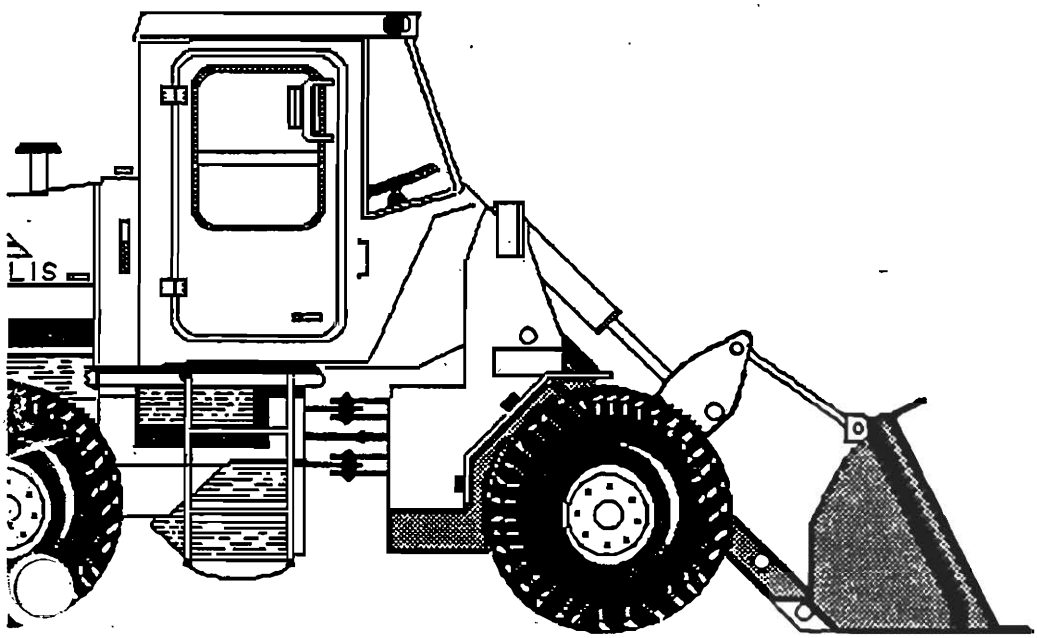
FIATALLIS®

545, 545H, 545-B
605-B, 645, 645-B

wheel loaders

service manual

TRANSMISSION



Form 73059226 English
8-89

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 cylinders, cable and/or mechanical devices used for controlling the equipment.

CALIFORNIA
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

545,545H,545-B, 605-B,645,645-B

wheel loaders

service manual

TRANSMISSION

Effective Transmission S/N 35207-up

Form 73059226 English

⚠ WARNING

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

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

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

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

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

الأعمال والأنشطة

الأعمال والأنشطة

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SAFETY RULES

GENERAL

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

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

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

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

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

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

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

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

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

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

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

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

Never leave the machine unattended with the engine running.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

SAFETY RULES

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, nontoxic 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.

FIATALLIS

GENERAL SUPPLEMENT
to

FORM 73059226 - Transmission Manual (545-B,605-B,645B)(Suppl. #8)
73142482 - Transmission Manual (FR10,12)
73127734 - S.I.M. Manual (FR10,12)
73127735 - S.I.M. Manual (FR15)

(6/83)

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Additional copies of this supplement are available. Please direct your request to:
Fiatallis North America - Publication Services Dept.
3000 South 6th Street - Springfield, Ill. 62710 U.S.A.

Fiatallis Europe S.p. gazzino Stampati
Viale Torino, n° Stupinigi (TO) ITALY

NOTICE
THESE CHANGES ARE INCLUDED IN THIS COPY

Write in the following changes:

Manual 73142482, Pg.51

Manual 73059226, Pg.49
(Note that Fig. references, Fig.58,59, become 59,60 for this manual.)

7.6.4
Fig.58. Install the double-row bearing (18) into the input accessory drive gear(19) -- notch in bearing opposite to the gear teeth.

7.6.5
Install the drive gear and bearing into the converter pump, Fig.59, aligning the gear and pump bolt holes. Be sure notch in bearing is toward inside of converter pump housing.

Manuals 73142482, Fig.58, and 73059226, Fig.59

- DELETE GASKET, ITEM 17 -

Manuals 73127734, Fig. B2228
73127735, Fig. B2222

- Text should read: "Load notch in bearing opposite to gear teeth -- toward inside of converter pump housing."

- Also, delete words "and gasket".

FIAT-ALLIS

SUPPLEMENT NO. 7

SERVICE MANUAL 73059226

TRANSMISSION

545, 545H, 545-B, 605-B, 645, 645-B WHEEL LOADERS

(7-79)

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Replace the following like pages:

53	(Revised)	54A	(Revised	59	(Revised)	113	(Revised)
54	(No change)	Blank		59A	(Revised)	114	(No change)

Reason:

Pages 53 and 54A

As a product improvement, a new converter pressure regulator valve spring P/N 73069440 has been released for the subject loaders. The new spring improves converter oil pressure to insure a more stable lube oil pressure under all transmission operating conditions. The new spring requires a different converter valve guide pin setting.

New spring P/N 73069440 is fully interchangeable on transmissions in field service regardless of transmission serial number, but the new valve guide pin installation setting must be observed as related in illustration 64B.

It is recommended that new spring P/N 73069440 replace spring P/N 73044431 in transmissions when down for overhaul or repair.

Pages 59 and 59A

These pages describe the removal and replacement procedure of forward and reverse piston ball check valves.

NOTICE
These changes are included in this copy

SUPPLEMENT NO. 6

SERVICE MANUAL FORM 73059226
TRANSMISSION

FIAT-ALLIS

545, 545H, 545-B, 605-B, 645, 645-B WHEEL LOADERS

(2-78)

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3000 South 6th Street, Springfield, Illinois 62710 U.S.A.

Insert this entire mailing in the front of the service manu

(See pages 59 and 59A)

Reason: This supplement covers the removal, insr ement of the forward and reverse clutch piston ball check valves which, i ause hard shifting.

NOTICE
These changes are included in this copy.

FIAT-ALLIS

SUPPLEMENT NO. 5

SERVICE MANUAL FORM 73059226

TRANSMISSION

545, 545H, 545-B, 605-B, 645, 645-B WHEEL LOADERS

(8-77)

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Replace the following like pages:

39 (No change)	75 (Revised)
40 (Revised)	76 (No change)

Reason: This supplement adds information concerning the installation of the rear cover.

NOTICE These changes are included in this copy.

NOTICE: Allis-Chalmers Corporation and FIAT S.p.A. entered into a joint venture agreement to combine their manufacture, sale and service of construction machinery products throughout the world after January 1, 1974.

In view of the new enterprise, wherever in this publication reference is made to Allis-Chalmers or your Allis-Chalmers dealer, such reference is intended to identify FIAT-ALLIS Construction Machinery Inc. or your FIAT-ALLIS dealer

SUPPLEMENT NO. 4

SERVICE MANUAL FORM 73059226

TRANSMISSION

FIAT-ALLIS

545, 545H, 545-B, 605-B, 645, 645-B WHEEL LOADERS

(7-76)

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Replace the following like pages:

75 (Revised)
76 (No change)

Reason: This supplement revises oil suction tub installation procedure.

NOTICE These changes are included in this copy

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SUPPLEMENT NO.3
TRANSMISSION SERVICE MANUAL FORM 73059226
(Same as 3059226-5)
545, 545H, 605, 645 WHEEL LOADERS
(Includes Series B)
(Eff. TRANSMISSION S/N 35207-UP)

FIAT-ALLIS

(10/74)

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Write in the following changes (changes are underlined)

PAGE	DESCRIPTION
4	Figure 3, change callout "FRONT COVER" to "REAR COVER"
7	Legend for Figure 3A, item 23 change "front cover" to "rear cover"
9	Paragraph 3 change weights to read: 910 lbs (412.7 kg) and 925 lbs (419.6 kg)
23	Paragraph 3.9.7 change "100 R.P.M." to "1,000 R.P.M."
30	Paragraph 4.7.1 delete last sentence of paragraph.
36	Paragraph 6.2.7 change second sentence of paragraph to read: "Refer to paragraph 7.4"
37	Paragraph 6.4.4 change "FIG. 41" to "Fig. 141"
38	Paragraph 6.6.3 change paragraph "6.5.3" to "6.5.3"
40	Paragraph 6.7.1 change last sentence of paragraph to read: "Refer to paragraph 7.10.3"
45	Paragraph 6.8.16 change last sentence of paragraph to read: "Refer to paragraph 7.10.9"
53	Paragraph 7.7.14 delete fifth sentence of paragraph.
53	Paragraph 7.7.16 change "(32)" to "(32)"
54	Paragraph 7.7.22 change "(32)" to "(32)"
56	Paragraph 7.9.6 change "piston housing (23)" to "piston housing (21)"
57	Paragraph 7.10.1 change "(20)" to "(16)"
59	Paragraph 7.10.3.6 change "(18)" to "(13)"
60	Paragraph 7.10.6.1 change "(Fig. 74)" to "(Fig. 74A)"
60	Paragraph 7.10.6.3 change "(16)" to "(6)"
64	Paragraph 7.10.9.4 change "(11)" to "(17)"
66	Paragraph 7.10.9.5 delete "(26)" and "(27)"
66	Paragraph 7.10.9.5 change "housing (8)" to "housing (11)(Fig. 3A)"
66	Paragraph 7.10.9.10 change "six inch bolts" to "six one-inch bolts"
68	Paragraph 8.3.5 change "shaft (Fig. 84)" to "shaft bearing (Fig. 84)"
79	Paragraph 8.9.2 change "4.4 mm" to 4.4 kg-m"
83	Paragraph 9.1.6 change to: "Refer to paragraph 2.9"
85	Paragraph 9.9.2 change "(Fig. 125)" to "(Fig. 126)"
95	Paragraph 10.2.6 change "Fig. 41" to "Fig. 141"
98	Paragraph 10.5.1 change "Fig. 74" to "Fig. 74A"
98	Paragraph 10.5.5 change "Fig. 74" to "Fig. 74A"
98	Paragraph 10.5.7 change "Fig. 74" to "Fig. 74A"
98	Paragraph 10.5.8 change "(9)" to "(7)"
105	Paragraph 10.14.12 change "(Fig. 74)" to "(Fig. 74A)"
105	Paragraph 10.14.16 change "(Fig. 74)" to "(Fig. 74A)"

NOTICE: These changes are included in this copy

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FIAT-ALLIS

SUPPLEMENT NO. 2

TRANSMISSION MANUAL 3059226-5

(Including Series B)

545, 545H, 605, 645 WHEEL LOADERS

(EFF. TRANSMISSION S/N 35207 - UP)

(10-72)

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Write in the following changes (changes are underlined)

Page 95, paragraph 10.2.6. . . . . Change (Fig. 41) to: (Fig. 1.41)

Page 98, paragraph 10.5.1 and 10.5.5 : . . . . . Change (Fig. 74) to: (Fig. 74A)

NOTICE — These changes are included in this copy

Replace the following like pages:

) (Revised)	53 (No C..	59 (Revised)
) (No Change)	54 (Revise..	60 (Revised)
25 (No Change)	54A (Added)	83 (No Change)
26 (Revised)		84 (Revised)

Reason: This mailing up-dates manual.

FIAT-ALLIS

SUPPLEMENT NO. 1
TRANSMISSION MANUAL 3059226-5
545, 545H, 605, 645 WHEEL LOADERS
(Including Series B)
(EFF. TRANSMISSION S/N 35207-UP)

(5-72)

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Write in: Refer to Spring Chart on page 113 and add the following that is underlined:

FIG	REF	SPRING	NO COILS	DIAMETER OF WIRE
55	14	Main-pressure r valve:		
		165-195 range	16	0.125 (2.174mm)
		138-165 r 5,605B)	17	0.118 (2.997mm)

NOTICE These changes are included in this copy

OUTSIDE DIA.	FREE LENGTH	LENGTH LOAD	POUNDS
0.787 (19.99mm)	3.589 (91.42mm)	2.50 (63.50mm)	96 to 106 (43.54-48.08kg)
0.754 (19.151mm)	3.61 (91.69mm)	2.50 (63.50mm)	80-90 (36.2-40.8 kg)

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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TOPIC 1 GENERAL INFORMATION

1.1 SCOPE OF MANUAL

1.1.1
COVERAGE. This Service Manual describes the operation, maintenance, and overhaul procedures for the TT, TRT 2221-1 and TT, TRT-2421-1 power shift transmissions.

1.1.2
Figure 1 and 3 are representative of the model configurations covered in this manual. The various features available for these models are discussed, and the function and operation of the hydraulic systems and torque paths are explained. Wear limits information, parts inspection procedures, and torque specifications also are included.

NOTE: Do not confuse references made to the front and rear of the transmission with the way the transmission sets in the loader. For clarification purposes use the following definitions:

Front = Converter end
Rear = Parking brake end
Left = Control valve side
Right = Strainer assembly side

1.2 MODEL DIFFERENCES

1.2.1
FOUR MODELS. Four basic models are discussed in this Service Manual. They are:

TT 2221-1	TT 2421-1
TRT 2221-1	TRT 2421-1

1.2.1.1
Each of these models include specific assemblies which differ in design or function.

NOTE: Only certain areas in this section actually apply to the TRT transmission. These areas are referred to in Topic 9, which should be read first.

1.2.2
DIFFERENCE. The basic difference between a 2221 and a 2421 model is in the diameter and vanes of the torque converter pump, turbines, and stator. The 2421 models have larger converter elements.

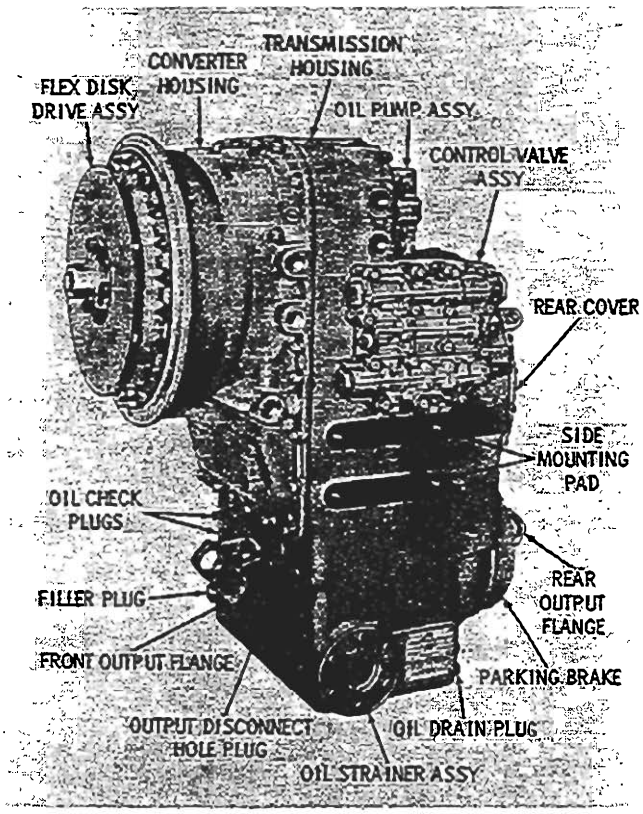

FIG. 1 MODEL TT 2221-1 (OR TT 2421-1)

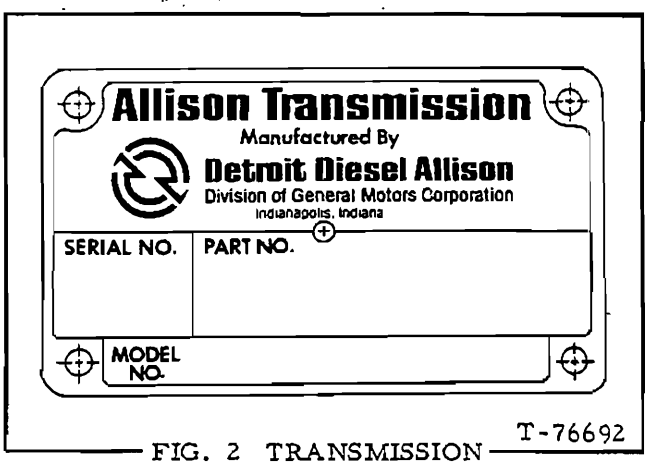

FIG. 2 TRANSMISSION NAME PLATE

1.3 ORDERING PARTS

1.3.1
TRANSMISSION NAME PLATE. The nameplate (Fig. 2), located on the lower left side of the transmission housing, has the serial number, assembly part number, and the model number assigned to define a specific configuration. Because of the differences in models, options, and component arrangement be sure to include all three numbers (and metal-stamped letters if present) when ordering parts or requesting service information.

Also give the Loader Model and serial number when ordering parts.

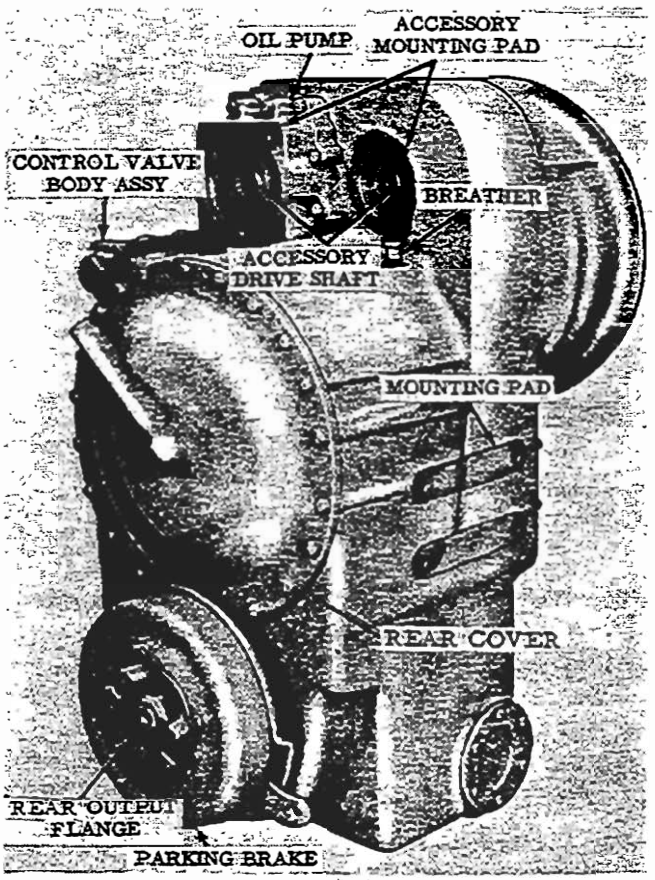

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FIG. 3 TRANSMISSION - Right Side

1.4 DESIGN FEATURES

1.4.1
MOUNTING, INPUT DRIVE (FIG.3A). The transmission is direct mounted. The transmission is coupled to the engine through a modified SAE 3 mounting face on torque converter housing (43), which is bolted to the engine flywheel housing. Flex disk drive assembly (1) bolts to the engine flywheel.

1.4.2
TWIN-TURBINE TORQUE CONVERTER (FIG. 3A). Each turbine is connected to its own output gear set. First turbine (7) provides high torque at low speed; second turbine (6) provides higher speed with less torque. There are four elements in the twin-turbine torque converter - pump (9), first turbine (7), second turbine (6), and stator (8).

NOTE: The converter elements in the 2421 models are larger than those in the 2221 models.

1.4.3
First-turbine drive gear (15) driven gear (39) and freewheel clutch (40) connect the first turbine to the range gears and clutches. Second turbine drive gear (42) and driven gear (41) connect second turbine (6) to the range gears and clutches. The first-turbine gear set provides a reduction in speed with an increase in torque delivered to the range gearing. The second-turbine gear set provides an increase in speed with a reduction in torque delivered to the range gearing.

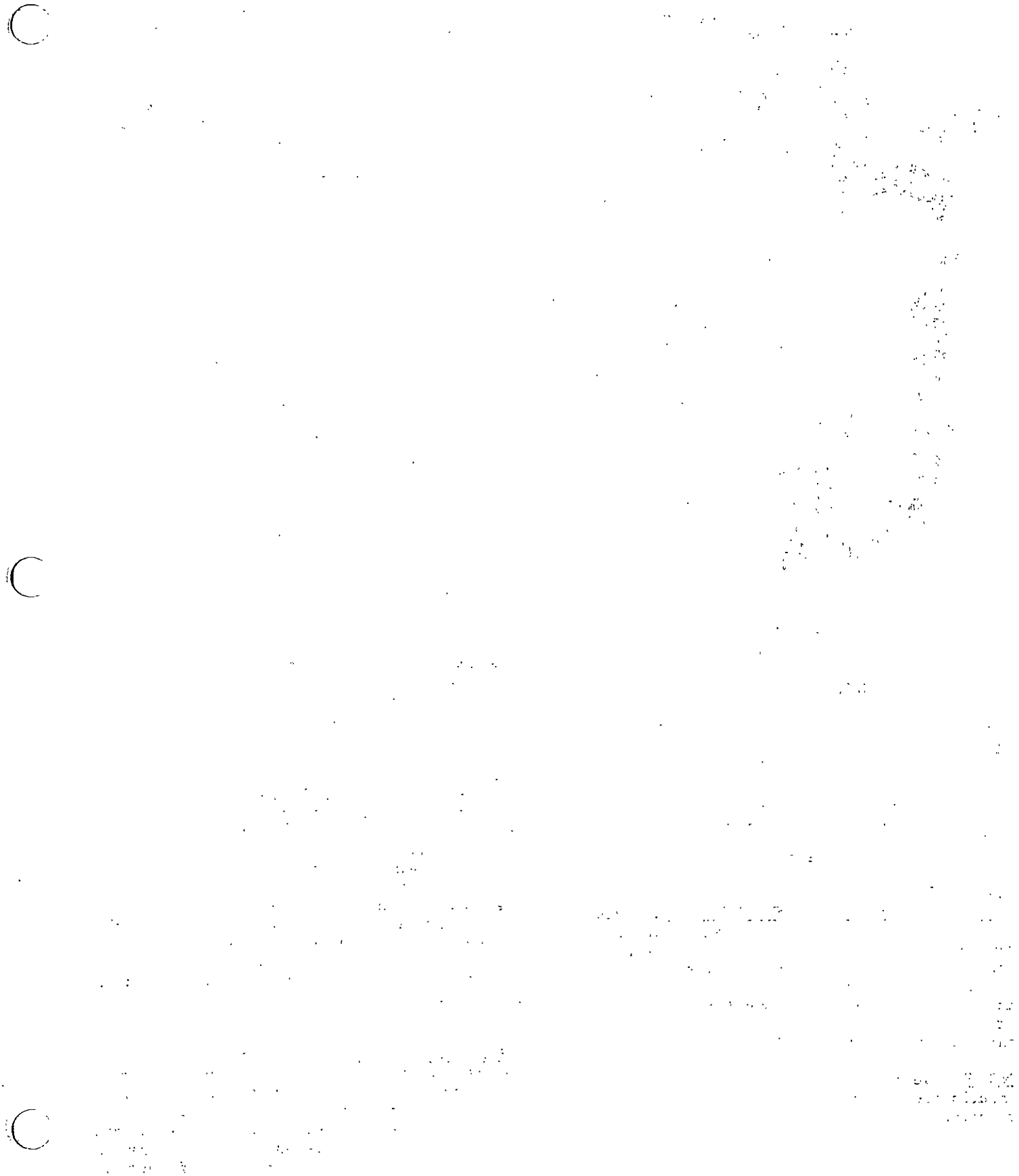
1.4.4
When torque demand is high, the freewheel clutch is engaged and the first turbine, assisted by the second turbine, drives the range gears. When the speed of the vehicle increases, torque demand decreases. When this occurs, the second turbine assumes the entire load and the freewheel clutch disengages. The transition from first turbine to second turbine (high torque to high speed) is automatic, being determined by speed and load conditions.

1.4.5
RANGE GEARING, CLUTCHES (FIG.3A). Both transmissions have two planetary range gear sets and three clutches. The reverse-range planetary gear set consists of ring gear (37), carrier assembly (38), and sun gear (26) (integral with low-range sun gear). The reverse-range gear set is controlled by reverse-range clutch (17).

1.4.6
The low-range planetary gear set consists of ring gear (36), carrier assembly (28), and sun gear (26) (integral with reverse-range sun gear). The low-range gear set is controlled by low-range clutch (19).

1.4.7
Torque is supplied to the reverse-and low-range planetary gear sets by the shaft of the second-turbine driven gear, which drives the reverse-and-low-range sun gear. High-range clutch (24) when engaged, gives direct drive from the turbine driven gears to transfer drive gear (22). Each of the three clutches is applied separately. Two forward gears (LF and HF) and reverse (R) are derived from the range gearing and clutches. All three clutches are multiplate, hydraulically applied, and spring released.

1.4.8
TRANSFER GEARS. The transmission output consists of transfer gears (22) and (32) which drive any one of three output shaft configurations - front and rear output, front disconnect output, and rear output. Constant-mesh, spur-type transfer gears are used in-line to provide a 19-inch (482.6mm) vertical drop from the input shaft to the output shaft.



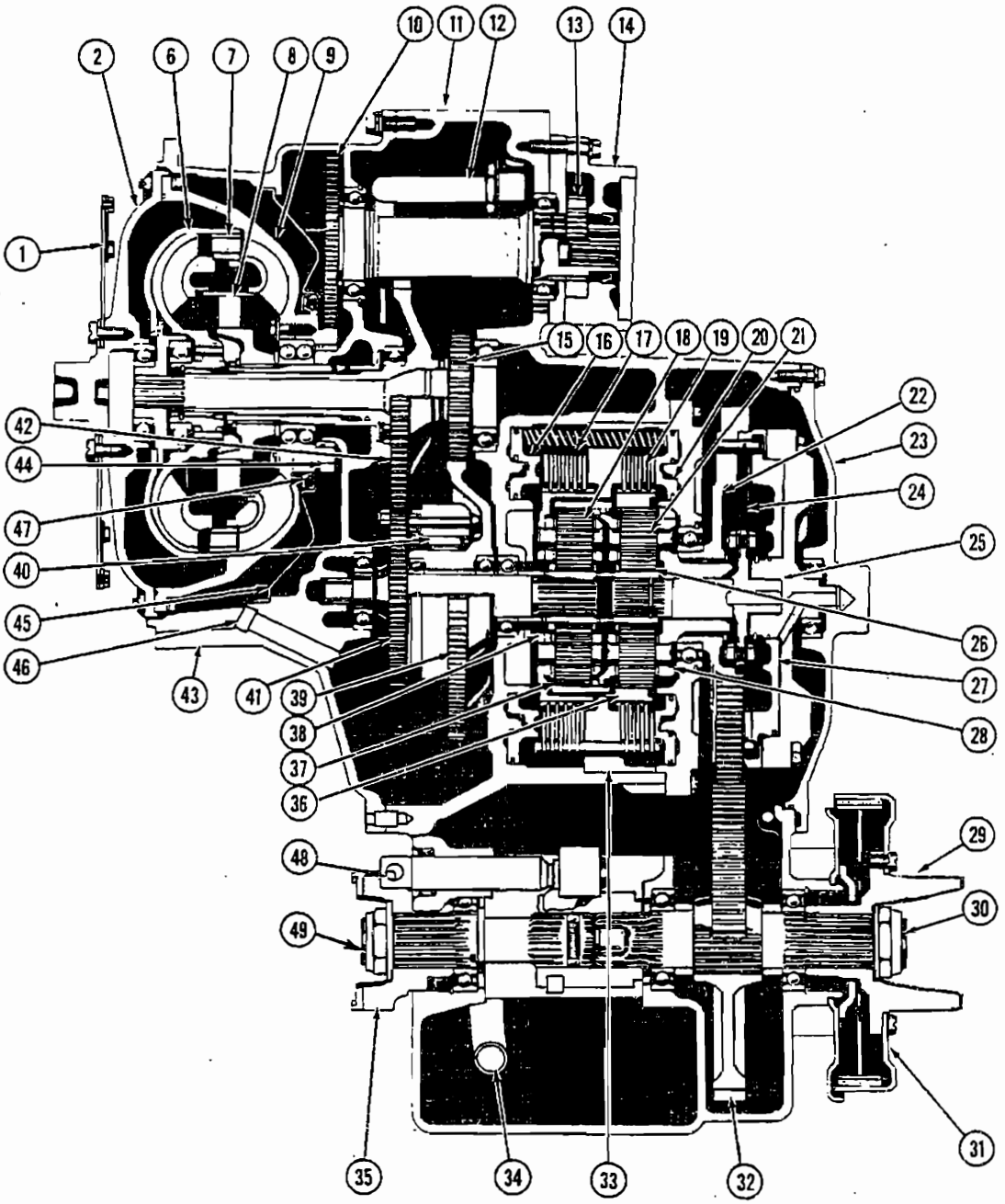


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FIG. 3A TT 2221-1 AND TT 2421-1 (Cross Section)

LEGEND FOR FIG. 3A

1. Flex disk drive assembly
2. Torque converter cover
6. Second turbine
7. First turbine
8. Torque converter stator
9. Torque converter pump
10. Accessory driven gear
11. Transmission housing
12. Oil suction tube
13. Oil pump
14. Accessory pump mounting pad
15. First tubrine drive gear
16. Reverse-range clutch piston
17. Reverse-range clutch
18. Reverse-range planetary pinion
19. Low-range clutch
20. Low-range piston
21. Low-range planetary pinion
22. Transfer drive gear
23. Transmission rear cover
24. High-range clutch
25. High-range clutch hub
26. Reverse and low-range sun gear
27. High-range piston
28. Low-range planetary carrier assembly
29. Output flange
30. Rear output shaft
31. Parking brake
32. Transfer driven gear
33. Reverse and low-range clutch anchor
34. Oil suction tube
35. Output flange
36. Low-range ring gear
37. Reverse-range ring gear
38. Reverse-range planetary carrier assy.
39. First turbine driven gear
40. Freewheel clutch
41. Second turbine driven gear
42. Second turbine drive gear
43. Torque converter housing
44. Accessory drive gear
45. Converter diaphragm
46. Plug
47. Oil seal
48. Disconnect shifter fork
49. Front output shaft

1.4.9
OUTPUT SHAFT (Fig. 3A) The transmission may be equipped with any one of two output shaft configurations, two-piece shaft (30 and 49), and rear output shaft (30).

1.4.10
The two-piece shaft and disconnect coupling allow front output shaft (49) to be disconnected from the drive line while drive at rear output shaft (30) is maintained. The rear output shaft is the same as that used for the two-piece configuration except that the front output and disconnect components are not included.

1.4.11
ACCESSORY DRIVE PAD. An SAE A, 2-bolt mounting pad is located at the upper right rear of the transmission housing to accommodate the steering pump or other accessory (in addition to that mounted at the rear of the oil pump).

1.4.12
OIL PUMP (Fig. 3A) A positive displacement, gear type oil pump (13) furnishes the oil flow and pressure necessary for hydraulic operation, lubrication, and cooling of the transmission components. Rotation of the pump is in a clockwise direction (viewed from rear) and is portional to the speed of the engine. A mounting pad (14) is provided at the rear of the oil pump to accommodate an implement pump.

1.4.13
CONTROL VALVE BODY ASSEMBLY (Fig. 55) Control valve body assembly (5) is mounted on the left side of the transmission housing (Fig. 1). The significant components contained within the valve body are the main pressure regulator valve (8), trimmer plug (16), range selector valve (27), and a clutch cutoff valve (20).

1.4.14
The clutch cut-off is operated hydraulically (by air over hydraulic brakes). When the loader brakes are applied, the valve releases the transmission drive clutch. Thus, when the loader is brought to a stop by the brakes, the power-driven pumps may be controlled by applying the accelerator pedal without having to shift to neutral.

1.4.15
Linkage connects the range selector valve to the operator's manual controls. A brake pressure line connects the clutch cutoff valve to the loader's brake system.

1.4.16
PARKING BRAKE (Fig. 3A) A 10 x 1.5 inch (254.0 x 38.1 mm) expanding shoe type parking brake (31) is available. The brake is mechanical, and manually operated.

1.4.17
HOUSING (Fig. 1). The torque converter housing is cast aluminum, and the transmission housing is cast iron. The front cover is cast iron. The front converter housing, bolts

to the engine flywheel. The lower part of the transmission housing serves as an oil sump. Openings in the transmission housing provide for installation of external piping, oil check plugs, breather, drain plug, oil filler tube and oil strainer.

1.4.18
OIL FILTER, COOLER. A full-flow oil filter and oil cooler are connected to the transmission. Refer to Fig. 10 for the points at which these items are attached.

1.5 OPERATING INSTRUCTIONS

1.5.1
RELATED TO LOADER. For information on controls and linkage, refer to the Operator's Manual.

1.5.2
RANGE SELECTION. Position the range selector control in the neutral position while starting the engine or at any time the loader is standing unattended.

1.5.3
When a shift is made from neutral to any driving range, the engine should be at idle speed. Any shift to a higher speed range, in the same direction, can be made at full throttle, under load. Downshift to the next lower speed range may be made at full throttle, under load, providing the loader is not exceeding the maximum speed attainable in the lower range.

1.5.4
CHANGING DIRECTION OF TRAVEL. Directional shifts can be made under full-power and /or full-speed conditions in the working ranges (LF to LR and LR to LF). Shifts from reverse should be made to LF drive range-not HF. Direct shifts from LR to HF will adversely affected clutch service life.

1.5.5
CLUTCH CUT OFF CONTROL. When the transmission is equipped with the clutch cutoff control, the driving clutch is completely released whenever the loader brakes are applied. Hydraulic pressure applies the brakes and actuates the clutch cutoff.

1.5.6
AXLE DISCONNECT (Optional Equipment). The transmissions front output may be disconnected by actuating the control which moves the disconnect coupling (at the front of the transmission drop box) forward. Rearward movement connects the front and rear output shafts through the splines of the coupling. Two spring-loaded ball detents retain the coupling in either position. The control should never be shifted while the loader is moving.

1.5.7
TEMPERATURES, PRESSURE. The transmission is equipped with a temperature gauge. The sending unit is mounted in the converter-out oil stream (Fig. 10). Temperature should never be permitted to exceed 250°F. (121°C) Extended, severe operating conditions may cause the temperature to reach this maximum. If so, the transmission should be shifted to neutral and the engine should be operated at approximately 1000 to 1500 rpm for several minutes until the normal temperature (180° to 220°F)(82° to 104°C) is restored. If the temperature reaches maximum (250°F)(121°C) during normal operation of the transmission, stop the engine and locate the trouble. Refer to the Trouble-Shooting Chart.

1.5.8
The clutch (main) pressure gauge is connected to the control valve body assembly (Fig. 10). The pressure shown is that which is effective in the operating range clutch. Shifting or use of the clutch cutoff will cause fluctuations in the pressure indicated. If abnormal pressures are evident, refer to the Trouble-Shooting Chart.

1.6 SPECIFICATIONS, DATA

1.6.1
The following table of specifications and data are applicable to the TT-2001 SERIES models within the scope of this Service Manual.

SPECIFICATIONS AND DATA

ITEM	DESCRIPTION
Transmission type	Torque converter and planetary gear
Rating:	
Input speed	3000rpm (max)
Input torque	310 lbs. ft. (42.8 kg/m)
Input horsepower	177 hp.

SPECIFICATIONS AND DATA (Continued)

Rotation, viewed from input end
- Input - Clockwise
- Output (forward operation) - Clockwise
- Output (reverse operation) - Counterclockwise

Gear ranges, selector positions - Low-Reverse (LR), Neutral (N), Low-Forward (LF), High-Forward (HF).

Weight, dry (approx.):
- Direct Mount — 2221 - 780 lbs. (354 kg)
- Larger Converter —2421 - 795 lbs. (361 kg)

Torque Converter - 2 stage, 4 element, twin-turbine

*Torque multiplication ratios:
- TT 2221-1 - TT 240 - 5.0:1
- TT 2421-1 - TT 425 - 5.1:1

Gearing - Constant mesh, straight spur, planetary type

*Gear ratios - 2nd turbine ratio, 0.83 : 1
- Transfer gear set ratios: LF - 0.846:1
  - Low range-standard - 2.66:1
  - High range HF - 0.70:1
  - Reverse LF - 1.96:1
  - Low range-high speed LF - 2.03:1

Clutch data:
- Type - Multidisk, hydraulic-actuated, spring released, oil-cooled; automatically compensates for wear
- Material - External-tanged reaction plates-polished steel
  Internal-splined friction plates-sintered bronze on steel or resin-graphite on steel

Parking brake:
- Size and type - 10"x 1-1/2", (254.0 x 38.1mm) expanding shoe, mechanical-applied
- Rating, (run-in and burnished) - 30,000 lb in. (13608 kgs) at 1400 lb (635.0 kgs) apply force

Oil system:
- Oil pump - Input driven, positive displacement, 2 spur gears
- Sump - Single, integral
- Oil type: above -10°F (-23°C) - Hydraulic transmission fluid type C2 or MIL-L-2104 Grade 10 to latest spec.
- Oil type and viscosity - Oil must meet one of the following:
  (a) Type C-3 Transmission fluid (oil)
  (b) Engine Oil TO-2 Qualified meeting Type C-3 specifications

ATMOSPHERIC TEMPERATURE	VISCOSITY
0°C (32°F) up	SAE 10W or 30
0°C (32°F) below	SAE 10W

**If temperature is below -10°F (-23°C) auxiliary preheat will be required to raise the temperature in the sump and external circuits to at least -10°F (-23°C).

- Oil capacity (less external circuits) - Initial fill -- 8-1/2 US gal. (32.2 lts)
- Oil filter - Remote mounted
- Converter-out oil temperature - 250°F max. (121°C)

*To obtain overall transmission torque ratios, multiply the applicable torque converter ratio times the gear ratio.

(Continued)

(Revised November 1980)

SPECIFICATIONS AND DATA (Continued)

Oil system (Continued)	
Main pressure, at full throttle	138 to 165 psi (9.70 to 11.60 kg/cm^2) (vehicle weight to 28,000 lb. [12701 kgs]) 165 to 195 psi (11.60 to 13.71 kg/cm^2) (vehicle weight above 28,000 lb. [12701 kgs])
Lubrication pressure, at full throttle	15 to 30 psi (1.05 to 2.10 kg/cm^2)
Converter-out pressure, at full throttle stall	40 psi (min.) (2.81 kg/cm^2)
Converter-out pressure, at full throttle, no-load	65 psi (max.) (4.56 kg/cm^2)
Control valve body assembly:	
Clutch cutoff	Hydraulically actuated

TOPIC 2 DESCRIPTION AND OPERATION

2.1 SCOPE OF TOPIC 2

2.1.1
This section describes the functions of the transmission components. The hydraulic systems are explained and schematically illustrated. The transmission torque paths are also explained for each gear range.

2.2 TWIN-TURBINE TORQUE CONVERTER

2.2.1
CONVERTER CONSTRUCTION (FIG. 3A). The torque converter consists of pump (9), first turbine (7), second turbine (6), and stator (8). Pump (9) is the driving member and is driven at engine output speed. First turbine (7) and second turbine (6) are driven members, connected by transfer gears (15), (39), (41), and (42) to the transmission range gearing. Stator (8) is the reaction member.

2.2.2
CONVERTER OPERATION (FIG. 3A). During operation, the first and second turbines function jointly or separately, depending upon the load demand and speed of the loader. The first-turbine gear train consists of gears (15) and (39). The second-turbine gear train consists of gears (41 and 45). The turbines are able to function jointly or separately by means of a freewheel clutch (40). At high load demand and low speed, the freewheel clutch is engaged, permitting both turbines to drive, and providing maximum input torque to the range gearing. As the loader speed increases and load demand decreases, the second-turbine speed, as it approaches the first-turbine speed, provides all of the torque. The first turbine then freewheels. Upon an increase in load demand and the resulting decrease in vehicle speed, the freewheel clutch automatically re-engages, permitting both the first turbine and second turbine to again provide the necessary torque multiplication.

2.3 LOW- REVERSE - RANGE GEARING AND CLUTCHES

2.3.1
Two planetary gear sets are used in the transmission gear train. One transmits low-speed forward and the other transmits reverse drive. The planetary gear sets are interconnected through integral sun gears (26) (Fig. 3A) and reverse-range ring gear (37) which is splined to low-range planetary carrier assembly (28).

2.3.2
The reverse-range planetary carrier assembly (41) (Fig. 3A) has four pinions. Low-range planetary carrier assembly (28) has four pinions. The four-pinion, low-range planetary provides a standard low-range ratio. Reverse-and-low-range sun gear (26) is driving member for both planetary gear sets. In the reverse-range planetary, carrier assembly (38) is the reaction member and ring gear (37) is the driven member. In the low-range planetary, ring gear (36) is the reaction member and carrier assembly (28) is the driven member.

2.3.3
Reverse-range clutch (17) (Fig. 3A) has five external-tanged reaction plates and five internal-splined friction plates. The reaction plates engage the anchor pins in reverse-and-low-range clutch anchor (33). The friction plates engage the splined hub of the reverse-range planetary carrier. Low-range clutch (19) has four internal-splined friction plates and four external-tanged reaction plates. The friction plates engage the splines of low-range ring gear (36) and the reaction plates engage the anchor pins in reverse-and-low range clutch anchor (33). Engagement of the reverse-range clutch holds the reverse-range carrier stationary, and engagement of the low-range clutch holds the low-range ring gear stationary.

2.4 HIGH RANGE CLUTCH

2.4.1
High-range drive is obtained through the high-range clutch-no planetary gearing is involved. High-range clutch (24) (Fig. 3A consists of two friction plates and one external-tanged reaction plate. The friction plates are bolted to high-range clutch hub (25) which is driven by reverse and low-range sun gear (26). The external tangs on the reaction plate engage the drive pins in transfer drive gear (22).

2.4.2
Thus, when the high-range clutch is applied, the transfer drive gear is locked to the reverse and low-range sun gear. This causes the transfer drive gear to rotate at a 1 to 1 ratio.

2.5 TRANSFER GEARS, OUTPUT SHAFTS

2.5.1
TRANSFER GEARS. The transfer gears consist of two spur gears which are in constant mesh. Transfer drive gear (22) Fig. 3A, is splined to the hub of low-range planetary carrier assembly (28). Transfer driven gear (32) is located directly below the drive gear and is splined to output shaft (30).

2.5.2
TWO-PIECE SHAFT, REAR AXLE DISCONNECT - The two-piece shaft configuration allows output shaft to be disconnected from drive line. The front disconnect consists mainly of disconnect coupling which is manually shifted by disconnect shifter fork (48) and shaft. In the engaged position, torque from output shaft (30) is transmitted through the coupling splines to the front output shaft. In the disengaged position the coupling rides on the rear splines of the front output and torque to the front output is interrupted.

2.5.3
REAR OUTPUT SHAFT. Output shaft Fig. 87 (23) provides torque to the rear output only. The shifter shaft hole is closed by shifter shaft orifice plug (28).

2.6 HYDRAULIC PUMP, ACCESSORY DRIVE PADS

2.6.1
HYDRAULIC PUMP DRIVE PAD. The hydraulic pump drive pad, located on the rear face of oil pump body (10) Fig. 116A is a four bolt configuration. Accessory driven gear (2) Fig. 63 is engine driven through accessory drive gear (19) Fig. 59 at ratios of 0.91 to 1. Regardless of the range selector position, the shaft rotation is clockwise as viewed from the rear.

2.6.2
ACCESSORY DRIVE PAD. A 2-bolt pad is located at the upper right rear face of the transmission housing. The drive at the pad is provided by accessory drive gear (1) Fig. 63 and gear shaft (8) which rotates at a 0.91 to 1 ratio. Regardless of the range selector position, the shaft rotation is clockwise as viewed from the rear.

2.7 OIL PUMP

2.7.1
Oil pump assembly (2) Fig. 116A consists mainly of two spur gears (5 and 7); body assembly (9) and cover (3). The oil pump assembly furnishes the entire oil flow and pressure for all transmission operations. The pump is driven by accessory drive gear (19) Fig. 59 and rotates any time the engine rotates. The transmission oil is drawn, through oil strainer (22), into the lower end of suction tube (2) which directs it to the pump assembly. The oil is then directed, under pressure, through passages in the transmission housing to the control valve assembly and other locations for lubrication and cooling.

2.8 CONTROL VALVE BODY ASSEMBLY

2.8.1
CONTROL VALVE BODY (Fig. 55). The control valve body contains a manual-operated range selector valve (27) for reverse, neutral, low or high-range operation, plus main pressure regulator valve (8), and clutch cutoff valve (20).

2.8.2
MAIN-PRESSURE REGULATOR, SELECTOR VALVES (Fig. 55) Main pressure regulator valve components and trimmer valve components are contained in the upper bore of the body; clutch cutoff valve components in the middle bore; and the selector valve components in the lower bore. The main pressure regulator valve group includes items (6, 7, 8, 13, and 14). The selector valve group contains items (26 through 33).

2.8.3
Main pressure regulator valve (8) is spring loaded and regulates the pressure for all hydraulic functions. The selector valve is a spool type valve which is manually moved lengthwise to the various range positions. Spring loaded detent balls (28) position the valve in each range.

2.8.4
CLUTCH CUTOFF VALVE (Fig. 55) Clutch cutoff valve (20) is located between the main pressure regulator valve and selector valve (27). It is spool type valve which is moved rearward by spring (19) pressure and forward by plug (21) when brake hydraulic pressure acts on the plug.

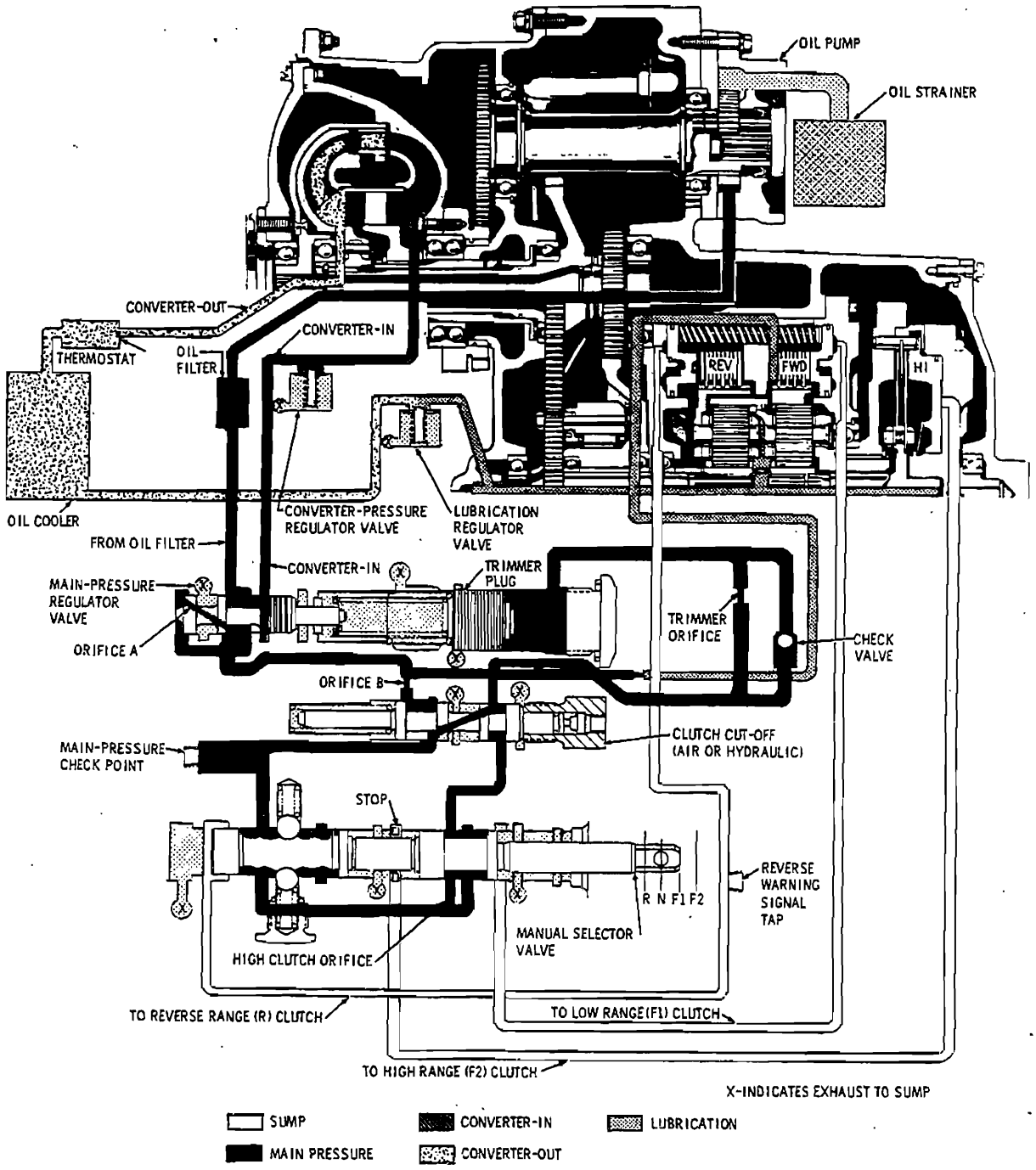

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FIG. 4 HYDRAULIC SYSTEM - SCHEMATIC VIEW

2.8.5
During normal operation, valve (20) is rearward. This allows main pressure to flow to the selector valve and trimmer plug (17). When loader brakes are applied, valve (20) moves against spring (19). This interrupts the flow of main pressure to the selector valve and exhausts clutch apply pressure, releasing the applied clutch.

2.9 PARKING BRAKE

2.9.1
An expanding shoe-type brake may be mounted at the lower-rear output location on the transmission housing. Brake back plate (1) (Fig. 124) is bolted to the transmission housing, and brake drum (6) is bolted to an output flange. The brake is manually operated.

2.10 HOUSINGS, COVERS

2.10.1
TORQUE CONVERTER HOUSING. Torque converter housing (32) (Fig. 63) is cast aluminum. It covers the large front opening of the transmission housing, and it supports and encloses the torque converter components. It is the front support member for the accessory driven gears and the converter driven gears. The front of converter housing bolts to the engine flywheel housing.

2.10.2 TRANSMISSION HOUSING. Transmission housing (1) Fig. 80, is cast iron and is the main structural member of the transmission assembly. It supports and encloses the rear ends of the accessory driven gears and converter driven gears, the range gearing and clutches. It also supports and encloses the output transfer gears and output shaft. It provides an external mounting surface for the transmission oil pump and accessory pump. It includes various oil passages within the casting for oil circuits.

2.10.3
The lower section of the housing provides a sump for the oil necessary for operation, lubrication, cooling, and control functions. Flat mounting surfaces with four tapped holes in each are provided at each side of the housing.

2.11 HYDRAULIC SYSTEM

2.11.1
SYSTEM FUNCTIONS. The hydraulic system generates, directs, and controls the pressure and flow of the hydraulic fluid with in the transmission. The hydraulic fluid is power-transmitting medium in the torque converter. Its flow lubricates and cools the transmission components, its pressure applies the clutches and its velocity drives the converter turbines.

2.11.2
OIL PUMP, FILTER CIRCUIT. Oil is drawn from the transmission sump, through a wire-mesh strainer, into the oil pump. The pump delivers its entire output to a full-flow oil filter. The oil filter is mounted external of the transmission. From the filter, the entire oil supply is returned to the transmission and control valve assembly.

2.11.3
MAIN PRESSURE REGULATOR VALVE CONVERTER-IN CIRCUIT. At the control valve assembly, oil from the oil filter enters the valve body, and flows around the main pressure regulator valve. The oil also flows through a diagonal passage (orifice A) to the left end of the valve. The resultant pressure at the left end of the valve pushes the valve rightward against a spring until the oil pressure is balanced by spring force.

2.11.4
The rightward movement of the valve against the spring exposes the port to converter-in circuit. Oil in excess of that required to maintain main pressure is allowed to escape into the converter-in circuit. Under certain conditions, the converter-in circuit can be charged with more oil than can be exhausted by the converter pressure regulator valve. When this is the case, the main-pressure regulator valve moves farther to the right and allows oil to flow directly into the exhaust port at the left end of the valve. This flow occurs between the two short lands at the left end of the regulator valve.

2.11.5
Oil flowing into the converter-in circuit is directed to the torque converter. A pressure regulator valve in the circuit limits converter-in pressure to 80 psi (5.6 kg/cm^2).

2.11.6
TORQUE CONVERTER. The torque converter is continuously filled with oil during transmission operation. Rotation of the converter pump imparts energy to the oil which, in turn, drives the turbines. The oil then flows between the stator vanes which redirects it to the pump.

2.11.7
CONVERTER-OUT, COOLER LUBRICATION CIRCUIT (FIG. 4). Oil flowing out of the torque converter is directed into the oil cooler. The oil cooler, like the oil filter, is loader mounted. The oil cooler is a heat exchanger in which the oil flows through water-or air-cooled passages.

2.11.8
From the cooler, oil flows to the lubrication circuit for distribution to the transmission components. All oil in excess of that required to maintain lubrication pressure is exhausted to sump through the lubrication regulator valve.

2.11.9
CLUTCH CUTOFF VALVE CIRCUIT FIG. 4. Main pressure oil supplied from the left end of the main-pressure regulator valve, flows through orifice B to the clutch cutoff valve bore and then to the manual selector valve. From the selector valve the flow is directed back through the clutch cutoff valve bore to the trimmer. The orifice functions in connection with the trimmer.

2.11.10
The clutch cutoff valve is normally in the position shown and functions only when the vehicle brakes are applied. A spring holds the valve rightward, allowing main pressure to flow through the valve bore to the manual selector valve.

2.11.11
Hydraulic brake pressure acts directly against a plug which moves the clutch cutoff valve leftward during brake application. When leftward against its spring, the clutch cutoff valve interrupts the flow of main pressure oil to the manual selector valve. In this position, the oil in the trimmer circuit is retained and the charged clutch is allowed to exhaust sump through the port shown at the top center of the valve. Thus, when the loader brakes are applied, the driving clutch is released.

2.11.12
MANUAL SELECTOR VALVE CIRCUIT FIG. 4
Main-pressure oil from the clutch cutoff valve flows into the manual selector valve bore and surrounds the valve in the area of the detents notches. Main oil then flows, regardless of valve position, to another surrounding area toward the right end of the valve. Here it is available for low range, high range, and operation of the trimmer.

2.11.13
Three clutch apply lines leave the bottom of the selector valve bore. From left to right these are reverse range (LR), high range (HF), and low range (LF). In neutral all three clutch lines are exhausted. Moving the selector valve one notch rightward will charge the low-range line and thus apply the clutch. This condition provides low-range operation.

2.11.14
Moving the selector valve a second notch rightward will close off oil to the low-range line and allow it to exhaust. At the same time, oil will charge the high-range line, thus apply the clutch. This condition provides high-range operation. When the selector valve is in the high-range position, oil to fill the high-range clutch must pass through both orifice B and the high-range clutch orifice. The high-range clutch orifice being smaller than orifice B restricts the volume of oil which can flow through in a given time. As a result, the high-range clutch fills at a slower rate and thus provides smoother engagement.

2.11.15
Moving the selector valve one notch leftward of neutral will charge the reverse line and thus apply the clutch. This condition provides reverse operation.

2.11.16
TRIMMER CIRCUIT (FIG. 4). The trimmer circuit works in conjunction with orifice B and the high-range orifice. The trimmer regulates clutch apply pressure during initial stages of clutch engagement, and the orifices provide a specific flow at a given pressure. The combination of the trimmer and orifices provide the final pressure and flow pattern to engage the clutches in the desired manner.

2.11.17
Normally, full main pressure holds the trimmer plug leftward against its spring and a shoulder in the valve body bore. This compresses the main-pressure regulator valve spring which causes main pressure to be regulated at maximum psi.

2.11.18
When any shift is made, oil is required to charge the oncoming clutch. This oil must flow through orifice B, directly below the main-pressure regulator valve. The restriction of the oil flow through the orifice causes pressure below the orifice to be reduced. This reduction in pressure allows the trimmer plug to move rightward. Force against the main-pressure regulator valve spring is reduced and main pressure is reduced.

2.11.19
When the clutch being charged is full, flow through the orifice stops and pressure below the orifice rises until it equals main pressure. This increased pressure acts against the right end of the trimmer plug, pushing the trimmer plug leftward. This compresses the main-pressure regulator valve spring and raises main pressure. As main pressure rises, the trimmer plug moves farther leftward until, finally, main pressure is restored to maximum

2.11.20
The check valve and orifice in parallel branches of the line connecting the selector valve bore to the trimmer plug bore insure rapid movement of the trimmer plug toward the right (check valve opens) and slower return of the trimmer plug leftward (check valve closes, orifice restricts flow). Main pressure is rapidly reduced but slowly restored.

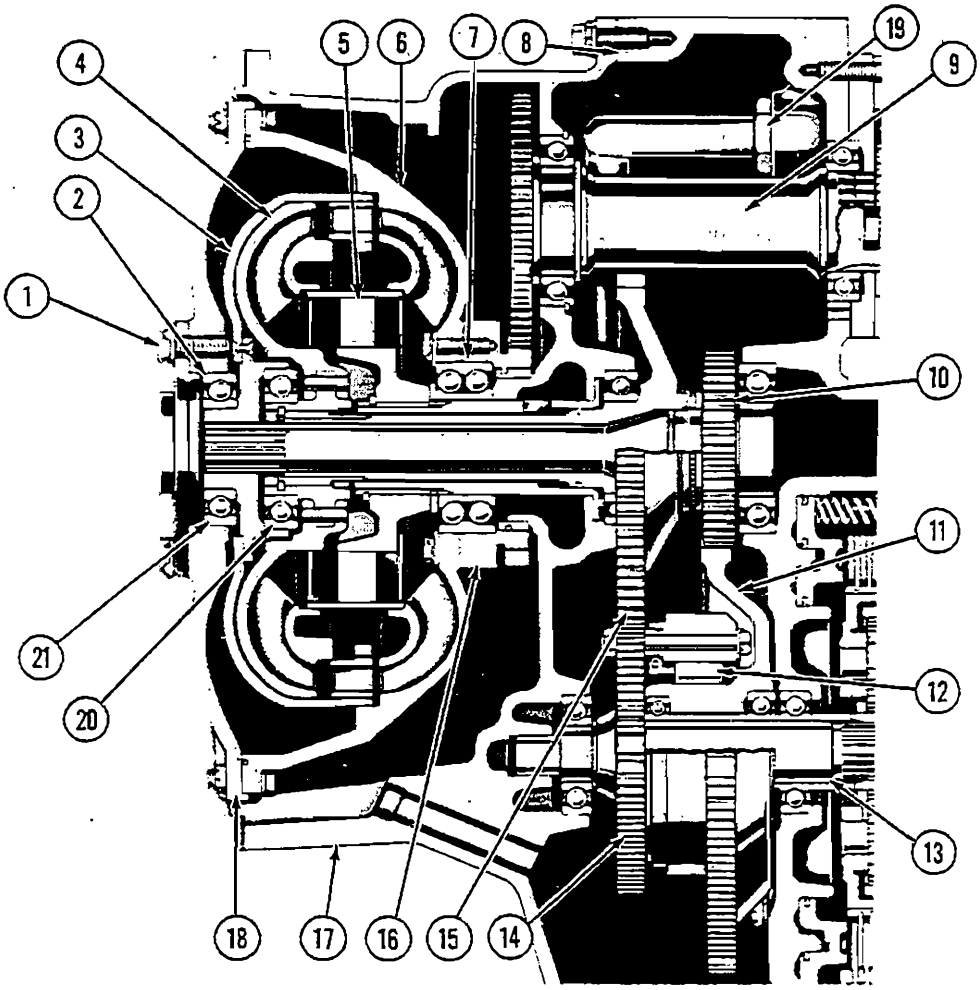

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FIG. 5 TORQUE CONVERTER AND CONVERTER GEARING - CROSS SECTION

1. Flex disk mounting capscrews
2. First-turbine support bearing
3. First-turbine assembly
4. Second-turbine assembly
5. Stator
6. Converter pump assembly
7. Converter pump bearing
8. Transmission housing
9. Accessory driven gear
10. First-turbine drive gear
11. First-turbine driven gear
12. Over-running (freewheel) clutch
13. Range gear input shaft
14. Second-turbine driven gear
15. Second-turbine drive gear
16. Input accessory drive gear
17. Torque converter housing
18. Converter drive cover
19. Oil suction tube
20. Second-turbine support bearing

2.12 TRANSMISSION TORQUE PATHS

2.12.1
COMPONENT FUNCTIONS. The torque converter, driven by the engine, directs torque through the first and/or second turbine to the second-turbine driven gear shaft. The shaft, splined to the reverse-and-low-range sun gear, drives the range planetaries and the high-range clutch hub. Hydraulic-actuated clutches, when applied, cause reactions within the involved range components. The interaction within the planetaries or application of the high-range clutch determines the gear ratio and direction of torque imparted to transfer gears. Thus, the torque path changes for each operating condition. Therefore, a knowledge of how these components direct the power flow through the transmission is necessary for proper diagnosis of transmission trouble. An understanding of the accessory gearing and converter-driven PTO is also helpful when the vehicle includes equipment driven by the transmission PTO components.

