

TM 9-8025-2

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

ORDNANCE FIELD AND
DEPOT MAINTENANCE
301MG AND 303M
HYDRA-MATIC
TRANSMISSIONS



HEADQUARTERS, DEPARTMENT OF THE ARMY

TECHNICAL MANUAL
No. 9-8025-2

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301MG AND 303M HYDRA-MATIC TRANSMISSIONS

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*This manual supersedes TM 9-1819AB, 14 February 1952, including C 1, 25 May 1953, and TB 9-1819AB-5, 21 January 1955.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1. Scope

a. This manual is published for the use of personnel responsible for field and depot maintenance of this materiel. It contains information on maintenance which is beyond the scope of the tools, equipment, or supplies normally available to using organizations. This manual does not contain information which is intended primarily for the using organization, since such information is available to ordnance maintenance personnel in the pertinent operator's technical manual or field manual.

b. This manual contains a description of and procedures for disassembly, inspection, repair, rebuild, and assembly of the hydra-matic transmission Models 303M and 301MG. The appendix contains a list of current references, including supply manuals, technical manuals, and other available publications applicable to the materiel.

c. TM 9-8024 (Model 303M) and TM 9-7002 (Model 301MG) contain operating and lubricating instructions for the materiel and contain all maintenance operations allocated to using organizations in performing maintenance work within their scope.

d. This manual differs from TM 9-1819AB, 14 February 1952, as shown in (1) and (2) below.

(1) Adds information on hydra-matic transmission Model 301MG.

(2) Revises information on hydra-matic transmission Model 303M (formerly known as Model 302M).

e. This edition is published in advance of complete technical review of all concerned. Any errors or omissions will be brought to the attention of the Chief of Ordnance, Washington 25, D. C., ATTN: ORDFM, using DA Form 468 (Unsatisfactory Equipment Report).

2. Field and Depot Maintenance Allocation

The publication of instructions for complete disassembly and rebuild is not to be construed as authority for the performance by

field maintenance units of those functions which are restricted to depot shops and arsenals. In general, the prescribed maintenance responsibilities will be reflected in the allocation of maintenance parts listed in the appropriate columns of the current ORD 8 supply manuals pertaining to those vehicles incorporating these items. Instructions for depot maintenance are to be used by maintenance companies in the field only when the tactical situation makes the repair functions imperative. Supply of parts listed in the depot guide column of ORD 8 supply manuals will be made to field maintenance only when the emergency nature of the maintenance to be performed has been certified by a responsible officer of the requisitioning organization, and upon express authorization by the chief of the service concerned. Those operations which can be performed as "emergency field maintenance" are specifically covered as such in this manual.

3. Forms, Records, and Reports

a. *General.* Responsibility for the proper execution of forms, records, and reports rests upon the officers of all units maintaining this equipment. However, the value of accurate records must be fully appreciated by all persons responsible for their compilation, maintenance, and use. Records, reports, and authorized forms are normally utilized to indicate the type, quantity, and condition of materiel to be inspected, to be repaired, or to be used in repair. Properly executed forms convey authorization and serve as records for repair or replacement of material in the hands of troops and for delivery of materiel requiring further repair to ordnance shops. The forms, records, and reports establish the work required, the progress of the work within the shops, and the status of the materiel upon completion of its repair.

b. *Authorized Forms.* The forms generally applicable to units operating this materiel are listed in the appendix. For a listing of all forms, refer to DA Pam 310-2. For instructions on use of these forms, refer to FM 9-10.

c. *Field Reports of Accidents.* The reports necessary to comply with the requirements of the Army safety program are prescribed in detail in SR 385-10-40. These reports are required whenever accidents involving injury to personnel or damage to materiel occur.

d. *Report of Unsatisfactory Equipment and Materials.* Any deficiencies detected in the equipment covered herein which occur under the circumstances indicated in AR 700-38 should be immediately reported in accordance with the applicable instructions in those regulations.

4. Description

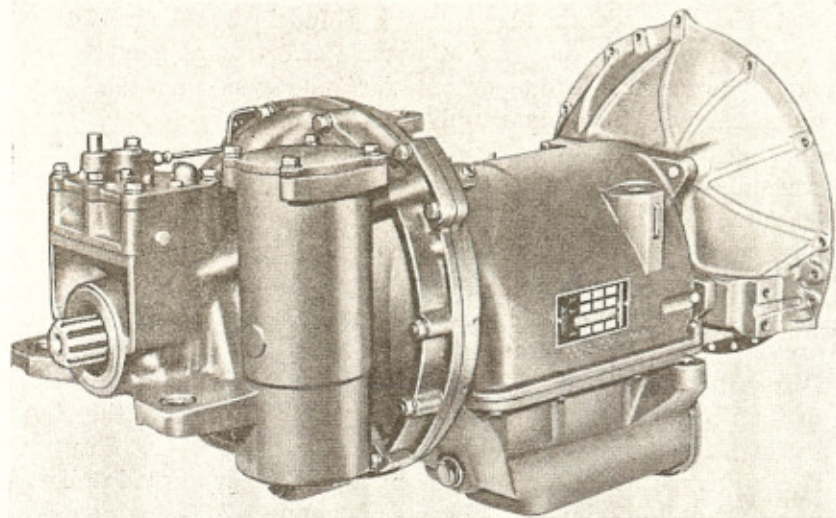
a. The hydra-matic transmission (Models 303M and 301MG) (figs. 1 and 2) provides for automatic selection of gear ratios to supply necessary torque output for operation under all conditions. Transmission assembly is attached to engine flywheel housing which incloses a fluid coupling used to transmit power to transmission. Fluid coupling eliminates the need for a manually operated clutch. The fluid coupling is combined with hydraulically controlled planetary gear units to provide four forward speeds and one reverse. On transmission Model 303M only, a 2-speed reduction unit is located in rear section of transmission, providing two driving ranges, HIGH RANGE and LOW RANGE. Direct drive output is obtained in HIGH RANGE and reduction in LOW RANGE. Choice of ranges is made by the driver through the use of a manually operated control lever. Transmission oil temperature is controlled by an oil cooler located in bottom of transmission oil pan. Oil cooler is connected to engine cooling system.

b. The fluid coupling is composed of two torus members inclosed in an oil-filled chamber formed by the flywheel and the torus cover. Engine power is transmitted from flywheel through torus cover which drives the front planetary unit, and power input to driving torus in fluid coupling is through the front planetary unit. Driven torus is mounted on transmission input shaft (main shaft) which drives rear planetary unit.

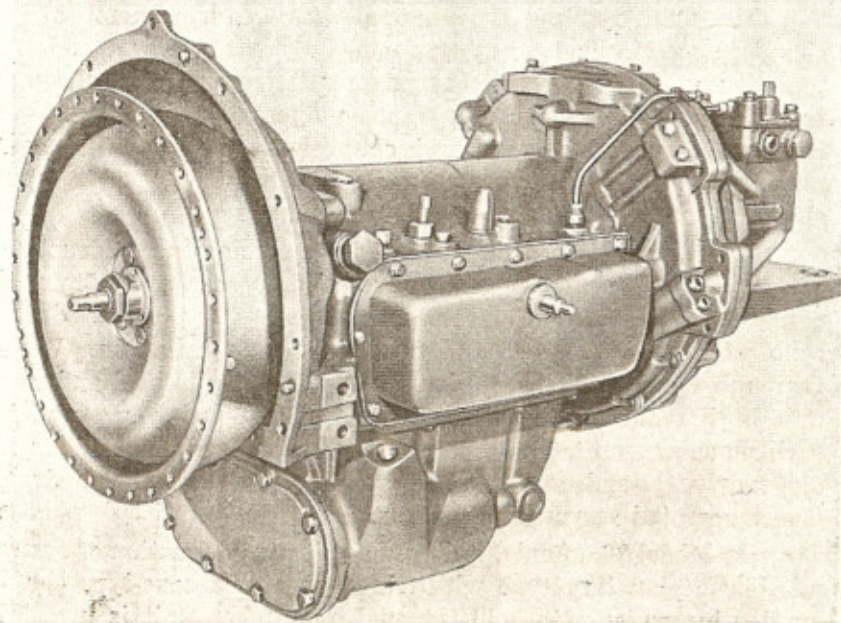
c. Front and rear planetary units are similar in construction, each having a band designed to be applied to or released from its respective drum. When front unit band is applied to drum, center (sun) gear is held and front unit is in reduction. When rear unit band is applied to drum, internal gear is held and rear unit is in reduction. A multiple disk clutch is incorporated in each planetary unit, and when clutch is engaged, the unit is in direct drive. Bands and clutches are actuated by springs, hydraulically operated servos, and pistons.

d. On Model 303M only, reduction unit at rear section of transmission is planetary type which incorporates a cone-type clutch applied by a piston to hold internal gear when unit is in LOW RANGE. A multiple disk-type clutch, also applied by a piston, is used for placing reduction unit in HIGH RANGE or direct drive.

e. For reverse operation, a third set of planetary gears is utilized which operate in conjunction with front and rear planetary units. Reverse unit has no provision for direct drive. A



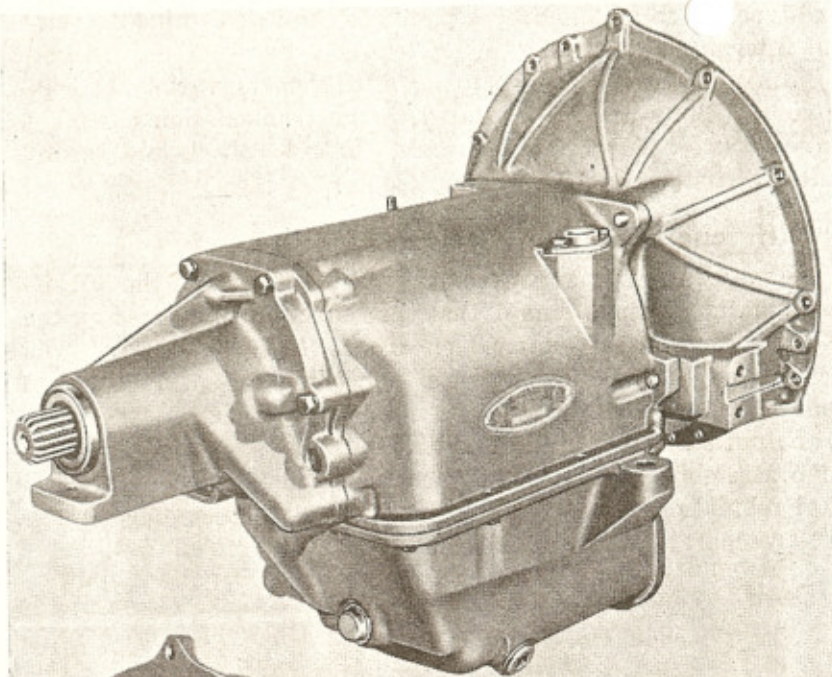
3/4 RIGHT REAR VIEW



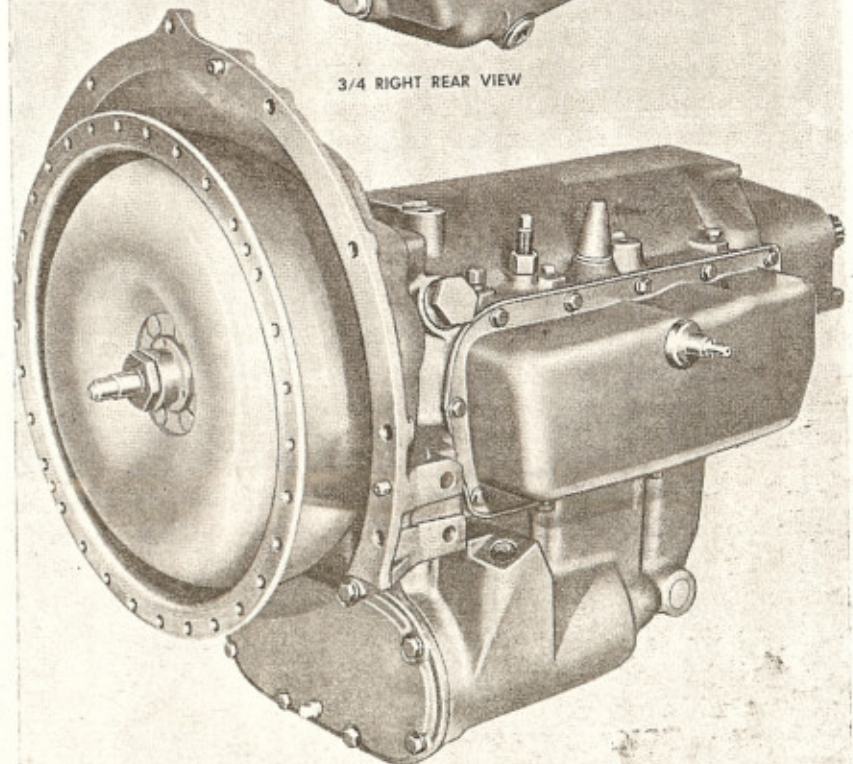
3/4 LEFT FRONT VIEW

RA PD 197885

Figure 1. Model 303M hydra-matic transmission.



3/4 RIGHT REAR VIEW



3/4 LEFT FRONT VIEW

RA PD 366637

Figure 2. Model 301MG hydra-matic transmission.

cone-type clutch actuated by a piston is employed to hold reverse unit internal gear.

f. In addition to the power-transmitting parts, various hydraulic control units are incorporated in the transmission assembly. These include oil pumps, governor, control valves, and servos, and an accumulator on Model 303M only.

5. Differences Between Models

The major difference between the Model 303M and the 301MG hydraulic transmissions is that the reduction unit, used on the 303M (fig. 184), is not used on the 301MG (fig. 185). This necessitates slight differences in some internal parts such as front oil pump assembly, front servo assembly, reverse mechanism and output shaft bearing retainer, output shaft assembly, rear oil pump assembly, and oil pan assembly. Where these differences effect rebuild procedures, such differences are either noted in the text or separate procedures are provided for each unit.

6. Data

a. Transmission Model 303M.

Speed	Ratios	
	High range	Low range
1st	4.08:1	15.67:1
2d	2.63:1	10.05:1
3d	1.55:1	5.95:1
4th	1.00:1	3.82:1
Reverse	4.54:1	17.35:1

b. Transmission Model 301MG.

Speed	Ratio
1st	4.08:1
2d	2.63:1
3d	1.55:1
4th	1.00:1
Reverse	4.54:1

CHAPTER 2

PARTS, SPECIAL TOOLS, AND EQUIPMENT FOR FIELD AND DEPOT MAINTENANCE

7. General

Tools and equipment and maintenance parts over and above those available to the using organization are supplied to ordnance field maintenance units and depot shops for maintaining, repairing, and/or rebuilding the materiel.

8. Parts

Maintenance parts are listed in Department of the Army Supply Manuals ORD 8 SNL G-749 (Model 303M) and ORD 8 SNL G-280 (Model 301MG), which are the authority for requisitioning replacements. Parts not listed in the ORD 8 manuals, but required by depot shops in rebuild operations, may be requisitioned from the listing in the corresponding ORD 9 manual and will be supplied if available. Requisitions for ORD 9 parts will contain a complete justification of requirements.

9. Common Tools and Equipment

Standard and commonly used tools and equipment having general application to this materiel are listed in ORD 6 SNL J-8, Sections 7, 13, and 18; ORD 6 SNL J-9, Sections 1, 2, 8, and 9; ORD 6 SNL J-10, Section 4; and are authorized for issue by TA and TOE.

10. Special Tools and Equipment

The special tools and equipment (figs. 3, 4, and 5) tabulated in table I are listed in Department of the Army Supply Manual ORD 6 SNL J-16, Section 62. This tabulation contains only those special tools and equipment necessary to perform the operations described in this manual, is included for information only, and is not to be used as a basis for requisitions.

Table I. Special Tools and Equipment For Field and Depot Maintenance

Item	Identifying No.	References		Use
		Fig.	Par.	
ANVIL, rivet, $\frac{3}{8}$ -in. thick, 3 in. wide, $2\frac{1}{4}$ -in. long (governor drive flange and pump drive gear).	B7950326 (41-A-281-200).	4, 97, 98	94	Use w/rivet PUNCH-A7950325 for removing and replacing governor drive flange and/or rear oil pump drive gear.
BOLT, eye, $2\frac{3}{4}$ -in. od, $1\frac{1}{2}$ -in. id, w/ $\frac{7}{16}$ -14 thds, length of shank $1\frac{3}{16}$ in. (transmission lifting).	A266327 (41-B-1586-300).	4, 16	57i	For lifting transmission assembly.
BRACKET, retainer, $1\frac{1}{4}$ -in. high, 1-in. wide, $2\frac{1}{4}$ -in. long (clutch hub).	A7950207 (41-B-1925-150).	4, 49, 128	73b, 102p	For holding clutch hub in rear drum during removal and installation of rear planetary units.
BRACKET, support, $5\frac{1}{2}$ -in. high, 5-in. wide, $17\frac{1}{4}$ -in. long.	7950331 (41-B-1925-200).	3, 176	128b	Used w/test INDICATOR-41-I-100 for checking torus cover oil seal collar runoff.
COMPRESSOR (front or rear clutch annular piston oil seal ring).	C8708711	4, 106, 112	97e, 99f, 100h, 102f	For removing and installing clutch piston small oil seal ring.
COMPRESSOR (front or rear clutch drum oil seal ring).	A8708710	3, 113	99i, 102i	For compressing clutch piston large oil seal ring while installing clutch piston in clutch drum.
COMPRESSOR, sleeve ring, $\frac{5}{8}$ -in. high, $2\frac{1}{2}$ -in. wide, $8\frac{1}{2}$ -in. long (oil delivery sleeve ring).	A266328 (41-C-2557).	3, 127, 128	104e, 104h	For compressing seal rings on oil delivery sleeve when installing sleeve and rear planetary unit.
COMPRESSOR, spring, $2\frac{5}{8}$ -in. high, $4\frac{7}{8}$ -in. wide, $10\frac{1}{2}$ -in. long w/2 legs (clutch reverse unit).	C7950251 (41-C-2555-839)	3, 132, 149	105i, 107k, 111d, 113f	For compressing reverse piston release springs during disassembly and assembly of output shaft bearing retainer.
COMPRESSOR, spring, $2\frac{3}{4}$ -in. high, $3\frac{5}{8}$ -in. wide, $17\frac{7}{8}$ -in. long (rear servo spring).	C7950334 (41-C-2555-843)	3, 79, 84	86, 88	For compressing springs when disassembling and assembling rear servo.
FIXTURE, holding, $6\frac{1}{4}$ -in. dia, $1\frac{1}{16}$ -in. wide (planetary unit).	B7079295 (41-F-2987-421)	4, 101	73h, 96b, 99a, 104b	For holding planet carrier assembly while removing and installing planetary units and oil delivery sleeve.
GAGE, alining, $1\frac{1}{8}$ -in. dia, $1\frac{3}{8}$ -in. wide (reverse blocker bracket to governor).	A7950067 (41-G-13-334)	4, 207	38f, 148	For alining governor and reverse blocker bracket.
GAGE, checking, $\frac{1}{8}$ -in. thick, $2\frac{7}{8}$ -in. wide, $5\frac{5}{8}$ -in. long (band adjusting).	B7950329 (41-G-98-575)	4, 203	145	For locating rear servo actuating lever when adjusting rear band.
GAGE, checking, $\frac{1}{4}$ -in. thick, $\frac{1}{2}$ -in. wide, $1\frac{1}{2}$ -in. long (indicator rod).	A7950250 (41-G-98-920)	4, 201	144e	For measuring length of front band adjusting rod.
GAGE, front servo adjusting.	8708127	4, 201, 202	144f	For checking front band adjusting rod.
GAGE, lever, w/two 45 deg and one 90 deg offset, $8\frac{1}{2}$ -in. long (throttle valve lever).	B7950168 (41-G-214-475)	3		For checking position of transmission throttle valve lever.
GAGE, pressure, 300 lb max, w/coupling and hose (oil pressure).	B7950330 (41-G-1127-500)	4	26	For making transmission oil pressure tests.
GUIDE, main shaft, $1\frac{3}{4}$ -in. dia., 5-in. long.	B7950327 (41-G-2502-500)	4, 30, 190	62d, 136a, 140b	Used w/test INDICATOR-41-I-100 and extension ROD-A266330 for measuring input shaft end play.
GUN, air, consisting of valve, elbow, nozzle, and ball.	B7950562 (41-G-1299-100)	4, 9, 28, 74, 78, 122, 133, 150, 204	30, 65b, 83a, 86a, 87b, 103c, 105k, 111e, 131b, 145e	To check for leaks in transmission case and units, and check action of servos and clutches.

Table I. Special Tools and Equipment For Field and Depot Maintenance—Continued

Item	Identifying No.	References		Use
		Fig.	Par.	
PUNCH, rivet, $\frac{3}{8}$ -in. dia, 5-in long (governor drive flange and pump drive gear).	A7950325 (41-P-3789-500)	4, 98	94	Used w/ANVIL-B7950326 for removing and replacing governor drive flange and/or rear oil pump drive gear.
REPLACER, oil seal, $3\frac{3}{8}$ -in. dia, $6\frac{7}{8}$ -in. long (main shaft and intermediate shaft).	C7950561 (41-R-2394-120)	4, 94	91l	For installing oil seal on front oil pump cover.
ROD, extension, $\frac{3}{8}$ -in. dia, $8\frac{1}{2}$ -in. long (indicator).	A266330 (41-R-2580)	3, 30, 190	62d, 136a, 140b	Used w/test INDICATOR-41-I-100 and GUIDE-B7950327 for measuring input shaft end play.
STAND, transmission, $33\frac{3}{4}$ -in. high, $32\frac{1}{4}$ -in. wide, 38-in. long, w/casters (transmission rebuild).	D7950874 (41-S-4981-950)	5, 18, 19	57k, 57l	For holding transmission during rebuild operations.
TOOL, bending, $\frac{3}{4}$ -in. thick, $1\frac{7}{8}$ -in. wide, 3-in. long (throttle valve lever).	C7950171 (41-T-3068-600)	4		For bending transmission throttle valve lever.
TOOL, installing, 0.025-in. thick, $\frac{1}{2}$ -in. wide, $21\frac{1}{16}$ -in. long (reverse piston to drum).	A7950335 (41-T-3215-960)	3, 145, 153	107i, 113d	For installing reverse clutch piston and seal in output shaft bearing retainer.
WRENCH, holding, single end, $\frac{1}{2}$ -in. x $1\frac{1}{2}$ -in. curved slot, $9\frac{1}{2}$ -in. long (front pump body).	B7950328 (41-W-1534-275)	3, 86	89, 91	For holding front oil pump body while removing and installing cover-to-body bolts.
WRENCH, single open end, double offset, 1.330-in. opening, $11\frac{5}{8}$ -in. long.	B7950256 (41-W-1587-350)	3, 220	57c, 153l	For holding when removing or installing input shaft nut.
<i>Note.</i> The following four items apply only to transmission Model 303M.				
HOOK, lifting (reduction unit), 2 required.	B7950336 (41-H-2644-940)	3, 17, 20	57j, 58c, 152a	For lifting reduction unit case.

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REMOVER, bearing, $\frac{5}{8}$ x 2 x $12\frac{1}{2}$ puller bar, $5\frac{1}{8}$ dia, $\frac{5}{8}$ -in. thick backing plate w/ $\frac{3}{4}$ -10NC-screws, $8\frac{1}{2}$ -in. long (reduction unit stationary bearing cone).	C7950372 (41-R-2637-790)	3, 162	123a	For pulling reduction unit stationary cone assembly out of reduction unit case.
REMOVER and REPLACER, bearing retainer (rear), $9\frac{3}{4}$ -in. high, $4\frac{1}{2}$ -in. wide, 15-in. long.	C7950563 (41-R-2378-955)	3, 31, 196	63, 139	For removing and installing transmission output shaft bearing retainer.
REPLACER, reduction unit rear oil seal	B7950063 (41-R-2395-518)	4, 173	125f	For installing reduction unit output shaft oil seal.
<i>Note.</i> The following item applies only to transmission Model 301MG.				
REPLACER, $1\frac{1}{4}$ -in. od, $\frac{5}{16}$ -in. long w/ $\frac{5}{16}$ -in. thick plate in one end, and $1\frac{1}{16}$ -in. thick, 3-in. dia driver in opposite end.	B8390035 (5120-034-8457)	4, 146	107g	For installing output shaft bearing retainer oil seal.

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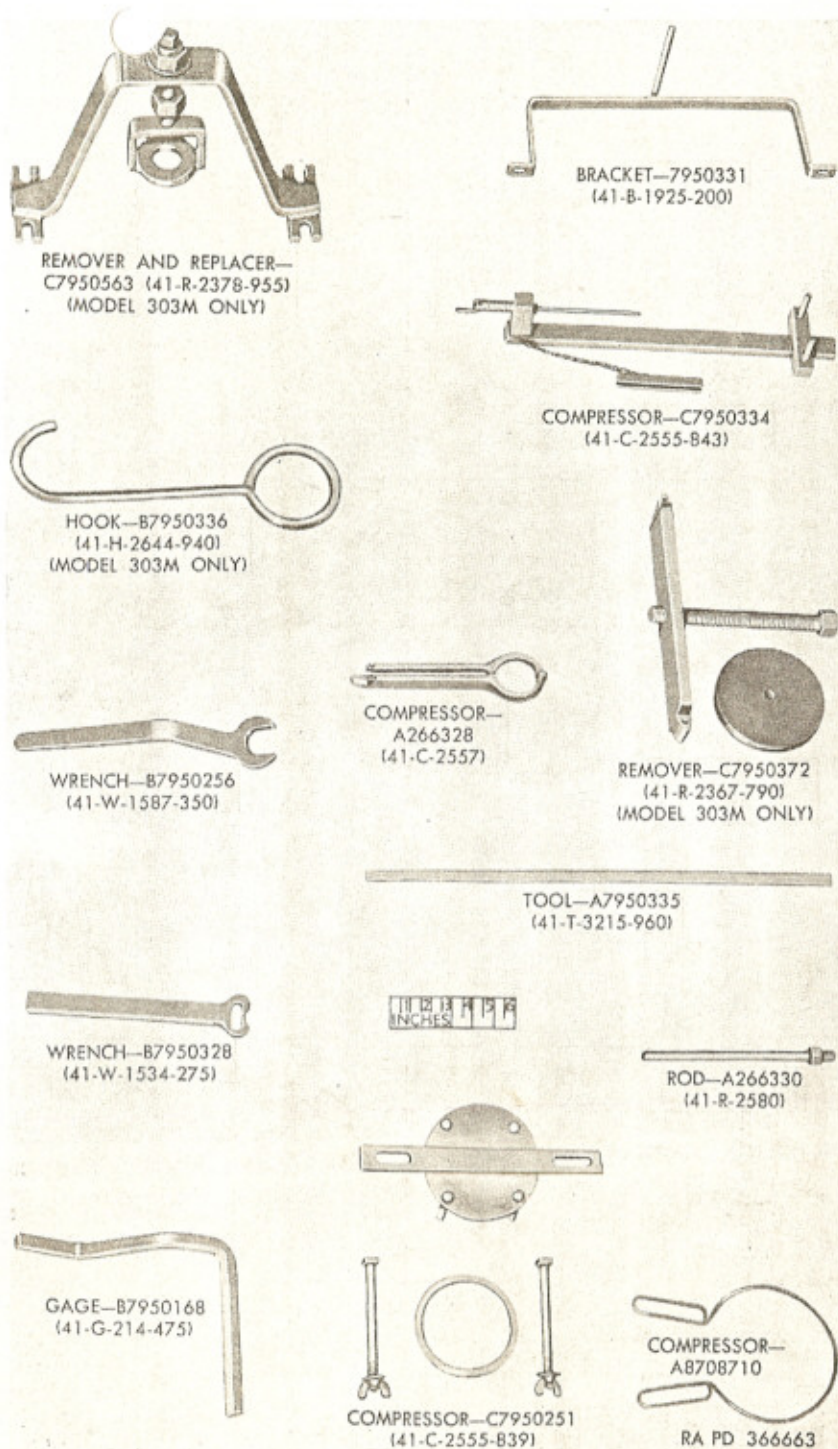


Figure 3. Special tools.

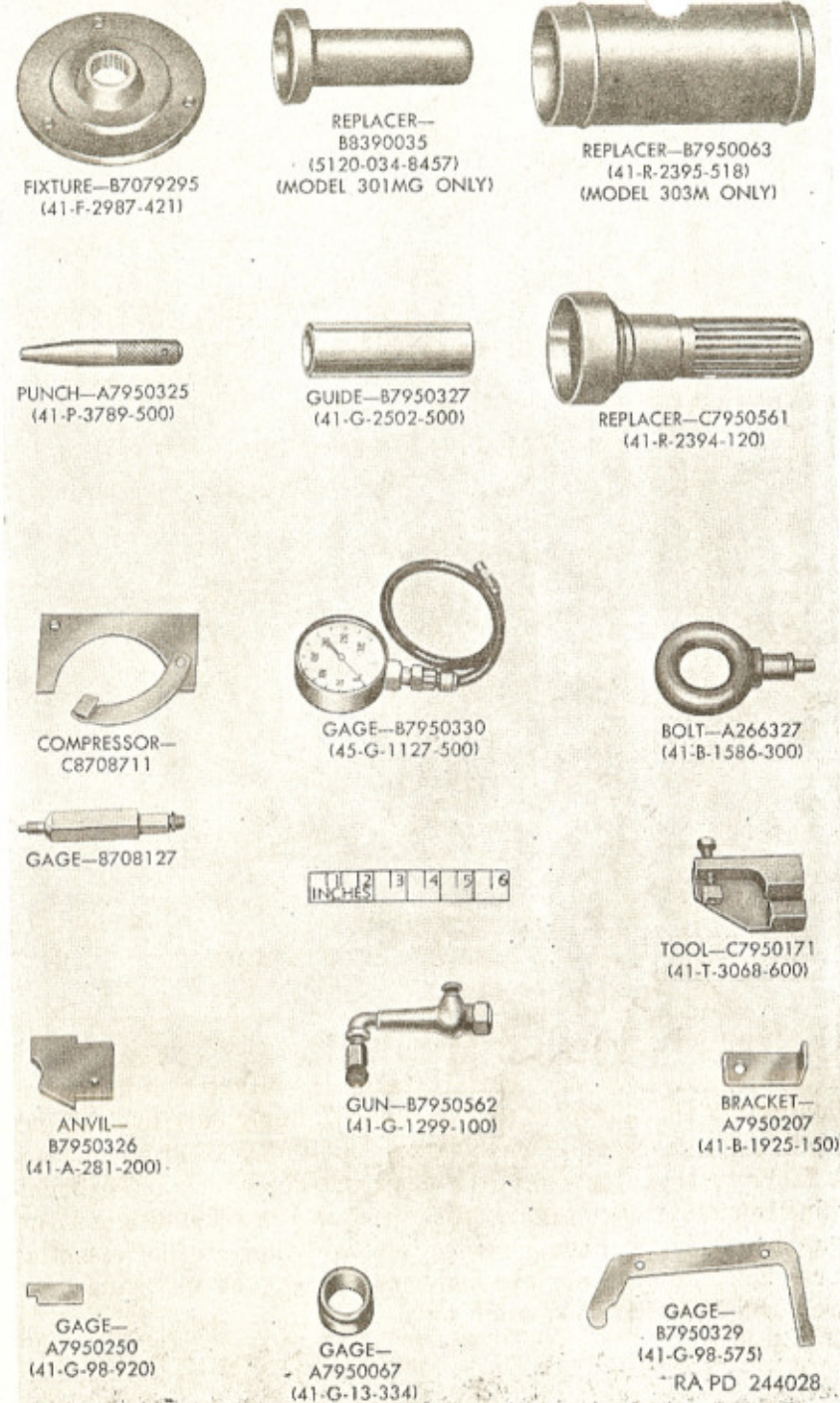


Figure 4. Special tools.

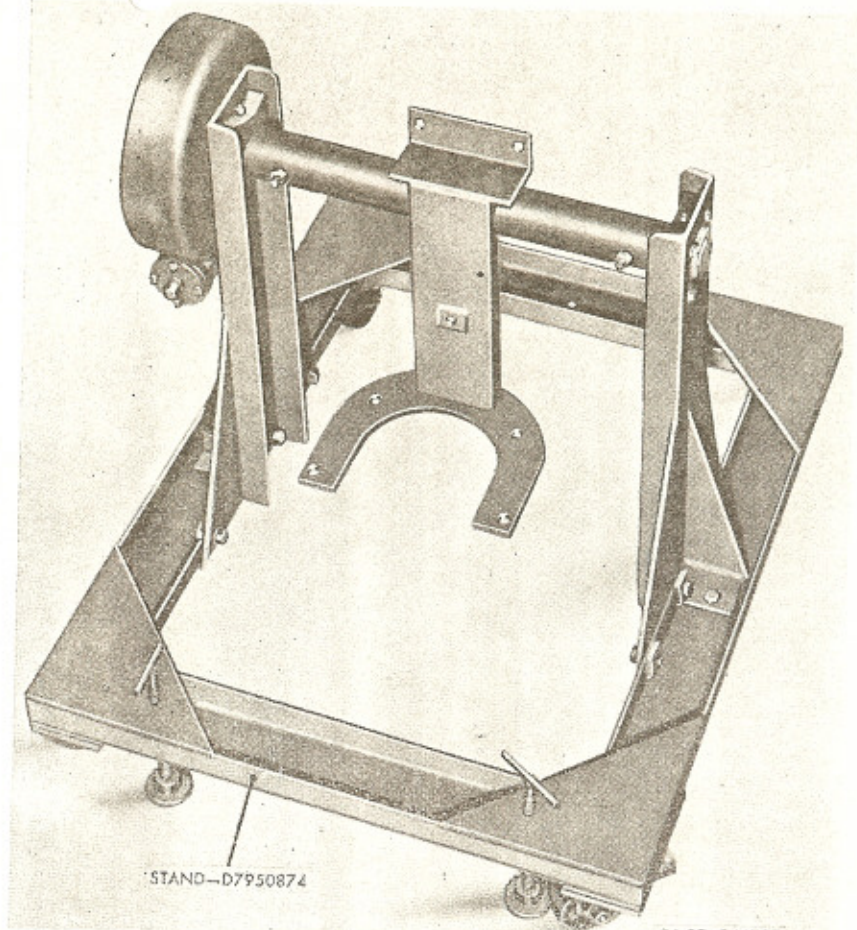


Figure 5. Special tools.

11. Improved Tools

The improvised tools listed in table II, with the dimensional detail drawings shown in figures 6 and 7, apply only to field and depot shops in order to enable these maintenance organizations to fabricate these tools locally if desired. These tools are of chief value to maintenance organizations engaged in rebuilding a large number of identical components; however, they are not essential for rebuild and are not available for issue. The following data are furnished for information only.

Table II. Improved Tools for Field and Depot Maintenance

Item	References		Use
	Fig.	Par.	
INSTALLER, output shaft ball bearing (301MG).	7, 146	107n	For installing ball bearing in output shaft bearing retainer on 301MG transmission.
INSTALLER, snap ring	6, 210	36f	For installing manual control valve lever shaft seal retainer snap ring.

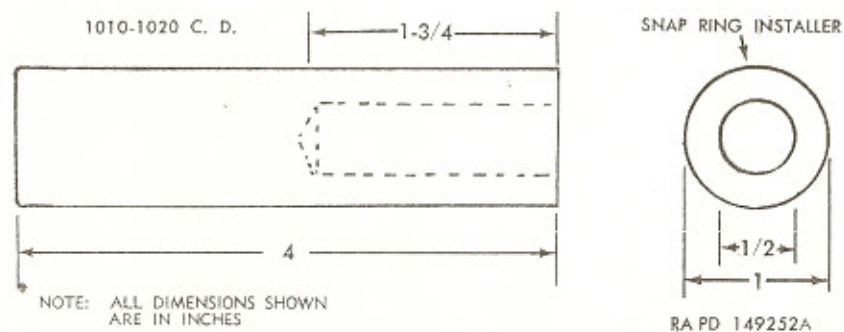


Figure 6. Improved snap ring installer.

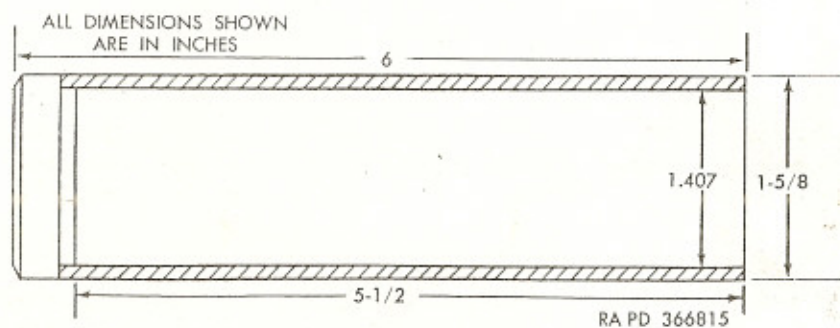


Figure 7. Improved bearing installer.

CHAPTER 3

TROUBLESHOOTING

Section I. GENERAL

12. Purpose

Note. Information in this chapter is for use of ordnance maintenance personnel in conjunction with and as a supplement to the troubleshooting section in the pertinent operator's manual. It provides the continuation of instructions where a remedy in the operator's manual refers to ordnance maintenance personnel for corrective action.

Operation of a deadlined vehicle without a preliminary examination can cause further damage to a disabled component and possible injury to personnel. By careful inspection and troubleshooting, such damage and injury can be avoided and, in addition, the causes of faulty operation of a vehicle or component can often be determined without extensive disassembly.

13. General Instructions and Procedures

This chapter contains inspection and troubleshooting procedures to be performed while a disabled component is mounted in the vehicle and after it has been removed.

a. The inspections made while the transmission assembly is mounted in vehicle without engine running or vehicle operating are, for the most part, visual and are to be performed before starting engine and actually operating the vehicle. The inspections are included in the before-operation procedures outlined in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

b. The troubleshooting performed while the transmission is mounted in vehicle with engine running and/or vehicle operating is that which is beyond the normal scope of using organization. Check the troubleshooting section of applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG); then proceed as outlined in this chapter. These troubleshooting operations are used to determine if the fault can be remedied without removing the component from the vehicle and also when subsequent removal is necessary, to indicate when repair can be made without complete disassembly of the component.

Note. Reference is made in this chapter to some tests normally within the scope of the using organization. This repetition is necessary to provide clarity and continuity to the various tests and troubleshooting procedures. However, whenever practical, remedial procedures within the scope of the using organization are omitted and reference made to applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

c. Troubleshooting a disabled component after it has been removed from the vehicle consists of subjecting it to the same tests as applied to a rebuilt assembly (pars. 25-28), to verify the diagnosis made when the component was in the vehicle, to uncover further defects, or to determine faults if the component alone is received by the ordnance establishment. This inspection is particularly important in the last case because it is often the only means of determining the trouble without completely disassembling the component.

d. Inspecting and checking the component during some stages of disassembly will also disclose malfunctions in some units and assist in determining the replacement of affected parts or sub-assemblies. Similar tests are also made during assembly to determine correct functioning of various component units.

Section II. TROUBLESHOOTING BEFORE REMOVAL AND DURING OPERATION

14. Purpose

Troubleshooting the hydra-matic transmission before removal from the vehicle must be accomplished with engine running under simulated operating conditions, and/or actual road testing the vehicle, to determine malfunctions in the transmission. Various tests and checks must be made during these operations to determine which component part of the transmission is malfunctioning. From the results of these checks or tests, some parts may be replaced without removing the transmission from the vehicle (ch 4). The checks will also disclose malfunctioning parts which should be replaced after transmission is removed from vehicle, and partially or completely disassembled.

15. Preliminary Checking Procedures

Several checks or tests should be accomplished prior to actually making a road or operating test for the purpose of determining trouble symptoms. In many instances, transmission malfunctions may be determined from the results of these preliminary procedures. These procedures are as shown in *a* through *d* below.

a. Oil Level. Refer to paragraph 16.

- b. *Engine Idle Adjustments.* Refer to paragraph 17.
- c. *Throttle and Manual Linkage.* Refer to paragraph 18.
- d. *Oil Pressure Tests.* Refer to paragraph 19.

16. Oil Level

Check oil level in transmission as described in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

Note. The transmission does not "burn" or use oil as an engine does. Any appreciable loss of oil is due to leakage (par. 20). If transmission oil level rises, the probable cause is due to leakage of water into the transmission (par. 21).

17. Engine Idle Adjustments

Engine idle speed should be correctly adjusted as described in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

18. Throttle and Manual Linkage

Incorrect throttle and manual linkage adjustment may cause many transmission malfunctions. Check and adjust linkage as described in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

19. Oil Pressure Tests

Incorrect oil pressure can contribute to many transmission malfunctions. Perform oil pressure tests as instructed in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG). Causes of improper oil pressure are listed in paragraph 23b.

20. Oil Leaks

If transmission oil level is found to be low at frequent checking intervals, cause is due to leakage. Source of leakage must be determined and condition corrected to avoid serious damage to transmission. Perform oil leakage checks as instructed in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

21. Water Leaks

a. *Internal Leaks.* If transmission oil level is found to be high at frequent checking periods, cause is probably due to internal water leaks from cooler core or cooler core connections. Check for internal water leakage by draining a small quantity of oil from transmission. Examine drained oil for presence of water. If evidence of water is found in oil, replace oil cooler assembly.

If no evidence of internal water leakage is found, refill transmission as instructed in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

b. *External Leaks.* Check and correct water leaks as instructed in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

22. Road Test

Perform road test as instructed in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

23. Troubleshooting Diagnosis, Probable Causes, and Remedies

a. *General.* A troubleshooting diagnosis guide, including probable causes and remedies, is given in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG). Subparagraphs b through s below provide a continuation of instructions where a remedy in the operator's manual refers to ordnance maintenance personnel for corrective action.

b. *Improper Oil Pressure.* Improper oil pressure, as determined by oil pressure tests in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG), is usually due to the malfunction of units in the transmission as described in (1) through (10) below.

- (1) *Oil pressure regulator valve.* An oil pressure regulator valve that is stuck may cause high, low, or fluctuating oil pressure. Remove, clean, inspect, and install oil pressure regulator valve (pars. 52 and 53).
- (2) *Front oil pump.* A defective front oil pump may cause high, low, or complete loss of oil pressure. Remove transmission and disassemble to replace front oil pump.
- (3) *Reverse unit.* Defective piston seals at reverse unit will allow slipping and oil pressure loss in reverse. Remove transmission and disassemble to inspect and replace reverse unit components.
- (4) *Reduction unit control valve pressure regulator (303M).* A stuck valve or broken valve spring may cause low oil pressure. Remove, clean, inspect, and install reduction unit control valve assembly (pars. 50 and 51).
- (5) *Front servo.* A defective front servo assembly may cause improper oil pressure. Remove, clean, inspect, and install front servo assembly (pars. 48 and 49).
- (6) *Rear planetary unit.* A defective rear planetary unit may cause low oil pressure. Remove transmission and disassemble to replace rear planetary unit.

- (7) *Oil delivery sleeve.* An improperly installed oil delivery sleeve or broken rings may cause improper oil pressure. Remove transmission and disassemble to replace oil delivery sleeve or rings.
- (8) *Front planetary unit.* Defective parts or internal leaks may cause low oil pressure. Remove transmission and disassemble to replace front planetary unit.
- (9) *Control valve.* A defective transmission control valve assembly may cause improper oil pressure. Remove, rebuild, and install control valve assembly (pars. 37 and 38).
- (10) *Oil passages.* Oil passages in transmission case and reduction unit case (303M) deliver oil to various operating units. Restricted, blocked, or leaking passages will cause improper oil pressures. Remove transmission and disassemble to inspect oil passages.
- c. Front Band Broken.* Remove transmission and partially disassemble to replace a broken front band.
- d. Rear Band Functioning Improperly.* Remove transmission and partially disassemble to repair or replace a rear band.
- e. Transmission Control Valve.* Should tests indicate that control valve is not functioning properly, replace valve (pars. 37 and 38).
- f. Governor.* Whenever tests indicate that governor is operating improperly, replace governor (pars. 41 and 42).
- g. Front Servo.* Whenever symptoms indicate that front servo is not functioning properly, replace servo (pars. 48 and 49).
- h. Rear Servo.* Whenever symptoms indicate that rear servo is not functioning properly, replace servo (pars. 48 and 49).
- i. Rear Oil Pump.* Whenever symptoms indicate that rear oil pump is not functioning properly, replace pump. Remove transmission and partially disassemble to replace rear oil pump and governor assembly.
- j. Reduction Unit Oil Pump (303M).* Whenever symptoms indicate that reduction unit oil pump is not functioning properly, replace pump. Remove transmission and partially disassemble to replace reduction unit oil pump.
- k. Reverse Unit Parts.* Remove transmission and disassemble whenever it is necessary to inspect and replace any of the reverse components.
- l. Front Planetary Unit.* Remove transmission and disassemble whenever it is necessary to inspect and replace any of the front planetary unit components.

m. Rear Planetary Unit. Remove transmission and disassemble whenever it is necessary to inspect and replace any of the rear planetary unit components.

n. Oil Delivery Sleeve. If oil delivery sleeve is defective or installed incorrectly, remove transmission. Inspect and replace sleeve.

o. Reverse Blocker Bracket. Whenever symptoms indicate that reverse blocker bracket assembly is defective, replace bracket (pars. 39 and 40).

p. Manual Control Valve Lever. The manual control valve lever (T, fig. 51) is a part of control valve assembly. Replace control valve assembly (pars. 37 and 38). For rebuild procedure, refer to paragraphs 74 through 76.

q. Oil Passages. Oil passages in transmission case and reduction unit case (303M) deliver oil to various operating units. Restricted, blocked, or leaking passages will cause various trouble symptoms. Inspection of oil passages can only be accomplished with transmission removed and completely disassembled.

r. Reduction Unit Control Valve (303M). Whenever symptoms indicate that reduction unit control valve is defective, replace valve (pars. 50 and 51).

s. Reduction Unit (303M). Whenever symptoms indicate that reduction unit is defective, remove transmission and partially disassemble. Inspect and replace reduction unit parts.

24. Noises

a. Noises which can be identified as "trouble" noises in the transmission proper are difficult to detect. There is a certain amount of normal "operating" sound during transmission operation. Normal operating and trouble noises in other power train units can be transmitted to the transmission, preventing positive isolation of actual transmission trouble noises.

b. As a general rule, transmission malfunctions will be evident and can be determined by other symptoms before any particular trouble noise can be detected. If during transmission operation, unusual noises at the transmission are heard, first determine if the noise is in the transmission or is being transmitted to the unit. If the "unusual" noise is actually in the transmission, other symptoms as indicated in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG), will generally be evident. Remedies can then be applied accordingly.

Section III. TROUBLESHOOTING DISABLED OR REBUILT TRANSMISSION ASSEMBLY

25. Purpose

a. Disabled Unit. In general, the tests outlined in this section can be applied to a disabled unit to verify diagnosis made when the unit was in a vehicle, or to determine faults if the unit is received by the ordnance establishment. If a disabled component is to be tested for purpose of trouble diagnosis, break-in cycling procedures will not be necessary as outlined for a rebuilt unit. However, other tests should be accomplished until actual malfunctions are determined.

b. Rebuilt Unit. A rebuilt transmission should be subjected to light load and full load cycling periods to insure the stabilizing of the components. In addition, the unit can be subjected to simulated operating conditions to check action and efficiency.

26. Equipment

a. A test stand must be devised to run-in and check a disabled or rebuilt unit. A type 302 engine may be used as the powerplant. The engine must be equipped with such standard accessories as necessary to simulate actual operating conditions. Throttle and manual control linkage must be used, and installed and adjusted in the same manner as on the vehicle.

b. A loading device, such as a dynamometer or a reversible water brake, must be used so that full throttle upshifts and downshifts can be checked as well as light throttle shifts.

c. A tachometer must be available to register engine revolutions per minute. A tachometer should also be available to adapt to the transmission output shaft. This tachometer must be calibrated in miles per hour. Pressure gages-B7950330 must be used to check oil pressures.

27. Methods of Testing

a. Preliminary Procedures. In order that an accurate test of the transmission can be made it is important that the average operating condition be duplicated on the test stand.

- (1) Engine and transmission must be properly attached and entire powerplant mounted on a test stand.
- (2) Remove pipe plugs and attach pressure gages-B7950330 at locations indicated in figure 8.
 - (a) Main line pressure at top left side of case.
 - (b) Reduction unit pump pressure (303M) at right side of reduction valve body.

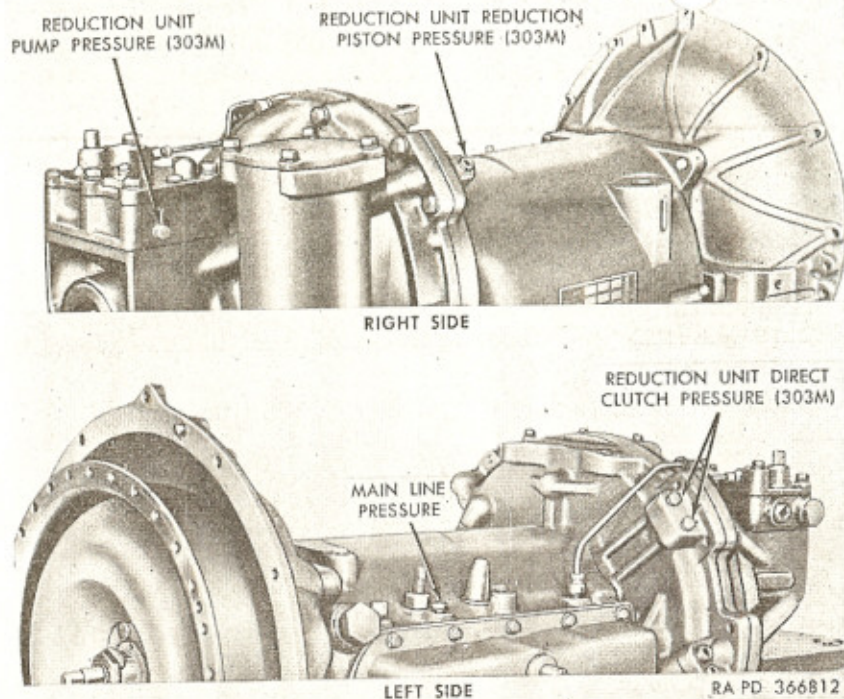


Figure 8. Connect oil pressure test gages at points indicated—(model 303M shown).

- (c) Reduction unit direct clutch pressure (303M) at left side of output shaft bearing retainer.
- (d) Reduction unit reduction piston pressure (303M) at right side of output shaft bearing retainer.
- (3) Before starting, check and, if necessary, fill transmission to proper oil level. Refer to applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG) for correct oil checking and filling procedure.
- (4) Before starting, be sure that an adequate supply of water is available and that all valves are open.
- (5) Start engine and check to see that the pressure gages for main line, reduction unit direct clutch, and reduction unit reduction piston pressures show sufficient pressure to operate transmission.

b. Cycling. A rebuilt transmission should have a light load cycling to insure that the new clutch packs, bands, and bearings can be stabilized before full loads are applied. "Cycling" the

transmission means going through the various upshifts and downshifts. Cycle in the manner shown in (1) and (2) below.

- (1) Cycle 1-2-3-4-3-2-1 with 100 pound-feet on output shaft on the 3 to 4 shift. Cycle in this manner 15 to 30 minutes.
- (2) After light load break-in, a full load break-in should be run, cycling in the same manner as (1) above for 30 to 45 minutes.

c. *Shift Points in RPM at Output Shaft.* Check all shift points at minimum throttle to detent throttle, and full throttle positions in "F-1" and "F-2" for 303M, or "Drive" and "Hilly" for 301MG.

Table III. Transmission Shift Points in RPM at Output Shaft

Shift	Upshift			Downshift		
	1-2	2-3	3-4	4-3	3-2	2-1
Minimum	480-570	825-960	1,075-1,225	860-740	770-670	550-425
To detent throttle	700-790	1,190-1,275	1,800-2,000	1,100-1,000	980-880	560-480
Full throttle high range—"F-1" (303M) or "Drive" (301MG).	780-880	1,290-1,400	2,080-2,260	2,050-1,900	1,050-950	580-480
Full throttle high range—"F-2" (303M) or "Hilly" (301MG).	780-880	No. 2-3 Under 1,500	2,080-2,260	2,050-1,900	1,120-950	580-480

d. *Direct Drive Oil Pressures.* Check main line oil pressure (303M and 301MG); also check reduction pump and direct clutch pressures (303M) as shown in table IV.

Table IV. Direct Drive Oil Pressures

	Main line	Reduction pump (303M)	Reduction direct clutch (303M)
Idle neutral (400 rpm).	90 min 110 max	-----	-----
Idle (375 rpm)	75 min	-----	-----
High range "F-1" (303M) or "Drive" (301MG).	110 max	-----	-----
4th Gear (3,000 rpm).	95 min 110 max	Line pressure ±10 lb.	-----
4th Gear (1,200 rpm).	95 min 110 max	Line pressure ±10 lb.	-----
Reverse (2,000 rpm).	180 min 220 max	100 min 115 max	Line pressure ±10 lb.

e. *Reduction Drive Oil Pressure (303M).* Check main line oil pressure, reduction pump, and reduction piston pressures as shown in table V.

Table V. Reduction Drive Oil Pressures (303M)

	Main line	Reduction pump	Reduction piston
Idle neutral (400 rpm).	90 min 110 max	-----	-----
Idle (375 rpm)	75 min	-----	-----
"F-1" low range.	110 max	-----	-----
4th Gear (3,000 rpm).	95 min 110 max	Line pressure ±10 lb.	-----
4th Gear (1,200 rpm).	95 min 110 max	Line pressure ±10 lb.	Line pressure ±10 lb.
Reverse (2,000 rpm).	180 min 220 max	100 min 115 max	Line pressure ±10 lb.

f. *Oil Pressure Test Limits.*

- (1) In both direct and reduction drive, there must not be more than a 30 psi pressure drop between neutral and drive at idle.
- (2) Oil pressure in neutral (400 rpm) must not drop more than 5 psi from direct to reduction.
- (3) Oil pressure in drive (375 rpm) must not drop more than 5 psi from direct to reduction.
- (4) Reduction pump pressure at 450 rpm, on coast, must be 50 psi minimum.
- (5) Reduction pump pressure at 200 rpm, after reverse, must be 45 psi minimum.
- (6) When checked in both direct and reduction drive and with transmission in neutral and engine stopped, accumulator must maintain at least 50 psi pressure for 50 seconds.

28. Diagnosis of Tests

The results of the checks and tests as described in paragraph 27 can be diagnosed by referring to transmission troubleshooting diagnosis guide in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG). Diagnosis guide lists probable causes in sequence of their usual occurrence and remedial measures to be taken when trouble has been determined.

SECTION IV. TROUBLESHOOTING DURING DISASSEMBLY AND ASSEMBLY OF TRANSMISSION

29. Purpose

At a specific stage of disassembly (par. 65), action of the servos and front and rear clutches can be checked by air pressure. Some oil leaks can also be determined by these checks. These checks may disclose malfunctions which will assist in determining the replacement of affected parts. The same checks are also made at a specific stage of assembly (par. 146) to check the proper installation of servos and clutches.

30. Air-Check of Case Passages

The air gun assembly—B7950562 must be installed on an air hose connected to a source of compressed air of approximately 100 psi. Apply the rubber end of the gun firmly to the passage hole. Gun is equipped with an on-and-off button. Refer to figure 9 for location of passage holes and method of applying gun. Paragraph 31 itemizes the checks to make and diagnosis of each check.

31. Diagnosis of Checks

a. Front Clutch Apply (E, Fig. 9).

- (1) Apply air pressure to passage E. Pressure should actuate front clutch. As pressure is intermittently ap-

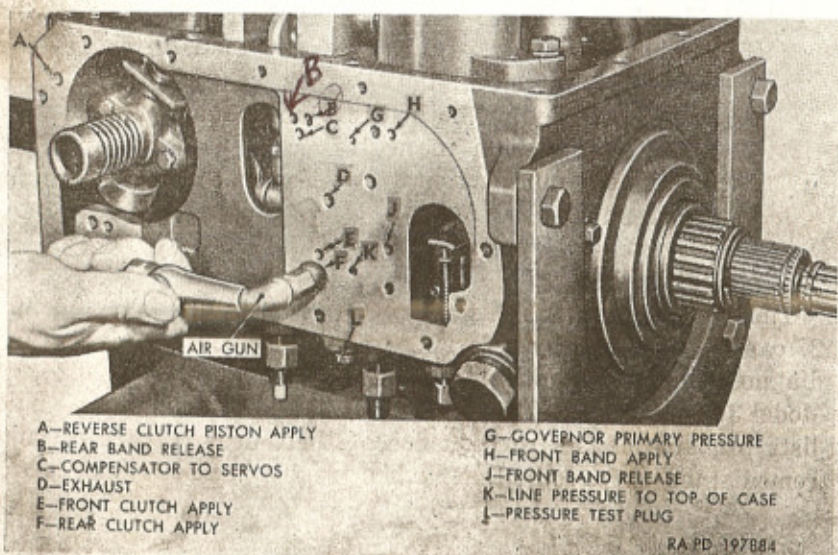


Figure 9. Location of passage holes for air-checking units with air gun assembly—B7950562.

plied; movement of the clutch piston should be audible, and in most cases, can be felt by holding front drum firmly with free hand.

- (2) If an unusual amount of air is escaping around oil delivery sleeve area, another check at passage E should be made after servos are removed (par. 66 or 67) to observe, more clearly, the point of leakage.
- (3) If a fog of oil is emitted from inside front of front drum, accompanied by escape of a great amount of air, leak is probably due to faulty front clutch piston seals.
- (4) Leakage from any other drilled passages inside of transmission case, while pressure is applied to passage E, is an indication of a faulty transmission case or oil delivery sleeve.

b. Rear Clutch Apply (F, Fig. 9).

- (1) Apply air pressure at passage F. Pressure should actuate rear clutch. As pressure is intermittently applied, movement of the clutch piston should be audible, and in most cases, can be felt by holding rear drum firmly with free hand.
- (2) If an unusual amount of air is escaping around oil delivery sleeve area, another check should be made at passage F after servos are removed (par. 66 or 67) to observe more clearly the point of leakage.
- (3) If a fog of oil is emitted from inside rear unit drum assembly accompanied by escape of a large amount of air, leak is probably due to faulty clutch piston seals or oil delivery sleeve rings.
- (4) Leakage from any other passage on side of case, while pressure is applied at passage F, is an indication of faulty transmission case (interconnected passages) or oil delivery sleeve.

c. Front Band Apply (H, Fig. 9).

- (1) Apply air pressure to passage H. Pressure should actuate the front servo with no unusual escape of air.
- (2) Observe area around flat surface of servo body that rests on case. No appreciable escape of air should be noticed at this point.
- (3) A small amount of leak from exhaust hole in front servo body and from passage at J is permissible. However, leak from hole at point J should not be an open blow-by, but only amount that would leak past servo apply piston ring gap.

d. Front Band Release (J, Fig. 9). Apply air pressure to passage J. Pressure will not actuate servo because servo apply

servo body and case, or around band release cylinder except that which would normally leak past piston ring gap.

e. Rear Band Release (B, Fig. 9).

- (1) Apply air pressure to point B. Pressure should release the rear servo and band with no unusual escape of air. A small amount of air will escape through piston ring gaps but this should not be enough to impair normal servo operation.
- (2) Observe area where rear servo body rests on case. There should be no appreciable amount of air escape at this point.
- (3) Check for leakage at other passage holes at side of case while applying air to point B. While a small amount of air may be emitted from passage at point C, blow-by from any other passage holes indicates interconnected passages in case, necessitating replacement of case.

f. Compensator to Front and Rear Servos (C, Fig. 9).

- (1) Apply air pressure to point C. Pressure should actuate rear servo to tighten rear band which is applied by spring pressure, and to actuate front servo to apply front band.
- (2) No appreciable amount of air should escape from either front or rear servo, or any other passages on side of case except that which may escape through piston ring gap.

g. Reverse Clutch Piston Apply (A, Fig. 9).

- (1) Apply air pressure to passage A. Pressure should actuate the reverse clutch piston. As pressure is intermittently applied, movement of the clutch piston should be audible. In most cases, movement can be felt by holding the reverse internal gear with free hand.
- (2) If an unusual amount of air is heard escaping around the clutch piston, the outer and/or inner seal on piston is leaking.

h. Line Pressure to Top of Case (K, Fig. 9). Apply air pressure to passage K. Pressure applied to this passage should produce no leaks if pressure test plug (L) is tight.

i. Exhaust (D, Fig. 9). Apply air pressure to passage D. Pressure should be a complete blow-by to inside of case. Remove gun from passage and visually inspect passage to be sure that

A partial obstruction in this passage can cause poor shift conditions.

j. Governor Primary Pressure (G, Fig. 9). Apply air pressure to passage G. No air escape should be noticeable between servo body and transmission case, or from any passage in side of the case, except possibly a small amount from passage J.

CHAPTER 4

SERVICE AND REPLACEMENT OF MAJOR COMPONENTS BEFORE TRANSMISSION REMOVAL

Section I. SERVICE AND EXTERNAL ADJUSTMENTS

32. Transmission Oil

Procedures for checking, draining, and filling transmission with proper oil are outlined in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG). Accomplishment of these services is extremely important, as improper oil level contributes to various trouble symptoms as outlined in chapter 3. The transmission oil referred to in this manual is OE-10 to atmospheric temperatures of +10°F. Below +10°F., OES is used.

33. Linkage Maintenance

The proper adjustment of manual and throttle linkage must be accomplished and maintained if the transmission is expected to operate correctly. Linkage adjustment and replacement procedures are covered in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

34. Front Band Adjustment

Other than linkage adjustments, front band adjustment for normal wear is the only transmission adjustment within the scope of the using organization. Procedures for these adjustments are covered in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

Section II. TRANSMISSION CASE SIDE COVER REPLACEMENT

35. Removal

a. On M59 vehicles, transmissions are accessible when right or left access panels are removed as instructed in operator's manual TM 9-7002.

b. Disconnect transmission control linkage (fig. 9 or 11) as described in (1) through (4) below.

- (1) Loosen throttle valve control lever bolt; then remove throttle valve control lever from throttle control valve lever shaft.
- (2) Loosen transmission shifting lever bolt; then remove transmission shifting lever from manual control valve lever shaft.
- (3) On 6 x 6 vehicles, disconnect transfer reverse rod from transmission shifting lever by removing cotter pin and clevis pin.
- (4) On 6 x 6 vehicles, disconnect transmission shifting lever trunnion from transmission shifting lever by removing nut and washer.

c. With snap ring pliers, remove snap ring from manual control valve lever shaft; then remove cup, seal spring, gasket, retainer, and seal ring from shaft. Discard seal ring and gasket.

d. Remove 12 cap screws with lockwashers attaching side cover to transmission case; then remove side cover. Side cover gasket may come off with side cover or remain with transmission case. Remove and discard gasket.

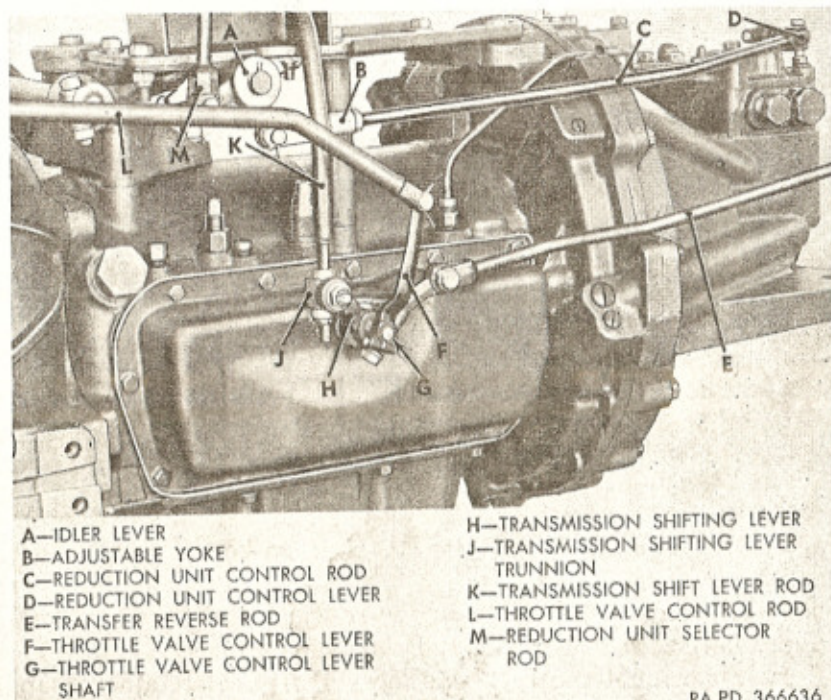
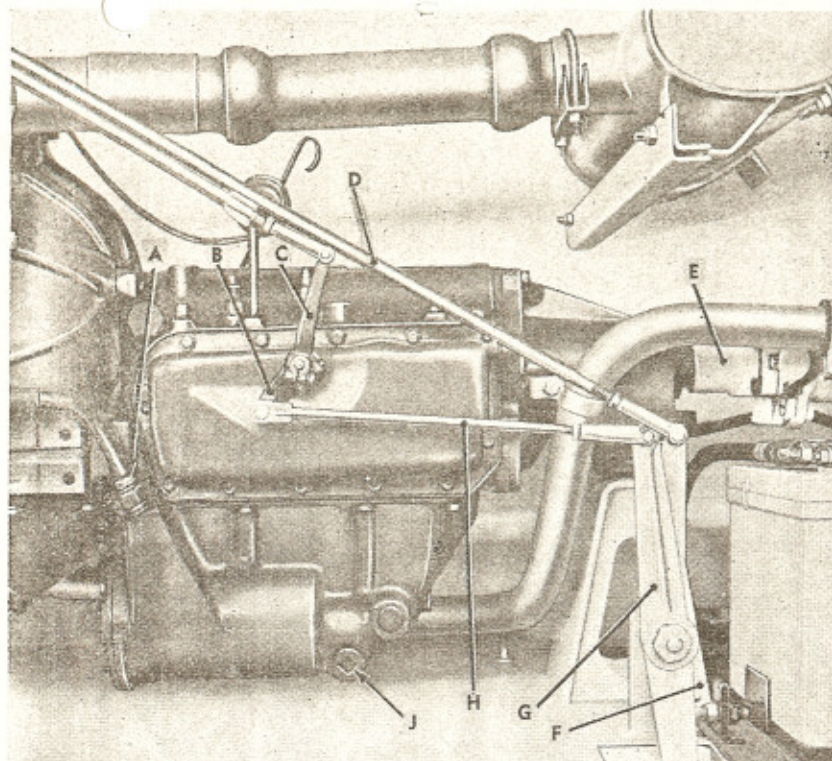


Figure 10. Transmission control linkage (303M).



A—OIL COOLER LINE NUT
 B—TRANSMISSION SHIFTING LEVER
 C—THROTTLE VALVE CONTROL LEVER
 D—THROTTLE CONTROL ROD
 E—UNIVERSAL JOINT

F—THROTTLE CONTROL IDLER LEVER
 G—MANUAL CONTROL IDLER LEVER
 H—MANUAL CONTROL ROD
 J—DRAIN PLUG

RA PD 366742

Figure 11. Transmission control linkage—301MG (left unit shown).

36. Installation

- a. Position new side cover gasket on transmission case.
- b. Attach case side cover to transmission case with twelve $\frac{1}{4} \times \frac{1}{2}$ cap screws with lockwashers.
- c. Before tightening cap screws, align side cover so it will not bond on manual control valve lever shaft. Tighten cap screws to 10 to 12 pound-feet torque.
- d. Install new seal ring inside the manual control valve lever shaft seal retainer. Install new O-ring gasket at outside of retainer.
- e. Install manual control valve lever shaft seal retainer over manual shaft with seal spring and cup over retainer.
- f. Install manual control valve lever shaft seal retainer snap ring on manual shaft. Tap snap ring into place using improvised installer and light hammer (fig. 210).

g. Connect linkage (fig. 10 or 11) as described (1) through (4) below.

- (1) Install transmission shifting lever on manual control valve lever shaft and tighten clamp bolt.
- (2) Position throttle valve control lever on throttle valve control lever shaft and tighten attaching bolt.
- (3) On 6 x 6 vehicles, position transmission shifting lever trunnion on transmission shifting lever and attach with $\frac{5}{16}$ -24 nut and $\frac{1}{32}$ -inch plain washer.
- (4) On 6 x 6 vehicles, attach transfer reverse rod to transmission shifting lever with clevis pin and cotter pin.

h. Check oil level and replenish as outlined in applicable operator's manual (TM 9-8024 for Model 303M or TM 9-7002 for Model 301MG).

i. Refer to TM 9-8024 (303M) or TM 9-7002 (301MG) for transmission control linkage adjustment.

j. On M59 vehicles, install access panels as instructed in operator's manual TM 9-7002.

Section III. TRANSMISSION CONTROL VALVE ASSEMBLY REPLACEMENT

37. Removal

- a. Remove transmission side cover (par. 35).
- b. Remove oil pressure regulator valve reverse oil pipe (fig. 34) by pulling straight out. It may be necessary to use light screwdriver pressure to start tube out. Be careful not to bend tube.
- c. Loosen two bolts which attach the reverse blocker bracket assembly (N, fig. 29) to transmission case. This is done to prevent damaging transmission control valve when removing control valve assembly.
- d. Remove four bolts and lockwashers which attach transmission control valve assembly (J, fig. 29) to transmission case, while supporting control valve assembly with hand.
- e. Pull valve body about one-eighth inch away from transmission case so valve inner body will not be damaged or case scratched. It may be necessary to lightly tap reverse clutch oil pipe (fig. 35) gradually out of transmission case as valve body moves away from case.
- f. Slide control valve assembly toward front of transmission; then remove control valve assembly. The three governor oil delivery lines may stay with the reverse blocker bracket assembly

or control valve assembly. Remove three oil delivery lines. Remove reverse blocker lever return spring (fig. 206). Remove reverse clutch oil pipe (fig. 35).

g. Refer to paragraph 74 through 76 for rebuild of transmission control valve assembly.

38. Installation

a. Position one governor oil delivery line into inner hole of reverse blocker bracket. Connect the reverse blocker lever return spring to the oil delivery line and reverse blocker lever pin (fig. 206). Check blocker lever for free movement and full return toward oil line.

b. Install two remaining oil delivery lines into bores in reverse blocker bracket. Install reverse clutch oil pipe with "L" or short end in passage in transmission case.

c. Position transmission control valve assembly over three governor oil delivery lines and the reverse clutch oil pipe. Make sure detent in manual control valve lever engages reverse blocker lever.

d. Start four $\frac{1}{4}$ x 2 bolts with $\frac{1}{4}$ -inch external-teeth lockwashers through valve body and into transmission case. Press control valve assembly and reverse blocker assembly into position against transmission case. Tighten four control valve assembly attaching bolts to 6 to 8 pound-feet torque.

e. Insert short end of oil pressure regulator valve reverse oil pipe into bore of transmission control valve and long end of pipe into passage in transmission case. Tap pipe gently into place, using soft hammer.

f. Position governor alining gage—A7950067 (fig. 207) in reverse blocker bracket assembly and over governor tower. With gage in place, tighten two reverse blocker bracket bolts, which were loosened at time of control valve removal, to 10 to 13 pound-feet torque.

g. Gage must rotate freely in reverse blocker bracket and governor tower must rotate freely within gage. Rotate gage to be sure that no binding exists. Rotate governor by turning transmission output shaft at propeller shaft.

h. Should gage or governor bind at any point, loosen reverse blocker bracket bolts and reposition bracket. Recheck governor-to-gage and gage-to-blocker bracket clearance at one-quarter turn intervals to be sure that no binding exists. Remove gage.

i. Install transmission side cover (par. 36).

Section IV. REVERSE BLOCKER BRACKET ASSEMBLY REPLACEMENT

39. Removal

a. Remove transmission control valve assembly from transmission case (par. 37).

b. Remove two bolts attaching reverse blocker bracket assembly to transmission case.

c. Slide the reverse blocker bracket assembly outward and off the governor tower.

d. Refer to paragraphs 77 through 79, for rebuild of reverse blocker bracket assembly.

40. Installation

a. With gap in all four oil rings on governor tower up, place chamfered side of reverse blocker bracket oil delivery sleeve over end of governor tower. Press reverse blocker bracket gently into position, guiding oil rings on governor tower into oil delivery sleeve of reverse blocker bracket.

b. Install two $\frac{5}{16}$ x $1\frac{3}{4}$ bolts with $\frac{5}{16}$ -inch lockwashers. Do not tighten bolts at this time, leaving reverse blocker bracket $\frac{1}{8}$ inch away from transmission case.

c. Install transmission control valve assembly (par. 38).

Section V. TRANSMISSION GOVERNOR ASSEMBLY REPLACEMENT

41. Removal

a. Remove reverse blocker bracket assembly (par. 39).

b. Mark governor body and governor drive flange to insure assembly in original position.

c. Remove two bolts and lockwashers which attach governor to governor drive flange; then remove governor assembly.

d. Refer to paragraphs 92 through 95 for rebuild of transmission governor assembly.

42. Installation

a. Position governor on governor drive flange, with matching marks alined (par. 41b).

b. Install two $\frac{1}{4}$ x $1\frac{1}{8}$ bolts and $\frac{1}{4}$ -inch external-teeth lockwashers which attach governor to drive flange. Tighten bolts to 6 to 8 pound-feet torque.

c. Check governor runout as indicated in (1) through (3) below.

- (1) Mount dial indicator—41-I-100 on transmission, with indicator spindle contacting governor tower approximately one-half inch from end of governor tower (fig. 193). Rotate governor by turning transmission output shaft several revolutions at propeller shaft and note dial indicator reading. Total runout should not exceed 0.005 inch. If runout is within limits prescribed, remove dial indicator and omit (2) and (3) below. If runout is not within limits, continue with (2) below.
 - (2) Remove dial indicator. Mark position of governor body on drive flange; then remove governor from drive flange. Reinstall governor on drive flange 180° from original position. Install dial indicator and check runout in the same manner as described in (1) above. If runout is still not within limits (0.005 inch), remove dial indicator and governor, and check as described in (3) below.
 - (3) Install dial indicator—41-I-100 (fig. 194) with spindle contacting drive flange just inside the tapped holes. Rotate governor by turning transmission output shaft several revolutions at propeller shaft and note indicator reading. If runout exceeds 0.002 inch, remove transmission from vehicle and replace governor drive flange and/or rear oil pump assembly; then recheck drive flange with indicator. If within limits (0.002 inch), install governor and check as described in (1) above. If not within limits, install new governor assembly, and recheck as described in (1) above.
- d. Install reverse blocker bracket assembly (par. 40).

Section VI. TRANSMISSION OIL PAN AND COOLER REPLACEMENT

43. General

Since the instructions necessary for replacement of transmission oil pan and cooler assembly differ in some respects between Model 301MG and Model 303M transmissions, this information is separated into individual paragraphs.

44. Oil Pan Assembly Removal—Model 303M

a. Remove drain plug from bottom of transmission oil pan at point marked WATER. Allow water to drain from transmission oil pan.

b. Remove magnetic oil drain plug from transmission oil pan at point marked OIL, and drain oil from transmission oil pan into clean receptacle.

c. Unscrew oil cooler line nuts at both sides of transmission oil pan; then pull lines free from connectors.

d. Remove transmission oil pan by removing 10 bolts, 2 stud nuts, and 12 copper washers. Lower pan from studs. Gasket may come off with oil pan or remain on transmission case. Remove and discard gasket.

e. Discard front oil pump intake pipe sealing ring.

f. Refer to paragraphs 80 through 82 for rebuild of transmission oil pan and cooler assembly.

45. Oil Pan Assembly Removal—Model 301MG

Note. The capitalized key letters shown below in parentheses refer to figure 11. Oil pan assembly removed is shown in figure 12.

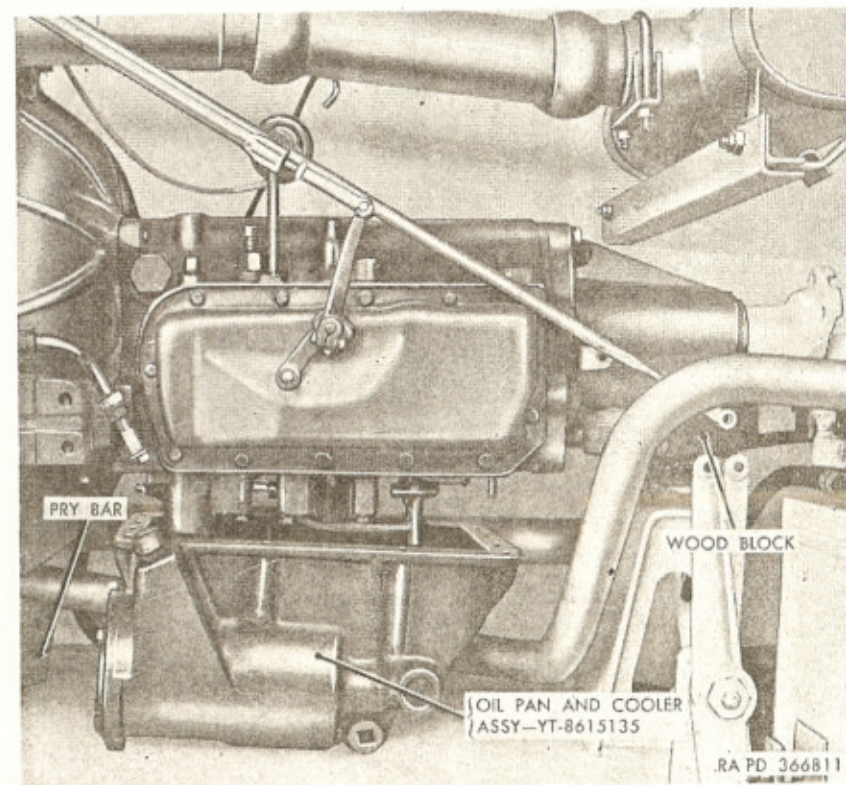


Figure 12. Removing or installing transmission oil pan—301MG (left unit shown).

a. On cycles equipped with Model 301MG transmissions, the transmissions are accessible when right or left access panels are removed as instructed in operator's manual TM 9-7002.

b. Remove pipe plug from oil pan oil cooler cover on oil pan. Allow water to drain from transmission oil pan.

c. Remove magnetic oil drain plug (J) from transmission oil pan (pan is marked OIL) and drain oil from transmission oil pan into clean receptacle.

d. Remove cotter pin and clevis pin attaching throttle control rod (D) to idler lever (F).

e. Remove cotter pins and clevis pins attaching manual control rod (H) to manual control idler lever (G) and transmission shifting lever (B); then remove rod assembly.

f. Loosen two fillister head screws at carburetor and pull choke cable from carburetor.

g. Remove two nuts and bolts attaching water inlet clamps to clips, one at oil pan oil cooler cover and another at rear of transmission.

h. Unscrew oil cooler line nuts (A) at both sides of transmission oil pan; then pull lines free from connectors.

i. Straighten locking plate tabs; then remove two transmission rear mounting cap screws and locking plates.

j. At propeller shaft universal joint (E), straighten tabs on two locking plates; then remove four cap screws and locking plates.

k. Loosen (do not remove) two engine front mounting bolt nuts.

l. At transmission oil pan, remove 10 bolts, 2 stud nuts, and 12 copper washers. Lower pan from studs and permit to rest on floor of engine compartment (fig. 12).

m. Use wooden pry bar under flywheel housing cover and lift transmission approximately 2 inches so that wood block (fig. 12) can be placed under transmission at rear mounting.

n. Oil pan and oil cooler assembly can now be pulled from under transmission. Gasket may come off with oil pan or remain on transmission case. Remove and discard gasket.

46. Oil Pan Assembly Installation—Model 303M

a. Install new front oil pump intake pipe sealing ring on intake pipe. Position new oil pan gasket on transmission oil pan. Position oil pan to transmission case, making sure front oil pump intake pipe is in proper position.

b. Install ten $\frac{5}{16}$ x $\frac{3}{4}$ cap screws, two $\frac{5}{16}$ -24 nuts, and twelve copper washers which attach oil pan to transmission case.

Tighten cap screws to 15 to 18 pound-feet torque and tighten nuts to 10 to 13 pound-feet torque.

c. Position transmission water lines at each side of transmission oil pan; then tighten line nuts firmly.

d. Install magnetic oil drain plug in transmission oil pan and tighten plug to 35 to 45 pound-feet torque.

e. Install water drain plug and tighten to 35 to 45 pound-feet torque. Fill cooling system as instructed in operator's manual TM 9-8024.

f. Replace oil drained at time of oil pan removal; then check oil level and replenish as outlined in operator's manual TM 9-8024.

47. Oil Pan Assembly Installation—Model 301MG

Note. The capitalized key letters shown below in parentheses refer to figure 11.

a. Install new oil pump intake pipe sealing ring on intake pipe. Position new oil pan gasket on transmission oil pan.

b. Position oil pan assembly to transmission case and secure with ten $\frac{5}{16}$ x $\frac{3}{4}$ cap screws, two $\frac{5}{16}$ -24 nuts, and twelve copper washers. Tighten cap screws to 15 to 18 pound-feet torque and tighten nuts to 10 to 13 pound-feet torque.

c. Position transmission water lines at each side of transmission oil pan; then firmly tighten oil cooler line nuts (A).

d. Using pry bar under flywheel housing cover, lift transmission sufficiently to remove wooden block at rear mounting (fig. 12). Aline rear mounting bolt holes as transmission is lowered.

e. Install two rear mounting bolts and locking plates. Tighten bolts to 33 to 43 pound-feet torque. Bend locking plate tab against flat of bolt.

f. Tighten the two engine front mounting bolt nuts which were loosened at time of oil pan removal.

g. At propeller shaft universal joint (E), install two locking plates and four $\frac{3}{16}$ x $1\frac{1}{16}$ cap screws. Tighten cap screws to 33 to 43 pound-feet torque; then bend tab of locking plate against flat of screw heads.

h. Secure water inlet line clips to oil pan oil cooler cover and to rear of transmission, using two $\frac{5}{16}$ x $\frac{5}{8}$ cap screws and $\frac{5}{16}$ -24 nuts.

i. Connect carburetor choke cable to carburetor, using two fillister head screws.

j. Connect throttle control rod (D) to throttle control idler lever (F), using clevis pin and cotter pin.

Connect manual control rod (H) to transmission shifting lever (B) and manual control idler lever (G), using two clevis pins and cotter pins.

l. Install magnetic oil drain plug in transmission oil pan and tighten plug to 35 to 45 pound-feet torque.

m. Install pipe plug in oil pan oil cooler cover and tighten to 6 to 7 pound-feet torque. Fill cooling system as directed in operator's manual TM 9-7002.

n. Replace oil drained at time of oil pan removal; then check oil level and replenish as outlined in operator's manual TM 9-7002.

Section VII. FRONT AND REAR SERVO ASSEMBLY REPLACEMENT

48. Removal

a. Remove transmission oil pan assembly (par. 44 or 45).

b. On Model 303M transmission, remove front oil pump intake pipe clip (Q, fig. 36) from front oil pump intake pipe assembly (L, fig. 36) and front oil pump discharge pipe assembly P, fig. 36). Remove screw with lockwasher (N, fig. 36) attaching front oil pump intake pipe clip (M, fig. 36) to rear servo assembly. Remove front oil pump discharge pipe clip (H, fig. 36) attaching discharge pipe to rear oil pump assembly.

c. On Model 301MG transmission, remove two screws with lockwashers (H, fig. 39) attaching front and rear oil pump intake pipe assembly (K, fig. 39) to rear oil pump assembly. Remove and discard flange gasket.

d. Using a $2\frac{5}{32}$ -inch and a $1\frac{1}{16}$ -inch open end wrench, disconnect the oil pump discharge pipe assembly (L, fig. 39 or P, fig. 36) from front servo line fitting.

e. Remove four bolts (A and C, fig. 36 or 39) and lockwashers attaching front and rear servo assemblies (B and E, fig. 36 or 39) to transmission case.

f. Move rear servo assembly (E, fig. 36 or 39) toward rear of transmission and remove rear servo assembly; then remove front servo oil transfer line (D, fig. 36 or 39) from front servo.

g. Remove front servo assembly (B, fig. 36 or 39) by pulling away from transmission. Front oil pump delivery line (JJ, fig. 182) may stick to either front servo or front oil pump. Remove front oil pump delivery line.

h. Refer to paragraph 83 through 88, for rebuild of front and rear servo assemblies.

49. Installation

a. Insert front oil pump delivery line (JJ, fig. 182) into front oil pump body.

b. On Model 303M transmission, insert front oil pump discharge pipe assembly (P, fig. 36) into passages at rear of transmission case, working line well back into position.

c. On Model 301MG transmission, insert plain end of rear oil pump discharge pipe assembly (L, fig. 39) into rear oil pump.

d. Position front band so that end of band is against adjusting stop.

e. Position front servo assembly (B, fig. 36 or 39) with piston stem in slot on end of front band. Place servo on front oil pump delivery tube. Push servo into position against transmission case, at the same time entering oil pump discharge pipe assembly (L, fig. 39 or P, fig. 36) into brass fitting on servo body.

f. Install one $\frac{3}{8}$ x 1 bolt (A, fig. 36 or 39), $\frac{3}{8}$ x 2 bolt (C, fig. 36 or 39), and two $\frac{3}{8}$ -inch lockwashers attaching front servo assembly to transmission case. Do not screw down more than two or three threads on bolts.

g. Insert front servo oil transfer line (D, fig. 36 or 39) into passage of front servo body.

h. Place rear servo assembly (E, fig. 36 or 39) in position, engaging rear band strut with actuating lever while inserting oil transfer line from front servo into rear servo passage. Make sure the rear band release spring is in its proper position.

i. Attach rear servo to transmission case with two $\frac{3}{8}$ x 2 bolts (C, fig. 36 or 39) and $\frac{3}{8}$ -inch lockwashers. Tighten all four front and rear servo attaching bolts to 23 to 28 pound-feet torque.

j. Using $2\frac{5}{32}$ -inch and $1\frac{1}{16}$ -inch open end wrenches, tighten the oil pump discharge pipe assembly (L, fig. 39 or P, fig. 36) to front servo pipe fitting.

k. Insert front oil pump intake pipe assembly (K, fig. 39 or L, fig. 36) into opening in front oil pump assembly.

l. On Model 301MG transmission, use gasket at flange and secure oil pump intake pipe flange to rear oil pump, using two No. 10 x $\frac{7}{16}$ screws with lockwashers (H, fig. 39).

m. On Model 303M transmission, secure front oil pump intake pipe clip (M, fig. 36) to rear servo with No. 10 x $\frac{7}{16}$ screw with lockwasher (N, fig. 36). Secure front oil pump intake pipe to discharge pipe with front oil pump intake pipe clip (Q, fig. 36); also secure front oil pump discharge pipe to rear oil pump with front oil pump discharge pipe clip (H, fig. 36).

145 and front band adjustment as instructed in paragraph 144.
(Install transmission oil pan assembly (par. 46 or 47).

Section VIII. REDUCTION UNIT CONTROL VALVE ASSEMBLY REPLACEMENT (303M ONLY)

50. Removal

a. Loosen clamping bolt at reduction unit control lever; then tap lever from control valve lever shaft.

b. Disconnect reduction blocker line assembly from the reduction unit control valve assembly.

c. Loosen pressure regulator valve stop plug (CC, fig. 155), body plug (DD, fig. 155), pipe plug (HH, fig. 155), and reduction blocker line connector (H, fig. 182), at valve body.

Note. These plugs and the connector should be loosened at this time to prevent possibility of damaging the control valve body during disassembly.

d. Remove six bolts and lockwashers attaching reduction unit control valve to reduction unit case. Remove control valve assembly (L, fig. 168). Gasket may come off with control valve assembly or remain with reduction unit case. Remove and discard gasket.

e. Refer to paragraphs 114 through 116 for rebuild of reduction unit control valve assembly.

51. Installation

a. Position new reduction unit control valve gasket on control valve assembly.

b. Aline control valve assembly and new gasket on reduction unit case (fig. 168).

c. Install five $\frac{3}{8}$ x $2\frac{3}{4}$ and one $\frac{3}{8}$ x $3\frac{1}{4}$ attaching bolts and six $\frac{3}{8}$ -inch lockwashers and tighten to 33 to 37 pound-feet torque.

d. Tighten pressure regulator valve stop plug (CC, fig. 155) to 35 to 40 pound-feet torque; also tighten reduction control valve body plug (DD, fig. 155) to 25 to 30 pound-feet torque and $\frac{1}{8}$ -inch pipe plug (HH, fig. 155) to 15 to 18 pound-feet torque.

e. Install and tighten reduction blocker line connector (H, fig. 182) at valve body. Connect reduction blocker line assembly to control valve assembly and tighten firmly.

f. Install reduction unit control lever on control valve lever shaft; then tighten clamping bolt to 10 to 13 pound-feet torque.

Section IX. TRANSMISSION OIL PRESSURE REGULATOR VALVE REPLACEMENT

52. Removal (fig. 41)

a. Unscrew pressure regulator plug assembly while holding palm of hand against spring tension.

b. Remove plug assembly, plug gasket, reverse booster plug, regulator valve spring, and oil pressure regulator valve from transmission case.

c. Refer to paragraph 130d for inspection of transmission oil pressure regulator valve components.

53. Installation (fig. 41)

a. Install oil pressure regulator valve and spring in front oil pump.

b. Install new gasket on plug and insert reverse booster plug in end of plug; then screw plug into case. Tighten plug to 35 to 45 pound-feet torque.

CHAPTER 5

DISASSEMBLY OF TRANSMISSION

Section I. GENERAL

54. Scope of Procedures

The procedures described in paragraphs 57 through 73 are in a practical sequence for the complete disassembly of the transmission into major components and subassemblies. Unless otherwise indicated, these procedures apply to both transmissions (303M and 301MG) covered by this manual. In some instances, slight differences in procedure are noted in the text; however, where differences are such that combined coverage is impractical, procedures for each unit are covered in separate paragraphs. Wherever practical, the rebuild procedures on various subassemblies are described in the respective sections of chapter 6. Many illustrations incorporated in paragraphs 57 through 73 can and should be referred to when assembling the transmission as instructed in paragraphs 132 through 154. Conversely, some illustrations in the assembly procedures are also referred to when disassembling the transmission.

55. Use of Tools and Equipment

Special tools and equipment referred to and illustrated in the disassembly and assembly procedures must be used to adequately and efficiently accomplish procedures as outlined. An adequate number of clean trays or containers should be available so that various parts can be segregated to facilitate assembly.

56. Inspection During Disassembly

During the various stages of disassembly, visual examination of many parts may be made to quickly determine the necessity of replacement. However, final inspection must be made as outlined in chapter 6 and paragraphs 126 through 131. During some stages of disassembly, inspection or tests should be accomplished as outlined. The results of these checks will assist in pointing out definite malfunctions.

Section II. DISASSEMBLY OF TRANSMISSION INTO MAJOR COMPONENTS AND SUBASSEMBLIES

57. Removal of Torus Assemblies and Cover

Note. The torus assemblies and cover must be removed at time transmission is disconnected from engine assembly. This is necessary in order to remove the housing rear half. The flywheel housing rear half as well as the front half must remain with its respective engine. The flywheel housing front and rear halves are marked with the engine serial number to which the housings are matched. The following procedures cover the disassembly of transmission assembly with flywheel rear housing (L, fig. 13) attached. Capitalized key letters shown below in parentheses refer to figure 13.

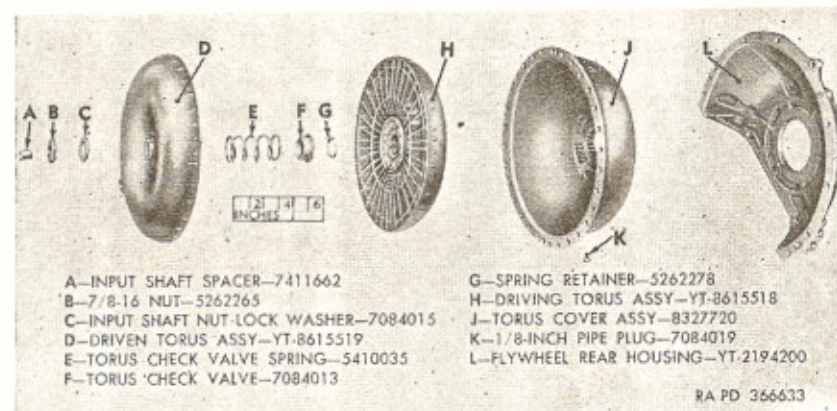


Figure 13. Torus members and cover components.

- Place transmission on a clean work bench.
- Remove input shaft spacer (A) from end of input shaft (fig. 14).

Note. It may be necessary to spread spacer slightly, using a thin blade screwdriver to facilitate spacer removal.

- Bend input shaft nut lockwasher (C) away from input shaft nut (B). While holding torus assembly with torus holding wrench—B7950256 (fig. 220), remove nut (B); then remove input shaft nut lockwasher (C) from input shaft.
- Pull driven torus assembly (D) from input shaft. If torus assembly sticks, lightly strike end of input shaft with plastic hammer.
- Remove torus check valve spring (E) and torus check valve (F) from input shaft.
- Remove spring retainer (G) with snap ring pliers (fig. 15). Remove driving torus assembly (H) and torus cover assembly (J) together by sharply pulling straight out on cover.

