GEREGISTREERD
18 NOV 1958
MINISTERIE VAN STAF ADJ.-GEN

M5_029

TM 9-1813

WAR DEPARTMENT TECHNICAL MANUAL

ORDNANCE MAINTENANCE

6-TON, 6x6 TRUCK

(WHITE, CORBITT, BROCKWAY, AND WARD LA FRANCE)—

POWER TRAIN, CHASSIS, AND WINCHES

WAR DEPARTMENT • 8 NOVEMBER 1945

WAR DEPARTMENT TECHNICAL MANUAL

TM 9-1813

This TM, together with TM 9-813, dated 19 Feb 44; and TM 9-1832A, dated 17 May 44, supersedes TM 10-1109, dated 27 Aug 41; TM 10-1159, dated 29 Aug 41; TM 10-1221, dated 3 Feb 42; TM 10-1529, dated 29 Sep 42; and TM 10-1553, dated 14 May 42. This TM supersedes portions of WDTB ORD 12, dated 12 Jan 44; WDTB ORD 147, dated 24 Jul 43; and OFSTB 800-17, dated 24 Jul 43, which apply to the materiel covered in this TM; however, these TB's remain in force until incorporated in all other affected TM's or specifically rescinded.

ORDNANCE MAINTENANCE

6-TON, 6 x 6 TRUCK

(WHITE, CORBITT, BROCKWAY, AND WARD LA FRANCE)—

POWER TRAIN, CHASSIS, AND WINCHES

WAR DEPARTMENT • *8 NOVEMBER 1945*

WAR DEPARTMENT
Washington 25, D. C., 8 November 1945

TM 9-1813, Ordnance Maintenance: 6-ton, 6 x 6 Truck (White, Corbitt, Brockway, and Ward La France)—Power Train, Chassis, and Winches, is published for the information and guidance of all concerned.

[A.G. 300.7 (11 Jul 45)
O.O. M.46/Rar. Ars. (8 Nov 45)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
EDWARD F. WITSELL,
Major General,
Acting The Adjutant General.

DISTRIBUTION: AGF (2); ASF (2); S Div ASF (1); T of Opn (10); Arm & Sv Bd (1); Tech Sv (2); SvC (10); FC (1); PE, Ord O (5); Dist O, 9 (3); Establishments, 9 (3) except Am Establishments (0); Decentralized Sub-O, 9 (2); Gen & Sp Sv Sch (5); A (3); CHQ (2); D (2); one (1) copy to each of the following T/O & E's: 9-7; 9-9; 9-37; 9-57; 9-65; 9-67; 9-76; 9-127; 9-197; 9-317; 9-325; 9-327; 9-328; 9-377.

(For explanation of symbols, see FM 21-6.)

CONTENTS

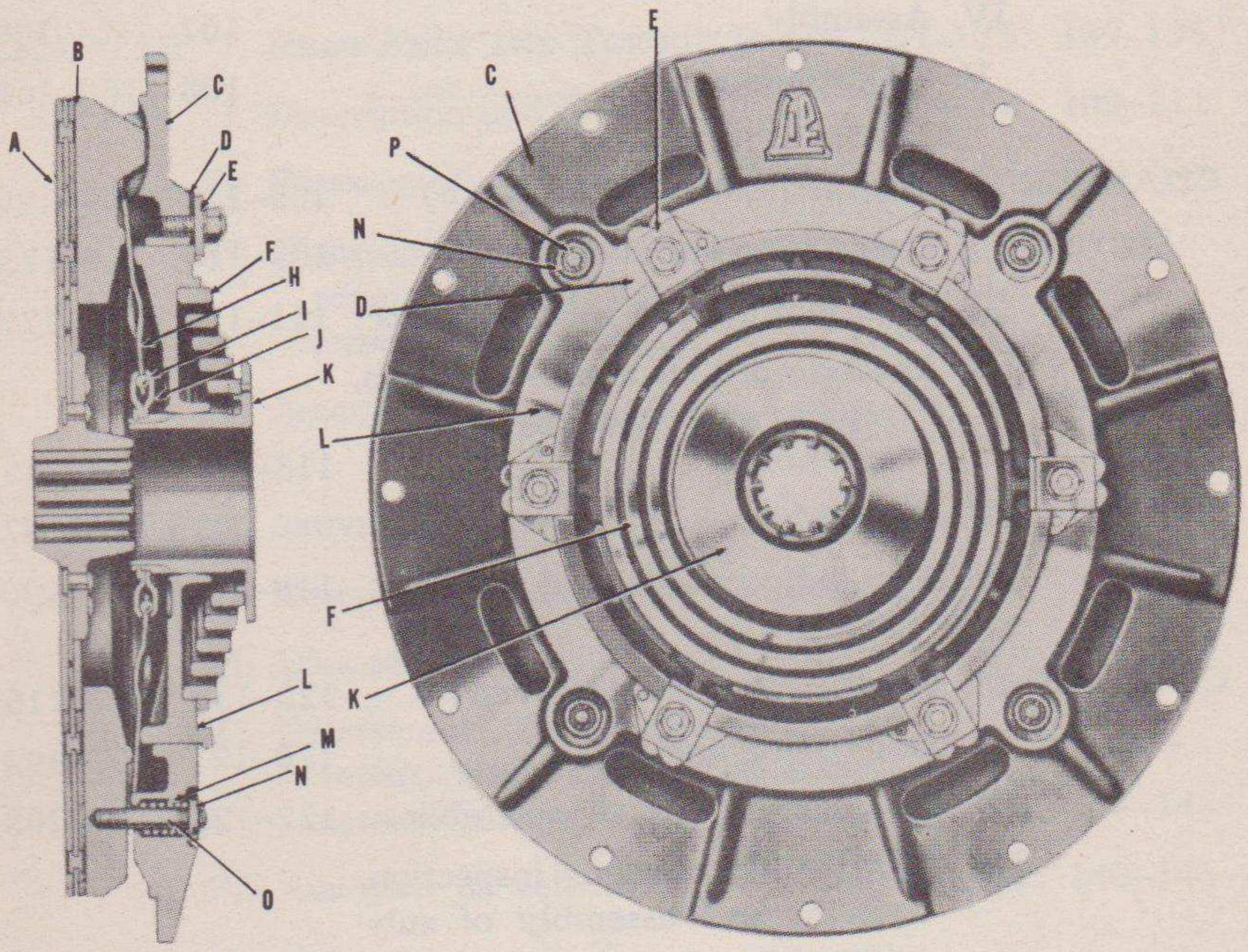
		Paragraphs	Pages
CHAPTER 1.	INTRODUCTION	1– 2	1– 3
CHAPTER 2.	CLUTCH	3– 10	4– 14
SECTION I.	Description and data	3– 4	4– 5
II.	Clutch cover plate assembly	5– 7	6– 14
III.	Driven disk and facings	8– 10	14
CHAPTER 3.	TRANSMISSION	11– 25	15– 38
SECTION I.	Description and data	11– 12	15– 17
II.	Disassembly into subassemblies	13– 14	17– 24
III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	15– 22	24– 35
IV.	Assembly	23– 24	35– 38
V.	Fits and tolerances	25	38
CHAPTER 4.	PROPELLER SHAFTS AND UNIVERSAL JOINTS	26– 34	39– 44
SECTION I.	Description and data	26– 27	39– 40
II.	Disassembly into subassemblies	28– 29	40– 41
III.	Cleaning, inspection, and repair	30	42– 43
IV.	Assembly and test	31– 34	43– 44
CHAPTER 5.	TRANSFER CASE	35– 47	45– 68
SECTION I.	Description and data	35– 36	45– 47
II.	Disassembly into subassemblies	37– 38	47– 54
III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	39– 44	54– 65
IV.	Assembly, test, and data	45– 47	65– 68
CHAPTER 6.	FRONT AXLE AND UNIVERSAL JOINTS	48– 60	69–108
SECTION I.	Description and data	48– 49	69– 71
II.	Disassembly into subassemblies	50– 51	72– 78

		Paragraphs	Pages
SECTION III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	52– 55	78–104
IV.	Assembly	56– 57	105–106
V.	Test, adjustment, and data	58– 60	107–108
CHAPTER 7.	REAR AXLE AND TORQUE RODS	61– 75	109–135
SECTION I.	Description and data	61– 62	109–111
II.	Disassembly into subassemblies	63– 64	111–115
III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	65– 71	115–133
IV.	Assembly, test, and data	72– 75	133–135
CHAPTER 8.	SERVICE BRAKES	76– 81	136–145
SECTION I.	Description and data	76– 77	136
II.	Disassembly	78	137
III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	79– 80	138–140
IV.	Assembly on vehicle	81	140–145
CHAPTER 9.	PROPELLER SHAFT BRAKE	82– 90	146–154
SECTION I.	Description and data	82– 83	146–147
II.	Disassembly into subassemblies	84	147–149
III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	85– 88	150–153
IV.	Assembly and adjustment	89– 90	154
CHAPTER 10.	SPRINGS AND WALKING BEAM	91–100	155–160
SECTION I.	Springs	91– 95	155–157
II.	Walking beam	96–100	157–160

		Paragraphs	Pages
CHAPTER 11.	STEERING GEAR	101–108	161–168
SECTION I.	Description and data	101	161–162
II.	Disassembly into subassemblies	102–103	163–164
III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	104–106	164–166
IV.	Assembly	107	166
V.	Adjustments	108	166–168
CHAPTER 12.	WINCH (CENTER MOUNTED)	109–119	169–190
SECTION I.	Description and data	109–110	169–173
II.	Disassembly into subassemblies	111–112	174–177
III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	113–116	178–185
IV.	Assembly	117	186–187
V.	Test, adjustments, and data	118–119	187–190
CHAPTER 13.	WINCH (FRONT MOUNTED)	120–138	191–216
SECTION I.	Description and data	120–121	191–193
II.	Disassembly into subassemblies	122–123	194–203
III.	Disassembly, cleaning, inspection, repair, and assembly of subassemblies	124–134	203–213
IV.	Assembly, test, and data	135–138	213–216
CHAPTER 14.	HOIST POWER TAKE-OFF	139–144	217–221
SECTION I.	Description and data	139–140	217
II.	Disassembly into subassemblies	141–142	217–220
III.	Assembly	143–144	220–221
CHAPTER 15.	SPECIAL TOOLS	145–146	222

APPENDIX

SECTION I.	References	147–149	223–225
INDEX			226–229



PARTS OF PRESSURE PLATE ASSEMBLY

A—DRIVEN DISK ASSEMBLY
B—PRESSURE PLATE
C—FLYWHEEL RING
D—ADJUSTING SHIMS
E—LOCK PLATE
F—PRESSURE SPRING
H—PRESSURE LEVER
I—PRESSURE LEVER BALL
J—SNAP RING
K—CLUTCH SLEEVE
L—ADJUSTING PLATE
M—RETRACTOR SPRING
N—WASHER
O—PRESSURE PLATE STUD
P—RETRACTOR SPRING RETAINING PIN

RA PD 353058

Figure 1 — Clutch — Sectional and Assembled View

This TM, together with TM 9-813, dated 19 Feb 44, and TM 9-1832A, dated 17 May 44, supersedes TM 10-1109, dated 27 Aug 41; TM 10-1159, dated 29 Aug 41; TM 10-1221, dated 3 Feb 42; TM 10-1529, dated 29 Sep 42; and TM 10-1553, dated 14 May 42. This TM supersedes portions of WDTB ORD 12, dated 12 Jan 44; WDTB ORD 147, dated 24 Jul 43; and OFSTB 800-17, dated 24 Jul 43, which apply to the materiel covered in this TM; however, these TB's remain in force until incorporated in all other affected TM's or specifically rescinded.

CHAPTER 1
INTRODUCTION

1. SCOPE.

a. The instructions contained in this manual are for the information and guidance of personnel charged with the maintenance and repair of the 6-ton, 6 x 6 White, Brockway, Corbitt, and Ward La France trucks. These instructions are supplementary to field and technical manuals prepared for the using arms. This manual does not contain information which is intended primarily for the using arms, since such information is available to Ordnance maintenance personnel in 100-series TM's or FM's.

b. This manual contains a description of, and procedure for, disassembly, cleaning, inspection, repair, and assembly of subassemblies for the clutch, transmission, transfer case, propeller shafts, propeller shaft brake, front axle, steering gear, rear axle, springs, winch, and service brakes of the 6-ton 6 x 6 White, Brockway, Ward La France, and Corbitt trucks.

c. TM 9-813 contains operating instructions for this equipment.

d. TM 9-1832A contains Ordnance maintenance instructions for the engine.

e. TM 9-1825A contains Ordnance maintenance instructions for the ignition, starting, and generating systems.

f. TM 9-1826C contains Ordnance maintenance instructions for the carburetor.

g. TM 9-1827A contains Ordnance maintenance instructions for the power brake system.

h. TM 9-1829A contains Ordnance maintenance instructions for the speedometer and tachometer.

i. TM 9-1828A contains Ordnance maintenance instructions for the fuel pump.

2. FORMS, RECORDS, AND REPORTS.

a. General. Forms, records, and reports are designed to serve necessary and useful purposes. Responsibility for the proper execution of these forms rests upon commanding officers of all units maintaining vehicles and components. It is emphasized, however, that forms, records, and reports are merely aids. They are not a substitute for thorough practical work, physical inspection, and active supervision.

b. Authorized forms. The forms, records, and reports generally applicable to units maintaining vehicles or components are listed below with brief explanations of each. No forms other than approved War Department forms will be used. Pending availability of forms listed, old forms may be used. For a current and complete listing of all forms, see current FM 21-6 (Lists and Index of War Department Publications).

(1) WAR DEPARTMENT LUBRICATION ORDER. War Department Lubrication Orders Nos. 9-813 and 9-813-1 prescribe lubrication maintenance for these vehicles. A lubrication order is issued with each vehicle and is to be carried with it at all times. Instructions contained therein are mandatory to all users of the equipment and supersede all conflicting lubrication instructions of prior date.

(2) WD AGO FORM 9-71, LOCATOR AND INVENTORY CONTROL CARD. Except when specified otherwise by the War Department, this form will be used as a bin tag, locator card, or inventory control card by all units authorized automotive spare parts.

(3) WD AGO FORM 9-72, ORDNANCE STOCK RECORD CARD. This form is prescribed for use by ordnance maintenance and depot companies.

(4) WD AGO FORM 9-74, MOTOR VEHICLE OPERATOR'S PERMIT. This form will be issued by commanders to all operators of vehicles who are qualified to operate the particular vehicles noted on the permit.

(5) WD AGO FORM 9-76, REQUEST FOR WORK ORDER. This form will be used for requesting repairs, alterations, or other type of work within or between organizations and departments.

(6) WD AGO FORM 9-77, JOB ORDER REGISTER. This form will be used to keep a chronological record of work orders.

(7) WD AGO FORM 13-1, AUTOMOTIVE DISABILITY REPORT OF VEHICLES DISABLED MORE THAN THREE DAYS. This form will be accomplished and submitted as directed in current War Department instructions.

(8) WD AGO FORM 461, WORK SHEET FOR WHEELED AND HALF-TRACK VEHICLES. This form will be used for maintenance services and for all technical inspections performed on wheeled or half-track vehicles.

(9) WD AGO FORM 461-5, LIMITED TECHNICAL INSPECTION. This form will be used for limited technical inspections to classify vehicles as to general over-all condition.

(10) WD AGO FORM 478, MODIFICATION WORK ORDER AND MAJOR UNIT ASSEMBLY REPLACEMENT RECORD AND ORGANIZATION EQUIPMENT FILE. This form will be kept in possession of second echelon personnel and will accompany vehicles upon transfer and evacuation to higher echelon. It will be a record of all modifications made and exchanges of major unit assemblies. Minor repairs, parts and accessory replacements will not be recorded. In the field, where no filing facilities are available, this form will be kept in a filing jacket.

(11) WD AGO FORM 811, WORK REQUEST AND JOB ORDER. This form will be used by organizational maintenance units when requesting repair by a higher echelon repair unit.

(12) WD AGO FORM 866, CONSOLIDATION OF PARTS. This form will be used by a maintenance company for the periodic report required by higher headquarters showing the parts and materials used and issued by the company for a given period.

(13) WD AGO FORM 867, STATUS OF MODIFICATION WORK ORDER. This form provides a record of the status at any time of any modification work order being performed by a maintenance shop.

(14) WD AGO FORM 461-3, WORK SHEET FOR WHEELED AND HALF-TRACK VEHICLES (PRODUCTION LINE MAINTENANCE). This form will be used for production line maintenance services.

CHAPTER 2

CLUTCH

Section I

DESCRIPTION AND DATA

3. DESCRIPTION AND OPERATION.

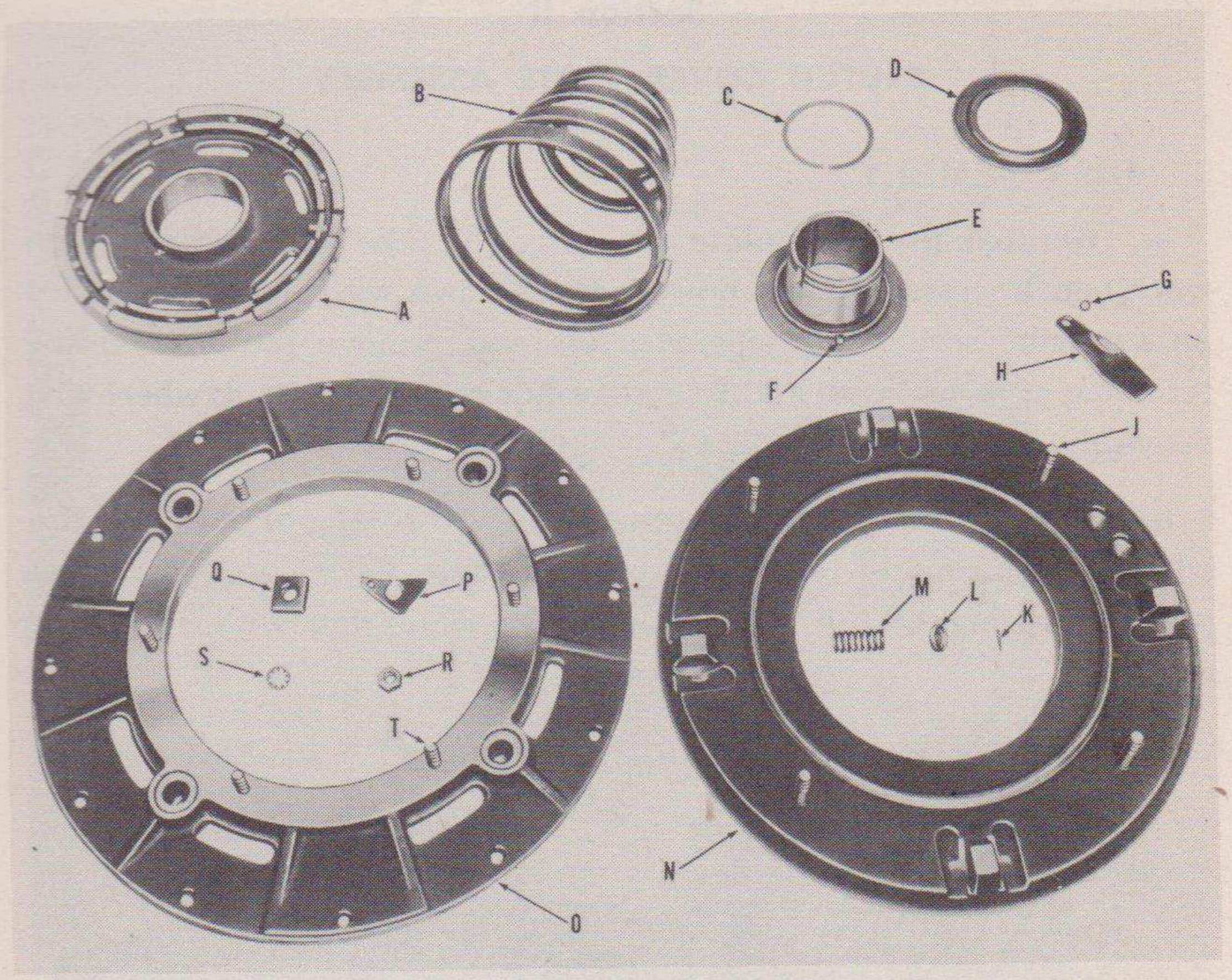
a. General. The clutch consists of a clutch pressure plate assembly and a driven disk assembly. The clutch functions by clamping the driven disk, splined to the transmission drive shaft, between the face of the flywheel and the clutch pressure plate. When the clutch is engaged, the pressure spring acts on a sleeve which transmits the energy to 20 ball-bearing hinged levers. The levers multiply the pressure of the spring and transmit the increased pressure to the pressure plate. When the clutch is released, the sleeve moves toward the flywheel, causing the outer end of the hinged levers to move in a direction opposite to the spring pressure on these levers. As the pressure on the pressure plate is relieved, the retractor springs pull the pressure plate out of contact with the driven disk (figs. 1 and 2).

4. DATA.

Make	W. C. Lipe
Type	Single Plate "Push"
Model	15-SP-Z40-SX
Size	15 in.

Driven disk—facings:

Outside diameter	15 in.
Inside diameter	8 in.
Facing thickness (each facing)	5/32 in.
Area of one face	256 sq in.



A—ADJUSTING PLATE
B—PRESSURE SPRING
C—SNAP RING
D—FULCRUM RING
E—SLEEVE ASSEMBLY
F—SPRING STOP PIN
G—LEVER LOCKING BALL
H—PRESSURE LEVER
J—PRESSURE PLATE STUD
K—RETRACTOR SPRING RETAINING PIN
L—RETRACTOR SPRING RETAINING WASHER
M—RETRACTOR SPRING
N—PRESSURE PLATE AND STUD ASSEMBLY
O—FLYWHEEL RING AND STUD ASSEMBLY
P—ADJUSTING SHIM
Q—ADJUSTING STRAP
R—FLYWHEEL RING STUD NUT
S—FLYWHEEL RING STUD NUT LOCK WASHER
T—FLYWHEEL RING STUD

RA PD 334413

Figure 2 — Clutch Pressure Plate Assembly — Disassembled

Pressure plate:

Adjusting shims—quantity under each strap (new) ..... 7 (6 steel, 1 copper)

Pressure spring—pressure at 1¼-in. height ..... 665 lb

Section II

CLUTCH COVER PLATE ASSEMBLY

5. DISASSEMBLY.

a. Remove pressure plate assembly (fig. 3). Place assembly on work bench, pressure plate down. Press down with thin-nosed pliers on retractor spring retaining washers and remove retractor spring retaining pins, washers, and four retractor springs. Lift flywheel ring assembly from pressure plate.

b. Remove clutch release sleeve assembly (fig. 4). Place flywheel ring assembly in a press with pressure levers up. Compress pressure spring to full extent. Remove snap ring with snap ring

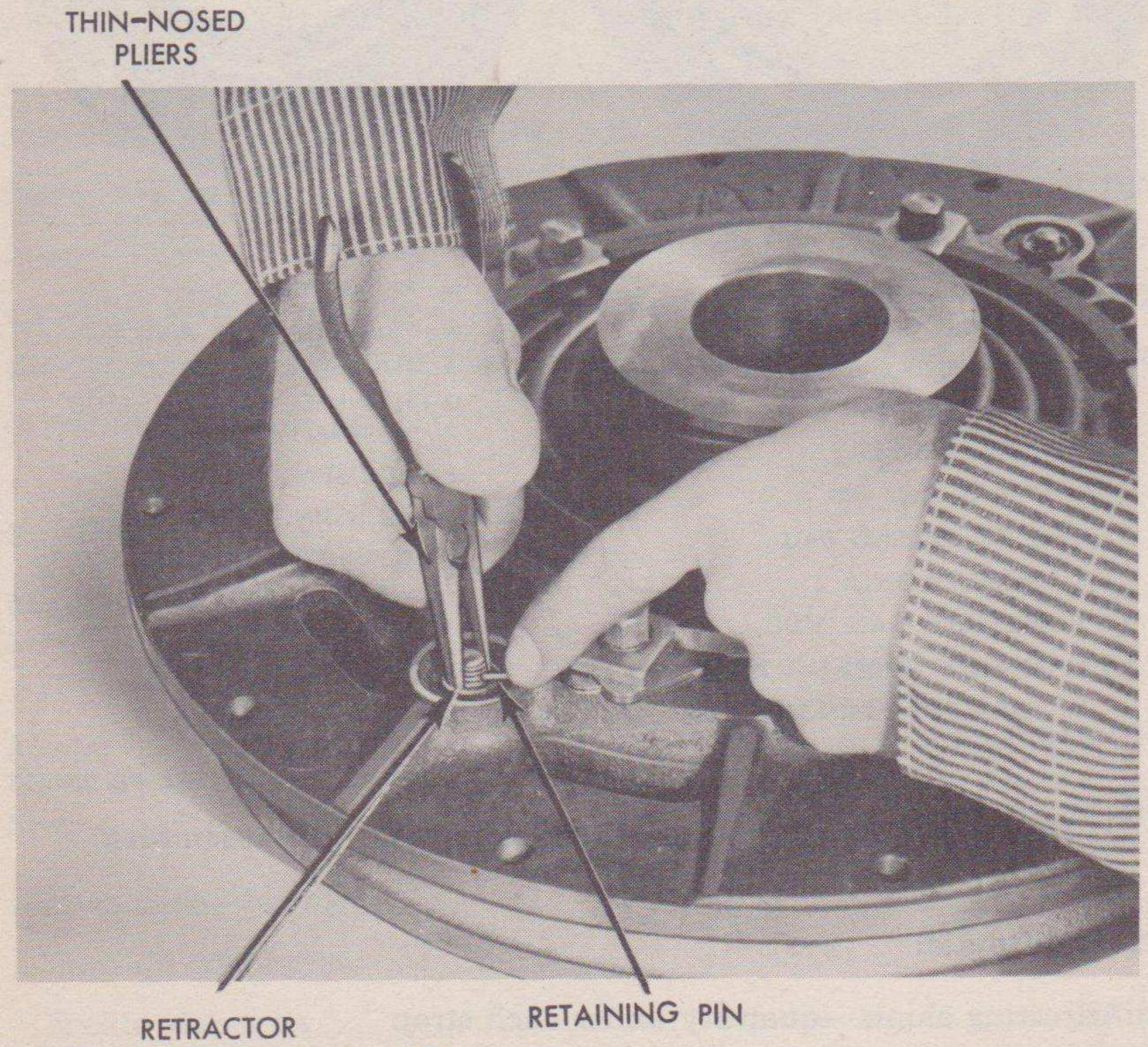
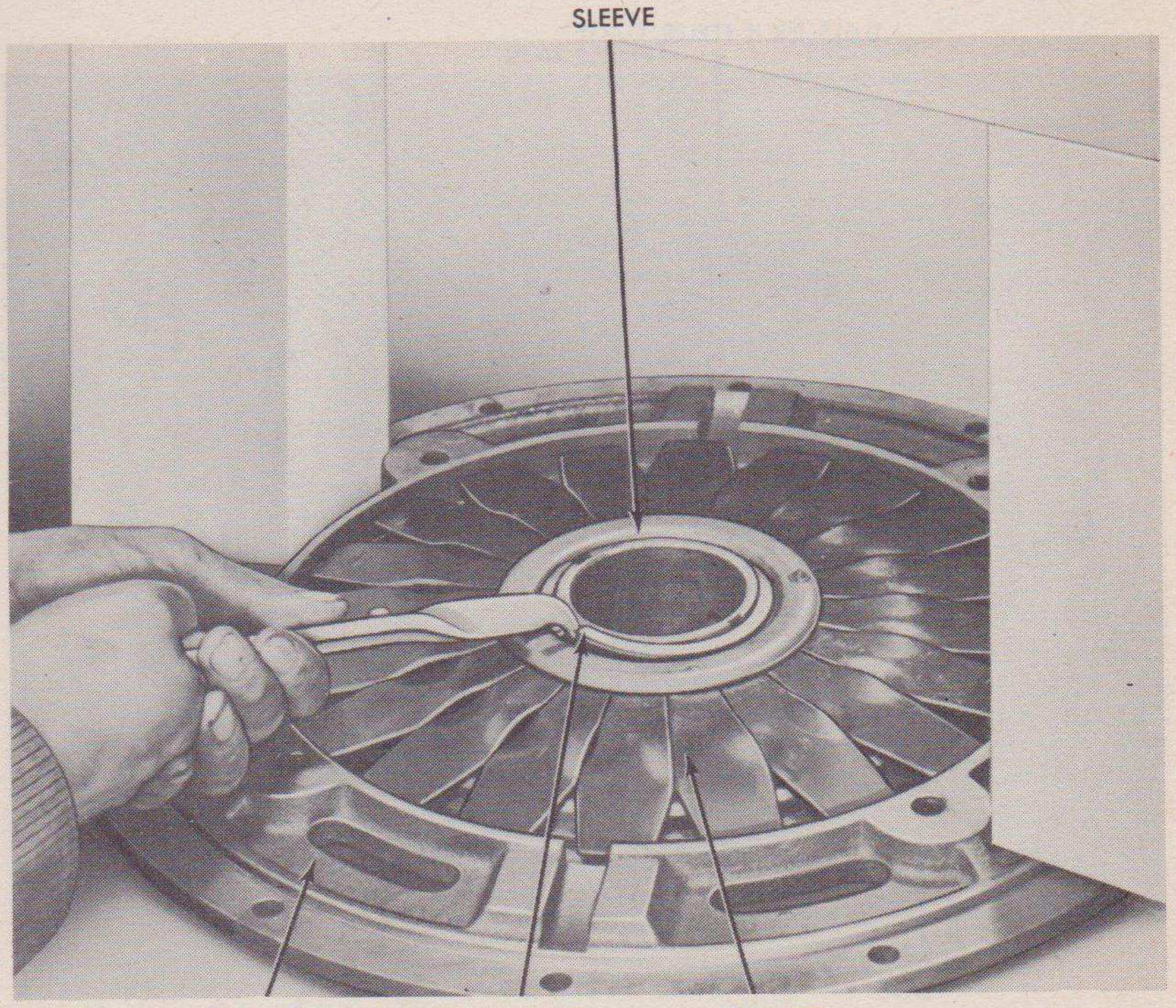


Figure 3 — Removing Retractor Spring Pins

Clutch Cover Plate Assembly



RA PD 334415

Figure 4 — Removing Fulcrum Ring Snap Ring

pliers. Lift off upper fulcrum ring, then remove 20 pressure levers and lever locking balls. Lift off lower fulcrum ring. Release pressure on press completely and raise flywheel ring assembly. The sleeve will then drop from the flywheel ring.

c. Remove adjusting plate. Remove six nuts and lock washers from flywheel ring studs, and lift adjusting straps from adjusting plate. Pull adjusting plate from flywheel ring. Remove adjusting shims from each flywheel ring stud (fig. 2).

6. CLEANING, INSPECTION, AND REPAIR.

a. Clean and inspect. Clean all parts (sleeve, fulcrum rings, levers, balls, and snap ring) thoroughly with dry cleaning solvent. Inspect all parts for excessive wear, roughness, or distortion. Replace all unserviceable parts.

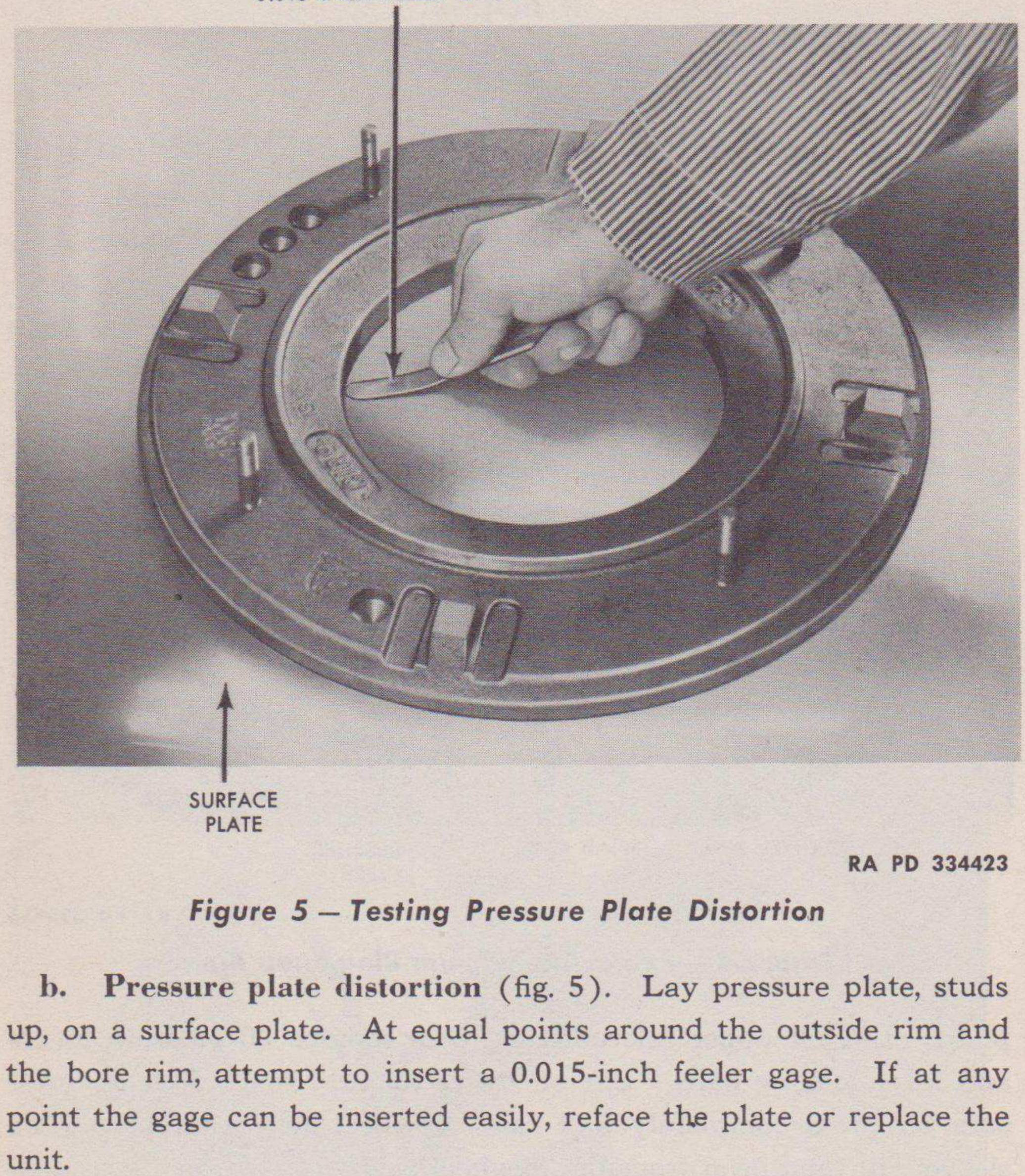


Figure 5 — Testing Pressure Plate Distortion

b. Pressure plate distortion (fig. 5). Lay pressure plate, studs up, on a surface plate. At equal points around the outside rim and the bore rim, attempt to insert a 0.015-inch feeler gage. If at any point the gage can be inserted easily, reface the plate or replace the unit.

c. Driving lugs and slots. The clearance between the flywheel ring slots and the lugs on the pressure plate should not be less than 0.004 or more than 0.006 inch. If the clearance does not come within these limits, replace either or both the pressure plate and flywheel ring.

7. ASSEMBLY.

a. Install adjusting plate.

(1) INSTALL SHIMS. If the pressure plate is new or has not been resurfaced, place seven adjusting shims on each of six flywheel ring

Clutch Cover Plate Assembly

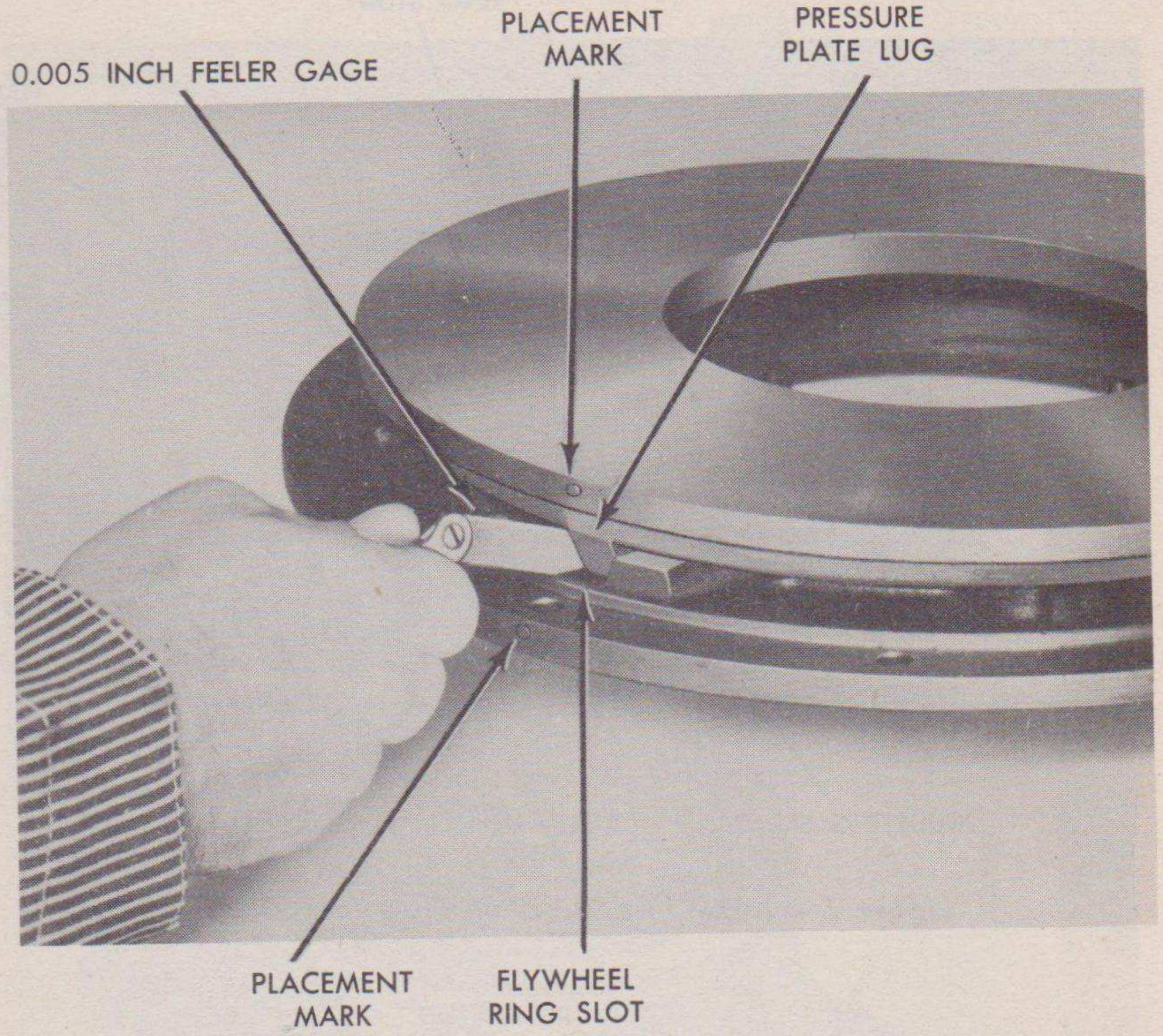


Figure 6 — Testing Lug and Slot Clearance

studs (six steel, with one copper shim on bottom), and line up inner edges of shims with inner edges of flywheel ring (fig. 7). If the pressure plate has been resurfaced, reduce the total shim thickness by the amount removed from the pressure plate.

(2) INSTALL ADJUSTING PLATE. Press adjusting plate into bore of flywheel ring and down onto adjusting shims. Install six adjusting straps (fig. 8), and install and tighten toothed lock washers and nuts on all studs.

b. Install sleeve in flywheel ring. Place clutch sleeve, flange down, on base of press. Lay pressure spring, large end up, with end of coil (at small end) butting against boss on clutch sleeve flange. Place flywheel ring assembly on top of coil, with end of spring butting against boss on adjusting plate (fig. 1). Place wood block arbor

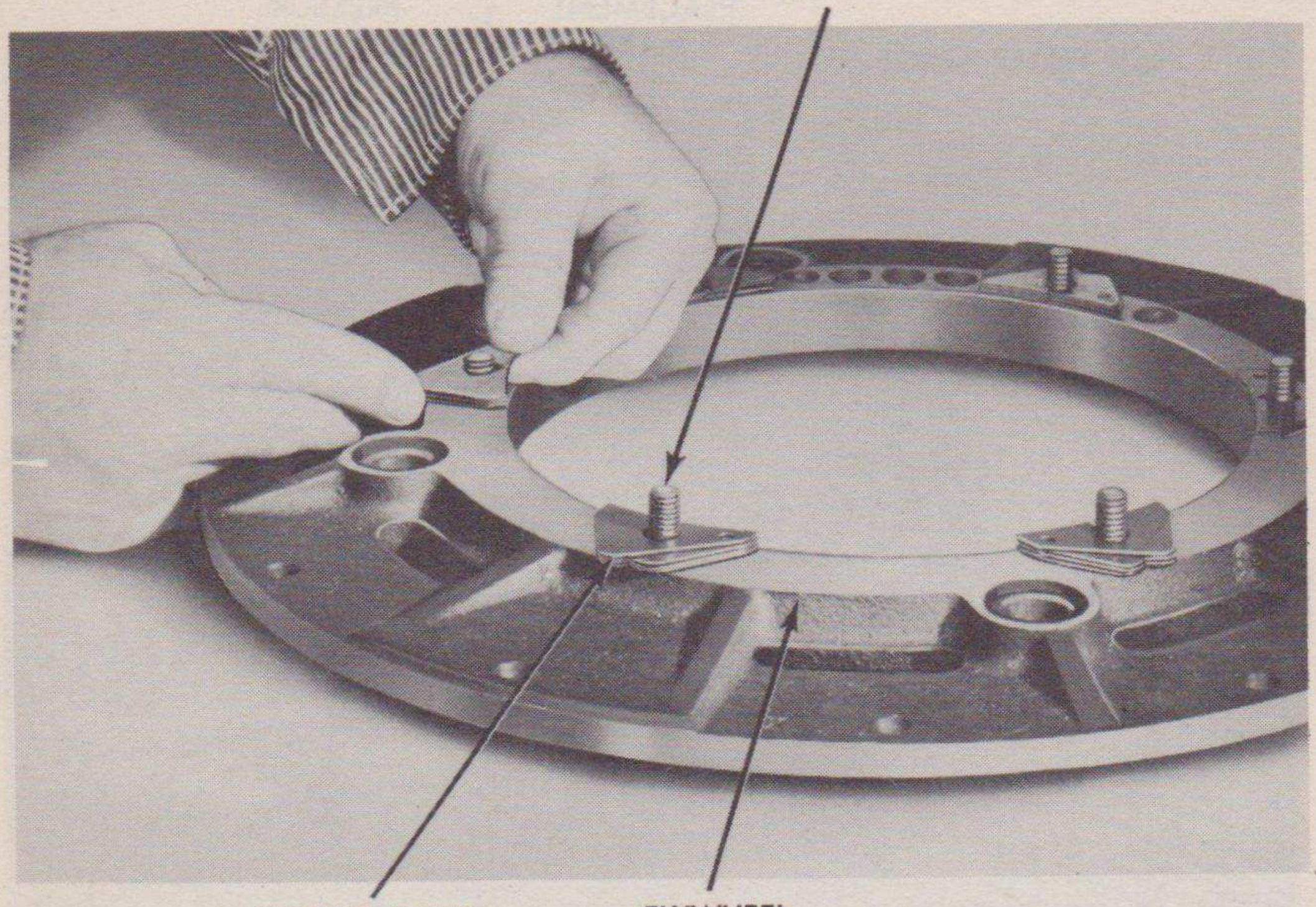


Figure 7 — Installing Shims on Flywheel Ring

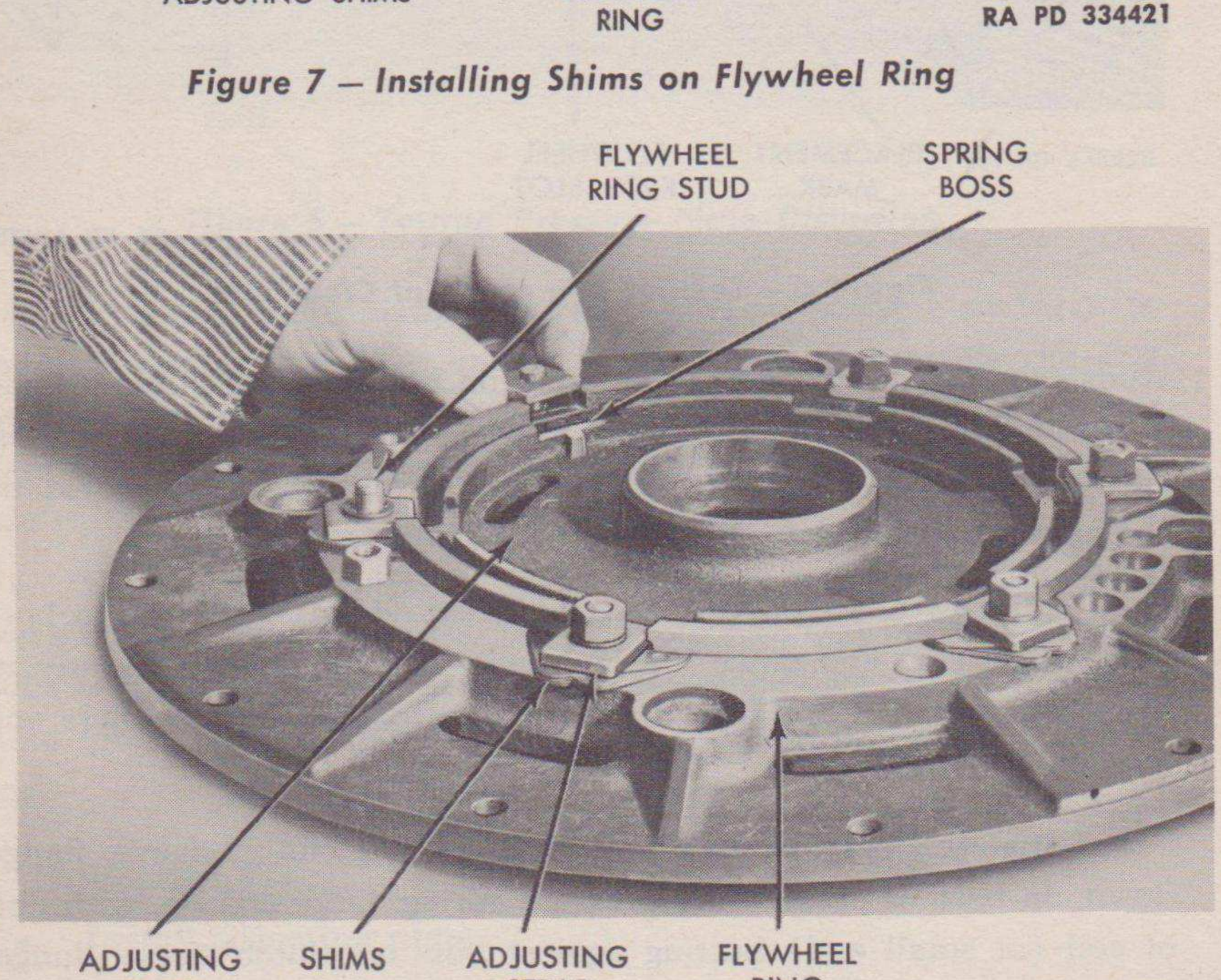


Figure 8 — Installing Adjusting Straps

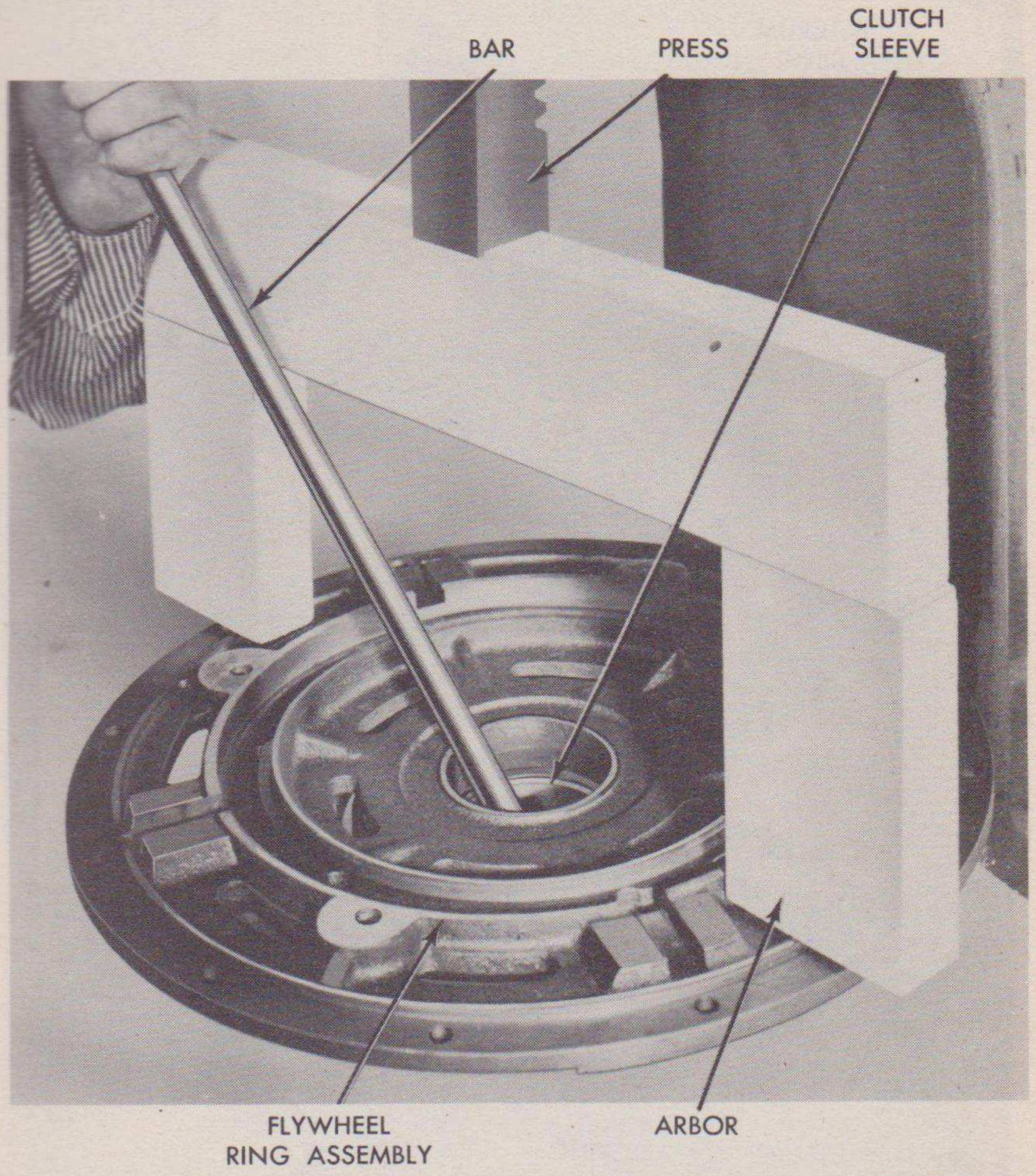


Figure 9 — Guiding Clutch Sleeve in Bore

in position, compress pressure spring guiding sleeve through adjusting plate bore (fig. 9), and lock press in position.

c. Install pressure levers. Lay fulcrum ring over sleeve. Place 20 pressure levers in position (fig. 10), and insert locking balls. CAUTION: *Be sure no levers overlap and that all balls are in position.*

d. Install snap ring. Lay top fulcrum ring over sleeve, balls, and inner ends of levers. Press snap ring on sleeve and tap lightly

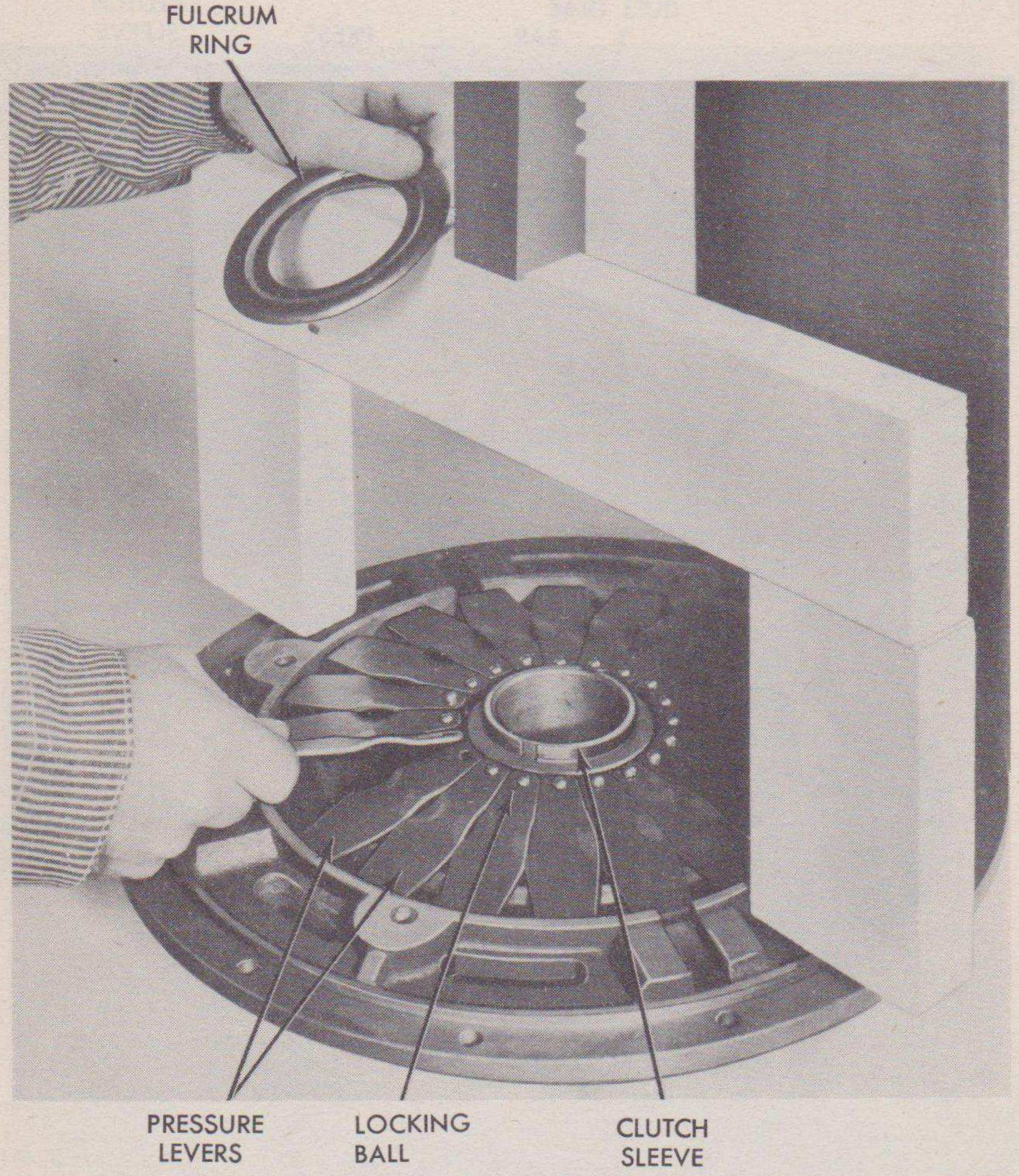


Figure 10 — Installing Pressure Levers and Balls

around ring until it seats on fulcrum ring. Place opening in snap ring away from slots in sleeve. Using staking tool, tap snap ring securely into sleeve groove (fig. 11). Release press slowly.

e. Install pressure plate. Lay flywheel ring and clutch sleeve assembly on bench, pressure levers up. Hold pressure plate (fig. 12) and line up "0" marks on rims of both assemblies. Lower pressure plate, guiding lugs into slots of flywheel ring. When these are engaged,

Clutch Cover Plate Assembly

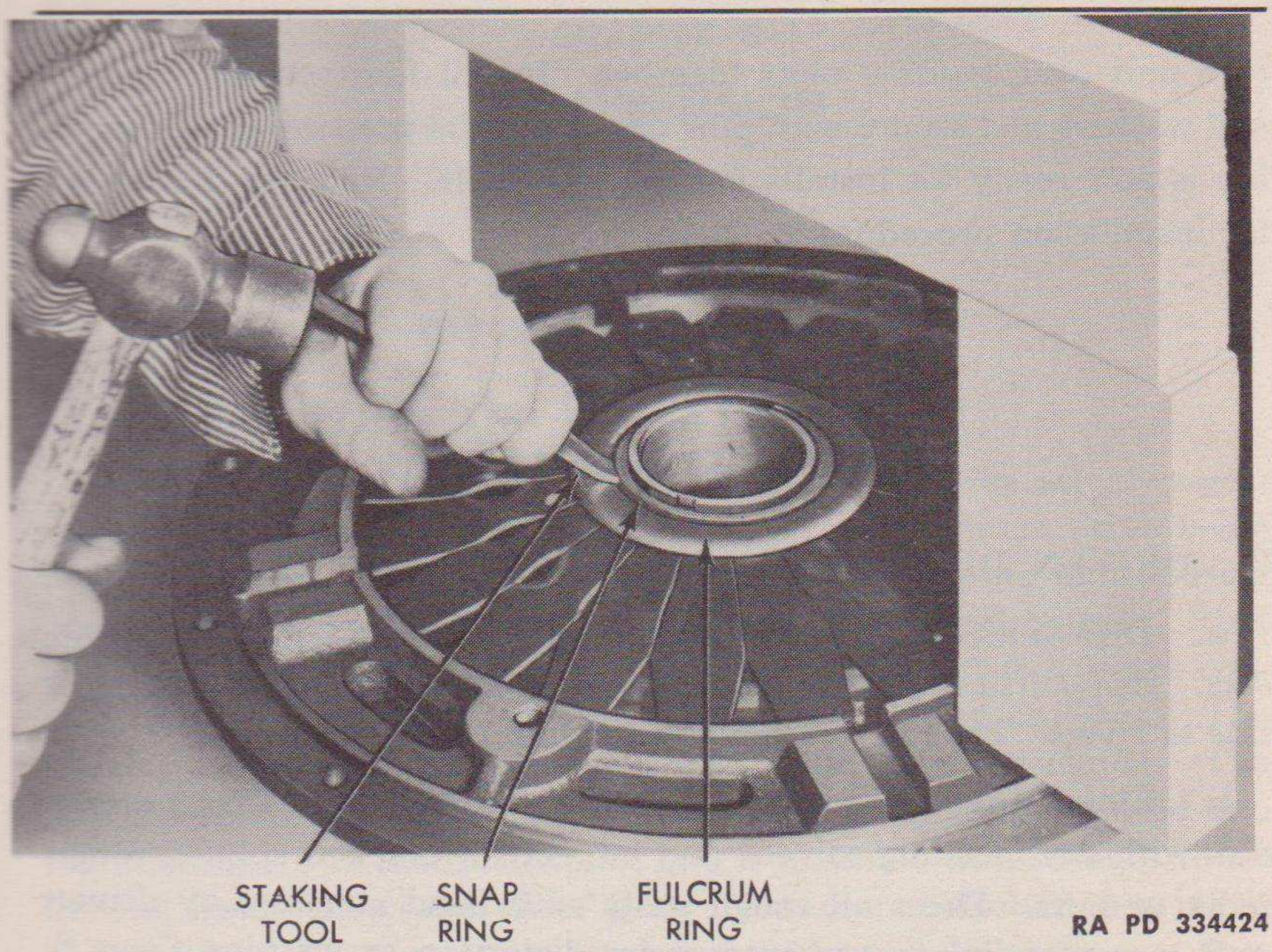


Figure 11 — Staking Snap Ring Into Groove

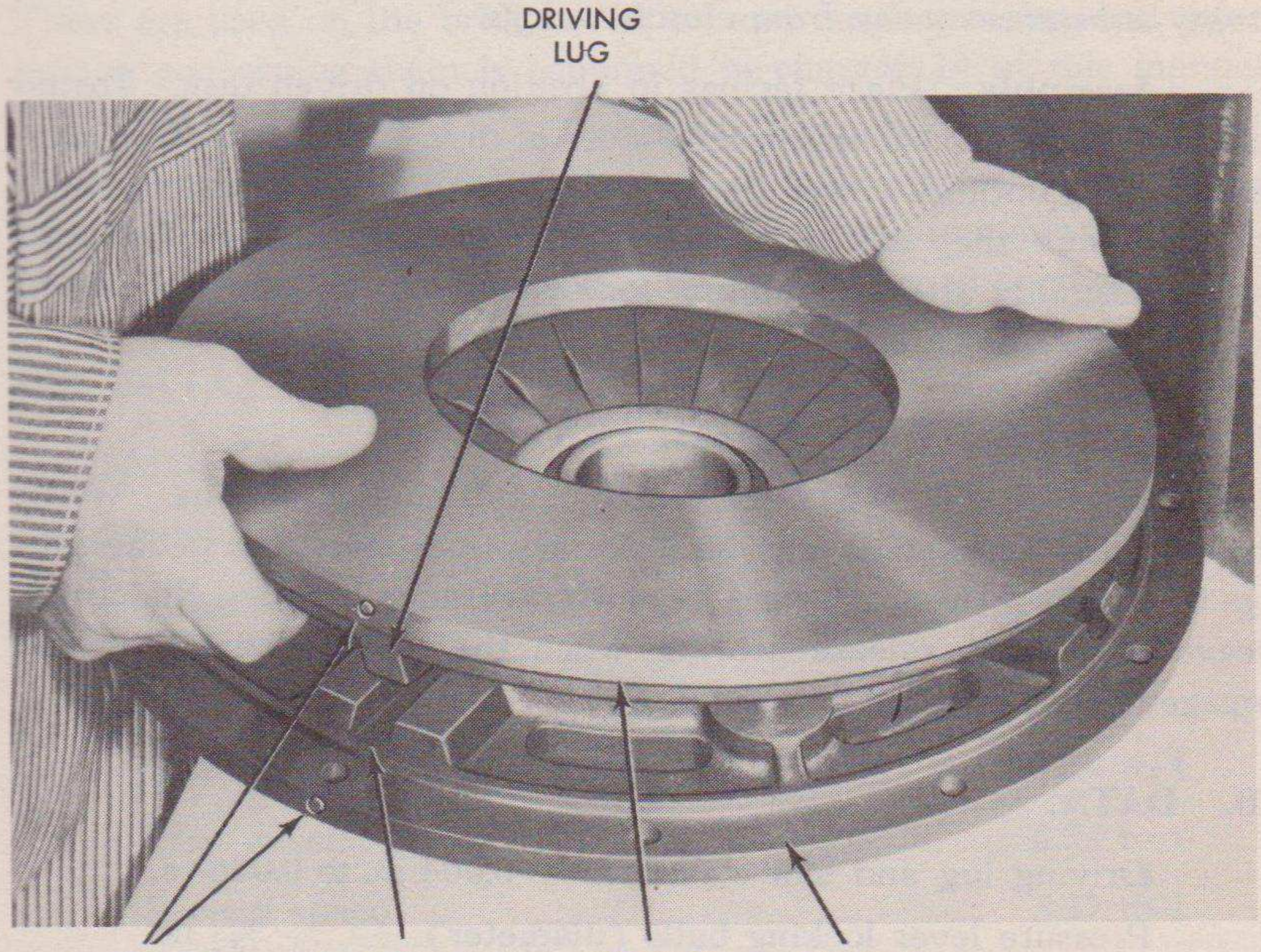


Figure 12 — Installing Pressure Plate

turn unit over, holding units together. Install four retractor springs and washers and secure with pins (fig. 1). The pressure plate assembly is now ready for installation in the vehicle. Refer to TM 9-813 for installation procedure.

Section III

DRIVEN DISK AND FACINGS

8. DRIVEN DISK AND FACINGS.

a. Disassembly. Drill out 36 rivets holding facings on driven disk. Use a drill slightly smaller than rivet shank and drill from head side of rivets. NOTE: *Do not remove hub from driven disk.*

b. Clean, inspect, and repair disk and facings. Clean driven disk with dry cleaning solvent and inspect for cracked splines, rough spots, or burs. Dress all rough spots with hand stone. Lay driven disk on surface plate and inspect for distortion or warping (par. 6, fig. 5). Replace all unserviceable parts. NOTE: *Keep all oily or greasy substances away from clutch facings.*

c. Assembly. Place facings in position on driven disk. Install and tighten two rivets on opposite sides of disk. Alternate rivet head installations until all rivets are installed, then tighten. Inspect rivets to make sure they are tight and below facings. Inspect disk and facing assembly after installation for distortion. If distorted, install complete new assembly.

9. ADJUSTMENT OF PEDAL TRAVEL.

a. Refer to TM 9-813 for clutch installation directions. When the clutch is installed, it may be necessary to readjust the pedal linkage to obtain between 1/8- and 5/32-inch clearance between the clutch sleeve and clutch release bearing, when the clutch pedal is in the engaged (out) position.

10. DATA.

Driving lug and slot clearance	0.004 in. to 0.006 in.
Pressure lever locking balls (diameter)	9/32 in.
Spline diameter	1 3/4 in.
Spring pressure, compressed 1 1/4 in.	665 lb

CHAPTER 3

TRANSMISSION

Section I

DESCRIPTION AND DATA

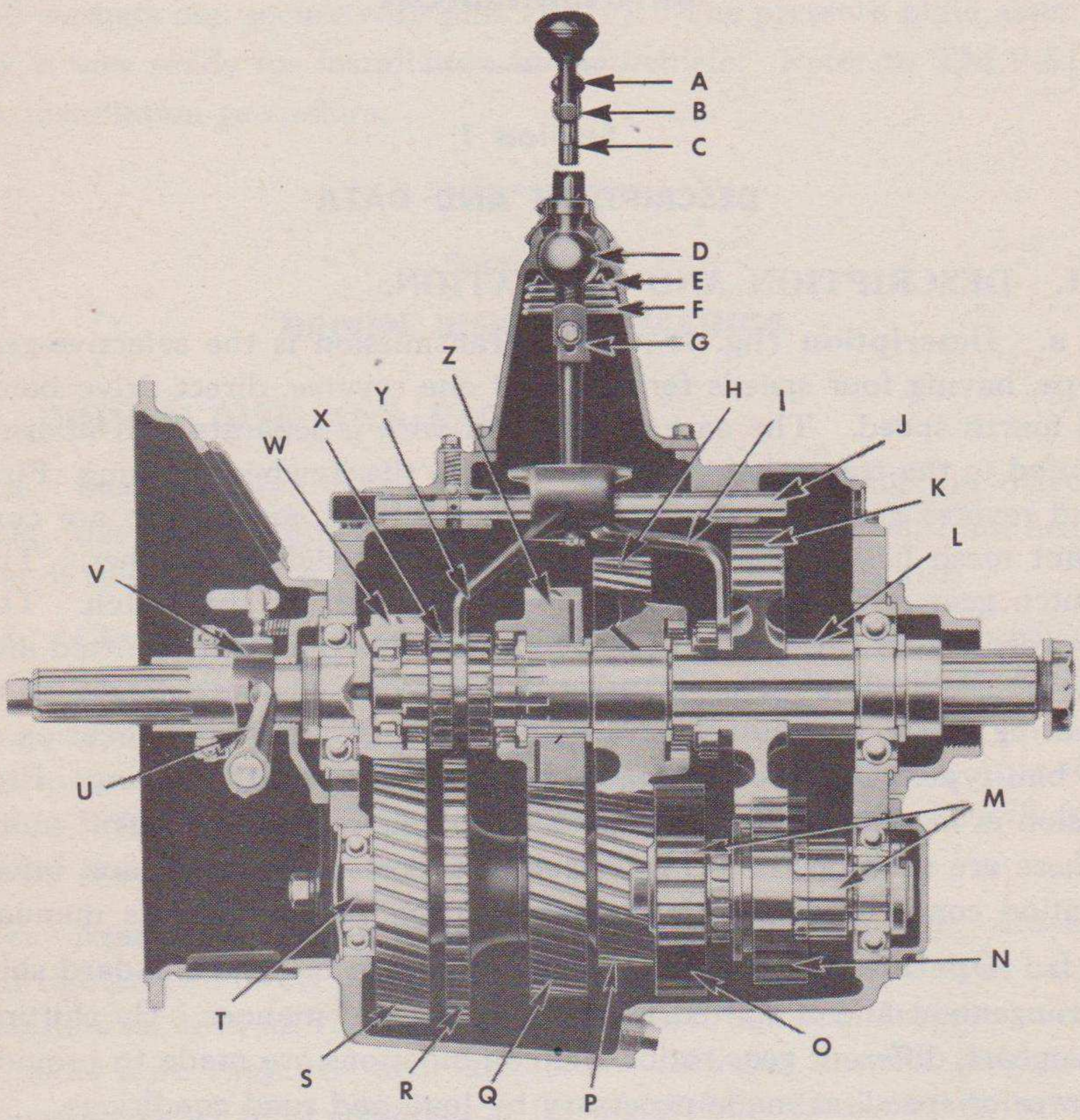
11. DESCRIPTION AND OPERATION.

a. Description (fig. 13). The transmission is the selective-gear type, having four speeds forward and one reverse, direct drive being in fourth speed. The case is cast iron with a separate bell housing bolted to the transmission and directly to the flywheel housing. First and reverse gears are spur type. Second, third, and fourth are constant mesh helical gears and are engaged by sliding clutches. The clutch gear is driven through a splined shaft from the clutch. The forward end of this clutch gear is mounted in a ball bearing fitted into the housing. The mainshaft pilot end is mounted in a straight roller bearing inside the clutch drive gear. The rear mainshaft bearing is of ball type. The countershaft is mounted in two ball bearings. Provision is made on both sides for attachment of power take-off units. These are used on the bridge erection and crane vehicles, and information concerning them is contained in chapter 14 of this manual.

b. Operation (fig. 14). The transmission has the standard shift arrangement and is shifted in the conventional manner. By shifting the gears, different gear ratios and combinations are made to provide power or speed, as made necessary by load and road conditions.

