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TM 9-1727D

RESTRICTED

WAR DEPARTMENT

TECHNICAL MANUAL

of

ORDNANCE MAINTENANCE

TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

APRIL 28, 1943

FOR ORDNANCE PERSONNEL ONLY

RESTRICTED

TECHNICAL MANUAL
No. 9-1727D

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ORDNANCE MAINTENANCE

TRANSFER UNIT 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)

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ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

Section I

INTRODUCTION

1. PURPOSE AND SCOPE.

a. TM 9-1727D is published for the information and guidance of all ordnance personnel charged with the maintenance and overhauling of Light Tanks M5, M5A1, and 75-mm Howitzer Motor Carriage M8. It includes complete maintenance information on the transfer unit. The other technical manuals covering these vehicles are listed in section III.

2. DESCRIPTION OF VEHICLES.

a. The Light Tanks M5 and M5A1 are armored, full-tracklaying combat vehicles, each carrying a crew of four men. They are each powered by two liquid-cooled, 90-degree, V-type, 8-cylinder engines, located in the engine compartment in the rear of the hull. Power is transmitted to the final drives and tracks through two Hydra-Matic transmissions, two propeller shafts, a two-speed, step-down transfer unit, and the controlled differential (fig. 4).

b. The Motor Carriage M8 (fig. 3) is an armored, full-tracklaying, self-propelled mount for a 75-mm howitzer. It carries a crew of four men. It is powered by the same engines, transmissions, and power train as the Light Tank M5.

3. REFERENCES.

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

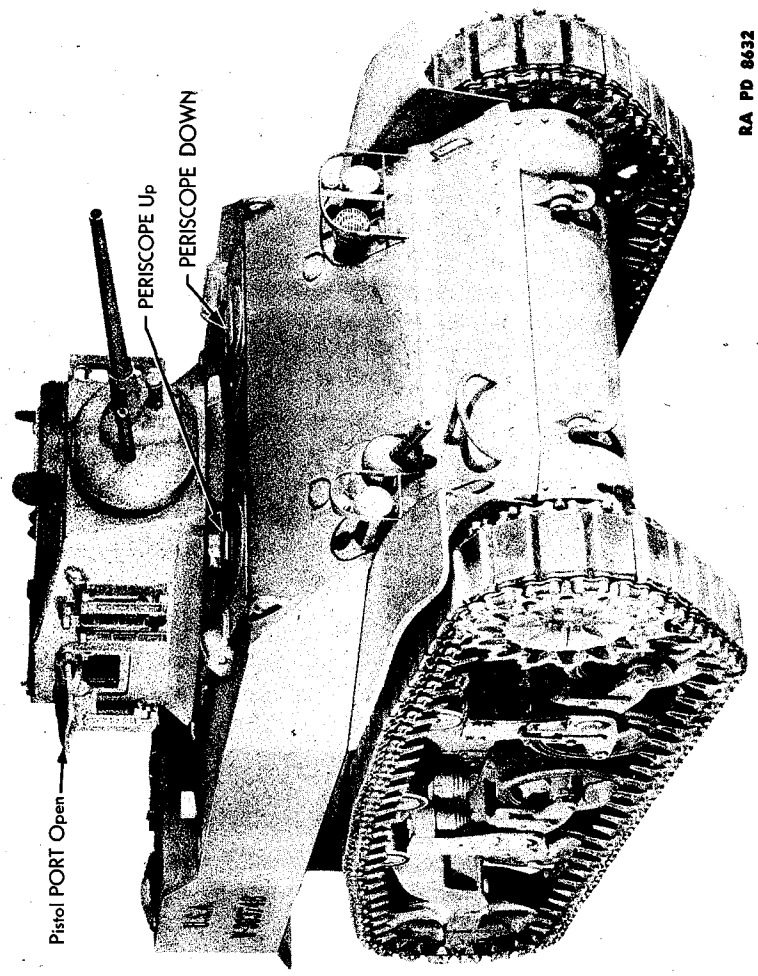

Figure 1 — Light Tank M5 — Right Front View

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

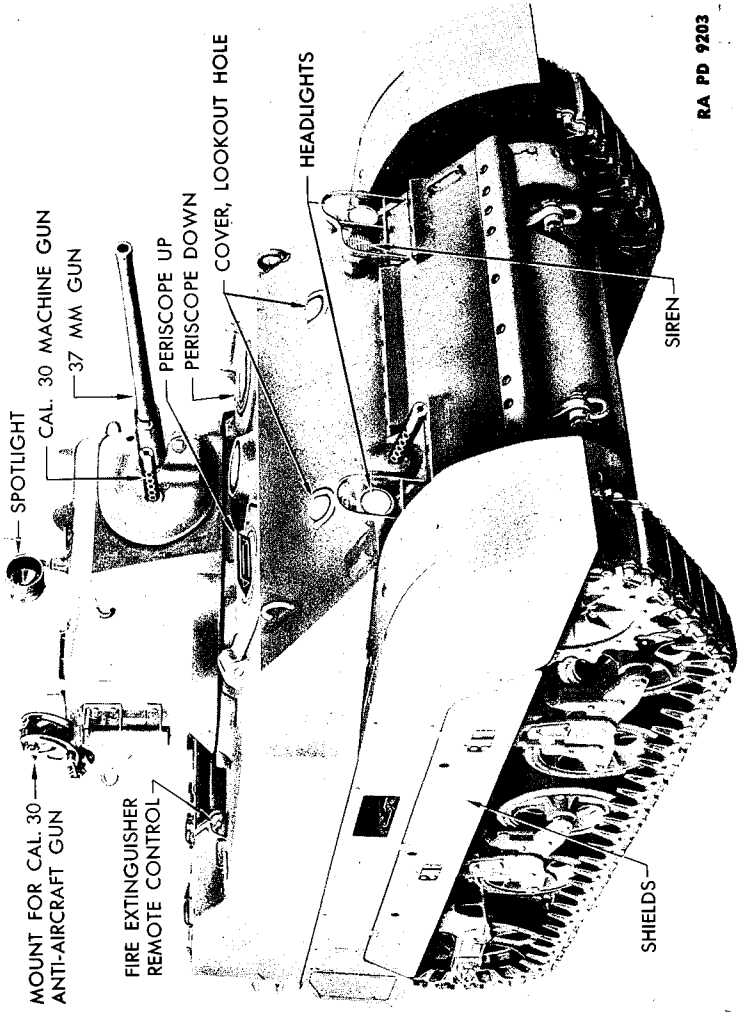

Figure 2 — Light Tank M5A1 — Right Front View

INTRODUCTION

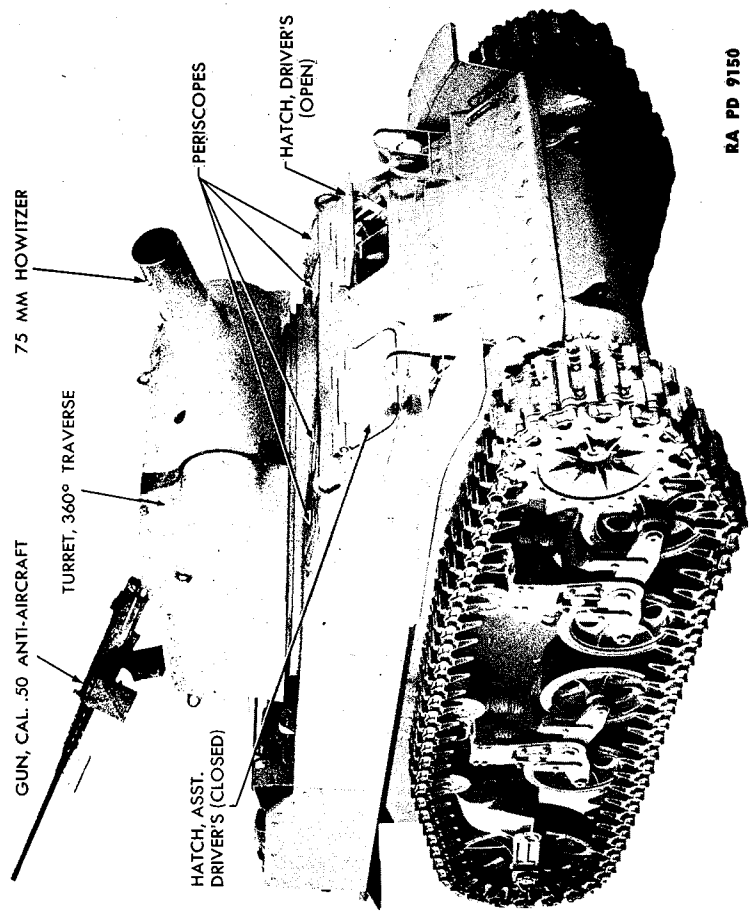

Figure 3 — Motor Carriage M8 — Right Front View

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

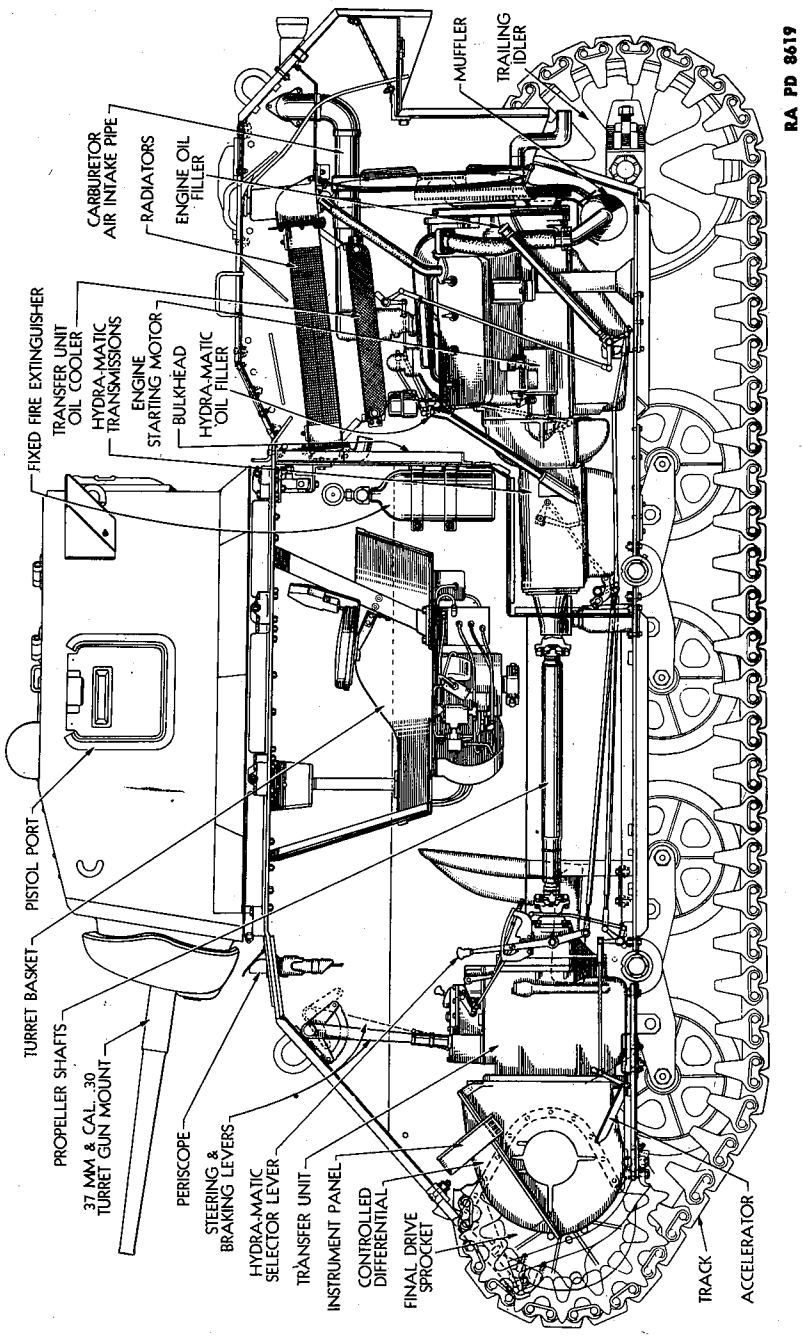

Figure 4 — Light Tank M5 — Longitudinal Cross Section

Section II

TRANSFER UNIT

4. DESCRIPTION.

a. The transfer unit performs two distinct functions. It takes the power of the two engines, delivered to the transfer unit by he propeller shafts, and combines these two power flows into one. It also provides a two-speed, hydraulic-controlled gear reduction which, combined with the reductions in the transmissions, permits a total of six forward speeds and one reverse speed.

b. The transfer unit is located in the front end of the vehicle, mounted on a flange on the rear of the controlled differential housing (fig. 5).

c. The transfer unit case is composed of two sections, a large main case at the front which contains the mechanism for the gear reduction unit and the hydraulic control parts, and a smaller case at the rear which contains the connector unit by means of which the torque from the two propeller shafts is combined into the one transfer unit main shaft.

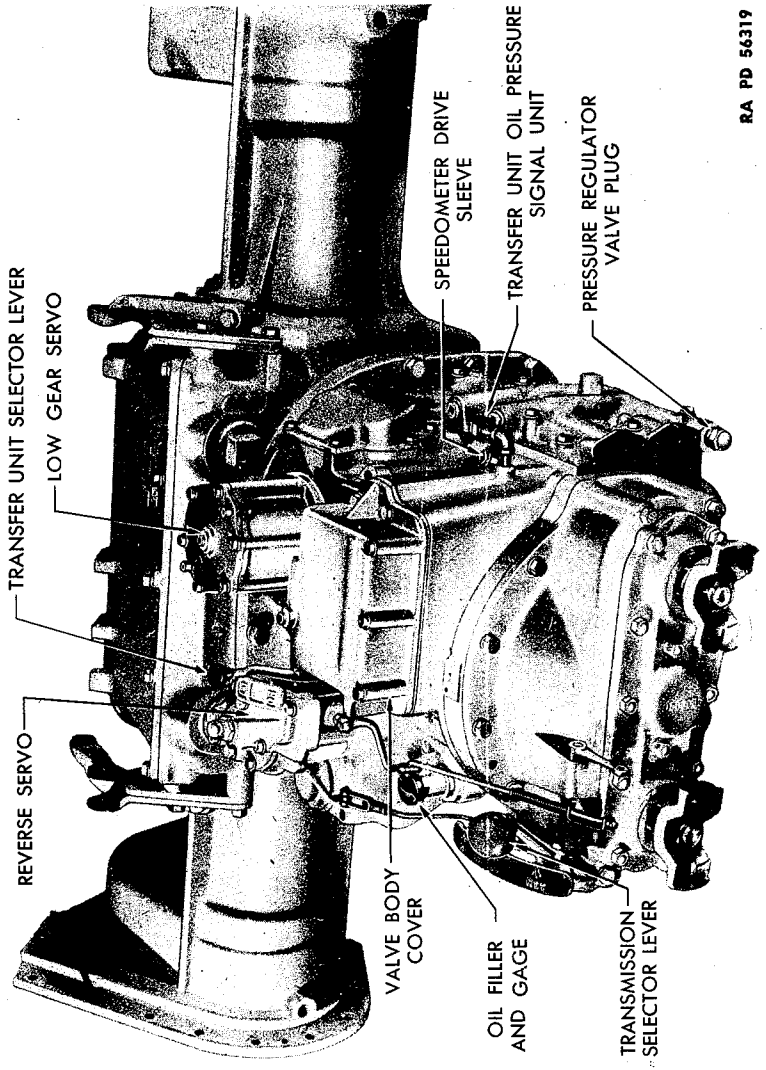

Figure 5 — Transfer Unit and Controlled Differential

d. The connector gears which combine the torque are all of the same diameter and thus do not provide any reduction. The connector gear shafts are mounted in the case in single row ball bearings. The main shaft or input shaft into the transfer unit proper is mounted at its rearward end on a double row ball bearing and on its forward or inner end on a roller pilot bearing (L, fig. 6) in the counterbore of the transfer unit output shaft.

e. The spiral drive pinion for the controlled differential is splined to the transfer unit output shaft and held securely in place by a cottered castle nut. The forward or pinion end of the output shaft is mounted in the transfer case on a large, double-row ball bearing, and the rearward or inner end on a single-row ball bearing.

f. The gear reduction unit is a compound planetary system with the two center gears integral with the main shaft, and the second planet carrier attached to the output shaft. Two bands are used to lock the brake drum and thus provide reduction. The low gear band is self-energizing in forward speeds and the reverse band, in reverse speeds. A multiple disk clutch, engaged by oil pressure, is contained in the clutch drum assembly, and locks the planetary gear train as a unit to provide direct drive.

g. The servos which apply and release the two bands are mounted on the top of the main transfer unit case (figs. 7 and 8). The oil pumps and governor are mounted on a carrier located on the right-hand side of the unit, and the valves which control the shifting are mounted in a valve body on top of the unit.

5. OPERATION.

a. Reduction. When the vehicle is started or operated at low speeds, the transfer unit is in reduction (fig. 10). The low gear band is applied to the drum by spring pressure in the low gear servo, and the clutch is released because there is no oil pressure to the clutch apply pistons. The reverse servo is released by oil pressure applied to the release piston and is held in the released position by a mechanically-operated latch and a ball check valve which prevents air from being drawn into the system. As the main shaft is rotated, the two center gears, being integral with the shaft, also rotate. The internal gear for the first planetary gear train is held from rotating by the low gear band; consequently, the planet gears in this train "walk around" inside the internal gear and carry the planet carrier at a speed less than that of the first center gear. The planet carrier for the first planetary gear train is integral with the internal gear for the second planetary train; consequently, this internal gear rotates

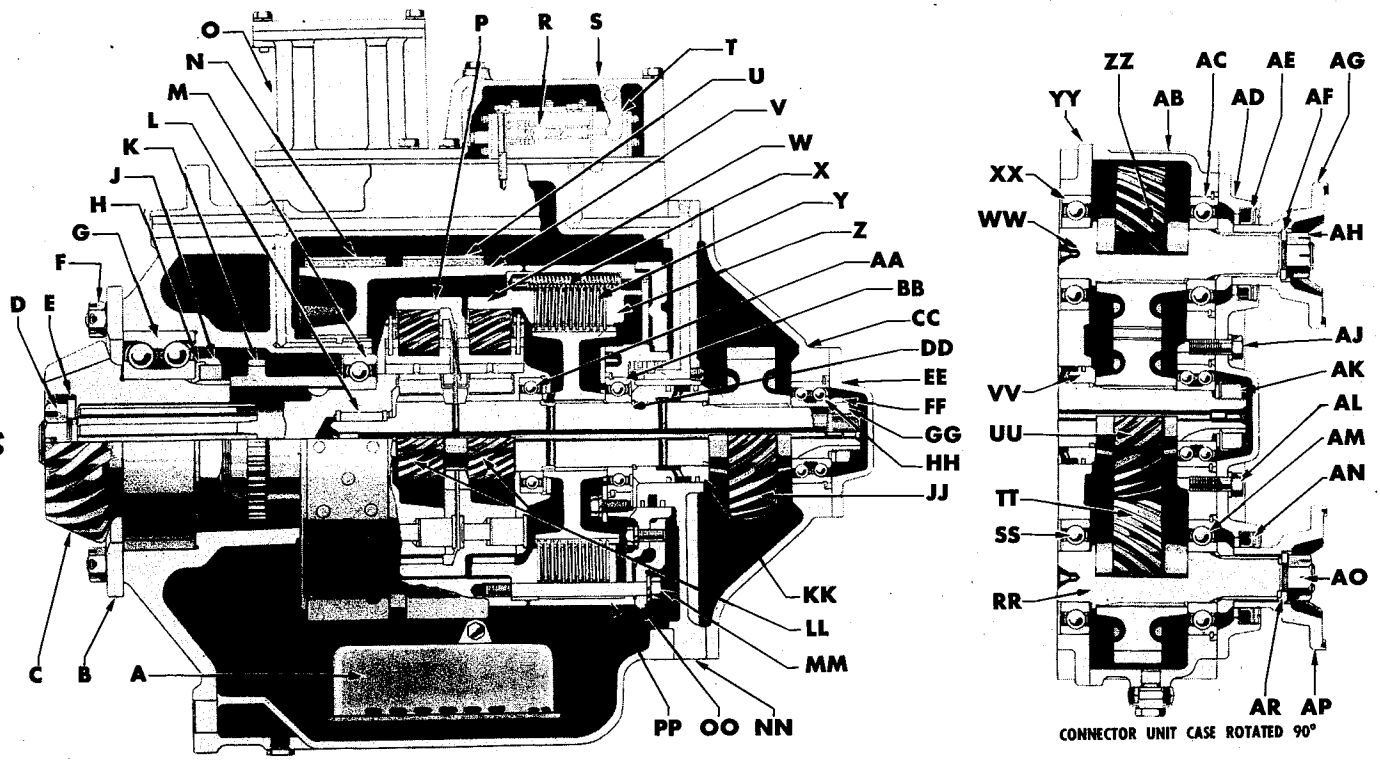

Figure 6 — Transfer Unit — Longitudinal Section

A—STRAINER, OIL

B—RETAINER, DRIVE PINION BEARING

C—PINION, SPIRAL DRIVE

D—NUT, SPIRAL DRIVE PINION

E—WASHER, SPIRAL DRIVE PINION NUT

F—NUT, BEARING RETAINER

G—BEARING, OUTPUT SHAFT, FRONT

H—WASHER, LOCK, BEARING, RETAINER NUT

J—NUT, BEARING RETAINER

K—GEAR, DRIVE, OIL PUMP AND GOVERNOR

L—BEARING, MAIN SHAFT PILOT

M—BEARING, OUTPUT SHAFT, REAR

N—BAND, LOW GEAR

O—SERVO, LOW GEAR

P—CARRIER, DIRECT DRIVE

R—BODY, VALVE AND ACCUMULATOR

S—COVER, VALVE, BODY

T—LEVER, THROTTLE VALVE CONTROL, INNER

U—BAND, REVERSE

V—DRUM, BRAKE

W—GEAR, INTERNAL, LOW GEAR CLUTCH DRUM

X—SPRING, CLUTCH RELEASE

Y—PLATE, CLUTCH, DRIVE

Z—PLATE, CLUTCH, PRESSURE

AA—BEARING, MAIN SHAFT

BB—BEARING, CLUTCH DRUM

CC—CASE, CONNECTOR UNIT

DD—SHAFT, MAIN

EE—COVER, CONNECTOR UNIT CASE

FF—WASHER, LOCK, MAIN SHAFT NUT

GG—NUT, MAIN SHAFT

HH—BEARING, MAIN SHAFT, REAR

JJ—GEAR, DRIVEN, CONNECTOR UNIT

KK—SPACER, MAIN SHAFT

LL—PINION, PLANETARY, DIRECT DRIVE CARRIER AND OUTPUT SHAFT

MM—BOLT, CLUTCH DRUM TO BRAKE DRUM

NN—COVER, TRANSFER UNIT CASE, REAR

OO—COVER, CLUTCH DRUM

PP—DRUM, CLUTCH

RR—SHAFT, CONNECTOR UNIT DRIVE GEAR

SS—BEARING, CONNECTOR DRIVE GEAR

TT—GEAR, DRIVE, CONNECTOR

UU—GEAR, DRIVEN, CONNECTOR UNIT

VV—SPACER, MAIN SHAFT

WW—SHAFT, CONNECTOR UNIT DRIVE GEAR

XX—BEARING, CONNECTOR DRIVE GEAR, FRONT

YY—COVER, TRANSFER UNIT CASE, REAR

ZZ—GEAR, DRIVE, CONNECTOR

AB—CASE, ASSEMBLY, CONNECTOR UNIT

AC—BEARING, CONNECTOR DRIVE GEAR, REAR

AD—COVER, CONNECTOR UNIT CASE

AE—OIL SEAL, CONNECTOR UNIT UNIVERSAL JOINT YOKE

AF—WASHER, YOKE

AG—YOKE, UNIVERSAL JOINT

AH—NUT, UNIVERSAL JOINT YOKE

AJ—SCREW, CONNECTOR COVER TO CASE

AK—NUT, MAIN SHAFT

AL—SCREW, CONNECTOR COVER TO CASE

AM—BEARING, CONNECTOR DRIVE GEAR, REAR

AN—OIL SEAL, CONNECTOR UNIT UNIVERSAL JOINT YOKE

AO—NUT, UNIVERSAL JOINT YOKE

AP—YOKE, UNIVERSAL JOINT

AR—WASHER, UNIVERSAL JOINT

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Legend for Figure 6 — Transfer Unit — Longitudinal Section

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

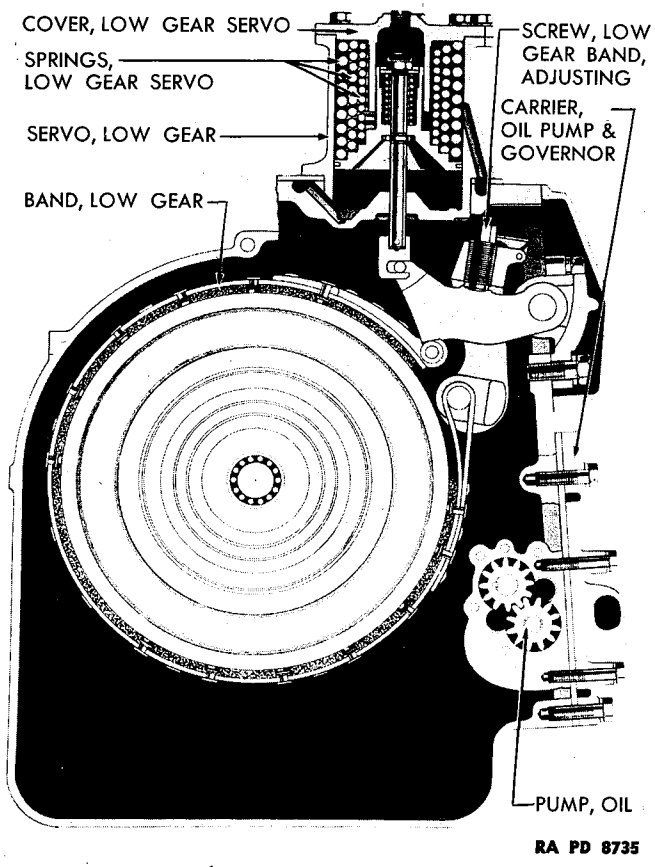

Figure 7 — Transfer Unit — Cross Section at Low Gear Servo

at a speed less than that of the second center gear. The planet gears of the second planetary train accordingly rotate with these gears and at the same time "walk around" the second center gear at an over-all gear reduction of 2.37 to 1. Since the output shaft is attached to the planet carrier of the second planetary gear train, this is the gear reduction of the transfer unit.

b. Upshift. When the vehicle speed is such that the transfer unit upshifts, oil pressure is applied to the release side of the low gear servo. This oil pressure overcomes the apply pressure of the springs and assures the gradual release of the low gear band from the brake drum. At the same time that this occurs, oil pressure is also delivered to the clutch apply pistons and the clutch is applied (fig. 11). Details of the hydraulic mechanism whereby this is accomplished are given in paragraph 5 j.

TRANSFER UNIT

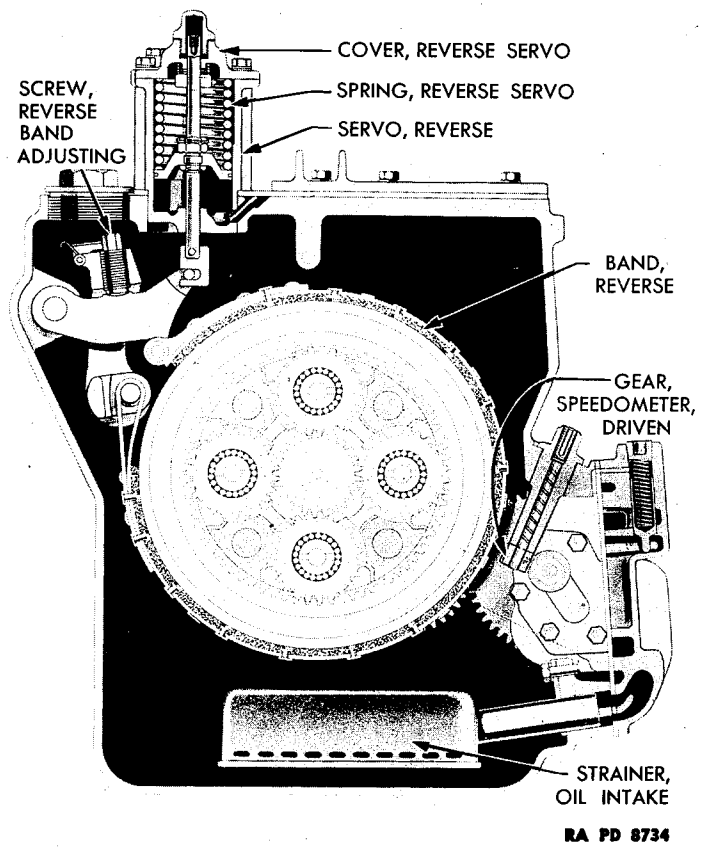

Figure 8 — Transfer Unit — Cross Section at Reverse Servo

c. Direct Drive. When the above action has taken place, the entire planetary gear train revolves as a unit and the rotation of the propeller shafts is transmitted without reduction to the pinion on the output shaft.

d. Reverse. When the selector lever for the Hydra-Matic transmissions is moved into the reverse position, a connection from this lever to the transfer unit releases a mechanical latch holding the reverse servo apply spring in the released position. This spring, being freed, applies the reverse servo. At the same time, a valve is repositioned to relieve the oil pressure that also holds the reverse servo in the released position. The flow of power to the transfer unit is exactly the same as previously described except that the direction of rotation is reversed. The reverse band application is necessary to provide self-energizing action with this direction of rotation, and both bands act to hold the drum from slipping (fig. 12).

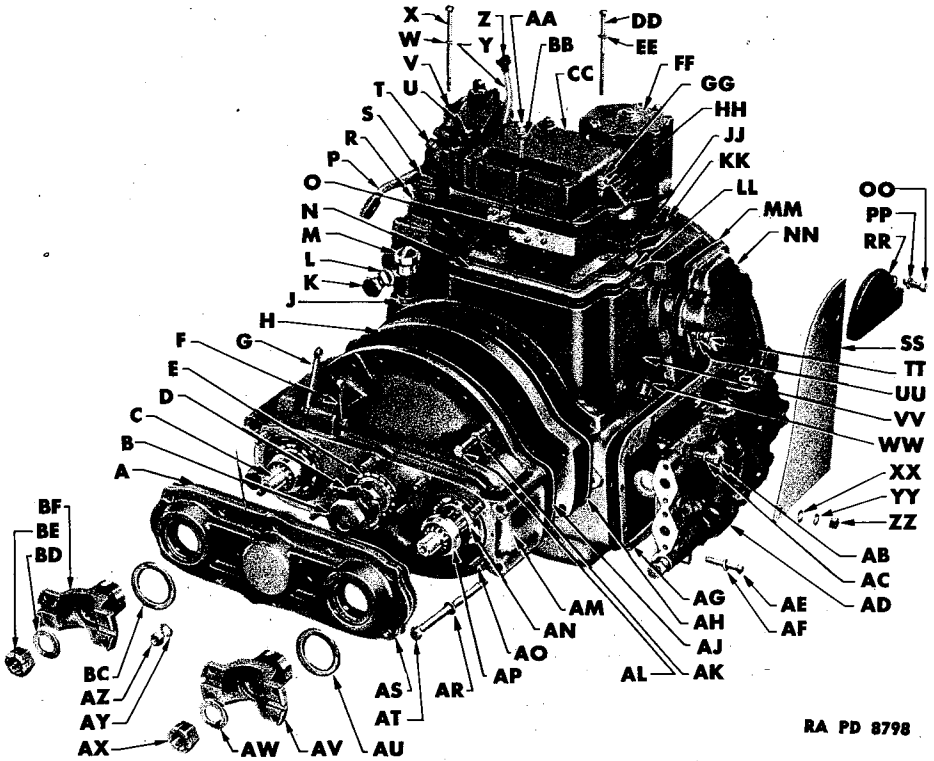

PLATE 9B-2—TRANSFER UNIT ASSEMBLY—EXPLODED VIEW

Figure 9 — Transfer Unit Assembly — Disassembled

A—GASKET, CONNECTOR UNIT CASE COVER
B—NUT, MAIN SHAFT
C—SHAFT, CONNECTOR UNIT DRIVE GEAR
D—WASHER, LOCK, MAIN SHAFT NUT
E—BEARING, MAIN SHAFT, REAR
F—LEVER, THROTTLE VALVE RELAY SHAFT, SHORT
G—LEVER, THROTTLE VALVE RELAY SHAFT, LONG
H—COVER, TRANSFER UNIT CASE, REAR
J—SLEEVE, OIL FILLER
K—PLUG, REVERSE BAND LEVER SHAFT
L—GASKET, REVERSE BAND LEVER SHAFT PLUG
M—INDICATOR, OIL LEVEL
N—PLATE, SPACER, TRANSFER UNIT CASE, TOP
O—BODY, VALVE AND ACCUMULATOR
P—LEVER, REVERSE BRAKE SERVO EXHAUST VALVE, OUTER
R—GASKET, REVERSE BRAKE ADJUSTMENT HOLE PLUG
S—PLUG, REVERSE BRAKE ADJUSTMENT HOLE
T—SCREW, CAP, HEX. HEAD
U—SCREW, CAP, HEX. HEAD
V—SERVO, REVERSE
W—WASHER, LOCK
X—SCREW, CAP, SERVO BODY TO CASE
Y—LEVER, MANUAL VALVE CONTROL, OUTER
Z—KNOB, MANUAL CONTROL VALVE OUTER LEVER
AA—SCREW, CAP, VALVE BODY COVER
BB—WASHER, LOCK
CC—COVER, VALVE BODY
DD—SCREW, SERVO BODY TO CASE
EE—WASHER, LOCK
FF—SERVO, LOW GEAR
GG—SCREW, VALVE BODY COVER
HH—WASHER, LOCK
JJ—GASKET, VALVE BODY COVER
KK—GASKET, LOW GEAR SERVO BODY
LL—GASKET, TRANSFER UNIT CASE, TOP
MM—GASKET, LOW GEAR BRAKE ADJUSTMENT HOLE COVER
NN—COVER, LOW GEAR BRAKE ADJUSTMENT HOLE
OO—SCREW, CAP
PP—WASHER, LOCK
RR—EXTENSION, LEG GUARD
SS—SHIELD, LEG GUARD
TT—SCREW, LOW GEAR, ADJUSTING COVER
UU—WASHER, LOCK
VV—CASE, TRANSFER UNIT
WW—SLEEVE, SPEEDOMETER DRIVE SHAFT
XX—WASHER, PLAIN, S., U.S. STD.
YY—WASHER, LOCK
ZZ—NUT, LEG GUARD, SHIELD
AB—SCREW, CARRIER
AC—WASHER, LOCK
AD—CARRIER, OIL PUMP AND GOVERNOR
AE—SCREW, CARRIER
AF—WASHER, LOCK
AG—GASKET, OIL PUMP AND GOVERNOR CARRIER
AH—GASKET, CASE, COVER
AJ—GASKET, CONNECTOR UNIT CASE
AK—WASHER, LOCK
AL—SCREW, CAP, CONNECTOR UNIT CASE TO TRANSFER UNIT CASE
AM—CASE, CONNECTOR UNIT
AN—BEARING, CONNECTOR DRIVE GEAR, REAR
AO—STUD, CONNECTOR UNIT CASE COVER
AP—SPACER, CONNECTOR UNIT DRIVE GEAR SHAFT
AR—WASHER, LOCK
AS—COVER, CONNECTOR UNIT CASE
AT—SCREW, CONNECTOR UNIT CASE TO TRANSFER UNIT CASE
AU—OIL SEAL, UNIVERSAL JOINT YOKE
AV—YOKE, UNIVERSAL JOINT
AW—WASHER, UNIVERSAL JOINT YOKE
AX—NUT, UNIVERSAL JOINT YOKE
AY—WASHER, LOCK
AZ—NUT
BC—OIL SEAL, UNIVERSAL JOINT YOKE
BD—WASHER, UNIVERSAL JOINT YOKE
BE—NUT, UNIVERSAL JOINT YOKE
BF—YOKE, UNIVERSAL JOINT

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Legend for Figure 9 — Transfer Unit Assembly — Disassembled

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

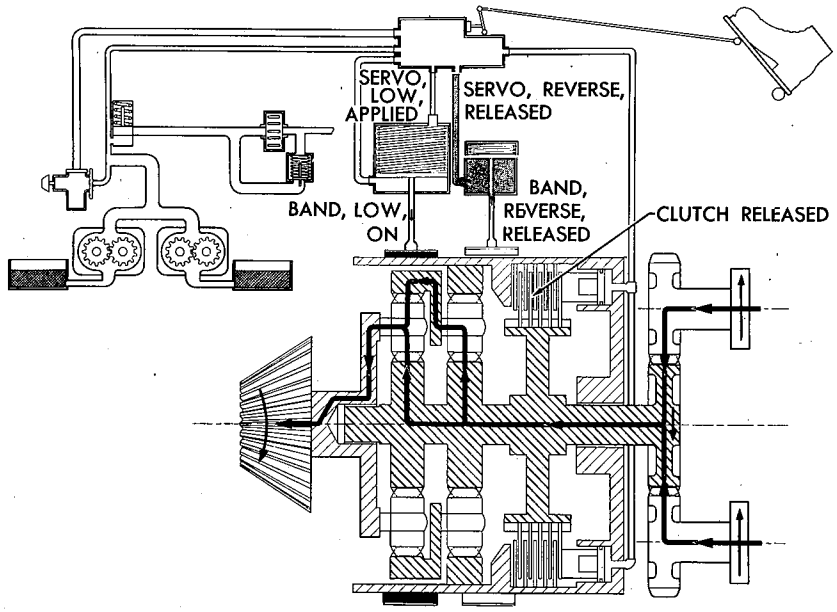

Figure 10—Transfer Unit in Reduction

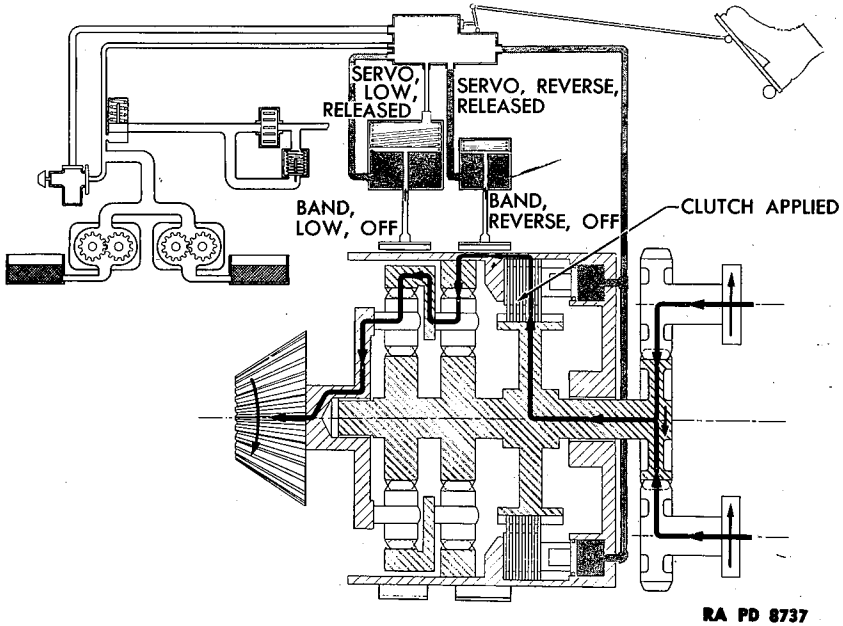

Figure 11—Transfer Unit in Direct Drive

TRANSFER UNIT

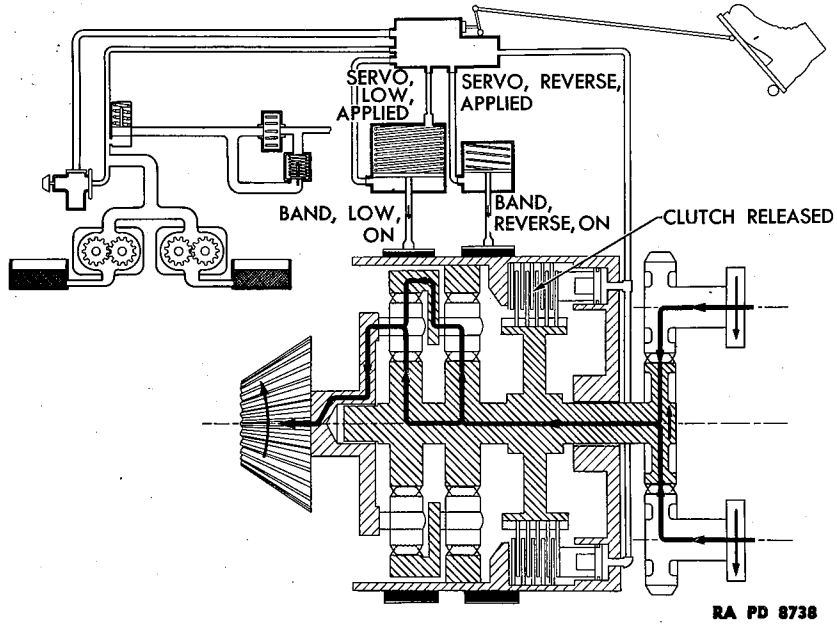

Figure 12—Transfer Unit in Reverse

e. Hydraulic Control System. The timing of the changes in gear ratios, either upshifting or downshifting, is the function of the hydraulic control system. This system is basically one of carefully balanced valves to provide a precise relationship between the velocity of the vehicle and the performance demands of the driver as expressed by the pressure on the accelerator. The hydraulic control units, illustrated in diagrammatic form in figure 13, consist of the following: a compound oil pump connected to an oil pressure regulator, a centrifugal-type governor, a control valve body containing the control valves and shift valves, and the necessary connecting passages.

f. The governor and oil pump are mounted on a carrier on the right-hand side of the transfer unit case and are driven by the same shaft, which in turn is geared to the output shaft. With this arrangement, the oil pump delivers oil only when the vehicle is in motion, at which time it provides both the oil pressure for operating the control mechanism and the oil for lubricating the gears and bearings of the transfer unit and the controlled differential.

g. The oil pressure supplied by the pump for the control mechanism is maintained between 85 and 90 pounds by means of the oil pressure regulator. This pressure is directed through control valves to apply or

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

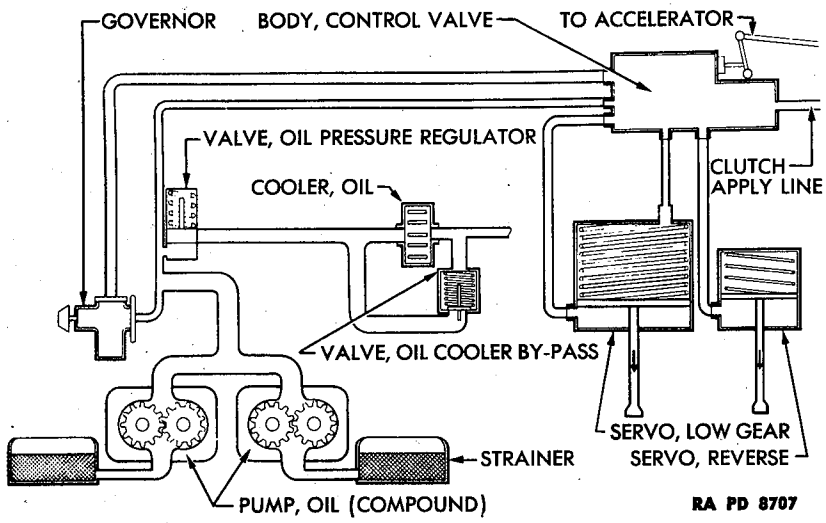

Figure 13 — Hydraulic Control System

release the bands and apply the clutch as required by the various operating conditions.

h. Reductions. As soon as the vehicle starts to move forward, oil under pressure is delivered to the control valve body. At the same time, this oil under pressure is directed to the governor in such a way that pressure is built up and applied to oppose the centrifugal force acting on the governor weight.

i. As the vehicle speed increases, the centrifugal force acting on the governor weight also increases and repositions the governor valve, so that a variable pressure from the governor is fed back to the control valve body. This pressure is directed to one end of the shift valve, tending to force it to the open position and upshift the transfer unit from reduction to direct drive. Spring pressure and throttle pressure on the opposite end of the valve act against the governor pressure and tend to oppose the upshift. Thus, the speed at which the upshift occurs is determined by the relation between throttle pressure and governor pressure (fig. 14).

j. Upshift. As the speed of the vehicle increases further, the oil pressure from the governor becomes great enough to overcome the opposing spring and throttle pressure on the shift valve, causing it to move to its open position. The movement of the shift valve causes oil to be directed

TRANSFER UNIT

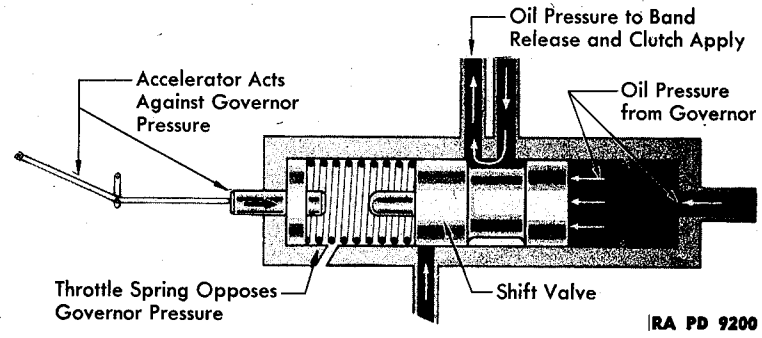

Figure 14 — Opposing Forces on Shift Valve

to the clutch apply pistons and also to the release side of the low gear servo, thus applying the clutch and releasing the low gear band. This arrangement causes the planetary gear system to rotate as a unit and the shift to direct drive is completed.

k. Downshift. When the speed of the vehicle is reduced to a point where the spring and throttle valve pressure against the shift valve in the valve body overcomes the oil pressure directed against it by the centrifugal governor, the shift valve moves back to the closed position. This action cuts off oil pressure to the release section of the low gear servo, allowing the springs in the servo to reapply the low gear band. At the same time, the oil pressure against the clutch relay valve in the valve body is cut off, which in turn permits release of the pressure applying the clutch. The clutch release springs then release the clutch at the same time as the band is being reapplied, thus putting the transfer unit again in reduction.

l. "LO" Range. When the control lever on the transfer unit is moved to the "LO" position, a valve in the control valve body is manually moved into a position where the full pressure from the oil pump is directed against the shift valve. This force, together with the spring pressure against the shift valve, is great enough so that the pressure from the governor cannot move the valve to its open position. Thus, no upshift can take place. Oil pressure is also directed to the low gear servo in such a manner as to assist the springs in holding the band tight on the drum.

m. If the transfer unit control lever should be moved to the "LO" position while the vehicle is being driven at high speed, the governor pressure existing at these high speeds will be high enough to oppose a downshift until the speed of the vehicle has been reduced to a point where the downshift can be made without damage to the mechanism.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

6. TABULATED DATA AND SPECIFICATIONS.

Connector gear ratio ..... 1 to 1
Connector gear type ..... Helical
Gear ration in reduction ..... 2.37 to 1
Lubrication ..... Oil under pressure
Number of speeds forward 2
Number of speeds reverse 1
Shift control ..... Hydraulic
Type of gearing ..... Compound planetary
Serial number ..... 1GT1 and up
(Located on the flat machined surface between the low gear and reverse servos)

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 (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, manufacturers' plants.

SERVICE:

(Including preventive maintenance) (par. 23 a (1) and (2) AR 850-15 (10-6-42)) — Consists of servicing, cleaning, lubricating, tightening bolts and nuts, and making external adjustments of subassemblies or assemblies and controls.

REPLACE:

(par. 23 a (4) AR 850-15 (10-6-42)) — 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:

(par. 23 a (3) and (5), in part, AR 850-15 (10-6-42)) — 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.

TRANSFER UNIT

REBUILD:

(par. 23 a (5), in part, and (6), AR 850-15 (10-6-42)) — 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.

b. Maintenance Allocations.

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.

UNIT, TRANSFER, ASSEMBLY	ECHELONS 2nd	3rd	4th	5th
Bands, transfer unit—adjust	X			
Bands, transfer unit—replace or repair (reline)			E	X
Body, control valve—replace	X			
Body, control valve—repair		X		
Body, control valve—rebuild			E	X
Unit, transfer, assembly—replace		X		
Unit, transfer, assembly—repair		E	X	
Unit, transfer, assembly—rebuild			E	X

8. INSPECTION IN VEHICLE.

a. Purpose. 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 all motor vehicles, including combat vehicles of the Ordnance Department. 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.

CLEAN RAGS
FLASHLIGHT
GAGE, pressure, 0 to 100-lb

d. Visual Inspection Procedure. The following periodic inspections of the transfer unit in the vehicle are prescribed.

(1) DAILY

(a) Check oil level. NOTE: Whenever checking oil level, vehicle should be on level ground.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

(2) AFTER 250 MILES OF OPERATION.

(a) Check oil level.

(b) Check oil cooler connections for leaks.

(c) Check entire transfer unit for leaks at any possible point.

(3) AFTER 3,000 MILES OF OPERATION.

(a) Drain oil in transfer unit, flush and refill (par. 10 b).

(b) Check and adjust bands (par. 10 c).

e. Operating Inspection. Check the transfer unit under actual operating conditions and notice whether it is functioning properly, at the various shift speeds.

(1) SHIFT SPEEDS. Check to make sure the transfer unit upshifts and downshifts in the proper speed ranges, as follows:

(a) Selector Lever in "DR".

Upshift	Light Throttle	Full Throttle
4th to 6th	1,600 to 2,000 rpm	3,400 to 3,900 rpm
Downshift		
6th to 4th	460 to 650 rpm	925 to 1,125 rpm
6th to 5th	——	2,100 to 2,400 rpm

(b) Selector Lever Moved to "LO".

Transfer unit should downshift 6th to 4th, no higher than 1,600 to 1,800 rpm.

f. Checking Transfer Unit Oil Pressure. Five oil pressures in the transfer unit hydraulic control system may be checked without removing the transfer unit from the vehicle. These are pump pressure, lubrication pressure, clutch apply pressure, governor pressure (except on early transfer units) and low servo apply pressure in low. Whenever the transfer unit is not operating properly, these oil pressures should be checked in accordance with the trouble-shooting outline in paragraph 9. The pressures are checked as follows:

(1) EQUIPMENT.

ADAPTER, pipe plug, ⅛-in.
ADAPTER, pipe plug, ¼-in.
GAGE, pressure, 0 to 100-lb
SCREWDRIVER
WRENCH, open-end, ⅜-in.
WRENCH, open-end, 1-in.
WRENCH, socket-head set screw, 3/16-in.
WRENCH, socket-head set screw, ¼-in.

(2) CHECK PUMP PRESSURE.

ADAPTER, pipe plug, ⅛-in.
GAGE, pressure, 0 to 100-lb
WRENCH, socket-head set screw, 3/16-in.
WRENCH, open-end, 1-in.

On early transfer units, remove ⅛-inch pipe plug on right side of case just behind speedometer driven gear adapter, using 3/16-inch socket-head

TRANSFER UNIT

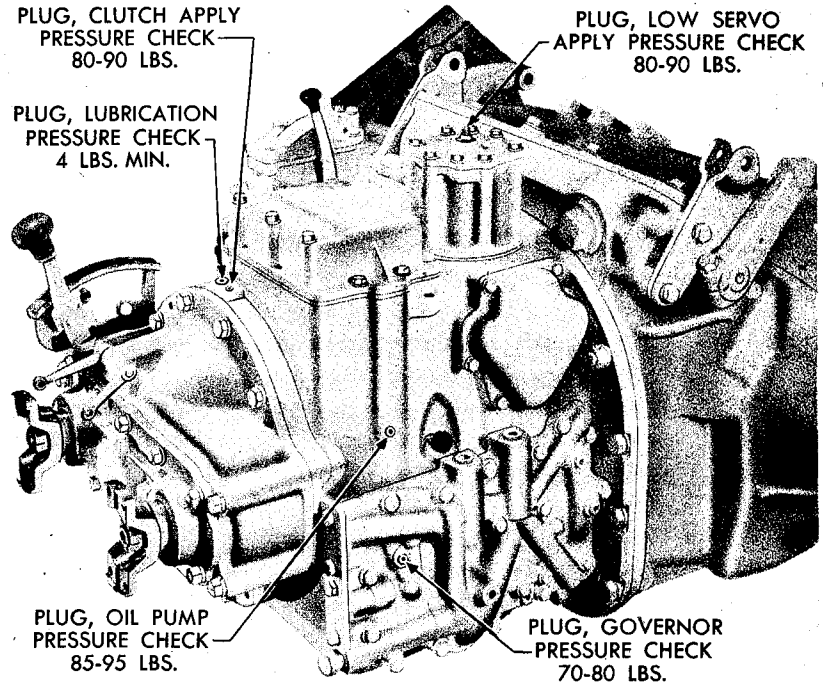

Figure 15 — Plugs for Oil Pressure Checks

set screw wrench (fig. 15). On later type units, remove the oil pressure gage unit which is installed at this point (1-in. open-end wrench). Connect pressure gage and adapter at opening from which plug or gage unit was removed. Start vehicle and drive at any speed above two miles per hour. The pump pressure should be from 85 to 95 pounds at these speeds in any gear. If pressure is less than this amount, check for cause of condition, as outlined in paragraph 9. Remove pressure gage and adapter and install plug or gage unit.

(3) CHECK LUBRICATION PRESSURE.

ADAPTER, pipe plug, ¼-in.
GAGE, pressure, 0 to 100-lb
SCREWDRIVER
WRENCH, socket-head set screw, ¼-in.

Remove ¼-inch pipe plug (large plug) at top of transfer unit rear cover (fig. 15). Connect pressure gage and adapter to transfer case rear cover where plug was removed. Start vehicle and drive at approximately 10 miles per hour. The lubrication pressure should be four pounds minimum at this speed in any gear. NOTE: The transfer unit should be

thoroughly warmed up to normal operating temperature when this check is made. If pressure is less than this amount, check for cause of condition as outlined in paragraph 9. Remove pressure gage and adapter, and install ¼-inch pipe plug.

(4) CHECK CLUTCH APPLY PRESSURE.

ADAPTER, pipe plug, ⅛-in.	SCREWDRIVER
GAGE, pressure, 0 to 100-lb	WRENCH, socket-head set screw, 3/16-in.

Remove ⅛-inch pipe plug (small plug) at top of transfer unit rear cover (fig. 15). Connect pressure gage and adapter to transfer unit rear cover where plug was removed. Start vehicle and increase speed until transfer unit shifts from reduction to direct drive. When the shift is made, the clutch apply pressure should be not more than five pounds less than the pump pressure. If pressure is less, check for cause of condition, as outlined in paragraph 9. Remove pressure gage and adapter, and install plug in transfer unit rear cover.

(5) CHECK GOVERNOR PRESSURE.

ADAPTER, pipe plug, ⅛-in.	WRENCH, socket-head set screw, 3/16-in.
GAGE, pressure, 0 to 100-lb	

Transfer units of early production did not have provision for making this check. On later transfer units, proceed as follows: remove the socket-head set screw wrench located toward the rear of the center of the oil pump and governor carrier (fig. 15), and connect pressure gage and adapter at opening. Drive vehicle with transmission and transfer unit selector levers in "DR" position. At 1,700 revolutions per minute, pressure should be 25 to 30 pounds; at 3,400 revolutions per minute, it should be 70 to 80 pounds. Reduce vehicle speed, shift transfer unit to "LO" range, and increase speed to 3,000 revolutions per minute. Pressure should then be between 50 and 60 pounds. If pressure is less than these amounts, check for causes of conditions as outlined in paragraph 9. Remove pressure gage and install plug.

(6) CHECK LOW SERVO APPLY PRESSURE.

ADAPTER, pipe plug, ¼-in.	WRENCH, socket-head set screw, ¼-in.
SCREWDRIVER	WRENCH, open-end, ⅜-in.

Remove adjusting plug from low gear servo cover, using screwdriver or socket-head set screw wrench. Connect gage and adapter to plug opening. Drive vehicle with transmission and transfer unit levers in "DR" position at a speed above 22 miles per hour. Move transfer unit lever to "LO" position, release accelerator, and let vehicle slow down. Transmission will downshift to 5th at about 22 miles per hour; transfer unit will downshift to 4th at about 20. After transfer unit downshifts,

accelerate engines to 2,200 revolutions per minute and check pressure on gage, which should be 85 to 95 pounds. If pressure is low, check for cause of condition as outlined in paragraph 9. Remove pressure gage and install plug.

(7) RELATION TO TROUBLE SHOOTING. The Trouble Shooting section (par. 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. When checking the transfer unit for possible malfunctioning, the first job is to determine definitely that the condition at hand is due to the transfer unit and not to other related units. The transmissions, for example, are so closely related to the transfer unit that often when the transfer unit is suspected of not operating properly, the original cause may lie in the transmissions. After the vehicle has been checked under actual operating 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 condition on the chart. NOTE: Do not remove the transfer unit until the condition is definitely determined.

b. Transfer Unit Does Not Respond to Selector Lever Position (will not upshift in "DR" position or downshift in "LO" position).

Possible Cause	Possible Remedy
Manual control valve in valve body not engaged with button on control lever.	Remove valve body cover and engage manual control valve with lever.

c. Transfer Unit Slips in 1st, 2nd, 3rd and 4th Speeds, but Operates Satisfactorily in 5th and 6th Speeds.

Low gear band not holding due to improper adjustment.	Adjust band.

d. Transfer Unit Drives Vehicle in 1st, 2nd, 3rd, and 4th Speeds, but Both Engines Race in 5th and 6th Speeds Due to Clutch Slipping.

No oil pressure to clutch pistons.	Check oil pressure as explained in paragraph 8 and repair or replace units as required.
Mainshaft spacer oil seal rings in clutch drum broken or sticking.	Clean, repair, or replace.
Clutch piston rings broken or sticking.	Clean, repair, or replace.
Low pump pressure.	Clean, repair, or replace.

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Possible Cause	Possible Remedy
Oil passages to clutch plugged.	Clean, repair, or replace.
Oil leaks in oil passages to clutch.	Clean, repair, or replace.
Oil leaks between valve body and spacer plate.	Clean, repair, or replace.
Clutch plates scored or burned.	Replace plates.

e. Transfer Unit Slips in Reverse.

Reverse band not holding.	Check reverse band adjustment.
Reverse band released due to release pressure or release latch not being tripped.	Check adjustment of control linkage to reverse servo. Remove reverse servo and check operation of release mechanism. Replace reverse servo.

f. Transfer Unit Starts in Reduction but Shifts to Direct Drive Immediately After Vehicle is Put in Motion.

Governor valve sticking in *"open"* position.	Clean, repair, or replace governor.
Clutch relay valve sticking in *"open"* position.	Clean, repair, or replace valve body assembly.
Shift valve sticking in *"open"* position.	Clean, repair, or replace valve body assembly.

g. Transfer Unit Will Not Upshift into Direct Drive for 5th or 6th Speeds.

Manual control valve not engaged with lever.	Clean, repair, or replace valve body assembly.
Governor valve sticking in *"closed"* position.	Clean, repair, or replace governor.
Oil pressure leak in passages between governor and valve body assembly.	Clean, repair, or replace valve body assembly.
Governor plug or shift valve sticking in *"closed"* position.	Clean, repair, or replace valve body assembly.
Clutch relay valve sticking.	Clean, repair, or replace valve body assembly.
Exhaust downshift valve sticking in *"open"* position.	Clean, repair, or replace valve body assembly.
Low oil pressure.	Check oil pressures as explained in paragraph 8 and repair or replace units as required.

TRANSFER UNIT

Possible Cause	Possible Remedy

h. Transfer Unit Shifts into Direct Drive at Lower Vehicle Speeds Than is Desirable.

Improperly adjusted throttle valve linkage between front throttle relay and transfer unit valve body.	Adjust throttle linkage.
Governor valve sticking.	Clean, repair, or replace valve body assembly.
Regulator plug in valve body sticking.	Clean, repair, or replace valve body assembly.
Throttle valve in valve body sticking.	Clean, repair, or replace valve body assembly.
Low oil pressure.	Check oil pressures (par. 8). Repair or replace units as required.

i. Transfer Unit Shifts into Direct Drive at Higher Vehicle Speeds than Desirable.

Improperly adjusted throttle valve linkage.	Adjust throttle linkage.
Sluggish or sticking governor valve.	Clean, repair, or replace governor.
Regulator plug in valve body sticking.	Clean, repair, or replace valve body.
Sluggish or sticking governor plug or shift valve in valve body.	Clean, repair, or replace valve body.
Throttle valve sticking in *"open"* position.	Clean, repair, or replace valve body.
Sluggish or sticking clutch relay valve in valve body.	Clean, repair, or replace valve body.
High oil pressure.	Check oil pressure as explained in paragraph 8 and repair or replace units as required.

j. Transfer Unit Slips in Low Range When Using Engine as Brake, but Operates Satisfactorily on Pull.

Low gear servo valve sticking in *"closed"* position.	Clean, repair, or replace valve body.

k. Transfer Unit Downshift from Direct Drive to Reduction with Wide Open Throttle Very Severe, or Engines Race Momentarily When Shift Occurs.

Accumulator valve or throttle downshift valve in valve body sticking.	Clean, repair, or replace valve body.

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Possible Cause	Possible Remedy
Low oil pressure.	Check oil pressure as explained in paragraph 8 and inspect for cause of condition until source is located. Repair or replace units as required.
Weak or broken oil pressure regulator spring.	Repair or replace.
Oil pressure regulator valve in governor and oil pump carrier sticking.	Repair or replace.
Oil pump loose on carrier.	Tighten.
Defective gasket between oil pump carrier and spacer plate.	Replace.
Worn oil pump gears.	Replace.
Defective gasket between top spacer plate and transfer unit case.	Replace.
Plugged oil lines in transfer unit case.	Clean, repair, or replace.

10. SERVICE IN VEHICLE.

a. Check Oil Level.

CLEAN RAGS

Make sure vehicle is on level ground. Clean area around transfer unit oil filler pipe. Remove gage indicator assembly and wipe plunger clean. Then return to filler pipe and push down until cap on indicator seats on filler pipe opening. Remove to check oil level. If necessary, add OIL, engine (seasonal grade).

b. Change Oil. When changing oil in the transfer unit, it is necessary to also change oil in the controlled differential.

(1) DRAIN OIL FROM TRANSFER UNIT AND CONTROLLED DIFFERENTIAL.

CLEAN RAGS
DRAIN PAN, 10-gal capacity
WRENCH, socket, 9/16-in.
WRENCH, socket-head set screw, 9/16-in.
WRENCH, socket-head set screw, 3/4-in.