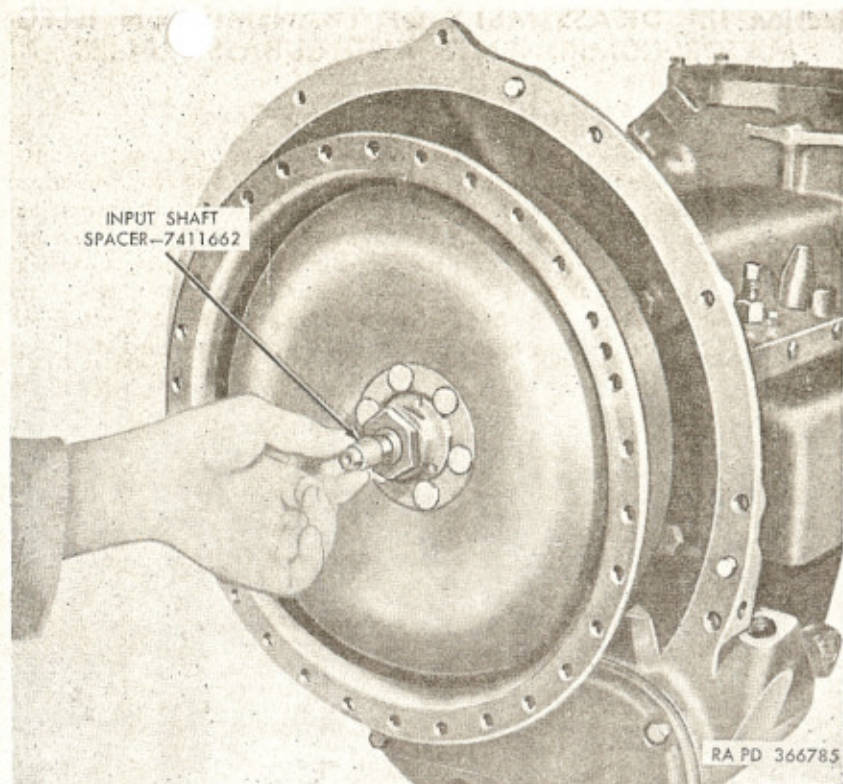


Figure 14. Removing or installing input shaft spacer.

Caution: Do not rock cover from side to side, as damage to oil seal and seal ring at front oil pump may occur.

g. Remove four bolts and lockwashers which attach flywheel rear housing (L) to transmission case. Remove flywheel rear housing from transmission; then temporarily attach to flywheel front housing on engine.

h. Refer to paragraph 128 for inspection and repair of torus assemblies.

Note. Use caution in performing procedures *i*, *j*, and *k* below to prevent damaging input shaft.

i. Use a chain hoist and lifting eye bolt—A266327 (fig. 16) to facilitate positioning of 301MG transmission from work bench to repair stand or vice versa.

j. Use a chain hoist and two lifting hooks—B7950336 (fig. 17) to facilitate positioning of 303M transmission from work bench to repair stand or vice versa.

k. Mount 301MG transmission to repair stand—D7950874 (fig. 18), using four $\frac{1}{2}$ -13 x $1\frac{1}{4}$ bolts to attach front of transmission

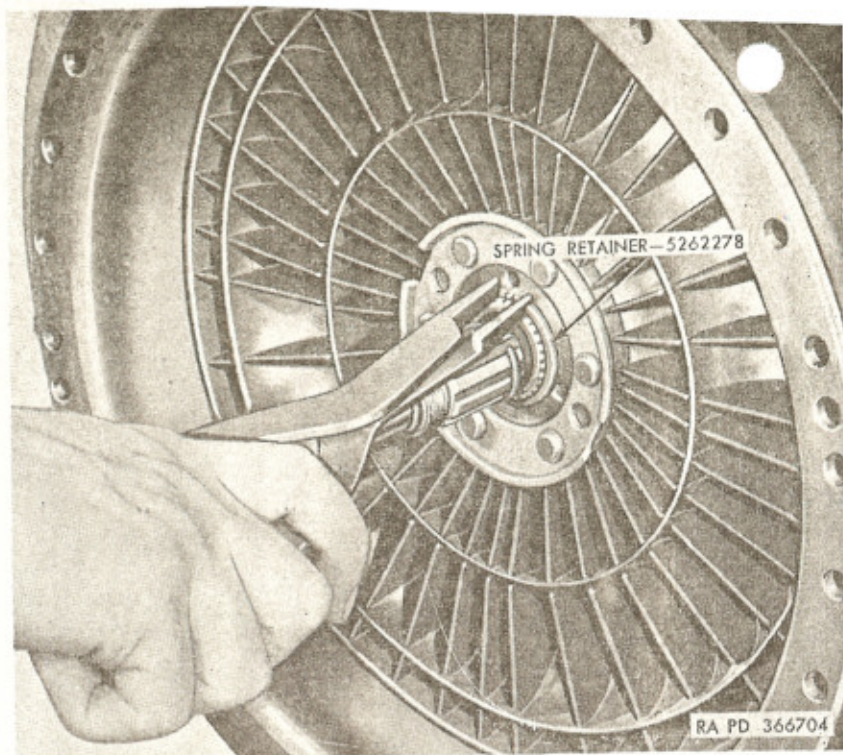


Figure 15. Removing or installing driving torus spring retainer.

to stand and one $\frac{7}{16}$ -13 x 1 bolt to attach top of transmission case to stand.

l. Mount 303M transmission on repair stand—D7950874 (fig. 19), using four $\frac{1}{2}$ -13 x $1\frac{1}{4}$ bolts to attach front of transmission to stand. Use one $\frac{7}{16}$ -13 x 1 bolt (fig. 18) to attach top of transmission case to stand and two $\frac{7}{16}$ -13 x $1\frac{1}{4}$ bolts to attach output shaft bearing retainer to stand.

58. Removal of Reduction Unit Case (303M)

a. Remove reduction blocker line assembly (fig. 19) and clip from transmission case and reduction unit control valve.

b. Remove reduction unit drain plug assembly and plug gasket from reduction unit case. Refer to paragraph 124*b* for cleaning and inspection of reduction unit case drain plug assembly.

c. Remove 12 bolts, 2 stud nuts, and 14 lockwashers which attach reduction unit case to output shaft bearing retainer and transmission case. Using lifting hooks—B7950336 (fig. 20) and chain hoist, raise reduction unit case from output shaft bearing retainer.

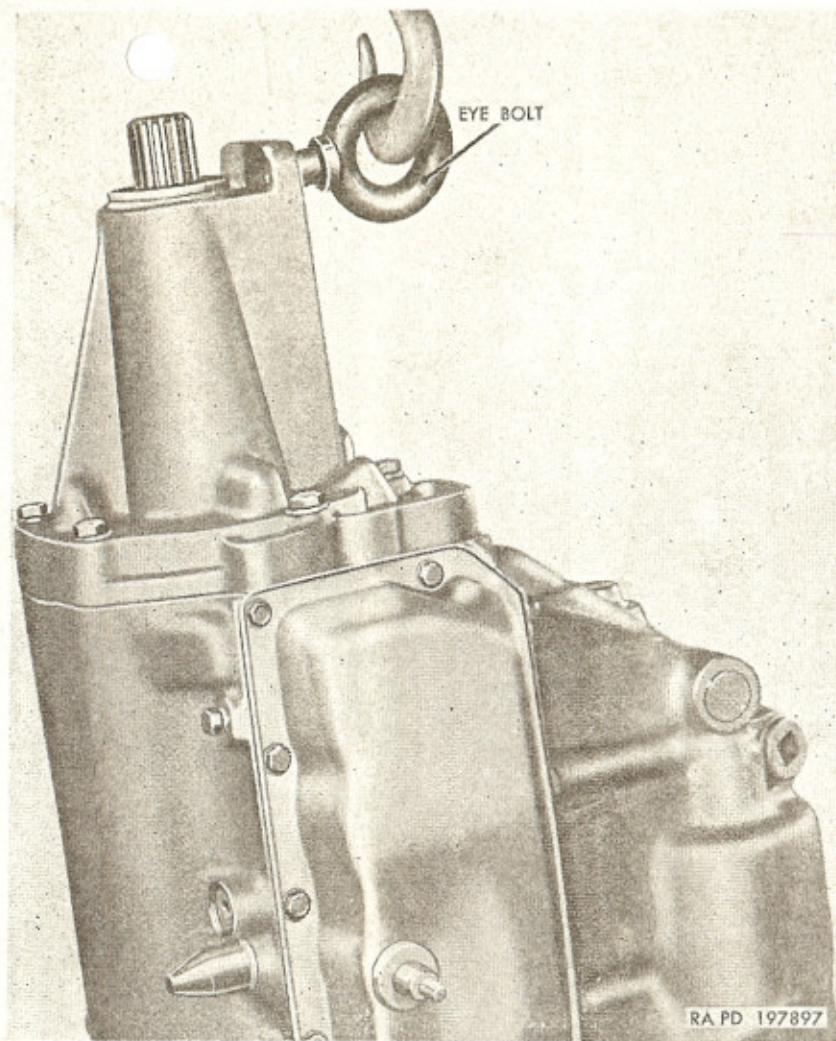


Figure 16. Use of transmission lifting eye bolt—A266327 (301MG).

d. Remove and discard reduction unit case to output shaft bearing retainer gasket.

e. Refer to paragraphs 123 through 125 for rebuild of reduction unit case.

59. Removal of Reduction Unit Parts From Transmission (303M)

a. With transmission positioned on stand, remove reduction unit clutch release spring (fig. 21). Remove eight bolts and four lock straps attaching reduction unit internal gear to reduction unit clutch drum. Discard lock straps.

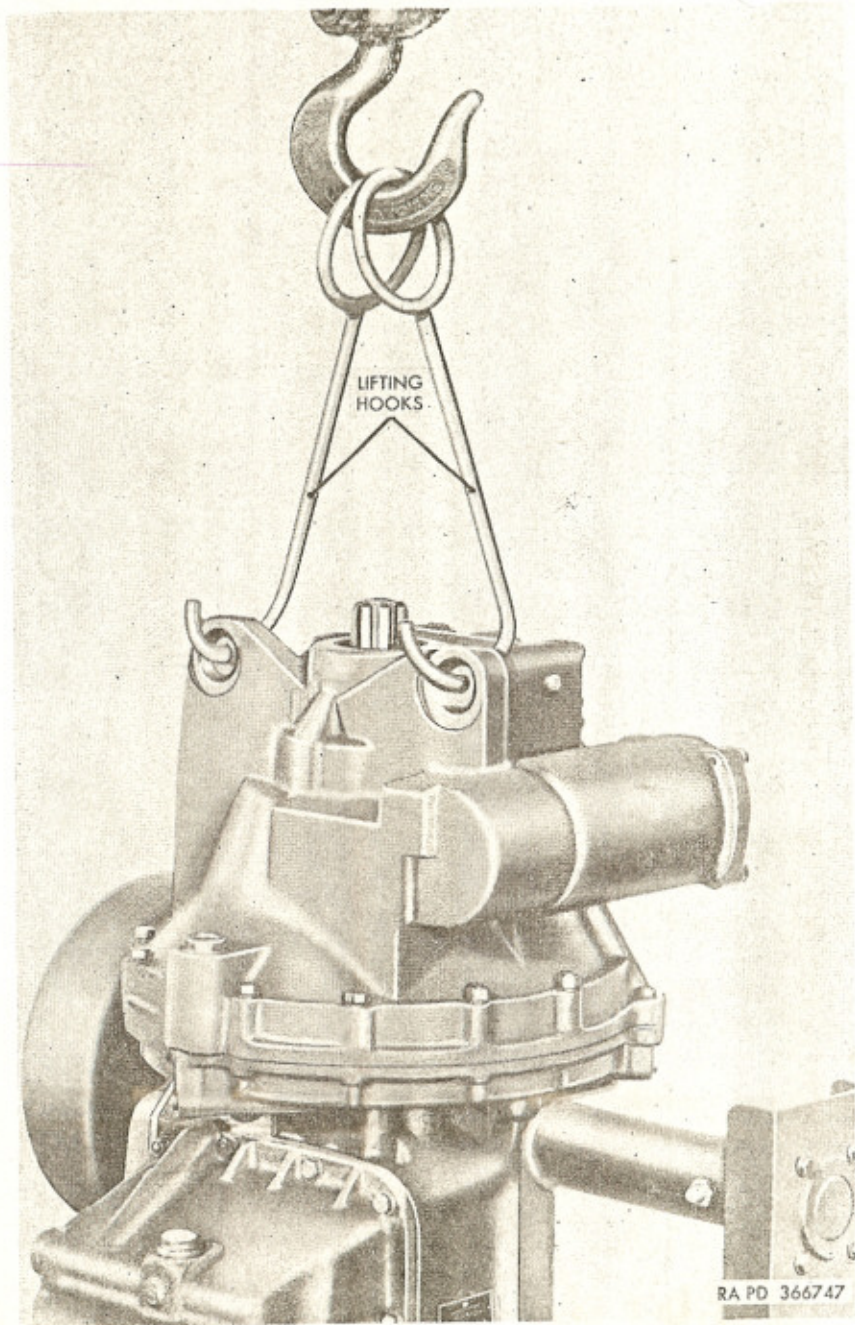


Figure 17. Use of transmission lifting hooks—B7950336 (303M).

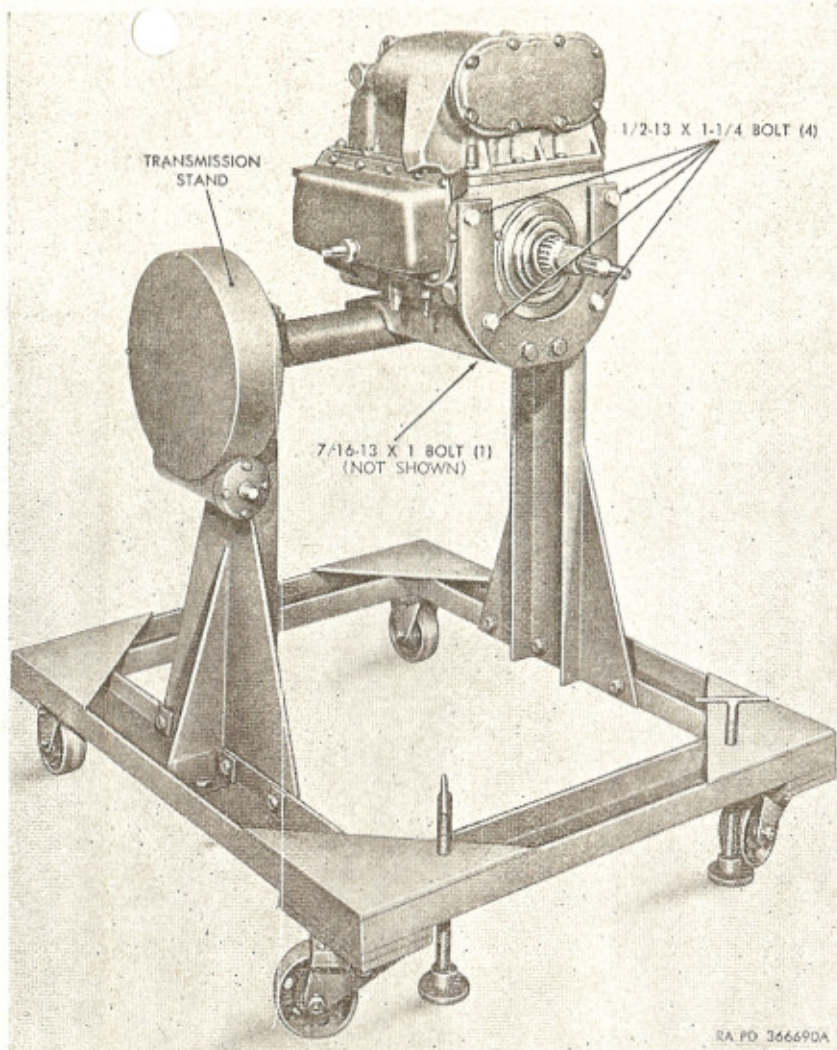


Figure 18. 301MG transmission mounted in stand—D7950874

b. Remove reduction unit internal gear assembly (fig. 22) by lifting straight up.

Note. The eight inner and outer clutch piston release springs may start to come up with the internal gear. Be certain the springs and the eight pins inside the springs are not lost. Lift eight outer release springs (fig. 217), inner springs, and spring pins out of clutch plates.

c. Remove reduction unit driven cone release spring and release spring retainer (fig. 23). Remove seven reduction clutch bronze drive plates and six steel driven plates by lifting the plates straight up.

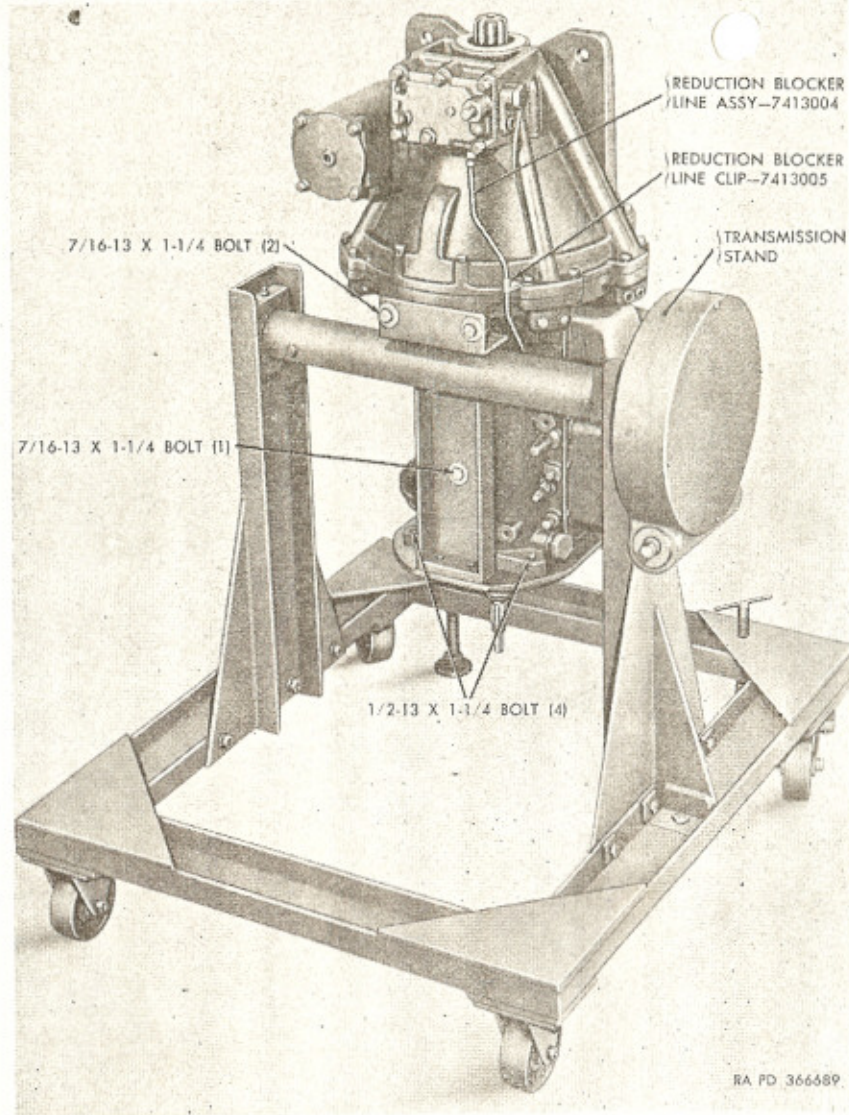


Figure 19. 303M transmission mounted in stand—D7950874.

d. Remove reduction unit driven cone by pulling cone straight up. It may be necessary to gently pry under edges of cone to get it started off.

e. Remove spring retainer which holds reduction unit sun gear to the reduction unit output shaft, using snap ring pliers. Lift reduction unit sun gear and reduction unit clutch hub from output shaft. Refer to figure 214 for location of parts.

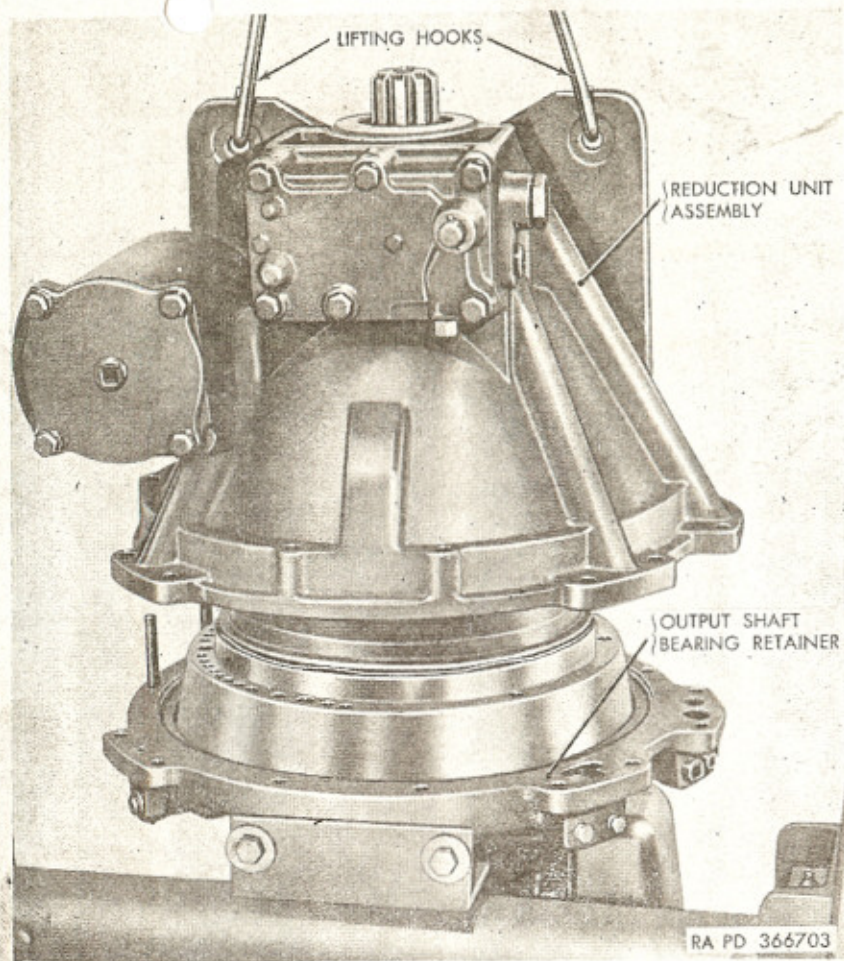


Figure 20. Removing or installing reduction unit case (303M).

f. With snap ring pliers, remove snap ring which holds reduction unit clutch drum to bearing retainer. Remove reduction unit clutch drum rear bronze thrust washer and steel backing washer (fig. 24). Remove reduction unit clutch drum assembly (fig. 25).

g. Remove direct clutch piston from reduction unit clutch drum by rotating piston about one-half inch; then screw two $\frac{3}{8}$ x 3 internal gear-to-drum bolts into drum from behind (inset in fig. 26). Alternately screw bolts same amount to prevent cocking piston. Bolts will partially press piston out of drum; then piston can easily be pulled out with fingers. Remove seals from clutch piston and clutch drum (fig. 26).

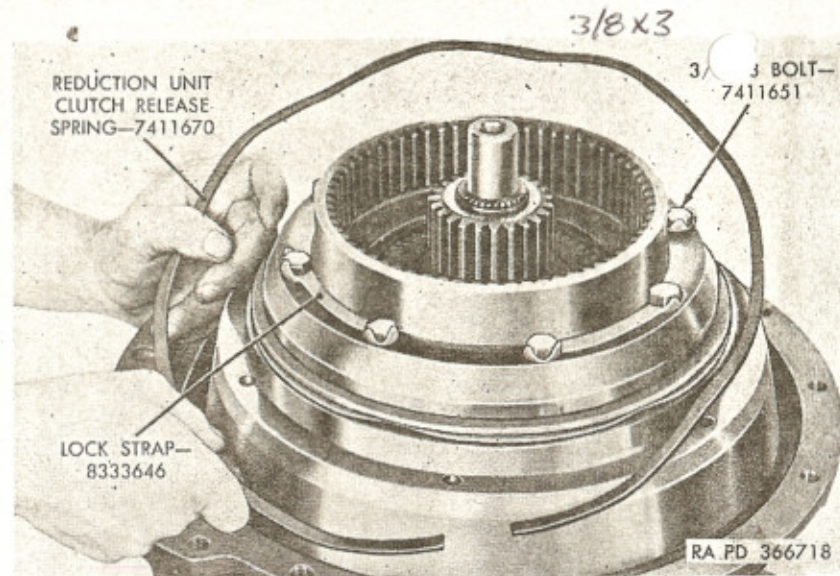


Figure 21. Removing or installing reduction unit clutch release spring (303M).

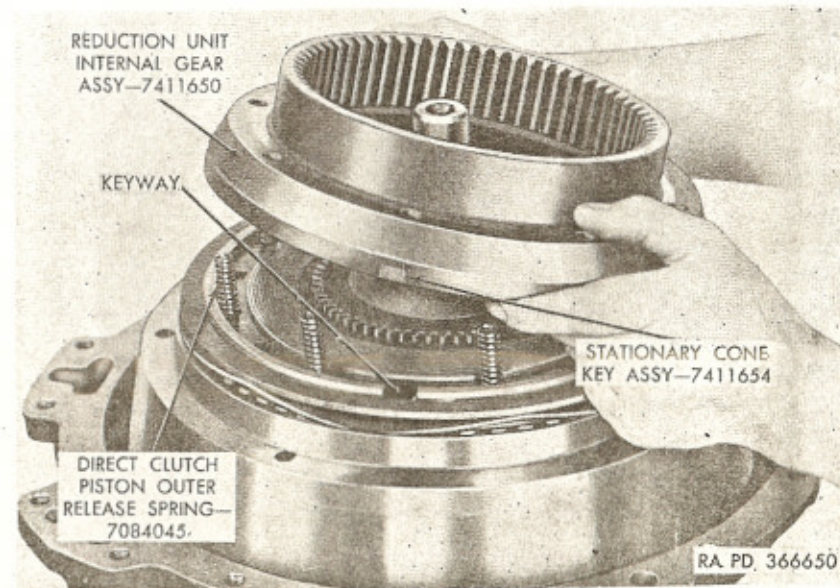


Figure 22. Removing or installing reduction unit internal gear assembly (303M).

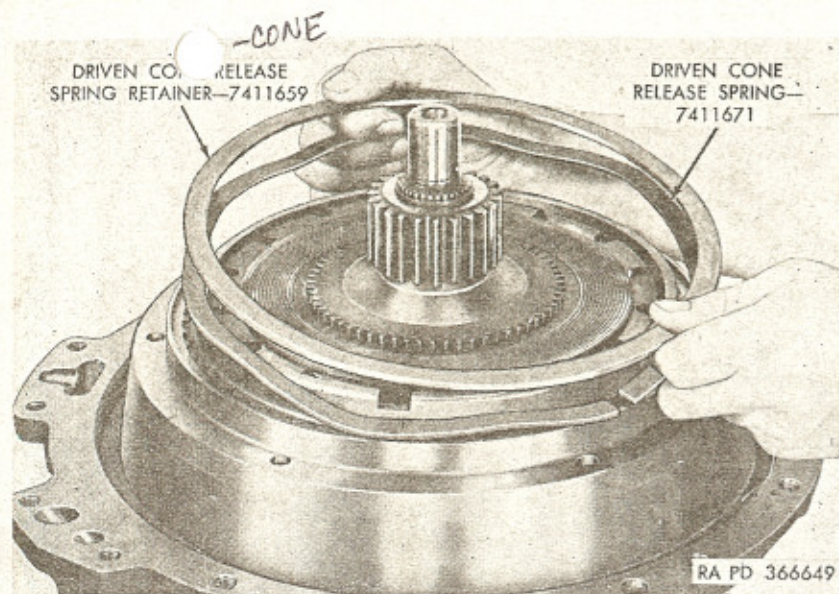


Figure 23. Removing or installing reduction unit driven cone release spring and retainer (303M).

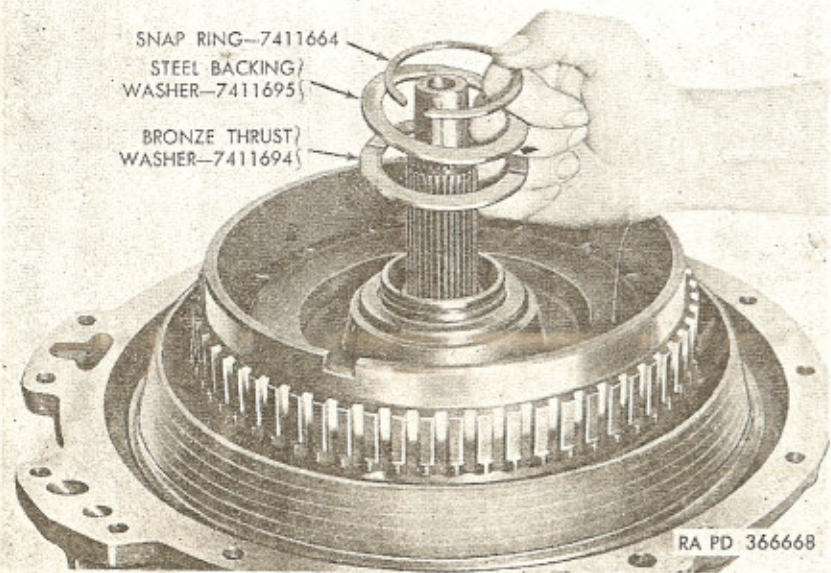


Figure 24. Removing or installing reduction unit clutch drum rear thrust washers and snap ring (303M).

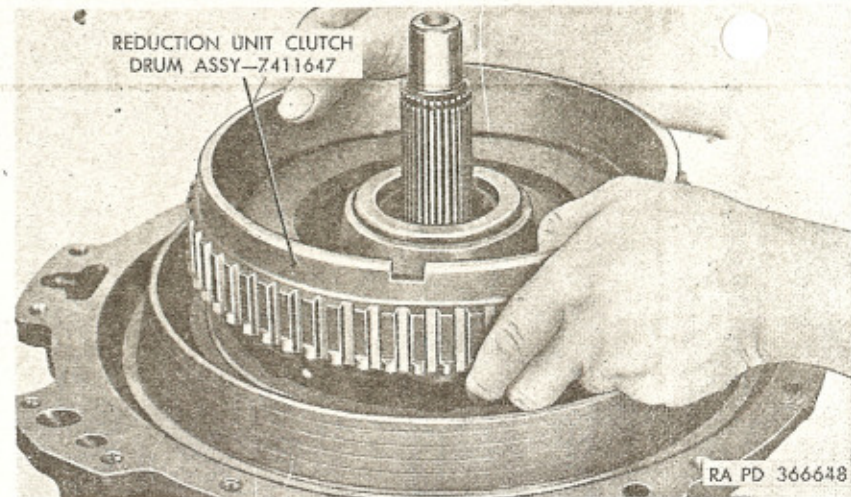


Figure 25. Removing reduction unit clutch drum assembly (303M).

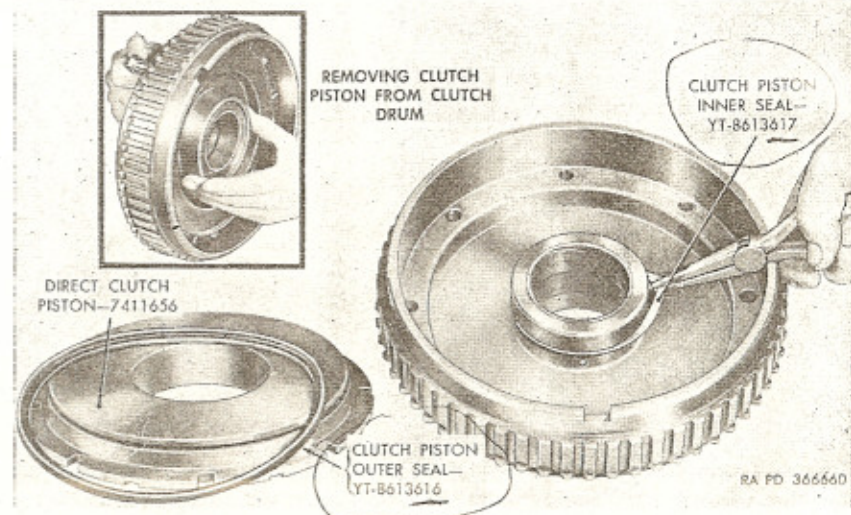


Figure 26. Disassembling reduction unit clutch drum (303M).

h. Remove reduction clutch piston (fig. 27), working gently out with pliers and fingers. The piston is mounted on four guide pins and cannot be rotated. Remove seal from reduction clutch piston.

Note. If difficulty is encountered when removing reduction clutch piston (h above), use air gun—B7950562 connected to a source of air pressure and apply air pressure gradually through small oil passage in output shaft bearing retainer as shown in figure 28.

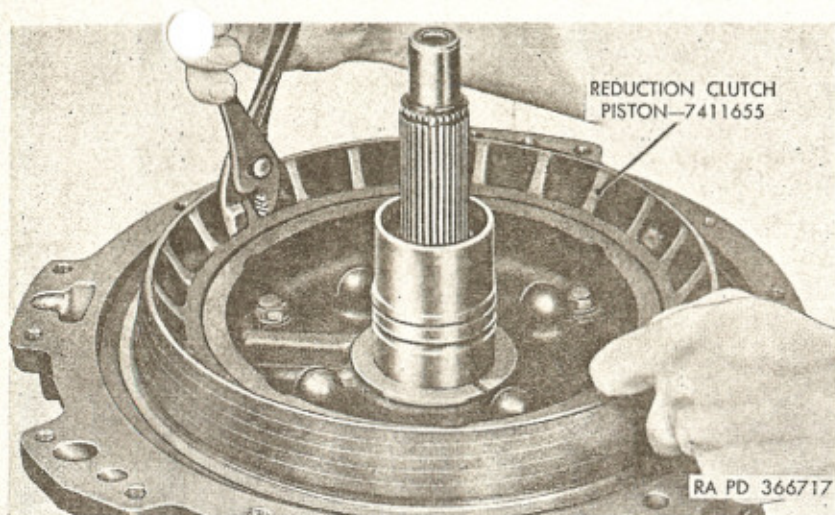


Figure 27. Removing reduction clutch piston (303M).

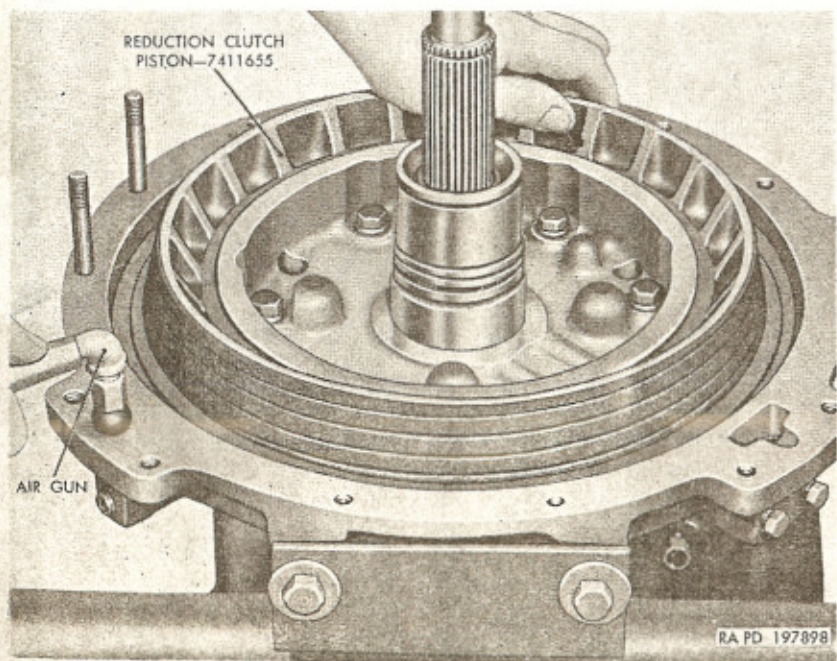


Figure 28. Removing reduction clutch piston using air gun—B7950562 (303M).

i. Refer to paragraph 129 for inspection and repair of reduction unit parts.

60. Removal of Oil Pan Assembly

a. Position transmission upside down in repair stand. Remove transmission oil pan by removing 10 bolts, 2 stud nuts, and copper washers. Lift pan from studs. Gasket may come off with oil pan or remain on transmission case. Remove and discard gasket.

b. Refer to paragraphs 80 through 82 for rebuild of oil pan and cooler assembly.

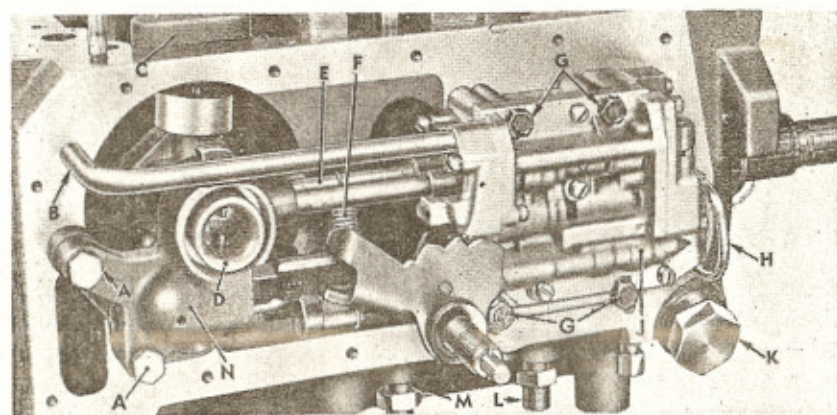
61. Removal of Transmission Case Side Cover

a. Remove snap ring from manual control lever shaft.

b. Remove retainer cup, seal spring, and retainer with seal ring and O-ring gasket from manual control lever shaft. Remove and discard O-ring gasket and seal ring.

c. Remove 12 cap screws and copper washers attaching side cover to case; then remove cover assembly. Cover gasket may come off with cover or remain with case. Remove gasket and discard. Relative locations of parts with side cover removed are shown in figure 29.

d. Refer to paragraph 130 for inspection of transmission case side cover and oil pipes.



- | | |
|---|---|
| A—5/16 X 1-3/4 BOLT—100125 | H—OIL PRESSURE REGULATOR VALVE REVERSE OIL PIPE—7411505 |
| B—REVERSE CLUTCH OIL PIPE—7411521 | J—CONTROL VALVE ASSY—7064881 |
| C—REAR OIL PUMP ASSY—7410903 (303M)
—7084082 (301MG) | K—PLUG ASSY—7411506 |
| D—GOVERNOR ASSY—7410974 | L—FRONT BAND ADJUSTING STOP SCREW—5266342 |
| E—GOVERNOR OIL DELIVERY LINE—5281277 | M—REAR BAND ADJUSTING STOP SCREW—5266342 |
| F—REVERSE BLOCKER LEVER RETURN SPRING—7413002 | N—REVERSE BLOCKER BRACKET ASSY—7416058 |
| G—1/4 X 2 BOLT—100114 | |

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Figure 29. Side cover assembly removed from case showing relative location of parts.

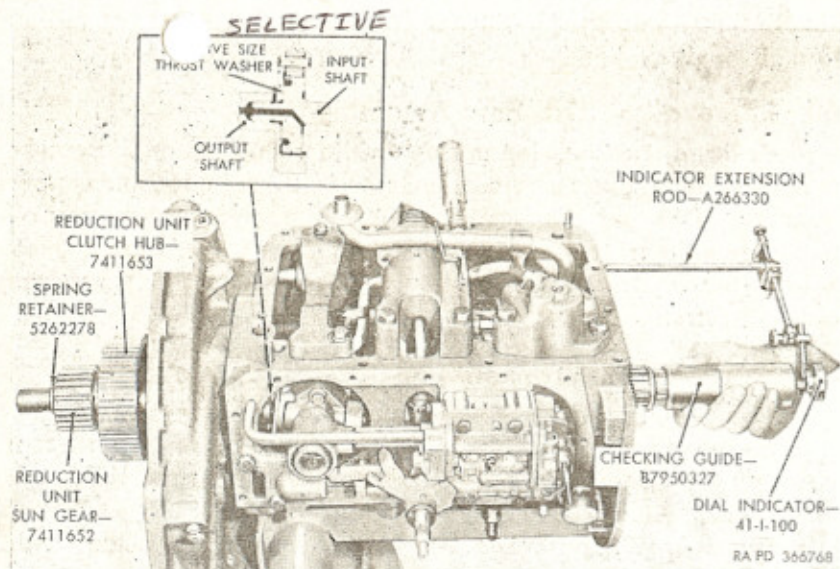


Figure 30. Checking input shaft end play using guide—B7950327 with indicator set and extension rod—A266330 (303M shown).

62. Input Shaft End Play Check

a. Input shaft end play should be checked at this time to determine thickness of thrust washer to be used at assembly between input shaft and output shaft (see inset, fig. 30). Remove cap from rear band adjusting stop screw.

b. Loosen both band adjusting stop screw locknuts. Back off both band adjusting stop screws at least five turns. Make sure rear servo actuating lever can be moved with fingers.

c. When checking input shaft end play of 303M transmission, temporarily install reduction unit clutch hub, reduction unit sun gear, and spring retainer on output shaft (fig. 30).

d. Check input shaft end play. Screw checking guide—B7950327 (fig. 30) on input shaft. Tap guide sharply with plastic hammer to make certain that guide is seated firmly to end of shaft. Install dial indicator—41-I-100, using extension rod—A266330. Wedge a large screwdriver at an angle between front clutch drum and center bearing cap to hold front unit forward. Screwdriver installed at an angle will prevent damage to oil delivery sleeve. Move input shaft fore and aft by means of guide on end of input shaft (fig. 30).

Note. Correct end play is 0.004 to 0.018 inch. Record amount of end clearance so that proper size variable thickness thrust washer can be installed at assembly to correct input shaft end play.

e. Remove input shaft end play checking equipment after end play has been checked.

Measured .018 - .020

.029

f. After 303M transmission input shaft end play has been checked, remove spring retainer, reduction unit sun gear, and reduction unit clutch hub from output shaft.

63. Removal of Output Shaft Bearing Retainer (303M)

a. Remove six bolts and lockwashers attaching output shaft bearing retainer to transmission case.

b. Remove two bolts which attach transmission output shaft bearing retainer to repair stand.

c. Position rear bearing retainer remover and replacer—C7950563 with center screw section over transmission output shaft so that the main body of the remover contacts rear of the output shaft bearing retainer. Align the four slots of the remover with the four tapped holes in the bearing retainer assembly (fig. 31) diagonally opposite the output shaft.

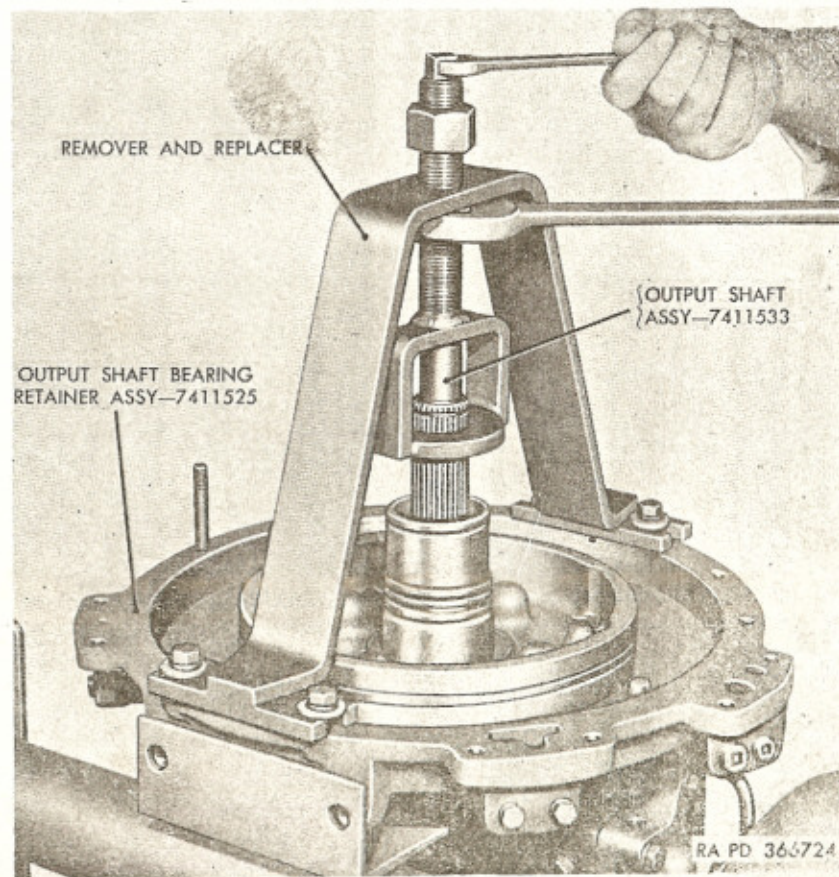


Figure 31. Removing output shaft bearing retainer assembly using remover and replacer—C7950563 (303M).

d. Attach legs or remover to bearing retainer with four $\frac{3}{8}$ -16 x $1\frac{1}{4}$ reduction-unit-case-to-rear-bearing-retainer bolts, using flat washers as necessary.

e. Back off the remover upper nut; then turn down on the center screw section until it contacts the end of the transmission output shaft.

f. Run remover lower nut up until it contacts the main body of the puller. Continue turning the remover lower nut with a wrench while holding center screw section from turning. It may be necessary to tap the underside of the bearing retainer with plastic hammer while turning the remover lower nut until the retainer can be removed. Remove the remover tool from the bearing retainer.

g. Remove and discard output-shaft-bearing-retainer-to-transmission-case gasket.

h. Remove output shaft bearing spacer from output shaft bearing retainer (fig. 32).

i. Remove clutch drum thrust washer from hub of output shaft bearing retainer (fig. 32).

j. Remove reverse carrier steel spacer (fig. 33) and reverse internal gear rear thrust washer from transmission output shaft.

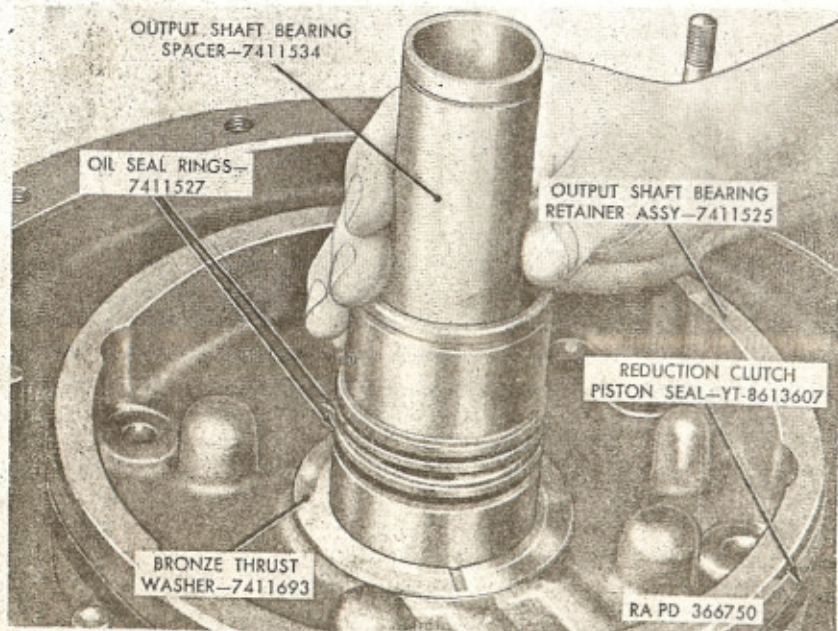


Figure 32. Removing or installing output shaft bearing spacer (303M).

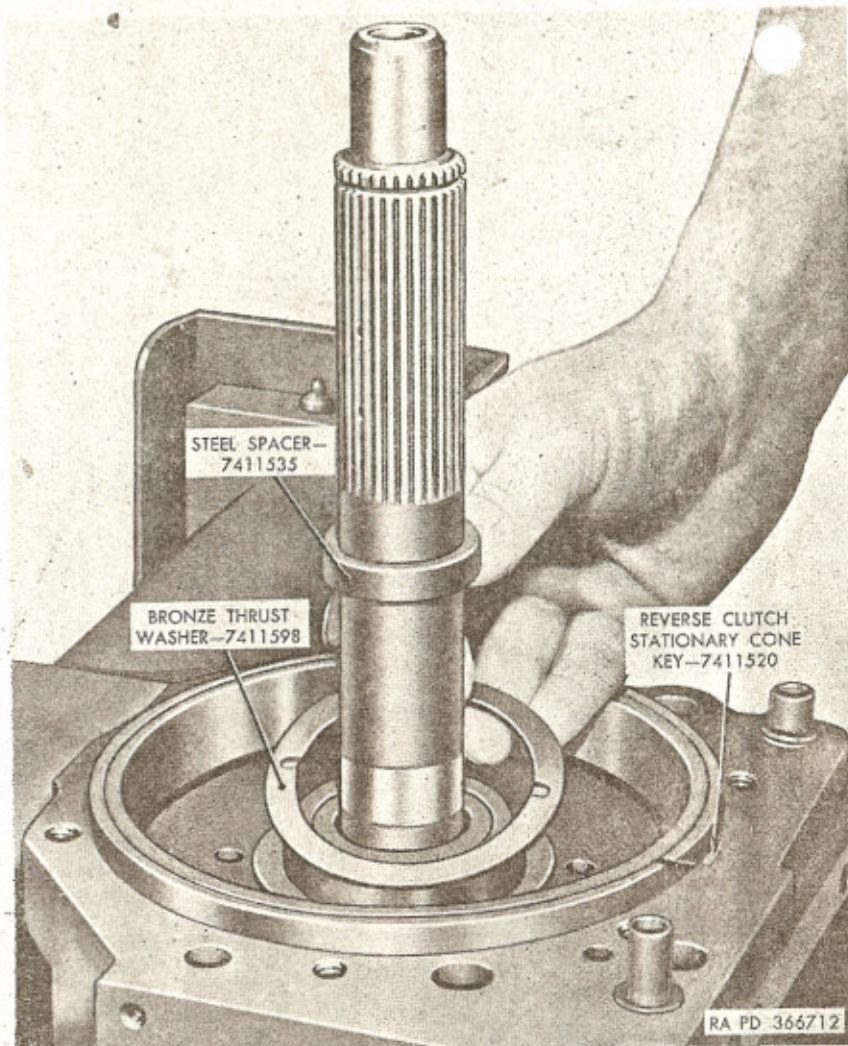


Figure 33. Removing or installing reverse carrier spacer and internal gear thrust washer (303M).

k. Refer to paragraphs 111 through 113, for rebuild of output shaft bearing retainer (303M).

64. Removal of Transmission Control Valve Assembly and Reverse Blocker Bracket Assembly

a. Remove oil pressure regulator valve reverse oil pipe (fig. 34) by pulling straight out. It may be necessary to use light screwdriver pressure to start pipe out. Be careful not to bend pipe.

b. Remove two bolts and lockwashers which attach reverse blocker bracket assembly (N, fig. 29) to transmission case.

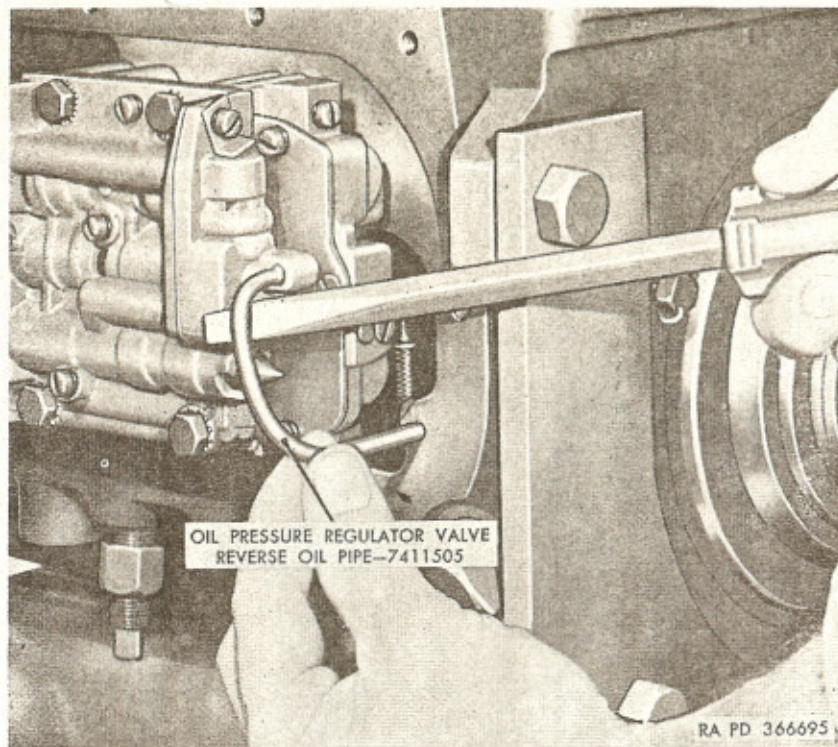


Figure 34. Removing oil pressure regulator valve reverse oil pipe.

c. Remove four bolts and lockwashers which attach transmission control valve assembly (J, fig. 29) to transmission case, supporting control valve assembly as bolts are removed.

d. Pull valve body and reverse blocker bracket (fig. 35) about one-eighth inch away from transmission case so valve inner body will not be damaged during removal. It may be necessary to lightly tap reverse clutch oil pipe gradually out of transmission case as valve body moves away from case.

e. Slide control valve assembly toward front of transmission; then remove control valve assembly. Governor oil delivery lines may stay with reverse blocker bracket assembly or control valve assembly. Remove the three governor oil delivery lines. Remove reverse blocker lever return spring. Remove reverse clutch oil pipe. Slide reverse blocker bracket assembly (fig. 35) off governor tower.

f. Wrap transmission control valve assembly in clean lint-free cloth for protection from dirt or damage. Refer to paragraphs 74 through 76, for rebuild of transmission control valve assembly.

g. Refer to paragraphs 77 through 79, for rebuild of reverse blocker bracket assembly.

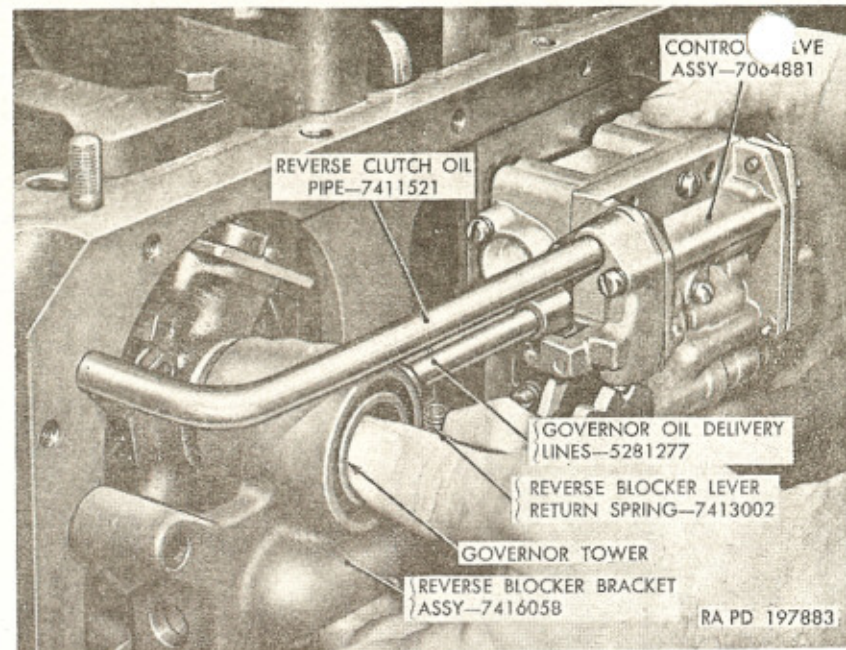


Figure 35. Removing or installing transmission control valve assembly.

65. Air-Check of Action of Servos, Clutches, and for Oil Leaks

a. A check of the action of servos and clutches, and for oil leaks should be made at this point of disassembly. The results of this check may point out various and definite malfunctions.

Note. To obtain an accurate check, bands must be properly adjusted as described in paragraphs 144 and 145.

b. Connect air hose and air gun—B7950562 to a source of compressed air of approximately 100 psi.

c. Apply gun to passages on SIDE of transmission case only at points shown on figure 9. Diagnosis of checks are described in paragraph 31.

66. Removal of Front and Rear Servo Assemblies (303M)

Note. The capitalized key letters shown below in parentheses refer to figure 36.

a. Remove front oil pump intake pipe clip (Q) which attaches front oil pump intake pipe to front oil pump discharge pipe. Remove screw with lockwasher (N) which holds front oil pump intake pipe assembly (L) to rear servo assembly (E). Remove front oil pump intake pipe assembly (L) and front oil pump intake pipe clip (M). Remove and discard intake pipe sealing ring (J).

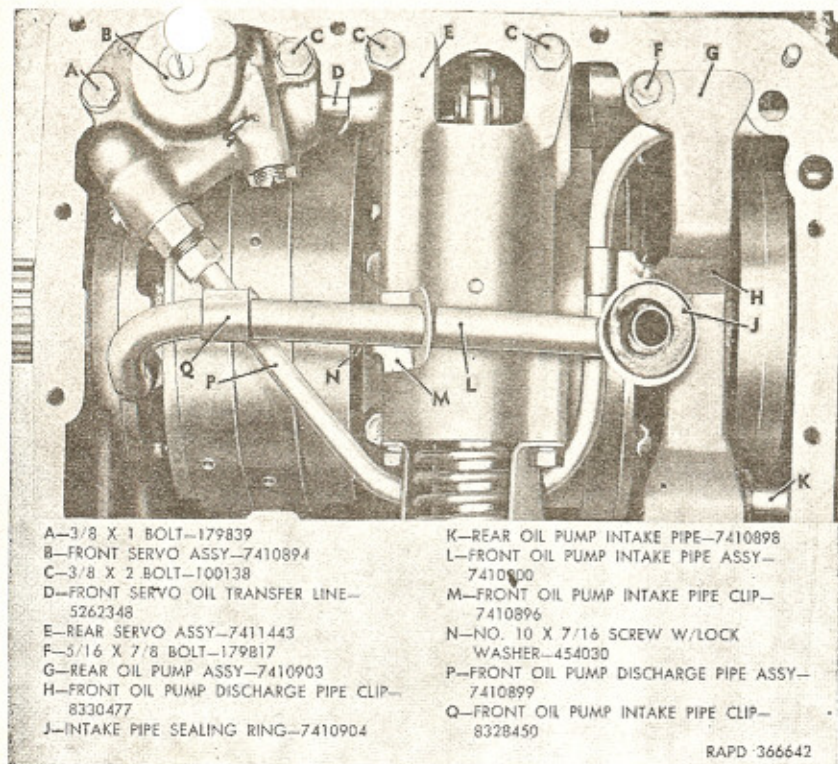


Figure 36. Transmission oil pan removed (303M).

b. Remove front oil pump discharge pipe clip (H) from front oil pump discharge pipe and rear oil pump.

c. Using a $2\frac{5}{32}$ - and a $1\frac{1}{16}$ -inch open end wrench, loosen the front oil pump discharge pipe assembly (P) from front servo pipe connector.

d. Remove four bolts (A and C) and lockwashers which hold front and rear servo assemblies (B and E) to transmission case.

e. Move rear servo assembly (E) toward rear of transmission and remove rear servo assembly. If necessary, pry rear servo from front servo oil transfer line (D), using a screwdriver (fig. 37). Remove front oil pump discharge pipe assembly (P). Remove O-ring gasket from rear of transmission case at discharge pipe opening in case.

f. Remove front servo assembly (fig. 38) by lifting straight up. Front oil pump delivery line (fig. 38) may stick to either the front servo or front oil pump. Remove delivery line.

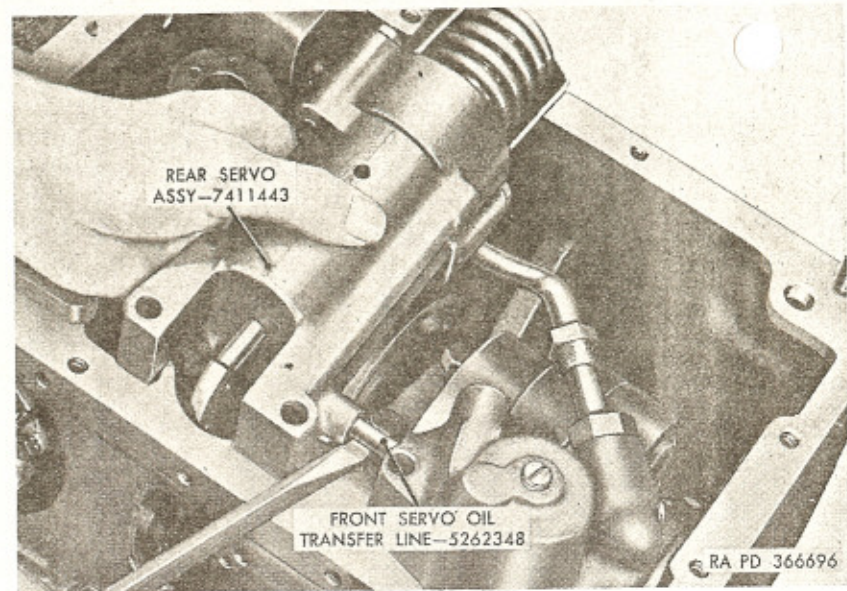


Figure 37. Removing rear servo assembly.

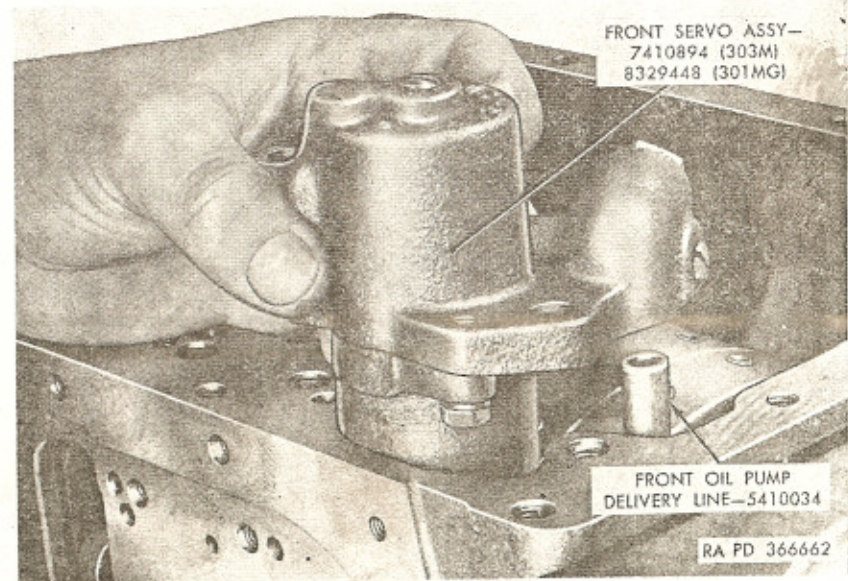


Figure 38. Removing front servo assembly.

g. Refer to paragraphs 83 through 88 for rebuild of front and rear servo assemblies.

67. Removal of Front and Rear Servo Assemblies (301MG)

Note. The capitalized key letters shown below in parentheses refer to figure 39.

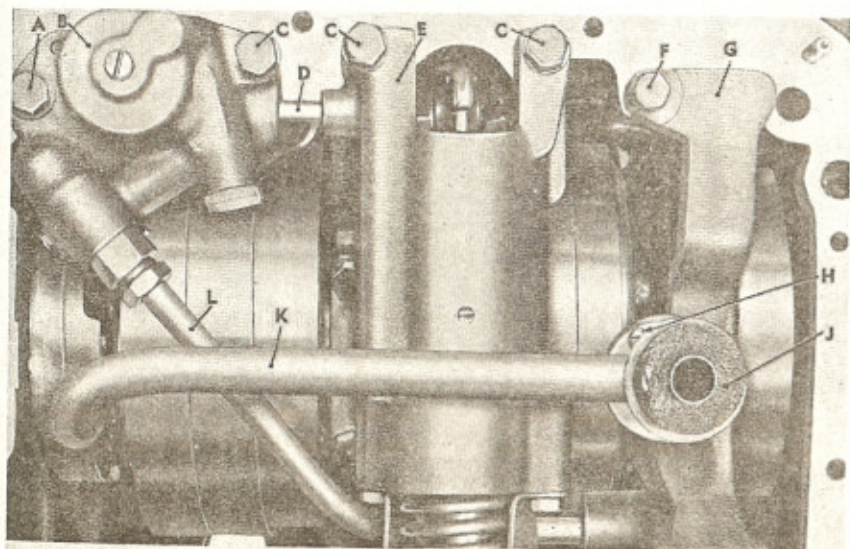
a. Remove intake pipe sealing ring (J) from inlet end of front and rear oil pump intake pipe assembly (K). Discard sealing ring.

b. Remove two screws (H) which attach flange of oil pump intake pipe to rear oil pump assembly (G). Remove front and rear oil pump intake pipe assembly (K) and discard gasket between pipe flange and flange of rear oil pump.

c. Using a $2\frac{5}{32}$ - and an $1\frac{1}{16}$ -inch open end wrench, loosen the rear oil pump discharge pipe assembly (L) at front servo connection.

d. Remove four bolts (A and C) and lockwashers which hold front and rear servo assemblies (B and E) to transmission case.

e. Move rear servo assembly (E) toward rear of transmission; then remove rear servo assembly. If necessary, pry rear servo



A—3/8 X 1 BOLT—179839
 B—FRONT SERVO ASSY—8329448
 C—3/8 X 2 BOLT—100138
 D—FRONT SERVO OIL TRANSFER LINE—5262348
 E—REAR SERVO ASSY—7411443
 F—5/16 X 7/8 BOLT—179817
 G—REAR OIL PUMP ASSY—7084082
 H—NO. 10 X 7/16 SCREW W/LOCK WASHER—454030
 J—INTAKE PIPE SEALING RING—7410904
 K—FRONT AND REAR OIL PUMP INTAKE PIPE ASSY—8333529
 L—REAR OIL PUMP DISCHARGE PIPE ASSY—5614297

RA PD 366664

Figure 39. Transmission oil pan removed (301MG).

assembly from front servo oil transfer line (D), using a screwdriver as shown in figure 37.

f. Remove rear oil pump discharge pipe assembly (L) from front servo and rear oil pump. Remove front servo assembly (B) by lifting unit straight up (fig. 38). Front oil pump delivery line (fig. 38) may stick to either the front servo or front oil pump. Remove delivery line.

g. Refer to paragraphs 83 through 88 for rebuild of front and rear servo assemblies.

68. Removal of Rear Oil Pump and Governor Assembly

a. Remove two bolts (F, figs. 36 and 39) which attach rear oil pump and governor assembly to transmission case.

b. On 303M transmission only, remove rear oil pump intake pipe (K, fig. 36) by pulling from rear of transmission case. Remove and discard intake pipe O-ring gaskets from pipe.

c. Position secondary (small) governor weight toward front of transmission; then remove rear oil pump and governor assembly (fig. 40).

d. Refer to paragraphs 92 through 95 for rebuild of rear oil pump and governor assembly.

69. Removal of Transmission Oil Pressure Regulator Valve Components

Remove transmission oil pressure regulator valve components from side of transmission case. Unscrew plug while holding palm

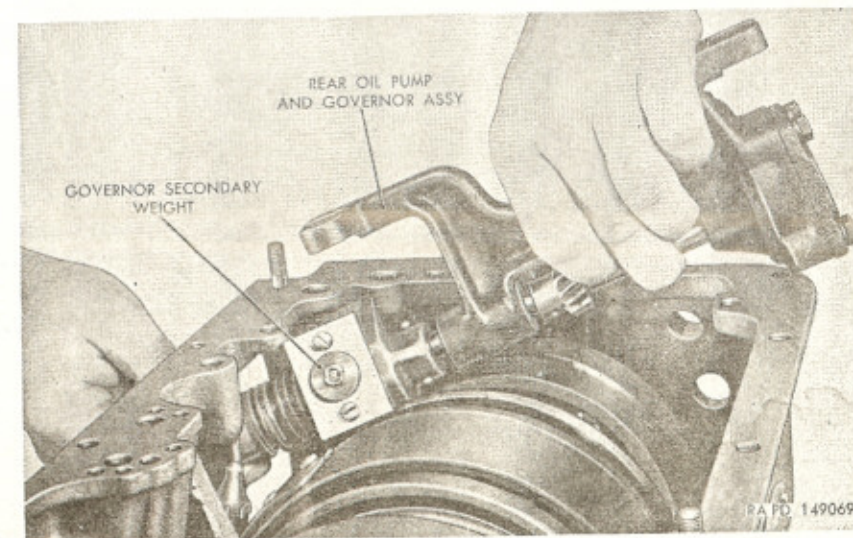


Figure 40. Removing or installing rear oil pump and governor.

of hand adjust spring tension (fig. 41). Remove plug, gasket, reverse booster plug, spring, and valve. Remove two rubber cushions from 301MG transmission regulator valve only. (Refer to figures 198 and 199 for components of each transmission pressure regulator valve.)

70. Removal of Front Oil Pump Assembly

a. Remove snap ring (fig. 42) from input shaft using snap ring pliers.

b. With snap ring pliers, remove spring retainer (fig. 42) from planet carrier intermediate shaft, immediately forward of the front oil pump drive gear.

c. Remove steel thrust washer and bronze thrust washer (fig. 42).

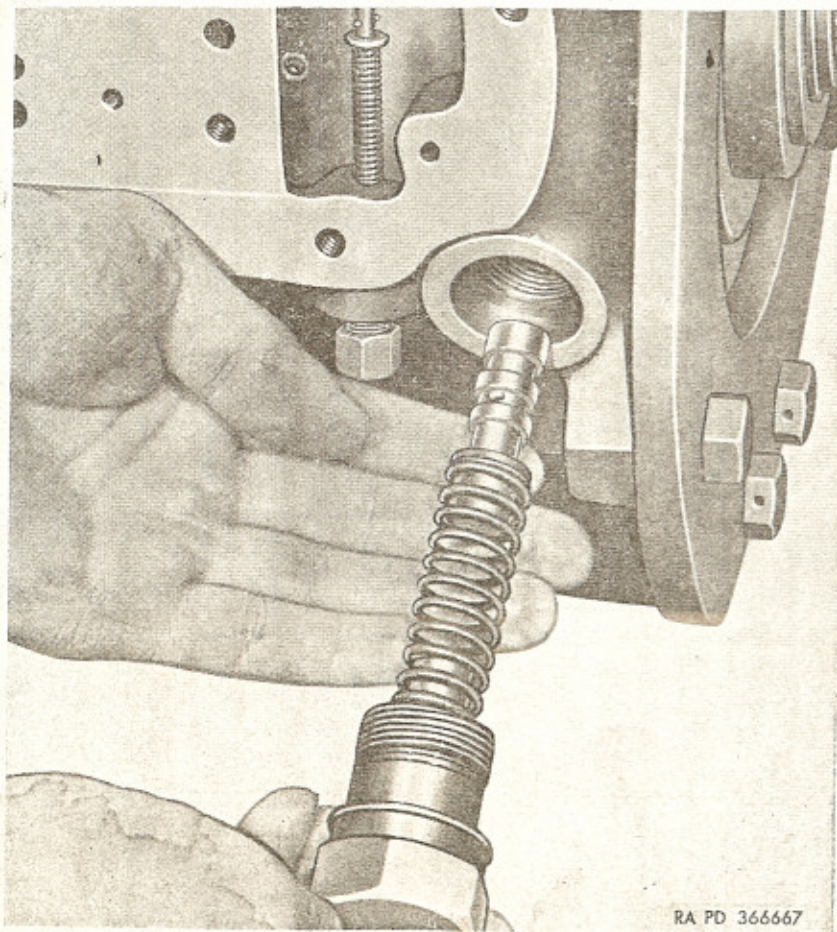


Figure 41. Removing pressure regulator valve components.

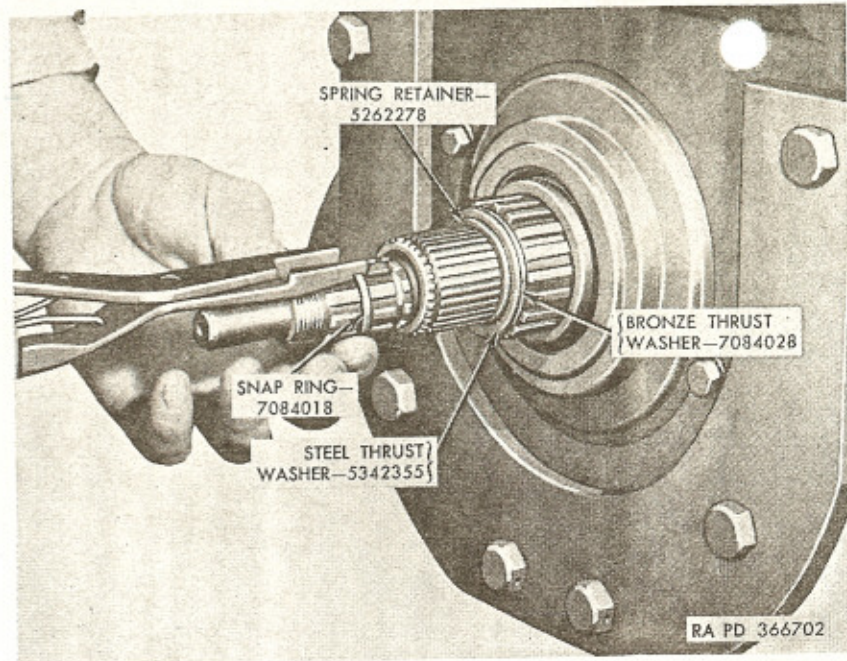


Figure 42. Removing or installing input shaft snap ring.

Note. These washers differ in size from other washers used in transmission. They should be tied together for identification at assembly of transmission.

d. Remove two bolts attaching front oil pump cover to transmission case. With snap ring pliers, remove front oil pump locating washer (fig. 43) from counterbore.

e. Remove front oil pump assembly and oil pump drive gear assembly (fig. 44) as an assembly by pulling straight out. If necessary, tap rear of front oil pump lightly with brass drift from inner side of case. Remove front drive gear bronze thrust washer from front planet carrier intermediate shaft, if it did not come off with front oil pump drive gear. Remove front oil pump drive gear assembly from front oil pump assembly. Remove and discard front oil pump to transmission case gasket. Using brass drift and hammer, remove drive key from front oil pump drive gear.

f. Refer to paragraphs 89 through 91 for rebuild of front oil pump assembly.

71. Removal of Input Shaft, Reverse Unit, and Output Shaft (303M)

a. Using chisel and hammer, bend tabs of three lock straps away from heads of six bolts attaching flange of reverse center

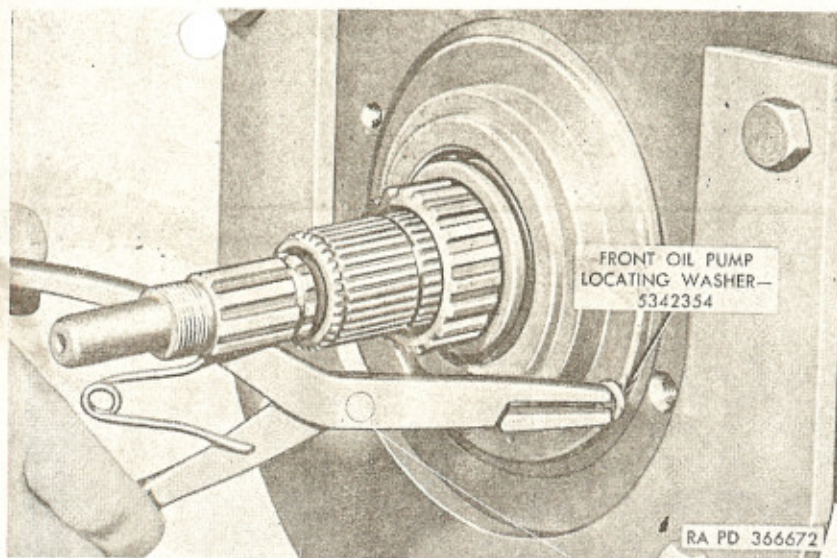


Figure 43. Removing or installing front oil pump locating washer.

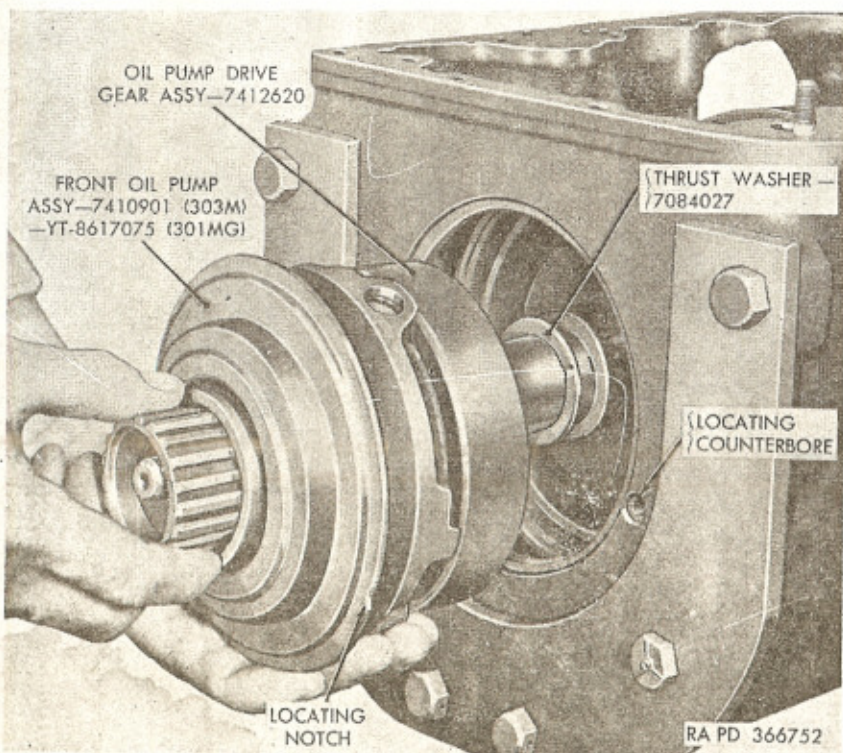


Figure 44. Removing or installing front oil pump assembly.

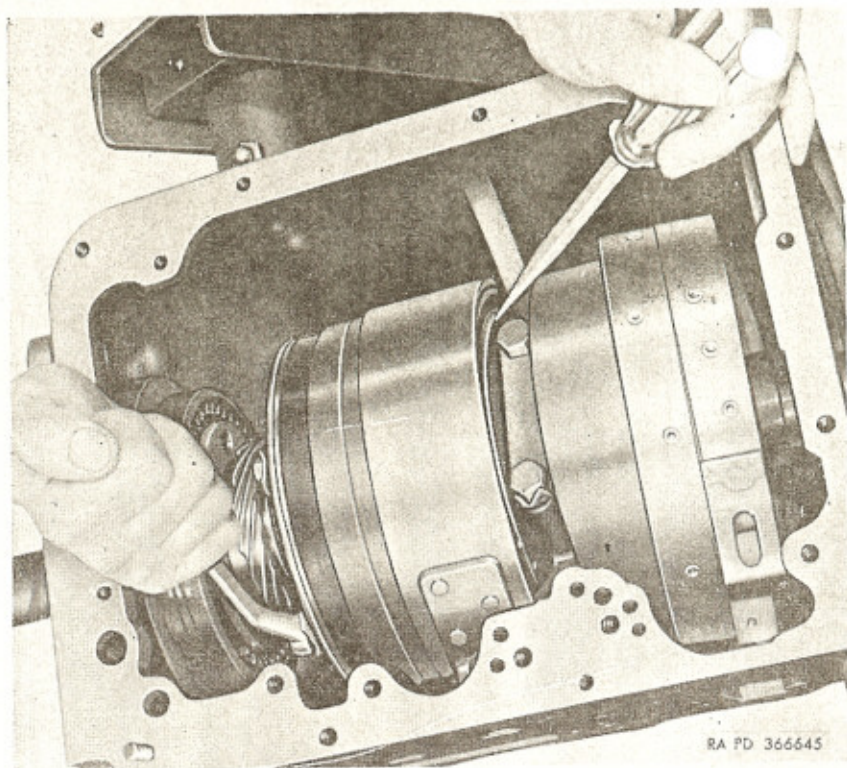


Figure 45. Removing or installing reverse center gear flange bolts (303M).

gear assembly to rear drum. With large screwdriver wedged into rear planetary unit drive pin hole and against case (fig. 45) to prevent turning, remove five of the six attaching bolts and lock straps. Discard lock straps.

b. Wedge large screwdriver between case center bearing cap and rear drum to prevent clutch hub thrust washer from dropping out of place. Remove remaining attaching bolt and lock strap attaching center gear flange to rear drum. Output shaft (fig. 46) can now be withdrawn. Input shaft may come out with output shaft. If remaining with transmission, remove input shaft.

Note. If output shaft assembly is not easily removed in the above manner, use a plastic hammer to tap front end of input shaft.

c. To prevent its loss, remove selective (variable thickness) thrust washer. Selective washer may remain with input shaft or in recess of output shaft.

d. Refer to paragraphs 108 through 110 for rebuild of input shaft, reverse unit, and output shaft (303M).

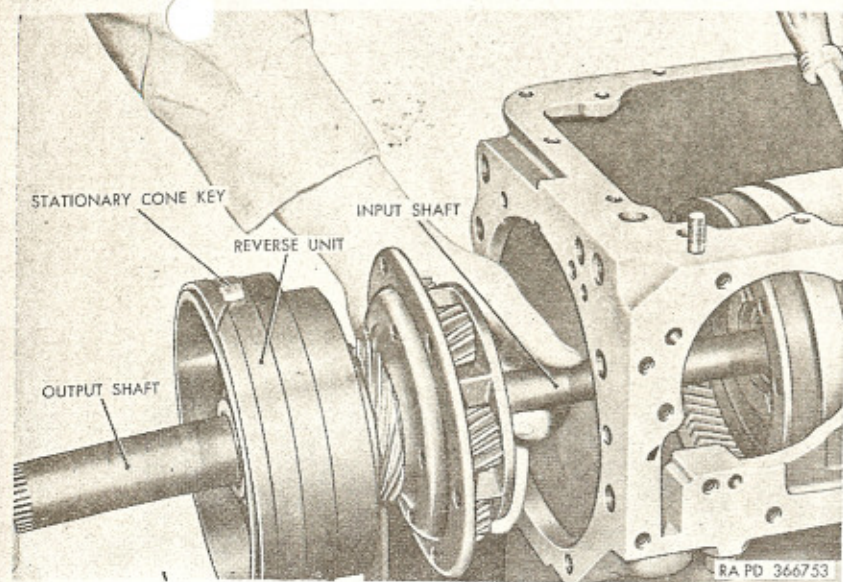


Figure 46. Removing or installing input shaft, reverse unit, and output shaft (303M).

72. Removal of Input Shaft, Reverse Unit, Output Shaft, and Bearing Retainer (301MG)

a. Using chisel and hammer, bend tabs of three lock straps away from heads of six bolts which attach flange of reverse center gear assembly to rear drum. Wedge large screwdriver into rear planetary unit drive pin hole and against case (fig. 47) to prevent unit turning; then remove only five of the six attaching bolts. Remove and discard lock straps.

b. Remove six bolts and washers which attach output shaft bearing retainer to transmission case.

c. Wedge large screwdriver between case center bearing cap and rear planetary drum to prevent clutch hub thrust washer from dropping out of place. Remove remaining center gear flange to rear drum attaching bolt and lock strap; then carefully withdraw output shaft bearing retainer (fig. 48) with shafts as a unit. Tap front end of input shaft with plastic hammer to start if necessary.

d. Remove and discard output shaft bearing retainer-to-transmission case gasket.

e. Remove small O-ring gasket from counterbore at rear of transmission case.

f. Refer to paragraphs 105 through 107 for rebuild of input shaft, reverse unit, output shaft, and bearing retainer (301MG).

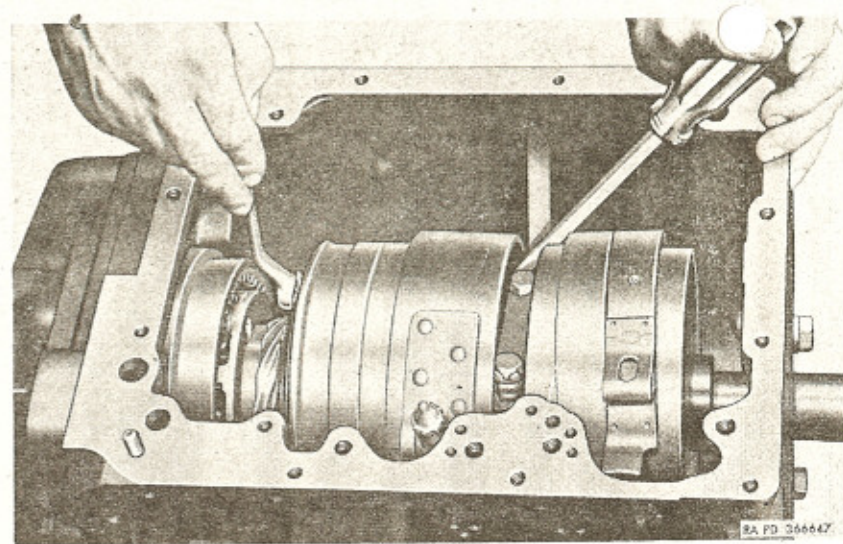


Figure 47. Removing or installing reverse center gear flange bolts (301MG).

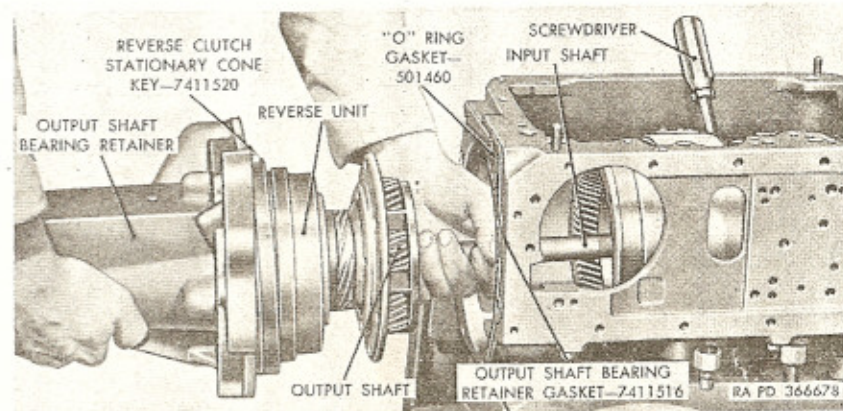


Figure 48. Removing or installing output shaft, output shaft bearing retainer, reverse unit, and input shaft (301MG).

73. Removal of Front and Rear Planetary Units and Carrier

a. Remove bronze thrust washer from rear of clutch hub.

b. Install rear hub retainer bracket—A7950207 (fig. 49) and remove wedging screwdriver from front of rear unit.

c. Using light hammer and chisel, bend back edges of lock plate under two transmission case center bearing cap attaching bolts.

d. Remove two bolts and lock plate attaching center bearing cap to case. Discard lock plate.

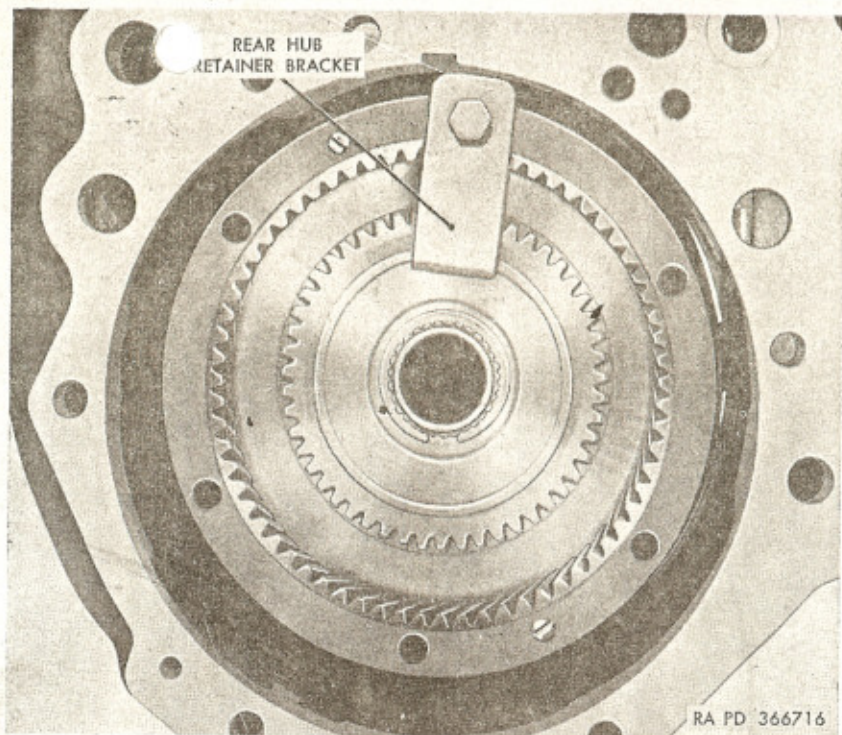


Figure 49. Use of rear hub retainer bracket—A7950207.

Note. It may be necessary to equalize distance between planetary units by moving front and rear clutch drums, to allow socket wrench to seat on bolt heads.

e. Remove release spring from rear band to prevent loss. Spring is located as shown in figure 186.

f. Remove rear band assembly and strut (fig. 186).

Caution: Bands are easily damaged. Do not close band except around drum. Do not spring band open.

g. Install an improvised spring (fig. 50) to hold front band on front unit drum.

h. Lift both front and rear planetary units and carrier as an assembly (fig. 50) from transmission case. Place assembly in holding fixture—B7079295 (fig. 101) to prevent possible damage to assembly.

i. Remove front band adjusting rod, spring, and seat from inside of case. Remove front band adjusting rod seal and seal cap from case.

j. Remove both band adjusting stop screws and locknuts from case.

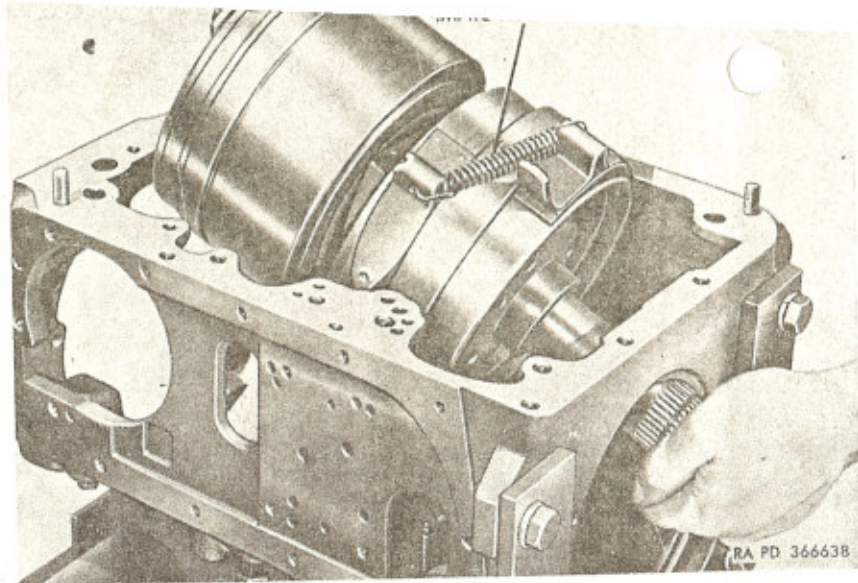


Figure 50. Removing or installing planetary units and carrier.

k. Refer to paragraphs 96 through 104 for rebuild of front and rear planetary units and carrier.

l. Refer to paragraph 131 for inspection and repair of transmission case.

CHAPTER 6

REBUILD OF SUBASSEMBLIES

Section I. REBUILD OF TRANSMISSION CONTROL VALVE ASSEMBLY

74. Disassembly

Note. Extreme care must be used in handling the hydra-matic transmission control valve assembly. Never grip the housings in a vise or use force in removing or installing valves or plugs. The control valve assembly should be laid flat on clean paper for disassembling. Keep screws with correct part as valve housing is disassembled. Keep component parts covered after disassembly. The capitalized key letters shown below in parentheses refer to figure 51.

a. Move manual control valve lever assembly (T) slowly counterclockwise; then remove detent plunger spring (Y) and detent plunger (Z) (fig. 52). Pull manual control valve (U) from outer body (M).

b. Remove manual control valve lever shaft seal and shaft seal inner and outer washers from shaft (fig. 53).

c. Remove three screws (N and LL) holding control valve inner and outer bodies (RR and M) together; then separate bodies and remove inner and outer body spacing plate (JJ) (fig. 54).

d. Remove three screws (MM) holding inner body cover (NN) to inner body (RR); then remove cover and inner body cover plate (PP) (fig. 55).

e. Remove three governor plugs (QQ) from inner body (RR).

f. Remove three screws (AL and AM) holding front body plate (AK) to front body (AC) (fig. 56); then remove front body plate.

g. While holding valve bodies together as shown in figure 57, remove three screws (AD and AE) attaching front body (AC) to inner body (RR). Separate the bodies; then remove 1-2, 2-3, and 3-4 shift valve regulator plugs (ZZ, YY, and AB) from front body (fig. 58) by striking body into palm of hand.

h. Remove screw (AH) holding front body hole plug (AF) in front body (AC). Jar front body hole plug (AF), "T" valve cutoff valve spring (AG), and "T" valve cutoff valve (AJ) free from front body (fig. 58) by striking body into palm of hand.

i. Remove the 1-2 shift valve spring (UU), 1-2 shift valve regulator plug spring (WW), 2-3 shift valve spring (VV), 2-3 shift valve regulator plug spring (XX), and 3-4 shift valve spring (VV) from inner body (RR) (fig. 59). The 2-3 and 3-4 shift valve springs (VV) are identical.

j. Remove 1-2, 2-3, and 3-4 shift valves (SS and TT) from inner body (RR) (fig. 59). Valves should be free to move from bores in body by pushing on opposite ends with 1/8-inch soft rod (fig. 60).

k. Remove three screws (AA and BB) which attach detent plunger retainer (X) to outer body (M). Remove retainer and detent plunger retainer spacer (W) (fig. 61).

l. Remove double transition valve (EE) and double transition valve spring (FF) from outer body (M) (fig. 61).

m. Remove "T" valve (V), throttle valve spring (CC), throttle valve (GG), and "T" valve transfer pin (DD) from outer body (M) (fig. 61).

n. Remove three screws (D and F) and exhaust body valve spring retainer (E) which holds exhaust body (G) over compensator valve (J) and throttle valve plug (K) in outer body (M). Remove exhaust body (G) and exhaust body plate (H) (fig. 62).

o. Remove compensator valve (J), compensator valve spring (L), and throttle valve plug (K) from outer body (M) (fig. 62).

p. Remove and discard exhaust body hole plug (A), exhaust body valve spring (B), and exhaust body valve (C) from exhaust body (G) (fig. 62).