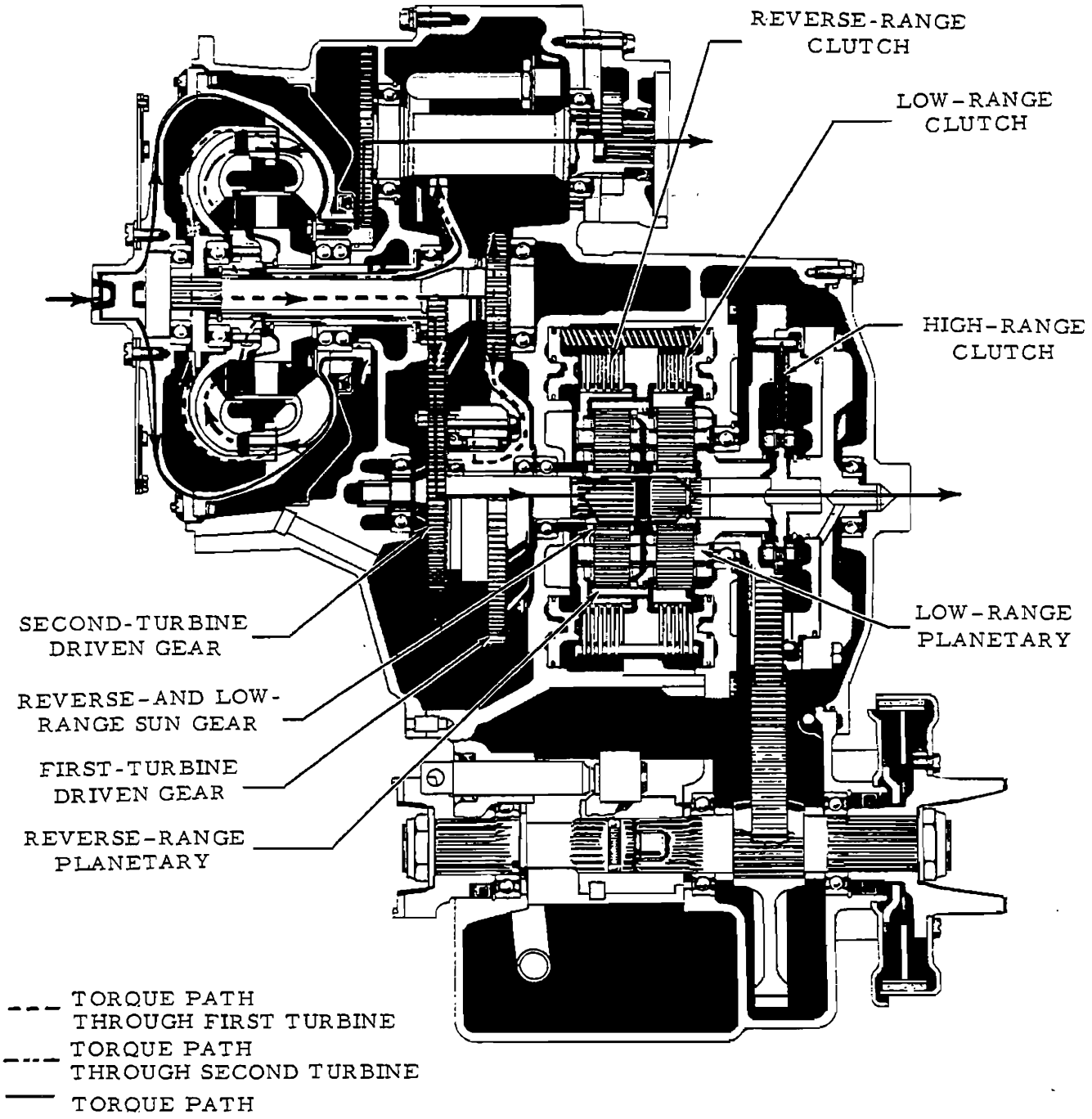

FIG. 6 NEUTRAL TORQUE PATH

2.12.2
CROSS-SECTION ILLUSTRATIONS. Figure 5 is a cross-section view of the twin-turbine torque converter. Figures 6 through 9 illustrate the paths through which the power flows from the engine to the transmission outputs.

2.12.3
Because the driving turbine is automatically determined by the load and speed requirement imposed by the loader, the torque path through the converter is not necessarily confined to a specific operating range. Thus, both paths are shown- a dotted line indicates the first-turbine torque path and a broken line indicates the second-turbine torque path. Engagement of the range clutches is indicated by horizontal bars across the clutch plates.

2.12.4
TORQUE CONVERTER, FREEWHEEL CLUTCH (FIG. 5). Power is transmitted from the engine to torque converter pump assembly (6) by a flex disk drive. From the pump, power must be transmitted hydraulically to either first-turbine assembly (3) or second-turbine assembly (4), or to both under certain operating conditions.

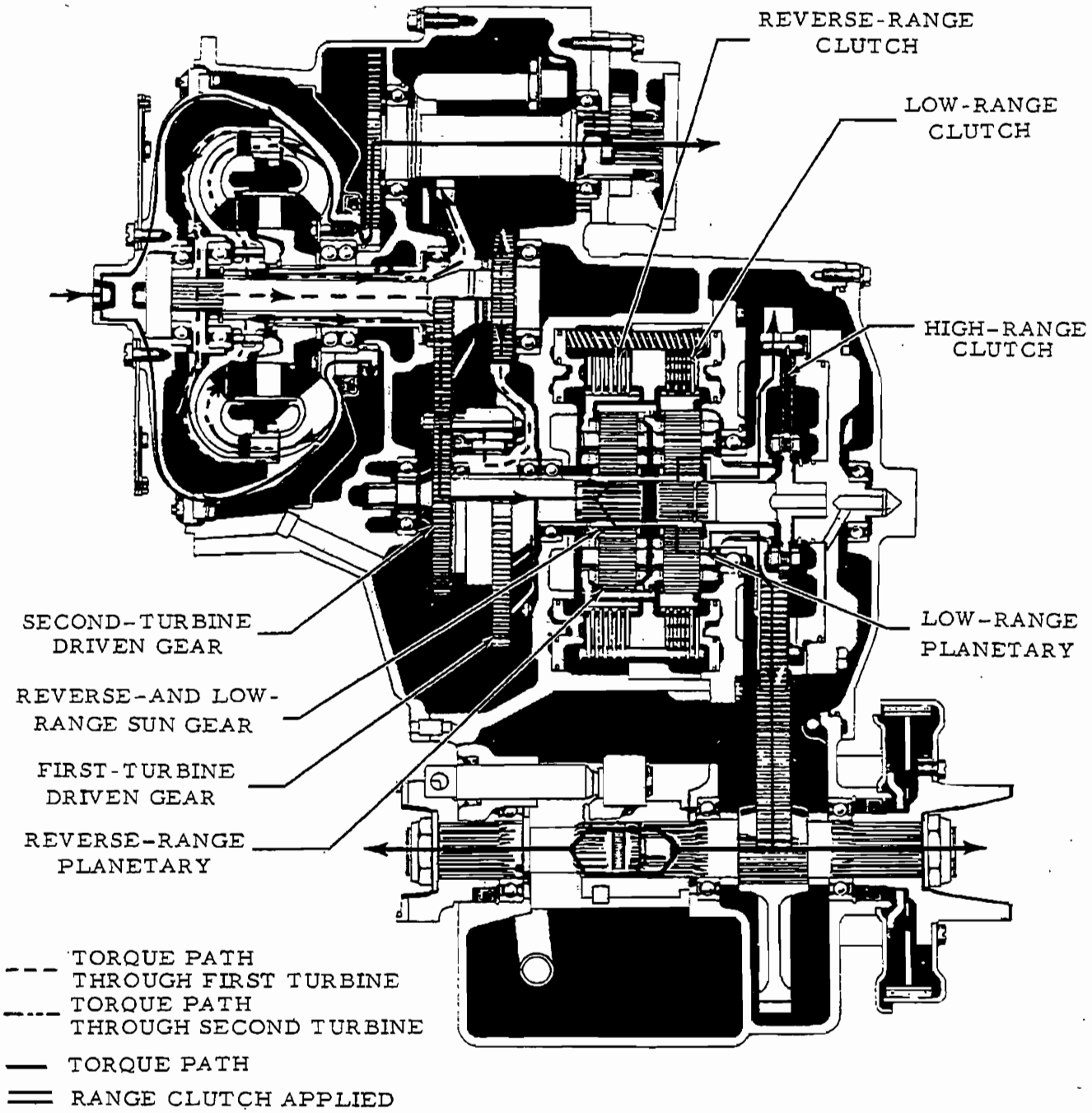

FIG. 7 LOW RANGE - TORQUE PATH

2.12.5
Speed and load determine whether the torque flows through the first - and second-turbine assemblies (3) and (4),or only through the second-turbine assembly (4). At high-load demand and low speed, freewheel clutch (12) is engaged and first-turbine assembly (3) acts as the driving member. As speed increases and load demand decreases, freewheel clutch (12) disengages and second-turbine assembly (4) becomes the primary driving member. Thus, first-turbine operation is related to higher torque, and second-turbine operation to higher speed. The transition from the torque phase to the speed phase is entirely automatic, governed by the load and speed of the vechicle.

2.13 CONVERTER GEARING TO REVERSE -AND - LOW-RANGE SUN GEAR -- TORQUE PATH

2.13.1
FIRST TURBINE (FIG. 5). Torque from converter pump assembly (6) is transmitted hydraulically to first-turbine assembly (3). The first turbine is splined to first-turbine drive gear (10) which meshes with first-turbine

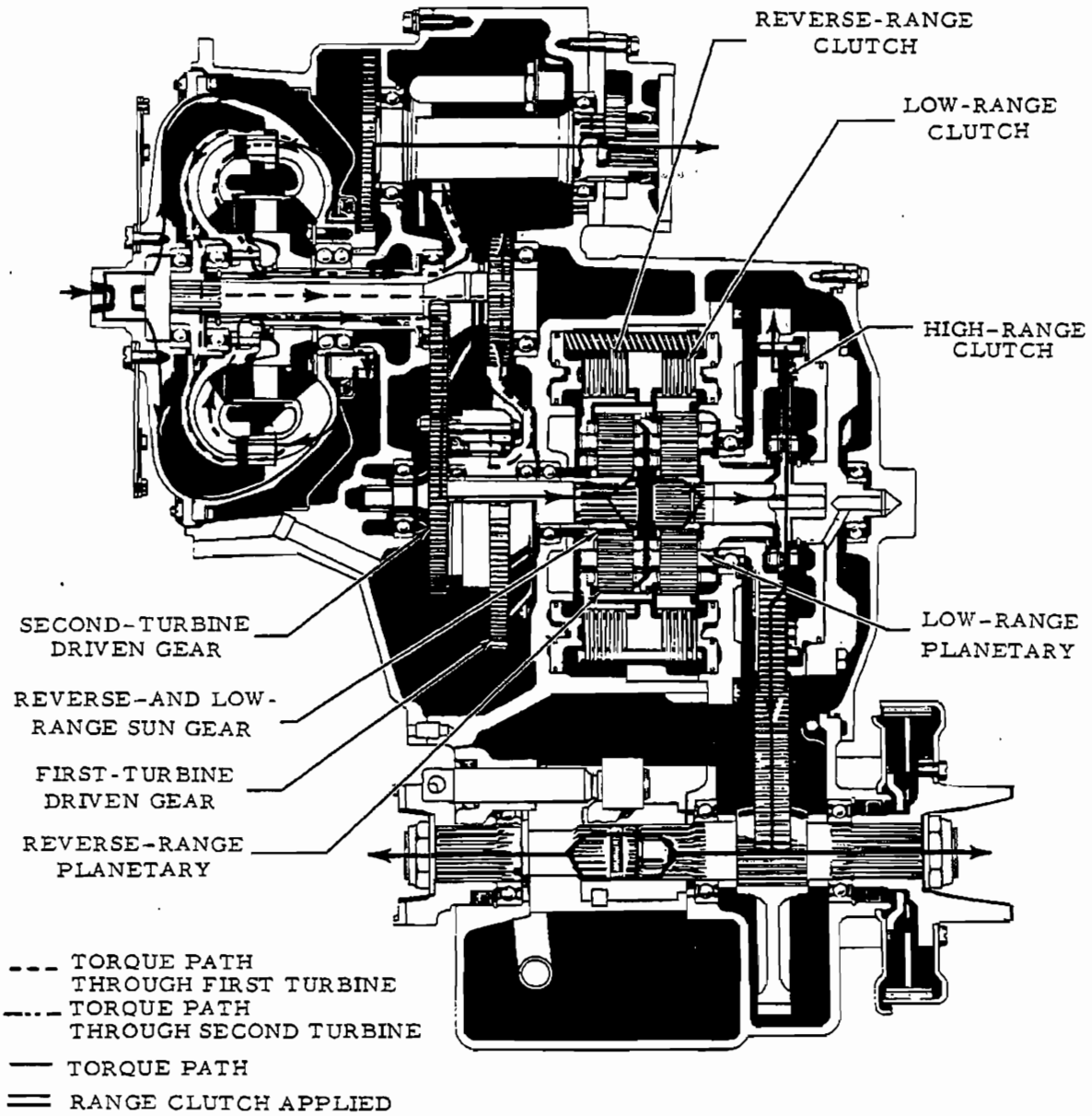

FIG. 8 HIGH RANGE TORQUE PATH

driven gear (11). The first-turbine driven gear is connected by freewheel clutch (12) to second-turbine driven gear (14). The second-turbine driven gear is integral with range gear input shaft (13). The reverse-and-low-range sun gear is splined onto the shaft end. Thus, all these components rotate when the loader is operating in a high-load, low-speed condition. The hydraulic action in the converter and the interconnection of the turbine-driven gears (first and second) permit the second turbine to assist the first until the freewheel clutch disengages.

2.13.2

SECOND TURBINE (FIG. 5). When the output speed of the converter increases, the load is assumed by second-turbine assembly (4), and when it attains sufficient speed, freewheel clutch (12) will disengage. This allows first-turbine assembly (3) to rotate freely, and no drive is contributed by the first turbine. Second-turbine assembly (4) is splined to the hollow shaft of second-turbine drive gear (15). The drive gear meshes with second-turbine driven gear (14) integral with range gear input shaft (13) which is splined with the reverse-and-low-range sun gear. Thus, all these components rotate when the loader is operating in a low-load, high-speed condition.

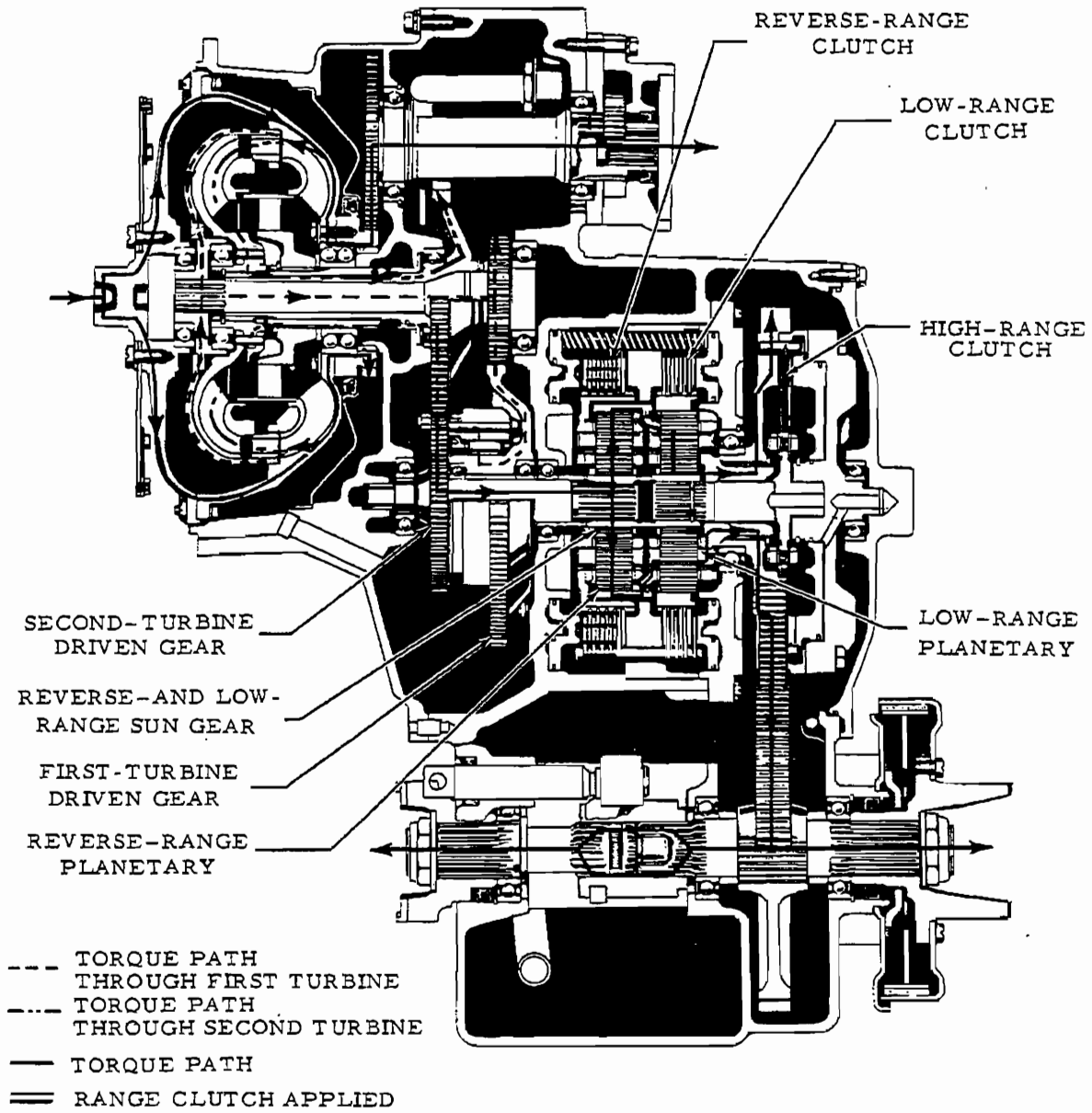

FIG. 9 REVERSE RANGE - TORQUE PATH

2.14 NEUTRAL AND POWER TAKEOFF -- TORQUE PATH (Fig. 6)

2.14.1
When the range selector is in neutral position, power is transmitted through the torque converter to the reverse-and-low-range sun gear. No range clutches are engaged. Thus, rotation of the sun gear causes the planetary pinions to rotate freely, and no power flow occurs in the range gearing.

2.14.2
Torque from the engine flows through the torque converter pump to the input accessory drive gear. Rotation of the input accessory drive gear drives the engine-driven PTO through the accessory driven gear. If the transmission is equipped with an implement pump drive, rotation of the input accessory drive gear also drives the accessory drive gear and shaft assembly. The gearing for the implement pump drive is located directly behind (relative to illustration) the engine-driven PTO gearing.

2.15 LOW RANGE -- TORQUE PATH (Fig. 7)

2.15.1
In low-range operation, torque is transmitted through the torque converter to the reverse-and-low-range sun gear in the same manner as described in paragraph 2.13. When the range selector is moved from neutral to low range (LF) the low-range clutch engages and holds the low-range ring gear stationary.

2.15.2
The rotating reverse-and-low-range sun gear drives the low-range planetary pinions within the stationary ring gear. This causes the low-range planetary carrier to rotate. The hub of the carrier is splined to the transfer drive gear. The drive gear meshes with the driven gear which is splined to the output shaft. The manually operated disconnect coupling, when moved forward, will interrupt the drive to the front output.

2.16 HIGH RANGE -- TORQUE PATH (Fig. 8)

2.16.1
In high-range operation, torque is transmitted through the torque converter to the reverse-and-low-range sun gear in the same manner as described in paragraph 2.13. When the range selector is moved from low range (LF), the low-range clutch releases and the high-range clutch engages.

2.16.2
The rotating reverse-and-low-range sun gear drives the high-range clutch hub which is bolted to the high-range clutch friction plates. Engagement of the high-range clutch locks the transfer drive gear to the rotating high-range clutch hub. The transfer drive gear meshes with the driven gear which is splined to the output shaft. The manual-operated disconnect coupling, when moved forward, will interrupt the drive to the front output.

2.17 REVERSE RANGE -- TORQUE PATH (Fig. 9)

2.17.1
In reverse-range operation, torque is transmitted through the torque converter to the reverse-and-low-range sun gear in the same manner as described in paragraph 2.13. When the range selector is moved to reverse-range position, the forward-range clutches (LF and HF) are exhausted and the reverse-range clutch engages and holds the reverse-range planetary hub (and carrier) stationary.

2.17.2
The rotating reverse-and-low-range sun gear drives the pinions which also are in mesh with the reverse-range ring gear. This causes the ring gear to rotate in a direction opposite to that of the sun gear. The ring gear is attached to the low-range planetary carrier. Thus, the reverse torque is transmitted from the reverse range ring gear through the low-range planetary carrier to the transfer drive gear. The transfer drive gear meshes with the driven gear which in turn drives the transfer drive gear and output shaft in reverse. The manually operated disconnect coupling, when moved forward, will interrupt the drive to the front output.

TOPIC 3 PREVENTIVE MAINTENANCE

3.1 SCOPE OF TOPIC 3

3.1.1
This section outlines the routine and periodic procedures required to maintain the transmission in good operating condition. Included are instructions for care of the oil system, minor adjustments of the transmission and control linkages, tests to determine condition, instructions for extended storage, and trouble-shooting, in handy chart form.

3.2 PERIODIC INSPECTIONS, CLEANING

3.2.1
INSPECTING EXTERIOR. The exterior of the transmission should be cleaned and inspected at regular intervals. The severity of service and operating environment will determine the frequency of such procedures. The transmission should be inspected for loose bolts, oil leaks, linkage troubles, and bent or damaged oil lines, Oil leaks that cannot be stopped by tightening the parts require immediate attention. Linkage must be kept clean,adjusted and well lubricated.

3.2.2
CLEANING BREATHER. The prevalence of dust and dirt will determine the frequency at which the breather requires cleaning. Clean the area around the breather stem before removing the breather. Wash the breather thoroughly by agitating it in mineral spirits or cleaning solvent. Dry it thoroughly with compressed air after cleaning. Always use a wrench of the proper size to remove or replace the breather. Pliers or a pipe wrench will crush or damage it and produce metal chips which could enter the transmission.

3.2.3
OIL CONTAMINATION. At each oil change examine the oil which is drained, for evidence of dirt or water. A normal amount of condensation will emulsify in the oil during operation of the transmission. However, if there is evidence of water, check the cooler (heat exchanger) for leakage between the water and oil areas. Oil in the water side of the cooler (or in the radiator) is another sign of leakage. This, however, may indicate leakage from the engine oil system. Any accumulation of sludge or soft dirt in the sump should be removed with flushing oil.

3.2.4
Metal particles in the oil (except for the minute particles normally trapped in the oil filter) indicate damage has occurred in the transmission. When these particles are found in the sump or on the magnetic drain plug, the transmission must be disassembled and closely inspected to find the source. Metal contamination will require complete disassembly of the transmission and cleaning of all internal and external circuits, cooler, filter, and all other areas where the particles could lodge.

3.2.5
If engine coolant containing ethylene glycol leaks into the transmission oil system, immediate action must be taken to prevent malfunction and possible serious damage. The transmission must be completely disassembled, inspected and cleaned. All traces of the coolant, and varnish deposits resulting from coolant contamination, must be removed.

3.3 CHECKING OIL LEVEL

3.3.1
COLD CHECK. With the transmission dipstick, check the oil level before starting the engine. It is safe to start the engine if the oil is in the range on the engine stopped side of the dipstick. If the oil level is not within this range, add oil.

IMPORTANT:The above method is only a precautionary method prior to starting a cold loader. After the transmission fluid reaches operating temperature a further fluid check must be made using method in 3.3.2. Always recheck fluid using method described in 3.3.2.

3.3.2
HOT CHECK. With the oil at normal operating temperature, engine operating at low idle, transmission in neutral, and parking brake set, check the oil level. The oil must be within the operating range on the engine running side of the dipstick. Add specified oil to bring level between operating range.

3.4 MAINTENANCE INTERVALS

3.4.1
FREQUENCY. The severity of service and the environment in which the transmission operates will determine the frequency of some maintenance operations. Under very dusty or dirty operating conditions the transmission oil should be changed more often. Oil should be changed immediately if it has been subjected to overheating-indicated by discoloration and a strong odor. The breather will require more frequent cleaning when dirt and dust conditions are severe.

3.4.2
OIL AND FILTER CHANGE. The oil and filter should be changed after each 1000 hours of operation. For severe service, refer to 3.4.1 above. Refer also to paragraph 3.2 before changing oil. Do not operate a transmission which is filled with preservative oil except for minimum necessary time and distance.

3.5 CHANGING OIL, FILTER

3.5.1
DRAINING OIL. Transmission should be at operating temperature (180°F)(82°C)when the oil is changed. Remove drain plug at lower-left rear of transmission housing (Fig. 1). Remove the oil filter element from the remote-mount filter. (Refer to Operators Manual). Remove and clean the oil strainer assembly (fig. 19). Let the oil drain 30 minutes if time permits. Replace the oil strainer, gasket and oil drain plug. Install a new oil filter element. (Refer to Operator's Manual).

3.5.2
REFILLING OIL SYSTEM. Add 7.5 US gallons (28,38 lts.) or 6.25 Imperial gallons) of specified transmission fluid after an oil change. Then conduct the hot check as described in paragraph 3.3.2, adding oil as necessary to establish the correct oil level for operation.

3.5.3
OIL SYSTEM CAPACITY. Add 8.5 US gallons (32,17 lts.) or (7.08 Imperial gallons) for an initial fill or after a complete overhaul. This amount does not include the oil necessary to fill the external filter and cooler circuits. Thus, the refill amount is less than the initial fill because some oil remains in the external circuits and transmission cavities.

3.6 PRESSURES, TEMPERATURES

Figure 10 illustrates the points where the transmission temperature and pressure may be measured. The loader is equipped with a temperature gauge and a pressure gauge. The temperature gauge registers the converter-out (to cooler) temperature, and the pressure gauge registers main (clutch) pressure. Clutch pressure during normal operation in any gear or in neutral is approximately equal to main pressure and may be regarded as main pressure. However, while the clutch cutoff control is being used, clutch pressure may fall to practically zero -- this does not indicate that main pressure has decreased. Therefore, when checking main pressure, do not actuate either of these controls.

3.7 LINKAGE CHECKS, ADJUSTMENTS

3.7.1
SELECTOR LINKAGE. (See Operator's Manual) The selector linkage must be adjusted so that the operator's control and selector valve are both in desired range at the same time. Make initial adjustment in neutral. Then shift through all range positions to make sure that the selector valve is in full detent position in each range. Linkage must be kept clean, adjusted and well lubricated. Bent or damaged linkage must be repaired or replaced.

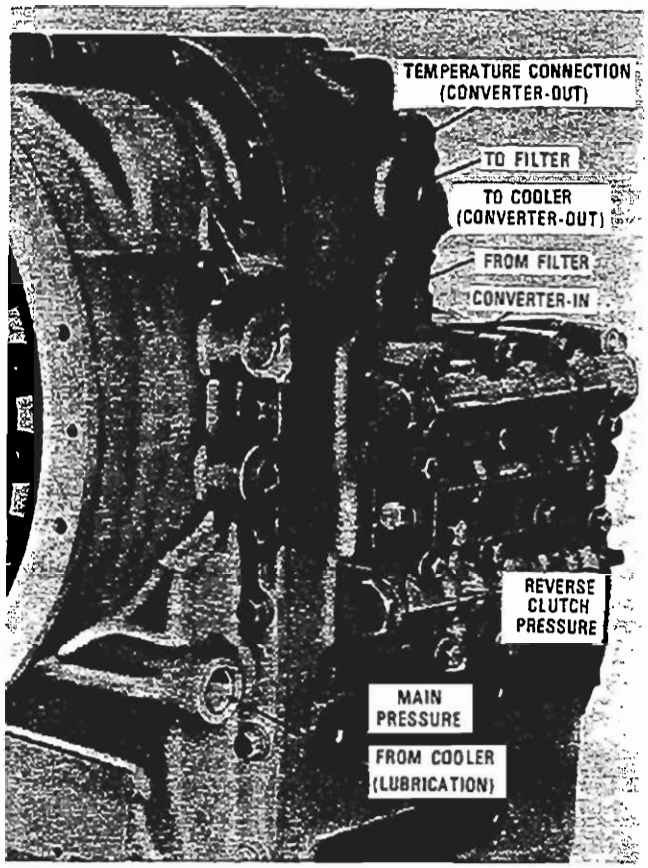

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FIG. 10 PRESSURE AND TEMPERATURE CHECK POINTS

3.7.2
FRONT OUTPUT DISCONNECT. There are two points of adjustment for the front output disconnect. The shifter shaft must be adjusted first, and then adjust the linkage. Push the shifter shaft inward (toward the rear) to its engaged position. A spring-loaded detent will indicate positive engagement. Adjust the shifter shaft by rotating it until the center of the clevis pin hole is approximately 3.8" (96.5mm) ahead of the linkage support bracket mounting pad faces.

3.7.3
When the shifter shaft is pulled outward (forward) to its disengaged position the detent ball should seat when the center of the clevis pin hole is approximately 2.12"(53.9 mm) ahead of the bracket mounting pad faces. Adjust the linkage so that the engaged and disengaged positions of the operators control correspond exactly with the detent positions of the shifter shaft.

3.8 TRANSMISSION STALL TEST

3.8.1
PURPOSE. A stall test should be conducted when the power package (engine and transmission) is not performing satisfactorily. The purpose of the test is to determine if the transmission is the malfunctioning component.

3.8.2
A stall test is conducted with the engine running at full throttle and the transmission outputs stalled. The data obtained from the test must be used in conjunction with engine-converter matched performance curves.

3.8.3
PROCEDURE. Connect a tachometer of known accuracy to the engine, and bring transmission to normal operating temperature (180°F)(82°C)

CAUTION

The stall condition should never be maintained for more than 30 seconds at any one time because of the rapid rise in oil temperature.

3.8.4
Apply the parking brake, block the loader securely, and shift the selector control to high range. (The test may also be conducted to low-or reverse-range, if necessary. However, such tests must be made with extreme caution because of the high torque delivered at the transmission output shaft).

3.8.5
Accelerate the engine to wide-open throttle. After reaching a stabilized converter-out temperature of 225°F (107°C) minimum, record the engine speed while the engine is at open throttle. Do not let the converter-out temperature exceed 250°F(121°C).

NOTE: Allow approximately 2 minutes of neutral operation between stall tests to prevent overheating. During the 2-minute period, engine speed should be maintained (except for the momentary throttle release when shifting to neutral).

3.8.6
RESULTS. Under stall test conditions, a comparison of actual engine speed with the established normal speed for such conditions will indicate if the engine or the transmission is malfunctioning. To determine the proper engine speed at stall, refer to the matched performance curve for the particular installation.

NOTE: Environmental conditions, such as ambient temperature, altitude, engine accessory loss variations, etc., affect the power input to the converter. These conditions may cause the stall speed to vary a + or - 150 rpm from the established normal value. When deviation can be attributed to such causes, the actual speed can be accepted as normal.

3.9 PRESERVATION, STORAGE

3.9.1
PRESERVATIVE SELECTION. When transmissions are to be stored or remain inactive for extended periods of time, specific preservative methods are recommended to prevent rust and corrosion damage. The length of storage will usually determine the preservative method to be used. Various methods are described below.

3.9.2
STORAGE, NEW UNITS. New units contain preservative oil when shipped and can be safely stored for 6 weeks without further treatment.

3.9.3
STORAGE, MONTH TO 6 WEEKS. The following procedures will prepare a transmission for a month to 6 weeks storage, depending on the environment.

3.9.4
Drain the oil as described in paragraph 3.5.1, above. Remove the transmission oil filter element.

3.9.5
Install the drain plugs and new filter element.

3.9.6
Fill the unit to operating level with any commercial preservative oil which meets US Military specifications MIL-L-21260, Grade 1, to latest specifications.

3.9.7
Operate the unit for at least 5 minutes at a minimum of 1,000 rpm. Shift the transmission slowly through all selector positions to thoroughly distribute the oil, then stall the converter to raise the oil temperature to 225°F(107°C).

CAUTION

Do not allow temperature to exceed 250°F. (122°C). If the unit does not have a temperature gauge, do not stall for more than 30 seconds.

3.9.8
As soon as the unit is cool enough to touch, seal all openings and breathers with moisture-proof tape.

3.9.9
Coat all exposed, unpainted surfaces with a good grade of preservative grease, such as Petrolatum (MIL-C-11796) Class 2.

3.9.10
Repeat the above procedures (3.9.7 through 3.9.9) at monthly intervals for indefinite storage.

3.9.11
STORAGE, 1YEAR -- WITHOUT OIL Drain oil as described in paragraph 3.5.1.

3.9.12
Seal all openings except oil drain hole and breathers with moisture-proof tape.

3.9.13
Coat all exposed, unpainted surfaces with a good grade of preserative grease.

3.9.14
Atomize or spray 2 ounces (56,7 gms.) of Motorstor*, or equivalent, into the transmission through the oil drain hole. Install drain plug.

*Motorstor is a preservative additive manufactured by the Daudert Chemical Company, Chicago, Illinois. Motorstor (under the designation of ('Nucle Oil") is covered by U.S. Military Specifications -- MIL-L-46002 (ORD) and MIL-I-23310 (WEP).

3.9.15
If additional storage time is required, 3.9.6 and 3.9.7, above, should be repeated at yearly intervals.

3.9.16
STORAGE, 1YEAR -- WITH OIL Drain the oil as described in paragraph 3.5.1. Remove the transmission oil filter element.

3.9.17
Install the drain plugs and new filter element.

3.9.18
Fill the transmission to operating level with a mixture of 30 parts hydraulic transmission fluid, type C2, 1 part Motorstor preservative or equivalant.

3.9.19
operate the unit approximately 5 minutes at a minimum of 1000 rpm. Shift the transmission slowly through all selector positions to thoroughly distribute the oil, then stall the converter to raise the oil temperature to 225°F (107°C).

CAUTION

Do not allow temperature to exceed 250°F (122°C). If the unit does not have a temperature gauge, do not stall for more than 30 seconds.

3.9.20
As soon as the unit is cool enough to touch, seal all openings and breathers with moisture-proof tape.

3.9.21
Coat all exposed, unpainted surfaces with a good grade of preservative grease.

3.9.22
If additional storage time is required, 3.9.16 through 3.9.18, above, should be repeated at yearly intervals, except it is not necessary to drain the transmission each year -- just add the Motorstor or equivalent.

3.9.23
RESTORING UNITS TO SERVICE. If Motorstor, or equivalent, was used in preparing the transmission for storage, use the following procedures to restore the unit to service.

3.9.24
Remove the tape from openings and breather.

3.9.25
Wash off all the external grease with solvent.

3.9.26
Add hydraulic transmission fluid, type C2 to proper level.

NOTE: It is not necessary to drain C2 oil and Motorstor mixture from the transmission.

3.9.27
If Motorstor, or equivalent, was not used in preparing the transmission for storage, use the following procedures to restore the unit to service.

3.9.28
Remove the tape from openings and breathers.

3.9.29
Wash off all the external grease with solvent.

3.9.30
Drain oil as described in paragraph 3.5.1.

3.9.31
Install a new oil filter element. Refill transmission with hydraulic transmission fluid type C2 to proper level.

3.10 TROUBLE-SHOOTING

3.10.1
IMPORTANCE Trouble-Shooting is the systematic search for the location of malfunctions in the engine or transmission that affect transmission performance. A thorough study of the description and operation of components and the hydraulic system (TOPIC 2) will be helpful in trouble-shooting. The engine and transmission must be regarded as a single package during trouble-shooting.

3.10.2
TROUBLE-SHOOTING CHART. The following chart outlines the possible causes of and remedies for transmission troubles.

TROUBLE-SHOOTING CHART

TROUBLE	CAUSES	REMEDY
Low main pressure	1. Low oil level	1. Add oil to correct level
	2. Clogged oil strainer	2. Clean strainer
	3. Clogged oil filter	3. Replace filter element
	4. Weak or broken main-pressure regulator valve spring	4. Replace spring
	5. Oil pump worn	5. Rebuild oil pump
	6. Air leak at intake side of oil pump	6. Check pump mounting bolts; check oil pickup tube
	7. Internal oil leakage	7. Disassemble transmission; rebuild subassemblies as required
	8. External oil leakage	8. Tighten bolts or replace gaskets
	9. Brake hydraulic pressure applying clutch cutoff valve	9. Check brake residual pressure (brakes released); check brakes for full release
	10. Trimmer plug stuck or leaking	10. Remove valve assembly and inspect
Overheating	1. High oil level	1. Restore proper oil level
	2. Clutch failed	2. Rebuild transmission
	3. Loader overloaded	3. Reduce load
	4. Low main pressure	4. Refer to low main pressure
	5. Engine water overheated	5. Correct engine overheating
	6. Cooler oil or water line kinked or clogged	6. Clean or replace line
Low clutch apply pressure	1. Low main pressure	1. Refer to low main pressure
	2. Clutch piston seal rings failed	2. Overhaul transmission
	3. Clutch cutoff control valve sticking	3. Rebuild control valve assy.
	4. Internal oil leakage	4. Overhaul transmission
Aerated (foaming) oil	1. Incorrect type oil used	1. Change oil; use proper type
	2. High oil level	2. Restore proper oil level
	3. Low oil level	3. Restore proper oil level
	4. Air entering suction side of oil pump	4. Check oil pump bolts and gasket; check oil pickup tube and nut
Loader will not travel	1. Low main pressure	1. Refer to low main pressure
	2. Low clutch apply pressure	2. See low clutch apply pressure
	3. Selector linkage broken or disconnected	3. Repair or connect linkage
	4. Internal mechanical failure	4. Overhaul transmission
Loader travels in neutral when engine is accelerated	1. Selector linkage out of adjustment	1. Adjust linkage
	2. Clutch failed (won't release)	2. Overhaul transmission
Loader lacks power and acceleration at low speed	1. Low main pressure	1. Refer to low main pressure
	2. Low clutch apply pressure	2. Refer to low clutch apply pressure
	3. Turbine freewheel clutch failed	3. Overhaul transmission
	4. Engine malfunction	4. Check engine; refer to engine service manual
	5. Aerated oil	5. Refer to aerated (foaming oil)
Stall speed too high	1. Clutch slipping	1. Overhaul transmission
	2. Low main pressure	2. See low main pressure and low clutch apply pressure, above

(Continued)

TROUBLE-SHOOTING CHART (Continued)

TROUBLE	CAUSES	REMEDY
Stall speed too low	1. Engine not producing full power 2. Torque converter failed 3. Loss of engine power thru accessories attached to engine.	1. Tune or repair engine; refer to engine service manual. 2. Rebuild converter 3. Disconnect accessories which are absorbing power.
Low lube pressure	1. Lube pressure valve spring weak or broken. 2. Lube valve stuck open 3. Excessive leakage in other parts of transmission circuit.	1. Remove and repair 2. Remove and repair 3. Check other section of the circuit.
Low converter charging pressure	1. Low lube pressure 2. Converter safety valve stuck open.	1. Refer to low lube pressure. 2. Remove and repair
Excessive noise at flywheel	1. Flex plates loose.	1. Tighten flywheel to flex plate bolts.
Shifts hard in both directions	1. Incorrect main regulating valve spring (small spring) from the control valve.	1. Count number of spring coils and look for color code. The 545 B and 605 B spring has 17 coils and is color coded blue. The 645 B spring has 16 coils and is not color coded. If problem still exists after check, look for uneven transmission control valve mounting capscrew torque and/or a sticking trimmer plug. If no problems are found here check for a cut piston stage teflon ring. Check for foreign matter holding nylon balls off their seats.

TOPIC 4 GENERAL OVERHAUL INFORMATION

4.1 SCOPE OF TOPIC 4

4.1.1
This section contains preliminary information required for the overhaul of the transmission. Cleaning instructions, inspection criteria, and recommended rework procedures are discussed. Good shop practices, coupled with the recommended procedures described herein, will aid in restoring high-quality performance.

4.2 MODEL CHANGES

4.2.1
The release of new assemblies may require new or different overhaul procedures. Major changes in the transmission will be described in supplementary issues to this manual. Contact your dealer or distributor for the latest information.

4.3 TOOLS, EQUIPMENT

4.3.1
The improvised tools required for overhaul are shown in figures 11, 12, and 13. Figure 11 illustrates a puller assembly and sleeve used to remove the converter pump; Figure 12 illustrates a holding fixture used to prevent rotation of the freewheel cam bolts. In addition to ordinary hand tools, the following items should also be available:

1. Chain hoist 1/2 ton (453.6 kg) capacity, min.
2. Suitable disassembly and assembly table
3. Press (for removal and installation of press-fit parts)
4. Supply of wood blocks
5. Clean wiping cloths (do not use linty waste)
6. Parts receptacles
7. Cleaning equipment (brushes, solvents, etc.)
8. Torque wrenches
9. Oil soluble grease
10. Dry ice (for cooling interference-fit parts)
11. Heating equipment or hot plate to provide oil at 300°F. (149°C) (for heating interference-fit parts)

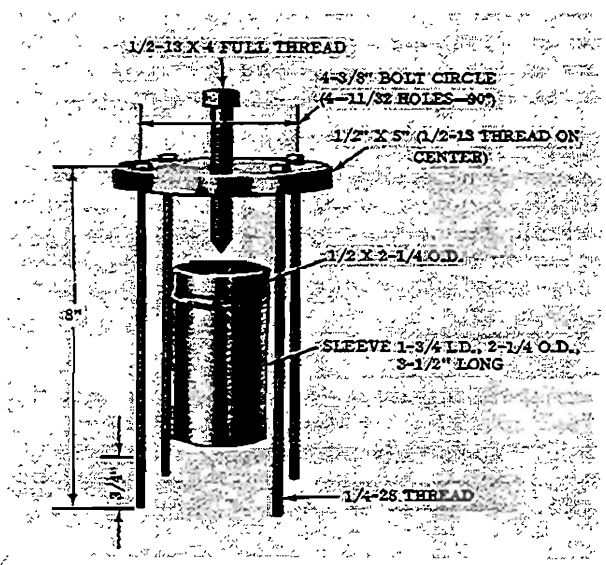

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FIG. 11 IMPROVISED PULLER FOR CONVERTER PUMP ASSEMBLY

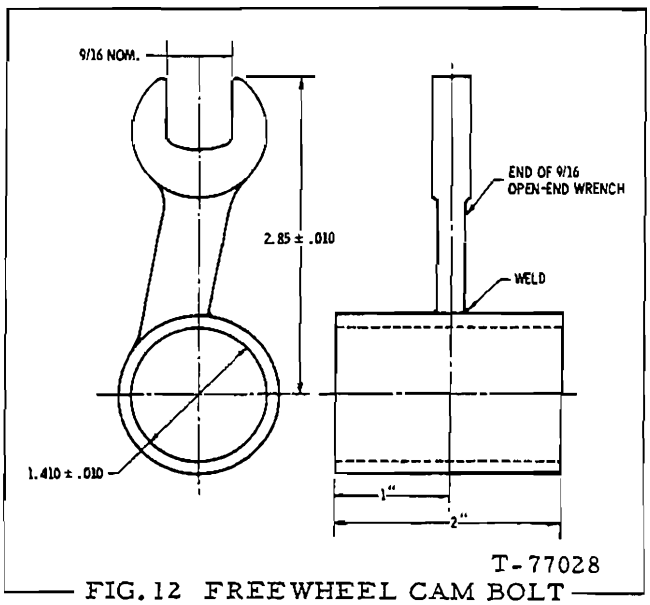

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FIG. 12 FREEWHEEL CAM BOLT HOLDING FIXTURE

4.4 REPLACEMENT PARTS

4.4.1
ORDERING INFORMATION. Refer to paragraph 1.3 for information on ordering parts and service kits.

4.4.2
SERVICE KITS. Make use of the repair and overhaul kits which contain the gaskets, seals, lockstrips, etc. required for a complete overhaul (refer to paragraph 1.3).

4.4.3
PARTS NORMALLY REPLACED. The following parts are normally replaced during overhaul: gaskets, cotter pins, lockstrips, lip-type oil seals (when removed), damaged snap rings, and washers.

WARNING

Do not burn discarded Teflon seals. Toxic gases are produced.

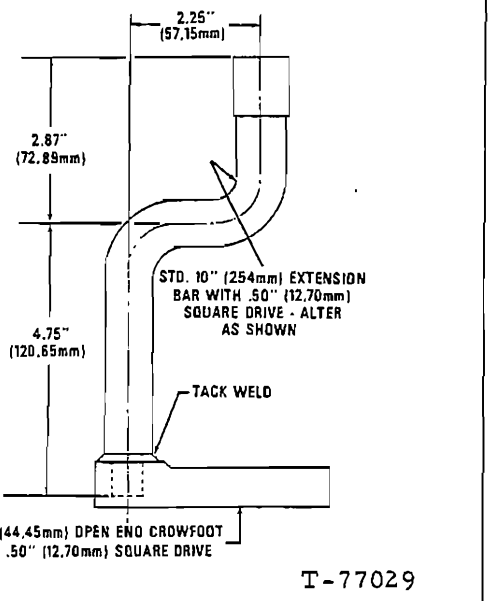

FIG. 13 SPECIAL WRENCH FOR OIL SUCTION TUBE NUT

4.5 CAREFUL HANDLING

4.5.1
Parts which have close operating tolerances must be handled carefully to prevent nicking, scratching, or denting. The slightest damage to these parts can result in erratic operation and possible malfunction of the transmission. These parts should be carefully handled and protected during removal, cleaning, inspection and installation.

4.6 CLEANING, INSPECTION

4.6.1
DIRT-FREE ASSEMBLY. All parts must be clean to permit effective inspection. During assembly, it is very important that no dirt or foreign matter enters the transmission. Even minute particles can cause the malfunction of close-fitting parts.

4.6.2
CLEANING PARTS. All metallic parts of the transmission (except bearings) should be cleaned thoroughly with volatile mineral spirts, or by the steam-cleaning method. Do not use a caustic soda solution for steam cleaning. Gum and varnish deposits should be removed by allowing the parts to soak in varnish remover.

4.6.3
Parts should be dried with compressed air. Steam-cleaned parts should be oiled immediately after drying.

4.6.4
Clean oil passages by working a piece of soft wire back and forth through the passages and flushing with spirits. Dry the passages with compressed air.

4.6.5
After cleaning, examine the parts and especially the oil passages to make certain they are entirely clean. Reclean them, if necessary.

4.6.6
CLEANING BEARINGS. Bearings that have been in service should be thoroughly washed in volatile mineral spirits.

4.6.7
If the bearings are particularly dirty or filled with hardened grease, soak them in the spirts before trying to clean them.

4.6.8
Before inspection, oil the bearings with the same type of oil that will be used in the transmission.

NOTE: Never dry bearings with conpressed air. Do not rotate bearings while they are not lubricated.

4.6.9
INSPECTING BEARINGS. Inspect bearings for roughness of rotation. Replace a bearing if its rotation is still rough after cleaning and oiling.

4.6.10
Inspect bearings for scored, pitted, scratched, cracked or chipped races, and for indication of excessive wear of rollers or balls. If one of these defects is found, replace the bearing.

4.6.11
Inspect the defective bearing's housing and shaft for grooved, burred, or galled conditions that indicate the bearing has been turning in its housing or on its shaft. If the damage cannot be repaired with crocus cloth, replace the defective part.

4.6.12
When installing a bearing on a shaft, heat the bearing to 200°F on an electric hot plate or in an oil bath. Coat the mating surfaces with white lead and use the proper size installation sleeve and a press to seat the bearing.

NOTE: Bearings must be heated long enough for sufficient expansion. Heating time is determined by the size of the bearing. Forty-five minutes is sufficient for the largest bearing in these transmission.

4.6.13
If a bearing must be removed or installed without a sleeve, be careful to drive or press only on the race which is adjacent to the mounting surface. If a press is not available, seat the bearing with a drift and a hammer, driving against the supported race.

4.6.14
KEEPING BEARINGS CLEAN. The presence of dirt or grit in ball bearings is usually responsible for bearing failures. It is important to keep bearings clean during installation and removal. Observance of the following rules will do much to insure maximum bearing life.

4.6.15
Do not remove the wrapper from new bearings until ready to install them.

4.6.16
Do not remove the grease in which new bearings are packed.

4.6.17
Do not lay bearings on a dirty bench; place them on clean paper.

4.6.18
If assembly is not to be completed at once, wrap or cover the exposed bearings with clean paper or cloth to keep out dust.

4.6.19
INSPECTING CAST PARTS, MACHINED SURFACES. Inspect bores for scratches, wear, grooves, and dirt. Remove scratches and burs with crocus cloth. Remove foreign matter. Replace parts that are deeply grooved or scratched.

4.6.20
Inspect all oil passages for obstructions. If an obstruction is found, remove it with compressed air, or by working a soft wire back and forth through the passage and flushing it out with cleaning solvent.

4.6.21
Inspect mounting faces for nicks, burs, scratches, and foreign matter. Remove such defects with crocus cloth or a honing stone. If scratches are deep, replace the defective part.

4.6.22
Inspect threaded openings for damaged threads. Chase damaged threads with correct size tap.

4.6.23
Replace housings or other cast parts that are cracked.

4.6.24
Inspect all machined surfaces for damage that could cause oil leakage or other malfunction of the part. Rework or replace defective parts.

4.6.25
INSPECTING BUSHINGS, THRUST WASHERS. Inspect bushings for scores, roundness, burs, sharp edges, and evidence of overheating. Remove scores with crocus cloth. Remove burs and sharp edges with a scraper or knife blade. If the bushing is out-of-round, deeply scored, or excessively worn, replace it, using the proper size replacer tool.

NOTE: Sometimes it is necessary to cut out a defective bushing. Be careful not to damage the bore into which the bushing fits.

4.6.26
Inspect thrust washers for distortion, scores, burs, and wear. Replace the thrust washer if it is defective or worn.

4.6.27
INSPECTING OIL SEALS, GASKETS. Inspect lip-type seal rings for cuts and hardness. Replace the seal rings if these defects are found.

4.6.28
When replacing lip-type seal rings, make sure the spring-loaded side is toward the oil to be sealed in (toward the inside of the unit). Use a nonhardening sealing compound on the outside diameter of the seal to help prevent oil leaks. Coat the inside diameter of the seal with high temperature grease (MIL-G-3545A or equivalent) to prtect the seal during shaft installation and to provide lubrication during initial operation.

4.6.29
Replace all composition gaskets.

4.6.30
Inspect the hook-type seal rings for wear, broken hooks, and distortion.

4.6.31
Install a new hook-type seal ring if it is worn so much that there is no gap between the hooks of the seal ring when it is installed.

4.6.32
The sides of the sealing ring should be smooth (0.005")(.1270 mm) (maximum side wear). The sides of the shaft groove (or the bore) in which the seal ring fits should be smooth (50 microinches) and square with the axis of rotation within 0.002" (.0507 mm). If the sides of ring grooves have to be reworked (0.020"(.5079mm) maximum side wear), install a new seal ring.

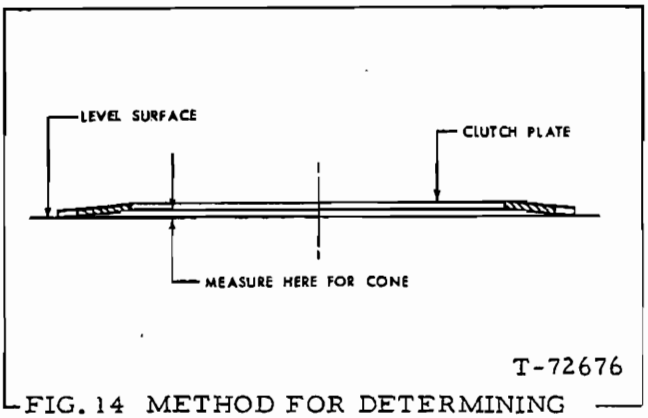

FIG. 14 METHOD FOR DETERMINING CONE OF CLUTCH PLATE

4.6.33
INSPECTING GEARS. Inspect gears for scuffed, nicked, burred, or broken teeth. If the defect cannot be removed with a soft honing stone, replace the gear.

4.6.34
Inspect gear teeth for wear that may have destroyed the original tooth shape. If this condition is found, replace the gear.

4.6.35
Inspect the thrust faces of gears for scores, scratches, and burs. Remove such defects with a soft honing stone.

4.6.36
INSPECTING SPLINED PARTS. Inspect parts for stripped, twisted or chipped splines. Replace the part if these defects are found. Remove any burs with a soft stone. Spline wear is not considered detrimental except where it affects tightness or fit of the splined parts.

4.6.37
INSPECTING CLUTCH PLATES. Inspect the friction-faced plates for burs, imbedded metal particles, severely pitted faces, excessive wear, cone, cracks, distortion, and damaged spline teeth. Remove burs, using a soft honing stone. Replace plates which have other defects.

4.6.38
Inspect steel plates for burs, scoring, excessive wear, cone, distortions, imbedded metal, galling, cracks, breaks, and damaged tangs. Remove burs and minor surface irregularities using a soft honing stone. Replace plates which have other defects.

4.6.39
The amount of cone is determined by measuring the distance between the inside diameter of plate and a level surface(Fig. 14). When assembling a clutch pack, soak clutch plates in type C 2 oil for at least 2 minutes and make sure that each plate is installed so that the cone is in the same direction as adjacent plates. (Refer to wear limits chart for maximum allowable cone).

4.6.40
INSPECTING THREADED PARTS. Inspect parts for burred or damaged threads. Remove burs with a soft honing stone or fine file. Replace damaged parts.

4.6.41
INSPECTING SNAP RINGS. Inspect all snap rings for nicks, distortion, and excessive wear. Replace the part if any one of these defects is found. The snap ring must snap tight in its groove for proper functioning.

4.6.42
INSPECTING SPRINGS. Inspect all the springs for signs of overheating, permanent set, or wear due to rubbing adjacent parts. Replace the spring if any one of these defects is found. Replace springs which do not meet the load-height specifications in the spring chart.

4.7 WEAR LIMITS, SPRING CHART

4.7.1
WEAR LIMITS INSPECTION. When parts are being inspected, those listed in Topic 11 should be measured for wear. Those parts which have reached or exceeded the specified wear limit should be discarded and replaced. All wear limits data are tabulated in Topic 11.

4.7.2
SPRING INSPECTION. The data presented in the Spring Chart in Topic 11 will aid in identification and inspection of the springs within the transmission.

4.8 TORQUE SPECIFICATIONS

The assembly procedures specify torque requirements for all bolts and nuts. For general reference, a torque specification chart is presented below. Torque specifications in the chart apply to all assembly procedures unless otherwise specified in the text or cross-section illustration at the end of Topic 7. The illustration may be used as a convenient reference for the torque required to tighten the hardware visible in the cross-section view.

GENERAL TORQUE SPECIFICATIONS--BOLTS AND SCREWS

[All torque values are given in pound feet (kg/m)]

Size	Threads per inch (mm)	Standard heat-treated bolts and screws 	Special heat-treated bolts, screws, Allen-head screws, and self-locking capscrews 	Nuts on bolts
.25"	20	9-11 (1.2-1.5)	9-11 (1.2-1.5)	
(6.4mm)	28	10-12 (1.4-1.6)	10-12 (1.4-1.6)	
.31"	18	12-16 (1.8-2.2)	17-20 (2.4-2.8)	
(7.9mm)	24	14-18 (1.9-2.5)	19-23 (2.6-3.2)	14-18 (1.9-2.5)
.38"	16	26-32 (3.6-4.4)	36-43 (5.0-5.9)	
(9.6mm)	24	33-40 (4.6-5.5)	41-49 (5.7-6.8)	33-40 (4.6-5.5)
.44"	14	42-50 (5.8-6.9)	54-65 (7.5-9.0)	
(11.11mm)	20	50-60 (6.9-8.3)	64-77 (8.8-10.6)	
.5"	13	67-80 (9.3-11.1)	81-97 (11.2-13.4)	
(12.7mm)	20	83-100 (11.5-13.8)	96-115 (13.3-15.8)	
.63"	11	117-140 (16.2-19.4)	164-192 (22-26.5)	
(15.9mm)	18	134-160 (18.5-22.1)	193-225 (26.7-31.1)	134-160 (18.5-22.1)

TOPIC 5 TRANSMISSION REMOVAL AND INSTALLATION

5.1 GENERAL

5.1.1
The following procedures cover two methods of transmission removal and installation. The serviceman has been left with the option of choosing whichever method he prefers.

5.2 REMOVAL -- METHOD 1

5.2.1
Remove drain plugs and drain transmission and engine oil. Allow loader to set all night with drain plugs removed, allow all oil to drain out.

5.2.2
Refer to the Operator's Manual and drain coolant from cooling system.

5.2.3
Reinstall drain plugs and close drain cocks.

5.2.4
Block front and rear wheels to prevent loader movement. Attach safety locking bar.

5.2.5
Disconnect drive shafts as described in the Axle Manual.

5.2.6
Remove bolts and raise both rear fenders.

5.2.7
Remove air intake cap and exhaust stack.

5.2.8
Remove ladder strut on rear frame. Remove capscrews and ladder platform.

5.2.9
Remove hood assembly capscrews, washer and nuts. Using a suitable hoist, remove hood.

5.2.10
Remove mechanical shut-off from hydraulic tank bonnet.

5.2.11
Remove master cylinder and brake tank cover plates on each side of the loader.

5.2.12
After plates are removed you willnow have access to the bonnet attaching capscrews. Remove bonnet with a suitable hoist.

5.2.13
With a suitable hoist, remove radiator grille.

5.2.14
Remove hydraulic oil cooler tubes and hoses.

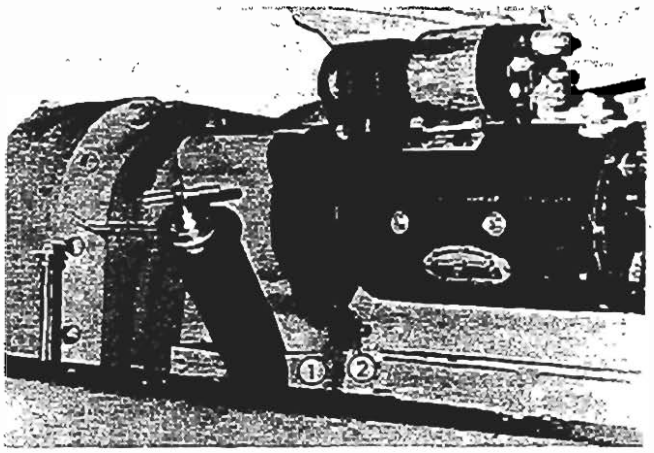

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FIG. 15 ALIGNING FLEX-PLATE AND FLYWHEEL FOR INSTALLATION OF CAPSCREWS

1. Flex plate access hole
2. Guide pin (Installation)

5.2.15
Remove radiator support, hoses and fan guard using hoist. See your Engine Service Manual for details.

2.5.16
Disconnect or remove the following:

NOTE: It is strongly urged that the mechanic tag all wires and hose assemblies for proper identification when assembling. Wires are color coded.

Right Side of Loader

5.2.16.1
Fuel pump hose to fuel tank.

5.2.16.2
Water conditioner hose.

5.2.16.3
Accelerator linkage.

5.2.16.4
Mechanical shut-off linkage.

5.2.16.5
All electrical wires and cables.

5.2.16.6
Transmission oif filter hoses and oil filter.

5.2.16.7
Engine air cleaner and restriction hose.

5.2.16.8
Hose to injection lines.

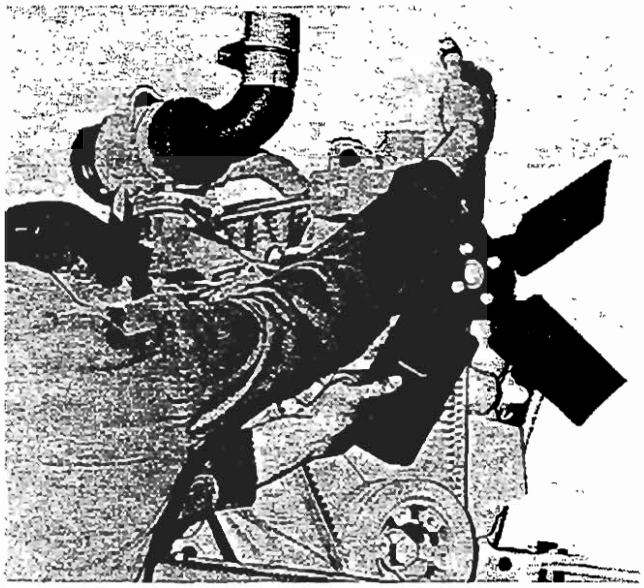

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FIG. 16 TURN FAN TO GAIN ACCESS TO EACH FLEX PLATE BOLT

5.2.16.9
Brake air tank tubes and hoses.

5.2.16.10
Boom and bucket control linkage.

NOTE: Cap all open hoses, tubes, and ports.

Left Side of Loader

5.2.16.11
Brake air tank tubes and hoses.

5.2.16.12
Transmission oil filler tube.

5.2.16.13
Transmission oil cooler hoses.

5.2.16.14
Hoses at compressor and governor.

5.2.16.15
All electrical wires.

5.2.16.16
Power cluster tubes.

NOTE: Cap all open hoses, tubes, and ports.