Remove cover plates on bottom of hull under transfer unit and controlled differential (9/16-in. socket wrench), and clean area around drain

TRANSFER UNIT

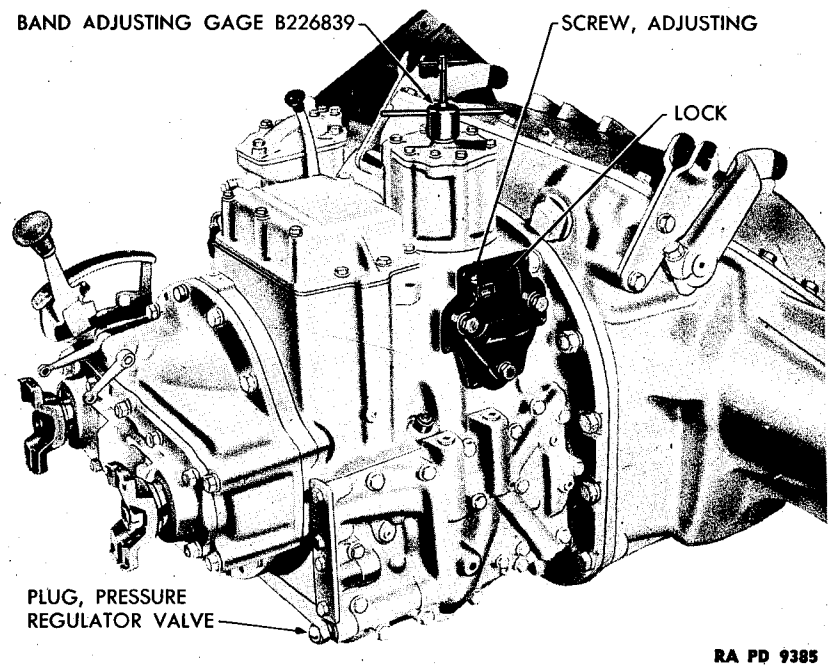

Figure 16 — Adjusting Low Gear Band

plugs. Place drain pan under three openings. Remove one drain plug from transfer unit (9/16-in. socket-head set screw wrench), and two plugs from controlled differential (3/4-in. socket-head set screw wrench) and allow oil to drain into the drain pan. Clean magnetic drain plugs, and if excessive metal particles are present, investigate condition of units.

(2) REFILL TRANSFER UNIT AND CONTROLLED DIFFERENTIAL.

WRENCH, socket, 9/16-in.
WRENCH, socket-head set screw, 9/16-in.
WRENCH, socket-head set screw, 3/4-in.

Position three drain plugs in bottom of transfer unit (9/16-in. socket-head set screw wrench) and controlled differential (3/4-in. socket-head set screw wrench) and tighten in place. Position three cover plates on bottom of hull and tighten in place (9/16-in. socket wrench). Fill transfer unit with 28 quarts of OIL, engine (seasonal grade).

c. Band Adjustments in Vehicle. Two bands are used in the transfer unit: a low gear band (toward front of vehicle) and a reverse band

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(toward rear of vehicle). The bands can be adjusted while the transfer unit is in the vehicle. Both bands should always be adjusted whenever it becomes necessary to adjust one or the other. The low gear band should always be adjusted before the reverse band is adjusted.

(1) EQUIPMENT.

GAGE, feeler
GAGE, low and reverse transit band adjusting, B226839
SCALE, 6-in.
SCREWDRIVER
WRENCH, 3/8-in.
WRENCH, 1/2-in.
WRENCH, 1 1/2-in.
WRENCH, deep socket, 9/16-in.
WRENCH, deep socket, 1 1/16-in.
WRENCH, open-end, 1 1/16-in.
WRENCH, open-end, 1 1/2-in.
WRENCH, socket, 1/2-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, 5/8-in.
WRENCH, socket-head set screw, 1/4-in.

(2) LOW GEAR BAND ADJUSTMENT.

(a) *Check Position of Reverse Servo Piston.*

GAGE, low and reverse transit band adjusting, B226839
SCALE, 6-in.
WRENCH, open-end, 1 1/16-in.

Before any adjustments are made, it is important to check the position of the reverse servo piston. To do this, remove the acorn plug on the top of the reverse servo cover with a 1 1/16-inch open-end wrench. The piston rod must be at least 1/2-inch above the top of the boss on the servo cover. This is the released position. If the piston rod is in this position, proceed with step (*b*) below; if not, release the band either by installing band adjusting gage B226839 in top of rod and tightening pressure nut until piston rod is pulled up to at least 1/2-inch above top of boss, or by driving vehicle forward a few feet. Place the selector lever in any position other than "REV"; this will hold the piston rod in the proper position for adjustment procedure.

(b) *Install Adjusting Tool in Low Gear Servo.*

GAGE, low and reverse transit band adjusting, B226839
WRENCH, 3/8-in. or
WRENCH, socket-head set screw, 1/4-in.

Remove plug from low gear servo cover, and screw in gage until it bottoms in tapped hole in upper end of low gear servo piston rod. Tighten pressure nut on band adjusting gage until "LO" marke on gage is flush with top of pressure nut (fig. 16).

(c) *Check Low Gear Band Adjustment.*

GAGE, feeler
GAGE, low and reverse transit band adjusting, B226839
SCALE, 6-in.

Note position of pressure nut. It should be just clear of servo cover if the low gear band is adjusted properly. There should be from 0.002-inch to 0.005-inch clearance between pressure nut and servo cover. If pressure nut is tight against servo cover, low gear band is too loose. **NOTE:** If band adjusting gage is not available, adjustment can be checked by measuring distance from boss on servo cover to upper end of piston rod. This distance should be 1 1/4 inches (plus or minus 1/32 in.).

(d) *Remove Leg Guard and Adjusting Hole Cover.*

WRENCH, socket, 1/2-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, 5/8-in.

Remove assistant driver's leg guard by removing two mounting screws (9/16-in. and 5/8-in. wrenches). Remove six screws and lock washers (1/2-in. socket wrench) holding low gear band adjusting hole cover on right side of transfer unit case, and remove cover and gasket.

(e) *Adjust Low Gear Band.*

GAGE, low and reverse transit band adjusting, B226839
SCREWDRIVER
WRENCH, 9/16-in.

Swing back lock plate (fig. 16) which keeps the low gear band adjusting screw from turning, and tighten adjusting screw (9/16-in. wrench). Continue tightening adjusting screw until pressure nut on the band adjusting gage is just lifting off low gear servo cover, or until rod end is 1 1/4 inches below boss on servo cover, as explained in step (2) (*a*) above.

(f) *Install Adjusting Hole Cover and Leg Guard.*

WRENCH, socket, 1/2-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, 5/8-in.

Position low gear band adjusting hole cover and a *new* gasket on side of screws and lock washers (9/16-in. and 5/8-in. socket wrenches). **NOTE:** Do not remove band adjusting gage from low gear servo until reverse band is adjusted.

(3) REVERSE BAND ADJUSTMENT.

(a) *Remove Plug in Reverse Servo Cover.*

GAGE, low and reverse transit band adjusting, B226839
WRENCH, deep socket, 1 1/16-in.

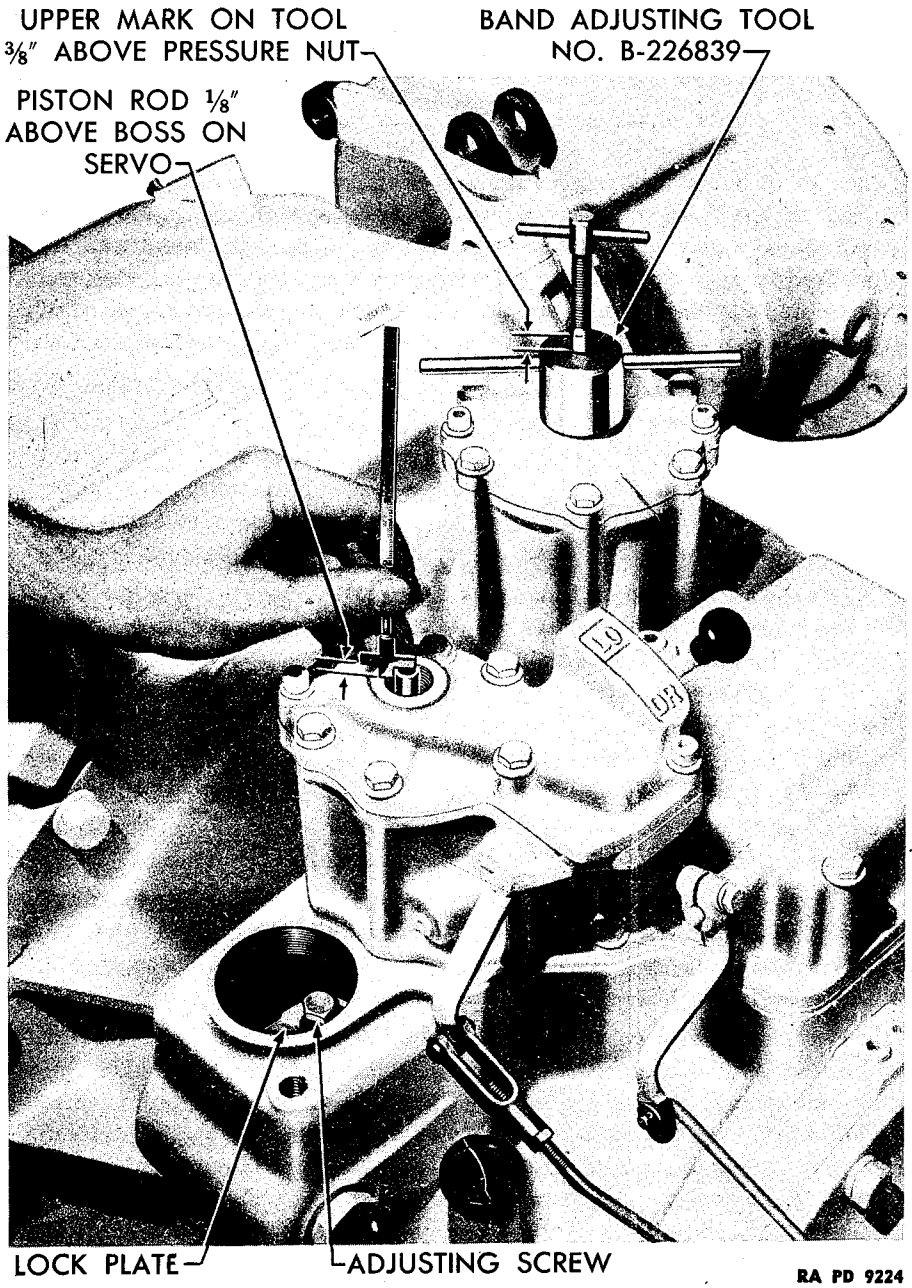

Figure 17 — Adjusting Reverse Band

TRANSFER UNIT

Be sure to check low gear band adjustment before proceeding with reverse band adjustment. Tighten pressure nut on band adjusting gage on low gear servo (installed in step c (2) above) until "LO" mark on gage is 3/8 inch above pressure nut. Place the transmission selector lever in the "REV." (reverse) position. Remove acorn plug and gasket from reverse servo cover (1 1/16-in. deep socket wrench).

(*b*) *Check Band Adjustment.*

SCALE, 6-in.
WRENCH, 1½-in.

Apply both steering brakes and lock with ratchets. Start both engines and accelerate to 800 revolutions per minute with selector lever in reverse. Shut off engines. Check position of reverse servo piston rod. Upper end of rod should be 1/8 inch plus or minus 1/32 inch *above* top of the boss on servo cover when reverse band is adjusted properly.

(*c*) *Adjust Reverse Band and Install Plug.*

GAGE, low and reverse transit band adjusting, B226839
SCREWDRIVER
WRENCH, deep socket, 9/16-in.
WRENCH, open-end, 1½-in.

If reverse band requires adjustment, remove reverse band adjusting plug (1½-in. open-end wrench) and copper gasket from top of transfer unit case (fig. 17). Lift up lock plate that keeps reverse band adjusting screw from turning, and tighten adjusting screw (9/16-in. deep socket wrench) until servo piston rod is 1/8 inch above boss on cover. NOTE: If band adjusting gage is not available to release low gear band, as explained in step (3) (*a*) above, it will be necessary to back off low gear band adjustment and readjust low gear band after reverse band adjustment is complete.

(*d*) *Remove Band Adjusting Gage, and Install Plugs on Low Gear and Reverse Servos.*

GAGE, low and reverse transit band adjusting, B226839
SCREWDRIVER
WRENCH, open-end, 1 1/16-in.
WRENCH, open-end, 1½-in.
WRENCH, socket-head set screw, ¼-in.

Install reverse band adjusting plug and a *new* copper gasket on transfer unit case (1½-in. open-end wrench). Install acorn plug and a new gasket on reverse servo cover (1 1/16-in. open-end wrench). Loosen pressure nut on band adjusting gage; then unscrew gage from low gear servo piston rod. Install plug in low gear servo cover (screwdriver or ¼-in. socket-head set screw wrench).

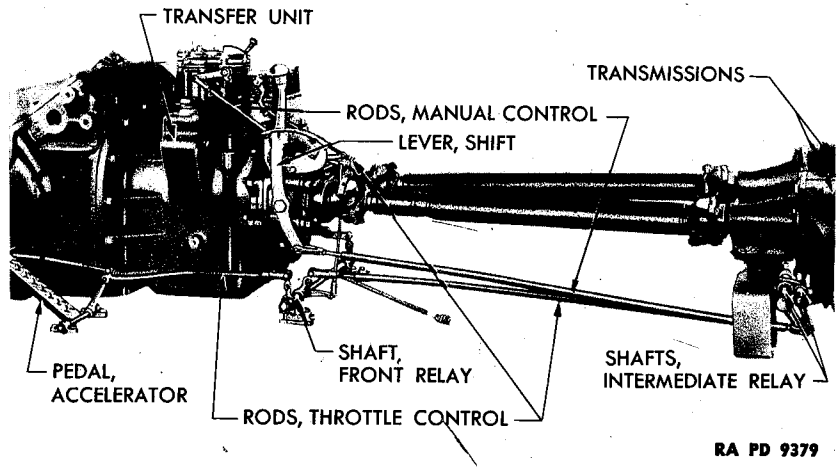

Figure 18 — Transfer Unit and Transmission Control Linkage

d. Linkage Adjustments.

(1) DISCONNECT RODS AT SHIFT LEVER.

PLIERS

Disconnect rod between shift lever and transfer unit reverse servo release lever at shift lever end (fig. 18). Place shift lever in "REV" position (make sure that it is in detent position shown on quadrant by the arrow), and disconnect rod at lower end of shift lever.

(2) INSTALL INTERMEDIATE RELAY GAGE PLATE.

GAGE, pin, throttle controls, adjusting, set, A266522

GAGE, throttle, intermediate relay, A266521

Install intermediate relay gage plate A266521 next to manual lever and throttle lever on left ends of intermediate relay cross shafts. Install 2 gage pins A266522 (long), through pinholes on intermediate relay throttle and manual levers, and into holes in gage plate to lock levers in a fixed position (fig. 19).

(3) ADJUST ROD AT SHIFT LEVER AND REMOVE INTERMEDIATE RELAY GAGE PLATE.

GAGE, pin, throttle controls adjusting, set, A266522

GAGE, throttle, intermediate relay, A266521

PLIERS

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

Adjust length of rod disconnected from lower end of shift lever by loosening clevis lock nut (9/16-in. open-end wrench), and rotating clevis with a pair of pliers until clevis pin slips into selector lever. **CAUTION:** Shift lever must be in "REVERSE" position. Install clevis pin and cotter

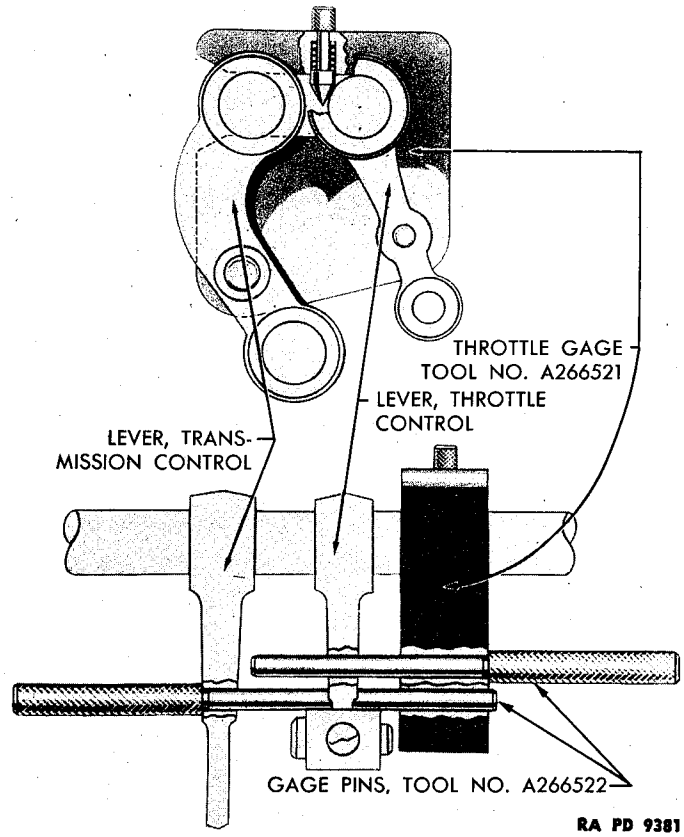

Figure 19 — Gage at Intermediate Relay

key, and tighten clevis lock nut. Remove gage pins and gage plate from intermediate relay.

(4) ADJUST MANUAL ROD TO TRANSFER UNIT REVERSE SERVO.

PLIERS

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

While working in fighting compartment, move transmission and transfer unit shift lever past "REVERSE" position (toward rear of vehicle) as far as it will go. Hold shift lever in that position while adjusting length of rod from shift lever to reverse servo release lever. When clevis pin is inserted, the stop on reverse servo release lever should just contact stop on servo body if rod is adjusted properly. Release shift lever, install clevis pin and cotter key, and tighten clevis lock nut (7/16-in. open-end wrench).

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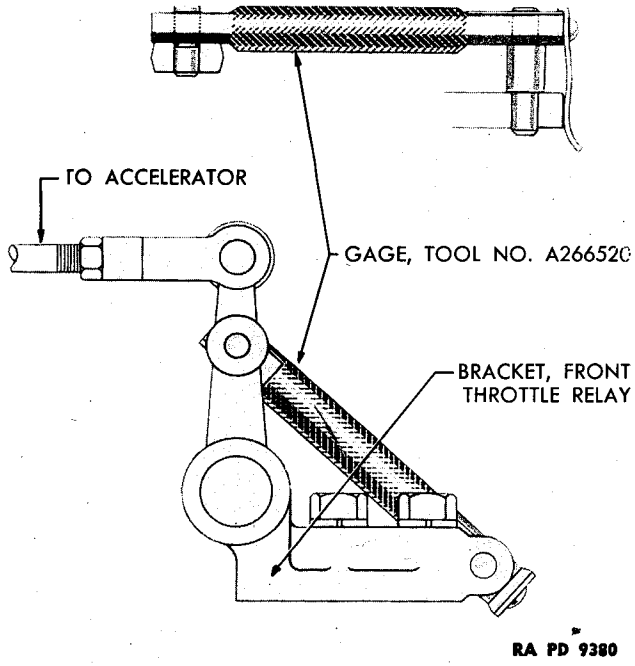

Figure 20 — Gage at Front Relay

(5) INSTALL FRONT RELAY GAGE AT FRONT RELAY FOR THROTTLE RODS.

GAGE, throttle, front relay, A266520
PLIERS
WRENCH, socket, 9/16-in.

Remove four screws and washers holding left propeller shaft front cover to supports and remove cover (9/16-in. socket wrench). Disconnect throttle rod that connects front relay and intermediate relay at front relay end (pliers). Install front relay gage A266520 on lever and mounting bracket as shown in figure 20.

(6) ADJUST THROTTLE ROD FROM INTERMEDIATE TO FRONT RELAY.

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

Adjust the length of this rod by loosening clevis lock nut at front relay end and rotating clevis until pin will slip into hole in lever. Install clevis pin, cotter key, and tighten lock nut (9/16-in. open-end wrench). Remove front relay gage.

(7) ADJUST ACCELERATOR PEDAL ROD TO FRONT RELAY.

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

Measure vertical distance from end of accelerator pedal to floor of vehicle. If distance is not six inches plus or minus 1/16 inch, disconnect

rod from pedal to front relay at front relay end. Adjust length of rod by loosening clevis lock nut (9/16-in. open-end wrench) and rotating clevis until proper distance is obtained when clevis pin is installed in front relay lever. Install clevis pin, cotter key, and tighten lock nut.

(8) ADJUST TRANSFER UNIT THROTTLE ROD.

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

Disconnect throttle rod from front relay to transfer unit relay at transfer unit relay end. Depress accelerator to floor, Adjust length of throttle rod by rotating clevis until clevis pin will enter hole in transfer unit relay, while holding relay forward until trunnion just begins to compress spring on throttle valve relay rod. Tighten lock nut on clevis.

e. Servicing Oil Cooler. The only attention required in the service of the oil cooler is keeping it clean and making sure that the oil passages are unobstructed.

(1) CLEAN OIL COOLER.

Remove cooler as explained in paragraph 11 g. Drain *all* oil from cooler. Fill cooler with SOLVENT, dry-cleaning, and allow to stand for one-half hour. Shake vigorously to obtain maximum solvent action, drain, and dry with compressed air. If the cooler is not completely cleaned by this process, fill the unit with a strong solution of SODA, caustic, or CLEANER, phosphate, and let it stand for 24 hours. The solution should be frequently agitated by steam, if available, or the unit immersed in a tank of hot water for the entire 24-hour period. Drain the solution, flush thoroughly with water to remove all trace of the solution, and dry with compressed air. NOTE: It is advisable to clean oil cooler in cases where failure of the transfer unit as the result of wear has necessitated replacement of the entire assembly, as metal particles from the worn parts may have settled in the oil cooler.

11. REPLACEMENT OF COMPONENTS IN VEHICLE.

a. Control Valve Body. The control valve body can be replaced while the transfer unit is in the vehicle.

(1) EQUIPMENT.

PLIERS
SOCKET, 7/16-in.
SOCKET, 1/2-in.
WRENCH, socket, 7/16-in.
WRENCH, socket, 1/2-in.
WRENCH, socket-head set screw, 1/4-in.
WRENCH, torque

(2) REMOVE CONTROL VALVE BODY.

PLIERS
WRENCH, socket, 1/2-in.
WRENCH, socket, 7/16-in.

Disconnect throttle control rod from lever on control valve body cover by removing cotter key, washer and clevis pin (pliers). Remove

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12 screws and washers (½-in. socket wrench) holding control valve body cover in position (fig. 44). NOTE: Do not remove screw on cover holding manual selector lever detent spring to cover. Pull control valve assembly cover and gasket off transfer unit case. Remove five screws and washers holding control valve body to spacer on transfer unit case. Remove control valve body from spacer.

(3) INSTALL CONTROL VALVE BODY.

PLIERS
SOCKET, 7/16-in.
SOCKET, ½-in.
WRENCH, socket-head set screw, ¼-in.
WRENCH, torque

Position control valve body assembly on transfer unit case spacer. Make sure that manual control valve is in position. Install five control valve body mounting screws, tightening them to 10 to 12 foot-pounds torque tightness. Position control valve body cover gasket and cover on transfer unit case over valve body. Remove sight plug from control valve body cover (¼-in. socket-head set screw wrench) and check to see that button on end of selector lever shaft engages neck on end of manual control valve. If button and valve are not engaged, remove cover and reposition manual control valve. Install plug. Install nine short and three long control valve body cover mounting screws and washers, tightening screws to 15 to 18 foot-pounds (torque wrench with ½-in. socket). Connect throttle control rod to lever on cover and install clevis pin, washer, and cotter key (pliers).

b. Low Gear Servo.

(1) EQUIPMENT.

GAGE, low and reverse transit band adjusting, B226839
SCREWDRIVER
WRENCH, open-end, 9/16-in.
WRENCH, socket, ½-in.

(2) REMOVE LOW GEAR SERVO.

SCREWDRIVER
WRENCH, socket, ½-in.
WRENCH, open-end, 9/16-in.

Remove six long screws and lock washers holding low gear servo to transfer unit case (½-in. socket wrench). CAUTION: Do not remove two low gear servo cover mounting screws. These are the two screws indicated in figure 40. Grasp low gear servo with both hands and pull outward until mounting boss on servo body clears case. Remove servo and gasket.

(3) INSTALL LOW GEAR SERVO.

GAGE, low and reverse transit band adjusting, B226839
WRENCH, socket, ½-in.

TRANSFER UNIT

Install gage B226839 through hole in top cover of low gear servo, screwing end of pressure screw on tool into threaded end of piston rod. Tighten pressure nut until it contacts top cover of low gear servo. Install low gear servo gasket on servo body and place servo in mounting hole in transfer unit case. Line up servo body mounting screw holes with holes in case and see that yoke on end of low gear servo piston rod is turned so that open end of yoke is toward outside of case. Hook low gear servo piston rod yoke into pin on actuating lever. Wrap low gear band to facilitate installation of servo. Tighten pressure nut on gage B226839, and at the same time push servo into transfer unit case. When servo is drawn up close enough to transfer unit case, install six mounting screws and lock washers (½-in. socket wrench). Adjust low gear band as explained in paragraph 10 c (2) above.

c. Reverse Servo.

(1) EQUIPMENT.

GAGE, low and reverse transit band adjusting, B226839
SCREWDRIVER
WRENCH, 1½-in.
WRENCH, deep socket, 9/16-in.
WRENCH, socket, ½-in.

(2) REMOVE REVERSE SERVO.

SCREWDRIVER
WRENCH, 1½-in.
WRENCH, deep socket, 9/16-in.
WRENCH, socket, ½-in.

Trip reverse servo latch by pulling release lever up against stop on servo cover. Remove six long screws and lock washers holding reverse servo to transfer unit case (½-in. socket wrench). CAUTION: Do not remove two short screws holding reverse servo cover to servo body. NOTE: To prevent servo from sticking in case, trip reverse servo latch by pulling release lever up against stop on servo cover. Grasp reverse servo with both hands, and pull servo out until mounting boss on servo clears transfer unit case.

(3) A new type reverse servo is being used beginning with transfer unit No. 1 GT4996. This new type servo can be identified by the two ½-inch socket-head pipe plugs on the side of the servo body below the outer exhaust valve lever in the place of one on the first type servo. The basic difference in the second type servo is the use of a spring-loaded sliding check valve instead of a ball check valve. Except for the two items above, the two types of servos are the same and are interchangeable as complete units. On the second type servo the check valve and valve spring can be removed from the servo body by loosening the set screw. On the first type servo the ball-check valve could not be removed.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

(4) INSTALL REVERSE SERVO.

GAGE, low and reverse transit band adjusting, B226839
WRENCH, socket, ½-in.

Install gasket over reverse servo body and insert reverse servo in case. See that yoke on end of rod has open face toward outside of case and hook over pin in actuating lever. Install gage B226839 into threaded end of reverse servo piston rod through hole in servo cover. Tighten pressure nut on tool until it contacts reverse servo cover. Tighten pressure nut, at the same time pushing servo into case. Install six screws and lock washers holding reverse servo to transfer unit case (½-in. socket wrench). Adjust reverse band as explained in paragraph 10 c (3).

d. Carrier Assembly.

(1) EQUIPMENT.

CLEAN RAGS
PAN, drain, 10-gal capacity
WRENCH, open-end, 9/16-in.
WRENCH, socket, ½-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, ¾-in.
WRENCH, socket-head set screw, 9/16-in.
WRENCH, socket-head set screw, ¾-in.

(2) REMOVE CARRIER ASSEMBLY.

CLEAN RAGS
PAN, drain, 10-gal capacity
WRENCH, open-end, 9/16-in.
WRENCH, socket, ½-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, ¾-in.
WRENCH, socket-head set screw, 9/16-in.
WRENCH, socket-head set screw, ¾-in.

Drain only transfer unit oil as explained in paragraph 10 b but not controlled differential oil. Remove two bolts holding right-hand leg guard (9/16-in. and ¾-in. socket wrenches) and remove guard. Remove 14 screws and lock washers holding oil pump and governor carrier to transfer unit case (9/16-in. socket wrench). Remove oil pump and governor carrier, with pump and governor attached, from transfer unit case, and remove carrier gasket.

(3) INSTALL CARRIER ASSEMBLY.

WRENCH, open-end, 9/16-in.
WRENCH, socket, ½-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, ¾-in.
WRENCH, socket-head set screw, 9/16-in.
WRENCH, socket-head set screw, ¾-in.

Install a new gasket on oil pump governor and carrier assembly and position carrier on transfer unit case, meshing speedometer driven gear

and oil pump idler gear. Install 14 screws and lock washers holding carrier to transfer unit case (9/16-in. socket wrench). Install right-hand leg guard (9/16-in. and ¾-in. socket wrenches). Fill transfer unit with required amount of OIL, engine (seasonal grade).

e. Replace Governor.

(Refer to pars. 13 b (6), 14 e (1), 16 f (5), and 17 e (5)).

f. Replace Oil Pump.

(Refer to pars. 13 b (6), 14 e (1), 16 f (5), and 17 e (5)).

g. Oil Cooler Assembly, Hoses, and Lines.

(1) EQUIPMENT.

SCREWDRIVER
WRENCH, open-end, ½-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 1⅛-in.
WRENCH, open-end, 1¼-in.
WRENCH, socket, 5/16-in.
WRENCH, socket, 7/16-in.
WRENCH, socket, ½-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, ¾-in.
WRENCH, socket, 15/16-in.

(2) REMOVE OIL COOLER.

(a) Remove Fan Shrouds.

WRENCH, open-end, ½-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, 5/16-in.
WRENCH, socket, ¾-in.

Remove center screw on engine compartment rear doors so that deflector (M5A1 and M8) can be swung up and hooked over clip on rear hood. Next, remove screws holding doors closed, and open doors (¾-in. socket wrench). CAUTION: Turn master battery switch to "OFF" position. Remove bolts holding clamps on exhaust outlet pipes (½-in. open-end wrench) and remove the pipes. Remove three screws from seal around each carburetor intake pipe (5/16-in. socket wrench) and slide seals toward rear. Remove screws holding fan shrouds (9/16-in. socket wrench) and remove shrouds.

(b) Remove Engine Fan, Fan Belt, and Bracket.

WRENCH, socket, 15/16-in.

Remove two nuts from fan bracket mounting studs and remove fan, fan belt, and bracket.

(c) Lower Oil Cooler.

WRENCH, socket, 7/16-in.

Lift out bulkhead doors and remove four nuts and bolts holding front end of oil cooler to shroud which is mounted underneath and between radiators (fig. 21). Work through engine compartment rear doors and remove four nuts and bolts holding rear end of oil cooler to shroud. Oil cooler may now be lowered to rest on top of upper rear relay cross shaft.

ORDNANCE MAINTENANCE — TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

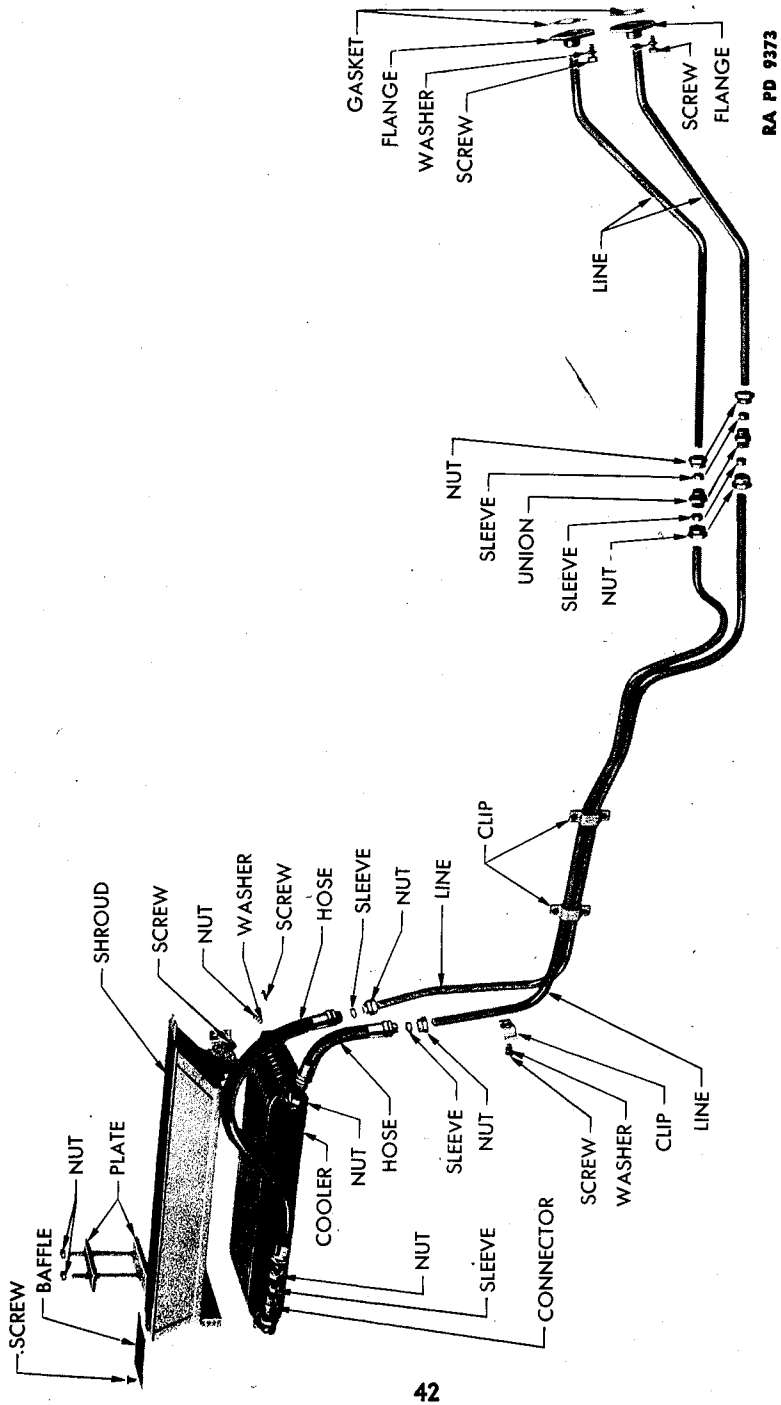

Figure 21 — Transfer Unit Oil Cooler — Exploded View

TRANSFER UNIT

(*d*) *Remove Oil Cooler Unit.*

WRENCH, open-end, 1¼-in. WRENCH, socket, ½-in.

Remove clip holding fuel line to left engine fuel pump (½-in. socket wrench). Disconnect *long* oil cooler hose at elbow at rear of cooler unit and disconnect short hose at oil cooler line connection on bulkhead (1¼-in. open-end wrench). Remove oil cooler unit, with short hose still attached, through rear doors.

(3) INSTALL OIL COOLER.

(*a*) *Install Oil Cooler Unit.*

WRENCH, open-end, 1¼-in. WRENCH, socket, ½-in.

Raise oil cooler unit through rear doors into position over upper rear relay cross shaft. Connect long oil cooler hose at elbow at rear of cooler unit. Support cooler unit and install four nuts and bolts which hold rear of oil cooler to shroud (½-in. socket wrench). Install clip holding fuel line to left engine fuel pump (½-in. socket wrench). Work through bulkhead doors and install four nuts and bolts holding front of oil cooler unit to shroud (½-in. socket wrench). Connect short hose to oil cooler line at bulkhead (1¼-in. open-end wrench). Install bulkhead doors.

(*b*) *Install Fan, Fan Belt, and Fan Bracket.*

WRENCH, socket, $^{15}/_{16}$-in.

Position fan, and fan bracket on mounting studs, and install two nuts and lock washers finger tight. CAUTION: Make sure master battery switch is "OFF" while working on fan. Slip fan belt over fan pulley and crankshaft pulley, and adjust fan belt tension by raising or lowering fan support until there is between ⅝—¾-inch slack when measured by pushing inward midway between fan pulley and crankshaft pulley. Tighten two fan support mounting stud nuts ($^{15}/_{16}$-in. socket wrench).

(*c*) *Install Fan Shrouds.*

WRENCH, open-end, ½-in. WRENCH, socket, $^{9}/_{16}$-in.
WRENCH, socket, $^{5}/_{16}$-in. WRENCH, socket, ¾-in.

Position fan shrouds on rear of engine compartment and install screws and lock washers ($^{9}/_{16}$-in. socket wrench). Position plate around carburetor air inlet pipe and install three screws ($^{5}/_{16}$-in. socket wrench). Connect exhaust outlet pipes to mufflers and tighten clamps (½-in. open-end wrench). Close engine compartment doors, lubricate, and install seven screws and lock washers on M5 vehicles. On M5A1 vehicles, install six screws leaving center screw out. Swing deflector into place and install remaining screw.

(4) REMOVE OIL COOLER HOSES.

WRENCH, open-end, 1¼-in.

Remove fan shrouds as explained in step (2) (*a*) above, and disconnect long oil cooler hose at elbow at rear of cooler unit. Remove

bulkhead doors and right-hand upper shell rack, disconnect long oil cooler hose from line at bulkhead, and remove hose. Disconnect short hose at line on bulkhead and front elbow on oil cooler unit, and remove hose.

(5) INSTALL OIL COOLER HOSES.

WRENCH, open-end, 1¼-in.

Connect short oil cooler hose to cooler unit elbow at front of unit and to line on bulkhead. Connect long hose to line at bulkhead. Install bulkhead doors and upper right-hand shell rack. Connect long oil cooler hose to elbow at rear of cooler unit. Install fan shrouds as explained in step (3) *(c)* above.

(6) REMOVE OIL COOLER LINES.

(a) Remove Turret Basket Guard (M5, and M5A1).

WRENCH, socket, 9/16-in.

Loosen screw from front of turret basket guard and lift rear of guard from hinges so that it can be removed.

(b) Remove Right-hand Bulkhead Door and Extension Cover (M5, and M5A1).

SCREWDRIVER WRENCH, 9/16-in.

Unfasten armor plate guard latch and raise shell rack cover to catch on bulkhead. Remove screw holding shell rack guard to shell rack, and pry guard from locating holes in extension cover. Remove three screws and lock washers holding the 37-mm shell rack and remove rack. Rotate bulkhead door latch so that door may be tilted forward at top and lifted off the hinges. Remove four screws and washers holding bulkhead extension cover to bulkhead extension. Pry cover upward at front end and remove.

(c) Remove Right-hand Bulkhead Door and Extension Cover (M8).

SCREWDRIVER WRENCH, 9/16-in.

Remove four screws and washers holding right-hand ammunition rack to fighting compartment walls and bulkhead, and remove ammunition rack. Rotate bulkhead door latches, tilt doors forward at top and lift off hinges. Remove four screws and washers holding right-hand bulkhead extension cover to bulkhead and extension. Pry cover upward at front end and remove from vehicle.

(d) Remove Right-hand Propeller Shaft Cover and Outer Housing.

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

On M8 vehicles, remove four cap screws and lift out subfloor (9/16-in. socket wrench). On *all* vehicles, remove cap screws holding front and

rear covers on top of right-hand propeller shaft housing and remove covers. Remove two screws holding propeller shaft housing air baffle to support and remove baffle (9/16-in. socket wrench). Remove cap screws holding outer housing and remove housing (9/16-in. open-end wrench).

(e) Remove Oil Cooler Lines.

WRENCH, open-end, 7/16-in. WRENCH, socket, ½-in.
WRENCH, open-end, 1⅛-in. WRENCH, socket, 9/16-in.

Disconnect the two sections of the oil cooler lines at the union in the center of the right-hand propeller shaft housing (1⅛-in. open-end wrench). Disconnect front lines at carrier (9/16-in. socket wrench), and remove lines. Remove clips holding transfer unit-to-oil cooler hose lines to side of inner housing and to inside of bulkhead (7/16-in. open-end wrench). Disconnect lines from hoses and remove by pulling back through propeller shaft housing.

(7) INSTALL OIL COOLER LINES.

(a) Install Oil Cooler Lines.

WRENCH, open-end, 7/16-in. WRENCH, socket, ½-in.
WRENCH, open-end, 1⅛-in. WRENCH, socket, 9/16-in.
WRENCH, open-end, 1¼-in.

Position transfer unit-to-oil cooler hose lines in the right-hand propeller shaft housing and secure in place with clips mounted on inner housing wall and on the engine side of the bulkhead (7/16-in. open-end wrench). Connect to oil cooler hoses (1¼-in. open-end wrench). Install transfer unit-to-oil cooler upper and lower front lines in propeller shaft housing and secure flanged ends to carrier (9/16-in. socket wrench). Reconnect the two sections of the oil cooler lines at the union in the center of the right-hand propeller shaft housing (1⅛-in. wrench).

(b) Install Propeller Shaft Outer Housing and Cover.

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

Position outer housing wall around right-hand propeller shaft and secure with six cap screws (9/16-in. open-end wrench). Position front cover over propeller shaft and install four mounting screws (9/16-in. socket wrench). Install two screws holding propeller shaft housing air baffle to support. Position rear cover over inner and outer walls and install five screws and lock washers holding rear cover to walls (9/16-in. socket wrench).

(c) Install Right-hand Bulkhead Door and Extension Cover (M5, and M5A1).

SCREWDRIVER WRENCH, 9/16-in.

Position bulkhead door on hinges, close door, and rotate latch to hold door closed. Place bulkhead extension cover in place and secure with screws and lock washers. Position 37-mm shell rack and fasten in

place with screws and lock washers. Insert armor plate guard around shell rack, making sure that button on guard engages slot in shell rack. Install screw and lock washer.

(*d*) *Install Right-hand Bulkhead Door and Extension Cover (M8).*

SCREWDRIVER
WRENCH, 9/16-in.

Position bulkhead door on hinges, close door, and rotate latch. Place bulkhead extension cover on bulkhead and secure with four screws and lock washers. Place 75-mm ammunition rack in position and fasten in place with four screws and lock washers.

(*e*) *Install Turret Basket Guard (M5, and M5A1).*

WRENCH, socket, 9/16-in.

Position rear of guard on hinges on the shell rack and bulkhead extension. Install and tighten screw at front of guard.

12. REMOVAL OF TRANSFER UNIT FROM VEHICLE.

a. When removing the transfer unit from the vehicle, it is necessary first to remove the controlled differential and transfer unit as a complete assembly. The procedure for this is given in the following paragraphs.

b. Equipment.

CHISEL
DRIFT, brass
HAMMER, light
HOIST
MALLET
PLIERS
PRYBAR
PUNCH, brass
SIDE CUTTERS
SLING, controlled differential and transfer unit, C105885
SLING, front deck, engine roof and gun turret, B226796
SLING, transfer unit, B226795
WRENCH, deep socket, 1 1/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 3/4-in. (2)
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 15/16-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.
WRENCH, socket, 15/16-in.
WRENCH, socket-head set screw, 9/16-in.
WRENCH, socket-head set screw, 3/4-in.

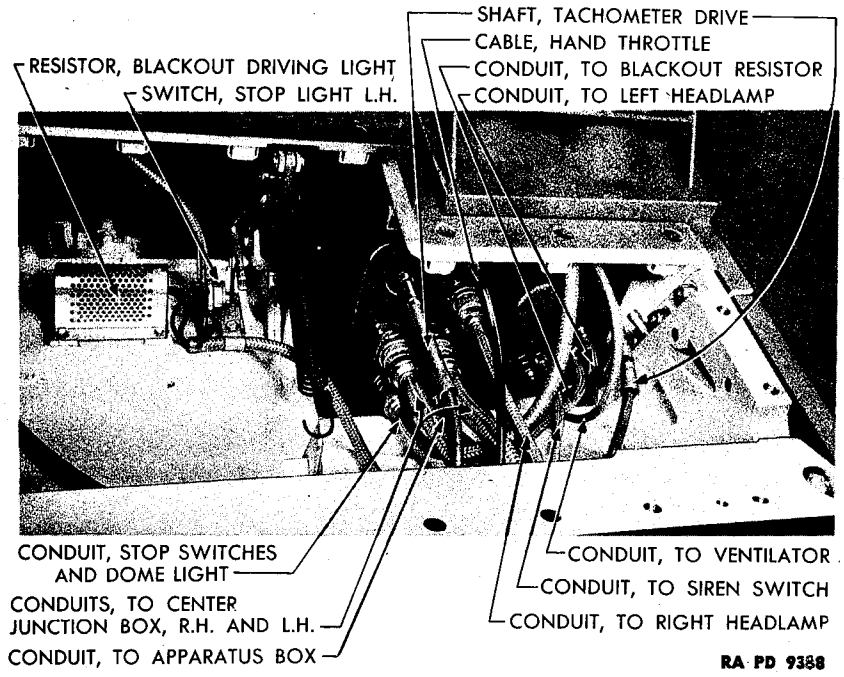

Figure 22 — Connections at Rear of Instrument Panel

c. Remove Transfer Unit and Controlled Differential.

(1) REMOVE TRACK FROM DRIVE SPROCKET.

DRIFT, brass
HAMMER, light
MALLET
PRYBAR
PUNCH, brass
WRENCH, open-end, 3/4-in.

Place vehicle on level ground. Remove wedge safety nut at inside and outside of end connectors on track shoes midway between bottom of drive sprockets and ground (3/4-in. open-end wrench). Drive wedges out of inside and outside track connectors with a brass punch and a hammer. Remove first the outside and then the inside end connectors on track shoes on each side of vehicle by prying with a prybar inserted between track links and end connectors, or by driving on end connectors with a brass drift and a mallet, if necessary. Pull the upper portion of each track backward off each drive sprocket by rotating sprocket with a prybar.

(2) DRAIN OIL FROM TRANSFER UNIT AND CONTROLLED DIFFERENTIAL.

(See Paragraph 10 b.)

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

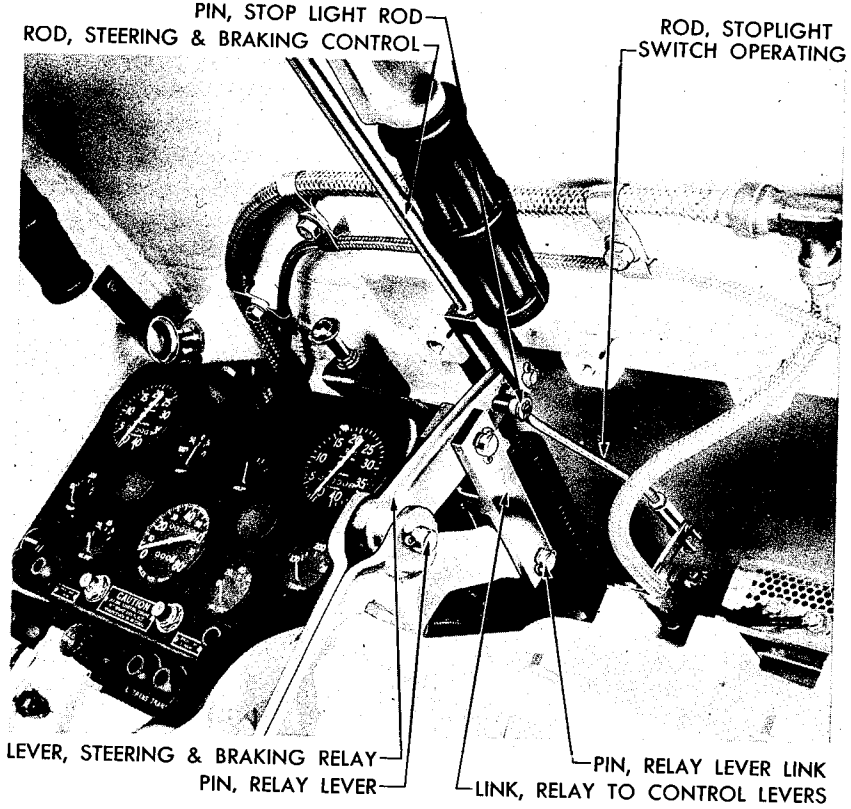

Figure 23 — Disconnecting, Steering, and Brake Levers

(3) REMOVE DRIVE SPROCKET.

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

Remove eight nuts on studs holding each drive sprocket to hub and pull sprockets from hub studs.

(4) REMOVE LOWER FRONT DECK PLATE.

SLING, front deck, engine roof and gun turret, B226796

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

Remove 27 lower front deck plate mounting screws. Install sling B226796 on two lower front deck lifting handles, connect a hoist to sling, and remove lower front deck.

(5) DISCONNECT SPEEDOMETER AND TACHOMETER CONDUITS AND CABLES.

PLIERS

WRENCH, open-end, $\frac{3}{8}$-in.

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

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

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

TRANSFER UNIT

Disconnect six electrical conduits, speedometer cable, and two tachometer cables from instrument panel (pliers). Disconnect opposite end of speedometer cable from transfer unit and remove cable. Remove two cable clip retaining screws ($\frac{1}{2}$-in. open-end wrench) and pull cables and conduits out from under differential housing into fighting compartment. Remove two mounting screws and lock washers holding each of the two stop light switches to differential housing ($\frac{7}{16}$-in. socket wrench). Disconnect wire leads to blackout light resistor ($\frac{3}{8}$-in. open-end wrench). Remove four screws holding resistor to controlled differential case ($\frac{5}{16}$-in. socket wrench) and remove resistor. Disconnect oil signal unit lead.

(6) DISCONNECT STEERING AND BRAKING LEVERS.

HAMMER, light

PUNCH, brass

PLIERS

SIDE CUTTERS

Remove three cotter keys and clevis pins holding each of the two steering and brake lever assembly links to mounting brackets on differential housing, using a pair of side cutters, a brass punch, and a light hammer. Disconnect links from mounting brackets. Remove left and right steering and brake lever retracting springs from differential housing (pliers).

(7) REMOVE INSTRUMENT PANEL.

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

Remove two screws and lock washers holding lower left instrument panel mounting bracket to fighting compartment wall. Remove two screws and lock washers holding upper right instrument panel mounting bracket and hand throttle cable bracket to upper front deck and swing instrument panel backward next to fighting compartment wall. Lower hand throttle cable and bracket down on differential housing.

(8) REMOVE SIREN SWITCH AND CABLE.

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

Remove two screws holding siren switch to floor, and pull siren switch and cable out from under differential housing.

(9) REMOVE HAND THROTTLE CABLE.

PLIERS

WRENCH, open-end, $\frac{3}{4}$-in. (2)

Remove hand throttle cable nut next to web on bottom of differential housing while holding hexagonal flange on cable (two $\frac{3}{4}$-in. open-end wrenches). Disconnect hand throttle cable trunnion at accelerator pedal relay and remove throttle cable by pulling it forward through web on bottom of differential housing (pliers).

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(10) DISCONNECT TRANSFER UNIT THROTTLE VALVE LINKAGE.

SIDE CUTTERS

Disconnect transfer unit throttle valve linkage at relay on rear end of transfer unit by removing cotter key.

(11) DISCONNECT TRANSMISSION AND TRANSFER UNIT MANUAL CONTROL ROD.

SIDE CUTTERS

Disconnect transmission and transfer unit manual control rod from selector lever to intermediate relay at selector lever, using a pair of side cutters to remove cotter key (fig. 18).

(12) DISCONNECT UNIVERSAL JOINT AT TRANSFER UNIT.

CHISEL
HAMMER, light
WRENCH, open-end, ½-in.
WRENCH, socket, 9/16-in.

Remove seven screws and lock washers holding left and right front universal joint covers on propeller shaft housings, and remove covers (9/16-in. socket wrench). NOTE: On M8 Vehicles, it is necessary to remove subfloor first. Bend back universal joint locking plates, using a chisel and a light hammer, and remove two screws that hold each universal joint bearing cap to yokes on rear of transfer unit (½-in. open-end wrench). Slide propeller shafts toward rear of vehicle, compressing sliding joint.

(13) DISCONNECT OIL COOLER PIPES AND BRACKETS.

WRENCH, socket, 9/16-in.

Remove four screws and lock washers holding oil cooler pipe mounting brackets to transfer unit case, and disconnect oil cooler pipes and brackets from transfer unit.

(14) REMOVE FILLER BLOCKS AND SHIMS.

WRENCH, socket, 7/8-in.

Remove two cap screws and lock washers holding each filler block to each end of differential housing, and remove both filler blocks and filler block shims.

(15) INSTALL TRANSFER UNIT AND CONTROLLED DIFFERENTIAL SLING.

HOIST
SLING, controlled differential and transfer unit, C105885

Install transfer unit and controlled differential assembly C105885 on differential housing. Sliding hooks on sling should extend under rib on bottom of housing. Lock hooks in position, using clevis pins and cotter

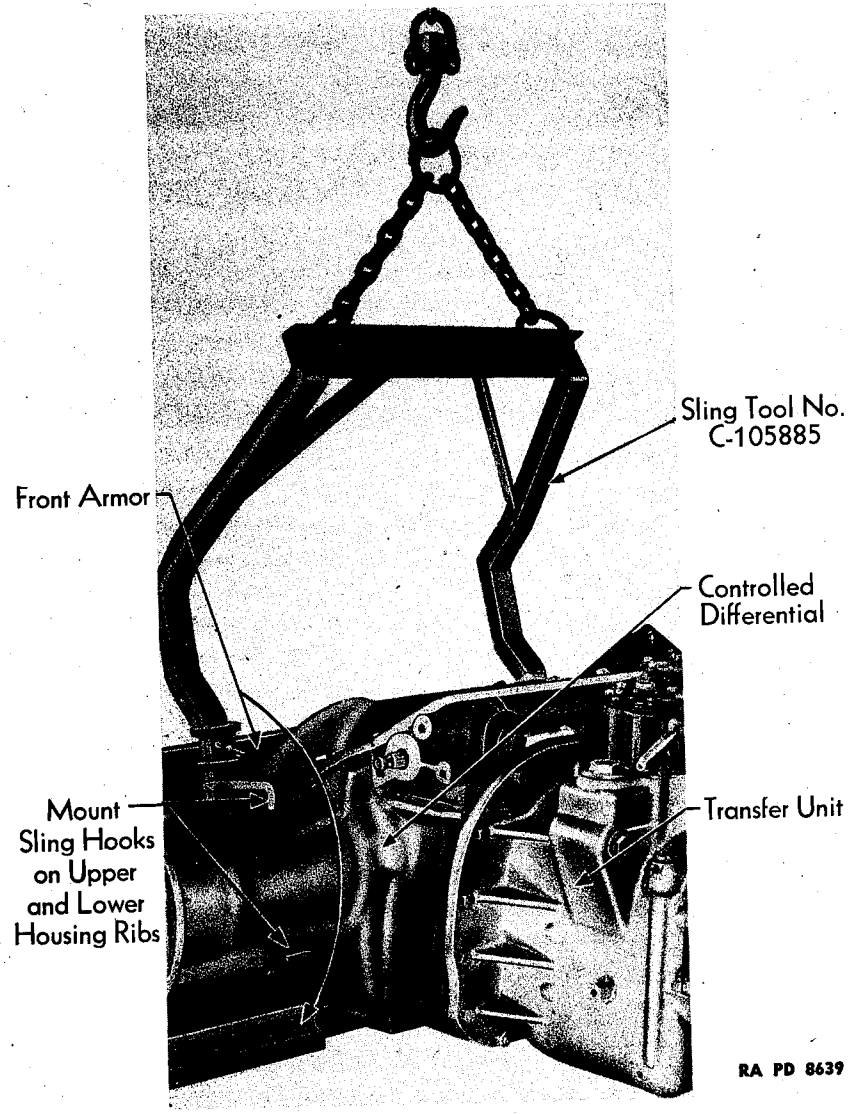

Figure 24 — Installation of Transfer Unit and Controlled Differential Sling

pins provided (fig. 24). Connect a hoist on sling and draw up cable until it is taut.

(16) REMOVE TRANSFER UNIT AND CONTROLLED DIFFERENTIAL.

WRENCH, open-end, ¾-in.
WRENCH, socket, ¾-in.
WRENCH, socket, 15/16-in.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

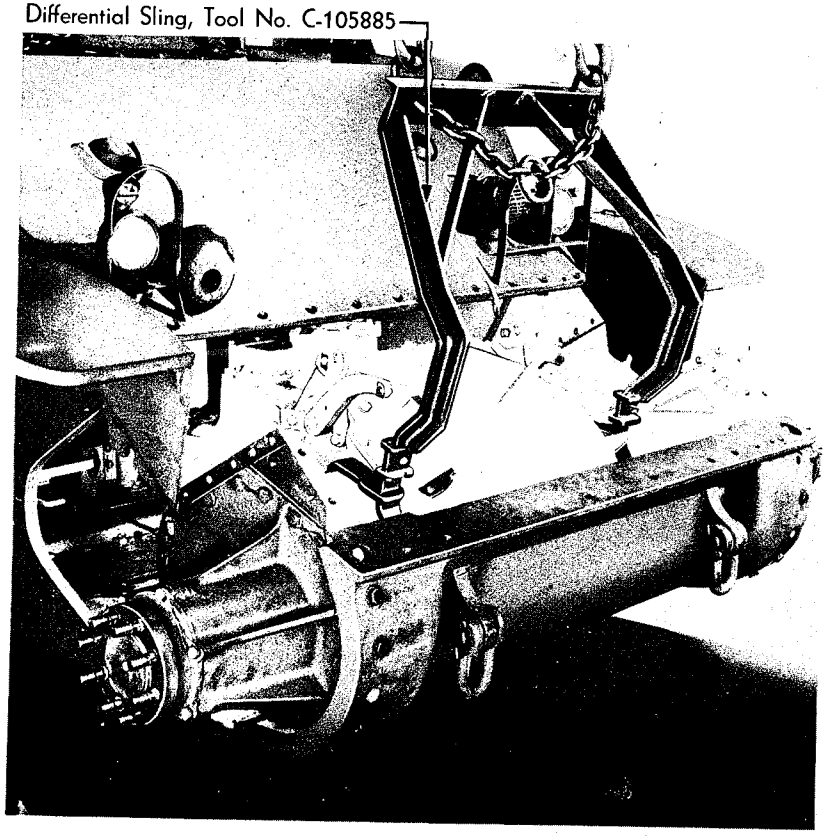

Figure 25 — Removing Transfer Unit and Controlled Differential (M5 Shown)

Remove 21 screws holding nose armor casting to hull floor ($15/16$-in. socket wrench). Remove 11 bolts that hold each end of differential housing to hull, using a ¾-inch open-end wrench on nut inside fighting compartment, and a ¾-inch socket wrench on bolthead outside of vehicle. Tighten hoist cable until it is bearing weight of nose armor casting, final drives, controlled differential, and transfer unit assembly; pull assembly forward and remove from vehicle (fig. 25). NOTE: Remove differential housing-to-hull shims as assembly clears hull. Keep left-hand shims separate from right-hand shims so that they may be installed on the same side as removed, if controlled differential and transfer unit are to be installed in same vehicle.

TRANSFER UNIT

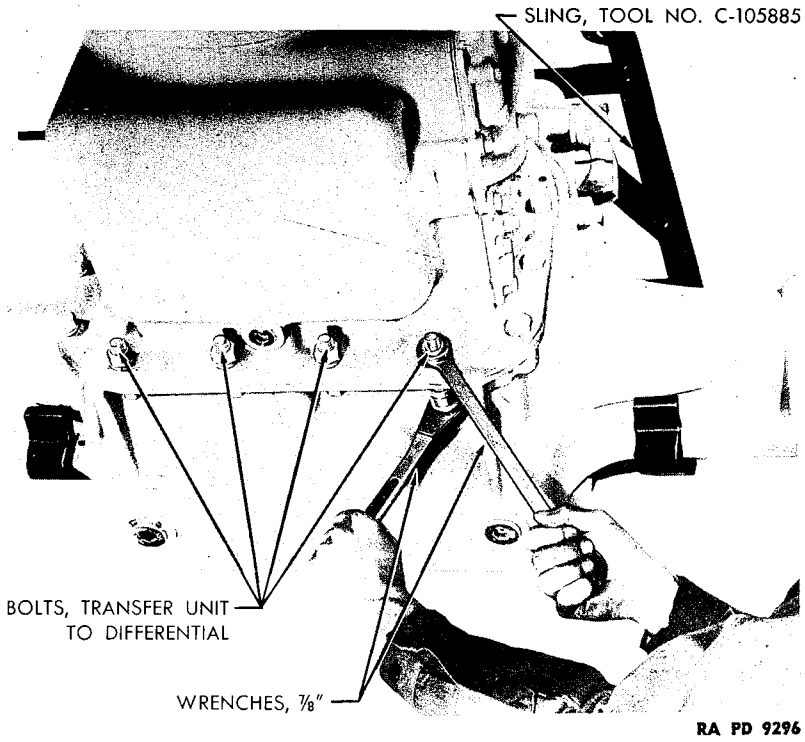

Figure 26 — Removing Lower Transfer Unit Bolts

d. Removal of Transfer Unit from Controlled Differential.

(1) REMOVE LOWER BOLTS.
WRENCH, socket, 7/8-in. (2)

While unit is still suspended on special sling, remove the four lower bolts and nuts that hold the transfer unit to the differential housing (fig. 26).

(2) REMOVE DIFFERENTIAL SLING.

Lower differential and transfer unit assembly at place where differential will remain. Remove cotter pin from upper clamp on sling, take out clamp, and remove sling from differential housing.

(3) INSTALL TRANSFER UNIT SLING.
SLING, transfer unit B226795 WRENCH, open-end, 5/8-in.

Install sling on transfer unit by turning sling bolts into holes in transfer unit (fig. 27) using an open-end wrench. Attach hook of hoist to sling and take up weight of transfer unit.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

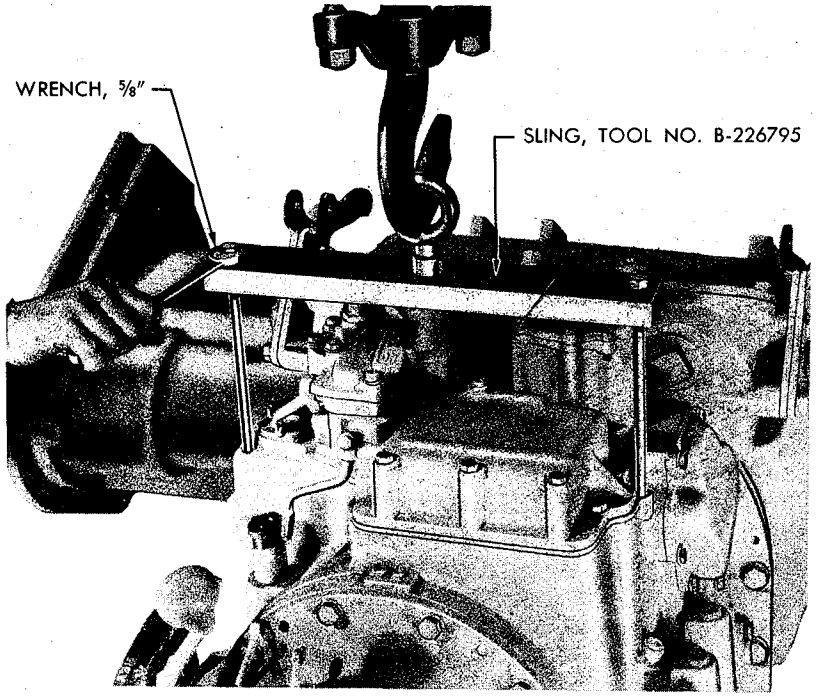

Figure 27 — Installing Transfer Unit Sling

(4) REMOVE TRANSFER UNIT.

WRENCH, open-end, $15/16$-in. WRENCH, socket, $7/8$-in.

With hoist just beginning to take the weight of the transfer unit, remove 11 cap screws ($7/8$-in. socket wrench) and five nuts, and lock washers ($15/16$-in. open-end wrench) that hold transfer unit to differential housing. Install two $7/16$-14 screws in holes in transfer unit case, shown in figure 28, and tighten screws to push transfer unit away from differential and off dowels. Lower transfer unit to bench and remove hoist and sling.

13. DISASSEMBLY OF TRANSFER UNIT.

a. Equipment.

