creeper pedal action is obtained through the newly designed linkage. In effect, the creeper pedal linkage is given a hydraulic and mechanical assist by the shift cylinder, cross shaft and cam plate. The amount of creeper pedal effort varies only with the force exerted by the creeper pedal return spring. This enables the operator to "ride" the creeper pedal for less effort when inching. It is not necessary to "pump" the creeper pedal for inching, it is only necessary to move it slightly up and down. After a few trips the operator can readily determine the amount of pedal travel necessary for inching.

TOWMOTORQUE
SERVICE MANUAL

The Service Manual is divided into sections as listed in the Table of Contents. It contains service and repair instructions for Towmotorque Transmissions as used on Towmotor Models 540, 600, 670 and 680-P.

The service and repair information contained in this manual covers the transmissions being currently produced and sold by the Towmotor Corporation.

When ordering replacement parts be sure to use genuine Towmotor Specified Replacement Parts. Use of substitute parts results in lower operating efficiency of the lift truck.

SERVICE DEPARTMENT
TOWMOTOR CORPORATION

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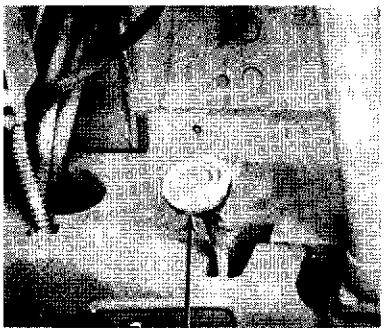
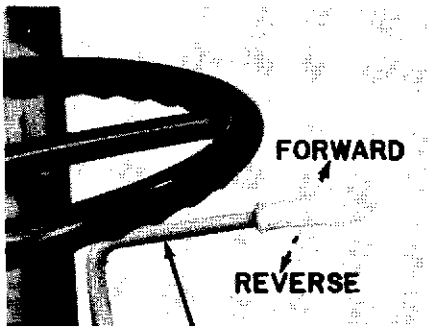
HOW TO DRIVE WITH TOWMOTORQUE



CREEPER PEDAL



SHIFT LEVER

1. Position shift lever in neutral and start engine. Positioning shift lever in neutral operates a safety switch which closes a circuit to the starting motor and permits operator to start engine.

2. Shift control lever and push gas pedal. Push shift lever forward to go forward. Pull lever backward for reverse. Push gas pedal and move shift lever at the same time.

3. Drive Towmotor. Once Towmotor is in motion, the driver need only step on the gas pedal for speed control - and move control lever if he wants to change direction.

4. To stop. Release gas pedal and step on brakes to stop Towmotor. It is not necessary to move control lever into neutral or step on creeper pedal.

HOW TO "CREEP" IN "TIGHT SPOTS" (EARLY MODELS)

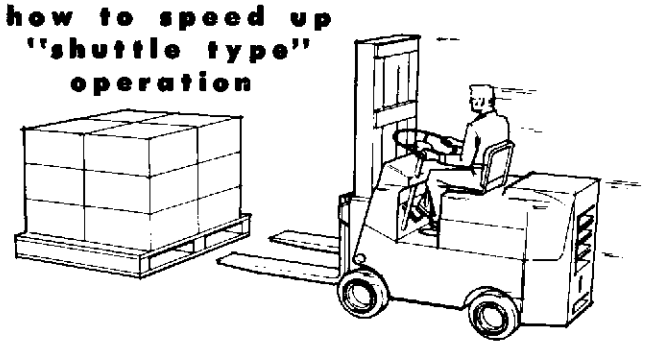
To drive Towmotor at a creeping speed and still operate engines at high speed for fast lifting, tilting or accessory operation...

First... Push creeper pedal to floor. This action stops power from engine to wheels.

Second... Lift foot to let pedal come back about halfway. This action will cause partial drive motion from engine to wheels.

Third... Move pedal up and down from floor to halfway position and at the same time press down on gas pedal. The repeated action of pushing creeper pedal down quickly and releasing it slowly will cause short periods of partial drive motion and Towmotor will move at a smooth, controlled creeping speed. High engine speed will allow fast lifting, tilting or other hydraulic actions.

HOW TO SPEED UP "SHUTTLE TYPE" OPERATION



For fast "shuttle type" operation, change travel direction without stopping Towmotor completely (low engine speed recommended).

First... When Towmotor is two or three feet from load, pull shift lever backward. This leaves driver's hands free to operate lift controls.

Second... Let Towmotor coast up to load, operating lift control levers as necessary and stepping on foot brakes if necessary.

Third... Press gas pedal when loading or unloading is completed.

DO NOT USE TOWMOTORQUE AS A BRAKE

When Towmotor is moving (high engine speed) and shift lever is moved for change of direction before stopping, step on brake pedal to slow down or stop. Do not use Towmotorque as a constant braking power.

TOWMOTOR TOWMOTORQUE DRIVE

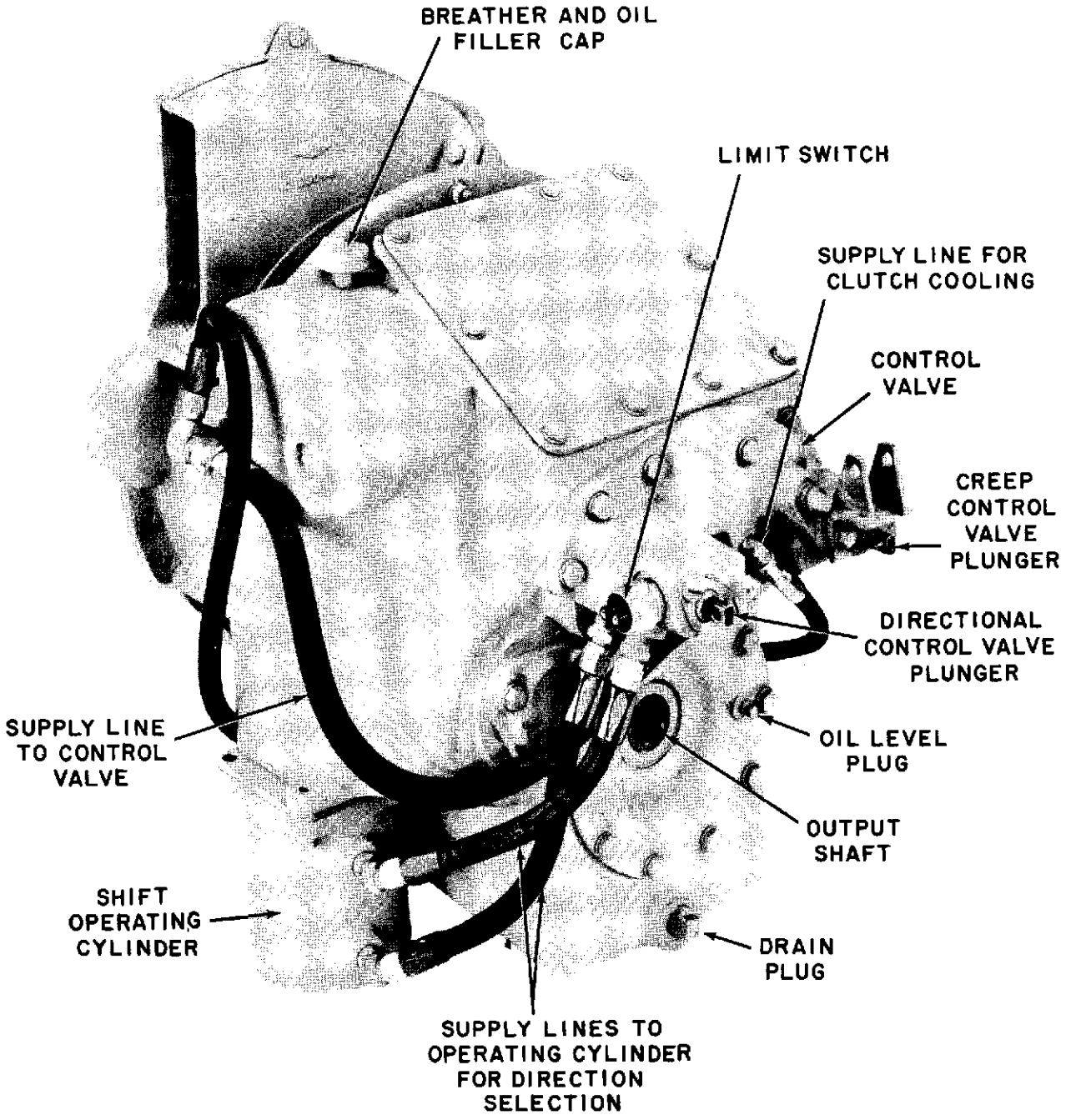


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Fig. 1. TowmoTorque Transmission - Assembled View

DESCRIPTION

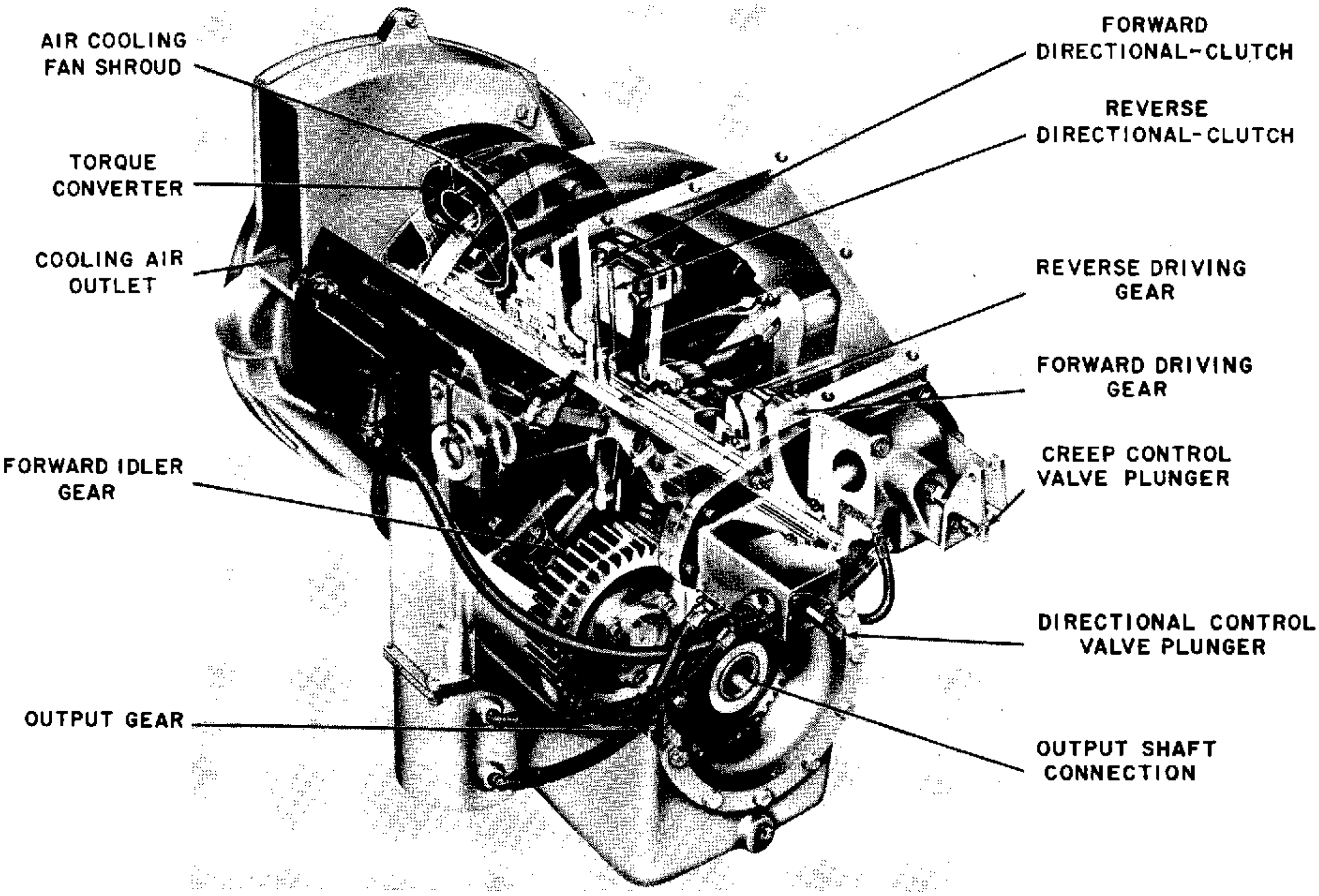

Fig. 2. TowmoTorque Cutaway

TowmoTorque is designed to provide hydraulically controlled power . . . to eliminate gear shifting and clutching delays . . . and to provide effortless driver control.