Under Platform of Loader

5.2.16.17
Hoses to treadle valve.

5.2.16.18
Range selector linkage.

5.2.16.19
Hoses and tubes to demand valve.

5.2.16.20
Parking brake linkage.

5.2.16.21
Hydraulic pump hoses.

5.2.16.22
Power steering pump hoses.

5.2.16.23
Hoses and tubes to steering gear.

5.2.16.24
Electrical wire harness and other wires.

5.2.16.25
Hydraulic control valve tubes and hoses.

5.2.16.26
Hoses and tubes on transmission.

5.2.16.27
Clutch cut-off lines.

5.2.16.28
Horn hoses.

5.2.16.29
Rear axle disconnect, on loaders equipped with this feature.

NOTE: Cap all open hoses, tubes, and ports.

5.2.17
Using a suitable hoist, remove platform. See Bucket and Chassis Manual.

5.2.18
Install two eyebolts into the 3/4" tapped openings provided in top of transmission housing assembly.

5.2.19
Attach hoist to transmission and engine eyebolts. Make lines taut.

5.2.20
Remove rear engine mounting brackets from each side.

5.2.21
Remove engine and transmission rocker brackets from each side.

IMPORTANT: Be certain that all hose assemblies, capscrews, wires, cables, etc. have been disconnected or removed. Cap all openings and mark for reassembly.

5.2.22
Carefully raise the transmission and engine assembly from the rear frame and place in suitable area.

5.2.23
Remove flex plate access hole plug. See Fig. 15

5.2.24
Remove flex-plate bolts from flywheel, by turning fan. Align each bolt with access hole for removal.

5.2.25
Remove all capscrews from flywheel and converter housing.

5.2.26
Steam clean exterior of transmission.

5.2.27
Remove capscrews that secure the hydraulic and power steering pumps to the transmission. Remove pumps and cap open ports of transmission.

NOTE: Place protective covering over splined ends of each pump.

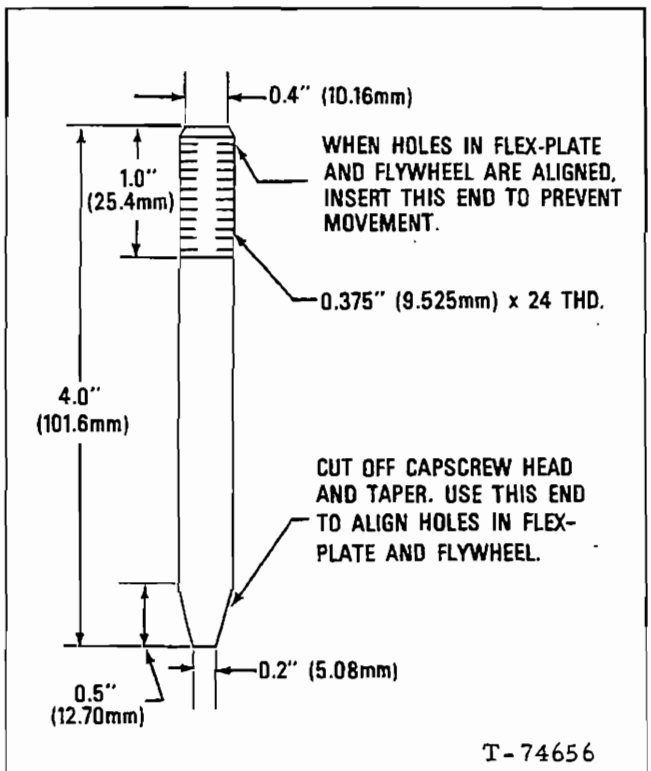

FIG. 17 GUIDE PIN DIMENSIONS (MADE FROM CAPSCREWS)

NOTE: Regardless of the care that has been taken to remove or install this piece of equipment, there are many conditions that cannot be completely safeguarded against. You are the best insurance against accidents.

5.3 INSTALLATION -- METHOD 1

NOTE: The engine flywheel pilot must be coated with molybdenum disulfide extreme pressure antisieze lubricant (such as "Molykote G") prior to transmission installation.

To install transmission reverse the procedure used for removal. Check the following:

5.3.1
When bringing transmission housing and engine housing together align flex-plate hole and flywheel hole. Insert pin see Fig.17. Then bring housings together. Be sure pin protrudes from engine housing access hole as shown in Fig. 15.

5.3.2
Be certain all hoses, wire connections, and capscrews are tightened securely.

5.3.3
Refill transmission with proper lubricant.

5.3.4
Refill engine with proper lubricant. Refer to Operators Manual.

5.3.5
Refill radiator with coolant.

IMPORTANT: Before starting engine, the crankshaft end play must be checked for proper clearance of .006" -- .014" (.152 -- .355 mm).

5.3.6
Check all hose assemblies for leaks.

5.4 REMOVAL -- METHOD 2

NOTE: You are the best insurance against accidents. Observe good safety procedures.

5.4.1
In this procedure the mechanic needs a floor jack, a cable come along, and another hi-lift or crane with enough capacity to lift the rear of the loader two feet off the ground.

5.4.2
Remove plug and drain transmission. If possible allow oil to drain over night.

5.3.3
Reinstall drain plug.

5.4.4
Block front and rear wheels securely.

5.4.5
Disconnect drive shafts from transmission. See your Axle Service Manual.

5.4.6
Disconnect all hoses and electrical wires from transmission. Tag all lines for identification.

5.4.7
Disconnect inlet and outlet hoses on the hydraulic pump and power steering pump. See your Hydraulic Service Manual for detailed instructions.

5.4.8
Disconnect transmission control linkage at transmission.

5.4.9
Disconnect parking brake cam lever. If used, separate rear axle disconnect.

5.4.10
Remove front engine mounting bolts and loosen rear engine mounting bolts.

NOTE: "FRONT" and "REAR" directions are determined with operator sitting in operators seat.

5.4.11
Set floor jack under transmission sump.

5.4.12
Remove engine breather tube. See Fig. 15.

5.4.13
Remove flex plate access hole plug. See Fig. 15.

5.4.14
Remove flex plate bolts from flywheel, by turning fan as shown in Fig. 16. Align each bolt with access hole for removal.

5.4.15
Remove all but four bolts from converter housing and flywheel housing.

5.4.16
Jack transmission high enough to block engine.

5.4.17
Install the cable come along around the converter and balance transmission.

5.4.18
Remove four remaining capscrews from converter housing.

5.4.19
Lower floor jack VERY SLOWLY. This will allow the transmission to lean out of the flywheel housing.

5.4.20
Working the cable and jack together, let the transmission down to floor.

5.4.21
Block transmission.

5.4.22
Remove cable.

5.4.23
Place hydraulic control lever in float position.

5.4.24
With a crane, raise rear of loader and allow transmission to clean frame for removal.

5.5 INSTALLATION -- METHOD 2

NOTE: The engine flywheel pilot must be coated with molybdenum disulfide extreme pressure antisieze lubricant (such as "Molykote G") prior to transmission installation.

5.5.1
To install transmission reverse the procedure used for removal. Check the following:

5.5.2
When bringing transmission housing and engine housing together align flex-plate hole and flywheel hole. Insert pin. Then bring housings together. Be sure pin protrudes from engine housing access hole as shown in Fig. 15.

5.5.3
Be certain all hoses, wire connections, and capscrews are tightened securely.

5.5.4
Refill transmission with proper lubricant.

IMPORTANT: Before starting engine, the crankshaft end play must be checked for proper clearance of 2900 Engine -- .004 to .007" (.10 -- .18 mm)3500 Engine -- .007 to .013" (.18" -- .33). Check all hose assemblies for leaks.

TOPIC 6 DISASSEMBLY OF TRANSMISSION INTO SUBASSEMBLIES

6.1 SCOPE OF TOPIC 6

6.1.1
MODELS COVERED. This section describes the disassembly of the transmission into its subassembly components.

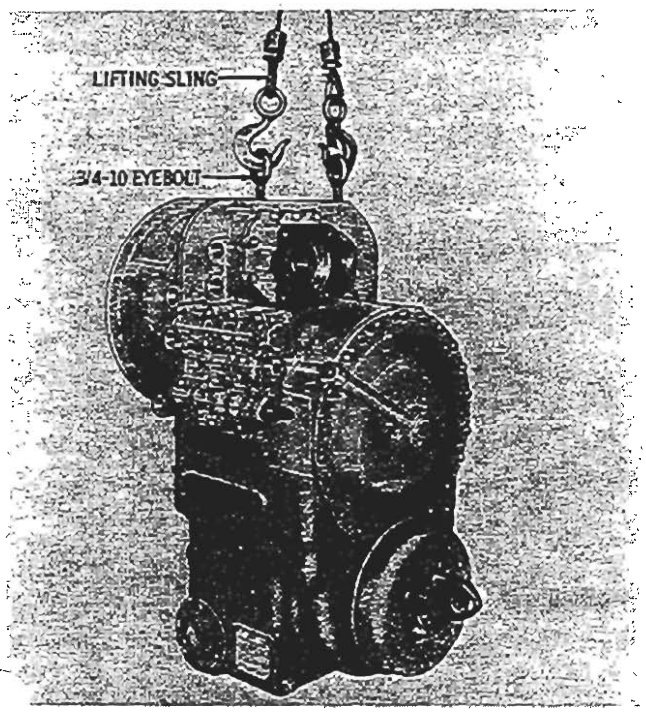

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FIG. 18 LIFTING TRANSMISSION

6.1.2
DISASSEMBLY SEQUENCE. The instructions depict, in logical sequence, the removal of exterior components, through the torque converter, to the front split line of the transmission housing. The transmission is then repositioned and the remaining components are removed from the rear.

6.2 REMOVAL OF EXTERIOR COMPONENTS

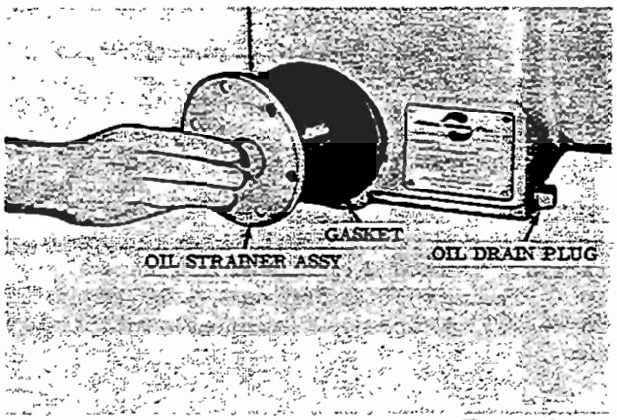
6.2.1
INSTALL EYE BOLTS. All transmissions have two tapped holes in the top of the transmission housing. Eye bolts may be installed into these holes to provide a means of supporting or positioning the transmission housing during disassembly Fig. 18.

6.2.2
OIL STRAINER ASSEMBLY. Remove the six bolts and lockwashers that retain the oil strainer assembly Fig. 19. Remove the oil strainer and gasket. Remove the oil drain plug.

6.2.3
PARKING BRAKE AND OUTPUT FLANGES. Remove flange retaining nut (2) Fig. 124, washer (11) and remove brake drum (29) and output flange (30) as an assembly. Remove four self-locking bolts (7) and separate the brake drum and flange.

6.2.4
To prevent rotation of the flange, install two bolts into the front output flange and place one end of bar stock between the bolts and allow

the other end to press against the assembly table. Remove the front output flange, retaining nut and washer, using the same procedure. If necessary, use a flange puller of the type shown in Fig. 11.

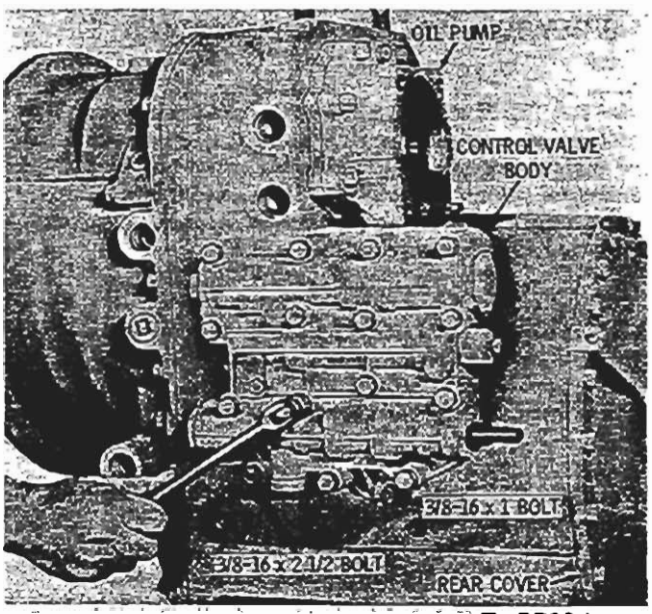


T-71467

FIG. 19 REMOVING OIL STRAINER AND GASKET

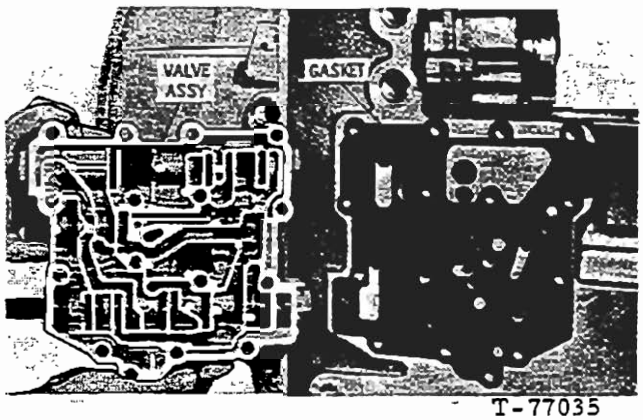
6.2.5
Remove brake shoe return springs (4) Fig. 124. and brake shoes and linings (3), roller (2) and brake apply arm (5). Remove four self-locking bolts (7) and remove brake back plate (1).

6.2.6
CONTROL VALVE ASSEMBLY. Remove 16 bolts and lockwashers that attach the control valve body to the transmission housing Fig. 20.



T-77034

FIG. 20 REMOVING VALVE BODY BOLTS



T-77035

FIG. 21 REMOVING VALVE BODY AND GASKET

6.2.7
Remove the control valve body and gasket Fig. 21. Refer to paragraph 7.4 for the control valve assembly rebuild instructions.

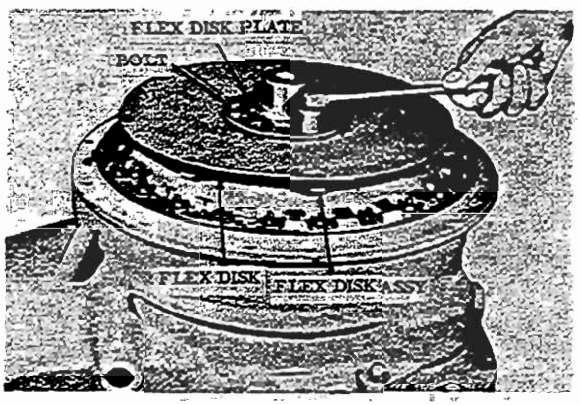
6.3 REMOVAL OF INPUT COMPONENTS

NOTE: Position the transmission to rest on its rear surface. Do not allow the trnasmission to rest on the

6.3.1
DIRECT MOUNT (FLEX DISK). Remove the six self-locking bolts and plate that retain the flex disk assembly Fig. 22.

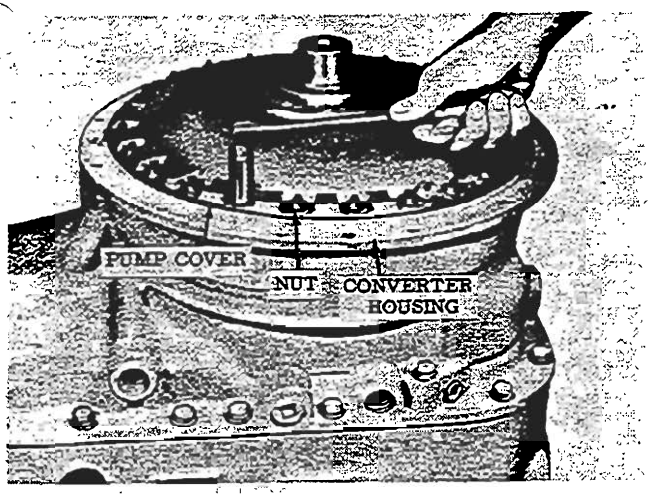
6.3.2
Remove the flex disk plate and flex disk assembly consisting of three flex disks and a disk and washer assembly Fig. 22.

6.3.3
Remove the twenty four self-locking nuts that retain the torque converter drive cover Fig. 23.



T-71474

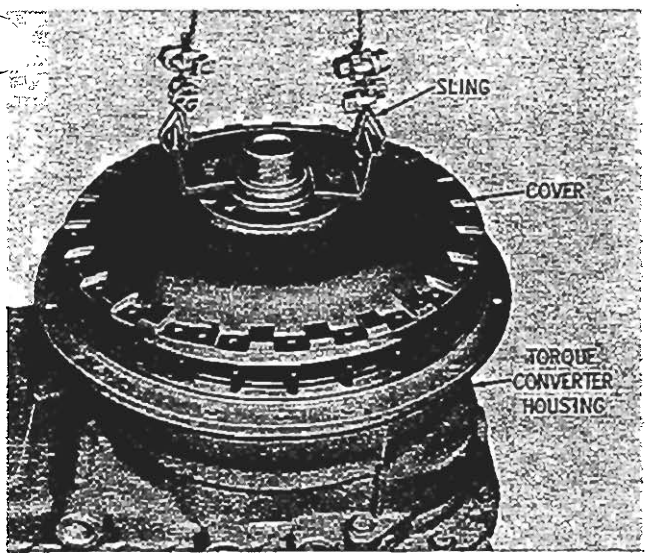
FIG. 22 REMOVING FLEX DISK BOLTS



T-71475

FIG. 23 REMOVING TORQUE CONVERTER DRIVE COVER NUTS

6.3.4
Attach a sling and remove torque converter drive cover Fig. 23. Ball bearing may remain in the torque converter drive cover; if so, remove the bearing.



T-77036

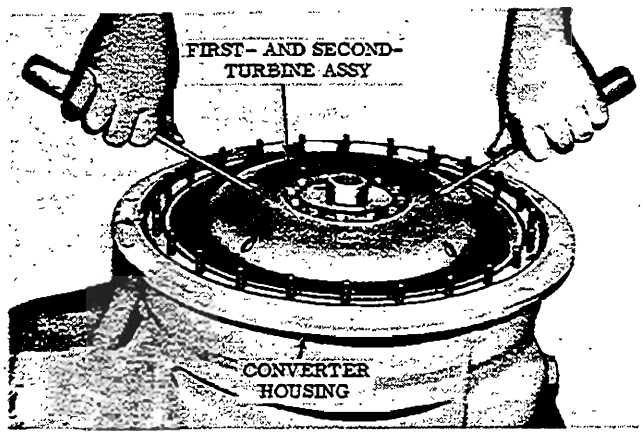
FIG. 24 REMOVING TORQUE CONVERTER DRIVE COVER

6.4 REMOVAL OF CONVERTER COMPONENTS AND HOUSING

6.4.1
CONVERTER COMPONENTS. Using two screwdrivers, and lifting straight upward, remove the first-and second-turbine assembly Fig. 25. Do not disassemble this unit unless inspection or parts replacement is necessary. If necessary refer to paragraph 7.5 for turbine assembly rebuild instructions. Remove the seal ring, from the converter pump.

6.4.2
Remove the snap ring that retains the converter stator and remove the stator from converter ground sleeve Fig. 26.

6.4.3
Remove the stator spacer from the converter ground sleeve Fig. 27.



T-71477

FIG. 25 REMOVING FIRST-AND SECOND TURBINE ASSEMBLY

6.4.4
Straighten the tabs of the lock strips at four places equidistant around the pump hub and remove four of the 12 bolts Fig. 28. Install an improvised puller Fig. 11, making sure the puller sleeve rests on the converter ground sleeve and extends above the end of the first turbine drive gear shaft. Tighten the puller screw.

6.4.5
When the converter pump bearing has been drawn from its seat on the ground sleeve, remove the pu puller.

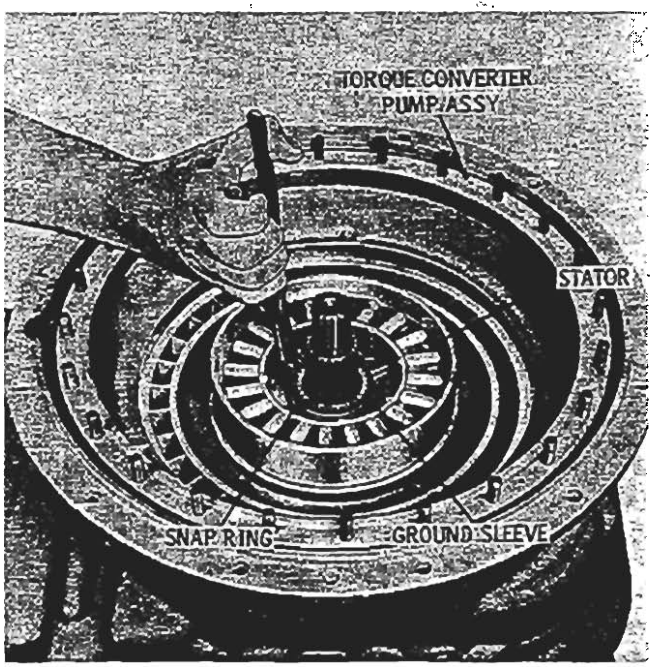
6.4.6
Remove the torque converter pump and reinstall the four bolts removed in paragraph 6.4.4 above. If further disassembly is planned, refer to paragraph 7.6 for converter pump rebuild instructions. If disassembly is not necessary, tighten the four 10 - 12 lbs. ft. (1.4 -- 1.7 kg/m) torque, and bend the lock strip tabs against the replaced bolts.

6.4.7
CONVERTER HOUSING. Remove the 24 bolts, lock washers, and plain washers that attach the converter housing to the transmission main housing Fig. 28.

6.4.8
Attach a sling to the converter housing flange Fig. 29. Apply slight tension on the sling and, using a soft hammer, bump the converter housing away from the transmission main housing.

CAUTION

When the converter housing has cleared the transmission housing (approximately 1-1/2 inches),(38.1mm), check to insure that the second turbine drive gear and the freewheel unit remain with the transmission main housing. If necessary, use two long screw drivers to pry the freewheel front bearing from the converter housing. On units equipped with internal thermostat, do not pry against the by-pass tube. If the free wheel unit is raised with the converter housing, the oil suction tube may be damaged. If the second-turbine drive gear is raised with the converter housing, it may fall unexpectedly, causing damage or injury.



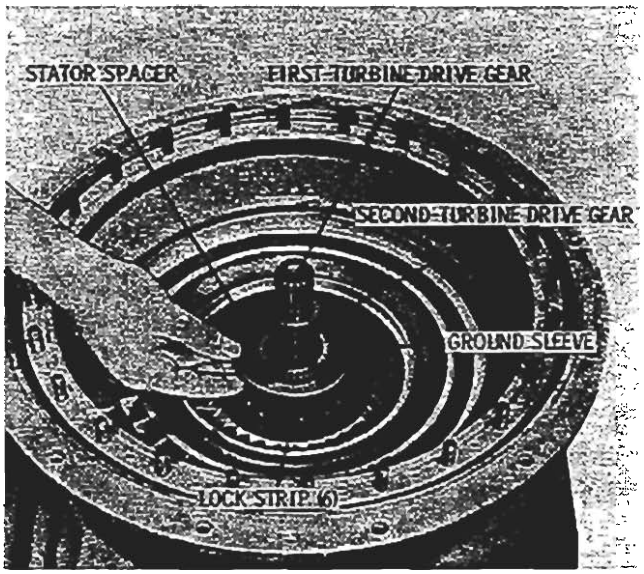
T-74377

FIG. 26 REMOVING STATOR SNAP RING

6.4.9
Remove the converter housing and attached parts Fig. 29. Remove the gasket. Refer to paragraph 7.7 for converter housing rebuild instructions.

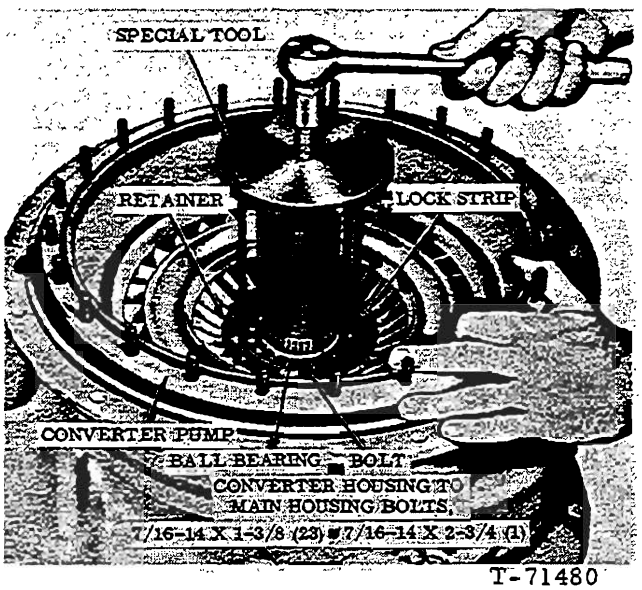
6.5 REMOVAL OF TURBINE GEARING AND OIL SUCTION TUBE

6.5.1
TURBINE GEARS AND FREEWHEEL CLUTCH. Remove the second-turbine drive gear and attached parts Fig. 30. Remove the step-joint seal ring from the drive gear shaft. Thrust race (25) Fig. 63, may remain on the hub of the second-turbine drive gear. If so, remove the race.



T-74378

FIG. 27 REMOVING STATOR SPACER



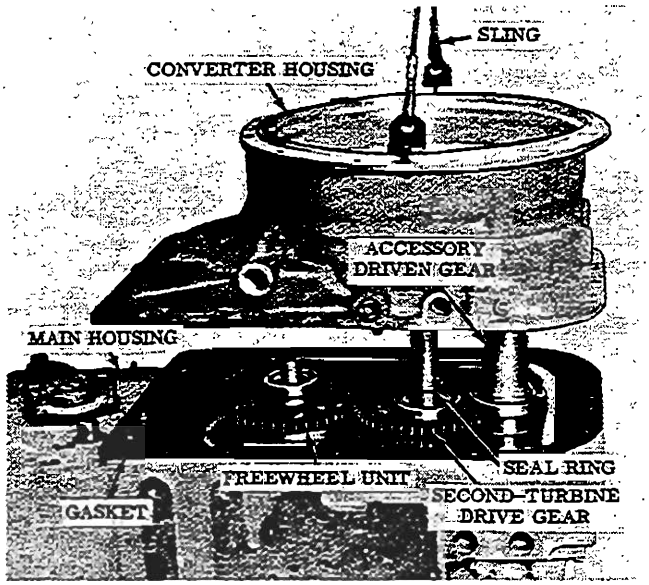
T-71480

FIG. 28 LOOSENING TORQUE CONVERTER PUMP BEARING

6.5.2
Remove the ball bearing from the second-turbine drive gear only if replacement is necessary Fig. 30.

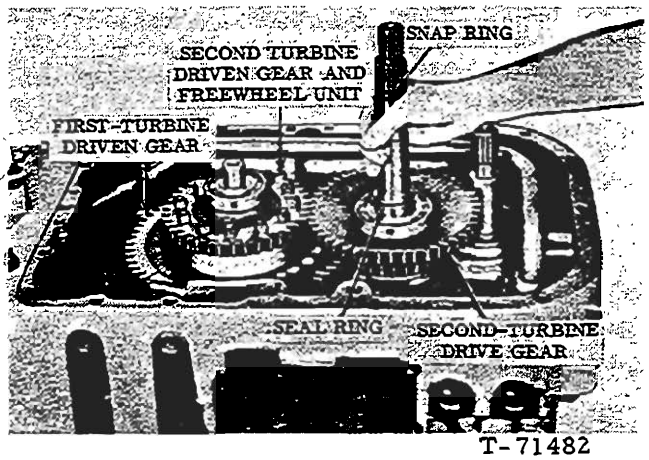
6.5.3
Remove the first-turbine driven gear and the second-turbine driven gear and freewheel unit as an assembly Fig. 30. Refer to paragraph 7.8 for freewheel unit rebuild instructions.

6.5.4
Remove the reverse-and-low-range sun gear as shown in Fig. 31.



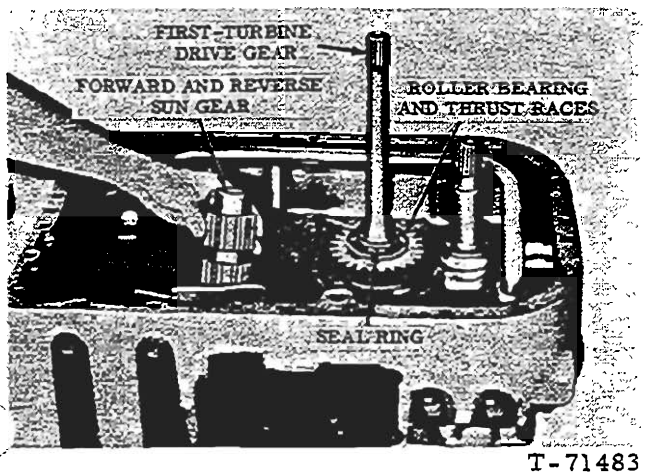
T-71481

FIG. 29 REMOVING TORQUE CONVERTER HOUSING ASSEMBLY



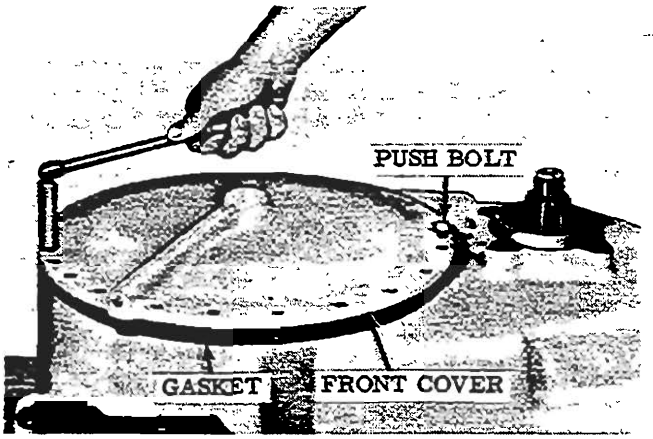
T-71482

FIG. 30 REMOVING SECOND-TURBINE DRIVE GEAR, TURBINE DRIVEN GEARS, AND FREEWHEEL UNIT



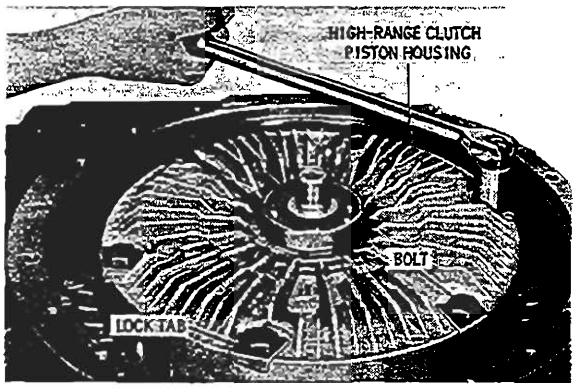
T-71483

FIG. 31 REMOVING STANDARD SPEED, FORWARD AND REVERSE-RANGE SUN GEAR



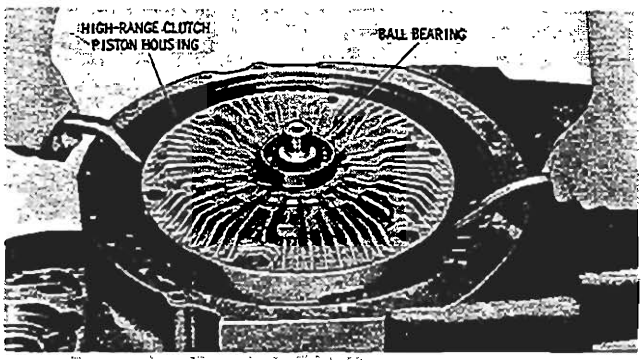
T-71485

FIG. 32 REMOVING TRANSMISSION REAR COVER



T-77037

FIG. 33 REMOVING HIGH-RANGE CLUTCH PISTON HOUSING BOLTS



T-77038

FIG. 34 REMOVING HIGH-RANGE CLUTCH PISTON HOUSING

6.5.5
Remove the needle roller bearing, two thrust races, and step-joint seal ring from the first-turbine drive gear Fig. 31. Remove the first-turbine drive gear and ball bearing as an assembly. Do not remove the bearing unless replacement is necessary. If necessary, refer to paragraph 7.9 for rebuild instructions.

6.5.6
ACCESSORY DRIVE SHAFT. Remove the accessory drive shaft FIG. 31. Remove bearing (9), FIG. 63, from accessory drive shaft (8) only if replacement is necessary.

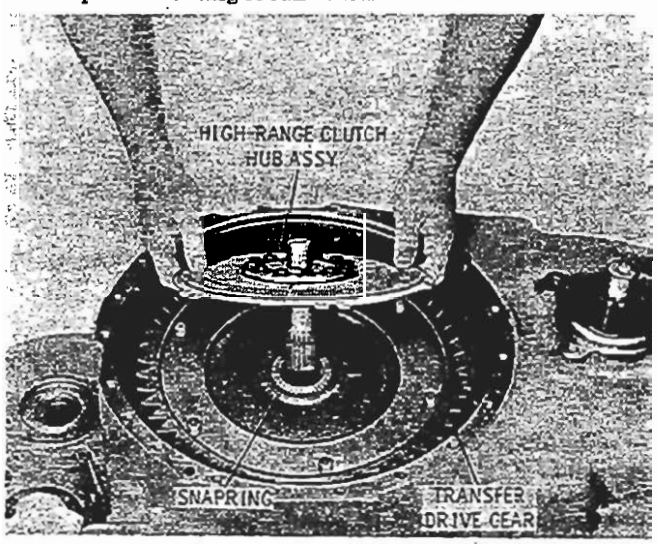
6.5.7
OIL SUCTION TUBE. Using a wrench, remove the male nut that retains the oil suction tube at the top of the housing FIG. 31. Also remove the self-locking bolt at the suction tube support. Remove the suction tube, and remove the male nut and compression seal ring.

6.6 REMOVAL OF REAR COVER AND HIGH RANGE CLUTCH PISTON HOUSING (TT Models)

6.6.1
REAR COVER. Position the transmission to rest on wood blocks, front splitline downward. Remove the 19 bolts and lockwashers that attach the rear cover to the transmission housing, FIG. 32. Carefully, without using excessive force, remove the rear cover and gasket. Do not pry or hammer the cover to remove it. During removal, be sure not to damage the high range clutch piston housing pilot which locates into a counterbore in the center of the rear cover. Remove seal ring (14), FIG. 80 from the rear cover. Remove pipe plug (16) only if replacement is necessary.

6.6.2
HIGH – RANGE CLUTCH PISTON HOUSING. Straighten the lock tabs, and remove the six bolts that attach the high-range clutch piston housing to the transfer drive gear FIG. 33. Remove the bolts and lock-tabs.

6.6.3
Using two screw drivers, pry the high-range clutch piston housing and attached parts from the transfer drive gear FIG. 34. Refer to paragraph 7.10 for the high-range clutch piston housing rebuild instructions.



T-74379

FIG. 35 REMOVING HIGH–RANGE CLUTCH HUB ASSEMBLY

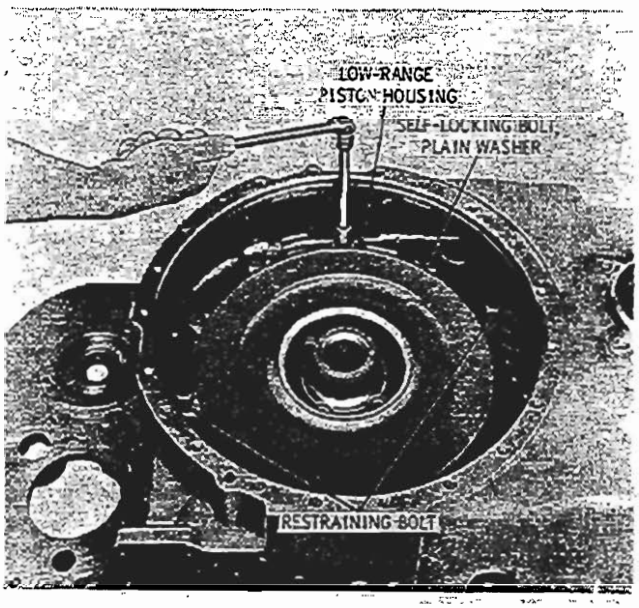
6.7 REMOVAL OF RANGE GEARING, CLUTCHES, AND OIL PUMP

6.7.1
HIGH–RANGE CLUTCH ASSEMBLY AND TRANSFER DRIVE GEAR. Remove the high-range clutch hub assembly from the transfer drive gear FIG. 35. Refer to paragraph 7.10.3 for high range clutch hub assembly rebuild instructions.

6.7.2
Remove the snap ring from the low-range planetary carrier, and remove the transfer drive gear assembly, FIG. 35.

6.7.3
LOW–RANGE CLUTCH AND PLANETARY. Replace two of the ten self-locking bolts that retain the low-range clutch piston housing with two bolts removed from the control valve assembly in paragraph 6.2.4 above. Refer to FIG. 36. Install the bolts at opposite sides of the piston housing to restrain the spring pressure.

6.7.4
Remove the remaining eight self-locking bolts and plain washers which retain the low-range clutch piston housing FIG. 36. Then, loosen the two restraining bolts evenly and remove them.



T-74374

FIG. 36 REMOVING LOW–RANGE CLUTCH PISTON HOUSING BOLTS

6.7.5
Remove the low-range clutch piston housing and piston as an assembly FIG. 37. Remove the low-range clutch piston from the low-range clutch piston housing. Do not remove seal rings unless replacement is necessary.

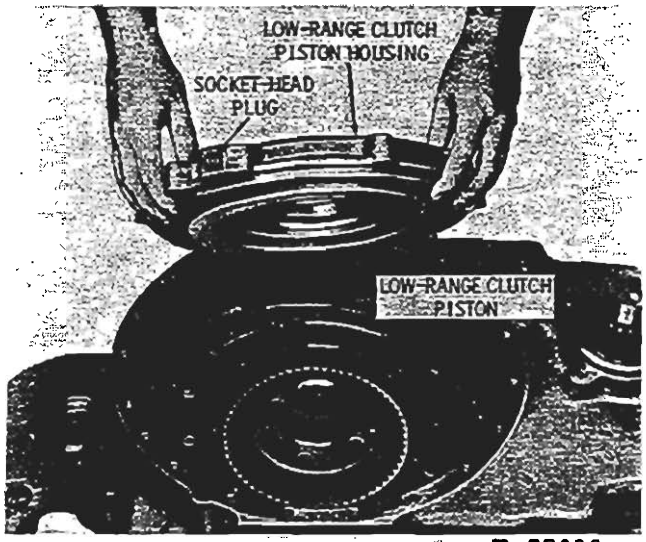


FIG. 37 REMOVING LOW-RANGE CLUTCH PISTON HOUSING AND PISTON

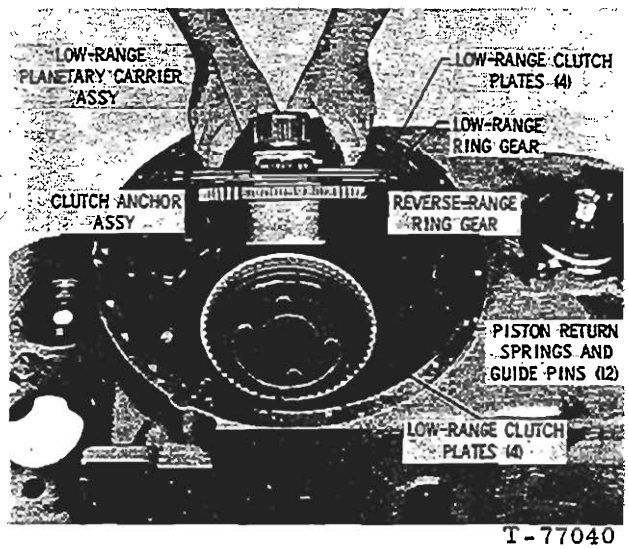


FIG. 38 REMOVING LOW-RANGE PLANETARY CARRIER ASSEMBLY

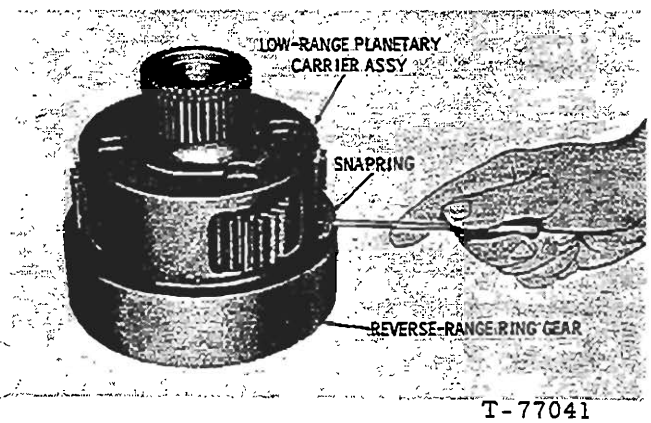


FIG. 39 REMOVING SNAP RING FROM REVERSE-RANGE RING GEAR

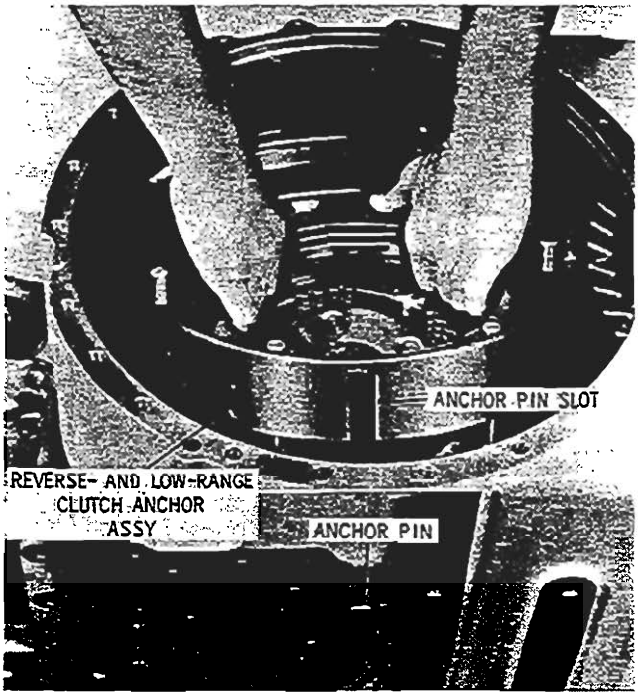


FIG. 40 REMOVING FORWARD-AND-REVERSE RANGE CLUTCH ANCHOR ASSEMBLY

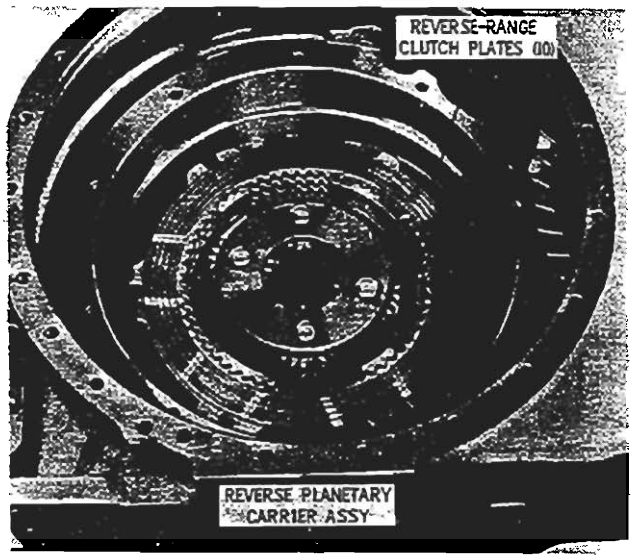
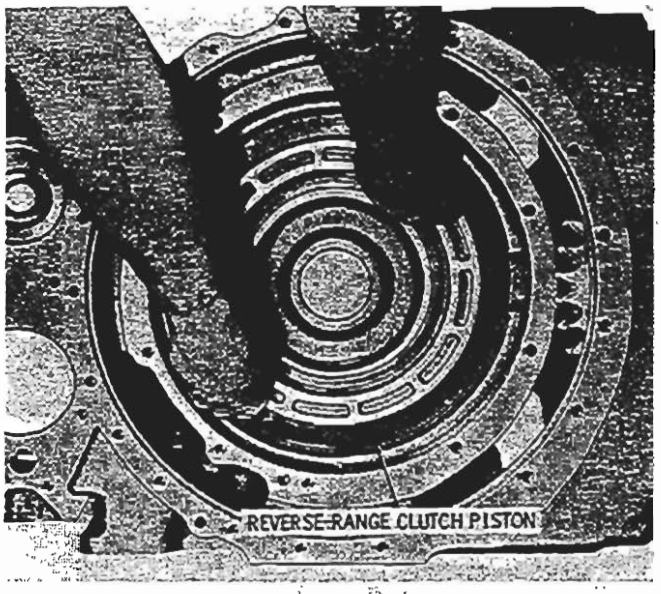


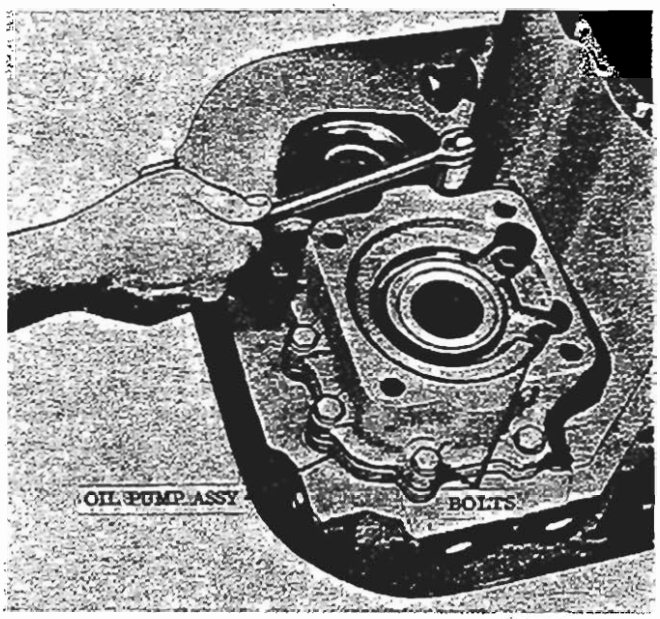
FIG. 41 REVERSE-RANGE PLANETARY CARRIER ASSEMBLY AND CLUTCH PLATES

6.7.6
Do not remove the socket-head plug from the low-range clutch piston housing unless necessary for replacement, or cleaning of the oil passage(Fig. 37).



T-77044

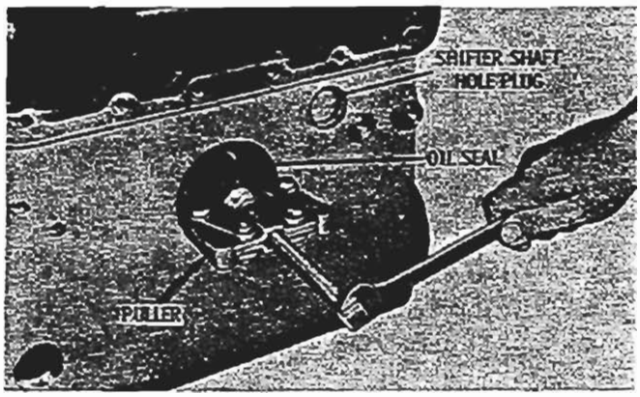
FIG. 42 REMOVING REVERSE-RANGE CLUTCH PISTON



T-71495

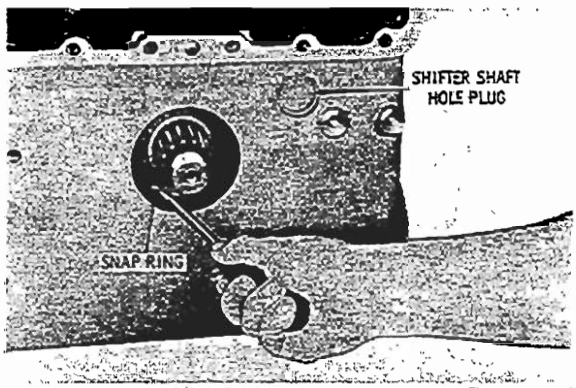
FIG. 43 REMOVING OIL PUMP ASSEMBLY

6.7.7
Remove the low-range planetary carrier assembly, low-range ring gear, four clutch plates, and the attached reverse-range ring gear as a unit (Fig. 38). Remove thrust washers (22 and 23, Fig. 74A) from carrier if present.



T-77045

FIG. 44 REMOVING OUTPUT SHAFT FRONT OIL SEAL



T-77046

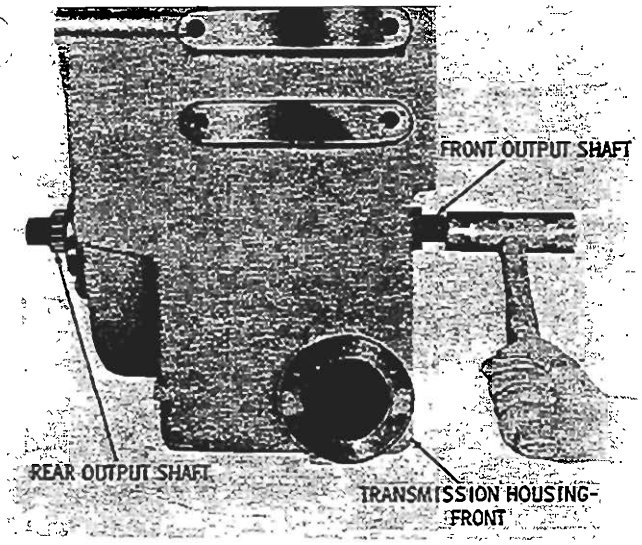
FIG. 45 REMOVING OUTPUT SHAFT FRONT BEARING SNAP RING

6.7.8
Separate the clutch plates and low- range ring gear from the planetary carrier assembly. Remove the twelve piston return springs and guide pins, and remove the remaining four low-range clutch plates from the clutch anchor assembly (Fig. 38).

6.7.9
Remove the snap ring that retains the reverse-range ring gear on the low-range planetary carrier assembly (Fig. 39)

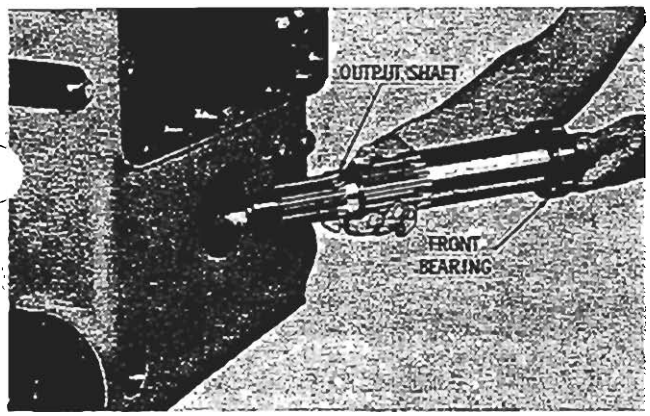
6.7.10
REVERSE-RANGE CLUTCH AND PLANETARY
Remove the reverse-and-low-range clutch anchor assembly (Fig. 40). Remove the anchor pin from the valve body mounting pad.

6.7.11
Remove the reverse-range planetary carrier assembly and one internal-splined clutch plate as a unit (Fig. 41). Separate the clutch plate from the carrier assembly. Remove the remaining nine reverse-range clutch plates from the transmission housing.



T-77047

FIG. 46 LOOSENING ONE-PIECE OUTPUT SHAFT FRONT BEARING



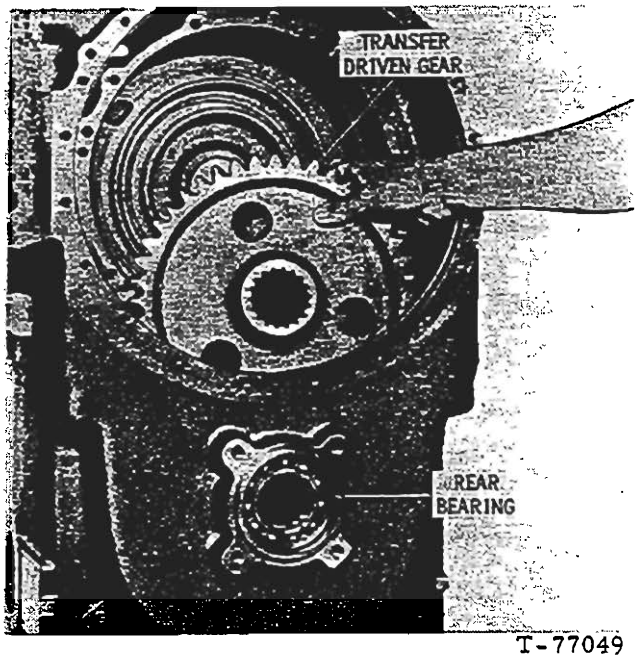
T-77048

FIG. 47 REMOVING ONE-PIECE OUTPUT SHAFT

6.7.12
Remove the reverse-range clutch piston from its bore in the transmission housing (Fig. 42). Do not remove seal rings from the reverse-range piston unless replacement is necessary.

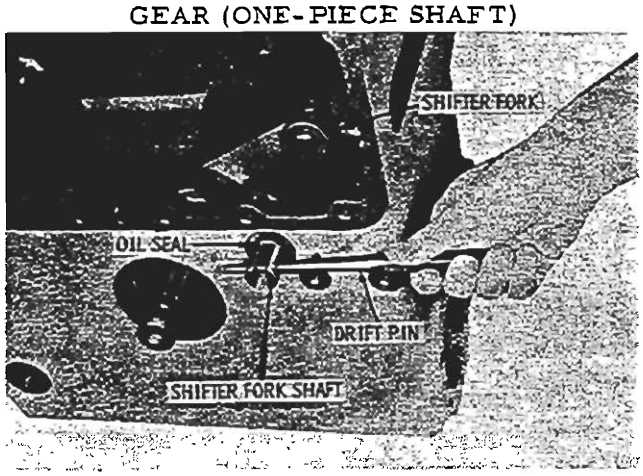
6.7.13
OIL PUMP Remove the nine bolts and lockwashers that attach the oil pump to the transmission housing (Fig 43).

6.7.14
Remove the oil pump and gasket, pump cover, and cover gasket as an assembly. Do not separate the oil pump components unless inspection or parts replacement is necessary.



T-77049

FIG. 48 REMOVING TRANSFER DRIVEN GEAR (ONE-PIECE SHAFT)



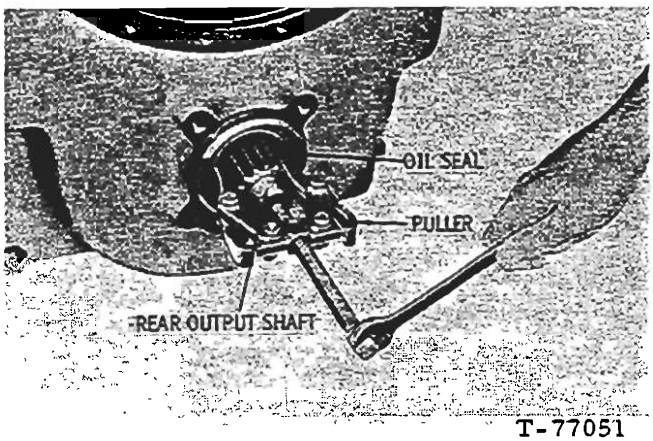
T-77050

FIG. 49 REMOVING DISCONNECT SHIFTER SHAFT

6.8 REMOVAL OF OUTPUT COMPONENTS AND TRANSFER DRIVEN GEAR

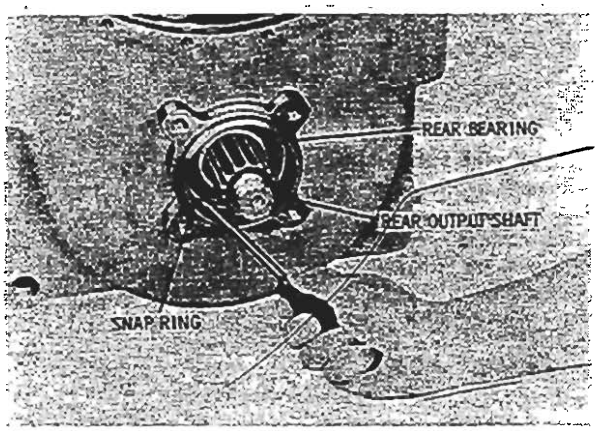
CAUTION

IF ONLY THE SHAFT SEAL REQUIRES REPLACEMENT, DO NOT REMOVE SHIFTER SHAFT. Removal of the shaft will allow the shifter fork to drop into the sump area, and partial disassembly of the transmission is required to reinstall the shifter components. (Destroy and remove the failed seal. Install the new seal and press it lightly against the shoulder in the bore).



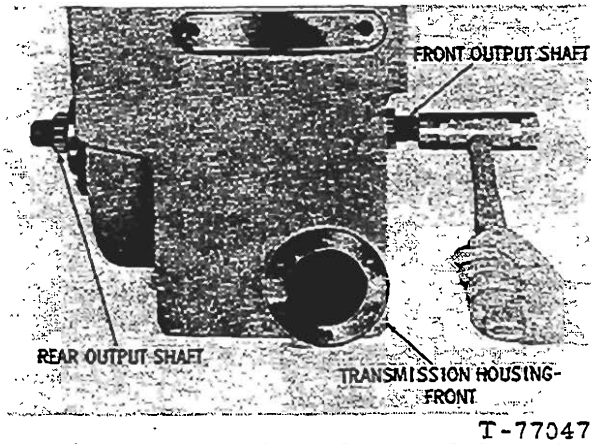
T-77051

FIG. 50 REMOVING REAR OUTPUT SHAFT OIL SEAL



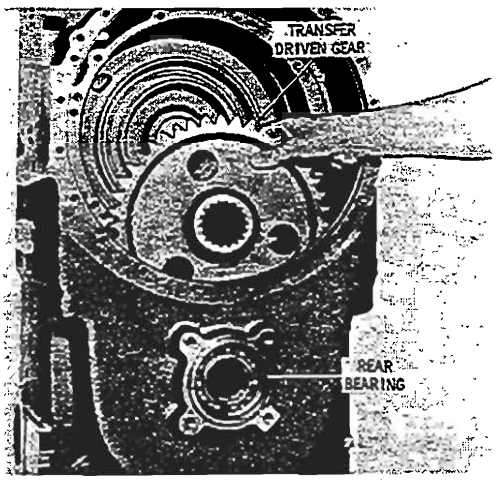
T-77052

FIG. 51 REMOVING REAR OUTPUT SHAFT BEARING SNAP RING



T-77047

FIG. 52 DRIVING TWO-PIECE OUTPUT SHAFT REARWARD FOR REMOVAL



T-77049

FIG. 53 REMOVING TRANSFER DRIVEN GEAR

6.8.1
ONE-PIECE OUTPUT SHAFT Using a puller, remove the oil seal from the front of the transmission housing (Fig. 44).

6.8.2
Remove the snap ring that retains the output shaft bearing in the housing bore (Fig. 45). Do not remove the shifter shaft hole plug unless replacement is necessary.

6.8.3
Using a soft hammer, drive the output shaft forward until the front bearing is free from the housing bore (Fig. 46).

6.8.4
Remove the output shaft and front bearing as an assembly (Fig. 47). Remove the front bearing from the output shaft.

6.8.5
Removal of the output shaft will free the transfer driven gear and spacer (24) (Fig. 87). Remove the transfer driven gear (Fig. 48) and remove the spacer from the sump area. Remove lip type oil seal (27) (Fig. 87) from the rear of the housing. Remove the output shaft rear bearing from its bore (Fig. 48)

6.8.6
TWO-PIECE OUTPUT SHAFT (TT ONLY)
Rotate shifter fork shaft counterclockwise to remove it from the front of the transmission housing (Fig. 49). Removal of the shifter fork shaft will allow the shifter fork to fall into the sump area. Remove the shifter fork. Remove the shifter shaft oil seal only if replacement is necessary.

6.8.7
Using a puller, remove the oil seal from the rear of the transmission housing (Fig. 50).

6.8.8
Remove the snap ring that retains the rear bearing in the housing bore (Fig. 51).

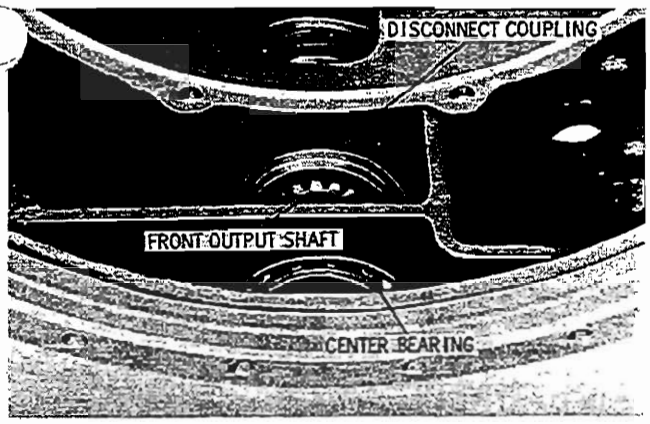


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FIG. 54 DISCONNECT COUPLING, FRONT OUTPUT SHAFT, AND CENTER BEARING

6.8.9
Using a soft hammer, drive the front output shaft rearward until the bearing on the rear output shaft is free from the housing bore (Fig. 52). Remove the rear output shaft and the attached bearing and spacer as an assembly. Remove the bearing only if replacement of the bearing or spacer is necessary. Do not remove bushing (22) from rear output shaft (23) unless replacement is necessary.