ARBOR, needle bearing loading, A266519
BLOCK, 3-in. (2)
CHISEL
DRIFT, brass
DRIVER, idler gear bearing, A266514
HAMMER, light
HAMMER, soft

TRANSFER UNIT

HOIST
HOOK, clutch and drum assembly, lifting, A266513
PLIERS
PLIERS, snap ring, removing, A266329
PRYBAR, small (2)
PULLER, gear, B226841
PULLER, idler gear shaft, A266518
PULLER, mainshaft bearing, A265515
PULLER, pinion gear, transfer case, C105886
SCREW, $1/4$-20 thread
SCREW, $7/16$-14, $2\frac{1}{2}$ in. long (2)
SCREWDRIVER (2)
SIDE CUTTERS
WRENCH, $1/2$-in.
WRENCH, $11/16$-in.
WRENCH, $5/8$-in.
WRENCH, $1\frac{1}{8}$-in.
WRENCH, box, $1\frac{1}{16}$-in.
WRENCH, deep socket, $9/16$-in.
WRENCH, deep socket, $1\frac{1}{4}$-in.
WRENCH, open-end, $7/16$-in.
WRENCH, open-end, $1/2$-in.
WRENCH, open-end, $9/16$-in.
WRENCH, open-end, $15/16$-in.
WRENCH, open-end, $1\frac{1}{2}$-in.
WRENCH, open-end, $1\frac{15}{16}$-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, $1\frac{1}{8}$-in.
WRENCH, socket, $1\frac{1}{4}$-in.
WRENCH, socket, $1\frac{13}{16}$-in.
WRENCH, socket, 2-in.
WRENCH, spanner, A161954

b. Disassembly of Case.

(1) REMOVE CONTROLLED DIFFERENTIAL BRAKE BAND LUBRICATION TUBE.

WRENCH, $1/2$-in.

Remove screw and lock washer holding controlled differential brake band lubrication tube asssembly from front face of transfer unit, and remove lubrication tube assembly (fig. 29).

(2) REMOVE OUTPUT SHAFT BEARING RETAINER.

SIDE CUTTERS WRENCH, open-end, $15/16$-in.

Remove two lock wires for output shaft bearing retainer mounting nuts (fig. 30), and remove four mounting nuts. Pull bearing retainer from transfer unit case (fig. 31).

(3) REMOVE PINION AND BEARING.

PULLER, pinion, gear, transfer case, C105886 WRENCH, open-end, $1\frac{15}{16}$-in.
SIDE CUTTERS WRENCH, socket, 2-in.

Straighten cotter pin in pinion retaining nut (fig. 31), and drive pin out of nut and shaft. Remove pinion retaining nut, using a 2-inch socket

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

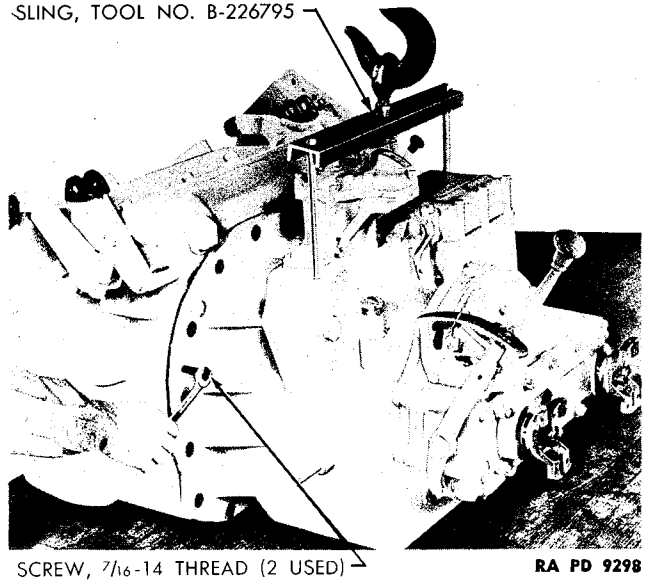

Figure 28 — Removing Transfer Unit

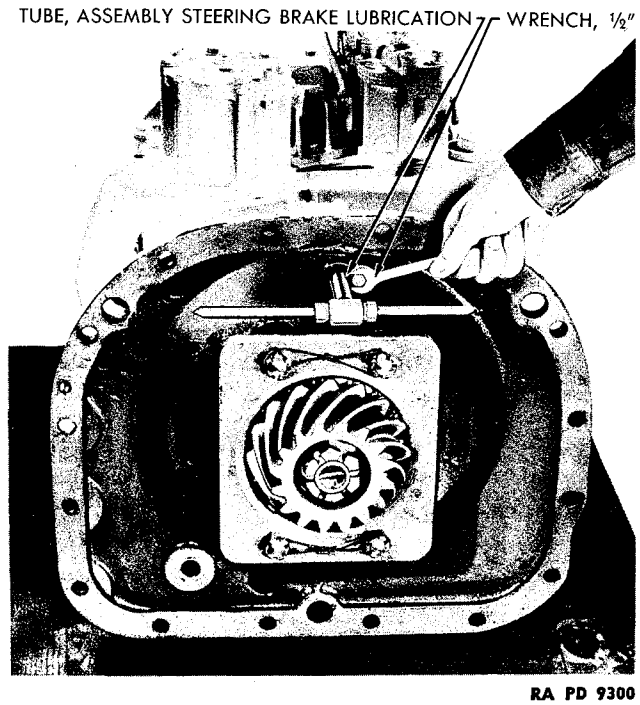

Figure 29 — Removing Lubrication Tube

TRANSFER UNIT

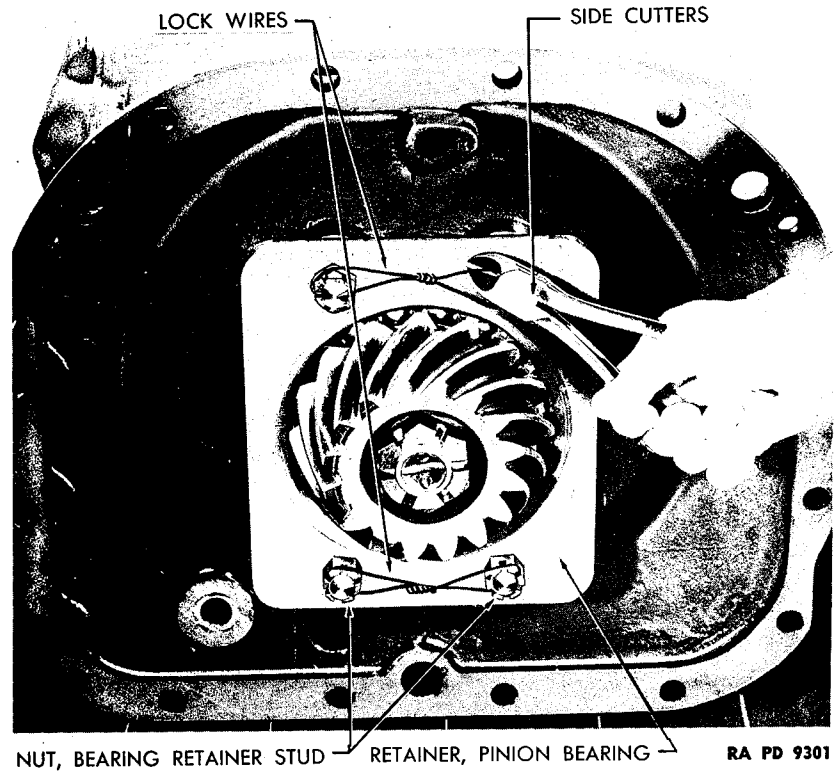

Figure 30 — Removing Lock Wires for Bearing Retainer Nuts

wrench, while keeping the transfer unit shafts from turning by holding one of the universal joint yokes with a $1\frac{15}{16}$-inch open-end wrench, as shown in figure 32. Take retaining nut and thrust washer from shaft. Attach special puller to pinion as shown in figure 33, and pull pinion and bearing from shaft. Remove puller from pinion.

(4) REMOVE BEARING FROM PINION.

DRIFT, brass	**WRENCH**, open-end, $1\frac{15}{16}$-in.
BLOCK, 3-in.	**WRENCH**, spanner, A161954
HAMMER, light	

Place pinion and bearing assembly on bench, and bend back tang on spanner nut lock plate, using a drift and hammer (fig. 34). Insert pinion and bearing assembly on output shaft with pinion *toward* case (fig. 35). Assembly is mounted in this position so that pinion can be kept from turning by holding one of the universal joint yokes as shown in figure 32. Remove spanner nut by using special spanner wrench. Take assembly from output shaft and bump pinion against a block of wood

ORDNANCE MAINTENANCE — TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

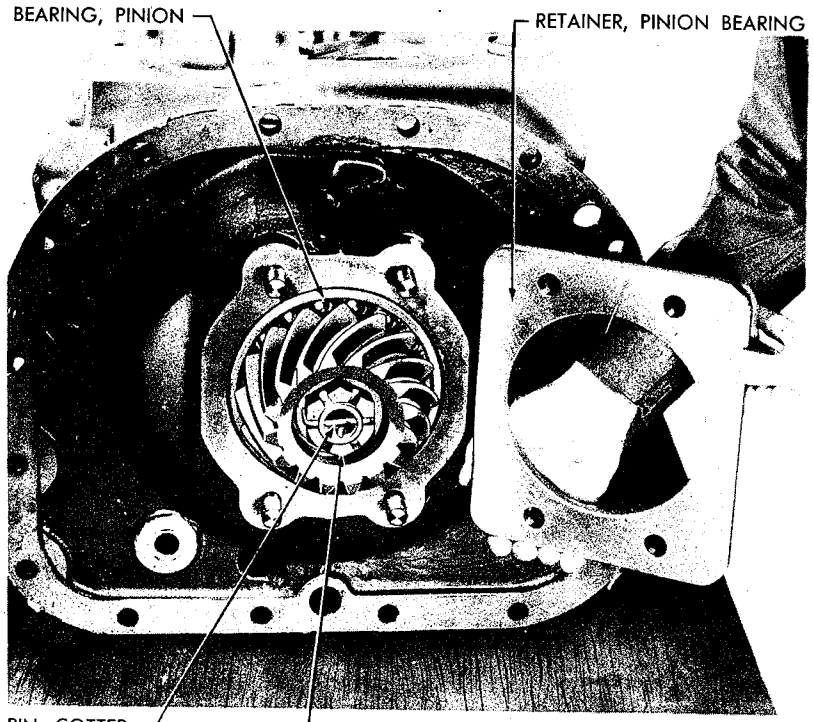

Figure 31 — Bearing Retainer Removed from Case

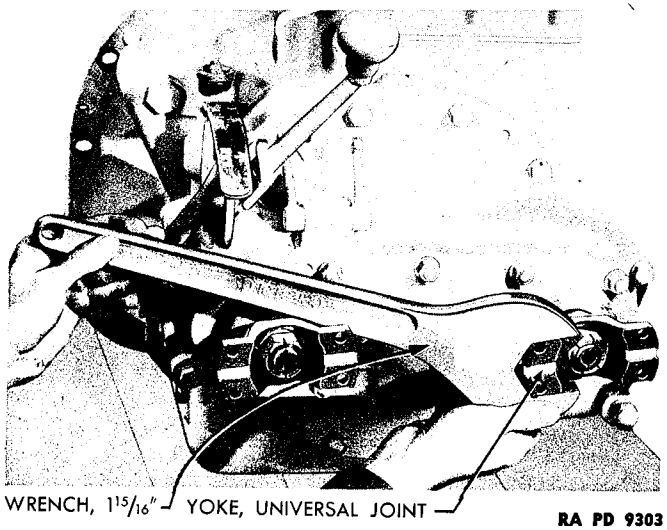

Figure 32 — Holding Transfer Unit Shafts

TRANSFER UNIT

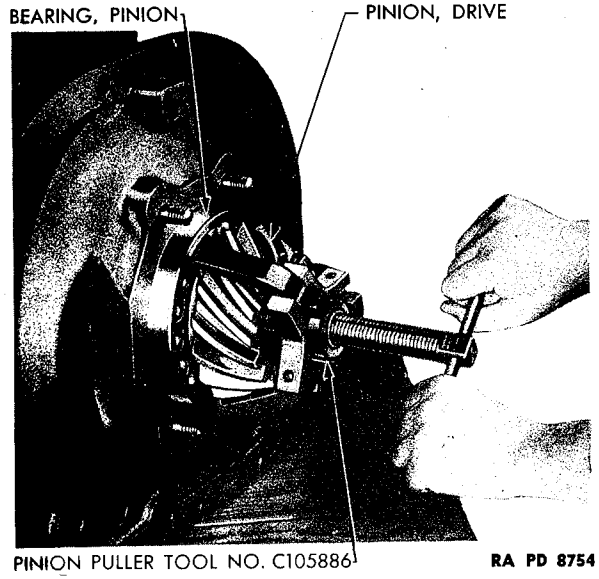

Figure 33 — Removing Pinion from Output Shaft

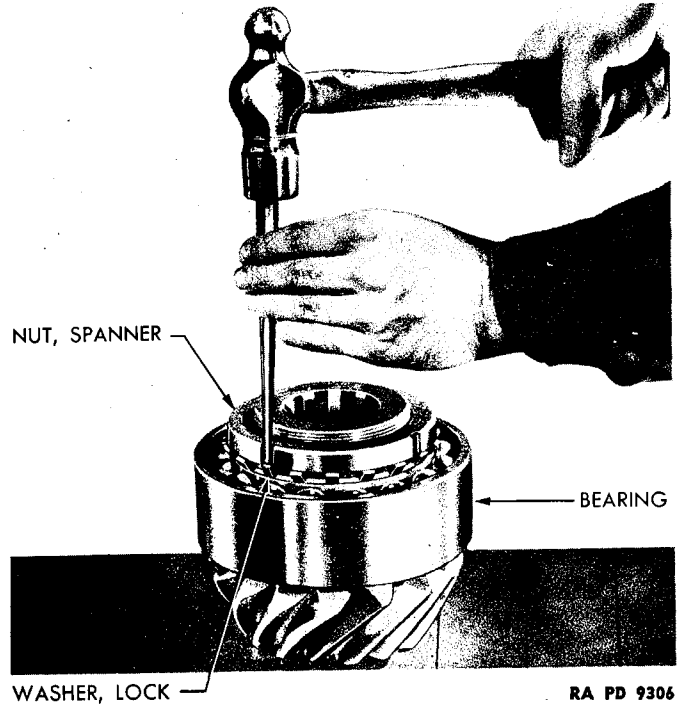

Figure 34 — Straightening Spanner Nut Lock Washer

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

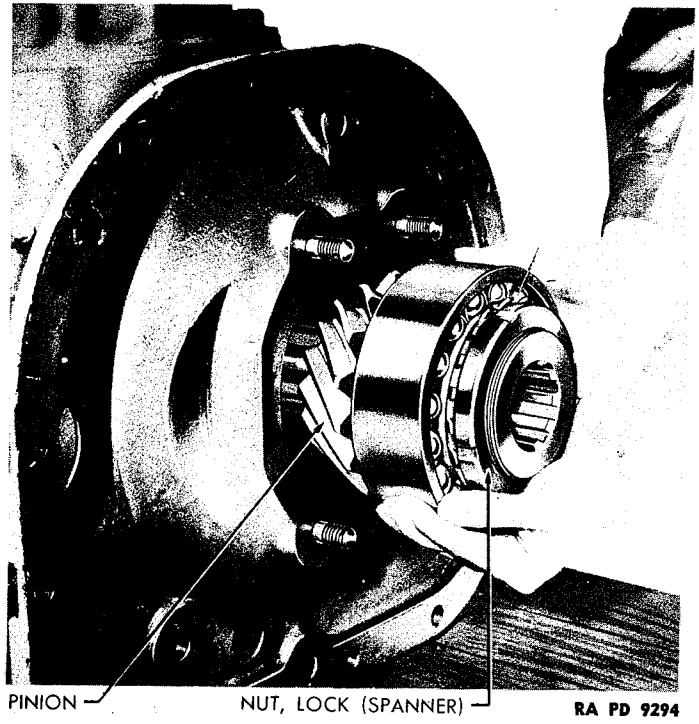

Figure 35 — Mounting Pinion for Spanner Nut Removal

to remove bearing and shims (fig. 36). NOTE: Save shims, if they are in good condition.

(5) REMOVE SHIFT LEVER AND SELECTOR.

WRENCH, ½-in. WRENCH, open-end, 1⅛-in.

Place shift lever between "DR" and "LO" positions, and remove pivot holding lever to case (1⅛-in. open-end wrench). Remove pivot, spacing washer and spring washer. Tilt upper end of lever inward toward transfer unit, meanwhile holding thumb over poppet to prevent loss of poppet and spring. Move lever up through opening in selector and lift out. Remove two screws holding selector to transfer unit case and remove selector (½-in. wrench).

(6) REMOVE OIL PUMP AND GOVERNOR CARRIER.

WRENCH, socket, 9/16-in.

Remove 14 screws and lock washers holding oil pump and governor carrier to transfer unit case (fig. 38). CAUTION: Do not remove the five ½-inch cap screws. Remove oil pump and governor carrier, with

TRANSFER UNIT

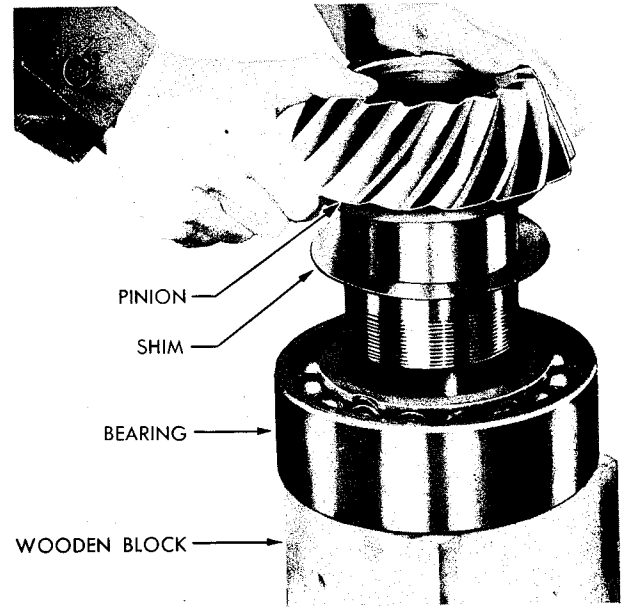

Figure 36 — Removing Bearing from Pinion

pump and governor attached, from transfer unit case and remove carrier gasket.

(7) REMOVE LOW GEAR SERVO.

SCREWDRIVER WRENCH, socket, ½-in.
WRENCH, open-end, 9/16-in.

Remove six long screws and lock washers holding low gear servo to transfer unit case (fig. 40). CAUTION: Do not remove two low gear servo cover mounting screws. These are the two short screws indicated in figure 40, or the two socket-head set screws, one of which is shown in figure 41. Grasp low gear servo with both hands and pull outward until mounting boss on servo body clears case. Remove servo and gasket (fig. 42).

(8) REMOVE REVERSE SERVO.

SCREWDRIVER WRENCH, open-end, ½-in.
WRENCH, deep socket, 9/16-in. WRENCH, socket, ½-in.

Trip reverse servo latch by pulling release lever up against stop on servo cover. Remove six long screws and lock washers holding reverse servo to transfer unit case (fig. 42). Hold servo lever in tripped position

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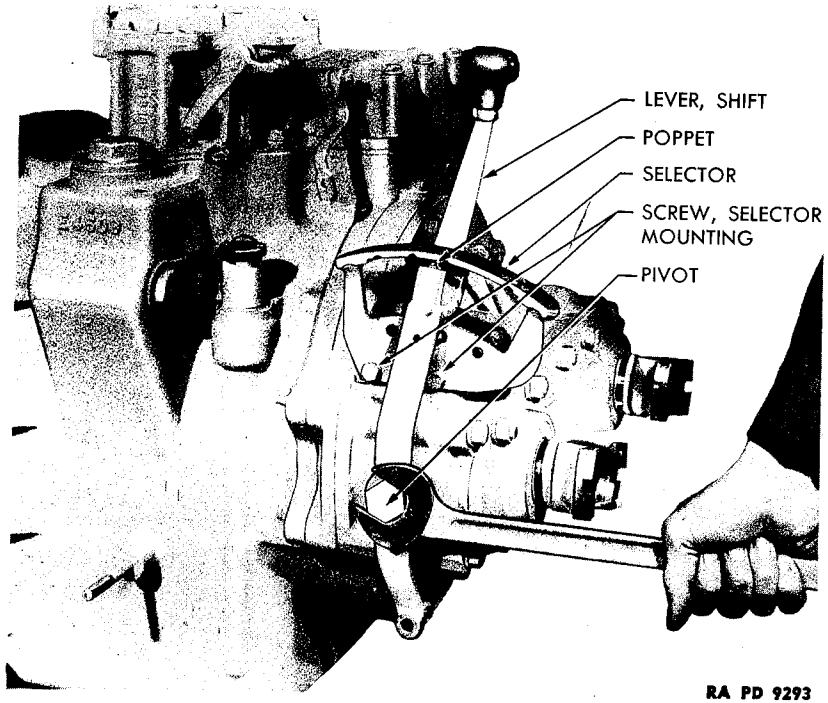

Figure 37 — Removing Shift Lever and Selector

while removing last two screws. CAUTION: Do not remove two short screws holding reverse servo cover to servo body. These are the two short screws indicated in figures 42 and 43. Grasp reverse servo with both hands and pull servo out until mounting flange on servo body clears transfer unit case (fig. 43).

(9) REMOVE CONTROL VALVE BODY COVER.

WRENCH, ½-in. WRENCH, socket, 7/16-in.

Remove 12 control valve body cover mounting screws and lock washers (fig. 44). NOTE: Do not remove screw on cover holding manual selector lever detent spring to cover. Pull control valve assembly cover and gasket off transfer unit case. CAUTION: After pulling cover out approximately one inch, reach under cover and grasp manual control valve to avoid its dropping out of valve body. Remove manual control valve from valve body after cover is removed.

(10) REMOVE CONTROL VALVE BODY.

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

TRANSFER UNIT

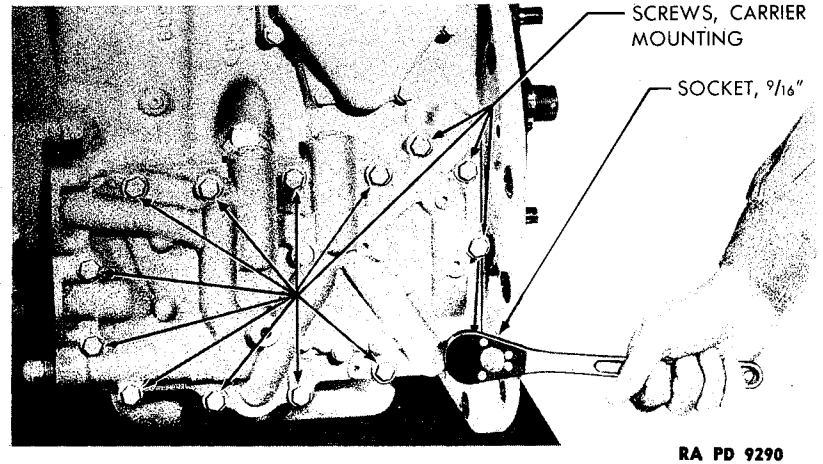

Figure 38 — Oil Pump and Governor Carrier Screws

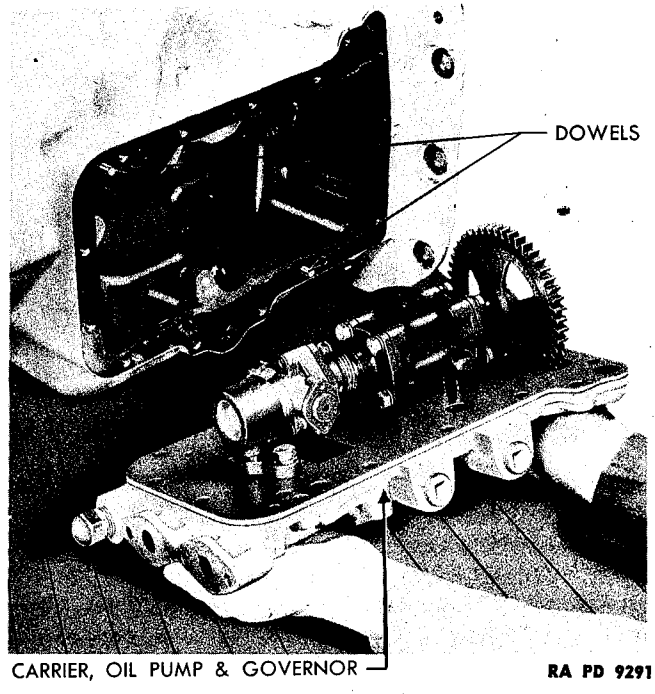

Figure 39 — Removing Oil Pump and Governor Carrier

ORDNANCE MAINTENANCE — TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

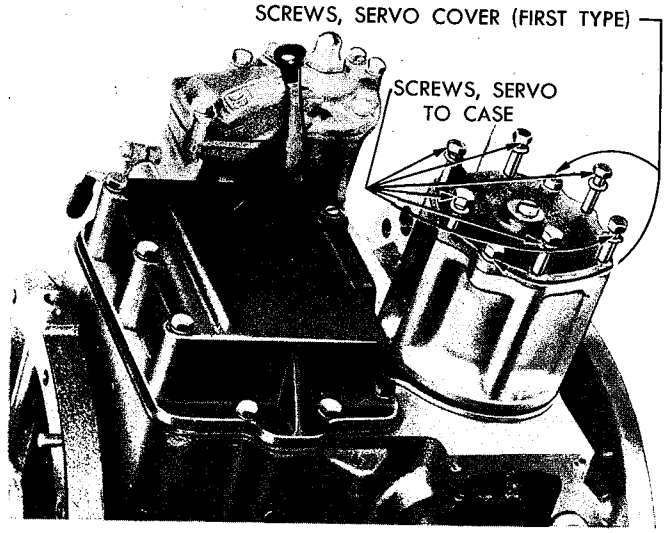

Figure 40 — Low Gear Servo Mounting Screws (First Type)

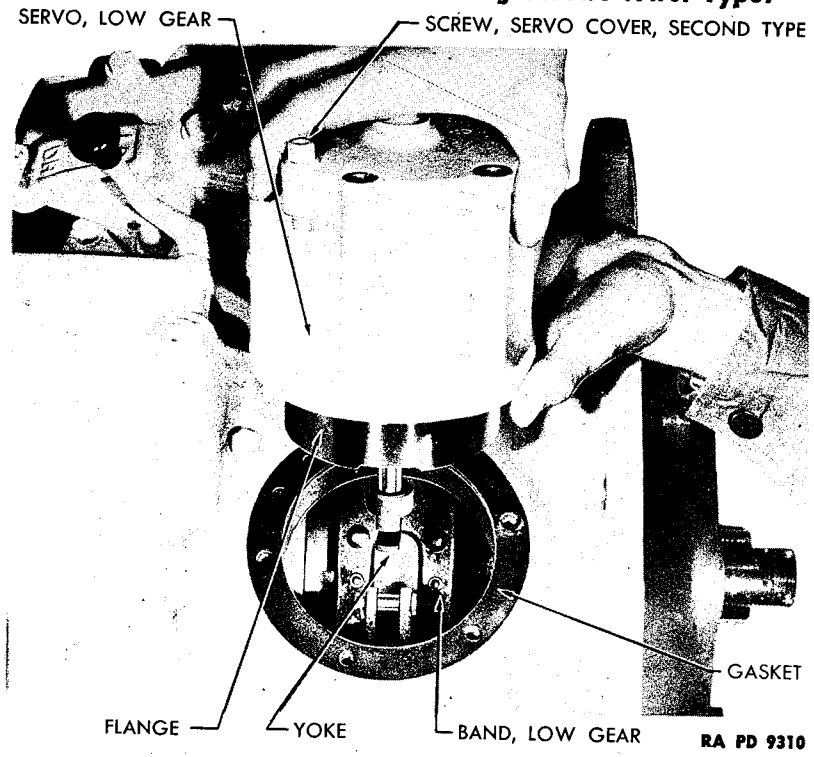

Figure 41 — Removing Low Gear Servo (Second Type)

TRANSFER UNIT

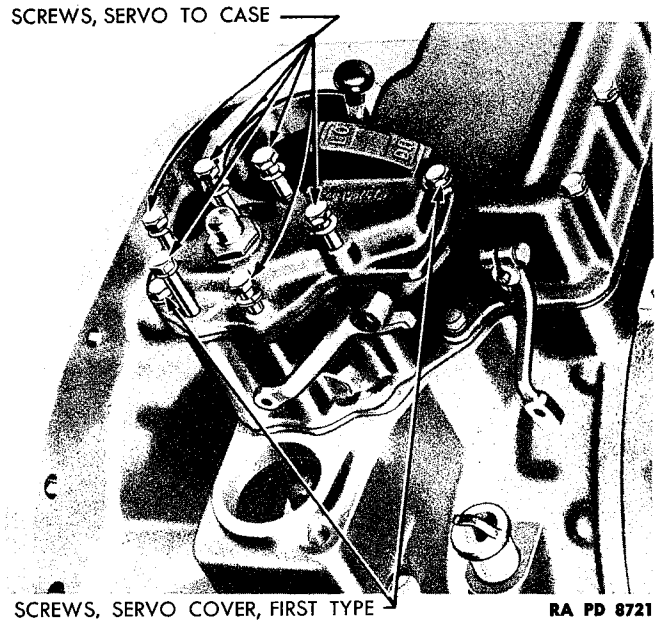

Figure 42 — Reverse Servo Mounting Screws

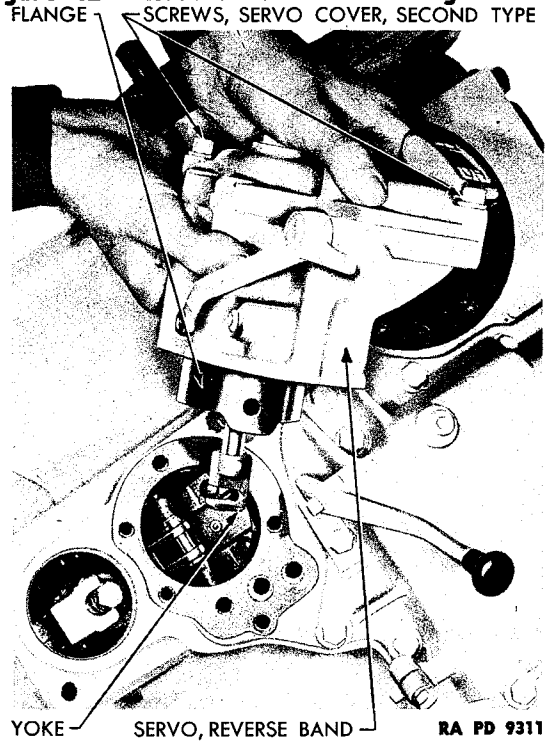

Figure 43 — Removing Reverse Servo

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

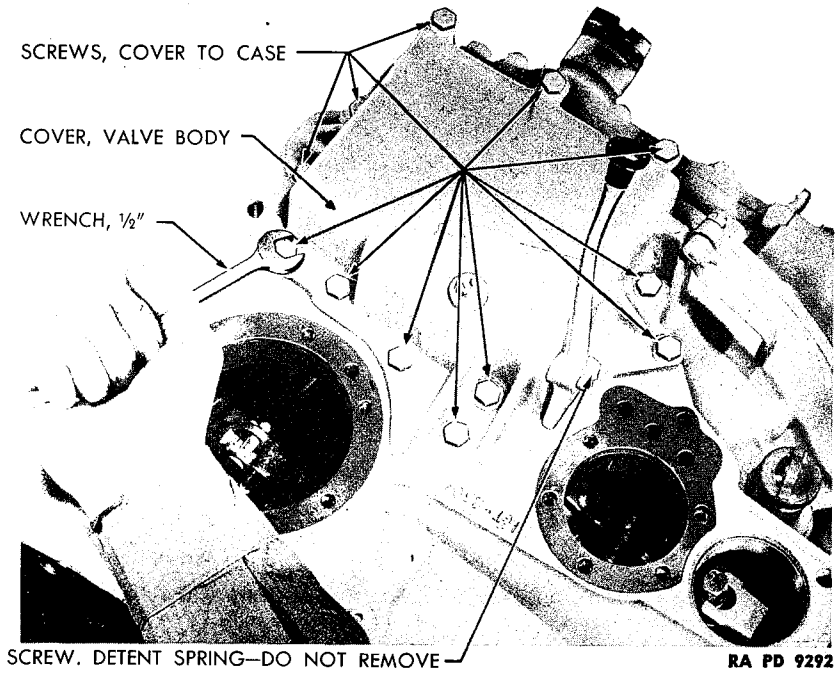

Figure 44 — Removing Control Valve Body Cover Screws

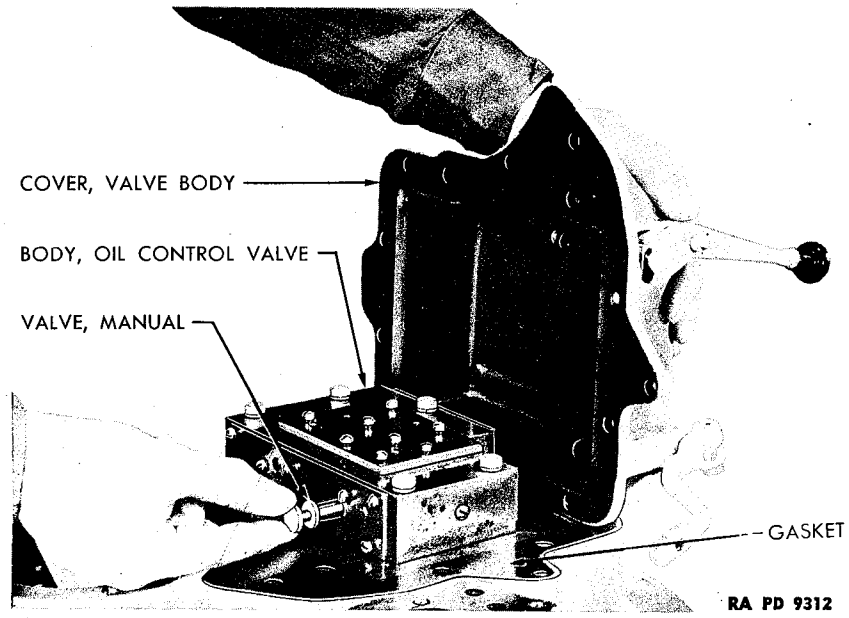

Figure 45 — Removing Control Valve Body Cover

TRANSFER UNIT

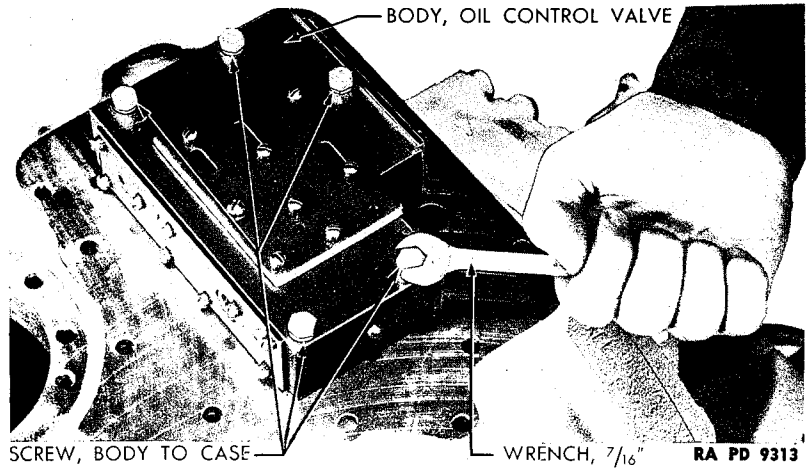

Figure 46 — Removing Control Valve Body

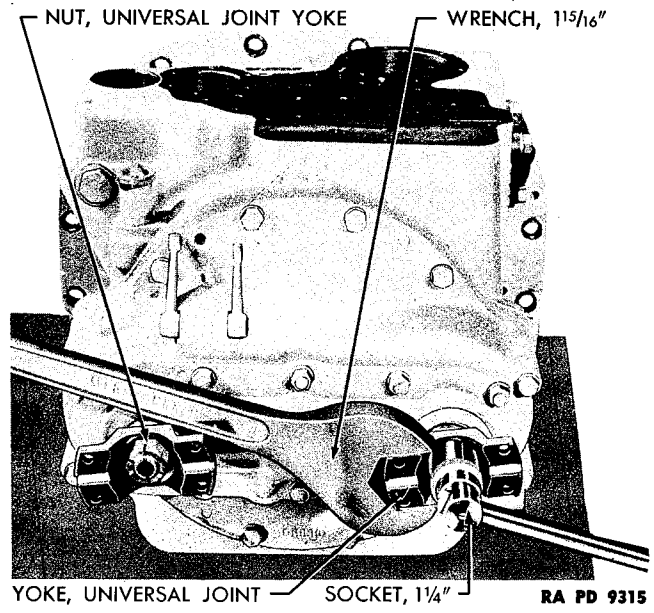

Figure 47 — Removing Universal Joint Nut

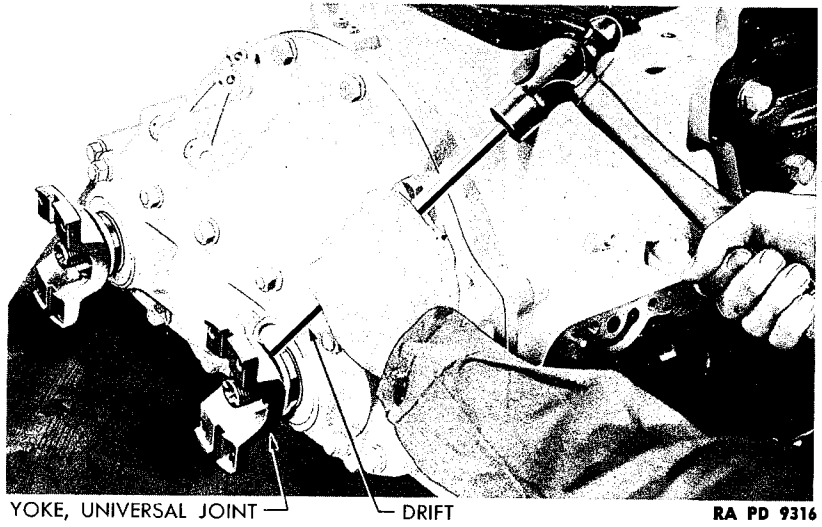

Figure 48 — Removing Universal Joint Yoke

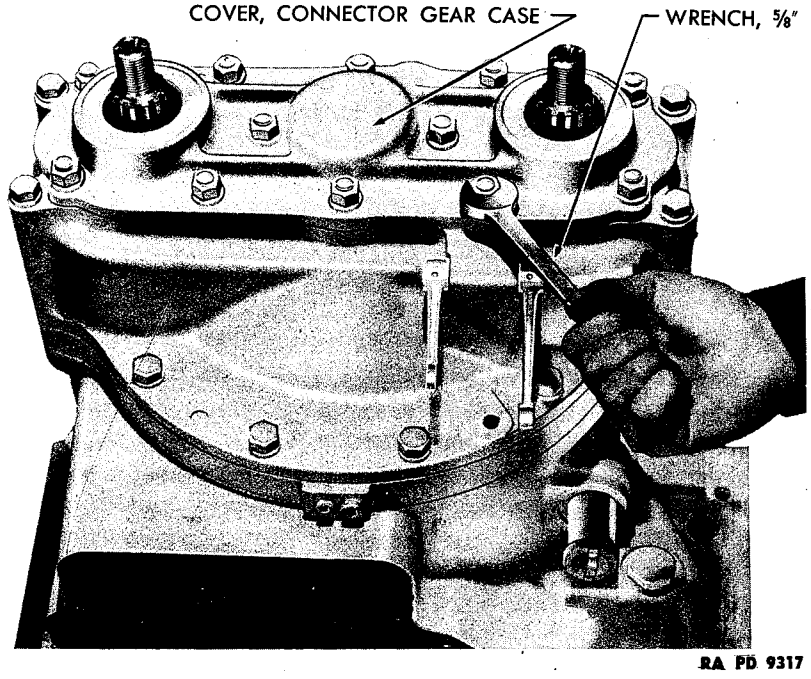

Figure 49 — Removing Connector Case Cover

TRANSFER UNIT

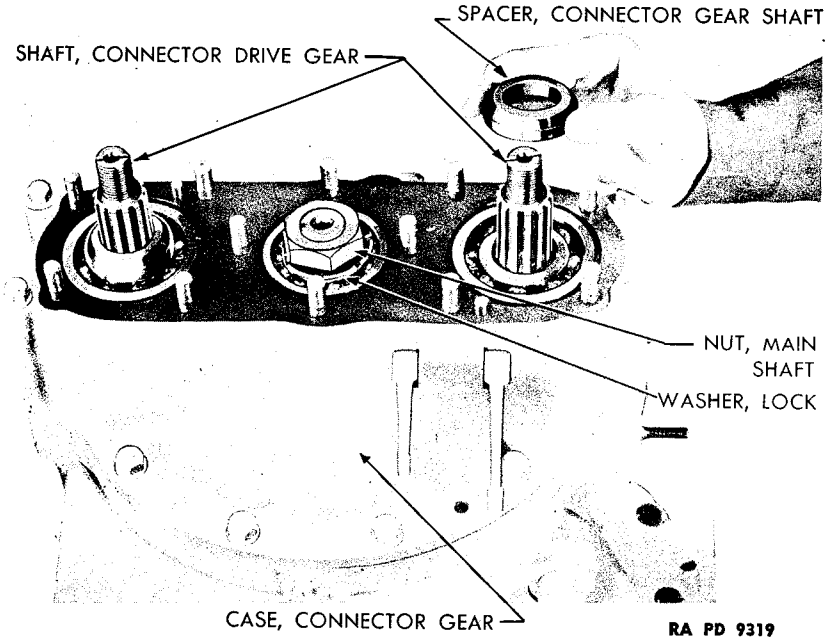

Figure 50 — Removing Connector Gear Spacer

Remove five screws and lock washers holding control valve body to spacer on transfer unit case (fig. 46), and remove valve body from spacer. Reinstall manual control valve in valve body. Lay these parts aside and cover to prevent dirt getting into valve body. Remove spacer and gasket from case. CAUTION: Do not pry spacer off; rock slightly to remove.

(11) REMOVE UNIVERSAL JOINT YOKES.

DRIFT, brass	**WRENCH**, open-end, $1\frac{15}{16}$-in.
HAMMER	**WRENCH**, socket, $1\frac{1}{4}$-in.

Remove nut holding right universal joint yoke to connector drive gear shaft. Hold yoke stationary with a $1\frac{15}{16}$-inch open-end wrench, while removing nut (fig. 47). Remove right universal joint yoke by driving it off with a hammer and brass drift applied to *hub of yoke* (fig. 48). CAUTION: Do not hammer on wing of yoke. Repeat procedure to remove left universal joint yoke.

(12) REMOVE CONNECTOR CASE COVER.

DRIFT, brass	**PRYBAR**
HAMMER, soft	**WRENCH**, $\frac{5}{8}$-in.

Remove 12 nuts and lock washers holding connector case cover to connector case studs (fig. 49). Lift off connector case cover after

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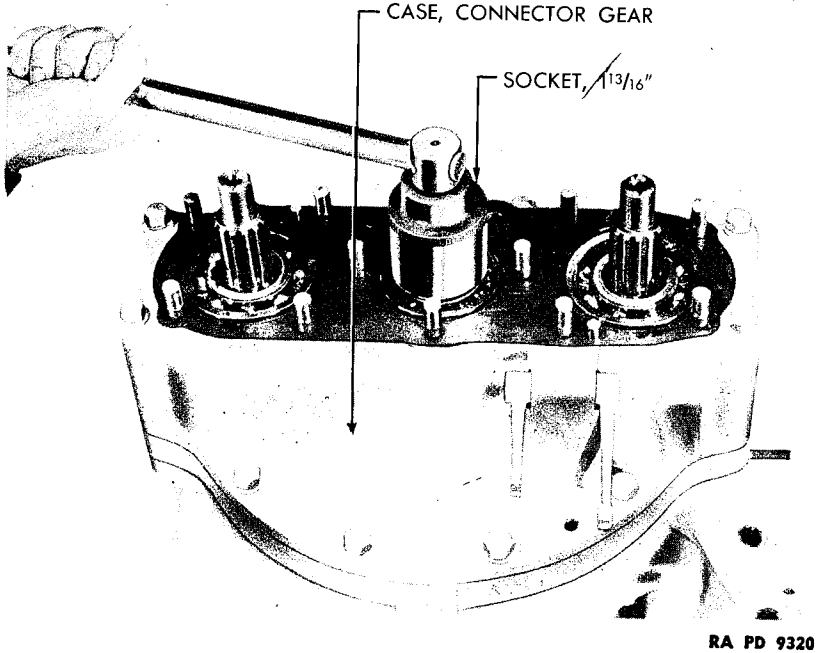

Figure 51 — Removing Main Shaft Nut

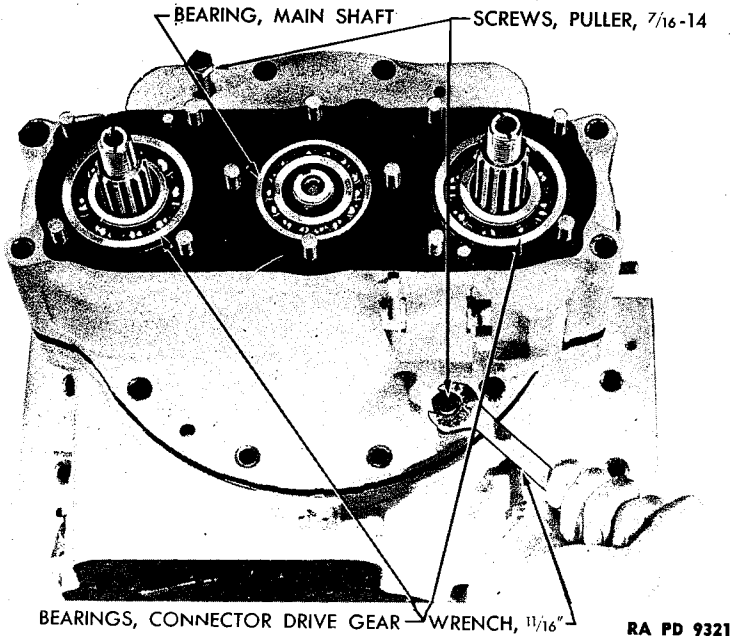

Figure 52 — Removing Connector Gear Case

TRANSFER UNIT

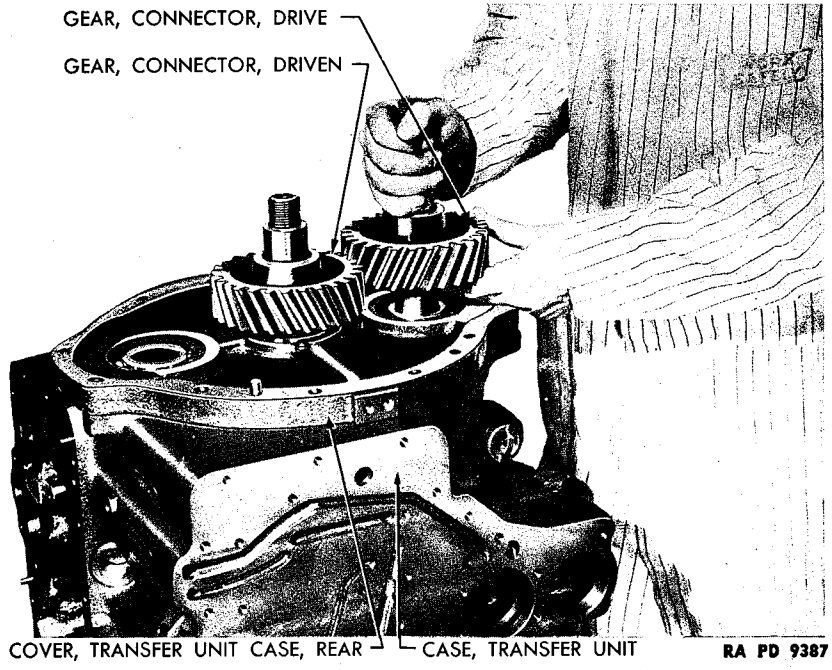

Figure 53 — Removing Connector Unit Drive Gears

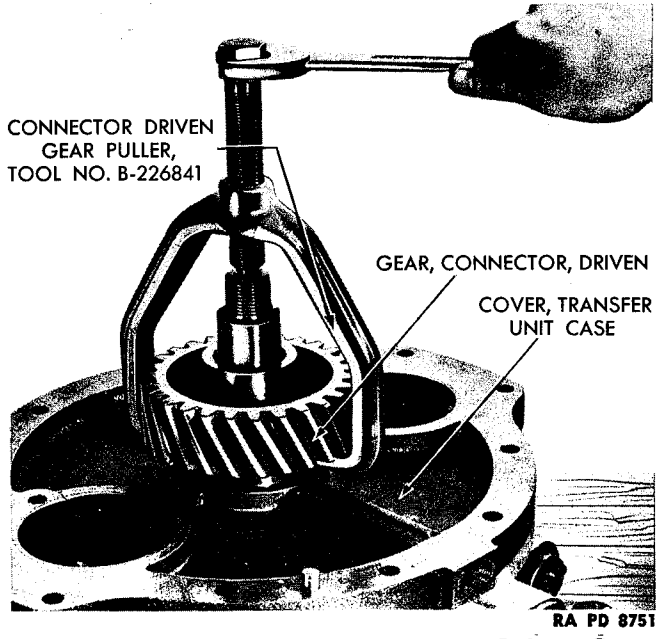

Figure 54 — Removing Connector Driven Gear

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

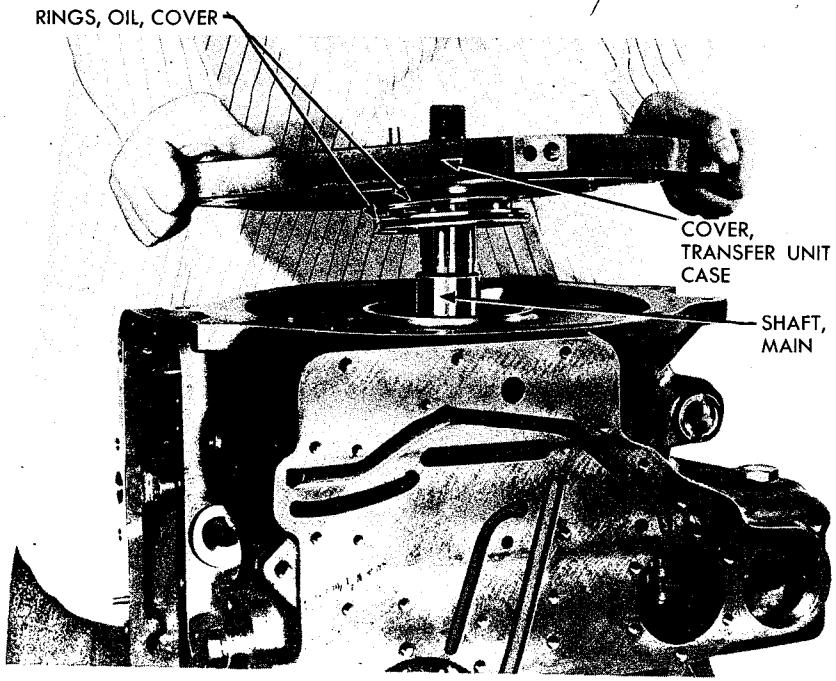

Figure 55 — Removing Transfer Unit Rear Cover

breaking it loose from dowel pins on case, using a soft hammer. Remove cover gasket. Remove oil seals from cover, using a short prybar or a hammer and drift. Discard seals.

(13) REMOVE CONNECTOR GEAR CASE.

CHISEL
HAMMER, light
SCREWS, 7/16-14 thread (2)
WRENCH, 11/16-in.
WRENCH, socket, 5/8-in.
WRENCH, socket, 1 13/16-in.

Remove spacers from left and right connector gear shafts (fig. 50). Straighten lock plate underneath nut on main shaft, using chisel and light hammer, and remove nut, using special 1 13/16-inch socket wrench (fig. 51). Remove four long screws at outer ends of case and eight shorter screws toward center of case. Install two special 7/16-14 puller screws into tapped holes in case as shown in figure 52, and remove case. If connector gear rear bearings come off with case, they can be removed by tapping on the outer race with a drift and light hammer. Otherwise, they can be pulled off the shafts by hand.

TRANSFER UNIT

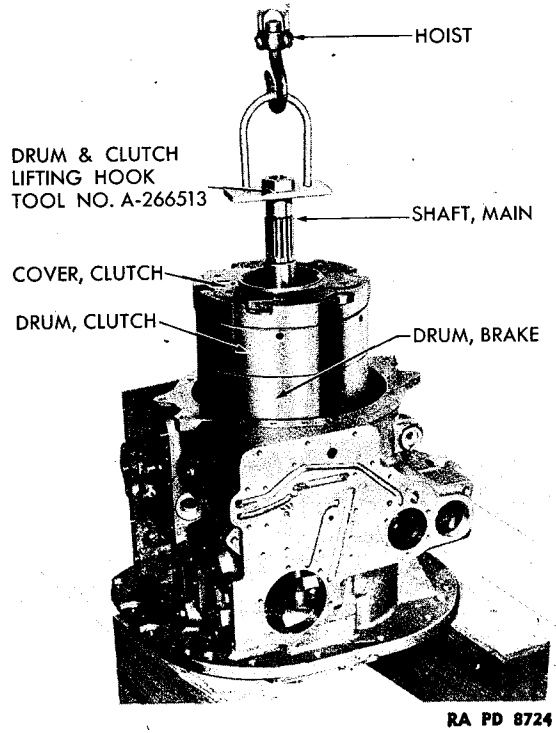

Figure 56 — Removing Drum and Gear Assembly

(14) REMOVE CONNECTOR GEARS AND BEARINGS.

HAMMER, light
PULLER, gear, B226841

Lift connector unit drive gears and shafts from transfer unit (fig. 53). If bearings come out with shafts, bearings as well as gears can be tapped off the shafts. Lift driven gear from transfer unit main shaft. If gear fits tightly, apply puller, as shown in figure 54, and pull gear from shaft.

(15) REMOVE REAR COVER AND MAIN SHAFT SPACER.

HAMMER, soft

Tap transfer unit rear cover lightly on both sides, using a soft hammer, to loosen cover from dowels. Grasp cover with both hands and lift straight up off main shaft (fig. 55). If connector gear bearings did not come out with shafts they should be removed now, by tapping around the outer race with a drift and hammer. Remove main shaft spacer from main shaft or from cover if it remained in cover.

(16) REMOVE DRUM AND GEAR ASSEMBLY.

BLOCK, 3-in.
HOIST
HOOK, drum and clutch assembly, lifting, A266513

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

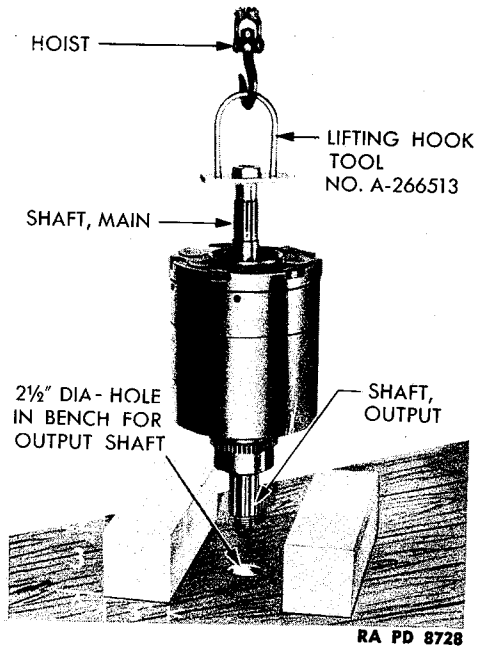

Figure 57 — Blocking Up Drum and Gear Assembly

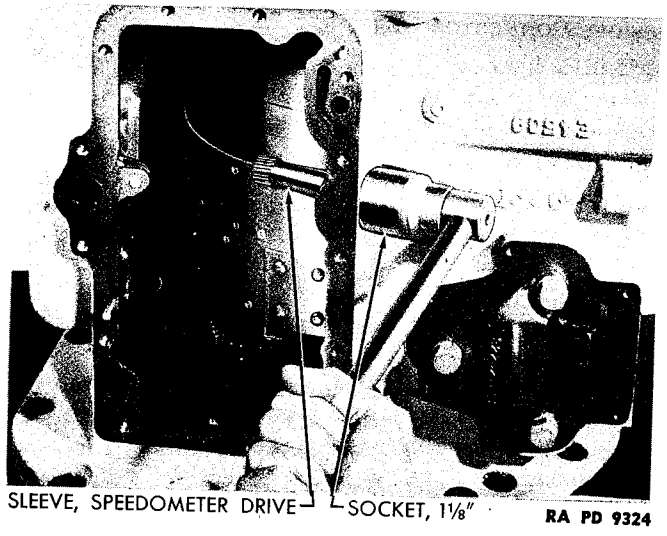

Figure 58 — Removing Speedometer Drive Shaft Assembly

TRANSFER UNIT

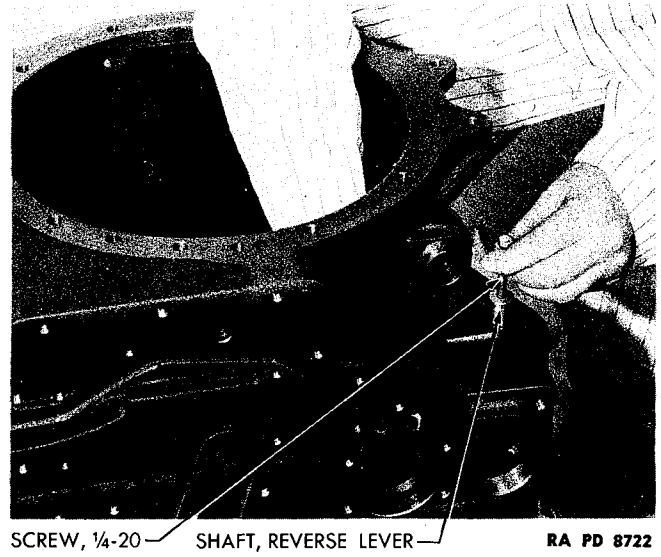

Figure 59 — Removing Reverse Band Lever Shaft

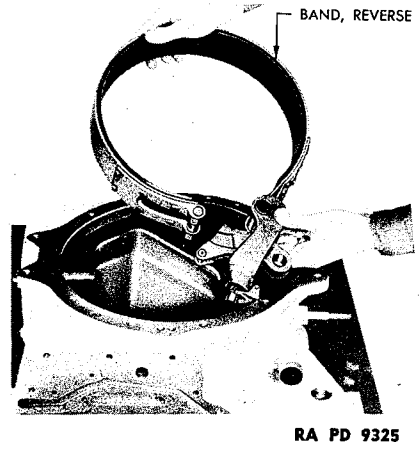

Figure 60 — Removing Reverse Band

Install lifting hook on end of main shaft, screwing on main shaft nut finger tight to hold tool in position. Attach a hoist to hook on main shaft, alining hoist above main shaft so that a straight lift will be secured. Raise drum and gear assembly *slowly* out of transfer unit case, being very careful that the assembly is not cocked, and that the brake bands do not wedge drum while being removed (fig. 56). Place drum and gear assembly on a bench, using a hoist. Output shaft should protrude through

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

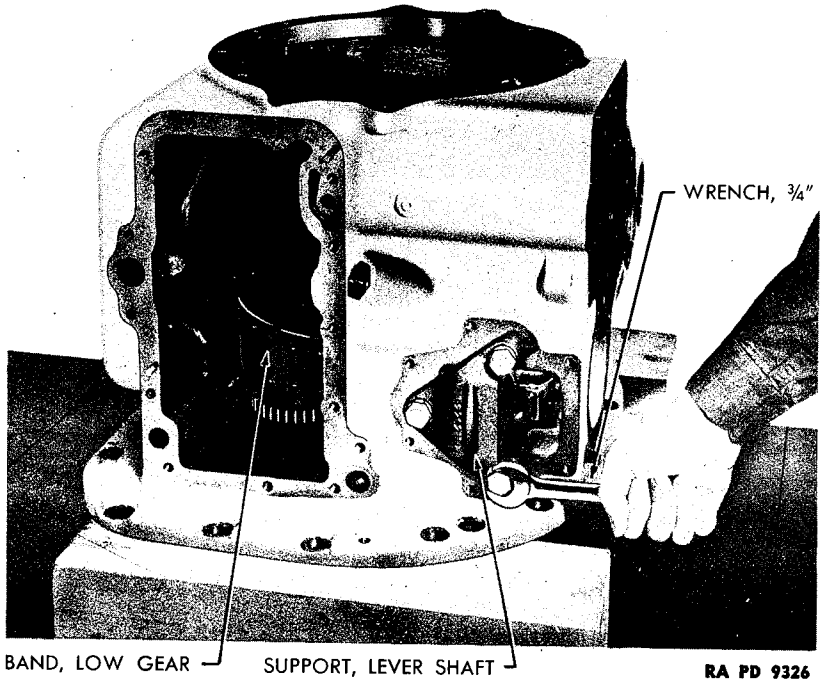

Figure 61 — Removing Low Gear Lever Shaft Support

a 2½-inch diameter hole in bench and drum must be blocked up with 3-inch blocks as shown in figure 57.

(17) REMOVE REVERSE BAND ASSEMBLY.

SCREW, ¼-20 thread
WRENCH, deep socket, 1¼-in.
WRENCH, socket, 1⅛-in.

Remove speedometer pinion and sleeve from transfer unit case (fig. 58). Remove oil level gage. Remove plug and copper gasket over reverse band lever shaft. Insert a ¼-20 thread screw in rear end of reverse band lever shaft and pull shaft out of case (fig. 59). Hold reverse band anchor lever up to prevent cocking on shaft. Remove lever from clevis. Lift reverse band assembly out of case (fig. 60).

(18) REMOVE LOW GEAR BAND ASSEMBLY.

WRENCH, ¾-in.

Remove three low gear brake band lever shaft support mounting screws and lock washers. Slide support away from case, and remove shaft support and lever. Remove low gear band assembly through rear opening in case (fig. 62).

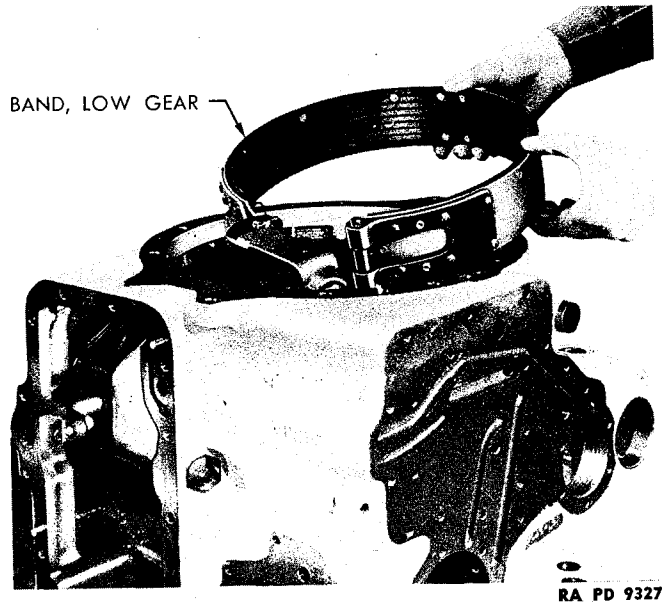

Figure 62 — Removing Low Gear Band

(19) REMOVE OIL STRAINER ASSEMBLY.

WRENCH, ½-in.

Remove screw and lock washer holding oil intake strainer pipe bracket to case. Remove oil strainer assembly by tapping pipe out of hole in case.

