

UNCLASSIFIED  
482.387  
1727C

RECLASSIFIED BY  
AUTHORITY OF DOD DIR 5200  
BY *RAH/EG* ON *10/13/30*

*Reynolds*

U.S. Army Military History Institute

Restricted Classification  
Removed Per  
Executive Order 13526

UNCLASSIFIED TM 9-1727C

~~RESTRICTED~~

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE  
HYDRA-MATIC TRANSMISSION and  
PROPELLER SHAFTS for LIGHT TANKS M5,  
M5A1, and 75-MM HOWITZER MOTOR  
CARRIAGE M8

FEBRUARY 5, 1943

This record was previously  
allocated to RG 318 (Entry  
No. 382) and is now assigned  
to RG 267.

DECLASSIFIED  
DATE: 10/17/85  
BY: 1042/MS/STW

*Handwritten notes and signatures:*  
310-24  
56

TECHNICAL MANUAL }  
 No. 9-1727C }

WAR DEPARTMENT  
 Washington, February 5, 1943

**ORDNANCE MAINTENANCE**  
**HYDRA-MATIC TRANSMISSION and PROPELLER SHAFTS**  
**for LIGHT TANKS M5, M5A1,**  
**and 75-MM HOWITZER MOTOR CARRIAGE M8**

Prepared under the direction of the  
**Chief of Ordnance**  
 (with the cooperation of the Cadillac Motor Car Division,  
 General Motors Corporation)

**CONTENTS**

	Paragraphs	Pages
SECTION I. Introduction .....	1-3	2-6
II. Hydra-Matic transmission .....	4-22	7-199
III. Propeller shafts .....	23-37	200-211
IV. References .....	38-39	212-213
INDEX .....		214-221

**Restricted Classification**  
 Removed Per  
 Executive Order 10501

\*This manual supersedes, in part, TB 1732-1, August 29, 1942.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**Section I**

**INTRODUCTION**

	Paragraph
Purpose and scope .....	1
Description of vehicles .....	2
References .....	3

**1. PURPOSE AND SCOPE.**

a. Technical Manual No. 9-1727C is published for the information and guidance of all ordnance personnel charged with maintenance and overhauling the Light Tanks M5, M5A1, and 75-mm Howitzer Motor Carriage M8.

b. Technical Manual No. 9-1727C covers the Light Tanks M5, M5A1, and 75-mm Howitzer Motor Carriage M8. It includes complete maintenance information on the Hydra-Matic transmissions and propeller shafts. The other technical manuals covering these vehicles are listed in section IV.

**2. DESCRIPTION OF VEHICLES.**

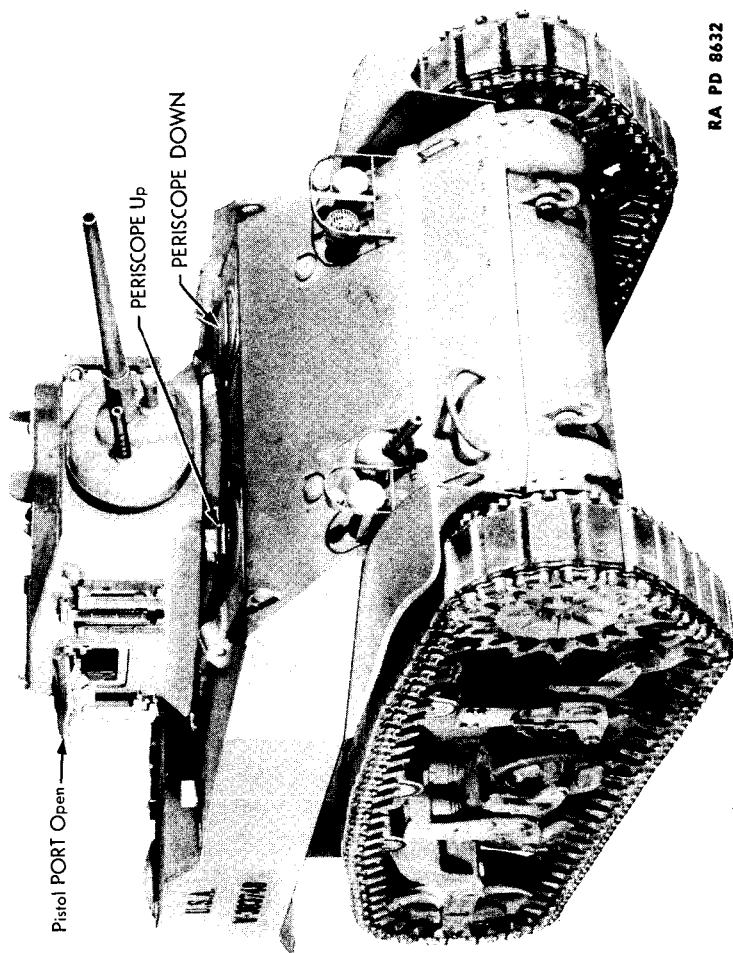
a. The Light Tank M5 (fig. 1) is an armored, full-tracklaying combat vehicle carrying a crew of 4 men. It is powered by 2 liquid-cooled, 90-degree, V-type, 8-cylinder Cadillac engines located in the engine compartment in the rear of the hull. Power is transmitted to the final drives and tracks through 2 Hydra-Matic transmissions, 2 propeller shafts, a 2-speed, step-down transfer unit, and the controlled differential (fig. 3). This same description applies to the Light Tank M5A1.

b. The Motor Carriage M8 (fig. 2) is an armored, full-tracklaying, self-propelled mount for a 75-mm howitzer. It carries a crew of 4 men. It is powered by the same engines, transmissions, and power train as the Light Tanks M5 and M5A1.

**3. REFERENCES.**

a. Section IV of this volume lists all technical manuals, standard nomenclature lists, and other publications relative to the materiel described herein.

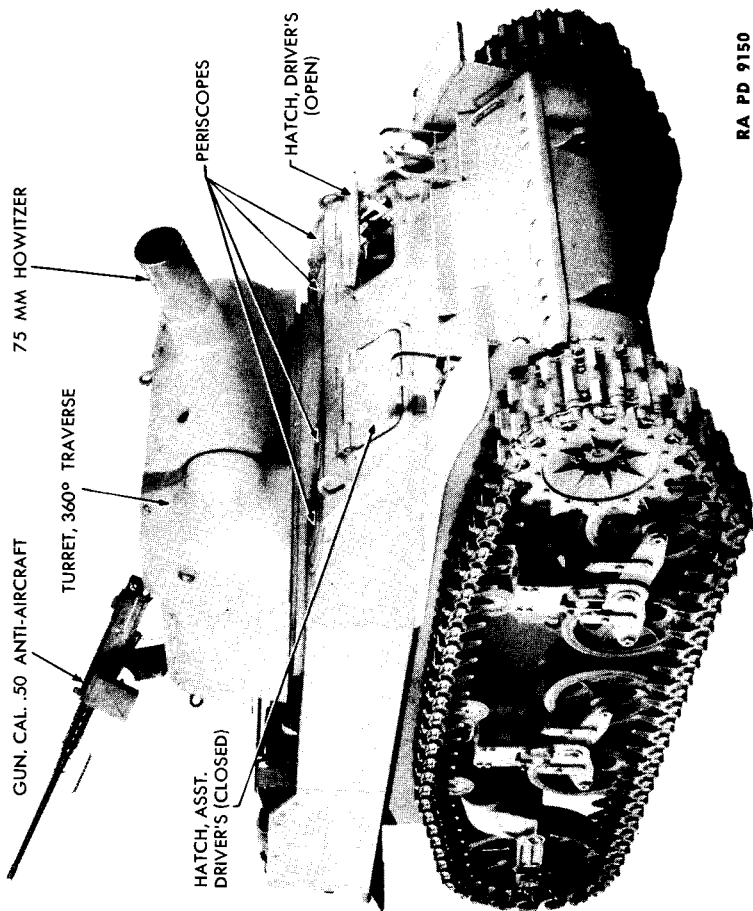
# INTRODUCTION



RA PD 8632

Figure 1 — Light Tank M5 — Right Front View

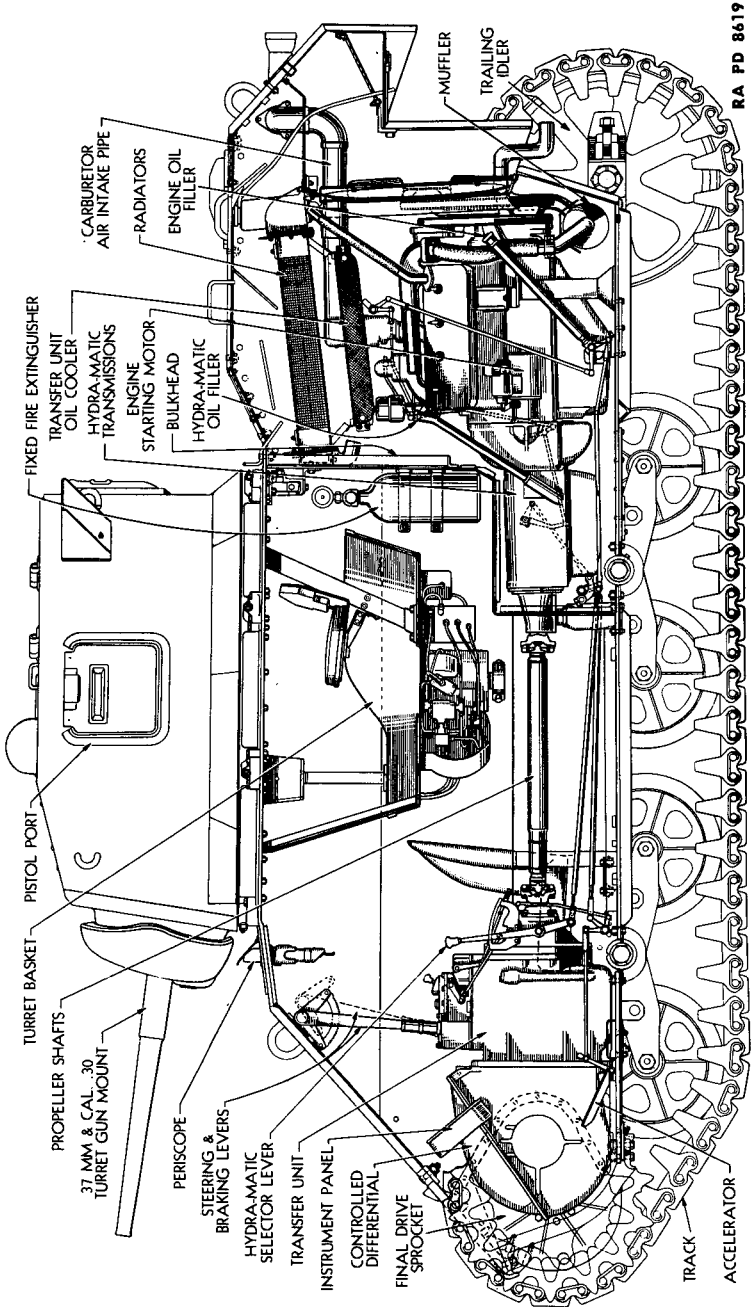
**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 9150

**Figure 2 — Motor Carriage M8 — Right Front View**

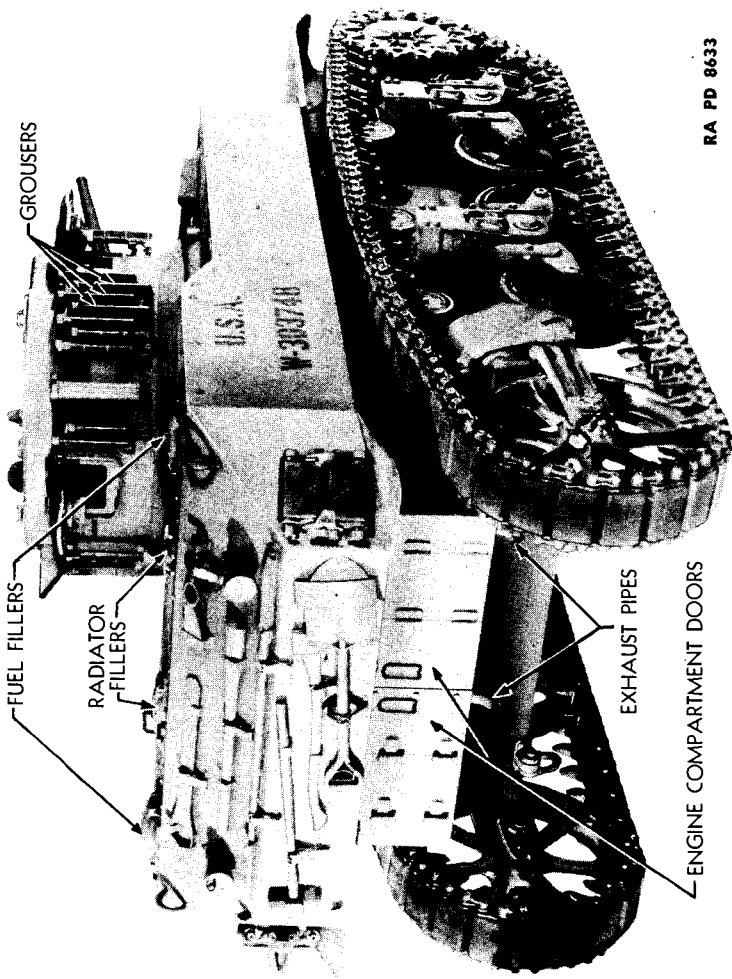
INTRODUCTION



RA PD 8619

Figure 3 — Light Tank M5 — Cross Section

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8633

Figure 4 — Light Tank M5 — Right Rear View

## Section II

**HYDRA-MATIC TRANSMISSION**

	Paragraph
Description .....	4
Operation .....	5
Tabulated data and specifications .....	6
Allocation of maintenance duties by echelons .....	7
Inspection in vehicle .....	8
Trouble shooting .....	9
Service in vehicle .....	10
Replacement of components with transmission in the vehicle..	11
Transmission removal from vehicle .....	12
Transmission disassembly .....	13
Inspection and repair of disassembled transmission .....	14
Disassembly, inspection, and assembly of transmission control units .....	15
Assembly of transmission and transmission control unit installation	16
Transmission installation in vehicle .....	17
Limits and tolerances .....	18
Torque tightnesses .....	19
Special tools .....	20
Preparation for extreme conditions .....	21
Packing, shipping, and storage .....	22

**4. DESCRIPTION.**

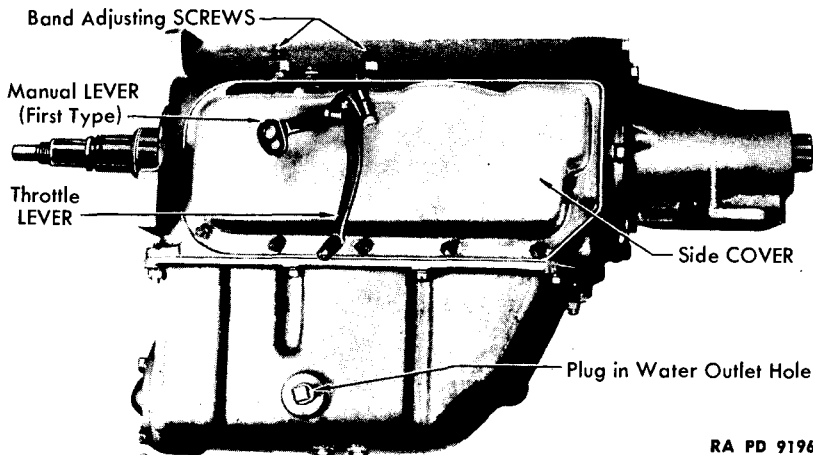
a. The Hydra-Matic transmission consists of the following power transmitting units, listed in the order in which they transmit the drive: the flywheel cover; the front planetary unit, consisting of single reduction planetary gears; the fluid coupling or torus members; the rear planetary unit, comprising compound reduction planetary gears; and the reverse unit. The last two units are connected to the output shaft.

b. The fluid coupling of the Hydra-Matic transmission, which replaces the conventional clutch, is composed of two torus members, each splined to an independent shaft (fig. 8). One member is known as the "driving" member; the other as the "driven" member. Both members are identical in construction except for the hubs, which serve to attach the members to their respective shafts.

(1) Rotation of the driving torus member creates centrifugal forces in the fluid contained in this member, and accordingly the fluid tends



ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 9196

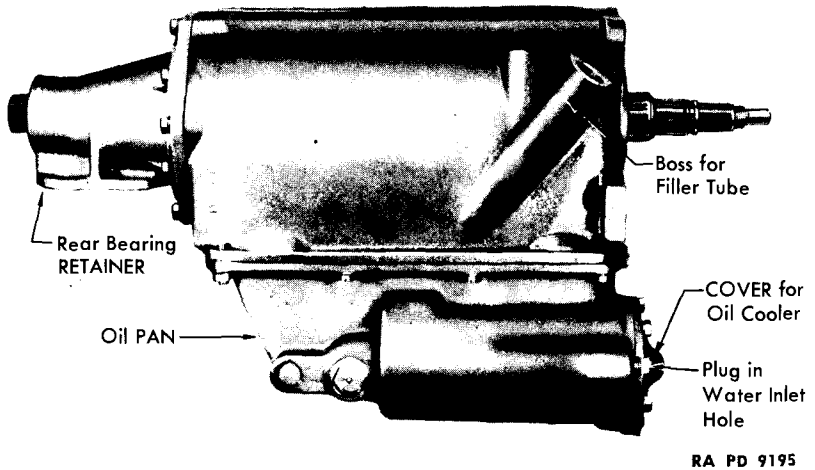
**Figure 5 — Hydra-Matic Transmission, Left Side**

to flow radially outward, this tendency increasing very rapidly as the rotating speed increases. As the fluid is forced to the outer part of the driving torus, it crosses over to the driven torus member, and sets up a driving force in the driven member which causes it to rotate at nearly the same speed as the driving member (figs. 9 and 10).

c. The planetary units each consist of three planet gears meshed between a sun gear and an internal gear, one of which is integral with a drum which can be held from rotating by a band. The band is released or applied by a "servo" mechanism, which is simply a double-acting piston and cylinder operated by oil and spring pressure. The front and rear planetary units also incorporate a friction drive or multiple disk clutch, which is applied by oil pressure and released by springs. The pressure lines are so arranged that the clutch is released when the band is applied and the clutch is applied when the band is released. In either unit, when the band is applied and the clutch released, either the center gear or the internal gear is held stationary, the planet gears "walk around" the driving gear at reduced speed, and the unit is in reduction (fig. 11). When the band is released and the clutch engaged, however, the entire assembly is locked together and rotates as a unit (fig. 12).

d. In addition to the power transmitting parts, there are the hydraulic control units, including two oil pumps, a governor and various

## HYDRA-MATIC TRANSMISSION



RA PD 9195

**Figure 6 — Hydra-Matic Transmission, Right Side**

control valves, and the servos that operate the front and rear clutches and bands (fig. 19).

### 5. OPERATION.

a. In the following description, steps b through g trace the flow of power through the transmission in the various gear ratios. The factors which cause the unit to change ratios and the mechanism which controls these changes are covered in steps h through q.

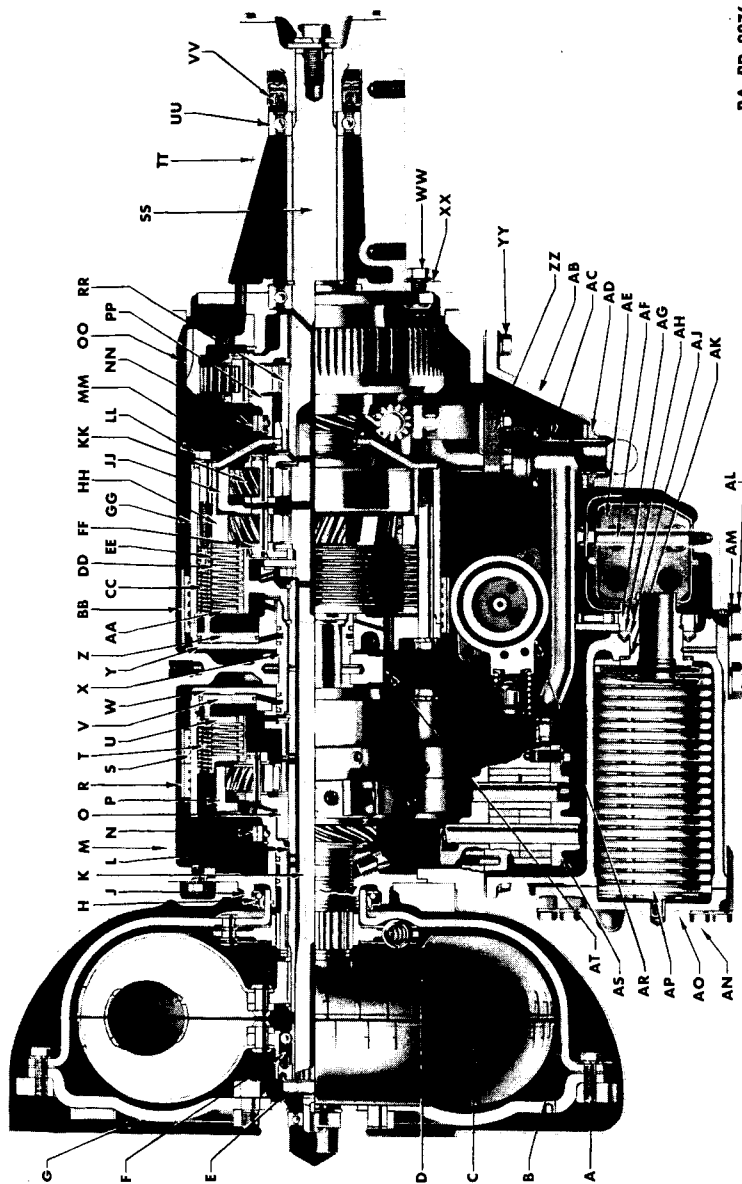
b. **Neutral.** In neutral, with the engine running, there is no oil pressure to the front servo or to either of the clutches. The front unit brake band is held in the released position by the release spring in the front servo. Oil pressure is directed to the rear servo, however, where it releases the rear brake band. Since both brake bands and both clutches are free, no drive can be taken through the transmission.

c. **First Speed** (fig. 14).

(1) When the control lever is moved into either the "DR" or "LO" range, the transmission shifts to first speed. The front unit brake band is applied by oil pressure to the front servo, and the rear unit brake band is applied by oil and spring pressure in the rear servo.

(2) Since the front band is applied, the front drum and the front sun gear are held stationary. Rotation of the internal driving gear causes the front planet gears to "walk around" the sun gear at a reduced speed of 1.44 to 1 gear ratio. The carrier for the planet gears is keyed

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8976

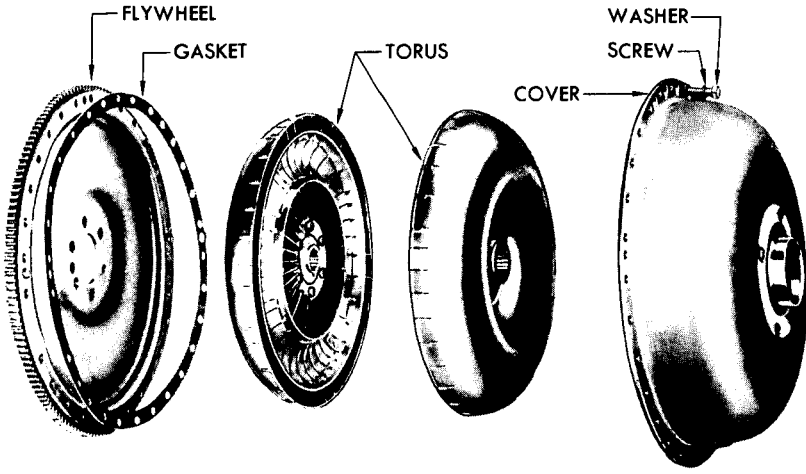
Figure 7 — Hydra-Matic Transmission, Cross Section

**HYDRA-MATIC TRANSMISSION**

<b>A</b> — SCREW	<b>T</b> — SPRING	<b>LL</b> — SCREW	<b>AE</b> — SCREEN, ASSEMBLY
<b>B</b> — COVER, ASSEMBLY	<b>U</b> — PLATE	<b>MM</b> — FLANGE	<b>AF</b> — BOLT
<b>C</b> — TORUS, ASSEMBLY	<b>V</b> — PISTON	<b>NN</b> — GEAR	<b>AG</b> — NUT
<b>D</b> — TORUS, ASSEMBLY	<b>W</b> — DRUM, ASSEMBLY	<b>OO</b> — GEAR	<b>AH</b> — RING
<b>E</b> — NUT	<b>X</b> — SLEEVE, ASSEMBLY	<b>PP</b> — CARRIER, ASSEMBLY	<b>AJ</b> — SEAL
<b>F</b> — SPRING	<b>Y</b> — DRUM, ASSEMBLY	<b>RR</b> — GEAR, ASSEMBLY	<b>AK</b> — GASKET
<b>G</b> — FLYWHEEL, ASSEMBLY	<b>Z</b> — PISTON	<b>SS</b> — SHAFT, ASSEMBLY	<b>AL</b> — PLUG
<b>H</b> — SEAL, ASSEMBLY	<b>AA</b> — PLATE	<b>TT</b> — RETAINER	<b>AM</b> — GASKET
<b>J</b> — COVER, ASSEMBLY	<b>BB</b> — BAND, ASSEMBLY	<b>UU</b> — BEARING, ASSEMBLY	<b>AN</b> — SCREW
<b>K</b> — SHAFT, ASSEMBLY	<b>CC</b> — SPRING	<b>VV</b> — SEAL, ASSEMBLY	<b>AO</b> — COVER
<b>L</b> — SHAFT, ASSEMBLY	<b>DD</b> — PLATE	<b>WW</b> — SCREW	<b>AP</b> — COOLER, ASSEMBLY
<b>M</b> — CASE, ASSEMBLY	<b>EE</b> — PLATE	<b>XX</b> — WASHER	<b>AR</b> — SERVO, ASSEMBLY
<b>N</b> — GEAR	<b>FF</b> — PIN	<b>YY</b> — SCREW	<b>AS</b> — SERVO AND OIL PUMP ASSEMBLY
<b>O</b> — CARRIER, ASSEMBLY	<b>GG</b> — DRUM, ASSEMBLY	<b>ZZ</b> — PUMP, ASSEMBLY	<b>AT</b> — CAP, ASSEMBLY
<b>P</b> — GEAR, ASSEMBLY	<b>HH</b> — GEAR, ASSEMBLY	<b>AB</b> — PAN	
<b>R</b> — BAND, ASSEMBLY	<b>JJ</b> — CARRIER, ASSEMBLY	<b>AC</b> — PIPE, ASSEMBLY	
<b>S</b> — DRUM, ASSEMBLY	<b>KK</b> — PINION	<b>AD</b> — SEAL	

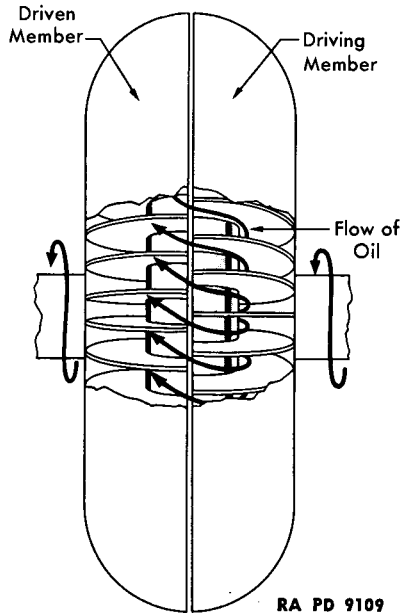
RA PD 8976B

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8683B

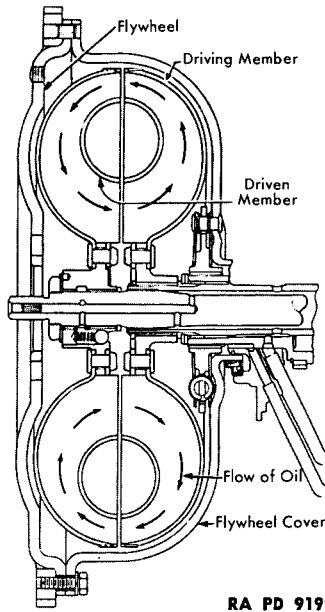
Figure 8 — Fluid Coupling, Disassembled



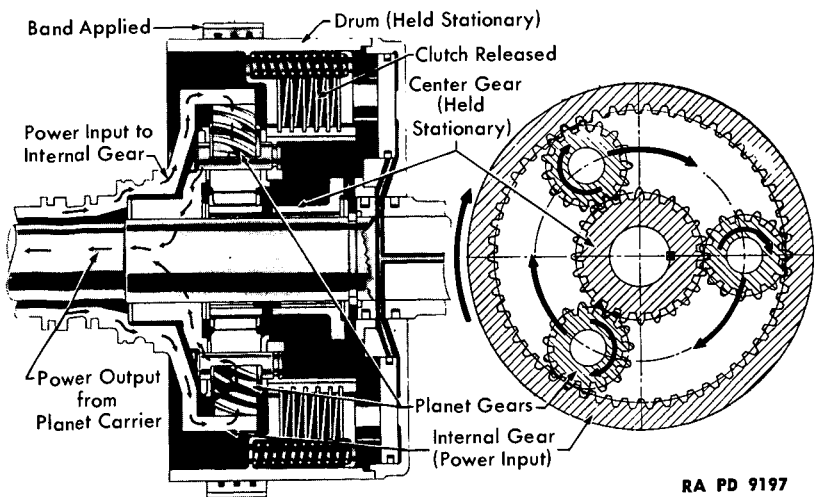
RA PD 9109

Figure 9 — Fluid Coupling, Schematic View

### HYDRA-MATIC TRANSMISSION

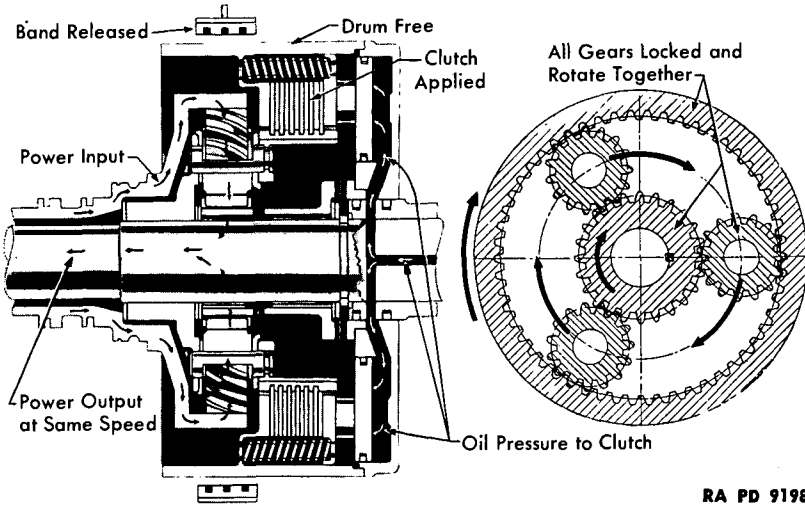


**Figure 10 — Fluid Coupling, Schematic Cross Section**



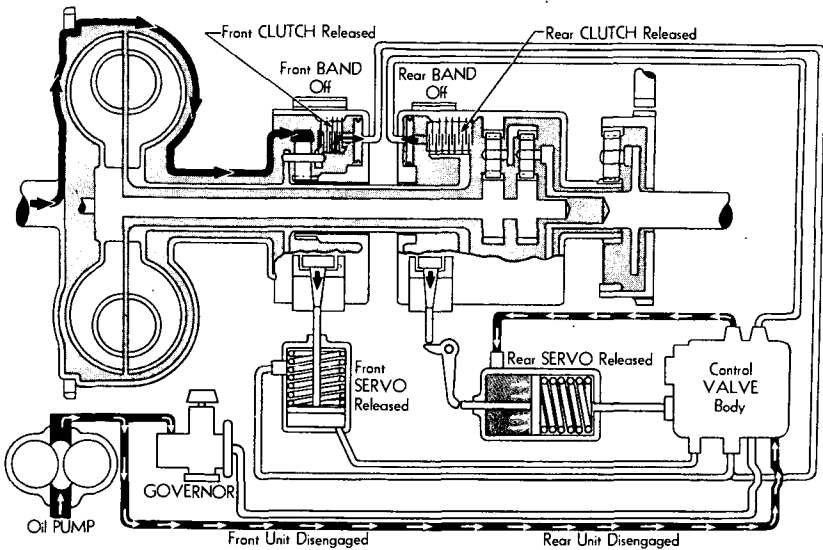
**Figure 11 — Planetary Unit in Reduction**

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 9198

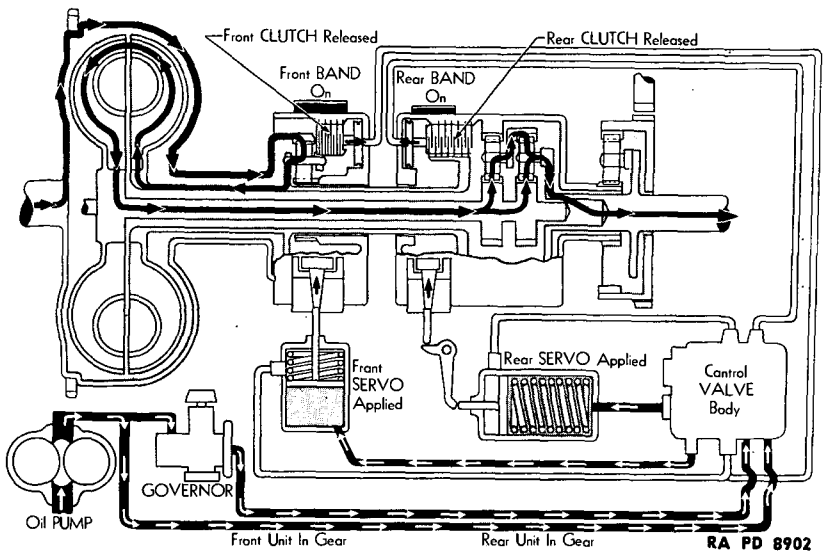
**Figure 12 — Planetary Unit in Direct Drive**



RA PD 8901

**Figure 13 — Transmission in Neutral**

## HYDRA-MATIC TRANSMISSION



**Figure 14 — Transmission in First Speed**

to the intermediate shaft which carries the driving (rear) torus member at its forward end.

(3) The power is then transferred from the rear or driving torus member to the front or driven torus member, which is splined to the main shaft that extends back to the two sun gears of the rear planetary unit.

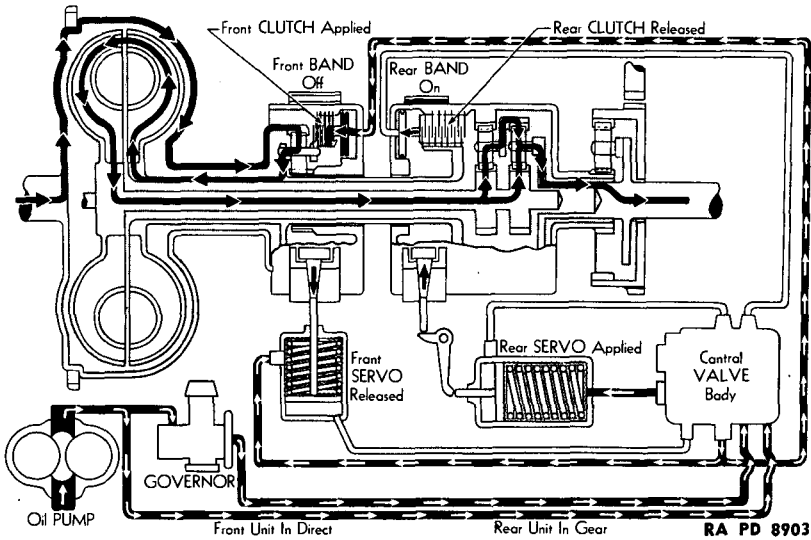
(4) Since the rear brake band is applied, the rear drum is locked and the first rear internal gear is held stationary; consequently, rotation of the first sun gear forces the first set of planet gears to walk around with the sun gear, but at a further reduction. Inasmuch as the carrier for these planet gears is integral with the internal gear of the second rear planetary, the rotation of this internal gear at a speed lower than that of the second sun gear causes the planet gears of the second planetary to rotate at an intermediate reduction of 2.26 to 1 in the rear unit. The total gear reduction of the transmission in first speed is thus 3.26 to 1.

**d. Second Speed (fig. 15).**

(1) When the speed of the vehicle is increased sufficiently for the change to second to be made, the brake band for the front unit is released and the clutch in the front unit is engaged. The rear unit is unchanged, staying in reduction.



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 15 — Transmission in Second Speed**

(2) As in first speed, the power flows to the internal gear of the front unit, but since the front clutch is engaged, all parts of the front unit are locked together and the intermediate shaft rotates at the same speed as the internal gear. The power then flows through the fluid coupling, back through the main shaft, and through the compound reduction gearing of the rear unit to the transmission output shaft for a 2.26 to 1 total reduction.

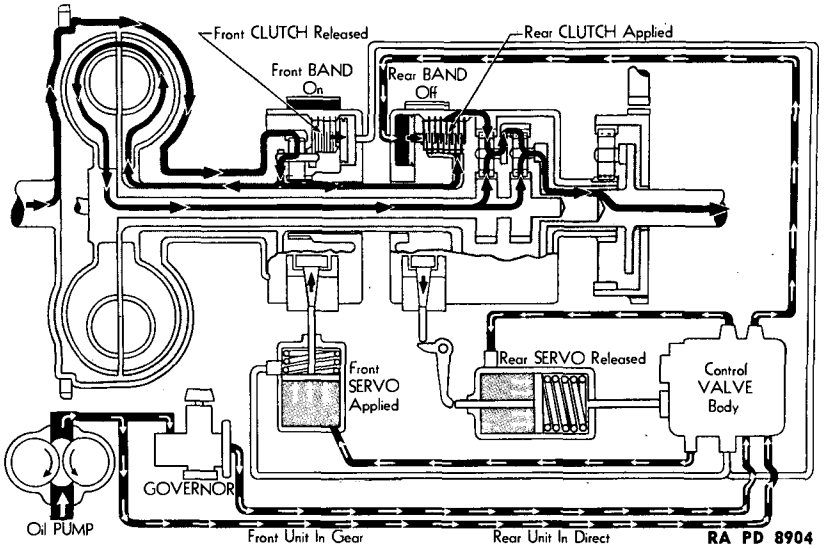
**e. Third Speed (fig. 16).**

(1) When the transmission changes into third speed, the front band is applied; the front clutch is released; the rear band is released; and the rear clutch is applied.

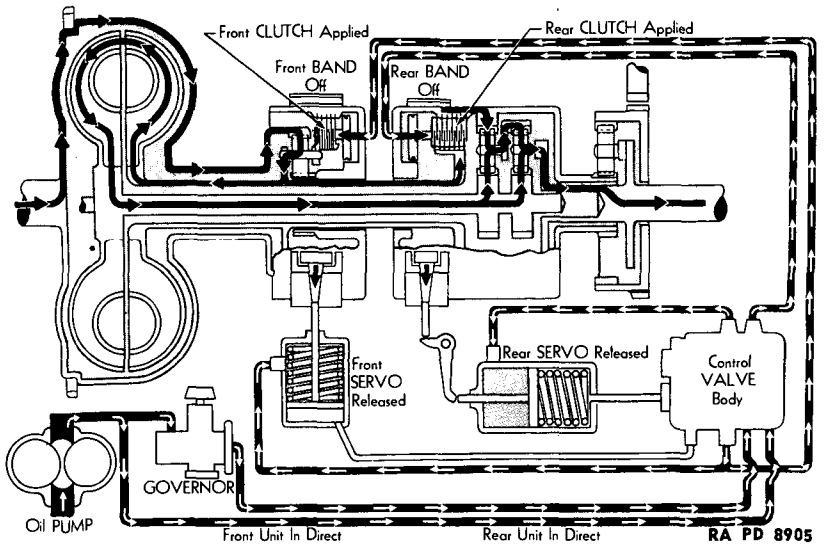
(2) The power then flows through the front unit planetary system exactly as in first speed, providing a 1.44 to 1 reduction. Since the rear planetary system is now locked by the rear clutch, it not only rotates as a unit, but also has a direct mechanical connection through the intermediate shaft to the planet gear carrier in the front unit as well as the connection through the fluid coupling.

(3) Because of this arrangement, the power delivered to the front planet gear carrier divides along the intermediate shaft. Approximately 60 percent of the power flows back through the locked rear unit, while

**HYDRA-MATIC TRANSMISSION**

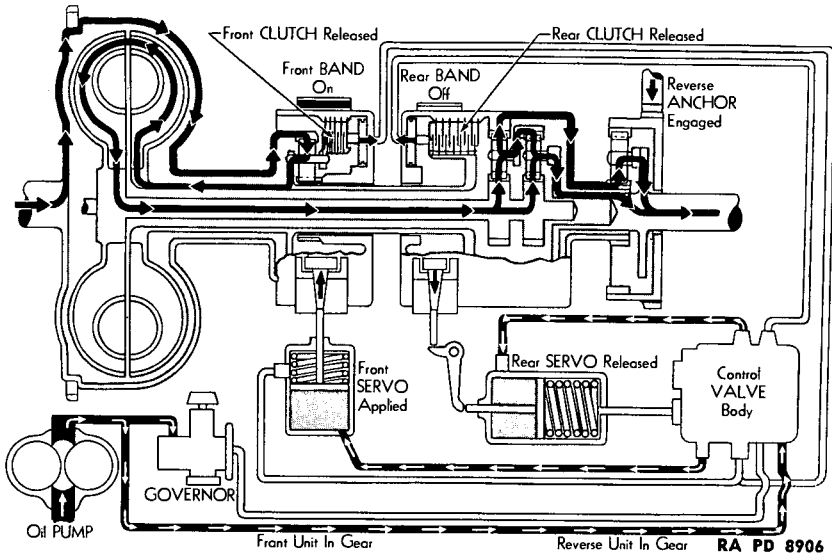


**Figure 16 — Transmission in Third Speed**



**Figure 17 — Transmission in Fourth Speed**

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



**Figure 18 — Transmission in Reverse**

the remaining 40 percent flows forward through the fluid coupling and back through the main shaft with its integral rear unit sun gears.

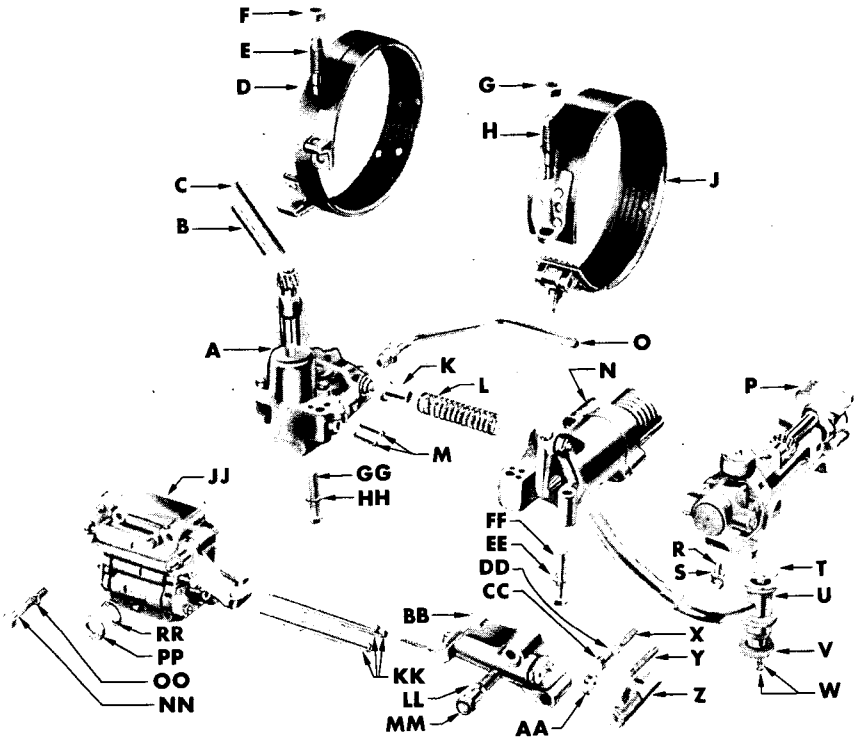
**f. Fourth Speed** (fig. 17). When the change into fourth speed is made, the front band is released and the front clutch is engaged. Thus, both the front and the rear planetary units are locked, and direct drive results. The front unit planet gear carrier revolves at engine speed, and delivers its power to the intermediate shaft. There the power divides (as for third speed) and is delivered to the output shaft without reduction.

**g. Reverse** (fig. 18).

(1) When the transmission control lever is moved into reverse, two things occur: first, the reverse anchor is moved into engagement with the external teeth of the reverse planetary unit internal gear; second, the oil control valves are moved so that the front unit band is applied and the front clutch released, and *both* the rear unit brake band and clutch are released.

(2) The power flows through the front planetary unit and the fluid coupling exactly the same as in first speed. The internal gears of the rear unit, however, are not held stationary either by the band or locked by the clutch; consequently, they are free either to rotate with the sun

HYDRA-MATIC TRANSMISSION

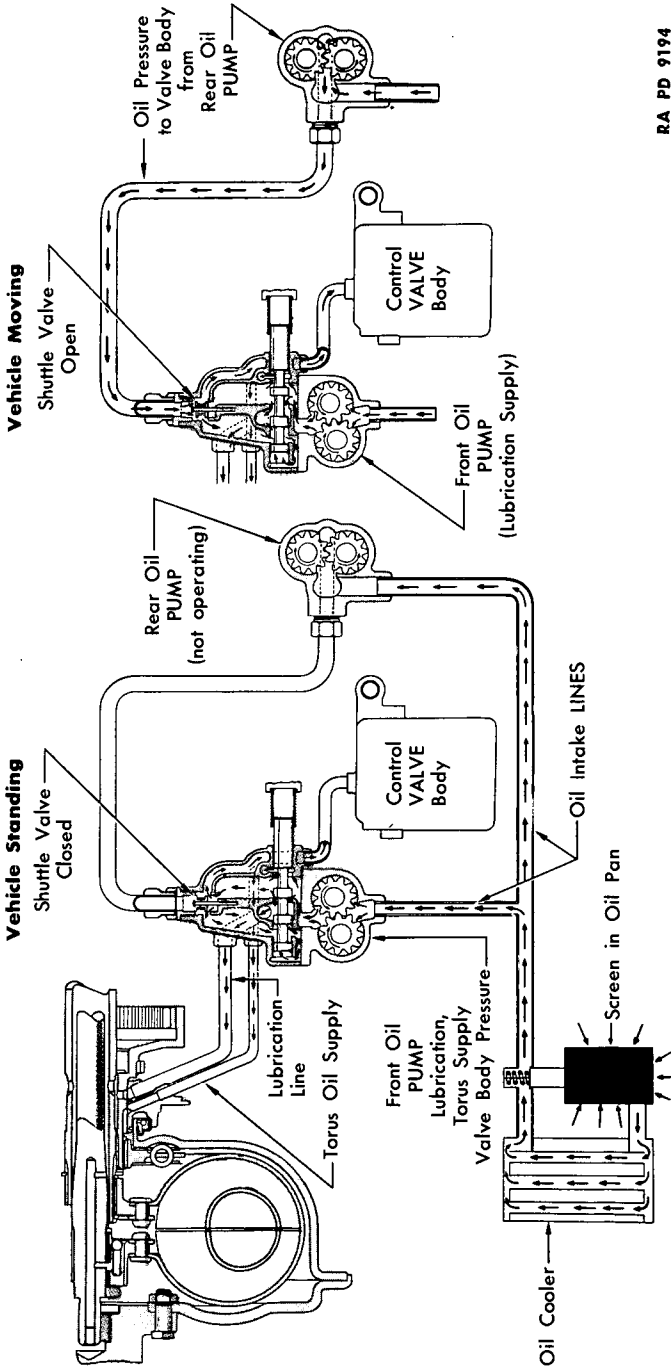


- A—SERVO AND OIL PUMP, ASSEMBLY
- B—PIPE
- C—PIPE
- D—BAND, ASSEMBLY
- E—SCREW
- F—NUT
- G—NUT
- H—SCREW
- J—BAND, ASSEMBLY
- K—GUIDE
- L—SPRING
- M—PIPE
- N—SERVO, ASSEMBLY
- O—PIPE, ASSEMBLY
- P—PUMP, ASSEMBLY
- R—SCREW
- S—WASHER
- T—GASKET
- U—PIPE, ASSEMBLY
- V—SEAL

- W—SCREW
- X—SPRING
- Y—SPRING
- Z—ANCHOR
- AA—ROLLER
- BB—BRACKET, ASSEMBLY
- CC—PLUNGER
- DD—SEAT
- EE—WASHER
- FF—SCREW
- GG—SCREW
- HH—WASHER
- JJ—VALVE, ASSEMBLY
- KK—PIPE
- LL—WASHER
- MM—SCREW
- NN—SCREW
- OO—WASHER
- PP—GASKET
- RR—RETAINER

RA PD 56431

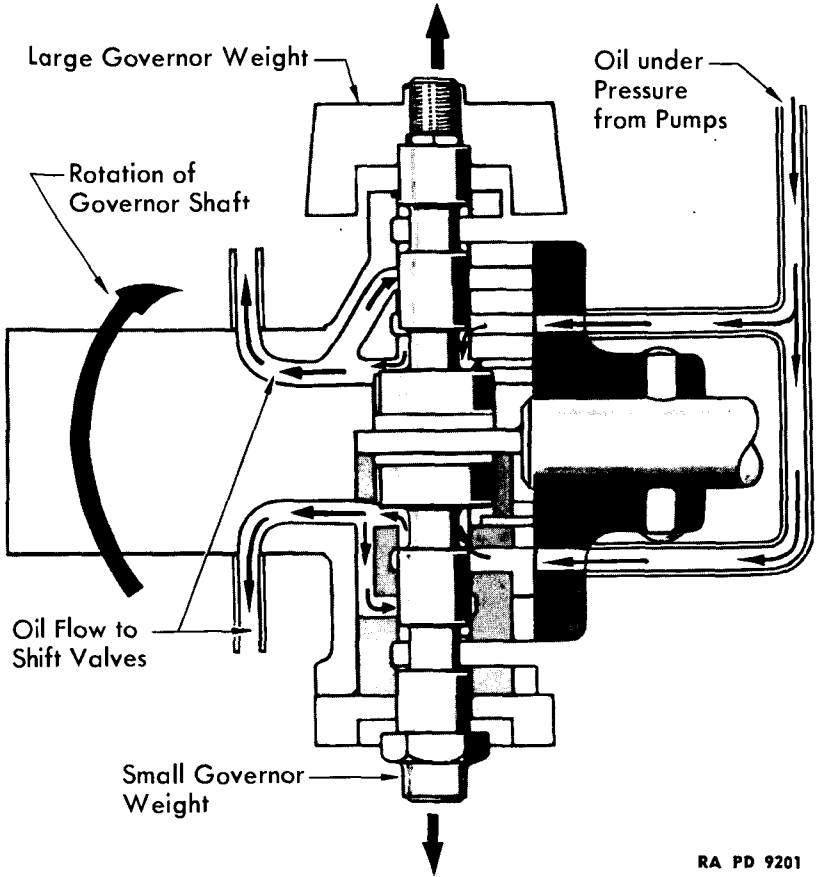
ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 9194

Figure 20 — Diagram of Oil Pumps

**HYDRA-MATIC TRANSMISSION**



**Figure 21 — Cross Section of Governor**

gears or to reverse their direction of rotation and “walk” backwards around the sun gear. The first rear unit internal gear rotates with the reverse unit sun gear, and the second rear unit planet set rotates with the reverse planetary. The reverse internal gear meanwhile is locked by the reverse anchor and it compels the reverse planetary to rotate backwards, providing the output shaft with reverse rotation.

**h. Hydraulic Control System.** The timing of the changes in gear ratios, either upshifting or downshifting, is the function of the hydraulic control system, which basically is a system of valves carefully balanced to provide a precise relationship between the momentum of the vehicle and the performance demands of the driver as expressed by the pres-

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

sure on the accelerator. The hydraulic control system consists of two interconnected oil pumps, an oil pressure regulator valve mechanism, a centrifugal governor, a control valve body containing regulator and shift valves, and the necessary connecting passages.

**i. Oil Pumps.** The front oil pump, which is driven by the engine, begins to build up pressure as soon as the engine is started. When this pressure exceeds a predetermined amount, the oil pressure regulator valve is moved off its seat, allowing oil to flow to the valve body, fluid coupling, and the lubricating system. As the vehicle moves forward, the rear pump, which is driven by the transmission output shaft, begins to operate and build up pressure. When this pressure exceeds that of the front pump, a shuttle valve, connecting the output of the rear pump to the front pump, opens, allowing the oil pressure to flow to the valve body. The front pump, however, continues to supply oil pressure to the fluid coupling and the lubricating system (fig. 20).

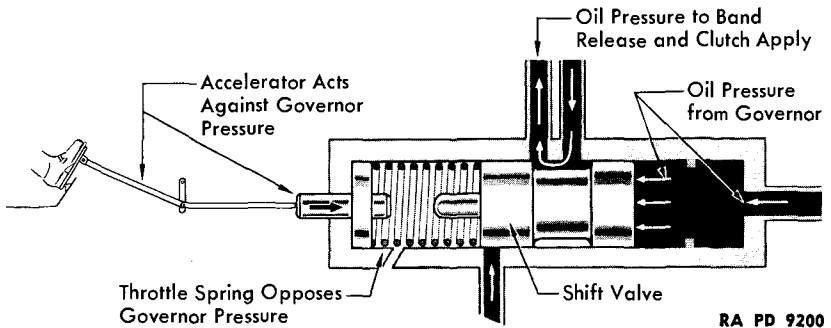
**j. Governor.** The governor, which is mounted on the rear oil pump and therefore operates only when the vehicle is moving, is of the compound type; that is, it has two valves of different operating characteristics through which metered oil pressures flow to the valve body. When the vehicle is standing or moving very slowly, oil pressure from the pumps keeps the governor valves closed. As vehicle speeds increase, however, centrifugal force moves the governor weights outward, and the oil pressure is directed around the governor valves to the shift valves (figs. 21 and 22).

**k. Oil Flow, Neutral.** When the vehicle is standing and the engine is not running, the front band is released and the rear band applied regardless of the position of the control lever. The front band is applied and released by oil pressure and is held off the drum in neutral by a light retracting spring. The rear band is applied by both spring and oil pressure and released by oil pressure. When the engine is running and the control lever is in neutral, the front band is still released, but oil pressure from the front oil pump also releases the rear band.

**l. High Range, First Speed.**

(1) When the control lever is moved from the neutral to the "DR" position, it relocates the manual valve in the main valve body so that oil pressure is directed to the front servo to apply the front band. At the same time, the oil pressure to the release section of the rear servo is shut off and the rear band is applied by spring pressure.

## HYDRA-MATIC TRANSMISSION



**Figure 22 — Opposing Forces on Shift Valve**

(2) The vehicle is now ready to move forward in first speed when the throttle is opened. Since the governor is driven from the transmission driven shaft, it starts to rotate as soon as the vehicle moves forward. The governor oil pressure, which varies according to the vehicle speed, is applied to one end of the shift valves and a fixed spring pressure and oil pressure, which is increased or decreased by depressing or releasing the accelerator, is applied to the opposite end (fig. 22).

**m. Shifting from First to Second.** When the vehicle gains sufficient momentum in first speed that the force exerted by the governor pressure on the first and second shift valve exceeds that exerted both by the throttle valve pressure and the fixed spring pressure on the opposite end, the valve will shift. When the valve shifts, oil pressure from the pumps is directed to the front servo to release the front unit brake band, and at the same time oil pressure is admitted to the front unit clutch pistons to apply the front unit clutch. This shifts the transmission from first to second speed (figs. 22, 14, and 15).

**n. Shifting from Second to Third.** As the vehicle speed increases in second, the governor weights travel outward further until the governor pressure acting against the second and third shift valve becomes great enough to overcome the spring pressure and the throttle pressure on the opposite end of the valve. When this occurs the valve shifts, and pump pressure is directed to release the rear unit brake band and to apply the rear unit clutch. At the same time, the front unit brake band is reapplied and the front unit clutch is released (fig. 16).

**o. Shifting from Third to Fourth.** As the speed is further increased, the governor pressure becomes great enough to shift the third



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

and fourth shift valve against spring and throttle pressure. When this valve shifts, the front unit brake band is again released and the front clutch applied, so that both the front and rear planetary units are locked and the vehicle is in direct drive (fig. 17).

**p. Downshifting.**

(1) When speed is decreasing, as when the vehicle is being brought to a stop, the governor pressure decreases until it is no longer able to hold the shift valves against spring pressure, and the shift valves move back, one at a time, causing the transmission to downshift.

(2) When the driver wishes to downshift from fourth to third for rapid acceleration, he presses the accelerator all the way down. The throttle valve then opens a separate oil passage that directs additional oil pressure to the third and fourth shift valve in opposition to governor pressure, and the transmission downshifts, providing the speed of the vehicle is not too high.

**q. Low Range.** Moving the manual control lever into the "LO" position applies additional pressure to the first and second regulator plug and full pump pressure against the second and third shift valve; consequently, the shift from first to second occurs at a higher speed for a given throttle opening in "LO" than in "DR." The governor pressure never can overcome the combined spring and oil pump pressure on the second and third shift valve, so the transmission never shifts into third gear.

**r. Oil Flow Reverse.** With the manual control valve in the reverse position, the governor input pressure is completely cut off, and in addition, oil pressure is directed to the rear servo to release the rear band. With no governor pressure available to shift the valves, the transmission will remain in reverse until the control lever is moved.

**6. TABULATED DATA AND SPECIFICATIONS.**

a. The following specifications are for one transmission only and apply to either the right- or left-hand unit unless otherwise noted.

**b. Tabulated Data.**

Clutch .....	Fluid coupling
Number of speeds forward .....	4
Number of speeds reverse .....	1
First speed gear ratio .....	3.26 to 1
Second speed gear ratio .....	2.26 to 1
Third speed gear ratio .....	1.44 to 1

## HYDRA-MATIC TRANSMISSION

Fourth speed gear ratio .....	1 to 1
Reverse gear ratio .....	3.77 to 1
Reduction gearing .....	Planetary

### 7. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. **Definitions.** Echelons and words as used in this list of maintenance allocations are defined as follows:

**SECOND ECHELON:** Line organization regiments, battalions, companies, detachments, and separate companies (first and second echelons).

**THIRD ECHELON:** Ordnance light maintenance companies, ordnance medium maintenance companies, ordnance divisional maintenance battalions, and post ordnance shops.

**FOURTH ECHELON:** Ordnance heavy maintenance companies and service command shops.

**FIFTH ECHELON:** Ordnance base regiments, ordnance bases, arsenals, and manufacturers' plants.

**SERVICE (Including preventive maintenance):** Consists of servicing, cleaning, lubricating, tightening bolts and nuts, and making external adjustments of subassemblies and controls.  
Refer to AR 850-15, paragraph 23 a (1) and (2).

**REPLACE:** Refer to AR 850-15, paragraph 23 a (4). Consists of removing the part, subassembly, or assembly from the vehicles and replacing it with a new or reconditioned or rebuilt part, subassembly, or assembly, whichever the case may be.

**REPAIR:** Refer to AR 850-15, paragraph 23 a (3) and (5), in part. Consists of making repairs to, or replacement of the part, subassembly, or assembly that can be accomplished without completely disassembling the subassembly or assemblies, and does not require heavy welding, or riveting, machining, fitting and/or alining or balancing.

**REBUILD:** Refer to AR 850-15, paragraph 23 a (5), in part, and (6). Consists of completely reconditioning and replacing in serviceable condition any unserviceable part, subassembly, or assembly of the vehicle, including welding, riveting, machining, fitting, alining, balancing, assembling, and testing.

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

ENGINE	ECHELONS			
	2nd	3rd	4th	5th
Bearing, transmission mainshaft, pilot—replace . .		X		
Bearings, camshaft—replace . . . . .			E	X
Bearings, connecting rod—replace . . . . .		E	E	X
Bearings, crankshaft, main—replace . . . . .		E	E	X
Block, cylinder and crankcase assembly—rebuild (recondition) . . . . .			E	X
Carburetor—replace . . . . .	X			
Carburetor—repair . . . . .		X		
Carburetor—rebuild . . . . .			E	X
Chain, timing—replace . . . . .		E	X	
Crankshaft, flywheel and flywheel cover—replace (as a complete assembly) . . . . .			E	X
(NOTE: These parts must be balanced as a complete assembly).				
Eccentric, fuel pump drive—replace . . . . .		X		
*Engine transmission assembly—replace . . . . .		X		
Engine transmission assembly—repair . . . . .		E	X	
Engine transmission assembly—rebuild . . . . .			E	X
Float and screen oil pump—replace . . . . .	E	X		
Gage, oil pressure, unit—replace . . . . .	X			
Gaskets, cylinder head—replace . . . . .	X			
Gear, idler, distributor drive—replace . . . . .		E	X	
Generator—replace . . . . .	X			
Generator—repair . . . . .		X		
Generator—rebuild . . . . .			X	
Heads, cylinder—replace . . . . .	E	X		
Lifter assemblies, valve—replace . . . . .	E	X		
Lifter assemblies, valve—repair . . . . .		E	X	
Lifter assemblies, valve—rebuild . . . . .			E	X
Lines, oil, external—clean, repair and replace . . .	X			
Manifold, exhaust, intake and gaskets—replace . .	E	X		
Muffler, exhaust pipe, and gaskets—replace . . .	E	X		
Pan, oil—clean and replace gaskets . . . . .	X			
Pins, piston—replace . . . . .		E	E	X
Pistons—replace . . . . .		E	E	X

\*The second echelon is authorized to remove and reinstall engine transmission assemblies, transfer unit controlled differential assembly, and other items marked by asterisk. However, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly or unit assembly, the assembly marked by asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.

**HYDRA-MATIC TRANSMISSION**

ENGINE—Cont'd	ECHELONS			
	2nd	3rd	4th	5th
Pulley, crankshaft, fan, generator and water pump drive—replace . . . . .	E	X		
Pump, oil—replace . . . . .	E	X		
Pump, oil—repair . . . . .		E	X	
Pump, oil—rebuild . . . . .			E	X
Pumps, fuel—replace . . . . .	X			
Pumps, fuel—repair . . . . .		X		
Pumps, fuel—rebuild . . . . .			X	
Rings, piston—replace . . . . .		E	E	X
Rods, connecting—replace . . . . .		E	E	X
Shaft, oil pump and distributor drive—replace . . . . .		E	X	
Springs, valve—replace . . . . .	E	X		
Sprockets, timing—replace . . . . .		E	E	X
Starter assembly—replace . . . . .	X			
Starter assembly—repair . . . . .		X		
Starter assembly—rebuild . . . . .			X	
Valve, guide, bushings—replace . . . . .		E	E	X
Valve, plunger unit assembly—replace . . . . .		E	X	
Valve, plunger unit assembly—repair . . . . .			E	X
Valves—replace . . . . .		E	X	
Valves—reface . . . . .		E	E	X
Valves, seat—reseat . . . . .		E	E	X
Ventilator, crankcase and lines—service or replace . . . . .		X		

**ENGINE COOLING SYSTEM**

Belts, generator, water pump, and fan—replace . . . . .	X			
Fan and hub assembly—replace . . . . .	E	X		
Fan and hub assembly—rebuild . . . . .		E	X	
Fan shroud assembly—replace . . . . .	X			
Fan shroud assembly—repair . . . . .		X		
Pump, water—replace . . . . .	X			
Pump, water—repair . . . . .		X		
Pump, water—rebuild . . . . .			X	
Radiator and connections—service (cleaning and flushing) and replace . . . . .	X			
Radiator assembly — repair (replace core and gaskets) . . . . .		E	X	
Radiator core and/or assembly—rebuild . . . . .			E	X
Radiator thermostat—replace . . . . .	X			

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

ELECTRICAL SYSTEM	ECHELONS			
	2nd	3rd	4th	5th
Apparatus box assembly (voltage and current regulator)—replace . . . . .	X			
Apparatus box assembly (voltage and current regulator)—adjust and repair . . . . .		X		
Apparatus box assembly (voltage and current regulator)—rebuild . . . . .			X	
Auxiliary generator—replace . . . . .	X			
Auxiliary generator—repair . . . . .		X		
Auxiliary generator—rebuild . . . . .			E	X
Battery—replace, recharge, and service . . . . .	X			
Battery—repair . . . . .		X		
Battery—rebuild . . . . .			E	X
Conduits and wiring, electrical—replace . . . . .	E	X		
Conduits and wiring, electrical—repair . . . . .		E	X	
Filters, electrical—replace . . . . .	X			
Filters, electrical—repair . . . . .		E	X	
Lights, all—service and replace . . . . .	X			
Lights, all—rebuild . . . . .		E	X	
Siren—replace . . . . .	X			
Siren—repair . . . . .		X		
Siren—rebuild . . . . .			X	
Switch, battery—replace . . . . .	X			
Switch, battery—repair . . . . .		X		
Switch, siren—replace . . . . .	X			
Switch, siren—repair . . . . .		X		
<b>IGNITION (ELECTRICAL SYSTEM)</b>				
Coil, ignition—replace . . . . .	X			
Condenser, distributor—replace . . . . .	X			
Distributor and cap assembly—replace . . . . .	X			
Distributor assembly—repair . . . . .		X		
Distributor assembly—rebuild . . . . .		E	X	
Distributor breaker points—replace . . . . .	X			
Plugs, spark—service and replace . . . . .	X			
Plugs, spark (2-piece)—repair . . . . .		X		
Wiring, ignition—replace . . . . .	X			
<b>EXTINGUISHER, FIRE SYSTEM</b>				
Extinguishers, fire—service and replace . . . . .	X			
Extinguishers, fire—repair and recharge, CO2-type . . . . .		X		
Extinguishers, fire—rebuild . . . . .			E	X

**HYDRA-MATIC TRANSMISSION**

	ECHELONS			
	2nd	3rd	4th	5th
<b>FINAL DRIVE</b>				
Final drive assembly—replace .....	X			
Final drive assembly—repair .....		X		
Final drive assembly—rebuild .....			E	X
Hub, sprocket—replace .....	X			
Hub, sprocket—rebuild .....			E	X
Sprockets—replace .....	X			
Sprockets—rebuild .....			E	X

**FUEL SYSTEM**

Cleaner, air—service and replace .....	X			
Cleaner, air—repair .....		X		
Filter, fuel—service and replace .....	X			
Filter, fuel—repair .....		X		
Filter, fuel—rebuild .....			X	
Lines, fuel—repair and replace .....	X			
Tanks, fuel—clean or replace .....	X			
Tanks, fuel—repair .....		X		

**HULL AND TURRET**

Covers, port and peep hole protectors—service or replace .....	X			
Covers, port and peep hole protectors—repair .....		X		
Doors, grilles and hood assemblies—replace .....		X		
Doors, grilles and hood assemblies—rebuild .....			E	X
Hull—rebuild .....			E	X
Insulation—replace or repair .....	X			
Lifting eyes—replace .....			X	
Lifting hooks—replace .....			X	
Mechanism, turret traversing—replace .....	X			
Mechanism, turret traversing—repair .....		X		
Mechanism, turret traversing—rebuild .....			E	X
Pads—replace .....	X			
Plate, armor—welding .....		E	X	
Plate, armor—replace .....			E	X
Rollers, turret—adjust, service and replace .....	X			
Rollers, turret—rebuild .....			E	X
Safety belts—replace .....	X			
Safety belts—repair .....		X		
Seats—replace .....	X			
Seats—repair .....		X		

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

HULL AND TURRET (FOR LIGHT TANKS M5 AND M5A1)	ECHELONS			
	2nd	3rd	4th	5th
Antiaircraft gun ring—service and replace . . . . .	X			
Antiaircraft gun ring—repair . . . . .		E	X	
Antiaircraft gun ring—rebuild . . . . .			E	X
Covers, pistol port and peep hole protectors — repair . . . . .	E	X		
Doors, grilles and hood assemblies—replace . . . . .		X		
Doors, grilles and hood assemblies—rebuild . . . . .			E	X
Hull—rebuild . . . . .			E	X
Lifting eyes—replace . . . . .			X	
Lifting hooks—replace . . . . .			X	
Mechanism, turret traversing—replace . . . . .	X			
Mechanism, turret traversing—repair . . . . .		X		
Mechanism, turret traversing—rebuild . . . . .			E	X
Pads—replace (antiaircraft gun ring) . . . . .	X			
Plate armor—welding . . . . .		E	X	
Plate armor—replace . . . . .			E	X
Safety belts—replace . . . . .	X			
Safety belts—repair . . . . .		X		
Seats—replace . . . . .	X			
Seats—repair . . . . .		X		
Subfloor—replace . . . . .	X			
Subfloor—repair . . . . .		X		
Turret ring and gear assembly—replace . . . . .		E	X	
Turret ring and gear assembly—rebuild . . . . .			E	X
<b>HYDRA-MATIC TRANSMISSION</b>				
Anchor, reverse—replace . . . . .	X			
Bands—adjust . . . . .	X			
Bands—replace . . . . .			E	X
Body, control valve—replace . . . . .	X			
Body, control valve—repair . . . . .		X		
Body, control valve—rebuild . . . . .			E	X
Linkage, throttle control—adjust or replace . . . . .	X			
Linkage, Hydra-Matic transmission—replace . . . . .	X			
Pan, oil, and cooler assembly—replace . . . . .	X			
Transmission assembly—replace . . . . .		X		
Transmission assembly—repair . . . . .			X	
Transmission assembly—rebuild . . . . .			E	X

**HYDRA-MATIC TRANSMISSION**

	ECHELONS			
	2nd	3rd	4th	5th
<b>INSTRUMENTS AND GAGES</b>				
Compass—replace .....	X			
Compass—repair .....		X		
Instruments and gages—service and replace ....	X			
Instruments and gages—repair .....		X		
Instruments and gages—rebuild .....			E	X
<b>MISCELLANEOUS</b>				
Sheet metal, repair .....		X		
Welding, light .....		X		
Welding, medium .....			X	
Welding, heavy .....			E	X
<b>PROPELLER SHAFTS AND UNIVERSAL JOINTS</b>				
Shaft, propeller assembly w/universal joints — replace .....	X			
Shaft, propeller assembly w/universal joints — repair .....		X		
Shaft, propeller assembly w/universal joints — rebuild .....			E	X
<b>SUSPENSION SYSTEM</b>				
Axle, front and rear—replace .....		X		
Axle, front and rear—rebuild .....			E	X
Bearings and seals, bogie wheel and idlers—replace	X			
Bogie components—replace .....	X			
Bogie components—repair .....		X		
Bogie components—rebuild .....			E	X
Roller track, supporting w/bracket—replace ....	X			
Roller track, supporting w/bracket—repair .....		X		
Roller, track, supporting w/bracket—rebuild....			E	X
Track—service and replace .....	X			
Track—reverse (rubber type) .....	X			
Wheels, bogie and idler—rebuild .....			E	X
Wheel, bogie—replace .....	X			
Wheel, bogie—repair and replace tire .....		X		
Wheel, idler—replace .....	X			
Wheel, idler—repair .....		X		
<b>TRANSFER UNIT AND CONTROLLED DIFFERENTIAL</b>				
Bands, transfer unit, reduction—adjust .....	X			
Bands, transfer unit, reduction—replace and reline			E	X
Body, control valve—replace .....	X			
Body, control valve—repair .....		X		
Body, control valve—rebuild .....			E	X



**ORDNANCE MAINTENANCE—HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

TRANSFER UNIT AND CONTROLLED DIFFERENTIAL—Cont'd	ECHELONS			
	2nd	3rd	4th	5th
Cooler, oil, transmission unit—replace . . . . .	X			
Cooler, oil, transmission unit—repair . . . . .		X		
Cooler, oil, transmission unit—rebuild . . . . .			E	X
*Differential, controlled, subassembly — replace D-59695 . . . . .		X		
Differential, controlled, subassembly — repair D-59695 . . . . .			E	X
Differential, controlled, subassembly — rebuild D-59695 . . . . .			E	X
Lever, brake and steering—replace . . . . .	X			
Lever, brake and steering—repair . . . . .		X		
Lever, Hydra-Matic selector—replace . . . . .	X			
Lever, transfer unit, manual control—replace . . . .	X			
Shoes, brake assembly brake and steering—adjust and replace . . . . .	X			
Shoes, brake assembly brake and steering—repair and reline . . . . .		X		
*Transfer unit and controlled differential assembly —replace . . . . .		X		
Transfer unit and controlled differential assembly —repair . . . . .		E	X	
Transfer unit and controlled differential assembly —rebuild . . . . .			E	X
<b>VEHICLE ASSEMBLY</b>				
Tank assembly — rebuild (with serviceable as- semblies) . . . . .			X	E
Tank assembly—service, bolts, nuts, and screws— tighten and replace . . . . .	X			
Tank assembly—service, cleaning . . . . .	X			
Tank assembly—service, lubrication . . . . .	X			
Tank assembly—service, painting . . . . .	X			
Tank assembly—service, tightening . . . . .	X			

\*The second echelon is authorized to remove and reinstall engine transmission assemblies, transfer unit controlled differential assembly, and other items marked by asterisk. However, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly or unit assembly, the assembly marked by asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.