The TowmoTorque drive is a heavy duty, air and oil cooled hydraulic torque converter type transmission. The principle operating parts are a hydraulic torque converter, a duplex directional clutch for forward and reverse travel, and a constant-mesh, drop-down type gear train that requires no shifting. Driving torque is transmitted smoothly and efficiently from the engine through the converter to the drive wheels for either forward or reverse movement. Control of forward or reverse direction is accomplished by a flip of the control lever which is positioned at the steering wheel.

The hydraulic torque converter is a combination fluid coupling and torque converter of the single-stage, three-element type. The three elements are the impeller, the turbine, and the stator. The impeller is driven by the engine flywheel, the turbine drives the clutch, and the stator provides the ability to multiply torque.

The duplex directional clutch consists of a clutch flywheel driven by the converter, a double-faced pressure plate, and forward and reverse clutch plates. These parts, plus operating links, pins, etc. are enclosed in a clutch cover. Clutch plates are coned to assure rapid disengagement.

The gear train is a drop-down type consisting of spur type gears which are in constant mesh. Gear shafts are supported by heavy-duty ball and/or roller bearings.

The converter, clutch, and gear train are housed in two individual cases bolted together. The converter case houses the hydraulic torque converter and the transmission case houses the duplex clutch and the gear train.

SHIFTING CYCLE TIME

The shifting cycle, to either forward or reverse, should be accomplished in 3/4 to 1-1/3 seconds after the control lever is moved into the desired position. For a complete reversal of direction, shifting should require 2 seconds after the control lever is moved.

The shifting lever is designed for finger tip control. Movement of the lever should require no more effort than a flipping of the fingers.

CREEPER PEDAL OPERATION

When the creeper pedal is in the fully released position or partially depressed up to the half-way position (with truck in motion), drive motion should continue.

When the creeper pedal is fully depressed with the truck in motion, power to the drive wheels will cease immediately, regardless of control lever position or engine speed. Do not confuse "over-roll" or coast with drive motion.

When the creeper pedal is released from a fully-depressed position to an approximate half-way position (with control lever in forward or reverse), gradual clutch engagement should occur.

BRAKING WITH TOWMOTORQUE

When Towmotor is in motion (high engine rpm) and control lever is shifted for opposite direction before stopping truck, stop or slow down truck with foot brakes. Do not use TowmoTorque torque converter as a constant braking power.

TOWMOTORQUE OIL SYSTEM

DESCRIPTION

The heart of the oil system is the oil pump which is located between the torque converter and the converter case. The sleeve extension at the center of the converter is provided with lugs which engage the oil pump drive gear. The pump is driven continuously while the engine is operating. Oil is pumped from the sump, through a strainer, then to the oil pump. The oil pump output is directed to the various units affected by the oil system.

The oil flow in the system is directed in the following manner: (1) pump to radiator heat exchanger, (2) radiator heat exchanger to converter, (3) radiator heat exchanger to clutch, and (4) pump to control system. See figure 3.

Converter System. Oil is directed to the converter through provisions in the pump support and the stator anchor. From the converter, it passes through a pressure regulator valve, converter output shaft, and pump support, then back to the sump.

Clutch System. Oil is directed through a restriction to the forward and reverse clutch. At the clutch, the oil flows out between the clutch hubs and onto the driven discs. This means that the clutch that is not driving can be cooled during its disengaged period so that it is cool and wet with oil when the next engagement is necessary. Oil from the clutch returns as spray directly to the sump.

Control System. The control system receives its oil from a connection in the pump output line. Basically, oil from the pump passes from the pump through the control valve, accumulator valve, into the shift cylinder, back through the accumulator valve to the control valve then it is discharged into the sump.

The control valve is provided with two plungers which act as valves to control direction selection and creeper action. The direction plunger is operated by the control lever mounted on the steering column. The creeper plunger is operated by the creeper pedal.

Shifting of the control lever moves the directional plunger to introduce oil into the double-acting shift cylinder, which in turn produces engagement of the clutch in the desired direction. Flow of oil to the directional plunger and eventually to the shift cylinder is controlled by the creeper plunger position.

When the creeper pedal is fully released, the creeper plunger is positioned to allow free flow of oil to the directional plunger. When directional plunger is in a forward or reverse position, oil flows to either side of shift cylinder which in turn engages the clutch in the desired direction.

When the creeper pedal is fully depressed, oil flows to the directional plunger and to the shift cylinder and is blocked, thus preventing shift cylinder operation to engage clutch.

When the creeper pedal is released half-way, oil flow to the directional plunger is permitted, but it must travel through a restricted opening. With the directional plunger in a forward or reverse position, oil flow to the shift cylinder is controlled by this restricted opening in such a manner that it slows down speed of clutch engagement. If the pedal is held in the half-way position, the clutch will soon become engaged but not as rapidly as when pedal is fully released.

A pressure regulator valve is mounted in the bore of the creeper plunger. This valve limits maximum pressures in the system by controlling oil return to the sump when the pump is delivering more oil than the system requires.

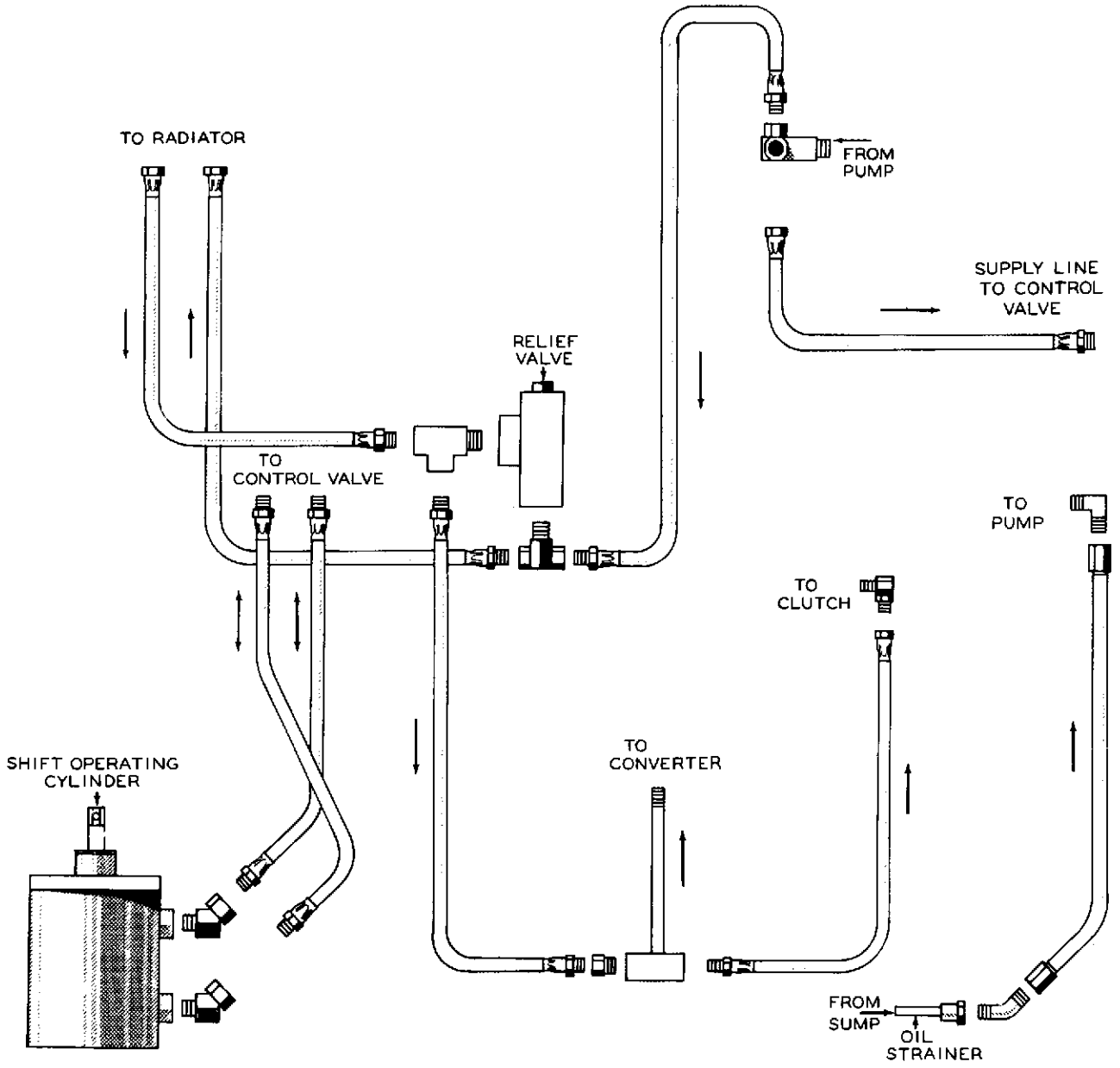

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Fig. 3. TowmoTorque Oil System

OIL CHECKING, DRAINING AND FILLING

The transmission should use little or no oil, however, periodic checking of the level is necessary to assure proper operation. Oil should be changed after each 1500 hours of operation.

Oil level should be checked immediately after stopping the engine. To check oil level remove oil level plug in front cover. Oil should be level with the bottom of the plug opening. If more than two or three quarts are added at any one time, examine transmission for external leaks. When filling is necessary, operate engine and recheck oil level after refilling.

To drain oil from converter, remove case cover to expose the converter. Remove plug from converter and crank engine 180° to drain the oil. Oil will drain through opening in the flywheel housing.

To drain oil from transmission case, remove the magnetic drain plug. Clean drain plug to remove metal chips or foreign material.

When draining is completed, replace bottom plug and transmission case plug.

Fill the transmission through the breather cap opening using a funnel. Capacity is 12 quarts. Operate engine for 10 or 15 minutes then remove oil level plug and recheck oil level.

The factory recommends the use of Automatic

Transmission Type "A" oil to assure best operation. Engine oil SAE 10 maybe used temporarily but not for any period of service longer than a few days.

