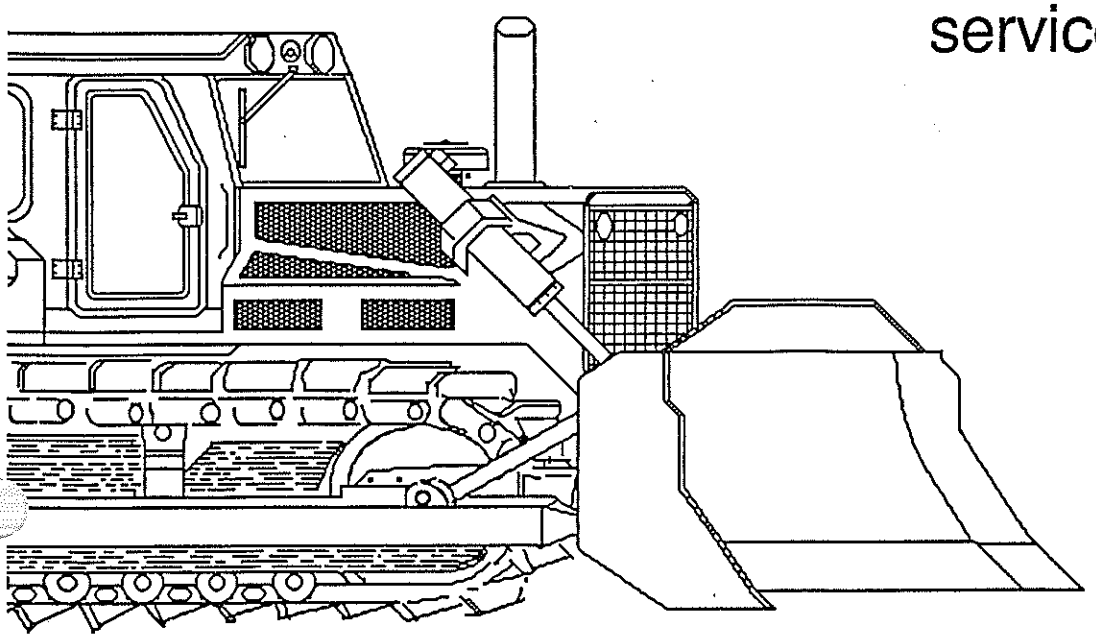
HD-6A, HD6-B
HD-6E, HD6G

crawler tractors

TRANSMISSION & BEVEL GEAR

service manual



FORM 70650432
2/89

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.

SUPPLEMENT NO. 2

SERVICE MANUAL FORM 0650432-8

TRANSMISSION, BEVEL GEAR, DRIVE SHAFT U-JOINT

HD-6A, B, E, and 6G

(1-73)

ATTENTION: Insert this sheet into the front of publication as record of receipt. Replace or add pages in the publication according to instructions below.

Write in the following change (change is underlined):

Sect. 2 pg. 20 2.a. Delete:(if removed)

Replace the following like pages:

Sect. 2, page 17 (Revised)
Sect. 2, page 18 (Revised)

Reason: Bevel gear shaft bearings pre-load adjustment on HD-6E tractors S/N 14484 - up.

NOTICE
THESE CHANGES ARE
INCLUDED IN THIS COPY

Printed in U.S.A.

NOTICE OF CHANGE

TO

SERVICE MANUAL 650432 (2-66)
TRANSMISSION, BEVEL GEAR, AND
DRIVE SHAFT UNIVERSAL JOINT

Write in the following change: (change is underlined)

The bevel pinion/bevel gear backlash setting for HD6E tractors S/N 14484-up is .008" - .014" (.203 - .355 mm). The backlash setting appears on the following pages in SECTION 2:

Page 15 - One place
Page 20 - One place
Page 21 - Three places
Page 25 - One place
Page 26 - One place

Replace the following like pages:

Sect. 1, page 9 (Revised)
Sect. 1, page 10 (Revised)
Sect. 1, page 25 (Revised)
Sect. 1 page 26 (No Change)

Reason: This mailing changes the bevel pinion/bevel gear backlash setting (HD6E S/N 14484-up) and some assembly procedures and fits and tolerances (HD6AG, B, G S/N 21448-up).

INSERT THIS SHEET INTO THE FRONT OF MANUAL 650432 (2-66) TO INDICATE RECEIPT OF THIS MAILING.

NOTICE

THESE CHANGES ARE
INCLUDED IN THIS COPY

Printed in U.S.A.

MAILING NO. 1
Issued 11-69

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.

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.

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.

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 overpressurization 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.

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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SECTION 1 - HD6A, B, AND G (ALL) HD6E (PRIOR TO TRACTOR SERIAL NO. 14484)

Index continued on next page.

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SECTION 2 - HD6E (EFFECTIVE WITH TRACTOR SERIAL NO. 14484)

Index also on preceding page.

SECTION 1 - HD6A, B, AND G (ALL) HD6E (PRIOR TO TRACTOR SERIAL NO. 14484)

TOPIC 1 - GENERAL DESCRIPTION

Power from engine is transmitted through engine clutch and drive shaft universal joint to transmission input shaft. The transmission output (bevel pinion) shaft drives bevel gear and shaft and steering clutches (mounted at each end of bevel gear shaft). The steering clutches transmit power to final drives and track driving sprockets.

TOPIC 2 - TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	REMEDY
Transmission hard to shift.	1. Clutch brake mal-function.	1. Adjust or replace clutch brake.
	2. Shifting mechanism worn.	2. Repair or replace worn or damaged parts.
	3. Shifting forks worn or damaged.	3. Replace worn or damaged parts.
Transmission disengages during operation.	1. Shifting forks incorrectly positioned on shafts.	1. Reposition shifting forks.
	2. Shift lock mechanism mal-function.	2. Inspect for worn or broken springs or rounded off detent notches on shifting shafts. Replace affected parts.
	3. Shifting forks worn.	3. Replace worn forks.
Noise in transmission.	1. Insufficient lubricant.	1. Fill to proper level with specified lubricant.
	2. Damaged or worn gears, bearings, or shafts.	2. Replace worn or damaged parts.
	3. Bevel gear and pinion, or bearings, improperly adjusted.	3. Adjust as necessary.

TOPIC 3 - TRANSMISSION AND BEVEL GEAR LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE

A. LUBRICANT SPECIFICATIONS

Specified lubricant for use in transmission and bevel gear compartment 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 a 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.

B. CAPACITY AND SERVICE

Capacity is 5 gals.

NOTE

Oil should be at normal operating temperature when draining.

1. Remove drain plug from bottom of bevel gear compartment. Allow oil to drain; reinstall drain plug.

2. Fill transmission with specified lubricant through oil filler plug opening in top of transmission case. Oil level should be within "Operating Range" marks on oil level gauge rod (HD6G eff. with Serial No. 12322); even with "Full" mark on oil level gauge rod (HD6G Serial No. 11094 thru 12321); even with oil level plug opening in transmission side cover (all other models).

TOPIC 4 - TRANSMISSION

A. DESCRIPTION

1. OPERATION

The transmission is a conventional straight tooth, splash lubricated, speed reduction unit designed to provide proper gear ratios for required speed or power during operation of tractor.

The transmission is controlled by one shift lever. Standard transmission in HD6A, B, and E Tractors provides five forward speeds and one reverse speed. Standard transmission in HD6G Tractors (optional equipment HD6A, B, and E Tractors) provides four forward speeds and two reverse speeds.

Speed and direction changes are accomplished by disengaging engine clutch and moving shift lever to desired speed range position. The shift lever moves sliding gears on bevel pinion shaft into mesh with their corresponding gears by actuating shifting shafts clamped to shifting forks engaged with sliding gears. The shifting movement of each shaft is controlled by detent balls located in transmission case. The detent balls enter detent notches in shifting shafts when shafts are shifted to desired speed range.

The transmission has a shifting lock mechanism actuated by engine clutch operating lever. The shifting lock mechanism is designed so transmission can be shifted ONLY when engine clutch is DISENGAGED.

When engine clutch is engaged, the shifting lock plunger moves between shifting shaft detent balls and locks balls in detent notches of respective shifting shafts. This action locks sliding gears in mesh with corresponding gears of speed range to which transmission has been shifted.

2. LUBRICATION

The transmission case is wet sump type; transmission bearings and components are splash lubricated by gears on bevel pinion shaft rotating in oil.

B. REMOVAL

1. Turn electrical system master switch to OFF position.

2. Remove drain plug from bottom of bevel gear compartment and allow oil to drain. Remove main frame closure plate below transmission.

3. Remove floor plates, seat frame, and seat supporting front channel. Disconnect steering control rods from rear operating lever(s). Remove capscrews attaching steering clutch operating lever bracket to top of transmission case; remove bracket, levers, and control rods as an assembly.

4. Remove capscrews and capscrew locks attaching universal joint assembly to front and rear yokes. Pry front yoke forward for clearance and remove universal joint assembly; remove front yoke from clutch shaft.

5. Remove yoke pin connecting gear shift locking plunger rod to locking plunger end.

6. Attach suitable hoist to transmission; remove capscrews attaching transmission to final drive housing and move transmission forward until top shaft and bevel pinion are clear of final drive housing; remove transmission.

C. DISASSEMBLY

1. Clean transmission case and place on work bench (top side up); remove transmission side cover and gasket.

2. Remove gear shift lever, lever boot, and clamp.

3. Remove shift lever pivot screws and lift shift lever out of shift lever housing.

4. Remove lock wire, universal joint yoke retaining capscrew, washer, and seal from input shaft.

5. Remove capscrews attaching shift lever housing to transmission case; use slide hammer puller, Fig. 4, to pull shift lever housing (with input shaft) from transmission case. Remove universal joint rear yoke (if input shaft seal is seal ring type, front seal ring and gasket will be removed with yoke).

6. Press or drive on front end of input shaft to remove from shift lever housing.

NOTE

Input shaft seal will remain in shift lever housing; after removing input shaft, remove seal.

7. Unlock and loosen shifting fork clamping capscrews.

NOTE

Capscrew locks were discontinued effective with S/N 8636.

8. Remove shifting shaft ball spring capscrews Fig. 3 (9); tilt transmission and allow steel balls and springs to fall from capscrew holes.

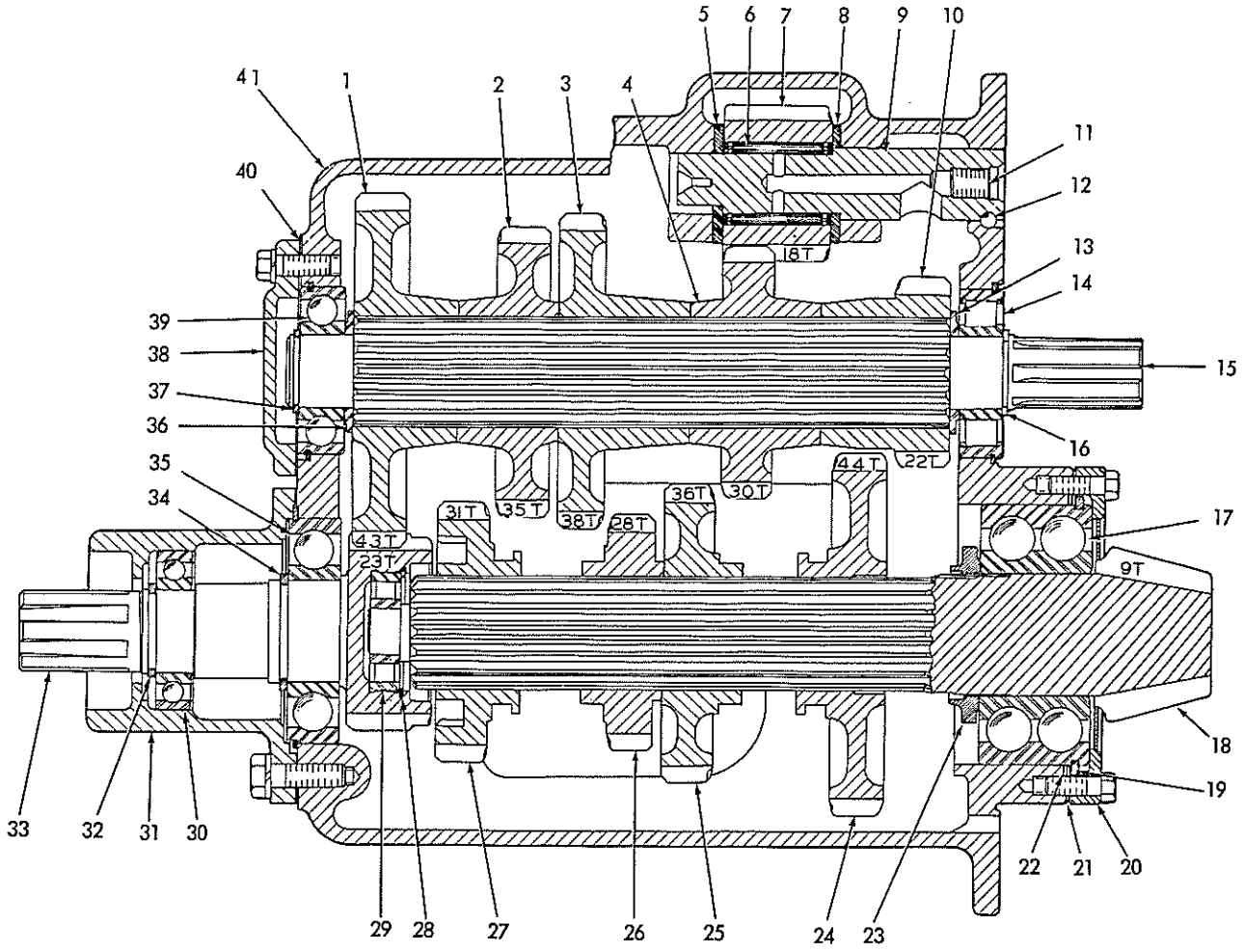

Fig. 1 One Speed Reverse Transmission (Standard HD6A, B, and E)
(T-18717)

1. Top shaft drive gear
2. Third speed gear
3. Fourth speed gear
4. Second speed gear
5. Inner thrust washer
6. Reverse gear bearing
7. Reverse gear
8. Outer thrust washer
9. Reverse gear shaft
10. First speed gear
11. Plug
12. Steel ball
13. Washer
14. Top shaft rear bearing w/snap ring
15. Top shaft
16. Snap ring
17. Bevel pinion shaft rear bearing
18. Bevel pinion shaft
19. Rear bearing snap ring
20. Rear bearing retainer
21. Bearing retainer shims
22. Pinion depth adjustment shims
23. Rear bearing retaining nut
24. First speed and reverse gear
25. Second speed gear
26. Fourth speed gear
27. Third and fifth speed gear
28. Front bearing snap ring
29. Bevel pinion shaft front bearing
30. Input shaft front bearing
31. Gear shift housing
32. Front snap ring
33. Input shaft
34. Rear snap ring
35. Input shaft rear bearing w/snap ring
36. Washer
37. Snap ring
38. Top shaft front bearing cover
39. Top shaft front bearing w/snap ring
40. Gasket
41. Transmission case

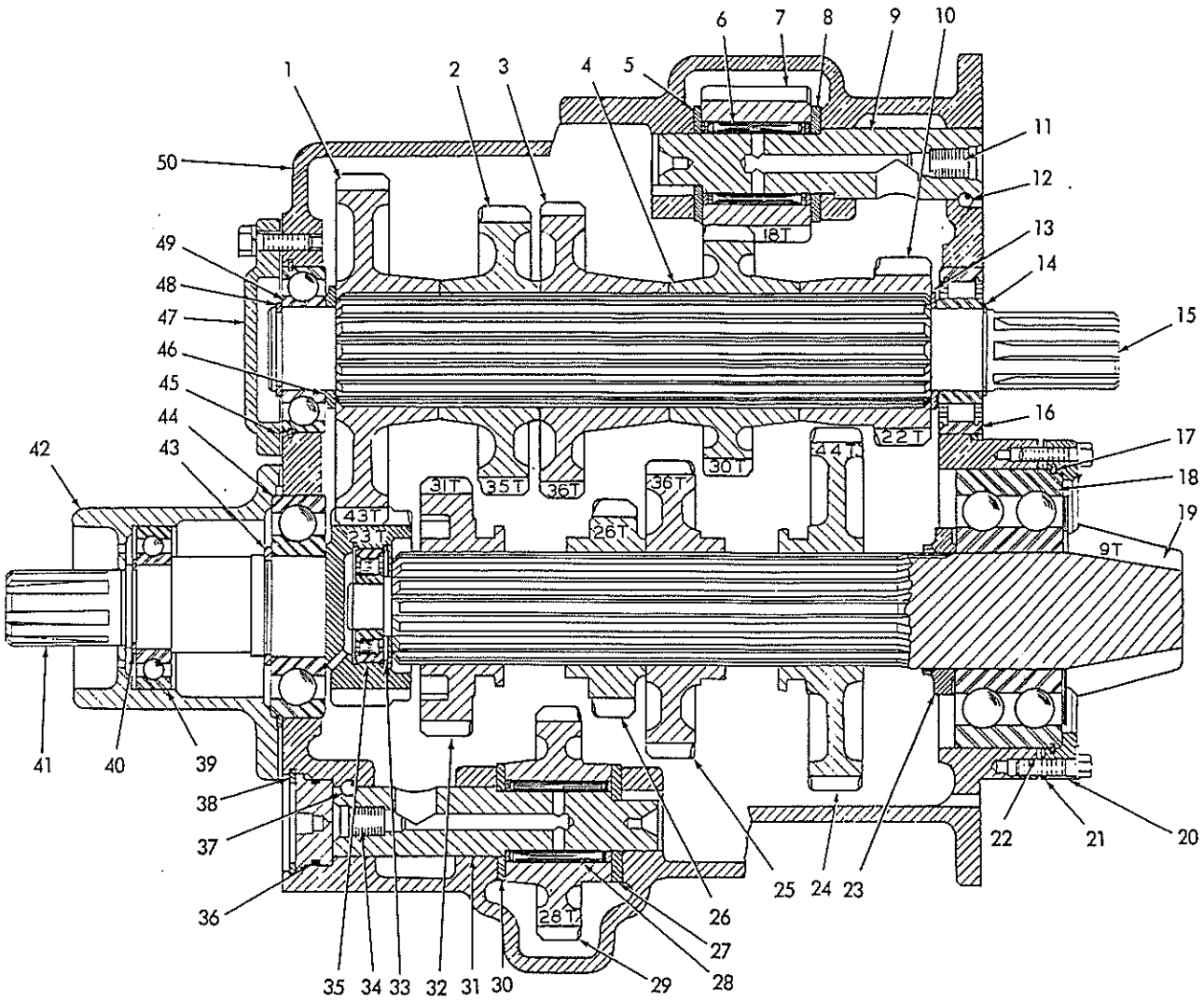

Fig. 2 Two Speed Reverse Transmission (Standard HD6G - Optional HD6A, B, and E) (T-18718)

1. Top shaft drive gear
2. Third speed gear
3. Top shaft high speed reverse gear
4. Second speed gear
5. Inner thrust washer
6. Reverse gear bearing
7. Low speed reverse gear
8. Outer thrust washer
9. Reverse gear shaft
10. First speed gear
11. Plug
12. Steel ball
13. Washer
14. Snap ring
15. Top shaft
16. Top shaft rear bearing w/snap ring
17. Rear bearing snap ring
18. Bevel pinion shaft rear bearing
19. Bevel pinion shaft
20. Rear bearing retainer
21. Bearing retainer shims
22. Pinion depth adjustment shims
23. Rear bearing retaining nut
24. First speed and reverse gear
25. Second speed gear
26. Bevel pinion shaft high speed reverse gear
27. Inner thrust washer
28. Reverse gear bearing
29. High speed reverse gear
30. Outer thrust washer
31. Reverse gear shaft
32. Third and fourth speed gear
33. Front bearing snap ring
34. Plug
35. Bevel pinion shaft front bearing
36. Sealing ring
37. Steel ball
38. Snap ring
39. Input shaft front bearing
40. Front snap ring
41. Input shaft
42. Gear shift housing
43. Rear snap ring
44. Input shaft rear bearing w/snap ring
45. Gasket
46. Washer
47. Top shaft front bearing cover
48. Snap ring
49. Top shaft front bearing w/snap ring
50. Transmission case

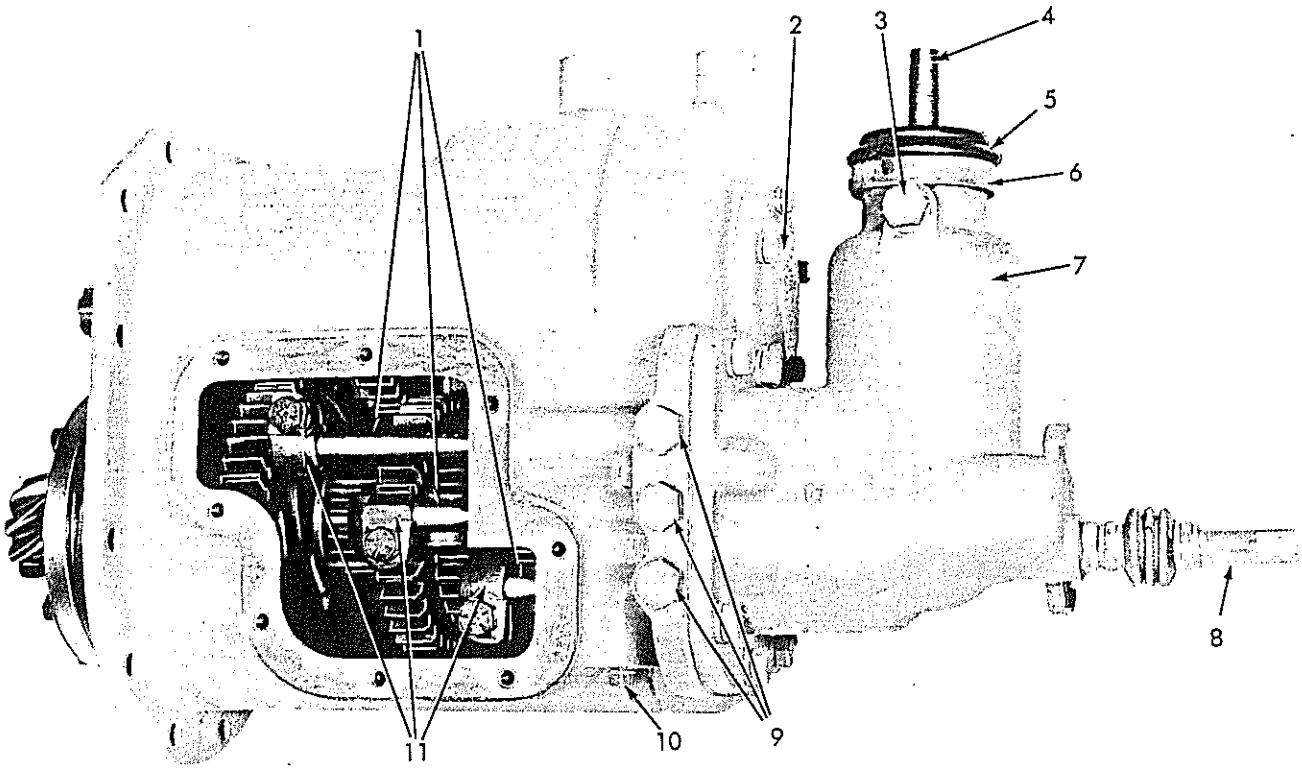

Fig. 3 Transmission Assembly - Side Cover Removed
(T-18042)

1. Shifting shafts
2. Top shaft front bearing cover
3. Shift lever pivot screw
4. Shift lever
5. Shift lever boot
6. Clamp
7. Shift lever housing
8. Locking plunger
9. Capscrews
10. Pipe plug
11. Shifting forks

9. Remove pipe plug Fig. 3 (10); hold lower shaft shifting fork; pull shaft from transmission. Two steel detent balls and shifting shaft interlock pin will fall from pipe plug hole as shaft is pulled.