(20) REMOVE IDLER GEAR SHAFT AND IDLER GEAR.

DRIVER, idler gear bearing, A266514
HAMMER, light
PULLER, idler gear shaft, A266518
WRENCH, open-end, 9/16-in.
WRENCH, open-end, ½-in.

Remove lock wire and loosen oil pump idler gear shaft retainer screw lock nut. Remove oil pump idler gear shaft retainer screw and lock nut (fig. 64). Install idler gear shaft puller, threading puller bolt into tapped hole in idler gear shaft. Tighten nut on puller screw and pull idler gear shaft out of case (fig. 65). Remove idler gear, two steel thrust washers, puller and shaft from transfer unit case. Place oil pump idler gear over an open vise and drive out idler gear roller bearing, using idler gear bearing driver A266514 (fig. 66).

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

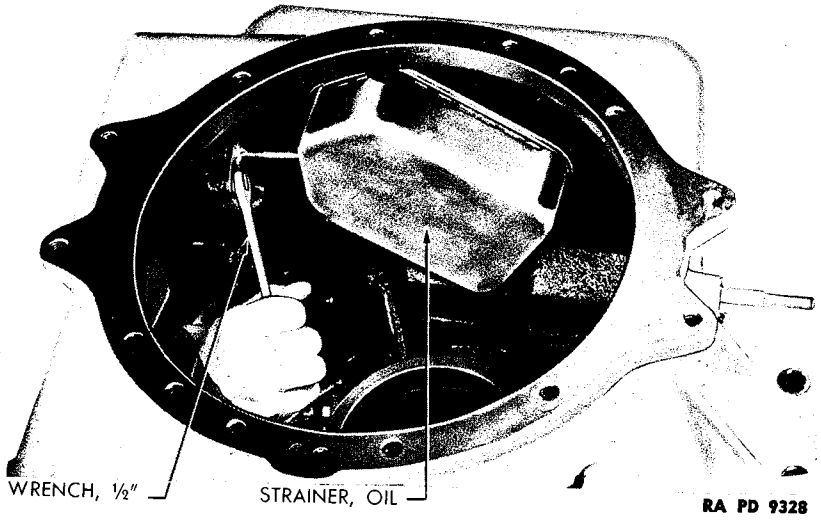

Figure 63 — Removing Oil Strainer Assembly

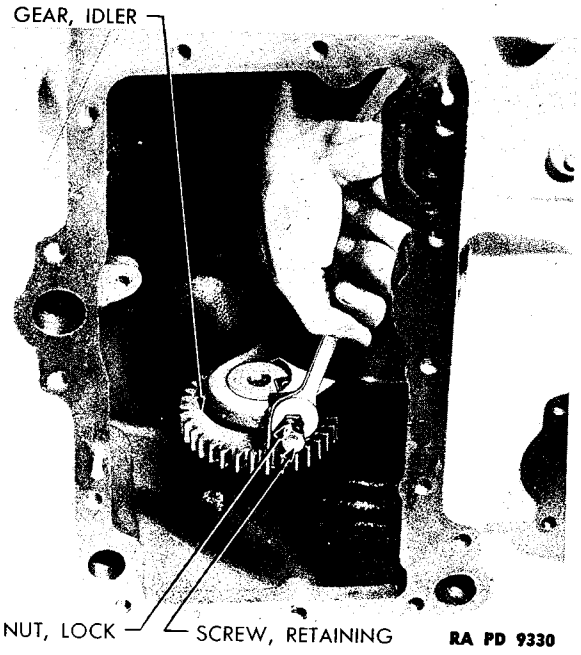

Figure 64 — Removing Idler Gear Shaft Lock Nut

TRANSFER UNIT

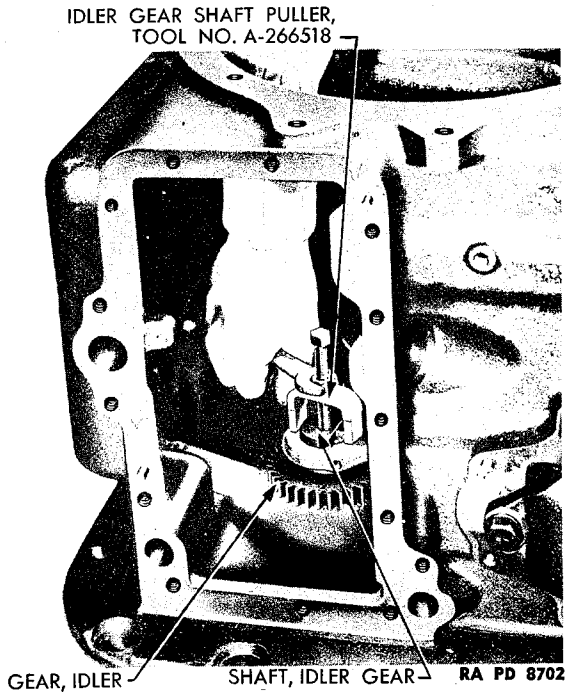

Figure 65 — Removing Idler Gear Shaft

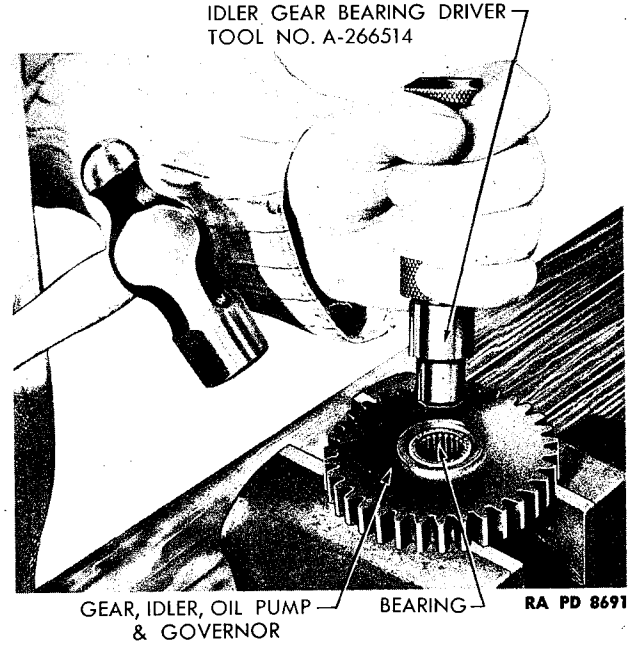

Figure 66 — Removing Idler Gear Bearing

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

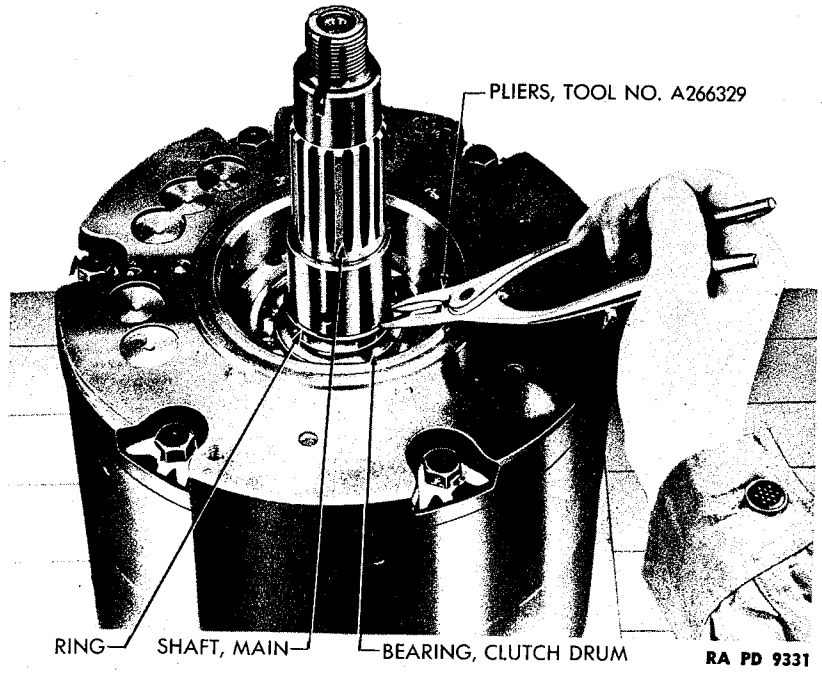

Figure 67 — Removing Snap Ring for Clutch Drum Bearing

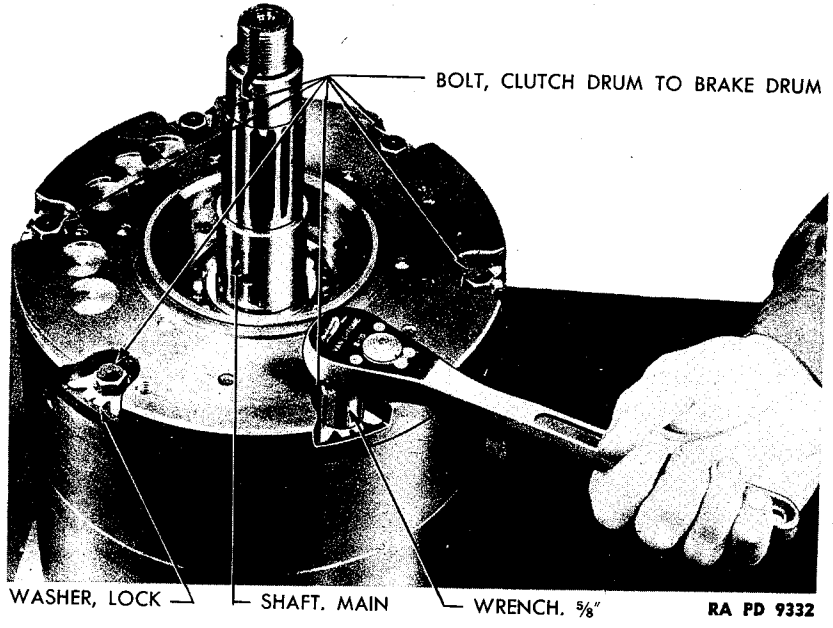

Figure 68 — Removing Clutch Drum Bolts

TRANSFER UNIT

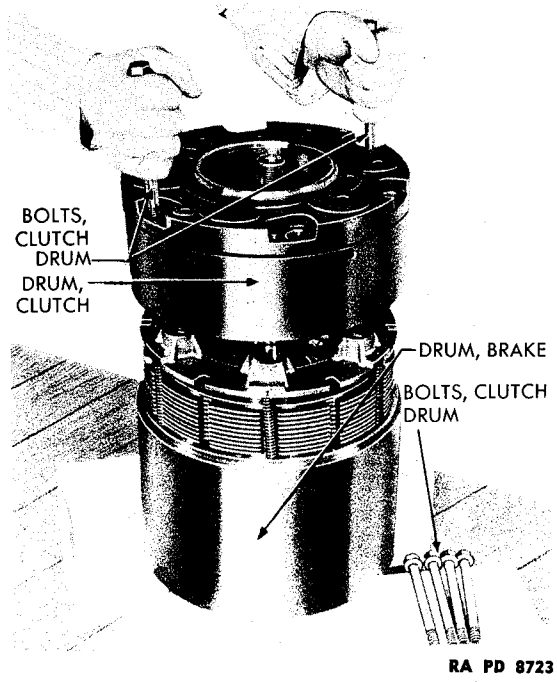

Figure 69 — Removing Clutch Drum

c. Disassembly of Drum and Gear Assembly.

(1) REMOVE CLUTCH DRUM.

HOOK, clutch and drum assembly, lifting, A266513
PLIERS, snap ring, removing, A266329
WRENCH, socket, 5/8-in.
WRENCH, socket, 9/16-in.

Remove main shaft lifting hook A266513, after removing main shaft retaining nut. Remove snap ring holding clutch drum bearing to main shaft (fig. 67). Remove six bolts and lock washers (or lock plates) holding clutch drum to brake drum (fig. 68). Install two clutch-to-brake drum bolts in tapped holes in clutch drum, grasp bolts, and use these bolts to lift clutch drum off brake drum (fig. 69).

(2) REMOVE CLUTCH DRUM BEARING.

HAMMER, soft
WRENCH, socket, 9/16-in.

Remove four screws holding clutch drum bearing retainer to clutch drum and remove retainer (fig. 70). Remove clutch drum bearing by tapping outer race with a soft hammer. CAUTION: Remove bearing evenly to avoid wedging in drum (fig. 71).

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

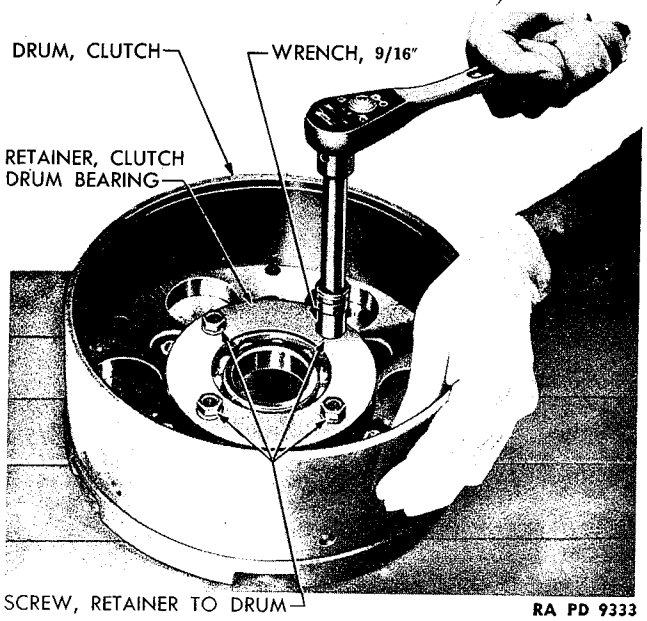

Figure 70 — Removing Screws for Clutch Drum Bearing Retainer

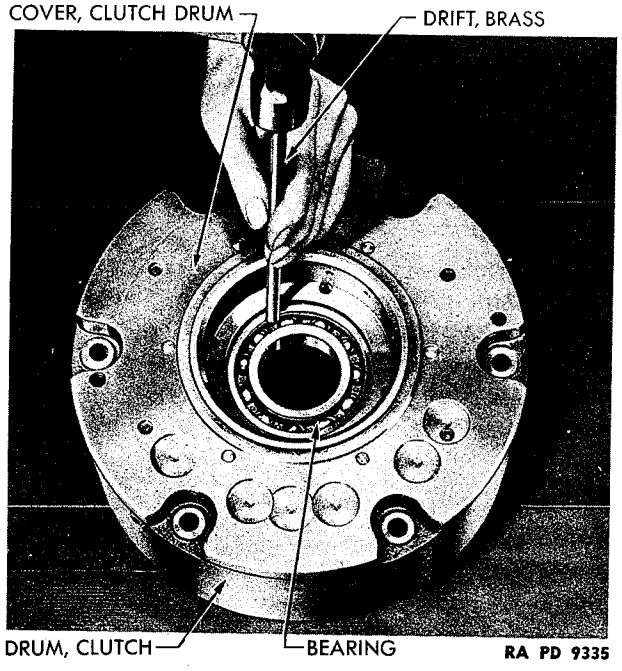

Figure 71 — Removing Clutch Drum Bearing

TRANSFER UNIT

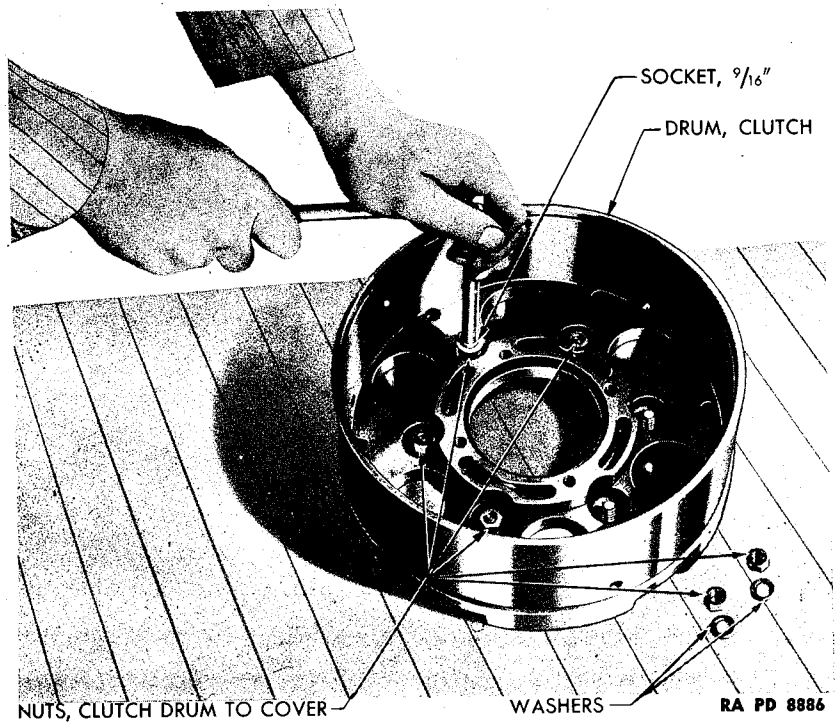

Figure 72 — Removing Clutch Cover Mounting Nuts

(3) REMOVE CLUTCH PISTONS.

DRIFT, brass
HAMMER
WRENCH, socket, 9/16-in.

Clutch pistons can usually be removed by bumping clutch drum on wooden block *without* removing cover. To remove cover, remove six nuts and lock washers holding cover to clutch drum (fig. 72). Using a hammer and brass drift, tap on six studs to drive cover off drum. Tap evenly to avoid cocking cover on drum, then push clutch pistons out of drum (fig. 73). Remove piston rings from pistons. NOTE: Do not remove clutch cover unless necessary.

(4) REMOVE CLUTCH PRESSURE PLATE, DISKS, AND HUB.

Remove clutch pressure plate by lifting up from release springs (fig. 74). Remove six clutch release springs and spring guide pins. Note that springs and guide pins fit into rounded holes in pressure plate. Square cut-outs are for screws that hold clutch drum to brake drum. Remove 11 bronze driving clutch disks and 10 steel driven clutch disks.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

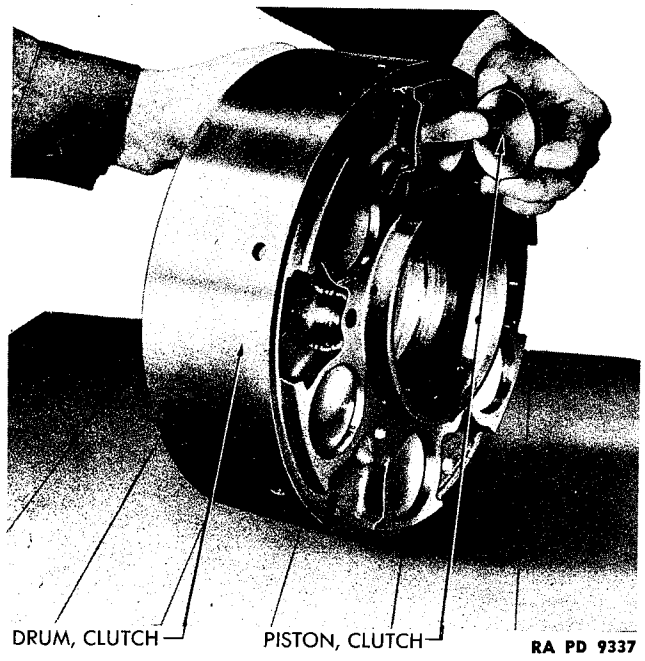

Figure 73 — Clutch Drum Piston

NOTE: Keep clutch disks in original order as removed. Lift clutch hub off main shaft and remove hub. NOTE: If hub is tight on main shaft, tap end of main shaft to loosen hub (fig. 75).

(5) REMOVE DIRECT DRIVE INTERNAL GEAR.

HAMMER, soft
HOIST
HOOK, clutch and drum assembly, lifting, A266513
SCREW, 7/16-14, 2½ in. long

Install main shaft lifting hook on end of main shaft and install main shaft nut finger tight. Connect a hoist onto lifting hook and raise main shaft and brake drum until assembly is just free of blocks. Install two cap screws in clutch drum internal gear next to dowel pins that hold internal gear to brake drum, and tap on end of screws (fig. 76). NOTE: It may be necessary to tap edge of drum around internal gear to loosen internal gear on drum. Remove two cap screws from internal gear. Lift main shaft and direct drive carrier out of brake drum, using a hoist (fig. 77). Remove hoist from lifting hook and remove lifting hook from main shaft. Remove internal gear from direct drive unit.

TRANSFER UNIT

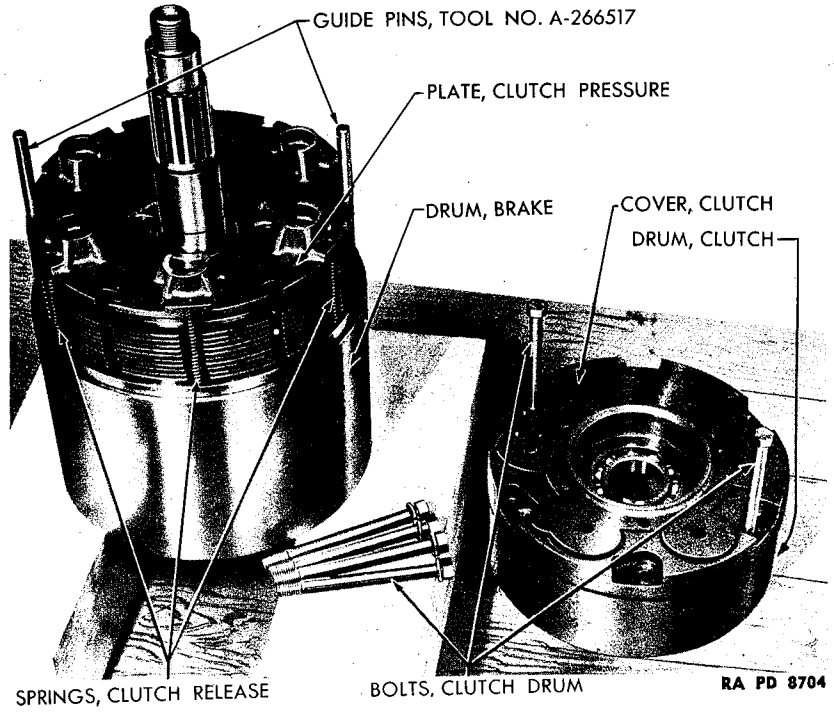

Figure 74 — Clutch Pressure Plate

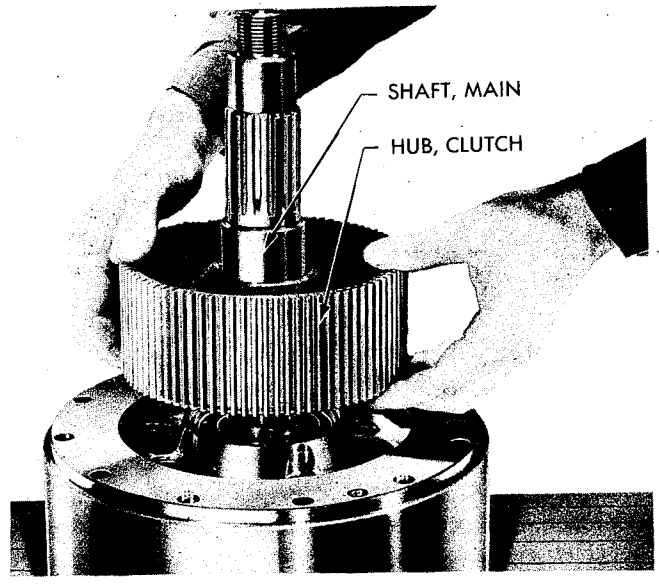

Figure 75 — Removing Clutch Hub

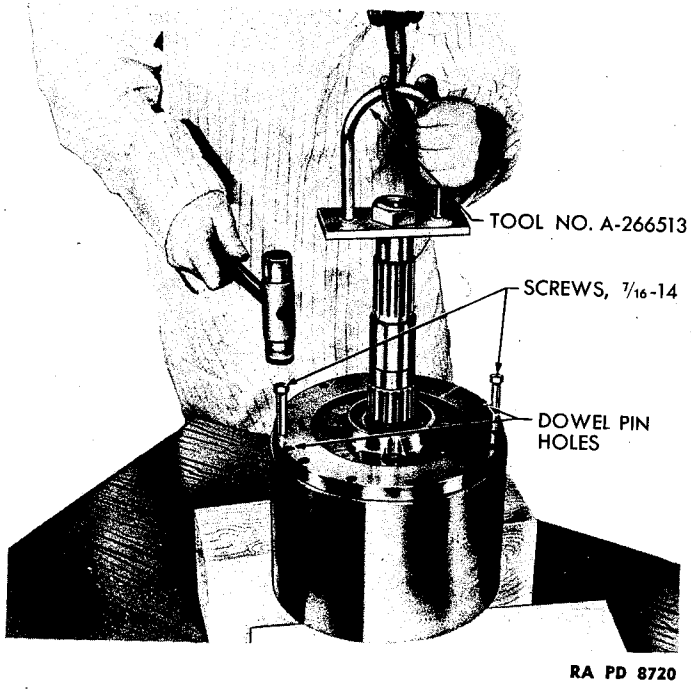

Figure 76 — Removing Clutch Drum Internal Gear

(6) REMOVE DIRECT DRIVE CARRIER FROM MAINSHAFT.

Lift direct drive carrier straight up off main shaft. If carrier sticks, bump input end of main shaft, while holding carrier in hands, to force shaft out of carrier and bearing. CAUTION: Do not damage gear teeth on main shaft by rough handling.

(7) REMOVE BEARING FROM DIRECT DRIVE CARRIER.

SCREWDRIVER

Remove snap ring holding direct drive carrier bearing in carrier, using screwdriver (fig. 78). Remove bearing from direct drive carrier. If necessary tap out bearing with hammer and brass drift, being careful to avoid cocking bearing.

(8) REMOVE PLANETARY PINIONS FROM DIRECT DRIVE CARRIER.

ARBOR, needle bearing loading, A266519
HAMMER, soft
PLIERS
SCREWDRIVER

Remove cotter pin holding one planetary pinion pin in carrier (pliers). Drive planetary pinion pin out of direct drive carrier with

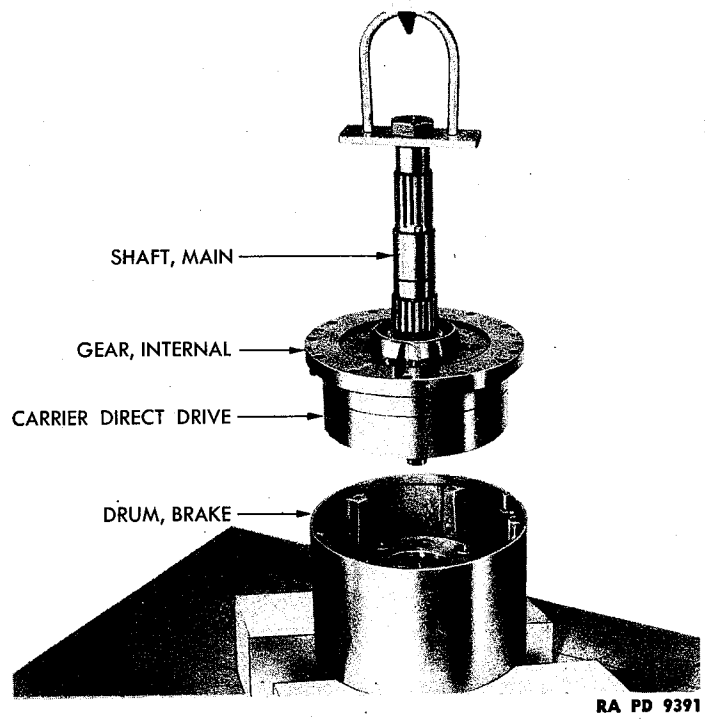

Figure 77 — Removing Direct Drive Carrier

special pinion arbor and a soft hammer (fig. 79). Leave arbor in planetary pinion to hold needle bearings in place. Remove pinion retaining washer with screwdriver (fig. 80). Pull planetary pinion, needle bearings, pinion arbor, and both thrust washers out of carrier (fig. 81). Repeat procedure to remove other three pinions.

(9) REMOVE OUTPUT SHAFT.

Lift output shaft and front planetary unit out of brake drum (fig. 82). Lift main shaft pilot roller bearing out of output shaft (fig. 83).

(10) REMOVE OIL PUMP DRIVE GEAR AND SLEEVE.

PRESS, arbor
SIDE CUTTERS

Place output shaft assembly in arbor press, supporting oil pump drive gear and sleeve on bed of press as shown in figure 84. Force spindle down against end of output shaft, loosening output shaft and bearing on oil pump gear and sleeve. Remove from press and remove oil pump gear and sleeve by hand. Remove key for oil pump drive gear and sleeve, using side cutters.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

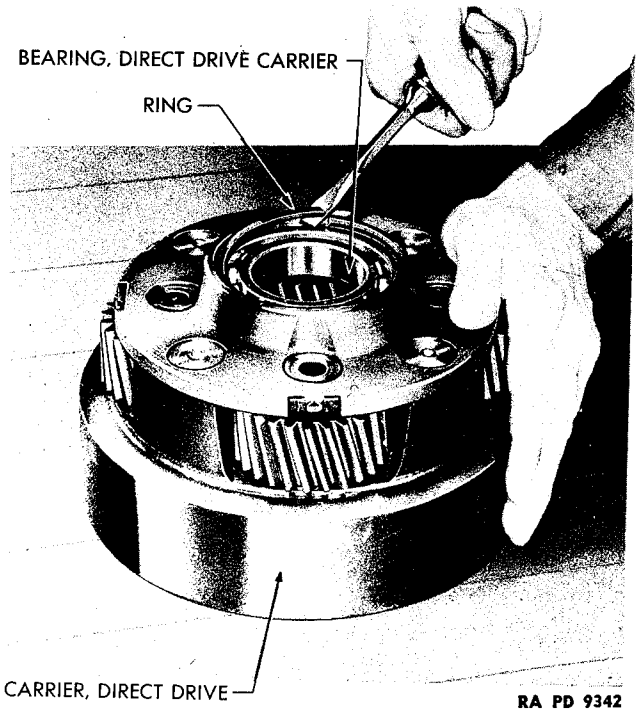

Figure 78 — Removing Snap Ring for Bearing

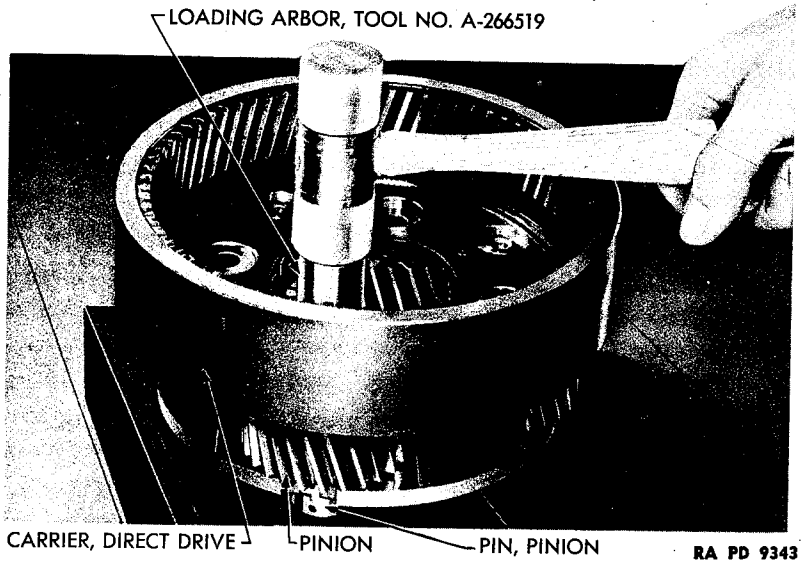

Figure 79 — Driving Out Planetary Pinion Pin from Carrier

TRANSFER UNIT

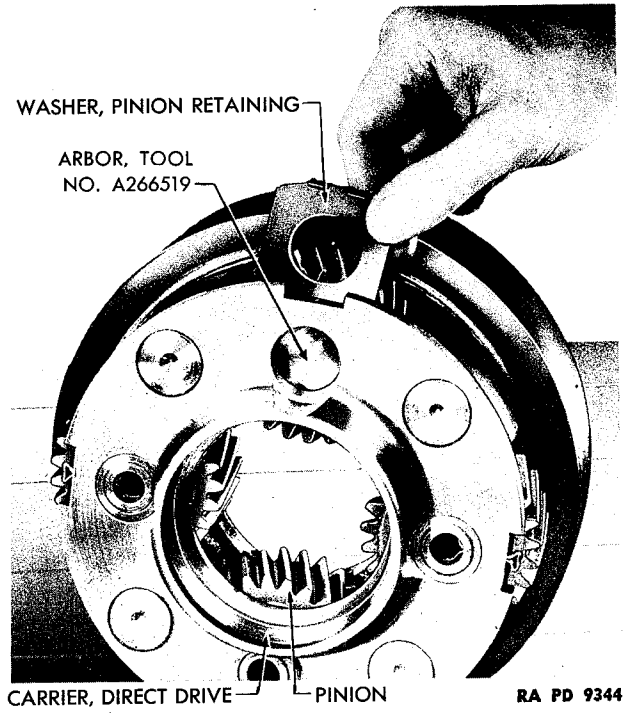

Figure 80 — Removing Pinion Retaining Washer

(11) REMOVE BEARINGS FROM OUTPUT SHAFT.

DRIFT, brass
HAMMER
PULLER, mainshaft bearing, A265515
WRENCH, box-end, $1\frac{1}{16}$-in.

Bump end of shaft against block of wood as shown in figure 85 to start bearing away from carrier. Then use two pry bars against *inner* race of bearing and pry bearing off shaft. If bearing sticks, place shaft assembly on front end and insert a brass drift pin through pinion pinhole so that drift contacts shoulder on bearing (fig. 86). Tap evenly on all four sides to drive bearing off output shaft. Install main shaft bearing puller on race in rear end of output shaft. Spring stud on tool must enter hole in bearing race, as shown in the cutaway view in figure 87. Pull bearing race out of shaft by tightening nut on puller screw with box wrench.

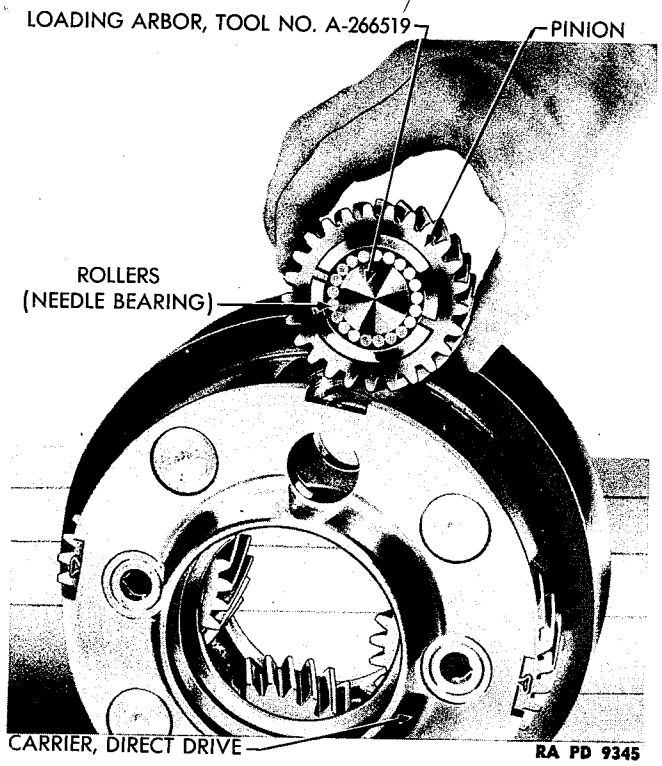

Figure 81 — Removing Pinion Bearings

(12) REMOVE PLANETARY PINIONS FROM OUTPUT SHAFT.

ARBOR, needle bearing loading, A266519
HAMMER, soft
PLIERS
SCREWDRIVER

Remove cotter pin holding one planetary pinion pin in carrier (pliers). Drive planetary pinion pin out of output shaft carrier (away from shaft) with special arbor and a soft hammer (fig. 88). Leave arbor in pinion to hold needle bearings in place. Remove pinion retaining washer with screwdriver. Pull planetary pinion, needle bearings, pinion arbor, and both thrust washers out of carrier (fig. 89). Repeat procedure to remove other three pinions.

14. DISASSEMBLY OF TRANSFER UNIT COMPONENTS.

a. Equipment.

DRIFT, brass
FILE
HAMMER
HAMMER, light

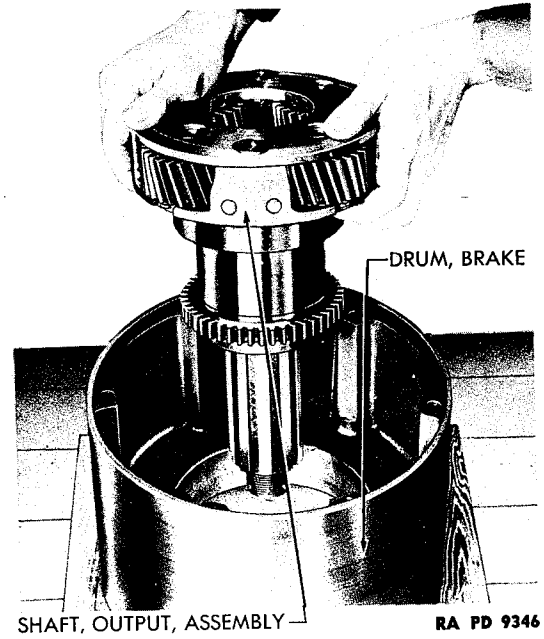

Figure 82 — Removing Output Shaft Assembly

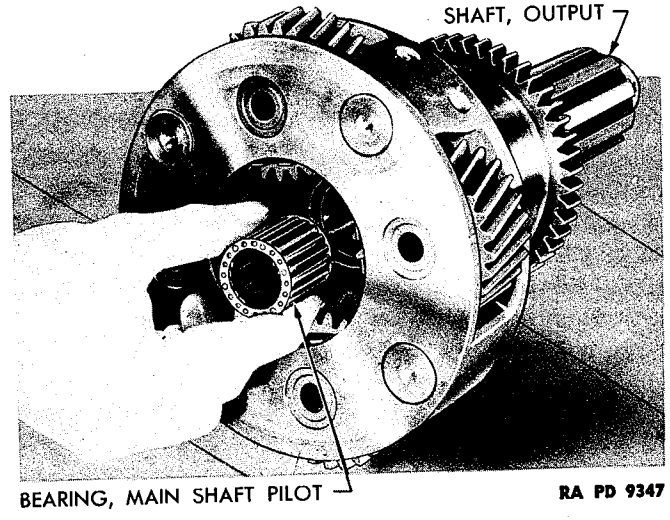

Figure 83 — Removing Main Shaft Pilot Bearing

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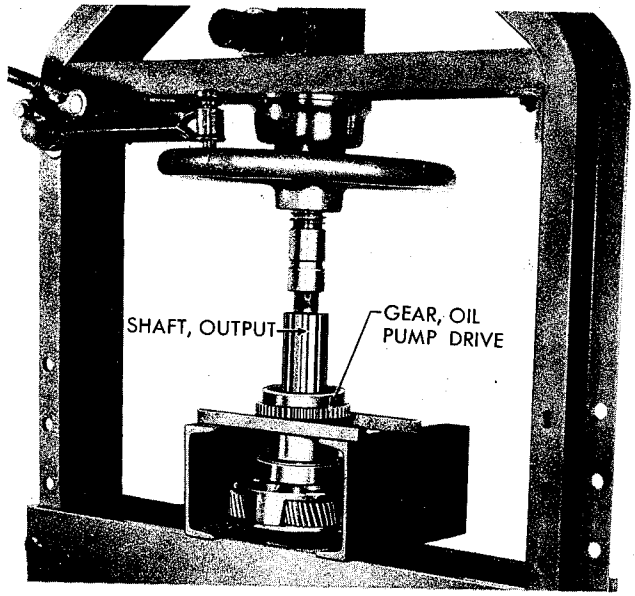
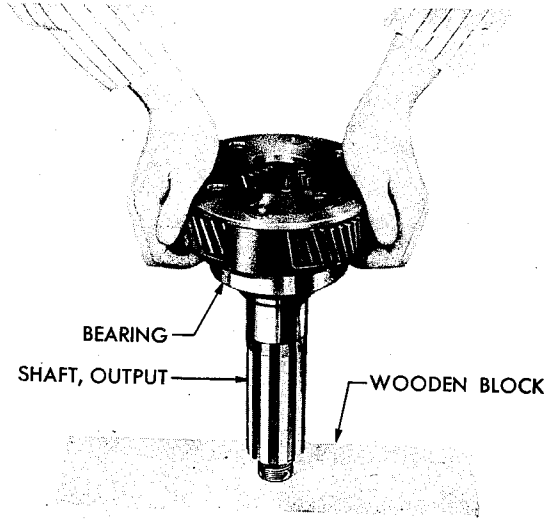


RA PD 8698

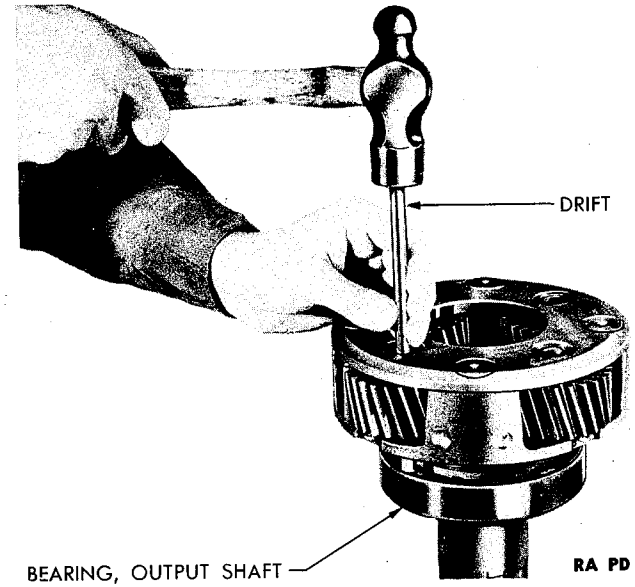
Figure 84 — Removing Oil Pump Drive Gear



RA PD 9390

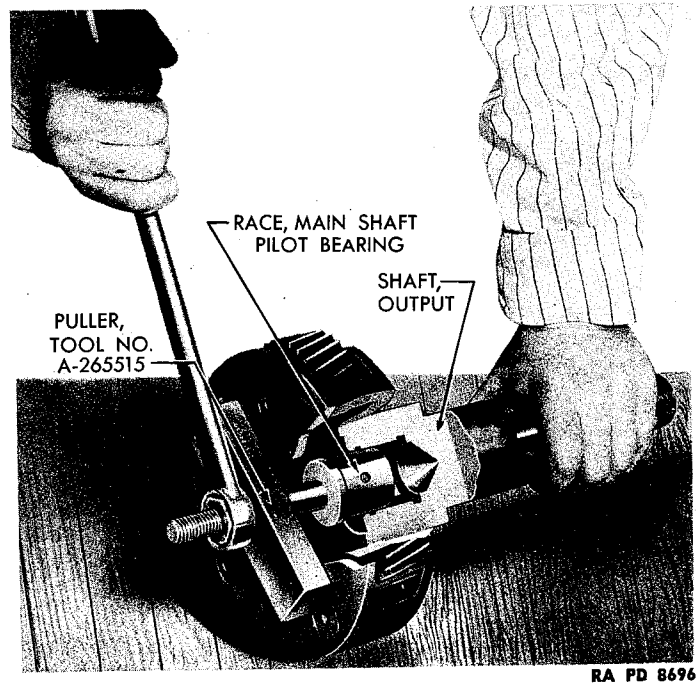
Figure 85 — Removing Output Shaft Bearing

TRANSFER UNIT



RA PD 9349

Figure 86 — Removing Output Shaft Bearing with Drift



RA PD 8696

Figure 87 — Removing Pilot Bearing Race

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

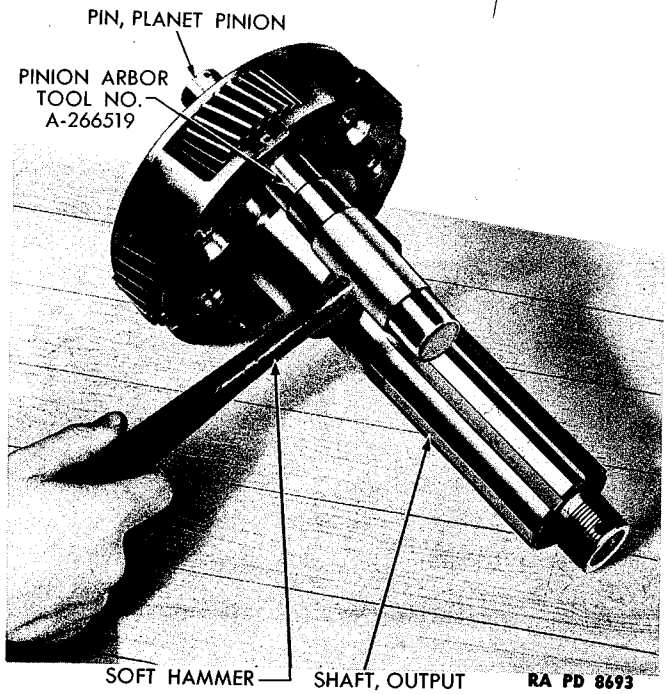


Figure 88 — Removing Planetary Pinion Pin from Output Shaft

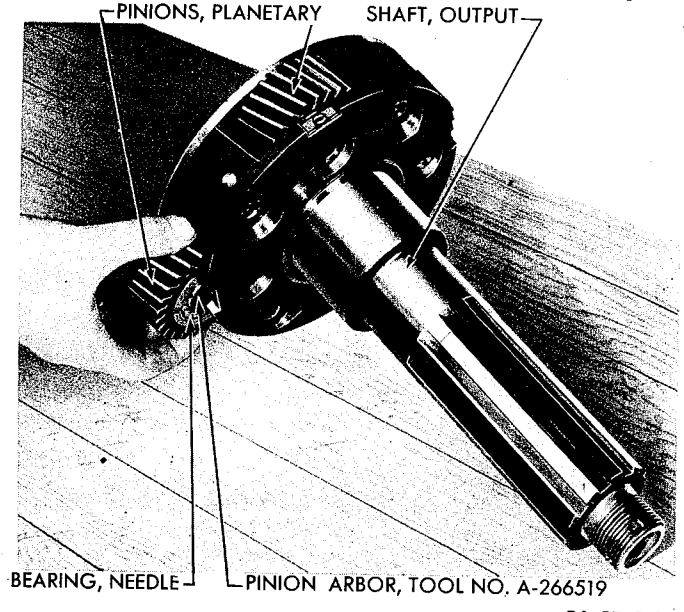


Figure 89 — Removing Planetary Pinion

TRANSFER UNIT

HAMMER, soft
HANDLE, "T," 3/8-in. square drive-end
PLIERS, snap ring, removing, A266329
PRESS, arbor
PUNCH, 3/32-in.
SCREWDRIVER
SOCKET, 7/8-in.
WRENCH, box, 1/2-in.
WRENCH, box, 11/16-in.
WRENCH, box, 3/4-in.
WRENCH, deep socket, 1 1/16-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 5/8-in. (2)
WRENCH, open-end, 15/16-in.
WRENCH, open-end, 1 1/8-in.
WRENCH, socket, 1/2-in.
WRENCH, socket, 7/8-in.
WRENCH, socket-head set screw, 3/16-in.

b. Disassembly of Control Valve Body.

(1) REMOVE MANUAL CONTROL VALVE.

Remove manual control valve (W, fig. 90) by sliding it out of valve body.

(2) REMOVE ACCUMULATOR PISTON.

SCREWDRIVER

Remove six screws and lock washers holding rear cover plate (A, fig. 90) to valve body. Hold cover firmly while removing screws. NOTE: Do not remove center mounting screw. Slide cover to one side until accumulator piston is exposed; hold piston in cylinder with one hand and remove center cover mounting screw cover with other hand (fig. 91). Allow accumulator piston to push out of cylinder, and remove accumulator piston springs (E and G, fig. 90).

(3) REMOVE GOVERNOR PLUG.

Remove governor plug (F, fig. 90), from the valve body by turning body up and allowing plug to drop out.

(4) REMOVE THROTTLE VALVE ASSEMBLY.

SCREWDRIVER

Remove two screws and lock washers holding throttle valve stop plate to valve body (fig. 91) and remove plate (NN, fig. 90). Remove throttle valve assembly, consisting of T-valve (MM), spring (LL), and throttle valve (KK).

(5) REMOVE LOW SERVO EXHAUST VALVE (fig. 90).

SCREWDRIVER

Remove low servo exhaust valve (JJ) by removing dowel screw (GG) in side of valve body. Remove exhaust valve spring (HH).

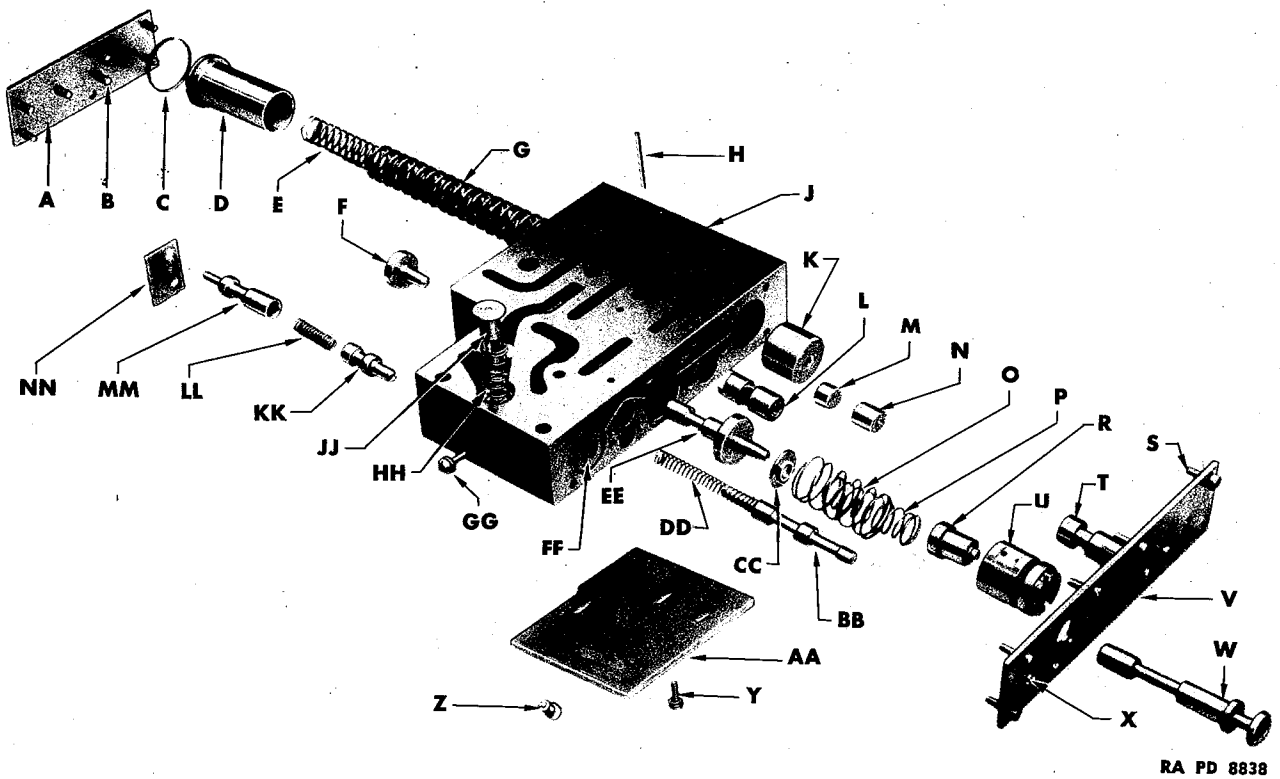


Figure 90 — Control Valve Body — Disassembled

A—PLATE, REAR COVER
B—SCREW, REAR COVER PLATE
C—RING, ACCUMULATOR PISTON
D—PISTON, ACCUMULATOR
E—SPRING, ACCUMULATOR, INNER
F—PLUG, GOVERNOR
G—SPRING, ACCUMULATOR, OUTER
H—PIN, ACCUMULATOR BODY
J—BODY, VALVE AND ACCUMULATOR
K—PLUG, ACCUMULATOR SPRING LOCATING
L—VALVE, CLUTCH RELAY
M—VALVE, EXHAUST DOWNSHIFT
N—VALVE, THROTTLE DOWNSHIFT
O—SPRING, SHIFTER VALVE, OUTER
P—SPRING, SHIFTER VALVE, OUTER
R—PLUG, REGULATOR
S—SCREW, FRONT COVER PLATE
T—STOP, RELAY VALVE
U—SLEEVE, REGULATOR PLUG
V—PLATE, FRONT COVER
W—VALVE, MANUAL COVER
X—STOP, THROTTLE VALVE
Y—SCREW, TOP COVER PLATE
Z—VALVE, ACCUMULATOR OIL
AA—PLATE, TOP COVER
BB—VALVE, LOW SERVO CONTROL
CC—SPACER, SHIFTER VALVE SPRINGS
DD—SPRING, LOW SERVO CONTROL VALVE
EE—VALVE, SHIFTER
FF—SLEEVE, THROTTLE VALVE
GG—SCREW, SERVO EXHAUST VALVE
HH—SPRING, SERVO EXHAUST VALVE
JJ—VALVE, SERVO EXHAUST
KK—VALVE, THROTTLE
LL—SPRING, THROTTLE VALVE
MM—VALVE, THROTTLE "T"
NN—PLATE, THROTTLE VALVE STOP

RA PD 8838B

Legend for Figure 90 — Control Valve Body — Disassembled

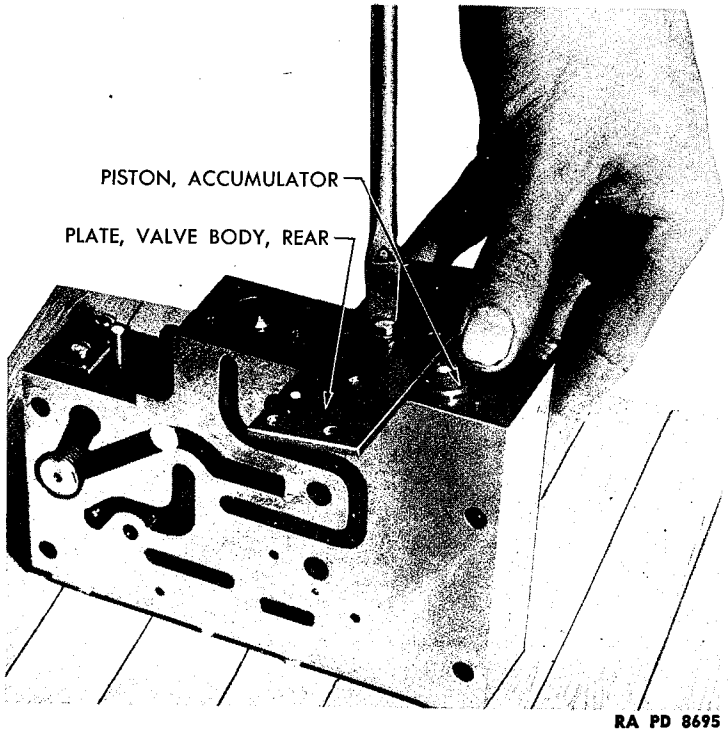


Figure 91 — Removing Accumulator Piston

(6) REMOVE FRONT COVER PLATE AND RELAY VALVE STOP.
SCREWDRIVER

Remove nine front cover plate mounting screws and lock washers, and remove front cover plate (V), and relay valve stop (T) as an assembly (fig. 92). Do not attempt to remove relay valve stop from plate.

(7) REMOVE VALVES AND SPRINGS FROM CONTROL VALVE BODY.
SCREWDRIVER

Remove round-head dowel screw in top cover plate, while holding thumb over regulator plug sleeve (fig. 93). Shifter valve springs (O and P, fig. 90) will force regulator plug sleeve (U) out. Note position of hole in sleeve where dowel screw fits. Remove shifter valve springs from valve body. Turn valve body so that clutch relay valve (L), throttle downshift valve (N), exhaust downshift valve (M), accumulator spring locating plug (K), and shifter valve (EE) with shifter valve spring spacer (CC) can be taken out of valve body. If necessary, tap

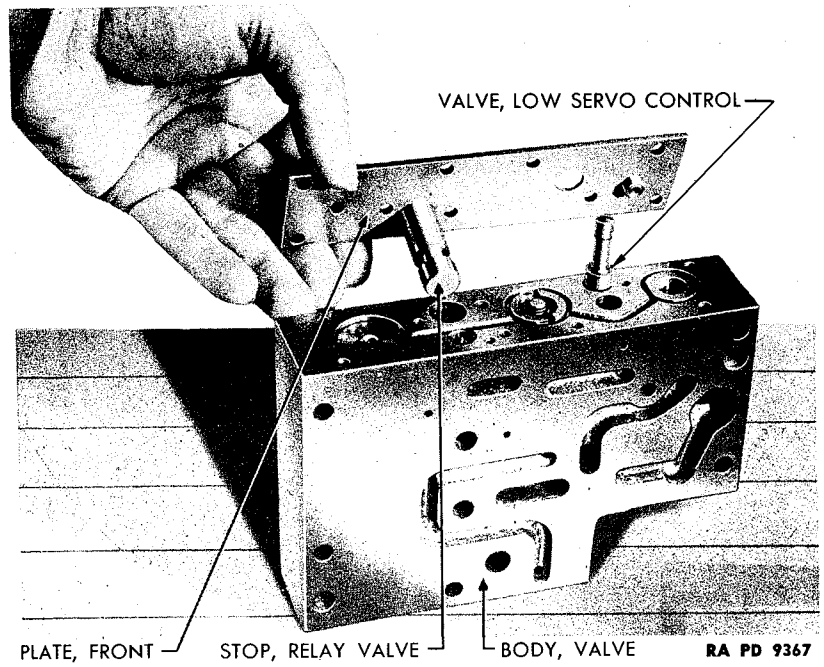


Figure 92 — Front Cover Plate and Relay Valve Stop

valve body on palm of hand to loosen valves and plugs. Note their respective positions. Remove low servo control valve (BB) and valve spring (DD), noting their position in relation to the manual control valve (W). NOTE: Do not attempt to remove throttle valve sleeve (FF) as it is pressed into valve body.

(8) REMOVE ACCUMULATOR OIL VALVE.
SCREWDRIVER

Remove seven screws and lock washers holding top cover plate to valve body (fig. 93). Lift accumulator oil valve out of valve body (fig. 94). Do *not* remove accumulator body pin (H, fig. 90).

c. Disassembly of Low Gear Servo.

(1) REMOVE COVER.

PRESS, arbor
SCREWDRIVER
WRENCH, socket-head set screw, $\frac{3}{16}$-in.

Remove servo adjusting plug from low gear servo cover, using screwdriver or socket-head set screw wrench as required. Place low gear servo in arbor press, and run stem of press down on servo cover. Remove

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

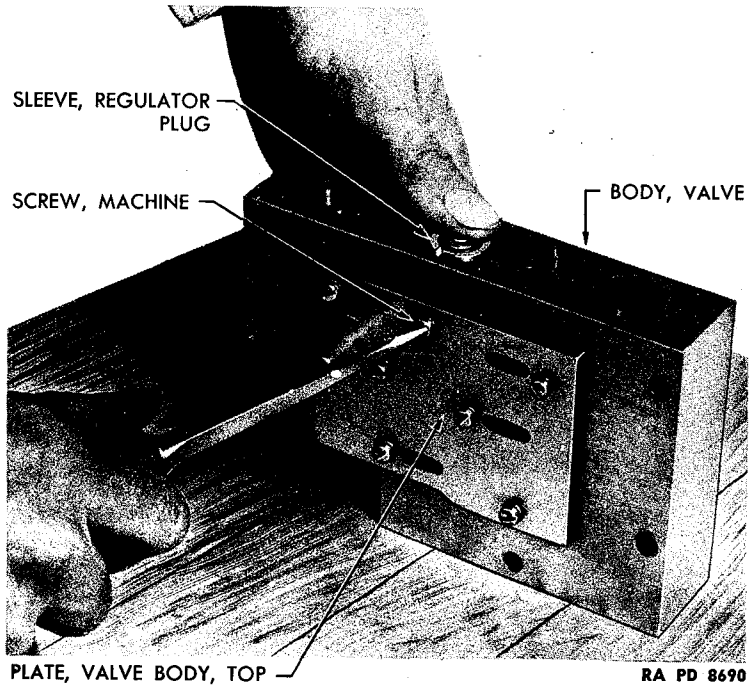


Figure 93 — Removing Regulator Sleeve

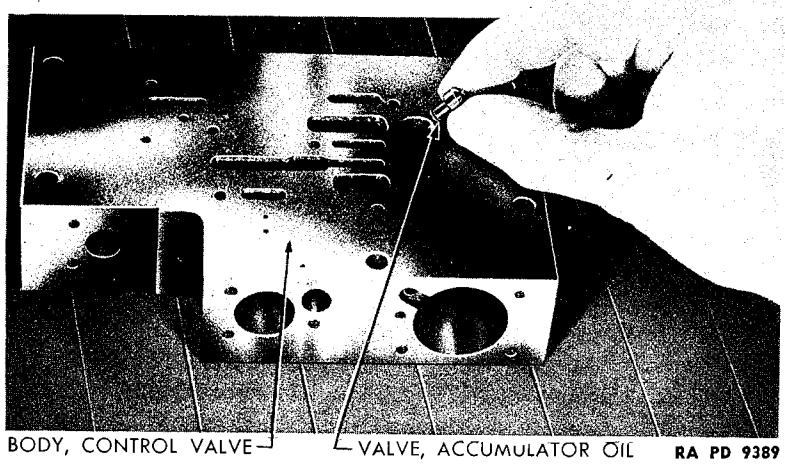


Figure 94 — Removing Accumulator Oil Valve

TRANSFER UNIT

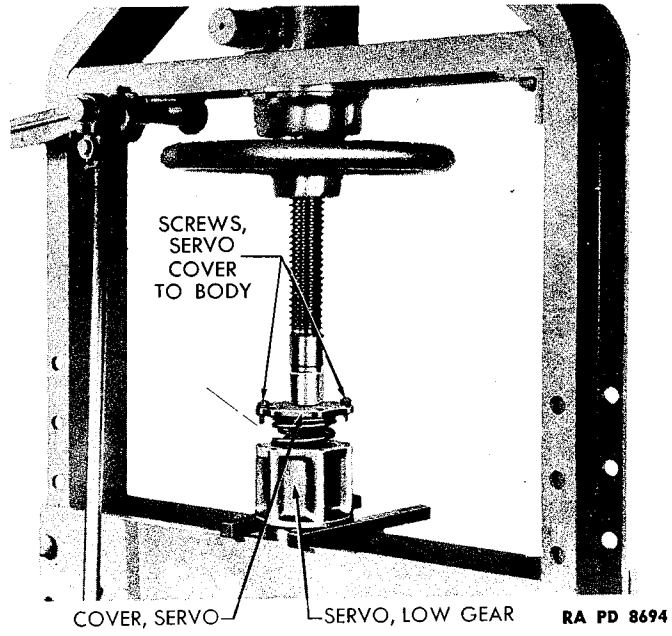


Figure 95 — Removing Low Gear Servo Cover

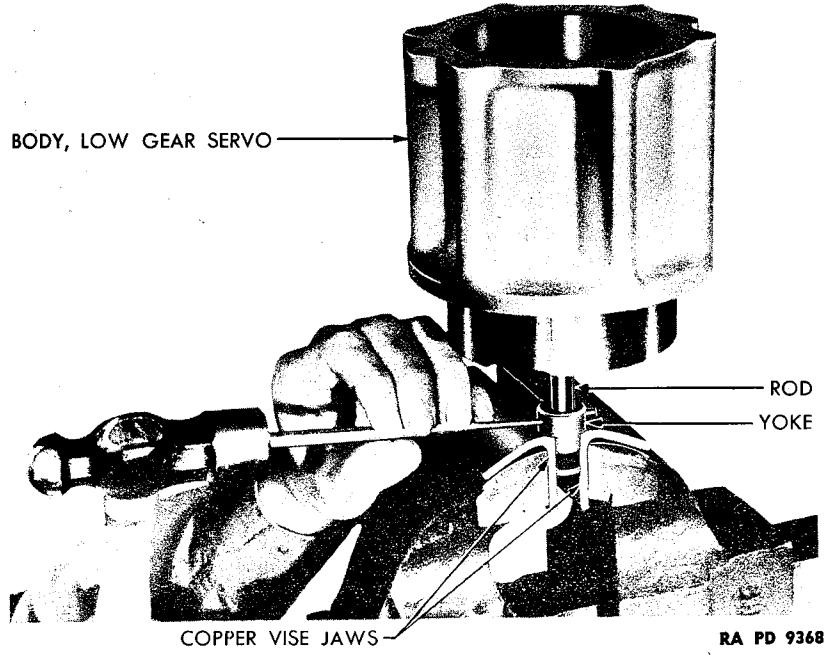


Figure 96 — Driving Out Yoke Pin

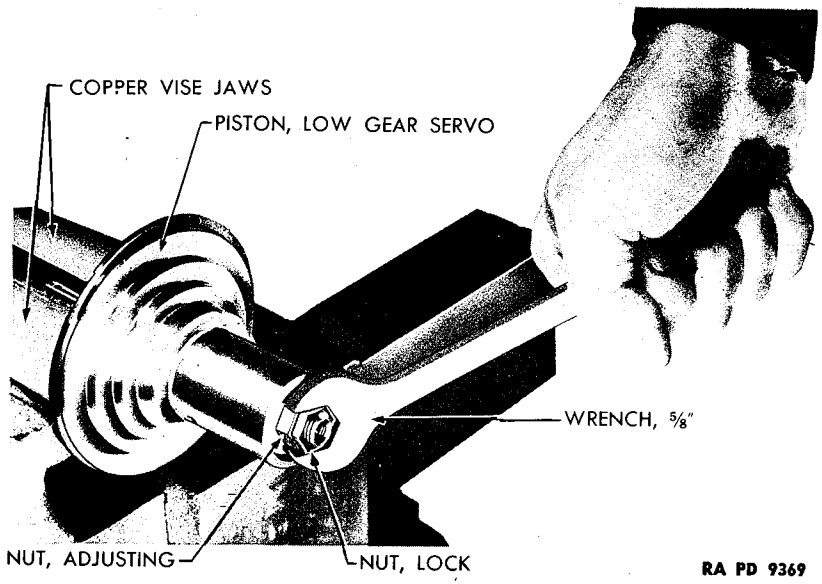


Figure 97 — Removing Piston Rod Lock Nut

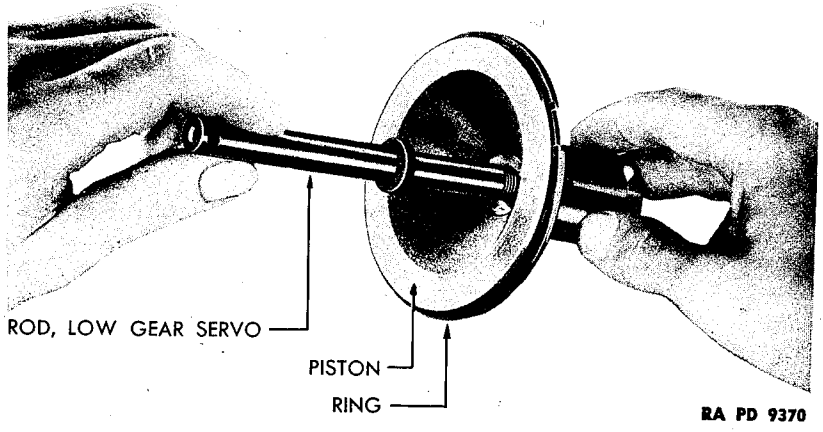


Figure 98 — Removing Low Gear Piston from Rod

two low gear servo cover mounting screws and lock washers. Raise arbor press slowly so that three servo piston apply springs are released gradually (fig. 95). Remove low gear servo cover, cover gasket, and three piston apply springs from servo body. Remove body from arbor press.