NOTE: Operations allocated will normally be performed in the echelon indicated by "X." Operations allocated to the echelons as indicated by "E" may be accomplished by the respective echelons in emergencies only.

**HYDRA-MATIC TRANSMISSION****8. INSPECTION IN VEHICLE.**

**a. Purpose.** Technical inspections by ordnance personnel are a follow up and check on organizational maintenance inspections and servicing. These inspections determine whether or not the vehicle should be continued in service or withdrawn from operation for overhaul.

**b. Inspection Form.** War Department O.O. Form No. 7351, "Preventive Maintenance Operation and Technical Inspection Form for Full-Track Vehicles," is the standard and official form for recording the inspection of the vehicles described in this manual. The extent to which use is made of this form or modification thereof depends entirely on the technical ability of available personnel, the time factor, and the test shop equipment available.

**c. Equipment Required.**

CLOTH, clean

FLASHLIGHT

**d. Visual Inspection Procedure.** The following periodic inspections of the transmission in the vehicle are prescribed.

**DAILY**

Check oil level in each transmission (par. 10 a).

**AFTER 500 MILES OF OPERATION**

Check oil level in each transmission.

Check for water leaks at oil cooler.

Check for oil leaks at oil pan.

**AFTER 3,000 MILES OF OPERATION**

Change oil in each transmission (par. 10 b).

Check and adjust bands (par. 10 c).

**e. Operating Inspection.** Check the transmissions under actual operating conditions and notice whether one or both units are not operating properly. If only one engine is affected the trouble is probably due to the transmission of the engine so affected. If both engines are affected, the fault may be with the transfer unit.

(1) **SHIFT POINTS.** Check to make sure the transmissions upshift and downshift within the proper speed ranges as follows:

Shift	Speeds
1 to 2	2 to 3 mph
2 to 3	3 to 7 mph
3 to 4	4 to 12 mph
4 to 5)	8 to 17 mph
4 to 6)	
5 to 6	17 to 29 mph

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

(2) **SMOOTHNESS.** Check to make certain the various upshifts and downshifts are performed smoothly.

(3) **RELATION TO TROUBLE SHOOTING.** Paragraph 9 of this manual should be studied closely in order that various trouble symptoms may be recognized during the operating inspection.

**9. TROUBLE SHOOTING**

a. After the vehicle has been checked under actual conditions and the fault determined, compare the condition with those listed in the chart below. When a comparable condition is found, repeat the test at least two more times to make sure that all symptoms agree with the conditions on the chart. **NOTE:** Do not remove the transmissions until the condition is definitely determined.

**Probable Cause**

**Probable Remedy**

**(1) ONE OR BOTH TRANSMISSIONS JUMP OUT OF REVERSE.**

Linkage connecting selector lever to transmission adjusted too short. Adjust manual control linkage.

**(2) TRANSMISSION DOWNSHIFTS FROM THIRD TO SECOND SPEEDS, OR THIRD TO FIRST SPEEDS WHEN THROTTLE IS OPENED AT SPEEDS ABOVE 5 MILES PER HOUR, AND DOWNSHIFTS AT SPEEDS ABOVE 3 MILES PER HOUR WITH THROTTLE CLOSED.**

Linkage connecting selector lever to transmission adjusted too short. Adjust manual control linkage.

**(3) TRANSMISSION HUNTS BETWEEN FOURTH AND SECOND SPEEDS ON ACCELERATION.**

Linkage connecting selector lever to transmission adjusted too short. Adjust manual control linkage.

**(4) TRANSMISSION HUNTS BETWEEN LOW AND HIGH RANGE SPEEDS WITH SELECTOR LEVER IN LOW RANGE, AND HUNTS BETWEEN NEUTRAL AND HIGH WITH LEVER IN HIGH RANGE.**

Incorrect position of manual valve. Adjust manual control linkage.  
Linkage connecting selector lever to transmission adjusted too long.

**(5) WITH SELECTOR LEVER IN "LOW" DURING ACCELERATION, ENGINE SPEEDS UP AND FAILS TO DRIVE VEHICLE.**

Linkage connecting selector lever to transmission adjusted too long. Adjust manual control linkage.

**HYDRA-MATIC TRANSMISSION**

- | <b>Probable Cause</b>  | <b>Probable Remedy</b>   |
|--|--|
| <b>(6) IN HIGH SPEED RANGE VEHICLE SHIFTS FROM FIRST TO SECOND SPEEDS PROPERLY, BUT SECOND TO THIRD AND THIRD TO FOURTH SPEED SHIFTS COME AT EXCESSIVELY HIGH SPEEDS OR NOT AT ALL. TRANSMISSION DOWNSHIFTS FOURTH TO SECOND SPEEDS RATHER THAN FOURTH TO THIRD.</b> |  |
| Linkage connecting selector lever to transmission adjusted too short.  | Adjust manual control linkage.   |
| <b>(7) ALL SHIFT SPEEDS ARE EXCESSIVELY HIGH.</b>  |  |
| Incorrectly adjusted throttle linkage, distributor relay lever improperly positioned, sticky governor valves.  | Adjust throttle linkage. Replace governor assembly or free valves.   |
| <b>(8) VEHICLE CREEPS EXCESSIVELY WITH ACCELERATOR CLOSED AND SELECTOR LEVER IN "DR" POSITION.</b>   |  |
| Throttle not returning to closed stop on carburetor or engine idling above 425 revolutions per minute.   | Eliminate binds in throttle linkage. Replace missing or weak throttle return springs. Adjust linkage. Reset engine idling speed at 425 revolutions per minute. |
| <b>(9) WHEN ACCELERATING THROUGH DIFFERENT SPEEDS WITH PART THROTTLE IN HIGH RANGE, SHIFTS FROM SECOND TO THIRD SPEED OR THIRD TO FOURTH SPEED COME AT AN EXCESSIVELY HIGH SPEED.</b>  |  |
| Throttle control linkage improperly adjusted, low governor pressure.   | Adjust throttle linkage. Replace governor assembly or free valves.   |
| <b>(10) WHEN ACCELERATING THROUGH DIFFERENT SPEEDS WITH PART THROTTLE IN HIGH RANGE, THE SHIFT FROM SECOND TO THIRD SPEEDS OCCURS TOO SOON AFTER FIRST TO SECOND SPEED SHIFT.</b>  |  |
| Throttle control linkage improperly adjusted or throttle valve lever loose on shaft.   | Adjust throttle control linkage. Replace valve body.   |
| <b>(11) TRANSMISSION WILL NOT THROTTLE DOWNSHIFT FOURTH TO THIRD SPEEDS (USUALLY OCCURS AT SPEEDS ABOVE 20 MILES PER HOUR).</b>  |  |
| Insufficient accelerator pedal travel due to interference in linkage or pedal. Throttle control linkage improperly adjusted.   | Locate and correct cause of interference with linkage or pedal. Check and adjust throttle linkage. Make sure selector lever mounting is tight.                 |

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**Probable Cause**

**Probable Remedy**

(12) **VEHICLE JUMPS OR JERKS WHEN SECOND TO THIRD SPEED SHIFT IS MADE.**

Incorrect throttle linkage adjustment, faulty valve body or rough clutch plates.

Adjust throttle linkage. Replace valve body. Replace clutch plates.

(13) **TRANSMISSION DOES NOT RESPOND TO SELECTOR LEVER POSITION.**

Pin which operates manual control valve is not operating in groove of manual valve or manual control lever is loose on shaft at valve body.

To check for this condition, shift control lever into reverse after first dwelling in "low" and then firmly moving lever toward reverse. If severe clashing results, or if selector lever goes into reverse but vehicle locks up and fails to move backward, then pickup pin is not operating manual valve. Remove side cover and engage pin in manual valve.

(14) **TRANSMISSION OIL PRESSURE WARNING SIGNAL REMAINS LIGHTED AFTER ENGINES ARE STARTED.**

Low oil pressure, due to: Low oil level, front oil pump worn or inoperative, oil pump drive inoperative, pressure regulator valve stuck closed or open.

Correct as necessary.

(15) **TRANSMISSION FAILS TO DRIVE VEHICLE WHEN LEVER IS MOVED TO ANY POSITION.**

Usually caused by one or more of the following conditions. Cause should be checked in the following order: Low oil pressure, due to causes listed under (14), front or rear bands loose, pin that operates manual control valve not in groove in manual valve (13), loose control valve body, loose or leaky oil pressure regulator body or valve, leaky front or rear servo, stuck servo pistons.

Correct as necessary.

**HYDRA-MATIC TRANSMISSION****Probable Cause****Probable Remedy**

- (16) **RESPONSE TO SELECTOR LEVER POSITIONING IS ERRATIC.**  
 Inner manual control lever on valve body loose on shaft. Replace control valve body. Replace rear servo.  
 Scored rear servo.
- (17) **TRANSMISSION DRIVES VEHICLE IN FIRST SPEED BUT ACTS AS IF IT WERE IN NEUTRAL AFTER SHIFTING OUT OF FIRST SPEED.**  
 No oil pressure to front clutch. Disassemble transmission and correct as required.  
 Check for probable causes in the following order: Leak in oil passage to clutch, leak in valve body, drilled hole in transmission case to oil delivery sleeve plugged, oil delivery sleeve not located correctly on dowel, oil delivery sleeve ring broken.
- (18) **TRANSMISSION DRIVES VEHICLE IN FIRST AND SECOND SPEEDS BUT ACTS AS IF IT WERE IN NEUTRAL AFTER SHIFTING OUT OF SECOND SPEED.**  
 No oil pressure to rear clutch. Disassemble transmission and correct as required.  
 Check for probable causes in the following order: Leak in the oil passage to clutch, leakage in valve body, drilled hole in transmission case to oil delivery sleeve plugged, oil delivery sleeve not located correctly, oil delivery sleeve ring broken.
- (19) **TRANSMISSION SLIPS IN FIRST, THIRD, AND REVERSE, BUT OPERATES PROPERLY IN SECOND AND FOURTH.**  
 Front band not holding due to improper adjustment, restriction in valve body, transmission case or servo or sticking front servo, or compensator valve. Adjust front band. Clean case, valve body, or front servo.
- (20) **TRANSMISSION SLIPS IN FIRST AND SECOND SPEEDS, BUT OPERATES PROPERLY IN THIRD AND FOURTH AND REVERSE.**  
 Rear band not holding due to improper adjustment or restriction or leak in valve body, case or servo or to sticking compensator valve. Adjust rear band. Clean case, valve body, or rear servo.

**ORDNANCE MAINTENANCE—HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**Probable Cause**

**Probable Remedy**

(21) TRANSMISSION SLIPS OR CHATTERS ON THROTTLE DOWNSHIFT THIRD TO SECOND SPEEDS OR THIRD TO FIRST SPEEDS.

Rear band not holding due to improper adjustment or restriction in valve body, case, or servo.	Adjust rear band. Clean case, valve body, or rear servo.
--	--

(22) THROTTLE DOWNSHIFT THIRD TO SECOND OR THIRD TO FIRST SPEEDS DOES NOT OCCUR UNTIL THROTTLE IS OPENED EXCESSIVELY, OR UNTIL LONG AFTER VEHICLE IS STOPPED.

(This condition usually occurs when transmission is cold.) Second to third shift valve in valve body held open, preventing rear unit from downshifting. Governor valve sticking.	Replace valve body or free valves. Replace governor or free valves.
--	--

(23) TRANSMISSION "CLUNKS" ON THIRD TO FIRST SPEED DOWNSHIFT WITH THROTTLE CLOSED.

Check valve not seated properly on rear servo accumulator body, sticking or broken ring in accumulator piston, sticking compensator valve.	Repair rear servo or replace valve body.
--	--

(24) TRANSMISSION DOWNSHIFTS INTO FIRST SPEED AT AN EXCESSIVELY HIGH SPEED WITH THROTTLE CLOSED.

Low governor pressure due to: low capacity of oil pump, leaks around governor, valve body or pump, sticking pressure regulator valve, leaky rear servo, manual control linkage improperly adjusted.	Check through causes until trouble is located. Correct as necessary.
---	--

(25) TRANSMISSION DOWNSHIFTS TO THIRD SPEED WITH LIGHT THROTTLE ABOVE 10 MILES PER HOUR.

Sticking or broken oil delivery sleeve ring or leaky clutch pistons.	Repair as required.
--	---------------------

(26) VEHICLE STARTS IN THIRD OR FOURTH SPEEDS IN HIGH RANGE OR SECOND IN LOW RANGE OR SHIFTS INTO FOURTH GEAR IN LOW RANGE.

One or both governor valves sticking in open position.	Replace governor or free valves.
--	----------------------------------

**HYDRA-MATIC TRANSMISSION****Probable Cause****Probable Remedy**

- (27) **TRANSMISSION MISSES SECOND SPEED ON UPSHIFT.**  
 Double transition valve or first to second shift valve sticking. Free valves in valve body.
- (28) **TRANSMISSION MISSES THIRD SPEED.**  
 Double transition valve or third to fourth shift valve sticking. Free valves in valve body.
- (29) **TRANSMISSION STARTS IN SECOND BUT MAKES ALL OTHER SHIFTS.**  
 First to second shift valve or governor valve sticking. Free valves. Replace valve body. Replace governor.
- (30) **TRANSMISSION OPERATES ONLY IN FIRST AND SECOND OR ONLY IN THIRD OR FOURTH SPEEDS.**  
 Caused by second to third shift valve or governor valve sticking. Free valves. Replace valve body. Replace governor.
- (31) **TRANSMISSION SHIFTS THROUGH FIRST, SECOND, AND THIRD SPEEDS BUT WILL NOT SHIFT INTO FOURTH SPEED.**  
 Caused by third to fourth shift valve sticking, or caused by oil foaming. Free third to fourth shift valve. Replace valve body. Use heavier oil; check for high oil level.
- (32) **TRANSMISSION WILL SHIFT INTO FOURTH SPEED, BUT WILL NOT STAY IN THAT SPEED.**  
 Leakage at valve body, scored, or sticking oil delivery sleeve rings or oil foaming. Check for looseness of valve body; on transmission case. Replace valve body if necessary. Check for high oil level.
- (33) **TRANSMISSION UPSHIFTS AT LIGHT THROTTLE OCCUR AT VERY LOW VEHICLE SPEED.**  
 Throttle valve in valve body sticking or low front oil pump pressure. Replace valve body. Check and correct oil pressure.
- (34) **BAND APPLICATION ON SHIFTS FROM NEUTRAL INTO HIGH OR LOW WITH VEHICLE STANDING ARE VIOLENT.**  
 Throttle valve in valve body sticking, or low front oil pump pressure. Sticky rear servo. Replace valve body. Check and correct oil pressure. Free or replace rear servo.
- (35) **DOWNSHIFT THIRD TO SECOND SPEED OCCURS AT 5 MILES PER HOUR WITH THROTTLE CLOSED.**  
 Throttle valve in valve body sticking or low front oil pump pressure. Replace valve body. Check and correct oil pressure.



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**Probable Cause**

**Probable Remedy**

**(36) CLUTCH ENGAGEMENT SEVERE AT LIGHT THROTTLE, BUT NORMAL AT GREATER THROTTLE OPENING.**

Throttle valve or compensator valve sticking.	Replace valve body. Unless this condition is severe, do not attempt correction until mileage on transmission is over 200 miles.
---	---

**(37) TRANSMISSION WILL NOT THROTTLE DOWNSHIFT FOURTH TO THIRD SPEEDS ABOVE 10 MILES PER HOUR.**

Caused by detent plug at end of throttle control valve sticking, insufficient accelerator travel due to interference at control linkage or pedal, or throttle controls improperly adjusted.	Replace valve body. Adjust throttle control linkage.
---	--

**(38) TRANSMISSION DRAGS IN FOURTH SPEED.**

Sticking front servo pistons or tight front band adjustment.	Adjust front band. Repair servos.
--	-----------------------------------

**(39) TRANSMISSION DRAGS IN REVERSE.**

Rear band not released due to low oil pressure. Check the following: Shuttle valve in oil pressure regulator body inoperative, looseness of valve body end plates and covers, looseness of valve body, capacity of front pump.	Correct as required.
--	----------------------

**(40) SHIFT OUT OF REVERSE IS DIFFICULT TO MAKE.**

Low front pump idle pressure. engine idling speed.	Replace front pump, if necessary. Correct idling speed of engine.
--	---

**(41) VEHICLE CREEPS FORWARD WHEN SELECTOR LEVER IS IN REVERSE.**

Excessive drag in rear unit clutch.	Repair as necessary.
-------------------------------------	----------------------

**(42) TRANSMISSION WILL NOT OPERATE IN REVERSE, BUT DOES NOT CLASH.**

Broken reverse shifter bracket.	Replace shifter bracket assembly.
---------------------------------	-----------------------------------

**(43) VEHICLE FAILS TO RESPOND TO ACCELERATOR AFTER COMING TO STOP WITH SELECTOR LEVER IN "DR" POSITION.**

Rear servo booster piston or front servo sticking.	Repair front or rear servo as required.
--	---

## HYDRA-MATIC TRANSMISSION

### Probable Cause

### Probable Remedy

- (44) TRANSMISSION CLASHES WHEN SHIFTING INTO REVERSE.  
 Improperly positioned anchor bracket. Adjust reverse anchor bracket.
- (45) TRANSMISSION BUZZES WHEN IN REVERSE BUT DOES NOT OPERATE. ONE ENGINE RACES AND HAS NO POWER IN REVERSE.  
 Broken reverse anchor. Replace reverse anchor.

## 10. SERVICE IN VEHICLE.

a. **Checking Oil Level.** Run engines for about 5 minutes, then stop engines and wait for about 1 minute. Open bulkhead doors to reach combination filler cap and plunger-type indicator (fig. 23). Remove fluid level indicator plunger and wipe clean. Replace plunger and then check level. Add fluid if necessary to bring level up to "FULL" mark.

### b. Changing Oil.

WRENCH, 1/2-in.

WRENCH, 3/16-in.

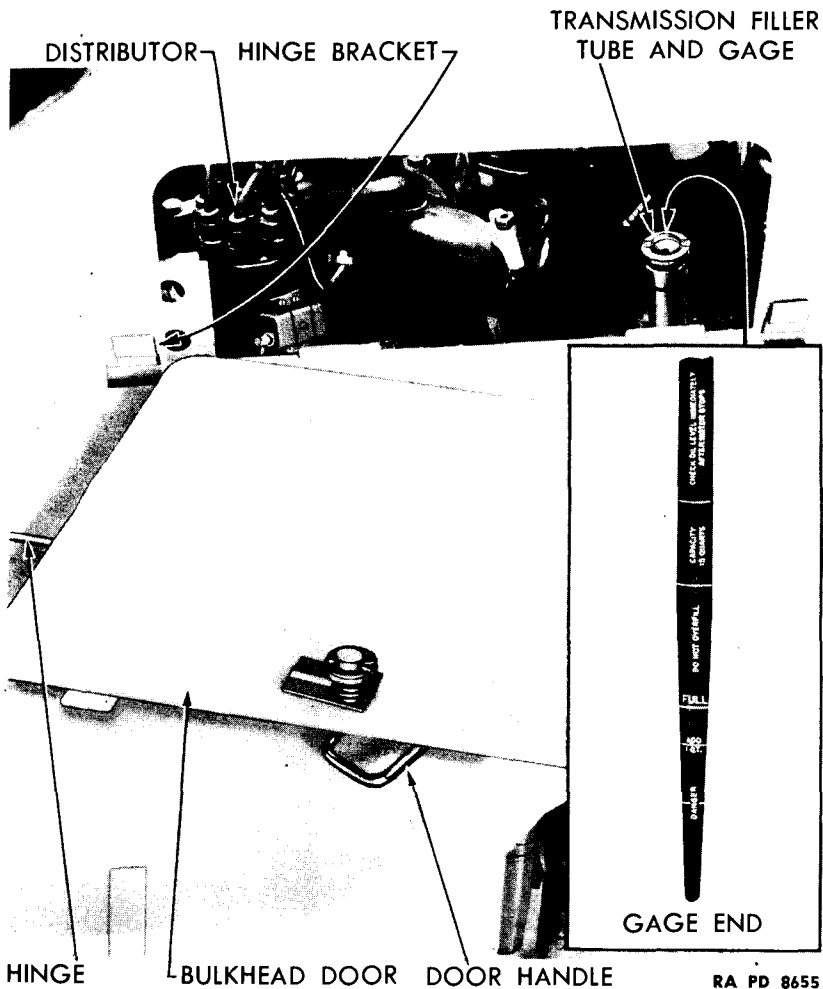
WRENCH, open-end, 7/8-in.

WRENCH, socket-head, set screw, 3/16-in.

Remove cover plate on opening in bottom of hull at front of engine compartment, as outlined in paragraph 11 b (1). **CAUTION:** Be sure to support plate with a jack or similar tool. Remove flywheel housing bottom pan by removing 6 mounting screws. Remove 2 oil drain plugs. One is in flywheel, either on front face (fig. 24) or on outside diameter, and requires a 3/16-in. socket-head set screw wrench; the other is in bottom of transmission case marked "OIL" and requires a 7/8-inch open-end wrench. Allow oil to drain completely. Install drain plugs, flywheel housing bottom pan, and cover plate on hull floor. Add approximately 15 quarts of heavy-duty engine oil, seasonal grade (as specified in lubrication guide for this vehicle in TM 9-727C). The correct level is indicated by the marking on the plunger and not by the quantity of oil added. Do not pour in entire quantity at once; add 10 quarts, start engine, and run 5 minutes. Recheck level and then add additional oil to bring level up to "FULL" (fig 25).

c. **Band Adjustments in Vehicle.** The front band designated in this manual is the band toward the fluid coupling while the rear band is the one toward the propeller shaft end of the transmission. Both bands may be adjusted while the transmission is in the vehicle according to the following procedure which is identical for each transmission.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 23 — Transmission Filler and Gage**

**(1) FRONT BAND ADJUSTMENT.**

**SCREWDRIVER**

**SOCKET**, square,  $\frac{5}{16}$ -in.

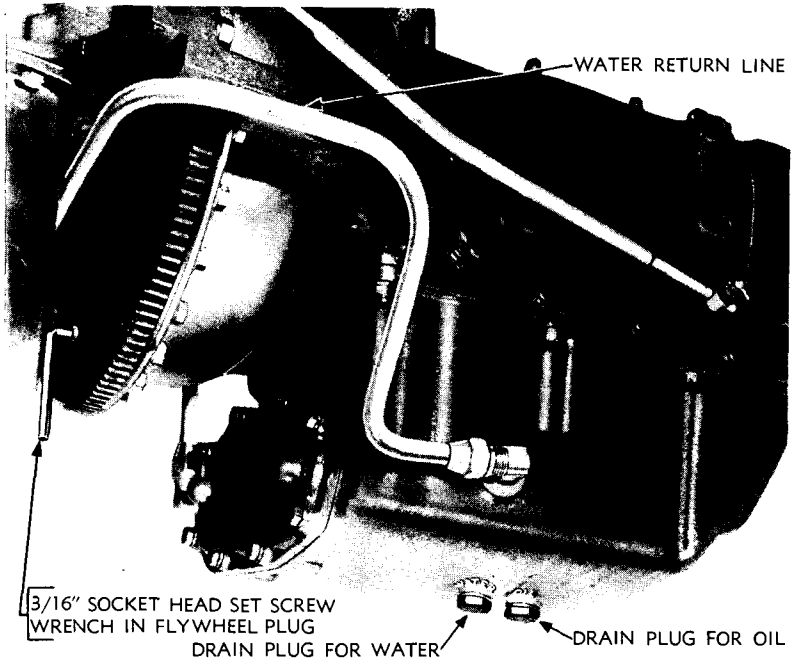
**WRENCH**,  $\frac{1}{16}$ -in.

**WRENCH**, open-end  $\frac{3}{4}$ -in.

**WRENCH**, torque, 0 to 25-lb

Remove screws and washers holding shell racks and bulkhead extension covers (fig. 26). Lift out shell racks and pry front ends of extension covers upward and remove. Loosen front band adjusting screw lock nut (toward rear of vehicle). Before making adjustment be sure that

**HYDRA-MATIC TRANSMISSION**



RA PD 58092

**Figure 24 — Transmission Drain Plugs**

adjusting screw is free enough to turn with fingers. Tighten front band adjusting screw to a tightness of 7 foot-pounds (fig. 27). Back off front band adjusting screw exactly 8 full turns to provide proper clearance between drum and band, and then tighten adjusting screw lock nut while holding adjusting screw stationary. Reposition bulkhead extension covers and shell racks and secure with screws and washers.

**(2) REAR BAND ADJUSTMENT.**

**SCREWDRIVER**

**SOCKET**, square,  $\frac{5}{16}$ -in.

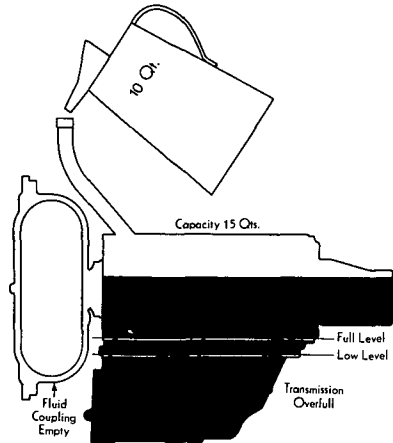
**WRENCH**,  $\frac{9}{16}$ -in.

**WRENCH**, open-end,  $\frac{3}{4}$ -in.

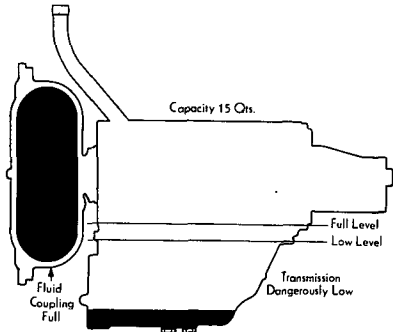
**WRENCH**, torque, 0 to 25-lb

Remove shell racks and bulkhead extension covers, as outlined in preceding step. Place transmission selector lever in neutral and start engine. Set hand throttle so that engines are running at approximately 1,000 revolutions per minute. Loosen rear band adjusting screw lock nut (toward front of vehicle). Check adjusting screw to see that it is loose enough to be turned with fingers. Tighten rear band adjusting screw to a tightness of 5 foot-pounds (fig. 28). Back off rear band exactly 2 full

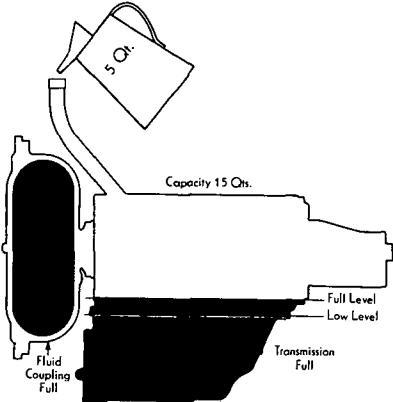
**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



1. Add 10 qts. of oil



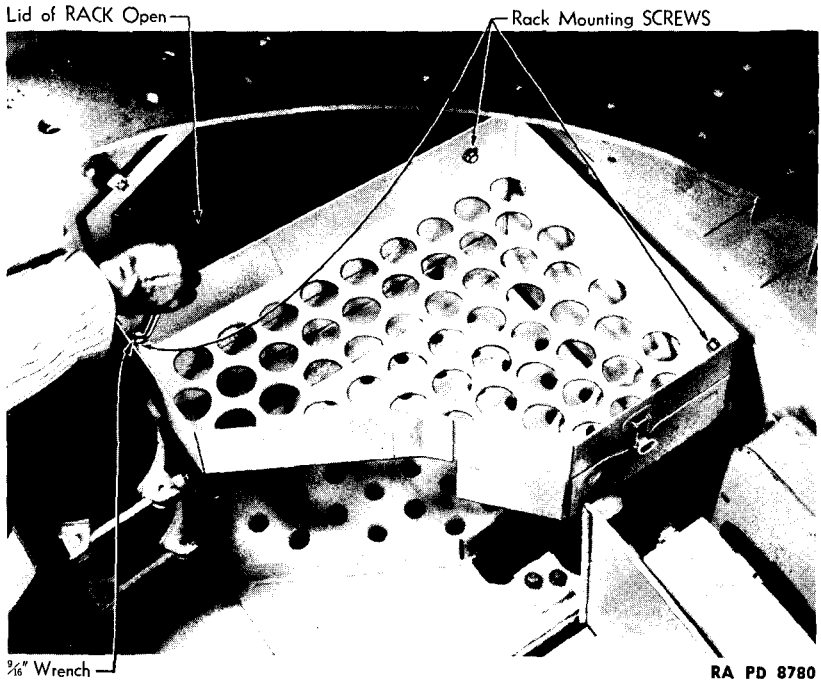
2. Run engine 5 minutes after adding 10 qts.



3. Add oil to "Full" mark on gauge.  
(approximately 5 more qts.)

RA PD 8956

**Figure 25 — Filling Transmission**

**HYDRA-MATIC TRANSMISSION**

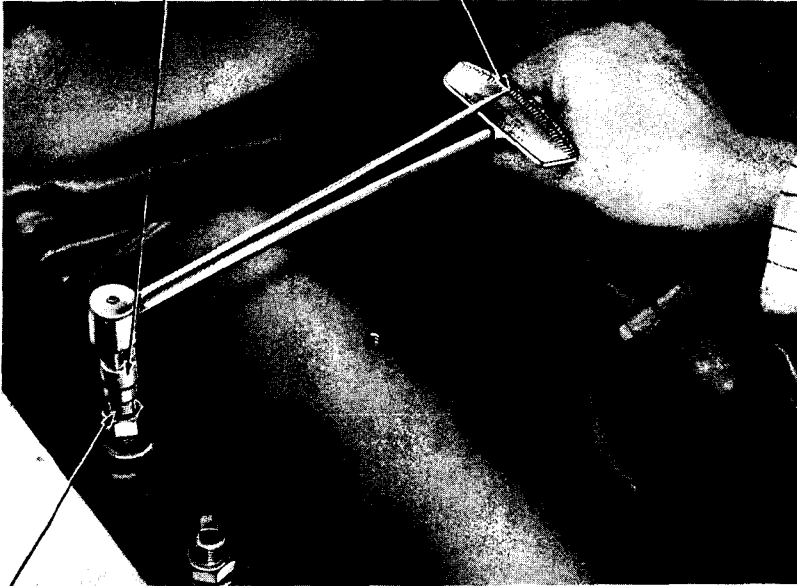
**Figure 26 — Removing 37-mm Shell Rack (M5 Only)**

turns to obtain proper clearance between drum and band and tighten band adjusting screw lock nut while holding adjusting screw stationary. Stop engine. Install shell racks and bulkhead extension covers securing in position with screws and washers.

**d. Correction of Leaks at Fluid Coupling.** If, during periodic lubrication inspections, the transmission oil level is found consistently to be low, the transmission should be checked for oil leaks. If evidence of leakage is found underneath the front end of the transmission or underneath the flywheel, it may be due to leakage at one or more of the following points: between flywheel and crankshaft, between flywheel and flywheel cover, between flywheel cover and front oil seal. To determine at which point leakage occurs, proceed as follows: Remove pan on floor of hull underneath Hydra-Matic transmissions and remove flywheel housing lower pan. Clean the engine side of the flywheel and flywheel cover thoroughly with SOLVENT, dry-cleaning, and allow to dry completely. Spread a clean piece of light paper underneath floor pan opening, and also on floor of hull just to the rear of the floor pan opening. Start engine and run at approximately 1,000 revolutions per minute,

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

5/16" Square Socket      1. Tighten front band adjusting SCREW to 7 ft. lbs.



2. Back off front band adjusting screw 8 turns

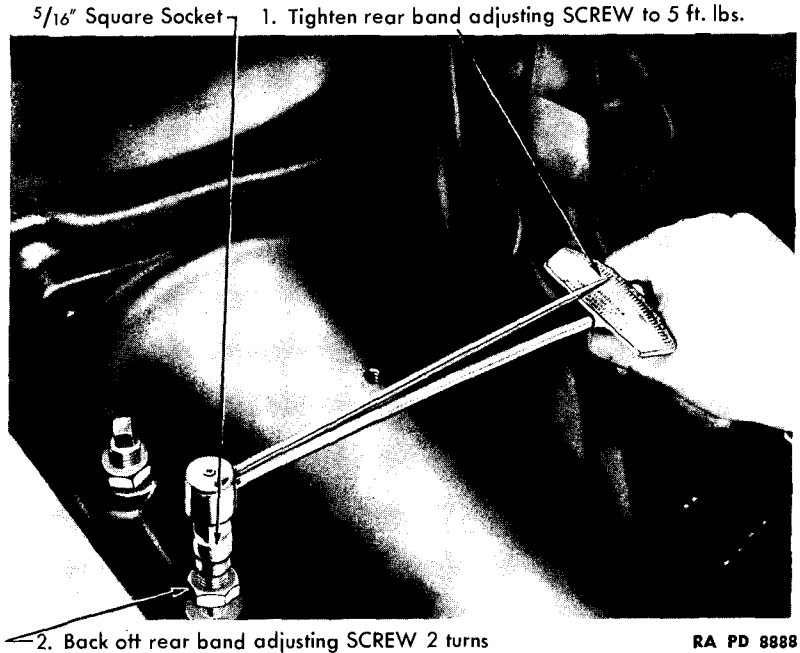
RA PD 8947

**Figure 27 — Front Band Adjustment**

watching for oil to appear on paper. If a spray appears on paper, shut off engine and check flywheel and flywheel cover for presence of transmission oil. If oil is streaked along front face of flywheel, leakage is occurring between flywheel and crankshaft. Leakage at this point should be corrected by removing flywheel and flywheel cap screws, sealing the threads and installing a new gasket. If oil is streaked along flywheel cover, the leakage is between flywheel cover and oil seal. Leakage between front oil seal and flywheel cover should be corrected by replacement of the oil seal, by replacing seal ring, if gap is over 0.012 in. or by replacement of the flywheel cover, if the runout is more than 0.005 in. If no oil is streaked on either flywheel or flywheel cover, the leakage is occurring at the joint between the flywheel and flywheel cover. This leakage should be corrected by checking tightness of screws. Torque tightness must be 20 to 25 foot-pounds. If tightness is within these limits, replace gasket and again tighten to 20 to 25 foot-pounds.

**e. Manual Linkage Adjustment.**

(1) The complete manual control linkage adjustment given in this paragraph should be performed whenever the engine and transmissions

**HYDRA-MATIC TRANSMISSION****Figure 28 — Rear Band Adjustment**

are removed and reinstalled, or whenever the linkage is being checked over to correct shifting difficulties.

(2) **EQUIPMENT.** The tools required to make the complete manual control linkage adjustment are as follows:

**JACK (2)**

**PIN, gage, A266522 (2)**

**PLATE, gage, A266521**

**PLIERS**

**WRENCH, open-end, 7/16-in.**

**WRENCH, open-end, 9/16-in.**

(3) **ADJUSTMENT PROCEDURE.**

(a) *Disconnect Rods at Selector Lever.*

**PLIERS**

Disconnect rod that extends from selector lever to transfer unit at selector lever end by removing cotter key and clevis pin, while working in driver's compartment (figs. 29 and 30). Move selector lever back to "REVERSE" position. Disconnect rod at lower end of selector lever by removing cotter key and clevis pin.



ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

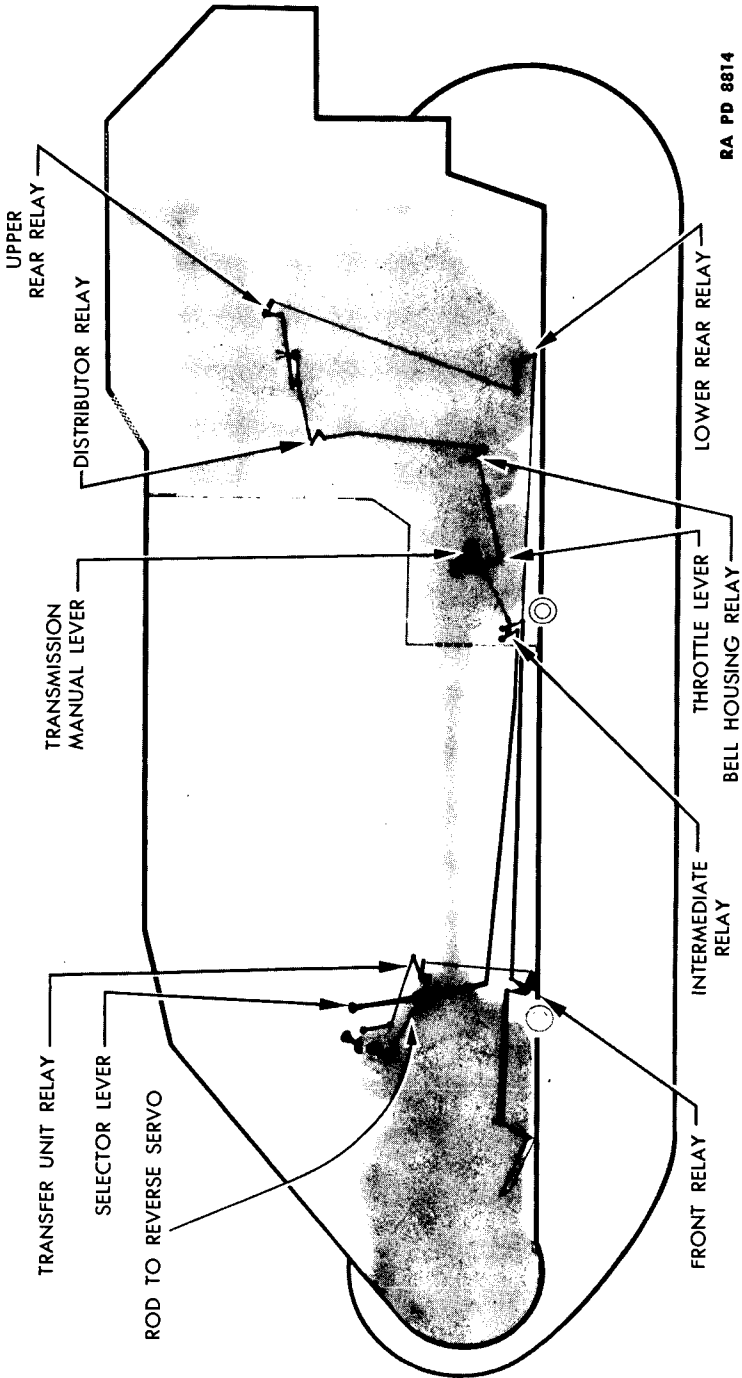


Figure 29 — Arrangement of Control Linkage

### HYDRA-MATIC TRANSMISSION

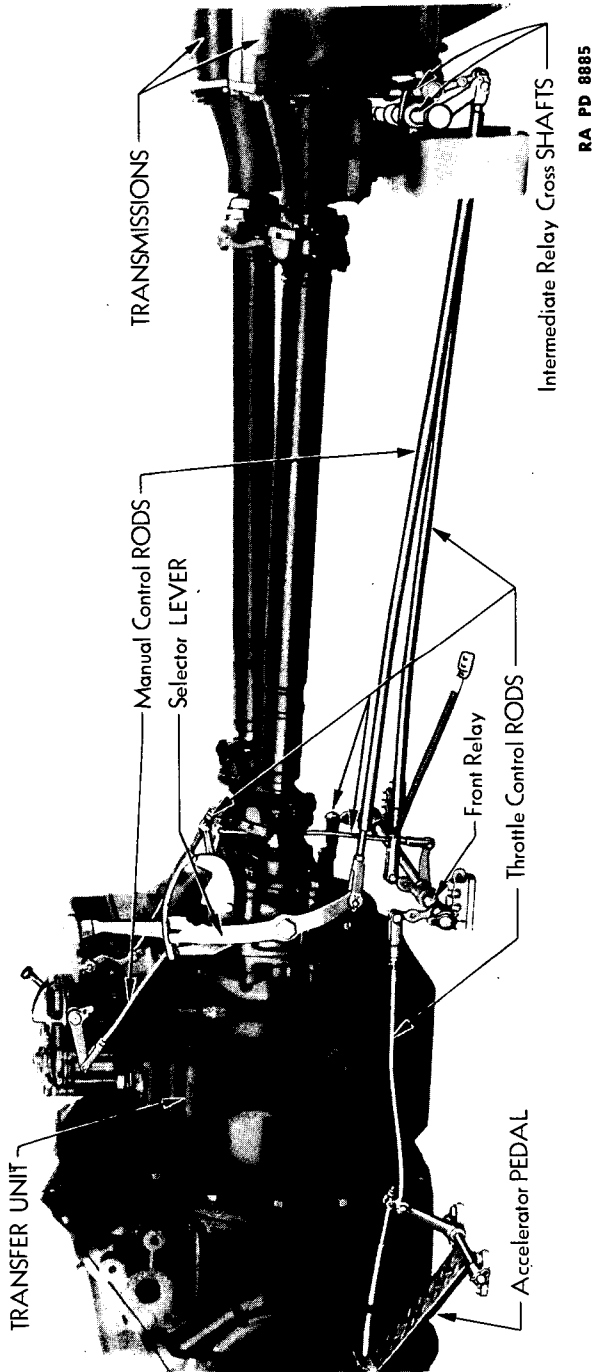
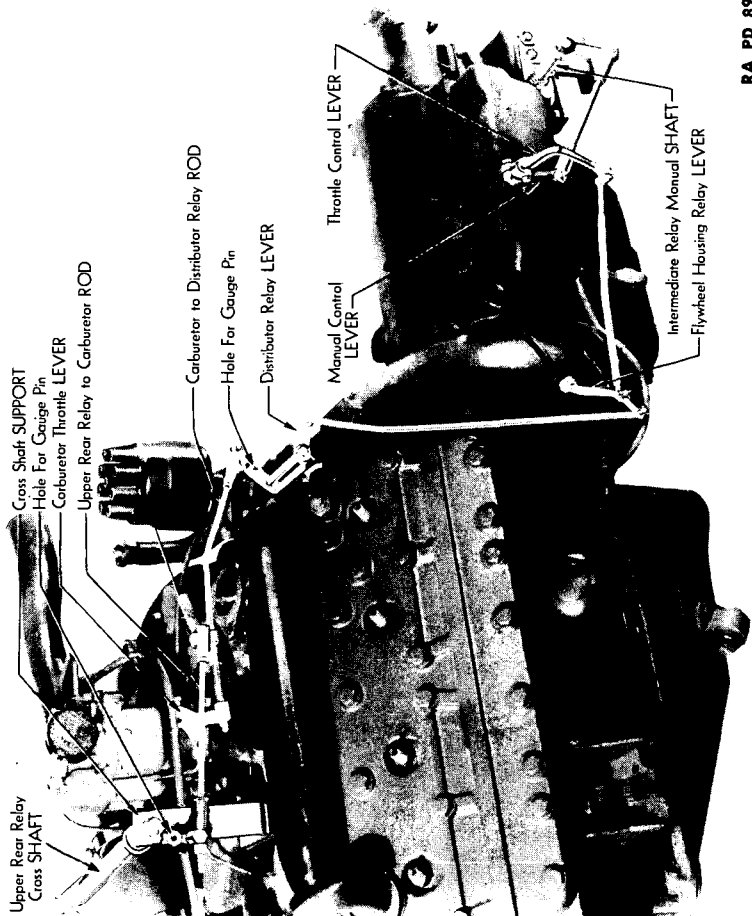


Figure 30 — Transfer Unit and Transmission Control Linkage

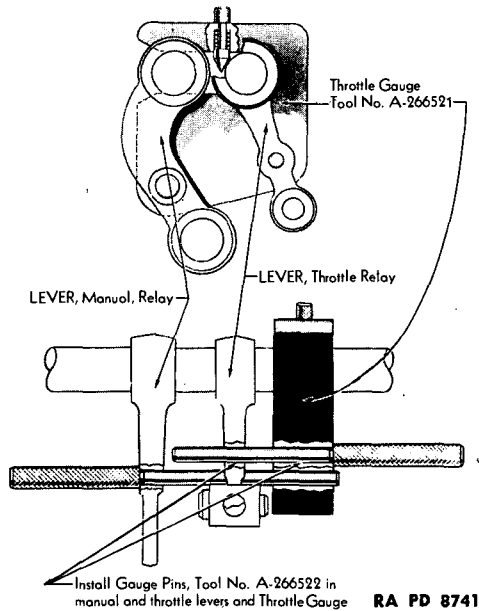
**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8914

**Figure 31 — Engine and Transmission Control Linkage**

**HYDRA-MATIC TRANSMISSION**



**Figure 32 — Gage Installation at Intermediate Relay**

(b) *Remove Floor Plate under Transmissions.*

**JACK (2)**

**WRENCH,  $\frac{7}{16}$ -in.**

**PLIERS**

**WRENCH,  $\frac{9}{16}$ -in.**

Remove floor plate in hull underneath transmissions by taking out 27 screws and lock washers and one nut on M5 vehicles, or 28 screws on M8 vehicles. **CAUTION:** Floor pan weighs over 80 pounds; support with jacks while removing.

(c) *Disconnect Transmission Control Rods.*

**PLIERS**

Disconnect manual rod for right-hand transmission at intermediate relay lever, by removing cotter key and clevis pin. Disconnect manual rod for left-hand transmission at manual control lever on transmission.

(d) *Install Intermediate Relay Gages.*

**PIN, gage, A266522 (2)**

**PLATE, gage, A266521**

Install intermediate relay gage plate A266521 on left ends of intermediate relay cross shafts next to manual lever and throttle lever. Install 2 gage pins A266522 (long), through pinholes in intermediate relay throttle and manual levers and into holes in gage plate, as shown in figure 32, to lock levers in a fixed position.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

*(e) Adjust Right-hand Manual Control Rod.*

**PLIERS**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

Place manual control lever on right-hand transmission in reverse position (all the way toward front of vehicle) while working underneath vehicle. **CAUTION:** Make sure reverse anchor is fully engaged. Adjust length of rod at intermediate relay end by loosening trunnion lock nut and rotating trunnion until clevis pin will slip into lever at intermediate relay. Install clevis pin and cotter key, and tighten lock nut.

*(f) Adjust Left-hand Manual Control Rod.*

**PLIERS**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

Place manual control lever on left-hand transmission in reverse position (all the way toward front of vehicle) while working underneath vehicle. **CAUTION:** Make sure reverse anchor is fully engaged. Adjust length of rod at transmission end by loosening trunnion lock nut and rotating trunnion until clevis pin will slip into transmission lever. Install clevis pin and cotter key, and tighten lock nut.

*(g) Adjust Rod at Selector Lever.*

**PLIERS**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

Adjust length of rod disconnected from lower end of transmission selector lever by loosening clevis lock nut and rotating clevis until clevis pin slips into selector lever, working in driver's compartment. **CAUTION:** Selector lever must be in "REVERSE."

*(h) Remove Gages and Install Floor Pan.*

**JACK (2)**

**WRENCH**,  $\frac{9}{16}$ -in.

**WRENCH**,  $\frac{7}{16}$ -in.

Working underneath vehicle, remove gage pins and gage plate from intermediate relay. Reinstall floor pan on hull, supporting with jacks while installing 27 cap screws and lock washers and one nut on M5 vehicles, or 28 cap screws and lock washers on M8 vehicles.

*(i) Adjust Manual Rod to Transfer Unit Reverse Servo.*

**PLIERS**

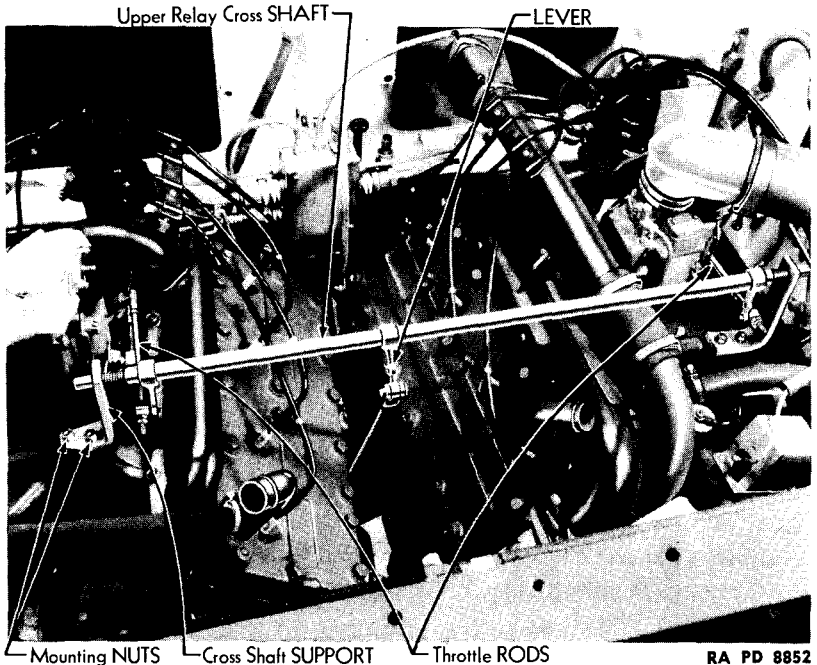
**WRENCH**, open-end,  $\frac{7}{16}$ -in.

Working in fighting compartment, move transmission selector lever past "REVERSE" position toward rear of vehicle as far as it will go. Hold in this position while adjusting length of rod that extends to reverse servo until, when clevis is inserted, stop on servo release lever just contacts stop on servo body. Install clevis pin and cotter key, tighten clevis lock nut, and release selector lever.

**f. Throttle Control Linkage.**

(1) The complete throttle control linkage adjustment is given in this paragraph, but the complete adjustment is required only when checking

**HYDRA-MATIC TRANSMISSION**



RA PD 8852

**Figure 33 — Upper Rear Relay Cross Shaft**

to correct shifting difficulties. When an engine and transmission are replaced, only the adjustment up to the intermediate relay, steps (a) through (j), and (m) need be made. When the transfer unit and differential are replaced, only the adjustments at the front relay, steps (b), and (k) through (p) are necessary.

(2) EQUIPMENT. The tools required to make the complete throttle linkage adjustment:

- GAGE, relay, front  
A266520
- JACK (2)
- PIN, gage, A266522 (2)
- PLATE, gage, A266521

- PLIERS
- WRENCH, open-end,  $\frac{7}{16}$ -in.
- WRENCH, open-end,  $\frac{9}{16}$ -in.
- WRENCH, socket,  $\frac{9}{16}$ -in.
- WRENCH, socket,  $\frac{3}{4}$ -in.

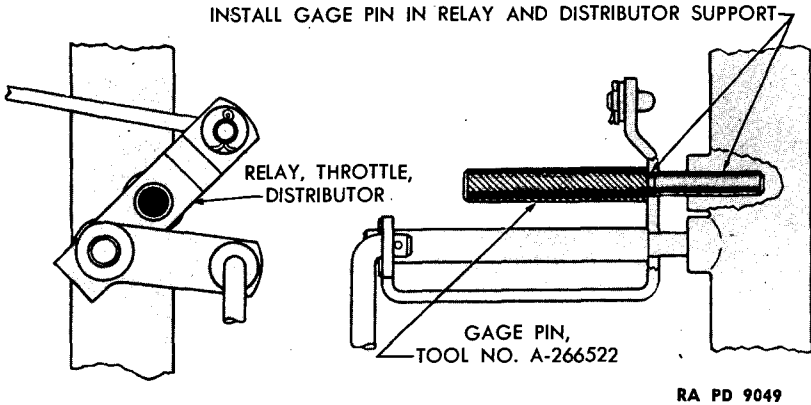
(3) ADJUSTMENT PROCEDURE.

(a) *Open all Engine Compartment Doors.*

- WRENCH, socket,  $\frac{9}{16}$ -in.
- WRENCH, socket,  $\frac{3}{4}$ -in.

Remove 7 cap screws, using  $\frac{3}{4}$ -inch socket wrench, and open engine compartment rear doors. Working in turret basket, remove 37-mm shell

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 34 — Gage in Distributor Relay**

racks on M5 vehicles (fig. 26) or 75-mm racks on M8 vehicles. Unlatch and remove bulkhead doors (fig. 23).

*(b) Remove Floor Pan under Transmissions.*

- JACK (2)
- PLIERS

- WRENCH,  $\frac{7}{16}$ -in.
- WRENCH,  $\frac{9}{16}$ -in.

Remove floor pan in hull underneath transmissions by taking out 27 screws and lock washers and one nut on M5 vehicles, or 28 screws on M8 vehicles. CAUTION: Floor pan weighs over 80 pounds; support with jacks while removing.

*(c) Disconnect Throttle Rods.*

- PLIERS

Working from underneath vehicle, disconnect throttle rod at throttle lever on each transmission by removing cotter key (fig. 31). Working through engine compartment rear doors, disconnect each throttle rod at cross shaft lever end, by removing cotter key (fig. 33).

*(d) Install Gage Pins.*

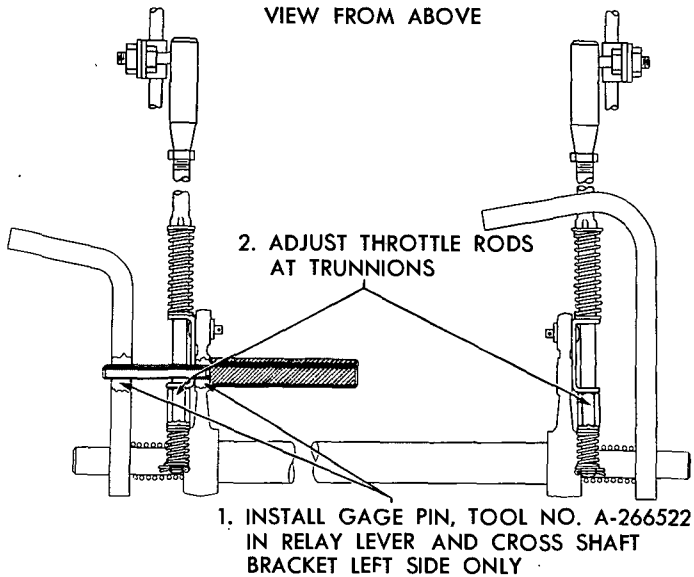
- PIN, gage, A266522 (2 short) (1 long)

Working through bulkhead doors, insert one short gage pin through pinhole in each distributor relay lever and into distributor support housing (fig. 34). Working through engine compartment rear doors, insert long gage pin through pinhole in left-hand upper rear relay cross shaft lever and into support bracket (figs. 33 and 35).

*(e) Adjust Carburetors.*

Make sure carburetors are in proper adjustment. Refer to information on the fuel system TM 9-1727B.

**HYDRA-MATIC TRANSMISSION**



RA PD 9047

**Figure 35 — Gage in Upper Rear Relay**

(f) *Adjust Throttle Rods at Transmissions.*

**PLIERS**

Working from underneath vehicle, place throttle valve lever on each transmission in turn, as far forward (toward front of vehicle) as it will go. Adjust length of each throttle rod from relay on bell housing to lever on transmission by rotating trunnion so that trunnion will slip in hole into throttle lever on transmission when lever is held forward. While holding throttle valve lever forward, connect trunnion and install cotter key.

(g) *Adjust Throttle Rods at Upper Rear Relay.*

**PLIERS**

**WRENCH**, open-end,  $\frac{7}{16}$ -in.

Working through engine compartment rear doors rotate adjusting nut at upper rear relay lever end of each throttle rod (from engine carburetor-distributor relay rod to upper rear relay lever) until trunnion pin will slip into hole in relay lever. Install washers and cotter keys.

(h) *Install Gage Pin on Lower Rear Relay.*

**PIN**, gage, A266522 (long)

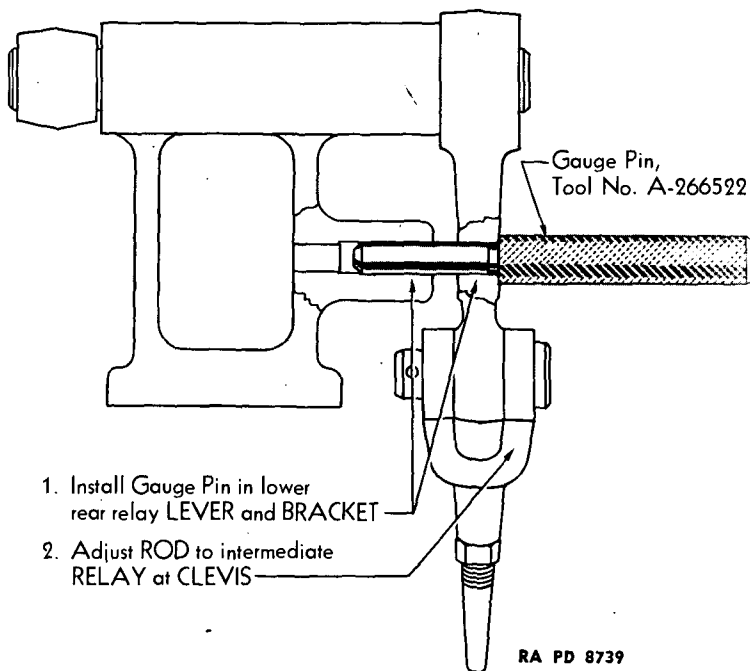
**WRENCH**, socket,  $\frac{9}{16}$ -in.

**PLIERS**

Working through engine compartment rear doors, disconnect rod between center lever on upper rear relay cross shaft and lower rear



ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM. HOWITZER MOTOR CARRIAGE M8



**Figure 36 — Gage in Lower Rear Relay**

relay lever, at upper rear relay, by removing cotter key and clevis pin. Working underneath vehicle, remove 8 screws and lock washers holding right engine oil drain plug cover plate to hull floor. Working through drain plug opening, install a gage pin, A266522 (long) through pinhole in lower rear relay lever and into mounting bracket (fig. 35).

(i) *Adjust Throttle Rod to Lower Rear Relay.*

**PLIERS**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

Working through engine compartment rear doors, loosen clevis lock nut on upper end of rod between upper and lower rear relays, and adjust length of rod by rotating clevis until clevis pin can be inserted. Install clevis pin and cotter key and tighten clevis lock nut.

(j) *Adjust Throttle Rods at Intermediate Relay.*

**PIN**, gage, A266522

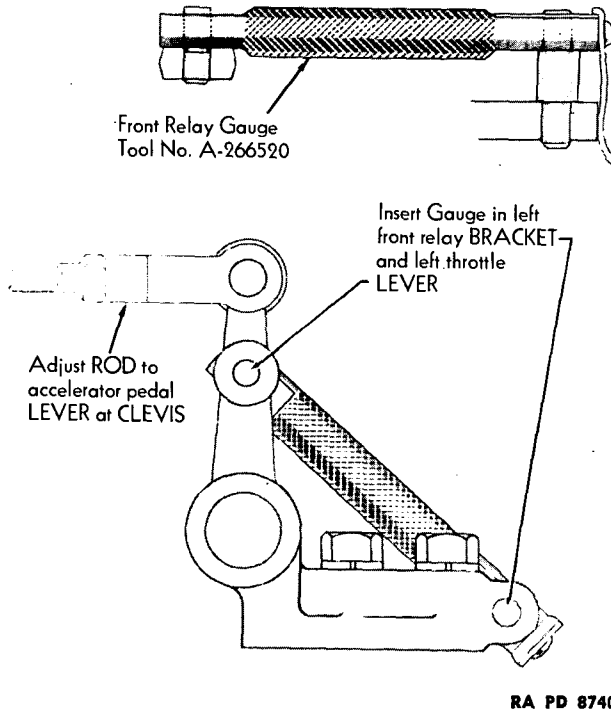
**PLIERS**

**PLATE**, gage, A266521

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

Disconnect rod between lower rear relay and intermediate relay at rear relay end, by removing cotter key and clevis pin, while working underneath vehicle. Install intermediate relay gage plate, A266521, and

**HYDRA-MATIC TRANSMISSION**



**Figure 37 — Gauge in Front Relay**

install one gage pin, A266522 (long) on intermediate relay (fig. 32). Adjust length of rod between lower rear relay and intermediate relay by loosening clevis lock nut on rear relay end and rotating clevis until clevis pin can be inserted through lower rear relay. Install clevis pin and cotter key and tighten clevis lock nut.

(k) *Install Front Relay Gage.*

**GAGE**, relay, front, A266520  
**PLIERS**

**WRENCH**, socket,  $\frac{9}{16}$ -in.

While working in fighting compartment remove screws and washers holding left propeller shaft front cover to supports and remove cover. On M8 vehicles, floorboards must first be removed. Disconnect throttle rod that connects front relay to intermediate relay at front relay end by removing cotter key and clevis pin. Install front relay gage A266520 on front relay left lever and relay left mounting bracket (fig. 36).

(l) *Adjust Throttle Rod from Intermediate Relay to Front Relay.*

**PLIERS**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

Adjust length of throttle rod from front relay to intermediate relay by loosening clevis lock nut on front relay end, and rotating clevis until clevis pin will slip into hole in lever. Install clevis pin through clevis in front relay lever and install cotter key. Tighten clevis lock nut.

(m) *Adjust Accelerator Pedal Throttle Rod at Front Relay.*

**PLIERS**

**WRENCH**, open-end,  $\frac{1}{16}$ -in.

Measure vertical distance from tip end of foot accelerator pedal to floor of vehicle. If distance is not 6 inches plus or minus  $\frac{1}{16}$  inch, disconnect rod from pedal to front relay at relay end by removing clevis pin and cotter key. Adjust length of this rod by loosening clevis lock nut on relay end, and rotating clevis. Install clevis pin and cotter key, and tighten clevis lock nut.

(n) *Remove Gages.*

Remove all gages, gage pins from front relay, intermediate relay, lower rear relay, upper rear relay, and distributor relays on both engines.

(o) *Adjust Transfer Unit Throttle Rod at Front Relay.*

**PLIERS**

**WRENCH**, open-end,  $\frac{3}{16}$ -in.

Disconnect throttle rod between transfer unit relay and front relay on floor of hull at transfer unit relay end by removing cotter key and clevis pin. Adjust length of rod by loosening clevis lock nut, and rotating clevis until clevis pin will just enter hole in lever when accelerator pedal is depressed to wide open throttle position and outer throttle lever on transfer unit is held as far forward as possible. Install clevis pin and cotter key, and tighten clevis lock nut.

(p) *Install Floor Pans and Close Doors.*

**WRENCH**, socket,  $\frac{9}{16}$ -in.

Install floor pan underneath transmissions. Install right engine drain plug cover plate. Install 37-mm or 75-mm shell rack, and close bulkhead doors. Close engine compartment rear doors. Install propellor shaft front cover on M8 vehicles, position floorboards on propellor shaft covers, and install 4 mounting screws and washers.

(q) *Oil Pump Pressure Check.* The pressure supplied by the front and rear oil pumps in the transmission may be checked without removing the transmission from the vehicle.

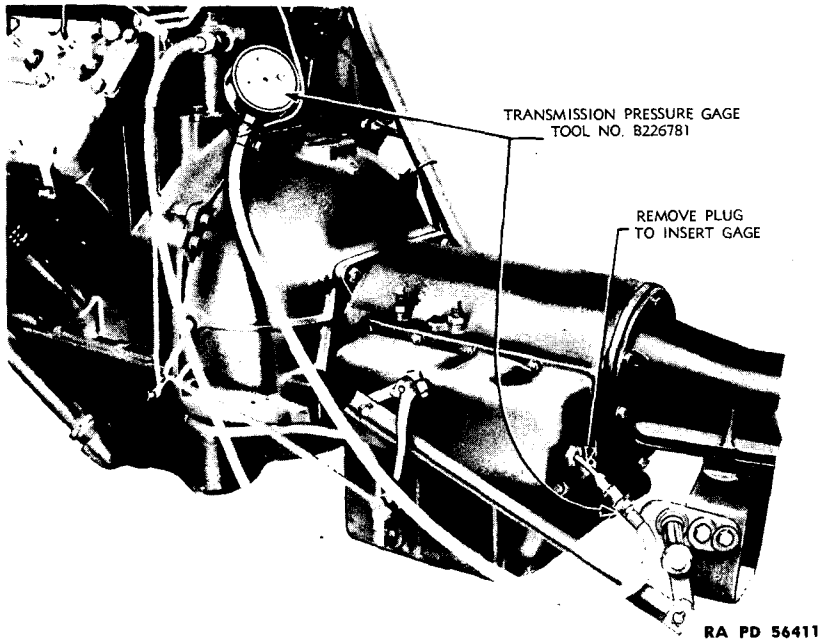
1. *Remove Shell Rack and Bulkhead Extension.*

**SCREWDRIVER**

**WRENCH**,  $\frac{9}{16}$ -in.

Remove screws and washers holding shell racks and bulkhead extensions in place and remove them (removal of 37-mm shell rack used on M5 is shown in fig. 26.)

## HYDRA-MATIC TRANSMISSION



**Figure 38 — Pressure Gage Installation, First Type Transmission**

2. *Install Pressure Gage.*

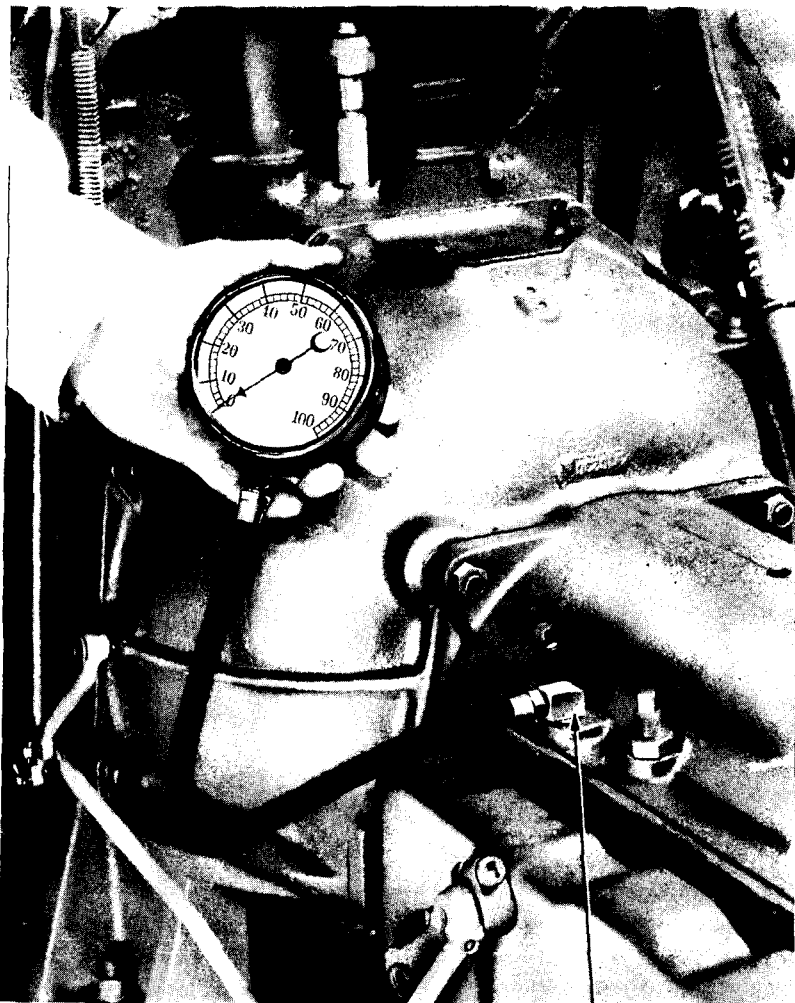
GAGE, B226781  
 SCREW, cap,  $\frac{1}{4}$  to 24,  
 2 in. long

WRENCH, open-end,  $\frac{7}{8}$ -in.