NOTE

Effective with S/N 10145 (except 10219 thru 10262) upper and lower shifting forks are keyed to shifting shafts.

10. Hold intermediate shaft shifting fork; pull shaft from transmission. Two steel detent balls will fall from pipe plug hole as shaft is pulled.

11. Hold upper shaft shifting fork; pull shaft from transmission. Remove shifting forks and place each fork with its respective shaft.

12. Unlock and remove capscrews from pinion shaft rear bearing retainer Fig. 5 (8). Remove retainer and retainer shims; tie shims to retainer to prevent loss.

13. Refer to Fig. 6; assemble tools as shown and press pinion shaft toward rear of transmission case until rear bearing is free of its bore. Remove tools and pull pinion shaft from case; remove shaft components as they are free of shaft. Tie pinion depth adjustment shims together and lay aside for reuse in assembly.

14. If pinion shaft rear bearing is to be replaced, unlock and remove bearing retaining nut, Fig. 7. Use hydraulic press and suitable puller tools to remove bearing from shaft.

15. Remove top shaft front bearing cover, Fig. 3 (2); remove snap ring from front end of shaft. Drive shaft out toward rear of case; remove gears as they are free of shaft.

16. Remove low speed reverse gear shaft plug, Fig. 5. Use slide hammer puller to pull shaft from transmission; catch steel locking ball, Fig. 1 (12) as shaft is removed. Remove reverse gear, bearing, and thrust washers from transmission.

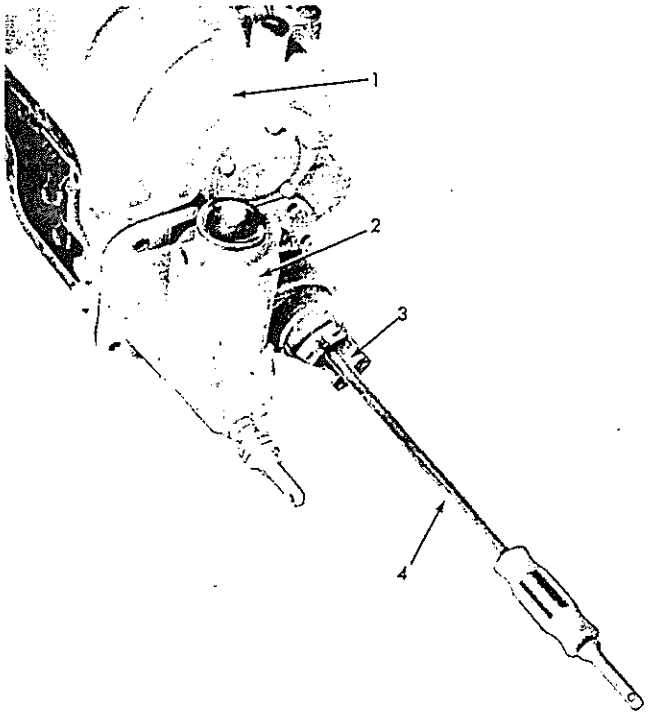

Fig. 4 Removing Shift Lever Housing
(T-18043)

1. Transmission case
2. Shift lever housing
3. Universal joint rear yoke
4. Slide hammer puller

17. HD6G (also other models with optional two speed reverse), remove snap ring Fig. 8 (2), high speed reverse gear shaft hole plug (1), and shaft plug Fig. 2 (34). Use slide hammer puller to pull shaft from case; catch steel locking ball, Fig. 2 (37) as shaft is removed. Remove high speed reverse gear, bearing, and thrust washers from transmission.

18. Bearings remaining in case or on shafts should now be removed, cleaned, inspected, and replaced if necessary; use suitable puller tools to prevent damage to shafts or bearings.

D. COMPONENTS INSPECTION

1. BALL AND ROLLER BEARINGS

a. Thoroughly clean bearings in clean solvent and dry with compressed air free of moisture.

b. Inspect bearings to see that they roll freely and are free from cracked, pitted, or worn balls, rollers, and races. Make certain ball retainers are in good condition and are not dented or damaged.

c. Badly worn ball bearings can be detected by presence of excessive end play between outer and inner races. This condition can be detected by holding one race steady and moving other race endwise, comparing difference in movement of races of a used bearing with a new bearing.

d. Check outer and inner races for indications of bearing creepage. This can be detected by marks on bearing races or on bearing area of bore or shaft where bearing has been used.

e. If bearings are to be reused, keep bearings clean, well lubricated, and wrapped in clean oil proof paper to prevent rust and entrance of dirt. When installing new bearings, do not remove bearings from package until ready for assembling. Do not wash lubricant from new bearing.

f. Use press and suitable sleeve or driver when installing bearings. If these are not available, a cold rolled soft steel rod and a hammer may be used to drive bearings into position; do not strike bearing shield or ball retainer when installing.

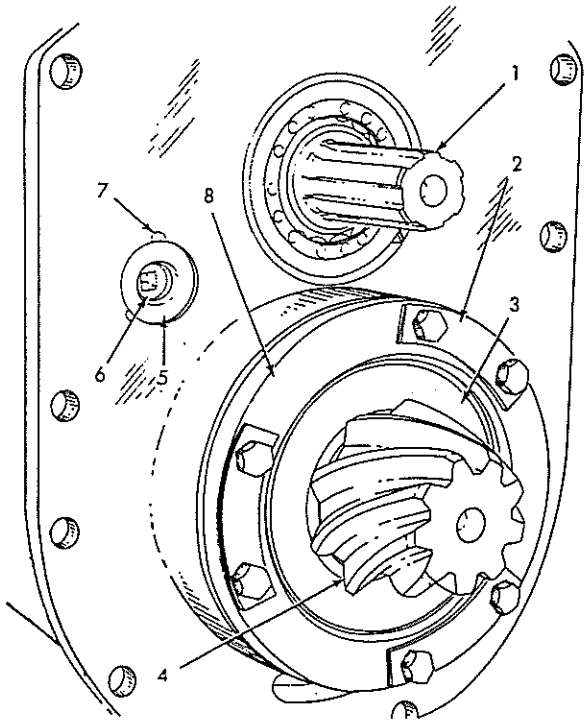

Fig. 5 Transmission Shafts Installed - Rear View
(T-72003)

1. Top shaft
2. Locking plate
3. Rear bearing shield
4. Bevel pinion shaft
5. Low speed reverse gear shaft
6. Plug
7. Hole for steel ball
8. Rear bearing retainer

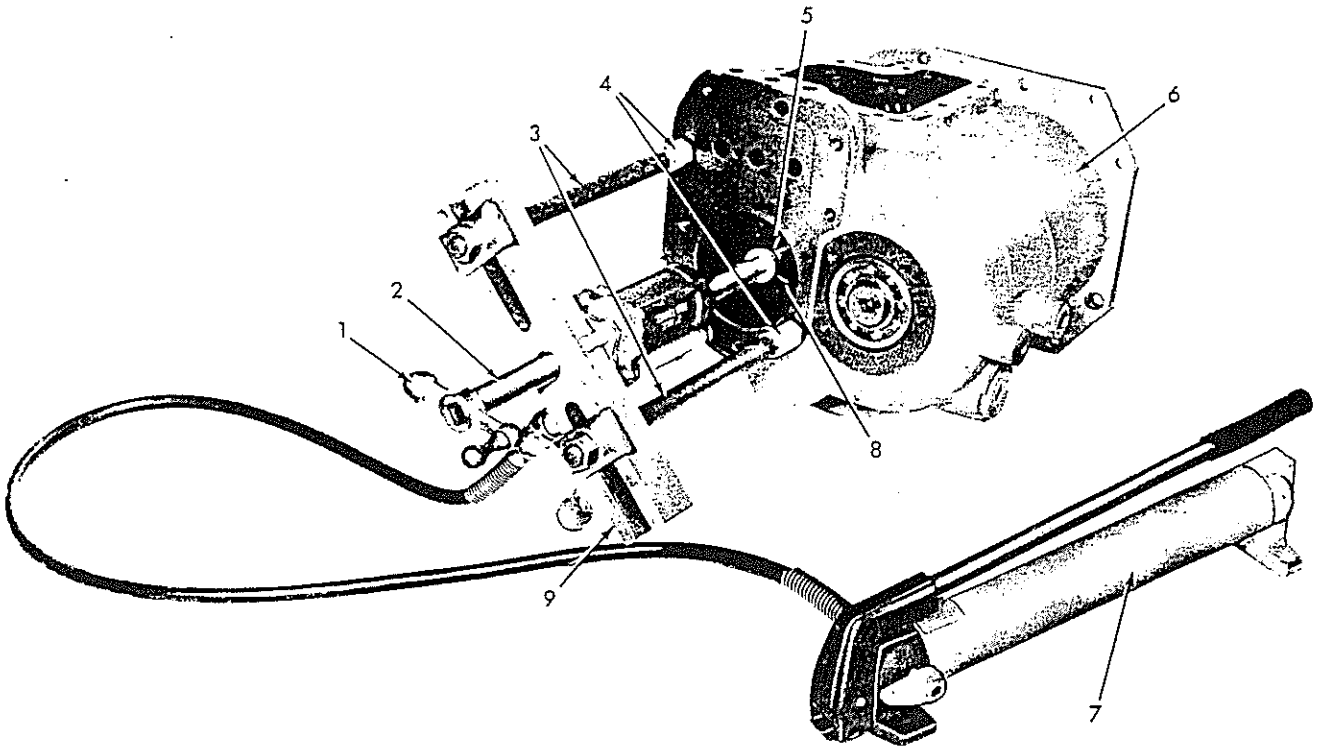

Fig. 6 Removing Pinion Shaft
(T-18044)

1. Adjusting crank
2. Forcing screw
3. Puller legs
4. Adapters
5. Bevel pinion shaft
6. Transmission case
7. Hydraulic ram and pump assembly
8. Shaft protector
9. Push-puller

g. Bearings may be heated to expand bore of inner race to facilitate installation of bearing on a shaft. One method of transferring heat to bearings is through the use of hot oil. The bearings should never be placed directly on bottom of tank or container, but should be placed on a screen so they may be heated uniformly. A light or medium grade of clean lubricating oil should be used and heated to approximately 275° F.

h. When installing bearing on shaft, drive or press on inner race; when installing in a bore, drive or press on outer race.

i. When using sliding hammer type puller to remove or install an assembly containing tapered roller bearings, be sure pull is evenly distributed on bearing. Do not allow cup and cone to become separated, as each blow of sliding hammer (with cup and cone separated) will cause cup and cone to be rammed together and damage will result.

2. SHAFTS AND SPLINES

a. Inspect shafts for worn areas and make certain they are not twisted or bent. Inspect splines of shafts for roughness, burrs, and wear. Remove all burrs and slight roughness from splines with mill file or stone. Try mating components on shaft to be sure they slide freely on splines.

b. Check bearing journals to be certain they are smooth and within specified tolerances.

3. OIL SEALS

a. When any work is done involving removal of shaft from oil seal, or removal of oil seal from shaft, sealing lip of seal must be carefully examined afterwards.

b. Sealing lip must not be scratched, folded over, torn, or charred from heat. The lip must be flexible; spring, located inside lip, must have proper

tension to return lip to proper position when lip is pressed in by hand.

c. When installing oil seal on shaft, or shaft through seal, be sure to protect sealing lip from damage which might be caused from a keyway, splines, threads, or hole through shaft. A scratch or cut, or fold in lip of seal, will render seal useless.

d. Before installing seal, coat bore lightly with liquid-type gasket cement.

e. Always lubricate lips of seals with clean oil at assembly.

4. GASKETS

When a gasket is removed, clean gasket and inspect for damage. If it is in good condition and is to be used again, immerse it in container of clean oil and keep it in container until needed. Do not use gasket if torn, hardened, shrunken, or stretched out of shape.

5. GEARS

a. Clean and inspect all gears for worn, pitted, chipped, or cracked teeth.

b. Check internal splines for galling, roughness, and wear; make certain gears slide freely on shaft splines.

E. ASSEMBLY

1. REVERSE SHAFT INSTALLATION

a. Stand transmission case on front end; place low speed reverse gear (with bearing assembly) and inner and outer thrust washers in position in case Fig. 1. Install reverse gear so chamfered ends of teeth are toward rear of transmission.

NOTE: Transmission in units S/N 21448-up has two inner thrust washers and one wide outer washer; see Fig. 6 or 7 in Section 2 in this Manual.

b. Turn thrust washers so flat surfaces in inside diameter are to top of transmission and in line.

c. Position reverse gear shaft Fig. 5 (5) so hole for steel ball is in line with notch in transmission (7). Start shaft in bore and install steel ball in shaft; drive shaft into position. Install plug (6) in end of shaft.

d. HD6G (also other models with optional two speed reverse), install high speed reverse shaft assembly, Fig. 2, using preceeding procedure. After shaft is installed, install shaft hole plug, Fig. 8; secure with snap ring.

2. TOP SHAFT INSTALLATION

a. Install washer, Fig. 1 (36) on front end of shaft, flat side of washer against shaft splines. Install front bearing (39) on shaft; install snap ring (37).

b. Turn transmission so side cover opening is up.

c. Insert rear end of shaft through front bore in transmission. Refer to Fig. 1, 2, or 7; install gears on shaft in order and position shown. Push shaft to rear until front bearing is seated in its bore; install front bearing cover, Fig. 3, (with new gasket).

d. Install washer, Fig. 1 (13) on rear end of shaft, flat side of washer against shaft splines. Install rear bearing inner race on shaft (chamfered end next to washer); install rear bearing and snap ring (16).

3. BEVEL PINION SHAFT INSTALLATION

a. Install rear bearing shield Fig. 7 (25) on shaft with concave side of offset against pinion gear (shield not used S/N 21448-up). Heat rear bearing in oil to 275°F; install bearing on shaft with snap ring groove in bearing toward rear. Install retaining nut, Fig.7(32), and lockwasher; torque nut to 500 lbs.ft. and lock with lockwasher.

NOTE

Effective with S/N 15586 lockwasher Fig. 7 (33) was discontinued and a new style bearing retaining nut (32A) used. Lock new style nut by staking in groove in shaft; torque is same.

b. Install front bearing inner race on shaft, chamfered end against shaft splines.

c. Refer to Fig. 1, 2, or 7; install pinion shaft gears in case in order and position shown. Insert shaft through rear bearing bore and gears, drive shaft forward until rear bearing snap ring is against case.

d. Use depth gauge and measure depth of recess in rear bearing retainer; lock depth gauge. Place depth gauge against rear face of rear bearing; use feeler gauge and measure gap between depth gauge and rear face of transmission case. Make shim pack equal to thickness of gap and add .001" to .002" shims to provide .000" to .002" bearing end play in retainer. Keep retainer and shim pack together.

e. Drive pinion shaft back slightly and remove snap ring from rear bearing. Install original pinion depth adjusting shim pack (removed at disassembly), or pack of approximately .054", in position on rear bearing.

LEGEND for Figure 7

1. Transmission assembly
2. Capscrew
3. Mounting gasket
4. Case
5. Side cover
6. Capscrew
7. Gasket
8. Oil filler plug
9. Gasket
10. Top shaft front bearing cover
11. Capscrew
12. Gasket
13. Top shaft
14. Snap ring
15. Top shaft front bearing
16. Top shaft rear bearing
17. Bearing snap ring
18. Washer
19. Top shaft drive gear
20. Top shaft third speed gear
21. Top shaft fourth speed gear (HD6A, B, and E)
    Top shaft high speed reverse gear (HD6G)
22. Top shaft second speed gear
23. Top shaft low speed gear
24. Bevel pinion shaft
*** 25. Rear bearing shield
26. Pinion shaft rear bearing
27. Pinion depth adjustment shims
28. Rear bearing retainer
29. Capscrew
30. Capscrew locking plate
31. Rear bearing adjustment shims
*32. Rear bearing retaining nut
**32A. Rear bearing retaining nut
*33. Lockwasher
34. Pinion shaft low speed and reverse gear
35. Pinion shaft second speed gear
36. Pinion shaft fourth speed gear (HD6A, B, and E)
    Pinion shaft high speed reverse gear (HD6G)
37. Pinion shaft third and high speed gear
38. Pinion shaft front bearing
39. Snap ring
40. Input shaft
41. Input shaft rear bearing
42. Snap ring
43. Input shaft front bearing
44. Snap ring
45. Reverse gear shaft
46. Shaft plug
47. Reverse gear bearing
**** 48. Inner thrust washer
49. Outer thrust washer
50. Low speed reverse gear
51. High speed reverse gear
52. Reverse shaft hole plug
53. O-ring
54. Snap ring
55. Input shaft seal ring (steel)
56. Input shaft seal ring (bronze)
57. Seal ring gasket
58. Seal spring assembly
59. Seal boot
60. Universal joint rear yoke
61. Sealing washer
62. Retaining washer
63. Capscrew
64. Locking wire

Following items used on HD6G only

65. Oil level gauge rod
66. Gauge rod seal
67. Oil filler extension
68. Gasket
69. Oil level gauge pipe

*Prior to HD6G Tractor Serial No. 15570; HD6A, B, E Tractor Serial No. 15586.
**Effective with HD6G Tractor Serial No. 15570; HD6A, B, E Tractor Serial No. 15586.
***Not used S/N 21448-up
****Two washers used S/N 21448-up

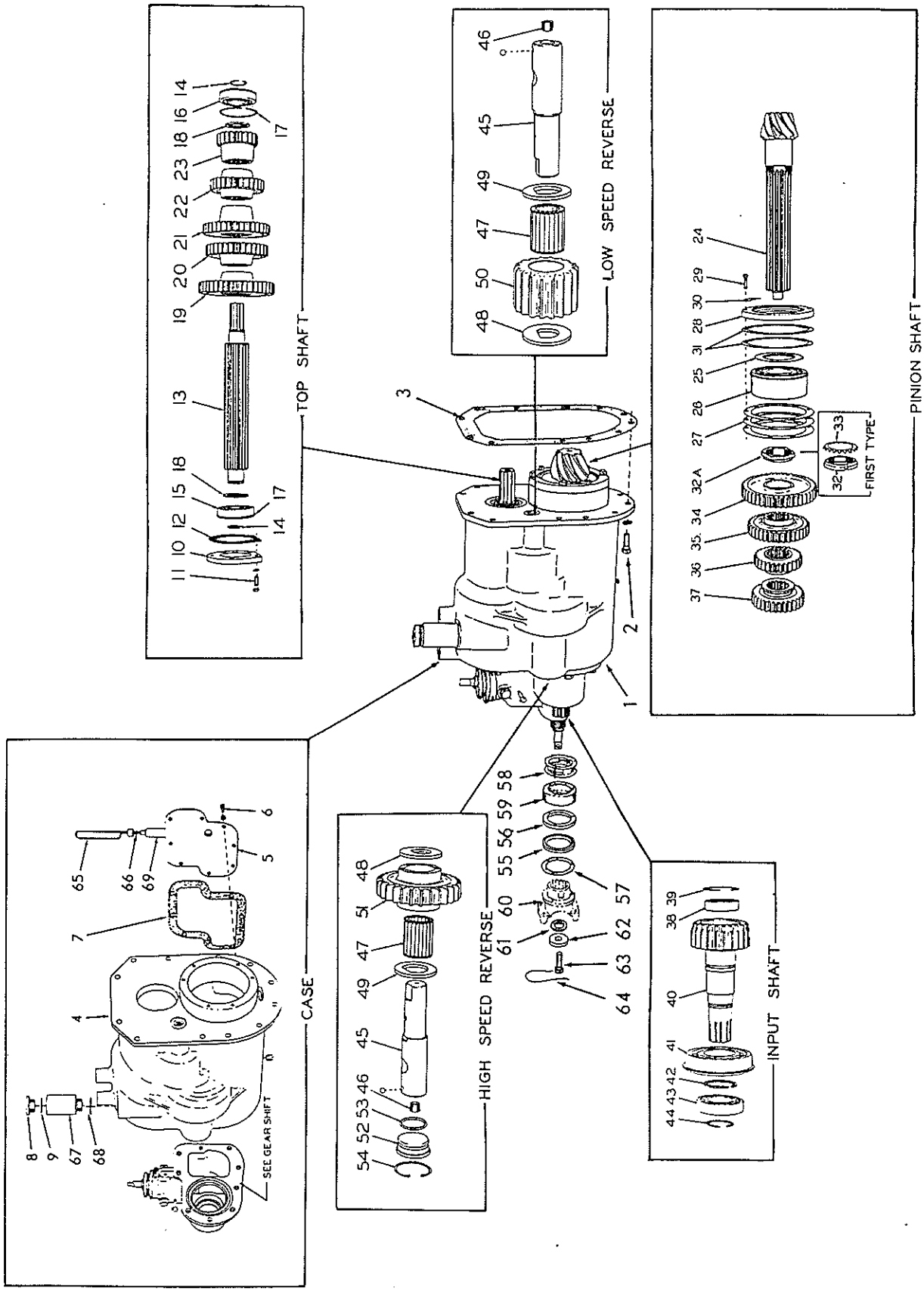

Fig. 7 Transmission Assembly
(T-4311)