75. Cleaning, Inspection, and Repair

Note. The capitalized key letters shown below in parentheses refer to figure 51. Refer to paragraph 157 for repair and rebuild standards.

a. *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Dry parts by playing an air stream across parts until thoroughly dry or by wiping dry with clean lint-free cloth. Blow out internal passages in valve bodies with compressed air.

b. *Inspection and Repair.*

(1) *Valves and plugs.*

(a) Examine all plugs and valves for burs, scores, or any other damage. Burs can be removed by using fine crocus cloth. All valves and plugs have sharp edges which prevent dirt wedging between valves, plugs, and valve bodies. Do not round these sharp edges when removing burs from valve and plug surfaces.

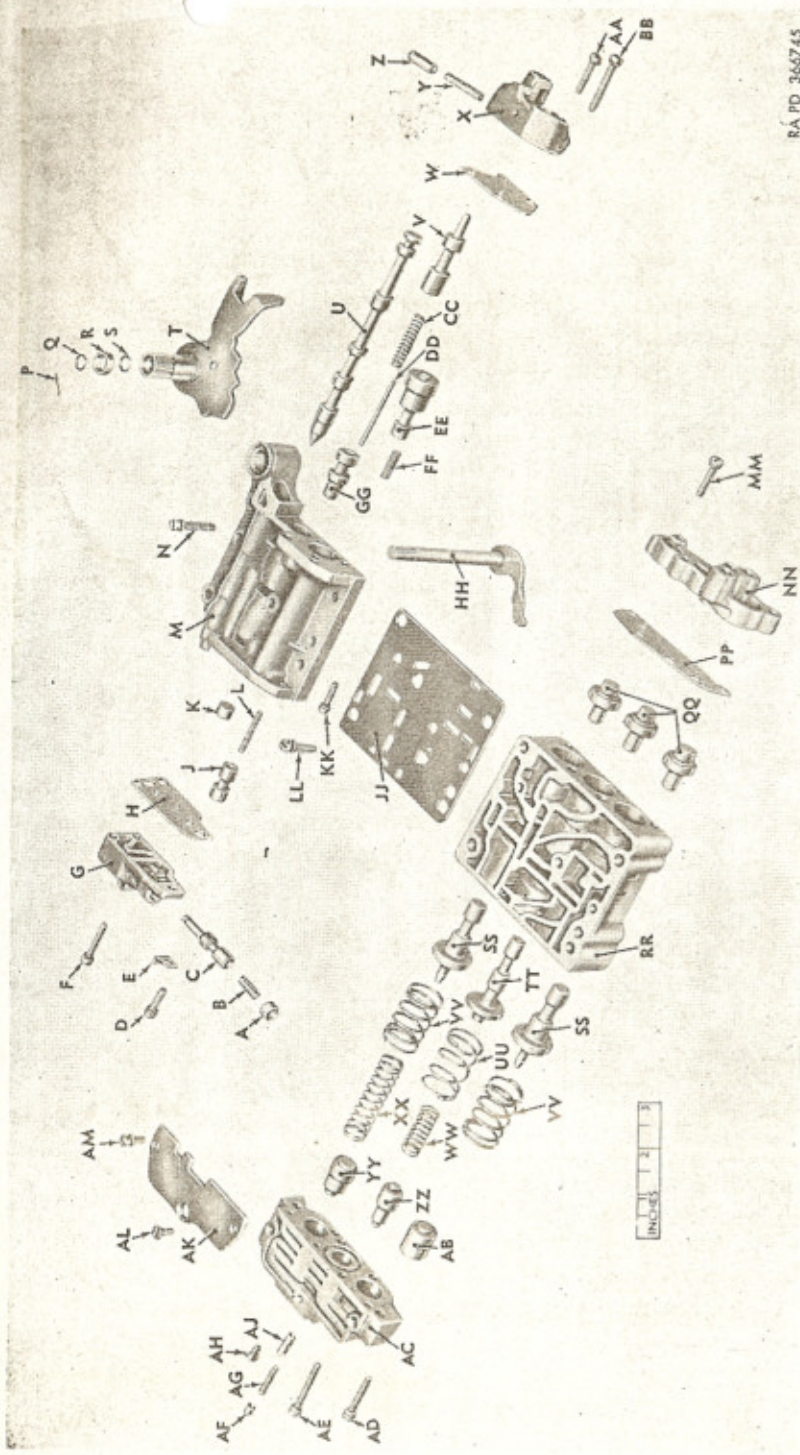


Figure 51. Transmission control valve components.

- A—Exhaust body hole plug YT-8613832
- B—Exhaust body valve spring YT-8613833
- C—Exhaust body valve YT-8613834
- D—No. 10 x $\frac{3}{8}$ screw w/lockwasher 454027
- E—Exhaust body valve spring retainer YT-8613858
- F—No. 10 x 1 screw w/lockwasher 454028
- G—Exhaust body YT-8613831
- H—Exhaust body plate YT-8613857
- J—Compensator valve YT-8614012
- K—Throttle valve plug YT-8614002
- L—Compensator valve spring A410036
- M—Outer body 8333710
- N—No. 10 x $1\frac{1}{2}$ screw w/lockwasher 454031
- P—Throttle valve control lever shaft retaining pin 187381
- Q—Throttle valve control lever shaft retaining pin washer 8328349
- R—Throttle valve control lever shaft seal retainer 8328348
- S—O-ring gasket 501219
- T—Manual control valve lever assembly 7412625
- U—Manual control valve 7411503
- V—"T" valve YT-8614013
- W—Detent plunger retainer spacer YT-8614004
- X—Detent plunger retainer YT-8614000
- Y—Detent plunger spring 7410981
- Z—Detent plunger 7410978
- AA—No. 10 x $\frac{3}{8}$ screw w/lockwasher 454029
- BB—No. 10 x $1\frac{1}{2}$ screw w/lockwasher 454031
- CC—Throttle valve spring YT-8614006
- DD—"T" valve transfer pin YT-8614020
- EE—Double transition valve YT-8614010
- FF—Double transition valve spring YT-8617066
- GG—Throttle valve YT-8614009
- HH—Throttle valve control lever w/shaft YT-8614015
- JJ—Inner and outer body spacing plate YT-8614089
- KK—No. 10 x $\frac{3}{8}$ screw w/lockwasher 454027
- LL—No. 10 x $\frac{3}{8}$ screw w/lockwasher 454029
- MM—No. 10 x $\frac{3}{8}$ screw w/lockwasher 454029
- NN—Inner body cover YT-8613999
- PP—Inner body cover plate YT-8613578
- QQ—Governor plug 7084173
- RR—Inner body YT-8614014
- SS—2-3 and 3-4 shift valve YT-8613379
- TT—1-2 shift valve YT-8613380
- UU—1-2 shift valve spring YT-8613865
- VV—2-3 and 3-4 shift valve spring YT-8613867
- WW—1-2 shift valve regulator plug spring YT-8613864
- XX—2-3 shift valve regulator plug spring YT-8613866
- YY—2-3 shift valve regulator plug YT-8614103
- ZZ—1-2 shift valve regulator plug 7084174
- AB—3-4 shift valve regulator plug A262296
- AC—Front body YT-8613997
- AD—No. 10 x 1 screw w/lockwasher 454028
- AE—No. 10 x $1\frac{1}{4}$ screw w/lockwasher 190163
- AF—Front body hole plug YT-8614088
- AG—"T" valve cutoff valve spring YT-8614242
- AH—No. 8 x $\frac{5}{16}$ screw 110809
- AJ—"T" valve cutoff valve YT-8614241
- AK—Front body plate YT-8614007
- AL—No. 10 x $\frac{3}{8}$ screw 451735
- AM—No. 10 x $\frac{7}{16}$ screw w/lockwasher 454030

Figure 51—Continued.

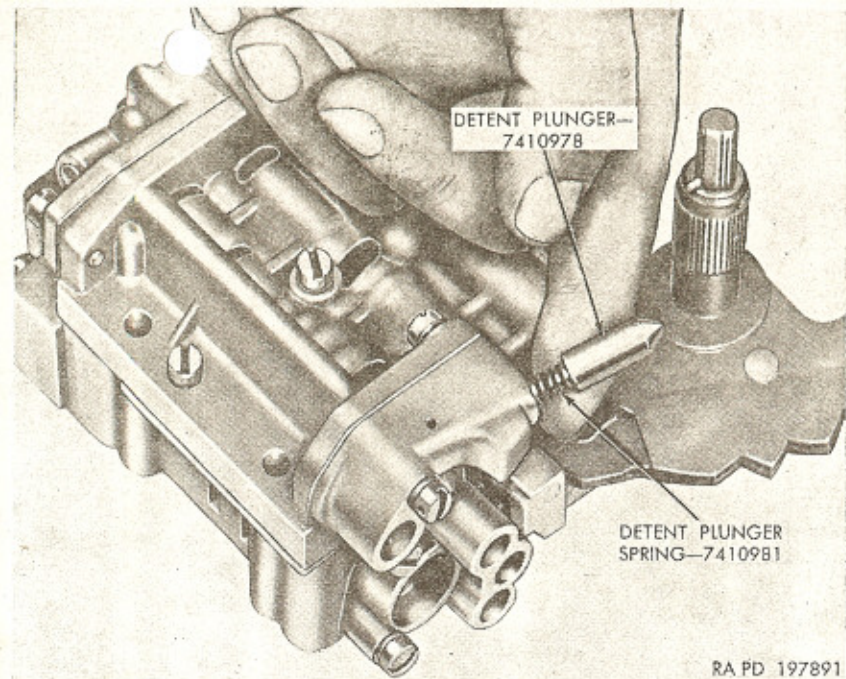


Figure 52. Removing or installing detent spring and plunger.

- (b) With the valves, plugs, and valve bodies clean and dry, check each shift valve, governor plug, and regulator plug for free movement in their respective bores in operating positions.

Note. Valves can be assumed to be free in their operating position if they will fall of their own weight in their respective bores when valve body is shaken slightly. Do not drop valves, plugs, or valve bodies. All governor plugs (QQ) are interchangeable. Likewise, the 2-3 and 3-4 shift valves (SS) are interchangeable. Therefore, if it is found that a shift valve or governor plug does not slide freely in one bore of valve inner body, try it in other bore.

- (c) Manual control valve (U) is the only valve furnished separately. If it becomes necessary to replace one of the other valves (J, V, EE, GG, SS, and TT) or one of the control valve bodies (inner body (RR), outer body (M), or front body (AC)), the complete control valve assembly must be replaced.
- (2) *Springs.* Check all springs for free length, collapsed coils, and compressed length. Dimensions will be found in paragraph 157.
- (3) *Valve bodies, plates, and covers.* Check all valve body, plate, and cover contact surfaces for scores or cracks.

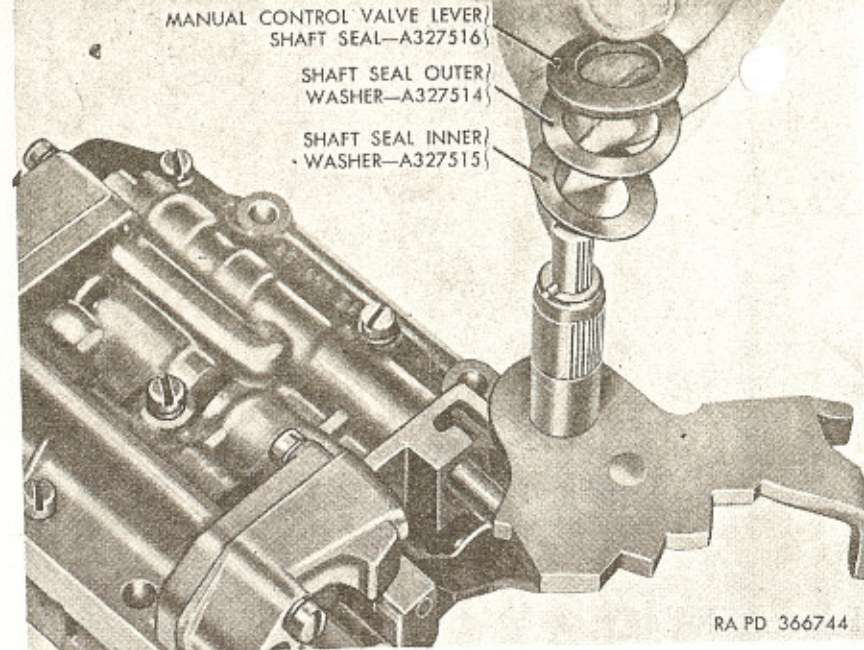


Figure 53. Removing or installing manual control valve shaft seal and washers.

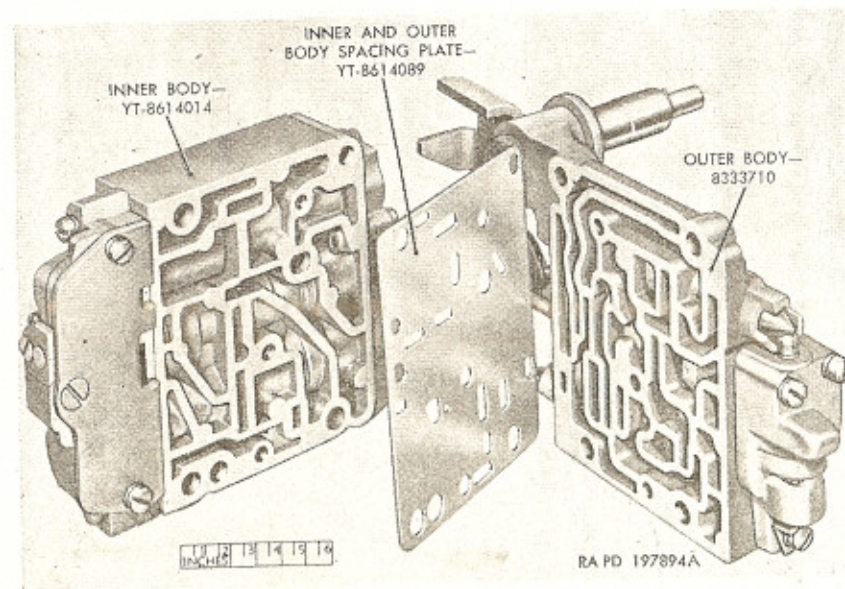


Figure 54. Control valve inner and outer bodies separated.

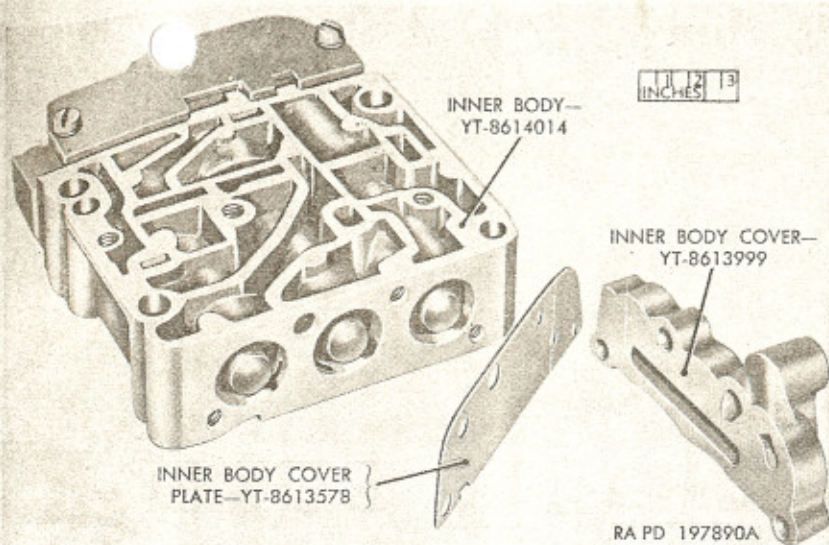


Figure 55. Control valve inner body cover removed.

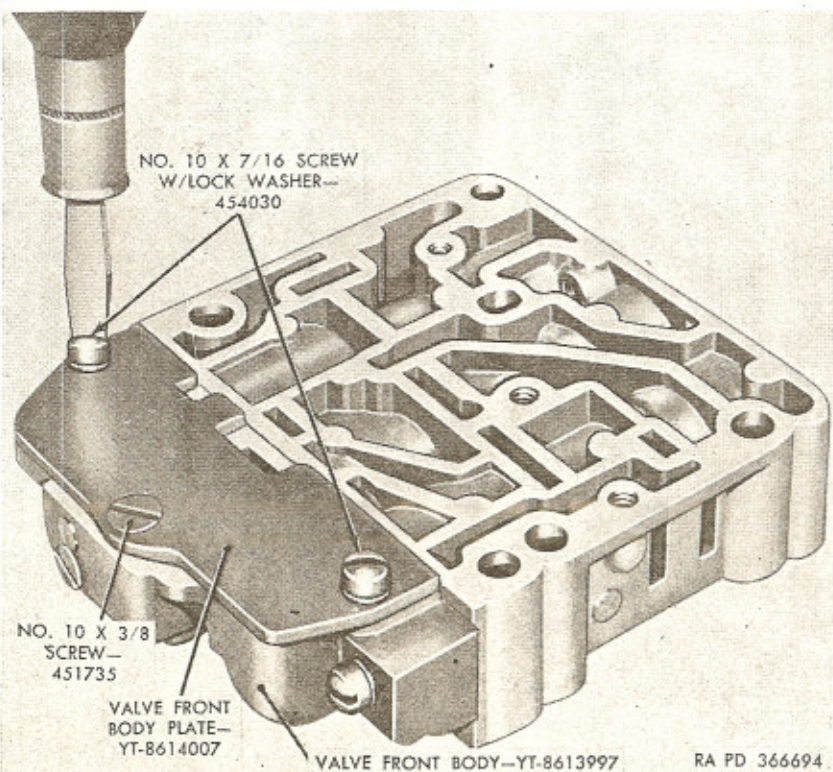


Figure 56. Removing or installing control valve front body plate.

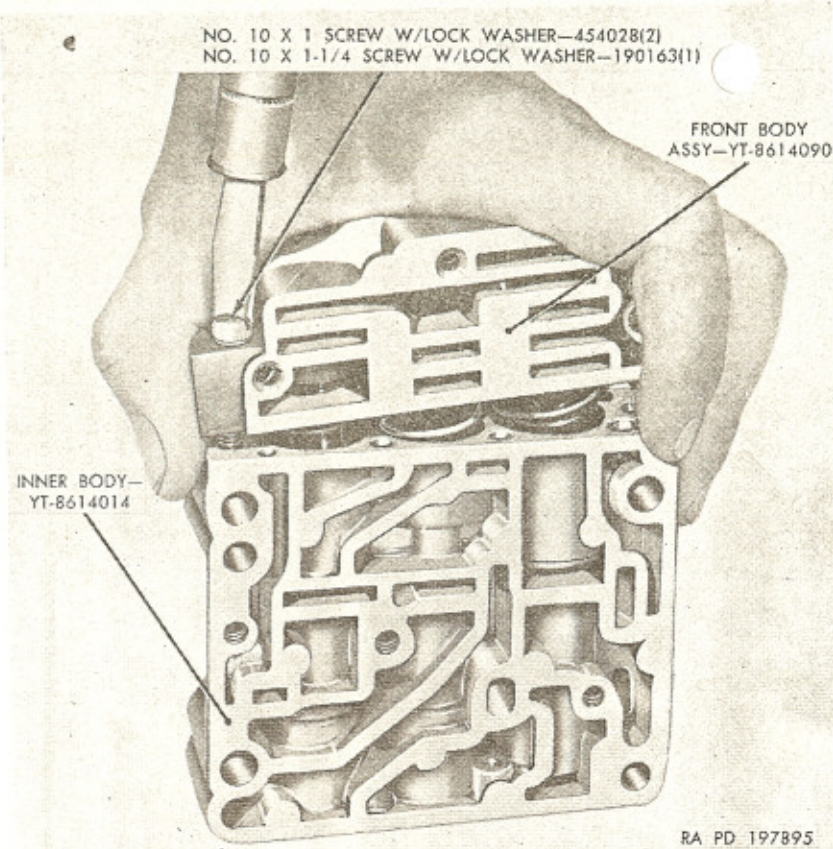


Figure 57. Removing or installing control valve front body assembly.

Clean out all passages thoroughly. Examine threads for crossed condition. Check bodies for warped condition by covering contact surface of each body with mechanics (prussian) blue. Check on a clean surface plate by moving body several times with an oscillating movement (fig. 63). The surfaces may be lapped with fine crocus cloth to remove slight warpage.

Note. If either the inner or outer body requires replacement (or valves (1)(c) above), the complete control valve assembly must be replaced.

- (4) *Throttle valve control lever assembly.* Check for looseness of peened over lever at inner end of throttle valve control lever with shaft (HH). Check fit of throttle valve control lever shaft in hub of manual control valve lever assembly (T) which was not removed from the valve outer body (G, fig. 64). If shaft binds in hub, is

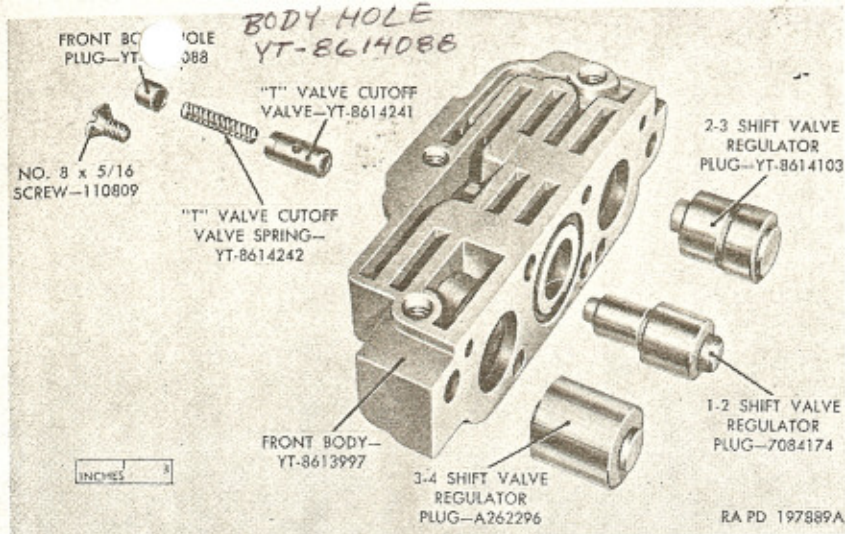


Figure 58. Control valve front body disassembled.

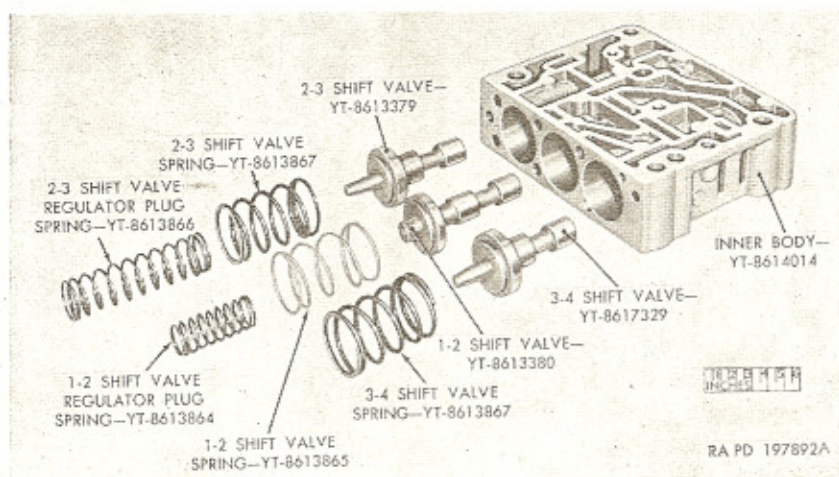


Figure 59. Control valve inner body disassembled.

excessively worn, or if seal is damaged or missing, repair as shown in (a) through (c) below (fig. 64).

- (a) Avoid damaging manual control valve lever or outer body while removing or installing throttle valve control lever shaft retaining pin (P).
- (b) Drive out throttle valve control lever shaft retaining pin (P). Pull throttle valve control lever with shaft

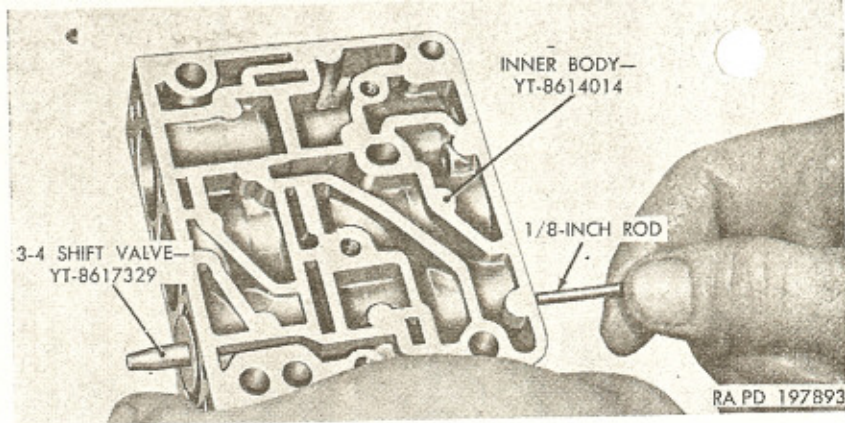


Figure 60. Removing shift valves from control valve inner body.

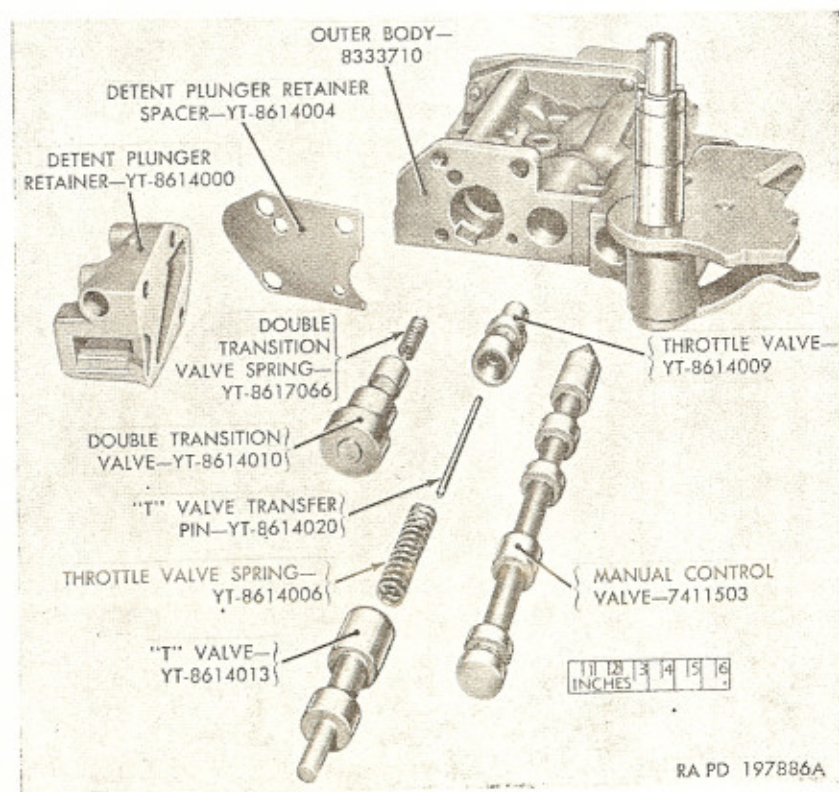


Figure 61. Detent plunger retainer and valves removed from valve outer body.

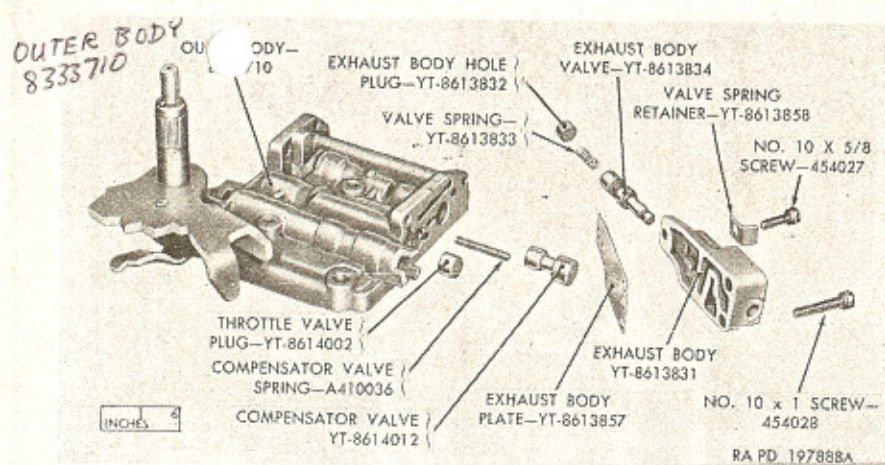


Figure 62. Exhaust body and compensator valve removed from control valve outer body.

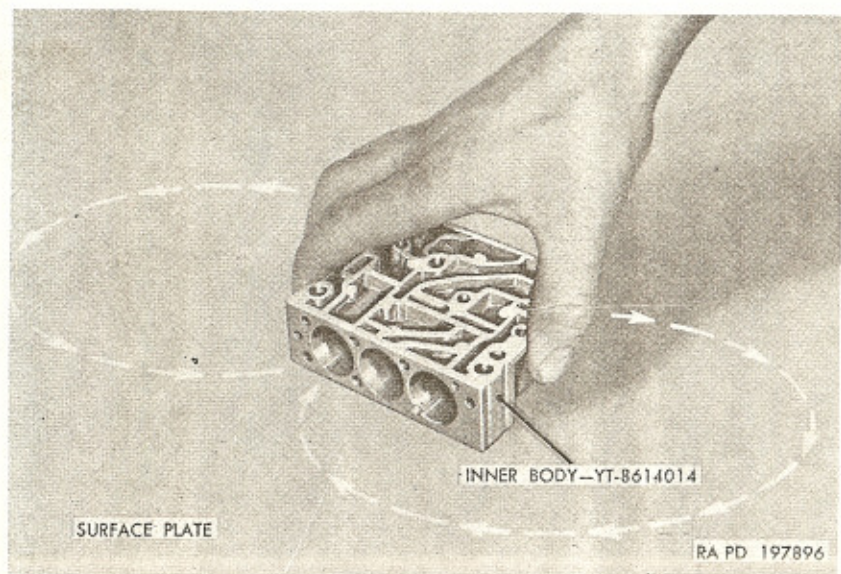
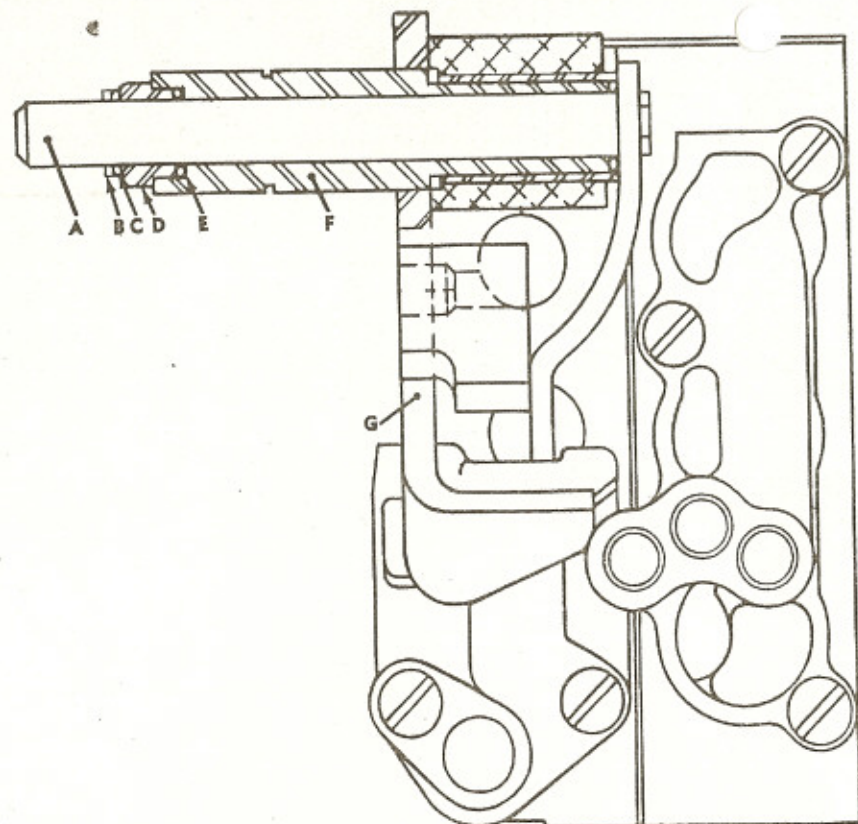


Figure 63. Checking control valve inner body for warpage.

(HH) from outer body and manual control valve lever.

- (c) Install throttle valve control lever with shaft (HH) into manual control valve lever assembly (T) and outer body (M), using necessary new parts. Install O-ring gasket (S), throttle valve control lever shaft seal retainer (R), and throttle valve control lever



- A—THROTTLE VALVE CONTROL LEVER W/SHAFT—YT-8614015
 B—THROTTLE VALVE CONTROL LEVER SHAFT RETAINING PIN—187381
 C—THROTTLE VALVE CONTROL LEVER SHAFT RETAINING PIN WASHER—8328349
 D—THROTTLE VALVE CONTROL LEVER SHAFT SEAL RETAINER—8328348
 E—“O” RING GASKET—501219
 F—MANUAL CONTROL VALVE LEVER ASSY—7412625
 G—OUTER BODY—8333710

RA PD 197877

Figure 64. Throttle valve control lever installed.

shaft retaining pin washer (Q) over throttle valve control lever shaft. Install new throttle valve control lever shaft retaining pin (P) through shaft.

(5) Manual control valve lever assembly.

- (a) Make sure small pick-up pin riveted to detent section of manual control valve lever assembly (T) is tight in place and not excessively worn. If pin is loose in lever, peen over end of pin in regular manner, making sure not to distort or enlarge area of pin which makes contact with manual control valve (U).
- (b) Check for damaged splines on manual control valve lever assembly (T).

76. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 51. Liberally lubricate all moving parts and passages with clean engine oil (OE 10) during assembling operations. Extreme cleanliness is necessary during assembly of control valve parts. Always use new lockwashers at assembly. Before installing control valve springs in valve bodies, refer to figure 65 for identification of springs.

- a. Install compensator valve spring (L) and compensator valve (J) in outer body (M). Install throttle valve plug (K) (fig. 62).
- b. Install new exhaust body valve (C) and exhaust body valve spring (B) in exhaust body (G) (fig. 66).
- c. Install new exhaust body hole plug (A) in exhaust body (G). Press plug in housing flush with body face (fig. 66).
- d. Install exhaust body (G) with exhaust body plate (H) on outer body (M). Contour of exhaust body plate must match contour of exhaust body. Install exhaust body valve spring retainer (E) and No. 10 x 5/8 screw with lock washer (D) at small end of exhaust body. Install two No. 10 x 1 screws with lockwashers (F) at other end of exhaust body; then tighten all three screws to 3 to 4 pound-feet torque.
- e. Install double transition valve spring (FF) and double transition valve (EE) in outer body (M).
- f. Install throttle valve (GG), "T" valve transfer pin (DD), throttle valve spring (CC), and "T" valve (V) in outer body (M) (fig. 61). Check each part in body bore for freeness.
- g. Install detent plunger retainer (X) and detent plunger retainer spacer (W) on outer body (M) and attach with three screws with lockwashers (AA, BB, and KK). Install No. 10 x 3/4

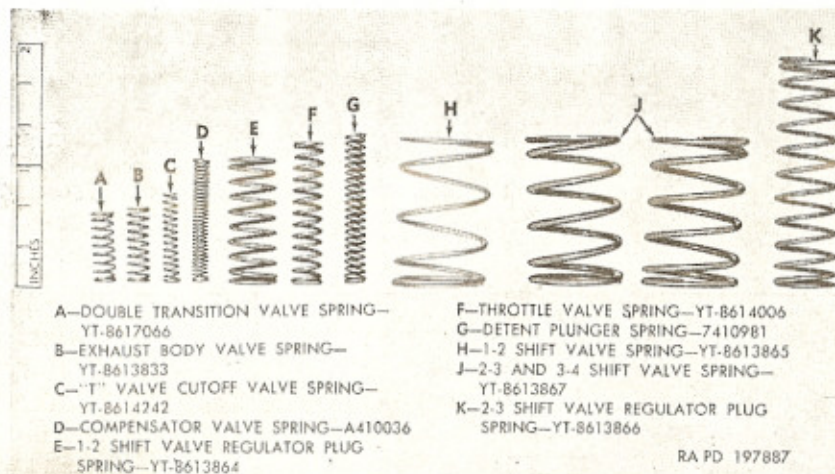
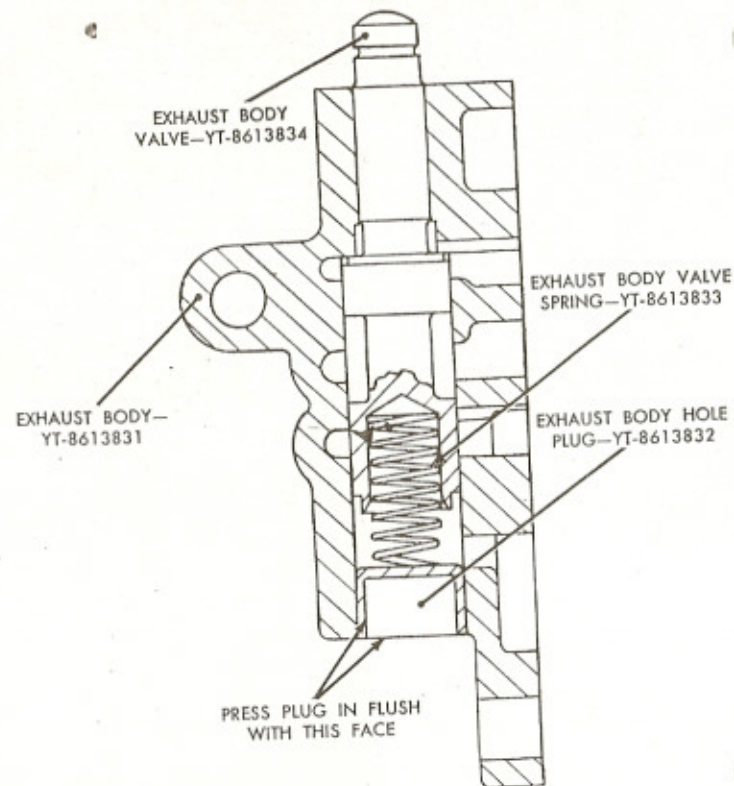


Figure 65. Control valve spring identification.



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Figure 66. Sectional view of exhaust body assembly.

screw with lockwasher (AA) and No. 10 x 1 1/8 screw with lockwasher (BB) through retainer into outer body. Install No. 10 x 5/8 screw with lockwasher (KK) through outer body into retainer. Tighten screws to 3 to 4 pound-feet torque.

h. Insert manual control valve (U) into outer body (M), making sure throttle valve control lever pick-up pin engages valve correctly as indicated in (1) through (4) below.

- (1) Rotate manual control valve lever assembly (T) counterclockwise, past the reverse position (last notch).
- (2) Insert detent plunger spring (Y) in bore of detent plunger retainer (X).
- (3) Insert detent plunger (Z) over detent plunger spring (Y) (fig. 52).
- (4) Push plunger and spring into bore with finger while rotating manual control valve lever clockwise, and at the same time engaging pick-up pin between the first two lands of the manual control valve (U).

Note: Check to see that manual control valve will go into neutral (lever clockwise all the way). If necessary, loosen screws attaching exhaust body (G) and raise housing as necessary to allow manual control valve to go into neutral.

i. Install the 1-2 shift valve (TT) and the 2-3 and 3-4 shift valves (SS) in outer bores of inner body (RR) fig. 59. Check each valve for freeness in its respective bore. The 2-3 and 3-4 shift valves are interchangeable.

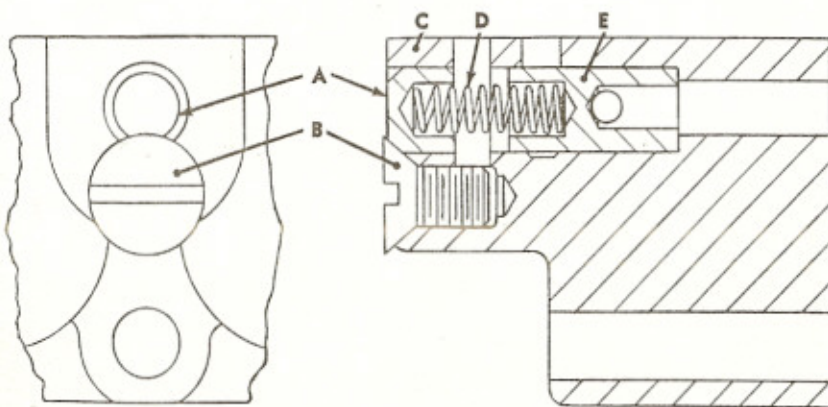
j. Install the 1-2 shift valve regulator plug spring (WW) and the 1-2 shift valve spring (UU) in the center bore of inner body (RR) (fig. 59).

k. Install the 2-3 shift valve spring (VV) and the 2-3 shift valve regulator plug spring (XX) in inner body (RR). Install the 3-4 shift valve spring (VV) in inner body (fig. 59).

l. Position "T" valve cutoff valve (AJ), "T" valve cutoff valve spring (AG), and front body hole plug (AF) in bore of front body (AC) (fig. 67); then retain parts in bore with No. 8 x 5/16 screw (AH). Tighten screw firmly.

m. Install the 1-2 shift valve regulator plug (ZZ), 2-3 shift valve regulator plug (YY), and 3-4 shift valve regulator plug (AB) in front body (AC) (fig. 58). Try each plug for freeness in its respective bore.

n. Lay front body (AC) and inner body (RR) on a clean surface. Line up 1-2 and 2-3 shift valve regulator plug springs (WW and XX) in inner body with regulator plugs in front body



A—FRONT BODY HOLE PLUG—
YT-8614088

B—NO. 8 x 5/16 SCREW—110809

C—FRONT BODY ASSY—8614090

D—"T" VALVE CUTOFF VALVE SPRING—
YT-8614242

E—"T" VALVE CUTOFF VALVE—
YT-8614241

RA PD 197880

Figure 67. Sectional view of control valve front body assembly.

(AC). Compress the springs with front body; then install one No. 10 x 1 1/4 screw with lockwasher (AE), and two No. 10 x 1 screws with lockwashers (AD) attaching front body to inner body (fig. 57). Tighten screws to 3 to 4 pound-feet torque.

o. Install three governor plugs (QQ) in inner body (RR). Check action of each shift valve by pushing against each governor plug with enough force to compress valve and regulator springs.

p. Position inner body cover plate (PP) and inner body cover (NN) on inner body (RR). Install three No. 10 x 3/4 screws with lockwashers (MM) attaching inner body cover (NN) to inner body (RR). Tighten screws to 3 to 4 pound-feet torque.

q. Position front body plate (AK) on front body (AC); then install one No. 10 x 3/8 screw (AL) and two No. 10 x 7/16 screws with lockwashers (AM) attaching plate to front body. Note that center screw (AL) has a flathead. Be sure valve front body plate (fig. 56) does not extend over face of inner body. Tighten screws to 3 to 4 pound-feet torque.

r. Position inner and outer body spacing plate (JJ) on inner body (RR).

Note. Make sure that all holes in plate index with all holes in inner body.

s. Position outer body (M) on inner and outer body spacing plate (JJ); then insert the four 1/4 x 2 bolts (Q, fig. 181) which are used to attach control valve assembly to transmission case through valve housings and spacing plate. These bolts will hold spacing plate in position while starting and tightening one No. 10 x 3/4 screw with lockwasher (LL) and two No. 10 x 1 1/8 screws with lockwashers (N) which attach inner and outer bodies together. Tighten screws to 3 to 4 pound-feet torque. Remove the four bolts used as guides.

t. Install manual control valve lever shaft inner washer (fig. 53) with small inside diameter over lever shaft, concave (dished side) up.

u. Install manual control valve lever shaft outer washer (fig. 53) with large inside diameter over lever shaft, concave (dished side) down.

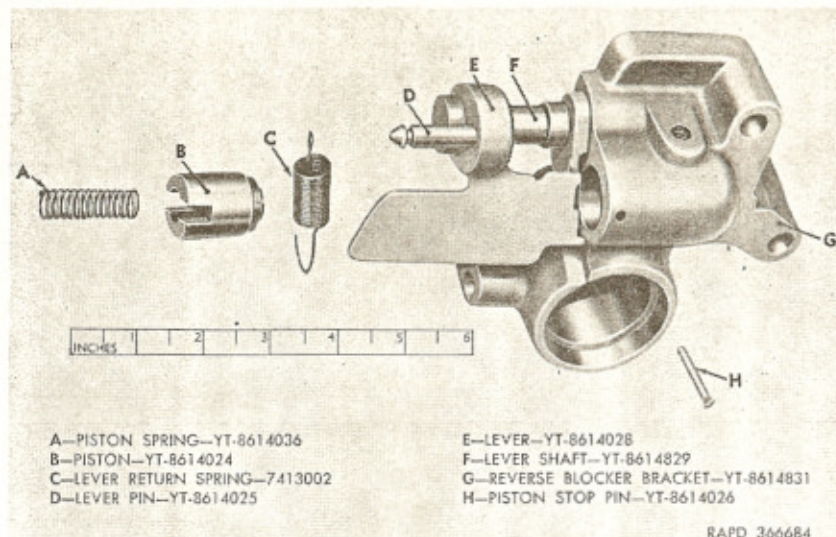
v. Install manual control valve lever shaft seal over lever shaft with lip of seal extending into inside diameter of lever shaft seal outer washer (fig. 53).

w. For protection against dirt or damage, wrap control valve assembly in clean lint-free cloth or paper until ready to assemble to transmission case.

Sect. II. REBUILD OF REVERSE BLOCKER BRACKET ASSEMBLY

77. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 68.



A—PISTON SPRING—YT-8614036
B—PISTON—YT-8614024
C—LEVER RETURN SPRING—7413002
D—LEVER PIN—YT-8614025

E—LEVER—YT-8614028
F—LEVER SHAFT—YT-8614829
G—REVERSE BLOCKER BRACKET—YT-8614831
H—PISTON STOP PIN—YT-8614026

RAPD 366684

Figure 68. Reverse blocker bracket assembly components.

a. Grind head off piston stop pin (H). While holding finger over piston spring (A), use long-nose pliers to remove pin from reverse blocker bracket (G).

b. Remove piston spring (A) and piston (B) from bore of reverse blocker bracket (G). Use snap ring pliers, if necessary, in manner shown in figure 69 to remove piston.

78. Cleaning and Inspection

Note. The capitalized key letters shown below in parentheses refer to figure 68. Repair and rebuild specifications are shown in paragraph 158.

a. *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Blow out all passages with compressed air. Dry parts by playing an air stream across parts until thoroughly dry or by wiping dry with lint-free cloth.

b. *Inspection.*

- (1) Check piston spring (A) and lever return spring (C) for free length, compressed length, collapsed coils, and distortion.

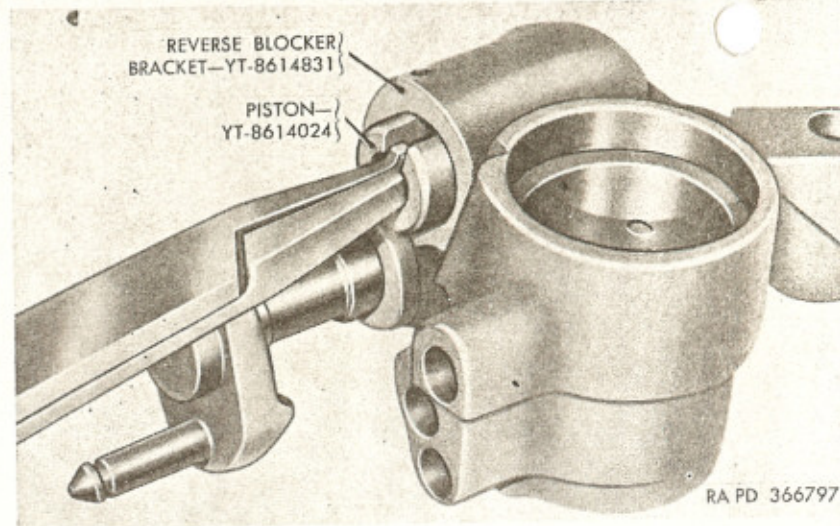


Figure 69. Removing piston from reverse blocker bracket.

- (2) Inspect piston (B) and piston bore in reverse blocker bracket (G) for scores or burs. Check fit of piston in bore.
- (3) Inspect $\frac{1}{4}$ -inch plug. Make sure plug is securely staked in reverse blocker bracket (G).
- (4) Inspect all oil passages in reverse blocker bracket (G). Use fine wire to check for obstructions and make sure all passages are clean.
- (5) Check governor tower bore of reverse blocker bracket (G) for signs of extreme wear and for size. Inspect bracket for cracks or other damage.
- (6) Rotate lever (E) on lever shaft (F) to see that lever operates freely without binding or excessive wear.
- (7) Check lever pin (D) and lever shaft (F) for looseness, wear, or bent condition.

79. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 68. All parts must be thoroughly lubricated with engine oil (OE-10) before assembly.

a. Install piston (B), with slotted end exposed, in bore of reverse blocker bracket (G); then insert piston spring (A) into piston.

b. Compress piston spring (A) into piston (B) with screwdriver and insert new piston stop pin (H). Peen ends of pin to lock in place.

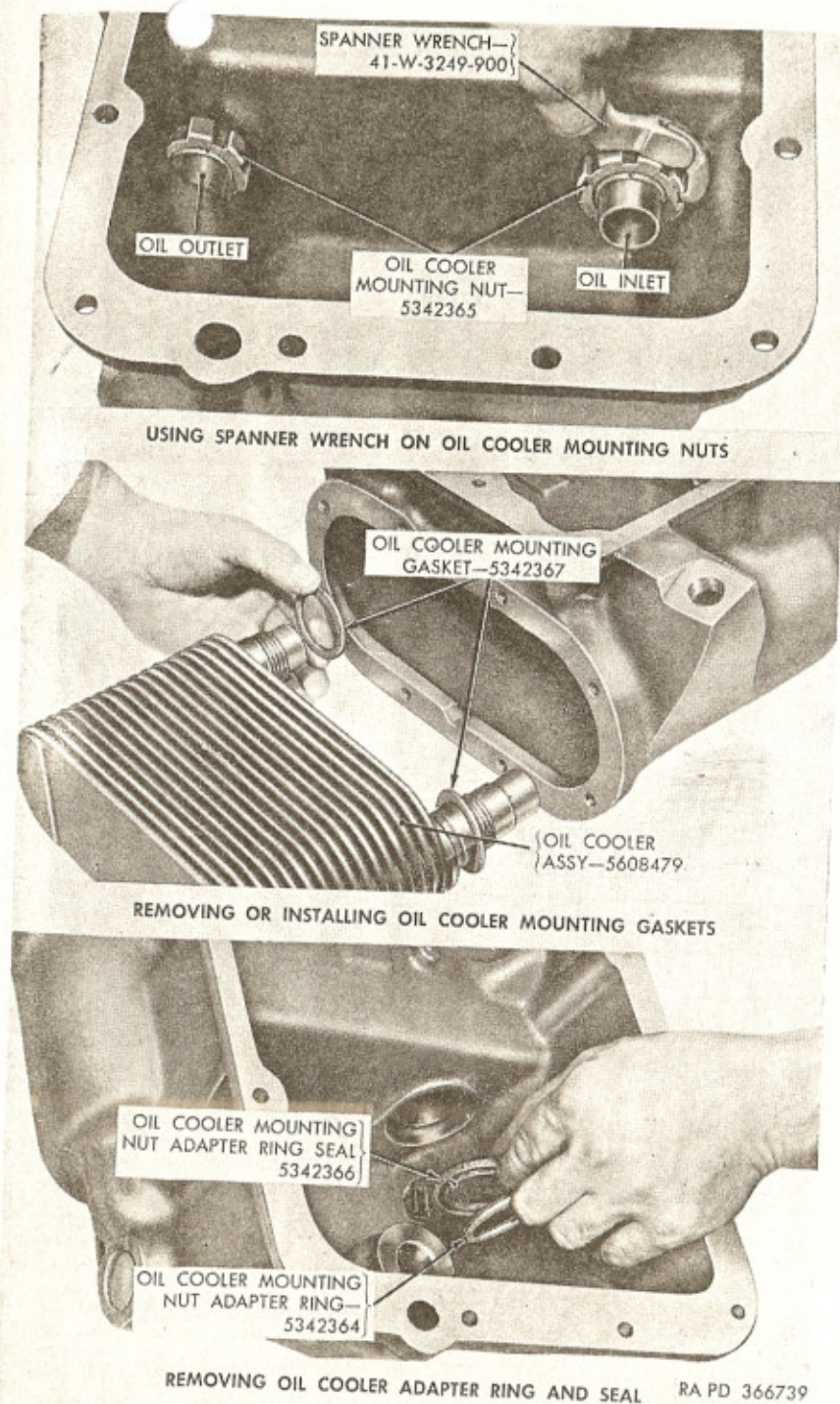


Figure 72. Removing oil cooler components from oil pan.

b. Inspection.

- (1) *Oil pan assembly (L)*. Inspect oil pan for cracks, dents, or other damage. Examine drain plug and by-pass valve openings for damaged threads. Make sure mounting surfaces are free from nicks or burs. Replace with new oil pan assembly if any damage is evident.
- (2) *Oil pan oil screen assembly (M)*. Inspect oil screen for cracked or plugged screen. If sludge cannot be thoroughly cleaned from screen, replace screen assembly.
- (3) *Oil cooler assembly (C)*. Examine oil cooler fins for cracks or dents which may cause leaks. Check inlet and outlet tubes for looseness or distortion. With the aid of a flashlight, inspect interior of oil cooler through inlet and outlet tubes for evidence of sludge deposits or corrosion not removed by the dry-cleaning solvent or mineral spirits paint thinner. If sludge or corrosion is evident, but cooler otherwise appears in good condition, boil cooler assembly in radiator cleaning solution or circulate hot solution of oxalic acid through cooler. Immerse cooler assembly in water, plug one opening, and apply not more than 35 to 40 psi air pressure to the other opening. Watch for bubbles in water to detect air leaks. Leaks can be repaired with silver solder only. Do not use tin-lead-antimony-type solder.
- (4) *By-pass valve assembly (S)*. Check action of valve on valve pin; valve must slide freely on pin. Examine spring for corrosion. If any damage is evident, replace valve assembly. If valve and spring are in good condition, install a new gasket on valve plug. Soak new gasket until soft and pliable, and install on valve plug while wet; then allow to dry before installing valve assembly. Gasket will shrink onto valve plug.

82. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 70.

a. Place new oil cooler mounting gaskets (D) on oil cooler inlet and outlet tubes (fig. 72).

b. Position oil cooler assembly (C) in oil pan with the oil outlet (long) tube on right side when facing oil cooler opening in oil pan. Insert oil cooler into oil pan until end of oil outlet (long) tube is through wall in oil pan. Place oil cooler mounting nut adapter ring seal (E), oil cooler mounting nut adapter ring (F), and oil cooler mounting nut (G) on oil outlet tube; then push oil cooler into place with oil outlet tube entering passage in pan.

Install oil cooler mounting nut adapter ring seal (E), oil cooler mounting nut adapter ring (F), and oil cooler mounting nut (G) on oil inlet (short) tube. Thread mounting nuts onto oil cooler inlet and outlet tubes and tighten, using spanner wrench—41-W-3249-900 (fig. 72). Nuts must be tightened to 130 to 140 pound-feet torque. After tightening, stake threads on oil cooler inlet and outlet tubes in two places each to prevent nuts loosening.

c. Position oil pan oil screen assembly (M) in oil pan, with hole in side of screen over oil cooler oil inlet tube. Install oil screen bolt (N) and tighten to 2 to 2½ pound-feet torque.

d. Install magnetic drain plugs (H) in oil pan, using new drain plug gaskets (J). Tighten drain plugs to 35 to 45 pound-feet torque.

e. Install by-pass valve assembly (S) in opening in oil pan, with new gasket in place (par. 81b(4)). Tighten by-pass valve plug to 35 to 45 pound-feet torque. Place by-pass valve cap (R) over valve plug and tap into place with hammer.

f. Using a new oil cooler cover gasket (B), install oil cooler cover (A) on oil pan and attach with eight ⅝ x ⅞ bolts (V) and ⅝-inch lockwashers (U). Tighten bolts to 15 to 18 pound-feet torque.

g. On Model 301MG, install ¼-inch square head drain plug (W) in oil cooler cover and tighten firmly.

Section IV. REBUILD OF FRONT AND REAR SERVO ASSEMBLIES

83. Disassembly of Front Servo

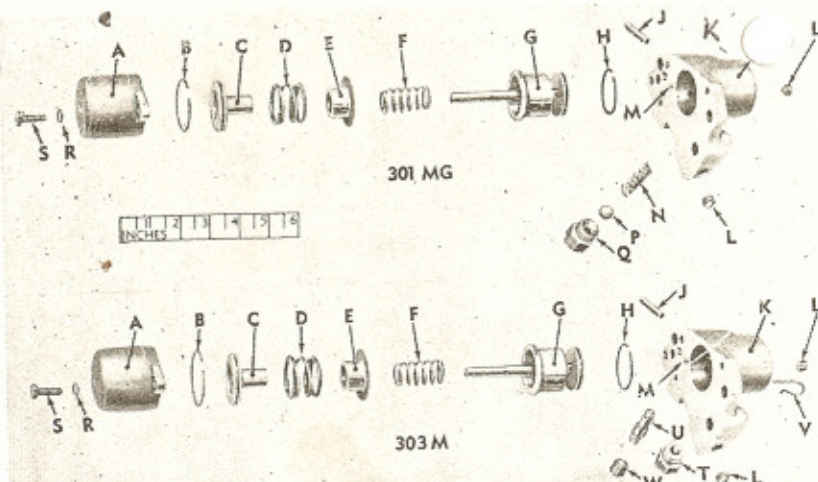
Note. The capitalized key letters shown below in parentheses refer to figure 73.

a. Test servo operation before disassembly by using a source of compressed air and air gun—B7950562. Direct stream of air through front band apply passage (fig. 74). When servo is operating properly, stem of body piston assembly (G) should fully extend and remain in an extended position as long as air pressure is applied.

b. Remove two bolts (S) and lockwashers (R) attaching cylinder (A) to body (K). Remove cylinder (A).

c. Remove cylinder piston spring (D); then remove cylinder piston (C) from cylinder. Remove cylinder piston oil seal ring (B) from cylinder piston (C).

d. Remove cylinder piston spring retainer (E) and body piston retracting spring (F) from stem of body piston assembly (G).



A—CYLINDER—7084032.
B—CYLINDER PISTON OIL SEAL RING—5262359
C—CYLINDER PISTON—7084034
D—CYLINDER PISTON SPRING—5262486
E—CYLINDER PISTON SPRING RETAINER—7084035
F—BODY PISTON RETRACTING SPRING—5262312
G—BODY PISTON ASSEMBLY—7084189
H—BODY PISTON OIL SEAL RING—5262277
J—OIL TRANSFER LINE—5262348
K—BODY—YT-8613535
L—1/8-INCH PIPE PLUG—103884

M—1/8 X 1/2 CYLINDER CENTERING PIN—141109
N—CHECK VALVE SPRING—7084116
P—CHECK VALVE BALL—169158
Q—CHECK VALVE SEAT—8333530
R—1/4-INCH LOCK WASHER—103319
S—1/4 X 3/4 BOLT—100109
T—FRONT OIL PUMP DISCHARGE PIPE FITTING—7410891
*U—VALVE—YT-8617352
*V—VALVE RETAINER—7410893
*W—1/4-INCH PIPE PLUG—103884
* EARLY MODEL 303M ONLY

RAPD 366685

Figure 73. Front servo assembly components.

e. Remove body piston assembly (G) from body (K). Remove body piston oil seal ring (H) from body piston assembly (G).

f. Remove two pipe plugs (L) from body (K).

g. Remove cylinder centering pin (M) and oil transfer line (J) only if loose or damaged.

h. Subparagraphs (1) and (2) below apply to individual transmission models as indicated.

(1) *Model 303M.* Remove front oil pump discharge pipe fitting (T). On early Model 303M transmissions only, remove pipe plug (W) and pull valve retainer (V) from body (K); then remove valve (U). Tap lightly on body with plastic hammer, if necessary, to dislodge valve.

(2) *Model 301MG.* Remove check valve seat (Q); then remove check valve ball (P) and check valve spring (N) from passage of body (K).

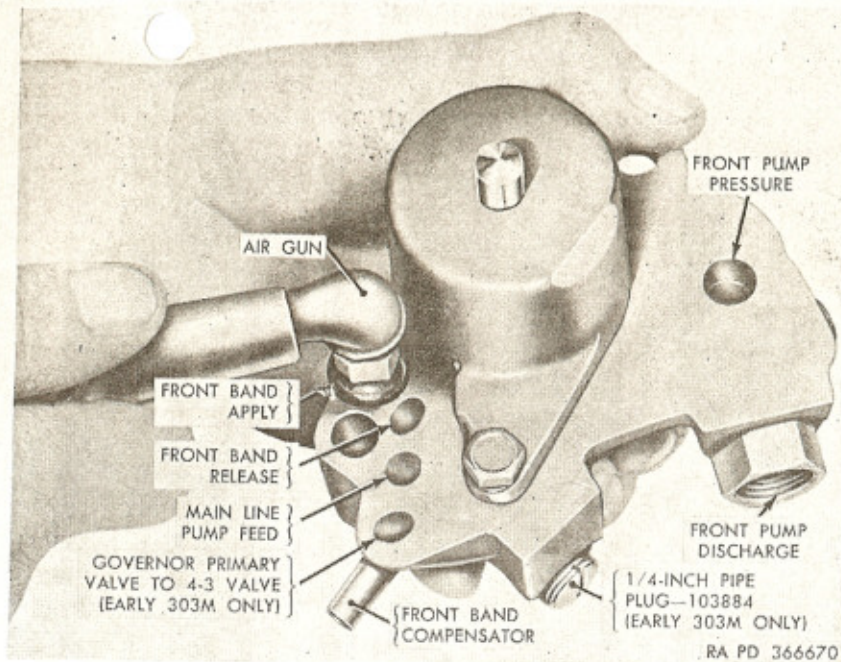


Figure 74. Checking front servo operation with air gun—B7950562.

84. Cleaning and Inspection of Front Servo Parts

Note. The capitalized key letters shown below in parentheses refer to figure 73. Repair and rebuild specifications are shown in paragraph 159.

a. Cleaning. Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Blow out all passages. Dry parts by playing an air stream across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

b. Inspection.

- (1) Inspect bore of body (K) and cylinder (A) for nicks and scores.
- (2) Insert cylinder piston (C), without cylinder piston oil seal ring (B), into bore of cylinder (A). Measure clearance between bore and piston with feeler gage. Insert new oil seal ring in bore and measure ring gap. Install new oil seal ring on cylinder piston (c). Measure groove clearance.
- (3) Insert body piston assembly (G), without oil seal ring, into bore of body (K). Measure clearance between piston and bore with feeler gage. Insert new body piston oil seal ring (H) on body piston assembly (G); then measure groove clearance.

- (4) Check free length and compressed length of body piston retracting spring (F) and cylinder piston spring (D).
- (5) Check stem clearance of body piston assembly (G) in cylinder (A).
- (6) Subparagraphs (a) and (b) below apply to individual transmission models as indicated.
 - (a) *Model 303M.* Inspect valve (U) for scores or blocked passage. This applies to early models only.
 - (b) *Model 301MG.* Inspect contact surface of check valve ball (P) and check valve seat (Q) for roughness. Check free length and compressed length of check valve spring (N).

85. Assembly of Front Servo

Note. The capitalized key letters shown below in parentheses refer to figure 73. All parts must be thoroughly lubricated with engine oil (OE-10) before assembly.

a. Install $\frac{1}{8}$ x $\frac{1}{2}$ cylinder centering pin (M) and oil transfer line (J) in body (K), if previously removed. Tap line into place with a plastic hammer.

b. Install two $\frac{1}{8}$ -inch pipe plugs (L) in body (K). Tighten plugs to 6 to 7 pound-feet torque.

c. Insert stem of body piston assembly (G) in bottom side (small hole) of cylinder (A). Stem of piston is to serve as a guide when installing cylinder piston (C) in cylinder.

d. Compress cylinder piston oil seal ring (B) on cylinder piston (C); then start piston in cylinder (A) over piston stem guide. Push cylinder piston and stem down carefully past two steps in cylinder wall until piston is seated against bottom of cylinder (fig. 75). Remove stem of body piston assembly (G) from cylinder (A).

e. Compress body piston oil seal ring (H) on body piston assembly (G) and work piston into body (K). Locate groove in body piston assembly at cylinder centering pin (M) (fig. 76).

f. Position body piston retracting spring (F), cylinder piston spring retainer (E), and cylinder piston spring (D) over stem of body piston assembly (G).

g. Aline notch in cylinder (A) with cylinder centering pin (M); then carefully guide cylinder piston spring (D) and stem of body piston assembly (G) into bore of cylinder.

h. Aline drilled bosses on cylinder (A) with tapped holes in body (K). Seat cylinder squarely on body. Install two $\frac{1}{4}$ x $\frac{3}{4}$ bolts (S) and $\frac{1}{4}$ -inch lockwashers (R). Tighten bolts to 6 to 8 pound-feet torque.

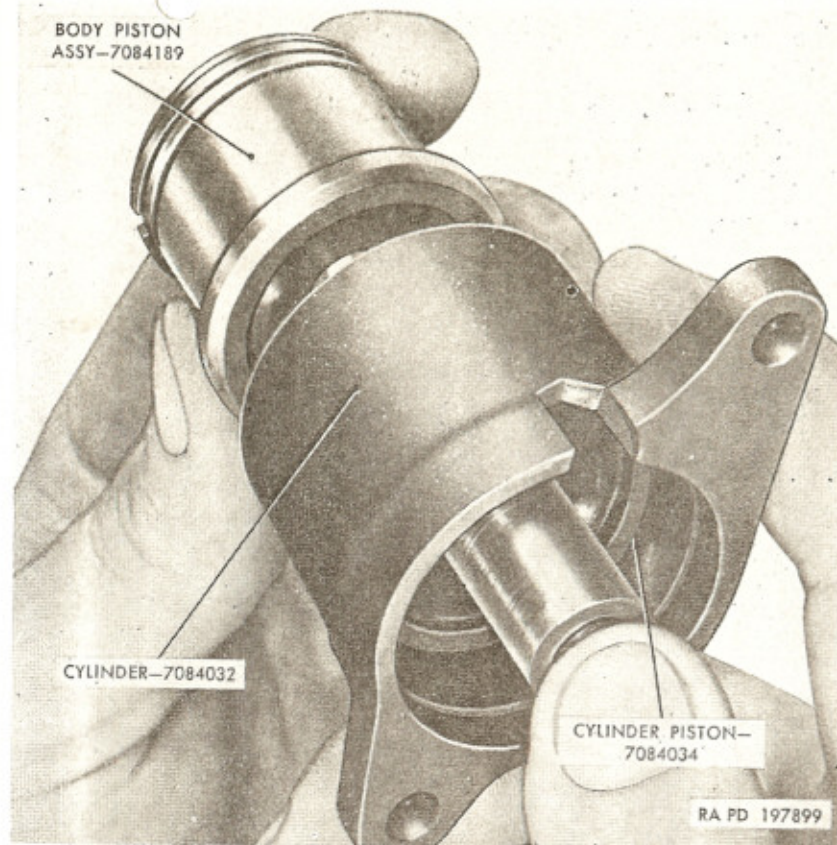


Figure 75. Installing cylinder piston in cylinder.

i. Remaining steps of assembly apply to individual transmission models as indicated.

(1) *Model 303M*. Install front oil pump discharge pipe fitting (T) in body (K) and tighten firmly. On early models only, install valve (U) in body. Aline slot of valve with hole for valve retainer (V) and insert retainer. Install $\frac{1}{4}$ -inch pipe plug (W) and tighten to 8 to 10 pound-feet torque.

(2) *Model 301MG*. Insert check valve spring (N) and check valve ball (P) in passage of body (K); then install check valve seat (Q). Tighten seat firmly in body.

j. Test operation of front servo assembly as instructed in paragraph 83a.

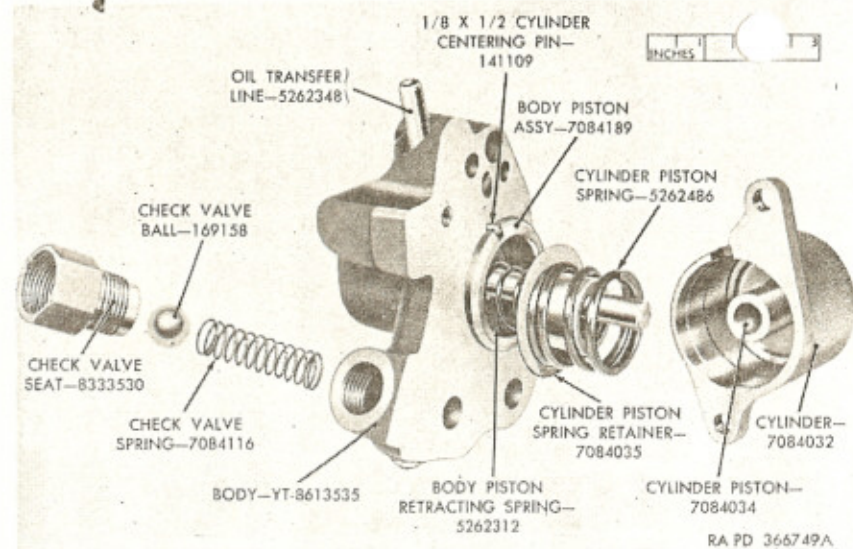


Figure 76. Assembling front servo (301MG shown).

86. Disassembly of Rear Servo

Note. The capitalized key letters shown below in parentheses refer to figure 77.

a. Test rear servo operation before disassembly by using a source of compressed air and air gun—B7950562. Direct stream of air through release pressure passage (fig. 78). When servo is operating properly, booster piston pin (N-2) should fully retract and stay in a retracted position as long as air pressure is applied.

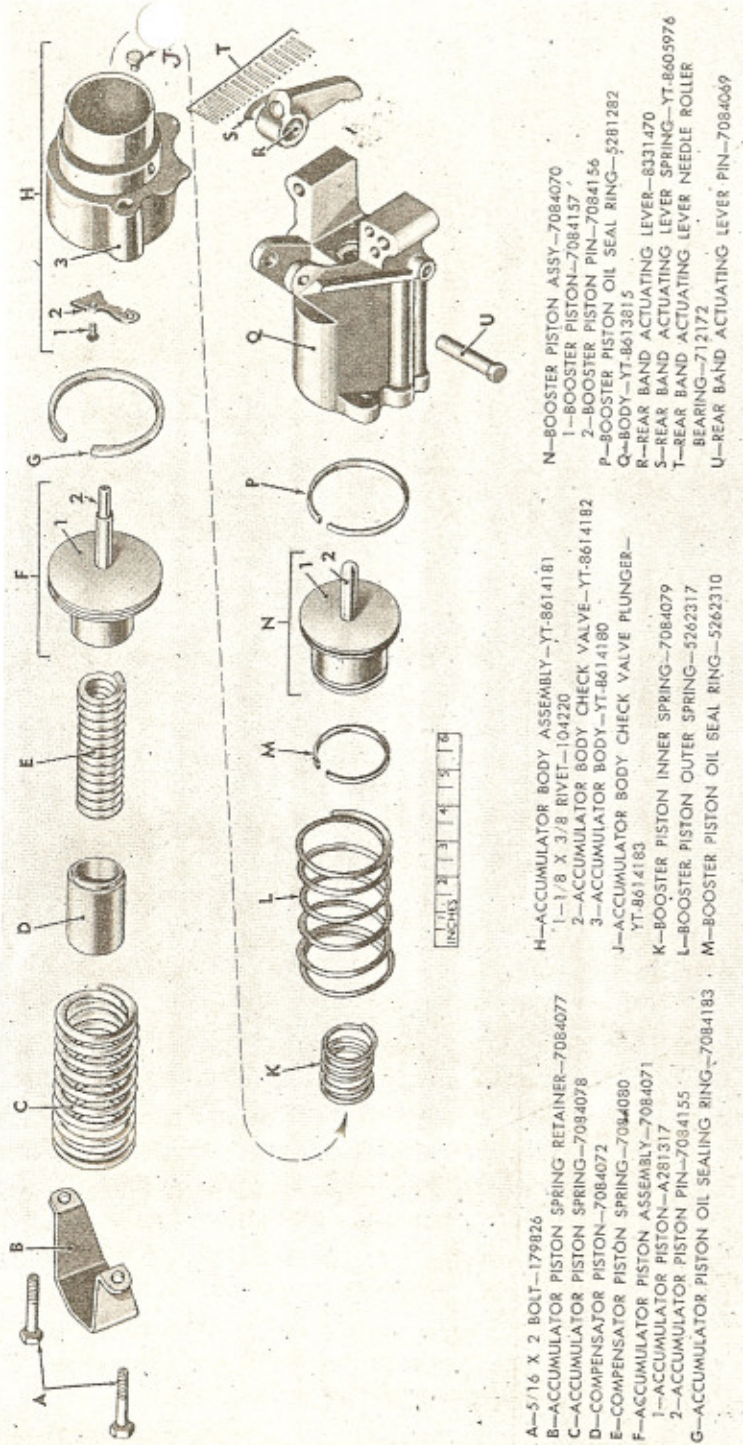
b. Clamp spring compressor—C7950334 in a vertical position in a vise. Position rear servo assembly on spring compressor (fig. 79).

c. Crank compressor ram down to rest on face of compensator piston (D). Place ram guide on ram. Avoid excessive pressure that might distort accumulator piston spring retainer (B).

d. While keeping ram guide against face of accumulator piston spring retainer (B), remove two bolts attaching spring retainer to body (Q).

e. Carefully back off ram until tension is relieved on accumulator piston spring (C). Remove ram guide and ram; then remove accumulator piston spring retainer (B). Remove servo assembly from spring compressor.

f. Remove accumulator piston spring (C), compensator piston (D), and compensator piston spring (E).



- A—5/16 X 2 BOLT—179826
- B—ACCUMULATOR PISTON SPRING RETAINER—7084077
- C—ACCUMULATOR PISTON SPRING—7084078
- D—COMPENSATOR PISTON—7084072
- E—COMPENSATOR PISTON SPRING—7084080
- F—ACCUMULATOR PISTON ASSEMBLY—7084071
 - 1—ACCUMULATOR PISTON—A281317
 - 2—ACCUMULATOR PISTON PIN—7084155
- G—ACCUMULATOR PISTON OIL SEALING RING—7084183

- H—ACCUMULATOR BODY ASSEMBLY—YT-8614181
 - 1—1/8 X 3/8 RIVET—104220
 - 2—ACCUMULATOR BODY CHECK VALVE—YT-8614182
 - 3—ACCUMULATOR BODY—YT-8614180
- J—ACCUMULATOR BODY CHECK VALVE PLUNGER—YT-8614183
- K—BOOSTER PISTON INNER SPRING—7084079
- L—BOOSTER PISTON OUTER SPRING—5262317
- M—BOOSTER PISTON OIL SEAL RING—5262310

- N—BOOSTER PISTON ASSY—7084070
 - 1—BOOSTER PISTON—7084157
 - 2—BOOSTER PISTON PIN—7084156
- P—BOOSTER PISTON OIL SEAL RING—5281282
- Q—BODY—YT-8613815
- R—REAR BAND ACTUATING LEVER—8331470
- S—REAR BAND ACTUATING LEVER SPRING—YT-8605976
- T—REAR BAND ACTUATING LEVER NEEDLE ROLLER BEARING—712172
- U—REAR BAND ACTUATING LEVER PIN—7084069

RA PD 366748

Figure 77. Rear servo assembly components.

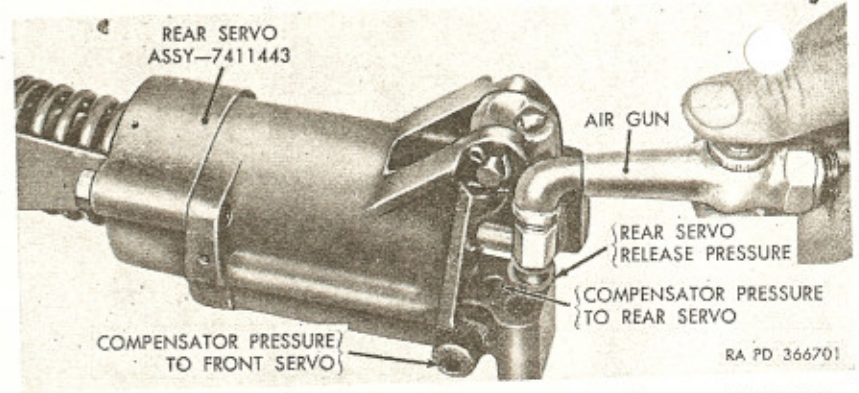


Figure 78. Checking rear servo operation with air gun—B7950562.

RA PD 366701

g. Remove accumulator body assembly (H); then remove accumulator piston assembly (F) from accumulator body assembly (H). Remove accumulator piston oil sealing ring (G).

h. Remove booster piston outer spring (L).

i. Remove booster piston assembly (N) and booster piston inner spring (K) from body (Q). Pull booster piston inner spring (K) out of booster piston assembly. Remove booster piston oil seal rings (M and P).

j. Remove cotter pin securing rear band actuating lever pin in body; then remove rear band actuating lever pin (U), rear band actuating lever (R), and 18 actuating lever needle roller bearings (T) from body (Q).

87. Cleaning, Inspection, and Repair of Rear Servo Parts

Note. The capitalized key letters shown below in parentheses refer to figure 77. Refer to paragraph 160 for repair and rebuild standards.

a. *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Blow out all passages. Dry parts by playing an air stream across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

b. *Inspection and Repair.*

- (1) Inspect body (Q) for scores, nicks, or cracks. Blow out the passages shown in figure 80 with air gun—B7950562. Make sure the two 1/4-inch plugs are tightly seated in passages.
- (2) Check rear band actuating lever (R) at socket and at bearing surface for signs of excessive wear. Inspect rear band actuating lever spring (S). Spring should not be bent or cracked and should be securely riveted to rear band actuating lever (R).

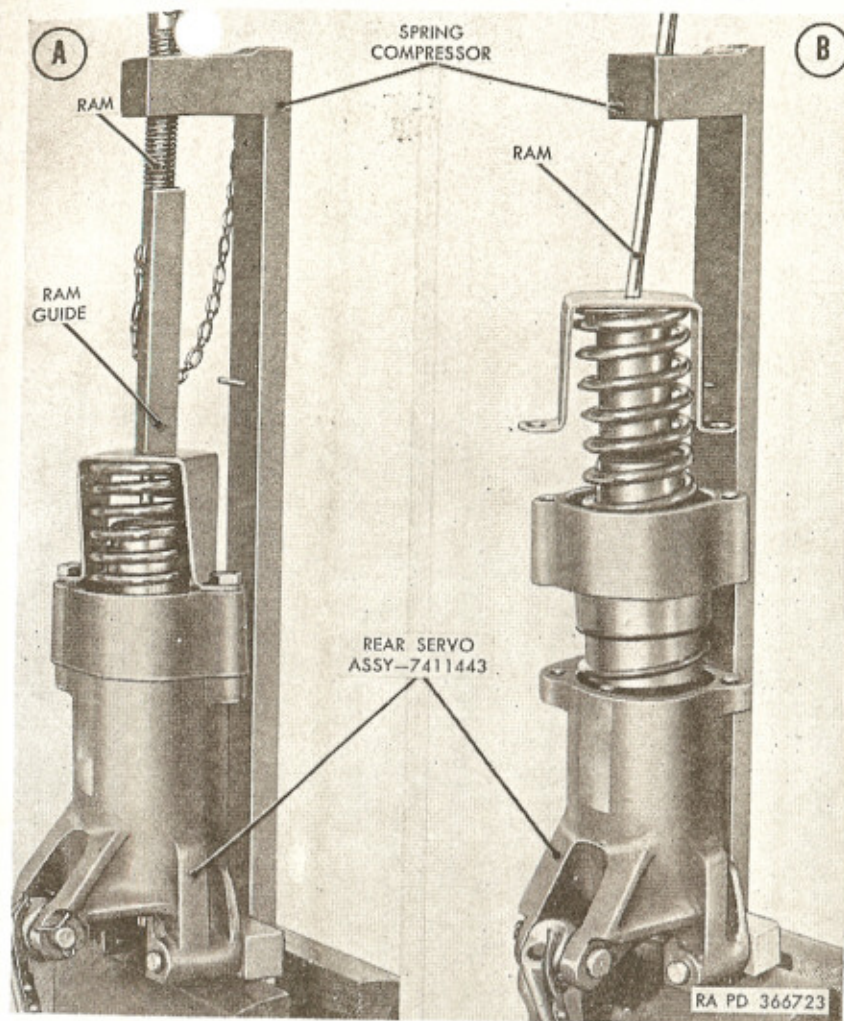


Figure 79. Use of rear servo spring compressor—C7950334 for disassembly.

- (3) Insert accumulator piston assembly (F), without accumulator piston oil sealing ring (G), into bore of accumulator body assembly (H). Measure clearance with feeler gage. Insert new accumulator piston oil sealing ring (G) in bore of accumulator body assembly (H) and check ring gap. Install accumulator piston oil sealing ring (G) on accumulator piston assembly (F); then measure groove clearance.
- (4) Insert large diameter of booster piston assembly (N) without oil sealing rings into bore of body (Q). Measure clearance with feeler gage. Insert new booster piston

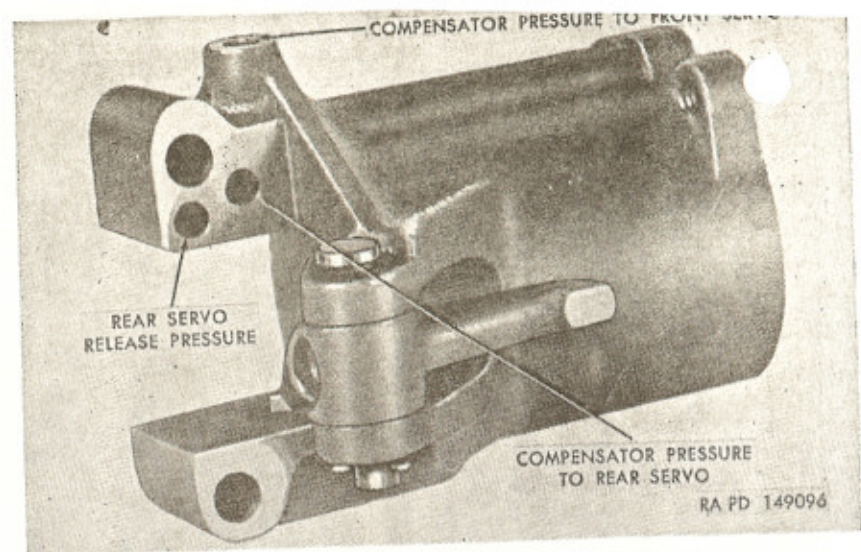
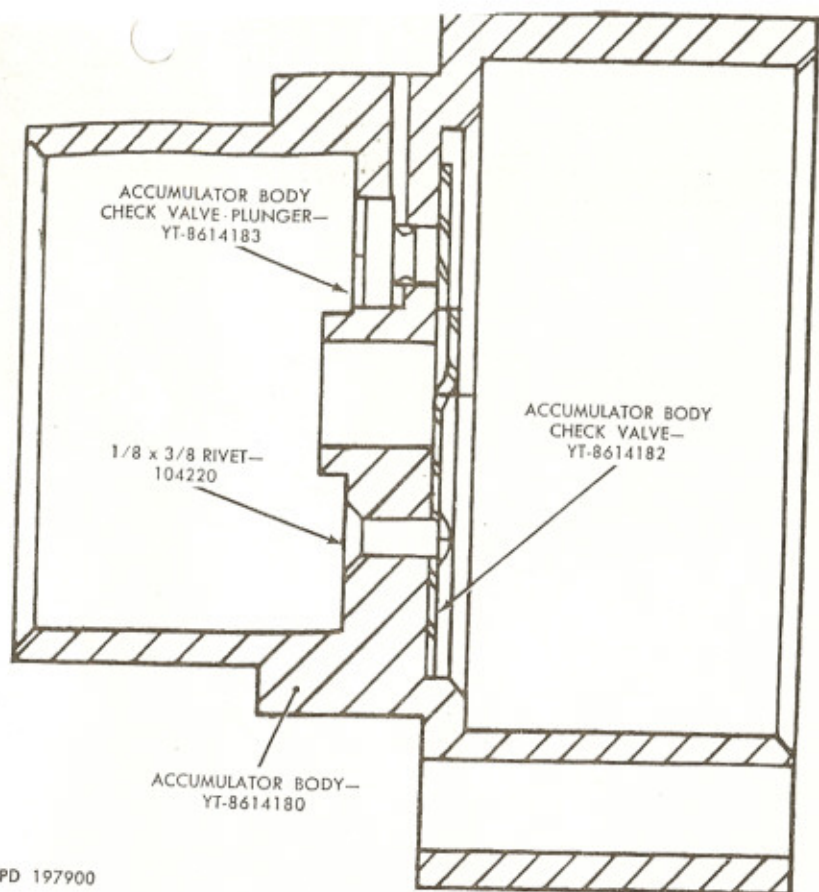


Figure 80. Location of rear servo oil passages.

- ton oil seal ring (P) into body bore; then measure ring gap. Insert small diameter of booster piston assembly (N) into bore of accumulator body assembly (H); then measure clearance with feeler gage. Insert new booster piston oil seal ring (M) in bore; then measure gap. Install booster piston oil seal rings (M and P) on booster piston assembly (N); then measure groove clearances.
- (5) Insert compensator piston (D) in accumulator piston assembly (F) and measure clearance with feeler gage.
- (6) Inspect all springs (C, E, K, and L) for free length and compression.
- (7) Inspect accumulator body assembly (H) for scores or blocked holes and passages. Make sure accumulator body check valve (H-2) is undamaged and riveted tightly. Be certain that accumulator body check valve plunger (J) moves freely and that accumulator body check valve (H-2) seats flat against accumulator body (H-3). Replace accumulator body check valve (H-2) or accumulator body check valve plunger (J), if necessary, as described in (a) through (g) below (fig. 81).
 - (a) Drive out rivet (H-1) attaching accumulator body check valve (H-2) to accumulator body (H-3).
 - (b) Remove accumulator body check valve (H-2) and accumulator body check valve plunger (J).
 - (c) Clean body and passages thoroughly.



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Figure 81. Sectional view of accumulator body.

- (d) Position accumulator body check valve plunger (J) in accumulator body (H-3).
- (e) Position accumulator body check valve (H-2) with notch in groove of plunger. Small hole in valve should be over hole in accumulator body (H-3).
- (f) Insert new $\frac{1}{8} \times \frac{3}{8}$ rivet (H-1) through accumulator body check valve (H-2) and into accumulator body (H-3). Peen rivet.
- (g) Work accumulator body check valve plunger (J) in and out to make sure plunger and accumulator body check valve (H-2) are free.

88. Assembly of Rear Servo

Note. The capitalized key letters shown below in parentheses refer to figure 77. All parts should be thoroughly lubricated, unless otherwise indicated, with engine oil (OE-10) before assembly.

a. Insert rear band actuating lever pin (U) in rear band actuating lever (R). Make sure parts are dry and free of oil. Place 18 rear band actuating lever needle roller bearings (T) in lever (fig. 82). Hold rollers in place with finger and carefully withdraw pin. Press rollers downward with thumb, at the same time rotating thumb (fig. 83). Rollers will lock in place in lever.

b. Position rear band actuating lever (R) between lever support extensions on body (Q); then insert rear band actuating lever pin (U). Secure lever pin with cotter pin.

c. Install booster piston innerspring (K) in booster piston assembly (N). Make sure spring bottoms in piston.

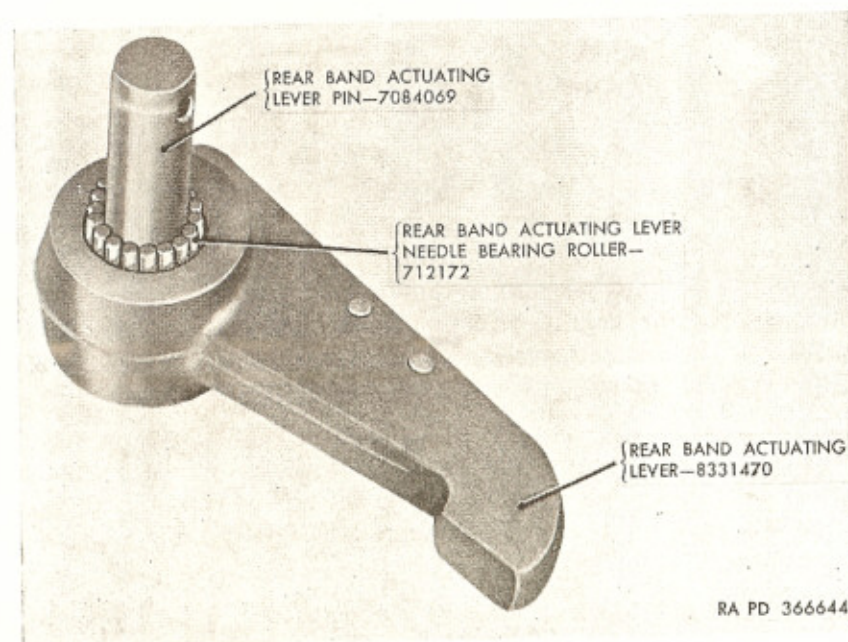
d. Install booster piston assembly (N) with booster piston inner spring (K) in body (Q.) Use care to avoid damage to booster piston oil seal ring (P) and body.

e. Install accumulator piston assembly (F) in accumulator body assembly (H). Use care to avoid damaging accumulator piston oil sealing ring (G).

f. Center booster piston oil seal ring (M) on booster piston assembly (N) so it will enter accumulator body assembly (H) when accumulator body is installed on body (Q).

g. Insert booster piston outer spring (L) in body (Q).

h. Seat accumulator body assembly (H) and accumulator piston assembly (F) on booster piston outer spring (L), aligning



RA PD 366644

Figure 82. Using lever pin to align needle bearing rollers.

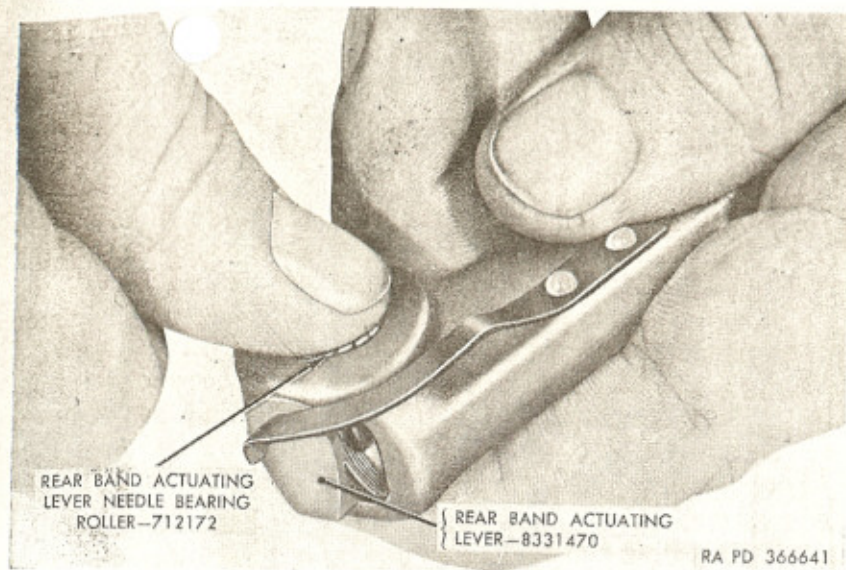


Figure 83. Locking bearing rollers in lever.

bosses on accumulator body assembly (H) with bosses on body (Q).

i. Insert compensator piston spring (E) in accumulator piston assembly (F).

j. Place compensator piston (D) over compensator piston spring (E).

k. Slide accumulator piston spring retainer (B) and accumulator piston spring (C) to top of ram on spring compressor—C7950334; then hook lower end of accumulator piston spring (C) over dowel pin. Refer to view A, figure 84.

l. Place rear servo assembly on spring compressor while pressing downward on compensator piston (D) and accumulator body assembly (H). Center ram on top of compensator piston. Slowly turn compressor handle to compress springs until compensator piston (D) is about to enter accumulator piston assembly (F).

m. Unhook accumulator piston spring (C). Place ram guide on ram.

n. Aline compensator piston (D) with accumulator piston assembly (F). Slowly compress springs with compressor ram until accumulator piston spring retainer (B) rests against accumulator body (H-3). Refer to view B, figure 84.

o. Install two $\frac{5}{16}$ x 2 bolts (A) through accumulator piston spring retainer (B) and accumulator body assembly (H) into body (Q). Tighten bolts to 10 to 13 pound-feet torque.

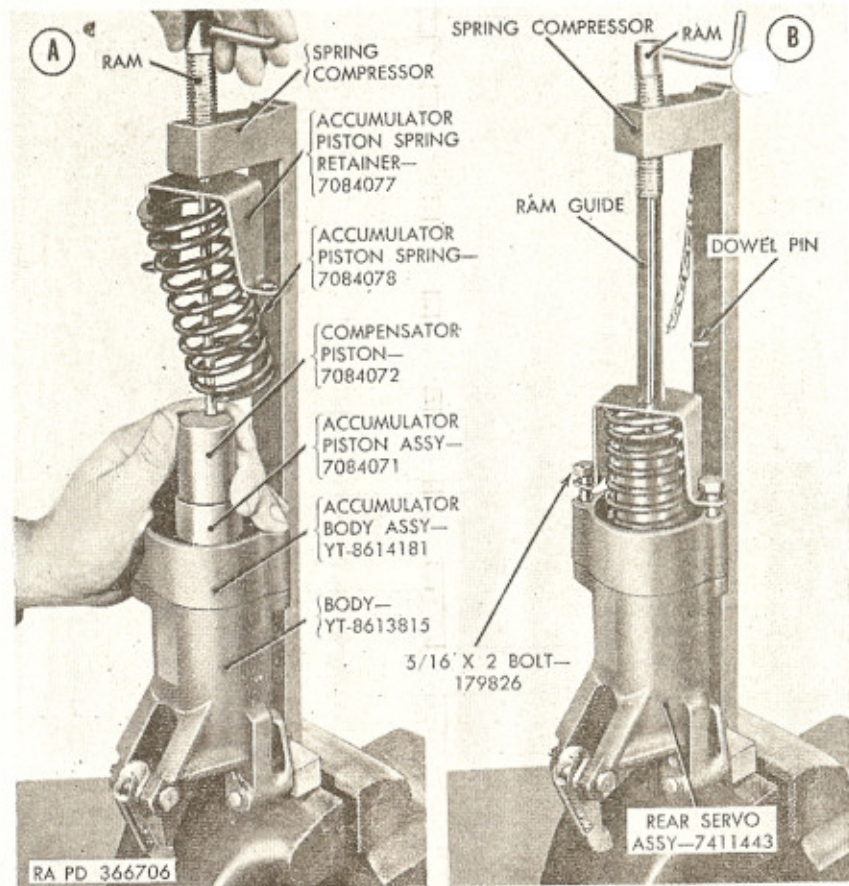


Figure 84. Use of rear servo spring compressor—C7950334 for assembly.

p. Remove rear servo assembly from spring compressor and test operation as instructed in paragraph 86a.