On first type transmissions, remove plug in rear of side cover on transmission (toward front of vehicle). Insert a  $\frac{1}{4}$  to 24 cap screw, 2 inches long, through plug hole in side cover and into plug in governor sleeve. Using this cap screw as a puller, remove plug from governor sleeve. Install gage B226781 through plug hole in side cover and into plug hole in governor sleeve (fig. 38). **CAUTION:** Exercise particular care when installing pressure checking gage not to put a bind on governor assembly. On second type transmissions, it is only necessary to substitute the gage connection for the warning signal electric switch (fig. 39).

3. *Check Oil Pump Pressure.*

Operate vehicle on road until fluid in transmission is at normal operating temperature. With the transmission selector lever in the "DR" position the oil pressure as indicated on the pressure gage should not be less than 85 pounds at 10 miles per hour. Pressure below 85 pounds

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

Gage, Tool No. B226781    Elbow for Signal Unit

RA PD 56442

**Figure 39 — Pressure Gage Installation, Second Type Transmission**

may be due to oil leakage somewhere in the transmission or pressure regulator valve assembly, or to worn oil pump gears. **NOTE:** The above operation will tell whether the line pressure supplied by both the front and rear oil pumps is satisfactory at speeds above 10 miles per hour. The rear pump will ordinarily supply the full 85 pounds of pressure. If the rear pump is not operating correctly, however, the front pump

## HYDRA-MATIC TRANSMISSION

may supply the 85 pounds of pressure, and above operation will not disclose faulty rear pump performance.

### 4. Check Rear Oil Pump Pressure.

To check the operation of the rear pump alone, stop the vehicle and turn off the engine of the transmission to which the pressure gage is connected. Start the other engine and begin to drive the vehicle slowly forward. Note the speed at which the rear pump attains 85 pounds of pressure on the transmission with the dead engine. The oil pump should produce 85 pounds of pressure at not more than 3 miles per hour. Low rear oil pump pressure should be corrected by replacing oil pump gears or by correcting excessive oil pump gear end play.

### 5. Remove Gage and Reinstall Plugs.

WRENCH, open-end,  $\frac{7}{8}$ -in.                      WRENCH, open-end,  $\frac{9}{16}$ -in.

On first type transmissions, removing gage end from governor sleeve, install plug in sleeve, and then install plug in side cover. On second type transmissions, remove gage end from case and install and reconnect switch for electric warning signal. Reinstall bulkhead extensions and shell racks.

## 11. REPLACEMENT OF COMPONENTS WITH TRANSMISSION IN THE VEHICLE.

a. When performing any service operations on the Hydra-Matic transmission while it is still in the vehicle, it is necessary to remove the cover plate on the bottom of the hull. If any of the component parts are to be replaced, the oil and water should be drained and the oil pan assembly and side cover must be removed. The following paragraphs cover in detail the necessary procedure to be followed when replacing component parts of the transmission in the vehicle. All operations are identical for each transmission unless otherwise indicated.

### b. Cover Plate.

#### (1) EQUIPMENT.

JACK    WRENCH, socket,  $\frac{9}{16}$ -in.  
WRENCH, socket,  $\frac{1}{2}$ -in.

#### (2) REMOVE TRANSMISSION COVER PLATE.

JACK    WRENCH, socket,  $\frac{9}{16}$ -in.  
WRENCH, socket,  $\frac{1}{2}$ -in.

Remove 27 screws and lock washers and one self-locking nut holding cover plate to bottom of hull under transmissions, and remove plate. NOTE: This cover plate weighs 80 pounds, and care should be taken to see that it is supported with a jack or similar piece of equipment when being removed.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**(3) INSTALL TRANSMISSION COVER PLATE.**

- |   |  |
|---|--|
| <b>JACK</b>   | <b>WRENCH, socket, <math>\frac{1}{16}</math>-in.</b> |
| <b>WRENCH, socket, <math>\frac{1}{2}</math>-in.</b> |  |

Support transmission cover plate under transmissions with a jack or similar piece of equipment and secure by tightening 27 screws and lock washers, and 1 self-locking nut.

**c. Shell Racks.**

**(1) EQUIPMENT.**

**WRENCH, open-end,  $\frac{1}{16}$ -in.**

**(2) REMOVE SHELL RACKS.**

**WRENCH, open-end,  $\frac{1}{16}$ -in.**

Remove screws holding 37-mm or 75-mm shell racks to bulkhead and hull side wall, and remove shell racks (fig. 26).

**(3) INSTALL SHELL RACKS.**

**WRENCH, open-end,  $\frac{1}{16}$ -in.**

Position shell racks in hull and secure by tightening screws holding racks to bulkhead and hull side wall.

**d. Bulkhead Extension Covers.**

**(1) EQUIPMENT.**

<b>SCREWDRIVER</b>	<b>WRENCH, open-end, <math>\frac{1}{16}</math>-in.</b>
--------------------	--

**(2) REMOVE BULKHEAD EXTENSION COVERS.**

<b>SCREWDRIVER</b>	<b>WRENCH, open-end, <math>\frac{1}{16}</math>-in.</b>
--------------------	--

Remove 2 screws and lock washers holding each of 2 bulkhead extension covers to bulkhead and 2 screws and lock washers holding each of the 2 covers to bulkhead extension walls. Remove bulkhead extension covers.

**(3) INSTALL BULKHEAD EXTENSION COVERS.**

<b>SCREWDRIVER</b>	<b>WRENCH, open-end, <math>\frac{1}{16}</math>-in.</b>
--------------------	--

Position bulkhead extension covers on bulkhead extension and install 2 screws and lock washers holding each extension cover to bulkhead and 2 screws and lock washers holding each cover to extension walls.

**e. Oil Pan.**

**(1) EQUIPMENT.**

<b>JACK</b>	<b>WRENCH, socket, <math>\frac{1}{16}</math>-in.</b>
<b>WRENCH, socket, <math>\frac{1}{2}</math>-in.</b>	<b>WRENCH, socket, <math>\frac{7}{8}</math>-in.</b>

**(2) REMOVE OIL PAN.**

<b>JACK</b>	<b>WRENCH, socket, <math>\frac{1}{16}</math>-in.</b>
<b>WRENCH, socket, <math>\frac{1}{2}</math>-in.</b>	<b>WRENCH, socket, <math>\frac{7}{8}</math>-in.</b>

**HYDRA-MATIC TRANSMISSION**

Remove transmission cover plate as outlined in step **b** (2) and drain oil from transmission by removing oil drain plug from bottom of transmission and plug from flywheel. Drain cooling system by removing water drain plug from bottom of transmission oil pan after first venting the radiator by turning the radiator cap to the left. Disconnect oil cooler intake and outlet pipes at oil pan fittings. **NOTE:** Before removing oil pan, clean thoroughly around pan flange. Remove oil pan and gasket by removing 9 screws and lock washers, and 2 nuts and lock washers.

**(3) INSTALL OIL PAN.**

<b>JACK</b>	<b>WRENCH</b> , socket, $\frac{9}{16}$ -in.
<b>WRENCH</b> , socket, $\frac{1}{2}$ -in.	<b>WRENCH</b> , socket, $\frac{7}{8}$ -in.

Position new gasket and oil pan on bottom of transmission case and secure by tightening 9 screws and lock washers and 2 nuts and lock washers. Connect oil cooler intake and outlet pipes at oil pan connections. Install oil drain plug in oil pan and drain plug in flywheel and fill transmission with 15 quarts of proper lubricant. Install water drain plug in oil pan and fill cooling system with proper coolant (water or antifreeze). Install cover plate on bottom of hull.

**f. Control Valve Body Assembly.****(1) EQUIPMENT.**

<b>JACK</b>	<b>WRENCH</b> , socket, $\frac{1}{2}$ -in.
<b>WRENCH</b> , open-end, $\frac{7}{8}$ -in.	<b>WRENCH</b> , socket, $\frac{9}{16}$ -in.
<b>WRENCH</b> , socket, $\frac{7}{16}$ -in.	<b>WRENCH</b> , socket, $1\frac{5}{16}$ -in.

**(2) REMOVE CONTROL VALVE BODY ASSEMBLY.**

<b>JACK</b>	<b>WRENCH</b> , socket, $\frac{1}{2}$ -in.
<b>WRENCH</b> , $\frac{7}{8}$ -in.	<b>WRENCH</b> , socket, $\frac{9}{16}$ -in.
<b>WRENCH</b> , socket, $\frac{7}{16}$ -in.	<b>WRENCH</b> , socket, $1\frac{5}{16}$ -in.

Remove transmission cover plate as outlined in step **b** (1). Disconnect throttle and manual control rods at levers on side of transmission. Loosen lock screw holding throttle valve lever and pull lever from shaft. Loosen lock screw holding manual control lever and pull lever from shaft. Remove oil drain plug and gasket from bottom of transmission. Turn engine over and remove drain plug from flywheel. Allow oil to drain completely from transmission oil pan and flywheel. Remove 11 screws and lock washers holding side cover on transmission and remove side cover. Remove 4 screws and lock washers holding control valve body assembly to transmission case, and remove control valve body assembly by sliding toward front of vehicle. **NOTE:** Oil delivery pipes from control valve body to governor sleeve may come off at this time. If not, they may be pulled out of governor sleeve.



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**(3) INSTALL CONTROL VALVE BODY ASSEMBLY.**

- |                                 |                                 |
|---------------------------------|---------------------------------|
| <b>JACK</b>                     | <b>WRENCH, socket, 1/2-in.</b>  |
| <b>WRENCH, 7/8-in.</b>          | <b>WRENCH, socket, 9/16-in.</b> |
| <b>WRENCH, socket, 7/16-in.</b> |                                 |

Install oil delivery pipes in control valve body and position complete assembly on side of transmission, sliding oil delivery pipes into governor sleeve while doing so. Secure in place by installing 4 screws and lock washers. Position side cover over control valve body assembly and secure with 11 screws and lock washers. Connect manual and throttle control levers on throttle valve shaft and manual control shaft. Install oil drain plugs and fill transmission with 15 quarts of lubricant, as specified in lubrication guide for this vehicle in TM 9-727C. Install cover plate on bottom of hull.

**g. Front Servo and Oil Pump.**

**(1) EQUIPMENT.**

- |                                  |                                  |
|----------------------------------|----------------------------------|
| <b>JACK</b>                      | <b>WRENCH, open-end, 7/8-in.</b> |
| <b>SCREWDRIVER</b>               | <b>WRENCH, socket, 9/16-in.</b>  |
| <b>WRENCH, open-end, 1/2-in.</b> |                                  |

**(2) REMOVE FRONT SERVO AND OIL PUMP.**

- |                                  |                                  |
|----------------------------------|----------------------------------|
| <b>JACK</b>                      | <b>WRENCH, open-end, 7/8-in.</b> |
| <b>SCREWDRIVER</b>               | <b>WRENCH, socket, 9/16-in.</b>  |
| <b>WRENCH, open-end, 1/2-in.</b> |                                  |

Remove transmission cover plate as outlined in step b (2) from bottom of hull and drain oil. Vent radiators and drain water. Disconnect oil cooler pipes and remove oil pan. Remove 2 screws and lock washers holding front pump oil inlet pipe to rear pump mounting bracket, and remove pipe by pulling toward front of vehicle. Remove oil pressure regulator spring. Loosen rear band adjusting screw lock nut and loosen adjusting screw. Loosen front band adjusting screw lock nut and loosen adjusting screw. Remove 2 screws and lock washers holding rear servo to transmission case. Remove 2 screws and lock washers holding front servo and oil pump to transmission case, and lift off both front servo and oil pump and rear servo as a unit. Pull servos apart and remove 2 oil delivery pipes connecting the servos.

**(3) INSTALL FRONT SERVO AND OIL PUMP.**

- |                        |                                 |
|------------------------|---------------------------------|
| <b>JACK</b>            | <b>WRENCH, 7/8-in.</b>          |
| <b>SCREWDRIVER</b>     | <b>WRENCH, socket, 9/16-in.</b> |
| <b>WRENCH, 1/2-in.</b> |                                 |

Place front servo and pump to rear servo oil delivery pipes in sleeves in front and rear servo, and position complete assembly on transmission

## HYDRA-MATIC TRANSMISSION

case, making certain front servo lines up on dowel pin on case. Secure in position by tightening 2 screws and lock washers holding rear servo, and 2 screws and lock washers holding front servo and oil pump to transmission case. Install oil pressure regulator spring. Install front pump oil inlet pipe and tighten in position with 2 screws and lock washers. Install oil pan and fill transmission and cooling system. Install cover plate on bottom of hull.

### h. Rear Oil Pump and Governor.

#### (1) EQUIPMENT.

JACK	WRENCH, socket, 1/2-in.
WRENCH, open-end, 7/8-in.	WRENCH, socket, 9/16-in.
WRENCH, socket, 7/16-in.	

#### (2) REMOVE REAR OIL PUMP AND GOVERNOR.

JACK	WRENCH, socket, 1/2-in.
WRENCH, open-end, 7/8-in.	WRENCH, socket, 9/16-in.
WRENCH, socket, 7/16-in.	

Remove transmission cover plate as outlined in step b (2) and drain oil. Vent radiator cap and drain water. Disconnect oil cooler pipes and remove oil pan from transmission case. Remove 2 screws and lock washers holding front pump intake oil line to mounting bracket on rear pump, and pull oil line out of mounting hole in front pump. Disconnect manual and throttle control rods and levers at side of transmission. Remove side cover over control valve body by removing 11 screws and lock washers. Remove 4 screws and lock washers holding control valve body assembly and remove complete assembly with oil delivery pipes. Remove 2 screws and lock washers holding rear pump and governor to transmission case and lift pump and governor out of case. NOTE: Governor must be rotated so that large, round, governor weight is toward rear of transmission while removing assembly.

#### (3) INSTALL REAR OIL PUMP AND GOVERNOR.

JACK	WRENCH, socket, 1/2-in.
WRENCH, open-end, 7/8-in.	WRENCH, socket, 9/16-in.
WRENCH, socket, 7/16-in.	

Position round governor weight and install rear oil pump and governor in transmission case, securing in position with 2 screws and lock washers. Place oil delivery pipes (if they have been removed) in control valve body and install complete assembly on side of transmission case, sliding ends of oil delivery pipes into sleeves in governor. Position side cover on transmission case over control valve body and secure in position by tightening 11 screws and lock washers. Connect manual and throttle control rods and levers to shafts protruding through transmission side cover. Position front pump intake oil line on mounting bracket on

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

governor and secure by tightening 2 screws and lock washers. Install oil pan and fill transmission and cooling system. Install cover plate on bottom of hull.

**i. Oil Cooler.**

**(1) EQUIPMENT.**

<b>JACK</b>	<b>WRENCH, socket, <math>\frac{9}{16}</math>-in.</b>
<b>WRENCH, open-end, <math>\frac{7}{8}</math>-in.</b>	<b>WRENCH, spanner, A266336</b>
<b>WRENCH, socket, <math>\frac{1}{2}</math>-in.</b>	

**(2) REMOVE OIL COOLER.**

<b>JACK</b>	<b>WRENCH, socket, <math>\frac{9}{16}</math>-in.</b>
<b>WRENCH, open-end, <math>\frac{7}{8}</math>-in.</b>	<b>WRENCH, spanner, A266336</b>
<b>WRENCH, socket, <math>\frac{1}{2}</math>-in.</b>	

Remove transmission cover plate as outlined in step b (2). Drain transmission oil and radiator and remove oil pan as outlined in step e (2). Remove oil pan front cover and metal cover intake screen. Remove bolt holding oil screen to oil pan. Remove oil cooler unit mounting nuts and oil seal packing in oil pan, and pull cooler from front end of pan.

**(3) INSTALL OIL COOLER.**

<b>JACK</b>	<b>WRENCH, socket, <math>\frac{9}{16}</math>-in.</b>
<b>WRENCH, open-end, <math>\frac{7}{8}</math>-in.</b>	<b>WRENCH, spanner, A266336</b>
<b>WRENCH, socket, <math>\frac{1}{2}</math>-in.</b>	

Position water seal packing washers on oil cooler unit and insert cooler into oil pan from front. Install oil seal packings on oil cooler pipes and secure with mounting nuts. Install a new oil pan front gasket and install oil pan front cover. Install oil screen and cover in oil pan on end of oil cooler pipe. Install oil pan assembly and fill transmission and cooling system. Install cover plate on bottom of hull.

**j. Pressure Regulator Body.**

**(1) EQUIPMENT.**

<b>JACK</b>	<b>WRENCH, socket, <math>\frac{1}{2}</math>-in.</b>
<b>SCREWDRIVER</b>	<b>WRENCH, socket, <math>\frac{9}{16}</math>-in.</b>
<b>WRENCH, open-end, <math>2\frac{5}{32}</math>-in.</b>	<b>WRENCH, socket, <math>1\frac{1}{16}</math>-in.</b>
<b>WRENCH, socket, <math>\frac{7}{16}</math>-in.</b>	

**(2) REMOVE PRESSURE REGULATOR BODY.**

<b>JACK</b>	<b>WRENCH, socket, <math>\frac{1}{2}</math>-in.</b>
<b>SCREWDRIVER</b>	<b>WRENCH, socket, <math>\frac{9}{16}</math>-in.</b>
<b>WRENCH, open-end, <math>2\frac{5}{32}</math>-in.</b>	<b>WRENCH, socket, <math>1\frac{1}{16}</math>-in.</b>
<b>WRENCH, socket, <math>\frac{7}{16}</math>-in.</b>	

## HYDRA-MATIC TRANSMISSION

Remove transmission cover plate as outlined in step b (2). Drain transmission and cooling system and remove oil pan assembly. Disconnect oil discharge pipe from front oil pump to rear oil pump at regulator valve body and remove pipe. **CAUTION:** Hold regulator valve body fitting with a  $2\frac{5}{32}$ -inch open-end wrench while removing oil pump fitting to avoid straining regulator valve body. Insert a screwdriver between rear servo and oil pressure regulator valve spring outer retainer, and cock oil pressure regulator valve spring and retainer downward to remove them from transmission case. Remove 3 screws and lock washers holding oil pressure regulator valve body to front servo and oil pump assembly. Pull regulator valve body downward and remove from front of oil pump body. **NOTE:** Oil delivery pipes from regulator valve body to transmission case front cover may come off with regulator valve body. If the pipes do not come off, they may be removed at this time by pulling them downward from front cover.

### (3) INSTALL PRESSURE REGULATOR BODY.

JACK	WRENCH, socket, $\frac{1}{2}$ -in.
SCREWDRIVER	WRENCH, socket, $\frac{9}{16}$ -in.
WRENCH, open-end, $2\frac{5}{32}$ -in.	WRENCH, socket, $1\frac{1}{16}$ -in.
WRENCH, socket, $\frac{7}{16}$ -in.	

Install oil delivery pipes in sleeves in regulator body and position regulator body on front pump assembly, sliding other end of oil delivery pipes into sleeves at front end of transmission cover. Secure in position by tightening 3 screws and lock washers. Insert oil pressure regulator valve spring retainer in spring and install assembly between end of oil pressure regulator valve and rear servo. Position oil discharge pipe in rear pump and connect fitting end to pressure regulator valve body and tighten fitting. Install oil pan and fill transmission and cooling system. Install cover plate on bottom of hull.

### k. Rear Servo.

#### (1) EQUIPMENT.

JACK	WRENCH, socket, $\frac{1}{2}$ -in.
SCREWDRIVER	WRENCH, socket, $\frac{9}{16}$ -in.

#### (2) REMOVE REAR SERVO.

JACK	WRENCH, socket, $\frac{1}{2}$ -in.
SCREWDRIVER	WRENCH, socket, $\frac{9}{16}$ -in.

Remove transmission cover plate as outlined in step b (2). Drain transmission and cooling system and remove oil pan assembly. Remove 2 screws and lock washers holding front pump intake oil line to mounting bracket on rear pump and remove line. Remove 2 screws and lock washers holding rear servo to transmission case and remove servo by sliding toward front of vehicle. **NOTE:** When servo is being removed,

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

oil pressure regulator spring and pipes from front servo and pump to rear servo will be removed.

**(3) INSTALL REAR SERVO.**

**JACK**

**SCREWDRIVER**

**WRENCH, socket, 1/2-in.**

**WRENCH, socket, 9/16-in.**

Position oil delivery pipes in front servo and pressure regulator spring in pressure regulator body. Position rear servo on transmission cover so that oil delivery pipes and pressure regulator spring fit into rear servo. Install 2 screws and lock washers, securing rear servo to transmission case. Position front pump intake oil line in front pump and secure on mounting bracket on rear pump, tightening with 2 screws and lock washers. Install oil pan assembly and fill transmission and cooling system. Install cover plate on bottom of hull.

**12. TRANSMISSION REMOVAL FROM VEHICLE.**

a. In order to service the transmission out of the vehicle, it is necessary to remove the transmission and engine from the vehicle as a complete unit. This procedure is outlined in the following paragraphs and the instructions are identical for either engine unless otherwise indicated. **CAUTION:** Before performing any of the following operations, be sure that the master battery switch, located at the front of the apparatus box on the left wall of the fighting compartment is turned to the "OFF" position. This is important for two reasons: first, to eliminate any danger of fire, and second, to prevent anyone starting the engines while another person is working around the fans.

**b. Equipment.**

**BOLT, eye, A266327**

**HOIST**

**JACK**

**PIN, gage, A266522 (2)**

**PLATE, gage, A266521**

**PLIERS**

**SCREWDRIVER**

**SCREWDRIVER, T-handle**

**SLING, B226796**

**SLING, engine, C107502**

**WRENCH, box, 1/2-in. (2)**

**WRENCH, box, 5/8-in.**

**WRENCH, open-end, 5/16-in.**

**WRENCH, open-end, 7/16-in.**

**WRENCH, open-end, 1/2-in.**

**(2)**

**WRENCH, open-end, 9/16-in.**

**WRENCH, open-end, 5/8-in.**

**WRENCH, open-end, 3/4-in.**

**WRENCH, open-end, 7/8-in.**

**WRENCH, open-end, 1-in.**

**WRENCH, open-end, 1 1/4-in.**

**WRENCH, socket, 1/2-in.**

**WRENCH, socket, 9/16-in.**

**WRENCH, socket, 5/8-in.**

**WRENCH, socket, 3/4-in.**

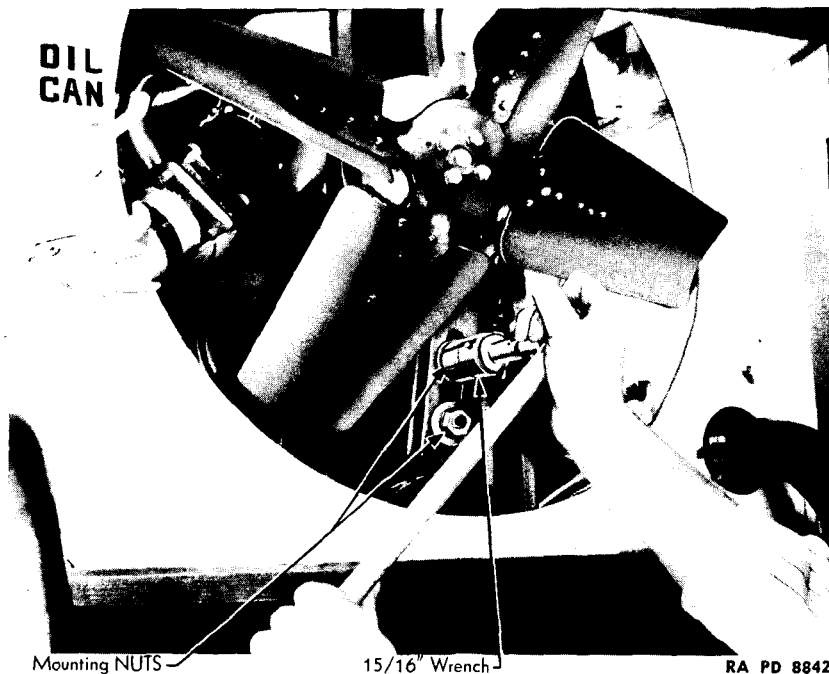
**WRENCH, socket, 15/16-in.**

**WRENCH, socket-head, set screw, 3/16-in.**

**HYDRA-MATIC TRANSMISSION****Figure 40 — Fan Shroud Mountings****c. Procedure.****(1) REMOVE FAN SHROUDS.**WRENCH, open-end,  $\frac{5}{16}$ -in.WRENCH, socket,  $\frac{9}{16}$ -in.WRENCH, open-end,  $\frac{9}{16}$ -in.WRENCH, socket,  $\frac{3}{4}$ -in.

Remove 7 screws from engine compartment rear doors and open doors. Disconnect exhaust outlet pipes. Remove 2 self-tapping screws from square seal around carburetor air inlet pipe and slide seal toward rear (fig. 40). Remove 9 screws holding fan shrouds and remove shrouds. **NOTE:** Left-hand shroud can be removed without removing right-hand shroud by taking out 5 of 9 screws, but right-hand shroud cannot be

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



**Figure 41 — Removing Fan**

removed without removing left-hand shroud. It is not necessary to remove oil can bracket from left-hand shroud or triangular plate from either shroud.

(2) REMOVE COVER PLATE.

JACK (2)

WRENCH, socket,  $\frac{9}{16}$ -in.

WRENCH, socket,  $\frac{1}{2}$ -in.

Remove 27 screws and lock washers and one nut (M5 vehicles) or 28 screws and lock washers (M8 vehicles), and remove cover plate from bottom of hull beneath transmissions. NOTE: Cover plate weighs over 80 pounds, and must be supported on jacks during removal.

(3) DRAIN COOLING SYSTEM.

WRENCH, open-end,  $\frac{7}{8}$ -in.

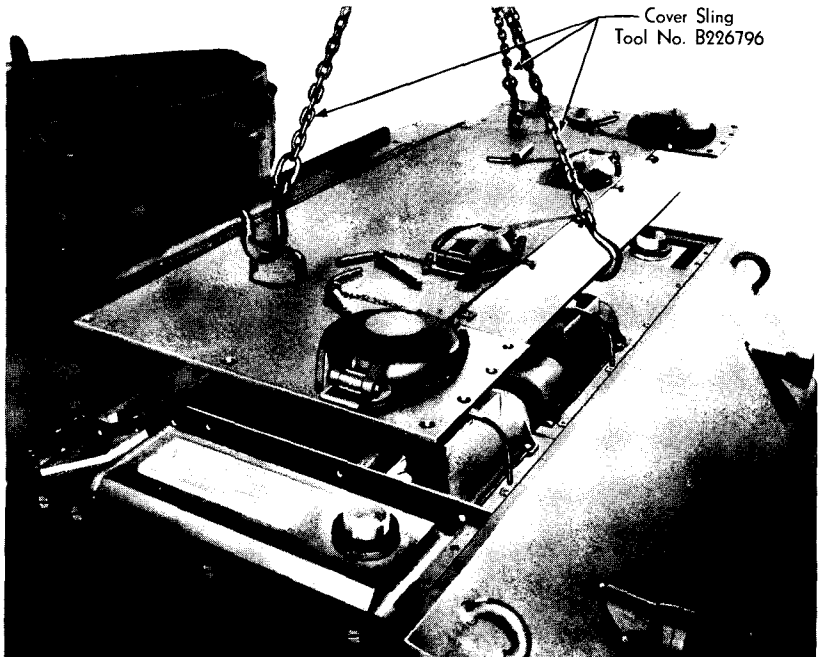
Drain cooling system by taking off radiator cap and removing water drain plug from bottom of transmission (fig. 24).

(4) REMOVE FAN, FAN BELT, AND FAN BRACKET.

WRENCH, socket,  $1\frac{5}{16}$ -in.

Remove 2 nuts and washers from fan bracket mounting studs and remove fan, fan belt, and fan brackets (fig. 41).

## HYDRA-MATIC TRANSMISSION



RA PD 8482

**Figure 42 — Removing Engine Compartment Cover (First Type M5)**

**(5) REMOVE ENGINE COMPARTMENT COVER.**

**HOIST**, ( $\frac{7}{8}$ -in. blade,  $\frac{3}{32}$ -in. thick, rounded)

**SCREWDRIVER**, T-handle

**SLING**, B226796

**WRENCH**, socket,  $\frac{9}{16}$ -in.

**WRENCH**, socket,  $\frac{3}{4}$ -in.

On first type M5 vehicles, remove covers over fuel fillers, and remove 34 cover mounting screws with T-handle screwdriver. On second type M5 and M8 vehicles, index turret 90 degrees from straight ahead position, remove 5 screws holding grille to cover and remove grille; then take out 9 cover mounting screws. On either type, hook sling under handles and lift cover off vehicle.

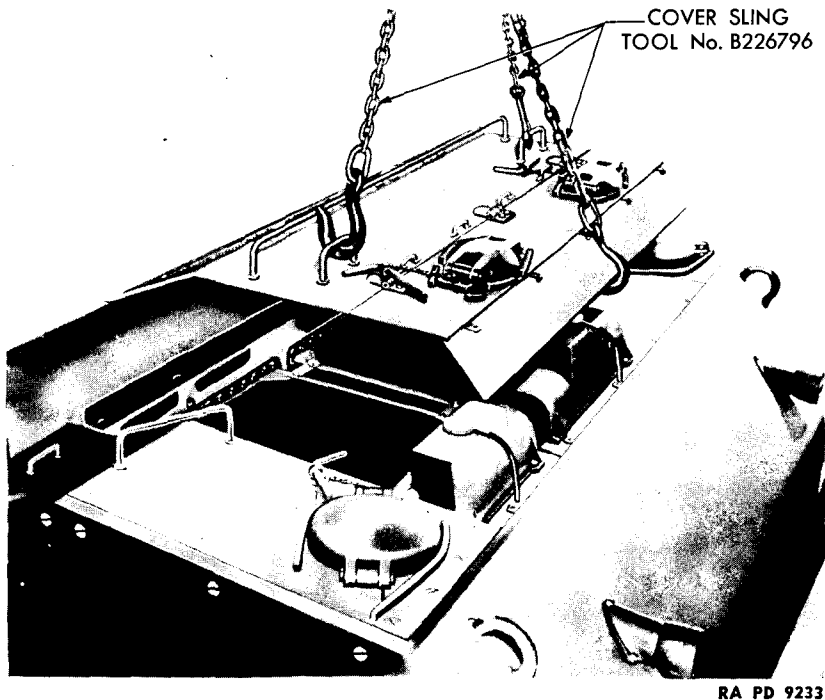
**(6) REMOVE BULKHEAD DOORS AND UPPER SHELL RACKS.**

**WRENCH**, socket,  $\frac{9}{16}$ -in.

Remove screw from front of turret basket guard and lift guard off hinges and remove. Unlatch bulkhead doors, swing toward front of vehicle, and lift off hinges. On M5 vehicles, remove 6 screws and lock washers holding upper shell racks to bulkhead and lift out racks (fig. 26).



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 9233

**Figure 43 — Removing Engine Compartment Cover  
(M8 and Second Type M5)**

**(7) REMOVE RADIATOR HOSES.**

**PLIERS**

Disconnect 2 radiator inlet hoses at radiator water inlet housing and at cylinder head outlet elbows and remove hoses. Disconnect radiator outlet hose at radiator outlet elbow, and water pump inlet hose at inlet pipe, and remove hoses complete with radiator-to-engine tube (fig. 44).

**(8) REMOVE RADIATORS.**

**HOIST**

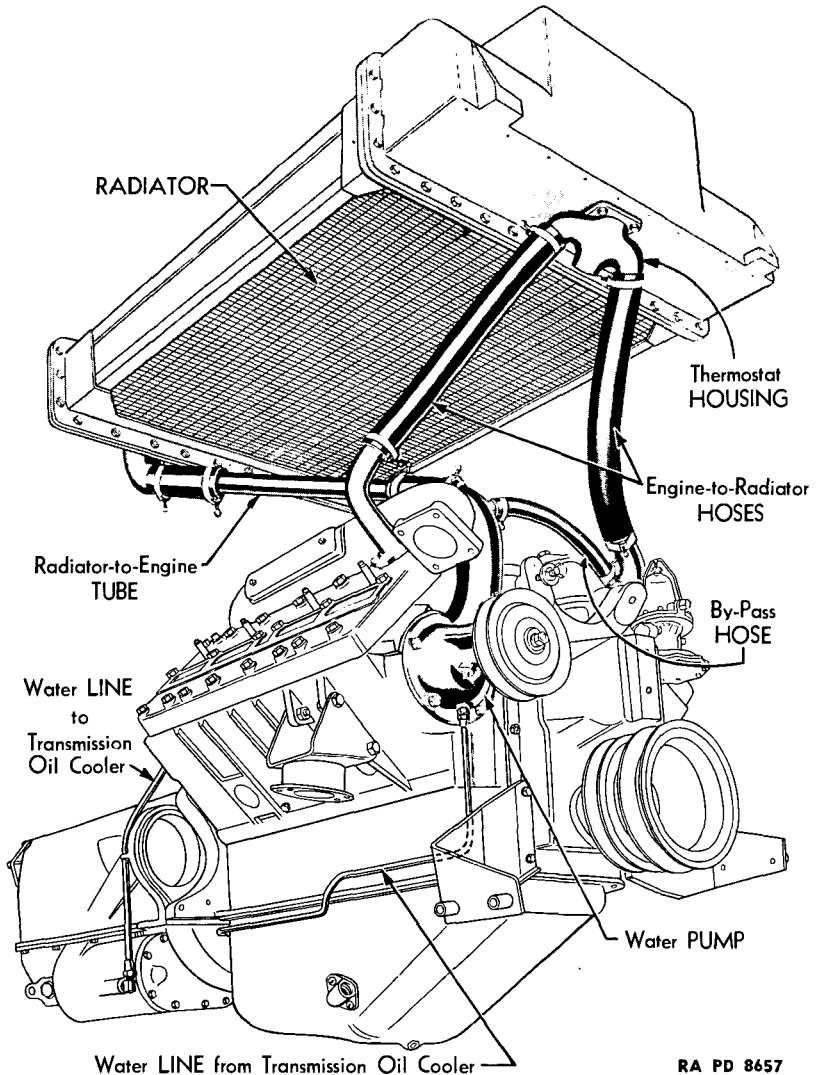
**SLING, B226796**

**WRENCH, open-end, ½-in.**

**WRENCH, socket, ⅜-in.**

Remove 4 screws and lock washers from bottom of radiator at front by reaching through bulkhead doors. Remove 4 screws and lock washers holding radiator to rear support. Remove 4 nuts supporting transfer unit oil cooler (fig. 45). Remove oil cooler mounting plates and lower cooler until it rests on engine. Hook sling into sling holes in radiator and remove radiator (fig. 46).

**HYDRA-MATIC TRANSMISSION**



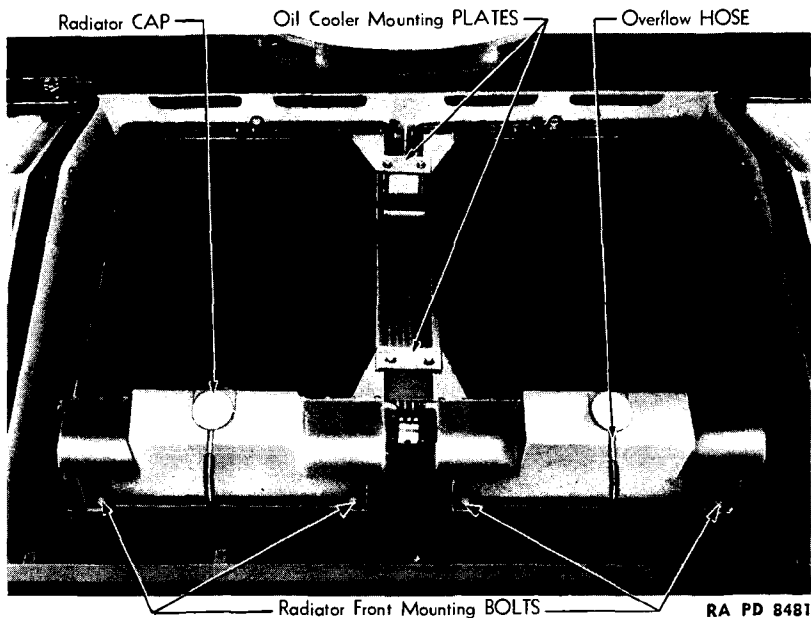
**Figure 44 — Cooling System Hoses and Connections**

(9) REMOVE TRANSFER UNIT OIL COOLER.

WRENCH, open-end, 1¼-in.

Working through bulkhead doors, disconnect short transfer unit oil cooler hose at connector nearest bulkhead. Disconnect long hose at rear connector to cooler. Remove oil cooler.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 45 — Radiator Mounting Screws**

**(10) REMOVE RADIATOR SUPPORT AND AIR BAFFLE.**

**WRENCH**, open-end,  $\frac{5}{8}$ -in.

**WRENCH**, socket,  $\frac{9}{16}$ -in.

**WRENCH**, open-end,  $\frac{3}{4}$ -in.

Shut off main fuel lines at filter located on front side of bulkhead. Disconnect fuel lines at fuel pumps. Disconnect fuel supply line where it passes through left engine compartment side wall (fig. 47). Remove 10 screws and lock washers from outer edge of air baffle. Remove 2 self-tapping screws from center of baffle and remove baffle. Remove 2 screws and lock washers from ends of radiator support and remove support with fuel line attached.

**(11) REMOVE REAR FIRE EXTINGUISHER NOZZLES.**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

**WRENCH**, open-end, 1-in.

Unscrew pipe from fire extinguisher nozzle. Remove fire extinguisher brackets and nozzles (fig. 48).

**(12) REMOVE AUXILIARY POWER PLANT AIR CLEANER.**

**SCREWDRIVER**

**WRENCH**, open-end,  $\frac{1}{2}$ -in.

**HYDRA-MATIC TRANSMISSION**

RA PD 8478

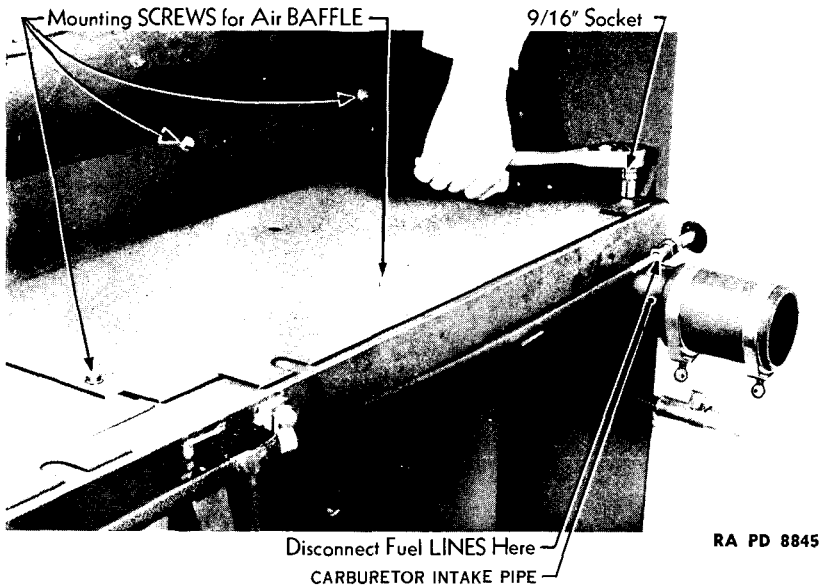
**Figure 46 — Removing Radiator**

Loosen screws that clamp air cleaner to tube and remove air cleaner (fig. 48).

**(13) DISCONNECT ELECTRICAL WIRING AND TACHOMETER CABLE.****PLIERS****WRENCH**, open-end,  $\frac{7}{16}$ -in.**SCREWDRIVER****WRENCH**, open-end,  $\frac{5}{8}$ -in.

Remove nut holding wire to oil pressure gage unit and disconnect wire. Remove nut holding wire to engine thermo gage unit and disconnect wire. Remove screws holding wires to generator filter and generator and disconnect wires. Remove nut holding starter feed cable and jumper cable to starter on right-hand engine. Disconnect conduit for right-hand starter relay at center junction box by unscrewing conduit end. Disconnect conduit for left-hand starter relay at outlet box on left-hand side wall by unscrewing conduit end. Pull conduit out of cleat on side wall. Disconnect coil primary wire from distributor filter. Disconnect coil secondary wire from coil by snapping off terminal. Disconnect tachometer cable at distributor support housing by unscrewing coupling.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 47 — Air Baffle and Fuel Line**

(14) REMOVE CARBURETOR AIR INTAKE PIPE.

PLIERS

WRENCH, open-end,  $\frac{9}{16}$ -in.

Remove 3 screws and lock washers that hold carburetor air intake pipe to engine compartment sidewall. Disconnect carburetor air intake pipe at carburetor by loosening lower clamp with pliers and remove pipe.

(15) DISCONNECT HYDRA-MATIC CONTROL LINKAGE.

PIN gage, A266522 (2)

PLIERS

PLATE, gage, A266521

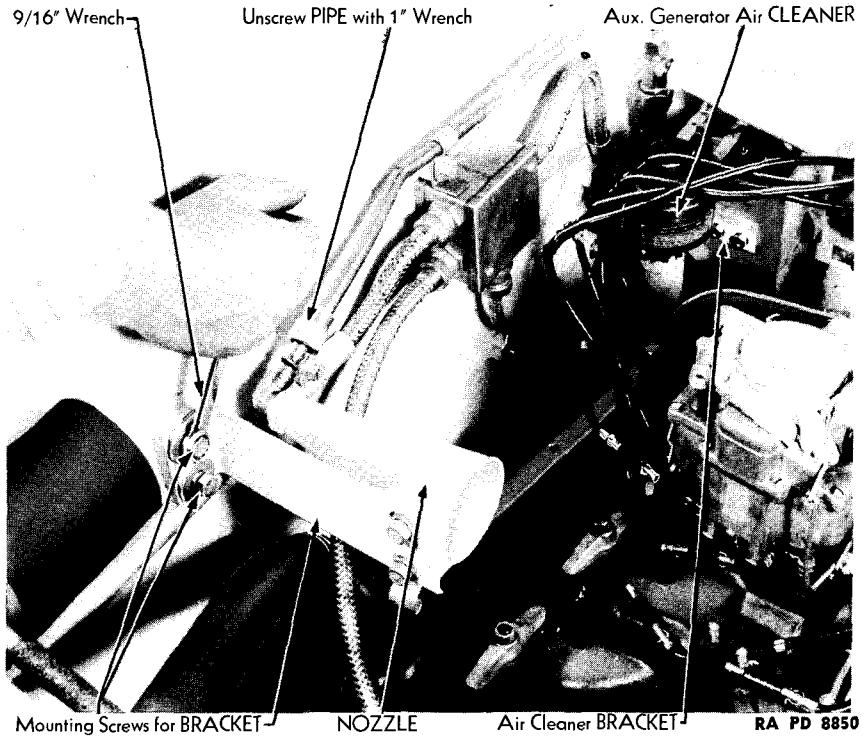
Working from underneath vehicle, insert gage plate A266521, over two intermediate relay cross shafts at the manual intermediate lever and throttle intermediate lever. Insert gage pin A266522 through curved manual lever and into hole in gage plate. Insert gage pin A266522 through straight throttle lever and into hole in gage plate (fig. 32). Disconnect Hydra-Matic manual control rod from manual lever on transmission by removing cotter key and clevis pin.

(16) REMOVE UPPER REAR RELAY CROSS SHAFT.

PLIERS

WRENCH, socket,  $\frac{1}{2}$ -in.

**HYDRA-MATIC TRANSMISSION**



**Figure 48 — Removing Fire Extinguisher Nozzles**

Remove clevis pin from lever on center of relay cross shaft. Disconnect throttle rods at cross shaft levers. Remove 4 nuts from two relay cross shaft supports and remove shaft and supports as a unit. **NOTE:** Do not lose springs from cross shaft.

**(17) REMOVE PROPELLER SHAFT COVERS.**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

Loosen 2 screws on top and remove 2 screws on side of propeller shaft housing cover. Slide cover toward side of vehicle and remove. Remove 6 screws on propeller shaft housing outer plate and remove plate. **NOTE:** (M5 only). Remove shield around bottom of turret basket by removing screws at front and lifting rear end off hinges.

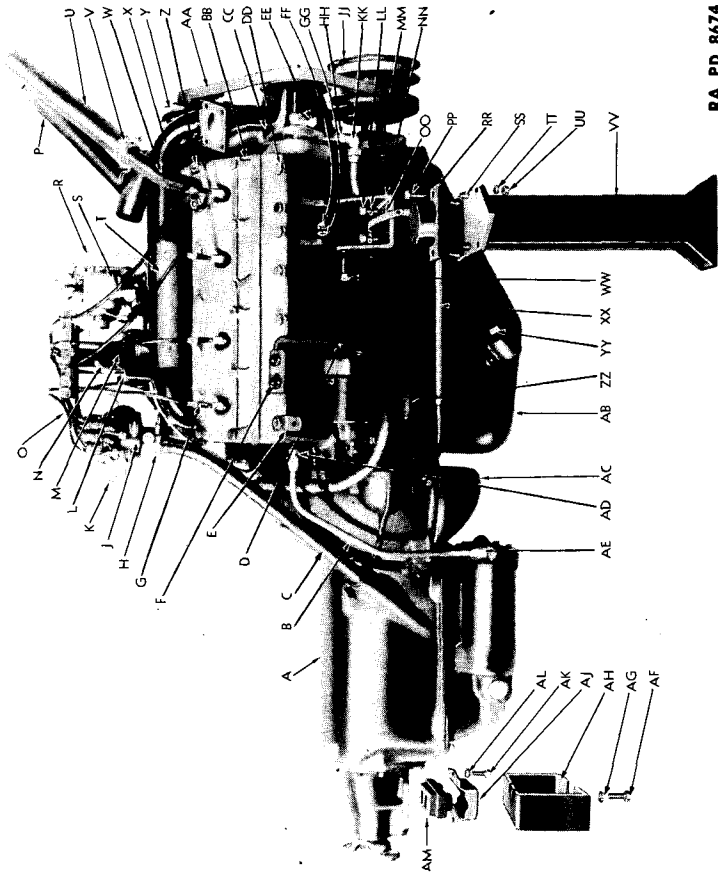
**(18) DISCONNECT PROPELLER SHAFT.**

**SCREWDRIVER**

**WRENCH**, open-end,  $\frac{1}{2}$ -in.

Bend back locking plate and remove 4 screws that hold universal bearing caps to yoke on rear of transmission. Slide propeller shaft toward front of vehicle, compressing sliding joint.

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8674

Figure 49 — Engine and Supports

**HYDRA-MATIC TRANSMISSION**

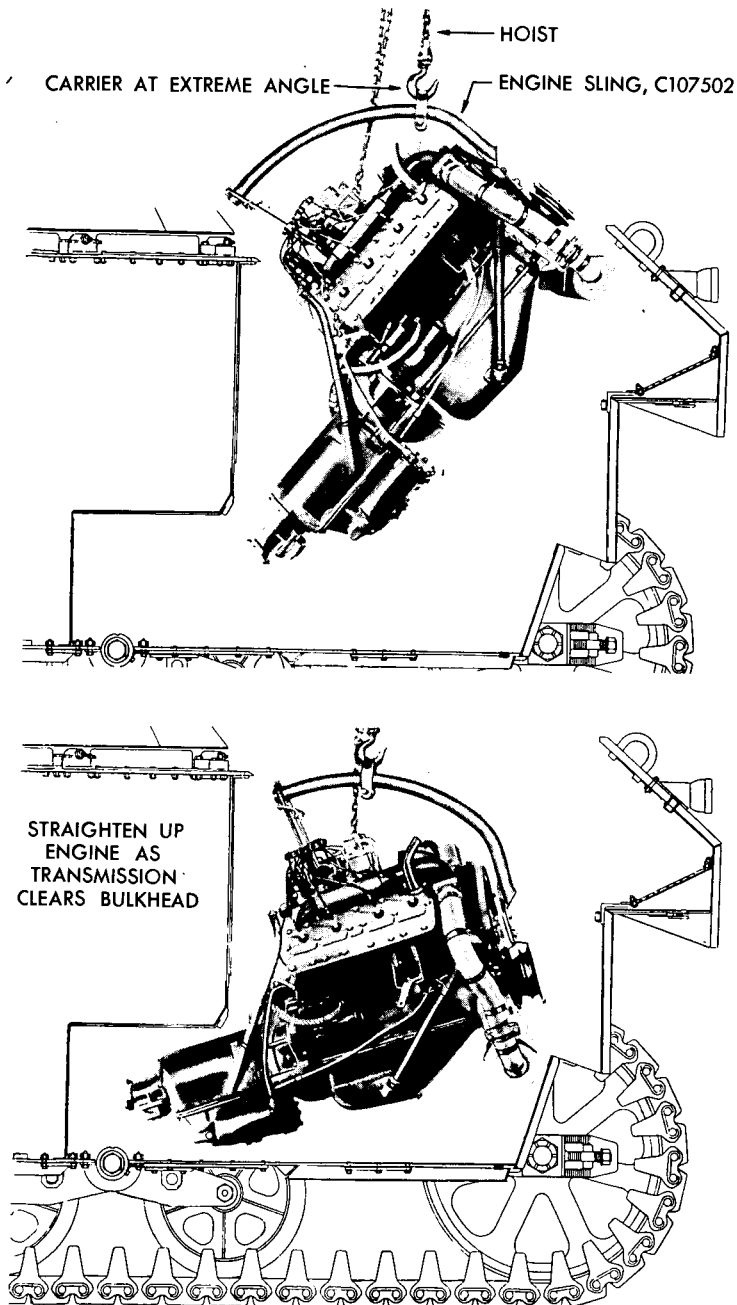
- A** — TRANSMISSION, HYDRA-MATIC ASSEMBLY
- B** — LINE, CYLINDER BLOCK TO TRANSMISSION OIL COOLER, ASSEMBLY
- C** — TUBE, TRANSMISSION OIL FILLER, ASSEMBLY
- D** — GUARD, STARTER SOLENOID RELAY
- E** — CLIP, STARTER RELAY CONDUIT TO CYLINDER HEAD
- F** — SCREW, ATTACHING, ENGINE CYLINDER HEAD
- G** — RESISTOR, SPARK PLUG
- H** — INDICATOR, OIL LEVEL, TRANSMISSION, ASSEMBLY
- J** — DISTRIBUTOR, ENGINE IGNITION, ASSEMBLY
- K** — FILTER, DISTRIBUTOR, ASSEMBLY
- L** — SCREW, CAP, CONNECTION TO MANIFOLD.
- M** — SUPPORT, IGNITION WIRES, ASSEMBLY
- N** — CONNECTION, EXHAUST MANIFOLD
- O** — WIRING, IGNITION, ASSEMBLY
- P** — HOSE, CYLINDER HEAD TO RADIATOR
- R** — LINE, CARBURETOR VENTILATING AND DRAIN, ASSEMBLY
- S** — CARBURETOR, ASSEMBLY
- T** — HEATER, AUTOMATIC CHOKE, CARBURETOR
- U** — HOSE, ENGINE CYLINDER HEAD TO RADIATOR
- V** — CLAMP, HOSE, CYLINDER HEAD TO RADIATOR
- W** — ELBOW, WATER OUTLET, ASSEMBLY
- X** — MANIFOLD, EXHAUST
- Y** — GENERATOR, ASSEMBLY
- Z** — SCREW, ATTACHING, CYLINDER HEAD
- AA** — BELT, WATER PUMP AND GENERATOR DRIVE
- BB** — HEAD, CYLINDER
- CC** — PUMP, WATER, ASSEMBLY
- DD** — SCREW, ATTACHING, CYLINDER HEAD
- EE** — FITTING, LUBRICATION, WATER PUMP BODY
- FF** — NUT, ENGINE FRONT CUSHION SUPPORT TO CRANKCASE SCREW
- GG** — WASHER, LOCK, ENGINE FRONT CUSHION SUPPORT TO CRANKCASE SCREW NUT
- HH** — NIPPLE, WATER PUMP TO TRANSMISSION COOLER LINE
- JJ** — PULLEY, FAN DRIVE, ASSEMBLY
- KK** — ELBOW, FLARED TUBE WATER PUMP TO TRANSMISSION COOLER LINE
- LL** — SCREW, ENGINE FRONT SUPPORT CUSHION
- MM** — WASHER, LOCK, ENGINE FRONT SUPPORT TO CUSHION SCREW
- NN** — SUPPORT, ENGINE FRONT CUSHION, ON CRANKCASE
- OO** — STRAP, ENGINE GROUND
- PP** — SCREW, ENGINE FRONT CUSHION TO SUPPORT
- RR** — CUSHION, ENGINE FRONT SUPPORT
- SS** — DOWEL, ENGINE FRONT SUPPORT
- TT** — WASHER, ENGINE FRONT CUSHION TO SUPPORT SCREW NUT
- UU** — NUT, ENGINE FRONT CUSHION TO SUPPORT SCREW
- VV** — SUPPORT, ENGINE FRONT, ASSEMBLY
- WW** — SCREW, ENGINE FRONT CUSHION SUPPORT TO CRANKCASE
- XX** — LINE, WATER PUMP TO TRANSMISSION OIL COOLER, ASSEMBLY
- YY** — PLUG, ENGINE OIL FILLER TUBE ADAPTER
- ZZ** — STARTER, ENGINE, ASSEMBLY
- AB** — PAN, ENGINE OIL, ASSEMBLY
- AC** — HOUSING, FLYWHEEL, LOWER
- AD** — NIPPLE, CYLINDER BLOCK TO TRANSMISSION COOLER LINE
- AE** — ELBOW, FLARED TUBE, WATER PUMP TO TRANSMISSION COOLER LINE
- AF** — SCREW, ATTACHING, ENGINE REAR SUPPORT
- AG** — WASHER, ENGINE REAR SUPPORT SCREW
- AH** — SUPPORT, ENGINE REAR, AT TRANSMISSION
- AJ** — RETAINER, ENGINE REAR SUPPORT CUSHION
- AK** — SCREW, ENGINE REAR SUPPORT CUSHION RETAINER
- AL** — WASHER, ENGINE REAR SUPPORT CUSHION RETAINER SCREW
- AM** — CUSHION, ENGINE REAR SUPPORT

RA PD 8674B

**Legend for Figure 49 — Engine and Supports**



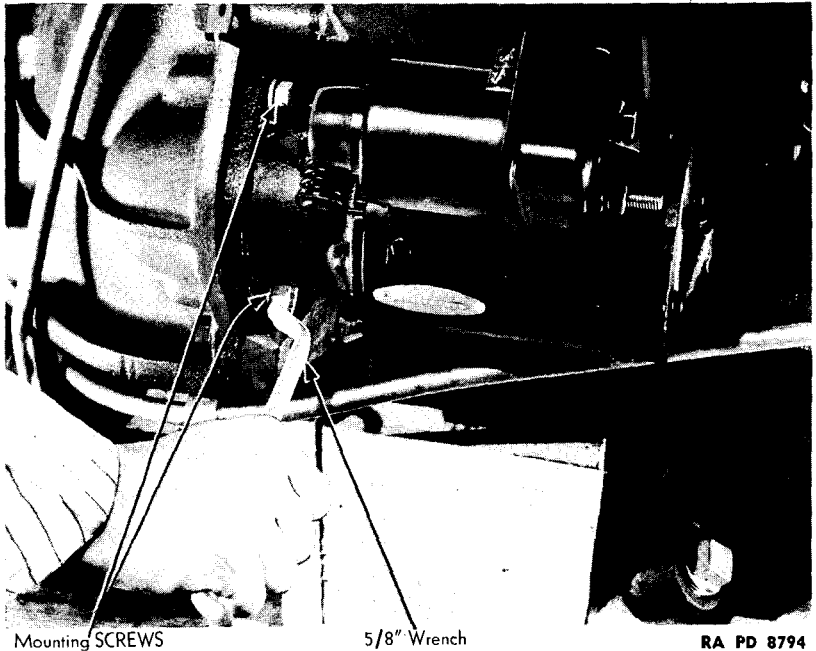
**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 9222

**Figure 50 — Removing Engine from Vehicle**

## HYDRA-MATIC TRANSMISSION



**Figure 51 — Removing Starter**

**(19) DISCONNECT ENGINE REAR SUPPORT.**

WRENCH, open-end,  $\frac{9}{16}$ -in.

WRENCH, socket,  $\frac{5}{8}$ -in.

WRENCH, socket,  $\frac{9}{16}$ -in.

Remove 2 engine rear support mounting screws from underneath bracket on floor beneath transmission (fig. 49).

**(20) DISCONNECT ENGINE FRONT SUPPORTS.**

WRENCH, open-end,  $\frac{9}{16}$ -in.

WRENCH, socket,  $\frac{9}{16}$ -in.

Disconnect screw holding ground strap to support bracket, using an open-end and a socket wrench.

Remove 2 bolts and nuts from bottom of each engine front support (fig. 49). **NOTE:** Leave rubber cushions attached to engine support bracket.

**(21) INSTALL ENGINE SLING ON ENGINE.**

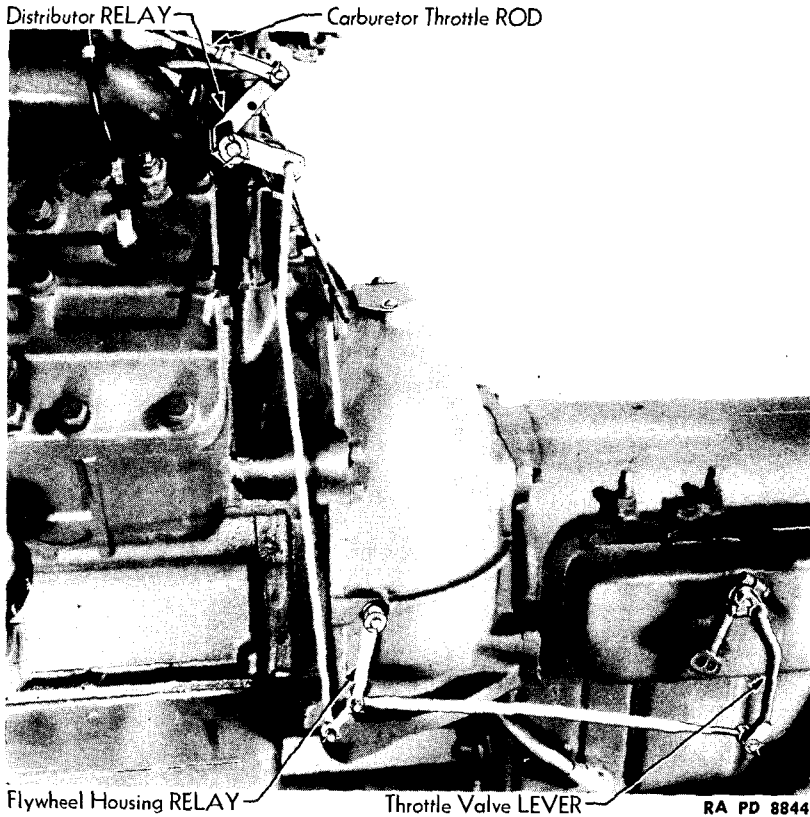
HOIST

WRENCH, socket,  $1\frac{5}{16}$ -in.

SLING, engine, C107502

Connect sling traveler to a hoist and lift sling into position over engine. Hook rear end of sling under exhaust manifold connection.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



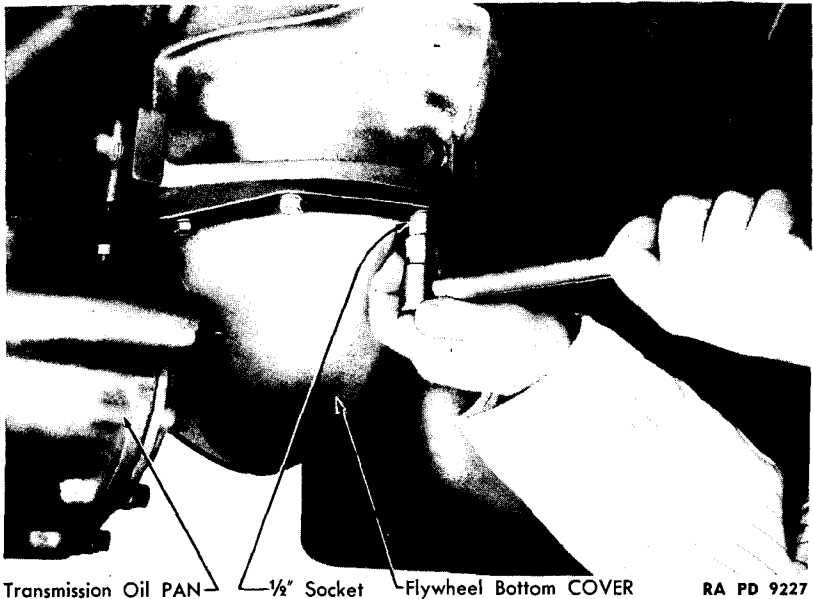
**Figure 52 — Removing Throttle Valve Linkage**

Install front end of sling over fan support mounting studs on engine front cover. Install both fan support mounting stud nuts and lock washers.

**(22) REMOVE ENGINE FROM VEHICLE.**

Lift engine slightly until engine supports clear dowel pins on center engine support mounting bracket. Move engine toward rear of vehicle; raise front end and lift engine slowly from vehicle, being extremely careful to guide engine so that it does not bump and damage various fittings or connections. Raise engine until clear of vehicle hull and lower into suitable stand (fig. 50).

## HYDRA-MATIC TRANSMISSION



**Figure 53 — Removing Flywheel Cover Attaching Screws**

**d. Removal of Transmission from Engine.**

**(1) DRAIN TRANSMISSION OIL.**

WRENCH, box, 1/2-in.

WRENCH, socket, 1-in.

WRENCH, socket-head,

set screw, 3/16-in.

Remove 6 flywheel housing lower cover mounting screws (fig. 53). Disconnect transmission oil cooler pipes at oil pan. Rotate flywheel by installing a 1-inch socket wrench on fan and water pump drive pulley mounting screw, and turning crankshaft until flywheel drain plug is toward bottom of engine. **NOTE:** Engine will rotate easier if spark plugs are removed. Remove drain plug using a 3/16-inch socket-head set screw wrench (fig. 24). Remove transmission oil pan drain plug and gasket. Allow oil to drain completely from transmission oil pan and flywheel.

**(2) REMOVE TRANSMISSION.**

BOLT, eye, A266327

HOIST

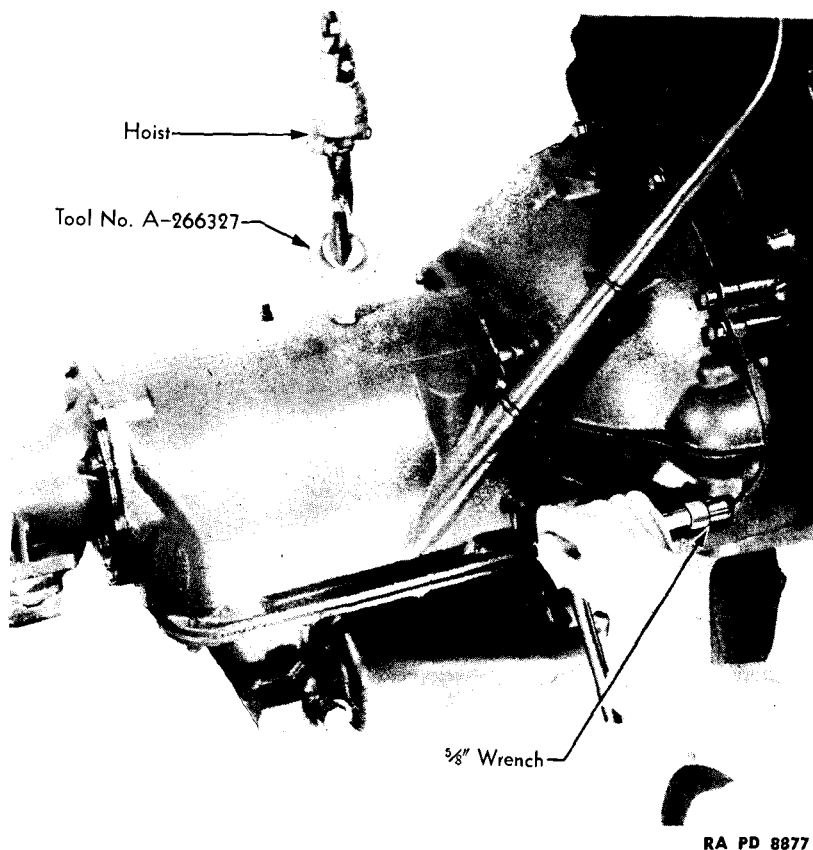
PLIERS

WRENCH, box or socket,  
1/2-in.

WRENCH, box or socket,  
5/8-in.

WRENCH, open-end, 7/16-in.

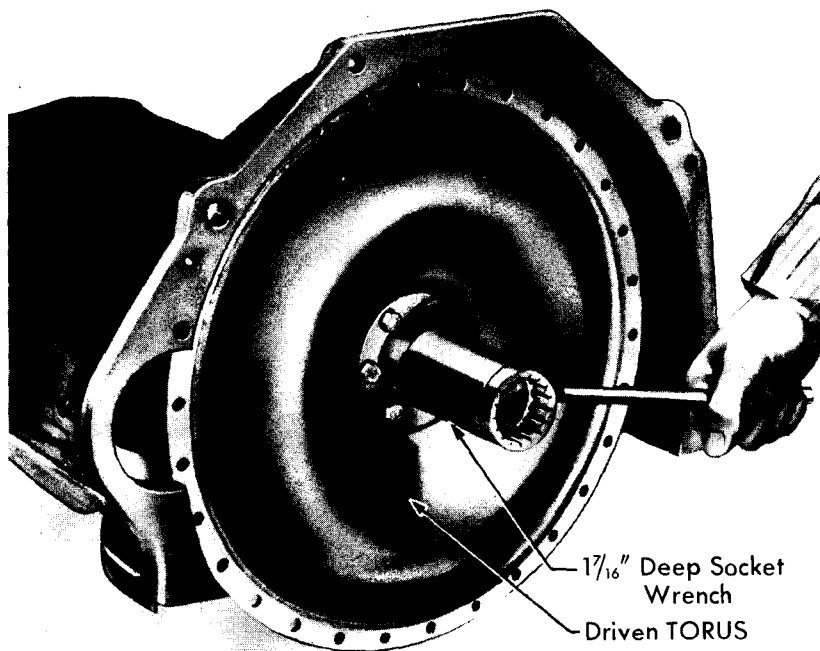
WRENCH, socket, 1-in.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**Figure 54 — Removing Transmission**

Disconnect carburetor ventilating and drain line from carburetor, if so equipped, and slide out of clip on left side of flywheel housing. Remove 2 screws holding starter to flywheel housing and remove starter (fig. 51). Remove throttle rod from flywheel housing and distributor relay by removing cotter pins and clevis pins (fig. 52). Install eye bolt A266327 in threaded hole on center of top of transmission case and connect a hoist to transmission eye bolt (fig. 54). Raise hoist just enough to take weight of transmission. Remove 30 screws holding flywheel cover to flywheel. Remove 6 screws holding flywheel housing to crankcase and tighten hoist cable until hoist is just beginning to take weight of transmission. Slide transmission away from engine until flywheel housing clears ends of dowel pins and remove transmission.

## HYDRA-MATIC TRANSMISSION



RA PD 9234

**Figure 55 — Removing Main Shaft Nut**

### 13. TRANSMISSION DISASSEMBLY.

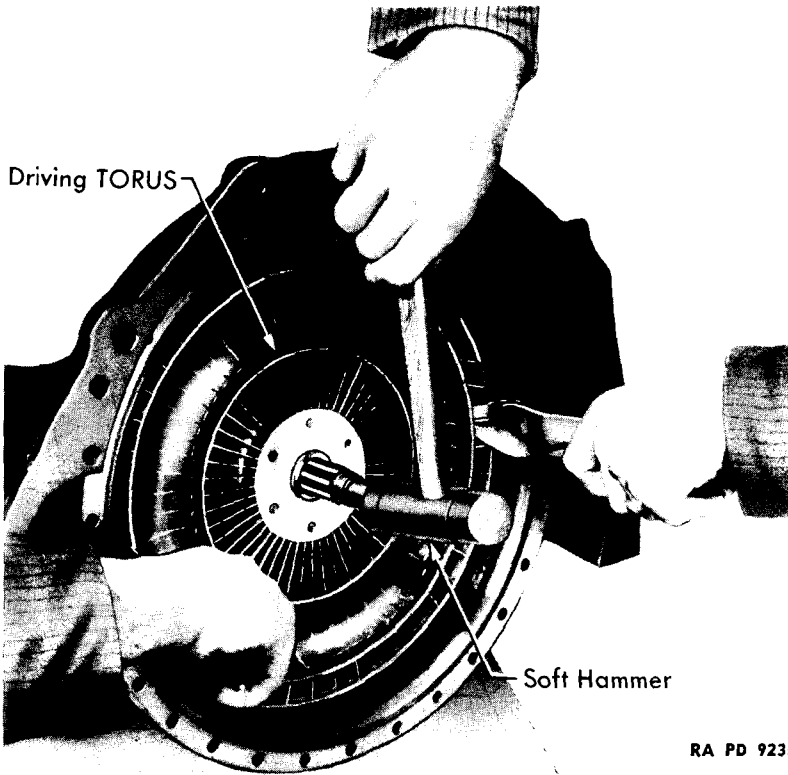
a. The transmission may be removed from the vehicle as described in paragraph 12. If the engine and transmission are out of the vehicle, the transmission may be removed from the engine as explained in paragraph 12 d.

