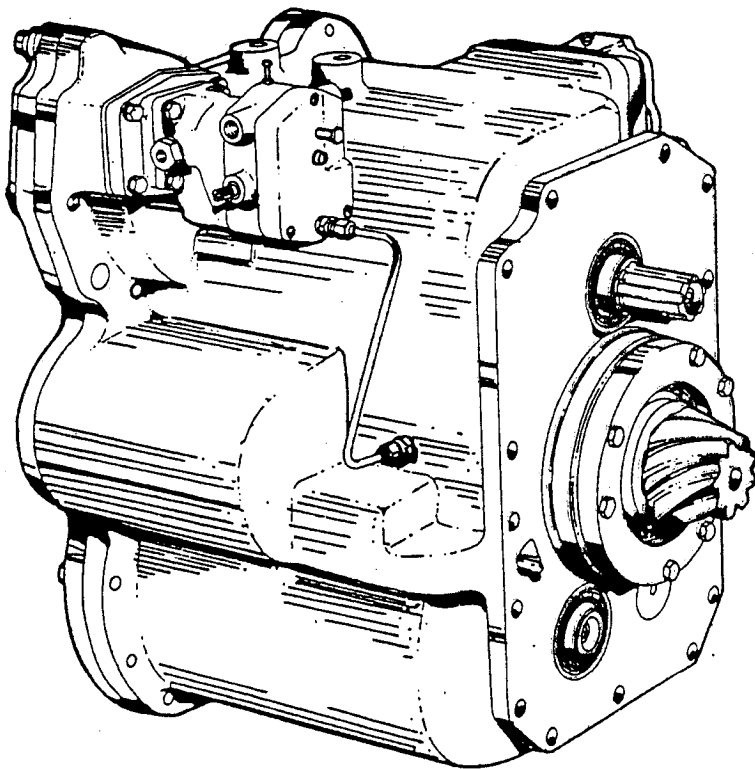


HD-6EP 7G

TRANSMISSION

service manual



AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home or on the highway, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason **MOST ACCIDENTS CAN BE PREVENTED** by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment there are conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

A careful operator is the best insurance against an accident.
The complete observance of one simple rule would prevent many thousand serious injuries each year.
That rule is:

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

WARNING

On machines having hydraulically, mechanically, and/or cable controlled equipment (such as shovels, loaders, dozers, scrapers, etc.) be certain the equipment is lowered to the ground before servicing, adjusting and/or repairing. If it is necessary to have the hydraulically, mechanically, and/or cable controlled equipment partially or fully raised to gain access to certain items, be sure the equipment is suitably supported by means other than the hydraulic lift cylinders, cable and/or mechanical devices used for controlling the equipment.

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HD-6EP

crawler tractor
and

7G

crawler loader

TRANSMISSION

service manual

HD-6EP S/N 14484 THRU 22250
S/N 88Y 22251 - UP
7G S/N 22222 THRU 27200

Form 70638891 English



WARNING

STUDY THE OPERATION AND MAINTENANCE
INSTRUCTION MANUAL THROUGH BEFORE STARTING.
OPERATING, MAINTAINING, FUELING OR SERVICING
THIS MACHINE.



The Operation and Maintenance Instruction Manual provides the instructions and procedures for starting, operating, maintaining, fueling, shutdown and servicing that are necessary for properly conducting the procedures for overhaul of the related components outlined in this Service Manual.



This symbol is your safety alert sign. It MEANS ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED.



Read and heed all safety instructions carrying the signal words WARNING and DANGER.



Machine mounted safety signs have been color coded yellow with black borders and lettering for warning and red with white borders and lettering for danger points.

SAFETY RULES

GENERAL

Study the Operation and Maintenance Instruction Manual before starting, operating, maintaining, fueling, or servicing machine.

Read and heed all machine-mounted safety signs before starting, operating, maintaining, fueling or servicing machine.

Machine-mounted safety signs have been color coded yellow with black border and lettering for **WARNING** and red with white border and lettering for **DANGER** points.

Never attempt to operate the machine or its tools from any position other than seated in the operator's seat. Keep head, body, limbs, hands and feet inside operator's compartment at all times to reduce exposure to hazards outside the operator's compartment.

Do not allow unauthorized personnel to operate service or maintain this machine.

Always check work area for dangerous features. The following are examples of dangerous work areas: slopes, over hangs, timber, demolitions, fire, high walls, drop off, back fills, rough terrain, ditches, ridges, excavations, heavy traffic, crowded parking, crowded maintenance and closed areas. Use extreme care when in areas such as these.

An operator must know the machine's capabilities. When working on slopes or near drop offs be alert to avoid loose or soft conditions that could cause sudden tipping or loss of control.

Do not jump on or off machine. Keep two hands and one foot, or two feet and one hand, in contact with steps grab rails and handles at all times.

Do not use controls or hoses as hand holds when climbing on or off machine. Hoses and controls are movable and do not provide a solid support. Controls also may be inadvertently moved causing accidental machine or equipment movement.

Keep operator's compartment, stepping points, grab-rails and handles clear of foreign objects, oil, grease, mud or snow accumulation to minimize the danger of slipping or stumbling. Clean mud or grease from shoes before attempting to mount or operate the machine.

Be careful of slippery conditions on stepping points, hand rails, and on the ground. Wear safety boots or shoes that have a high slip resistant sole material.

For your personal protection. Do not attempt to climb on or off machine while machine is in motion.

Never leave the machine unattended with the engine running.

Always lock up machine when leaving it unattended. Return keys to authorized security. Heed all shut down procedures of the Operation and Maintenance Instruction Manual. Always set the parking brake when leaving the machine for any reason.

Do not wear rings, wrist watches, jewelry, loose or hanging apparel, such as ties, torn clothing, scarves, unbuttoned or unzipped jackets that can catch on moving parts. Wear proper safety equipment as authorized for the job. Examples: hard hats, safety shoes, heavy gloves, ear protectors, safety glasses or goggles, reflector vests, or respirators. Consult your employer for specific safety equipment requirements.

Do not carry loose objects in pockets that might fall unnoticed into open compartments. Do not use machine to carry loose objects by means other than attachments for carrying such objects.

DO NOT CARRY RIDERS unless the machine is equipped for carrying people to reduce personal exposure to being thrown off.

Do not operate machinery in a condition of extreme fatigue or illness. Be especially careful towards the end of the shift.

Roll Over Protective Structures are required on wheel loaders, dozer tractors, track type loaders, graders and scrapers by local or national requirements. **DO NOT** operate this machine without a Roll Over Protective Structure.

Do not operate a machine without a falling object protective structure (FOPS).

Do not operate this machine without a rear canopy screen when machine is equipped with rear mounted towing winch.

Seat belts are required to be provided with roll over protective structures or roll protection cabs by local or national regulations. Keep the safety belt fastened around you during operation.

Where noise exposure exceeds 90 dBA for 8 hours, wear authorized ear protective equipment per local or national requirements that apply.

Keep clutches and brakes on machine and attachments such as power control units, winches and master clutches adjusted according to Operation and Maintenance Instruction Manuals of the manufacturers at all times. **DO NOT** adjust machine with engine running except as specified.

Do not operate a machine with brakes out of adjustment. See the Operation and Maintenance Instruction Manual.

Move carefully when under, in or near machine or implements. Wear required protective equipment, such as hard hat, safety glasses, safety shoes, ear protectors.

To move a disabled machine, use a trailer or low boy truck if available. If towing is necessary, provide warning signals as required by local rules and regulations and follow Operation and Maintenance Instruction Manual recommendations. Load and unload on a level area that gives full support to the trailer wheels. Use ramps of adequate strength, low angle and proper height. Keep trailer bed clean of clay, oil and all materials that become slippery. Tie machine down securely to truck or trailer bed and block tracks (or wheels) as required by the carrier.

SAFETY RULES

To prevent entrapment in cabs or mounted enclosures, observe and know the mechanics of alternate exit routes.

On machines equipped with suction radiator fans, be sure to periodically check all engine exhaust parts for leaks as exhaust gases are dangerous to the operator. Keep a vent open to outside air at all times when operating within a closed cab.

STARTING FLUID IS FLAMMABLE. Follow the recommendations as outlined in the Operation and Maintenance Instruction Manual and as marked on the containers. Store containers in cool, well-ventilated place secure from unauthorized personnel. **DO NOT PUNCTURE OR BURN CONTAINERS.**

Follow the recommendations of the manufacturer for storage and disposal.

Wire rope develops steel slivers. Use authorized protective equipment such as heavy gloves, safety glasses when handling.

OPERATION

Before starting machine, check, adjust and lock the operator's seat for maximum comfort and control of the machine.

DO NOT START OR OPERATE AN UNSAFE MACHINE. Before working the machine, be sure that any unsafe condition has been satisfactorily remedied. Check brakes, steering and attachment controls before moving. Advise the proper maintenance authority of any malfunctioning part or system. Be sure all protective guards or panels are in place, and all safety devices provided are in place and in good operating condition.

Check instruments at start-up and frequently during operation.

Do not run the engine of this machine in closed areas without proper ventilation to remove deadly exhaust gases.

Be sure exposed personnel in the area of operation are clear of the machine before moving the machine or its attachments. **WALK COMPLETELY AROUND** the machine before mounting. Sound horn. Obey flag man, safety signals and signs.

Know the principles of cross steering of crawler tractors. Read section in Operation and Maintenance Instruction Manual on cross steering.

Keep engine exhaust system and exhaust manifolds clear of combustible material. Equip machine with screens and guards when working under conditions of flying combustible material.

If engine has a tendency to stall for any reason under load or idle, report this for adjustment to a proper maintenance authority immediately. Do not continue to operate machine until condition has been corrected.

Never use bucket as a man-lift.

Use recommended bucket for machine and material load ability and heaping characteristics of material, terrain, and other pertinent job conditions.

Avoid abrupt starts and stops when transporting a loaded bucket.

Inspect your seat belt webbing and hardware at least twice a year for signs of fraying, wear or other weakness that could lead to failure.

Use only designated towing or pulling attachment points. Use care in making attachment. Be sure pins and locks as provided are secure before pulling. Stay clear of draw bars, cables or chains under load.

When pulling or towing through a cable or chain, do not start suddenly at full throttle. Take up slack carefully. Guard against kinking chains or cables. Inspect carefully for flaws before using. Do not pull through a kinked chain or cable due to the high stresses and possibility of failure of the kinked area. Always wear heavy gloves when handling chain or cable.

Be sure cables are anchored and the anchor point is strong enough to handle the expected load. Keep exposed personnel clear of anchor point and cable or chain. **DO NOT PULL OR TOW UNLESS OPERATOR'S COMPARTMENT OF MACHINES INVOLVED ARE PROPERLY GUARDED AGAINST POTENTIAL CABLE OR CHAIN BACKLASH.**

During operation always carry ripper in full raised position when not in use and lowered to ground when parked.

When counterweights have been provided, do not work machine if they have been removed unless their equivalent weight has been replaced. See the Operation and Maintenance Instruction Manual.

When operating a machine know what clearances will be encountered, overhead doors, wires, pipes, aisles, roadways; also the weight limitations of ground, floor, and ramps.

Know bridge and culvert load limits and do not exceed them. Know machine's height, width, and weight. Use a signal person when clearance is close.

Be sure that the exact location of gas lines, utility lines, sewers, overhead and buried power lines, and other obstructions or hazards are known. Such locations should be precisely marked by the proper authorities to reduce the risk of accidents. Obtain shut-down or relocation of any such facilities before starting work, if necessary.

Be certain to comply with all local, state, and federal regulations regarding working in the vicinity of power lines.

When roading find out what conditions are likely to be met - clearances, congestion, type of surface, etc. Be aware of fog, smoke or dust element that obscure visibility.

When backing, always look to where the machine is to be moved. Be alert to the position of exposed personnel. **DO NOT OPERATE** if exposed personnel enter the immediate work area.

SAFETY RULES

Never travel a machine on a job site, in a congested area, or around people without a signal person to guide the operator.

In darkness, check area of operation carefully before moving in with machine. Use all lights provided. Do not move into area of restricted visibility.

Maintain clear vision of all areas of travel or work. Keep cab windows clean and repaired. Carry blade low for maximum visibility while traveling. Obtain and use fan blast deflectors where tractors are used a pusher tractors in tandem.

Transport a loaded bucket with the bucket as far tipped back and in as low a position as possible for maximum visibility, stability, and safest transport of the machine. Carry it at a proper speed for the load and ground conditions.

Carry the bucket low when traveling with a load.

Maintain a safe distance from other machines. Provide sufficient clearance for ground and visibility conditions. Yield right-of-way to loaded machines.

Avoid going over obstacles such as rough terrain, rocks, logs, curbs, ditches ridges, and railroad tracks whenever possible. When obstructions must be crossed, do so with extreme care at an angle if possible. Reduce speed - down-shift. Ease up to the break over point - pass the balance point slowly on the obstruction and ease down on the other side.

Cross gullies or ditches at an angle with reduced speed after insuring ground conditions will permit a safe traverse.

Be alert to soft ground conditions close to newly constructed walls. The fill material and weight of machine may cause the wall to collapse under the machine.

Operate at speeds slow enough to insure complete control at all times. Travel slowly over rough ground, on slopes or near drop offs, in congested areas or on ice or slippery surfaces.

Be alert to avoid changes in traction conditions that could cause loss of control. **DO NOT** drive on ice or frozen ground conditions when working the machine on steep slopes or near drop offs.

Keep the machine well back from the edge of an excavation.

Be especially careful when traveling up or down slopes. Position the bucket in such a way as to provide a possible anchorage on the ground in case of a slide.

When proceeding across a hill side proceed slowly. Never turn sharply up hill or down hill.

Avoid side hill travel whenever possible. Drive up and down the slope. Should the machine start slipping sideways on a grade, turn it immediately downhill.

In steep down hill operation, do not allow engine to over speed. Select proper gear before starting down grade.

There is no substitute for good judgement when working on slopes.

The grade of slope you should attempt will be limited by such factors as condition of the ground, load being handled, the type of machine, speed of machine and visibility.

NEVER COAST the machine down grades and slopes with the transmission in neutral on power shift machines, or clutch disengaged on manually shifted machines.

To reduce the danger of uncontrolled machine, choose a gear speed before proceeding down grade that will hold machine to proper speeds for conditions.

Operating in virgin rough terrain that includes previously mentioned hazards is called pioneering. Be sure you know how this is done. Danger from falling branches and upturning roots is acute in these areas.

When pushing over trees, the machine must be equipped with proper over head guarding. Never allow a machine to climb up on the root structure particularly while the tree is being felled. Use extreme care when pushing over any tree with dead branches.

Avoid brush piles, logs or rocks. **DO NOT DRIVE THE MACHINE ONTO BRUSH PILES, LOGS, LARGE ROCKS** or other surface irregularities that break traction with the ground especially when on slopes or near drop offs.

Avoid operating equipment too close to an over hang or high wall either above or below the machine. Be on the look out for caving edges, falling objects and slides. Beware of concealment by brush and under growth of these dangers.

Park in a non-operating and non-traffic area or as instructed. Park on firm level ground if possible. Where not possible, position machine at a right angle to the slope, making sure there is no danger of uncontrolled sliding movement. Set the parking brake.

Never park on an incline without carefully blocking the machine to prevent movement.

If parking in traffic lanes cannot be avoided, provide appropriate flags, barriers, flares and warning signals as required. Also provide advance warning signals in the traffic lane of approaching traffic.

Move the machine away from pits, trenches, overhangs and over head power lines before shutting down for the day.

When stopping operation of the machine for any reason, always return the transmission or hydrostatic drive control to neutral and engage the control lock to secure the machine for a safe start up. Set parking brake, if so equipped.

Never lower attachments or tools from any position other than seated in operator's seat. Sound the horn. Make sure the area near the attachment is clear. Lower the attachment slowly. **DO NOT USE** float position to lower hydraulic equipment.

SAFETY RULES

Always before leaving the operator's seat and after making certain all people are clear of the machine, slowly lower the attachments or tools flat to the ground in a positive ground support position. Move any multi purpose tool to positive closed position. Return the controls to hold. Place transmission control in neutral and move engine controls to off position. Engage all control locks, set parking brake, and open and lock the master (key, if so equipped) switch. Consult Operation and Maintenance Instruction Manual.

Always follow the shut down instructions as outlined in the Operation and Maintenance Instruction Manual.

MAINTENANCE

Do not perform any work on equipment that is not authorized. Follow the Maintenance or Service Manual procedures.

Machine should not be serviced with anyone in the operator's seat unless they are qualified to operate the machine and are assisting in the servicing.

Shut off engine and disengage the Power Take Off lever if so equipped before attempting adjustments or service.

Always turn the master switch (key switch if so equipped) to the OFF position before cleaning, repairing, or servicing and when parking machine to forestall unintended or unauthorized starting.

Disconnect batteries and TAG all controls according to local or national requirements to warn that work is in progress. Block the machine and all attachments that must be raised per local or national requirements.

Never lubricate, service or adjust a machine with the engine running, except as called for in the Operation and Maintenance Instruction Manual. Do not wear loose clothing or jewelry near moving parts.

Do not run engine when refueling and use care if engine is hot due to the increased possibility of a fire if fuel is spilled.

Do not smoke or permit any open flame or spark near when refueling, or handling highly flammable materials.

Always place the fuel nozzle against the side of the filler opening before starting and during fuel flow. To reduce the chance of a static electricity spark, keep contact until after fuel flow is shut off.

Do not adjust engine fuel pump when the machine is in motion.

Never attempt to check or adjust fan belts when engine is running.

When making equipment checks that require running of the engine, have an operator in the operator's seat at all times with the mechanic in sight. Place the transmission in neutral and set the brakes and lock. **KEEP HANDS AND CLOTHING AWAY FROM MOVING PARTS.**

Avoid running engine with open unprotected air inlets. If such running is unavoidable for service reasons, place protective screens over all inlet openings before servicing engine.

Do not place head, body, limbs, feet, fingers, or hands near rotating fan or belts. Be especially alert around a pusher fan.

Keep head, body, limbs, feet, fingers, or hands away from bucket, blade or ripper when in raised position.

If movement of an attachment by means of machine's hydraulic system or winches is required for service or maintenance, do not raise or lower attachments from any position other than when seated in the operator's seat. Before starting machine or moving attachments or tools, set brakes, sound horn and call for an all clear. Raise attachments slowly.

Never place head, body, limbs, feet, fingers, or hands into an exposed portion between uncontrolled or unguarded scissor points of machine without first providing secure blocking.

Never align holes with fingers or hands - Use the proper aligning tool.

Disconnect batteries before working on electrical system or repair work of any kind.

Check for fuel or battery electrolyte leaks before starting service or maintenance work. Eliminate leaks before proceeding.

BATTERY GAS IS HIGHLY FLAMMABLE. Leave battery box open to improve ventilation when charging batteries. Never check charge by placing metal objects across the posts. Keep sparks or open flame away from batteries. Do not smoke near battery to guard against the possibility of an accidental explosion.

Do not charge batteries in a closed area. Provide proper ventilation to guard against an accidental explosion from an accumulation of explosive gases given off in the charging process.

Be sure to connect the booster cables to the proper terminals (+ to +) and (- to -) at both ends. Avoid shorting clamps. Follow the Operation and Maintenance Instruction Manual procedure.

Due to the presence of flammable fluid, never check or fill fuel tanks, storage batteries or use starter fluid near lighted smoking materials or open flame or sparks.

Rust inhibitors are volatile and flammable. Prepare parts in well ventilated place. Keep open flame away - **DO NOT SMOKE.** Store containers in a cool well ventilated place secured against unauthorized personnel.

Do not use an open flame as a light source to look for leaks or for inspection anywhere on the machine.

DO NOT pile oily or greasy rags - they are a fire hazard. Store in a closed metal container.

SAFETY RULES

Never use gasoline or solvent or other flammable fluid to clean parts. Use authorized commercial, non-flammable, non-toxic solvents.

Never place gasoline or diesel fuel in an open pan.

Shut off engine and be sure all pressure in system has been relieved before removing panels, housings, covers, and caps. See Operation and Maintenance Instruction Manual.

Do not remove hoses or check valves in the hydraulic system without first removing load and relieving pressure on the supporting cylinders. Turn radiator cap slowly to relieve pressure before removing. Add coolant only with engine stopped or idling if hot. See Operation and Maintenance Instruction Manual.

Fluid escaping under pressure from a very small hole can almost be invisible and can have sufficient force to penetrate the skin. Use a piece of card board or wood to search for suspected pressure leaks. **DO NOT USE HANDS.** If injured by escaping fluid, see a doctor at once. Serious infection or reaction can develop if proper medical treatment is not administered immediately.

Never use any gas other than dry nitrogen to charge accumulators. See Operation and Maintenance Instruction Manual.

When making pressure checks use the correct gauge for expected pressure. See the Operation and Maintenance Instruction Manual or Service Manual for guidance.

For field service, move machine to level ground if possible and block machine. If work is absolutely necessary on an incline, block machine and its attachments securely. Move the machine to level ground as soon as possible.

Brakes are inoperative when manually released for servicing. Provision must be made to maintain control of the machine by blocking or other means.

Block all wheels before bleeding or disconnecting any brake system lines and cylinders.

Never use make shift jacks when adjusting track tension. Follow the Undercarriage Service Manual.

Know your jacking equipment and its capacity. Be sure the jacking point used on the machine is appropriate for the load to be applied. Be sure the support of the jack at the machine and under the jack is appropriate and stable. Any equipment up on a jack is dangerous. Transfer load to appropriate blocking as a safety measure before proceeding with service or maintenance work according to local or national requirements.

Always block with external support any linkage or part on machine that requires work under the raised linkage, parts, or machine per local or national requirements. Never allow anyone to walk under or be near unblocked raised equipment. Avoid working or walking under raised blocked equipment unless you are assured of your safety.

When servicing or maintenance requires access to areas that cannot be reached from the ground, use a ladder or step platform that meets local or national requirements to reach the service point. If such ladders or platforms are not available, use the machine hand holds and steps as provided. Perform all service or maintenance carefully.

Shop or field service platforms and ladders used to maintain or service machinery should be constructed and maintained according to local or national requirements.

Lift and handle all heavy parts with a lifting device of proper capacity. Be sure parts are supported by proper slings and hooks. Use lifting eyes if provided. Watch out for people in the vicinity.

In lifting and handling heavy parts, slings must be of adequate strength for the purpose intended and must be in good condition.

Handle all parts with extreme care. Keep hands and fingers from between parts. Wear authorized protective equipment such as safety glasses, heavy gloves, safety shoes.

When using compressed air for cleaning parts use safety glasses with side shields or goggles. Limit the pressure to 207 kPa (30 psi) according to local or national requirements.

Wear welders protective equipment such as dark safety glasses, helmets, protective clothing, gloves and safety shoes when welding or burning. Wear dark safety glasses near welding. **DO NOT LOOK AT ARC WITHOUT PROPER EYE PROTECTION.**

Replace seat belts every two years on open canopy units and every three years on machines with cabs or at change of ownership.

Wear proper protective equipment such as safety goggles or safety glasses with side shields, hard hat, safety shoes, heavy gloves when metal or other particles are apt to fly or fall.

Use only grounded auxiliary power source for heaters, chargers, pumps and similar equipment to reduce the hazards of electrical shock.

Keep maintenance area **CLEAN** and **DRY**. Remove water or oil slicks immediately.

Remove sharp edges and burrs from reworked parts.

Be sure all mechanics tools are in good condition. **DO NOT** use tools with mushroomed heads. Always wear safety glasses with side shields.

Do not strike hardened steel parts with anything other than a soft iron or non-ferrous hammer.

Do not rush. Walk, do not run.

Know and use the hand signals used on particular jobs and know who has the responsibility for signaling.

SAFETY RULES

Face the access system when climbing up and down.

Apply the parking device and place the transmission in neutral before starting the machine.

Do not bypass the starter safety switch. Repair the starter safety controls if they malfunction.

Fasten seat belt before operating.

Steering should be checked to both right and left. Brakes should be tested against engine power. Clutch and transmission controls should be moved through or to neutral positions to assure disengagement. Operate all controls to insure proper operation. If any malfunctions are found, park machine, shut off engine, report and repair before using machine.

If the power steering or the engine ceases operating, stop the machine motion as quickly as possible. Lower equipment, set parking device and keep machine securely parked until the malfunction is corrected or the machine can be safety towed. Never lift loads in excess of capacity.

Should the machine become stuck or frozen to the ground, back out to avoid roll over.

Know and understand the job site traffic flow patterns.

Keep the machine in the same gear going down hill as used for going up hill.

When roading a machine, know and use the signaling devices required on the machine. Provide an escort for roading where required.

Always use the recommended transport devices when roading the machine.

Do not attempt repairs unless proper training has been provided.

Use extreme caution when removing radiator caps, drain plugs, grease fittings or pressure taps. Park the machine and let it cool down before opening a pressurized compartment.

Release all pressure before working on systems which have an accumulator.

When necessary to tow the machine, do not exceed the recommended towing speed, be sure the towing machine has sufficient braking capacity to stop the towed load. If the towed machine cannot be braked, a tow bar must be used or two towing machines must be used - one in front pulling and one in the rear to retard. Avoid towing over long distances.

Observe proper maintenance and repair of all pivot pins, hydraulic cylinders, hoses, snap rings and main attaching bolts.

Always keep the brakes and steering systems in good operating condition.

Replace all missing, illegible or damaged safety signs. Keep all safety signs clean.

Do not fill the fuel tank to capacity. Allow room for expansion.

Wipe up spilled fuel immediately.

Always tighten the fuel tank cap securely. Should the fuel cap be lost, replace it only with the original manufacturers approved cap. Use of a non-approved cap may result in over-pressurization of the tank.

Never drive the machine near open fires.

Use the correct fuel grade for the operating season.

FOREWORD

Always furnish serial number if making an inquiry to dealer or factory about this machine.

Many equipment owners employ the Dealer Service Department for all work other than routine lubrication and minor service. This practice is encouraged, as our Dealers are well informed and equipped to render efficient service by factory trained mechanics.

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Illustrations show standard and optional items.

IMPORTANT

The information in this manual was current at the time of publication. It is our policy to constantly improve our product and to make available additional items. These changes may affect procedures outlined in this manual. If variances are observed, verify the information through your Dealer.