6.8.10
Removal of the rear output shaft from the transmission housing will free transfer driven gear (20) and allow spacer 19 to fall into the sump area. Remove the transfer driven gear (Fig. 53), and remove the fallen spacer from the sump.

6.8.11
Remove the center bearing from its bore in the housing web (Fig. 54).

6.8.12
Remove the front output shaft and disconnect coupling as an assembly (Fig. 54).

NOTE: A spring and two detent balls will be released when the disconnect coupling is removed from the front output shaft. Drape a shop towel over the assembly to prevent possible loss of the balls.

6.8.13
Remove the disconnect coupling from the front output shaft, and place the two detent balls and spring in a parts receptacle.

6.8.14
Remove the front oil seal only if necessary. If necessary, remove the seal as described above.

6.8.15
Remove the front snap ring and output shaft bearing (refer to Fig. 45) only if part replacement is necessary. If necessary, remove the snap ring and, using a puller which will apply its force to the rear surface of the outer race, draw the bearing from its bore. If such a puller is not available, use a drift and tap evenly around the outer race to drive the bearing forward.

6.8.16
Remove remaining parts from the transmission housing only if part replacement or additional servicing is required. Refer to paragraph 7.10.9 for the transmission housing rebuild instruction.

6.8.17
REAR OUTPUT SHAFT Using a puller, remove the oil seal from the rear of the transmission (Fig. 50).

6.8.18
Remove the snap ring that retains the rear bearing in the housing bore (Fig. 51).

6.8.19
Remove plug (28) Fig. 87 if necessary, from the front of the housing. Using a drift, drive rear output shaft (23) rearward until bearing (25) is free in its bore. Remove rear output shaft (23), spacer (24) and bearing (25) as an assembly. Remove the bearing only if replacement of the bearing or spacer is necessary.

6.8.20
Removal of the rear output shaft from the transmission housing will free the transfer driven gear and allow spacer (19) to fall into the sump area. Remove the transfer driven gear (Fig. 53), and remove the fallen spacer from the sump.

6.8.21
Remove bearing (18)(Fig. 87) from its bore in the housing web.

6.8.22
Remove the remaining parts from the transmission housing only if part replacement or additional servicing is required.

TOPIC 7 REBUILD OF SUBASSEMBLIES

7.1 SCOPE OF TOPIC 7

7.1.1
This section contains the rebuild procedures for the subassemblies which were removed in Topic 6.

7.1.2
The subassemblies are presented in this section in the same order as they were removed in Topic 6.

7.2 GENERAL INFORMATION FOR SUBASSEMBLY REBUILD

7.2.1
Tools, Parts, Methods. Refer to paragraphs 4.3 through 4.5.

7.2.2
Cleaning, Inspection. Refer to paragraph 4.6.

7.2.3
Torque Specifications. The specific torque value for each threaded fastener installed in this section is stated in the applicable assembly paragraph. Torque values are also presented in paragraph 4.10 and Fig. 81.

7.2.4
Wear Limits, Spring Data. Refer to Section 11 for wear limits and spring data, which includes tabulations.

7.2.5
Lubrication. Soak each friction (faced) clutch plate in transmission fluid for a minimum of 2 minutes prior to assembly.

7.2.6
Use oil-soluble grease (petroleum jelly) with a low melting point when it is required to facilitate assembly. Do not use animal fats.

7.2.7
Pack the ID of metal-encased, lip-type oil seals with high-temperature grease (MIL-G-3545A or equivalent).

7.3 CONTROL VALVE BODY DISASSEMBLY

7.3.1
Disassembly (Fig. 55). Remove plug (6) and gasket (7) that retain main-pressure regulator valve (8). Remove the main-pressure regulator valve.

7.3.2
Remove plug (18) and gasket (17) that retain trimmer plug (16). Remove the trimmer plug, and main-pressure regulator spring (14), spring retainer (13), and trimmer spring (15).

7.3.3
Remove main-pressure check plug (34). Remove selector valve plug (33) and gasket (32).

7.3.4
Remove retainer plug (25) and gasket (23). Remove cut-off valve plug (21) from retainer plug (25). Remove seal ring (22) and cup (24) from cut-off valve plug (21). Remove clutch cut-off valve (20) and valve spring (19) from control valve body (9).

7.3.5
Remove plug (29) and gasket (30), and remove one spring (31) and ball (28). At the inner (mounting) side of control valve body (9), remove valve stop (12) from its position on range selector valve (27).

7.3.6
Insert a bolt through the linkage pin hole in selector valve (27). Pull the selector valve and seal (26) from the bore and remove them from control valve body (9). Remove the seal from the selector valve. Remove the remaining detent ball (28) and spring (31) which were freed during removal of the selector valve.

7.3.7
Do not remove retainer plug (11) and ball (10) from control valve body (9) unless parts replacement is necessary.

Note: Refer to paragraph 7.2, above.

7.4 CONTROL VALVE BODY ASSEMBLY

7.4.1
If the retainer plug and ball were removed from the control valve body, install a new ball and retainer (Fig. 56). Place the retainer plug, open end upward, over the ball. Press the retainer plug until it is flush with, to 0.010 inch (.25 mm) below, the surface of the three supporting bosses.

7.4.2
Install one spring (31) (Fig. 55) and detent ball (28) into control valve body (9). Depress the ball against the spring, and install selector valve (27) linkage end last, through the seal bore of the control valve body.

7.4.3
Install the remaining detent ball (28) and spring (31); install gasket (30) and plug (29) to retain the ball and spring. Tighten the plug securely.

7.4.4
Position the selector valve in the middle

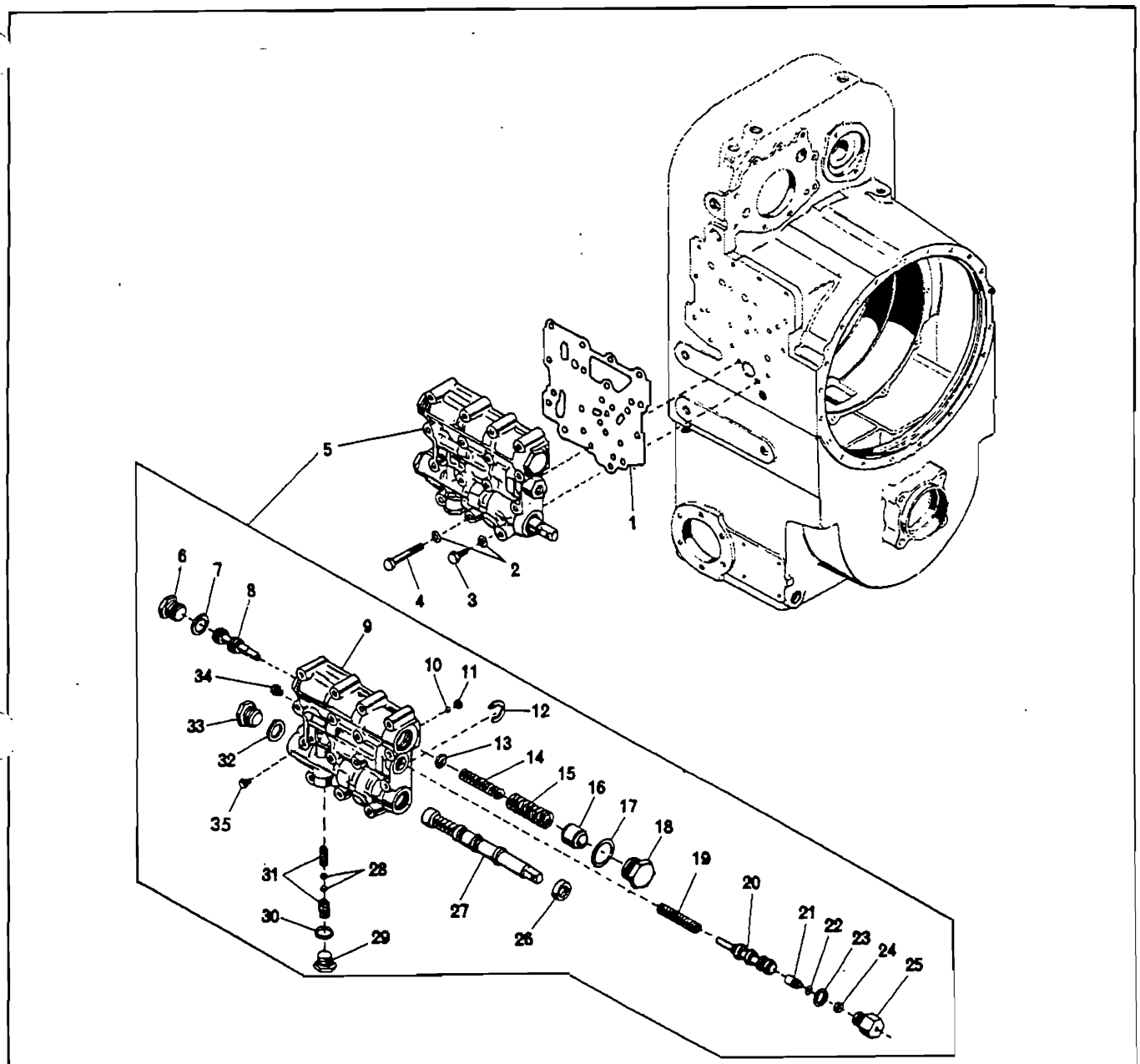

FIG. 55 CONTROL VALVE ASSEMBLY

1. Control valve body gasket
2. Lock washer
3. Bolt
4. Bolt
5. Control valve body assembly
6. Plug
7. Gasket
8. Regulator valve
9. Valve body
10. Ball
11. Ball retainer plug
12. Valve stop
13. Spring retainer
14. Regulator spring
15. Trimmer spring
16. Trimmer plug
17. Gasket
18. Plug
19. Clutch cut-off valve spring
20. Clutch cut-off valve
21. Valve plug
22. Seal ring
23. Gasket
24. Cup
25. Retainer plug
26. Oil seal
27. Selector valve
28. Detent ball
29. Plug
30. Gasket
31. Detent spring
32. Gasket
33. Plug
34. Plug
35. Plug

detent position (neutral), and install the valve stop in the location shown in Fig. 56.

7.4.5
Coat the outer circumference of the new selector valve oil seal with nonhardening sealer. Install the seal, spring-loaded lip first, over the linkage end of the selector valve into its bore (Fig. 56). Press the seal into the bore until it is flush with, to 0.030 inch (.76 mm) below, the surrounding surface.

Note: At assembly, all spool valves must move freely by their own weight within their bores.

7.4.6
Install main-pressure regulator valve (8) (Fig. 55), and install gasket (7) and plug (6). Tighten plug (6) securely. Install plug (34), and tighten sufficiently to prevent leakage.

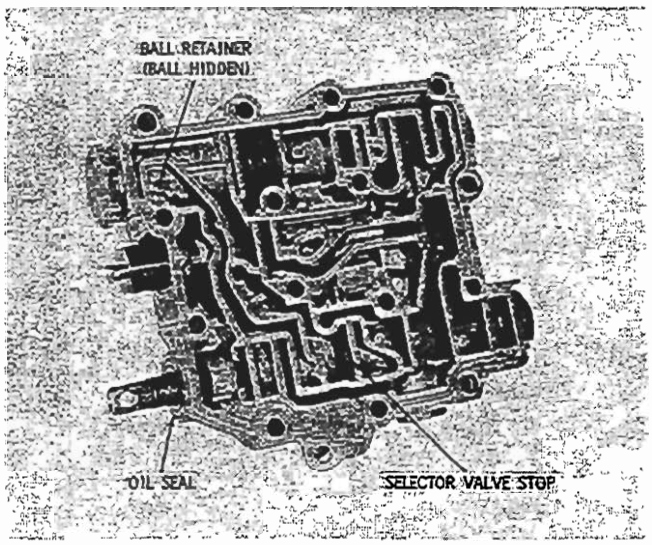

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FIG. 56 CONTROL VALVE BODY ASSEMBLY - MOUNTING SIDE

7.4.7
Install spring retainer (13), concave side first, onto the stem end of main-pressure regulator valve (8). Install main-pressure regulator spring (14), trimmer spring (15), and trimmer plug (16) into the valve bore. Install gasket (17) and plug (18), and tighten the plug securely.

7.4.8
Assemble valve spring (19) onto clutch cut-off valve (20) and install them, spring first, into valve body (9). Install seal ring (22) onto cut-off valve plug (21). Install cup (24), small diameter first, onto the stemmed end of the cut-off valve plug. Lubricate and install the assembled cut-off valve plug, cup first, into the smooth bore end of retainer plug (25). Install retainer plug (25) and gasket (23), and tighten the plug securely. Cover the exposed orifice in the retainer plug until the hydraulic brake line is to be attached.

7.5 FIRST-AND-SECOND- TURBINE ASSEMBLY

7.5.1
Disassembly (Fig. 59). Locate the index marks (V-groove) in the outer rims of the first turbine support and the first turbine (Fig. 57). Make sure these marks are well defined in both parts. If the marks are not prominent, deepen them to 0.040 inch (1.016 mm) (maximum) before continuing with disassembly.

7.5.2
Drive the six roll pins (nine in the 2421 model series) inward toward the hub until they clear the holes in the first turbine support (Fig. 57). Remove the roll pins only if replacement is necessary.

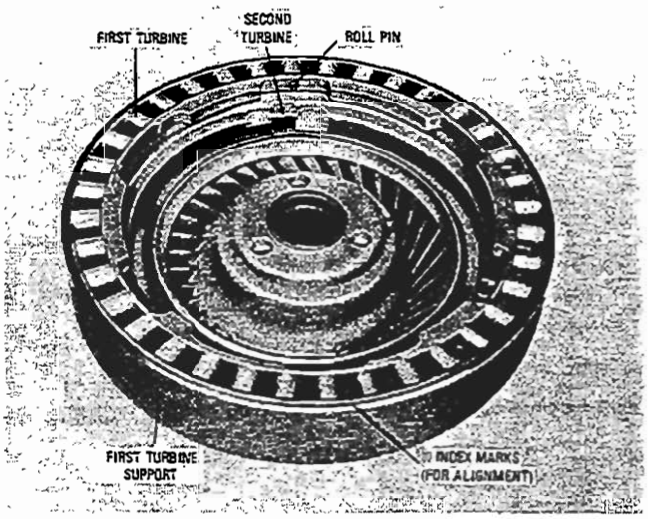

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FIG. 57 FIRST AND SECOND-TURBINE ASSEMBLY

7.5.3
Remove the first turbine from its support (Fig. 58). Remove the second turbine and its bearing from the first turbine support.

7.5.4
Remove bearing (8) (Fig. 59) from second turbine (6) only if replacement is necessary. If replacement is necessary, bearing (8) may be removed by pressing lengths of drill rod through the three removal holes in the hub of second turbine (6). Remove snap ring (7) from second turbine (6) only if replacement is necessary.

7.5.5
Remove bearing (1) from first turbine support (3), only if replacement is necessary. If replacement is necessary, bearing (1) may be removed by pressing lengths of drill rod through the three removal holes in the hub of first turbine support (3).

Note: Refer to paragraph 7.2, above.

7.5.6
Assembly (Fig. 59). If bearing (1) was removed from first turbine support (3), install its replacement. Position the bearing, manufacturer's identification outward, and press the bearing firmly against its seat on the hub of support (3).

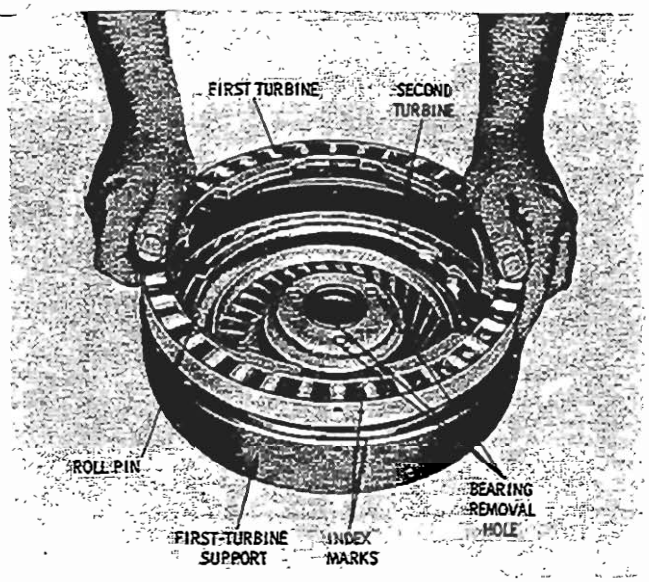

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FIG. 58 REMOVE FIRST TURBINE

7.5.7
If bearing (8) was removed from the second turbine (6), install its replacement. Position the bearing, manufacturer's identification outward, and press the bearing firmly onto its seat in the turbine hub. If snap ring (7) was removed, install its replacement.

7.5.8
Install the second turbine (and bearing) into the first turbine support (Fig. 58).

7.5.9
Install the first turbine into the first turbine support and aline the V-groove index marks (Fig. 58).

7.5.10
Drive the six roll pins (nine in the 2421 model series) outward until they are flush with, to 0.030 inch (.76199 mm) below, the outer surface of the first turbine support (Fig. 58).

7.6 TORQUE CONVERTER PUMP

7.6.1
Disassembly (Fig. 60). Straighten the ears of the six lockstrips. Remove the 12 bolts that attach the pump retainer and input accessory drive gear to the torque converter pump. Remove the six lockstrips, pump retainer, input accessory drive gear, bearing, and gasket.

7.6.2
Inspect the 24 special bolts around the circumference of the pump. Remove any defective bolts by pressing them from the pump flange.

Note: Refer to paragraph 7.2, above.

7.6.3
Assembly (Fig. 60). If any of the special bolts were removed from the pump, install their replacements. Aline the flat side of the bolt head next to the pump and press the new bolt into place.

7.6.4
Fig. 59. Install the double-row bearing (18) into the input accessory drive gear (19) -- notch in bearing opposite to the gear teeth.

7.6.5
Install the drive gear and bearing into the converter pump, Fig.60, aligning the gear and pump bolt holes. Be sure the notch in bearing is toward inside of converter pump housing.

7.6.6
Install the pump retainer, and install the six lockstrips and twelve bolts. Tighten the bolts to 10 and 12 pound feet (11.5 to 13.8 kg/m) torque. Bend the lockstrip ears against the bolt heads.

7.7 TORQUE CONVERTER HOUSING

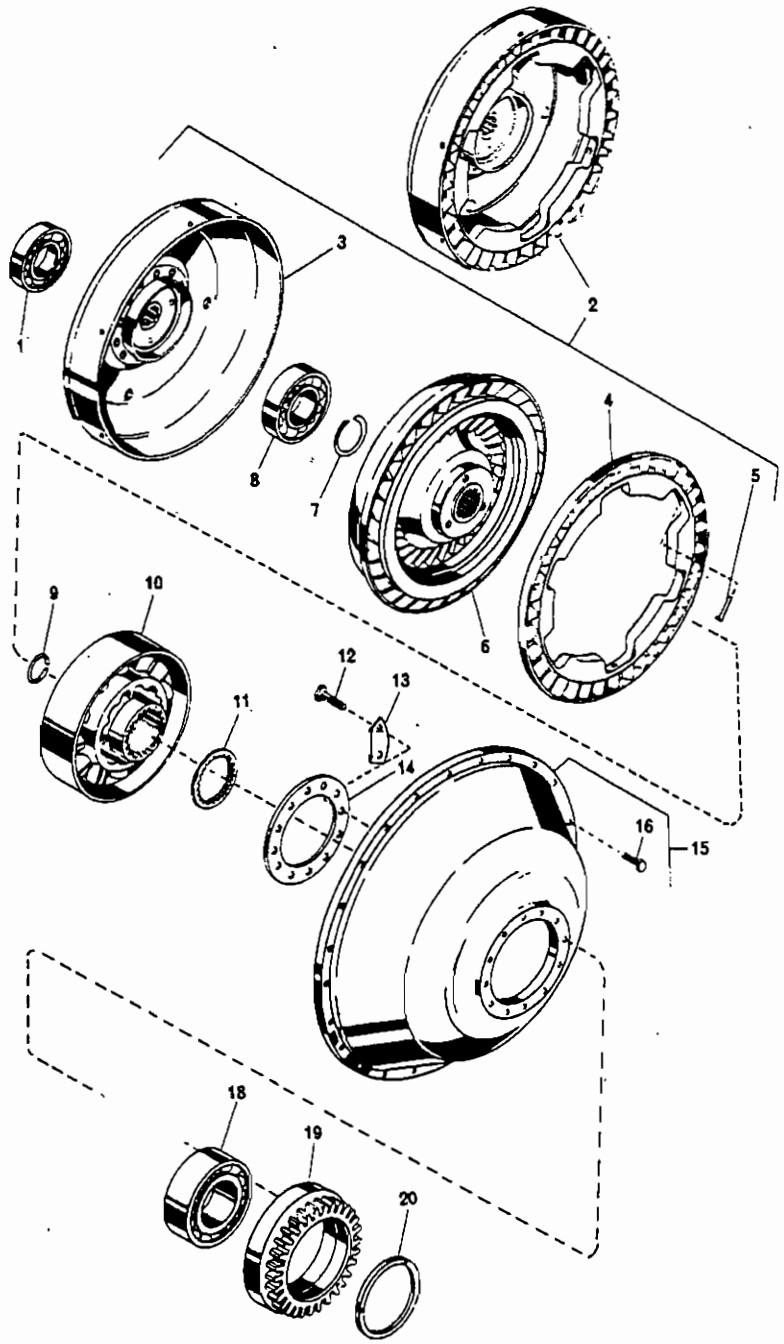

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FIG. 59 TORQUE CONVERTER

1. Ball bearing
2. First turbine and support assembly
3. First turbine support
4. First turbine
5. First turbine retaining pin
   Model TT 2221-1 (6)
   Model TT 2421-1 (9)
6. Second turbine
7. Internal snap ring
8. Ball bearing
9. External snap ring
10. Torque converter stator
11. Spacer
12. Bolt
13. Lockstrip
14. Torque converter pump retainer
15. Torque converter pump assembly
16. Special bolt
18. Double-row ball bearing
19. Input accessory drive gear
20. Step-joint seal ring

(Revised January 1986)

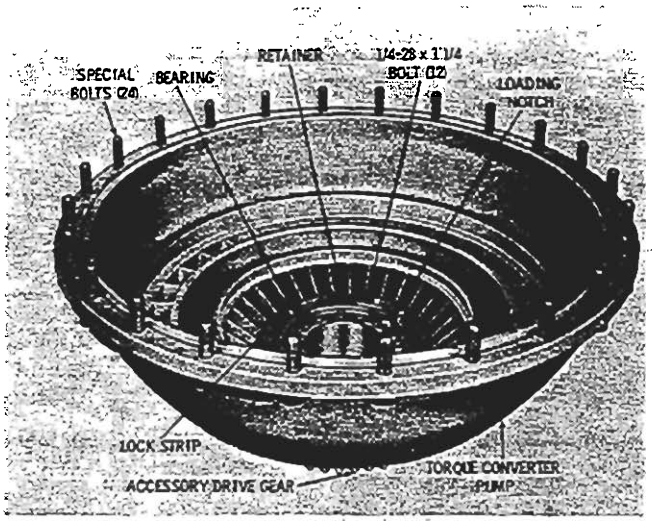

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FIG. 60 TORQUE CONVERTER PUMP ASSEMBLY

7.7.1
Disassembly (Fig. 59). The pressed steel diaphragm and oil seal (Fig. 61) must be removed. Removal of the diaphragm destroys the diaphragm and seal.

Note: The seal can not be purchased separately.

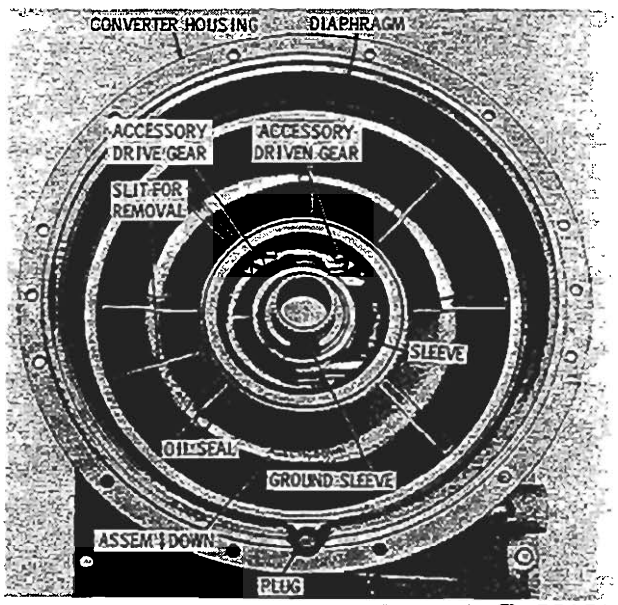

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FIG. 61 TORQUE CONVERTER HOUSING FRONT VIEW

7.7.2
To remove the diaphragm, cut a slit through the diaphragm, as shown in Fig. 61. Insert a hooked tool into the slit and pry the metal above the slit outward. This will push the metal below the slit inward. Deforming the diaphragm in this manner will reduce its outside diameter and allow the diaphragm to be lifted from the converter housing.

7.7.3
Clean the bore from which the diaphragm was removed. A smooth, clean bore will prevent leakage after the new diaphragm has been installed.

7.7.4
Remove the welch plug from the converter housing only if replacement is necessary (Fig. 61). If necessary, drive the plug from its bore, and clean the bore from which the plug was removed.

7.7.5
Remove the step-joint seal from the converter housing sleeve (Fig. 61). If replacement of the converter housing sleeve is necessary, remove it from the front of the housing.

7.7.6
At the rear of the converter housing, remove the snap ring from accessory driven gear bearing (Fig. 62). Tap the accessory driven gear forward and remove it and the attached parts from the housing.

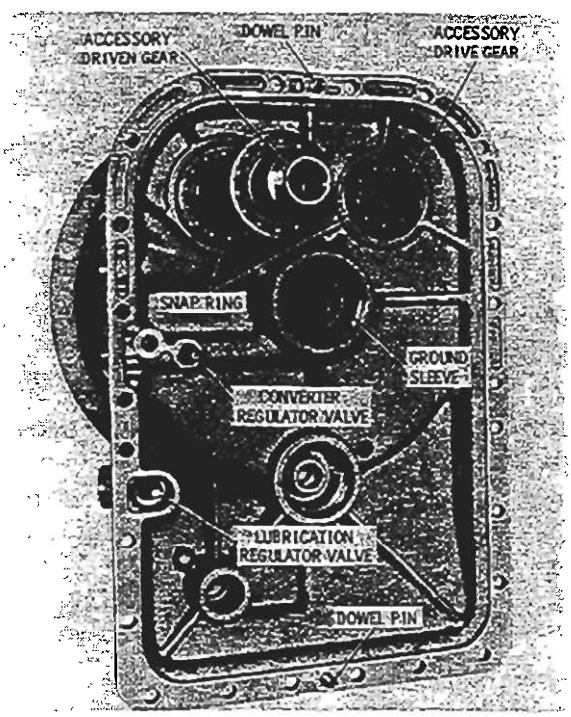

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FIG. 62 TORQUE CONVERTER HOUSING REAR VIEW

7.7.7
Press bearing 12 (Fig. 63) from accessory driven gear 2. Also remove snap ring (11) and bearing (10).

7.7.8
On transmissions equipped with an accessory drive gear, remove the snap ring from the accessory drive gear bearing (Fig. 63). Tap the accessory drive gear forward and remove it and the attached parts from the housing.

7.7.9
Remove snap ring (7) (Fig. 63) and bearing (6) from accessory drive gear (1).

7.7.10
If replacement of the ground sleeve is necessary, remove the four attaching bolts and press the sleeve from the converter housing (Fig. 62).

7.7.11
If the converter pressure regulator valve components (21), (22), and (23) (Fig. 63) require replacement, remove them by twisting pin (21) from the converter housing.

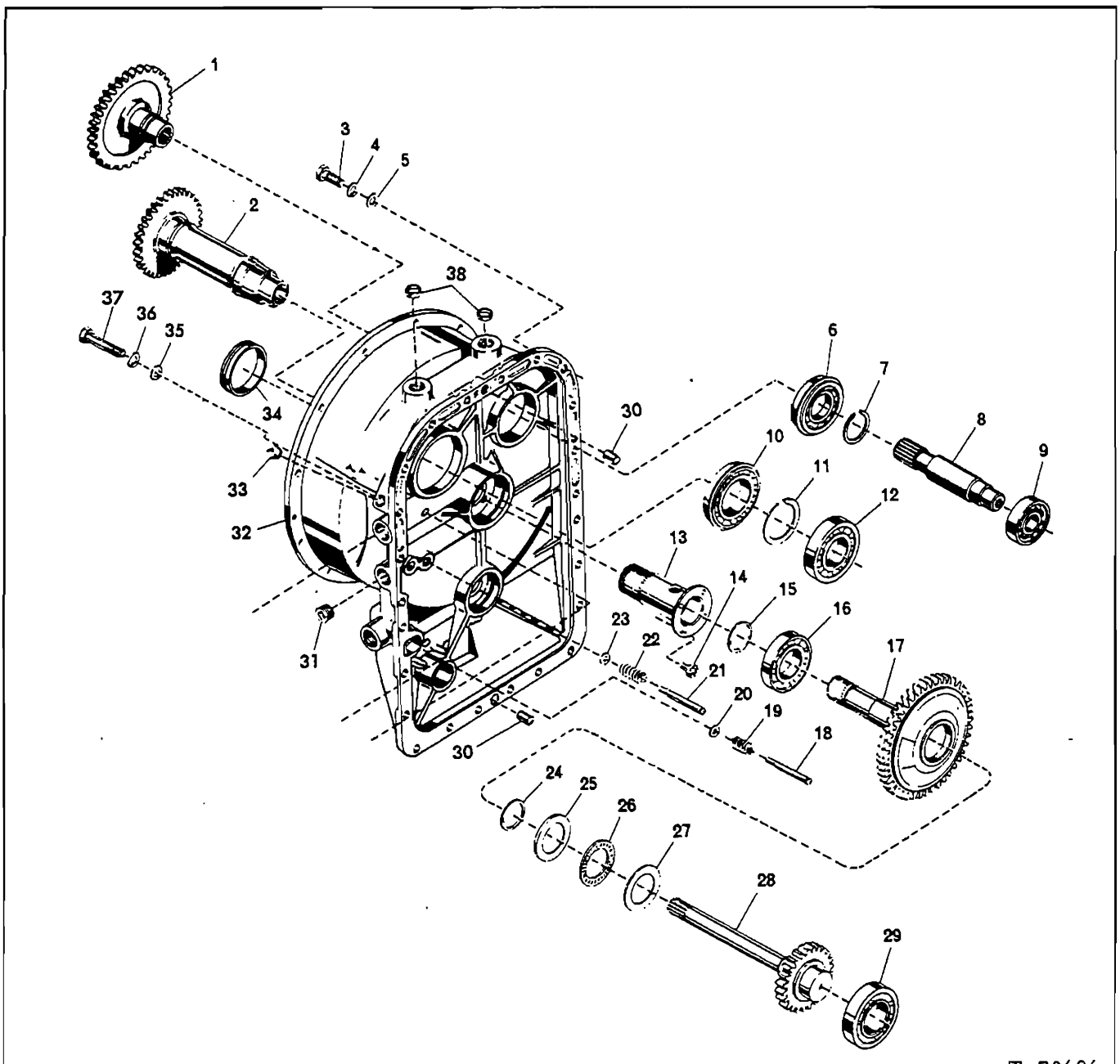

FIG. 63 TORQUE CONVERTER HOUSING

1. Accessory drive gear
2. Accessory driven gear
3. Bolt
4. Lockwasher
5. Washer
6. Ball bearing
7. External snap ring
8. Accessory drive shaft
9. Ball bearing
10. Ball bearing
11. External snap ring
12. Ball bearing
13. Converter ground sleeve
14. Self locking bolt
15. Step joint seal ring
16. Ball bearing
17. Second turbine drive gear
18. Valve guide pin
19. Valve spring
20. Converter regulator valve
21. Valve guide pin
22. Valve spring
23. Converter regulator valve
24. Step joint seal ring
25. Thrust race
26. Thrust roller bearing
27. Thrust race
28. First turbine drive gear
29. Ball bearing
30. Dowel pins
31. Pipe plug
32. Converter housing
33. Plug
34. Converter housing sleeve
35. Washer
36. Lockwasher
37. Bolt
38. Plugs

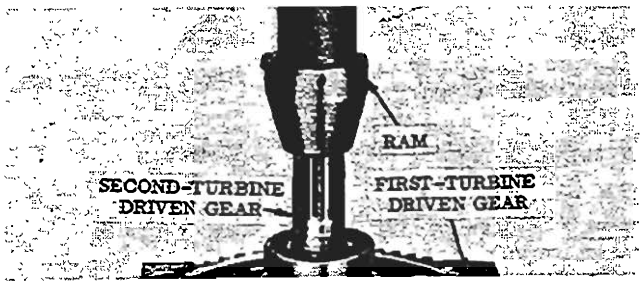

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FIG. 64 PRESS SECOND TURBINE GEAR

7.7.12
If the lubrication regulator valve components (18), (19), and (20) require replacement, remove them by twisting pin (18) from the converter housing.

7.7.13
Do not remove plugs (31), (33), or (38) unless necessary for cleaning or replacement. Do not remove dowel pins (30) unless necessary for replacement.

Note: Refer to paragraph 7.2, above.

7.7.14
Assembly (Fig. 63). If plugs (38) were removed, install new plugs, closed end first, into converter housing (32). Tighten plugs sufficiently to prevent leakage. If plugs were removed, replace them. If dowel pins (30) were removed, install new dowel pins. Press the pins into their bores until they protrude 0.430 to 0.450 inches (10.92 to 11.43 mm).

7.7.15
If lubrication regulator valve (20) (Fig. 63) was removed, install spring (19) and valve (20) onto guide pin (18). Install the assembled parts, pressing pin (18) into housing (32) until it is flush with, to 0.010 inch (.254 mm) below, the housing splitline.

7.7.16 (Refer to Fig. 64B)
If converter pressure regulator valve (23) was removed, install second type spring (22) and valve (23) onto guide pin (21). Install the assembled parts, pressing pin (21) into housing (32) until it projects 1.16" to 1.18" (29.5 - 29.9 mm) above the valve seat.

Note: If the press fit of pins (18) or (21) is not satisfactory, apply Loctite Grade B (Loctite Corp., Newington, Conn.) or equivalent. Clean the bore and pin of all oil residue.

Apply the sealant to the bore and mating surface of pin and install as described above. Allow the sealant to cure for 2 hours at room temperature.

7.7.17
If ground sleeve (13) was removed, chill the replacement sleeve in dry ice for at least 1 hour. Aline the bolt holes in ground sleeve (13) with those in housing (32), and press the sleeve to a firm seat against the rear of the housing. Install four self-locking bolts (14), and tighten them to 17 to 20 pound feet (2.4 - 2.8 kgm) torque.

7.7.18
If the transmission is equipped with accessory drive gear (1), install bearing (6), with snap ring groove away from the gear. Install snap ring (7) to retain bearing (6).

7.7.19
Install accessory drive gear (1) and assembled bearing (outer race snap ring removed) into the front of housing (32). Install the snap ring onto the outer race of the bearing.

7.7.20
Install bearing (10), with its snap ring groove away from the gear, onto accessory driven gear (2). Install snap ring (11) to retain bearing (10). Press bearing (12) against the rearward seat on accessory driven gear (2).

7.7.21
Install accessory driven gear (2) and assembled bearings (outer race snap ring removed) into the front of housing (32). Install the snap ring onto the outer race of bearing (10).

7.7.22
If converter housing sleeve (34) was removed from housing (32), install new replacement sleeve. Heat the sleeve for ease of replacement. Install converter housing sleeve (34), seal ring groove last, and press it onto the

hub of housing (32). Seat the sleeve firmly against the shoulder on the hub. Install step-joint seal ring (20) (Fig. 59) into the groove in the converter housing sleeve. Retain the seal ring with oil-soluble grease.

7.7.23
Coat the outer diameter of diaphragm Figure 115A (10) with nonhardening sealer, and start it, convex side first and arrow pointing toward bottom of transmission into the front of the converter housing. Using two soft hammers (one driving against the other or a block of wood contoured to the circumference of the diaphragm), (Fig. 64A), drive the diaphragm onto its seat in the housing bore. Move the driver evenly around the circumference, driving only slightly at each position.

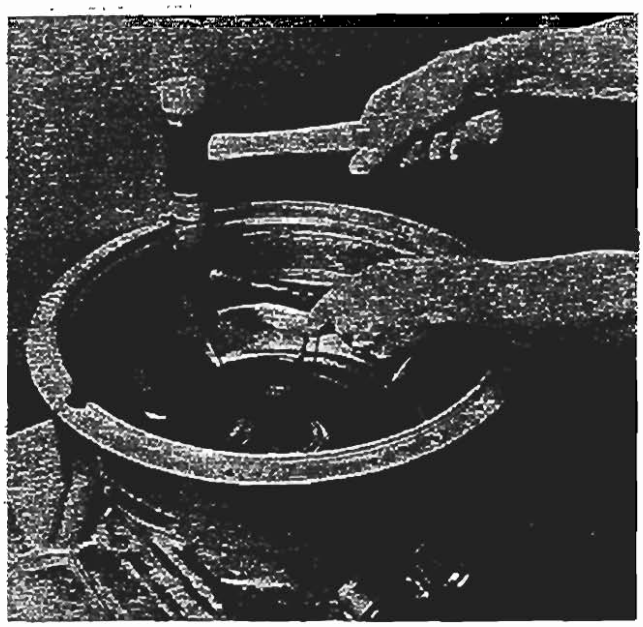

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FIG. 64A INSTALLING DIAPHRAGM ASSEMBLY

7.7.24
If plug (11), Fig. 115A, was removed, coat outer diameter of the new plug with nonhardening sealer. Drive plug (11), flat side first, into the converter housing, and seal it against the shoulder in the bore.

7.8 TURBINE - DRIVEN GEARS AND FREEWHEEL CLUTCH

7.8.1
Disassembly (Fig. 65). Press the second turbine driven gear out of the assembled unit (Fig. 64). This will free spacers (16) and (18) (Fig. 65) and bearing (19) which may be removed. Remove fifteen rollers (9), also freed.

7.8.2
Remove bearing (17) from gear (15). Remove twelve nuts (2) from bolts (14).

7.8.3
Using a screwdriver, pry cam assembly (10) away from gear (3). Remove spring plate (5) and roller cage (8). Remove three spring pins (6) and springs (7) from the roller cage. Remove bolts (14) and retainer plate (13) from cam assembly (10). Remove roll pin (11) from cam (12) if replacement is necessary.

7.8.4
If replacement is necessary, remove bearings (1) and (4) from gear (3).

Note: Refer to paragraph 7.2, above.

7.8.5
Assembly (Fig. 65). If bearings (1) and (4) were removed from gear (3), install the bearings by pressing them against the shoulders on the gear.

7.8.6
Install the roll pin into the cam and press it to the bottom of the bore (Fig. 66).

7.8.7
Insert the roller cage into the freewheel cam, and aline the index marks on the cam and cage as shown in Fig. 66. Install the spring retainer plate onto the cam, indexing the small hole with the roll pin. Install three springs and pins into ears of cage (Fig. 67).

7.8.8
Place the retainer plate, flat side first, against the rear face of the assembled cam and cage, and insert the twelve bolts (Fig. 68). Install the assembled cam onto gear.

7.8.9
Secure the assembled parts with twelve self-locking nuts (Fig. 69). To prevent rotation of the bolt heads, use the tool shown in Fig. 13, or an open-end wrench and tighten the nuts to 41 to 49 pound feet (5.7 - 6.8 kg/m) torque.

7.8.10
Install fifteen rollers into the cam pockets; use oil-soluble grease to retain the rollers in the cage (Fig. 70).

7.8.11
Install the first turbine driven gear by placing the lead chamfer on the gear hub against rollers, and while pressing downward, rotate the first turbine driven gear in a counter-clockwise direction (Fig. 71).

7.8.12
Install the bearing spacer onto the shaft of the second turbine driven gear (Fig. 72).

7.8.13
Install the remaining bearings and spacer, as shown in Fig. 78, onto the shaft of the second turbine driven gear. Accurately center the spacer to prevent it from getting caught on the shaft shoulder. Press the bearings and spacer firmly into place while supporting the second turbine driven gear.

7.9 FIRST-TURBINE DRIVE GEAR AND BEARING ASSY.

Note: Not all bearings are installed with Loctite. If the bearing can be easily pressed from the drive gear, remove the bearing. If unusual resistance is encountered, refer to below.

7.9.1
Disassembly (Fig. 63). Heat the inner race of bearing (29) to 450° F. (232°C) and press first turbine drive gear (28) from the bearing.

7.9.2
Discard bearing (29) and clean the journal of gear (28).

Note: Refer to paragraph 7.2, above.

7.9.3
Assembly (Fig. 63). Apply Loctite Retaining Compound (Loctite Corp., Newington, Conn.) or equivalent to the ID of new bearing (29) and its journal on first turbine drive gear (28).

7.9.4
Press bearing (29) firmly against its seat on first turbine drive gear (28). Allow assembled parts to cure for 2 hours at room temperature.

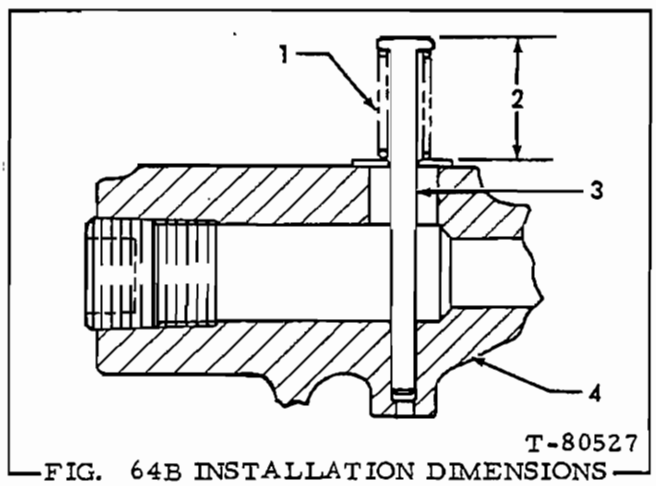

FIG. 64B INSTALLATION DIMENSIONS FOR CONVERTER REGULATOR VALVE GUIDE PIN

1. Valve spring (See Topic 11 Spring Chart)
2. 1.18" - 1.20" (29.9 - 30.5 mm) with first type valve spring used prior to transmission S/N 92911
   1.16" - 1.18" (29.5 - 29.9) with second type valve spring used in transmission S/N 92911 and up
3. Valve guide pin
4. Converter housing

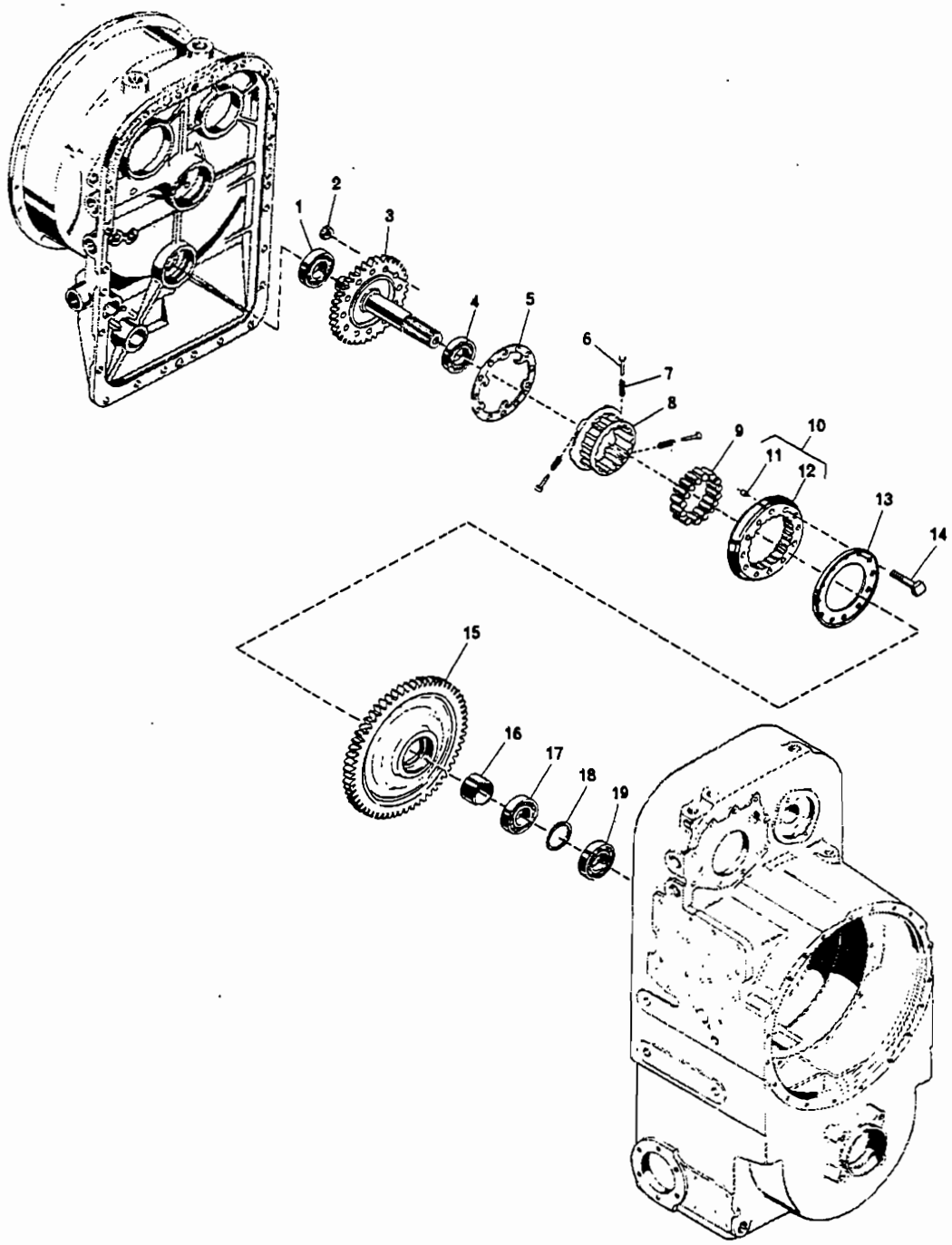

FIG. 65 TURBINE DRIVEN GEARS AND FREEWHEEL UNIT

1. Ball bearing
2. Self-locking nut
3. Second-turbine driven gear
4. Ball bearing
5. Spring plate
6. Spring pin
7. Spring
8. Freewheel roller cage
9. Freewheel roller
10. Freewheel cam assembly
11. Index pin
12. Freewheel cam
13. Retainer plate
14. Square-head bolt
15. First turbine gear
16. Bearing spacer
17. Ball bearing
18. Bearing spacer
19. Ball bearing

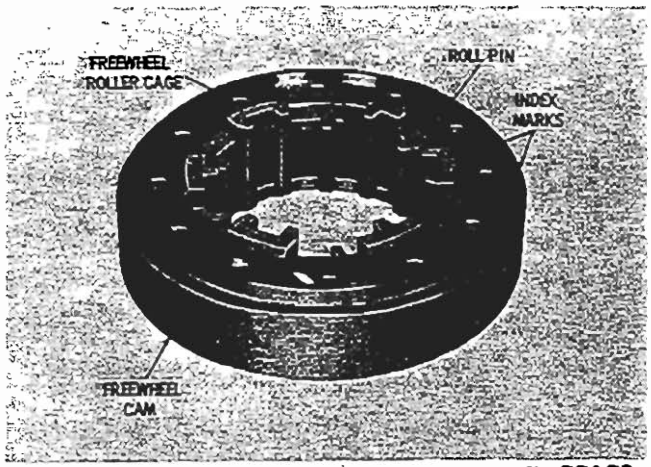

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FIG. 66 FREEWHEEL ROLLER CAGE INSTALLED IN FREEWHEEL CAM

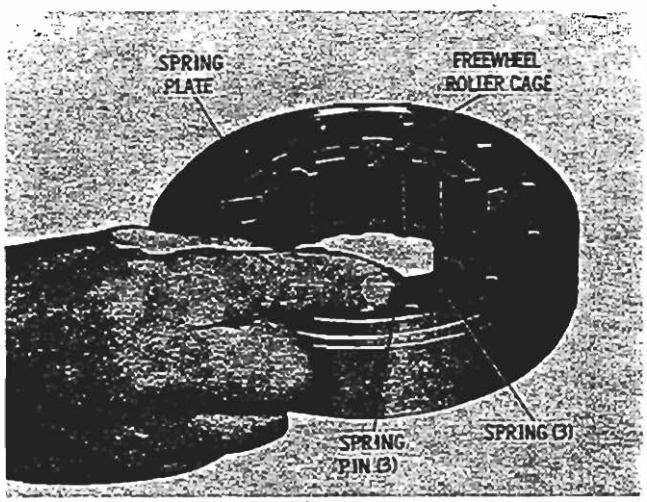

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FIG. 67 INSTALLING SPRING AND SPRING PIN INTO ROLLER CAGE

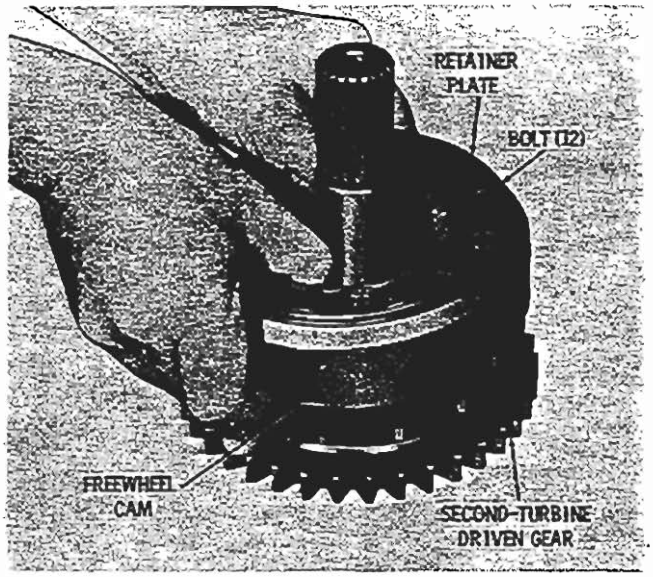

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FIG. 68 INSTALLING ASSEMBLED CAM ONTO ASSEMBLED SECOND TURBINE DRIVEN GEAR

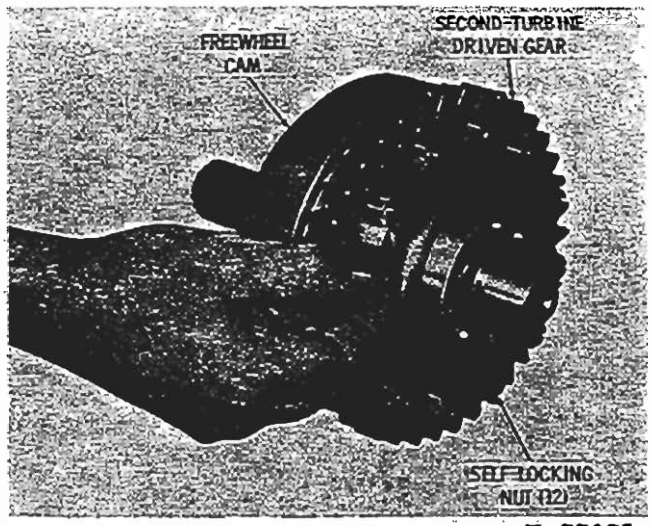

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FIG. 69 INSTALLING SELF-LOCKING NUT ONTO FREEWHEEL CAM BOLT

7.9.5 HIGH RANGE CLUTCH PISTON HOUSING

7. 9. 6
Disassembly (Fig. 74). Remove bearing (23) from high-range clutch piston housing (21).

7. 9. 7
Position the high-range clutch piston and housing, piston side up, in a press. Use care to prevent spring (15) and remove snap ring (14).

7.9.8
Remove piston (17), seal ring (18), and on units prior to S/N 116147, remove expander ring (19) from high range clutch piston housing (21). Refer to paragraph with clutch piston rebuild instructions.

7. 9. 9
Remove hook-type seal ring (16) (Fig. 74) from the inner hub of high-range clutch piston housing (21). Remove bushings (20) and (23) from high-range clutch piston housing (21) only if replacement is necessary.

Note: Refer to paragraph 7. 2, above.

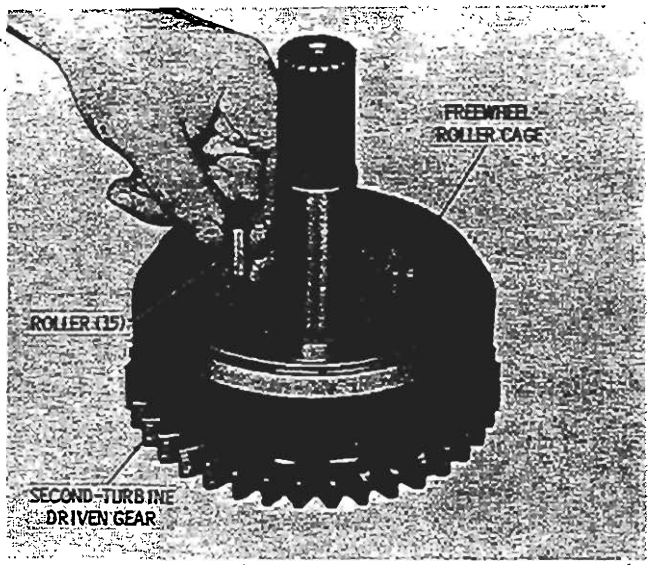

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FIG. 70 INSTALLING ROLLER INTO ROLLER CAGE

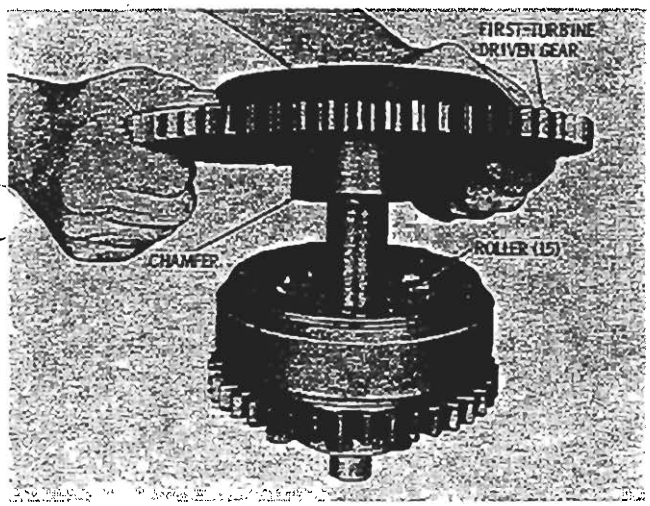

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FIG. 71 INSTALLING FIRST TURBINE DRIVEN GEAR

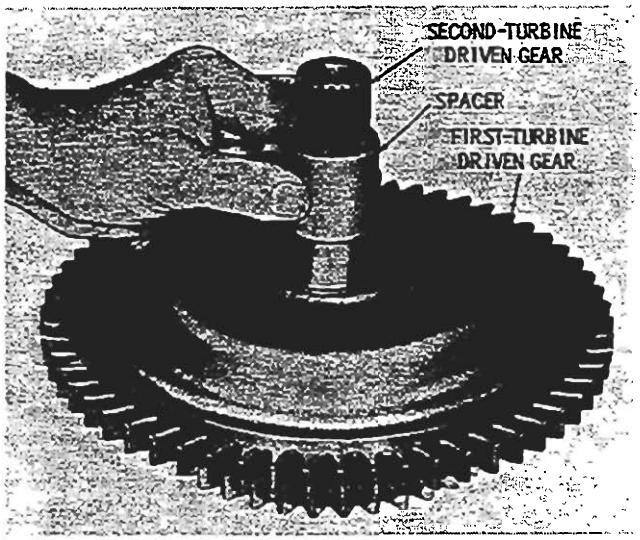

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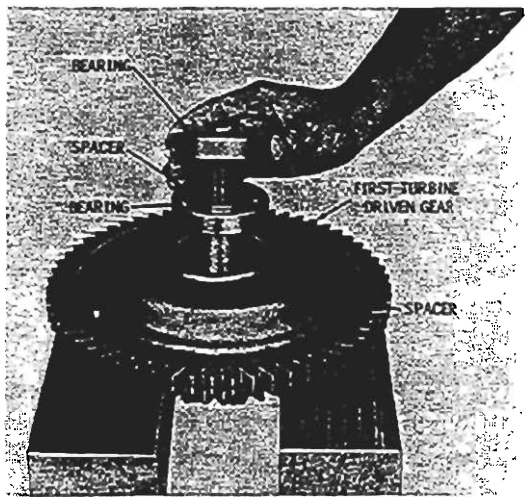
FIG. 72 INSTALLING BEARING SPACER ONTO SECOND TURBINE DRIVEN GEAR



T-77079

FIG. 73 INSTALLING BEARINGS AND SPACER ONTO SECOND TURBINE DRIVEN GEAR

7.10 CLUTCH HUB AND PISTON, DRIVE GEAR, PLANET CARRIER'S, PUMP, AND HOUSING

Assembly (Fig. 74). If bushing (20) was removed from high-range clutch piston housing (21), install a new bushing. Press the new bushing to 0.040 to 0.080 inch (1.016 to 2.032 mm) below the face of the hub. If bushing (22) was removed, install a new sleeve. Press the new sleeve against the shaft shoulder.

7.10.1
Install hook-type seal ring (16) onto the inner hub of high range piston housing (21). Install piston (17), seal ring (18), and on units prior to S/N 117147, install expander ring (19) into piston housing (21).

7.10.2
Install piston return spring (15), convex side up, onto piston (17). Place the assembled parts, piston side upward, in a press. Depress the piston return spring and install snap ring (14).

Install bearing (23) onto the rear hub of high-range clutch piston housing (21).

7.10.3 HIGH-RANGE CLUTCH HUB

7.10.3.1
Disassembly (Fig. 74). Position the assembly so that nut (5) and lockstrips (6) are

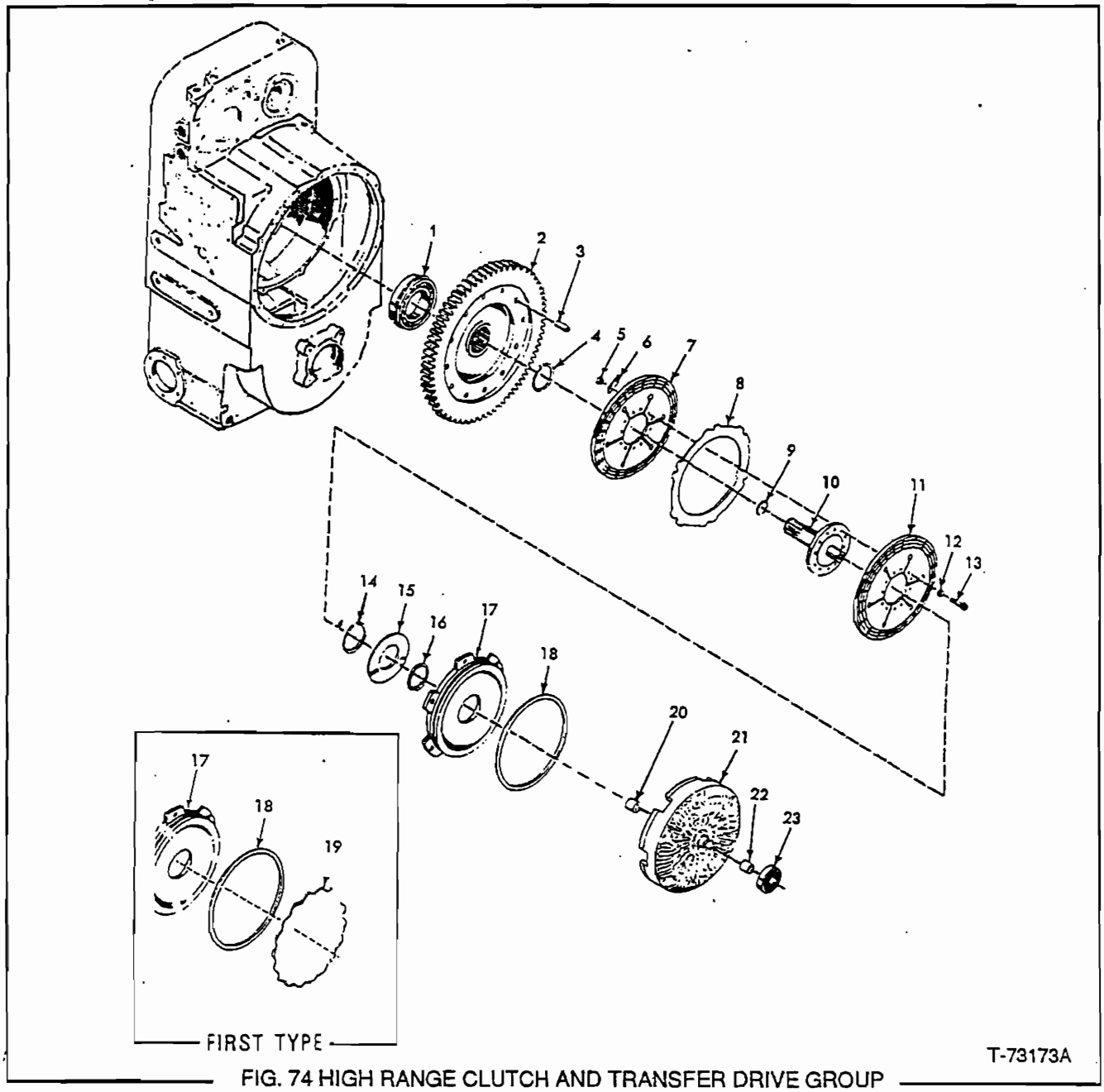


FIG. 74 HIGH RANGE CLUTCH AND TRANSFER DRIVE GROUP

1. Bearing
2. Drive gear assembly
3. Pin
4. Snap ring
5. Nut
6. Locking strip
7. Clutch plate
8. External tanged plate
9. Snap ring
10. High range clutch hub
11. Clutch plate
12. Washer
13. Capscrew
14. Snap ring
15. Return piston spring
16. Seal ring
17. High range clutch piston
18. Seal (prior to trans. S/N 116147)
    Seal (Lip-type)(effective trans. S/N 116147)
19. Expander (prior to trans. S/N 116147)
20. Housing bushing
21. Housing assembly
22. Housing bushing
23. Clutch piston bearing

(Revised July 1988)

upward. Remove snap ring (9) from hub (10).