OIL PRESSURE CHECK

Normal operating pressures for the Towmo-Torque oil systems are as follows:

Engine Speed (rpm)	Oil Pressure (psi)
500	25 - 35
1200	55 - 75
2400	70 - 90

Procedure

1. Pressures should be checked after a warm-up period so that the inspection will reflect actual operating conditions.

2. Insert test gage (160 psi) in pump outlet fitting.

3. Check pressures with engine operating, transmission shift lever in neutral, and creeper pedal depressed. If normal pressures are not obtained, refer to Trouble Shooting, Condition VI and VII.

CLUTCH COOLING CHECK

Check cooling supply to the clutches by disconnecting the oil line from the control valve housing and inserting a fitting with a 1/16" diameter restriction hole so that the discharge oil can be measured. Start the engine, operate at 1200 rpm and measure time required to pump 1 or 2 quarts of oil through the restricted hole in the fitting. One quart should take 15 seconds and two quarts should take 30 seconds. While the cap is off, blow through the shaft to assure that the passage is clean.

TOWMOTORQUE ADJUSTMENTS (EARLY MODELS)

CREEPER PEDAL ADJUSTMENT.

Creeper pedal travel should be set so that the pedal contacts the stop bolt (1/32" additional travel after the valve plunger is all the way into the valve body). Adjust creeper pedal by lengthening or shortening the adjustable yoke at the valve.

CONTROL LEVER ADJUSTMENT.

Control lever travel in both directions should be equal distance from the shift lever stop which is located on the steering column. Adjust lever travel by lengthening or shortening the control lever rod (rod from the foot of the lever to the valve).

CLUTCH ADJUSTMENT AND OPERATION CHECK.

No adjustments are required or provided for clutch wear. The stroke of the shift cylinder is designed to completely wear out both clutch plates. Adjustment shims located under the shift cylinder mounting flange are factory adjustments for neutral setting. In the event of shift cylinder replacement, dimensions for neutral setting must be measured so that correct neutral setting can be obtained through shift cylinder adjusting shims. To check this dimension, remove transmission top cover, then measure the distance between the face of the clutch flywheel and the edge of one of the pressure plate driving lugs. Dimension should be as shown in figure 4.

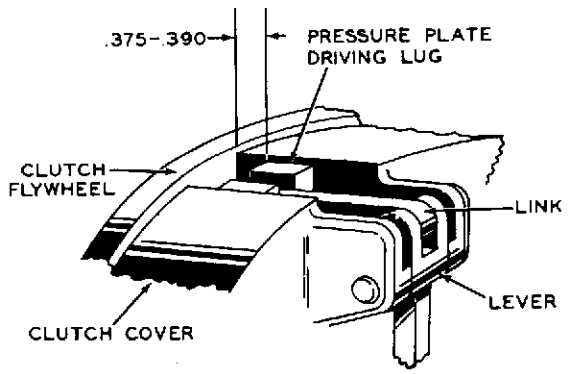


Fig. 4. Clutch Neutral Setting Adjustment Dimensions

A simple check of correct clutch operation is as follows: Set hand brake or move the truck against something immovable with a little weight on the forks. Race the engine with shift lever in neutral and shift into a direction. Proper action should sharply decrease engine speed to approximately 1200 to 1400 rpm and hold it there. Also it should take no longer than three seconds from start to completion of engagement.

If clutches are slipping, a sharp decrease in engine speed will not be apparent but only a slight momentary slow down will occur for an instant, then engine will return to its approximate original speed.

To check clutch engagement with the creeper pedal in the half-way position, vehicle held stationary as described above, and engine running about 1000 rpm, shift into a direction. The clutches should engage normally in the manner described above, but a longer period of time is necessary to accomplish complete engagement.

TOWMOTORQUE TROUBLE SHOOTING

This trouble shooting guide is divided into two sections: (1) Primary checks and (2) specific trouble conditions with their possible causes and remedies.

If trouble is encountered, perform checks with the transmission warmed up. This can be conveniently accomplished by an exploratory road test in an effort to definitely establish the abnormal operating condition. After the transmission is warmed up, perform operations contained under Primary Checks, then proceed with other inspections indicated for specific trouble conditions.

Normal operating characteristics of the TowmoTorque are described under instructions for Operating Towmotor with TowmoTorque Drive. It is suggested that the service man become familiar with these characteristics before attempting to analyze a troubled situation.

PRIMARY CHECKS

I. CHECK OIL LEVEL.

1. Check immediately after operating engine to make sure that all TowmoTorque cavities requiring oil are full. Refer to TowmoTorque Oil System for additional information.

II. CHECK CREEPER PEDAL AND SHIFT LEVER LINKAGE.

1. Check all linkage for good condition and correct adjustment.
2. Shift lever travel in both directions should be equal distance from the shift lever stop which is located on the steering column. Adjust lever travel by lengthening or shortening the shift lever rod (rod from the foot of the lever to the valve).
3. Creeper pedal should be set for operator comfort and travel should be set so that the pedal contacts the stop bolt (1/32" additional travel after the valve plunger is all the way into the valve body). Adjust creeper pedal by lengthening or shortening the adjustable yoke at the valve.

III. CHECK TRANSMISSION OIL PRESSURE.

1. Pressure should be checked after a warm-up period so that the inspection will reflect actual operating conditions. Method for checking is described under instructions for TowmoTorque Oil System. Normal pressures should be as follows:

Engine Speed (rpm)	Oil Pressure (psi)
500	25 - 35
1200	55 - 75
2400	70 - 90

IV. CHECK OIL COOLING SYSTEM.

1. Check cooling supply to clutches by measuring oil flow. For procedure, refer to instructions under TowmoTorque Oil System.

TROUBLE CONDITIONS AND CHECK POINTS

V. TRANSMISSION OIL FOAMS OR OIL IS DISCHARGED FROM BREATHER.

1. Transmission over filled.
2. Transmission oil contaminated with water.
3. Incorrect oil in transmission.
4. Air leak in pump suction line.

VI. LOW OIL PRESSURE.

1. Low transmission oil level.
2. Plugged pump inlet screen in sump. Refer to Condition IX, Item 4.
3. Pump faulty. Refer to Condition IX, Item 1.
4. System relief valve stuck open or leaking because of dirt.
5. Converter pressure regulator valve stuck open. Check by applying air pressure into nipple (at bottom of transmission) which feeds oil to the transmission. Valve should crack at approximately 25 psi or slightly more up to 35 psi.
6. Worn bushing (supporting converter output shaft in collector ring). Valve operation check performed in Item 5 above, would not differentiate between valve or bushing troubles, but either trouble would necessitate disassembly for further inspection and correction.
7. Pinched or clogged supply line.
8. Air leak into pump supply passage or line. Refer to Condition V for indication of leakage.
9. Pump drive lugs sheared off converter sleeve. Check by plugging pump outlet and turning converter by hand, either with engine or after disconnecting converter drive straps from the flywheel. If the converter can be turned, the lugs are probably sheared. This condition

would probably be accompanied by excessive noise.

10. Worn O-ring seal in control cylinder.
11. If other checks fail to conclusively locate the difficulty, the pump may be faulty. The pump should deliver approximately 3-1/2 gallons per minute at 1000 rpm engine speed and 100°F. oil temperature.

VII. HIGH OIL PRESSURE.

1. Jammed system relief valve.
2. Pinched oil line.
3. Plugged oil line or passage.

VIII. ENGINE WILL NOT START OR STARTING MOTOR NOT WORKING.

1. A safety switch is mounted in the control valve. This switch will operate only when the shift lever is in neutral. If lever is not in neutral the engine will not start.
2. Perform usual checks for standard causes of engine failing to start or starting motor failing to operate.
3. If starting motor will not turn engine over, make sure the usual standard checks are made. If trouble is not found, check for pump seizure by disconnecting torque converter from flywheel, then see if starting motor will turn engine. Remote possibilities would be plugged hydraulic line and extreme pressure resulting in engine stall.

IX. TOWMOTOR WILL NOT MOVE WITH WHEELS FREE TO TURN.

1. If this condition exists after truck has been standing over night and truck continues to refuse to move after operating engine for one minute, check oil pressure. If the pressure reading is low, it indicates loss of pump prime due to excessive clearances. Inspect pump and upon verification of the trouble, replace pump. Also, check the clutches to assure that prolonged use of a truck operating under this condition (reduced pressure) has not damaged the clutches due to slippage.
2. Low oil pressure. Check Items listed under Condition VI.
3. Faulty Control linkage. Visually inspect all control linkage to make sure it is in good condition and correct adjustment.
4. Pump oil inlet screen plugged. This pump inlet screen is located at bottom of transmission. If plugged condition does exist, it should have been indicated by a gradual slowing down of the shift cycle time.
5. Clutches Worn. A completely worn set of clutches is also a possible cause of truck not moving. If this condition exists, it would probably occur in one direction only and would be preceeded by excessive slippage.
6. Truck refuses to move in one direction and/or tends to creep. If truck operates in this manner when the shift lever is in neutral or with creeper pedal depressed but was operating correctly previously, check for a buckled shift cylinder to shifter yoke push pull rod.

   Also, if truck refuses to move in one direction, check the shift cylinder for a broken neutral return spring which could have jammed and caused limited cylinder travel. With the transmission cover removed, the shift mechanism can be operated manually and visually inspected for other type interference which might be causing the trouble.

X. TOWMOTOR WILL NOT MOVE WITH WHEELS FREE TO TURN WHEN OFF FLOOR.

1. This trouble is usually caused by interference in the transmission or line of drive. Refer to Items under Condition XIII.

XI. TOWMOTOR CREEPS FORWARD OR BACKWARDS WITH SHIFT LEVER IN NEUTRAL AND/OR CREEPER PEDAL DEPRESSED.

1. Cylinder neutral return springs broken. Broken spring nearest the piston rod end will cause creepage in forward. It will cause creepage in this direction only when the shift lever is in neutral, and will cause slow release from this direction or occasionally hang up when the creeper pedal is depressed. When the other spring is broken, the truck will act normal when the lever is in neutral but the broken spring will affect creeper pedal response in reverse. With either or both springs broken, the clutch will hang up and not release properly when the creeper pedal is depressed.
2. Loss of pump prime. Refer to Condition IX, Item 1.
3. Faulty needle bearing in the clutch flywheel at the clutch output sleeve. This would cause creepage in reverse and would probably be very noisy in the opposite direction. It can be checked by removing the transmission cover and manually spinning the clutch flywheel. Flywheel should turn very freely and without noise.
4. Scored and/or sticking shift cylinder or bent piston rod in the cylinder. Check for this trouble through the transmission access opening.
5. Scored shifter carrier and shifter which would

result in sluggishness. Inspect visually through opening in transmission.

6. Faulty control linkage. Inspect all control linkage to make sure it is in good condition and correct adjustment.

XII. LACK OF ACCELERATION AND POWER UNDER FULL THROTTLE AND HIGH POWER REQUIREMENTS WITH LOW ENGINE SPEED (approx. 1000 rpm or less)

1. Oil pressure too high. Refer to Condition VII.
2. Engine power low. Check timing and other standard conditions that may cause the engine to lose power.
3. Transmission oil pump or pump drive sleeve bushing binding. This condition would probably be accompanied by excessive noise.
4. Stator one-way clutch slippage. Replace torque converter. Do not replace converter unless all other possible troubles have definitely been eliminated.

XIII. LACK OF ACCELERATION AND POWER UNDER FULL THROTTLE AND HIGH POWER REQUIREMENTS WITH NORMAL ENGINE SPEED (1200 to 1400 rpm).