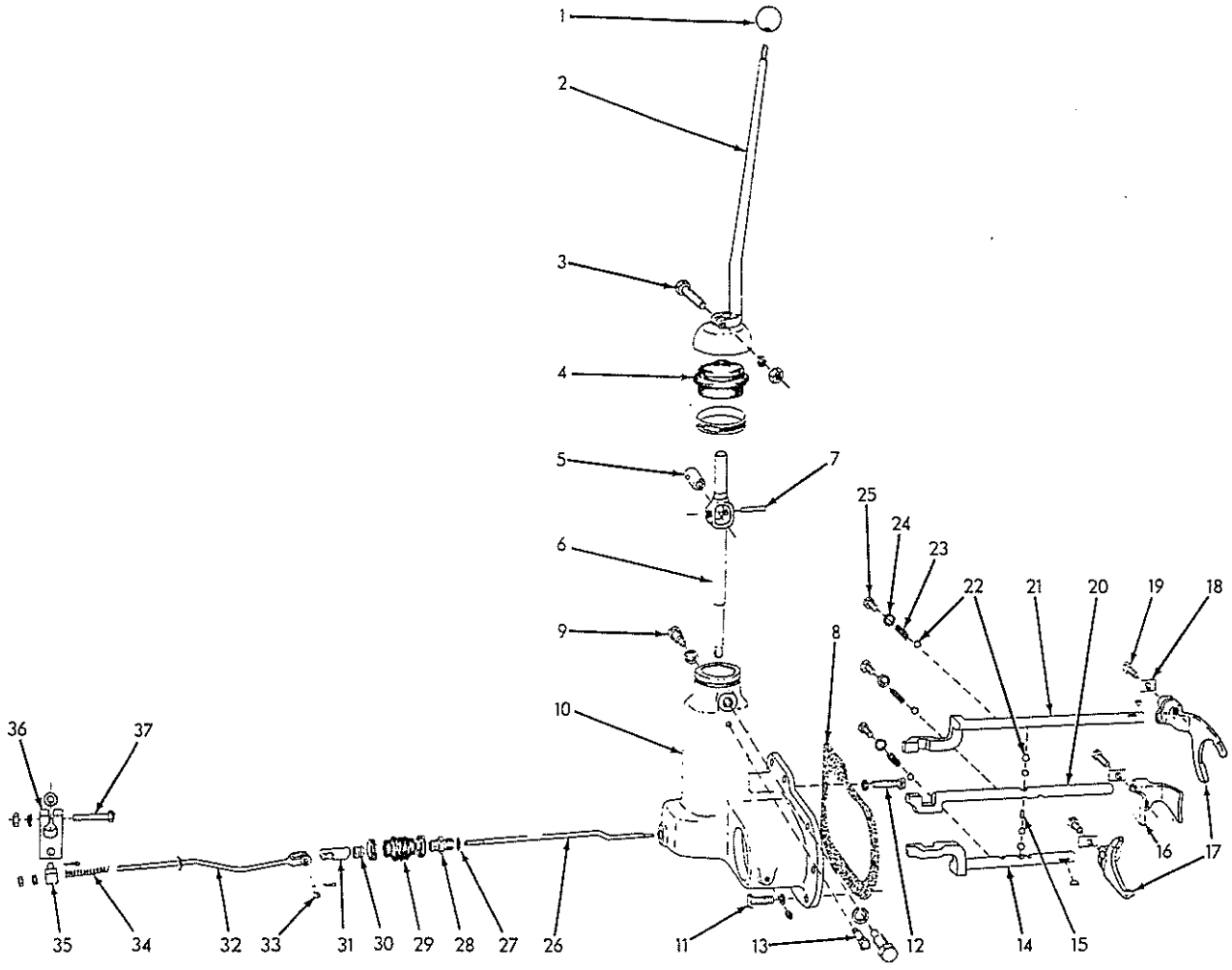

Fig. 9 Gear Shift Details
(T-24063)

1. Knob
2. Gear shift lever
3. Capscrew
4. Boot
5. Pivot lever shaft
6. Shift lever
7. Roll pin
8. Gasket
9. Pivot lever screw
10. Shift lever housing
11. Capscrew
12. Capscrew
13. Breather assembly
14. Lower shifting shaft
15. Shifting shaft interlock pin
16. Intermediate shaft shifting fork
17. Upper and lower shaft shifting forks
*18. Lock
19. Capscrew
20. Intermediate shifting shaft
21. Upper shifting shaft
22. Detent balls
23. Spring
24. Washer
25. Capscrew
26. Locking plunger
27. Copper washer
28. Locking plunger sleeve
29. Locking plunger boot
30. Locking plunger nut
31. Locking plunger end
32. Locking plunger rod
33. Pin
34. Spring
35. Swivel
36. Shift lock lever
37. Capscrew

*Used prior to Tractor Serial No. 8636.

e. Install detent ball, Fig. 9 (22) and spring (23) in each of three tapped holes on right front side of transmission case. Start capscrews (with washers) Fig. 3 (9); tighten capscrews enough to compress springs slightly.

f. Position shifting forks on shafts and sliding gears on pinion shaft to obtain maximum tooth contact between mating gears when engaged and clearance between gears when in neutral. Clamp shifting forks to shafts by torquing capscrews, Fig. 9 (19) to 83 to 93 lbs. ft. Return all shafts to neutral position; tighten capscrews, Fig. 3 (9).

g. Install locking plunger sleeve and washer, Fig. 9 (28) (27) in shift lever housing; install locking plunger (26) through sleeve from rear side of housing.

h. Use care to prevent damage to input shaft seal; install shift lever housing (with new gasket) over input shaft; tighten attaching capscrews. Insert locking plunger between detent balls in transmission case as housing is installed.

i. Coat I.D. at each end of locking plunger boot, Fig. 9 (29) with "Neoprene" cement; clamp one end of boot to locking plunger sleeve. Turn nut (30) to end of threads on locking plunger; install locking plunger end (31) and lock against nut (30). Clamp end of boot (29) to plunger end.

j. Install shift lever Fig. 9 (6) in shift lever housing; make certain lower end of lever is in notched ends of shifting shafts. Secure shift lever with pivot screws (9). Install shift lever boot (4); secure with clamp.

k. Install gear shift lever, Fig. 9 (2); push lever down so top of shift lever (6) is above clamping boss. Tighten clamping capscrew.

l. Use spring scale and weigh pull required at top of gear shift lever to "shift gears"; specified pull is 25 to 35 lbs. Add or remove washers beneath capscrews, Fig. 3 (9) to obtain specified pull. Make certain shifting lock plunger, Fig. 3 (8) is fully disengaged (pulled out as far as possible) when checking pull on gear shift lever.

m. Install transmission side cover and gasket; install pipe plug, Fig. 3 (10).

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. 10 and check bearing end-play by positioning a 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, the steering clutches must be removed and bearing pre-load readjusted; refer to "BEVEL GEAR AND SHAFT".

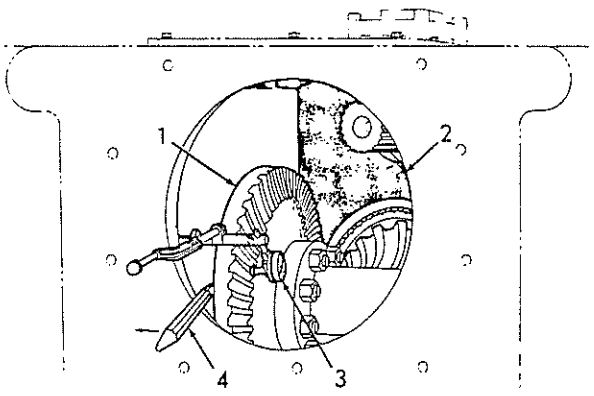

Fig. 10 Checking for Bevel Gear End-Play (T-70854)

1. Bevel gear
2. Power take-off access hole
3. Dial indicator
4. Small pry bar

2. Install two guide studs in steering clutch housing; install transmission (with new mounting gasket).

3. Check backlash between bevel gear and bevel pinion; also make certain tooth contact pattern is correct. The 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. 11; 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.

CAUTION

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

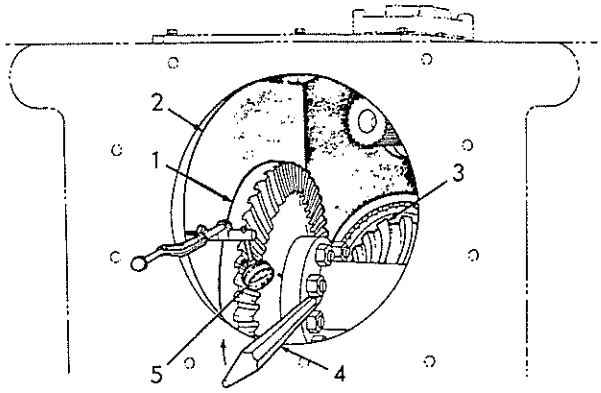

Fig. 11 Checking Backlash Between Bevel Gear and Bevel Pinion (T-70855)

1. Bevel gear
2. Power take-off access hole
3. Bevel pinion
4. Small pry bar
5. Dial indicator

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. 1 (22) 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 a 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. 12. If contact pattern is NOT satisfactory, add or remove pinion depth adjusting shims Fig. 1 (22), until pattern is satisfactory.

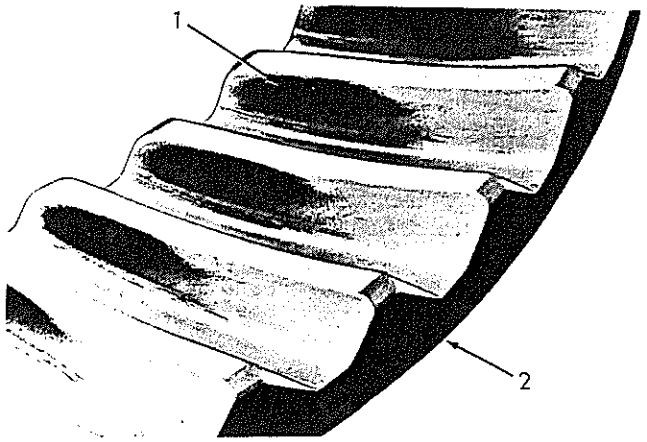

Fig. 12 Satisfactory Tooth Contact - No Load (T-31450)

1. Contact pattern
2. Bevel gear

e. Re-check backlash! If backlash is not within specifications refer to "BEVEL GEAR AND SHAFT" and perform complete procedure.

4. Connect locking plunger rod, Fig. 9 (32) to plunger end (31). Adjust length of control rod (32) so transmission will shift with engine clutch disengaged and will not shift with engine clutch engaged.

5. Install drive shaft universal joint.

6. Install steering clutch operating lever bracket assembly on top of transmission case; connect rear end of control rods to operating lever(s). Check steering control linkage adjustment (refer to Steering Clutches and Brakes Service Manual, Part Number 650433 for detailed information).

7. Install seat supporting front channel, seat frame, and seat.

8. Install oil drain plug in bevel gear compartment; fill transmission to proper level with specified lubricant (refer to "TRANSMISSION AND BEVEL GEAR LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE").

9. Turn electrical system master switch ON and start engine. Move tractor short distance in each speed range to make certain transmission is working properly. Check for oil leaks; stop engine; correct any leaks found.

10. Install floor plates and main frame closure plate.

TOPIC 5 - BEVEL GEAR AND SHAFT

A. DESCRIPTION

The bevel gear, located in center compartment of steering clutch and final drive housing, is attached to flange on bevel gear shaft, Fig. 13. The 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

The bevel gear, bevel gear shaft, and bevel gear shaft bearings may be removed and replaced 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 should not be reinstalled in tractor until after bevel gear, shaft and bearings have been reinstalled, and pre-load on bevel gear shaft

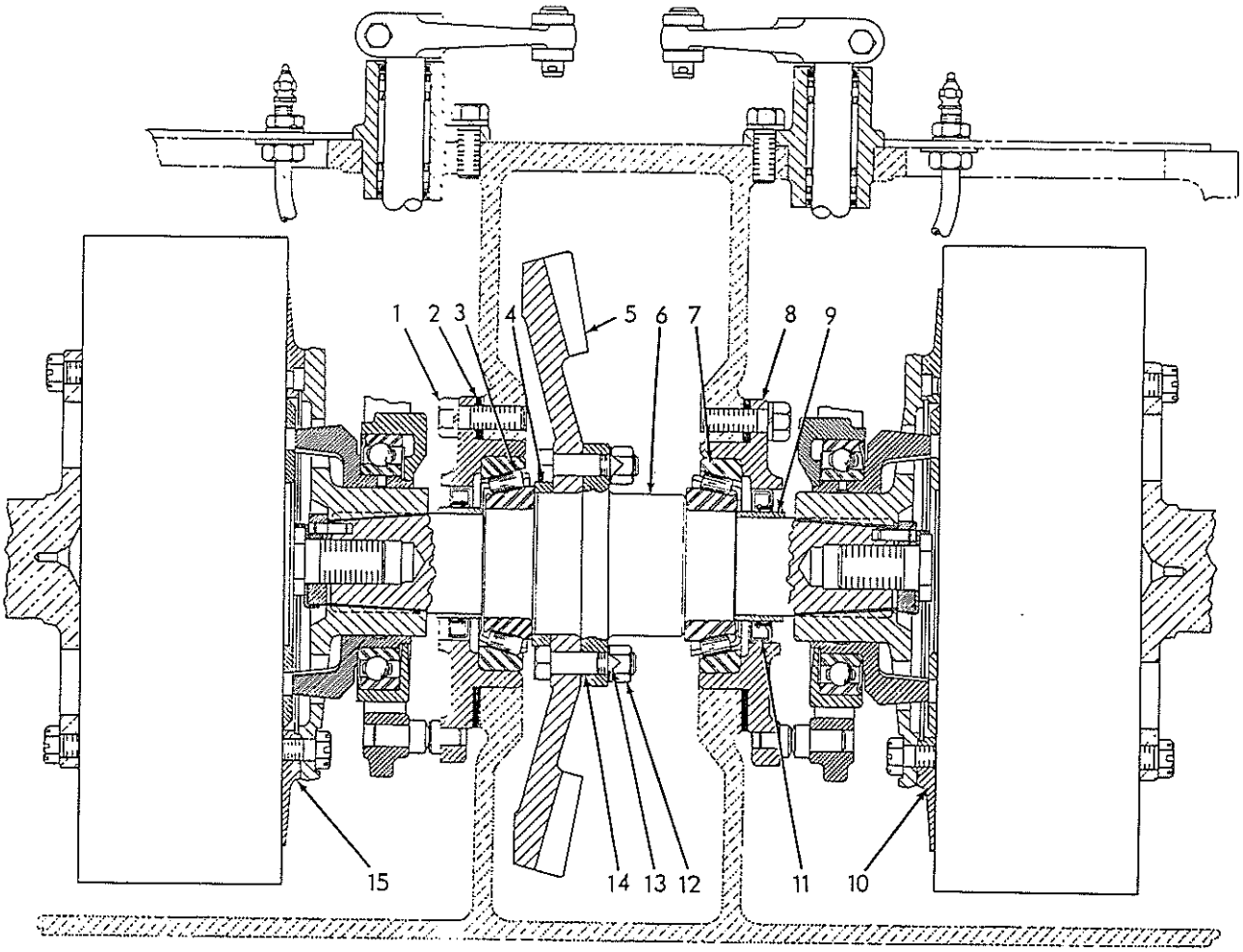

Fig. 13 Bevel Gear and Shaft - Sectional View
(T-72013)

1. Capscrew
2. Bearing adjustment shims
3. Bearing cone
4. Capscrew locking ring
5. Bevel gear
6. Bevel gear shaft
7. Bearing cup
8. Bearing cage
9. Sleeve
10. Right steering clutch assembly
11. Oil seal
*12. High nut
*13. Locking plate
14. Capscrew
15. Left steering clutch assembly

*Replaced by elastic stop nuts effective Tractor Serial No. 16846.

bearings have been adjusted. If bevel gear, shaft or bearings are to be replaced without removing transmission, pre-load on bevel gear shaft bearings must be adjusted without bevel gear installed on shaft. Then remove shaft and install bevel gear.

Remove bevel gear and shaft as follows:

1. Remove drain plug from bevel gear compartment and allow oil to drain. Refer to Steering Clutches and Brakes Service Manual, Part Number 650433; remove steering clutches and brakes.

2. Remove bevel gear compartment cover; remove high nuts and locking plates securing bevel gear to bevel gear shaft.

NOTE

Effective with S/N 16846, elastic stop nuts replace locking plates and high nuts.

3. Refer to Fig. 13; 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 their respective cages to prevent loss. Mark bearing cages so they will be reinstalled in their original positions (left and right).

4. Refer to Fig. 14, 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.

NOTE

The 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 and oil seals 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, pre-load on bevel gear shaft bearings must be adjusted without bevel gear installed on shaft; then remove shaft and install bevel gear.

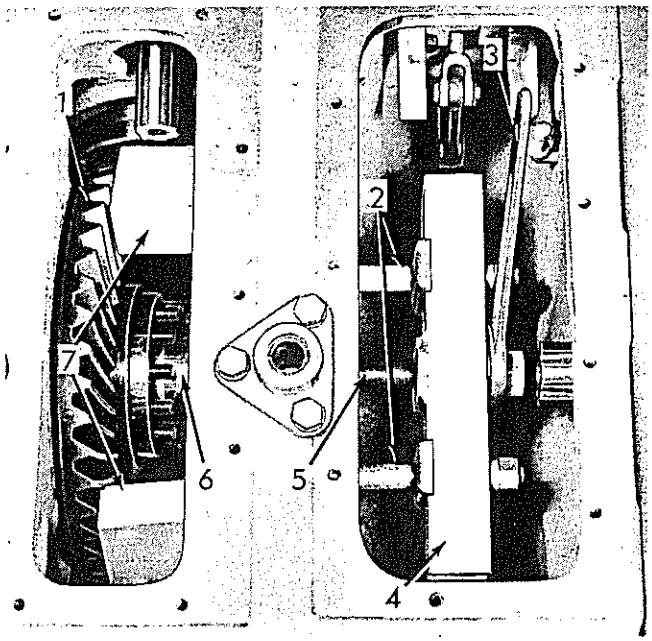

Fig. 14 Removing Bevel Gear Shaft (T-17887)

1. Bevel gear
2. Puller legs
3. Wrench
4. Push-puller
5. Puller screw
6. Bevel gear shaft
7. Wooden blocks

1. Install sleeves, Fig. 15 (6), if removed; press sleeves against shoulder on shaft.

2. Press one bearing cone, Fig. 15 (8) on long end of shaft with large O.D. of bearing tight against shoulder on shaft. Place bevel gear on suitable work bench (with teeth of gear downward). Position capscrew locking ring (5) on bevel gear and install capscrews (2) in bevel gear; turn capscrew heads as necessary to clear locking ring as capscrews are installed.

NOTE

Installation of bearing cones on shaft will be much easier if bearing cones are heated in oil to approximately 275°F. before installation.

3. Remove locking ring and position bevel gear in bevel gear compartment with teeth of gear 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. 15 (4) and high nuts (3) can be started on capscrews. Install locking ring (5) and tighten nuts evenly until bevel gear is properly located on shaft.

4. Lubricate other bearing cone, Fig. 15 (8) and start it on short end of bevel gear shaft with large

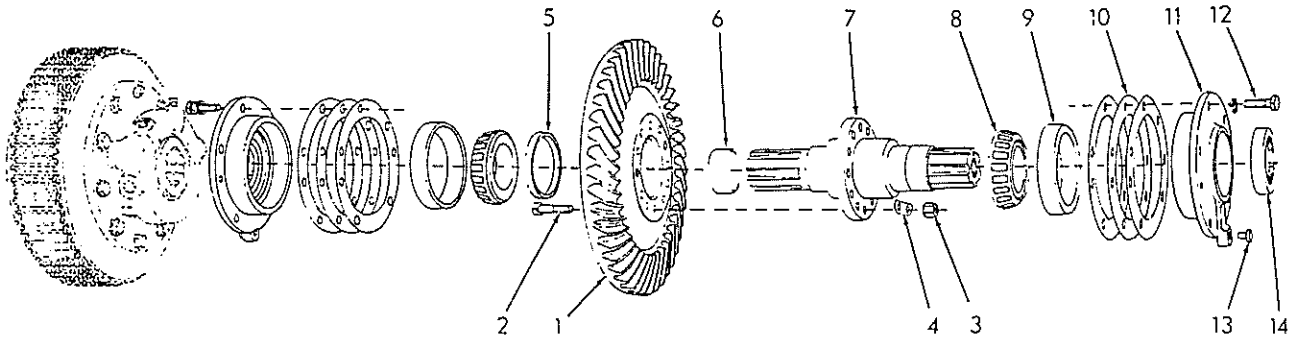

Fig. 15 Bevel Gear and Shaft Details
(T-38211)

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

*Replaced by elastic stop nuts effective with S/N 16846.

O.D. of bearing toward bevel gear. Refer to Fig. 16; 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 tight against shoulder on shaft; remove tools.