12. DATA.

Make	Fuller
Model	4A-86
Bell housing	SAE No. 1
Gear ratios:	
Reverse	7.24 to 1
First speed	6.54 to 1
Second speed	3.27 to 1
Third speed	1.76 to 1
Fourth speed	1.00 to 1



A—LEVER SPOON LATCH

B—GEARSHIFT LEVER

C—LEVER LATCH ROD

D—GEARSHIFT LEVER BALL

E—SPRING RETAINER WASHER

F—SPRING

G—REVERSE STOP PLATE

H—SECOND SPEED GEAR

I—FIRST AND SECOND SPEED SHIFTING FORK

J—THIRD AND FOURTH SPEED YOKE BAR

K—FIRST SPEED SLIDING GEAR

L—MAINSHAFT

M—COUNTERSHAFT GEARS (FIRST AND REVERSE)

N—IDLER GEAR (PHANTOM)

O—REVERSE IDLER GEAR (PHANTOM)

P—COUNTERSHAFT, SECOND SPEED GEAR

Q—COUNTERSHAFT, THIRD SPEED GEAR

R—POWER TAKE-OFF GEAR

S—COUNTERSHAFT DRIVE GEAR

T—COUNTERSHAFT

U—CLUTCH RELEASE YOKE

V—CLUTCH RELEASE ASSEMBLY

W—CLUTCH MAIN DRIVE GEAR

X—SLIDING CLUTCH GEAR

Y—THIRD AND FOURTH SPEED SHIFTING FORK

Z—THIRD SPEED GEAR

RA PD 353218

Figure 13 — Transmission — Sectional View

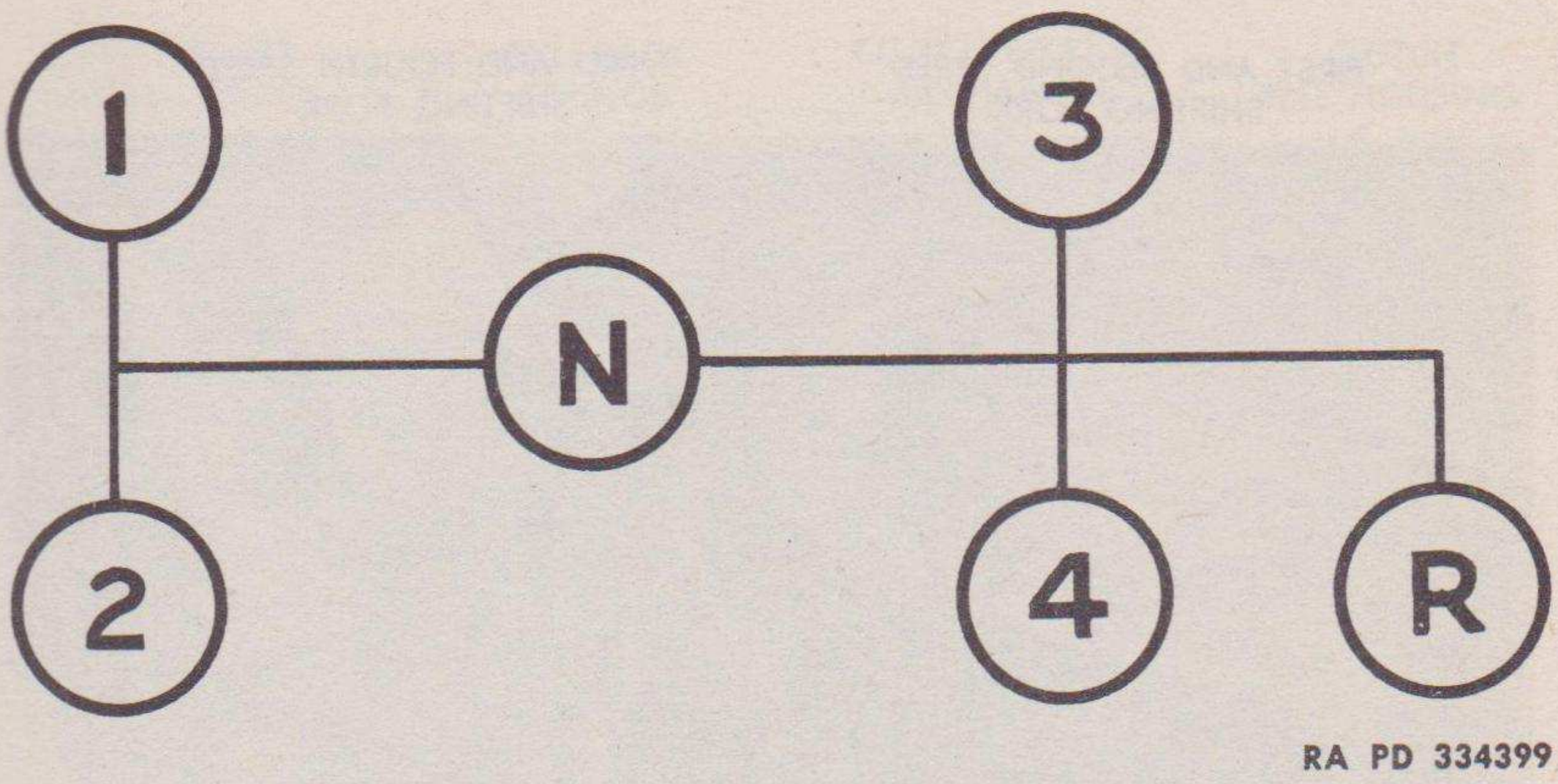


Figure 14 — Gearshift Diagram

Bearings:

Countershaft (front)	MRC 309-MF
Countershaft (rear)	MRC 310-MFG
Mainshaft (rear)	MRC 312-SG
Drive gear	MRC 311-MFG
Reverse idler	Fuller 5242, Hyatt 95732
Mainshaft pilot	Fuller 5892, Morma-Hoffman R-335-LR, Bower BS-1307B
Clutch release	B. C. of A., CTDES-88
Weight	420 lb

Section II

DISASSEMBLY INTO SUBASSEMBLIES

13. PRELIMINARY INSTRUCTIONS.

a. Remove transmission. Refer to TM 9-813 for instructions on removing transmission.

b. Cleaning. Remove all foreign material from the exterior of the transmission with a wire brush and a putty knife. Place the unit in a container of dry cleaning solvent and wash thoroughly. Wipe

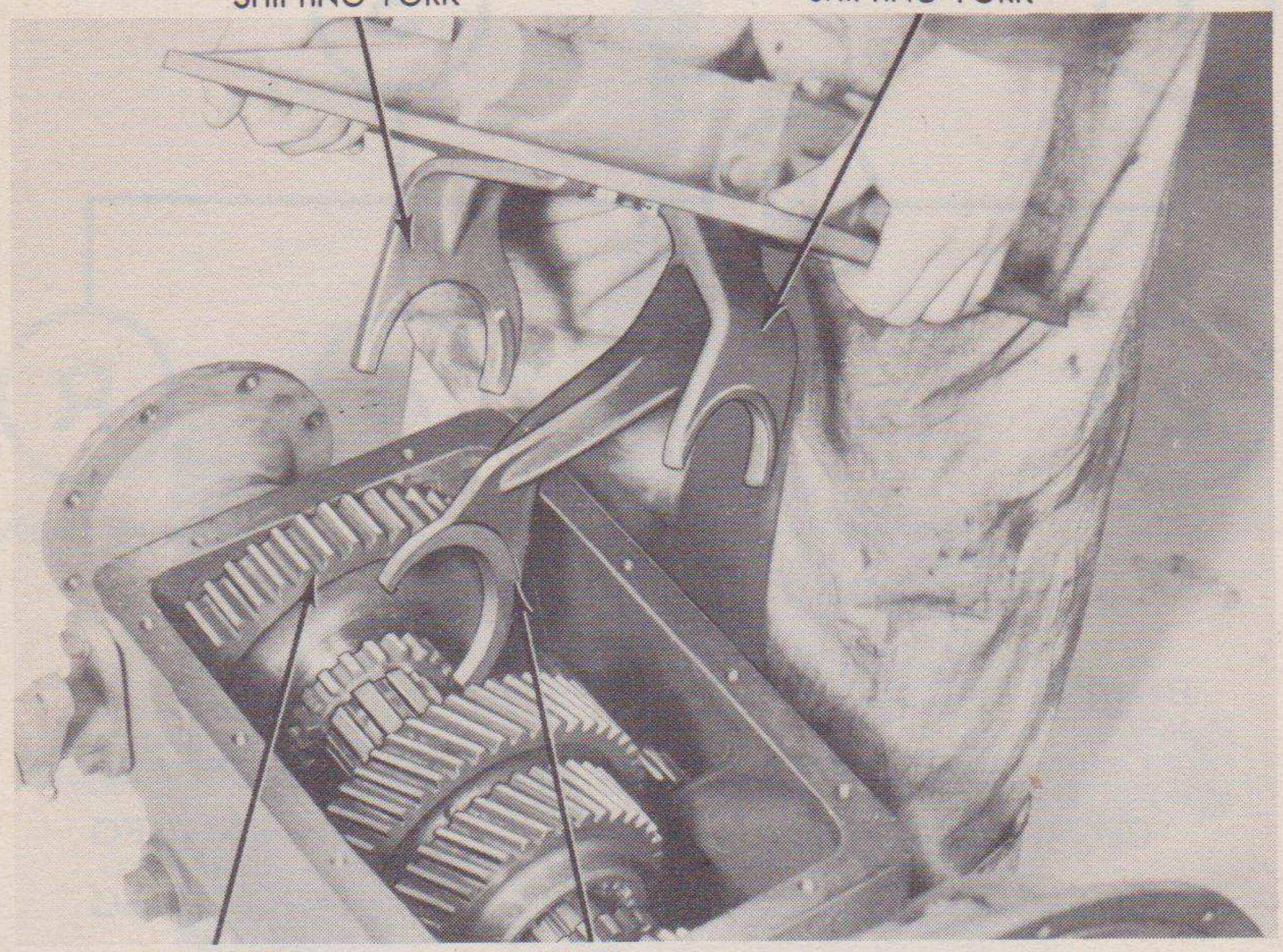


Figure 15 — Removing Shifting Bar Housing

dry with clean cloth. Keep all dirt or foreign material from the transmission. NOTE: *As disassembly proceeds, clean all parts and wrap in paper or cloth.*

14. DISASSEMBLY OF TRANSMISSION.

a. Remove gearshift lever housing assembly (fig. 23). Unscrew drain plug at bottom rear of transmission and drain lubricant. Shift the transmission into first speed position. Remove four cap screws and lock washers from gearshift lever housing, and lift gearshift lever assembly from the transmission.

b. Remove shifting bar housing assembly. Place assembly in first speed position. Remove 12 cap screws and lock washers that attach housing assembly to the transmission, and lift from the case. Guide edge of reverse shifting fork (fig. 15) into and up through the space between first speed sliding gear and countershaft gears until clear, and then remove assembly from transmission.

Disassembly Into Subassemblies

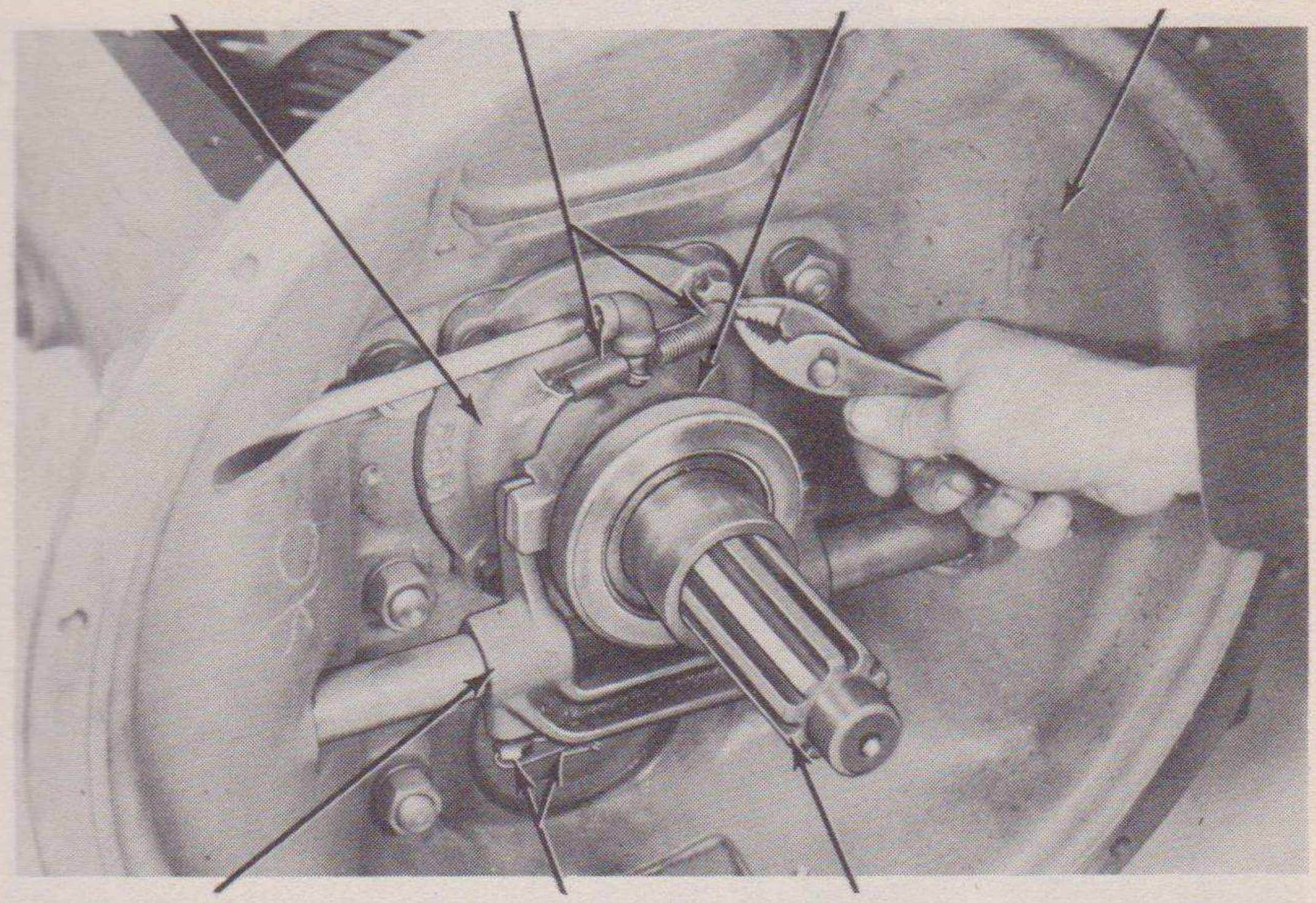


Figure 16 — Removing Pull-back Springs From Clutch Release Mechanism

c. Remove clutch release assembly (fig. 16).

(1) REMOVE BEARING CARRIER. Unscrew lubrication pipe from elbow of clutch release mechanism. Unhook bearing carrier pull-back springs from cap screws of front bearing cover. Slide bearing carrier forward and remove from clutch shaft.

(2) REMOVE CLUTCH PEDAL SHAFT. Cut lock wire and remove screws from clutch release yoke. Drive short pedal shaft from yoke and housing, applying force against inside end. Drive long pedal shaft from yoke in the same direction. Remove Woodruff key assembled in inner end, and withdraw shaft. Remove six nuts and lock washers and pull bell housing from transmission. CAUTION: *Do not bur dowel pin holes, dowels, or machined surfaces, since these determine alinement between engine and transmission.*

d. Remove clutch shaft and drive gear. Remove four cap screws that attach drive gear bearing cover to housing and remove cover.

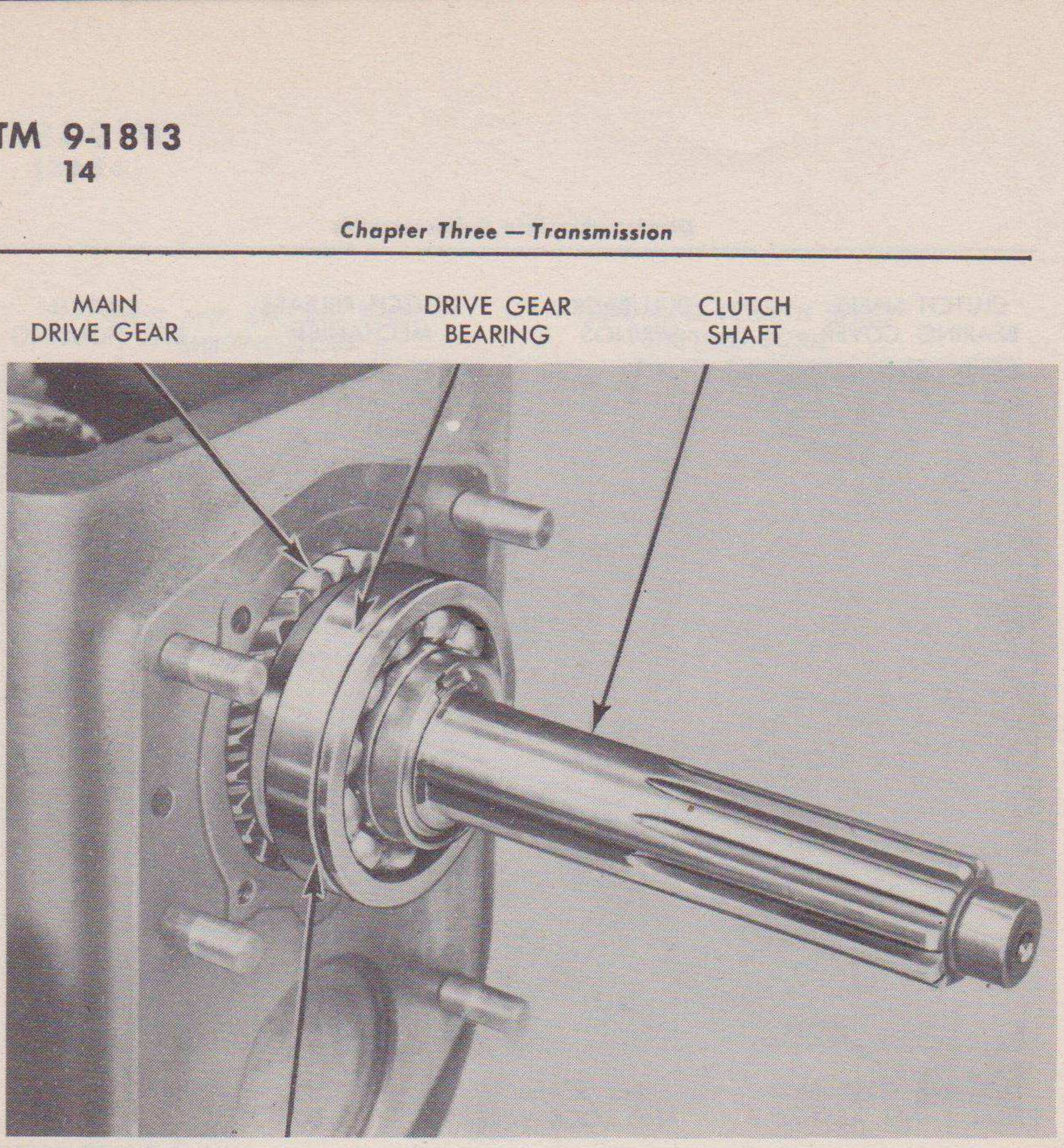


Figure 17 — Removal of Clutch Shaft and Drive Gear

Pry snap ring from bearing. Place a pinch bar in snap ring groove, pry bearing shaft and drive gear forward (fig. 17), and remove from housing.

e. Remove mainshaft assembly.

(1) REMOVE COMPANION FLANGE (fig. 18). Lock transmission by moving first speed sliding gear up against case. Remove cotter pin, nut, and washer from rear end of mainshaft. Use bar (41-B-312-200), 1-inch square drive head (41-H-1779-50), and socket wrench (41-W-3058-450) and remove companion flange nut. Remove companion flange. Remove four cap screws and lock washers from mainshaft rear bearing cover and remove cover, spacer, and plain washer (fig. 19).

(2) REMOVE REAR MAINSHAFT BEARING. Pry snap ring from rear mainshaft bearing. Using a soft drift and hammer, drive on opposite end to remove mainshaft rear bearing from case. Use a puller to remove mainshaft rear bearing from mainshaft.

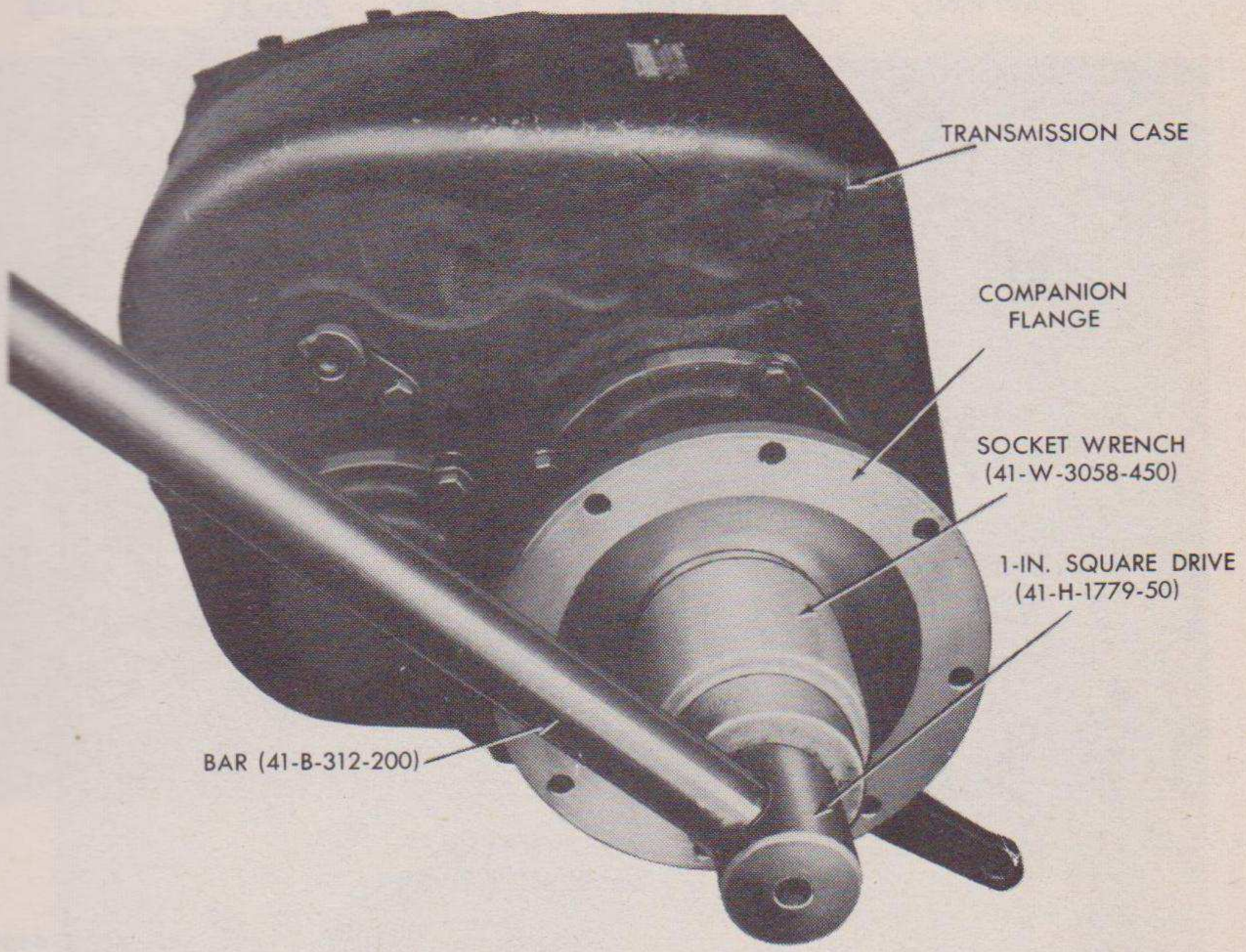
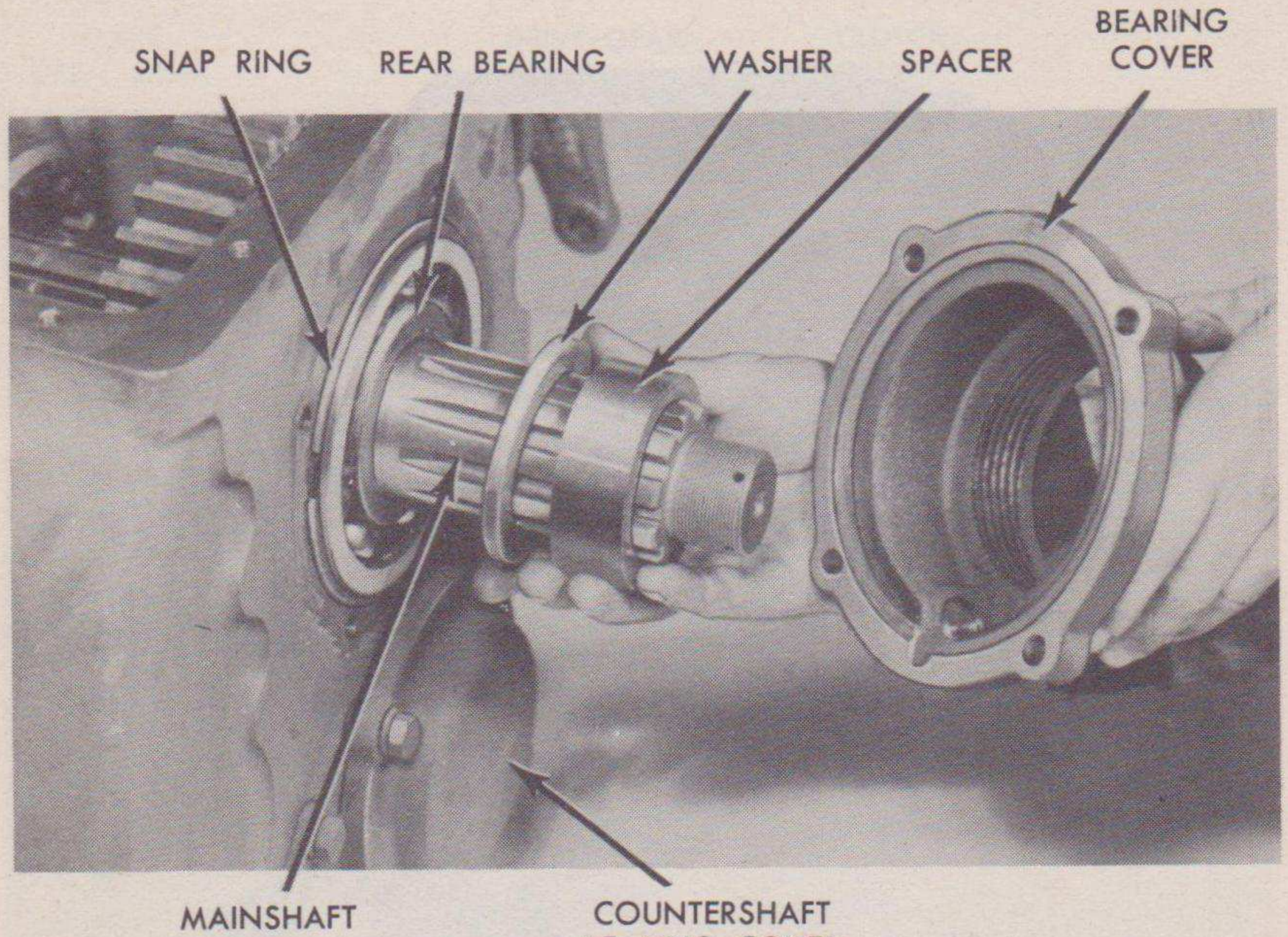


Figure 18 — Removal of Companion Flange Nut

(3) REMOVE MAINSHAFT ASSEMBLY FROM HOUSING. Tilt forward end of mainshaft assembly upward and withdraw it through top of case, leaving first speed sliding gear inside. Remove loose sliding gear from the case.

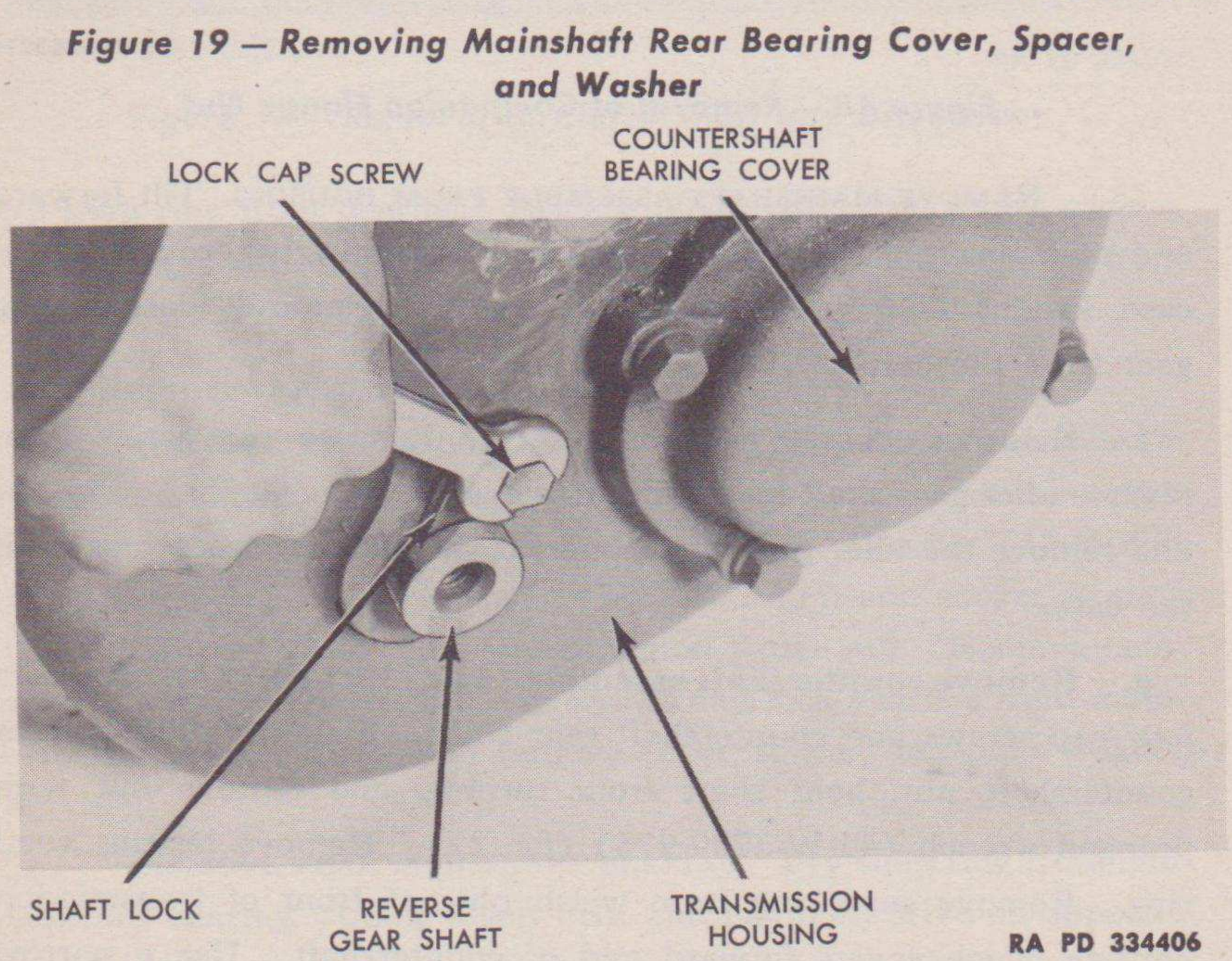
f. **Remove reverse gear assembly.** Remove cap screw from reverse idler gear shaft lock and remove shaft lock (fig. 20). Pry out and remove the idler gear shaft, and lift the gears and bearings from the case.

g. **Remove countershaft assembly** (figs. 13, 21 and 22). Remove four cap screws and countershaft rear cover. Remove staking from countershaft nut, hold shaft from turning, and remove nut with pronged wrench (41-W-3739-975) (fig. 22). Remove bearing snap ring. Remove snap ring from welsh plug at front of transmission housing which covers forward end of countershaft. Use a narrow chisel to puncture the welsh plug at the center and remove welsh



RA PD 334405

Figure 19 — Removing Mainshaft Rear Bearing Cover, Spacer, and Washer



RA PD 334406

Figure 20 — Removing Reverse Gear Shaft Lock

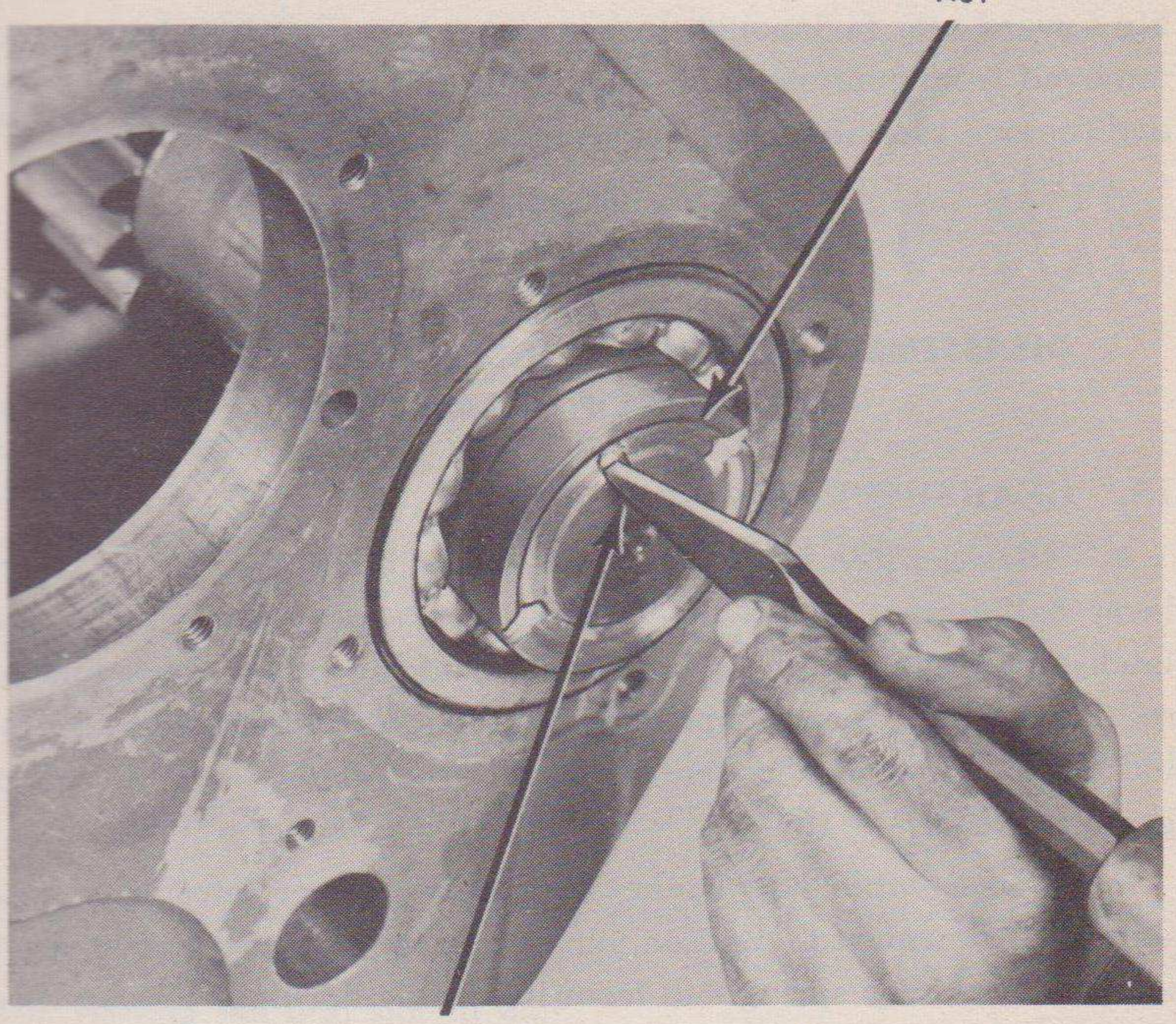


Figure 21 — Removing Stake From Countershaft Nut

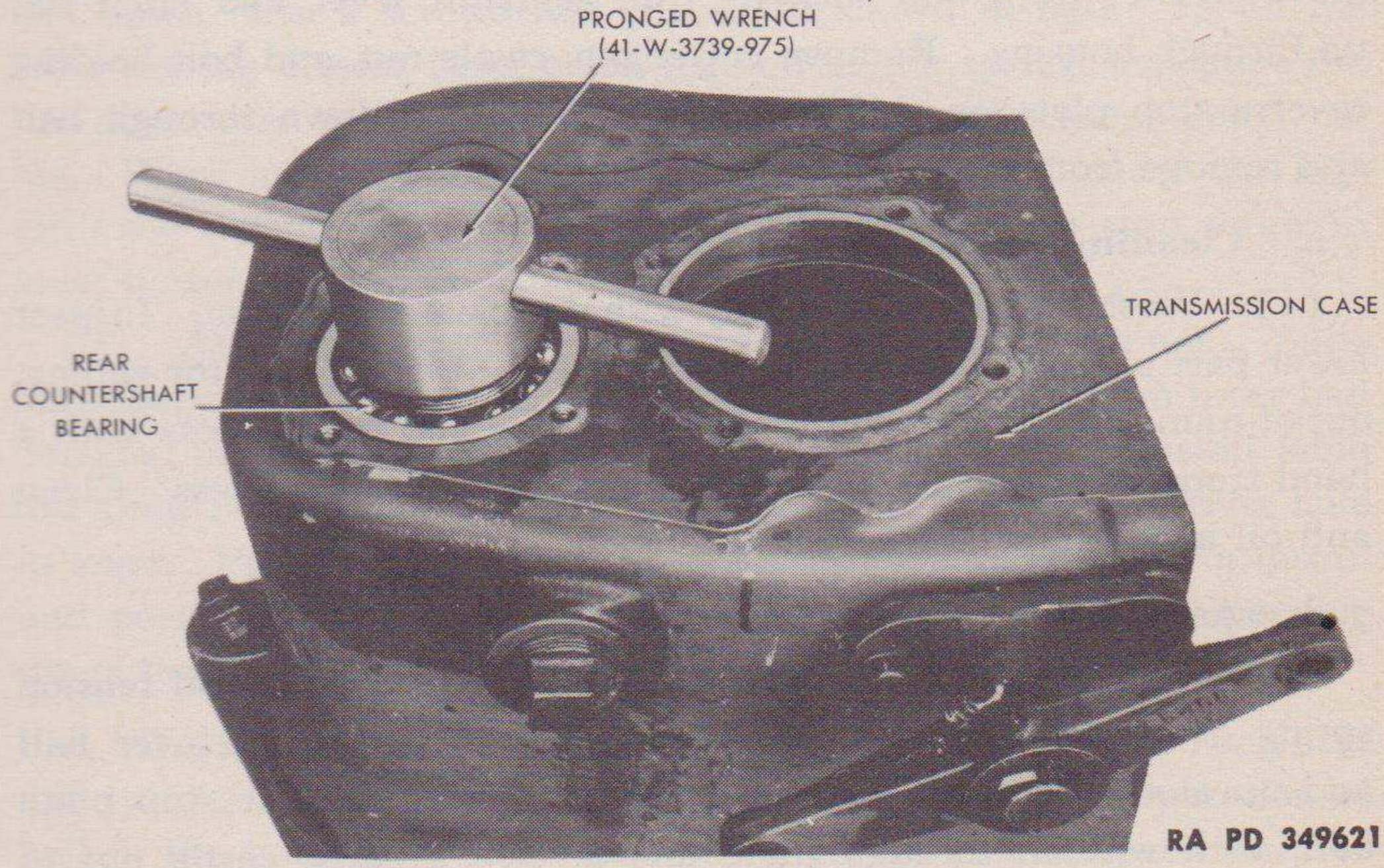


Figure 22 — Removal of Countershaft Nut

plug. Use a hammer and soft drift and drive the countershaft assembly toward rear far enough to permit rear countershaft bearing to be removed from countershaft. Tilt front end of countershaft assembly and remove assembly from transmission housing.

Section III

DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

15. GEARSHIFT LEVER HOUSING.

a. Disassemble lever ball and spoon latch (fig. 23). Unscrew lever ball from top end of gearshift lever and remove. File spoon latch hinge rivets flush on small side, and tap out of lever and latch rod hinge nut. Remove spoon nut and latch rod hinge nut. Remove lock screw from dust cover, tap cover from flange, and lift off over gearshift lever.

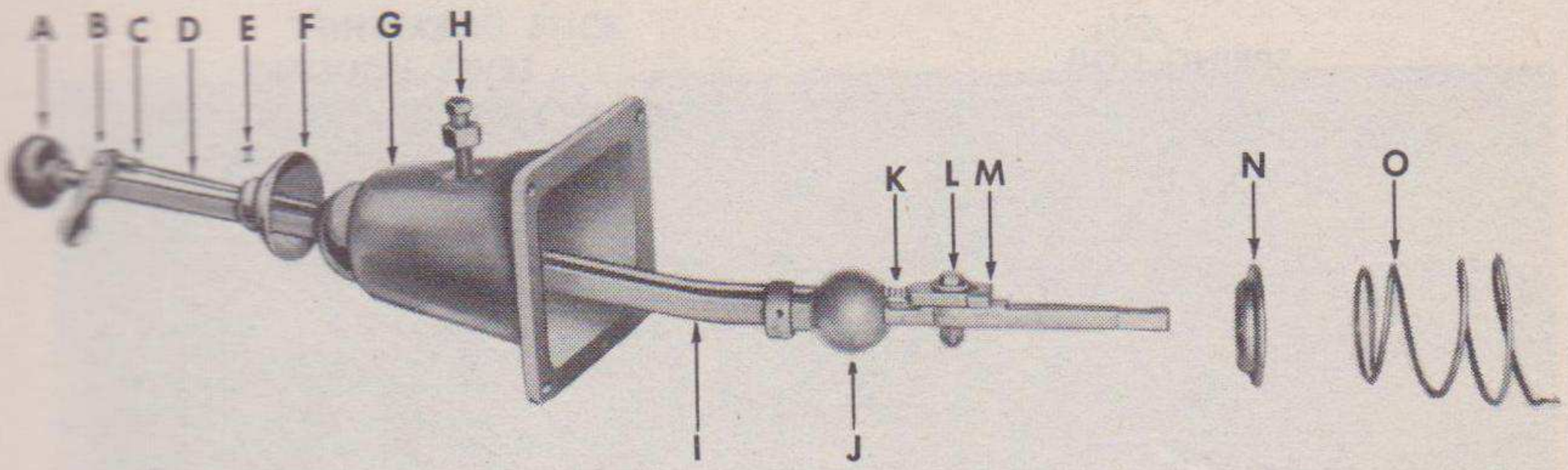
b. Disassemble ball socket assembly. Place housing in a vise, shift lever downward. Loosen jam nut on reverse stop screw; unscrew and remove. Pry spring end from lug inside housing. Grasp wire at large spring end with pliers (fig. 24) and apply twisting motion in clockwise direction, threading spring out of lugs and housing. Remove washer from ball socket. Pull gearshift lever and latch rod up through housing. Remove cotter pin, castle nut, and bolt holding reverse stop plate on shift rod. Push latch rod down through ball and remove from lever. Slide spring off rod.

c. Cleaning, inspection, and repair.

(1) Wash all parts thoroughly with dry cleaning solvent. Inspect lower part of shift lever rod for straightness. Inspect ball for galling, out-of-round, or rough spots. Dress all burs and rough spots with a hand stone. Inspect all springs for tension and completeness. Clean and oil all parts before assembly.

d. Assembly of ball socket assembly (fig. 26).

(1) ASSEMBLE BALL SOCKET ASSEMBLY. Slide latch rod tension spring over rod. Push threaded end of rod up through lever ball and up alongside lever until in position. Install reverse stop plate bolt, with washer, through plate and lever. Tighten castle nut to finger-tight position and lock with a cotter pin. Place gearshift lever



A—GEARSHIFT LEVER BALL
B—SPOON LATCH W/RIVETS
C—LATCH ROD HINGE NUT
D—LATCH ROD
E—DUST CAP LOCK SCREW
F—DUST CAP
G—GEARSHIFT LEVER HOUSING
H—REVERSE STOP SCREW W/JAM NUT
I—GEARSHIFT LEVER
J—GEARSHIFT LEVER BALL
K—LATCH ROD SPRING
L—REVERSE PLATE BOLT W/WASHER AND CASTLE NUT
M—REVERSE PLATE
N—WASHER
O—SPRING

RA PD 353060

Figure 23 — Gearshift Lever and Housing Assembly

housing upside down in vise. Place gearshift lever in housing, pushing through until ball fits into socket. Make sure that positioning lug in housing fits into slot in ball.

(2) ASSEMBLE WASHER AND LEVER BALL SPRING. Place spring washer in position against lever ball. Place spring in housing, small coil down. Use a screwdriver placed as shown in figure 25 on the retaining lug closest (and below) a coil of the spring, and push the coil down over the lug with a hardwood stick until it snaps under the lug. Work around the housing lugs, forcing the coil under the lugs until the complete coil is in position. Install reverse stop screw in lever housing and tighten jam nut.

(3) ASSEMBLE DUST COVER, SPOON LATCH, AND LEVER BALL. Slide dust cover over latch rod and lever, and place in position on lever ball housing; insert and tighten set screw and lock washer. Install latch rod hinge nut, screwing it down until rivet hole is level with rivet hole in lever. Place latch spoon in position on nut and lever, then install and peen over rivets. Do not bind latch spoon clevis by peening rivets too tightly. Screw lever ball on top end of gearshift lever.

e. Test operation of assembly. With gearshift lever housing held tightly in a vise, rotate gearshift lever, inspect for free operation of ball in the housing socket. Operate latch spoon and check for free travel and return operation of latch rod.

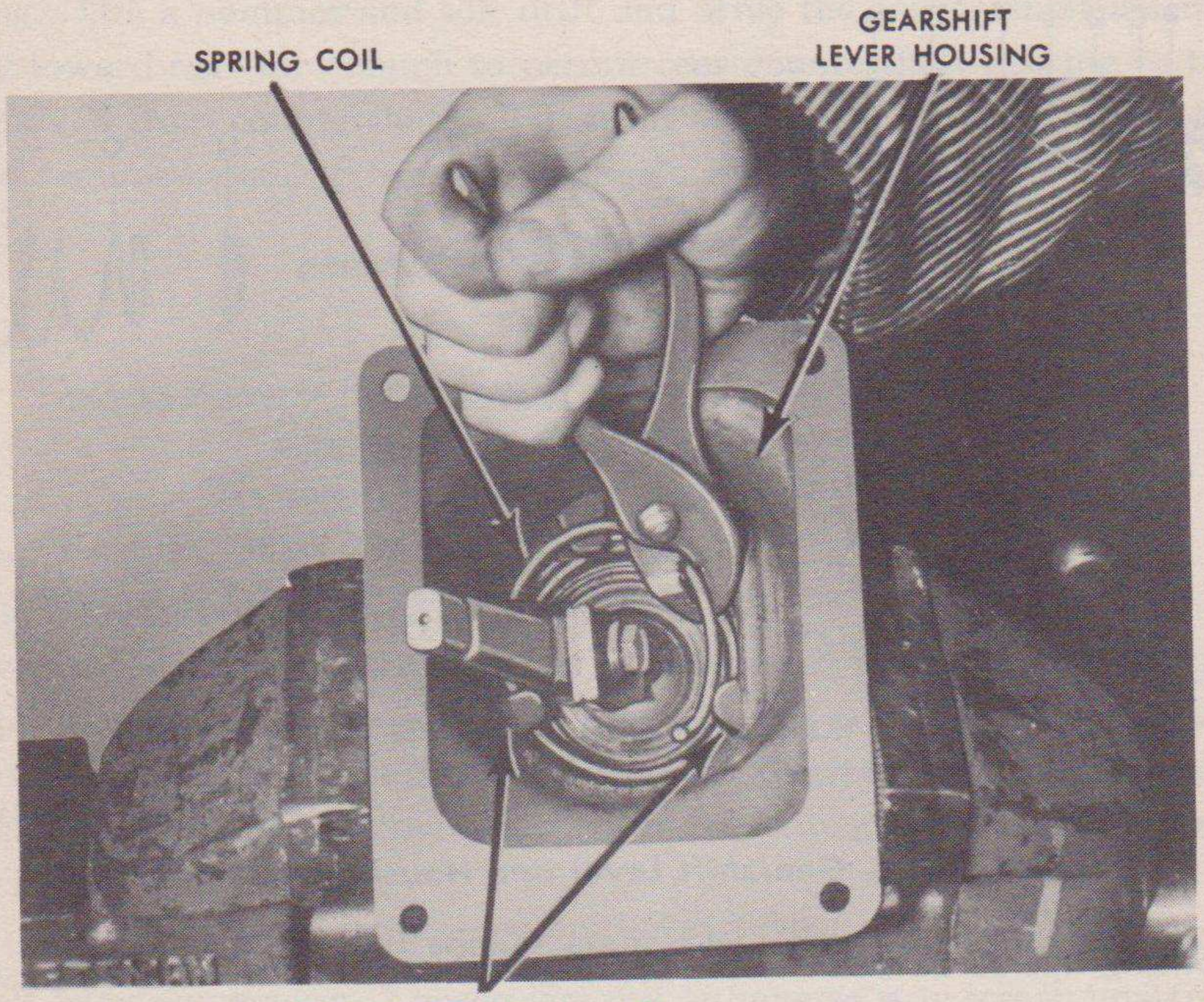


Figure 24 — Removing Ball Spring

16. SHIFTING BAR HOUSING.

a. Disassemble shifting bar assembly (fig. 26).

(1) REMOVE SPRINGS, BALLS, AND SHIFTING FORK SET SCREWS. Secure assembly in a vise. Using a pinch bar, place the lever slots in the shifting forks in a straight-across position (neutral). Remove the locking wires and set screws from the shifting forks. Remove cap screws from the shifting bar spring cover, and remove cover. Turn housing upside down to remove the three springs and balls and one interlock cross pin, then install housing in vise.

(2) REMOVE SHIFTING BARS AND SHIFTING FORKS. Remove expansion plugs from housing. Tap bars through front of housing, starting with the top bar. This will also drive the covers (and balls from front of third and fourth speed shifting bar, and reverse shifting bar) from the front end of the housing. Tag bars to insure correct assembly. NOTE: *With spring tension removed, some hand adjustment may be necessary to place bars in neutral position before the upper bar will move. Be sure all small parts are carefully noted and put in a clean, safe place.*

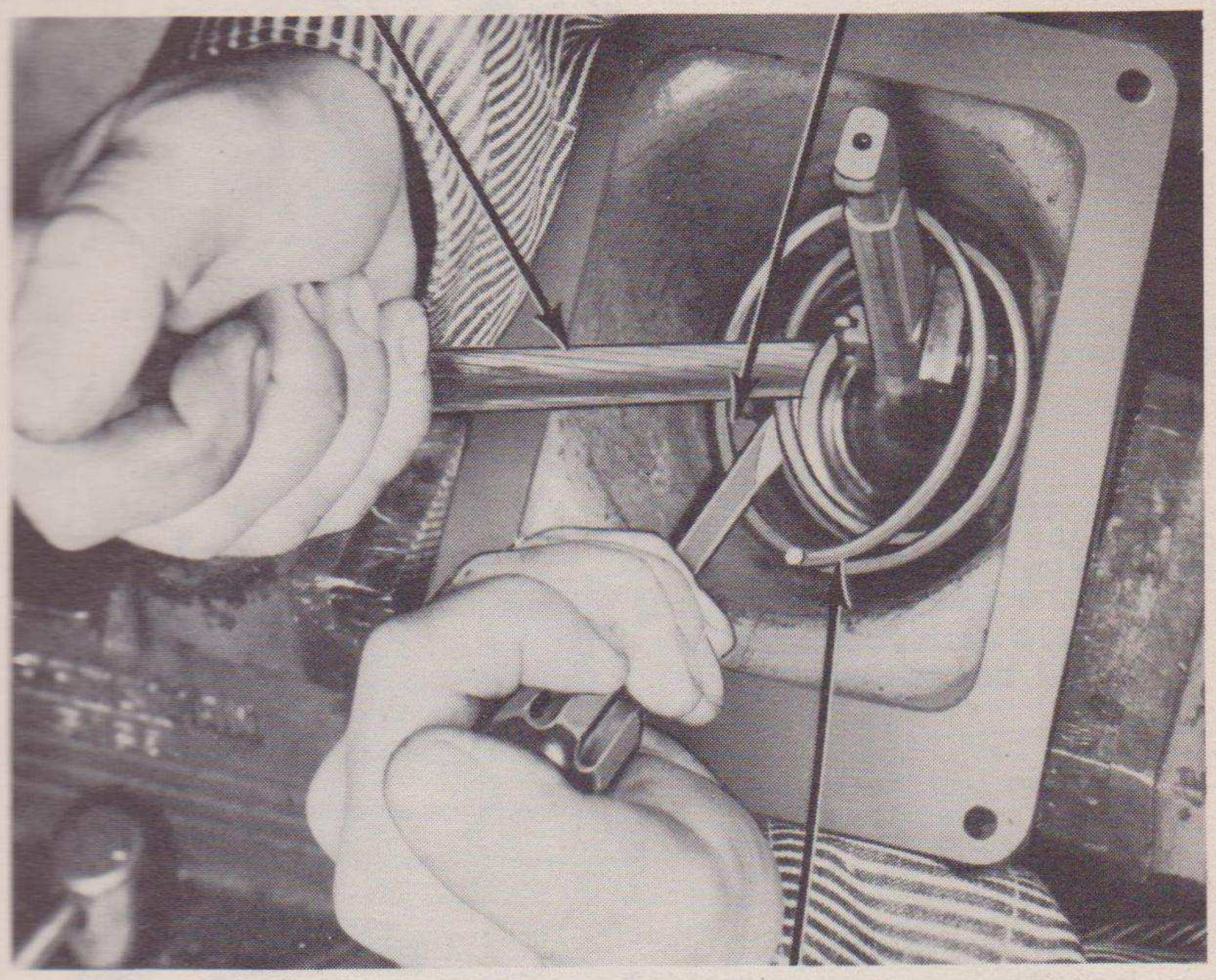
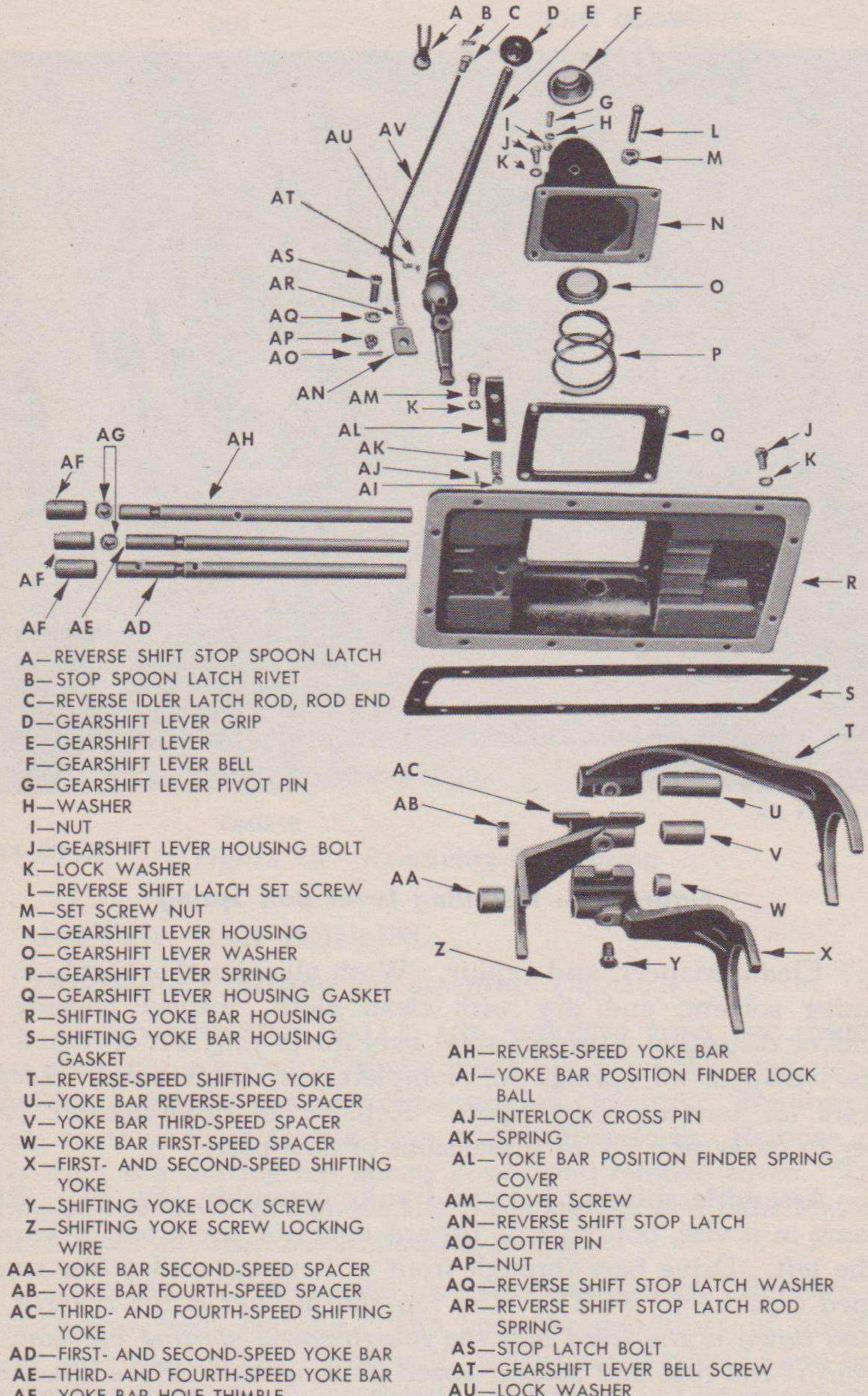


Figure 25 — Installing Lever Ball Spring

b. **Clean, inspect, and repair.** Wash all parts thoroughly in dry cleaning solvent, and dry with clean cloth. Inspect housing for cracks or distortion. Inspect steel bars for galling, out-of-round, and nicks. Inspect all springs for completeness and tension. Inspect spacers for burs or rough spots. Replace all unserviceable parts. Refer to paragraph 25 for dimensions of new parts.

c. **Assemble shifting bars and yoke assembly** (fig. 26). Place housing in a vise, bottom side toward operator and front of housing to the left. Drive bars through front of housing until yokes can be slipped over bars. NOTE: *The top shifting bar is the reverse, the second down is the third and the fourth speed shifting bar, and the bottom is the first and second speed shifting bar.* Place spacers in position on shifting bars between front of housing and yoke blocks. This applies only to the first and second speed, and third and fourth speed shifting bars. After yokes have been placed on bars, install other three spacers (one on each bar) and drive bars until they enter rear of housing. Refer to figure 26 for correct order of assembly. Insert retaining balls (½-in. dia) in holes in top of housing; install



A—REVERSE SHIFT STOP SPOON LATCH
B—STOP SPOON LATCH RIVET
C—REVERSE IDLER LATCH ROD, ROD END
D—GEARSHIFT LEVER GRIP
E—GEARSHIFT LEVER
F—GEARSHIFT LEVER BELL
G—GEARSHIFT LEVER PIVOT PIN
H—WASHER
I—NUT
J—GEARSHIFT LEVER HOUSING BOLT
K—LOCK WASHER
L—REVERSE SHIFT LATCH SET SCREW
M—SET SCREW NUT
N—GEARSHIFT LEVER HOUSING
O—GEARSHIFT LEVER WASHER
P—GEARSHIFT LEVER SPRING
Q—GEARSHIFT LEVER HOUSING GASKET
R—SHIFTING YOKE BAR HOUSING
S—SHIFTING YOKE BAR HOUSING GASKET
T—REVERSE-SPEED SHIFTING YOKE
U—YOKE BAR REVERSE-SPEED SPACER
V—YOKE BAR THIRD-SPEED SPACER
W—YOKE BAR FIRST-SPEED SPACER
X—FIRST- AND SECOND-SPEED SHIFTING YOKE
Y—SHIFTING YOKE LOCK SCREW
Z—SHIFTING YOKE SCREW LOCKING WIRE
AA—YOKE BAR SECOND-SPEED SPACER
AB—YOKE BAR FOURTH-SPEED SPACER
AC—THIRD- AND FOURTH-SPEED SHIFTING YOKE
AD—FIRST- AND SECOND-SPEED YOKE BAR
AE—THIRD- AND FOURTH-SPEED YOKE BAR
AF—YOKE BAR HOLE THIMBLE
AG—SHIFTING BAR INTERLOCK BALL
AH—REVERSE-SPEED YOKE BAR
AI—YOKE BAR POSITION FINDER LOCK BALL
AJ—INTERLOCK CROSS PIN
AK—SPRING
AL—YOKE BAR POSITION FINDER SPRING COVER
AM—COVER SCREW
AN—REVERSE SHIFT STOP LATCH
AO—COTTER PIN
AP—NUT
AQ—REVERSE SHIFT STOP LATCH WASHER
AR—REVERSE SHIFT STOP LATCH ROD SPRING
AS—STOP LATCH BOLT
AT—GEARSHIFT LEVER BELL SCREW
AU—LOCK WASHER
AV—REVERSE SHIFT STOP LATCH ROD

RA PD 353062

Figure 26 — Gearshift Lever Housing and Shifting Bar Housing Assemblies — Disassembled

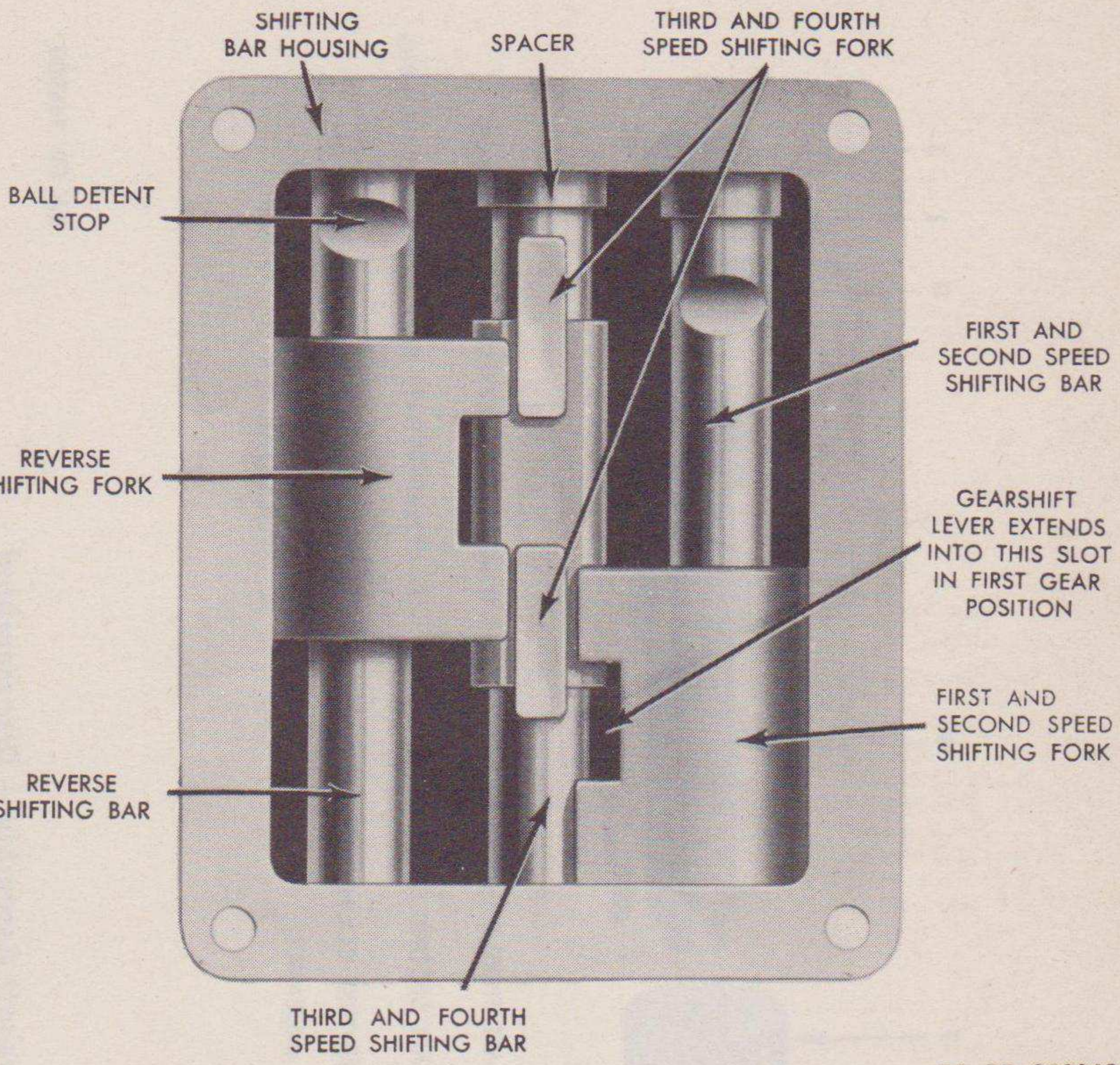
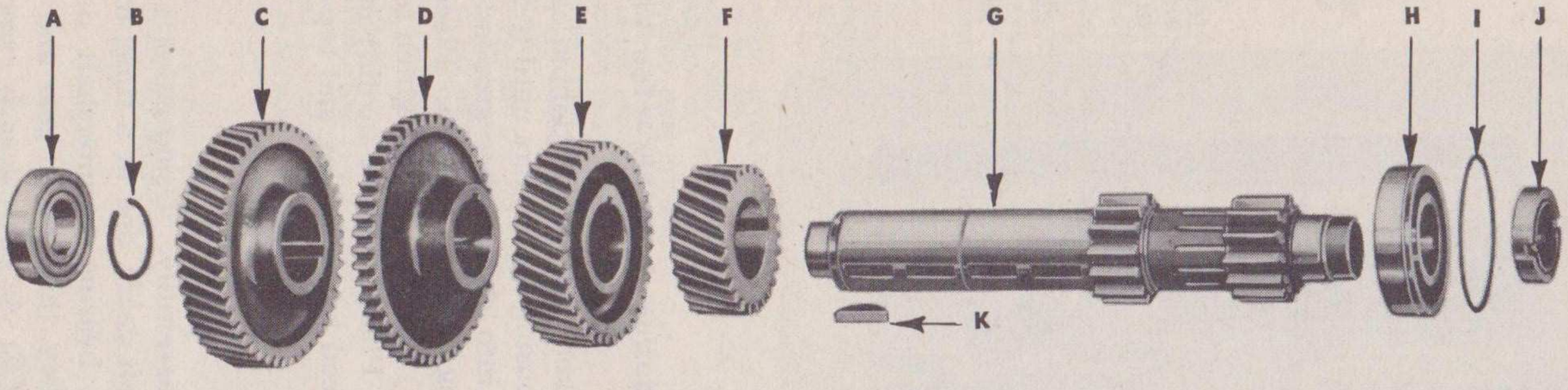


Figure 27 — Shifting Bar Housing Assembly — Top View

springs and retainer plate and gasket. Insert and tighten cap screws securing retainer plate to top of housing. Tap bars until it is evident that retainer balls have dropped into shifting bar grooves. In this position the rear ends of the shifting bars will be even. Place shifting forks in first speed position (fig. 27), and insert and tighten set screws. Install locking wires in set screws. Place balls (¾-in. dia) in position in reverse and third and fourth speed bar thimbles, and tap all thimbles into position.