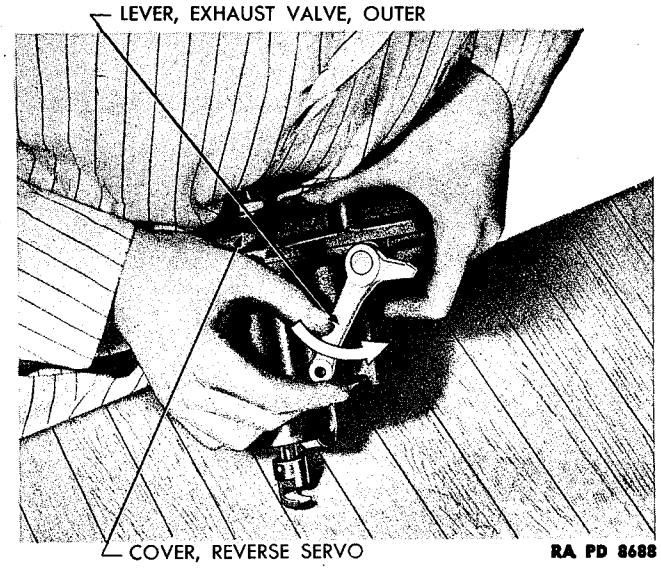


Figure 99 — Releasing Reverse Servo

(2) REMOVE LOW GEAR SERVO YOKE.

FILE
HAMMER
PUNCH, 3/32-in.

File off one peened end of pin holding low gear servo yoke to servo piston rod, and drive pin out of yoke and rod. Slide yoke off end of shaft.

(3) DISASSEMBLE PISTON ROD AND PISTON ROD SPRING ASSEMBLY.

WRENCH, open-end, 5/8-in. (2)

Pull low gear servo piston, piston rod, and piston rod spring assembly out of servo body. Place yoke end of piston rod in a vise which has *copper jaws*. Hold adjusting nut on piston rod and remove lock nut (two 5/8-in. open-end wrenches). Remove adjusting nut (fig. 97). Remove spring seat and piston rod spring from piston. Remove piston rod from vise and pull piston off piston rod (fig. 98). Remove piston ring from piston.

d. Disassembly of Reverse Servo.

CAUTION: Before attempting any disassembly operations, make sure that reverse servo spring is released. To release servo spring, place servo upright on bench with yoke end of piston shaft downward, press

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

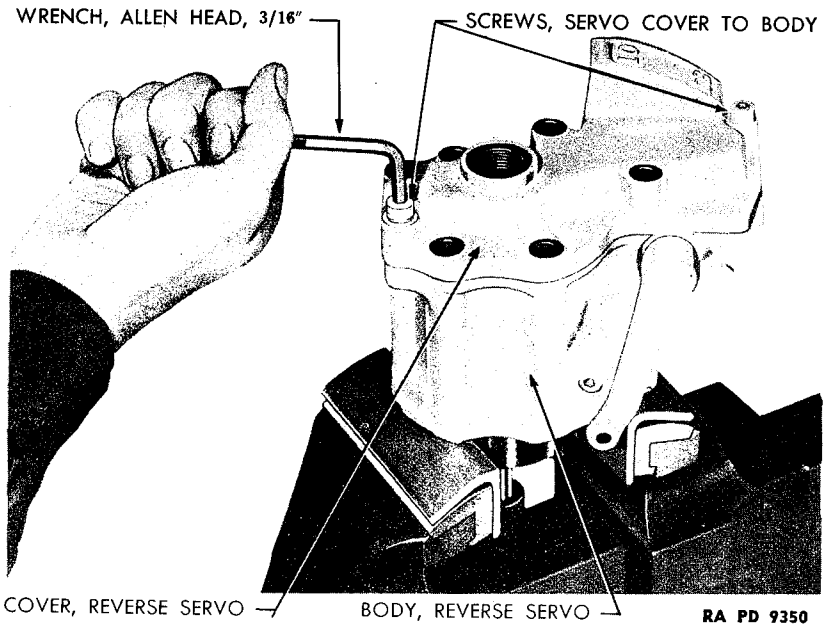


Figure 100 — Removing Reverse Servo Cover Screws

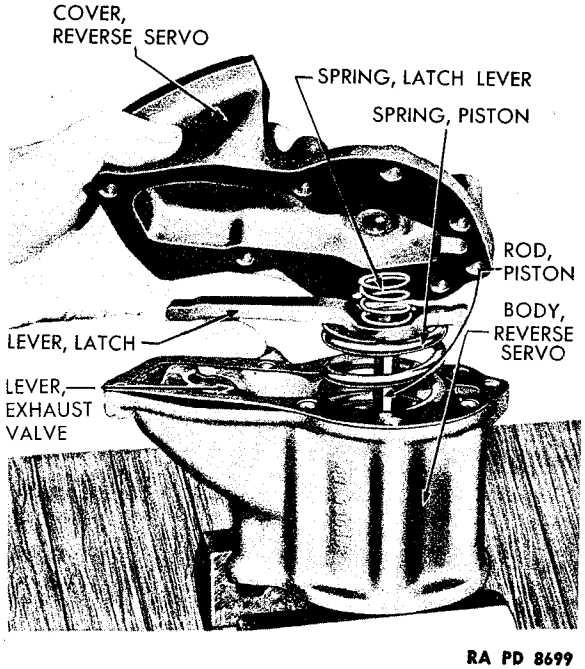


Figure 101 — Removing Reverse Servo Cover

TRANSFER UNIT

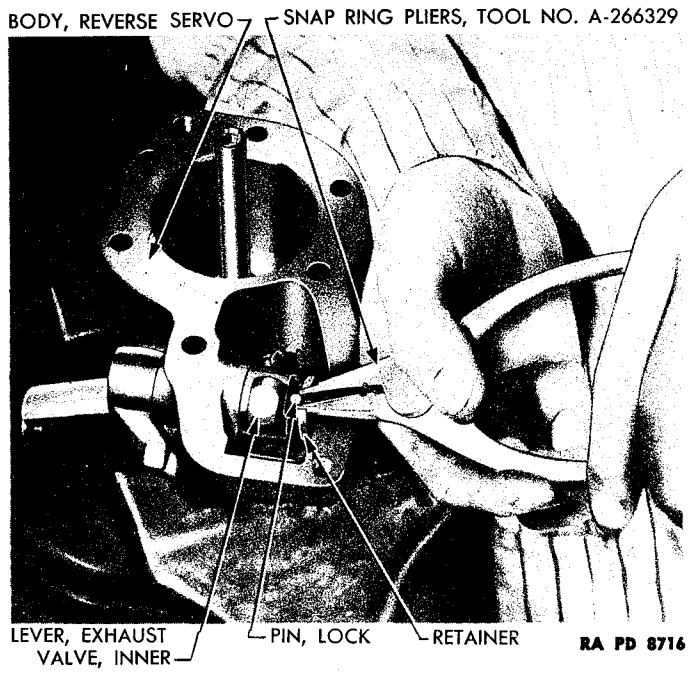


Figure 102 — Removing Retaining Ring for Exhaust Lever Shaft

firmly on upper side of cover, meanwhile rotating exhaust valve release lever slowly counterclockwise, as shown in figure 99, until spring releases.

(1) REMOVE COVER.

WRENCH, socket-head set screw, $\frac{3}{16}$-in.
WRENCH, deep socket, $1\frac{1}{16}$-in.
WRENCH, open-end, $\frac{1}{2}$-in.

Place reverse servo in a vise with copper jaws and remove acorn nut and washer over end of piston rod ($1\frac{1}{16}$-in. open-end wrench). Remove two servo cover mounting screws slowly and evenly to release servo apply spring pressure gradually. NOTE: These screws may either be hex-head, or socket-head set screw head, as shown in figure 100. Remove reverse servo cover and gasket (fig. 101). Remove reverse servo latch lever apply spring and latch lever. Remove reverse servo piston apply spring.

(2) REMOVE EXHAUST VALVE LEVERS AND EXHAUST VALVE.

PLIERS, snap ring, removing, A266329

Remove inner exhaust valve lever lock pin retaining ring (fig. 102). Remove servo from vise, invert, and shake to remove lock pin. Remove

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

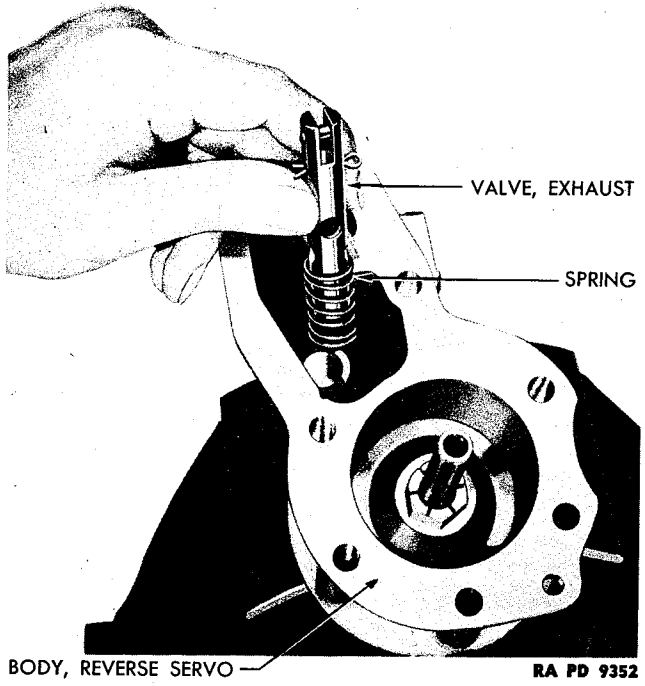


Figure 103 — Removing Exhaust Valve and Spring

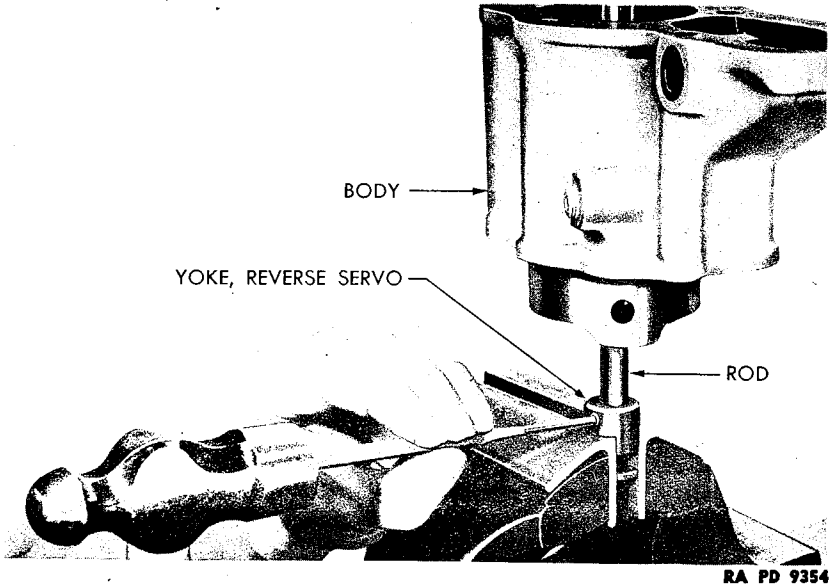


Figure 104 — Removing Yoke Pin from Reverse Servo Rod

TRANSFER UNIT

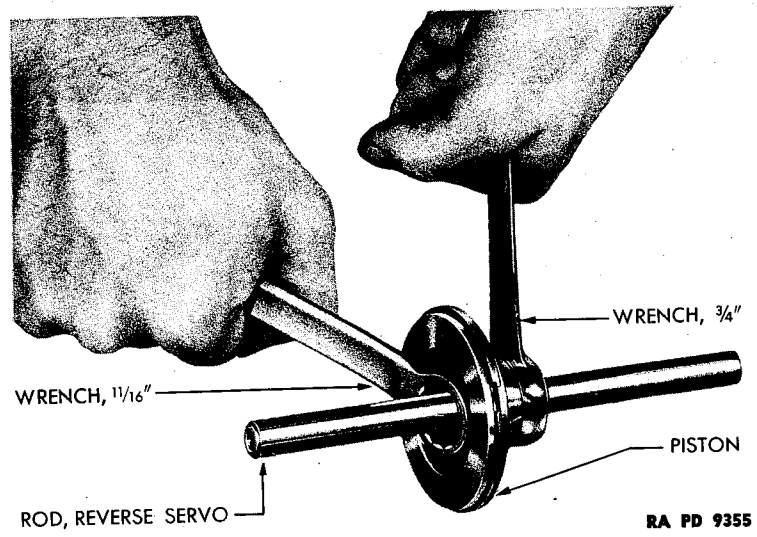


Figure 105 — Removing Piston from Piston Rod

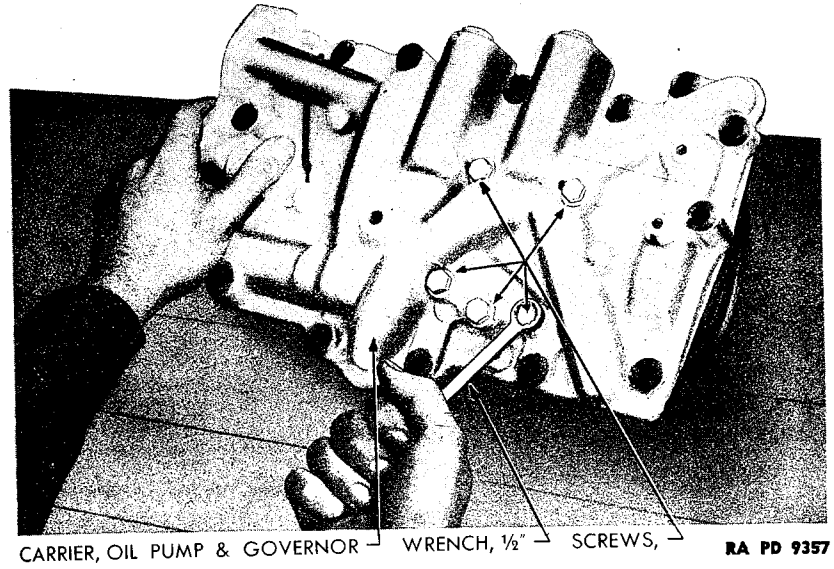


Figure 106 — Removing Oil Pump and Governor Screws

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

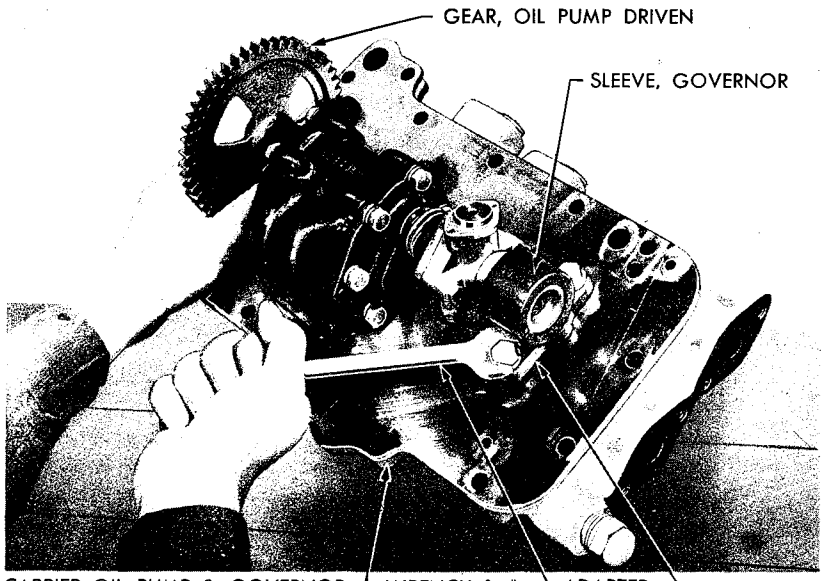


Figure 107 — Removing Governor Sleeve

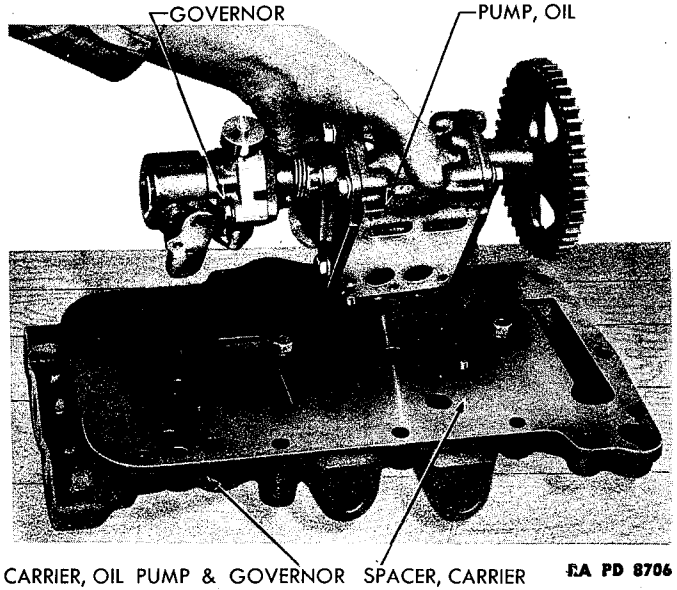


Figure 108 — Removing Oil Pump and Governor from Carrier

TRANSFER UNIT

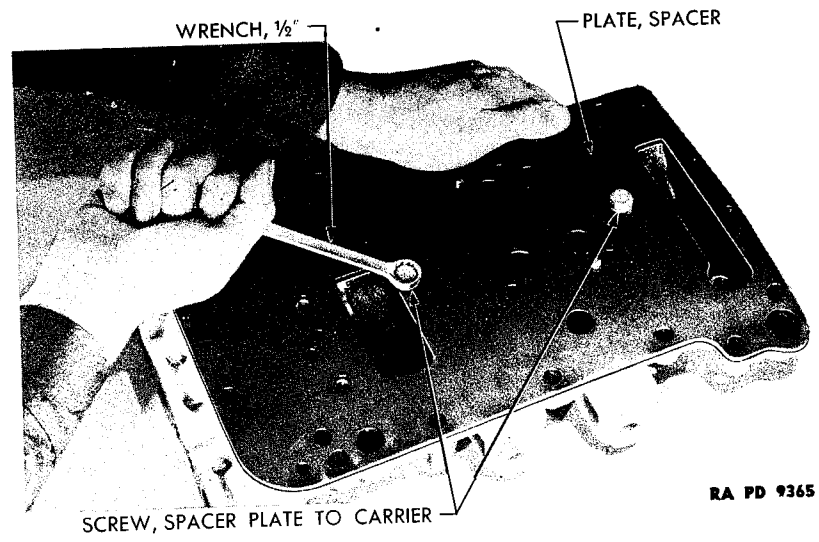


Figure 109 — Removing Spacer Plate

outer exhaust valve lever and shaft from servo body. Lift inner lever upward with exhaust valve and spring (fig. 103).

(3) DISASSEMBLY OF PISTON AND PISTON ROD ASSEMBLY.

DRIFT, brass
FILE
HAMMER
WRENCH, box, $^{11}/_{16}$-in.
WRENCH, box, $^{3}/_{4}$-in.

File off peened end of pin holding yoke on piston rod and drive pin out of yoke and rod (fig. 104). Pull yoke off rod. Pull piston and rod out of servo body. Remove nut holding piston on rod, while holding hexagonal shaped flange on rod (at opposite end of piston) with a $^{11}/_{16}$-inch box wrench (fig. 105). Remove piston from rod. Remove piston ring from piston.

e. Disassembly of Carrier.

(1) REMOVE OIL PUMP AND GOVERNOR FROM CARRIER.

WRENCH, box or socket, $^{1}/_{2}$-in.
WRENCH, open-end, $^{9}/_{16}$-in.

Remove five cap screws and lock washers holding oil pump and governor assembly to carrier ($^{1}/_{2}$-in. box or socket wrench, fig. 106). Remove two cap screws and lock washers holding governor sleeve tube and adapter to carrier ($^{9}/_{16}$-in. wrench, fig. 107), and remove oil pump and governor assembly from carrier.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

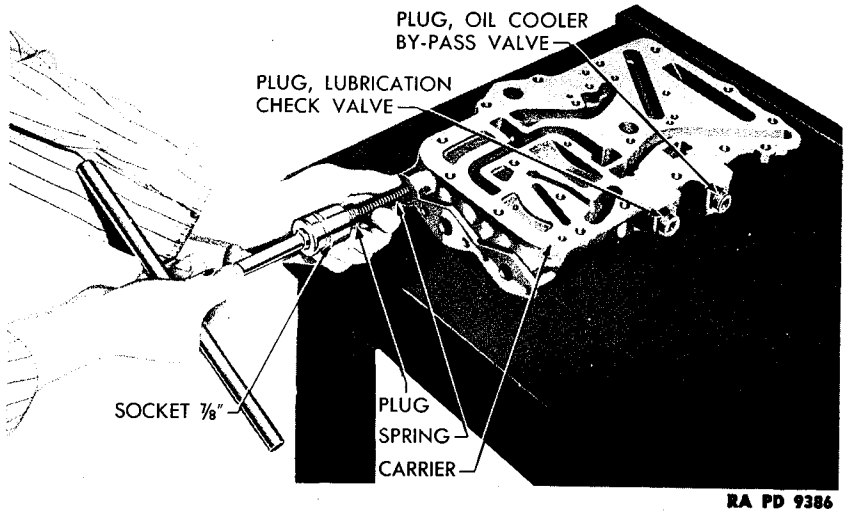


Figure 110 — Removing Pressure Regulator Valve

(2) REMOVE SPACER PLATE.
WRENCH, socket, ½-in.

Remove two cap screws and lock washers holding spacer plate to governor and oil pump carrier (½-in. socket wrench). Remove spacer plate and gasket (fig. 109). CAUTION: Keep all valves and valve springs in order as they are removed from carrier so that they may be spring, guide pin, and oil pressure regulator valve.

(3) REMOVE PRESSURE REGULATOR VALVE.
WRENCH, socket, 7/8-in.

Loosen oil pressure regulator valve acorn plug in end of carrier (7/8-in. socket wrench). Take care to hold plug against spring pressure as it spring, guide pin, and oil pressure regulator valve.

(4) REMOVE OIL COOLER BYPASS VALVE.
HANDLE, "T," with 3/8-in. square drive end
SOCKET, 7/8-in.

Loosen oil cooler bypass valve pipe plug in carrier, using a T-handle with a 3/8-inch square drive end (fig. 110). Exercise care to hold plug in against spring pressure as it is being loosened. Remove oil cooler bypass valve pipe plug, valve spring, and valve.

TRANSFER UNIT

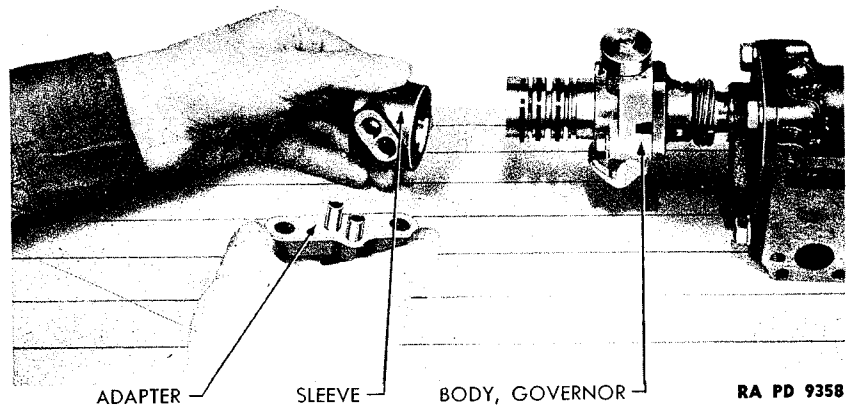


Figure 111 — Removing Governor Delivery Sleeve

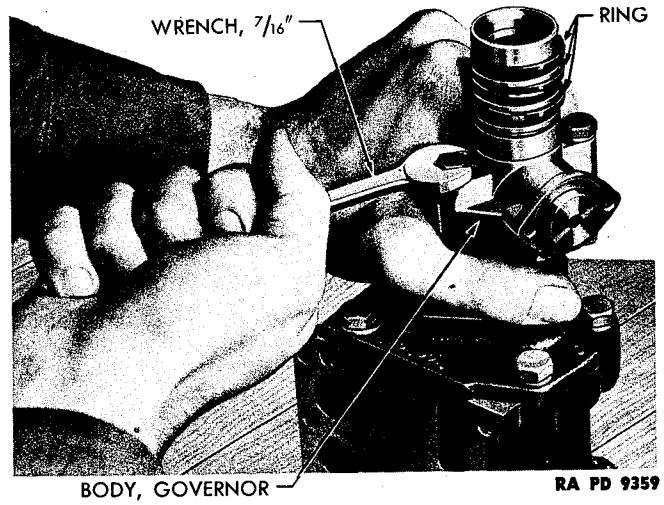


Figure 112 — Removing Governor from Drive Flange

(5) REMOVE LUBRICATION PRESSURE CHECK VALVE.
HANDLE, "T," with 3/8-in. square drive end
SOCKET, 7/8-in.

Loosen lubrication pressure check valve in carrier, using a T-handle with a 3/8-inch square drive end (fig. 110). Exercise care to hold plug in against spring pressure as it is being loosened. Remove lubrication pressure check valve pipe plug, valve spring, and valve.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

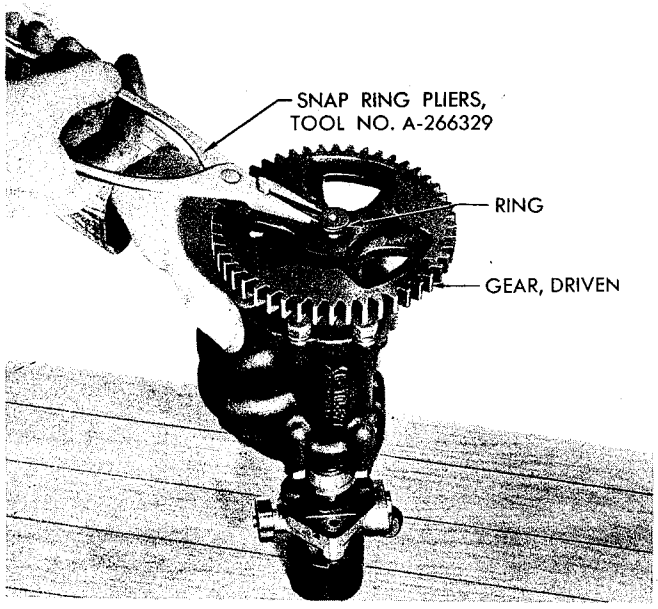


Figure 113 — Removing Driven Gear Snap Ring

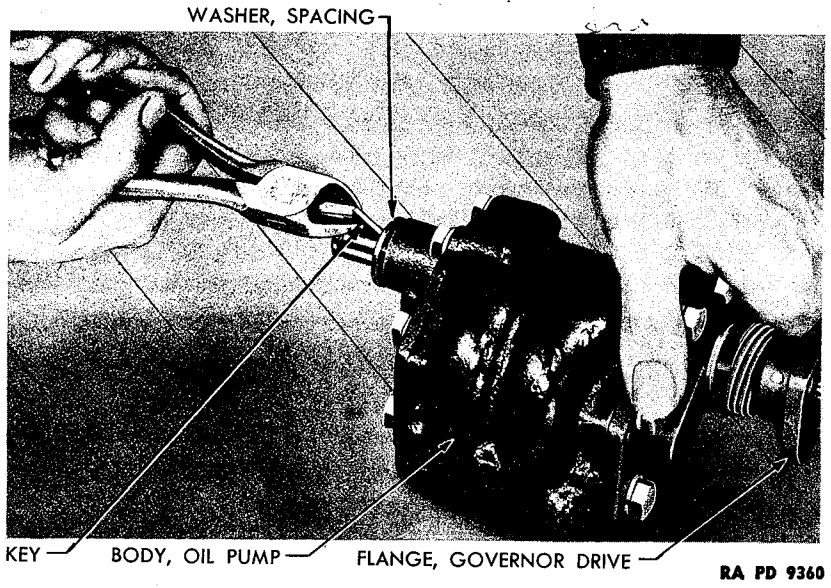


Figure 114 — Removing Driven Gear Key

TRANSFER UNIT

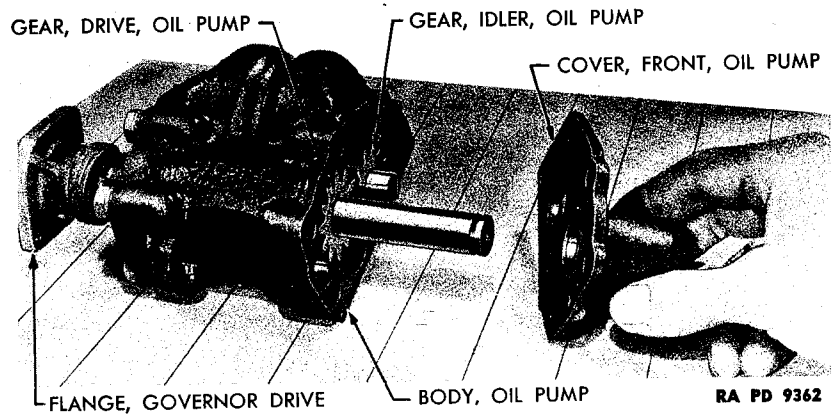


Figure 115 — Removing Oil Pump Front Cover

f. Disassembly of Governor.

NOTE: The front end of the oil pump and governor assembly as designated in this manual is toward the front of the vehicle when the transfer unit is installed. The front end of the oil pump and governor assembly may be identified out of the transfer unit as the end of the drive shaft on which the large oil pump and governor driven gear is mounted. The rear end of the oil pump and governor assembly is the end of the drive shaft on which the governor is mounted.

(1) DISASSEMBLE GOVERNOR.

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

Pull governor oil delivery sleeve off outer end of governor. Remove governor sleeve tubes and adapter from delivery sleeve (fig. 111). Remove two cap screws and lock washers holding governor to governor drive flange, using a 7/16-inch open-end wrench, and remove governor assembly (fig. 112). CAUTION: Do not disassemble governor valve from body. If governor is faulty, replace complete unit as removed from drive flange.

g. Disassembly of Oil Pump.

(1) REMOVE DRIVEN GEAR.

DRIFT, brass
HAMMER, soft
PLIERS, snap ring, removing, A266329

Remove snap ring holding oil pump driven gear on shaft, using snap ring pliers (fig. 113). Remove driven gear from drive shaft, using a soft hammer and brass drift, and tapping as close to the hub as possible.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

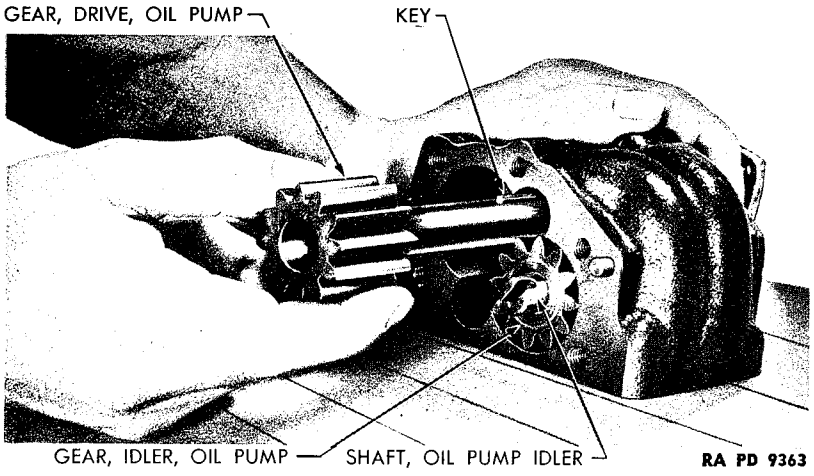


Figure 116 — Removing Oil Pump Front Drive Gear

emove Woodruff key that holds driven gear on drive shaft (fig. 114). emove driven gear spacing washer from drive shaft.

(2) REMOVE OIL PUMP FRONT DRIVE AND FRONT IDLER GEAR.

HAMMER, soft
WRENCH, socket, ½-in.

Remove five cap screws and lock washers holding oil pump body nt cover on oil pump body (½-in. socket wrench). Remove cover m pump body by tapping cover with a soft hammer to move cover dowel pins. Remove oil pump front drive gear from oil pump body d driveshaft (fig. 116). Remove oil pump front idler gear from pump dy and idler gear shaft. Remove key for front drive gear. CAUTION: ese pump gears come in matched sets and should not be inter- nged with rear pump gears.

(3) DISASSEMBLE OIL PUMP BODY.

WRENCH, socket, ½-in.

Remove five screws and lock washers holding oil pump body rear er to oil pump body (½-in. socket wrench). Pull oil pump drive ft and oil pump body rear cover out of oil pump body. Remove odruff key that holds rear drive gear to drive shaft. Remove rear e gear from oil pump body. Remove rear idler gear from oil pump y. Remove idler gear shaft from oil pump body by pulling straight Remove governor drive flange spacing washer from drive shaft. JTION: Governor drive flange, speedometer drive gear, and drive t are a permanent assembly and are to be serviced as such.

TRANSFER UNIT

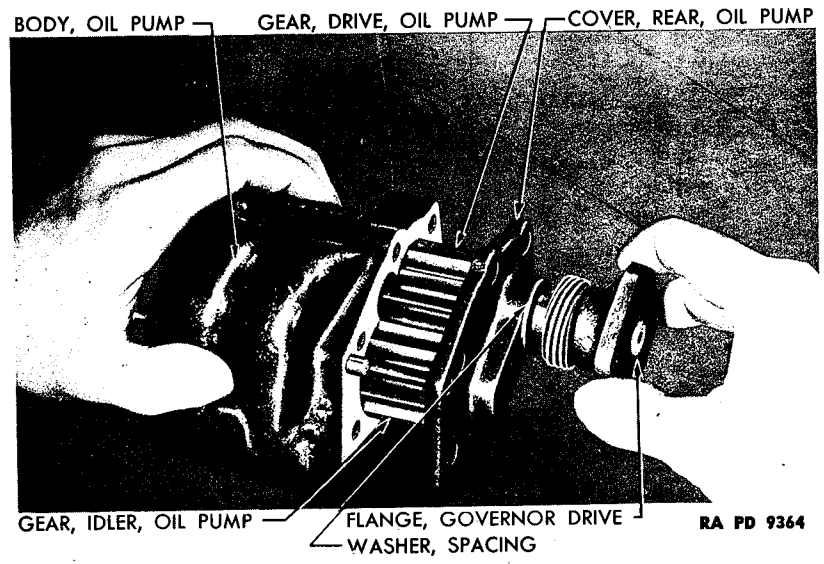


Figure 117 — Removing Oil Pump Drive Shaft

h. Disassembly of Oil Cooler Unit, and Lines.

(1) DISASSEMBLE OIL COOLER UNIT.

WRENCH, open-end, $^{15}/_{16}$-in.

Remove connector (fig. 21) from rear end of oil cooler unit.

(2) DISASSEMBLE OIL COOLER LINES.

WRENCH, open-end, 1⅛-in. (two)

The only disassembly operations that may be performed on the oil cooler lines are to remove the unions, which connect the lines in the propeller shaft housing or to release the nuts that connect the oil cooler lines to the hoses.

15. INSPECTION AND REPAIR OF TRANSFER UNIT AND COMPONENTS.

a. In order to make a thorough inspection of all transfer unit components, the various parts should be cleaned thoroughly in SOLVENT, dry-cleaning, to remove all trace of oil or grease. The parts should be dried with compressed air or clean rags.

b. Equipment.

CLEAN, RAGS
CLOTH, crocus
FILE
GAGE, feeler
SCALE, 6-in.
SCALE, 12-in.
SOLVENT, dry-cleaning
WHETSTONE

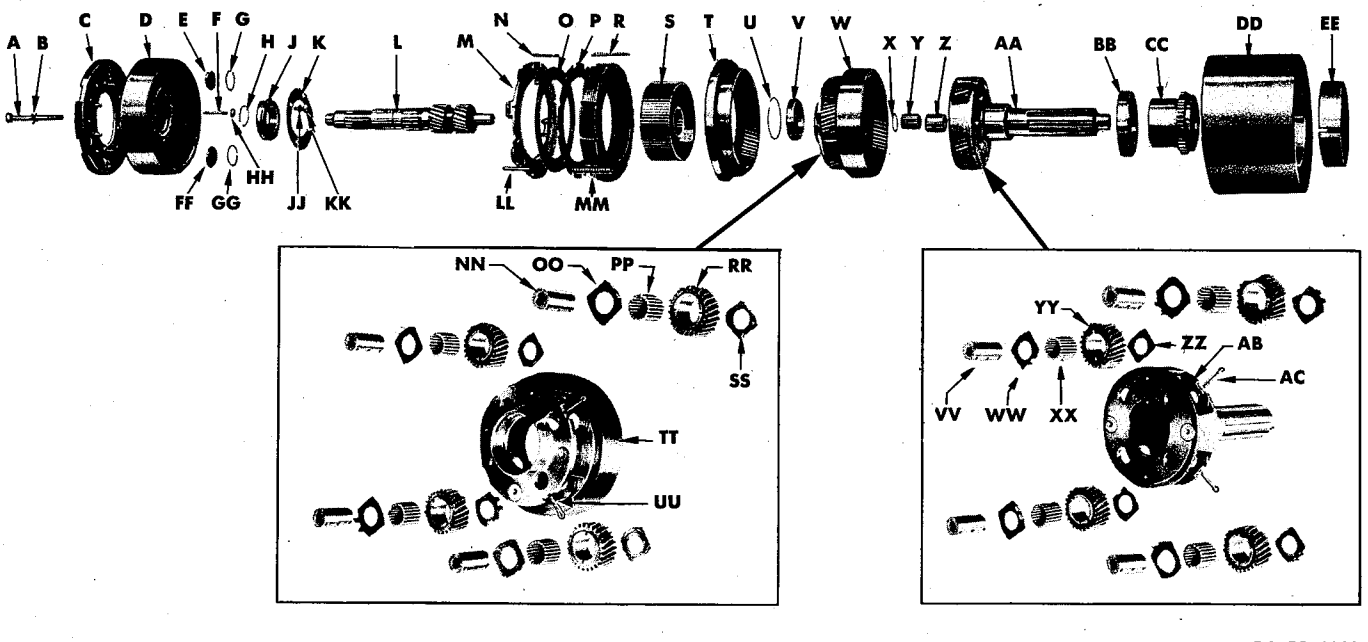


Figure 118 — Transfer Unit Drum and Gears — Disassembled

A—BOLT, CLUTCH DRUM ATTACHING
B—WASHER, LOCK
C—COVER, CLUTCH DRUM
D—DRUM, TRANSFER UNIT CLUTCH
E—PISTON, CLUTCH DRUM
F—STUD, COVER TO DRUM
G—RING, PISTON OIL SEAL
H—RING, SNAP, MAIN SHAFT BEARING
J—BEARING, LOW GEAR CLUTCH DRUM
K—RETAINER, CLUTCH DRUM BEARING
L—SHAFT, ASSEMBLY, TRANSFER UNIT MAIN
M—PLATE, CLUTCH PRESSURE
N—PIN, CLUTCH RELEASE SPRING
O—PLATE, CLUTCH DRIVE (BRONZE)
P—PLATE, CLUTCH DRIVEN (STEEL)
R—SPRING, CLUTCH RELEASE
S—HUB, LOW GEAR CLUTCH DRUM
T—GEAR, CLUTCH DRUM INTERNAL
U—RING, SNAP, DIRECT DRIVE CARRIER BEARING RETAINING
V—BEARING, DIRECT DRIVE CARRIER
W—CARRIER, ASSEMBLY, DIRECT DRIVE
X—RING, RETAINING, MAIN SHAFT PILOT BEARING
Y—BEARING, NEEDLE, MAIN SHAFT PILOT
Z—RACE, PILOT BEARING
AA—SHAFT, ASSEMBLY, TRANSFER UNIT OUTPUT
BB—BEARING, OUTPUT SHAFT
CC—GEAR, DRIVE, OIL PUMP AND GOVERNOR
DD—DRUM, LOW GEAR BRAKE
EE—BUSHING, LOW GEAR DRUM
FF—PISTON, CLUTCH DRUM
GG—RING, PISTON OIL SEAL
HH—NUT, REGULAR, HEX.
JJ—WASHER, LOCK
KK—SCREW, BEARING RETAINER
LL—PIN, CLUTCH RELEASE SPRING
MM—SPRING, CLUTCH RELEASE
NN—PIN, CARRIER PINION
OO—WASHER, PINION RETAINING
PP—ROLLER, PINION BEARING
RR—PINION, PLANETARY, CARRIER
SS—WASHER, PINION RETAINING
TT—CARRIER, ASSEMBLY, DIRECT DRIVE
UU—PIN, COTTER
VV—PIN, OUTPUT SHAFT PINION
WW—WASHER, PINION RETAINING
XX—ROLLER, PINION BEARING
YY—PINION, PLANETARY, OUTPUT SHAFT
ZZ—WASHER, PINION RETAINING
AB—SHAFT, ASSEMBLY TRANSFER UNIT OUTPUT
AC—PIN, COTTER

RA PD 8800B

Legend for Figure 118 — Transfer Unit Drum and Gears — Disassembled

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

c. Transfer Unit.

(1) OUTPUT SHAFT ASSEMBLY.

Inspect outer race of main shaft pilot bearing (Z, fig. 118) for indication of roughness that may cause failure. Inspect each roller in main shaft pilot roller bearing (Y) for imperfections or roughness. Oil output shaft ball bearing (BB) and test for roughness. CAUTION: Do not use compressed air to blow out bearing. Inspect teeth on oil pump drive gear (CC) for nicks or burs. Inspect output shaft planetary assembly (AA) for nicks or burs in pinion teeth.

(2) DIRECT DRIVE CARRIER ASSEMBLY.

Inspect planetary pinions and internal gear teeth on direct drive carrier assembly (W, fig. 118) for nicks and burs. Oil carrier and main shaft bearing (V), and test it for roughness.

(3) MAIN SHAFT.

Inspect splines and the gear teeth of the two center gears on the main shaft (L, fig. 118) for nicks, burs, or roughness.

(4) INTERNAL GEAR (T) AND BRAKE DRUM ASSEMBLY (DD, fig. 118).

GAGE, feeler

Inspect brake drum internal gear teeth for nicks and burs. Also inspect rear face of internal gear (T) which contacts front bronze clutch plate for scores. Inspect babbitt-lined bushing (EE) in end of brake drum for indication of damage. Check oil grooves in bushing to make sure they are clean. Check clearance between this bushing and case. It should be 0.003 inch to 0.005 inch as measured with a feeler gage. Inspect brake drum surface for nicks and burs.

(5) CLUTCH DRUM ASSEMBLY (D, fig. 118).

GAGE, feeler

Oil clutch drum bearing (J) and check for roughness. Remove piston rings (G and GG) from clutch pistons (E and FF). Insert rings in piston bores in clutch drum. Measure ring gap, using a feeler gage. Gap should be 0.0015 inch minimum to 0.0095 inch maximum. Inspect clutch piston rings for cuts and scores that might cause oil pressure leaks. Insert clutch pistons (without rings) in bores in clutch drum and check clearance, using a feeler gage. This clearance should be 0.0055 inch minimum to 0.0085 inch maximum, with low limit preferred. Check clearance between clutch piston ring and ring groove in clutch pistons, using a feeler gage. This clearance should be 0.001 inch minimum to 0.003 inch maximum. Inspect clutch piston bores in clutch drum for cuts and scores that might cause oil leaks. Inspect clutch drum surface for nicks and burs.

TRANSFER UNIT

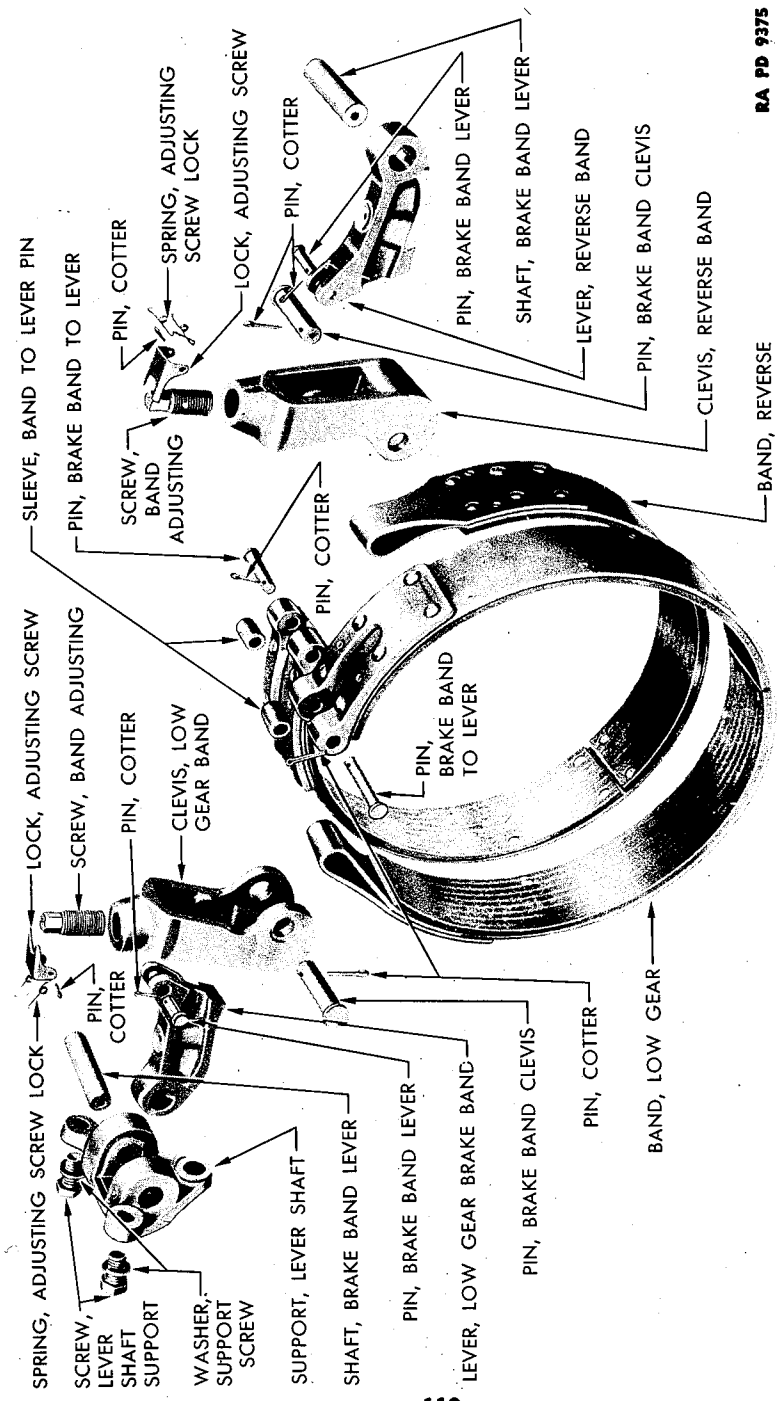
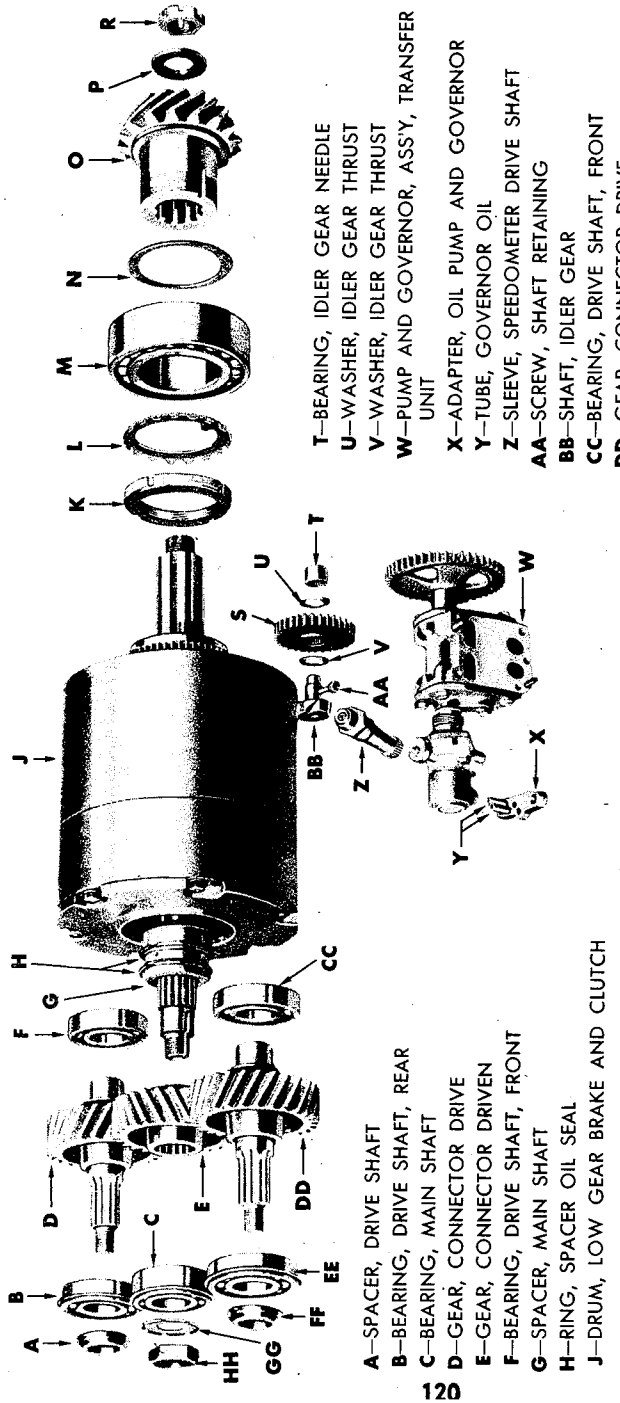


Figure 119—Transfer Unit Bands and Levers—Disassembled

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8



A—SPACER, DRIVE SHAFT
B—BEARING, DRIVE SHAFT, REAR
C—BEARING, MAIN SHAFT
D—GEAR, CONNECTOR DRIVE
E—GEAR, CONNECTOR DRIVEN
F—BEARING, DRIVE SHAFT, FRONT
G—SPACER, MAIN SHAFT
H—RING, SPACER OIL SEAL
J—DRUM, LOW GEAR BRAKE AND CLUTCH
K—NUT, PINION BEARING RETAINING
L—WASHER, LOCK
M—BEARING, DRIVE PINION
N—SHIM, SPIRAL DRIVE PINION
O—PINION, SPIRAL DRIVE
P—WASHER, DRIVE PINION NUT
R—NUT, DRIVE PINION
S—GEAR, GOVERNOR DRIVE, IDLER
T—BEARING, IDLER GEAR NEEDLE
U—WASHER, IDLER GEAR THRUST
V—WASHER, IDLER GEAR THRUST
W—PUMP AND GOVERNOR, ASS'Y, TRANSFER UNIT
X—ADAPTER, OIL PUMP AND GOVERNOR
Y—TUBE, GOVERNOR OIL
Z—SLEEVE, SPEEDOMETER DRIVE SHAFT
AA—SCREW, SHAFT RETAINING
BB—SHAFT, IDLER GEAR
CC—BEARING, DRIVE SHAFT, FRONT
DD—GEAR, CONNECTOR DRIVE
EE—BEARING, DRIVE SHAFT, REAR
FF—SPACER, DRIVE SHAFT
GG—WASHER, MAIN SHAFT NUT LOCK
HH—NUT, MAIN SHAFT

Figure 120 — Transfer Unit Connector Gears and Clutch Drum — Disassembled

TRANSFER UNIT

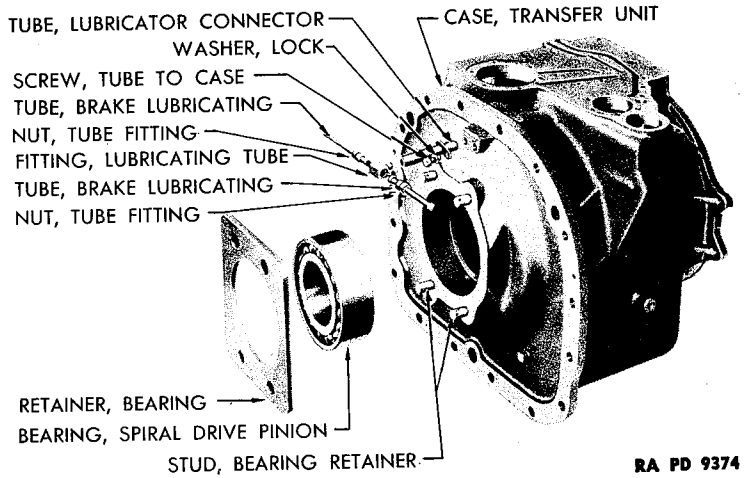


Figure 121 — Transfer Unit Case — Disassembled

(6) CLUTCH PLATES (O and P, fig. 118).

Inspect each clutch plate for indications of cuts and scores. Any small particles embedded in clutch plates should be removed. If particles cannot be removed, replace clutch plates. Check bronze plates to see that they are flat, and steel plates to see that they are coned.

(7) CLUTCH PRESSURE PLATE AND SPRINGS.

SCALE 6-in.

Check six clutch release springs (R, fig. 118). They should be $3^{39}/_{64}$ inches long and register 81 to 86 pounds pressure when compressed to $2^{23}/_{32}$ inches. Inspect clutch pressure plate (M, fig. 118) for cuts and scores. Remove any dirt collected in pockets.

(8) LOW GEAR AND REVERSE BAND ASSEMBLIES (fig. 119).

Inspect condition of low gear brake band assembly, paying particular attention to condition of lining. Inspect low and reverse band lever shafts for roughness. Inspect reverse band assembly, paying particular attention to condition of lining.

(9) SPEEDOMETER SHAFT SLEEVE AND PINION (Z, fig. 120).

Inspect pinion teeth in speedometer sleeve assembly for nicks and burs.

(10) MAIN SHAFT SPACER OIL SEAL RINGS.

GAGE, feeler

Inspect condition of oil seal rings (H, fig. 120) on main shaft spacer. Check clearance between rings and ring grooves, using a feeler gage.

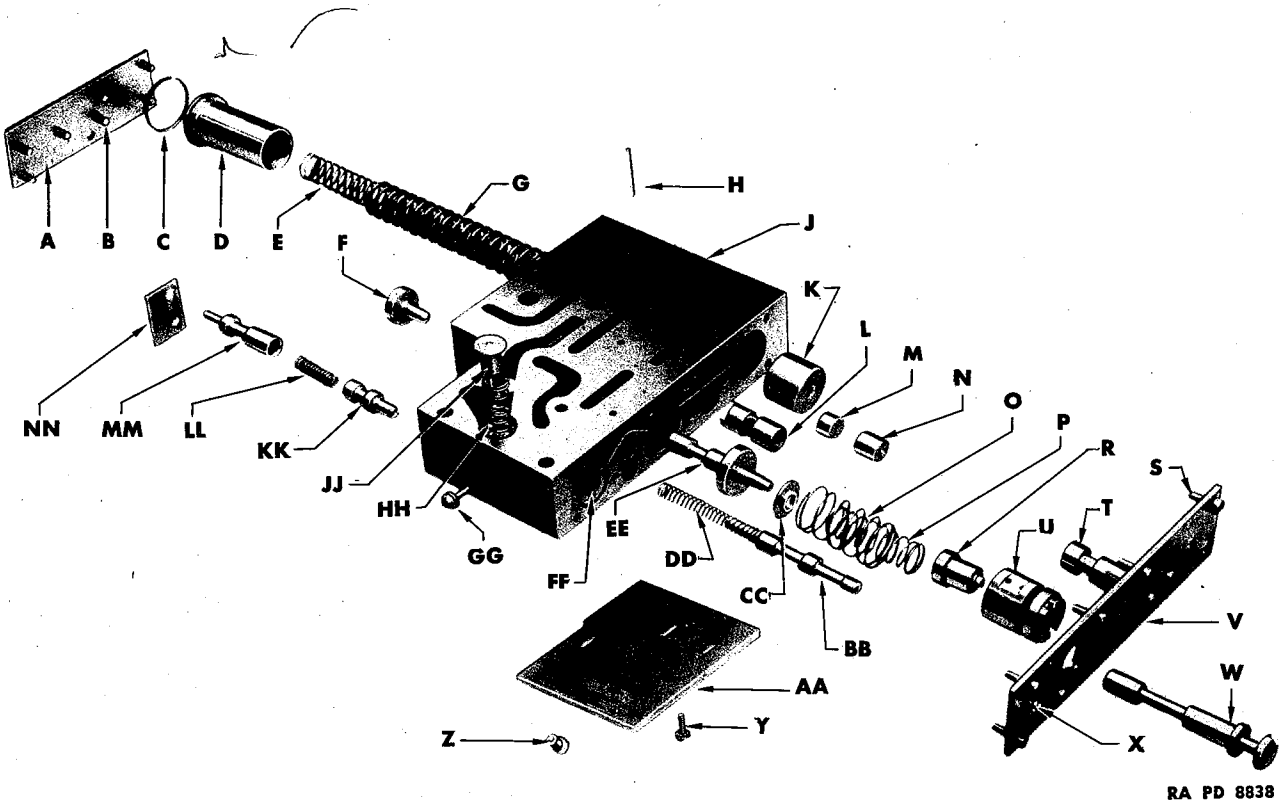


Figure 122 — Oil Control Valve Body — Exploded View

A—PLATE, REAR COVER
B—SCREW, REAR COVER PLATE
C—RING, ACCUMULATOR PISTON
D—PISTON, ACCUMULATOR
E—SPRING, ACCUMULATOR, INNER
F—PLUG, GOVERNOR
G—SPRING, ACCUMULATOR, OUTER
H—PIN, ACCUMULATOR BODY
J—BODY, VALVE AND ACCUMULATOR
K—PLUG, ACCUMULATOR SPRING LOCATING
L—VALVE, CLUTCH RELAY
M—VALVE, EXHAUST DOWNSHIFT
N—VALVE, THROTTLE DOWNSHIFT
O—SPRING, SHIFTER VALVE, OUTER
P—SPRING, SHIFTER VALVE, ~~OUTER~~ INNER
R—PLUG, REGULATOR
S—SCREW, FRONT COVER PLATE
T—STOP, RELAY VALVE
U—SLEEVE, REGULATOR PLUG
V—PLATE, FRONT COVER
W—VALVE, MANUAL COVER
X—STOP, THROTTLE VALVE
Y—SCREW, TOP COVER PLATE
Z—VALVE, ACCUMULATOR OIL
AA—PLATE, TOP COVER
BB—VALVE, LOW SERVO CONTROL
CC—SPACER, SHIFTER VALVE SPRINGS
DD—SPRING, LOW SERVO CONTROL VALVE
EE—VALVE, SHIFTER
FF—SLEEVE, THROTTLE VALVE
GG—SCREW, SERVO EXHAUST VALVE
HH—SPRING, SERVO EXHAUST VALVE
JJ—VALVE, SERVO EXHAUST
KK—VALVE, THROTTLE
LL—SPRING, THROTTLE VALVE
MM—VALVE, THROTTLE "T"
NN—PLATE, THROTTLE VALVE STOP

RA PD 8838B

Legend for Figure 122 — Oil Control Valve Body — Exploded View

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

This clearance should be 0.001 inch to 0.003 inch maximum. Remove spacer oil rings and install them in bore of transfer unit cover. Check ring gap, using a feeler gage. This gap should be 0.003 inch minimum to 0.014 inch maximum.