#### b. Equipment.

CHISEL  
DRIVER, C-washer  
FIXTURE, holding, B226780  
HAMMER, soft  
HOLDER, drum, A266232  
INDICATOR, dial  
PLIERS

PLIERS, snap ring, A266329  
REMOVER, lock ring,  
A266333  
ROD, dial indicator extension,  
A266330  
SCREWDRIVER

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 9235

**Figure 56 — Removing Driving Torus**

SCREWDRIVER, cross-recess

WRENCH, box-end, 1/2-in.

WRENCH, open-end, 5/16-in.

WRENCH, open-end, 7/16-in.

WRENCH, open-end, 1/2-in.

WRENCH, open-end, 11/16-in.

WRENCH, open-end, 3/4-in.

WRENCH, open-end, 25/32-in.

WRENCH, open-end, 7/8-in.

WRENCH, socket, 7/16-in.

WRENCH, socket, 1/2-in.

WRENCH, socket, 9/16-in.

WRENCH, socket, 5/8-in.

WRENCH, socket, 3/4-in.

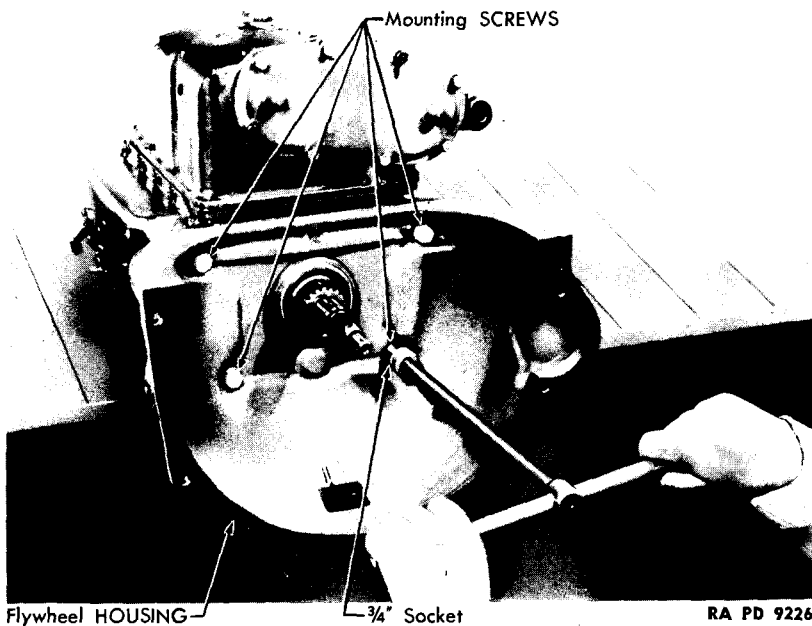
WRENCH, socket, deep, 1 7/16-in.

WRENCH, spanner, A266336

**c. Disassemble Transmission.**

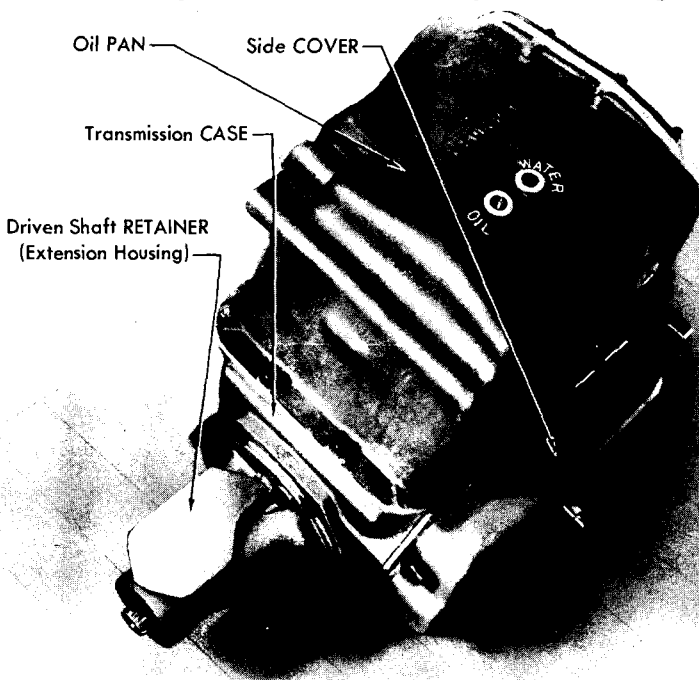
- (1) DISCONNECT THROTTLE VALVE ROD.  
PLIERS

**HYDRA-MATIC TRANSMISSION**



RA PD 9226

**Figure 57 — Removing Flywheel Housing**

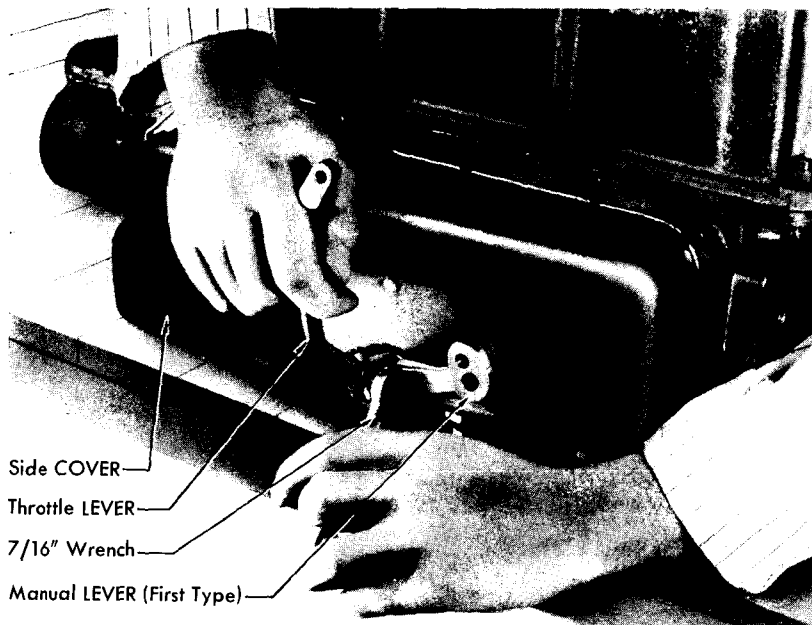


RA PD 8565

**Figure 58 — Transmission Upside Down on Bench**



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8558

**Figure 59 — Removing Throttle Lever**

Disconnect throttle valve rod from throttle lever on transmission side cover and relay on flywheel housing (fig. 52). Move manual control lever (short lever) on transmission side cover all the way back to reverse position, or toward propeller shaft universal joint yoke to lock transmission in reverse.

**(2) REMOVE MAIN SHAFT NUT.**

**CHISEL**  
**HAMMER**

**WRENCH**, socket, deep,  $1\frac{7}{16}$ -in.

Straighten main shaft nut lock plate with a chisel and light hammer, and remove main shaft nut, using a special wrench.

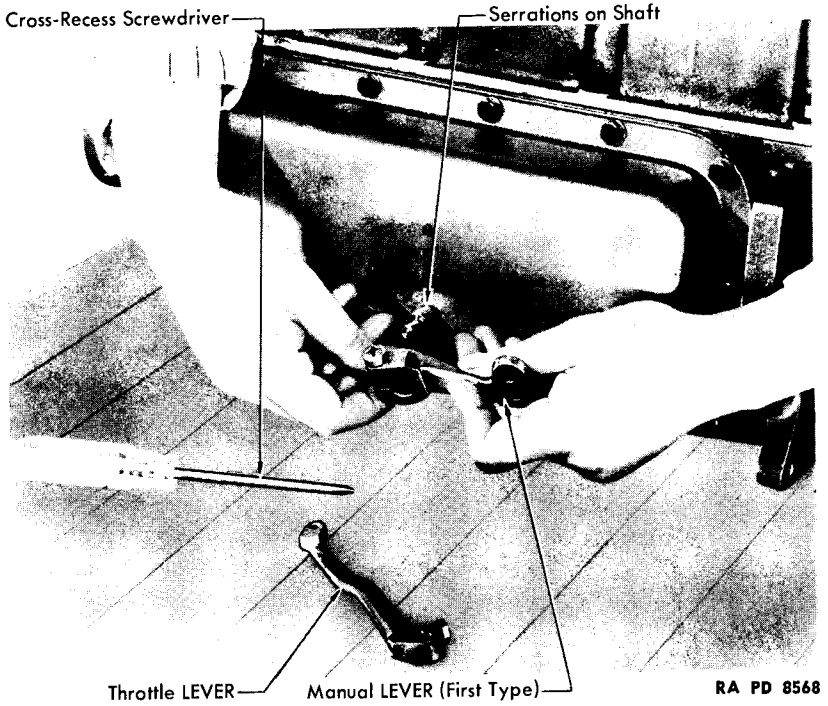
**(3) REMOVE TORUS MEMBERS.**

**HAMMER**, soft

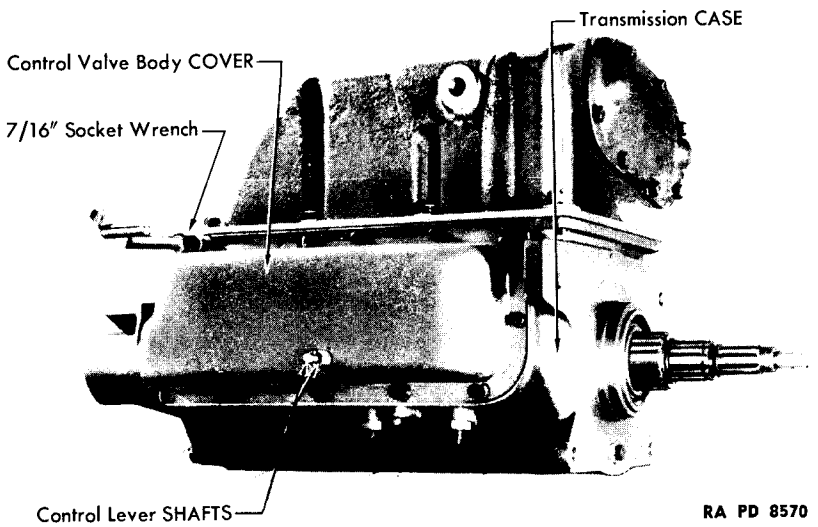
**PLIERS**, snap ring, A266329

Slide driven torus member off front end of transmission main shaft. Remove driving torus member snap ring from main shaft, using snap ring pliers A266329, and remove driving torus member from intermediate shaft by gripping vanes with pliers at two opposite points, and at the same time tapping end of main shaft with a soft hammer

### HYDRA-MATIC TRANSMISSION

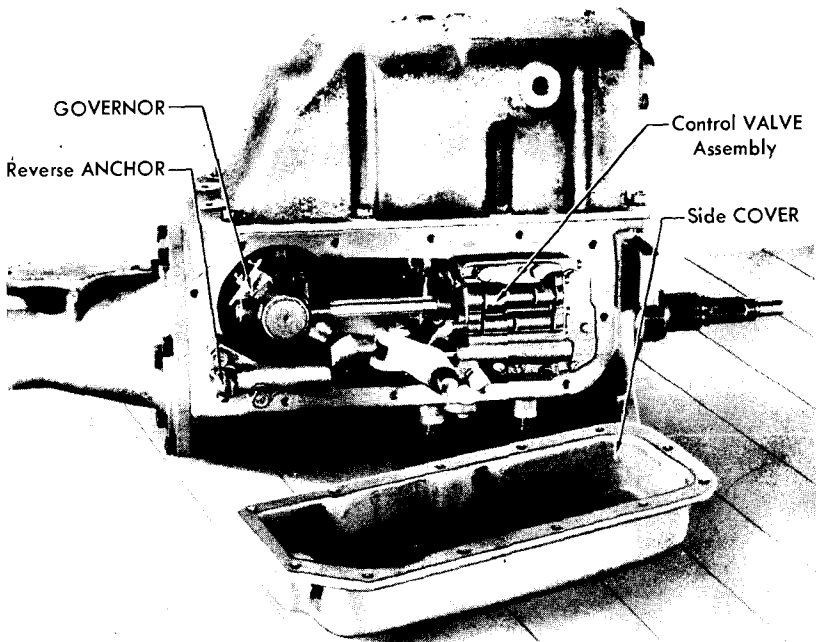


**Figure 60 — Removing Manual Lever**



**Figure 61 — Removing Side Cover**

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8573

**Figure 62 — Side Cover Removed**

(fig. 56). **CAUTION:** Do not attempt to remove driving torus member by pulling or pushing on flywheel cover as this may result in a broken oil seal ring.

**(4) REMOVE FLYWHEEL COVER AND FLYWHEEL HOUSING.**

**WRENCH**, socket,  $\frac{3}{4}$ -in.

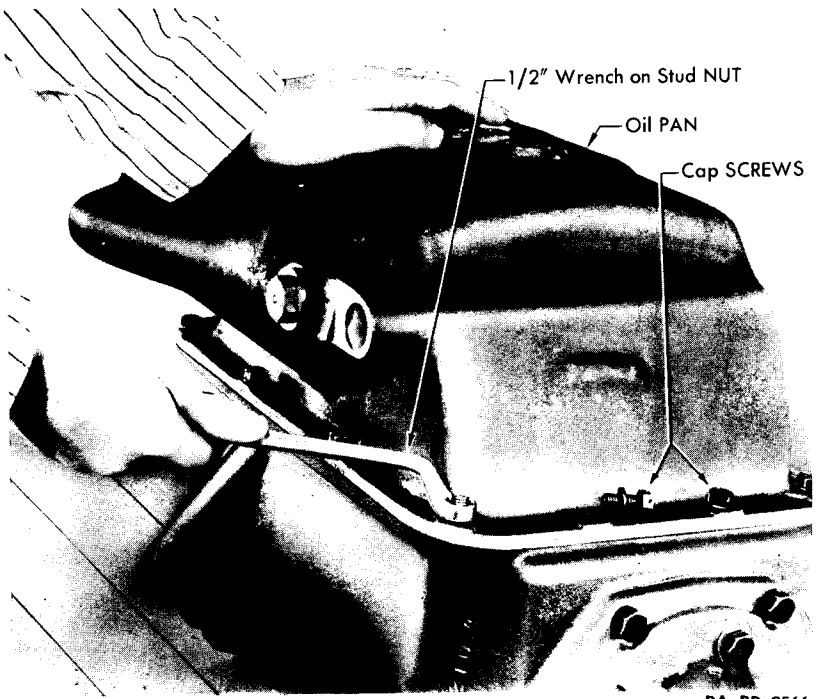
Pull flywheel cover off splines on front end of front unit drive gear toward front of transmission. Remove 4 cap screws and lock washers holding flywheel housing to front of transmission case, and remove flywheel housing from transmission case (fig. 57).

**(5) REMOVE MANUAL AND THROTTLE LEVER.**

**SCREWDRIVER**, cross-recess      **WRENCH**, open-end,  $\frac{7}{16}$ -in.

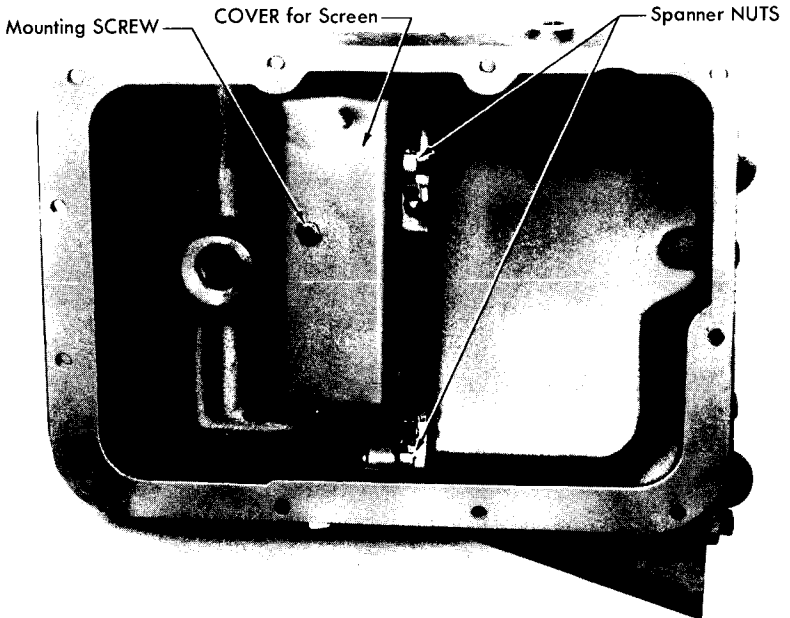
Loosen lock screw holding throttle lever to shaft protruding from transmission side cover, and pull throttle lever off shaft. Loosen lock

**HYDRA-MATIC TRANSMISSION**



RA PD 8566

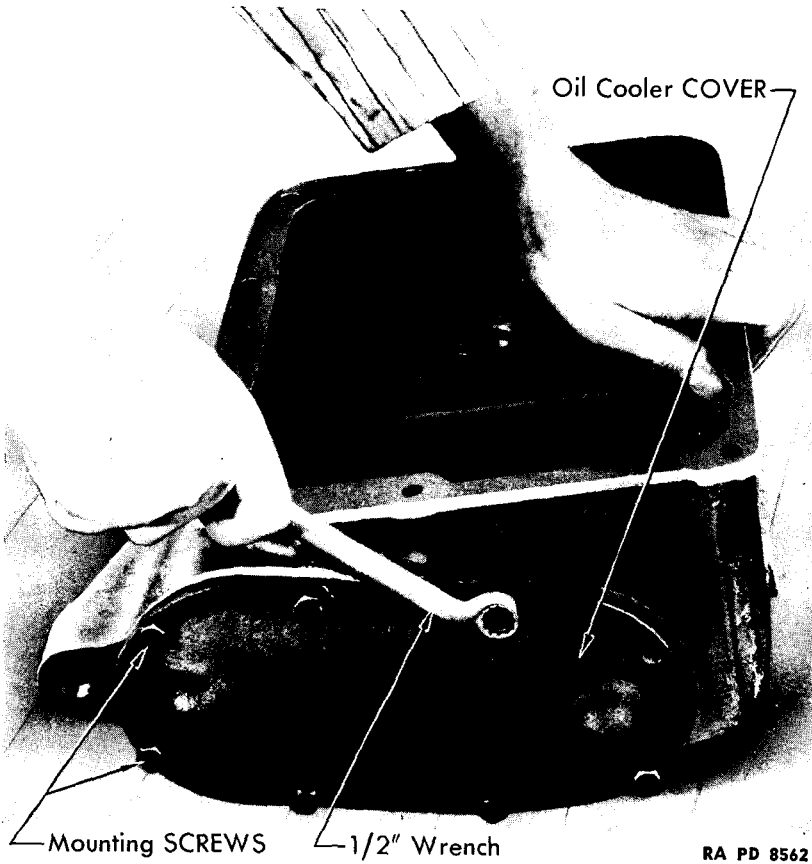
**Figure 63 — Removing Oil Pan**



RA PD 8574

**Figure 64 — Oil Pan Interior**

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8562

**Figure 65 — Removing Oil Cooler Cover**

screw holding manual control lever to shaft and pull manual lever off shaft (figs. 59 and 60).

**(6) REMOVE TRANSMISSION SIDE COVER.**

**WRENCH**, socket,  $\frac{7}{16}$ -in.

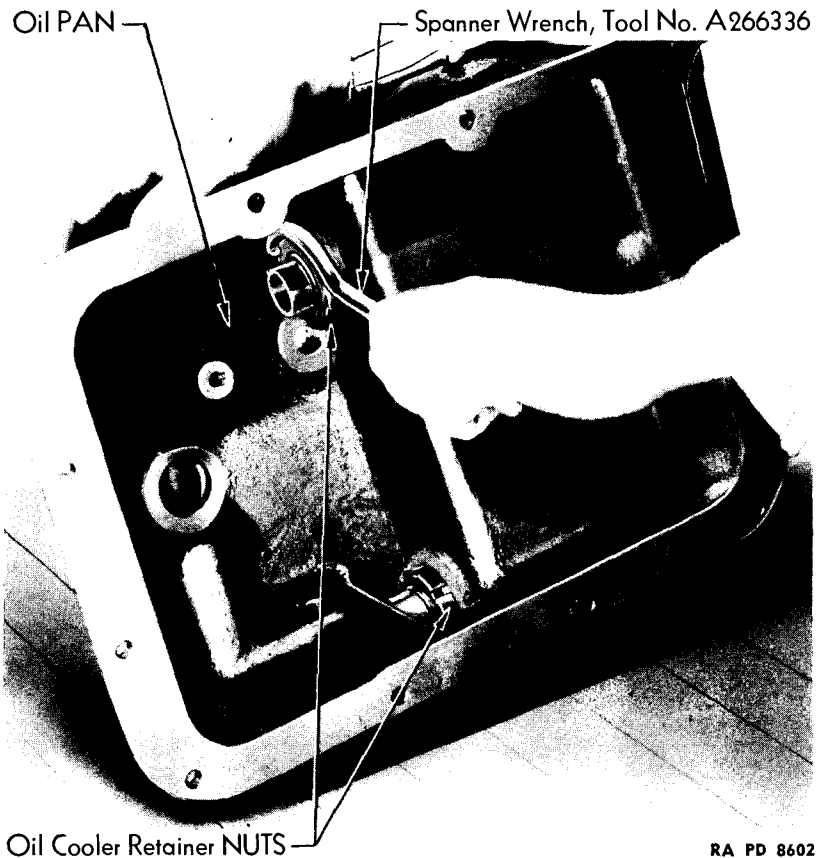
Remove 11 cap screws and washers holding side cover to transmission case. **NOTE:** All of these screws have copper washers to prevent oil leakage. Remove neoprene seal and retainer from end of control lever shaft (figs. 61 and 62).

**(7) REMOVE OIL PAN.**

**WRENCH**,  $\frac{7}{8}$ -in.

**WRENCH**, socket,  $\frac{1}{2}$ -in.

## HYDRA-MATIC TRANSMISSION



RA PD 8602

**Figure 66 — Removing Oil Cooler Spanner Nuts**

Position transmission bottom side up on bench and remove oil and water drain plugs and gaskets from oil pan (if not already removed) (fig. 58). Remove 9 screws and lock washers holding oil pan to transmission case. Remove 2 nuts and lock washers on oil pan mounting studs, and remove oil pan and gasket (fig. 63).

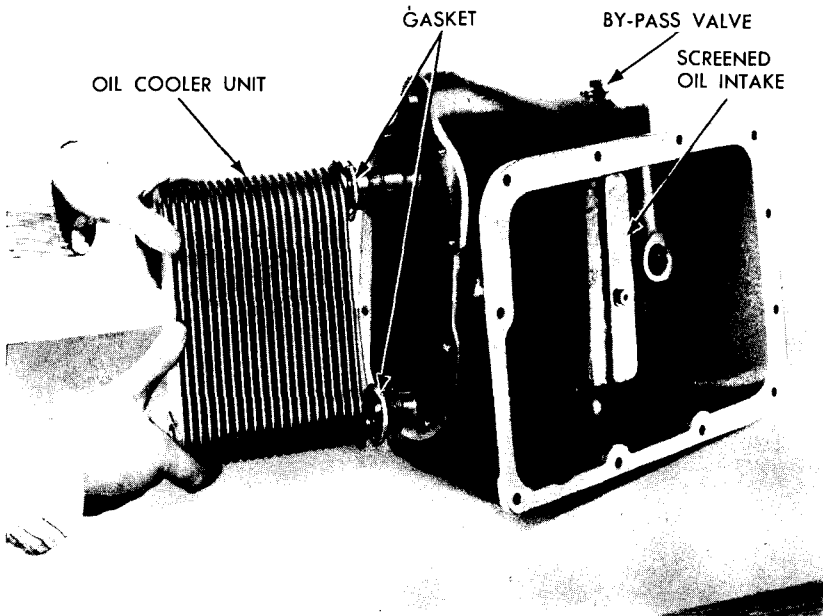
**(8) REMOVE OIL COOLER SCREEN.**

WRENCH, socket,  $\frac{7}{16}$ -in.

WRENCH, socket,  $\frac{1}{2}$ -in.

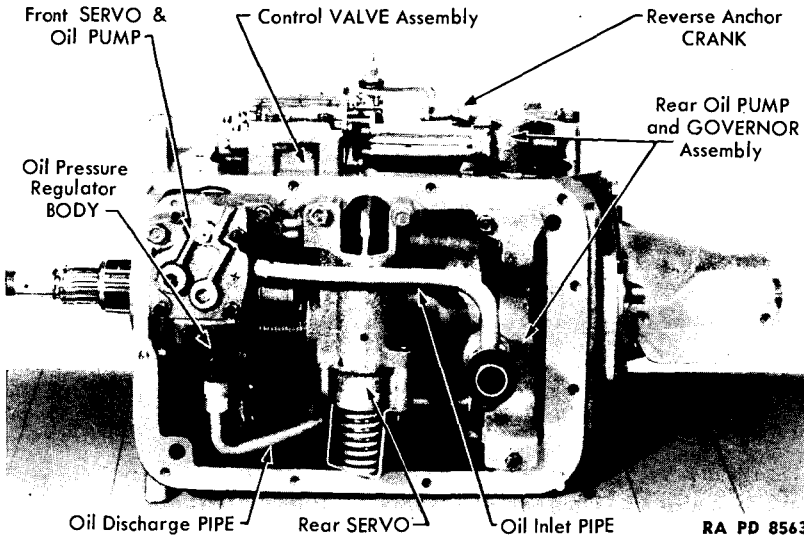
Remove 8 oil cooler cover mounting screws and copper washers, and remove oil cooler cover and gasket from front end of oil pan (fig. 65). Remove oil pan screen cover mounting screw and lock washer, and

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



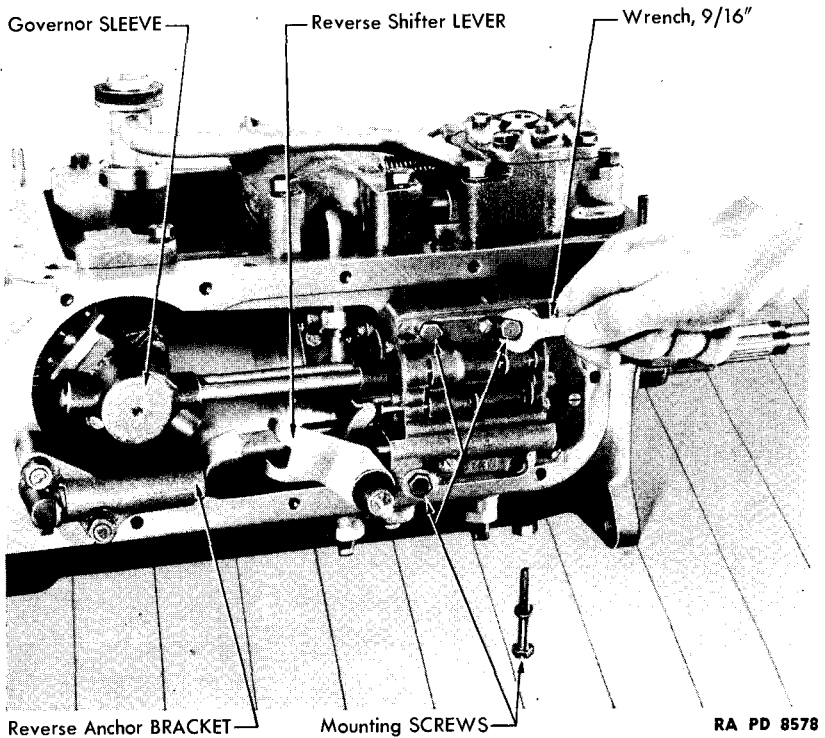
RA PD 8468

**Figure 67 — Removing Oil Cooler**



RA PD 8563

**Figure 68 — Transmission with Pan and Cover Removed**

**HYDRA-MATIC TRANSMISSION**

**Figure 69 — Removing Control Valve Body Screws**

remove cover. Remove oil pan screen mounting screw, and remove oil pan screen from oil pan (fig. 64).

**(9) REMOVE OIL COOLER UNIT AND BYPASS VALVE ASSEMBLY.**

**WRENCH**, socket,  $\frac{7}{8}$ -in.

**WRENCH**, spanner, A266336

Remove 2 spanner nuts holding oil cooler unit to oil pan bulkhead, using spanner wrench A266336 (fig. 66). Pry oil cooler seals out of oil pan, using a screwdriver. Discard seals. Remove oil cooler and bypass valve assembly from side of oil pan.

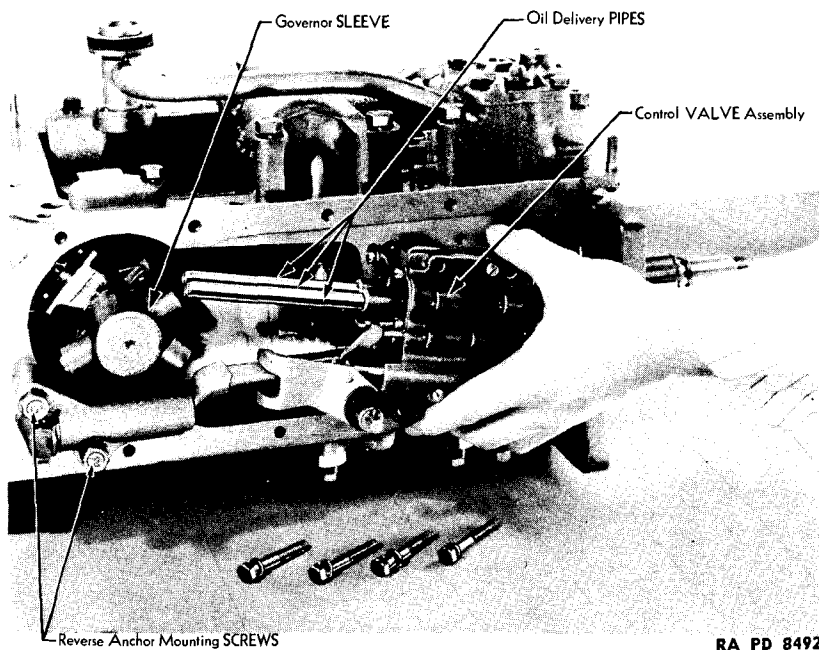
**(10) REMOVE CONTROL VALVE BODY.**

**WRENCH**, socket,  $\frac{7}{16}$ -in.

Remove 4 control valve body mounting screws and lock washers, and remove control valve body by sliding forward along transmission case (figs. 69 and 70). **NOTE:** Oil delivery pipes from control valve body to governor sleeve may come off with control valve body. If pipes do not come off with control valve body, they should be pulled out of governor sleeve at this time.



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8492

**Figure 70 — Removing Control Valve Body**

**(11) REMOVE REVERSE ANCHOR.**

**WRENCH**, socket,  $\frac{9}{16}$ -in.

Remove 2 reverse anchor bracket mounting screws and lock washers, and remove reverse anchor bracket assembly from transmission case. Pull reverse anchor pawl and retracting spring out of transmission case (fig. 69).

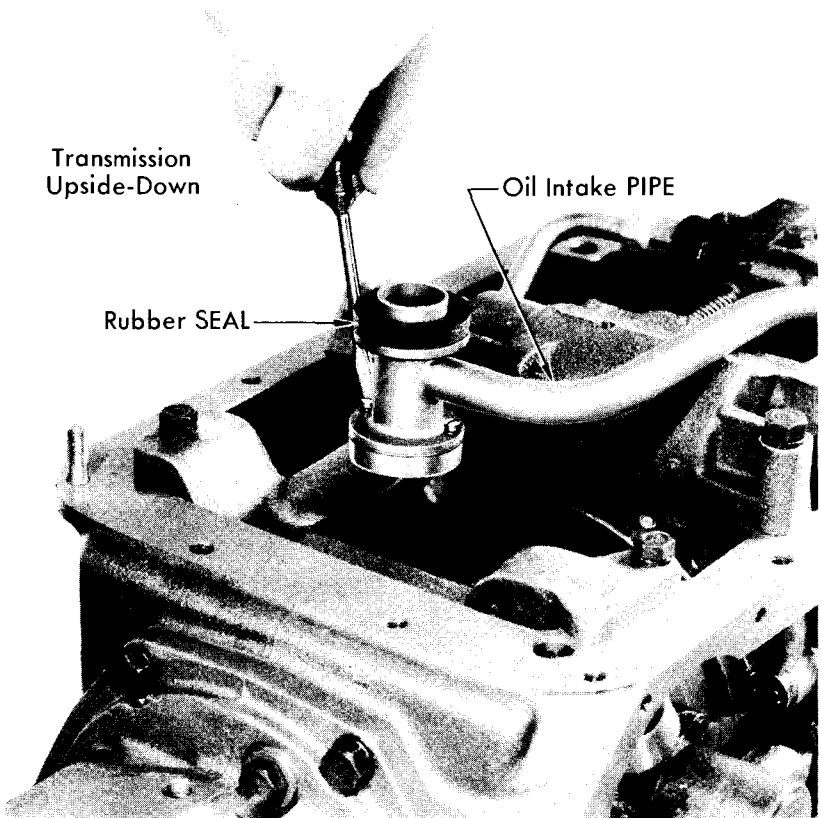
**(12) REMOVE OIL INTAKE AND DISCHARGE PIPES.**

**SCREWDRIVER**

**WRENCH**, open-end,  $\frac{25}{32}$ -in.

**WRENCH**, open-end,  $\frac{11}{16}$ -in.

Remove rubber gasket from oil intake pipe. Remove 2 screws and lock washers holding front pump intake oil line to mounting bracket on rear pump, and pull oil line out of mounting hole in front pump. Disconnect oil discharge pipe from front oil pump to rear oil pump at regulator valve body. **CAUTION:** Hold regulator valve body fitting with a  $\frac{25}{32}$ -inch open-end wrench while removing oil pipe fitting to avoid straining regulator valve body (figs. 71 and 72).

**HYDRA-MATIC TRANSMISSION**

RA PD 8567

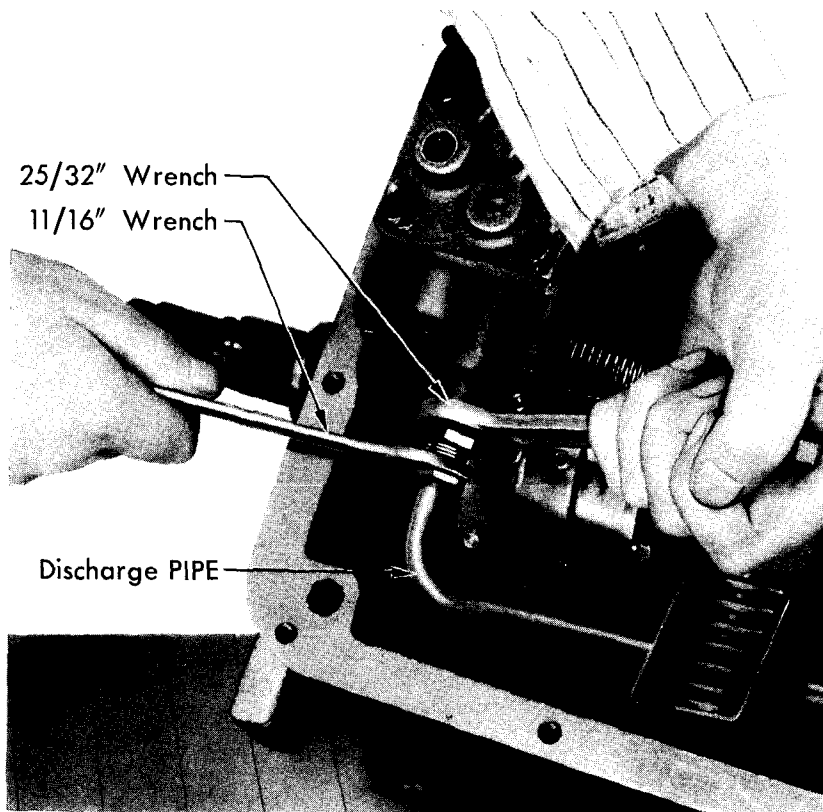
**Figure 71 — Removing Intake Pipe Screws****(13) REMOVE OIL PRESSURE REGULATOR.****SCREWDRIVER****WRENCH, socket,  $\frac{7}{16}$ -in.**

Insert a screwdriver between rear servo and oil pressure regulator valve spring outer retainer; compress spring and pry upward to remove from transmission (fig. 73). Remove 3 screws and lock washers holding regulator body to front servo and oil pump assembly, and pull upward and outward to remove (fig. 74).

**(14) REMOVE FRONT AND REAR SERVOS.****WRENCH, open-end,  $\frac{5}{16}$ -in.****WRENCH, socket,  $\frac{9}{16}$ -in.****WRENCH, open-end,  $\frac{3}{4}$ -in.**

Loosen rear band adjusting screw lock nut and loosen adjusting screw. Loosen front band adjusting screw lock nut and loosen adjusting

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE MB**



RA PD 8576

**Figure 72 — Removing Oil Discharge Pipe Fitting**

screw (fig. 75). Remove 2 rear servo mounting screws and lock washers. Remove 2 screws and lock washers holding front servo and oil pump to transmission case (fig. 76). Lift off both front and rear servos as a unit (fig. 77). Pull servos apart and remove 2 oil pipes that connect them.

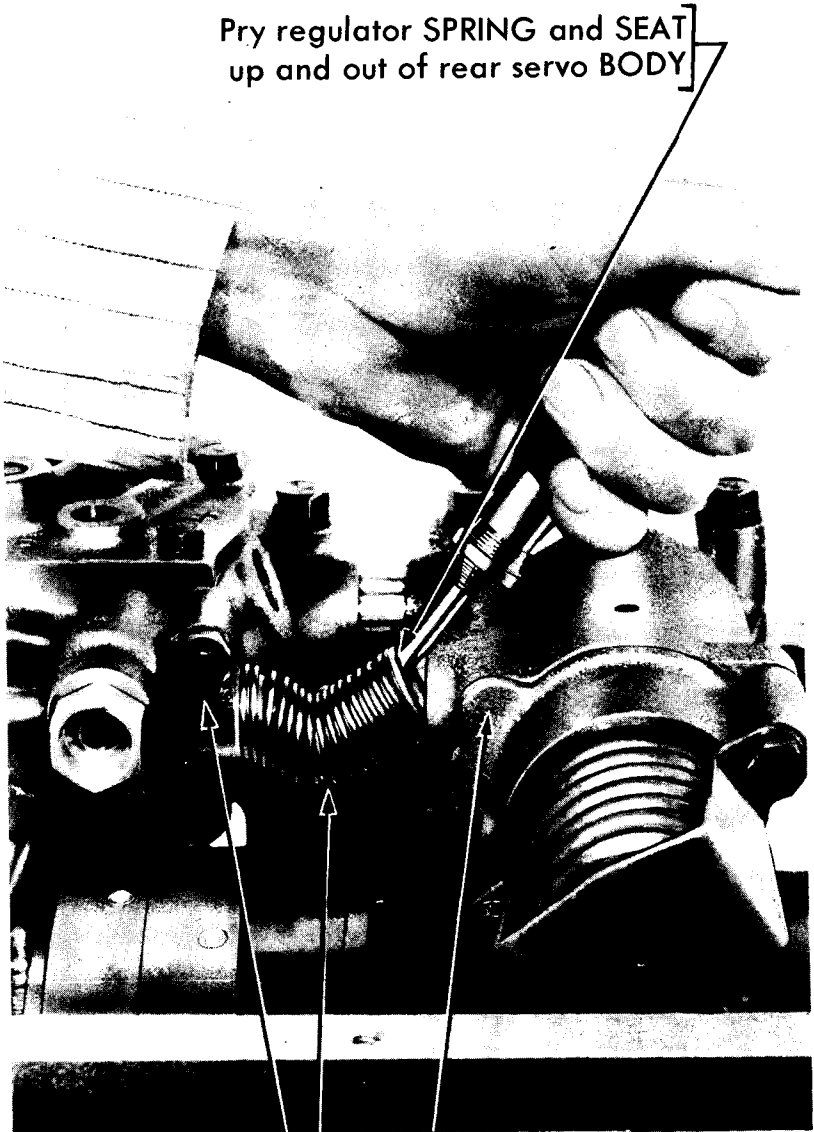
**(15) REMOVE REAR OIL PUMP AND GOVERNOR.**

**WRENCH**, socket,  $\frac{1}{2}$ -in.

Remove 2 screws and lock washers holding rear oil pump and governor to transmission case. Remove rear oil pump and governor assembly from transmission case. Governor must be rotated so that large, round governor weight is toward rear of transmission while removing assembly (fig. 78).

## HYDRA-MATIC TRANSMISSION

Pry regulator SPRING and SEAT  
up and out of rear servo BODY

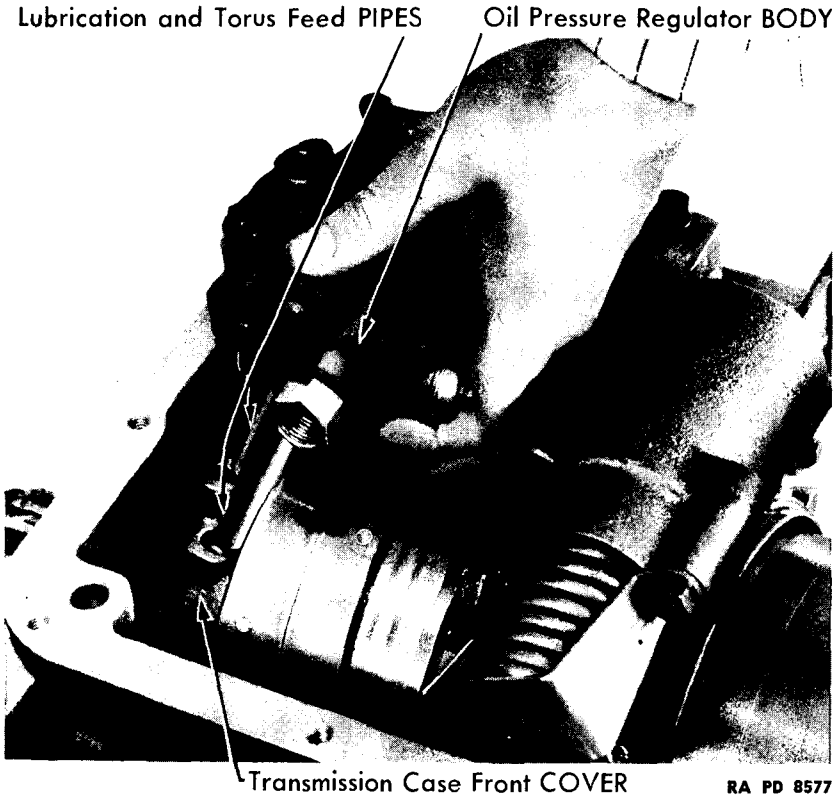


Rear SERVO  
Oil Pressure Regulator SPRING  
Oil Pressure Regulator BODY

RA PD 8560

**Figure 73 — Removing Regulator Spring**

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8577

**Figure 74 — Removing Regulator Body**

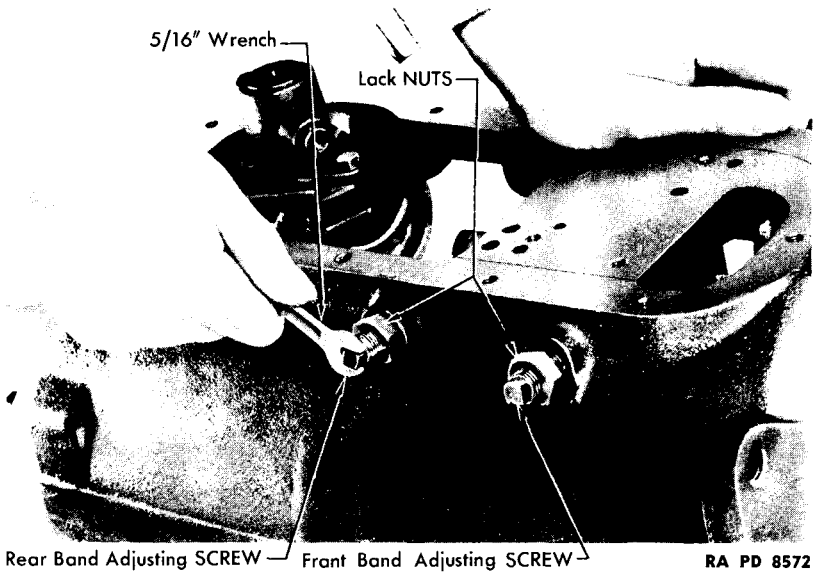
**(16) CHECK MAIN SHAFT END CLEARANCE.**

INDICATOR, dial

SCREWDRIVER

ROD, dial indicator extension, A266330

Checking end clearance at this time will guard against reassembling transmission with wrong end clearance limit. Place dial indicator against end of main shaft, mounting in place as shown in figure 140. Insert a screwdriver between front drum and center bearing cap, holding planetary units forward. Care must be observed to prevent screwdriver point from damaging oil delivery sleeve. Move main shaft back and forth. End clearance should be from 0.006 to 0.014 inch. If not within these limits make sure, upon reassembly, to install the proper variable thickness thrust washers in the machined recess in the rear unit clutch hub to bring within these limits.

**HYDRA-MATIC TRANSMISSION**

**Figure 75 — Loosening Band Adjusting Screws**

**(17) REMOVE REAR BEARING RETAINER.**

**HOLDER**, drum, A266232

**WRENCH**, socket,  $\frac{9}{16}$ -in.

**WRENCH**, box-end,  $\frac{1}{2}$ -in.

Loosen 4 screws and lock washers, and 2 nuts and lock washers holding reverse unit drive flange to rear unit drum. Rear unit drum should be held from turning by using drum holder A266232 (fig. 79). **NOTE:** The 2 nuts may be removed, but do not attempt to remove 4 cap screws from drive flange at this time, but leave hanging loosely in flange. Remove 6 screws and lock washers holding rear bearing retainer on rear of transmission case. Pull rear bearing retainer and reverse gear assembly as a unit from rear of transmission case (fig. 80).

**(18) REMOVE MAIN SHAFT.**

**DRIVER**, C-washer

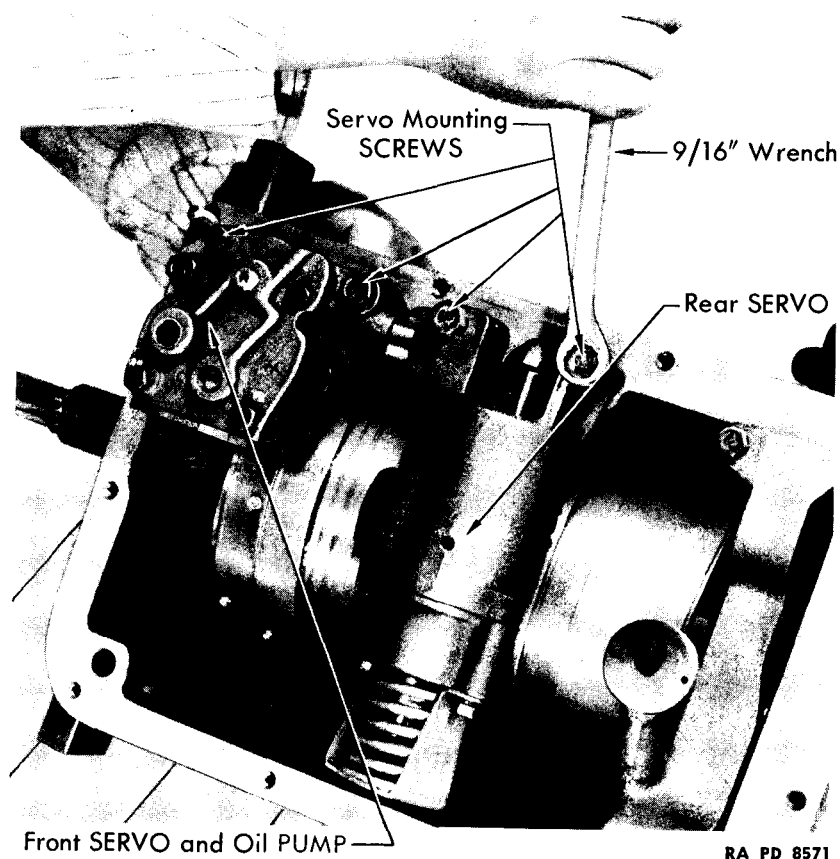
**REMOVER**, lock ring, A266333

**HAMMER**

**WRENCH**, socket,  $\frac{1}{2}$ -in.

Remove rear brake band from rear drum. Remove main shaft lock ring from front end of transmission main shaft, using lock ring remover A266333 (fig. 81), and remove main shaft from rear of transmission case. **NOTE:** Make sure bronze thrust washer is removed at the same time main shaft is removed.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 76 — Removing Rear Servo Screws**

**(19) REMOVE FRONT COVER.**

**HAMMER**

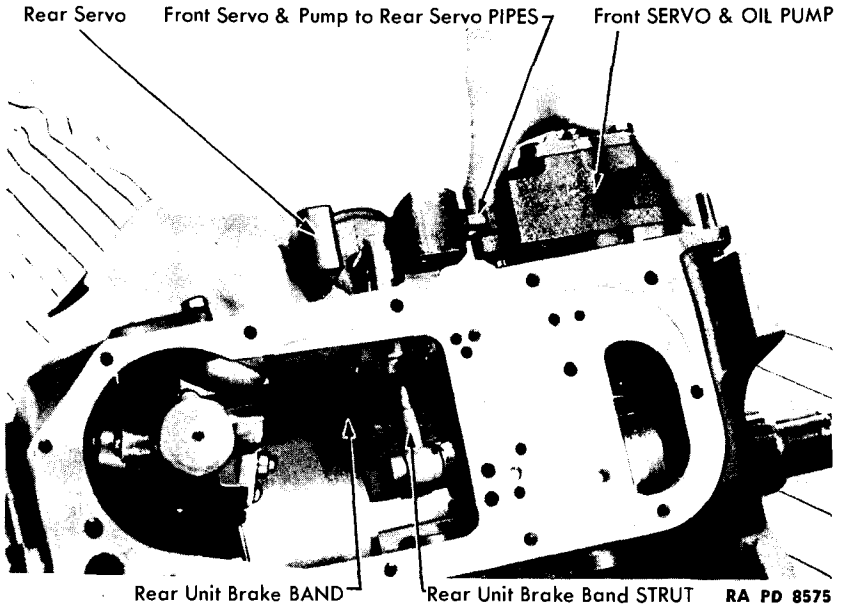
**WRENCH**, socket, 1/2-in.

Mark edge of front cover and transmission case so that front cover may be reinstalled in same position (fig. 82). Remove transmission front cover retaining screw and copper washer, and pull cover from front of transmission case. **NOTE:** It may be necessary to tap inside edge of cover lightly with a soft hammer to loosen it in transmission case.

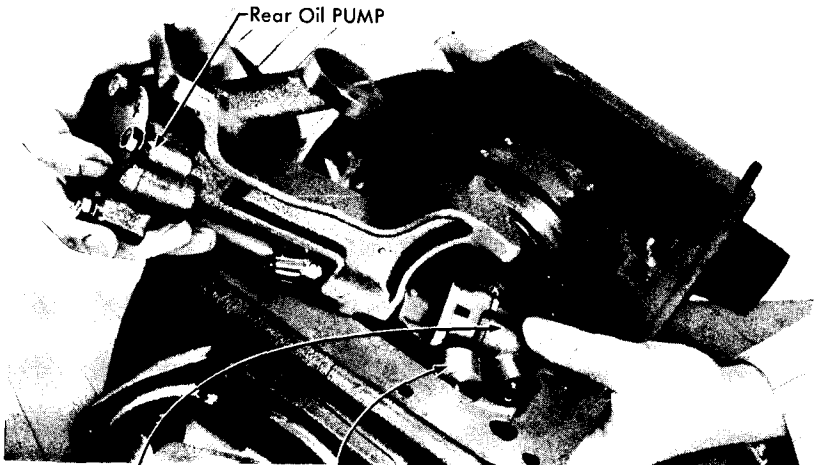
**(20) REMOVE FRONT UNIT DRIVE GEAR.**

**PLIERS**, snap ring, A266329

### HYDRA-MATIC TRANSMISSION



**Figure 77 — Removing Front and Rear Servos**

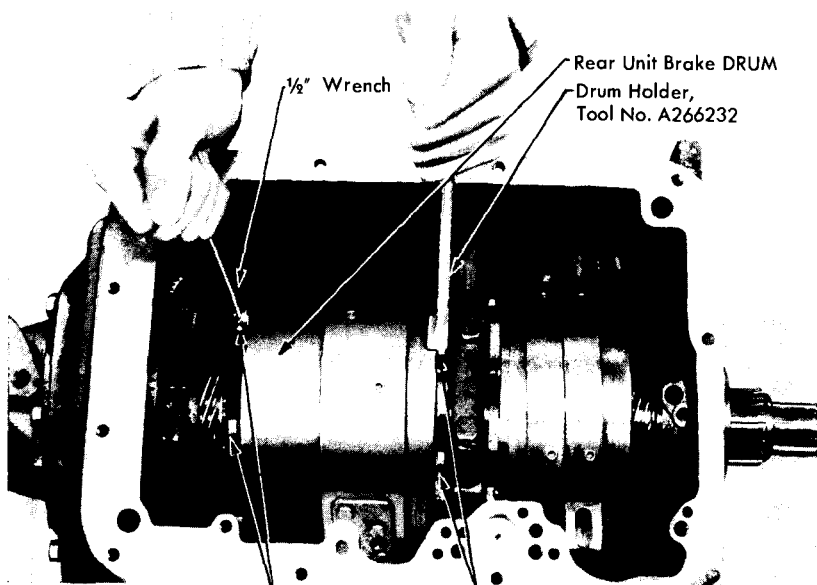


Revolve GOVERNOR to bring round WEIGHT here - and remove from case    RA PD 8588

**Figure 78 — Removing Rear Oil Pump and Governor**

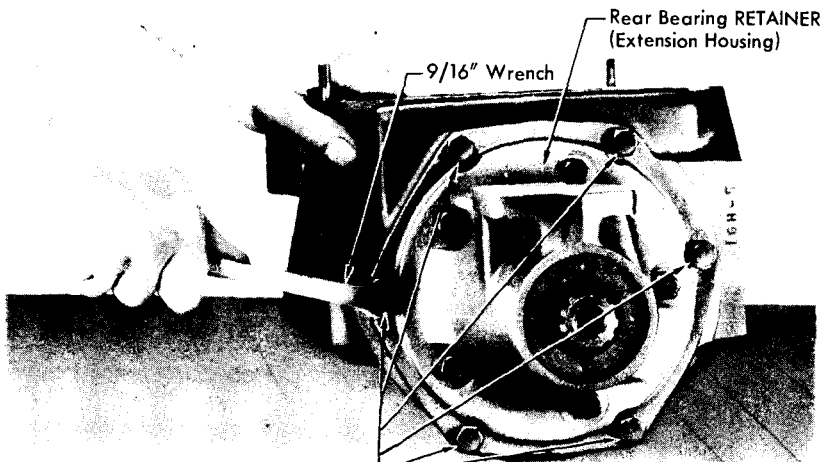


**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



Brake Drum To Drive Flange SCREWS Clutch Drum To Brake Drum SCREWS RA PD 8829

**Figure 79 — Removing Reverse Drive Flange Screws**

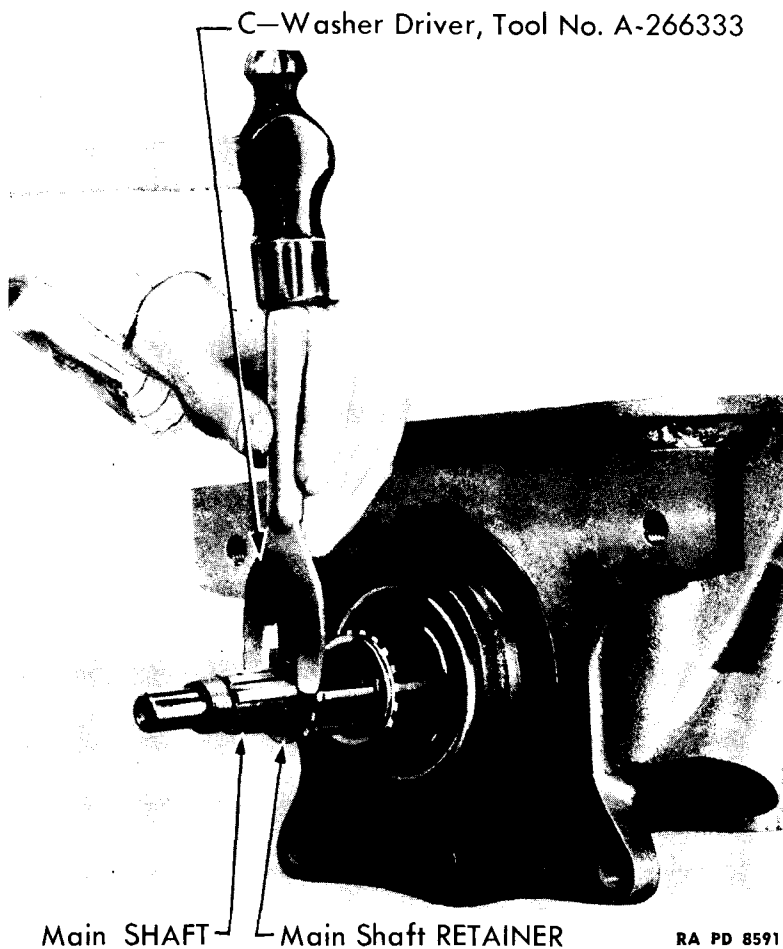


Remove Outer 6 SCREWS Only

RA PD 8586

**Figure 80 — Removing Rear Bearing Retainer Attaching Screws**

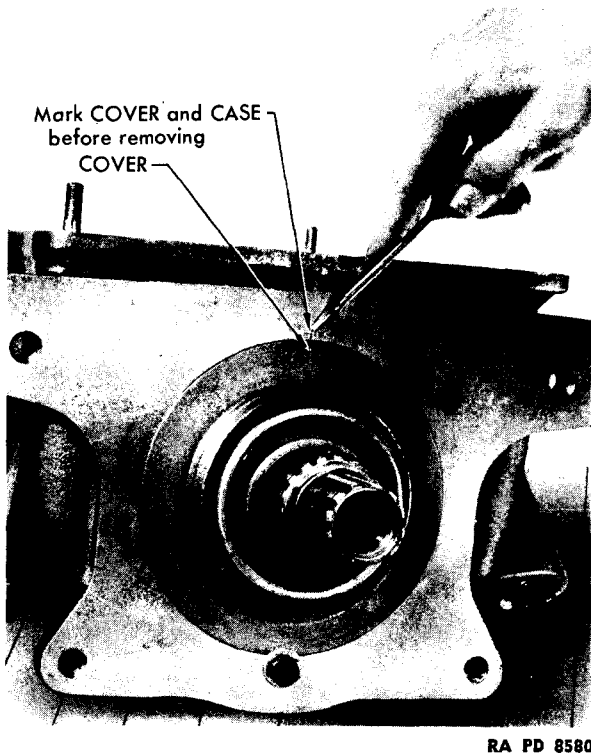
## HYDRA-MATIC TRANSMISSION



**Figure 81 — Removing Main Shaft Retainer**

Remove snap ring holding unit drive gear on front end of intermediate shaft using snap ring pliers A266329 (fig. 83), and remove steel and bronze thrust washers from intermediate shaft. **NOTE:** These washers should be kept separate from other thrust washers in transmission as their only difference is a smaller outside diameter and should be used only in front of the front unit drive gear. Pull front unit drive gear out of front end of transmission case, making sure to remove bronze thrust washer from shaft at the same time (fig. 84).

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8580

**Figure 82 — Marking Front Cover**

**(21) REMOVE FRONT AND REAR PLANETARY UNITS.**

**CHISEL**

**WRENCH, socket, 5/8-in.**

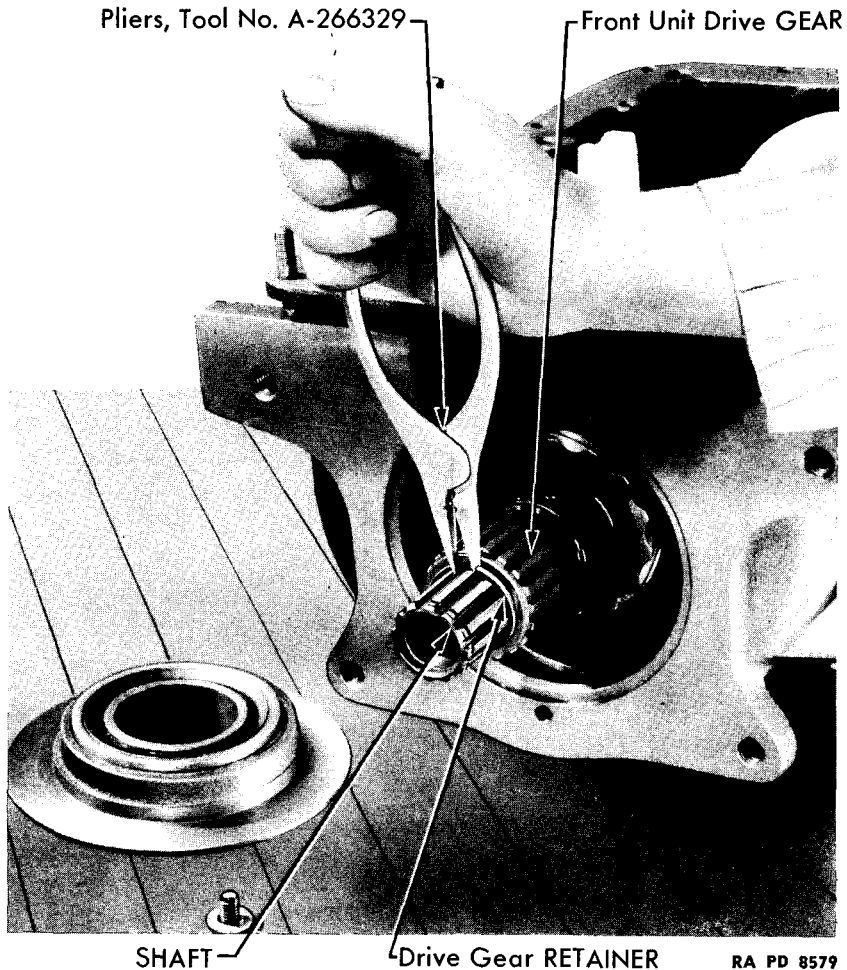
**HAMMER, soft**

Use a light hammer and a chisel and bend back edges of lock plate under 2 center bearing cap mounting screws. Remove 2 center bearing cap mounting screws (fig. 85), and lift both front and rear planetary unit assemblies, still mounted on intermediate shaft, from transmission case (fig. 86).

**(22) REMOVE CENTER MAIN BEARING CAP.**

**HAMMER, soft**

Remove front brake band from front unit drum. Raise front end of assembly so that 6 clutch retracting springs and guide pins slide out of rear unit brake drum. Tap center main bearing cap lightly with a soft hammer to remove it from oil delivery sleeve on intermediate shaft.

**HYDRA-MATIC TRANSMISSION**

RA PD 8579

**Figure 83 — Removing Retainer for Front Unit Drive Gear**

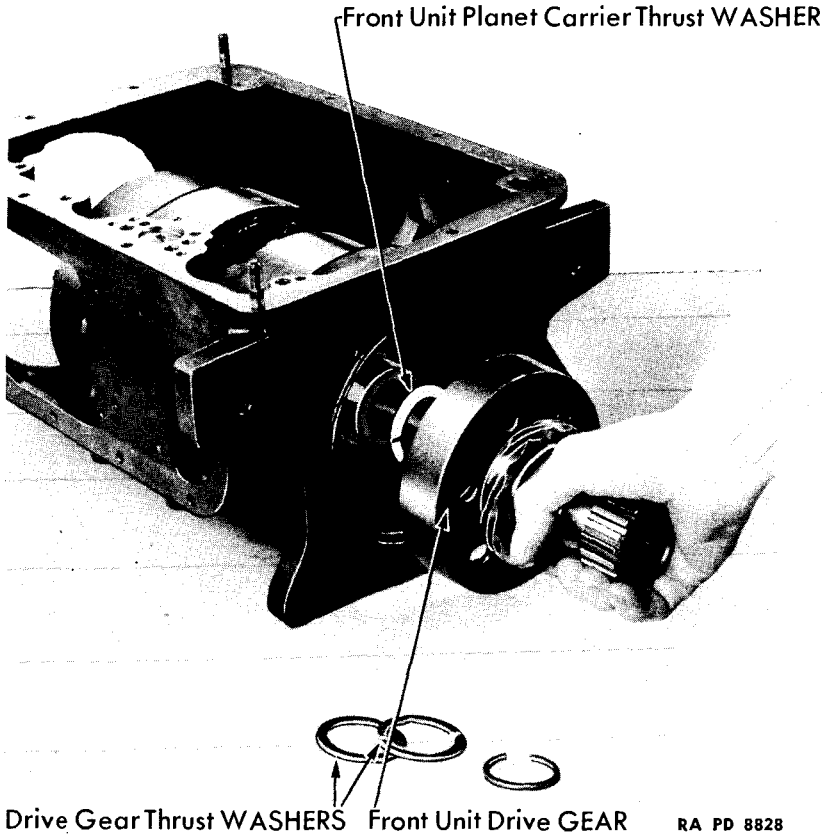
**(23) REMOVE ACCUMULATOR VALVE.**

**SCREW, ¼ to 24**

**SCREWDRIVER**

First type transmissions were equipped with a front unit accumulator valve which should be removed and discarded when the transmission is disassembled. Proceed as follows: Install a ¼ to 24 screw in accumulator plug and pry under screw head to remove plug (fig. 87). **CAUTION:** Spring pressure under plug may force out other parts. If it does not, remove accumulator piston, valve, seat and 2 springs (fig. 109). Reinstall plug and tap into place until slightly below top of case.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 84 — Removing Front Unit Drive Gear**

(24) REMOVE BRAKE DRUM AND INTERNAL GEAR.

FIXTURE, holding, B226780

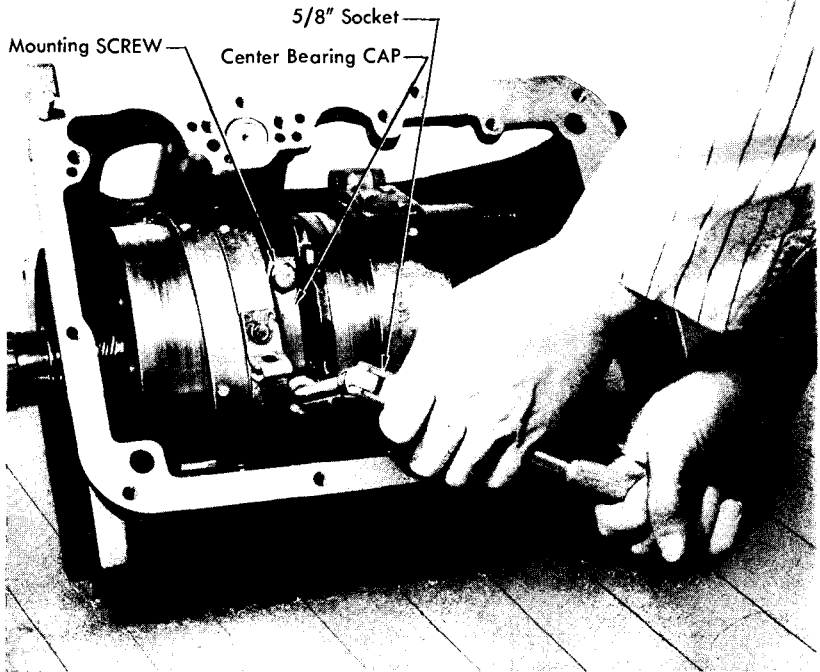
HOLDER, drum, A266232

HAMMER, soft

WRENCH, box-end,  $\frac{9}{16}$ -in.

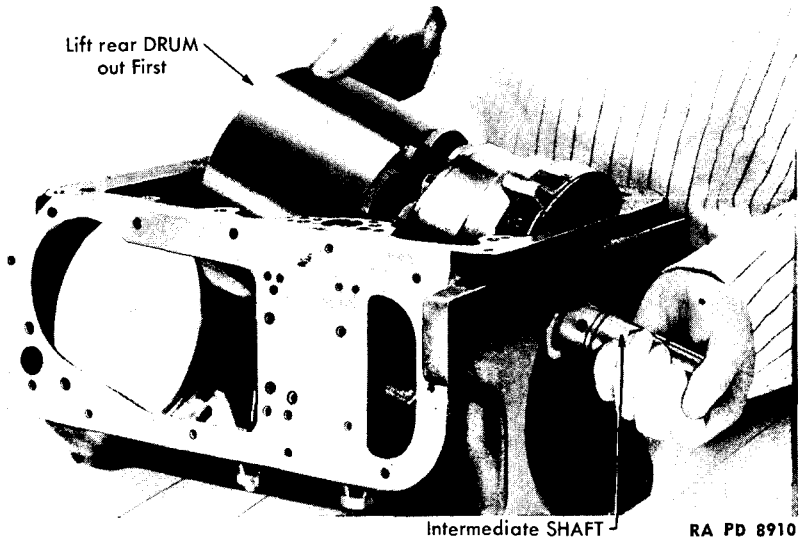
Place intermediate shaft with front and rear planetary unit assemblies on holding fixture B226780. Loosen 6 cap screws holding rear unit clutch drum to brake drum. Tap brake drum on all sides with soft hammer to loosen from clutch drum. Remove brake drum and internal gear as a unit (fig. 88). Internal gear may be lifted out of brake drum (fig. 89).