Section V. REBUILD OF FRONT OIL PUMP ASSEMBLY

89. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 85.

a. Place front oil pump assembly on work bench with cover side down. Hold pump body with holding wrench—B7950328 (fig. 86) while removing four bolts (S) and lockwashers (R).

b. Lift pump body assembly (H) from pump cover assembly (B). Figure 87 illustrates disassembled parts. Do not lift cover from body as parts will fall from assembly and become damaged.

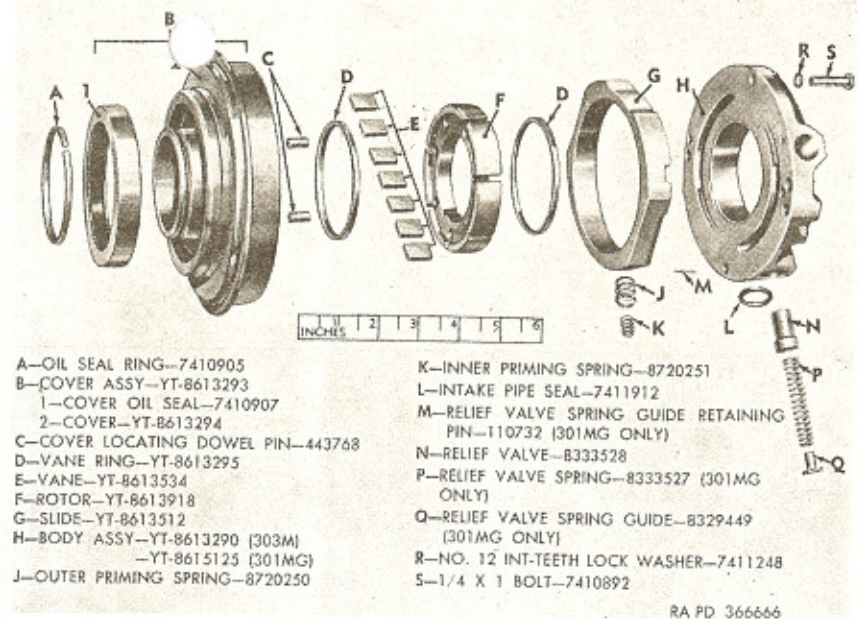


Figure 85. Front oil pump components.

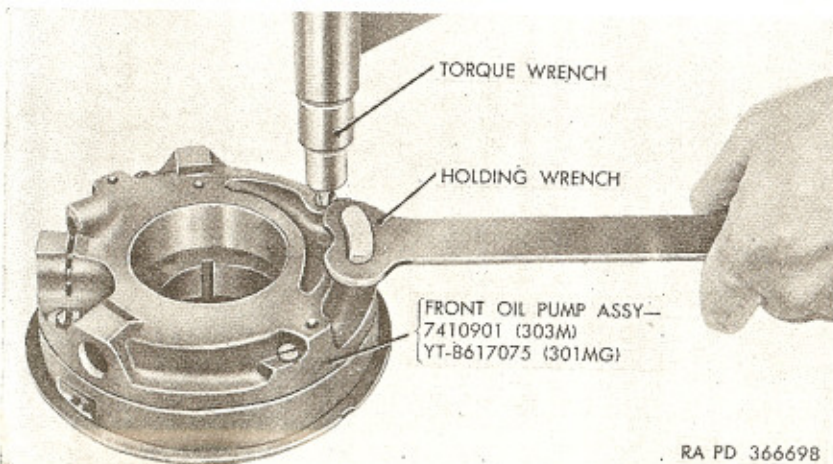


Figure 86. Use of holding wrench—B7950328 at front oil pump.

c. On 301MG transmission, press on relief valve spring guide (Q) with a screwdriver (fig. 88) while relief valve spring guide retaining pin (M) is being removed. Remove relief valve spring guide (Q), relief valve spring (P), and relief valve (N) from pump body.

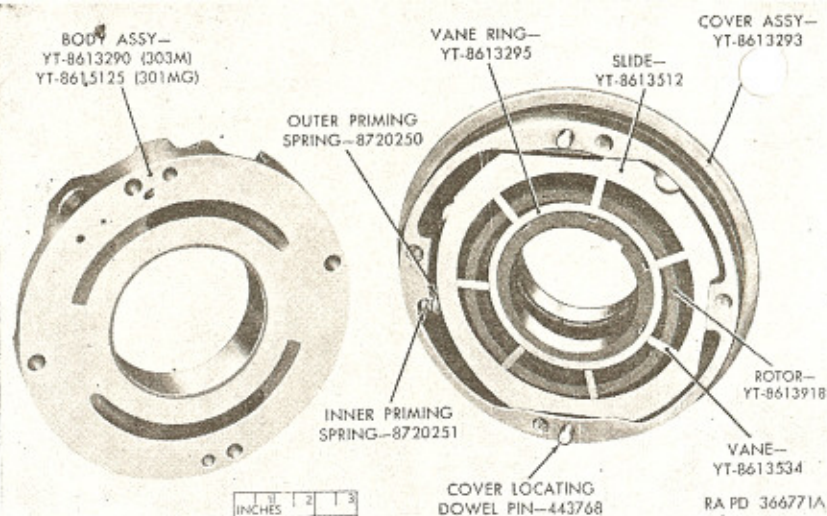


Figure 87. Front oil pump cover removed (303M shown).

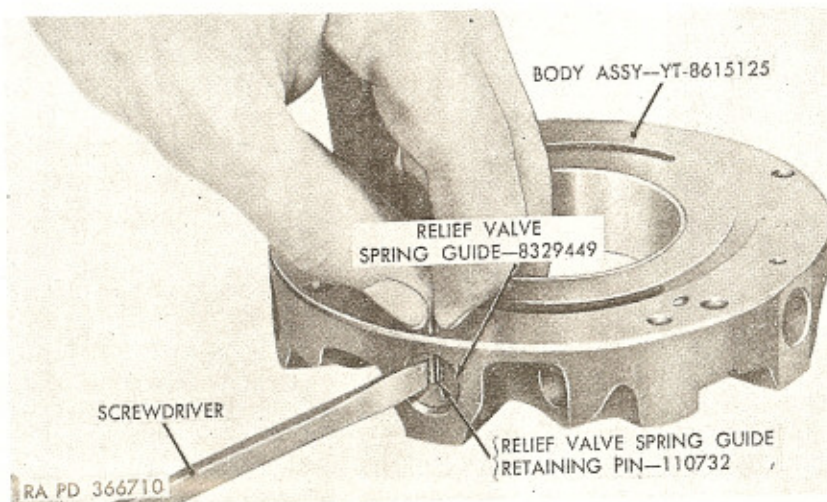


Figure 88. Removing or installing relief valve retaining pin (301MG).

d. Remove intake pipe seal (L) from pump body opening. Discard seal.

e. Mark face of rotor (F) with pencil or prussian blue so that it will be returned in the same position at assembly.

f. Remove two vane rings (D), rotor (F), and seven vanes (E) from pump slide.

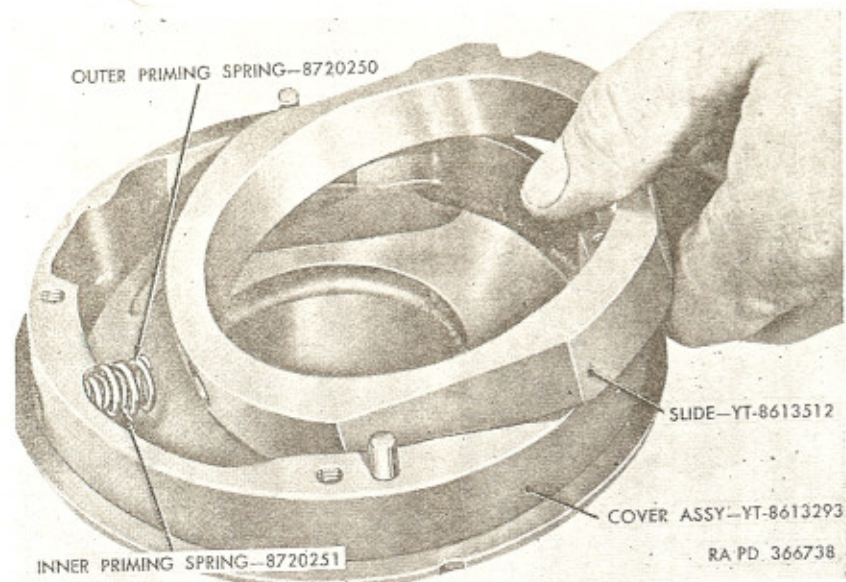


Figure 89. Removing or installing oil pump slide.

g. Push pump slide (G) toward priming springs; then lift slide out of pump cover (fig. 89). Remove inner and outer priming springs (J and K) from cover.

h. Remove oil seal ring (A) from ring groove in cover.

i. Use chisel and hammer to drive cover oil seal (B-1) from cover; then discard seal.

90. Cleaning, Inspection, and Repair

Note. The capitalized key letters shown below in parentheses refer to figure 85. Refer to paragraph 161 for repair and rebuild standards.

a. *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Dry parts by playing an air stream across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

b. Inspection.

- (1) Check bleed holes in pump slide (G) to be sure holes are not restricted. Make sure that slide is free fit in pump cover and does not bind or stick. Examine slide for nicks, scores, or excessive wear.
- (2) Examine pump vanes (E) for scores, burs, nicks, or pits. Vanes will have a distinct polished wear pattern on side which contacts pump slide. Check for excessive wear. Check pump vanes in slot of rotor for freeness (par. 161).

- (3) Check pump rotor (F) for excessive wear (par. 161). Inspect all surfaces for nicks, burs, chips, or cracks.
- (4) Check oil pump cover (B-2) for cracks, nicks, or scores. Be sure that surface mating with body is smooth. Check oil seal ring groove in cover for excessive wear (par. 161) or other damage. Inspect inner slide surface of pump cover to be sure that part is satisfactory for continued service.
- (5) Check oil pump body for cracks, nicks, or scores. Be sure that surface mating with body is smooth.
- (6) Inspect pump body bushing for excessive wear (par. 161). Slight wear is permissible. If bushing shows evidence of excessive wear on one side, it is an indication that either the bushing is not concentric with cover or the locating bore in flywheel housing is not aligned with crankshaft bore in crankcase.
- (7) Check pressure regulator valve in bore of pump body (fig. 90). Valve must be free and operate without sticking.
- (8) On Model 301MG transmission, check fit of relief valve (N) in pump body (par. 161). Valve must operate

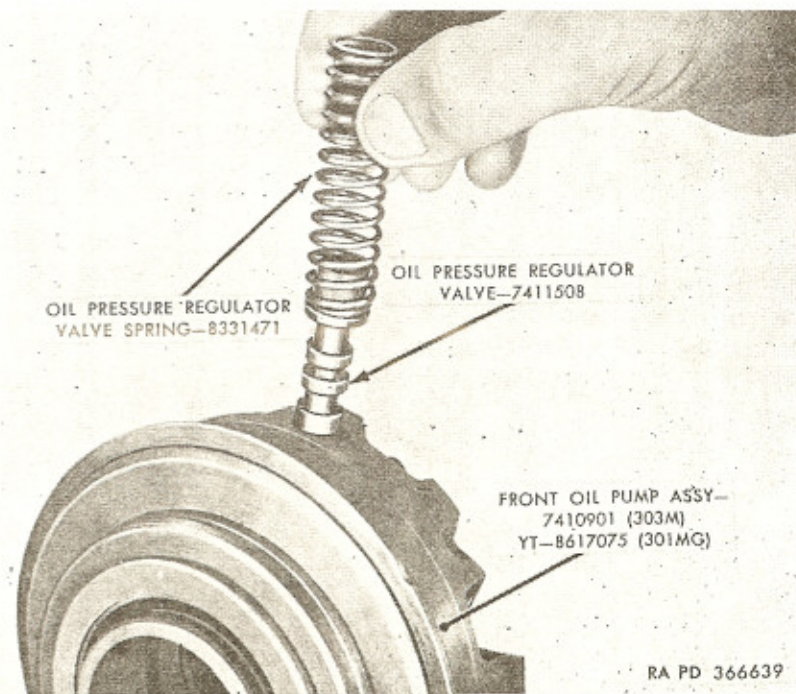


Figure 90. Checking fit of pressure regulator valve in pump body.

freely without binding or sticking. Check relief valve spring (P) and spring guide (Q) for wear or damage (par. 161).

- (9) Inspect oil seal ring (A) for wear or damage; also check fit of ring for freeness in groove of pump cover (par. 161).
- (10) Examine vane rings (D) for evidence of damage or excessive wear (par. 161).
- (11) Check inner and outer priming springs (J and K) for free length, compressed length, distortion, collapsed, or broken coils (par. 161).

c. Repair.

- (1) *Oil pump body bushing removal.* Use hack saw to split bushing; then drive or press bushing from body.
- (2) *Oil pump body bushing installation.* Position bushing in body with chamfered edge toward outside of body, also with split in bushing located as illustrated in figure 91. When bushing is properly positioned, press in until inner edge of bushing is within 0.005 inch of inner surface of body (fig. 91). Check inside diameter (par. 161) after installation.

91. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 85.

a. During assembly operations, lubricate all parts with clean engine oil (OE-10) before part is installed.

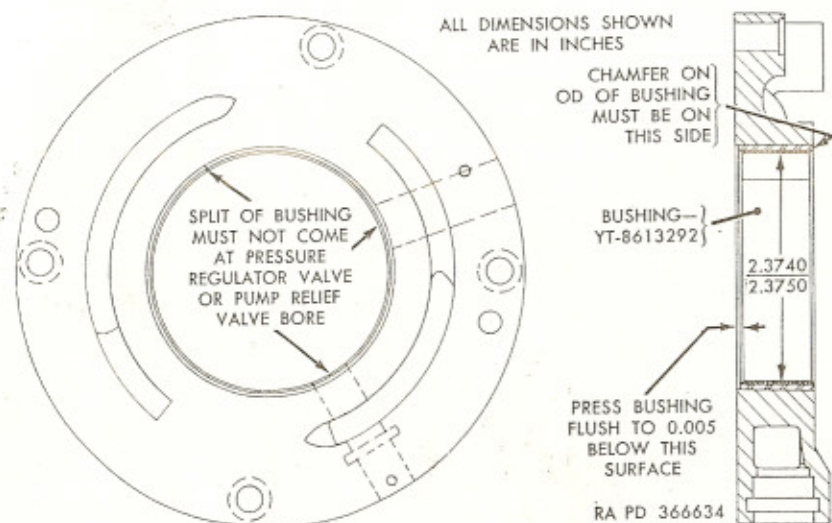


Figure 91. Sectional view of front oil pump body (301MG shown).

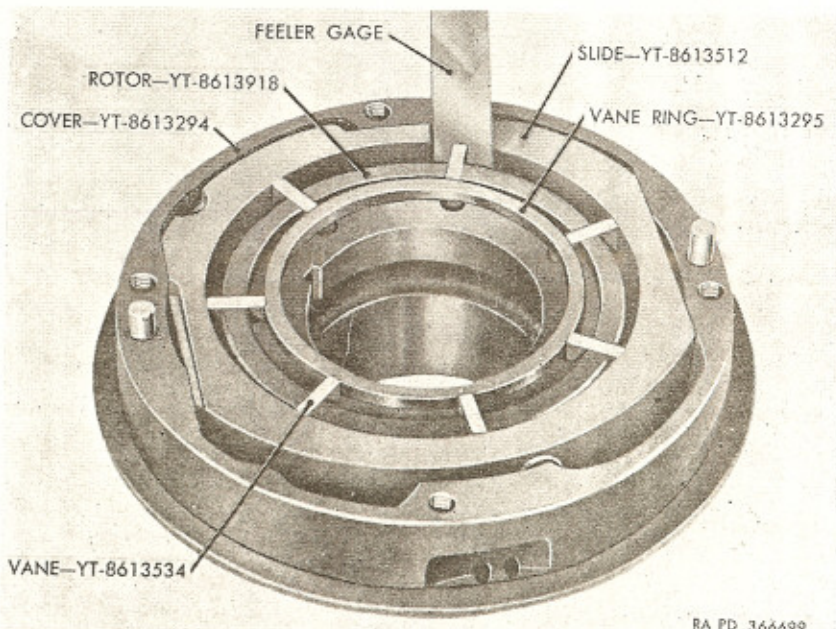


Figure 92. Checking clearance between oil pump vanes and slide.

b. On Model 301MG transmission, install relief valve (N), relief valve spring (P), and relief valve spring guide (Q). Use a blunt tool such as a screwdriver to compress spring (fig. 88) while installing relief valve spring guide retaining pin (M).

c. Install intake pipe seal (L) in body, being sure it is carefully seated in groove in body.

d. Install inner and outer priming springs (K and J) in pump cover; then install pump slide (G). Check springs for location by moving pump slide against spring pressure, and then releasing. Spring pressure should return slide against opposite side of cover.

e. Install one vane ring (D); then install pump rotor (F) with previously marked face of rotor up.

Note. Observe wear pattern on vanes. One edge of vane will be polished the entire length; this edge must face pump slide. Opposite edge will be polished only where it contacts the vane rings.

f. Install seven pump vanes (E) in pump rotor slots. Install second vane ring (D) in pump rotor.

g. Check clearance between pump vanes and pump slide, using feeler gage (fig. 92). With vanes contacting slide, clearance should be 0.000 to 0.003 inch.

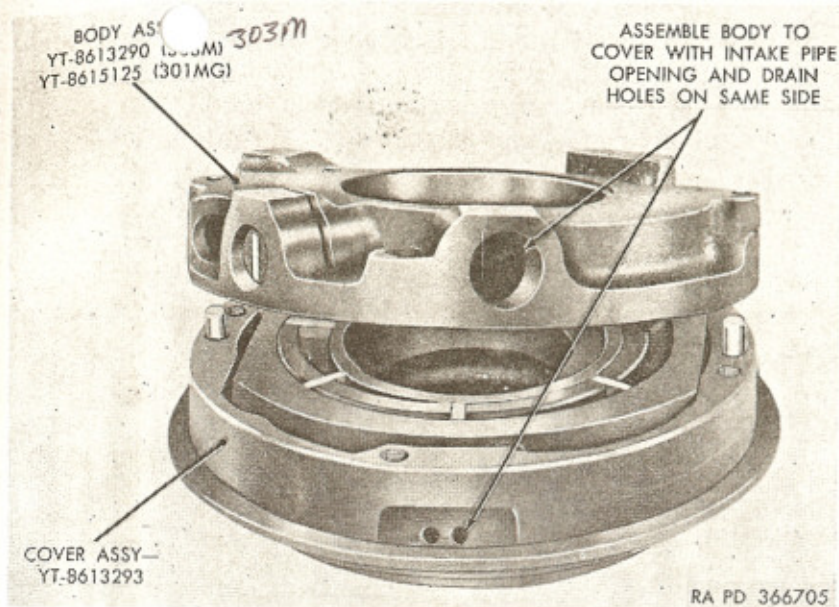


Figure 93. Positioning oil pump body and cover.

h. Position pump body assembly (H) on pump cover assembly with two drain holes in cover opposite the intake pipe hole in body (fig. 93). Body should fit freely on dowel pins.

i. Install four $\frac{1}{4}$ x 1 bolts (S) and No. 12 internal-teeth lockwashers (R) attaching body to cover. Hold pump body with holding wrench—B7950328 (fig. 86) while tightening bolts to 12 to 15 pound-feet torque.

j. Move pump rotor by hand to make sure that rotor, vanes, and slide operate freely without binding. Priming springs must return pump slide after springs are released.

k. Install oil seal ring (A) in ring groove of pump cover.

l. Apply thin film of sealing compound to outer surface of cover oil seal (B-1) and oil seal bore in pump cover. Position new cover oil seal (B-1) in pump cover with lip of seal toward cover. Using replacer—C7950561 (fig. 94) drive oil seal into cover until fully seated.

m. Again operate pump by hand to be sure that all parts operate freely without binding. Thoroughly lubricate pump assembly and protect from dirt until installed.

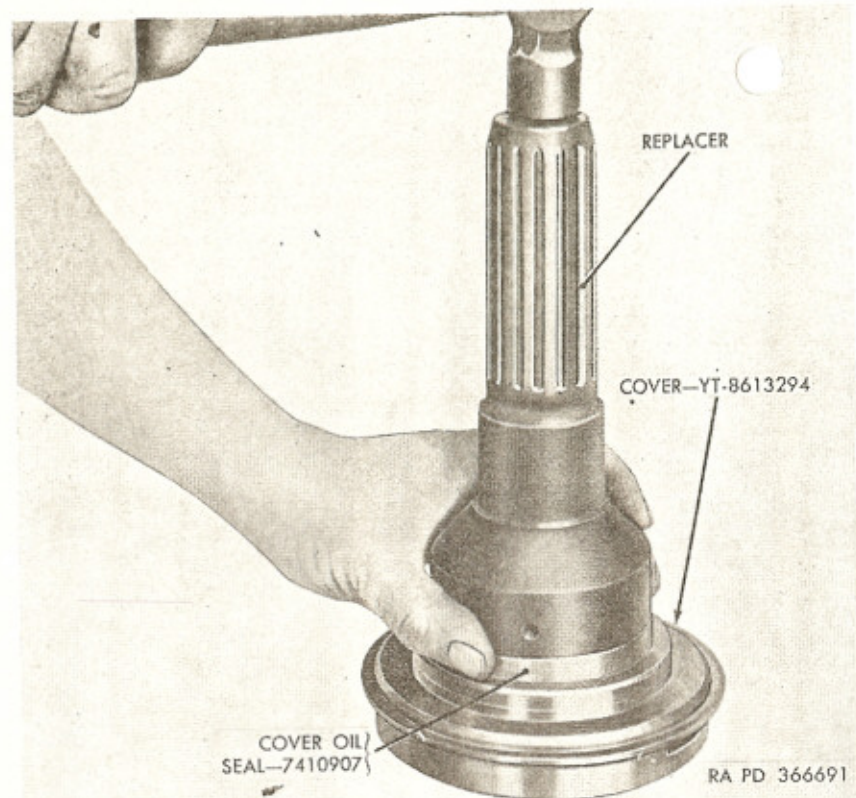


Figure 94. Installing front oil pump oil seal using replacer—C7950561.

Section VI. REBUILD OF REAR OIL PUMP AND GOVERNOR ASSEMBLY

92. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 95.

a. Using a file, mark edge of governor body (M) and governor drive flange (L) so they may be assembled in the same relative position.

b. Remove two bolts (P) and external-teeth lockwashers (N) which attach governor body (M) to governor drive flange (L). Remove governor assembly from drive flange.

c. Remove two screws with lockwashers (S) which attach governor secondary weight retainer to governor body (M); then remove governor plunger, secondary weight, bushing, and retainer (R) from governor body. Do not attempt to remove primary (large) governor weight from body.

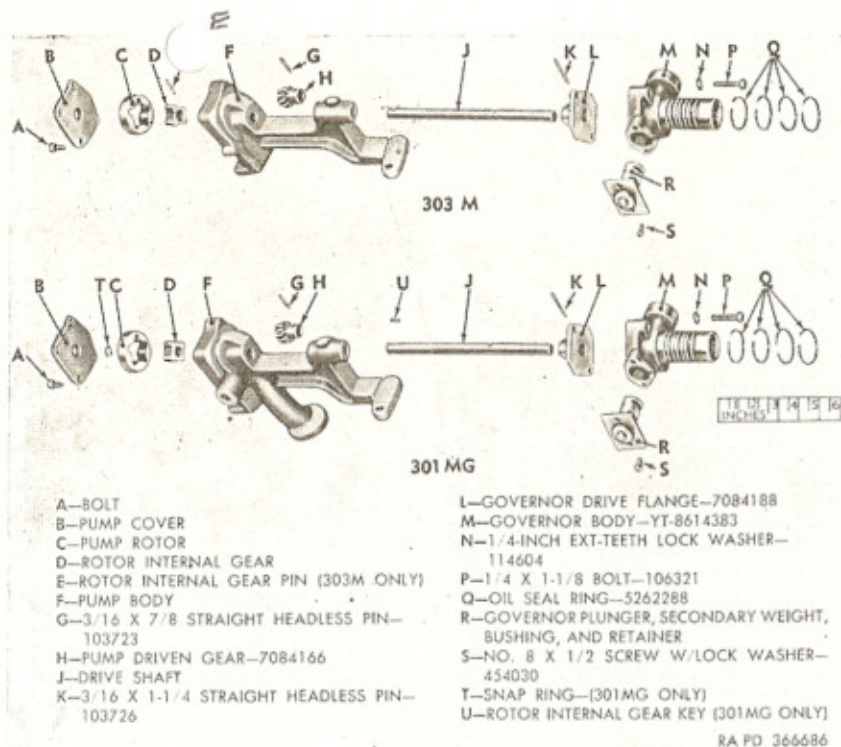


Figure 95. Rear oil pump and governor components.

d. Remove four oil seal rings (Q) from grooves in governor body (M). Discard rings.

e. Remove four bolts (A) with lockwashers attaching pump cover (B) to pump body (F). Remove cover from body.

f. Mark outer faces of rotor internal gear (D) and pump rotor (C) with mechanics blue so they can be assembled in the same relative position. Remove pump rotor (C) from gear pocket in pump body (F).

g. It is not necessary to further disassemble rear oil pump unless replacement of governor drive flange (L) or pump driven gear (H) is necessary as indicated in paragraph 93b.

93. Cleaning and Inspection

a. *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Dry parts by playing an air stream across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

b. Inspection.

Note. The inspection which follows is to determine serviceability of rear oil pump and governor components. If inspection reveals excessive wear or damage to any parts except governor driven gear, governor drive flange, or oil seal rings, the complete rear oil pump and/or governor assembly must be replaced. Refer to paragraph 162 for repair and rebuild standards. The capitalized key letters shown below in parentheses refer to figure 95.

- (1) Inspect pump body (F) for cracks or other damage. Check for looseness of drive shaft (J) in body.
- (2) Examine pump cover (B) for wear caused by pump rotor (C).
- (3) Check pump rotor (C) and rotor internal gear (D) for wear or damage.
- (4) Examine pump driven gear (H) for wear or broken teeth. If worn or damaged, replace driven gear (par. 94).
- (5) Mount pump body (F) in vise and install dial indicator—41-I-100 on body (fig. 96). Set dial indicator pin against machined face of drive flange just inside the tapped holes. Turn shaft and check runout of drive flange. If runout exceeds 0.002-inch total indicator reading, replace drive flange.
- (6) Inspect governor body (M) and secondary weight bushing for wear. Check primary and secondary plungers for sticking condition or for looseness which indicates excessive wear.

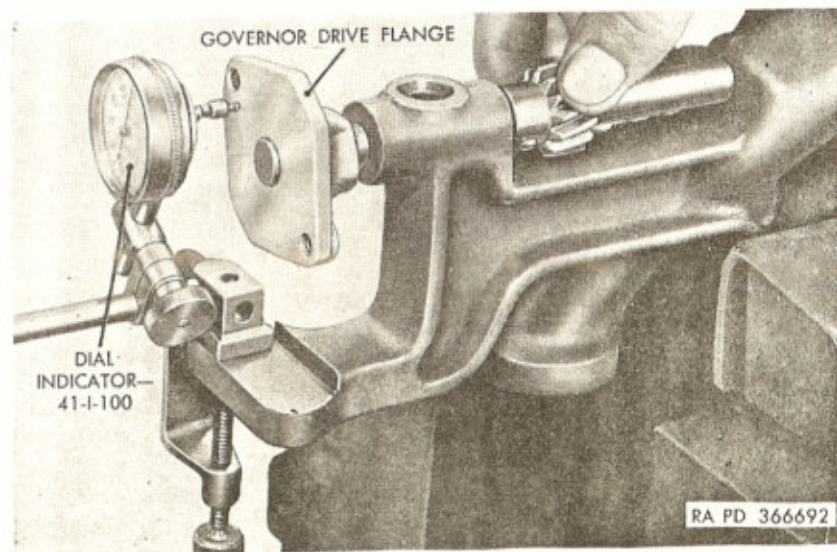


Figure 96. Checking governor drive flange run-out.

- (7) Any wear or damage necessitates replacing the complete rear oil pump and/or governor assembly, except as indicated in (4) and (5) above.

94. Governor Drive Flange and/or Pump Driven Gear Replacement

Note. The capitalized key letters shown below in parentheses refer to figure 95.

a. Model 303M Transmission.

(1) Remove governor drive flange.

- (a) Grind off one end of pin (K) securing governor drive flange (L) on drive shaft (J).
- (b) While supporting drive flange hub on anvil—B7950326, center punch ground end of pin and drill down to shaft with $\frac{1}{8}$ -inch drill. Drive pin (fig. 97) out with punch. Remove drive flange from shaft.

Note. If pump driven gear requires replacement, proceed with (2 and 3) below. If pump driven gear does not require replacement, install drive flange as instructed in (4) below.

(2) Remove pump driven gear.

- (a) Remove governor drive flange ((1) above).
- (b) Grind off one end of pin (G) securing pump driven gear (H) on drive shaft (J).

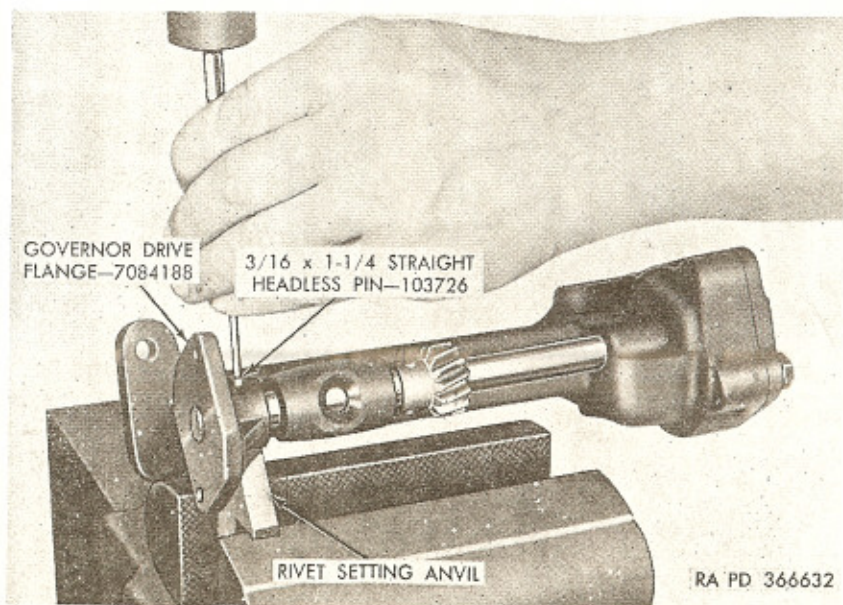


Figure 97. Using anvil—B7950326 to remove governor drive flange retaining pin.

- (c) While supporting driven gear hub on anvil—B7950326, center punch ground end of pin and drill down to shaft with $\frac{1}{8}$ -inch drill. Drive pin out with punch in same manner shown in figure 97 for driving pin out of drive flange.
- (d) Remove drive shaft (J) with rotor internal gear (D) from pump body (F), stripping pump driven gear (H) from shaft as shaft is removed.

(3) Install pump driven gear.

- (a) Insert drive shaft (J) through pump end of pump body (F) and place pump driven gear (H) on drive shaft with teeth toward pump end of body; then insert shaft through governor end of pump body.
- (b) Aline holes in pump driven gear hub with hole in shaft and install $\frac{3}{16}$ x $\frac{7}{8}$ straight headless pin (G) through gear hub and shaft.
- (c) While supporting driven gear hub on anvil—B7950326, use punch—A7950325 to peen ends of pin to fill holes in driven gear hub (fig. 98). Peened ends of pin must not project more than 0.078 inch above gear hub.

(4) Install governor drive flange.

- (a) Place governor drive flange (L) on drive shaft (J) with pin holes alined.
- (b) Before installing drive flange retaining pin, check run-out of drive flange (par. 93b(5)). Rotate drive flange 180° and recheck runout.
- (c) Leave drive flange in position which provides smaller amount of runout, which should not exceed 0.002 inch. If runout exceeds 0.002 inch in either position, select another drive flange or replace complete oil pump assembly.
- (d) Install a $\frac{3}{16}$ x $1\frac{1}{4}$ straight headless pin (K) through holes in drive flange hub and shaft.
- (e) While supporting hub of drive flange on anvil—B7950326, use punch—A7950325 to peen ends of pin to fill holes in drive flange hub in same manner shown in figure 98 for peening driven gear pin. Peened ends of pin must not project more than 0.078 inch above the drive flange hub.

b. Model 301MG Transmission. If both the governor drive flange (L) and pump driven gear (H) require replacement, follow the same procedure described in a above. If only the pump driven gear (H) requires replacement, the governor drive flange (L) need not be removed; to replace pump driven gear only, proceed as instructed in (1) through (5) below.

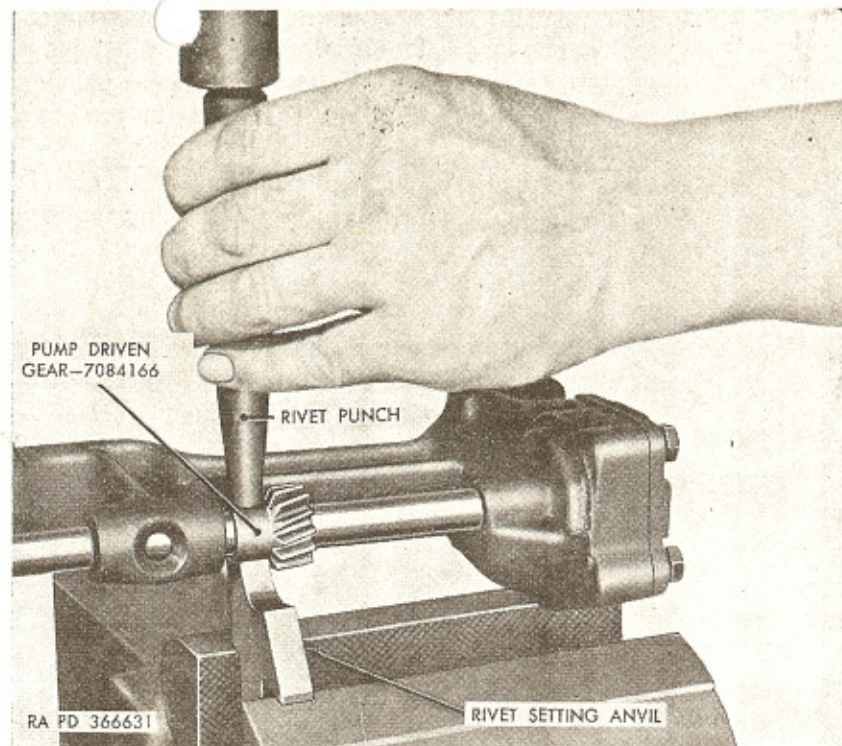


Figure 98. Using anvil—B7950326 and punch—A7950325 to install governor driven gear retaining pin.

- (1) Remove pump driven gear retaining pin (G) as instructed in a(2) (b) and (c) above.
- (2) Remove snap ring (T), rotor internal gear (D), and rotor internal gear key (U) from end of shaft; then remove shaft and drive flange from pump body, stripping driven gear off shaft as shaft is removed.
- (3) Insert drive shaft (J) through governor end of body, and place pump driven gear (H) on drive shaft with teeth toward pump end of body; then insert end of drive shaft through pump end of body.
- (4) Install pump driven gear retaining pin (G) as instructed in a(3) (b) and (c) above.
- (5) Install rotor internal gear key (U) in keyway in drive shaft (J); then install rotor internal gear (D) on end of drive shaft and secure with snap ring (T).

95. Assembly of Rear Oil Pump and Governor

Note. The capitalized key letters shown below in parentheses refer to figure 95.

- a. Lubricate all internal parts with engine oil (OE-10) before assembly.
- b. Install pump rotor (C) over rotor internal gear (D) in pump body, with marks made at disassembly aligned.
- c. Install pump cover (B) on body and attach with four bolts (A) and lockwashers. Tighten bolts to 10 to 12 pound-feet torque.
- d. Insert governor plunger, secondary weight, bushing, and retainer (R) in bore of governor body (M) (fig. 99). Ear on end of bushing must be toward flat side of governor body. Governor body has a slot on inside to accommodate ear on bushing. When properly installed, outer end of bushing will be flush with face of body (fig. 99). Ear on bushing can then be seen through passage in governor body.
- e. Attach governor bushing retainer to governor body with two No. 8 x 1/2 screws with lockwashers (S). Tighten screws to 3 to 4 pound-feet torque.
- f. Position governor assembly on drive flange with file marks made prior to disassembly aligned. Attach governor to drive flange with two 1/4 x 1 1/8 bolts (P) and 1/4-inch external-teeth lockwashers (N). Tighten bolts to 6 to 8 pound-feet torque.
- g. Install four oil seal rings (Q) in grooves in governor body.
- h. Clamp pump body in vise and install dial indicator—41-I-100 (fig. 100) to check governor body runout. Dial indicator button should contact governor body midway between end of body and outer oil seal ring groove. Turn governor several revolutions and note reading on dial indicator. Runout should not exceed 7.005-inch total indicator reading.
- i. If runout exceeds 0.005-inch total indicator reading, remove governor from drive flange and install 180° from original position. Recheck governor runout.

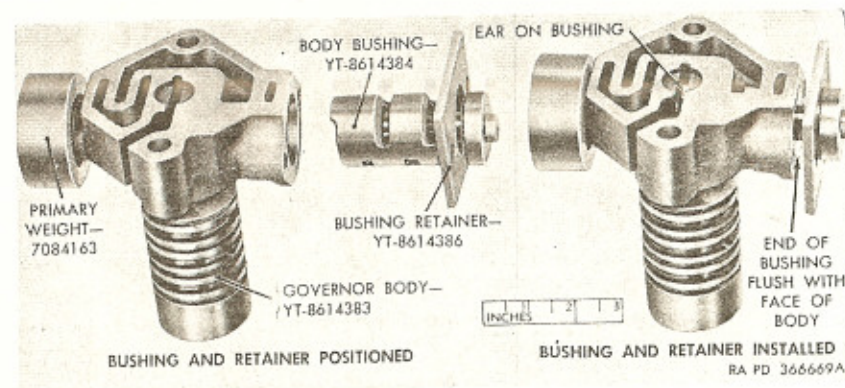


Figure 99. Installing governor plunger and secondary weight.

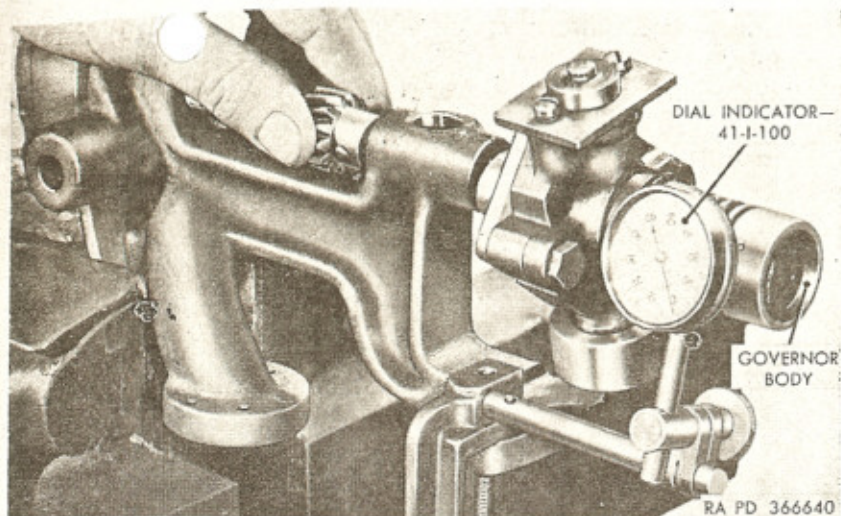


Figure 100. Checking governor body runout.

j. If governor runout still exceeds 0.005 inch, and drive flange run out checked satisfactory during inspection (par. 93b(5)), a new governor assembly must be installed, or the complete oil pump and governor assembly must be replaced.

Section VII. REBUILD OF FRONT AND REAR PLANETARY UNITS AND CARRIER

96. Removal of Front and Rear Planetary Units from Carrier

a. Remove improvised spring retaining front band to front planetary unit. Remove front band assembly.

b. Place front and rear planetary units with carrier in holding fixture—B7079295 (fig. 101). Using snap ring pliers, remove spring retainer from top of rear clutch hub (fig. 101).

c. While holding center bearing cap assembly down to prevent front clutch oil delivery sleeve assembly from coming up and getting hung on snap ring, lift rear planetary unit (fig. 101) from planet carrier shaft.

d. The rear clutch washer (fig. 102) may come off with rear unit or stay on planet carrier shaft. Remove rear clutch washer.

e. Using snap ring pliers, remove rear clutch hub front spring retainer from planet carrier shaft.

f. Remove center bearing cap assembly (fig. 102) from oil delivery sleeve. Tap cap with plastic hammer to loosen if necessary.

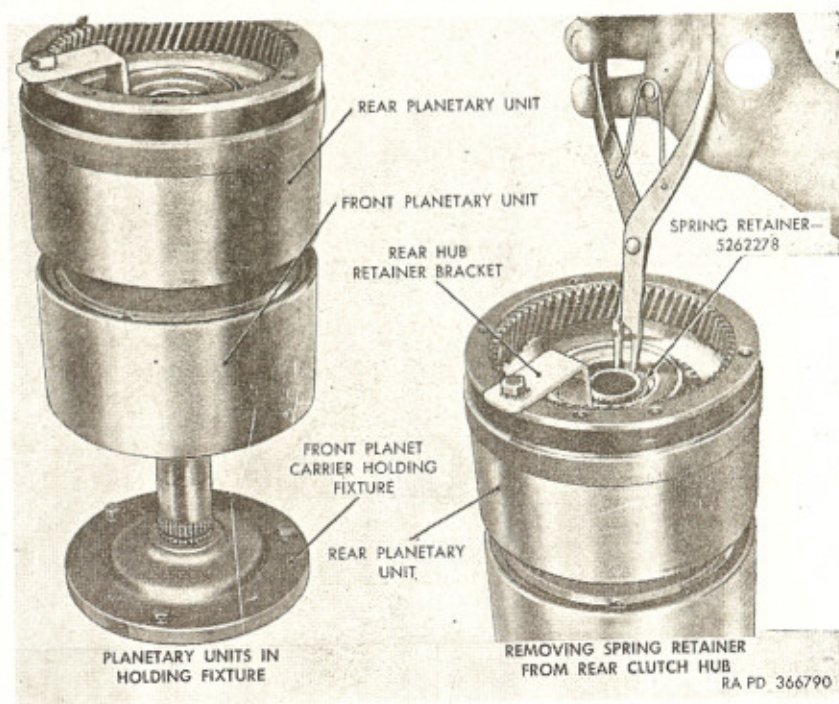


Figure 101. Planetary units and carrier in holding fixture—B7079295.

g. Slide oil delivery sleeve assembly (fig. 102) upward off planet carrier assembly.

h. Use care to avoid damaging bearing surface on shaft in this operation. Using snap ring pliers, remove spring retainer from planet carrier shaft at rear of front planetary unit. Hold spring retainer well open to avoid raking shaft bearing surface.

i. Lift front planetary unit from planet carrier. Remove bronze thrust washer from planet carrier hub; then remove steel and bronze thrust washers from recess in front planetary unit.

97. Disassembly of Front Planetary Unit

Note. The capitalized key letters shown below in parentheses refer to figure 103.

a. Position front planetary unit assembly in arbor press, with wood block between press ram and clutch drum. Apply only enough pressure to remove snap ring (K) by prying with screwdriver (fig. 104).

b. Remove front planetary unit assembly from press and place on bench with unit on its side.

c. Remove clutch drum assembly (J), with clutch piston (F), from front drum assembly (A). This can be accomplished by

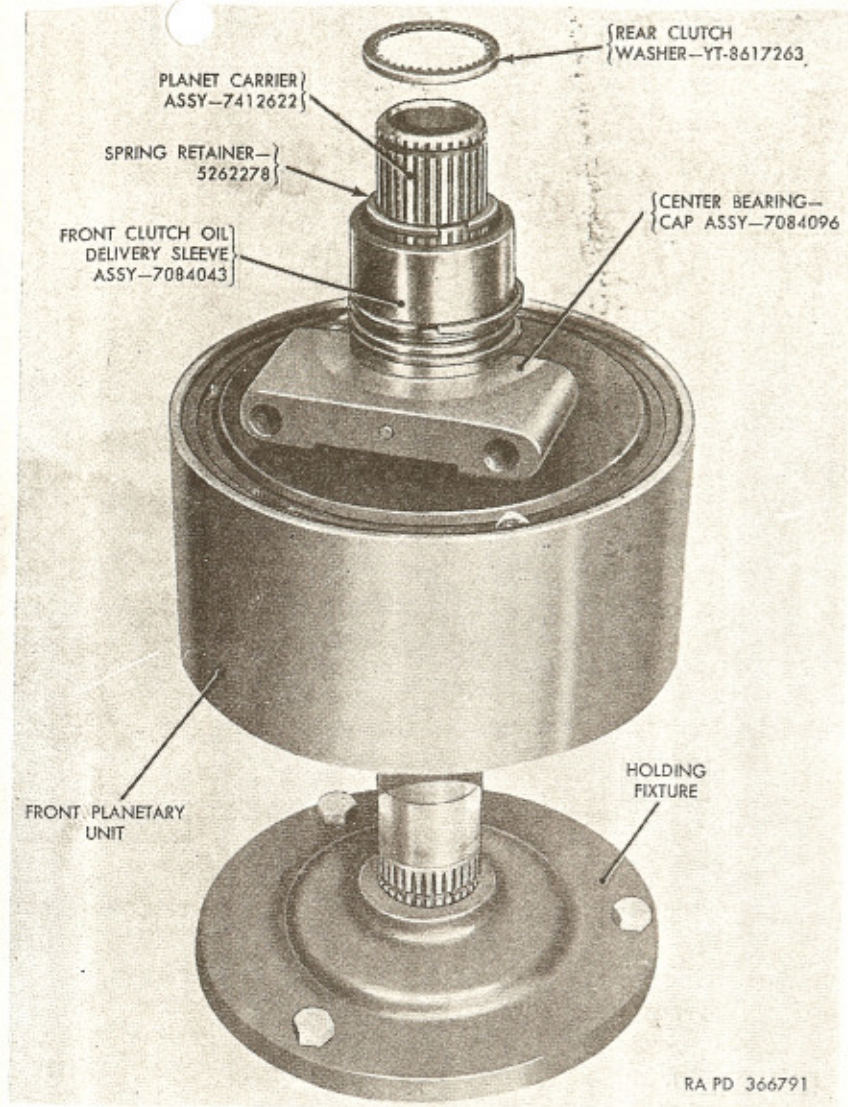


Figure 102. Planet carrier with rear planetary unit removed.

tapping on gear end of clutch drum. Remove six clutch inner and outer release springs (D and E) from front drum assembly. Remove five clutch drive plates (C) and four clutch driven plates (B) from drum.

d. Hold clutch drum assembly (J) in hand with gear end of clutch drum up (fig. 105). Tap gear end with plastic hammer around face of gear, which will cause clutch piston to "walk" up out of clutch drum assembly (fig. 105).

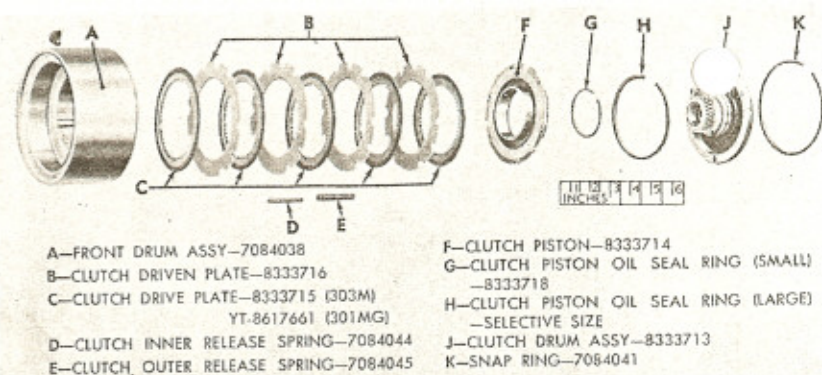


Figure 103. Front planetary unit components.

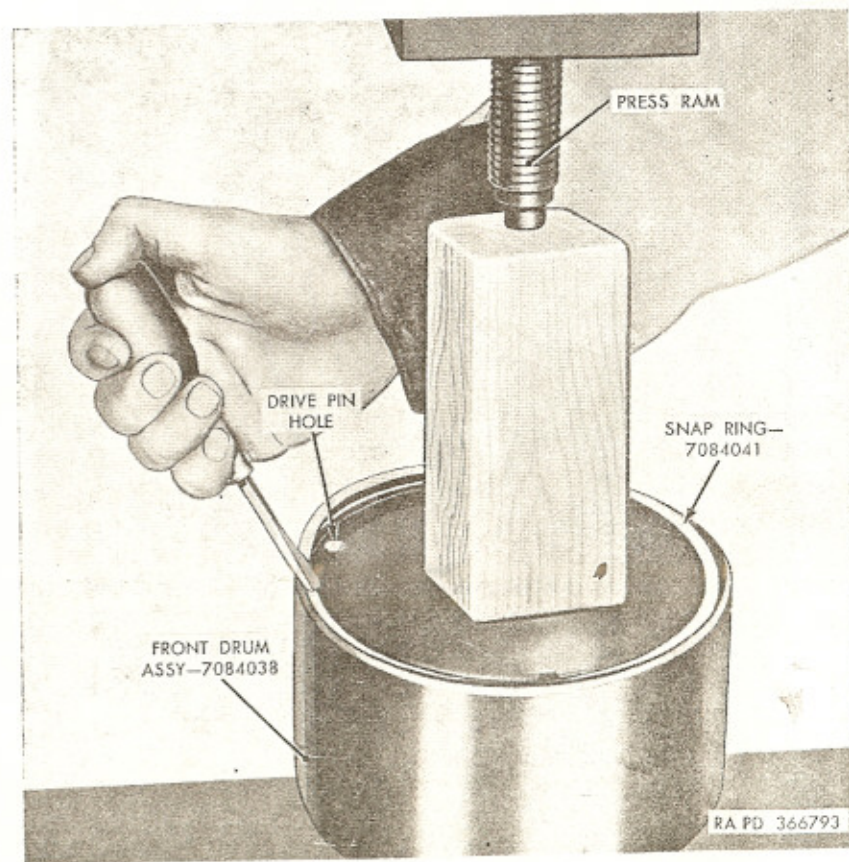


Figure 104. Removing clutch drum snap ring.

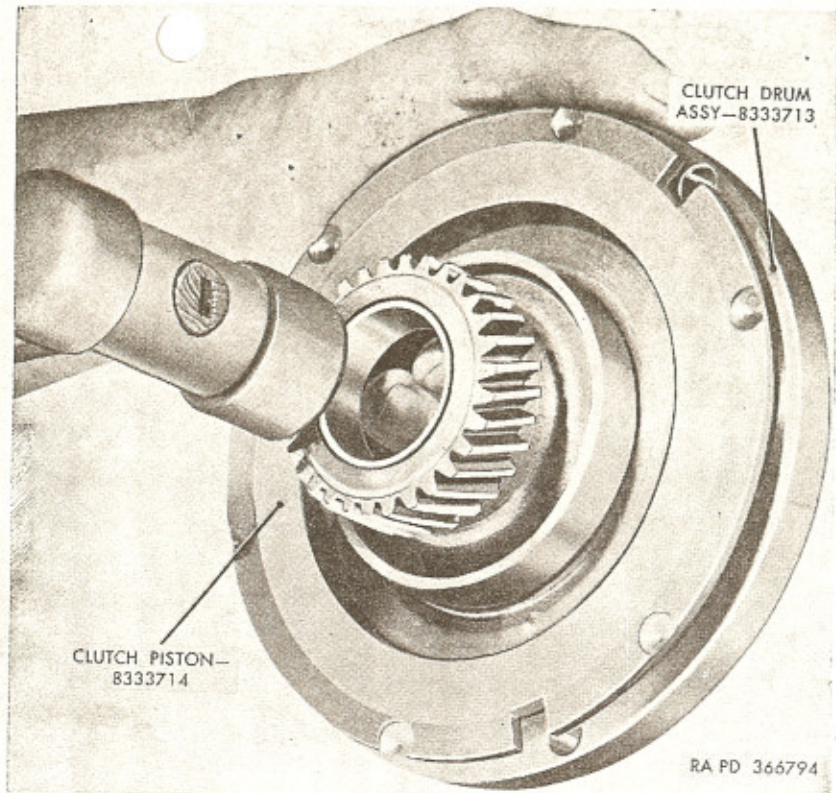


Figure 105. Removing clutch piston from clutch drum.

e. With clutch piston oil seal ring compressor—C8708711 and thumb, compress clutch piston small oil seal ring (G) in manner shown in figure 106; then using a small pick or screwdriver, unhook ends of oil seal ring. Remove ring from drum groove.

f. Using fingers (fig. 107), remove clutch piston large oil seal ring (H) from groove in clutch piston.

98. Cleaning, Inspection, and Repair of Front Planetary Parts

Note. The capitalized key letters shown below in parentheses refer to figure 103. Refer to paragraph 163 for repair and rebuild standards.

a. *Cleaning.* All parts should be thoroughly cleaned with dry-cleaning solvent or mineral spirits paint thinner before inspection. Do not immerse clutch drive plates (C) in solution. Wipe these parts clean using cloth dampened with thinner. Dry all parts by playing an air stream across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

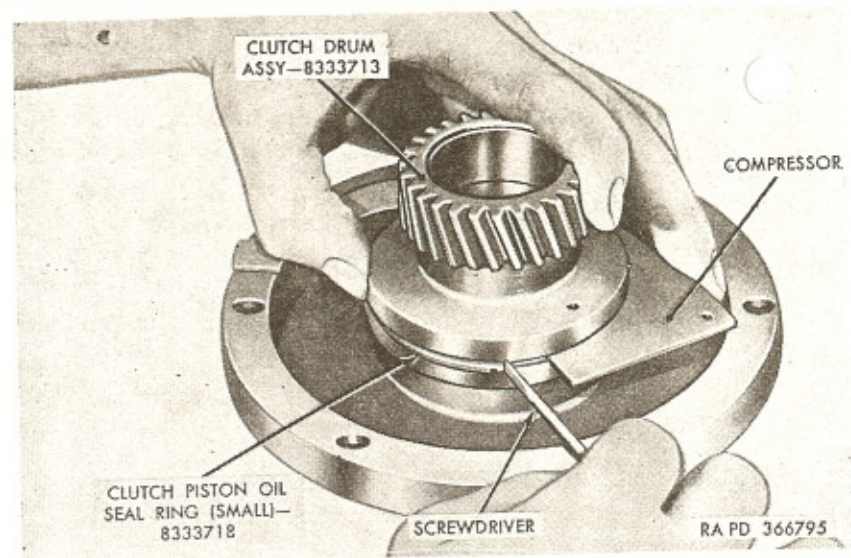


Figure 106. Removing clutch piston small oil seal ring using compressor—C8708711.

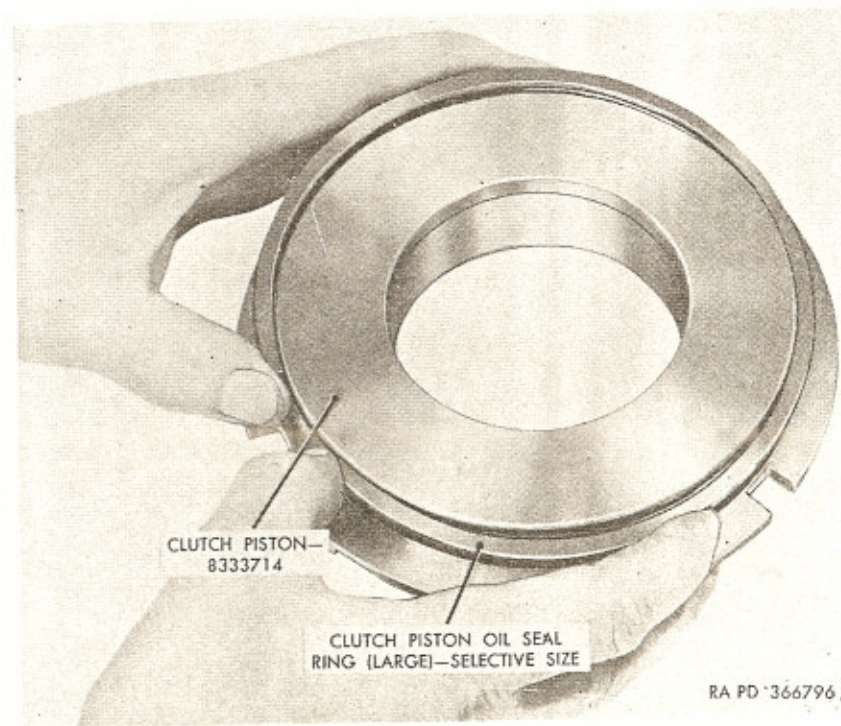


Figure 107. Removing clutch piston large oil seal ring.

b. Inspection and Repair.

- (1) Inspect clutch drive plates (C) for damage and rough surfaces and worn teeth. If any facing is damaged, inspect the steel clutch driven plates (B) on either side to determine if driven plate or foreign material caused the damage.

Note. If flakes of facing material can be removed by scratching the surface with thumb nail, plate assembly must be replaced. Discoloration, however, is not an indication of failure.

- (2) Inspect the clutch driven plates (B) for scored surfaces and flatness.
- (3) The driven plates have six distinct "waves." Check depth of waves on surface of plate (fig. 108). Waves should be 0.008 to 0.012 inch deep.
- (4) Check clutch inner and outer release springs (D and E) for free length, compressed length, and collapsed coils.

Note. Slight wear (bright spots) on side of outer release springs, indicating slight contact with drum, is permissible.

- (5) Check clutch piston (F) for scores and distortion. Examine oil seal ring groove for damage.
- (6) Inspect clutch drum assembly (J) for scores on clutch piston contact surface. Examine teeth and thrust face for scores, nicks, and damage. Check oil seal ring

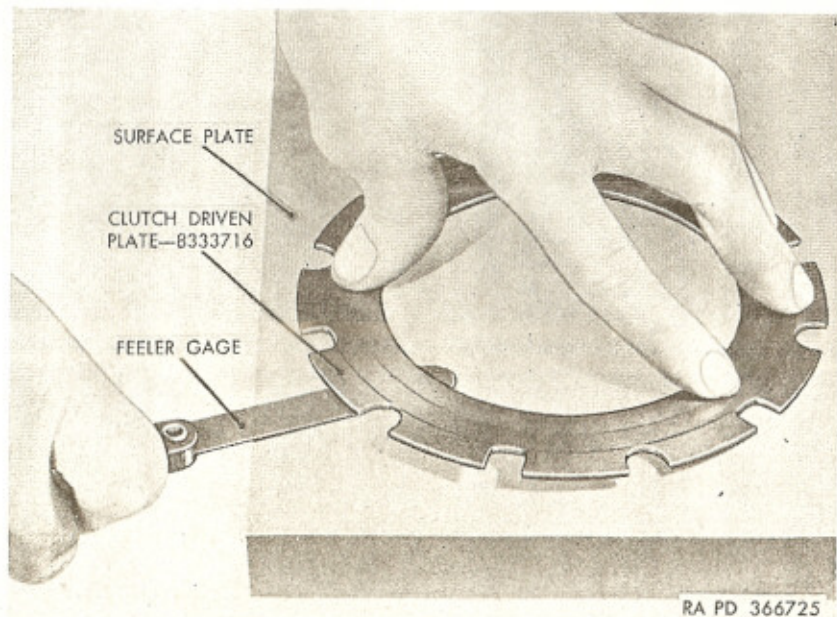


Figure 108. Measuring depth of waves in clutch driven plate.

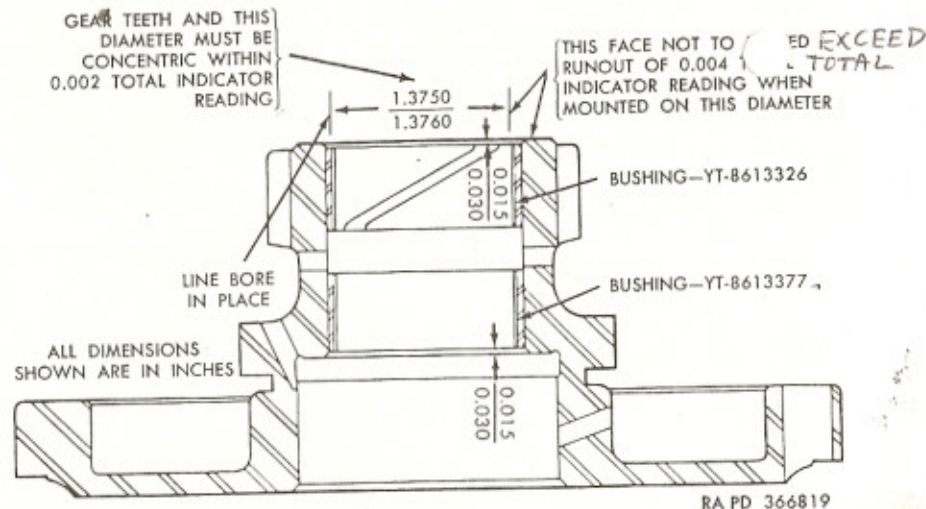


Figure 109. Section view of front clutch drum assembly.

groove for damage. Check wear of bushings. If necessary to replace bushings, proceed as shown in (a) through (d) below (fig. 109).

- (a) Remove bushings with suitable tool.
 - (b) Press inner bushing into drum with chamfer toward inside. Press only to dimensions shown (fig. 109).
 - (c) Press outer bushing (with oil groove) into drum to dimensions shown in figure 109.
 - (d) Finish inside diameter of both bushings to dimensions shown in figure 109.
- (7) Check front drum assembly (A) for scores and damage. Examine drum for scores at band and clutch plate contact surfaces. Inspect drum pins. If pins are loose, bent, or excessively scored, replace drum and pin assembly.
 - (8) Inspect clutch piston oil seal rings (G and H) for damage and for freeness in grooves of clutch piston and drum.
 - (9) Insert large clutch piston oil seal ring (H) squarely in clutch drum as shown in figure 110; then using a feeler gage, check ring gap. Ring gap should be 0.001 to 0.011 inch at outside diameter of ring. If gap is not within limits, use next selective size oil seal ring. See table VI. Size of oil seal ring is indicated by color on outside diameter of ring.

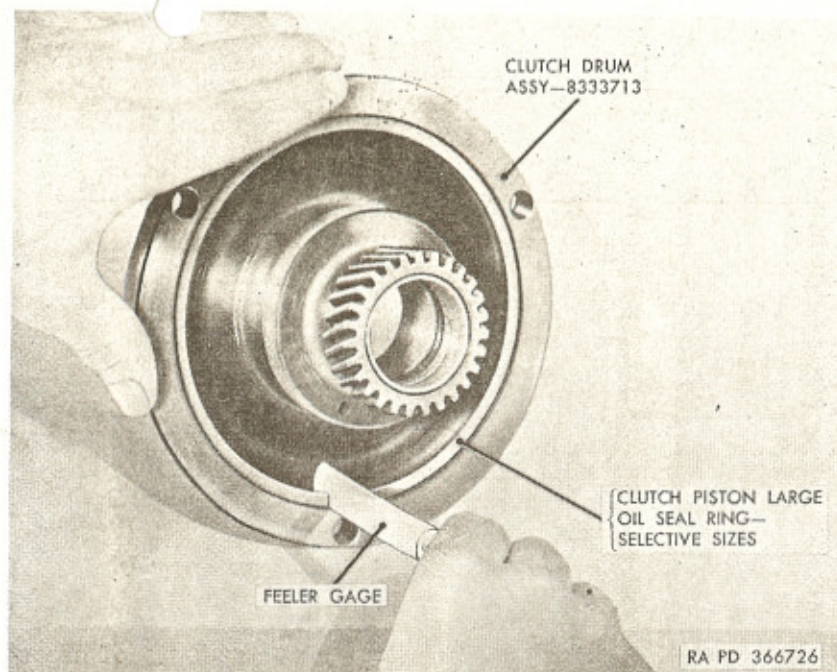


Figure 110. Checking front clutch piston large oil seal ring gap.

Table VI. Clutch Piston Selective Size (Large) Oil Seal Ring

Part No.	Identification	For use in drum bore size
YT-8617006	Black	5.1250 to 5.1265
YT-8617007	Yellow stripe on od	5.1235 to 5.1250
YT-8617008	White stripe on od	5.1220 to 5.1235

- (10) Hold ends of small oil seal ring; then insert ring squarely into bore of clutch piston. Using feeler gage, check ring gap which should be 0.002 to 0.007 inch at outside diameter of ring.

99. Assembly of Front Planetary Unit

Note. The capitalized key letters shown below in parentheses refer to figure 103.

a. Position planet carrier assembly in holding fixture—B7079295.

b. Place front drum assembly (A), with drive pins up, over hub of planet carrier (fig. 111) and rest on planet carrier pinion gears.

c. Apply clean engine oil (OE 10) to both sides of clutch plates. Install four clutch driven plates (B) and five clutch drive plates

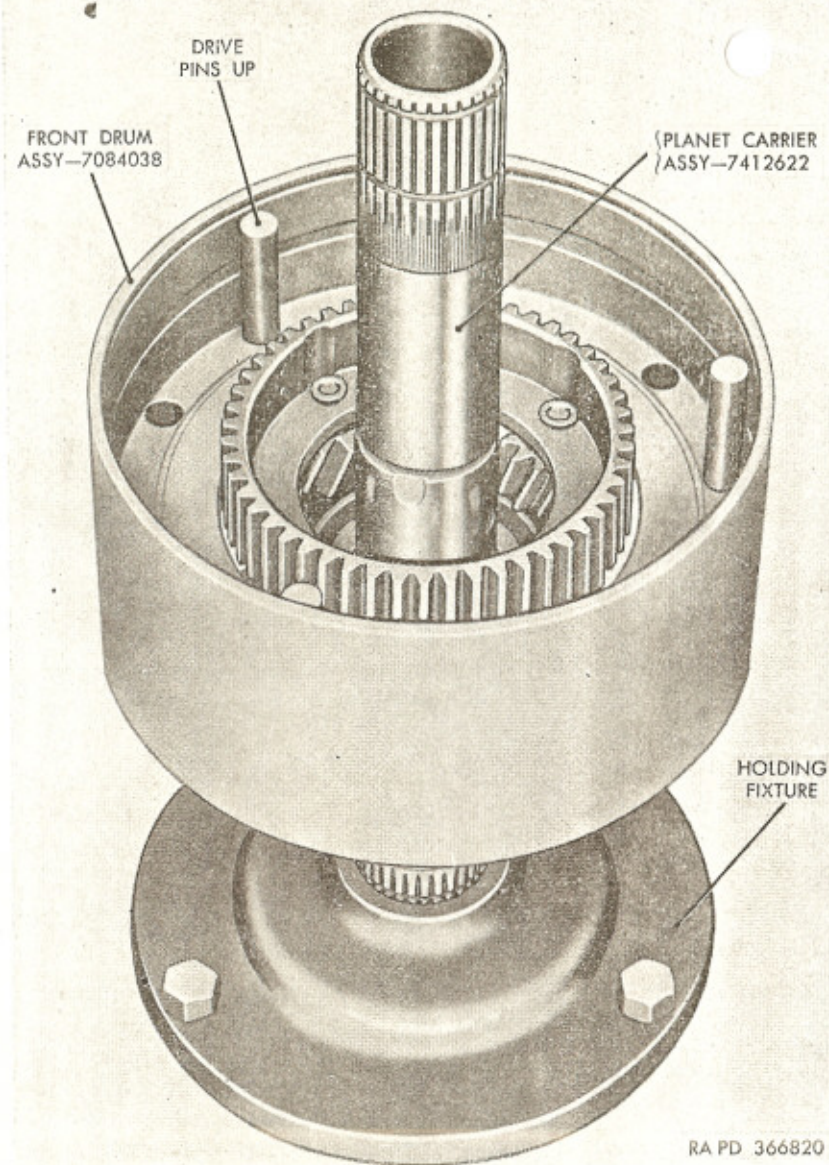


Figure 111. Front drum positioned on planet carrier to facilitate assembling front planetary unit.

(C) in front drum assembly (A), alternating plates starting with a drive (composition face) plate (C). Install clutch driven plates (B) with square notches over clutch drive pins.

d. Install six clutch outer release springs (E) through clutch plates into holes of clutch drum. Install six clutch inner release springs (D) into outer springs.

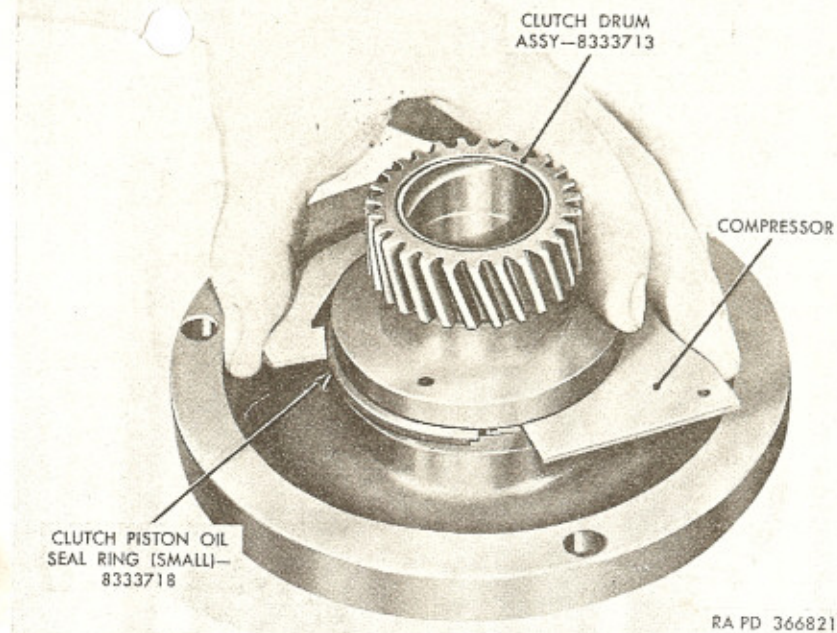


Figure 112. Installing small oil seal ring on clutch drum using compressor—C8708711.

e. Position front clutch drum assembly (J) on bench, gear end up; then use fingers to install clutch piston small oil seal ring (G) in groove of clutch drum. Expand oil seal ring only enough to make installation.

f. Place clutch piston oil seal ring compressor—C8708711 (fig. 112) on ring with edge of compressor near end of ring.

g. Move arm of compressor and compress oil seal ring until ends of ring engage and become locked.

h. Install clutch piston large selective size oil seal ring (H) (table VI, par. 98) in outer groove of clutch piston. Refer to figure 113.

i. Place clutch piston oil seal ring compressor—A8708710 over oil seal ring in piston; then compress oil seal ring and at same time push piston down into drum, until it bottoms against compressor (fig. 113). Remove compressor by spreading compressor ends. Press clutch piston completely into drum.

j. With gear end of clutch drum assembly (J) down, install clutch drum and piston assembly over front planet carrier and into front drum assembly, engaging release springs in pockets of clutch piston.

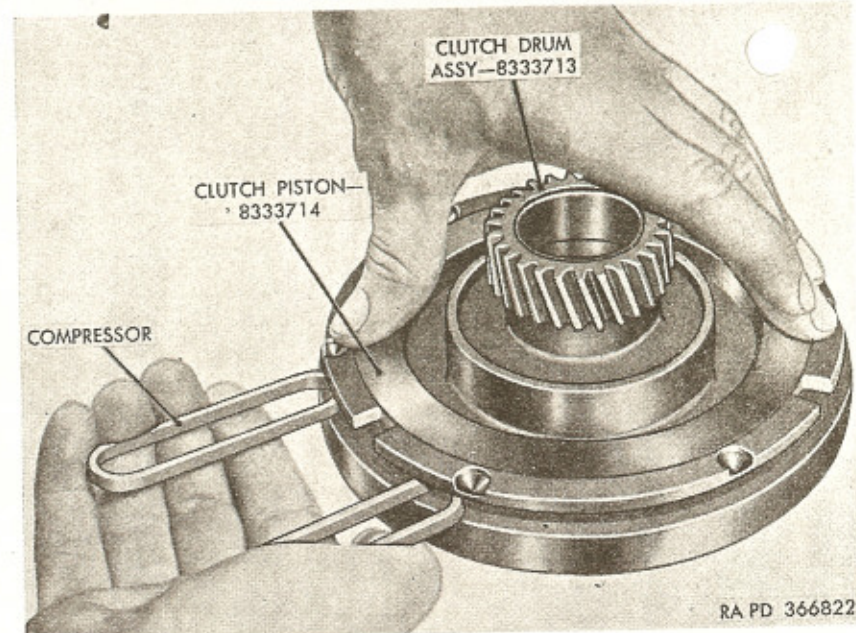


Figure 113. Installing clutch piston large oil seal ring using compressor—A8708710.

k. Lift front planetary unit from carrier assembly and place unit in arbor press, with wood block between press ram and clutch drum (fig. 104). Apply only enough pressure to permit installation of clutch drum snap ring (K). Position gap of snap ring half-way between two of the front drum guide pins. Set snap ring into groove, using a blunt punch.

Important: Snap ring must be well seated in groove to prevent interference with ledge on clutch drum.

l. Remove front planetary unit from arbor press, then tap gear end of clutch drum with plastic hammer to seat drum against snap ring (fig. 114).

m. Check freeness of clutch plates, making sure they are loose in front planetary unit.

100. Disassembly of Rear Planetary Unit

Note. The capitalized key letters shown below in parentheses refer to figure 115.

a. Remove rear clutch hub retainer bracket—A7950207 from rear planetary unit drum.

b. Remove rear clutch hub (Q) and bronze thrust washer (N).

c. Position rear unit in arbor press with wooden block between clutch drum assembly and press ram (fig. 104). Press downward

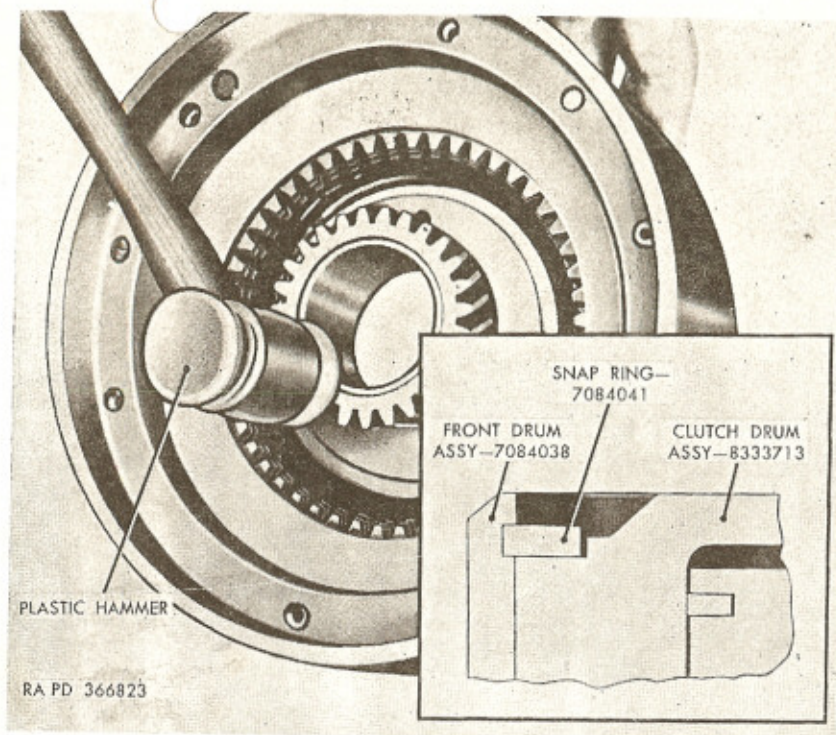


Figure 114. Seating clutch drum in front drum.

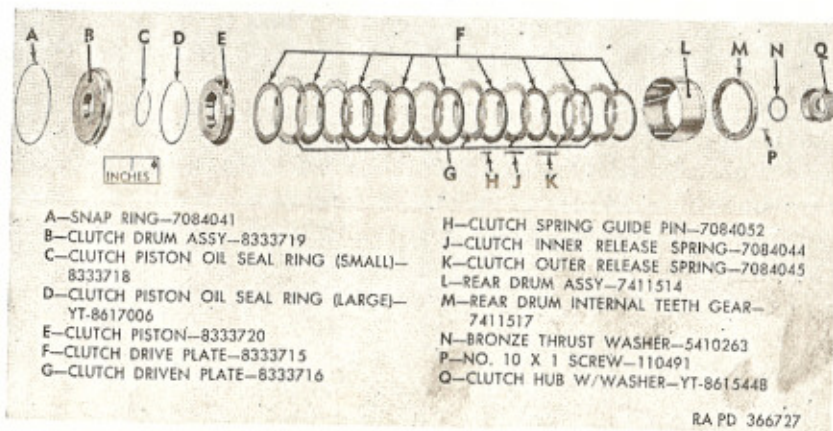


Figure 115. Rear planetary unit components.

on drum sufficiently to clear locking shoulder of rear drum; then pry out clutch drum snap ring with screwdriver (fig. 104).

d. Remove rear planetary unit from arbor press. Separate clutch drum assembly (B) from rear drum assembly (L) by tapping lightly on clutch drum rear thrust face, using a block of wood and hammer.

e. Remove six clutch outer release springs (K), six clutch inner release springs (J), and six clutch spring guide pins (H) from rear drum assembly (L).

f. Remove eight clutch driven plates (G) (steel) and nine clutch drive plates (F) (composition faced), as a unit, from rear unit drum. Do not separate plates.

g. Hold clutch drum assembly (B) in hand and tap against inner hub of drum with plastic hammer, in same manner used for front planetary unit (fig. 105). This will cause clutch piston (E) to "walk" out of clutch drum.

h. With clutch piston oil seal ring compressor—C8708711 (fig. 106) and thumb, compress oil seal ring on clutch drum; then using a small pick or screwdriver, unhook ends of oil seal ring. Remove clutch piston oil seal ring (C) from groove of clutch drum (B). Do not expand oil seal ring more than necessary for removal.

i. Using fingers in same manner as shown in figure 107, remove the clutch piston large oil seal ring (D) from groove in clutch piston (E). Do not expand oil seal ring more than necessary for removal.

j. If necessary to replace the rear drum internal-teeth gear (M), remove two fillister head screws (P) attaching gear to rear drum; then remove gear (fig. 117). This gear should not be removed from rear planetary unit drum unless replacement is deemed necessary.

101. Cleaning, Inspection, and Repair of Rear Planetary Parts

Note. The capitalized key letters shown below in parentheses refer to figure 115. Refer to paragraph 163 for repair and rebuild standards.

a. *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Do not immerse clutch drive plates (F) in solution. Wipe these parts clean using cloth dampened with thinner. Dry all parts by playing an air stream across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

b. *Inspection and Repair.*

- (1) Inspect rear drum internal-teeth gear (M) for damaged teeth.

- (2) Inspect clutch drive pins in rear drum assembly (L). If scored, loose, or distorted, replace rear drum assembly. Drive pins are not furnished separately.
- (3) Inspect rear drum assembly (L) for deep grooves, scores, or cracks at band and clutch plate surfaces.
- (4) Removing one clutch plate at a time, inspect clutch drive plates (F) for damage or rough surfaces. Plates must be flat. If any facing is damaged, inspect clutch driven plates (G) on either side to determine if plates or foreign material caused damage.

Note. If flakes of plate facing can be removed by scratching with thumb nail, plate must be replaced. Discoloration, however, is not an indication of failure.
- (5) Inspect clutch driven plates (G) for scored surfaces and for flatness. Driven plates should have six waves at least 0.008 to 0.012 inch deep. Check surface plate with feeler gage as shown in figure 108.
- (6) Inspect clutch drum assembly (B) for scores on piston contact surface. Inspect thrust surface for scores or damage. Check oil seal ring groove for damage. Check wear of bushing. If necessary to replace bushing (fig. 116), proceed as indicated in (a) through (c) below.
 - (a) Remove bushing with suitable tool.
 - (b) Press new bushing into drum with outer chamfer toward outside of drum. Press bushing into drum until seated.
 - (c) Check inside diameter of bushing (fig. 116) to dimension shown and finish as necessary.
- (7) Inspect clutch piston (E) for scores, cracks, or distortion. Make sure oil seal ring groove is clean.

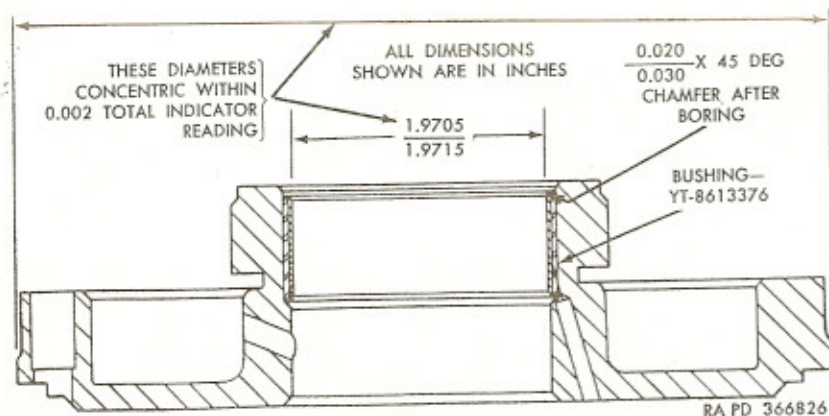


Figure 116. Sectional view of rear clutch drum assembly.

- (8) Inspect clutch inner and outer release springs (J and K) for free length, compressed length, distortion, or collapsed coils.

Note. Slight wear (bright spots) on sides of outer springs, indicating slight contact with drum, is permissible.
- (9) Inspect clutch spring guide pins (H) for distortion. Make sure all pins are approximately the same length.
- (10) Inspect front and rear thrust faces of clutch hub with washer (Q) for scoring. Inspect inner and outer splines for nicks or damage. Blow out drilled passages in clutch hub.
- (11) Inspect oil seal rings for damage and freeness in groove of clutch piston and rear drum.
- (12) Insert clutch piston large oil seal ring (D) squarely in clutch drum assembly (B); then using a feeler gage, check ring gap. Ring gap should be 0.001 to 0.011 inch at outside diameter of ring.
- (13) Hook ends of clutch piston small oil seal ring (C); then insert ring squarely into bore of clutch piston (E). Using feeler gage, check gap of oil seal ring which should be 0.002 to 0.007 inch.

102. Assembly of Rear Planetary Unit

Note. The capitalized key letters shown below in parentheses refer to figure 115. Liberally lubricate all parts with clean engine oil (OE-10) at assembly.

a. If previously removed, position rear drum internal-teeth gear (M) on rear drum assembly (L) (fig. 117); then install two No. 10 x 1 screws (P) which attach gear to drum. Tighten screws to 3 to 4 pound-feet torque.

b. Place the rear drum and internal-teeth gear assembly on bench with drive pins up.

c. Install clutch drive (composition faced) plate (F) first; then install clutch driven steel plate (G) next, with square notches over drive pins. Continue alternating with drive and driven plates until nine drive and eight driven plates have been installed.

d. Install six clutch outer release springs (K) in round notches in driven plates. Install six clutch inner release springs (J) inside outer springs. Install six clutch spring guide pins (H) inside inner release springs.

e. Position rear clutch drum assembly (B) on bench with hub up; then use fingers to install clutch piston oil seal ring (C) in groove of drum. Do not expand oil ring more than necessary to make the installation.

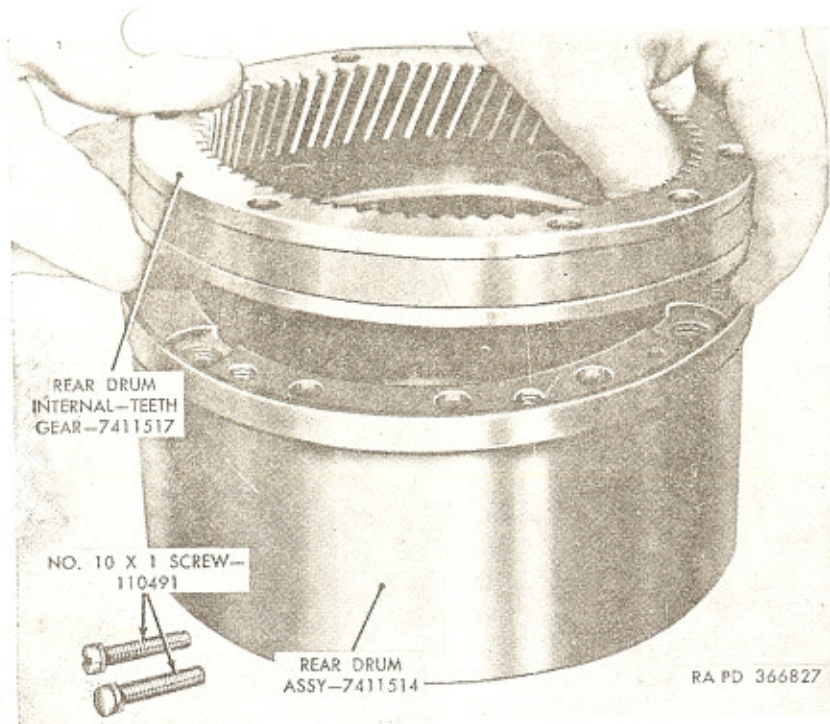


Figure 117. Removing or installing rear drum internal-teeth gear assembly.

f. Place compressor—C8708711 (fig. 112) on oil seal ring, with edge of compressor near end of oil seal ring.

g. Move arm of compressor to compress oil seal ring until ends of ring lock automatically.

h. Using fingers, install clutch piston large oil seal ring (D) in groove of clutch piston (E). Refer to figure 107.

i. Place compressor—A8708710 (fig. 113) over oil seal ring in piston; then with clutch drum seated on bench with hub up, compress oil seal ring with compressor and push piston down until it bottoms against compressor. Remove compressor by spreading compressor ends. Press clutch piston completely into clutch drum.

j. Install rear clutch drum assembly (B) and clutch piston over drive pins and into rear unit drum assembly.

k. Position rear planetary unit in arbor press with wood block between press ram and clutch drum (fig. 104). Apply only enough pressure to install snap ring retaining clutch drum in rear drum. Position snap ring with gap in ring between two drive pins. Set ring into groove with blunt punch.

Important: Snap ring must be well seated in groove to prevent interference with ledge on drum.

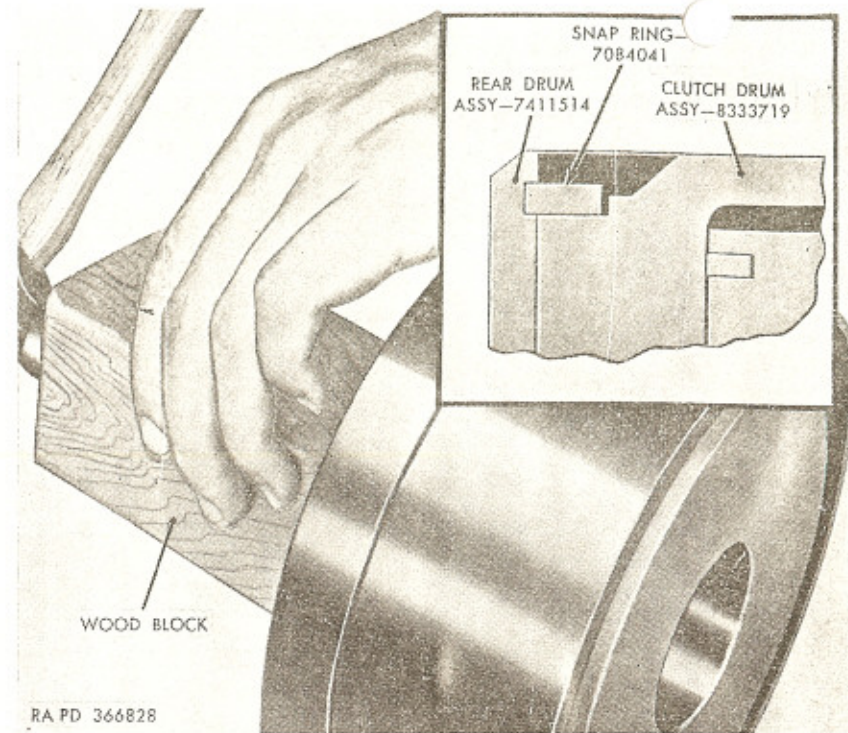


Figure 118. Seating clutch drum in rear drum.

l. Remove rear planetary unit from arbor press and place on bench. With wood block and hammer, tap clutch drum rear thrust face to seat clutch drum against snap ring (fig. 118).

m. Check clutch drive and driven plates, making sure they are loose in rear drum assembly.

n. Coat bronze thrust washer (N) lightly with artillery and automotive grease (GAA). Install thrust washer in deep counterbore of rear clutch hub (Q).

o. Install clutch hub (fig. 119) and thrust washer into clutch drive plates. Rotate hub and drum on bench in opposite directions to mesh splines of hub with teeth of clutch plates. When properly installed, clutch hub should be flush with or slightly below counterbore in rear drum assembly.

p. Install rear clutch hub retainer bracket—A7950207 (fig. 128) on rear unit drum assembly to hold clutch hub in place. Use one reverse-center-gear-drive-flange-to-rear-drum attaching bolt to hold bracket in place. Refer to figure 128 for view of bracket installed.

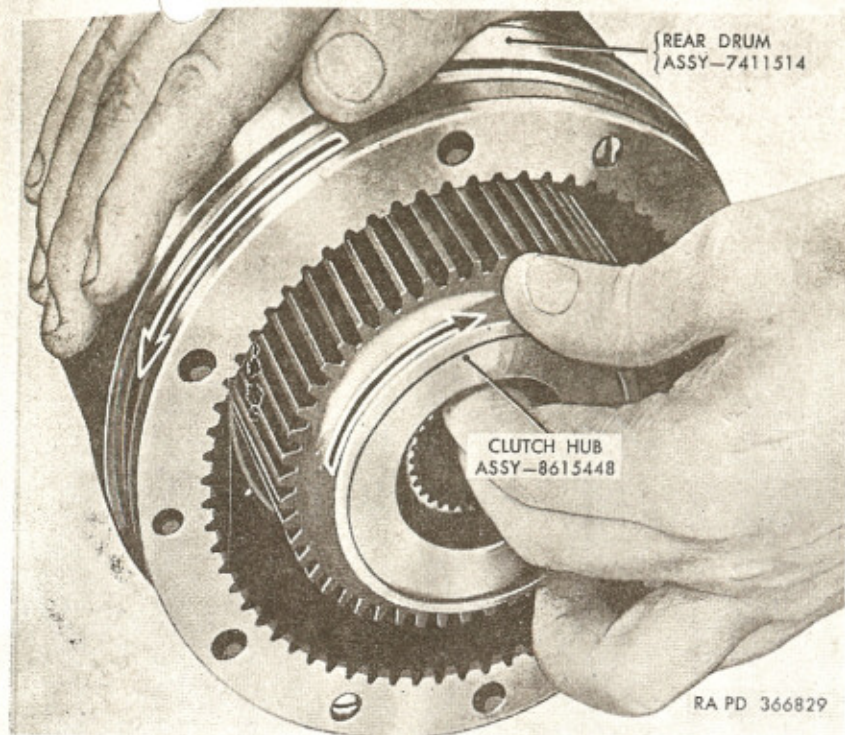


Figure 119. Installing clutch hub.