(11) REAR COVER OIL SEAL RINGS.

GAGE, feeler

Inspect condition of oil seal rings on transfer unit cover boss and condition of machined surfaces of cover. Check clearance between rear cover oil seal rings and ring grooves in cover boss. This clearance should be 0.001 inch minimum to 0.003 inch maximum. Remove rear cover oil seal rings from boss on cover and install rings in bore of clutch drum. Check ring gap clearance, using a feeler gage. Gap should be 0.003 inch minimum to 0.014 inch maximum.

(12) CONNECTOR GEAR CASE AND GEARS (fig. 120).

WHETSTONE

Oil five connector gear drive shaft bearings (EE, C, B, F, and CC, fig. 120) and check for indication of roughness. Inspect teeth on three connector unit gears (D, E, and DD) for indication of burs and nicks. Small burs and nicks can be removed with a fine whetstone. Inspect machined surfaces of connector unit case for indication of nicks and burs. Inspect connector unit case cover machined surfaces for indications of nicks and burs. Inspect machined surfaces on universal joint yokes for damage. Pay particular attention to the surface where oil seal operates and to surfaces where universal joint bearing caps are attached. Inspect threads on ends of two connector drive gear shafts. If threads are burred by stakings on universal joint retaining nut, recut threads, using a $\frac{7}{8}$-inch 14 Am. Thd. die.

(13) TRANSFER UNIT CASE.

CLOTH, crocus FILE

Check all machined surfaces on transfer unit case for nicks and burs. Remove any burs, using a fine file. Check large bearing surface on inside of front face of transfer unit case for roughness. Smooth up bearing surface as necessary, using fine CLOTH, crocus. Inspect machined surfaces of transfer unit top cover where control valve body is installed for small burs and nicks.

d. Control Valve Body Assembly.

(1) VALVE BODY.

WHETSTONE

Inspect valve bores in valve body (fig. 123) for cuts or scores which might cause valves to stick or cause oil leakage. Inspect machined

surfaces on valve body for nicks or burs which might cause oil leakage. Small burs may be removed with a fine whetstone.

(2) VALVES

CLOTH, crocus

Inspect all valves for nicks or burs which might cause sticking or oil leakage. Insert each valve, in turn, in its proper bore in valve body and check for freeness of operation of valve. Valves should drop in valve body of their own weight without springs or valve rings installed. If any valve does not operate freely, remove valve and recheck for nicks or burs in valve or bore. Polish out any burs, using very fine CLOTH, crocus. CAUTION: Edges of valves must be left straight and sharp to prevent sticking.

(3) ACCUMULATOR PISTON RING.

GAGE, feeler

Remove accumulator piston oil seal ring (fig. 123) from accumulator piston and insert in bore of valve body. Check ring gap, using a feeler gage. This gap should be 0.0015 inch to 0.0095 inch. Reinstall accumulator piston oil seal ring on accumulator piston and check clearance between ring and ring grooves in piston. Clearance should be 0.001 inch to 0.003 inch.

(4) ACCUMULATOR PISTON SPRINGS (fig. 123).

SCALE, 6-in.

Check free length of outer accumulator piston spring (fig. 123). Free length should be $5\frac{11}{16}$ inches. Compress outer accumulator piston spring to $3\frac{3}{4}$ inches and measure pressure while compressed. Pressure should be 15 pounds to 16.5 pounds. Check free length of inner accumulator piston spring. Free length should be $5\frac{23}{64}$ inches. Compress inner accumulator piston spring to $3\frac{3}{4}$ inches and measure pressure while compressed. Pressure should be 6.45 pounds to 7.45 pounds.

(5) SHIFTER VALVE SPRINGS (fig. 123).

SCALE, 6-in.

Check free length of inner shifter valve spring (fig. 123). Free length should be $1\frac{1}{2}$ inches. Compress inner shifter valve spring to $\frac{13}{16}$ inch and measure pressure while compressed. Pressure should be 4.9 pounds to 5.3 pounds. Check free length of outer shifter valve spring. Free length should be $1\frac{7}{16}$ inches. Compress outer shifter valve spring to $\frac{5}{8}$ inch and measure pressure while compressed. Pressure should be 4.1 pounds to 4.75 pounds.

(6) THROTTLE VALVE SPRING (fig. 123).

SCALE, 6-in.

Check free length of throttle valve spring. Free length should be 0.900 inch to 0.910 inch. Compress throttle valve spring to 0.625 inch

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

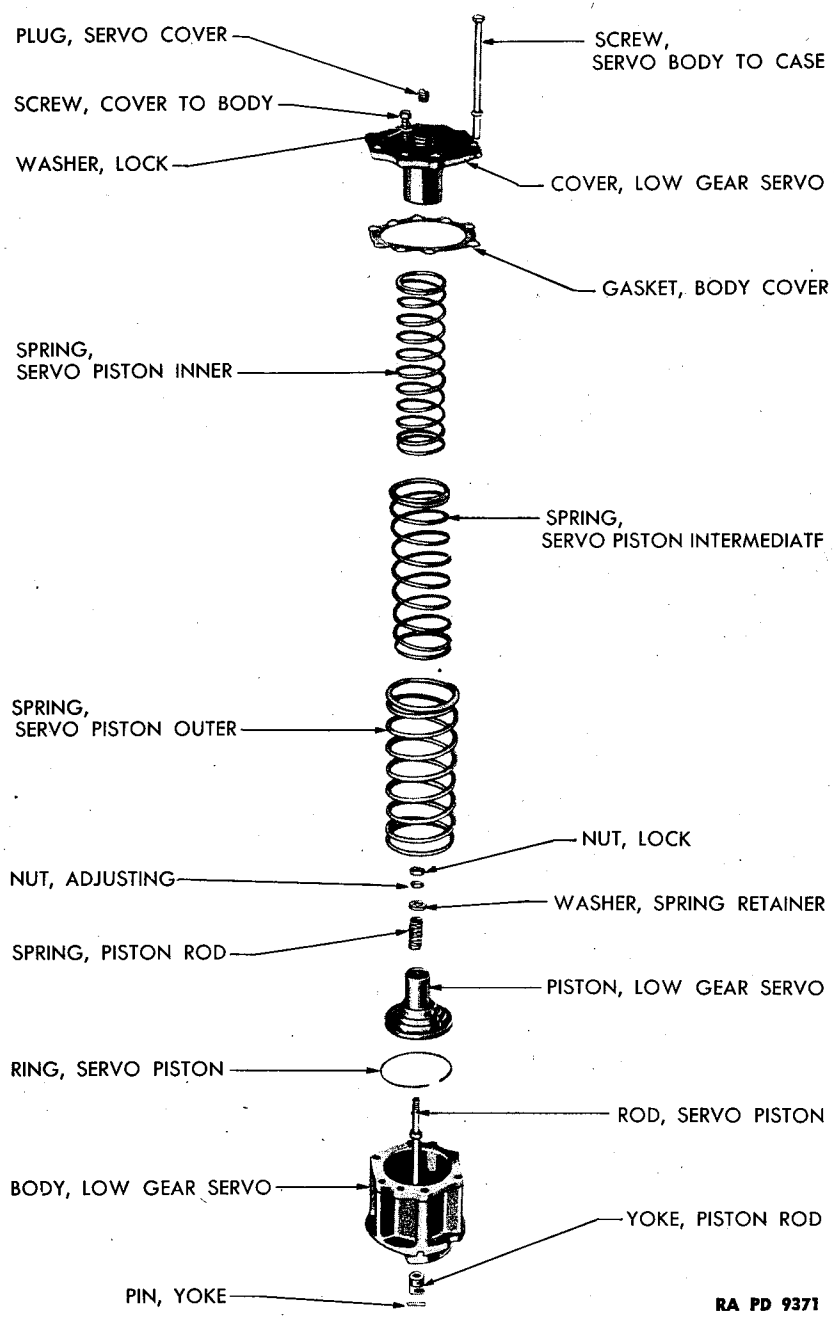


Figure 123 — Low Gear Servo — Disassembled

TRANSFER UNIT

and measure pressure while compressed. Pressure should be 6.29 pounds to 6.51 pounds.

(7) LOW GEAR SERVO SPRINGS (fig. 123).

SCALE, 6-in.

Check free length of low gear servo control valve spring. Free length should be $1\frac{61}{64}$ inches. Compress low gear servo control valve spring to $\frac{25}{32}$ inch and measure pressure while compressed. Pressure should be 1.90 pounds to 2.10 pounds. Check free length of low gear servo exhaust valve spring. Free length should be $1\frac{13}{64}$ inches.

e. Low Gear Servo.

(1) PISTON AND PISTON RING.

GAGE, feeler

Install low gear servo piston ring in bore of servo body (fig. 123). Check ring gap, using a feeler gage. This gap should be 0.0015 inch to 0.0095 inch. Install low gear servo piston (without ring) in bore of servo body and check clearance of piston, using a feeler gage. The clearance should not exceed 0.008 inch. NOTE: Make sure that this measurement is made with piston mounted on piston rod so that piston will not wedge in bore. Inspect condition of piston ring. Install ring on piston and check clearance between ring and ring groove in piston, using a feeler gage. Clearance should be not more than 0.003 inch. Inspect small end of servo piston for scores and cuts where it enters servo cover. Also inspect servo cover bore for same conditions. Check fit of piston in cover. This should be free with 0.001 inch to 0.004 inch clearance.

(2) PISTON ROD AND PISTON ROD SPRING.

SCALE, 6-in.

Inspect condition of surface of piston rod for scores where it contacts servo body. Inspect threads in end of piston rod where band adjusting gage is attached. Measure free length of servo piston rod spring. It should not be less than $1\frac{11}{16}$ inches. Measure pressure of spring when compressed to $1\frac{7}{16}$ inches. This pressure should not be less than 22.5 pounds. Inspect yoke on end of low gear servo piston rod for indication of being sprung or cracked.

(3) SERVO SPRINGS.

SCALE, 12-in.

Measure free length of inner servo spring. It should be not less than $8\frac{3}{32}$ inches. Measure inner spring pressure when compressed to $3\frac{51}{64}$ inches. This pressure should not be less than 96 pounds. Measure free length of intermediate low gear servo spring. It should be not less than $8\frac{9}{64}$ inches. Measure intermediate spring pressure when compressed

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

to $4\frac{1}{64}$ inches. This pressure should not be less than 137 pounds. Measure free length of outer low gear servo spring. It should be not less than $8\frac{3}{8}$ inches. Measure outer spring pressure when compressed to $4\frac{15}{64}$ inches. This pressure should not be less than 198 pounds. Inspect all low gear servo springs for indications of being badly sprung out of line.

(4) SERVO BODY.

Inspect bore of low gear servo body for cuts and scores that might allow oil pressure to escape by piston ring.

f. Reverse Servo.

(1) SERVO BODY.

Inspect bore of reverse servo body for cuts or scores that might cause oil pressure to leak past servo piston rings. Check condition of reverse servo exhaust valve bore in servo body and see that check valve ball is positioned against its seat. Inspect other machined faces of reverse servo body for nicks and burs.

(2) EXHAUST VALVE AND SPRING.
SCALE, 6-in.

Inspect reverse servo exhaust valve for cuts and scores. Check exhaust valve lock pin hole for excessive wear. Check free length of exhaust valve spring. Free length should be not less than $1\frac{1}{64}$ inches. Compress spring to $\frac{7}{16}$ inch and measure pressure while compressed. Pressure should not be less than 7 pounds.

(3) INNER EXHAUST VALVE LEVER.

Inspect slot in end of inner exhaust valve lever for indications of excessive wear. Inspect inner exhaust valve lever lock pin retaining ring for tension. It should clamp securely around groove in lever.

(4) PISTON ROD.

Inspect yoke on end of reverse servo piston rod for indications of being sprung or cracked. Inspect reverse servo piston rod for scores and cuts from latch lever operation.

(5) PISTON CLEARANCE (WITHOUT RING).
GAGE, feeler

Install reverse piston on piston rod (without ring) and insert assembly in bore of servo body. Check clearance of piston, using a feeler gage. Clearance should not be more than 0.008 inch. Install cover without spring or latch cover and check freedom of operation of piston and rod.

(6) PISTON RING GAP AND CLEARANCE.
GAGE, feeler

Install reverse servo piston ring in bore of servo body $2\frac{1}{2}$ inches below top of body and check ring gap, using a feeler gage. Ring gap

TRANSFER UNIT

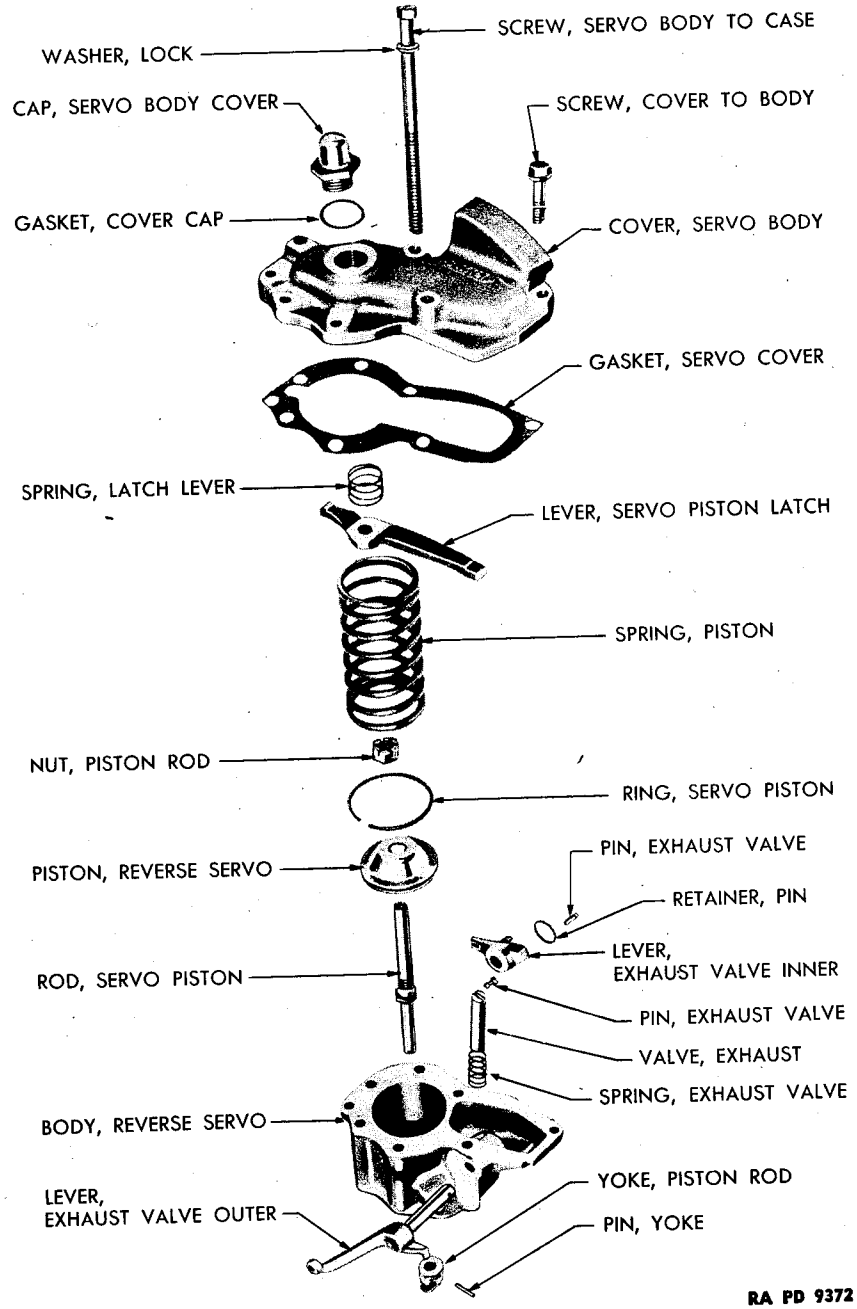


Figure 124 — Reverse Servo — Disassembled

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

should not be more than 0.008 inch. Install servo piston ring on piston and check clearance between ring and ring grooves in piston. Clearance should not be more than 0.003 inch.

(7) APPLY SPRING.

SCALE, 6-in.

Measure free length of reverse servo apply spring. Free length should not be less than 4¾ inches. Compress apply spring to 2¼ inches and measure pressure while spring is compressed. Pressure should be not less than 195 pounds.

(8) LATCH LEVER AND SPRING.

SCALE, 6-in.

Inspect condition of piston rod hole in latch lever for indications of burs that might scratch piston rod. Check free length of latch lever spring. It should be not less than $1\frac{59}{64}$ inches. Compress latch lever spring to $1\frac{3}{32}$ inches and measure pressure while compressed. Pressure should not be less than 3.5 pounds.

(9) SERVO COVER.

Inspect machined surfaces of reverse servo cover for burs. Insert release latch in socket in servo cover and check to see that release latch does not bind in cover.

g. Carrier.

(1) CARRIER BODY.

Inspect machined surfaces of cast oil pump and governor carrier for indications of nicks and burs. Also inspect oil pump and governor spacer plate (fig. 126) for same conditions. Inspect oil pressure regulator valve bore in oil pump and governor carrier for cuts and scores.

(2) OIL PRESSURE VALVE AND SPRING.

SCALE, 6-in.

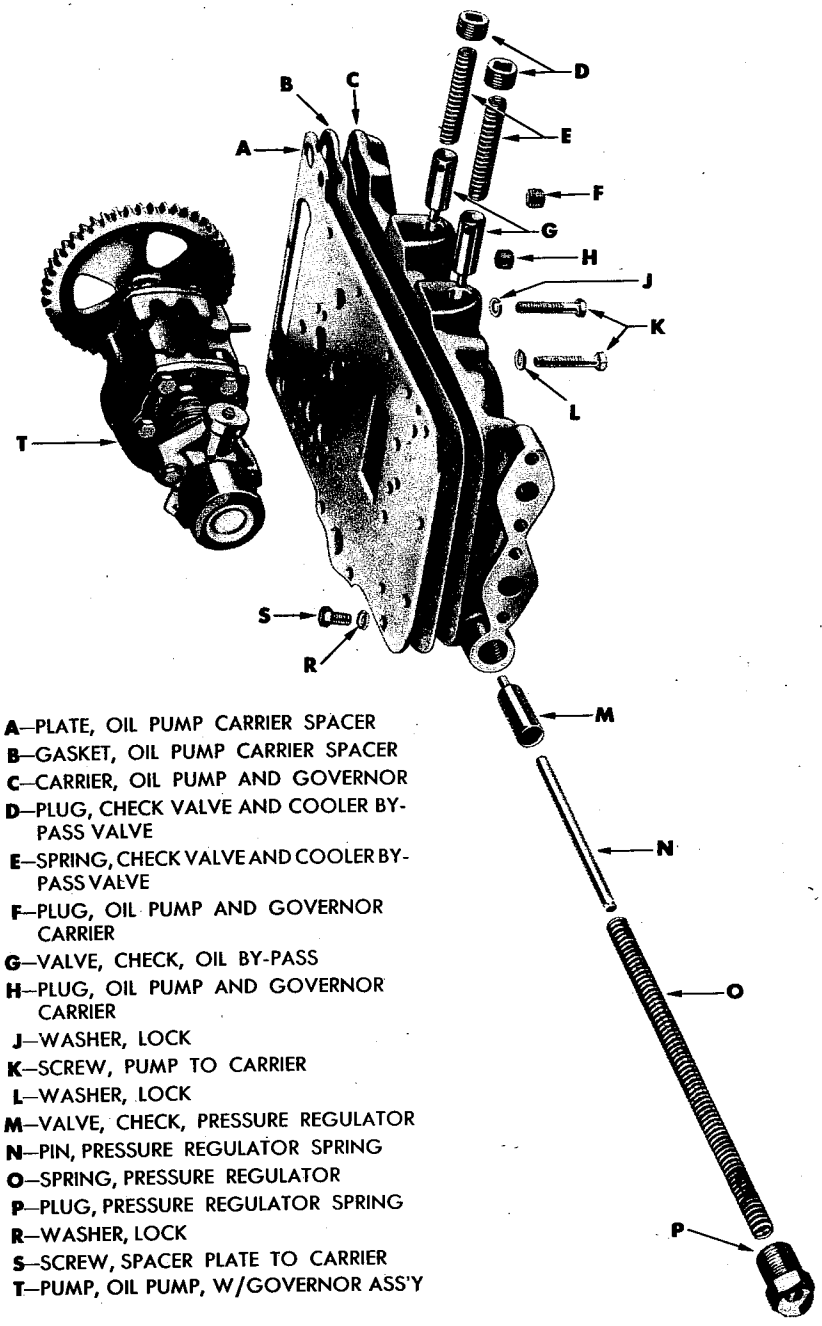
Inspect oil pressure regulator valve for cuts and scores. Install valve in bore in carrier and check to see that it will operate of its own weight. Measure free length of oil pressure regulator valve spring. Free length should be $8\frac{1}{16}$ inches. NOTE: If spring shows excessive wear on outside diameter, replace with new spring. Compress oil pressure regulator valve spring to $5\frac{13}{16}$ inches. The pressure when compressed to the above length should be 32.8 pounds minimum to 34 pounds maximum.

(3) LUBRICATION CHECK VALVE AND SPRING.

SCALE, 6-in.

Inspect lubrication check valve for cuts and scores. Install lubrication check valve in bore in carrier and check to see that it will operate of its own weight. Measure free length of lubrication check valve spring.

TRANSFER UNIT



A—PLATE, OIL PUMP CARRIER SPACER
B—GASKET, OIL PUMP CARRIER SPACER
C—CARRIER, OIL PUMP AND GOVERNOR
D—PLUG, CHECK VALVE AND COOLER BY-PASS VALVE
E—SPRING, CHECK VALVE AND COOLER BY-PASS VALVE
F—PLUG, OIL PUMP AND GOVERNOR CARRIER
G—VALVE, CHECK, OIL BY-PASS
H—PLUG, OIL PUMP AND GOVERNOR CARRIER
J—WASHER, LOCK
K—SCREW, PUMP TO CARRIER
L—WASHER, LOCK
M—VALVE, CHECK, PRESSURE REGULATOR
N—PIN, PRESSURE REGULATOR SPRING
O—SPRING, PRESSURE REGULATOR
P—PLUG, PRESSURE REGULATOR SPRING
R—WASHER, LOCK
S—SCREW, SPACER PLATE TO CARRIER
T—PUMP, OIL PUMP, W/GOVERNOR ASS'Y

RA PD 9378

Figure 125 — Oil Pump and Governor Carrier — Disassembled

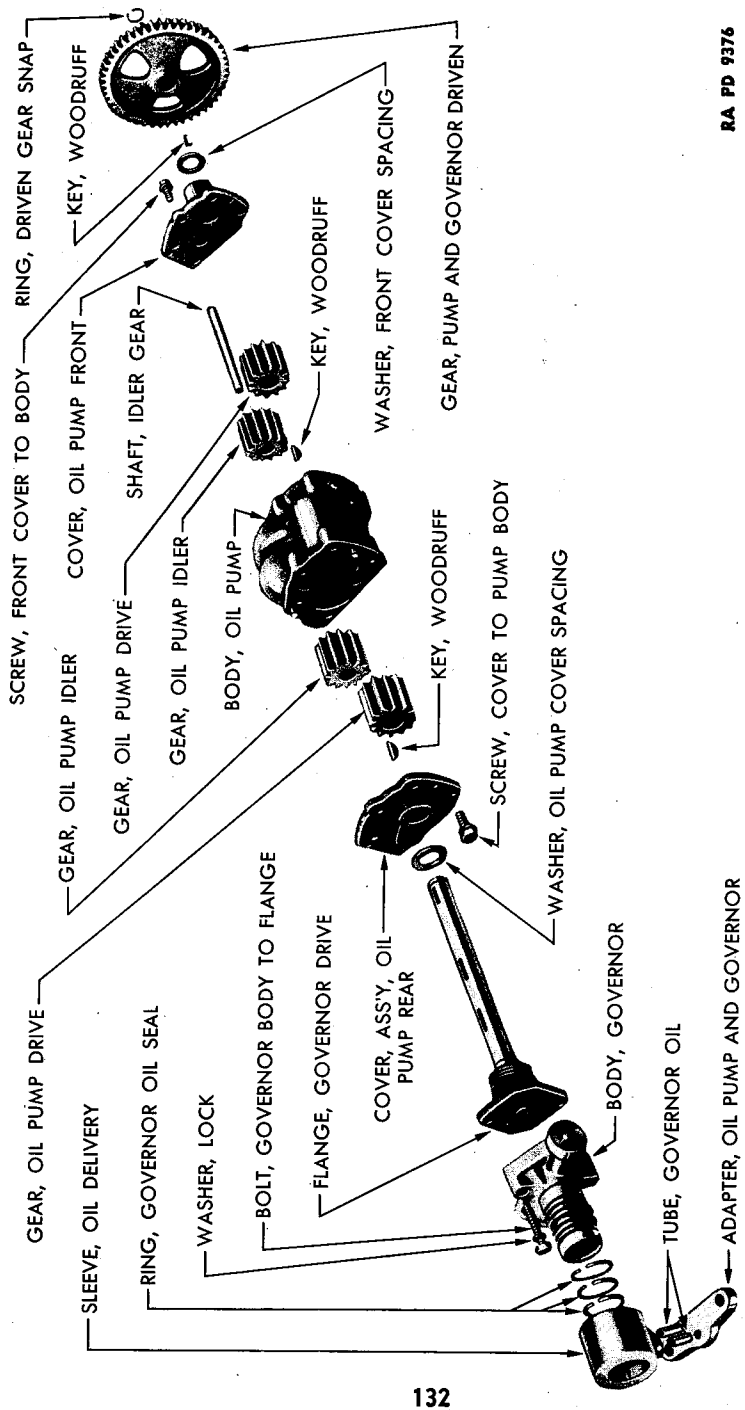


Figure 126 — Oil Pump and Governor — Disassembled

TRANSFER UNIT

Free length should be $3\frac{3}{16}$ inches minimum to $3\frac{1}{4}$ inches maximum. Compress lubrication check valve spring to $1\frac{7}{8}$ inches and measure pressure while compressed. This pressure should be 14.3 pounds minimum to 15.3 pounds maximum.

(4) Oil Cooler Bypass Valve and Spring.

SCALE, 6-in.

Inspect oil cooler bypass valve for cuts and scores. Install valve in bore in carrier and check to see that it will operate of its own weight. Measure free length of oil cooler bypass valve spring. Free length should be $3\frac{3}{16}$ inches minimum to $3\frac{1}{4}$ inches maximum. Compress oil cooler bypass valve spring to $1\frac{7}{8}$ inches and measure pressure while compressed. This pressure should be 14.3 pounds minimum to 15.3 pounds maximum.

h. Oil Pump and Governor.

(1) Oil Pump Body and Covers.

Inspect oil pump gear bores in oil pump body for cuts and scores (fig. 126). Also check condition of bushing in bulkhead between the two sections of oil pump body. Inspect machined surfaces of both oil pump body covers for nicks and burs. Inspect condition of bushings in both oil pump body covers.

(2) Oil Pump and Governor Drive Shaft.

Inspect oil pump and governor drive shaft for indications of excessive wear. Inspect spacing washers on oil pump and governor drive shaft for indications of excessive wear.

(3) Oil Pump Gears.

Inspect all oil pump gears for indications of nicks and burs. Inspect oil pump driven gear for indications of nicked or worn teeth. Inspect fit of oil pump driven gear on oil pump and governor drive shaft. It should be a light drive fit.

(4) Governor Oil Delivery Sleeve.

Inspect governor oil delivery sleeve for indication of scores and cuts that might allow oil pressure leakage.

(5) Governor Body Oil Seal Ring Gap and Clearance.

GAGE, feeler

Carefully remove oil seal rings from governor body. Install them in governor sleeve and check ring gap, using a feeler gage. Gap should be 0.0015 inch minimum to 0.0095 inch maximum. Install oil seal rings on governor body and measure clearance between rings and ring grooves in body, using a feeler gage. Clearance should be 0.001 inch to 0.003 inch.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

(6) GOVERNOR VALVE, BODY, AND DRIVE FLANGE.

Inspect condition of governor valve insofar as possible without removal. Make sure that governor valve is free enough to fall of its own weight. Inspect condition of machined surfaces on governor body for nicks and burs that might cause oil pressure leaks. Inspect governor drive flange for these conditions.

i. Inspection and Repair of Oil Cooler, Hoses, and Lines.

(1) OIL COOLER.

Wash cooler unit thoroughly in SOLVENT, dry-cleaning. After washing, direct a flow of oil through unit to see that circulation is unobstructed. Test for leaks by plugging one hose connection, and connecting an air hose to the other elbow. Then submerge the unit in water and apply light air pressure, watching closely for any bubbles which may indicate leakage. Replace clogged or leaking coolers.

(2) HOSE ASSEMBLY.

Hose assemblies may be inspected closely for any cuts which might weaken and develop leaks. Also the hoses may be tested under water in a similar manner as that followed to check the cooler although more air pressure should be used to locate possible high pressure leaks.

(3) LINES.

Oil cooler lines may be inspected closely for nicks or cracks which may lead to leaks. Also check lines for any sharp bends or dents which may cause an oil stoppage.

16. ASSEMBLY OF TRANSFER UNIT COMPONENTS.

a. Equipment.

CLAMP, "C"
HAMMER, light
HAMMER, soft
HANDLE, "T," with 3/8-in. drive-end
INDICATOR, dial
PLIERS, snap ring, removing, A266329
PRESS, arbor
SCALE
SCREWDRIVER, small
SOCKET, 7/8-in.
VISE, with soft jaws
WRENCH, 7/16-in.
WRENCH, 9/16-in.
WRENCH, box-end, 11/16-in.
WRENCH, box-end, 3/4-in.
WRENCH, deep socket, 1 1/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 5/8-in. (2)
WRENCH, socket, 1/2-in.
WRENCH, socket, 7/8-in.
WRENCH, socket-head, set screw, 3/16-in.

b. Assembly of Control Valve Body (fig. 122).

(1) INSTALL ACCUMULATOR OIL VALVE.

SCREWDRIVER, small

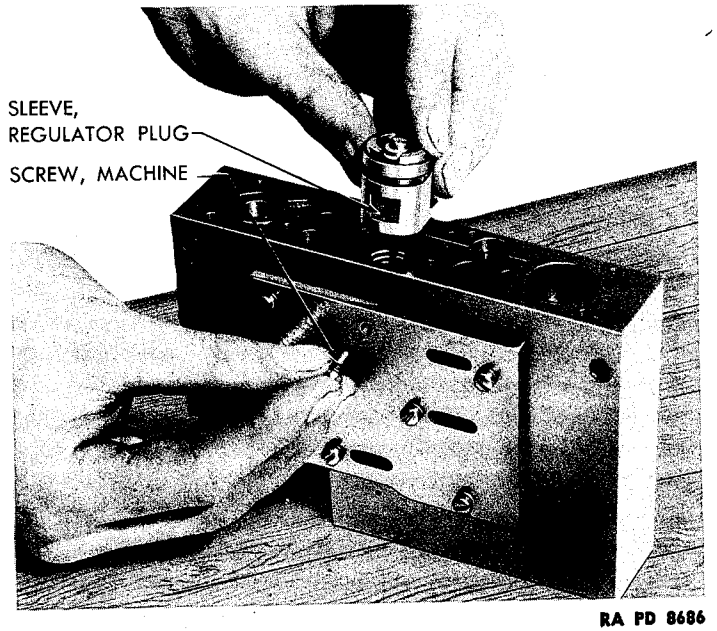


Figure 127 — Installing Regulator Sleeve

Install accumulator oil valve (Z) in its seat in valve body. Position top cover plate (AA) on valve body and install seven mounting screws and lock washers, leaving screws loose. NOTE: Do not install round-head dowel screw.

(2) INSTALL SHIFT VALVES AND SPRINGS IN VALVE BODY (fig. 122).

SCREWDRIVER, small

Install shifter valve (EE), shifter valve spring spacer (CC), and shifter valve springs (O and P) in valve body. Install regulator plug (R) in regulator plug sleeve (U), and insert entire assembly in valve body, compressing shifter valve springs. NOTE: Line up hole in sleeve for machine screw (fig. 127), insert round-head machine screw through cover plate, and tighten, making sure that screw enters proper hole in regulator plug sleeve.

(3) INSTALL ACCUMULATOR AND REAR COVER (fig. 122).

SCREWDRIVER, small

Install accumulator piston ring (C), piston (D), and governor plug (F) in valve body, being careful when compressing ring on accumulator piston. Position rear cover plate (A) on valve body and install seven mounting screws and lock washers.

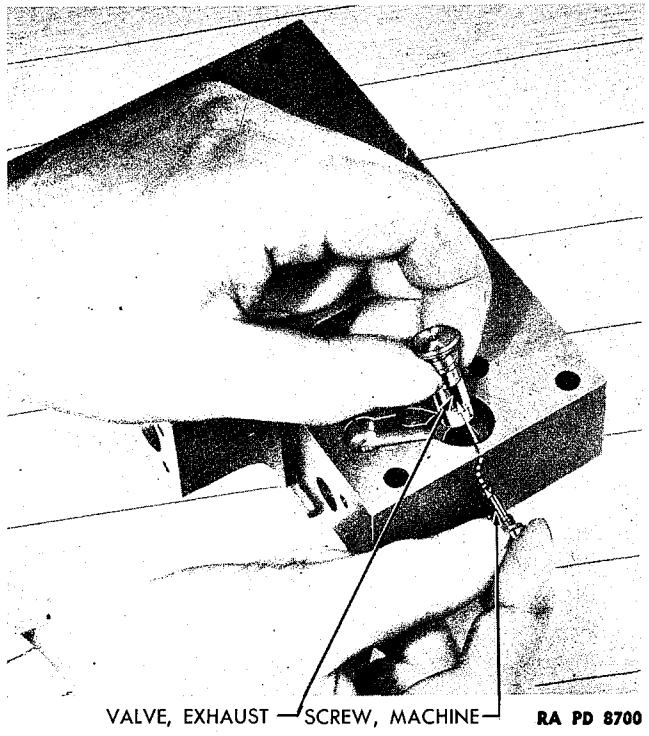


Figure 128 — Installing Exhaust Valve

(4) INSTALL CONTROL VALVES AND FRONT COVER (fig. 122).
SCREWDRIVER, small

Install low servo control valve spring (DD) and low servo control valve (BB) in valve body. Install clutch relay valve (L) in valve body, open end first. Install exhaust downshift valve (M), and then throttle downshift valve (N) in valve body. Install accumulator springs (E and G) in valve body and accumulator spring locating plug (K) on accumulator springs. Position front cover plate (V) over accumulator spring locating plug and compress accumulator springs until both the relay valve stop (T) and the accumulator spring locating plug (K) enter their respective holes. Install nine front cover plate mounting screws and lock washers. Tighten screws in top plate.

(5) INSTALL THROTTLE VALVE ASSEMBLY (fig. 122).
SCREWDRIVER, small

Install throttle valve assembly, consisting of throttle valve (KK), throttle valve spring (LL), and throttle T-valve (MM) in valve body.

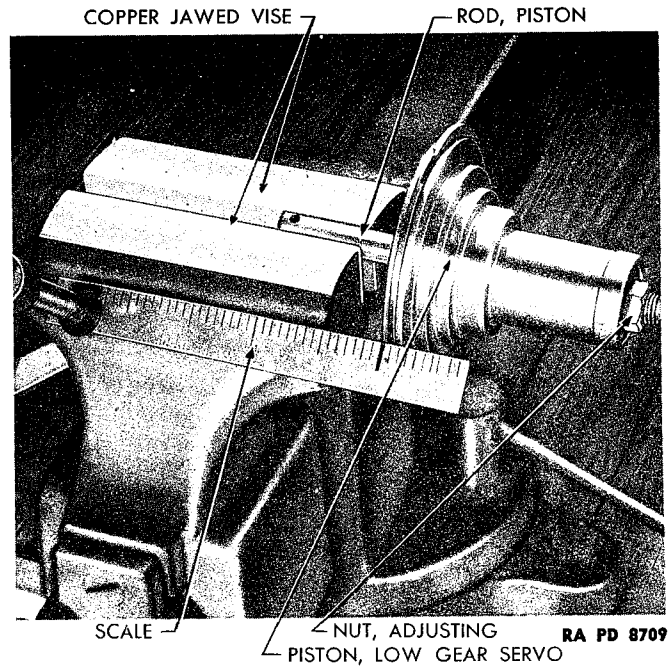


Figure 129 — Low Gear Servo Piston and Rod in Vise

Position throttle valve stop plate (NN) on valve body and install two mounting screws and lock washers.

(6) INSTALL LOW SERVO EXHAUST VALVE (fig. 122).
SCREWDRIVER, small

Install low servo exhaust valve (JJ) and exhaust valve spring (HH) in valve body (fig. 128). Lock low servo exhaust valve in place by installing round-head machine screw in side of valve body. Make sure that screw enters slot in low servo exhaust valve and that valve operates freely after screw is installed.

(7) INSTALL MANUAL CONTROL VALVE.

c. Assembly of Low Gear Servo.

(1) ASSEMBLE AND ADJUST PISTON ASSEMBLY.

CLAMP, "C"	VISE, with soft jaws
SCALE	WRENCH, open-end, 5/8-in. (2)

Install piston ring on piston. Install piston rod in piston. Threaded end of rod must be toward small end of piston. Place piston rod and piston in a vise with soft jaws. Yoke end of piston rod should be between

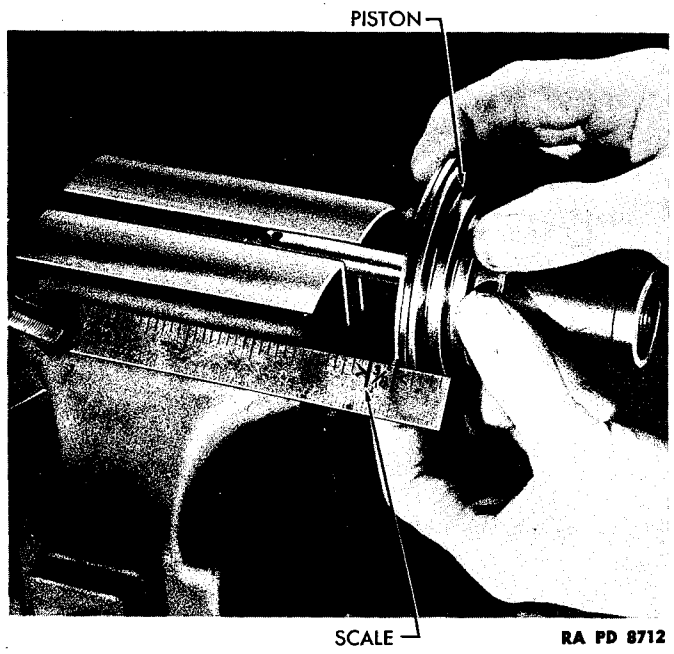


Figure 130 — Checking Piston Rod Adjustment

vise jaw. Install piston rod spring and outer spring seat in small end of piston on piston rod. Install piston rod spring adjusting nut. Mount a scale on vise with a C-clamp so that scale protrudes past edge of piston and ring (fig. 129). Note position of edge of apply piston next to scale. Grasp piston with both hands and pull outward against piston rod spring tension until piston bottoms on shoulder of piston rod. Note position of edge of piston next to scale (fig. 130). Total travel of piston should be ⅜ inch. Tighten adjusting nut to reduce piston travel and loosen nut to increase piston travel. Install adjusting nut lock nut on piston rod, using a ⅝-inch open-end wrench on lock nut and another on adjusting nut. Tighten lock nut one-third turn after face of lock nut contacts standard nut. Recheck piston rod spring adjustment and remove piston and rod assembly from vise.

(2) ASSEMBLE PISTON AND PISTON ROD ASSEMBLY INTO SERVO BODY.

HAMMER, light

Push piston and piston rod assembly into servo body, being careful to compress piston ring as piston enters body. Piston rod should pro-

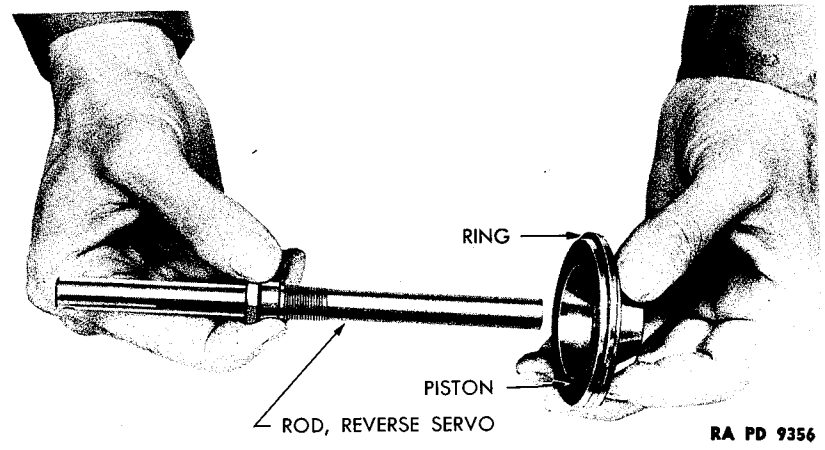


Figure 131 — Reverse Servo Piston and Rod

trude through inside end of body. Place piston rod yoke onto outer end of piston rod. Make sure pinhole in yoke lines up with pinhole in rod. Push a new piston rod yoke lock pin through pinhole in yoke and piston rod. Peen both ends of pin securely, being sure to remove all play between yoke and rod.

(3) ASSEMBLE LOW GEAR SERVO.

PRESS, arbor
WRENCH, open-end, ½-in.
WRENCH, socket-head, set screw, 3/16-in.

Install three low gear servo apply springs in servo case, seating each spring on its proper step. Mount low gear servo assembly in an arbor press and position servo cover and a *new* gasket on top of servo body over apply springs. Line up servo cover so that two mounting screw holes in cover line up with holes in body. NOTE: Two of the long servo to transfer unit mounting screws may be inserted through cover and into body as a guide. Put assembly in arbor press and press servo cover down onto body. Install two servo cover mounting screws and lock washers. Remove two guide screws, if installed. CAUTION: Small end of low gear servo piston fits into large boss on inside face of servo cover. Use extreme care to see that piston enters cover evenly without cocking to avoid damaging parts. Remove low gear servo assembly from arbor press.

d. Assembly of Reverse Servo.

(1) ASSEMBLE PISTON ASSEMBLY.

WRENCH, box-end, 11/16-in.
WRENCH, box-end, ¾-in.

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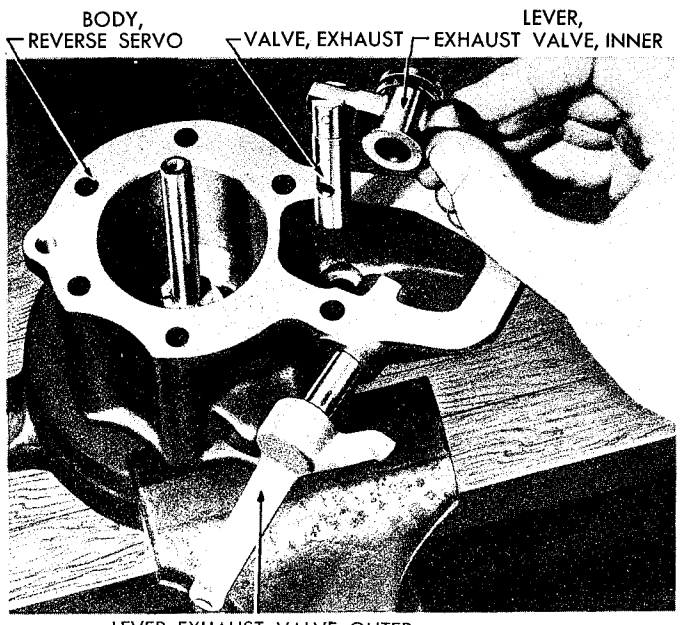

Figure 132 — Assembling Exhaust Valve and Levers

Push reverse servo piston on piston rod. Concave side of piston goes toward hexagonal flange on piston rod (fig. 131). Install piston retaining nut on piston rod on convex side of piston. Tighten nut with a ¾-inch box-end wrench on nut and a $1\frac{1}{16}$-inch box-end wrench on hexagonal flange of piston rod. Install piston ring on piston.

(2) INSTALL APPLY PISTON ASSEMBLY INTO SERVO BODY.
HAMMER, light

Push piston and piston rod in reverse servo body. Yoke end of rod should enter servo body first and protrude from inner end of body. Push piston rod yoke on end of piston rod protruding from inner end of servo body. Make sure pinhole in yoke lines up with pinhole on rod. Install a new piston rod yoke lock pin through pinholes in yoke and rod, and peen over ends of pin. Lubricate thoroughly with OIL, engine (seasonal grade).

(3) INSTALL EXHAUST VALVE AND LEVERS.
PLIERS, snap ring, removing, A266329
VISE, with soft jaws

Mount servo in a vise with soft jaws, with yoke end pointing down. Install pin that holds inner exhaust lever to upper end of exhaust

TRANSFER UNIT

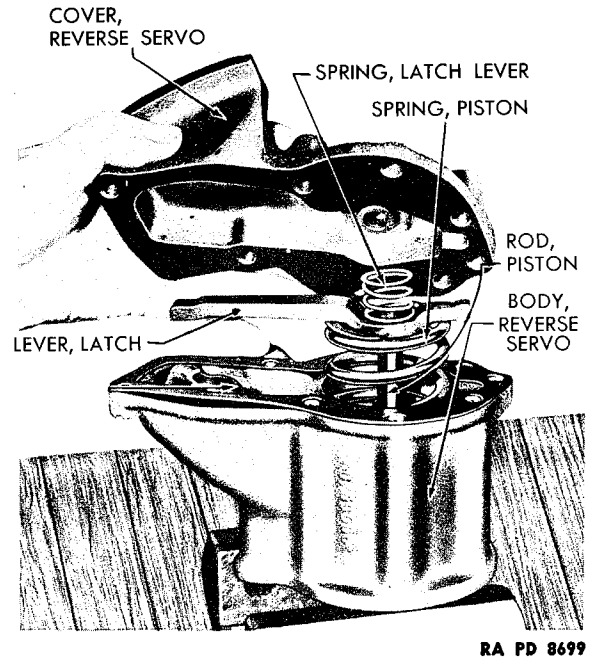

Figure 133 — Installing Reverse Servo Cover

valve and insert slot in lever over pin. Position inner exhaust valve lever, with exhaust valve attached and over exhaust valve bore in body, and position outer exhaust valve lever shaft in hole in body (fig. 132). Lower exhaust valve into its bore in servo body, making sure that relief hole is toward servo body (fig. 103). Hold inner lever in alinement with shaft and push outer lever and shaft through hole in body and inner lever. Pinhole in shaft should line up with pin slot in inner lever. Position pin in hole in shaft and slip ring over it (snap ring pliers).

(4) INSTALL LATCH LEVER AND SERVO COVER.
WRENCH, deep socket, $1\frac{1}{16}$-in.
WRENCH, socket-head, set screw, $\frac{3}{16}$-in.
WRENCH, socket, ½-in.

Install reverse servo piston apply spring in body above piston (fig. 133). Lay latch lever on servo body over piston rod. Long end of latch lever should be just above inner exhaust valve lever. Install latch lever spring over top of latch lever and centralize around piston rod. Position a *new* reverse servo cover gasket on servo body. Install servo body cover over cover gasket on body. NOTE: Cover should be pressed down as

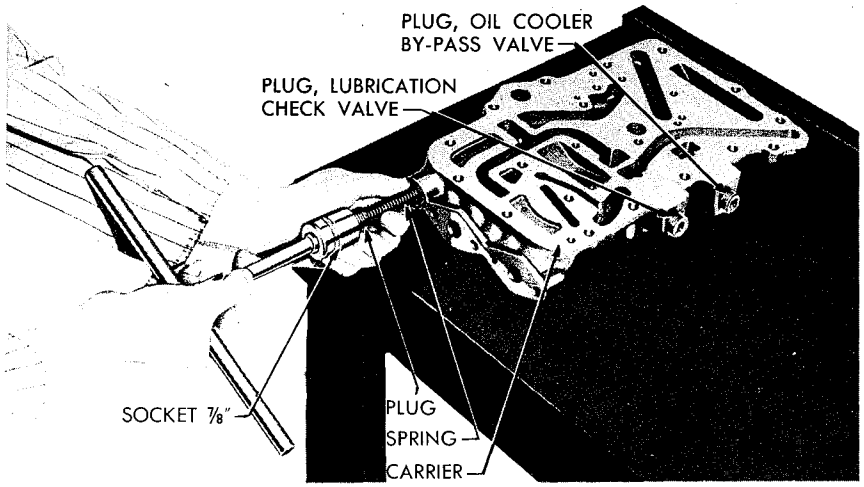

Figure 134 — Installing Oil Pressure Regulator Valve

evenly as possible to avoid misalinement of release latch. Install two screws and lock washers holding servo cover to body to compress apply spring (½-in. socket wrench or 3/16-in. socket-head set screw wrench). Install screws evenly. Install acorn nut and *new* gasket on servo cover over piston rod (1 1/16-in. deep socket wrench). Push piston rod in and out a few times to check for any binds. If there is any piston bind when servo is released, loosen cover screws and readjust position of cover until piston can be operated freely.

e. Assembly of Oil Pump and Governor.

(1) INSTALL REAR DRIVE GEAR AND IDLER GEAR INTO OIL PUMP BODY.

HAMMER, soft WRENCH, socket, ½-in.

Install oil pump spacing washer on drive shaft next to speedometer drive gear (fig. 125). Install oil pump body rear cover on drive shaft. Install large Woodruff key in rear key slot on drive shaft. Tap rear drive gear on drive shaft over Woodruff key. Install rear idler gear in oil pump body. Push drive shaft, thrust washer, drive gear and rear cover assembly into oil pump body, meshing rear drive gear with rear idler gear and lining up cover on dowels. Install five cap screws and lock washers holding oil pump rear cover to oil pump body.

(2) INSTALL FRONT DRIVE GEAR AND IDLER GEAR.

HAMMER, soft WRENCH, socket, ½-in.

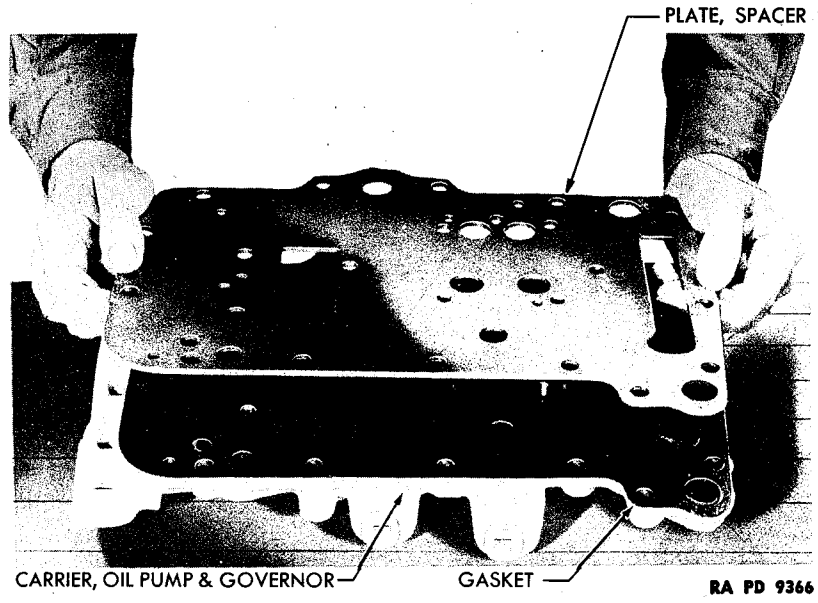

Figure 135 — Installing Spacer Plate

Install large Woodruff key in center key slot on drive shaft. Tap front drive gear on drive shaft over Woodruff key into oil pump body. Install front idler gear in oil pump body, meshing it with front drive gear. Install idler gear shaft in housing with slotted end toward front cover. Position front cover on body, lining up pin in front cover with slot in front end of idler gear shaft. Push front cover into place over dowel pins. Install five cap screws and lock washers holding front cover to oil pump body.

(3) INSTALL OIL PUMP AND GOVERNOR DRIVEN GEAR.

HAMMER, soft PLIERS, snap ring, removing, A266329

Install spacing washer on front end of drive shaft next to oil pump body. Install small Woodruff key in front key slot in drive shaft. Tap oil pump and governor driven gear on drive shaft over Woodruff key, using a soft hammer. Convex side of gear must be toward oil pump body. Install snap ring that holds oil pump and governor driven gear on end of drive shaft, using snap ring pliers.

(4) INSTALL GOVERNOR BODY.

WRENCH, 7/16-in.

Position governor body on end of governor drive flange, and install two mounting screws and lock washers. NOTE: Further assembly of

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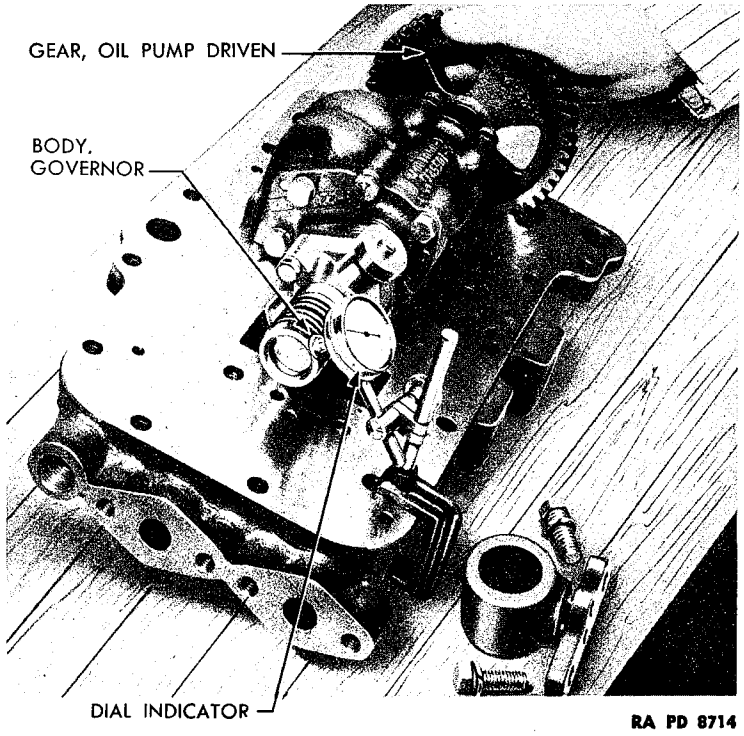

Figure 136 — Checking Governor Body Runout

the governor should not be performed until after the governor runout is checked as part of the assembly of the carrier.

f. Assembly of Carrier.

(1) INSTALL LUBRICATION CHECK VALVE.
HANDLE, "T," with 3/8-in. drive-end SOCKET, 7/8-in.

Install lubrication pressure check valve (fig. 134) in oil pump and governor carrier. Install check valve spring and plug, using a T-handle with a 3/8-inch square drive-end.

(2) INSTALL OIL COOLER BYPASS VALVE.
HANDLE, "T," with 3/8-in. drive-end SOCKET, 7/8-in.

Install oil cooler bypass valve (fig. 134) in oil pump and governor carrier. Install bypass valve spring and plug, using a T-handle with a 3/8-inch square drive-end.

TRANSFER UNIT

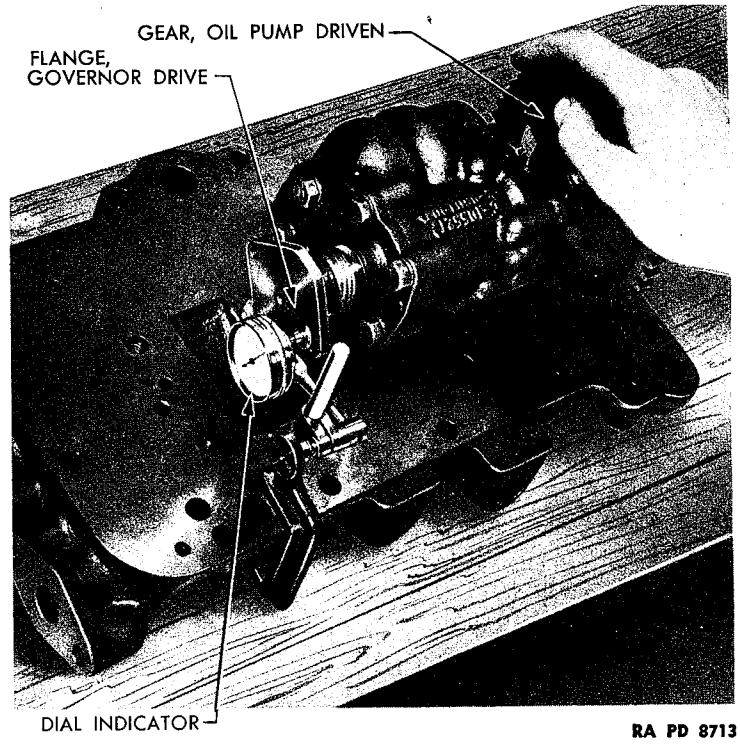

Figure 137 — Checking Governor Drive Flange Runout

(3) INSTALL OIL PRESSURE REGULATOR VALVE.
WRENCH, socket, 7/8-in.

Install oil pressure regulator valve in end of carrier. Install regulator valve spring and guide pin in back of valve, allowing spring to protrude from end of carrier. Position regulator valve acorn plug on outer end of valve spring, compress spring and install acorn plug in carrier (7/8-in. socket wrench) (fig. 134).

(4) INSTALL SPACER PLATE.
WRENCH, socket, 1/2-in.

Install a *new* carrier spacer plate gasket on inside face of carrier (fig. 135). Install carrier spacer plate on carrier gasket. Install two cap screws and lock washers holding spacer plate to carrier, using a 1/2-inch socket wrench.

(5) INSTALL OIL PUMP AND GOVERNOR ASSEMBLY.
WRENCH, socket, 1/2-in.

Position oil pump and governor assembly on carrier spacer plate and install five cap screws and lock washers.

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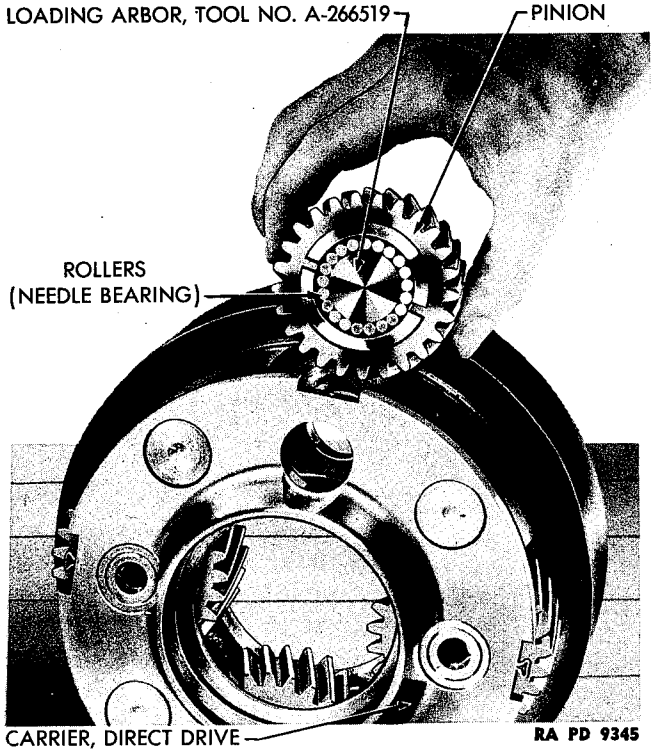

Figure 138 — Loading Pinion Needle Bearings

(6) CHECK GOVERNOR RUNOUT.

CLAMP, "C" INDICATOR, dial

Mount a dial indicator on the carrier with the indicator spindle touching the governor body at the outer ring band (fig. 136). Set indicator needle at "ZERO" and rotate governor body by turning oil pump driven gear. Total runout should not exceed 0.0025 inch. If it does, perform step (7) below; otherwise proceed directly to step (8), below.

(7) CORRECT GOVERNOR RUNOUT.

CLAMP, "C" WRENCH, socket, ½-in.
INDICATOR, dial WRENCH, 7/16-in.

If runout of governor body exceeds 0.0025 inch, remove governor body from drive flange and reinstall after turning 180 degrees from previous position, and again check runout. If runout still exceeds 0.0025 inch, again remove governor body and mount dial indicator with spindle touching face of governor drive flange (fig. 137). If runout of drive flange is *less* than 0.0005 inch, replace governor body; if runout *exceeds* 0.0005 inch, replace drive flange and shaft assembly.

(8) INSTALL GOVERNOR SLEEVE.

WRENCH, 7/16-in. WRENCH, 9/16-in.

Reinstall governor body, if removed, as explained in paragraph e (4) above. Slide governor oil delivery sleeve over end of governor assembly, making sure that chamfered end of sleeve goes on first. Be very careful not to damage the oil rings on the governor body. Install adapter and oil tube on governor delivery sleeve and attach to carrier spacer plate with two cap screws and lock washers (9/16-in. wrench).

17. ASSEMBLY OF TRANSFER UNIT.

a. Equipment.

ARBOR, needle bearing loading, A226519
BLOCK, 3-in.
CHISEL
COMPRESSOR, piston ring
DRIFT, brass
DRIVER, idler gear bearing, A266514
DRIVER, main shaft roller bearing, outer race, A266516
GAGE, low and reverse transit band adjusting, B226839
HAMMER
HAMMER, light
HAMMER, soft
HOIST
HOOK, clutch and drum assembly, lifting, A266513
INSTALLER, transfer unit cover oil ring, B248234
PIN, guide, clutch and drum assembly, A266517
PRESS, arbor
PUSHER, driven gear, B226840
PUSHER, oil seal, A293103
REPLACER, input shaft oil seal, A293103
SCREWDRIVER
SOCKET, 7/16-in.
SOCKET, ½-in.
SOCKET, 5/8-in.
SOCKET, ¾-in.
SOCKET, 1¼-in.
SOCKET, 1 13/16-in.
WRENCH, deep socket, 1 1/16-in.
WRENCH, deep socket, 1¼-in.
WRENCH, open-end, ½-in. (2)
WRENCH, open-end, 15/16-in.
WRENCH, open-end, 1⅛-in. (2)
WRENCH, open-end, 1 15/16-in.
WRENCH, socket, ½-in.
WRENCH, socket, 9/16-in.
WRENCH, socket, 5/8-in.
WRENCH, socket, ¾-in.
WRENCH, socket, 1⅛-in.
WRENCH, socket, 1¼-in.
WRENCH, torque, 0 to 25 ft-lb
WRENCH, torque, 0 to 50 ft-lb
WRENCH, torque, 0 to 100 ft-lb
WRENCH, torque, 150 to 200 ft-lb

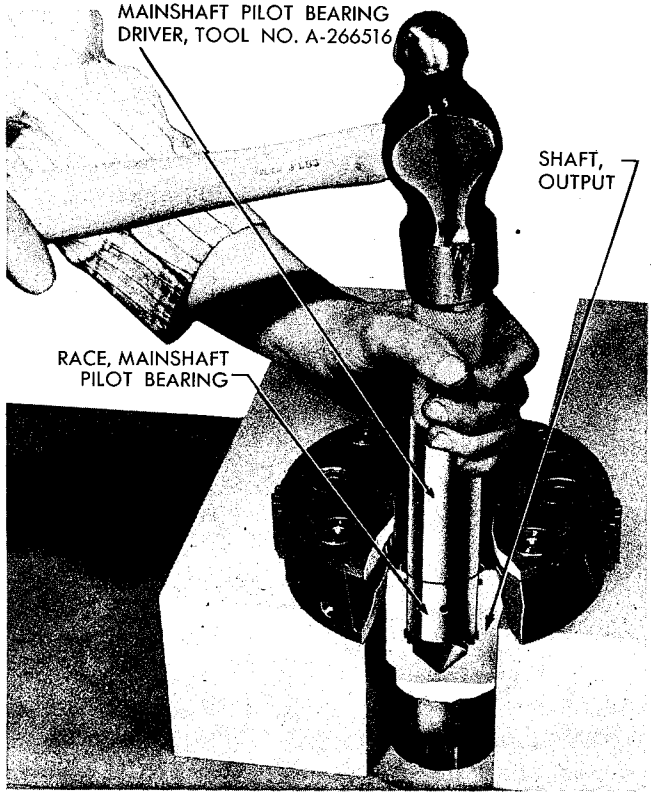

Figure 139 — Installing Main Shaft Bearing Pilot Race

b. Assemble Drum and Gear Assembly.