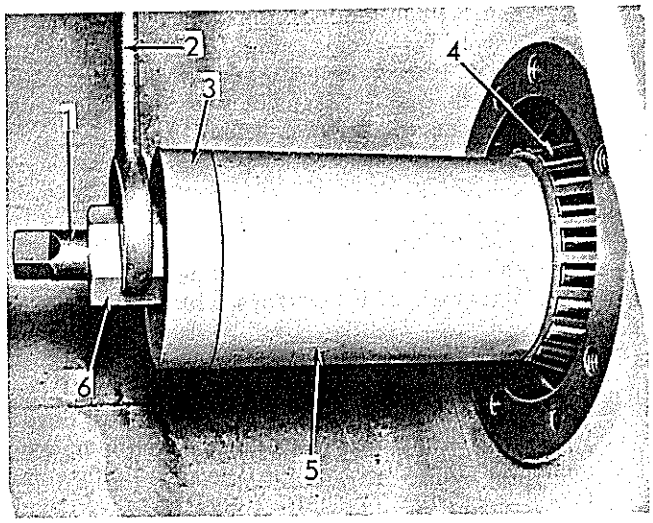

Fig. 16 Installing Bevel Gear Shaft Bearing Cone
(T-17899)

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

5. Press bearing cups Fig. 13 (7) in bearing cages (8); make certain cups are seated firmly in cages. Lubricate bearing with clean oil and install each bearing cage (with original bearing adjustment shims). Make certain wear pins Fig. 15 (13) in each bearing cage is at bottom; start bearing cage attaching capscrews (12), but do not tighten at this time.

NOTE

Do not install oil seals, Fig. 15 (14) in bearing cages until bevel gear adjustments have been made (refer to "ADJUSTMENTS").

6. Torque high nuts on bevel gear attaching capscrews to 70 to 90 lbs. ft. Lock high nuts in position with locking plates.

NOTE

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

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

D. ADJUSTMENTS

1. BEVEL GEAR SHAFT BEARING PRE-LOAD

a. Install capscrew in end of bevel gear shaft; tighten until it bottoms in shaft.

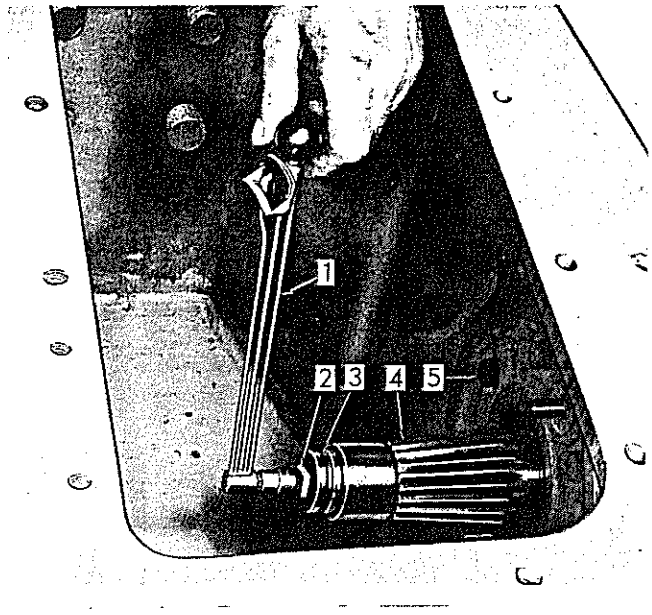

Fig. 17 Checking Pre-Load of Bevel Gear Shaft Bearings (T-25732)

1. Torque wrench
2. Adapter
3. Socket
4. Bevel gear shaft
5. Bearing cage

b. Refer to Fig. 17, turn bevel gear shaft with a pounds inch indicating torque wrench to determine pre-load on bearings; specified pre-load is 10 to 20 lbs. in. (.003"-.004" tight).

c. Add or remove bearing adjustment shims (equally) under bearing cages to obtain specified pre-load. When adjusting, bump bearing cages to make certain bearings are properly seated.

2. BACKLASH AND TOOTH CONTACT PATTERN

a. Install transmission (if removed), 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 the other. In this manner bevel gear is moved, but pre-load on bearings will remain as adjusted; move 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. 18. Area of contact when gears are loaded, should increase in length as shown in Fig. 19.

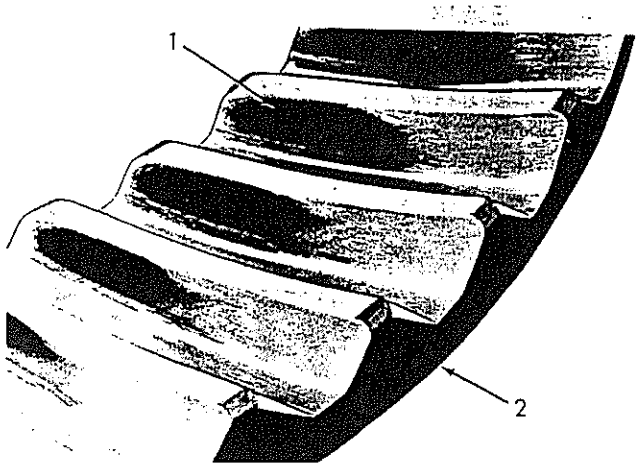

Fig. 18 Satisfactory Tooth Contact - No Load (T-31450)

1. Contact pattern
2. Bevel gear

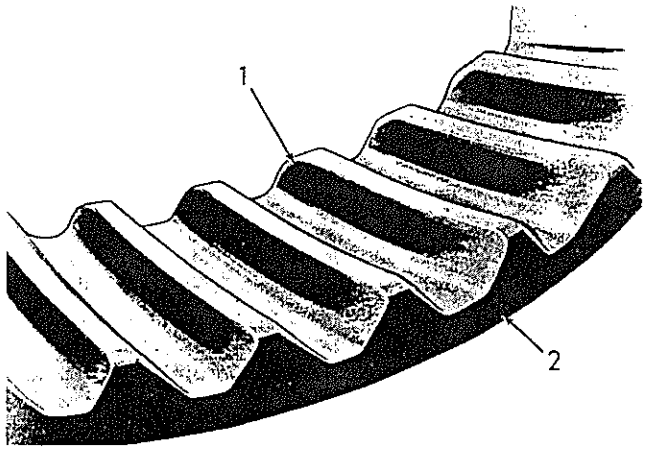

Fig. 19 Satisfactory Tooth Contact - Gears Loaded (T-31449)

1. Contact pattern
2. Bevel gear

HIGH CONTACT as shown in Fig. 20 is not desirable and will result in galling and rolling over of the top edges of teeth. To correct a high contact pattern, move bevel pinion TOWARD bevel gear by adding pinion depth adjusting shims between transmission case and snap ring on pinion shaft rear bearing. This adjustment will DECREASE backlash between bevel pinion and bevel gear. Specified backlash is .008"

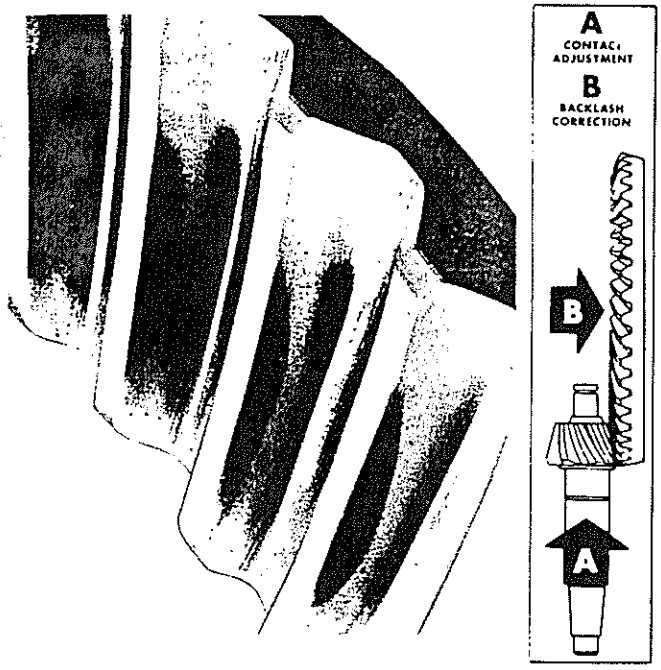

Fig. 20 High Contact - No Load
(T-71900)

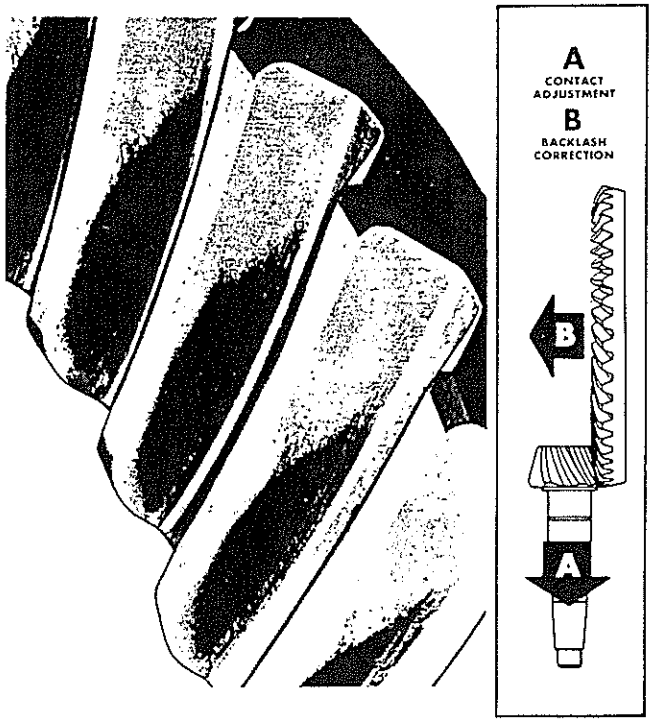

Fig. 21 Low Contact - No Load
(T-26963)

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. 21, will result in galling and grooving of the teeth. To correct a low contact pattern, move bevel pinion AWAY from bevel gear by removing pinion depth adjusting 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 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. 22, will result in chipped tooth edges and excessive wear due to small contact area. To correct a short toe contact pattern, move bevel pinion AWAY from bevel gear by removing pinion depth adjusting 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 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.

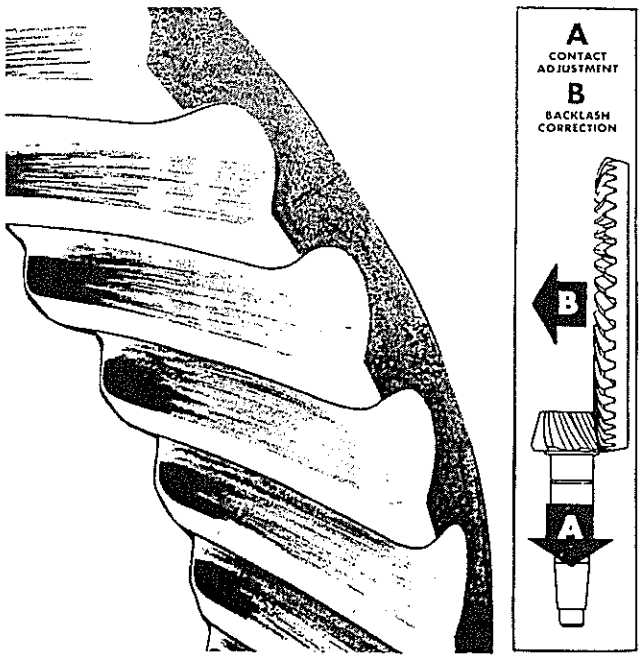

Fig. 22 Short Toe Contact - No Load
(T-71901)

e. After adjustments are completed, remove bevel gear shaft bearing cages and install oil seal Fig. 15 (14) in each cage (sealing lip inward). Reinstall bearing cages (with bearing adjustment shims); bump bearing cages while tightening capscrews to make certain bearings are properly seated.

E. FINAL INSTALLATION

1. Clean interior of bevel gear compartment and steering clutch compartments. Install bevel gear compartment cover.

2. Install steering clutches and steering brakes; refer to Steering Clutches and Brakes Service Manual, Part Number 650433 for detailed information.

3. Install bevel gear compartment oil drain plug; fill transmission with specified lubricant (refer to "TRANSMISSION AND BEVEL GEAR LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE").

TOPIC 6 - DRIVE SHAFT UNIVERSAL JOINT

"Spicer" universal joint, Fig. 23 used on following models: Tractor Serial No. 7191 thru 8190; Tractor Serial No. 9773 thru 10171. "Mechanics" universal joint, Fig. 24, used on all other models. Use applicable repair procedure.

A. "SPICER"

1. REMOVAL, DISASSEMBLY AND INSPECTION

a. Turn electrical system master switch "OFF"; remove floor plates.

b. Remove U-bolts, Fig. 23 (9) from front and rear yokes; remove bearing caps held in position by U-bolts. Pry front yoke forward and remove universal joint.

c. Put universal joint in a vise; remove snap rings, Fig. 23 (5). Drive spider one direction until opposite bearing cap may be removed; repeat operation on other side and other end to remove all bearing caps.

2. 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 a complete assembly. However, if spider and bearings are in good condition, assemble each spider as follows:

a. Coat needle bearings with grease to hold them in position in bearing caps; start two bearing caps, Fig. 23 (4) in holes in one end of shaft (8). Install shaft in vise; close vise until bearing

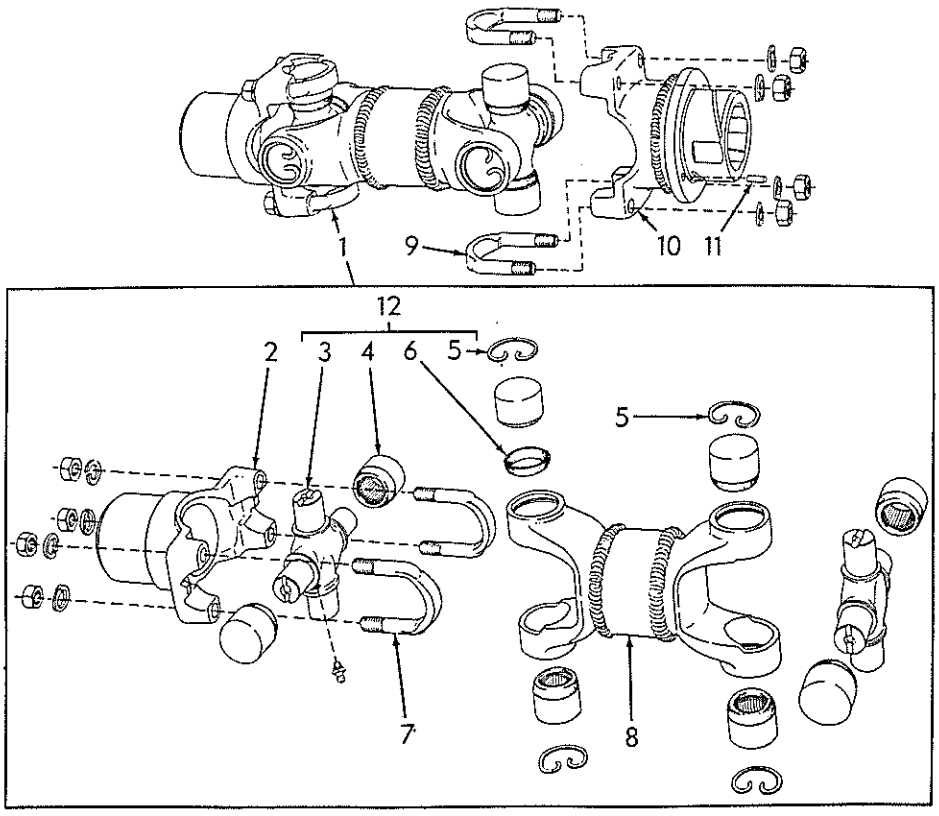

Fig. 23 "Spicer" Universal Joint Assembly
(T-17454)

1. Universal joint assembly
2. Front yoke
3. Cross journal
4. Bearing cap
5. Snap ring
6. Gasket
7. U-bolt (front yoke)
8. Shaft
9. U-bolt (rear yoke)
10. Rear yoke
11. Pin
12. Journal kit

caps are approximately half in their holes. Install gasket, Fig. 23 (6) on two opposing bearing journals on cross journal (3); install cross journal in shaft, centered between bearing caps. Close vise to press bearing caps on cross journal; turn cross journal while closing vise to make certain bearing caps are properly aligned. Remove shaft from vise; drive each bearing cap down until snap rings (5) can be installed.

b. Repeat step a. on opposite end of shaft; align lube fittings in cross journals when installing second journal.

c. Install gasket Fig. 23 (6) and bearing cap (4) on other bearing journals; attach shaft assembly to front and rear yokes. Torque U-bolt nuts to 20 to 24 lbs. ft.

d. Lubricate universal joint; install floor plates and turn electrical system master switch "ON".

B. "MECHANICS"

1. REMOVAL, DISASSEMBLY AND INSPECTION

a. Turn electrical system master switch "OFF"; remove floor plates.

b. Refer to Fig. 24, unlock and remove capscrews attaching universal joint to front and rear yokes; pry front yoke forward and remove universal joint.

c. Refer to Fig. 24, unlock and remove capscrews (3); remove front and rear spider assemblies (5) from connecting yoke (2).

d. Remove bearing assemblies from spider assemblies; identify bearing assemblies so they may be installed in original position if re-used.

e. Wash all components in clean solvent. Inspect for excessive wear or damage; replace necessary parts.

2. 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 a complete assembly. However, if spider and bearings are in good condition, assemble each spider as follows:

a. Refer to Fig. 24, install new seal washer (6) in each bearing cap; lubricate bearings with light coat of grease and install bearing caps on

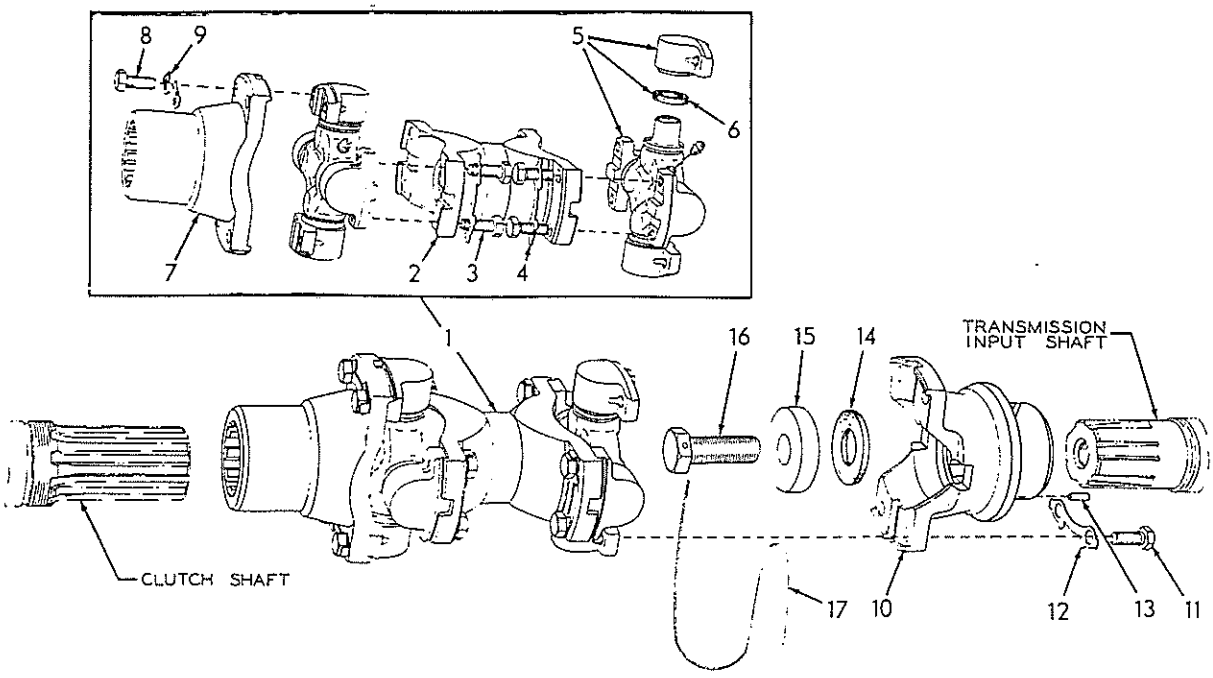

Fig. 24 "Mechanics" Universal Joint Assembly
(T-14022)

1. Universal joint assembly
2. Connecting yoke
3. Capscrew
4. Locking plate
5. Spider assembly
6. Seal washer
7. Front yoke
8. Capscrew
9. Locking plate
10. Rear yoke
11. Capscrew
12. Locking plate
13. Pin
14. Seal
15. Washer
16. Capscrew
17. Locking wire

TOPIC 7 - FITS AND TOLERANCES

A. TRANSMISSION

1. CASE

Topshaft front bearing bore	3.5427"-3.5437"
Topshaft rear bearing bore	3.5431"-3.5441"
Low speed reverse shaft	
Outer bore	1.504"-1.510"
Inner bore	1.4990"-1.5005"
High speed reverse shaft	
Outer bore	1.504"-1.510"
Inner bore	1.4990"-1.5005"
Input shaft rear bearing bore	4.7236"-4.7246"
*Bevel pinion shaft rear bearing bore	5.5113"-5.5123"

2. TOP SHAFT

Shaft	
O.D. at front bearing location	1.5749"-1.5754"
O.D. at rear bearing location	1.5752"-1.5758"
Front Bearing	
O.D.	3.5427"-3.5433"
I.D.	1.5743"-1.5748"
Washers (Front and rear)	
I.D.	1.580"-1.590"
Width	.193"-.197"
Flat within	.0005"
Rear Bearing	
O.D.	3.5425"-3.5433"
I.D.	1.5743"-1.5748"

3. BEVEL PINION SHAFT

Shaft	
Number of pinion teeth	9
O.D. at front bearing location	.9845"-.9850"
*O.D. at rear bearing location	2.5592"-2.5598"
Backlash with bevel gear	.008"-.014"
Front Bearing	
O.D.	2.4403"-2.4409"
I.D.	.9839"-.9843"
* Rear Bearing	
O.D.	5.5110"-5.5118"
I.D.	2.5585"-2.5591"

* 4. LOW SPEED REVERSE SHAFT

Shaft	
O.D. at bearing location	1.2490"-1.2495"
O.D. at bore location	1.4975"-1.4985"
Reverse Gear	
Number of gear teeth	18
I.D.	1.750"-1.751"
Thrust Washers	
Thickness	.183"-.187"
Flat within	.001"

5. HIGH SPEED REVERSE SHAFT

Shaft	
O.D. at bearing location	1.2490"-1.2495"
O.D. at bore location	1.4975"-1.4985"
Reverse Gear	
Number of gear teeth	28
I.D.	1.750"-1.751"
Thrust Washers	
Thickness	.183"-.187"
Flat within	.001"

6. INPUT SHAFT

Shaft	
O.D. at front bearing location	1.7718"-1.7723"
O.D. at rear bearing location	2.1655"-2.1661"
I.D. for pinion shaft front bearing	2.4404"-2.4414"
Front Bearing	
O.D.	3.3465"
I.D.	1.7717"
Rear Bearing	
O.D.	4.7238"-4.7244"
I.D.	2.1648"-2.1654"

7. GEAR SHIFT HOUSING

I.D. for input shaft front bearing	3.3463"-3.3471"
I. D. for input shaft rear bearing	4.729"-4.734"

B. BEVEL GEAR COMPONENTS

1. GEAR

Number of teeth	44
I. D. at shaft location	3.249"-3.250"
Backlash with bevel pinion	.008"-.014" (.203-.355mm)

2. SHAFT

O.D. at gear location	3.247"-3.248"
O.D. at bearing location	2.5015"-2.5025"
O.D. at oil seal sleeve location	2.2495"-2.2500"

*Refer to FITS AND TOLERANCES in SECTION 2 for these dimensions on units S/N 21448-up.