Fiatallis is not responsible for any liability arising from any damage resulting from defects caused by parts and/or components not approved by Fiatallis for use in maintaining and/or repairing products manufactured or merchandized by Fiatallis.

In any case, no warranty of any kind is made or shall be imposed with respect to products manufactured or merchandized by Fiatallis when failures are caused by the use of parts and/or components not approved by Fiatallis.

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TOPIC 1 GENERAL DESCRIPTION

Torque converter, drive shaft universal joint, transmission, and bevel gear and shaft transmit engine power to steering clutches and final drives. Single stage torque converter is connected directly to engine; torque converter absorbs sudden loads on tractor and increases torque to prevent "lugging" engine. Drive shaft universal joint connects torque converter to transmission. Power shift transmission

has four speeds (two forward, two reverse) to provide suitable speed and power ranges. Bevel gear is driven by transmission pinion; bevel gear shaft delivers power to steering clutches.

Torque converter and transmission have common hydraulic system; adjustable pressure relief valves maintain specified operating pressures.

TOPIC 2 TROUBLE SHOOTING AND PRESSURE CHECKING

IMPORTANT

Always be certain hydraulic system is filled to proper level with specified lubricant before trouble-shooting.

A. TROUBLE SHOOTING

TRACTOR WILL NOT OPERATE IN ANY SPEED OR IS LOW ON POWER.

CAUSES	REMEDIES
1. Main pressure low.	Check pressures in order given; refer to "PRESSURE CHECKING".
2. Transmission clutch apply pressure low.	
3. Torque converter pressure low.	

TRACTOR WILL NOT OPERATE IN A PARTICULAR SPEED.

CAUSES	REMEDIES
Defective transmission clutch.	Disassemble transmission; replace necessary parts.

TRACTOR CREEPS WITH TRANSMISSION IN NEUTRAL.

CAUSES	REMEDIES
1. Speed shift linkage improperly adjusted.	1. Adjust linkage; refer to "RANGE SELECTOR VALVE".
2. Transmission clutch dragging.	2. Determine which clutch is dragging as follows: Operate tractor for fifteen minutes in one speed in range which tractor creeps; record transmission oil temperature. Repeat test in other speed in same range. Oil temperature will be higher when dragging clutch is disengaged. Disassemble transmission and make necessary repairs.

B. PRESSURE CHECKING

Hydraulic system contains pressure regulating valves to limit and maintain various circuit pressures. These valves are adjusted at factory and should not require further adjustment. However, if tractor is not operating properly and low pressure is suspected, individual pressure checks should be made.

Before any major work is done to transmission or torque converter, be certain engine is functioning properly. Low engine rpm will not allow hydraulic pump to pump its full volume and transmission or

torque converter may appear to be at fault.

Main pressure and transmission clutch lube pressure are shown on "Operating Range" type gauges on cowl; hydraulic system pressures may be checked and trouble diagnosed by observing pressures shown on these gauges. However, information in this topic is provided to assist service personnel who wish to record pressures on dial-type (direct reading) gauge.

Check system pressures after service work has been performed on any system component.

Pressure Check Points	Pressure Being Checked	Specified Pressures (psi)	Engine Speed	Trans. Range Position	Oil Temp. For Checking
Fig. 2	Main	230 maximum	High idle	Neutral	180°F. minimum
Fig. 3	Trans. Clutch Apply	150 - 170	High idle	Note #1	
Fig. 3	Trans. Clutch Lube	10 - 15	High idle	Note #2	
Fig. 4	Torque Converter	35 - 45	High idle	Engaged (any range)	

NOTE #1 Engage each transmission clutch individually; read pressure at points indicated in Fig. 3.

NOTE #2 Check pressure when opposing clutch is engaged.

Fig. 1 -- Hydraulic System Pressure Specifications
(T-72352)

IMPORTANT

Possible causes given for unsatisfactory pressures are listed in order they are most likely to occur and/or order which is easiest to check. Each cause takes for granted that preceding causes have been checked out and found to be OK.

1. MAIN PRESSURE

- a. Remove left front floor plate, and cap from oil distributing front cross, Fig. 2; install pressure gauge at this point.
- b. Check pressure (refer to Fig. 1).
- c. Pressure check results:
 - (1) NO PRESSURE. Pump drive train damaged; check pump driving shaft and pump drive shaft (refer to "HYDRAULIC PUMP").
 - (2) LOW AND ERRATIC PRESSURE. Suction line screen clogged. Clean screen; refer to "HYDRAULIC SYSTEM LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE".
 - (3) LOW PRESSURE. Transmission clutch apply pressure relief valve defective. Check transmission clutch apply pressure.

2. TRANSMISSION CLUTCH APPLY PRESSURE, AND TRANSMISSION CLUTCH LUBE PRESSURE

These pressures should be checked at same time on each clutch shaft to detect leakage within clutches or around shaft sealing rings. Proceed as follows:

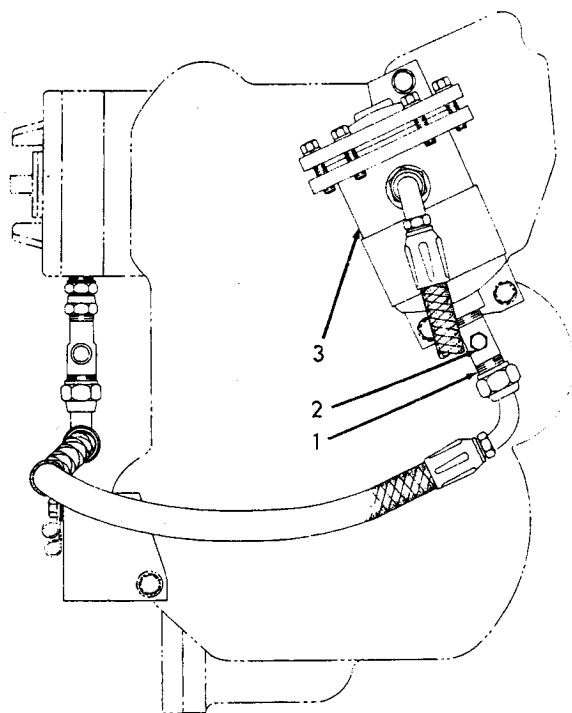
- a. Remove floor plates; install pressure gauges to check both clutches in one range, Fig. 3.
- b. Repeat procedure to check other range.

NOTE

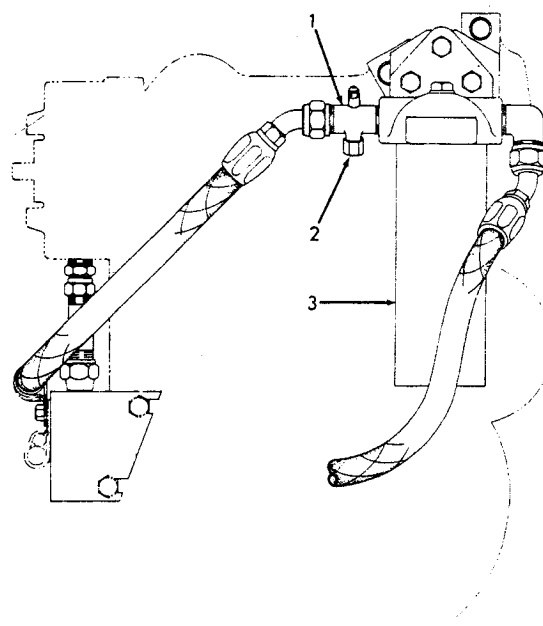
Apply brakes or hold tractor stationary in some way when checking clutch apply pressure.

c. Pressure check results:

- (1) APPLY PRESSURE LOW (ALL CLUTCHES), indicates relief valve defective. Refer to "RANGE SELECTOR VALVE"; make necessary repairs.
- (2) APPLY PRESSURE LOW IN ONE CLUTCH, LUBE PRESSURE IN OPPOSING CLUTCH NORMAL, indicates leakage in clutch; remove transmission and make necessary repairs.



HD6EP PRIOR TO S/N 16007
HD7G PRIOR TO S/N 22728



HD6EP EFF. S/N 16007 AND UP
HD7G EFF. S/N 22728 AND UP

Fig. 2 -- Main Pressure Check Point
(T-33401 & T-37180)

1. Oil distributing front cross
2. Pressure check point cap
3. Transmission oil filter

(3) APPLY PRESSURE LOW IN ONE CLUTCH, LUBE PRESSURE IN OPPOSING CLUTCH HIGH, indicates clutch shaft front seals leaking; remove oil collectors and replace seals. If seals are OK, leakage is in clutch; remove transmission and make necessary repairs.

(4) APPLY PRESSURE LOW IN TWO OR MORE CLUTCHES, LUBE PRESSURE HIGH IN TWO OR MORE CLUTCHES. Adjust speed shift linkage; refer to "RANGE SELECTOR VALVE". If linkage is OK, remove range selector valve and check for leakage around rotor.

(5) APPLY PRESSURE NORMAL, LUBE PRESSURE LOW. Relief valve defective; refer to "RANGE SELECTOR VALVE" and make necessary repairs.

3. TORQUE CONVERTER PRESSURE

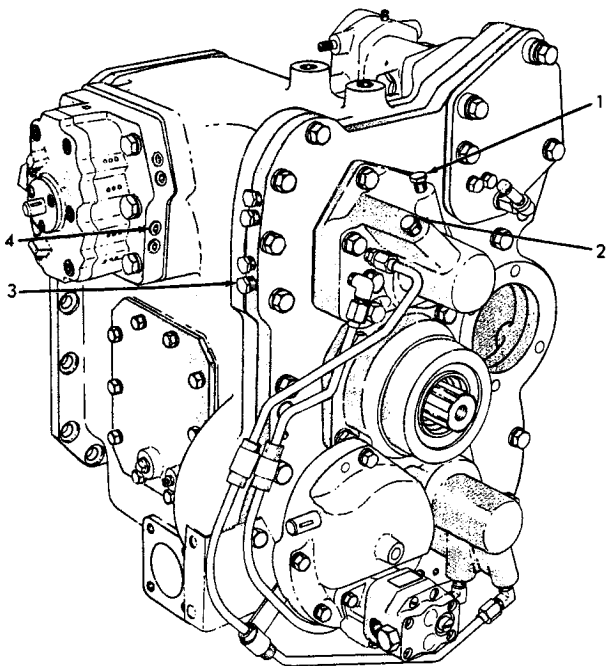
a. Remove left front floor plate; move throttle operating lever to provide clearance beneath cowl.

b. Disconnect oil supply line, Fig. 4, from torque converter; install necessary fittings and oil lines, Fig. 4. Check pressure; refer to Fig. 1.

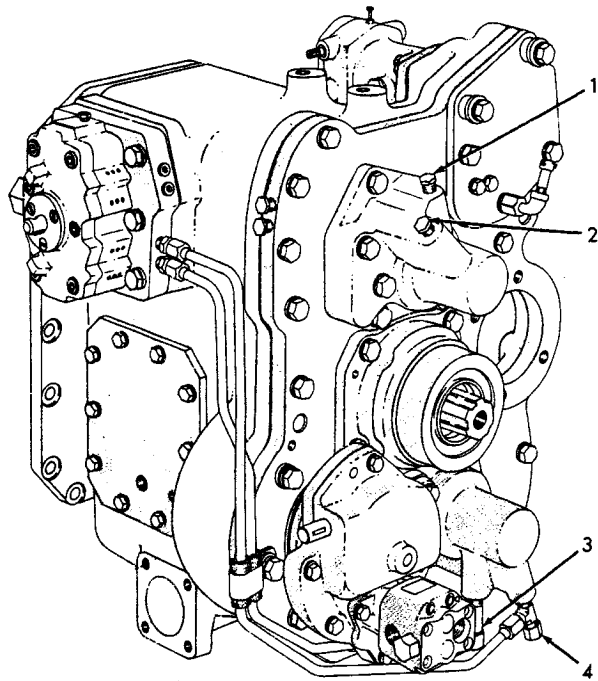
c. Pressure check results:

(1) LOW PRESSURE. Relief valve defective; refer to "RANGE SELECTOR VALVE" and make necessary repairs.

(2) HIGH PRESSURE. Torque converter return line screen and/or restrictor clogged; clean screen and/or restrictor; recheck pressure. If pressure is still high, check pressure relief valve; refer to "RANGE SELECTOR VALVE".



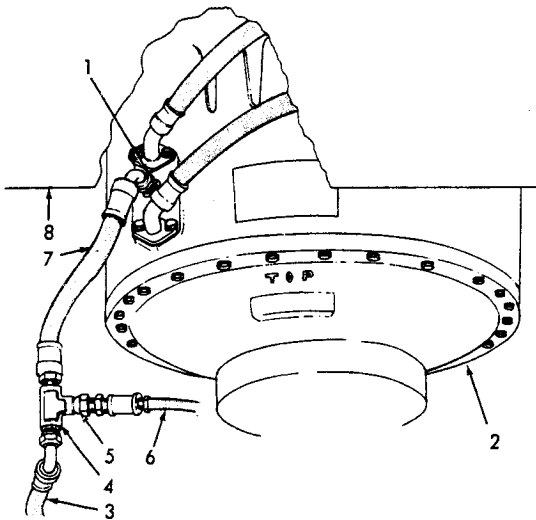
HD6EP PRIOR TO S/N16007
HD7G PRIOR TO S/N23003



HD6EP EFF. S/N16007 AND UP
HD7G EFF. S/N23003 AND UP

Fig. 3 -- Transmission Pressure Check Points
(T-70916 & T-70917)

- | | |
|----------------|----------------|
| 1. 2nd forward | 3. 2nd reverse |
| 2. 1st forward | 4. 1st reverse |



- 1. Check point
- 2. Torque converter
- 3. Oil line (torque converter supply)
- *4. Tee
- *5. Connector
- *6. Oil line (pressure gauge)
- *7. Oil line
- 8. Cowl

* Used only when checking pressure

Fig. 4 -- Torque Converter Pressure Check Point
(T-70995)

TOPIC 3 HYDRAULIC SYSTEM

A. HYDRAULIC OPERATION

Hydraulic system, shown schematically in Fig. 5, contains three circuits: transmission clutch apply; torque converter; and transmission clutch lube. Each circuit contains a shim adjusted pressure regulating valve to maintain specified operating pressure; valves are cascade type, enclosed in transmission range selector valve.

Dual, tandem-type oil pump mounted on rear of torque converter, is driven by engine flywheel through gear train in front part of torque converter housing. Pump front gears scavenge oil from transmission case and return it to sump in steering clutch housing; pump rear gears draw oil from sump (through cored passage in transmission case) and supply same to charge hydraulic system. System flow description (also refer to Fig. 5): oil from pump enters transmission clutch apply circuit and flows through oil filter, travel speed governor on some models, and range selector valve. Circuit pressure is maintained by transmission clutch apply pressure valve; valve opens at specified pressure and bypasses oil to torque converter circuit.

Oil in torque converter circuit charges torque converter; oil is cooled by circulating through oil cooler.

Excess oil returns to sump on some models (transmission case on other models); refer to Fig. 5. Torque converter seal leakage drains to transmission case. Circuit pressure is maintained by torque converter pressure valve; valve opens at specified pressure and bypasses oil to transmission clutch lube circuit.

Oil in this lube circuit flows through range selector valve to lubricate transmission clutches and components. Circuit pressure is maintained by transmission lube pressure valve; valve opens at specified pressure and dumps excess oil in transmission case.

Range selector valve directs oil to engage and lubricate transmission clutches. Oil in transmission clutch apply circuit enters valve through passage in valve rotor. When rotor is in neutral position, oil deadheads against valve body; when rotor is moved (by mechanical linkage) to engage transmission clutch, passage in rotor is aligned with passage in valve body leading to an external oil line, allowing oil to flow through rotor and engage desired clutch.

Oil in transmission clutch lube circuit enters valve, flows around rotor, and fills valve body. Oil passages in valve body leading to disengaged clutches are uncovered; oil in valve body enters these passages and flows through external oil lines to lubricate disengaged transmission clutches.

Some models are equipped with push-start pump, Fig.

5, to charge hydraulic system when tractor is pushed or towed to start engine. Pump operates only when mechanically actuated; check valve opens when pump is operating and allows oil to enter transmission clutch apply circuit.

B. LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE

1. LUBRICANT SPECIFICATIONS

Specified lubricant for use in hydraulic system is SAE 10W lubricating oil meeting following specifications:

- a. Transmission fluid "Type C-1",
- b. American Petroleum Institute (API) classification "MS",
- c. Military Specification "MIL-L-2104A" or "MIL-L-2104B" GRADE 10W.

Automatic Transmission Fluid "Type A-Suffix A" may be used if desired. API classification "DS" or "Series 3" oil is not recommended.

When atmospheric temperature is below -10° F., Automatic Transmission Fluid "Type A-Suffix A" or lubricating oil meeting Military Specification "MIL-L-10295A OES" may be used if operating conditions warrant.

CAUTION

Do not use "MIL-L-10295A OES" if atmospheric temperature remains consistently above -10° F.

2. CAPACITY AND SERVICE

Capacity of system (including steering clutches and brakes) is 21 gallons. Transmission hydraulic system and steering clutches and brakes hydraulic system are serviced simultaneously, as both systems have common sump. Normal oil change interval is 1000 hours and oil filter change interval is 500 hours. On new machine, or after major repairs to system components, change oil filters after 50 hours; thereafter at normal intervals. Oil should be at normal operating temperature when drained (for detailed information to perform services, refer to pertinent "Operating Instructions and Field Maintenance" Manuals).

C. HYDRAULIC PUMP

Dual, tandem-type pump, mounted on rear of torque

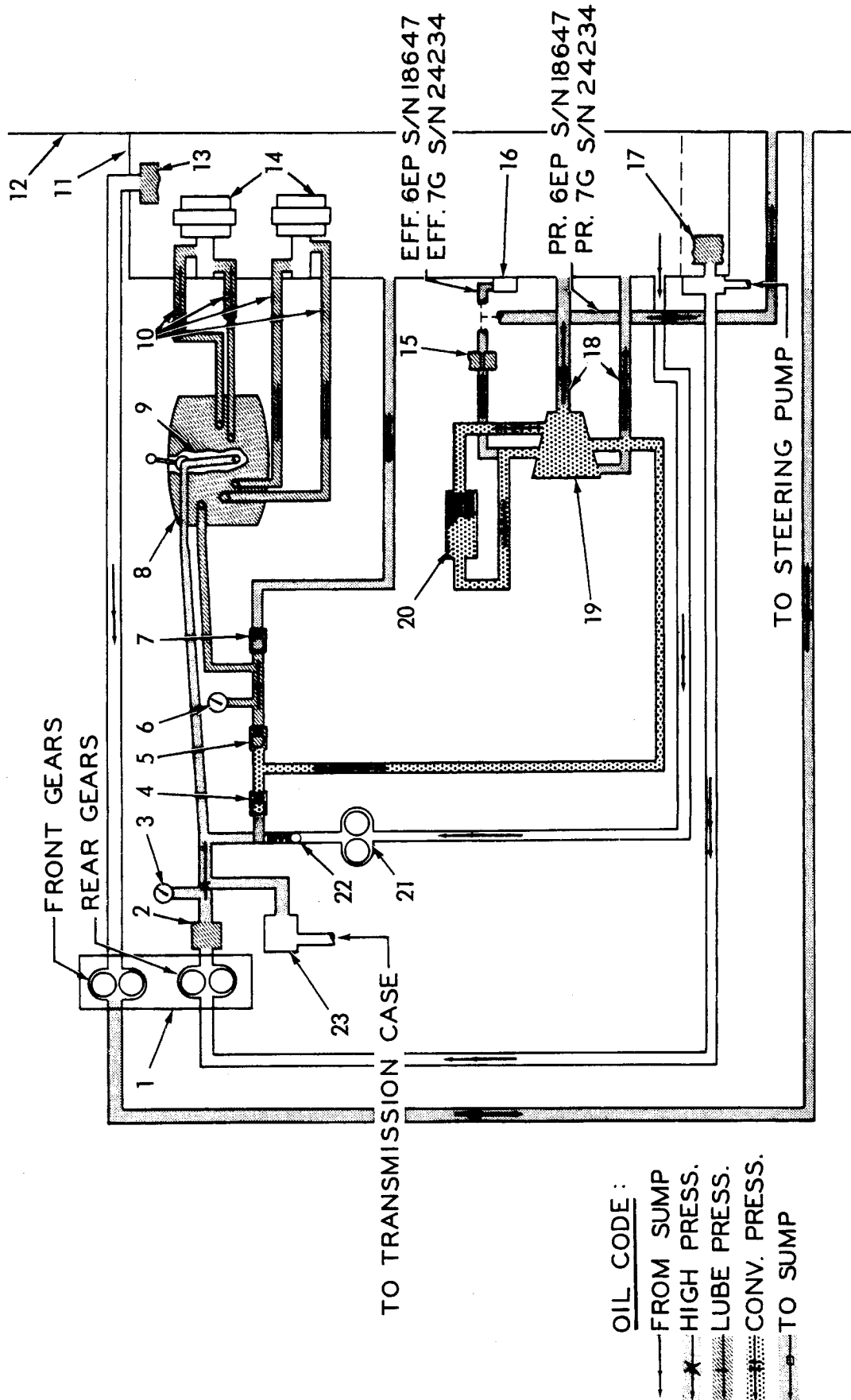


Fig. 5 -- Hydraulic System Oil Flow Schematic -
Neutral Position
(T-72038)

1. Pump, transmission
 2. Filter
 3. Gauge, high pressure
 4. Relief valve, apply pressure
 5. Relief valve, torque converter
 6. Gauge, lube pressure
 7. Relief valve, lube pressure
 8. Valve, range selector
 9. Rotor
 10. Oil lines, transmission clutches
 11. Transmission case
 12. Steering clutch and final drive housing
 13. Screen, transmission scavenge pump
 14. Clutches
 15. Screen and restrictor, HD6EP prior to S/N 18985, HD7G prior to S/N 24394
 16. Bearing retainer, input shaft
 17. Screen, transmission pressure pump
 18. Oil lines, seal drain
 19. Torque converter
 20. Oil cooler
 - *21. Pump, push-start
 - *22. Ball, check
 - *23. Travel speed governor
- * Special equipment some models

converter, is driven by engine flywheel through gear train and splined shaft in torque converter housing. Two different pumps are used; both are mounted in same location in a similar manner and operate the same.

1. REMOVAL

- a. Remove right front floor plate; clean pump and surrounding area.
- b. Disconnect hoses from pump; cover hose openings and identify hoses to aid installation.
- c. Remove pump from torque converter; pull splined driving shaft from torque converter housing.

2. DISASSEMBLY (HD6EP PRIOR TO S/N 18754, HD7G PRIOR TO S/N 24276)

- a. Scribe mark length of pump to make certain pump is reassembled correctly.
- b. Remove back plate, Fig. 6; tap gear case lightly on soft block to remove shafts, gears, and bearings. Mark each set of gears while still in case so they may be reinstalled in original position if reused. Remove gears and bearings from each shaft; remove snap ring from drive shaft.
- c. Remove front plate, Fig. 6; drive oil seal out front end of plate.

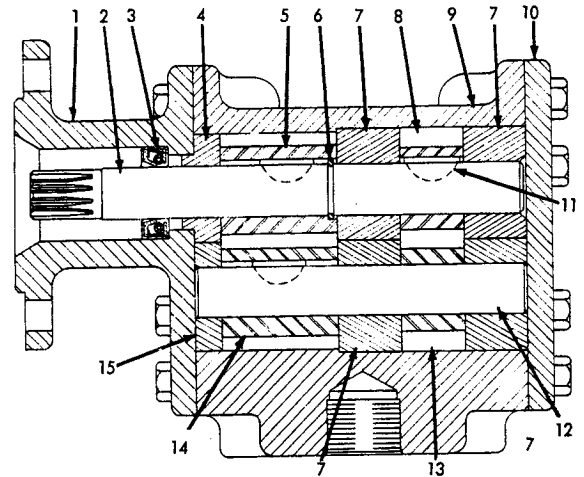


Fig. 6 -- Transmission Oil Pump (HD6EP Prior to S/N 18754, HD7G Prior to S/N 24276)
(T-35404)

1. Plate, front
2. Drive shaft
3. Oil seal
4. Bearing, drive shaft front
5. Gear, scavenge pump
6. Snap ring
7. Bearings, intermediate and rear
8. Gear, pressure pump
9. Gear case
10. Plate, back
11. Woodruff key
12. Shaft, idler
13. Gear, pressure pump
14. Gear, scavenge pump
15. Bearing, idler shaft front

3. INSPECTION (HD6EP PRIOR TO S/N 18754, HD7G PRIOR TO S/N 24276)

Wash parts in solvent; dry with compressed air. Remove burrs from gear teeth, machined surfaces of gear case, and end covers. Wash after deburring.

- a. GEAR CASE. Refer to Fig. 7; if wear pattern extends no closer to 12:00 than 45° line, housing may be reused; if pattern extends to 1:00 area, housing must be considered worn out.
- b. GEARS. Deburr if possible; replace gears having worn or chipped teeth.
- c. DRIVE AND IDLER SHAFTS. Replace shaft(s) if O.D. at any location is less than .686"; replace drive shaft if rough at oil seal location. Check splines of drive shaft for wear or signs of twisting; replace as necessary.
- d. BEARINGS. Replace either front bearing if I.D. is more than .692" or width is less than .373". Replace any intermediate

6 or 8; assemble pump as follows:

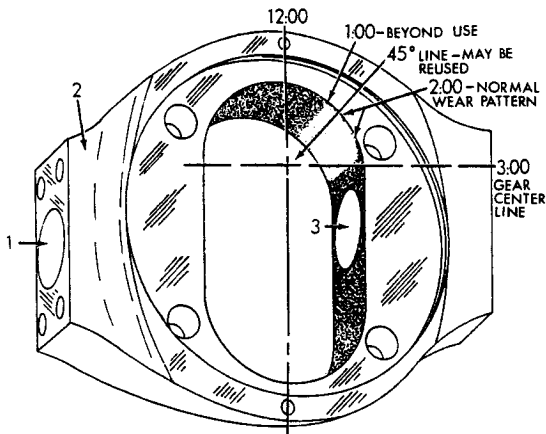


Fig. 7 -- Typical Gear Case Wear Pattern
(T-70604)

1. Pressure port
2. Case
3. Suction port

or rear bearing if I.D. is more than .691"
or width is less than .873".

e. PUMP DRIVING SHAFT. Replace if
splines are worn or indicate shaft has
twisted.