(1) INSTALL PLANETARY PINIONS IN OUTPUT SHAFT.

ARBOR, needle bearing loading, A266519 — HAMMER, soft

Place planetary needle bearing loading arbor in planetary pinion and load needle bearings around arbor, one at a time, until all 21 bearings are in pinion; lock bearings in pinion by twisting them with palm of hand (fig. 138). NOTE: Coat needle bearings and bore of gear with a film of PETROLATUM to facilitate installation. Place pinion thrust washers on arbor next to pinion and place assembly in carrier, lining it up so that pinion pin can be entered on side away from output shaft, thus forcing arbor out toward shaft end of assembly. Line up cotter key hole in pinion pin with hole in carrier; tap in pin, using a soft hammer,

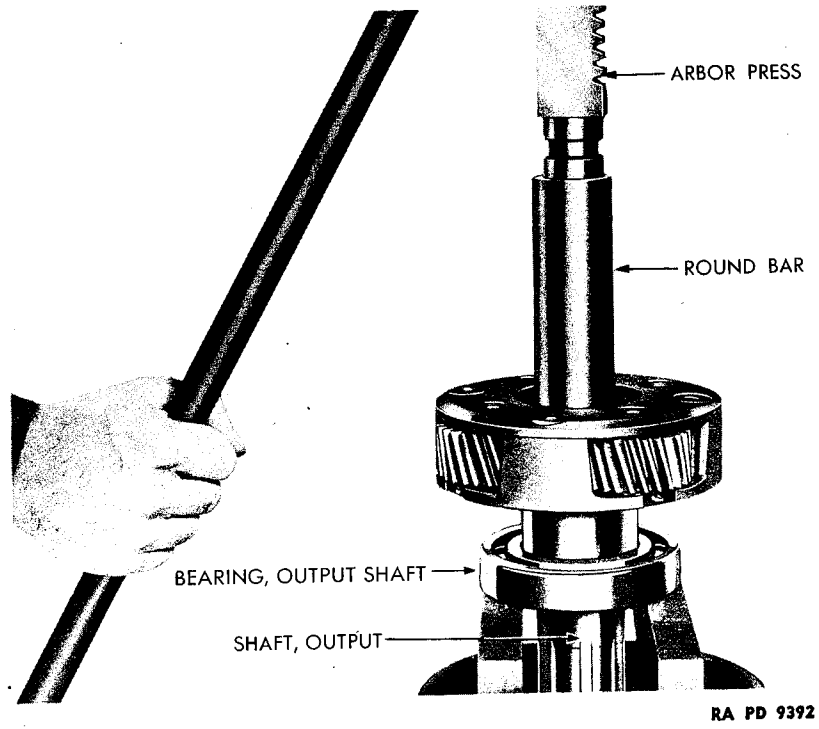

Figure 140 — Installing Output Shaft Bearing

forcing out arbor as pin is installed. Install a new cotter key through carrier and pinion shaft. Repeat these steps to install other three planetary pinions in output shaft carrier.

(2) INSTALL MAIN SHAFT PILOT BEARING RACE.

DRIVER, main shaft roller bearing, outer race, A266516 — HAMMER

Place output shaft on square blocks over hole in work bench. Install main shaft pilot bearing outer race in rear end of output shaft, using special driver (fig. 139). NOTE: End of race which is stamped with part number must be to outside. Install pilot bearing outer race retaining ring in output shaft.

(3) INSTALL OUTPUT SHAFT BEARING.

PRESS, arbor

Place output shaft bearing on bed of arbor press so that inner race contacts press. Position output shaft over bearing and install a round bar large enough to contact carrier and small enough to clear pinion

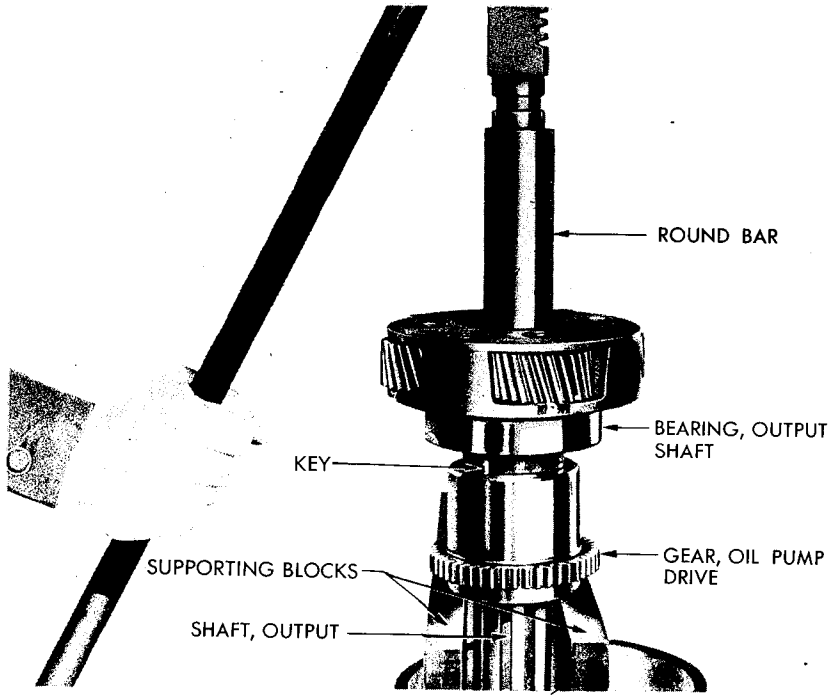

Figure 141 — Installing Oil Pump Gear

teeth (fig. 140). Press output shaft through bearing until bearing contacts shoulder on carrier.

(4) INSTALL OIL PUMP GEAR AND SLEEVE.

PRESS, arbor HAMMER

Tap Woodruff key for oil pump gear and sleeve into slot in output shaft (hammer). Place oil pump gear and sleeve on bed of arbor press, and position output shaft over sleeve so that slot in sleeve lines up with key on shaft. Press output shaft down until sleeve contacts output shaft bearing.

(5) INSTALL PLANETARY PINIONS IN DIRECT DRIVE CARRIER.

Install planetary pinions in direct drive carrier in same manner as for output shaft, as explained above in step (1). Drive pinion pins in from pinion end (toward internal gear) (fig. 142).

(6) INSTALL OUTPUT SHAFT.

BLOCK, 3-in.

Support brake drum on blocks on bench over hole for output shaft. Lower output shaft and front planetary assembly into brake drum so

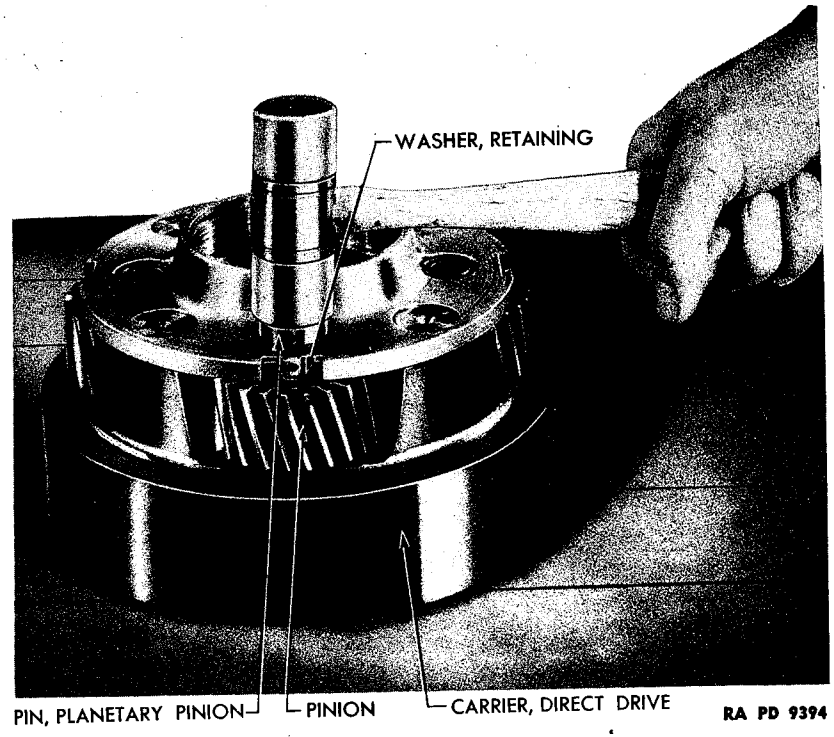

Figure 142 — Installing Pinion Pin in Direct Drive Carrier

that output shaft protrudes through hole in bench. Install main shaft pilot roller bearing in output shaft.

(7) INSTALL DIRECT DRIVE CARRIER.

Lower direct drive carrier into place, meshing internal gear with front planetary pinions (fig. 143).

(8) INSTALL MAIN SHAFT.

Install main shaft bearing on main shaft, using an arbor press if necessary. Install main shaft through direct drive carrier, carefully meshing center gears on shaft with front and rear planetary units (fig. 144). Make sure main shaft bearing is seated in direct drive carrier and install bearing retainer ring (fig. 145).

(9) INSTALL CLUTCH DRUM INTERNAL GEAR.

Install clutch drum internal gear over main shaft in brake drum, locating gear on two dowel pins in brake drum and meshing internal gear with rear planetary pinions in direct drive carrier. Tap internal gear, using a soft hammer, to make sure that it is firmly seated in drum (fig. 146).

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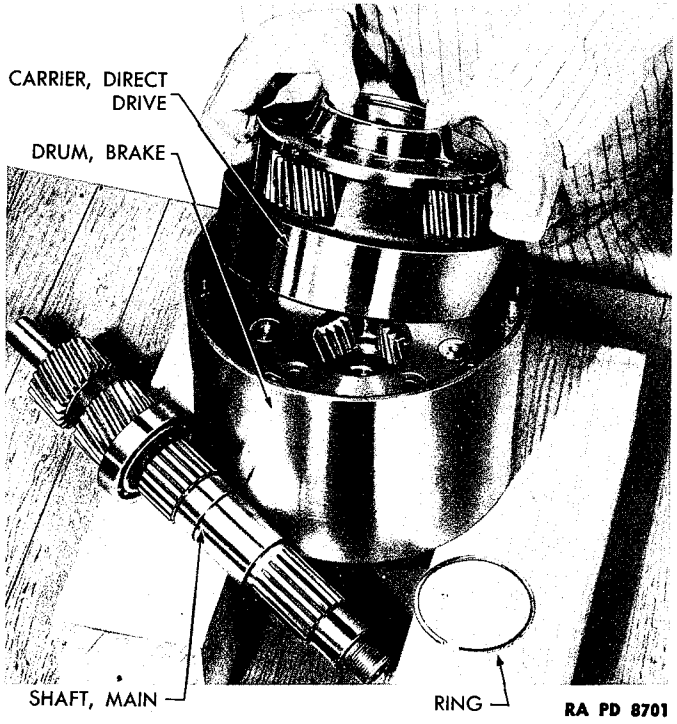

Figure 143 — Installing Direct Drive Carrier

(10) ASSEMBLE CLUTCH DRUM.

HAMMER, soft
WRENCH, socket, 9/16-in.

Position clutch cover on clutch drum so that arrows on each part line up (fig. 147) and install six screws holding cover to drum. Install clutch drum bearing in clutch drum by tapping *outer race* of bearing with a soft hammer. Make sure bearing is driven in evenly so as not to wedge it in drum. Position bearing retainer in drum and install four mounting screws and lock washers (fig. 148). Install the six clutch pistons in the bores, exercising particular care while compressing clutch piston rings.

(11) INSTALL CLUTCH PLATES.

PIN, guide, clutch and drum assembly, A266517

Install clutch hub on main shaft inside rear internal gear. **NOTE:** Oilholes in clutch hub must point *toward* output shaft. Install two guide pins in opposite clutch drum mounting screw holes in brake drum, finger-

TRANSFER UNIT

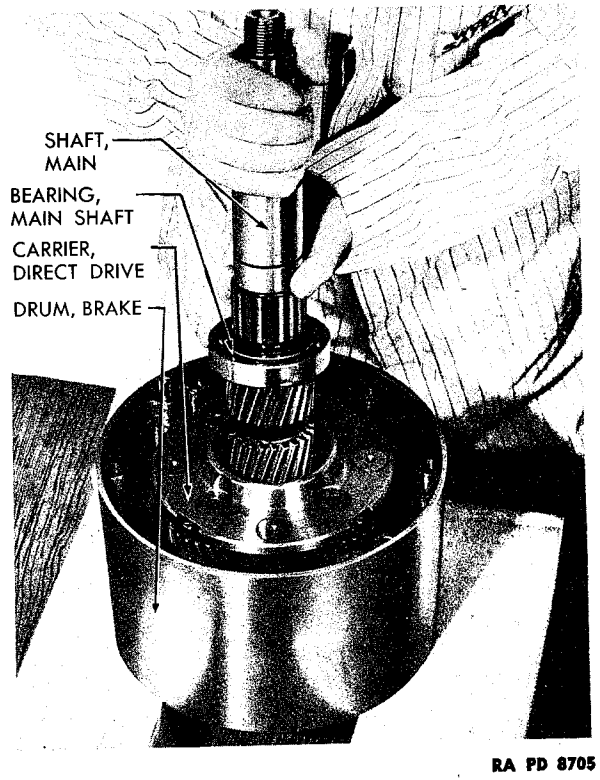

Figure 144 — Installing Transfer Unit Main Shaft

tight. Check clutch plates to see that there are 11 bronze and 10 steel plates. Install bronze and steel clutch plates alternately over guide pins, *starting with a bronze plate first.* Make sure steel clutch plates are installed so that the concave side of plate faces the connector unit end of the transfer unit or toward the rear of the vehicle. **NOTE:** All the later units and spare parts have the word "REAR" etched on the concave side of the plate (fig. 149). Square holes in steel plates should be over guide pins. **CAUTION:** Lubricate each plate as it is installed.

(12) INSTALL CLUTCH PRESSURE PLATE.

Install six clutch release springs and release spring guide pins in spring holes in brake drum (fig. 150). Install clutch pressure plate over top bronze clutch disk, making sure clutch release springs seat in pockets in clutch pressure plate (fig. 151).

(13) ASSEMBLE CLUTCH DRUM TO BRAKE DRUM.

WRENCH, open-end, 1/2-in.
WRENCH, socket, 5/8-in.
WRENCH, torque, 0 to 50 ft-lb

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

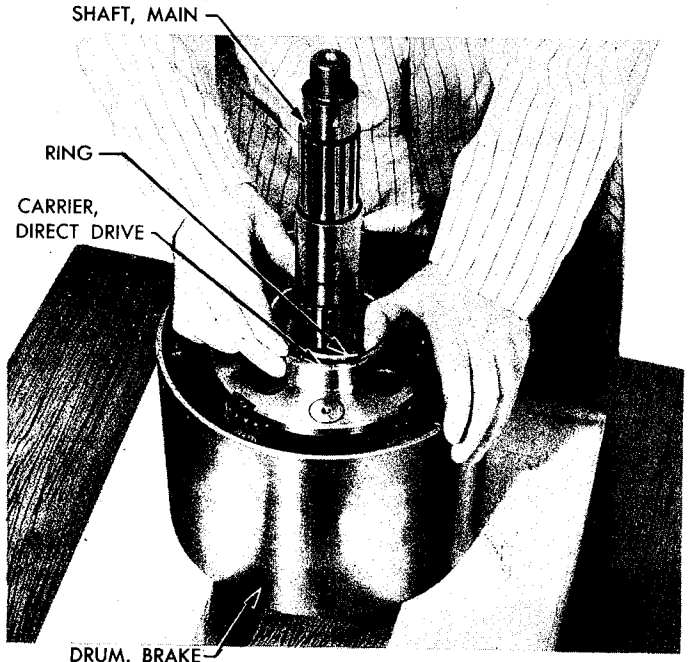

Figure 145 — Installing Main Shaft Bearing Snap Ring

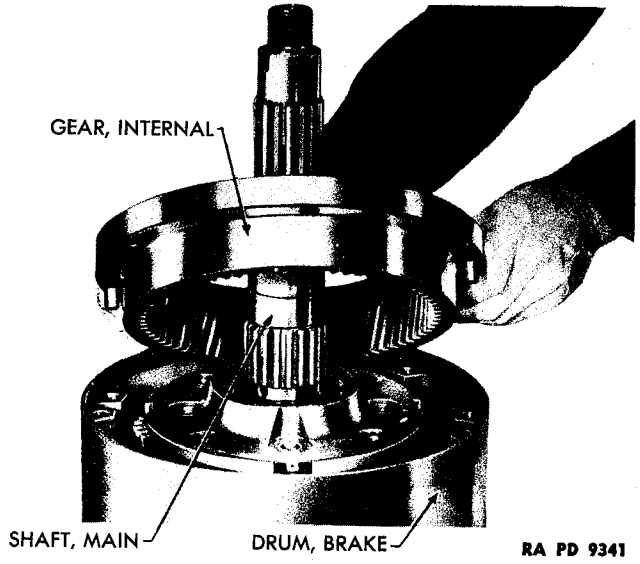

Figure 146 — Installing Clutch Drum Internal Gear

TRANSFER UNIT

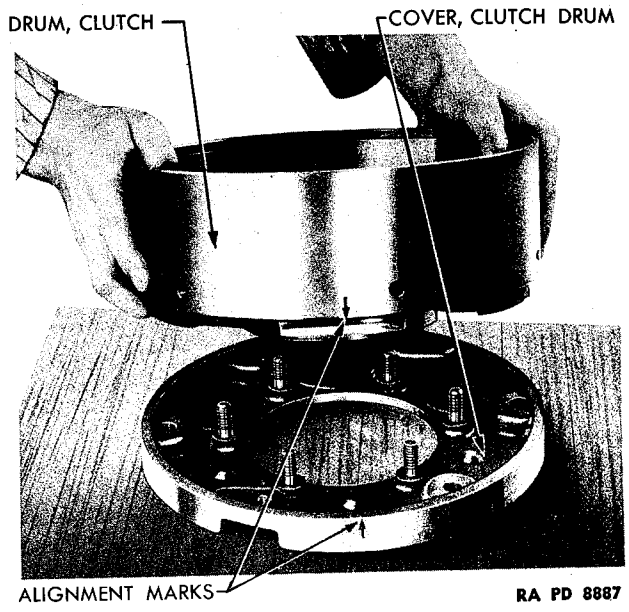

Figure 147 — Installing Clutch Cover on Drum

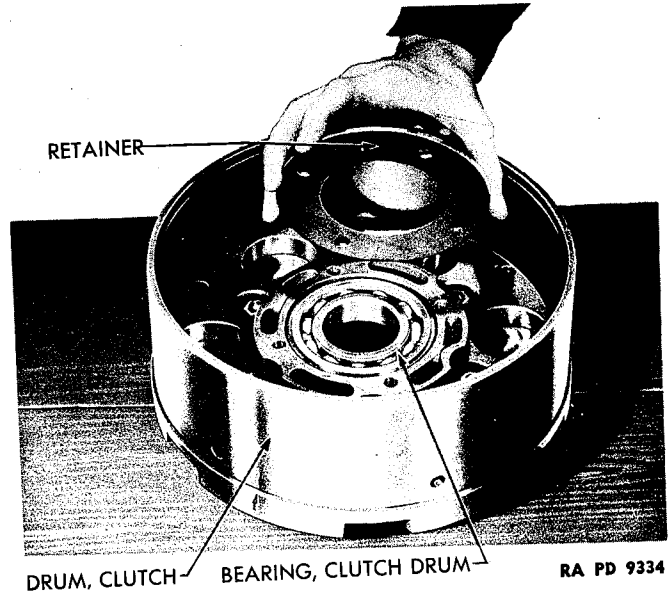

Figure 148 — Installing Clutch Drum Bearing Retainer

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

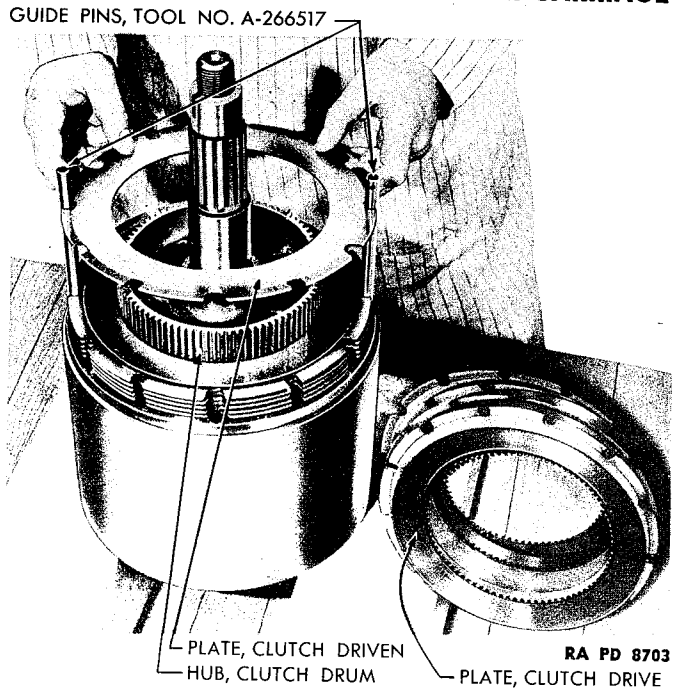

Figure 149 — Installing Clutch Plates

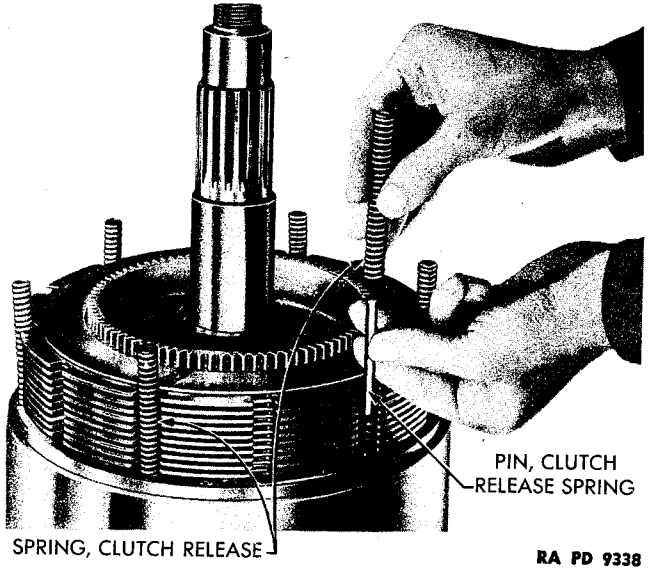

Figure 150 — Installing Clutch Guide Pins and Springs

TRANSFER UNIT

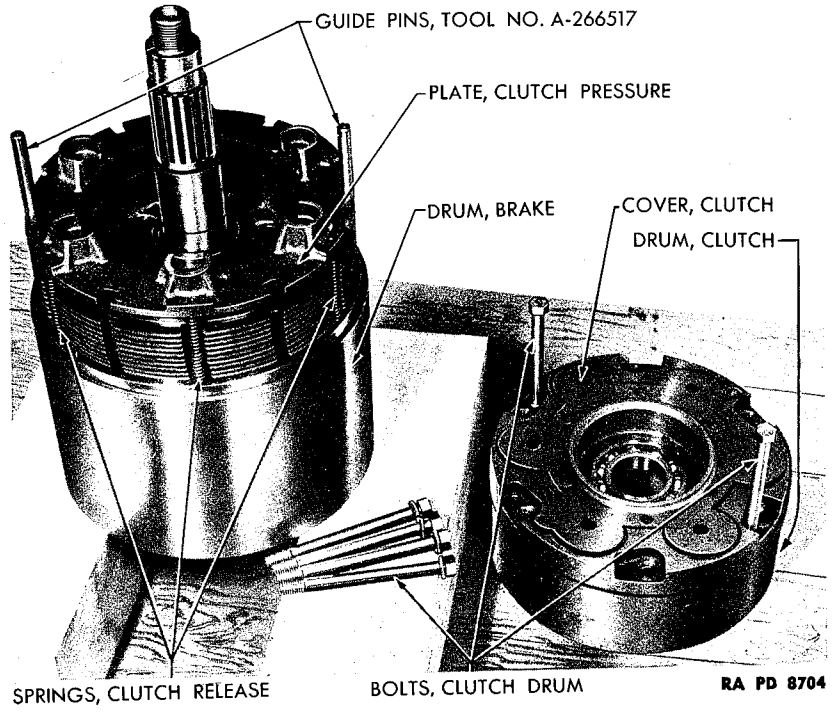

Figure 151 — Clutch Pressure Plate Installed

Install clutch drum over clutch pressure plate and clutch disks, making sure to aline holes in drum over guide pins. Install four clutch drum to brake drum mounting bolts and lock washers finger-tight. Remove two guide pins A266517 from brake drum. Install other two bolts and lock washers holding clutch drum to brake drum. Tighten all six clutch drum bolts to *35 foot-pounds only* (fig. 152). Recheck each screw twice. Bend up tangs on lock washers. Install lock ring on main shaft behind rear end of clutch bearing inner race.

c. Assemble Units into Transfer Case.

(1) INSTALL IDLER GEAR BEARING.

DRIVER, idler gear bearing, A266514 HAMMER, light

Install oil pump and governor idler gear bearing in idler gear by placing the gear over the jaws of a vise (jaws open) and driving in bearing, using the special driver. CAUTION: The numbered side of the bearing *must* point toward the driver (fig. 153). Drive bearing in until it is flush with both sides of gear.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

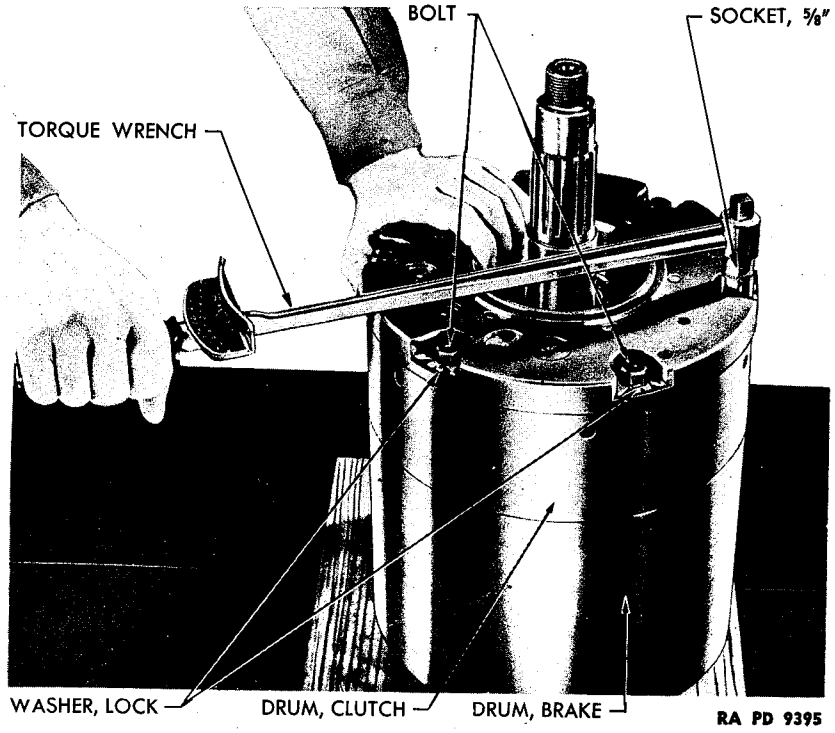

Figure 152 — Installing Clutch Drum on Brake Drum

(2) INSTALL OIL PUMP IDLER GEAR.
WRENCH, open-end, ½-in. (2)

Position oil pump and governor idler gear in transfer unit case with a steel thrust washer on each side of idler gear. Push idler gear shaft into position, making certain that bearing surface of shaft passes through both thrust washers. NOTE: Idler gear should have 0.004 inch to 0.016 inch end-play. Install idler gear shaft set screw lock plate, set screw, and lock nut, using a ½-inch open-end wrench. While holding set screw with one ½-inch open-end wrench, tighten set screw lock nut, using another ½-inch open-end wrench. Install lock wire through plate and screw (fig. 64).

(3) INSTALL OIL PUMP INTAKE SCREEN.
WRENCH, open-end, ½-in.

Install oil pump intake screen and cover in transfer unit case; install mounting screw and lock washer (½-in. wrench).

TRANSFER UNIT

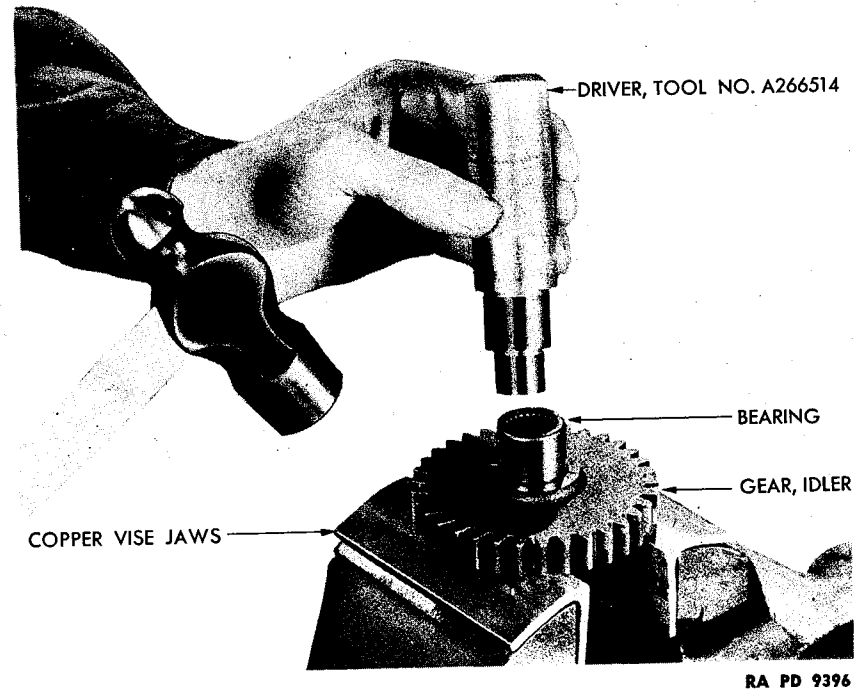

Figure 153 — Installing Idler Gear Bearing

(4) INSTALL LOW GEAR BAND.
WRENCH, socket, ¾-in. WRENCH, torque, 1-100 ft-lb

Lower band and clevis assembly into case. Slide low gear band lever into clevis on band, and install pin through lever and support on transfer unit case. Install three mounting screws and lock washers, tightening to 80 to 85 foot-pounds (fig. 154).

(5) INSTALL REVERSE BAND.

Lower reverse band and clevis assembly into case. Work lever through clevis and line up hole in lever with hole in transfer unit case. Install lever shaft holding band so that it does not cock and bind shaft. Install plug and a *new* gasket over lever shaft (fig. 59).

(6) INSTALL OIL LEVEL GAGE IN TRANSFER UNIT CASE.

(7) INSTALL DRUM AND GEAR ASSEMBLY.
HOIST HOOK, clutch and drum assembly, lifting, A266513

Install lifting hook on rear end of main shaft on drum and gear assembly and lock in place with main shaft nut installed finger-tight.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

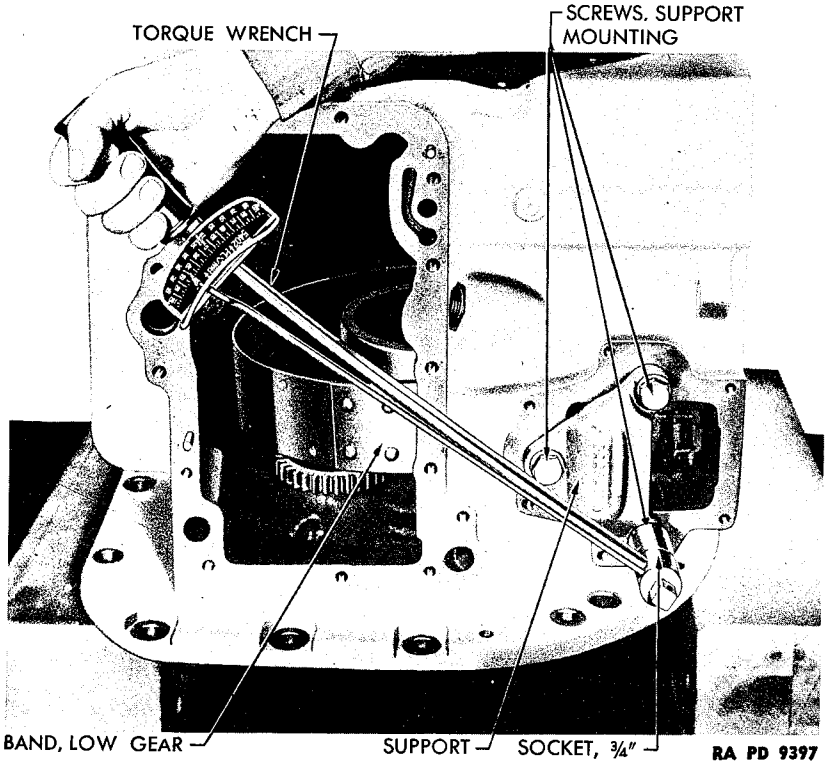

Figure 154 — Tightening Low Gear Band Support

Attach hoist to hook and raise entire drum and gear assembly up over transfer unit case. Lower drum and gear assembly slowly into transfer unit case, making sure that there is perfect alinement between drum and gear assembly and bands in transfer unit case. Reach in through oil pump and governor carrier mounting hole and guide drum and gear assembly. Also hold up two brake bands so that they do not wedge drum. CAUTION: It is essential that this part of assembly be handled very carefully so as not to damage babbitt bearing in brake drum while lowering drum assembly onto bearing support in front end of transfer unit case. Remove chain hoist and lifting hook from main shaft.

(8) INSTALL SPEEDOMETER DRIVEN PINION.
WRENCH, deep socket, 1¼-in.
Install speedometer driven pinion and support in transfer unit case.

TRANSFER UNIT

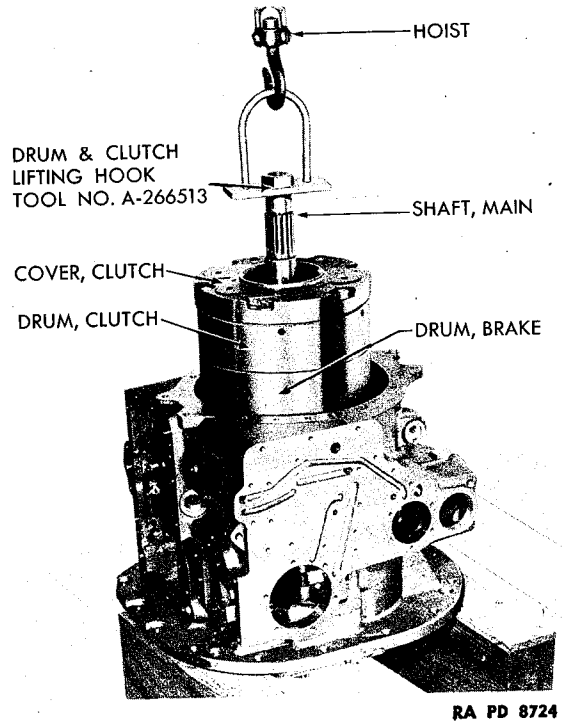

Figure 155 — Installing Drum and Gear Assembly

(9) INSTALL REAR COVER.
HAMMER, soft
INSTALLER, transfer unit cover oil ring, B248234

Install transfer unit rear cover gasket on dowel pins of transfer unit case, making sure that all oilholes line up. Position ring installer through three holes on cover and over rings (fig. 156), and place cover over main shaft and dowels. Keep the cover alined as closely as possible with case, and push it down onto case, tapping in place with a soft hammer if necessary. Pull installer out of cover. It will be partially pushed out as the installation is completed.

(10) INSTALL MAIN SHAFT SPACER.
COMPRESSOR, piston ring

Install main shaft spacer, using a standard piston ring compressor to compress oil rings. The beveled end of main shaft spacer extends inside transfer unit case (fig. 157).

d. Install Connector Gears and Case.

(1) INSTALL CONNECTOR GEARS.
HAMMER, soft
PUSHER, driven gear, B226840

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

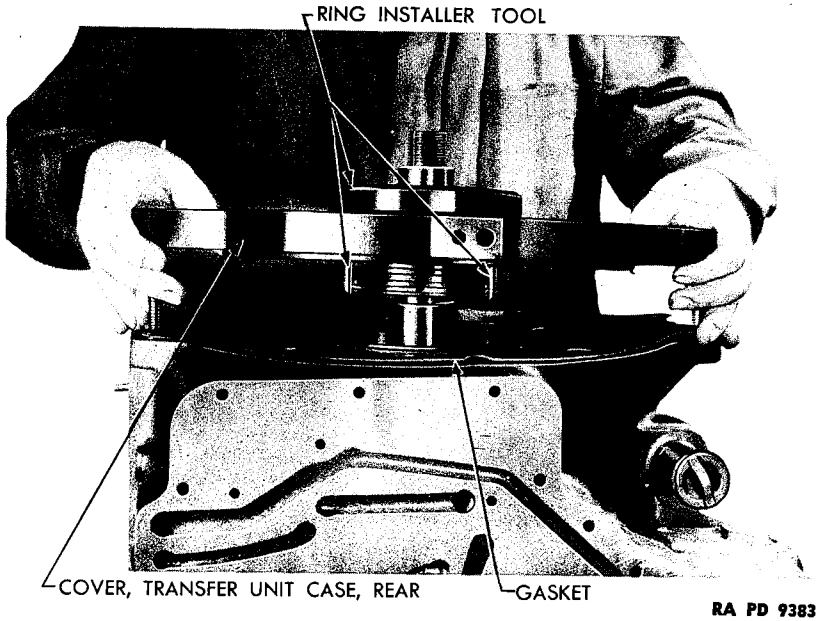

Figure 156 — Installing Rear Cover

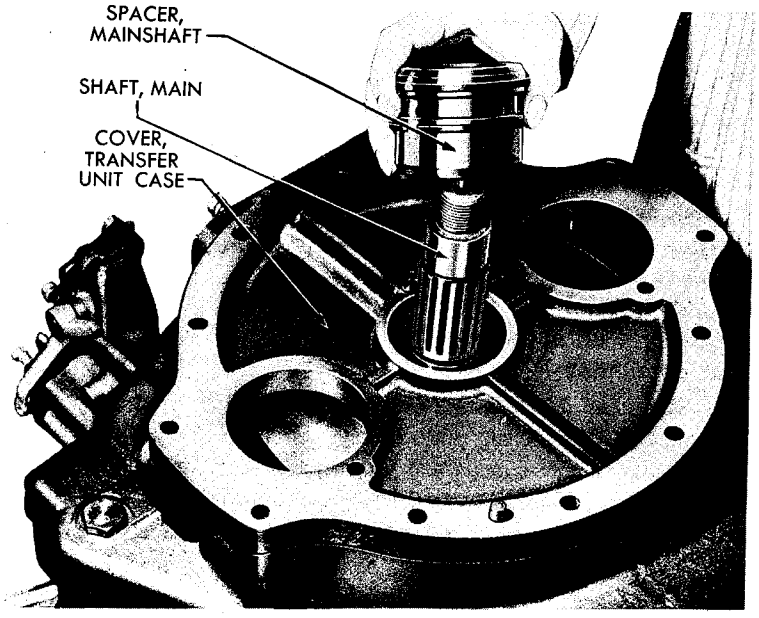

Figure 157 — Installing Main Shaft Spacer

TRANSFER UNIT

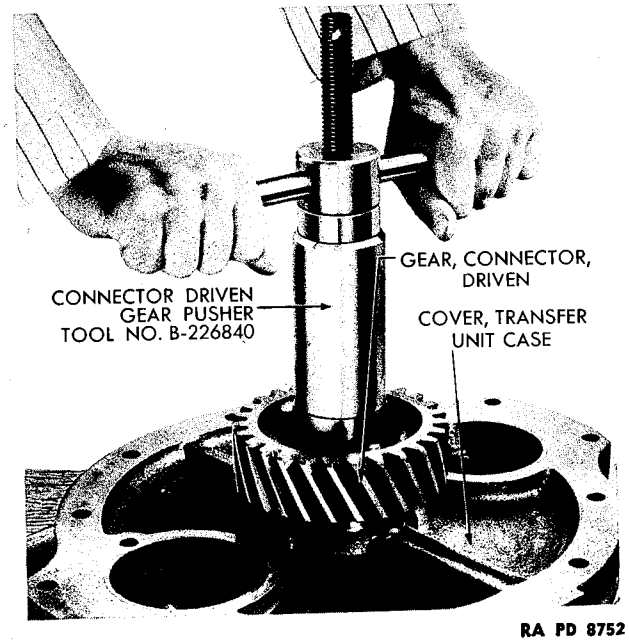

Figure 158 — Installing Connector Driven Gear

Install connector unit driven gear on splines on main shaft, using pusher (fig. 158). NOTE: The side of gear where splines are visible in gear hub goes up or to rear of transfer unit. Coat connector unit drive gear front bearings with heavy oil and install bearings on connector unit drive shafts, tapping in place with a soft hammer (fig. 159). Install connector unit drive gears and bearings in transfer unit rear cover, meshing the gear teeth with the driven gear in the cover. Coat splineways of gears with heavy OIL, engine, SAE 30, before installation.

(2) INSTALL CONNECTOR GEAR CASE.

CHISEL	SOCKET, $1\frac{13}{16}$-in.
HAMMER	WRENCH, open-end, $1\frac{15}{16}$-in.
HAMMER, soft	WRENCH, torque, 150 to 200-ft-lb
SOCKET, $\frac{5}{8}$-in.	WRENCH, torque, 0 to 100-ft-lb

Install connector gear case gasket on dowel pins in transfer unit rear cover. Install outer bearings for two connector drive gears and driven gear by tapping into case. Install case on dowel pins in rear cover and tap on edges to seat properly. Install 12 (4 long and 8 short) screws and lock washers that hold connector gear case to transfer unit rear cover, tightening to 50 to 55 foot-pounds. Install connector driven gear

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

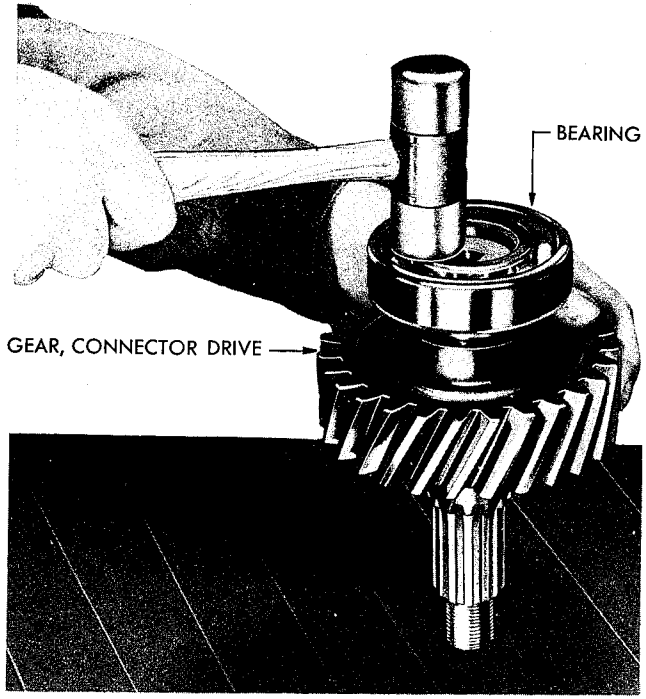

Figure 159 — Installing Connector Drive Gear Bearings

washer, lock plate, and retaining nut on main shaft (fig. 161). Tighten nut to 150 to 175 foot-pounds. NOTE: To hold main shaft stationary, install one universal joint yoke on one drive gear and hold with a $1\frac{15}{16}$-inch open-end wrench. Bend one or two tangs on connector driven gear retaining nut lock plate up around nut.

(3) INSTALL CONNECTOR GEAR CASE COVER.

HAMMER, light	WRENCH, socket, $\frac{5}{8}$-in.
REPLACER, input shaft oil seal, A293103	WRENCH, torque, 0 to 100-ft-lb

Install spacers over connector drive gear shafts with chamfered side upward (fig. 161). Install *new* connector drive gear oil seals in connector case cover, using oil seal replacer A293103 (fig. 162). Install connector gear case cover gaskets (same number as removed), making sure oil-hole for main shaft is not covered up by installation of gasket (fig. 163). Install 12 mounting stud nuts and lock washers holding connector gear case cover to case, tightening to 50 to 55 foot-pounds.

TRANSFER UNIT

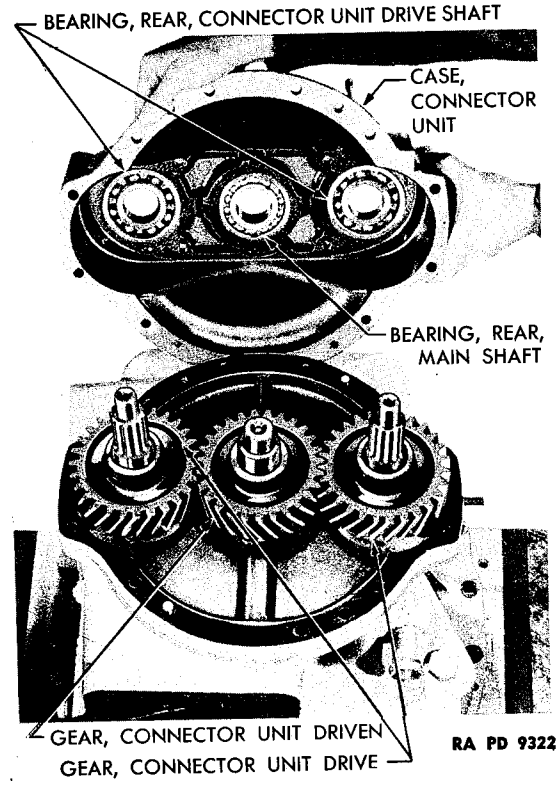

Figure 160 — Installing Connector Gear Case

(4) INSTALL UNIVERSAL JOINT YOKES.

CHISEL	HAMMER, light
DRIFT, brass	WRENCH, socket, $1\frac{1}{4}$-in.
HAMMER	WRENCH, torque, 150 to 200 ft-lb

Install universal joint yokes on connector drive gear shafts, using a hammer and a brass drift *applied to hubs of yokes.* Yokes should be parallel. Install *new* yoke retaining nuts and washers, and tighten them to 200 foot-pounds. Stake universal joint yoke retaining nuts lightly to connector drive gear shafts, using a chisel and light hammer.

e. Install Components on Top of Case.

(1) INSTALL CONTROL VALVE BODY.

SCREWDRIVER	SOCKET, $\frac{1}{2}$-in.
SOCKET, $\frac{7}{16}$-in.	WRENCH, torque, 0 to 25-ft-lb

Install gasket and top spacer plate (fig. 164) on top face of transfer unit case, making sure that all holes line up. Position control valve

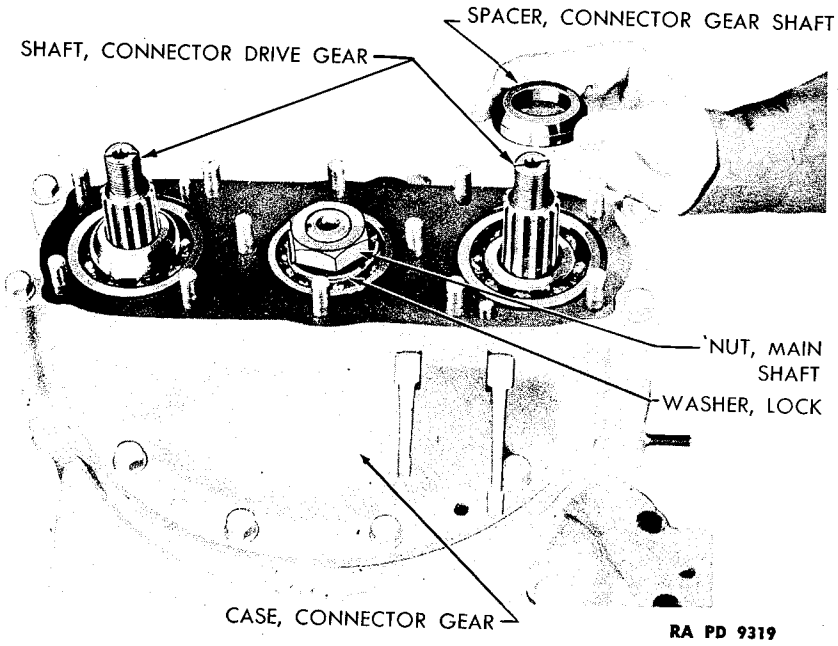

Figure 161 — Installing Connector Drive Gear Spacers

body on transfer unit case spacer. Install five control valve body mounting screws, tightening to 10 to 12 foot-pounds. Make sure that manual control valve is in place and install control valve body cover and a new gasket on transfer unit case (fig. 165). Remove sight plug from control valve body cover and check to see that button on end of selector lever shaft engages neck on end of manual control valve. Reinstall plug. Install nine short and three long control valve body cover mounting screws and lock washers, tightening screws to 15 to 18 foot-pounds.

(2) INSTALL REVERSE SERVO.

GAGE, low and reverse transit band adjusting, B226839
SCREWDRIVER
WRENCH, socket, ½-in.

While supporting reverse band at rear, reach in through reverse servo mounting hole with a metal hook and pull clevis pin on reverse band lever out toward adjusting hole. Hook lever under sleeve at end of band by forcing band around drum. Hold band and lever in position, using a screwdriver, through adjusting hole. Install gasket over reverse servo body and insert reverse servo in case, placing yoke of reverse servo over

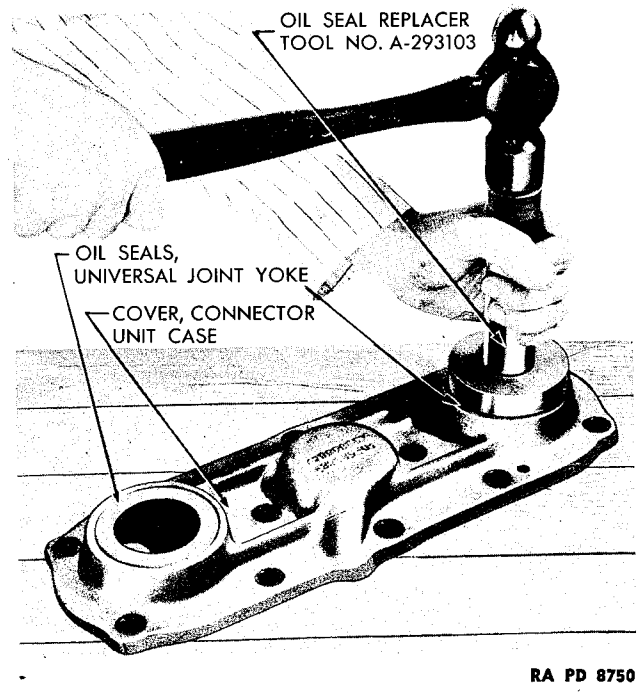

Figure 162 — Installing Connector Gear Cover Oil Seals

pin in reverse *band* lever with open end of hook toward adjusting hole. Install low and reverse transit band adjusting gage on reverse servo by turning power screw of tool into threaded end of reverse servo piston rod through hole in servo cover (fig. 166). Tighten pressure nut on tool until it contacts reverse servo cover. This will draw servo down into transfer unit case. See that boss on servo enters the bore in the case evenly and that gasket holes line up. Install six screws and lock washers holding reverse servo to transfer unit case (½-in. wrench). Remove low and reverse transit band adjusting gage.

(3) INSTALL LOW GEAR SERVO.

GAGE, low and reverse transit, band adjusting, B226839
WRENCH, socket, ½-in.

Install low and reverse transit band adjusting gage through hole in top cover of low gear servo turning end of pressure screw on tool into threaded end of piston rod. Tighten pressure nut until it contacts top cover of low gear servo. Install low gear servo gasket on servo body and place servo in mounting hole in transfer unit case. Line up servo

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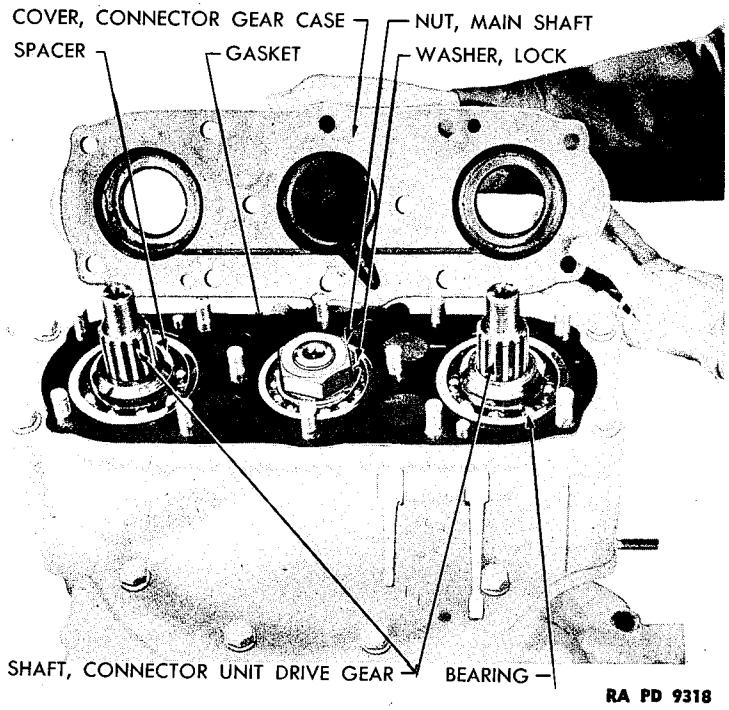

Figure 163 — Oil Seals and Gaskets in Connector Gear Cover

body mounting screw holes with holes in case and see that yoke on end of low gear servo piston rod is turned so that open end of yoke is away from low gear band. Hook low gear servo piston rod yoke into pin on actuating lever with open end of hook toward adjusting hole. NOTE: Wrap in low gear band to facilitate installation of servo. Tighten pressure nut on gage, and at the same time push servo into transfer unit case (fig. 167). When servo is drawn up close enough to transfer unit case, install six mounting screws and lock washers. Remove low and reverse transit band adjusting gage and install screw in top cover.

(4) INSTALL ADJUSTING PLUG AND COVER.

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

Install reverse servo adjusting plug and copper gasket ($1\frac{1}{16}$-in. deep socket wrench). Install *new* gasket for low gear servo adjusting cover; install cover and mounting screws ($\frac{1}{2}$-in. socket wrench).

(5) INSTALL OIL PUMP AND GOVERNOR CARRIER ASSEMBLY.

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

TRANSFER UNIT

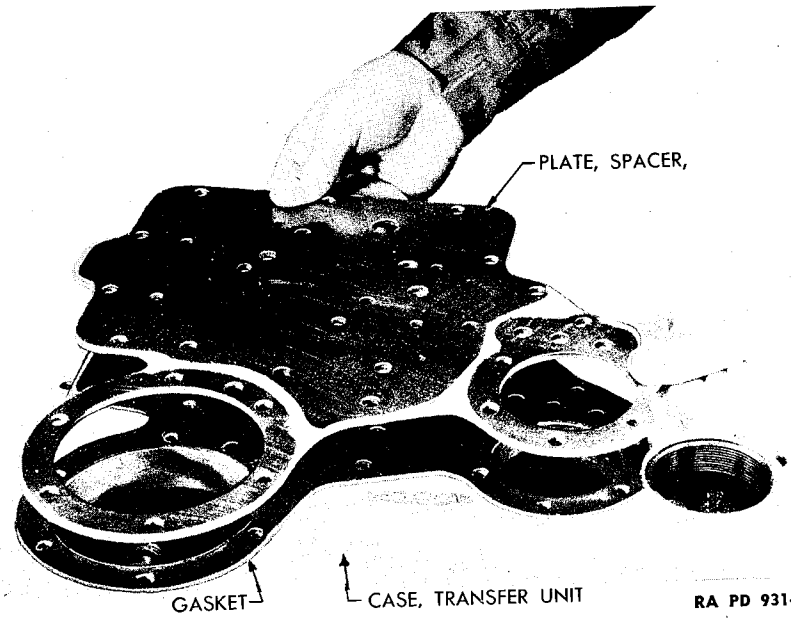

Figure 164 — Transfer Unit Spacer and Gasket

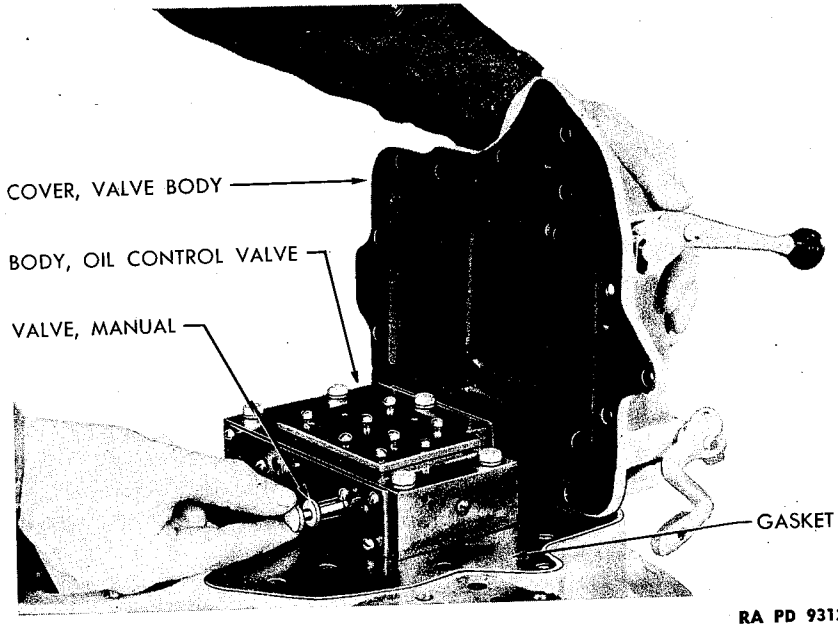

Figure 165 — Installing Control Valve Body Cover

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

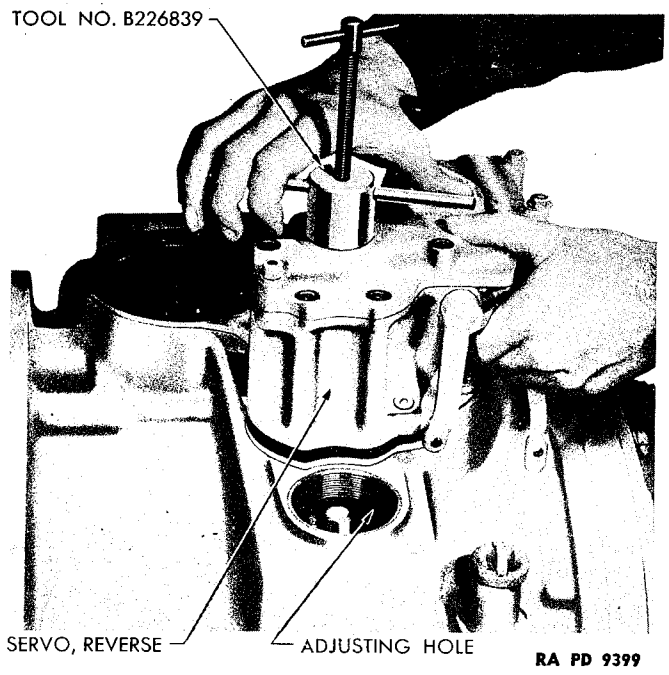

Figure 166 — Installing Reverse Servo

Install a new gasket on oil pump and governor carrier assembly, and position carrier on transfer unit case, meshing speedometer driven gear and oil pump idler gear (fig. 168). Be sure holes in cover line up with dowels in case. Install 14 screws and lock washers that hold carrier to transfer unit case.

(6) INSTALL SHIFT LEVER AND SELECTOR.
WRENCH, ½-in. WRENCH, 1⅛-in.

Install two screws holding selector to transfer unit case (½-in. wrench). Install poppet and poppet spring in shift lever (fig. 169). Slide shift lever through selector so that poppet on lever contacts underside of selector. Place spring washer over boss on transfer unit case, then heavy flat washer, and install pivot pin through selector lever and into case (fig. 170), tightening with 1⅛-inch wrench.

(7) INSTALL BRAKE BAND LUBRICATION TUBE.
WRENCH, socket, ½-in.

Install steering and brake band lubricating tube on front face of transfer unit case. Install steering and brake band lubricating tube retaining screw and lock washer.

TRANSFER UNIT

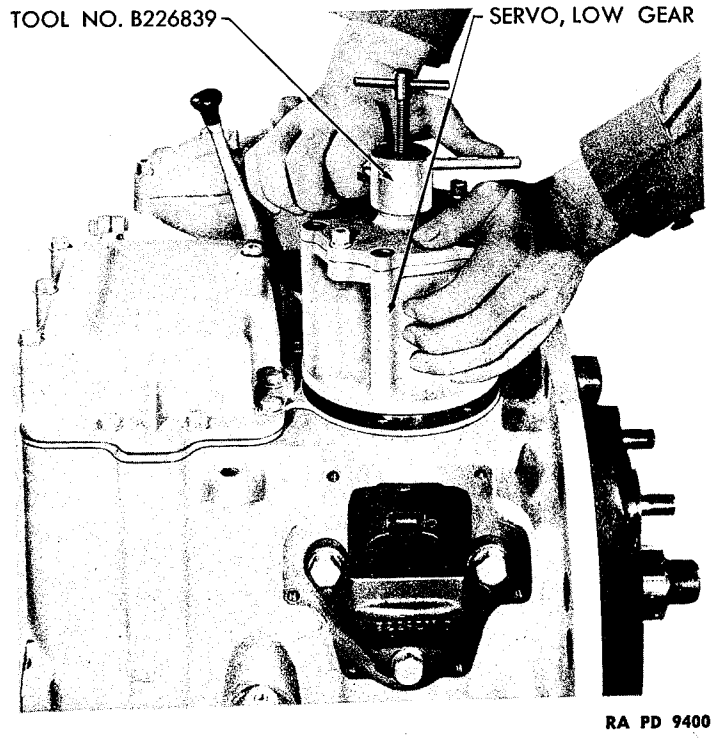

Figure 167 — Installing Low Gear Servo

f. Assemble Drive Pinion End of Transfer Unit.
(This operation is covered in paragraph 18 **d.**)

g. Assembly of Oil Cooler Unit, and Lines.