7.10.3.2
Flatten the corners of six lockstrips (6) and remove twelve nuts (7). Remove twelve bolts (13) and washers (12).

7.10.3.3
Separate hub (10) from clutch plates (7), (8), and (11).

Note: Refer to paragraph 7.2, above.

7.10.3.4
Assembly (Fig. 74). Assemble twelve washers (12) onto twelve, self-locking bolts (13). Install bolts (13) into clutch plate (11).

7.10.3.5
Install clutch hub (10) onto the bolt and clutch plate assembly. Note that the unsplined end of hub (10) should be at the same side of clutch plate (11) as washers (16).

7.10.3.6
Install external-tanged plate (8) onto the front side of clutch plate (11). Install clutch plate (7) onto the front side of external-tanged plate (8), engaging bolts (13).

7.10.3.7
Install six lockstrips (6) and twelve nuts (5). Tighten the nuts to 14 to 18 pound feet (1.9 - 2.5 kg/m) torque, and bend the lockstrip corners against the bolt heads.

7.10.3.8
Install snap ring (9) into its groove on the splined shaft.

7.10.4 TRANSFER DRIVE GEAR

7.10.4.1
Disassembly (Fig. 74). Remove bearing (1) and six pins (3) from transfer drive gear (2) only if replacement is necessary.

7.10.4.2
If bearing replacement is necessary, pull bearing (1) from transfer drive gear assembly. If drive pins require replacement, press pins (3) from transfer drive gear (2).

Note: Refer to paragraph 7.2, above.

7.10.4.3
Assembly (Fig. 74). If pins (3) were removed, place transfer drive gear (2), hub downward, in a press and install new pins. Press the pins until they project 0.74 to 0.76 inch (18.80 to 19.34 mm) above the surface into which they are pressed.

7.10.4.4
If bearing (1) was removed from transfer drive gear assembly, install a new bearing, outer snap ring first, onto the gear hub. Seat bearing firmly against the shoulder on the gear hub.

7.10.5 CLUTCH PISTON ASSEMBLIES

Note: Warming the Teflon seal rings in oil at 150° F. (66°C.) will make them easier to remove and install.

7.10.5.1
Disassembly. Do not use sharp-edged or pointed tools to remove Teflon seal rings. Rather, slip a very thin, flat blade into piston groove, between the seal ring and side of the groove and work the seal out of the groove until it can be grasped with the fingers.

7.10.5.2
Remove the seal rings.

7.10.5.3
Remove expanders from grooves in the high-range clutch piston.

7.10.5.4
Check the three holes in the reverse clutch piston (4), FIG. 77, and the low-range clutch piston (15), FIG. 74A. One hole must be empty. The other two holes have nylon ball check valves and retaining plugs in them. These must be inspected whenever the transmission has been disassembled to the extent that the valves are accessible. The nylon balls must be replaced if they are so worn that they are not perfectly round. A symptom that the nylon balls are worn or missing is hard shifting, especially in one direction only. Service the check balls and retaining plugs as follows:

7.10.5.4.1
Pry out retainer plugs (25), FIG.'s 74A and 77, from piston using a pointed instrument. Be careful not to damage the pistons.

7.10.5.4.2
Remove and discard oil nylon ball check valves.

7.10.5.4.3
Visually inspect check valve bores in pistons for signs of damage. Be sure bores are clean and free from sludge, varnish or other debris.

7.10.5.4.4 (Refer to FIG. 74B)
Install new nylon (white) ball check valves and press in new retainer plug to a depth of .010-.030 in (.25 - .76 mm) below bore surface on reverse pistons prior to transmission S/N 106708, and forward pistons prior to transmission S/N 106046. Press retainers to a depth of .040 - .060 in. (1.0 -1.5 mm) below the bore surface on reverse pistons and forward pistons effective with above serial numbers.

7.10.5.4.5
With a center punch, stake the piston in four places, equally spaced. The stakes will hold the plug in place in the piston. Be sure the nylon balls move freely in the piston bores.

7.10.5.5
Assembly. Install the seal ring expanders into the grooves in the high-range clutch piston. Make sure the free ends of the expander turn away from the seal ring. The ends of some expanders may require additional bending to insure they turn toward the bottom of the groove.

7.10.5.6
Oil the installed expander and seal ring. Start the seal ring into the piston groove at a point directly opposite the gap in the expander.

7.10.5.7
Carefully work the seal ring into the groove, compressing the expander while moving both directions from the starting point to the expander gap location. Do not stretch or distort the seal ring more than absolutely necessary.

7.10.5.8
Liberally apply petroleum jelly and install lip-type seal rings (no expanders required) into the grooves of the low-range and reverse clutch pistons. Make sure that the lip of each seal ring is toward the oil pressure side of the piston. Refer also to illustration for lip direction.

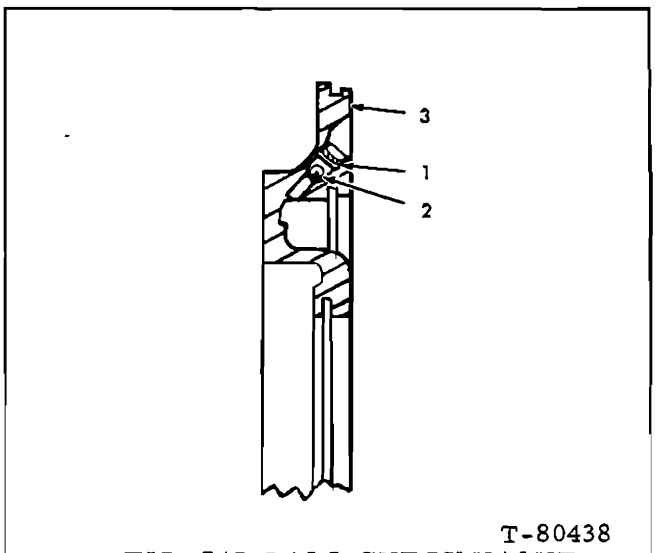


FIG. 74B BALL CHECK VALVE AND PLUG INSTALLATION

1. Retainer plug
2. Ball check valve
3. Piston

Caution: Improperly installed seal rings (lip in wrong direction) will cause improper clutch application or leakage.

7.10.5.9
After installation, adjust the seal rings in their grooves to center them radially in the piston.

7.10.6 LOW-RANGE PLANETARY CARRIER ASSEMBLY

Note: Do not disassemble low-range planetary carrier assembly (2) (Fig.74A) unless there is evidence of undue wear or failure. The failure of one pinion requires replacement of all pinions in the carrier assembly.

7.10.6.1
Disassembly (Fig. 74A). Drill into the ends of four pinion spindles (4) to weaken the swage. Use a .75 inch (19.0 mm) drill at the spindle ends near the smaller, splined hub (rear) of the carrier.

Caution: Do not drill into the carrier. The diameter of the spindles is slightly more than .75 inch (19.0 mm). Centering the drill accurately will prevent drilling into the carrier.

7.10.6.2
Place carrier assembly (2), small hub upward, in a press, and press out four spindles (4).

7.10.6.3
Remove the two thrust washers (5) and (8), pinion (7), and twenty-two pinion rollers (6).

7.10.6.4
Repeat step 7.10.6.3, above, for removal of the remaining three pinion assemblies.

Note: Refer to paragraph 7.2, above.

7.10.6.5
Assembly (Fig. 74A). If facilities are available, chill four new spindles (4) in dry ice for one hour.

7.10.6.6
Install thrust washer (5) on a spindle alining tool.

Note: An alining tool can be made by grinding a used spindle to 0.005 inch (.1270 mm) undersize.

7.10.6.7
Coat the bore of pinion (7) with oil soluble grease, and install the pinion onto the alining tool.

7.10.6.8
Install twenty-two pinion rollers (6) into the space between the alining tool and the pinion bore. Install the second thrust washer (8) onto the pinion.

7.10.6.9
Remove the alining tool, and install the assembled pinion parts into low-range planetary carrier (3). Insert the alining tool to center the assembled pinion parts with the spindle pin bore in the carrier.

7.10.6.10
Place the carrier assembly, hub end upward, into a press, remove the alining tool, and start a chilled spindle pin (4) into spindle bore.

7.10.6.11
Press the spindle into the bore, to 0.180 inch (4.57 mm) below the shoulder surface near the hub end. Refer to Fig. 75.

7.10.6.12
Support the spindle and swage it securely at both ends with an octagon punch. The pinion must rotate freely after assembly. Refer to Fig. 76 for swaging tool information.

7.10.6.13
Install the remaining three pinion assemblies in the same manner as described in 7.10.6.6 through 7.10.6.12, above.

7.10.7 REVERSE-RANGE PLANETARY CARRIER ASSEMBLY

Note: Do not disassemble reverse range planetary carrier assembly (Fig. 77) unless there is evidence of undue wear or failure. The failure of one pinion requires replacement of all pinions in the carrier assembly.

7.10.7.1
Disassembly (Fig. 77). Drill into the ends of four pinion spindles (14) to weaken the swage. Use a .75 inch (19.0 mm) drill at the ends, which are swaged to carrier (15).

Caution: Do not drill into the carrier. The diameter of spindles is slightly more than .75 inch (19.0 mm). Centering the drill accurately will prevent drilling into the carrier.

7.10.7.2
Place carrier assembly (9) in a press, and press out four spindles (14).

7.10.7.3
Remove two thrust washers (10) and (13), pinion (11) and twenty-two rollers (12).

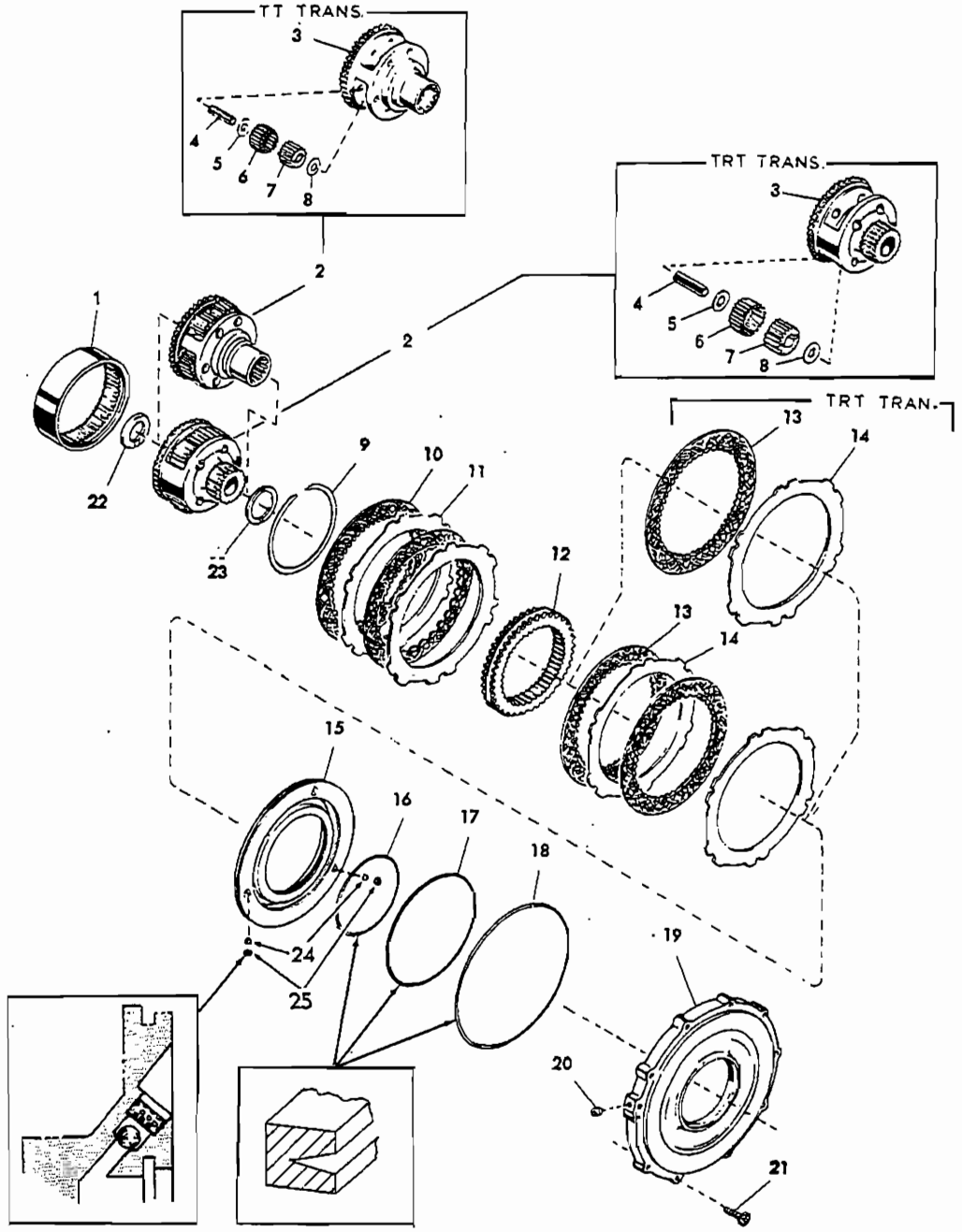


FIG. 74A LOW-RANGE CLUTCH AND FORWARD PLANETARY

1. Reverse ring gear
2. Low-range planetary carrier assembly
3. Low-range planetary carrier
4. Spindle
5. Thrust washer
6. Pinion rollers
7. Planetary pinion
8. Thrust washer
9. Internal snap ring
10. Low-range internal-splined clutch plate
11. Low-range external-tanged clutch plate
12. Low-range ring gear
13. Low-range internal-splined clutch plate
14. Low-range external-tanged clutch plate
15. Low-range clutch piston
16. Piston seal ring
17. Piston seal ring
18. Piston seal ring
19. Low-range clutch piston housing
20. Plug
21. Self-locking bolt
22. Thrust washer (TRT)
23. Thrust washer (TRT)
24. Ball check valve
25. Retaining plug

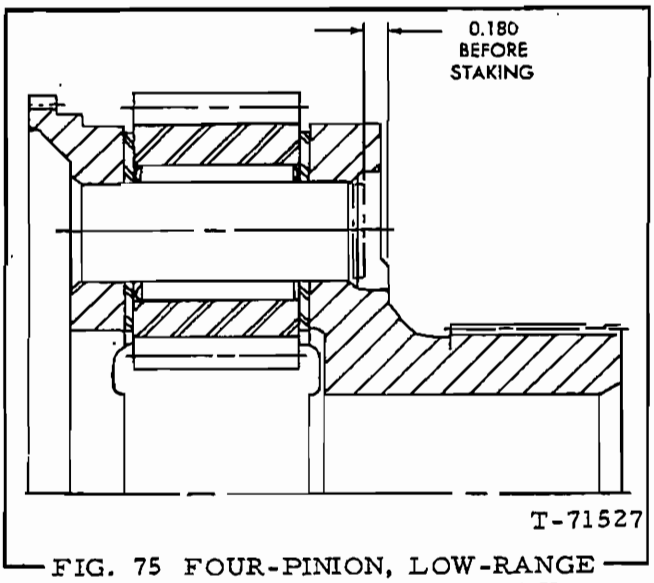


FIG. 75 FOUR-PINION, LOW-RANGE PLANETARY CARRIER ASSEMBLY - CROSS-SECTION VIEW

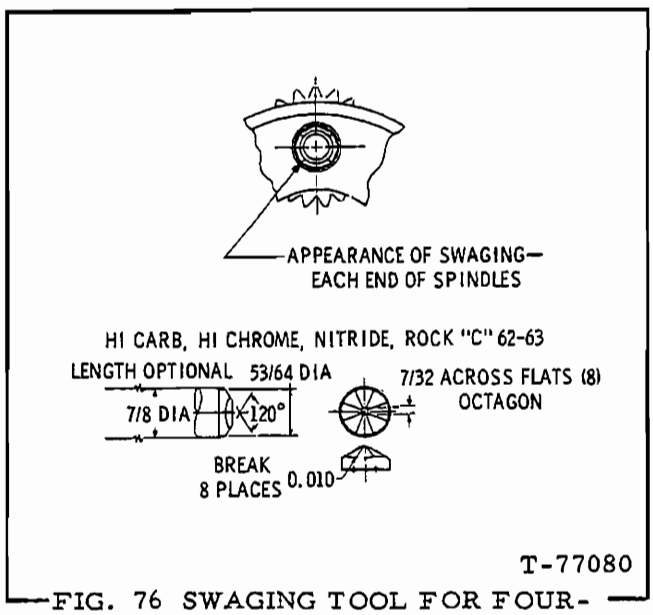


FIG. 76 SWAGING TOOL FOR FOUR-PINION LOW-RANGE AND REVERSE-RANGE PINION SPINDLES

7.10.7.4
Repeat step 7.10.7.3, above, for removal of the remaining three pinion assemblies.

Note: Refer to paragraph 7.2, above.

7.10.7.5
Assembly.

7.10.7.6
If facilities are available, chill four new spindles (14) in dry ice for one hour.

7.10.7.7
Install thrust washer (10) onto a spindle alining tool.

Note: An alining tool can be made by grinding a used spindle to 0.005 inch (.1270 mm) undersize.

7.10.7.8
Coat the bore of a pinion (11) with oil soluble grease, and install the pinion onto the alining tool.

7.10.7.9
Install twenty-two pinion rollers (12) into the space between the alining tool and the pinion bore. Install the second thrust washer (13) onto the pinion.

7.10.7.10
Position carrier (15) chamfered side of spindle bores upward, on a level surface. Remove the alining tool and install the assembled pinion parts into the carrier. Insert the alining tool to aline the assembled pinion parts with the spindle pin bore in the carrier.

7.10.7.11
Repeat step 7.10.7.6 through 7.10.7.10, above, for installation of the remaining three pinion assemblies.

7.10.7.12
Start a chilled spindle (14) into the chamfered spindle bore of carrier (15). Press the spindle into the bore until it projects 0.130 to 0.150 inch (3.30 to 3.81 mm) below the location shown in Fig. 78.

7.10.7.13
Repeat steps, above, for installation of the remaining three spindles.

7.10.7.14
Support one of spindle (4) (Fig.74A) and swage it securely with an octagon punch. The pinion must rotate freely after assembly. Refer to Fig. 76 for swaging tool information.

7.10.7.15
Swage the remaining three spindles in the manner described in 7.10.7.14, above.

7.10.8 OIL PUMP

7.10.8.1
Disassembly (Fig. 79). Remove the pump cover and cover gasket.

7.10.8.2
Remove the drive gear and driven gear assembly.

7.10.8.3
Inspect the needle bearings. If replacement is necessary, remove them from the driven gear.

7.10.8.4
Inspect dowel pin which is pressed into the

pump body. Remove it only if replacement is necessary.

Note: The dowel pin can be removed by clamping it in a vise and twisting the pump body.

7.10.8.5
Inspect the oil seal. If replacement is necessary, remove the seal by driving or pressing it toward the rear (accessory mounting face) of the pump. If the driven gear shaft, pump body, drive gear or driven gear require replacement, a new pump assembly must be used.

Note: Refer to paragraph 7.2, above.

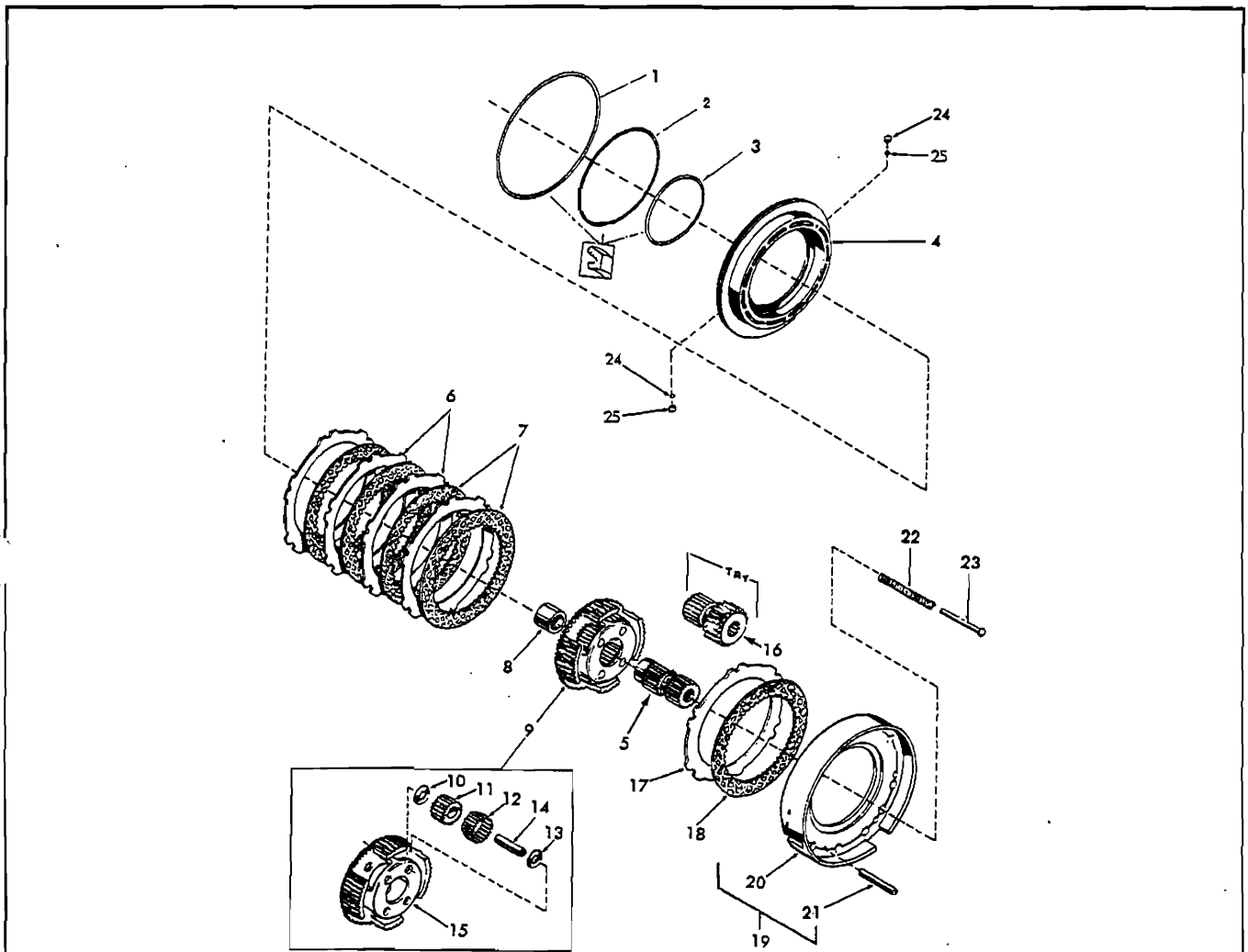


FIG. 77 REVERSE CLUTCH AND PLANETARY

1. Piston seal ring
2. Piston seal ring
3. Piston seal ring
4. Reverse-range clutch piston
5. Forward and reverse-range sun gear (TT)
6. External-tanged, reverse range clutch plate
7. Internal-splined, reverse-range clutch plate
8. Spacer (TRT only)
9. Reverse-range planetary carrier assembly
10. Thrust washer
11. Planetary pinion
12. Pinion roller
13. Thrust washer
14. Spindle
15. Reverse-range planetary carrier
16. Forward and reverse sun gear (TRT only)
17. External tanged reverse clutch plate
18. Internal-splined reverse clutch plate
19. Reverse-and-low-range clutch anchor assembly
20. Reverse-and-low-range clutch anchor
21. Anchor pin
22. Spring
23. Return guide pin
24. Ball check valve
25. Retaining plug

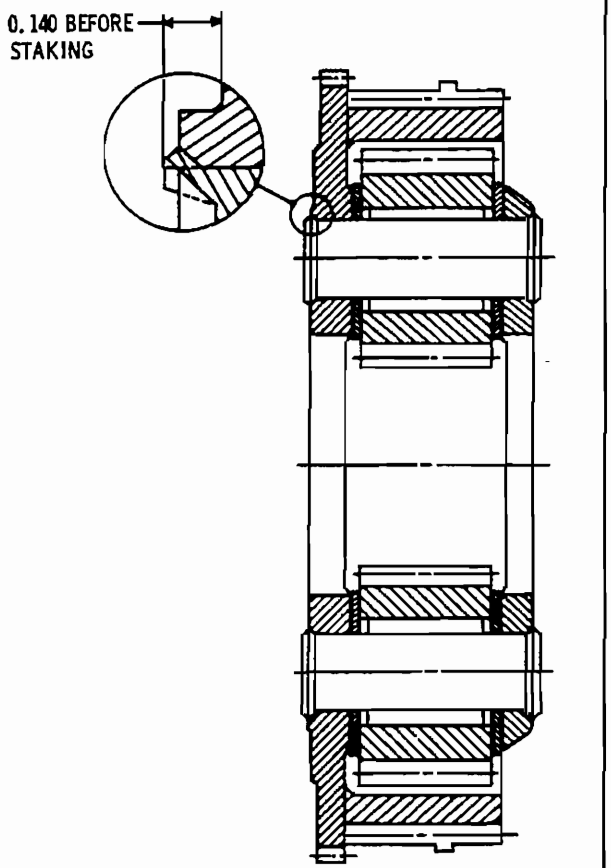


FIG. 78 REVERSE-RANGE PLANETARY CARRIER ASSEMBLY - CROSS-SECTION VIEW

7.10.8.6
Assembly (Fig. 79). If the oil seal was removed, coat the outer circumference of the new seal with non-hardening sealer. Install the seal, spring-loaded lip first, into the rear of the pump body. Press the seal until it seats lightly on the shoulder in the body bore.

7.10.8.7
If the dowel pin was removed, press a new pin into pump body. The pin is properly installed when it projects 0.41 to 0.43 inch (10.41 to 10.92 mm) above the front surface of the pump body.

7.10.8.8
If the needle bearings were removed from the driven gear, install new bearings so that the replacer tool rests against the part number end of bearing race. Press each bearing flush with, to 0.020 inch (.51 mm) below, the end surface of the driven gear.

7.10.8.9
Install the driven gear assembly over the gear shaft and into the pump body. Also install the drive gear into the pump body.

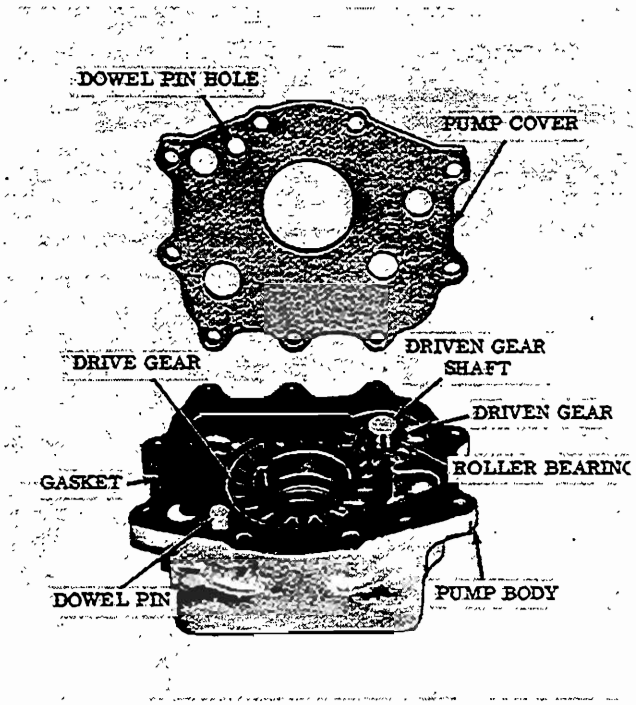


FIG. 79 OIL PUMP ASSEMBLY

Note: When properly installed, end faces of both gears will project 0.002 to 0.003 inch (.051 to .076 mm) above the front surface of the pump body (measured before gasket is installed). If end faces of the gears are below the flush line of the pump body, the pump will not perform satisfactorily and should be replaced.

7.10.8.10
Apply a liberal amount of oil onto the pump gears, and install the cover gasket and cover. Position the pump assembly front upward, until ready for installation onto the transmission housing.

7.10.9 TRANSMISSION HOUSING

7.10.9.1
Disassembly (Fig. 80). Remove six bolts and lockwashers, and remove core hole cover (12) and gasket.

7.10.9.2
Remove plug, but do not remove filter plug (10) unless replacement is necessary. If necessary, measure and record the depth of installed plug (10) prior to removal of the plug.

7.10.9.3
Remove breather (11).

7.10.9.4
If the transmission is equipped with an accessory drive gear, remove lip-type oil seal (17). If the transmission is not equipped

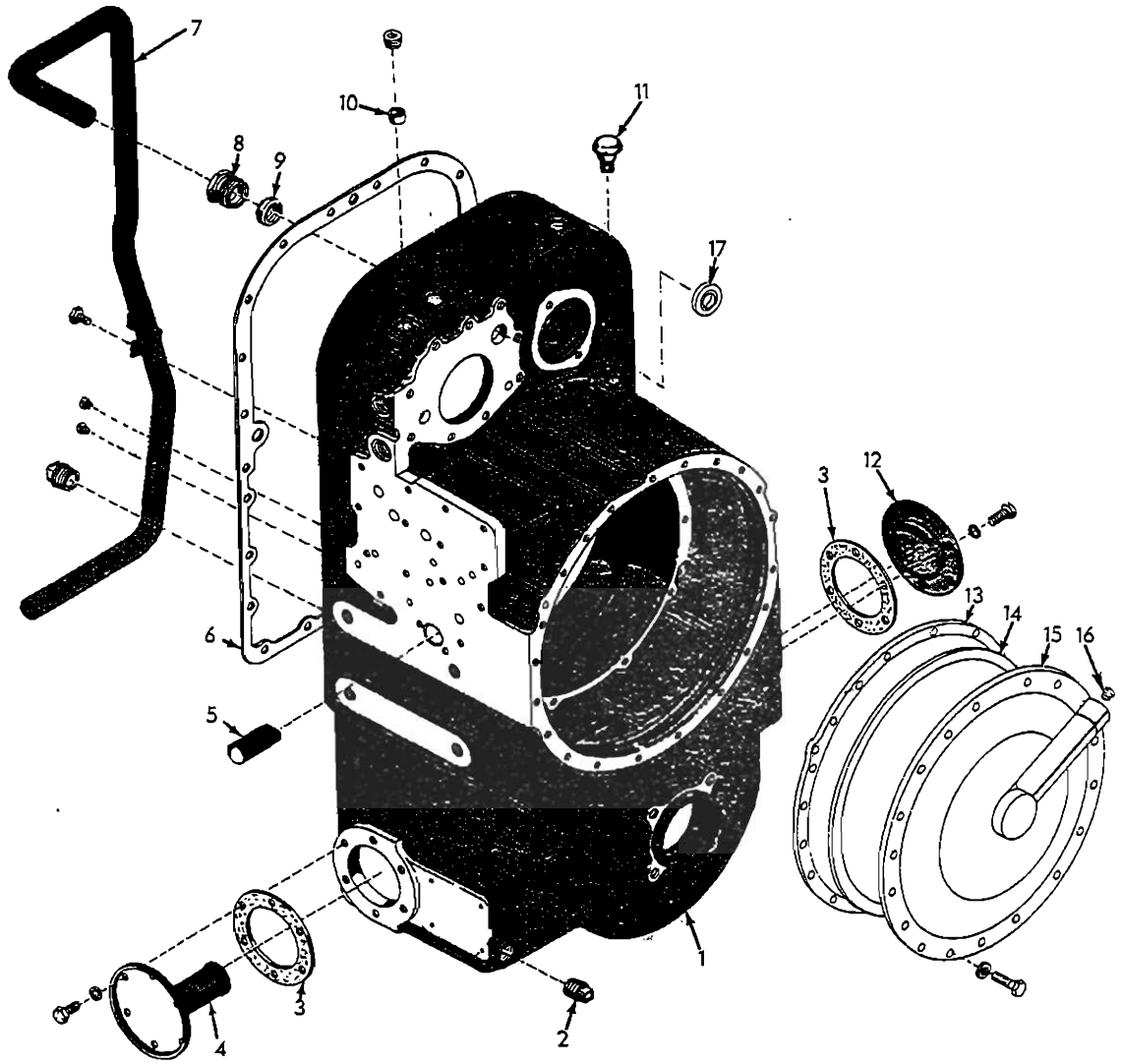


FIG. 80 TRANSMISSION HOUSING AND COVERS

1. Transmission housing
2. Drain plug
3. Gasket
4. Oil strainer assembly
5. Anchor pin
6. Transmission housing gasket
7. Suction tube
8. Male nut
9. Suction tube compression seal
10. Remote filter plug
11. Transmission breather
12. Core hole cover
13. Rear cover gasket
14. Seal ring
15. Rear cover
16. Pipe plug
17. Oil seal

with an accessory drive gear, remove cup plug (12) only if replacement is necessary.

7.10.9.5
Remove oil level plugs from the front face of housing (11) (Fig. 3A).

7.10.9.6
Assembly (Fig. 80). If oil level plugs were removed, replace them. Tighten the plugs sufficiently to prevent leakage.

7.10.9.7
If lip-type oil seal (17) was removed, install a new seal, spring-loaded lip first, into the rear face of housing (1). Press the seal lightly against the shoulder in the bore.

7.10.9.8
Install breather (11) and tighten it sufficiently to prevent leakage.

7.10.9.9.
If plug (10) was removed, apply non-hardening sealant onto the outside diameter of the new plug. Install the new plug, closed end first, into the passage. Press the plug to the exact depth recorded prior to removal. Install plug and tighten it sufficiently to prevent leakage.

7.10.9.10
Install core hole cover (12) and gasket, and retain them with six one-inch bolts and lockwashers. Tighten the bolts to 26 to 32 pounds feet (3.6 to 4.4 kg/m) torque.

7.10.10 TORQUE VALUES-ILLUSTRATED

Fig. 81, which follows, shows the torque values for the threaded fasteners visible in the illustration.

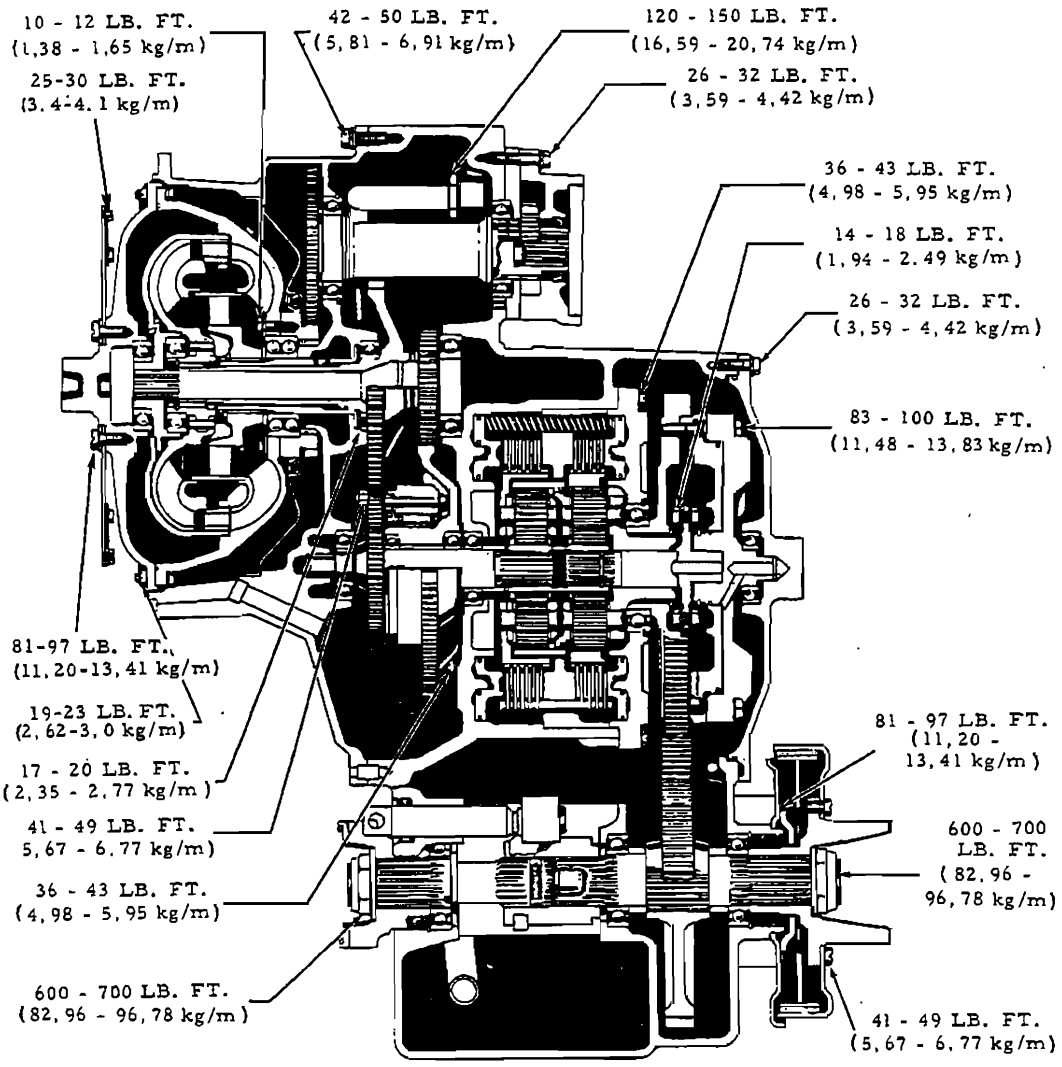


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FIG. 81 TORQUE VALUES FOR THREADED FASTENERS

TOPIC 8 ASSEMBLY OF TRANSMISSION FROM SUBASSEMBLIES

8.1 SCOPE OF TOPIC 8

8.1.1
The procedures in this section describe the assembly of the transmission from the parts removed in Topic 6 and the subassemblies rebuilt in Topic 7.

8.1.2
Whenever possible, the sequence of assembly is presented in reverse order of the removal sequence in Topic 6. Techniques also are presented for installation of components in a vehicle-mounted transmission.

8.2 GENERAL INFORMATION FOR FINAL ASSEMBLY

8.2.1
Tools, Parts, Methods. Refer to paragraphs 4.3 through 4.5.

8.2.2
Cleaning, Inspection. Refer to paragraph 4.6.

8.2.3
Torque Specifications. The specific torque value for each threaded fastener installed in this section is stated in the applicable paragraph. Torque values are also presented in paragraphs 4.10 and 7.10.10.

8.2.4
Lubrication. Soak each friction (faced) clutch plate in transmission fluid prior to assembly.

8.2.4.1
Use oil soluble grease with a low melting point (petroleum jelly) when it is required to facilitate assembly.

8.2.4.2
Pack the inside diameter groove of the metal-encased, lip-type oil seals with high temperature grease (MIL-G-3545A or equivalent).

8.2.4.3
During final assembly, lubricate all moving parts with transmission fluid. The lubricant film will protect the friction surfaces and ferrous metals until the transmission is in service.

8.2.4.4
Component Cleanliness. Continually check each of the components during assembly to insure that they are free of lint, dirt, or foreign particles.

8.3 INSTALLATION OF OUTPUT COMPONENTS, TRANSFER DRIVEN GEAR

8.3.1
One-piece Output Shaft. Install the transfer driven gear into the rear of the housing (Fig. 82).

8.3.2
If shifter shaft hole plug was removed, install a new plug (Fig. 83). Apply nonhardening sealant onto the outside diameter of the new plug. Install the plug, closed end first, and seat it against the shoulder in the housing bore.

8.3.3
Install the output shaft, double-splined end first, through the front of the housing and the splined hub of the transfer driven gear (Fig. 83).

8.3.4
Start bearing (9), the shield side last, into front bore of the housing.

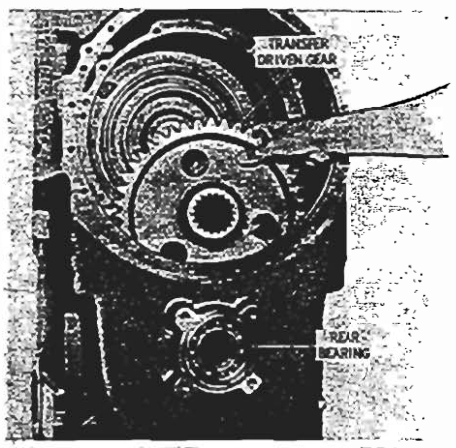

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FIG. 82 INSTALLING TRANSFER DRIVEN GEAR

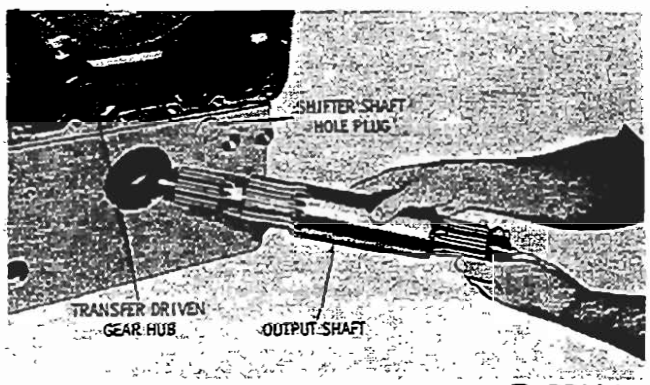

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FIG. 83 INSTALLING ONE-PIECE OUTPUT SHAFT

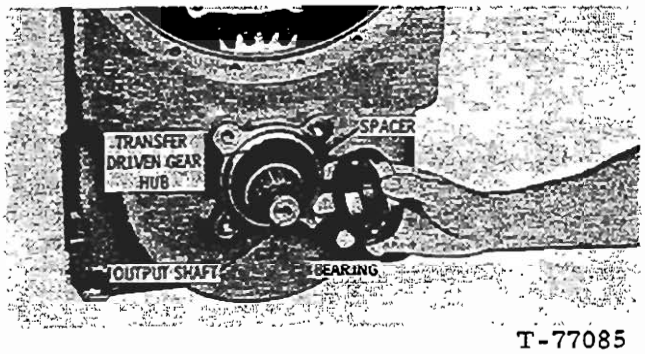

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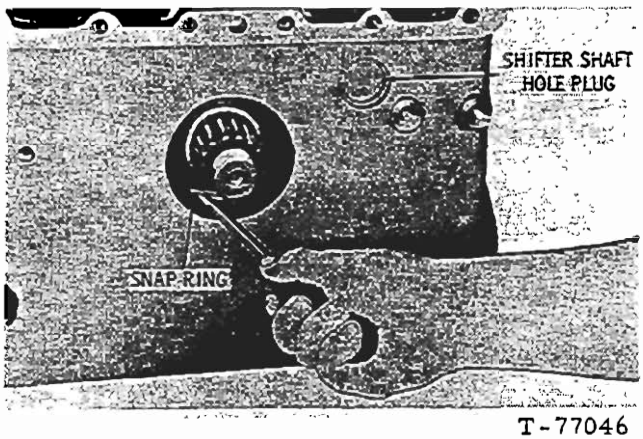
FIG. 84 INSTALLING OUTPUT SHAFT REAR BEARING AND SPACER



T-77046

FIG. 85 INSTALLING OUTPUT SHAFT FRONT BEARING SNAP RING

T-77087

FIG. 86 OUTPUT SHAFT FRONT BEARING AND SEAL RING

8.3.5
Install the spacer onto the rear end of the output shaft bearing (Fig. 84). Start the rear bearing, loading groove first, into its bore in the housing, pushing the spacer toward the transfer gear hub.

8.3.6
Supporting the shaft at the front end surface, drive the rear bearing and spacer forward until they are firmly seated against the transfer gear hub.

8.3.7
At the front of the transmission housing, drive the bearing rearward and seat it firmly against the shoulder in the bore. Install the snap ring to retain the bearing (Fig. 85).

8.3.8
Reseat the rear bearing, if necessary.

8.3.9
Apply nonhardening sealant onto the outside diameter of lip-type oil seal (7), and install the seal, spring-loaded lip first into the front output bore. Press or drive the seal squarely and lightly against the counterbore in the housing.

8.3.10
Apply nonhardening sealant onto the outside diameter of lip-type oil seal (27) and install the seal, spring-loaded lip first, into the rear output bore. Press or drive the seal squarely and lightly against the counterbore in the housing.

8.3.11
Two-piece Output Shaft. If the front output shaft bearing was removed, replace the bearing, shield side last, into the housing bore (Fig. 86). Seat the front bearing firmly against the shoulder in the bore, and install the snap ring against the bearing outer race.

8.3.12
If the lip-type oil seal was removed, apply nonhardening sealant onto the outside diameter of a new seal. Install the seal, spring-loaded lip first, and press it squarely into the bore until it is lightly seated against the counterbore shoulder (Fig. 86).

8.3.13
If the shifter shaft oil seal was removed, apply nonhardening sealant onto the outside diameter of a new seal. Install the seal, spring-loaded lip first, and press it squarely into the bore at the front of the housing, until it is lightly seated against the counterbore shoulder.

8.3.14
Install one ball (11) (Fig. 87), spring (12), and other ball (11) into front output shaft (10). While holding these balls against the spring pressure, slide disconnect coupling (13), grooved end first, onto shaft (10) until the rear end of the coupling is flush with the shaft rear splines (disengaged position) (Fig. 88).

8.3.15
Install the front output shaft and assembled disconnect coupling, threaded end first into the rear output shaft bearing bore (Fig. 88). Support the inner race of the front output bearing (Fig. 86), and seat the shoulder of the front output shaft against the bearing.

8.3.16
Install the output shaft center bearing, shield side first, into the web of the transmission housing (Fig. 89). Press or tap on the bearing outer race to seat it against the shoulder

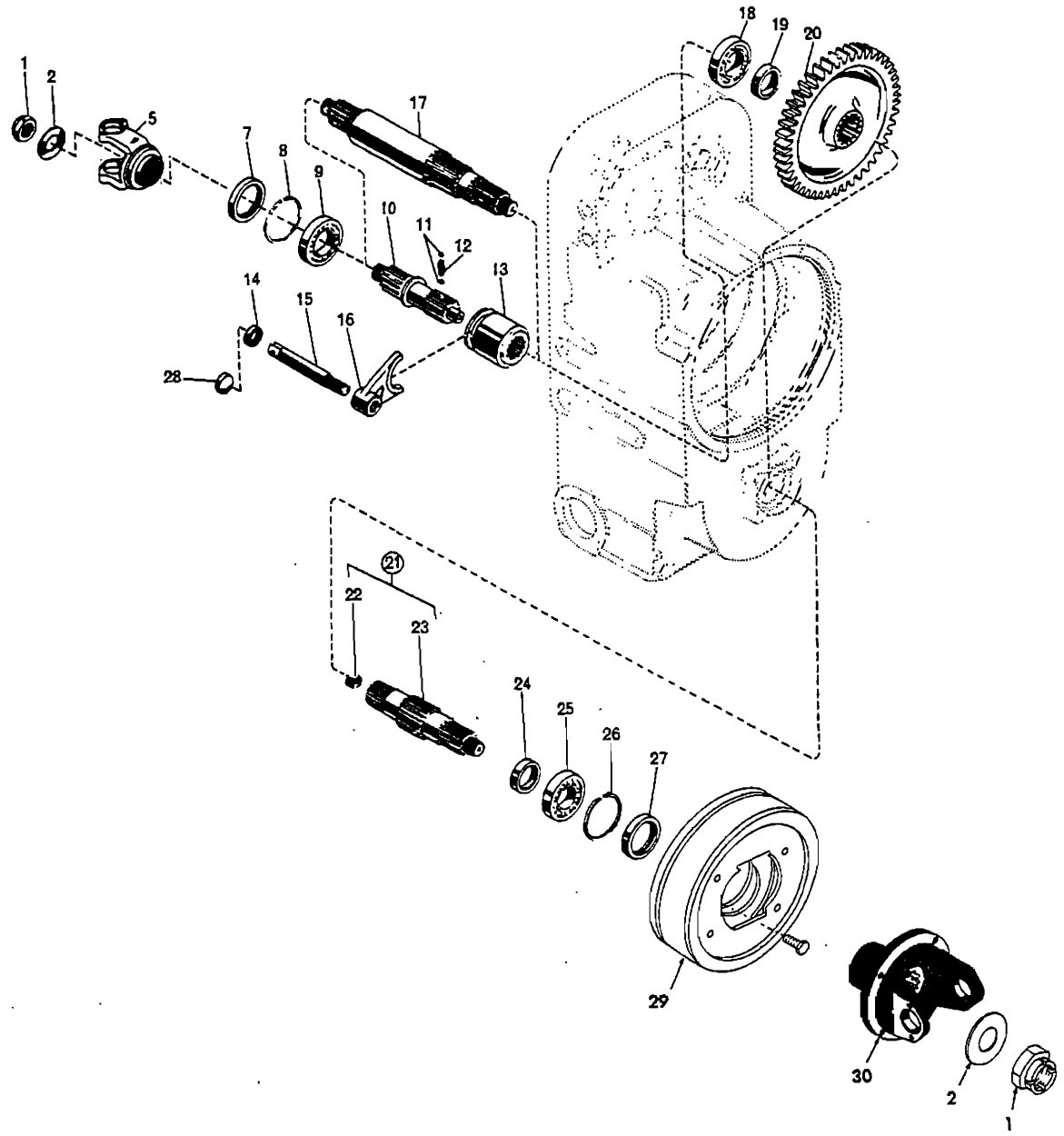


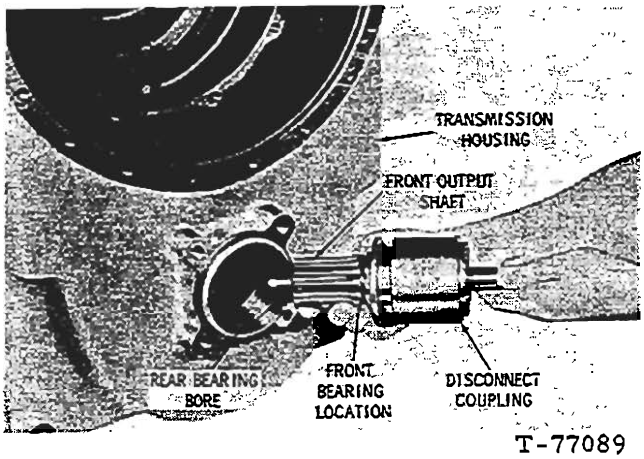
FIG. 87 OUTPUT SHAFTS AND REAR AXLE DISCONNECT ASSEMBLY

1. Nut (nylon insert)
2. Washer
5. Flange (yoke type)
7. Lip-type oil seal
8. Internal snap ring
9. Ball bearing
*10. Front output shaft
*11. Detent ball
*12. Detent spring
*13. Disconnect coupling
14. Lip-type oil seal
*15. Shifter fork shaft
*16. Shifter fork
*17. Output shaft
*18. Ball bearing
19. Spacer
20. Transfer driven gear
*21. Rear output shaft assembly
*22. Bushing
*23. Rear output shaft
24. Spacer
25. Ball bearing
26. Internal snap ring
27. Lip-type oil seal
28. Shifter fork shaft orifice plug
29. Brake assembly
30. Output yoke

*Used on transmissions equipped with rear axle disconnects only.

in the housing web bore.

8.3.17
Install the transfer driven gear (Fig. 53).



T-77089

FIG. 88 INSTALLING FRONT OUTPUT SHAFT AND DISCONNECT COUPLING

8.3.18
If bushing (22) (Fig. 87), was removed from rear output shaft (23), install a new bushing. Press the bushing into the front bore of the shaft until it is recessed 0.160 to 0.200 inch (3.06 to 5.08 mm) below the shaft end surface.

8.3.19
If bearing (25) or spacer (24) were removed from rear output shaft assembly (21), replace them. Install spacer (24) and bearing (25), shield side last, onto the shaft. Seat the bearing firmly against the spacer.

8.3.20
Place the spacer at the front side of the transfer driven gear hub (Fig. 90). Install the assembled rear output shaft, splined end first, through the splined hub of the gear, the spacer, and the center support bearing.

8.3.21
Support the transfer driven gear and drive the rear output shaft assembly and bearing forward (Fig. 91). If necessary, reseat the rear bearing by driving on its inner race until the outer race clears the snap ring groove in the bore.

8.3.22
Install the snap ring, and tap progressively around its circumference until it snaps into place against the bearing (Fig. 92).

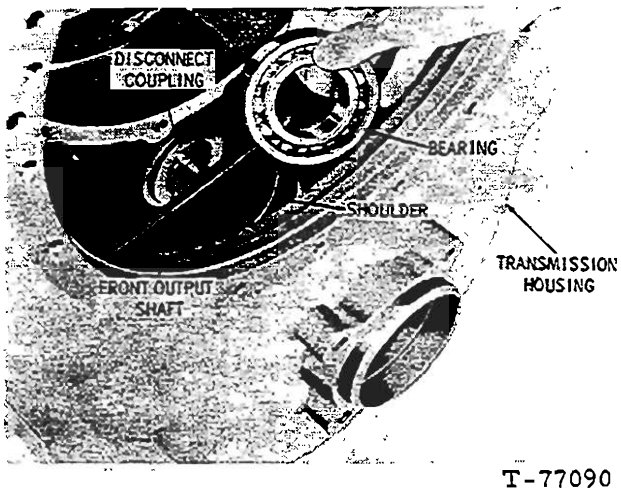


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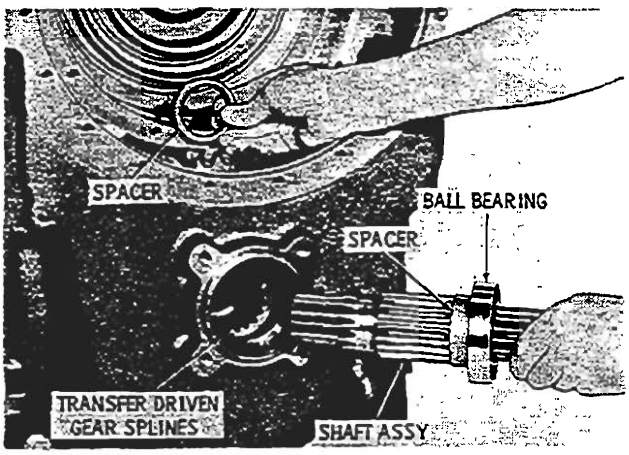
FIG. 89 INSTALLING OUTPUT SHAFT CENTER BEARING

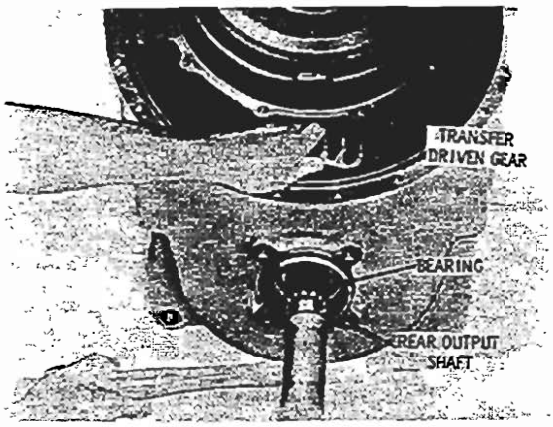


T-77091

FIG. 90 INSTALLING REAR OUTPUT SHAFT ASSEMBLY

8.3.23
Apply nonhardening sealant onto the outside diameter of a new lip-type oil seal. Install the new seal, spring-loaded lip first, and press it squarely into the bore until it is lightly seated against the counterbore shoulder (Fig. 93).

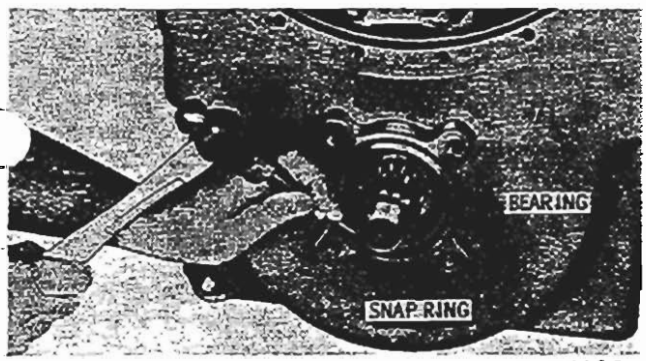
8.3.24
Position the disconnect shifter fork in the groove of the disconnect coupling (Fig. 93). While holding the fork in position, install the shifter fork shaft, threaded end first, through the oil seal in the front of the housing and fully engage the threads in the shifter fork. Refer to paragraph 3.7.2 for final adjustment of the shifter fork shaft.



T-77096

FIG. 91 SEATING REAR OUTPUT SHAFT IN HOUSING

8.3.25
Rear Output Shaft (when no front shaft is used) Install bearing (18) (Fig. 87), shield side first, into the web of the transmission housing (Fig. 89). Press or tap on the bearing outer race to seat it against shoulder in the housing web bore.



T-77097

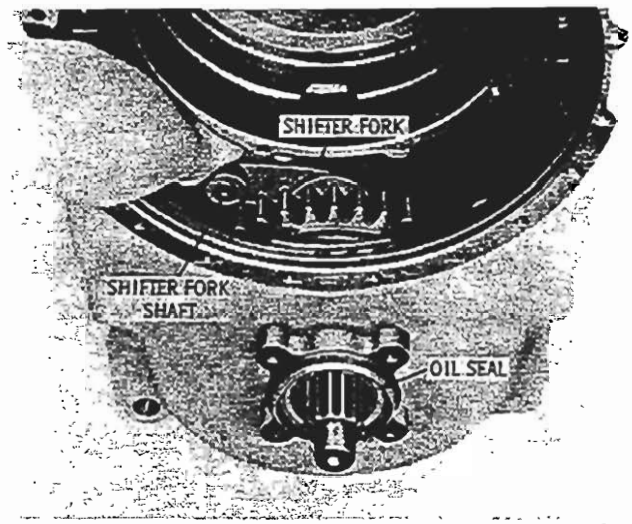
FIG. 92 INSTALLING REAR OUTPUT SHAFT SNAP RING

8.3.26
Install the transfer driven gear (Fig. 53).

8.3.27
If bearing (25) (Fig. 87) or spacer (24) were removed from rear output shaft (23), replace them. Install spacer (24) and bearing (25), shield side last, onto the shaft. Seat the bearing firmly against the spacer.

8.3.28
Place the spacer at the front side of the transfer driven gear hub (Fig. 90). Install the assembled rear output shaft, splined end first, through the splined hub of the gear, the spacer, and the bearing installed in the housing web.

8.3.29
Support the transfer driven gear, and drive the assembled rear output shaft forward (Fig. 91). If necessary, reseat the rear bearing by driving on its inner race until the outer race clears the snap ring groove in the bore.



T-77098

FIG. 93 INSTALLING DISCONNECT SHIFTER FORK AND SHAFT

8.3.30
Install the snap ring, and tap progressively around its circumference until it snaps into place against the bearing (Fig. 92).

8.3.31
Apply nonhardening sealant onto the outside diameter of a new lip-type oil seal. Install the new seal, spring-loaded lip first, and press it squarely into the bore until it is lightly seated against counterbore shoulder (Fig. 93).

8.3.32
If shifter shaft hole plug (28) was removed, replace it. Apply nonhardening sealant onto the outside diameter of the plug. Install the plug, closed end first, and seat it against the shoulder in the housing bore.