4. ASSEMBLY (HD6EP PRIOR TO S/N 18754,
HD7G PRIOR TO S/N 24276)

Oil all parts prior to assembly. Refer to Fig.

- a. Install drive shaft oil seal in front plate,
(with sealing lip directed toward rear of
plate). Align locating marks placed on
pump at disassembly; install front plate on
gear case.
- b. Install drive shaft snap ring; install front
woodruff keys and scavenge pump (wide)
gears on respective shaft (drive shaft snap
ring in gear counterbore). Install shaft
front bearings, idler shaft, and drive shaft
in gear case.

CAUTION

Do not damage drive shaft oil seal.

- c. Install intermediate bearings and drive
shaft rear woodruff key; install pressure
pump (narrow) gears on respective shaft.
- d. Install rear bearings; align locating marks
placed at disassembly and install back
plate (with new gasket).
- e. If pump is bench tested, following
minimum specifications must be met:

(1) PRESSURE PUMP

Oil: Automatic Transmission Fluid
Type "A"
Oil Temp: 200° F.
Pump Speed: 1200 rpm
Pump Output: 5 gpm
Pressure: 160 psi

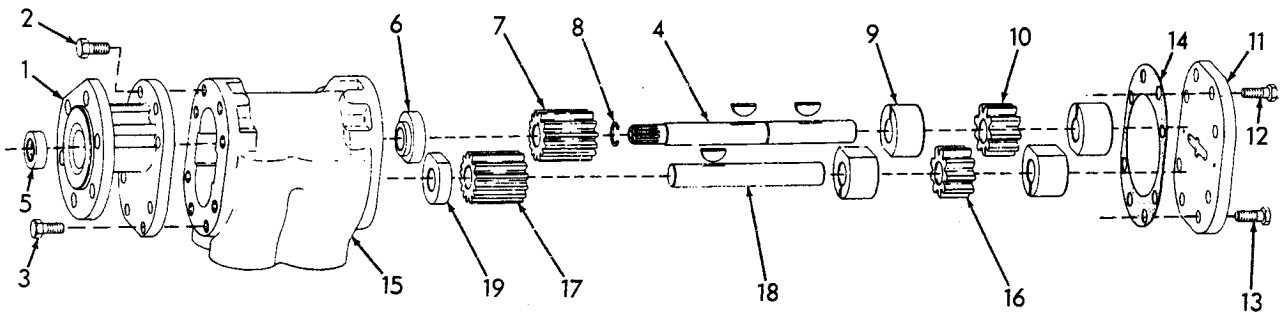


Fig. 8 -- Transmission Oil Pump Parts (HD6EP Prior to S/N 18754, HD7G Prior to S/N 24276)
(T-70936)

- | | |
|------------------------------------|--------------------------------|
| 1. Plate, front | 11. Plate, back |
| 2. Capscrew | 12. Capscrew |
| 3. Capscrew | 13. Capscrew |
| 4. Drive shaft | 14. Gasket |
| 5. Oil seal, drive shaft | 15. Gear case |
| 6. Bearing, drive shaft front | 16. Gear, pressure pump |
| 7. Gear, scavenge pump | 17. Gear, scavenge pump |
| 8. Snap ring | 18. Idler shaft |
| 9. Bearings, intermediate and rear | 19. Bearing, idler shaft front |
| 10. Gear, pressure pump | |

(2) SCAVENGE PUMP

Oil: Automatic Transmission Fluid
Type "A"
Oil Temp: 200° F.
Pump Speed: 1200 rpm
Pump Output: 6 gpm
Pressure: 30 psi

5. DISASSEMBLY (HD6EP EFF. S/N 18754 AND UP, HD7G EFF. S/N 24276 AND UP)

- a. Scribe mark length of pump to be certain pump is reassembled correctly.
- b. Remove capscrews from back plate, Fig.

9(1); pull back plate and gear housing (3) from dowels.

CAUTION

Do not pry pump sections apart.

- c. Mark position of pressure pump gears, Fig.9 (18); slide idler gear from shaft and pull drive gear from woodruff key in shaft. Remove woodruff key, center housing (9), and gear housing (10).
- d. Mark position of scavenge pump gears; remove drive shaft, idler shaft, and drive shaft oil seal from front plate.

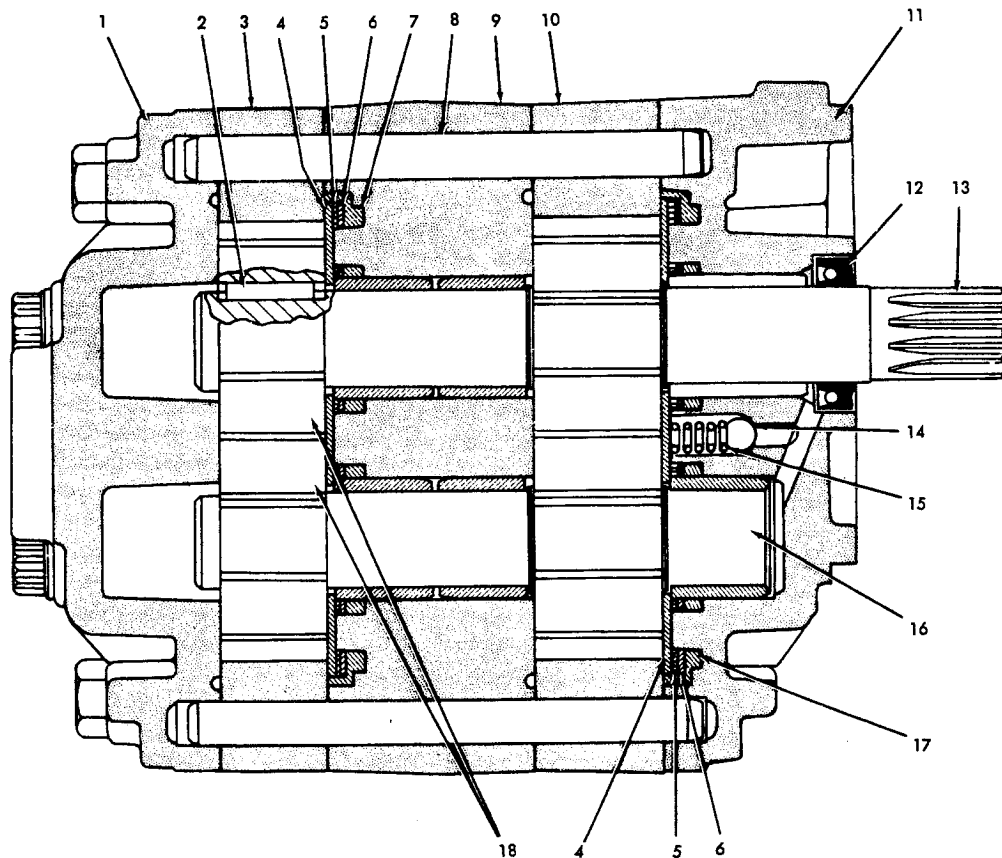


Fig. 9 -- Transmission Oil Pump (HD6EP Eff. S/N 18754 and Up, HD7G Eff. S/N 24276 and Up) (T-72353)

- | | |
|--------------------------------|-----------------------------------|
| 1. Plate, back | 10. Gear housing, scavenge pump |
| 2. Woodruff key | 11. Plate, front |
| 3. Gear housing, pressure pump | 12. Oil seal |
| 4. Diaphragm | 13. Drive shaft and gear assembly |
| 5. Gasket, thick (phenolic) | 14. Ball, check |
| 6. Gasket, thin | 15. Spring, check ball |
| 7. Seal, diaphragm | 16. Idler shaft and gear assembly |
| 8. Dowel | 17. Seal, diaphragm |
| 9. Housing, center | 18. Gears, pressure pump |

- e. Remove diaphragm, Fig. 9 (4), diaphragm gaskets (5) (6), and diaphragm seal (7) or (17) from center housing and front plate; remove springs (15) and balls (14) from front plate.

6. INSPECTION (HD6EP EFF. S/N 18754 AND UP, HD7G EFF. S/N 24276 AND UP)

Wash parts in solvent; dry with compressed air. Remove burrs from gear teeth and mating machined surfaces of gear housings, center housing, and front and rear plates. Wash after deburring.

- a. GEAR HOUSINGS. Refer to Fig. 7; if wear pattern extends no closer to 12:00 than 45° line, housing may be reused; if pattern extends to 1:00 area, housing must be considered worn out.
- b. GEARS AND SHAFT AND GEAR ASSEMBLIES. Replace gears with worn or chipped teeth. Replace shaft(s) if O.D. at any location is less than .685"; replace drive shaft if rough at oil seal location, or if splines show excessive wear or signs of twisting.

NOTE

Gears DO NOT have to be replaced in pairs.

- c. BACK PLATE, FRONT PLATE, AND CENTER HOUSING. Replace if bushing I.D. is more than .691". (Bushings are not serviced.)
- d. DRIVE SHAFT OIL SEAL, DIAPHRAGMS,

AND DIAPHRAGM GASKETS AND SEALS. Replace.

- e. PUMP DRIVING SHAFT. Replace if splines are worn or indicate shaft has twisted.

7. ASSEMBLY (HD6EP EFF. S/N 18754 AND UP, HD7G EFF. S/N 24276 AND UP)

Oil all parts prior to assembly.

- a. Install springs and check balls, Fig. 10, in bores in front plate. Install seals (4) (13) with open side down, gaskets (5) (6), and diaphragms (7) with bronze side up, in front plate and center housing; seal with "ears" goes in front plate. Use dull tool to "tuck" seals into grooves in front plate and center housing; diaphragms (7) will be flush with outer lip of seals when properly installed.
- b. Clamp front plate in a "soft jawed" vise, diaphragm up. Install drive shaft assembly and idler shaft assembly; align marks placed at disassembly and install gear housing, Fig. 10 (11) and center housing (12).

IMPORTANT

Half moon cavities in gear housing must face up (toward center housing) with hole in base of one cavity on pressure side of pump.

- c. Install drive shaft woodruff key, Fig. 10 (10) and pressure pump gears (15). Align marks placed at disassembly; install gear housing (16) and back plate (17).

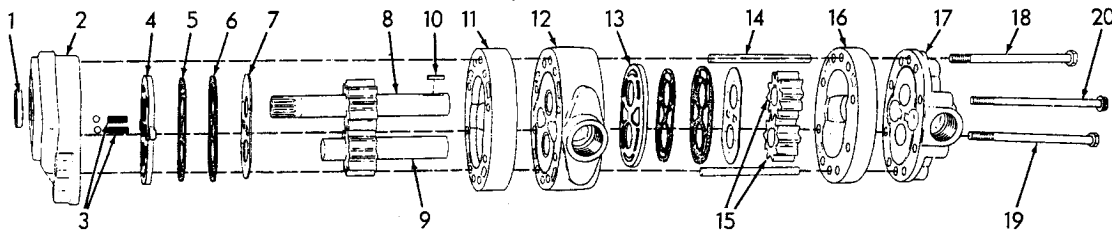


Fig. 10 -- Transmission Oil Pump Parts (HD6EP Eff. S/N 18754 and Up, HD7G Eff. S/N 24276 and Up) (T-71382)

- | | |
|----------------------------------|--------------------------------------|
| 1. Oil seal, drive shaft | 11. Gear housing, scavenge pump |
| 2. Plate, front | 12. Center housing |
| 3. Check balls and springs | 13. Seal, diaphragm |
| 4. Seal, diaphragm | 14. Dowel |
| 5. Gasket, thin | 15. Gears, pressure pump |
| 6. Gasket, thick (phenolic) | 16. Gear housing, pressure pump |
| 7. Diaphragm | 17. Plate, back |
| 8. Drive shaft and gear assembly | 18. Capscrew (4 3/4" long) |
| 9. Idler shaft and gear assembly | 19. Capscrew (5" long) |
| 10. Woodruff key | 20. Capscrew (5" long - 12 pt. head) |

IMPORTANT

Half moon cavities in gear housing must face up (toward back plate) with hole in base of one cavity on pressure side of pump.

- d. Install capscrews, Fig. 10 (18)(19)(20) in proper location; tighten evenly to 25 lb. ft. **DO NOT OVERTIGHTEN!**
 - e. Install drive shaft oil seal, sealing lip directed in.
 - f. Turn drive shaft with pliers; slight drag will be noticed if pump is properly assembled.
8. INSTALLATION

- a. Install splined pump driving shaft in torque converter housing; install pump (with new gasket). Connect oil lines to pump; check hydraulic system oil level.
- b. Check hydraulic system pressures (refer to "TROUBLE SHOOTING AND PRESSURE CHECKING").

D. RANGE SELECTOR VALVE (INCLUDES RELIEF VALVES)

Range selector valve, located on upper right side of transmission case, Fig. 11, directs oil to hydraulic system components; three pressure regulating valves on rear side of valve maintain various circuit pressures.

1. REMOVAL AND DISASSEMBLY

- a. Tilt steering levers and seat assembly forward. Remove brake control rear rod, Fig. 11; loosen rear hose clamp and pull spool from right brake valve.

CAUTION

Keep valve spool and bore **CLEAN**.

Disconnect lube pressure gauge hose, Fig. 11.

- b. Remove transmission bottom guard; disconnect oil lines from range selector valve and cross fitting beneath valve. Identify each hose; cover openings.
- c. Disconnect cross shaft lever from connecting rod, Fig. 11; remove valve; cover opening.
- d. Remove detent cap and washer Fig. 12; pull detent assembly from housing. Loosen rotor lever capscrew; pull lever and woodruff key from rotor stem.
- e. Remove capscrews from valve head;

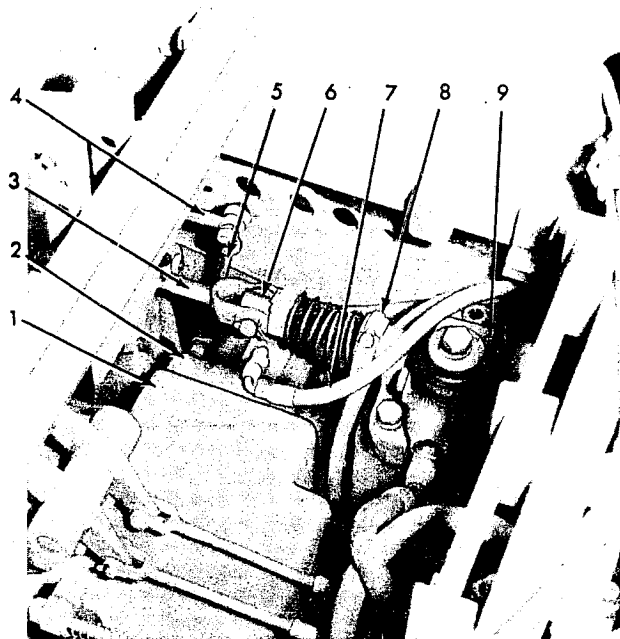


Fig. 11 -- Range Selector Valve Installed (HD6EP Shown - HD7G Similar) (T-35348)

1. Transmission
2. Range selector valve
3. Rod, brake control rear
4. Lever, cross shaft
5. Rod, connecting
6. Spool
7. Hose
8. Hose clamp
9. Brake valve, right

separate valve sections. Remove round plate from head; remove rotor stem seal and retaining washer.

- f. Remove pressure spring retaining plate, Fig. 13; remove springs, valves, and shims (if any). Keep each valve and spring together.

2. INSPECTION

- a. **HEAD, ROTOR HOUSING, VALVE HOUSING.** Remove burrs from machined surfaces; blow out all oil passages with compressed air. Replace rotor housing if rotor bore is out of round or larger than 1.753". Replace valve housing if any valve bore is larger than 1.004" or if valve seats are rough or cracked.
- b. **ROTOR.** Replace: if detent notches are worn excessively or chipped; if out of round or if O.D. is less than 1.746"; if seal area O.D. is rough or less than .620".
- c. **CLUTCH APPLY PRESSURE SPRING.** Free height - 2 1/16"; load when com-

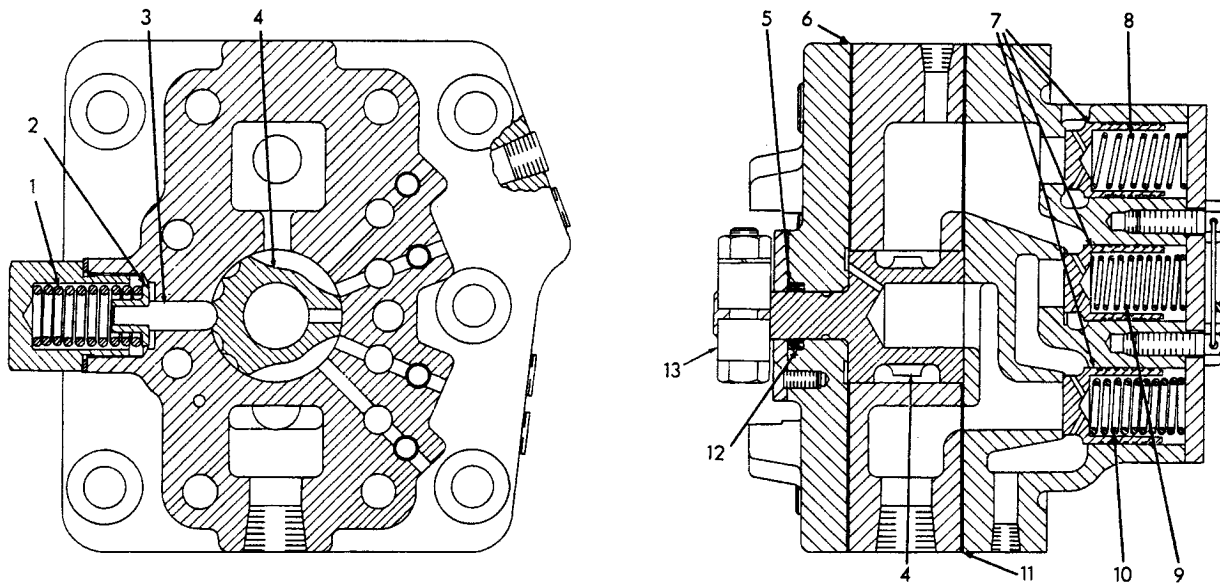


Fig. 12 -- Range Selector Valve - Sectional View
(T-32098)

- | | |
|---|---|
| <ul style="list-style-type: none"> 1. Spring, detent 2. Seat, detent pin 3. Detent pin 4. Rotor 5. Washer, seal retaining 6. Gasket 7. Valves, pressure regulating | <ul style="list-style-type: none"> 8. Spring, clutch lube pressure 9. Spring, torque converter pressure 10. Spring, clutch apply pressure 11. Gasket 12. Oil seal 13. Lever |
|---|---|

pressed to $1 \frac{9}{32}$ " - 34.7 lbs. Shims may be added to bring spring within specifications.

sticking in bore. Replace if seat area is rough or chipped. Clean oil passages in seat end.

d. TORQUE CONVERTER PRESSURE SPRING.

3. ASSEMBLY AND INSTALLATION

(1) Prior to HD6EP S/N 16007 and HD7G S/N 23003 - Free height $2 \frac{1}{32}$ "; load when compressed to $1 \frac{9}{32}$ " 9.2 lbs. Shims may be added to bring spring within specifications.

Clean and dry valve components; coat with light oil prior to assembly; use NEW rotor oil seal.

(2) Eff. with HD6EP S/N 16007 and HD7G S/N 23003 - Free height $2 \frac{1}{8}$ "; load when compressed to $1 \frac{9}{32}$ " 5 lbs. Shims may be added to bring spring within specifications.

a. Install rotor and place gasket on each side of rotor housing. Align the three valve sections; install attaching capscrews but do not tighten. Coat rotor oil seal and rotor stem with oil; carefully install seal over rotor stem into valve head (sealing lip directed toward rotor). Install seal retaining washer and plate Fig. 13; tighten capscrews attaching the three valve sections.

e. CLUTCH LUBE PRESSURE SPRING. Free height - $1 \frac{17}{32}$ "; load when compressed to $1 \frac{9}{32}$ " - 3 lbs. Shims may be added to bring spring within specifications.

b. Turn rotor so keyway in stem is directly opposite detent location; install detent assembly, Fig. 13, spring, and cap. Install woodruff key and rotor lever; move lever each direction to be certain detent assembly works properly. Return rotor to neutral (middle) position.

f. DETENT SPRING. Free height - $2 \frac{1}{32}$ "; load when compressed to $1 \frac{9}{32}$ " - 9.2 lbs. Replace if not close to specifications.

g. VALVES. Replace or dress down if

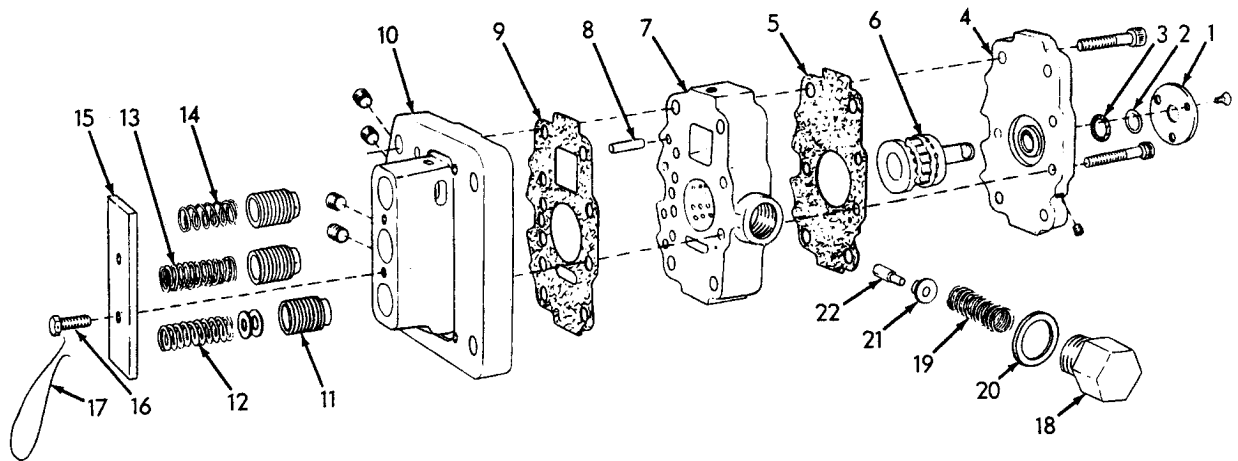


Fig. 13 -- Range Selector Valve Parts
(T-41793)

- | | |
|-------------------------------|---------------------------------------|
| 1. Plate, seal retaining | 12. Spring, clutch apply pressure |
| 2. Washer, seal retaining | 13. Spring, torque converter pressure |
| 3. Oil seal | 14. Spring, clutch lube pressure |
| 4. Head | 15. Plate, spring retaining |
| 5. Gasket | 16. Capscrew |
| 6. Rotor | 17. Locking wire |
| 7. Housing, rotor | 18. Cap, detent spring |
| 8. Pin | 19. Spring, detent |
| 9. Gasket | 20. Washer |
| 10. Housing, regulating valve | 21. Seat, detent spring |
| 11. Valves | 22. Detent pin |

- c. Install pressure regulating valves, Fig. 12; install pressure springs (with required shims) in proper valve, Fig. 13. Install spring retaining plate; lock capscrews with locking wire.
- d. Clean mating surface of valve and transmission case; install valve (with new gasket) Fig. 11.
- e. Connect oil lines to valve and cross fitting beneath valve; install transmission bottom guard. Install right brake valve spool, Fig. 11, and rear control rod.
- f. Move valve rotor to neutral (middle) position and speed shift hand lever to neutral. Adjust length of connecting rod, Fig. 11 as necessary to align capscrew hole in connecting rod and cross shaft right lever; install capscrew.
- g. Tilt seat and steering levers back to normal position; check hydraulic system pressures (refer to "TROUBLE SHOOTING AND PRESSURE CHECKING").

E. TRAVEL SPEED GOVERNOR

Travel speed governor, mounted on upper left side of transmission, automatically maintains constant tractor speed; governor setting is controlled by operator.

1. REMOVAL AND DISASSEMBLY

- a. Tilt steering levers and seat assembly forward. Disconnect control rod and oil lines from governor; remove governor from transmission case.
- b. Refer to Fig. 16, remove high speed adjustment screw and jam nut from top of governor housing; remove housing cover and gasket.
- c. Remove speed control and terminal shaft levers. Refer to Fig. 14, remove lever pin (5) and roll pin (16); remove speed control shaft, ballhead plunger (with fork, spring, and bearing assembly), floating lever, and speed control lever.

- d. Remove cotter pins, Fig. 14 (9), terminal shaft Fig. 16 (41) and stub shaft (18). Remove terminal lever assembly, power piston pin, Fig. 16 (39) and piston (40) from housing.

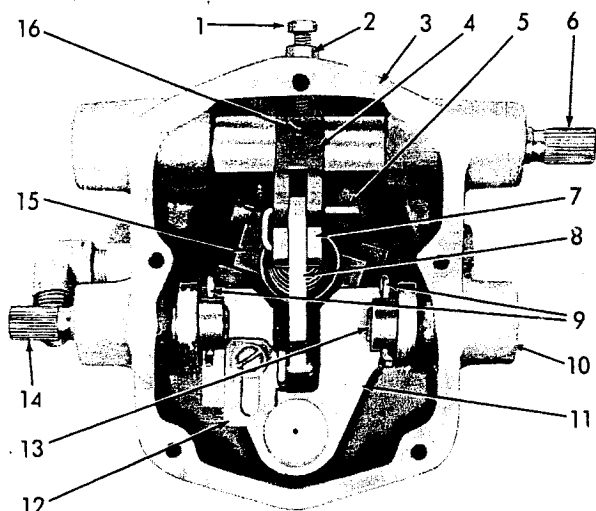


Fig. 14 -- Travel Speed Governor - Cover Removed (T-35103)

1. Screw, high speed adjustment
2. Jam nut
3. Housing
4. Lever, speed control
5. Pin
6. Shaft, speed control
7. Fork
8. Lever
9. Cotter pins
10. Plug
11. Lever assembly, terminal
12. Bracket, droop adjustment
13. Shaft, terminal lever stub
14. Shaft, terminal lever
15. Ballarms
16. Roll pin

- e. Remove ballhead shaft snap ring, Fig. 15; pull ballhead assembly from housing.
- f. Remove base, Fig. 16 (2), sealing ring (3), and spacer (4); remove oil inlet plug (42), spring (11), and sleeve (43).