17. COUNTERSHAFT.

a. Disassemble countershaft assembly. Using either a press or gear puller, remove the countershaft gears, one at a time, in the following order: Front countershaft bearing, countershaft drive gear and key, power take-off gear and key, third speed gear and key, and second speed gear and key. NOTE: *As each gear is removed, the key for that gear must be removed from the shaft.*



A—COUNTERSHAFT FRONT BALL BEARING

B—COUNTERSHAFT SNAP RING

C—COUNTERSHAFT DRIVE GEAR

D—COUNTERSHAFT POWER TAKE-OFF GEAR

E—COUNTERSHAFT THIRD-SPEED GEAR

F—COUNTERSHAFT SECOND-SPEED GEAR

G—FIRST AND REVERSE COUNTERSHAFT WITH GEAR ASSEMBLY

H—COUNTERSHAFT REAR BALL BEARING

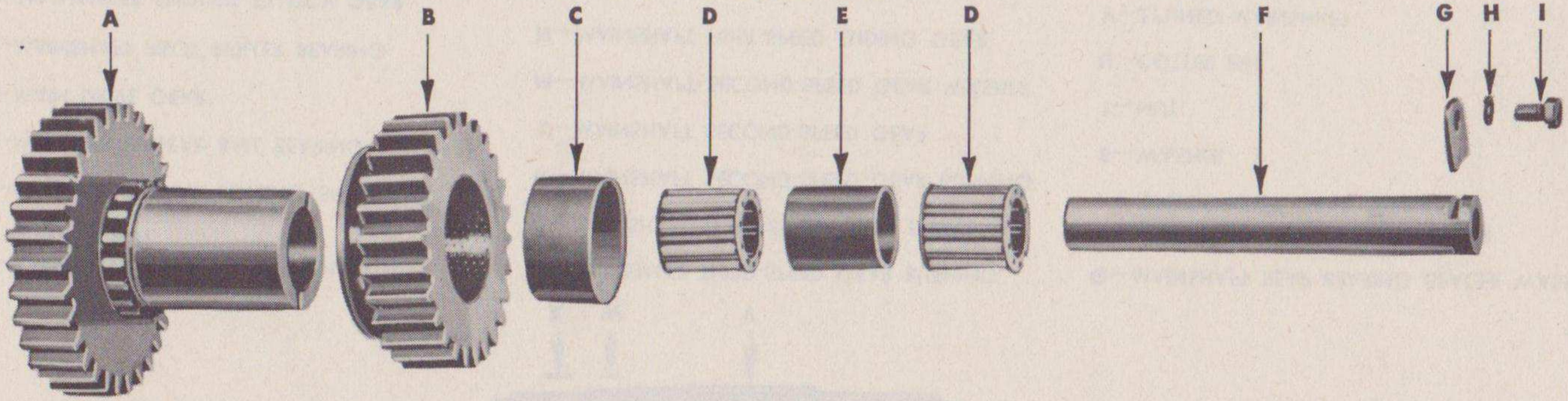
I—COUNTERSHAFT REAR BEARING SNAP RING

J—COUNTERSHAFT REAR BEARING NUT

K—WOODRUFF KEY

RA PD 344900

Figure 28 — Countershaft Assembly — Disassembled



A—REVERSE IDLER GEAR

B—REVERSE IDLER SLIDING GEAR

C—REVERSE IDLER SLIDING GEAR BUSHING

D—REVERSE IDLER ROLLER BEARING

E—REVERSE IDLER GEAR BEARING SPACER

F—REVERSE IDLER SHAFT

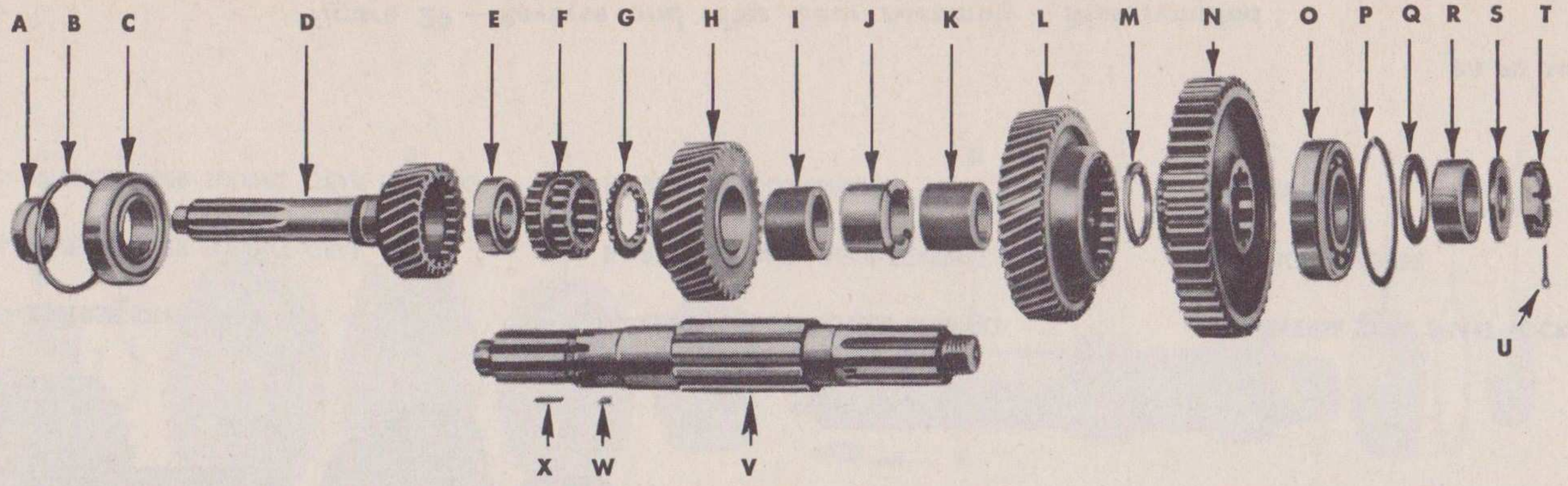
G—REVERSE IDLER SHAFT LOCK

H—LOCK WASHER

I—SCREW

RA PD 344901

Figure 29 — Reverse and Idler Gear Assembly — Disassembled



A—MAIN DRIVE GEAR (CLUTCH SHAFT) BEARING NUT

B—MAIN DRIVE GEAR BEARING SNAP RING

C—MAIN DRIVE GEAR BALL BEARING

D—MAIN DRIVE GEAR

E—MAINSHAFT PILOT ROLLER BEARING

F—MAINSHAFT SLIDING CLUTCH GEAR

G—MAINSHAFT THIRD-SPEED GEAR WASHER

H—MAINSHAFT THIRD-SPEED GEAR

I—MAINSHAFT THIRD-SPEED GEAR BUSHING

J—MAINSHAFT THIRD-SPEED GEAR SLEEVE

K—MAINSHAFT SECOND-SPEED GEAR BUSHING

L—MAINSHAFT SECOND-SPEED GEAR

M—MAINSHAFT SECOND-SPEED GEAR WASHER

N—MAINSHAFT FIRST-SPEED SLIDING GEAR

O—MAINSHAFT REAR BALL BEARING

P—MAINSHAFT REAR BEARING SNAP RING

Q—MAINSHAFT REAR BEARING SPACER WASHER

R—MAINSHAFT REPLACEMENT SPACER (SPEEDOMETER GEAR SUBSTITUTE)

S—WASHER

T—NUT

U—COTTER PIN

V—SPLINED MAINSHAFT

W—WOODRUFF KEY

X—MAINSHAFT WASHER KEY

RA PD 353064

Figure 30 — Mainshaft and Main Drive Gear Assemblies — Disassembled

b. Clean and inspect. Wash all parts thoroughly in dry cleaning solvent. Inspect for burs, rough spots, cracked teeth, and excess wear. Replace all unserviceable parts as described in subparagraphs **b** and **c**. Dress all burs and nicks with hand stone. Refer to paragraph 25 for dimensions of new parts.

c. Assemble countershaft assembly. Place assembly in position. Install parts on countershaft in order shown in figure 28, pressing gears on in the following order: Second speed key and gear, third speed key and gear, power take-off key and gear, and drive gear key and gear. Do not install the rear countershaft bearing, snap ring and nut at this time.

18. REVERSE AND IDLER GEAR.

a. Disassemble gears and shaft. Slide sliding gear and bushing from shaft of reverse idler gear. Pull roller bearings from bore of idler gear.

b. Clean, inspect, and repair gear and shaft parts. Wash all parts thoroughly in dry cleaning solvent. Inspect for broken bearing rollers, cracked or broken gear teeth, or evidence of excess wear. Replace all unserviceable parts. Refer to paragraph 25 for dimensions of new parts.

c. Assemble gears and bearings (fig. 29). Insert roller bearings with spacer between, in reverse idler gear bore. Slide sliding gear on reverse idler gear. Slide shaft into assembly until ready for installation.

19. MAINSHAFT ASSEMBLY (fig. 30).

a. Disassembly. Remove mainshaft drive gear roller bearing and sliding clutch gear, using the latter part to start the bearing. Remove third speed gear retaining washer key located between splines over which the sliding clutch fits. Rotate retaining washer in its groove until the lugs of washer line up with splines in shaft and remove. Remove mainshaft bushed gears, sleeve, and washers, using the second speed gear to start the third speed gear sleeve.

b. Cleaning, inspection, and repair.

(1) GENERAL. Refer to paragraph 25 for dimensions of new parts. Wash all parts in dry cleaning solvent. Inspect for cracked or broken gear teeth, and excessive wear on all parts. Replace unserviceable parts with new parts.

(2) GEAR BUSHING REPLACEMENT. Press old bushing from gear if bushing is worn out and gear is unserviceable. Clean bore of gear and remove all burs. Aline locking lugs of bushing (if present) with notches in gear and press bushing into gear. If end of bushing

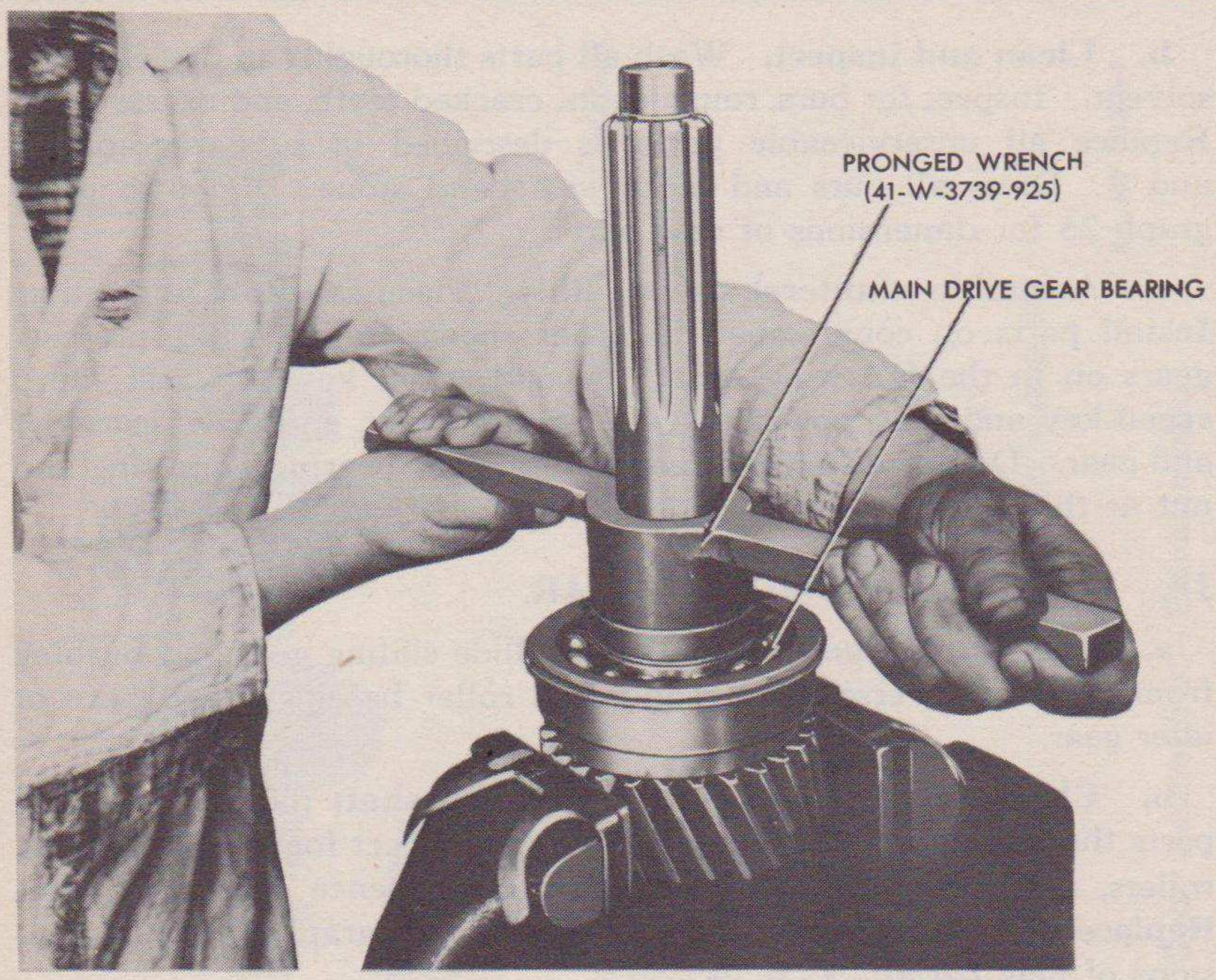


Figure 31 — Removing Main Drive Gear Bearing Nut

projects from gear hub face, machine bushing flush with gear hub face. Drill oilholes in bushing, using holes in gear for size and to act as a guide for drill. Make sure all oilholes are open, and remove all burs and sharp edges with a hand stone.

c. Assembly. Coat parts with recommended lubricant (TM 9-813). Install second speed gear washer followed by second speed gear onto mainshaft. Install third speed gear sleeve key in mainshaft, and press third speed gear sleeve onto mainshaft. Install third speed gear, mainshaft third speed retaining washer, third speed gear retaining washer key, sliding clutch gear, and main drive gear roller bearing onto mainshaft in the above-mentioned order. Slide first speed sliding gear onto mainshaft, and place with remaining parts of mainshaft assembly until ready to install in transmission case.

20. MAIN DRIVE GEAR ASSEMBLY (fig. 30).

a. Disassembly. Remove front bearing nut from shaft, using pronged wrench (41-W-3739-925) (fig. 31). Remove bearing.

b. Cleaning, inspection, and repair. Wash all parts thoroughly in dry cleaning solvent. Inspect shaft for burs and rough spots.

Inspect bearing for evidence of cracked balls or distortion. Inspect gear for cracked or broken teeth, excess wear, and roughness. Replace all unserviceable parts. Refer to paragraph 25.

c. Assemble shaft and gear assembly. Push bearing over shaft and against drive gear. Install and tighten bearing nut on shaft, using pronged wrench (41-W-3739-925) (fig. 31).

21. CLUTCH RELEASE ASSEMBLY.

a. Disassembly. Refer to paragraph 14 **c.**

b. Cleaning, inspection, and repair. Wash all parts in dry cleaning solvent. Inspect clutch sleeve, yoke, cross shaft, and housing bores for roughness burs, and excessive wear. Replace all unserviceable parts, including throw-out bearing if original is not serviceable.

c. Assembly. Refer to paragraph 23 **e.**

22. TRANSMISSION CASE.

a. Wash case in dry cleaning solvent and inspect case for cracks and wear in bearing bores. Remove all burs from machined surfaces with a hand stone. If old case is unserviceable and cannot be repaired, use a new or reconditioned case. Refer to paragraph 25.

Section IV
ASSEMBLY

23. ASSEMBLY.

a. Preliminary instructions. Lubricate all parts with recommended lubricant (see lubrication order) before final assembly.

b. Install countershaft (figs. 13 and 28). Press countershaft front ball bearing into lower front bore of transmission housing. Place countershaft and gear assembly in housing, guiding rear of shaft out through rear lower bore of housing. Move assembly forward, insert shaft in front bearing bore, and tap forward until tight. Drive rear bearing on shaft and into housing bore with bearing replacer (41-R-2384-128) (fig. 32). Install countershaft nut using pronged wrench (41-W-3739-975) (fig. 32). Stake nut to shaft. Install rear bearing cover, using a new gasket; install and tighten four lock washers and cap screws. Install expansion plug and snap ring in housing, securing front bearing.

c. Install reverse gear, idler gear, and shaft (figs. 13 and 29). Hold gear assembly in position in case and tap shaft through into bracket bore in housing. Be sure slot in shaft faces lock plate cap screw bore. Install lock plate in shaft, and insert and tighten cap screw in lock plate.

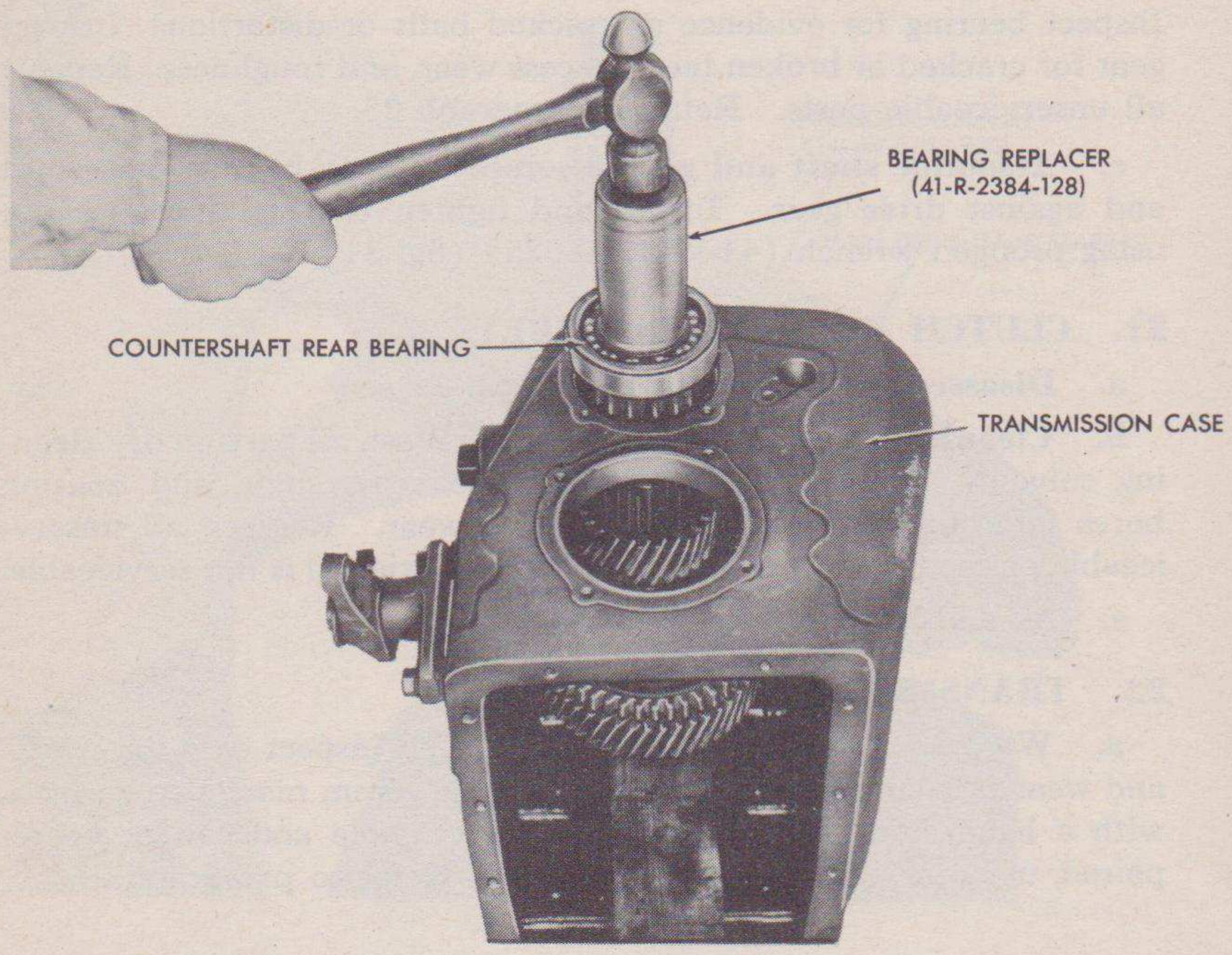


Figure 32 — Replacing Countershaft Rear Bearing

d. Install mainshaft and main drive gear assemblies (figs. 13 and 30). Place mainshaft and gears in position in housing, meshing second speed and third speed gears with countershaft second and third speed gears to position assembly. Drive mainshaft rear bearing over shaft and into rear transmission housing bore with hammer and bearing replacer (41-R-2389-905) (fig. 33). Install main drive gear assembly into case, making sure end of mainshaft enters roller bearing. Install snap ring on front bearing. Install main drive gear bearing cover using a new gasket, and secure with four lock washers and cap screws. Install snap ring on rear main bearing, then install mainshaft rear bearing cover using a new gasket, securing with four lock washers and cap screws. Pull first speed gear (large rear mainshaft gear) back against case to lock transmission. Install washer and spacer and press companion flange on rear mainshaft. Install and tighten castle nut and secure with cotter pin.

e. Install bell housing, clutch pedal shaft, and bearing carrier (figs. 13 and 16). Place bell housing in position on six engine studs; install and tighten six lock washers and nuts. Holding yoke of clutch release mechanism in position (vertical), push long shaft through

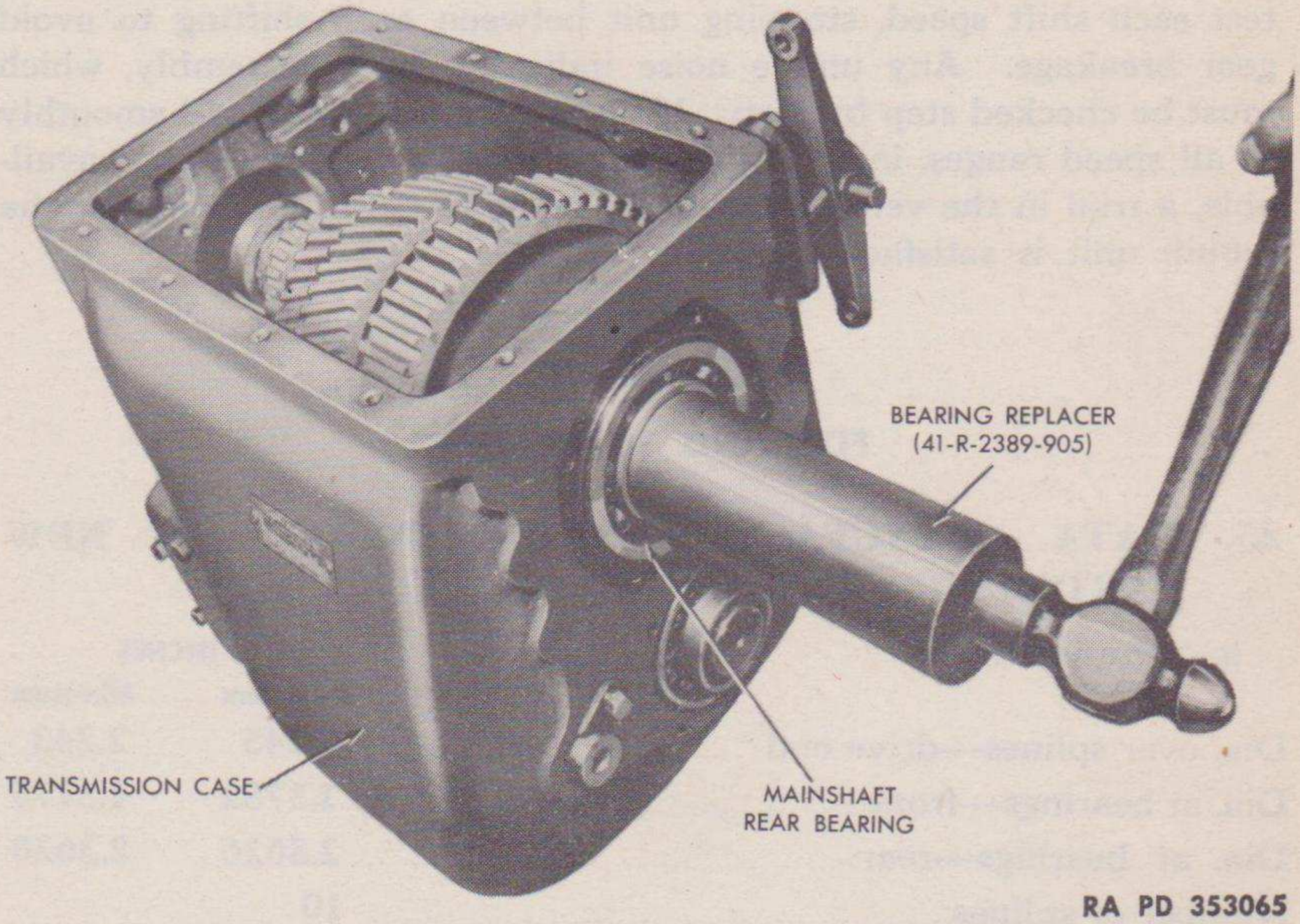


Figure 33 — Replacing Mainshaft Rear Bearing

right side of housing (facing front) and through yoke end. Insert Woodruff key in shaft slot and pull back into yoke. Push short shaft through left side of housing into yoke. Center yoke on clutch pilot shaft, insert and tighten yoke set screws on shaft. Slide clutch release carrier, bearing, and sleeve over shaft and against release yoke arms. Install lubricant pipe. Hook bearing carrier pull-back springs into cap screws of front bearing cover.

f. Install shifting bar housing assembly. Push first speed gear (large rear mainshaft gear) to rear of housing. Move shifting forks into position (fig. 27). Use a new gasket on transmission housing, and lower shifting bar assembly into position. Guide reverse fork arm down past first speed gear and into space in front of reverse idler gear on the left side of the case (fig. 15). Slowly lower fork into place in the sliding clutch and first speed gear fork slots (fig. 13). Inspect these installations closely, making sure they are correct. Install and tighten six lock washers and cap screws securing housing to transmission. The shifting bar slots will now be in position (fig. 27). Install a new gasket and the gearshift lever housing and assembly. Secure with four lock washers and cap screws.

24. TEST.

a. Test transmission operation. Fill transmission with proper grade and quantity of lubricant (see lubrication order) and give

rotary power test. Attach clutch pilot shaft to power source and test each shift speed, stopping unit between each shifting to avoid gear breakage. Any undue noise indicates faulty assembly, which must be checked step by step. If unit operates quietly and smoothly in all speed ranges, install in the vehicle. If a test unit is not available, a trial in the vehicle should be made to determine whether the rebuilt unit is satisfactory.

Section V

FITS AND TOLERANCES

25. DATA (MANUFACTURING DIMENSIONS OF NEW PARTS).

a. Mainshaft.

	INCHES	
	Maximum	Minimum
Dia. over splines—drive end	2.245	2.243
Dia. at bearings—front	1.3782	1.3777
Dia. at bearings—rear	2.3626	2.3620
Number of splines	10	
Countershaft—front (dia. at bearings)	1.7721	1.7716
Countershaft—rear (dia. at bearings)	1.9687	1.9682
Third speed gear thrust washer thickness (front)	0.328 or 0.323	0.326 or 0.321
Third speed gear shaft dia.	2.2505	2.2500
Mainshaft—out-of-true	Not over 0.001	

b. Clearance.

Mainshaft and sliding gears—width	0.008	0.003
Shifting fork and sliding gear—width	0.025	0.009
Fourth speed gear bushing and sleeve	0.003	0.002

c. End play.

Helical gears—new limits	0.010	0.006

d. Spring tension.

Shifting bar lock spring	Free length third, fourth, reverse—1½ in.; first and second (5549)—$1\frac{15}{32}$ in.
Shifting bar lock spring	70 to 80 lb pressure at 1 in.
Reverse latch spring	Free length 1½ in.
Reverse latch spring pressure	10 to 12 lb at ¾ in.

CHAPTER 4

PROPELLER SHAFTS AND UNIVERSAL JOINTS

Section I

DESCRIPTION AND DATA

26. DESCRIPTION AND OPERATION.

a. Description (fig. 34). There are four propeller shafts used on this vehicle. Each propeller shaft assembly consists of a tubular shaft with a non-slip joint at one end and a slip joint at the other. On each shaft a yoke is welded to one end of the tubular shaft and a splined shaft to the other end.

(1) Propeller shaft (A, fig. 34) is furnished with a flange yoke at the slip joint, which is bolted to the companion flange on the transmission, and an end yoke on the non-slip joint which attaches to the transfer case.

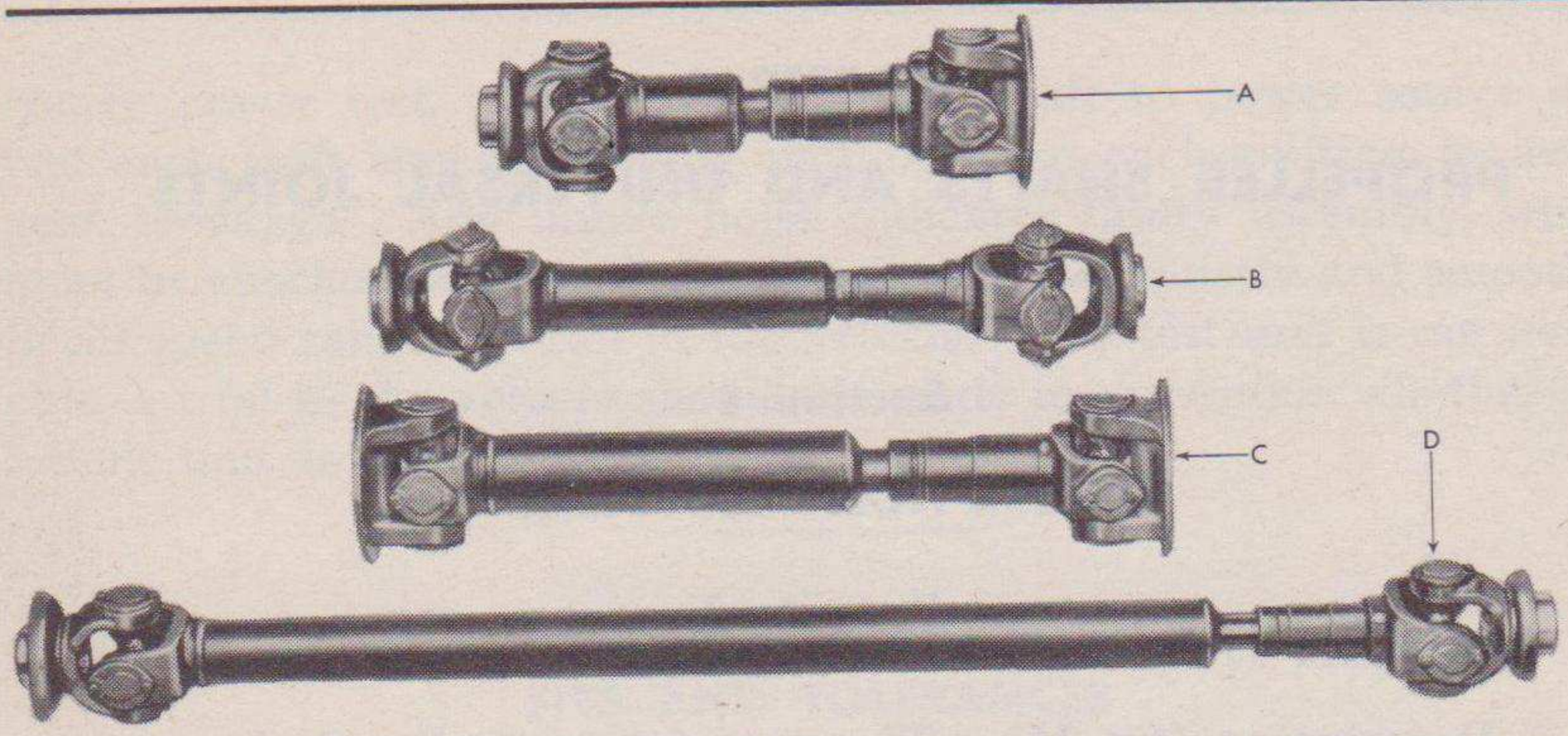
(2) Propeller shaft (B, fig. 34) is furnished with an end yoke at each end.

(3) Propeller shaft (C, fig. 34) is furnished with a flange yoke at each end. The flange yoke on the slip joint end is bolted to the brake disk which is mounted on the companion flange at the transfer case, while the flange yoke on the non-slip joint is bolted to the companion flange at the forward rear axle.

(4) Propeller shaft (D, fig. 34) is furnished with a yoke at each end; the one being attached to the transfer case, and the other to the front axle.

b. Operation (fig. 34). The propeller shaft (A) transmits power from the transmission to the transfer case. The shaft (C) transmits power from the transfer case to the forward rear axle. The shaft (B) transmits power from the forward rear axle to the rearward rear axle. The shaft (D) transmits power from the transfer case to the front axle.

(1) The slip joint permits variations in length between connecting units, caused by flexing of the springs while the truck is in motion.



A—TRANSMISSION TO TRANSFER CASE
B—FORWARD TO REARWARD REAR AXLE
C—TRANSFER CASE TO FORWARD REAR AXLE
D—TRANSFER CASE TO FRONT AXLE

RA PD 334514

Figure 34 — Propeller Shafts

27. PROPELLER SHAFT DATA.

	PRIME MOVER, GAS TANK CHASSIS, VAN White	PRIME MOVER Corbitt	BRIDGE ERECTION Brockway, White, Ward La France	CRANE AND FIRE CRASH Brockway
Make	Spicer	Blood	Spicer	Spicer
Transmission to transfer case	9000-1SF	6N-9346	9113-1SF	9113-1SF
Transfer case to front axle	9001-1SF	7N-9071	9114-1SF	9114-1SF
Transfer case to forward rear axle	9002-1SF	7N-9072	9115-1SF	9115-1SF
Interaxle	8215-1SF	6N-9073	8215-1SF	8215-1SF

Section II

DISASSEMBLY INTO SUBASSEMBLIES

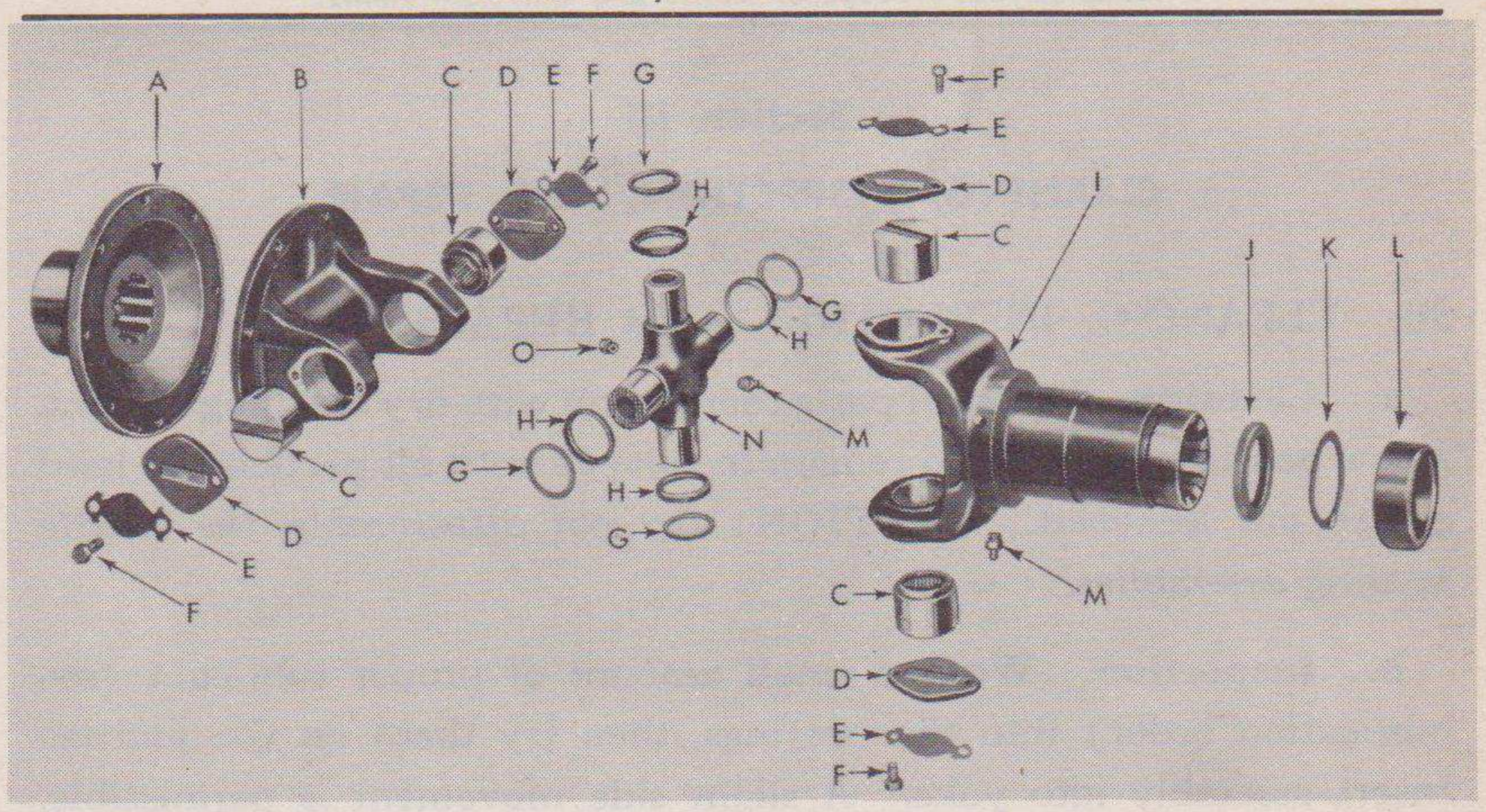
28. PRELIMINARY INSTRUCTIONS.

a. Remove propeller shafts. Refer to TM 9-813 for instructions on removing propeller shafts.

b. Cleaning. Remove all foreign matter from the exterior of the propeller shafts with a wire brush and a putty knife. Place the unit in a container of dry cleaning solvent and wash thoroughly. Wipe dry with clean cloths. Wrap all parts in clean paper or cloth as disassembly proceeds.

c. Construction (fig. 36). In each universal joint assembly there are four block plates, bearing caps, and bearing assemblies. A lock plate bearing cap and bearing assembly fit over each end of the journal. To disassemble the joint, all four lock plates, bearing caps, and bearing assemblies must be removed. The procedure in removing all lock plates, bearing caps, and bearing assemblies is identical.

Disassembly Into Subassemblies



A— COMPANION FLANGE
B— FLANGE YOKE
C— BEARING ASSEMBLY
D— BEARING CAP
E— LOCK PLATE
F— CAP SCREW
G— GASKET
H— RETAINER
I— SLIP JOINT YOKE
J— WASHER
K— STEEL WASHER
L— DUST CAP
M— FITTING
N— JOURNAL CROSS
O— RELIEF VALVE

RA PD 334515

Figure 35 — Universal Joint — Disassembled

29. DISASSEMBLY OF PROPELLER SHAFT.

a. Remove slip joint (fig. 35). Look for arrow marks on propeller shaft and slip joint yoke (fig. 36). If the marks are not easily seen, mark the shaft and slip joint yoke with a punch and hammer so that they can be reassembled in exactly the same relative position. Unscrew slip yoke dust cap (L, fig. 35) by hand. Withdraw shaft. Slip dust cap off the shaft. Lift the steel washer and the felt washer out of the cap.

b. Disassembly, universal joint. Straighten out lugs on lock plate with screwdriver. Remove two cap screws, on each end of flange yoke. Tap on end of bearing assembly until opposite bearing is forced out of yoke. Then turn assembly over and drive the first bearing back out of its lug by driving on the exposed end of the journal. NOTE: *Use a soft, round drift with a flat face about* $\frac{1}{32}$ *inch smaller in diameter than the hole in the yoke, to prevent damaging the bearing.*

(1) Repeat the above operation for the other two bearings of the slip joint yoke. Lift out the journal by sliding to one side and tilting over the top of yoke lug. Tap retainers and gaskets off the four prongs of the journal. Pry the cork gasket out of each retainer with an awl. Remove release valve assembly and lubrication fitting from the journal.

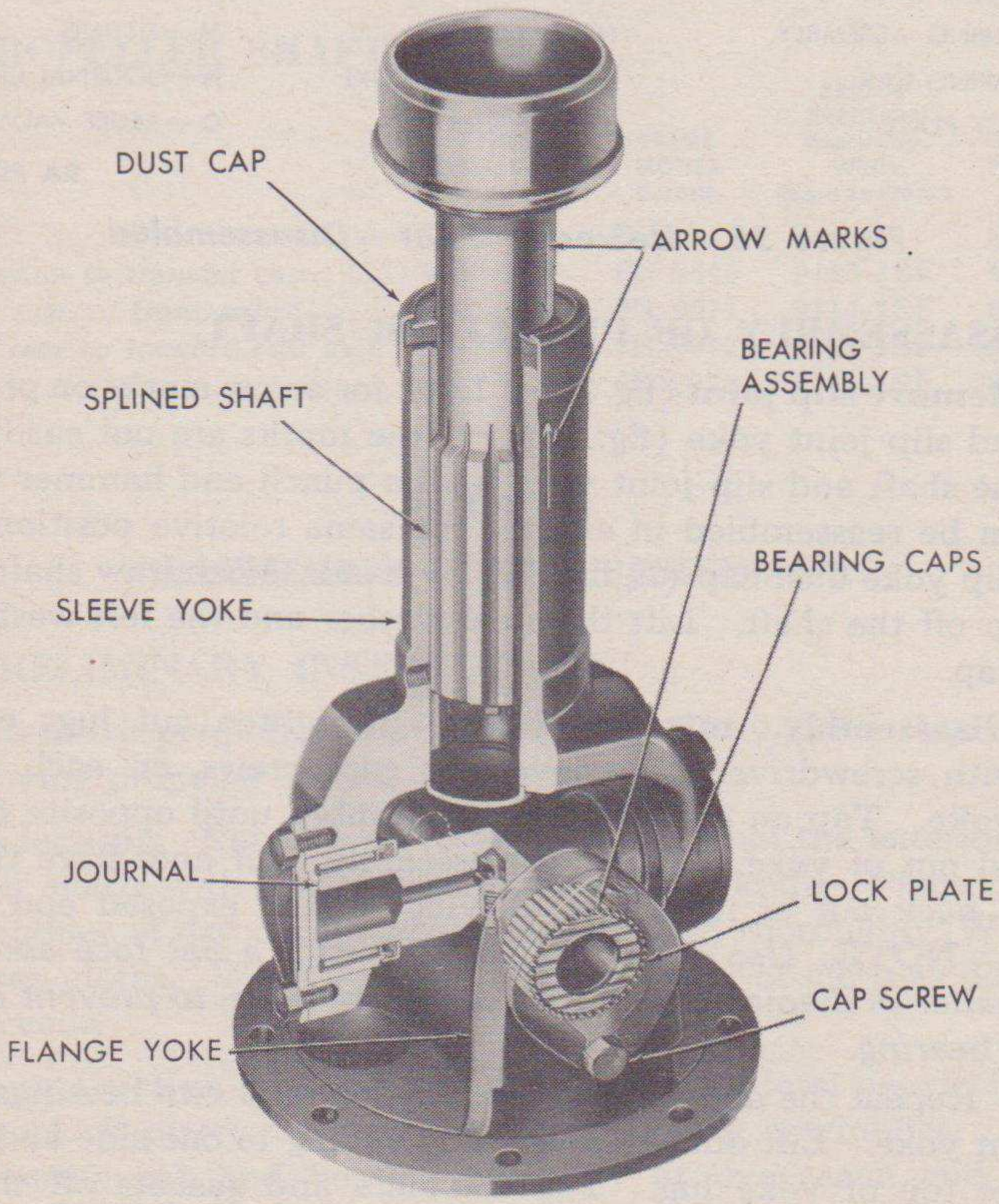
Section III

CLEANING, INSPECTION, AND REPAIR

30. CLEANING, INSPECTION, AND REPAIR.

a. Cleaning. Wash all parts thoroughly with dry cleaning solvent. Allow bearing assembly to remain in solvent until all particles of hard grease are loosened. CAUTION: *Do not disassemble the needle bearing assemblies.*

b. Inspection. Work a small amount of proper lubricant (see lubrication order) into the bearings, then try them on the journal. Insert assembly into yoke. A slight side movement is permissible. Too much side movement indicated by backlash or jerky action re-



RA PD 334548

Figure 36 — Section Through Journal

quires replacement of parts necessary to remedy condition. NOTE: *If the ends of the journal cross do not have lubrication grooves as shown in figure 36, grind one groove to approximately* $\frac{3}{32}$ *inch in width and* $\frac{1}{16}$ *inch in depth across the diameter of each end of the journal cross to provide a means for lubricant to pass into needle bearings.*

c. Repair. The dust cap, steel washer, dust cap felt washer, and trunnion cork washer must be entirely free of any wear or compression. If they appear worn or compressed, install new parts.

(1) Remove any burs or rough spots from the journal and yokes, using a hand stone. Also remove all burs or nicks from yoke splines. Refer to paragraph 34 **a** for clearance between splines of shaft and yoke.

Section IV

ASSEMBLY AND TEST

31. PRELIMINARY INSTRUCTIONS.

a. Clean and lubricate bearings and splines. Make sure the universal joint bearings are clean and properly lubricated (see lubrication order). Make sure splines on spline shaft are lubricated. When inserting the spline of propeller shaft into the slip joint, be sure the arrows on propeller shaft (fig. 36) and slip joints are in line. Make sure oil passages in journal are clean and free from foreign matter.

32. ASSEMBLE PROPELLER SHAFT.

a. Assemble universal joint (fig. 35). Insert journal gasket into journal gasket retainer. Install relief valve and lubrication fitting in journal. Place a retainer assembly on each end of journal. Insert one trunnion of journal into bearing hole in lug of the yoke from the inside between the lugs, and tilt until journal trunnion will enter opposite hole in lug. Pack bearings and reservoir with lubricant specified in pertinent lubrication order. NOTE: *If a manufacturer's lubrication instruction plate is present, deface the plate. Lubrication will be performed only as instructed in War Department lubrication orders.* Insert bearings from outside of yoke, pressing them into place with an arbor press, or tapping with a soft drift. Install bearing cap; be sure the key on bearing cap lines up with slot in the

bearing. Install new lock plate. Install cap screws and tighten evenly. Bend up lugs on lock plate around flat side of cap screws. NOTE: *When assembled, if joint appears to bind, tap lugs lightly with a hammer. This will relieve any pressure of the bearing on the end of the journal.*

b. Assemble slip joint. Insert steel washer followed by a new cork washer in dust cap. Slip dust cap assembly over spline end of shaft with open end toward universal joint. Lubricate splines thoroughly. Insert splines of propeller shaft into slip joint so that arrows are in line (fig. 36), screw dust cap onto sleeve.

33. TEST.

a. Procedure. Fill propeller shaft journal and slip joint grease fittings with proper grade and quantity of lubricant (see lubrication order). Check the shaft for run-out. The shaft tube must not run-out to an indicator reading in excess of 0.020 inch, and neck of spline, 0.005 inch.

34. FITS AND TOLERANCES.

a. Clearance. Propeller shaft splines to yoke splines must have clearance of from 0.001 inch to 0.006 inch.

b. Propeller shaft run-out (permissible).

At tube	0.020 in.
At neck of spline	0.005 in.

CHAPTER 5

TRANSFER CASE

Section I

DESCRIPTION AND DATA

35. DESCRIPTION AND OPERATION.

a. Description (fig. 37). The transfer case is a 2-speed gear box, mounted behind the transmission between the frame side rails. The front and rear axles and winch are driven through this unit. A declutching device is provided for engaging and disengaging the front axle and the power take-off drive. The main drive gear, idler shaft rear gear, and driven shaft gear are the herringbone type. The mainshaft sliding gear and the idler shaft low speed gear are the spur type. The mainshaft, driven shaft, power take-off, and declutch shaft are mounted in tapered roller bearings. These bearings are adjusted by means of shims. The idler shaft is mounted on radial ball bearings and is not adjustable for wear. The speedometer drive gears are fully enclosed in a small housing on the forward end of the idler shaft and gear assembly and are lubricated from the transfer case.

b. Operation (fig. 37). High and low speed ranges in the transfer case, the engagement and disengagement of the front axle, and the power take-off, are controlled by three separate shift levers in the cab.

36. DATA.

Make	Timken-Wisconsin
Model	T-77-3-6
Type	Two-speed with front axle power take-off declutching units

Gear ratios:

High speed	1.00 to 1
Low speed	2.55 to 1

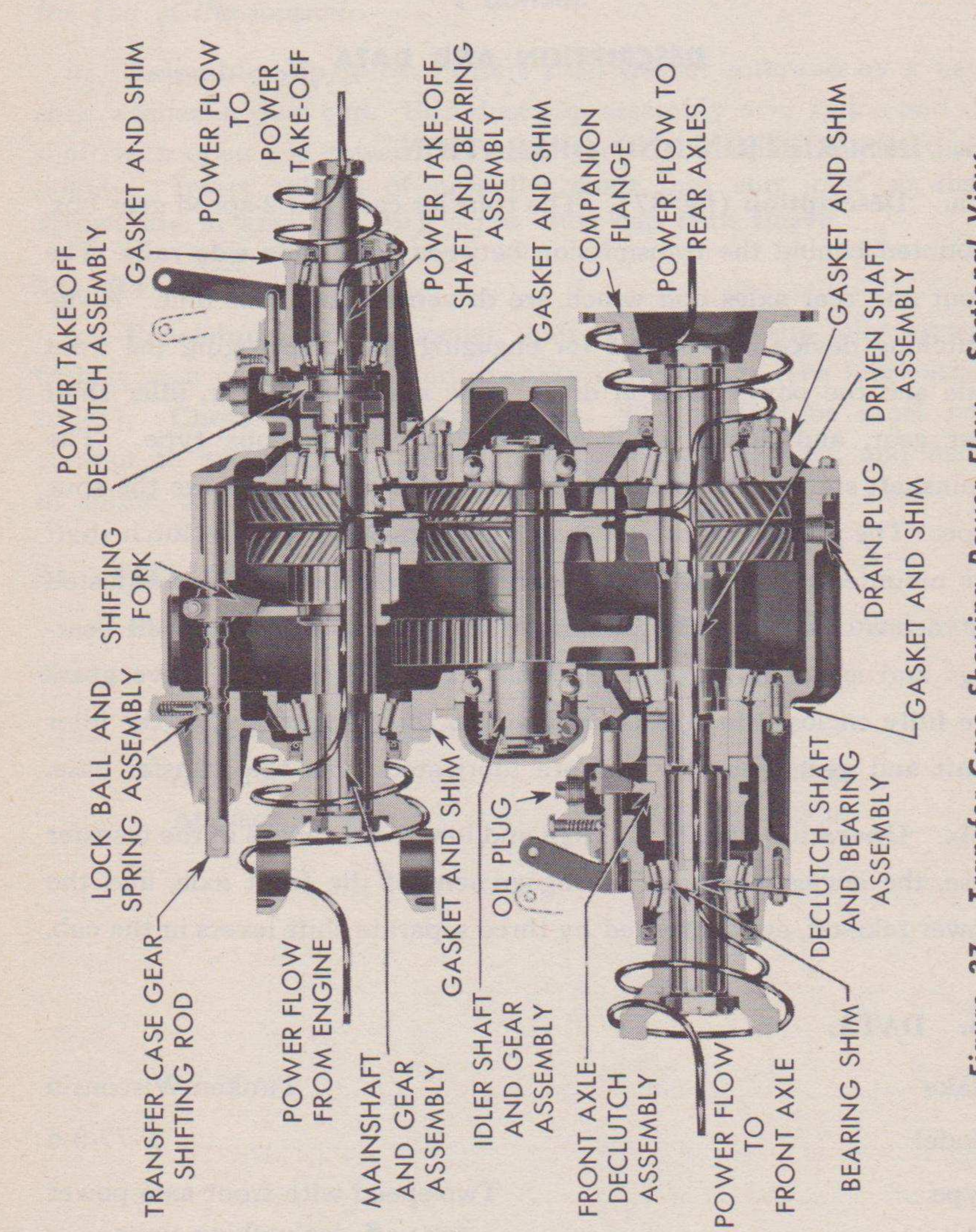


Figure 37 — Transfer Case Showing Power Flow — Sectional View

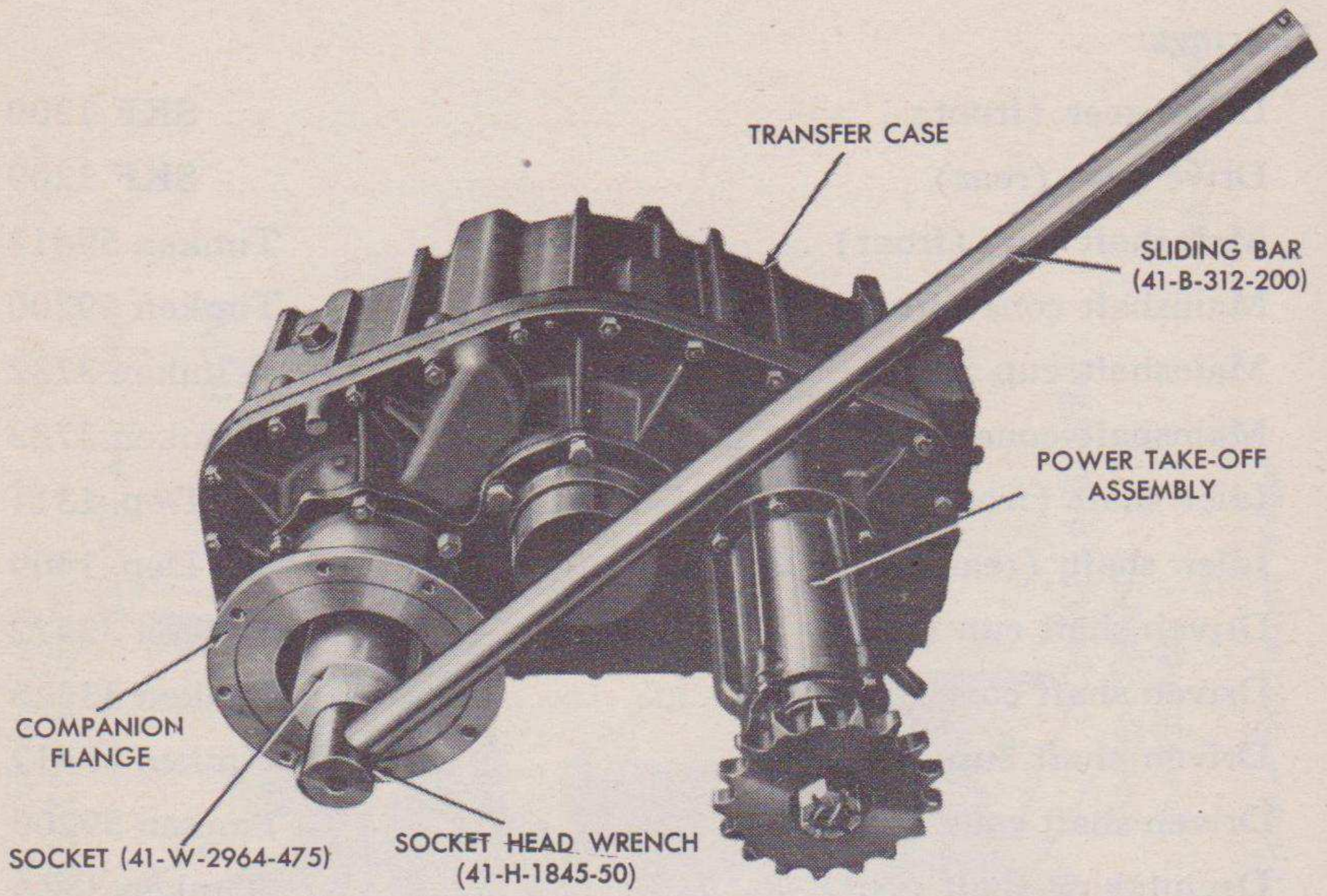
Bearings:	
Drive gear (front)	SKF 1209
Drive gear (rear)	SKF 1209
Mainshaft cup (front)	Timken 59412
Mainshaft cone (front)	Timken 59200
Mainshaft cup (rear)	Timken 3732
Mainshaft cone (rear)	Timken 3782
Idler shaft (front)	New Dep. 1311
Idler shaft (rear)	New Dep. 1409
Driven shaft cup (front)	Timken 33472
Driven shaft cone (front)	Timken 33225
Driven shaft cup (rear)	Timken 59412
Driven shaft cone (rear)	Timken 59200
Declutching shaft cup	Timken 382A
Declutching shaft cone	Timken 385A
Power take-off shaft cup (front and rear)	Timken 332
Power take-off shaft cone (front and rear)	Timken 342S
Bearing adjustment method:	
Main drive shaft	Shims between transfer case cover and power take-off declutch housing
Driven shaft	Shims under rear bearing cap
Idler shaft	None, ball-bearing type front bearing spacing
Front axle declutch shaft	Spacer shims between bearings
Power take-off declutch shaft	Shims under rear bearing power take-off cap

Section II

DISASSEMBLY INTO SUBASSEMBLIES

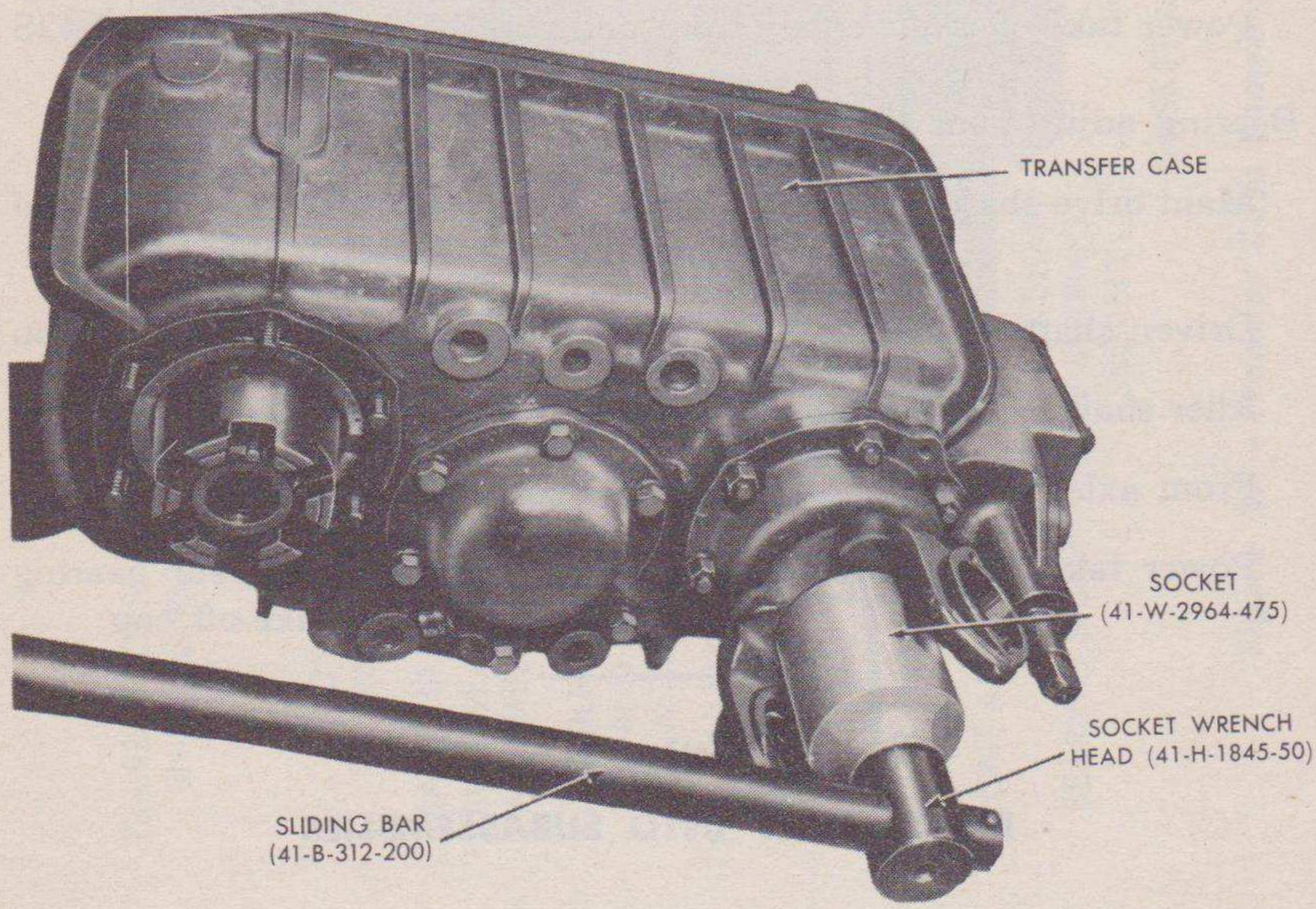
37. PRELIMINARY INSTRUCTIONS.

a. Remove transfer case. Refer to TM 9-813 for instructions on removing transfer case.



RA PD 353067

Figure 38 — Removing Driven Shaft Nut



RA PD 353068

Figure 39 — Removing Mainshaft Nut

Disassembly Into Subassemblies

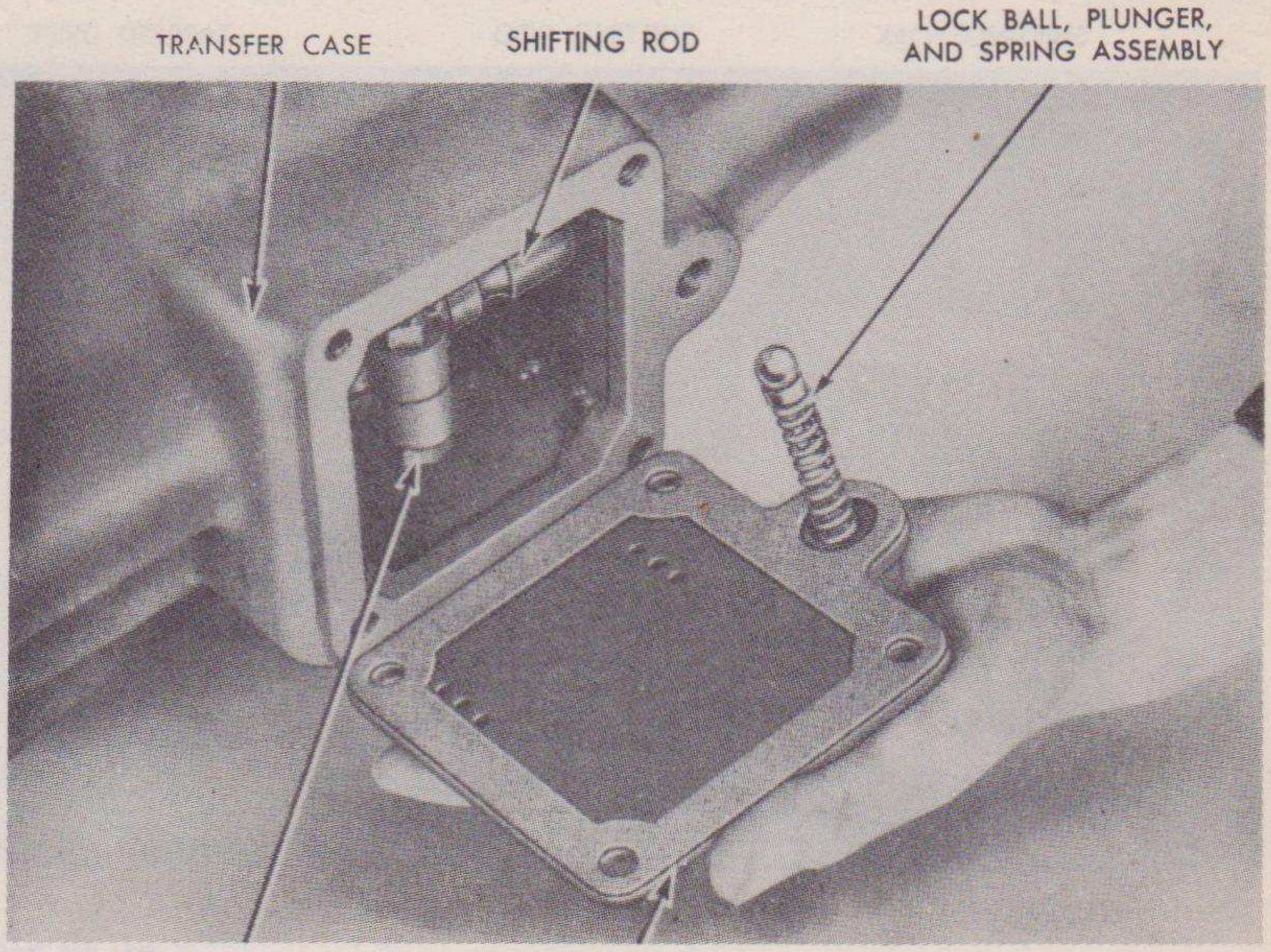


Figure 40 — Removing Gearshift Rod Cover

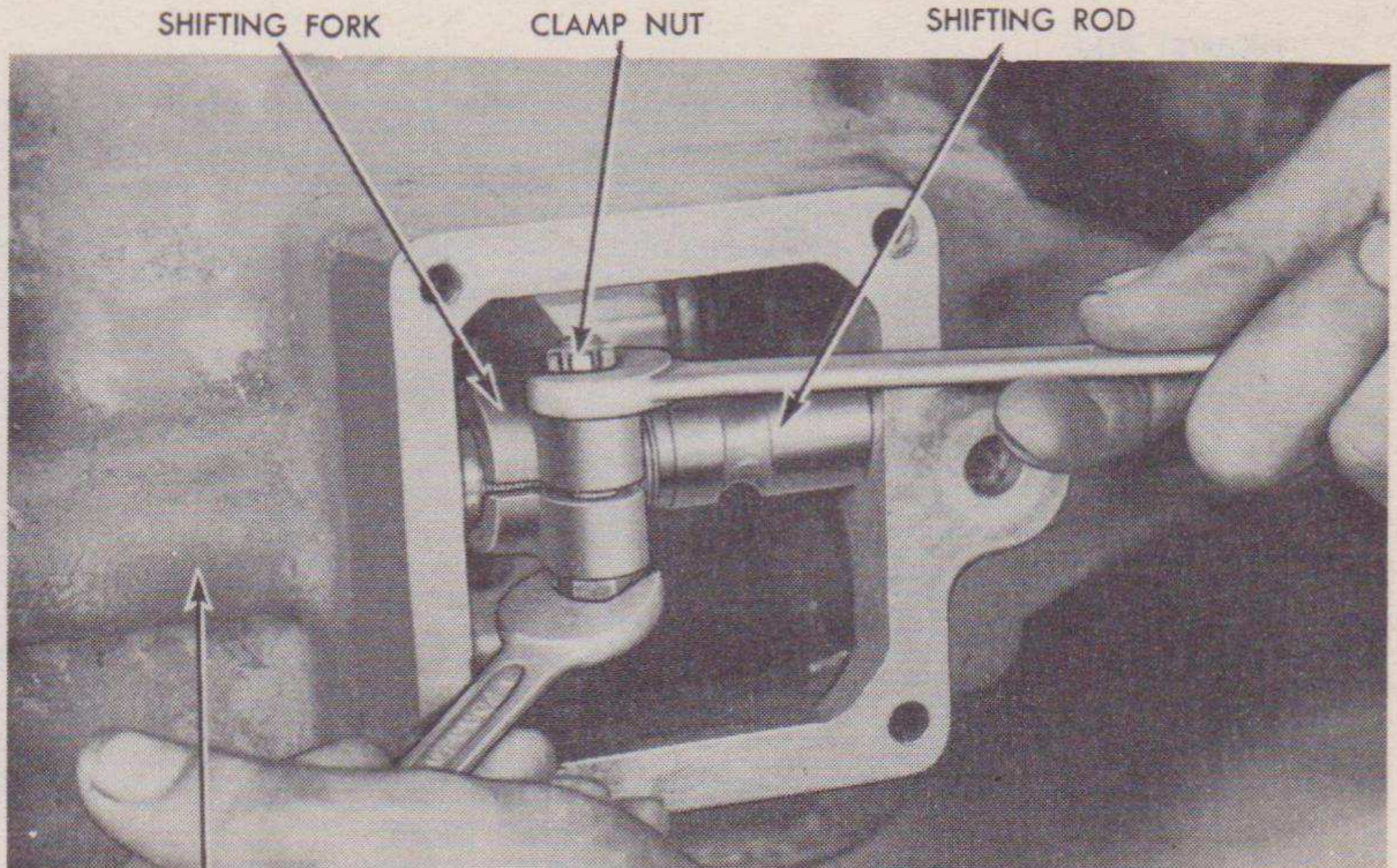
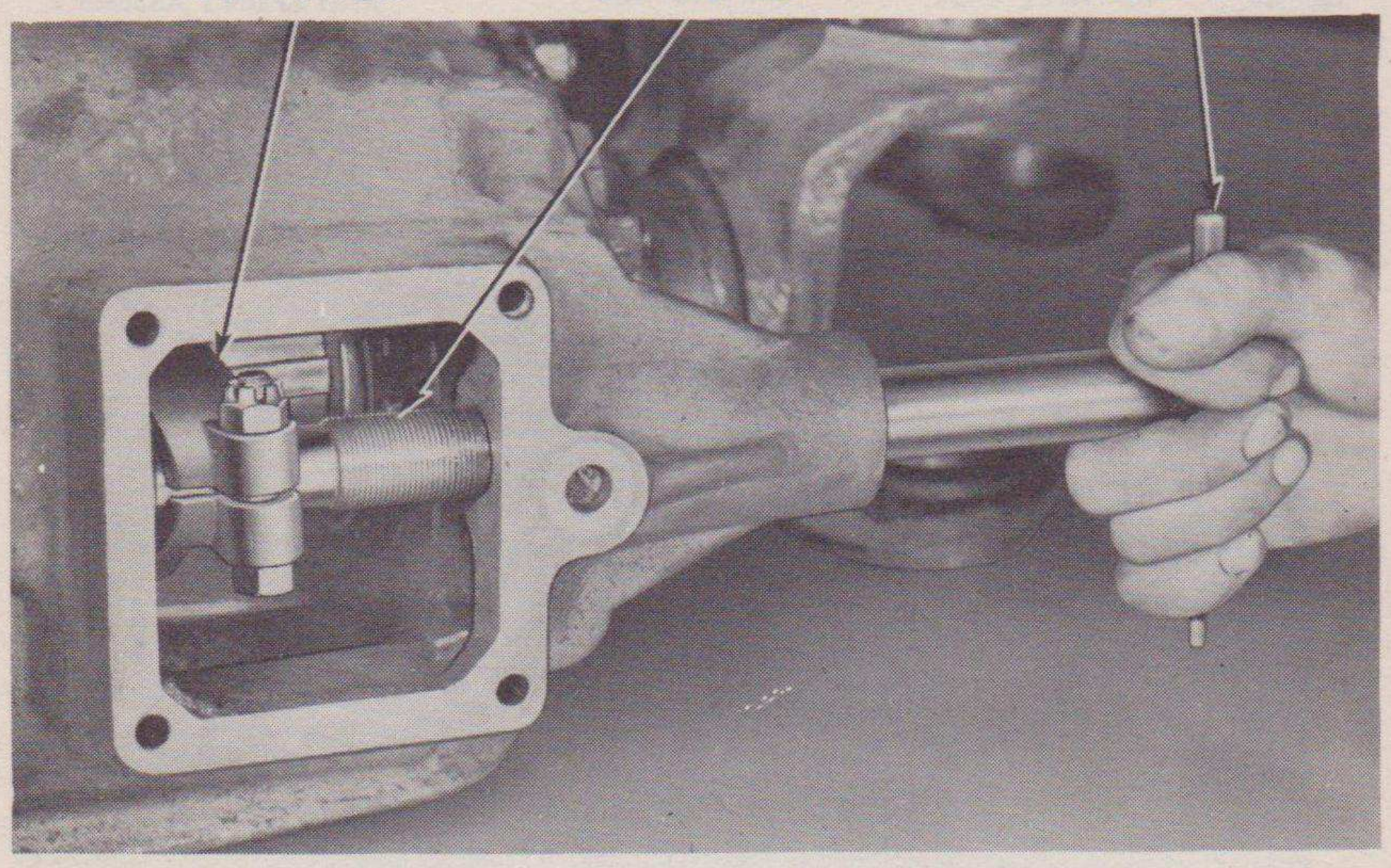
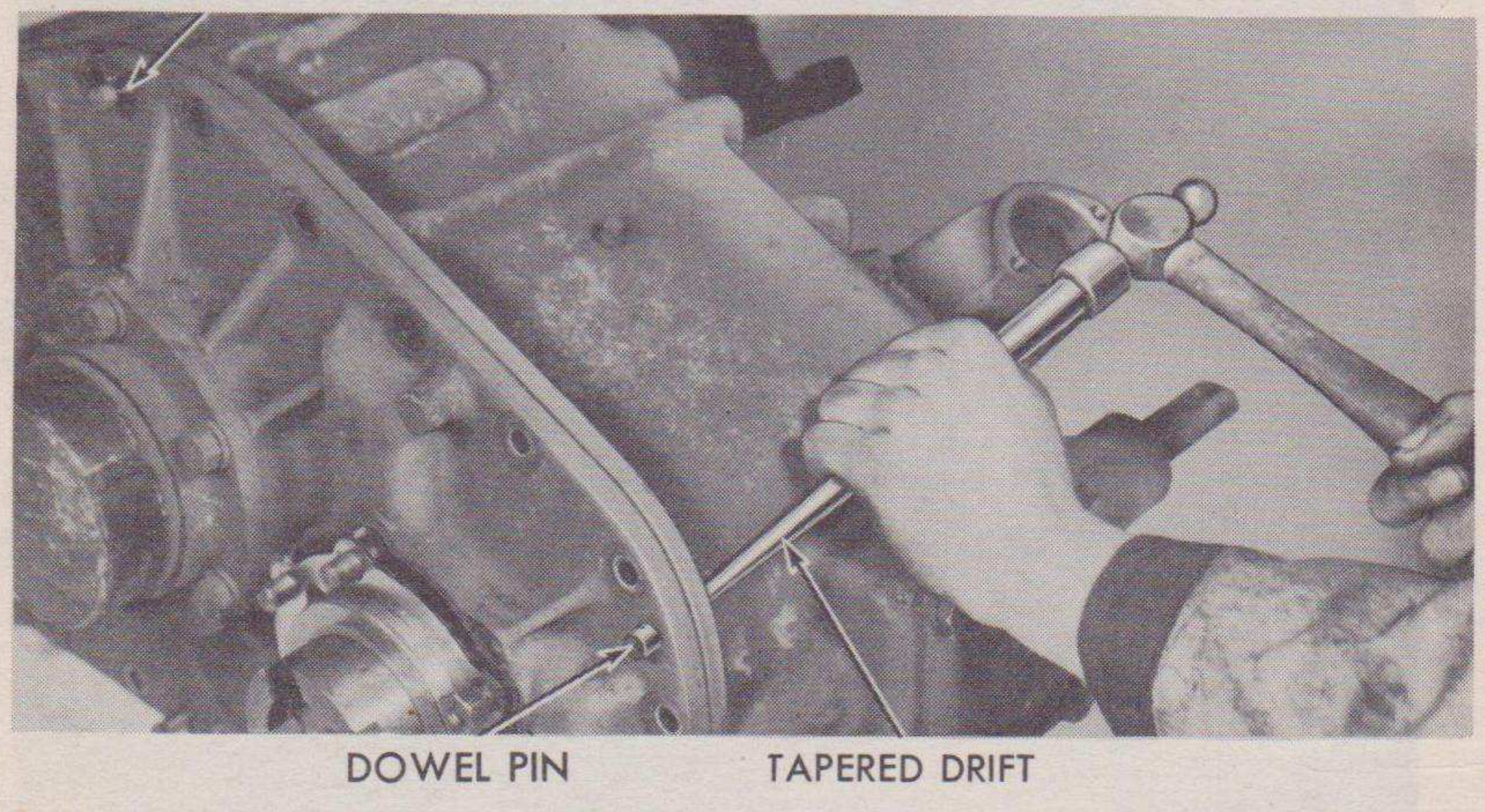