1. Check for binding in transmission caused by a faulty bearing or interference at other points. check bushing between clutch output sleeve and output shaft. If the universal joint is disconnected, it would help isolate the cause of the trouble.
2. If lack of acceleration and power is in reverse only, check the flywheel for free spin with the transmission cover removed. If it does not spin freely, the clutch output shaft bearing could be faulty.
3. Drag in drive axle. Check for drag in drive axle including hand brake and foot brakes. This condition is likely to appear in new trucks due to tightness of new parts. In this case, the condition should disappear after a few hours of operation.

XIV. LACK OF ACCELERATION AND POWER UNDER FULL THROTTLE AND HIGH POWER REQUIREMENTS WITH HIGH ENGINE SPEED (above 1500 rpm).

1. Excessive clutch slippage. Refer to Condition XV.

XV. EXCESSIVE CLUTCH SLIPPAGE IN EITHER OR BOTH DIRECTIONS.

1. Low oil pressure. Refer to Condition VI.
2. Air leak in pump suction line. Refer to Condition V for indication of leakage.
3. Pump oil inlet screen plugged. Refer to Condition IX, Item 4.
4. Faulty shift cylinder or linkage. Refer to Condition IX, Item 6 and Condition XI, Item 4.
5. Scored shifter and carrier. Refer to Condition XI, Item 5.
6. Loss of pump prime. Refer to Condition IX, Item I.
7. Clutches worn. Refer to Condition IX, Item 5.
8. If slippage occurs when starting a stationary truck and not while operating the truck, the trouble could be in the control linkage. This condition would also be accompanied by slow shifting, unless the trouble is in the forward accumulator valve for the "small series" trucks. Tighten adjusting screw all the way to see if the trouble stops. If so, simply readjust to maintain 1-1/2 to 3 seconds engagement.

XVI. CLUTCHES DO NOT DISENGAGE CLEANLY AND QUICKLY WHEN SHIFTED TO NEUTRAL OR WHEN CREEPER PEDAL IS DEPRESSED.

1. Loss of pump prime. Refer to Condition IX, Item 1.
2. Check shift cylinder, linkage, and clutch output sleeve bearing as indicated under Condition XI.
3. Check clutch driven discs for proper cone and grooving.

XVII. SLUGGISHNESS IN ENGAGEMENT TIME IN SHIFTING CYCLE.

1. Make sure that control linkage is in good condition and correct adjustment.
2. Low oil pressure. Refer to Condition VI.
3. Air leak in pump suction line. Refer to Condition V for indication of leakage.
4. Pump oil inlet screen plugged. Refer to Condition IX, Item 4.
5. Faulty shift cylinder or linkage. Refer to Condition IX, Item 6, and Condition XI, Item 4.
6. Scored shifter or carrier. Refer to Condition XI, Item 5.
7. Loss of pump prime. Refer to Condition IX, Item 1.
8. Clutches worn. Refer to Condition IX, Item 5.

XVIII. OVERHEATING AS EVIDENCED BY AN OFFENSIVE ODOR FROM THE OIL, OR THIS PLUS RADIATOR OVERHEATING.

1. Check for clutch slippage. Refer to Condition XV.

2. If overheating is in radiator only, check fan belt and other standard usual causes for cooling system overheating.
3. Binding in line of drive. Check for interference in line of drive as indicated in Items under Condition XIII.
4. If only oil overheating is present, check all cooler lines for plugging. Check cooler for a plugged condition. Check cooler bypass valve for leaking (valve should crack at 30 psi). Check water side of cooler for cleanliness. Check all Items under Condition VI for causes of low pressure.
5. Check truck operating conditions for factors which may cause overheating.

NOTE

Automatic Transmission Oil Type A does not have an original bad odor but when it has been overheated it assumes a very offensive odor. This odor can easily be used as evidence of overheated oil. It would be good practice to make a complete oil change after an overheating situation has been corrected, first because of damage to the oil and second for evidence that the problem has been solved.

REPAIR INSTRUCTIONS

TOWMOTORQUE REPLACEMENT

Remove Transmission and Engine from Truck.

1. Remove engine hood, left and right side plates, front plate, counterweight top plate and counterweight.

2. Drain cooling system, then remove radiator and hoses.

3. Remove floor plates, then disconnect creeper pedal linkage and shift lever and linkage.

4. Disengage hydraulic pump from engine timing gear cover by removing nuts and washers.

5. Disconnect exhaust system, fuel lines, electrical system connector and accelerator pedal and linkage.

6. Disconnect engine mountings. Using a suitable hoist and cable sling, raise engine and transmission up and out of vehicle, disengaging universal joint as engine is removed.

Remove Transmission from Engine.

CAUTION

The following procedure must be followed to eliminate damage by allowing total weight of transmission to hang on converter.

Remove converter case cover. This will expose six screws that fasten converter to engine flywheel. Remove these screws before separating transmission from engine. Converter can be removed from transmission after TowmoTorque is separated from engine.

Install Transmission on Engine.

Prior to installing transmission on engine, mount converter, carefully aligning driving lugs with oil pump drive gear. When mounted properly, converter should touch the converter case. With converter in this position, assemble transmission to engine and bolt case to engine. Slide converter toward engine flywheel and align bolt holes. Install screws securing converter to engine flywheel and lock wire in pairs. Install converter case cover.

Install Transmission and Engine in Truck.

1. Using a suitable hoist and cable sling, lower engine in place and engage the universal joint at the same time. Connect engine mountings.

2. Install the exhaust system, fuel lines, electrical system connector and accelerator pedal and linkage.

3. Install hydraulic pump on timing gear cover and secure with nuts and washers.

4. Connect shift lever and linkage, and creeper pedal and linkage. Install floor plates.

5. Install radiator and hoses and fill system with proper coolant.

6. Install counterweight, counterweight top plate, front plate, left and right side plates and engine hood.

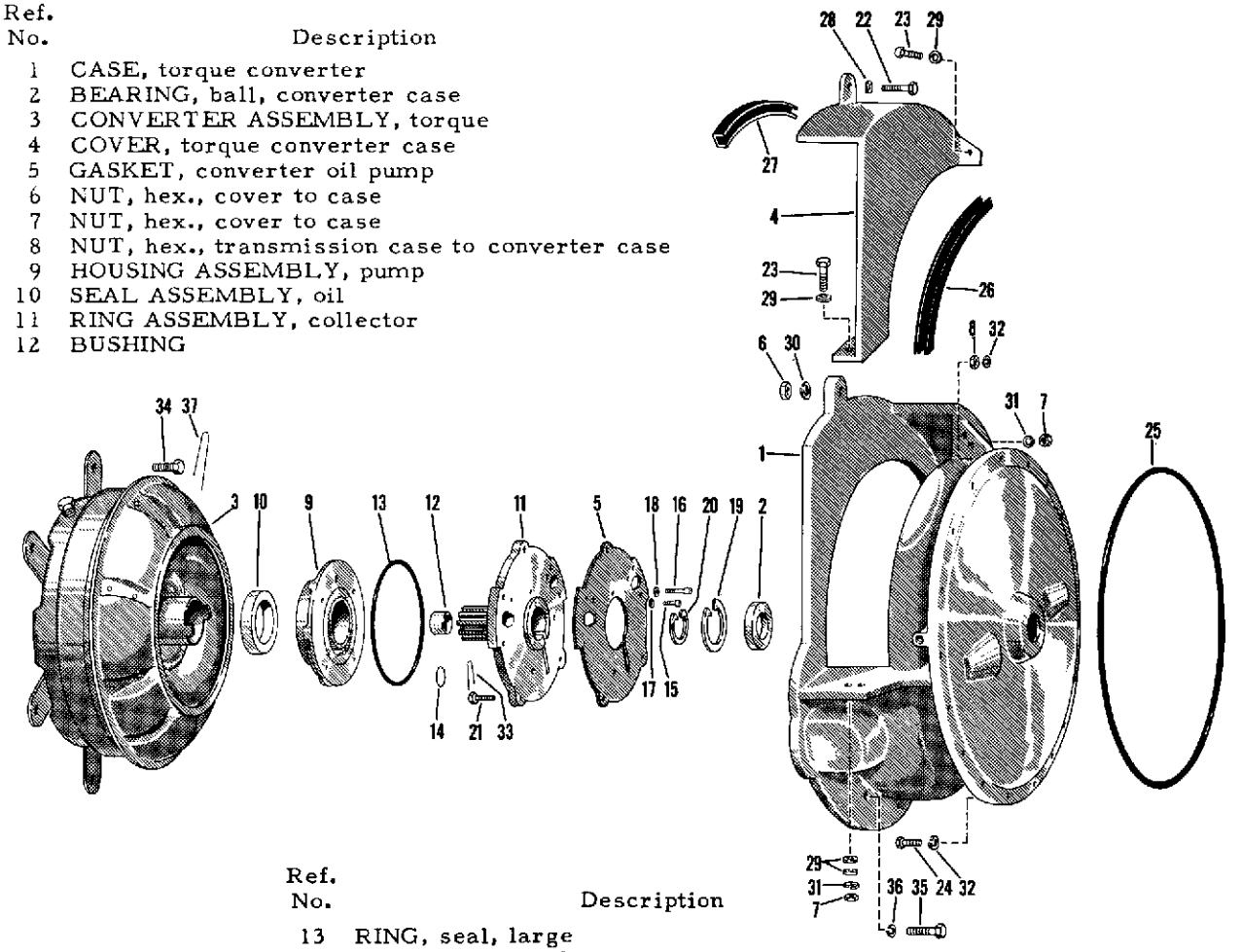
DISASSEMBLY

DISASSEMBLE TRANSMISSION. Disassemble the TowmoTorque transmission as outlined in the following numbered procedures.

1. REMOVE TORQUE CONVERTER.

a. See Figure 5. With transmission and engine assembly out of truck, remove torque converter (3) when separating transmission from engine, see Towmotorque replacement.