### HYDRA-MATIC TRANSMISSION



RA PD 8585

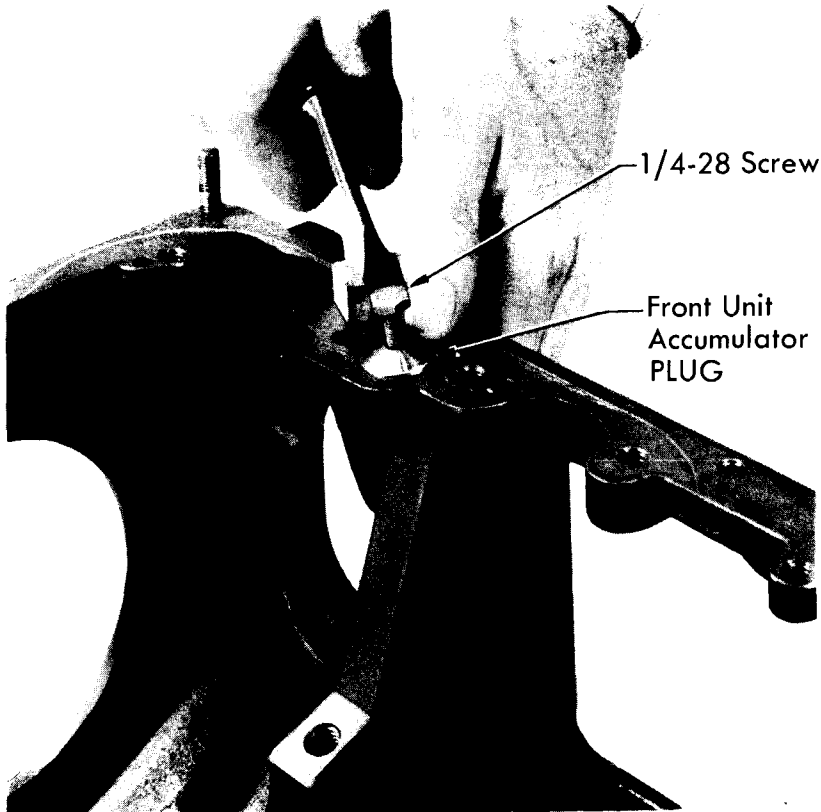
**Figure 85 — Removing Cap Screws for Main Bearing Cap**



RA PD 8910

**Figure 86 — Removing Front and Rear Unit**

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8825

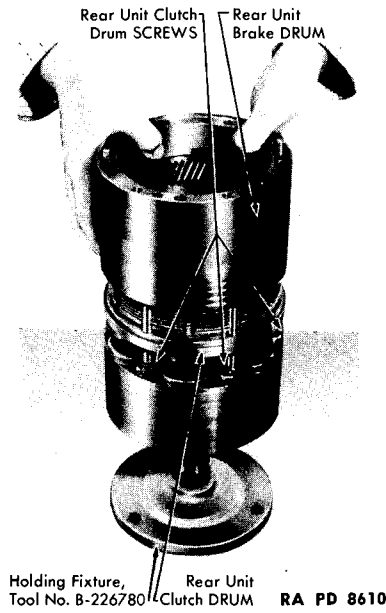
**Figure 87 — Removing Front Unit Accumulator Plug**

**(25) REMOVE CLUTCH ASSEMBLY.**

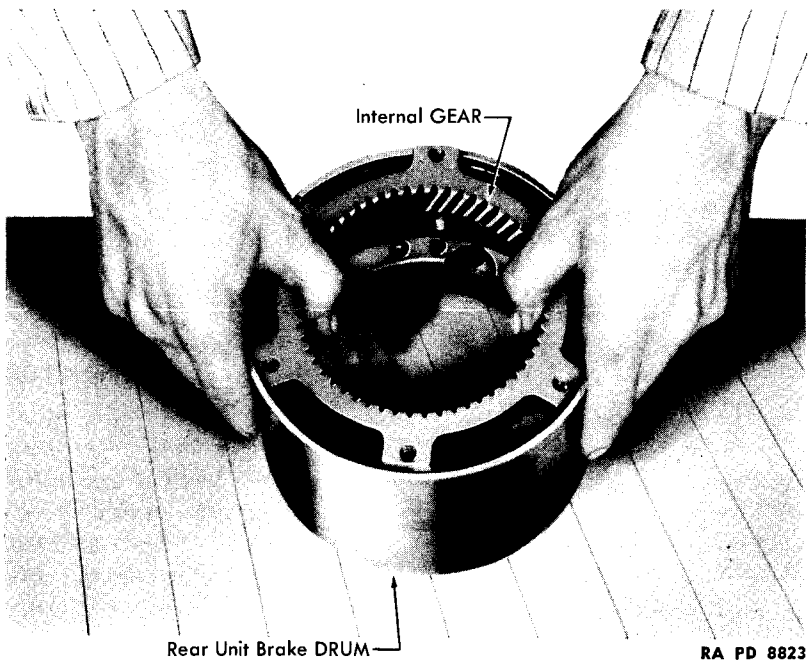
**PLIERS**, snap ring, A266329

Remove 12 steel and 10 bronze clutch disks, making a note of the order in which the disks were installed so that they may be reinstalled in exactly the same order when assembling transmission (fig. 90). Remove clutch pressure plate (fig. 91). Remove rear unit clutch hub lock ring from intermediate shaft, using snap ring pliers A266329 (fig. 92), and remove rear unit clutch hub. Remove bronze and steel thrust washers. Remove rear unit clutch drum and 6 screws by lifting from oil delivery sleeve. Remove pistons from clutch drum by applying compressed air to each clutch piston oil passage (fig. 93).

### HYDRA-MATIC TRANSMISSION



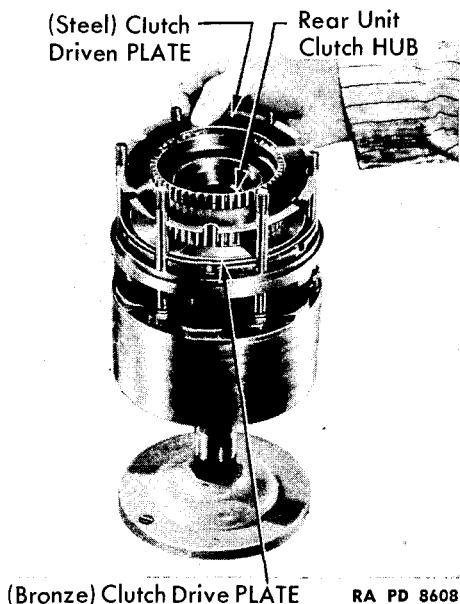
**Figure 88 — Removing Rear Unit Brake Drum**



**Figure 89 — Removing Rear Unit Internal Gear**



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 90 — Removing Rear Unit Clutch Plates**

**(26) REMOVE FRONT UNIT CLUTCH DRUM.**

**HOLDER**, drum, A266232

**WRENCH**, socket,  $\frac{9}{16}$ -in.

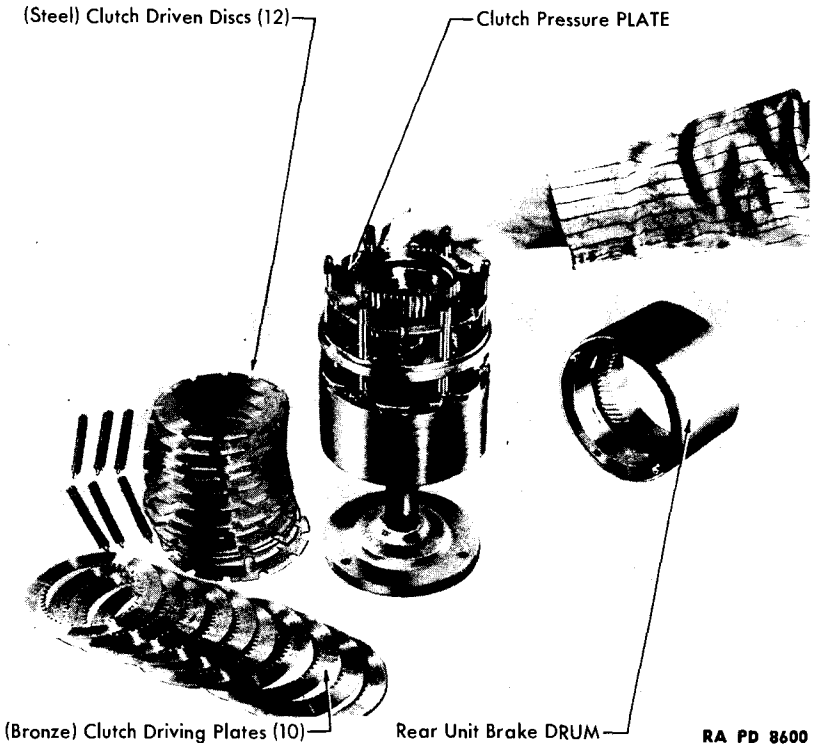
**PLIERS**, snap ring, A266329

Remove oil delivery sleeve from intermediate shaft. Remove snap ring holding front unit clutch drums assembly on intermediate shaft. Remove 6 screws and lock washers holding front unit clutch drum to front unit brake drum, while keeping drum from turning with holder A266232 (fig. 94). Lift front unit clutch drum off front unit brake drum and intermediate shaft (fig. 95).

**(27) REMOVE CLUTCH ASSEMBLY AND INTERMEDIATE SHAFT.**

Invert clutch drum and remove bronze and steel thrust washers from inside of drum. Remove pistons from clutch drum by applying compressed air to each clutch piston oil passage. Remove front unit clutch pressure plate (fig. 96). Remove steel and bronze clutch plates from front unit drum. Remove 6 front unit clutch retracting springs from front unit drum and lift front unit brake drum off intermediate shaft (fig. 97). Remove intermediate shaft from holding fixture B226780 (fig. 98).

**HYDRA-MATIC TRANSMISSION**



**Figure 91 — Removing Rear Unit Clutch Pressure Plate**

**(28) REMOVE DRIVEN SHAFT.**

**PRESS**, hydraulic

**WRENCH**, socket,  $\frac{9}{16}$ -in.

Remove 5 screws and copper washers holding rear bearing retainer to reverse gear internal support (fig. 99). Slide rear bearing retainer from driven shaft. Remove ball bearing and oil seal from rear bearing retainer. Discard oil seal. Remove bearing spacer from driven shaft. Place reverse gear assembly in a hydraulic press, supporting assembly on reverse internal gear, and press driven shaft out of rear internal gear support (fig. 100).

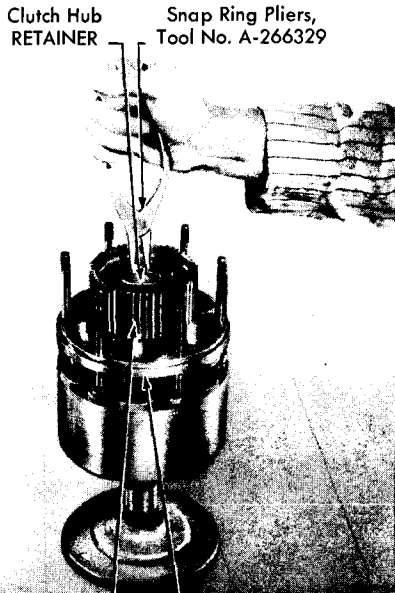
**(29) REMOVE PLANET CARRIER GEAR ASSEMBLY.**

**PLIERS**, snap ring, A266329

**PRESS**, hydraulic

Remove retaining ring holding reverse internal gear to reverse internal gear support (fig. 101). Press ball bearing out of reverse

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



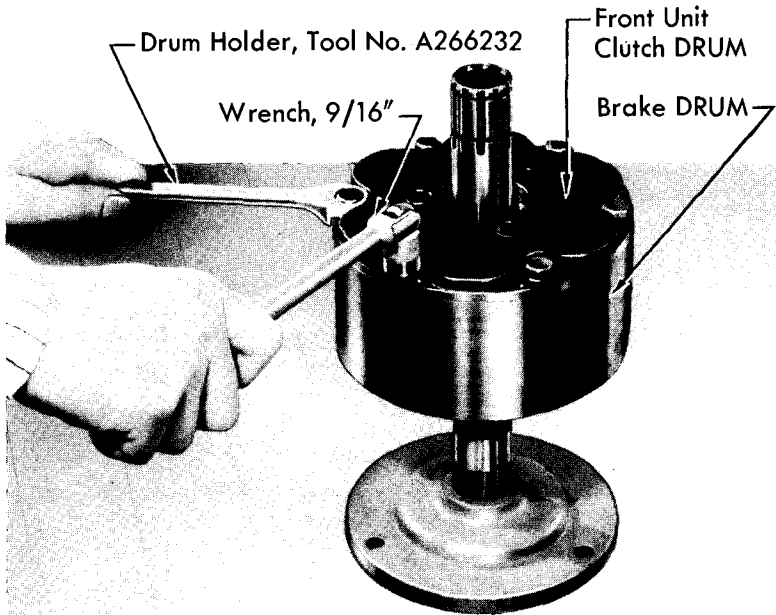
**Figure 92 — Removing Retainer for Rear Unit Clutch Hub**



RA PD 9236

**Figure 93 — Removing Clutch Pistons**

## HYDRA-MATIC TRANSMISSION



RA PD 8587

**Figure 94 — Removing Front Unit Screws**

internal gear support on hydraulic press. NOTE: It will be necessary to replace bearing if this operation is performed. Remove planet carrier gear assembly by lifting from driven shaft.

**(30) REMOVE SUN GEAR.**

PLIERS, snap ring, A266329

Remove reverse unit sun gear retaining ring from driven shaft (fig. 102). Remove sun gear and drive flange assembly. Remove retaining ring on sun gear and separate sun gear and drive flange. Remove bronze and steel thrust washers from reverse driven shaft (fig. 103).

### **14. INSPECTION AND REPAIR OF DISASSEMBLED TRANSMISSION.**

- a. Replace all parts not conforming to specifications with new parts.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



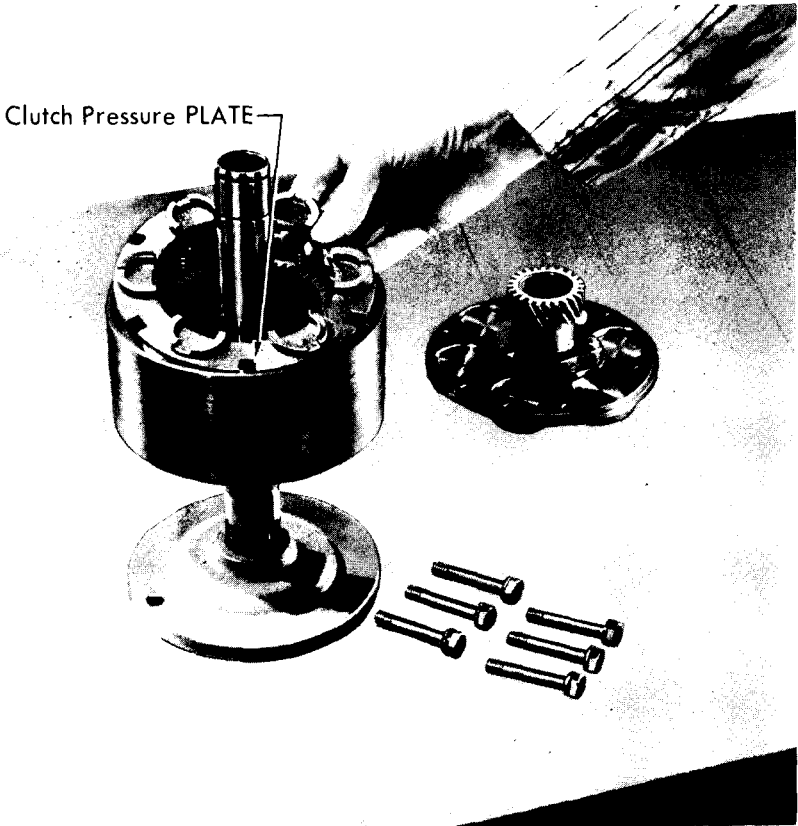
**Figure 95 — Removing Front Unit Clutch Drum**

**b. Inspection and Repair.**

(1) FLYWHEEL COVER. Inspect flywheel cover for nicks or burs on the hub splines or on the front face which contacts the flywheel. Remove any burs with a fine file (fig. 8).

(2) TORUS MEMBERS. Inspect driving and driven torus members to see that all vanes are tight and that splines in hub are in good condition. When installing driven and driving torus members on transmis-

**HYDRA-MATIC TRANSMISSION**



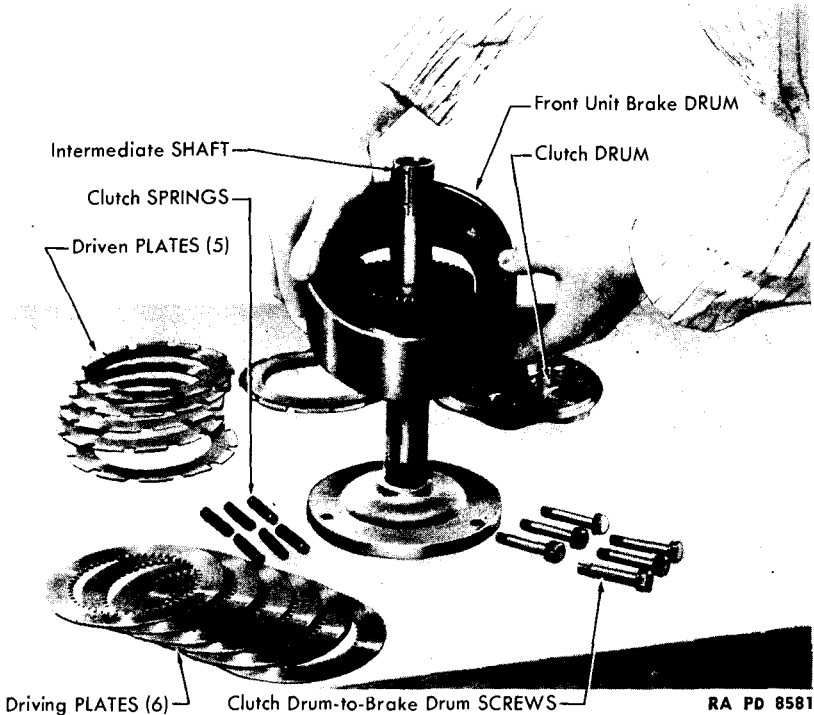
RA PD 8584

**Figure 96 — Removing Front Unit Clutch Pressure Plate**

sion, measure runout of face of each member. Maximum runout should not exceed 0.015 inch. Measure free length of driven torus vent valve spring. Free length should be  $1\frac{11}{32}$  inches. Compress driven torus vent valve spring to  $\frac{11}{16}$  inch, and measure pressure while compressed. Pressure should be from 0.5 to 0.6 pounds.

(3) **FRONT COVER AND OIL SEAL.** Inspect front cover to make sure that oil passages are clear and check oil delivery pipe bores in cover for nicks or burs which might cause oil leakage. Insert front cover oil seal ring in neck in flywheel cover and measure ring gap, using a feeler gage (fig. 104). Ring gap should be 0.002 inch to 0.012 inch. Insert oil seal ring on front cover and measure clearance between ring and groove in cover, using a feeler gage (fig. 105). Clearance should

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 97 — Removing Front Unit Brake Drum**

be 0.0005 inch to 0.0035 inch. Check front cover fit in transmission case to make sure that it seats securely.

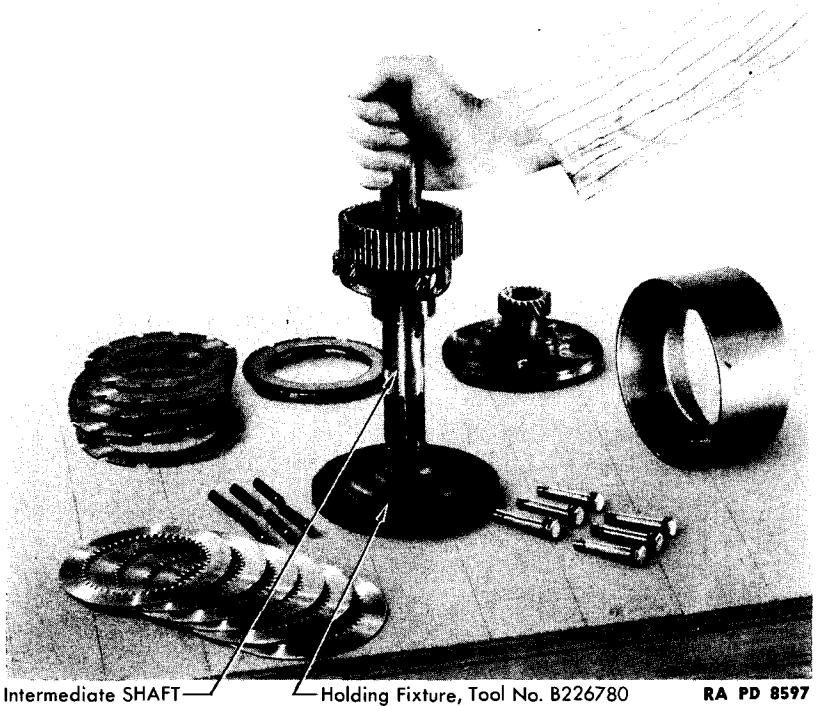
**(4) FRONT UNIT.**

(a) Inspect all gear teeth on front unit drive gear for nicks or burs which might cause roughness or gear wear, cracks, or other damage. Check front oil pump drive gear on front unit drive gear to make sure that it is securely held in place.

(b) Check thickness of steel and bronze front unit drive gear thrust washer ("E" and "F", fig. 106). Steel thrust washer should be 0.090 inch to 0.092 inch thick and bronze thrust washer 0.063 inch to 0.067 inch thick. Measure backlash of front unit drive gear when installed on transmission, using a dial indicator. Backlash of drive gear with planet gears should be 0.003 inch to 0.005 inch.

(c) Insert front unit drive gear oil seal rings ("N" and "O", fig. 106) in bore of front cover and measure ring gap, using a feeler gage. Gap should be 0.0015 inch to 0.010 inch. Install front unit drive gear oil seal rings on drive gear and measure clearance between rings and

## HYDRA-MATIC TRANSMISSION



**Figure 98 — Removing Intermediate Shaft**

ring grooves, using a feeler gage. Clearance should be 0.0005 inch to 0.0025 inch.

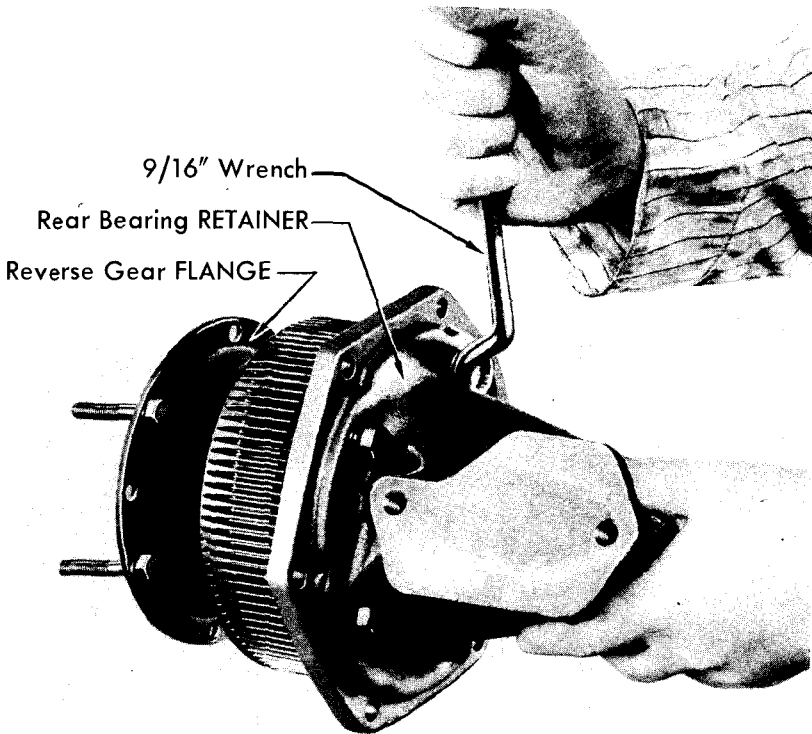
(d) Insert front unit clutch drum pistons (BB) without piston rings in front unit clutch cover piston bores and measure clearance, using a feeler gage. Clearance should be 0.003 inch to 0.006 inch. Insert clutch drum piston oil seal rings in piston bores in clutch cover and measure ring gap, using a feeler gage. Ring gap should be 0.0015 inch to 0.010 inch.

(e) Inspect front unit clutch drum (CC) and attached center gear for any evidence of damage, watching particularly for nicks or burs in clutch piston bores and center gear teeth.

(f) Inspect front unit driving clutch plates (bronze) and driven plates (steel) for scoring or burning. Lay driving clutch plates on a surface plate and check for warpage, using a feeler gage. The bronze plate should be flat within 0.005 inch. Lay driven clutch plates on a surface plate and measure amount of "cone" in plates. Steel driven plates should have 0.030-inch to 0.037-inch cone. Inspect clutch pressure plate for damage.



ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



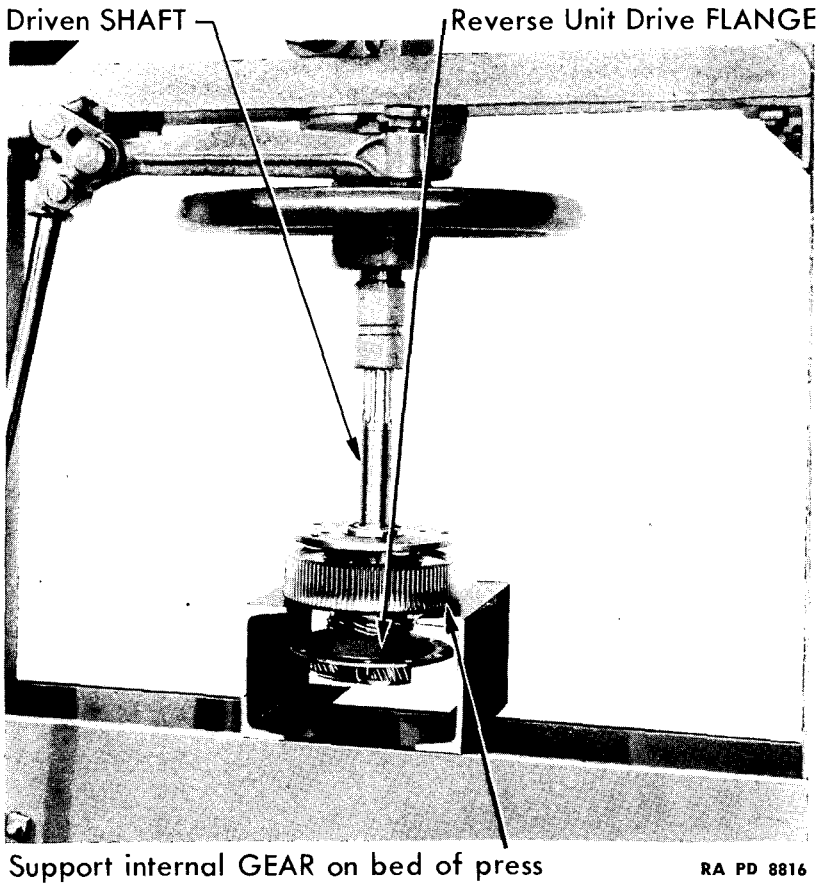
RA PD 8601

**Figure 99 — Removing Rear Bearing Retainer**

(g) Check free length of front unit clutch release springs (V). Free length should be  $1\frac{5}{8}$  inches. Compress these springs to  $1\frac{3}{32}$  inches and measure pressure while compressed. Pressure should be 26 to 30 pounds.

(h) Inspect intermediate shaft with attached front unit planet carrier and clutch hub (S) carefully for evidence of damage or excessive wear, paying particular attention to planetary pinion teeth, clutch hub teeth, and intermediate shaft splines.

(i) Check thickness of intermediate shaft thrust washers, using a 1-inch micrometer. The bronze thrust washer should be 0.063 inch to 0.067 inch thick. The front steel thrust washer should be 0.049 inch

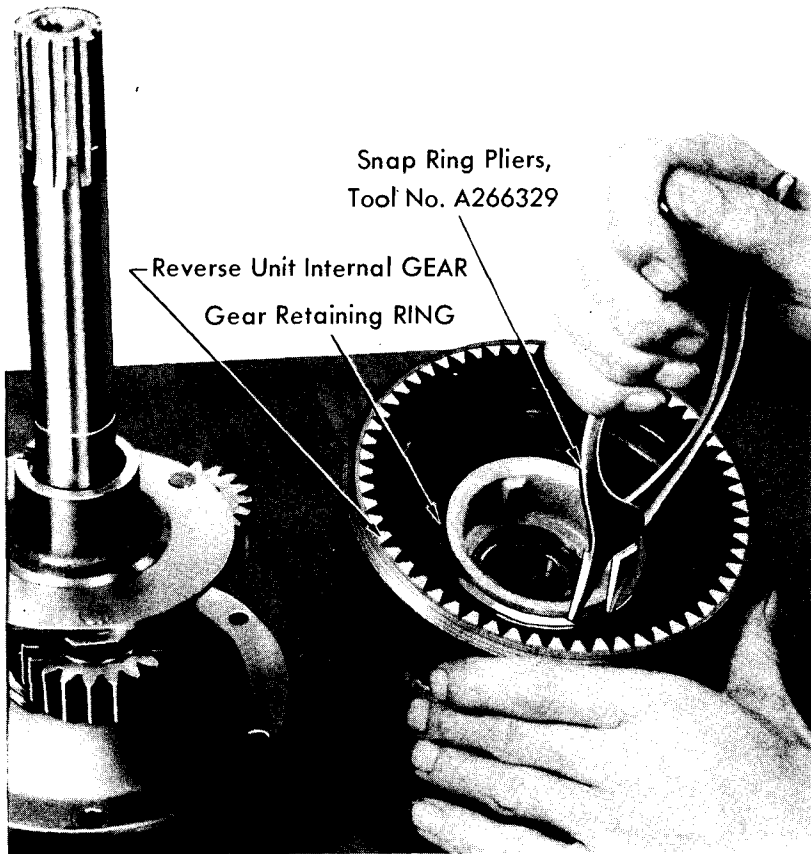
**HYDRA-MATIC TRANSMISSION****Figure 100 — Removing Driven Shaft**

to 0.052 inch thick, and the rear steel thrust washer should be 0.090 inch to 0.092 inch thick.

(j) Check end play of planet pinions on intermediate shaft planet carrier, using a feeler gage. End play should be 0.005 inch to 0.026 inch.

(5) OIL PRESSURE REGULATOR. Check free length of oil pressure regulator shuttle valve spring (fig. 111). Free length should be  $3\frac{9}{64}$  inch. Measure free length of oil pressure regulator valve spring. Free length should be  $3\frac{1}{16}$  inches. Compress oil pressure regulator valve spring ("L", fig. 19) to  $1\frac{9}{16}$  inches and measure pressure while compressed. Pressure should be 19 to 20 pounds.

**ORDNANCE MAINTENANCE—HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

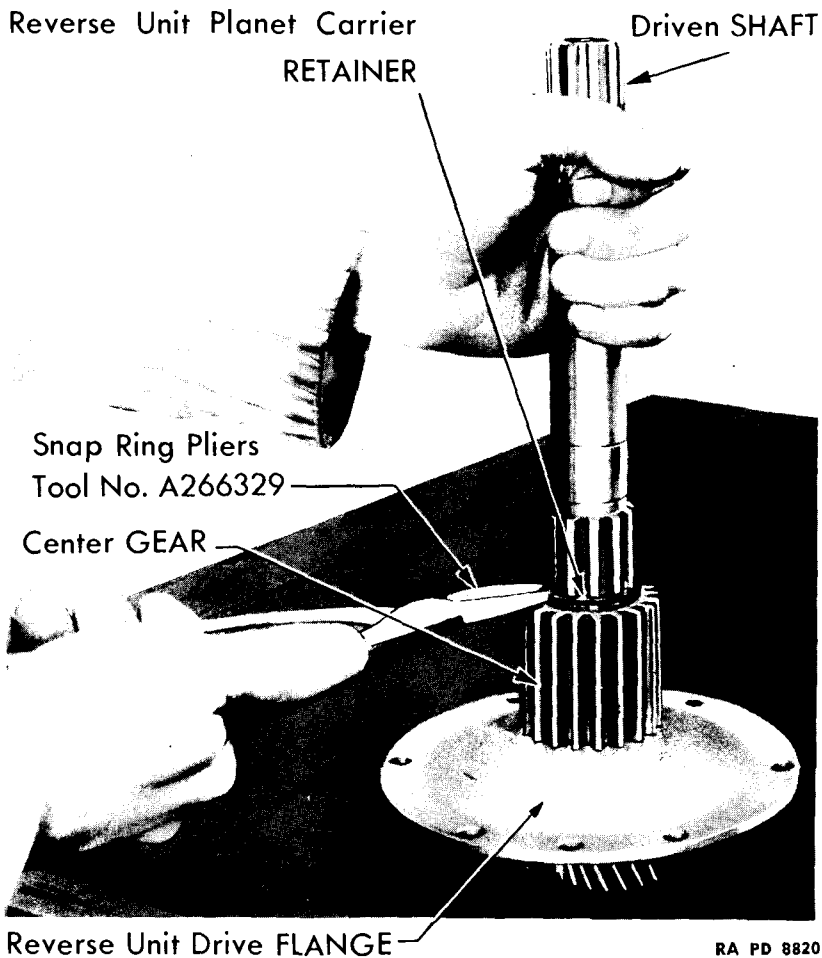


RA PD 8818

**Figure 101 — Removing Retaining Ring for Reverse Internal Gear**

(6) OIL DELIVERY SLEEVE. Check oil delivery sleeve ("KK," fig. 106) for wear by inserting it (without oil seal rings) in turn on the following parts: intermediate shaft, front and rear unit clutch drums; front unit center gear and rear unit clutch drum bushing. The clearance on the intermediate shaft should be 0.002 inch to 0.004 inch; front and rear unit clutch drums 0.0215 inch to 0.0255 inch; front unit center gear 0.0115 inch to 0.0155 inch; rear unit clutch drum 0.0115 inch to 0.0135 inch; and rear unit clutch drum bushing 0.0015-inch to 0.0035-inch clearance. Insert oil delivery sleeve oil seal rings in their respective bores and measure ring gap, using a feeler gage. Gap should be from 0.0015 inch to 0.007 inch. Install oil delivery sleeve oil seal rings on

## HYDRA-MATIC TRANSMISSION



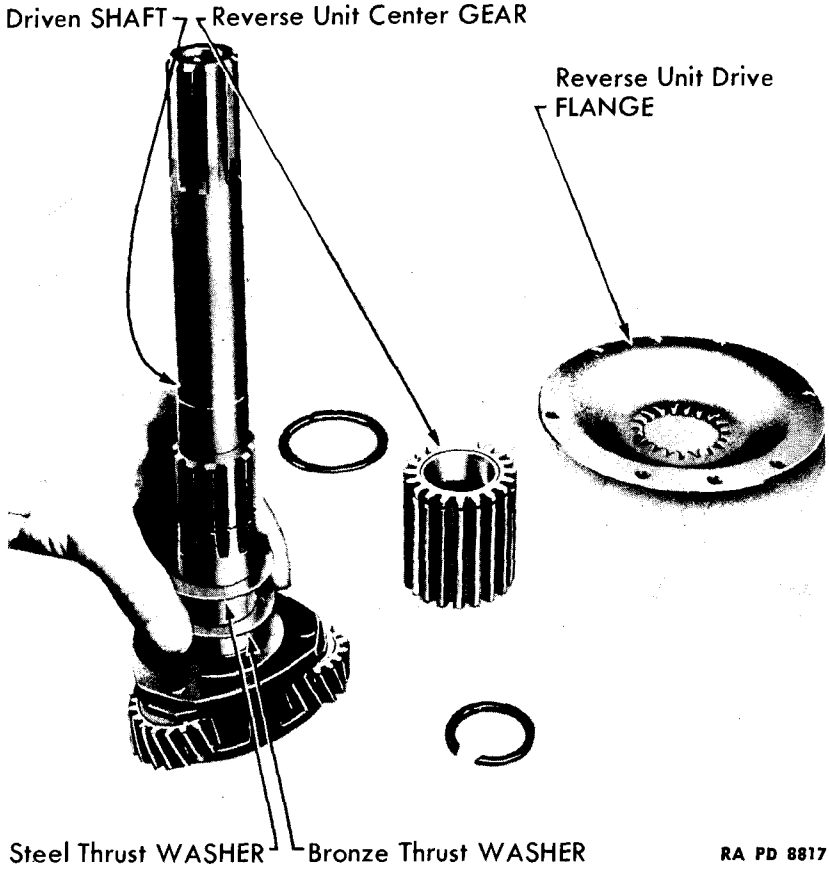
**Figure 102 — Removing Retaining Ring for Reverse Planet Carrier**

oil delivery sleeve and measure clearance between rings and grooves, using a feeler gage. Clearance should be from 0.0005 inch to 0.0025 inch.

(7) REAR UNIT (fig. 107).

(a) Insert rear unit clutch drum pistons (without rings) in piston bores in rear unit clutch drum and measure clearance, using a feeler gage. Clearance should be 0.003 inch to 0.006 inch. Install rear unit clutch piston rings in piston bores in clutch cover and measure ring gap, using a feeler gage. Gap should be 0.0015 inch to 0.010 inch. Install rear unit clutch piston rings on pistons and measure clearance

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8817

**Figure 103 — Removing Driven Shaft Thrust Washers**

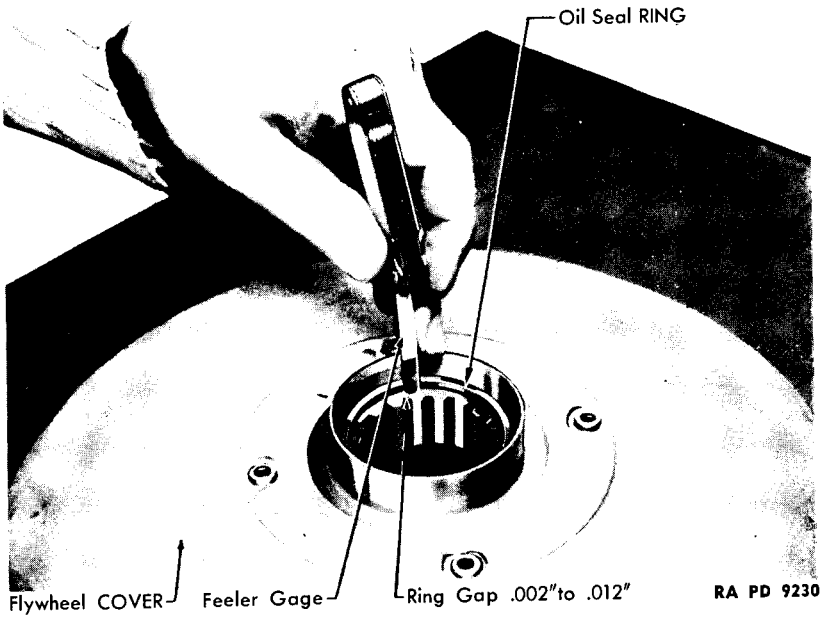
between rings and ring grooves. Clearance should be 0.0005 inch to 0.0025 inch.

(b) Inspect rear unit clutch drum ("C," fig. 107) for damage or nicks and burs which might cause sticking or oil leakage.

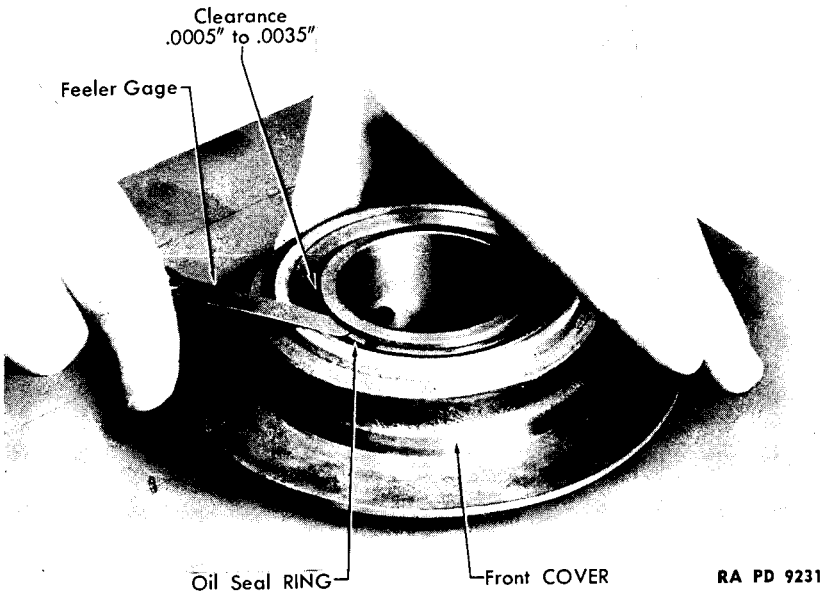
(c) Inspect rear unit clutch hub teeth for roughness or excessive wear. Measure thickness of clutch hub thrust washers ("D" and "E"), using a 1-inch micrometer. The bronze thrust washer should be 0.063 inch to 0.065 inch thick, while the steel thrust washer should be 0.049 inch to 0.052 inch thick.

(d) Lay clutch pressure plate (G) on a surface plate and check for warpage, using a feeler gage. Pressure plate should be flat within 0.005 inch.

### HYDRA-MATIC TRANSMISSION



**Figure 104 — Measuring Ring Gap**



**Figure 105 — Measuring Ring Clearance**

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

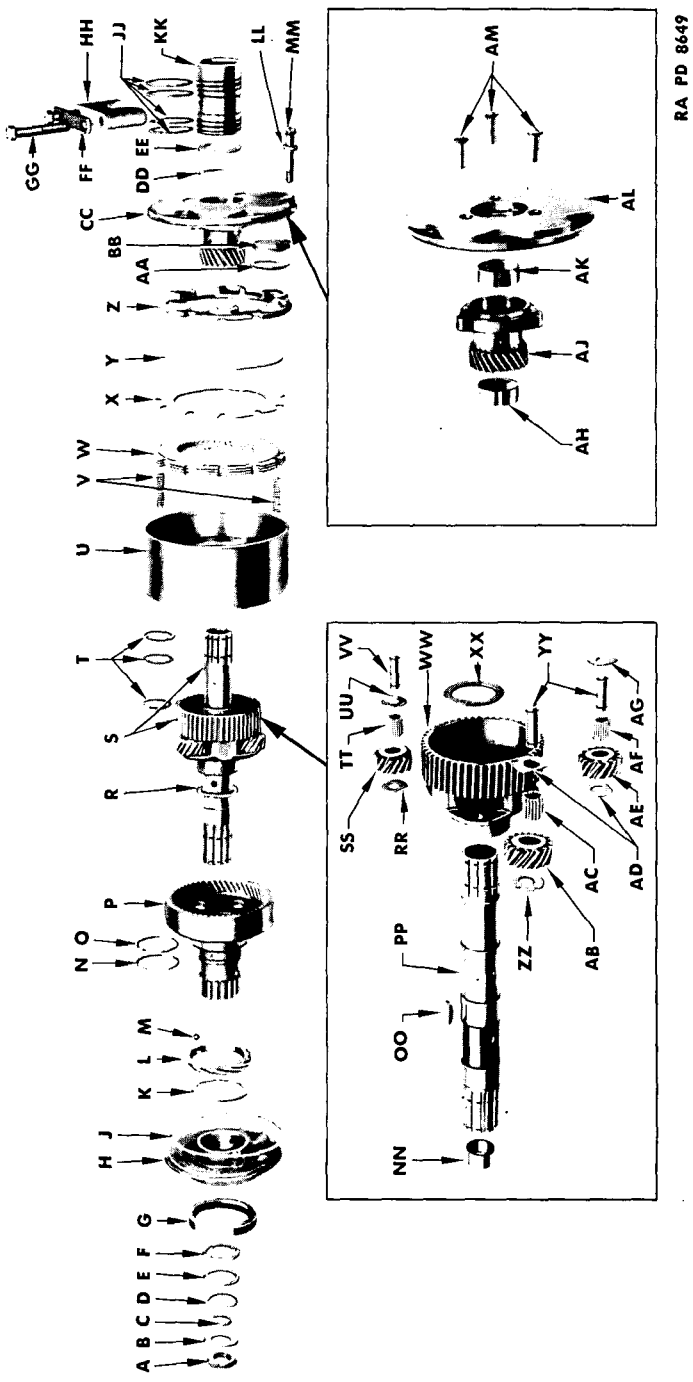


Figure 106 — Front Unit, Disassembled

## HYDRA-MATIC TRANSMISSION

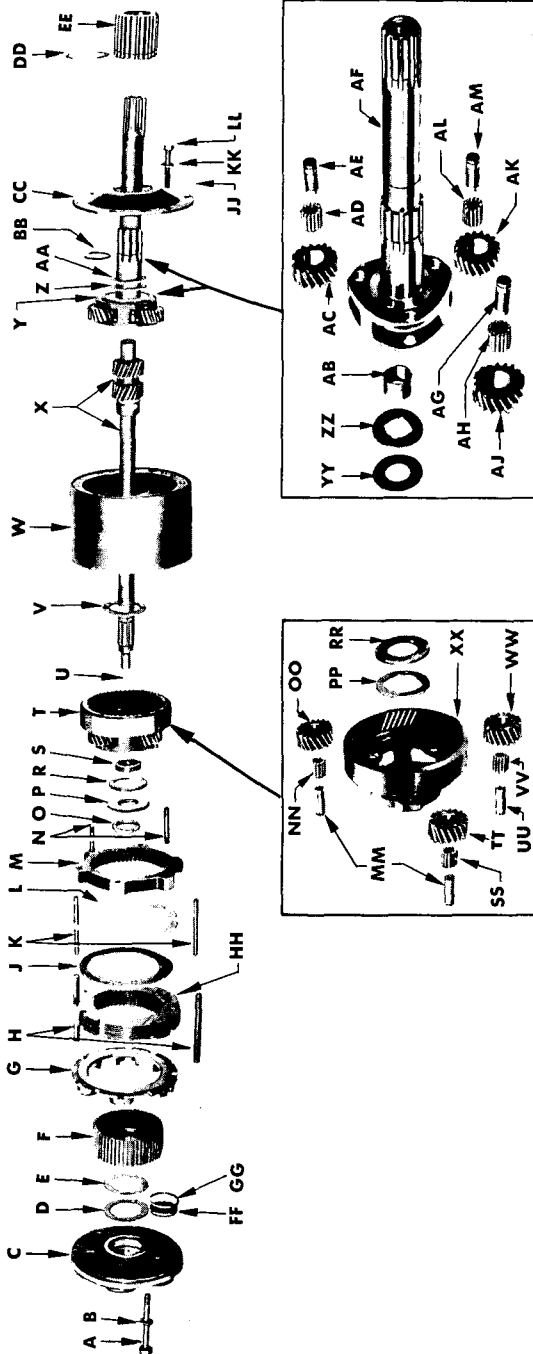
A — NUT	R — WASHER	GG — SCREW	XX — WASHER
B — WASHER	S — CARRIER, ASSEMBLY	HH — CAP, ASSEMBLY	YY — PIN
C — RETAINER	T — RETAINER	JJ — RING	ZZ — WASHER
D — RETAINER	U — DRUM	KK — SLEEVE, ASSEMBLY	AB — PINION
E — WASHER	V — SPRING	LL — WASHER	AC — ROLLER
F — WASHER	W — PLATE	MM — SCREW	AD — WASHER
G — OIL SEAL, ASSEMBLY	X — PLATE	NN — BUSHING	AE — PINION
H — COVER	Y — PLATE	OO — KEY	AF — ROLLER
J — GASKET	Z — PLATE	PP — SHAFT	AG — WASHER
K — RING	AA — RING	RR — WASHER	AH — BUSHING
L — GEAR	BB — PISTON	SS — PINION	AJ — GEAR
M — BALL	CC — DRUM, ASSEMBLY	TT — ROLLER	AK — BUSHING
N — RING	DD — WASHER	UU — WASHER	AL — DRUM
O — RING	EE — WASHER	VV — PIN	AM — RIVET
P — GEAR	FF — PLATE	WW — CARRIER	

RA PD 8649B

Legend for Figure 106 — Front Unit, Disassembled



ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8650

Figure 107 — Rear Unit, Disassembled

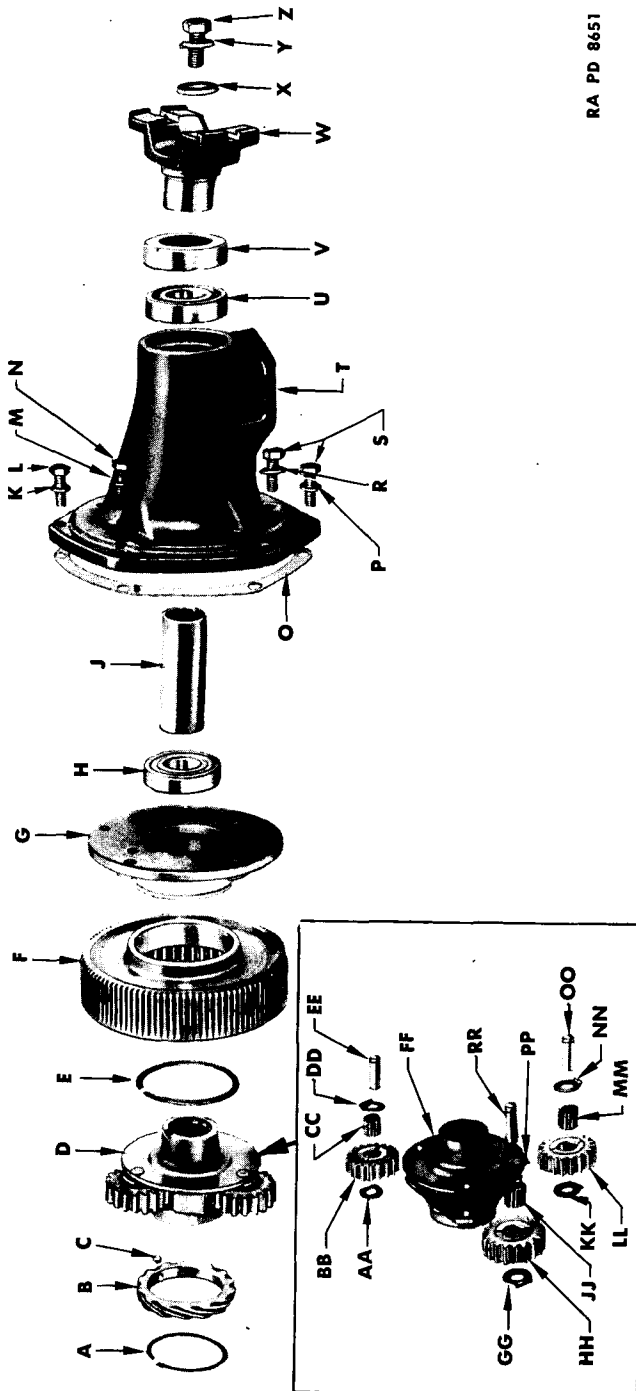
HYDRA-MATIC TRANSMISSION

RA PD 8650B

- |                       |                     |              |
|-----------------------|---------------------|--------------|
| A — SCREW             | W — DRUM            | SS — ROLLER  |
| B — WASHER            | X — SHAFT, ASSEMBLY | TT — PINION  |
| C — DRUM              | Y — SHAFT, ASSEMBLY | UU — PIN     |
| D — WASHER            | Z — WASHER          | VV — ROLLER  |
| E — WASHER            | AA — WASHER         | WW — PINION  |
| F — HUB               | BB — RETAINER       | XX — CARRIER |
| G — PLATE             | CC — FLANGE         | YY — WASHER  |
| H — SPRING            | DD — RING           | ZZ — WASHER  |
| J — PLATE             | EE — GEAR, ASSEMBLY | AB — BUSHING |
| K — PIN               | FF — PISTON         | AC — PINION  |
| L — PLATE             | GG — RING           | AD — ROLLER  |
| M — GEAR              | HH — PLATE          | AE — PIN     |
| N — STUD              | JJ — NUT            | AF — SHAFT   |
| O — NUT               | KK — WASHER         | AG — PIN     |
| P — WASHER            | LL — SCREW          | AH — ROLLER  |
| R — WASHER            | MM — PIN            | AJ — PINION  |
| S — SPACER            | NN — ROLLER         | AK — PINION  |
| T — CARRIER, ASSEMBLY | OO — PINION         | AL — ROLLER  |
| U — PIN               | PP — WASHER         | AM — PIN     |
| V — WASHER            | RR — WASHER         |              |

Legend for Figure 107 — Rear Unit, Disassembled

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8651

Figure 108 — Reverse Unit and Bearing Retainer, Disassembled

**HYDRA-MATIC TRANSMISSION**

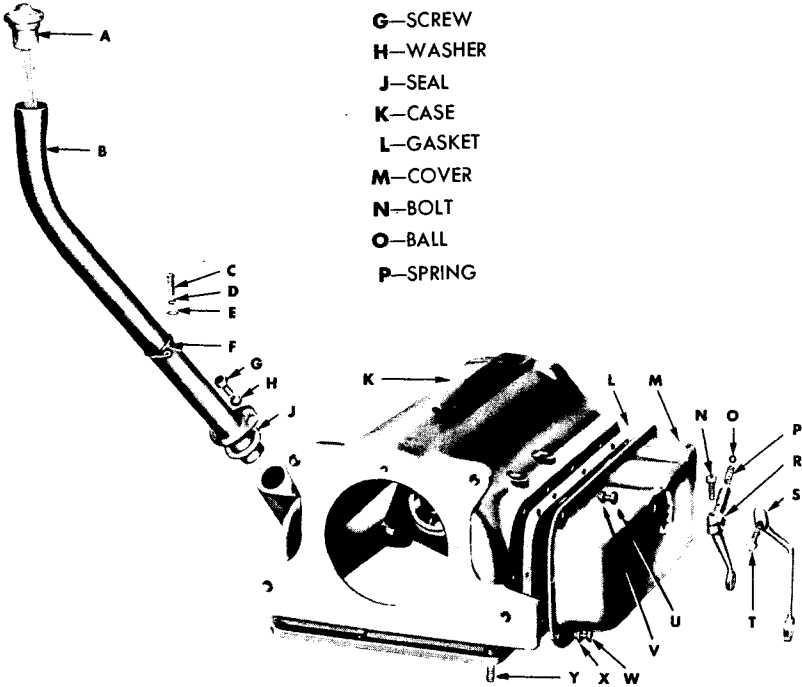
<b>A</b> — RING	<b>W</b> — YOKE
<b>B</b> — GEAR	<b>X</b> — WASHER
<b>C</b> — BALL	<b>Y</b> — WASHER
<b>D</b> — CARRIER, ASSEMBLY	<b>Z</b> — SCREW
<b>E</b> — RING	<b>AA</b> — WASHER
<b>F</b> — GEAR	<b>BB</b> — PINION
<b>G</b> — SUPPORT	<b>CC</b> — ROLLER
<b>H</b> — BEARING	<b>DD</b> — WASHER
<b>J</b> — SPACER	<b>EE</b> — PIN
<b>K</b> — WASHER	<b>FF</b> — CARRIER
<b>L</b> — SCREW	<b>GG</b> — WASHER
<b>M</b> — WASHER	<b>HH</b> — PINION
<b>N</b> — SCREW	<b>JJ</b> — ROLLER
<b>O</b> — GASKET	<b>KK</b> — WASHER
<b>P</b> — WASHER	<b>LL</b> — PINION
<b>R</b> — WASHER	<b>MM</b> — ROLLER
<b>S</b> — SCREW	<b>NN</b> — WASHER
<b>T</b> — RETAINER	<b>OO</b> — PIN
<b>U</b> — BEARING	<b>PP</b> — WASHER
<b>V</b> — OIL SEAL, ASSEMBLY	<b>RR</b> — PIN

RA PD 8651B

**Legend for Figure 108 — Reverse Unit and Bearing Retainer, Disassembled**

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

- A—INDICATOR
- B—TUBE
- C—SCREW
- D—WASHER
- E—WASHER
- F—CLIP
- G—SCREW
- H—WASHER
- J—SEAL
- K—CASE
- L—GASKET
- M—COVER
- N—BOLT
- O—BALL
- P—SPRING



- R—LEVER
- S—LEVER
- T—SCREW
- U—SCREW
- V—WASHER
- W—SCREW
- X—WASHER
- Y—STUD
- Z—SPRING
- AA—SEAT
- BB—VALVE
- CC—SPRING
- DD—PISTON
- EE—PLUG

- Z—SPRING
- AA—SEAT
- BB—VALVE
- CC—SPRING
- DD—PISTON
- EE—PLUG

RA PD 86788

**Figure 109 — Transmission Case and Related Parts**

**HYDRA-MATIC TRANSMISSION**

(e) Measure free length of rear unit clutch release springs (H). Free length should be  $4\frac{21}{64}$  inches. Compress clutch release springs to  $3\frac{13}{32}$  inches, and measure pressure while compressed. Pressure should be from 27 to 33 pounds.

(f) Inspect rear unit clutch driving plates (bronze) and driven plates (steel) for burning or scoring. Lay driving plates on a surface plate and check for warpage. Bronze driving plates should be flat within 0.005 inch. Lay clutch driven plates on a surface plate and check amount of "cone". Steel driven plates should have 0.030-inch to 0.037-inch cone.

(g) Inspect rear unit front planet carrier assembly (T) for damage, wear, looseness of pinion, or nicks and burs. Measure end play of rear unit front planet pinions, using a feeler gage. End play should be 0.004 inch to 0.011 inch.

(h) Measure thickness of planet carrier thrust washers ("P" and "R"). The bronze thrust washer should be 0.063 inch to 0.067 inch thick, while the steel thrust washer should be 0.119 inch to 0.121 inch thick.

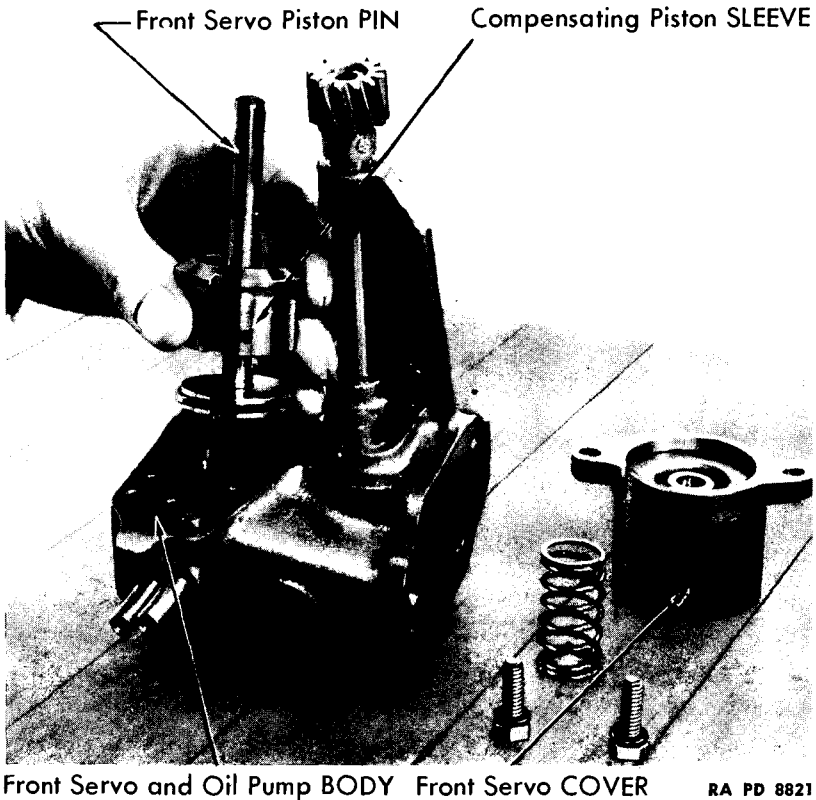
(i) Inspect rear unit brake drum and internal gear (W) for wear or damage.

(8) MAIN SHAFT (fig. 107). Inspect main shaft (X) for alinement or damage, paying particular attention to rear unit center gear teeth on main shaft and splines on front end of shaft.

(9) REVERSE UNIT (fig. 108). Inspect reverse unit internal gear ("F," fig. 108) for damage and wear on gear teeth. Inspect driven shaft ("AF") for alinement and wear on reverse unit center gear, rear unit planet gears, reverse unit splines, and universal joint yoke splines. Measure end play of rear unit planet pinions on driven shaft, using a feeler gage. End play should be 0.005 inch to 0.026 inch. Measure thickness of reverse unit center gear thrust washers ("Z" and "AA"). The bronze thrust washer should be 0.063 inch to 0.067 inch thick, while the steel thrust washer should be 0.049 inch to 0.052 inch thick.

(10) REVERSE ANCHOR. Inspect reverse anchor plunger ("Z," fig. 19) and gear for wear or damage. Measure free length of reverse anchor plunger spring ("X," fig. 19). Free length should be  $6\frac{3}{64}$  inch. Compress reverse anchor plunger spring to  $2\frac{9}{32}$  inch, and measure pressure while compressed. Pressure should be from 10 to 14 pounds. Measure free length of reverse anchor retracting spring ("Y," fig. 19). Free length should be  $1\frac{11}{16}$  inches. Compress reverse anchor retracting spring to  $1\frac{1}{8}$  inches, and measure pressure while compressed. Pressure should be from 4.5 to 5.5 pounds. Check reverse anchor assembly to make sure that there are no blinds. Inspect reverse unit driven shaft bearings for roughness.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 110 — Removing Front Servo Piston**

(11) **TRANSMISSION CASE** (fig. 109). Inspect transmission case, rear bearing retainer, and front cover for damage such as cracks, nicks, or burs which might cause failure or oil leakage.

(12) **INSPECT OIL PAN**. Inspect oil pan for cracks, dents, or nicks. Inspect bypass valve and plug for scores, burs, or other damage that may cause leaks. Inspect oil screen in pan for cracks, broken mesh, or plugged condition. If broken, screen should be replaced. If plugged with sludge, clean thoroughly with **SOLVENT**, dry-cleaning. If cleaning does not make screen satisfactory, it should be replaced. Inspect water and oil drain plugs for cracks, cross-threaded condition, nicks, or burs and replace if necessary.

(13) **INSPECT OIL COOLER**. Inspect oil cooler radiator for sludge and clean with solvent if necessary. Inspect radiator for cracks, nicks,

## HYDRA-MATIC TRANSMISSION

or dents which may cause leaks. Inspect connections on oil cooler for looseness or other conditions that may cause leaks. Inspect cover for cracks, dents, or burs. If cover is cracked, replace. If burred, remove burs with a file or emery cloth.

### 15. DISASSEMBLY, INSPECTION, AND ASSEMBLY OF TRANSMISSION CONTROL UNITS.

#### a. Front Oil Pump and Servo.

##### (1) EQUIPMENT.

FILE

PUNCH, pin,  $\frac{3}{32}$ -in.

HAMMER

WRENCH, open-end,  $\frac{7}{16}$ -in.

##### (2) DISASSEMBLY.

FILE

PUNCH, pin,  $\frac{3}{32}$ -in.

HAMMER

WRENCH, open-end,  $\frac{7}{16}$ -in.

Remove 2 cap screws and lock washers holding front servo cylinder to body. Pull servo cylinder off servo piston rod and remove initial servo spring, spring retainer and booster spring from piston rod. Remove servo piston from cylinder (fig. 110). Remove servo piston rod and booster piston from servo body (fig. 111). Remove 4 screws and lock washers holding front pump cover on pump and servo body, and remove cover. Remove idler gears from drive shaft and idler gear shaft in pump body. Remove driven gear from driven gear shaft in body. File off peened end on pin holding pump drive gear to pump drive shaft. Remove pin, and slide gear off end of shaft. Remove Woodruff key from drive shaft. File off burs at keyway. Slide drive shaft and gear from body.

##### (3) INSPECTION.

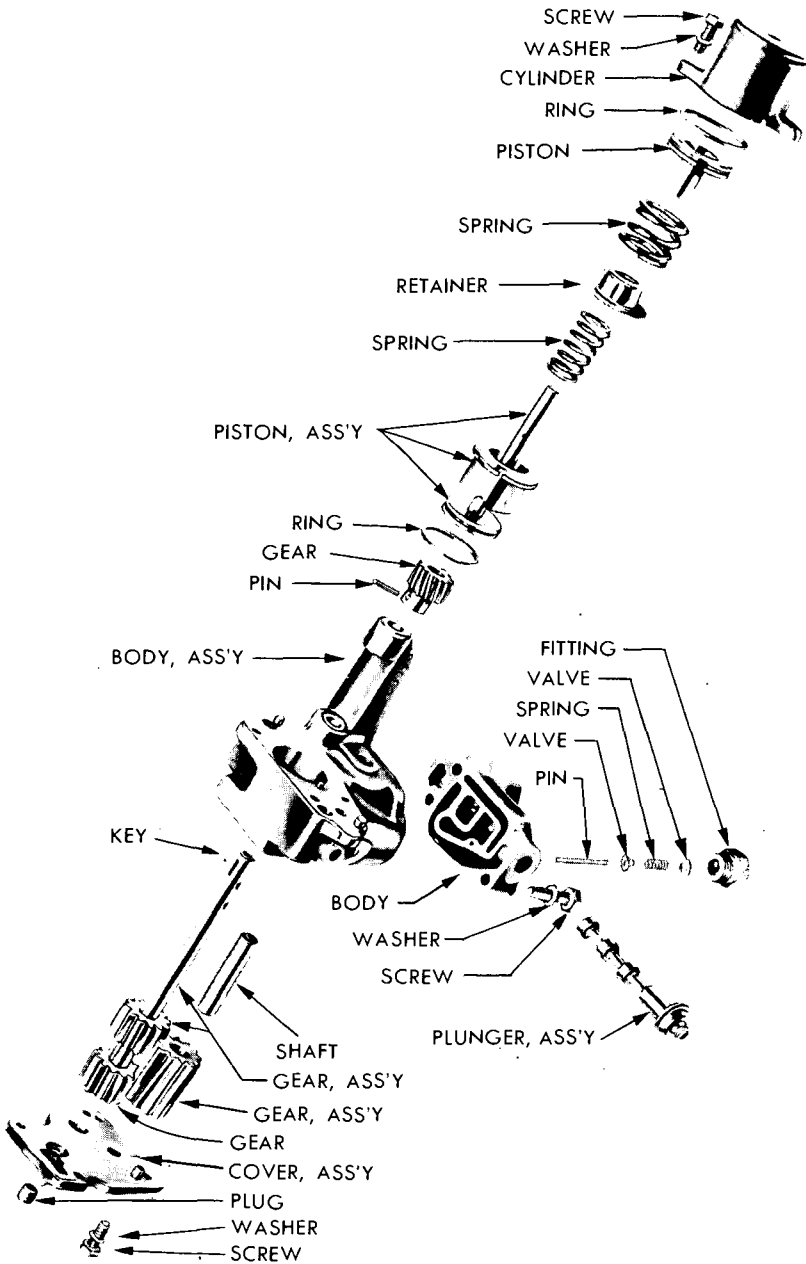
(a) Clean all parts thoroughly in SOLVENT, dry-cleaning, and dry them thoroughly, preferably with compressed air if available.

(b) Inspect machined surfaces on servo cylinder for nicks or burs which might cause oil leakage or piston ring failure.

(c) Install servo release piston (without oil ring) in servo cylinder and check clearance between piston and cylinder, using a feeler gage. Clearance should be from 0.003 inch to 0.006 inch. Inspect servo release piston for nicks or burs which might cause oil leakage and inspect bore in servo release piston for roughness. Insert servo release piston oil ring in servo cylinder and measure gap between ends of ring, using a feeler gage. Gap should be from 0.0015 inch to 0.010 inch. Insert servo release piston oil ring on release piston and measure clearance between ring groove in piston and ring, using a feeler gage. Clearance should be from 0.0005 inch to 0.003 inch.



ORDNANCE MAINTENANCE—HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 9021

Figure 111 — Front Oil Pump and Servo, Disassembled

**HYDRA-MATIC TRANSMISSION**

(d) Measure free length of front servo initial spring. Free length should be  $1\frac{33}{64}$  inches. Compress servo initial spring to  $\frac{25}{32}$  inch, and measure pressure while compressed. Pressure should be from 18 to 22 pounds.

(e) Measure free length of front servo booster spring. Free length should be  $\frac{15}{16}$  inch. Compress booster spring to  $1\frac{1}{16}$  inch, and measure pressure while compressed. Pressure should be from 38 to 46 pounds.