103. Cleaning, Inspection, and Repair of Planet Carrier, Bands, and Oil Delivery Sleeve

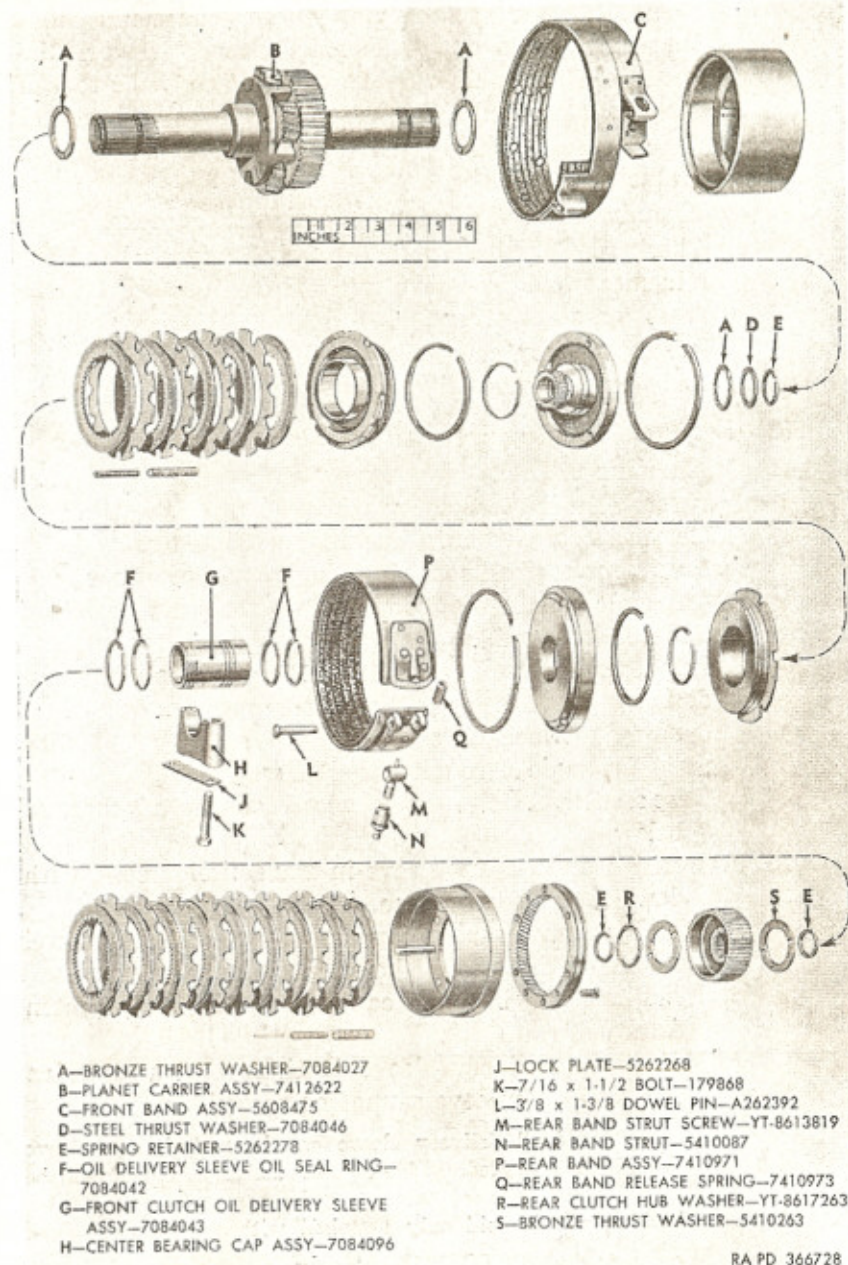
Note. The capitalized key letters shown below in parentheses refer to figure 120.

a. *General.* Parts covered in this paragraph are shown in figure 120. Parts not keyed in figure 120 are covered in paragraphs 96 through 102 and are shown in this view for orientation purposes only. Discard spring retainer (E), front clutch oil delivery sleeve oil seal rings (F), and lock plate (J) and obtain new parts for assembly. Refer to paragraph 163 for repair and rebuild standards of parts when necessary.

b. *Cleaning.* All parts should be thoroughly cleaned with dry-cleaning solvent or mineral spirits paint thinner before inspection. Do not immerse front and rear band assemblies (C and P). Wipe these parts clean using cloth dampened with thinner. Dry all parts by playing an air stream across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

c. *Inspection and Repair*

(1) *Front and rear band assemblies (C and P).*



A—BRONZE THRUST WASHER—7084027
 B—PLANET CARRIER ASSY—7412622
 C—FRONT BAND ASSY—5608475
 D—STEEL THRUST WASHER—7084046
 E—SPRING RETAINER—5262278
 F—OIL DELIVERY SLEEVE OIL SEAL RING—7084042
 G—FRONT CLUTCH OIL DELIVERY SLEEVE ASSY—7084043
 H—CENTER BEARING CAP ASSY—7084096

J—LOCK PLATE—5262268
 K—7/16 x 1-1/2 BOLT—179868
 L—3/8 x 1-3/8 DOWEL PIN—A262392
 M—REAR BAND STRUT SCREW—YT-8613819
 N—REAR BAND STRUT—5410087
 P—REAR BAND ASSY—7410971
 Q—REAR BAND RELEASE SPRING—7410973
 R—REAR CLUTCH HUB WASHER—YT-8617263
 S—BRONZE THRUST WASHER—5410263

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Figure 120. Front and rear planetary units and carrier.

Note. Do not pry either band open or distort in any way. Bands are surface ground at factory for drum fit.

- (a) Replace all parts which are not in good condition.
- (b) Inspect both bands for burned, glazed, or worn linings. If face of linings are worn down to bottom of grooves, band and lining assemblies must be replaced.
- (c) Check band rivets to see that they are not loose or contacting drum.
- (d) Examine steel bands for distortion and cracks.
- (e) Check rear band strut screw (M) on rear band for alignment and free pivoting. Make sure strut turns freely on strut screw.
- (f) Inspect anchor ends of front band for broken welds and worn sockets.

(2) *Front clutch oil delivery sleeve assembly (G).*

- (a) Examine oil delivery sleeve for scored bearing surfaces. Refer to paragraph 163 for diameter of sleeve at clutch drum bushing contact area. Check for freeness of oil seal rings in grooves of sleeve.
- (b) Inspect oil seal ring grooves to see that they are clean and not damaged.
- (c) Insert end of soft wire (fig. 121) through both oil delivery sleeve holes to check for open passages into opening between oil seal ring grooves. End of wire must protrude through cored passage as shown.
- (d) Test oil delivery sleeve for leaks as shown in 1 through 8 below.
 1. Position oil delivery sleeve in transmission case, with dowel hole *toward* case.
 2. Install center bearing cap assembly (H) with dowel in one of the two oil holes in delivery sleeve.
 3. Install center bearing cap bolts (K) and tighten firmly.
 4. Make sure delivery sleeve is tight in transmission case and that sleeve cannot be rocked.

Note. If oil delivery sleeve can be rocked, new sleeve should be installed. If new oil delivery sleeve can be rocked, transmission case must be replaced, since center bearing cap is sold only matched with transmission case.

5. Apply engine oil (OE-10) freely to each side of center bearing cap.
6. With air gun—B7950562 (fig. 122) connected to source of air pressure, apply pressure to each of the clutch holes in side of transmission case.

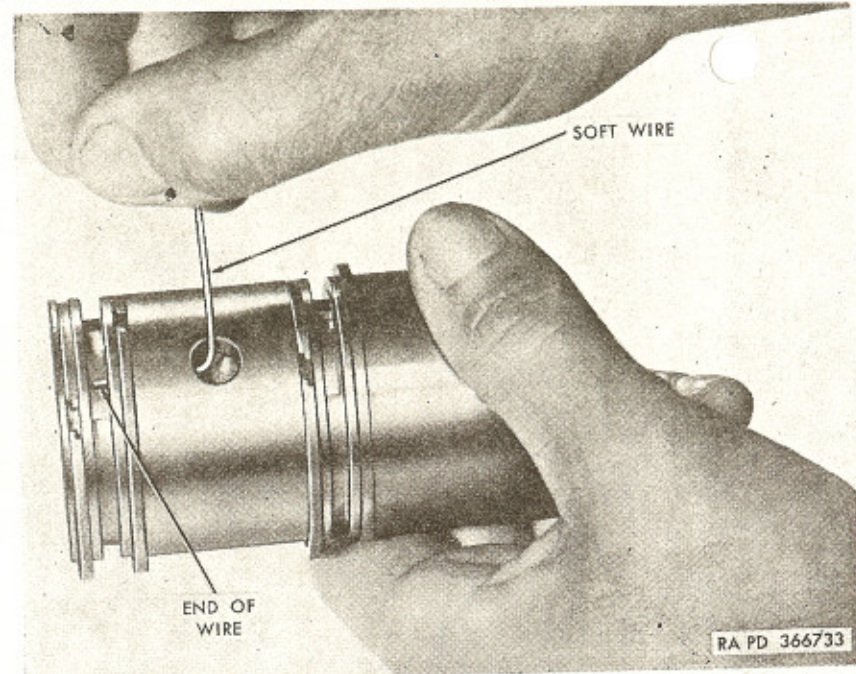


Figure 121. Checking and cleaning passages in front clutch oil delivery sleeve assembly.

7. If leakage is indicated, install new oil delivery sleeve. If new sleeve leaks, dress down center bearing cap with fine emery cloth on surface plate. Repeat test. If oil delivery sleeve still leaks, replace transmission case.
 8. Remove center bearing cap, bolts, and oil delivery sleeve.
 - (e) Inspect bushing (fig. 123) in oil delivery sleeve for wear (par. 163). If necessary to replace center bearing bushing, remove bushing with suitable tool; then press new bushing into oil delivery sleeve and finish to dimensions shown on figure 123. Split of bushing must center over dowel hole in sleeve.
- (3) *Planet carrier assembly (B).*
- (a) Check looseness of planet pinions by hand. Excessive looseness indicates worn pins or needle bearings. If worn, replace complete planet carrier assembly.
 - (b) Inspect planet carrier snap ring grooves to see that they are clean and not damaged. Inspect carrier shaft splines and gear teeth for cracks, nicks, and burs. Slight imperfections may be cleaned up with crocus

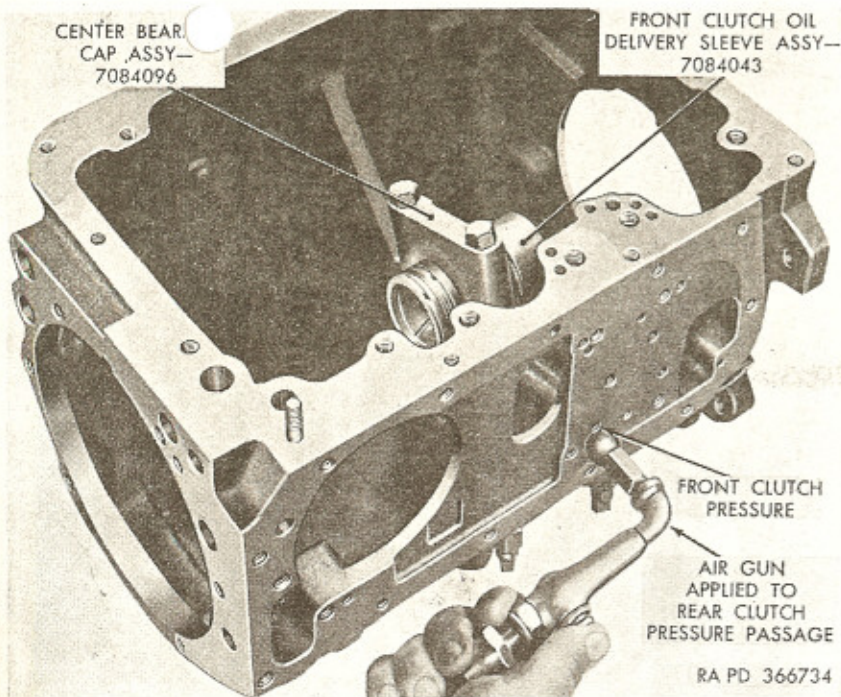


Figure 122. Testing front clutch oil delivery sleeve for leaks using air gun—B7950562.

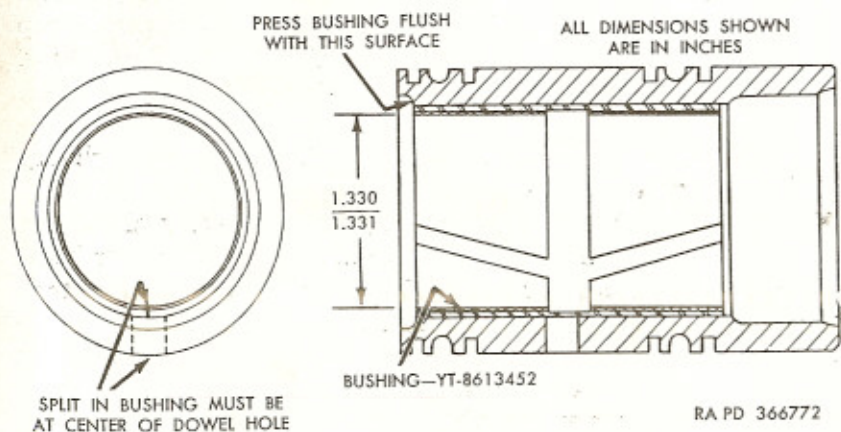


Figure 123. Sectional view of front clutch oil delivery sleeve assembly.

cloth. If badly damaged, replace complete planet carrier assembly.

(c) Measure shaft diameters at points indicated in paragraph 163.

- (d) Examine all thrust surfaces for scoring, cracks, or burs.
- (e) At root of every seventeenth spline of drive hub, clean out small oil passage using soft wire.
- (4) Planet carrier hub and clutch drum thrust washers (A, D, and S). Refer to paragraph 163 for thrust washer thickness. Replace with new parts if worn or damaged.
- (5) Rear clutch hub washer (R). Refer to paragraph 163 for washer thickness. Replace washer if worn or damaged.

104. Assembly of Front and Rear Planetary Units on Planet Carrier

a. Install bronze thrust washer against the rear of front planet carrier hub (fig. 124).

b. Install planet carrier assembly in front planetary unit. Rotate drum and carrier (fig. 125) in opposite directions while working carrier into place. Position planet carrier assembly with drum into holding fixture—B7079295. Refer to figure 102 for use of holding fixture.

c. Install planetary hub bronze thrust washer; then install clutch drum steel thrust washer (fig. 125) over planet carrier

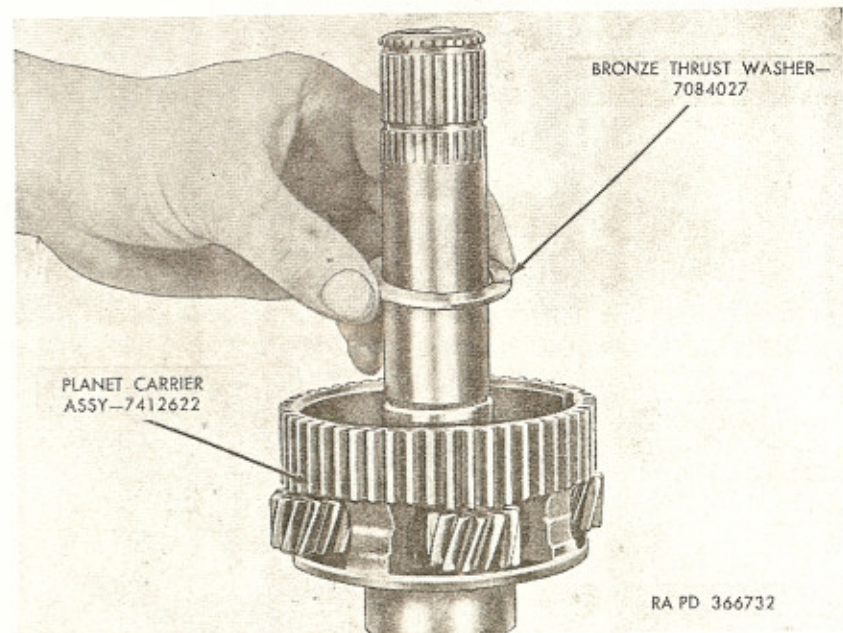


Figure 124. Installing planet carrier bronze thrust washer.

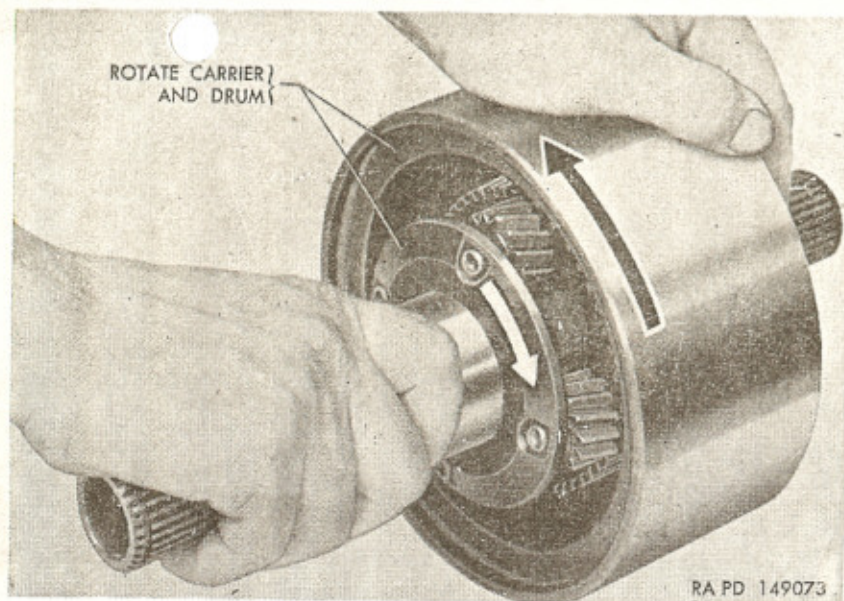


Figure 125. Installing planet carrier assembly in front planetary unit.

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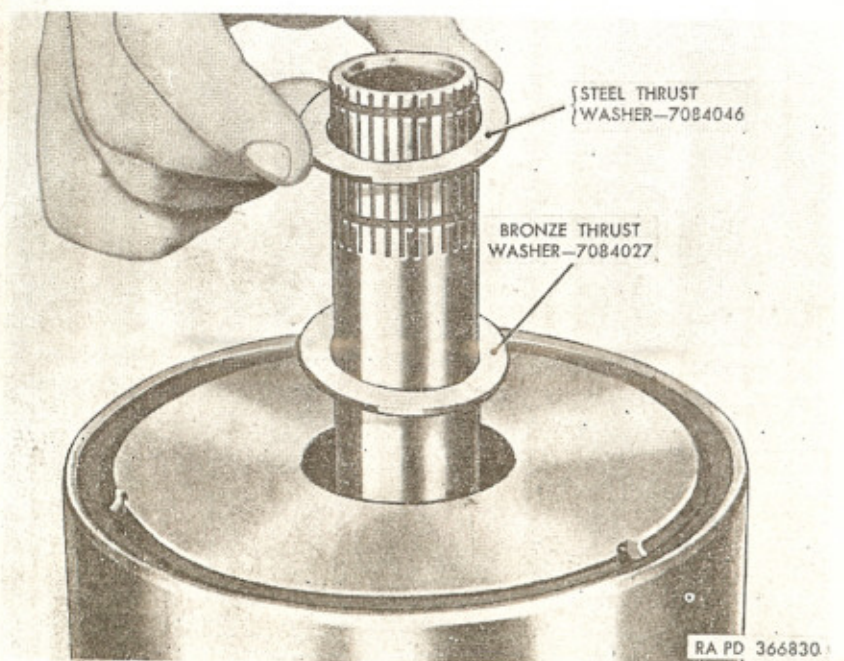


Figure 126. Installing front planetary unit thrust washers.

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into recess of front unit. Locating lug on steel thrust washer must fit over flat on planet carrier shaft.

d. In this step, avoid damaging bearing surface of planet carrier. Install new spring retainer with tapered points up. With snap ring pliers held vertically, engage points of retainer. While guiding retainer with one hand, slide retainer downward over planet carrier shaft and into groove above clutch drum steel thrust washer. Hold spring retainer well open to avoid scraping planet carrier bearing surface.

e. Position oil delivery sleeve assembly on planet carrier with the oil seal rings, which are located close to end of sleeve, downward into front planetary unit. Start end of sleeve into front planetary unit; then install ring compressor—A266328 around rings. Do not latch tool handles. With a plastic hammer, tap oil delivery sleeve assembly (fig. 127) until it bottoms in bore of drum. Remove oil seal ring compressor.

f. Install rear clutch hub front spring retainer (fig. 128) in groove of planet carrier assembly.

g. Place rear clutch hub washer (fig. 102) down over planet carrier shaft and seat over rear clutch hub front spring retainer.

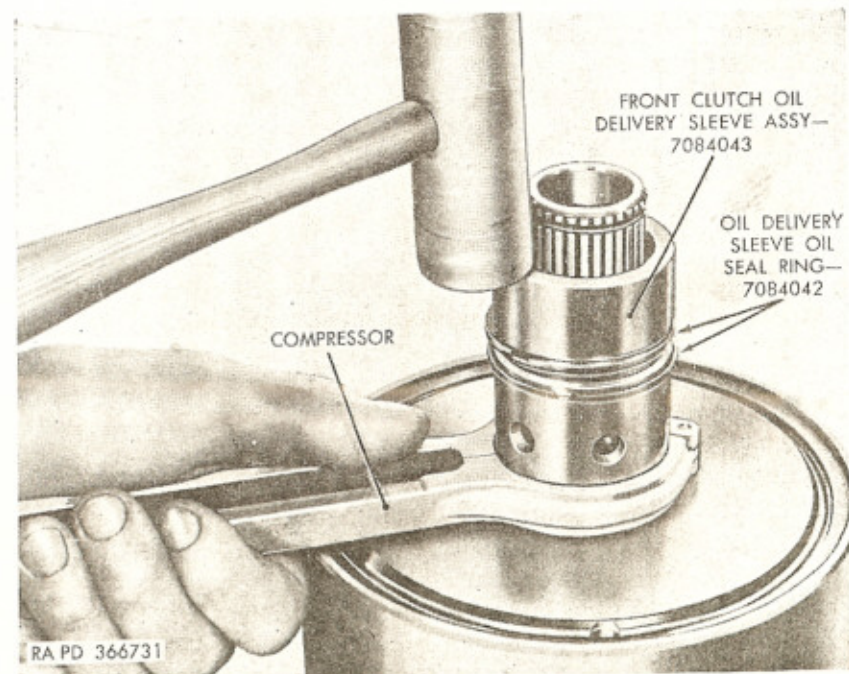


Figure 127. Using compressor—A266328 to install front clutch oil delivery sleeve assembly.

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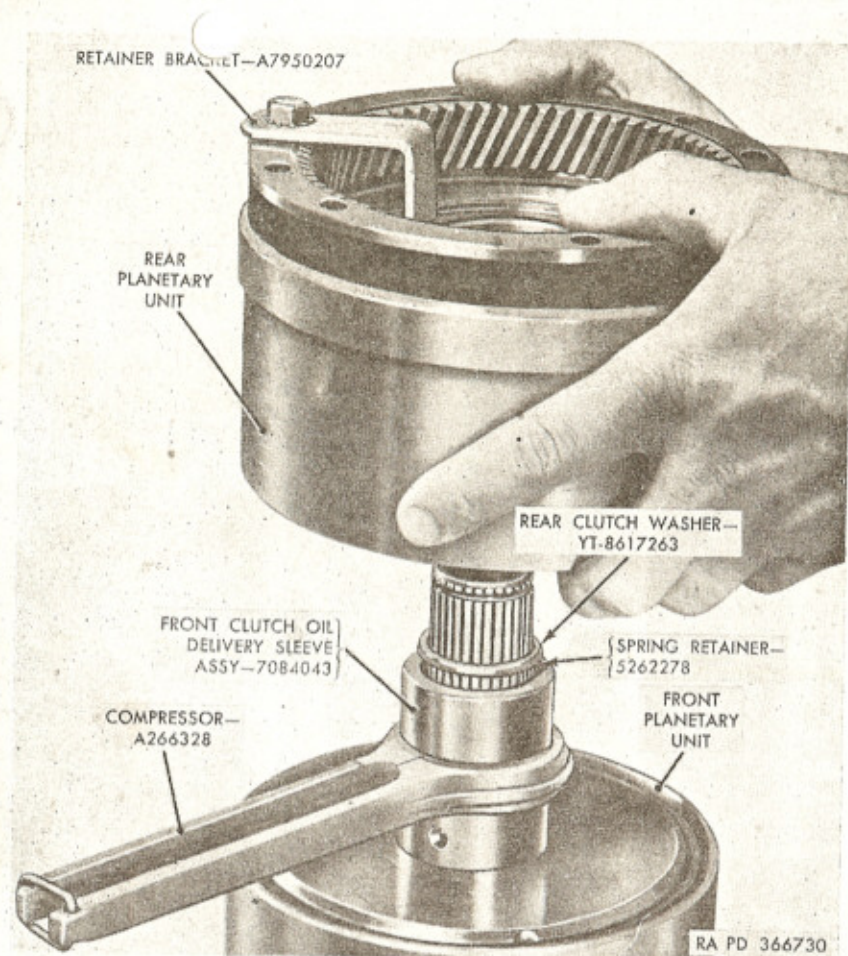


Figure 128. Installing rear planetary unit.

h. Install compressor—A266328 (fig. 128) over exposed oil delivery sleeve oil seal rings. Latch handles of ring compressor securely.

i. Position rear planetary unit over planet carrier assembly and oil delivery sleeve, bottoming planetary unit against compressor (fig. 128).

j. Keep rings compressed with compressor and release tool handle latch. While slightly releasing pressure on compressor handles, push rear planetary unit downward on sleeve over oil seal rings. Remove compressor.

k. Install rear clutch hub rear spring retainer (fig. 101).

Note. Make sure front and rear drums rotate with slight force. If either drum binds, disassemble and correct cause of binding.

l. After the above check, remove planetary units and carrier from holding fixture.

Section VIII. REBUILD OF INPUT SHAFT, REVERSE UNIT, OUTPUT SHAFT, AND BEARING RETAINER (301MG ONLY)

105. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 129.

a. Remove input shaft (A) and bronze thrust washer (B) from output shaft (C). Remove reverse clutch stationary cone key (Q) from notches in reverse clutch stationary cone (R).

b. Using a chisel and hammer, remove output shaft oil seal (GG) from bore in rear end of output shaft bearing retainer assembly (AA). Discard oil seal.

c. Remove outer spring retainer (DD) from groove in output shaft assembly (C), using snap ring pliers as shown in figure 130.

d. Remove snap ring (FF) from groove in output shaft bearing retainer assembly (AA), using long nosed pliers (fig. 130).

e. Lift output shaft, bearing retainer, and reverse unit assembly off bench with output shaft end up; then tap end of shaft with plastic hammer (fig. 131) until end of output shaft is flush with end of bearing retainer. Push bearing retainer down against reverse unit; then turn the assembly over and tap bearing retainer with plastic hammer (fig. 131) to jar output shaft ball bearing (EE) out of retainer and off shaft.

f. Remove inner spring retainer (DD) from groove in output shaft assembly (C), using snap ring pliers (fig. 130).

g. Lift output shaft bearing retainer assembly (AA) off output shaft and reverse unit assembly.

h. Lift reverse internal gear assembly and reverse clutch stationary cone (P and R) off output shaft assembly (C).

i. Mount spring compressor—C7950251 (fig. 132) on output shaft bearing retainer. Turn down wing nuts on spring compressor to force reverse piston release spring retainer away from spring retainer snap ring. Using snap ring pliers (fig. 132), remove snap ring (T) from groove in bearing retainer. Remove spring compressor from bearing retainer.

j. Remove reverse piston release spring retainer (U) and six reverse piston release springs (V) from reverse clutch piston (W).

k. Lift reverse clutch piston (W) straight out of output shaft bearing retainer (AA) (fig. 133). Piston is located on four guide pins and cannot be rotated. If piston does not readily lift out of bearing retainer, apply air pressure behind piston using air gun—B7950562 (fig. 133) at hole in bearing retainer. Apply only sufficient air pressure to force piston out of bearing retainer.

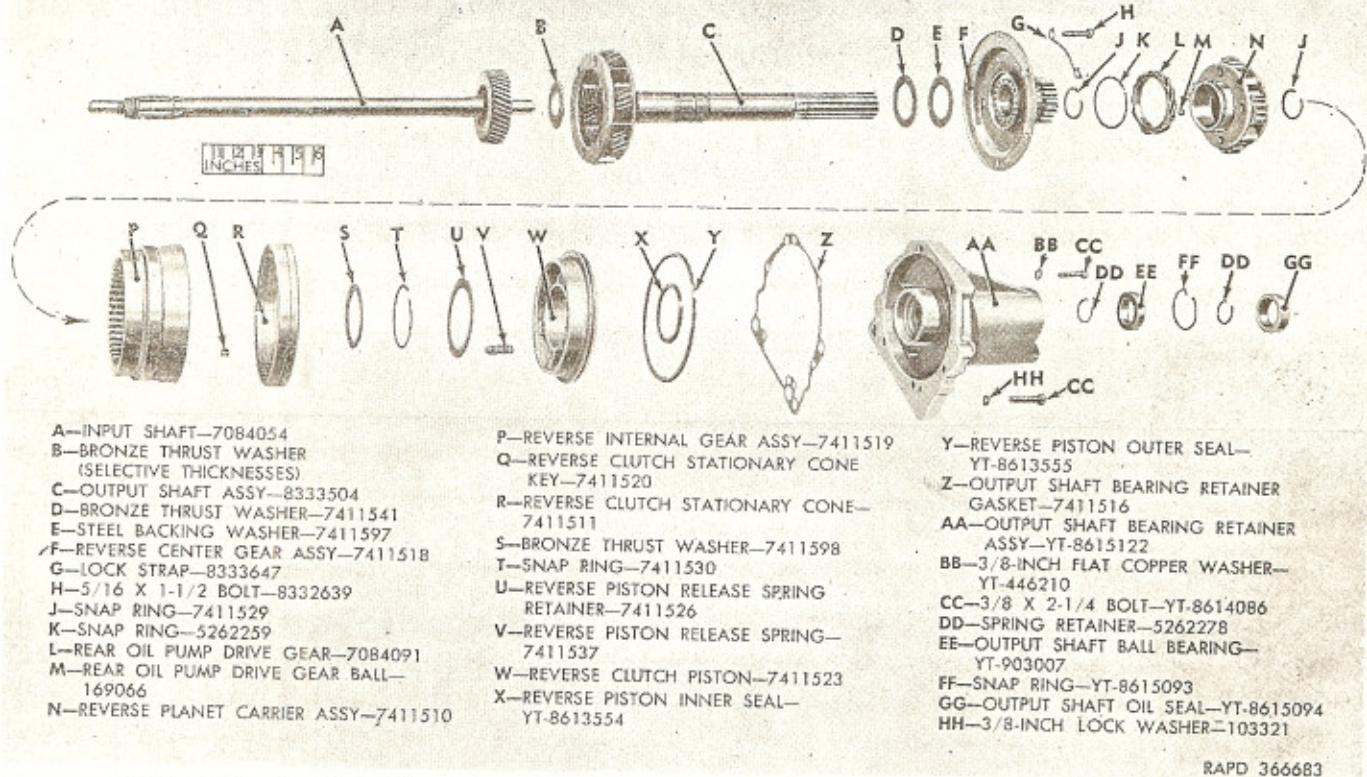


Figure 129. Input shaft, reverse unit, output shaft, and bearing retainer components (301MG).

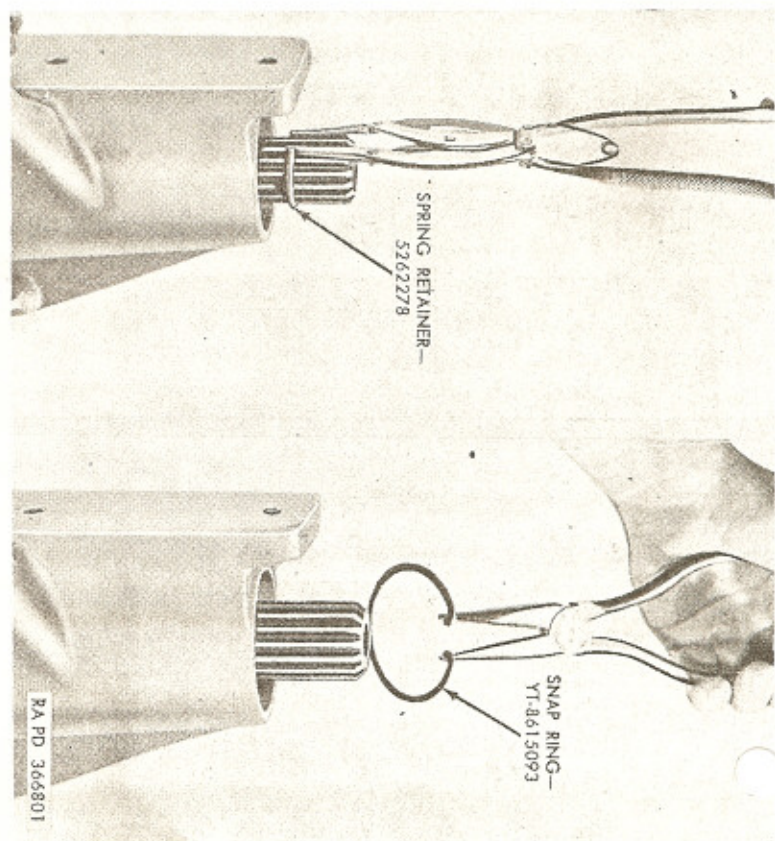


Figure 130. Removing or installing output shaft bearing rings.

l. Remove reverse piston outer seal (Y) from groove in reverse clutch piston (W). Discard seal.

m. Remove reverse piston inner seal (X) from groove in output shaft bearing retainer (AA) (fig. 134). Discard seal.

n. Remove bronze thrust washer (S) from reverse internal gear assembly (P).

o. With reverse internal gear assembly (P) positioned on bench (fig. 135), use snap ring pliers to expand reverse clutch stationary cone (R) and remove cone from gear assembly. Do not expand cone more than necessary to remove from gear.

Note. On some units, reverse clutch stationary cone (R) will require less expansion if removed from forward side of reverse internal gear instead of from rear side as shown in figure 135.

p. Remove snap ring (J) securing reverse planet carrier assembly (N) on output shaft assembly (C), using snap ring pliers. Keep snap ring well spread to prevent damaging output shaft splines during removal. Lift reverse planet carrier assembly (N) off output shaft assembly (C). Remove reverse planet

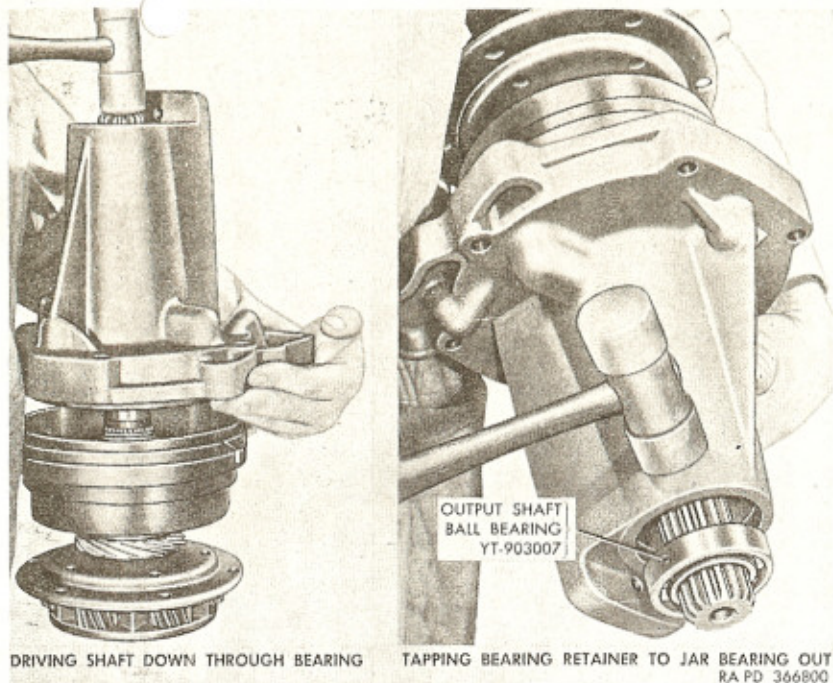


Figure 131. Removing output shaft bearing.

carrier locating snap ring (J) from output shaft, using snap ring pliers.

g. Lift reverse center gear assembly (F) off output shaft assembly (C); then remove steel backing washer (E) and bronze thrust washer (D) from output shaft.

106. Cleaning, Inspection, and Repair

Note. The capitalized key letters shown below in parentheses refer to figure 129.

a. *General.* Discard all seals (X, Y, and GG), snap rings (J, T, and FF), and spring retainers (DD) and obtain new parts for assembly. Refer to paragraph 164 for repair and rebuild standards.

b. *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Do not immerse reverse clutch piston (W) and reverse clutch stationary cone (R) in solution. Wipe these parts clean using cloth dampened with thinner. Dry parts by playing an air stream across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

c. *Inspection and Repair.*

(1) *Input shaft (A).* Inspect input shaft splines, snap ring grooves, and gear teeth for cracks, nicks, burs, or other

damage. Examine thrust surfaces on both sides ^{OF} gear for scoring or excessive wear. Slight imperfections may be cleaned up with crocus cloth. If badly damaged, replace shaft.

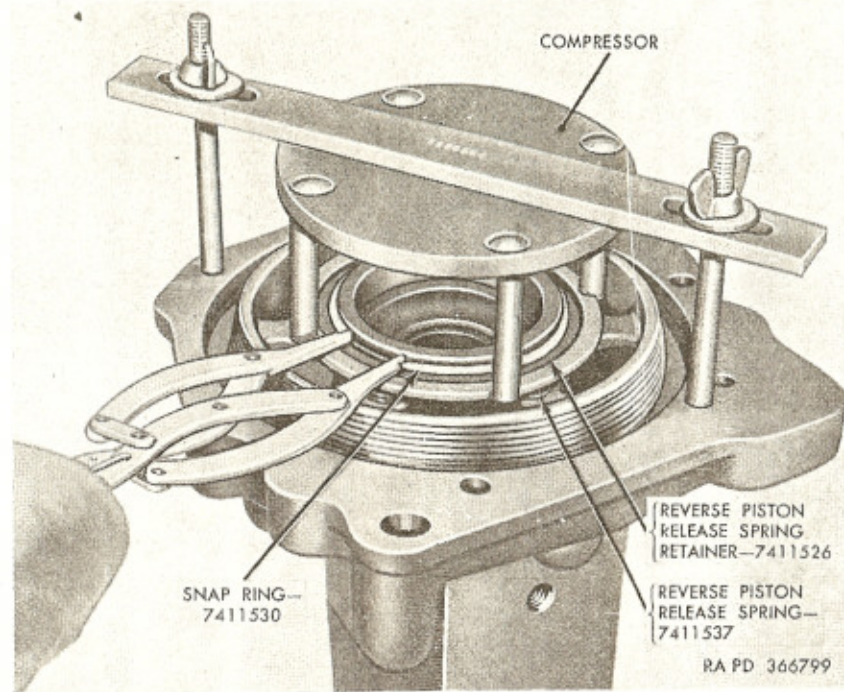


Figure 132. Using compressor—C7950251 to compress reverse piston release springs.

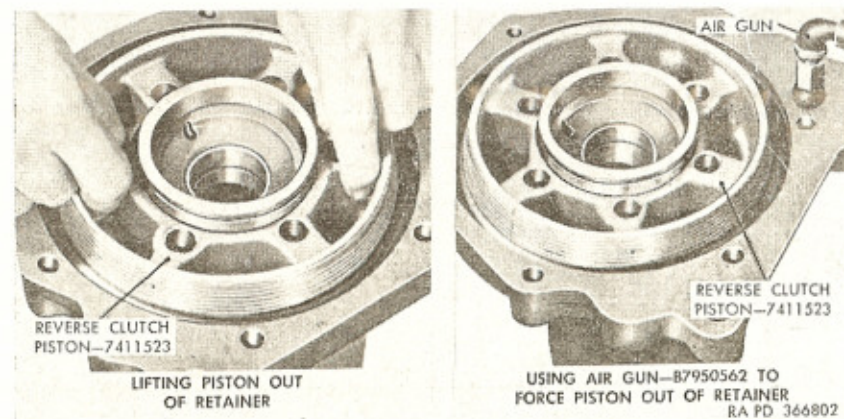


Figure 133. Removing reverse clutch piston from bearing retainer.

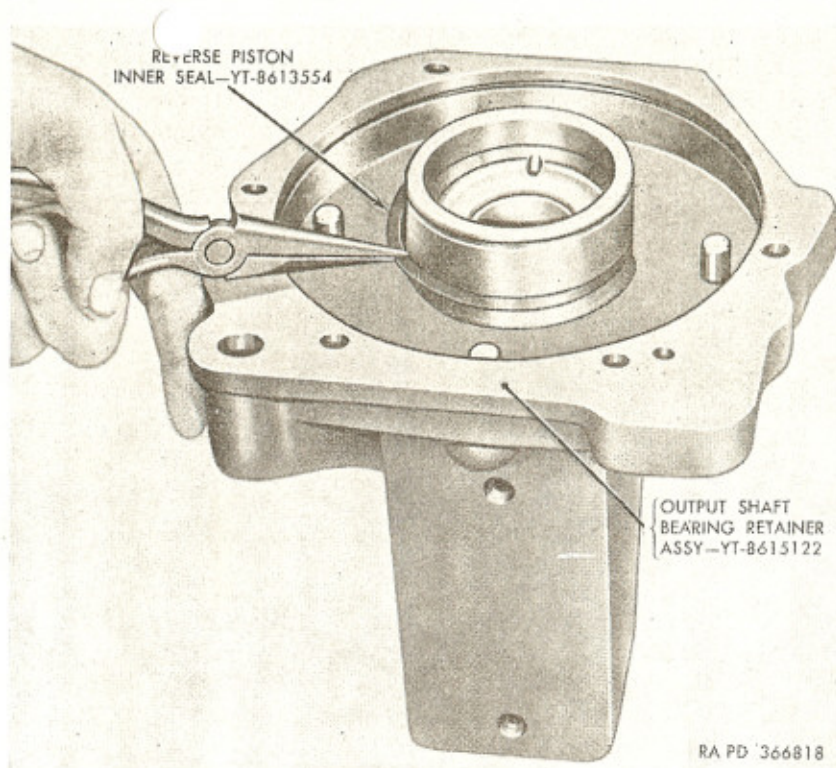


Figure 134. Removing reverse piston inner seal.

(2) Output shaft assembly (C).

- (a) Check looseness of output shaft pinions. Excessive radial looseness indicates worn pins or bearing rollers. Normal pinion end play is 0.005 to 0.026 inch. If excessive radial clearance or end play is evident, shaft assembly must be replaced.
- (b) Examine thrust surfaces on both sides of shaft pinion flange for scoring or wear.
- (c) Measure outside diameter at reverse center gear and output shaft bearing retainer bushing surfaces (par. 164). If excessive wear is evident, replace shaft.
- (d) Check inside diameter of input shaft pilot bushing in output shaft bore (fig. 136). If wear is evident, remove bushing from shaft by threading a tap of correct size into bushing; then pull tap and bushing out of shaft. Press new bushing into shaft and finish to dimensions shown in figure 136.

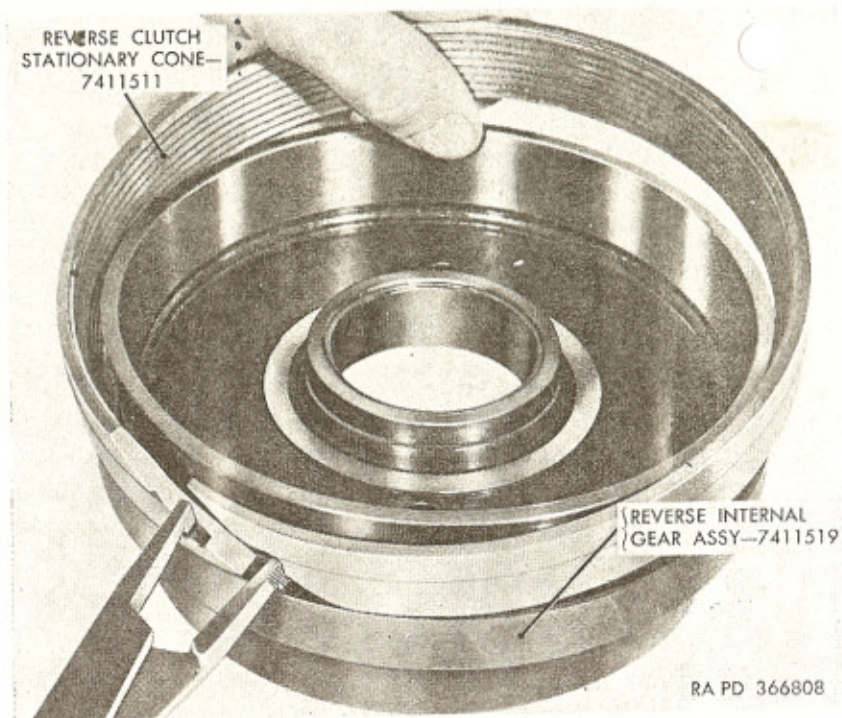


Figure 135. Removing or installing reverse clutch stationary cone.

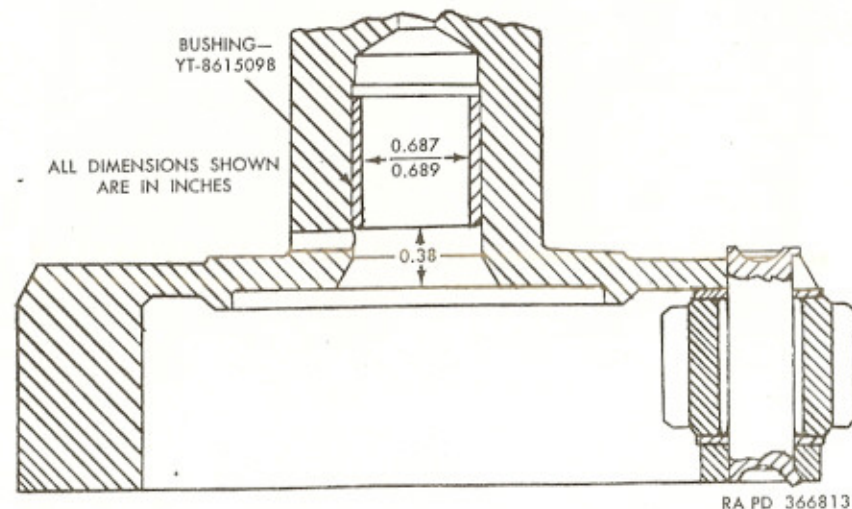


Figure 136. Sectional view of output shaft and bushing.

- (e) Inspect output shaft splines for cracks, nicks, or burs. Slight imperfections may be cleaned up with crocus cloth. If badly damaged, replace shaft assembly.

(3) Reverse center gear assembly (F).

- (a) Examine reverse center gear assembly for damaged gear teeth or distorted flange. Any damage necessitates replacing the gear and flange assembly.
- (b) Check bushing in reverse center gear for wear (fig. 137). If necessary to replace bushing, remove bushing with suitable tool. Press new bushing into place and finish to dimensions shown in figure 137.

(4) Reverse planet carrier assembly (N).

- (a) Check looseness of reverse planet carrier pinions. Excessive radial looseness indicates worn pins or needle bearings. Normal pinion end clearance is 0.005 to 0.026 inch. If excessive radial clearance or end play is evident, replace complete planet carrier assembly.
- (b) Examine splines in reverse planet carrier for evidence of wear or damage. Replace planet carrier assembly if damage is evident.
- (c) Examine bronze oil pump drive gear on hub of planet carrier for damage or evidence of excessive wear. Make sure gear is tight on planet carrier. If wear, damage, or looseness is evident, replace drive gear as shown in 1 through 9 below.

1. Remove snap ring (K) securing rear oil pump drive gear (L) on hub of reverse planet carrier, using snap ring pliers and screwdriver (fig. 138).
2. Place reverse planet carrier assembly in vise equipped with soft jaw protectors; then saw into bronze drive

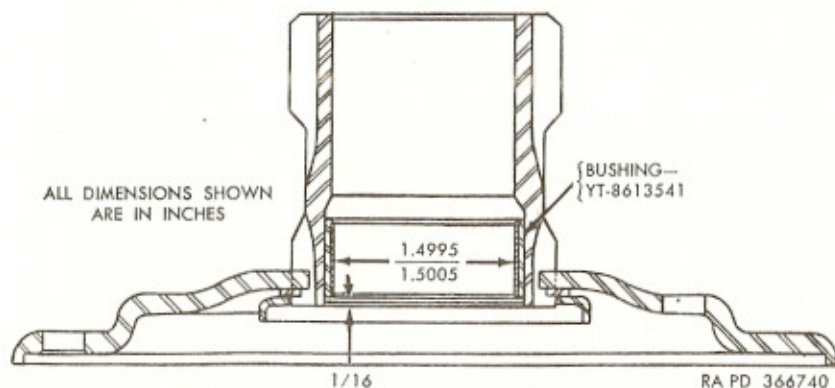


Figure 137. Sectional view of reverse center gear and bushing.

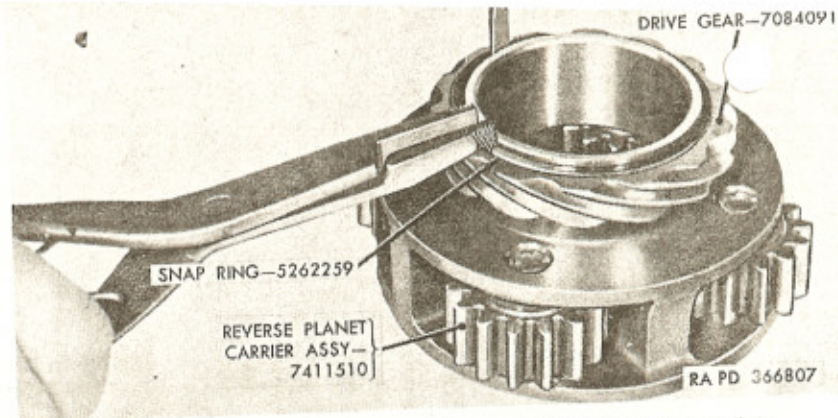


Figure 138. Removing rear oil pump drive gear snap ring.

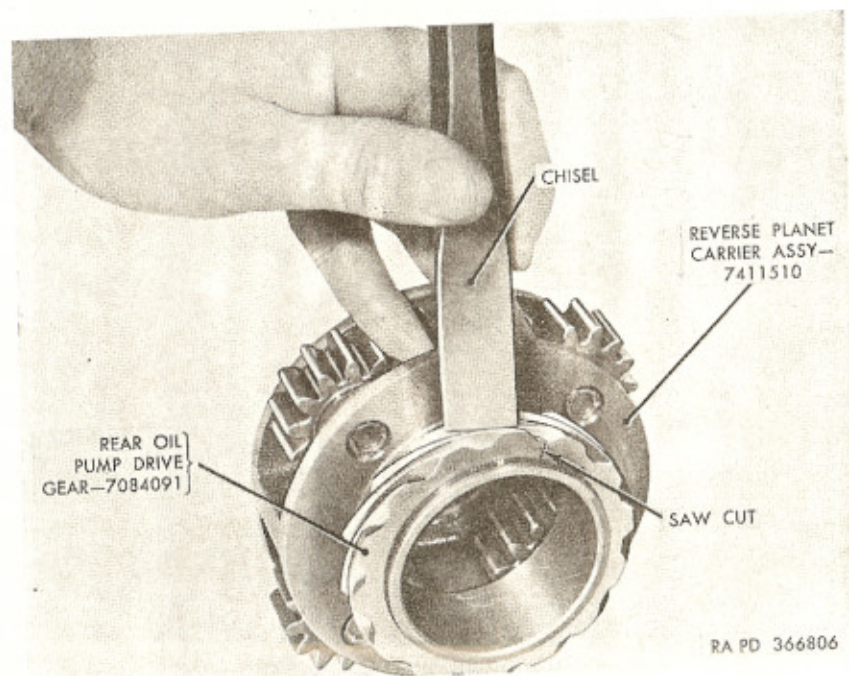


Figure 139. Removing rear oil pump drive gear.

3. Using blunt taper chisel and hammer, remove gear by splitting at saw cut (fig. 139). Use care not to damage hub of planet carrier with chisel.

4. Discard steel ball (M) which locates drive gear on planet carrier hub.
5. Clean all parts thoroughly (b above). Smooth up surface of planet carrier hub with crocus cloth. Make sure snap ring groove is clean and not damaged.
6. Place new drive gear locating ball (M) in notch in planet carrier hub. Use artillery and automotive grease (GAA) to hold ball in place.
7. Place new drive gear on a metal plate supported by two bricks; then use a torch to heat gear (fig. 140) until it just begins to discolor or show traces of turning blue. Temperature must not exceed 800°F.
8. The face of drive gear having the forged depression goes down toward shoulder of planet carrier. With heavy asbestos gloves, pick up drive gear and quickly drop it over hub of planet carrier with groove in gear over locating ball. Push gear down until it bottoms against shoulder of planet carrier.
9. Install new snap ring (K) to secure drive gear on planet carrier.

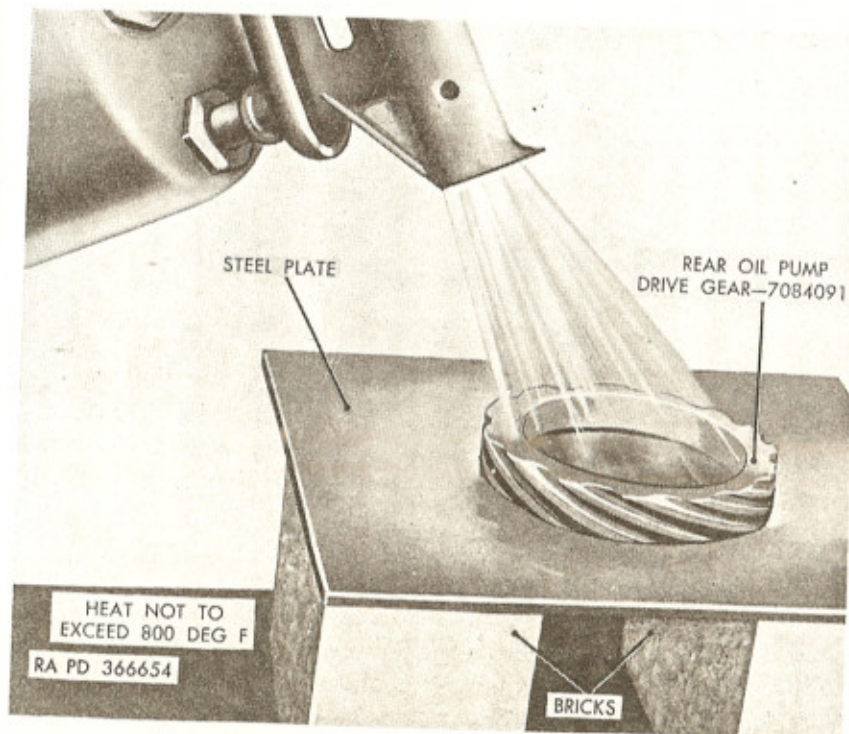


Figure 140. Heating rear oil pump drive gear.

- (5) *Reverse internal gear assembly (R)*.
 - (a) Inspect reverse internal gear for chipped, cracked, or excessively worn internal gear teeth. Also check for evidence of scored or burned cone surface. Reverse internal gear must be magnafluxed or inspected with black light before installation in the transmission. Magnaflux gear circumferentially with gear inside the coil. Inspect for hardening or fatigue cracks. If any cracks are noted, the gear must be discarded. Superficial cracks in the gear hub surfaces normally do not result in gear failure and do not make replacement necessary. Gear must be free of all magnafluxing compound before use.
 - (b) Check bushing in gear hub for wear (par. 164) or damage. If necessary to replace bushing, press bushing out. Press new bushing into place and finish to dimension shown in figure 141. Be sure groove in bushing is toward gear teeth as shown (fig. 141).
- (6) *Reverse clutch stationary cone (R)*.
 - (a) Check fit of reverse clutch stationary cone key (Q) in notches in reverse clutch stationary cone (R). If key or notches show evidence of wear or damage, replace with new parts.
 - (b) Inspect lining on cone for evidence of burning and for wear (par. 164). If lining is worn down to bottom of grooves, replace cone and lining assembly.

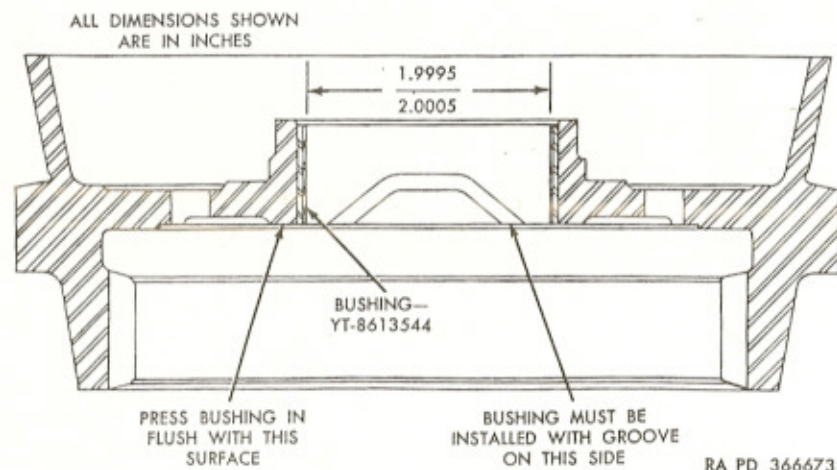


Figure 141. Sectional view of reverse internal gear and bushing.

(7) Reverse clutch piston (W).

- (a) Inspect reverse clutch piston lining for wear (par. 164) or damage. If face of lining is worn down to bottom of grooves, replace piston assembly.
 - (b) Inspect piston for burning or scoring of cone surface.
 - (c) Make sure clutch piston seal groove is clean and not damaged.
 - (d) Check inner seal contact area of clutch piston for nicks, burs, or scoring.
 - (e) Inspect clutch piston guide pin holes for dirt, nicks, or damage.
 - (f) Remove burs from clutch piston with crocus cloth. If any of the other conditions are evident, replace piston.
- (8) Output shaft bearing retainer assembly (AA).

- (a) Inspect gasket areas for nicks or burs.
- (b) Inspect reverse clutch piston and stationary cone bores for nicks, scores, or other damage.
- (c) Make sure reverse clutch piston inner seal groove in hub of retainer is clean and not damaged.
- (d) Inspect entire casting for cracks and for damaged threads in tapped holes.
- (e) Check reverse clutch piston dowel pins for looseness or distortion.
- (f) Check output shaft ball bearing bore in retainer for wear (par. 164).
- (g) Inspect output shaft bushing in bearing retainer for wear (fig. 142) or damage. If bushing is worn or damaged, press old bushing out of retainer, press new bushing into place, and finish to dimension shown in figure 142.

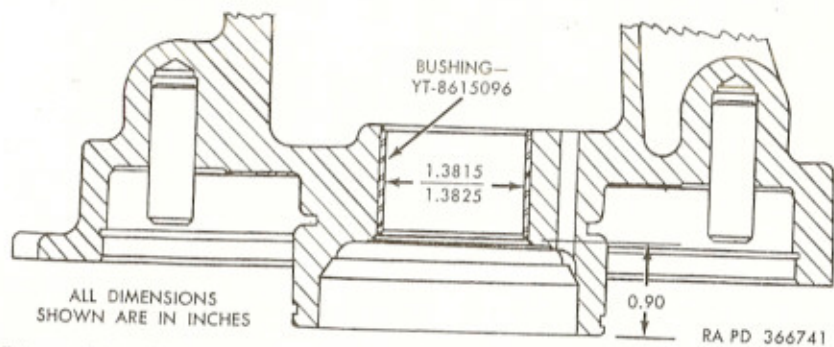


Figure 142. Sectional view of output shaft bearing retainer and bushing.

- (h) Small nicks and burs may be removed with crocus cloth. Any other damage necessitates replacement of retainer assembly.
- (9) Output shaft ball bearing (EE). Clean, inspect, and lubricate output shaft ball bearing as directed in TM 37-265.
- (10) Thrust washers (B, D, E, and S). Check thrust washers for wear (par. 164). Replace with new parts if not within limits listed.
- (11) Reverse piston release springs (V). Check springs for free length and compression (par. 164). Replace with new springs if not within limits listed.

107. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 129.

a. Coat steel backing washer (E) lightly with artillery and automotive grease (GAA); then place backing washer and bronze thrust washer (D) in cupped retainer in reverse center gear assembly (F) (fig. 143).

b. Insert end of output shaft assembly (C) through washers and reverse center gear; then lift reverse center gear up against planet end of output shaft. Hold parts firmly together to prevent thrust and backing washers from getting out of place while turning the assembly over and setting on bench.

c. Install snap ring (J) in groove in output shaft at end of reverse center gear hub, using snap ring pliers.

Note. Snap ring (J) and spring retainer (DD) are similar in appearance. Make sure larger snap rings (J) are used on either side of reverse planet carrier assembly (N) and the smaller spring retainers (DD) are used on either side of output shaft ball bearing (EE).

d. Install reverse planet carrier assembly (N) over output shaft (fig. 143) with oil pump drive gear down. Position reverse planet carrier assembly on reverse center gear assembly, with pinions in planet carrier meshing with external teeth on reverse center gear. Make sure the reverse planet carrier hub bottoms against the snap ring installed in c above. Install other snap ring (J) in groove in output shaft to hold reverse planet carrier in position.

e. With reverse internal gear assembly (P) positioned on bench as shown in figure 135, use snap ring pliers to expand reverse clutch stationary cone (R) and install cone on gear. Do not expand cone more than necessary to make the installation.

Note. On some units, reverse clutch stationary cone (R) will require less expansion if installed over forward side of reverse internal gear (fig. 135) instead of from rear side.

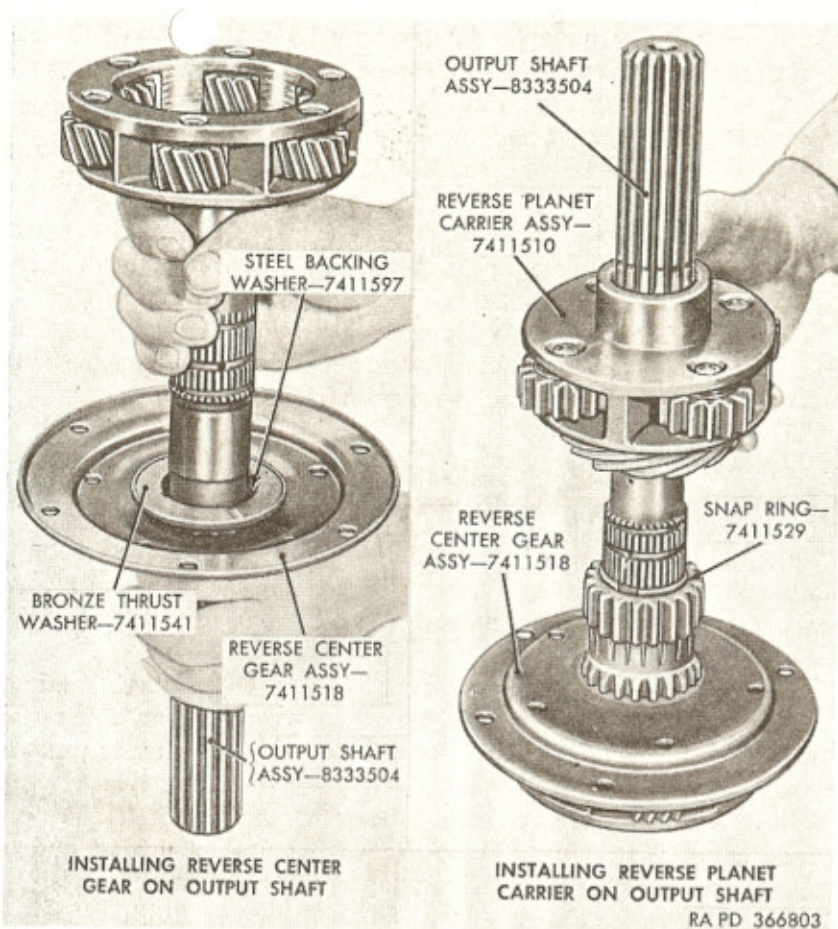


Figure 143. Installing reverse center gear and reverse planet carrier on output shaft.

f. Place reverse internal gear and cone assembly (P and R) over output shaft and position over reverse planet carrier, with internal gear teeth in reverse internal gear meshing with pinions in planet carrier. Place bronze thrust washer (S) over output shaft and position on hub of reverse internal gear assembly (fig. 144).

g. Install new reverse piston inner seal (X) in groove in hub of output shaft bearing retainer (AA), with seal lip pointing toward bottom of reverse clutch piston bore in retainer. Refer to figure 134 for location of seal in retainer.

h. Install new reverse piston outer seal (Y) in groove in outer edge of reverse clutch piston (W), with seal lip pointing toward guide pin hole side of piston.

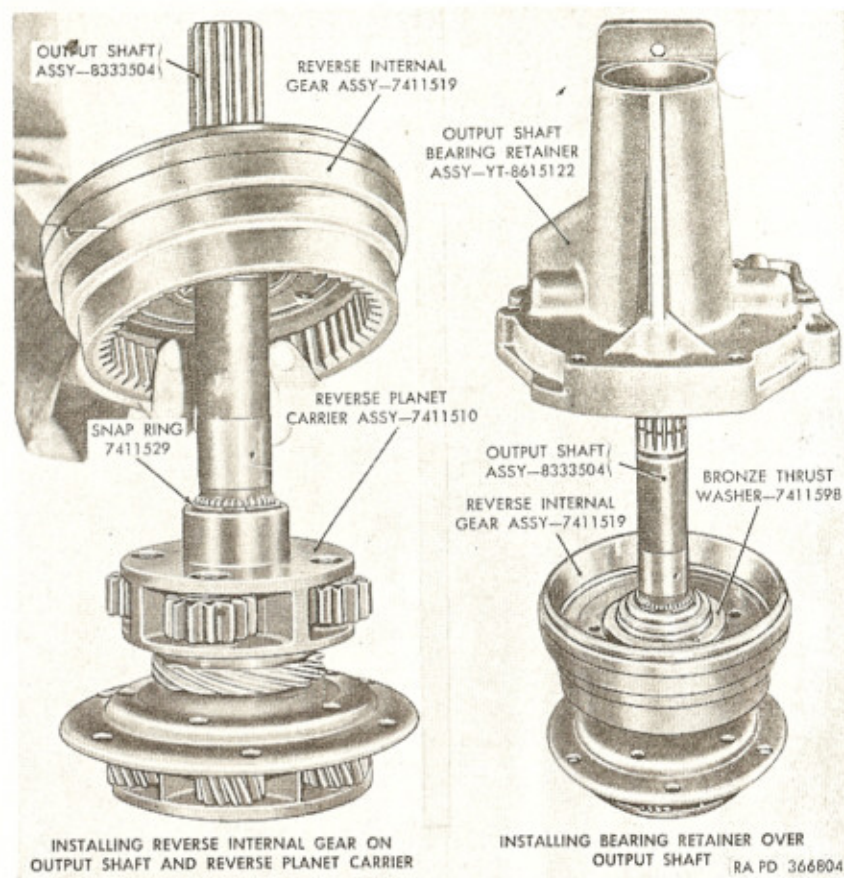


Figure 144. Installing reverse internal gear assembly and output shaft bearing retainer on output shaft.

i. Install reverse clutch piston (W) in output shaft bearing retainer (AA) as shown in (1) through (3) below.

- (1) With output shaft bearing retainer positioned on bench with large end up, position reverse clutch piston (W) over retainer with dowel pin holes in piston *not* aligned with dowel pins in retainer. This prevents piston from entering far enough to damage outer seal.
- (2) Wrap installing tool—A7950335 (fig. 145) around piston and insert into bearing retainer between piston and retainer. Work tool down against ledge in retainer. This will provide a smooth surface inside the bearing retainer, permitting the piston outer seal to pass the ledge without interference or damaging the seal.

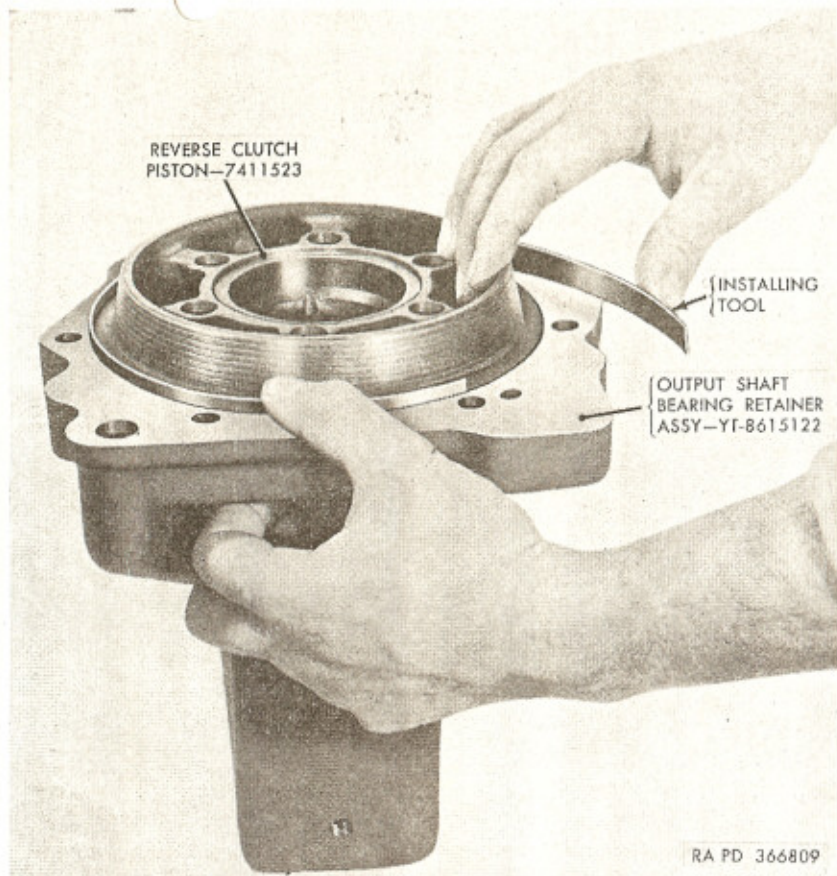


Figure 145. Using installing tool—A7950335 to install reverse clutch piston in output shaft bearing retainer.

(3) Turn piston until dowel pin holes in piston align with dowel pins in retainer; then push piston down into retainer. Remove installing tool.

j. Install six reverse piston release springs (V) in holes in reverse clutch piston; then place reverse clutch piston release spring retainer (U) and retainer snap ring (T) on top of springs.

k. Install spring compressor—C7950251 (fig. 132) on output shaft bearing retainer, with legs on compressor resting on release spring retainer. Turn wing nuts on compressor down to compress springs, forcing spring retainer down beyond the snap ring groove in hub of retainer. Install snap ring (T) in groove in bearing retainer; then remove spring compressor.

l. Install output shaft bearing retainer assembly over output shaft (fig. 144). Carefully lower retainer assembly into place until reverse clutch piston seats in reverse internal gear.

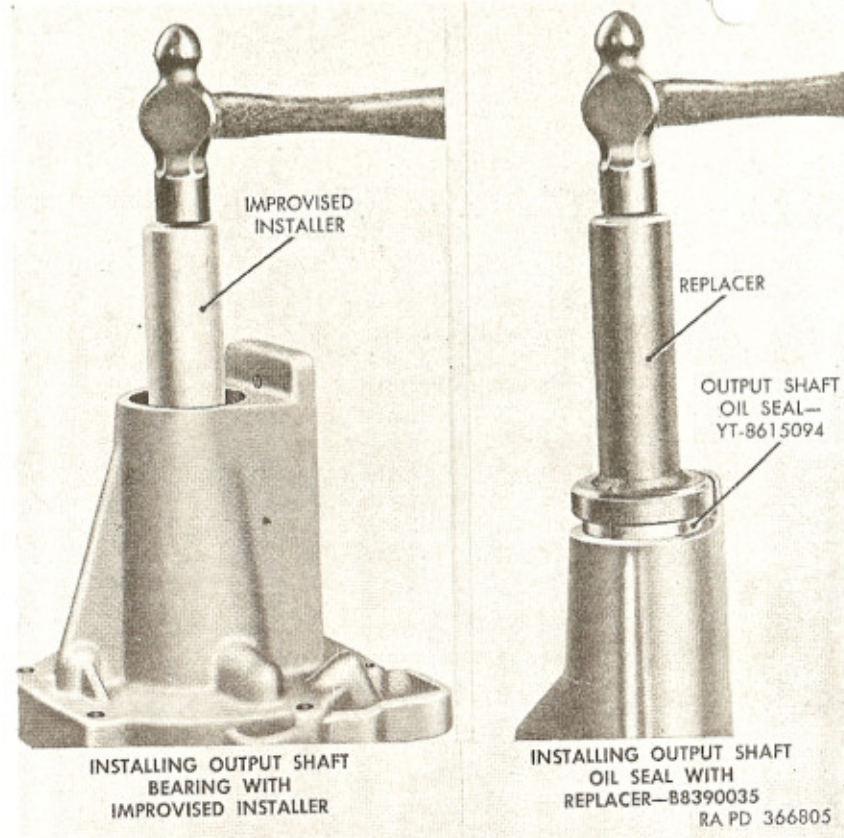


Figure 146. Installing output shaft ball bearing and oil seal.

m. Install output shaft ball bearing inner spring retainer (DD) in inner groove in output shaft bearing retainer, using snap ring pliers (fig. 130).

n. Place output shaft ball bearing (EE) over output shaft and drive into place, using improvised installer and hammer (fig. 146). Drive bearing down until it seats against inner snap ring.

o. Install output shaft ball bearing outer spring retainer (DD) in groove in output shaft at outer side of bearing inner race, using snap ring pliers (fig. 130).

p. Install large snap ring (FF) in groove in output shaft bearing retainer next to bearing outer race, using long nosed pliers (fig. 130).

q. Coat outer circumference of case of output shaft oil seal (GG) sparingly with sealing compound; then place oil seal over output shaft with seal lip down toward bearing. Using oil seal

replacer—1 00035 (fig. 146) and hammer, drive oil seal down until seal case seats against shoulder in retainer.

r. Install reverse clutch stationary cone key (Q) in notches in reverse clutch stationary cone, using screwdriver to spread cone enough to permit installing key. Make sure cone is seated against counterbore in bearing retainer.

s. Coat bronze thrust washer (B) lightly with artillery and automotive grease (GAA); then place thrust washer in counterbore in output shaft. Insert end of input shaft into bushing in output shaft, meshing output shaft gear with pinions in output shaft.

Note. If proper input shaft end play was indicated by check made during the disassembly of transmission (par. 62) and the same parts are to be assembled in transmission, use original bronze thrust washer (B) between input shaft and output shaft. If improper input shaft end play was indicated or if any parts were replaced which would affect the end play, use new selective size bronze thrust washer (B) (see table VII, par. 136). Proper thickness of thrust washer will be determined later when making the input shaft end play check (par. 136) during the assembly of the transmission.

Section IX. REBUILD OF INPUT SHAFT, REVERSE UNIT, AND OUTPUT SHAFT (303M ONLY)

108. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 147.

a. Pull input shaft (A) from output shaft assembly (C).

b. Remove bronze thrust washer (B) from counterbore of output shaft assembly.

c. Remove reverse internal gear assembly (M) and reverse clutch stationary cone (N).

d. Remove reverse clutch stationary cone key (P). With snap ring pliers, expand cone; then carefully remove reverse clutch stationary cone (fig. 135) from reverse internal gear.

Caution: Do not expand stationary cone more than absolutely necessary for removal, as cone may be damaged.

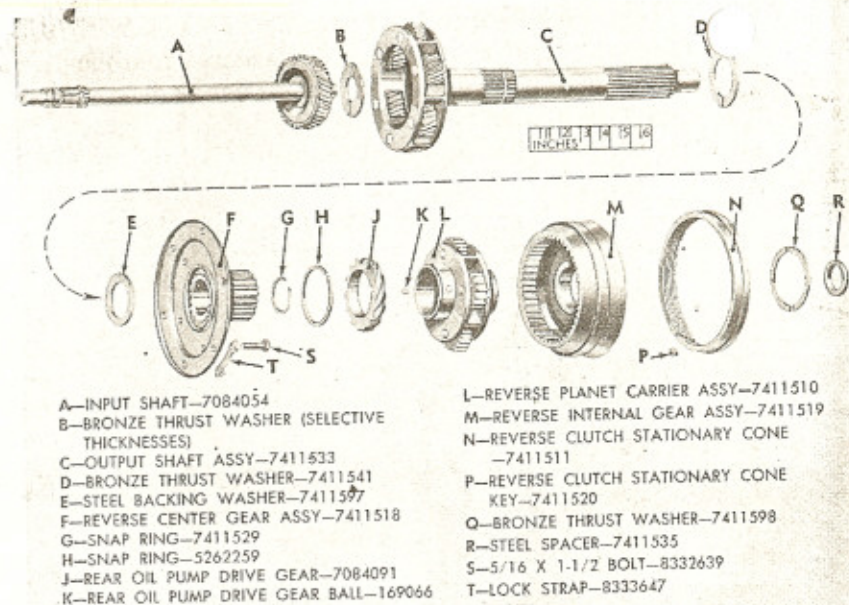
e. Slide reverse planet carrier assembly (L), off output shaft assembly (C).

Note. Do not remove rear oil pump drive gear (J) from reverse planet carrier assembly (L) until inspected as described in paragraph 106c(4).

f. Remove reverse planet carrier assembly (L) locating snap ring (G).

g. Remove reverse center gear assembly (F).

h. Remove steel backing washer (E) and bronze thrust washer (D).



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Figure 147. Output shaft, reverse unit, and input shaft (303M).

109. Inspection and Repair

Refer to paragraph 106 for inspection and repair of output shaft, reverse unit, input shaft, and parts. Paragraph 106, covering inspection and repair of 301MG transmission parts which are similar, will apply. Refer to paragraph 165 for repair and rebuild standards of parts when necessary.

110. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 147.

a. Coat steel backing washer (E) and bronze thrust washer (D) lightly with artillery and automotive grease (GAA). Install the steel backing washer (E); then install the bronze thrust washer (D) in the recess of the drive flange of center gear assembly (fig. 143).

Note. The thrust washers must be installed in drive flange of center gear assembly (fig. 143) and not on the shaft.

b. Insert end of output shaft assembly (C) through drive flange of reverse center gear assembly until carrier assembly end of output shaft bottoms on the backing and thrust washers (fig. 143).

c. While holding drive flange of the reverse center gear tightly against end of output shaft to keep thrust washers from moving, set output shaft assembly on table on the carrier end.

d. Install front snap ring (G).

e. Coat selective size bronze thrust washer (B) lightly with artillery and automotive grease (GAA); then insert thrust washer into counterbore of output shaft. Insert input shaft (A) into output shaft assembly (C), meshing pinion of output shaft assembly with teeth of input shaft.

Note. If proper input shaft end play was indicated by check made during the disassembly of transmission (par. 62) and the same parts are to be assembled in transmission, use original bronze thrust washer (B) between input shaft and output shaft. If improper input shaft end play was indicated or if any parts were replaced which would affect the end play, use new selective size bronze thrust washer (B) (see table VII, par 136). Proper thickness of thrust washer will be determined later when making the input shaft end play check (par. 140) during the assembly of the transmission.

f. Install reverse clutch stationary cone (N) on reverse internal gear assembly (M). Use snap ring pliers to spread reverse clutch stationary cone (fig. 135) for installation.

Caution: Do not expand cone more than necessary to make the installation, as cone may be damaged.

g. Using screwdriver, spread ends of stationary cone (N) slightly; then insert reverse clutch stationary cone key (P).

Note. Reverse internal gear assembly will be installed after tightening reverse center gear attaching bolts during assembly of transmission.

Section X. REBUILD OF OUTPUT SHAFT BEARING RETAINER (303M ONLY)

111. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 148, except where otherwise indicated.

a. Remove two oil seal rings (M) from hub of output shaft bearing retainer assembly (J). Discard oil seal rings.

b. Remove two studs (K) from output shaft bearing retainer assembly (J).

c. Remove reduction clutch piston seal (A, fig. 178) from groove in output shaft bearing retainer assembly (J). Discard seal.

d. Mount spring compressor—C7950251 (fig. 149) on output shaft bearing retainer assembly (J). Tighten wing nuts to compress reverse piston release springs (P). Remove snap ring (C) and discard. Remove compressor. Remove reverse piston

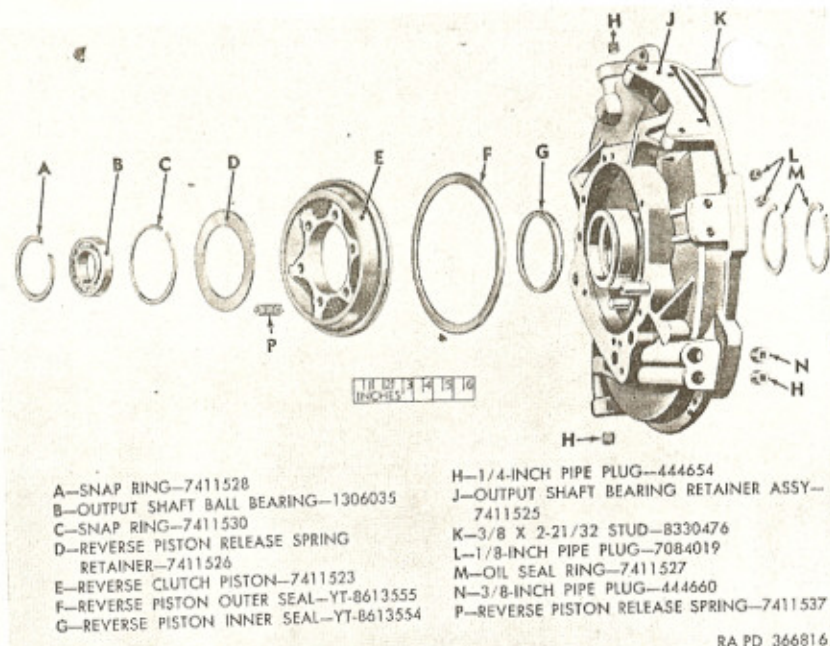


Figure 148. Output shaft bearing retainer assembly components (303M).

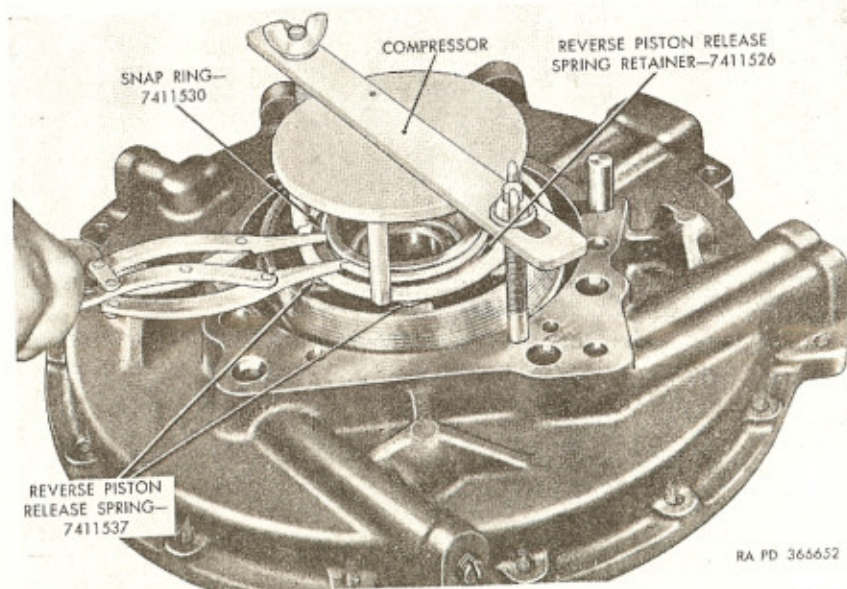


Figure 149. Use of compressor—C7950251 to compress reverse piston release springs.

release spring retainer (D) and six reverse piston release springs (P).

e. Pull reverse clutch piston (E) straight out from output shaft bearing retainer assembly (J). Piston is seated on four guide pins and cannot be rotated.

Note. If piston is difficult to remove, use air gun—B7950562 (fig. 150) and apply air pressure through hole in bearing retainer to force piston up out of retainer.

f. Using long-nose pliers as shown in figure 151, remove reverse piston outer seal (F) from reverse clutch piston (E) and remove reverse piston inner seal (G) from bearing retainer hub. Discard seals.

g. Remove snap ring (A) holding output shaft ball bearing (B) in bearing retainer (fig. 152), using screwdriver. Discard snap ring. Tap ball bearing out of retainer, using hammer and block of wood.

h. Remove six pipe plugs (H, L, and N) from around edge of bearing retainer.

112. Cleaning and Inspection

Note. The capitalized key letters shown below in parentheses refer to figure 148. Refer to paragraph 166 for repair and rebuild standards.

a. *Cleaning.* Clean all parts except ball bearing thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Do not immerse reverse clutch piston (E) in solution. Wipe this part clean using cloth dampened with thinner. Blow out all internal passages of parts with compressed air. Dry parts by playing an air stream across parts until thoroughly dry or by wiping

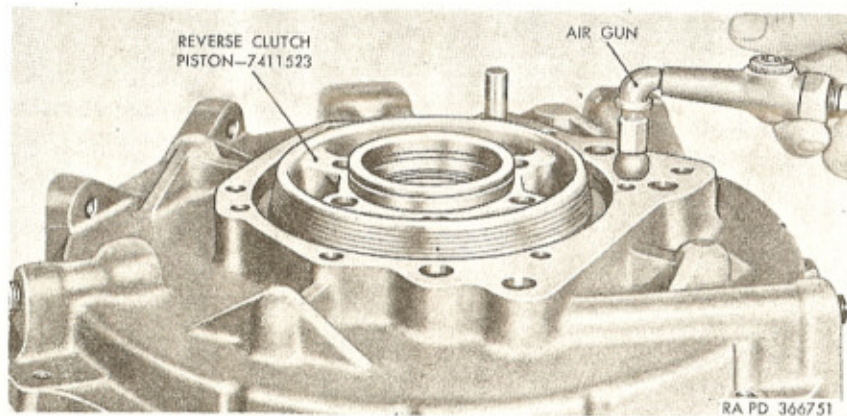


Figure 150. Use of air gun—B7950562 to remove reverse clutch piston.

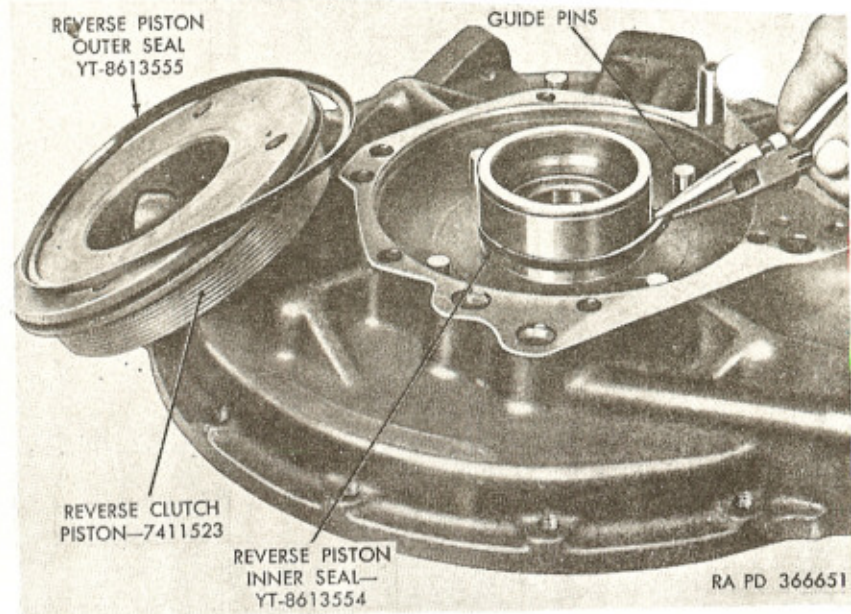


Figure 151. Removing seals from output shaft bearing retainer and reverse clutch piston.

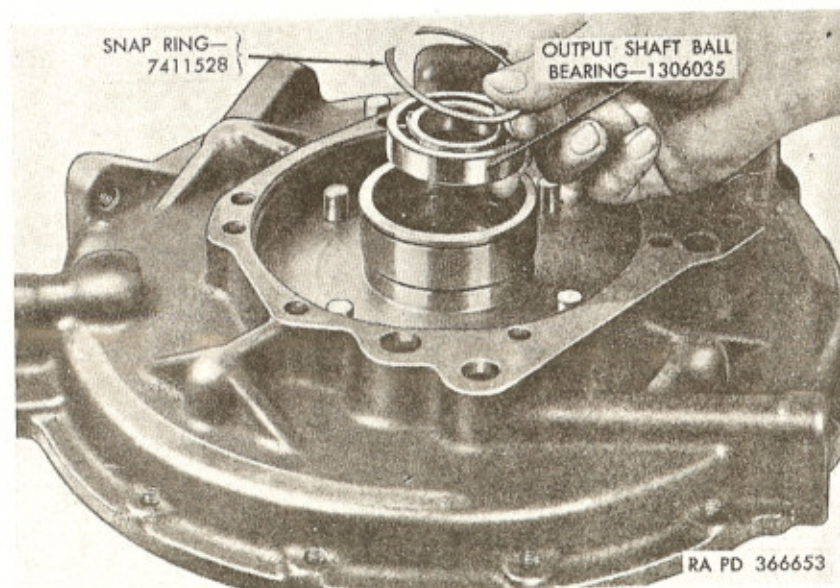


Figure 152. Output shaft bearing and snap ring removed from bearing retainer.

with lint-free cloth. Refer to TM 37-265 for cleaning of ball bearing.

b. Inspection.

(1) *Bearing retainer.*

- (a) Check gasket surfaces on output shaft bearing retainer assembly (J) for nicks or burs. Smooth roughened surface, if necessary, with crocus cloth and re-clean.
- (b) Inspect reverse clutch and reduction clutch piston bores in bearing retainer for nicks or scores.
- (c) Check seal grooves and seal ring grooves for signs of damage.
- (d) Examine entire surface of bearing retainer. Replace part if damage is such that repair is not practical.
- (e) Check all dowel pins. Replace loose or damaged pins.
- (f) Examine threads of pipe plugs (H, L, and N). Replace plugs having damaged threads.

(2) *Reverse clutch piston.*

- (a) Inspect lining of reverse clutch piston (E) for evidence of overheating, excessive wear, or damage. Replace piston if lining is worn to bottom of grooves.
- (b) Inspect seal groove, inner seal contact surface, and guide pin holes in piston for nicks, scratches, or other signs of damage. Remove surface roughness, if necessary, with crocus cloth.
- (c) Inspect entire surface of piston for cracks. Replace piston with new parts, if damage is such that repair is not practical.

(3) *Thrust washer, spacer, and spring retainer.*

- (a) Check bronze thrust washer (Q, fig. 147) for scoring or excessive wear.
 - (b) Check steel spacer (R, fig. 147) for nicks, scratches, or excessive wear.
 - (c) Inspect reverse piston release spring retainer (D) for signs of damage.
 - (d) Remove surface roughness, if necessary, with crocus cloth. Replace damaged or badly worn parts.
- (4) *Release springs.* Check six reverse piston release springs (P) for free length and compressed length. Replace broken spring or springs not meeting standards.

(5) *Output shaft bearing.*

- (a) Measure inside and outside diameter of output shaft ball bearing (B). Check fit of bearing in bore of output shaft bearing retainer assembly (J).

- (b) Inspect and lubricate output shaft ball bearing (B) as directed in TM 37-265.

113. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 148. All parts must be thoroughly lubricated with engine oil (OE-10) before assembly.

- a. Install the following parts in output shaft bearing retainer assembly (J): three 1/4-inch pipe plugs (H) and tighten to 8 to 10 pound-feet torque; two 1/8-inch pipe plugs (L) and tighten to 15 to 18 pound-feet torque; and one 3/8-inch pipe plug (N) and tighten to 18 to 23 pound-feet torque.

b. Install new reverse piston inner seal (G), with lip downward, in hub seal groove of bearing retainer.

c. Install a new reverse piston outer seal (F) on reverse clutch piston (E) with lip of seal toward piston guide pin holes. Refer to figure 151. Work seal well down into groove of piston.

d. Install reverse clutch piston (E) in bearing retainer as shown in (1) through (3) below.

- (1) Place piston in bearing retainer so that guide pins are not aligned with holes in piston. Pins hold piston out far enough to prevent damage to seal.
- (2) Wrap tool—A7950335 (fig. 153) around piston inside bearing retainer. Work tool down against shoulder in bearing retainer. Use of tool permits seal to slide past shoulder.

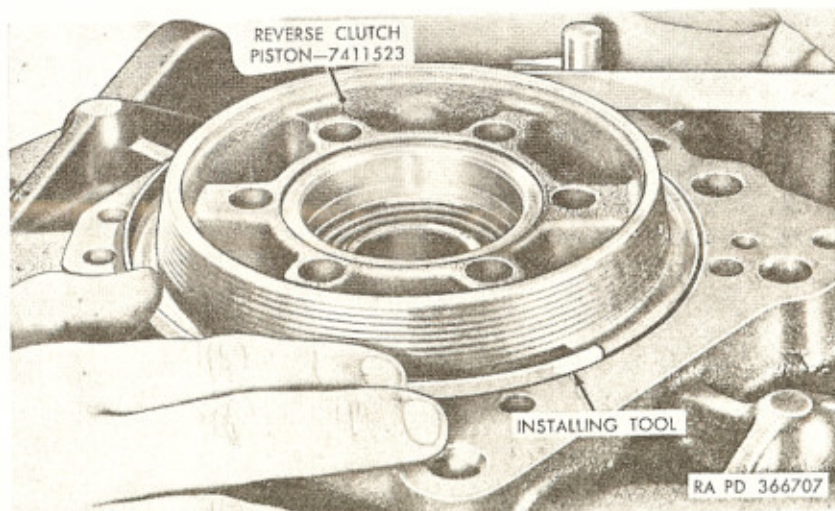


Figure 153. Using tool—A7950335 to install reverse clutch piston assembly.

(3) ^{ROTATE} Rotate the piston so that guide pins align with holes in piston. Ease piston past shoulder into place. Remove tool.

e. Insert six reverse piston release springs (P) in reverse clutch piston (E).

f. Place reverse piston release spring retainer (D) and new snap ring (C) on reverse piston release springs (P). Compress springs with compressor—C7950251 (fig. 149).

g. Install snap ring (C) to lock spring retainer in place; then remove compressor.

h. Using block of wood and hammer, tap output shaft ball bearing (B) into bearing retainer until bearing bottoms squarely.

i. Insert new snap ring (A) in bearing retainer and seat firmly in groove, locking bearing in place.

j. Turn bearing retainer on opposite side and install two new output shaft bearing retainer oil seal rings (M) on retainer hub.

k. Install new reduction clutch piston seal in bearing retainer (fig. 154) with lip of seal down.

l. Install two $\frac{3}{8} \times 2\frac{1}{2}$ studs (K) in bearing retainer. Tighten to 23 to 28 pound-feet torque.

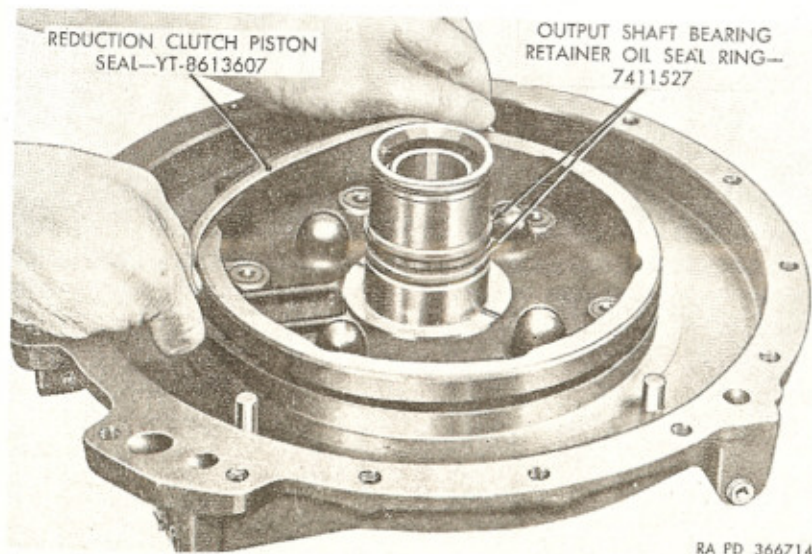


Figure 154. Installing reduction clutch piston inner seal.