TOPIC 9 - CONVERSION TABLES

DECIMAL AND METRIC EQUIVALENTS OF FRACTIONS OF AN INCH

Inches			Millimeters	Inches			Millimeters
Fractions	Decimals	*Nom. Dec.		Fractions	Decimals	*Nom. Dec.	
1/64	.015625	.02	.397	33/64	.515625	.52	13.097
1/32	.03125	.03	.794	17/32	.53125	.53	13.494
3/64	.046875	.05	1.191	35/64	.546875	.55	13.891
1/16	.0625	.06	1.588	9/16	.5625	.56	14.288
5/64	.078125	.08	1.984	37/64	.578125	.58	14.684
3/32	.09375	.09	2.381	19/32	.59375	.59	15.081
7/64	.109375	.11	2.778	39/64	.609375	.61	15.478
1/8	.125	.12	3.175	5/8	.625	.62	15.875
9/64	.140625	.14	3.572	41/64	.640625	.64	16.272
5/32	.15625	.16	3.969	21/32	.65625	.66	16.669
11/64	.171875	.17	4.366	43/64	.671875	.67	17.066
3/16	.1875	.19	4.763	11/16	.6875	.69	17.463
13/64	.203125	.20	5.159	45/64	.703125	.70	17.859
7/32	.21875	.22	5.556	23/32	.71875	.72	18.256
15/64	.234375	.23	5.953	47/64	.734375	.73	18.653
1/4	.250	.25	6.350	3/4	.750	.75	19.050
17/64	.265625	.27	6.747	49/64	.765625	.77	19.447
9/32	.28125	.28	7.144	25/32	.78125	.78	19.844
19/64	.296875	.30	7.541	51/64	.796875	.80	20.241
5/16	.3125	.31	7.938	13/16	.8125	.81	20.638
21/64	.328125	.33	8.334	53/64	.828125	.83	21.034
11/32	.34375	.34	8.731	27/32	.84375	.84	21.431
23/64	.359375	.36	9.128	55/64	.859375	.86	21.828
3/8	.375	.38	9.525	7/8	.875	.88	22.225
25/64	.390625	.39	9.922	57/64	.890625	.89	22.622
13/32	.40625	.41	10.319	29/32	.90625	.91	23.019
27/64	.421875	.42	10.716	59/64	.921875	.92	23.416
7/16	.4375	.44	11.113	15/16	.9375	.94	23.813
29/64	.453125	.45	11.509	61/64	.953125	.95	24.209
15/32	.46875	.47	11.906	31/32	.96875	.97	24.606
31/64	.484375	.48	12.303	63/64	.984375	.98	25.003
1/2	.500	.50	12.700	1	1.000	1.00	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
Cubic Yards x .7645 = Cubic Meters

TORQUE & PRESSURE CONVERSION CONSTANTS -

lb. ft. x 0.1383 = m-kg
lb. in. x 1.1521 = cm-kg
psi x 0.0703 = kg/cm^2

LENGTH CONVERSION CONSTANTS — U.S. TO METRIC

Inches x 25.400 = Millimeters
Inches x .0254 = Meters
Feet x .3048 = Meters
Statute Miles x 1.60935 = Kilometers

*Nominal decimals are used in place of fractions of an inch, with exception of such items as bolts, screws, washers, tubing, wire, etc.

SECTION 2 - HD6E (EFFECTIVE WITH TRACTOR SERIAL NO. 14484)

TOPIC 1 - GENERAL DESCRIPTION

Power from the engine is transmitted through engine clutch and drive shaft universal joint to transmission input shaft. The transmission output (bevel pinion) shaft drives bevel gear and shaft and steering clutches (mounted at each end of bevel gear shaft). The steering clutches transmit power to final drives and track driving sprockets.

TOPIC 2 - TROUBLESHOOTING

TROUBLE	POSSIBLE CAUSES	REMEDY
Transmission hard to shift.	1. Clutch brake mal-functioning.	1. Adjust or repair clutch brake.
	2. Shifting mechanism worn.	2. Repair or replace worn or damaged parts.
	3. Shifting forks worn or damaged.	3. Replace worn or damaged parts.
Transmission disengages during operation.	1. Shifting forks incorrectly positioned on shafts.	1. Reposition shifting forks.
	2. Shift lock mechanism mal-function.	2. Inspect for worn or broken springs or rounded off detent notches on shifting shafts. Replace affected parts.
	3. Shifting forks worn.	3. Replace worn forks.
Noise in transmission.	1. Insufficient lubricant.	1. Fill to proper level with specified lubricant.
	2. Damaged or worn gears, bearings, shafts or bushings.	2. Replace worn or damaged parts.
	3. Bevel gear and pinion, or bearings, improperly adjusted.	3. Adjust as necessary.

d. Install tank on filter head and tighten tank retaining capscrew to a torque of 80 to 90 lbs. ft.

2. CLEAN SUCTION LINE SCREEN

The suction line screen is located in left front side of transmission case, Fig. 2.

a. Clean screen cover area.

b. Loosen hose clamps on outlet line hose and remove capscrews securing cover to transmission case; remove cover with suction line screen attached.

c. Turn suction line screen out of cover. Wash screen in clean solvent and inspect screen for damage; replace if necessary.

d. Install screen on cover and place cover on transmission case. Tighten attaching capscrews evenly; connect outlet line hose and tighten hose clamps.

3. CLEAN BREATHERS

Remove the four breathers (two each side), Fig. 3, and wash in solvent or fuel oil. Blow dry with compressed air and reinstall. Operating in extremely dusty conditions may require a more frequent cleaning.

4. CHANGE OIL

To change transmission oil, the steering clutch compartments (left and right) and bevel gear compartment must be drained. Oil should be at normal operating temperature before draining.

a. Remove steering clutch and bevel gear compartment drain plugs. Allow oil to drain; clean and re-install drain plugs.

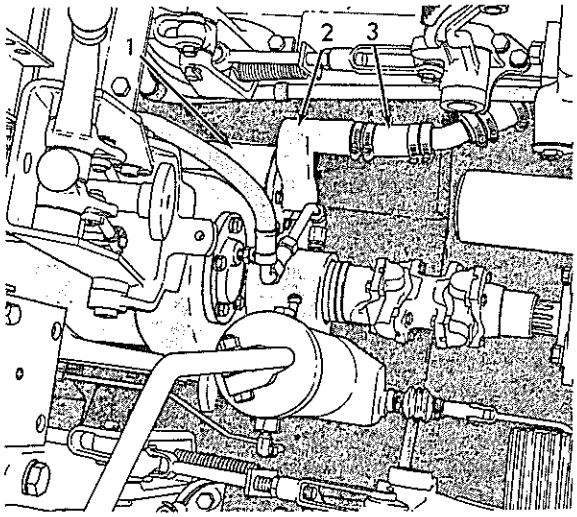

Fig. 2 Suction Line Screen Location (T-72006)

1. Transmission case
2. Suction screen cover
3. Steering pump suction line

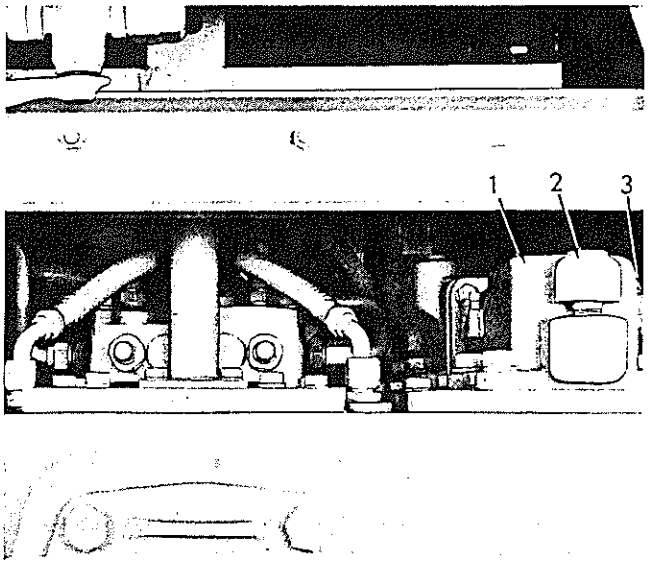

Fig. 3 Steering Clutch and Final Drive Breathers (T-70892)

1. Right brake control valve
2. Steering clutch breather
3. Final drive breather

NOTE

Filter elements should be replaced and suction line screen cleaned before proceeding.

b. Pour specified lubricant through oil filler pipe Fig. 4. Before starting engine, check to make certain oil is noted on gauge rod; if no oil is noted on gauge rod, add only enough to bring oil level to lower end of "Operating Range".

c. Start engine and run at approximately 1/4 throttle long enough to heat oil to operating temperature. Operate steering levers and brake pedals a few times; stop engine and check oil level. Oil level must be within "Operating Range" marks.

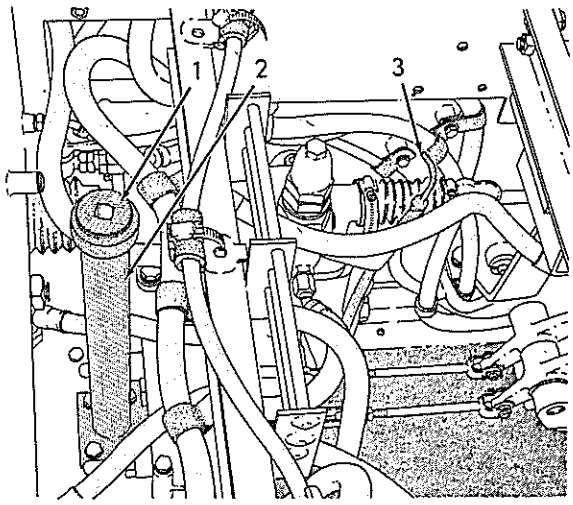

Fig. 4 Oil Filler Pipe and Oil Level Gauge Rod (T-72005)

1. Plug
2. Oil filler pipe
3. Oil level gauge rod

TOPIC 4 - TRANSMISSION

A. DESCRIPTION

1. OPERATION

The transmission is a conventional straight tooth, pressure lubricated, speed reduction unit designed to provide proper gear ratios for the required speed or power during operation of tractor.

The transmission is controlled by one shift lever. Standard transmissions provide five forward speeds and one reverse speed. Optional transmissions provide four forward speeds and two reverse speeds.

Speed and direction changes are accomplished by disengaging engine clutch and moving shift lever to desired speed range position. The shift lever moves sliding gears on bevel pinion shaft into mesh with corresponding gears by actuating shifting shafts clamped to shifting forks engaged with sliding gears. The shifting movement of each shifting shaft is controlled by detent balls located in transmission case. The detent balls enter detent notches in shifting shafts when shafts are shifted to desired speed range.

The transmission has a shifting lock mechanism actuated by engine clutch operating lever. The shifting lock mechanism is designed so transmission can be shifted ONLY when engine clutch is DISENGAGED.

When engine clutch is engaged, shifting lock plunger moves between shifting shaft detent balls and locks balls in detent notches of respective shifting shafts. This action locks sliding gears in mesh with corresponding gears of speed range to which transmission has been shifted.

2. LUBRICATION

Pressure lubrication to transmission components and shift lever housing is supplied by steering clutch and brake hydraulic system through oil lines from brake valves (Fig. 5). Oil entering tee (1) is directed to shift lever housing; oil also flows through tee to spray lubricate transmission components.

Oil entering tee in top shaft front bearing retainer lubricates top shaft front bearing. Oil also flows through tee to side of shift lever housing and lubricates input shaft bearings.

Lubricating oil from various components spills to bottom of transmission case and runs through pinion shaft rear bearing into bevel gear compartment (sump). Bevel gear compartment is connected with a cored passage in transmission case; steering clutches and brakes hydraulic system suction line is attached to, and draws its oil from, this cored area in transmission case.

B. REMOVAL

1. Turn electrical system master switch "OFF".

2. Remove drain plugs from bevel gear compartment and both steering clutch compartments; allow oil to drain. Remove main frame closure plate below transmission.

3. Remove floor plates, seat frame, and seat supporting front channel. Disconnect steering control lower rods from steering control valve operating plungers. Remove capscrews attaching steering clutch operating lever bracket to top of transmission case; remove bracket, levers and control rods as an assembly.

4. Remove capscrews and capscrew locks attaching universal joint assembly to front and rear yokes. Pry front yoke forward for clearance and remove universal joint assembly; remove front yoke from clutch shaft.

5. Remove yoke pin connecting gear shift locking plunger rod to locking plunger end.

6. Disconnect steering pump suction tube, Fig. 2, from oil screen cover.

7. Disconnect lubricating oil lines, Fig. 5 (2) (5) from transmission case; remove hose supporting clip (7) and lay hoses aside for clearance.

8. Attach suitable hoist to transmission; remove capscrews attaching transmission to final drive housing and move transmission forward until top shaft and bevel pinion are clear of final drive housing; remove transmission.

C. DISASSEMBLY

1. Clean transmission before disassembly. Place transmission on work bench (top side up). Remove transmission side cover and gasket, Fig. 8.

2. Remove gear shift lever.

3. Remove shift lever boot and clamp, Fig. 8. Remove shift lever pivot screws (3), lift shift lever out of shift lever housing.

4. Remove locking wire, universal joint yoke retaining capscrew, washer, and seal from input shaft.

5. Remove capscrews attaching shift lever housing to transmission case. Use a slide hammer puller, Fig. 9; pull shift lever housing (with input shaft)

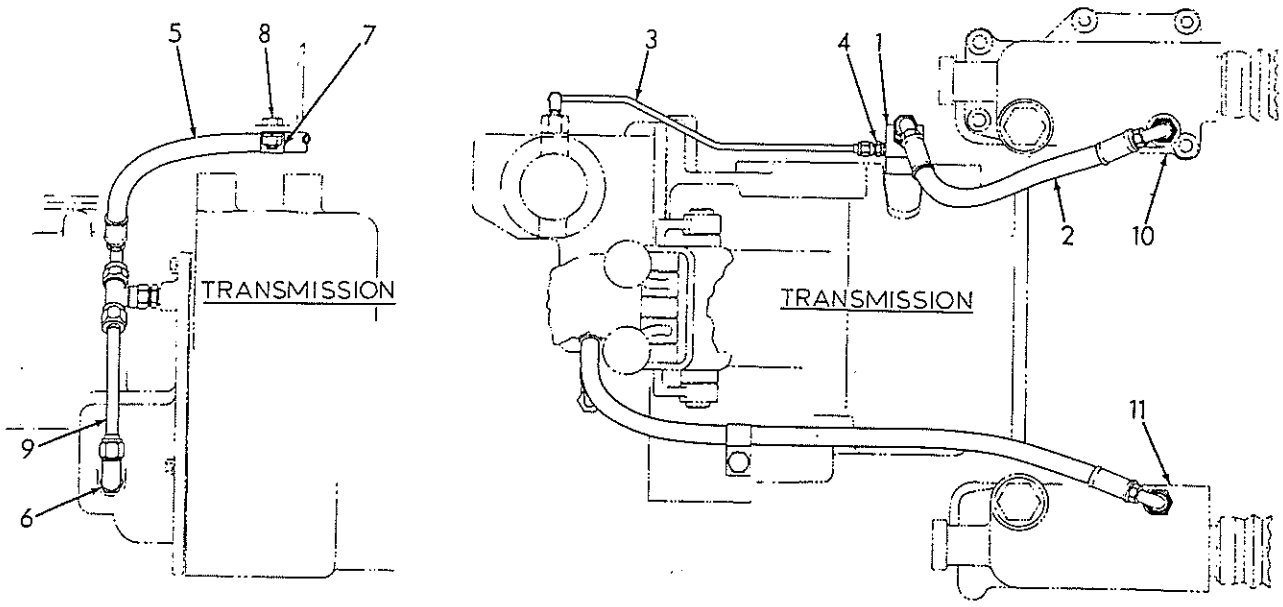

Fig. 5 Transmission Lubricating Oil Lines
(T-32134)

1. Oil distributing tee
2. Oil line, right brake valve-to-tee
3. Oil line, tee-to-shift lever housing
4. Connector
5. Oil line, left brake valve-to-top shaft
6. Connector
7. Hose supporting clip
8. Capscrew
9. Oil line, top shaft-to- shift lever housing
10. Right brake valve
11. Left brake valve

from transmission case. Remove universal joint rear yoke (if input shaft seal is seal ring type, front seal ring and gasket will be removed with yoke).

6. Press or drive on front end of input shaft to remove assembly from shift lever housing.

NOTE

Input shaft seal will remain in shift lever housing. After removing input shaft, remove seal.

7. Loosen capscrews clamping shifting forks to shifting shafts.

8. Remove shifting shaft ball spring capscrews, Fig. 8 (9); tilt transmission case and allow steel balls and springs to fall from capscrew holes.

9. Remove pipe plug, Fig. 8 (10). Hold lower shaft shifting fork; pull shaft from transmission; steel detent balls and shifting shaft interlock pin will fall from pipe plug hole as shaft is pulled from case.

10. Hold intermediate shaft shifting fork; pull shaft from transmission; steel detent balls will fall from pipe plug hole as shaft is pulled from case.

11. Hold upper shaft shifting fork; pull shaft from transmission. Remove shifting forks and place each fork with its respective shaft.

12. Unlock and remove capscrews from pinion shaft rear bearing retainer Fig. 10 (8). Remove retainer and retainer shims; tie shims to retainer to prevent loss.

13. Refer to Fig. 11, assemble tools as shown and press pinion shaft toward rear of transmission until rear bearing is free of its bore. Remove tools and pull pinion shaft from case; remove shaft components as they are free of shaft. Tie pinion depth adjustment shims together and lay aside for reuse in assembly.

14. If pinion shaft rear bearing is to be replaced, unlock and remove bearing retaining nut Fig. 6. Use hydraulic press and suitable puller tools to remove bearing from shaft.