Figure 41 — Loosening Shifting Fork Clamp Nut



RA PD 349790

Figure 42 — Removing Gearshift Rod



RA PD 334431

Figure 43 — Driving Out Dowel Pins

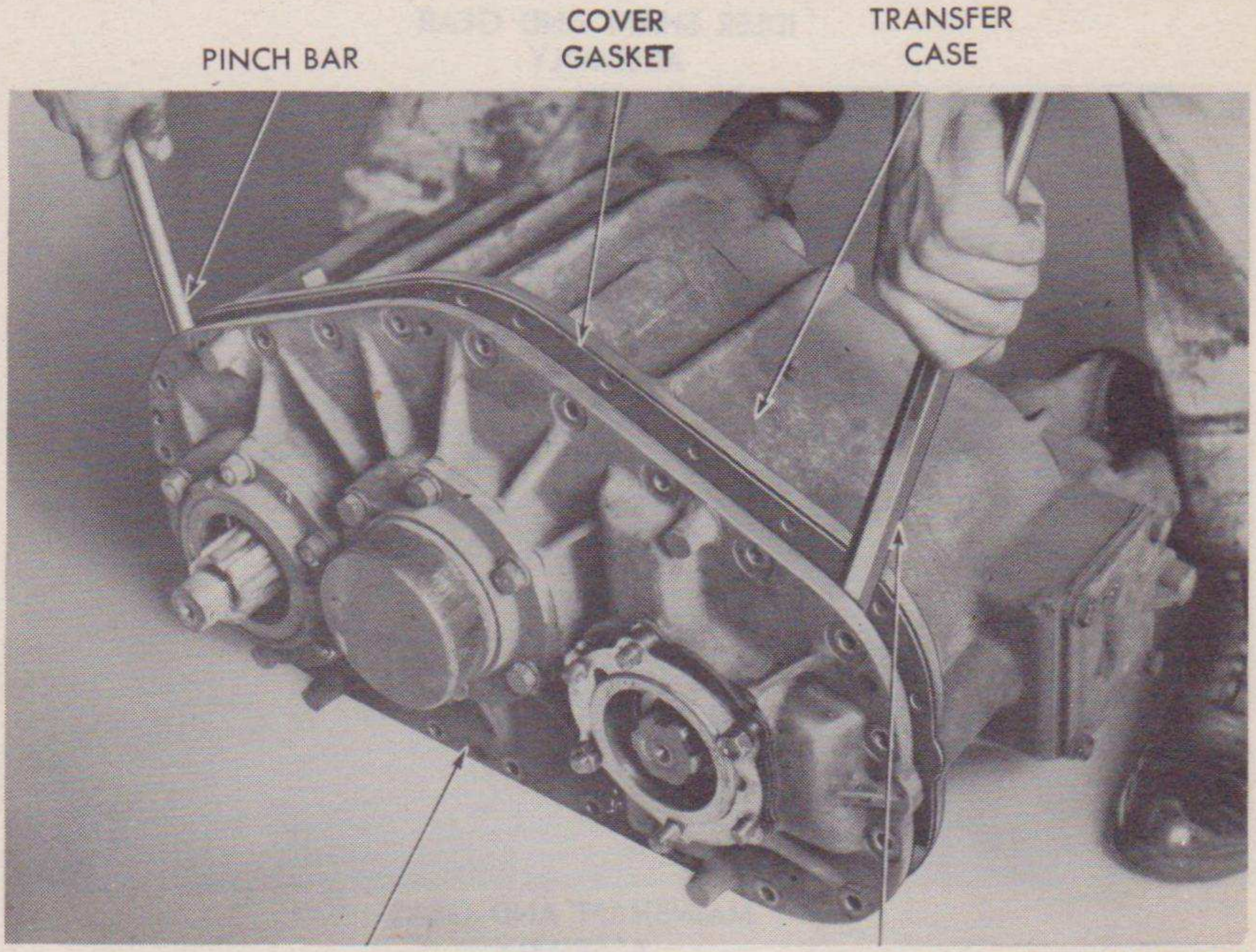


Figure 44 — Removing Transfer Case Cover

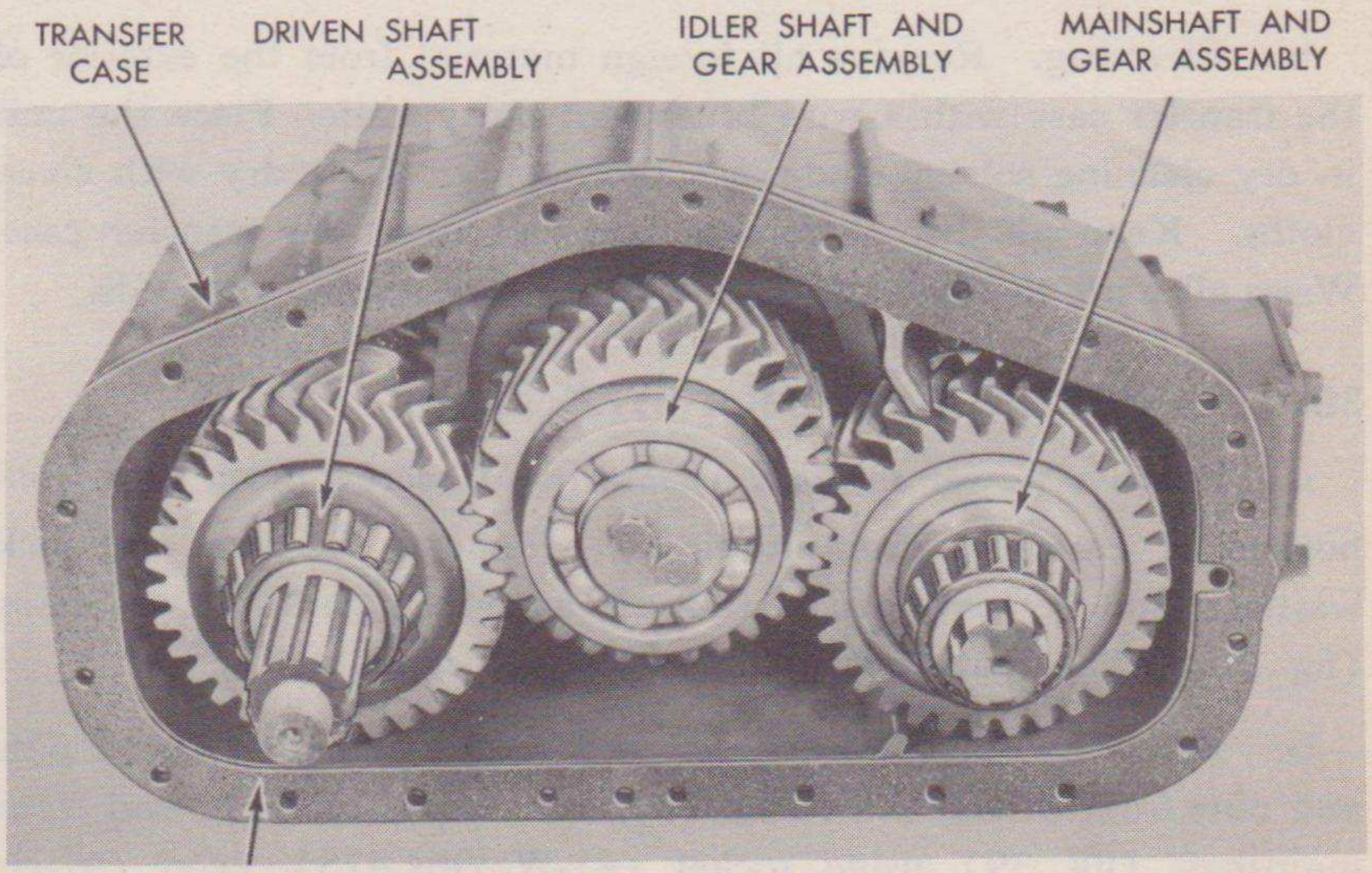


Figure 45 — Transfer Case and Gears With Cover Removed

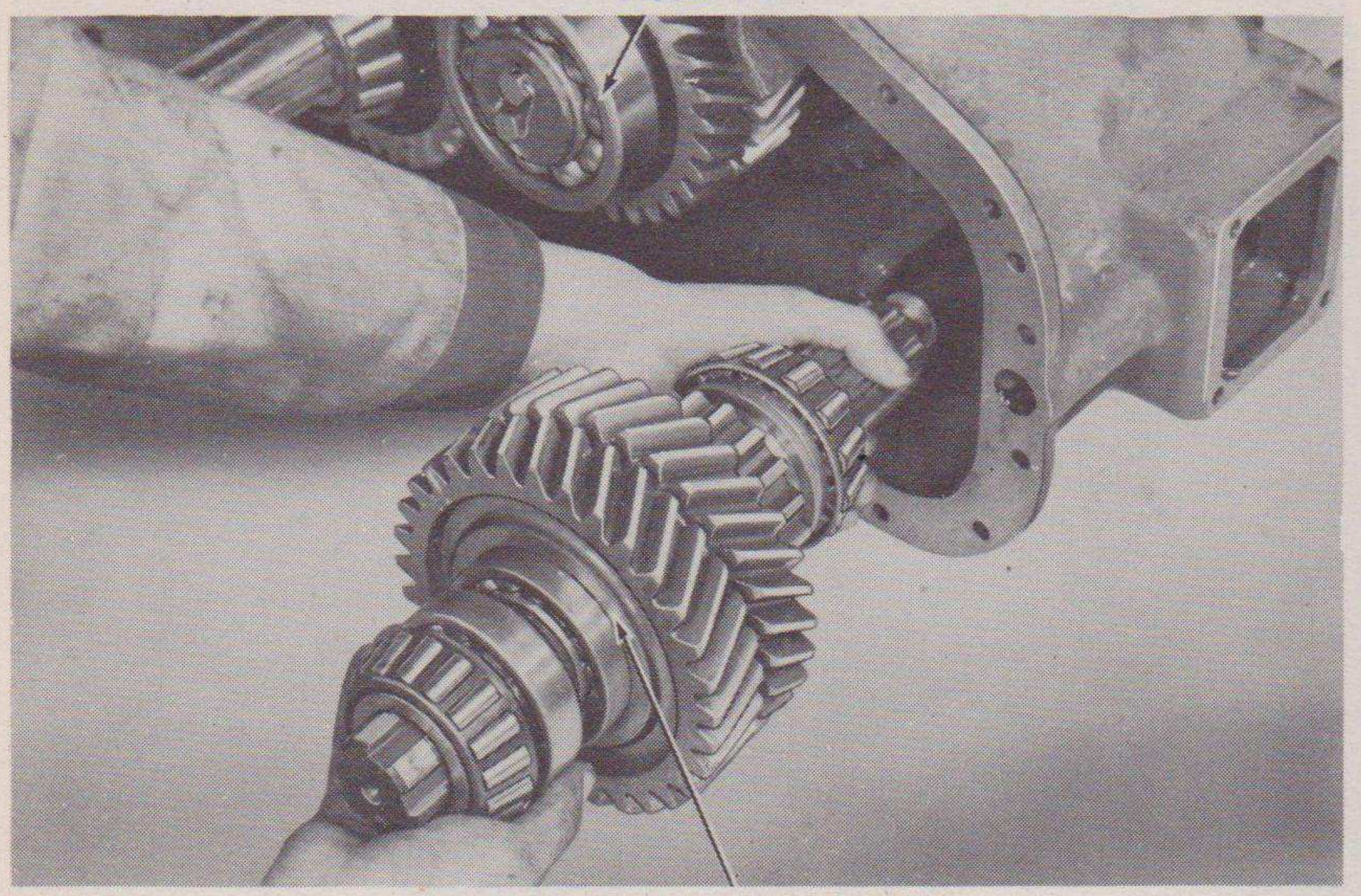


Figure 46 — Removing Mainshaft and Gear Assembly

b. Cleaning. Remove all foreign material from the exterior of the transfer case with a wire brush and putty knife. Place the unit in dry cleaning solvent and wash thoroughly. Wipe dry with clean cloths. Keep all dirt or foreign material from the transfer case. Wrap all parts in clean paper or cloth as disassembly proceeds.

38. DISASSEMBLY OF TRANSFER CASE.

a. Remove power take-off assembly. Unscrew drain plug from bottom of case and drain lubricant. Remove six nuts and lock washers, and remove power take-off assembly, gasket, and shims (fig. 38). Tag the shims to insure correct assembly.

b. Remove companion flange and yokes. Remove cotter pins and nuts from driven shaft (fig. 38), from declutch shaft, and from mainshaft (fig. 39), using socket (41-W-2964-475), head (41-H-1845-50) and bar (41-B-312-200). Remove companion flange from driven shaft. Remove yokes from declutch shaft and mainshaft.

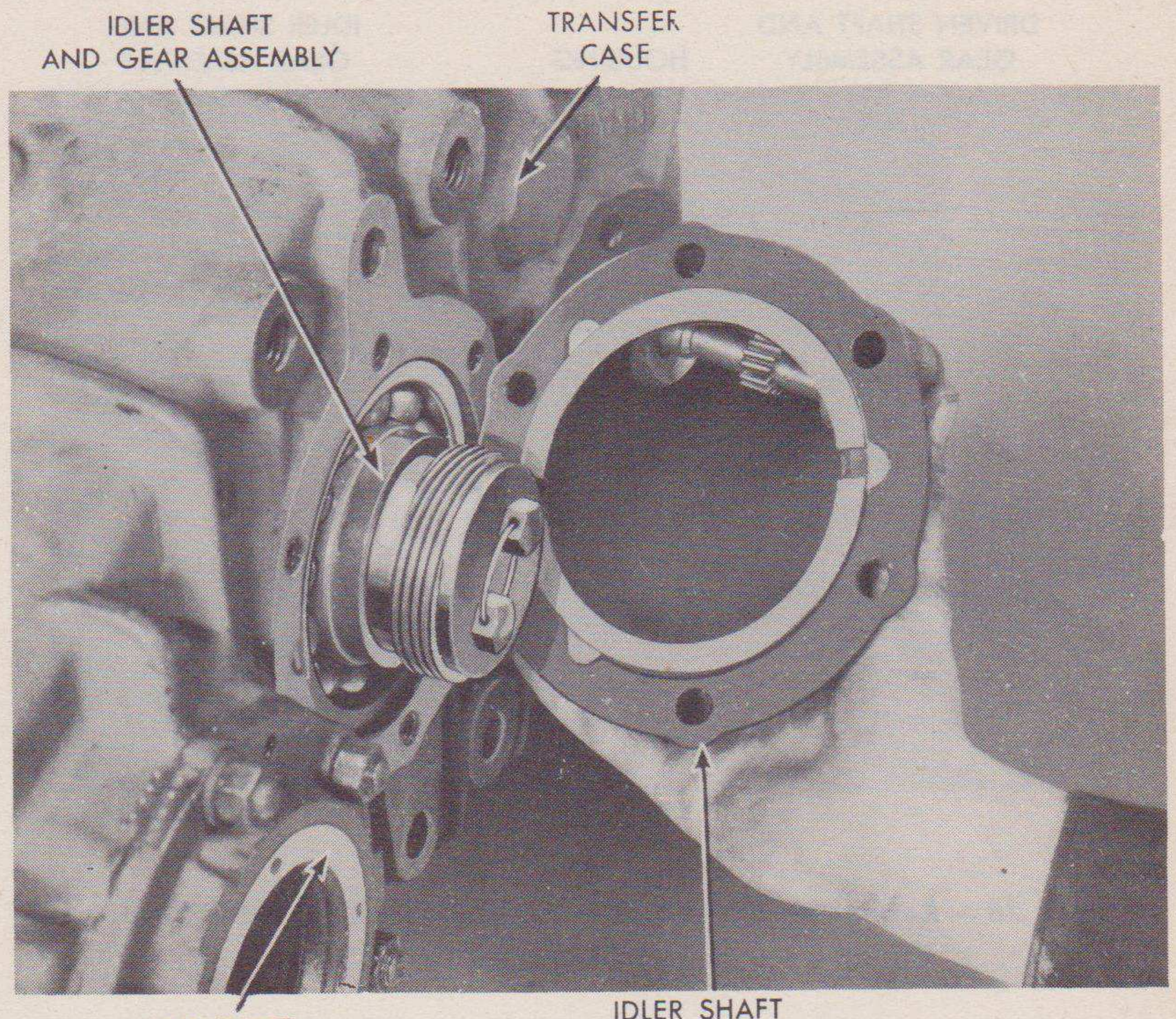


Figure 47 — Removing Idler Shaft Front Bearing Cap

c. Remove gearshift shaft assembly. Remove four cap screws and lock washers and lift off gearshift cover with two gaskets and a plate (fig. 40). Remove cotter pin and loosen nut on clamp bolt in shifting fork (fig. 41). Turn out gearshift rod and remove shifting fork (fig. 42).

d. Remove front axle declutch assembly (fig. 37). Remove six declutch carrier attaching nuts and lock washers. Remove the declutch carrier and gasket.

e. Remove transfer case cover. Remove power take-off driving clutch set screw and pull off driving clutch. Remove oil retaining ring. Remove cap screws and lock washers attaching cover to transfer case. Drive out four dowel pins (fig. 43). Use two pinch bars (fig. 44) and remove transfer case cover. CAUTION: *Do not tilt or "cock" the cover or parts will be damaged.*

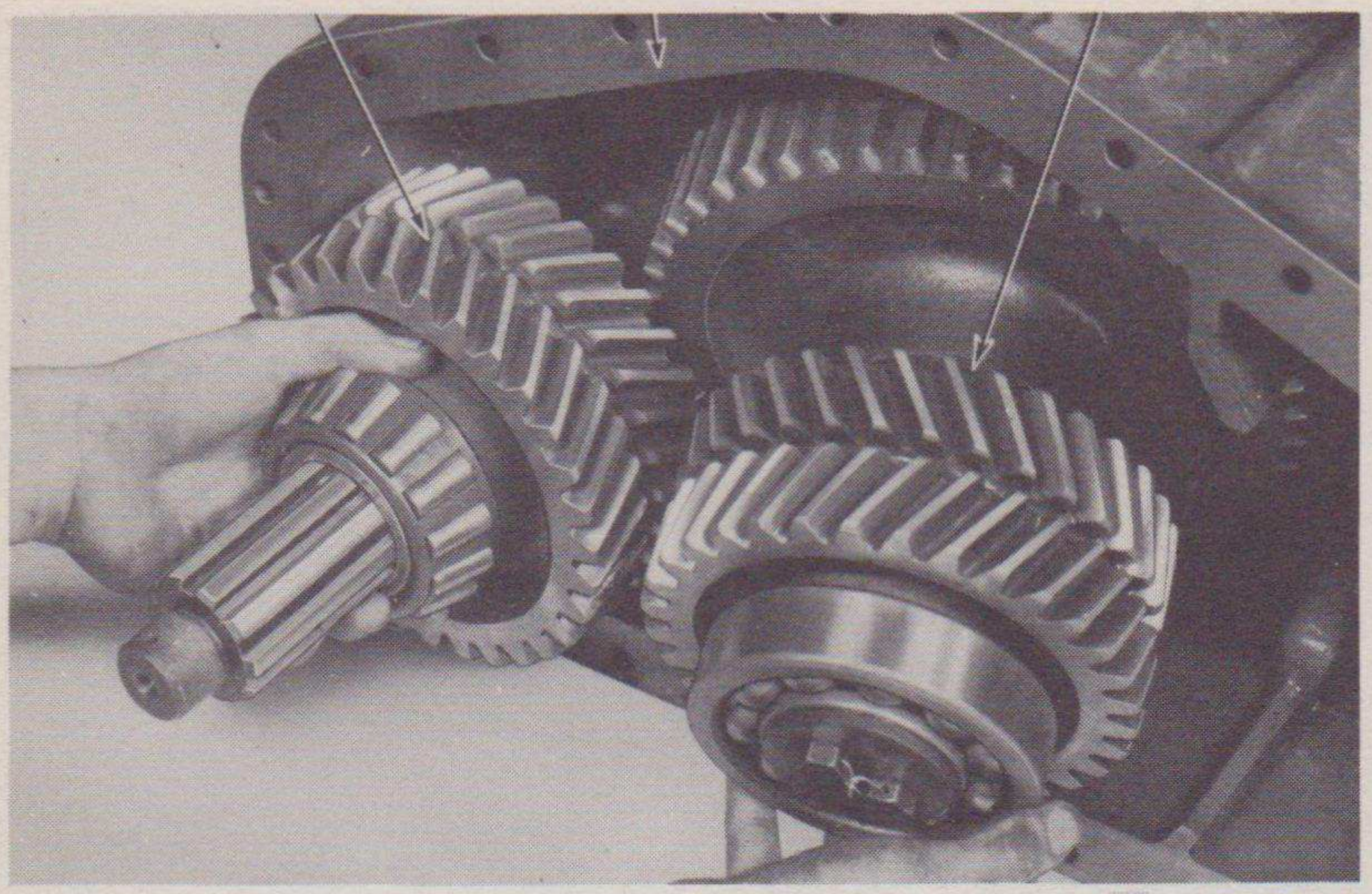


Figure 48 — Removing Driven Shaft and Gear and Idler Shaft and Gear Assemblies

f. Remove shaft assemblies. Remove mainshaft and gear assembly (fig. 46). Remove six cap screws and lock washers, and remove idler shaft front bearing cap (fig. 47). Drive out driven shaft and gear and idler shaft and gear assemblies by tapping each one alternately with a soft hammer from the front end until front bearings have cleared front bearing bores of transfer case (fig. 48).

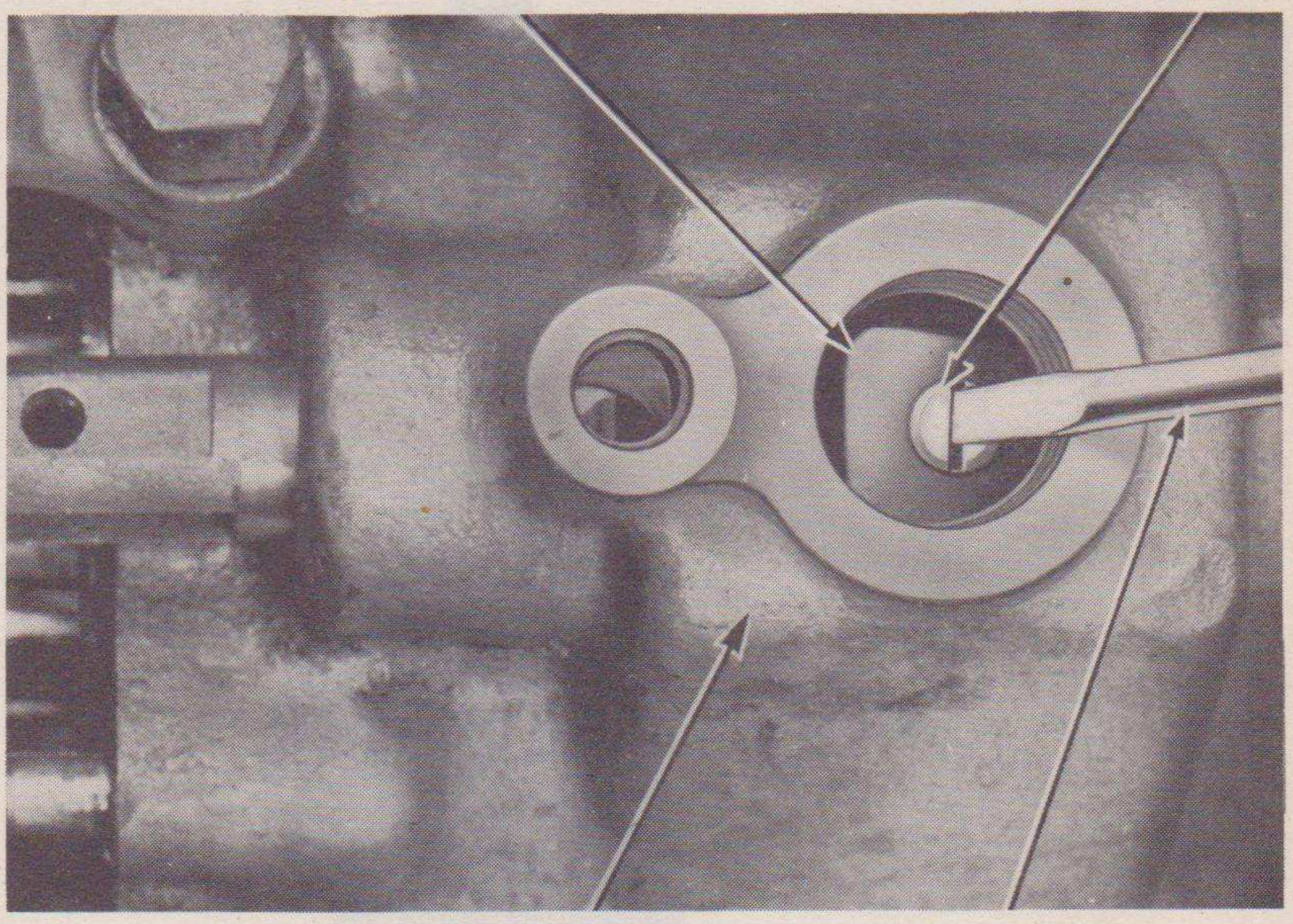
Section III

DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

39. POWER TAKE-OFF DECLUTCH ASSEMBLY.

a. Disassembly.

(1) REMOVE SHIFTING ROD. Remove the shifting rod lock ball retainer screws, washer, spring, and ball (fig. 52). Turn assembly so that hole is downward, to permit ball to fall out. Disconnect shifting rod from declutch lever. Remove oil plug from housing. Remove shifting fork set screw (fig. 49), then remove shifting rod and sliding clutch gear.



RA PD 334443

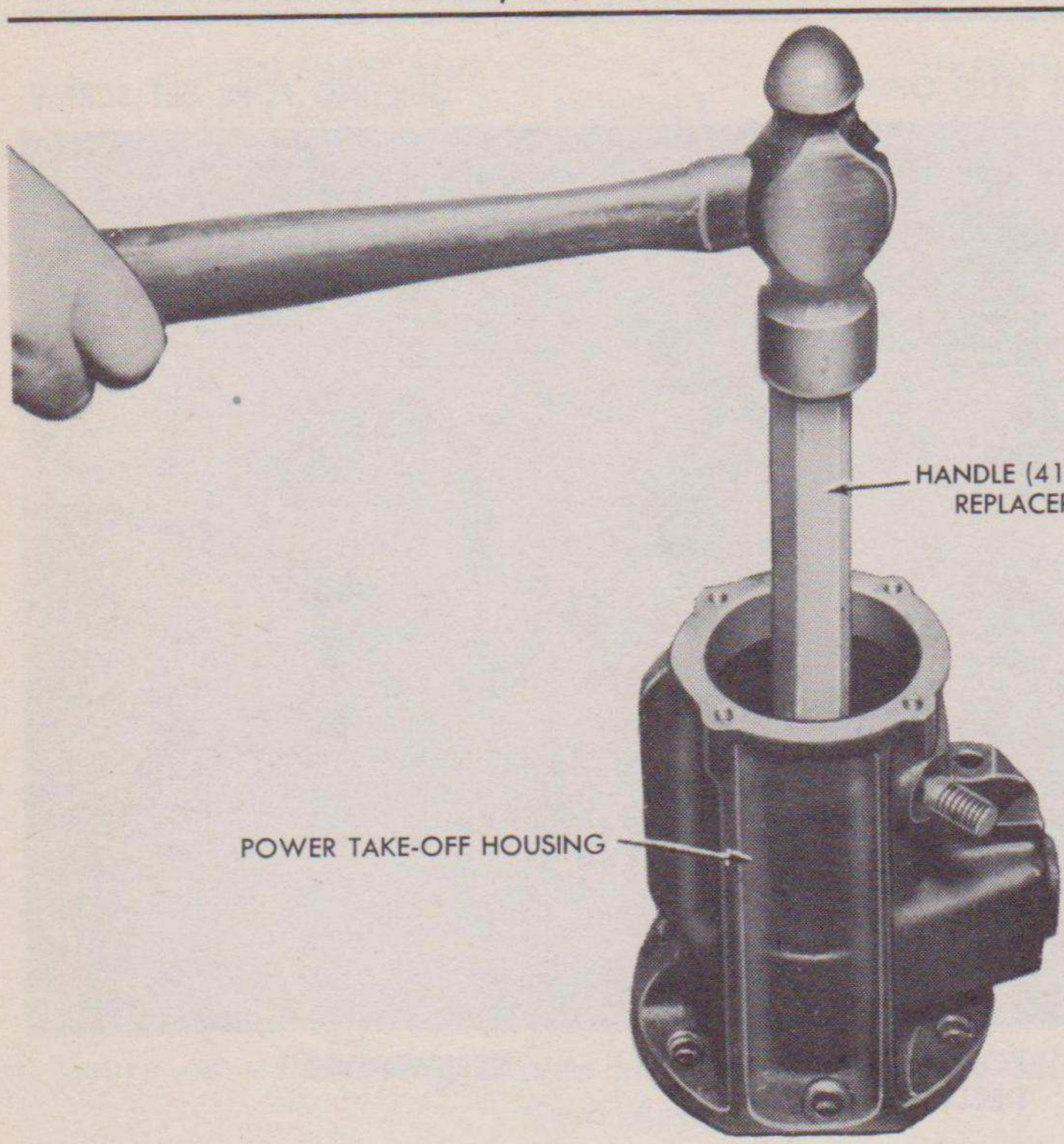
Figure 49 — Loosening Declutch Shifting Fork Set Screw

(2) REMOVE POWER TAKE-OFF DECLUTCH SHAFT. Remove the four cap screws and lock washers which attach the bearing cap to housing. Lift off the cap, gasket, and shim. Remove oil seal from cap. With the power take-off housing clamped in a vise, use a soft drift and drive on the forward end of the shaft, to remove shaft with bearings from housing. Lift shifting fork out of housing. Drive front bearing cup out of housing. Remove bearing cones from shaft with arbor press.

b. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent and dry thoroughly. Check bearings carefully for damage. Check power take-off shaft for damage or wear. Inspect shifter rod for burs and wear. Inspect spring for tension. Refer to paragraph 47 for clearances of new parts. Repair consists of replacing unserviceable parts with serviceable parts.

c. Assembly.

(1) POSITION OF PARTS IN ASSEMBLY. Refer to figure 37 for position of assembled parts.



RA PD 349654

Figure 50 — Driving Front Bearing Cup Into Power Take-off Housing

(2) INSTALL DECLUTCH SHAFT BEARING CONES, CUPS, AND OIL SEALS. Drive the forward bearing cup into its recess in the power take-off housing (fig. 50). Make sure cup "bottoms" in housing. Use replacer (41-R-2385-260) with handle (41-H-1397). Insert a new oil seal into rear bearing cap. Press the bearing cones to seat against the shoulders on the shaft.

(3) INSTALL POWER TAKE-OFF DECLUTCH SHAFT. Turn housing so that oil plug hole is facing downward. Insert the shifting fork, with set screw started in position, into housing. The boss on the fork must face rear of the assembly. Place the sliding clutch gear on splines of the shaft with shifter fork groove toward rear. Slide the shaft and clutch into housing. Install rear bearing cup. Turn the housing upward and make sure the fork inside cage fits into deep groove of the sliding clutch gear.

(4) INSTALL SHIFTING ROD. Slide shifting rod into the power take-off housing and through the shifting fork. Line up shifting rod so that depression in the rod is directly under set screw hole in the

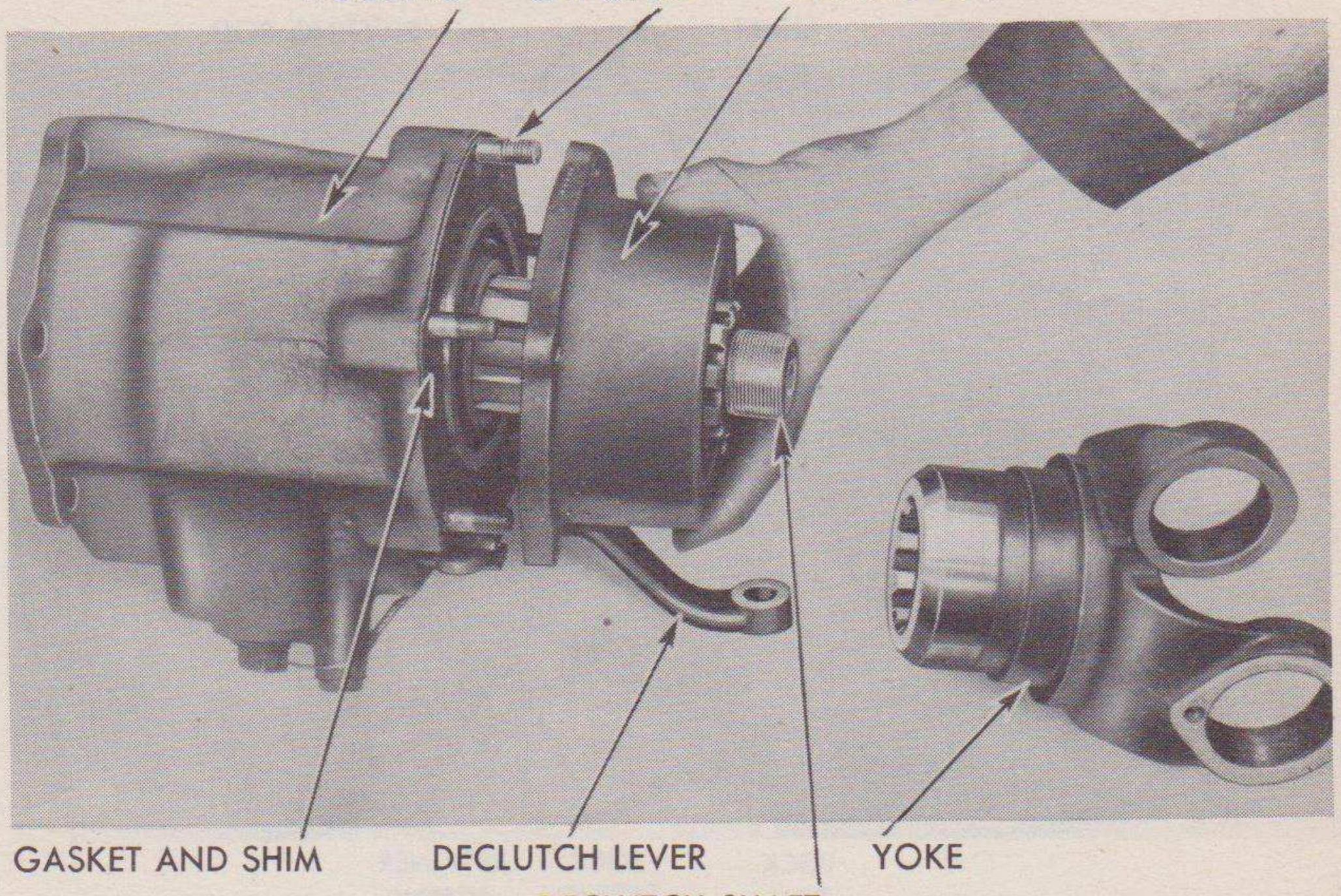


Figure 51 — Removing Front Axle Declutch Carrier Bearing Cap

fork (fig. 52). Insert a screwdriver through the oil plug opening and tighten the set screw (fig. 49). Connect the lever to the shifting rod (fig. 51).

(5) INSTALL POWER TAKE-OFF REAR BEARING CAP. Install the cap with new gasket and proper shims on the housing with lock washers and cap screws. Tighten screws alternately, testing end play in shaft during tightening operation. Refer to step (7) below.

(6) INSTALL LOCK BALL ASSEMBLY AND OIL PLUG. Drop ball and spring into position in the power take-off cage. Place washer on ball spring screw, and insert screw, then turn down tightly.

(7) TEST OPERATION OF ASSEMBLY. Turn shaft to see if bearing adjustment is necessary. Bearings must be adjusted to from 0.003- to 0.005-inch maximum end play. Decreasing shim thickness decreases end play. Increasing shim thickness increases end play.

40. FRONT AXLE DECLUTCHING ASSEMBLY (fig. 37).

a. Disassembly.

(1) REMOVE DECLUTCH CARRIER BEARING CAP (fig. 51). Remove the carrier cap nuts and lock washers. Pull cap off shaft by hand with forward bearing cone. Lift off cap gasket.

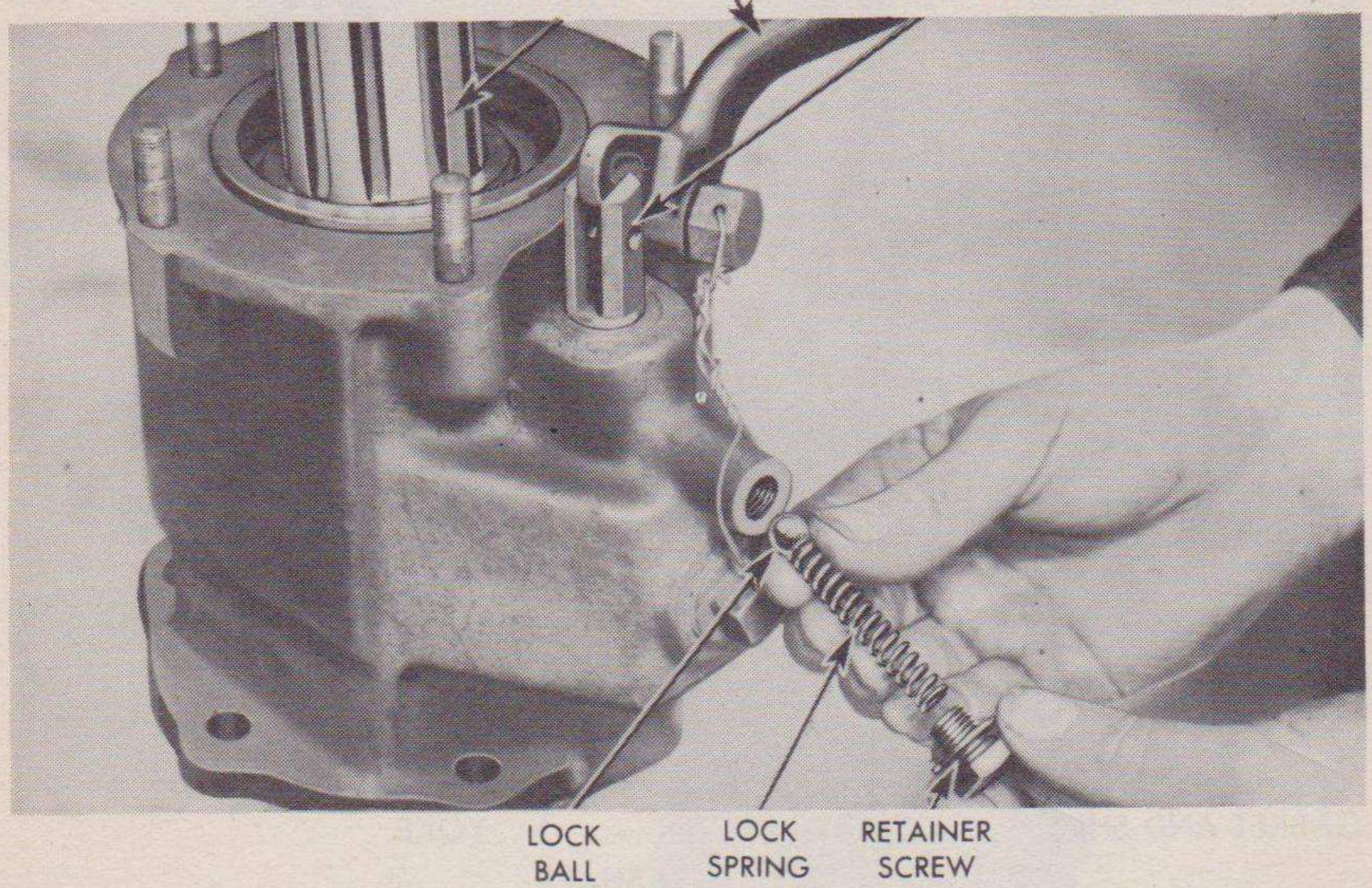


Figure 52 — Removing Front Axle Declutch Shifting Rod Retainer Screw, Spring, and Ball

(2) REMOVE DECLUTCH SHIFTING ROD. Remove the shift lever retaining screw, washer, spring, and lock ball (fig. 52). Remove oil filler plug. Insert a screwdriver through the oil filler plug hole and loosen the shifting fork set screw (fig. 49). Disconnect shifting rod from declutch lever. Pull shifting rod from housing.

(3) REMOVE DECLUTCH SHAFT FROM HOUSING. With soft hammer, drive on rear end of declutch shaft and remove from carrier. Remove sliding clutch gear and shifting fork from housing. Press bearing and spacer off shaft if shaft or bearing is defective.

(4) DISASSEMBLE DECLUTCH CARRIER BEARING CAP. Place bearing cap in a vise. Remove and discard oil seal. If forward bearing cup or cone is defective, remove cup for cap.

(5) REMOVE SHIFTING ROD PACKING AND RETAINER FROM HOUSING. Place the housing in a vise. Using a screwdriver, pry out packing and packing retainer from housing.

b. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent and dry thoroughly. Check bearings carefully for damage. Check declutch shifting shaft for damage and wear. Inspect shifting rod for burs and wear. Use a new oil seal and shift-

ing rod packing. Refer to paragraph 47 for specifications of new parts. Check shifting rod spring for tension. Repair consists of substituting serviceable parts for unserviceable parts.

c. Assembly.

(1) POSITION OF PARTS IN ASSEMBLY. Refer to figure 37 for position of assembled parts.

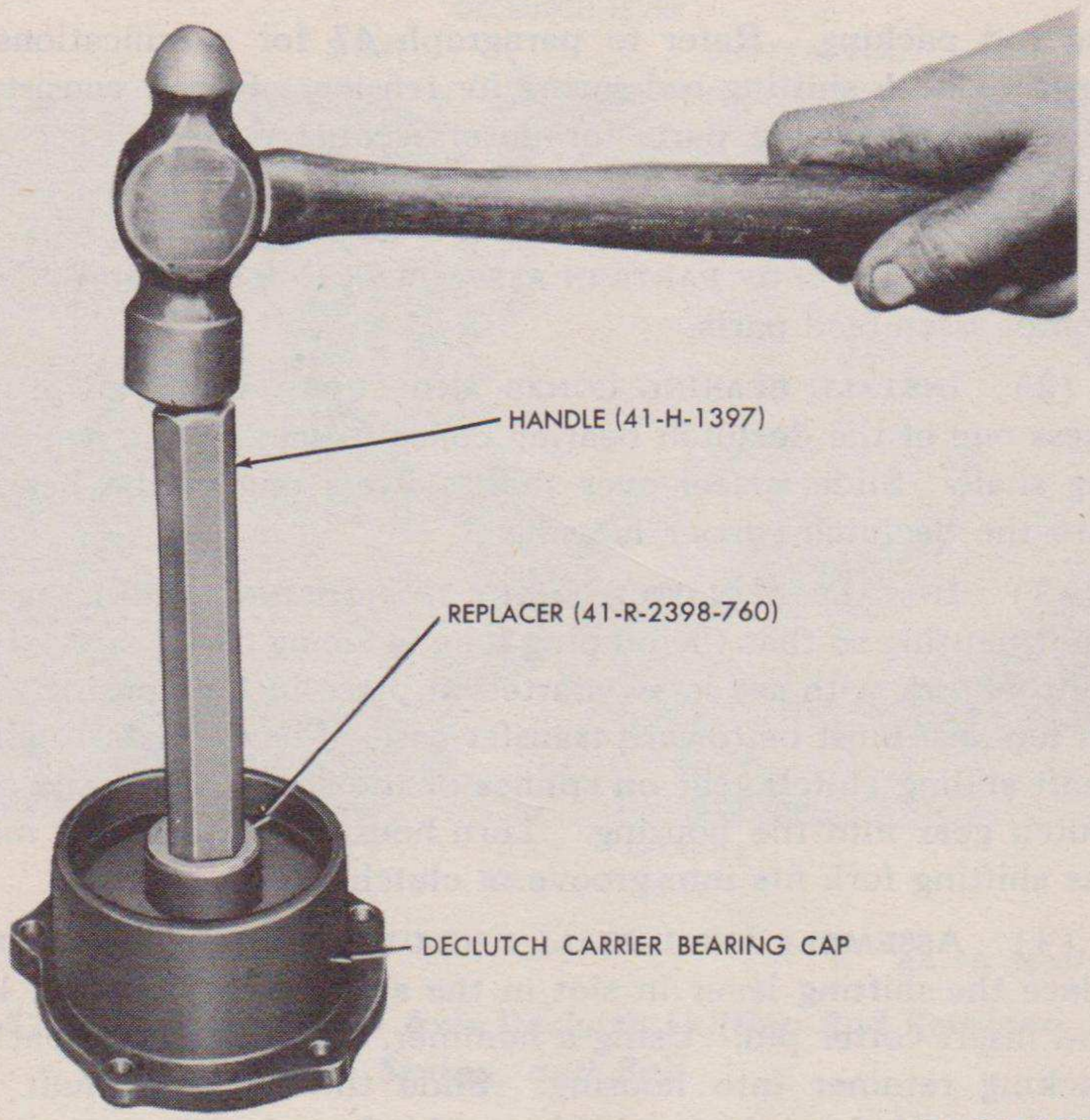
(2) INSTALL BEARING CONES AND CUPS. Using an arbor press, press one of the declutch bearing cones to seat on the declutch shifting shaft. Slide spacer over shaft. Press one of the bearing cups into the declutch carrier housing.

(3) INSTALL DECLUTCH SHAFT IN HOUSING. Turn the declutch shaft housing so that the oil plug hole is facing downward. Insert the shifting fork with set screw started in place in the housing. The boss on the fork must be toward transfer case. Place the declutch shifting shaft sliding clutch gear on splines of the shaft. Slide the shaft and clutch gear into the housing. Turn housing upward and make sure the shifting fork fits into groove in clutch gear.

(4) ASSEMBLE AND INSTALL DECLUTCH SHIFTING ROD IN HOUSING. Place the shifting lever in slot in the shifting rod. Install lever pin and insert cotter pin. Using a hammer, tap shifting rod packing and packing retainer into housing. Slide the declutch shaft into the housing and through the shifting rod. Line up the rod so that depression in rod is directly under set screw hole in the fork. Insert a screwdriver through oil plug hole and tighten set screw in the shifting fork (fig. 49). Install the shifting lever cap screw to attach lever to housing.

(5) INSTALL DECLUTCH HOUSING BEARING CAP (fig. 51). Install bearing cup in cap (fig. 53) using replacer (41-R-2398-760) and handle (41-H-1397). Install cap gasket over studs. Slide housing cap over shaft onto housing studs. Install lock washers and tighten nuts fingertight. Install bearing shim over shaft. Press second bearing cone over shaft. Install the universal joint yoke. Install the declutch shaft nut and cotter pin, making sure nut seats against yoke and that yoke is against forward bearing. Tighten cap to housing nuts. Adjust shaft bearings, step (6) below. Remove yoke, install oil seal flush with face of cap, and install yoke.

(6) TEST BEARING ADJUSTMENT (fig. 37). Turn shaft to see if bearing adjustment is necessary. Shaft must turn easily with no perceptible end or side play. Increasing thickness of bearing shim increases bearing play; conversely, decreasing bearing shim thickness decreases play. After properly adjusting bearings, perform remaining operations in step (5) above.



RA PD 353073

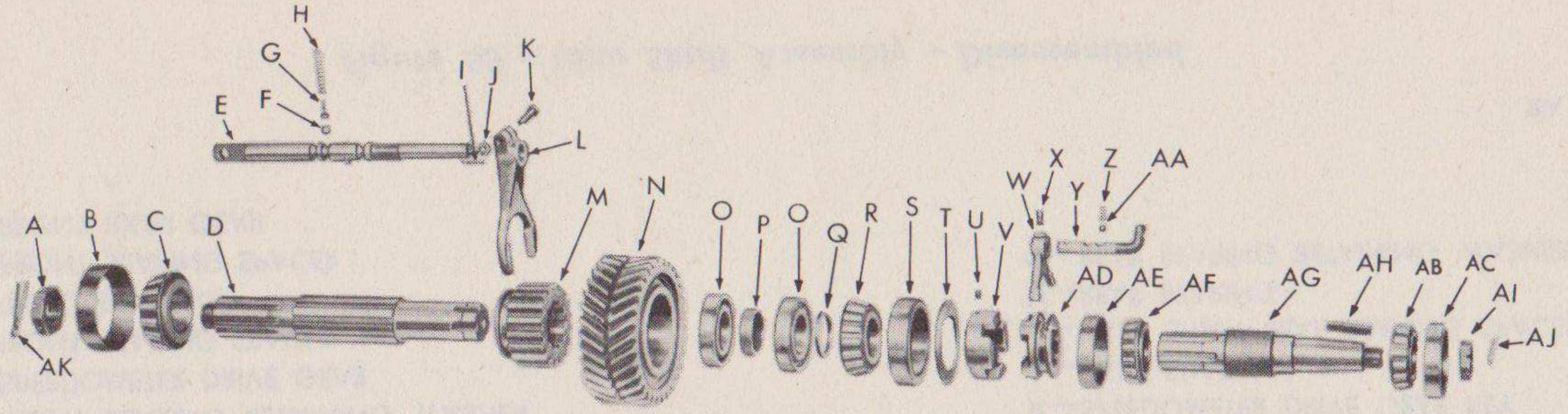
Figure 53 — Installing Bearing Cup in Front Axle Declutch Assembly Cap

(7) INSTALL DECLUTCH SHIFTING ROD RETAINER SCREW, SPRING, AND BALL (fig. 52). Drop the lock ball and spring into position in the declutch shaft housing. Place washer on the screw and insert screw in place in housing.

41. MAINSHAFT ASSEMBLY (fig. 54).

a. Disassembly (fig. 54). Press off front bearing cone from mainshaft. Remove sliding gear from mainshaft. Remove set screw in driving clutch gear. Press off the driving clutch gear; oil dam, rear bearing cup and cone, rear bearing spacer, and direct drive gear with two bearings with spacer between from mainshaft.

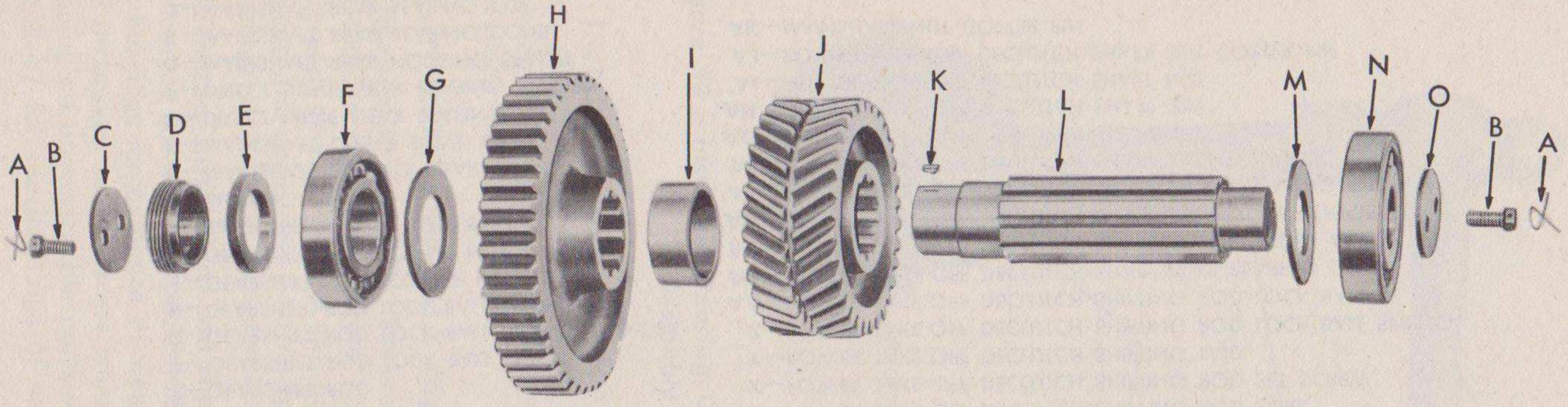
b. Cleaning, inspection, and repair. Wash all parts thoroughly in dry cleaning solvent. Inspect shaft for wear, burs, and rough spots. Inspect bearings for evidence of wear or damage. Inspect gears for cracked or broken teeth, excess wear, or roughness. Repair consists of replacing all unserviceable parts with serviceable parts. Refer to paragraph 47 for specifications of new parts.



A—MAINSHAFT NUT
B—MAINSHAFT FRONT BEARING CUP
C—MAINSHAFT FRONT BEARING CONE
D—MAINSHAFT
E—GEARSHIFT ROD
F—GEARSHIFT ROD LOCK BALL
G—GEARSHIFT ROD LOCK BALL SPRING PLUNGER
H—GEARSHIFT ROD LOCK BALL SPRING
I—GEARSHIFT FORK COTTER PIN
J—GEARSHIFT FORK CLAMP NUT
K—GEARSHIFT FORK CLAMP BOLT
L—SHIFTING FORK
M—MAINSHAFT SLIDING GEAR
N—MAINSHAFT DIRECT DRIVE GEAR
O—DIRECT DRIVE GEAR BEARING
P—DIRECT DRIVE GEAR BEARING SPACER
Q—MAINSHAFT REAR HOUSING SPACER
R—MAINSHAFT REAR BEARING CONE
S—MAINSHAFT REAR BEARING CUP
T—MAINSHAFT REAR BEARING OIL DAM
U—MAINSHAFT DRIVING CLUTCH GEAR SET SCREW
V—MAINSHAFT DRIVING CLUTCH GEAR
W—POWER TAKE-OFF DECLUTCH SHIFTING ROD FORK
X—POWER TAKE-OFF DECLUTCH SHIFTING ROD SET SCREW
Y—POWER TAKE-OFF DECLUTCH SHIFTING ROD
Z—POWER TAKE-OFF DECLUTCH SHIFTING ROD LOCK BALL SPRING
AA—POWER TAKE-OFF DECLUTCH SHIFTING ROD LOCK BALL
AB — POWER TAKE-OFF DECLUTCH SHAFT REAR BEARING CONE
AC — POWER TAKE-OFF DECLUTCH SHAFT REAR BEARING CUP
AD — POWER TAKE-OFF DECLUTCH SHAFT SLIDING CLUTCH GEAR
AE — POWER TAKE-OFF DECLUTCH SHAFT FRONT BEARING CUP
AF — POWER TAKE-OFF DECLUTCH SHAFT FRONT BEARING CONE
AG — POWER TAKE-OFF DECLUTCH SHAFT
AH — POWER TAKE-OFF DECLUTCH SHAFT KEY
AI—POWER TAKE-OFF DECLUTCH SHAFT NUT
AJ—POWER TAKE-OFF DECLUTCH SHAFT NUT COTTER PIN
AK—MAINSHAFT-NUT COTTER PIN

RA PD 353074

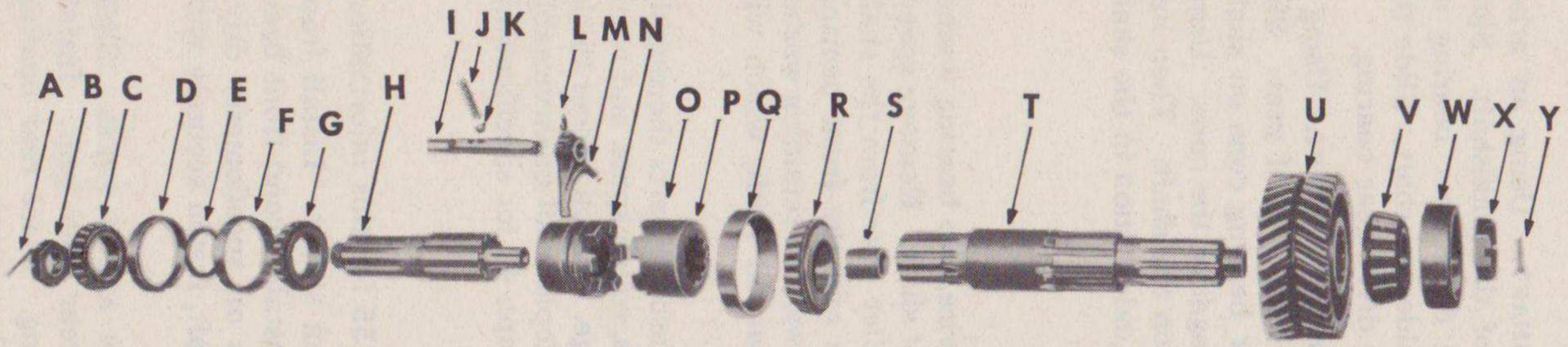
Figure 54 — Mainshaft and Power Take-off Declutch Shaft Assemblies — Disassembled



A—BEARING WASHER SCREW LOCK WIRE
B—BEARING WASHER SCREW
C—FRONT BEARING RETAINING WASHER
D—SPEEDOMETER DRIVE GEAR
E—FRONT BEARING SPACER
F—FRONT BEARING
G—FRONT BEARING SPACER
H—FRONT IDLER GEAR
I—IDLER GEAR SPACER
J—REAR IDLER GEAR
K—SPEEDOMETER DRIVE GEAR KEY
L—IDLER SHAFT
M—IDLER SHAFT REAR BEARING SPACER
N—REAR BEARING
O—REAR BEARING RETAINING WASHER

RA PD 353075

Figure 55 — Idler Shaft Assembly — Disassembled



A—DECLUTCH SHAFT COTTER PIN
B—DECLUTCH SHAFT NUT
C—DECLUTCH SHAFT FRONT BEARING CONE
D—DECLUTCH SHAFT BEARING CUP
E—DECLUTCH SHAFT BEARING SHIM
F—DECLUTCH SHAFT REAR BEARING CUP
G—DECLUTCH SHAFT REAR BEARING CONE
H—DECLUTCH SHAFT
I—DECLUTCH SHIFTING ROD
J—DECLUTCH SHIFTING ROD LOCK BALL SPRING
K—DECLUTCH SHIFTING ROD LOCK BALL
L—DECLUTCH SHIFTING ROD FORK SET SCREW
M—DECLUTCH SHIFTING ROD FORK
N—DECLUTCH SHAFT SLIDING CLUTCH GEAR
O—DRIVEN SHAFT DRIVING CLUTCH GEAR SET SCREW
P—DRIVEN SHAFT DRIVING CLUTCH GEAR
Q—DRIVEN SHAFT FRONT BEARING CUP
R—DRIVEN SHAFT FRONT BEARING CONE
S—DECLUTCH SHAFT PILOT BUSHING
T—DRIVEN SHAFT
U—DRIVEN GEAR
V—DRIVEN SHAFT REAR BEARING CONE
W—DRIVEN SHAFT REAR BEARING CUP
X—DRIVEN SHAFT NUT
Y—DRIVEN SHAFT NUT COTTER PIN

RA PD 353076

Figure 56 — Driven and Front Axle Declutch Shaft Assemblies — Disassembled

c. Assembly.

(1) POSITION OF ASSEMBLED PARTS. Refer to figures 37 and 54 for this information.

(2) ASSEMBLE SLIDING GEAR ON MAINSHAFT. Using an arbor press, press the front bearing on front end of the mainshaft. Slide the sliding gear on shaft. Press the direct drive gear bearing on shaft. Press bearing to seat against the shoulder on shaft. Slide the spacer on shaft, then press on the rear direct drive gear bearing.

(3) ASSEMBLE THE DIRECT DRIVE GEAR ON MAINSHAFT. Using a soft hammer, tap gear so bearings are flush with side of gear. Slip rear bearing spacer on the shaft. Press rear bearing cone on shaft. Slide rear bearing cup and oil dam on shaft against the cone. Using a soft hammer, drive the driving clutch gear on the shaft. Then line up the set screw hole in clutch gear with the indentation in the shaft. Install clutch set screw and tighten securely.

42. IDLER SHAFT ASSEMBLY.

a. Disassembly (fig. 55). Remove lock wire, two bearing washer screws, and retaining washer from front end of shaft. Remove speedometer drive gear and key. Press off front idler gear from the shaft, which will remove two front bearing spacers and the front bearing. Remove locking wire, two bearing washer screws, and retaining washer from rear end of shaft. Press rear idler gear off shaft, which will remove rear bearing spacer and rear bearing.

b. Cleaning, inspection, and repair. Wash all parts thoroughly in dry cleaning solvent. Inspect shaft for burs, rough spots, and wear. Inspect bearings and gears for wear or damage. Check spacer thicknesses (par. 47). Replace spacers, if worn. Replace all unserviceable parts with serviceable parts. Refer to paragraph 47 for specifications of new parts.

c. Assembly.

(1) POSITION OF PARTS. Refer to figure 55 for this information.

(2) PRESS FRONT IDLER GEAR ONTO IDLER SHAFT. Install front bearing spacer, press on front bearing, then install second front bearing spacer. Insert key in keyway and press on speedometer drive gear. Position retaining washer on end of shaft, fasten securely with two screws, and lock with lock wire.

(3) REVERSE POSITION OF ASSEMBLY ON ARBOR PRESS. Slide idler gear spacer onto shaft, then press on rear idler gear. Install rear bearing spacer, then press on rear bearing. Place rear bearing retaining washer on end of shaft, fasten securely with two screws, and lock with lock wire.

43. DRIVEN SHAFT ASSEMBLY.

a. Disassembly (fig. 56). Press off rear bearing cone and driven gear. Reverse the position of shaft in the press. Remove driving clutch gear set screw from clutch gear, and press off front bearing and clutch gear.

b. Cleaning, inspection, and repair. Wash all parts thoroughly in dry cleaning solvent. Inspect shaft and pilot bushing for burs, rough spots, and wear. Inspect bearings for wear or damage. Inspect gear for wear or damage. Replace all unserviceable parts with serviceable parts. Refer to paragraph 47 for specifications of new parts.

c. Assembly. Refer to figures 56 and 37 for position of assembled parts. Press driven gear on shaft, then press on rear bearing cone. Reverse position of shaft in press, and press on front bearing cone. Slide clutch gear onto front end of shaft. Line up set screw hole in clutch gear with indentation in shaft. Insert set screw and tighten securely.

44. TRANSFER CASE, COVER, CAPS, AND DECLUTCH HOUSINGS.

a. Clean and inspect these parts for damage and wear. Check diameters of all bearing bores. Replace worn or damaged parts with serviceable parts. In the transfer case cover, install the rear mainshaft bearing cup and the driven shaft rear bearing cup. In transfer case, install front mainshaft bearing cup and front driven shaft bearing cup.

Section IV

ASSEMBLY, TEST, AND DATA

45. ASSEMBLY (fig. 37).

a. Preliminary instructions. Lubricate all subassemblies with a light coating of prescribed lubricant (see lubrication order).

b. Position mainshaft, idler shaft, and driven shaft assemblies in case. Position driven shaft assembly in case, then carefully position idler shaft assembly in case, being careful to avoid gear tooth injury when meshing driven and rear idler gears. Use a soft-faced hammer, and tap ends of shafts alternately until front bearing of idler shaft is in correct position (fig. 37). Carefully position mainshaft and gear assembly in case, being careful to mesh rear idler gear with direct drive gear of the mainshaft.

c. Install transfer case cover. Place a new gasket on transfer case. Place transfer case cover in position and, using a soft hammer,

drive until seated over shaft bearings. Carefully guide mainshaft and idler shaft rear bearings into position in the cover, by hand. Install four taper pins and drive into place to hold transfer case to cover. Install transfer case-to-cover bolts, lock washers, and nuts.

d. Adjust end play of drive and driven shafts and adjust mesh of drive, idler, and driven gears (fig. 37).

(1) Install power take-off declutch assembly (subpar. **e** below), then assemble and install mainshaft front bearing cap (subpar. **f** below). Test end play of mainshaft. If end play is present, remove a sufficient number of shims from beneath the front bearing cap to remove all end play without preloading mainshaft bearings. If no end play is present, add a sufficient quantity of shims under front bearing cap to remove bearing preload, without adding end play to mainshaft.

(2) Position the idler shaft assembly (by tapping end of shaft with a soft hammer) to obtain the maximum backlash between drive gear and idler gear. NOTE: *Make a record of this backlash.*

(3) Remove the power take-off declutch housing from the cover, and keep the gasket and shims with the assembly. Remove the mainshaft front bearing cap and keep gasket and shims with the assembly.

(4) Install front axle declutch assembly (subpar. **h** below). Assemble and install driven shaft rear bearing cap (subpar. **g** below). Test end play of driven shaft. If end play is present, remove a sufficient number of shims from beneath the rear bearing cap to remove all end play without preloading bearings. If no end play is present, add a sufficient quantity of shims under rear bearing cap to remove bearing preload, without adding end play to shaft.

(5) Position the idler shaft assembly (by tapping end of shaft with a soft hammer) to obtain the maximum backlash between driven gear and idler gear. NOTE: *Make a record of this backlash.*

(6) With the previously determined correct gasket and shims for the power take-off declutch housing and the mainshaft front bearing cap, install these assemblies. If backlash between the idler and the drive and driven gears is less than the records obtained in steps (2) and (5) above, obtain the original backlash by relocating the position of the mainshaft in the transfer case. To move the mainshaft toward rear, remove a shim from under the power take-off declutch housing and add this shim to the pack under the mainshaft front bearing cap. To move the mainshaft forward, reverse this procedure.

(7) After the mainshaft has been positioned correctly, add one 0.0015-inch shim under the power take-off declutch housing, main-

shaft front bearing cap, driven shaft rear bearing cap, and front axle declutch housing. This will give the required 0.003- to 0.005-inch end play in the mainshaft and driven shaft.

e. Install power take-off declutch assembly. Place a new power take-off housing gasket on the studs. Place the shims on the studs (these were tagged at disassembly). Make sure the oil holes in gasket and shims line up properly. Place the power-take-off assembly over studs, and install lock washers and nuts.

f. Assemble and install mainshaft front bearing cap (fig. 37). Install bearing cup into bearing cap. Tap a new oil seal into cap. Install a new gasket on cage studs. Place the cage on the studs and install lock washers and nuts. Refer to subparagraph **d** above, for adjustment instructions.

g. Assemble and install driven shaft bearing cap. Using an arbor press, install bearing cup into the bearing cap. Tap oil seal into cage. Install shim and a new gasket on the cage studs. Place cap on the studs and install lock washers and nuts.

h. Install front axle declutch assembly. Place shim and new declutch housing gasket on studs. Place housing over studs and install lock washers and nuts. Refer to subparagraph **d** above, for adjustment instructions.

i. Install idler shaft rear bearing cover. Place the idler shaft rear bearing cover gasket and cover in position. Install lock washers and cap screws.

j. Install transfer case gear shifting fork, rod, and cover.

(1) Insert the shifting fork bolt in fork. Install lock washer and thread nut about eight turns. Place fork assembly in transfer case (through fork cover opening) with the fork fitting into groove around the mainshaft sliding gear. Place the shifting rod packing in transfer case and tap it down with a soft hammer. Position the retainer and tap it down until flush with case.