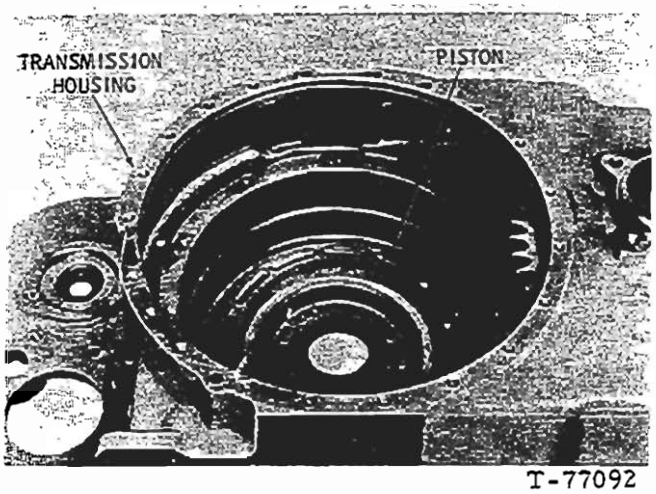
8.4 INSTALLATION OF RANGE CLUTCH

8.4.1
Reverse-range Clutch, Planetary. Position the transmission housing on blocks on its front splitline (Fig. 94). Install the reverse range clutch piston (as assembled in paragraph 7.10.5) into the transmission housing.

8.4.2
Beginning with an external-tanged clutch plate, alternately install four external-tanged clutch plates and four internal-splined clutch plates onto the reverse-range piston (Fig. 95). Install the reverse-range planetary carrier assembly, long splines first, into the reverse-range plates stacked on the

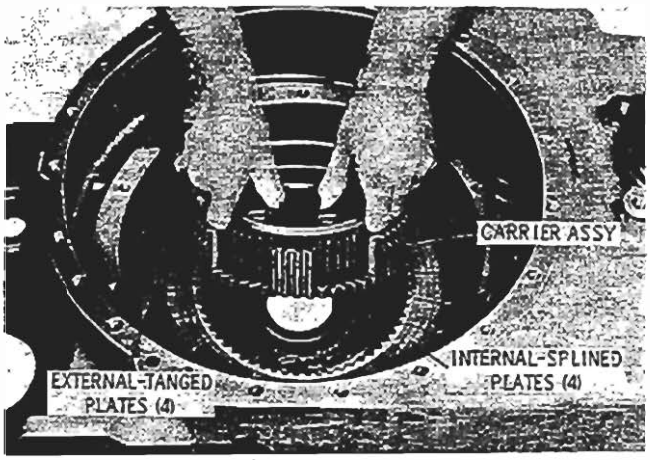
piston.

8.4.3
Install one external-tanged plate and one internal-splined plate onto the reverse-range planetary carrier assembly (Fig. 96).



T-77092

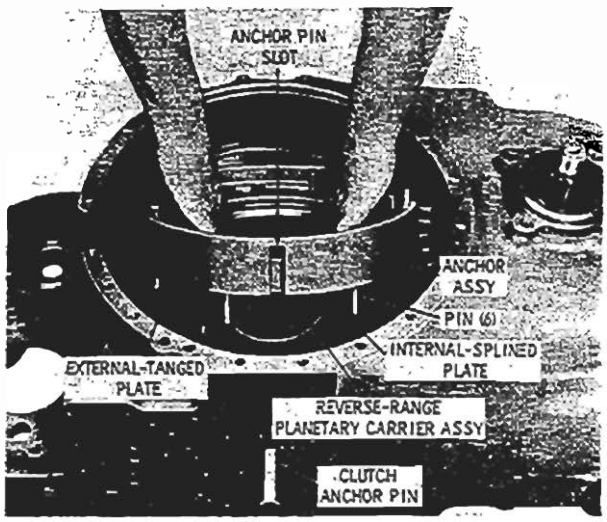
FIG. 94 REVERSE-RANGE CLUTCH PISTON INSTALLED



T-77093

FIG. 95 INSTALLING REVERSE-RANGE PLANETARY CARRIER ASSEMBLY

8.4.4
Aline the slots of the five reverse-range, external-tanged clutch plates to receive the pins in the clutch anchor assembly (Fig. 96). Install the clutch anchor pin into the control valve mounting pad on the left side of the transmission housing. Alining the anchor pin slot with the clutch anchor pin hole within the transmission housing, install the reverse-and-low-range clutch anchor assembly, longer ends of pins downward, and engage the slots of the five external-tanged clutch plates. Be sure that the six notches of the five external-tanged plates are engaged by the six anchor pins in the anchor assembly.



T-77094

FIG. 96 INSTALLING REVERSE-AND-LOW-RANGE CLUTCH ANCHOR ASSEMBLY

8.4.5
Push the clutch anchor pin into the slot in the reverse-and-low-range clutch anchor assembly (Fig. 97). Temporarily install a bolt and a flat washer to retain the anchor pin during subsequent assembly operations.

8.4.6
Low-range Clutch and Planetary. Assemble the low-range planetary carrier assembly onto the reverse-range ring gear (Fig. 39).

8.4.7
Install the assembled reverse-range ring gear and low-range planetary carrier, engaging the reverse-range ring gear teeth with the planetary pinion teeth (Fig. 97).

8.4.8
Place an external-tanged plate between two internal-splined plates and install them as a unit onto the flat side of the low-range ring gear (Fig. 98). Install the assembled clutch plates and ring gear, flat side first, onto the low-range planetary carrier assembly; and engage the slots of the external-tanged plate onto the six clutch anchor pins.

8.4.9
Starting with an external-tanged clutch plate, alternately install three external-tanged clutch plates and two internal-splined clutch plates onto the low-range ring gear (Fig. 99).

8.4.10
Install the 12 piston return springs and spring guide pins into the holes in the clutch anchor assembly (Fig. 99).

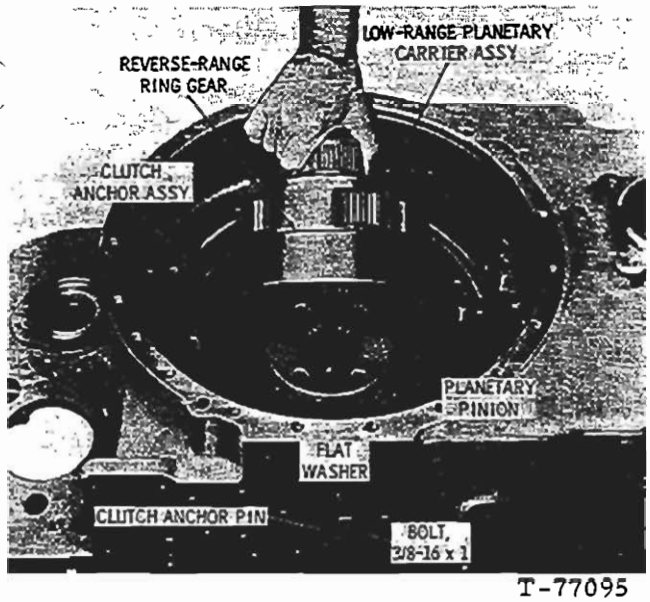


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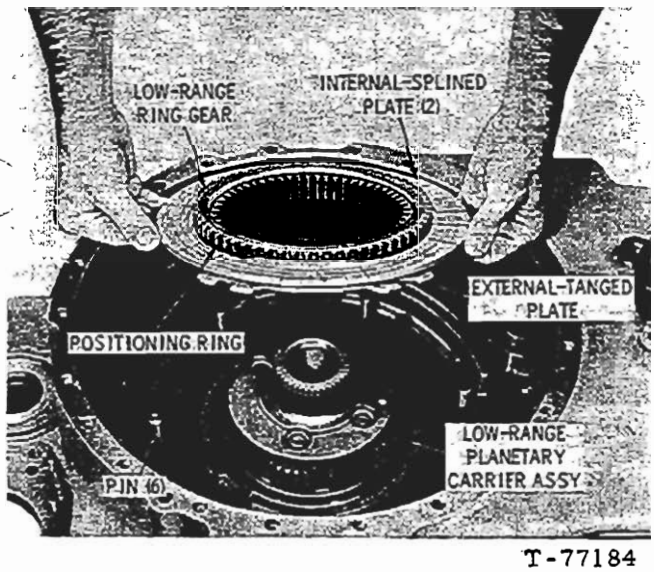
FIG. 97 INSTALLING LOW-RANGE PLANETARY CARRIER ASSEMBLY AND REVERSE-RANGE RING GEAR



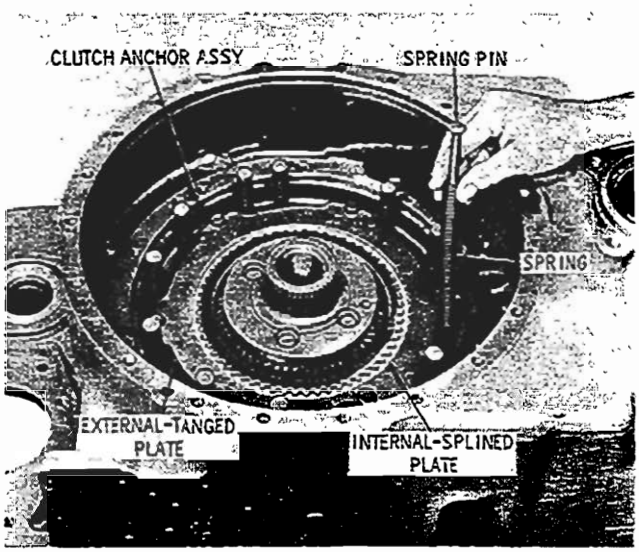
T-77184

FIG. 98 INSTALLING LOW-RANGE RING GEAR AND THREE CLUTCH PLATES

8.4.11
If plug (20) (Fig. 74) was removed from low-range clutch piston housing (19), replace it. Apply nonhardening sealant onto the plug threads, and install the plug into the housing. Tighten the plug sufficiently to prevent leakage.

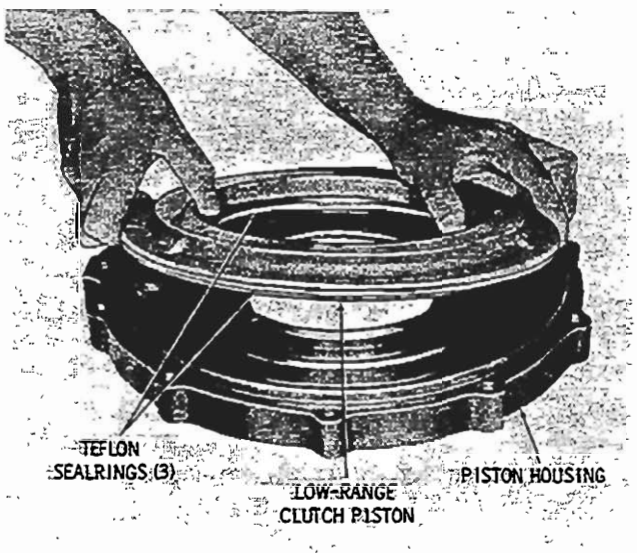
8.4.12
Install the low-range clutch piston (as assembled in paragraph 7.10.5), flat side first, into the low-range clutch piston housing (Fig. 100).

8.4.13
Install the low-range clutch piston housing and piston assembly and attach it with ten self-locking bolts (Fig. 101). Use two of the longer valve body mounting bolts to draw the piston housing down sufficiently to engage the self-locking bolts. Remove the two draw bolts, and install the two remaining, self-locking bolts. Tighten the bolts to 36 to 43 pound feet (5.0 to 5.9 kg/m) torque.



T-77099

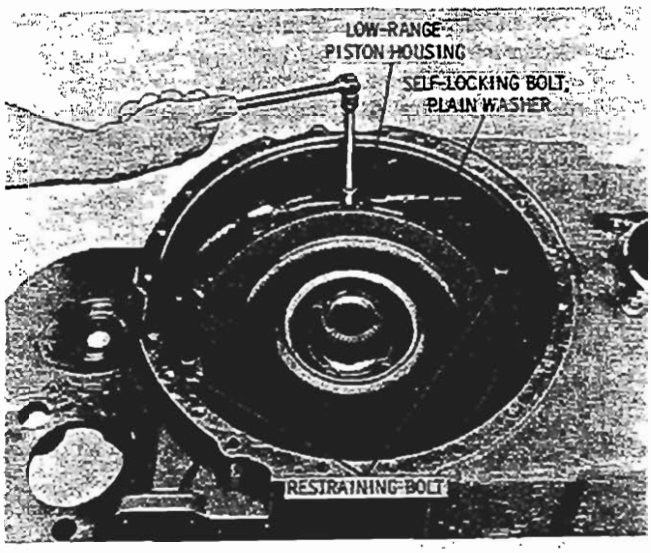
FIG. 99 INSTALLING PISTON RETURN SPRINGS AND GUIDE PINS



T-77100

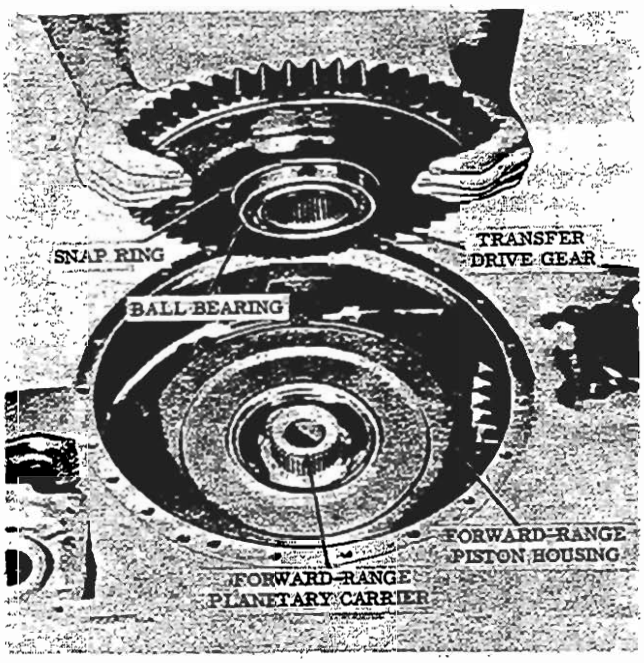
FIG. 100 INSTALLING LOW-RANGE CLUTCH PISTON INTO PISTON HOUSING

8.4.14
Transfer Drive Gear, High-range Clutch Assembly. Install the transfer drive gear (as assembled in paragraph 7.10.4), bearing first, onto the splined hub of the low-range planetary carrier (Fig. 102).



T-74374

FIG. 101 INSTALLING LOW-RANGE CLUTCH PISTON HOUSING BOLTS



T-71510

FIG. 102 INSTALLING TRANSFER DRIVE GEAR ASSEMBLY

8.4.15
Using a suitable hook-type tool, raise the low-range planetary carrier sufficiently to expose the snap ring groove in the splined hub, and install the snap ring (Fig. 103).

8.4.16
Install the high-range clutch hub (as assembled in paragraph 7.10.3) onto the transfer drive gear (Fig. 104). Install the high-range clutch hub assembly, splined end of shaft first, into the hub of the transfer drive gear (Fig. 35).

8.5 INSTALLATION OF HIGH-RANGE CLUTCH PISTON HOUSING, REAR COVER

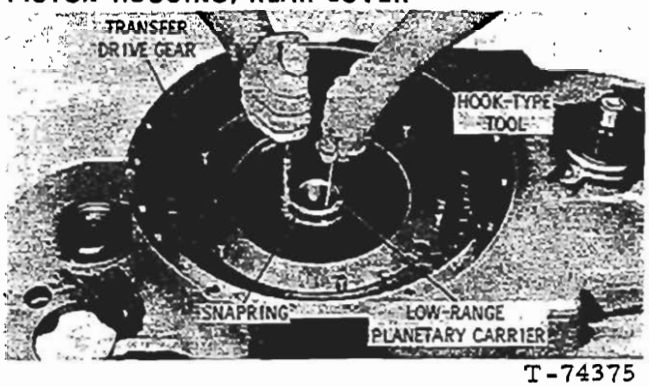


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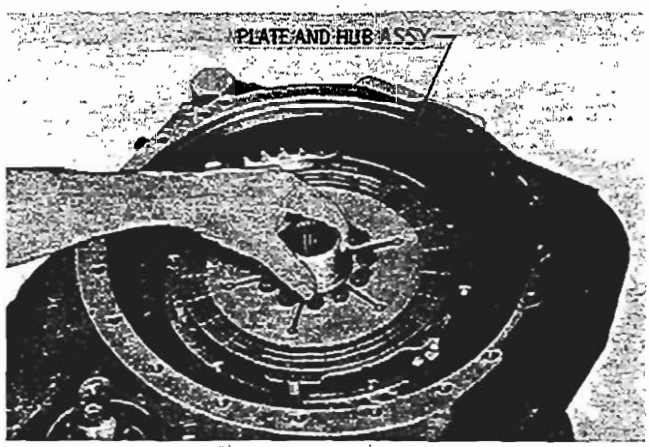
FIG. 103 INSTALLING TRANSFER DRIVE GEAR SNAP RING



T-77101

FIG. 104 INSTALLING HIGH-RANGE CLUTCH PLATE AND HUB ASSEMBLY

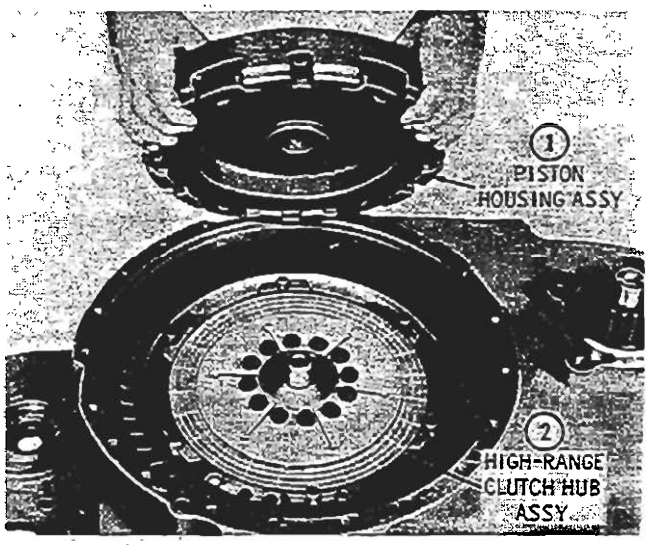
8.5.1
High-range Clutch Piston Housing. Install the high-range clutch piston housing and attached parts (as assembled in paragraph 7.10) onto the transfer drive gear (Fig. 105). During installation, aline and engage the recesses in the piston with the drive pins in the transfer drive gear.

8.5.2
Using a soft hammer, seat the piston housing in the counterbore of the drive gear, and install the six locktabs and six bolts (Fig. 106). Tighten the bolts to 83 to 100 pound feet (11.5 to 13.8 kg/m) torque. Bend the locktabs against the bolt heads.

8.5.3
Rear Cover. If the pipe plug was removed from the rear cover, replace it (Fig. 106). Apply nonhardening sealant onto the plug threads and install the plug into the rear cover. Tighten the plug sufficiently to prevent leakage.

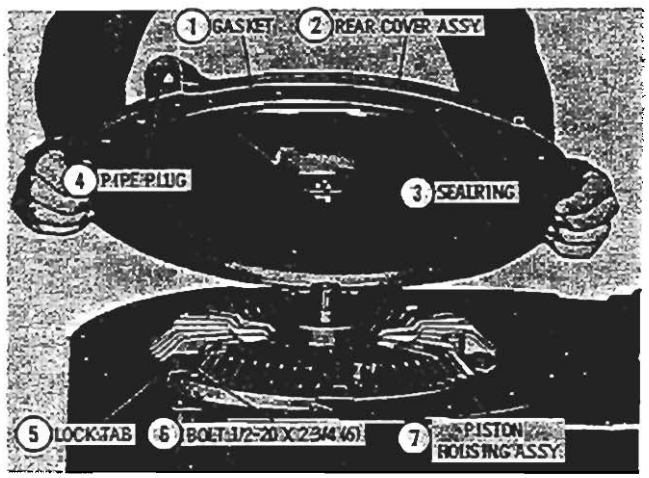
8.5.4
Lubricate the seal ring and install it into the

groove in the rear cover pilot diameter (FIG. 106). Apply oil soluble grease onto the gasket and install the gasket onto the rear cover pilot diameter. Carefully install the rear cover onto the transmission housing, being sure to locate the pilot on the high-range clutch piston housing into the counterbore in the rear cover. Do not force or hammer the cover onto the housing pilot, or damage to the housing may result. Retain it with nineteen bolts and lockwashers. Tighten the bolts to 26 to 32 lb-ft (3.6 to 4.4 kg-m) torque.



T-74376

FIG. 105 INSTALLING HIGH–RANGE CLUTCH PISTON HOUSING ASSEMBLY



T-77102

FIG. 106 INSTALLING TRANSMISSION REAR COVER

8.6 INSTALLATION OF TURBINE GEARING AND OIL SUCTION TUBE

8.6.1
Accessory drive shaft assembly. If bearing (9), FIG. 63 was removed from accessory drive shaft (8), replace it.

8.6.2
Install bearing (9) onto drive shaft (8) and seat the bearing firmly against the shaft shoulder.

8.6.3
Install the accessory drive shaft and bearing into the transmission housing (FIG. 107).

8.6.4
Turbine Gears, Freewheel Clutch. Install the forward-and-reverse-range sun gear, as shown in FIG. 107.

8.6.5
Install the first-turbine drive gear and bearing (as assembled in paragraph 79) as a unit (FIG. 108). Install the step-joint seal ring into the groove in the drive gear hub. Install the rear thrust bearing race (flat) and the needle roller bearing onto the drive gear.

8.6.6
Install the turbine-driven gears and freewheel clutch assembly (as assembled in paragraph 7.8) as a unit (FIG. 109). Rotate the assembly to engage the second-turbine driven gear splines with those of the reverse-and-low range sun gear.

8.6.7
Lubricate the compression seal ring with clean transmission fluid. Install the male nut and compression seal ring onto the pump end of the oil suction tube (FIG. 109). Insert the suction end of the tube into the sump area, and the pump end into the threaded hole at the pump intake. Make sure the seal ring is squarely seated in the intake boss.

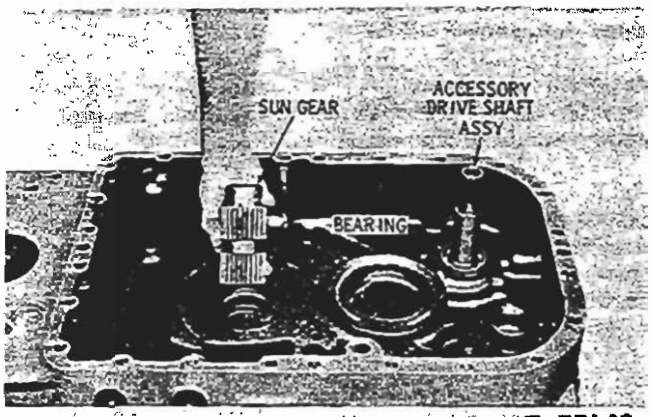
8.6.8
Install one self-locking bolt to secure the suction tube to the housing (FIG. 110), but do not tighten bolt at this time. Seat the compression seal ring evenly into the housing bore and tighten the male nut to 120-150 lb-ft (16.6 - 20.7 kg-m). Tighten the self-locking bolt to 36-43 lb-ft (5.0 - 5.9 kg-m).

8.6.9
If the ball bearing was removed from the second-turbine drive gear, install a new bearing (FIG. 110). Install the step-joint seal ring into its groove near the bearing. Install the front thrust bearing race, flange first, onto the bottom (rear) of the drive gear. Use oil soluble grease to retain the bearing race on the drive gear. Install the second-turbine drive gear and assembled parts onto the first-turbine drive gear.

8.7 INSTALLATION OF CONVERTER HOUSING, CONVERTER COMPONENTS

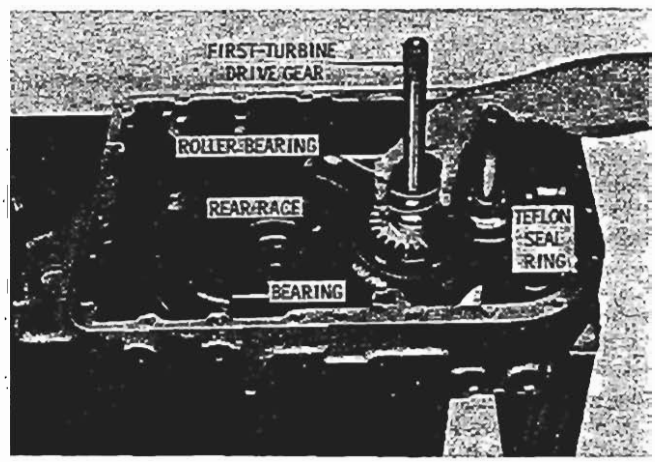
8.7.1
Converter Housing. Install the gasket onto the converter housing splitline. Use oil soluble grease to retain the gasket during installation of the housing (FIG. 111). Attach a sling to the housing front flange and, while lowering the converter housing (as assembled in paragraph 7.7) onto the transmission

housing, guide the accessory driven gear past the second-turbine drive gear. Seat the converter housing and remove the sling.



T-77103

FIG. 107 INSTALLING REVERSE-AND-LOW RANGE SUN GEAR



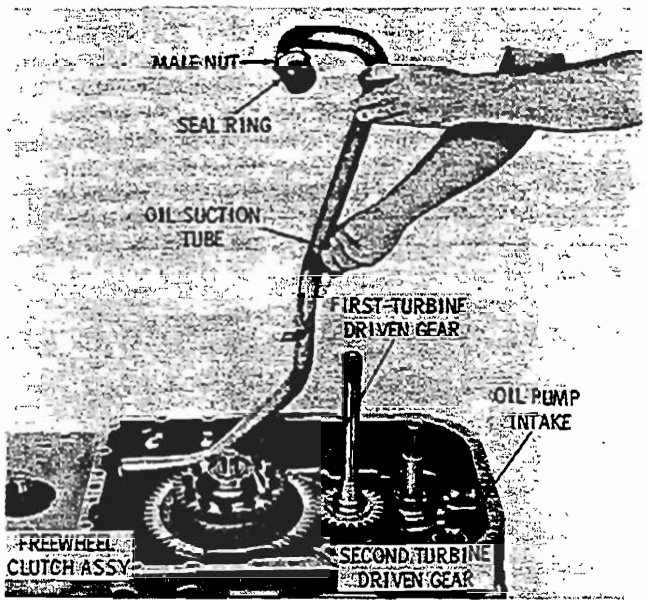
T-77104

FIG. 108 INSTALLING FIRST-TURBINE DRIVE GEAR COMPONENTS

8.7.2
To attach the converter housing, install one bolt, twenty-three capscrews, twenty-four flat washers, and twenty-four lockwashers (Fig. 112). Tighten the bolts to 42 to 50 pound feet (5.8 to 6.9 kg/m) torque.

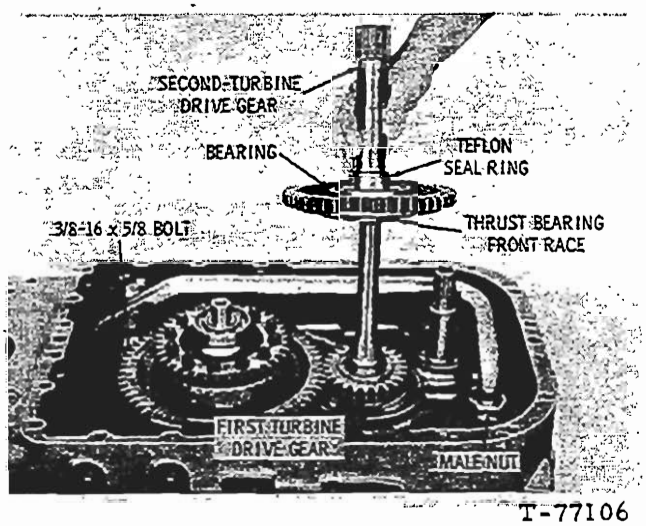
8.7.3
Converter Components. Check to insure that the step-joint seal ring (installed in paragraph 7.7) is firmly seated in the converter housing sleeve, and that the diaphragm oil seal is packed with high-temperature grease (Fig. 112).

8.7.4
Install the torque converter pump (as assembled in paragraph 7.6) onto the converter ground sleeve (Fig. 113). Install the splined, flat stator spacer and stator, hub projection first, onto the ground sleeve.



T-77105

FIG. 109 INSTALLING OIL SUCTION TUBE



T-77106

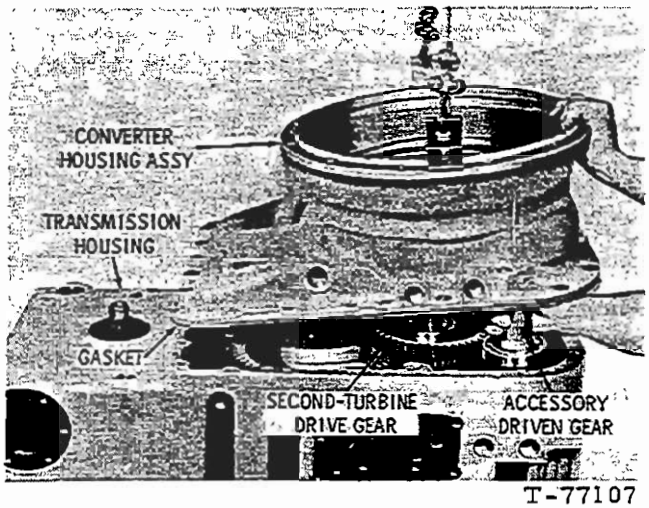
FIG. 110 INSTALLING SECOND-TURBINE DRIVE GEAR

8.7.5
Install the snap ring onto the converter ground sleeve to retain the stator (Fig. 114). Install the first-and second-turbine assembly (as assembled in paragraph 7.5) onto the turbine drive gear shafts.

8.7.6
Install the seal ring into the groove in the converter pump splitline (Fig. 115).

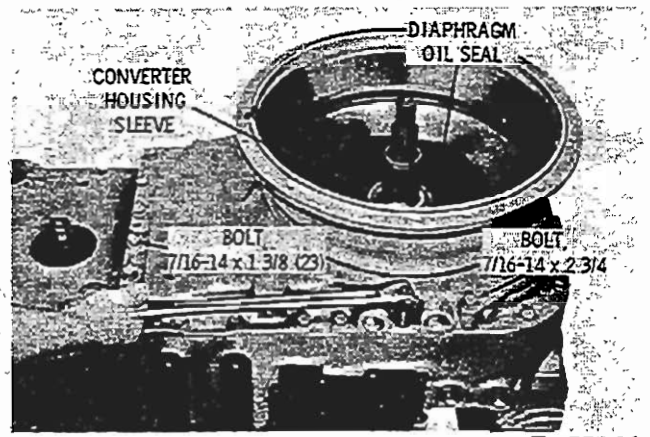
8.8 INSTALLATION OF INPUT COMPONENTS

8.8.1
Direct Mount (flex disk). Install the torque converter drive cover (Fig. 115).



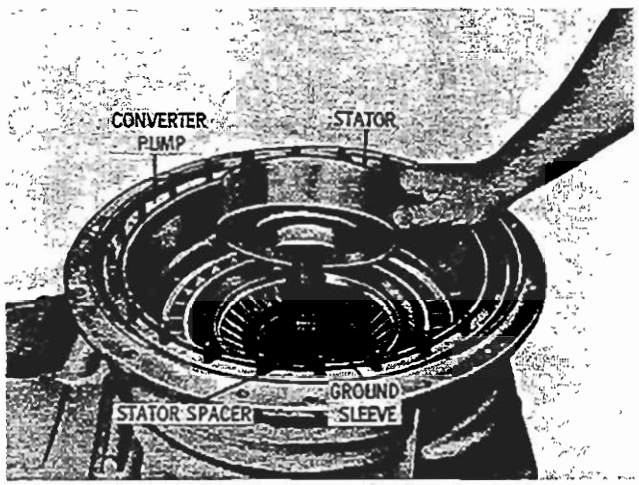
T-77107

FIG. 111 INSTALLING TORQUE CONVERTER HOUSING ASSEMBLY



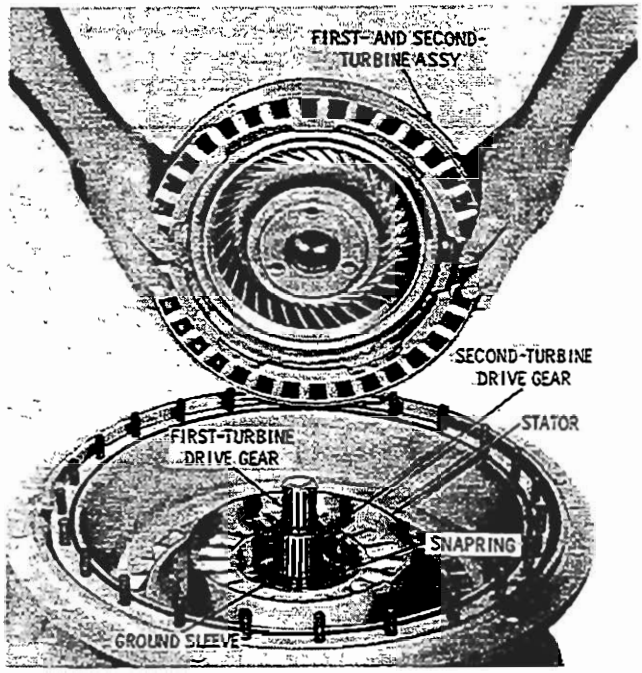
T-77108

FIG. 112 INSTALLING TORQUE CONVERTER HOUSING BOLTS



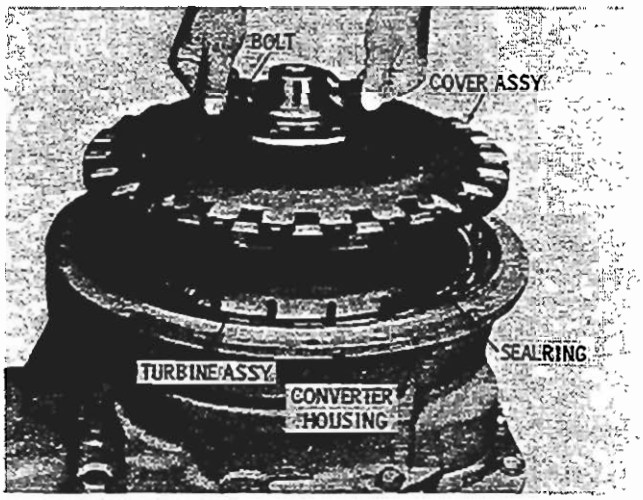
T-77109

FIG. 113 INSTALLING TORQUE CONVERTER STATOR



T-77110

FIG. 114 INSTALLING FIRST-AND-SECOND-TURBINE ASSEMBLY



T-77111

FIG. 115 INSTALLING TORQUE CONVERTER DRIVE COVER - DIRECT MOUNT

8.8.2
Install twenty-four, self-locking nuts to retain the cover (Fig. 116). Tighten the nuts to 14 to 18 pound feet (1.9 to 2.5 kg/m) torque.

8.8.3
Install the flex disk and washer assembly, washer side first, onto the hub of the converter cover (Fig. 116). Assemble the three flex disks so that the cone of each will be parallel to the flex disk and washer assembly and install the three disks as a unit. Install the

disk plate and aline all the disk holes with the tapped holes in the converter drive cover. Install six self-locking bolts and tighten them to 81 to 97 pound feet (11.2 to 13.4 kg/m) torque. Install gasket (12) (Fig. 115A) when attaching transmission to engine housing.

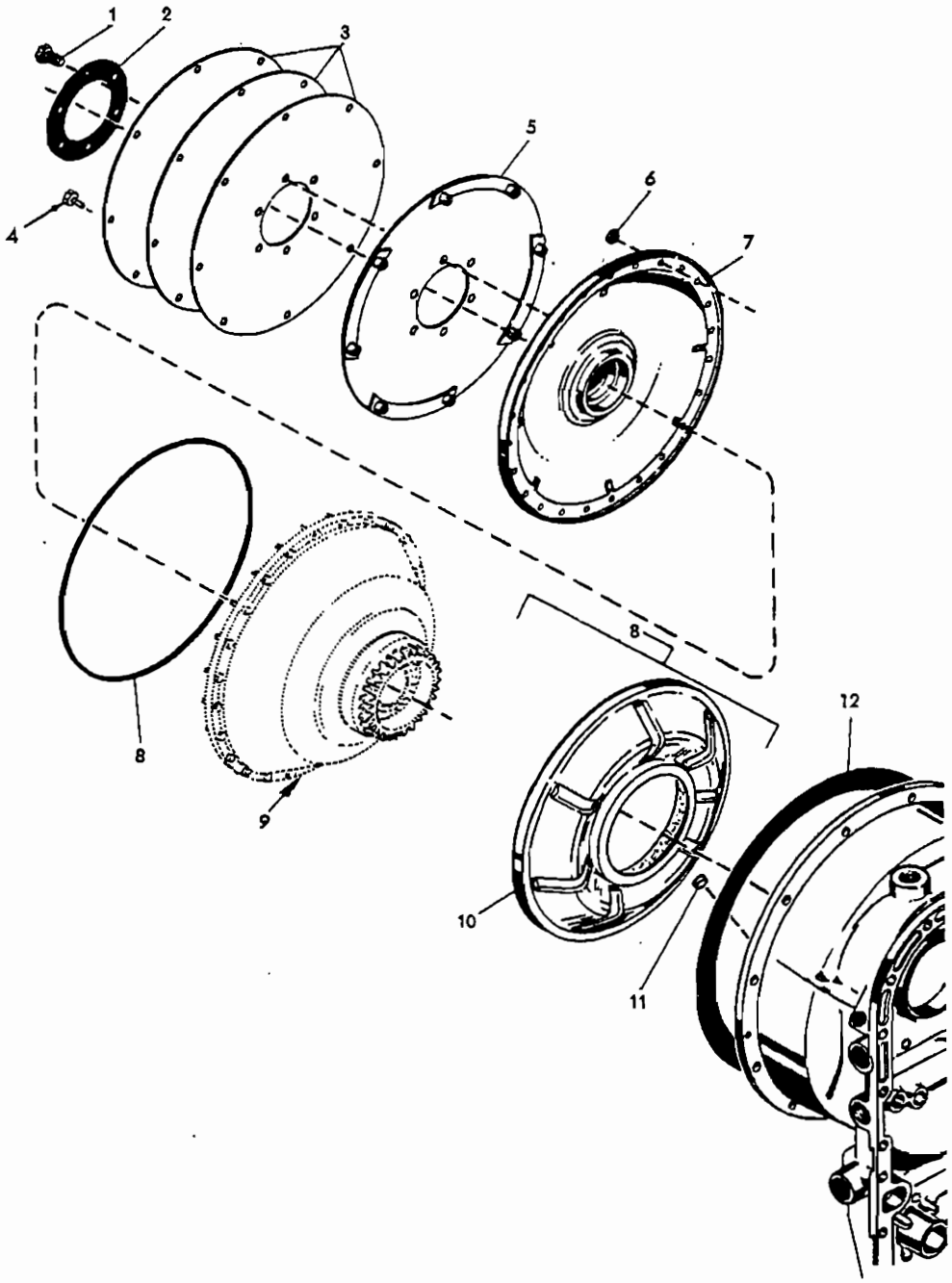
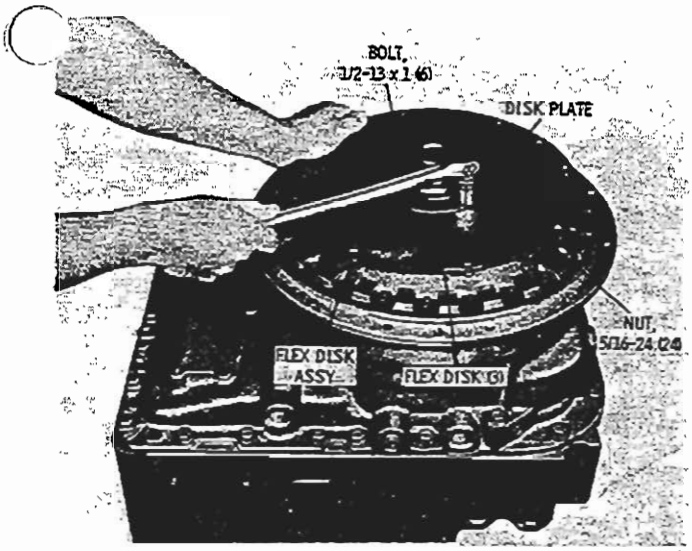


FIG. 115A FLEX DISK AND CONVERTER DRIVE

1. Self-locking bolt
2. Flex disk plate
3. Flex disk
4. Capscrew
5. Flex disk and washer assy.
6. Nut
7. Torque converter drive cover
8. Seal ring
9. Torque converter pump assy. (See Torque Converter Hsg.)
10. Converter diaphragm
11. Plug
12. Gasket



T-77179

FIG. 116 INSTALLING FLEX DISK ASSEMBLY (DIRECT MOUNT)

8.9 INSTALLATION OF EXTERIOR COMPONENTS

8.9.1
Oil Pump. Install the oil pump assembly and oil pump gasket onto the pump mounting pad Fig. 117A).

8.9.2
Retain the pump with two bolts, seven capscrews and nine lockwashers (Fig. 43). Tighten the bolts to 26 to 32 pound feet (3.6 to 4.4 kg-m) torque.

8.9.3
Control Valve Body. Remove the temporarily installed bolt and washer from the valve body mounting pad (Fig. 97). Install the valve body gasket and retain it with oil soluble grease (Fig. 118). Install the control valve body assembly.

8.9.4
Install fifteen bolts, one capscrew, and sixteen lockwashers (Fig. 20). Progressing from the center of the valve body outward, tighten the bolts evenly to 26 to 32 pound feet (3.6 to 4.4 kg/m) torque.

8.9.5
Parking Brake, Output Flanges. Install the brake back plate onto its mounting pad (Fig. 119). Secure the back plate with four self-locking bolts. Tighten the bolts to 81 to 97 pound feet (11.2 to 13.4 kg/m) torque.

8.9.6
Install the spacer roller onto the back plate lever, and install the brake apply arm (Fig. 120).

8.9.7
Install two brake shoes and two springs (Fig. 120). Install the two springs into the brake shoe holes nearer the back plate.

8.9.8
Install the brake drum onto the output flange (Fig. 123). Attach the brake drum with four self-locking bolts. Tighten the bolts to 41 to 49 pound feet (5.7 to 6.8 kg/m) torque. Apply molybdenum disulfide grease (Molykote Type G, or equivalent) onto the threads of the flange retaining nut (10) (Fig. 124) and install output flange (8), washer (9) and nut (10) onto the output shaft. Attach an improvised holder to the flange ears as shown in Fig. 122 and tighten the nut to 600 to 700 pound feet (82.9 to 96.7 kg/m) torque.

8.9.9
Install the front output flange (Fig. 123). Apply molybdenum disulfide grease (Molykote Type G, or equivalent) onto the threads of flange retaining nut (1) (Fig. 87) and install washer (2) and nut (1) onto the output shaft.

8.9.10
Using an improvised holder and torque wrench in a manner similar to that shown in Fig. 122 tighten the nut to 600 to 700 pound feet (82.8 to 97.7 kg/m) torque.

8.9.11
Burnish New Brake Linings. Operate loader at a speed of 10 mph (16.09 km/h) then stop it by applying the parking brake. Repeat operation at least ten times at one minute intervals. The loader engine should be at closed throttle during each stop.

8.9.12
Check brake holding ability by parking loader on a reasonable grade or incline.

8.9.13
Repeat procedure in paragraph 8.9.11 until the check in step 8.9.12 is satisfactory.

8.9.14
Oil Strainer Assembly. Install the oil strainer and gasket (Fig. 19). Secure the oil strainer with six bolts and lockwashers. Tighten the bolts to 26 to 32 pound feet (3.6 to 4.4 kg/m) torque. Install oil drain plug and tighten it sufficiently to prevent leakage.

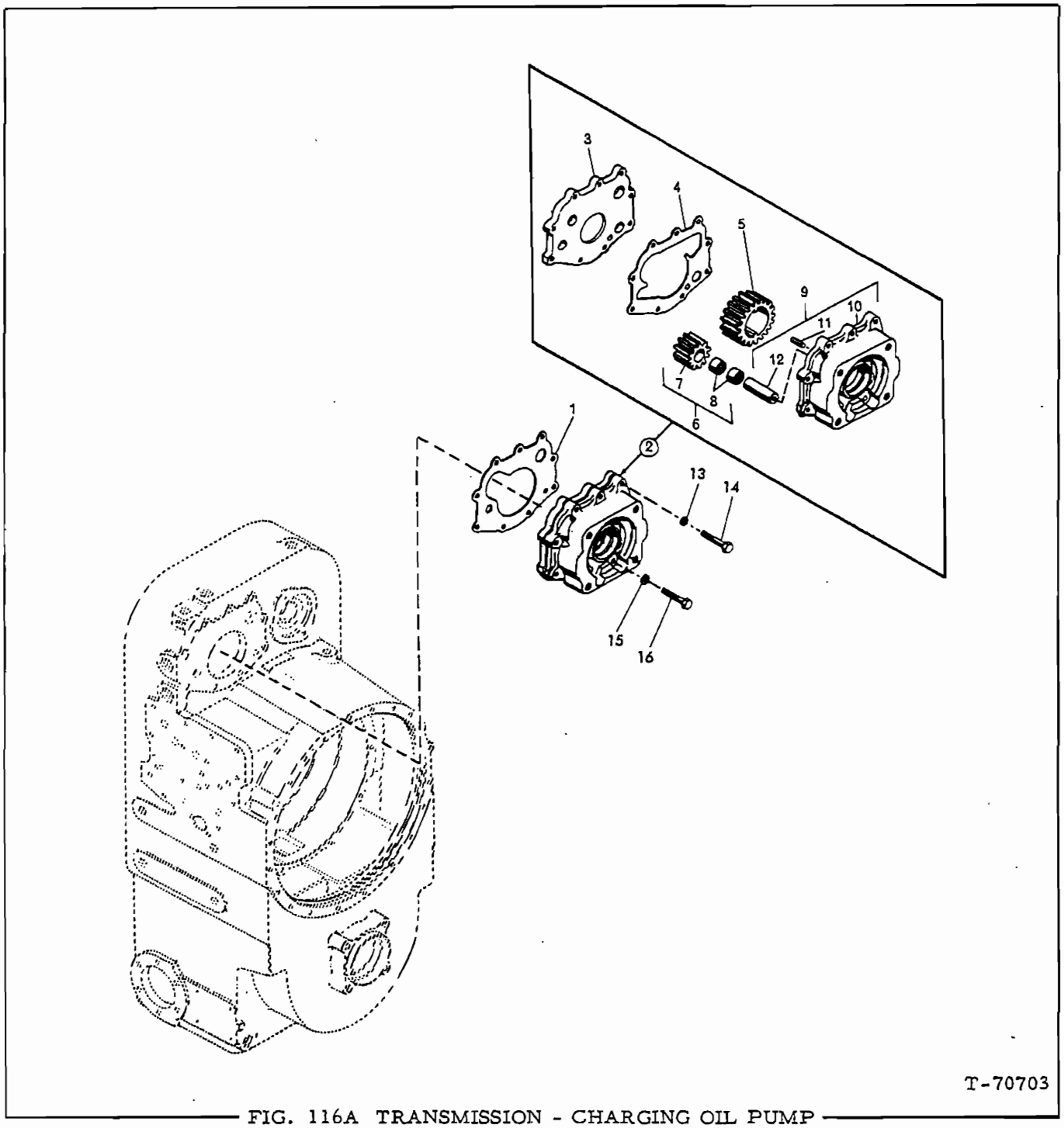
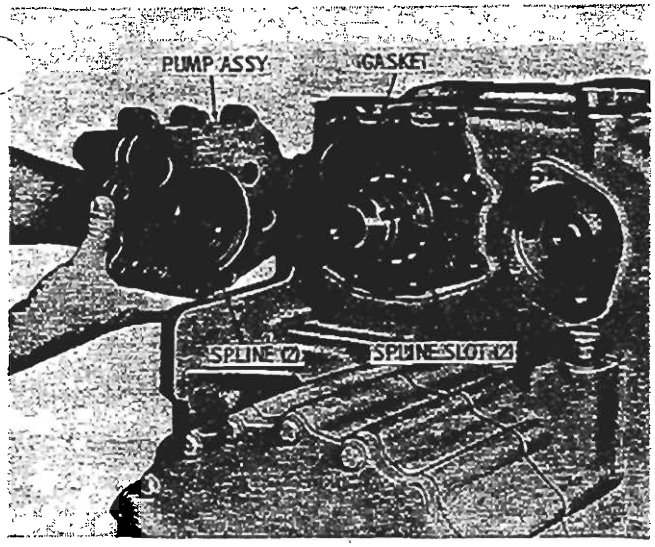


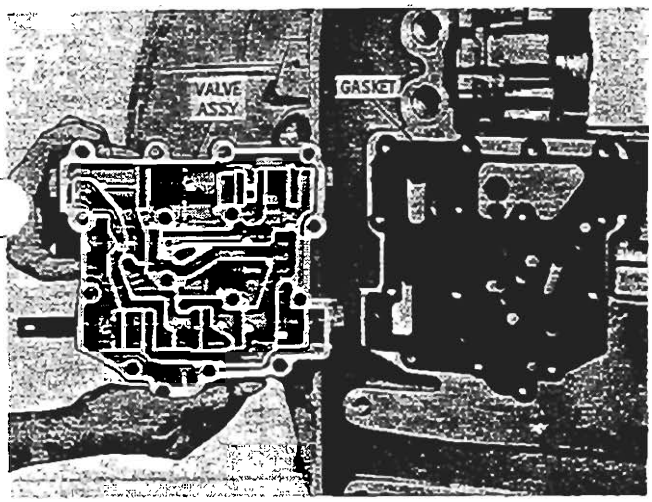
FIG. 116A TRANSMISSION - CHARGING OIL PUMP

1. Gasket
2. Oil pump assembly
3. Oil pump cover
4. Oil pump cover gasket
5. Drive gear
6. Drive gear assembly
7. Driven gear
8. Needle bearing
9. Oil pump body assembly
10. Oil pump body
11. Dowel pin
12. Driven gear shaft
13. Lockwasher
14. Bolt
15. Lockwasher
16. Bolt



T-77180

FIG. 117 INSTALLING OIL PUMP ASSEMBLY



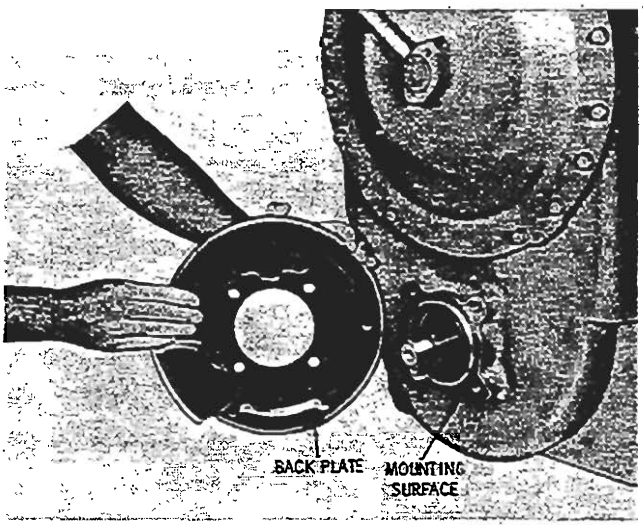
T-77035

FIG. 118 INSTALLING CONTROL VALVE BODY ASSEMBLY

8.10 ASSEMBLY TECHNIQUES

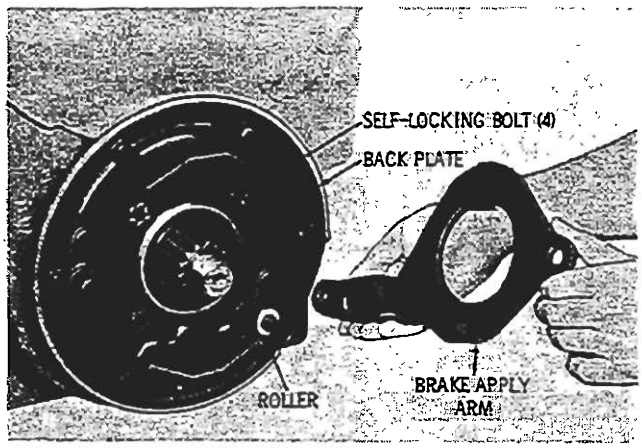
8.10.1
Similar Procedures. Components are installed into the transmission in the loader by methods similar to those used when the transmission is removed. The methods and sequence outlined in the manual are a general guide but may require some variation because of positioning and space limitations.

8.10.2
Clutch Installation. Special care is required to install clutch assemblies into a transmission mounted in the loader. Make sure that all clutch plates are properly engaged with their mating components, and that all clutch springs are properly positioned.



T-77182

FIG. 119 INSTALLING PARKING BRAKE BACK PLATE



T-77112

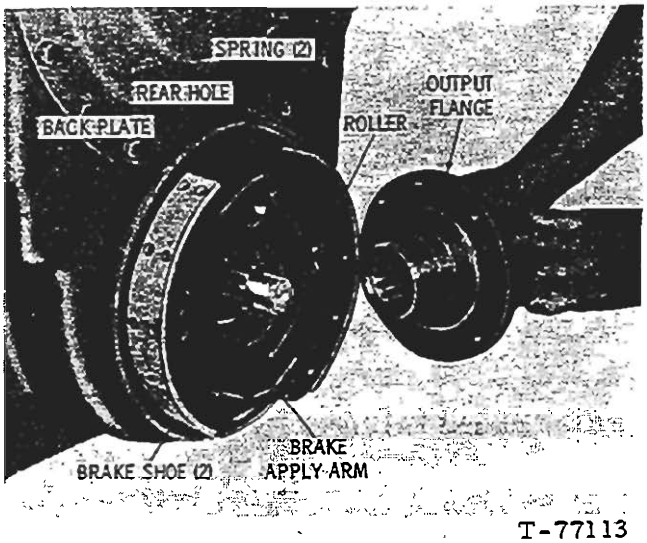
FIG. 120 INSTALLING BRAKE APPLY ARM

8.10.3
The reverse-range clutch requires that the clutch components be installed as an assembled unit. The assembly of the reverse-range clutch components described in paragraph 8.4.2 - 8.4.4 through (4) results in a clutch and planetary unit similar to that shown in Fig. 124A.

8.10.4
Using two wires or cords, tie the clutch plates to the clutch anchor assembly by passing the wires or cords over opposite tangs of the clutch plates, around the inner side of the anchor pins, and through the adjacent holes in the anchor (Fig. 124A). Secure the wire or cord ends at the under (rear) side of the clutch anchor.

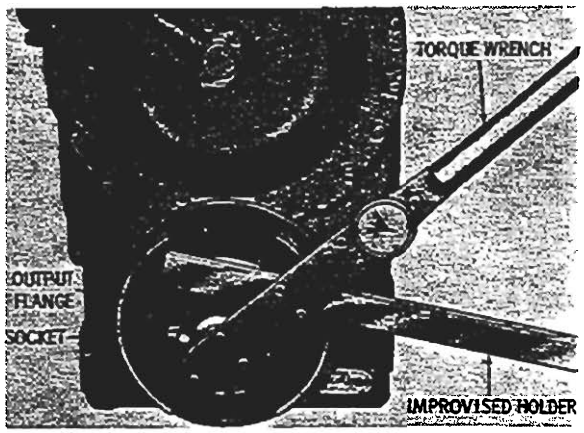
8.10.5
Install the entire assembly, clutch plates first, into the rear of the transmission, engaging the anchor pin slot with the anchor in

the transmission housing. Remove the wires or cords and continue with the assembly procedures as applicable.



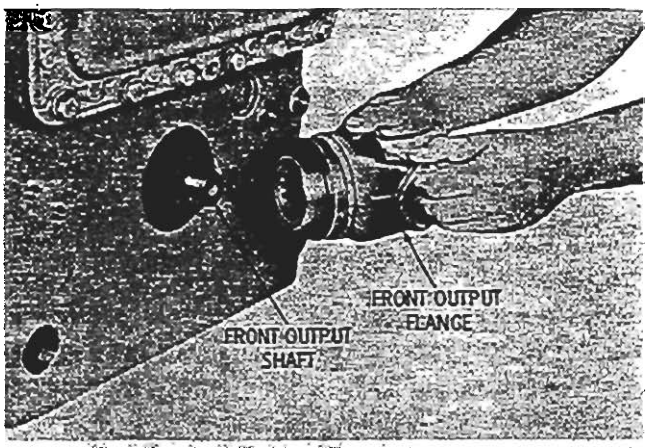
T-77113

FIG. 121 INSTALLING REAR OUTPUT FLANGE



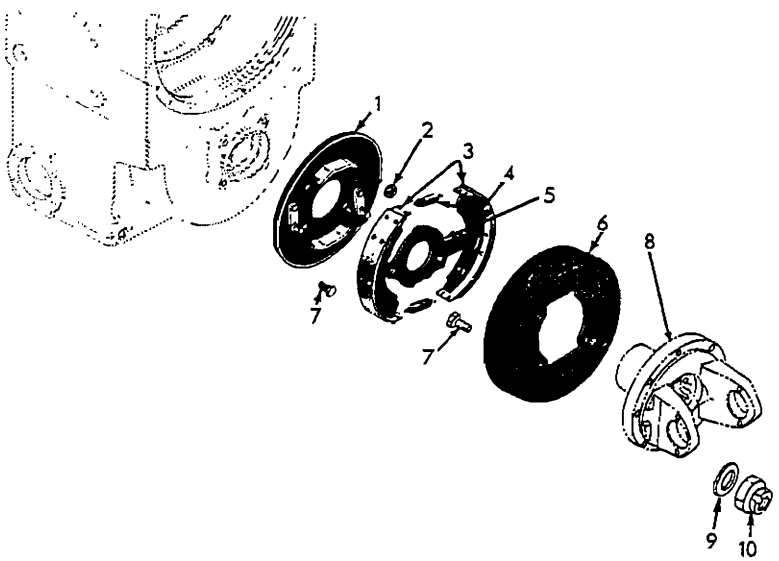
T-77114

FIG. 122 TIGHTENING REAR OUTPUT FLANGE NUT



T-77116

FIG. 123 INSTALLING FRONT OUTPUT FLANGE

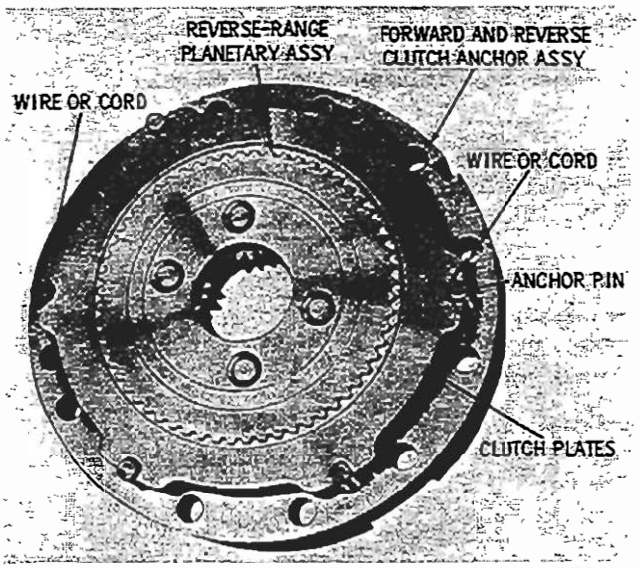


T-70704

FIG. 124 PARKING BRAKE ASSEMBLY

Assembly of Transmission from Subassemblies

1. Backing plate
2. Roller
3. Shoe assembly
4. Return spring
5. Brake apply arm
6. Brake drum
7. Bolt
8. Flange
9. Flange washer
10. Flange retaining nut



T-77117

FIG. 124A REVERSE-RANGE CLUTCH PLATES AND PLANETARY WIRED IN POSITION ON REVERSE-AND-LOW-RANGE CLUTCH ANCHOR

TOPIC 9 TRT TRANSMISSION - OPERATION AND DESCRIPTION

9.1 GENERAL

9.1.1
Nameplate. The nameplate is located on the left side of the transmission housing. Always furnish information, on this plate, to your dealer when ordering parts to insure that the correct parts will be supplied.

9.1.2
Range Gearing and Clutches. The range gearing consists of the forward, reverse, high- and low-range planetaries. Refer to the specifications, data chart at the end of this section. The clutches are multidisk, hydraulic-actuated type, which automatically compensate for wear.

9.1.3
Transfer Gearing and Housing. The output drive of the transmission is 19 inches (482.6 mm) (long drop) below the transmission input centerline. The housing is designed to provide front and rear output drive. The transfer gearing consists of two spur type gears having a 0.85 to 1 or 0.68 to 1 drive ratio.