(1) ASSEMBLE OIL COOLER UNIT.
WRENCH, open-end, $^{15}/_{16}$-in.

Install connector (fig. 21) on elbow at rear end of oil cooler.

(2) ASSEMBLE OIL COOLER LINES.
WRENCH, open-end, 1⅛-in. (2)

The upper front oil cooler line is assembled to the transfer unit-to-oil cooler rear hose line by means of a union, two sleeves and two nuts (fig. 21). The lower front oil cooler line is assembled to the transfer unit-to-oil cooler front hose in the same manner.

18. INSTALLATION OF TRANSFER UNIT.

a. It is necessary when installing a transfer unit in a vehicle first to assemble the transfer unit to the controlled differential inasmuch as

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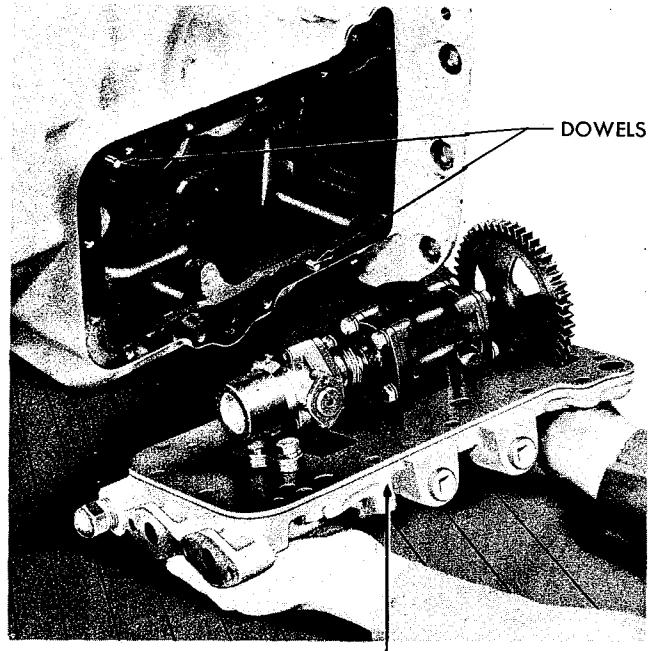

Figure 168 — Installing Oil Pump and Governor Carrier

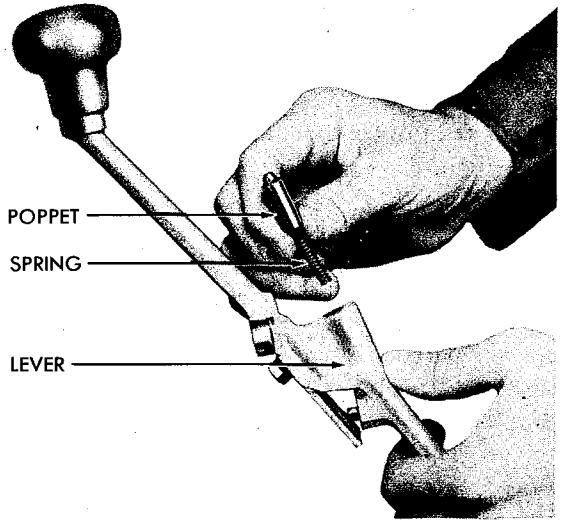

Figure 169 — Installing Selector Lever Poppet and Spring

TRANSFER UNIT

these two units are always removed or installed as one operation. The procedure covering this is given in the following paragraphs.

b. Equipment.

CHISEL
FIXTURE, track connecting, B248215
HAMMER, light
HOIST
PLIERS
PLIERS, side-cutting
PRUSSIAN BLUE
PRYBAR
PUNCH, brass
PUSHER, pinion, B226794
SLING, controlled differential and transfer unit, C105885
SLING, front deck, engine roof and gun turret, B226796
SLING, transfer unit, B226795
SOCKET, 15/16-in.
SOCKET, 2-in.
WRENCH, deep socket, 1 1/16-in.
WRENCH, open-end, 3/8-in.
WRENCH, open-end, 7/16-in.
WRENCH, open-end, 1/2-in.
WRENCH, open-end, 9/16-in.
WRENCH, open-end, 3/4-in.
WRENCH, open-end, 7/8-in.
WRENCH, open-end, 15/16-in.
WRENCH, open-end, 1 15/16-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, 7/8-in.
WRENCH, socket, 15/16-in.
WRENCH, socket-head set screw, 7/16-in.
WRENCH, socket-head set screw, 9/16-in.
WRENCH, socket-head set screw, 3/4-in.
WRENCH, spanner, B226891
WRENCH, torque, 100 to 200 ft-lb

c. Selection of Transfer Unit Pinion Shims. Before installing the transfer unit on the controlled differential, it is necessary to determine the correct sizes of transfer unit drive pinion shims required. If the same pinion is installed, the original pinion shims may be installed, if they are in good condition. If a new pinion is installed shims must be checked and a new differential ring gear must be installed, as the ring gear and pinion are furnished in matched sets.

(1) MEASUREMENTS REQUIRED. Inasmuch as the backlash between the transfer unit pinion and the controlled differential ring gear depend partially upon the pinion shims behind the pinion, a number of measurements are required. These include the distance from the centerline of the controlled differential ring gear to the rear face of the differential housing; the distance from the front face of the transfer unit to the bottom of the pinion bearing counterbore; the thickness of the pinion bearing; and the cone distance of the pinion itself. To determine proper pinion shim thickness, proceed as follows:

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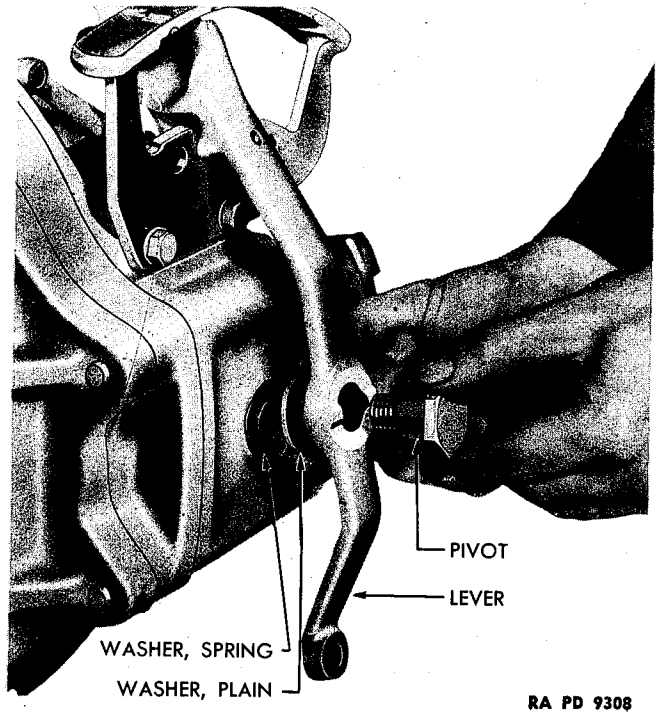

Figure 170 — Installing Selector Lever

(*a*) *Distance from Centerline of Controlled Differential Ring Gear to Rear Face of Differential Housing.* Record pinion shim code number for distance from centerline of controlled differential ring gear to rear face of differential housing. This shim code number (0.0125″ to 0.0225″) is stamped on differential housing just above rear face where transfer unit mounts and directly above transfer unit pinion (fig. 171). **NOTE:** The actual distance (9.5575″ to 9.5675″) is also stamped just above pinion shim code number.

(*b*) *Distance from Front Face of Transfer Unit to Bottom of Pinion Bearing Counterbore.* Record pinion shim code number for distance from front face of transfer unit, which contacts controlled differential, to bottom of pinion bearing counterbore. This code number (0.000″ to 0.010″) is stamped on top of transfer unit case just ahead and to the right of the low gear servo. **NOTE:** The actual distance (0.156″ to 0.166″) is also stamped next to the pinion shim code number.

(*c*) *Distance from Rear Face of Pinion to Center Line of Controlled Differential Ring Gear.* Record pinion shim code number for

TRANSFER UNIT

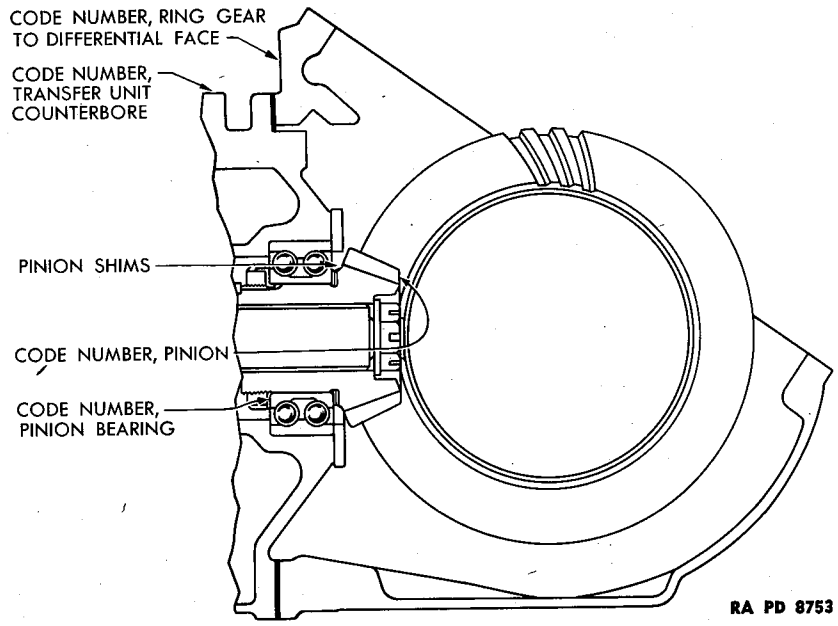

Figure 171 — Selecting Pinion Shims

distance from rear face of pinion to center line of controlled differential ring gear. This code number (0.000″ to 0.010″) is etched on front end of transfer unit pinion and is preceded by the letters "CD".

(*d*) *Thickness of Pinion Bearing.* Record pinion shim code number for thickness of pinion bearing. This code number (0.000″ to 0.005″) is etched on inner race of bearing. **NOTE:** The actual thickness (2.1825″ to 2.1875″) is also etched on bearing.

(*e*) *Determine Thickness of Pinion Shim.* Add the four measurements obtained in steps (*a*), (*b*), (*c*), and (*d*) above. The answer is the thickness of the pinion shim required. **NOTE:** When selecting shims to obtain this total thickness always install shim which comes closest to total of pinion shim code numbers.

d. Installation of Transfer Unit on Controlled Differential.

(1) ASSEMBLE PINION AND BEARING ASSEMBLY.

CHISEL	WRENCH, open-end, $1\frac{15}{16}$-in.
HAMMER	WRENCH, spanner, B226891

Select proper sizes of pinion shims and slip shim or shims over rear end of transfer unit pinion. Install pinion bearing over rear end of pinion and push firmly into place on pinion behind pinion shims

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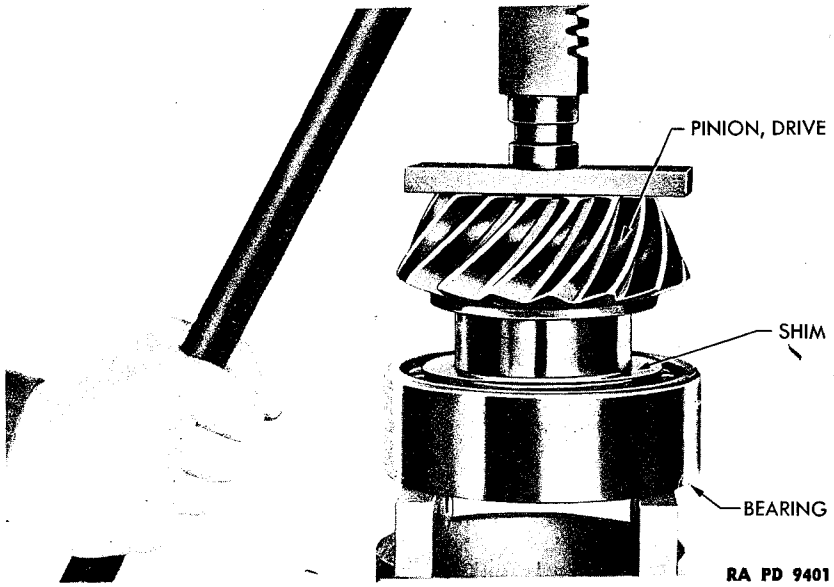

Figure 172 — Installing Pinion Bearing

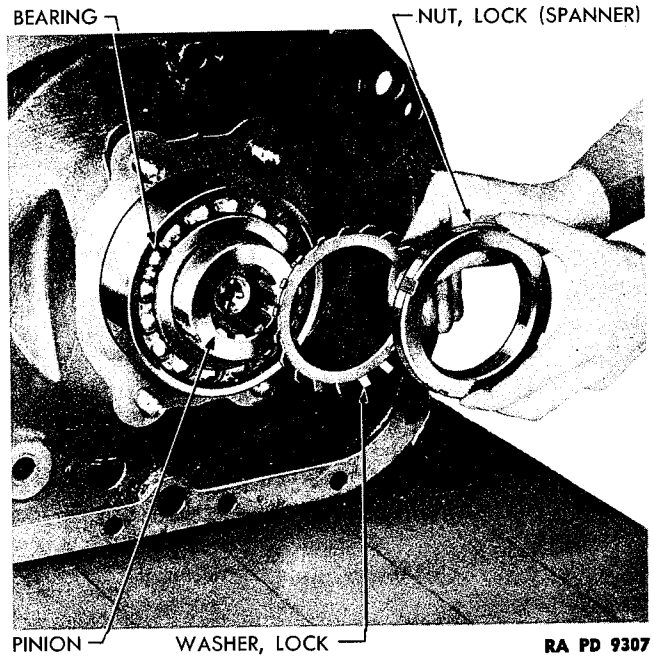

Figure 173 — Pinion Bearing Spanner Nut and Lock Plate

TRANSFER UNIT

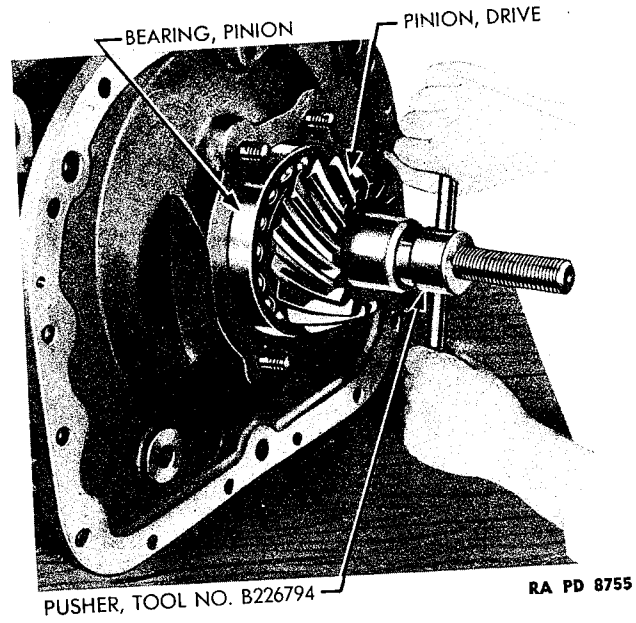

Figure 174 — Installing Pinion

(fig. 172). Install a *new* pinion bearing spanner nut lock plate on rear end of pinion just behind pinion bearing and install pinion bearing spanner nut on pinion finger-tight (fig. 173). Push pinion and bearing assembly onto output shaft with gear end of pinion *toward* transfer unit. Hold output shaft stationary by installing a $1\frac{15}{16}$-inch open-end wrench on a universal joint yoke and tighten spanner nut, using wrench B226891. Remove pinion from output shaft. Bend locking tangs of spanner nut lock plate up over spanner nut.

(2) INSTALL PINION ASSEMBLY ON OUTPUT SHAFT.

PLIERS	SOCKET, 2-in.
PUSHER, pinion, B226794	WRENCH, open-end, $1\frac{15}{16}$-in.
SOCKET, $\frac{15}{16}$-in.	WRENCH, torque, 100 to 200-ft-lb

Push pinion, pinion bearing and spanner nut assembly on front end of transfer unit output shaft as far as it will go with gear end of pinion *away* from transfer unit, engaging splineways of pinion with splines on output shaft. Install pusher B226794 on output shaft, tightening pressure screw of tool on output shaft finger-tight. Push transfer unit pinion into place on output shaft by tightening T-handle (fig. 174). Install pinion retaining nut and flat washers on front end of output shaft, tightening to 200 foot-pounds minimum (fig. 175). NOTE: Hold

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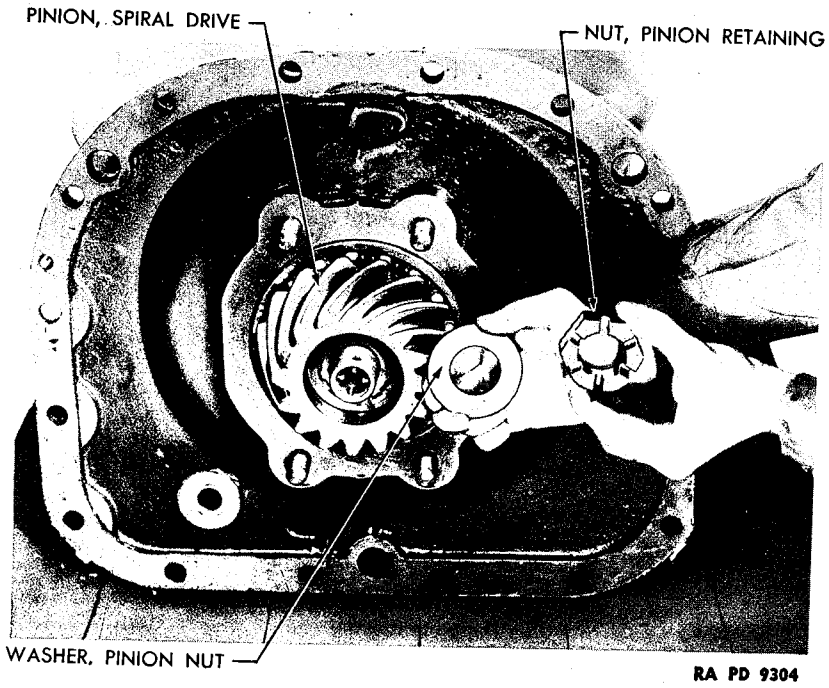

Figure 175 — Pinion Retaining Nut and Washer

output shaft from turning while installing pinion retaining nut by placing a $1\frac{15}{16}$-inch open-end wrench over one of the universal joint yokes at input end of transfer unit. Install pinion retaining nut cotter key. Position output shaft bearing retainer on front face of transfer unit case and install mounting stud nuts, tightening to 160 to 170 foot-pounds. Install lock wires in bearing retainer mounting studs and nuts.

(3) INSTALL TRANSFER UNIT ON CONTROLLED DIFFERENTIAL.

HOIST	WRENCH, open-end, $\frac{15}{16}$-in.
SLING, transfer unit, B226795	WRENCH, socket, $\frac{5}{8}$-in.
WRENCH, open-end, $\frac{7}{8}$-in.	WRENCH, socket, $\frac{7}{8}$-in.

Install a *new* gasket on front face of transfer unit housing. Install transfer unit sling B226795, on transfer unit attaching sling bolts into sling screw holes on transfer unit case (fig. 176). Connect a hoist to sling and lift transfer unit assembly into place on controlled differential housing, being very careful to avoid damage to parts while engaging transfer unit pinion with controlled differential ring gear. Install nine

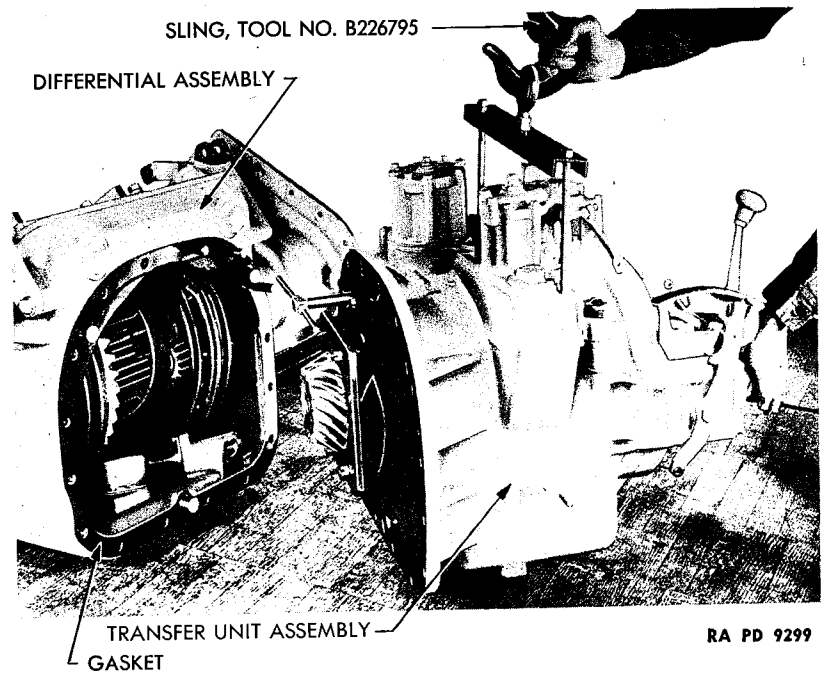

Figure 176 — Installing Transfer Unit on Controlled Differential

screws and lock washers holding transfer unit to controlled differential. Install three stud nuts and lock washers holding transfer unit to controlled differential ($\frac{15}{16}$-in. wrench). Install four bolts, nuts, and lock washers holding transfer unit to controlled differential ($\frac{7}{8}$-in. and $\frac{15}{16}$-in. wrenches). Remove sling from transfer unit ($\frac{5}{8}$-in. socket wrench) and disconnect hoist from sling. CAUTION: Before installing transfer unit and controlled differential assembly in vehicle; or before releasing assembly to using arms, the tooth contact of the transfer unit pinion and controlled differential ring gear must be checked as explained in subparagraph c above.

e. Checking Ring Gear and Pinion Tooth Contact.

(1) REMOVE CONTROLLED DIFFERENTIAL FRONT COVER.

WRENCH, socket, $\frac{5}{8}$-in.	WRENCH, socket, $\frac{3}{4}$-in.

NOTE: Before checking tooth contact, the correct thickness of transfer unit pinion shims should be determined as explained in subparagraph **c** above, and the transfer unit installed on the differential as explained in subparagraph **d** above. CAUTION: The controlled differential must be clean and free from lubricant when checking tooth

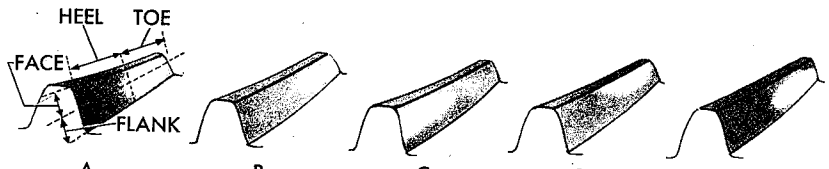

Figure 177 — Ring Gear and Pinion Tooth Contact

contact. Remove 18 screws and lock washers holding controlled differential front cover to housing. Remove cover and cover gasket from differential housing.

(2) CHECK TOOTH CONTACT.

PRUSSIAN BLUE WRENCH, open-end, $1\frac{15}{16}$-in.

Smear a small quantity of PRUSSIAN BLUE on controlled differential ring gear teeth. Install a $1\frac{15}{16}$-inch open-end wrench on one transfer unit connector drive gear universal joint yoke, and rotate yoke until differential ring gear has made one complete revolution. NOTE: Apply steering brake bands by tightening band adjusting nuts until about 40 foot-pounds torque is required to rotate universal joint yoke. Check tooth contact of transfer unit pinion and controlled differential ring gear. Contact will be indicated by a clean spot on each ring gear tooth (fig. 177). If contact is centralized on face of ring gear teeth (bottom to top of teeth) and in the toe position (center to inside edge of tooth), tooth contact is normal. Proper contact is approximately 1½ inches long, therefore, it should extend slightly past toe position. Using SOLVENT, dry-cleaning, wash PRUSSIAN BLUE from gears and install differential housing cover.

(3) ADJUST RING GEAR AND PINION TOOTH CONTACT. (Refer to TM 9-1727E.)

f. Installation of Transfer Unit and Controlled Differential.

(1) INSTALL HOUSING TO HULL SHIMS. Measure distance between inside edges of hull walls of vehicle and measure total length of differential housing; subtract the length of the differential housing from the inside width of the hull to obtain sizes of differential housing-to-hull shims required for installation of differential and transfer unit. NOTE: If controlled differential and transfer unit are installed on vehicle from which they were removed, step (1) need not be performed. Two types

of differential housing-to-hull shims are available: first, there are base shims of which there are two thicknesses, ¼-inch and $\frac{7}{32}$-inch; second, there are adjustment shims of 0.010-inch, 0.015-inch, 0.020-inch and 0.025-inch thicknesses to obtain the final adjustment of differential housing-to-hull wall clearance. Select first the correct size base shim and then the correct size of one or more adjustment shims, allowing not over 0.010-inch final clearance between differential housing and hull walls. Install thick shim on right side of differential housing, tightening it in place with three flat head screws. NOTE: This applies to later vehicles only. On the first vehicles, the thick shim is not installed until the transfer unit and differential are in the vehicle. In addition, the thick shim is installed next to the hull on the first vehicles.

(2) INSTALL TRANSFER UNIT AND CONTROLLED DIFFERENTIAL SLING.

HOIST SLING, controlled differential and transfer unit, C105885

Install transfer unit and controlled differential sling C105885 on differential housing. Sliding hooks on sling should extend under rib on bottom of housing (fig. 25). Lock hooks in position, using clevis pins and cotter pins provided. Connect a hoist to transfer unit and controlled differential assembly sling and lift assembly with hoist even with opening in front of vehicle. NOTE: Make sure vehicle is in level position.

(3) INSTALL TRANSFER UNIT AND CONTROLLED DIFFERENTIAL ASSEMBLY IN HULL.

WRENCH, open-end, ¾-in. WRENCH, socket, $\frac{7}{8}$-in.
WRENCH, socket, ¾-in. WRENCH, socket, $\frac{15}{16}$-in.

Push transfer unit and controlled differential assembly through opening in front of hull until cap screw holes on ends of housing line up with mounting holes in hull. Install three differential-housing-to-hull bolts through left end of differential housing and hull, tighten bolts with a ¾-inch socket wrench on bolt head outside of vehicle, and a ¾-inch open-end wrench on nut on inside of vehicle. NOTE: One bolt should be installed in the third hole from the top of the differential housing, one bolt at the extreme front of the housing, and the third bolt in the third hole up from the bottom of the differential housing. Install two bolts through right end of differential housing and hull but do not tighten the bolt at the extreme front of the differential housing. On first type vehicles, install a thick shim between right side of differential housing and hull, and install as many thin shims as possible between thick shim and differential housing. On second type vehicles, install as many thin shims as possible between the thick shim previously installed and the side of the hull. NOTE: It will be necessary to slot out the holes in the shims which mount around the two bolts. Install a third bolt through bolt hole on extreme front on right end of differential housing and hole

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in hull, and tighten all three bolts on end of differential housing, using a ¾-inch socket wrench on bolt head outside of vehicle and a ¾-inch open-end wrench on nut on inside of vehicle. Remove three bolts holding left end of differential housing from hull, measuring clearance between left end of differential housing and hull. If clearance exceeds 0.010 inch, a thin shim should be installed between left end of housing and hull wall. NOTE: Occasionally, a clearance over 0.010 inch will be noted at one portion of the housing while other portions of the housing will have normal clearance. If this occurs, a thin shim should be cut apart and a piece installed at the point of maximum clearance. Install remainder of bolts holding ends of differential housing to hull as explained above. Install 21 screws holding nose armor casting to hull floor. Disconnect hoist from sling and disconnect sling from controlled differential housing by removing cotter pins and clevis pins which lock sling hooks in position.

(4) INSTALL FILLER BLOCKS AND SHIMS.

WRENCH, socket, ⅞-in.

Position filler blocks and filler block shims, either ¼ inch or 7/32 inch thick as required, above each end of differential housing and position flange on each front fender over bolt holes in each filler block. Install two cap screws and lock washers holding each of the two filler blocks and front fender mounting flanges to hull.

(5) CONNECT OIL COOLER LINES.

WRENCH, socket, ½-in.

Position both transfer unit and controlled differential oil cooler pipes and mounting brackets on transfer unit case, and install four mounting screws and lock washers. NOTE: Install two *new* gaskets under each bracket.

(6) CONNECT UNIVERSAL JOINTS AT TRANSFER UNIT.

CHISEL — WRENCH, open-end, ½-in.
HAMMER — WRENCH, open-end, 9/16-in.

Slide propeller shafts toward front of vehicle, opening sliding joints, and line up universal joint yokes on transfer unit with universal joint bearing caps on propeller shafts. Position *new* locking plates on bearing caps on universal joints, and install four mounting screws that hold bearing caps on each propeller shaft to each yoke with 20 to 25 foot-pound torque on screws. Bend over locking plates, using a chisel and a light hammer. Position both propeller shaft universal joint covers in place above propeller shafts and install seven screws and lock washers holding covers to propeller shaft covers.

(7) CONNECT AND ADJUST MANUAL CONTROL LINKAGE TO SHIFT LEVER ON TRANSFER UNIT. See paragraph 10 **d**.

TRANSFER UNIT

(8) CONNECT AND ADJUST THROTTLE CONTROL LINKAGE TO TRANSFER UNIT. See paragraph 10 **d**.

(9) INSTALL HAND THROTTLE CABLE.

PLIERS — WRENCH, open-end, ¾-in.

Push rear end of hand throttle cable through differential web and install mounting nut. Connect hand throttle cable to accelerator pedal relay.

(10) INSTALL SIREN SWITCH AND CABLE.

WRENCH, socket, ½-in.

Slide siren switch and cable underneath differential housing, and line up siren switch in position on hull floor. Install two siren switch mounting screws and lock washers, and insert siren switch cable in clip on nose armor plate casting.

(11) INSTALL INSTRUMENT PANEL.

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

Swing instrument panel forward into position crosswise to hull side walls and install two screws and lock washers holding upper right instrument panel mounting bracket to upper front deck. NOTE: Hand throttle cable bracket should be installed between instrument panel bracket and front deck before installing screws. Install two screws and lock washers, holding lower left instrument panel mounting bracket to hull side wall.

(12) CONNECT STEERING AND BRAKING LEVERS.

HAMMER, light — PUNCH, brass
PLIERS, side-cutting

Position each of the two steering and brake lever assembly links to mounting brackets on each side of differential housing and install clevis pins and cotter keys, using a brass punch, a light hammer and a pair of side-cutting pliers. Adjust steering and brake bands as explained in paragraph 10 **c**. NOTE: The remaining steps are performed while working outside of vehicle.

(13) CONNECT INSTRUMENT PANEL CONDUITS AND SHAFTS.

PLIERS — WRENCH, open-end, 9/16-in.
WRENCH, open-end, ⅜-in. — WRENCH, socket, 9/16-in.

Position both stoplight switches on differential housing and install two mounting screws and lock washers holding each switch to differential housing. Position blackout light resistor on differential housing and secure with four screws and lock washers (⅜-in. open-end wrench). Connect all electrical conduits, speedometer shaft, and two tachometer shafts to instrument panel (fig. 178). Position two cable and conduit clips over cables and install retaining screws. Insert other cables into snaptype

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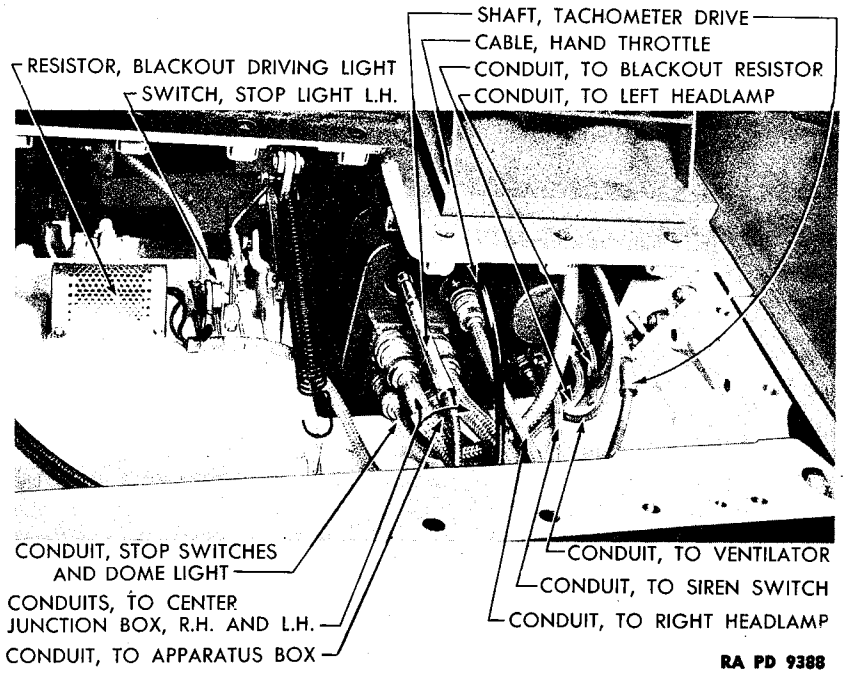

Figure 178 — Connection at Rear of Instrument Panel

clips. Connect speedometer shaft to transfer unit. Position head lamp stowage case on differential housing and install stowage case bracket mounting screws and lock washers.

(14) INSTALL LOWER FRONT DECK PLATE.

SLING, front deck, engine roof and gun turret, B226796
WRENCH, socket, $1\frac{5}{16}$-in.

Install sling on two lower front deck lifting handles, connect a hoist to sling and push front deck into position on hull. NOTE: Before positioning front deck on hull, coat edges of hull and deck plates with non-hardening, high temperature sealing compound. Install 27 lower front deck mounting screws.

(15) INSTALL DRIVE SPROCKETS.

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

Push track drive sprockets onto drive sprocket housing studs and install eight mounting stud nuts holding each drive sprocket to hub.

TRANSFER UNIT

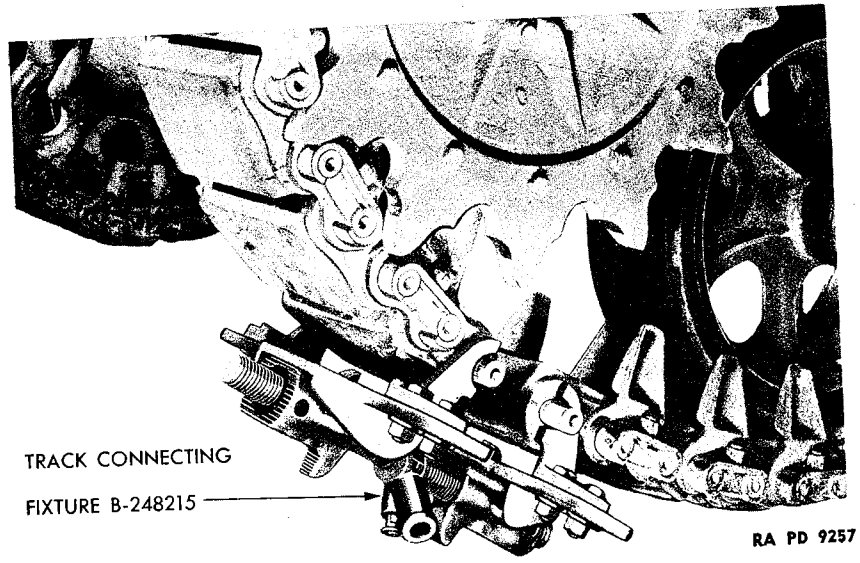

Figure 179 — Connecting Track

(16) INSTALL TRACK.

FIXTURE, track connecting B248215
HAMMER
PRYBAR
WRENCH, open-end, $\frac{3}{4}$-in.
WRENCH, socket, $\frac{5}{8}$-in.

Pull upper portion of each track over idler wheels supporting rollers and drive sprockets. Take up slack in each track by revolving drive sprocket forward with a prybar. Mount track stretcher on inside and outside track connectors on shoes next to end shoes (fig. 179). Tighten track stretcher adjusting screw with a $\frac{5}{8}$-inch socket wrench to bring track shoes on one track together as far as possible. Drive inside and outside end connectors on end track shoe links as far as possible. Position end connector wedges on end connectors and install safety nuts, using a $\frac{3}{4}$-inch open-end wrench. Loosen track stretcher adjusting screws, using a $\frac{5}{8}$-inch socket wrench and remove track stretchers.

(17) FILL CONTROLLED DIFFERENTIAL AND TRANSFER UNIT WITH OIL. See paragraph 10 **b.**

19. LIMITS AND TOLERANCES.

DESCRIPTION	SPECIFICATIONS
Case and Covers	
Brake drum bushing and case clearance	0.003—0.005 in.
Main shaft spacer	0.003—0.014 in.
Gap compressed	0.001—0.003 in.
Clearance in ring grooves	

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DESCRIPTION	SPECIFICATIONS
Case and Covers—Cont'd	
Rear cover oil rings	
Gap compressed	0.003—0.014 in.
Clearance in ring grooves	0.002—0.005 in.
Clutch	
Clutch pistons	
Clearance in bore	0.0055—0.0085 in.
Clutch piston rings	
Gap compressed	0.0015—0.0095 in.
Clearance in ring grooves	0.001—0.003 in.
Clutch release springs	
Free length	3 39/64 in.
Lb. pressure compressed to 2 23/32 in.	81—86 lb
Planet Pinions	
Planet pinions	
Backlash	0.004—0.008 in.
Diameter of hole	1.4477—1.4482 in.
Planet pinion needle bearings	
Number per pinion	21
Diameter	0.1873—0.1875 in.
Planet pinion pins	
Small diameter	1.0720—1.0725 in.
Large diameter	1.0770—1.0775 in.
Planet pinion thrust washers	
Thickness	0.047—0.051 in.
Oil Pump	
Cover thrust washer	
Thickness	0.083—0.085 in.
Idler gear in transfer case	
End play	0.004—0.016 in.
Backlash with drive gear and driven gear	0.006—0.010 in.
Drive and idler gears in pump body	
Backlash	0.006—0.010 in.
End play	0.002—0.004 in.
Clearance between gears and body	0.002—0.0035 in.
Governor	
Body runout	not over 0.002 in.
Drive flange runout	not over 0.0005 in.
Oil rings	
Gap compressed	0.0015—0.0095 in.
Clearance between ring grooves and rings	0.001—0.003 in.

TRANSFER UNIT

DESCRIPTION	SPECIFICATIONS
Carrier	
Lubrication pressure check valve spring	3 7/32 in.
Free length	14.3—15.3 lb
Lbs. pressure compressed to 1 7/8-in.	
Oil cooler by-pass valve spring	3 7/32-in.
Free length	14.3—15.3 lb
Lbs. pressure compressed to 1 7/8-in.	
Oil pressure regulator valve spring	8 1/16 in.
Free length	32.8—34 lb
Lbs. pressure compressed to 5 13/16-in.	
Low Gear Servo	
Inner apply spring	8 3/32 in.
Free length	96—104 lb
Lbs. pressure compressed to 3 51/64-in.	
Intermediate apply spring	8 9/64 in.
Free length	137—145 lb
Lbs. pressure compressed to 4 1/64-in.	
Outer apply spring	8 3/8 in.
Free length	198—206 lb
Lbs. pressure compressed to 4 15/64-in.	
Piston	
Clearance between piston and cylinder	0.005—0.008 in.
Piston ring	
Gap compressed	0.0015—0.0095 in.
Clearance between ring and ring groove	0.001—0.003 in.
Piston rod spring	1 11/16 in.
Free length	22.5—28.5 lb
Lbs. pressure compressed to 1 7/16 in.	
Reverse Servo	
Exhaust valve spring	1 1/64 in.
Free length	7 lb
Lbs. pressure compressed to 7/16 in.	
Latch spring	3/4 in.
Free length	4—6 lb
Lbs. pressure compressed to 19/64 in.	
Piston	
Clearance between piston and cylinder	0.005—0.008 in.
Piston ring	
Gap compressed	0.0015—0.0095 in.
Clearance between ring and ring grooves	0.001—0.003 in.
Piston spring	4 3/4 in.
Free length	195—205 lb
Lbs. pressure compressed to 2 1/4 in.	

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DESCRIPTION	SPECIFICATIONS
Control Valve Body	
Accumulator piston ring	
Gap compressed	0.0015—0.010 in.
Clearance between ring and ring grooves	0.001—0.003 in.
Inner accumulator piston spring	
Free length	$5\frac{23}{64}$ in.
Lbs. pressure compressed to $3\frac{3}{4}$ in.	6.45—7.45 lb
Outer shift valve spring	
Free length	$1\frac{7}{16}$ in.
Lbs. pressure compressed to $\frac{5}{8}$ in.	4.1—4.75 lb
Low gear servo exhaust valve spring	
Free length	$1\frac{13}{64}$ in.
Lbs. pressure compressed to $\frac{5}{16}$ in.	3.8—4.2 oz
Piston ring	
Gap compressed	0.0015—0.0095 in.
Clearance between ring and ring groove	0.001—0.003 in.
Piston rod spring	
Free length	$1\frac{11}{16}$ in.
Lbs. pressure compressed to $1\frac{7}{16}$ in.	22.5—28.5 lb
Reverse Servo	
Exhaust valve spring	
Free length	$1\frac{1}{64}$ in.
Lbs. pressure compressed to $\frac{7}{16}$ in.	7 lb
Latch spring	
Free length	$1\frac{59}{64}$ in.
Lbs. pressure compressed to $1\frac{3}{32}$ in.	3.5—4 lb
Piston	
Clearance between piston and cylinder	0.005—0.008 in.
Piston ring	
Gap compressed	0.0015—0.0095 in.
Clearance between ring and ring grooves	0.001—0.003 in.
Piston spring	
Free length	$4\frac{3}{4}$ in.
Lbs. pressure compressed to $2\frac{1}{4}$ in.	195—205 lb
Control Valve Body	
Accumulator piston ring	
Gap compressed	0.0015—0.010 in.
Clearance between ring and ring grooves	0.001—0.003 in.
Inner accumulator piston spring	
Free length	$5\frac{23}{64}$ in.
Lbs. pressure compressed to $3\frac{3}{4}$ in.	6.45—7.45 lb
Outer shift valve spring	
Free length	$1\frac{7}{16}$ in.
Lbs. pressure compressed to $\frac{5}{8}$ in.	4.1—4.75 lb

TRANSFER UNIT

DESCRIPTION	SPECIFICATIONS
Control Valve Body—Cont'd	
Low gear servo exhaust valve spring	
Free length	$1\frac{13}{64}$ in.
Low gear servo control valve spring	
Free length	$1\frac{61}{64}$ in.
Lbs. pressure compressed to $\frac{25}{32}$ in.	1.90—2.10 lb
Outer accumulator piston spring	
Free length	$5\frac{11}{16}$ in.
Lbs. pressure compressed to $3\frac{3}{4}$ in.	15—16.5 lb
Inner shift valve spring	
Free length	$1\frac{1}{2}$ in.
Lbs. pressure compressed to $\frac{13}{16}$ in.	4.9—5.3 lb
Throttle valve spring	
Free length	0.900—0.910 in.
Lbs. pressure compressed to .625 in.	6.29—6.51 lb

20. TORQUE TIGHTNESSES.

Location	Thread Size	Torque Ft-Lb
Clutch drum to brake drum	$\frac{7}{16}$—14	30—35
Connector gear case to main case	$\frac{7}{16}$—14	50—55
Connector gear cover to connector gear case	$\frac{7}{16}$—20	50—55
Differential band lubricator tube to transfer unit case	$\frac{5}{16}$—18	15—18
Governor body to governor drive flange	$\frac{1}{4}$ —20	10—12
Idler gear shaft locking screw	$\frac{5}{16}$—18	15—18
Low gear band support to transfer unit case	$\frac{1}{2}$ —13	80—85
Low gear servo cover to servo body	$\frac{5}{16}$—18	15—18
Low gear servo cover to case	$\frac{5}{16}$—18	15—18
Main shaft bearing retainer to clutch drum	$\frac{3}{8}$ —24	25—30
Main shaft nut	$1\frac{1}{8}$ —12	150—175
Oil pump body to oil pump and governor carrier	$\frac{5}{16}$—18	15—18
Oil pump covers to oil pump body	$\frac{5}{16}$—18	15—18
Oil pump and governor carrier to case	$\frac{3}{8}$ —16	25—29
Oil screen mounting bracket to case	$\frac{5}{16}$—18	15—18
Output shaft bearing retainer to case	$\frac{5}{8}$ —18	160—170
Output shaft pinion nut	$1\frac{3}{8}$ —12	200 plus
Reverse servo cover to case	$\frac{5}{16}$—18	15—18
Reverse servo cover to servo body	$\frac{5}{16}$—18	15—18
Valve body cover to case	$\frac{5}{16}$—18	15—18
Valve body to mounting plate	$\frac{1}{4}$ —20	10—12
Universal joint yoke to retaining nut	$\frac{7}{8}$ —14	200 plus
Universal joint bearing to yoke	$\frac{5}{16}$—24	20—25

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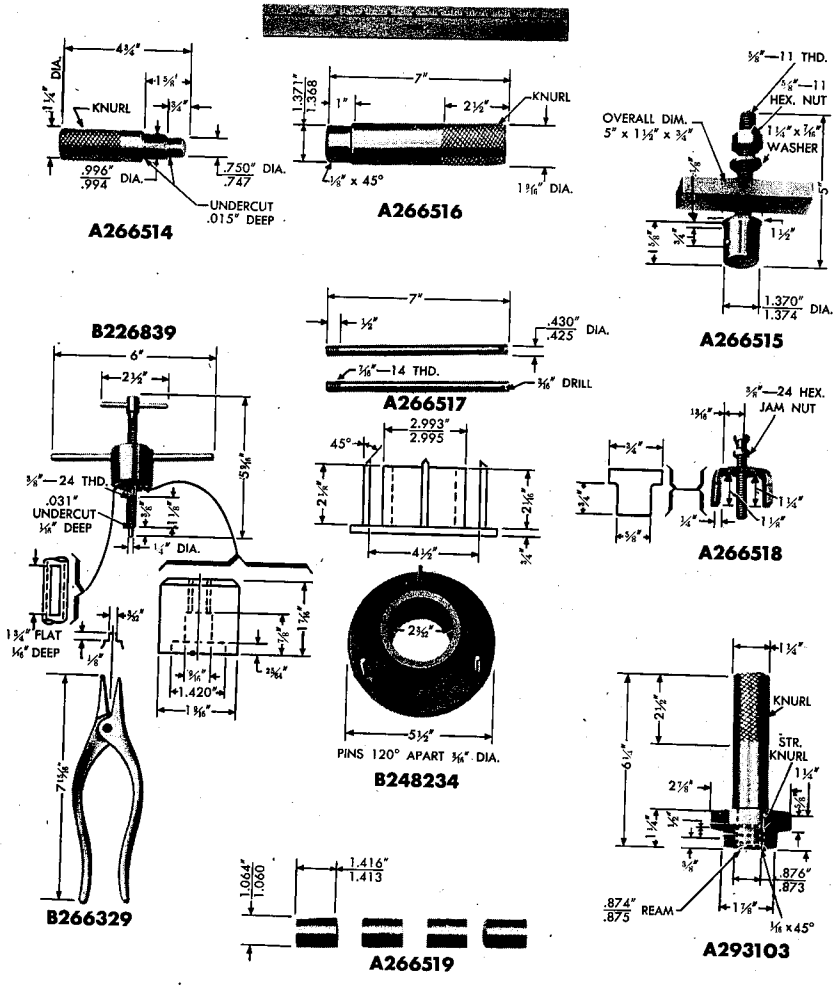

Figure 180 — Transfer Unit Special Tools

21. SPECIAL TOOLS.

a. The following special tools are required to service the transfer unit completely:

Description	Ordnance Tool No.
ARBOR, needle bearing loading	A266519
DRIVER, idler gear bearing	A266514
DRIVER, mainshaft roller bearing, outer race	A266516
FIXTURE, track connecting	B248215

TRANSFER UNIT

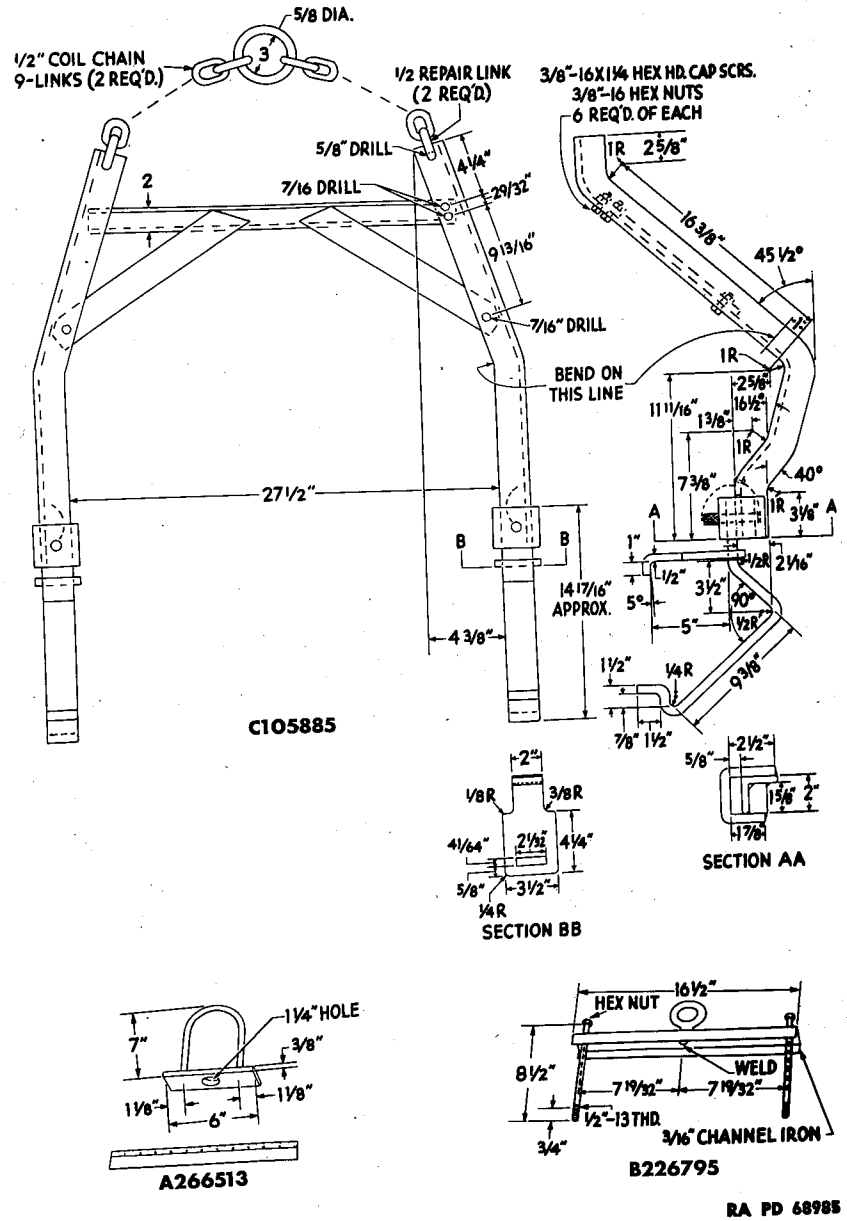

Figure 181 — Transfer Unit Slings

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

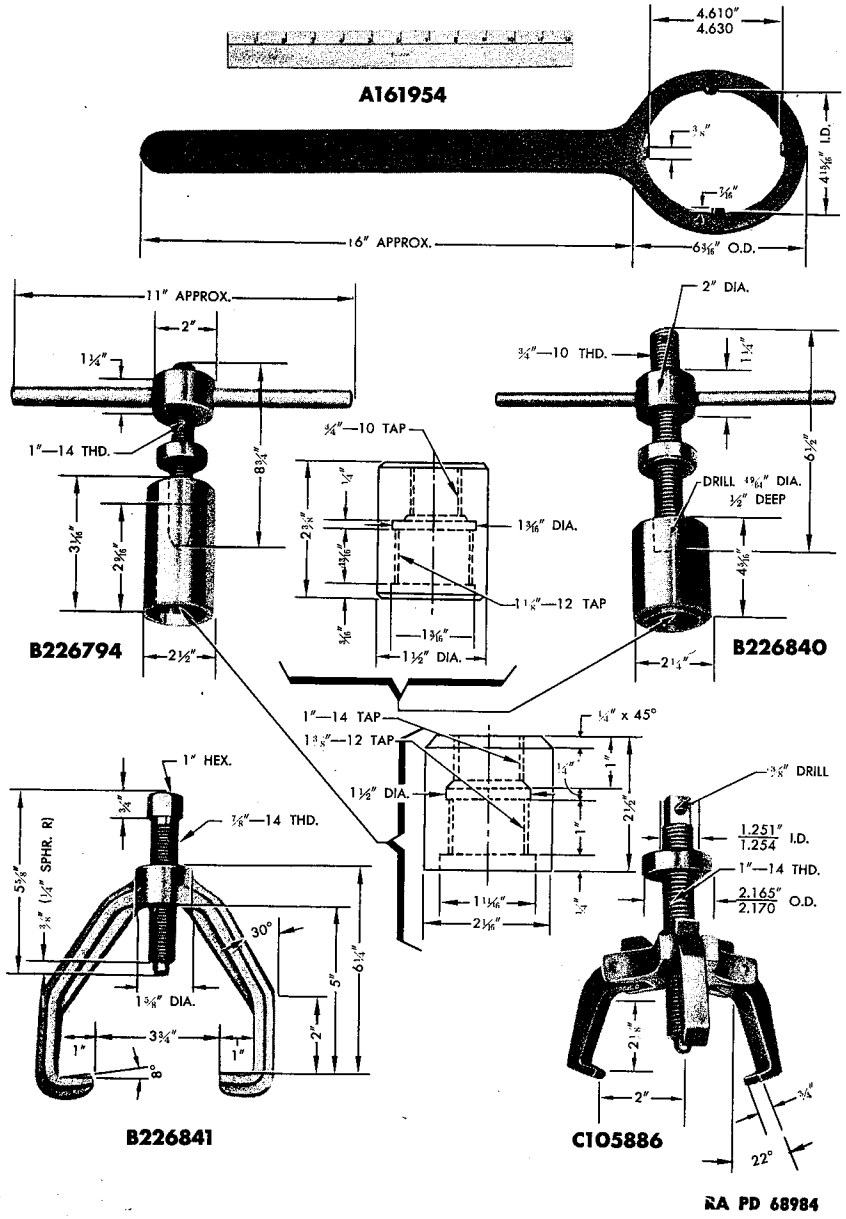

Figure 182 — Pinion and Connector Gear Tools

TRANSFER UNIT

Description	Ordnance Tool No.
GAGE, low and reverse transit band adjusting	B226839
GAGE, pins, throttle controls, adjusting, set	B266522
GAGE, throttle, front relay	A266520
GAGE, throttle, intermediate relay	A266521
HOOK, clutch, and drum assembly, lifting	A266513
INSTALLER, transfer unit cover oil ring	B248234
PINS, drum assembly	A266517
PLIERS, snap ring, removing	A266329
PULLER, gear	B226841
PULLER, idler gear shaft	A266518
PULLER, mainshaft bearing	A265515
PULLER, pinion gear, transfer case	C105886
PUSHER, driven gear	B226840
PUSHER, pinion	B226794
REPLACER, connector drive gear shaft oil seal	A293103
SLING, controlled differential and transfer unit	C105885
SLING, front deck, engine roof and gun turret	B226796
SLING, transfer unit	B226795
WRENCH, spanner	A161954

22. PREPARATION FOR EXTREME CONDITIONS.

a. It is not necessary to perform any special operation on the transfer unit when it is being operated under extreme conditions of heat, cold, dust or salt water other than to make certain that the same grade of oil is used in the transfer unit as is used in the transmission and engine.

23. PACKING AND SHIPPING.

a. Individual Parts. When making ready for packing, shipping or storing, transfer unit parts should be adequately cleaned, preserved, and wrapped as prescribed in "Instructions for Cleaning and Preservation of Ordnance Materiel," dated January 29, 1943.

b. Complete Transfer Units. The complete transfer unit is always shipped with the controlled differential as one assembly. When packing the controlled differential and the transfer unit for shipment or storage, the assembly should be adequately cleaned, preserved, and packaged as prescribed in "Instructions for Cleaning and Preservation of Ordnance Materiel," dated January 29, 1943, and the complete assembly then placed in a special nailed wood shipping crate lined with waterproof

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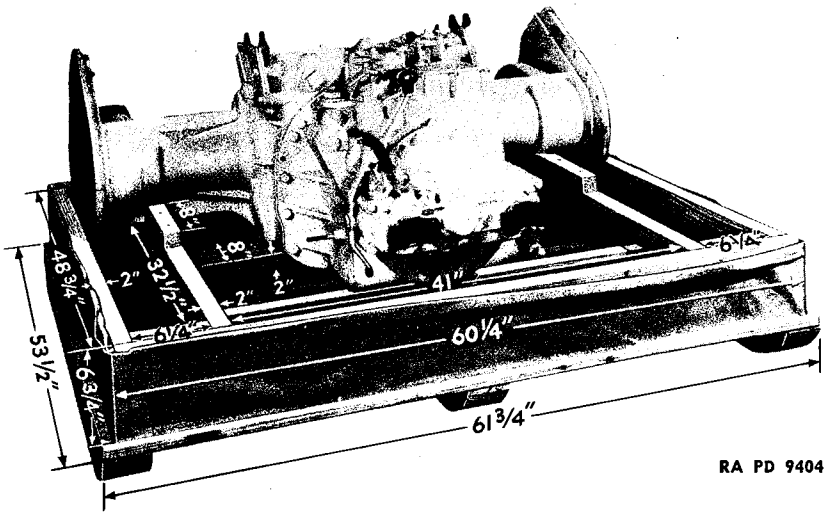
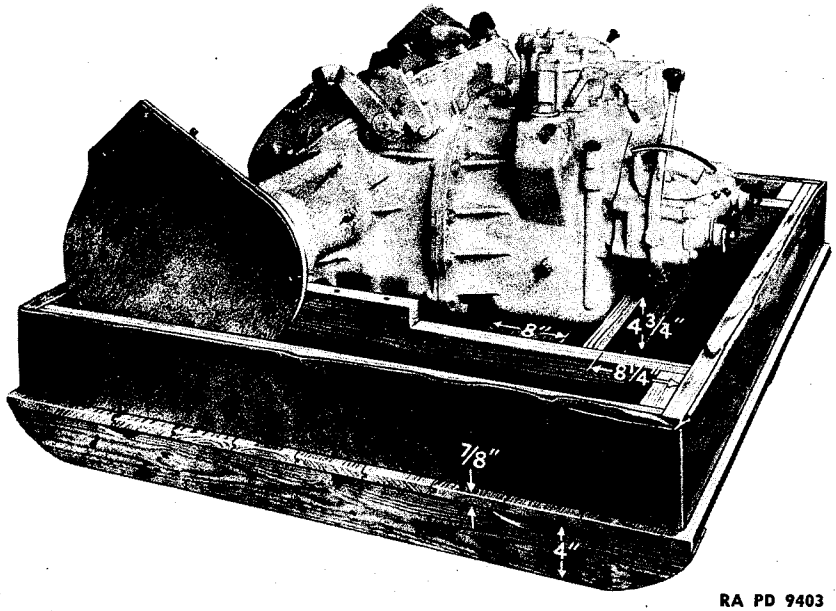


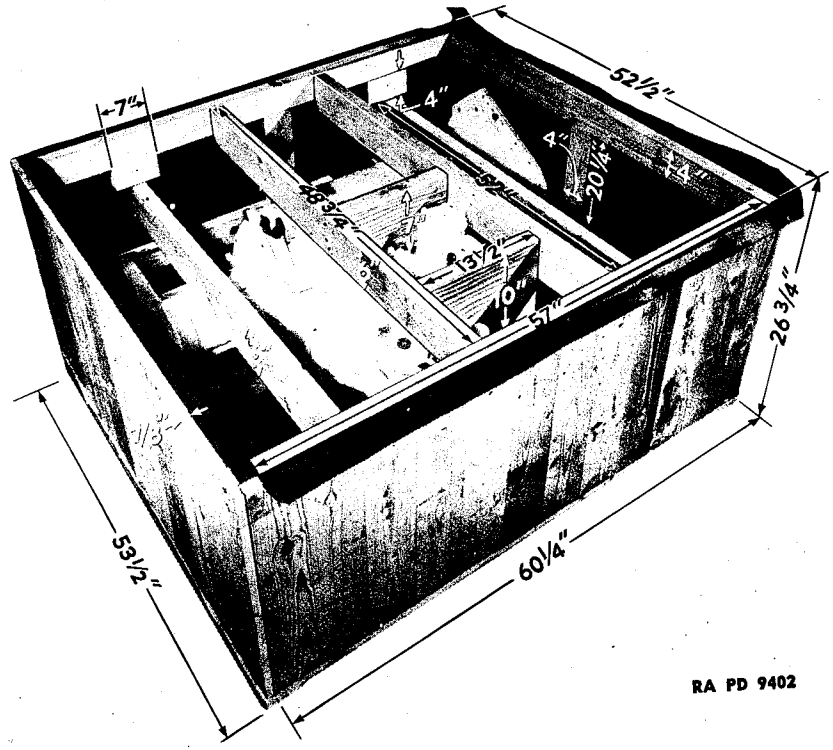
RA PD 9404



RA PD 9403

Figure 183 — Transfer Unit and Controlled Differential Packing Box

TRANSFER UNIT



RA PD 9402

Figure 184 — Transfer Unit and Controlled Differential Packed in Box

paper (figs. 183 and 184) as prescribed in "U. S. Army Specifications No. 100-14A," dated February 15, 1943. The assembly should then be braced securely in the shipping crate (fig. 184). 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 transfer unit and controlled differential assembly is completely sealed in waterproof paper inside the box.

ORDNANCE MAINTENANCE—TRANSFER UNIT FOR LIGHT TANKS M5, M5A1, AND 75-MM HOWITZER MOTOR CARRIAGE M8

Section III

REFERENCES

Paragraph

24. STANDARD NOMENCLATURE LISTS.

a. Automotive Materiel.

Carriage, motor, 75-mm, howitzer, M8 (light tank M5, chassis) ..... SNL G-127
Tank, light, M5 ..... SNL G-103 Vol. II
Tank, light, M5A1 ..... SNL G-103 Vol. VIII

b. Cleaning, preserving and lubricating materials; recoil fluids, special oils, and miscellaneous related items ..... SNL K-1

Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained in the "Ordnance Publications for Supply Index"... OPSI

25. EXPLANATORY PUBLICATIONS.

a. Care and Preservation.

Automotive lubrication ..... TM 10-540
Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ordnance Department ..... TM 9-850
Detailed lubrications for ordnance materiel..... OFSB 6-series

b. Maintenance and Inspection.

Automotive power transmission units ..... TM 10-585
Light tank M5 ..... TM 9-732
Light tank M5A1 ..... TM 9-727C
Motor transport inspections ..... TM 10-545
Ordnance maintenance: Engine cooling, engine electrical and engine fuel systems for light tank M5 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: Hydra-Matic transmission and propeller shafts for light tanks M5, M5A1, and 75-mm howitzer motor carriage M8..... TM 9-1727C

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[A.G. 062.11 (3-15-43)
O.O.M. 461/130 (5-5-43)
O.O. 461/Raritan (5-12-43) (R)]

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)

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