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Section XI. REBUILD OF REDUCTION UNIT CONTROL VALVE ASSEMBLY (303M ONLY)

114. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 155. Be careful when separating control valve cover (B) and body (Y). Do not lose accumulator check valve (JJ), accumulator check valve spring (T), detent ball (X), and detent ball spring (W). These parts are illustrated in a view of control valve with cover removed (fig. 156).

a. Remove two bolts (D) and lockwashers (C) attaching control valve cover (B) to body (Y); then separate cover from body. Remove and discard body spacer plate gasket (V).

b. With a pin punch, drive control lever pin (F) from the control lever assembly (L).

c. Remove control lever washer (E) and O-ring gasket (G) from control lever shaft; then remove control lever assembly (L) from cover (B).

d. Remove body spacer plate (U). Remove and discard cover gasket (A). Remove control lever inner seal (H), control lever outer and inner washers (J and K), reduction blocker piston (P), reduction blocker piston retainer (M), and reduction blocker piston inhibitor spring (N) from cover (B). Remove reduction blocker line connector (H, fig. 182) from cover.

e. Remove detent ball spring retaining plug (GG) from end of body (Y); then remove detent ball spring (W) and detent ball (X).

f. While holding hand against pressure regulator valve stop plug (CC), unscrew plug from body (Y). Remove and discard pressure regulator valve stop plug washer (BB). Remove pressure regulator valve spring (AA) and pressure regulator valve (Z) from valve body (Y).

g. Remove body plug (DD) from valve body (Y); then tip valve body so that the reduction control valve (EE) will slide out.

h. Do not remove cover check valve spring (Q), cover check valve (R), and cover check valve guide pin (S) from cover (B), unless replacement is necessary as indicated in paragraph 115b(8).

i. Remove pipe plug (HH) from valve body (Y).

115. Cleaning and Inspection

Note. The capitalized key letters shown below in parentheses refer to figure 155. Refer to paragraph 167 for repair and rebuild standards.

a. *Cleaning.* Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Dry parts by playing an

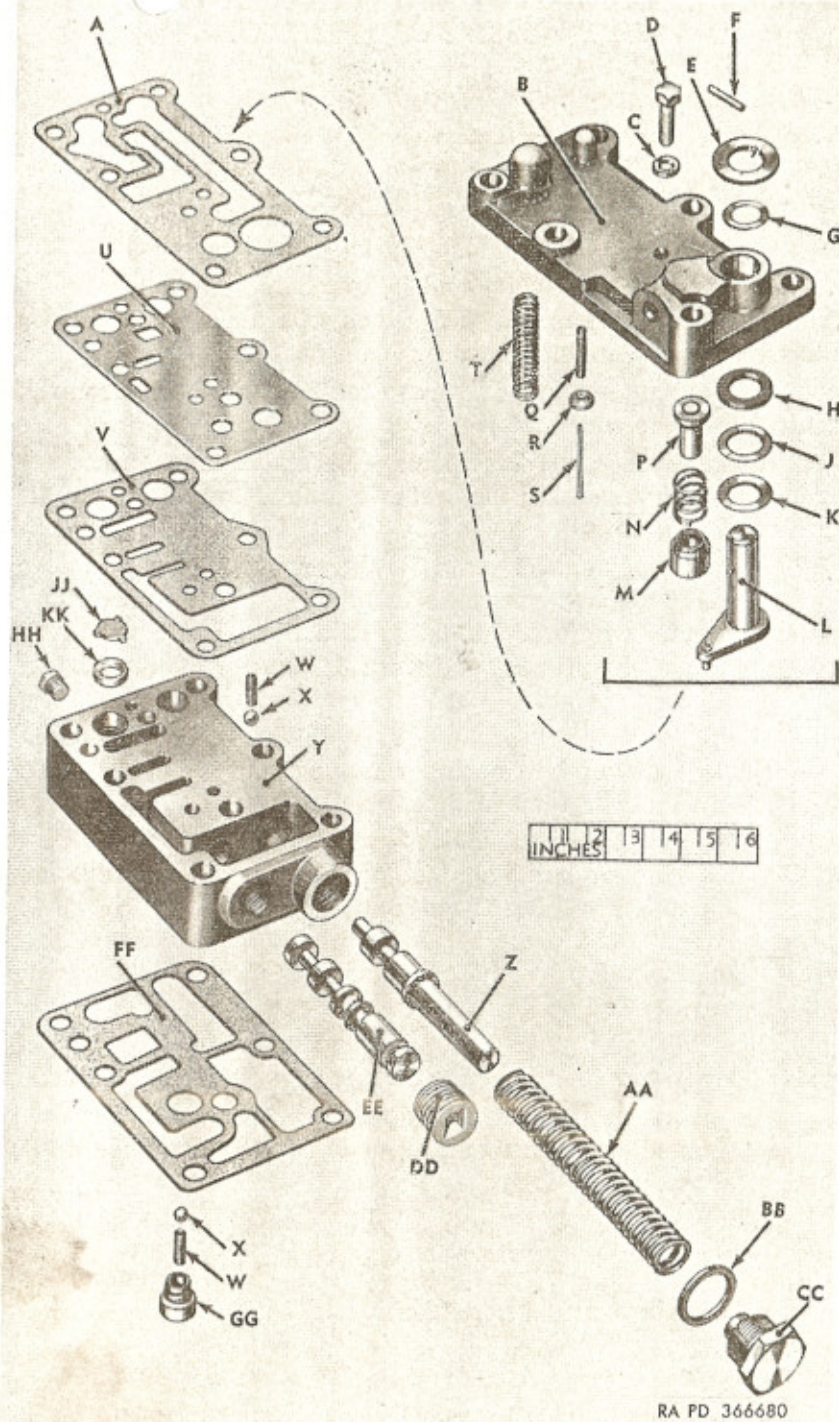


Figure 155. Reduction unit control valve components.

- A—Cover gasket 7411457
- B—Cover YT-8613681
- C— $\frac{1}{4}$ -Inch lockwasher 103319
- D— $\frac{1}{4}$ x 1 Bolt 100110
- E—Control lever washer 7411473
- F—Control lever pin 443127
- G—O-Ring gasket 501223
- H—Control lever inner seal A327516
- J—Control lever outer washer A327514
- K—Control lever inner washer A327515
- L—Control lever assembly 7411461
- M—Reduction blocker piston retainer YT-8614040
- N—Reduction blocker piston inhibitor spring YT-8614033
- P—Reduction blocker piston YT-8614039
- Q—Cover check valve spring A410036
- R—Cover check valve A262254
- S—Cover check valve guide pin YT-8613587
- T—Accumulator check valve spring 7411466
- U—Body spacer plate YT-8613686
- V—Body spacer plate gasket 7411458
- W—Detent ball spring 7411467
- X—Detent ball 169108
- Y—Body YT-8613669
- Z—Pressure regulator valve 7411472
- AA—Pressure regulator valve spring 7411468
- BB—Pressure regulator valve stop plug washer 7411456
- CC—Pressure regulator valve stop plug 7411261
- DD—Body plug YT-8614229
- EE—Reduction control valve 7411471
- FF—Reduction unit control valve gasket 7411459
- GG—Detent ball spring retaining plug 7411463
- HH— $\frac{1}{4}$ -Inch pipe plug 103883
- JJ—Accumulator check valve 7411470
- KK—Accumulator check valve seat 7411465

Figure 155—Continued.

air stream across parts until dry or by wiping dry with lint-free cloth. Blow out all passages with compressed air.

b. Inspection.

- (1) *Valve body and cover.* Inspect control valve body (Y) and cover (B) for damage (cracks, nicks, burs, or scores) on surfaces. Check on surface plate for warpage. Small burs may be removed with crocus cloth. Blow out all passages. Inspect tapped holes in cover and body for crossed or stripped threads.
- (2) *Valves.* Inspect reduction control and pressure regulator valves (EE and Z) for damage and for free movement in their bores. With valves and body bores clean and dry, insert each valve in operating position in body (Y). Valves can be assumed to be free in operating positions if they fall of their own weight in their respective bores when valve body is tipped slightly. Burs can be removed by carefully using crocus cloth. When removing burs, do not round sharp edges of valves.

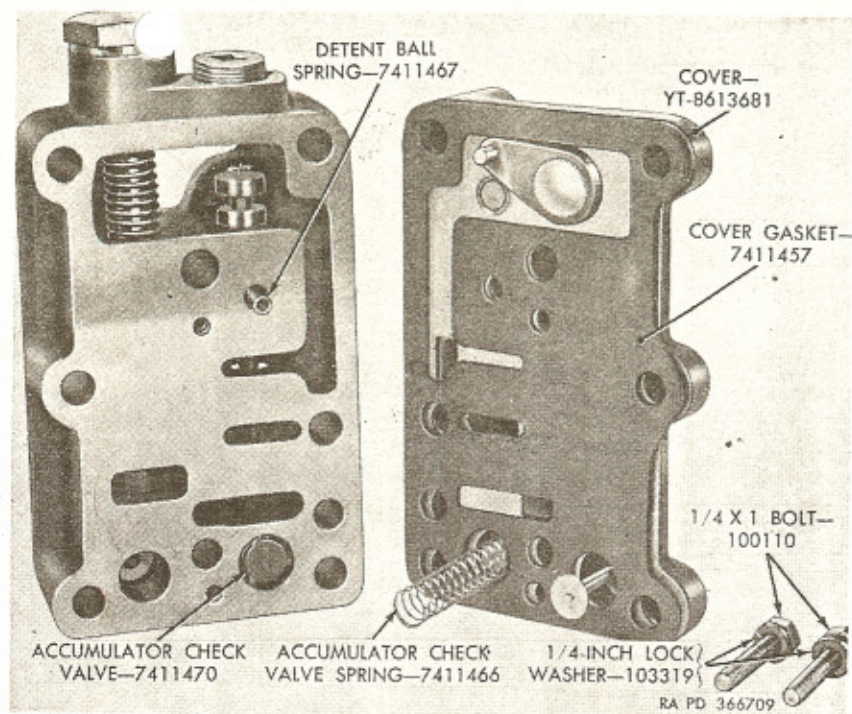


Figure 156. Control valve with cover removed.

- (3) *Springs.* Check all springs (N, Q, T, W, and AA) for free length, compressed length, and distortion (par. 167). Replace with new parts if damaged or weakened.
- (4) *Gaskets.* Discard gaskets (A, G, V, and FF) and pressure regulator valve stop plug washer (BB). Replace with new parts.
- (5) *Seals.* Discard control lever inner seal (H), and control lever outer and inner washers (J and K). Replace with new parts.
- (6) *Spacer plate.* Check body spacer plate (U) for warpage, scores, or nicks. Replace with new part if damaged in any way.
- (7) *Detent balls.* Check detent balls (X) for roughness and out-of-round condition. Replace with new parts if damaged in any way.
- (8) *Cover check valve, guide, and spring.* Inspect cover check valve guide pin (S) in cover for bent or loose condition. Inspect cover check valve (R) for wear and for free movement on guide pin. If check valve, guide pin, or cover check valve spring (Q) are damaged, re-

place all three parts. Pull guide pin (S) ^{OUT OF} cover (B). With new cover check valve (R) and cover check valve spring (Q) installed on new guide pin (S), press guide pin into cover until guide pin extends twenty-seven thirty-seconds of an inch above face of cover.

- (9) *Control lever assembly.* Check fit of shaft on lever assembly (L) in control valve cover (B) (par. 167). Inspect lever to make sure it is not loose on shaft. Check actuating pin in lever for looseness or excessive wear. Replace with new control lever assembly if worn or damaged.
- (10) *Accumulator check valve.* Replace accumulator check valve (JJ) with new part. Accumulator check valve seat (KK) is pressed into body. Removal is necessary only if damage necessitates replacement.

116. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 155. Also refer to figure 156. All parts must be thoroughly lubricated with engine oil (OE-10) before assembly.

- a. Position the reduction unit control valve body (Y) on bench with bottom side up.
- b. Install reduction control valve (EE) in body (Y).
- c. Install lower detent ball (X) in body (Y) into groove in reduction control valve (EE). Install lower detent ball spring (W) and detent ball spring retaining plug (GG) in body (Y).
- d. Turn valve body over; then install upper detent ball (X) and upper detent ball spring (W) in body (Y) into groove in reduction control valve (EE).
- e. Install body plug (DD) into proper bore of body (Y). Tighten plug fingertight.
- f. Install pressure regulator valve (Z), pressure regulator valve spring (AA), new pressure regulator valve stop plug washer (BB), and pressure regulator valve stop plug (CC) in body (Y). Tighten plug fingertight.
- g. Install 1/8-inch pipe plug (HH) in body (Y). Tighten plug fingertight.

Note. Tighten plugs to specified torque after valve is installed on reduction unit (par. 125b).

- h. Position reduction blocker piston (P), reduction blocker piston inhibitor spring (N), and reduction blocker piston retainer (M) in bore of cover (B).
- i. Insert shaft of control lever assembly (L) through proper hole of body spacer plate (U).

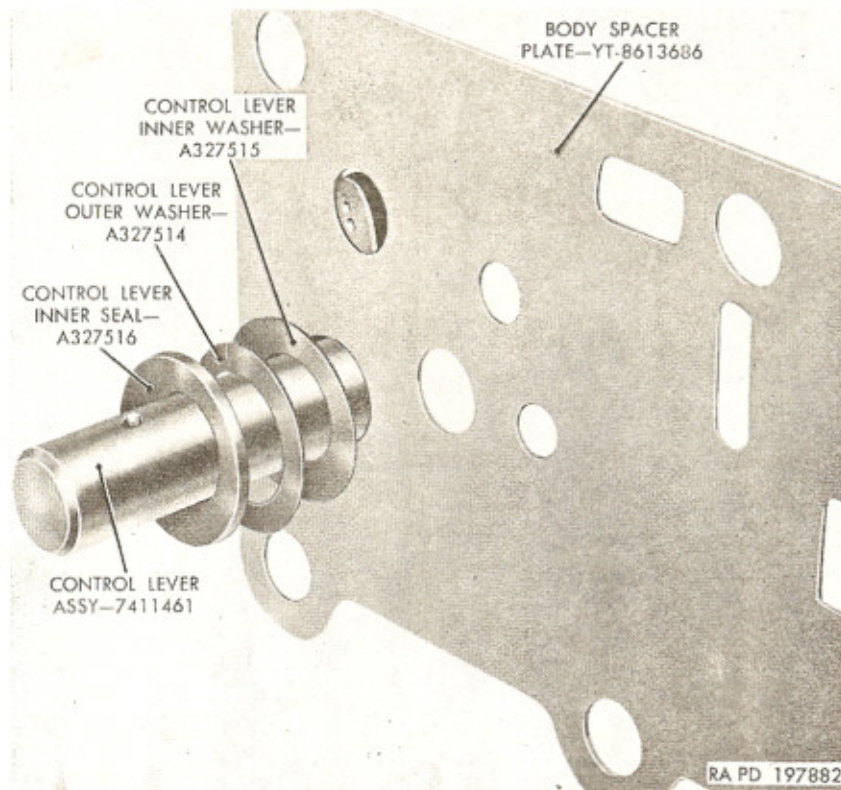


Figure 157. Washers and seal positioned on control lever shaft.

j. Position control lever inner washer (K) (small hole) dished side up, control lever outer washer (J) (large hole) dished side down, control lever inner seal (H) flat side up on shaft of control lever assembly (L). Refer to figure 157.

k. Position new cover gasket (A) on cover (B); then install body spacer plate (U) and control lever assembly (L) in cover (B).

l. Install O-ring gasket (G) and control lever washer (E) on shaft of control lever assembly (L).

m. Install new control lever pin (F) through hole in shaft of control lever assembly (L).

Note. Position cover (B) on body (Y), aligning pin on control lever assembly (L) with groove in reduction control valve (EE). Be certain cover check valve (R) is in line with check valve bore in body (Y). These adjustments are necessary so that parts may be more easily assembled in a later step.

n. Position new body spacer plate gasket (V) on body (Y).

o. Install new accumulator check valve (JJ) in passage of valve body (Y).

p. Position accumulator check valve spring (T) in passage of valve body (Y) over accumulator check valve (JJ).

q. Carefully fit cover (B) on body (Y). Make sure pin on control lever assembly (L) aligns with groove in pressure regulator valve (Z), and cover check valve (R) aligns with opening in valve body (Y) so that no parts will be damaged.

r. Insert four $\frac{3}{8} \times 2\frac{3}{4}$ bolts, one at each corner of control valve assembly, to properly align control valve cover with control valve body.

s. Install two $\frac{1}{4} \times 1$ bolts (D) and $\frac{1}{4}$ -inch lockwashers (C); then with cover and body properly aligned, tighten bolts to 6 to 8 pound-feet torque.

t. Install reduction blocker line connector (H, fig. 182) in cover (B).

u. Turn control lever shaft to see if reduction unit control valve operates smoothly.

Section XII. REBUILD OF REDUCTION UNIT OIL PUMP ASSEMBLY (303M ONLY)

117. Disassembly

a. Remove two bolts and lockwashers attaching pump cover to pump body; then remove pump cover (fig. 158).

b. Before removing the pump drive and driven gears, mark outer face of gears with mechanics blue so that gears may be assembled in same relative position. Remove gears from body.

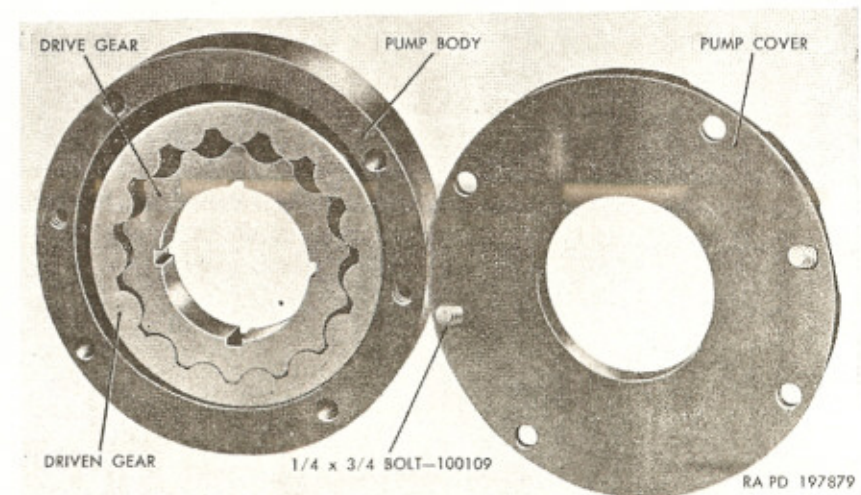


Figure 158. Reduction unit oil pump components.

118. Cleaning and Inspection

- Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Blow out passages in pump body with compressed air. Dry parts by playing an air stream across parts until thoroughly dry or by wiping dry with lint-free cloth.
- Inspect pump body for cracks or damage.
- Inspect gear pocket in body for wear.
- Inspect pump cover for scores. Check cover for warpage on a surface plate.
- Inspect pump gears for wear and broken teeth.
- Check output shaft drive key notches in pump drive gear for damage.

119. Assembly

- All parts should be thoroughly cleaned and liberally oiled with engine oil (OE-10) at time of assembly.
- Install pump drive and driven gears with sides marked with mechanics blue (at disassembly) up in pump body.
- Position pump cover on pump body; then align six holes in cover with six holes in pump body.
- Attach pump cover to pump body with two $\frac{1}{4}$ x $\frac{3}{4}$ bolts and $\frac{1}{4}$ -inch lockwashers. Tighten bolts to 6 to 8 pound-feet torque.
- Check for free movement of oil pump gears by shaking oil pump assembly.

Section XIII. REBUILD OF REDUCTION UNIT ACCUMULATOR ASSEMBLY (303M ONLY)

120. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 159.

a. Fabricate a rod from straight round steel stock $\frac{3}{8}$ inch in diameter, 4 inches long, and chamfer each $\frac{1}{8}$ inch. The rod must be installed in the accumulator before disassembly procedures are started. Remove pipe plug (L) from cover (G); then insert rod into accumulator. Firmly reinstall pipe plug (L) into cover (G).

b. Remove piston seal (B) from accumulator piston (C).

c. Place accumulator assembly under press ram with cover down. Place 1-inch block of wood on each side of piston pin; then lay a flat block across the two blocks (fig. 160). Press accumulator piston down until snap ring (A) can be removed. Be sure accumulator piston (C) comes off piston pin (K) as press

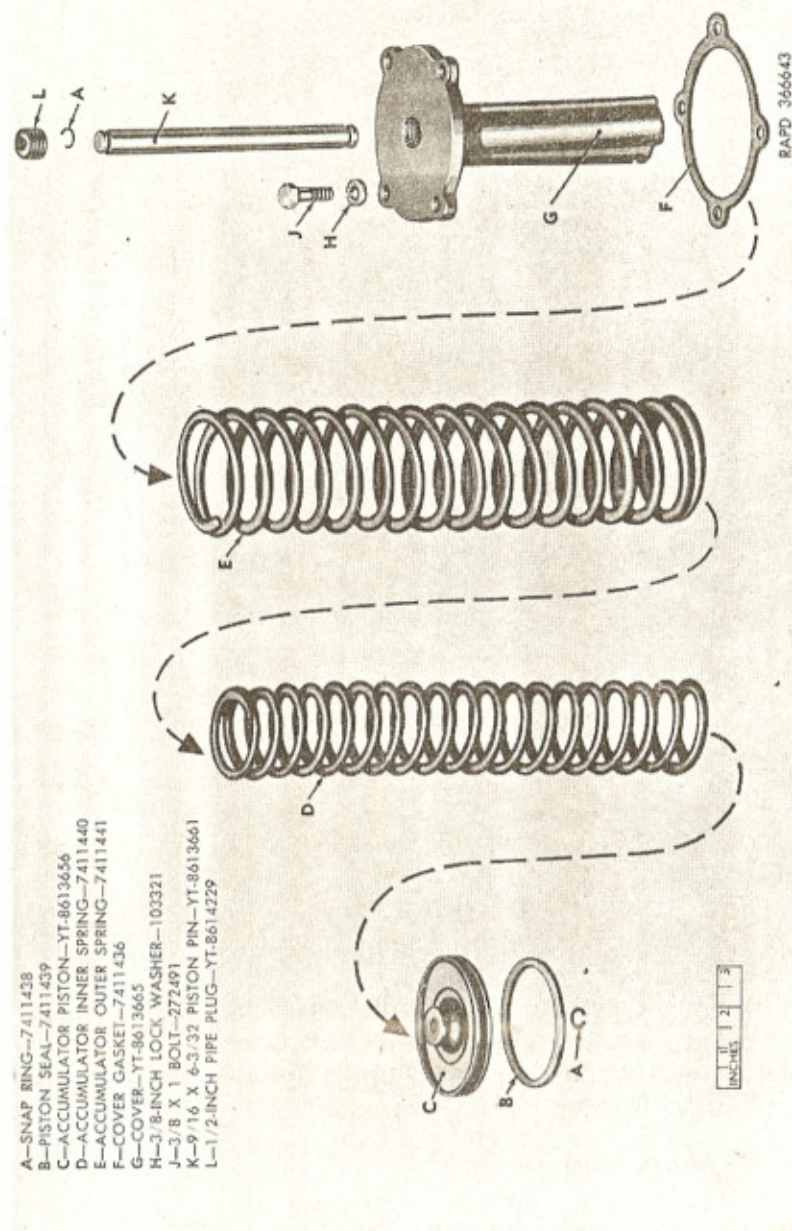


Figure 159. Accumulator assembly components.

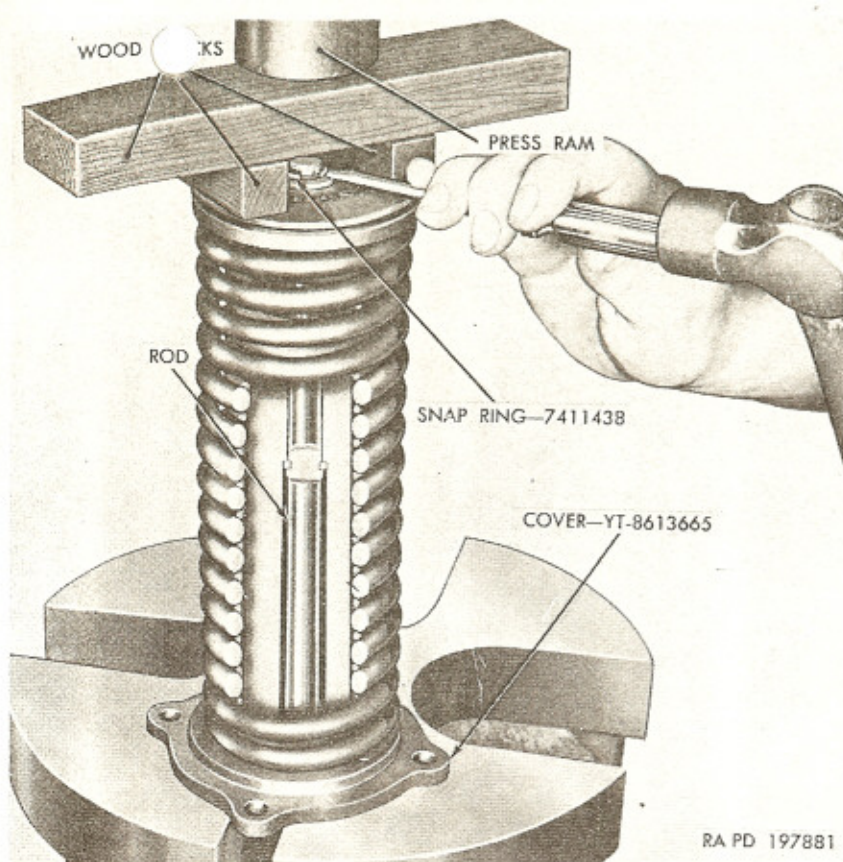


Figure 160. Removing accumulator piston pin snap ring using fabricated accumulator rod.

is released (fig. 160). It may be necessary to tap piston to make it come off pin.

Caution: After removing snap ring, do not remove the assembly from press until piston has been removed.

d. Remove assembly from press.

e. Remove accumulator inner and outer springs (D and E).

f. Remove pipe plug (L) from cover (G); then remove accumulator rod (fig. 160). Remove piston pin (K). Remove snap ring (A) from cover end of piston pin.

121. Cleaning and Inspection

Note. The capitalized key letters shown below in parentheses refer to figure 159. Refer to paragraph 169 for repair and rebuild standards on accumulator assembly components.

a. Clean all parts thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Dry parts by playing an air stream

across parts until they are thoroughly dry or by wiping dry with lint-free cloth.

b. Inspect parts as shown in (1) through (5) below.

(1) *Cover (G)*. Inspect cover for cracks or scores. Check fit of piston pin (K) in cover.

(2) *Piston pin (K)*. Examine snap ring grooves in each end of piston pin for damage. Check pin surface for scoring or excessive wear.

(3) *Accumulator piston (C)*. Examine seal groove for scoring. Check fit of piston pin (K) in piston (par. 169).

(4) *Springs*. Check accumulator inner and outer springs (D and E) for damage. Check free length and compressed length of springs (par. 169).

(5) *Snap rings and seal*. Discard snap rings (A) and piston seal (B).

122. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 159. Liberally lubricate all parts with engine oil (OE-10) before assembling.

a. Install new snap ring (A) on piston pin (K) at cover end.

b. Insert piston pin (K) in hole in cover (G) and install accumulator rod (fig. 160); then install 1/2-inch pipe plug (L) in cover.

c. Position accumulator inner and outer springs (D and E) over cover (G).

d. Position accumulator piston (C) on top of springs with flat side of piston away from springs.

e. Position assembly in arbor press (fig. 160) with cover down.

f. Lubricate piston pin hole in piston to prevent scoring when pressing on pin. Press piston over piston pin far enough to install new snap ring (A).

g. Release press ram. Be sure piston seats against snap ring; then remove assembly from press.

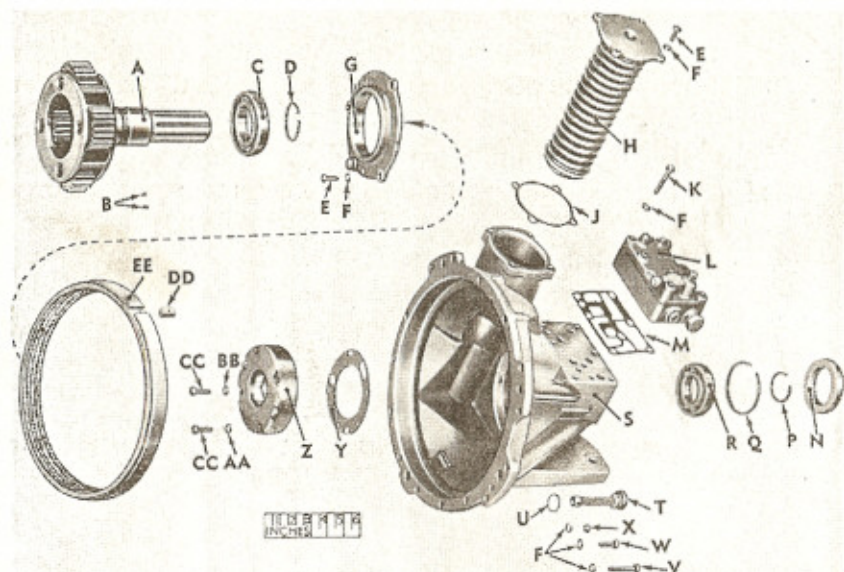
h. Install new piston seal (B) on accumulator piston (C) with lip of seal away from springs.

i. Remove pipe plug (L) and remove accumulator rod from cover; then install pipe plug in cover and tighten fingertight. Tighten pipe plug to specified torque after accumulator assembly is installed in reduction unit (par. 125a(3)).

Section X
XIV
REBUILD OF REDUCTION UNIT CASE
(303M ONLY)

123. Disassembly

Note. The capitalized key letters shown below in parentheses refer to figure 161 except where otherwise indicated.



- A—OUTPUT SHAFT ASSY—7411669
- B—OIL PUMP DRIVE KEY—7084021
- C—OUTPUT SHAFT FRONT BEARING—700083
- D—SNAP RING—7411660
- E—3/8 X 1 BOLT—272491
- F—3/8-INCH LOCK WASHER—103321
- G—OUTPUT SHAFT FRONT BEARING SUPPORT—7411672
- H—ACCUMULATOR ASSY—7411367
- J—COVER GASKET—7411436
- K—3/8 X 2-3/4 BOLT—272492
- L—CONTROL VALVE ASSY—7411469
- M—CONTROL VALVE GASKET—7411459
- N—OUTPUT SHAFT OIL SEAL ASSY—7411666
- P—SNAP RING—7411663

- Q—SNAP RING—7411661
- R—OUTPUT SHAFT REAR BEARING—700125
- S—CASE—7411448
- T—DRAIN PLUG—YT-8614227
- U—DRAIN PLUG GASKET—120428
- V—3/8 X 2-1/4 BOLT—7412626
- W—3/8 X 1-1/4 BOLT—272489
- X—3/8-24 NUT—103026
- Y—OIL PUMP GASKET—7411435
- Z—OIL PUMP ASSY—7411437
- AA—1/4-INCH LOCK WASHER—103319
- BB—9/32-INCH COPPER FLAT WASHER—116102
- CC—1/4 X 1-3/4 BOLT—272490
- DD—STATIONARY CONE KEY ASSY—7411654
- EE—STATIONARY CONE—7411449

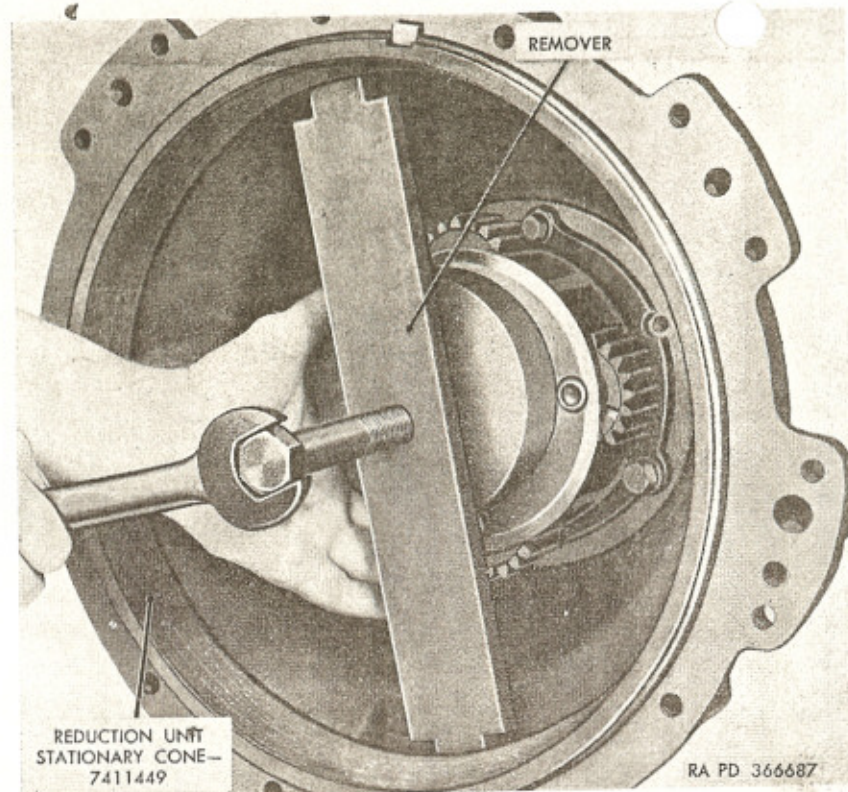
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Figure 161. Reduction unit case and parts.

a. Pull stationary cone (EE) out of case (S) with remover—C7950372 (fig. 162).

b. Remove snap ring (P) from output shaft assembly (A), using snap ring pliers (fig. 163). Discard snap ring.

c. Remove output shaft assembly (A) from front of case (S) (fig. 164). Tap end of output shaft assembly, if necessary, with soft hammer.



REDUCTION UNIT
STATIONARY CONE—
7411449

RA PD 366687

Figure 162. Use of remover—C7950372 to remove stationary cone.

d. Remove parts from output shaft assembly (A) as shown in (1) through (4) below.

- (1) Place output shaft assembly on bench, planet pinion side down.
- (2) Drive two oil pump drive keys (B) from keyways with brass drift and hammer (fig. 165).
- (3) Remove snap ring (D) with snap ring pliers (fig. 165). Discard snap ring.
- (4) Remove output shaft front bearing (C) with puller from bearing puller set—41-P-2905-60.

e. Remove three bolts (E) and lockwashers (F) holding output shaft front bearing support (G) to case (S). Discard lockwashers. Pull support from case (fig. 166).

f. Remove four bolts (CC), three lockwashers (AA), and one copper flat washer (BB) holding oil pump assembly (Z) to case (S). Discard lockwashers and copper washer.

Note. The four 1/4 x 1 3/4 bolts (fig. 172) holding pump to case are 90° apart and should not be confused with two bolts that are part of oil pump assembly (Z).

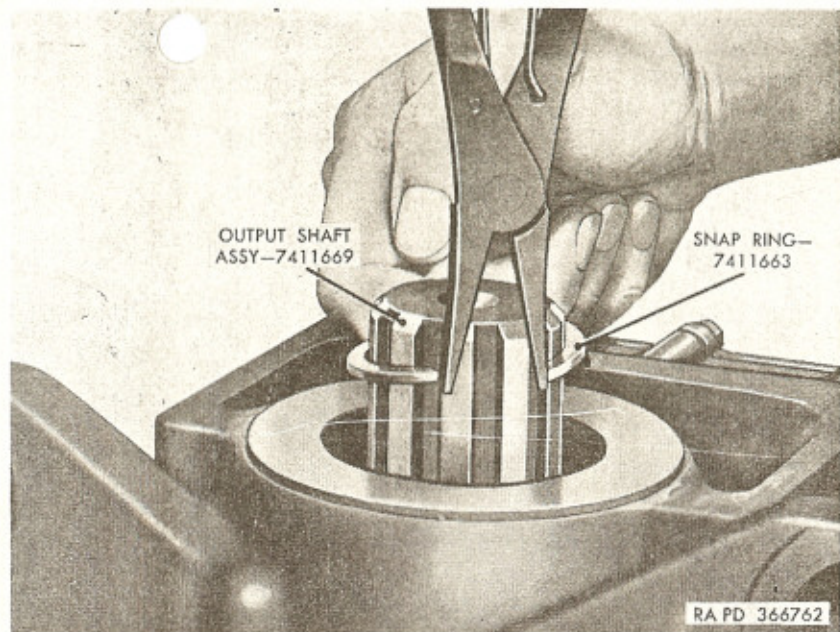


Figure 163. Removing or installing output shaft snap ring.

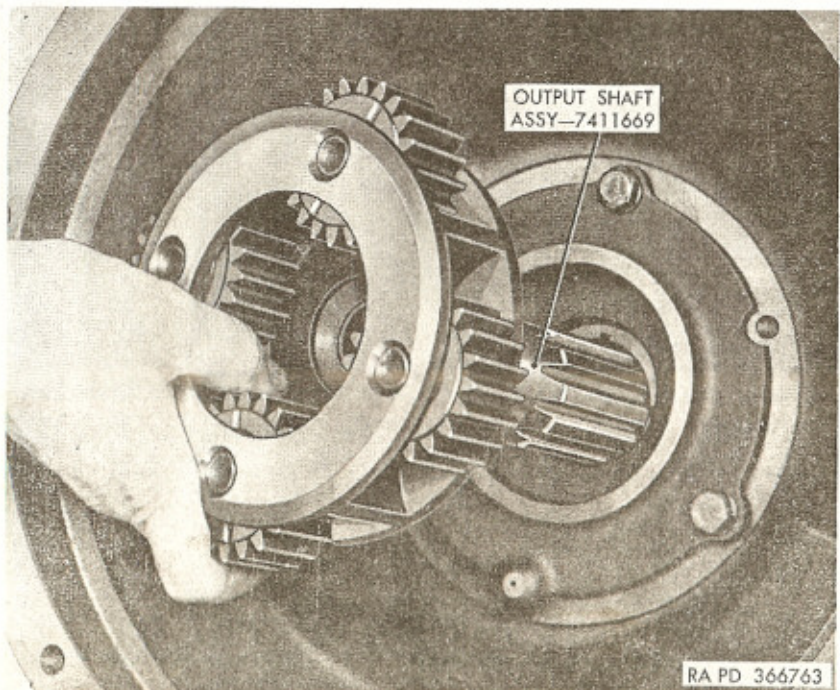


Figure 164. Removing or installing reduction unit output shaft assembly.

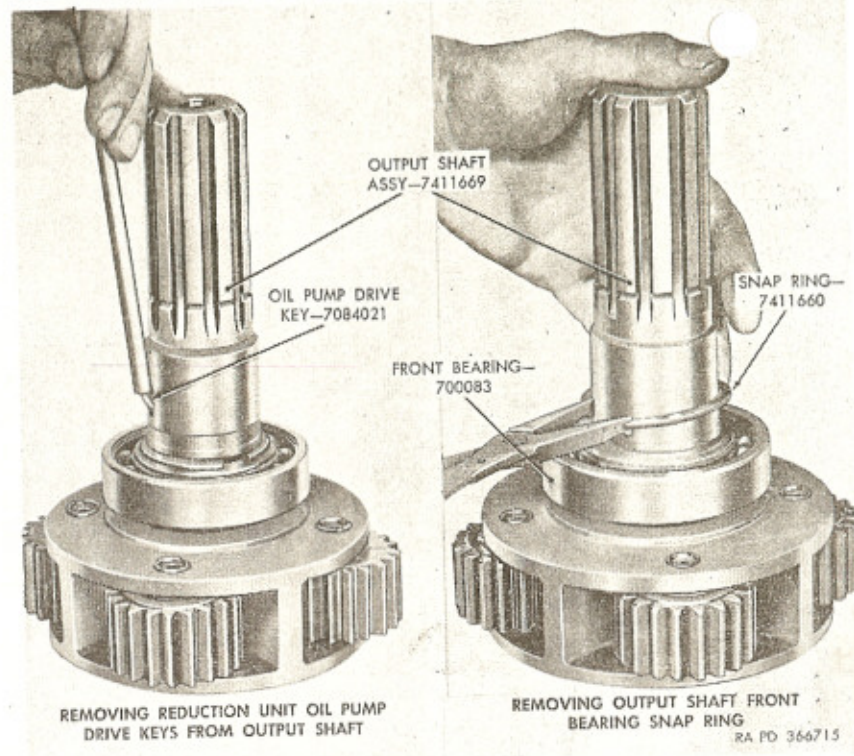


Figure 165. Removing parts from output shaft assembly.

Pull oil pump assembly out of case. Remove and discard oil pump gasket (Y). Refer to paragraphs 117 through 119 for rebuild of oil pump assembly.

g. Remove output shaft oil seal assembly (N) from rear of case (S) and discard. Remove snap ring (Q) with a screwdriver and long-nosed pliers. Discard snap ring. Drive output shaft rear bearing (fig. 167) from case by tapping with a hammer on a flat wood driving block.

h. Loosen pressure regulator valve stop plug and body plug (fig. 167).

Note. These plugs should be loosened at this time to avoid damaging the control valve body during disassembly.

i. Remove six bolts (K) and lockwashers (F) holding control valve assembly (L) to case (S). Remove control valve assembly (fig. 168). Remove and discard control valve gasket (M). Refer to paragraphs 114 through 116 for rebuild of reduction unit control valve assembly.

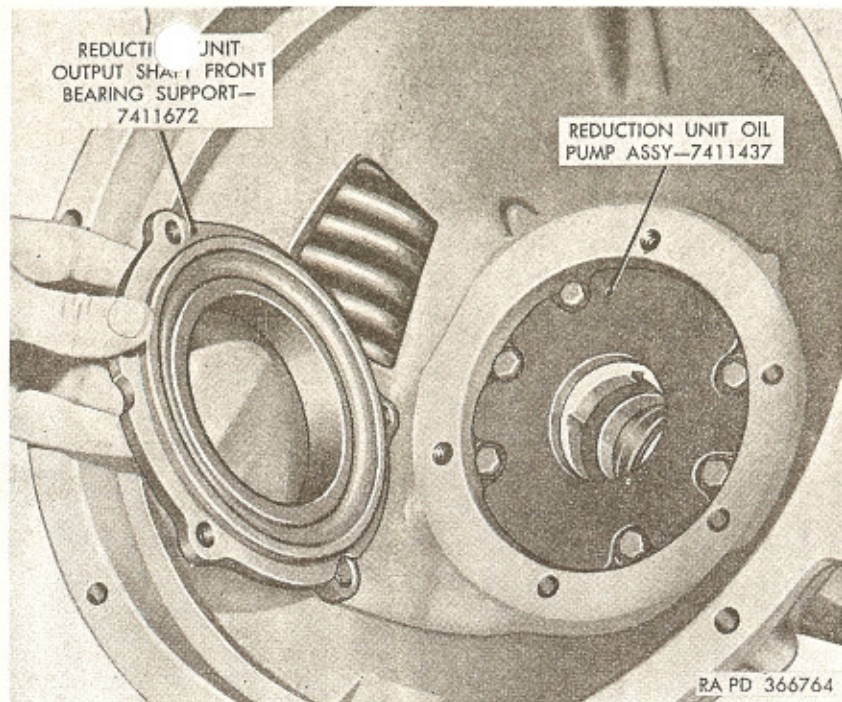


Figure 166. Removing or installing output shaft front bearing support.

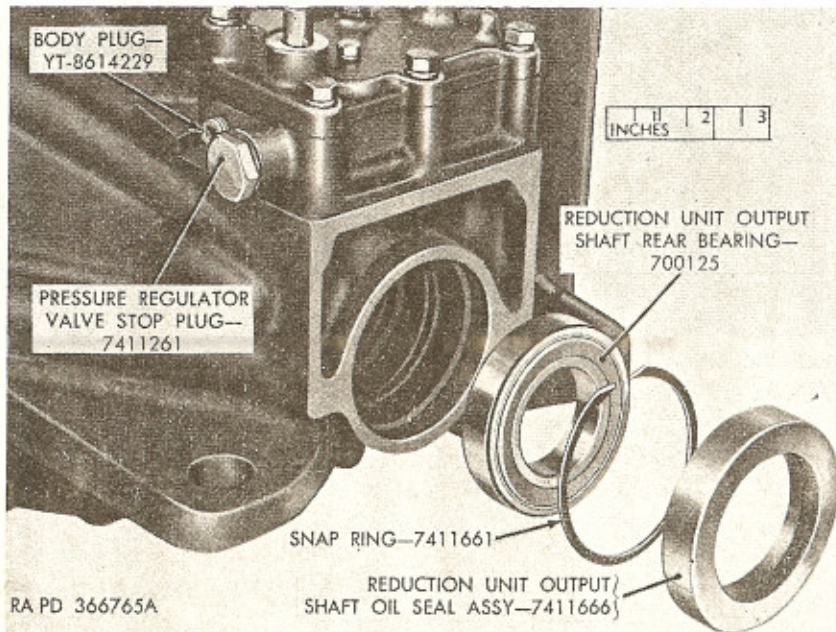


Figure 167. Output shaft oil seal, bearing, and snap ring removed.

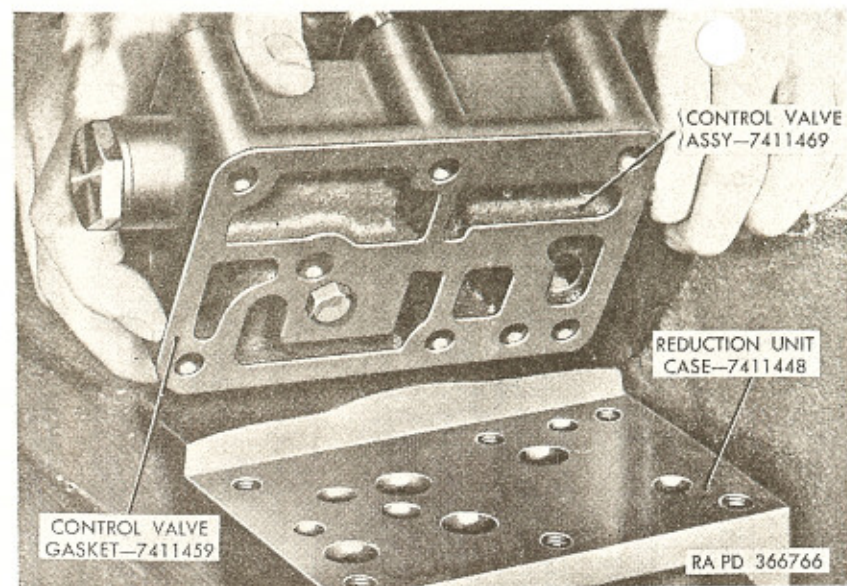


Figure 168. Removing or installing reduction unit control valve assembly.

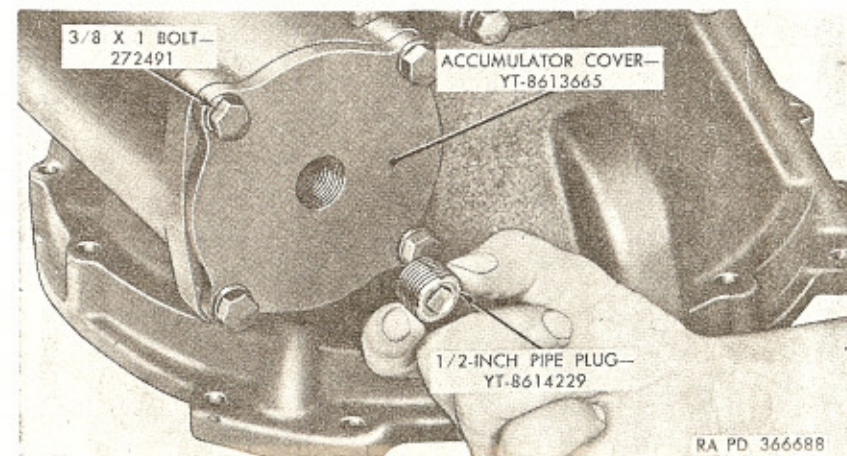


Figure 169. Location of accumulator cover, bolts, and plug.

j. Loosen pipe plug (fig. 169); then alternately loosen a thread or two at a time the four bolts (E) holding accumulator cover to case until bolts and lockwashers (F) can be removed.

Caution: If, while loosening the bolts (E), the cover raises more than three-eighths of an inch from case, stop loosening bolts until unit is placed in a press to control spring tension while removing bolts.

k. Remove ^{four} four bolts (E) and lockwashers (F); then lift accumulator assembly (H) out of case (S). Discard lockwashers. Remove and discard cover gasket (J). Refer to paragraphs 120 through 122 for rebuild of reduction unit accumulator assembly.

124. Cleaning, Inspection, and Repair

Note. The capitalized key letters shown below in parentheses refer to figure 161. Refer to paragraph 170 for repair and rebuild standards.

a. *Cleaning.* Clean all parts except ball bearings thoroughly with dry-cleaning solvent or mineral spirits paint thinner. Do not immerse reduction unit stationary cone (EE) in solution. Wipe this part clean using cloth dampened with thinner. Blow out all internal passages with compressed air. Dry parts by playing an air stream across parts until thoroughly dry or by wiping with lint-free cloth. Refer to TM 37-265 for cleaning of ball bearings.

b. *Inspection.*

(1) *Case and drain plug.*

(a) Examine all surfaces of case (S) for cracks or signs of damage. If damage cannot easily be repaired, replace with new case. Remove any scratches or burs on gasket surfaces or in accumulator assembly bore with crocus cloth.

(b) Inspect all tapped holes for damaged threads.

(c) Inspect screen of drain plug (T) for holes or other damage. Replace plug assembly if screen, threads, or gasket surface of plug is damaged.

(2) *Output shaft assembly (A).*

(a) Inspect planet pinions for broken, pitted, or worn teeth.

(b) Check looseness of planet pinions by hand. Excessive looseness indicates worn pins or needle bearings. If worn, replace complete output shaft assembly.

(c) Inspect splines on shaft for nicks, burs, or cracks. If damage is evident, replace output shaft assembly.

(d) Check oil pump drive keys (B) for signs of shearing. Replace keys if damaged.

(e) Check pilot bushing for wear. If necessary to replace, remove with suitable tool and install new bushing. Bushing must be installed and finished to dimensions shown on figure 170.

(3) *Stationary cone and key.*

(a) Examine lining of stationary cone (EE) for wear or signs of damage. Replace cone and lining assembly if face of lining is worn down to bottom of grooves.

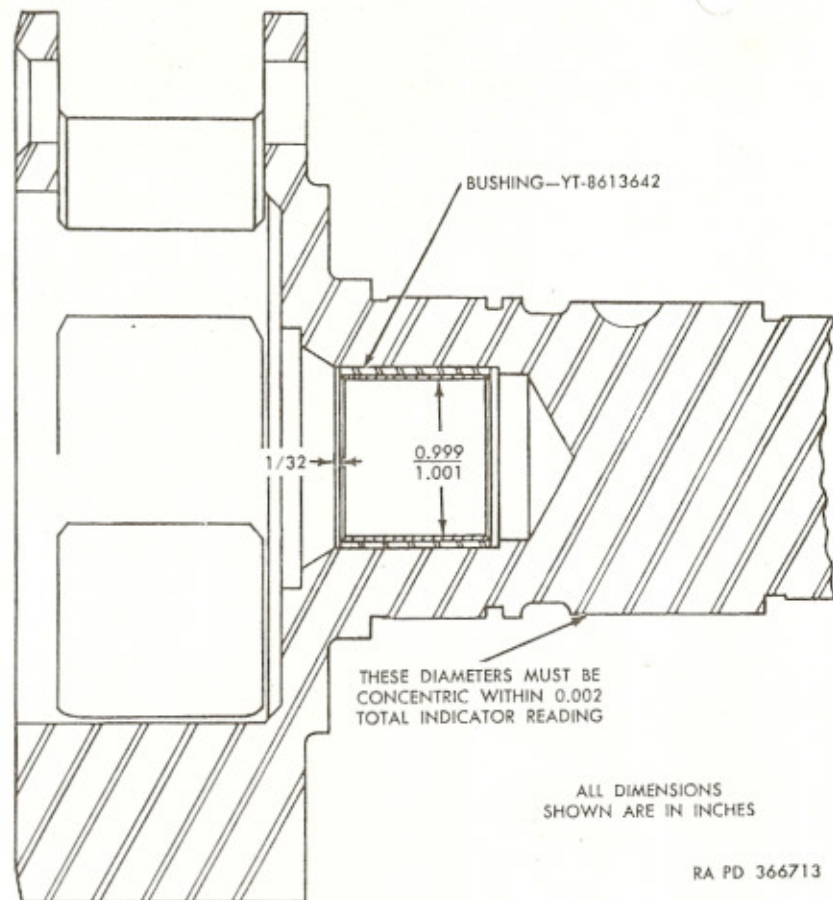


Figure 170. Sectional view of reduction unit output shaft assembly.

(b) Check stationary cone key assembly (DD) for broken or damaged pin. Replace key if damaged.

(4) *Output shaft front and rear bearing, and front bearing support.*

(a) Inspect and lubricate output shaft front and rear bearings (C and R) as instructed in TM 37-265. Measure inside and outside diameter of bearings (par. 170).

(b) Check the front bearing support (G) for cracks or damage. Measure diameter of bore (par. 170).

125. Assembly

Note. The capitalized key letters shown below in parentheses refer to figure 161. All parts must be thoroughly lubricated with engine oil (OE-10) before assembly.

a. *Install Accumulator Assembly.*

- (1) Position new cover gasket (J) on gasket surface of accumulator assembly (H).
- (2) Apply engine oil (OE-10) freely in accumulator bore of case (S). Install accumulator assembly carefully in bore to avoid damage to piston seal.

Caution: The accumulator assembly bottoms before cover meets case. Do not try to force a fit. Cover bolts will pull cover down.

- (3) Install four $\frac{3}{8}$ x 1 bolts (E) and new $\frac{3}{8}$ -inch lockwashers (F) in cover. Tighten bolts alternately and evenly to 23 to 28 pound-feet torque. Tighten pipe plug in cover to 25 to 30 pound-feet torque. Refer to figure 169.

b. *Install Control Valve Assembly.*

- (1) Position new control valve gasket (M) on control valve assembly (L).
- (2) Aline control valve assembly and gasket on case (S) as shown in figure 168.
- (3) Install five $\frac{3}{8}$ x $2\frac{3}{4}$ bolts (K), one $\frac{3}{8}$ x $3\frac{1}{4}$ bolt, and six new $\frac{3}{8}$ -inch lockwashers (F) through control valve assembly and thread into tapped holes in case. Tighten bolts to 33 to 37 pound-feet torque.
- (4) Tighten pressure regulator valve stop plug (fig. 167) to 35 to 40 pound-feet torque and tighten body plug to 25 to 30 pound-feet torque.

c. *Install Rear Bearing Assembly (Fig. 167).*

- (1) Install output shaft rear bearing (R) in case (S) with shielded side of bearing toward rear of case.
- (2) Tap bearing into case far enough to permit installation of snap ring (Q).
- (3) Install new snap ring (Q) and work into place with screwdriver.

d. *Install Oil Pump Assembly (Fig. 171).*

- (1) Install new oil pump gasket (Y) on case (S), alining bolt and passage holes with similar holes in case.
- (2) Install oil pump assembly (Z), alining four attaching holes with four tapped holes in case and passages with passage openings in oil pump gasket and case.

Caution: Install $\frac{1}{4}$ x $1\frac{3}{4}$ bolt (CC) with new $\frac{3}{32}$ -inch copper flat washer (BB) in upper right bolt hole (fig. 172). Copper washer must be installed at this location to prevent loss of oil pressure, as bolt hole is drilled into oil passage.

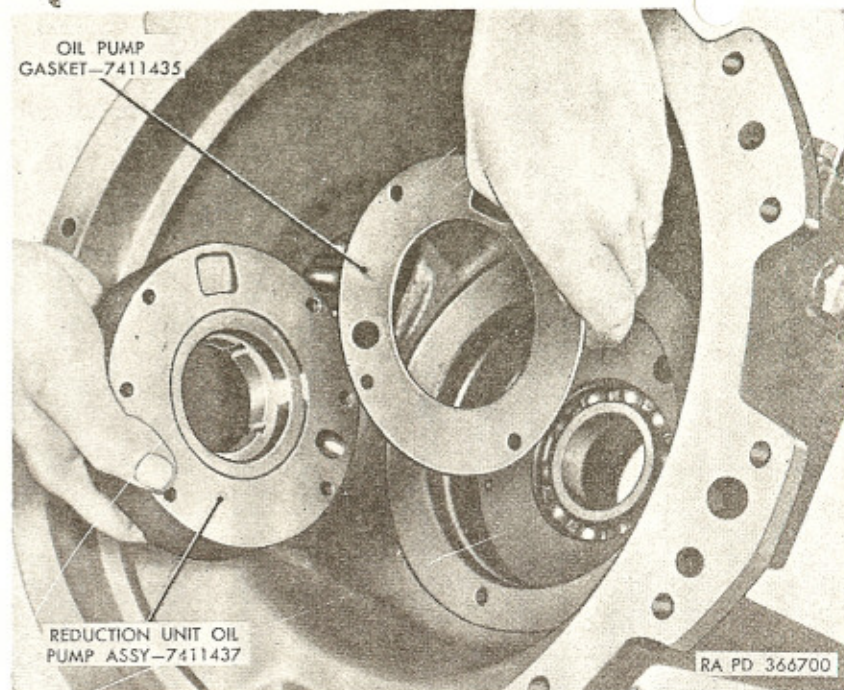


Figure 171. Positioning oil pump and gasket in reduction unit case.

- (3) Install remaining three $\frac{1}{4}$ x $1\frac{3}{4}$ bolts (CC) with new $\frac{1}{4}$ -inch lockwashers (AA); then tighten all four bolts evenly to 10 to 12 pound-feet torque.

e. *Install Output Shaft Front Bearing Support.*

- (1) Install output shaft front bearing support (G). Refer to figure 166.
- (2) Install three $\frac{3}{8}$ x 1 bolts (E) and new $\frac{3}{8}$ -inch lockwashers (F) which attach bearing support to case. Tighten bolts evenly to 23 to 28 pound-feet torque.

f. *Install Output Shaft (Fig. 165).*

- (1) Place output shaft assembly (A) in press with planet pinion side down; then press output shaft front bearing (C) on shaft until inner race seats against shoulder of shaft.
- (2) Using snap ring pliers, install snap ring (D) which holds output shaft front bearing (C) on shaft.
- (3) Tap both oil pump drive keys (B) into keyways of output shaft.
- (4) Install output shaft (fig. 164) through front of case, output shaft front bearing support (G), and oil pump assembly (Z). Aline oil pump drive keys (B) with key-

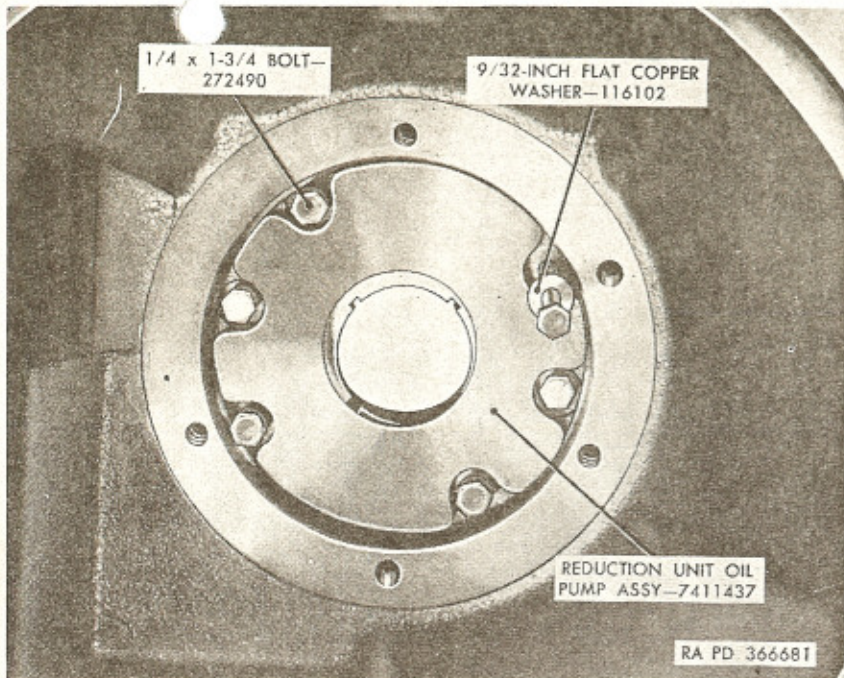


Figure 172. Location of reduction unit oil pump copper washer.

ways in oil pump drive gear; then work output shaft into place far enough to allow installation of snap ring (P).

- (5) Install new snap ring (P), using snap ring pliers as shown in figure 163.
- (6) Install new output shaft oil seal assembly (N), using replacer—B7950063 (fig. 173).

g. Install Stationary Cone.

- (1) Aline stationary cone key assembly (DD) with keyway in case.
- (2) Tap stationary cone carefully into place with plastic hammer (fig. 174).

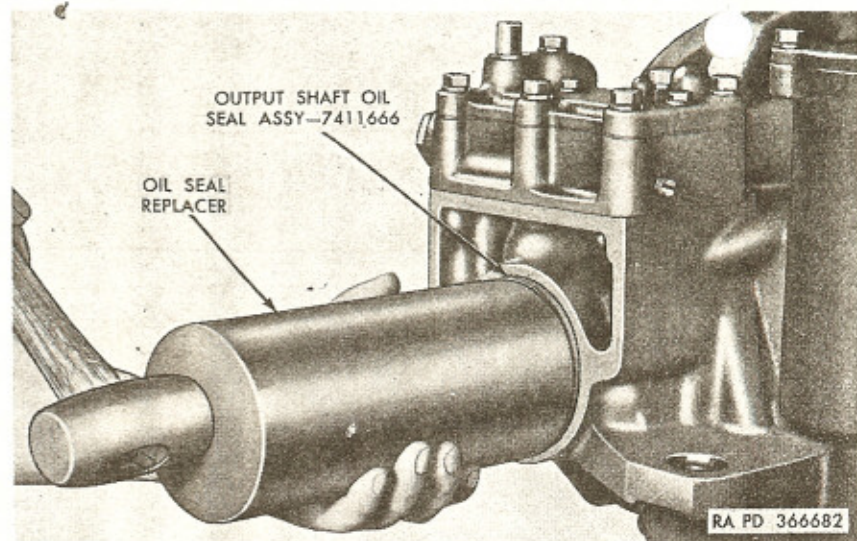


Figure 173. Using replacer—B7950063 to install reduction unit output shaft oil seal.

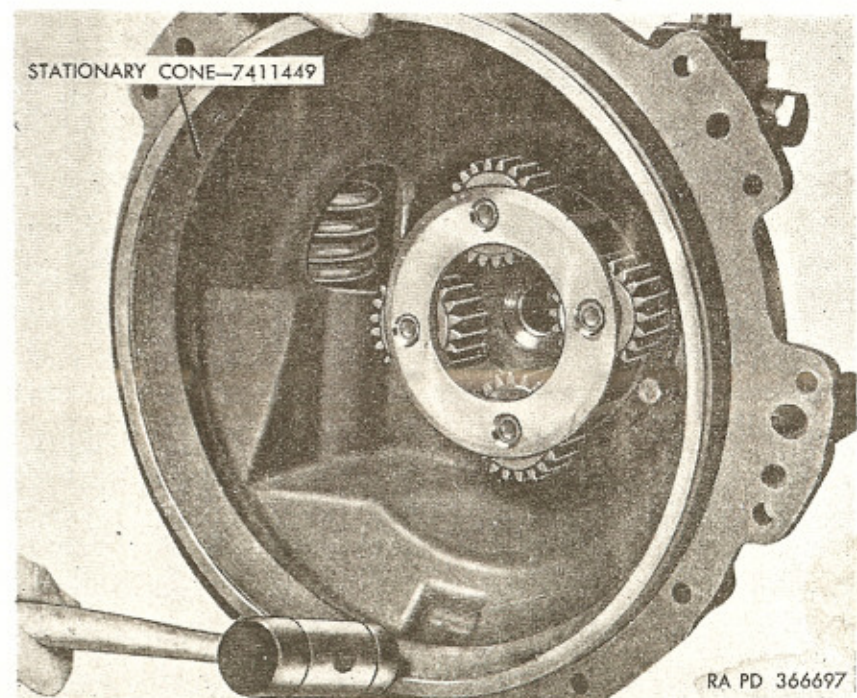


Figure 174. Installing reduction unit stationary cone assembly.

CHAPTER 7

ASSEMBLY OF TRANSMISSION

Section I. CLEANING, INSPECTION, AND REPAIR OF MISCELLANEOUS COMPONENTS

126. General

a. This chapter includes detailed cleaning, inspection, and repair procedures for miscellaneous parts of transmission which are not parts of the subassemblies covered in chapter 6. Capitalized key letters in parentheses refer to exploded views as indicated after the paragraph titles. Exploded views of subassemblies are included in chapter 6.

b. The sequence in which the component parts of transmission are inspected follows, as far as practical, the order in which parts are shown on exploded views.

c. Reference should be made to chapter 8 for repair and rebuild standards whenever necessary.

d. At many points in the transmission, a metal-to-metal contact (without gasket) is depended on to prevent leakage of fluid at high pressure. Consequently, a bur of only a few thousandths of an inch may cause transmission trouble. Avoid nicking, marring, or burring all surfaces, particularly those which are precision finished.

127. Cleaning Parts

All parts should be thoroughly cleaned with dry-cleaning solvent or mineral spirits paint thinner before actual inspection. Do not immerse the reduction unit clutch piston (303M transmission only) in solution. Wipe this part clean using cloth dampened with thinner. All parts should be thoroughly dried by playing an air stream across parts until thoroughly dry or by wiping dry with a clean lint-free cloth. Parts should be segregated in clean trays and covered with clean lint-free cloth after inspection and until assembly procedures are to be accomplished.

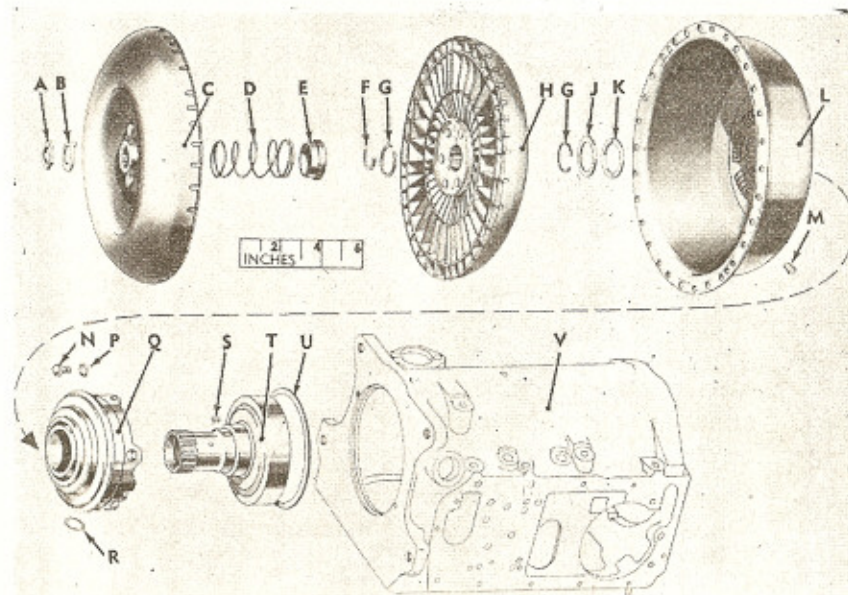
128. Inspection and Repair of Torus Assemblies

Note. The capitalized key letters shown below in parentheses refer to figure 175.

a. *General.* Parts covered in this paragraph ^{are shown} in figure 175. Refer to paragraphs 89 through 91 for rebuild of front oil pump assembly (Q). Discard input shaft nut lock washer (B), snap ring (F), spring retainer (G), front oil pump intake pipe seal (R), and front oil pump gasket (U), and obtain new parts for assembly. Refer to paragraph 156 for repair and rebuild standards of torus components.

b. *Torus Cover Assembly (L).*

- (1) Inspect inner and outer diameter of torus cover oil seal collar for scores, grooves, or roughness. Measure outer diameter of torus cover oil seal collar. Refer to paragraph 156 for dimension of collar.
- (2) Examine grooved torus-cover-to-flywheel gasket surface for nicks or burs. Two continuous ridges should appear on the sealing surface.



A—1/8-16 NUT—5262265	N—5/16 X 1/2 BOLT—7410902
B—INPUT SHAFT NUT LOCK WASHER—7084015	P—FRONT OIL PUMP LOCATING WASHER—5342354
C—DRIVEN TORUS ASSY—YT-8615519	Q—FRONT OIL PUMP ASSY—7410901 (303M), YT-8617075 (301 MG)
D—TORUS CHECK VALVE SPRING—5410035	R—FRONT OIL PUMP INTAKE PIPE SEAL—7411912
E—TORUS CHECK VALVE—7084013	S—FRONT OIL PUMP DRIVING KEY—7084021
F—SNAP RING—7084018	T—OIL PUMP DRIVE GEAR ASSY—7412620
G—SPRING RETAINER—5262278	U—FRONT OIL PUMP GASKET—5262287
H—DRIVING TORUS ASSY—YT-8615518	V—CASE ASSY—7410963
J—STEEL THRUST WASHER—5342355	
K—BRONZE THRUST WASHER—7084028	
L—TORUS COVER ASSY—8327720	
M—1/8-INCH PIPE PLUG—7084019	

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Figure 175. Torus members and cover with front oil pump and drive gear.

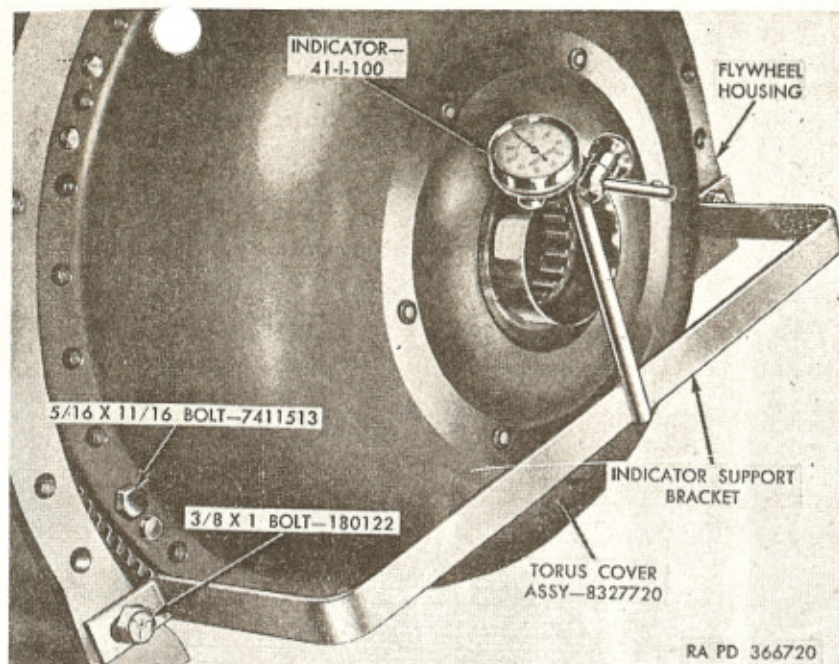


Figure 176. Checking torus cover collar runout using test indicator and indicator support bracket—7950331.

- (3) Check splines of hub for damage.
- (4) Inspect dampener springs visually for broken springs.
- (5) Examine rivets for fractures or loose rivets.
- (6) Measure torus cover assembly oil seal collar as shown in (a) through (f) below (fig. 176).
 - (a) Assemble torus cover to the flywheel, using only four $\frac{5}{16} \times 1\frac{1}{16}$ bolts evenly spaced.
 - (b) Attach test indicator supporting bracket—7950331 to flywheel housing, using two $\frac{3}{8} \times 1$ bolts.
 - (c) Assemble dial-type test indicator—41-I-100 to support bracket—7950331 (fig. 176) so the indicator set rocker arm attachment contacts oil seal area of torus cover collar.
 - (d) Rotate the engine and observe collar runout. Runout must not exceed 0.005 inch.
 - (e) If runout exceeds 0.005 inch and flywheel runout ((f) below) does not exceed 0.005 inch, replace torus cover.
 - (f) With torus cover removed, mount test indicator—41-I-100 on flywheel housing so the stem will contact the sealing surface of flywheel, just inside the row of torus cover bolt holes. Rotate engine and observe fly-

wheel runout. Flywheel runout should not exceed 0.005 inch.

c. *Torus Check Valve (E).*

- (1) Inspect rear face of check valve for scores, wear, or damage.
- (2) Check the inside diameter of check valve for scores or damage. Measure inside diameter of check valve (par. 156).
- (3) Check fit of check valve on hub of driven torus member (par. 156).

d. *Torus Check Valve Spring (D).*

- (1) Inspect check valve spring for distortion and collapsed coils.
- (2) Measure check valve spring free length and compressed length (par. 156).

e. *Driving and Driven Torus Assemblies (H and C).*

- (1) Inspect driving and driven torus assemblies to see that all vanes and vane rings are not distorted, and that they are anchored tightly in place.
- (2) Check splines in torus hubs for nicks or cracks. Measure outside diameter of driven torus hub contacted by the torus check valve (par. 156).
- (3) Examine torus shells for dents or damage.
- (4) Check torus member rivets for looseness.

f. *Thrust Washers (J and K).* Measure thickness of thrust washers (par. 156). Replace with new parts if worn or damaged.

g. *Front Oil Pump Drive Gear Assembly (T).*

- (1) Examine drive gear for scored surfaces.
- (2) Inspect gear teeth for nicks, cracks, and pitting.
- (3) Inspect drive gear key and keyway in gear for damage.
- (4) Check drive gear bushings (fig. 177) for wear. If necessary to replace bushings, remove bushings with suitable tool and install new bushings. Bushings must be installed and finished to dimensions shown on figure 177.

129. Inspection and Repair of Reduction Unit Parts (303M)

Note. The capitalized key letters shown below in parentheses refer to figure 178.

a. *General.* Parts covered in this paragraph are shown in figure 178. Discard clutch piston inner and outer seals (G and H), snap ring (S), spring retainer (CC), and all bolt lock straps (Z), and obtain new parts for assembly. Refer to paragraph 171 for repair and rebuild standards of reduction unit parts.

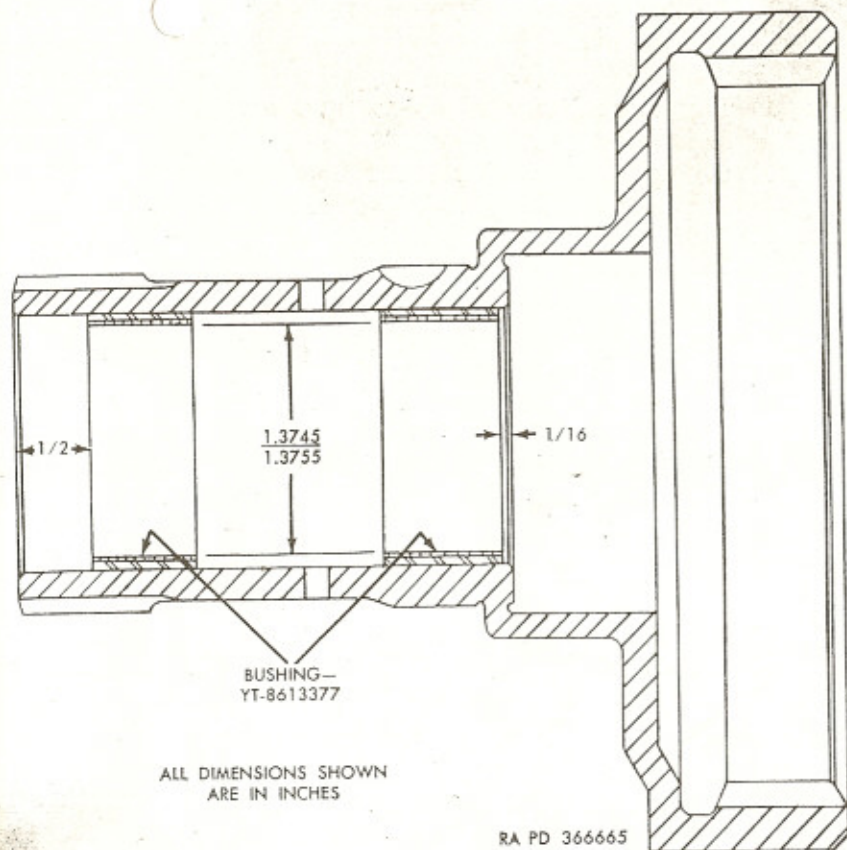


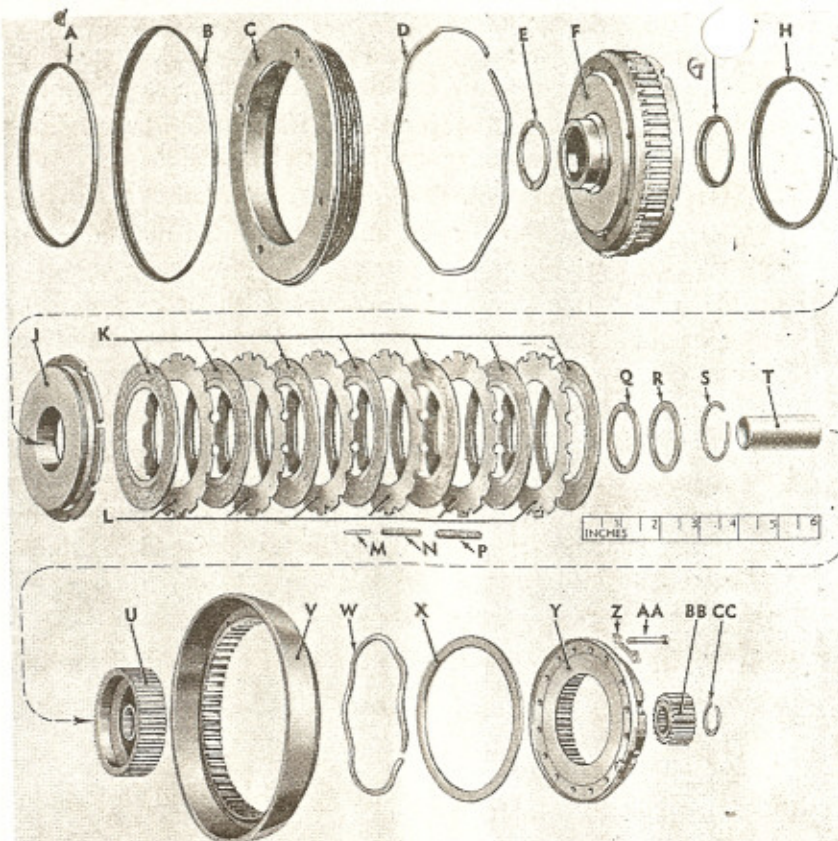
Figure 177. Sectional view of drive gear.

b. Reduction Clutch Piston (C).

- (1) Check clutch piston lining for wear (par. 171) or damage. If face of lining is worn down to bottom of grooves, replace piston.
- (2) Inspect clutch piston dowel pin holes for dirt, nicks, or damage.
- (3) Be sure seal groove in clutch piston is clean and not damaged.
- (4) Check entire clutch piston for cracks or damage.
- (5) If reduction clutch piston is damaged, replace with new part.

c. Clutch Release Spring (D).

- (1) Inspect clutch release spring for damage or distortion.
- (2) Check release spring free height and compressed height (par. 171).



- | | |
|---|--|
| <p>A—REDUCTION CLUTCH PISTON SEAL—YT-8613607
 B—REDUCTION CLUTCH PISTON SEAL—YT-8613606
 C—REDUCTION CLUTCH PISTON—7411655
 D—CLUTCH RELEASE SPRING—7411670
 E—BRONZE THRUST WASHER—7411693
 F—CLUTCH DRUM ASSY—7411647
 G—CLUTCH PISTON INNER SEAL—YT-8613617
 H—CLUTCH PISTON CENTER SEAL—YT-8613616
 J—DIRECT CLUTCH PISTON—7411656
 K—CLUTCH DRIVE PLATE—7411657
 L—CLUTCH DRIVEN PLATE—7411658
 M—DIRECT CLUTCH PISTON RELEASE SPRING PIN—7084052
 N—DIRECT CLUTCH PISTON INNER RELEASE SPRING—7084044</p> | <p>P—DIRECT CLUTCH PISTON OUTER RELEASE SPRING—7084045
 Q—BRONZE THRUST WASHER—7411694
 R—STEEL BACKING WASHER—7411695
 S—SNAP RING—7411664
 T—OUTPUT SHAFT BEARING SPACER—7411534
 U—CLUTCH HUB—7411653
 V—DRIVEN CONE—7411450
 W—DRIVEN CONE RELEASE SPRING—7411671
 X—DRIVEN CONE RELEASE SPRING RETAINER—7411659
 Y—INTERNAL GEAR ASSY—7411650
 Z—LOCK STRAP—8333646
 AA—3/8 X 3 BOLT—7411651
 BB—SUN GEAR—7411652
 CC—SPRING RETAINER—5262278</p> |
|---|--|

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Figure 178. Transmission reduction unit parts (303M).

d. Clutch Drum Front and Rear Bronze Thrust Washers (E and Q) and Clutch Drum Steel Backing Washer (R). Check thrust washers for nicks or burrs and clean up with crocus cloth if damage is slight. Measure thrust washer thickness (par. 171) and replace if worn.

e. Clutch Drum Assembly (F).

- (1) Inspect clutch drum splines for nicks, cracks, or visible wear. Replace drum if these conditions are evident.
- (2) Blow out oil passages in hub with compressed air. Probe passages with welding rod if restricted.
- (3) Check all tapped holes for damaged threads.
- (4) Be sure oil seal groove in hub is clean and not damaged.
- (5) Examine direct clutch piston seal contact area for nicks or burs. Remove nicks or burs with crocus cloth if damage is slight. If damage is too evident, replace direct clutch piston.
- (6) Inspect keyway in clutch drum for damage or wear.
- (7) Measure clutch drum bushings for wear or damage. If necessary to replace bushings, remove bushings with suitable tool; then press new bushings into clutch drum hub. Bushings must be installed and finished to dimensions shown on figure 179.

f. Direct Clutch Piston (J).

- (1) Be sure seal groove on direct clutch piston is clean and not damaged.
- (2) Inspect inner seal contact area in hub of piston for nicks or burs. Remove nicks or burs with crocus cloth. If nicks cannot be removed this way, replace direct clutch piston.
- (3) Check square notches on edge of piston for wear.
- (4) Inspect clutch drive plate area on side of piston for scores or visible wear. Replace direct clutch piston if visibly worn or scored.

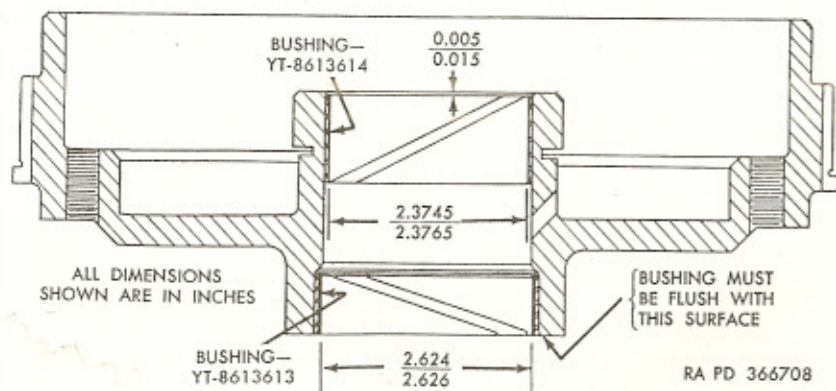


Figure 179. Sectional view of reduction clutch drum assembly (303M).

g. Clutch Drive and Driven Plates (K and L).

- (1) Inspect clutch drive plates (bronze) for nicks, burs, scratches, or scores.
- (2) Inspect teeth on inner diameter of drive plates for visible wear.
- (3) Check drive plates to make sure they are flat.
- (4) Spiral grooves on both sides of drive plates must run from inside diameter to outside diameter in clockwise direction, in respect to each face.
- (5) Remove nicks or burs on drive plates with crocus cloth. If any of the other conditions are found, replace drive plates.
- (6) Inspect clutch driven plates (steel) for nicks, burs, scratches, or scores. Remove burs with crocus cloth.
- (7) Check square notches in driven plates for wear or distortion.
- (8) Driven plates (fig. 180) must be concave.
- (9) If driven plates are scratched, scored, distorted, or have worn notches, replace with new parts.

h. Direct Clutch Piston Release Spring Pins (M). Inspect release spring pins for distortion. Replace pins if distorted.

i. Direct Clutch Piston Inner and Outer Release Springs (N and P). Inspect direct clutch piston inner and outer release springs for distortion or collapsed coils. Check springs for free length and compressed length (par. 171) and replace as necessary.

j. Output Shaft Bearing Spacer (T).

- (1) Check ends of output shaft bearing spacer for burs, nicks, or scores. Remove with crocus cloth if imperfections are slight.

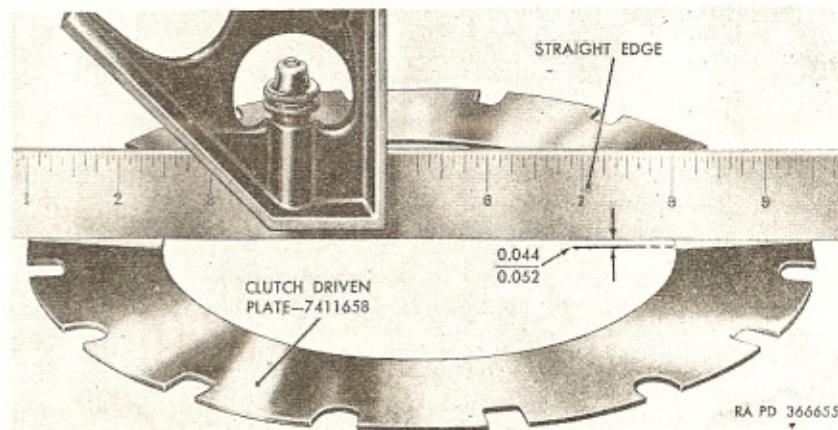


Figure 180. Checking reduction unit clutch driven plates (303M).

(2) Insure overall length of spacer (par. 171).

k. *Clutch Hub (U)*.

- (1) Inspect clutch hub for worn or damaged splines.
- (2) Inspect clutch hub teeth for cracks or nicks.
- (3) Make sure lubrication holes in clutch hub are open.
- (4) Check both ends of clutch hub for scores, nicks, or visible wear.
- (5) Replace hub if any of the above conditions are evident.

l. *Driven Cone (V)*.

- (1) Inspect driven cone splines for nicks, cracks, or wear and replace if these conditions are evident.
- (2) Examine cone inner and outer contact areas for scoring or visible wear. Replace cone if scored or grooved.

m. *Driven Cone Release Spring (W) and Release Spring Retainer (X)*. Inspect cone release spring and spring retainer for nicks or burrs and clean up if necessary. Check free and compressed height of release spring (par. 171). Make sure spring retainer is flat.

n. *Internal Gear Assembly (Y)*.

- (1) Inspect the internal gear teeth for cracks, pits, or rough edges.
- (2) Examine area contacted by clutch plates for scoring or wear.
- (3) Check internal gear key and keyway in gear for wear or damage.
- (4) If any of the above conditions exist, replace gear and key assembly.

o. *Sun Gear (BB)*. Examine reduction unit sun gear external teeth and internal splines for scoring, cracks, or pits. Replace if damaged in any way.

130. Inspection of Transmission Side Cover and Oil Pipes

Note. The capitalized key letters shown below in parentheses refer to figure 181.

a. *General*. Parts covered in this paragraph are shown in figure 181. Rebuild of transmission control valve assembly (T), manual control valve lever shaft seal (P), and outer and inner shaft seal washers (N and M) is covered in paragraph 74 through 76. Discard side cover gasket (B), snap ring (K), manual control valve lever shaft seal ring (E), and manual control valve lever shaft O-ring gasket (G) and obtain new parts for assembly.

b. *Case Side Cover Assembly (C)*. Inspect transmission case side cover for cracks or damage. Replace with new part if damaged.

c. *Manual Control Valve Lever Shaft Cup (J), Shaft Seal Retainer (F), and Shaft Seal Spring (H)*.

- (1) Inspect manual control valve lever shaft cup (J) and shaft seal retainer (F) to see that they are clean and not damaged. Clean or replace as necessary.
- (2) Inspect shaft seal spring (H) to see that it is not broken or distorted. Replace if damaged.

d. *Oil Pressure Regulator Valve Reverse Oil Pipe (S) and Reverse Clutch Oil Pipe (L)*. Inspect oil pipes to see that they are not broken or distorted and make sure passages are open. Replace pipes if damaged.

131. Inspection and Repair of Transmission Case and Components

Note. The capitalized key letters shown below in parentheses refer to figure 182.

a. *General*. Parts covered in this paragraph are shown in figure 182. Some parts shown in figure 182 are covered in other paragraphs as described in (1) through (3) below.

- (1) Front servo assembly (HH) (pars. 83-85).
- (2) Rear servo assembly (CC) (pars. 86-88).
- (3) Rear oil pump assembly (BB) and governor assembly (Z) (pars. 92-95).
- (4) Discard gaskets (K, P, and LL), rear oil pump intake pipe O-ring gaskets (S), and all lockwashers and obtain new parts for assembly. On 301MG transmission only, discard pressure regulator valve rubber cushions (fig. 199).

b. *Case Assembly (A)*.

- (1) Using air gun—B7950562 connected to air pressure, blow out all passages in transmission case (fig. 183). Air blown through passages should emit from passages as shown in (a) through (r) below.

Note. The capitalized key letters shown in parentheses in (a) through (r) below identify passages in figure 183.

- (a) Breather passage (A) through inside of case.
- (b) Drain back passage (B) through inside of case.
- (c) Drain back passage (C) through inside of case.
- (d) Rear oil pump suction passage (D) through inside of case (303M only).
- (e) Reverse pressure passage (E) interconnects with reverse passage (EE).
- (f) Rear pump pressure passage (F) interconnects with rear pump pressure passage (G).

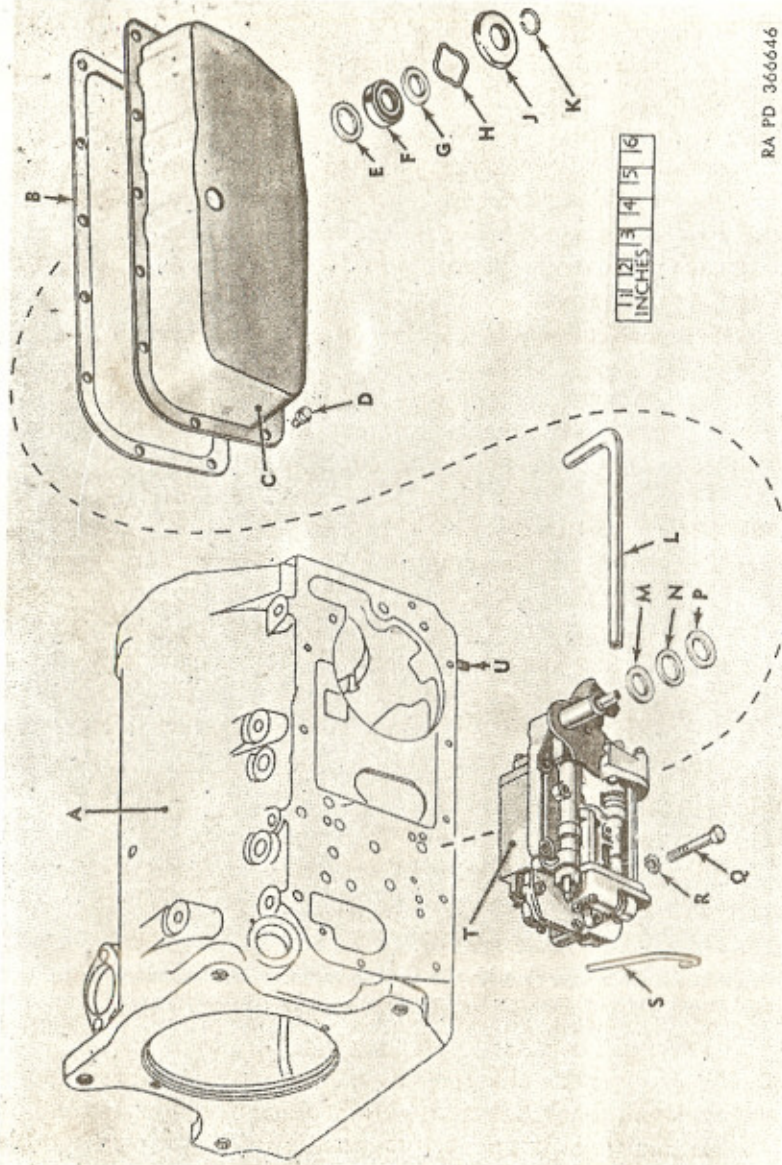
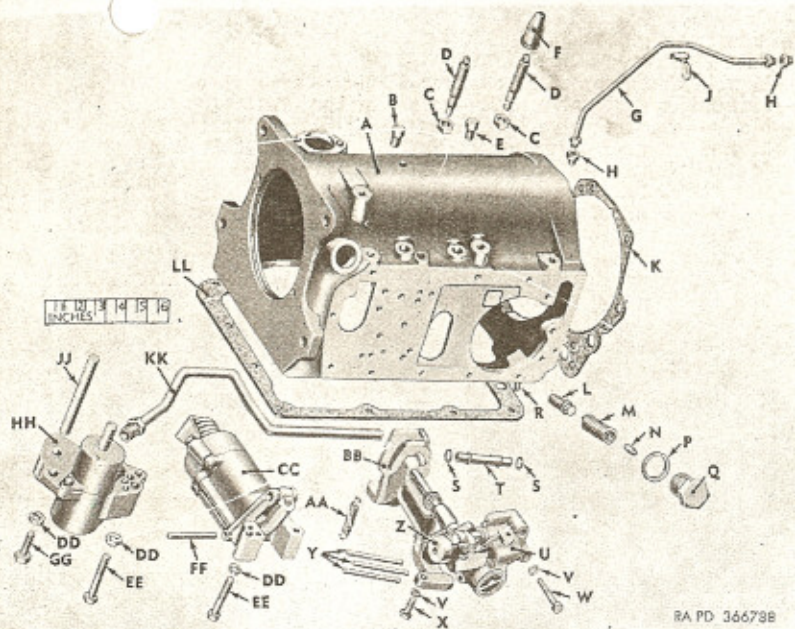


Figure 181. Transmission side cover, oil pipes, control valve, and seal components.