(2) Slide shifting rod into the case until it meets the fork, then screw it in the rest of the way through the fork. Position shifting rod as shown in figure 37. Tighten fork nut and insert cotter pin. Drop lock ball, plunger, and spring into hold in case. Position the breather plate with a gasket on each side, on transfer case, and install lock washers and cap screws.

k. Install idler shaft forward bearing cover. Place idler shaft front bearing cover gasket and cover in position, and install lock washers and cap screws.

l. Install mainshaft yoke, and driven shaft companion flange. Press yoke on mainshaft, and install nut and cotter pin. Press companion flange on driven shaft. Install nut and cotter pin.

46. TEST.

a. Procedure. Fill transfer case with proper grade and quantity of lubricant (see lubrication order) and give rotary power test if available. NOTE: *Do not neglect to fill power take-off and declutch units.* Attach mainshaft to power source and test in both speeds, stopping unit between each shifting to avoid breaking gears. Any undue noise will indicate faulty assembly, which must be checked step by step. If unit operates quietly and smoothly in both speeds, install in vehicle.

47. DATA.

a. Gear backlash.

Helical	0.005 in. to 0.008 in.
Spur	0.005 in. to 0.010 in.

b. Clearances.

Mainshaft sliding gear to shifting fork	0.012 in. to 0.017 in.
Declutch sliding clutch to fork	0.009 in. to 0.012 in.
Declutch sliding clutch to shaft	0.003 in. to 0.004 in.
End play in mainshaft and driven shaft	0.003 in. to 0.005 in.

c. Spring specifications.

(1) HIGH AND LOW SHIFT ROD LOCK SPRING.

Free length	2 in.
Pressure at 1 in.	50 to 60 lb

(2) DECLUTCH SHAFT LOCK SPRING.

Free length	2 in.
Pressure at 1 in.	40 to 50 lb

CHAPTER 6

FRONT AXLE AND UNIVERSAL JOINTS

Section I

DESCRIPTION AND DATA

48. DESCRIPTION AND OPERATION.

a. Description (figs. 57 and 58). The front axle is a driving unit of the double-reduction, full-floating type. The double reduction is accomplished by a spiral bevel pinion and bevel ring gear in connection with a spur gear second reduction. Power is transmitted to the front axle from the engine through the transfer case, and through a propeller shaft. Constant velocity type universal joints transmit the power from the axle to the driving wheels.

b. Operation. A control lever in the cab enables the driver to engage or disengage the front axle at will.

49. DATA.

Make	Timken
Model	F-3100-W-X-6
Suspension	Through springs
Gear ratio	7.33 to 1
Bearings	Timken tapered roller
Bevel pinion cone (front	No. 59200-Front
Bevel pinion cup (front)	No. 59412-Front
Bevel pinion cone (rear)	No. 623-Rear
Bevel pinion cup (rear)	No. 612-Rear
Differential cone	No. 581
Differential cup	No. 572
Spur pinion and cross shaft cone (right hand)	No. 65225
Spur pinion and cross shaft cone (left hand)	No. 623
Spur pinion cup (right hand)	No. 65500
Spur pinion cup (left hand)	No. 612
Steering knuckle cone	No. 53176
Steering knuckle cup	No. 53387

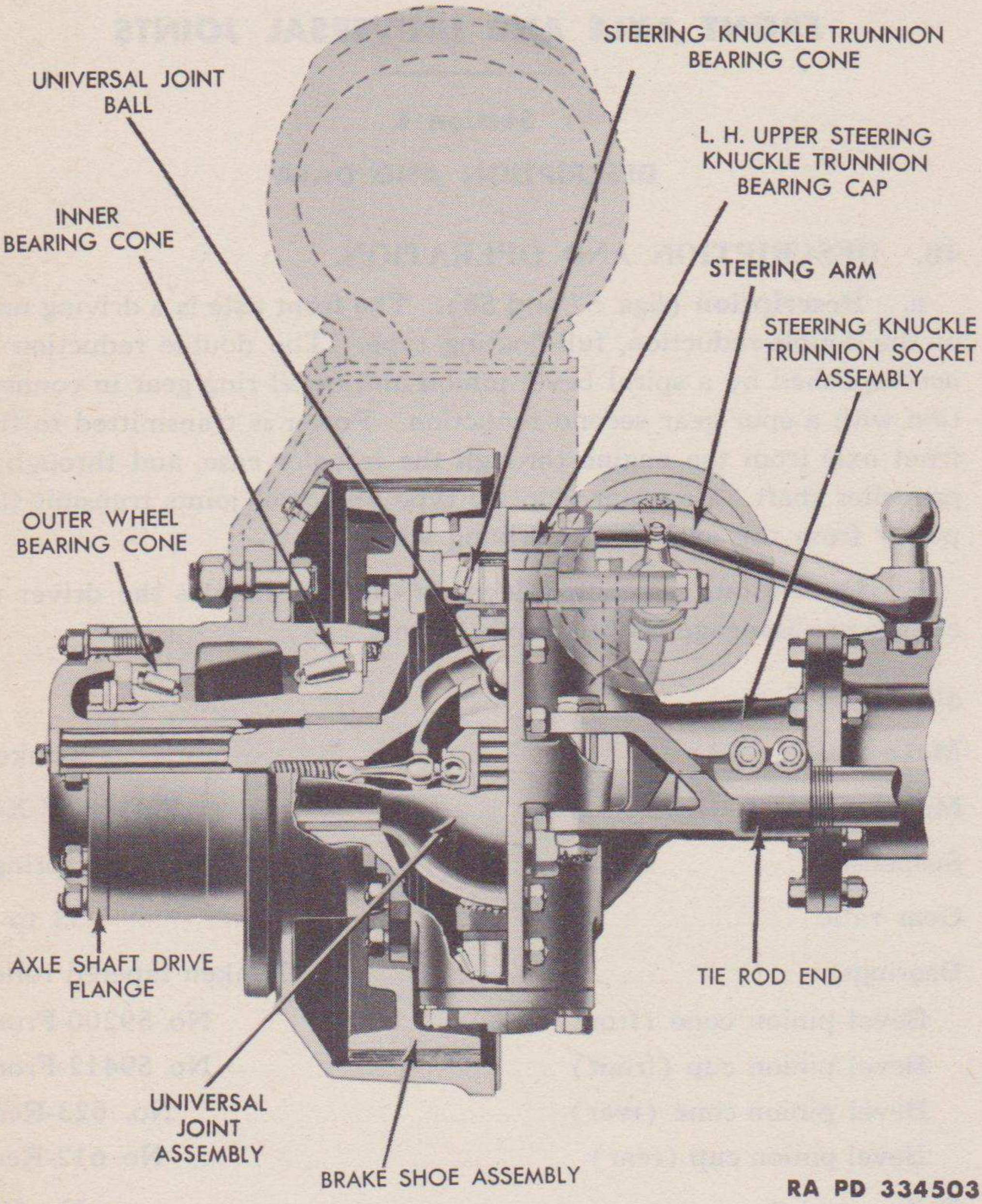


Figure 57 — Front Axle (Wheel End) — Sectional View

Bearing Adjusting Method

Bevel pinion and shaft	Shims
Differential	Adjusting ring
Spur pinion and cross shaft	Shims
Steering knuckle	Shims

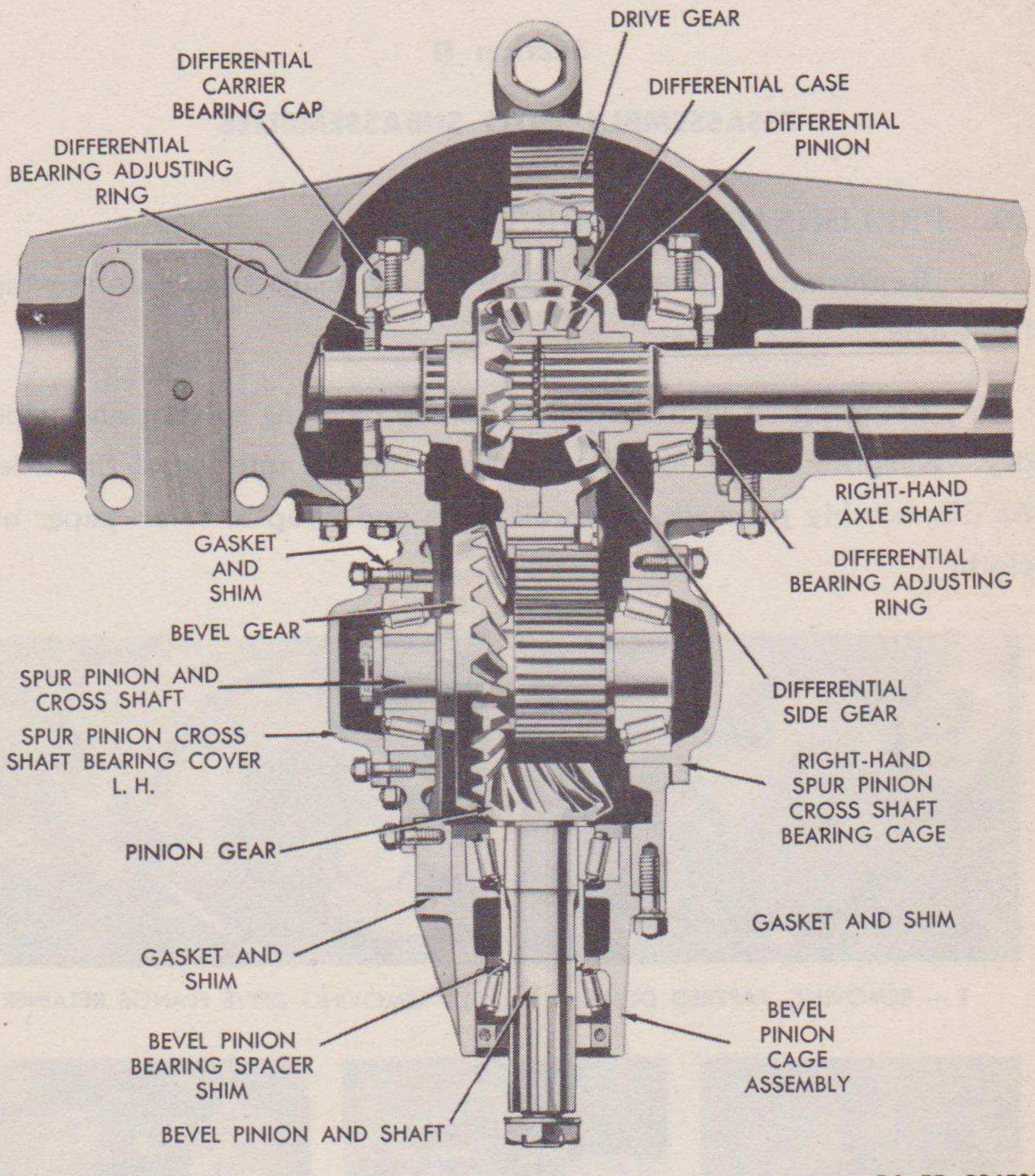


Figure 58 — Front Axle Differential and Carrier Assembly — Sectional View

Bearing Adjustment	
Bevel pinion	4 to 8 inch-pounds of torque
Differential	4 to 8 inch-pounds of torque
Spur pinion and cross shaft	4 to 8 inch-pounds of torque
Steering knuckle	Barely perceptible, but loose enough so bearings do not bind
Backlash	
Bevel gear to bevel pinion	0.006 to 0.010 in.

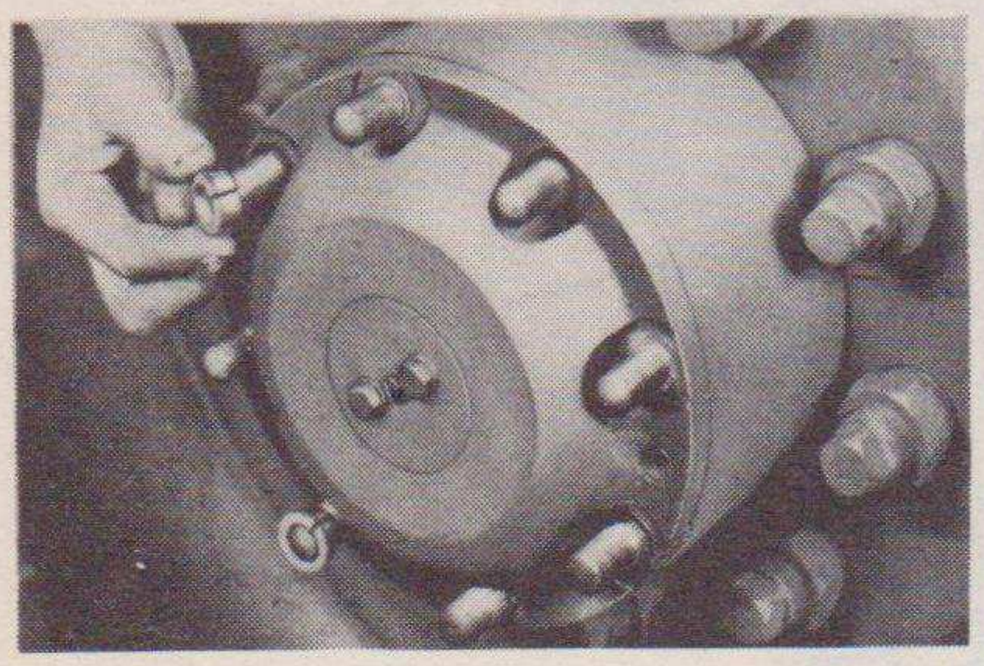
Section II

DISASSEMBLY INTO SUBASSEMBLIES

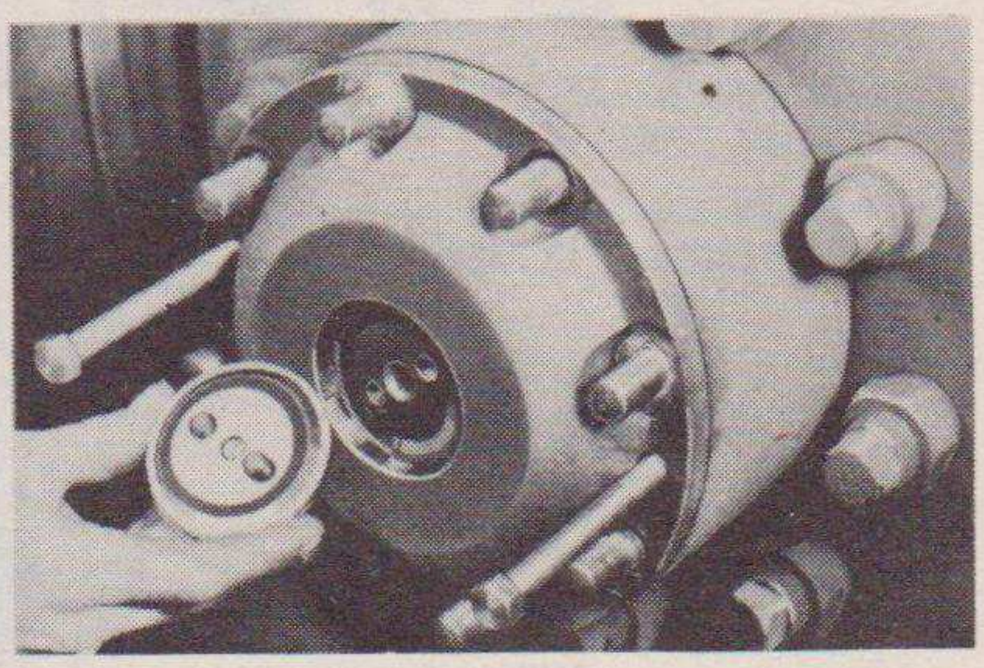
50. PRELIMINARY INSTRUCTIONS.

a. Remove axle. Refer to TM 9-813 for instructions on removing front axle.

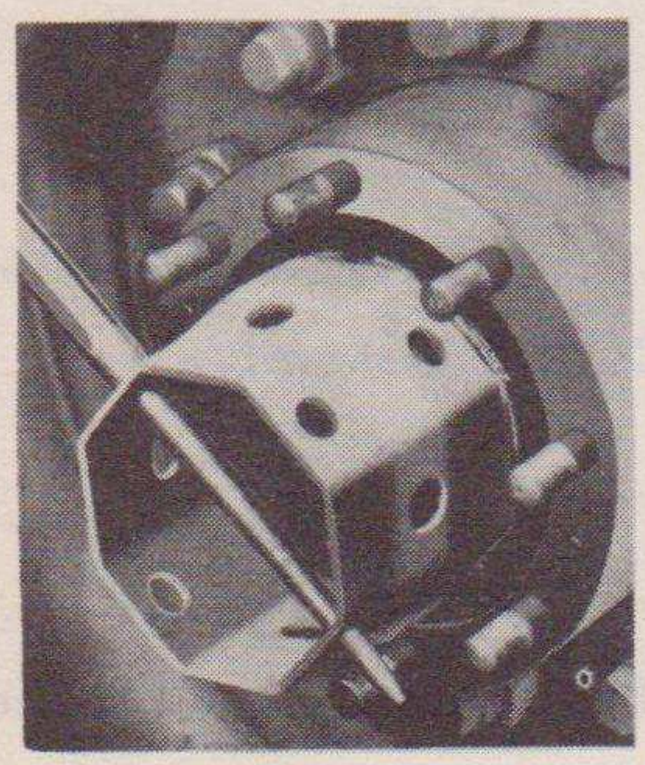
b. Cleaning. Clean the unit with dry cleaning solvent and wipe dry. Keep all dirt or foreign material from the interior of the axle. As disassembly proceeds, clean all parts and wrap in clean paper or cloth.



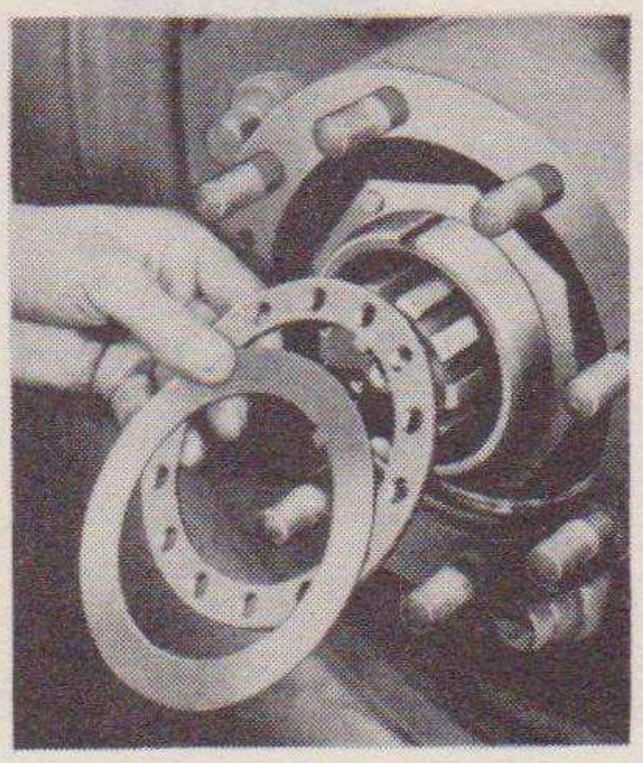
1 — REMOVING TAPERED DOWEL



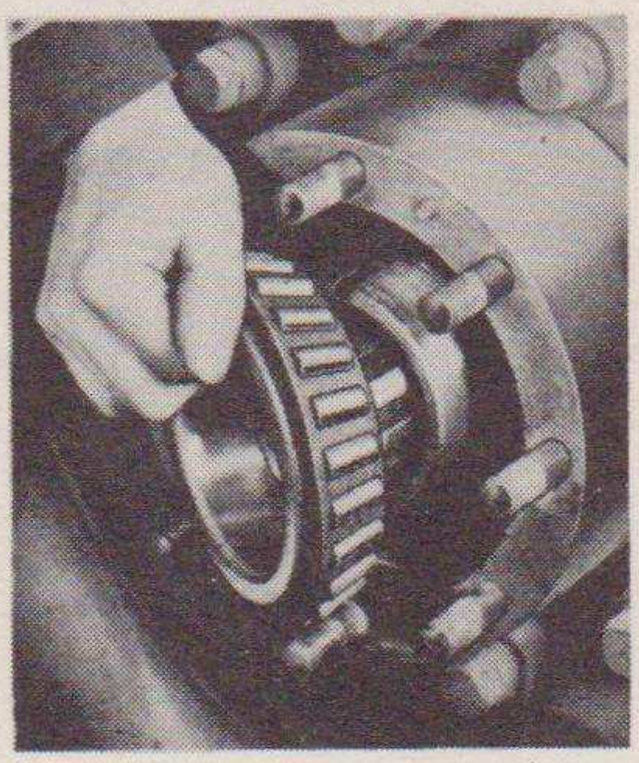
2—REMOVING DRIVE FLANGE RETAINER



3 — REMOVING WHEEL BEARING LOCK NUT WITH WRENCH (41-W-3825-72)



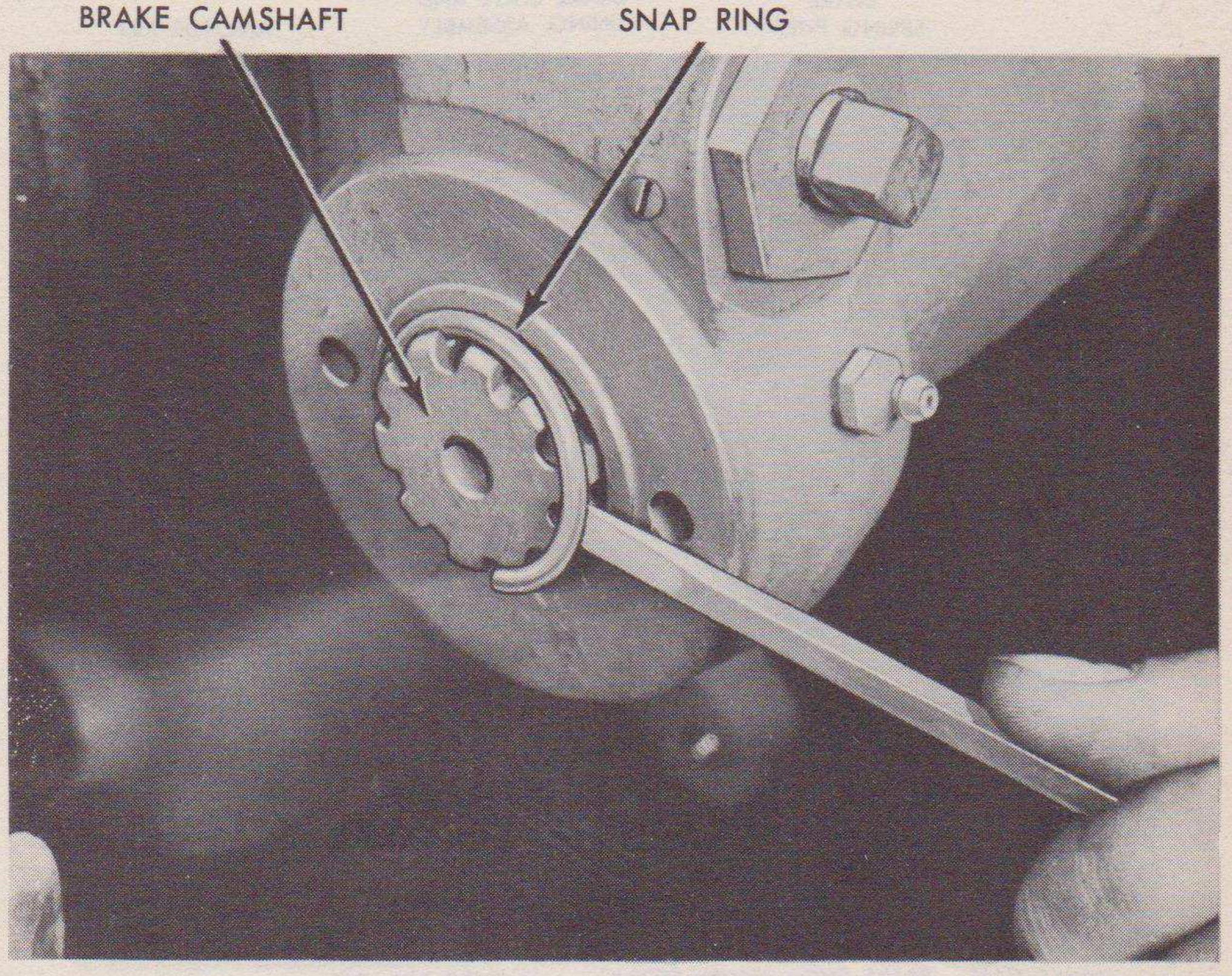
4 — REMOVING LOCK RING NUT AND WASHER



5 — REMOVING OUTER BEARING CONE

RA PD 353077

Figure 59 — Removing Outer Bearing Cone



RA PD 334458

Figure 60 — Removing Brake Camshaft Snap Ring

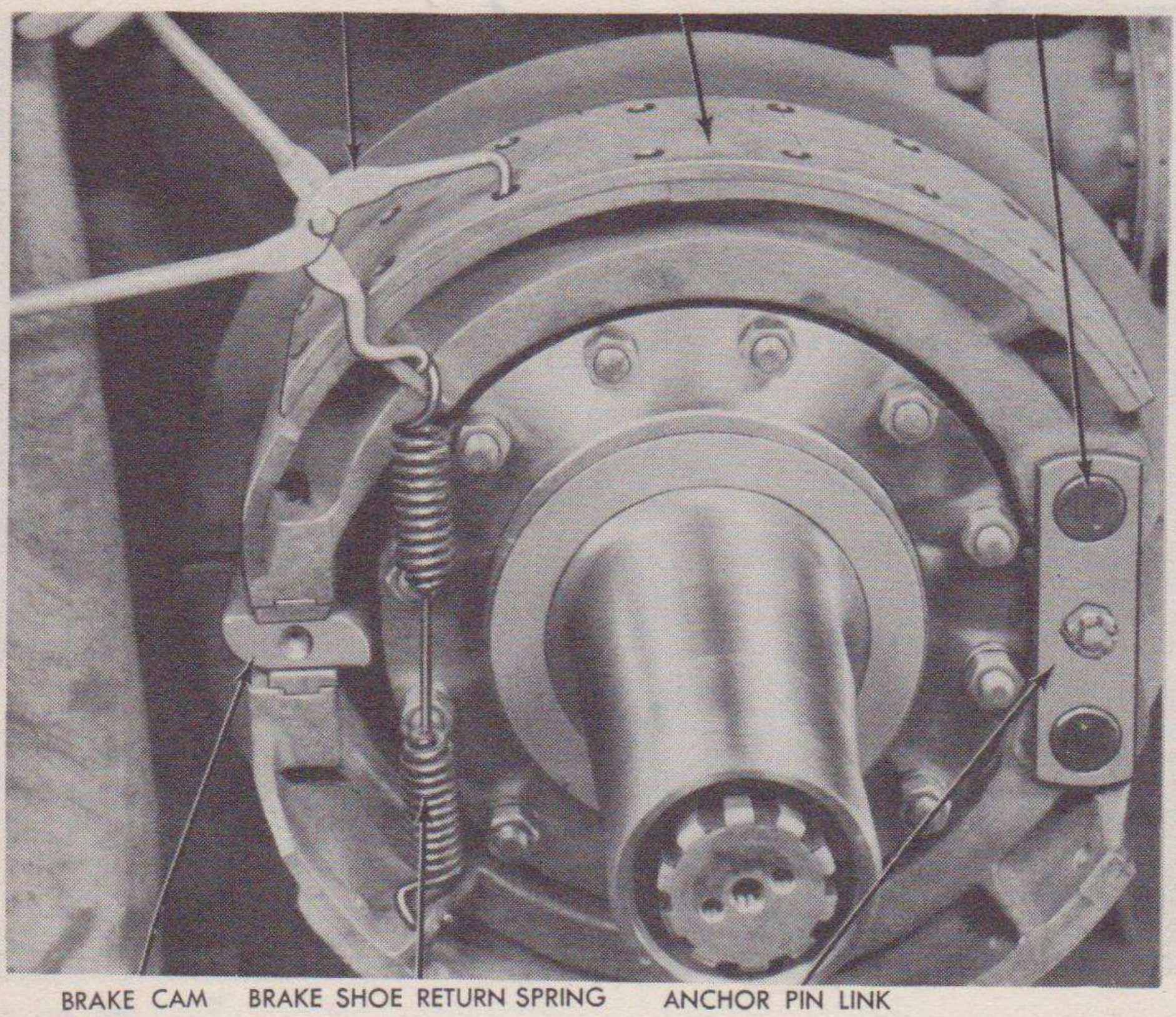
51. DISASSEMBLY.

a. Drain lubricant. Remove drain plug from axle housing and drain lubricant.

b. Remove tie rod (fig. 57). Remove cotter pin and nut from tie rod bolt (one on each side) and drive out bolt with soft drift.

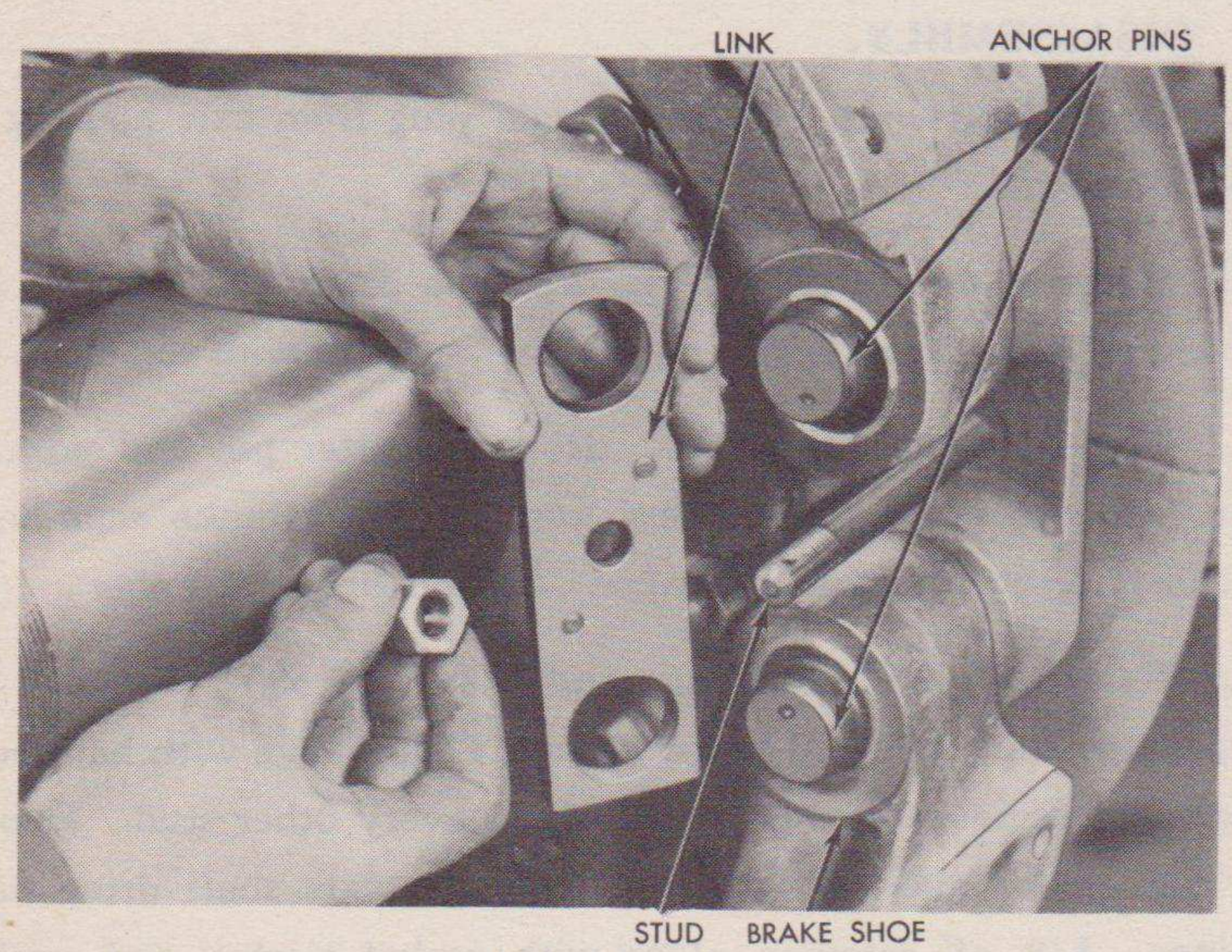
c. Remove brake chamber. Remove cotter pin and yoke pin from yoke end of diaphragm push rod. Remove brake chamber-to-knuckle cap screw and lock washer. Lift off brake chamber

d. Remove wheel, bearing, and hub (fig. 59). Remove axle drive flange stud nuts and lock washers. Tap flange with hammer to loosen and remove tapered dowels from every other stud. Remove two cap screws and lock washers from the axle shaft drive flange retainer. Lift off retainer, along with gasket washer and packing.



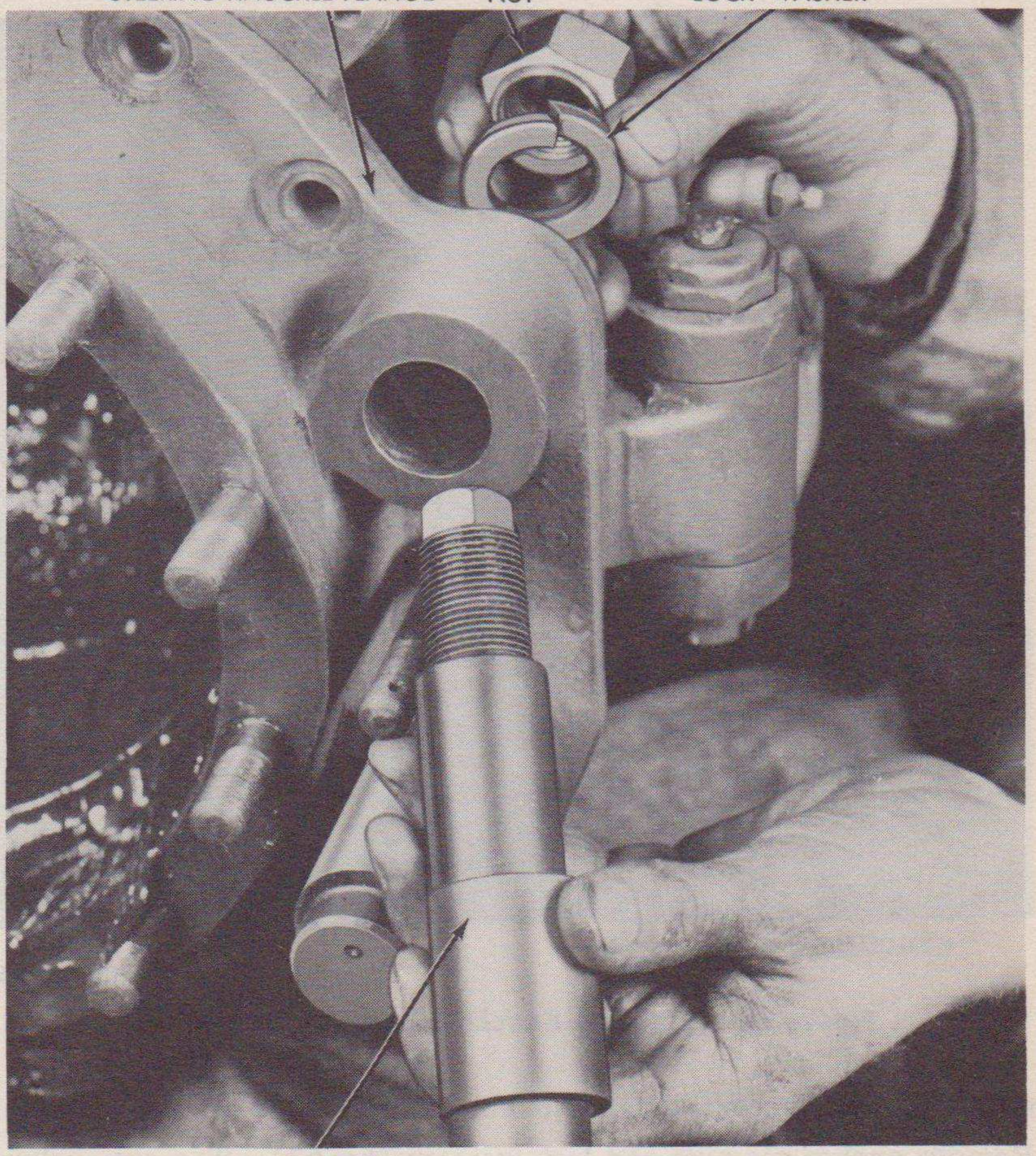
RA PD 334463

Figure 61 — Removing Brake Shoe Return Spring



RA PD 334464

Figure 62 — Removing Anchor Pin Link



RA PD 334465

Figure 63 — Removing Anchor Pin

Insert two puller screws in the axle shaft drive flange. Turn in screws and remove flange and gasket. Remove wheel bearing lock nut with wrench (41-W-3825-72). Remove wheel bearing washer, lock ring, and adjusting nut. Remove outer wheel bearing cone. Slip off wheel with hub and brake drum. (Repeat operation on opposite side.)

e. Removing brake shoes and anchor pin. Remove brake shoe return springs (fig. 61). Remove lock nut and lock washer from

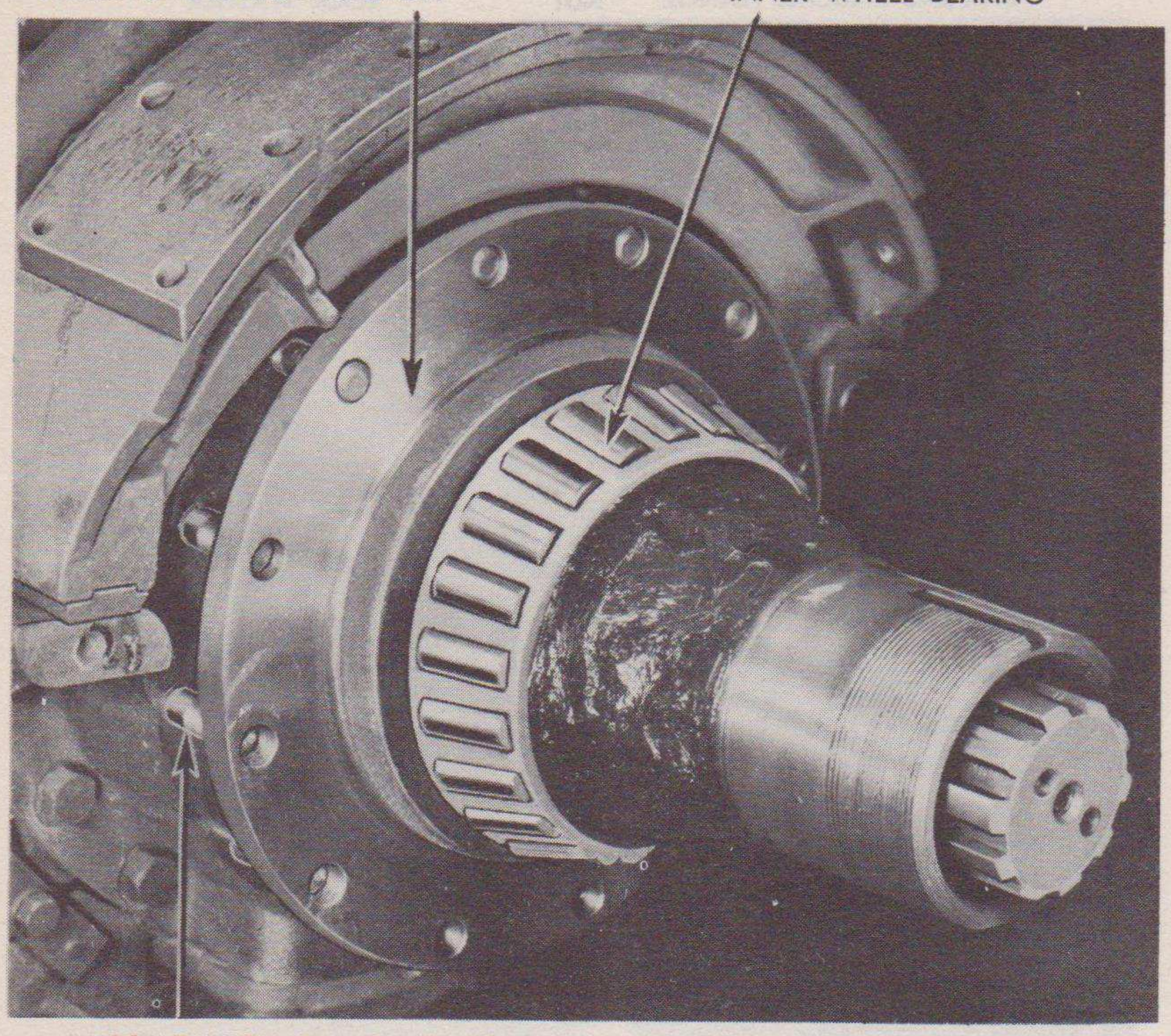


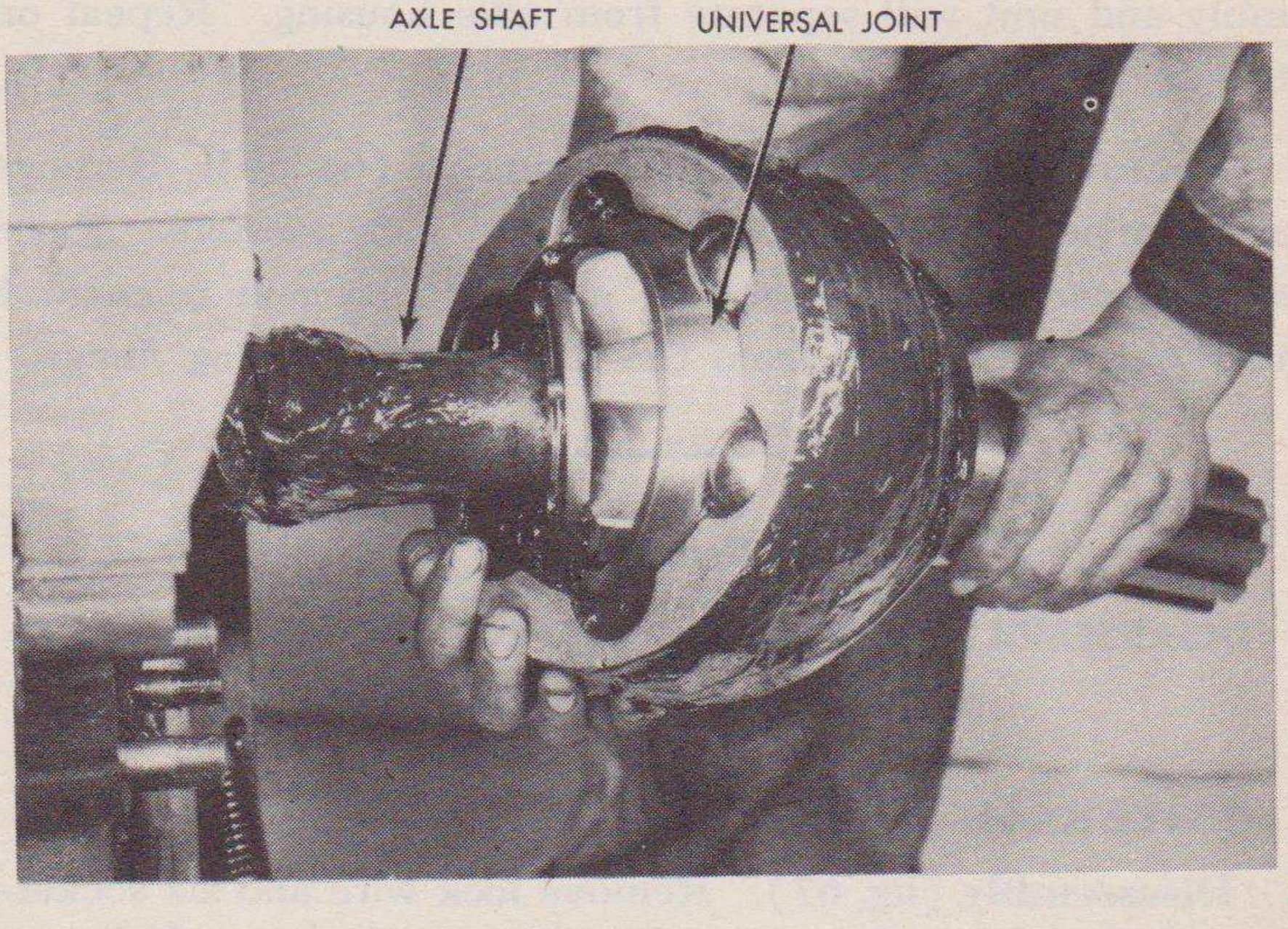
Figure 64 — Steering Knuckle Assembly Removal

anchor pin. Remove anchor pin link. Slide shoes off anchor pins. Remove anchor pin nuts and lock washers (fig. 63). Tap out anchor pins from dust shield side.

f. Remove universal joint and axle shaft assembly. Remove the 12 nuts and lock washers holding steering knuckle and bushing assembly to knuckle companion flange assembly. Remove knuckle assembly (fig. 64). Remove axle shaft and universal joint assembly (fig. 65). Repeat on opposite side.

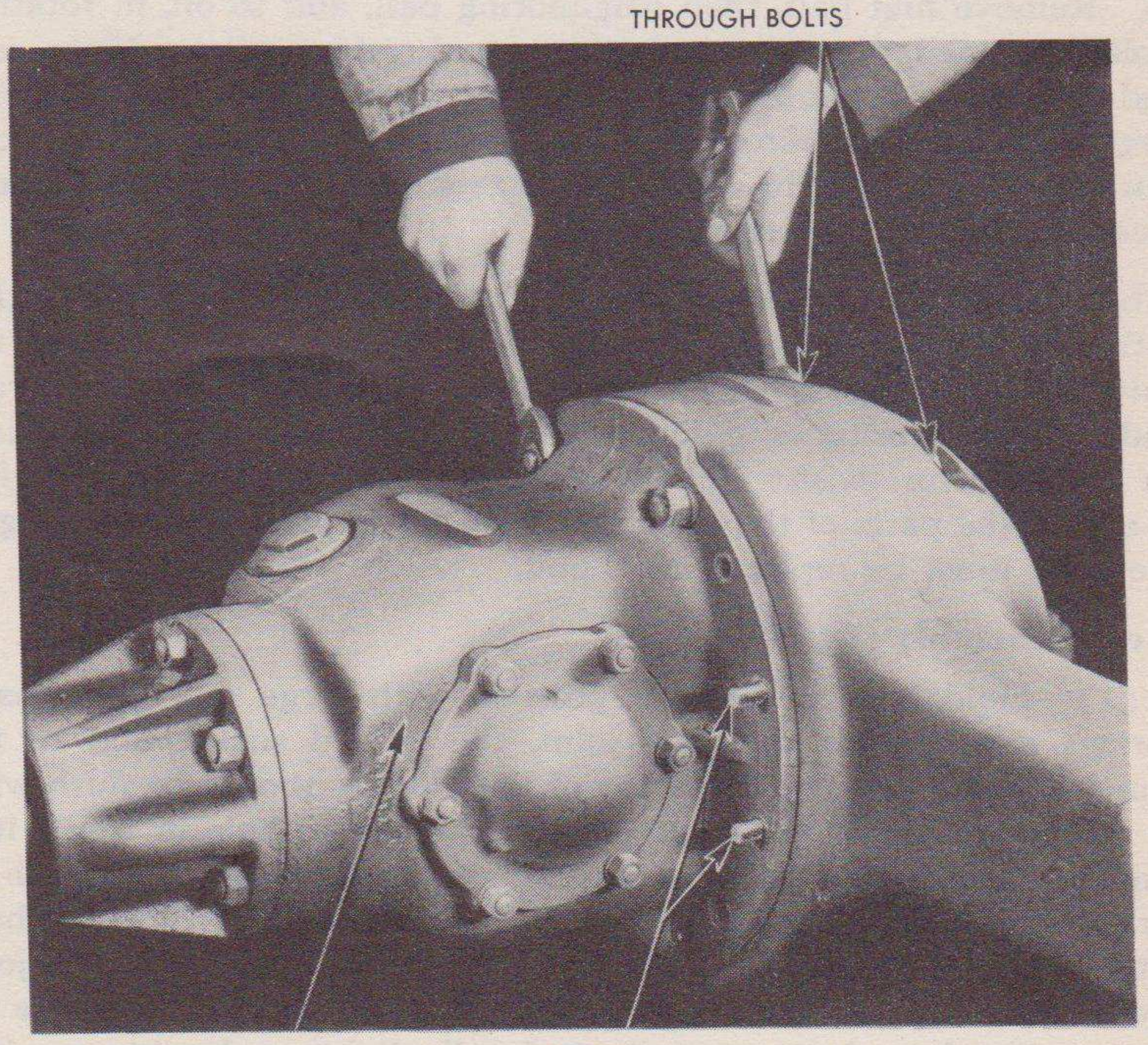
g. Remove steering knuckle trunnion socket assembly (fig. 57). Remove eight nuts, lock washers, and bolts holding knuckle trunnion socket assembly to axle housing. Tap the upper inside of the flange

Disassembly Into Subassemblies



RA PD 334467

Figure 65 — Removing Axle Shaft and Universal Joint Assembly



RA PD 334468

Figure 66 — Removing Carrier Nuts

assembly and unit will separate from axle housing. Repeat on opposite side.

h. Remove differential carrier assembly (fig. 66). Remove differential carrier to housing stud nuts and lock washers. Raise the differential carrier assembly with a rope sling and a chain hoist. Remove the stud dowels from the differential housing flange.

Section III

DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

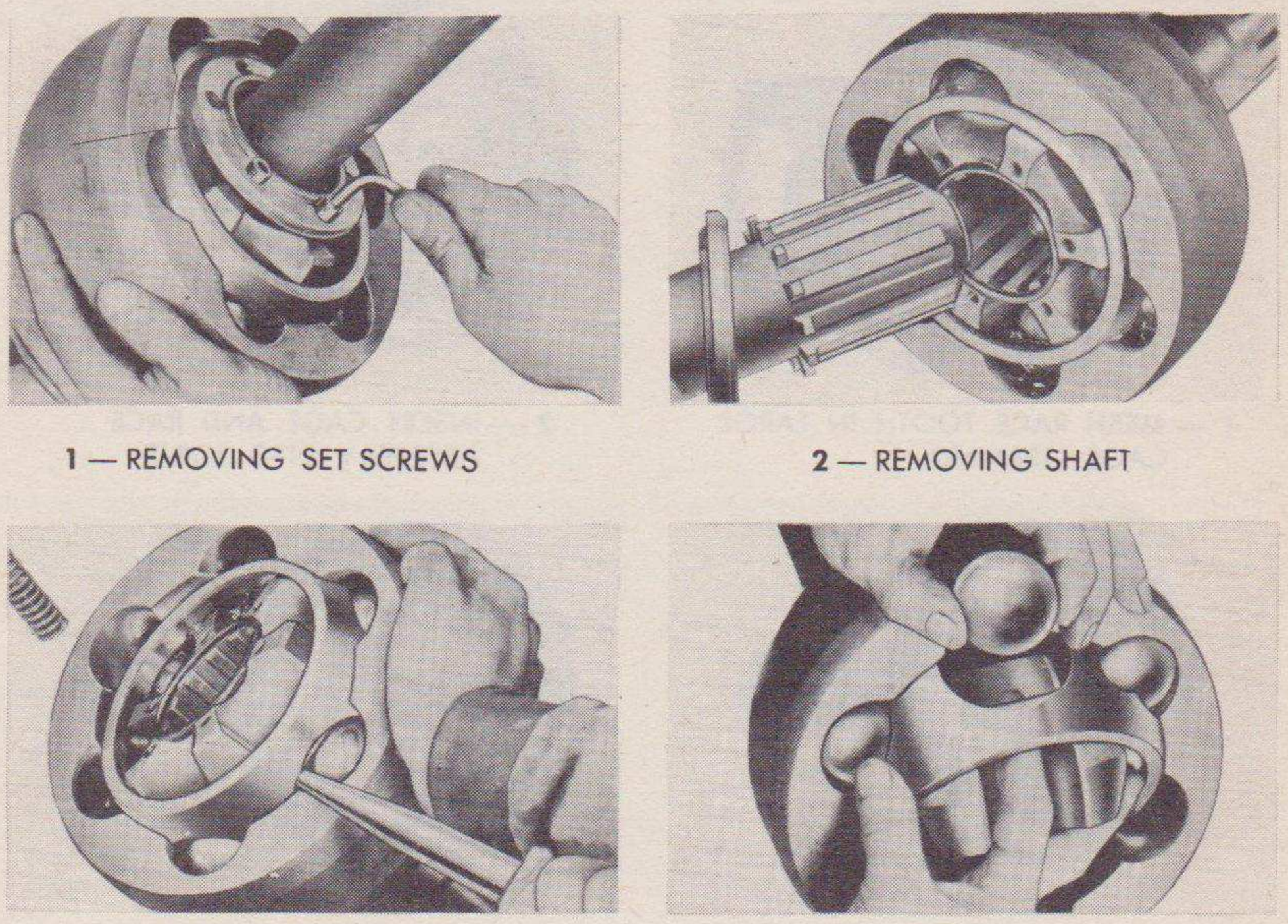
52. UNIVERSAL JOINT.

a. Disassembly (fig. 67). Remove lock wire and six socket-head set retaining screws. Remove axle shaft and retainer. Using a drift, pry out pilot pin seat and inner race spacer ring. Remove pilot pin and spring. Tilt inner race to double angle of cage as far as it will go. Remove first ball, then neighboring ball, and so on, in rotation. Roll cage one-half turn, upside down, and remove pilot. Move cage and inner race assembly at right angles from outer race by passing large cage openings across opposite teeth of outer race, and roll out. Turn inner race to right angle with cage and remove by inserting one race tooth into large cage opening.

b. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent and dry with clean cloths. Inspect the universal joint cage balls for out-of-round condition. Examine race and cage for scoring or galling. Check the condition of the splines on the joint for twist. Inspect pilot, pilot pin, plunger, and spring. If any of the parts of the universal joint are badly worn or damaged, the joint must be replaced as a unit.

c. Assembly (fig. 68).

(1) Hold joint in vertical position with large end up. Insert springs and plunger into the joint, the curved socket end of the plunger facing upward. The top of the plunger should be flush with, or somewhat higher than, the edge of the drilled hole in which it is guided. Insert race at right angles into cage, mesh race tooth in large cage opening, and when both parts are concentric, turn both into same plane, and try for free fit. Insert cage and race into joint teeth until cage bottoms. Turn all parts flat and try for free fit. Insert pilot face down on cage and roll all internal parts one-half turn until pilot is at bottom of recess in joint.



1 — REMOVING SET SCREWS

2 — REMOVING SHAFT

3 — TILTING INNER RACE

4 — REMOVING FIRST BALL

5 — REMOVING PILOT

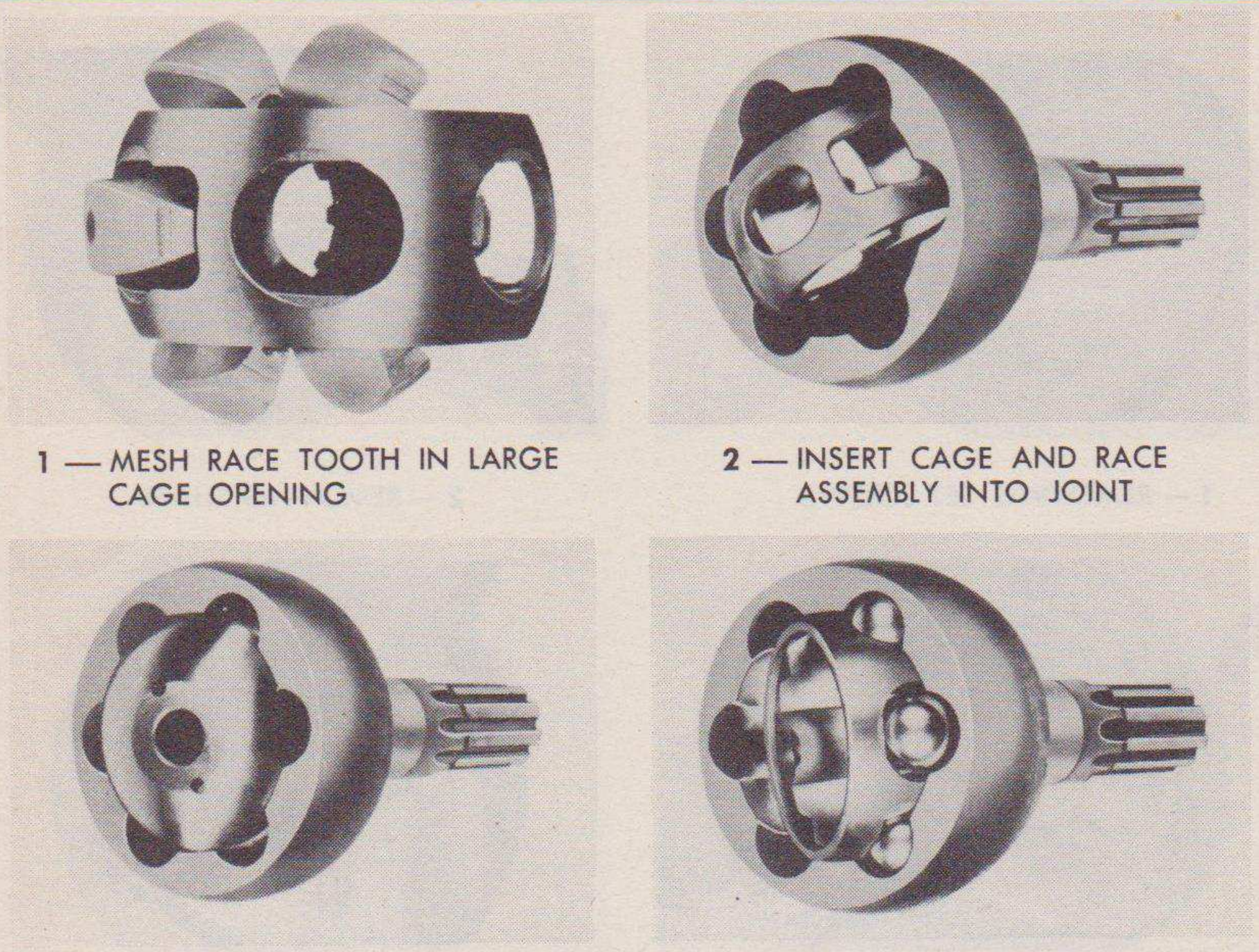
6 — ROLLING OUT CAGE AND INNER RACE ASSEMBLY

7 — REMOVING INNER RACE

RA PD 334460

Figure 67 — Universal Joint Disassembly

(2) Pack entire assembly with lubricant specified in pertinent lubrication order. Fill the inner race and cage. This will bring one of the ball sockets of the cage in line with one of the six raceways in the joint outer race, and toward the top, to allow one ball to drop into place. Tilt the race and cage assembly to the other five positions in turn to install the remaining balls. Drop the pilot pin into the assembly, small end first, so that it will seat on the head of the pilot pin spring plunger. Place the spacer ring on the inner race. Thumb-press the pilot pin seat into the joint end of the axle shaft. Then insert the axle shaft into the inner race. Place the shaft retainer over



1 — MESH RACE TOOTH IN LARGE CAGE OPENING

2 — INSERT CAGE AND RACE ASSEMBLY INTO JOINT

3 — INSERT PILOT

4 — INSERT BALLS

RA PD 334461

Figure 68 — Assembly of Universal Joint

the axle shaft against the inner race. Install retainer screws and lock with wire.

53. STEERING KNUCKLE.

a. Remove steering arm and caps. Remove four upper knuckle trunnion bearing cap stud nuts and lock washers. NOTE: *The right-hand knuckle assembly has upper and lower bearing caps.* Lift off steering arm and shims (fig. 69). Tie shims together and tag them to insure correct assembly. Remove nuts and lock washers retaining caps. Lift off cap and shims, tie shims together and tag for proper assembly.

b. Disassemble trunnion socket (fig. 72). Remove knuckle companion flange nuts and lock washers. Tap outer half of knuckle companion flange assembly with soft-faced hammer to separate the two halves (fig. 70). Remove the trunnion socket felt and pressure spring from the inner half of the companion flange assembly. Remove knuckle trunnion bearing cones with puller. Remove grease retainer. Remove oil seal from knuckle trunnion socket by breaking in several places and prying out (fig. 71).

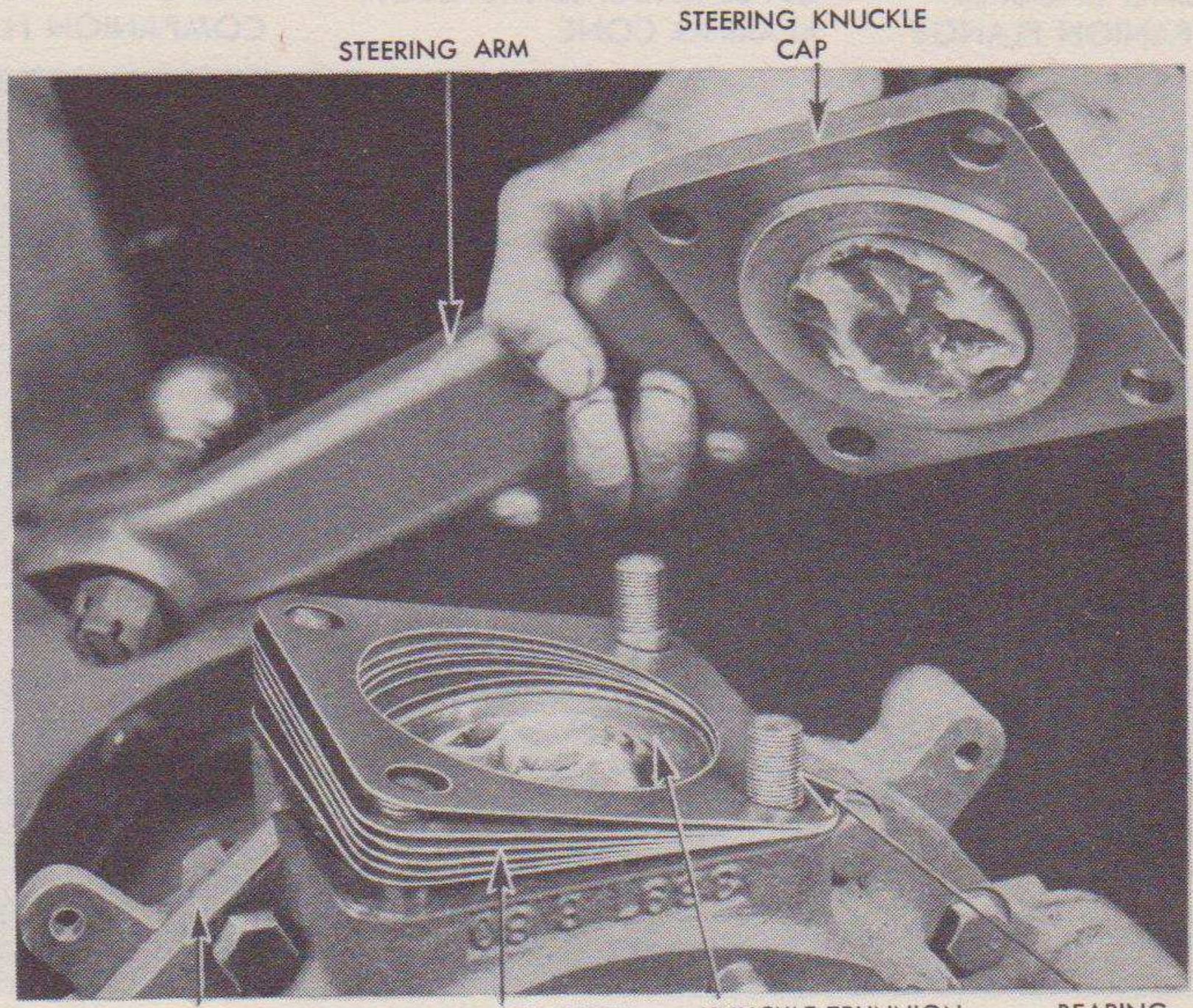


Figure 69 — Removing Steering Arm

c. Cleaning, inspection, and repair. Wash all parts with dry cleaning solvent and dry thoroughly. Check bearings carefully for damage or wear. Use new oil seals. Lubricate all parts before assembly (see lubrication order). Repair consists of replacing unserviceable parts with serviceable parts. Replace brake camshaft, and steering cross tube end pin bushings if badly worn or damaged. If bushing in end of steering knuckle is worn, press out old bushing and install new bushing with handle (41-H-1397) and replacer (41-R-2385-260) (fig. 73).

d. Assembly of steering knuckle.

(1) ASSEMBLE TRUNNION SOCKET (fig. 72). Place the upper trunnion bearing grease retainer on the upper trunnion bearing pin. Place the retainer opposite the oil hole in the trunnion socket. Tap the upper and lower trunnion bearing cones on the bearing pins, using replacer (41-R-2396-275) (fig. 74). Place axle shaft oil seal in the hub of the trunnion socket with replacer (41-R-2385-260) and handle (41-H-1397) (fig. 75).

(2) INSTALL TRUNNION SOCKET IN COMPANION FLANGE ASSEMBLY (fig. 72). Place inner half of companion flange assembly on a bench. Insert a new grease retainer felt in its groove in the inner

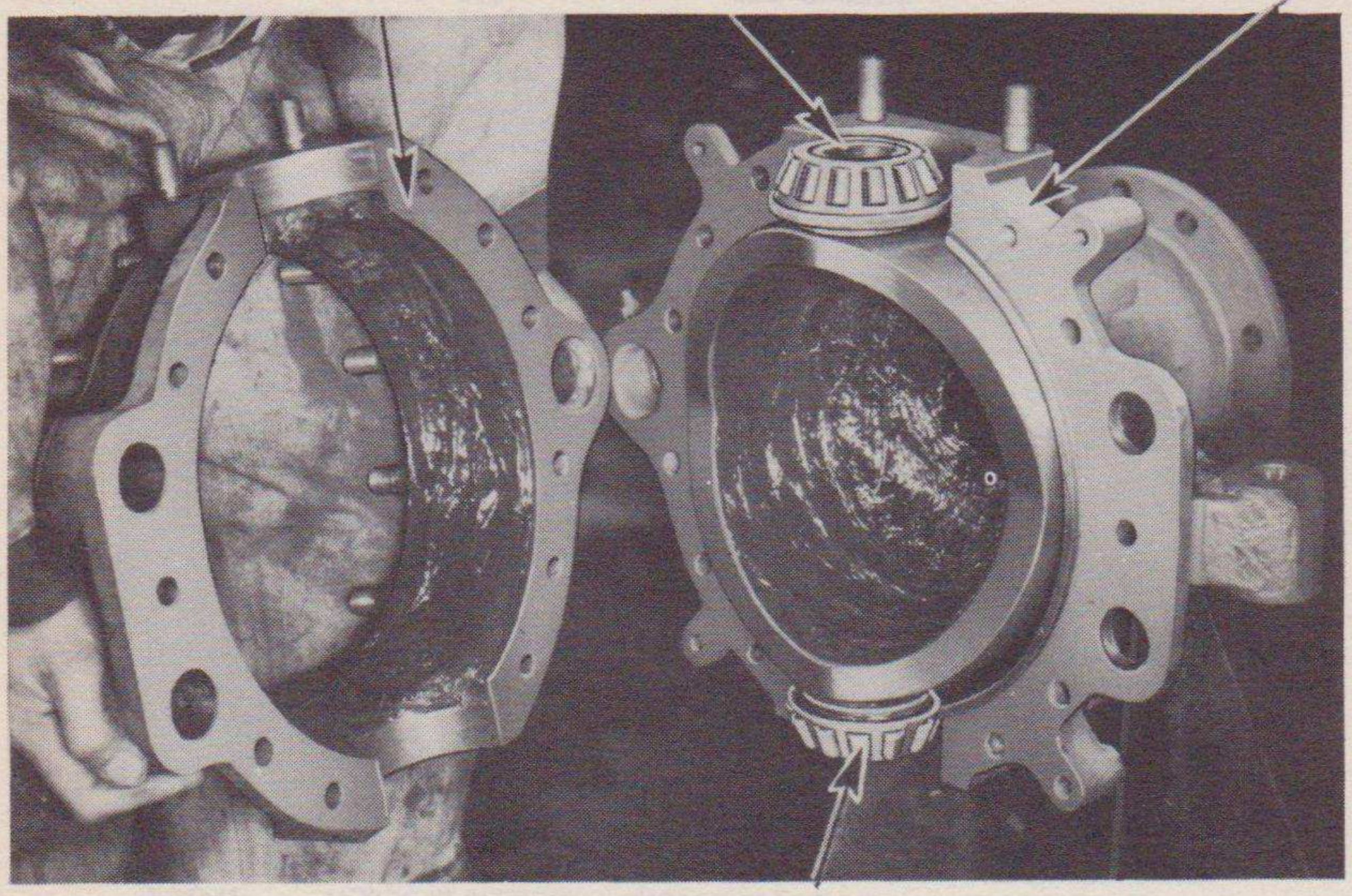


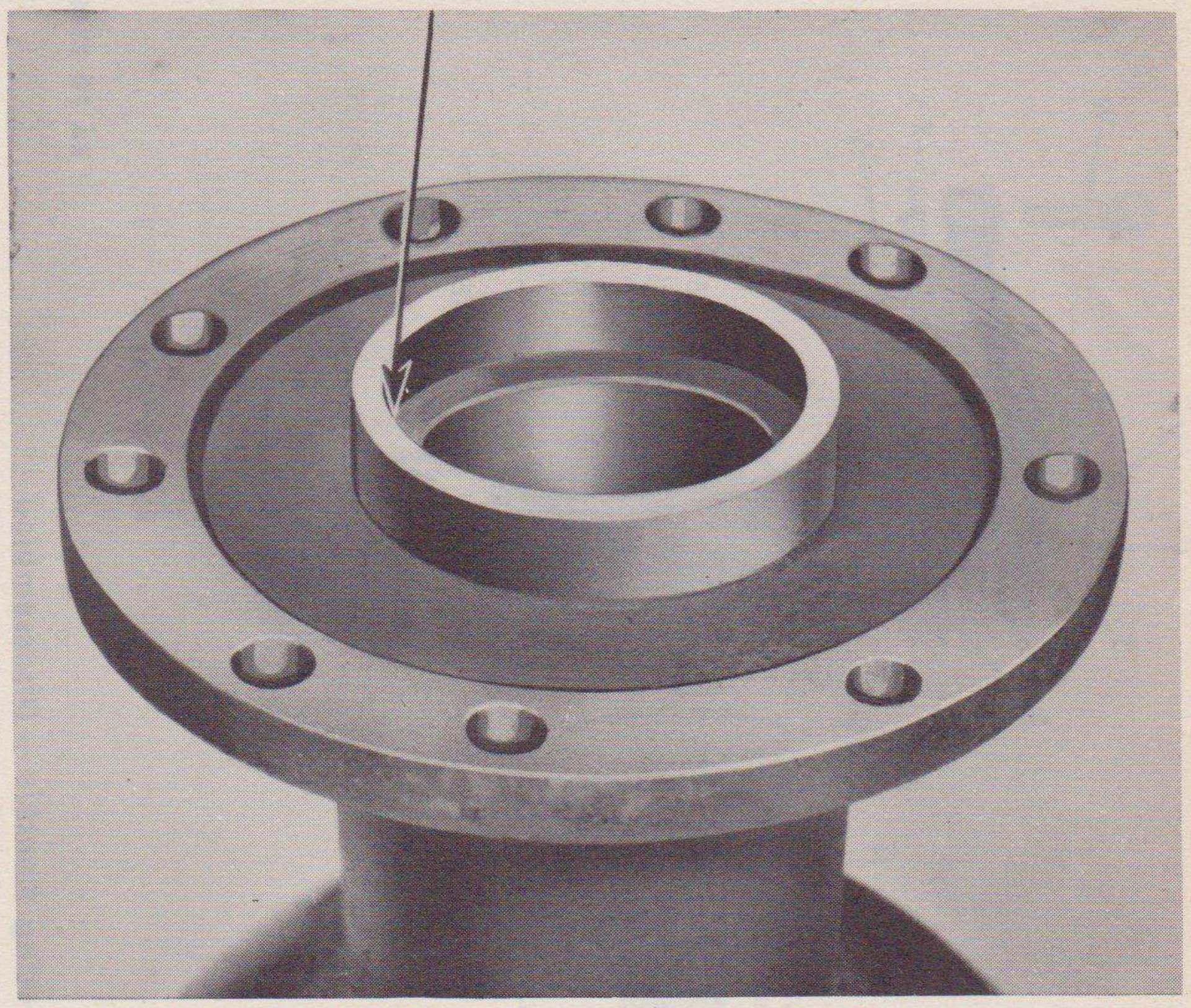
Figure 70 — Separating Steering Knuckle Companion Flange

half of the knuckle flange assembly, and clamp in place with spring. Place the trunnion socket flange upward, on a bench and slip the inner half of the companion flange over the trunnion socket. Place the outer companion flange in position on the trunnion socket. At this time the two halves meet around the bearing cones. Position four of the companion flange bolts, lock washers, and nuts. Tighten the nuts just enough to hold the two halves in position. Install the remaining bolts, lock washers, and nuts. Tighten all nuts.