NOTE

Do not remove terminal shaft bearings, Fig. 16 (19) or speed control shaft bearings (16) unless shafts are excessively worn.

2. INSPECTION

Clean all components in clean solvent and dry with compressed air. Inspect speed

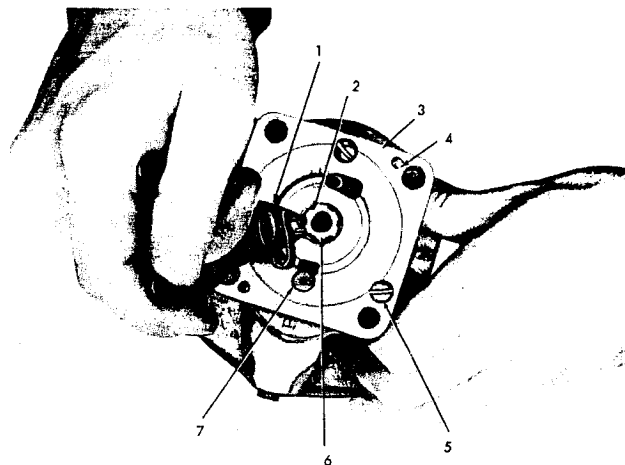


Fig. 15 -- Removing Ballhead Shaft Snap Ring (T-35117)

1. Pliers
2. Snap ring
3. Base
4. Dowel
5. Screw
6. Shaft, ballhead
7. Stud

control shaft and terminal shafts for wear; if diameter of surfaces contacting bearings is .372" or less, shafts and bearings should be replaced. Check power piston for wear, scoring, or grooves. Piston diameter should not be less than .748"; replace if necessary. Inspect ballhead valve plunger for nicking or chipping on land edges; edges must be sharp and clean and contact surfaces should be smooth and free of scoring. Install ballhead valve plunger into ballhead shaft and check for free movement within ballhead shaft. Replace valve plunger if diameter is less than .249". It is advisable to install new oil seals and gaskets when assembling governor.

3. ASSEMBLY

- a. If speed control shaft and terminal shaft bearings were removed, install speed control shaft bearings so inner ends of bearings are .507" to .522" apart and equidistant from centerline of ballhead shaft bore. Install terminal shaft bearings so inner ends of bearings are 2.573" to 2.588" apart and equidistant from power piston bore. Ream bearings to .3755" - .3765" after installation.
- b. Install oil inlet sleeve, Fig. 16 (43) and spring (11) in bore; install oil inlet plug (42) with washer (12).
- c. Install spacer Fig. 16 (4) on stud (6); install base (2) on housing (use new sealing ring).

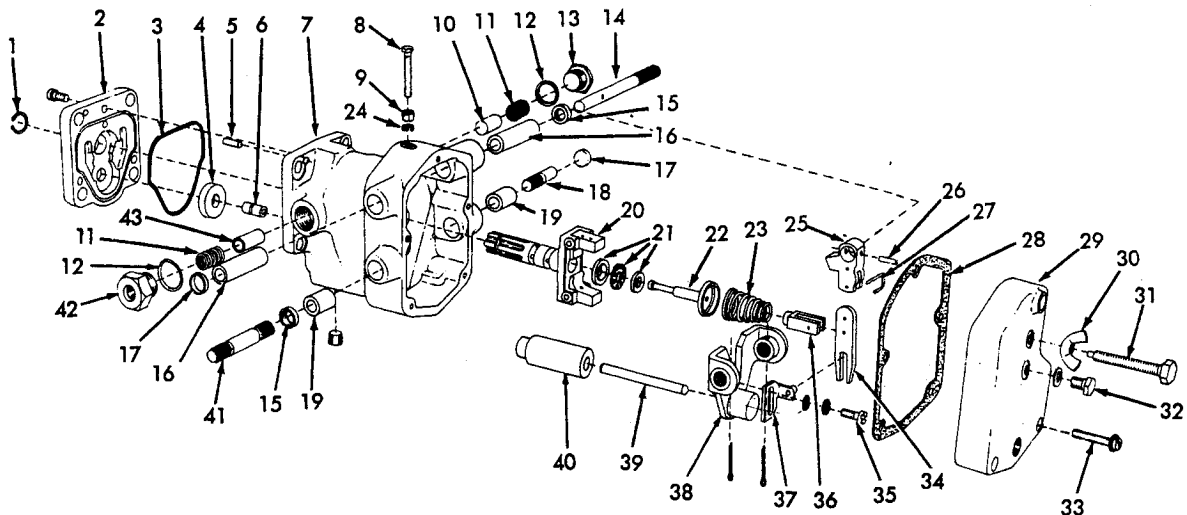


Fig. 16 -- Travel Speed Governor Parts
(T-70864)

- | | |
|------------------------------------|---------------------------------|
| 1. Snap ring | 23. Spring |
| 2. Base | 24. Washer |
| 3. Ring, sealing | 25. Lever, speed control |
| 4. Spacer | 26. Roll pin |
| 5. Dowel | 27. Pin |
| 6. Stud | 28. Gasket |
| 7. Housing | 29. Cover |
| 8. Capscrew, high speed adjustment | 30. Wing nut |
| 9. Jam nut | 31. Screw, low speed adjustment |
| 10. Plug | 32. Vent capscrew |
| 11. Spring | 33. Screw |
| 12. Washer | 34. Floating lever |
| 13. Plug | 35. Screw, droop adjustment |
| 14. Shaft, speed control | 36. Fork |
| 15. Oil seal | 37. Bracket, droop adjustment |
| 16. Bearing, speed control shaft | 38. Lever, terminal shaft |
| 17. Plug | 39. Pin |
| 18. Shaft, terminal lever stub | 40. Piston |
| 19. Bearing, terminal shaft | 41. Shaft, terminal |
| 20. Ballhead | 42. Plug |
| 21. Bearing assembly | 43. Sleeve |
| 22. Plunger | |

- d. Install ballhead assembly Fig. 16 (20), power piston (40) and pin (39) in housing; install ballhead snap ring, Fig. 15.
- e. Install shaft oil seals in their respective bores (sealing lip of seals directed inward); lubricate seals freely.
- f. Refer to Fig. 14, place terminal lever assembly (11) in housing; install terminal lever shafts and secure to terminal lever assembly with cotter pins (9). Install cup plug (10) in stub shaft bore.
- g. Move droop adjustment bracket to maximum droop position, Fig. 14; secure with droop adjustment screw.
- h. With ballarms, Fig. 14 (15) in collapsed position, install thrust bearings, Fig. 16 (21), ballhead valve plunger (22), spring (23), and ballhead spring fork (36) on ballhead assembly.
- i. Place speed control lever, Fig. 14 (4) in housing; install speed control shaft (6) and secure to lever with roll pin (16).
- j. Position floating lever Fig. 14 (8) on droop adjustment bracket (12), ballhead spring fork (7), and speed control lever (4); secure floating lever with pin (5). Lock pin by bending end.
- k. Install housing cover (with new gasket).

4. ADJUSTMENT AND INSTALLATION

- a. HD6EP, HD7G prior to S/N 23003, temporarily install speed control shaft lever, Fig. 17 (3). Adjust high speed screw (2) to obtain 7/8" total lever travel, DIM. "A"; remove lever and reinstall to obtain 7/16" travel each direction from vertical, DIM. "C".

Turn terminal shaft clockwise against internal stop; install lever, Fig. 17 (6) with yoke pin hole centerline 1 3/4" rear of vertical, DIM. "B".

IMPORTANT

Terminal shaft lever must clear governor housing when in forward position. Reposition lever if necessary.

Install governor on transmission case (use new gasket); connect governor oil lines. Move engine controls to low idle position (DO NOT START ENGINE). Hold terminal shaft lever so yoke pin hole centerline is 1 1/2" rear of vertical; adjust length of

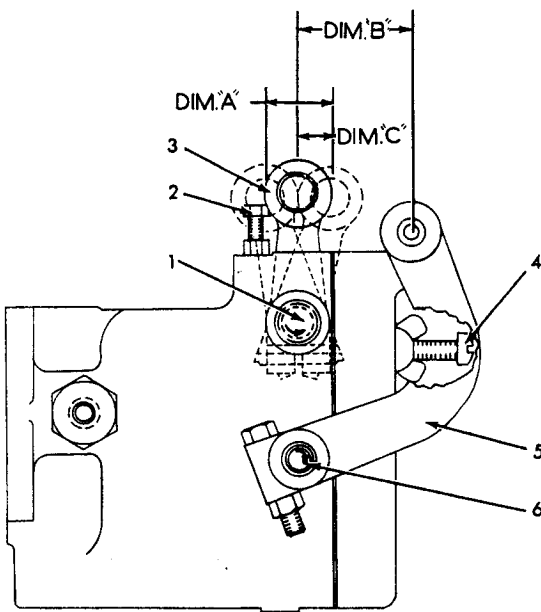
lever control rod so yoke pin is easy slip fit through control rod and lever. Install yoke pin.

Hold speed control shaft lever all the way forward; adjust length of lever control rod so swivel pin is easy slip fit in lever (over-travel assembly fully extended). Install swivel pin.

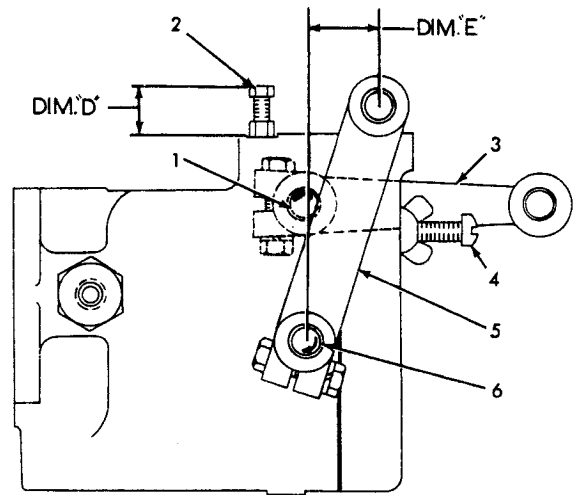
- b. HD7G eff. S/N 23003 and up, turn high speed adjustment screw, Fig. 17 (2) in or out until top of adjustment screw head is 3/4" above housing, DIM. "D"; lock cap-screw.

Turn speed control shaft clockwise against internal stop; install lever, Fig. 17 (3) in horizontal position. Turn terminal shaft clockwise against internal stop; install lever, Fig. 17 (5) with yoke pin hole centerline 1 1/2" rear of vertical, DIM. "E".

Install governor on transmission case (use new gasket); connect governor oil lines. Move engine controls to low idle position (DO NOT START ENGINE). Hold terminal



HD6EP, HD7G PRIOR TO S/N 23003



HD7G EFF S/N 23003 AND UP

Fig. 17 -- Travel Speed Governor Lever Installation
(T-72354)

1. Shaft, speed control
2. Screw, high speed adjustment
3. Lever, speed control shaft
4. Screw, low speed adjustment
5. Lever, terminal shaft

6. Shaft, terminal
- DIM. "A" 7/8" DIM. "D" 3/4"
 DIM. "B" 1 3/4" DIM. "E" 1 1/2"
 DIM. "C" 7/16"

shaft lever so yoke pin hole centerline is 1" rear of vertical; adjust length of lever control rod so yoke pin slips easily through control rod and lever. Install yoke pin.

Connect link to speed control shaft lever; disconnect governor control (vertical) rod from bellcrank lever assembly. Hold speed control shaft lever all the way up; adjust length of governor control rod so swivel pin is slip fit in bellcrank lever (over-travel assembly fully extended). Install swivel pin.

- c. All models, start engine; warm to normal operating temperature. Operate engine at low idle; transmission in neutral; turn low speed adjustment screw, Fig. 17 (4) until terminal shaft just contacts internal stop; back screw out 1/2 turn and lock. Adjust engine control linkage to obtain specified low and high idle speeds (refer to pertinent "Operating Instructions and Field Maintenance" Manuals).

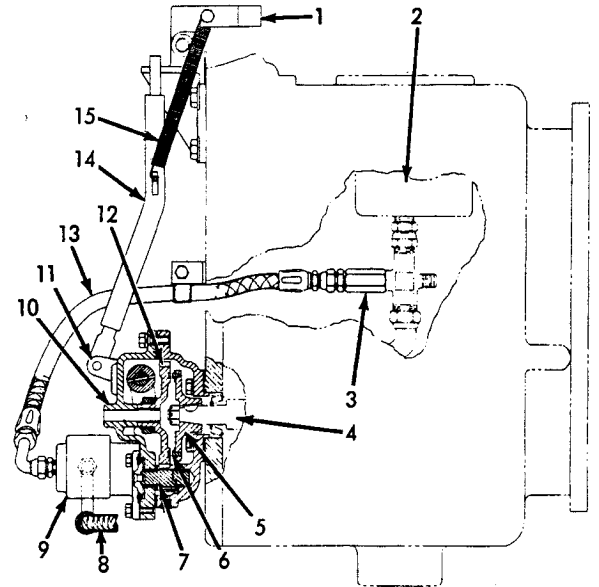


Fig. 18 -- Push-Start Pump and Controls (T-32152)

F. PUSH-START PUMP (SPECIAL EQUIPMENT)

Pump supplies oil to hydraulic system when tractor is pushed or towed to start engine. Pump is driven from reverse shaft but operates only when drive, Fig. 18, is engaged by operator. Check valve, Fig. 18(3) opens only when push-start pump is operating.

1. REMOVAL AND DISASSEMBLY

- a. Drain oil from left steering clutch compartment; reinstall drain plug. Remove transmission bottom guard; disconnect pump hoses; remove pump.

NOTE

If pump drive appears to be damaged, remove front housing, Fig. 19 and repair or replace necessary parts; reinstall front housing.

- b. Mark pump sections; remove screws from gear housing; separate gear housing from stator, Fig. 20. DO NOT PRY APART. Remove shafts and gears from gear housing.
- c. If needle bearings are to be replaced (refer to "INSPECTION"), drive or pull bearings from their bores. Pull drive shaft oil seal from stator.
- d. Remove relief valve assembly, Fig. 20, from gear housing.

2. INSPECTION

a. REPLACE:

- (1) Gear housing and/or stator if excessively worn or scored;

1. Lever, operating
2. Valve, range selector
3. Valve, check
4. Shaft, high speed reverse idler
5. Disc
6. Pin
7. Gear
8. Oil line, suction
9. Pump
10. Housing
11. Lever, cross shaft
12. Gear
13. Oil line, pressure
14. Rod
15. Spring

- (2) Drive shaft and/or idler shaft if O.D. at bearing area is less than .438";

- (3) Needle bearings if .021" feeler gauge can be inserted between needles;

- (4) Gears if teeth are chipped or worn.

- b. Relief valve spring tension should be 13 3/4 lbs. when compressed to 1.44". Spring may be shimmed to meet specifications.

- c. Use new drive shaft oil seal when assembling pump.

3. ASSEMBLY AND INSTALLATION

NOTE

Before installing pump, remove and inspect check valve, Fig. 18(3). Valve must open at 1 to 5 psi from male end and must not leak from female end.

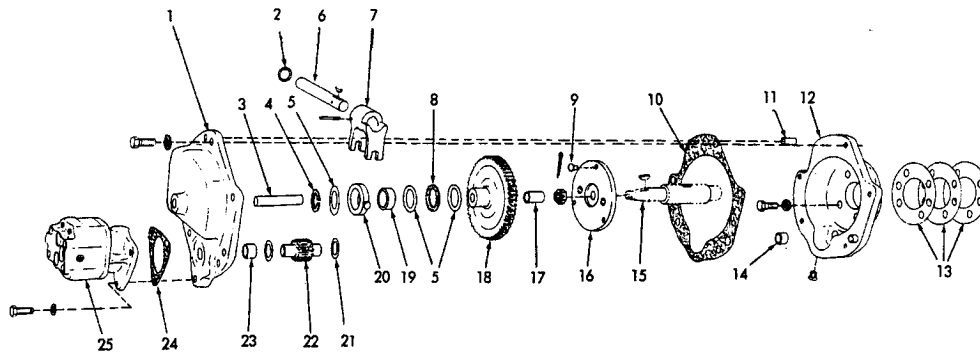


Fig. 19 -- Pump Drive Components
(T-41784)

- | | | |
|-------------------------|--------------------------|------------------|
| 1. Housing, front | 10. Gasket | 19. Bushing |
| 2. Seal | 11. Dowel | 20. Yoke |
| 3. Pin, gear supporting | 12. Housing, rear | 21. Race, thrust |
| 4. Snap ring | 13. Shims | 22. Gear |
| 5. Race, thrust bearing | 14. Bushing | 23. Bushing |
| 6. Shaft, cross | 15. Shaft, reverse idler | 24. Gasket |
| 7. Lever | 16. Disc, friction | 25. Pump |
| 8. Bearing, thrust | 17. Bushing | |
| 9. Pin | 18. Gear | |

- a. If new needle bearings are used, drive or press slightly below machined surface around bores.
- b. Install relief valve assembly and expansion plugs in gear housing, Fig. 20. Install drive shaft oil seal in stator, sealing lip directed toward stator bolting flange.
- c. Install drive shaft and idler shaft assemblies in gear housing; align marks placed at disassembly; secure gear housing to stator (use new gasket).

CAUTION

Do not damage drive shaft oil seal.

- d. Pump capacity (for bench test):
 - Oil: SAE #10
 - Oil Temp.: 130° F.
 - Pump Speed: 3600 rpm
 - Pump Output: 7.0 gpm
- e. Clean mating surface of pump and pump drive front housing, Fig. 19; install pump (with new gasket). Connect pump hoses; install transmission bottom guard.
- f. Fill hydraulic system with specified lubricant (refer to "LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE").

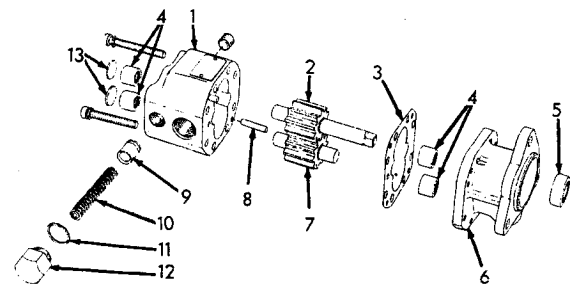


Fig. 20 -- Push-Start Pump Parts
(T-30900)

1. Housing, gear
2. Drive shaft and gear
3. Gasket
4. Bearings
5. Oil seal
6. Stator
7. Idler shaft and gear
8. Dowel
9. Plunger
10. Spring
11. Gasket
12. Cap
13. Plugs

G. OIL COOLER

Oil cooler **MUST** be removed, cleaned, and inspected

whenever major repairs are made to any component in hydraulic system. Complete instructions for servicing is contained in Engine Service Manual, Form 645120.

TOPIC 4 TRANSMISSION

A. MECHANICAL OPERATION

Transmission, Fig. 21, is constant mesh, with front and rear gear trains. Two power shift hydraulic clutch assemblies provide smooth high speed shifts. Each clutch assembly is actually two clutches on one shaft; top shaft, Fig. 21, carries forward clutches and gears, bottom shaft carries reverse clutches and gears. Clutches are hydraulically applied and spring released.

Engine power is transmitted through torque converter to transmission input shaft, Fig. 21; input shaft gear is in mesh with front (drive) gear on each clutch shaft. When tractor is operating in 1st forward, rear clutch on top shaft is engaged. Respective clutch drum and gear, Fig. 21, drives low speed gear on bevel pinion shaft. When tractor is operating in 2nd forward, front clutch on top shaft is engaged. Respective clutch drum and gear, Fig. 21, drives high speed gear on bevel pinion shaft. When tractor is operating in 1st reverse, rear clutch on bottom shaft is engaged. Respective clutch drum and gear, Fig. 21, drives idler gear (7); idler drives low speed gear on bevel pinion shaft. When tractor is operating in 2nd reverse, front clutch on bottom shaft is engaged. Respective clutch drum and gear, Fig. 21, drives idler gear (13); idler drives high speed gear on bevel pinion shaft.

Some models are equipped with push-start pump and/or travel speed governor. Push-start pump is driven from front end of 2nd reverse idler shaft; travel speed governor is driven through an idler by input shaft gear.

B. REMOVAL

Clean transmission area before removal. When disconnecting oil lines, cover openings to prevent entrance of dirt.

1. Drain oil from steering clutch compartments and bevel gear compartment; clean and reinstall drain plugs. Remove transmission bottom guard; drain transmission by removing suction line screen.
2. Disconnect and identify oil lines beneath range selector valve. Disconnect torque converter return lines from transmission side cover. Remove supporting clips.
3. Tilt steering levers and seat frame forward; remove rear jam nuts from rod ends, Fig. 22 (8). Remove attaching capscrews from seat supporting front channel; remove seat frame and support channel assembly.
4. Disconnect cross shaft end levers, Fig. 22 (9), from connecting rod ends and steering control rods (2) from control valve plungers.

Remove two capscrews from steering lever bracket (6); remove steering controls and cross shaft (7) as an assembly.

5. Disconnect and remove travel speed governor control rods, Fig. 23, (if so equipped). Identify and disconnect oil lines from oil filter; remove filter and mounting bracket.
6. Remove rear pin from brake control rear rods, Fig. 23 (3); remove brake pedal, control rods, and bellcrank bracket (each side) as an assembly. Pull spool from each brake valve.

CAUTION

Keep valve spool and bore CLEAN.

7. Disconnect transmission pump and steering pump suction lines from oil reservoir cover on front of transmission and transmission pump (scavenging) return line from front of left steering clutch compartment. Disconnect steering reservoir vent hose (late models only); remove transmission oil pump with attached hoses.
8. Remove universal joint; disconnect oil lines from push-start pump and remove pump (if so equipped). Swing oil level gauge tube, Fig. 23, aside for clearance.
9. Remove transmission with suitable hoist.

C. DISASSEMBLY

Clean transmission case before disassembly; identify and disconnect remaining oil lines on case.

1. If equipped, remove travel speed governor and push-start pump operating lever and bracket. Remove push-start pump and drive gear front housing, Fig. 25; remove pump drive disc, Fig. 24. Use pusher screws; remove rear housing, Fig. 24, with bearing adjustment shims; keep shims with housing.
2. Remove drive shaft rear yoke with puller similar to one in Fig. 24.
3. Refer to Fig. 25, remove range selector valve, side cover, closure plate, and top and bottom shaft oil collectors (with bearing adjustment shims).
4. Insert clean cloth between input shaft gear and clutch shaft front gears to prevent clutch shafts turning; unlock and remove clutch shaft front bearing retaining nuts. Remove cloth; use pusher screws to remove input shaft bearing retainer (with shaft and gear assembly).