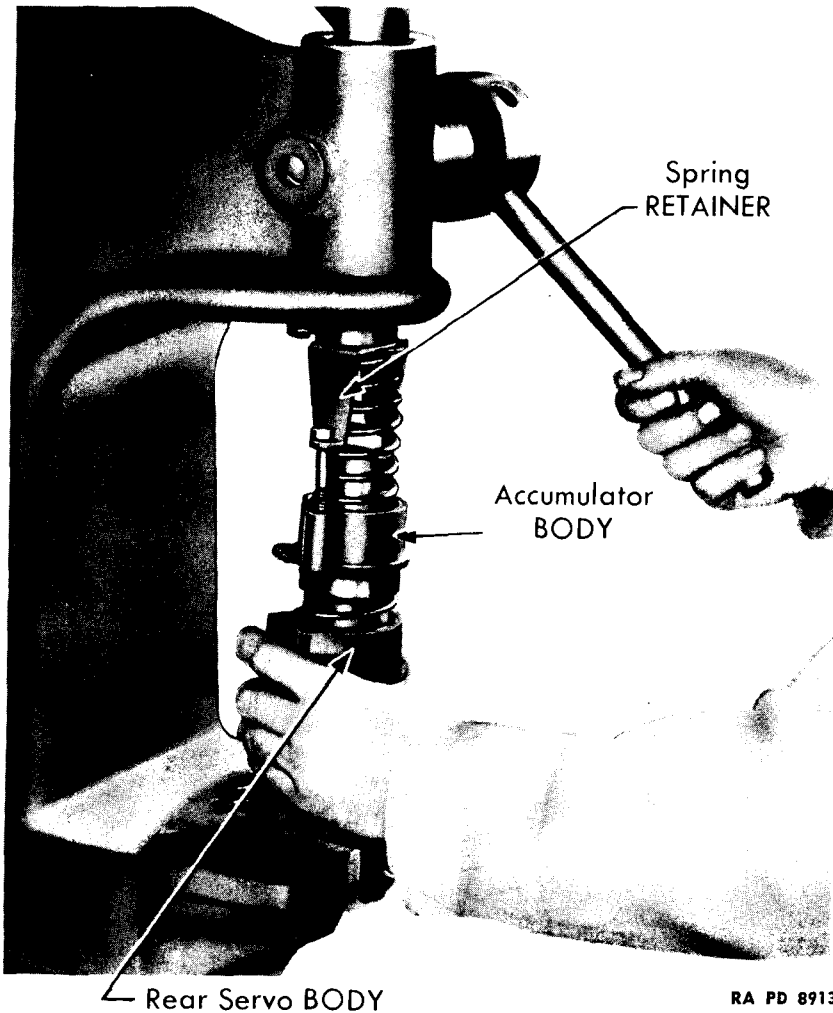
(f) Inspect servo; apply piston rod for nicks or burs which might cause piston to stick on rod. Remove any burs with a fine whetstone. Inspect booster sleeve for nicks or burs. Insert servo; apply piston (without oil ring) in servo and oil pump body, and measure clearance between piston and cylinder, using a feeler gage. Clearance should be from 0.003 inch to 0.006 inch. Insert servo; apply piston oil ring in cylinder in servo and oil pump body, and measure ring gap, using a feeler gage. Ring gap should be from 0.0015 inch to 0.010 inch. Install servo; apply piston oil ring on apply piston and measure clearance between ring and edge of ring groove in piston. Clearance should be from 0.0005 inch to 0.003 inch.

(g) Inspect all machined surfaces of servo and oil pump body for any indication of roughness or other damage, particularly those surfaces around oil passages at bolting pads which must hold pump pressure. Check servo cylinder and oil pump cover dowel pins in body for tightness or small burs.

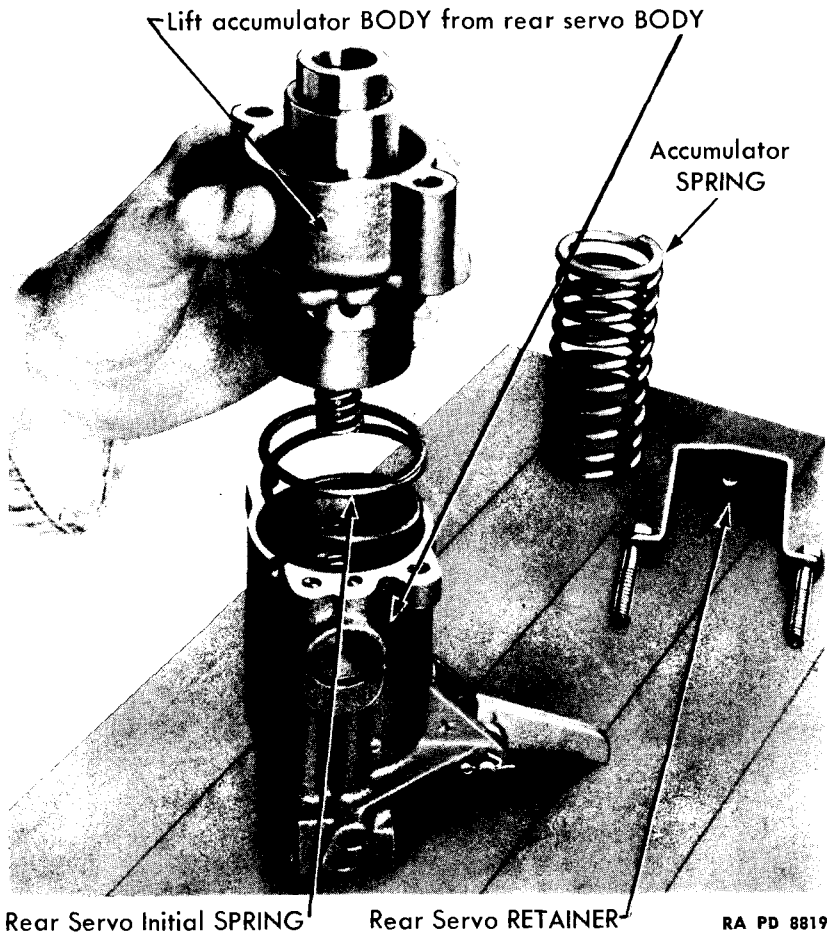
(h) Inspect all oil pump gears, including drive gear, driven gear and idler gears for wear or nicks or burs. Measure clearance between driven gear and large idler gear, and the clearance between large idler gear and small idler gear, using a feeler gage. Clearance in both instances should be from 0.002 inch to 0.006 inch. Inspect machined surfaces on oil pump body cover for nicks or burs, removing any small burs with a fine file.

**(4) ASSEMBLY.****HAMMER****WRENCH**, open-end,  $\frac{7}{16}$ -in.

Push oil pump drive shaft and driven gear into position in oil pump body. Tap Woodruff key into key slot on drive gear end of drive shaft. Position drive gear over end of drive shaft, lining up key slot in gear with Woodruff key on drive shaft and push gear into place so that lock pin hole in gear lines up with hole in shaft. Install a new lock pin through drive gear and drive shaft, and peen over edges of pin. **CAUTION:** Be careful not to damage gear. Install small oil pump idler gear on drive shaft. Install large oil pump idler gear on idler gear shaft. Position oil pump body cover on body and install 4 mounting screws and lock washers. Install servo piston in servo

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8****Figure 112 — Disassembling Rear Servo**

cylinder, using particular care when compressing piston ring. Install initial spring, spring retainer, and booster spring in servo cylinder around servo piston bushing. Install booster piston and rod in body. Take particular care while compressing booster piston ring. Position servo cylinder assembly on body and install 2 mounting screws and lock washers.

**HYDRA-MATIC TRANSMISSION****Figure 113 — Removing Accumulator Body****b. Rear Servo.****(1) EQUIPMENT.****HAMMER**, soft**PLIERS****PRESS**, hydraulic**PUNCH**,  $\frac{3}{32}$ -in.**SCREWDRIVER****WRENCH**, open-end,  $\frac{1}{2}$ -in.**(2) DISASSEMBLY.****HAMMER****PLIERS****PRESS**, hydraulic**PUNCH**,  $\frac{3}{32}$ -in.**SCREWDRIVER (2)****WRENCH**, open-end,  $\frac{1}{2}$ -in.

Place rear servo in hydraulic press and bring ram down to rest on spring retainer. Remove 2 screws and lock washers holding spring

ORDNANCE MAINTENANCE—HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

RA PD 9022

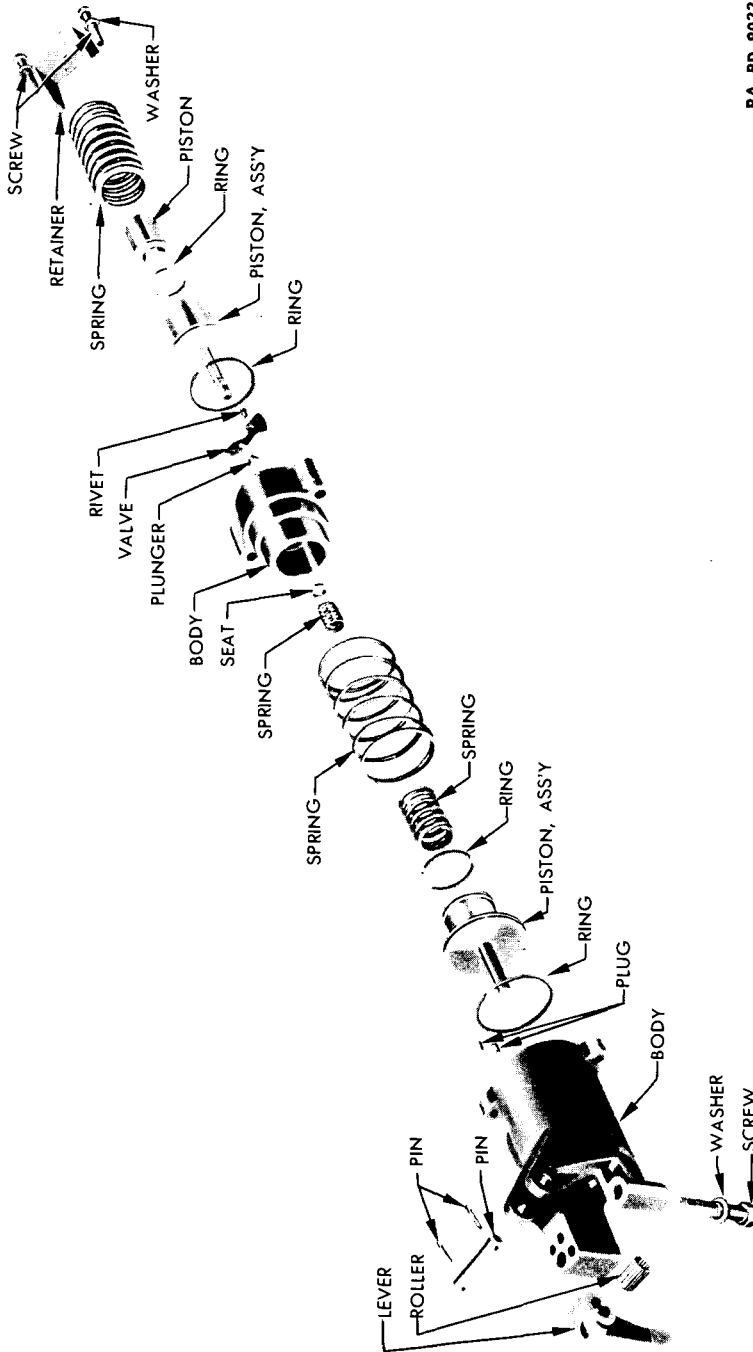


Figure 114 — Rear Servo Disassembled

## HYDRA-MATIC TRANSMISSION

retainer to servo body, while keeping ram of hydraulic press against spring retainer (fig. 112). Release hydraulic press slowly until servo springs are released, and remove rear servo assembly from press. Remove spring retainer, servo spring, and accumulator assembly from servo body (fig. 113). Remove compensator piston from accumulator piston. Place accumulator body in a vise with copper jaws and pry accumulator piston spring off groove in accumulator piston rod. Pry booster piston spring seat off accumulator piston rod. **CAUTION:** Pry off spring seat evenly. Slide accumulator piston out of accumulator body. Remove booster spring, initial spring and booster piston from servo body. Remove cotter pin from each end of pivot pin holding band actuating lever to bracket on servo body. Push pivot pin out of servo body bracket and band actuating lever. **CAUTION:** Take care not to lose any needle bearings out of band actuating lever when removing pivot pin. Remove lever and needle bearings.

### (3) INSPECTION.

(a) Clean all parts thoroughly in SOLVENT, dry-cleaning, and dry with compressed air (fig. 114).

(b) Inspect servo spring retainer for being bent or evidence of severe strain. Reshape retainer as required.

(c) Insert rear servo compensator piston (without oil ring) in bore in accumulator piston and check clearance between compensator piston and accumulator piston, using a feeler gage. Clearance should be from 0.003 inch to 0.005 inch. Insert compensator piston oil ring in bore in accumulator piston and measure ring gap, using a feeler gage. Gap should be from 0.0015 inch to 0.010 inch. Install compensator piston oil ring on compensator piston and measure clearance between ring and edge of ring groove in piston, using a feeler gage. Clearance should be from 0.0005 inch to 0.0025 inch.

(d) Inspect accumulator piston and piston rod for any nicks or burs which might cause oil leakage or sticking. Remove any small burs with a fine whetstone or CLOTH, crocus. Pay particular attention to bores in accumulator piston and compensator piston, surface on piston rod which contacts accumulator body, and surface on accumulator piston which contacts accumulator body. Insert accumulator piston and rod (without oil ring) in accumulator body, and measure clearance between piston and body, using a feeler gage. Clearance should be from 0.005 inch to 0.0095 inch. Inspect accumulator body for nicks or burs which might cause oil leakage or sticking. Check clearance between booster piston and bore in accumulator body, using a micrometer and a telescope gage. Clearance should be from 0.006 inch

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

to 0.010 inch. Check accumulator piston rod lock ring to see that it is a snug fit in groove in piston rod.

(e) Check free length of accumulator piston rod spring. Free length should be  $1\frac{5}{16}$  inch. Compress accumulator piston rod spring to  $1\frac{1}{16}$  inch, and measure pressure while compressed. Pressure should be from 36 to 44 pounds. Check free length of rear servo booster spring. Free length should be  $1\frac{7}{32}$  inches. Compress booster spring to  $1\frac{1}{16}$  inches, and measure pressure while compressed. Pressure should be from 103 to 114 pounds. Check free length of rear servo initial spring. Free length should be 4 inches. Compress initial spring to  $1\frac{9}{16}$  inches, and measure pressure while compressed. Pressure should be from 32 to 38 pounds.

(f) Insert small booster piston oil ring in bore in accumulator body and check ring gap, using a feeler gage. Gap should be from 0.0015 inch to 0.010 inch. Install small booster piston oil ring on booster piston and measure clearance between ring and ring groove in booster piston. The clearance should be from 0.0015 inch to 0.003 inch. Inspect booster piston and rod for nicks or burs which might cause oil leakage or sticking, and remove any burs with a fine whetstone. Insert booster piston and rod (without large oil ring) in servo body and measure clearance between piston and body, using a feeler gage. Clearance should be from 0.006 inch to 0.010 inch. Insert large booster piston oil ring in servo body and measure ring gap, using a feeler gage. Ring gap should be from 0.0015 inch to 0.010 inch. Install large booster piston oil ring on booster piston and measure clearance between ring and edge of ring groove in piston. Clearance should be from 0.0005 inch to 0.0025 inch. Check rod on booster piston to see that it operates freely in servo body.

(g) Inspect all machined surfaces on servo body, servo pistons and rings for nicks, burs, scores, or other conditions which might cause oil leakage or prevent free operation.

**(4) ASSEMBLY.**

**GREASE**, heavy

**HAMMER**, soft

**PLIERS**

**PRESS**, hydraulic

**WRENCH**, open-end,  $\frac{1}{2}$ -in.

Coat band actuating lever needle bearings with heavy grease and assemble in pivot pin hole in lever. Position band actuating lever and needle bearings in bracket on rear servo body and push pivot pin through bracket and lever. Install cotter pins holding pivot pin in servo body bracket. Install booster piston in servo body, being careful not to damage piston ring while compressing it. Install initial spring and booster spring in servo body. Insert accumulator piston in accumu-

### HYDRA-MATIC TRANSMISSION

RA PD 9020

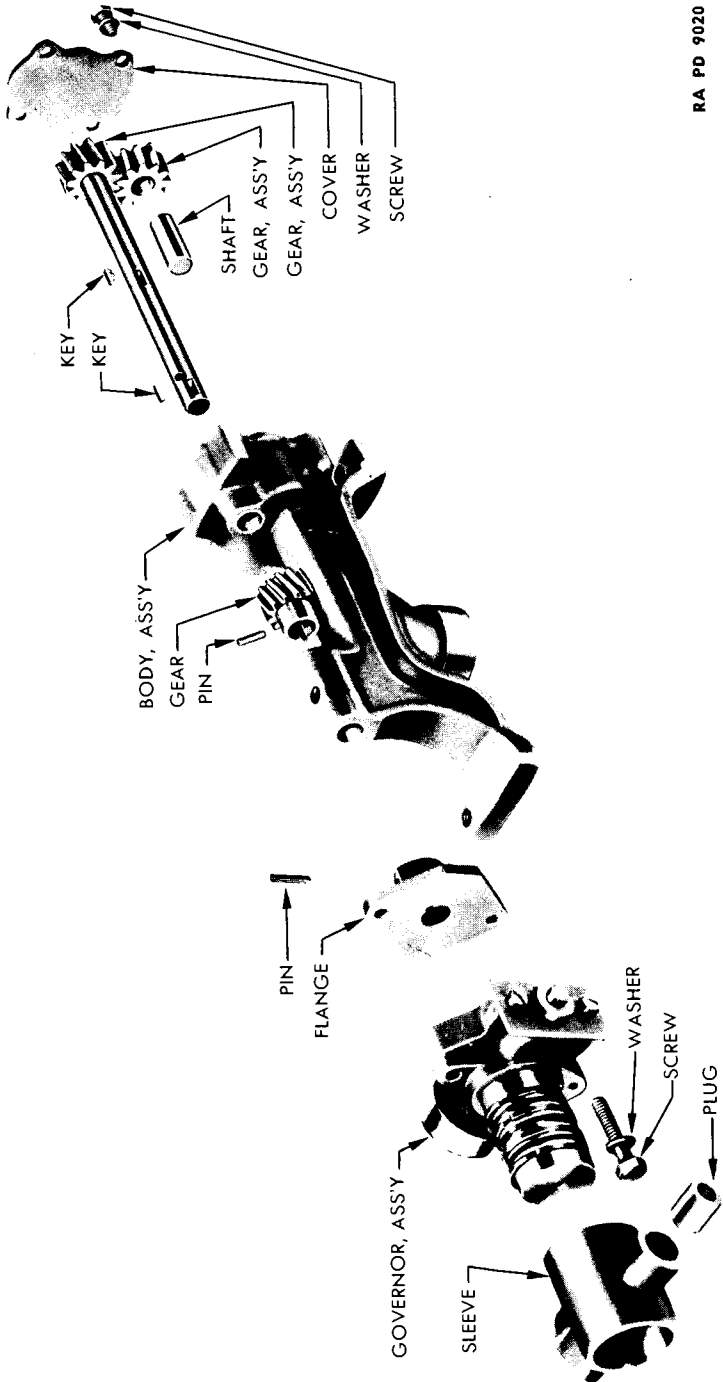


Figure 115 — Rear Oil Pump and Governor, Disassembled



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

lator body so that piston rod protrudes through body, being careful not to damage piston ring while compressing it. Tap booster piston spring seat on end of accumulator piston rod until it seats in second groove in rod. **NOTE:** Tap seat evenly to avoid cocking it. Install accumulator piston spring over end of rod with small tapered end of spring toward accumulator body and tap spring on rod until small end of spring seats in groove on piston rod. Install compensator piston in accumulator piston. Install accumulator body assembly in servo body, lining up mounting screw holes in accumulator body with those in servo body. Install servo spring in accumulator body. Place spring retainer and cap screws over servo spring, and place complete rear servo assembly in hydraulic press, supporting servo body on bed of hydraulic press. Press spring retainer down slowly, lining up screw holes in retainer with those in accumulator body. **CAUTION:** Take care to see that upper piston ring on booster piston is not damaged when being pushed into accumulator body. Install 2 screws and lock washers holding spring retainer and accumulator body to servo body, while holding spring retainer in position with hydraulic press. Remove rear servo from hydraulic press.

**c. Rear Oil Pump and Governor.**

**(1) EQUIPMENT.**

**FILE**

**PUNCH,  $\frac{3}{32}$ -in.**

**HAMMER**

**WRENCH, socket,  $\frac{7}{16}$ -in.**

**PRESS, hydraulic**

**(2) DISASSEMBLY.**

**FILE**

**PUNCH,  $\frac{3}{32}$ -in.**

**HAMMER, light**

**WRENCH, socket,  $\frac{7}{16}$ -in.**

**PRESS, hydraulic**

Mark edge of governor body and edge of governor drive flange so that they may be installed later in original position. Remove 2 screws and lock washers holding governor body to governor drive flange. Pull governor oil delivery sleeve off governor body. Remove governor oil rings from governor body, being very careful not to damage rings while they are being removed. **NOTE:** No attempt should be made to disassemble valves in governor body. If they stick and cannot be freed up by thoroughly washing, the governor body should be replaced. File off one end of lock pin which holds governor drive flange to oil pump drive shaft. Drive out lock pin holding governor drive flange to oil pump drive shaft. Remove governor drive flange and Woodruff key from drive shaft. File off one end of lock pin which holds drive gear on oil pump drive shaft. Drive lock pin out of drive gear and

## HYDRA-MATIC TRANSMISSION

shaft. Slide drive gear toward pump end of drive shaft and remove small Woodruff key which holds drive gear to shaft. Remove 4 screws and lock washers holding oil pump body cover to body, and remove cover. Check drive shaft to see that it is free of burrs and slide drive shaft and driven gear out of oil pump body. Install drive shaft and driven gear in a hydraulic press, supporting gear on bed of press, and press drive shaft out of driven gear. Remove oil pump idler gear.

### (3) INSPECTION.

(a) Clean all parts thoroughly in SOLVENT, dry-cleaning, and dry with compressed air (fig. 115).

(b) Insert governor body (without oil rings) in governor oil delivery sleeve and measure clearance between body and sleeve, using a feeler gage. Clearance should be from 0.002 inch to 0.004 inch. Insert governor body oil rings (one at a time) in oil delivery sleeve and measure ring gap, using a feeler gage. Gap should be from 0.0015 inch to 0.010 inch. Install governor body oil rings on body and measure clearance between edge of oil ring and groove in governor body. Clearance should be from 0.001 inch to 0.003 inch. Inspect governor oil delivery sleeve bore for any nicks or burrs which might cause oil leakage. Inspect all machined surfaces on governor body.

(c) Check governor body and check to see that both governor valves will operate of their own weight. NOTE: No attempt should be made to disassemble valves in governor body. If they stick and cannot be freed up by thoroughly washing, the governor body should be replaced.

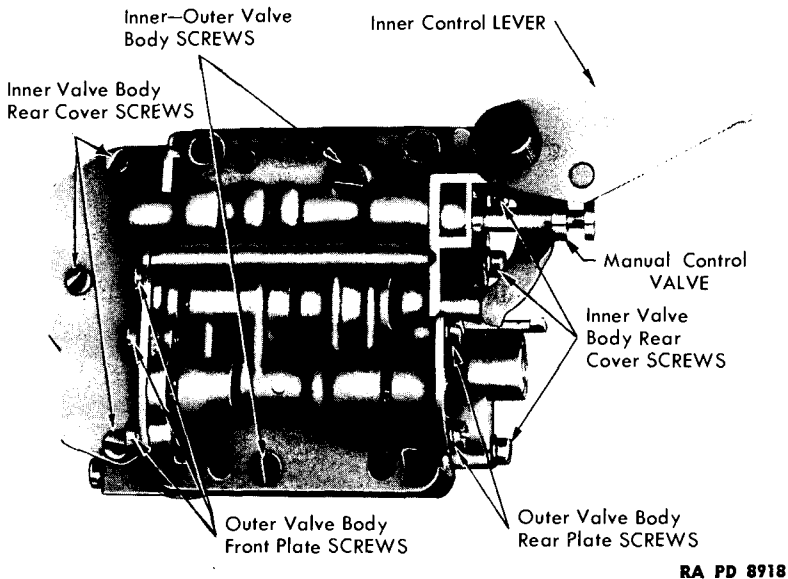
(d) Measure runout of governor body and drive flange as explained in paragraph 16 a (20).

(e) Inspect governor drive flange on drive shaft to see that flange is flat and free from nicks and burrs.

(f) Inspect rear oil pump drive gear, driven gear and idler gear for wear or evidence of damage. Check backlash between driven gear and idler gear, using a feeler gage. Backlash should be from 0.006 inch to 0.010 inch. Check clearance between oil pump drive shaft and bushings in oil pump body, using a pair of 1-inch micrometers and a telescope gage. Clearance should be from 0.001 inch to 0.0023 inch. Measure clearance between idler gear and idler gear shaft, using a 1-inch micrometer and a telescope gage. Clearance should be from 0.001 inch to 0.0023 inch. Inspect oil pump drive shaft to see that it is straight and operates freely in oil pump body. Inspect all machined surfaces on oil pump body for nicks or burrs.

(g) Install driven gear and idler gear in oil pump body and insert a 0.004 inch shim on top of each gear. Install cover and check to see

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**RA PD 8918**

**Figure 116 — Control Valve Body Assembly**

that the gears are tight in body. If gears are still free to rotate in body, end play of the drive shaft and idler gear is excessive. Inspect oil pump body cover for any nicks or burrs and to see that face which contacts body is not warped.

**(4) ASSEMBLY.**

**HAMMER**

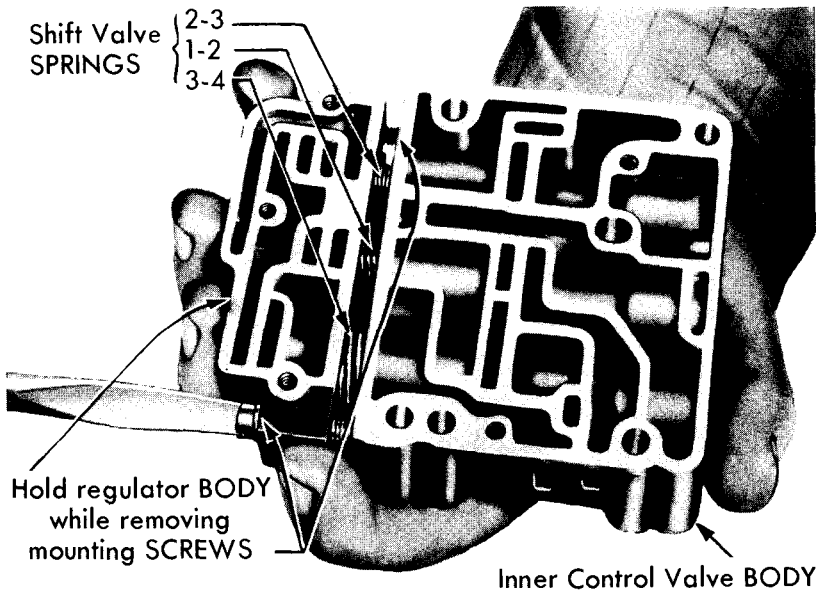
**PRESS, hydraulic**

**PUNCH,  $\frac{3}{32}$ -in.**

**WRENCH, socket,  $\frac{7}{16}$ -in.**

Place driven gear on bed of hydraulic press and press drive shaft through gear until end of shaft is flush with end of gear. Remove gear and shaft from hydraulic press. Slide drive shaft and driven gear into oil pump body. **NOTE:** Slip drive gear on shaft before shaft goes through support on governor end of oil pump body. Install idler gear on idler gear shaft in oil pump body. Position oil pump body cover on body and install 4 mounting screws and lock washers. Install small Woodruff key in oil pump drive shaft. Line up key slot on drive gear with key on shaft and push gear over key. **NOTE:** Line up lock pinhole in gear with pinhole in shaft. Install a new lock pin through drive gear and oil pump drive shaft, and peen ends of lock pin securely.

## HYDRA-MATIC TRANSMISSION



RA PD 8919

**Figure 117 — Removing Regulator Valve Body**

**CAUTION:** Take care not to strike gear teeth with hammer while peening pin. Install Woodruff key on end of drive shaft and slide governor drive flange on drive shaft over key, being sure that lock pinholes in flange and shaft are lined up. Install a *new* lock pin through governor drive flange and drive shaft and peen both ends of lock pin securely. Install 4 governor body oil rings on body, being very careful not to damage rings while expanding them over body. Install governor oil delivery sleeve on governor body, taking care not to damage rings while compressing them into delivery sleeve. **NOTE:** Governor sleeve is installed on governor body with chamfered end toward governor. Position governor body and delivery sleeve assembly on governor drive flange, lining up marks on body and flange which were made before parts were disassembled. Install 2 screws and lock washers that hold governor drive flange to body.

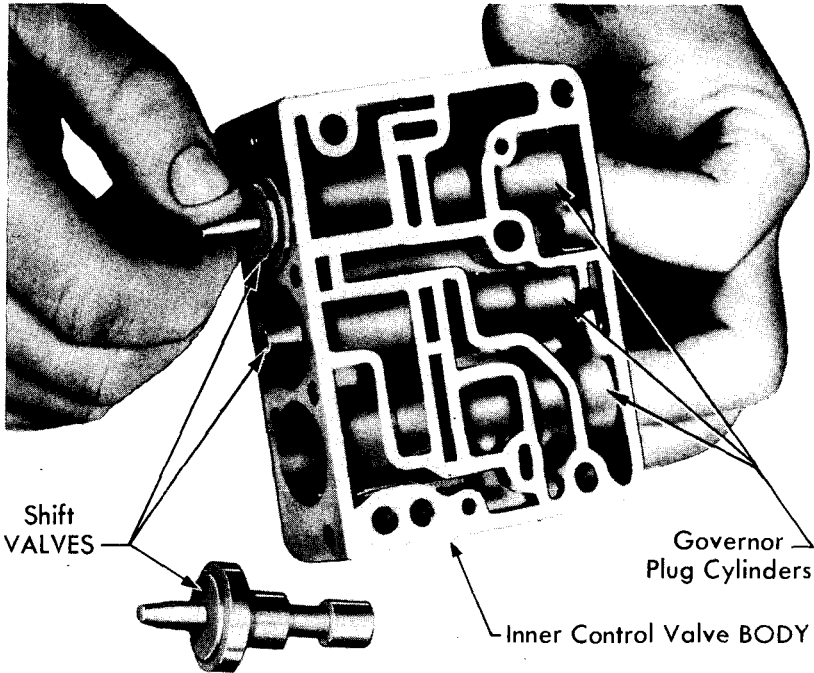
**d. Control Valve Body.**

(1) **EQUIPMENT.**

**HAMMER**  
**PLIERS**

**PUNCH,  $\frac{3}{32}$ -in.**  
**SCREWDRIVER**

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8920

**Figure 118 — Removing Shift Valves**

(2) **DISASSEMBLY.**

(a) *Separate Valve Body Castings.*

**SCREWDRIVER**

**NOTE:** Extreme care must be taken in handling the transmission control valve body assembly (fig. 116). Never grip the castings in a vise or use force in removing or installing valves or plugs. Remove 2 screws holding inner and outer valve body castings together. Separate castings and remove separator plate ("B," fig. 123).

(b) *Remove Governor Pipe End Casting.*

**SCREWDRIVER**

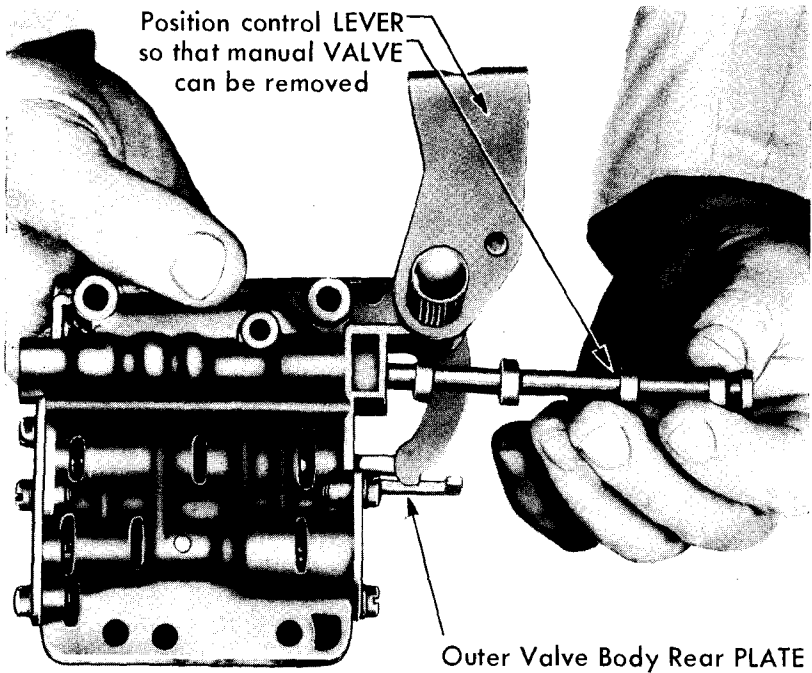
Remove 3 screws holding governor pipe end cover ("KK," fig. 123) to valve body, and remove governor pipe end cover and separator plate ("JJ," fig. 123).

(c) *Remove Regulator Plugs (fig. 123).*

**SCREWDRIVER**

Remove 3 screws holding steel cover plate (A) to regulator plug body (Z) and remove plate. Remove 3 screws holding regulator plug

## HYDRA-MATIC TRANSMISSION



RA PD 8921

**Figure 119 — Removing Manual Control Valve**

body to valve body, and remove regulator plug body and regulator plugs (Y), (BB) and (CC). CAUTION: Be sure to hold regulator plug body and valve body together while removing screws (fig. 117) because it is under spring tension.

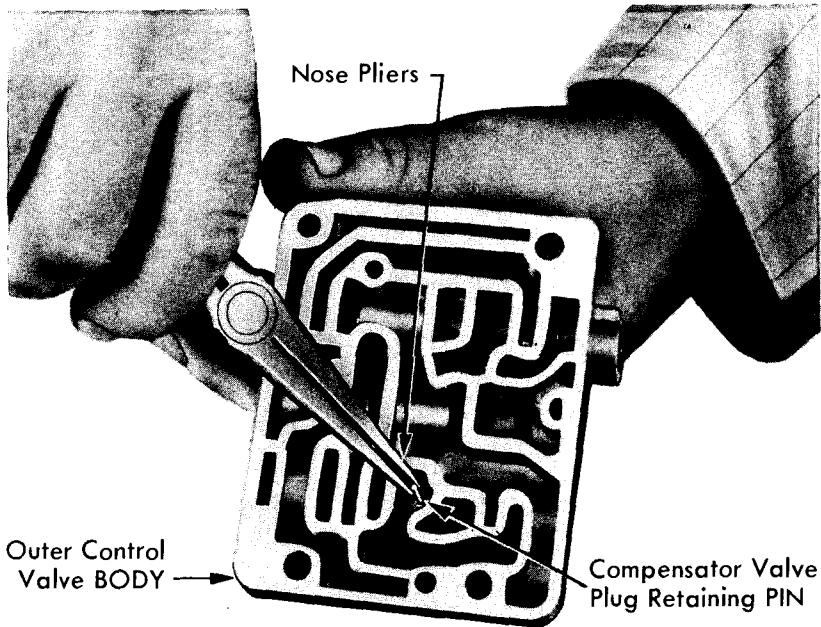
(d) *Remove Shift Valves* (fig. 123).

Remove regulator plug spring (DD). Remove both shift valve spring (W) and regulator plug spring (X). Remove shift valve spring (EE). Remove 3 shift valves (V), (FF) and (GG). Valves should be free to move from body by pushing on opposite ends against governor plugs with fingers.

(e) *Remove Governor Plugs* (fig. 123).

Remove 3 governor plugs (LL), bumping valve body on palm of hand, if necessary.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8922

**Figure 120 — Removing Compensator Valve Pin**

(f) *Remove Manual Valve* (fig. 123).

Position manual valve lever so that pin will allow manual control valve (L) to be removed, and remove valve (fig. 119).

(g) *Remove Throttle Lever Stop Plate* (fig. 123).

**SCREWDRIVER**

Remove 2 screws holding throttle lever stop plate (O) to valve body and remove plate.

(h) *Remove Compensator Valve Cover Plate.*

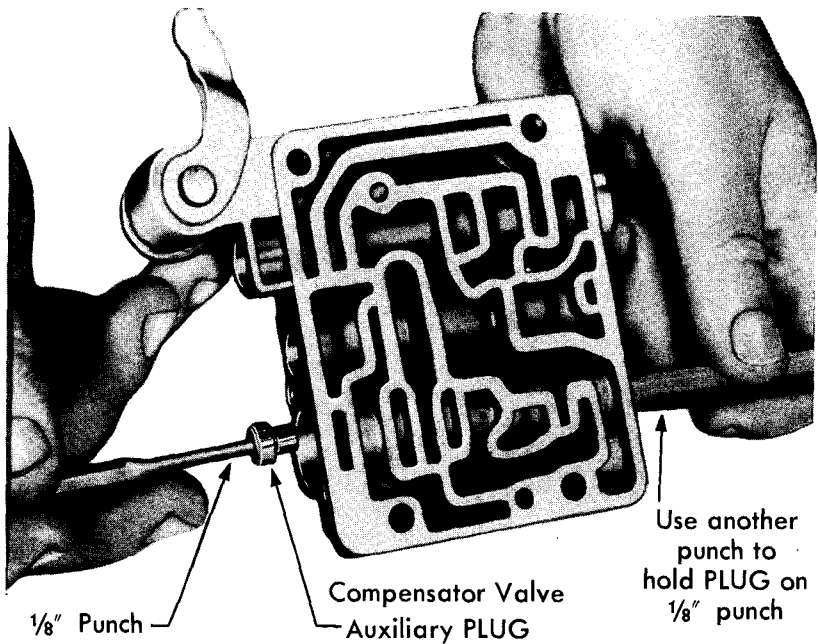
**SCREWDRIVER**

Remove 3 screws holding compensator valve cover plate ("D," fig. 123), to valve body, and remove cover plate.

(i) *Remove Throttle Valve, Double Transition Valve and Compensator Valve* (fig. 123).

Remove T-valve (N), spring (S), throttle valve (M), and detent plug (F). Remove double transition valve (R) and remove compensator valve (E).

## HYDRA-MATIC TRANSMISSION



RA PD 8923

**Figure 121 — Removing Compensator Valve Auxiliary Plug**

(j) *Remove Compensator Valve Auxiliary Plug* (fig. 123).

PLIERS

PUNCH,  $\frac{3}{32}$ -in. (2)

Remove pin (T) holding compensator valve auxiliary plug (U) in place (fig. 120). Remove compensator valve auxiliary plug by inserting a  $\frac{1}{8}$ -inch punch in hole in plug and using another small punch to push plug from the valve body (fig. 121). **CAUTION:** Since this plug is short, be very careful not to let it drop from the punch and become lodged in valve body.

(3) **INSPECTION** (fig. 123).

(a) *Valve Body Castings, Cover Plates.*

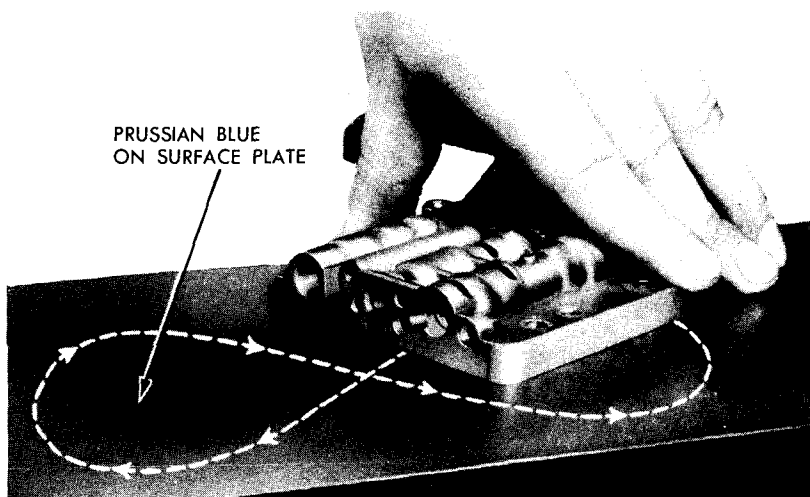
Clean all parts thoroughly in SOLVENT, dry-cleaning. Inspect both sections of valve body, end bodies, cover plates, and valves for nicks or burrs which might cause oil leakage or sticking (fig. 123). Remove any small burrs, using a very fine piece of CLOTH, crocus.

(b) *Valves.*

**CAUTION:** When removing burrs on valves, do not round off shoulders on valves as sharp corners are necessary for proper operation. Insert all valves and plugs, one at a time, in their proper bores and



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 9228

**Figure 122 — Checking Valve Body for Warp**

check to see that valves operate freely. If valves or plugs stick, recheck for nicks or burs.

(c) *Throttle Valve Springs* (fig. 123).

Check free length of throttle valve spring (S). Free length should be from  $\frac{29}{32}$  inch to  $\frac{15}{16}$  inch. Compress throttle valve springs to  $\frac{5}{8}$  inch and measure pressure while compressed. Pressure should be from 6.29 to 6.51 pounds.

(d) *Shift Valve Springs* (fig. 123).

Check free length of regulator plug spring (DD). Free length should be  $1\frac{15}{16}$  inches. Compress first and second shift valve spring to  $\frac{27}{32}$  inch, and measure pressure while compressed. Pressure should be from 2.6 to 2.7 pounds. Check free length of regulator plug spring (X). Free length should be  $1\frac{7}{16}$  inches. Compress regulator plug spring to  $\frac{5}{8}$  inch, and measure pressure while compressed. Pressure should be from 4.1 to 4.75 pounds. Check free length of shift valve spring (W). Free length should be  $1\frac{61}{64}$  inches. Compress shift valve spring to  $\frac{25}{32}$  inch, and measure pressure while compressed. Pressure should be from 1.9 to 2.1 pounds. Check free length of shift valve spring (EE). Free length should be  $1\frac{1}{4}$  inches. Compress shift valve spring to  $\frac{5}{7}$  inch, and measure pressure while compressed. Pressure should be from 12.5 to 13.2 pounds.

**HYDRA-MATIC TRANSMISSION***(e) Valve Body, Lower Section.*

Lay lower section of control valve body on a surface plate coated with PRUSSIAN BLUE, with surface on body which contacts separator plate next to surface plate and check to see that valve body is flat. If body is warped, it may be lapped flat with a piece of very fine CLOTH, crocus (fig. 122).

*(f) Valve Body, Upper Section.*

Lay upper section of control valve body on a surface plate, coated with PRUSSIAN BLUE, with surface on body which contacts separator plate next to surface plate and check to see that valve body is flat. If body is warped slightly, it may be lapped flat with a piece of very fine CLOTH, crocus. NOTE: Surface plate must be perfectly clean and cloth free from dirt.

**(4) ASSEMBLY (fig. 123).***(a) Compensator Valve Auxiliary Plug.***HAMMER****PUNCH,  $\frac{3}{32}$ -in.**

Body castings should be washed and blown out before beginning assembly. Clean each part and install immediately. Do not assemble parts that have been exposed several minutes in open air. Carefully assemble compensator valve auxiliary plug (U, fig. 123) into valve body, using a small pin punch (fig. 121), pinning in place with pin (T, fig. 123).

*(b) Install Throttle Valve, Compensator Valve and Double Transition Valve (fig. 123).*

Install throttle valve (M), valve spring (S), and T-valve (N). Install compensator valve (E), and double transition valve (R), and check assembly for freeness.

*(c) Install Compensator Valve Cover Plate.***SCREWDRIVER**

Position compensator valve cover plate (D) on valve body and install 3 mounting screws.

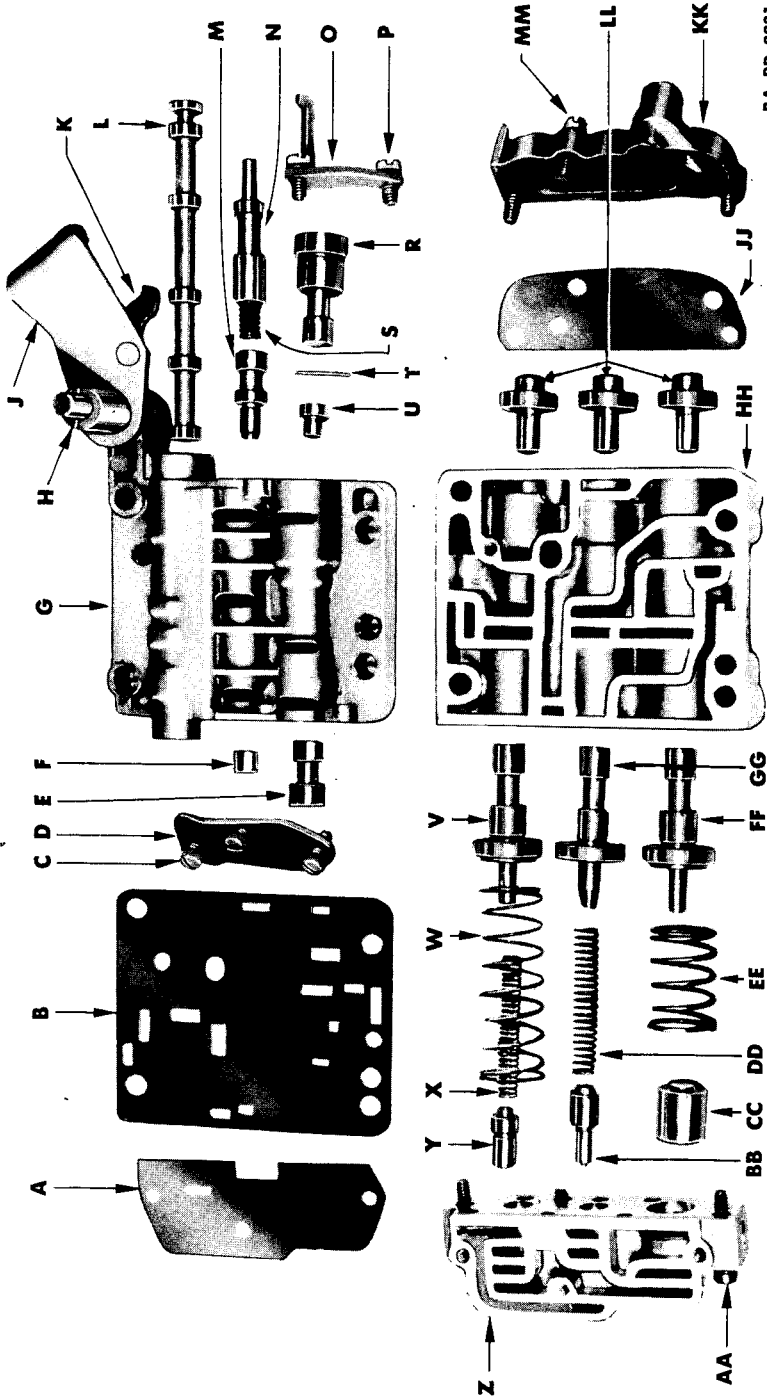
*(d) Install Throttle Lever Stop Plate.***SCREWDRIVER**

Position throttle stop plate (O) on valve body, making sure throttle lever is inside stop. Install 2 screws holding throttle stop plate to valve body.

*(e) Install Manual Valve.*

Position manual valve in valve body and move manual valve lever so that operating pin engages groove in manual valve.

ORDNANCE MAINTENANCE—HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8881

Figure 123 — Control Valve Body, Disassembled

## HYDRA-MATIC TRANSMISSION

A — PLATE	U — PLUG
B — PLATE	V — VALVE
C — SCREW	W — SPRING
D — PLATE	X — SPRING
E — VALVE	Y — PLUG
F — PLUG	Z — BODY
G — BODY	AA — SCREW
H — SEAL	BB — PLUG
J — LEVER, ASSEMBLY	CC — PLUG
K — LEVER, ASSEMBLY	DD — SPRING
L — VALVE	EE — SPRING
M — VALVE	FF — VALVE
N — VALVE	GG — VALVE
O — PLATE	HH — BODY
P — SCREW	JJ — PLATE
R — VALVE	KK — COVER
S — SPRING	LL — PLUG
T — PIN	MM — SCREW

RA PD 8881B

Legend for Figure 123 — Control Valve Body, Disassembled

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

(f) *Assemble Control Valve Body Inner Casting Components* (fig. 123).

**SCREWDRIVER**

*1. Governor pipe end.*

Install governor plugs (LL) in valve body. Position separator plate (JJ) and governor pipe end cover (KK) on valve body. **NOTE:** Make sure separator plate is installed with holes in line with passages in end cover. Install 3 screws holding governor pipe end cover and separator plate to valve body.

*2. Regulator plug end.*

Install first and second (BB); second and third (Y) and third and fourth (CC) regulator plugs in regulator plug body (Z), making sure all parts have a free sliding fit.

*3. Control valve body.*

Install first and second shift valve (GG); second and third shift valve (V); third and fourth shift valve (FF) in valve body, checking each assembly for freeness. Install regulator plug spring (DD); shift valve spring (W) and spring (X), and shift valve spring (EE) in valve body. Position regulator plug body (Z) with plugs in place on valve body. Make sure valve springs register with holes in body. Install 3 screws holding regulator plug body to valve body.

*4. Inner and outer casting assemblies.*

**SCREWDRIVER**

Position cover plate (A) on regulator body and install 3 mounting screws. Position separator plate (B) and outer casting of valve body on inner casting and install 2 mounting screws.

**16. ASSEMBLY OF TRANSMISSION AND TRANSMISSION CONTROL UNIT INSTALLATION.**

**a. Equipment.**

**CHISEL**

**COMPRESSOR, A266328**

**FIXTURE, holding, B226780**

**HAMMER**

**HOLDER, drum, A266232**

**INSTALLER, oil seal,**

**A266335**

**PLIERS, snap ring, A266329**

**PRESS, hydraulic**

**SCREWDRIVER**

**WRENCH, spanner, A266336**

**WRENCH, box-end, 9/16-in.**

**WRENCH, deep socket, 1 7/16-in.**

**WRENCH, open-end, 1/2-in.**

**WRENCH, open-end, 1 1/16-in.**

**WRENCH, open-end, 2 5/32-in.**

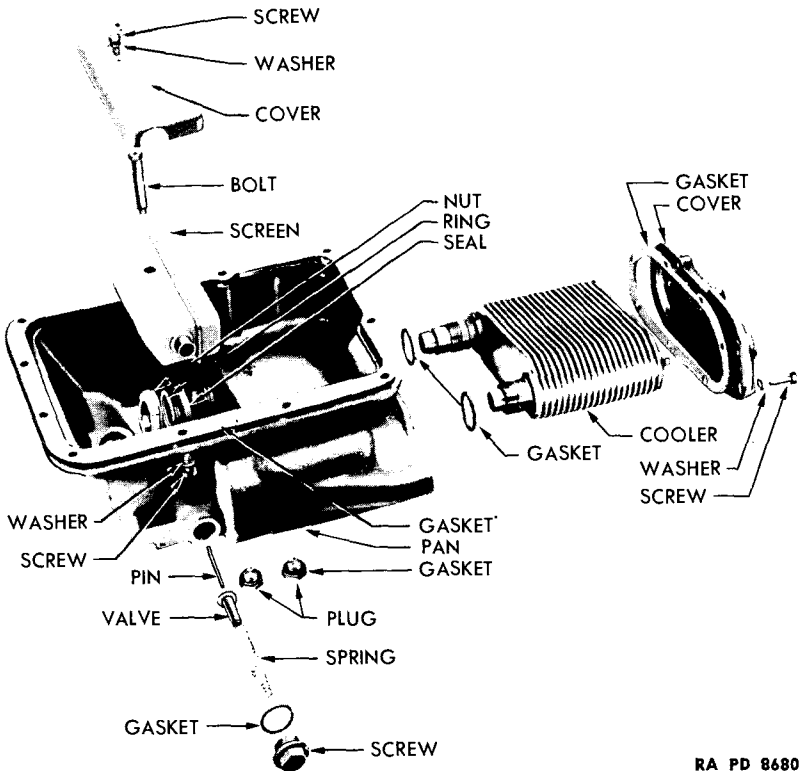
**WRENCH, socket, 7/16-in.**

**WRENCH, socket, 9/16-in.**

**WRENCH, socket, 5/8-in.**

**WRENCH, socket, 3/4-in.**

**WRENCH, socket, 7/8-in.**

**HYDRA-MATIC TRANSMISSION**

RA PD 8680B

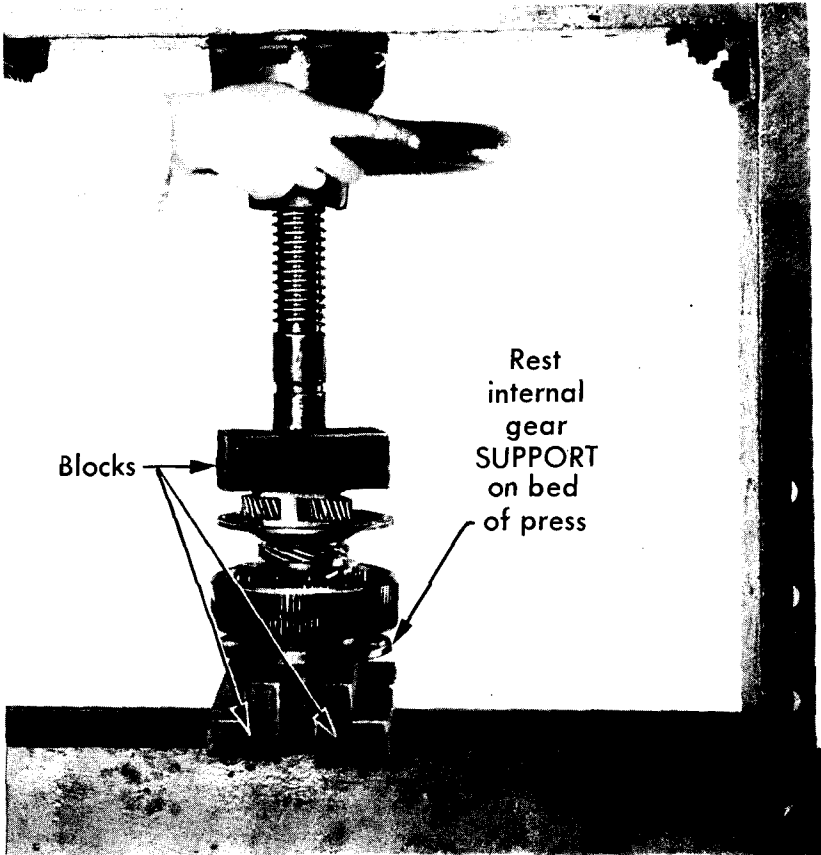
**Figure 124 — Oil Pan and Oil Cooler, Disassembled****b. Assembly Procedure.****(1) INSTALL CENTER GEAR.****PLIERS**, snap ring, A266329

Install first the bronze and then the steel thrust washer on driven shaft nest to the planet carrier (fig. 103). Assemble reverse unit center gear and drive flange and install retaining ring. **NOTE:** Concave side of drive flange should extend over end of center gear. Install center gear and drive flange unit on driven shaft with drive flange toward rear unit planet carrier. Install snap ring holding center gear on driven shaft (fig. 102).

**(2) INSTALL PLANET CARRIER GEAR ASSEMBLY.****PLIERS**, snap ring, A266329

Install reverse unit planet carrier assembly on driven shaft and mesh planet pinions with center gear. Install a new ball bearing in internal reverse gear support. Place reverse unit internal gear over internal reverse gear support. Install snap ring holding gear on support (fig. 101).

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

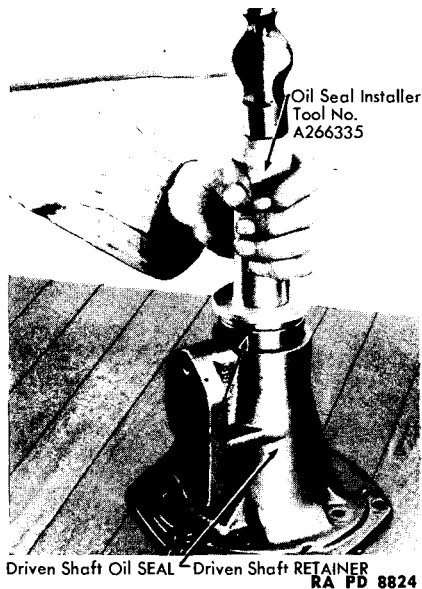


RA PD 8604

**Figure 125 — Assembling Reverse Unit on Driven Shaft**

**(3) INSTALL DRIVEN SHAFT.**  
**PRESS, hydraulic**

Place reverse internal gear and support assembly on driven shaft so that gear teeth on internal gear begin to mesh with planet pinions. Place reverse internal unit assembly in a hydraulic press with internal gear support bearing on bed of hydraulic press and press reverse unit internal gear and support into place on driven shaft (fig. 125). **CAUTION:** Press on inner race of bearing only. Install rear bearing retainer in a hydraulic press with large face of retainer on bed of hydraulic press and press rear bearing into retainer. **CAUTION:** Press on *outer* race of bearing only.

**HYDRA-MATIC TRANSMISSION**

**Figure 126 — Installing Driven Shaft Oil Seal**

- (4) **ASSEMBLE REVERSE UNIT.**  
**INSTALLER**, oil seal, A266335  
**WRENCH**, socket,  $\frac{9}{16}$ -in.

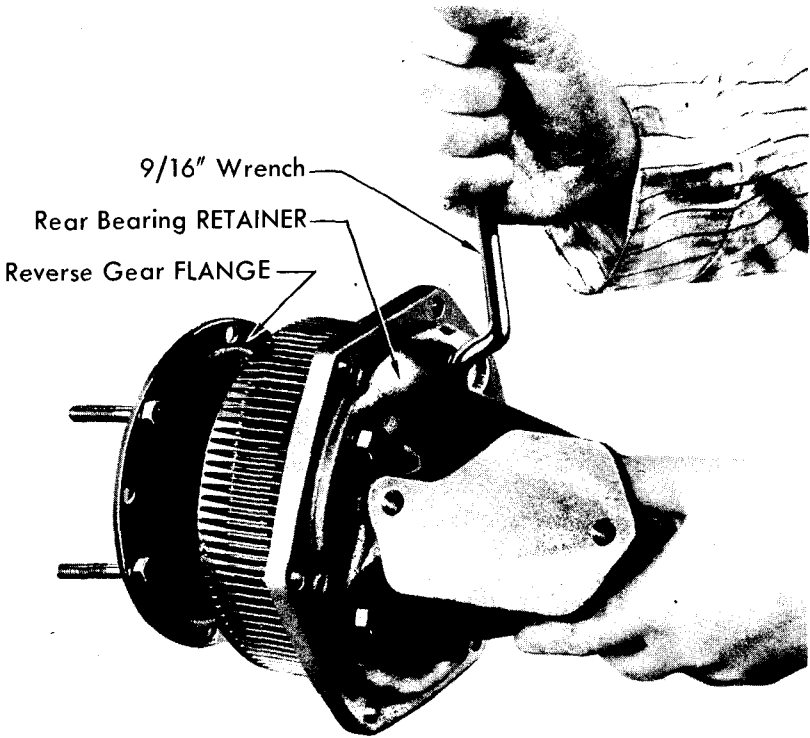
Install a new rear oil seal in rear bearing retainer over rear bearing (fig. 126). Install rear bearing spacer on driven shaft. Slide rear bearing retainer and rear bearing assembly over driven shaft on reverse unit assembly, making sure that mounting screw holes in housing line up with screw holes in reverse internal gear support. Install 5 screws and copper washers holding rear bearing retainer to reverse internal gear support (fig. 127). **NOTE:** Dip screws in sealer before installation. Slide 4 screws and lock washers holding reverse unit drive flange to rear unit drum into place on screw holes in drive flange. Lay reverse unit aside and proceed to assemble front and rear planetary units.

- (5) **INSTALL CLUTCH ASSEMBLY AND INTERMEDIATE SHAFT.**  
**FIXTURE**, holding, B226780

Place intermediate shaft in holding fixture with front end of intermediate shaft in fixture. Install front unit brake drum on intermediate



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

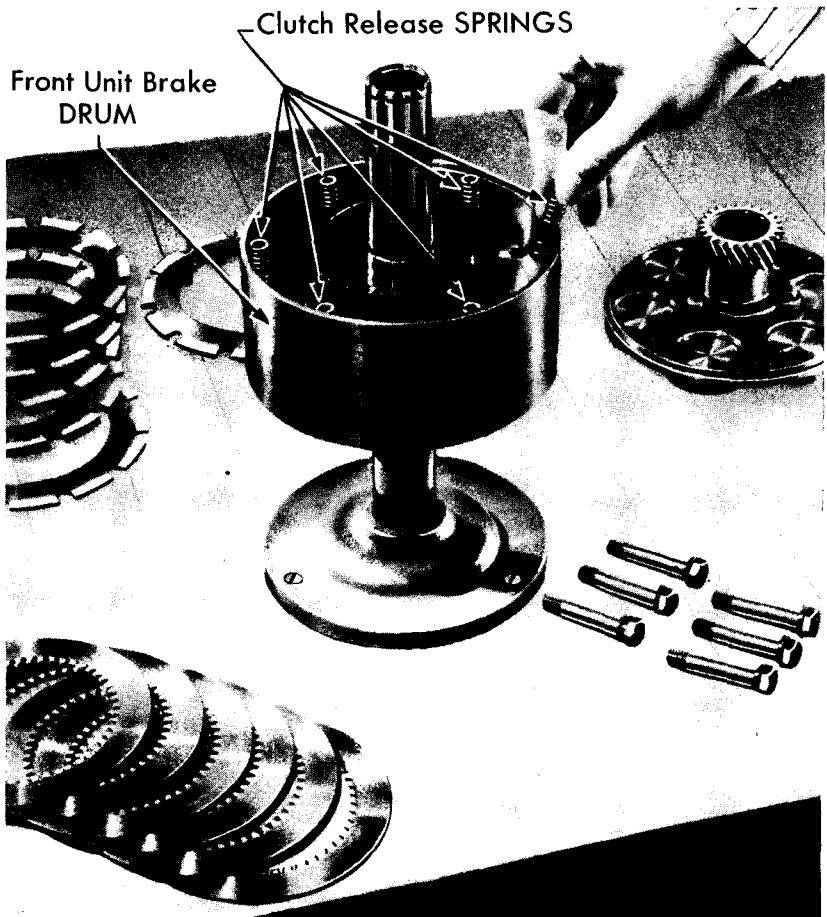


RA PD 8601

**Figure 127 — Installing Rear Bearing Retainer Screws**

shaft. **CAUTION:** Machined surface of internal flange on drum should point toward top. Install 6 front unit clutch release springs in spring holes in front unit brake drum (fig. 128). Install front unit driven and driving clutch plates, starting with a bronze plate first, laying it over splines on clutch hub. Then, install a steel plate, after noting direction of "cone," with round slots in plate over clutch release springs. Install bronze and steel plates alternately until all are installed (fig. 129). **CAUTION:** "Cone" of all steel clutch plates must point the same direction. Install clutch pressure plate over top bronze clutch plate in brake drum, being careful to see that clutch release springs engage in spring seats in pressure plate.

## HYDRA-MATIC TRANSMISSION



RA PD 8589

**Figure 128 — Installing Front Unit Clutch Springs**

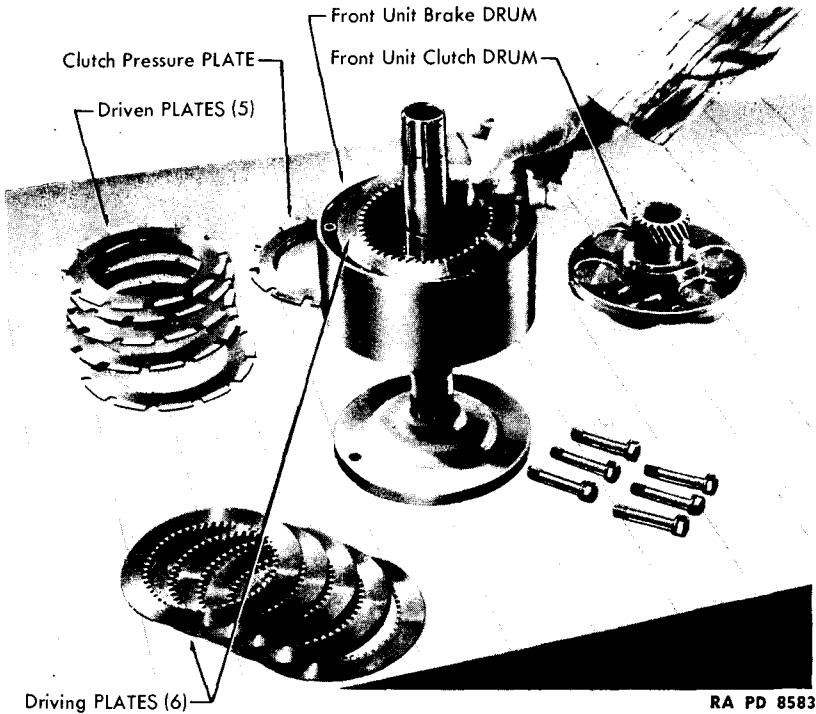
**(6) INSTALL FRONT UNIT CLUTCH DRUM.**

**HOLDER**, drum, A266232

**WRENCH**, socket,  $\frac{1}{16}$ -in.

Install 6 front unit clutch pistons and rings in clutch cylinders in front unit clutch drum. **NOTE:** Use particular care to avoid damaging piston rings when compressing them into cylinders in clutch drum. Install front unit clutch drum over intermediate shaft with center gear pointing downward. Rotate clutch drum clockwise and counterclockwise to engage center gear with planetary gears. **NOTE:** Be sure to line up clutch drum mounting screw holes with square notches in steel clutch plates, and to line up boss in clutch drum with rabbet in brake drum. Install 6 screws.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 129 — Installing Front Unit Clutch Plates**

and lock washers that hold clutch drum to brake drum, keeping drum from turning with holder (fig. 130).

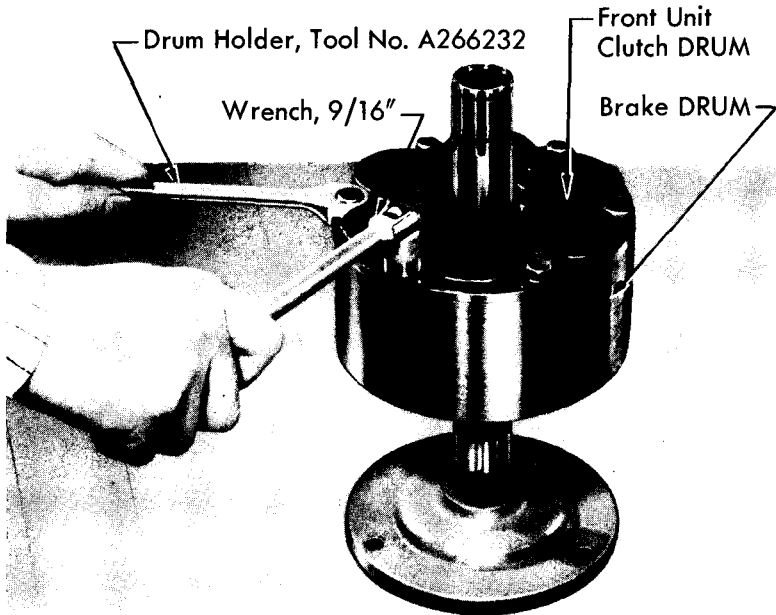
**(7) INSTALL OIL DELIVERY SLEEVE.**

**COMPRESSOR, A266328  
HAMMER**

**PLIERS, snap ring, A266329**

Install first the bronze and then the steel thrust washers over upper end of intermediate shaft. **CAUTION:** Make sure that lug on inside diameter of steel thrust washer lines up with slot on intermediate shaft. Install snap ring holding thrust washers on intermediate shaft. Slide oil delivery sleeve over end of intermediate shaft. Oil rings closest to end of oil delivery sleeve ring should be next to front unit clutch drum. Compress lower set of oil rings on oil delivery sleeve, and tap lower end of oil delivery sleeve ring into front unit clutch drum (fig. 131). **CAUTION:** Tap very lightly. Install snap ring holding oil delivery sleeve on intermediate shaft.