(3) INSTALL STEERING ARM. Place the upper knuckle trunnion bearing cap shims on the studs. These were tagged at disassembly and should total approximately 0.045-inch thickness. Place the steering arm on the studs and install the four lock washers and nuts. Adjust end play in trunnion bearing to 0.005 to 0.008 inch. Removing shims decreases end play and adding shims increases end play.

(4) INSTALL LOWER KNUCKLE TRUNNION BEARING CAP. Install the knuckle trunnion bearing lower cap, inserting between it and the knuckle flange assembly the shims which were removed and tagged as disassembly. These should total approximately 0.045-inch thickness. Install lock washers and cap screws. Tighten cap screws. Loosen nuts on steering arm cap four turns. Adjust end play of lower

OIL SEAL RECESS IN AXLE
STEERING KNUCKLE TRUNNION SOCKET



RA PD 334453

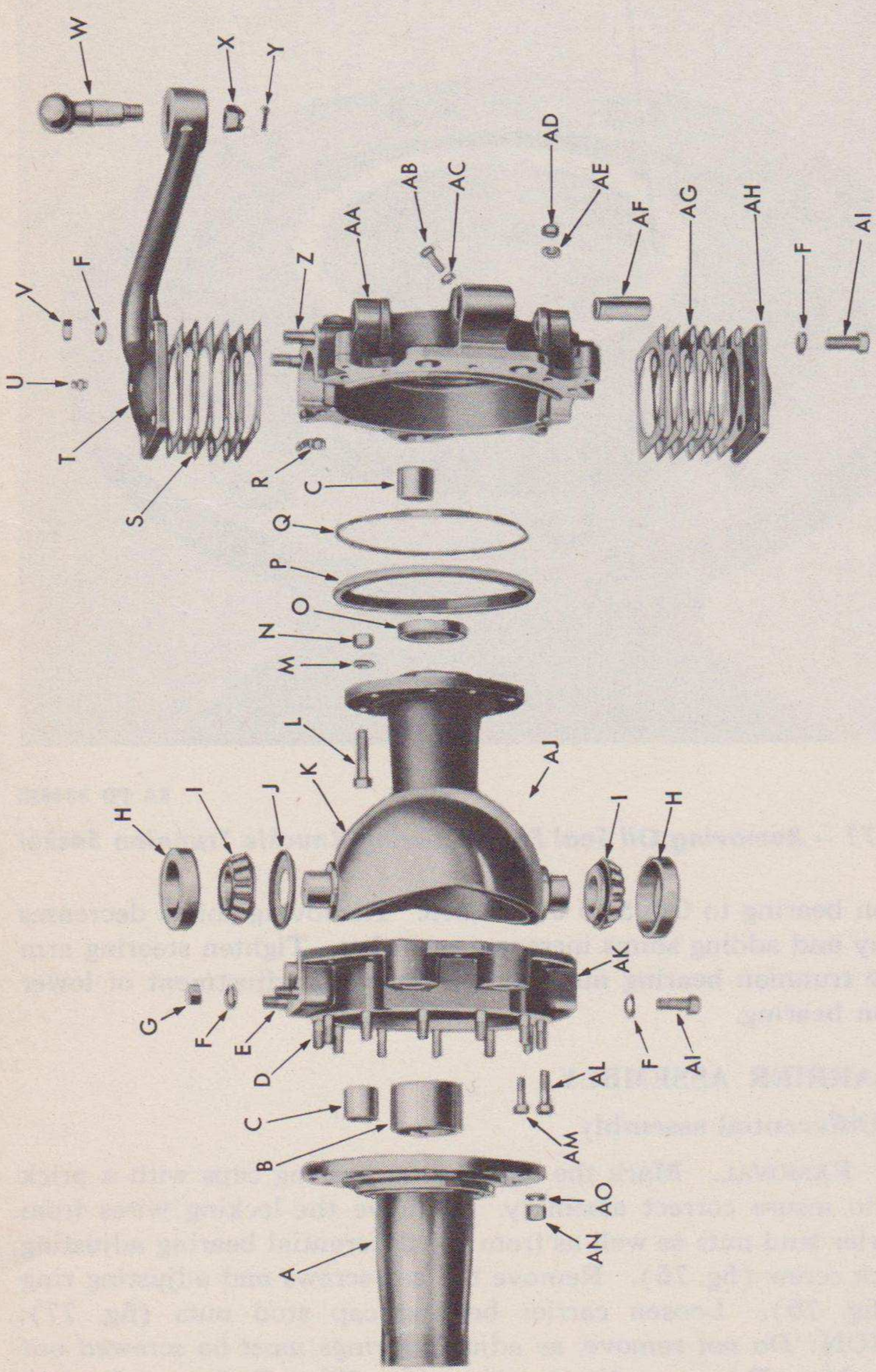
Figure 71 — Removing Oil Seal From Steering Knuckle Trunnion Socket

trunnion bearing to 0.005 to 0.008 inch. Removing shims decreases end play and adding shims increases end play. Tighten steering arm knuckle trunnion bearing nuts after completing adjustment of lower trunnion bearing.

54. CARRIER ASSEMBLY.

a. Differential assembly.

(1) REMOVAL. Mark the carrier and bearing caps with a prick punch to insure correct assembly. Remove the locking wires from the carrier stud nuts as well as from the differential bearing adjusting ring lock screw (fig. 76). Remove the cap screws and adjusting ring lock (fig. 76). Loosen carrier bearing cap stud nuts (fig. 77). CAUTION: *Do not remove, as adjusting rings must be screwed out of assembly.* Remove adjusting ring (fig. 78). Remove adjusting ring on opposite side, using same procedure. Remove carrier cap stud nuts and lift off caps. Lift out differential assembly.



RA PD 334479

Figure 72 — Left Steering Knuckle — Disassembled

A—STEERING KNUCKLE
B—STEERING KNUCKLE BUSHING
C—BRAKE CAMSHAFT BUSHING
D—STEERING KNUCKLE STUD
E—STEERING KNUCKLE TRUNNION BEARING CAP STUD
F—STEERING KNUCKLE TRUNNION BEARING CAP STUD NUT LOCK WASHER
G—STEERING KNUCKLE TRUNNION BEARING CAP STUD NUT
H—STEERING KNUCKLE TRUNNION BEARING CUP
I—STEERING KNUCKLE TRUNNION BEARING CONE
J—UPPER STEERING KNUCKLE BEARING GREASE RETAINER
K—STEERING KNUCKLE TRUNNION SOCKET
L—STEERING KNUCKLE TRUNNION BOLT
M—STEERING KNUCKLE TRUNNION BOLT NUT LOCK WASHER
N—STEERING KNUCKLE TRUNNION BOLT NUT
O—AXLE SHAFT OIL SEAL
P STEERING KNUCKLE TRUNNION SOCKET FELT AND RETAINER
Q—STEERING KNUCKLE TRUNNION SOCKET FELT PRESSURE SPRING
R—LUBRICATION FITTING
S—STEERING KNUCKLE TRUNNION BEARING CAP SHIM
T—STEERING ARM
U—LUBRICATION FITTING
V—STEERING KNUCKLE TRUNNION BEARING CAP STUD NUT
W—STEERING ARM BALL STUD
X—STEERING ARM BALL STUD NUT
Y—STEERING ARM BALL STUD NUT COTTER PIN
Z- STUD
AA—STEERING KNUCKLE COMPANION FLANGE
AB—STEERING KNUCKLE COMPANION FLANGE STOP SCREW
AC—STEERING KNUCKLE COMPANION FLANGE STOP SCREW NUT
AD—STEERING KNUCKLE COMPANION FLANGE BOLT NUT
AE—STEERING KNUCKLE COMPANION FLANGE BOLT NUT LOCK WASHER
AF—STEERING CROSS TUBE END PIN BUSHING
AG—STEERING KNUCKLE TRUNNION BEARING CAP SHIM
AH—STEERING KNUCKLE TRUNNION BEARING CAP
AI—STEERING KNUCKLE TRUNNION BEARING CAP SCREW
AJ—STEERING KNUCKLE TRUNNION SOCKET INSPECTION PLUG
AK—STEERING KNUCKLE COMPANION FLANGE
AL—STEERING KNUCKLE COMPANION FLANGE BOLT
AM—STEERING KNUCKLE COMPANION FLANGE SCREW
AN—STEERING KNUCKLE STUD NUT
AO—STEERING KNUCKLE STUD NUT LOCKWASHER

RA PD 334479B

Legend for Figure 72

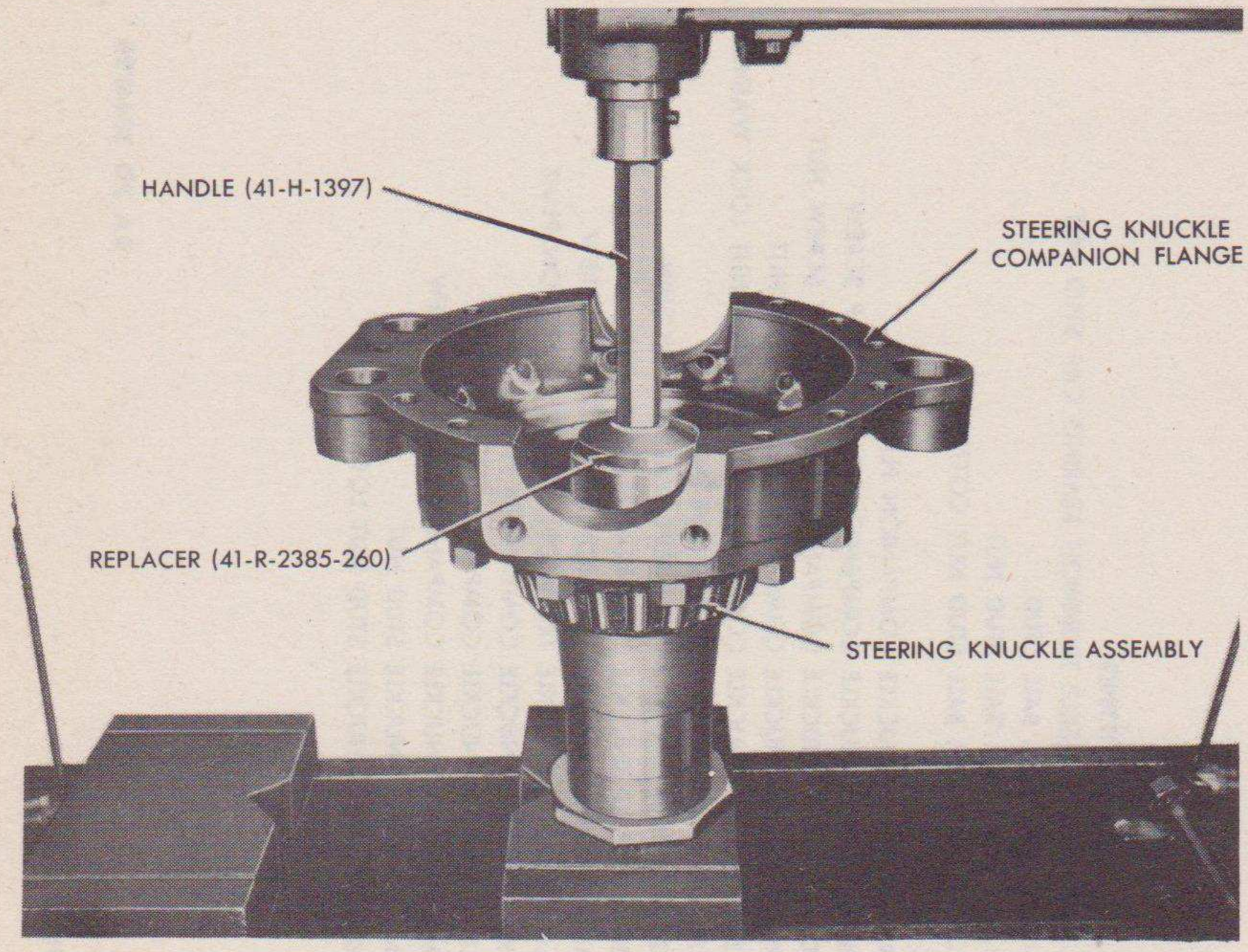
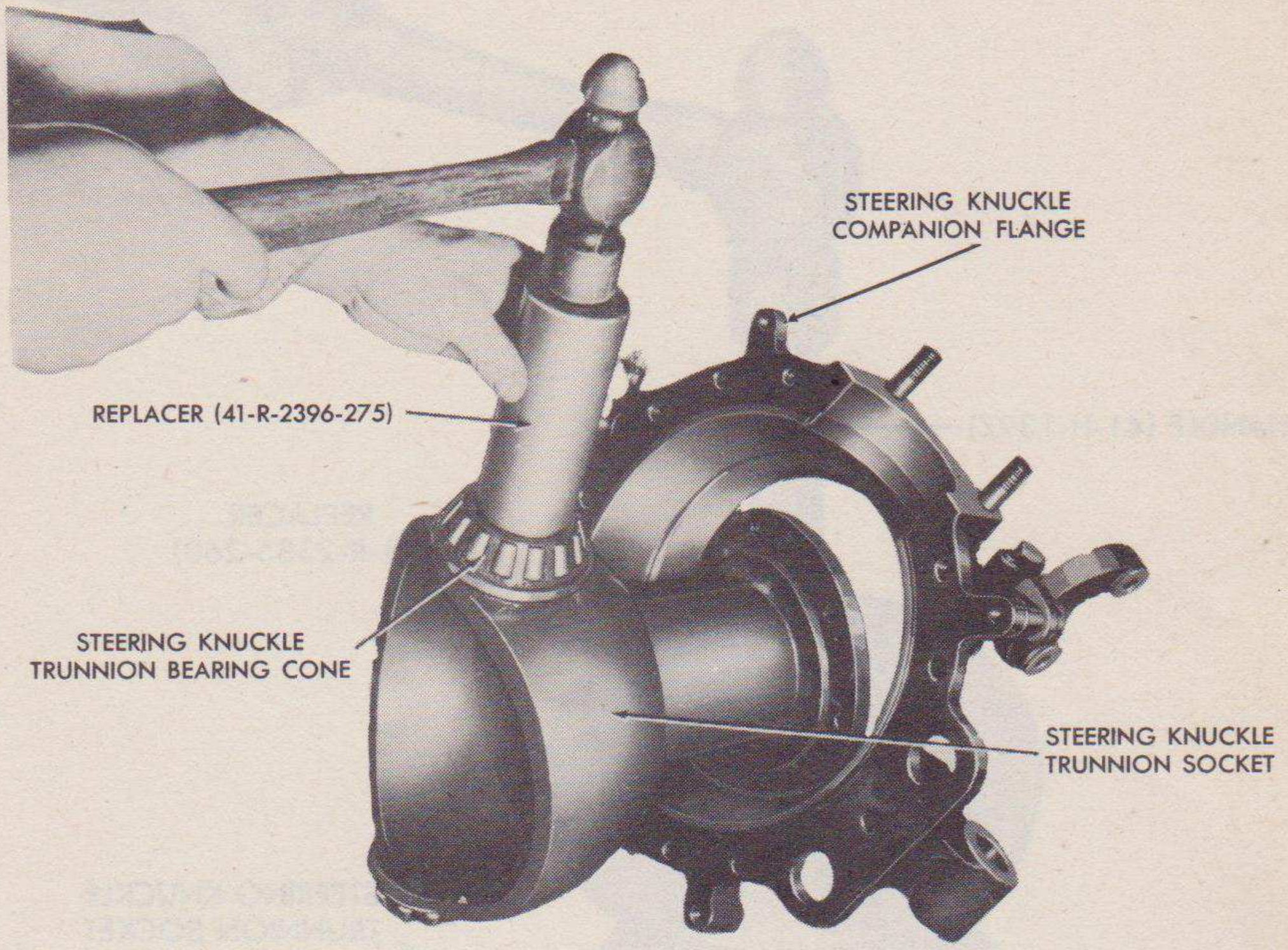


Figure 73 — Replacing Bushing in Front Axle Steering Knuckle

(2) DISASSEMBLY (fig. 79). Remove bearings from differential side case hubs. Remove cotter pins and nuts from the eight differential case bolts and drive bolts out with hammer and punch. After bolts have been removed, it will be found that one side of differential case (that is not fitted tightly on outside diameter to differential drive gear) can be removed by hand. Place the half just removed on a bench, open end up. Remove the side gear thrust washer and differential side gear by hand. Pry out the spider and differential pinion gears and the differential side gear and washer with a screwdriver. Tap the opposite half of the differential case assembly from the differential gear with a soft hammer. Place one side of the differential case in a copper-jawed vise and pull the differential bearing cones from the differential case hubs with puller (41-P-2910) (fig. 80).

(3) CLEANING, INSPECTION, AND REPAIR. Wash all parts with dry cleaning solvent and dry thoroughly. Inspect all gears and thrust washers for wear or damage. Check bearings carefully for wear and damage. Inspect both differential cases for wear, scores and cracks. Install both differential cases on a lathe or any similar device, in order that case may be entered and revolved. Using dial indicator check for alinement; concentricity not to exceed inches. If either half of the differential cases is defective, replace both halves. Clean and



RA PD 353079

Figure 74 — Replacing Bearing in Front Axle Steering Knuckle Trunnion Socket

lubricate all parts before assembly. Refer to paragraph 59 **c**, **d**, and **e** for specifications.

(4) ASSEMBLY (fig. 81).

(a) Install differential pinions on spider (fig. 79 and 81). Using an arbor press, install one of the differential bearing cones on the hub of the thin half of the differential case. Turn the thin half of the case over and place the differential drive gear in position, lining up the bolt holes in the gear with the differential case bolt holes. The flat side of the gear should be down, and the chamfered side up. Insert a differential side gear thrust washer and side gear in position in thin half of the differential case. Place the differential pinion gears on the spider arms with the thrust washers in position and install in mesh with the differential side gear. Install the remaining differential side gear, with thrust washer, in mesh with the pinion gears.

(b) Assemble differential case (fig. 81). Press the bearing cone on the hub of the thick half of the differential case assembly using replacer (41-R-2384-165) (fig. 82). Place the thick half on the differential gear, lining up bolt holes in both halves of case with holes in differential gear. Insert differential case assembly bolts. Tap in

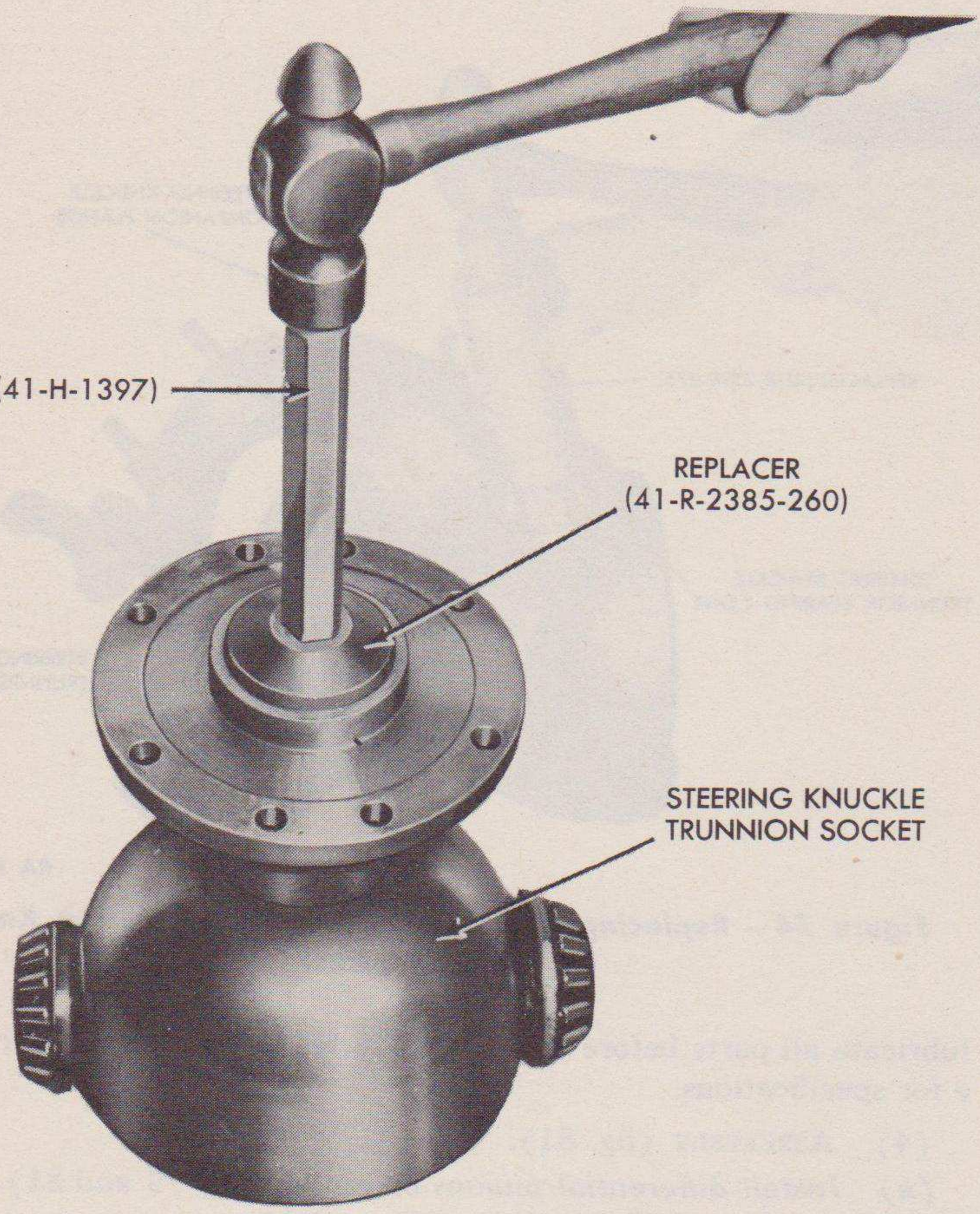


Figure 75 — Replacing Oil Seal in Front Axle Steering Knuckle Trunnion Socket

place with soft-faced hammer. Install nuts and cotter pins. Install differential bearing cups in place over the bearing cones on the hubs of the differential case assembly.

b. Bevel pinion cage assembly (figs. 58, 83, 84).

(1) REMOVAL. Remove the six bevel pinion bearing cage nuts and lock washers. Insert the puller screws in the holes tapped between the bevel pinion bearing cage studs. Tighten them until the bearing cage is loosened enough to be removed. Lift off the bevel pinion bearing cage. Remove the shims and gasket from the bevel

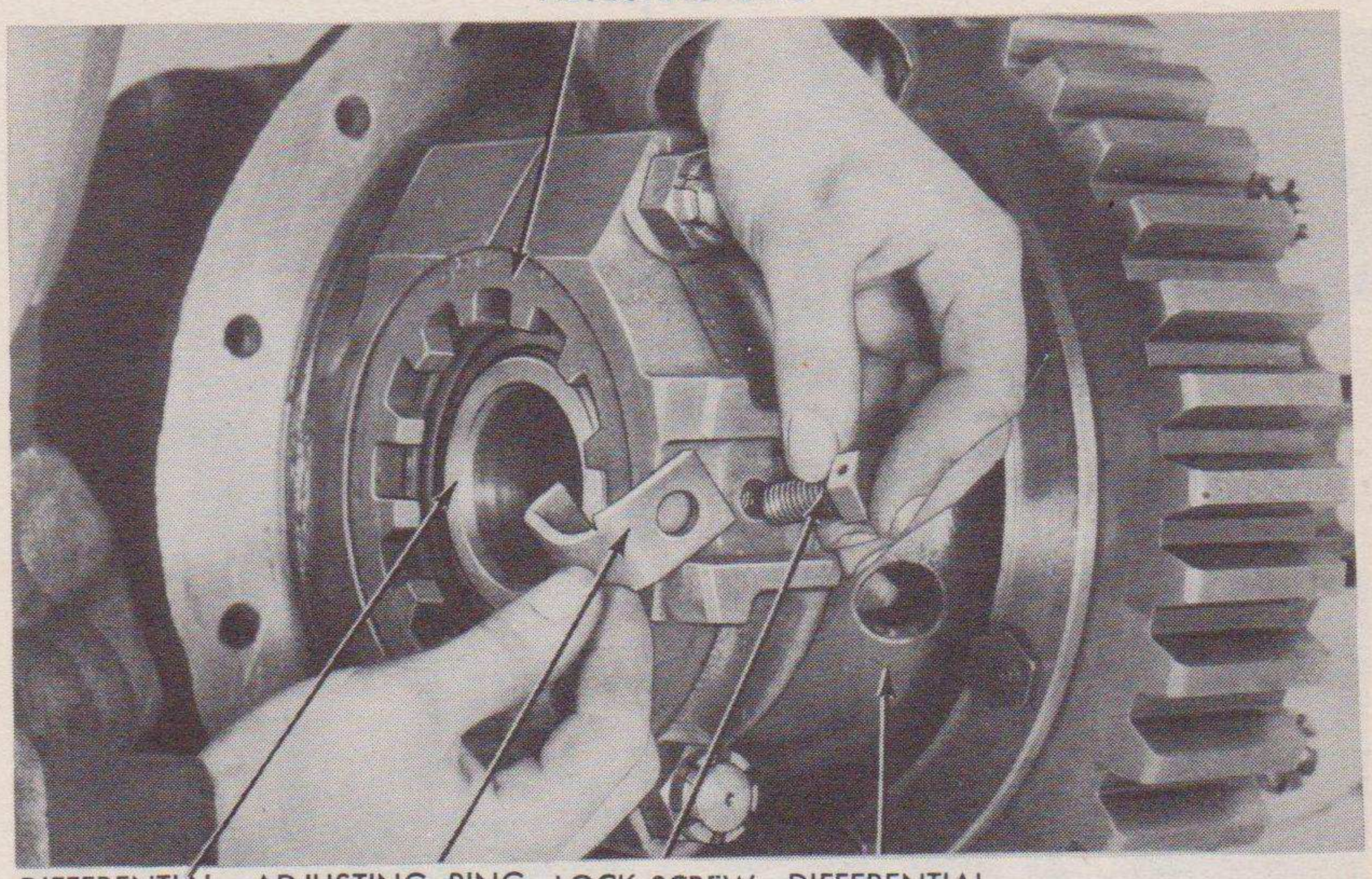


Figure 76 — Removing Differential Bearing Adjusting Ring Lock

pinion bearing cage studs. NOTE: *Do not try to pry the bevel pinion bearing cage loose, as this will damage the shims and machined surfaces, thus causing oil leaks.*

(2) DISASSEMBLY. Place bevel pinion bearing cage in vise and remove cotter pin and nut from bevel pinion and shaft. Using a puller, pull yoke from the bevel and pinion and shaft. Place cage in arbor press. Press pinion and shaft with pinion bearing front cone out of bearing cage. Lift bearing spacer and shims off shaft of bevel pinion (fig. 84). Place pinion and shaft in arbor press and press off front cone (fig. 85). Place bevel pinion bearing cage in vise. Using a drift and hammer, drive bevel pinion bearing rear cone, cup, and cage oil seal out of cage. With bevel pinion bearing cage clamped in a vise, as in the preceding step, remove bevel pinion bearing front cup (fig. 86), with bearing remover (41-R-2369-50).

(3) CLEANING, INSPECTION, AND REPAIR. Wash all parts with dry cleaning solvent and dry thoroughly. Make a visual inspection of bearing, rollers for roughness and for cracked or chipped teeth on bevel pinion. NOTE: *Careful inspection should be made of oil seal assembly for being bent or damaged and replace if necessary to prevent oil leakage (W, fig. 70).* If either bevel pinion or bevel gear

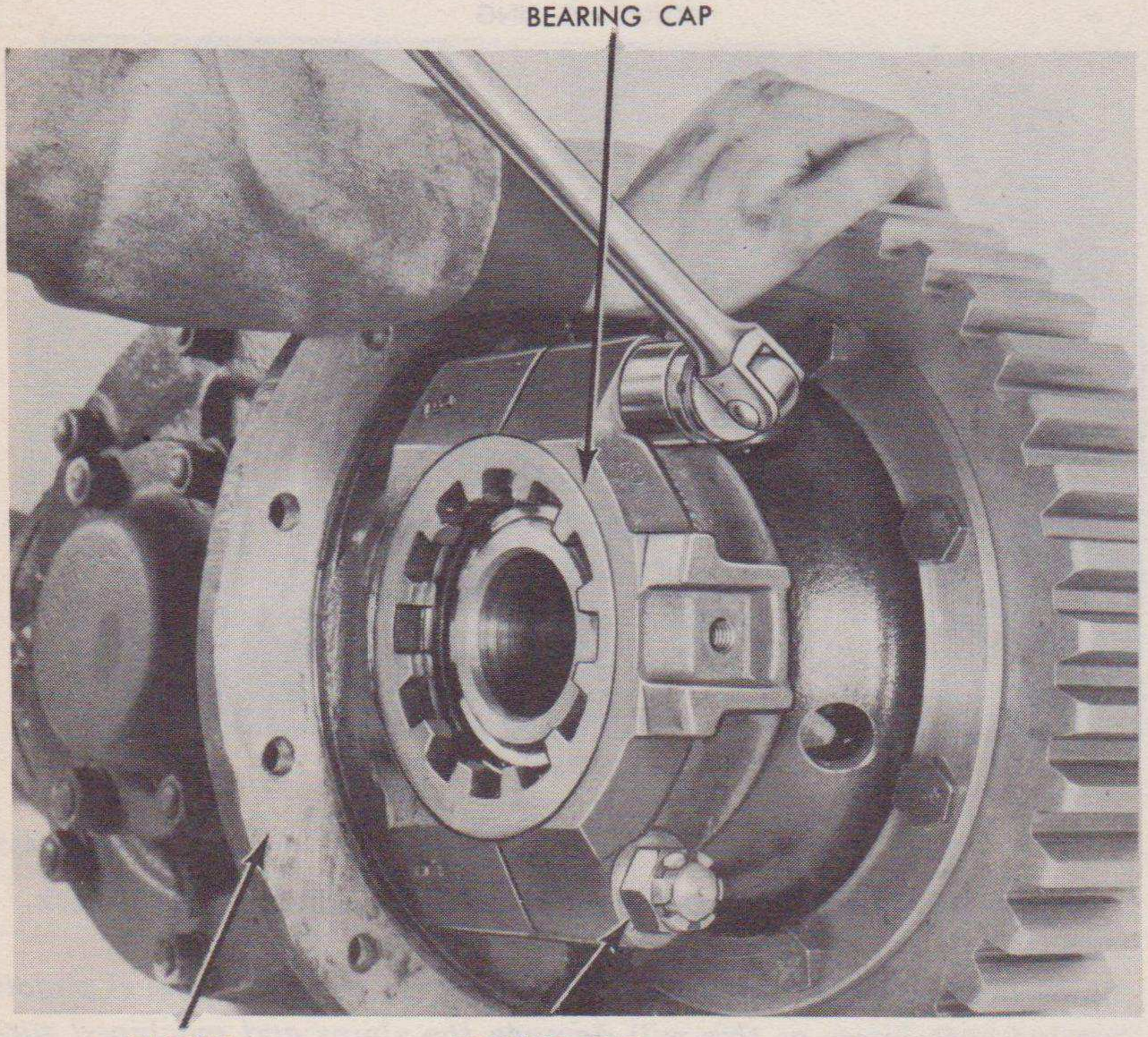
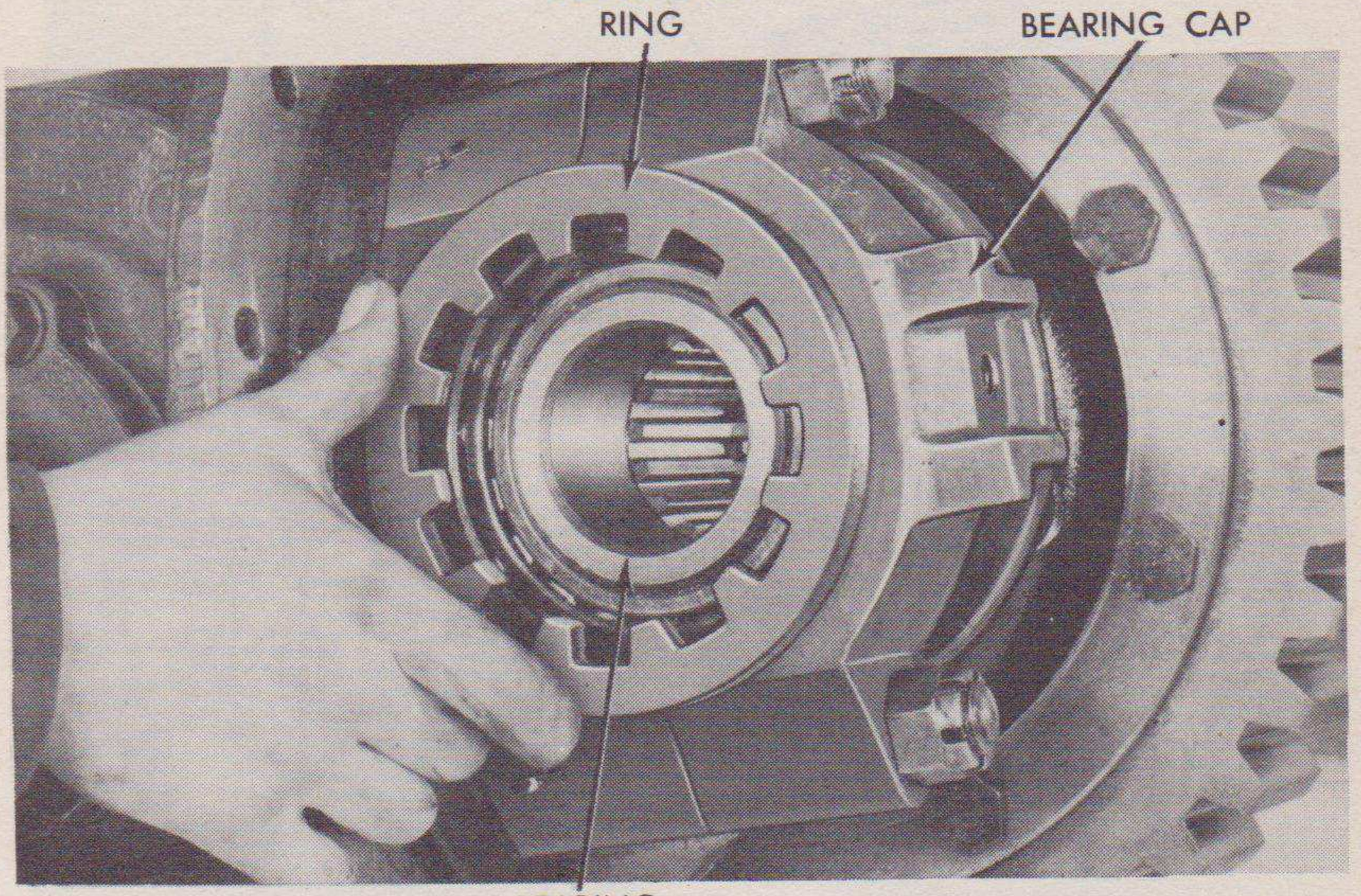


Figure 77 — Loosening Differential Carrier Bearing Cap Stud Nut

is damaged it will be necessary to replace both gears, as these gears are mated and paired (C and E, fig. 84).

(4) ASSEMBLY AND ADJUSTMENTS OF BEVEL PINION BEARINGS (figs. 58, 83, 84). Using a soft-faced hammer, tap the front and rear bevel pinion bearing cups (U and Q, fig. 83), into each end of the bevel pinion bearing cage (T, fig. 83). Press front bearing cone against shoulder of gear. Install spacer and original bevel pinion bearing spacer shims on pinion shaft (G and F, fig. 84). Shims should total approximately, 0.045-inch thickness. Install this assembly in pinion bearing cage. Press rear bearing cone on bevel pinion bearing shaft, firmly against shims and spacer, leaving oil seal assembly out until check is made for end play. Press yoke on shaft and seat it firmly against bearing cone. Install pinion shaft washer and nut drawing



RA PD 334448

Figure 78 — Removing Differential Bearing Adjusting Ring

tight against yoke. Check end play. The proper bevel pinion bearing preload is between 4 and 8 inch-pounds of torque. Install a bevel pinion bearing spacer shim (fig. 58) to increase end play and decrease torque or remove a bevel pinion bearing spacer to decrease end play and increase torque until the proper adjustment is obtained. Remove nut, washer and yoke. Install oil seal assembly; install yoke, washer and nut, drawing up very tight. Install cotter pin.

c. Bevel gear and spur pinion cross shaft assembly.

(1) REMOVAL (fig. 87). Remove spur pinion bearing cap nuts and lock washers. Lift off the spur pinion bearing cap, shims, and gasket. Remove the spur pinion bearing cage nuts and gasket along with attached spur pinion bearing cover. Remove the spur pinion bearing cover nuts and lock washers. Lift out the cover and shims from cage. Place cage in soft-jawed vise. Drive out left-hand spur pinion cup from bearing cage. Then remove right-hand cup from bearing cage. Using a wooden block and hammer, drive against the bevel gear until the bevel and spur gear assembly is loosened. Lift out the bevel and spur gear assembly (fig. 87).

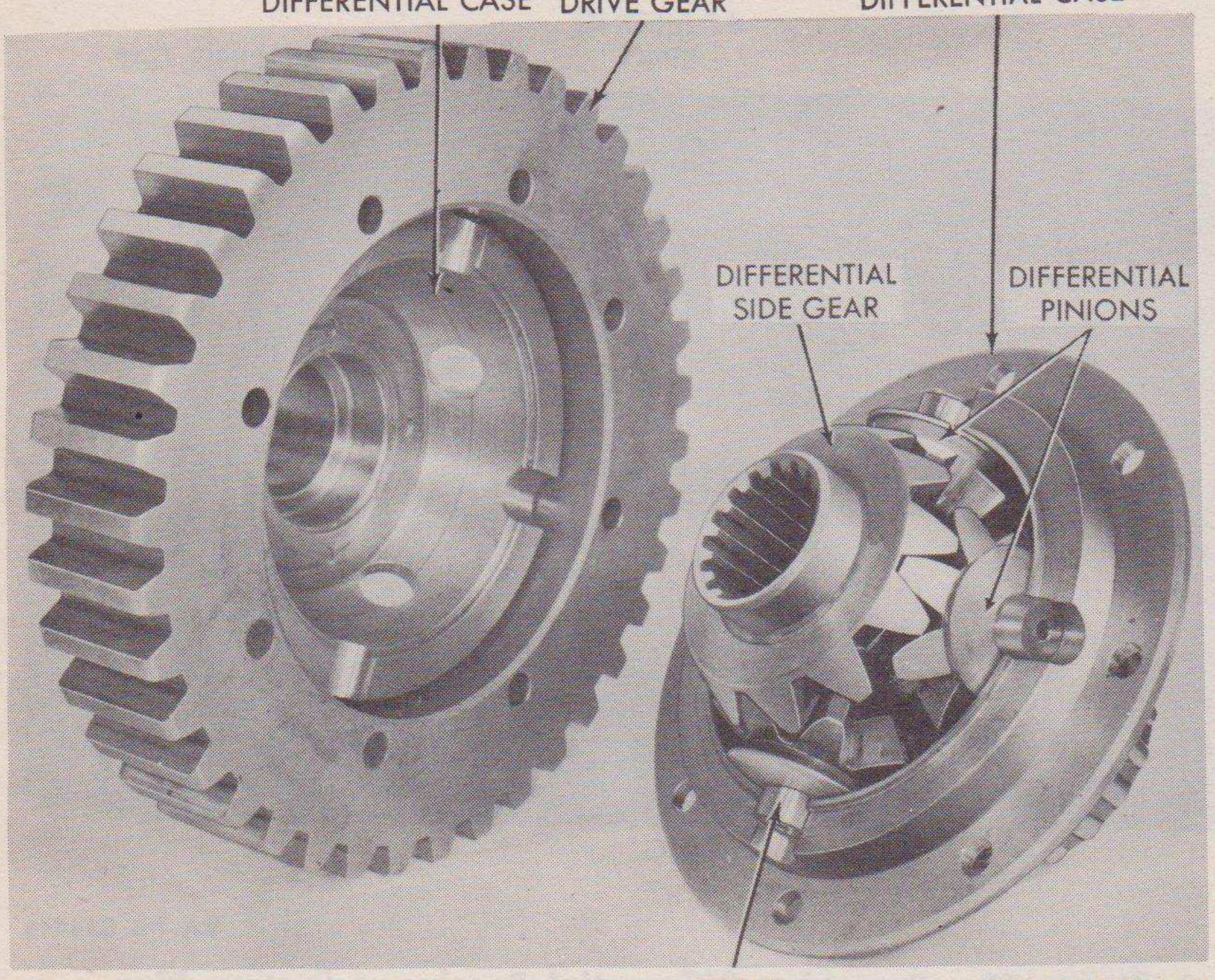


Figure 79 — Differential Case Assembly

(2) DISASSEMBLY (figs. 58, 83, 84). Place the bevel and spur gear assembly in a soft-jawed vise. Remove the locking wire from the two spur pinion bearing retainer plate screws. Remove the cap screws. Lift off cross shaft retainer plate. Place the bevel and spur gear assembly in an arbor press. Press the bevel gear and left-hand cone off the spur pinion shaft. Clamp the spur pinion in a vise. Remove the right-hand bearing cone from the pinion shaft.

(3) CLEANING, INSPECTION, AND REPAIR. Wash all parts with dry cleaning solvent and dry thoroughly. Inspect all surfaces for scores and cracks. Check the condition of the bevel gear, spur pinion, and cross shaft assembly. Carefully examine teeth for cracks, chipping, scores, and wear. If it is necessary to install a new bevel gear, the bevel pinion and shaft assembly must be replaced because these gears are mated and paired. The installation of one unit, instead of a mated pair, will result in a noisy assembly, and the life and per-

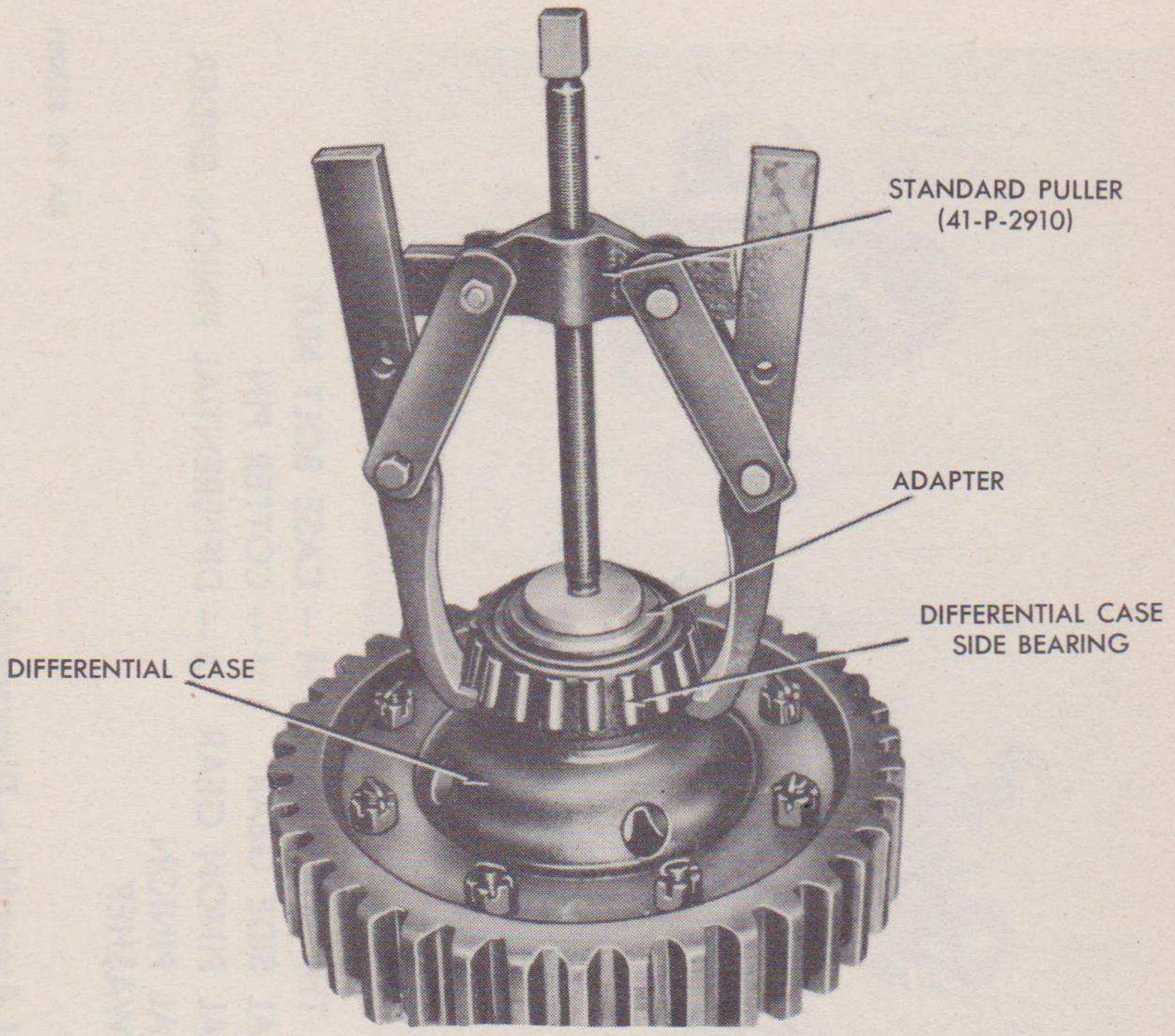
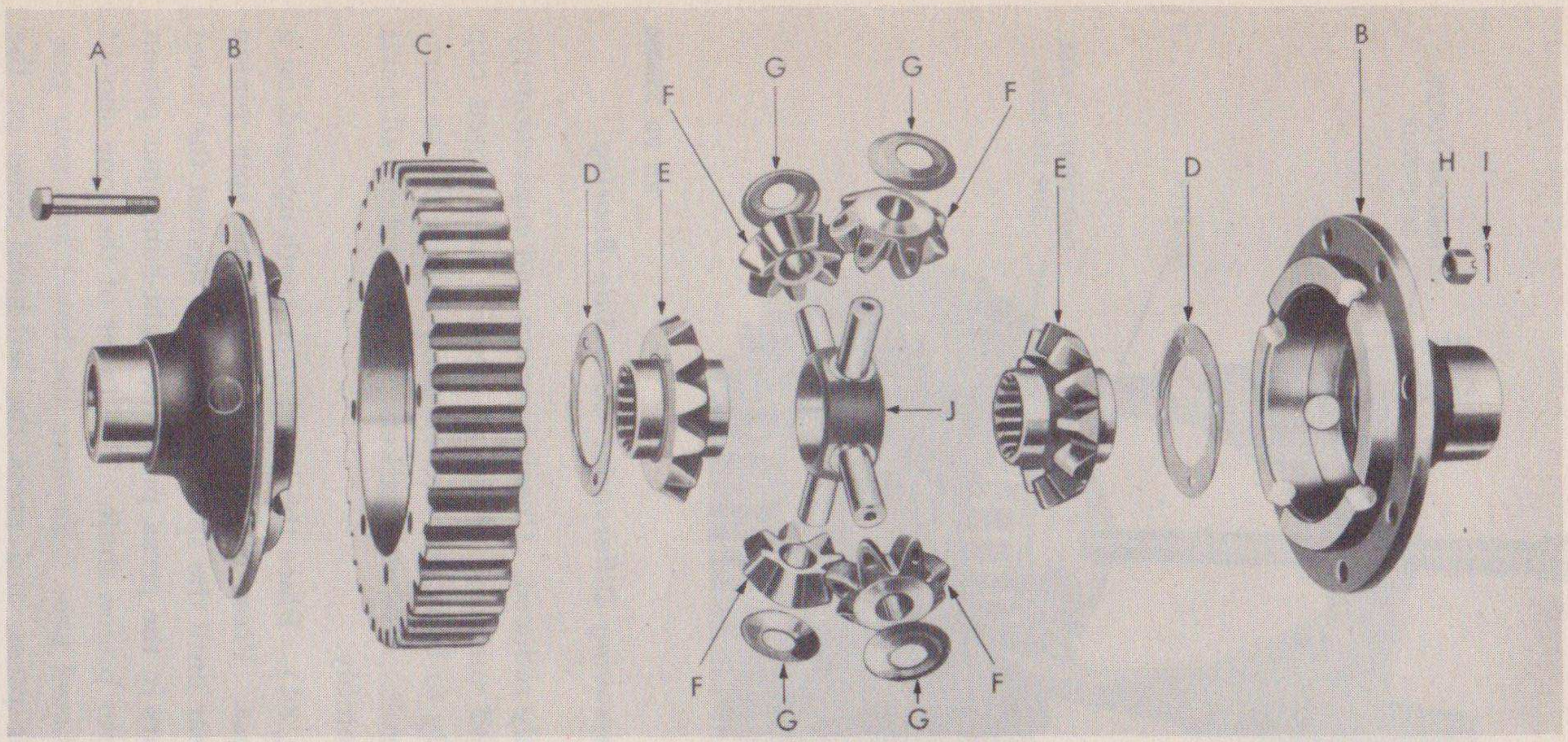


Figure 80 — Removing Differential Case Side Bearing

formance will be greatly reduced. Check bearings and cups carefully for damaged and pitted surfaces. A rough bearing and scored cup will cause the assembly to be noisy, and an early failure of the complete assembly will result. Use new gaskets. Clean and oil all parts thoroughly before assembly.

(4) ASSEMBLY (fig. 84). Place the bevel gear, teeth upward, on a collar in an arbor press. Press the splined end of the spur pinion shaft into the bevel gear until the spur pinion rests against the bevel gear. Leaving the gears in the press, press the right-hand spur pinion bearing cone on the spur pinion shaft. The taper of the cone should slant away from the bevel gear. Reverse the bevel and spur gear assembly in the arbor press, and press the left-hand cone on the protruding spur pinion shaft. The bearing cone must seat against the splined shoulder of the spur gear shaft. Install the spur pinion bearing retainer plate (the machined surface of the plate must be



A — DIFFERENTIAL CASE BOLT
B — CASE
C — DRIVE GEAR
D — SIDE GEAR THRUST WASHER
E — DIFFERENTIAL SIDE GEAR
F — DIFFERENTIAL PINON GEAR
G — DIFFERENTIAL PINION THRUST WASHER
H — CASE BOLT NUT
I — COTTER PIN
J — DIFFERENTIAL PINION SPIDER

RA PD 353081

Figure 81 — Differential Assembly — Disassembled

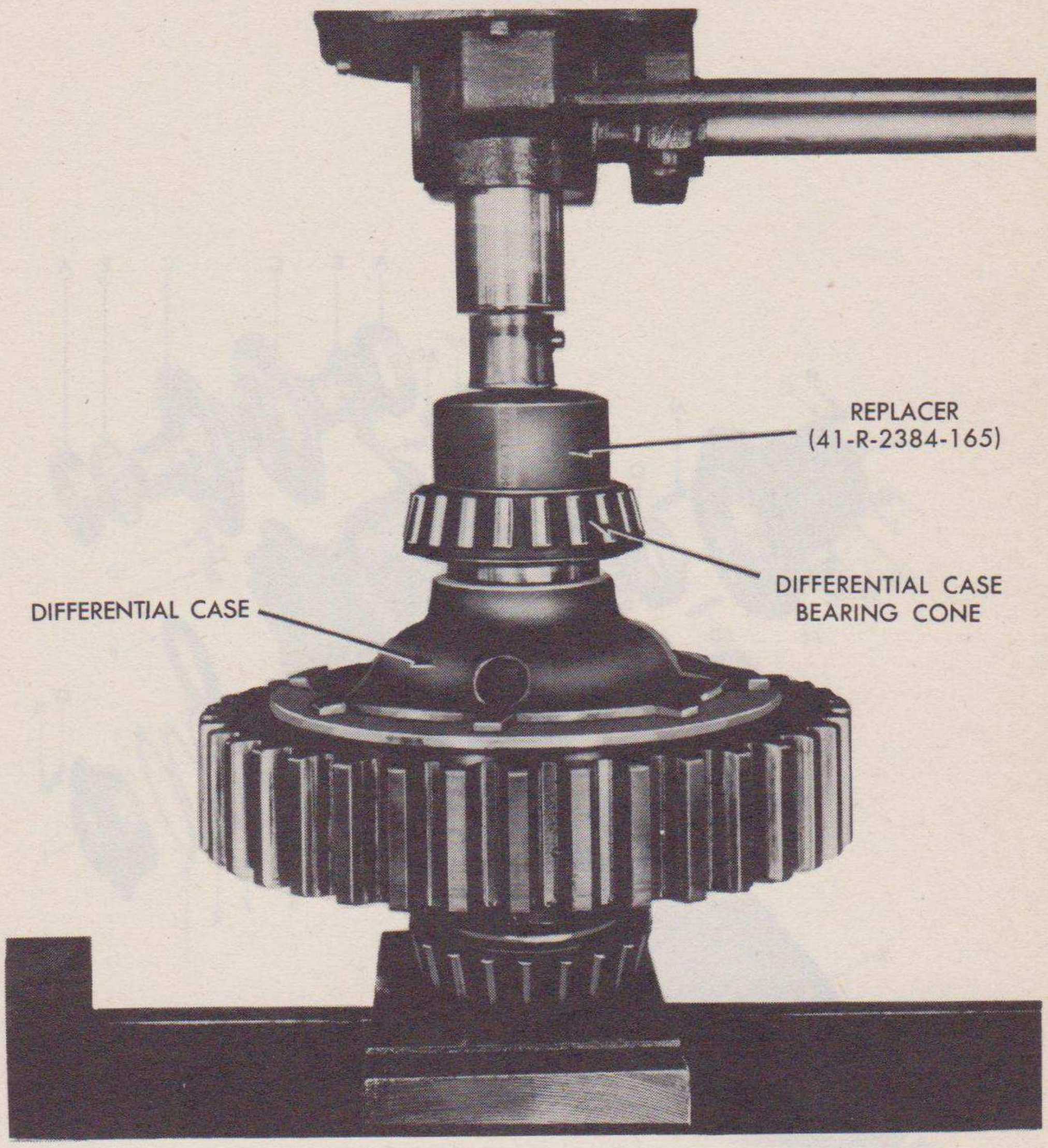


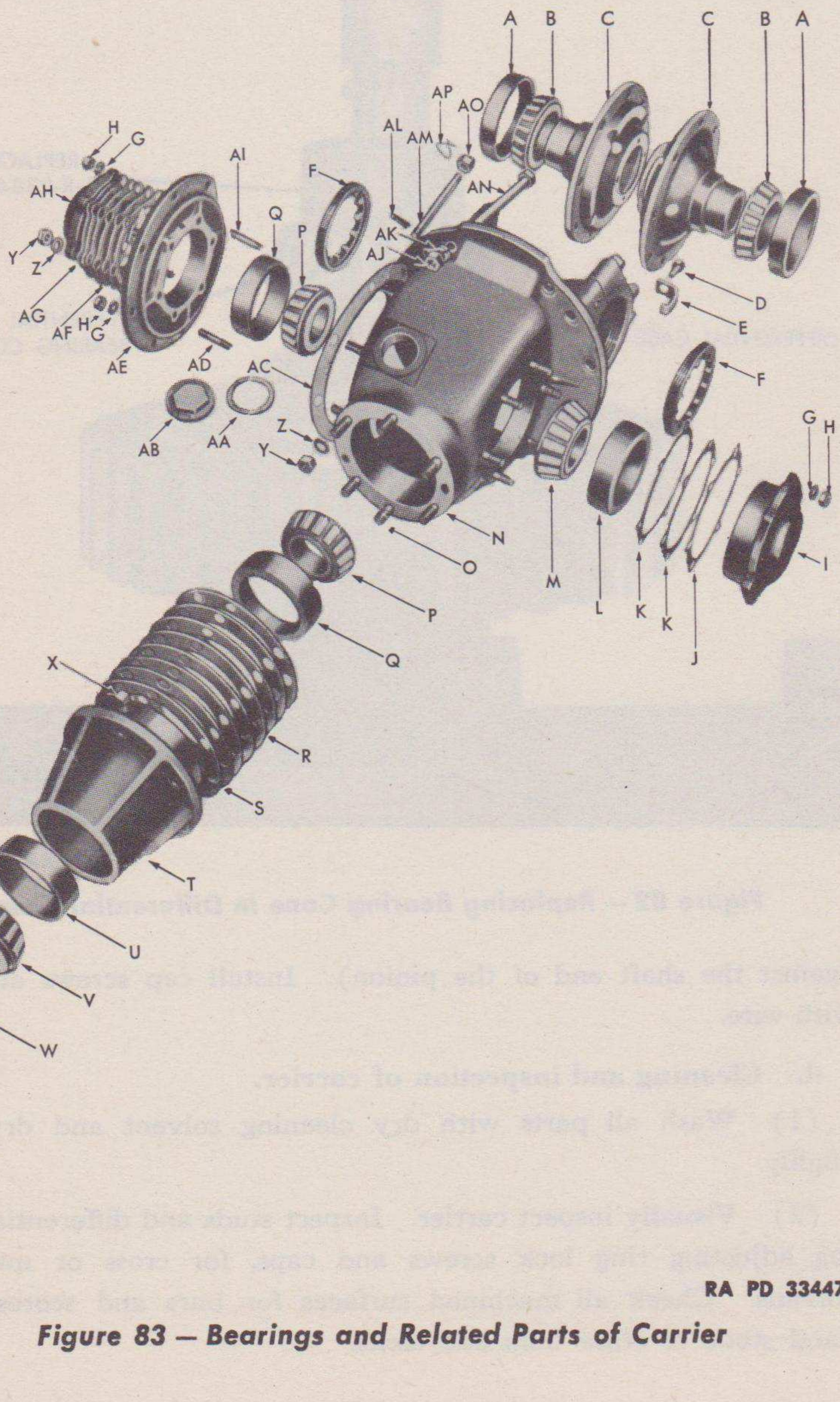
Figure 82 — Replacing Bearing Cone in Differential Case

against the shaft end of the pinion). Install cap screws and lock with wire.

d. Cleaning and inspection of carrier.

(1) Wash all parts with dry cleaning solvent and dry thoroughly.

(2) Visually inspect carrier. Inspect studs and differential bearing adjusting ring lock screws and caps, for cross or mutilated threads. Check all machined surfaces for burs and scores. Use hand stone to erase burs and nicks.



RA PD 334477

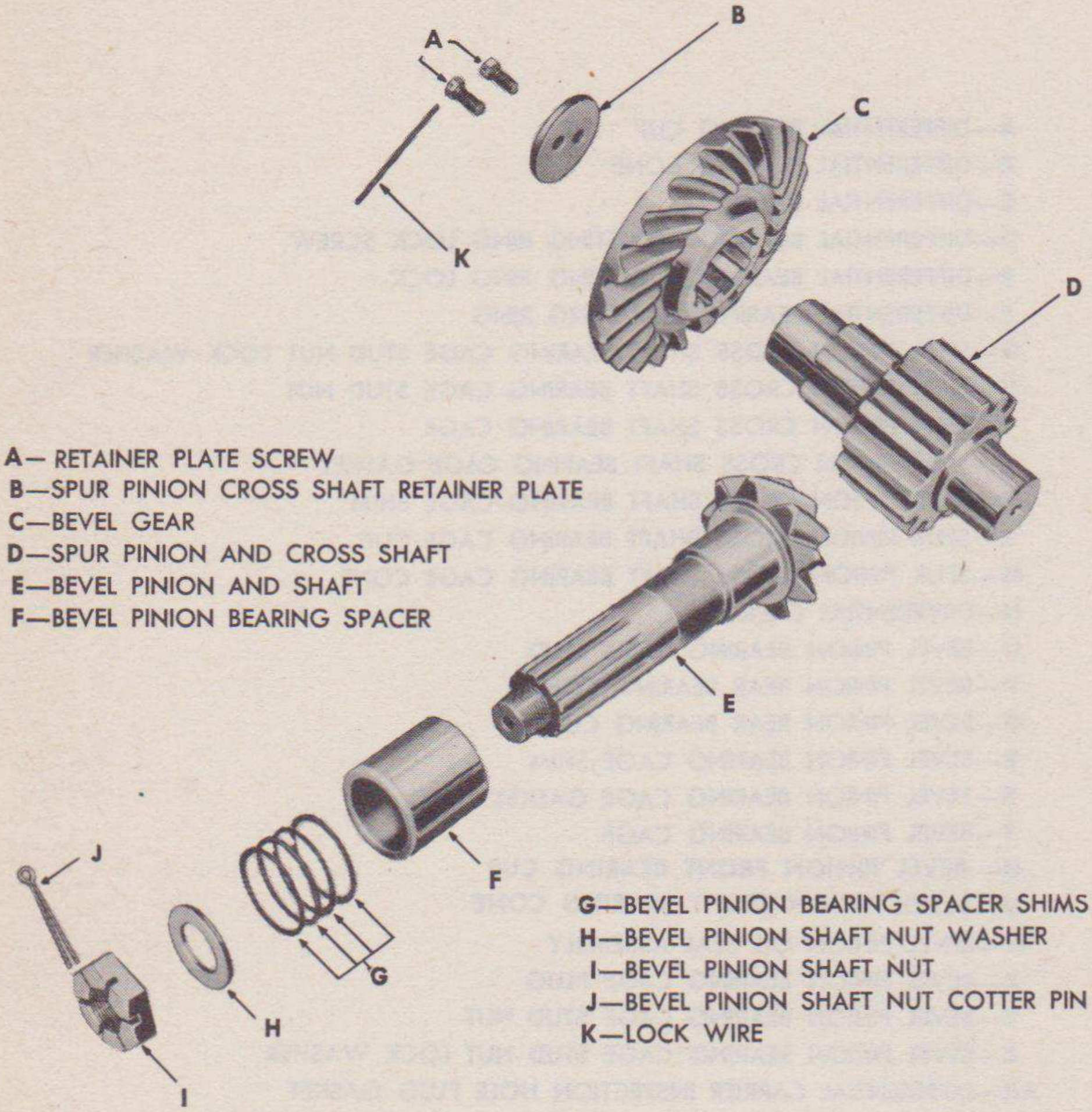
Figure 83 — Bearings and Related Parts of Carrier

A—DIFFERENTIAL BEARING CUP
B—DIFFERENTIAL BEARING CONE
C—DIFFERENTIAL CASE
D—DIFFERENTIAL BEARING ADJUSTING RING LOCK SCREW
E—DIFFERENTIAL BEARING ADJUSTING RING LOCK
F—DIFFERENTIAL BEARING ADJUSTING RING
G—SPUR PINION CROSS SHAFT BEARING CAGE STUD NUT LOCK WASHER
H—SPUR PINION CROSS SHAFT BEARING CAGE STUD NUT
I—SPUR PINION CROSS SHAFT BEARING CAGE
J—SPUR PINION CROSS SHAFT BEARING CAGE GASKET
K—SPUR PINION CROSS SHAFT BEARING CAGE SHIM
L—SPUR PINION CROSS SHAFT BEARING CAGE CUP
M—SPUR PINION CROSS SHAFT BEARING CAGE CONE
N—DIFFERENTIAL CARRIER
O—BEVEL PINION BEARING CAGE STUD
P—BEVEL PINION REAR BEARING CONE
Q—BEVEL PINION REAR BEARING CUP
R—BEVEL PINION BEARING CAGE SHIM
S—BEVEL PINION BEARING CAGE GASKET
T—BEVEL PINION BEARING CAGE
U—BEVEL PINION FRONT BEARING CUP
V—BEVEL PINION FRONT BEARING CONE
W—BEVEL PINION OIL SEAL ASSEMBLY
X—BEVEL PINION BEARING CAGE PLUG
Y—BEVEL PINION BEARING CAGE STUD NUT
Z—BEVEL PINION BEARING CAGE STUD NUT LOCK WASHER
AA—DIFFERENTIAL CARRIER INSPECTION HOLE PLUG GASKET
AB—DIFFERENTIAL CARRIER INSPECTION HOLE PLUG
AC—SPUR PINION CROSS SHAFT BEARING COVER GASKET
AD—SPUR PINION CROSS SHAFT BEARING COVER CAP STUD—LOWER
AE—SPUR PINION CROSS SHAFT BEARING COVER
AF—SPUR PINION CROSS SHAFT BEARING COVER CAP SHIM
AG—SPUR PINION CROSS SHAFT BEARING COVER CAP GASKET
AH—SPUR PINION CROSS SHAFT BEARING COVER CAP
AI—SPUR PINION CROSS SHAFT BEARING COVER STUD—UPPER
AJ—HOUSING THROUGH BOLT NUT
AK—HOUSING THROUGH BOLT NUT LOCK WASHER
AL—HOUSING THROUGH BOLT NUT COTTER PIN
AM—HOUSING AND DIFFERENTIAL CARRIER STUD
AN—HOUSING THROUGH BOLT NUT
AO—HOUSING AND DIFFERENTIAL CARRIER STUD NUT
AP—HOUSING AND DIFFERENTIAL CARRIER STUD NUT LOCK WIRE

RA PD 334477C

RA PD 334477C

Legend for Figure 83



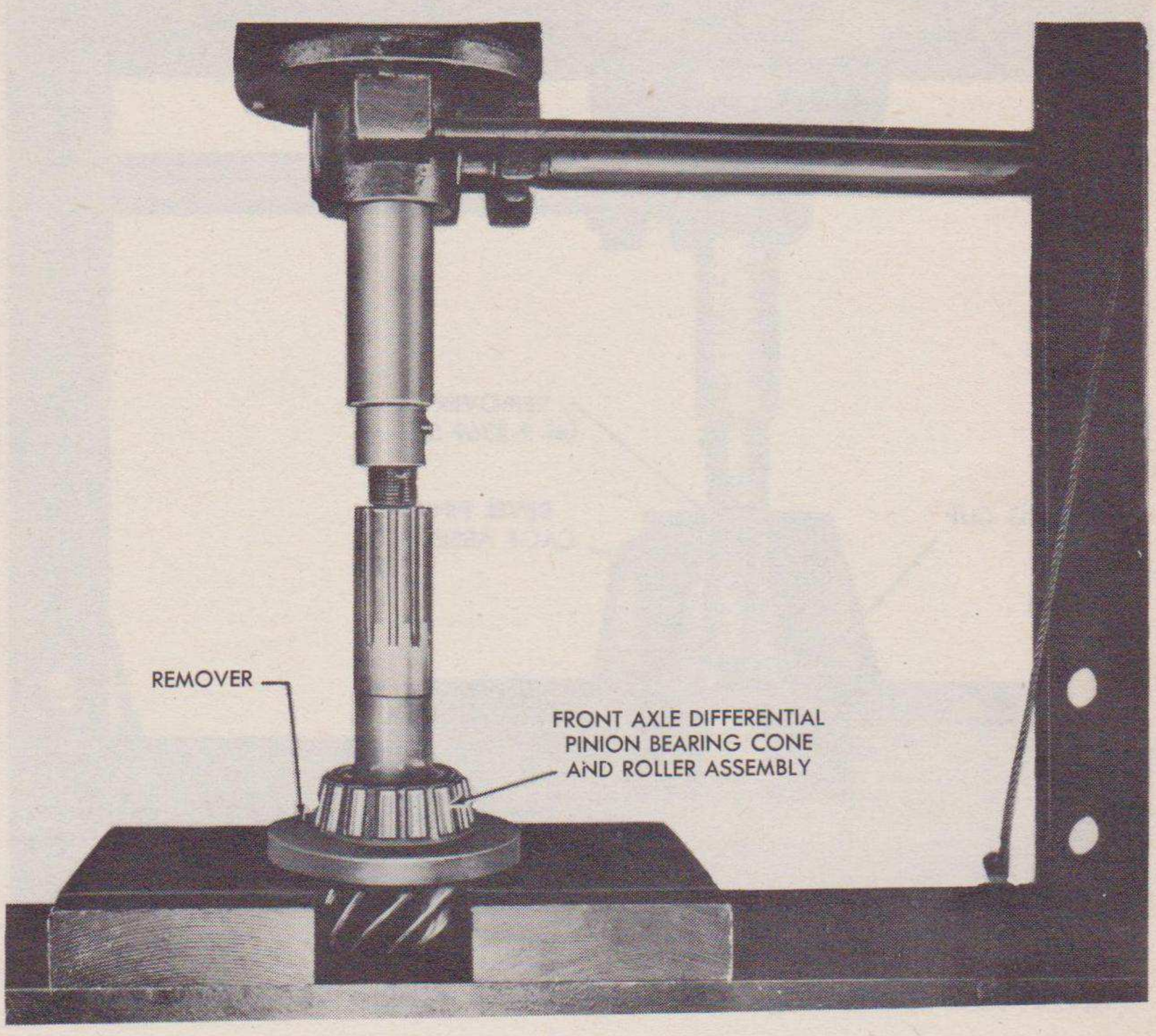
A— RETAINER PLATE SCREW
B—SPUR PINION CROSS SHAFT RETAINER PLATE
C—BEVEL GEAR
D—SPUR PINION AND CROSS SHAFT
E—BEVEL PINION AND SHAFT
F—BEVEL PINION BEARING SPACER
G—BEVEL PINION BEARING SPACER SHIMS
H—BEVEL PINION SHAFT NUT WASHER
I—BEVEL PINION SHAFT NUT
J—BEVEL PINION SHAFT NUT COTTER PIN
K—LOCK WIRE

RA PD 353082

Figure 84 — Spur Pinion and Cross Shaft and Bevel Pinion and Shaft With Related Parts

e. Assembly.