- A—Cage assy 7410963
- B—Side cover gasket 7410966
- C—Case side cover assy 7412619
- D— $\frac{1}{4}$ x $\frac{1}{2}$ Cap screw w/lockwasher 6230003
- E—Manual control valve lever shaft seal ring 7410980
- F—Manual control valve lever shaft seal retainer 7410979
- G—Manual control valve lever shaft O-ring gasket 501223
- H—Manual control valve lever shaft seal spring 7411201
- J—Manual control valve lever shaft cup 7410977
- K—Snap ring 7412624
- L—Reverse clutch oil pipe 7411521
- M—Manual control valve lever shaft seal inner washer A327515
- N—Manual control valve lever shaft seal outer washer A327514
- P—Manual control valve lever shaft seal 5327516
- Q— $\frac{1}{4}$ x 2 Bolt 100114
- R— $\frac{1}{4}$ -Inch ext-teeth lockwasher 114604
- S—Oil pressure regulator valve reverse oil pipe 7411505
- T—Control valve assy 7064881
- U— $\frac{5}{16}$ x $1\frac{1}{4}$ Stud 103173

Figure 181—Continued.

- (g) Front pump pressure passage (H) through inside of case.
 - (h) Compensator pressure passage (J) interconnects with compensator pressure passage (Q).
 - (i) Rear band release passage (K) interconnects with rear band release passage (R).
 - (j) Primary pressure passage (L) interconnects with primary pressure passage (T).
 - (k) Line pressure passage (M) interconnects with line pressure passage (U).
 - (l) Front band release passage (N) interconnects with front band release passage (V).
 - (m) Front band apply passage (P) interconnects with front band apply passage (S).
 - (n) Line pressure passage (W) interconnects with line pressure passage (AA).
 - (o) Front clutch passage (X) interconnects with passage (BB) in the oil delivery sleeve support.
 - (p) Rear clutch pressure passage (Y) interconnects with passage (BB) in oil delivery sleeve support.
 - (q) Exhaust passage (Z) through inside of case.
 - (r) Governor feed to reduction unit passage (CC) interconnects with passage at top of case (DD).
- (2) If any two passages other than those specified in (1) (a) through (r) above are interconnected due to cracked or broken passage walls, replace transmission case. Transmission will not function properly if this condition exists.



- A—Case assy 7410963
 B—Front band adjusting cap 5302204
 C— $\frac{1}{2}$ -20 hex nut 106638
 D—Band adjusting stop screw 5266342
 E— $\frac{1}{8}$ -Inch pipe plug 7084019
 F—Band adjusting stop screw cap 7006500
 G—Reduction blocker line assy 7413004 (303M only)
 H—Reduction blocker line connector 137405 (303M only)
 J—Reduction blocker line clip 7413005 (303M only)
 K—Output shaft bearing retainer gasket 7411516
 L—Oil pressure regulator valve 7411508 (303M) YT-8615128 (301MG)
 M—Oil pressure regulator valve spring 8331471
 N—Reverse booster plug 7411524
 P—Plug gasket 741504
 Q—Plug assy 7411506
 R— $\frac{3}{16}$ x 1 $\frac{1}{4}$ Stud 103173
 S—Rear oil pump intake pipe O-ring gasket 501460 (303 M only)
 T—Rear oil pump intake pipe 7410893 (303M only)
 U—Reverse blocker bracket assy 7416058
 V— $\frac{5}{16}$ -Inch lockwasher 103320
 W— $\frac{3}{16}$ x 1 $\frac{3}{4}$ Hex bolt 100125
 X— $\frac{5}{16}$ x $\frac{7}{8}$ Hex bolt 179817
 Y—Governor oil delivery line 5281277
 Z—Governor assy 7410974
 AA—Reverse blocker lever return spring 7413002
 BB—Rear oil pump assy 7410903 (303M) YT-8615132 (301MG)
 CC—Rear servo assy 7411443
 DD— $\frac{3}{8}$ -Inch lockwasher 103321
 EE— $\frac{3}{8}$ x 2 Bolt 100138
 FF—Front servo oil transfer line 5262348
 GG— $\frac{3}{8}$ x 1 Bolt 179839
 HH—Front servo assy 7410894 (303M) 8329448 (301MG).
 JJ—Front oil pump delivery line 5410034
 KK—Front oil pump discharge pipe assy 7410899 (303M)
 Rear oil pump discharge pipe assy 5614297 (301MG)
 LL—Oil pan gasket 7411444

Figure 182. Transmission case and parts (303M shown).

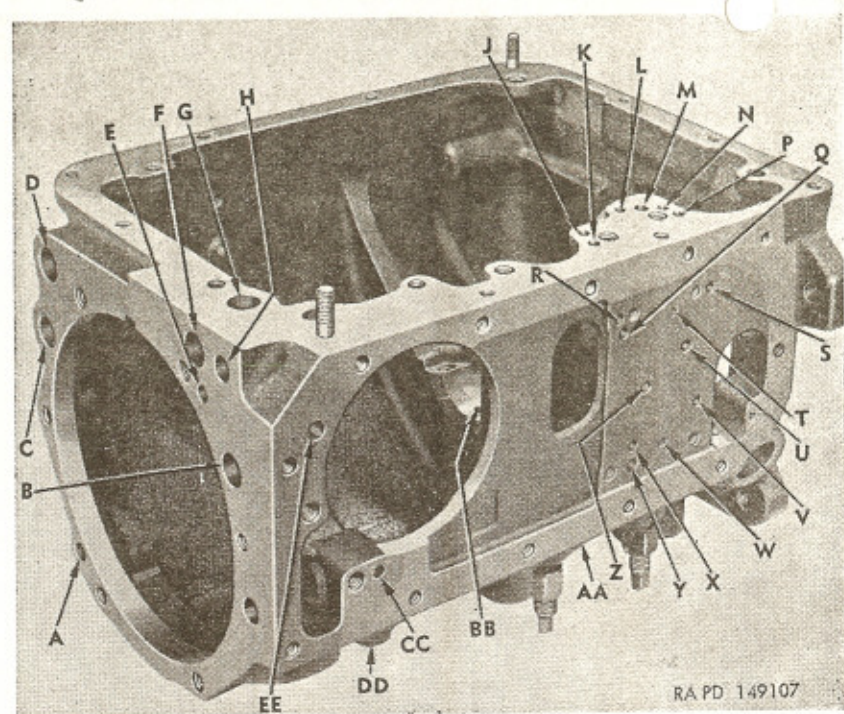


Figure 183. Transmission case oil passages.

- (3) Examine transmission case finished surface for cracks, nicks, and burs.
- (4) Use $\frac{1}{8}$ -inch welding rod and check for restricted passages in transmission case.
- (5) Inspect band adjusting stop screw threads in transmission case.

Note. If adjusting stop screw threads are stripped, the transmission case must be replaced. Do not attempt to repair transmission case by tapping threads and inserting oversize adjusting stop screws. To do this would make a proper external band adjustment impossible because of the difference in lead of the oversize thread.

c. Band Adjusting Stop Screws (D) and $\frac{1}{2}$ -20 Nuts (C).

- (1) Check adjusting stop screws to see that threads are not worn or stripped.
- (2) Inspect contact end of adjusting stop screws to see that they are not mushroomed.
- (3) Inspect locknuts for damage.
- (4) Replace any part which is damaged.

d. Oil Pressure Regulator Valve (L) and Reverse Booster Plug (N).

- (1) Blow out oil passages in plug assembly (Q), making certain they are clear.
- (2) Inspect reverse booster plug (N) and bore in pressure regulator plug for wear, nicks, and burs. Make sure booster plug fits freely in regulator plug.
- (3) Check oil pressure regulator valve spring (M) for distortion or collapsed coils. Check spring free length and compressed length (par. 158).
- (4) Inspect oil pressure regulator valve (L) for nicks and burs.
- (5) Check fit of pressure regulator valve in bore of front pump assembly (fig. 90).

e. Oil Pipes (T and KK) and Oil Lines (Y, FF, and JJ).

- (1) Blow out oil lines and pipes, making sure they are clean and that passages are not restricted.
- (2) Check lines and pipes for cracks, holes, and distortion.
- (3) Make sure oil line fittings are in good condition and the threads are not stripped.

Section II. ASSEMBLY OF TRANSMISSION FROM MAJOR COMPONENTS AND SUBASSEMBLIES

132. General

a. *Sequence of Procedures.* Operation procedures, outlined in paragraphs 132 through 154, are arranged in a practical sequence of assembling the transmission from major components and sub-assemblies. Unless otherwise indicated, the procedures described in this section apply to both transmissions (303M and 301MG) covered by this manual. In some instances, slight differences in procedure are noted in the text; however, where differences are such that combined coverage is impractical, procedures for each unit are covered in separate paragraphs. Refer to figure 184 or 185 for relative position of transmission parts. It is assumed that all components and subassemblies have been cleaned, inspected, and repaired or replaced as deemed necessary at inspections outlined in paragraphs 74 through 131.

b. *Cleanliness.* Cleanliness is essential when handling components of the transmission. The bench or work stand must be thoroughly clean to minimize the entry of foreign materials into the parts and assemblies. All parts must be laid on a clean surface and covered with lint-free cloth until ready to be assembled.

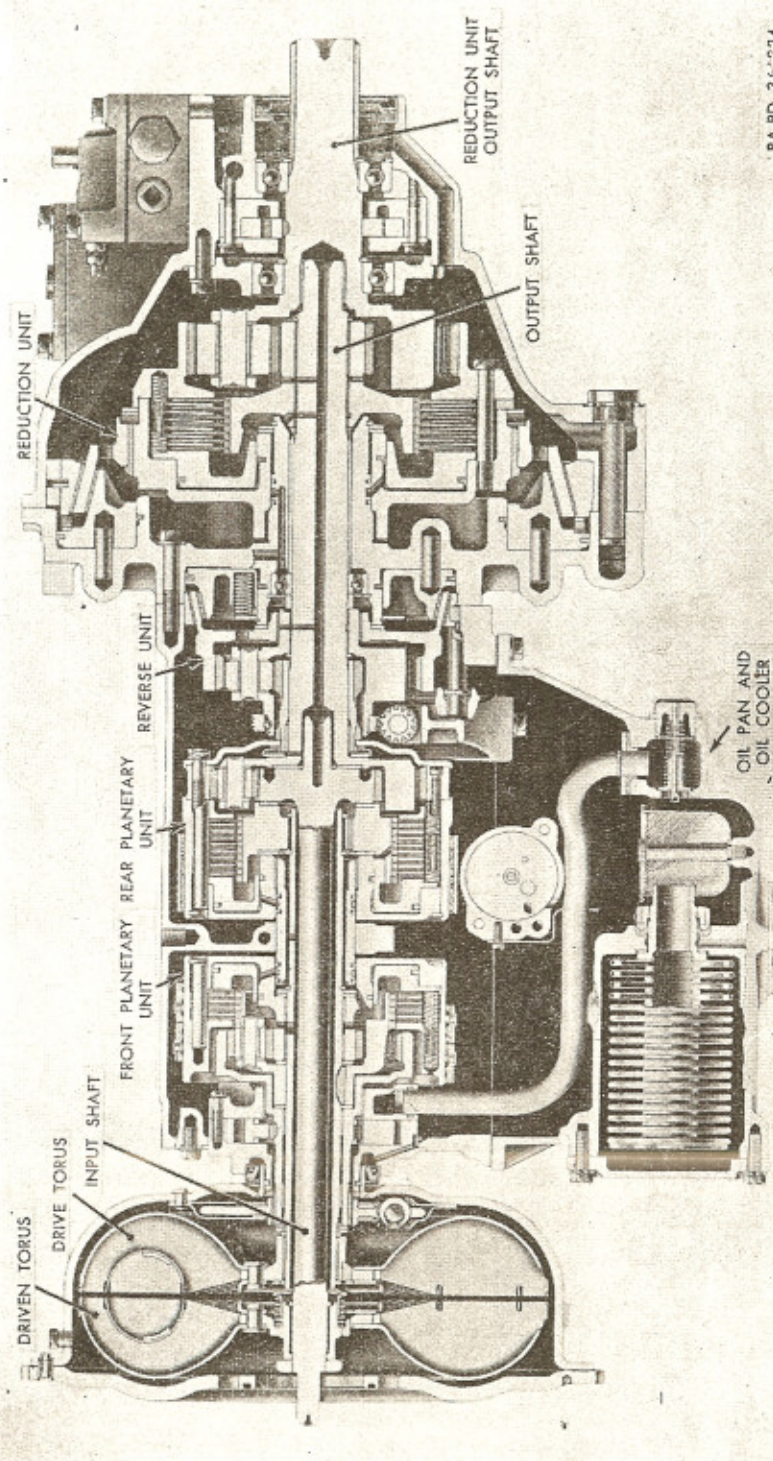
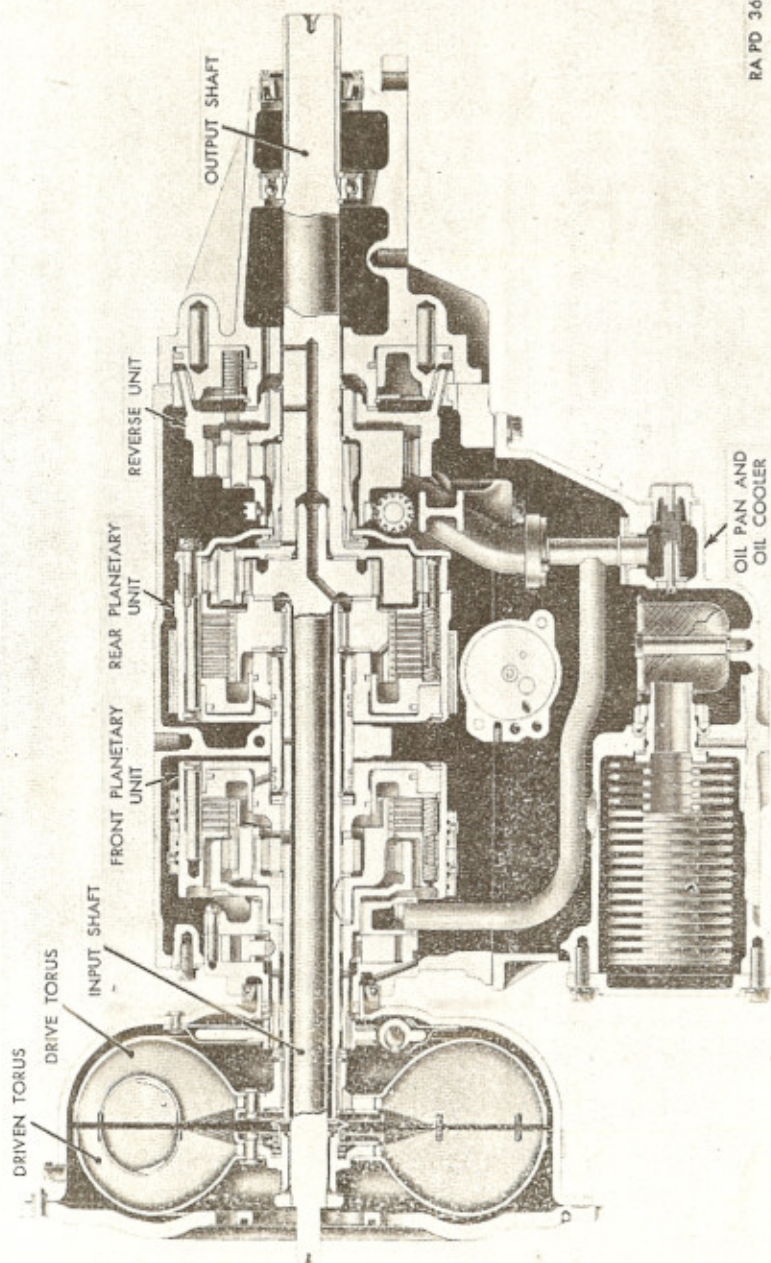


Figure 184. Sectional view of 303M transmission.

RA PD 30094

366824



RA PD 366825

Figure 185. Sectional view of 301MG transmission.

c. *Lubrication.* All parts must be liberally lubricated with clean engine oil (OE-10) at time of assembly.

d. *New Parts.* All snap rings, seal, gaskets, lockwashers, and oil seal rings must be replaced with new parts as indicated in the following procedures.

133. Installation of Front and Rear Planetary Units and Carrier

a. Install front and rear band adjusting stop screws and locknuts loosely into case. Install front band adjusting rod (use new rod when new band, drum, transmission case, or front servo are used), seat, and spring into case (fig. 201). Install felt adjusting rod seal into case around adjusting rod. Temporarily install front band adjusting rod cap into case.

b. Install front band on front drum, positioned so that short (anchor) end of the band will rest on adjusting stop screw when both planetary units are installed in case.

c. Install an improvised spring (fig. 50) to hold front band in place on drum.

d. Case center bearing cap must be positioned on oil delivery sleeve with dowel in cap registered in dowel hole in delivery sleeve. The dowel hole in sleeve is on the side of sleeve opposite the two oil delivery holes.

Note. Cast taper on bearing cap should be toward front planetary unit. Tap bearing cap lightly into place.

e. When lowering planetary units and carrier into case (fig. 50), guide carrier shaft downward and forward. Remove improvised spring used to hold front band in place during installation; then move band into operating position against adjusting stop screw.

f. Install rear band on rear drum so anchor end of band will rest on adjusting stop screw. Install rear band release spring (fig. 186) in recess at one end of rear band and over guide pin on rear band strut screw.

g. Install new center bearing cap lock plate on bolts; then install plate and two $\frac{7}{16} \times 1\frac{1}{2}$ bolts into center bearing cap. Tighten bolts snugly. Do not final-tighten bolts at this time.

Note. It may be necessary to equalize distance between planetary units by moving front and rear clutch drums to allow socket wrench to seat on bolt heads.

h. Check to make sure oil delivery sleeve is properly positioned by applying air pressure through each of the clutch passages in side of case at passage marked E and F on figure 9. Listen for sound of clutch application and make sure both clutches operate.

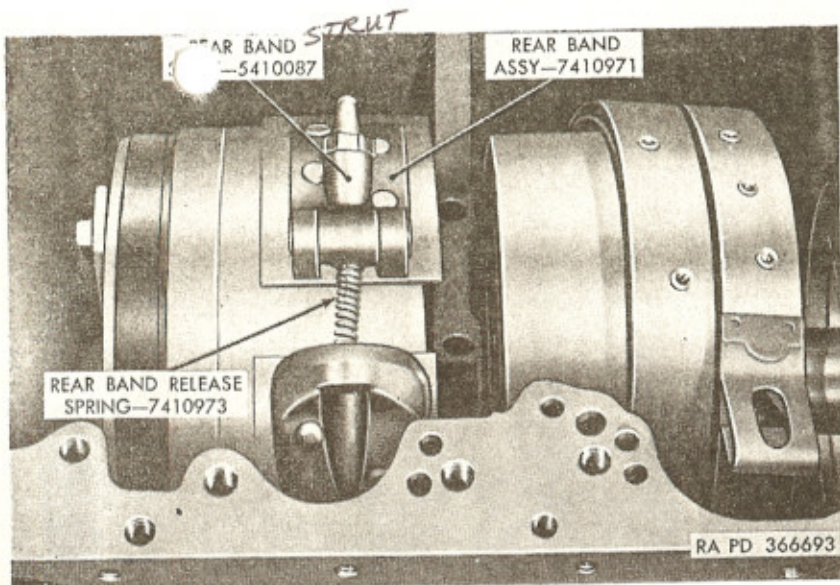


Figure 186. Rear band release spring installed.

134. Installation of Front Oil Pump Assembly

a. Place front oil pump drive key into keyway of front oil pump drive gear, then assemble drive gear to front pump assembly. Aline key in drive gear with keyway in front pump assembly. Do not use force in installation.

b. Position new front oil pump cover gasket over front oil pump cover. Install front oil pump drive gear bronze thrust washer over planet carrier shaft against front planet carrier shoulder (fig. 44).

c. Install front oil pump and drive gear assembly over front planet carrier intermediate shaft. Aline locating notch in pump cover with counterbore in case (fig. 44).

d. Install $2\frac{1}{16}$ -inch plain (front oil pump locating) washer (fig. 43) in counterbore of transmission case.

Note. This plain washer is 0.09-inch thick and has $\frac{1}{2}$ -inch outside diameter.

e. Install two $\frac{7}{16} \times \frac{1}{2}$ bolts which attach front oil pump cover to transmission case. Tighten bolts to 10 to 13 pound-feet torque.

Note. Cover should protrude 0.003 to 0.015 inch out of case (fig. 187). If cover protrudes less than 0.003 inch, add another pump cover gasket to allow cover to protrude within limits.

f. Install the bronze thrust washer; then install the steel thrust washer (fig. 188) over intermediate shaft against front end of front drive gear. These washers were tied together during disassembly.

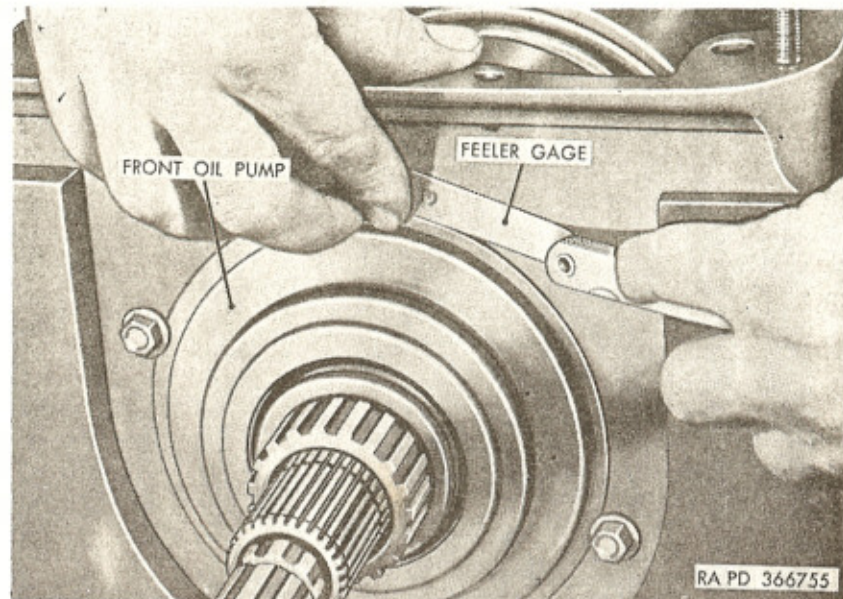


Figure 187. Checking installed position of front oil pump cover.

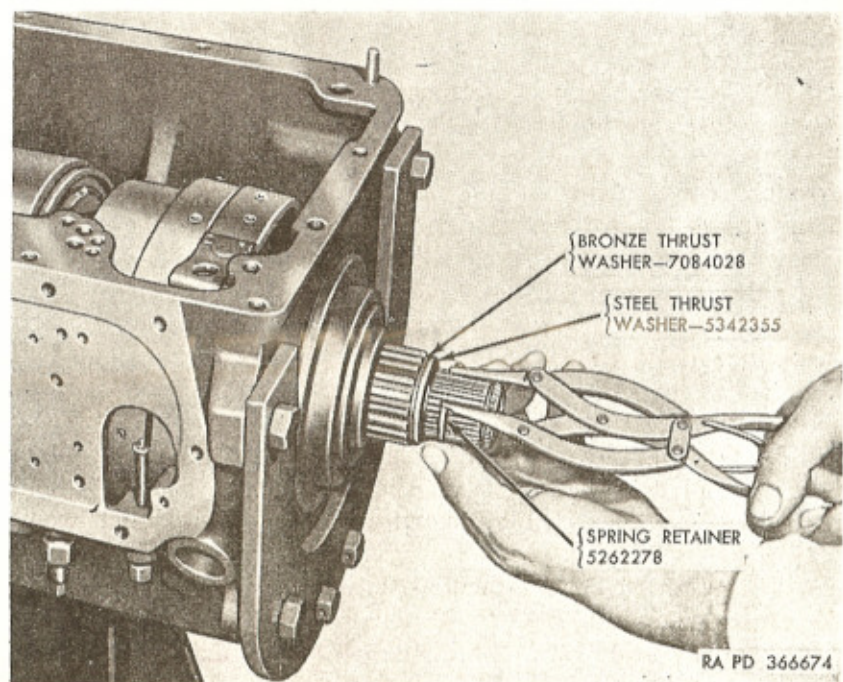


Figure 188. Installing spring retainer on intermediate shaft.

- g. Install spring retainer (fig. 188) which holds thrust washers in place on intermediate shaft.
- h. Final-tighten two center bearing cap bolts alternately and gradually to 40 to 50 pound-feet torque.
- i. With large pliers, bend lock plate up against flats of center bearing cap attaching bolt heads to lock bolts securely.
- Caution:** Do not pry lock plate with screwdriver or use a chisel. Such action may damage case sufficiently to necessitate replacement.

135. Installation of Input Shaft, Reverse Unit, Output Shaft, and Bearing Retainer Assembly (301MG)

- a. Install large screwdriver between transmission center bearing cap and rear clutch drum to prevent the rear drum from moving forward. The screwdriver should be placed at an angle to prevent damage to oil delivery sleeve.
- b. Remove rear clutch hub retainer bracket—A7950207 (fig. 49) from rear unit drum.
- c. Coat rear clutch hub rear thrust washer very lightly with artillery and automotive grease (GAA); then install thrust washer in counterbore of rear clutch hub.
- d. Position small O-ring gasket into counterbore at rear of transmission case (fig. 48).
- e. Position new output shaft bearing retainer gasket on transmission case.
- f. With reverse clutch stationary cone key placed in slot of reverse clutch stationary cone as shown in figure 48, insert input shaft, bearing retainer, reverse unit, and output shaft as a unit through rear of transmission case, guiding input shaft through planetary units. Aline stationary cone key with keyway in transmission case, and rear bearing retainer bolt holes with holes in transmission case.
- g. Attach rear bearing retainer to transmission case by loosely installing six $\frac{3}{8}$ x $1\frac{7}{8}$ bolts, five $\frac{3}{8}$ -inch lockwashers, and one $\frac{3}{8}$ -inch flat copper washer. Install flat copper washer in position shown in figure 189.
- h. Rotate input shaft to aline holes in reverse center gear flange with rear planetary unit drum; then install six $\frac{5}{16}$ x $1\frac{1}{2}$ bolts with three new lock straps fingertight. Remove wedging screwdriver.
- i. Final-tighten bolts attaching output shaft bearing retainer to transmission case to 28 to 33 pound-feet torque (fig. 189).
- j. Insert screwdriver into rear planetary unit drive pin hole and against transmission case to keep drum from turning (fig. 47); then temporarily tighten any two opposed reverse center gear

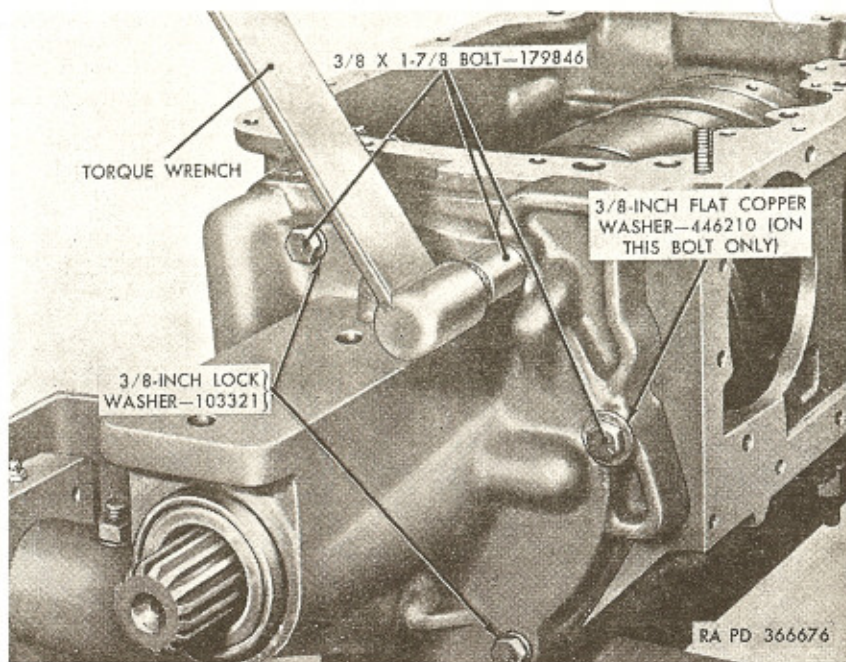


Figure 189. Tightening output shaft bearing retainer bolts (301MG).

flange attaching bolts snugly. Remove wedging screwdriver; then turn planetary units to check for freeness. All attaching bolts are to be final-tightened later after making input shaft end play check.

Note. Do not bend edges of attaching bolt lock straps against bolt heads at this time.

136. Input Shaft End Play Check (301MG)

End play between input shaft and output shaft should measure 0.004 to 0.018 inch and should be checked at this time. This end play clearance is determined by the thickness of bronze thrust washer located between the input shaft and output shaft (fig. 30). Selective size thrust washers are listed in table VII. Make end play check in the following manner, using one of the selective size thrust washers.

- a. Screw checking guide—B7950327 on input shaft. Install dial indicator—41-I-100, using extension rod—A266330 (fig. 190). Wedge a large screwdriver between front clutch drum and center bearing cap to hold front unit forward. The screwdriver should be placed at an angle to prevent damage to oil delivery sleeve.

Table VII. Input ^{install} aft Selective (Various Thickness) Thrust Washers

Stamped No.	Thickness (inch)	Part No.
1	0.055 to 0.059	7084061
2	0.063 to 0.067	7084062
3	0.071 to 0.075	7084063
4	0.079 to 0.083	7084064
5	0.087 to 0.091	7084065
6	0.095 to 0.099	7084066
7	0.103 to 0.107	7084067
8	0.111 to 0.115	7084068

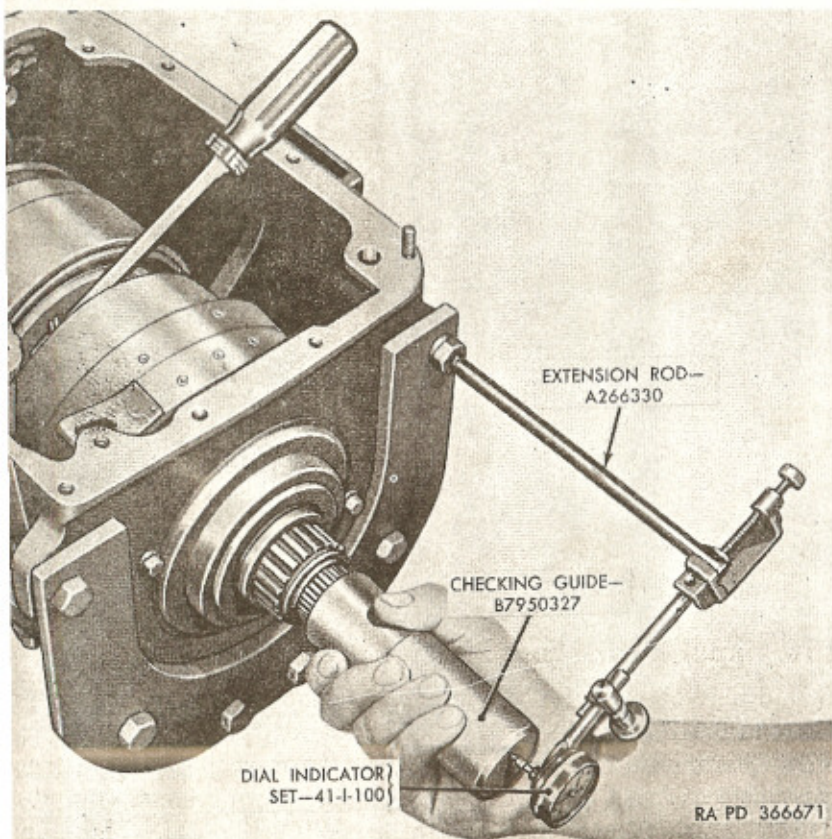


Figure 190. Checking input shaft end play before final assembly of transmission.

b. Move input shaft fore and aft while holding shaft checking guide (fig. 190). End play should be 0.004 to 0.018 inch. Be sure to get free input shaft end play. Forcing shaft will not give an accurate reading.

Note. If end play is not within limits, disassemble unit and install correct size selective thrust washer in counterbore of output shaft; then recheck end play.

c. After obtaining correct shaft end play, remove dial indicator, checking guide, and extension rod. Remove screwdriver from between front clutch drum and center bearing cap.

d. Final-tighten all six reverse center gear attaching bolts to 15 to 18 pound-feet torque; then using large pliers, bend up all four edges of each bolt lock strap against bolt heads, making sure one ear of each strap is pressed against flat of bolt head.

137. Installation of Input Shaft, Reverse Unit, and Output Shaft Assembly (303M)

a. Install a large screwdriver between center bearing cap and rear clutch drum to prevent the rear drum from moving forward. The screwdriver should be placed at an angle to prevent damage to oil delivery sleeve.

b. Remove rear clutch hub retainer bracket—A7950207 from rear unit drum.

c. Coat rear clutch hub rear thrust washer very lightly with artillery and automotive grease (GAA); then install thrust washer in counterbore of rear clutch hub.

d. Insert input shaft and output shaft through rear of transmission case, guiding input shaft through intermediate shaft of front planet carrier.

e. Rotate input shaft to aline holes in reverse center gear flange; then install six $\frac{5}{16} \times 1\frac{1}{2}$ bolts with three new lock straps. Tighten bolts fingertight; then remove screwdriver from between center bearing cap and rear clutch drum.

f. Insert screwdriver into rear planetary unit drive pin hole and against transmission case to keep drum from turning; then tighten reverse center flange attaching bolts to 15 to 18 pound-feet torque (fig. 191).

Note. Do not bend edges of lock straps up against reverse center gear attaching bolt heads at this time.

g. Install reverse planet carrier assembly over output shaft, mesh-pinions with teeth of reverse center gear.

h. Install reverse internal gear and stationary cone as an assembly, meshing internal gear teeth with reverse planet pinions. Aline stationary cone key (fig. 192) with keyway in transmission case; then compress stationary cone with fingers and at same time push cone and reverse internal gear into place.

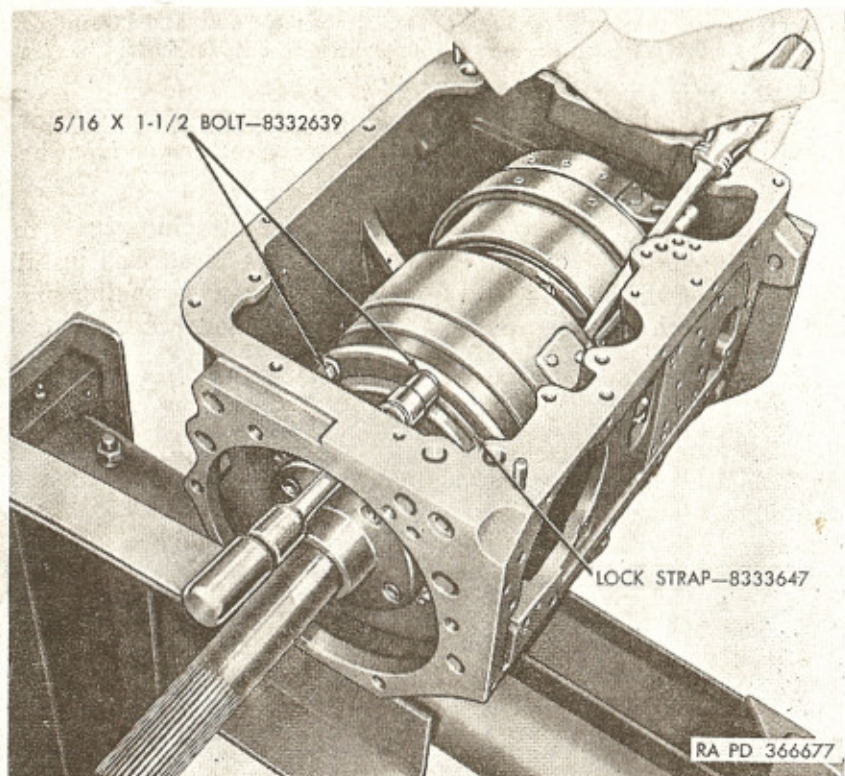


Figure 191. Tightening reverse center gear attaching bolts (303M).

i. Test planetary units for freeness by turning input and output shafts and planetary unit drums. Drums should turn with light force. If either drum binds, disassemble and correct cause of binding.

138. Installation of Rear Oil Pump and Governor Assembly

a. Position secondary (small) governor weight toward front of transmission; then install rear oil pump and governor assembly (fig. 40) in transmission. Make sure gear on pump shaft is meshing properly with bronze drive gear on reverse planet carrier. Secure pump to case with two $\frac{5}{16}$ x $\frac{7}{8}$ bolts and $\frac{5}{16}$ -inch lock-washers. Tighten bolts to 15 to 18 pound-feet torque.

b. Check governor runout in manner shown in (1) through (3) below.

(1) Mount dial indicator—41-I-100 (fig. 193) on transmission with indicator spindle contacting governor tower approximately one-quarter inch from end of tower.

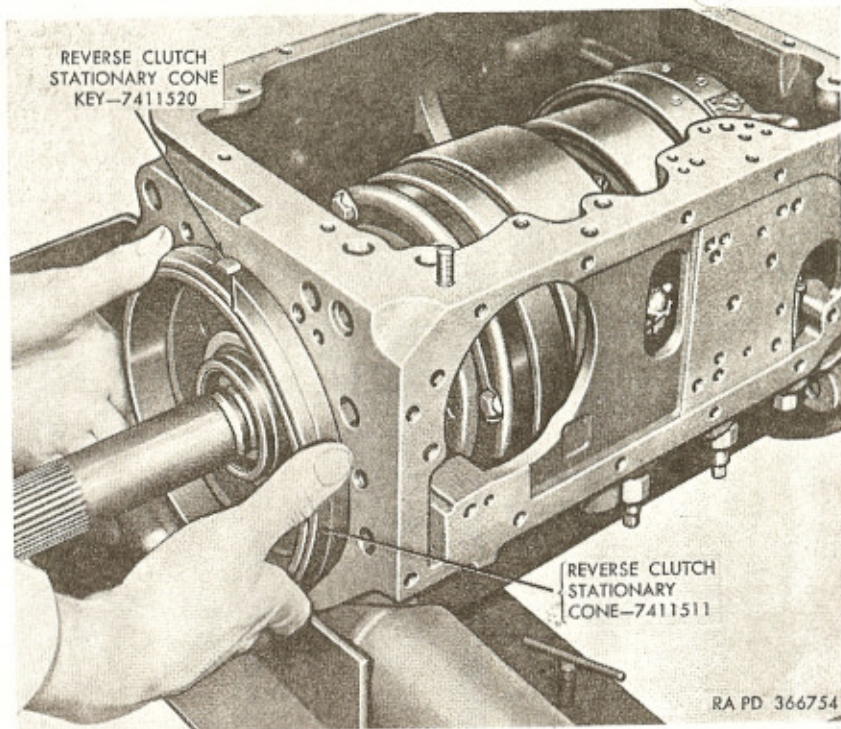


Figure 192. Installing reverse clutch stationary cone and key (303M).

Rotate input shaft several revolutions and note indicator reading. Total runout should not exceed 0.005 inch. If runout is within limits, remove dial indicator and omit (2) and (3) below. If runout is not within limits, continue with (2) below.

- (2) Remove dial indicator. Mark position of governor body on drive flange; then remove governor from drive flange. Reinstall governor on drive flange 180° from original position. Install dial indicator and check runout in the same manner as described in (1) above. If still not within limits (0.005 inch), remove dial indicator and governor, and check as described in (3) below.
- (3) Install dial indicator—41-I-100 (fig. 194) with spindle contacting drive flange just inside tapped holes. Rotate input shaft several turns and note reading. If runout exceeds 0.002 inch, replace governor drive flange and/or rear oil pump assembly; then recheck drive flange with indicator. If within limits, install governor and check as described in (1) above. If not within limits, install

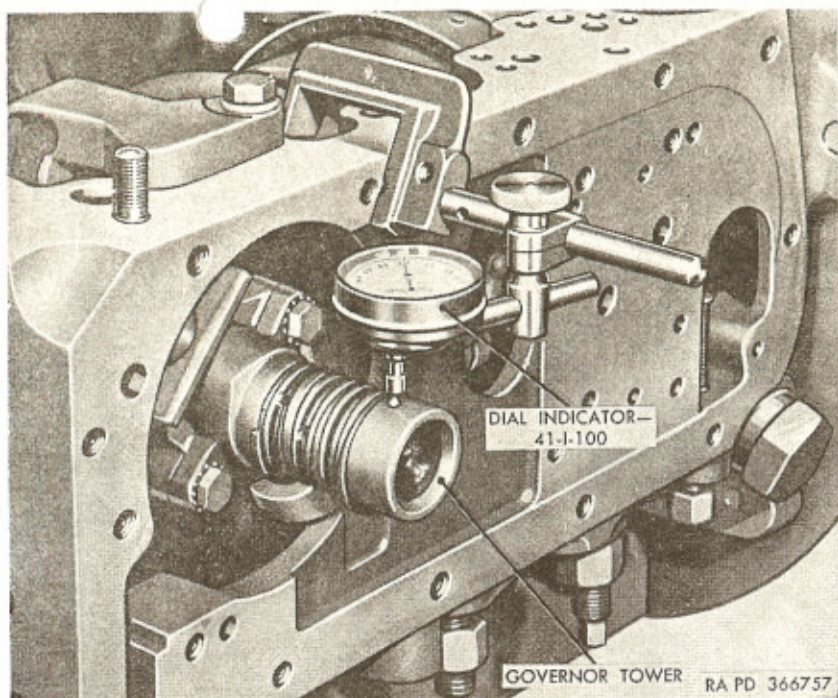


Figure 193. Checking governor runout.

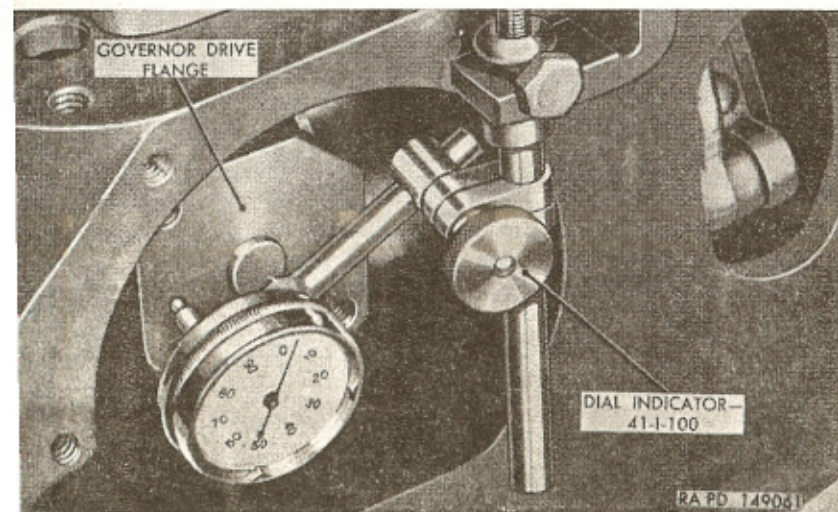


Figure 194. Checking governor drive flange runout.

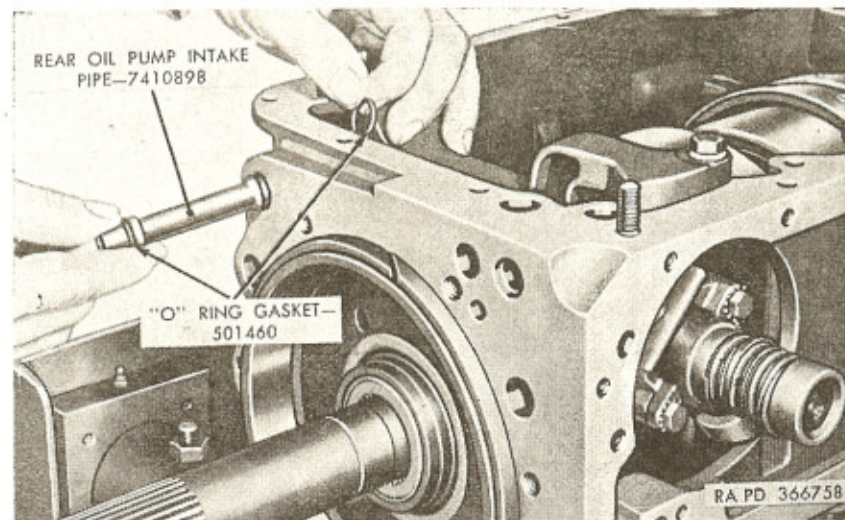


Figure 195. Installing rear oil pump intake pipe (303M).

new governor assembly and recheck as described in (1) above.

c. On 303M transmission only, insert one end of rear oil pump intake pipe (fig. 195) through passage at rear of transmission case. Install new O-ring gasket on inner end of intake pipe. Press pipe firmly into rear oil pump. Install another new O-ring gasket over outer end of intake pipe.

139. Installation of Output Shaft Bearing Retainer (303M)

a. Install reverse carrier spacer and reverse internal gear bronze thrust washer (fig. 33) on transmission output shaft.

b. Position new output shaft bearing retainer gasket on transmission case.

c. Install O-ring gasket in counterbore around the front oil pump discharge pipe assembly hole in case.

d. Position assembled rear bearing retainer on rear of transmission.

e. Position output shaft bearing retainer remover and replacer—C7950563 with center screw section of tool over transmission output shaft assembly (fig. 196) so that the main body of the tool contacts the bearing retainer. Align the four slots of the tool with the four tapped holes in the bearing retainer diagonally opposite the output shaft assembly.

f. Attach remover and replacer to bearing retainer with four $\frac{3}{8}$ x $1\frac{1}{4}$ bolts, using flat washers as necessary. Tighten bolts firmly.

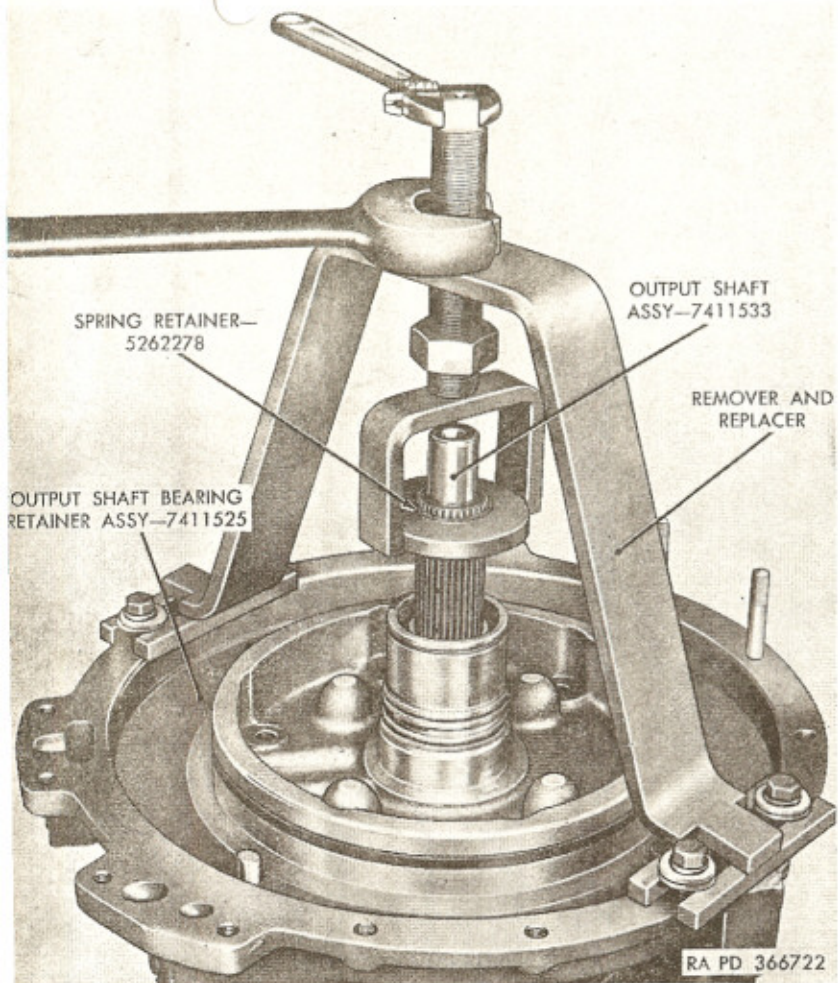


Figure 196. Installing assembled output shaft bearing retainer with remover and replacer—C7950563 (303M).

g. Position the collar of the tool center screw section so that it is below the spring retainer groove in the transmission output shaft. Temporarily install spring retainer in groove of output shaft.

h. Run the lower tool nut down on the screw. Run the upper nut down until it contacts the main body of the tool. Continue tightening down on the upper nut with a wrench while holding center screw from turning until the rear bearing contacts the transmission case.

i. Loosen the tool center screw section so snap ring can be removed. Remove snap ring; then remove tool.

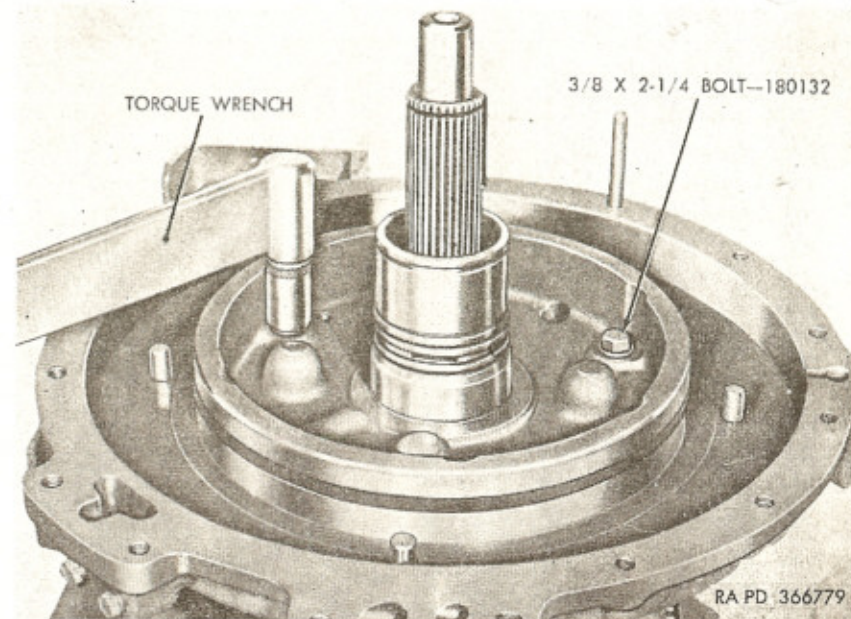


Figure 197. Tightening bolts attaching output shaft bearing retainer to transmission case (303M).

j. Install six $\frac{3}{8}$ x $2\frac{1}{4}$ bolts (fig. 197) and six $\frac{3}{8}$ -inch lockwashers which attach bearing retainer to transmission case. Tighten bolts to 32 to 37 pound-feet torque.

k. Install two $\frac{7}{16}$ -13 x $1\frac{1}{4}$ bolts and flat washers attaching output shaft bearing retainer to repair stand.

l. Change position of transmission in repair stand to horizontal so input shaft end play can be checked.

140. Input Shaft End Play Check (303M)

End play between input shaft and the output shaft should measure 0.004 to 0.018 inch and should be checked at this time. This end play clearance is determined by the thickness of bronze thrust washer located between the input shaft and output shaft (fig. 30). Selective size thrust washers are listed in table VII. Make end play check in the following manner, using one of the selective size thrust washers.

a. Temporarily install output shaft bearing spacer, reduction unit clutch hub, reduction unit sun gear, and spring retainer on end of output shaft (fig. 30).

b. Screw checking guide—B7950327 on input shaft. Install dial indicator—41-I-100, using extension rod—A266330 (fig. 190). Wedge a large screwdriver between front clutch drum and

enter bearing cap to hold front unit forward. The screwdriver should be placed at an angle to prevent damage to oil delivery leeve.

c. Move input shaft fore and aft while holding shaft checking guide (fig. 190). End play should be 0.004 to 0.018 inch. Be sure to get free input shaft end play. Forcing shaft will not give an accurate reading.

Note. If end play is not within limits, disassemble unit and install correct size selective thrust washer in counterbore of output shaft; then recheck end play.

d. After obtaining correct input shaft end play, remove dial indicator, checking guide, and extension rod. Remove screwdriver from between front clutch drum and center bearing cap. Remove spring retainer, reduction sun gear, and reduction clutch hub from output shaft. Do not remove output shaft bearing spacer.

e. Using large pliers, bend up all four edges of each reverse center gear flange bolt lock strap against bolt heads, making sure one ear of each lock strap is pressed against flat of bolt head.

141. Installation of Transmission Oil Pressure Regulator Valve Components

a. Install reverse booster plug (fig. 198 or 199) in pressure regulator plug assembly.

b. On 301MG transmission regulator valve only, install inner and outer cushion on valve into grooves as shown in inset of figure 199.

c. Install pressure regulator valve and spring in front oil pump (fig. 41).

d. Install regulator plug and new gasket over spring; then screw plug into case. Tighten plug to 35 to 45 pound-feet torque.

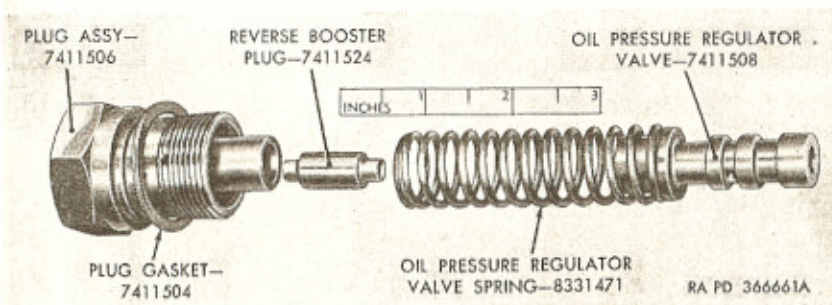


Figure 198. Transmission oil pressure regulator valve components (303M).

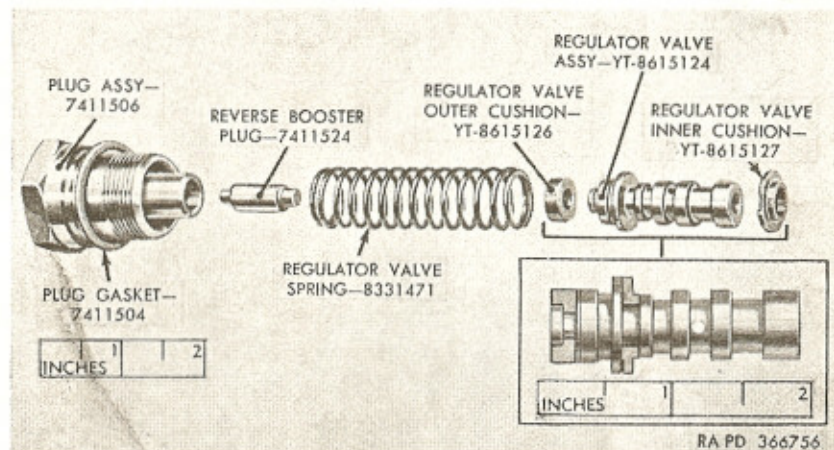


Figure 199. Transmission oil pressure regulator valve components (301MG).

142. Installation of Front Servo

a. Loosen, but do not remove, two bolts attaching front oil pump cover to transmission case. Loosening these bolts will facilitate installation of front servo on front pump delivery line.

b. Insert front oil pump delivery line (fig. 200) in passage of front pump.

c. On 301MG transmission, insert rear oil pump discharge pipe assembly (L, fig. 39) into rear oil pump outlet passage.

d. On 303M transmission, insert front oil pump discharge pipe assembly (P, fig. 36) into passage at rear of transmission case, working line well back into position.

e. Position front servo with piston stem in slot at end of front band, and front oil pump delivery line aligned with passage in servo body (fig. 200).

f. Lower servo over delivery line, and at same time engage fitting of servo with discharge pipe assembly.

g. Loosely install $\frac{3}{8}$ x 1 bolt (A, fig. 36 or 39), $\frac{3}{8}$ x 2 bolt (C, fig. 36 or 39), and two $\frac{3}{8}$ -inch lockwashers. Do not turn down more than two or three threads on bolts. Leaving bolts loose will facilitate installation of rear servo later.

h. On 303M transmission only, install front oil pump discharge pipe clip (H, fig. 36) attaching discharge pipe to rear oil pump body.

143. Installation of Rear Servo

a. Loosen rear band adjusting stop screw; then with rear band release spring installed in recess on end of rear band and

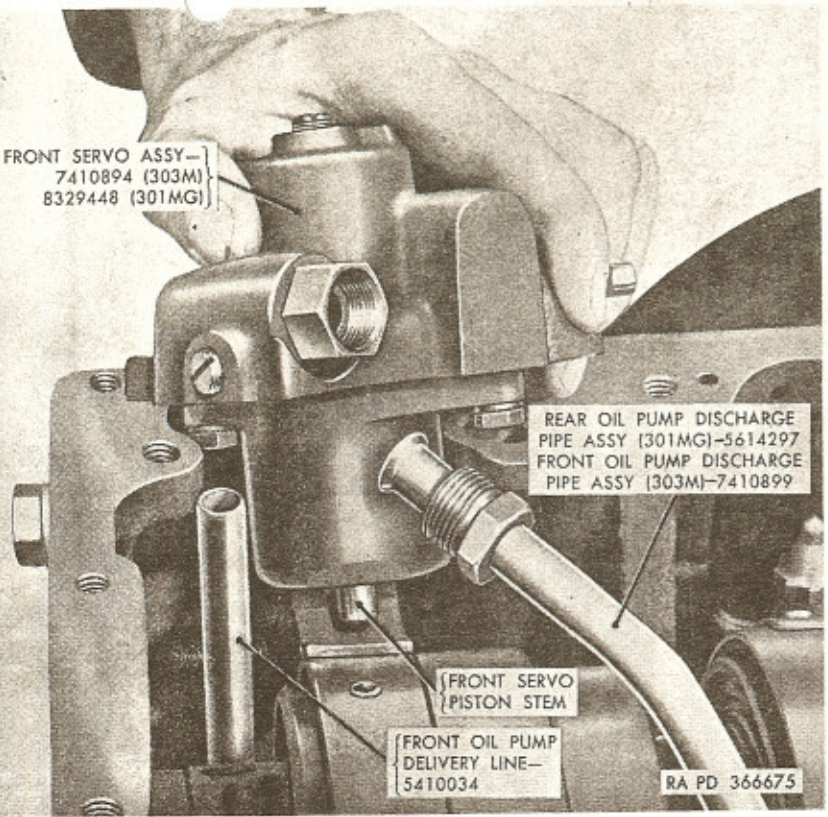


Figure 200. Installing front servo assembly.

over guide pin on rear band strut screw, turn rear band until end of band is against band adjusting stop screw.

b. Screw strut onto rear band until fingertight; then back off one-half turn.

c. Position rear servo on case, engaging rear band strut with servo actuating lever while inserting oil transfer line (fig. 37) from front servo into rear servo passage.

d. Install two 3/8 x 2 bolts (C, fig. 36 or 39) and 3/8-inch lockwashers. Tighten the two front and two rear servo attaching bolts to 28 to 33 pound-feet torque. While tightening rear servo bolts, observe position of rear band release spring between ends of band.

e. Using 2 5/16-inch and 1 1/16-inch open-end wrenches, tighten pump discharge line assembly to front servo line fitting.

f. Tighten the two bolts which attach front oil pump cover to transmission case to 10 to 13 pound-feet torque. These were temporarily loosened as described in paragraph 142a.

g. On 301MG transmission, insert front oil pump intake pipe assembly (K, fig. 39) well down into passage of front oil pump. At rear end of pipe, position gasket between pipe flange and rear oil pump; then attach pipe flange to rear oil pump with two No. 10 x 7/16 screws with lockwashers. Tighten screws to 3 to 4 pound-feet torque.

h. On 303M transmission, position front oil pump intake pipe clip (M, fig. 36) over intake pipe; then insert front end of pipe well down into front oil pump passage. Attach intake pipe clip to rear servo with No. 10 x 7/16 screw with washer. Tighten screw to 3 to 4 pound-feet torque.

i. Install new intake pipe sealing ring (J, fig. 36 or 39) on flange of pump intake pipe.

j. On 303M transmission, install front oil pump intake pipe clip (Q, fig. 36) over discharge pipe as shown.

144. Front Band Adjusting Rod Trimming and Band Adjustment

Note. Before making adjustment, be sure anchor of band is seated on front band adjusting stop screw and that band is centered on front drum.

a. Loosen front band adjusting stop screw locknut and back out band adjusting stop screw until band is completely free.

b. Remove headless slotted pipe plug from bottom of front servo body. Loosen the "hex" adjusting screw of front servo gage—8708127 (fig. 201), until approximately one-eighth inch of threads are exposed above gage body. Install gage in bore of servo body from which pipe plug was removed. Tighten gage in bore by hand only until gage is firmly seated.

c. Tighten the "hex" adjusting stop screw of gage with fingers until stem of gage is felt to JUST TOUCH piston within front servo.

d. Using a wrench, tighten "hex" adjusting screw of gage ten complete turns from point where it was felt to just touch piston in front servo. After making the ten turns on gage, the front band should be free and loose on drum.

e. With checking gage—A795025^o (fig. 201), measure front band adjusting rod. Cut end of rod off even with notch on gage, making a clean cut which is free of burrs.

f. Back out adjusting screw of gage—8708127 (fig. 202) five complete turns; then tighten front band adjusting stop screw until knurled washer of gage is JUST FREE to turn. Keep front band centered on drum while tightening stop screw. After making this adjustment, front band adjusting rod should be approximately flush with case.

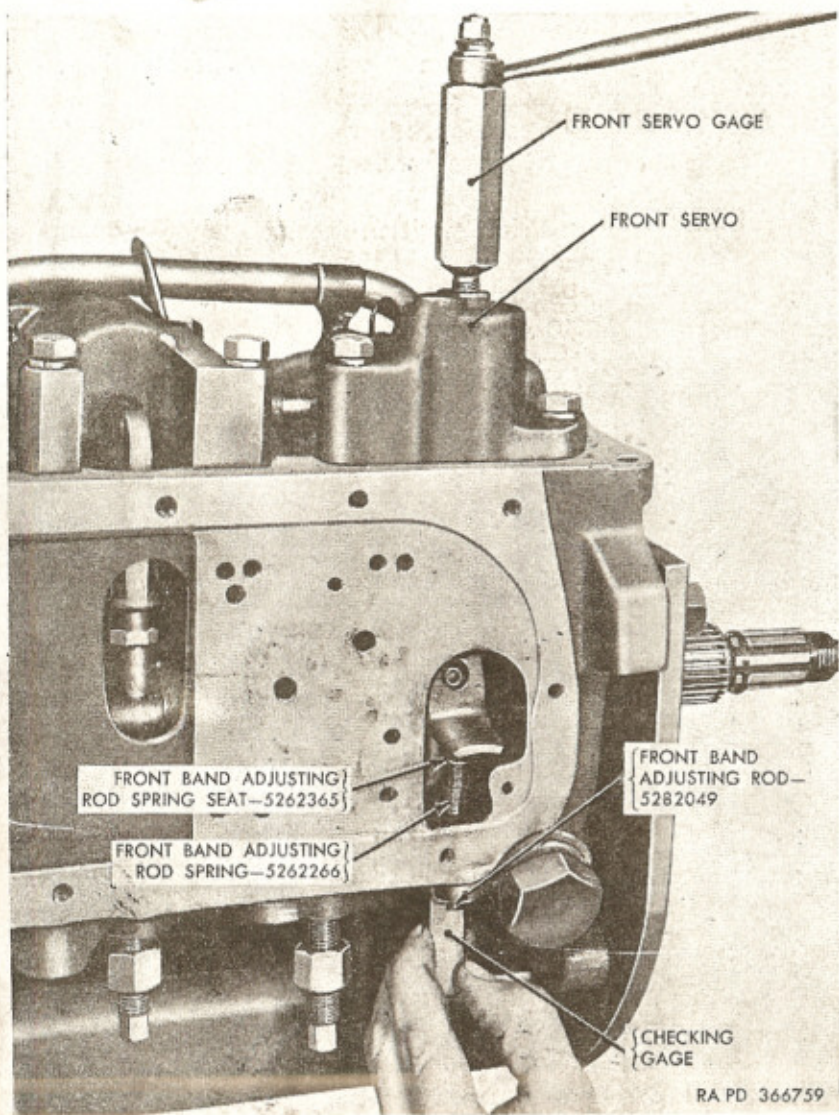


Figure 201. Use of adjusting rod checking gage—A7950250 and front servo adjusting gage—8708127.

g. Install front band adjusting cap (B, fig. 182) in bore of transmission case. Tighten cap to 15 to 18 pound-feet torque.

h. Hold front band adjusting stop screw stationary and tighten adjusting stop screw locknut to 40 to 50 pound-feet torque.

i. Remove adjusting gage—8708127 from bore in front servo body; then install pipe plug in bore from which gage was removed. Tighten plug to 6 to 7 pound-feet torque.

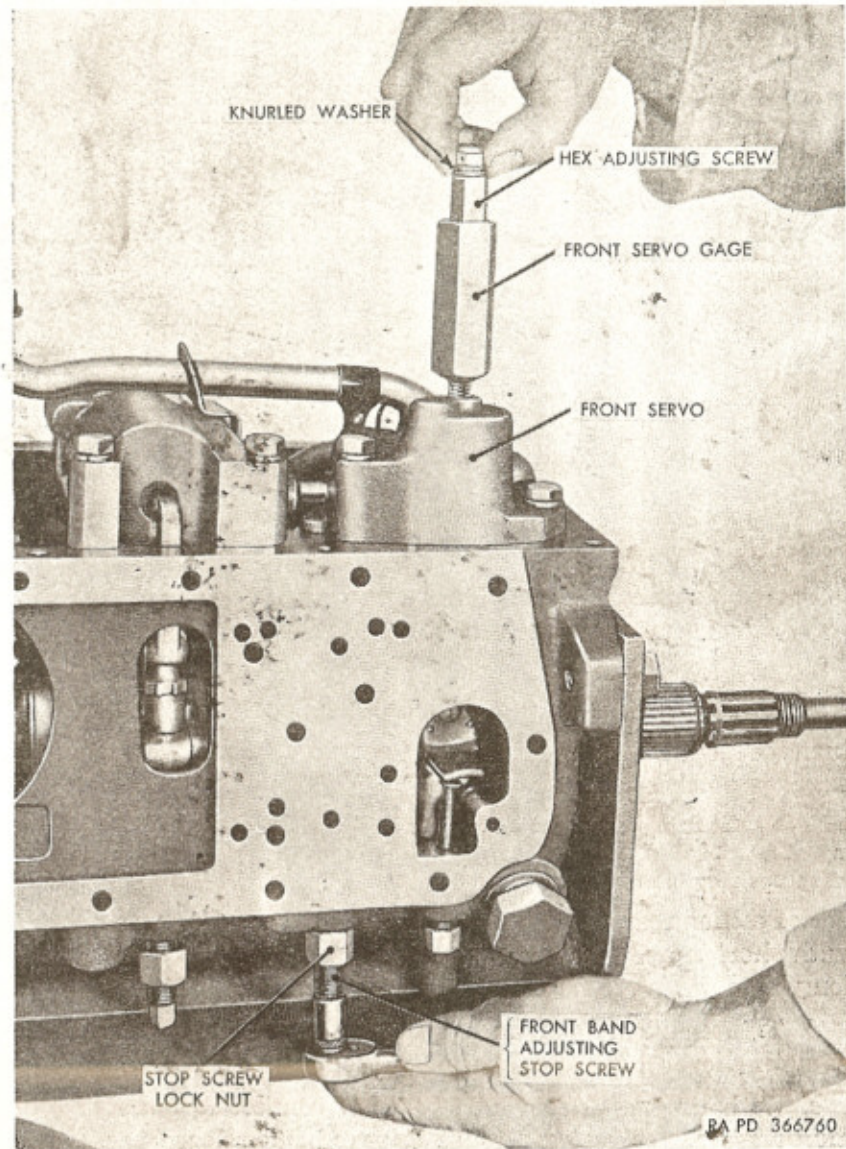


Figure 202. Adjusting front band using adjusting gage—8708127.

145. Rear Band Adjustment

Note. Before making rear band adjustment, make sure anchor of band is seated on rear band adjusting stop screw.

a. With band centered on drum, loosen rear band adjusting stop screw and locknut to allow free band.

b. Turn band strut down (clockwise) with fingers until tight on strut screw; then back off strut one-half turn. Make sure strut

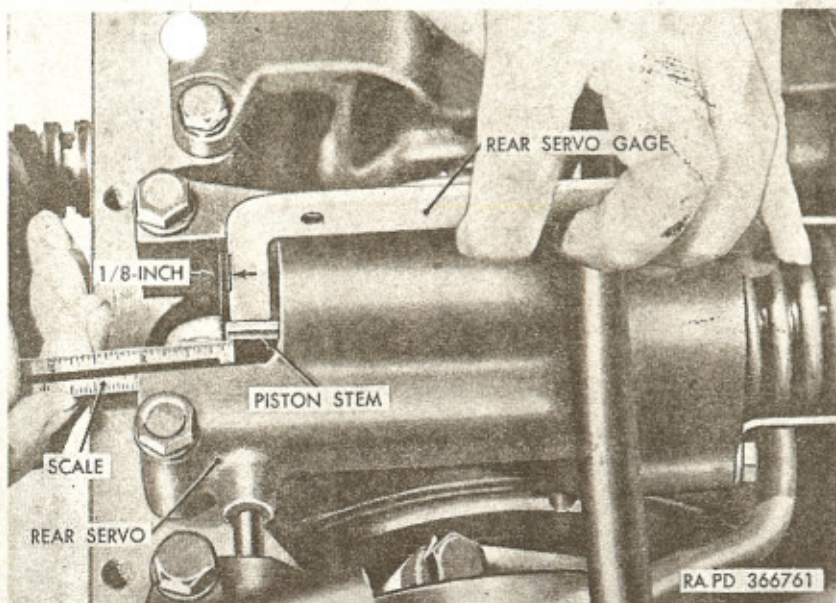


Figure 203. Checking rear band adjustment, using rear servo gage—B7950329.

turns freely on screw, and that rear servo actuating lever spring engages notches on band strut.

Note. Actuating lever spring must be held from strut lugs to allow turning of strut clockwise. Do not bend spring beyond lugs of strut, as tension of spring may be lessened.

c. Position rear servo gage—B7950329 (fig. 203) on rear servo, with short leg of gage hooked over end of accumulator body and long leg of gage resting on servo piston stem.

d. Tighten rear band adjusting stop screw until rear servo actuating lever is three-eighths of an inch from face of servo gage.

e. With air gun—B7950562 (fig. 204) connected to a source of air pressure, apply air pressure to rear band release passage in side of transmission case. While applying air, look through opening in side of transmission case to see that rear servo actuating lever spring engages notches on rear band strut and turns strut; then apply air pressure to compensator passage (fig. 204) before again checking ratchet action of lever spring and strut. After the automatic adjuster checks satisfactorily, turn rear band adjusting stop screw in until actuating lever is one-eighth inch from face of rear servo gage (fig. 203).

f. When correct adjustment is obtained, hold adjusting stop screw and tighten locknut to 40 to 50 pound-feet torque.

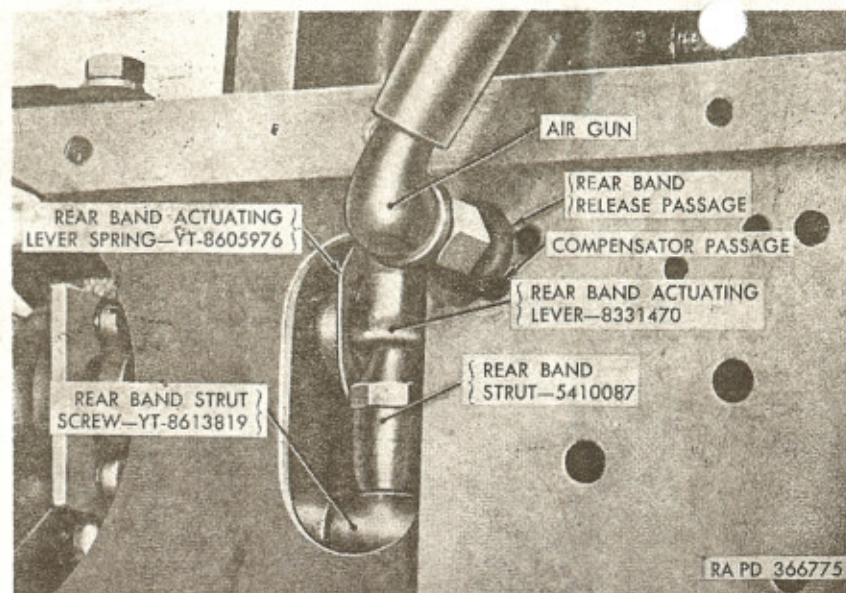


Figure 204. Checking operation of rear band, using air gun—B7950562.

g. With plastic hammer, tap band adjusting stop screw cap (F, fig. 182) over rear band adjusting stop screw locknut.

146. Air-Check of Action of Servos and Clutches, and for Oil Leaks

Refer to paragraph 30.

147. Installation of Reverse Blocker Bracket Assembly

a. With gap in the four oil rings on governor tower up, place chamfered side of reverse blocker bracket assembly over end of governor tower. Press reverse blocker bracket gently into position, guiding oil rings on governor tower into reverse blocker bracket (fig. 205).

b. Install two $\frac{5}{16}$ x $1\frac{3}{4}$ bolts and $\frac{5}{16}$ -inch lockwashers which attach reverse blocker bracket to transmission case. Do not tighten bolts at this time, leaving reverse blocker bracket approximately one-eighth inch away from transmission case which will facilitate installation of control valve and connecting lines later.

148. Installation of Transmission Control Valve Assembly

a. Install one governor oil delivery line into inner bore of reverse blocker bracket as shown in figure 206. Referring to figure 35, install reverse clutch oil pipe into transmission case.

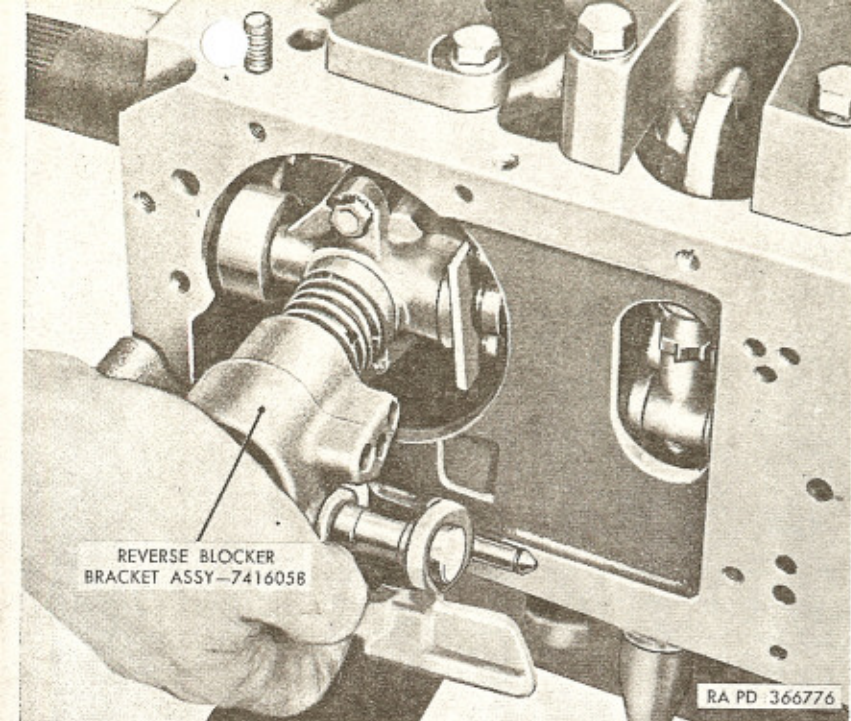


Figure 205. Installing reverse blocker bracket assembly.

b. Position reverse blocker lever return spring over governor oil delivery line; then hook other end of spring over reverse blocker lever pin (fig. 206).

Note. Hook of spring must be installed over governor oil delivery line (fig. 206).

c. Install remaining two governor oil delivery lines into bores of reverse blocker bracket.

d. Position transmission control valve assembly over three governor oil delivery lines and the reverse clutch oil pipe. Make sure control valve detent lever engages reverse blocker lever (fig. 207).

e. Start four $\frac{1}{4}$ x 2 bolts and $\frac{1}{4}$ -inch lockwashers which attach control valve assembly to transmission case. Press control valve assembly and reverse blocker assembly into position against transmission case. Tighten control valve assembly attaching bolts to 6 to 8 pound-feet torque.

f. Insert short end of oil pressure regulator valve reverse oil pipe into bore of transmission control valve and long end of pipe into passage in transmission case. Tap pipe into place with plastic hammer (fig. 208).

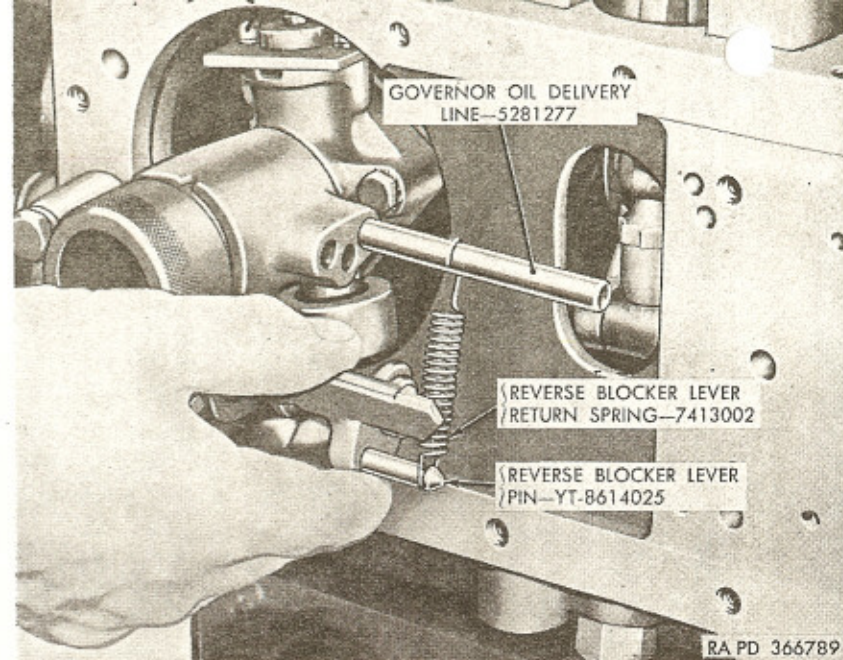


Figure 206. Reverse blocker lever return spring installed.

g. Loosen, but do not remove, two bolts attaching rear oil pump and governor to transmission case to facilitate governor alignment.

h. Position alignment gage—A7950067 (fig. 207) on governor tower and into reverse blocker bracket assembly.

i. With alignment gage in place, tighten two bolts attaching rear oil pump and governor to transmission case to 15 to 18 pound-feet torque. Tighten two bolts attaching reverse blocker bracket to transmission case to 10 to 13 pound-feet torque (fig. 207).

j. Rotate gage; gage should rotate freely. Turn input shaft to rotate governor one-quarter turn; then recheck governor and gage again for freeness. If governor or gage bind at any point, loosen reverse blocker bracket and/or rear oil pump and reposition to give governor free movement. Recheck governor each one-quarter turn for a complete revolution.

k. Remove governor alignment gage—A7950067 from reverse blocker bracket assembly and governor tower.

149. Installation of Transmission Case Side Cover

a. Position case side cover assembly, using new gasket, on transmission case.

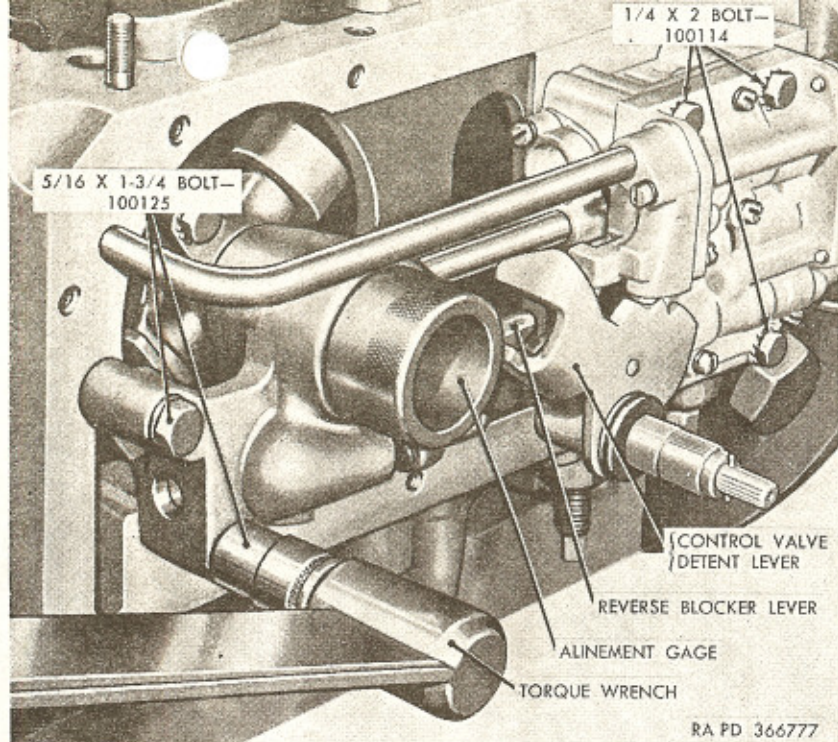


Figure 207. Aiming reverse blocker bracket to governor using gage—A7950067.

b. Install twelve $\frac{1}{4}$ x $\frac{1}{2}$ side cover attaching cap screws with copper washers.

c. Before tightening cap screws, aline side cover so it will not bind on manual control valve lever shaft. Tighten cap screws to 10 to 12 pound-feet torque.

d. Install new O-ring gasket inside the manual control valve lever shaft seal retainer (C, fig. 209). Install new seal ring in groove at side of retainer.

e. Install retainer with seal ring and O-ring gasket over manual control valve lever shaft with seal spring and cup over retainer.

f. Install manual control valve lever shaft seal retainer snap ring on shaft, using improvised installer (par. 11). Tap snap ring into place with improvised installer (fig. 210) and hammer.

150. Installation of Oil Pan Assembly

Note. Before installing oil pan assembly, remove any loose particles of metal or foreign matter which may have fallen to bottom of case. Wearing safety glasses, direct air pressure in and around planetary units to blow out foreign material.

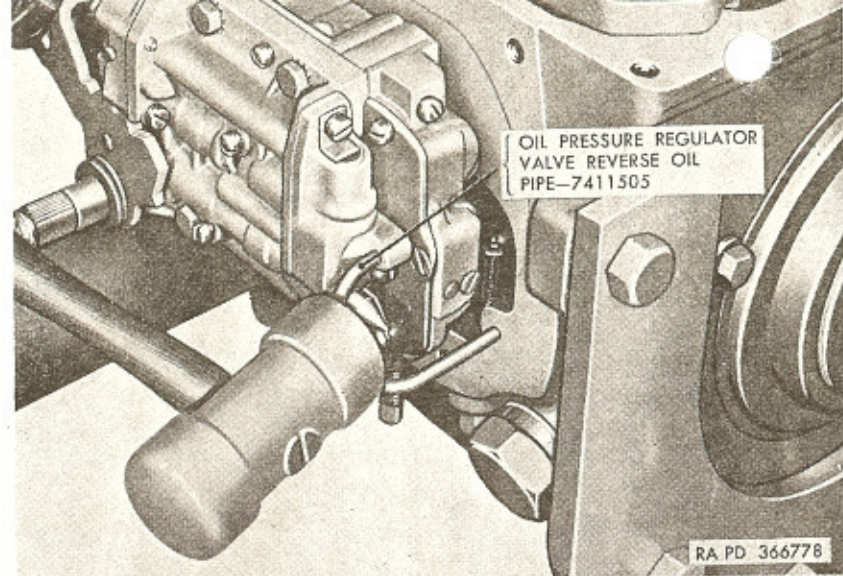


Figure 208. Installing oil pressure regulator valve reverse oil pipe.

a. Position new oil pan gasket on transmission case.

b. With intake pipe sealing ring (J, fig. 36 or 39) installed over flanged end of pump intake pipe, install oil pan on transmission case. Make sure that passage in oil pan engages end of oil pump intake pipe.

c. Install ten $\frac{5}{16}$ x $\frac{3}{4}$ cap screws (with copper washers), two $\frac{5}{16}$ -inch stud nuts, and two new stud $\frac{5}{16}$ -inch copper washers which attach transmission oil pan to transmission case. Tighten cap screws evenly to 15 to 18 pound-feet torque. Tighten stud nuts to 10 to 13 pound-feet torque.

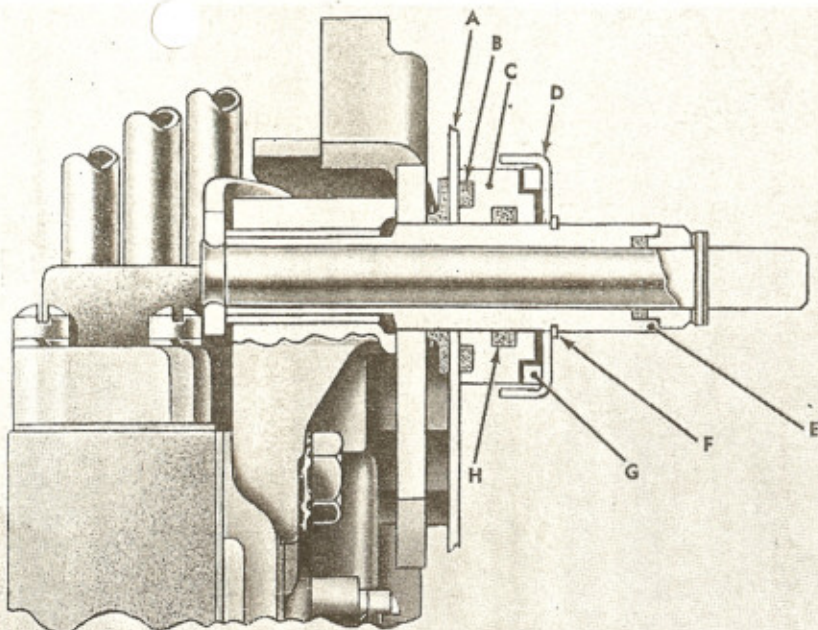
151. Installation of Reduction Unit Parts (303M)

a. Position transmission vertically on repair stand.

b. Install clutch drum front bronze thrust washer over the two hook type oil seal rings (fig. 32) located on output shaft bearing retainer hub.

c. Install reduction clutch piston seal on clutch piston with lip of seal toward guide pin holes (fig. 211).

d. Install reduction clutch piston assembly in output shaft bearing retainer. Revolve clutch piston until the holes in piston index with guide pins on output shaft bearing retainer, at the same time working clutch piston seal into recess of bearing retainer. Push reduction clutch piston assembly (fig. 212) into bore of output shaft bearing retainer.



- | | |
|--|---|
| A—CASE SIDE COVER ASSY—7412619 | E—MANUAL CONTROL VALVE LEVER SHAFT ASSY—7412625 |
| B—MANUAL CONTROL VALVE LEVER SHAFT SEAL RING—7410980 | F—SNAP RING—7412624 |
| C—MANUAL CONTROL VALVE LEVER SHAFT SEAL RETAINER—7410979 | G—MANUAL CONTROL VALVE LEVER SHAFT SEAL SPRING—7411201 |
| D—MANUAL CONTROL VALVE LEVER SHAFT CUP—7410977 | H—MANUAL CONTROL VALVE LEVER SHAFT "O" RING GASKET—501223 |

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Figure 209. Sectional view of manual control valve shaft, seals, and seal retainer installed.

e. Install new outer seal in groove of direct clutch piston with lip away from, notches, working seal well into groove. Install new seal in reduction unit clutch drum. Refer to figure 26 for location of parts.

f. Install direct clutch piston assembly over hub of reduction unit clutch drum while revolving and applying downward pressure on direct clutch piston. Be sure piston is at bottom of its bore; then revolve piston until square notches in piston align with tapped holes in reduction unit clutch drum assembly (fig. 213).

g. Carefully install reduction unit clutch drum and piston assembly over hub of output shaft bearing retainer. Use care to avoid damage to oil seal rings on bearing retainer.

h. Install bronze thrust washer, steel backing washer, and snap ring (fig. 24) on hub of output shaft bearing retainer.

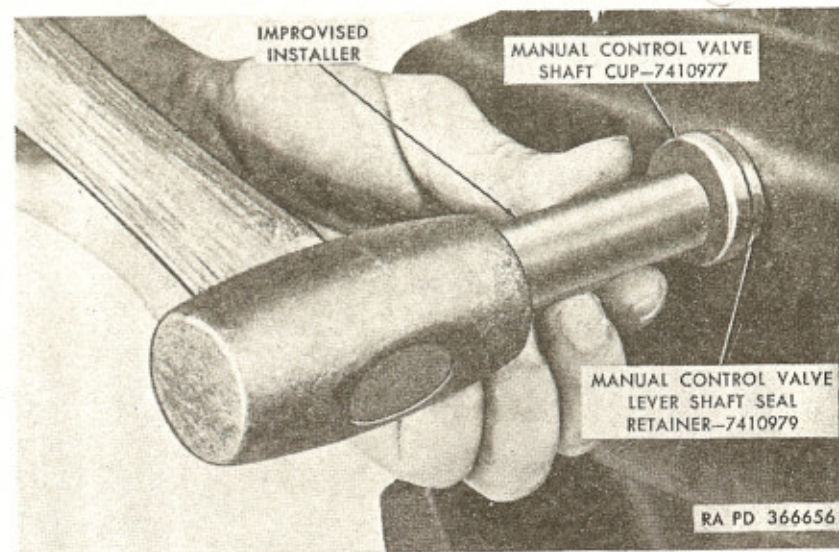


Figure 210. Installing manual control valve shaft seal retainer snap ring with improvised installer.

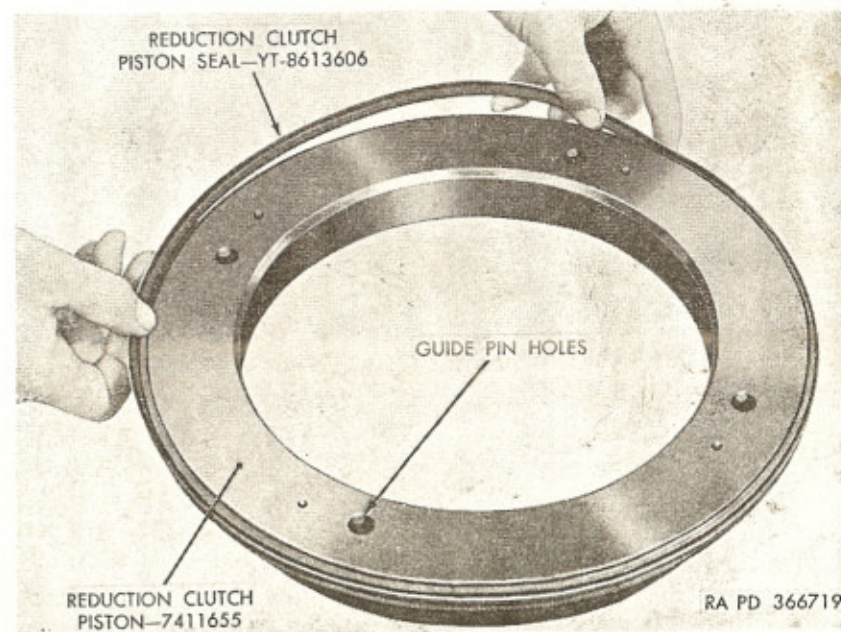


Figure 211. Installing reduction unit clutch piston seal (303M).

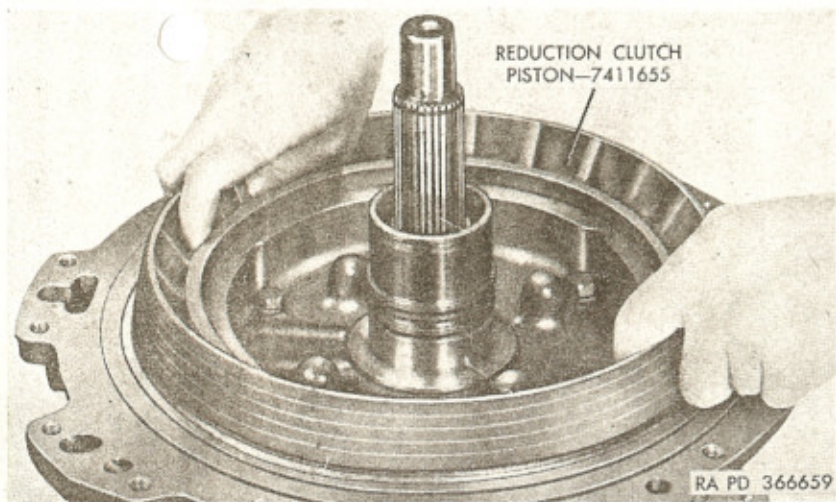


Figure 212. Installing reduction clutch piston assembly (303M).