Ref. No.	Description
1	CASE, torque converter
2	BEARING, ball, converter case
3	CONVERTER ASSEMBLY, torque
4	COVER, torque converter case
5	GASKET, converter oil pump
6	NUT, hex., cover to case
7	NUT, hex., cover to case
8	NUT, hex., transmission case to converter case
9	HOUSING ASSEMBLY, pump
10	SEAL ASSEMBLY, oil
11	RING ASSEMBLY, collector
12	BUSHING



Ref. No.	Description
13	RING, seal, large
14	RING, seal, small
15	SCREW, cap, collector ring to housing
16	SCREW, cap, collector ring to housing
17	WASHER, lock, collector ring screw
18	WASHER, lock, collector ring screw
19	RING, retainer, converter case bearing
20	RING, retainer, output shaft and valve
21	SCREW, cap, converter pump to converter case
22	SCREW, cap, cover to case
23	SCREW, cap, cover to case
24	SCREW, cap, torque converter case to transmission case
25	SEAL, converter case to transmission case
26	SEAL, converter cover, lower
27	SEAL, converter cover, upper
28	WASHER, flat, cover to case
29	WASHER, flat, cover to case
30	WASHER, lock, cover to case
31	WASHER, lock, cover to case
32	WASHER, lock, transmission case to torque converter case
33	WIRE, locking, converter pump to converter case
34	SCREW, cap, converter to flywheel
35	SCREW, cap, transmission to flywheel housing
36	WASHER, lock, transmission to flywheel housing screw
37	WIRE, locking, torque converter to flywheel

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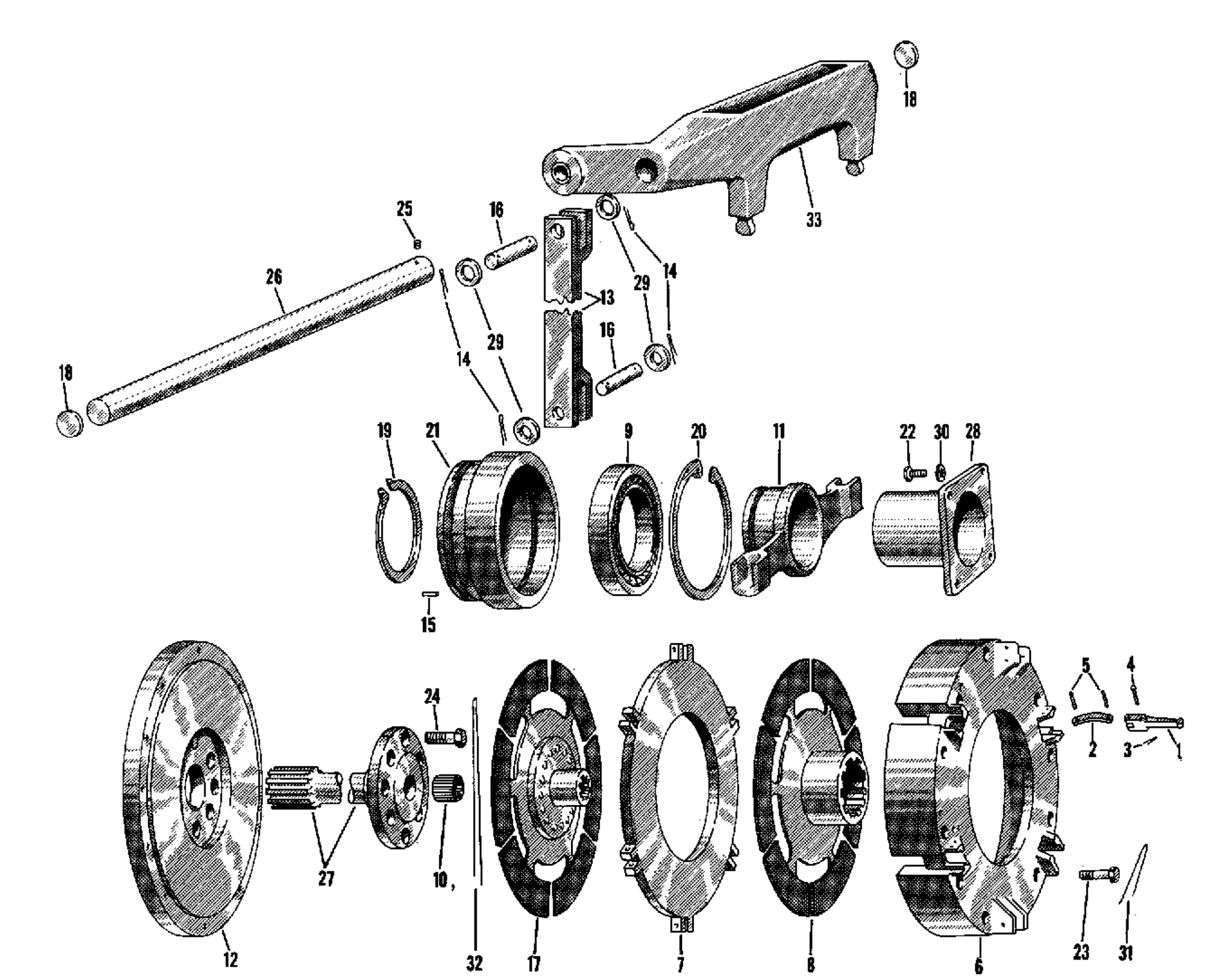
Fig. 5. Converter, Converter Case and Oil Pump



Ref. No.	Description
1	LEVER, clutch operating
2	LINK, lever to pressure plate
3	PIN, cotter, anchor pin
4	PIN, lever anchor
5	PIN, link pivot
6	PLATE, clutch cover
7	PLATE, clutch pressure
8	PLATE ASSEMBLY, reverse clutch
9	BEARING, ball, shifter carrier
10	BEARING, needle, forward clutch shaft
11	CARRIER, shifter
12	FLYWHEEL, clutch
13	LINK ASSEMBLY, shift operating
14	PIN, cotter, link to operating yoke and operating cylinder
15	PIN, groove, shifter ring
16	PIN, link to yoke and operating cylinder
17	PLATE ASSEMBLY, forward clutch
18	PLUG, operating yoke shaft
19	RING, retainer, carrier to shifter ring
20	RING, retainer, carrier bearing
21	RING, shifter
22	SCREW, cap, shifter sleeve to transmission case
23	SCREW, cap, clutch assembly to clutch flywheel
24	SCREW, cap, converter output shaft to clutch
25	SCREW, set, operating yoke shaft
26	SHAFT, operating yoke
27	SHAFT and VALVE ASSEMBLY, converter output
28	SLEEVE, shifter
29	WASHER, flat, link to yoke and operating cylinder
30	WASHER, lock, shifter sleeve screw
31	WIRE, locking, clutch cover screw
32	WIRE, locking, converter output shaft to clutch flywheel screw
33	YOKE, shifter operating

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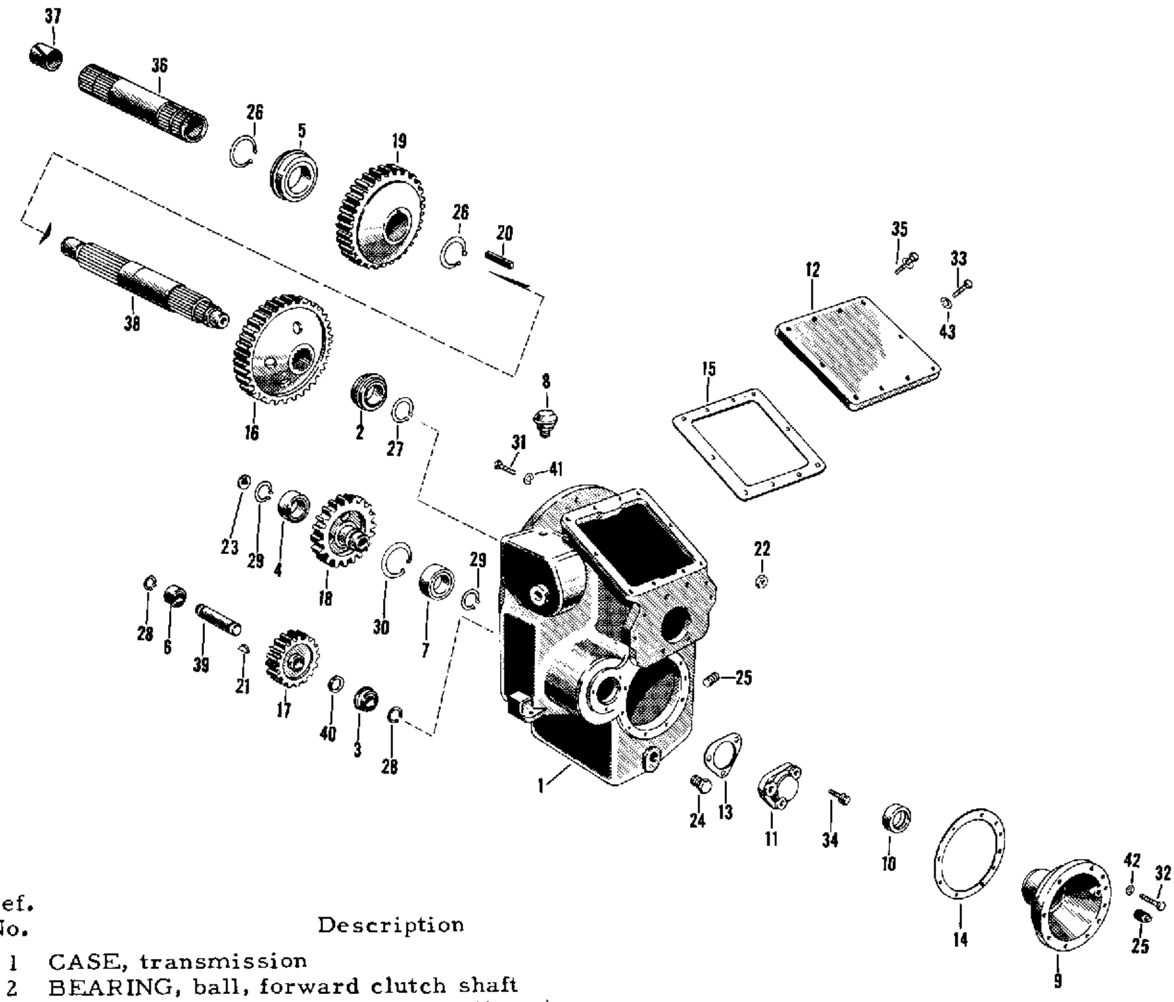
Fig. 6. Clutch Assembly, Carrier and Linkage



Ref. No.	Description
1	CASE, transmission
2	BEARING, ball, forward clutch shaft
3	BEARING, ball, idler gear shaft (front)
4	BEARING, ball, output shaft (rear)
5	BEARING, ball, reverse clutch shaft
6	BEARING, ball, idler gear shaft (rear)
7	BEARING, ball, output shaft (front)
8	BREATHER, transmission case
9	COVER and SEAL ASSEMBLY, output shaft (front)
10	SEAL, oil, output shaft
11	COVER, idler gear shaft
12	COVER, transmission case top
13	GASKET, idler gear shaft cover
14	GASKET, output shaft front cover
15	GASKET, transmission case top cover
16	GEAR, forward
17	GEAR, forward idler
18	GEAR, output shaft
19	GEAR, reverse
20	KEY, reverse gear
21	KEY, woodruff, idler gear
22	NUT, hex., case to converter housing
23	PLUG, output gear
24	PLUG, magnetic drain
25	PLUG, oil level
26	RING, retainer, reverse gear and reverse gear shaft bearing
27	RING, retainer, clutch forward shaft bearing
28	RING, retainer, idler gear shaft
29	RING, retainer, output shaft, front and rear bearing (small)
30	RING, retainer, output shaft, front bearing (large)
31	SCREW and WASHER, cap, case to converter housing
32	SCREW, cap, output shaft front cover
33	SCREW, cap, transmission case top cover
34	SCREW and WASHER, idler gear shaft cover
35	SCREW and WASHER, transmission case cover
36	SHAFT, reverse clutch
37	BUSHING, shaft
38	SHAFT, forward clutch
39	SHAFT, idler gear
40	SPACER, idler gear
41	WASHER, lock, case to converter housing
42	WASHER, lock, output shaft cover screw
43	WASHER, lock, transmission case top cover screw