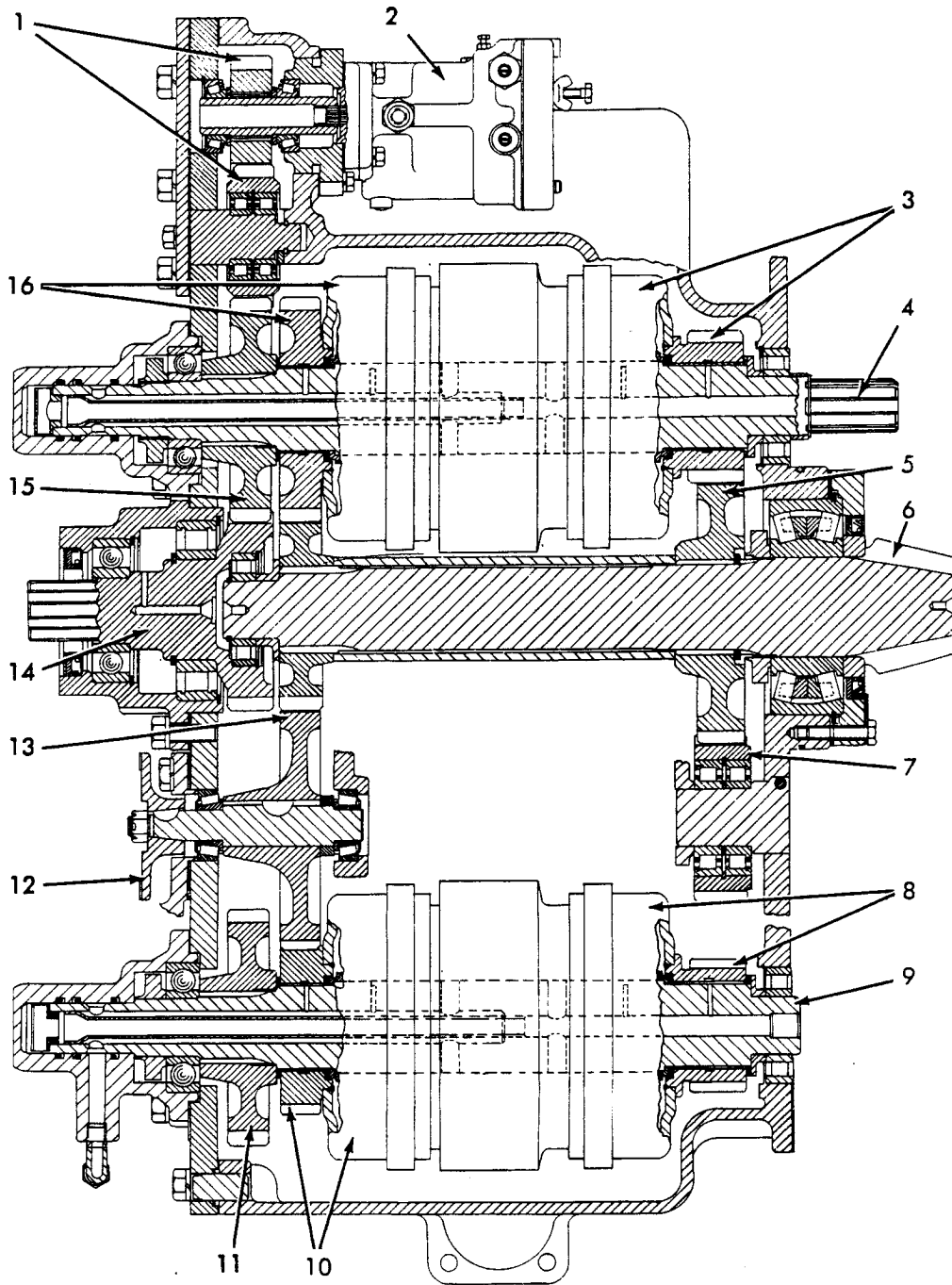


Fig. 21 -- Transmission Assembly
(T-25890)

- | | |
|--------------------------------------|---------------------------------------|
| * 1. Gears, governor driving | 9. Shaft, bottom |
| * 2. Governor, travel speed | 10. Clutch drum and gear, 2nd reverse |
| 3. Clutch drum and gear, 1st forward | 11. Gear, drive |
| 4. Shaft, top | * 12. Flange, push-start pump driving |
| 5. Gear, low speed | 13. Gear, 2nd reverse idler |
| 6. Shaft, bevel pinion | 14. Shaft, input |
| 7. Gear, 1st reverse idler | 15. Gear, drive |
| 8. Clutch drum and gear, 1st reverse | 16. Clutch drum and gear, 2nd forward |

*Special equipment some models

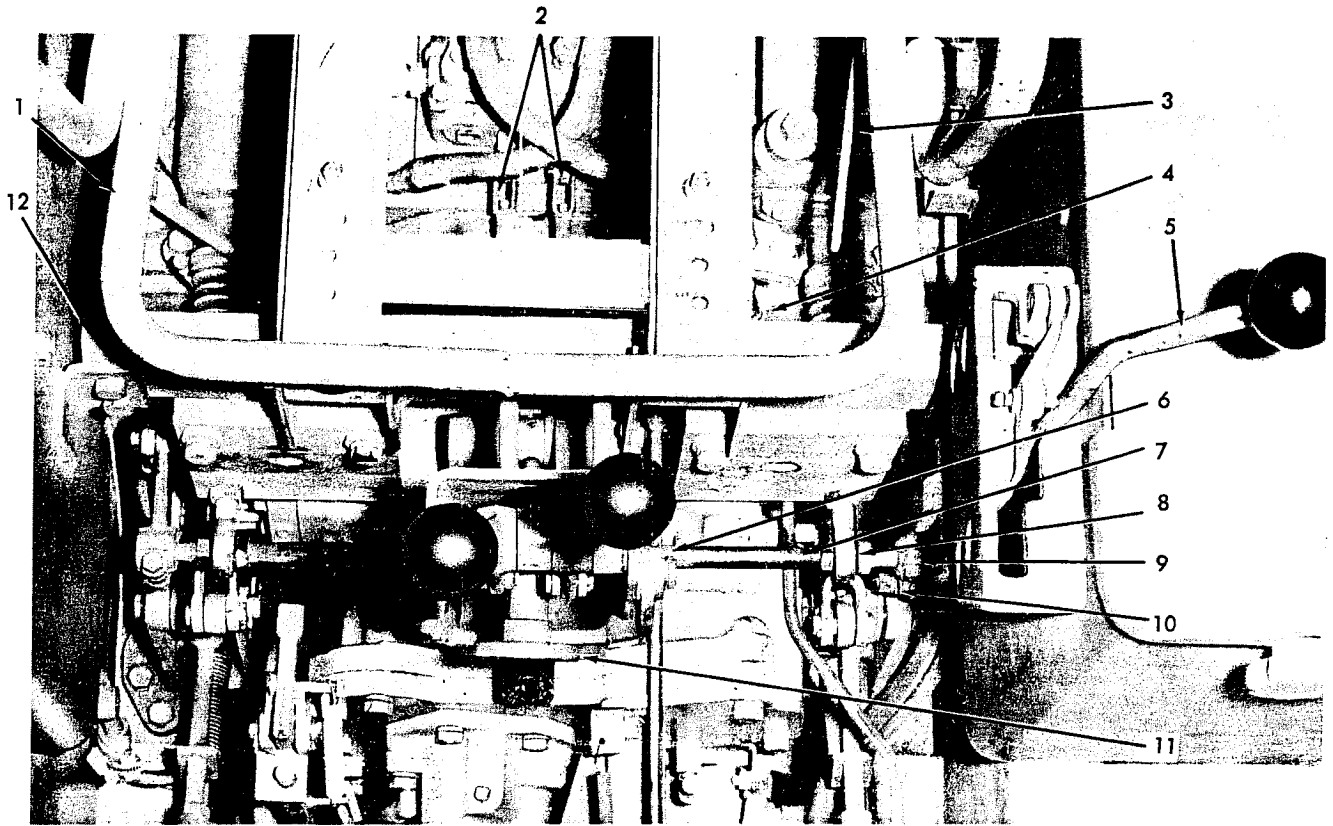


Fig. 22 -- Transmission Installed Prior to Removal of Seat Frame
(Early HD6EP Shown - HD7G Similar)
(T-35121)

- | | |
|----------------------------|------------------------------|
| 1. Seat frame | 7. Cross shaft |
| 2. Control rods, steering | 8. Rod end |
| 3. Seat lock | 9. Lever, end |
| 4. Gauge rod, transmission | 10. Capscrew |
| 5. Lever, range selector | 11. Knob |
| 6. Bracket | 12. Channel, seat supporting |

5. Remove clutch shaft front bearings; use pusher screws to remove front cover, Fig. 26.

NOTE

If impossible to remove bearings without damaging shaft ends or front cover, cover and bearings may be removed together, Fig. 27, by alternately raising front cover and pushing shafts down. Do not damage shaft ends or shaft rear bearings.

6. Refer to Fig. 28, remove travel speed governor drive gear (if equipped), top and bottom shaft drive gears, and high speed reverse idler gear and shaft assembly.
7. Remove snap ring from front end of bevel pinion shaft; use puller similar to one in Fig. 29 to remove bevel pinion shaft high speed gear, washer, and front bearing race.

8. Use lifting tool shown in Fig. 30; remove top and bottom shaft assemblies. Remove bevel pinion shaft spacer and low speed (rear) gear, Fig. 31.

9. Remove bevel pinion shaft rear bearing retainer, Fig. 31, and bearing adjustment shims; tie shims to retainer. Remove rear bearing snap ring (11) and pinion depth adjustment shims; tie shims to snap ring. Remove shaft from case. If rear bearing must be replaced, remove snap ring, Fig. 31(7) and bearing retaining nut (9); use suitable press to remove rear bearing and spacer.

10. Drive low speed reverse idler shaft out rear of case; catch steel locking ball as it falls from rear of shaft. Remove gear and bearings from case; remove bearings from each side of gear if worn.

11. Remove clutch shaft rear bearings from case if worn.

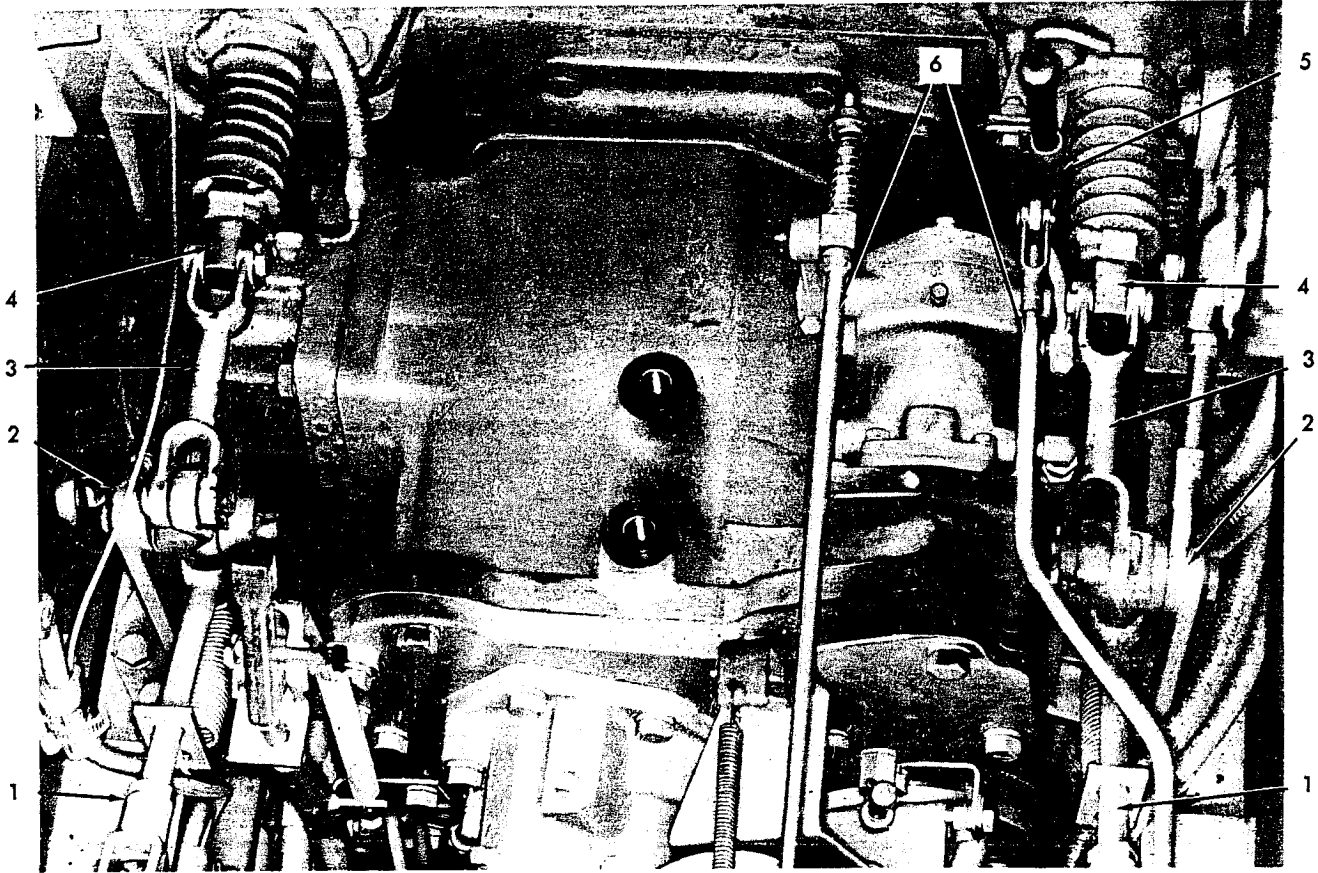


Fig. 23 -- Transmission Installed After Removal of Steering Lever Bracket
(Early HD6EP Shown - HD7G Similar)
(T-35010)

- | | |
|-----------------------------|---|
| 1. Rod, brake control front | 4. Spool, brake valve |
| 2. Bracket, bellcrank | 5. Tube, gauge rod |
| 3. Rod, brake control rear | *6. Rods, travel speed governor control |
- *Special equipment some models

12. Disassemble each clutch shaft as follows:

- a. Remove snap ring from rear end of shaft. Attach puller behind rear clutch drum gear teeth, Fig. 32; pull oil seal sleeve (top shaft only), rear bearing inner race, rear bearing spacer, rear clutch drum and gear, and clutch drum thrust washer as an assembly.
- b. Refer to Fig. 33, slide thrust washer and lock plate from shaft; remove capscrews (3). Press clutch hub back plate down by hand and remove clutch hub retainer (4); remove clutch assembly from shaft.
- c. Remove front clutch drum and gear; remove front clutch assembly as in Step b.
- d. Remove actuating piston retaining snap ring, Fig. 34; install filler ring, Fig. 39 in snap ring groove with chamfered side toward piston. Slide piston housing off piston; remove piston and housing from shaft.

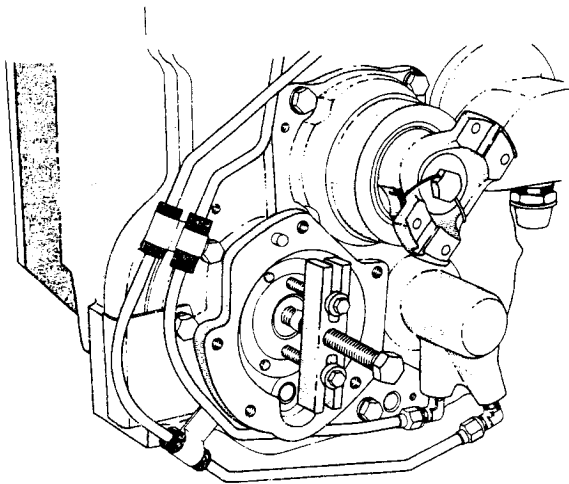
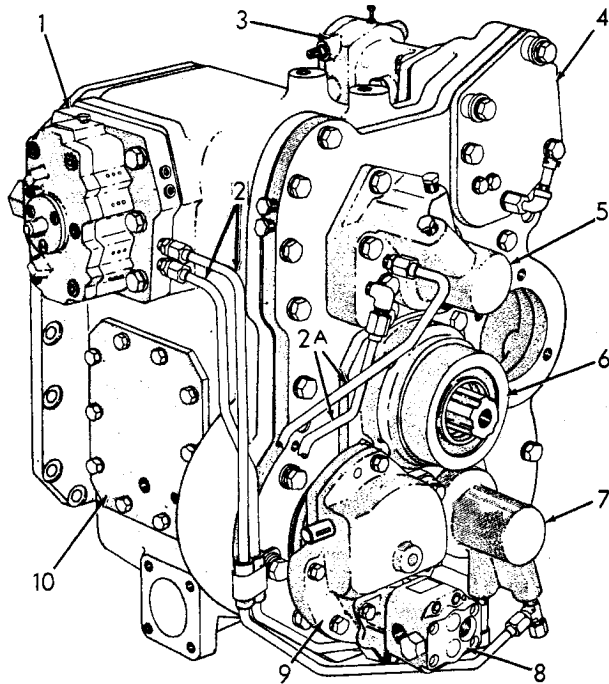
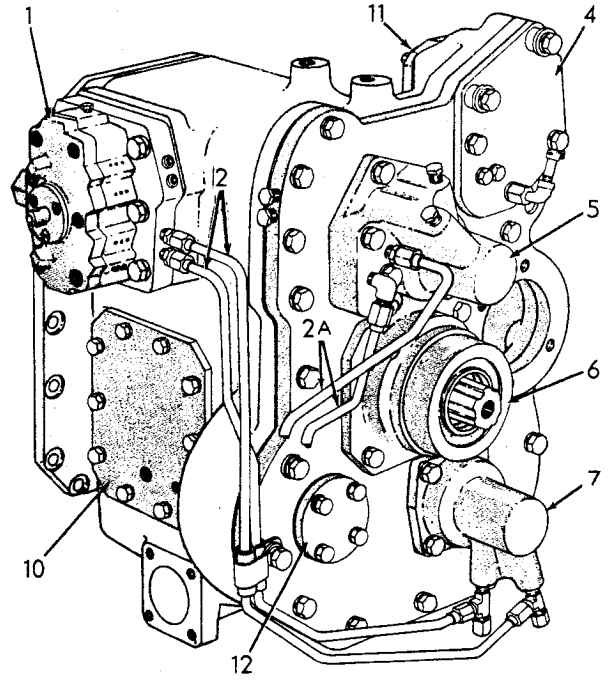


Fig. 24 -- Removing Push-Start Pump Drive Disc
(T-72375)



WITH PUSH-START PUMP
AND TRAVEL SPEED GOVERNOR



WITHOUT PUSH-START PUMP
AND TRAVEL SPEED GOVERNOR

Fig. 25 -- Transmission Front View
(T-72355)

- | | |
|--|---|
| <ul style="list-style-type: none"> 1. Valve 2. Oil lines, bottom shaft (HD6EP eff. S/N 16007 and up, HD7G eff. S/N 23003 and up) 2A. Oil lines, bottom shaft (HD6EP prior to S/N 16007, HD7G prior to S/N 23003) 3. Governor 4. Plate, closure 5. Collector, top shaft | <ul style="list-style-type: none"> 6. Retainer, input shaft 7. Collector, bottom shaft 8. Pump 9. Housing 10. Cover, side 11. Cover, governor 12. Cover, reverse shaft bearing |
|--|---|

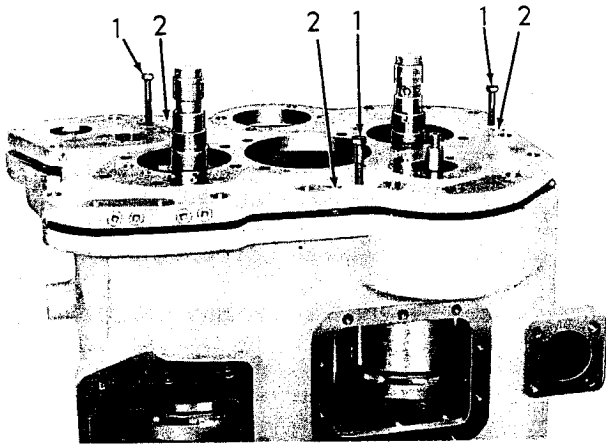


Fig. 26 -- Removing Transmission Front Cover
(T-35039)

- 1. Pusher screws
- 2. Dowels

- e. Remove accelerator piston snap rings, Fig. 35; slide pistons from shaft. Remove shaft sealing rings and accelerator piston sealing rings.
- f. Remove valve discs and backing discs, Fig. 35, and separator plate o-ring. If necessary to replace separator plate, remove snap ring from each side of plate, Fig. 38. Cut separator plate to within 3/16" of shaft in two places and drive wedge in one cut to expand separator plate bore; slide separator plate from shaft.
- g. Remove clutch hub back plate snap ring and clutch hub snap ring, Figs. 36 and 37; remove locking pin retaining ring, Fig. 38 (21), back plate (19), and locking pin (22). Remove friction plates from clutch hub.

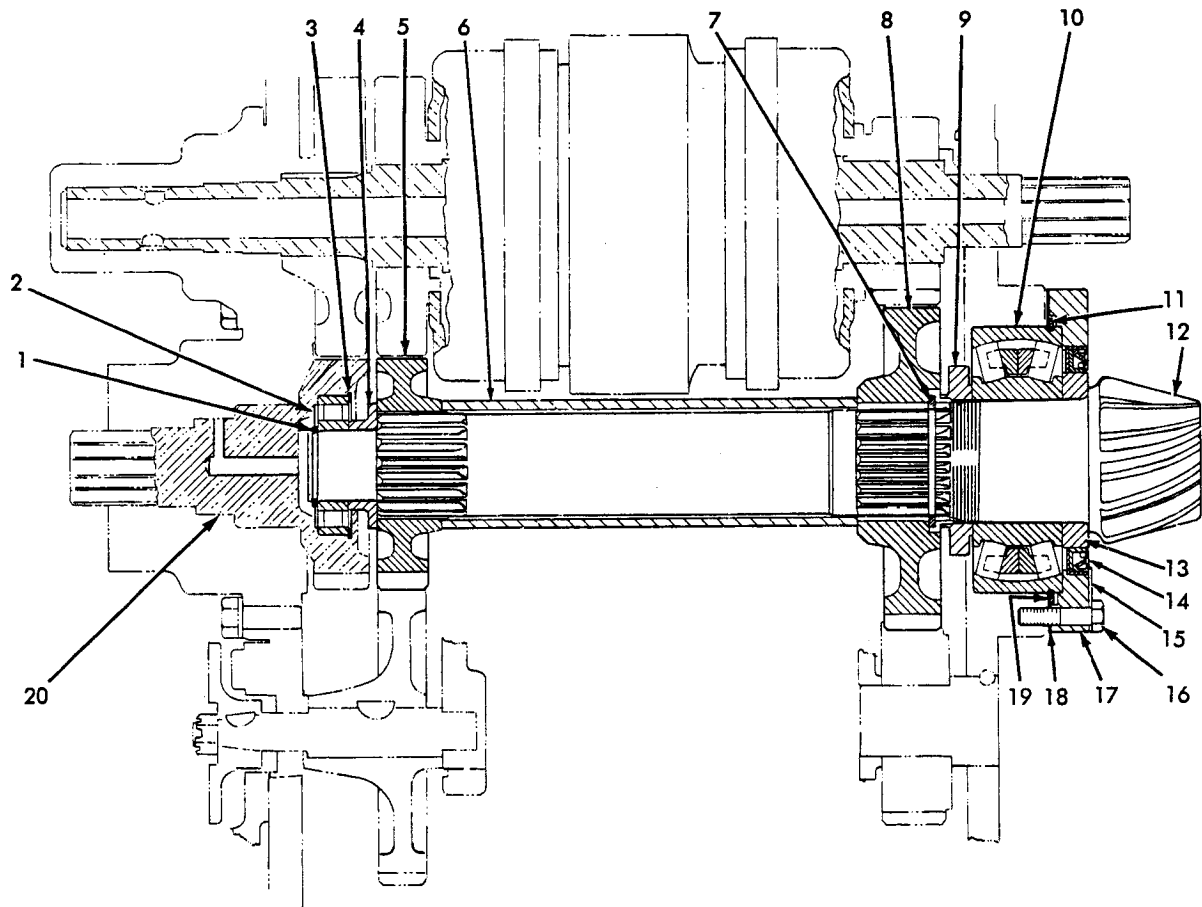


Fig. 31 -- Bevel Pinion Shaft
(T-35127)

- | | |
|---------------------------|------------------------------------|
| 1. Snap ring | 11. Snap ring |
| 2. Bearing, front | 12. Shaft |
| 3. Snap ring | 13. Spacer |
| 4. Washer | 14. Oil seal |
| 5. Gear, high speed | 15. Locking plate |
| 6. Spacer | 16. Capscrew |
| 7. Snap ring | 17. Retainer, rear bearing |
| 8. Gear, low speed | 18. Shims, bearing adjustment |
| 9. Nut, bearing retaining | 19. Shims, pinion depth adjustment |
| 10. Bearing, rear | 20. Shaft, input |

- c. Install accelerator pistons Fig. 38 (24) on shaft, over sealing rings and against valve discs; secure each piston with snap ring, Fig. 35.
- d. Install each accelerator piston sealing ring, Fig. 38 (25) and shaft sealing rings (23) in grooves nearest accelerator pistons; interlock ends of each ring.
- e. Install snap ring groove filler ring, Fig. 39 (2) with chamfer toward outside; carefully slide piston housing (from front of shaft) over shaft sealing ring, accelerator piston sealing ring, and separator plate

o-ring. Install actuating piston sealing ring (3); carefully slide piston (from rear of shaft) over shaft sealing ring, accelerator piston sealing ring, and into piston housing. Remove snap ring groove filler ring and install snap ring.

- f. Turn clutch hub spring retainer so springs are straight. Alternately install bronze and steel friction plates on clutch hub; start and finish stack with bronze plate.
- g. Align locking pin grooves in clutch hub and back plate, Fig. 38 (19); install back plate (flat side against friction plates) and locking

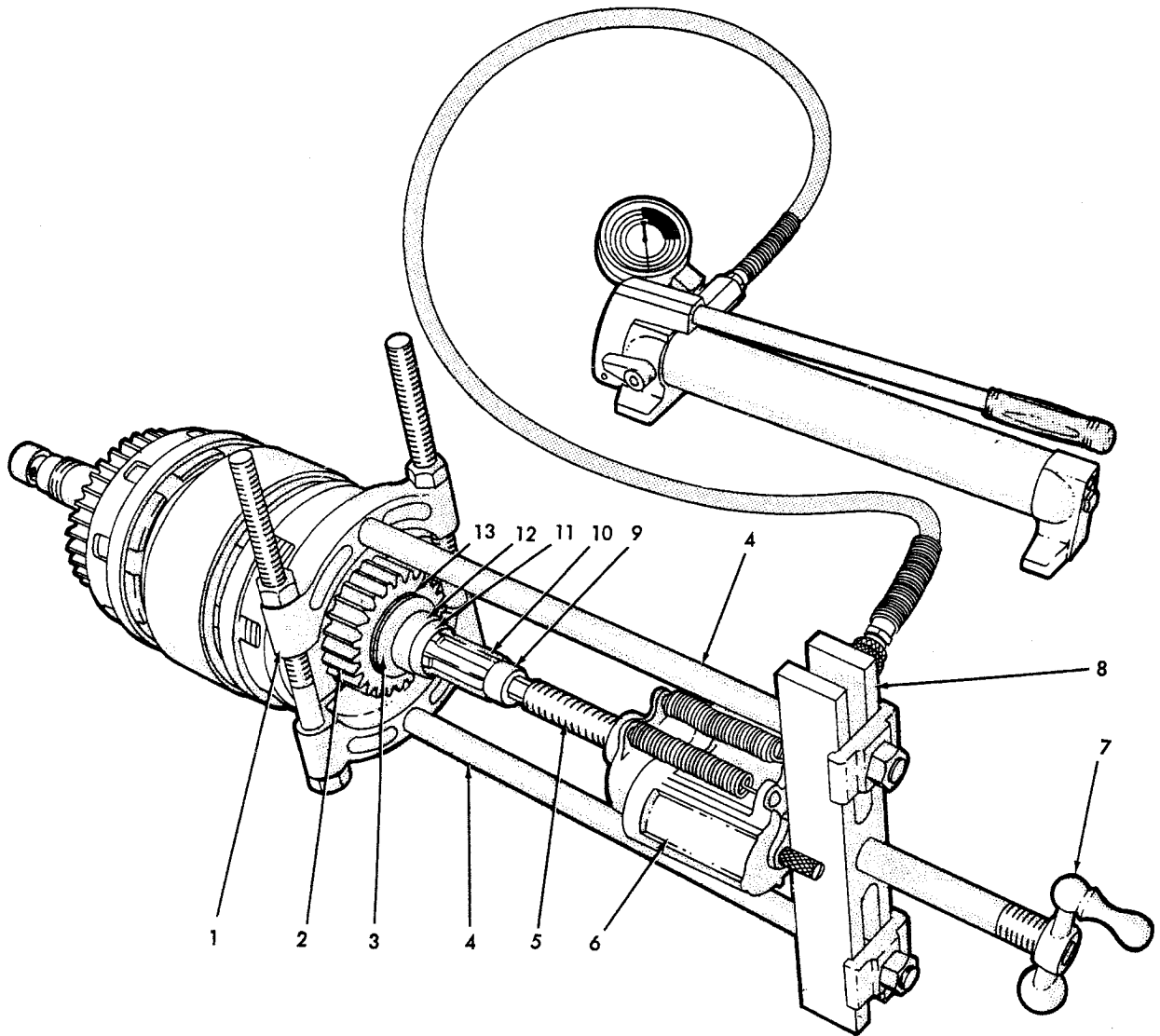


Fig. 32 -- Removing Rear Clutch Drum and Gear
(T-72340)

- | | |
|------------------------------------|---------------------|
| 1. Puller attachment | 8. Push-puller |
| 2. Clutch drum and gear | 9. Protector |
| 3. Spacer, rear bearing | 10. Shaft |
| 4. Legs | 11. Oil seal sleeve |
| 5. Ram screw | 12. Bearing race |
| 6. Hydraulic ram and pump assembly | 13. Thrust washer |
| 7. Crank | |

pin (22). Install locking pin retaining washer (21), clutch hub snap ring (18), and back plate snap ring (20).