(1) INSTALL BEVEL GEAR AND SPUR PINION CROSS SHAFT ASSEMBLY INTO CARRIER (fig. 83). Place a new gasket on the spur pinion bearing cage studs. Install metal adjusting shims on the studs. These should total about 0.045 inch. Adjust later, if necessary. NOTE: *Be sure the oil groove holes in the gasket and shims line up with the oil groove holes in the cover.* Using a hammer, tap the right-hand bearing cup into the bearing cage. Install the bearing cage on the studs, lining up the oil grooves in the cage with the oil holes in the shims and gasket. Install lock washers and nuts. Tighten the nuts. Place the bevel and spur gear assembly in the carrier (fig. 87). Apply gasket cement to the machined surface of the spur pinion bearing



RA PD 350567

Figure 85 — Removing Front Axle Differential Pinion Bearing Cone and Roller Assembly

cage opening in the carrier, and install a new gasket. Place the spur pinion bearing cage on the studs, tapping to seat with hammer. Install lock washers and nuts. Place a new gasket on the spur pinion bearing cone studs. Add shims approximately 0.045 inch thick. Make sure oil holes in gasket and shims line up with oil holes in bearing cage. Place the cover on the studs. Install lock washers and nuts. Tighten the nuts.

(2) TEST SPUR PINION BEARING ADJUSTMENT. Bearings should be adjusted to a preload of 4 to 8 inch-pounds of torque adjustable by shims. Add a shim to decrease the bearing preload and remove a shim to increase the bearing preload. NOTE: *Shims vary from 0.003 to 0.030 inch thickness.*

(3) INSTALL BEVEL PINION BEARING CAGE ASSEMBLY (fig. 58). Install a new bevel pinion bearing cage gasket on the bevel pinion bearing cage studs. Place the shims on the studs. These should

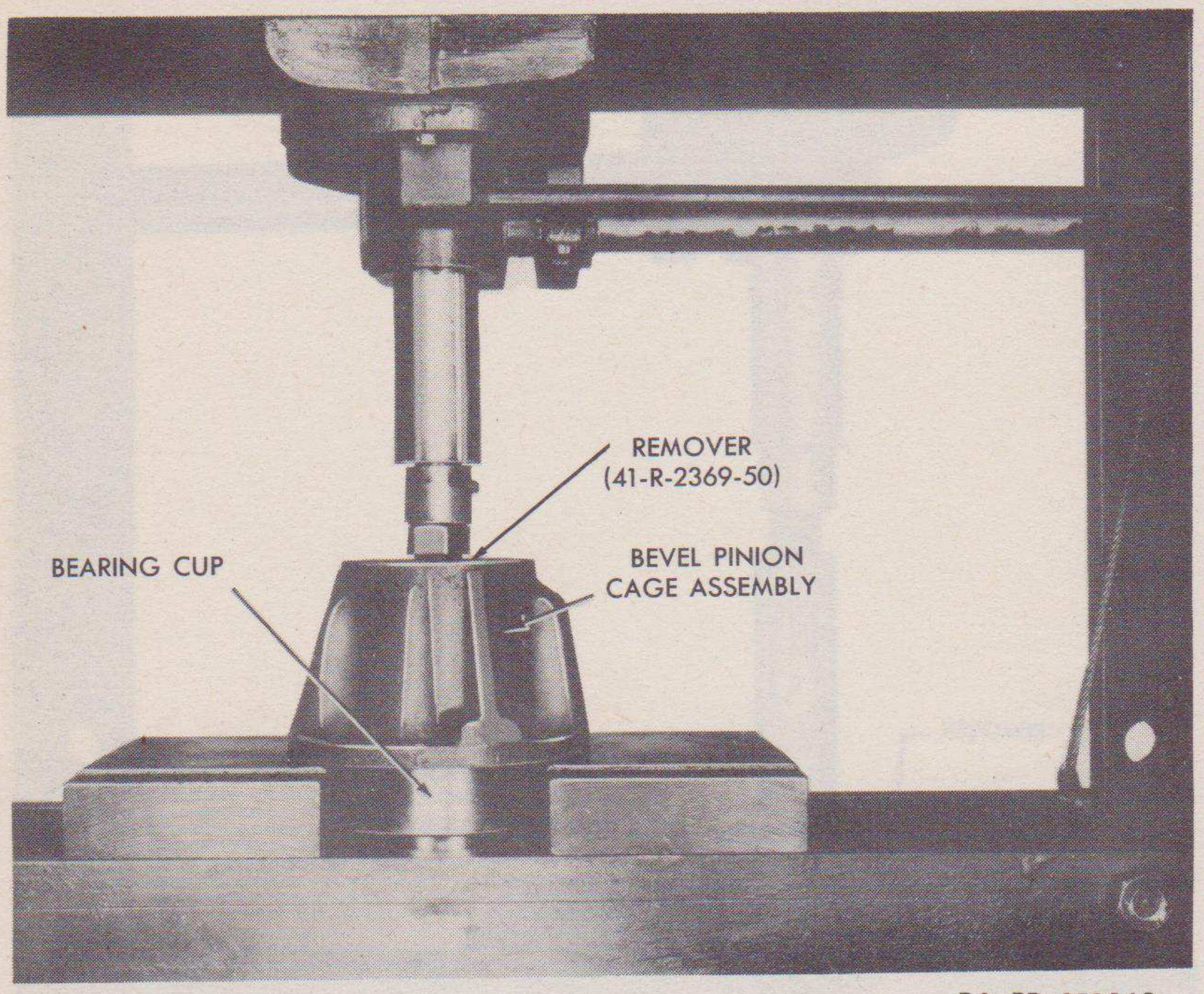


Figure 86 — Removing Front Axle Bevel Pinion Shaft Bearing Cup

total about 0.065-inch thickness. Place the bearing cage assembly on the studs and tap to seat with hammer. For the present, install only two of the six lock washers and stud nuts. This will simplify removing the bevel pinion bearing cage, if adjustment is necessary.

(4) TEST BEVEL GEAR AND BEVEL PINION TOOTH CONTACT. Paint four or five teeth of the bevel gear with prussian blue. Rotate the bevel pinion until the bevel gear has made one complete revolution. This will mark the bevel gear teeth, showing tooth contact with the bevel pinion. Inspect the markings on the teeth of the bevel gear. There are four types of incorrect tooth contact (fig. 88). NOTE: *When removing or adding shims at the spur pinion bearing cap or cover (to move the bevel gear), another shim or shims of the same thickness must be added or removed at the opposite cover or cap. It will be found that an adjustment of one gear to correct poor tooth contact necessitates a slight adjustment of the other gear in order to maintain the proper amount of backlash. Refer to figure 88 for correct procedure in each case.*

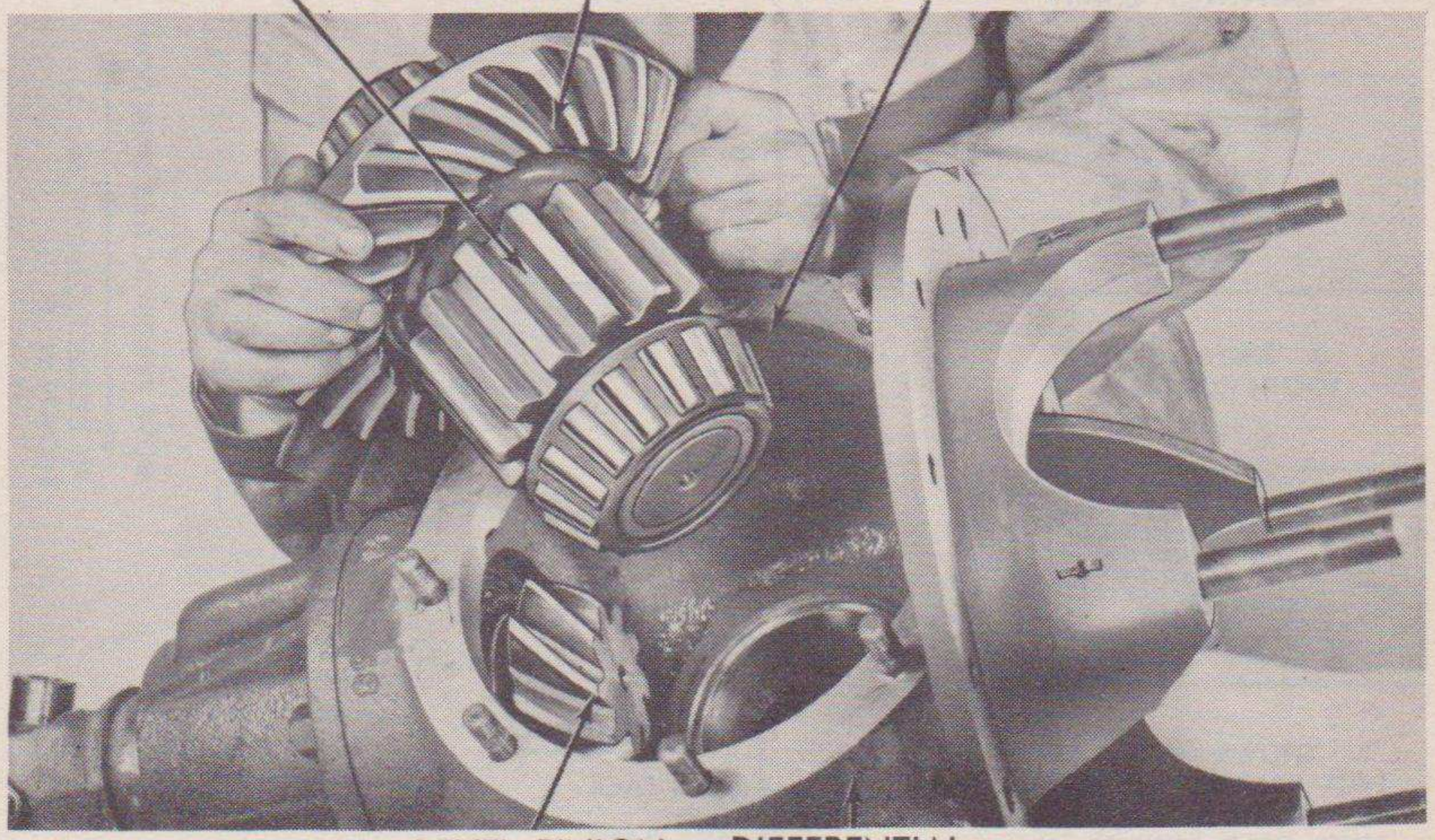
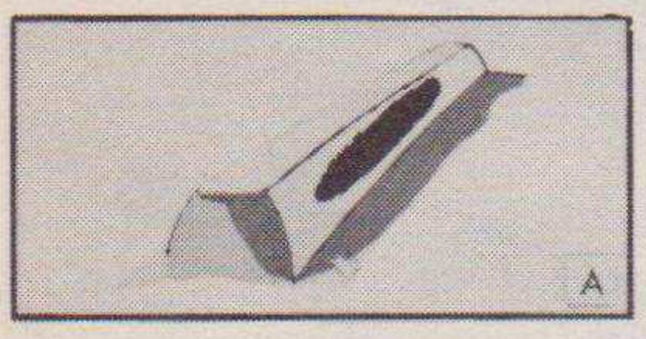


Figure 87 — Removing Spur Pinion and Cross Shaft Assembly

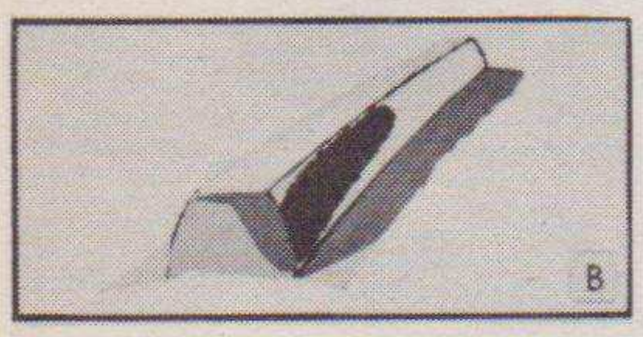
(5) TEST BACKLASH ADJUSTMENT (fig. 88). Fasten dial indicator to the housing of the carrier. Adjust the dial indicator to contact a bevel gear tooth near the outside diameter and set indicator at zero. Rotate the bevel gear forward and backward without turning the pinion, while watching the indicator. A correct reading will show from 0.006- to 0.010-inch movement. If the movement is more than 0.010 inch, remove the spur pinion bearing left-hand cover (fig. 58). Remove a shim at the left-hand cover and add a shim of equal thickness beneath the right-hand spur pinion bearing cage cover. If the movement is less than 0.006 inch, remove a shim from beneath the right-hand cover and add a shim of equal thickness beneath the left-hand cover. Install bearing cage and cover, tighten the side from which a shim has been removed first. Then tap the side to make sure the bevel gear has moved. Several adjustments may be necessary to obtain the proper backlash. After proper adjustment is made, install remaining four lock washers and nuts, that hold pinion cage assembly to carrier.

(6) INSTALL DIFFERENTIAL ASSEMBLY (fig. 89). Place front axle housing on a bench with oil filler plug upward. Grasp the differential

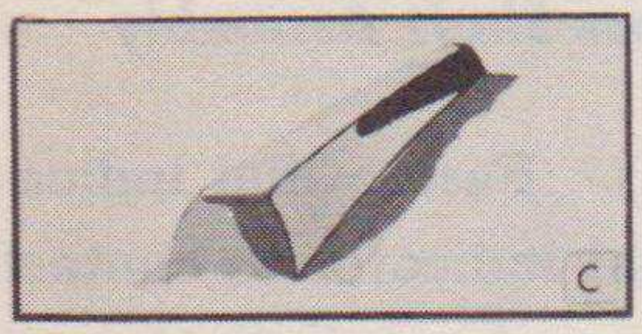
CONTACT CHART



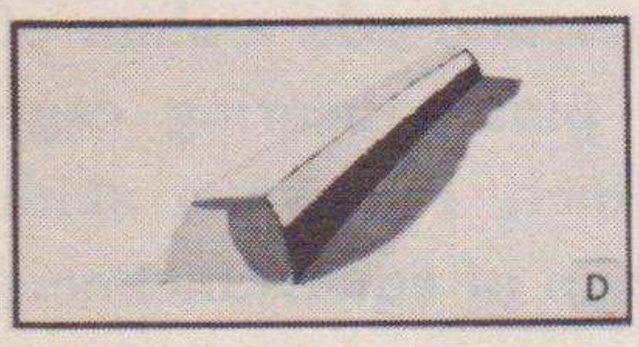
A SHOWS CORRECT TOOTH CONTACT



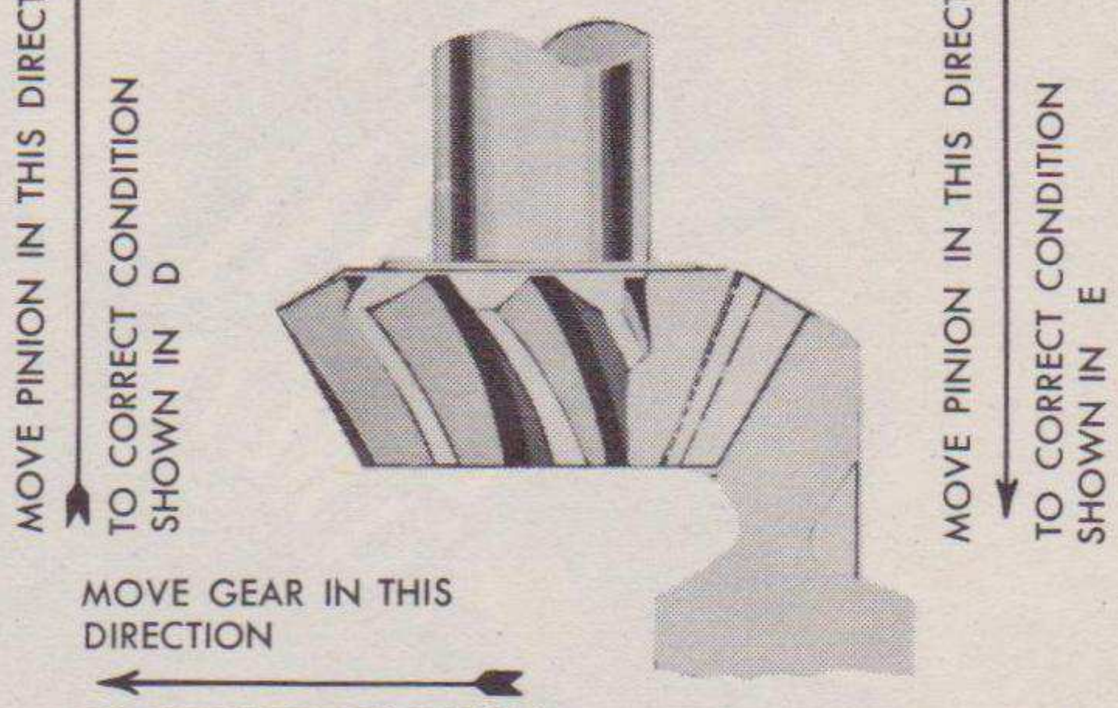
B SHOWS HEAVY CONTACT ON HEEL OF TOOTH. TO CORRECT THIS, MOVE BEVEL GEAR TOWARD PINION. MOVE PINION AWAY FROM GEAR TO AGAIN SECURE CORRECT BACKLASH

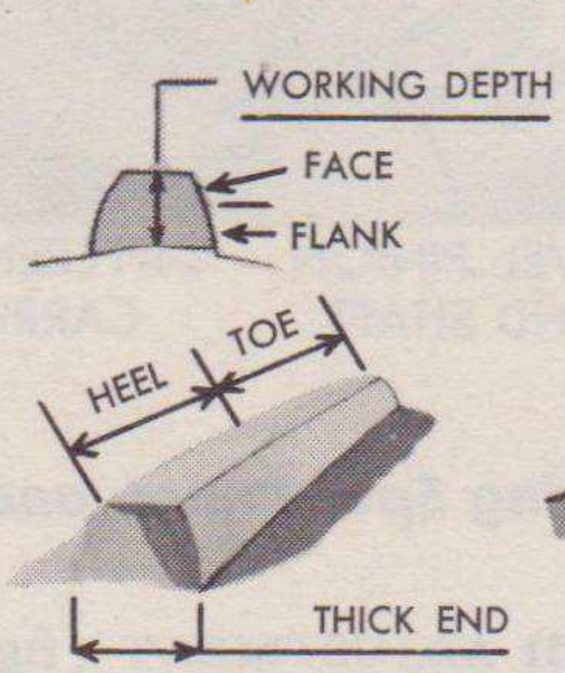


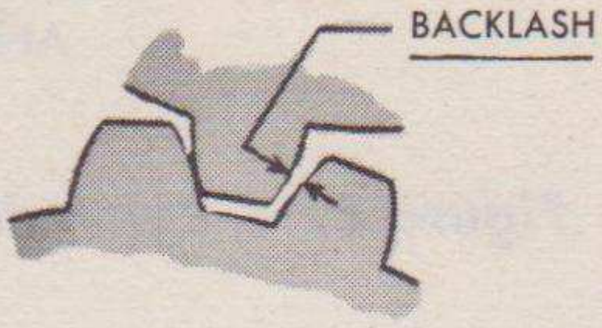
C SHOWS HEAVY CONTACT ON TOE OF TOOTH. TO CORRECT THIS, MOVE BEVEL GEAR AWAY FROM PINION. MOVE PINION TOWARD BEVEL GEAR TO AGAIN SECURE CORRECT BACKLASH



D SHOWS HEAVY CONTACT ON FLANK OF TOOTH. TO CORRECT THIS MOVE PINION AWAY FROM GEAR UNTIL CONTACT COMES TO FULL WORKING DEPTH OF GEAR TOOTH WITHOUT BREAKING CONTACT AT FLANK. MOVE GEAR TOWARD PINION TO SECURE CORRECT BACKLASH





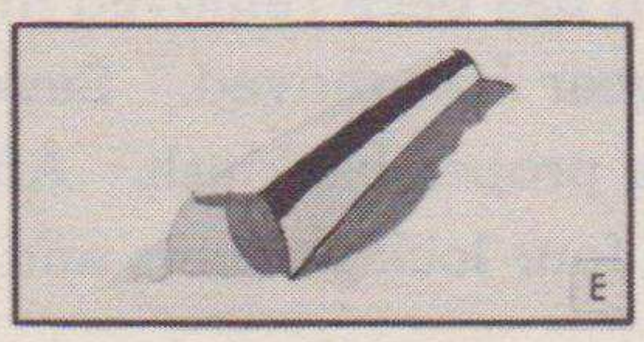


1. ADJUST PINION AND GEAR UNTIL HEELS (THICK ENDS) ARE FLUSH ALLOWING 0.006-0.010-IN BACKLASH

2. PAINT THREE OR FOUR TEETH OF RING GEAR WITH RED LEAD OR PRUSSIAN BLUE, AND ROTATE PINION UNTIL RING GEAR MAKES COMPLETE REVOLUTION

3. NOTE TOOTH CONTACT WHICH SHOULD COVER TWO-THIRDS OF FACE OF TOOTH WITH NO HEEL OR TOE BEARING. SEE A

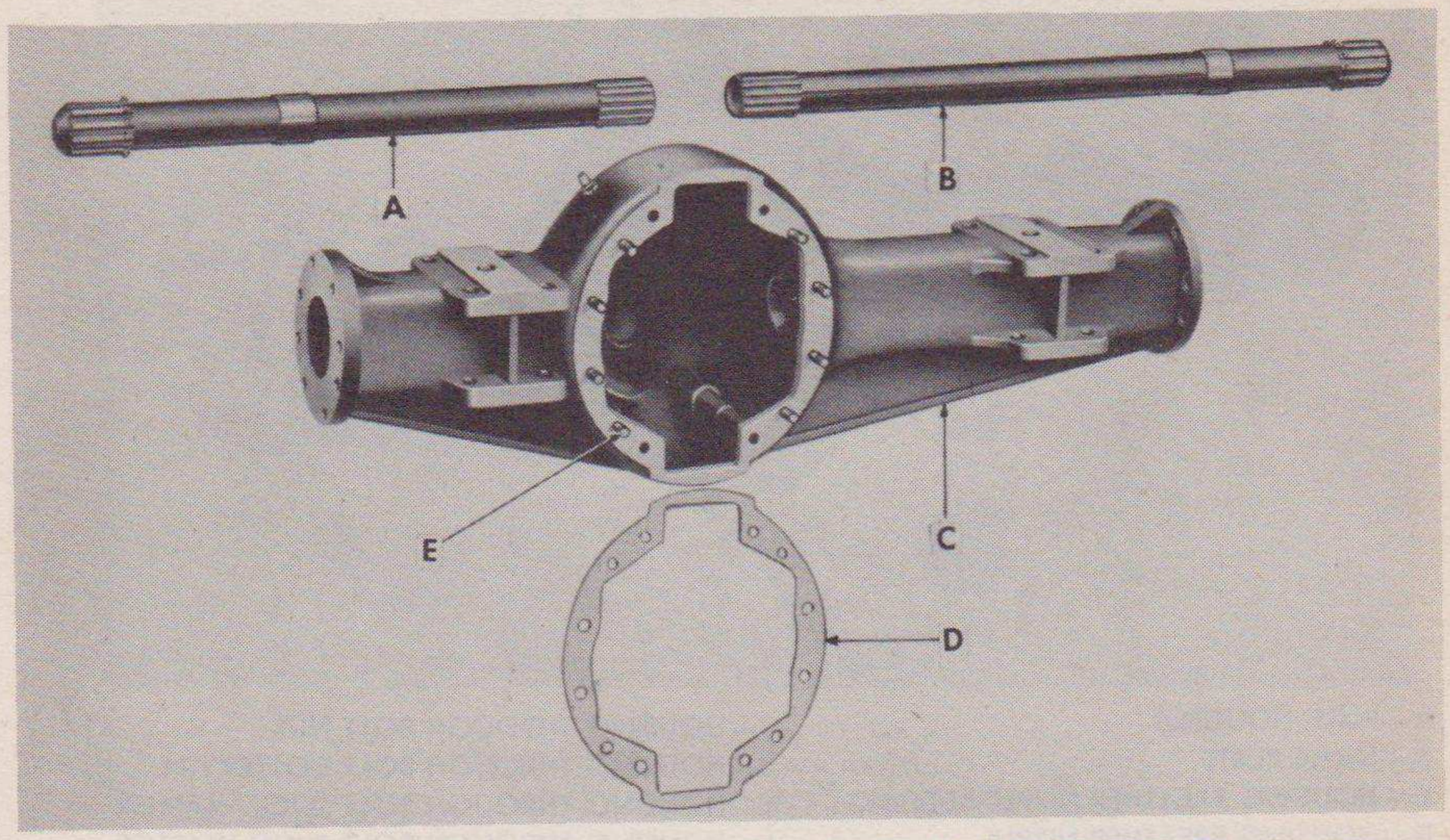
4. VARY POSITION OF PINION AND GEAR AS PER CHART UNTIL PROPER TOOTH CONTACT IS OBTAINED. BE SURE THAT SUFFICIENT BACKLASH HAS BEEN ALLOWED SO THAT GEAR CAN BE COMPLETELY REVOLVED WITHOUT ANY HIGH SPOTS BEING FELT.



E SHOWS HEAVY CONTACT ON FACE OF TOOTH. TO CORRECT THIS MOVE PINION TOWARD GEAR UNTIL CONTACT COVERS FLANK OF TOOTH WITHOUT BREAKING CONTACT AT FACE. MOVE GEAR AWAY FROM PINION TO SECURE CORRECT BACKLASH

RA PD 334459

Figure 88 — Bevel Gear and Pinion Adjustment Chart



A—LEFT AXLE SHAFT

B—RIGHT AXLE SHAFT

C—FRONT AXLE HOUSING ASSEMBLY

D—HOUSING AND DIFFERENTIAL CARRIER GASKET

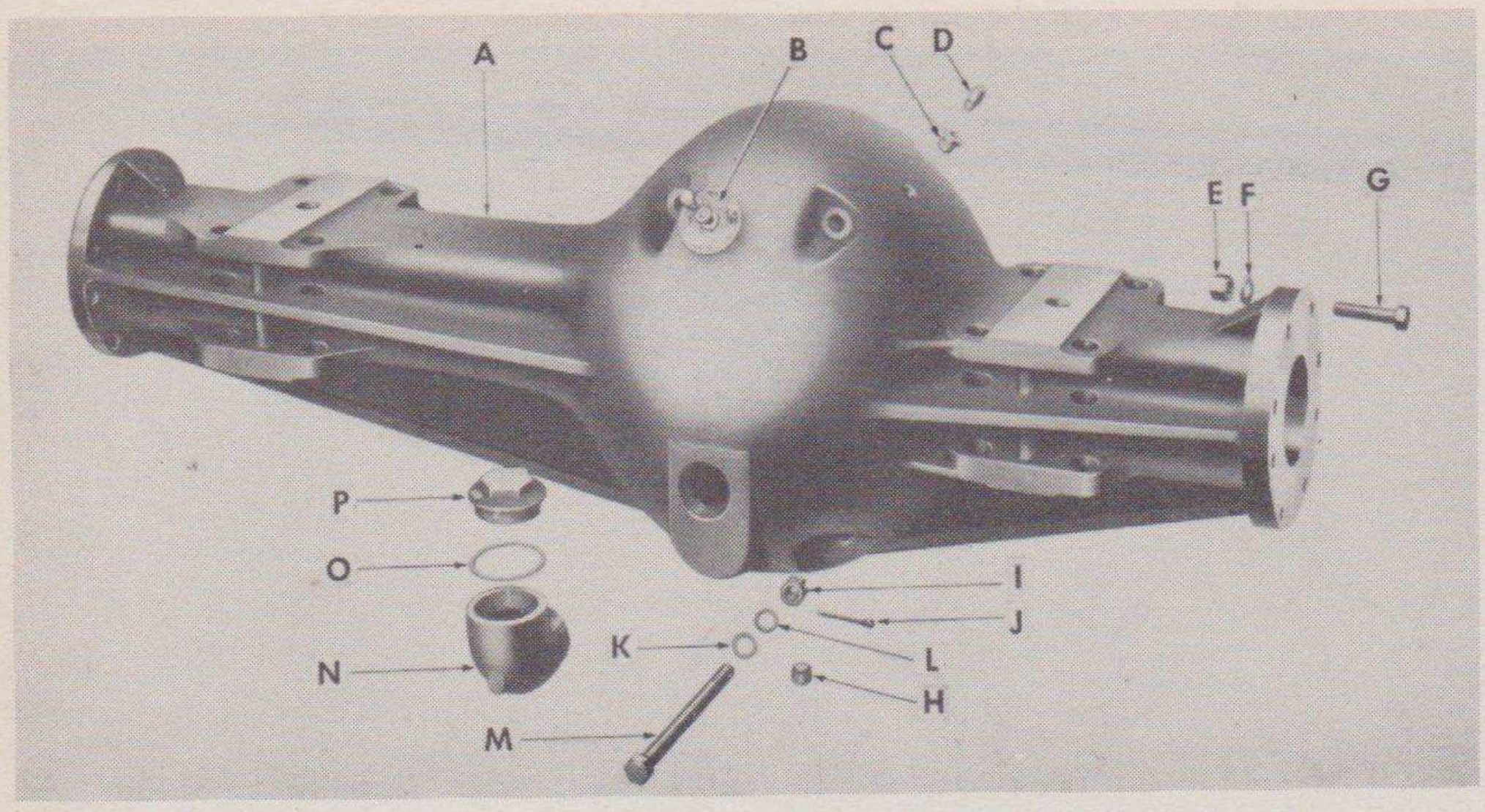
E—HOUSING AND DIFFERENTIAL CARRIER STUD

RA PD 334476

Figure 89 — Front Axle Housing and Shafts — Rear View

assembly at the bearing cones on the hubs of the case assembly and slide the differential case assembly into the carrier. Make sure the thick ends of the bolt heads are toward the hubs and the teeth of the differential gear mesh with the teeth of the spur gear. Avoid injury to teeth of either gear. Place the bearing adjusting rings (fig. 78) in position. Install carrier caps on studs. These were marked at disassembly to assure proper assembly. Check the position of the threads on the rings (fig. 77) so that they will fit perfectly with threads of caps. Install carrier cap, nuts, and cotter pins.

(7) TEST ADJUSTMENT OF DIFFERENTIAL BEARING CONES. Tighten both adjusting rings (fig. 78), just tight enough to remove all end play in the differential assembly. Observe the position of the gear in the carrier. There should be clearance on one side between the drive gear and the edge of the carrier. Make sure the heads of the differential case bolts clear the bevel gear. With everything correctly positioned, turn each adjusting ring in two more notches.



A—AXLE HOUSING
B—NAME PLATE
C—HOUSING BREATHER NIPPLE BUSHING
D—HOUSING BREATHER NIPPLE
E—STEERING KNUCKLE FLANGE BOLT NUT
F—STEERING KNUCKLE FLANGE BOLT NUT LOCK WASHER
G—STEERING KNUCKLE FLANGE BOLT
H—HOUSING OIL DRAIN PLUG
I—HOUSING THROUGH BOLT NUT
J—HOUSING THROUGH BOLT COTTER PIN
K—HOUSING THROUGH BOLT LOCK WASHER
L—HOUSING THROUGH BOLT PLAIN WASHER
M—HOUSING THROUGH BOLT
N—HOUSING OIL FILLER ELBOW
O—HOUSING OIL FILLER PLUG GASKET
P—HOUSING OIL FILLER PLUG

RA PD 334474

Figure 90 — Front Axle Housing — Front View

(8) COMPLETE INSTALLATION OF DIFFERENTIAL ASSEMBLY. When adjustment has been completed, place adjusting ring locks in position. Install cap screws and locking wire (fig. 76).

55. FRONT AXLE HOUSING (figs. 89 and 90).

a. Remove axle housing drain plug, filler cap, gasket, filler and breather nipple assembly. Clean the axle housing thoroughly with dry cleaning solvent, making sure all lubricant is removed from surfaces and crevices. Clean drain plug and check for magnetism. If no longer magnetized, replace. Clean breather nipple assembly thoroughly. If the assembly is plugged, it will create a back pressure in housing and force lubricant through oil seals. Inspect housing sleeves for looseness in housing. If loose, install new sleeves. Install filler and filler cap. Install drain plug and breather nipple assembly. Install all new gaskets.

Section IV

ASSEMBLY

56. PRELIMINARY INSTRUCTIONS.

a. Clean housing interior and test all assemblies. Make sure all subassemblies are clean and free from dirt and chips. Coat all gears and bearings with light oil, and rotate to prove free operation.

57. ASSEMBLE AXLE.

a. Install carrier assembly (figs. 77 and 89). Place a new gasket on the carrier studs. Hoist carrier assembly (chain hoist or unit lift) and swing into position. Install carrier lock washers and nuts. Position four carrier-to-housing through bolts. Install and tighten nuts, install cotter pins.

b. Install universal joint assembly and axle shaft into steering knuckle assembly. Clamp steering knuckle assembly in vise. Slide universal joint assembly (axle shaft end) part way into knuckle flange assembly. Apply grease to the universal joint assembly and push the assembly the rest of the way into position.

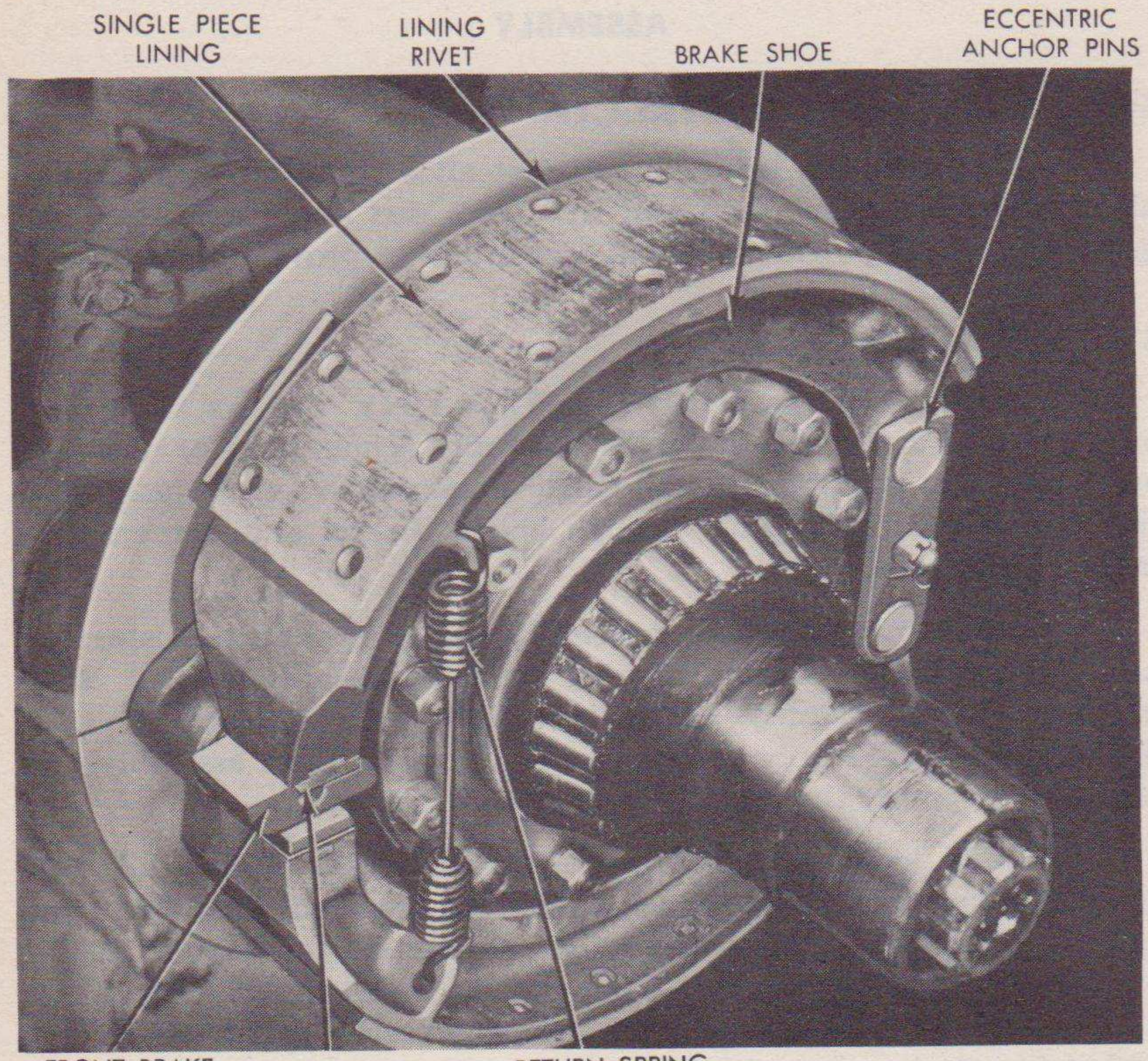
c. Install knuckle assembly with universal joint and axle assembly (fig. 64). Place knuckle over the universal joint shaft, and against the knuckle flange assembly. Be certain the keyway in the outer end of the knuckle is in line with the steering arm. Place gasket on axle housing flange and attach steering knuckle trunnion socket to axle housing with bolts, lock washer and nuts.

d. Install brake dust shield. Place two halves of brake dust shield in position on the knuckle flange assembly. Install cap screws and lock washers.

e. Install brake assembly. Position brake camshaft, tapping in place with a hammer. Insert two brake shoe anchor pins, through the knuckle flange assembly (fig. 63). Install the brake shoe anchor pin lock washers and nuts and tighten (fig. 62). Place grease fittings in end of anchor pins. Place brake shoes over anchor pins and tap into place. Install brake shoe return spring. Place anchor pin link over anchor pins. Install anchor pin nut and cotter pin (figs. 61 and 62).

f. Install hubs and drums. Refer to TM 9-813.

g. Install axle shaft flange (fig. 65). Place a new axle shaft flange gasket on studs. Place the axle shaft drive flange on the studs and tap in place with hammer. Install the four tapered dowels on every other stud. Install lock washers and nuts. Install axle shaft drive flange retainer, placing new retainer packing, gasket, and washer in



RA PD 334505

Figure 91 — Brake Assembly Installed — Front Wheel

front of the retainer in the order named. Install the retainer lock washers and cap screws. Repeat same operation on right-hand side.

h. Install tie rod. Place one tie rod end on knuckle arm and tap into position so that tie rod bolt can be inserted. Insert bolt from bottom and install nut. Tighten nut at left end only, then back off one castellation and insert cotter pin. Purpose of leaving out cotter pin at right end, so that toe-in adjustment can be made later.

i. Install brake chambers. Place brake chamber in place on knuckle assembly. Install cap screw and lock washer. Slip clevis over slack adjuster end and install clevis pin and cotter pin.

j. Install slack adjuster. Slide slack adjuster on inner end of brake camshaft. Install snap ring (fig. 60).

k. Install axle in vehicle. Refer to TM 9-813 for installation procedures.

Section V

TEST, ADJUSTMENT, AND DATA

58. TEST FRONT AXLE OPERATION.

a. Fill front axle housing with proper grade and quantity of lubricant (see lubrication order) and give rotary power test. Do not neglect to fill reservoir between pinion bearings. Attach yoke to power source and test. Any undue noise will indicate faulty assembly, which must be checked step by step. If unit operates quietly and smoothly, it may be installed in vehicle.

59. TOE-IN AND TURNING RADIUS ADJUSTMENTS.

a. Toe-in. The right-hand end of the tie rod has 12 threads per inch. The left-hand end of the tie rod has 16 threads per inch. Their construction permits a fine adjustment of the length of the tie rod in the following manner. Refer to TM 9-813 (fig. 110).

(1) TO LENGTHEN TIE ROD 1/48 OF AN INCH. Loosen the two binder bolts at left-hand tie rod end. Remove right-hand tie rod bolt. Swing tie rod toward rear of vehicle about 18 inches. Unscrew tie rod one complete turn from left-hand tie rod end. Tighten binder bolt nuts on left-hand tie rod end. Loosen binder bolts and lock nut on right-hand tie rod end. Screw right-hand tie rod end, one complete turn inward, on tie rod. This adjustment decreases toe-in 1/48 of an inch. Reverse this procedure to increase toe-in. Install tie rod bolt, nut and cotter pin. Tighten binder bolt nuts and lock nut. Tie rod must be adjusted to meet specified toe-in (1/8 to 3/16 inch).

NOTE: *Always check toe-in after any change in caster or camber angles, or after any alteration in the tie rod end adjustment.*

b. Adjust turning radius. Adjust turning radius stop screws to obtain an inside turning angle of 28 degrees and an outside turning angle of 24 degrees. These adjustments provide proper turning angle for steering joints.

60. DATA.

a. Backlash.

Bevel pinion	0.006 to 0.010 in.

b. Shims available.

Bevel pinion cage	0.003 to 0.005 to 0.030 in.
Bevel pinion bearing	0.021 to 0.024 to 0.030 to 0.034 in.
Spur pinion shaft	Thick or thin
Steering knuckle (up and down)	0.005 to 0.010 in.

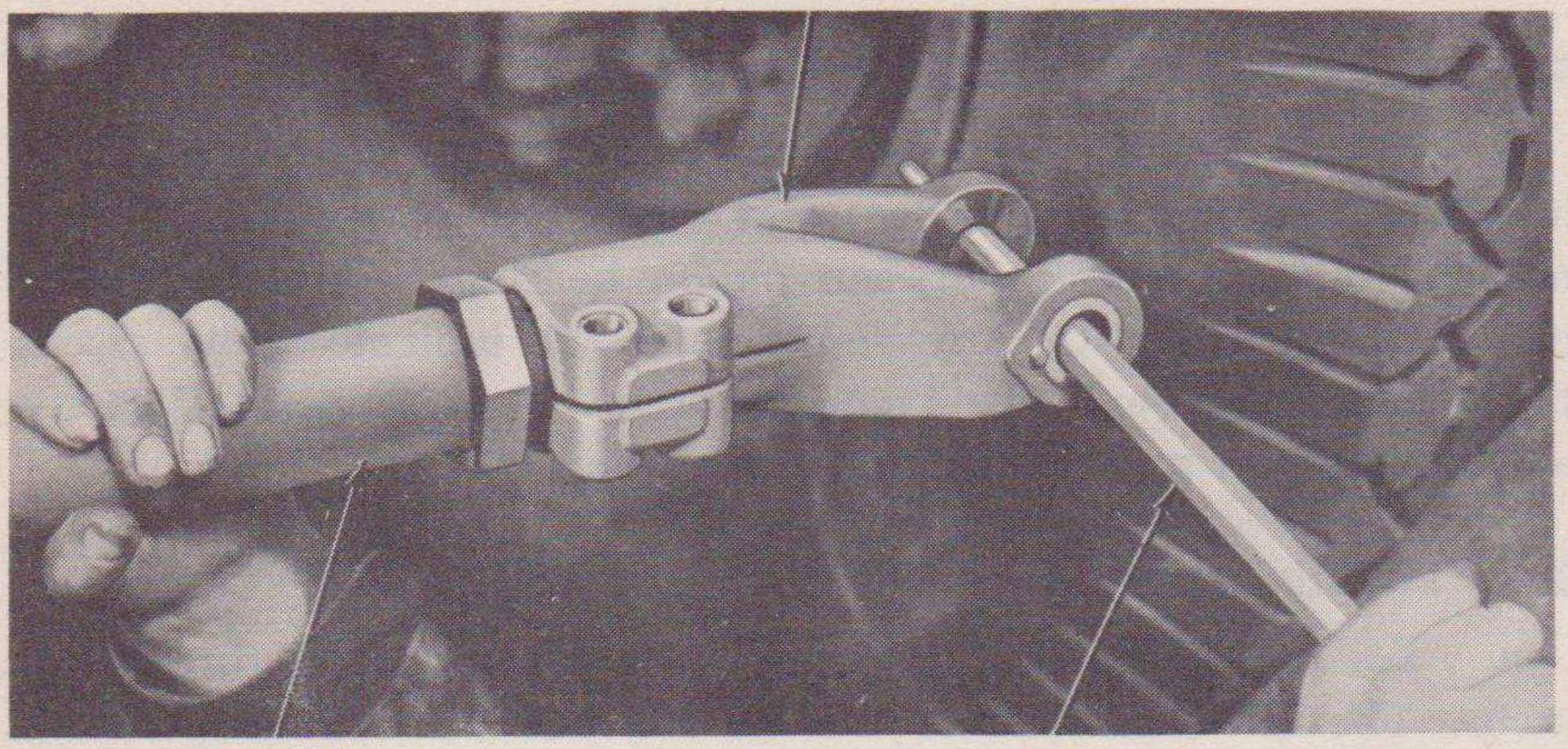


Figure 92 — Adjusting Toe-in

c. Clearances.

Differential side bearings	Preload to 4 to 8 in.-lb
Between spider and pinion	0.004 to 0.006 in.
Between side gear and case	0.005 to 0.009 in.
Pinion shaft bearing adjustment	Preload to 4 to 8 in.-lb
Steering knuckle (up and down)	Barely perceptible, but loose enough so bearings do not bind
Side gear to axle shaft	0.000 to 0.004 in.

d. New limits.

Side gear thrust washer	0.062 to 0.058 in.
Pinion gear thrust washer	0.0625 to 0.0585 in.

e. Worn limits.

Side gear thrust washer	0.048 in.
Pinion gear thrust washer	0.048 in.

f. Steering data.

Caster	4-deg to 6-deg
Camber	¾ deg
Toe-in	⅛ to 3/16 in.
Inside turning angle	28 deg
Outside turning angle	24 deg

g. Axle shaft data.

Diameter at differential end	2.500 to 2.502 in.
Splines at differential end	12
Splines at hub end	10

CHAPTER 7

REAR AXLE AND TORQUE RODS

Section I

DESCRIPTION AND DATA

61. DESCRIPTION AND OPERATION.

a. Description (fig. 93).

(1) The tandem driving rear axle units are of the double-reduction, full-floating type. The double reduction is accomplished by a spiral bevel pinion and bevel ring gear in connection with a spur gear second reduction. Both carrier assemblies are identical except that on the rearward rear axle, a cap extends over the rear end of the through shaft, making a rear oil seal unnecessary. The two axle assemblies are the same except that they face in opposite directions. In view of this similarity, the following instructions will cover one axle only.

(2) The bevel pinion and the through shaft on which it is mounted is carried in two tapered bearing cones, one bearing being mounted directly on the bevel pinion. The bevel gear is keyed to the end of the spur pinion shaft which is mounted in one single row and one double row roller bearings. The large differential drive gear is mounted in the differential case and bolted to it between the two halves of the case. The differential case is mounted in the carrier on roller bearings. The axle shafts are drop forged heat-treated alloy steel; the driving flange is forged integral with the shaft.

(3) The following is a list of Timken rear axle models which are used on the various chassis:

Crane chassis	SD-353-W-X-16 (Hi-traction differential)
Prime mover and van chassis	SD-353-W-X-7 (Hi-traction differential) SD-353-W-X-12 (Standard differential)
All other chassis	SD-353-W-X-13 (Hi-traction differential) SD-353-W-X-14 (Standard differential)

b. Operation. Power is transmitted from the engine through the transfer case to the forward rear axle by means of a propeller shaft, then to the rearward rear axle by means of a propeller shaft which connects the forward rear axle to the rearward rear axle.

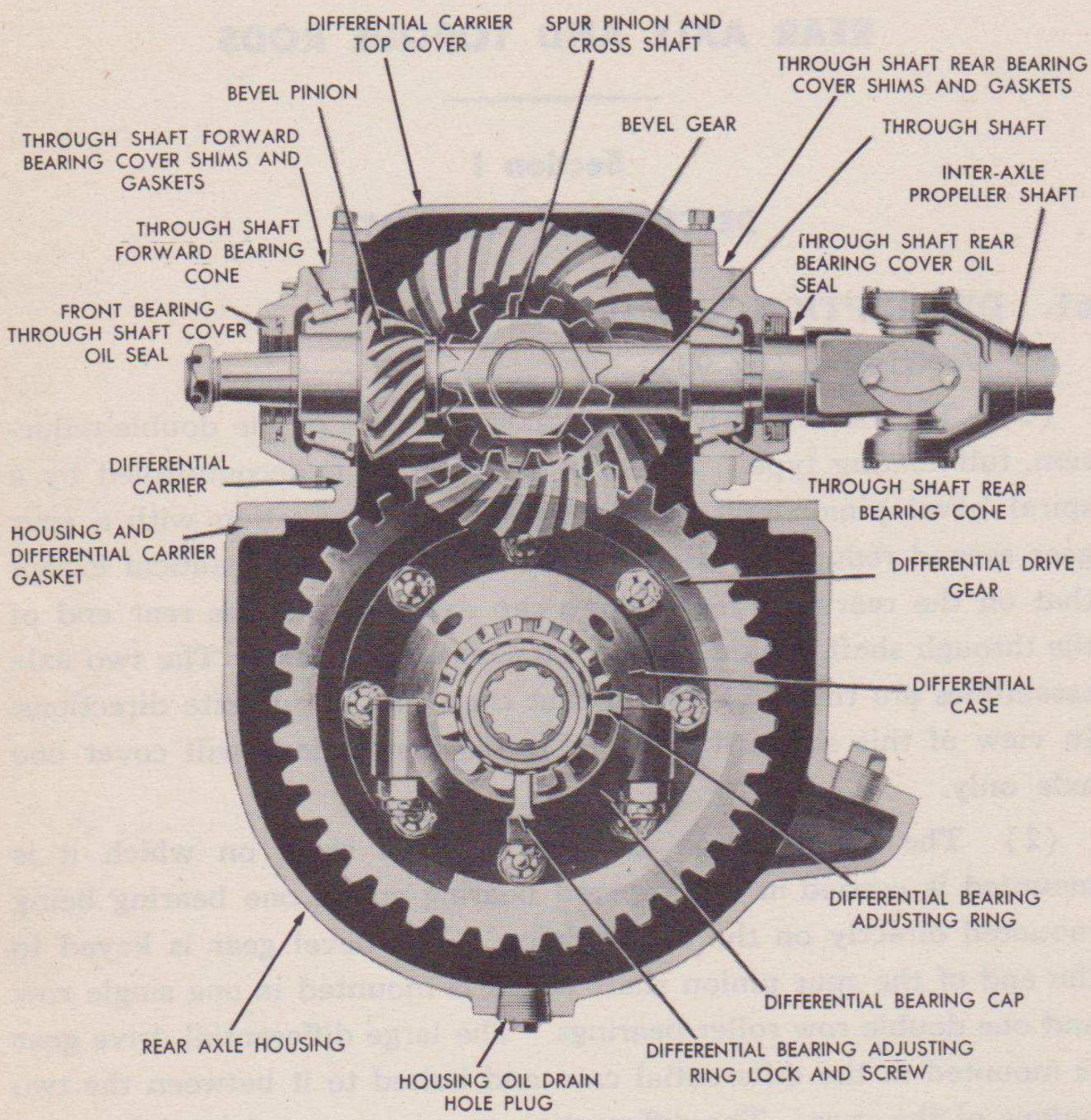
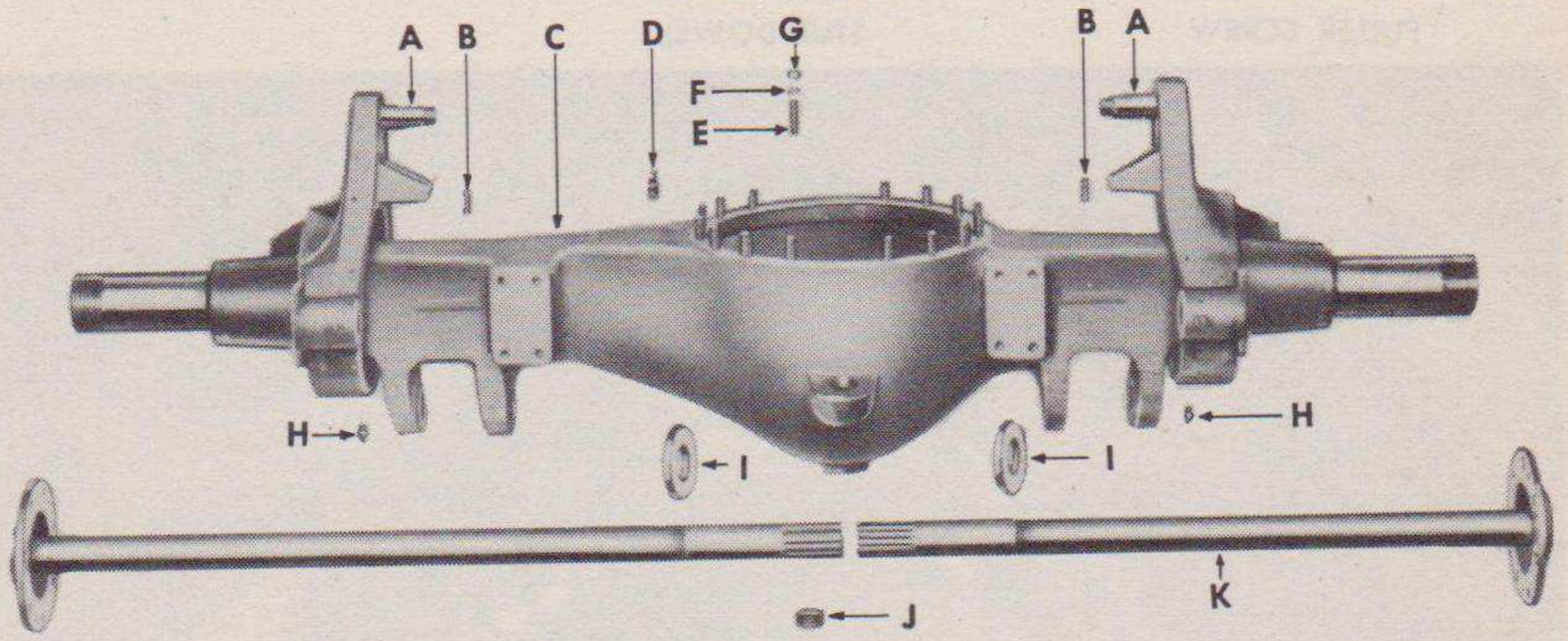


Figure 93 — Rear Axle Differential Carrier Assembly — Sectional View

62. DATA.

Make	Timken
Model	SD 353-W-X-7
Type	Double reduction, full floating, tandem
Drive	Torque rod
Housing	Bowl type
Gear ratio	7.33 to 1
Bearings	
Differential cone	Timken 581
Differential cup	Timken 572
Through shaft cone (forward)	Timken 570



A—UPPER TORQUE ROD END PIN
B—DRIVE FLANGE STUD DOWEL
C—REAR AXLE HOUSING
D—HOUSING BREATHER NIPPLE ASSEMBLY
E—HOUSING AND DIFFERENTIAL CARRIER STUD
F—HOUSING AND DIFFERENTIAL CARRIER STUD LOCK WASHER
G—HOUSING AND DIFFERENTIAL CARRIER STUD NUT
H—HOUSING LUBRICATION FITTING
I—AXLE HOUSING SLEEVE OIL SEAL
J—DRAIN PLUG
K—AXLE SHAFT ASSEMBLY

RA PD 334501

RA PD 334501

Figure 94 — Rear Axle Housing and Shaft Assembly

Through shaft cup (forward)	Timken 563
Through shaft cone (rear)	Timken 536
Through shaft cup (rear)	Timken 532A
Spur pinion cone	Timken 438
Spur pinion cup	Timken 432
Straight roller	Hyatt No. U-1218 TAM

Section II

DISASSEMBLY INTO SUBASSEMBLIES

63. PRELIMINARY INSTRUCTIONS.

a. Remove axles. Refer to TM 9-813 for instructions for removing rear axles.

b. Cleaning. Clean the unit with dry cleaning solvent. Remove all foreign material from the exterior of the axle. Wipe dry. Keep all dirt or foreign material from the interior of the axle. As disassembly proceeds, clean all parts and wrap in clean paper or cloth.

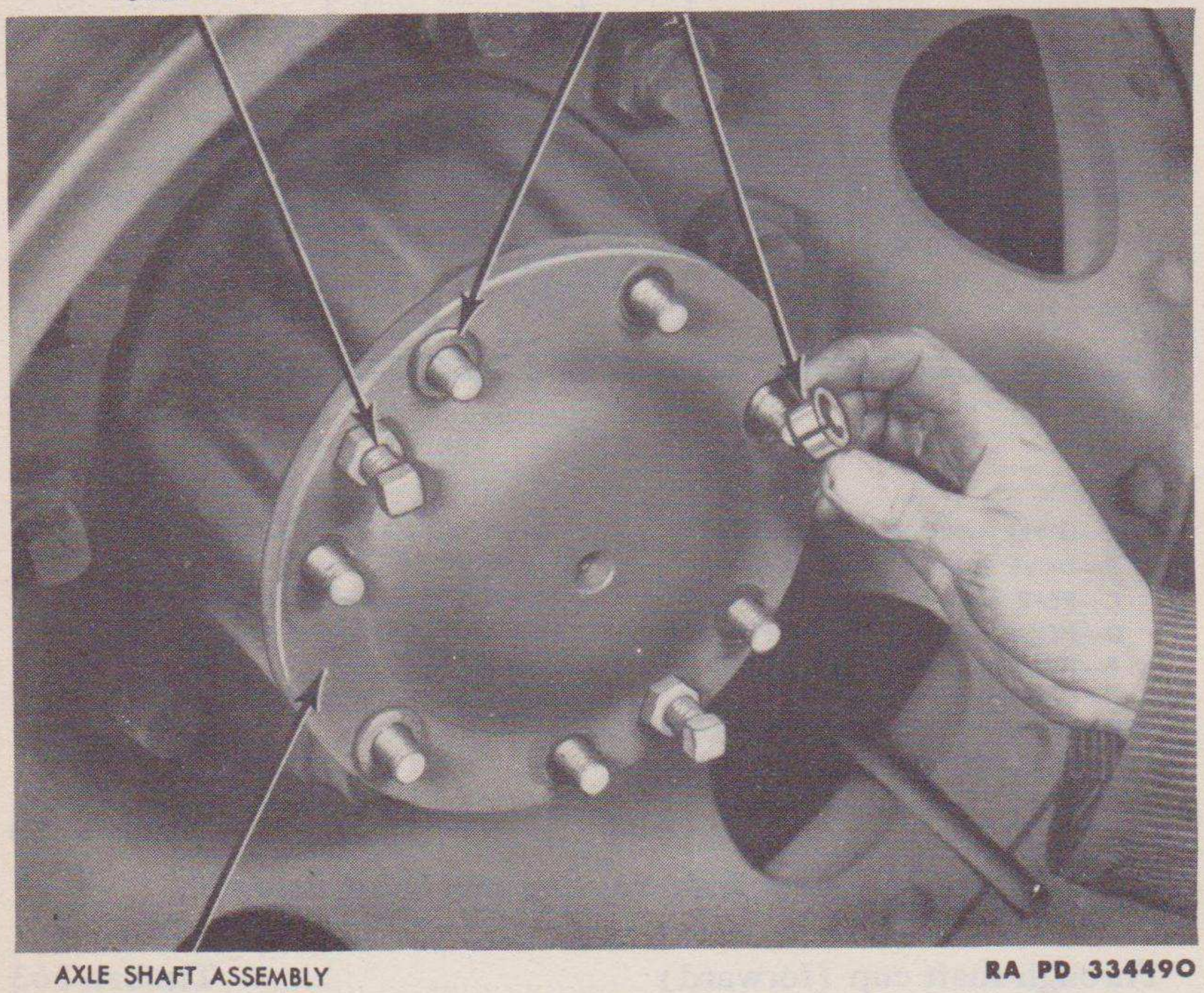


Figure 95 — Removing Drive Flange Stud Dowels

64. DISASSEMBLY.

a. Remove upper and lower torque rods. Refer to TM 9-813 for instruction on removal.

b. Drain lubricant. Remove drain plug from axle housing and drain lubricant.

c. Remove brake chamber and bracket. Remove cotter pin and drive pin from yoke end of diaphragm push rod. Remove four brake chamber-to-bracket cap screws and lock washers. Lift off brake chamber. Remove four bracket-to-housing nuts and lock washers. Lift off brackets.

d. Remove rear axle shafts (figs. 95, 96, and 97). Remove rear axle drive flange nuts. Remove taper dowels by tapping flange

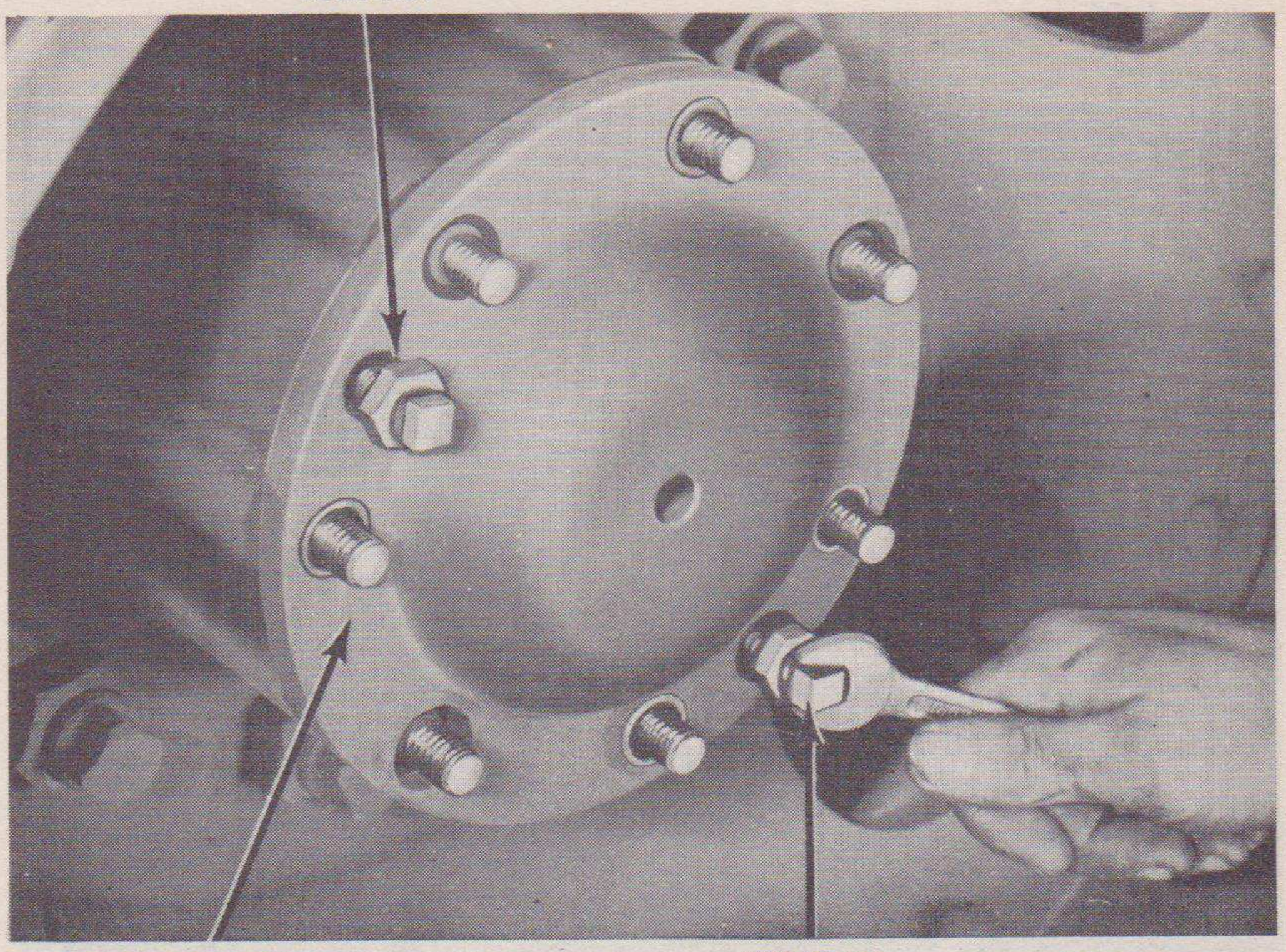


Figure 96 — Turning in Puller Screws

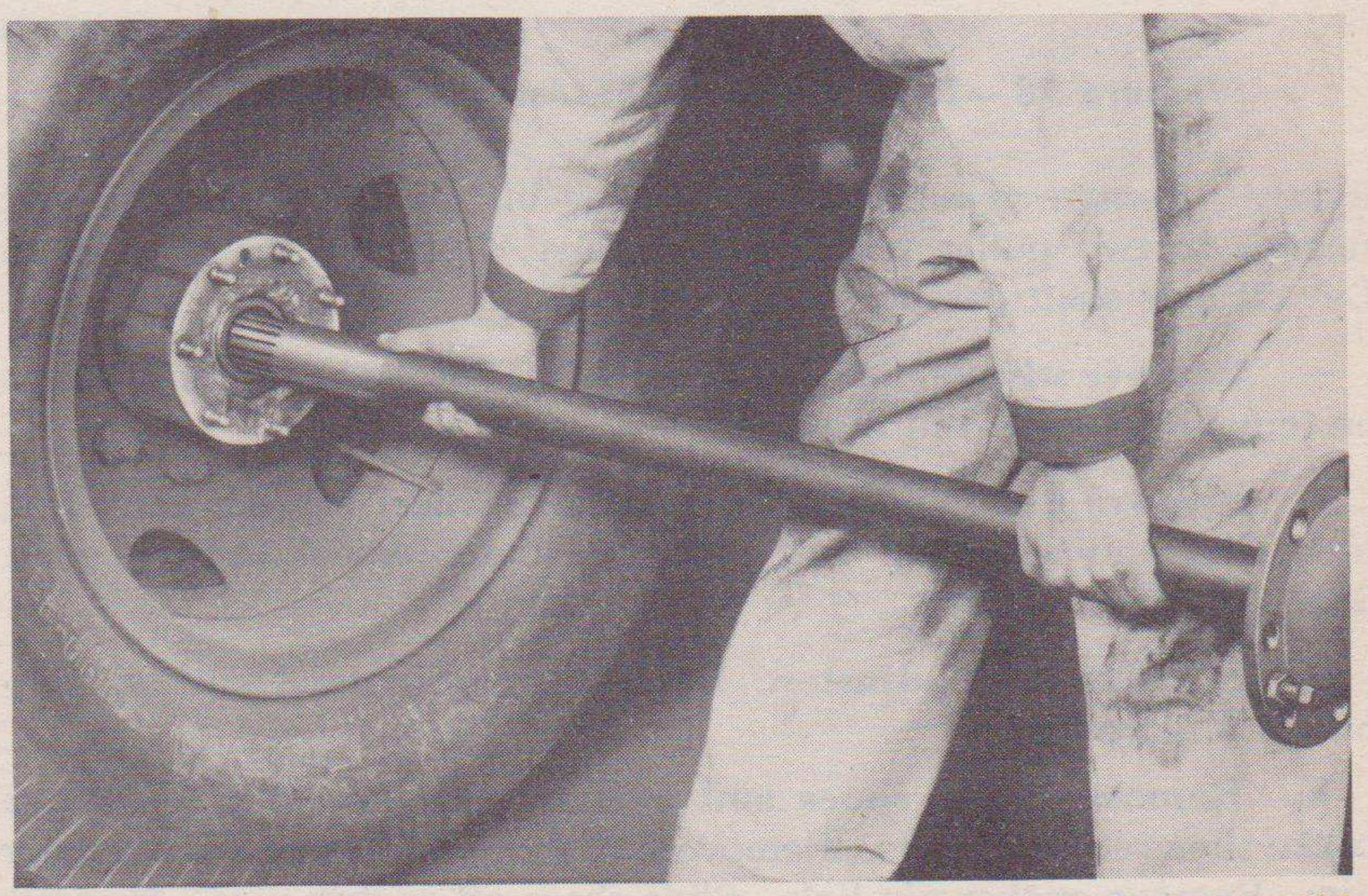


Figure 97 — Removing Rear Axle Shaft

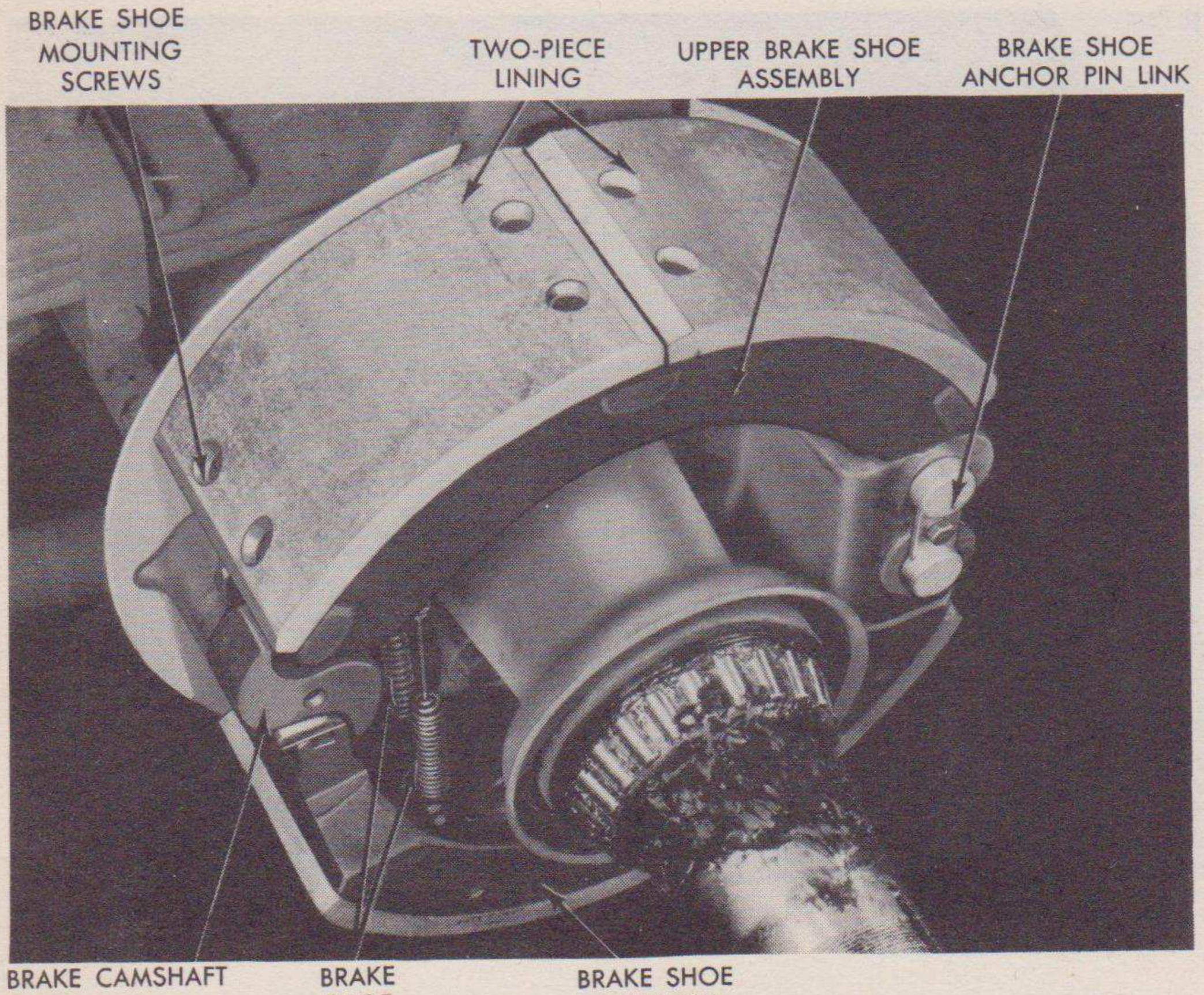


Figure 98 — Rear Wheel Brake Assembly — Installed

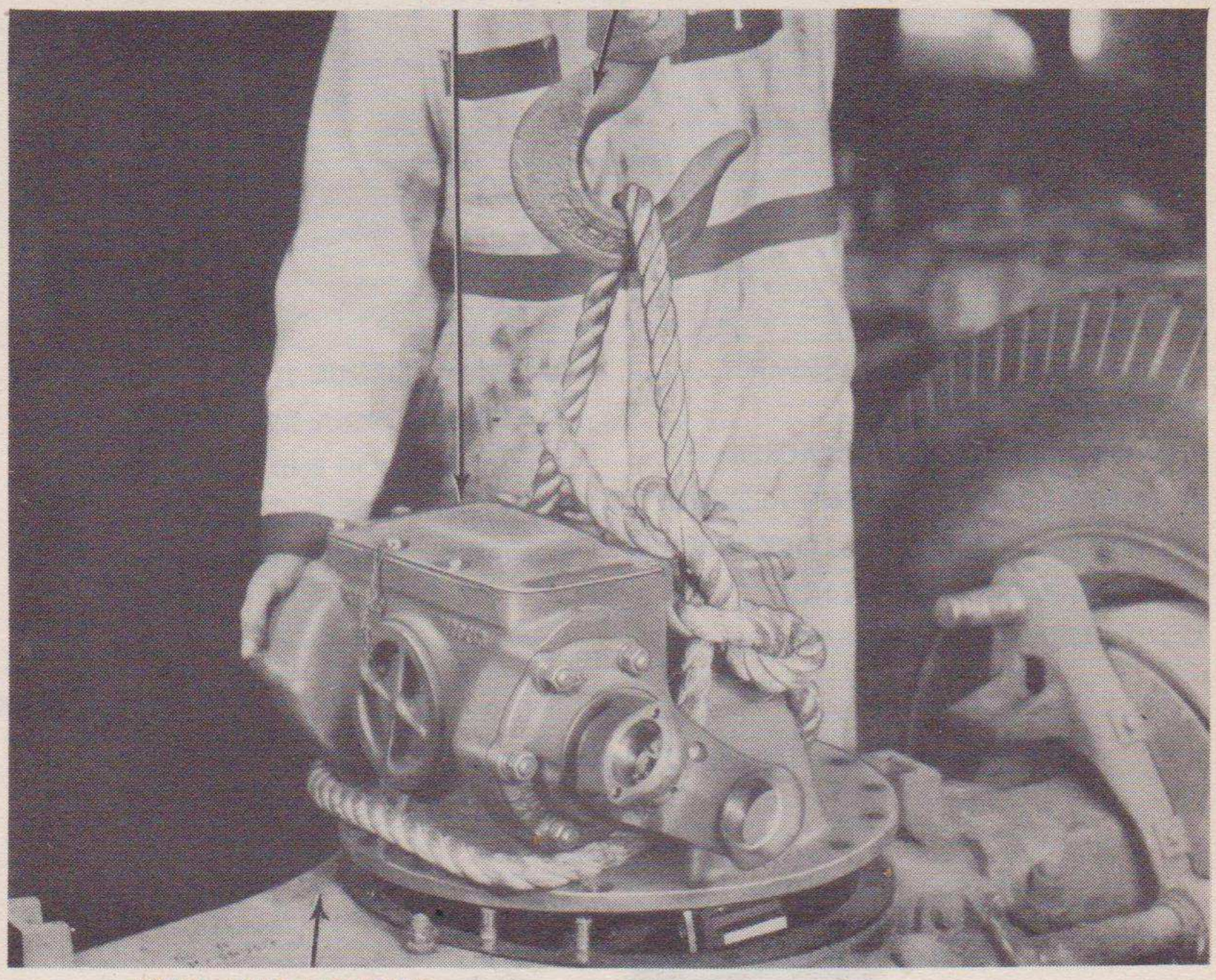
lightly. Loosen axle shaft by backing off on the lock nuts and turning in two puller screws alternately. Pull out the axle shaft. Lift off axle shaft gasket.

e. Remove wheels and tires. Refer to TM 9-813 for instructions on removing wheels and tires.

f. Remove hubs and drums. Remove wheel bearing outer nut, lock ring, and adjusting nut. Remove outer wheel bearing cone. Slip off hub and drum.

g. Remove slack adjuster. Remove cotter pin and washer. Slip off slack adjuster.

h. Remove brake shoes and anchor pins (fig. 98). Remove brake shoe return springs. Remove nut and lock washer from anchor pin. Remove anchor pin link. Slide shoes off anchor pins. Remove anchor pin nuts and lock washers. Tap out anchor pins from dust shield slide.