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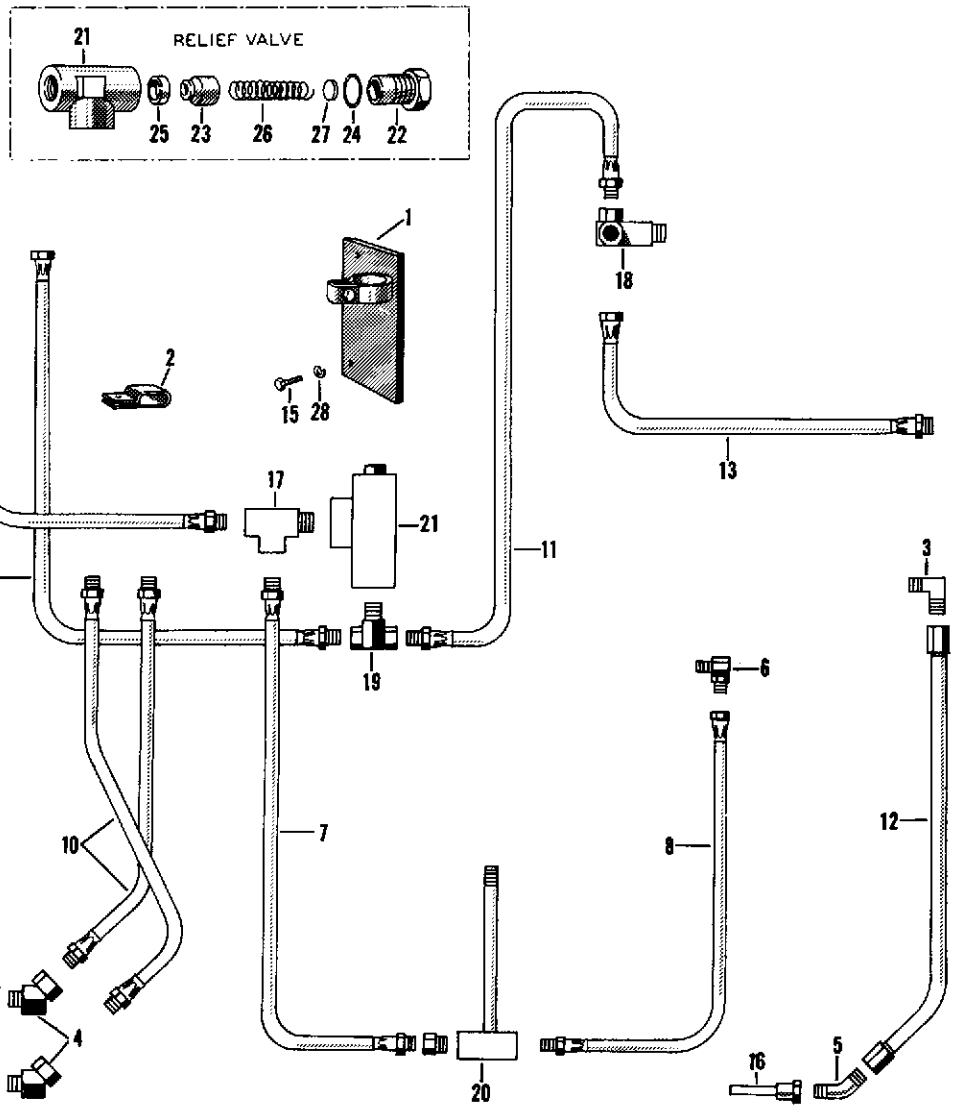
Fig. 7. Case, Covers, Gears and Shafts



Ref. No.	Description
1	BRACKET ASSEMBLY, relief valve mounting
2	CLIP, hose, relief valve to radiator
3	ELBOW, 90°, in right side of converter case
4	ELBOW, 45°, in shift operating cylinder
5	ELBOW, 45°, in strainer assembly
6	ELBOW, 90°, in transmission case front cover
7	HOSE ASSEMBLY, converter case tee to tee in relief valve
8	HOSE ASSEMBLY, flexible, converter case tee to clutch
9	HOSE ASSEMBLY, lower tee at relief valve to lower radiator connection
10	HOSE ASSEMBLY, operating cylinder to control valve
11	HOSE ASSEMBLY, relief valve tee to 3-way tee in converter housing
12	HOSE ASSEMBLY, right side on converter housing to strainer assembly
13	HOSE ASSEMBLY, shifter control valve to 3-way tee in converter housing
14	HOSE ASSEMBLY, upper tee at relief valve to upper radiator connection
15	SCREW, cap, relief valve, mounting bracket to case
16	STRAINER ASSEMBLY
17	TEE, 90°, in relief valve
18	TEE, 3-way in converter housing
19	TEE, lateral, in relief valve
20	TEE, converter case
21	VALVE ASSEMBLY, relief
22	CAP, adjustment
23	PLUNGER
24	RING, seal
25	SEAT, plunger
26	SPRING, plunger
27	WASHER, plunger spring
28	WASHER, lock, relief valve mounting bracket

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Fig. 8. Hydraulic Lines and Fittings

2. REMOVE AND DISASSEMBLE HYDRAULIC LINES, FITTINGS AND CONTROL VALVE.

a. See Figure 8. Disconnect hydraulic lines and fittings.

b. See Figure 10. Remove screws and washers (28, 29 and 31), then separate control valve assembly and gasket (27) from transmission case. To disassemble control valve for repair purposes, refer to Control Valve repair section.

3. REMOVE TORQUE CONVERTER CASE COVER AND TRANSMISSION TOP COVER.

a. See Figure 5. Remove screws (22 and 23), washers (28, 29, 30 and 31) and nuts (6 and 7), then remove cover (4) and cover seals (26 and 27).

b. See Figure 7. Remove screws and washers (33, 35 and 43) and separate top cover (12) and gasket (15) from transmission case (1).

4. REMOVE AND DISASSEMBLE OIL PUMP ASSEMBLY.

a. See Figure 5. Cut lock wire (33) and remove screws (21), then separate oil pump assembly (9 through 18) and gasket (5) from inside converter case. To disassemble oil pump, refer to Oil Pump repair section.

5. REMOVE AND DISASSEMBLE CONVERTER CASE WITH CLUTCH FLYWHEEL AND OUTPUT SHAFT ASSEMBLED.

a. See Figure 6. Cut lock wire (31) and remove screws (23) fastening clutch assembly (1 through 8) to clutch flywheel (12).

b. See Figure 5. Remove nuts, screws and washers (8, 24 and 32), then separate converter case, with clutch flywheel and output shaft assembled, from transmission case. Remove large seal ring (25).

c. See Figure 6. Remove bearing (10) from flanged end of output shaft (27).

d. See Figure 5. Remove retainer ring (20), then press clutch flywheel and output shaft assembly out of converter case bearing (2).

e. See Figure 6. Cut lock wire (32) and remove screws (24) securing output shaft (27) to clutch flywheel (12).

f. See Figure 5. Remove retainer ring (19) and press bearing (2) out of converter case (1).

6. REMOVE AND DISASSEMBLE CLUTCH ASSEMBLY.

a. See Figure 6. Remove forward clutch plate (17) from face of clutch pressure plate (7).

b. See Figure 6. Lift out clutch assembly (7, 8 and 6). To disassemble clutch for repair purposes, refer to Clutch Repair section.

7. REMOVE SHIFT OPERATING LINK, YOKE AND SHAFT.

a. See Figure 6. Remove cotter pins, washers and link pins (14, 29 and 16) from inside transmission case, Lift out link (13).

b. See Figure 6. Remove set screw (25), then using a brass drift and hammer, drive against either plug (18) until the opposite plug (18) pops out and the yoke shaft (26) is exposed. Drive on the exposed yoke shaft, in the opposite direction, until the other plug (18) pops out. Continue driving, until yoke shaft is removed. Remove operating yoke. (33).

8. REMOVE AND DISASSEMBLE CARRIER AND BEARING, AND SHIFTER SLEEVE.

a. See Figure 6. Slide carrier and bearing assembly, (9, 11, 15, 19, 20 and 21) assembled, from shifter sleeve (28).

b. See Figure 6. To disassemble carrier and bearing, remove retainer ring (19) and press carrier (11) out of shifter ring (21). Remove retainer ring (20) and press bearing (9) out of shifter ring.

c. See Figure 6. Remove screws and washers (22 and 30) and separate shifter sleeve (28) from transmission case.

9. REMOVE AND DISASSEMBLE SHIFT OPERATING CYLINDER.

a. See Figure 9. Remove screws and washers (14) and separate shift operating cylinder (1) from transmission case. To disassemble shift operating cylinder, refer to Operating Cylinder repair section. Keep shims (16) intact for use in reassembly.

10. REMOVE AND DISASSEMBLE FORWARD CLUTCH SHAFT AND GEAR.

a. See Figure 7. Remove retainer ring (27), then press forward clutch shaft (38) out of bearing (2). Remove gear (16).

b. See Figure 7. Remove bearing (2) from transmission case.

11. REMOVE AND DISASSEMBLE REVERSE CLUTCH SHAFT AND GEAR.

a. See Figure 7. Remove front retainer ring (26) and press reverse clutch shaft (36) with bearing (5) assembled out of transmission case. Lift out gear (19).

b. See Figure 7. To disassemble reverse clutch shaft and bearing, remove key (20), then press bearing (5) off shaft. Remove rear retainer ring (26) from shaft.

12. REMOVE AND DISASSEMBLE IDLER GEAR SHAFT COVER, SHAFT AND GEAR.

a. See Figure 7. Remove screws and washers (34) and separate cover (11) and gasket (13) from transmission case.

b. See Figure 7. Remove retainer rings (28). Press shaft (39), with bearing (3) assembled, out of transmission case. Remove gear (17) and spacer (40). Press shaft (39) out of bearing (3). Remove key (21) from shaft.

c. Remove bearing (6) from transmission case.

13. REMOVE AND DISASSEMBLE OUTPUT SHAFT COVER AND GEAR ASSEMBLY.

a. See Figure 7. Remove screws (32) and washers (42) fastening cover (9) to transmission case.

b. See Figure 7. Remove retainer ring (29), at plug end of gear, and press complete cover, gear and shaft assembly (4, 7, 9, 10, 18, 29 and 30) out of transmission case. Remove gasket (14).

c. See Figure 7. To disassemble cover and gear assembly, remove oil seal (10) and retainer ring (29). Press gear assembly out of cover (9). Remove retainer ring (30) and press bearing (4) out of cover. Press gear (18) out of bearing (4). Do not remove plug (23) from gear (18) unless replacement is necessary.

ASSEMBLY

ASSEMBLE TRANSMISSION. Assemble the TowmoTorque transmission as outlined in the following numbered procedures.

1. ASSEMBLE AND INSTALL OUTPUT SHAFT GEAR AND COVER ASSEMBLY.

a. See Figure 7. If plug (23) was removed from gear (18), install new plug. Press bearing (4) on gear (18) and secure with retainer ring (29). Press bearing (7) in cover (9) and secure with retainer ring (30). Install gear, with bearing assembled, in cover (9) and secure with retainer ring (29).

b. See Figure 7. Position a new gasket (14) in place on cover, then install cover assembly in transmission case. Secure cover with screws (32) and washers (42). Install new oil seal (10) in cover.

2. ASSEMBLE AND INSTALL IDLER GEAR SHAFT AND COVER.

a. See Figure 7. Install key (21) in idler shaft (39). Position gear (17) in transmission case, then press shaft and key into gear. Install spacer (40) and bearings (3 and 6). Secure bearings with retainer rings (28).

b. Install gasket (13), cover (11), then secure with screws and washers (34).