IMPORTANT

Be certain back plate snap ring is fully seated in groove.

h. Start clutch hub assembly (back plate

first) on shaft to align splines in clutch hub and spring retainer with splines on shaft without twisting clutch hub springs. Withdraw clutch hub assembly and reinstall (spring retainer end first) on shaft.

i. Press clutch hub back plate down and install clutch hub retainers, Fig. 33 (4) in groove in shaft. Align bolt holes in retainers with holes in clutch hub; draw clutch hub up

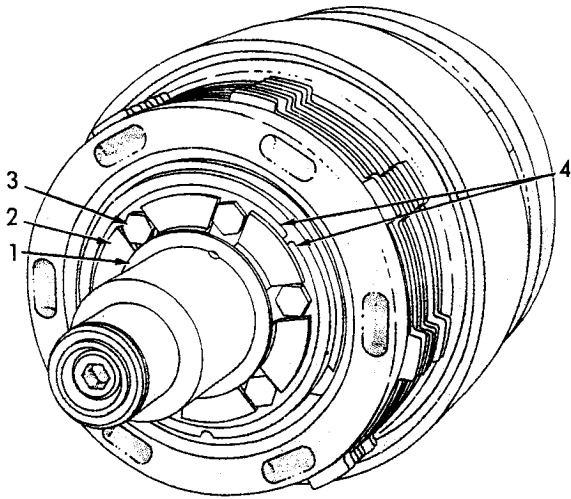


Fig. 33 -- Clutch Shaft Assembly - Clutch Drum and Gear Removed (T-72341)

1. Thrust washer
2. Spacer (capscrew lock plate)
3. Capscrews
4. Retainers

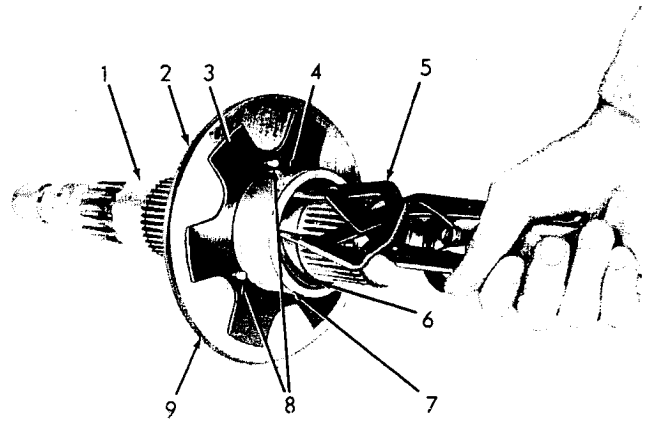


Fig. 35 -- Removing Clutch Accelerator Piston Snap Ring (T-35088)

1. Shaft
2. Plate, separator
3. Discs, valve and backing
4. Piston
- *5. Pliers (Tool #AC-802)
6. Snap ring
7. Sealing rings, accelerator piston
8. Dowels
9. O-ring

*Order from Owatonna Tool Company, Owatonna, Minnesota

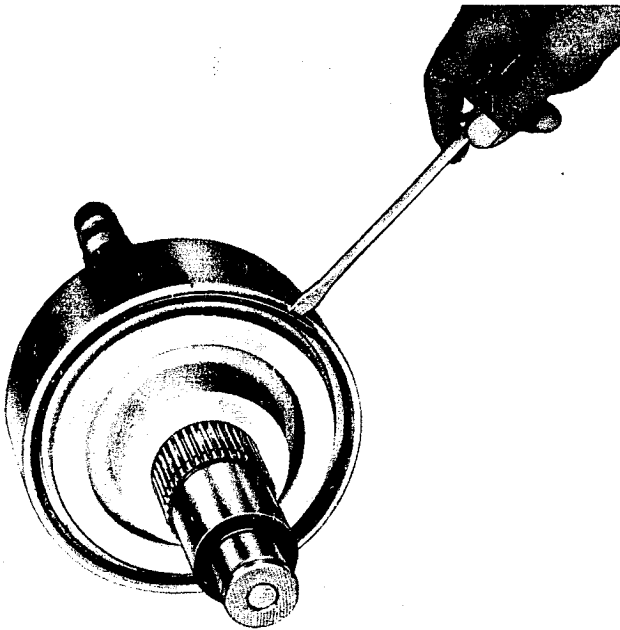


Fig. 34 -- Removing Clutch Actuating Piston Retaining Snap Ring (T-35085)

against retainers by tightening clutch hub retainer capscrews (3). Turn capscrews so that slots in spacer (2) will go over capscrew heads; install spacer on shaft

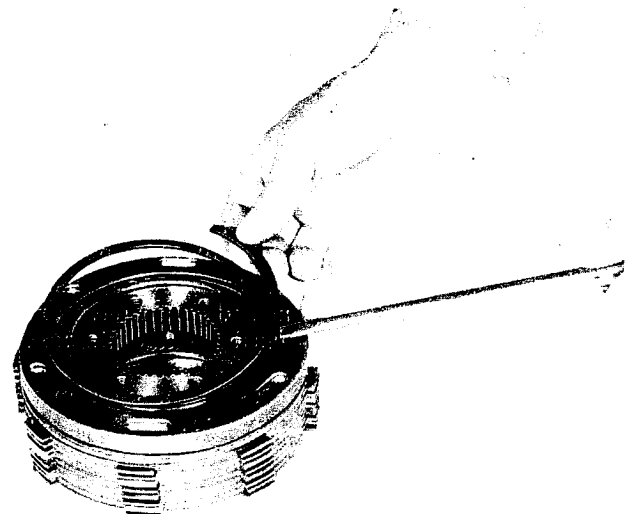


Fig. 36 -- Removing Clutch Hub Back Plate Snap Ring (T-35069)

with flat side against clutch hub retainers. Install thrust washer (1).

j. If clutch drum bushing must be replaced

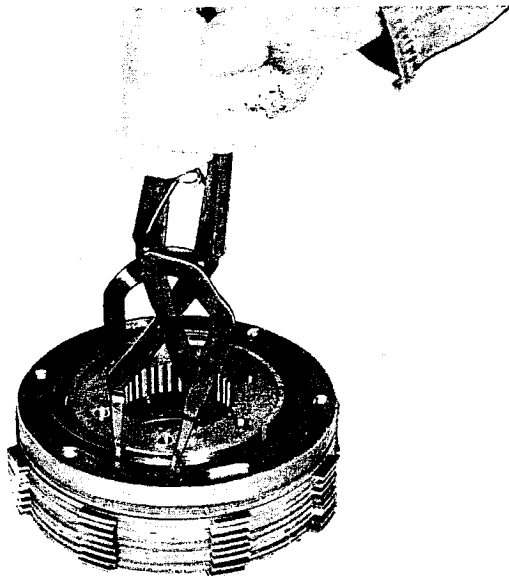


Fig. 37 -- Removing Clutch Hub Snap Ring
(T-35070)

(refer to "INSPECTION") drive out old bushing; drive new bushing in bore until approximately $1/32$ " below machined surface of gear. After bushing is properly positioned stake in two places in oil groove 180° apart. Install proper clutch drum and gear over clutch plates.

- k. Install thrust washer, Fig. 38 (11), spacing washer (37), oil seal sleeve (40) (top shaft only), and snap ring (41).
- l. Turn clutch shaft end for end, install front clutch assembly on shaft; secure with clutch hub retainers and capscrews. Turn capscrews so slots in spacer will go over capscrews heads; install spacer with flat side against clutch hub retainer. Install thrust washer, Fig. 38 (11), proper clutch drum and gear (12), and thrust washer (11). Tie front and rear clutch drum and gear together until installed in case.
- m. Assemble bottom shaft in same manner as top shaft; refer to Fig. 40.

2. BEVEL PINION SHAFT

- a. Heat bearing spacer, Fig. 41 (2) and rear bearing (10) in oil at 275° F. Install spacer with chamfer in I.D. toward gear; install bearing with snap ring groove in O.D. toward gear. Tap spacer and bearing firmly against gear.
- b. Install rear bearing retaining nut and torque to 530 to 570 lbs. ft.; lock nut by staking. Install shaft snap ring, Fig. 41 (13).

3. INPUT SHAFT

NOTE

HD6EP Tractors eff. S/N 18647 and up and HD7G Tractors eff. S/N 24234 and up, torque converter return oil drains to input shaft bearing retainer to provide additional lubrication for input shaft bearings, and bevel pinion shaft front bearing. If rebuilding transmission from tractor prior to either of these serial no's., we recommend that late style input shaft, input shaft bearing retainer, oil line and fitting be installed to update transmission. Refer to pertinent Parts Catalog for part numbers.

- a. Refer to Fig. 42, install front bearing (6) and snap ring (7); rear bearing (14) and snap ring (10) in bearing retainer. Install oil seal (5) in retainer with sealing lip directed inward.
- b. Install rear bearing inner race, Fig. 42 (13) and snap ring (8) on input shaft; install bevel pinion shaft front bearing (11) and snap ring (12) in I.D. of input shaft gear.
- c. Refer to Fig. 43, press input shaft through front bearing in retainer; remove shaft from press and install drive shaft rear yoke, Fig. 42 (19), seal (4), washer (3), and capscrew (2). Tighten capscrew until snug.

4. INSTALLATION OF COMPONENTS IN TRANSMISSION CASE

Clean inside of transmission case before installing components.

- a. Install clutch shaft rear bearings, Figs. 38 and 40; drive bearings in from rear until against snap ring in bore. Assemble low speed reverse idler gear and bearings, Fig. 40, and install in case with flat side of gear toward front. Drive idler shaft, Fig. 40 (48) through bearings from rear until solid against bearings; align shaft locking ball with notch in case while installing shaft. Install high speed reverse idler bearing cup, Fig. 40 (14) in its bore.
- b. Install bevel pinion shaft rear bearing snap ring; install shaft from rear and drive forward until snap ring is tight against case. Hold rear bearing retainer (without shims) firmly against rear bearing; measure gap between retainer and transmission case. Make shim pack equal to measurement plus $.001$ " to obtain specified bearing endplay; keep shims with retainer. Drive shaft back slightly and remove rear bearing snap ring; install original pinion depth adjustment shims or shim pack approximately $.071$ " thick and reinstall

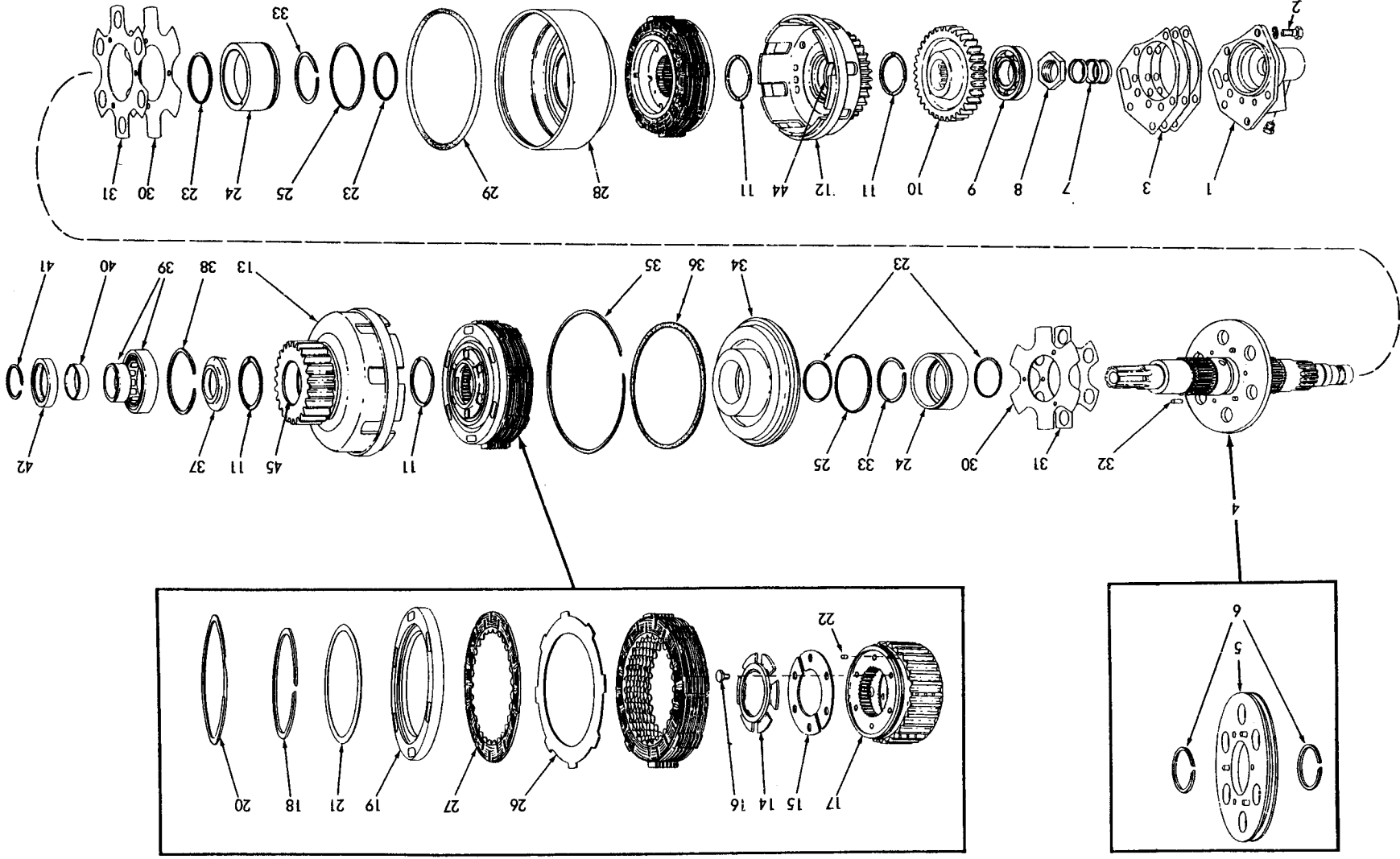


Fig. 38 -- Top Shaft Parts
(T-70923)

1. Collector
2. Capscrew
3. Shims
4. Shaft
5. Plate, separator
6. Snap rings
7. Seals, collector
8. Nut
9. Bearing, front
10. Gear, drive
11. Washer, thrust
12. Clutch drum and gear, high speed
13. Clutch drum and gear, low speed
14. Spacer (capscrew lock plate)
15. Retainers, clutch hub
16. Capscrew
17. Hub, clutch
18. Snap ring, clutch hub
19. Back plate
20. Snap ring, back plate
21. Retainer, locking pin
22. Locking pin
23. Sealing rings, shaft
24. Piston, accelerator
25. Sealing ring, accelerator piston
26. Plate, steel friction
27. Plate, bronze friction
28. Housing, actuating piston
29. O-ring, separator plate
30. Disc, valve
31. Disc, backing
32. Dowel pin
33. Snap ring
34. Piston, actuating
35. Snap ring
36. Sealing ring, actuating piston
37. Washer, spacing
38. Snap ring
39. Bearing, rear
40. Sleeve, oil seal
41. Snap ring
42. Oil seal
43. Sealing ring kit (not illustrated)
44. Bushing
45. Bushing

snap ring. Drive shaft forward until snap ring is tight against shims.

- c. Install oil seal, Fig. 41 (3) in bevel pinion shaft rear bearing retainer with spring side out. Install bearing retainer (with shim pack previously determined); lock attaching capscrews with lock plates.
- d. Install bevel pinion shaft rear gear, Fig. 41 (12) with long hub toward front, and sleeve (14).
- e. Refer to Fig. 30, install top and bottom shafts; be certain shaft rear bearing races are properly seated in rear bearings. Remove retaining wires from clutch drums.

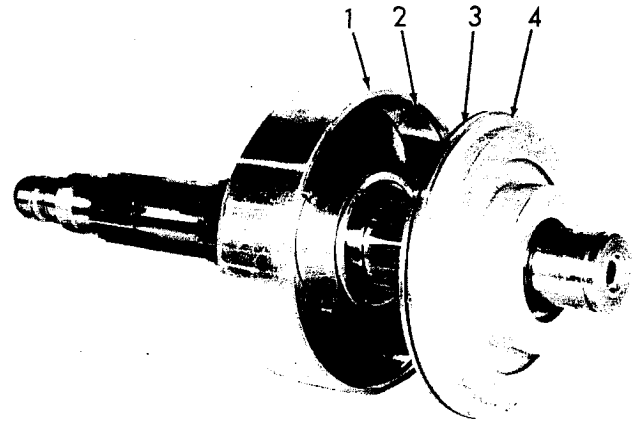


Fig. 39 -- Actuating Piston Prior to Installation in Piston Housing
(T-70968)

1. Housing
- *2. Tool, snap ring groove filler ring (Tool #AC-801)
3. Sealing ring
4. Piston

*Order from Owatonna Tool Company, Owatonna, Minnesota

- f. Refer to Fig. 44, install bevel pinion shaft high speed gear (5) with long hub toward rear and washer (6), flat side against gear. Install front bearing race (7) and secure with snap ring.
- g. Refer to Fig. 40, install thrust washers (18) on front of each clutch drum and gear; assemble high speed reverse idler gear (11), spacer (12) and bearings (15) (16) on shaft. Install reverse idler gear and shaft assembly, Fig. 44, and clutch shaft front gears.
- h. Transmissions with travel speed governor refer to Fig. 45, install snap ring (12) and front bearing cup (9) in front cover bore; install rear bearing cup (9) in retainer (4). Assemble gear (11), spacers (10), and bearings (8) on shaft (7); install shaft assembly in case, Fig. 44.

Install snap ring Fig. 45 (15), spacer (16), and bearings (14) in I.D. of gear (13); install gear and bearing assembly on shaft (17); secure with spacer (19) and snap ring (20). Drive shaft and gear assembly in front cover bore from rear until shaft is flush with front side of cover.

- i. Install high speed reverse front bearing cup in front cover, flush with rear side of cover.
- j. Install front cover (with new gasket); install hose supporting clips under proper capscrews.

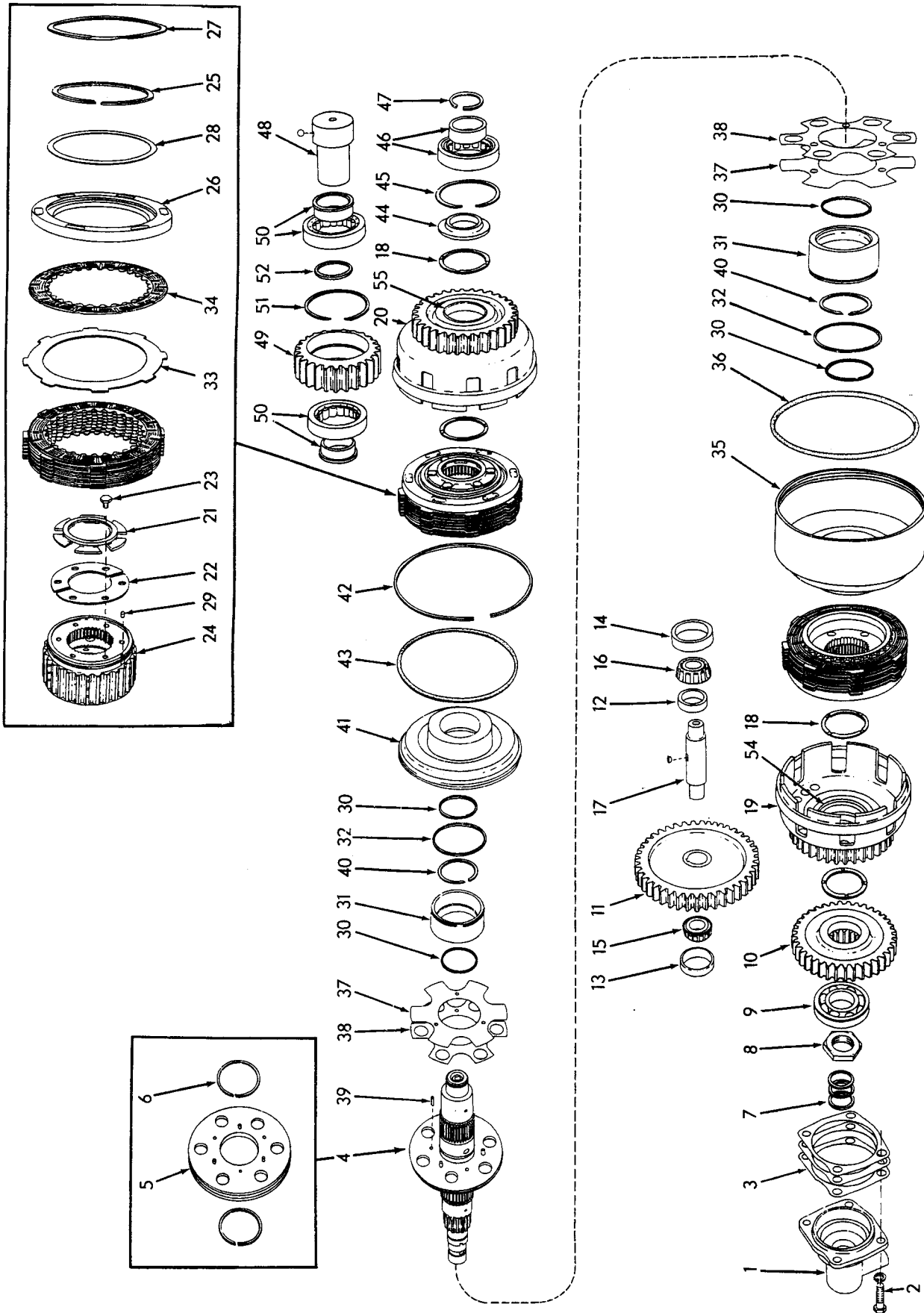


Fig. 40 -- Bottom Shaft Parts
(T-70922)

- | | |
|--------------------------------------|--|
| 1. Collector | 29. Locking pin |
| 2. Capscrew | 30. Sealing rings, shaft |
| 3. Shims | 31. Piston, accelerator |
| 4. Shaft | 32. Sealing ring, accelerator piston |
| 5. Plate, separator | 33. Plate, steel friction |
| 6. Snap rings | 34. Plate, bronze friction |
| 7. Seals, collector | 35. Housing, actuating piston |
| 8. Nut | 36. O-ring, separator plate |
| 9. Bearing, front | 37. Disc, valve |
| 10. Gear, drive | 38. Disc, backing |
| 11. Idler gear, high speed reverse | 39. Dowel pin |
| 12. Spacer | 40. Snap ring |
| 13. Cup, front | 41. Piston, actuating |
| 14. Cup, rear | 42. Snap ring |
| 15. Cone assembly, front | 43. Sealing ring, actuating piston |
| 16. Cone assembly, rear | 44. Washer, spacing |
| 17. Shaft | 45. Snap ring |
| 18. Washer, thrust | 46. Bearing, rear |
| 19. Clutch drum and gear, high speed | 47. Snap ring |
| 20. Clutch drum and gear, low speed | 48. Shaft |
| 21. Spacer (capscrew lock plate) | 49. Idler gear, low speed reverse |
| 22. Retainers, clutch hub | 50. Bearing |
| 23. Capscrew | 51. Snap ring |
| 24. Hub, clutch | 52. Spacer |
| 25. Snap ring, clutch hub | 53. Sealing ring kit (not illustrated) |
| 26. Back plate | 54. Bushing |
| 27. Snap ring, back plate | 55. Bushing |
| 28. Retainer, locking pin | |

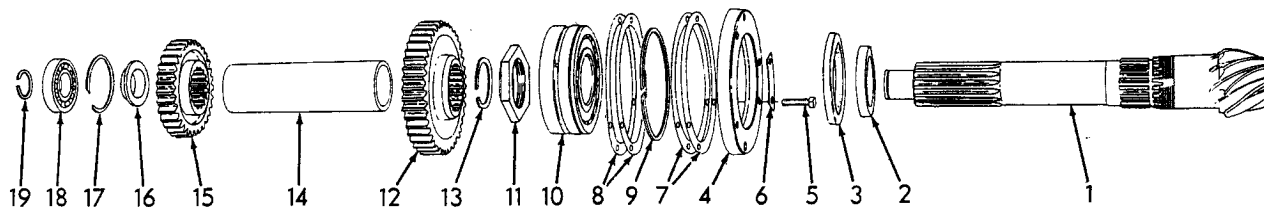


Fig. 41 -- Bevel Pinion Shaft Parts
(T-38141)

- | | |
|-----------------------------------|----------------------|
| 1. Shaft | 11. Nut |
| 2. Spacer | 12. Gear, low speed |
| 3. Oil seal | 13. Snap ring |
| 4. Retainer, rear bearing | 14. Sleeve |
| 5. Capscrew | 15. Gear, high speed |
| 6. Lock plate | 16. Washer, spacing |
| 7. Shims, bearing adjustment | 17. Snap ring |
| 8. Shims, pinion depth adjustment | 18. Bearing, front |
| 9. Snap ring | 19. Snap ring |
| 10. Bearing, rear | |

5. INSTALLATION AND ADJUSTMENT OF FRONT BEARINGS

NOTE

Refer to Step b. under INSTALLATION OF

COMPONENTS IN TRANSMISSION CASE for bevel pinion shaft rear bearing adjustment.