**HYDRA-MATIC TRANSMISSION**



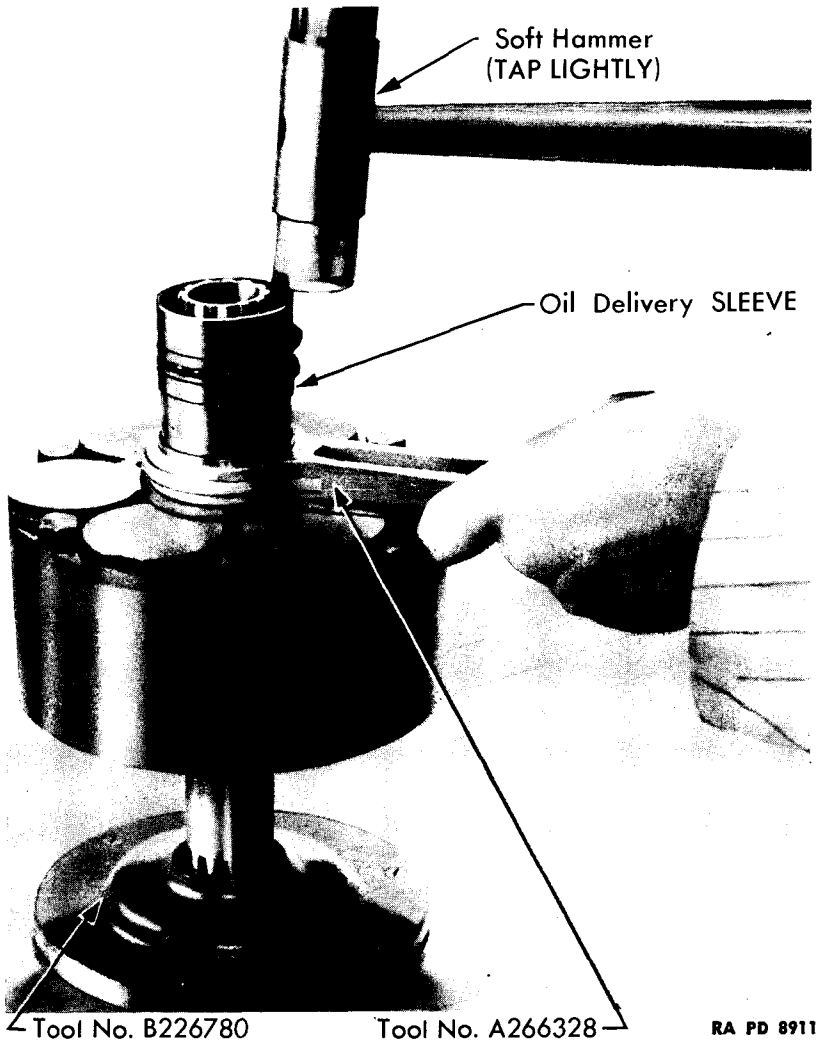
RA PD 8587

**Figure 130 — Tightening Front Unit Drum Screws**

**(8) INSTALL REAR UNIT CLUTCH DRUM.  
COMPRESSOR, A266328**

Install 6 clutch pistons in clutch cylinders in rear unit clutch drum, being very careful not to damage piston rings while compressing them into cylinders. Install compressor over upper set of oil rings on oil delivery sleeve and compress rings, locking tool in position on sleeve with ring on handle. Slip 6 rear unit clutch drum to brake drum mounting screws in screw holes in clutch drum. Install rear unit clutch drum and screws over end of intermediate shaft with clutch piston side of drum upward (fig. 132). Allow mounting screws to slide down onto front unit clutch drum. Press rear unit clutch drum over oil rings on oil delivery sleeve, pushing oil ring compressor downward. Unlock compressor and remove from oil delivery sleeve.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



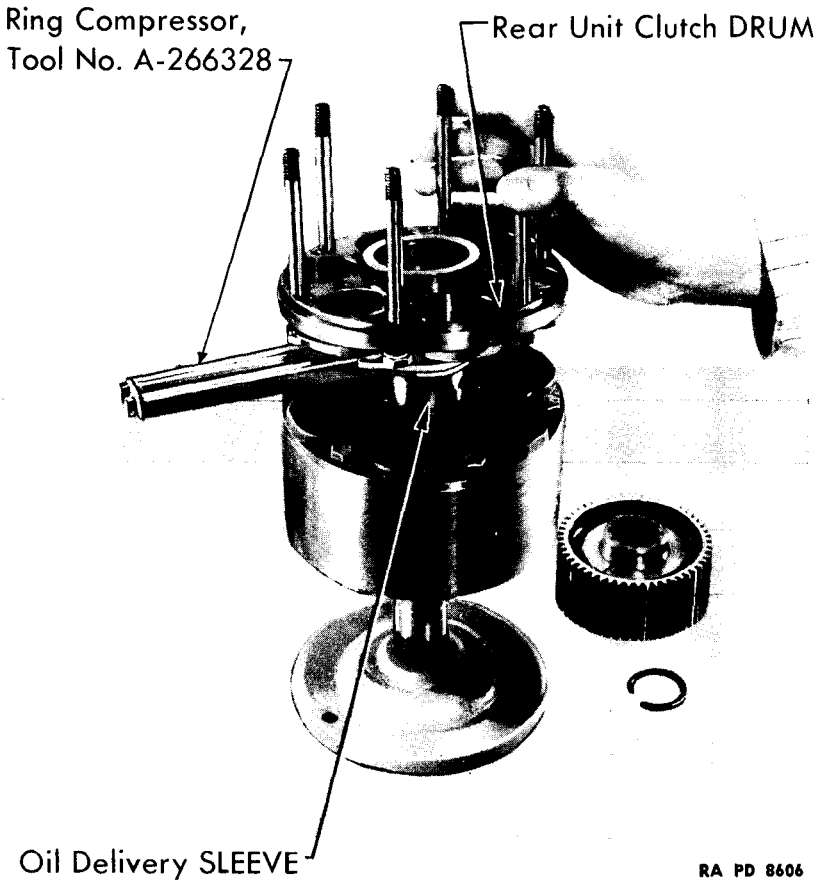
**Figure 131 — Installing Oil Delivery Sleeve**

**(9) INSTALL REAR UNIT CLUTCH HUB.**

**PLIERS**, snap ring, A266329

Install first the bronze thrust washer and then the steel thrust washer over the intermediate shaft and in place on boss on rear unit clutch drum (fig. 133). Install clutch hub over intermediate shaft. **CAUTION:** Convex end of hub should point downward (fig. 134). Install snap ring holding clutch hub on intermediate shaft.

## HYDRA-MATIC TRANSMISSION

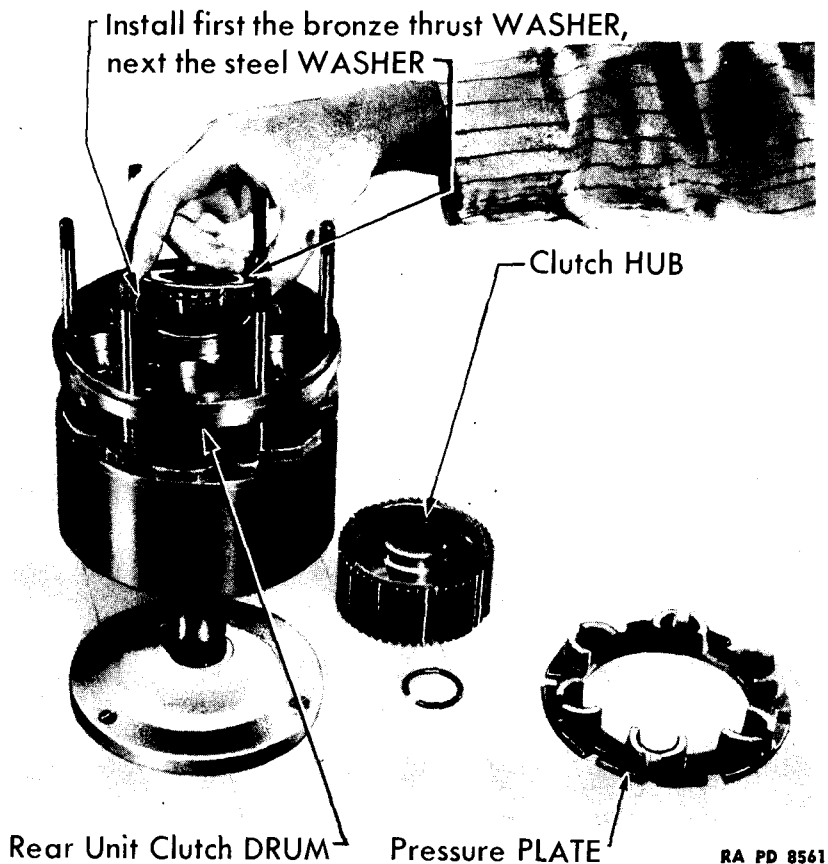


**Figure 132 — Installing Rear Unit Clutch Drum**

**(10) INSTALL CLUTCH PRESSURE PLATE AND CLUTCH PLATES.**

Install rear unit clutch pressure plate on rear unit clutch drum. **NOTE:** Lugs on pressure plate should rest on clutch pistons. Check a rear unit steel clutch plate to note in which direction it cones and install plate over clutch hub and onto pressure plate. **NOTE:** Square notches on steel plate should be around clutch drum mounting screws. Install a bronze clutch plate over steel clutch plate, engaging teeth on plate with teeth on clutch hub. Next, install a steel plate, making sure that the cone is in the same direction as the first steel plate. Continue installing bronze and steel clutch plates alternately until all are installed. **NOTE:** The last two steel plates will be next to each other.

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



**Figure 133 — Installing Clutch Hub Thrust Washers**

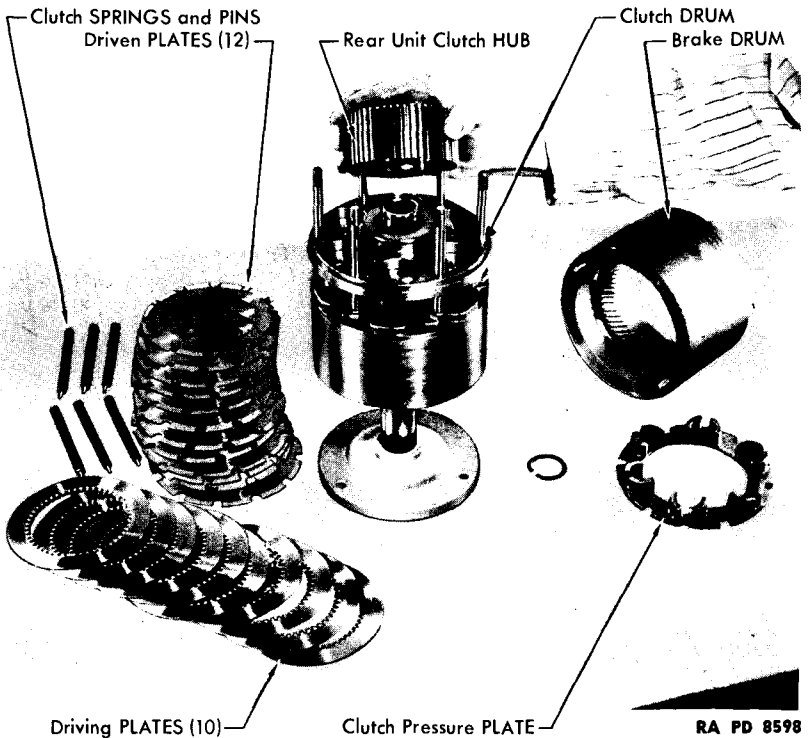
(11) INSTALL BRAKE DRUM AND INTERNAL GEAR.

HOLDER, drum, A266232

WRENCH,  $\frac{9}{16}$ -in.

Install rear unit internal gear in rear unit brake drum. Two studs on internal gear fit into *untapped holes without a counterbore* in brake drum. NOTE: Gear fits inside of drum with studs protruding from end of drum. Install rear unit brake drum over rear unit clutch assembly, lining up tapped holes in inner flange on brake drum with 6 rear unit clutch drum to brake drum mounting screws so that brake drum encloses clutch assembly. Tighten 6 screws holding rear unit clutch cover to brake drum (fig. 135). NOTE: Tighten screws evenly to pull boss on brake drum onto rabbet on clutch drum.

## HYDRA-MATIC TRANSMISSION



**Figure 134 — Installing Rear Unit Clutch Hub**

**(12) INSTALL CENTER BEARING CAP.**

Install 6 clutch release springs and spring guide pins in spring holes in rear unit brake drum (fig. 136). Remove front and rear unit assembly from fixture and slip front unit band (double wrap band) over front unit brake drum. **CAUTION:** Long anchor on band should be toward front of front unit. Install center bearing cap on intermediate shaft between front and rear unit clutch covers so that dowel pin in cap enters dowel hole in oil delivery sleeve.

**(13) INSTALL FRONT AND REAR PLANETARY UNITS.**

**CHISEL**

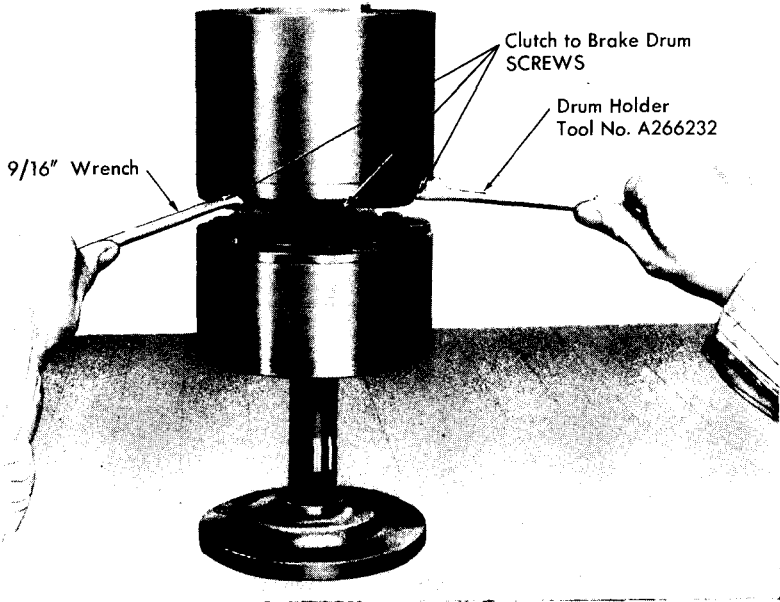
**WRENCH**, socket,  $\frac{5}{8}$ -in.

**HAMMER**, light

Install front and rear unit assemblies in transmission case by lowering front end of intermediate shaft into case first. Install a new center bearing cap mounting screw lock plate on cap and install 2 screws hold-

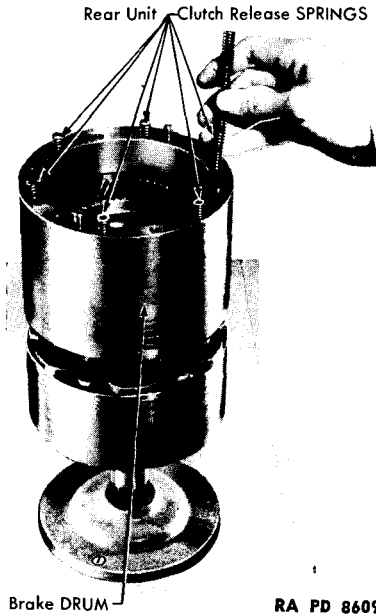


**ORDNANCE MAINTENANCE—HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8826

**Figure 135 — Tightening Rear Unit Drum Screws**

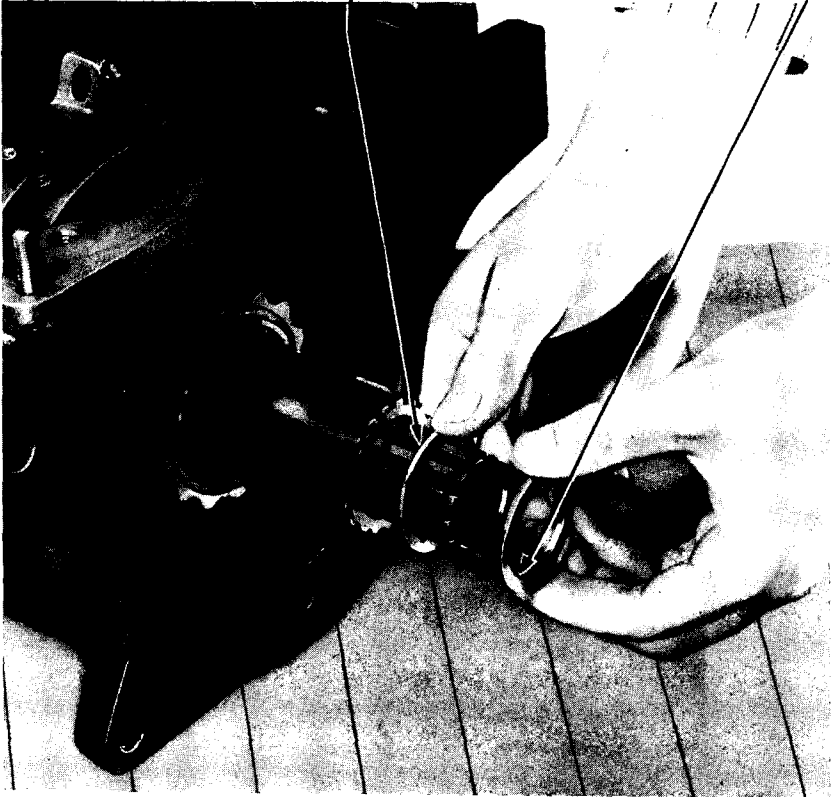


RA PD 8609

**Figure 136 — Installing Rear Unit Clutch Springs**

**HYDRA-MATIC TRANSMISSION**

Install first a bronze thrust WASHER, then a steel thrust WASHER



RA PD 8594

**Figure 137 — Installing Thrust Washers for Front Unit Drive Gear**

ing bearing cap to center bulkhead (fig. 85). Bend lock plate up around screws.

**(14) INSTALL FRONT UNIT DRIVE GEAR.**

**PLIERS**, snap ring, A266329

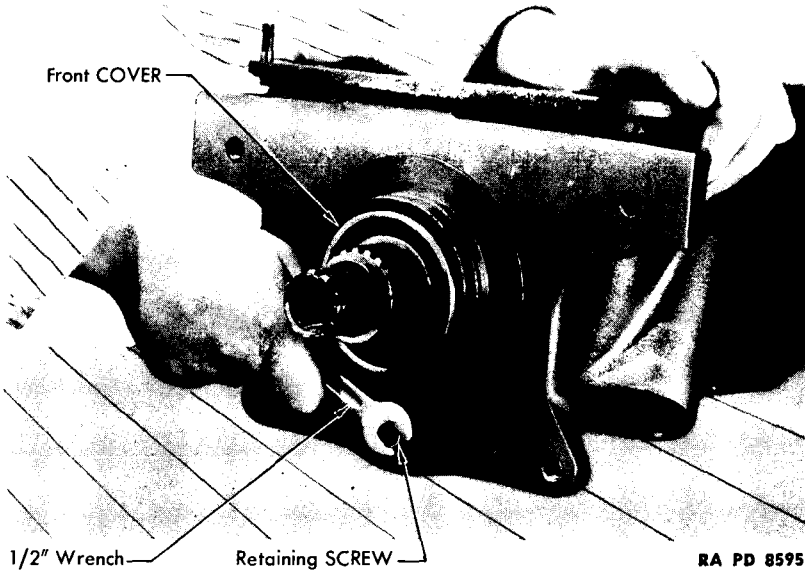
Install rear band around rear unit drum so that socket end of band lines up with rear unit band adjusting screw. Install front unit drive gear over front ends of main shaft and intermediate shaft, meshing internal gear teeth on drive gear with front unit planet pinions. Install first a bronze thrust washer and then a steel thrust washer over intermediate shaft next to front end of front unit drive gear (fig. 137). Install lock ring holding thrust washers on intermediate shaft.

**(15) INSTALL MAIN SHAFT.**

**HAMMER**

Place bronze thrust washer over transmission main shaft and position on planet carrier with a daub of grease. Install transmission main shaft

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 138 — Tightening Front Cover Screw**

through intermediate shaft from rear, meshing planet pinions on main shaft with internal gear on rear unit brake drum. Install snap ring holding main shaft in position at front of intermediate shaft. Install bronze thrust washer in large end of front unit drive gear.

**(16) INSTALL FRONT COVER.**

**INSTALLER**, front cover oil seal, B226782      **WRENCH**, open-end, 1/2-in.

Install front cover with a new oil seal and gasket over front unit drive gear on front of case, lining up marks that were made on the case at the time of disassembly. **CAUTION:** Be very careful while compressing oil rings on front unit drive gear into hub of cover. Install screw and copper washer holding front cover on transmission case.

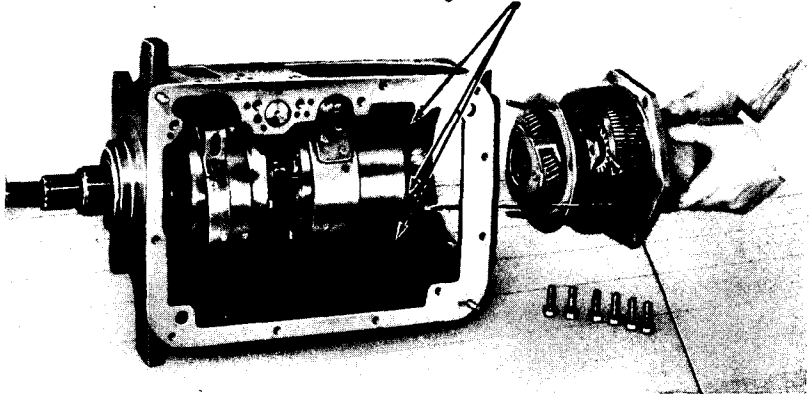
**(17) INSTALL REVERSE UNIT.**

**HOLDER**, drum, A266232      **WRENCH**, socket, 9/16-in.  
**WRENCH**, open-end, 1/2-in.

Install a new rear bearing retainer to transmission case gasket on housing. Install reverse unit assembly on rear end of transmission case (fig. 139), so that screws holding reverse unit drive flange to rear unit

**HYDRA-MATIC TRANSMISSION**

1. Make sure clutch release SPRINGS and guide PINS are installed



2. Lift reverse UNIT assembly into transmission CASE

RA PD 8596

**Figure 139 — Installing Reverse Unit**

brake drum line up with corresponding holes in drum. **NOTE:** Revolve driven shaft and main shaft to facilitate meshing planet pinions on driven shaft with internal gear on main shaft. Install 6 screws and washers holding rear bearing retainer to transmission case. **NOTE:** Two screws on bottom of housing have copper washers. Tighten 4 screws holding reverse unit drive flange to rear unit brake drum using drum holder. **NOTE:** Tighten screws evenly to draw flange into rabbet in brake drum. Install 2 nuts and lock washers holding reverse unit drive flange to studs in rear unit internal gear, using drum holder.

**(18) CHECKING MAIN SHAFT END PLAY.**

INDICATOR, dial

SCREWDRIVER

ROD, dial indicator extension,

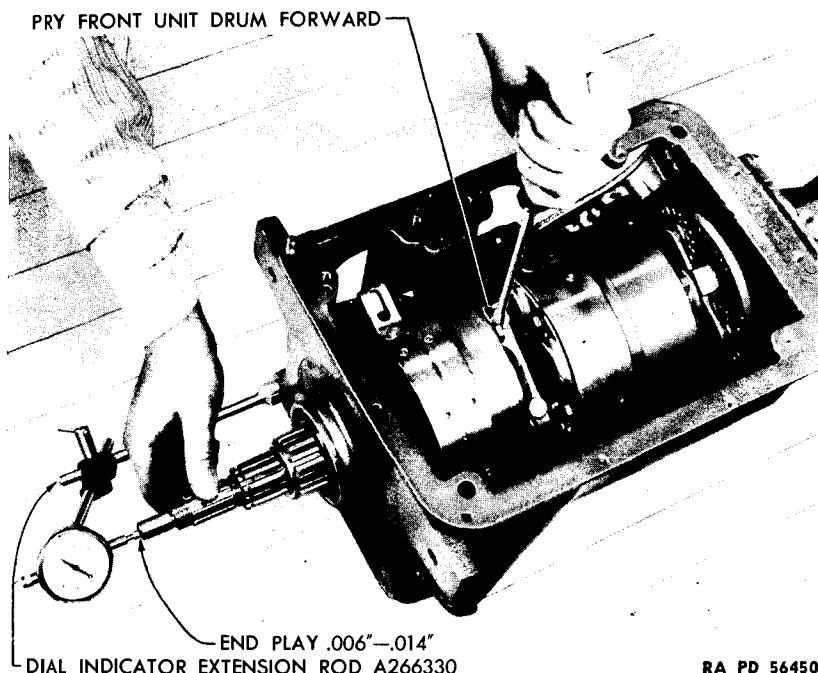
A266330

Place dial indicator against end of main shaft, mounting in place (fig. 140). Insert a screwdriver between front drum and center bearing cap, holding planetary units forward. Move main shaft back and forth. End clearance should be 0.006 inch to 0.014 inch. If end clearance is beyond these limits, proceed as follows: Remove reverse gear assembly and main shaft from transmission case. Remove or add 0.010-inch shims as required between the 2 bronze faced steel spacing washers to bring end play within limits. Install main shaft and reverse gear assembly.

**(19) INSTALL REAR PUMP AND GOVERNOR.**

WRENCH, socket, ½-in.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 140 — Checking Main Shaft End-play**

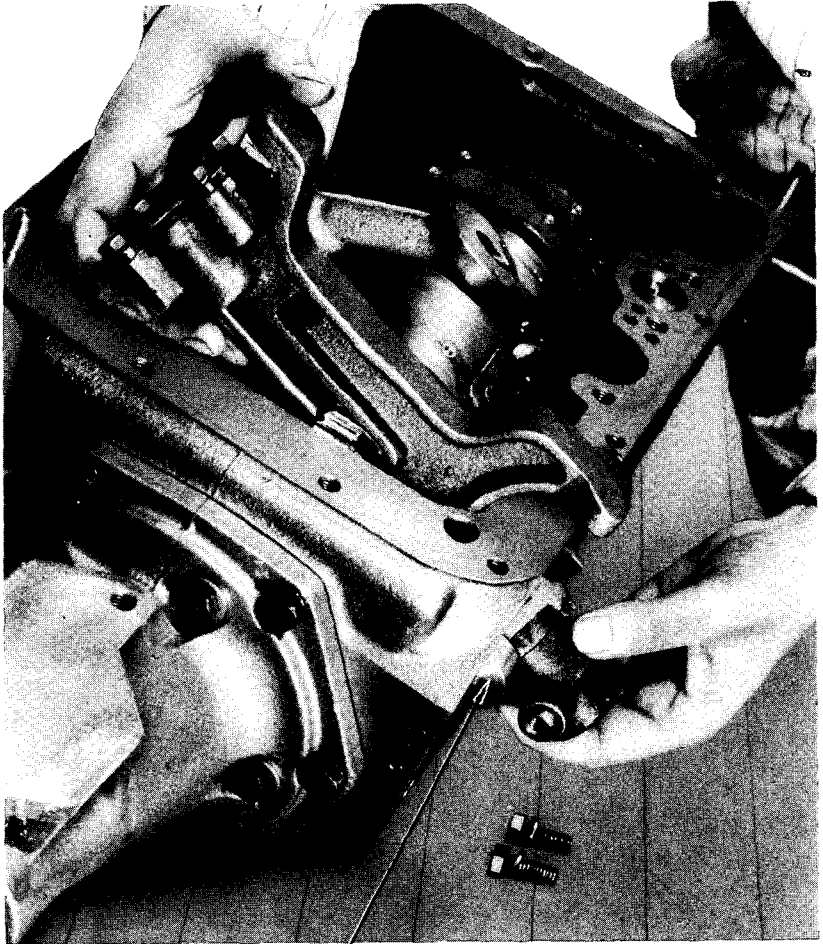
Install rear oil pump and governor in transmission case. **NOTE:** Turn large round governor weight toward rear of case to obtain room to install governor (fig. 141). Install 2 screws and lock washers holding rear oil pump and governor to transmission case.

**(20) CHECK GOVERNOR RUNOUT.**

**INDICATOR**, dial

**WRENCH**, socket,  $\frac{7}{16}$ -in.

Mount dial indicator on side of transmission case so that spindle rests against governor sleeve (fig. 142). Rotate transmission driven shaft by hand, several revolutions. Total runout shown on indicator should not exceed 0.005 inch. If runout is too great, mark position of governor body on drive flange, and remove governor body by taking out 2 cap screws. Relocate dial indicator so that spindle rests against governor drive flange (fig. 143). Again rotate driven shaft several revolutions and observe runout. If runout of drive flange exceeds 0.002 inch replace drive flange and oil pump drive shaft. If it is less than 0.002 inch reinstall governor body on flange 180 degrees from original position. Then check runout of gov-

**HYDRA-MATIC TRANSMISSION**

Turn Large Weight to Rear — and Insert Governor End First

RA PD 8590

**Figure 141 — Installing Rear Pump and Governor**

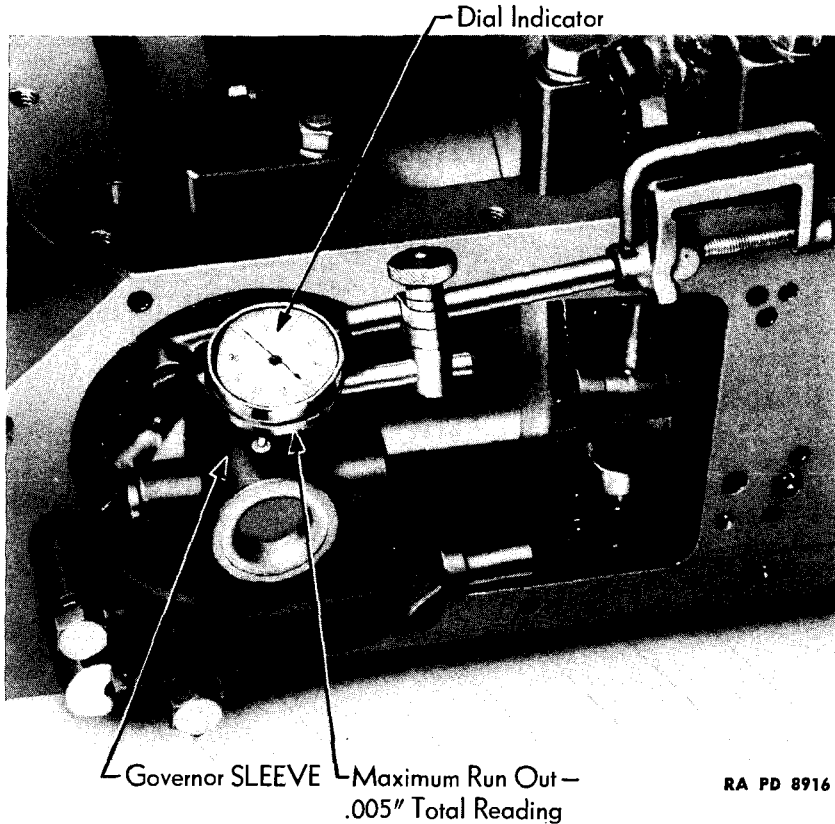
error sleeve again. If it still exceeds 0.005 inch, replace governor body and sleeve.

(21) **INSTALL FRONT PUMP AND SERVO AND REAR SERVO.**

**WRENCH**, socket,  $\frac{9}{16}$ -in.

Tighten front and rear unit band adjusting screws enough to slip band anchors over ends of screws. Install 2 short oil pipes connecting front and rear servos, in both units. Position front pump and servo and rear servo on transmission case, making sure that piston rod on front servo and toggle on rear servo are engaged on front and rear band brackets

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8916

**Figure 142 — Checking Governor Runout**

and also that dowels on front servo enter holes in transmission case (fig. 77). Install 4 screws and lock washers holding front pump and servo and rear servo assembly to transmission case. Adjust front and rear bands as explained in paragraph 10 c.

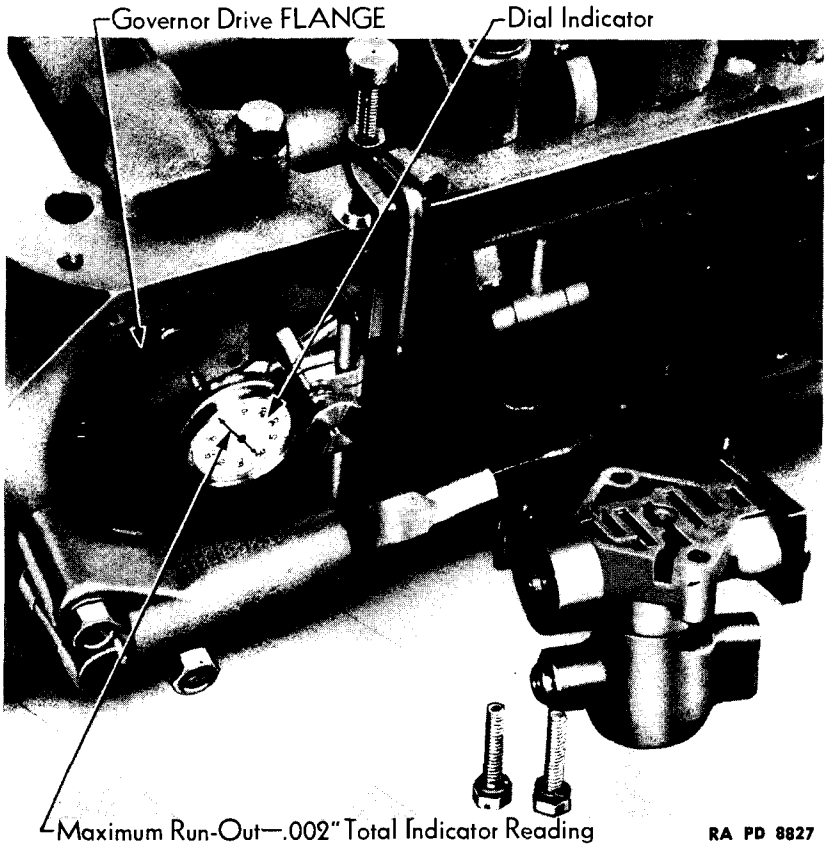
**(22) INSTALL OIL PRESSURE REGULATOR VALVE BODY.**

**WRENCH**, open-end,  $\frac{25}{32}$ -in.      **WRENCH**, socket,  $\frac{7}{16}$ -in.

Install oil pressure regulator valve in oil pressure regulator valve body. Install fitting over shuttle valve in oil pressure regulator valve body. Position large and small oil pipes in pipe holes in transmission front cover. Install oil pressure regulator valve body in front oil pump, engaging oil pipes in pipe holes on regulator body (fig. 74).

Install 3 screws holding oil pressure regulator valve body to front oil pump.

**HYDRA-MATIC TRANSMISSION**



**Figure 143 — Checking Governor Drive Flange Runout**

**(23) INSTALL REGULATOR VALVE SPRING.**

Insert oil pressure regulator valve spring retainer in spring, and install assembly between end of oil pressure regulator valve and rear servo (fig. 74).

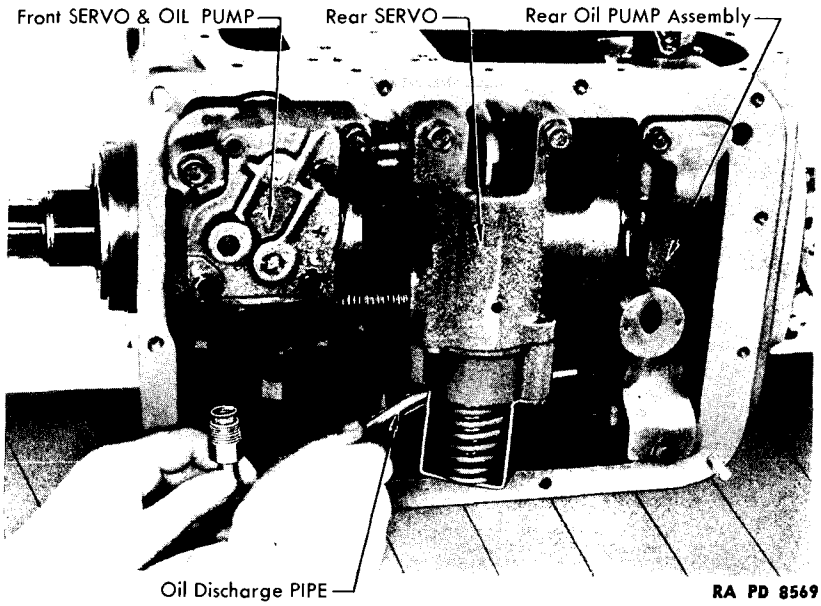
**(24) INSTALL OIL INTAKE AND DISCHARGE PIPES.**

**SCREWDRIVER**, small                      **WRENCH**, open-end,  $\frac{25}{32}$ -in.  
**WRENCH**, open-end,  $\frac{11}{16}$ -in.

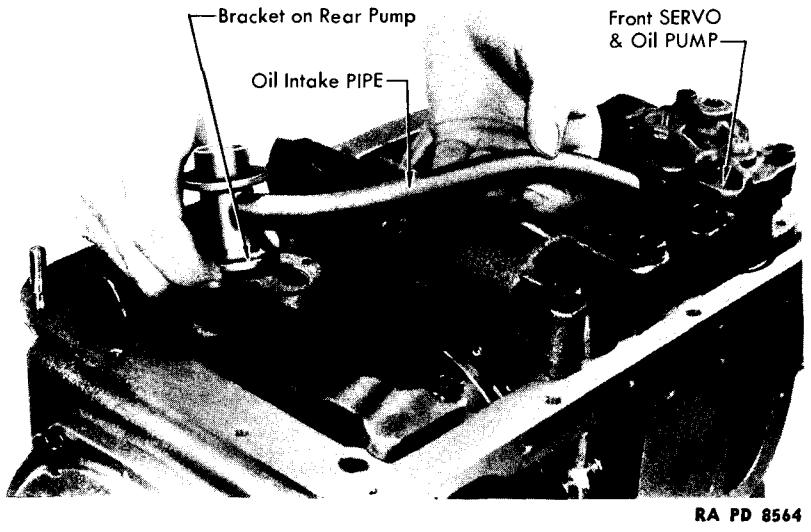
Insert rear end of oil discharge pipe in rear oil pump and connect fitting on front end of pipe with fitting on oil pressure regulator valve body. Position a new oil intake pipe gasket on intake flange of rear oil pump. Insert front end of oil intake pipe in pipe hole in front oil pump and position rear end of pipe on intake flange of rear oil pump. Install 2



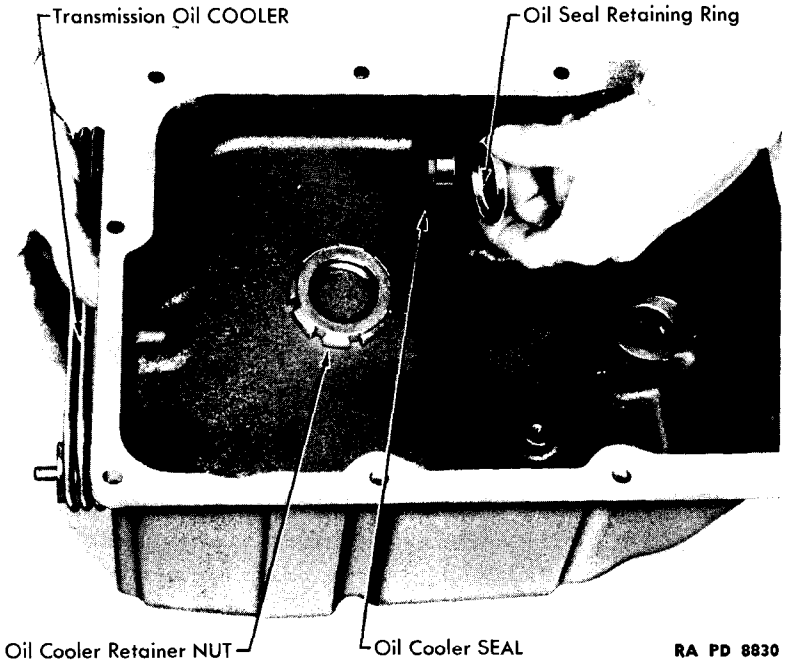
**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



**Figure 144 — Installing Oil Discharge Pipe**



**Figure 145 — Installing Oil Intake Pipe**

**HYDRA-MATIC TRANSMISSION**

**Figure 146 — Installing Oil Cooler Oil Seals**

screws and lock washers holding intake pipe to rear oil pump. Install neoprene rubber gasket on lower end of oil intake pipe (figs. 144 and 145).

**(25) INSTALL OIL COOLER UNIT.**

Install rubber composition water seals on oil intake and outlet pipes on oil cooler. Install oil cooler through opening in front of oil pan until end of long oil cooler pipe protrudes slightly through pipe hole in oil pan. **NOTE:** Long oil pipe on cooler should be toward right side of oil pan. Position oil seal, oil seal retainer, and spanner nut over end of long oil pipe (fig. 146). Push oil cooler the rest of the way into oil pan. Install oil seal, oil seal retainer, and spanner nut on short oil seal pipe, tightening spanner nut finger tight. Tighten spanner nut finger tight on long oil cooler pipe.

**(26) INSTALL OIL PAN FRONT COVER.**

**WRENCH**, socket, ½-in.

**WRENCH**, spanner, A266336

Position front oil pan cover and gasket on oil pan, lining up pinholes in cover with pins on front end of cooler. Install 8 screws and copper washers holding front cover to oil pan. Tighten spanner nut on each oil cooler pipe, using spanner wrench.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**(27) INSTALL OIL SCREEN.****WRENCH**, socket,  $\frac{7}{16}$ -in.**WRENCH**, socket,  $\frac{1}{2}$ -in.

Install oil screen in oil pan, sliding pipe on screen into counterbore in side of oil pan and short oil cooler pipe into large hole in screen. Install hollow head bolt holding oil pan screen to oil pan. Position oil screen cover over oil screen and install mounting screw and lock washer.

**(28) INSTALL OIL BYPASS VALVE.****WRENCH**, open-end,  $\frac{7}{8}$ -in.

Install oil bypass valve and plug assembly in side of oil pan and tighten plug. **NOTE:** Make sure fibre gasket is in place on plug (fig. 124).

**(29) INSTALL OIL PAN.****WRENCH**, open-end,  $\frac{1}{2}$ -in.**WRENCH**, socket,  $\frac{1}{2}$ -in.**WRENCH**, open-end,  $\frac{7}{8}$ -in.

Install water and oil drain plugs in oil pan. Position oil pan gasket on transmission case and install oil pan over studs on case. Install 9 screws and lock washers holding oil pan to case. Install 2 nuts and lock washers on oil pan mounting studs.

**(30) INSTALL REVERSE ANCHOR.****WRENCH**, socket,  $\frac{7}{16}$ -in.

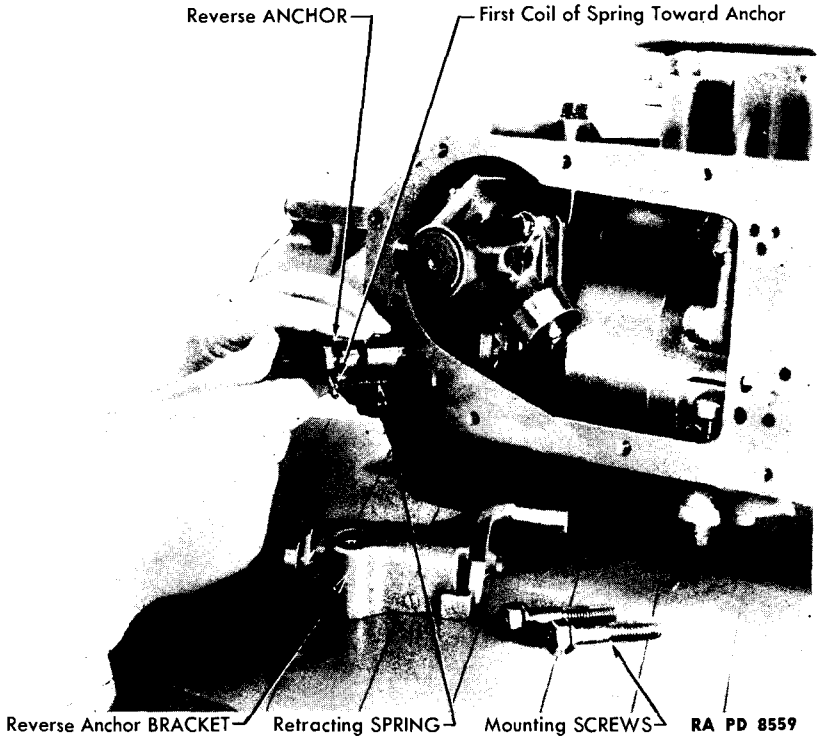
Install reverse anchor pawl retracting spring on pawl pin. **NOTE:** Outer loop of spring next to pin should be next to pawl. Install reverse anchor pawl and retracting spring in transmission case. Position reverse anchor crank in slot in pawl and install 2 screws holding reverse anchor bracket to transmission case (fig. 147).

**(31) INSTALL CONTROL VALVE BODY.****WRENCH**, socket,  $\frac{7}{16}$ -in.

Install 3 governor oil pipes in governor pipe casting on valve body. Position control valve body and oil pipes on side of transmission case and line up pipe holes in governor sleeve with pipes. Push valve body rearward connecting pipes with governor sleeve, and install 4 screws and lock washers holding valve body to case.

**(32) INSTALL SIDE COVER.****WRENCH**, socket,  $\frac{7}{16}$ -in.

Install steel washer and 2 composition oil seals on throttle control lever shaft. Position a new side cover gasket on transmission case. Check to make sure that oil pressure plug is in place in rear end of governor sleeve, and position side cover on transmission case. Install 11 screws and copper washers holding side cover to transmission case.

**HYDRA-MATIC TRANSMISSION**

**Figure 147 — Installing Reverse Anchor**

**(33) INSTALL CONTROL LEVERS ON SHAFT.**

**SCREWDRIVER**, cross-recess      **WRENCH**, open-end,  $\frac{7}{16}$ -in.

Install manual control lever on control lever shaft, lining up serrations on lever and shaft. Tighten lever clamp screw. Install throttle control lever on control lever shaft, lining up serration on lever and shaft. Tighten lever clamp screw.

**(34) INSTALL FLYWHEEL HOUSING.**

**WRENCH**, socket,  $\frac{3}{4}$ -in.

Position flywheel housing on front of transmission case and install 4 screws and lock washers holding housing to transmission case.

**(35) INSTALL TORUS MEMBERS.**

**PLIERS**, snap ring, A266329

Push flywheel cover on splines on front end of front unit drive gear being careful not to break seal ring in front cover. Push driving torus member on splines on front end of intermediate shaft and install lock ring holding driving member on intermediate shaft. Install driven torus member on splines on front end of main shaft.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**(36) INSTALL MAIN SHAFT NUT.**

**CHISEL  
HAMMER**

**WRENCH**, socket, deep,  $1\frac{7}{16}$ -in.

Move manual control lever (short lever) on transmission side cover all the way toward back to the reverse position (toward rear of transmission). Install a new main shaft nut lock plate and install main shaft nut. Bend main shaft nut lock plate up around nut.

**(37) CONNECT THROTTLE VALVE ROD.**

**PLIERS**

Connect throttle valve rod to throttle lever on transmission side cover and to throttle relay on flywheel housing.

**17. TRANSMISSION INSTALLATION IN VEHICLE.**

a. When the transmission is ready for installation in the vehicle, it is necessary that it be first installed on the engine so that both the engine and transmission may be installed in the vehicle at the same time.

**b. Equipment.**

**BOLT**, eye, A266327

**WRENCH**, open-end,  $\frac{3}{8}$ -in.

**CHISEL**

**WRENCH**, open-end  $\frac{7}{16}$ -in.

**HAMMER**, light

**WRENCH**, open-end,  $\frac{1}{2}$ -in.

**HOIST**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

**PLIERS**

**WRENCH**, open-end,  $\frac{5}{8}$ -in.

**PUNCH**, taper,  $\frac{1}{4}$ -in.

**WRENCH**, open-end,  $\frac{3}{4}$ -in.

**SCREWDRIVER**

**WRENCH**, open-end,  $\frac{7}{8}$ -in.

**SCREWDRIVER**, T-handle,

**WRENCH**, open-end,  $1\frac{1}{4}$ -in.

$\frac{7}{8}$ -in. blade,  $\frac{3}{32}$ -in. thick

**WRENCH**, socket,  $\frac{1}{2}$ -in.

**SLING**, engine, C107502

**WRENCH**, socket,  $\frac{9}{16}$ -in.

**SLING**, engine compartment cover, B226796

**WRENCH**, socket,  $\frac{5}{8}$ -in.

**SLING**, radiator, B226799

**WRENCH**, socket,  $1\frac{5}{16}$ -in.

**SOCKET**, torque wrench,  $\frac{1}{2}$ -in.

**WRENCH**, socket, 1-in.

**WRENCH**, open-end,  $\frac{5}{16}$ -in.

**WRENCH**, socket-head, set screw,  $\frac{3}{16}$ -in.

**WRENCH**, torque, 0-75 lb

**c. Transmission Installation on Engine.**

**(1) INSTALL TRANSMISSION.**

**BOLT**, eye, A266327

**WRENCH**, socket,  $\frac{1}{2}$ -in.

**PLIERS**

**WRENCH**, socket-head, set screw,  $\frac{3}{16}$ -in.

**WRENCH**, box-end,  $\frac{5}{8}$ -in.

**WRENCH**, open-end,  $\frac{7}{16}$ -in.

**WRENCH**, torque, 0-75 lb

**WRENCH**, open-end,  $\frac{7}{8}$ -in.

## HYDRA-MATIC TRANSMISSION

Install eye bolt in threaded hole in center of top of transmission case, connect hoist to transmission eye bolt and lift transmission into position behind engine. Line up dowel pins on rear end of crankcase with holes in flywheel housing, and slide transmission and flywheel housing onto dowel pins. Install 6 screws holding flywheel housing to crankcase. Tighten lower screws first, upper screws last to a torque tightness of 45 to 50 foot-pounds. **NOTE:** Make sure clip for carburetor drain pipe on first type engines is on proper bolt. Connect both transmission oil cooler pipes to oil pan. Insert a punch through a screw hole in flywheel cover to line up cover holes properly with flywheel holes and dowel pins, and install 30 screws holding flywheel cover to flywheel to a torque tightness of 20 to 25 foot-pounds. Remove eye bolt from transmission case and remove hoist.

### (2) INSTALL STARTER.

WRENCH, box-end,  $\frac{5}{8}$ -in.

Position starter on flywheel housing and install 2 mounting screws.

### (3) INSTALL FLYWHEEL DRAIN PLUG.

WRENCH, socket, 1-in.

WRENCH, socket-head, set screw,  $\frac{3}{16}$ -in.

Rotate flywheel by installing a 1-inch socket wrench on crankshaft pulley mounting screw and turning crankshaft until flywheel drain plug hole is toward bottom of engine. Install flywheel drain plug.

### (4) INSTALL FLYWHEEL HOUSING LOWER PAN.

WRENCH, socket,  $\frac{1}{2}$ -in.

Position flywheel housing lower pan on housing, and install 6 mounting screws.

### (5) CONNECT THROTTLE ROD.

PLIERS

Connect throttle rod from flywheel housing relay to distributor relay, and install cotter pins at both ends. **NOTE:** Transmission throttle linkage must be adjusted before engine is tested as explained in paragraph 10.

### (6) CONNECT CARBURETOR VENTILATING LINE.

WRENCH, open-end,  $\frac{7}{16}$ -in.

Slide carburetor ventilating and drain line (used on first type engines only) into clip on left side of flywheel housing, and connect line to carburetor.

## d. Transmission and Engine Installation in Vehicle.

### (1) CONNECT ENGINE SLING.

HOIST

WRENCH, socket,  $1\frac{5}{16}$ -in.

SLING, engine, C107502

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

Install 2 engine front support screws loosely in support. Connect engine sling traveler to a hoist and lift sling into position over engine. Hook rear end of sling under exhaust manifold connection. Install front end of sling over fan support mounting studs on engine front cover. Install both fan support mounting stud nuts and lock washers.

**(2) INSTALL ENGINE AND TRANSMISSION IN ENGINE COMPARTMENT.**

**HOIST**

**SLING, engine, C107502**

Lift engine into position over vehicle slightly to rear of engine compartment. **CAUTION:** Make sure that throttle rod from lower rear relay to upper rear relay is swung backward so that upper end is next to engine compartment rear door opening. Lower transmission end of engine as much as possible until traveler is at extreme front of sling (fig. 50). Lower engine into engine compartment until universal joint yoke on transmission output shaft is about even with center of engine compartment bulkhead opening. **NOTE:** Observe the following precautions.

(a) Watch distributor cap to make sure that it does not strike edge of hull roof.

(b) Make sure transmission filler pipe does not interfere with transfer unit oil cooler pipes.

(c) Make sure that rear corner of right cylinder head on left engine does not strike auxiliary power plant air cleaner pipe.

(d) Make sure that muffler does not strike lower edge of engine compartment door opening.

(e) Keep all wires and conduits as far back on engine compartment wall as possible.

(f) Keep engine toward side wall rather than toward center of engine compartment.

(g) Watch tachometer cable to see that it does not catch on engine. Continue lowering engine slowly, and begin to straighten it up and move forward in vehicle by pulling on universal joint yoke while working through bulkhead opening. Line up engine rear support bolts on transmission extension housing with bolt slots on engine support in fighting compartment, and pull engine forward until screws begin to enter slots in support. Line up engine front support bracket with dowels on engine support, and lower engine until support bracket engages with dowels on support. Continue lowering engine until outside rear engine support bracket is resting on engine support on hull side wall.

**(3) TIGHTEN ENGINE SUPPORTS.**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

**WRENCH**, socket,  $\frac{5}{8}$ -in.

**WRENCH**, socket,  $\frac{9}{16}$ -in.

## HYDRA-MATIC TRANSMISSION

Position engine ground strap on support and install 2 screws, nuts, and lock washers on each engine front support finger-tight, working through engine compartment rear doors. Tighten 2 engine rear support mounting screws on bracket on hull floor beneath Hydra-Matic transmission. Tighten 2 screws and nuts on each front support.

### (4) DISCONNECT ENGINE SLING.

WRENCH,  $1\frac{5}{16}$ -in.

Lower sling until hook on rear end can be disconnected from exhaust pipe connection. Raise hoist until sling is in almost a vertical position. Remove 2 fan support mounting stud nuts and washers holding sling to engine front cover, and lift sling from vehicle.

### (5) CONNECT PROPELLER SHAFT.

CHISEL

WRENCH, open-end,  $\frac{1}{2}$ -in.

HAMMER, light

Slide propeller shaft toward rear of vehicle until bearing caps on universal joint line up with yoke on rear of transmission. Install a new lock plate on each universal joint bearing cap, and install 2 screws and lock washers holding each bearing cap to yoke on rear of transmission. Bend locking plates up over universal joint bearing cap mounting screws.

### (6) INSTALL PROPELLER SHAFT HOUSING COVER.

WRENCH, open-end,  $\frac{9}{16}$ -in.

Position propeller shaft housing outer panel in place and install 6 mounting screws. Position propeller shaft housing cover in place over propeller shaft housing panels, and install 2 screws and lock washers on top and 2 screws and lock washers on side of propeller shaft housing cover.

### (7) CONNECT AND ADJUST MANUAL CONTROL LINKAGE.

Connect and adjust transmission manual control linkage as explained in paragraph 10 e.

### (8) INSTALL UPPER REAR RELAY CROSS SHAFT.

WRENCH, socket,  $\frac{1}{2}$ -in.

Position upper rear relay cross shaft and lever assembly on intake manifolds of both engines. Install 2 mounting stud nuts and lock washers holding each support to engine manifold. NOTE: Do not connect carburetor throttle linkage at this time.

### (9) INSTALL CARBURETOR AIR INTAKE PIPE.

PLIERS

WRENCH, socket,  $\frac{9}{16}$ -in.

Coat a new carburetor air intake pipe-to-engine compartment side wall gasket liberally with gasket paste, and position in place on mounting boss for carburetor air intake pipe on side wall. Position carburetor air intake pipe on top of carburetor and over gasket on engine compartment



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

side wall. Install 3 screws and lock washers holding intake pipe to side wall. Connect intake pipe to carburetor by tightening clamps on pipe.

**(10) CONNECT WIRES TO GAGE UNITS.**

**WRENCH**, open-end,  $\frac{3}{8}$ -in.

Connect oil pressure unit wire to unit on front of engine and install retaining nut. Connect wire to engine temperature indicator and install retaining nut. Snap wire connectors on pressure and temperature warning signal units, when used.

**(11) CONNECT GENERATOR WIRES.**

**SCREWDRIVER**

**WRENCH**, open-end,  $\frac{7}{16}$ -in.

Connect red generator wires to generator and yellow wire to filter, and install retaining screws.

**(12) CONNECT STARTER FEED CABLES AND CONDUITS.**

**PLIERS**

**WRENCH**, open-end,  $\frac{5}{8}$ -in.

**WRENCH**, open-end,  $\frac{7}{16}$ -in.

Connect starter feed cable and jumper cable to starter on right-hand engine. Connect conduit for right-hand starter relay at center junction box by connecting coupling. Connect left-hand starter relay conduit to outlet box on left-hand side wall by connecting coupling. Clip conduit in cleat in side wall.

**(13) CONNECT COIL WIRES.**

**SCREWDRIVER**

**WRENCH**, open-end,  $\frac{3}{8}$ -in.

Connect coil primary and secondary wires to distributor.

**(14) INSTALL AUXILIARY GENERATOR AIR CLEANER (M5 ONLY).**

**SCREWDRIVER**

**WRENCH**, open-end,  $\frac{1}{2}$ -in.

Position auxiliary power plant air cleaner and bracket on air cleaner pipe and next to mounting bracket on bulkhead, and install 2 bracket mounting screws and lock washers. Tighten clamp screw holding air cleaner to pipe.

**(15) INSTALL FIRE EXTINGUISHER NOZZLES.**

**WRENCH**, open-end,  $\frac{9}{16}$ -in.

**WRENCH**, open-end, 1-in.

Install both rear fire extinguisher nozzles and mounting brackets on engine compartment side walls. Install both rear fire extinguisher nozzles on fire extinguisher pipes.

**(16) CONNECT FUEL LINES.**

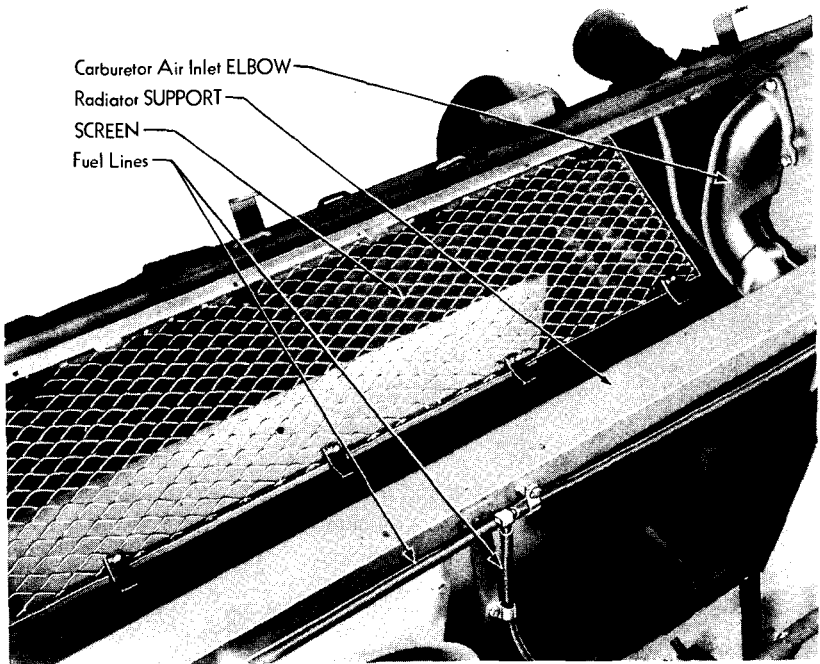
**WRENCH**, open-end,  $\frac{1}{2}$ -in.

**WRENCH**, open-end,  $\frac{3}{4}$ -in.

**WRENCH**, open-end,  $\frac{5}{8}$ -in.

**WRENCH**, socket,  $\frac{9}{16}$ -in.

Position radiator support with fuel lines attached in rear end of engine compartment and install 2 bolts holding ends of radiator support to engine compartment side walls. Connect fuel lines to fuel pumps on

**HYDRA-MATIC TRANSMISSION**

RA PD 8849

**Figure 148 — Radiator Support and Screen**

both engines. Connect fuel line on radiator support to fuel line from fuel filters at left engine compartment side wall.

**(17) INSTALL RADIATOR AIR BAFFLE.****WRENCH**,  $\frac{3}{8}$ -in.**WRENCH**, open-end,  $\frac{9}{16}$ -in.

Position radiator air baffle on radiator support and install 10 screws on outer edges of baffle. Install 2 self-tapping screws in center of air baffle (fig. 47). **NOTE:** It is advisable at this point to check the engine oil level and then to start both engines and run them for 10 or 15 seconds to make sure that they are operating correctly.

**(18) CONNECT TRANSFER UNIT OIL COOLER.****WRENCH**, open-end,  $1\frac{1}{4}$ -in.

Lay transfer unit oil cooler between engines and connect short oil cooler hose to coupling next to engine compartment bulkhead. Connect long oil cooler hose at rear connector.

**(19) INSTALL RADIATORS.****HOIST****WRENCH**, open-end,  $\frac{1}{2}$ -in.**SLING**, radiator, B226799**WRENCH**, socket,  $\frac{9}{16}$ -in.

Connect Sling, B226799, to one radiator and connect a hoist to sling. Swing radiator over engine compartment and lower into place on radia-

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

tor support at rear and radiator support mounting brackets at front. Install 2 screw and lock washers holding radiator to mounting support brackets at front of engine compartment. Install 2 screws holding radiator to rear support. Remove sling and hoist from radiator. Repeat above steps to install other radiator.

**(20) SECURE TRANSFER UNIT OIL COOLER.**

**WRENCH**, ½-in.

Position transfer unit oil cooler mounting plates between radiators and tighten oil cooler hanger mounting bolt nuts finger-tight, while working from top of vehicle (fig. 45). Raise transfer unit oil cooler into position on hangers and tighten 4 hanger nuts.

**(21) INSTALL RADIATOR HOSES.**

**PLIERS**

Install water pump inlet hose on radiator outlet elbow and inlet pipe on each engine. Tighten radiator inlet hose clamps on each engine. Install radiator inlet hose on radiator inlet housing and cylinder head outlet elbow on each engine.

**(22) INSTALL BULKHEAD DOORS, BULKHEAD EXTENSION AND AMMUNITION RACKS.**

**WRENCH**, socket, ⅞<sub>16</sub>-in.

Position bulkhead doors on hinges and rotate latches holding doors closed. Position bulkhead extension cover on bulkhead and attach to extension and to hull wall. Position ammunition racks on bulkhead wall and install retaining screws and lock washers.

**(23) INSTALL BASKET SHIELD.**

**WRENCH**, open-end, ⅞<sub>16</sub>-in.

Position rear end of basket shield on hinges on engine compartment bulkhead and lower front end of shield in place over propeller shaft housing. Install 2 screws and lock washers holding rear of shield to bulkhead. Install screw and lock washer holding front end of basket shield to propeller shaft housing cover.

**(24) INSTALL ENGINE COMPARTMENT COVER.**

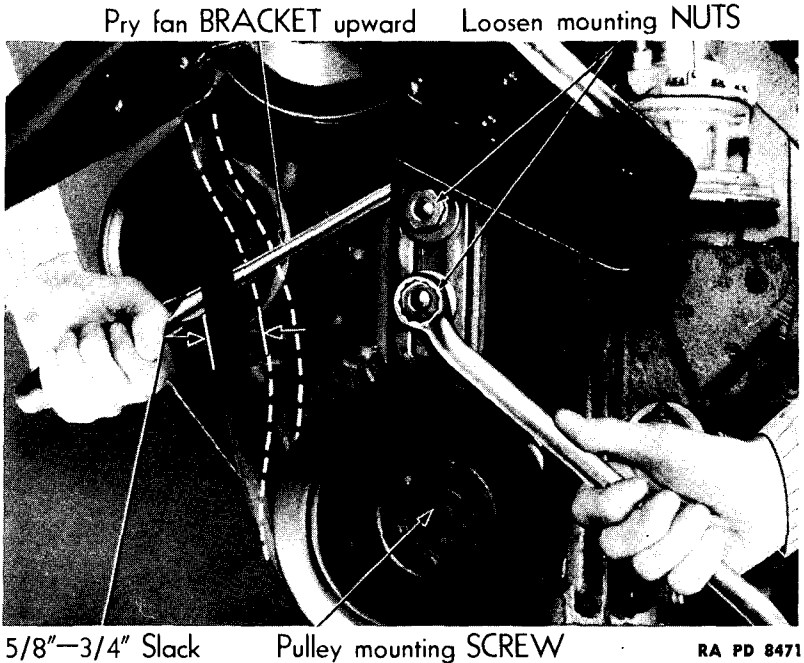
**HOIST**

**SCREWDRIVER**, T-handle

**SLING**, engine compartment cover, B226796

**WRENCH**, socket, ¾-in.

Index turret 90 degrees from straight ahead position, hook sling B226796 under lifting handles on engine compartment cover and connect a hoist to sling. Lift engine compartment cover into position on vehicle, on first type M5 vehicles, install 34 engine compartment cover

**HYDRA-MATIC TRANSMISSION****Figure 149 — Adjusting Fan Belt**

mounting screws, using a T-handle screwdriver, while working from top of vehicle, and install fuel filler cap covers. On second type M5 and all M8 vehicles, install 9 engine compartment cover mounting screws. Position grille on cover and install 5 mounting screws.

**(25) FILL COOLING SYSTEM.**

WRENCH, socket, 1/2-in.

WRENCH, socket, 3/8-in.

Make sure water drain plug is in place in bottom of transmission. Make sure drain plugs in front face of crankcase are in place. Fill both cooling systems with water or ANTIFREEZE, as required. Capacity of each system is 35 quarts, run engine long enough to open thermostat valve if cooling system seems full before 35 quarts have been added.

**(26) INSTALL COVER PLATE.**

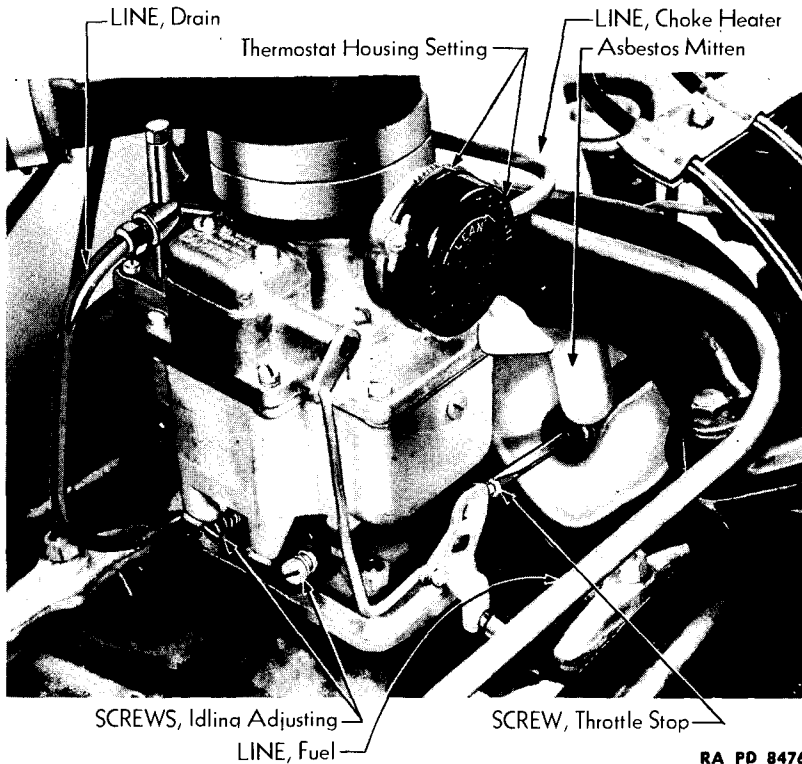
JACK (2)

WRENCH, socket, 3/16-in.

WRENCH, socket, 7/16-in.

Install cover plate on hull under transmissions, attaching in place with 27 screws and lock washers and one nut on M5 vehicles, and with 28

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 8476

**Figure 150 — Carburetor Adjustment**

screws and lock washers on M8 vehicles. **CAUTION:** Cover plate weighs over 80 pounds and must be supported with jacks when installing.

**(27) INSTALL FAN, FAN BRACKET, AND FAN BELT.**

Position fan and fan bracket on mounting studs on front of engine front cover, and install 2 fan support mounting stud nuts and washers finger-tight, working through engine compartment rear doors. **CAUTION:** Battery switch must be opened while working on fan. Slip fan belt over fan pulley and crankshaft pulley and adjust fan belt tension, as shown in figure 149.

**(28) ADJUST THROTTLE LINKAGE.**

Adjust transmission and transfer unit throttle control linkage as explained in paragraph 10.

## HYDRA-MATIC TRANSMISSION

### (29) ADJUST CARBURETOR FAST IDLE.

#### SCREWDRIVER

Only first type carburetors are equipped with a fast idle system, which is adjusted as follows: Check from fighting compartment to see that fast idle screw is resting on high lobe of fast idle cam. NOTE: Engine must be cold. Start engine and note engine speed indicated on tachometer, which should be from 625 to 675 revolutions per minute. Adjust if necessary by rotating fast idle adjusting screw.

### (30) ADJUST CARBURETOR SLOW IDLE.

#### SCREWDRIVER

Run engine until thoroughly warm (at least 165 F) so that choke valve is open. Adjust stop screw so that engine speed is from 400 to 425 revolutions per minute as noted on tachometer (fig. 150). Stop engine, shut off master switch and working through engine compartment rear doors, tighten 2 idling mixture adjusting screws as far as possible without forcing, then loosen  $\frac{3}{4}$  to  $1\frac{1}{4}$  turns. Start engine to see that it runs smoothly without loping or stalling. Stop engine and readjust if necessary. Check to see that choke setting mark on thermostat housing is opposite mark on carburetor flange (fig. 150).

### (31) INSTALL FAN SHROUDS.

WRENCH, open-end,  $\frac{5}{16}$ -in.

WRENCH, socket,  $\frac{9}{16}$ -in.

WRENCH, open-end,  $\frac{9}{16}$ -in.

Position fan shrouds on rear of engine compartment and install 10 mounting screws and lock washers. Position plate around carburetor air inlet pipe on engine compartment wall and install 2 self-tapping screws. Connect exhaust outlet pipes to mufflers and tighten clamps.

### (32) CLOSE ENGINE COMPARTMENT REAR DOORS.

WRENCH, socket,  $\frac{3}{4}$ -in.

Close engine compartment rear doors. Lubricate and install 7 retaining screws and lock washers.

## 18. LIMITS AND TOLERANCES.

### a. Flywheel Cover and Torus Assemblies.

Driven torus vent valve spring:

Free length .....	$1\frac{11}{32}$ in.
Pressure compressed to $1\frac{1}{16}$ in.....	0.5 to 0.6 lb
Flywheel cover, maximum runout of hub.....	0.004 in.
Torus members, maximum runout of face.....	0.015 in.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**b. Transmission Case Front Cover and Oil Seal Assembly.**

Oil seal rings (2 in.):

Clearance in groove.....	0.0005 in. to 0.0035 in.
Gap installed .....	0.0015 in. to 0.010 in.
Width .....	0.0925 in. to 0.0935 in.

Oil seal rings (2<sup>3</sup>/<sub>8</sub> in.):

Clearance in groove.....	0.0005 in. to 0.0035 in.
Gap installed .....	0.002 in. to 0.012 in.
Width .....	0.0925 in. to 0.0935 in.

**c. Front Unit.**

Clutch drum pistons, clearance in cylinders... 0.003 in. to 0.006 in.

Clutch drum piston oil seal rings (1<sup>5</sup>/<sub>8</sub> in.):

Clearance in groove.....	0.0005 in. to 0.0025 in.
Gap installed .....	0.0015 in. to 0.010 in.
Width .....	0.0930 in. to 0.0935 in.