3. ASSEMBLE AND INSTALL REVERSE CLUTCH SHAFT AND GEAR.

a. See Figure 7. If bushing (37) was removed from shaft (36) install new bushing. Install rear retainer ring (26) in groove near middle of shaft, then install bearing (5). Install key (20) in shaft. Place gear (19) in position and press shaft into gear. Secure gear to shaft with front retainer ring (26).

4. ASSEMBLE AND INSTALL FORWARD CLUTCH SHAFT AND GEAR.

a. See Figure 7. Install bearing (2) in transmission case. Place gear (16) in position and slide shaft (38) through hollow shaft (36) and engage splines in gear. Press shaft (38) into bearing (2) and secure with retainer ring (27).

5. ASSEMBLE AND INSTALL SHIFT OPERATING CYLINDER.

a. See Figure 9. Assemble shift cylinder as described in repair section. Place same number of shims (16), removed in disassembly, on shift operating cylinder and install against transmission case. Secure with screws and washers (14).

NOTE

If new case or shift operating cylinder is used, adjust clearance as described in adjustment section.

6. ASSEMBLE AND INSTALL SHIFTER SLEEVE, AND CARRIER AND BEARING.

a. See Figure 6. Install shifter sleeve (28) and secure with screws and washers (22 and 30).

b. See Figure 6. Install bearing (9) in shifter ring (21) and secure with retainer ring (20). Install carrier (11) in shifter ring bearing and secure with retainer ring (19). Slide complete assembly on shifter sleeve (28).

7. ASSEMBLE AND INSTALL SHIFT OPERATING YOKE, SHAFT AND OPERATING LINK.

a. See Figure 6. Place shift operating yoke (33) in position and install operating yoke shaft (26). Secure shaft with set screw (25). Install plugs (18). Install links (13) and connect to operating cylinder and operating yoke with pins, washers and cotter pins (16, 29 and 14).

8. ASSEMBLE AND INSTALL CLUTCH ASSEMBLY.

a. See Figure 6. Assemble clutch assembly as described in clutch repair section. Install complete assembly (7, 8 and 6). Make certain that all clutch levers (1) are inserted in shifter ring groove (21) and that reverse clutch plate splines are fully engaged on reverse clutch shaft.

b. See Figure 6. Install forward clutch plate

(17) and make sure that splines of clutch plate are fully engaged on forward clutch shaft.

9. ASSEMBLE AND INSTALL CONVERTER CASE WITH CLUTCH FLYWHEEL AND OUTPUT SHAFT ASSEMBLED.

a. See Figure 5. Install bearing (2) in converter case (1) and secure with retainer ring (19).

b. See Figure 6. Assemble output shaft (27) to clutch flywheel (12) and secure with screws and lock wire (24 and 32).

c. See Figure 6. Install clutch flywheel and output shaft (12 and 27) in converter case bearing and secure with retainer ring (20). Install bearing (10) in flanged end of output shaft.

d. See Figure 5. Place new seal ring (25) in position on transmission case and install converter case assembly. Secure with nuts, screws and washers (8, 24 and 32).

10. ASSEMBLE AND INSTALL OIL PUMP ASSEMBLY.

a. Assemble oil pump as described in repair section.

b. See Figure 5. Place new gasket (5) (do not use sealing compound) in position and install oil pump (9 through 18). Secure pump with screws (21), and lock wire (33).

11. INSTALL TRANSMISSION TOP COVER AND TORQUE CONVERTER CASE COVER.

a. See Figure 7. Place a new gasket (15) in position and install top cover (12). Secure with screws and washers (33, 35 & 43).

b. See Figure 5. Place seals (26 and 27) in position on cover (4) and install on converter case. Secure with screws (22 and 23), washers (28, 29, 30 and 31), and nuts (6 and 7).

12. ASSEMBLE AND INSTALL CONTROL VALVE FITTINGS AND HYDRAULIC LINES.

a. See Figure 10. Assemble control valve as described in repair section. Install control valve using a new gasket (27) against transmission case and secure with screws and washers (28, 29 and 31).

b. See Figure 8. Install hydraulic lines and fittings.

13. INSTALL TORQUE CONVERTER.

a. See Figure 5. Install torque converter (3) when assembling transmission to engine, see TowmoTorque replacement.

OIL PUMP

DESCRIPTION

The transmission oil pump is mounted on the front side of the torque converter case directly in front of the torque converter. Its function is to supply the necessary oil pressure to the torque converter, hydraulic control system, and lubrication and oil cooling to the clutch forward and reverse plates. The oil pump is driven by the torque converter through two driving lugs.

OIL PUMP REPLACEMENT

To remove oil pump, it is necessary to remove the transmission from the vehicle (See Towmo-Torque Replacement). With transmission out of vehicle and oil drained from the unit, slide torque converter off converter output shaft and oil pump collector ring. Remove lock wire, screws and washers and oil pump from converter case.

When installing oil pump, use a new gasket (do not use sealing compound) between oil pump and converter case. Slide torque converter over splines of converter output shaft and oil pump collector ring and make sure drive lugs of torque converter are engaged fully with notches cut in the oil pump internal gear. Install transmission and fill to proper oil level. Refer to "Oil Checking, Draining and Filling" for proper procedures.

OIL PUMP REPAIR

If the oil pump is found to be faulty, it is recommended that an exchange pump be procured from your Towmotor Representative.

Disassemble Oil Pump. See Figure 5. Remove four 5/16 inch diameter socket head screws (15) and one 1/4 inch diameter socket head screw (16). Tap along parting line and separate oil collector ring (11) from pump housing (9). Remove large and small "O" rings (13 and 14). Lift out pump gears. Remove oil seal (10) from pump housing.

Clean and Inspect Oil Pump. Was all parts in a clean solvent and dry with compressed air. Inspect gears and body for evidence of wear or damage. If excessive wear or clearances is evident install a new pump body and gears. Note: Gears and body are matched and must be replaced as a unit. Inspect face of collector ring for scratches, scoring or excessive grooving, inspect bearing also.

Use new "O" rings, oil seal and gasket when reassembling pump.

Assemble Oil Pump. See Figure 5. Install gears in pump body and make sure the side of the internal gear with driving lugs is toward the outside. Lubricate the gears with Automatic Transmission Fluid.

Position large and small "O" rings (13 and 14) in collector ring and assemble collector ring (11) to pump housing. Secure assemblies together with socket head screws (15 and 16). Check freeness of gear rotation after assembling.

DUPLEX CLUTCH AND SHIFTING LINKAGE

DESCRIPTION

The duplex clutch is a double pressure plate type with two driving plates and is oil cooled by a spray system. Clutch plates are coned to assure quick release from the pressure plates. Control of direction is handled through a shifter ring engaging the clutch operating levers. Shifter ring is moved back and forth by a yoke supported on a shaft. Shift operating cylinder piston rod is connected to the yoke through linkage.

CLUTCH AND SHIFTER CARRIER REPLACEMENT

To remove clutch assembly it is suggested that the transmission be removed from the vehicle, see TowmoTorque Replacement. With transmission removed and oil drained from the unit, slide torque converter off converter output shaft and oil pump collector ring. Remove transmission top cover. Cut wire and remove screws fastening clutch assembly to clutch flywheel. Remove bolts nuts and washers securing converter case to transmission case. Lift off converter case with oil pump and clutch flywheel assembled. Remove forward clutch plate. Lift out clutch assembly. Slide off clutch carrier assembly.

When installing clutch assembly be sure that all clutch operating levers are in the groove of the clutch shifter ring and that clutch plates are installed properly, clutch plate hubs must face the inside of the transmission or the unit cannot be assembled properly.

With clutch assembly installed, place forward clutch plate on clutch pressure plate and slide splines of hub over splines of forward clutch shaft. Insert new "O" ring between cases and install converter case, with oil pump and clutch flywheel assembled, against transmission case and secure with bolts, nuts and washers. Using a drift, align holes in clutch cover with holes in clutch flywheel. Install screws and lock wire in pairs. Install top cover. Slide torque converter in place and install transmission, see TowmoTorque Replacement.

CLUTCH AND SHIFTER CARRIER REPAIR

If clutch assembly is found to be faulty, because of excessive clutch plate slippage or because it's completely worn out, repair parts are available to a certain extent, that is, if replacement of pressure plate, operating levers, links, or cover is necessary, a complete clutch cover assembled with these items must be replaced because of alignment on the clutch operating levers. This clutch cover assembly is available from your Towmotor Factory Representative on an exchange basis.

Disassemble Clutch. See Figure 6. The Clutch Cover assembly is made up of matched parts. When disassembly is contemplated note the match markings, one on the extension lug of the pressure plate, and one matching mark on the cover adjacent to it. On reassembly make sure these two marks are in the same relation. The pressure plate, cover, levers and links are not individually replacable. If any of these are damaged replace the complete clutch cover assembly with a new or rebuilt assembly. Levers and links must be kept in same relation to this position and levers must not be turned over. Remove cotter pins (3) and lever clevis pins (4) fastening operating levers to clutch cover (6), slide out clutch pressure plate (7) and remove pivot pins (5), links (2) and levers (1). Lift out clutch plate (8).

Disassemble Carrier, Bearing and Shifter Ring. See Figure 6. Remove retainer ring (19) and press carrier (11) out of shifter ring (21). Remove retainer ring (20) and press bearing (9) out of shifter ring (21).

Clean and Inspect Clutch and Shifter Carrier. Wash all parts in a clean solvent and dry with compressed air. Inspect clutch plates for worn linings and loose hub rivets. Inspect operating levers, links and pins for excessive wear, one at a time and replace in original position. Inspect faces of pressure plate and clutch cover. Inspect carrier bearing. Inspect bore of shifter carrier for excessive wear. Replace all faulty parts except, that if cover, pressure plate, levers or links need replacing, replace the complete clutch cover assembly.

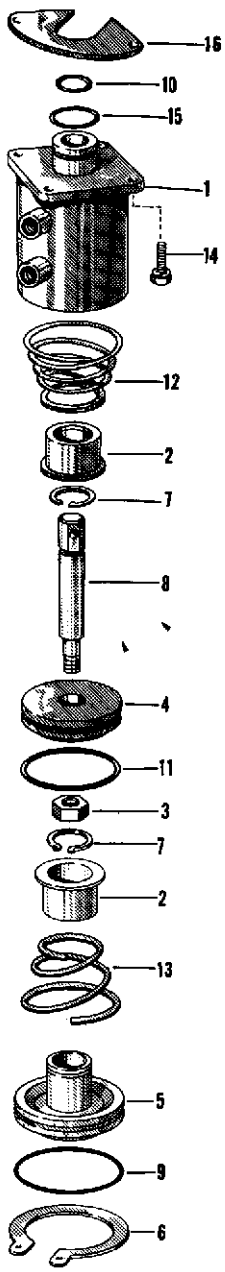
Reassemble Clutch. See Figure 6. With index markings in proper relation on pressure plate and cover, place clutch plate (8) on face of clutch cover (6). Slide pressure plate (7) with links (2) and pins (5) attached, in slots provided in clutch cover. Clutch construction eliminates need for cotter pinning link pins. Align operating lever with holes in clutch cover and install clevis pins (4) and cotter pins (3).

Assemble Carrier, Bearing and Shifter Ring. See Figure 6. Press bearing (9) in shifter ring (21) and secure with retainer ring (20). Press carrier (11) in shifter ring (21) and secure with retainer ring (19).