- a. Models equipped with travel speed governor, hold bearing retainer, Fig. 45 (4) (without shims) firmly against bearing

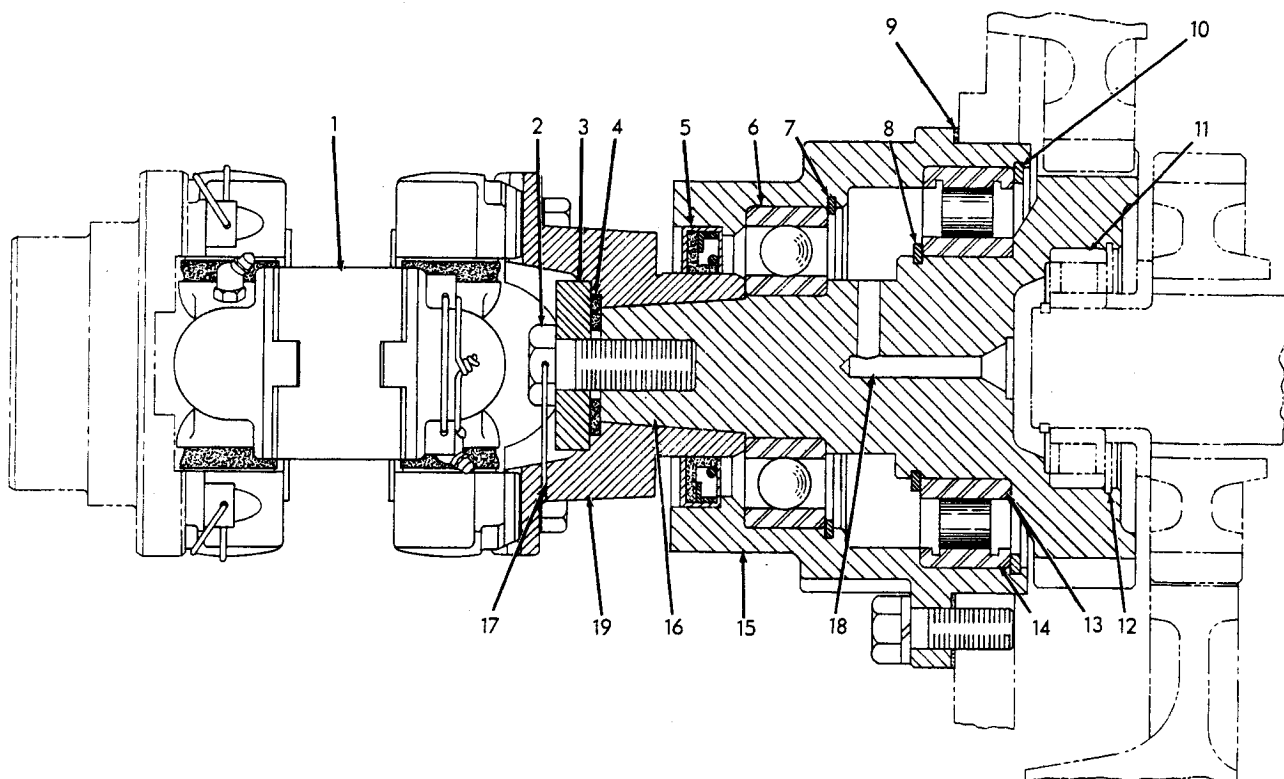


Fig. 42 -- Input Shaft Sectional View
(T-32094)

- | | |
|--|--|
| <ul style="list-style-type: none"> 1. U-joint 2. Capscrew 3. Washer 4. Seal 5. Oil seal 6. Bearing, front 7. Snap ring 8. Snap ring 9. Gasket 10. Snap ring 11. Bearing, bevel pinion shaft front | <ul style="list-style-type: none"> 12. Snap ring 13. Inner race, rear bearing 14. Outer race assembly, rear bearing 15. Retainer 16. Shaft and gear 17. Lockwire 18. Cross drilled passage for added bearing lubrication (HD6EP eff. tractor S/N 18647 and up and HD7G eff. tractor S/N 24234 and up) 19. Yoke, drive shaft rear |
|--|--|

and measure gap between retainer and transmission case. Make shim pack (6) equal to measurement MINUS .001" to obtain specified bearing preload. Install bearing retainer (with shims) and travel speed governor (with new gasket). Connect governor return line; install governor closure plate, Fig. 25.

- b. Install input shaft bearing retainer and shaft assembly (with new gasket); mesh input shaft gear with top and bottom shaft drive gears.
- c. Use suitable driver and install top and bottom shaft front bearings (snap ring groove end first); be certain bearings are seated against shoulder on shafts.

CAUTION

When installing front bearings, raise shaft slightly and support rear end to prevent damage to rear bearings.

- d. Insert clean cloth between input shaft gear and top and bottom shaft drive gears to lock shafts. Install top and bottom shaft front bearing retaining nuts; torque to 180-220 lbs. ft. and lock by staking. Torque universal joint rear yoke capscrew to 168-178 lbs. ft.; lock with locking wire. Remove cloth from gears.
- e. Hold top shaft oil collector, Fig. 38 (1) (without shims or oil seals) firmly against front bearing. Measure gap between col-

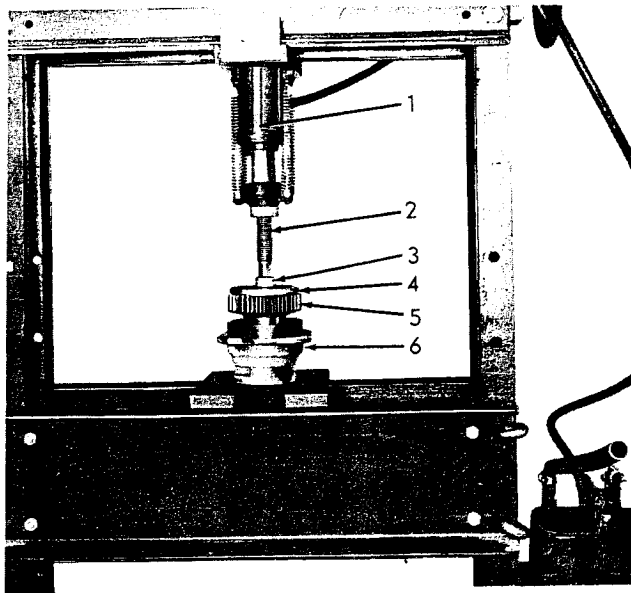


Fig. 43 -- Installing Input Shaft in Bearing Retainer
(T-35051)

1. Ram
2. Screw
3. Shaft protector
4. Pressing plate
5. Shaft and gear
6. Retainer

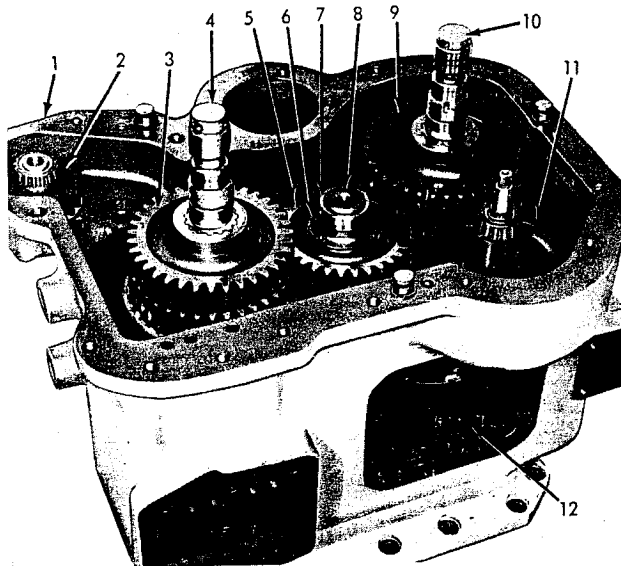


Fig. 44 -- Transmission Prior to Installation of
Front Cover
(T-35041)

1. Case
- * 2. Gear, governor drive
3. Gear, top shaft drive
4. Shaft, top

5. Gear, high speed
 6. Washer
 7. Bearing race
 8. Shaft, bevel pinion
 9. Gear, bottom shaft drive
 10. Shaft, bottom
 11. Idler gear and shaft assembly, high speed reverse
 12. Idler gear and shaft assembly, low speed reverse
- *Special equipment some models

lector and front cover; make shim pack equal to measurement plus .003" to provide specified bearing end play. Repeat procedure to determine bottom shaft oil collector shim pack. Keep shims with proper collector.

- f. Refer to Fig. 46, install seals in both oil collectors; lubricate seals freely. Install oil collectors (with shim packs previously determined) on front cover.

IMPORTANT

HD6EP prior to S/N 16007 and HD7G prior to S/N 23003 top shaft oil collector only, use copper washer beneath capscrew installed through oil passage in front cover.

- g. Connect oil lines to bottom shaft oil collector; HD6EP prior to S/N 16007 and HD7G prior to S/N 23003 connect other end of oil lines to top shaft oil collector. Install supporting clips.
- h. Refer to Fig. 25, hold reverse shaft bearing cover or push-start pump rear housing (without shims) firmly against high speed reverse shaft front bearing and measure gap between bearing cover (or housing) and front cover. Make shim pack equal to measurement MINUS .001" to obtain specified bearing preload; install bearing cover (or housing) with shims. If transmission has push-start pump, refer to Fig. 19 and assemble pump drive; install front housing with new gasket. Install push-start pump operating lever and bracket.
- i. Use new gaskets, install range selector valve and side cover, Fig. 25. HD6EP eff. S/N 16007 and up, HD7G eff. S/N 23003 and up connect bottom shaft oil collector oil lines to range selector valve.
- j. Clean transmission pump suction screen (replace if necessary); install screen and cover in side of transmission case (use new gasket). Install elbow in cover and tighten securely with opening facing front.
- k. Clean steering pump suction screen (replace if necessary); install screen and

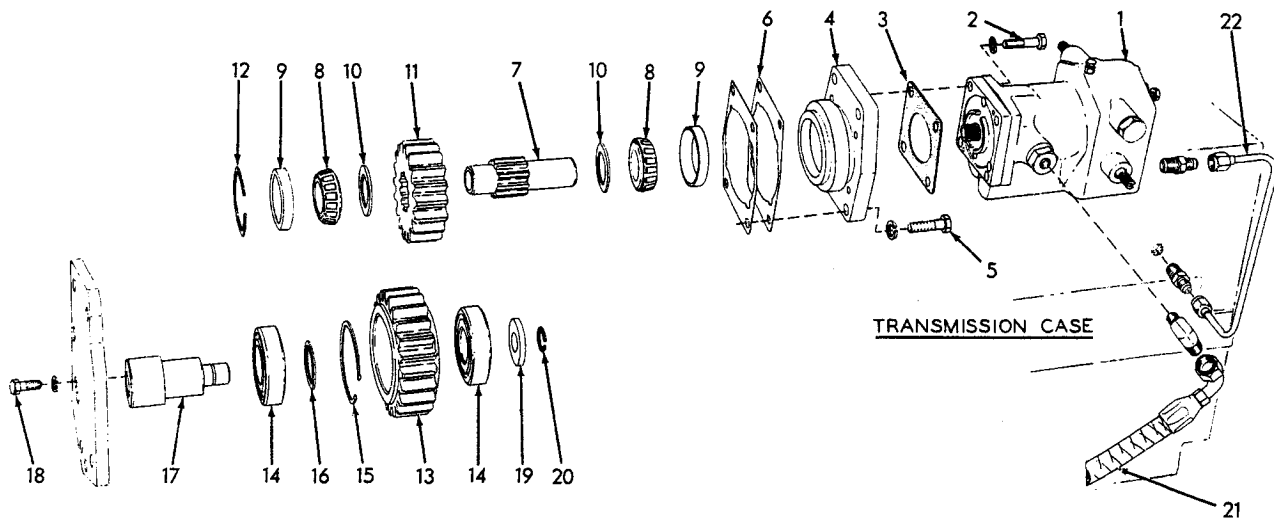


Fig. 45 -- Travel Speed Governor Drive
(T-70911)

- | | |
|---------------------------|----------------------|
| 1. Governor | 12. Snap ring |
| 2. Capscrew | 13. Gear, idler |
| 3. Gasket | 14. Bearings |
| 4. Retainer, rear bearing | 15. Snap ring |
| 5. Capscrew | 16. Spacer |
| 6. Shims | 17. Shaft, idler |
| 7. Shaft, drive | 18. Capscrew |
| 8. Bearing cones | 19. Spacer |
| 9. Bearing cups | 20. Snap ring |
| 10. Spacers | 21. Oil line, inlet |
| 11. Gear, drive | 22. Oil line, outlet |

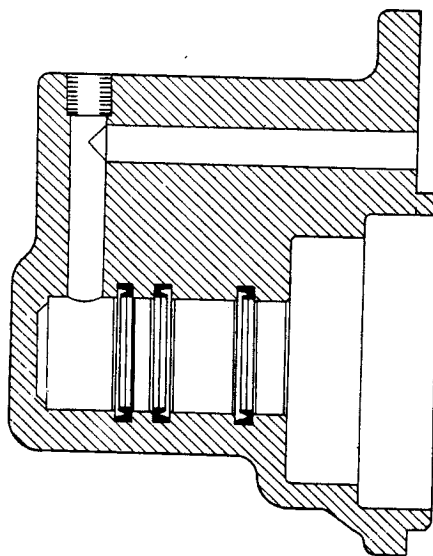


Fig. 46 -- Seals Installed in Oil Collector
(T-72356)

cover in front of transmission case (use new gasket).

NOTE

Some models have line from top of screen compartment to suction side of transmission scavenge pump; line allows pump to draw air from steering pump screen compartment. Line may be added to other models; consult Allis Chalmers Dealer for necessary parts.

- l. Install new o-ring around O.D. of bevel pinion shaft rear bearing boss; lubricate freely.
- m. Connect oil lines removed from case; cover all openings in case, fittings, or oil lines to prevent entrance of dirt during installation.

F. INSTALLATION (WITH BEVEL GEAR AND PINION ADJUSTMENT CHECKS)

1. Before installing transmission, bevel gear shaft bearings must be checked for end-play. As it is impractical to check bearing preload as described in "BEVEL GEAR AND SHAFT" (steering clutches removed), refer to Fig. 47 and check bearing end-play by positioning dial indicator through power take-off access hole (if tractor has rear mounted equipment, remove bevel gear compartment cover and work through top of bevel gear compartment). Pry bevel gear in both directions (not too hard); if ANY end-play is shown on dial indicator, steering clutches must be removed and bearing pre-load readjusted; refer to "BEVEL GEAR AND SHAFT".

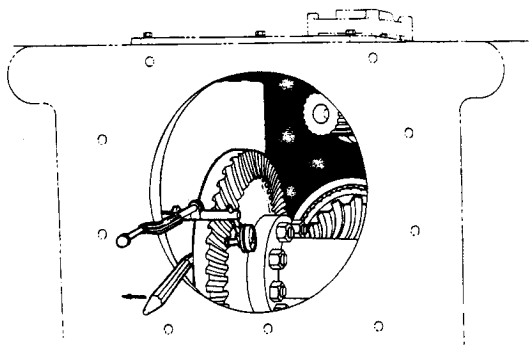


Fig. 47 -- Checking for Bevel Gear End-Play (T-70854)

2. Remove top shaft oil seal from bore in steering clutch housing. Install at least three guide studs to keep transmission aligned and prevent damage to o-ring on bevel pinion shaft rear bearing boss; install transmission (with new

mounting gasket). Reach through bevel gear compartment and install top shaft oil seal (lip directed toward transmission).

3. Check backlash between bevel gear and bevel pinion; also be certain tooth contact pattern is correct. Following procedure is to be used ONLY when bevel gear is in good condition and was NOT removed and/or replaced; if bevel gear was removed and/or replaced, refer to "BEVEL GEAR AND SHAFT" for complete procedure.
 - a. Refer to Fig. 48; position dial indicator as shown. Block bevel pinion solid. Insert small pry bar and rotate gear back and forth; total gear movement (gear freeplay), as indicated by reading on dial indicator, is backlash; if desired, dial indicator may be mounted so reading can be taken from bevel pinion. Check backlash at four points (90° apart) around gear; block bevel pinion solid each time if reading is being taken from bevel gear.

IMPORTANT

Several attempts may be necessary to become accustomed to the "feel" in order to obtain correct backlash readings. DO NOT HURRY THIS STEP.

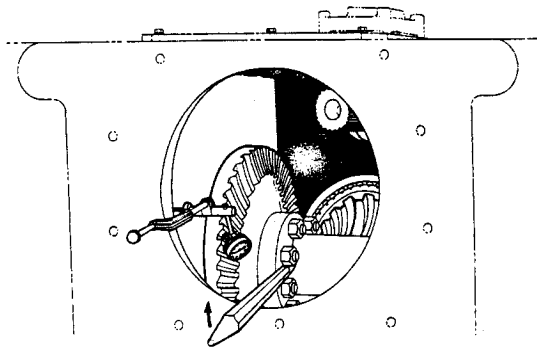


Fig. 48 -- Checking Backlash Between Bevel Gear and Bevel Pinion (T-70855)

- b. Specified backlash is .008" - .014". If backlash is slightly less than .008" or slightly more than .014", (and tooth contact pattern has not been set) it is possible to obtain correct backlash by adding or removing pinion depth adjusting shims, Fig. 41 (8) located between transmission case and snap ring on pinion shaft rear bearing.

If specified backlash CANNOT be obtained in this manner, steering clutches must be removed so bevel gear can be repositioned; refer to "BEVEL GEAR AND SHAFT" for complete procedure.

- c. Check bevel gear-to-bevel pinion tooth contact pattern by applying marking compound (bluing or red lead) to approximately 12 bevel gear teeth. Rotate bevel gear far enough to show tooth contact pattern.

NOTE

Gears may be rotated by moving tractor (pushing, pulling, etc.) or by raising tractor and rotating track.

- d. Correct tooth contact pattern is shown in Fig. 49. If contact pattern is NOT satisfactory, add or remove pinion depth adjusting shims Fig. 41 (8) until pattern is satisfactory.
- e. Re-check backlash! If backlash is not within specifications refer to "BEVEL GEAR AND SHAFT" and perform complete procedure.

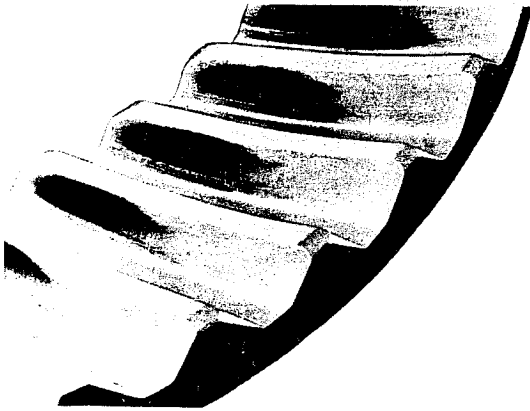


Fig. 49 -- Satisfactory Tooth Contact - No Load (T-31450)

4. Models so equipped, install push-start pump (with new gasket); connect pump oil lines.
5. Connect oil lines to range selector valve and torque converter drain lines to transmission side cover; install supporting clips.
6. Install drive shaft universal joint assembly.
7. Install transmission oil pump; connect oil lines as removed. Connect steering pump suction line to oil reservoir cover on front of transmission. Connect steering reservoir

vent line (if equipped) to suction side of transmission scavenge pump. Connect torque converter return line to input shaft bearing retainer.

8. Refer to Fig. 23; clamp oil level gauge tube in position; install brake valve spool, bell-crank bracket and brake pedal (both sides); connect brake linkage.
9. Install transmission oil filter and mounting bracket; connect oil lines. Connect travel speed governor control rods (if so equipped).
10. Refer to Fig. 22, install steering lever bracket and cross shaft assembly. Connect and adjust steering control rods; refer to "Steering Clutches and Brakes" Service Manual FORM 648095.
11. Install seat frame and seat supporting front channel; install rear jam nuts on rod ends, Fig. 22 (8). Move range selector lever to neutral and range selector valve rotor to neutral position; connect speed shift linkage (adjust if necessary).
12. Be certain torque converter, steering clutch, and bevel gear compartment drain plugs are tight; fill hydraulic system to proper level with specified lubricant (refer to "LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE").
13. Turn electrical system master switch ON and start engine. Observe transmission operating and lube pressure gauges; they should indicate normal operating pressure.

CAUTION

If no pressure is indicated by gauges, engine must be stopped immediately and cause determined and corrected.

14. Move tractor short distance in each speed range to be certain transmission is working properly. Check for oil leaks; stop engine; correct any leaks found.
15. Start engine and check oil level of hydraulic system; oil level must be within operating range marks on oil level gauge rod. Stop engine.
16. Install floor plates and transmission bottom guards.

TOPIC 5—BEVEL GEAR AND SHAFT

A. DESCRIPTION

Bevel gear, located in center compartment of steering clutch and final drive housing, is attached to bevel gear shaft, Fig. 50. Bevel gear shaft is supported at each end by tapered roller bearings in removable cages. Bevel gear is driven by transmission bevel pinion; power from bevel gear is transmitted through steering clutches to final drives.

B. REMOVAL

Bevel gear, bevel gear shaft, and bevel gear shaft bearings may be removed without removing transmission; however, any damage to

these parts will usually have also affected transmission pinion.

Therefore, transmission will have been removed for repair and must not be reinstalled in tractor until after bevel gear, shaft, and bearings have been reinstalled, and pre-load on bevel gear shaft bearings has been adjusted.

1. Before bevel gear and shaft can be removed, it

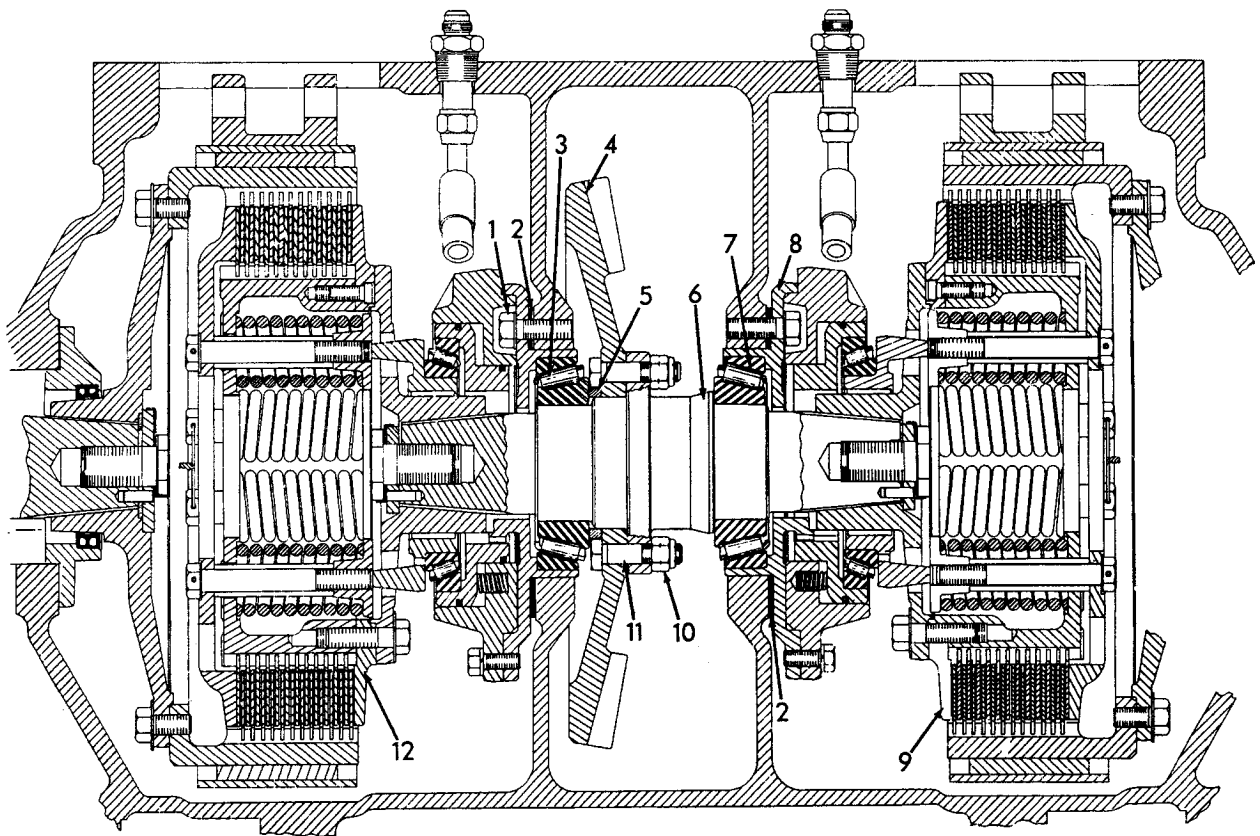


Fig. 50 -- Bevel Gear and Shaft - Sectional View
(T-71363)

- | | | |
|-----------------------------|--------------------------|-----------------------------------|
| 1. Capscrew | 5. Capscrew locking ring | 9. Right steering clutch assembly |
| 2. Bearing adjustment shims | 6. Bevel gear shaft | *10. Elastic stop nut |
| 3. Bearing cone | 7. Bearing cup | 11. Capscrew |
| 4. Bevel gear | 8. Bearing cage | 12. Left steering clutch assembly |

*High nuts and locking plates used prior to HD6EP S/N 16846 and HD7G S/N 23424

is necessary to remove steering clutches, brakes, and steering clutch throwout bearing assemblies.

Refer to Steering Clutches and Brakes Service Manual for detailed information.

2. Remove bevel gear compartment cover and steering control valve as a unit. Remove high nuts and locking plates (or elastic stop nuts) securing bevel gear to shaft.
3. Refer to Fig. 50; remove capscrews attaching bearing cages (8) to inner walls of steering clutch compartments; place wooden block under bevel gear to support gear and shaft and remove bearing cages; tie bearing adjustment shims (2) to respective cages to prevent loss. Mark bearing cages so they will be reinstalled in original positions (left and right).

NOTE

Prior to HD6EP S/N 15948 and HD7G S/N 23054 oil pan capscrews Fig. 52 (13) replace two bottom capscrews in left bearing cage.

4. Refer to Fig. 51, install wooden blocks between bevel gear teeth and compartment wall to hold gear stationary. Install puller tools similar to those shown; pull bevel gear shaft from bevel gear.