9.1.4
Oil Pump - Refer to paragraph 2.7.

9.1.5
Control Valve Body Assembly - Refer to paragraph 2.8.

9.1.6
Parking Brake - Refer to paragraph 2.9.

9.1.7
Range Selection - Refer to paragraph 1.5.2.

9.1.8
Changing Direction of Travel - Refer to paragraph 1.5.3.

9.1.9
Clutch Cutoff Control - Refer to paragraph 1.5.4.

9.1.10
Temperatures, Pressures - Refer to paragraph 1.5.6.

9.2 SPECIFICATIONS

9.2.1
The following specifications apply to the TRT transmission only.

SPECIFICATIONS, DATA

Transmission type . . . . . Torque converter and planetary gear

Input rating (max):
- Input speed . . . . . Up to 3000 rpm
- Input torque . . . . . Up to 310 lb.ft. (36.6 kg/m)
- Input hp, net . . . . . Up to 150

Rotation, viewed from input end:
- Input . . . . . Clockwise
- Output - (forward gears) . . . . . Clockwise
- (reverse gears) . . . . . Counterclockwise

Gear ranges, selector positions: High Reverse (HR), Low Reverse (LR), Neutral (N), Low Forward (LF), High Forward (HF)

Weight, dry (lb):	Model	2221-1	2421-1
Direct mount		910	925

*Torque converter:

Transmission models	TRT-2221-1	TRT-2421-1
Converter model	TT240	TT425
Stages	2	2
Elements	4	4
Torque multiplication ratio	5.1:1	5.1:1

Gearing . . . . . Constant mesh, straight spur, planetary type

*Gear ratios:	Forward 1	Forward 2	Reverse 1	Reverse 2
TRT 2221-1, 2421-1	2.03:1	0.74:1	1.96:1	0.71:1

*To obtain overall transmission torque ratios, multiply the applicable torque converter ratio times the gear ratio.

Oil system:
- Oil pump. . . . . Input driven, gear type, positive displacement
- Sump . . . . . Integral, single
- Oil type and viscosity . . . . . Oil must meet one of the following:
  (a) Type C-3 Transmission fluid (oil)
  (b) Engine Oil TO-2 Qualified meeting Type C-3 specifications.

ATMOSPHERIC TEMPERATURE	VISCOSITY
0°C (32°F) up	SAE 10W or 30
0°C (32°F) below	SAE 10W

If temperature is below -10°F (-23°C) auxiliary preheat will be required to raise the temperature in the sump and external circuits to at least -10°F (-23°C).

Oil capacity: (less external circuits) . . . . . 8 1/2 US gal. (32.17) (initial fill)

Oil filter . . . . . Remote, mounted

Converter-out oil temperature . . . . . 250°F. max. (122°C)

Main pressure, at full throttle . . . . . 138 to 165 psi (9.7 - 11.6 kg/cm^2) (vehicle weight to 28000 lb. 12701 kgs)
165 to 195 psi (11.6 - 13.7 kg/cm^2) (vehicle weight over 28000 lb. 12701 kgs)

(Revised November 1980)

Lubrication pressure at full throttle	15 to 30 psi (1.05 - 2.10 kg/cm^2)
Converter-out pressure at full throttle stall	40 psi (2.8 kg/cm^2) (min.)
Converter-out pressure, at full throttle no load	65 psi (4.56 kg/cm^2) (max.)
Control valve body	
Clutch cutoff	Hydraulic

9.3 COMPONENT DESCRIPTION

9.3.1
The TRT models are torque converter, planetary gear-type transmissions. The transmissions provide 2 speeds forward and 2 speeds reverse. The twin turbine type torque converter extends the torque multiplication of the converter, in each gear range, providing broad torque coverage equal to two normal planetary gear ratios. This extended. Coverage is accomplished automatically and efficiently.

9.4 TWO-TURBINE TORQUE CONVERTER

9.4.1
Converter Construction and Operation are similar to that described in paragraph 2.2.

9.5 TRT CHARACTERISTICS (Refer to Fig. 125)

9.5.1
All TRT 2001 series transmissions include forward and reverse gearing and clutch configuration (items 15, 16, 18, 33, 35, 36, 38, 39, 40, 41 and 42, Fig. 125). Gearing for forward and reverse consists of a 6-and a 4-pinion planetary gear set, respectively. The planetaries are interconnected and provide the speed and torque ratio for the forward or reverse drive of the loader. The multidisk clutches consist of resin-graphite or bronze-faced steel, internal-splined, and external-tanged plain steel clutch plates, alternately assembled. They are hydraulic-actuated and spring released.

9.6 HIGH AND LOW RANGE

9.6.1
The high range gearing and two clutches, provide two speed ranges for either forward or reverse operation. The high range planetary gear is a 4 pinion gear set and is connected to the forward gear planetary. The clutch plates are the same as described in the above paragraph. These components work with either the forward or reverse gear sets to produce drive at the transmission output.

9.7 OIL STRAINER - Refer to your Operator's Manual.

9.8 CONTROL VALVE BODY - Refer to paragraph 2.8.

9.9 HYDRAULIC SYSTEM

Basically, the clutch cut-off feature will determine the difference in the hydraulic system. The number of drive ranges obtained hydraulically is controlled by the pre-determined movement of the selector valve. The various hydraulic systems are described below.

9.9.1
Oil Pump and Filter Circuit. Oil is drawn from the transmission sump through a wire-mesh strainer. The pump delivers its entire output to a full-flow oil filter. The oil filter is mounted external of the transmission. From the filter, the entire oil supply is directed to the control valve assembly.

9.9.2
Main-pressure Regulator Valve and Converter-in Circuit (Fig. 126). At the control valve assembly, oil flows around the main-pressure regulator valve and to the selector valve bore. At the regulator valve, oil flows through a diagonal passage (orifice A), to the left end of the valve. The oil pressure pushes the valve rightward against its spring. This uncovers the port which directs oil to the torque converter. When sufficient oil flow to the converter occurs, main-pressure will establish a balance against the force of the main-pressure regulator valve spring.

9.9.3
Under certain conditions, more oil than the converter-in line can handle must be exhausted to prevent excessive pressure. The oil cooler, like the oil filter, is external of the transmission. It is a heat exchanger on the engine in which the transmission oil flows through air or water-cooled passages.

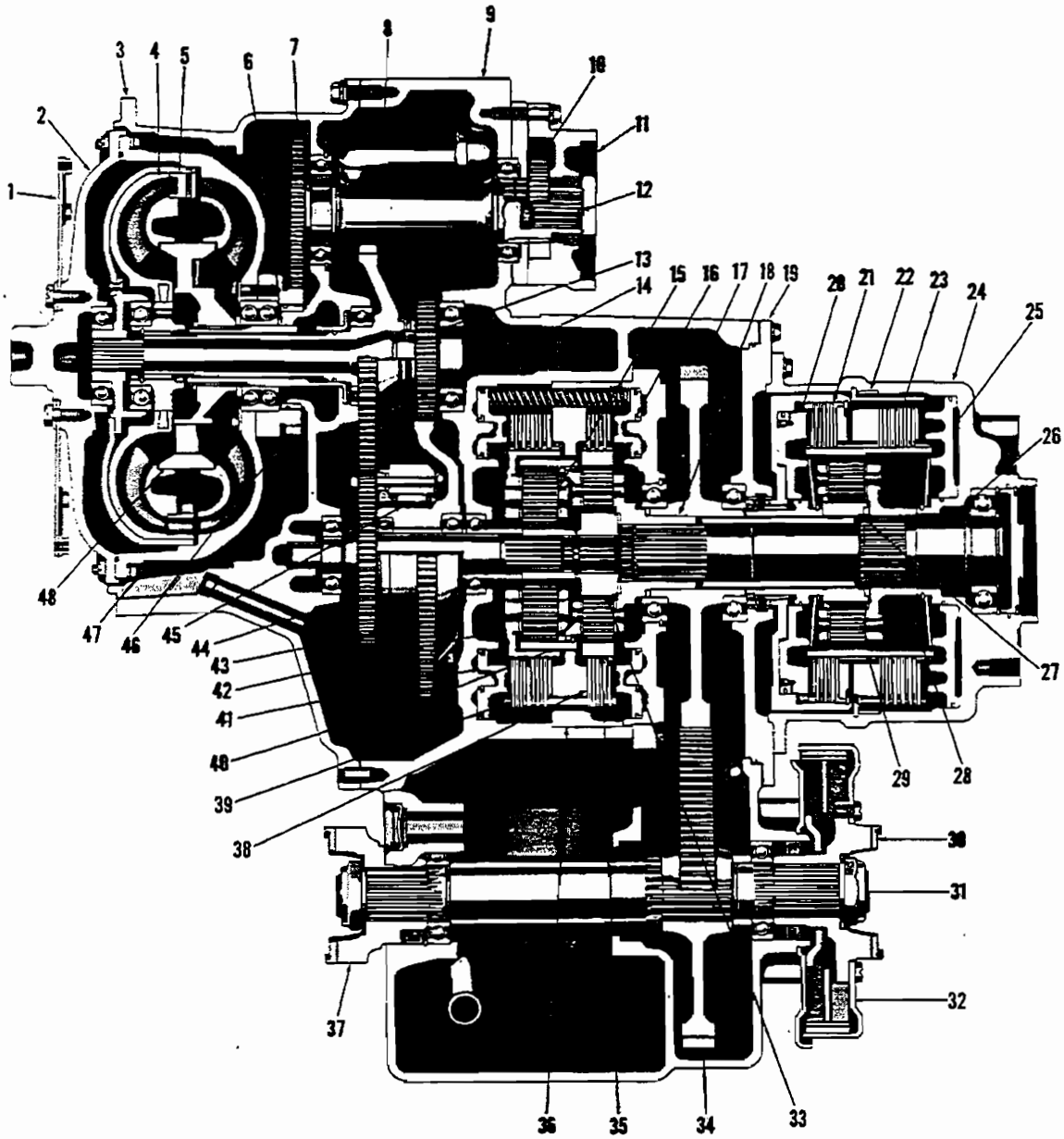


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FIG. 125 TRT CROSS SECTION

1. Flex disk drive
2. Torque converter cover
3. Converter housing
4. Second turbine
5. First turbine
6. Converter ground sleeve
7. Accessory driven gear
8. Oil suction tube
9. Transmission housing
10. Oil pump drive gear
11. Accessory mounting pad
12. Accessory drive splines
13. First-turbine drive gear
14. Second-turbine drive gear
15. Reverse planetary carrier
16. Forward clutch piston
17. Transfer drive gear
18. Forward planetary carrier
19. Adapter
20. Low-range clutch piston
21. Low-range clutch plates
22. High-range clutch anchor
23. High-range clutch plates
24. Rear housing
25. High-range clutch piston
26. Output shaft
27. High-range sun gear
28. High-range planetary carrier
29. High-range ring gear
30. Rear output flange
31. Transmission output shaft
32. Parking brake
33. Forward, reverse sun gear
34. Transfer driven gear
35. Forward ring gear
36. Forward, reverse clutch
37. Front output flange
38. Forward clutch plates
39. Reverse clutch plates
40. Reverse ring gear
41. Reverse clutch piston
42. Reverse clutch hub
43. First-turbine driven gear
44. Second-turbine driven gear
45. Freewheel clutch
46. Accessory drive gear
47. Converter pump
48. Converter stator

9.9.4
Oil flowing into the converter-in line is directed to the torque converter. A pressure regulator valve in the converter-in circuit limits the converter-in pressure to 80 psi (5.62 kg/cm^2).

9.9.5
Converter-out, Cooler, Lubrication Circuit. Oil flowing out of the torque converter is directed into the oil cooler.

9.9.6
Clutch Cutoff Valve Circuit. Main pressure oil, supplied from the left end of the main-pressure regulator valve, flows through orifice B to the clutch cutoff valve bore and then to the manual selector valve. The orifice functions in connection with trimmer action as explained in paragraph above.

9.9.7
The clutch cutoff valve is normally in the position shown, and functions only when the vehicles brakes are applied. A spring holds the valve rightward, allowing mail oil pressure to flow through the valve bore and to the manual selector valve.

9.9.8
When the vehicle has hydraulic brakes, hydraulic brake pressure acts directly against a plug which moves the clutch cutoff valve leftward during brake application. When the vehicle is equipped with air brakes, air brake pressure actuates a miniature air cylinder. The air cylinder piston rod pushes the clutch cutoff valve leftward. When leftward against its spring, the clutch cutoff valve interrupts the flow of main pressure oil to the manual selector valve. In this position, clutch apply pressure exhausts to the sump through a port shown at the top center of the valve bore. Thus, when the loader brakes are applied, the driving clutch (or clutches) in the transmission is completely released.

9.9.9
When the brake is released, the clutch cutoff valve returns to its normal position (as shown). This allows the oil retained at the trimmer to enter the exhausted clutch circuit. This additional volume from the trimmer assists in the quick application of the clutch.

9.9.10
Main Selector Valve Circuit (Fig. 126). Main-pressure oil from orifice B flows into the manual selector valve bore and surrounds the valve in the area of the detent notches. From this area, main oil flows, regardless of valve position, to another area at the right surrounding the valve. Here it is available for high range and forward clutches and for operation of the trimmer.

9.9.11
Four clutch apply lines leave the bottom of the selector valve bore. From left to right these are reverse, low range, high range, and forward. In neutral, the low range clutch is applied, and the remaining three are exhausted. Moving the selector valve one notch rightward will leave the low-range clutch applied and will charge the forward clutch. This is low forward.

9.9.12
Moving the selector valve a second notch rightward will close off oil to the low-range clutch and allow it to exhaust. The forward clutch will remain applied and the high-range clutch will be charged. This is high forward.

9.9.13
Moving the selector valve one notch leftward of neutral will charge the reverse clutch while allowing the low-range clutch to remain charged. This is low reverse.

9.9.14
Moving the valve a second notch leftward will close off oil to the low-range clutch and allow it to exhaust. The reverse clutch will remain applied and the high-range clutch will be charged. This is high reverse.

9.9.15
When the selector valve is moved to the high-range position (either HF or HR), oil to fill the high-range clutch must pass through both orifice B and the high-range clutch orifice. This is due to the oil passage immediately to the right of the high-range clutch orifice being blocked by the manual selector valve. The high-range clutch orifice is smaller than orifice B and restricts the flow of oil to the high range clutch. As a result, the high-range clutch fills at a slower rate than other clutches and thus provides smoother engagement.

9.9.16
Trimmer Circuit. The trimmer regulates clutch apply pressure during initial stages of clutch engagement, to obtain smooth operation. Normally, full-main pressure holds the trimmer plug leftward against its spring and a shoulder.

9.9.17 TORQUE PATHS THROUGH TRANSMISSION

9.9.18
How Power Flows, Input to Output. Knowledge of how engine power flows through the transmission under all operating conditions and in all gears is necessary for diagnosis of transmission troubles. The unique torque converter and its gearing, forward and reverse gearing, range gearing, output

transfer gearing, and direction and range clutches are all involved in the transmission of power through the transmission to the loader driveline. A study also of the accessory gearing is helpful when the loader includes equipment driven by the transmission power takeoff components.

9.9.19
Power Flow From Engine to Transmission Gearing. Power is transmitted from the engine to torque converter pump assembly by a flex disk drive. From the pump, power must be transmitted hydraulically to either first-turbine assembly or second-turbine (or to both, under certain operating conditions).

9.9.20
When first starting the load and bringing it up to a moderate speed, both turbines function. The converter pump, rotated by the engine, throws oil outward from its center and directs it forward into the first turbine vanes. The impact of the oil on the first turbine vanes tends to rotate the first turbine. Oil passes between the first turbine vanes and strikes second turbine vanes, tending to rotate the second turbine also. This condition exists until the second turbine reaches a speed which disengages over-running (freewheel) clutch between turbine driven gears.

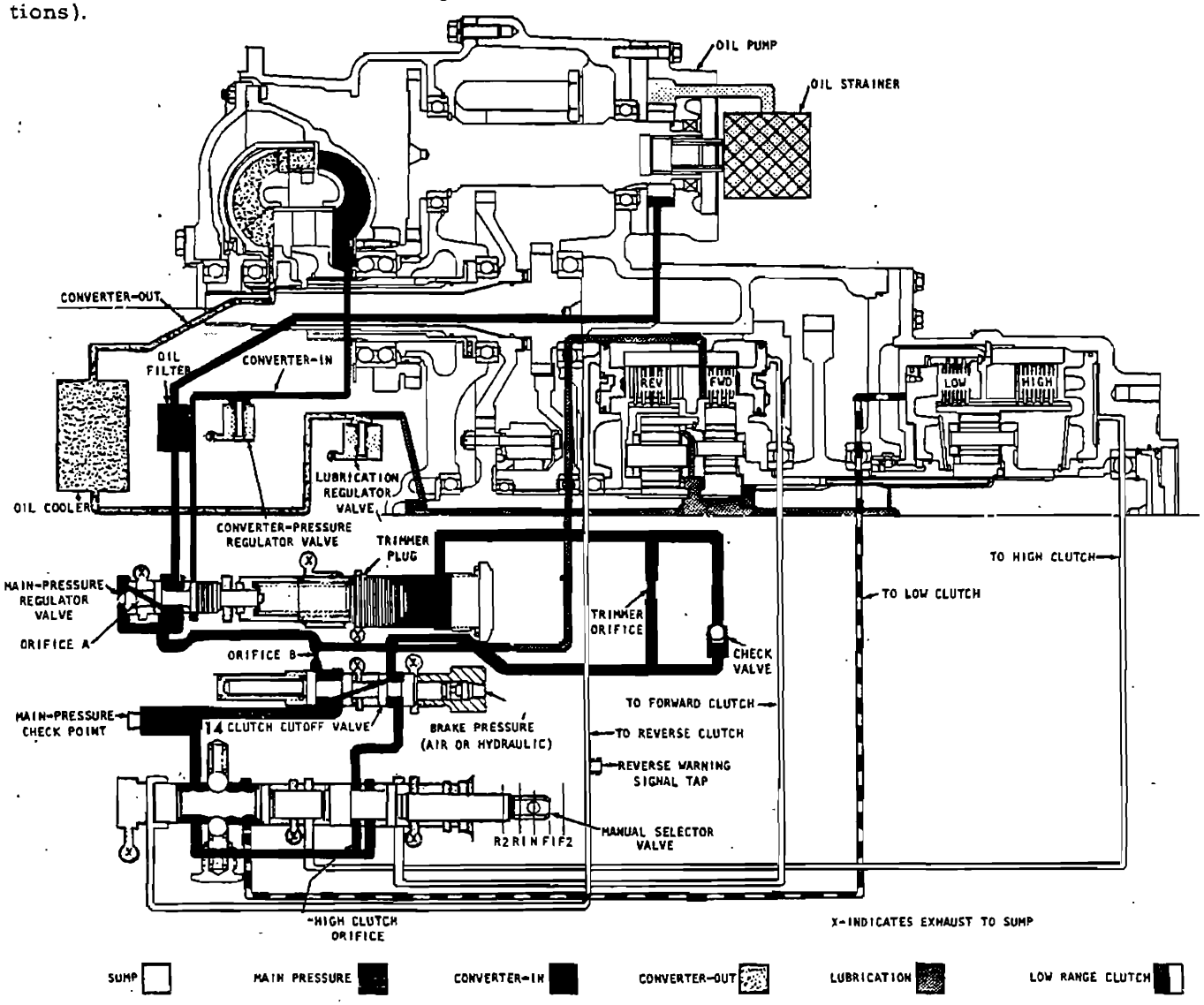

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FIG. 126 HYDRAULIC SYSTEM - SCHEMATIC VIEW

9.9.21
Oil leaves second turbine near its center and passes between the vanes of stator. The stator vanes redirect the oil to enter the pump vanes on a course which will assist pump rotation. This is the key to the ability of the torque converter to multiply torque.

9.9.22
Although both turbines work together at certain speeds, explanation is simplified if the first turbine is considered as the output member of the converter during start and low transmission output speed, and the second turbine is considered as working at higher transmission output speed. Accordingly, when starting the first turbines is the primary torque converter output member. It is splined to the shaft of first-turbine drive gear which meshes with first-turbine driven gear.

9.9.23
First-turbine driven gear is connected by a freewheel clutch to the second-turbine driven gear which is integral with the range gear input shaft. Thus, the rotation of the first turbine will rotate the range gear input shaft at a reduction in speed. At the same time, the second turbine will rotate, but at a speed lower than that of the first turbine.

9.9.24
When output speed of the converter increases, the load is assumed by the second turbine, and when it attains sufficient speed, the freewheel clutch will disengage. This leaves first turbine rotating freely but contributing no drive. The second turbine is splined to the hollow shaft of the second turbine drive gear, which meshes with the second turbine driven gear.

9.9.25
First-turbine gear set gives a reduction in speed from the converter to the transmission gearing. The second-turbine gear set gives an increase in speed. Thus, first-turbine operation may be related to higher power; and second-turbine operation to higher speed. The transition from the power phase to the speed phase is entirely automatic, depending upon only the load and speed demands of the transmission output.

9.9.26
The power flow in specific transmission models, from the direction and/or range gearing input to the transmission output, is explained in paragraphs below.

9.9.27
TRT 2221-1, 2421-1 - TORQUE PATHS

9.9.28
Neutral (Fig. 127). In neutral, power is transmitted only to the combined reverse and forward planetary sun gears (refer to paragraph 9.9.19 above). The low-range clutch is engaged but no torque is transmitted because neither the forward nor reverse clutch is engaged. The reverse carrier and forward ring gear rotate freely.

9.9.29
The power takeoff drive torque path is illustrated in Fig. 127. The rotation of either power takeoff spline is opposite engine rotation (or clockwise - viewed from rear).

9.9.30
Low Forward (Fig. 128). Refer to paragraph 9.9.19, above, for explanation of power flow from the engine to the transmission gearing.

9.9.31
When the manual selector valve was at neutral, the low-range clutch was engaged. In low forward, it remains engaged while the forward clutch also engages. The forward clutch, engaged, holds the forward planetary ring gear stationary.

9.9.32
The forward planetary sun gear rotates the forward planetary pinions within the stationary ring gear. This causes the forward carrier to rotate in the same direction as the sun gear, but at a reduction in speed. The carrier drives a shaft, the rear end of which is splined to the high-range planetary carrier.

9.9.33
The high-range planetary sun gear is splined to a sleeve, which is splined to both the low-range clutch drum and to the transfer drive gear. The high-range ring gear is splined to the low-range clutch internal-splined plates. The low-range clutch external-splined plates engage internal splines in the low-range clutch drum.

9.9.34
Thus, when the forward planetary carrier rotates, the high-range planetary carrier rotates. This causes both the high-range planetary sun gear and ring gear to rotate in the same direction and speed because the low-range clutch is engaged. There is no relative movement of the sun and ring gears.

9.9.35
The low-range clutch drum drives the splined sleeve which, in turn, drives the transfer drive gear. The rotation of the transfer drive gear is opposite that of the converter turbine, and at a reduced speed. This results from the combination of the converter transfer gearing (which may be underdrive or overdrive), and the reduction ratio of the forward planetary.

9.9.36
The transfer drive gear rotates the driven

gear and output shaft, and rotation is converted to that of the engine. The output shaft rotates at a speed greater than that of the transfer drive gear. Fig. 128 illustrates the one-piece output shaft.

9.9.37
High Forward. Refer to Fig. 125. Refer to paragraph 9.9.19, above, for explanation of power flow from the engine to the transmission gearing.

9.9.38
When the manual selector valve is shifted from low forward to high forward, the low-range clutch releases and the high-range clutch engages. The forward clutch remains engaged, holding the forward planetary ring gear stationary.

9.9.39
The forward planetary sun gear rotates the forward planetary pinions, and drive is transmitted to the high-range planetary carrier, as described in 9.9.33 above.

9.9.40
The engaged high-range clutch holds the high-range planetary ring gear stationary. The rotation of the high-range carrier pinions within the stationary ring gear overdrives the high-range sun gear. The sun gear, splined to a sleeve which is splined also to the transfer drive gear, rotates the transfer

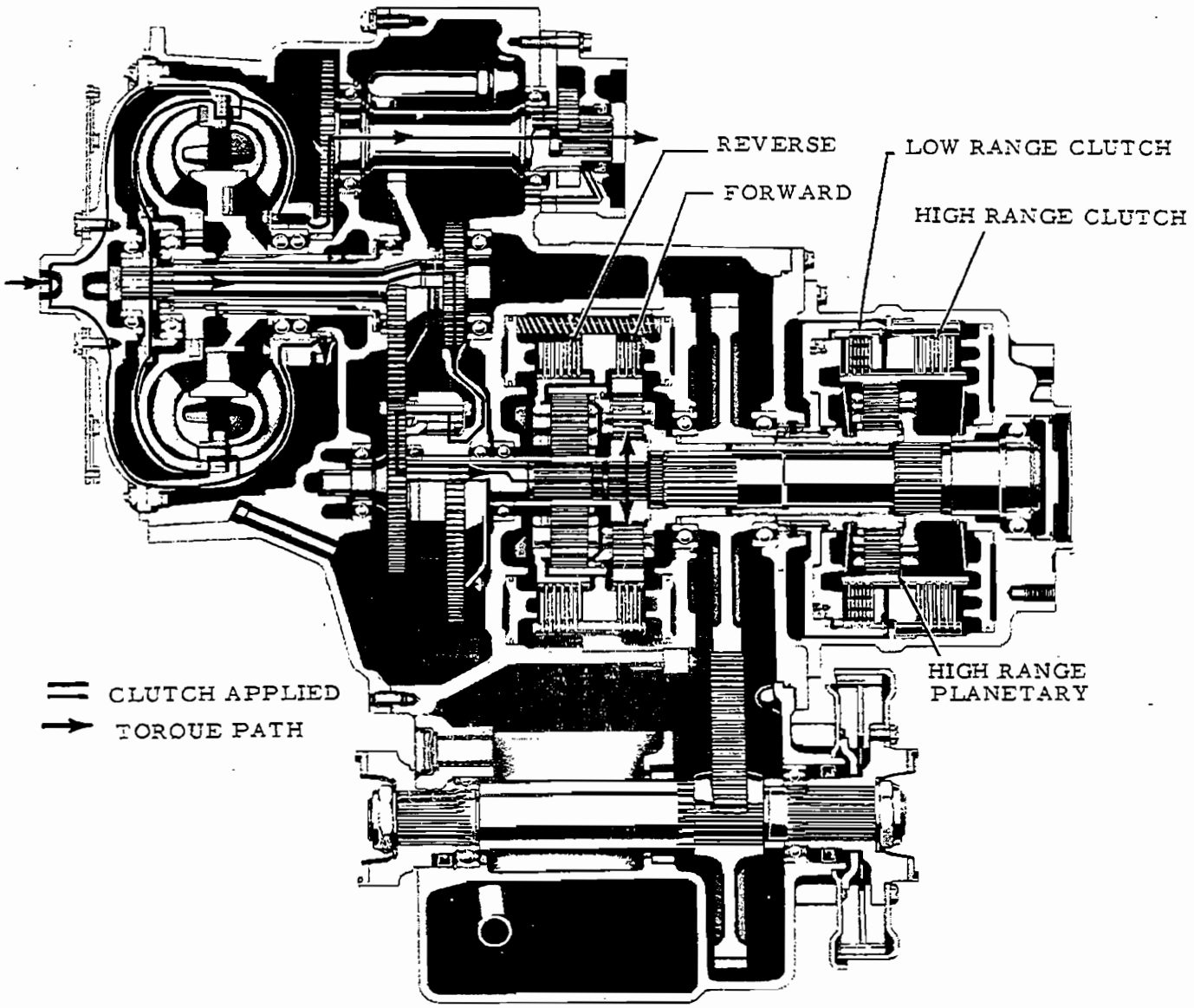

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FIG. 127 TRT 2421-1 TRANSMISSION, NEUTRAL AND PTO TORQUE PATH

drive gear.

9.9.41
Refer to 9.9.27.9, above, for explanation of the remainder of the torque path.

9.9.42
Low Reverse. Refer to Fig. 125. Refer to paragraph 9.9.19, above, for explanation of power flow from the engine to the transmission gearing.

9.9.43
When the manual selector is shifted from neutral to low reverse, the low-range clutch remains engaged while the reverse clutch also engages. The reverse clutch, engaged, holds the reverse planetary carrier stationary.

9.9.44
The reverse planetary sun gear rotates the carrier pinions which, in turn, rotate the reverse ring gear in a direction opposite that of the sun gear. The ring gear, being connected by splines to the forward carrier, rotates the forward carrier. The forward carrier drives a shaft, the rear end of which is splined to the high-range planetary carrier.

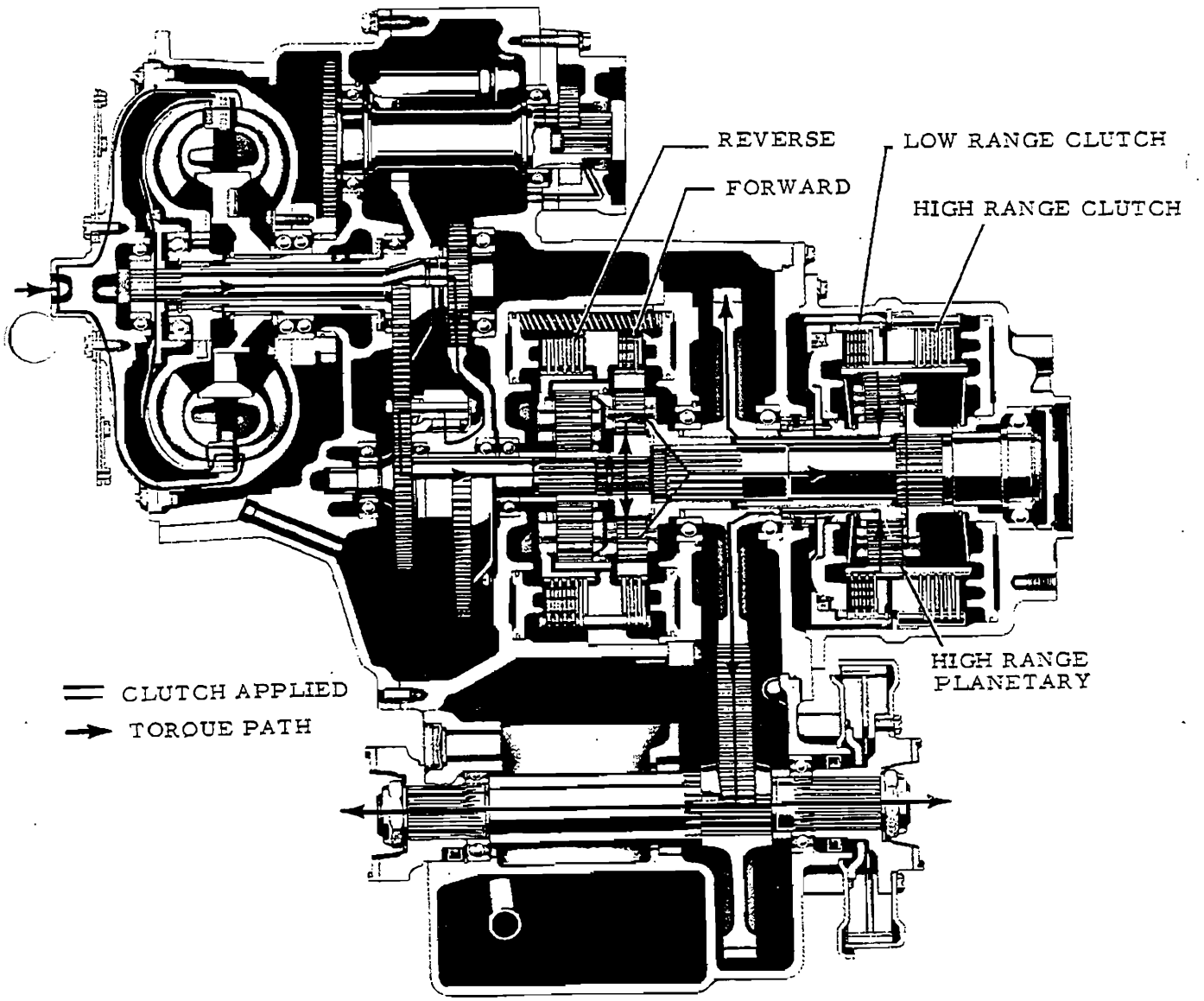

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FIG. 128 TRT 2420-1 TRANSMISSION, LOW FORWARD, FIRST TURBINE - TORQUE PATH

9.9.45
From this point, to the transmission output flanges, the flow of power is the same as described in 9.9.33 through 9.9.36, above, except that all rotations are reversed.

9.9.46
When the manual selector valve is shifted from low reverse to high reverse, the low-range clutch releases, the high-range clutch engages, and the reverse clutch remains engaged. The high-range clutch, engaged, holds the high-range planetary ring gear stationary.

9.9.47
The reverse planetary sun gear rotates the carrier pinions in the stationary carrier. They, in turn, rotate the reverse ring gear, driving it in a direction opposite that of the sun gear. The ring gear, being connected by splines to the forward carrier assembly, rotates it. The forward carrier drives a shaft, the rear end of which is splined to the high-range planetary carrier.

9.9.48
The engaged high-range clutch holds the high-range ring gear stationary. The rotation of the high-range planetary carrier within the stationary ring gear causes the carrier pinions to overdrive the sun gear. The sun gear, splined to a sleeve which is splined also to the transfer drive gear, rotates the transfer drive gear.

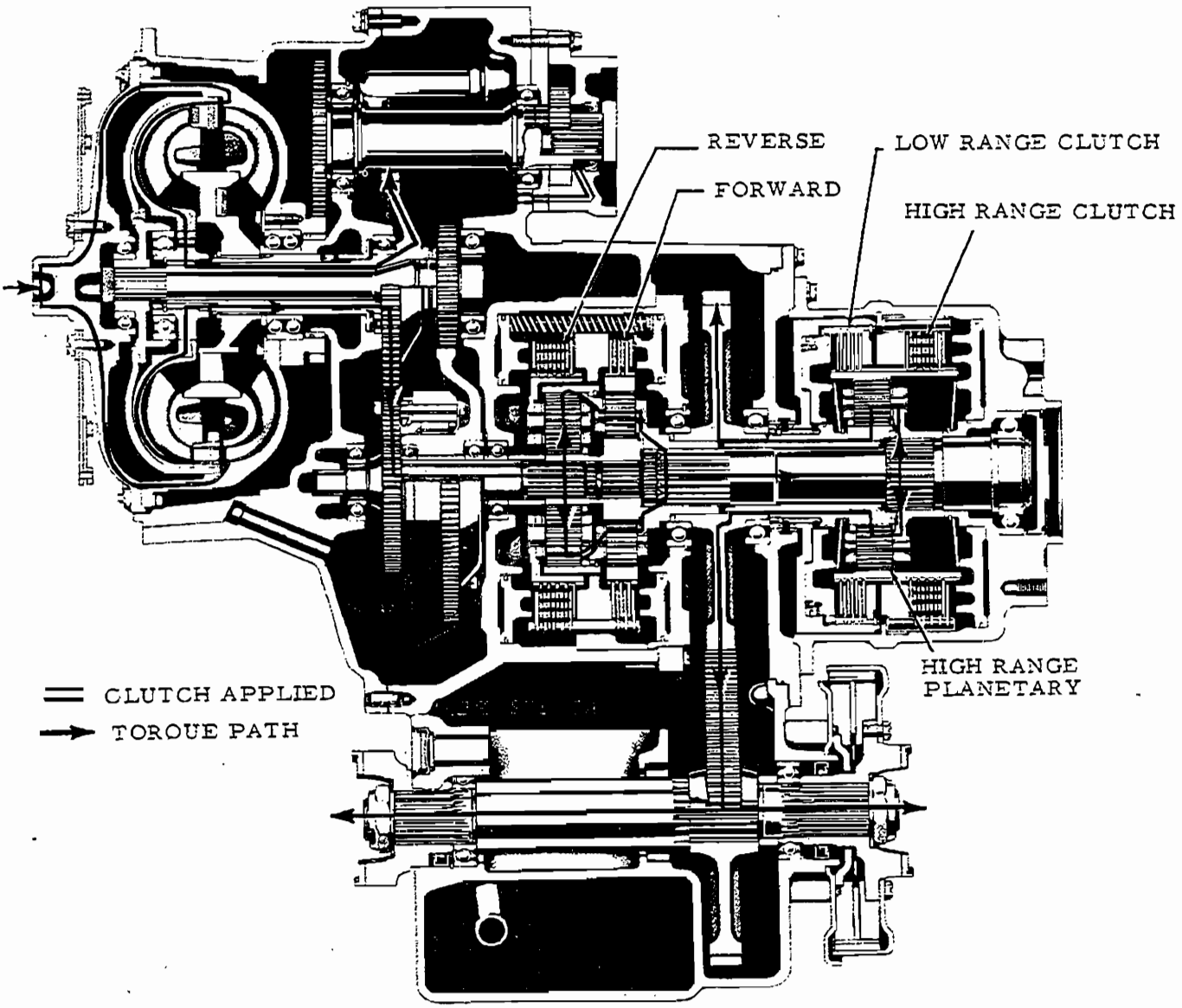

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FIG. 129 TRT 2420-1 TRANSMISSION, HIGH REVERSE, SECOND TURBINE - TORQUE PATH

TOPIC 10 TRT TRANSMISSION - DISASSEMBLY AND ASSEMBLY

NOTE: Because the TT and TRT are similar in design, only the assemblies that are different than the TT are described in this section. When a specific area in the transmission is not described in this section, the procedures mentioned in the previous TT sections must be used. Refer to the alphabetical index and table of contents for assistance.

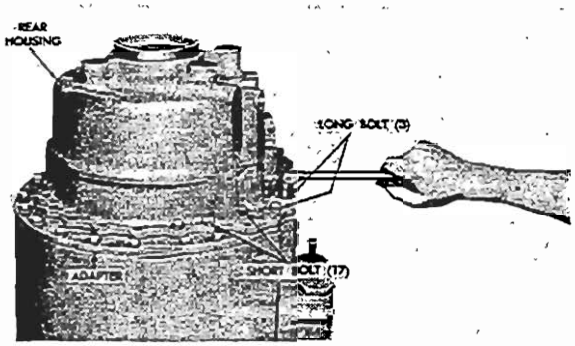
10.1 REMOVAL OF REAR HOUSING

10.1.1
Position the transmission, front downward, and remove 17 short bolts and three long bolts with lockwashers (Fig. 130).

10.1.2
Remove the rear housing and internal parts in the rear housing, as a unit (Fig. 131). Remove the gasket.

10.1.3
Position rear housing (2), (Fig. 133), on blocks. Remove snap ring (11) holding oil retainer (10) in the rear housing. Remove the oil retainer, seal ring (9) and internal snap ring (8) that retains rear bearing (6) in housing.

10.1.4
Using a soft hammer, tap shaft (5) (Fig. 133) rearward to remove the shaft from the housing. Remove snap ring (7) and rear bearing (6) from the shaft, if replacement is necessary.



T-77122

FIG. 130 REMOVING REAR HOUSING BOLTS

10.1.5
Remove the internal snap ring which retains the high-range clutch anchor assembly (Fig. 132).

10.1.6
Grasp the high-range clutch pack and anchor assembly together and remove from the rear housing (Fig. 134). Separate the parts. Refer to rebuild of the clutch anchor assembly. Remove the clutch anchor pin.

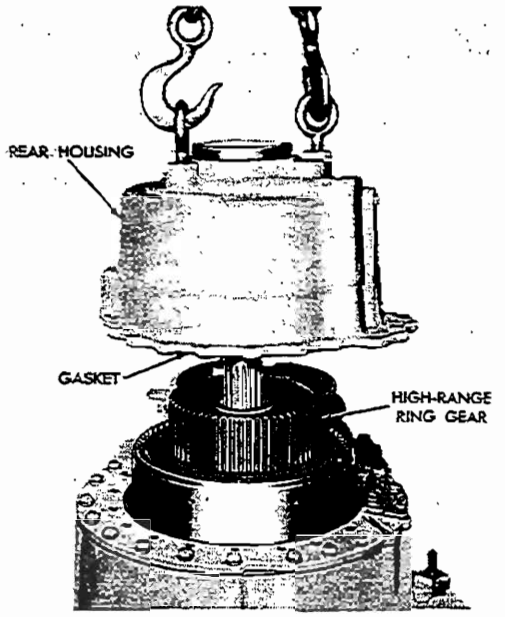


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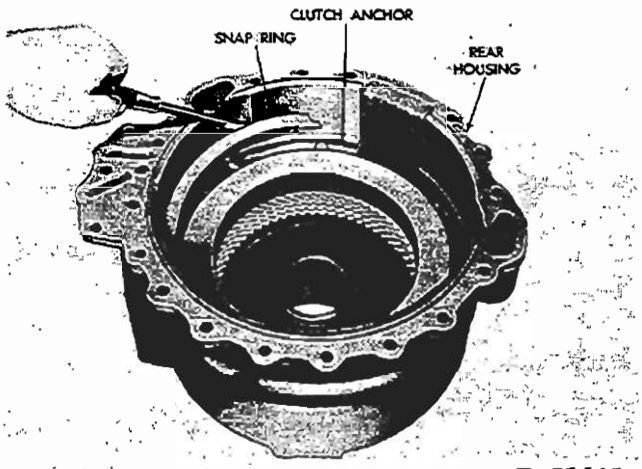
FIG. 131 REMOVING TRANSMISSION REAR HOUSING ASSEMBLY



T-72505

FIG. 132 REMOVING CLUTCH ANCHOR SNAP RING

10.1.7
Depress the inner diameter of the clutch piston return spring and remove the snap ring and return spring (Fig. 135).

10.1.8
Remove the high-range clutch piston assembly (Fig. 135). Remove the hook-type seal ring from the housing inner hub. Refer to rebuild of the clutch piston and to rebuild of the rear housing assembly.

10.2 REMOVAL OF HIGH-RANGE PLANETARY, LOW-RANGE CLUTCH AND ADAPTER

10.2.1
Lift the high-range planetary carrier assembly out of the ring gear (Fig. 136). Refer to rebuild of the high-range planetary carrier assembly. Remove the sun gear and thrust washer assembly. Remove the thrust washer only if it is worn or damaged. Refer to wear limits, Section 11.

10.2.2
Remove the internal snap ring retaining low-range clutch back plate (Fig. 136).

10.2.3
Lift out the ring gear, bringing with it the back plate, three internal-splined plates, and two external-tanged plates (Fig. 137). Remove the two remaining clutch plates.

10.2.4
Remove the snap ring from the splined sleeve (Fig. 138).

10.2.5
Lift the low-range clutch drum assembly out of the adapter assembly (Fig. 139). Remove the two step-type Teflon seal rings from the hub of the drum. Refer to rebuild of the clutch drum assembly.

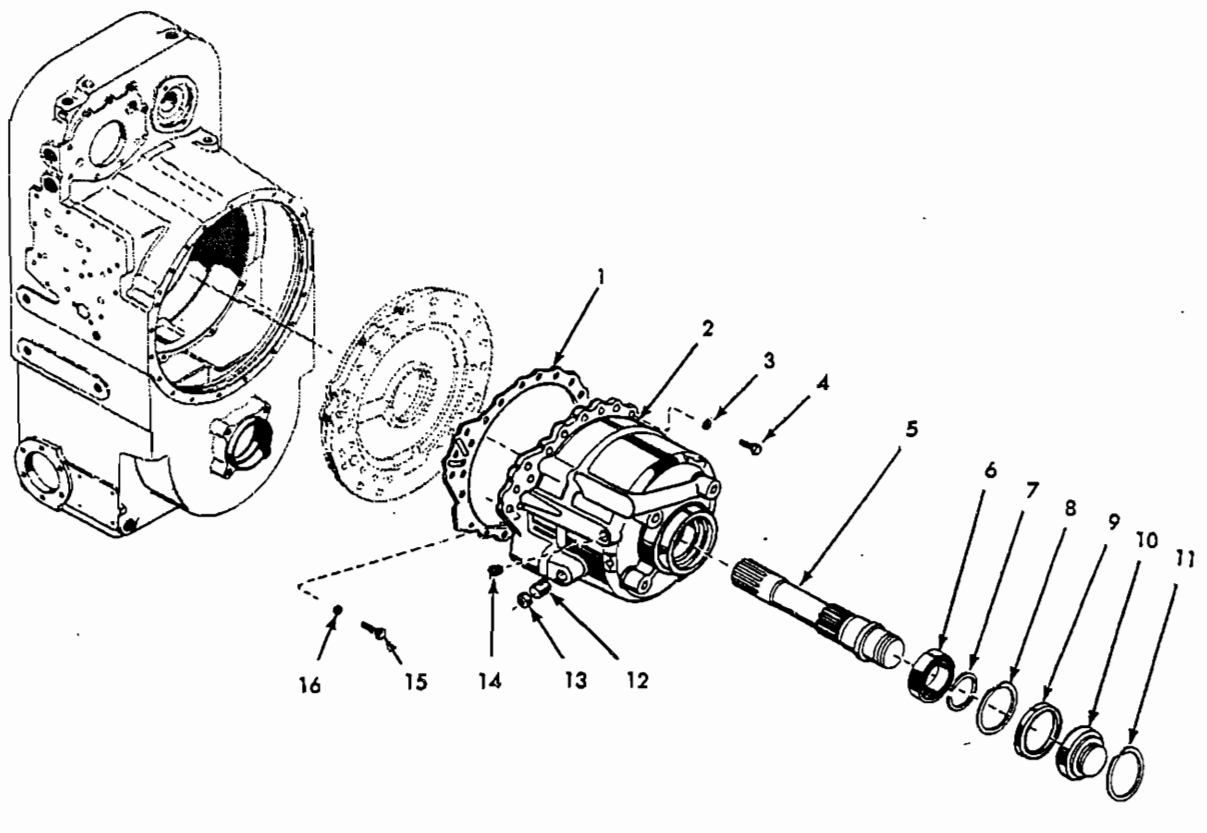


FIG. 133 REAR HOUSINGS AND OUTPUT SHAFT

1. Rear housing gasket
2. Rear housing
3. Lockwasher
4. Bolt
5. High-and low-range input shaft
6. Rear bearing
7. External snap ring
8. Internal snap ring
9. Seal ring
10. Oil retainer
11. Internal snap ring
12. Clutch anchor pin
13. Welch plug
14. Plug
15. Bolt
16. Lockwasher

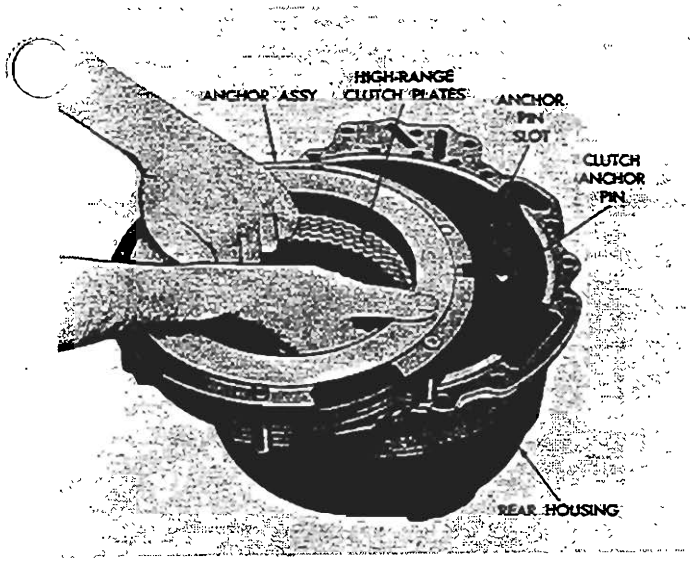


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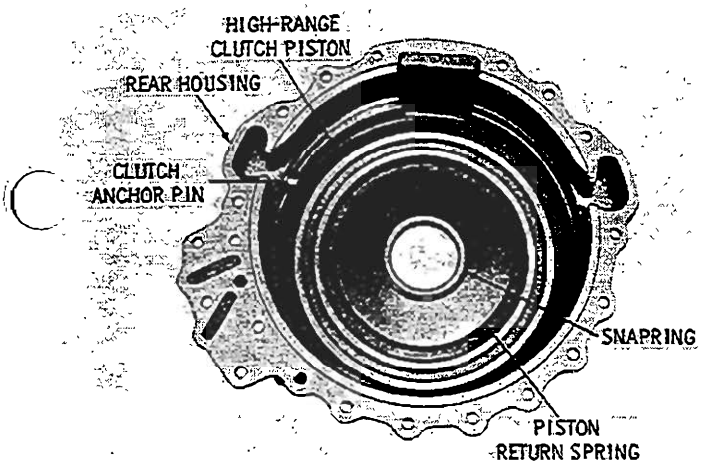
FIG. 134 REMOVING HIGH-RANGE CLUTCH ANCHOR AND PLATES



T-77125

FIG. 135 REAR HOUSING AND PISTON ASSEMBLY

10.2.6
Remove sixteen bolts (10) (Fig.141) and lockwashers (11) which retain the rear housing adapter assembly (7).

10.2.7
Remove the rear housing adapter assembly. Remove the seal ring (6) and gasket (5), from the adapter. Refer to rebuild of the rear housing adapter assembly.

10.3 REMOVAL OF TRANSFER DRIVE GEAR, FORWARD PISTON HOUSING

10.3.1
Remove the transfer drive gear and sun gear sleeve (Fig. 140). Remove the sleeve from the gear and the snap ring from the sleeve. Refer to rebuild of the transfer drive gear

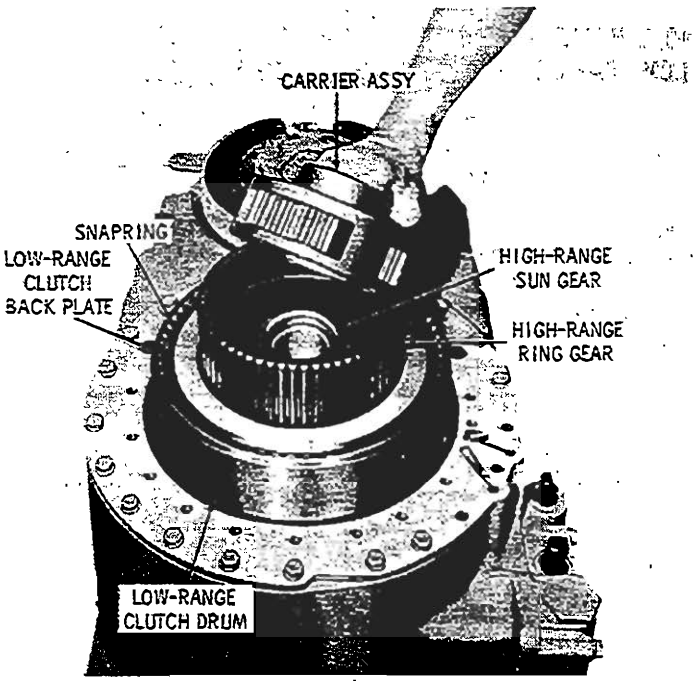


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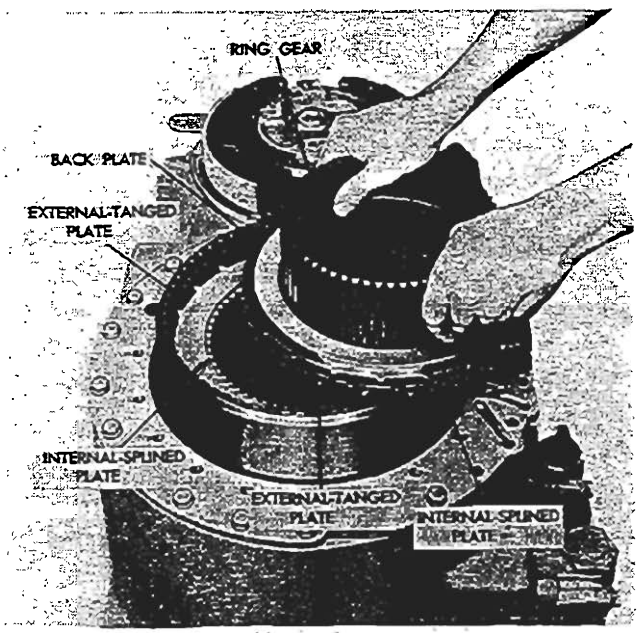
FIG. 136 REMOVING HIGH-RANGE PLANETARY CARRIER ASSEMBLY



T-72507

FIG. 137 REMOVING HIGH-RANGE RING GEAR AND LOW-RANGE CLUTCH PLATES

sleeve assembly, and to rebuild of the output transfer drive gear.

NOTE: The forward carrier thrust washer may remain with the transfer drive gear when it is removed, or it may stay with the forward carrier. Remove it.

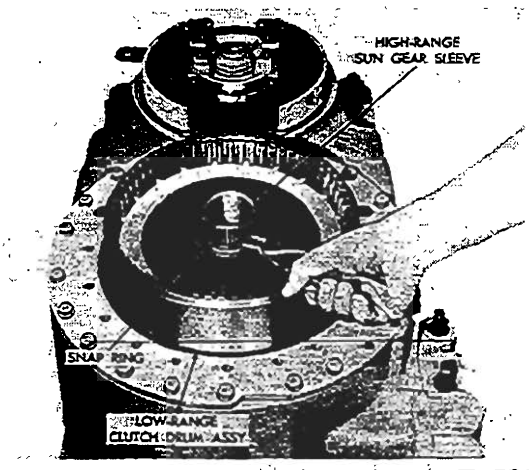
10.3.2
Replace two of ten self-locking bolts that

retain the forward-clutch piston housing with two 3/8"-16 x 2 1/2-inch bolts. Install the two bolts at opposite sides of the piston housing (Fig. 126).

CAUTION

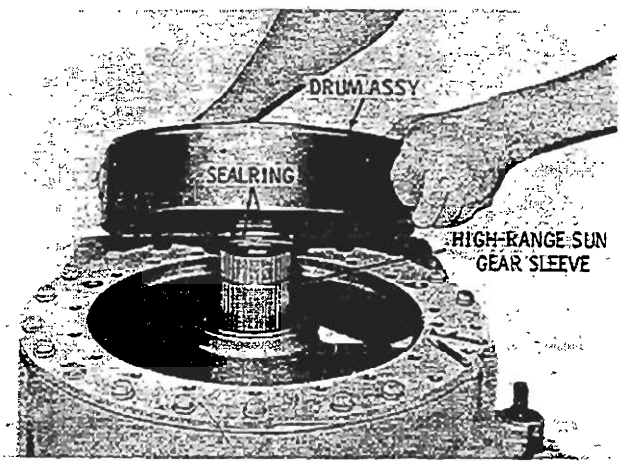
The piston housing compresses the piston return springs. The installation of the two longer bolts will restrain the piston housing during disassembly, and prevent possible damage.

10.3.3
Remove the eight remaining self-locking bolts which retain the piston housing (Fig. 126). Then, loosen the two restraining bolts evenly and remove them.



T-72508

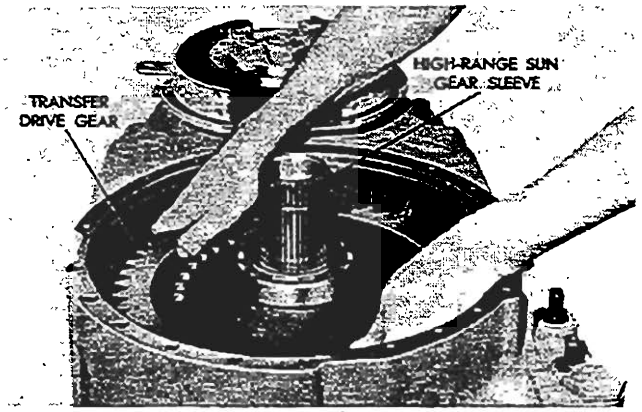
FIG. 138 REMOVING HIGH-RANGE SUN GEAR SLEEVE SNAP RING



T-77127

FIG. 139 REMOVING LOW-RANGE CLUTCH DRUM ASSEMBLY

10.3.4
Remove the forward clutch piston housing and clutch piston, as an assembly. Remove the clutch piston from the piston housing. Refer to rebuild of the clutch piston.



T-77128

FIG. 140 REMOVING TRANSFER DRIVE GEAR AND SUN GEAR SLEEVE

10.3.5
Remove the twelve piston return springs and pins (Fig. 143).

10.4 REMOVAL OF FORWARD AND REVERSE CLUTCHES, PLANETARIES

10.4.1
Remove the forward ring gear, one external-tanged clutch plate and one internal-splined clutch plate (Fig. 143). The plates come with the ring gear when it is removed. Remove the two remaining internal-splined clutch plates and two external-tanged clutch plates.

10.4.2
Remove forward planetary carrier assembly (2) (Fig. 74) and reverse planetary ring gear (1) as an assembly. Remove the snap ring and separate the ring gear from the carrier assembly.

NOTE: The sun gear thrust washer may come out with the forward carrier. If so, remove it from the carrier.

Refer to rebuild of the forward planetary carrier assembly.

10.4.3
Remove the forward and reverse sun gear, and thrust washer if not removed in (2), above (Fig. 143).

10.4.4
Remove the bolt and flat washer which were installed temporarily when the control valve assembly was removed.

10.4.5
Remove the forward and reverse clutch anchor assy. (19) Fig. 77 and clutch anchor pin.

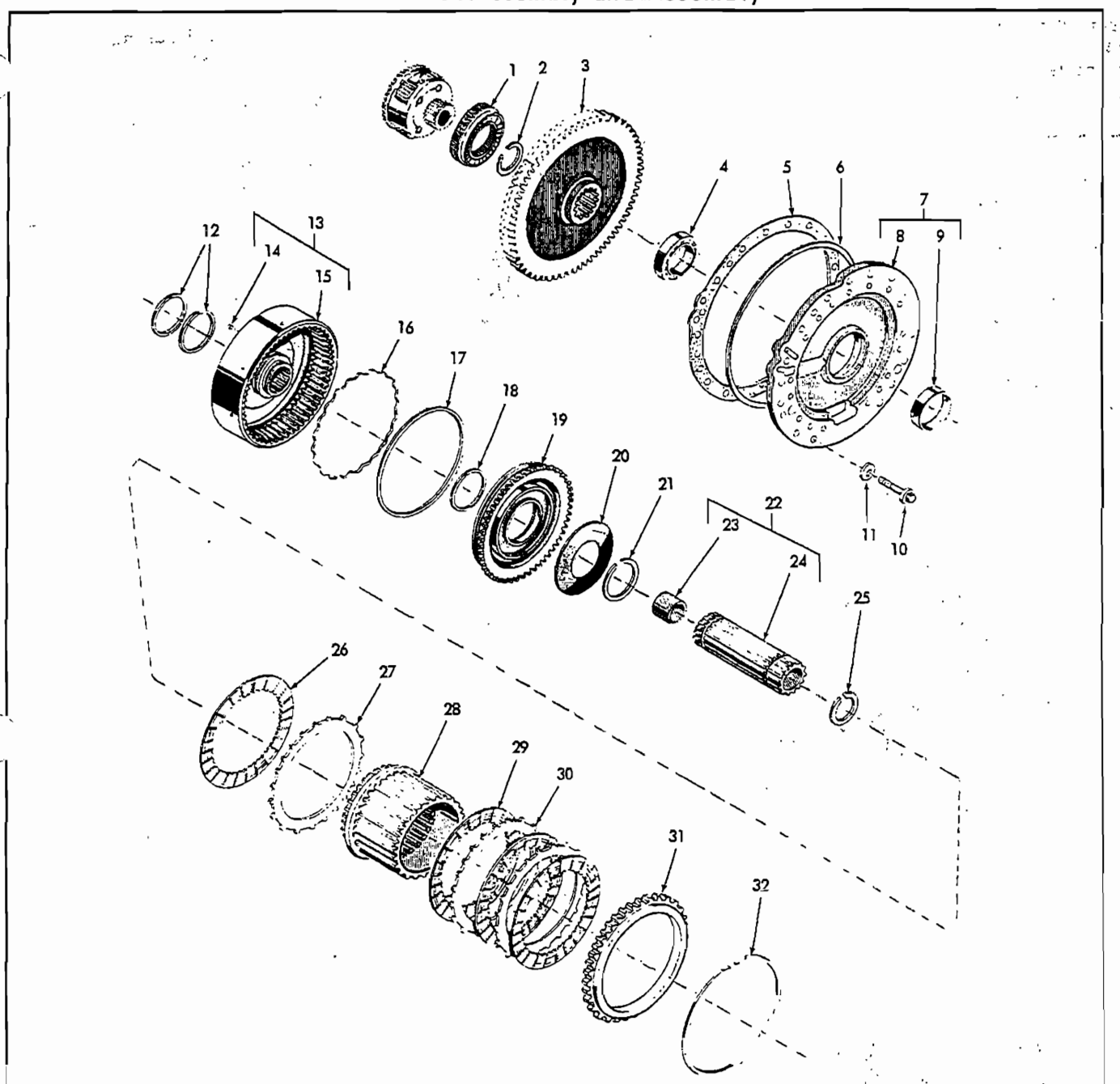


FIG. 141 LOW RANGE CLUTCH AND TRANSFER DRIVE GEAR

1. Ball bearing
2. External snap ring
3. Transfer drive gear
4. Ball bearing
5. Adapter gasket
6. Adapter seal ring
7. Adapter assembly
8. Adapter
9. Sleeve
10. Bolt
11. Lockwasher
12. Seal ring
13. Low-range clutch drum assembly
14. Pin
15. Clutch drum
16. Seal ring expander
17. Clutch piston outer seal ring
18. Clutch piston inner seal ring
19. Low-range clutch piston
20. Clutch piston return spring
21. External snap ring
22. Sleeve assembly
23. Bushing
24. Sleeve
25. External snap ring
26. Internal-splined clutch plate
27. External-splined clutch plate
28. High-range clutch ring gear
29. Internal-splined clutch plate
30. External-splined clutch plate
31. Low-range clutch back plate
32. Internal snap ring

NOTE: The clutch anchor pin may be removed from inside the transmission housing if the control valve assembly has not been removed.