Clutch hub:

Bronze thrust washers:

Thickness .....	0.063 in. to 0.067 in.
-----------------	------------------------

Steel thrust washer (front):

Thickness .....	0.049 in. to 0.052 in.
-----------------	------------------------

Steel thrust washer (rear):

Thickness .....	0.090 in. to 0.092 in.
-----------------	------------------------

Clutch plates, driving (bronze):

Number used .....	6
Thickness .....	0.0605 in. to 0.0630 in.
Parallel within .....	0.0005 in.
Flat within .....	0.005 in.

Clutch plates, driven (steel):

Number used .....	5
Thickness .....	0.049 in. to 0.051 in.
Amount of "cone".....	0.030 in. to 0.037 in.

Clutch release springs:

Free length .....	1 <sup>5</sup> / <sub>8</sub> in.
Pressure compressed to 1 <sup>3</sup> / <sub>32</sub> in.....	26 to 30 lb

**HYDRA-MATIC TRANSMISSION****Drive gear:****Steel thrust washer:**

Thickness .....0.090 in. to 0.092 in.

**Bronze thrust washer:**

Thickness .....0.063 in. to 0.067 in.

End play .....0.003 in. to 0.027 in.

Backlash .....0.003 in. to 0.005 in.

Front unit end play... ..0.004 in. to 0.035 in.

**Oil pump drive gear, maximum:**

Runout .....0.002 in.

Planet carrier pinions, end play.....0.005 in. to 0.026 in.

**d. Front Servo and Oil Pump Assembly.**

Apply piston, clearance in cylinder.....0.003 in. to 0.006 in.

Compensating piston, clearance in cylinder.....0.003 in. to 0.006 in.

**Oil pump assembly:**

Pressure at 375 rpm.....55 lb

Pressure at 600 rpm.....80 lb min

Oil pump drive gear, backlash.....0.002 in. to 0.006 in.

**Oil pump driven gear:**

Backlash .....0.002 in. to 0.006 in.

End play .....0.0005 in. to 0.0025 in.

**Oil pump idler gears:**

Clearance on shafts.....0.001 in. to 0.003 in.

Backlash .....0.002 in. to 0.006 in.

End play .....0.0005 in. to 0.0025 in.

**Oil seal rings (1 in.):**

Clearance in groove.....0.0005 in. to 0.003 in.

Width ..... 0.0925 in. to 0.0935 in.

**Oil seal rings (1 $\frac{1}{8}$  in.):**

Clearance in groove.....0.0005 in. to 0.0025 in.

Gap installed .....0.0015 in. to 0.010 in.

Width .....0.0930 in. to 0.0935 in.

**Oil seal rings (1 $\frac{7}{16}$  in.):**

Clearance in groove.....0.0005 in. to 0.003 in.

Gap installed .....0.0015 in. to 0.010 in.

Width .....0.0925 in. to 0.0935 in.



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

Release piston, clearance in cylinder.....0.003 in. to 0.006 in.

Servo booster spring:

Free length ..... $1\frac{5}{16}$  in. to  $1\frac{61}{64}$  in.

Pressure compressed to  $1\frac{1}{16}$  in.....38 to 46 lb

Servo initial spring:

Free length ..... $1\frac{33}{64}$  in.

Pressure compressed to  $2\frac{5}{32}$  in.....18 to 22 lb

**e. Oil Pressure Regulator.**

Check valve spring, free length..... $3\frac{3}{64}$  in.

Pressure regulator plunger:

Clearance in cylinder.....0.001 in. to 0.0025 in.

Pressure regulator spring:

Free length ..... $3\frac{11}{16}$  in.

Pressure compressed to  $1\frac{9}{16}$  in.....19 to 20 lb

**f. Oil Delivery Sleeve.**

Oil delivery sleeve assembly:

Clearance on intermediate shaft.....0.002 in. to 0.004 in.

Clearance in front unit clutch drum.....0.0215 in. to 0.0255 in.

Clearance in front unit sun gear.....0.0115 in. to 0.0155 in.

Clearance in rear clutch drum.....0.0115 in. to 0.0135 in.

Clearance in rear clutch drum bushing....0.0015 in. to 0.0035 in.

Oil seal rings (2 in.):

Clearance in grooves.....0.0005 in. to 0.0025 in.

Gap installed .....0.0015 in. to 0.007 in.

Width .....0.0925 in. to 0.0935 in.

**g. Rear Unit.**

Brake drum and clutch drum assembly:

Maximum runout of outside diameter of brake drum.....0.005 in.

Clutch drum assembly, maximum runout of outside diameter.0.005 in.

Clutch drum pistons, clearance in cylinders.....0.003 in. to 0.006 in.

Clutch hub:

Bronze thrust washer (early models used 1 bronze and  
1 steel washer):

Thickness .....0.063 in. to 0.065 in.

**HYDRA-MATIC TRANSMISSION**

Clutch plates; driving (bronze faced steel):	
Number used .....	10
Thickness .....	0.0605 in. to 0.0630 in.
Parallel within .....	0.0005 in.
Flat within .....	0.005 in.
Clutch plates, driven (steel):	
Number used .....	12
Thickness .....	0.049 in. to 0.051 in.
Amount of "cone" .....	0.030 in. to 0.037 in.
Clutch release springs:	
Free length .....	4 <sup>21</sup> / <sub>64</sub> in.
Pressure compressed to 3 <sup>13</sup> / <sub>32</sub> in. ....	27 to 33 lb
Oil seal rings (1 <sup>5</sup> / <sub>8</sub> in.):	
Clearance in groove .....	0.0005 in. to 0.0025 in.
Gap installed .....	0.0015 in. to 0.010 in.
Width .....	0.0930 in. to 0.0935 in.
Planet carrier and internal gear assembly:	
Backlash of pinions .....	0.002 in. to 0.006 in.
End play of pinions .....	0.004 in. to 0.011 in.
Planet carrier:	
Bronze thrust washer:	
Thickness .....	0.063 in. to 0.067 in.
Steel main shaft thrust washer:	
Thickness .....	0.119 in. to 0.121 in.
 <b>h. Rear Servo.</b>	
Accumulator apply spring:	
Free length .....	1 <sup>15</sup> / <sub>16</sub> in.
Pressure compressed to 1 <sup>11</sup> / <sub>16</sub> in. ....	36 to 44 lb
Accumulator body, clearance in servo body. .	0.0005 in. to 0.0025 in.
Accumulator piston, clearance in cylinder. . . .	0.005 in. to 0.0095 in.
Accumulator piston pin, clearance in	
accumulator body .....	0.0005 in. to 0.002 in.
Check valve plunger, clearance in cylinder. . . .	0.0005 in. to 0.002 in.
Compensator piston, clearance in cylinder. . . .	0.003 in. to 0.005 in.
Oil seal ring (2 <sup>1</sup> / <sub>4</sub> in.):	
Clearance in groove .....	0.0005 in. to 0.0025 in.
Gap installed .....	0.0015 in. to 0.010 in.
Width .....	0.0930 in. to 0.0935 in.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

Oil seal ring ( $1\frac{7}{16}$ in.):	
Clearance in groove.....	0.0005 in. to 0.003 in.
Gap installed .....	0.0015 in. to 0.010 in.
Width .....	0.0925 in. to 0.0935 in.
Oil seal ring (2 in.):	
Clearance in groove .....	0.0005 in. to 0.003 in.
Gap installed .....	0.0015 in. to 0.010 in.
Width .....	0.0925 in. to 0.0935 in.
Oil seal ring ( $1\frac{1}{8}$ in.):	
Clearance in groove.....	0.0005 in. to 0.0025 in.
Gap installed .....	0.0015 in. to 0.010 in.
Width .....	0.0930 in. to 0.0935 in.
Servo booster piston, clearance in cylinder.....	0.006 in. to 0.010 in.
Servo initial spring:	
Free length .....	4 in.
Pressure compressed to $1\frac{9}{16}$ in.....	32 to 38 lb
Servo booster spring:	
Free length .....	$1\frac{37}{64}$ in. to $1\frac{39}{64}$ in.
Pressure compressed to $1\frac{1}{16}$ in.....	103 to 114 lb

**i. Rear Oil Pump and Governor Assembly.**

Governor body, clearance in sleeve.....	0.002 in. to 0.004 in.
Governor body bushing, clearance in cylinder..	0.0002 in. to 0.0022 in.
Governor drive flange, maximum runout of face.....	0.002 in.
Oil pump driven gear, clearance in body.....	0.003 in. to 0.006 in.
Oil pump drive shaft clearance in bushings....	0.001 in. to 0.0023 in.
End play .....	0.002 in. to 0.004 in.

**Oil pump idler gear assembly:**

Backlash .....	0.006 in. to 0.010 in.
End play .....	0.002 in. to 0.004 in.
Clearance on shaft.....	0.001 in. to 0.0023 in.
Clearance in body.....	0.003 in. to 0.006 in.

**Oil seal rings ( $1\frac{3}{16}$  in.):**

Clearance in groove .....	0.001 in. to 0.003 in.
Gap installed .....	0.0015 in. to 0.010 in.
Width .....	0.0925 in. to 0.0935 in.

**j. Reverse Anchor and Plunger Assembly.**

Anchor gear, clearance in cylinder.....	0.001 in. to 0.0025 in.
Anchor plunger, clearance in bore.....	0.001 in. to 0.0055 in.
Anchor plunger spring:	
Free length .....	$\frac{63}{64}$ in.
Pressure compressed to 0.906 in.....	10 to 14 lb

**HYDRA-MATIC TRANSMISSION**

Anchor retracting spring, 1/4-in. diameter:

Free length .....	1 <sup>11</sup> / <sub>16</sub> in.
Pressure compressed to 1 <sup>1</sup> / <sub>8</sub> in.....	4.5 to 5.5 lb

**k. Valve Body.**

Throttle valve spring:

Free length .....	2 <sup>9</sup> / <sub>32</sub> in. to 1 <sup>5</sup> / <sub>16</sub> in.
Pressure compressed to 5/8 in.....	6.29 to 6.51 lb

1-2 Shift valve spring:

Free length .....	1 <sup>15</sup> / <sub>16</sub> in.
Pressure compressed to 2 <sup>7</sup> / <sub>32</sub> in.....	2.60 to 2.70 lb

2-3 Shift valve spring (large):

Free length .....	1 <sup>61</sup> / <sub>64</sub> in.
Pressure compressed to 2 <sup>5</sup> / <sub>32</sub> in.....	1.90 to 2.10 lb

2-3 Shift valve spring (small):

Free length .....	1 <sup>7</sup> / <sub>16</sub> in.
Pressure compressed to 5/8 in.....	4.10 to 4.75 lb

3-4 Shift valve spring:

Free length .....	1 <sup>1</sup> / <sub>4</sub> in.
Pressure compressed to 5/8 in.....	12.5 to 13.2 lb

Valves, clearance in cylinders.....0.0005 in. to 0.002 in.

**l. Reverse Unit.**

Internal gear:

Backlash .....	0.007 in. to 0.010 in.
End play .....	0.006 in. to 0.019 in.

Oil pump drive gear (bronze):

Maximum face runout.....	0.002 in.
--------------------------	-----------

Planet carrier assembly, end play of pinions..0.005 in. to 0.026 in.

Sun gear assembly:

Clearance on driven shaft.....	0.0015 in. to 0.0035 in.
--------------------------------	--------------------------

Backlash .....	0.010 in. to 0.012 in.
----------------	------------------------

Bronze thrust washer:

Thickness .....	0.063 in. to 0.067 in.
-----------------	------------------------

Steel thrust washer:

Thickness .....	0.049 in. to 0.052 in.
-----------------	------------------------

**m. Shafts.**

Main shaft:

End play .....	0.005 in. to 0.019 in.
----------------	------------------------

Large thrust washer:

Thickness .....	0.200 in. to 0.202 in.
-----------------	------------------------

Thrust washer spacer:

Length .....	0.344 in. to 0.347 in.
--------------	------------------------

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

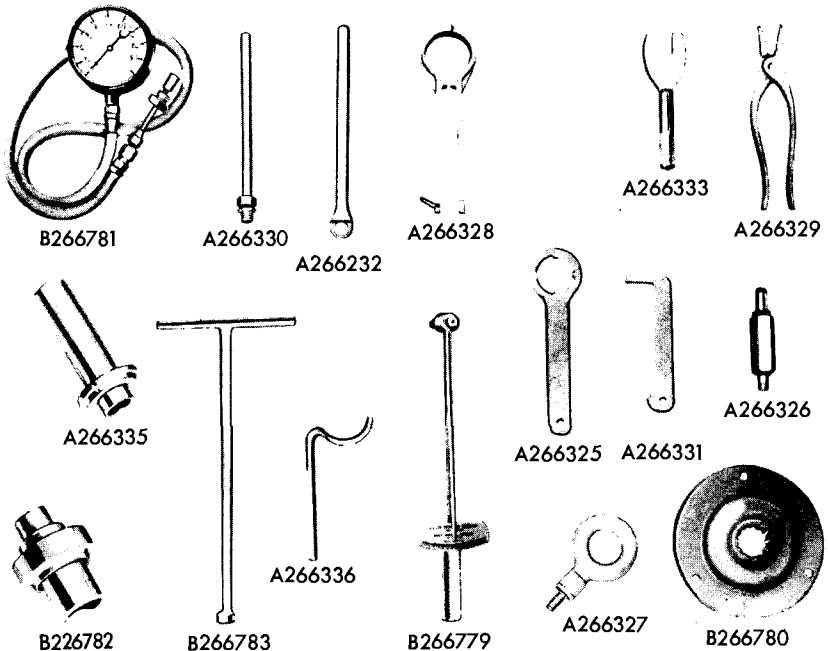
Selective thrust washer:

Thickness .....	0.050 in. to 0.052 in.
	0.063 in. to 0.065 in.
	0.076 in. to 0.078 in.
	0.089 in. to 0.091 in.
	0.102 in. to 0.104 in.

**19. TORQUE TIGHTNESSES.**

Description	Wrench Head Size	Thread Size	Torque Tightness	
			Min.	Max. ft-lb
Control valve body screws.....	7/16 in.	1/4 in.-20	6 to 8	
Extension housing to case screws..	9/16 in.	3/8 in.-16	23 to 28	
Extension housing to reverse unit support screws .....	9/16 in.	3/8 in.-16	23 to 28	
Flywheel cover screws .....	1/2 in.	5/16 in.-24	20 to 25	
Flywheel housing screws .....	5/8 in.	7/16 in.-14	45 to 50	
Front oil pump cover screws.....	7/16 in.	1/4 in.-20	6 to 8	
Front pump and servo screws.....	9/16 in.	3/8 in.-16	23 to 28	
Front servo cover to oil pump screws.....	7/16 in.	1/4 in.-20	6 to 8	
Front unit clutch drum to brake drum screws.....	9/16 in.	3/8 in.-16	10 to 12	
Governor body screws .....	7/16 in.	1/4 in.-20	6 to 8	
Main shaft retaining nut .....	1 7/16 in.	7/8 in.-16	50 to 60	
Oil pan drain plugs .....	7/8 in.	5/8 in.-18	35 to 45	
Oil pan screws and nuts .....	1/2 in.	5/16 in.-18	10 to 13	
Pressure regulator body screws...	7/16 in.	1/4 in.-20	6 to 8	
Rear bearing retainer to case screws .....	9/16 in.	3/8 in.-16	23 to 28	
Rear bearing retainer to reverse unit support screws .....	9/16 in.	3/8 in.-16	23 to 28	
Rear servo screws .....	9/16 in.	3/8 in.-16	23 to 28	
Reverse unit drive flange to rear unit drum screws and nuts....	1/2 in.	5/16 in.-18	15 to 18	
Rear servo spring retainer to accumulator body screws .....	1/2 in.	5/16 in.-18	15 to 18	
Rear unit clutch drum to brake drum screws .....	9/16 in.	3/8 in.-16	15 to 20	
Rear pump cover to housing screws	7/16 in.	1/4 in.-20	6 to 8	
Reverse anchor crank bracket screws .....	9/16 in.	3/8 in.-16	23 to 28	
Rear oil pump screws .....	1/2 in.	5/16 in.-18	15 to 18	
Side cover screws .....	7/16 in.	1/4 in.-20	6 to 8	
Transmission housing to flywheel housing screws .....	3/4 in.	1/2 in.-13	80 to 90	

**HYDRA-MATIC TRANSMISSION**



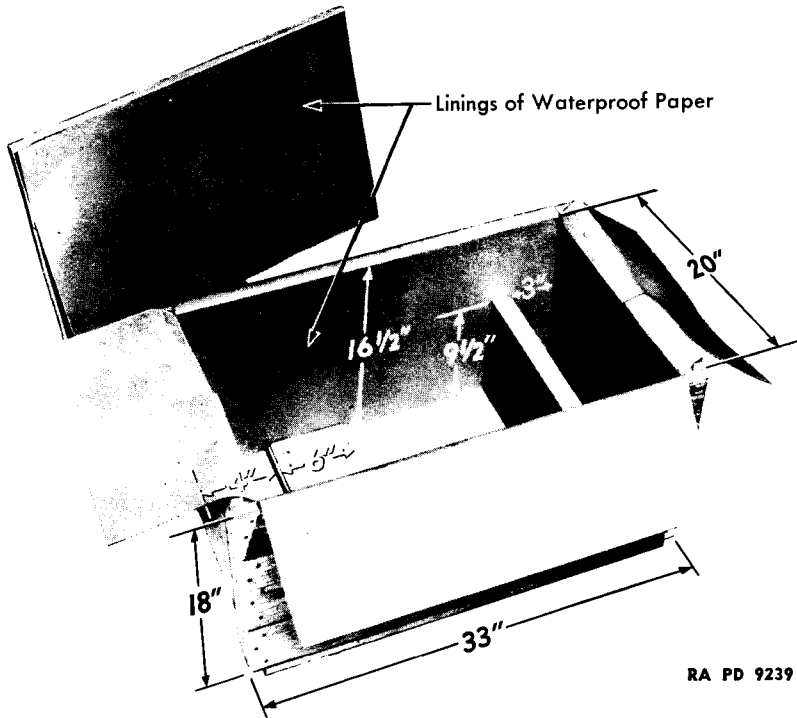
RA PD 56497

**Figure 151 — Transmission Tools**

**20. SPECIAL TOOLS.**

Description	Ordnance Tool Number
BOLT, eye, transmission lifting.....	A266327
COMPRESSOR, oil delivery sleeve ring.....	A266328
DRIVER, C-Washer .....	A266333
FIXTURE, holding .....	B226780
GAGE, front servo adjusting.....	A266326
GAGE, rear servo .....	A266331
GAGE, transmission oil pressure.....	B226781
HOLDER, drum .....	A266232
INSTALLER, front cover oil seal.....	B226782
PLIERS, snap ring removing.....	A266329
REPLACER, extension housing oil seal .....	A266335
ROD, dial indicator extension.....	A266330
WRENCH, main shaft spanner nut.....	A266325
WRENCH, oil cooler nut spanner.....	A266336
WRENCH, oil pan screw.....	B226783
WRENCH, torque 0 to 25 ft-lb (band adjusting).....	B226779

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**



RA PD 9239

**Figure 152 — Transmission Packing Box**

## 21. PREPARATION FOR EXTREME CONDITIONS.

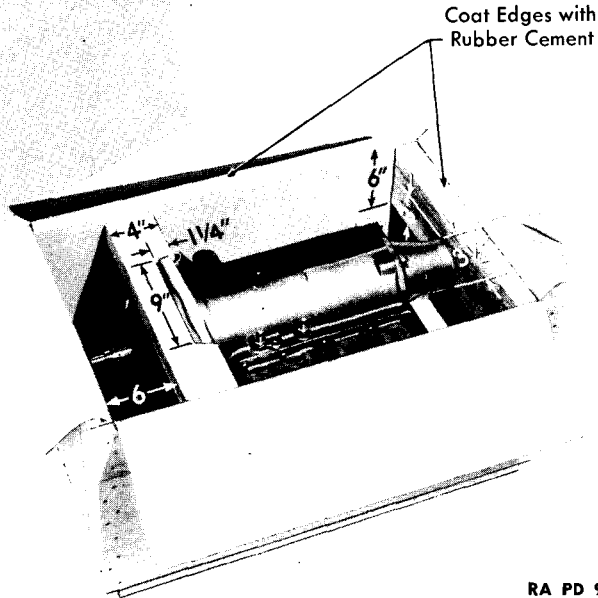
a. No special precautions are necessary when operating a Hydra-Matic transmission under any condition of heat, dust, or salt water other than to make sure that the same grade of oil is used in the transmission as is used in the engine. For operation at temperatures below 0 F, drain transmission immediately after use while lubricant is still warm. Refill with a mixture prepared by diluting 2 parts OIL, lubricating, engine, SAE 10, with one part of gasoline or Diesel fuel.

## 22. PACKING, SHIPPING, AND STORAGE.

a. **Individual Parts.** In making ready for packing, shipping or storing, transmission parts should be well lubricated and wrapped in non-oxide cloth in order that they may be thoroughly sealed from various changes in weather or climatic conditions.

b. **Complete Transmissions.** When packing complete transmissions for shipment or storage all bare metal parts should be well lubricated and the complete unit then placed in a special wooden packing box,

## HYDRA-MATIC TRANSMISSION



RA PD 9240

**Figure 153 — Transmission Packed in Box**

lined with waterproof paper (fig. 152). The transmission should then be braced securely in the packing box (fig. 153). The waterproof paper which overlaps the edges of the box should then be coated with rubber cement so that when the cover (which is also lined with waterproof paper) is secured in position the transmission is completely sealed in waterproof paper within the box.



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**Section III**

**PROPELLER SHAFTS**

	Paragraph
Description .....	23
Operation .....	24
Tabulated data and specifications.....	25
Allocation of maintenance duties by echelons.....	26
Inspection of vehicle .....	27
Trouble shooting .....	28
Service of vehicle .....	29
Removal from vehicle .....	30
Disassembly .....	31
Inspection and repair .....	32
Assembly .....	33
Installation in vehicle .....	34
Limits and tolerances .....	35
Preparation for extreme conditions .....	36
Packing, shipping, and storage .....	37

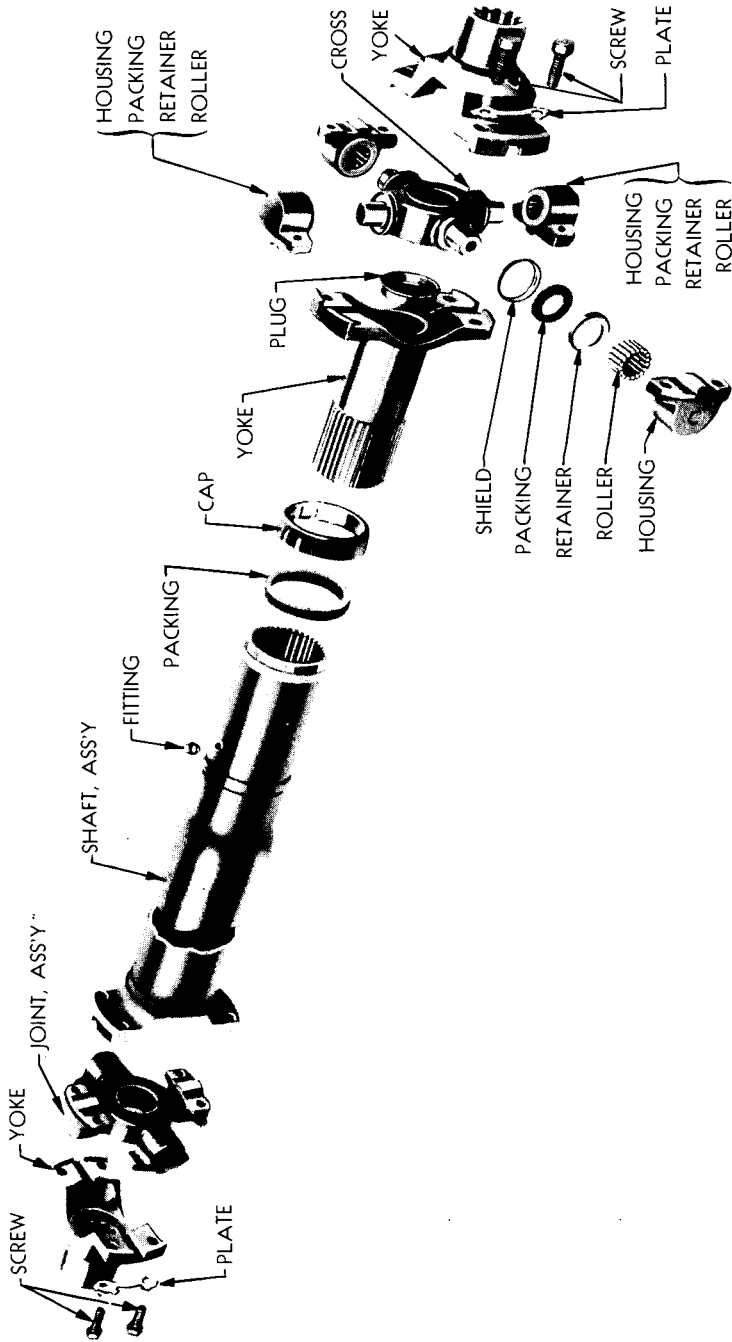
**23. DESCRIPTION.**

**a. Propeller Shafts.** The propeller shafts are of hollow welded steel tube construction, with a sliding joint on the front or transfer unit end (fig. 154). A universal joint yoke is welded to the propeller shaft at the rear, while another yoke is attached to the sliding joint, which in turn slides on spline ways in the propeller shaft tube at the front. Each propeller shaft has a lubrication fitting at the front for lubrication of the sliding joint.

**b. Universal Joints.** The universal joints at the front and rear of each propeller shaft are identical. These joints, which consist of a "cross," bearings, and bearing housings, are mounted on the universal joint yokes on the propeller shafts and the transfer unit and transmission. The cross is supported in the bearing housings by needle bearings at each end. Each of the four bearing assemblies is held in place by a retainer and an oil seal.

**c. Housings and Covers.** Each propeller shaft, as mounted in the vehicle, is covered by a protective housing to prevent the possibility of anything being caught in the revolving shaft. This housing is composed

**PROPELLER SHAFTS**



RA PD 9019

**Figure 154 — Propeller Shaft Disassembled**

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

of 4 major pieces; a cover, inner wall, outer wall, and a front cover over the universal joint yoke and sliding joint at the transfer unit end (fig. 155). These parts are mounted on steel brackets attached to the hull floor and are easily removable for service.

**24. OPERATION.**

a. The propeller shafts transmit the power from the transmissions to the transfer unit at the front of the vehicle, and compensate for differences in plane between the two units they connect by means of the universal joints at each end.

**25. TABULATED DATA AND SPECIFICATIONS.**

a. The following specifications are for one propeller shaft only and apply to either right or left-hand unit unless otherwise indicated.

**b. Tabulated Data.**

Propeller shaft:

Construction .....Welded tube with slip spline

Universal joint:

Bearings .....Needle type

Number bearings (each cross)..... 18

Number oil seals ..... 4

**26. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.**

a. Refer to paragraph 7.

**27. INSPECTION OF VEHICLE.**

a. **Purpose.** Technical inspections by ordnance personnel are a follow-up and check on organizational maintenance inspections and servicing. These inspections determine whether or not the vehicle should be continued in service or withdrawn from operation for overhaul.

b. **Inspection Form.** War Department O.O. Form No. 7351, "Preventive Maintenance Operation and Technical Inspection Form for Full-Track Vehicles," is the standard and official form for recording the inspection of the vehicles described in this manual. The extent to which use is made of this form or modification thereof depends entirely on the technical ability of available personnel, the time factor, and the test shop equipment available.

**c. Equipment Required.**

CLOTH, wiping  
FLASHLIGHT

WRENCH, socket, 1/16-in.

**PROPELLER SHAFTS**

**d. Visual Inspection Procedure.** The propeller shafts may be inspected in the vehicle by removing the basket shield as outlined in paragraph 30 b (on M5 vehicles) and the front and rear propeller shaft housing covers, and checking the shafts for a cracked tube weld or bent condition or oil leakage at the slip joint.

**e. Operating Inspection.** Check the propeller shafts under actual operating conditions for vibration at universal joints, heavy thumps on rough terrain, high pitched squeal, or a click in the shaft.

**28. TROUBLE SHOOTING.**

**a. Vibration at Universal Joints.**

Probable Cause	Probable Remedy
Worn needle bearings or excessive runout at yokes . . . . .	Replace universal joint and universal joint yokes.

**b. Heavy Thumps on Rough Terrain.**

Frozen slip joint . . . . . Replace propeller shaft.

**c. High Pitched Squeal.**

No lubricant in universal joints . . . . . Replace universal joints.

**d. Oil Leakage at Universal Joint.**

Defective oil seals . . . . . Replace oil seals.

**e. Oil Leakage at Propeller Shaft.**

Defective dust cap . . . . . Replace propeller shafts.

**f. Click in Propeller Shaft.**

Worn splines in slip joint . . . . . Replace propeller shaft.

**29. SERVICE OF VEHICLE.**

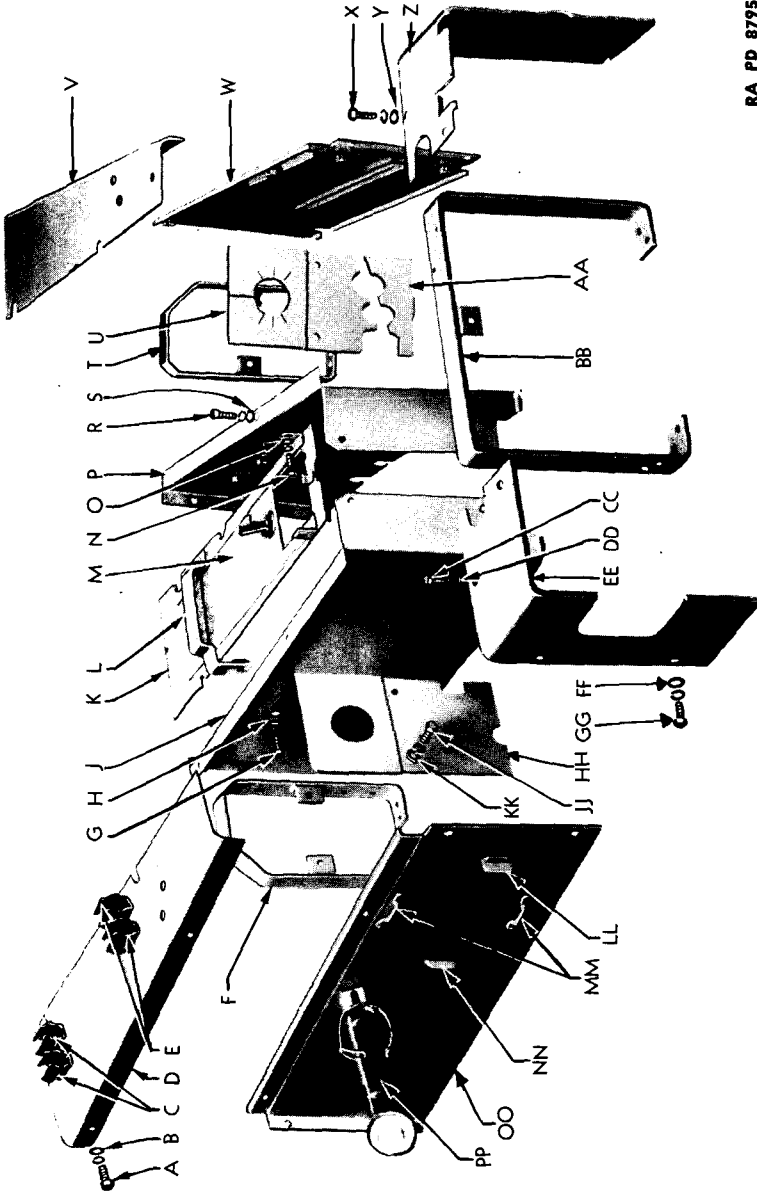
**a. Slip Joint Lubrication.** Since the lubrication interval on the slip joint is 3,000 miles, which is approximately the overhaul period, it is recommended that universal joints be lubricated at the same time by disassembling the joints, repacking with GREASE, general purpose (seasonal grade), and reassembling. **NOTE:** The universal joints in the early Light Tanks M5 were equipped with a 1/8-inch pipe plug which could be removed and a lubrication fitting installed for the purpose of lubricating the slip joints. In lubricating joints with this type fitting, avoid applying too much pressure with the grease gun; otherwise the grease seals in the joints may be damaged.

**30. REMOVAL FROM VEHICLE.**

**a. Equipment.**

- WRENCH, open-end, 1/2-in.                      WRENCH, socket, 9/16-in.
- WRENCH, open-end, 9/16-in.

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



RA PD 8795

Figure 155 — Propeller Shaft Housing Disassembled

**PROPELLER SHAFTS**

- |                              |                               |                               |
|------------------------------|-------------------------------|-------------------------------|
| <b>A</b> — SCREW             | <b>P</b> — PLATE, ASSEMBLY    | <b>EE</b> — COVER, ASSEMBLY   |
| <b>B</b> — WASHER            | <b>R</b> — SCREW              | <b>FF</b> — WASHER            |
| <b>C</b> — CLIP              | <b>S</b> — WASHER             | <b>GG</b> — SCREW             |
| <b>D</b> — COVER, ASSEMBLY   | <b>T</b> — BRACKET, ASSEMBLY  | <b>HH</b> — BAFFLE, ASSEMBLY  |
| <b>E</b> — CLIP              | <b>U</b> — BAFFLE, ASSEMBLY   | <b>JJ</b> — SCREW             |
| <b>F</b> — BRACKET           | <b>V</b> — COVER, ASSEMBLY    | <b>KK</b> — WASHER            |
| <b>G</b> — SCREW             | <b>W</b> — PLATE, ASSEMBLY    | <b>LL</b> — STOP              |
| <b>H</b> — WASHER            | <b>X</b> — SCREW              | <b>MM</b> — FASTENER          |
| <b>J</b> — PLATE, ASSEMBLY   | <b>Y</b> — WASHER             | <b>NN</b> — STOP              |
| <b>K</b> — TOP, ASSEMBLY     | <b>Z</b> — COVER              | <b>OO</b> — PLATE, ASSEMBLY   |
| <b>L</b> — BRACKET, ASSEMBLY | <b>AA</b> — BAFFLE            | <b>PP</b> — BRACKET, ASSEMBLY |
| <b>M</b> — LID, ASSEMBLY     | <b>BB</b> — BRACKET, ASSEMBLY |                               |
| <b>N</b> — SCREW             | <b>CC</b> — SCREW             |                               |
| <b>O</b> — WASHER            | <b>DD</b> — WASHER            |                               |

RA PD 8795B

**Legend for Figure 155 — Propeller Shaft, Housing, Disassembled**

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**b. Procedure.**

**(1) REMOVE BASKET SHIELD (M5 AND M5A1 ONLY).**

**WRENCH**, socket,  $\frac{1}{16}$ -in.

Loosen screw holding turret basket shield to support. Raise front end of shield so it swings clear of screw and lift off hinges at rear. Remove shield. **NOTE:** There is no basket shield on M8 vehicles.

**(2) REMOVE COVERS AND OUTER HOUSINGS ON M5 AND M8.**

**WRENCH**, open-end,  $\frac{1}{16}$ -in.      **WRENCH**, socket,  $\frac{1}{16}$ -in.

On M8 vehicles, remove 4 cap screws and lift out subfloor. On all vehicles, remove cap screws holding front and rear covers on top of propeller shaft housing and remove covers. Remove cap screws holding outer housing and remove housing. **NOTE:** To remove left-hand outer housing it is necessary to remove the vehicle tool box front partition.

**c. Remove Propeller Shaft.**

**CHISEL**

**WRENCH**, open-end,  $\frac{1}{2}$ -in.

**HAMMER**

**WRENCH**, socket,  $\frac{1}{16}$ -in.

Remove basket shield, covers, and outer housings. Remove 2 screws holding air baffle to support and remove baffle. **NOTE:** Top of baffle is split to permit it to slip over propeller shaft. Wrap a piece of wire around universal joint bearing housings that are connected to the transmission and transfer unit, to prevent housings from slipping off cross and possibly losing some of the needle bearings when disconnected. Straighten lock plate under each of the 4 universal joint bearing housings attached to the transmission and transfer unit universal joint yokes. Disconnect universal joints at transmission and transfer unit ends by removing 8 bearing housing mounting screws (fig. 156). Push front universal joint yoke toward rear of vehicle to telescope sliding joint. Remove propeller shaft and universal joints.

**31. DISASSEMBLY.**

**a. Equipment.**

**CHISEL**

**SCREWDRIVER**

**HAMMER**

**WRENCH**, open-end,  $\frac{1}{2}$ -in.

**PLIERS**

**b. Procedure.**

**(1) REMOVE UNIVERSAL JOINTS.**

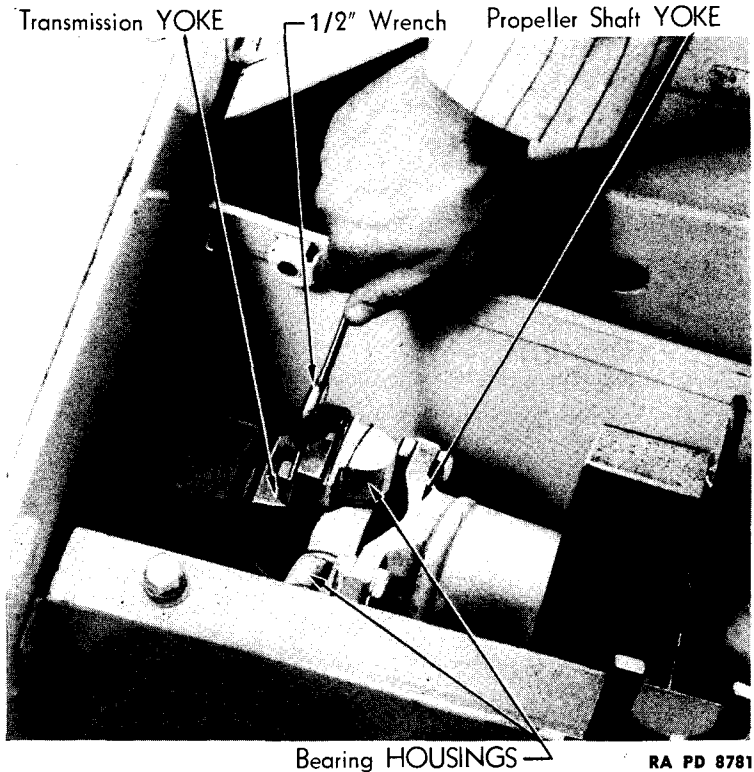
**CHISEL**

**PLIERS**

**HAMMER**

**WRENCH**, open-end,  $\frac{1}{2}$ -in.

Remove wires holding universal joint bearing housings disconnected from yokes on transmission and transfer unit at each end of propeller

**PROPELLER SHAFTS**

**Figure 156 — Disconnecting Universal Joint**

shaft. Straighten lock plates holding 2 universal joint bearing housings on yokes at each end of propeller shaft. Remove 2 screws holding each bearing housing to yoke, and remove bearing housing and universal joint crosses as a unit from propeller shaft.

**(2) REMOVE PROPELLER SHAFT YOKE.**

**SCREWDRIVER**

Pry sliding joint dust cap and packing loose from front end of propeller shaft. Slide dust cap and packing off propeller shaft toward universal joint yoke. Pull front propeller shaft yoke off splines in propeller shaft. **NOTE:** Discard packing removed from yoke.

**(3) DISSASSEMBLE UNIVERSAL JOINTS.**

**SCREWDRIVER**



**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

Remove bearing housings, oil seals, and bearings from universal joint cross. Pry oil seal retainer from each bearing housing. Remove needle bearings from each bearing housing. **CAUTION:** Be very careful not to lose any of the needle bearings.

### 32. INSPECTION AND REPAIR (fig. 154).

#### a. Equipment.

CLOTH, wiping

#### b. Procedure.

##### (1) PROPELLER SHAFT.

CLOTH, wiping

SOLVENT, dry-cleaning

Wash all propeller shaft parts thoroughly in cleaning solvent and dry with compressed air or wiping cloth. Inspect propeller shaft integral universal joint yoke for nicks and burs which might cause failure. Inspect splines in propeller shaft for nicks or burs which might cause oil leakage around sliding joint, and inspect front propeller shaft universal joint yoke and sliding joint for same conditions. Insert front propeller shaft universal joint yoke in propeller shaft and check backlash in splines at sliding joint. Backlash must not be more than 0.0042 to 0.0070 inch.

##### (2) UNIVERSAL JOINTS.

CLOTH, wiping

SOLVENT, dry-cleaning

Inspect both universal joint crosses for nicks or burs. Any nicks or burs may be removed with a fine whetstone. Measure bearing diameter on each universal joint cross, using a 1-inch micrometer. Diameter should be 0.600 to 0.601 inch. Measure diameter of needle bearings, using a 1-inch micrometer. Diameter should be 0.1260 to 0.1262 inch. Measure inside diameter of each bearing housing, using a 1-inch micrometer and telescope gage. Diameter should be 0.8534 to 0.8544 inch. Inspect bearing housings for any nicks or burs which might cause oil leakage or bearing wear.

### 33. ASSEMBLY.

#### a. Equipment.

CHISEL

WIRE

HAMMER

WRENCH, open-end, 1/2-in.

PLIERS

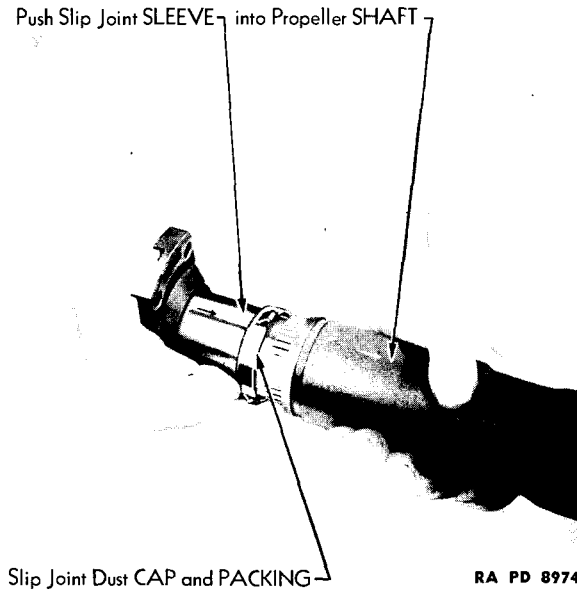
WRENCH, socket, 9/16-in.

#### b. Procedure.

##### (1) ASSEMBLE UNIVERSAL JOINT.

Smear a liberal coating of **GREASE**, general purpose (seasonal grade), on inside bore of each universal joint bearing housing and posi-

**PROPELLER SHAFTS**



**Figure 157 — Installing Slip Joint Yoke**

tion 18 needle bearings in each housing. Install a new bearing and retainer on each universal joint bearing housing by pressing into place between the jaws of a vise. Place a bearing housing shield on each end of both universal joint crosses. Install new oil seals on universal joint crosses. Install all 4 bearing housings on each universal joint cross. Use wires to hold bearing housings in place on cross. **NOTE:** Use wires to hold bearing housings in place on cross.

**(2) INSTALL PROPELLER SHAFT YOKE.**

Lubricate splines on front propeller shaft yoke, using **GREASE**, general purpose (seasonal grade). Slide a new propeller shaft sliding joint dust cap and packing over splines on front propeller shaft universal joint yoke and up onto smooth collar of yoke. Push front yoke and dust cap assembly into splines on front end of propeller shaft, positioning oil seal and retainer on front end of shaft (fig. 157). **CAUTION:** Be sure to line up arrow on yoke with arrow on propeller shaft. **NOTE:** Sliding joint dust cap will snap into position on propeller shaft as yoke is installed.

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**(3) INSTALL UNIVERSAL JOINTS.**

**CHISEL  
HAMMER  
PLIERS**

**WIRE  
WRENCH, open-end, 1/2-in.**

Position universal joint cross and bearing housing assembly on integral propeller shaft universal joint yoke and place a new bearing housing mounting screw lock plate over screw holes in each bearing housing next to universal joint yoke. Install 2 screws holding each bearing housing to universal joint. Bend up end of mounting screw lock plate around head of screw. Install a wire around the 2 universal joint bearing housings which were not connected to propeller shaft universal joint yoke to hold them in position on cross while propeller shaft is installed.

**34. INSTALLATION IN VEHICLE.**

**a. Equipment.**

**CHISEL  
HAMMER**

**WRENCH, open-end, 1/2-in.  
WRENCH, socket, 9/16-in.**

**b. Procedure.**

**(1) INSTALL PROPELLER SHAFT.**

**CHISEL  
HAMMER**

**WRENCH, open-end, 1/2-in.  
WRENCH, socket, 9/16-in.**

Position propeller shaft between universal joint yokes on transmission, and transfer unit and expand sliding joint so that universal joints on propeller shaft are touching yokes. Install a new mounting screw lock plate on each of the 4 bearing housings which attach to the transmission and transfer unit yokes. Install 2 screws holding each of the 4 bearing housings to yokes. Bend ends of lock plates up around each of the bearing housing mounting screws. Remove wires around the bearing housings, which were installed to prevent housings falling off universal joint crosses.

**(2) INSTALL OUTER HOUSINGS AND COVERS.**

**WRENCH, socket, 9/16-in.**

Position propeller shaft housing front cover over propeller shaft and install 4 mounting screws. Install 2 screws holding propeller shaft housing air baffle to support. Position propeller shaft housing rear cover on propeller shaft housing inner and outer walls, and install 5 screws and lock washers holding rear cover to walls.

**(3) INSTALL BASKET SHIELD (M5 AND M5A1 ONLY).**

**WRENCH, socket, 9/16-in.**

## PROPELLER SHAFTS

Position basket shield hooks over brackets at rear and over support screw at front. Tighten screw holding basket shield to support on propeller shaft housing cover.

### 35. LIMITS AND TOLERANCES.

Universal joint cross:

Diameter.....0.600 in. to 0.601 in.

Length.....3.999 in. to 4.000 in.

Universal joint yoke outside diameter.....1.8793 in. to 1.18798 in.

Bearing housing, inside diameter.....0.8534 in. to 0.8544 in.

Needle bearings:

Number used .....18

Diameter .....0.1260 in. to 0.1262 in.

Backlash, sliding joint splines.....0.0070 in. to 0.0042 in.

### 36. PREPARATION FOR EXTREME CONDITIONS.

a. If a propeller shaft is being overhauled under normal temperatures, **GREASE**, general purpose (seasonal grade), should be used. For operation at temperatures below 0 F, the universal joints should be disassembled, cleaned, and relubricated with **GREASE, OD, No. 00**.

### 37. PACKING, SHIPPING, AND STORAGE.

a. In making ready for shipping or storing, propeller shaft assemblies or parts of assemblies should be well lubricated and wrapped in non-oxide paper in order that they may be thoroughly sealed from various climatic conditions.

ORDNANCE MAINTENANCE—HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

Section IV

REFERENCES

	Paragraph
Standard nomenclature lists .....	38
Explanatory publications .....	39

38. STANDARD NOMENCLATURE LISTS.

a. Armament.

Gun, 37-mm, M5 and M6, and cradle, tank,  
37-mm, T2 ..... SNL A-45

Gun, machine, cal. .30, Browning, M1919A4, fixed  
and flexible, and M1919A5, fixed, and ground  
mounts ..... SNL A-6

Gun, machine, cal. .50, Browning, M2, heavy bar-  
rel, fixed and flexible, and ground mounts..... SNL A-39

Gun, submachine, cal. .45, Thompson, M1928A1  
and M1 ..... SNL A-32

Howitzer (pack), 75-mm, M1 and M1A1; and  
carriage, howitzer (pack), 75-mm, M1 ..... SNL C-20

Current Standard Nomenclature Lists are as tabu-  
lated here. An up-to-date list of SNL's is main-  
tained in the "Ordnance Publications for Supply  
Index" ..... OPSI

b. Carriage, motor, howitzer, 75-mm, M8 (tank, light,  
M5, chassis) ..... SNL G-127

c. Cleaning, preserving and lubricating materials; re-  
coil fluids, special oils, and miscellaneous re-  
lated items ..... SNL K-1

d. Tank, light, M5 ..... SNL G-103  
VOL. 2

39. EXPLANATORY PUBLICATIONS.

a. Armament.

37-mm gun, tank, M6 (mounted in tanks)..... FM 23-81

75-mm howitzer materiel ..... TM 9-320

Browning machine gun, cal. .30, HB, M1919A4,  
ground ..... FM 23-50

Browning machine gun, cal. .50, HB, M2 (mounted  
in combat vehicles) ..... FM 23-65

Thompson submachine gun, cal. .45, M1928A1.. FM 23-40

## REFERENCES

**b. Automotive Materiel.**

- 75-mm howitzer motor carriage M8..... TM 9-732B  
 Light tank M5 ..... TM 9-732  
 Ordnance maintenance: Auxiliary generator, electrical system and instrument for light tanks M5, M5A1, and 75-mm howitzer motor carriage M8 TM 9-1727F  
 Ordnance maintenance: Differential, final drive, tracks and suspension for light tanks M5, M5A1, and 75-mm howitzer motor carriage M8 TM 9-1727E  
 Ordnance maintenance: Engine cooling, engine electrical and engine fuel systems for light tanks M5, M5A1, and 75-mm howitzer motor carriage M8 ..... TM 9-1727B  
 Ordnance maintenance: Engine, exhaust system and ignition system for light tank M5, and 75-mm howitzer motor carriage M8 ..... TM 9-1732A  
 Ordnance maintenance: Hull, turret, gun mounts, and equipment for light tanks M5, M5A1, and 75-mm howitzer motor carriage M8..... TM 9-1727G

**c. Care and Preservation.**

- Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ordnance Department ..... TM 9-850  
 Decontamination, 1941 ..... TC No. 38

**d. Maintenance and Inspection.**

- Automotive lubrication ..... TM 10-540  
 Echelon system of maintenance..... TM 10-525  
 Fire prevention safety precaution accidents..... TM 10-360  
 Maintenance and repair ..... TM 10-520  
 Motor transport inspections ..... TM 10-545

**e. Storage and Shipment.**

- Rules governing the loading of mechanized and motorized army equipment, also, major calibre guns for the United States Army and Navy, on open top equipment—Published by Operations and Maintenance Department of Association of American Railroads  
 Storage of military motor vehicles..... AR 850-18

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

**INDEX**

<b>A</b>	<b>Page No.</b>	<b>C</b>	<b>Page No.</b>
Accumulator valve, remove.....	107	Carburetor air intake pipe	
Adjustments:		install .....	183-184
band in vehicle .....	41-45	remove .....	76
carburetor(s) .....	54	Carburetor ventilating line, connect	181
fast and slow idle .....	189	Carburetors, adjustment .....	54
manual control linkage .....	46-52	fast and slow idle .....	189
throttle control linkage... 52-61, 188		Carriage, motor, 75-mm howitzer,	
throttle rods .....	55-58	M8 .....	2
Air baffle, remove .....	74	Center (main) bearing cap	
Ammunition racks, install .....	186	install .....	167
Anchor plunger spring, limits and		remove .....	106
tolerances .....	194	Changing oil .....	41
Anchor retracting spring, limits and		Clutch assembly	
tolerances .....	195	install .....	159-160
Assembly		remove .....	110
propeller shafts and universal		Clutch assembly and intermediate	
joints .....	208-210	shaft, remove .....	112
transmission and control unit in-		Clutch drum pistons and oil seal	
stallation .....	156-180	rings, limits and tolerances ...	190
(See <i>specific names of compo-</i>		Clutch hub, limits and tolerances	
<i>ments</i> )		front unit .....	190
transmission control units		rear unit .....	192
control valve body .....	153-156	Clutch plates	
front oil pump and servo..	137-138	install .....	165
rear oil pump and governor	146-147	limits and tolerances	
rear servo .....	142-144	front unit .....	190
Auxiliary air cleaner		rear unit .....	193
install .....	184	Clutch pressure plate, install.....	165
remove .....	74-75	Clutch release springs, limits and	
		tolerances	
		front unit .....	190
		rear unit .....	193
		Coil wires, connect .....	184
		Control levers, install on shaft... 179	
		Control valve body assembly	
		assembly .....	153-156
		disassembly .....	148-151
		illustration .....	154-155
		illustration .....	146
		inspection .....	151-153
		install .....	64, 178
		remove .....	63, 95
		Controlled differential, maintenance	32
		Cooling system	
		drain .....	70
		fill .....	187
		maintenance .....	27

**B**

Band adjustments in vehicle ...	41-45
Basket shield, install .....	186
Bearing retainer, disassembled,	
illustration .....	130-131
Brake drum	
install .....	166
remove .....	108
Brake drum and clutch drum assem-	
bly, limits and tolerances .....	192
Bulkhead doors	
install .....	186
remove .....	71
Bulkhead extension, install .....	186
Bulkhead extension covers, replace-	
ment .....	62
Bypass valve assembly .....	95

**INDEX**

<b>C—Cont'd</b>	<b>Page No.</b>	<b>E</b>	<b>Page No.</b>
Cover plate		Echelons, definition of.....	25
install .....	187-188	Electrical system, maintenance....	28
remove .....	70	Electrical wiring, disconnect.....	75
replacement .....	61-62	Engine	
Crew, data on .....	2	description .....	2
		disconnect front and rear supports	81
		maintenance .....	26-27
		removal from vehicle.....	82
		removal of transmission from..	83-84
<b>D</b>		Engine compartment	
Data		cover	
propeller shaft and universal joint	202	install .....	186-187
transmission .....	24	remove .....	71
Definition of echelons and maintenance terms .....	25	install engine in.....	182
Description		rear doors, close .....	189
engine .....	2	Engine cooling system (See Cooling system)	
Hydra-Matic transmission .....	7-9	Engine sling	
power flow through transmission	9-24	disconnect .....	183
propeller shafts and universal joints .....	200-202	install on engine.....	81-82
vehicle and mount .....	2	Engine supports, tighten.....	182-183
Disassembly		Extinguishers, fire, maintenance....	28
propeller shafts and universal joints .....	206-208	Extreme conditions, preparation for	
transmission .....	85-115	propeller shafts .....	211
(See <i>specific names of components</i> )		transmission .....	198
transmission control units			
control valve body.....	148-151	<b>F</b>	
front oil pump and servo....	135	Fan, fan belt, and fan bracket	
rear oil pump and governor	144-145	install .....	188
rear servo .....	139-141	remove .....	70
illustration .....	138	Fan shrouds	
Discharge pipes, oil		install .....	189
install .....	175-177	remove .....	69-70
remove .....	96	Filling cooling system.....	187
Downshifting .....	24	transmission, illustration .....	44
Drain plugs, transmission, illustration .....	43	Final drive, maintenance.....	29
Draining:		Fire extinguisher nozzles, install...	184
cooling system .....	70	Fire extinguishers, maintenance....	28
transmission at O F.....	198	First speed, transmission in.....	9-15
transmission oil .....	83	high range .....	22-23
Drive gear (front unit), limits and tolerances .....	191	Fluid coupling of transmission.....	7-8
Driven shaft		correction of leaks at.....	45-46
install .....	158	Flywheel cover	
remove .....	113	inspection .....	116
illustration .....	121	limits and tolerances.....	189
thrust washers, removing, illustration .....	124	remove .....	90
		Flywheel drain plug, install.....	181
		Flywheel housing	
		install .....	179
		lower pan .....	181
		remove .....	90



ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

INDEX

F—Cont'd

Page No.

Page No.

Form, inspection ..... 33

Fourth speed, transmission in..... 18

Front band adjustment..... 42-43

Front cover  
inspection ..... 117-118  
install ..... 170  
remove ..... 102

Front oil pump and servo  
assembly ..... 137-138  
disassembly ..... 135  
illustration ..... 136  
front and rear servo removed after  
transmission out ..... 97-98  
inspection ..... 135-137  
install ..... 64-65  
limits and tolerances..... 191-192  
removed as a unit..... 64

Front planetary units  
description ..... 8  
install ..... 167-169  
remove ..... 106

Front pump and servo and rear servo  
install ..... 173-174  
remove ..... 97-98

Front servo piston, removing, illus-  
tration ..... 134

Front unit  
disassembly, illustration .... 126-127  
inspection ..... 118-121  
limits and tolerances..... 190-191

Front unit brake drum, removing,  
illustration ..... 118

Front unit clutch drum  
install ..... 161-162  
remove ..... 112  
illustration ..... 116

Front unit clutch pressure plate, re-  
moving, illustration ..... 117

Front unit drive gear  
install ..... 169  
remove ..... 102-105

Fuel lines, connect..... 184-185

Fuel system, maintenance..... 29

Generator wires, connect..... 184

Governor  
checking run-out of..... 172-173  
description and operation..... 22  
(See also Rear oil pump and gov-  
ernor)

H

High range, first speed..... 22-23

Hull and turret, maintenance.... 29-30

Hydra-Matic control linkage, discon-  
nect ..... 76

Hydra-Matic transmission  
assembly and control unit installa-  
tion ..... 156-180  
control units, disassembly, inspec-  
tion, and assembly  
control valve body.... 147-156  
front oil pump and servo 135-138  
rear oil pump and gover-  
nor ..... 144-147  
rear servo ..... 139-144  
data and specifications..... 24-25  
description ..... 7-9  
disassembly ..... 85-115  
inspection and repair.... 116-135  
extreme conditions, preparation  
for ..... 198  
inspection in vehicle..... 33-34  
installation in vehicle..... 180-189  
limits and tolerances (See Limits  
and tolerances)  
maintenance duties, allocation  
of ..... 25-32  
(See under Maintenance for  
specific components)

operation  
downshifting ..... 24  
first speed ..... 9-15  
fourth speed ..... 18  
governor ..... 22  
high range, first speed..... 22-23  
hydraulic control system.... 21-22  
low range ..... 24  
neutral ..... 9  
oil flow, neutral..... 22  
oil flow, reverse ..... 24  
oil pumps ..... 22

G

Gages, maintenance ..... 31

Gear ratios, transmission in (See  
operation under Hydra-Matic  
transmission)

## INDEX

<b>H—Cont'd</b>	<b>Page No.</b>	<b>Page No.</b>
Hydra-Matic transmission—Cont'd		
operation—Cont'd		
reverse .....	18-21	
second speed .....	15-16	
shifting from first to second..	23	
shifting from second to third...	23	
shifting from third to fourth	23-24	
third speed .....	16-18	
packing, shipping, and stor- age .....	198-199	
removal from vehicle		
general discussion and caution.	68	
procedure .....	69-82	
removal of transmission from engine .....	83-84	
replacement of components with transmission in vehicle		
bulkhead extension covers...	62	
control valve body assem- bly .....	63-64	
cover plate .....	61-62	
front servo and oil pump.	64-65	
oil cooler .....	66	
oil pan .....	62-63	
pressure regulator body..	66-67	
rear oil pump and governor	65-66	
rear servo .....	67-68	
wheel racks .....	62	
servicing in vehicle		
band adjustments .....	41-45	
fluid coupling, correction of leaks at .....	45-46	
manual linkage adjustment.	46-52	
oil level, checking.....	41	
throttle control linkage adjust- ment .....	52-61	
special tools .....	197	
torque tightnesses .....	196	
trouble shooting .....	34-41	
Hydraulic control system.....	21-22	
<b>I</b>		
Ignition (electrical system), main- tenance .....	28	
Inspection		
disassembled transmission		
flywheel cover .....	116	
front cover and oil seal... ..	117-118	
front unit .....	118-121	
main shaft .....	133	
oil cooler .....	134-135	
oil delivery sleeve.....	122-123	
oil pan .....	134	
oil pressure regulator.....	121	
rear unit .....	123-133	
reverse anchor .....	133	
reverse unit .....	133	
torus members .....	116-117	
transmission case .....	134	
transmission control units		
control valve body.....	151-153	
front oil pump and servo..	135-137	
rear oil pump and governor	145-146	
rear servo .....	141-142	
transmission in vehicle.....	33-34	
Inspection and repair of propeller shafts and universal joints.....	208	
Inspection of vehicle.....	202-203	
Intermediate shaft		
install .....	159-160	
removing, illustration .....	119	
Internal gear		
install .....	166	
remove .....	108	
Instruments, maintenance .....	31	
<b>L</b>		
Leaks at fluid coupling, correction of .....	45-46	
Limits and tolerances		
flywheel cover and torus assem- blies .....	189	
front servo and oil pump assem- bly .....	191-192	
front unit .....	190-191	
oil delivery sleeve.....	192	
oil pressure regulator.....	192	
propeller shaft and universal joints .....	211	
rear oil pump and governor as- sembly .....	194	
rear servo .....	193-194	
rear unit .....	192-193	
reverse anchor and plunger as- sembly .....	194-195	
reverse unit .....	195	
shafts .....	195-196	

ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

**L—Cont'd**

Page No.

**O**

Page No.

Limits and tolerances—Cont'd  
 transmission case front cover and  
 oil seal assembly..... 190  
 valve body ..... 195  
 Low range ..... 24  
 Lubrication, slip joints..... 203

**M**

Main shaft  
 end clearance, checking..... 100  
 end play, checking..... 171  
 inspection ..... 133  
 install ..... 169-170  
 limits and tolerances..... 195  
 remove ..... 101

Main shaft nut  
 install ..... 180  
 remove ..... 88

Maintenance  
 definitions of echelons and terms. 25  
 duties, allocation of by echelons  
 engine ..... 26-27  
 engine cooling system..... 27  
 electrical system ..... 28  
 final drive ..... 29  
 fire extinguishers ..... 28  
 fuel system ..... 29  
 hull and turret..... 29-30  
 Hydra-Matic transmission .... 30  
 ignition (electrical system)... 28  
 instruments and gages..... 31  
 propeller shafts and universal  
 joints ..... 31  
 suspension system ..... 31  
 transfer unit and controlled dif-  
 ferential ..... 31-32  
 vehicle assembly ..... 32

Manual control linkage  
 adjustment ..... 46-52  
 connect and adjust..... 183

Manual control valve, removing, il-  
 lustration ..... 119

Manual lever, remove..... 90-92

Measuring ring clearances, illustra-  
 tion ..... 125

Measuring ring gap, illustration.... 125

**N**

Neutral, transmission in..... 9

Oil  
 changing ..... 41  
 leakage at propeller shaft and uni-  
 versal joint, cause and remedy. 203  
 transmission, draining ..... 83  
 Oil bypass valve, install..... 178  
 Oil cooler screen  
 install ..... 178  
 remove ..... 93-95  
 Oil cooler unit  
 inspection ..... 134-135  
 install ..... 177  
 remove ..... 95  
 replacement with transmission in  
 vehicle ..... 66  
 Oil delivery sleeve  
 inspection ..... 122-123  
 install ..... 162  
 limits and tolerances..... 192  
 Oil flow  
 neutral ..... 22  
 reverse position ..... 24  
 Oil intake pipes  
 install ..... 175-177  
 remove ..... 96  
 Oil level, checking..... 41  
 Oil pan  
 front cover, install..... 177  
 inspection ..... 134  
 install ..... 63, 178  
 remove ..... 62-63, 92-93  
 Oil pressure regulator  
 inspection ..... 121  
 install ..... 174  
 limits and tolerances..... 192  
 remove ..... 97  
 Oil pump idler gear assembly, limits  
 and tolerances ..... 194  
 Oil pumps  
 description and operation..... 22  
 pressure check ..... 58-61  
 (See also Front oil pump and  
 servo)  
 Oil seal (assembly)  
 inspection ..... 117-118  
 limits and tolerances..... 190  
 Oil seal rings, limits and toler-  
 ances ..... 193-194

INDEX

O—Cont'd	Page No.	Page No.
Operating inspection		
propeller shafts and universal joints	203	
transmission	33-34	
Operation		
propeller shafts and universal joints	202	
transmission at O F.	198	
(See also operation under Hydra-Matic transmission)		
universal joints at O F.	211	
<b>P</b>		
Packing:		
propeller shafts	211	
transmission	198-199	
Periodic inspections of transmission in vehicle	33	
Planet carrier and internal gear assembly, limits and tolerances	193	
Planet carrier gear assembly		
install	157	
remove	113-115	
Planetary units of transmission	8	
Power		
flow of through transmission in gear ratios	9-24	
transmission of	2	
Pressure regulator body		
install	67	
remove	66-67	
Pressure regulator plunger and spring, limits and tolerances	192	
Propeller shaft cover		
install	183	
remove	77	
Propeller shafts		
assembly	208-210	
connect	183	
data and specifications	202	
description	200-202	
disassembly	206-208	
disconnect	77	
extreme conditions, preparation for	211	
inspection and repair	208	
inspection of vehicle	202-203	
installation in vehicle	210-211	
limits and tolerances	211	
maintenance	31	
operation	202	
packing, shipping, and storage	211	
removal from vehicle	203-206	
service of vehicle (slip joint lubrication)	203	
trouble shooting	203	
<b>R</b>		
Radiator air baffle, install	185	
Radiator hoses		
install	186	
remove	72	
Radiator support, remove	74	
Radiators		
install	184-185	
remove	72	
Rear band adjustment	43-45	
Rear bearing retainer, remove	101	
illustration	120	
Rear fire extinguisher nozzles, remove	74	
Rear oil pump and governor		
assembly	146-147	
disassembly	144-145	
illustration	143	
inspection	145-146	
install	65-66, 171-172	
limits and tolerances	194	
remove	65, 98	
Rear planetary units		
description	8	
install	167-169	
remove	106	
Rear servo		
assembly	142-144	
disassembly	139-141	
illustrations	138, 140	
inspection	141-142	
install	68, 173-174	
limits and tolerances	193-194	
remove	67-68, 97-98	
Rear unit		
clutch drum, install	163	
clutch hub, install	164	
disassembled, illustration	128-129	
inspection	123-133	
limits and tolerances	192-193	
Rebuild defined	25	
Regulator valve spring, install	175	

**ORDNANCE MAINTENANCE — HYDRA-MATIC TRANSMISSION AND PROPELLER SHAFTS FOR  
LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8**

<b>R—Cont'd</b>	<b>Page No.</b>	<b>Page No.</b>	
Repair defined .....	25	Shipping:	
Replace defined .....	25	propeller shafts .....	211
Replacement (See replacement of components with transmission in vehicle <i>under</i> Hydra-Matic trans- mission)		transmission .....	198-199
Retaining ring for reverse internal gear, removing, illustration....	122	Side cover, install.....	178
Retaining ring for reverse planet carrier, removing, illustration....	123	Slip joint lubrication.....	203
Reverse		Special tools for transmission.....	197
oil flow .....	24	Starter, install .....	181
transmission in .....	18-21	Starter feed cables and conduits, connect .....	184
Reverse anchor		Storage	
inspection .....	133	propeller shafts .....	211
install .....	178	transmission .....	198
remove .....	96	Sun gear, remove.....	115
Reverse anchor and plunger assem- bly, limits and tolerances..	194-195	Suspension, system, maintenance..	31
Reverse unit		<b>T</b>	
assemble .....	159	Tachometer cable, disconnect ....	75
disassembled, illustration ..	130-131	Tank assembly, maintenance.....	32
inspection .....	133	(See <i>also</i> Vehicle)	
install .....	170-171	Third speed, transmission in....	16-18
limits and tolerances.....	195	Throttle control linkage adjust- ment .....	52-61, 188
Ring clearance, measuring, illustra- tion .....	125	Throttle rods	
Ring gap, measuring, illustration..	125	adjustment .....	55-58
Rotation of power unit.....	8	connect .....	181
Run-out of governor, checking. 172-173		disconnect .....	58
		Throttle valve drive	
		connect .....	180
		remove .....	90-92
		Thrust washers, installing for front unit drive gear, illustration... 169	
<b>S</b>		Tightnesses, torque .....	196
Second speed, transmission in... 15-16		Timing changes in gear ratios... 21-22	
Service defined .....	25	Tolerances (See Limits and toler- ances)	
Service of vehicle.....	203	Tools, special, transmission.....	197
Servicing transmission vehicle		Torque tightnesses .....	196
(See servicing in vehicle <i>under</i> Hydra-Matic transmissions)		Torus members	
Servo, front (See Front oil pump and servo)		inspection .....	116-117
"Servo" mechanism .....	8	install .....	179
Servo, rear (See Rear servo)		limits and tolerances.....	189
Shafts, limits and tolerances.. 195-196		remove .....	88-90
Shell racks, replacement.....	62	Transfer unit and controlled differ- ential, maintenance .....	31-32
Shifting		Transfer unit oil cooler	
downshifting .....	24	connect .....	185
from first to second.....	23	remove .....	73
from second to third.....	23	secure .....	186
from third to fourth.....	23-24	Transmission (See Hydra-Matic transmission)	

**INDEX**

<b>T—Cont'd</b>	<b>Page No.</b>	<b>V</b>	<b>Page No.</b>
Transmission case, inspection . . . . .	134	Valve body, limits and tolerances.	195
Transmission case and related parts, illustration . . . . .	132	Vehicle	
Transmission case front cover, lim- its and tolerances. . . . .	190	inspection of transmission in. . . . .	33-34
Transmission side cover, remove. . . . .	92	installation of propeller shaft in . . . . .	210-211
Trouble shooting:		installation of transmission in 180-189	
propeller shafts and universal joints . . . . .	203	removal of propeller shaft from . . . . .	203-206
transmissions . . . . .	34-41	Vehicle assembly, maintenance. . . . .	32
Turret and hull, maintenance. . . . .	29-30	Visual inspection of:	
		propeller shafts . . . . .	203
		transmission in vehicle. . . . .	33
<b>U</b>			
Universal joint (See Propeller shafts)		<b>W</b>	
Upper rear relay cross shaft, re- move . . . . .	76-77	Waterproof paper, packing box for transmission . . . . .	198-199
Upper shell racks, remove. . . . .	71	Wires, connect to gage units. . . . .	184

[ A.G. 062.11 (12-30-42) ]  
[ O.O. 461/30612 O.O. (2-5-43) ]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,  
*Chief of Staff.*

OFFICIAL:

J. A. ULIO,  
*Major General,*  
*The Adjutant General.*

DISTRIBUTION: R 9(2); Bn 9(1); C 9(4)  
(For explanation of symbols, see FM 21-6)