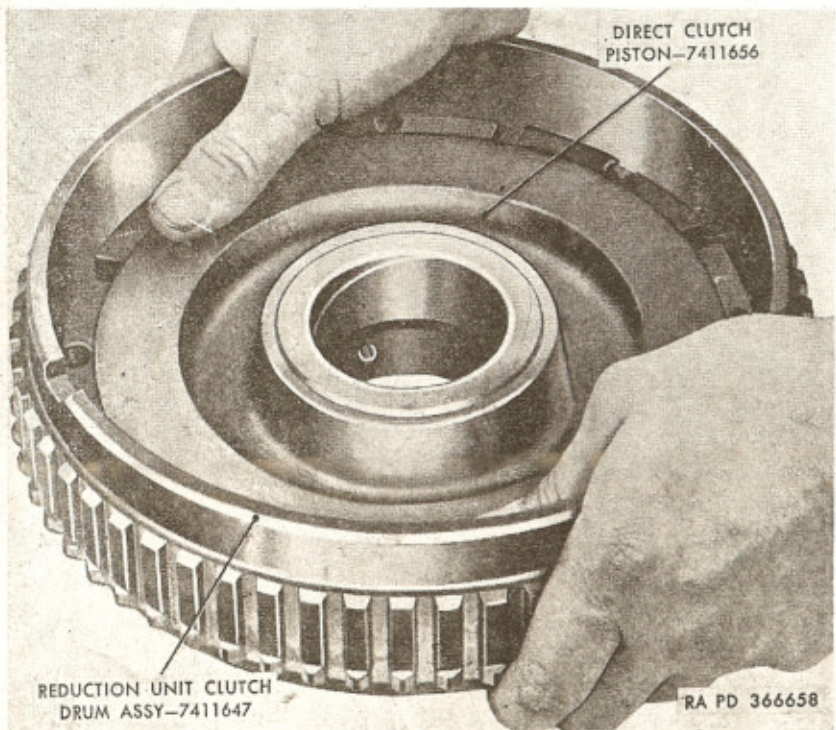


Figure 213. Installing direct clutch piston assembly in reduction unit clutch drum (303M).

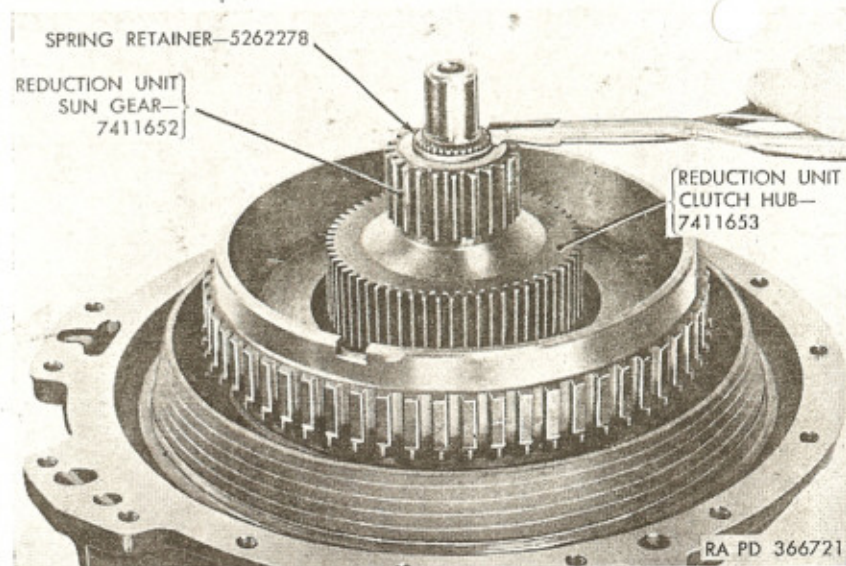


Figure 214. Installing spring retainer on output shaft (303M).

i. Install reduction unit clutch hub and reduction unit sun gear (fig. 214) on the transmission output shaft.

j. With snap ring pliers, install spring retainer (fig. 214) in groove of transmission output shaft.

Note. If there is not sufficient clearance for spring retainer, remove sun gear. With a block of wood and hammer, tap on reduction clutch hub until spring retainer can be installed.

k. Install reduction unit driven cone (fig. 215) on reduction unit clutch drum, aligning splines in clutch drum with splines in driven cone. Make sure cone is free on drum. Rotate until free sliding fit is obtained.

l. Install reduction unit driven cone release spring with open end down on the driven cone. Install release spring retainer on release spring (fig. 23).

m. Temporarily install one of the $\frac{3}{8}$ x 3 bolts which attach reduction unit internal gear to clutch drum in reduction unit clutch drum. This will act as a guide for installing the clutch driven plates (fig. 216) in reduction unit clutch drum.

n. Install clutch plates in reduction unit clutch drum. There are seven bronze clutch drive plates and six steel clutch driven plates (fig. 216). Start with a bronze plate; then alternate plates, ending with a bronze plate. Square notches of steel plates must index with tapped holes of reduction unit clutch drum. The concave side of all steel plates must face in the same direction, either up or down.

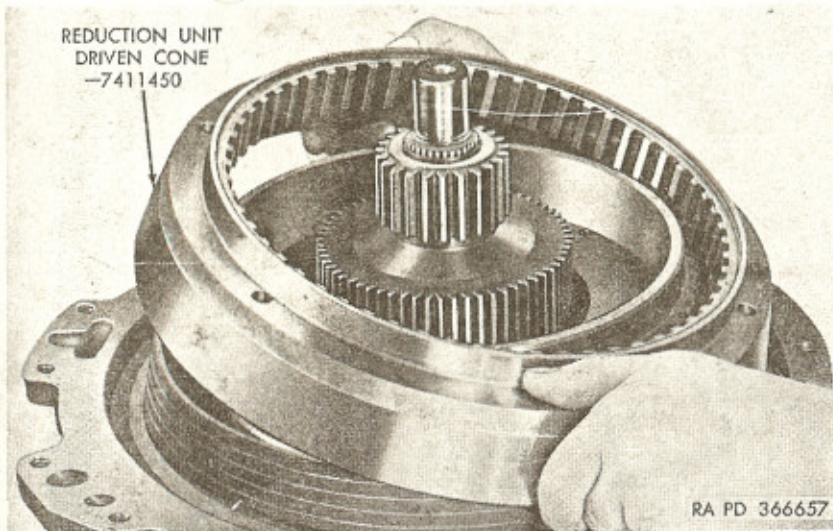


Figure 215. Installing reduction unit driven cone (303M).

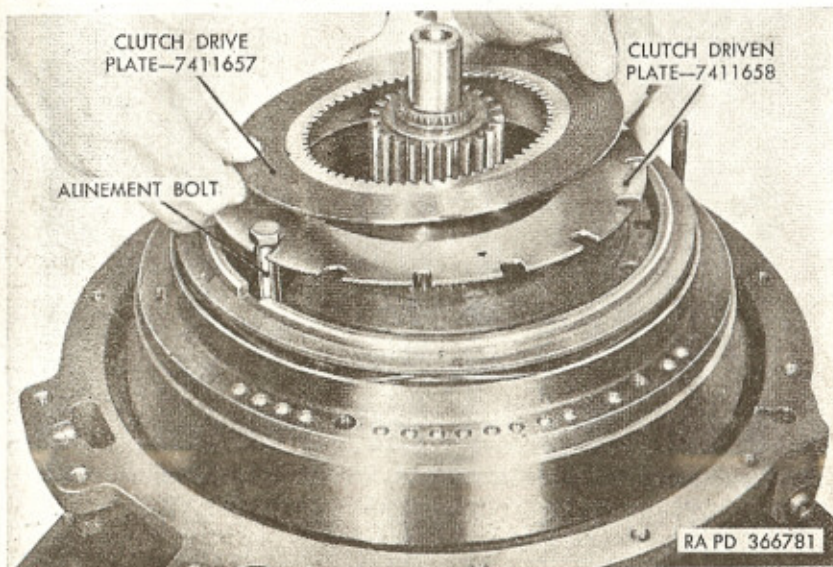


Figure 216. Installing reduction clutch plates (303M).

o. Line up square notches of driven plates with internal gear attaching bolt holes, using a second bolt to assist in alignment. Install second bolt 180° from first bolt.

p. Install eight outer and eight inner direct clutch piston release springs (fig. 217) in round notches of clutch driven plates. Be sure release springs seat in recess of clutch piston.

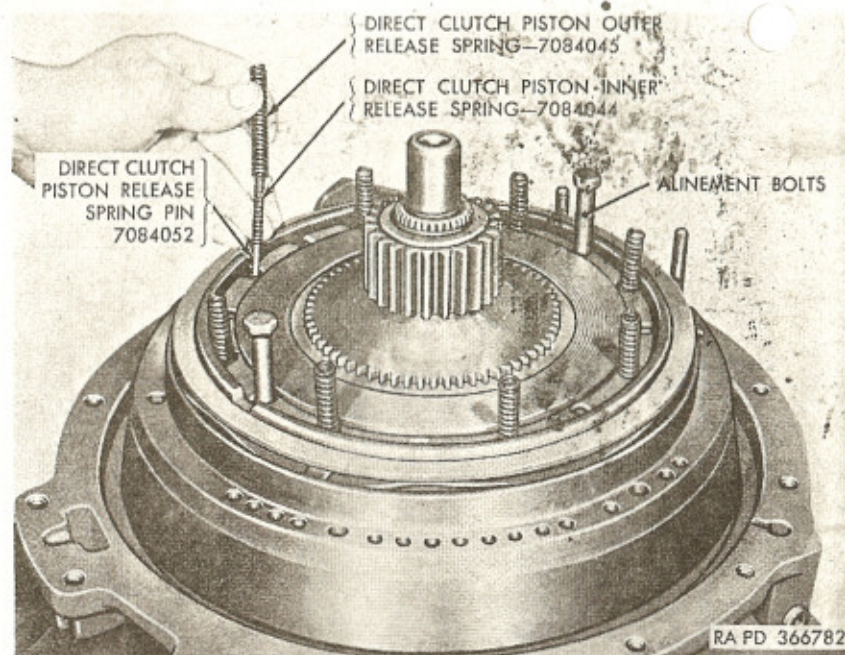


Figure 217. Installing release spring and guide pins (303M).

q. Install eight release spring pins into eight inner release springs; then remove two bolts used for alignment of plates.

r. Lower internal gear assembly onto reduction unit clutch drum, with key in the internal gear aligned with the keyway (fig. 22) of the reduction clutch drum. Be sure outer piston clutch release springs are indexed with spring pockets.

s. Install eight $\frac{3}{8}$ x 3 bolts and four new lock straps which attach reduction unit internal gear assembly (fig. 218) to reduction clutch drum. Tighten bolts evenly to 28 to 33 pound-feet torque. Wedge a screwdriver between bolt and gear to hold drum while tightening bolts. Using large pliers, bend edges of lock straps up against flats of bolt heads.

t. Install reduction clutch release spring (fig. 21), open end down, over the reduction drive cone. Be sure spring fits in recess of reduction clutch piston.

u. Position new gasket on output shaft bearing retainer.

152. Installation of Reduction Unit Case (303M)

a. Using lifting hooks—B7950336 (fig. 20) in the mounting holes of the reduction unit case and an overhead hoist, lift reduction unit case over transmission and lower into position on output shaft bearing retainer. It may be necessary to rotate output shaft

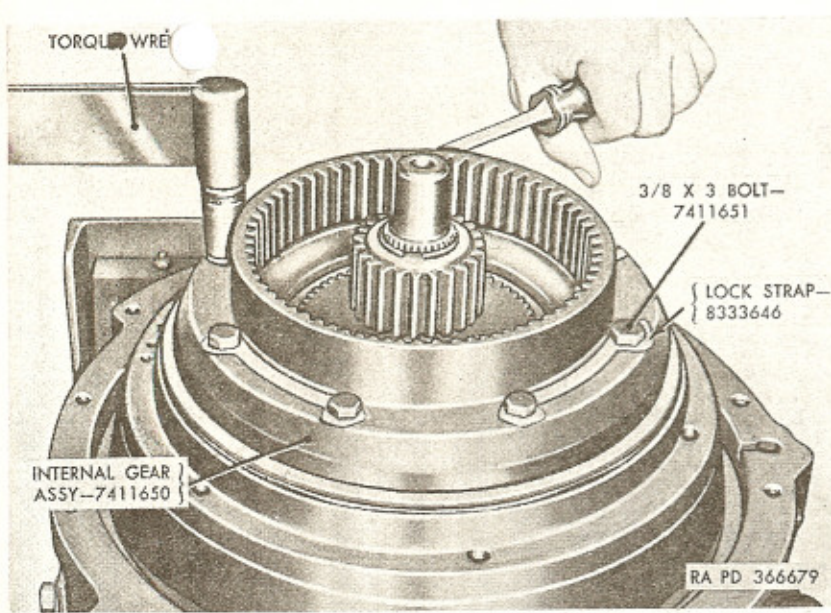


Figure 218. Tightening internal gear attaching bolts (303M).

to align gear teeth so reduction unit case will seat properly to transmission case.

b. Install six $\frac{3}{8}$ x $1\frac{1}{4}$ and seven $\frac{3}{8}$ x $2\frac{1}{4}$ bolts, two $\frac{3}{8}$ -24 nuts, and fifteen $\frac{3}{8}$ -inch lockwashers which attach reduction unit case to output shaft bearing retainer. Tighten bolts to 33 to 37 pound-feet torque. Tighten stud nuts to 23 to 28 pound-feet torque.

c. Using new plug gasket, install reduction unit case drain plug assembly. Tighten plug to 35 to 45 pound-feet torque.

d. Install one reduction blocker line connector (H, fig. 182) in reduction unit control valve and one line connector in top of transmission case. Tighten connectors firmly.

e. Install reduction blocker line assembly (fig. 19) and clip on transmission. Tighten line connections firmly.

f. Remove transmission from repair stand and place on repair bench.

153. Installation of Torus Members and Cover

Note. The torus assemblies and cover cannot be installed on transmission until transmission is to be connected to engine. The flywheel housing rear half must be installed to transmission before torus parts can be installed. The flywheel housing rear half and front half are matched parts and must remain with the engine from which they are removed. If new flywheel housings are to be used, concentricity of bore in rear housing with crankshaft must be checked as described in TM 9-1819AA. Also, rear face of rear housing must be checked for squareness with crankshaft. Failure

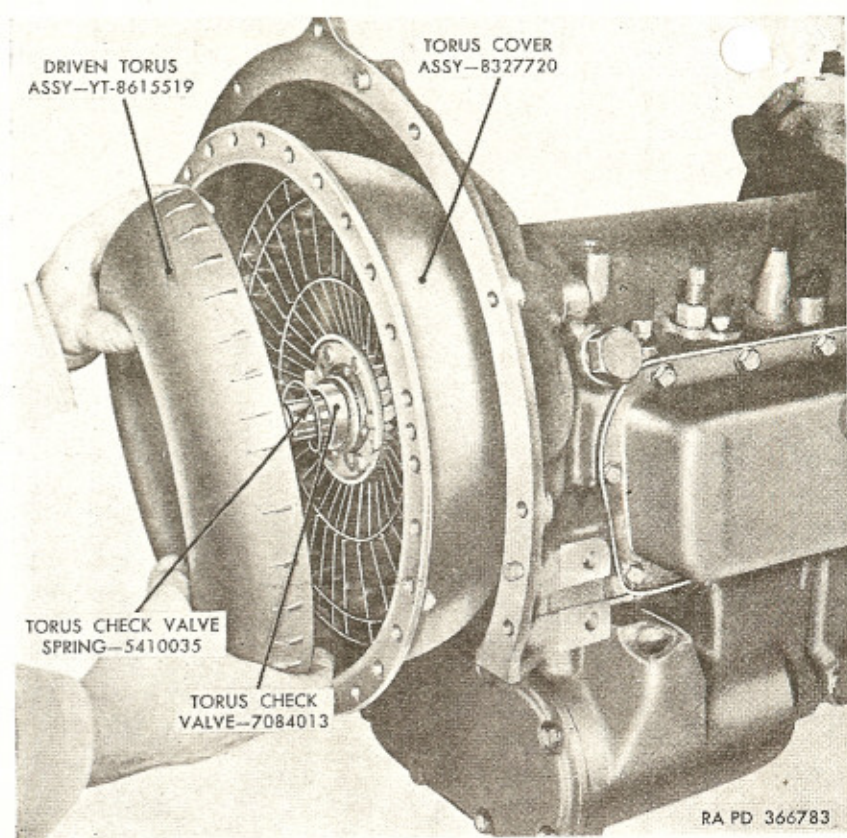


Figure 219. Installing driven torus assembly (303M shown).

to check rear flywheel housing may result in serious damage to transmission. The following procedures include the connecting of the transmission to the engine. These procedures are also shown in TM 9-8024, but are repeated here for clarity and information. The capitalized key letters shown below in parentheses refer to figure 13.

a. Thoroughly clean exposed surface of flywheel with dry-cleaning solvent or mineral spirits paint thinner. Wipe surface dry using lint-free cloth.

b. Check engine flywheel runout as directed in TM 9-1819AA.

c. Position flywheel rear housing (L) on front of transmission case; then install four $\frac{1}{2}$ x $1\frac{1}{2}$ attaching bolts and $\frac{1}{2}$ -inch lockwashers. Tighten opposite bolts alternately to 70 to 75 pound-feet torque.

d. Install torus cover assembly (J) carefully on splines of front drive gear. Make sure gap in oil sealing ring in front oil pump is upward. This will prevent damage to ring and help to avoid burs.

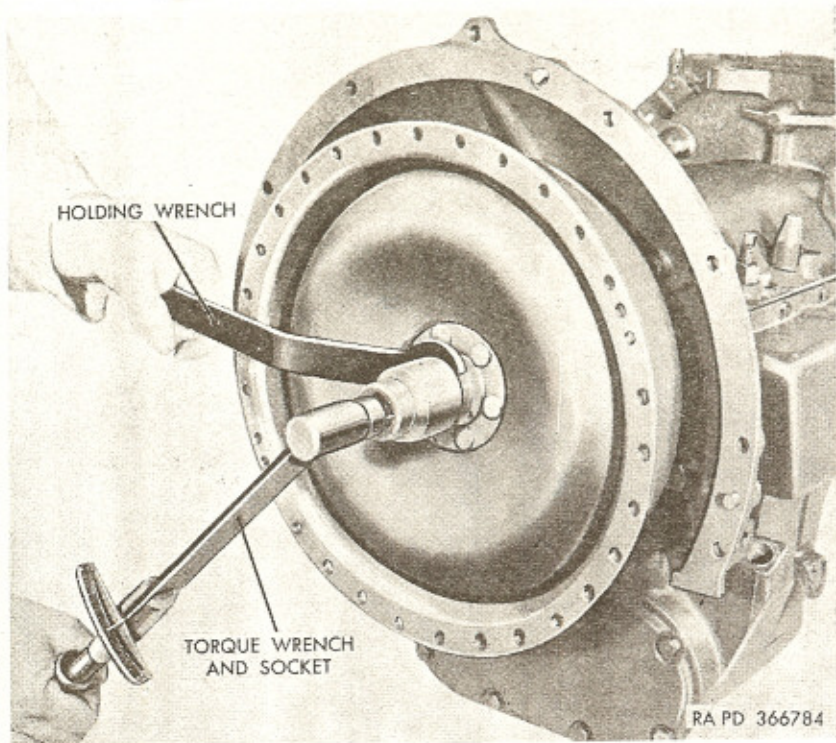


Figure 220. Tightening input shaft nut using holding wrench—B7950256.

Note. Push torus cover on drive gear evenly without rocking, to prevent damage to front pump oil seal and oil ring.

e. Install driving torus assembly (H) on splines of intermediate shaft of front planet carrier. Position new spring retainer (G) flat on bench; then spread ring, with snap ring pliers held in vertical position. Holding pliers parallel with shaft, install driving torus spring retainer (fig. 15).

f. Install driven torus snap ring on input shaft.

g. Slide torus check valve (F) over driven torus hub to check freeness; then remove torus check valve.

h. Install torus check valve (F) and check valve spring (E) over transmission input shaft (fig. 219).

i. Start driven torus assembly (D) on input shaft, at the same time guide torus check valve spring (E) over hub of driven torus assembly (fig. 219).

j. Locate driven torus assembly against driven torus snap ring in groove of input shaft.

k. Install new input shaft nut lockwasher (C) with ear over flat of driven torus hub.

l. Install $\frac{7}{8}$ -16 nut on input shaft. Tighten nut to 50 to 60 pound-feet torque, using holding wrench—B7950256 (fig. 220).

m. Bend tab of lockwasher up against flat of input shaft nut. Make sure input shaft nut is securely locked in position.

n. Install input shaft spacer on transmission input shaft (fig. 14).

154. Test of Unit After Assembly

Refer to paragraphs 25 through 28 for test procedures.

CHAPTER 8

REPAIR AND REBUILD STANDARDS

155. General

a. The repair and rebuild standards included herein give the minimum, maximum, and key clearances of new parts. In the "Sizes and fits of new parts" column, the letter "L" indicates a loose fit (clearance) and the letter "T" indicates a tight fit (interference).

Note. It will be noted that no figures are given for "Wear limits." These values will not be available until these transmissions have been in service for a considerable period of time.

b. The sequence in which the repair and rebuild standards are shown follows as far as is practical the order in which the component parts and subassemblies of the transmission are cleaned and inspected. The capitalized key letters shown in the "Ref letter" column refer to the illustrations listed in the "Fig. No." column.

156. Torus Members and Cover, and Front Oil Pump Drive Gear

a. Torus Cover.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
221	F	Outside diameter of oil seal collar.....	2.680 to 2.685

b. Torus Check Valve.

221	C	Inside diameter of check valve.....	1.3765 to 1.3800
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c. Driven Torus Member.

221	A	Outside diameter of driven torus hub..	1.3745 to 1.3755
	C-A	Fit of check valve on driven torus hub	0.0010L to 0.0055L

d. Torus Check Valve Spring.

221	B	Approximate free length.....	3 $\frac{17}{32}$
	B	Compressed length at 9 lb.....	2 $\frac{3}{32}$

e. Thrust Washers.

221	D	Thickness of thrust washer.....	0.088 to 0.092
	E	Thickness of thrust washer.....	0.0875 to 0.0900

f. Front Oil Pump Drive Gear.

221	G	Outside diameter of drive gear shoulder	2.3705 to 2.3715
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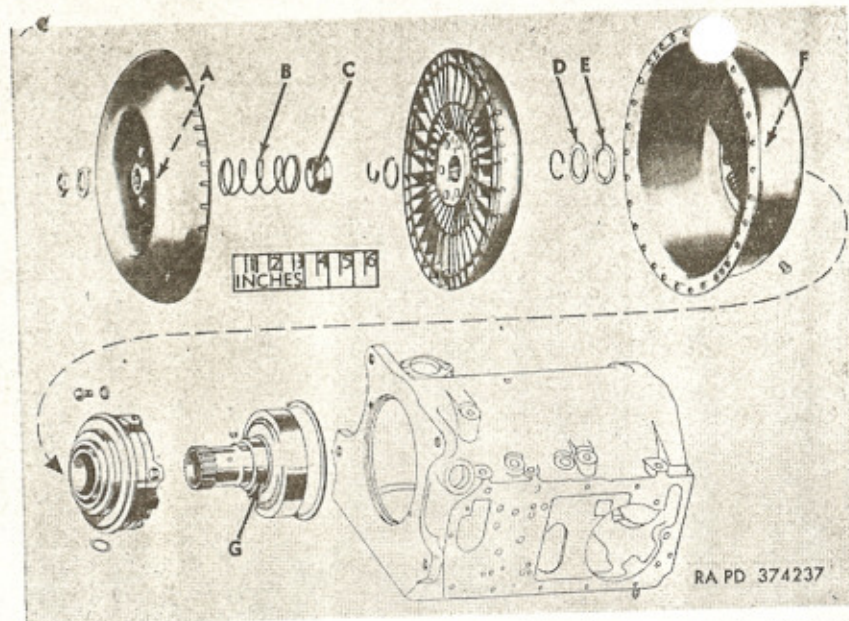


Figure 221. Repair and rebuild standard points of measurement for torus members and cover, and front oil pump drive gear.

157. Transmission Control Valve

a. Exhaust Valve Spring.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
222	A	Approximate free length.....	2 $\frac{1}{32}$
	A	Compressed length under 1.1 to 1.4 lb..	1 $\frac{3}{32}$

b. Check Valve Spring.

222	K	Approximate free length.....	1 $\frac{3}{16}$
	K	Compressed length under 0.4 to 0.6 lb..	$\frac{3}{4}$

c. Throttle Valve Spring.

222	W	Approximate free length.....	1.186 to 1.196
	W	Compressed length under 7.04 to 7.28 lb	0.618

d. Double Transition Valve Spring.

222	AA	Approximate free length.....	2 $\frac{1}{32}$
	AA	Compressed length under 3.75 to 4.25 lb	$\frac{3}{8}$

e. Detent Plunger Spring.

222	U	Approximate free length.....	1.312
	U	Compressed length under 7.0 to 8.5 lb..	0.987

f. 1-2 Shift Valve Spring.

222	TT	Approximate free length.....	1.312
	TT	Compressed length under 6.75 to 7.25 lb	0.384

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
g. 2-3 a 3-4 Shift Valve Springs.			
222	UU	Approximate free length	1.344
	UU	Compressed length under 14.5 to 15.5 lb	0.625
h. 2-3 Regulator Plug Spring.			
222	WW	Approximate free length	2.234
	WW	Compressed length under 7.5 to 8.0 lb	0.781
i. 1-2 Regulator Plug Spring.			
222	XX	Approximate free length	1.031
	XX	Compressed length under 4.0 to 4.5 lb	0.516
j. "T" Valve Cutoff Valve Spring.			
222	VV	Approximate free length	0.750
	VV	Compressed length under 0.71 to 0.87 lb	0.473
k. Manual Valve.			
222	T	Outside diameter of control valve	0.4362 to 0.4367
	Q	Diameter of valve bore in outer body	0.4370 to 0.4380
	Q-T	Fit of valve in bore in body	0.0003L to 0.0018L
l. Front Servo Exhaust Valve.			
222	D	Outside diameter of valve	0.2130 to 0.2180
	C	Outside diameter of valve	0.2485 to 0.2490
	B	Outside diameter of valve	0.3735 to 0.3740
	G	Diameter of valve bore in body	0.2495 to 0.2505
	F	Diameter of valve bore in body	0.260 to 0.270
	E	Diameter of valve bore in body	0.3745 to 0.3755
	D-G	Fit of valve in bore in body	0.0315L to 0.0375L
	C-F	Fit of valve in bore in body	0.0110L to 0.0215L
	B-E	Fit of valve in bore in body	0.0005L to 0.0020L
m. Compensator Valve.			
222	H	Outside diameter of valve	0.4270 to 0.4275
	J	Outside diameter of valve	0.3800 to 0.3805
	L	Diameter of valve bore in outer body	0.4280 to 0.4290
	M	Diameter of valve bore in outer body	0.3810 to 0.3820
	H-L and J-M	Fit of valve in bore in outer body	0.0005L to 0.0020L
n. Throttle Valve.			
222	R	Outside diameter of valve	0.3480 to 0.3485
	S	Outside diameter of valve	0.4760 to 0.4765
	N	Diameter of bore in outer body	0.3490 to 0.3500
	P	Diameter of bore in outer body	0.4770 to 0.4780
	N-R and P-S	Fit of valve in bore in body	0.0005L to 0.0020L
o. "T" Valve.			
222	V	Outside diameter of valve	0.4760 to 0.4765
	EE	Diameter of bore in outer body	0.4770 to 0.4780
	V-EE	Fit of valve in bore in body	0.0005L to 0.0020L
p. Double Transition Valve.			
222	Z	Outside diameter of valve	0.3740 to 0.3745
	Y	Outside diameter of valve	0.5390 to 0.5395

Figure No.	Reference letter	Point of measurement	0.6730	Sizes and fits of parts
	X	Outside diameter of valve	0.67	0.6735
	BB	Diameter of bore in outer body	0.3750	to 0.3760
	CC	Diameter of bore in outer body	0.5400	to 0.5410
	DD	Diameter of bore in outer body	0.6740	to 0.6750
	Z-BB, Y-CC, and X-DD	Fit of valve in bore in outer body	0.0005L	to 0.0020L
q. 2-3 and 3-4 Shift Valves.				
222	HH	Outside diameter of valve	0.3740	to 0.3745
	GG	Outside diameter of valve	0.4560	to 0.4565
	FF	Outside diameter of valve	0.8740	to 0.8743
	LL	Diameter of bore in inner body	0.3750	to 0.3760
	KK	Diameter of bore in inner body	0.4570	to 0.4580
	JJ	Diameter of bore in inner body	0.8750	to 0.8760
	HH-LL and GG-KK	Fit of valve in bore in inner body (small diameters)	0.0005L	to 0.0020L
	FF-JJ	Fit of valve in bore in inner body (large diameter)	0.0007L	to 0.0020L
r. 1-2 Shift Valve.				
222	RR	Outside diameter of valve	0.3740	to 0.3745
	SS	Outside diameter of valve	0.3910	to 0.3915
	NN	Outside diameter of valve	0.8740	to 0.8743
	MM	Diameter of bore in inner body	0.3750	to 0.3760
	QQ	Diameter of bore in inner body	0.3920	to 0.3930
	PP	Diameter of bore in inner body	0.8750	to 0.8760
	RR-MM and SS-QQ	Fit of valve in inner body (small diameters)	0.0005L	to 0.0020L
	NN-PP	Fit of valve in inner body (large diameter)	0.0007L	to 0.0020L
s. "T" Valve Cutoff Valve.				
222	YY	Outside diameter of valve	0.2490	to 0.2495
	ZZ	Diameter of bore in front body	0.2500	to 0.2510
	YY-ZZ	Fit of valve in bore in front body	0.0005L	to 0.0020L
t. Governor Plug.				
222	AN	Outside diameter of plug (small diameter)	0.2675	to 0.2680
	AP	Outside diameter of plug (large diameter)	0.7170	to 0.7175
	AM	Diameter of plug bore in inner body	0.2690	to 0.2700
	AQ	Diameter of plug bore in inner body	0.7180	to 0.7190
	AN-AM and AP-AQ	Fit of plug in inner body (small diameter)	0.0010L	to 0.0025L
		Fit of plug in inner body (large diameter)	0.0005L	to 0.0020L

u. 3-4 Shift Valve Regulator Plug.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
222	AB	Outside diameter of plug.....	0.5990 to 0.5995
	AC	Diameter of bore in front body.....	0.6000 to 0.6010
	AB-AC	Fit of plug in bore in front body.....	0.0005L to 0.0020L

v. 1-2 Shift Valve Regulator Plug.

222	AD	Outside diameter of plug (small diameter).....	0.3110 to 0.3115
	AE	Outside diameter of plug (large diameter).....	0.4700 to 0.4705
	AF	Diameter of bore in front body.....	0.3120 to 0.3130
	AG	Diameter of bore in front body.....	0.4710 to 0.4720
	AD-AF and AE-AG	Fit of plug in bore in front body.....	0.0005L to 0.0020L

w. 2-3 Shift Valve Regulator Plug.

222	AJ	Outside diameter of plug (small diameter).....	0.5135 to 0.5140
	AH	Outside diameter of plug (large diameter).....	0.5690 to 0.5695
	AK	Diameter of bore in front body.....	0.5145 to 0.5155
	AL	Diameter of bore in front body.....	0.5700 to 0.5710
	AJ-AK and AH-AL	Fit of plug in bore in front body.....	0.0005L to 0.0020L

x. Throttle Valve Control Lever Shaft.

222	AR	Outside diameter of shaft.....	0.3105 to 0.3125
	AS	Inside diameter of manual control valve lever shaft.....	0.3150 to 0.3170
	AR-AS	Fit of control lever shaft in manual control valve lever shaft.....	0.0025L to 0.0065L

158. Reverse Blocker Bracket and Pressure Regulator Valve

a. Reverse Blocker Piston Spring

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
223	A	Approximate free length.....	1.000
	A	Compressed length under load of 1.9 to 2.1 lb.....	0.625

b. Reverse Blocker Piston.

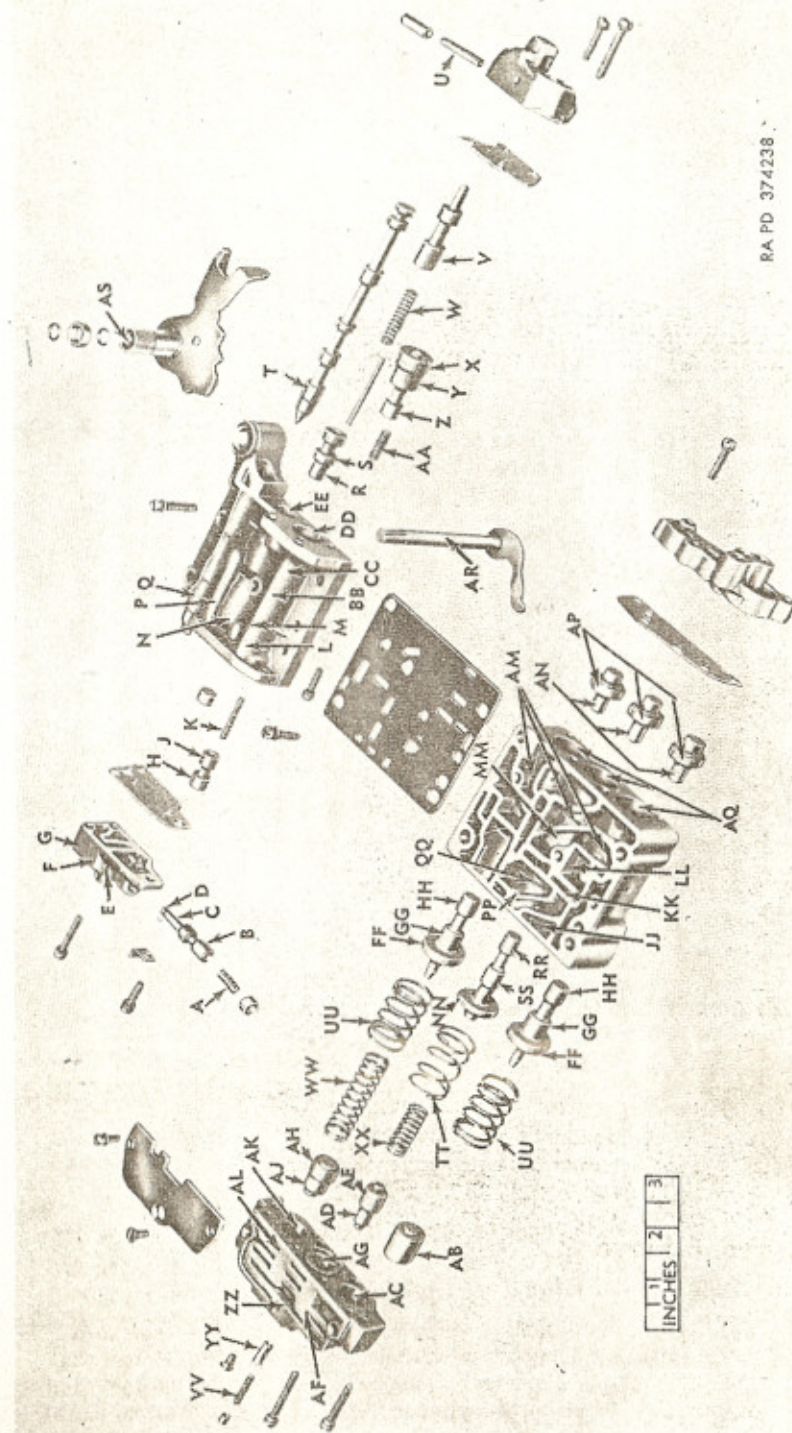
223	B	Outside diameter of piston.....	0.6860 to 0.6865
	D	Diameter of piston bore in blocker bracket.....	0.6870 to 0.6880
	B-D	Fit of piston in bore in bracket.....	0.0005L to 0.0020L

c. Reverse Blocker Lever Return Spring.

223	C	Approximate free length.....	1¾
	C	Extended length of spring loaded at 3.1 to 3.9 lb.....	2¾

d. Reverse Blocker Bracket Governor Bore.

223	E	Diameter of bore in bracket.....	1.1873 to 1.1883
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Figure 222. Repair and rebuild standard points of measurement for transmission control valve.

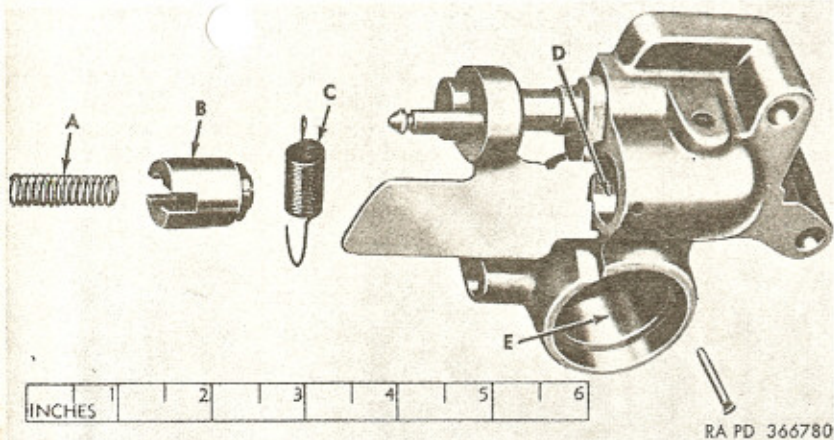


Figure 223. Repair and rebuild standard points of measurement for reverse blocker bracket.

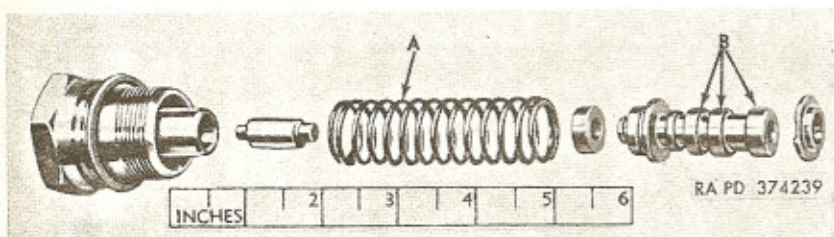


Figure 224. Repair and rebuild standard points of measurement for transmission oil pressure regulator valve.

e. Transmission Oil Pressure Regulator Valve.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
224	B	Outside diameter of valve	0.4985 to 0.4990

f. Pressure Regulator Valve Spring.

224	A	Approximate free length	2 $\frac{3}{16}$
	A	Compressed length under load of 20 $\frac{1}{2}$ to 21 $\frac{1}{2}$ lb	1 $\frac{1}{16}$

159. Front Servo

a. Cylinder and Piston.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
225	A	Inside diameter of cylinder	1.6245 to 1.6255
	E	Outside diameter of piston	1.6105 to 1.6145
	E-A	Fit of piston in cylinder	0.010L to 0.015L
	E	Width of ring groove in piston	0.0940 to 0.0955

b. Cylinder Piston Oil Seal Ring.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
225	C	Gap in oil seal ring (free)	0.001 to 0.006
	C	Gap in oil seal ring (assembled)	0.0015 to 0.0070
	B	Thickness of oil seal ring	0.0930 to 0.0935
	D	Width of oil seal ring	0.065 to 0.075

c. Cylinder Piston Spring.

225	F	Approximate free length	0.953
	F	Compressed length under 38 to 46 lb.	0.695

d. Body Piston Retracting Spring.

225	G	Approximate free length of spring	1 $\frac{3}{16}$
	G	Compressed length under 18 to 22 lb.	$\frac{25}{32}$

e. Body and Body Piston.

225	N	Diameter of bore in body	1.437 to 1.438
	J	Outside diameter of piston	1.415 to 1.420
	J-N	Fit of piston in body	0.017L to 0.023L
	J	Width of ring groove in piston	0.0940 to 0.0955
	H	Outside diameter of sleeve	1.4355 to 1.4365
	H-N	Fit of sleeve in body	0.0005L to 0.0025L

f. Body Piston Oil Seal Ring.

225	L	Gap in oil seal ring (free)	$\frac{7}{64}$
	L	Gap in oil seal ring (assembled)	0.002 to 0.007
	K	Thickness of oil seal ring	0.0925 to 0.0935
	M	Width of oil seal ring	0.055 to 0.065

g. Check Valve Spring (301MG Only).

225	P	Approximate free length	1.437
	P	Compressed length under 1.80 to 2.20 lb	0.452

h. 4-3 Valve (Early 303M Only).

225	Q	Outside diameter of valve (small diameter)	0.3660 to 0.3665
	R	Outside diameter of valve (large diameter)	0.4050 to 0.4055
	S	Diameter of bore in body (small)	0.3670 to 0.3680
	T	Diameter of bore in body (large)	0.4060 to 0.4070
	Q-S and R-T	Fit of valve in bore in body	0.0005L to 0.0020L

160. Rear Servo

a. Accumulator Piston Spring.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
226	A	Approximate free length	4 $\frac{11}{32}$
	A	Compressed length under 118 to 128 lb	2 $\frac{13}{16}$

b. Compensator Piston Spring.

226	C	Approximate free length	3 $\frac{61}{64}$
	C	Compressed length under 40 to 80 lb.	2 $\frac{9}{16}$

c. Booster Piston Outer Spring.

226	Z	Approximate free length	4
	Z	Compressed length under 32 to 38 lb.	1 $\frac{9}{16}$

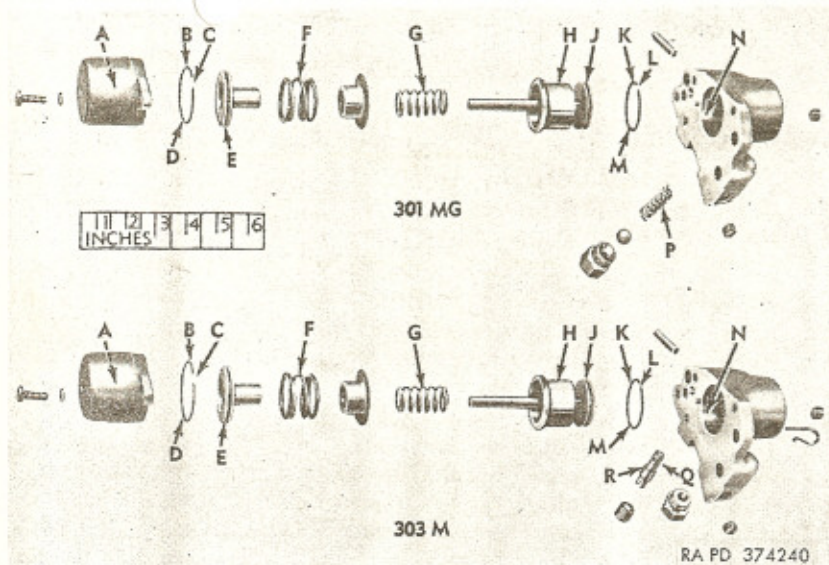


Figure 225. Repair and rebuild standard points of measurement for front servo.

d. Booster Piston Inner Spring.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
226	Y	Approximate free length	1 1/2 to 1 3/16

e. Accumulator Piston.

226	G	Outside diameter of piston	2.366 to 2.369
	L	Inside diameter of accumulator body	2.374 to 2.375
	G-L	Fit of piston in body	0.005L to 0.009L
	E	Width of ring groove in piston	0.0940 to 0.0955

f. Accumulator Piston Oil Seal Ring.

226	H	Gap in oil seal ring	0.003 to 0.008
	J	Thickness of oil seal ring	0.0925 to 0.0935
	K	Width of oil seal ring	0.100 to 0.110

g. Booster Piston.

226	T	Outside diameter of piston (small end)	1.679 to 1.683
	M	Inside diameter of accumulator body	1.687 to 1.688
	T-M	Fit of piston in accumulator body	0.004L to 0.009L
	S	Outside diameter of piston (large end)	2.2390 to 2.2430
	N	Inside diameter of body	2.2495 to 2.2505
	S-N	Fit of piston in bore of body	0.0065L to 0.0115L
	F	Ring groove in piston (large end)	0.0940 to 0.0955
	U	Ring groove in piston (small end)	0.0940 to 0.0955

h. Booster Piston Oil Seal Rings.

226	V	Width of small oil seal ring	0.065 to 0.075
	W	Thickness of small oil seal ring	0.0930 to 0.0935
	X	Free gap in small oil seal ring	0.001 to 0.006

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
	X	Assembled gap in small oil seal ring	0.0015 to 0.0070
	P	Width of large oil seal ring	0.095 to 0.105
	Q	Thickness of large oil seal ring	0.0930 to 0.0935
	R	Free gap in large oil seal ring	0.002 to 0.007
	R	Assembled gap in large oil seal ring	0.0015 to 0.0070
i. Compensator Piston.			
226	B	Outside diameter of piston	1.2485 to 1.2490
	D	Inside diameter of accumulator piston	1.2495 to 1.2505
	B-D	Fit of compensator piston in accumulator piston	0.0005L to 0.0020L

161. Front Oil Pump

a. Pump Vanes.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
227	W	Thickness of vanes	0.1240 to 0.1250
	E	Width of slots in pump rotor	0.1252 to 0.1272
	W-E	Fit of vanes in pump rotor	0.0002L to 0.0032L
	U	Width of vanes	0.4845 to 0.4855
	V	Length of vanes	0.638 to 0.639
	F	Length of slots in pump rotor	0.510 to 0.520

b. Vane Rings.

227	T	Outside diameter of vane rings	2.6795 to 2.6805
	S	Inside diameter of pump slide	3.652 to 3.653
92		Fit of rings and vanes in pump slide	0.00L to 0.003L

c. Outer Priming Spring.

227	Q	Approximate free length	0.679
	Q	Compressed length under 6.5 to 7.5 lb	0.375

d. Inner Priming Spring.

227	R	Approximate free length	0.395 to 0.405
	R	Compressed length under 18 to 26 lb.	0.350

e. Relief Valve Spring (301MG Only).

227	N	Approximate free length	1.8906
	N	Compressed length under 12.25 to 13.05 lb	1.057

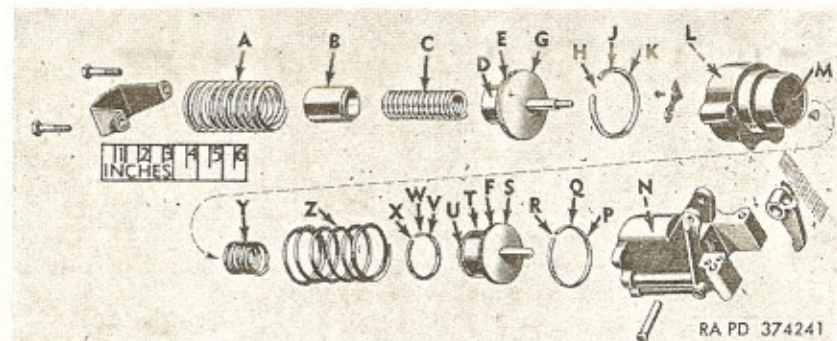


Figure 226. Repair and rebuild standard points of measurement for rear servo.

f. Pump Cover.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
227	X	Inside diameter of pump cover.....	4.1885 to 4.1910
	P	Outside diameter of pump slide.....	4.1870 to 4.1880
	P-X	Fit of slide in cover.....	0.0005L to 0.0040L
	Y	Width of oil seal ring groove in cover.....	0.1255 to 0.1275

g. Oil Seal Ring.

227	A	Thickness of oil seal ring.....	0.1230 to 0.1240
	Z	Width of oil seal ring.....	0.100 to 0.110
	B	Gap in oil seal ring.....	0.005 to 0.010
	Z-Y	Clearance between edge of oil seal ring and edge of groove in cover.....	0.0015 to 0.0045

h. Cover Oil Seal.

227	C	Outside diameter of oil seal.....	3.3530 to 3.3570
	D	Diameter of oil seal bore in cover.....	3.3495 to 3.3515
	C-D	Fit of oil seal in cover.....	0.0015T to 0.0075T

i. Pump Body.

227	J	Inside diameter of pump body.....	2.4995 to 2.5005
	K	Outside diameter of bushing.....	2.4995 to 2.5005
	G	Inside diameter of bushing.....	2.3740 to 2.3750
	G, fig. 227 and G, fig. 221	Fit of pump body bushing on front oil pump drive gear.....	0.0025L to 0.0045L
	H	Diameter of pressure regulator valve bore in pump body.....	0.4995 to 0.5005
	B, fig. 224-H, fig. 227	Fit of pressure regulator valve in bore of pump body.....	0.0005L to 0.0020L

j. Pump Relief Valve.

227	M	Outside diameter of valve.....	0.4800 to 0.4805
	L	Diameter of relief valve bore in body.....	0.4810 to 0.4820
	M-L	Fit of relief valve in bore in body.....	0.0005L to 0.0020L

162. Rear Oil Pump and Governor

a. Governor Body.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
228	F	Outside diameter of governor tower.....	1.1720 to 1.1740
	F, fig. 228 and E, fig. 223	Fit of governor tower in bore in reverse blocker bracket.....	0.0133L to 0.0163L
226	G	Width of ring groove in governor tower.....	0.094 to 0.095

b. Oil Seal Rings.

228	D	Thickness of oil seal rings.....	0.0925 to 0.0935
	E	Width of oil seal ring.....	0.050 to 0.060

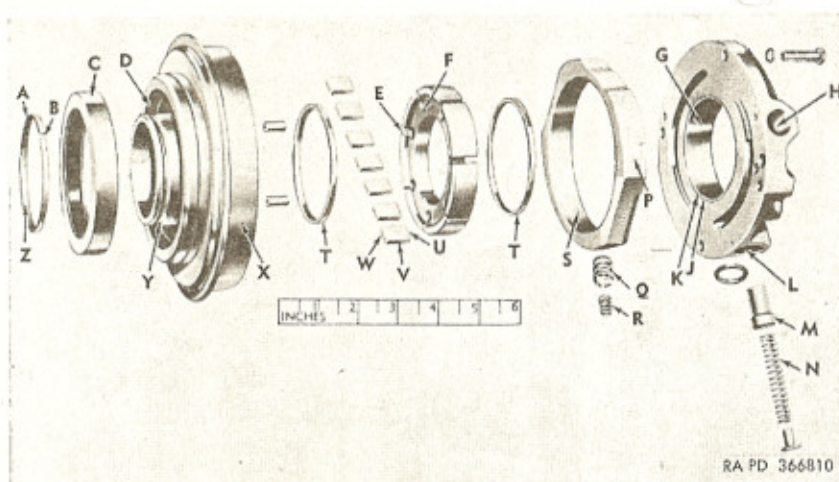


Figure 227. Repair and rebuild standard points of measurement for front oil pump.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
	C	Gap in oil seal ring (free).....	0.001 to 0.006
	C	Gap in oil seal ring (assembled).....	0.0015 to 0.0070
c. Governor Bushing.			
228	A	Inside diameter of bore in governor body.....	0.8120 to 0.8130
	B	Outside diameter of bushing.....	0.8113 to 0.8118
	B-A	Fit of governor bushing in bore in governor body.....	0.0002L to 0.0017L

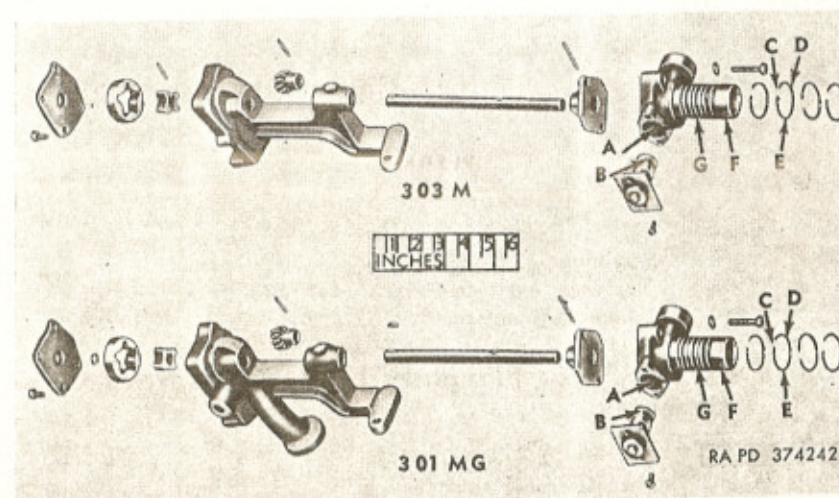


Figure 228. Repair and rebuild standard points of measurement for governor.

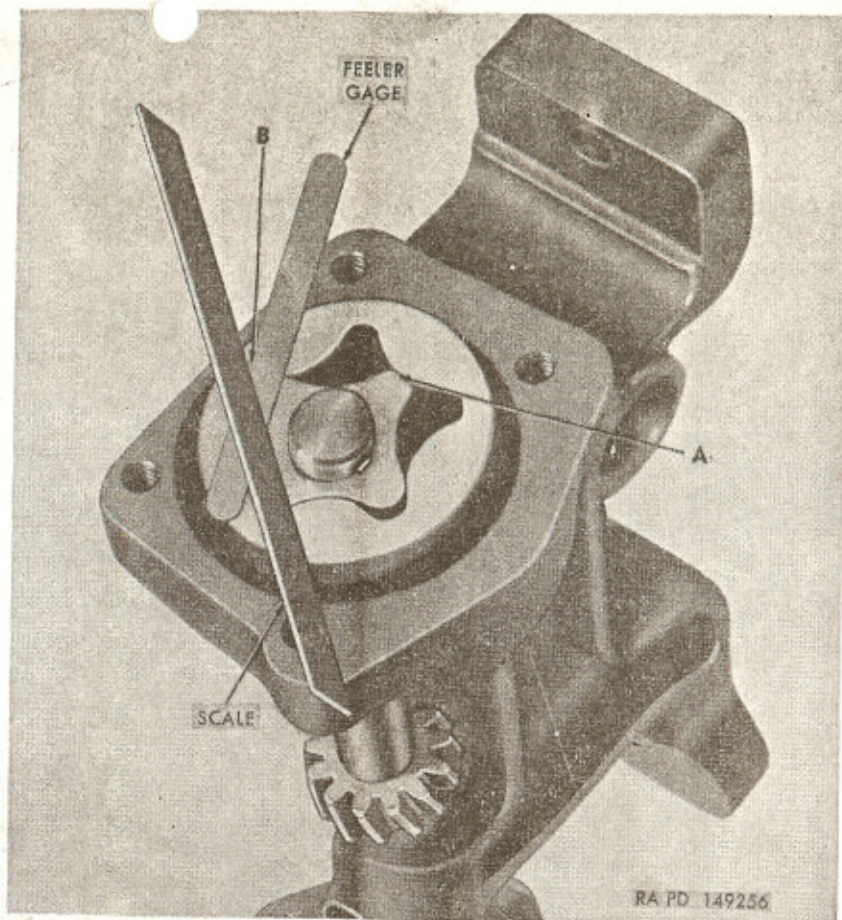


Figure 229. Repair and rebuild standard points of measurement for rear oil pump.

d. Rear Oil Pump.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
229	A	Maximum tooth clearance.....	0.009
	B	Clearance between driven gear and face of pump body.....	0.0035 to 0.0040

163. Front and Rear Planetary Units and Carrier Components

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
230	A	Thrust washer thickness.....	0.0875 to 0.0900
	N	Thrust washer thickness.....	0.087 to 0.091
	P	Thrust washer thickness.....	0.088 to 0.093
	B	Outside diameter of shaft.....	1.3725 to 1.3730

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
Fig. 177-B, fig. 230		Fit of front oil pump drive gear on planet carrier shaft.....	0.0015L to 0.0030L
	C	Outside diameter of shaft.....	1.3370 to 1.3450
	F	Outside diameter of front clutch drum bushings.....	1.4995 to 1.5005
	F	Inside diameter of front clutch drum bushings.....	1.3750 to 1.3760
	F-C	Fit of front clutch drum on carrier shaft.....	0.0300L to 0.0390L
	D	Outside diameter of shaft.....	1.3265 to 1.3275
	J	Inside diameter of oil delivery sleeve bushings.....	1.3300 to 1.3310
	J-D	Fit of oil delivery sleeve on carrier shaft.....	0.0025L to 0.0045L
	K	Outside diameter of oil delivery sleeve.....	1.9670 to 1.9680
	L	Outside diameter of rear clutch drum bushings—press fit in hole.....	2.091 to 2.093
	L	Inside diameter of rear clutch drum bushings.....	1.9705 to 1.9715
	K-L	Fit of oil delivery sleeve in rear clutch drum.....	0.0025L to 0.0045L
	E	Depth of waves in driven plates.....	0.008 to 0.012
	Q	Depth of grooves in band lining.....	$\frac{3}{64}$
	G	Approximate free length of clutch release inner springs.....	$2\frac{15}{64}$
	G	Compressed length under 14 to 16 lb.....	$1\frac{13}{16}$
	H	Approximate free length of clutch release outer springs.....	$2\frac{31}{64}$
	H	Compressed length under 22 to 26 lb.....	$1\frac{13}{16}$
	Q	Rear clutch hub washer thickness.....	0.027 to 0.030

164. Input Shaft, Reverse Unit, Output Shaft, and Bearing Retainer (301MG)

a. Thrust Washers.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
231	B	Thrust washer thickness—selective fit—See table VII, paragraph 136.....
	F	Thrust washer thickness.....	0.087 to 0.091
	G	Thrust washer thickness.....	0.049 to 0.052
	K	Thrust washer thickness.....	0.087 to 0.091

b. Output Shaft.

231	C	Inside diameter of output shaft bushing.....	0.687 to 0.689
	A	Outside diameter of input shaft pilot.....	0.685 to 0.686
	A-C	Fit of input shaft pilot in output shaft bushing.....	0.001L to 0.004L
	D	Outside diameter of output shaft at reverse center gear bushing.....	1.497 to 1.498

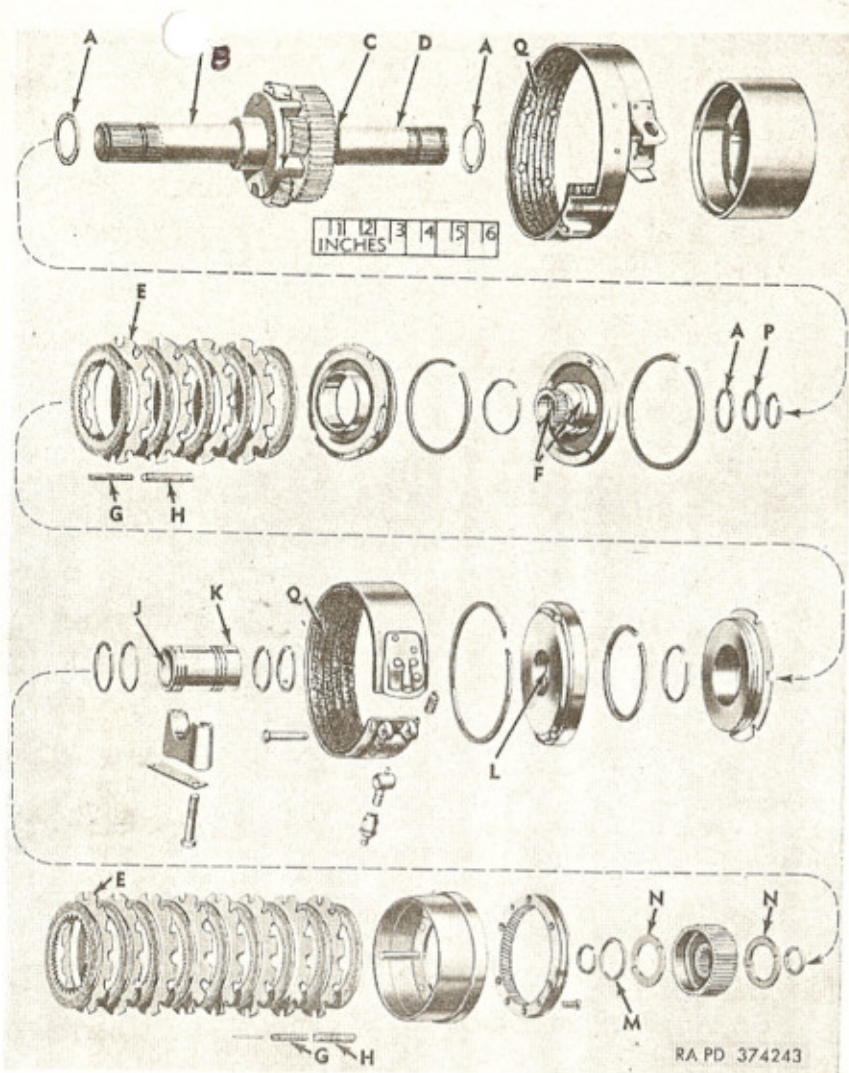


Figure 230. Repair and rebuild standard points of measurement for planetary units and carrier.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
	S	Outside diameter of output shaft at bearing retainer bushing	1.3775 to 1.3782
	E	Outside diameter of output shaft at bearing	1.3775 to 1.3782
c. Reverse Center Gear.			
231	H	Inside diameter of bushing	1.4995 to 1.5005
	H-D	Fit of reverse center gear on output shaft	0.0015L to 0.0035L

d. Output Shaft Bearing Retainer and Ball Bearing

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
231	N	Inside diameter of bushing	1.3815 to 1.3825
	P	Inside diameter of bearing bore in retainer	2.3319 to 2.4409
	Q	Outside diameter of ball bearing	2.4404 to 2.4409
	R	Inside diameter of ball bearing	1.3775 to 1.3780
	N-S	Fit of retainer bushing on output shaft	0.0015L to 0.0035L
	Q-P	Fit of ball bearing in retainer	0.0010L to 0.0023L
	R-E	Fit of ball bearing on output shaft	0.0005T to 0.0005L

e. Reverse Clutch Piston and Stationary Cone.

231	J	Depth of grooves in cone lining	0.010 to 0.020
	M	Depth of grooves in piston lining	0.010 to 0.015

f. Reverse Piston Release Springs.

231	L	Approximate free length	1 1/32
	L	Compressed length under 29 to 35 lb.	1 1/32

g. Reverse Planet Carrier and Reverse Internal Gear.

231	T	Outside diameter of planet carrier hub	1.9955 to 1.9965
	U	Inside diameter of internal gear bushing	1.9995 to 2.0005
	U-T	Fit of internal gear on planet carrier hub	0.0030L to 0.0050L

165. Input Shaft, Reverse Unit, and Output Shaft (303M)

a. Thrust Washers.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
232	A	Thrust washer thickness—selective fit —See table VII, paragraph 136—	—
	E	Thrust washer thickness	0.087 to 0.091
	F	Thrust washer thickness	0.049 to 0.052
	L	Thrust washer thickness	0.087 to 0.091
	M	Steel spacer thickness	0.357 to 0.359

b. Output Shaft and Reverse Center Gear.

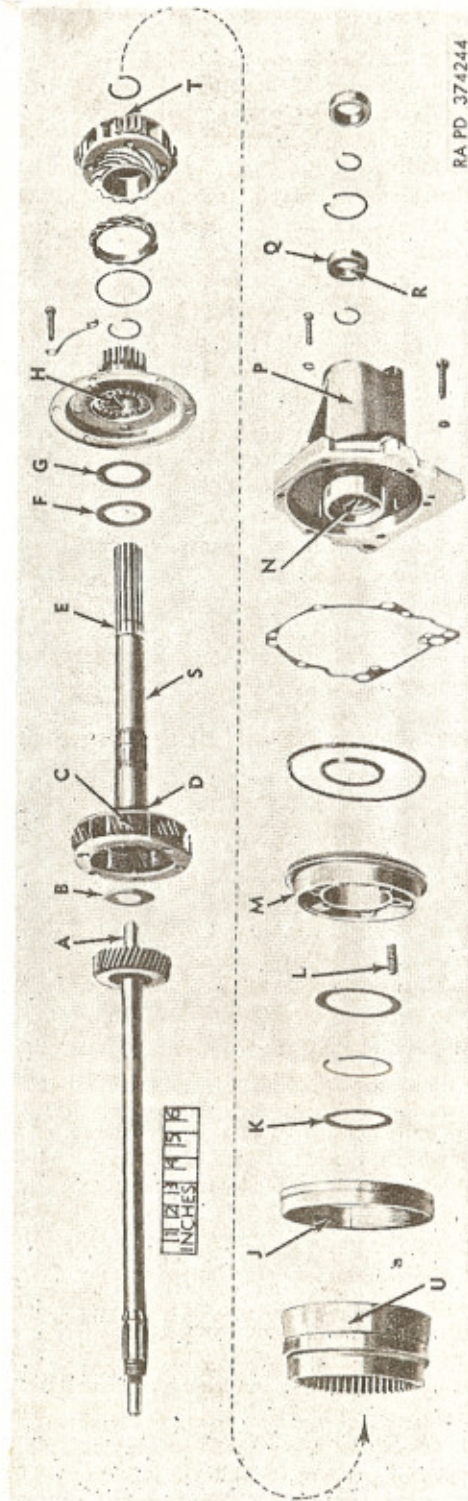
232	B	Outside diameter of shaft	1.4970 to 1.4980
	C	Outside diameter of shaft	1.3775 to 1.3782
	D	Outside diameter of shaft	0.007 to 0.998
	G	Inside diameter of reverse center gear bushing	1.4995 to 1.5005
	G-B	Fit of reverse center gear on output shaft	0.0015L to 0.0035L

c. Reverse Planet Carrier and Reverse Internal Gear.

232	H	Outside diameter of planet carrier hub	1.9955 to 1.9965
	J	Inside diameter of internal gear bushing	1.9995 to 2.0005
	J-H	Fit of internal gear on planet carrier hub	0.0030L to 0.0050L

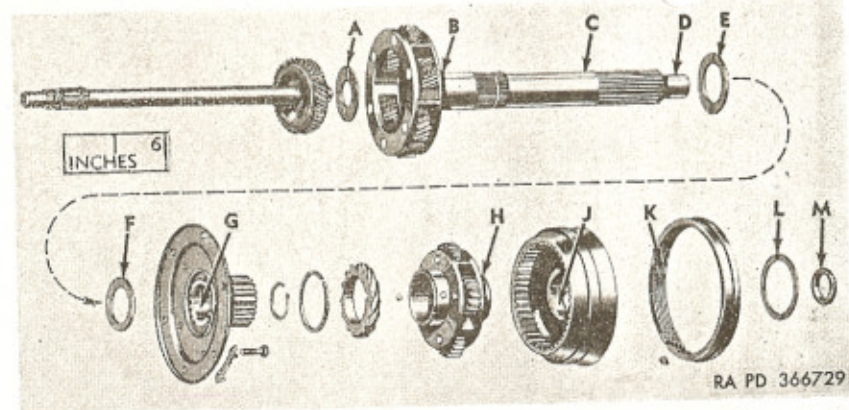
d. Reverse Clutch Stationary Cone.

232	K	Depth of grooves in lining	0.010 to 0.020
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RA PD 374244

Figure 231. Repair and rebuild standard points of measurement for input shaft, reverse unit, output shaft, and bearing retainer (301MG).



RA PD 366729

Figure 232. Repair and rebuild standard points of measurement for input shaft, reverse unit, and output shaft (303M).

166. Output Shaft Bearing Retainer Components (303M)

a. Output Shaft Ball Bearing and Retainer.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
233	A	Inside diameter of bearing	1.3775 to 1.3780
	B	Outside diameter of bearing	2.4404 to 2.4409
	E	Diameter of bearing bore in retainer	2.4408 to 2.4416
	B-E	Fit of bearing in bore in retainer	0.0001T to 0.0012T
	A, fig. 233-C, fig. 232	Fit of bearing on output shaft	0.0000 to 0.0002T

b. Reverse Piston Release Springs.

233	C	Approximate free length	1 1/32
	C	Compressed length under 29 to 35 lb	1 1/32

c. Reverse Clutch Piston.

233	D	Depth of grooves in lining	0.010 to 0.015
-----	---	----------------------------	----------------

167. Reduction Unit Control Valve (303M)

a. Pressure Regulator Valve.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
234	J	Outside diameter of valve	0.6235 to 0.6240
	L	Diameter of valve bore in body	0.6245 to 0.6255
	J-L	Fit of valve in bore in body	0.0005L to 0.0020L

b. Reduction Control Valve.

234	N	Outside diameter of control valve	0.6235 to 0.6240
	M	Diameter of valve bore in body	0.6245 to 0.6255
	N-M	Fit of valve in bore in body	0.0005L to 0.0020L

c. Reduction Blocker Piston Inhibitor Spring.

234	E	Approximate free length	0.766
	E	Compressed length under 4.30 to 4.80 lb	0.406

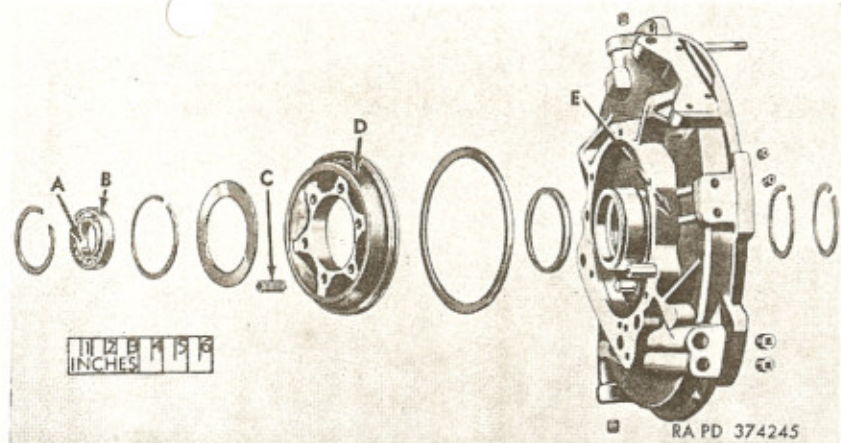


Figure 233. Repair and rebuild standard points of measurement for output shaft bearing retainer components (303M).

d. Cover Check Valve Spring.

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
234	B	Approximate free length	$1\frac{3}{16}$
	B	Compressed length under 0.4 to 0.6 lb	$\frac{3}{4}$

e. Accumulator Check Valve Spring.

234	A	Approximate free length	$2\frac{9}{32}$
	A	Compressed length under 0.95 to 1.05 lb	0.57

f. Detent Ball Springs.

234	K	Approximate free length	$\frac{3}{32}$
	K	Compressed length under 10.5 to 11.5 lb	$\frac{7}{16}$

g. Reduction Blocker Piston.

234	D	Outside diameter of piston	0.625
	C	Diameter of piston bore in cover	0.687 to 0.688
	D-C	Fit of piston in bore in cover	0.062L to 0.063L

h. Pressure Regulator Valve Spring.

234	H	Approximate free length	$4\frac{5}{64}$
	H	Compressed length under 32.5 to 35.5 lb	$2\frac{9}{16}$

i. Control Lever Shaft.

234	F	Outside diameter of shaft	0.560 to 0.561
	G	Diameter of lever shaft bore in cover	0.562 to 0.563
	F-G	Fit of shaft in bore in cover	0.001L to 0.003L

168. Reduction Unit Oil Pump (303M)

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
235	A	Maximum tooth clearance between drive gear and driven gear	0.008
	B	End clearance between pump gears and body	0.0035 to 0.0040

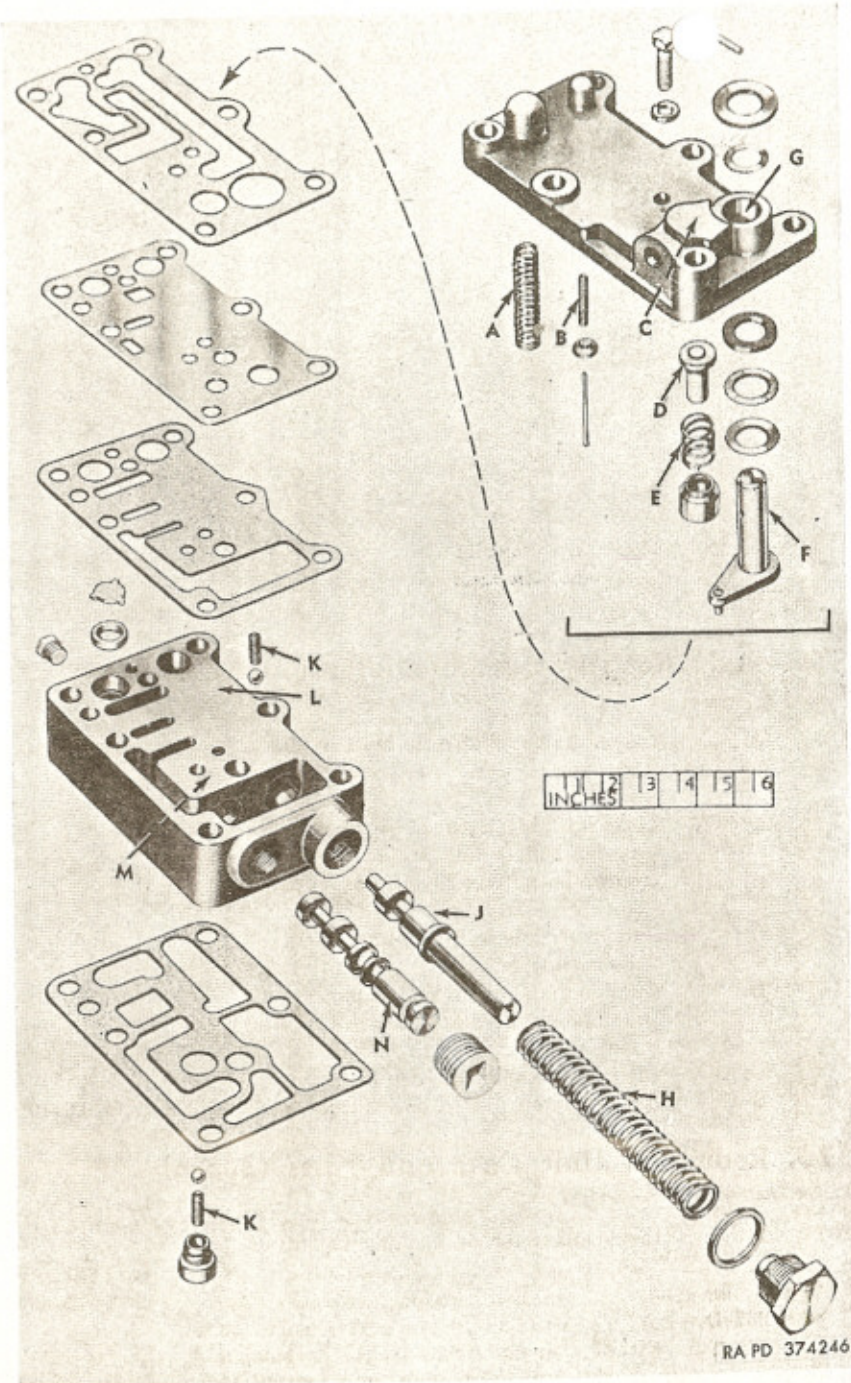


Figure 234. Repair and rebuild standard points of measurement for reduction unit control valve (303M).

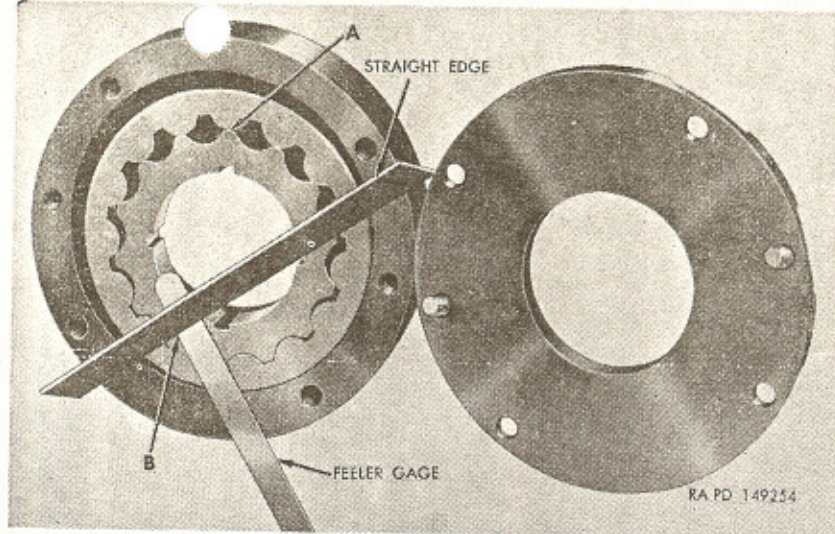


Figure 235. Repair and rebuild standard points of measurement for reduction unit oil pump (303M).

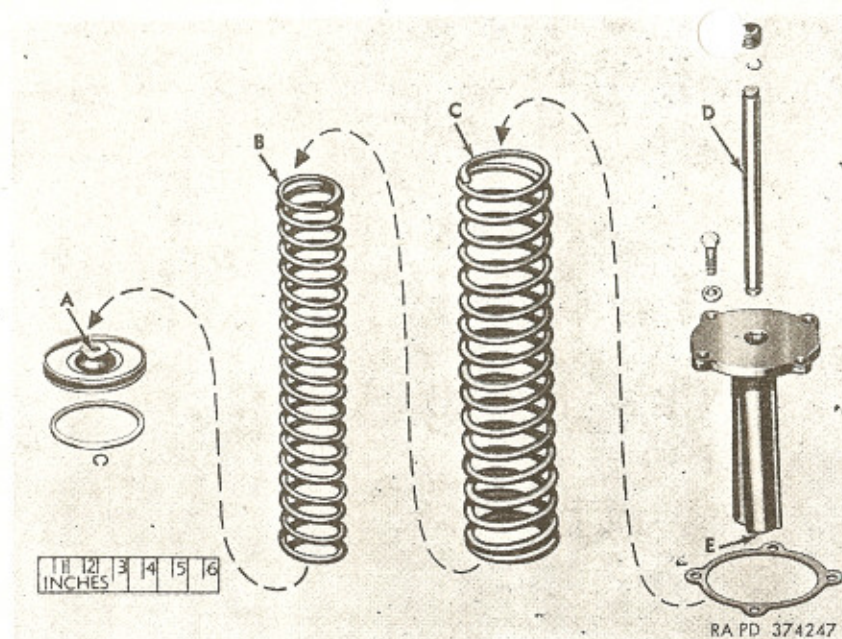


Figure 236. Repair and rebuild standard points of measurement for reduction unit accumulator (303M).

169. Reduction Unit Accumulator (303M)

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
236	A	Inside diameter of accumulator piston	0.5590 to 0.5609
	B	Approximate free length of inner spring	13.76
	B	Compressed length of inner spring under 295 to 325 lb	6.46
	C	Approximate free length of outer spring	13.68
	C	Compressed length of outer spring under 481 to 531 lb	6.46
	D	Outside diameter of piston pin	0.5600 to 0.5605
	E	Diameter of piston pin bore in lower end of cover	0.5690 to 0.5710
	D-A	Fit of piston pin in bore in piston	0.000 to 0.0015T
	D-E	Fit of piston pin in bore in cover	0.0085L to 0.0110L

170. Reduction Unit Case and Parts (303M)

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
237	A	Inside diameter of bushing in output shaft	0.999 to 1.001
	A, fig. 237-D, fig. 232	Fit of transmission output shaft in bushing in reduction unit output shaft	0.001L to 0.004L
	B	Outside diameter of shaft at front bearing	1.9684 to 1.9689

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
	C	Outside diameter of shaft at rear bearing	1.7716 to 1.7721
	D	Inside diameter of front bearing	1.9680 to 1.9685
	E	Outside diameter of front bearing	3.5427 to 3.5433
	F	Diameter of bearing bore in bearing support	3.5431 to 3.5441
	G	Depth of grooves in cone lining	0.010 to 0.020
	H	Diameter of rear bearing bore in case	3.3463 to 3.3473
	J	Inside diameter of rear bearing	1.7712 to 1.7717
	K	Outside diameter of rear bearing	3.3465 to 3.3469
	D-B	Fit of front bearing on output shaft	0.0001L to 0.0009L
	E-F	Fit of front bearing in support	0.0014L to 0.0002T
	J-C	Fit of rear bearing on output shaft	0.001L to 0.009T
	K-H	Fit of rear bearing in bore in case	0.0008L to 0.0006T

171. Reduction Unit Parts (303M)

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
238	A	Depth of grooves in piston lining	0.010 to 0.020
	B	Approximate free height of spring	0.500
	A	Compressed height under 580 to 812 lb	0.168
	C	Thrust washer thickness	0.087 to 0.091
	D	Inside diameter of clutch drum piston bore	7.248 to 7.252

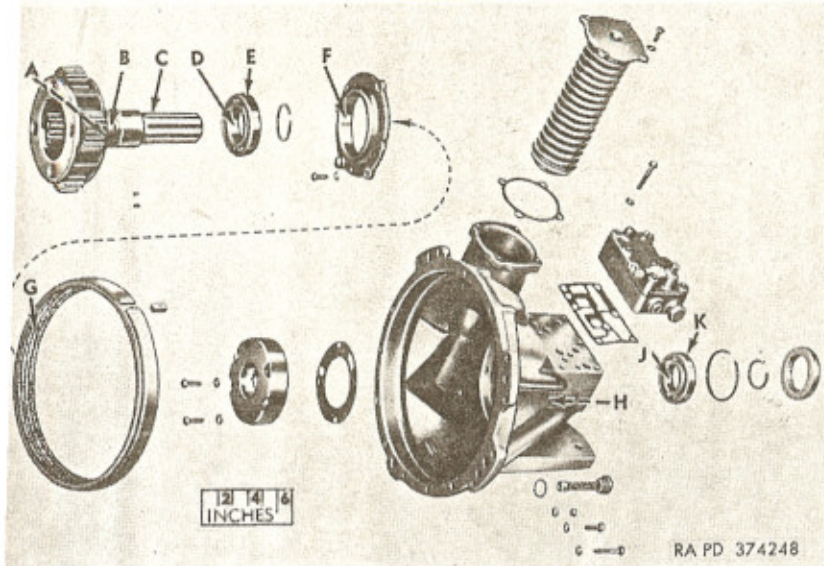


Figure 237. Repair and rebuild standard points of measurement for reduction unit case and parts (303M).

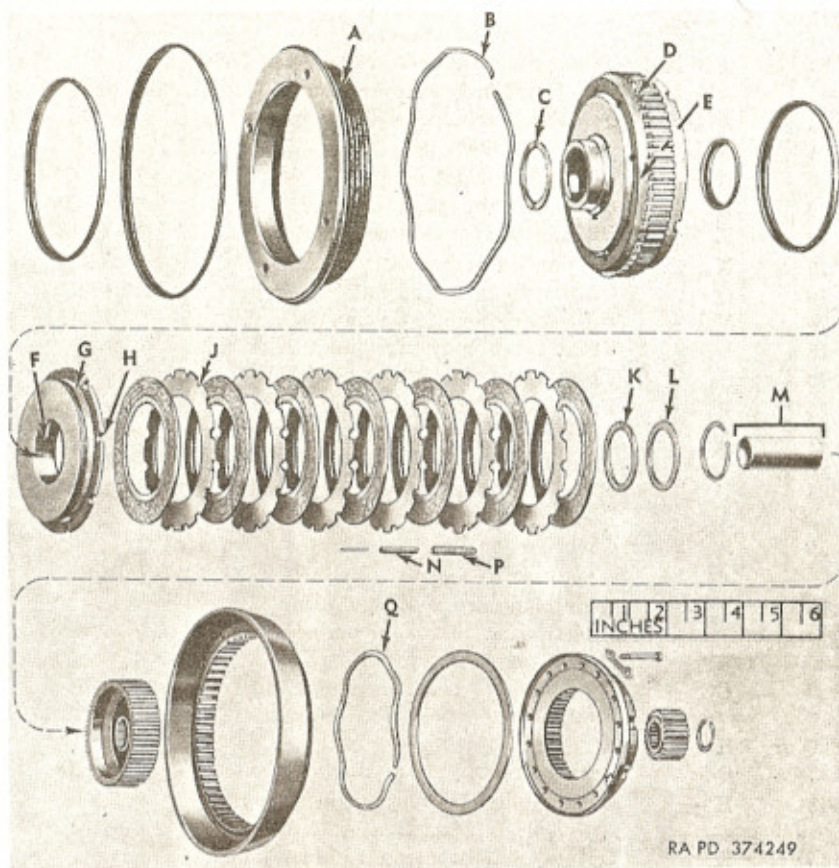


Figure 238. Repair and rebuild standard points of measurement for reduction unit parts (303M).

Figure No.	Reference letter	Point of measurement	Sizes and fits of new parts
	E	Outside diameter of clutch drum hub.....	3.2445 to 3.2465
	F	Inside diameter of direct clutch piston bore.....	3.2505 to 3.2535
	G	Outside diameter of direct clutch piston.....	7.099 to 7.109
	H	Width of notches in direct clutch piston.....	0.375 to 0.379
	J	Width of square notches in driven plates.....	0.375 to 0.378
	K	Thrust washer thickness.....	0.087 to 0.091
	L	Backing washer thickness.....	0.088 to 0.093
	M	Overall length of bearing spacer.....	3.724 to 3.728
	N	Approximate free length of inner release spring.....	2 ¹⁵ / ₆₄
	N	Compressed length under 14 to 16 lb.....	1 ¹³ / ₁₆
	P	Approximate free length of outer release spring.....	2 ³¹ / ₆₄
	P	Compressed length under 22 to 26 lb.....	1 ¹³ / ₁₆
	Q	Approximate free height of spring.....	0.422
	Q	Compressed height under 420 to 588 lb.....	0.200
238	G-D	Fit of direct clutch piston in clutch drum bore.....	0.139L to 0.153L
	F-E	Fit of direct clutch piston over clutch drum hub.....	0.004L to 0.009L

172. Torque Wrench Specifications

Figure No.	Reference letter	Location	Torque (lb-ft)
36	N	Front oil pump intake pipe to rear servo screw.....	3 to 4
36 & 39	A, B, and C	Front and rear servo to case bolts.....	23 to 28
39	H	Front and rear oil pump intake pipe to rear oil pump screws (301MG).....	3 to 4
51	D and F	Transmission control valve exhaust body to outer body screws.....	3 to 4
51	N and LL	Transmission control valve inner body to outer body screws.....	3 to 4
51	AA, BB, and KK	Transmission control valve detent plunger retainer to outer body screws.....	3 to 4
51	MM	Transmission control valve inner body cover to inner body screws.....	3 to 4

No.	Letter	Location	Torque (lb-ft)
51	AD	Transmission control valve front body	
	AE	to inner body screws	3 to 4
51	AL and AM	Transmission control valve front body plate to front body screws	3 to 4
70	G	Oil cooler mounting nuts	130 to 140
70	H	Oil pan drain plugs	35 to 45
70	K	Oil pan to case cap screws	15 to 18
70	N	Oil pan oil screen bolt	2 to 2½
70	Q	Oil pan to case stud nuts	10 to 13
70	V	Oil cooler cover to oil pan bolts	15 to 18
73	L	Front servo body pipe plugs	6 to 7
73	S	Front servo cylinder to body bolts	6 to 8
73	W	Front servo body pipe plug (301MG)	8 to 10
77	A	Rear servo accumulator piston spring retainer to accumulator body bolts	10 to 13
85	U	Front oil pump body to cover bolts	12 to 15
95	A	Rear oil pump cover to body bolts	10 to 12
95	S	Governor bushing retainer to governor body screws	3 to 4
115	P	Rear planetary unit rear drum internal-teeth gear to rear drum screws	3 to 4
120	K	Center bearing cap bolts	40 to 50
129	CC	Output shaft bearing retainer to transmission case bolts (301MG)	28 to 33
129 or	H		
147	S	Reverse center gear attaching bolts	15 to 18
148	H	Output shaft bearing retainer pipe plugs (303M)	8 to 10
148	K	Output shaft bearing retainer studs (303M)	23 to 28
148	L	Output shaft bearing retainer pipe plugs (303M)	15 to 18
148	N	Output shaft bearing retainer pipe plug	18 to 23
155	D	Reduction unit control valve cover to body bolts (303M)	6 to 8
155	CC	Reduction unit control valve pressure regulator valve stop plug (303M)	35 to 40
155	DD	Reduction unit control valve pipe plug (303M)	25 to 30
155	HH	Reduction unit control valve pipe plug (303M)	15 to 18
158	---	Reduction unit oil pump cover to body bolts (303M)	6 to 8
159	L	Reduction unit accumulator cover pipe plug (303M)	25 to 30
161	E	Reduction unit accumulator cover to case bolts (303M)	23 to 28
161	E	Reduction unit output shaft front bearing support to case bolts (303M)	23 to 28
161	K	Reduction unit control valve to case bolts (303M)	33 to 37

Figure No.	Reference letter	Location	Torque (lb-ft)
161	V and W	Reduction unit case to output shaft bearing retainer bolts (303M)	33 to 37
161	X	Reduction unit case to output shaft bearing retainer stud nuts (303M)	23 to 28
161	CC	Reduction unit oil pump to case bolts (303M)	10 to 12
175	A	Input shaft nut	50 to 60
175	N	Front oil pump cover to transmission case bolts	10 to 13
178	AA	Reduction unit internal gear to reduction clutch drum bolts (303M)	28 to 33
181	D	Side cover to case cap screws	10 to 12
181	Q	Control valve to case bolts	6 to 8
182	B	Front band adjusting cap	15 to 18
182	C	Front and rear band adjusting stop screw locknut	40 to 50
182	Q	Transmission oil pressure regulator valve plug	35 to 45
182	W	Reverse blocker bracket to case bolts	10 to 13
182	X	Rear oil pump to transmission case bolts	15 to 18
197	---	Output shaft bearing retainer to transmission case bolts (303M)	32 to 37

APPENDIX REFERENCES

1. Publications Indexes

DA pamphlets of the 310-series and DA Pam 108-1 should be consulted frequently for latest changes or revisions of references given in this appendix and for new publications relating to materiel covered in this technical manual.

2. Supply Manuals

The following manuals of the Department of the Army supply manual pertain to this materiel:

- a. Destruction to Prevent Enemy Use.*
Ammunition Explosives, Bulk Propellants and Explosive Devices SM 9-5-1375
- b. General.*
Index of Supply Manuals—Ordnance Corps..... DA Pam 310-29
Introduction ORD 1
- c. Repair and Rebuild.*
Abrasives, Adhesives, Cleaners, Preservatives, Recoil Fluids, Special Oils, and Related Items ORD 3 SNL K-1
Antifriction Bearings and Related Items..... ORD 5 SNL H-12
Lubricating Equipment, Accessories, and Related Dispensers ORD (*) SNL K-3
Oil Seals ORD 5 SNL H-13
Standard Hardware ORD 5 SNL H-1
- d. Vehicle.*
Infantry Vehicle, Armored, Tracked, M59 (T59) ORD 9 SNL G-280
Truck, Cargo: 2½-Ton, 6 x 6, M135, M211; Truck, Dump: 2½-Ton, 6 x 6, M215; Truck, Tank: Gasoline, 2½-Ton, 6 x 6, 1200-Gal., M217; Truck, Tank: Water, 2½-Ton, 6 x 6, 1000-Gal., M222; Truck Tractor: 2½-Ton, 6 x 6, M221; Truck, Van, Shop: 2½-Ton, 6 x 6, M220 ORD 9 SNL G-749

(*) See DA Pam 310-29, Index of Supply Manuals—Ordnance Corps, for published types of manuals of the Ordnance section of the Department of the Army supply manuals.

3. Forms

- The following forms pertain to this materiel:
DA Form 9-1, Materiel Inspection Tag
DA Form 9-3, Processing Record for Shipment and Storage of Vehicles and Boxed Engines
DA Form 9-71, Locator and Inventory Control Card
DA Form 9-77, Job Order Register
DA Form 9-78, Job Order
DA Form 9-79, Parts Requisition
DA Form 9-80, Job Order File
DA Form 9-81, Exchange Part or Unit Identification Tag
DA Form 446, Issue Slip
DA Form 447, Turn-In Slip
DA Form 460, Preventive Maintenance Roster
DA Form 468, Unsatisfactory Equipment Report
DA Form 478, Organizational Equipment File
DA Form 811, Work Request and Job Order
DA Form 865, Work Order
DA Form 866, Consolidation of Parts
DA Form 867, Status of Modification Work Order
DD Form 6, Report of Damaged or Improper Shipment

4. Other Publications

The following explanatory publications contain information pertinent to this materiel and associated equipment:

- a. Destruction to Prevent Enemy Use.*
Demolition Materials TM 9-1946
Explosives and Demolitions FM 5-25
Ordnance Service in the Field FM 9-5
- b. General.*
Inspection of Ordnance Materiel in Hands of Troops TM 9-1100
Instruction Guide: Operation and Maintenance of Ordnance Materiel in Extreme Cold (0° to -65° F.) TM 9-2855
Truck, 2½-Ton 6 x 6, M135, M211, M215, M217, M220, M221, M222 LO 9-8024
Carrier, Personnel, Full Tracked: Armored, M59 LO 9-7002
Ordnance Maintenance and General Supply in the Field FM 9-10
- c. Repair and Rebuild.*
Abrasive, Cleaning, Preserving, Sealing, Adhesive, and Related Materials Issued for Ordnance Materiel TM 9-850

Instruction Guide: Care and Maintenance of Ball and Roller Bearings	TM 37-265
Lubrication	TM 9-2835
Maintenance of Supplies and Equipment: Maintenance Responsibilities and Shop Operation	AR 750-5
Ordnance Maintenance: Vehicular Maintenance Equipment; Grinding, Boring, Valve Reseating Machines, and Lathes	TM 9-1834A
<i>d. Shipment and Limited Storage.</i>	
Instruction Guide: Ordnance Preservation, Packaging, Packing, Storage, and Shipping	TM 9-1005
Report of Damaged or Improper Shipment	AR 700-58
Marking of Arctic Lubricated Materiel and Equipment	SR 746-30-10
Marking of Oversea Supply	SR 746-30-5
Shipment Digit Marking	SR 746-30-6
Military Standard-Marking of Shipments	MIL STD 129 ¹
Ordnance Storage and Shipment Chart Group G: Major Items and Major Combinations of Group G	TB 9-OSSC-G
Army Shipping Document	TM 38-705
Preservation, Packaging, and Packing of Military Supplies and Equipment	TM 38-230
Processing of Unboxed and Uncrated Equipment for Oversea Shipment	AR 747-30
Protection of Ordnance General Supplies in Open Storage	TB ORD 379
Standards for Oversea Shipment and Domestic Issue of Ordnance Materiel Other than Ammunition and Army Aircraft	TB ORD 385

¹ Copies may be obtained from Aberdeen Proving Ground, Aberdeen, Maryland.

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