10.4.6
Remove the reverse planetary carrier assembly and one internal-splined clutch plate as a unit. Remove the clutch plate from the carrier assembly. Refer to rebuild of the reverse planetary carrier assembly. Remove the remaining nine reverse-range clutch plates from the housing.

10.4.7
Remove reverse clutch piston (4) (Fig. 77). Refer to rebuild of the clutch piston.

10.5 FORWARD PLANETARY CARRIER ASSY.

10.5.1
Disassembly (Fig.74A). Disassemble the forward planetary carrier assembly only if there is evidence of damage or undue wear. The failure of one pinion requires the replacement of all pinions in the carrier assembly.

10.5.2
Drill into the ends of the pinions spindles to weaken the swaging. Use a.5 inch (12.7 mm) drill at the spindle end which is most accessible.

CAUTION

Do not drill into the carrier. The diameter of the spindles is slightly more than.5 inches (12.7 mm). Centering the drill accurately will prevent drilling into the carrier.

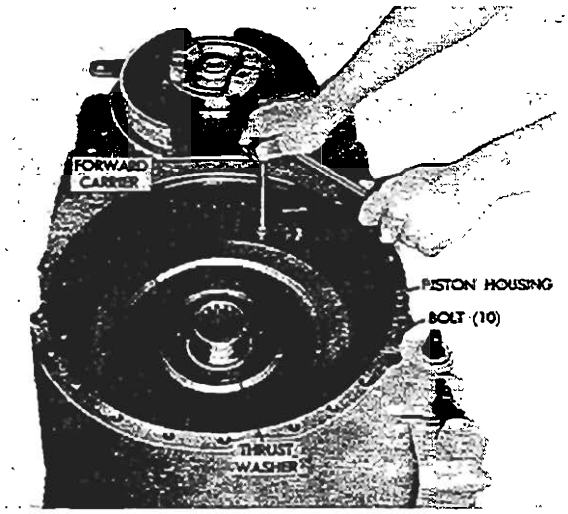
10.5.3
Position the carrier, drilled end of spindles upward, in a press. Press the six spindles out of the carrier.

10.5.4
Remove pinion, roller and thrust washer groups and put each in a separate container.

10.5.5
Assembly (Fig.74A).

NOTE: Chill spindles in dry ice for at least 1 hour before installing them.

10.5.6
Make a pinion alining tool by grinding a used spindle 0.005 inch (.1270 mm) undersize.



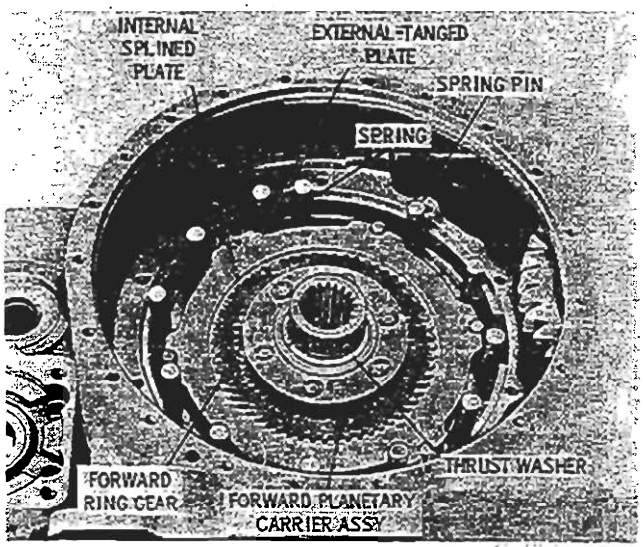
T-72509

FIG. 142 REMOVING FORWARD CLUTCH PISTON HOUSING BOLTS

10.5.7
Install a thrust washer (5) (Fig.74A) onto the alining tool.

10.5.8
Coat the inside diameters of pinions (7) with oil soluble grease. Install a pinion onto the alining tool.

10.5.9
Install twenty rollers (6) into the space between the bore of pinion (7) and the alining tool. Install a second thrust washer onto pinion (7).



T-77129

FIG. 143 FORWARD CLUTCH AND PLANETARY AND CLUTCH PISTON SPRINGS AND PINS

10.5.10
Install the assembled pinion group into

carrier (3).

10.5.11
Assemble and install the five remaining pinion groups as outlined previously. Aline the groups with the spindle bores in the carrier.

10.5.12
Position the carrier assembly, hub or shaft upward, in a press and install spindles to the 0.092 inch (3.34 mm) dimension.

10.5.13
Using a swaging tool as shown in Fig. 144, press both ends of the spindles to the form shown, while supporting the opposite ends.

NOTE: Pinions must rotate freely in the carrier after the spindles are swaged.

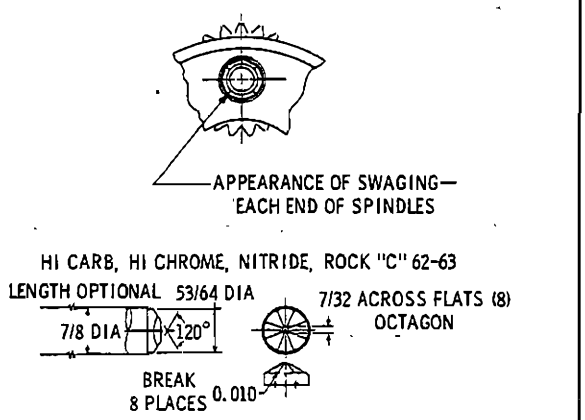


FIG. 144 SWAGING TOOL FOR FORWARD, LOW-AND HIGH-RANGE PINION SPINDLES

10.6 HIGH-RANGE PLANETARY CARRIER ASSY.

10.6.1
Disassembly (Fig. 145). Disassemble the high range planetary carrier assembly only if there is evidence of damage or undue wear. The failure of one pinion will require the replacement of all the pinions in the assembly.

10.6.2
Drill into the ends of spindles (9) (Fig. 145) to weaken the staking. Use a .5 inch (12.7 mm) drill at the ends of the spindles nearer the carrier hub.

CAUTION

Do not drill into the carrier. The diameter of the spindles is slightly more than .5 inch (12.7 mm). Centering the drill accurately will prevent drilling into the carrier.

10.6.3
Position the carrier, drilled ends of spindles upward, in a press. Press the six spindles (9) out of the carrier.

10.6.4
Remove the six pinion, roller and thrust washer groups, and place them in separate containers.

10.6.5
Assembly (Fig. 145).

NOTE: Chill spindles (9) in dry ice for at least 1 hour before installing them in the carrier.

10.6.6
Install a thrust washer (6) onto the alining tool made for assembling the forward carrier.

10.6.7
Coat the bores of pinions (7) with oil soluble grease. Install a pinion onto the alining tool.

10.6.8
Install sixteen rollers (8) into the space between the bore of pinion (7) and the alining tool. Install a second thrust washer (10) onto the pinion.

10.6.9
Install the assembled pinion group into carrier (5) positioned flat side of downward. Aline the pinion group with the spindle bore in the carrier.

10.6.10
Assemble and install the five remaining pinion groups as outlined above.

10.6.11
Position the carrier assembly, flat side downward, in a press. Install six spindles (9) to the 0.095 inch (.222 mm) dimensions, shown in Fig. 146.

10.6.12
Using a swaging tool, as shown in Fig. 144, press both ends of spindles to the form shown, while supporting the opposite ends.

NOTE: Pinions must rotate freely in the carrier after the spindles are swaged.

10.7 HIGH-RANGE CLUTCH ANCHOR ASSY.

10.7.1
Disassembly (Fig. 145). Disassemble anchor assembly (12) (Fig. 145) only if parts replacement is necessary.

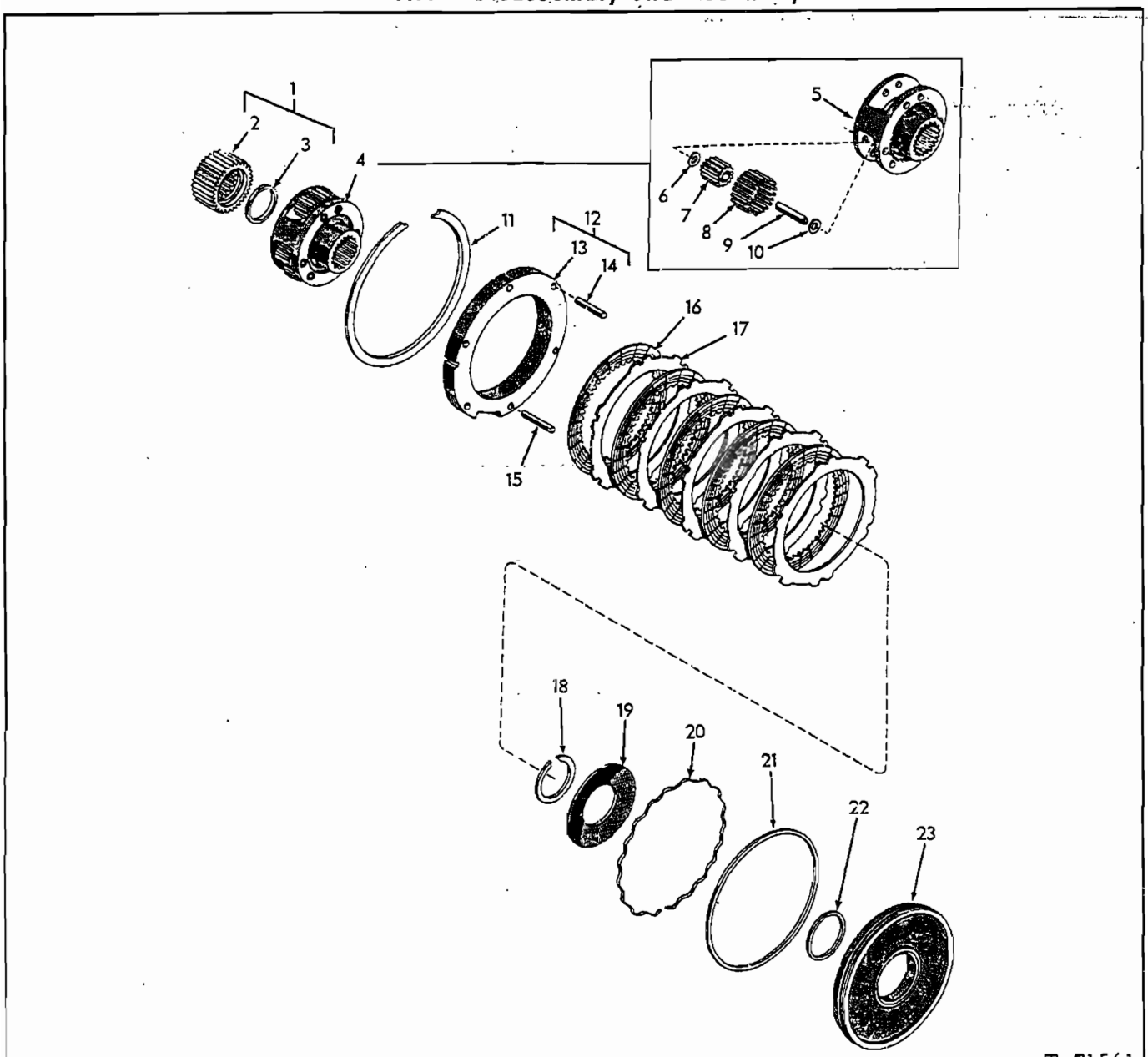


FIG. 145 HIGH RANGE CLUTCH AND PLANETARY

1. High-range planetary carrier sun gear assembly
2. Sun gear
3. Thrust washer
4. High-range planetary carrier assembly
5. Carrier
6. Thrust washer
7. Pinion (matched set of six pinions)
8. Roller
9. Spindle
10. Thrust washer
11. Internal snap ring
12. High-range clutch anchor assembly
13. Anchor
14. Pin (short)
15. Pin (long)
16. Internal-splined clutch plate
17. External-tanged clutch plate
18. External snap ring
19. Clutch piston return spring
20. Seal ring expander
21. Clutch piston outer seal ring
22. Clutch piston inner seal ring
23. High-range clutch piston

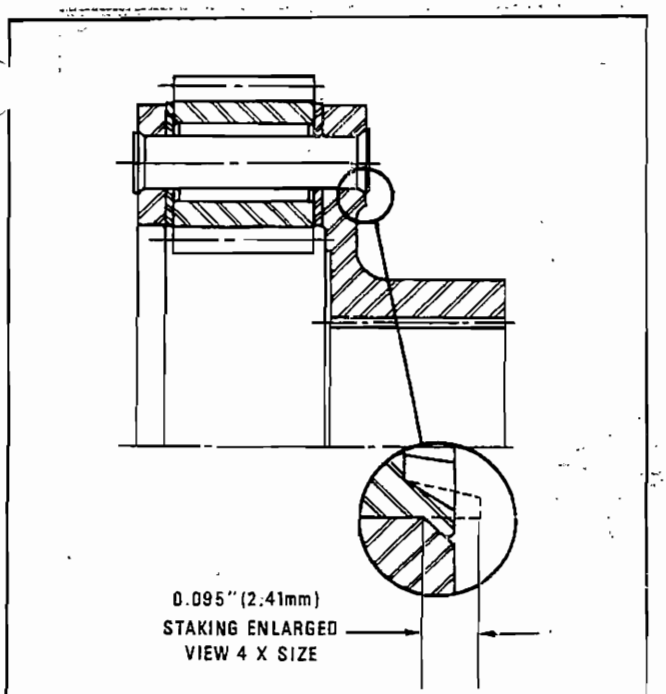


FIG. 146 HIGH-RANGE PLANETARY CARRIER ASSEMBLY, SHOWING SPINDLE INSTALLATION DIMENSION - CROSS SECTION

10.7.2
Position the assembly, pins downward, in a press. Press pins (14) and (15) out of anchor (13).

10.7.3
Assembly (Fig. 145).

NOTE: Chill pins (14) and (15) in dry ice for at least 1 hour before installing them in anchor (13).

10.7.4
Position anchor (13), flat (rear) side upward, in a press. Install two (longer) pins (15) at each side of the large cutout in the outer perimeter of anchor (13). Press the pins in until they project 1.56 inches (39.62 mm) above the flat surface of the anchor.

NOTE: Longer pins (15) project slightly at the front side of anchor (13). They prevent snap ring (11) from rotating.

10.8 REAR HOUSING ADAPTER ASSY.

10.8.1
Disassembly (Fig. 141). Remove sleeve (9) from adapter (8) only if replacement is necessary.

10.8.2
Assembly (Fig. 141). If the sleeve was removed from the center bore of the adapter, install a new one as outlined below.

10.8.3
Position sleeve (9) internal chamfer first, into the front (ball bearing bore side) of adapter (8).

10.8.4
Press the sleeve in (rearward) until its forward (unchamfered) end is flush with, or to 0.010 inch (.2540 mm) below, the shoulder against which the ball bearing assembly (4) seats.

10.9 OUTPUT TRANSFER DRIVE GEAR

10.9.1
Disassembly (Fig. 141). Remove the bearings from gear (3) only if parts replacement is necessary.

10.9.2
Remove the snap ring from bearing assembly (1). Using a bearing puller, remove bearings (1) and (4) from gear (3).

10.9.3
Assembly (Fig. 141). Press bearing (4) manufacturer's number outward, onto the splined hub of gear (3). Seat it firmly against the hub shoulder.

10.9.4
Press bearing (1) outer snap ring groove toward gear, onto the smooth-bore hub of gear (3). Seat it firmly against the hub shoulder.

10.9.5
Install the external snap ring into the groove in the outer race of bearing assembly (1).

10.10 CLUTCH DRUM ASSEMBLY

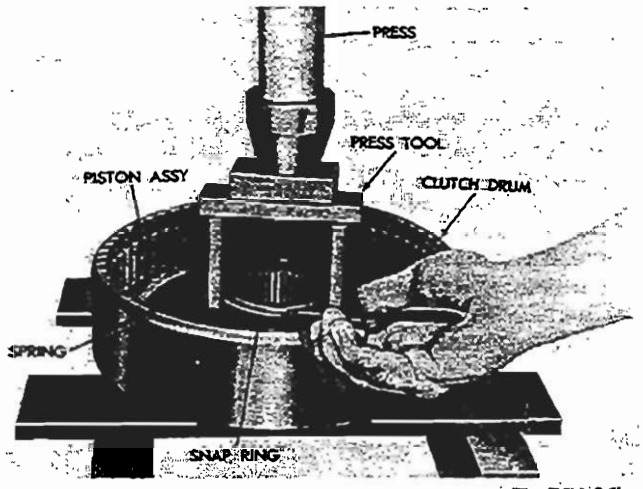
10.10.1
Disassembly (Fig. 141). Position the drum assembly in a press. Depress the inner diameter of the piston return spring. Remove the snap ring which retains the spring (Fig. 147). Remove the spring.

10.10.2
Remove the clutch piston assembly (Fig. 147).

10.10.3
Rebuild the clutch piston assembly, as outlined previously.

10.10.4
Remove hook-type seal ring (18) (Fig. 141), from the hub of drum (15).

10.10.5
Do not remove dowel pins (14) from drum (15).



T-77132

FIG. 147 REMOVING (OR INSTALLING) PISTON RETURN SPRING

10.10.6
Assembly. Install hook-type seal ring (18) onto the hub of drum (15).

10.10.7
Install piston (19), as assembled previously.

10.10.8
Position the clutch drum in a press and install the piston return spring, concave side downward onto clutch drum hub (Fig. 147).

10.10.9
Depress the inner diameter of the piston return spring and install the snap ring (Fig. 147).

10.11 TRANSFER DRIVE GEAR SLEEVE ASSY.

10.11.1
Disassembly (Fig. 141). Disassemble sleeve assembly (22) only if parts replacement is necessary.

10.11.2
Remove bushing (23) from sleeve (24). If the bushing must be cut out, do not damage the sleeve bore.

10.11.3
Assembly (Fig. 141). Install bushing (23) into the larger bore of sleeve (24). Press it in until the front (outer) end of the bushing is 0.30 inch (7.62 mm) below the end (front) of sleeve (24).

10.11.4
The bushing is prebored to give the proper inside diameter when installed.

10.12 TRANSMISSION REAR HOUSING ASSEMBLY

10.12.1
Disassembly (Fig. 133). The only operations required are the removal, if replacement is necessary, of welch plug (13) and pipe plug (14).

10.12.2
To remove plug (13), insert a punch from the inside of housing (2), through the clutch anchor pin hole, and drive out plug (13). Clean the bore from which it was removed.

10.12.3
Assembly (Fig. 133). If welch plug (13) was removed, coat the outer circumference of a new plug with nonhardening sealer. Press or drive the plug, closed end first, into the housing (2) until its outer end is even with the inner end of the chamfer in the bore.

10.12.4
If plug (14) was removed, install it into the threaded opening in the housing.

10.12.5
If the needle bearing(s) were removed from the driven gear, install new bearing(s) so that the replacer tool rests against the part number end of bearing race. Press each bearing flush with, to 0.020 inch (.5079 mm) below, the end surface of the driven gear.

10.12.6
Install the driven gear assembly over the gear shaft and into the pump body. Also install the drive gear into the pump body.

NOTE: When properly installed, end faces of both gears will project 0.002 to 0.003 inch (.0507 to .0761 mm) above the front surface of the pump body measured before gasket is installed). If end faces of the gears are below the flush line of the pump body, the pump will not perform satisfactorily and should be replaced.

10.12.7
Apply a liberal amount of oil onto the pump gears, and install the cover gasket and cover. Position the pump assembly front upward, until ready for installation onto the transmission housing.

10.13 TORQUE VALUES - ILLUSTRATED

10.13.1
Fig. 148, which follows, shows the torque values for threaded fasteners visible in the illustration.

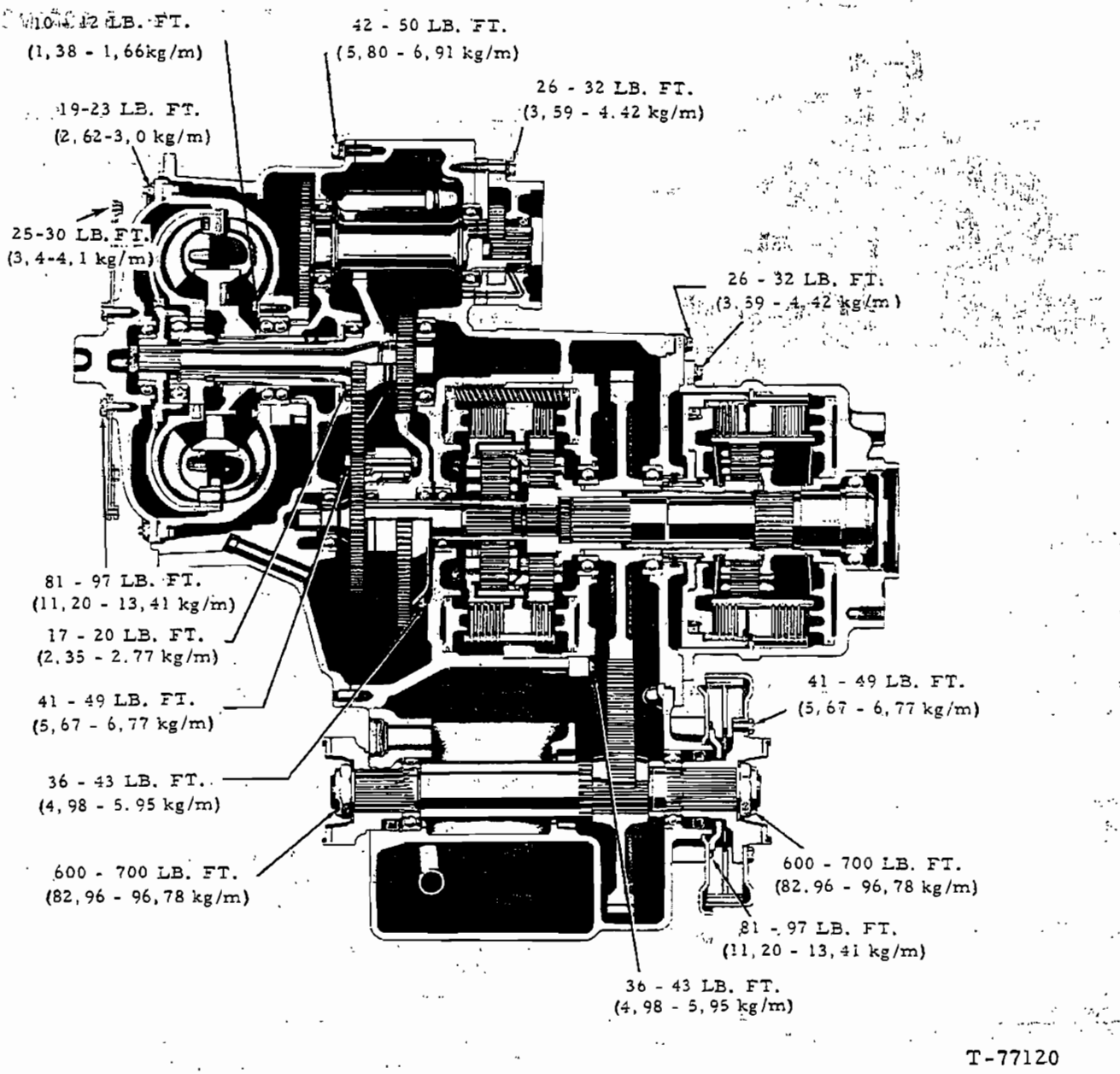


FIG. 148 TYPICAL TRANSMISSION, SHOWING TORQUE USED TO TIGHTEN BOLTS

10.14 INITIAL ASSEMBLY

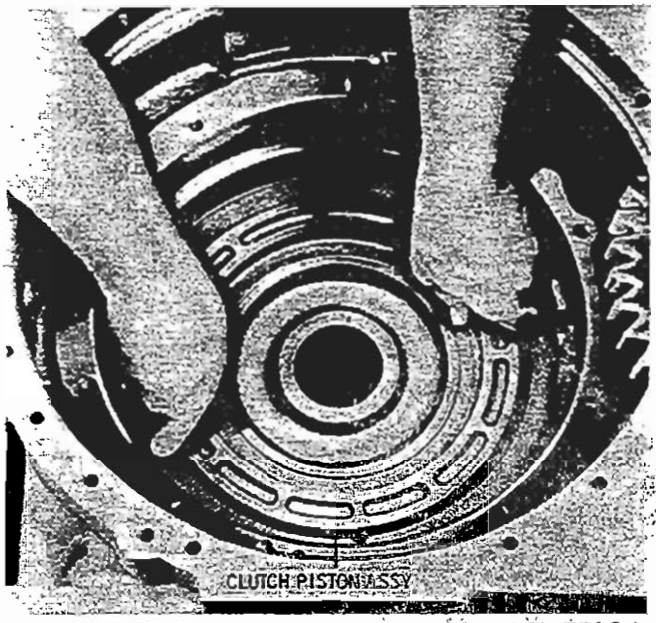
10.14.1
The following procedures are the assembly of the transmission from subassemblies. Refer to the cross section view, Fig. 125, for functional location of parts.

10.14.2
To assure proper lubrication of clutch plates, soak plates for two minutes in transmission oil before assembling. Lubricate all moving parts when assembling.

10.14.3
Installation of Forward, Reverse Clutches and Planetaries. Install the reverse clutch piston assembly, flat side first, after checking to insure that the lip of each seal ring is in its proper position (Fig. 149).

10.14.4
Refer to the note following 10.14.6, below. Beginning with an external-tanged plate, and alternating with internal-splined plates, install five external-tanged and four internal-splined reverse clutch plates (Fig. 150).

10.14.5
Install the remaining internal-splined plate onto the reverse planetary carrier assembly, behind the positioning ring on the clutch hub. Install the carrier assembly (Fig. 150), engaging the hub splines in the internal-splined plates installed above.



T-77134

FIG. 149 INSTALLING REVERSE CLUTCH PISTON ASSEMBLY

10.14.6
Install the clutch anchor pin (Fig. 151). Leave the anchor pin projecting from the housing (so that the anchor assembly may be rotated).

NOTE: The anchor pin may be installed at the inside of the transmission housing prior to operation 10.14.4, above, if the control valve assembly is in place.

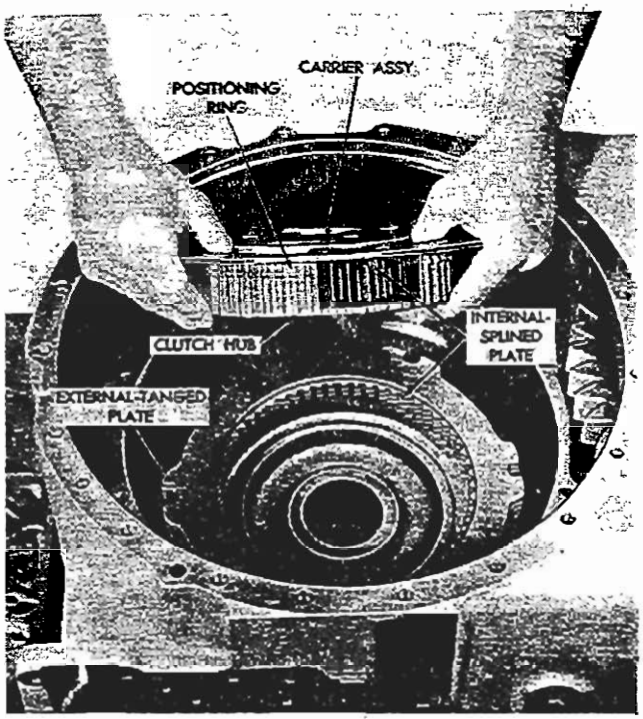
10.14.7
Install the forward and reverse clutch anchor assembly, longer ends of pins first. Engage the pins with the slots in the tangs of the reverse clutch plates (Fig. 151). Aline the anchor pin slot with the anchor pin. Be sure that all five external-tanged plates are engaged with the pins. Push the anchor pin into the housing to engage the anchor assembly.

10.14.8
Install the forward and reverse sun gear (16) (Fig. 77) into the reverse planetary carrier assembly.

10.14.9
Beginning with an internal-splined plate and alternating with external-tanged plates, install two internal-splined plates (10) (Fig. 74) and two external-tanged plates. The external tangs must engage the clutch anchor pins.

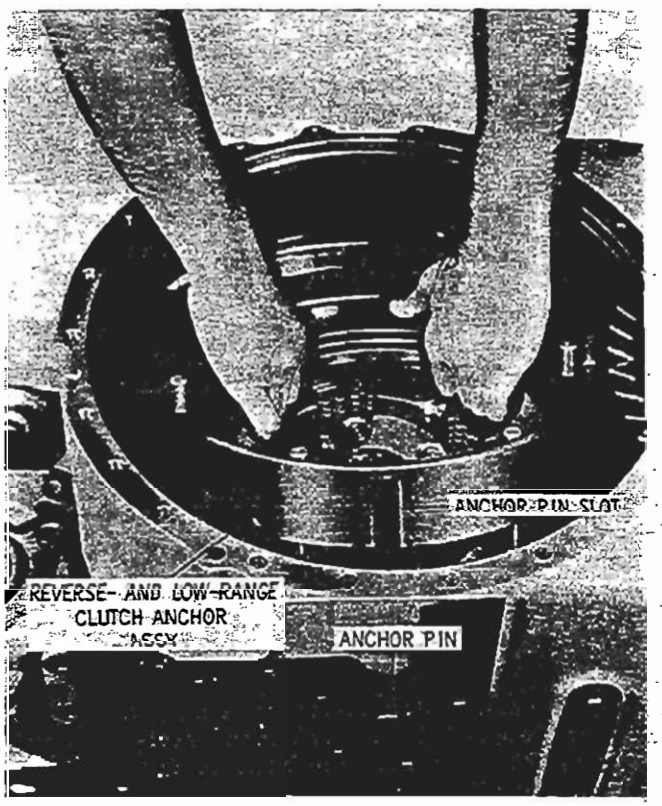
10.14.10
Install carrier assembly (2) into ring gear (1) and retain it with snap ring (9).

10.14.11
Install sun gear thrust washer (2) (Fig. 74) into the forward carrier assembly, using oil soluble grease to retain it.



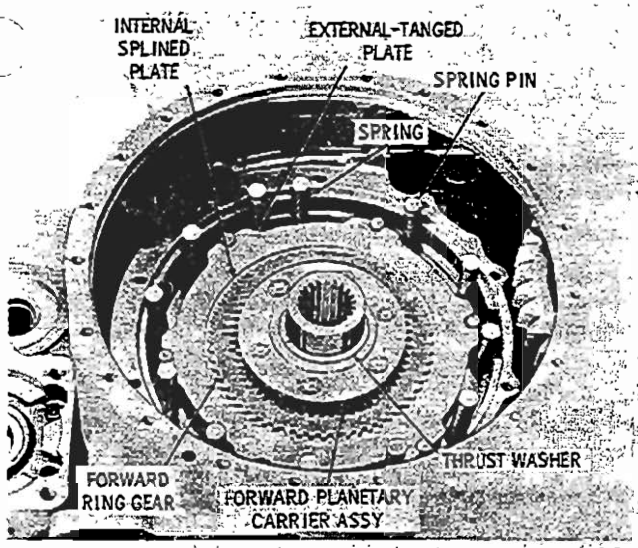
T-77135

FIG. 150 INSTALLING REVERSE CLUTCH PLATES AND PLANETARY CARRIER ASSEMBLY



T-77136

FIG. 151 INSTALLING FORWARD AND REVERSE CLUTCH ANCHOR ASSEMBLY



T-77129

FIG. 152 FORWARD CLUTCH AND PLANETARY AND CLUTCH PISTON SPRINGS AND PINS INSTALLED

10.14.12
Install the parts assembled in 10.14.10 and 10.14.11, above, meshing the reverse ring gear with the reverse pinions (Fig. 152). Install ring gear (12) (Fig.74A) longer ends of external splines first (toward front of transmission), onto the forward carrier assembly. The external splines of the ring gear must engage the internal-splined plates installed in 10.14.9, above.

10.14.13
Install the remaining internal-splined clutch plate and then the remaining external-tanged plate (Fig. 152).

10.14.14
Install the thrust washer onto the hub of the forward planetary carrier (Fig. 152).

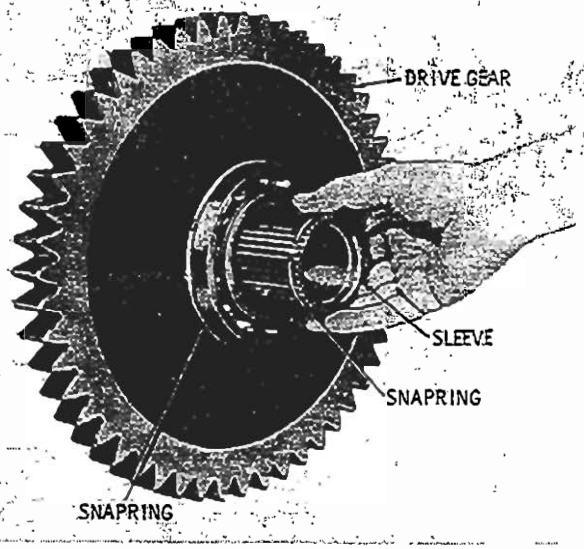
10.14.15
Install twelve clutch piston return springs and pins (springs first) into openings around the forward clutch plates (Fig. 152).

10.14.16
Installation of Forward Piston Housing, Transfer Drive Gear and Adapter Assembly. Install forward clutch piston (15) (Fig.74A), with seal rings properly positioned, into housing (19). Check to insure that plug (20) is in place in housing (19).

10.14.17
Install the forward clutch piston housing and retain it with ten 3/8-16 x 1 1/2 inch, self-locking bolts (21). Tighten the bolts to 36 to 43 pound feet.

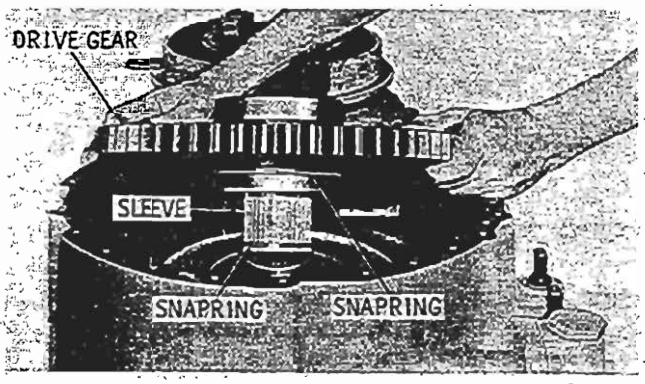
10.14.18
Install the snap ring into the groove near the end of the high-range sun gear splined sleeve. Install the sleeve into the transfer drive gear assembly at the side which has a smooth bore in the hub (Fig. 153).

10.14.19
Install the transfer drive gear and splined sleeve, bearing with snap ring first, onto the forward planetary carrier (Fig. 154)



T-77137

FIG. 153 INSTALLING HIGH-RANGE SUN GEAR SLEEVE INTO TRANSFER DRIVE GEAR



T-72514

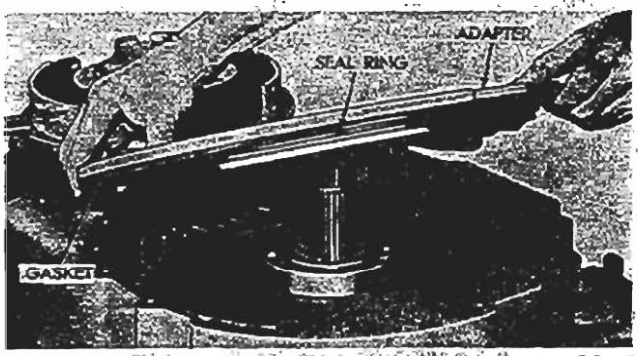
FIG. 154 INSTALLING TRANSFER DRIVE GEAR ASSEMBLY

10.14.20
Install the gasket and seal ring onto the rear housing adapter assembly. Install the adapter assembly (Fig. 155).

10.14.21
Install the sixteen 3/8-16 1 1/8 bolts, with lockwashers, to retain the adapter (Fig. 156). Tighten the bolts to 26 to 32 pound feet (3.5 to 4.4 kg/m) torque.

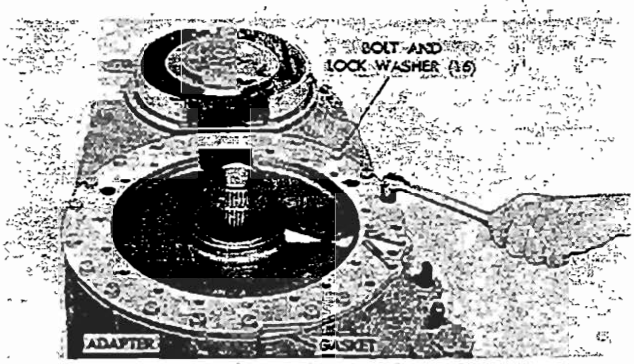
10.14.22
Installation of Low-range Clutch High-range Planetary. Install two step-joint seal rings (12) (Fig. 41) into the grooves in the front hub of low-range clutch drum (15). Use oil soluble grease to retain them.

NOTE: New Teflon seal rings may require forming by hand to help retain their proper circular shape. Wrap them in a circle around an object about two-thirds the diameter of the groove they fit.



T-72515

FIG. 155 INSTALLING REAR HOUSING ADAPTER



T-77138

FIG. 156 INSTALLING REAR HOUSING ADAPTER BOLTS

10.14.23
Install low-range clutch drum assembly (13) onto the high-range sun gear sleeve.

10.14.24
Install snap ring (25) into the groove in the high-range sun gear sleeve.

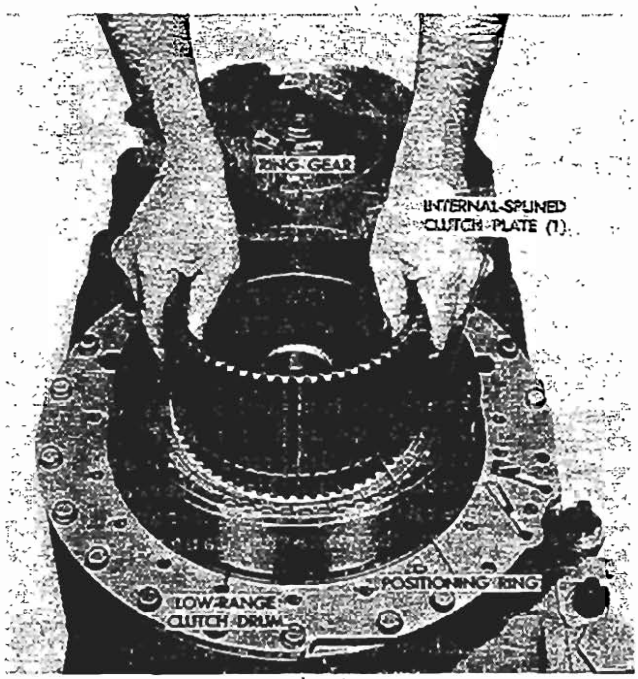
10.14.25
Install one low-range, internal-splined clutch plate into the low-range clutch drum (Fig. 157). Install the high-range ring gear, positioning ring first, into the clutch plate splines.

10.14.26
Beginning with an external-splined plate, alternately install three external and three internal-splined, low-range clutch plates (Fig. 158).

10.14.27
Install the low-range clutch back plate, flat side first, into the low-range clutch drum (Fig. 158).

10.14.28
Install the internal snap ring which retains the clutch back plate (Fig. 159).

10.14.29
Install the high-range planetary sun gear, thrust washer upward, onto the splines of the sun gear sleeve (Fig. 159).



T-72516

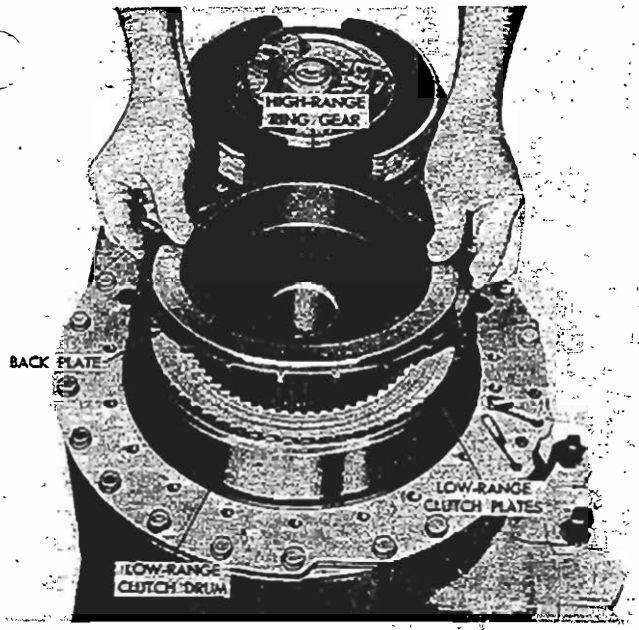
FIG. 157 INSTALLING HIGH-RANGE RING GEAR

10.14.30
Install high-range planetary carrier assembly into high-range ring gear.

10.14.31
Installation of High-range Clutch, Rear Housing. Install the high-range clutch piston, with seal rings and expanders, flat side first, into the rear housing assembly (Fig. 160).

10.14.32
Install the piston return spring, convex side upward. Depress the inner diameter of the spring and install the snap ring which retains it (Fig. 160).

10.14.33
Install the clutch anchor pin, leaving the flat milled end extending at the inside of the housing (Fig. 160).



T-72517

FIG. 158 INSTALLING LOW-RANGE CLUTCH BACK PLATE

10.14.34
Position the high-range clutch anchor assembly (12) (Fig. 146), pins upward on a flat surface. Beginning with an internal-splined clutch plate, alternately install five internal-splined and five external-tanged, high-range clutch plates. Engage the external tangs with the clutch anchor pins.

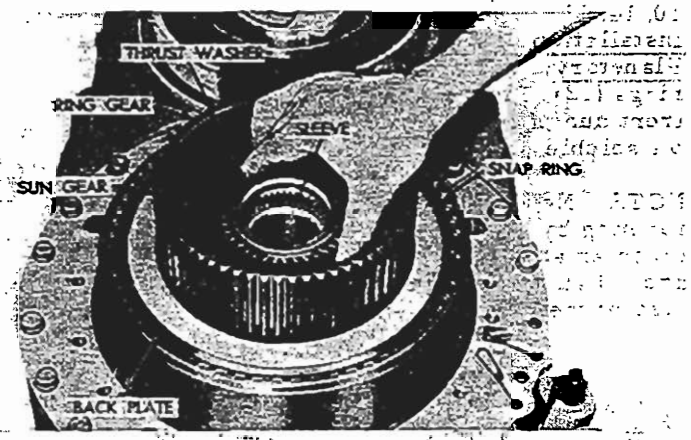
10.14.35
Grasp the entire anchor and plate assembly to hold the parts together. Install the anchor and plates into the rear housing, alining the anchor pin slot with the clutch anchor pin (Fig. 161).

10.14.36
Install the heavy internal snap ring which retains the clutch anchor. Note the position of the ends of the snap ring in relation to the two slightly extended pins in the anchor.

10.14.37
If bearing (6) (Fig. 133) was removed from shaft (5), install the bearing and snap ring (7). Press the assembled shaft and bearing, splined end first, into the rear of housing (2). Seat the bearing against the shoulder in the housing.

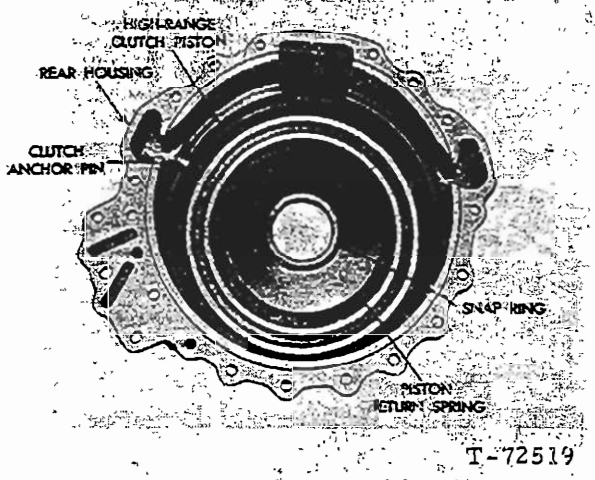
10.14.38
Install the internal snap ring which retains the shaft rear bearing (Fig. 162).

10.14.39
Install the seal ring into the groove in the rear bore of the rear housing (Fig. 162). Install the retainer, chamfered side first.



T-72518

FIG. 159 INSTALLING HIGH-RANGE SUN GEAR



T-72519

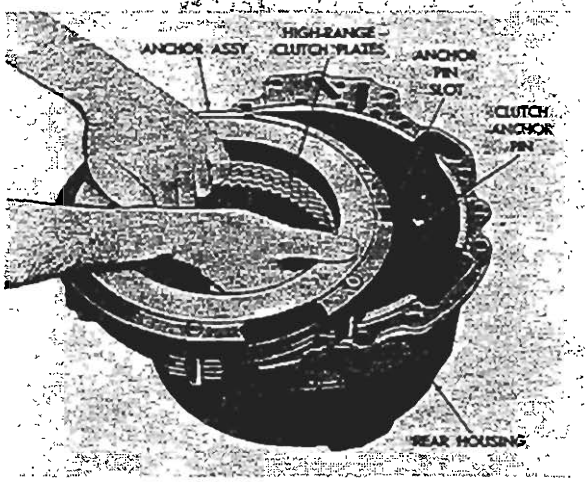
FIG. 160 REAR HOUSING AND PISTON ASSEMBLY

10.14.40
Install the snap ring which holds the oil retainer in the rear of the rear housing (Fig. 163).

10.14.41
Install the rear housing gasket onto the rear housing, using oil soluble grease to retain it. Install the rear housing onto the transmission.

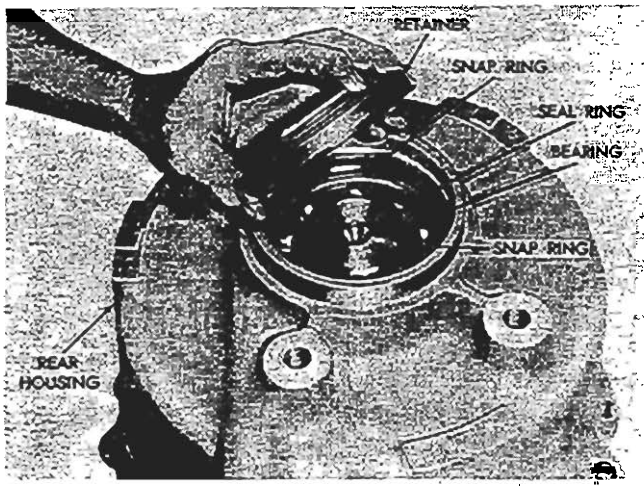
NOTE: Rotate the transmission output shaft slowly to engage the splines of the high-range clutch plates with the splines of the high-range ring gear.

10.14.42
Install three 3/8-16 x 1 1/2 inch bolts and lockwashers, and seventeen 3/8-16 x 1 1/8 inch bolts and lockwashers to retain the rear housing on the adapter. Tighten the bolts to 26 to 32 pound feet (3.5 to 4.4 kg/m) torque.



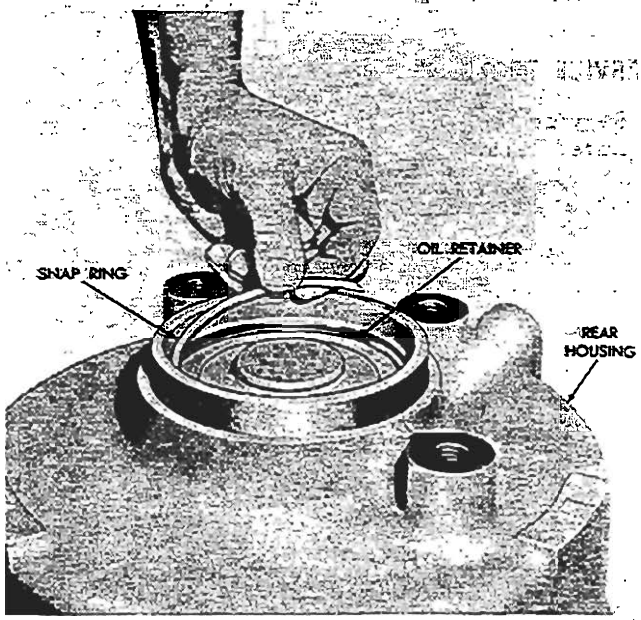
T-77124

FIG. 161 INSTALLING HIGH-RANGE CLUTCH ANCHOR AND PLATES



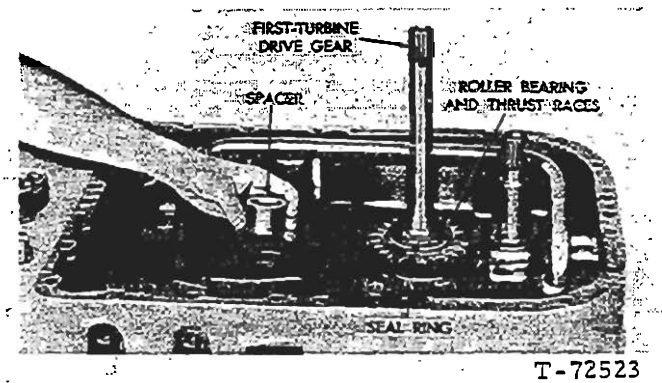
T-72521

FIG. 162 INSTALLING OIL RETAINER



T-72522

FIG. 163 INSTALLING OIL RETAINER SNAP RING



T-72523

FIG. 164 INSTALLING FORWARD AND REVERSE SUN GEAR SPACER

10.15 INSTALLING FORWARD AND REVERSE SUN GEAR SPACER

10.15.1
Position the transmission, front downward, and block it in a level position. Install the forward and reverse sun gear spacer (Fig. 164).

TOPIC 11 SERVICE TOOLS, WEAR LIMITS AND SPRING DATA

11.1 SERVICE TOOLS

Service tools required to perform the various repairs explained in this manual are listed below.

Order service tools from your local Fiat-Allis dealer.

IMPORTANT: Refer to Fiat-Allis Tool Catalogs, as follows, for complete tool illustrations, descriptions and usage:

English	No. 73128466
French	No. 73128467
Spanish	No. 73128468
Italian	No. 73128469

FIGURE NO.	PART NO.	DESCRIPTION
26	75295295	Snap ring pliers
122	75300810	Torque wrench

11.2 WEAR LIMITS

11.2.1
Maximum Variations. The wear limits information in this section shows the maximum wear at which components are expected to function satisfactorily.

11.2.2
Cleaning, Inspection. Parts must be clean to permit effective inspection for wear or damage. Refer to paragraph 4.6, above.

11.2.3
Bearings, Bearing Journals, Bores. The application of bearings to any product is based on the recommendations of the bearing manufacturer and, therefore, no diametral dimensional deviation should be permitted in the bearing or mated parts. Bearings should be carefully checked for signs of distress before reinstalling in the transmission.

11.2.4
Gears. Gears should be inspected for load pattern and signs of distress. Any distress indicates a possible future failure, and the reuse of such gears should be the decision of the individual customer, based on experience. Backlash cannot be used to establish critical wear of a gear. The backlash tolerances are of such nature that a gear usually pits, scuffs, scores, or galls long before the gear wear becomes critical.

11.2.5
Splines. Unless severe, spline wear is not considered detrimental except where it affects tightness of an assembly such as driveline flanges. Here, again, backlash cannot be used to establish critical wear because both mating parts must be concentrically located to obtain accurate measurement of backlash.

11.2.6
Hook-type Seal rings. Sides of the seal ring should be smooth (maximum wear 0.005 inch .1270 mm). The sides of the groove into which the seal rings fit should be smooth (50 microinch equivalent), and square with the axis of rotation within 0.002 inch (.0507 mm). A new seal ring should be installed if grooves are reworked, or seal ring outside diameter wear causes the possibility of a closed gap between seal ring hooks when the ring is installed.

11.3 WEAR LIMITS CHART

11.3.1
The chart which follows lists the wear limits data and is referenced to the exploded views throughout the manual.

11.4 SPRING DATA

11.4.1
Springs must be clean to permit effective inspection. Springs should be replaced if there are signs of overheating, wear due to rubbing adjacent parts, or permanent set. Discard springs which do not meet the load-height specifications in the spring chart.

11.5 SPRING CHART

11.5.1
Inspection criteria (load versus height) and identification characteristics of the springs are presented in the chart following the wear limits chart. The spring chart data are keyed to the exploded views throughout the manual.

(Revised November 1980)

Wear Limits and Spring Data

WEAR LIMITS CHART

FIG.	DESCRIPTION	WEAR LIMIT	CONE (MAX)
Fig. 63	TORQUE CONVERTER HOUSING AND TURBINE DRIVE GEARS		
25	Thrust bearing race thickness	0.028 (.7111 mm)	
27	Thrust bearing race thickness	0.120 (3.048 mm)	
Fig. 65	TURBINE DRIVEN GEARS AND FREEWHEEL CLUTCH		
9	*Freewheel roller diameter	0.4980 (12.649 mm)	
10	*Freewheel cam surface wear	0.005 (0.1270 mm)	
10	*Freewheel cam pocket wear	0.003 (0.0762 mm)	
15	First-turbine driven gear hub outside diameter	3.0327 (TT) (77.189 mm) 3.0377 (TRT) (89.89 mm)	
Fig. 77	REVERSE-RANGE CLUTCH AND PLANETARY		
6, 17	Clutch plate thickness	0.097 (2.463 mm)	0.030 (.7619 mm)
7, 18	Clutch plate thickness	0.130 (3.302 mm)	0.012 (.3047 mm)
	**Minimum clutch pack thickness	1.185 (30.099 mm)	
11	Pinion end play in carrier (15)	0.055 (1.347 mm)	
20	Clutch anchor face wear reverse range face	0.020 (.5079 mm)	
	low-range face	0.020 (.5079 mm)	
Fig.	LOW-RANGE CLUTCH AND PLANETARY		
7	Pinion end play in carrier (3)	0.055 (1.397 mm)	
10, 13	Clutch plate thickness	0.130 (3.302 mm)	0.012 (.3047 mm)
11, 14	Clutch plate thickness	0.097 (2.463 mm)	0.030 (.7619 mm)

*Total wear of freewheel parts (2 x roller wear - sum of cam surface wear at two opposing points - gear hub wear) must not exceed 0.010 inch (.2540 mm). (Determine cam surface wear by measuring depth of groove caused by roller contact in the cam pocket.)

**Total of individual plate thicknesses. Replace plates having the most wear with new plates to increase pack thickness.

(Revised November 1980)

WEAR LIMITS CHART (cont'd)

FIG.	DESCRIPTION	WEAR LIMIT	CONE (MAX)
	**Minimum clutch pack thickness	0.908 (TT) (23.063 mm) 0.691 (TRT) (17.551 mm)	
22	Thrust washer thickness	0.125 (TRT) (3.175 mm)	
23	Thrust washer thickness	0.089 (TRT) (2.261 mm)	
Fig. 74	HIGH-RANGE CLUTCH AND PISTON HOUSING		
2	Transfer gear clutch face wear	0.020 (.5079 mm)	
7, 11	Clutch plate thickness	0.130 (3.302 mm)	0.012 (.3047 mm)
8	Clutch plate thickness	0.097 (2.463 mm)	0.030 (.7619 mm)
	**Minimum clutch pack thickness	0.357 (9.068 mm)	
10	Diametral Clearance between: high-range clutch hub bushing in piston housing (21)	0.005 (.1270 mm)	
16	Seal ring thickness	0.088 (9.067 mm)	
17	Piston face wear	0.020 (.5079 mm)	
Fig. 87	OUTPUT SHAFTS AND DISCONNECT ASSEMBLY		
10 22	Diametral clearance between: front output shaft and bushing in output shaft (23)	0.010 (.2540 mm)	
Fig. 116A	OIL PUMP ASSEMBLIES		
3	Cover at gear face	0.001 (.0254 mm)	
12	Driven gear shaft OD	0.749 (19.024 mm)	
Fig. 55	CONTROL VALVE ASSEMBLIES		
8	Valve clearance in body 9	0.004 (.1016 mm)	
16	Plug clearance in body 9	0.0035 (.0888 mm)	
20	Valve clearance in body 9	0.004 (.1016 mm)	

**Total of individual plate thicknesses. Replace plates having the most wear with new plates to increase pack thickness.

WEAR LIMITS CHART (cont'd)

FIG.	DESCRIPTION	WEAR LIMIT	GONE (MAX)
21	Valve plug clearance in plug 25	0.004 (.1016 mm)	
27	Valve clearance in body 9	0.003 (.0761 mm)	
Fig. 141	LOW-RANGE CLUTCH AND TRANSFER DRIVE GEAR (TRT ONLY)		
9	Adapter sleeve - No scoring permissible		
19	Clutch piston face wear	0.010 (.2540 mm)	
22	Sleeve bushing	2.008 (5.283 mm)	
26, 29	Clutch plate thickness	0.130 (.7619 mm)	0.012 (.3047 mm)
27, 30	Clutch plate thickness	0.097 (2.463 mm)	0.030 (.7619 mm)
31	Backplate face wear	0.010 (.2540 mm)	
	Minimum clutch pack thickness	0.841 (21.361 mm)	
Fig. 145	HIGH-RANGE CLUTCH AND PLANETARY (TRT ONLY)		
1	High-range sun gear assembly thickness	1.718 (43.640 mm)	
7	Pinion end play in carrier 5	0.055 (1.397 mm)	
13	Anchor face wear (rear)	0.020 (.5079 mm)	
16	Clutch plate thickness	0.130 (3.302 mm)	0.012 (.3047 mm)
17	Clutch plate thickness	0.097 (2.463 mm)	0.030 (.7619 mm)
	Minimum clutch pack thickness	1.135 (41.402 mm)	

SPRING CHART

FIG	REF	SPRING	NO COILS	DIAMETER OF WIRE	OUTSIDE DIAMETER	FREE LENGTH	UNDER LENGTH LOAD	POUNDS
55	14	Main-pressure regulator valve: 645 B, 165 - 195 range	16	0.125 (2.174 mm)	0.787 (19.99 mm)	3.599 (19.99 mm)	2.50 (63.50 mm)	96 to 106 (43.54 - 48.08 kg)
		545 B, 605 B, 138 - 165 range	17	0.118 (2.997 mm)	0.754 (19.151 mm)	3.61 (91.69 mm)	2.50 (63.50 mm)	80 to 90 (36.2 - 40.8 kg)
55	15	Trimmer	8	0.128 (3.251 mm)	1.110 (27.19 mm)	2.580 (65.53 mm)	1.43 (36.32 mm)	72.20 to 82.20 (35.54 - 37.36 kg)
55	19	Clutch cutoff valve (250 psi)	20	0.091 (2.311 mm)	0.625 (15.87 mm)	3.200 (81.28 mm)	2.38 (60.45 mm)	27.9 to 34.1 (12.6 - 15.50 kg)
55	31	Selector valve detent	11	0.054 (1.371 mm)	0.480 (12.19 mm)	1.236 (31.39 mm)	0.78 (19.81 mm)	7.84 to 8.16 (3.56 - 3.70 kg)
63	19	Lubrication pressure regulator valve	13.5	0.047 (1.193 mm)	0.042 (1.066 mm)	1.440 (36.57 mm)	1.00 (25.40 mm)	5.58 to 6.82 (2.54 - 3.10 kg)
63	22	Converter pressure regulator valve - First type	10	0.080 (2.032 mm)	0.468 (11.88 mm)	1.206 (30.63 mm)	1.00 (25.40 mm)	23.4 to 28.6 (10.6 - 13.0 kg)
64B	4	Second type (Lt. green)	12	0.067 (1.7 mm)	.406 (10.3 mm)	1.55 (39.4 mm)	1.02 (25.9 mm)	28.3 to 34.5 (12.6 - 15.3 kg)
65	7	Freewheel clutch	27	0.033 (.8381 mm)	0.185 (4.699 mm)	1.580 (40.13 mm)	1.14 (28.96 mm)	6.05 to 7.25 (2.75 - 3.29 kg)
74	15	High-range clutch piston return	-- Belleville spring		5.140 (130.5 mm)	0.275 (6.984 mm)	--	--
77	22	Reverse-and low-range clutch piston return spring	37.5	0.105 (2.667 mm)	0.625 (15.87 mm)	6.127 (155.6 mm)	4.80 (121.9 mm)	45.1 to 49.9 (20.50 - 22.68 kg)
87	12	Disconnect detent	14	0.062 (1.574 mm)	0.353 (8.966 mm)	1.320 (33.52 mm)	1.15 (29.21 mm)	11.88 to 14.52 (5.40 - 6.60 kg)
141	20	Low-range clutch piston return	-- Belleville spring		6.700 (170.1 mm)	0.279 (7.087 mm)	--	--
145	19	High-range clutch piston return	-- Belleville spring		6.700 (170.1 mm)	0.279 (7.087 mm)	--	--