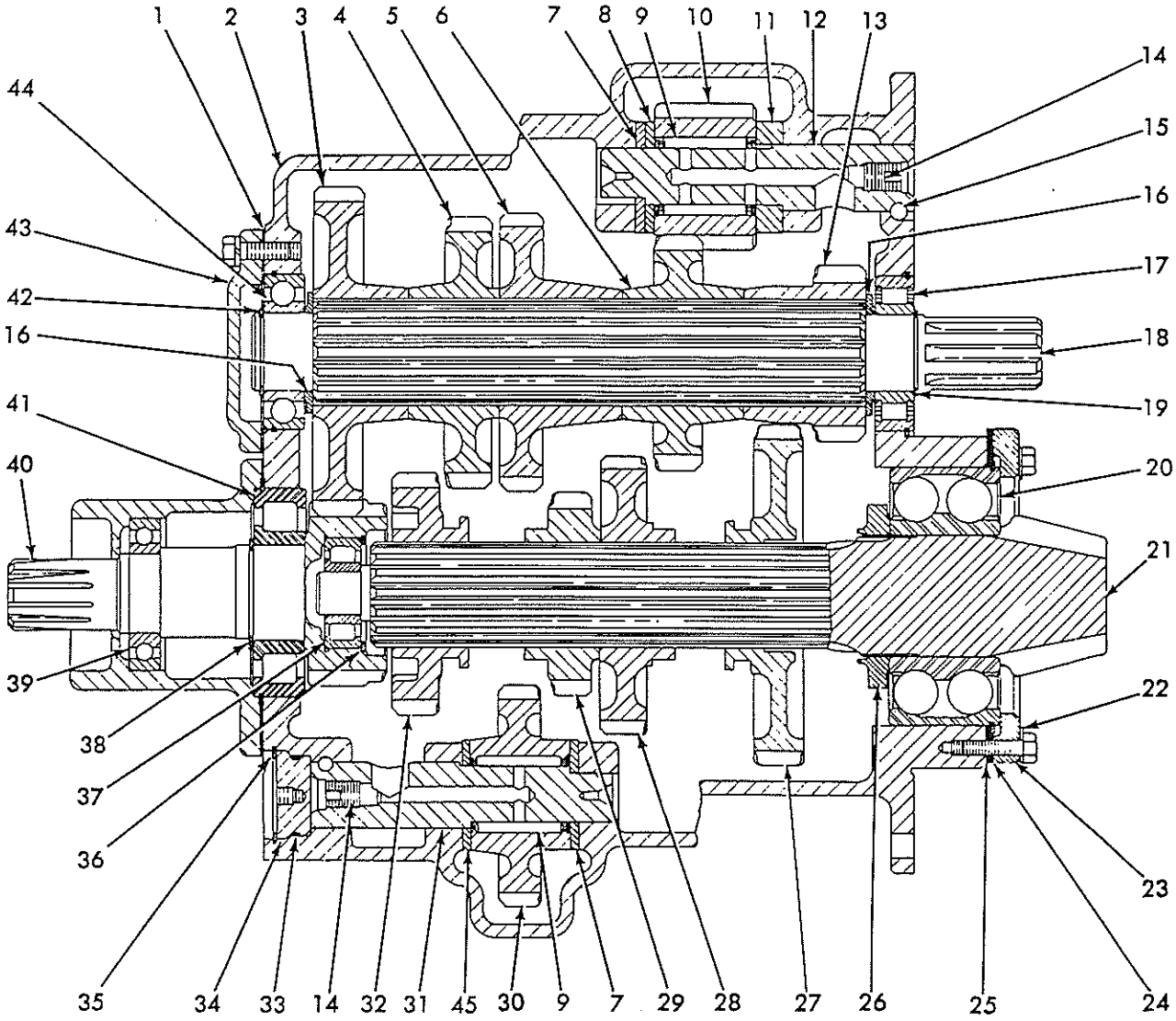

Fig. 7 Two Speed Reverse Transmission (Optional Equipment)
(T-32123)

1. Gasket
2. Case
3. Top shaft drive gear
4. Third speed gear
5. Top shaft high speed reverse gear
6. Second speed gear
7. Thrust washer
8. Thrust washer
9. Reverse gear bearing
10. Low speed reverse gear
11. Spacing washer
12. Low speed reverse gear shaft
13. First speed gear
14. Plug
15. Steel ball
16. Washer
17. Top shaft rear bearing w/snap ring
18. Top shaft
19. Snap ring
20. Pinion shaft rear bearing
21. Pinion shaft
22. Locking plate
23. Rear bearing retainer
24. Bearing retainer shims
25. Pinion depth adjustment shims
26. Rear bearing retaining nut
27. First speed and reverse gear
28. Second speed gear
29. Pinion shaft high speed reverse gear
30. High speed reverse gear
31. High speed reverse gear shaft
32. Third and fourth speed gear
33. Sealing ring
34. Plug
35. Snap ring
36. Snap ring
37. Pinion shaft front bearing
38. Snap ring
39. Input shaft front bearing
40. Input shaft
41. Input shaft rear bearing w/snap ring
42. Snap ring
43. Top shaft front bearing cover
44. Top shaft front bearing w/snap ring
45. Thrust washer

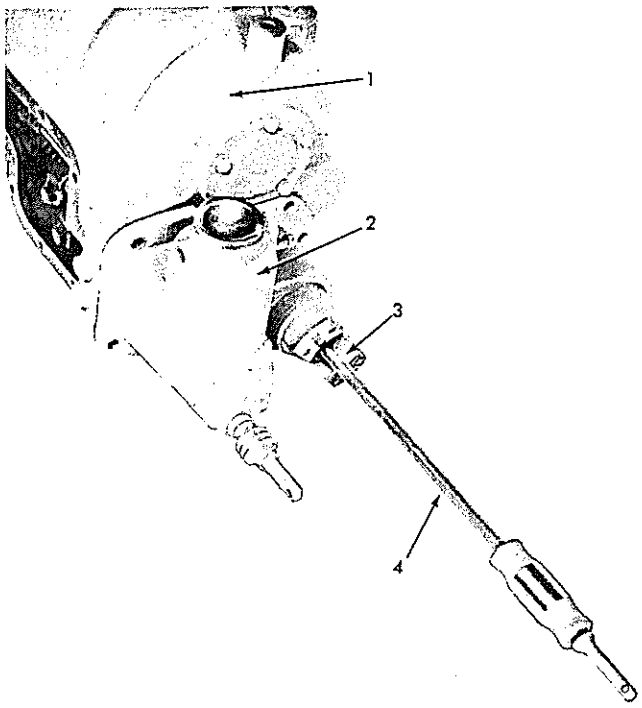

Fig. 9 Removing Shift Lever Housing (T-18043)

1. Transmission case
2. Shift lever housing
3. Universal joint rear yoke
4. Slide hammer puller

e. If bearings are to be reused, keep bearings clean, well lubricated, and wrapped in clean oil proof paper to prevent rust and entrance of dirt. When installing new bearings, do not remove bearings from package until ready for assembling. Do not wash lubricant from new bearing.

f. Use press and suitable sleeve or driver when installing bearings. If these are not available, cold rolled soft steel rod and hammer may be used to drive bearings into position; do not strike bearing shield or ball retainer when installing.

g. Bearings may be heated to expand bore of inner race to facilitate installation of bearing on shaft. One method of transferring heat to bearings is through use of hot oil; the bearings should never be placed directly on bottom of tank or container, but should be placed on screen so they may be heated uniformly. A light or medium grade of clean lubricating oil should be used and heated to approximately 275° F.

h. When installing bearing on shaft, drive or press on inner race; when installing in a bore, drive or press on outer race.

i. When using sliding hammer type puller to remove or install an assembly containing tapered roller bearings, be sure pull is evenly distributed on bearing. Do not allow cup and cone of bearings to become separated, as each blow of hammer (with cup and cone separated) will cause cup and cone to be rammed together and damage will result.

2. SHAFTS AND SPLINES

a. Inspect shafts for worn areas and make certain they are not twisted or bent. Inspect splines of shafts for roughness, burrs, and wear; remove all burrs and slight roughness from splines with mill file or stone. Try mating components on shaft to be sure they slide freely on splines.

b. Check bearing journals to be certain they are smooth and within specified tolerances.

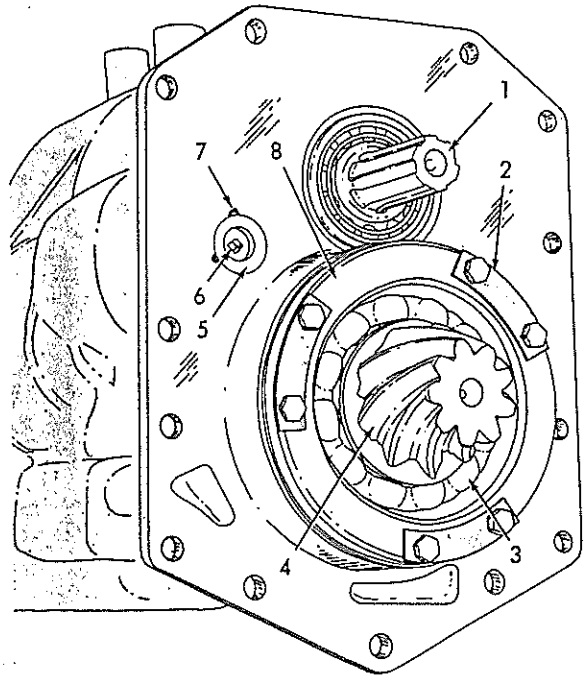

Fig. 10 Transmission Shafts Installed - Rear View (T-72011)

1. Top shaft
2. Locking plate
3. Bevel pinion shaft rear bearing
4. Bevel pinion shaft
5. Low speed reverse gear shaft
6. Plug
7. Hole for steel ball
8. Rear bearing retainer

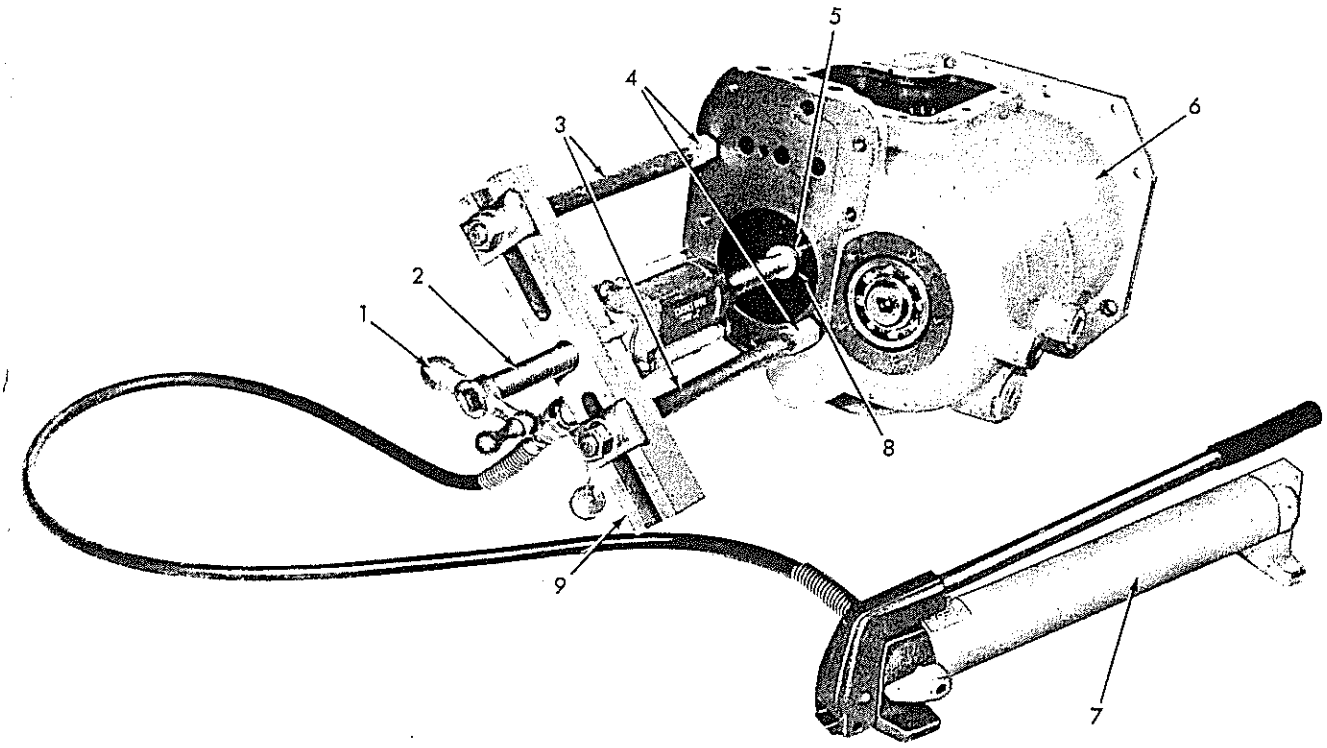

Fig. 11 Removing Pinion Shaft
(T-18044)

1. Adjusting crank
2. Forcing screw
3. Puller legs
4. Adapters
5. Bevel pinion shaft
6. Transmission case
7. Hydraulic ram and pump assembly
8. Shaft protector
9. Push-puller

3. OIL SEALS

a. When any work is done which involves removal of shaft from oil seal, or oil seal from shaft, sealing lip of seal must be carefully examined afterwards.

b. Sealing lip must not be scratched, folded over, torn, or charred from heat. Lip must be flexible; spring, located inside lip, must have proper tension to return lip to proper position when lip is pressed in by hand.

c. When installing oil seal on shaft, or shaft through seal, be sure to protect sealing lip from damage which might be caused from keyway, splines, threads, or hole through shaft. A scratch or cut, or fold in lip of seal, will render seal useless.

d. Before installing seal in bore, coat bore lightly with liquid-type gasket cement.

e. Always lubricate lips of seals with clean oil at assembly.

4. GASKETS

When gasket is removed, clean gasket and inspect for damage; if in good condition and to be used again, immerse in container of clean oil and keep in container until needed. Do not use torn, hardened, shrunken, or stretched gaskets.

5. GEARS

a. Clean and inspect all gears for worn, pitted, chipped, or cracked teeth.

b. Check internal splines for galling, roughness, and wear; make certain gears slide freely on shaft splines.

E. ASSEMBLY

1. REVERSE SHAFT INSTALLATION

a. Stand transmission case on front end; place low speed reverse gear (with bearing assembly), thrust washers, Fig. 6 (7) (8) (washer with round I.D. against gear), and spacer (11) in case.

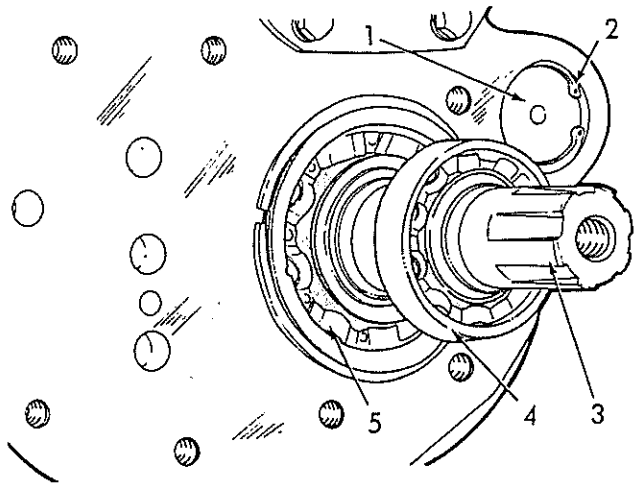

Fig. 12 Input Shaft Installed
(T-72004)

1. High speed reverse gear shaft hole plug
2. Snap ring
3. Input shaft
4. Input shaft front bearing
5. Input shaft rear bearing

IMPORTANT

Chamfered ends of gear teeth must be toward rear of case.

b. Turn thrust washer and spacer so flat surface in inside diameter is to top of transmission case and in line.

c. Position reverse gear shaft, Fig. 6 (12) so hole for steel ball is in line with notch in transmission case. Start shaft in its bore and install steel ball in shaft; drive shaft into position. Install plug in end of shaft, Fig. 10.

d. Models with optional two speed reverse, install high speed reverse shaft assembly, Fig. 7, using preceeding procedure.

NOTE

High speed reverse gear has one thrust washer at each end.

After shaft is installed, install shaft hole plug Fig. 12; secure with snap ring.

2. TOP SHAFT INSTALLATION

a. Install washer Fig. 6 (38) on front end of shaft, flat side of washer against shaft splines. Install front bearing (41) and snap ring (39).

b. Turn transmission case so side cover opening is up.

c. Insert rear end of shaft through front bore in transmission case. Refer to Fig. 6 or 7; install gears on shaft in order and position shown. Push shaft to rear until front bearing is seated in its bore; install front bearing cover, Fig. 8 (with new gasket).

d. Install washer Fig. 6 (16) on rear end of shaft, flat side of washer against shaft splines. Install rear bearing inner race on shaft (chamfered end next to washer); install rear bearing and snap ring (19).

3. BEVEL PINION SHAFT INSTALLATION

a. Heat rear bearing in oil to 275° F.; install bearing on shaft with snap ring groove in bearing toward rear of shaft. Install bearing retaining nut lockwasher and retaining nut; torque nut to 500 lbs. ft. and lock with lockwasher.

NOTE

Effective with S/N 15586 lockwasher was discontinued and new style bearing retaining nut used. Lock new style nut by staking in groove in shaft. Torque is same.

b. Install front bearing inner race on shaft, chamfered end against shaft splines.

c. Refer to Fig. 6 or 7; install pinion shaft gears in transmission case in order and position shown. Insert shaft through rear bearing bore and gears, drive shaft forward until rear bearing snap ring is against case.

d. Use depth gauge and measure depth of recess in rear bearing retainer; lock depth gauge; place depth gauge against rear face of rear bearing; use feeler gauge and measure gap between depth gauge and rear face of transmission case. Make shim pack equal to thickness of gap and add .001" to .002" shims to provide .000" to .002" bearing end play in retainer. Keep retainer and shim pack together.

e. Drive pinion shaft back slightly and remove snap ring from rear bearing. Install original pinion depth adjusting shim pack (removed at disassembly), or pack of approximately .054" in position on rear bearing.

NOTE

Bevel pinions are machined to close tolerances at factory and machining variation between pinions will be very little, if any. If original amount of pinion depth adjusting shims are used (or approximate .054" shim pack) pinion will be at closest possible (average) STARTING point (in relation to bevel gear) when adjusting for correct tooth contact pattern.

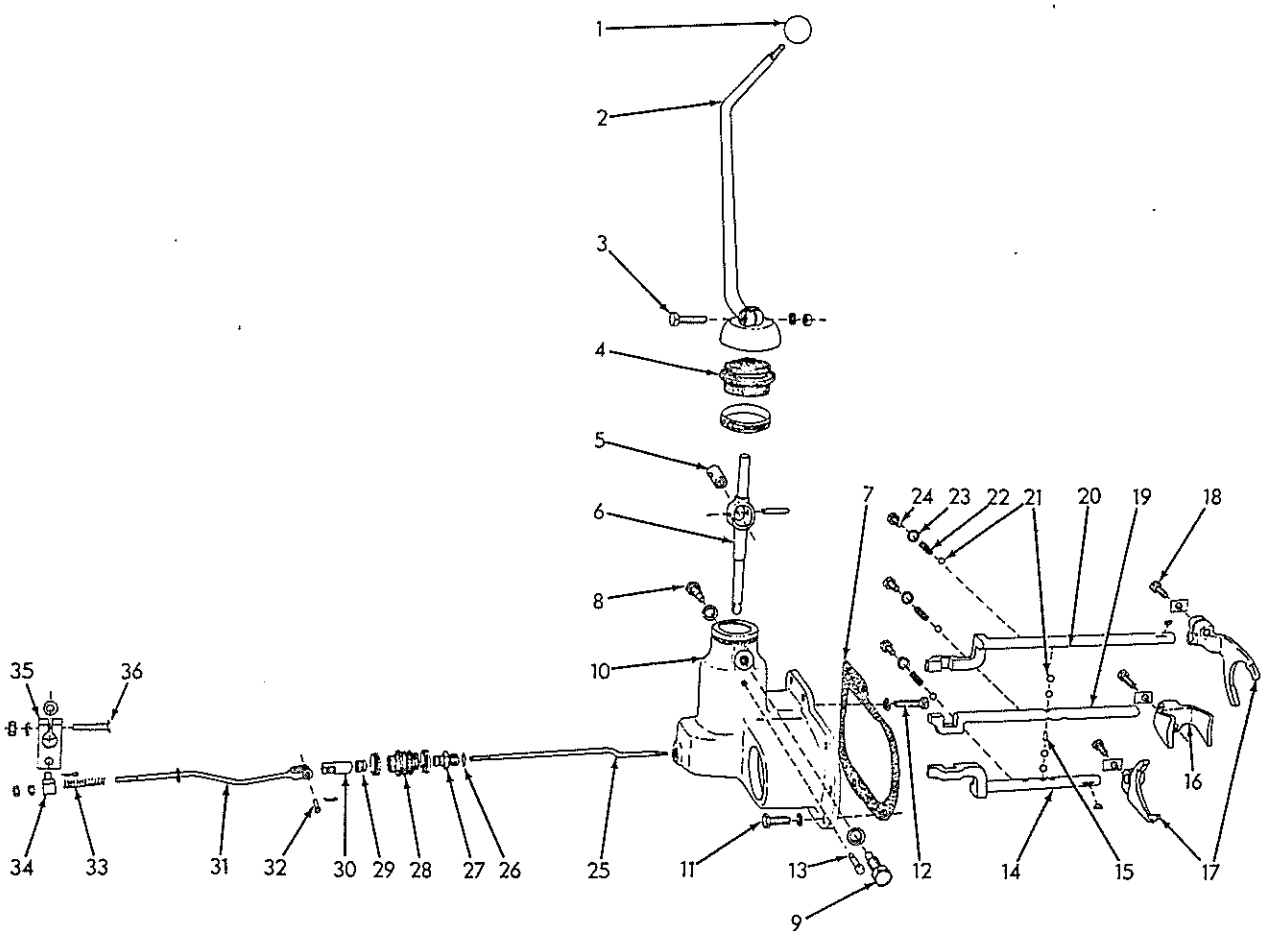

Fig. 14 Gear Shift Details
(T-4315A)

1. Gear shift lever knob
2. Gear shift lever
3. Capscrew
4. Shift lever boot
5. Pivot lever shaft
6. Shift lever
7. Gasket
8. Pivot lever screw
9. Pivot lever screw
10. Shift lever housing
11. Capscrew
12. Capscrew
13. Breather assembly
14. Lower shifting shaft
15. Shifting shaft interlock pin
16. Intermediate shaft shifting fork
17. Upper and lower shaft shifting forks
18. Capscrew
19. Intermediate shifting shaft
20. Upper shifting shaft
21. Detent ball
22. Spring
23. Washer
24. Capscrew
25. Locking plunger
26. Copper washer
27. Locking plunger sleeve
28. Locking plunger boot
29. Locking plunger nut
30. Locking plunger end
31. Locking plunger rod
32. Pin
33. Spring
34. Swivel
35. Shift lock lever
36. Capscrew

case. Install detent balls (21) in their bore above shaft.

c. Install interlock pin Fig. 14 (15) in intermediate shifting shaft (19); push shaft through transmission case and middle shifting fork until interlock pin in shaft is directly above detent balls previously installed. Install detent balls (21) in their bore above shaft.

d. Insert upper shifting shaft Fig. 14 (20) through upper shaft bore in transmission case. Install woodruff key in shaft; push shaft through rear shifting fork until center detent notch in shaft is aligned with detent ball bore in transmission case.

e. Install detent ball, Fig. 14 (21) and spring (22) in each of three tapped holes on right front side of transmission case. Start capscrews (with