SHIFT OPERATING CYLINDER

DESCRIPTION

The shift operating cylinder is mounted on the



Ref. No.	Description
1	BODY
2	GUIDE, spring
3	NUT, piston shaft
4	PISTON
5	PLUG, end
6	RING, retainer, large
7	RING, retainer, small
8	ROD, piston
9	SEAL, end plug
10	SEAL, piston
11	SEAL, piston
12	SPRING, upper
13	SPRING, lower
14	SCREW and WASHER, cylinder to transmission case
15	SEAL, cylinder to transmission case
16	SPACER, cylinder adjusting (1/32 thick)
16	SPACER, cylinder adjusting (1/8 thick)

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Fig. 9. Shift Operating Cylinder Assembly

bottom of the transmission case. Its function is to change engagement of either forward or reverse clutch plates by oil pressure admitted to either side of the piston. The cylinder is double acting and actuates the clutch through linkage connected to an operating yoke.

SHIFT OPERATING CYLINDER REPAIR

If the operating cylinder is found to be faulty because of broken neutral springs or leakage past the piston seal or end plug seal, it is possible to repair the cylinder while the transmission is installed in the vehicle or with the transmission removed from the vehicle.

SHIFT OPERATING CYLINDER REPLACEMENT
(with transmission installed in vehicle)

See Figure 9. To disassemble, remove end plug retainer ring (7). Screw a 3/8-16NC bolt in the tapped hole of the end plug and use as a puller. Remove the piston nut (3). Remove screws and washers (14), then pull the cylinder body free of the transmission case, leaving the piston rod attached intact. Reassemble in the reverse manner using a new gasket between cylinder and case.

After installation of shift cylinder, check for clutch neutral setting. Refer to "Adjustments" section and figure 4.

SHIFT OPERATING CYLINDER REPLACEMENT
(with transmission removed from vehicle)

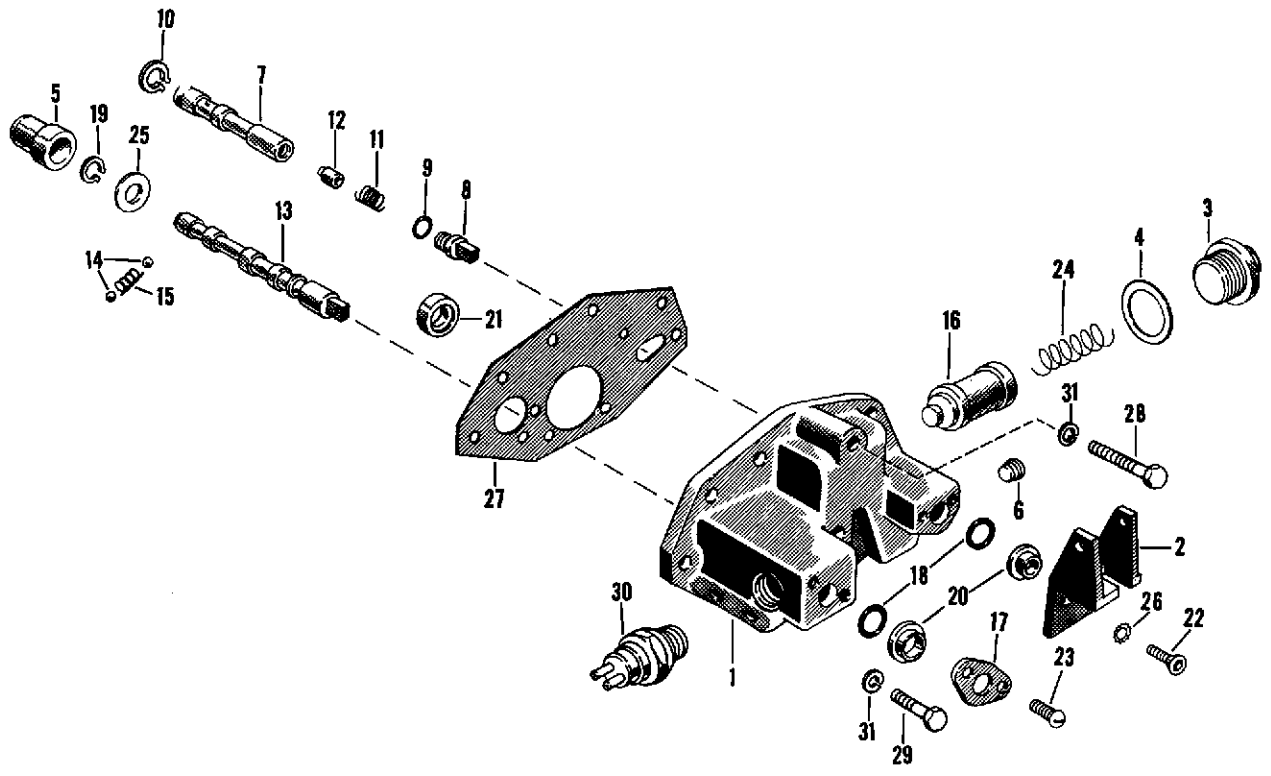
To replace shift operating cylinder it is necessary to disassemble the transmission only as far as follows: Disconnect lines at cylinder, remove converter, converter case with oil pump and clutch flywheel and output shaft assembled, and complete clutch assembly. Disconnect shift cylinder linkage at operating yoke. Remove screws and washers and withdraw shift cylinder and shims.

When installing shift cylinder, use a new seal ring between cylinder and case. Connect link assembly. Install clutch assembly, converter case with oil pump and clutch flywheel and output shaft assembled. Connect lines to cylinder and install converter.

After installation of shift cylinder, check for clutch neutral setting. Refer to "Adjustments" section and figure 4.

Disassemble Shift Operating Cylinder. (with transmission removed from truck.)

See Figure 9. To disassemble cylinder for cleaning, inspection or repair purposes, remove large retainer ring (6) at bottom of cylinder. Screw a 3/8-16NC bolt in tapped hole of the end plug assembly (5) and use as a puller. To disassemble end plug assy, use a vise or arbor press and com-



Ref. No.	Description
1	BODY, shifter control valve
2	BRACKET, bellcrank support
3	CAP, accumulator valve
4	GASKET, accumulator valve cap
5	HOUSING, forward and reverse plunger
6	PLUG, pipe
7	BODY, plunger
8	EYE, plunger
9	RING, seal, plunger eye
10	RING, snap
11	SPRING, compression
12	VALVE, plunger
13	PLUNGER ASSEMBLY, forward and reverse
14	BALL, forward and reverse plunger
15	SPRING, compression
16	PLUNGER, accumulator valve
17	RETAINER, forward and reverse plunger
18	RING, seal, plunger
19	RING, snap, forward and reverse plunger
20	RING, wiper, control valve plunger
21	SEAL, oil, clutch shaft
22	SCREW, bracket to control valve
23	SCREW, mach., plunger retainer to control valve
24	SPRING, accumulator valve
25	WASHER, plain, forward and reverse plunger
26	WASHER, lock, bellcrank support bracket
27	GASKET, control valve to transmission case
28	SCREW, cap, control valve mounting
29	SCREW, cap, control valve mounting
30	SWITCH, limit
31	WASHER, lock, shifter valve

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Fig. 10. Control Valve Assembly

press spring guide, remove retainer ring (7), then release press or vise slowly and remove guide (2), and spring (13). Remove end plug seal (9) from end plug (5).

Unscrew piston rod nut (3) and remove piston (4) and "O" ring (11) assembled from piston rod (8). Compress other spring guide and remove retainer ring (7), spring guide (2) and spring (12).

Clean and Inspect Shift Operating Cylinder. Wash all parts in a clean solvent and dry with compressed air. Inspect cylinder bore for scratches and grooves which would cause cutting or scratching the seal ring and cause leakage. Use new seal rings when reassembling cylinder.

Assemble Shift Operating Cylinder. (with transmission removed from truck.)

See Figure 9. Insert small diameter spring (12) and spring guide (2) over boss in cylinder body. Compress spring and install retainer ring (7). Install piston (4), with new seal ring (10) assembled in bore, and slide over piston rod end. Note, piston is equipped with recess for nut, install with recess toward nut. Secure piston with nut (3).

Position large diameter spring (13) and spring guide (2) on end plug (5) and secure with retainer ring (7). Install new seal ring (9) on end plug (5) and install plug assembly in bottom of cylinder. Secure plug with large retainer ring (6).

CONTROL VALVE

DESCRIPTION

The control valve is mounted on the front cover of the transmission case. Its function is to distribute oil under pressure to the shift operating cylinder. The control valve consists mainly of a housing in which two plungers are fitted to control oil direction through valve. One plunger is operated by the transmission shift lever and the other plunger is operated by the creeper pedal. The creeper pedal plunger is equipped with a relief valve to control maximum pressures in the system.

CONTROL VALVE REPLACEMENT

See Figure 10. To remove control valve, disconnect oil lines and control linkage. Remove screws (28 and 29) and washers (31) fastening valve to transmission case.

When installing control valve, use a gasket (27) between valve and case. Connect linkage. Check linkage for free operation and correct adjustment, see Adjustment Section. Connect oil lines.

CONTROL VALVE REPAIR

If the control valve is found to be faulty, it is recommended that a complete valve be procured from your Towmotor Factory Representative. The control valve requires no service other than cleaning if the valve should become inoperative due to dirt or other foreign matter in the oil system. To prevent this situation from occurring, the oil in the system must be kept clean and free of all dirt or sediment.

Disassemble Control Valve. See Figure 10. To disassemble valve for cleaning or inspection purposes, remove screws (22 and 23) and washers (26) and remove retainer (17) and bracket (2). Remove wiper rings (20) and seal rings (18). Remove plug (6) and limit switch (30). Mark valve plungers so that they can be returned to their original position if used in reassembly. Remove plunger.

The forward and reverse plunger (13) is equipped with detent balls and a spring. When disassembling, care should be taken when removing the plunger (13) from the housing (5) as the detent balls (14) and spring (15) will pop out. Remove snap ring (19) and washer (25).

The creeper valve plunger (7) is equipped with a relief valve. To disassemble, unscrew and remove plunger eye (8) and seal ring (9). Remove spring (11) and valve (12).

The control valve is equipped with an accumulator valve. To disassemble, unscrew and remove cap (3), gasket (4), spring (24) and plunger (16). Remove clutch shaft oil seal (21).

Clean and Inspect Valve. Wash all parts in a clean solvent. Blow out all passages in valve housing with dry compressed air. Inspect relief valve and seat for grooves and scratches that may cause poor seating. Inspect plungers for grooves or excessive wear. Check fit of plungers in housing. There should be no perceptible side play. If plungers are loose or faulty in other respects, replace valve assembly. Use new gaskets and seals when reassembling control valve.

Assemble Control Valve. See Figure 10. Install new plunger seal rings (18) and wiper rings (20) in housing. Install plunger (16) and spring (24) in bore of housing (1) and secure with new gasket (4) and cap (3).

Install relief valve (12) and spring (11) in bore of creeper valve plunger and secure with new seal ring (9) and eye (8). Insert plunger (7), with snap ring (10) assembled, in valve housing.

Install washer (25) on plunger (13) and secure with snap ring (19). Install detent balls (14) and spring (15) in plunger (13) and slide housing (5) over end of plunger until balls slip into recessed groove. Install complete plunger in valve housing.

Position retainer (17) and bracket (2) over plungers and secure with screws (22 and 23) and washer (26). Install limit switch (30) plug (6) and shaft seal. (21).