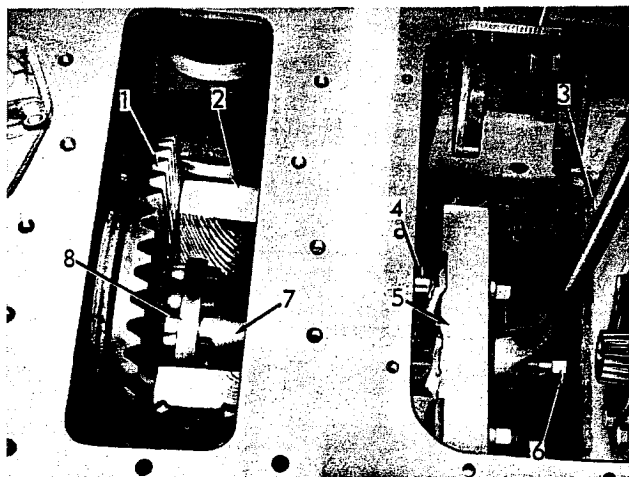


Fig. 51 -- Pulling Bevel Gear Shaft
(T-11897)

- | | |
|------------------|---------------------|
| 1. Bevel gear | 5. Push-puller |
| 2. Wooden blocks | 6. Puller screw |
| 3. Wrench | 7. Bevel gear shaft |
| 4. Legs | 8. Bolting flange |

NOTE

Left bearing cone will be pressed from bevel gear shaft as shaft is pulled from bevel gear.

5. Remove puller tools, remove bevel gear shaft (with right bearing cone) through right steering clutch compartment; remove bevel gear, left bearing cone, capscrew locking ring, and wooden blocks from bevel gear compartment.
6. Remove right bearing cone from bevel gear shaft; remove bearing cups from bearing cage assemblies.
7. Clean and inspect all parts for damage or excessive wear; replace parts where necessary.

C. INSTALLATION

If service work was done on bevel gear components without removing transmission, the transmission must be pulled forward to disengage the bevel pinion from bevel gear when the bevel gear shaft bearing pre-load adjustment is made.

1. Refer to Fig. 50, press one bearing cone (3) on long end of shaft with large O.D. of bearing against shoulder on shaft. Place bevel gear on bench (gear teeth down). Position capscrew locking ring (5) on bevel gear and install bevel gear capscrews (11); turn capscrew heads as necessary to clear locking ring as capscrews are installed.

NOTE

Heat bearing cones in oil to approximately 275° F. to aid installation.

2. Remove locking ring and position bevel gear in bevel gear compartment with gear teeth facing right steering clutch compartment. Install bevel gear shaft through right steering clutch compartment and align capscrews in bevel gear with holes in bolting flange of shaft. Bump or drive bevel gear shaft into bevel gear until locking plates Fig. 52 (4) and high nuts (3) (or elastic stop nuts Fig. 50 (10) can be started on capscrews. Install locking ring Fig. 52 (6) and tighten nuts evenly until bevel gear is properly located on shaft.
3. Lubricate other bearing cone, Fig. 52 (7) and start on short end of bevel gear shaft with large O.D. of bearing toward bevel gear. Refer to Fig. 53; install puller screw in tapped hole in end of shaft and place tube against inner race of bearing cone. Install tube end plate, thrust washer, and hex-nut; tighten hex-nut until bearing cone is against capscrew locking ring. Remove tools.
4. Press bearing cups Fig. 50 (7) in bearing cages (8); be certain cups are seated firmly in cages. Lubricate bearings with clean oil and install each bearing cage (with original bearing adjustment shims) in bore from which

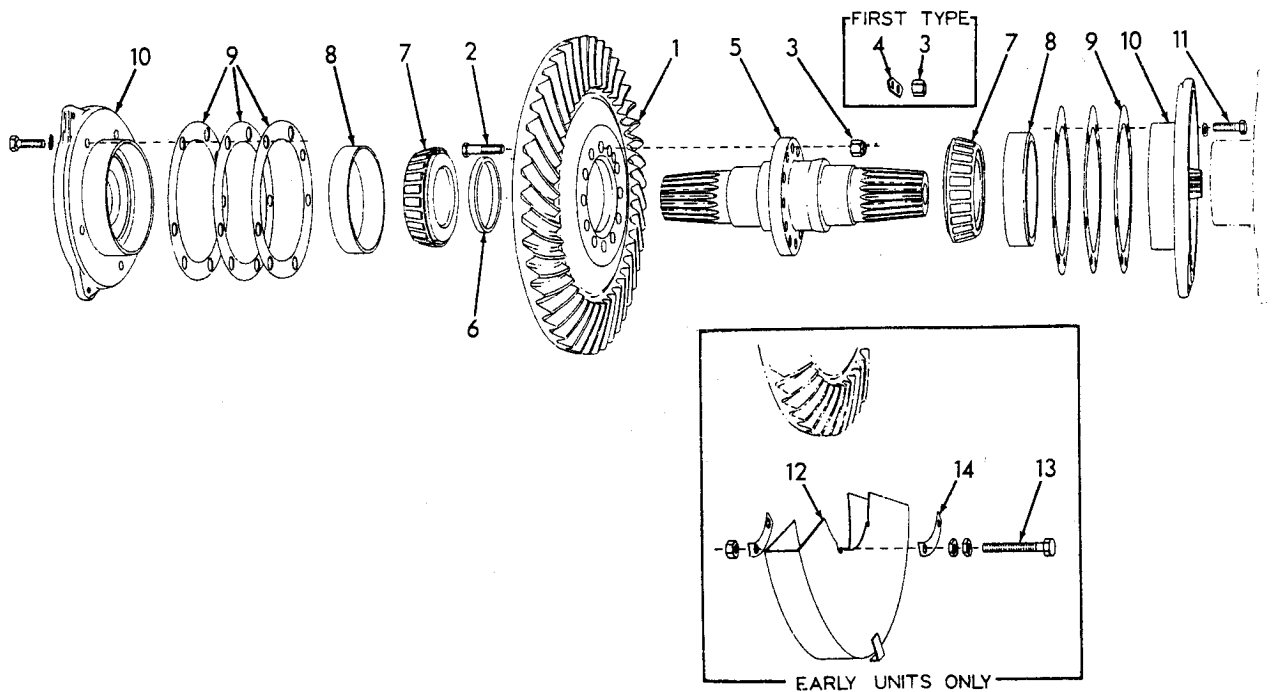


Fig. 52 -- Bevel Gear and Shaft Parts
(T-38140)

- | | |
|---------------------|-----------------------------|
| 1. Bevel gear | 8. Bearing cup |
| 2. Capscrew | 9. Bearing adjustment shims |
| *3. High nut | 10. Bearing cage |
| *4. Locking plate | 11. Capscrew |
| 5. Bevel gear shaft | **12. Oil pan |
| 6. Locking ring | **13. Capscrew |
| 7. Bearing cone | **14. Lock plate |

*Replaced by elastic stop nuts effective with HD6EP S/N 16846 and HD7G S/N 23424
 **Used prior to HD6EP S/N 15948 and HD7G S/N 23054

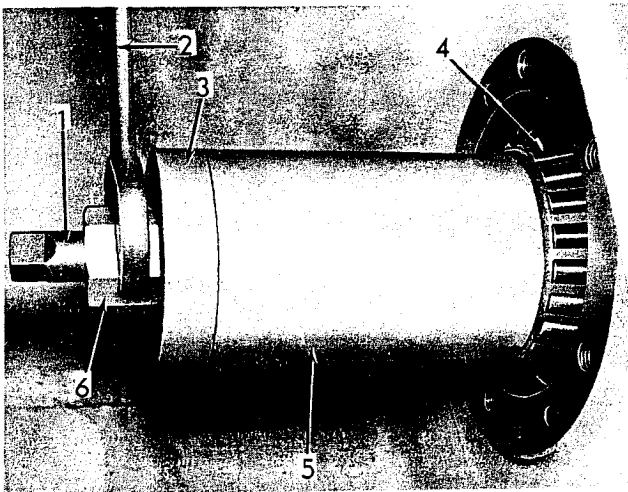


Fig. 53 -- Installing Bevel Gear Shaft Bearing Cone
(T-17899)

- | | |
|-------------------|-----------------|
| 1. Puller screw | 4. Bearing cone |
| 2. Wrench | 5. Tube |
| 3. Tube end plate | 6. Hex nut |

it was removed. Start bearing cage attaching capscrews (1), but do not tighten at this time.

- Torque high nuts on bevel gear attaching capscrews to 70 to 90 lbs. ft.; lock with locking plates.

NOTE

Effective with HD6EP S/N 16846 and HD7G S/N 23424, elastic stop nuts replace locking plates and high nuts. Torque is same.

- Tighten bearing cage attaching capscrews; bump cages to be certain bearings are properly seated; retighten capscrews if necessary.

D. ADJUSTMENTS

1. BEVEL GEAR SHAFT BEARING PRE-LOAD

- a. Install capscrew in end of bevel gear shaft; tighten until bottomed.
- b. Refer to Fig. 54, turn bevel gear shaft with pounds inch indicating torque wrench to determine pre-load on bearings; specified pre-load is 10 to 20 lbs. in. (.003"-.004" tight). Add or remove bearing adjustment shims (equally) under bearing cages to obtain specified pre-load. When adjusting, bump bearing cages to be certain bearings are properly seated.



Fig. 54 -- Checking Pre-Load of Bevel Gear Shaft Bearings (T-25732)

2. BACKLASH AND GEAR TOOTH CONTACT PATTERN

- a. Install transmission—refer to "INSTALLATION".
- b. Check backlash between bevel gear and bevel pinion. Mount dial indicator so readings can be taken from bevel gear. Check backlash at four points (90° apart) around gear; block bevel pinion solid each time reading is taken.
- c. Specified backlash is .008" - .014"; adjust backlash by transferring bearing adjustment shims from under one bevel gear shaft bearing cage to other. In this manner bevel gear is moved, but pre-load on bearings will remain as adjusted; move bevel gear toward pinion to decrease backlash, or away from pinion to increase backlash.

- d. Check tooth contact pattern. Paint approximately 12 bevel gear teeth with marking compound or bluing and turn transmission pinion; tooth contact pattern will show plainly on bevel gear teeth. Area of contact (no load) must favor toe of gear tooth, extend approximately 1/2 of tooth length toward heel, and be centered between top and bottom of tooth, Fig. 55; area of contact when gears are loaded should increase in length as shown in Fig. 56.

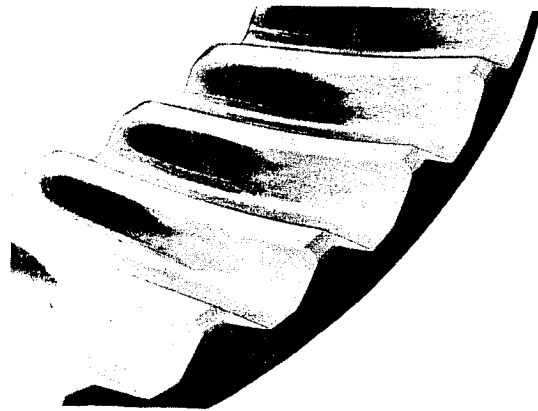


Fig. 55 -- Satisfactory Tooth Contact - No Load (T-31450)

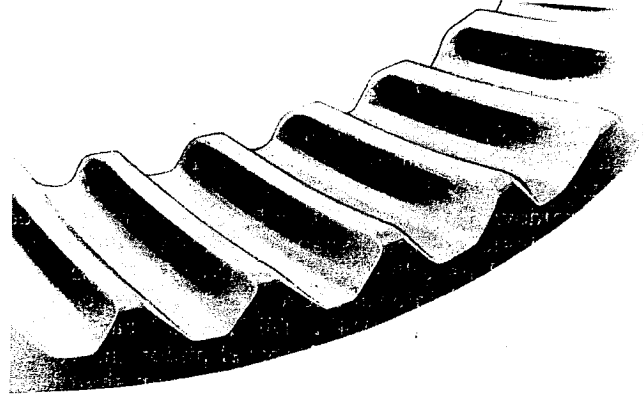


Fig. 56 -- Satisfactory Tooth Contact - Gears Loaded (T-31449)

HIGH CONTACT as shown in Fig. 57 is not desirable and will result in galling and rolling over of top edges of teeth. To correct high contact pattern, move bevel pinion TOWARD bevel gear by adding pinion



Fig. 57 -- High Contact - No Load
(T-71900)

depth adjusting shims between transmission case and snapping on pinion shaft rear bearing. This adjustment will DECREASE backlash between bevel pinion and bevel gear. Specified backlash is .008" to .014". INCREASE backlash by moving bevel gear AWAY from bevel pinion; move gear away from pinion by transferring bevel gear shaft bearing adjustment shims from bearing cage on tooth side of gear to bearing cage on flat side of gear.

NOTE

Each .005" bevel gear shaft bearing adjustment shim transferred will change backlash approximately .003".

LOW CONTACT as shown in Fig. 58 will result in galling and grooving of teeth. To correct low contact pattern, move bevel pinion AWAY from bevel gear by removing pinion depth adjusting shims between transmission case and snapping on pinion shaft rear bearing. This adjustment will INCREASE backlash between bevel pinion and bevel gear. Specified backlash is .008" to .014". DECREASE backlash by moving bevel gear TOWARD bevel pinion; move gear toward pinion by transferring bevel gear shaft bearing adjustment shims from bearing cage on flat side of gear to bearing cage on tooth side of gear.

SHORT TOE CONTACT as shown in Fig. 59 will result in chipped tooth edges and excessive wear due to small contact area. To correct short toe contact pattern, move bevel pinion AWAY from bevel gear by removing pinion depth adjustment shims between transmission case and snap ring on pinion shaft rear bearing. This adjustment will INCREASE backlash between bevel pinion and bevel gear. Specified backlash is .008" to .014". DECREASE

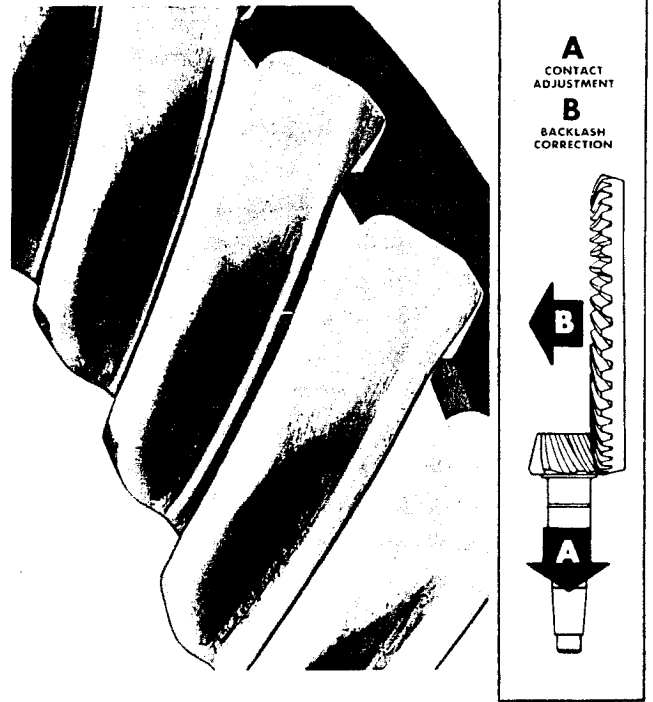


Fig. 58 -- Low Contact - No Load
(T-26963)

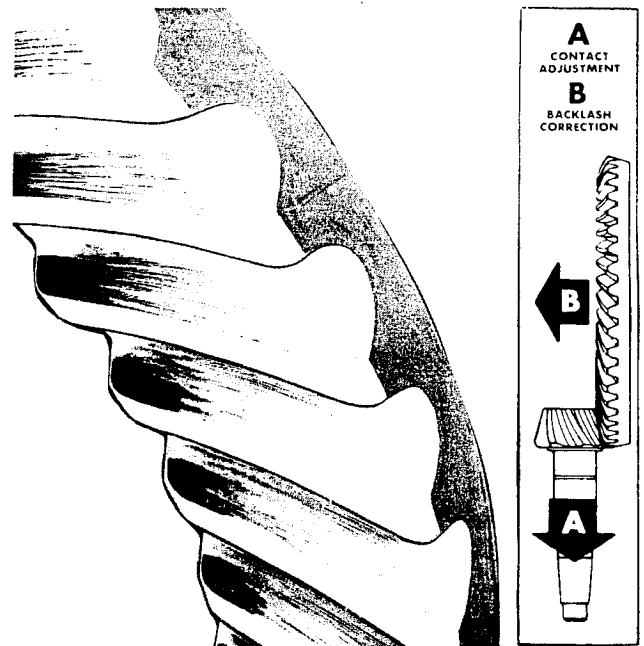


Fig. 59 -- Short Toe Contact - No Load
(T-71901)

backlash by moving bevel gear TOWARD bevel pinion; move gear toward pinion by transferring bevel gear shaft bearing adjustment shims from bearing cage on flat side of gear to bearing cage on tooth side of gear.

NOTE

Several adjustments of both bevel pinion and

bevel gear may be necessary before correct tooth contact pattern and correct backlash are obtained.

E. FINAL INSTALLATION

1. Clean interior of bevel gear compartment and steering clutch compartments. Install bevel gear compartment cover and steering control valve as unit.
2. Install steering clutch throwout bearing assemblies, steering clutches, and steering brakes; refer to "Steering Clutches and Brakes" Service Manual, FORM 648095 for detailed information.
3. Be certain all oil drain plugs are tight; fill system to proper level with specified lubricant (refer to "LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE").

TOPIC 6—DRIVE SHAFT UNIVERSAL JOINT

A. REMOVAL, DISASSEMBLY, AND INSPECTION

1. Turn electrical system master switch OFF; remove floor plates.
2. Unlock and remove capscrews attaching universal joint to front and rear yokes; pry front yoke forward and remove universal joint.
3. Refer to Fig. 60, unlock and remove capscrews (5); remove front and rear spider assemblies from coupling plate (2).

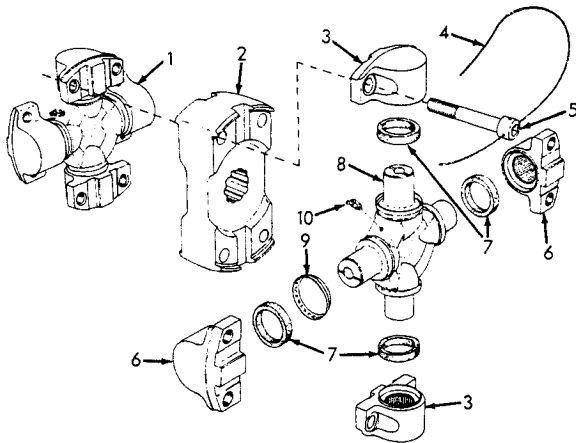


Fig. 60 -- Universal Joint Parts
(T-5121)

1. Spider assembly, front
2. Coupling plate
3. Bearing (w/plain holes)
4. Locking wire
5. Capscrew
6. Bearing (w/tapped holes)
7. Cork seal
8. Spider assembly, rear
9. Dust shield
10. Lube fitting

4. Remove bearing assemblies from spider assemblies; identify bearing assemblies so they may be installed in original position if re-used.
5. Wash all components in clean solvent. Inspect for excessive wear or damage; replace necessary parts.

B. ASSEMBLY AND INSTALLATION

If bearings or bearing journals on spiders show damage or excessive wear, it will be necessary to replace spider and bearings as complete assembly. However, if spider and bearings are in good condition, assemble each spider as follows:

1. Refer to Fig. 60, install new seal (7) and dust shield (9) in each bearing cup; lubricate bearings with light coat of grease and install bearing cups on spider journals from which they were removed. Be certain bearings are fully seated on spider journals. Install front and rear spider assemblies on coupling plate (2); secure with attaching capscrews (5). Lock capscrews with locking wire.

NOTE

Install spider assemblies on connecting yoke with lubricating fittings in line. This will allow both fittings to be lubricated without turning drive shaft.

2. Place universal joint assembly on rear yoke (with lubrication fittings aligned with lubrication fitting in front yoke) and install attaching capscrews; lock capscrews with locking plates or wire.
3. Align universal joint with front yoke; move front yoke rearward and install attaching capscrews. Lock capscrews with locking plates.
4. Lubricate universal joint.
5. Install floor plates; turn electrical system master switch on.

TOPIC 7 FITS AND TOLERANCES

A. HYDRAULIC SYSTEM

1. RANGE SELECTOR VALVE

- a. Rotor
 - Rotor O.D. 1.747" - 1.748"
 - Rotor stem O.D.622" - .624"
- b. Regulating valve housing
 - Valve bore(s) I.D. 1.001" - 1.003"
 - Valve(s) O.D.997" - .998"
- c. Transmission clutch apply pressure spring
 - Approximate free length 2 1/16"
 - Load when compressed to 1 9/32" 34.7 lbs.
- d. Transmission clutch lubricating pressure spring
 - Approximate free length 1 17/32"
 - Load when compressed to 1 9/32" 3 lbs.
- e. Torque converter pressure spring (prior to HD6EP S/N 16007, HD7G S/N 23003)
 - Approximate free length 2 1/32"
 - Load when compressed to 1 9/32" 9.2 lbs.
- f. Torque converter pressure spring (eff. with HD6EP S/N 16007, HD7G S/N 23003)
 - Approximate free length 2 1/8"
 - Load when compressed to 1 9/32" 5 lbs.

2. PUMP (Prior to HD6EP S/N 18754, HD7G S/N 24276)

- a. Drive shaft and idler shaft
 - O.D.6870" - .6875"
 - Maximum allowable wear001"
- b. Front bearings
 - I.D.6907" - .6912"
 - Width374" - .375"
 - Maximum allowable wear (I.D. and width)001"
- c. Intermediate and rear bearings
 - I.D.6892" - .6897"
 - Width8745" - .8750"
 - Maximum allowable wear (I.D. and width)001"

3. PUMP (Eff. HD6EP S/N 18754 and up, HD7G S/N 24276 and up)

- a. Replace shaft(s) if O.D. is less than685"
- b. Replace back plate, front plate, and/or center housing if bushing I.D. is more than691"
- c. Capscrew torque 25 lbs. ft.

B. TRANSMISSION

1. CLUTCH FRICTION PLATES

- a. Steel Plates:
 - Thickness081" - .085"

Replace if thickness is less than071"
 Must be flat within002"

- b. Bronze Plates:
 - Thickness098" - .102"
 - Replace if thickness is less than092"
 - Groove depth010" min.
 - Must be flat within002"

2. BRONZE THRUST WASHERS

- a. Replace if thickness is less than087"
- b. Must be flat within001"

3. TOP AND BOTTOM SHAFT

- a. O.D. at clutch drum and gear location (front and rear). 2.2494" - 2.2500"
- b. Maximum allowable wear002"

4. CLUTCH DRUM AND GEAR

- a. 1st forward
 - Number of teeth24
 - Replace if bushing I.D. is more than 2.256"
- b. 2nd forward
 - Number of teeth35
 - Replace if bushing I.D. is more than 2.256"
- c. 1st reverse
 - Number of teeth22
 - Replace if bushing I.D. is more than 2.256"
- d. 2nd reverse (prior to HD6EP S/N 16007, HD7G S/N 23003)
 - Number of teeth26
 - Replace if bushing I.D. is more than 2.256"
- e. 2nd reverse (eff. HD6EP S/N 16007 and up, HD7G S/N 23003 and up)
 - Number of teeth32
 - Replace if bushing I.D. is more than 2.256"

5. BEARING ADJUSTMENT

- a. Bevel pinion shaft rear bearing000" - .002" loose
- b. Top and bottom shaft front bearing002" - .004" loose
- c. Travel speed governor drive shaft bearings001" - .002" tight
- d. High speed reverse idler shaft bearings001" - .002" tight

6. SPECIFIED TORQUE

- a. Bevel pinion shaft rear bearing nut 530 to 570 lbs. ft.
- b. Top and bottom shaft front bearing nuts 180 to 220 lbs. ft.
- c. All others - standard torque

C. BEVEL GEAR AND SHAFT

- 1. BACKLASH008" - .014"

- 2. BEARING PRELOAD 10 - 20 lbs. in.
(.003" - .004" tight)
- 3. CAPSCREW TORQUE. 70 - 90 lbs. ft.

TOPIC 8 SERVICE TOOLS

No service tools other than standard hand tools and/or shop tools are required for servicing components covered in this manual; EXCEPT when tools are listed (with manufacturer and manufacturer's tool numbers) under illustrations in this manual.

Refer to Service Tools Manual, FORM 650850 for complete listing of tools available. Tools must be ordered directly from tool manufacturers.

TOPIC 9—CONVERSION TABLES

DECIMAL AND METRIC EQUIVALENTS OF FRACTIONS OF AN INCH

Inches		Milli- meters	Inches		Milli- meters
Fractions	Decimals		Fractions	Decimals	
1/64	.015625	.397	33/64	.515625	13.097
1/32	.03125	.794	17/32	.53125	13.494
3/64	.046875	1.191	35/64	.546875	13.891
1/16	.0625	1.588	9/16	.5625	14.288
5/64	.078125	1.984	37/64	.578125	14.684
3/32	.09375	2.381	19/32	.59375	15.081
7/64	.109375	2.778	39/64	.609375	15.478
1/8	.125	3.175	5/8	.625	15.875
9/64	.140625	3.572	41/64	.640625	16.272
5/32	.15625	3.969	21/32	.65625	16.669
11/64	.171875	4.366	43/64	.671875	17.066
3/16	.1875	4.763	11/16	.6875	17.463
13/64	.203125	5.159	45/64	.703125	17.859
7/32	.21875	5.556	23/32	.71875	18.256
15/64	.234375	5.953	47/64	.734375	18.653
1/4	.250	6.350	3/4	.750	19.050
17/64	.265625	6.747	49/64	.765625	19.447
9/32	.28125	7.144	25/32	.78125	19.844
19/64	.296875	7.541	51/64	.796875	20.241
5/16	.3125	7.938	13/16	.8125	20.638
21/64	.328125	8.334	53/64	.828125	21.034
11/32	.34375	8.731	27/32	.84375	21.431
23/64	.359375	9.128	55/64	.859375	21.828
3/8	.375	9.525	7/8	.875	22.225
25/64	.390625	9.922	57/64	.890625	22.622
13/32	.40625	10.319	29/32	.90625	23.019
27/64	.421875	10.716	59/64	.921875	23.416
7/16	.4375	11.113	15/16	.9375	23.813
29/64	.453125	11.509	61/64	.953125	24.209
15/32	.46875	11.906	31/32	.96875	24.606
31/64	.484375	12.303	63/64	.984375	25.003
1/2	.500	12.700	1	1.000	25.400

VOLUME AND WEIGHT CONVERSION CONSTANTS — U.S. TO METRIC

Pints x .4732 = Liters
 Quarts x .9463 = Liters
 Gallons x 3.7853 = Liters
 Pounds x .4536 = Kilograms