CONVERSION TABLES

DECIMAL AND METRIC EQUIVALENTS OF FRACTIONS OF AN INCH

Inches				Inches			
Fractions	Decimals	*Nom. Dec.	Milli-meters	Fractions	Decimals	*Nom. Dec.	Milli-meters
1/64	.015625	.02	.397	33/64	.515625	.52	13.097
1/32	.03125	.03	.794	17/32	.53125	.53	13.494
3/64	.046875	.05	1.191	35/64	.546875	.55	13.891
1/16	.0625	.06	1.588	9/16	.5625	.56	14.288
5/64	.078125	.08	1.984	37/64	.578125	.58	14.684
3/32	.09375	.09	2.381	19/32	.59375	.59	15.081
7/64	.109375	.11	2.778	39/64	.609375	.61	15.478
1/8	.125	.12	3.175	5/8	.625	.62	15.875
9/64	.140625	.14	3.572	41/64	.640625	.64	16.272
5/32	.15625	.16	3.969	21/32	.65625	.66	16.669
11/64	.171875	.17	4.366	43/64	.671875	.67	17.066
3/16	.1875	.19	4.763	11/16	.6875	.69	17.463
13/64	.203125	.20	5.159	45/64	.703125	.70	17.859
7/32	.21875	.22	5.556	23/32	.71875	.72	18.256
15/64	.234375	.23	5.953	47/64	.734375	.73	18.653
1/4	.250	.25	6.350	3/4	.750	.75	19.050
17/64	.265625	.27	6.747	49/64	.765625	.77	19.447
9/32	.28125	.28	7.144	25/32	.78125	.78	19.844
19/64	.296875	.30	7.541	51/64	.796875	.80	20.241
5/16	.3125	.31	7.938	13/16	.8125	.81	20.638
21/64	.328125	.33	8.334	53/64	.828125	.83	21.034
11/32	.34375	.34	8.731	27/32	.84375	.84	21.431
23/64	.359375	.36	9.128	55/64	.859375	.86	21.828
3/8	.375	.38	9.525	7/8	.875	.88	22.225
25/64	.390625	.39	9.922	57/64	.890625	.89	22.622
13/32	.40625	.41	10.319	29/32	.90625	.91	23.019
27/64	.421875	.42	10.716	59/64	.921875	.92	23.416
7/16	.4375	.44	11.113	15/16	.9375	.94	23.813
29/64	.453125	.45	11.509	61/64	.953125	.95	24.209
15/32	.46875	.47	11.906	31/32	.96875	.97	24.606
31/64	.484375	.48	12.303	63/64	.984375	.98	25.003
1/2	.500	.50	12.700	1	1.000	1.00	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
Cubic Yards x .7645 = Cubic Meters

TORQUE & PRESSURE CONVERSION CONSTANTS –

lb. ft. x 0.1383 = m-kg
lb. in. x 1.1521 = cm-kg
psi x 0.0703 = kg/cm^2

LENGTH CONVERSION CONSTANTS — U.S. TO METRIC

Inches x 25.400 = Millimeters
Inches x .0254 = Meters
Feet x .3048 = Meters
Statute Miles x 1.60935 = Kilometers

*Nominal decimals are used in place of fractions of an inch, with exception of such items as bolts, screws, washers,

washers) Fig. 8 (9); tighten capscrews enough to compress springs slightly.

f. Position shifting forks on shafts and sliding gears on pinion shaft to obtain maximum tooth contact between mating gears when engaged and clearance between gears when in neutral. Clamp shifting forks to shafts by torquing capscrews, Fig. 14 (18) to 83 to 93 lbs. ft. Return all shafts to neutral position; tighten capscrews, Fig. 8 (9).

g. Install locking plunger sleeve and washer, Fig. 14 (27) (26) in shift lever housing; install locking plunger (25) through sleeve from rear side of housing.

h. Use care to prevent damage to input shaft seal; install shift lever housing (with new gasket) over input shaft. Tighten attaching capscrews. Insert locking plunger between detent balls in transmission case as housing is installed.

i. Coat I.D. at each end of locking plunger boot, Fig. 14 (28) with "Neoprene" cement; clamp one end of boot to locking plunger sleeve. Turn nut (29) to end of threads on locking plunger; install locking plunger end (30) and lock against nut (29). Clamp end of boot (28) to plunger end.

j. Install shift lever, Fig. 14 (6) in shift lever housing; make certain lower end of lever is in notched ends of shifting shafts. Secure shift lever with pivot screws (8) (9); install screw with tapped head (8) in right side of housing. Install shift lever boot (4); secure with clamp.

k. Install gear shift lever, Fig. 14 (2); push lever down so top of shift lever (6) is above clamping boss; tighten clamping capscrew.

l. Use spring scale and weigh pull required at top of gear shift lever to "shift gears"; specified pull is 25 to 35 lbs. Add or remove washers beneath capscrews, Fig. 8 (9) to obtain specified pull. Make certain shifting lock plunger, Fig. 8 (8) is fully disengaged (pulled out as far as possible) when checking pull on gear shift lever.

m. Install transmission side cover and gasket; install pipe plug, Fig. 8 (10).

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. 15 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".

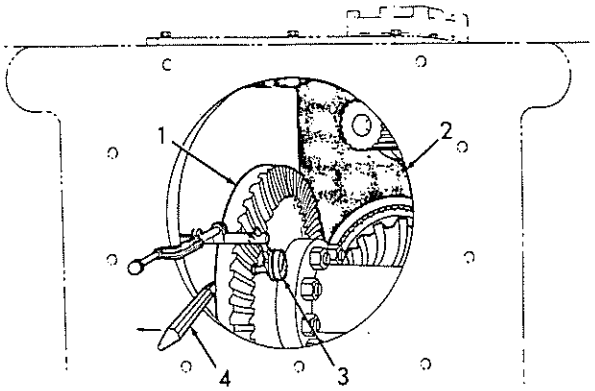

Fig. 15 Checking for Bevel Gear End-Play (T-70854)

1. Bevel gear
2. Power take-off access hole
3. Dial indicator
4. Small pry bar

2. Install two guide studs in steering clutch housing; install transmission (with new mounting gasket).

3. Check backlash between bevel gear and bevel pinion; also make certain tooth contact pattern is correct. The 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, 16; 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.

CAUTION

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

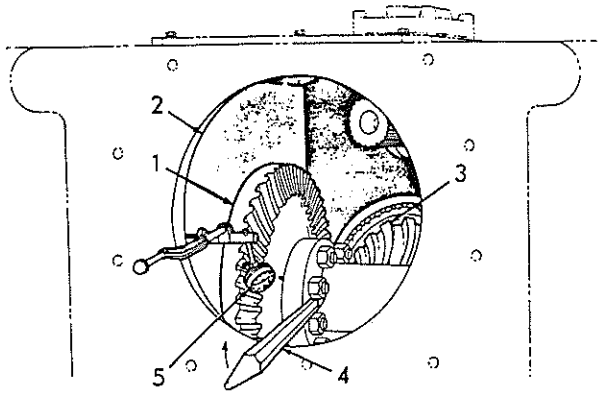

Fig. 16 Checking Backlash Between Bevel Gear and Bevel Pinion (T-70855)

1. Bevel gear
2. Power take-off access hole
3. Bevel pinion
4. Small pry bar
5. Dial indicator

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. 6 (25) 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. 17. If contact pattern is NOT satisfactory, add or remove pinion depth adjusting shims Fig. 6 (25), until pattern is satisfactory.

e. Re-check backlash! If backlash is not within specifications refer to "BEVEL GEAR AND SHAFT" and perform complete procedure.

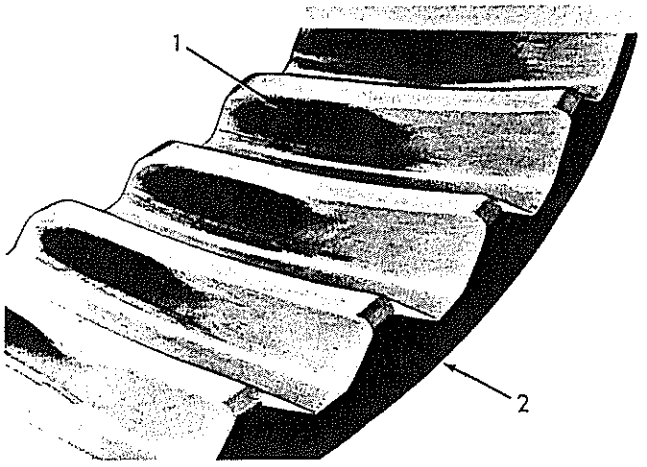

Fig. 17 Satisfactory Tooth Contact - No Load (T-31450)

1. Contact pattern
2. Bevel gear

4. Connect locking plunger rod, Fig. 18 (10) to plunger end (11). Adjust length of control rod (10) so transmission will shift with engine clutch disengaged and will not shift with engine clutch engaged.

5. Install drive shaft universal joint (9).

6. Install steering clutch operating lever bracket assembly Fig. 18 (14) on top of transmission case; connect rear end of control rods (2) to steering control valve operating plungers. Check steering control linkage adjustment (refer to Steering Clutches and Brakes Service Manual, Part Number 648095 for detailed information).

7. Refer to Figs. 5 and 18; connect transmission lubricating oil lines. Connect steering pump suction tube, Fig. 18 (8) to suction screen cover (5).

8. Install seat supporting front channel, seat frame, and seat.

9. Install oil drain plugs in steering clutch compartments and bevel gear compartment; fill system to proper level with specified lubricant (refer to "TRANSMISSION AND BEVEL GEAR LUBRICATING SYSTEM LUBRICANT SPECIFICATIONS, CAPACITY, AND SERVICE").

10. Turn electrical system master switch "ON" and start engine. Move tractor short distance in each speed range to make certain transmission is working properly. Check for oil leaks; stop engine; correct any leaks found.

11. Install floor plates and main frame closure plate.

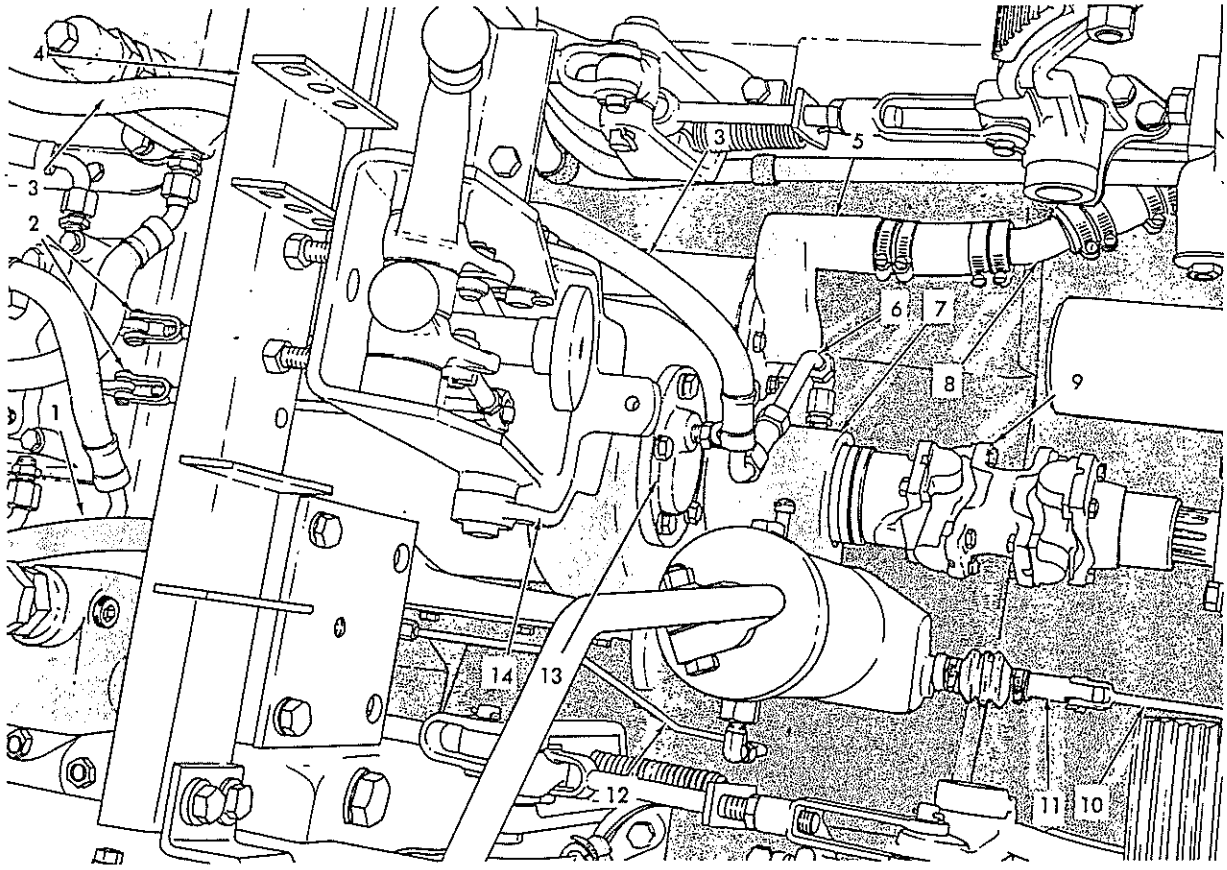

Fig. 18 Transmission Installed
(T-72006)

1. Oil line, right brake valve-to-tee
2. Steering control rods
3. Oil line, left brake valve-to-top shaft
4. Seat supporting front channel
5. Steering pump suction screen cover
6. Oil line, top shaft-to-gear shift housing
7. Gear shift housing
8. Steering pump suction tube
9. Universal joint
10. Locking plunger rod
11. Locking plunger end
12. Oil line, tee-to-gear shift housing
13. Top shaft front bearing cover
14. Steering clutch operating lever bracket

TOPIC 5 - BEVEL GEAR AND SHAFT

A. DESCRIPTION

The bevel gear, located in center compartment of steering clutch and final drive housing, is attached to bevel gear shaft, Fig. 19. 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 is necessary to remove steering clutches, brakes, and steering clutch throwout bearing assemblies.

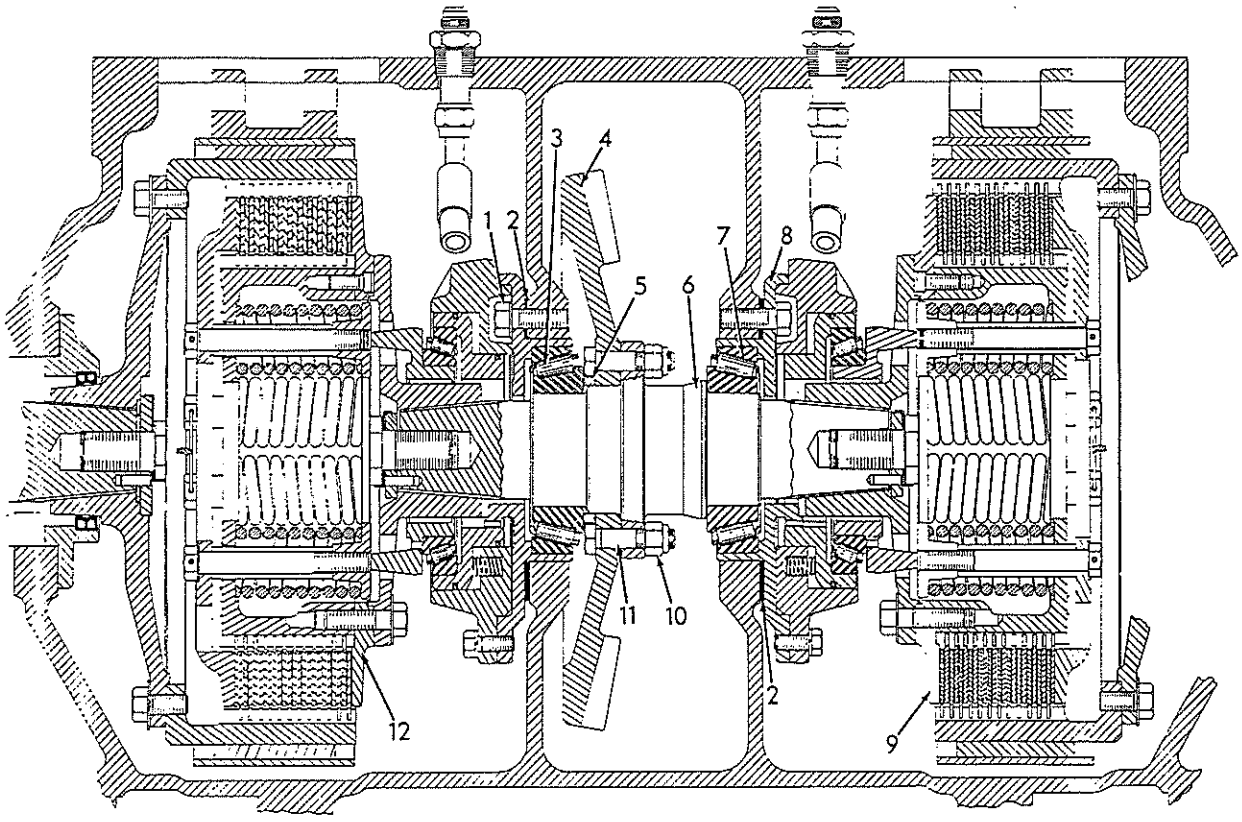

Fig. 19 Bevel Gear and Shaft - Sectional View
(T-71363)

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

*High nuts and locking plates used prior to S/N 16846.

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 securing bevel gear to shaft.

NOTE

Effective with S/N 16846, elastic stop nuts replace high nuts and locking plates.

3. Refer to Fig. 19; 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 S/N 15948, oil pan capscrews Fig. **21** replace two bottom capscrews in left bearing cage.

4. Refer to Fig. 20, 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.

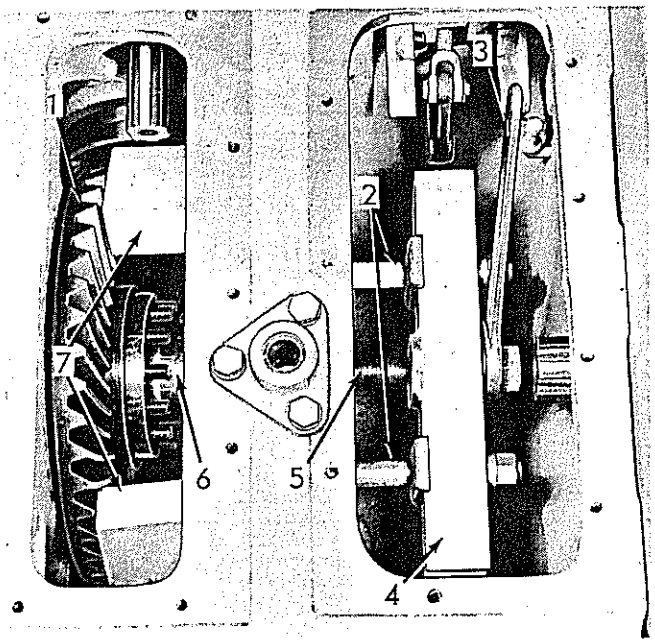

Fig. 20 Removing Bevel Gear Shaft
(HD6B Shown - HD6E Similar)
(T-17887)

1. Bevel gear
2. Puller legs
3. Wrench
4. Push-puller
5. Puller screw
6. Bevel gear shaft
7. Wooden blocks

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. 19, 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 (with teeth of gear downward). 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

Installation of bearing cones on shaft will be much easier if bearing cones are heated in oil to approximately 275°F. before installation.

2. Remove locking ring and position bevel gear in bevel gear compartment with teeth of gear 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. 21 (4) and high nuts (3) (or elastic stop nuts Fig. 19 (10)) can be started on capscrews. Install locking ring Fig. 21 (6) and tighten nuts evenly until bevel gear is properly located on shaft.

3. Lubricate other bearing cone, Fig. 21 (7) and start on short end of bevel gear shaft with large O.D. of bearing toward bevel gear. Refer to Fig. 22; 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.

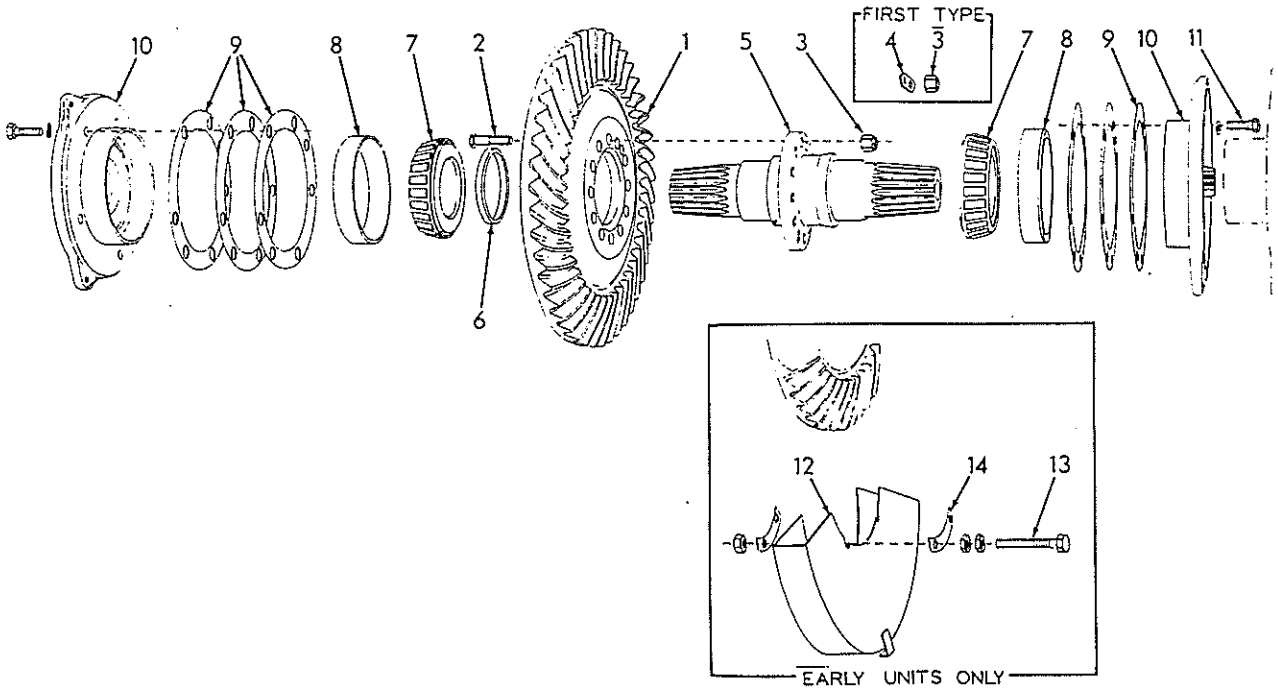

Fig. 21 Bevel Gear and Shaft Details
(T-38140)

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

*Replaced by elastic stop nuts effective with S/N 16846.
**Used prior to S/N 15948.

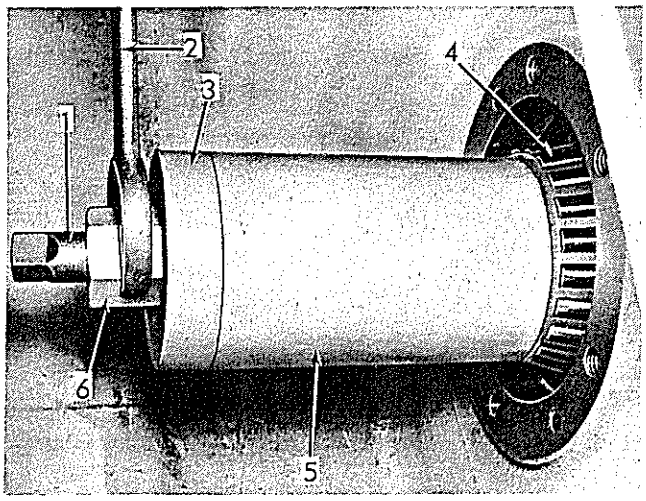

Fig. 22 Installing Bevel Gear Shaft Bearing Cone
(T-17899)

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

4. Press bearing cups Fig. 19 (7) in bearing cages (8); make 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 it was removed. Start bearing cage attaching capscrews (1), but do not tighten at this time.

5. Tighten high nuts on bevel gear attaching capscrews to a torque of 70 to 90 lbs. ft. Lock high nuts in position with locking plates.

NOTE

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

6. Tighten bearing cage attaching capscrews; bump cages to make 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 it bottoms in shaft.

b. Refer to Fig. 23, 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 make certain bearings are properly seated.

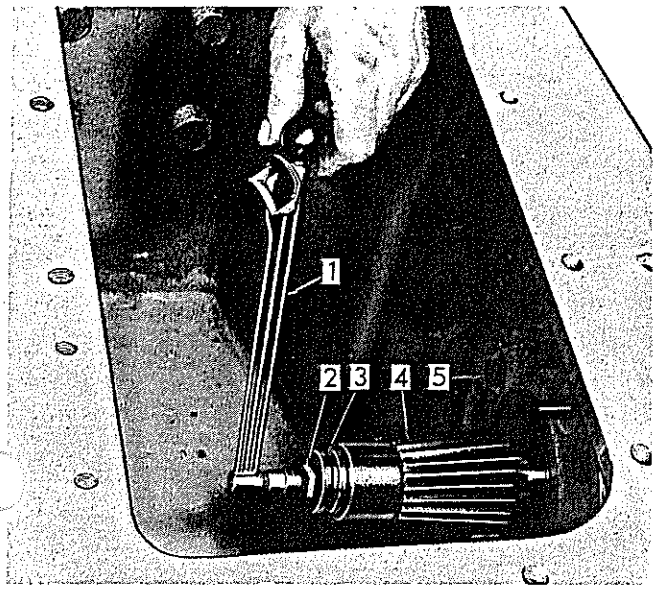

Fig. 23 Checking Pre-Load of Bevel Gear Shaft Bearings (T-25732)

1. Torque wrench
2. Adapter
3. Socket
4. Bevel gear shaft
5. Bearing cage

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 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. 24. The area of contact when gears are loaded should increase in length as shown in Fig. 25.

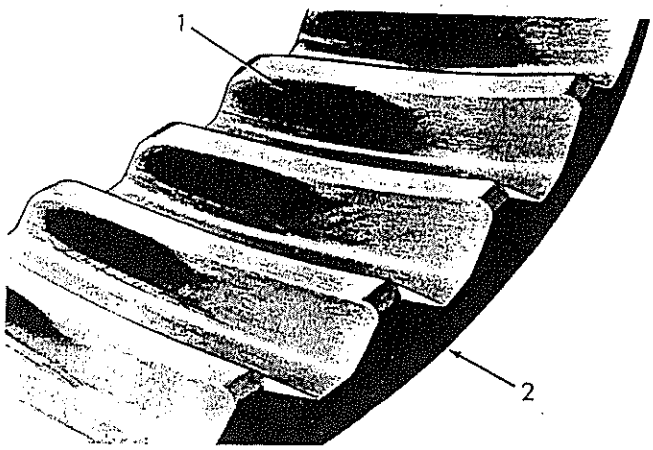

Fig. 24 Satisfactory Tooth Contact - No Load (T-31450)

1. Contact pattern
2. Bevel gear

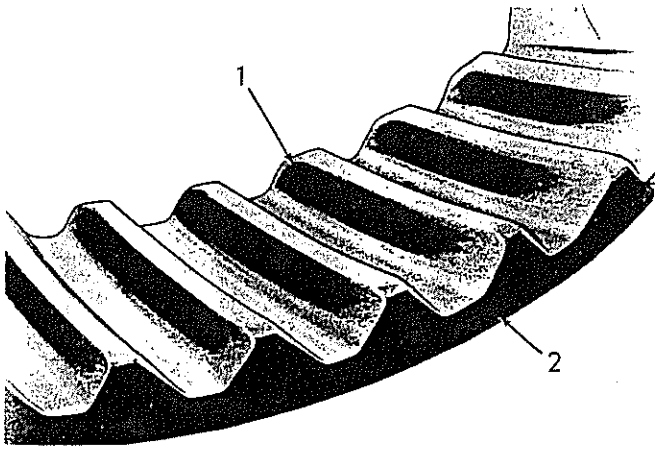

Fig. 25 Satisfactory Tooth Contact - Gears Loaded (T-31449)

1. Contact pattern
2. Bevel gear

HIGH CONTACT as shown in Fig. 26 is not desirable and will result in galling and rolling over of top edges of teeth. To correct high contact pattern, move

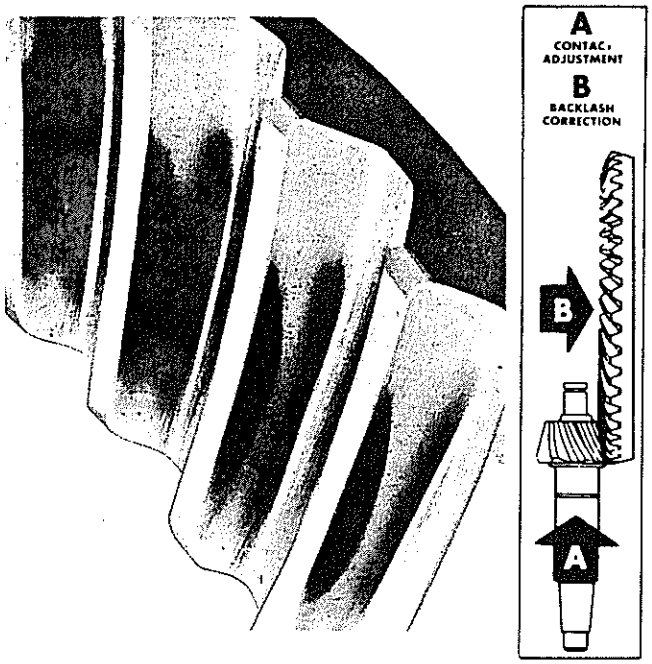

Fig. 26 High Contact - No Load
(T-71900)

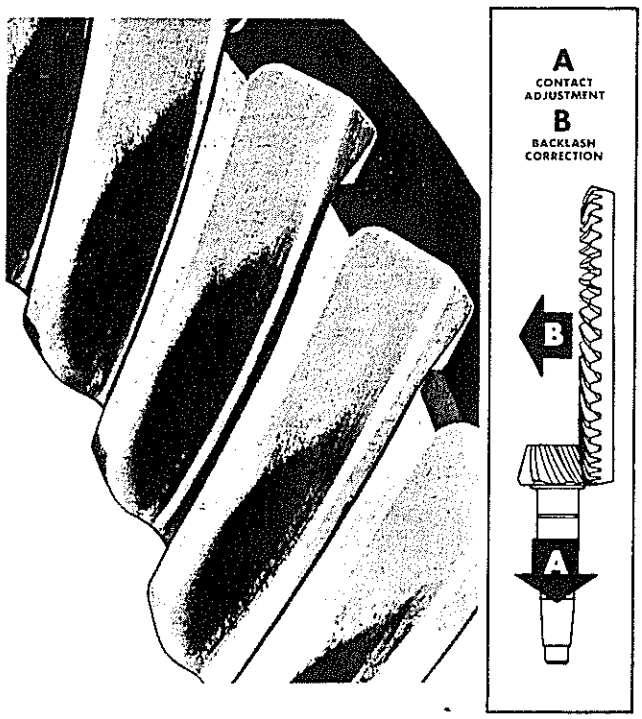

Fig. 27 Low Contact - No Load
(T-26963)

bevel pinion TOWARD bevel gear by adding pinion depth adjusting shims between transmission case and snap ring 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. 27 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 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 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. 28 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 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.

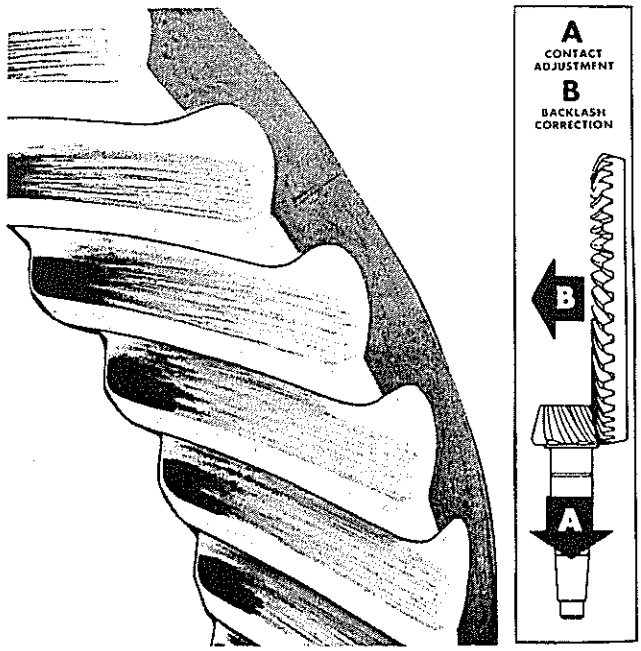

Fig. 28 Short Toe Contact - No Load
(T-71901)

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, Part Number 648095 for detailed information.

3. Make certain all oil drain plugs are tight; fill system to proper level with specified lubricant (refer to "TRANSMISSION AND BEVEL GEAR LUBRICATING SYSTEM 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. 29, unlock and remove capscrews (3); remove front and rear spider assemblies (5) from connecting yoke (2).

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. 29, install new seal washer (6) in each bearing cup; lubricate bearings with light coat of grease and install bearing cups on spider journals from which they were removed. Make certain bearings are fully seated on spider journals. Install front and rear spider assemblies (5) on connecting yoke (2); secure with attaching capscrews (3). Lock capscrews with locking wire.

NOTE

Install spider assemblies on connecting yoke with lubricating fittings in line. This will allow

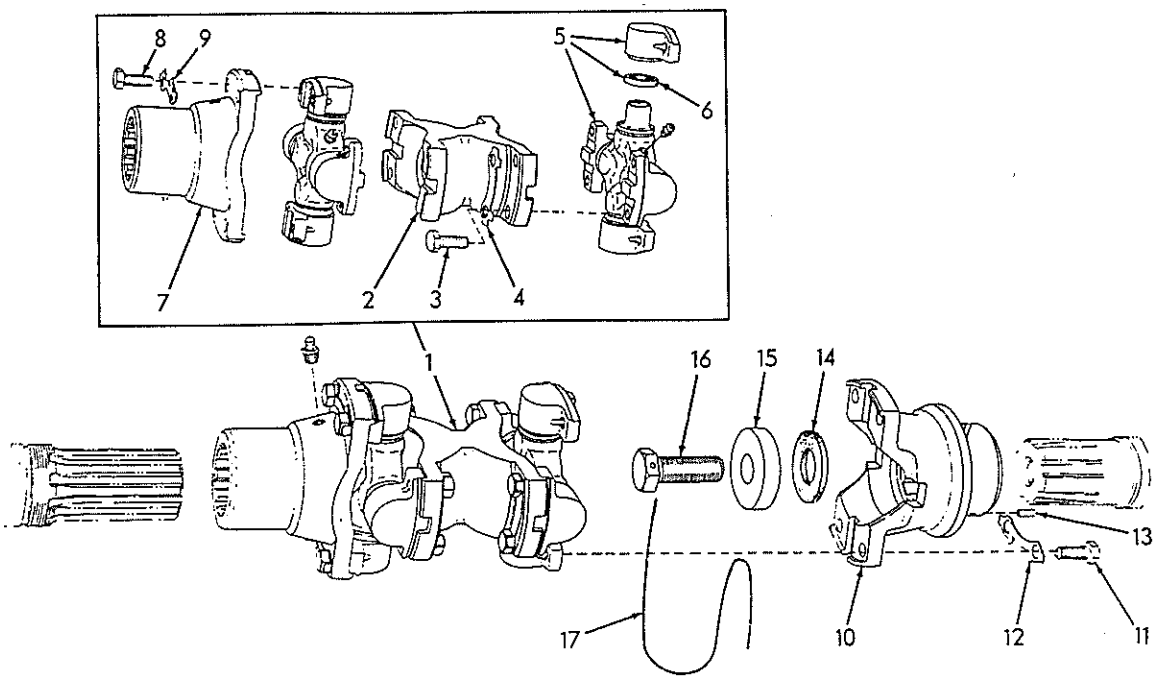

Fig. 29 Universal Joint
(T-30861)

1. Universal joint assembly
2. Connecting yoke
3. Capscrew
4. Locking plate
5. Spider assembly
6. Seal washer
7. Front yoke
8. Capscrew
9. Locking plate
10. Rear yoke
11. Capscrew
12. Locking plate
13. Pin
14. Seal
15. Washer
16. Capscrew
17. Locking wire

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. TRANSMISSION

1. CASE

Topshaft front bearing bore	3.5427"-3.5437"
Topshaft rear bearing bore	3.5431"-3.5441"
Low speed reverse shaft	
Outer bore	1.504"-1.510"
Inner bore	1.4990"-1.5005"
High speed reverse shaft	
Outer bore	1.504"-1.510"
Inner bore	1.4990"-1.5005"
Input shaft rear bearing bore	4.7236"-4.7246"
Bevel pinion shaft rear bearing bore	5.9053"-5.9063"

2. TOP SHAFT

Shaft	
O. D. at front bearing location	1.5749"-1.5754"
O. D. at rear bearing location	1.5752"-1.5758"
Front Bearing	
O. D.	3.5427"-3.5433"
I. D.	1.5743"-1.5748"
Washers (Front and Rear)	
I. D.	1.580"-1.590"
Width	.193"-.197"
Flat within	.0005"
Rear Bearing	
O. D.	3.5425"-3.5433"
I. D.	1.5743"-1.5748"

3. BEVEL PINION SHAFT

Shaft	
Number of pinion teeth	9
O. D. at front bearing location	.9845"-.9850"
O. D. at rear bearing location	2.7560"-2.7565"
Backlash with bevel gear	.008"- .014" (.203 - .355mm)
Front Bearing	
O. D.	2.4403"-2.4409"
I. D.	.9839"-.9843"
Rear Bearing	
O. D.	5.9047"-5.9055"
I. D.	2.7553"-2.7559"

4. LOW SPEED REVERSE SHAFT

Shaft	
O. D. at bearing location	1.2490"-1.2495"
O. D. at bore location	1.4975"-1.4985"
Thrust Washers	
Front	
Thickness	.183"-.187"
Flat within	.001"
Rear	
Thickness	.246"-.250"
Flat within	.001"
Spacer	
Thickness	.683"-.687"
Flat within	.001"
Reverse Gear	
Number of gear teeth	18
I. D.	1.750"-1.751"

5. HIGH SPEED REVERSE SHAFT

Shaft	
O. D. at bearing location	1.2490"-1.2495"
O. D. at bore location	1.4975"-1.4985"
Thrust Washers	
Thickness	.183"-.187"
Flat within	.001"
Reverse Gear	
Number of gear teeth	28
I. D.	1.750"-1.751"

6. INPUT SHAFT

Shaft	
O. D. at front bearing location	1.7718"-1.7723"
O. D. at rear bearing location	2.1655"-2.1661"
I. D. for pinion shaft front bearing	2.4404"-2.4414"
Front Bearing	
O. D.	3.3465"
I. D.	1.7717"
Rear Bearing	
O. D.	4.7238"-4.7244"
I. D.	2.1648"-2.1654"

7. GEAR SHIFT HOUSING

I. D. for input shaft front bearing	3.3463"-3.3471"
I. D. for input shaft rear bearing	4.729"-4.734"

B. BEVEL GEAR COMPONENTS

1. GEAR

Number of teeth	44
I. D. at shaft location	3.249"-3.250"
Backlash with bevel pinion	.008"-.014" (.203-.355mm)

2. SHAFT

O. D. at gear location	3.247"-3.248"
O. D. at bearing location	2.8140"-2.8150"

3. BEARINGS

I. D. of cone assembly	2.8125"-2.8126"
O. D. of cup	5.250"-5.251"
Pre-load	10-20 lbs. in. (.003" - .004" tight)

C. TORQUE SPECIFICATIONS

Shifting fork capscrew	83 - 93 lbs. ft.
U-joint yoke retaining capscrew	168 - 178 lbs. ft.
Bevel gear attaching nuts	70 - 90 lbs. ft.

TOPIC 8 - SERVICE TOOLS

In many cases, use of service tools for disassembly and assembly are required to perform particular operations and obtain best results. Use of service tools enables service personnel to perform operation in proper manner and in least amount of time.

The following service tools listing was prepared to assist service personnel in selection of proper tools and combinations of tools to accomplish various service maintenance operations described and illustrated in this manual.

Service tools listed below must be ordered directly from tool manufacturer.

TOOL MANUFACTURER

(K-M) Kent-Moore Organization, Inc.
28635 Mound Road
Warren, Michigan 48092

(OTC) Owatonna Tool Company
Owatonna, Minnesota 55060

FIG. NO.		MFG'S TOOL NO.	DESCRIPTION
9	(OTC)	960	Slide Hammer Puller
	(OTC)	24-M	Adapter
11	(OTC)	Y-21A	Hydraulic Pump (with gauge)
	(OTC)	Y-15A	Hydraulic Ram
	(OTC)	Y-15-13	Adjusting Crank
	(OTC)	Y-15-12	Ram Screw
	(OTC)	938	Push-Puller
	(OTC)	930-B	Legs
	(OTC)	17-M	Adapters
	(OTC)	630-6	Plate
15, 16	(K-M)	J 5959	Dial Indicator and Attachment Set
20	(OTC)	938	Push-Puller
	(OTC)	930-E	Puller Leg
	(OTC)	938-2	Puller Screw (Special-over-all length 7")
22	(OTC)	AC-307	Tube
	(OTC)	AC-308	Tube End Plate
	(OTC)	938-2	Puller Screw (Special-over-all length 7")
23	(OTC)	DR-200-1	Torque Wrench (Inch lbs.)

CONVERSION TABLES

DECIMAL AND METRIC EQUIVALENTS OF FRACTIONS OF AN INCH

Inches				Inches			
Fractions	Decimals	*Nom. Dec.	Milli-meters	Fractions	Decimals	*Nom. Dec.	Milli-meters
1/64	.015625	.02	.397	33/64	.515625	.52	13.097
1/32	.03125	.03	.794	17/32	.53125	.53	13.494
3/64	.046875	.05	1.191	35/64	.546875	.55	13.891
1/16	.0625	.06	1.588	9/16	.5625	.56	14.288
5/64	.078125	.08	1.984	37/64	.578125	.58	14.684
3/32	.09375	.09	2.381	19/32	.59375	.59	15.081
7/64	.109375	.11	2.778	39/64	.609375	.61	15.478
1/8	.125	.12	3.175	5/8	.625	.62	15.875
9/64	.140625	.14	3.572	41/64	.640625	.64	16.272
5/32	.15625	.16	3.969	21/32	.65625	.66	16.669
11/64	.171875	.17	4.366	43/64	.671875	.67	17.066
3/16	.1875	.19	4.763	11/16	.6875	.69	17.463
13/64	.203125	.20	5.159	45/64	.703125	.70	17.859
7/32	.21875	.22	5.556	23/32	.71875	.72	18.256
15/64	.234375	.23	5.953	47/64	.734375	.73	18.653
1/4	.250	.25	6.350	3/4	.750	.75	19.050
17/64	.265625	.27	6.747	49/64	.765625	.77	19.447
9/32	.28125	.28	7.144	25/32	.78125	.78	19.844
19/64	.296875	.30	7.541	51/64	.796875	.80	20.241
5/16	.3125	.31	7.938	13/16	.8125	.81	20.638
21/64	.328125	.33	8.334	53/64	.828125	.83	21.034
11/32	.34375	.34	8.731	27/32	.84375	.84	21.431
23/64	.359375	.36	9.128	55/64	.859375	.86	21.828
3/8	.375	.38	9.525	7/8	.875	.88	22.225
25/64	.390625	.39	9.922	57/64	.890625	.89	22.622
13/32	.40625	.41	10.319	29/32	.90625	.91	23.019
27/64	.421875	.42	10.716	59/64	.921875	.92	23.416
7/16	.4375	.44	11.113	15/16	.9375	.94	23.813
29/64	.453125	.45	11.509	61/64	.953125	.95	24.209
15/32	.46875	.47	11.906	31/32	.96875	.97	24.606
31/64	.484375	.48	12.303	63/64	.984375	.98	25.003
1/2	.500	.50	12.700	1	1.000	1.00	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
Cubic Yards x .7645 = Cubic Meters

TORQUE & PRESSURE CONVERSION CONSTANTS –

lb. ft. x 0.1383 = m-kg
lb. in. x 1.1521 = cm-kg
psi x 0.0703 = kg/cm^2

LENGTH CONVERSION CONSTANTS — U.S. TO METRIC

Inches x 25.400 = Millimeters
Inches x .0254 = Meters
Feet x .3048 = Meters
Statute Miles x 1.60935 = Kilometers

*Nominal decimals are used in place of fractions of an inch, with exception of such items as bolts, screws, washers, tubing, wire, etc.