RA PD 334488

Figure 99 — Removing Differential Carrier Assembly

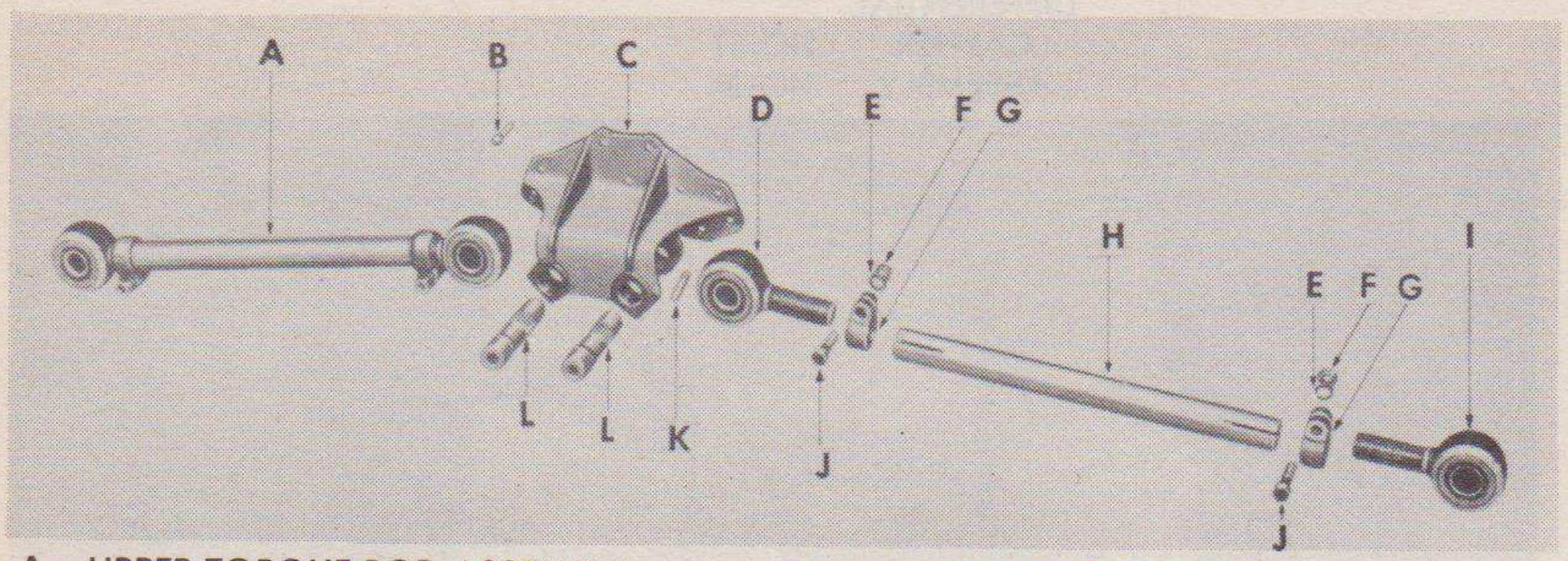
i. Remove differential carrier assembly (fig. 94). Remove differential carrier-to-housing stud nuts and lock washers. Raise the differential carrier assembly with a rope sling and a chain hoist (fig. 99). Remove the stud dowels from the differential housing flange.

Section III

DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

65. UPPER TORQUE ROD.

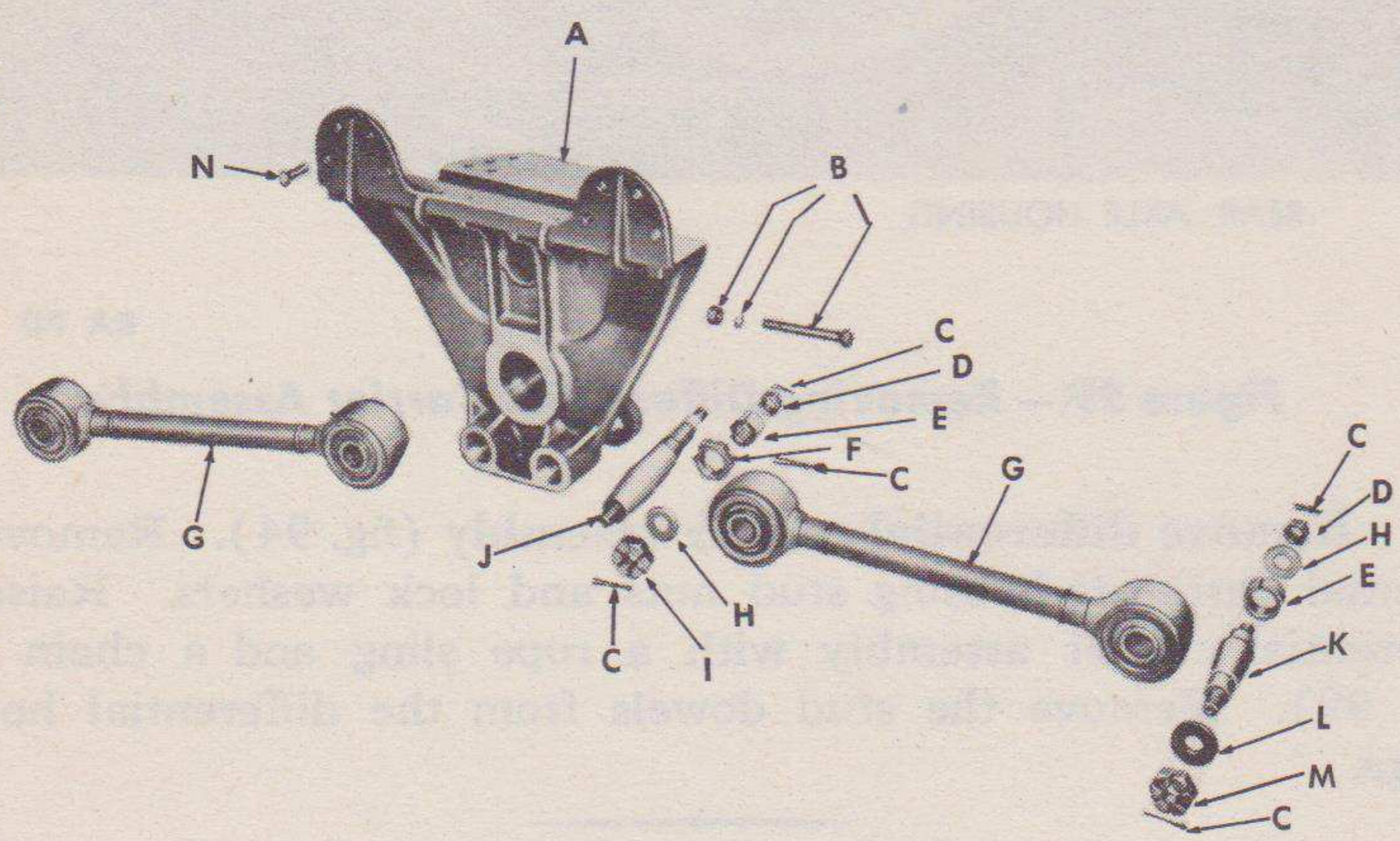
a. Disassembly (fig. 100). Remove nut, lock washer, and clamp bolt from rod and clamps. Screw out torque rod end. Remove rod end clamp (each end of torque rod).



A—UPPER TORQUE ROD ASSEMBLY
B—BRACKET RIVET
C—TORQUE ROD FRAME BRACKET
D—INNER TORQUE ROD END ASSEMBLY
E—TORQUE ROD END PIN LOCK WASHER
F—TORQUE ROD END PIN NUT
G—TORQUE ROD END CLAMP
H—UPPER TORQUE TUBE
I—OUTER TORQUE ROD END ASSEMBLY
J—TORQUE ROD END CLAMP BOLT
K—TORQUE ROD END PIN KEY
L—UPPER CENTER TORQUE ROD END PIN

RA PD 334500

Figure 100 — Upper Torque Rods — Disassembled



A—REAR AXLE TORQUE ROD FRAME BRACKET
B—BRACKET BOLT ASSEMBLY
C—COTTER PIN
D—TORQUE ROD END PIN NUT
E—TORQUE ROD END PIN DOWEL BUSHING
F—INNER TORQUE ROD END PIN NUT
G—LOWER TORQUE ROD ASSEMBLY
H—INNER TORQUE ROD END PIN NUT WASHER
I—INNER TORQUE ROD END PIN NUT
J—LOWER CENTER TORQUE ROD END PIN
K—LOWER OUTER TORQUE ROD END PIN
L—OUTER TORQUE ROD END PIN NUT WASHER
M—OUTER TORQUE ROD END PIN
N—TORQUE ROD FRAME BRACKET RIVET

RA PD 334499

Figure 101 — Lower Torque Rods — Disassembled

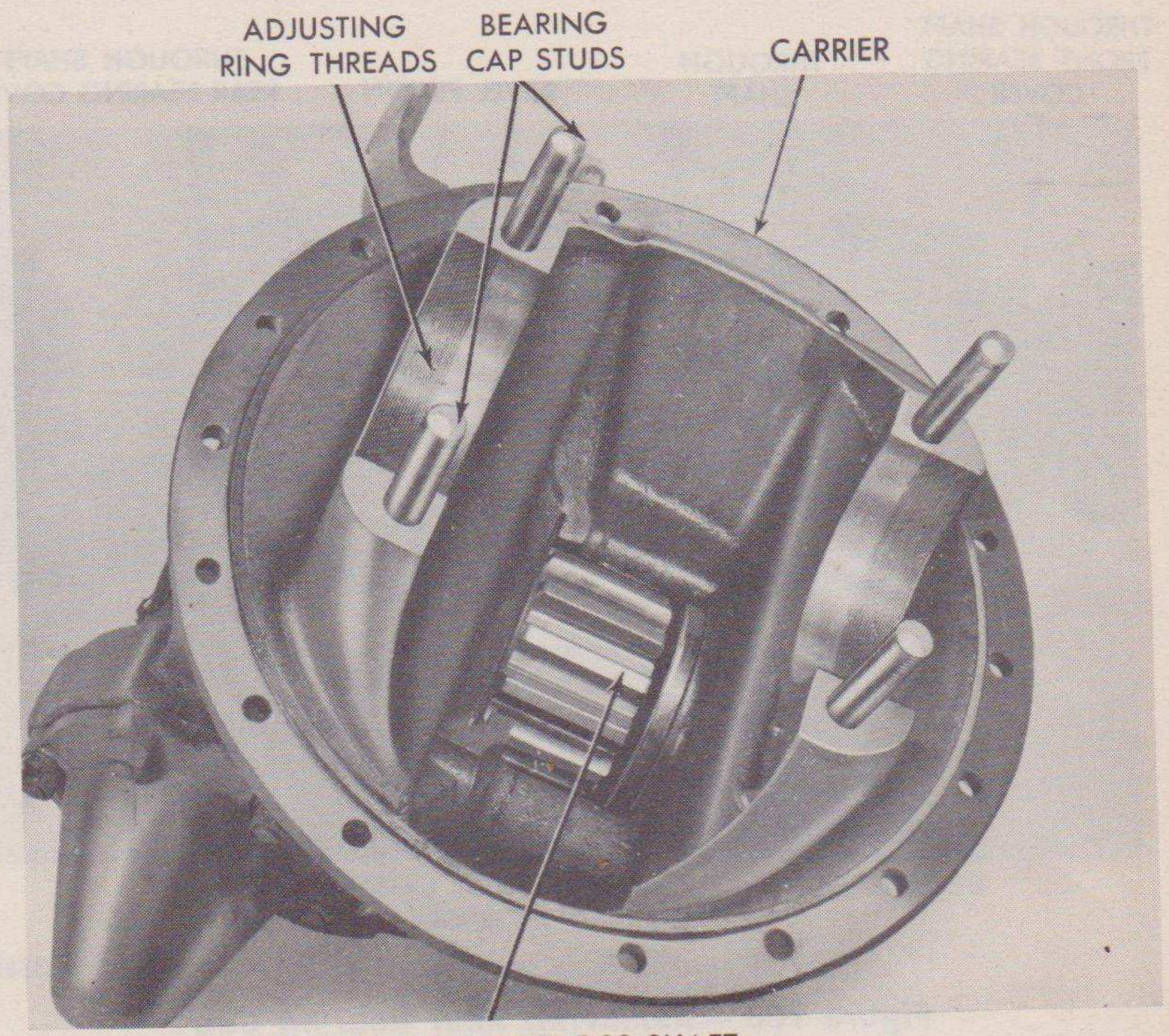


Figure 102 — Differential Carrier

b. Cleaning, inspection, and repair. Wash all parts with dry cleaning solvent and dry thoroughly. Place rod in two V-blocks. Using a dial indicator, check alinement by rotating rod. It must turn true without the slightest evidence of wobble. If rod is not true, replace with new rod. Inspect the bushing in the torque rod end of the rod and replace the end if unserviceable.

c. Assembly (fig. 100). Screw one rod end into rod (full length of thread). Slip both rod end clamps over opposite end of rod. Screw second rod end into rod. Insert bolts in rod clamps and install washers, and nuts on bolts. Make sure all four rods are of equal length. Tighten nuts securely.

66. LOWER TORQUE ROD.

a. Cleaning and inspection (fig. 101). Wash rod thoroughly with dry cleaning solvent, then dry, being careful not to get any oil or

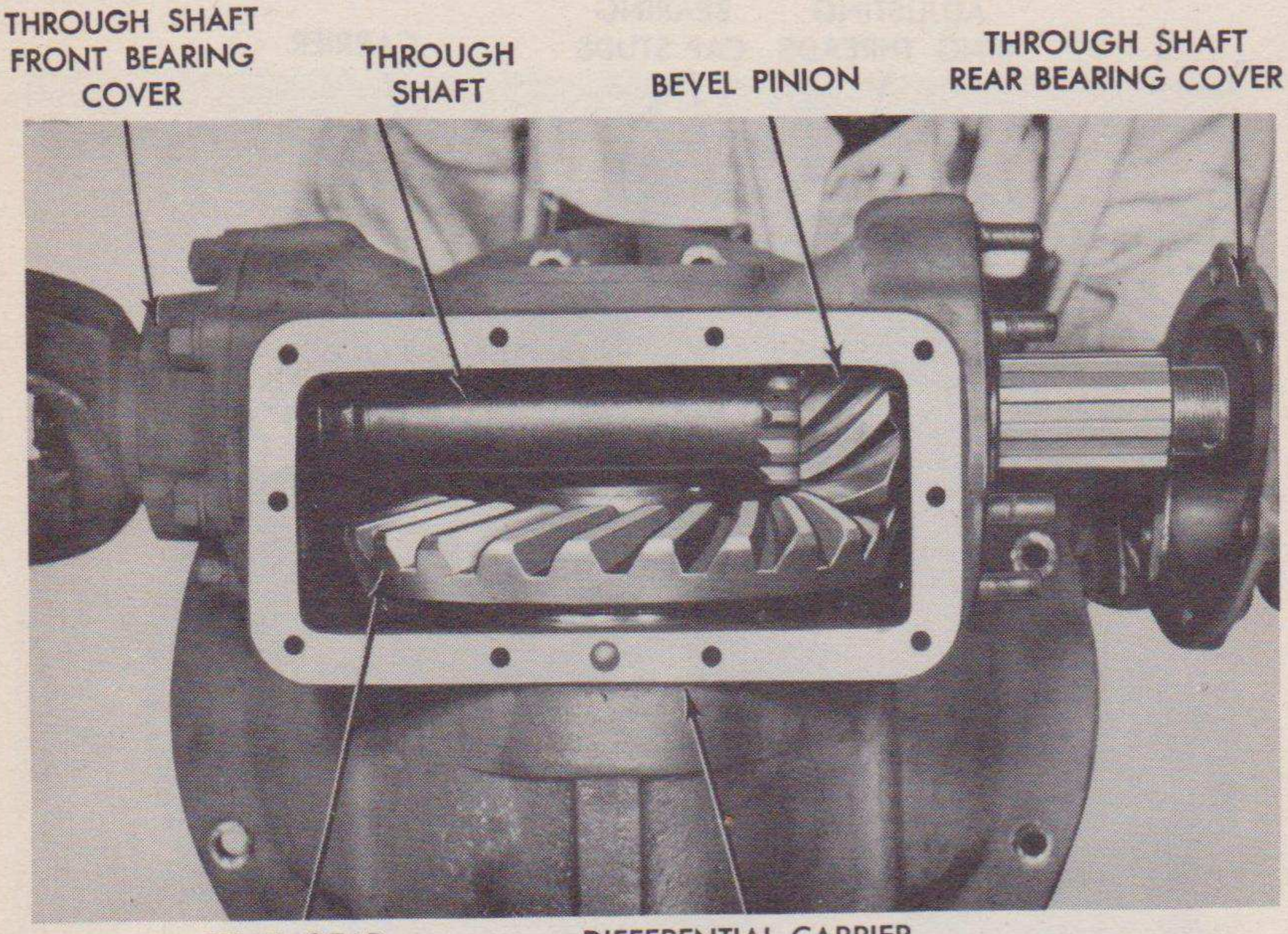


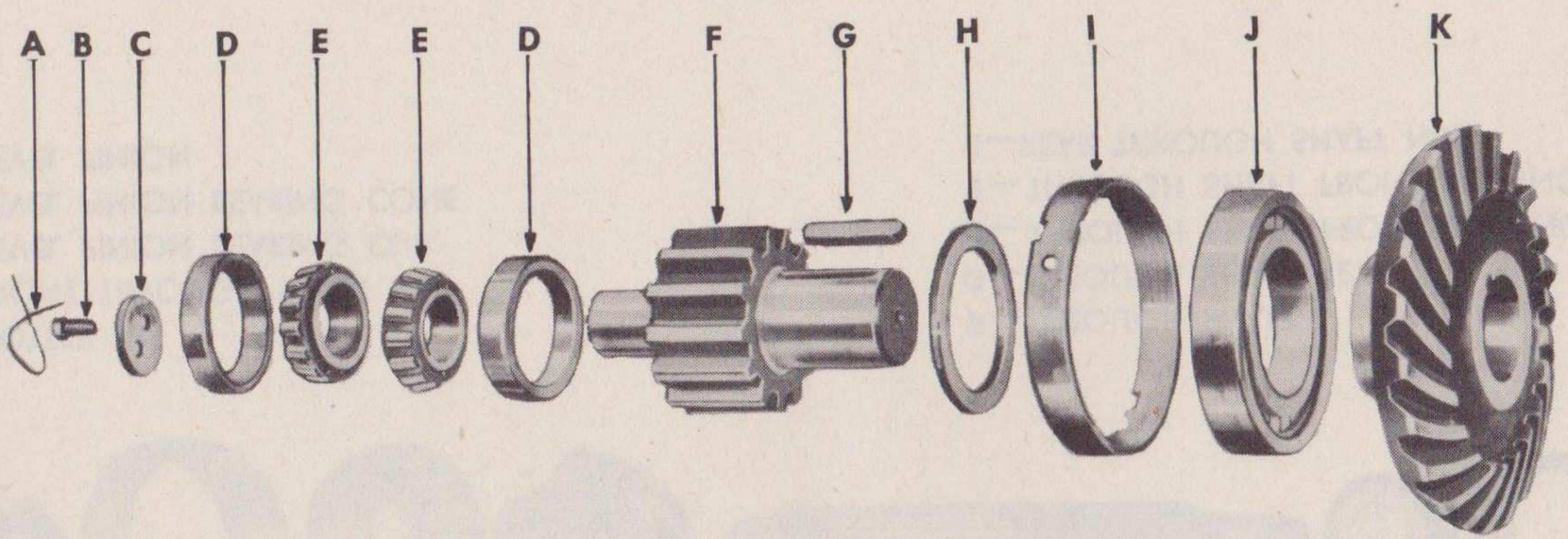
Figure 103 — Removing Rear Bearing Cap

solvent on the rubber in the rod ends. Place the rod in two V-blocks. Each V-block should be about 12 inches from the extreme end of the rod. Using a dial indicator, check alinement by rotating rod. It must turn true without the slightest evidence of wobble. If the rod is not true, install a new rod. Examine the bushing in the rod end of the rod. It must be firm and solid. If the rubber is soft or spongy, replace with a new rod.

67. DIFFERENTIAL ASSEMBLY OF CARRIER ASSEMBLY.

a. Removal (figs. 76, 77, and 78). Mark the carrier and bearing caps to insure correct assembly. Remove lock wires, lock screws, and locks (fig. 76). Loosen bearing cap stud nuts (fig. 77). CAUTION: *Do not remove entirely, as adjusting rings must be screwed out of assembly.* Unscrew adjusting ring (fig. 78). Remove adjusting ring on opposite side. Remove carrier cap stud nuts and lift off caps. Lift out differential assembly.

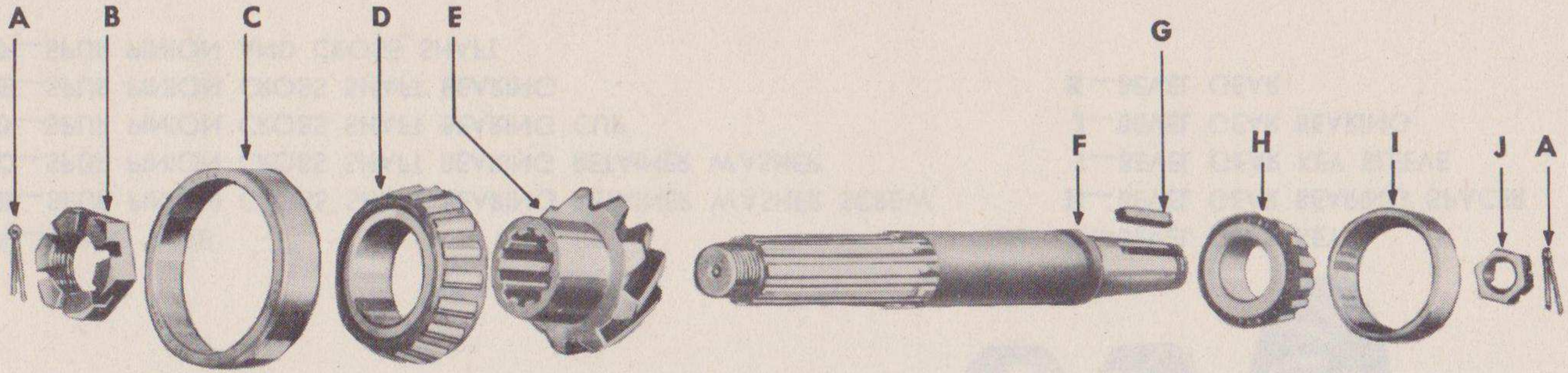
b. Disassembly (figs. 79, 80, 81, and 102). Remove bearings from the differential side of case hubs. Remove cotter pins and nuts from the eight differential case bolts and drive bolts out with hammer and punch. After bolts have been removed, it will be found that one side



A—LOCK WIRE
B—SPUR PINION CROSS SHAFT BEARING RETAINER WASHER SCREW
C—SPUR PINION CROSS SHAFT BEARING RETAINER WASHER
D—SPUR PINION CROSS SHAFT BEARING CUP
E—SPUR PINION CROSS SHAFT BEARING
F—SPUR PINION AND CROSS SHAFT
G—BEVEL GEAR KEY
H—BEVEL GEAR BEARING SPACER
I—BEVEL GEAR KEY SLEEVE
J—BEVEL GEAR BEARING
K—BEVEL GEAR

RA PD 353084

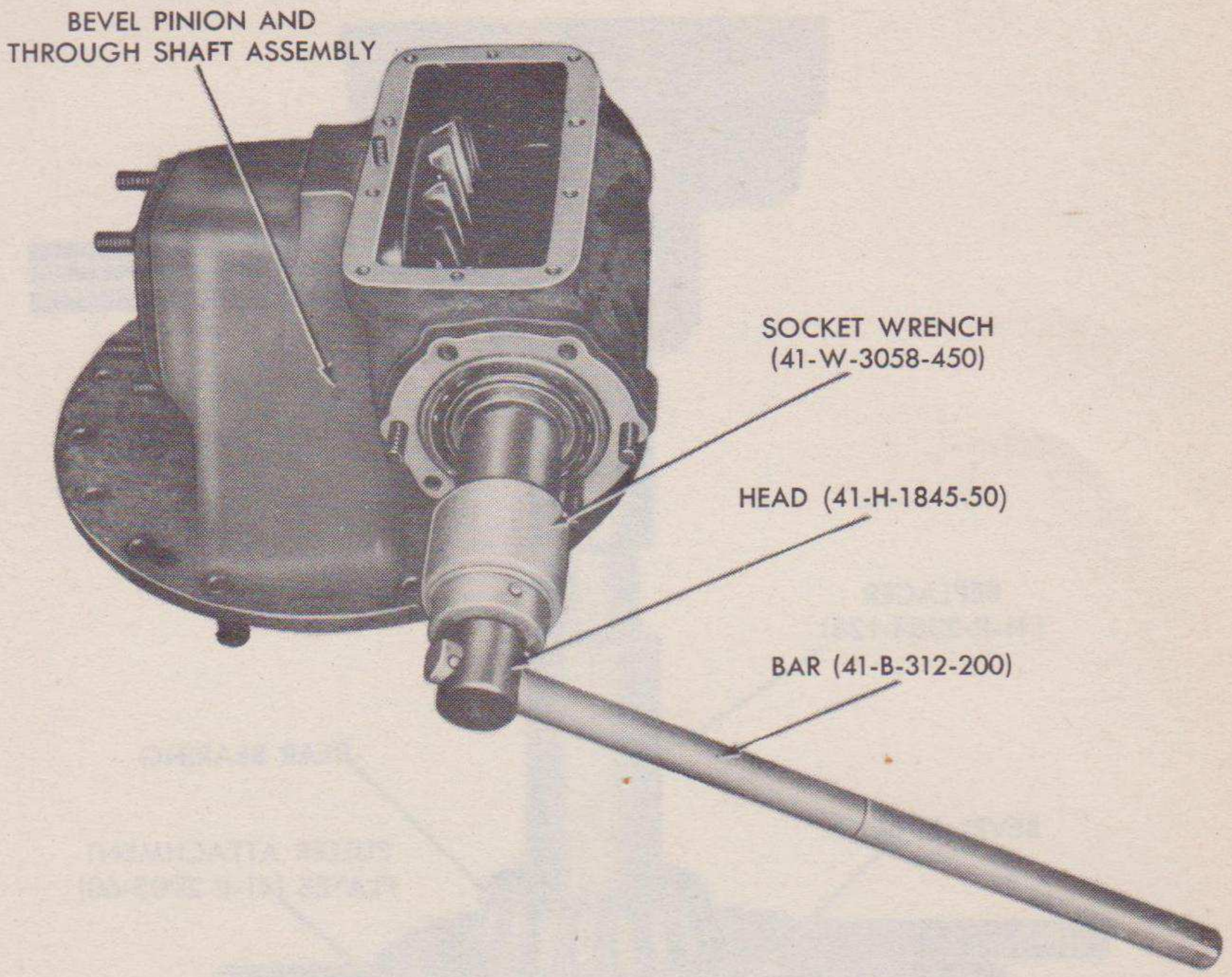
Figure 104 — Spur Pinion Cross Shaft Assembly — Disassembled



A—COTTER PIN
B—FRONT THROUGH SHAFT NUT
C—BEVEL PINION BEARING CUP
D—BEVEL PINION BEARING CONE
E—BEVEL PINION
F—THROUGH SHAFT
G—THROUGH SHAFT KEY
H—THROUGH SHAFT FRONT BEARING CONE
I—THROUGH SHAFT FRONT BEARING CUP
J—REAR THROUGH SHAFT NUT

RA PD 353085

Figure 105—Bevel Pinion and Through Shaft Assembly—Disassembled



RA PD 353086

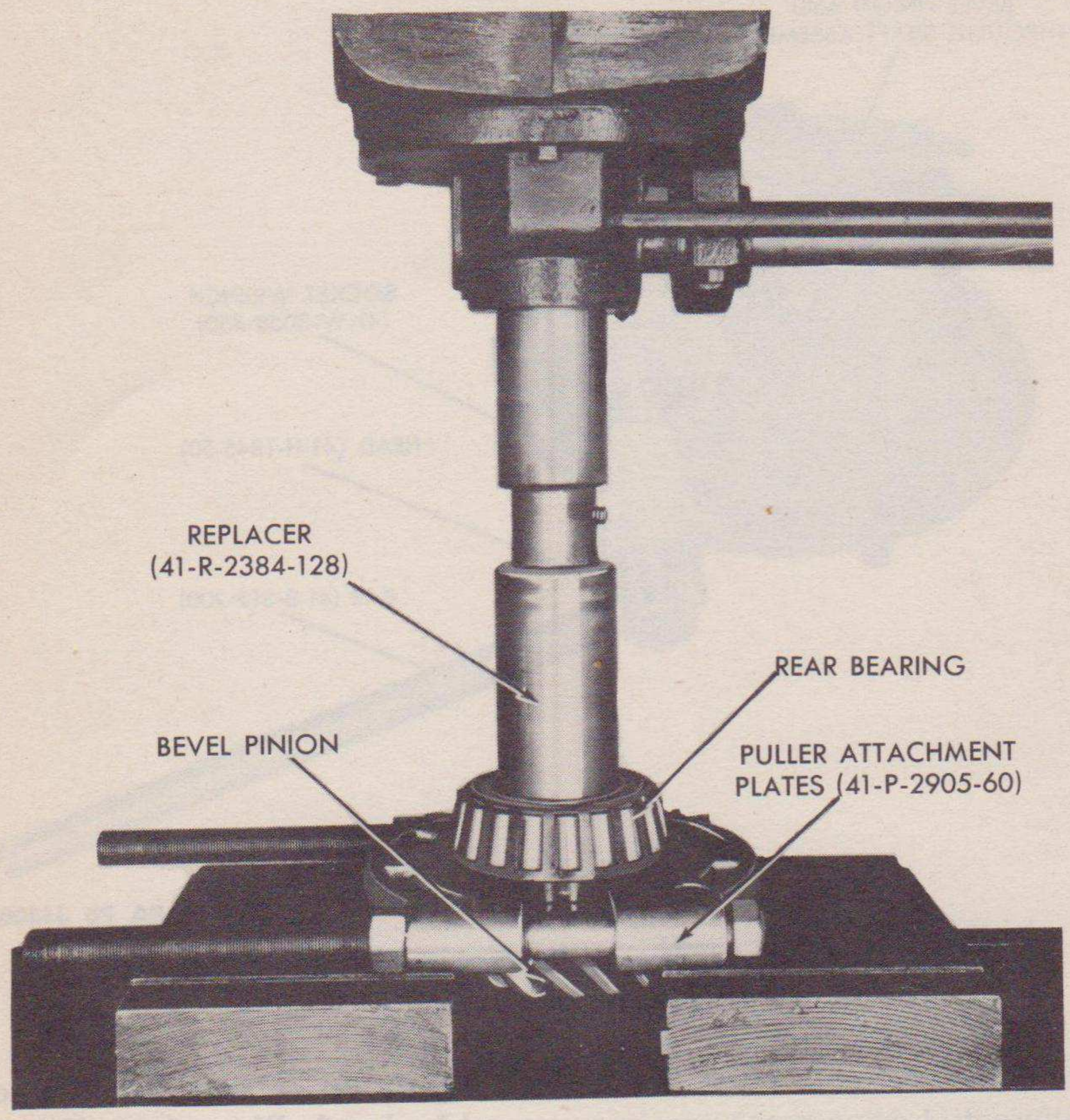
Figure 106 — Removing or Replacing Through Shaft Nut — Rearward Rear Axle

of differential case (that is not fitted tightly on outside diameter to differential drive gear) can be removed by hand. Place the half just removed on a bench, open end up. Remove the side gear thrust washer and differential side gear by hand. Pry out the spider and differential pinion gears and the remaining differential side gear and washer with a screwdriver. Tap the opposite half of the differential case assembly from the differential gear with a soft hammer.

c. Cleaning, inspection, and repair. Wash all parts with dry cleaning solvent and dry thoroughly. Inspect all gears and thrust washer for wear and damage. Check bearing cones carefully for wear and damage. Clean and oil all parts thoroughly.

d. Assembly.

(1) INSTALL DIFFERENTIAL PINIONS ON SPIDER (figs. 79, 81, and 82). Using an arbor press, install one of the differential bearing cones on the hub of the thin half of the differential case (fig. 82). Turn the thin half of the case over and place the differential drive gear in position, lining up the bolt holes in the gear with the case bolt holes. Insert the differential side gear thrust washer and side



RA PD 349664

Figure 107 — Removing Bevel Pinion From Rear Bearing

gear in position in the thin half of the case. Place the differential pinion gears on the spider arms, with the thrust washer in position, and install in mesh with the differential side gear. Install the remaining differential side gear with thrust washer in mesh with the pinion gears.

(2) ASSEMBLE DIFFERENTIAL CASE (figs. 79 and 82). Press the bearing cone on the hub of the thick half of the differential case assembly using replacer (41-R-2384-165). Place the thick half on the differential gear, lining up bolt holes in both halves of case with holes in differential gear. Insert differential case assembly bolts. Tap in place with soft hammer. Install nuts and cotter pins. Place the bearing cups over the bearing cones on the hub of the differential case assembly.

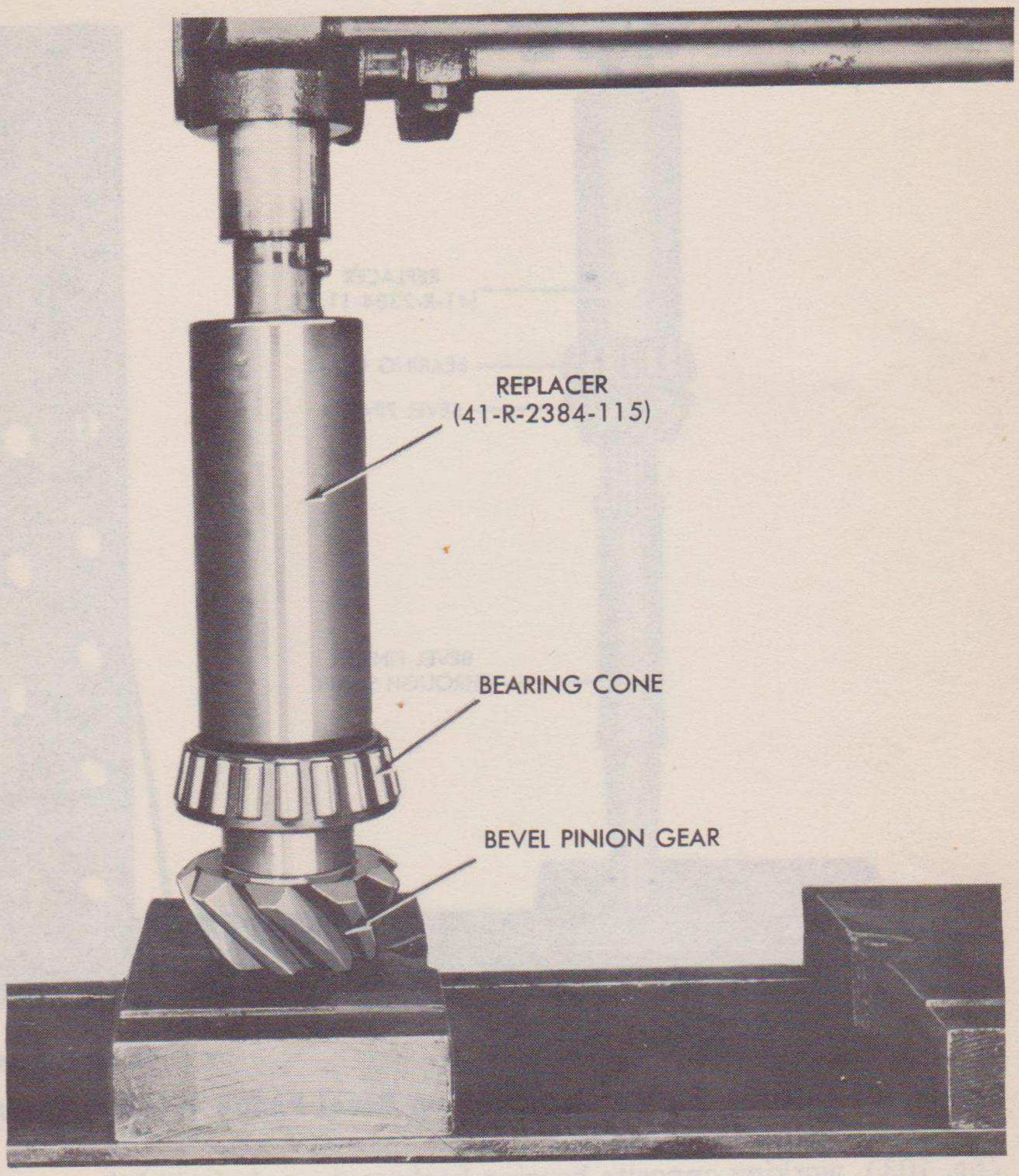
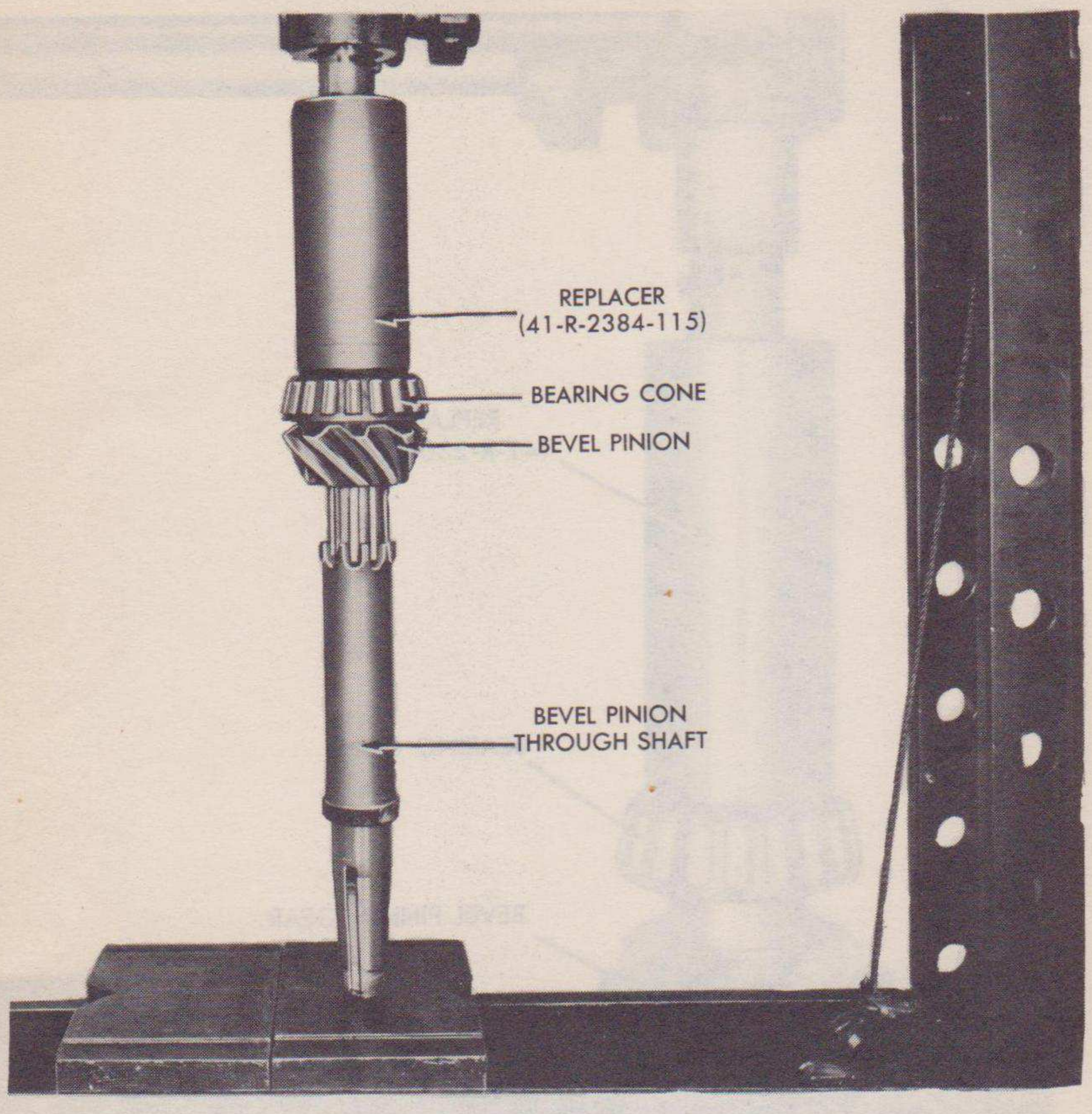


Figure 108 — Replacing Bearing Cone on Bevel Pinion Gear

68. BEVEL PINION AND THROUGH SHAFT ASSEMBLY (figs. 103, 105, and 111).

a. Removal. Remove the 10 carrier top cover cap screws and lock washers. Lift off the carrier top cover and gasket. Remove front and rear pinion bearing cap nuts and lock washers. Remove yoke cotter pin and nut (fig. 106) using bar (41-B-312-200), head (41-H-1845-50), and wrench (41-W-3058-450). Remove yoke. Remove bearing caps, keeping shims with caps to facilitate reassembly. With soft hammer, drive out pinion assembly through pinion end



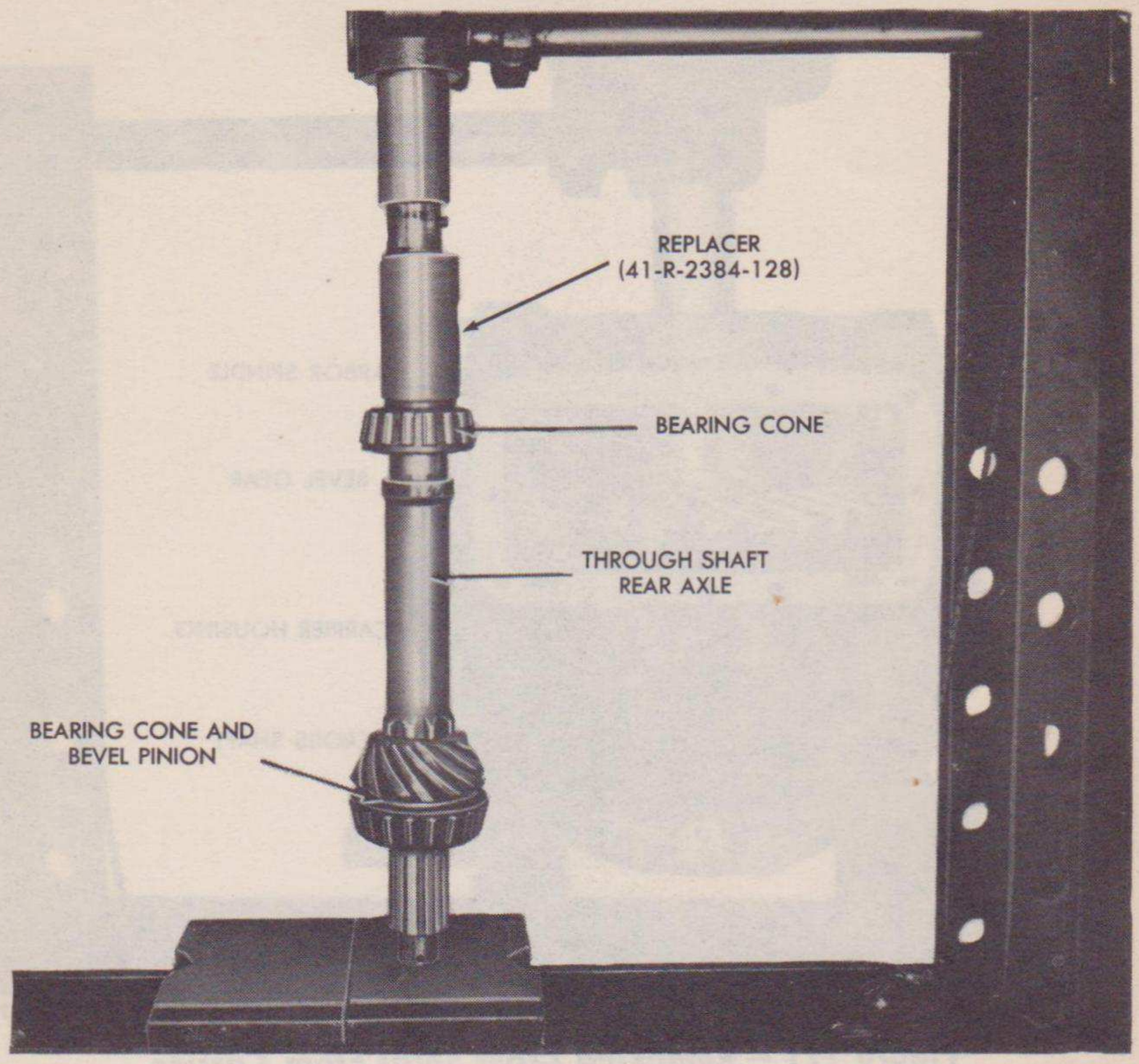
RA PD 349774

Figure 109 — Replacing Bearing Cone on Bevel Pinion Through Shaft

(fig. 103), working opposite bearing backward on shaft with hammer and soft punch until bearing seat is cleared.

b. Disassembly. Place assembly in arbor press and remove pinion and bearing from shaft. Press bearing from pinion (fig. 107), using replacer (41-R-2384-128) and plate (41-P-2905-60). Drive small bearing cup out of carrier with hammer and soft punch.

c. Cleaning, inspection, and repair. Wash all parts with dry cleaning solvent and dry thoroughly. Inspect bevel pinion for cracked teeth, and if mutilated install new bevel pinion. Also replace bevel gear, as these gears are mated and paired, and installation must be made in paired sets. Check keyway in cross shaft for excessive wear and replace key if there is evidence of wear. Inspect bearing cones and cups, for pitted or scored rollers and surfaces. Check for any



RA PD 349775

Figure 110 — Replacing Bearing Cone on Through Shaft Rear Axle

roughness of rollers by holding inner bearing race stationary and slowly revolving rollers back and forth. If the slightest roughness is felt, new bearing cone must be installed to prevent complete axle failure. NOTE: *Carefully inspect through shaft oil seal assemblies, if damaged, bent, or do not fit tight around through shaft, assembly must be replaced, to eliminate oil leakage.*

d. Assembly. Using arbor press install bearing cone on hub of bevel pinion (fig. 108) using replacer (41-R-2384-115), and with large end of roller bearing facing shoulder of bevel pinion. Place this assembly on spline end of through shaft, with small end of bevel pinion facing downward, press firmly against shoulder of shaft (fig. 109) using replacer (41-R-2384-115). Press on bearing cone at opposite end of through shaft (fig. 110), making sure pinion is pressed firmly against shoulder of shaft and using replacer (41-R-2384-128).

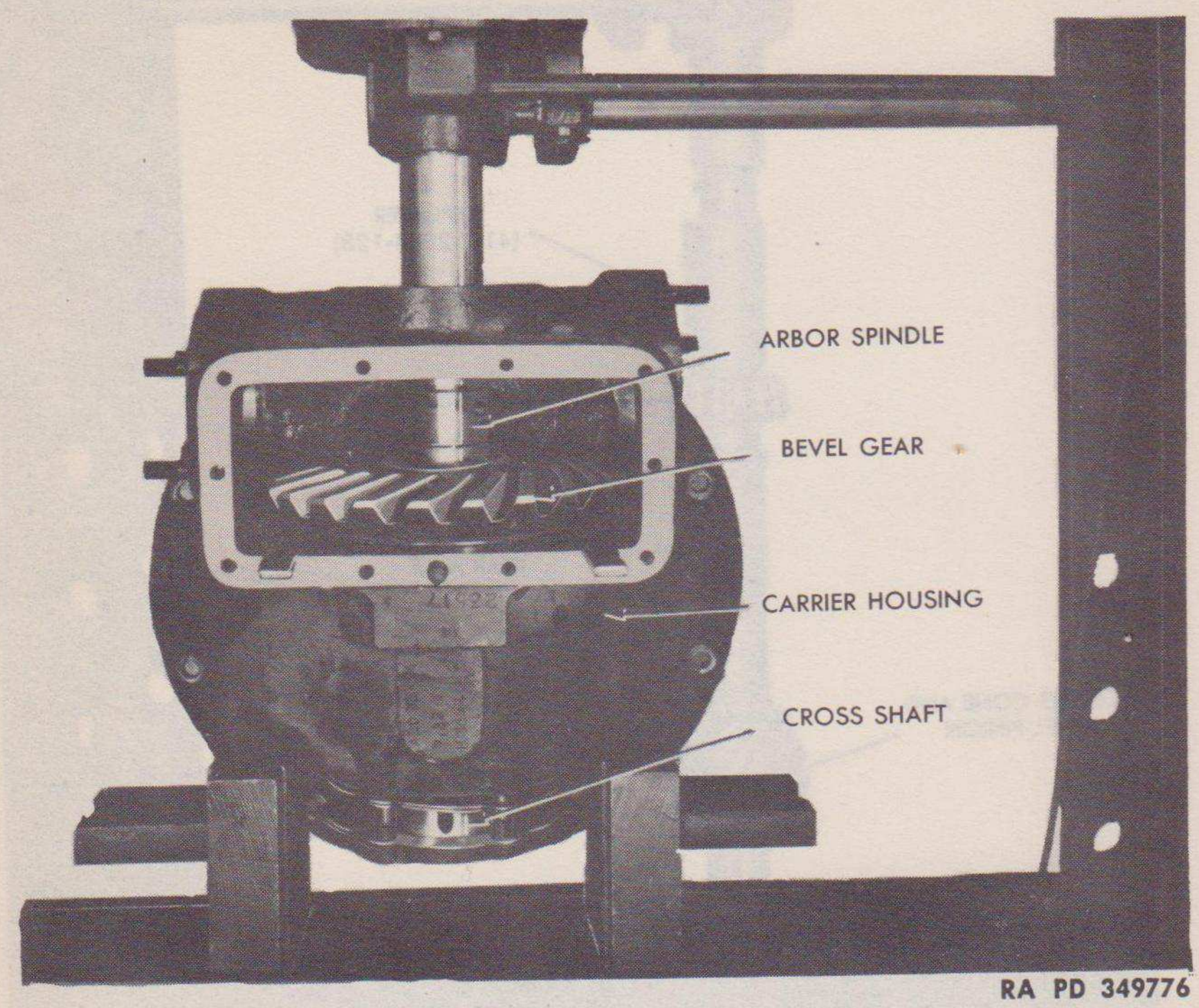


Figure 111 — Removing Cross Shaft From Carrier

69. SPUR PINION CROSS SHAFT ASSEMBLY.

a. Removal and disassembly (figs. 103, 104, and 113). Remove threaded side cap and gasket from bevel gear side of carrier. Remove six nuts and lock washers, bearing cap gasket, and shims from opposite side of case, noting the number and attaching the shims together. Remove lock wire and cap screws from end of cross shaft. Press cross shaft out of carrier from bevel gear side (fig. 111). This removes bevel gear and assembly from shaft, and bearing and cage on opposite end of shaft are pressed out of carrier casting at the same time. Remove bevel gear bearing retainer lock screw and using a punch, tap bevel gear and bearing assembly out of bearing seat in carrier. CAUTION: *Do not damage bearing.* Remove bearing from gear hub. Place cross shaft in arbor press and press shaft out of bearing and bearing cage. Then press bearing out of bearing cage.

b. Cleaning, inspection, and repairs. Wash all parts thoroughly with dry cleaning solvent. Dry with clean cloths. Make a visual inspection of studs and tapped holes in the carrier. Inspect all surfaces for scoring and cracks. Examine the carrier housing for cracks.

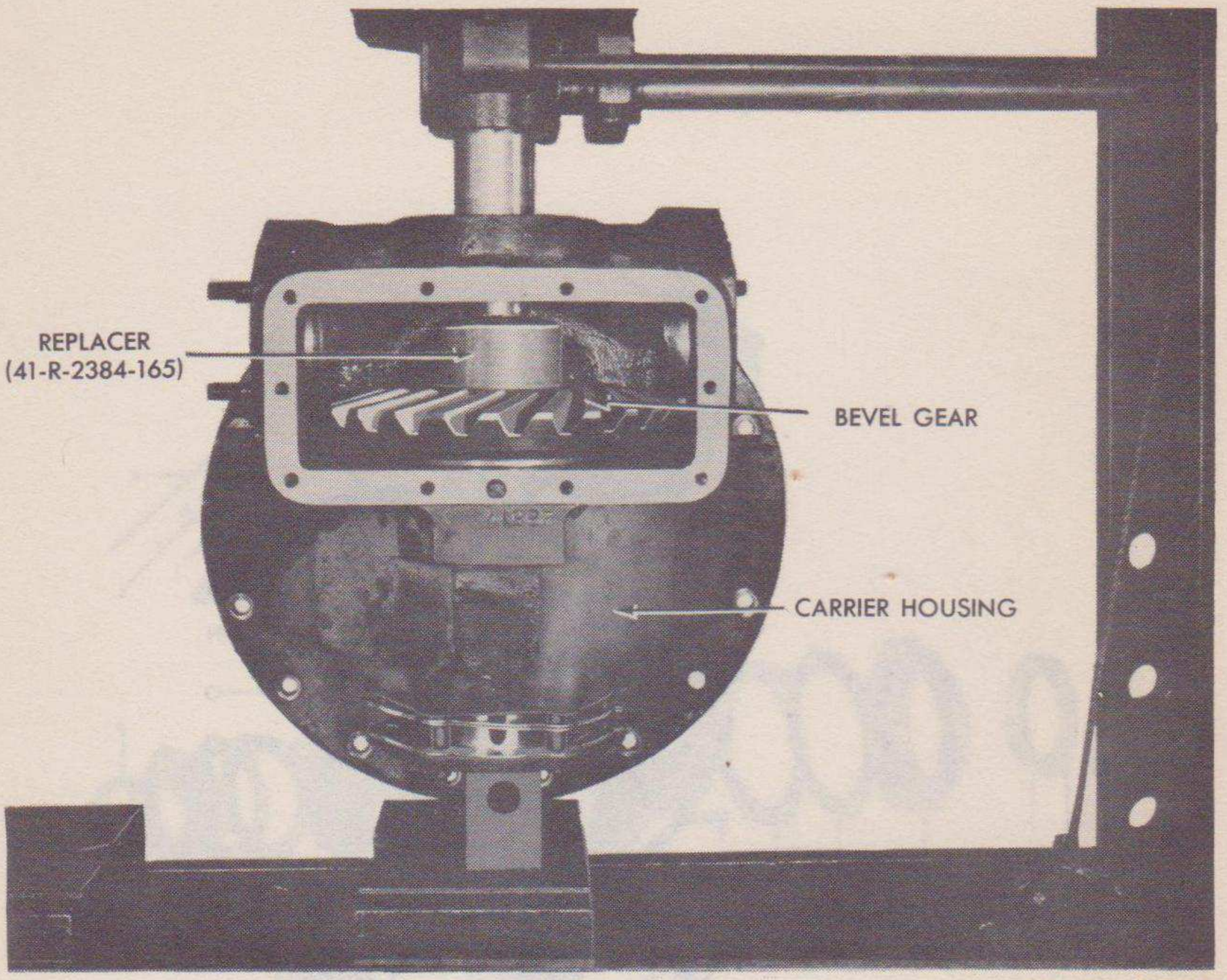
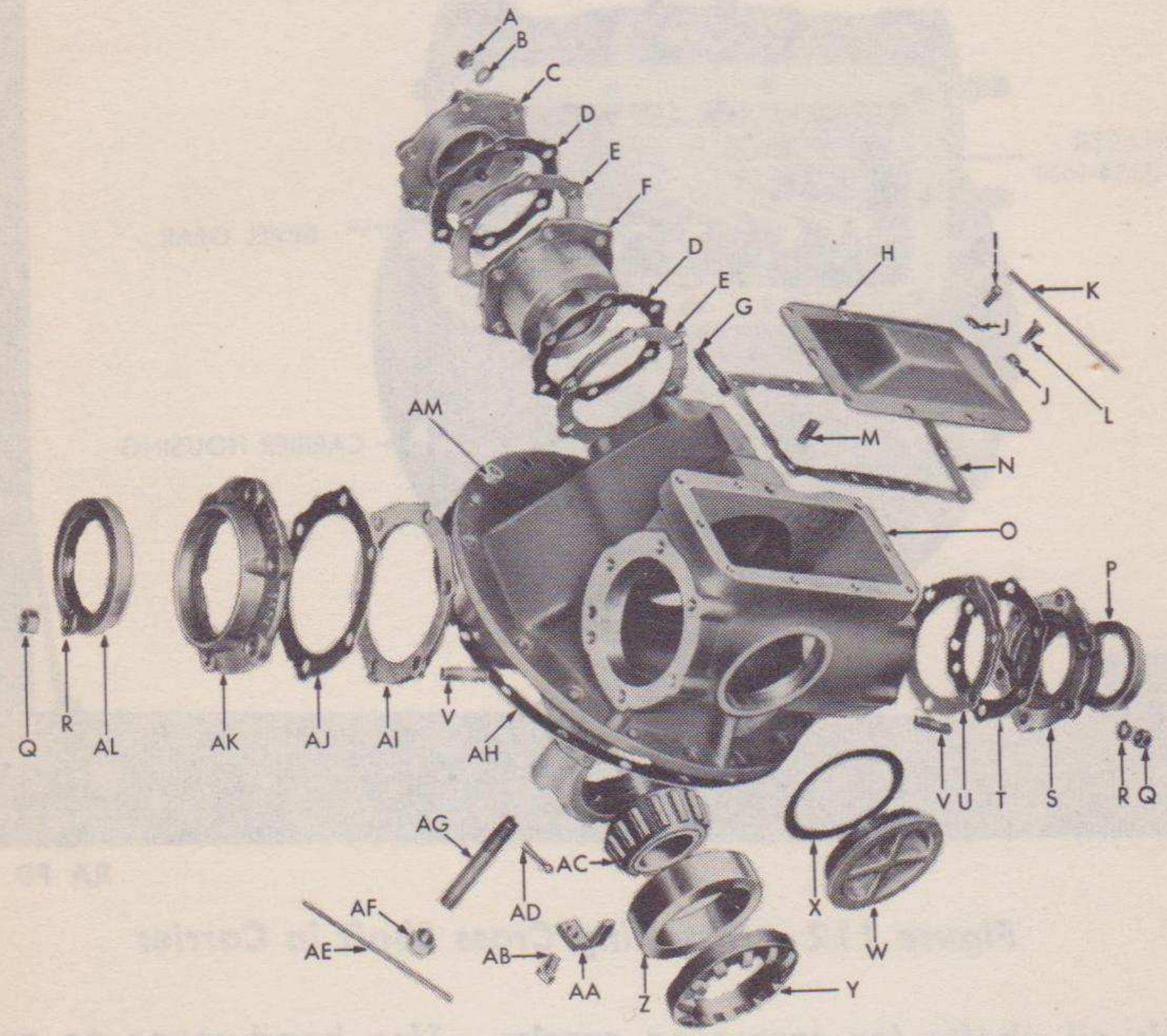


Figure 112 — Installing Cross Shaft in Carrier

Check all shafts for scores or cracks. Use hand stone to smooth out small burs. Check the condition of the bevel gear and spur gear. Carefully examine for cracked or broken teeth. If it is necessary to install a new bevel gear, the bevel pinion must be replaced with new one, because these gears are mated and paired. The installation of one unit, instead of a mated pair, will result in a noisy assembly and the life and performance will be greatly reduced. Check for any roughness of rollers and surface of inner race, by holding inner bearing race stationary and slowly revolving rollers back and forth. If the slightest roughness is felt, new bearing cone must be installed to prevent complete differential failure. New gaskets must be installed at each overhaul.

70. ASSEMBLY OF CARRIER ASSEMBLY.

a. Cleaning and inspection of carrier housing. Wash all parts with dry cleaning solvent and dry thoroughly. Visually inspect carrier. Inspect all machined surfaces for scores and burs. Inspect studs and threads for cross or mutilated threads. Use hand stone to smooth burs and nicks. Carefully check carrier casting for damage and cracks.



A—SPUR PINION CROSS SHAFT COVER STUD NUT
B—SPUR PINION CROSS SHAFT COVER STUD NUT LOCK WASHER
C—SPUR PINION CROSS SHAFT COVER
D—SPUR PINION CROSS SHAFT COVER GASKET
E—SPUR PINION CROSS SHAFT BEARING SHIMS
F—SPUR PINION CROSS SHAFT BEARING CAGE
G—SPUR PINION CROSS SHAFT COVER STUD
H—DIFFERENTIAL CARRIER TOP COVER
I—DIFFERENTIAL CARRIER TOP COVER CAP SCREW
J—LOCK WASHER
K—LOCK WIRE
L—DIFFERENTIAL CARRIER TOP COVER CAP SCREW
M—BEVEL GEAR BEARING SLEEVE LOCK SCREW
N—DIFFERENTIAL CARRIER TOP COVER GASKET
O—DIFFERENTIAL COVER HOUSING
P—THROUGH SHAFT REAR BEARING COVER OIL SEAL
Q—THROUGH SHAFT NUT
R—LOCK WASHER
S—THROUGH SHAFT REAR BEARING COVER
T—GASKET
U—SHIMS
V—THROUGH SHAFT BEARING COVER STUD
W—CARRIER INSPECTION HOLE PLUG
X—GASKET
Y—DIFFERENTIAL DRIVE GEAR BEARING ADJUSTING RING
Z—DIFFERENTIAL DRIVE GEAR BEARING CUP
AA—LOCK PLATE
AB—LOCK PLATE SCREW
AC—DIFFERENTIAL DRIVE GEAR BEARING CONE
AD—COTTER PIN
AE—LOCK WIRE
AF—DIFFERENTIAL BEARING CAP STUD NUT
AG—DIFFERENTIAL BEARING CAP STUD
AH—HOUSING AND DIFFERENTIAL CARRIER GASKET
AI—THROUGH SHAFT FRONT BEARING COVER SHIMS
AJ—GASKET
AK—THROUGH SHAFT FRONT BEARING COVER
AL—THROUGH SHAFT FRONT BEARING COVER OIL SEAL
AM—TAPERED DOWEL

RA PD 353221

Figure 113 — Rear Axle Differential Carrier and Related Components

b. Assembly of carrier.

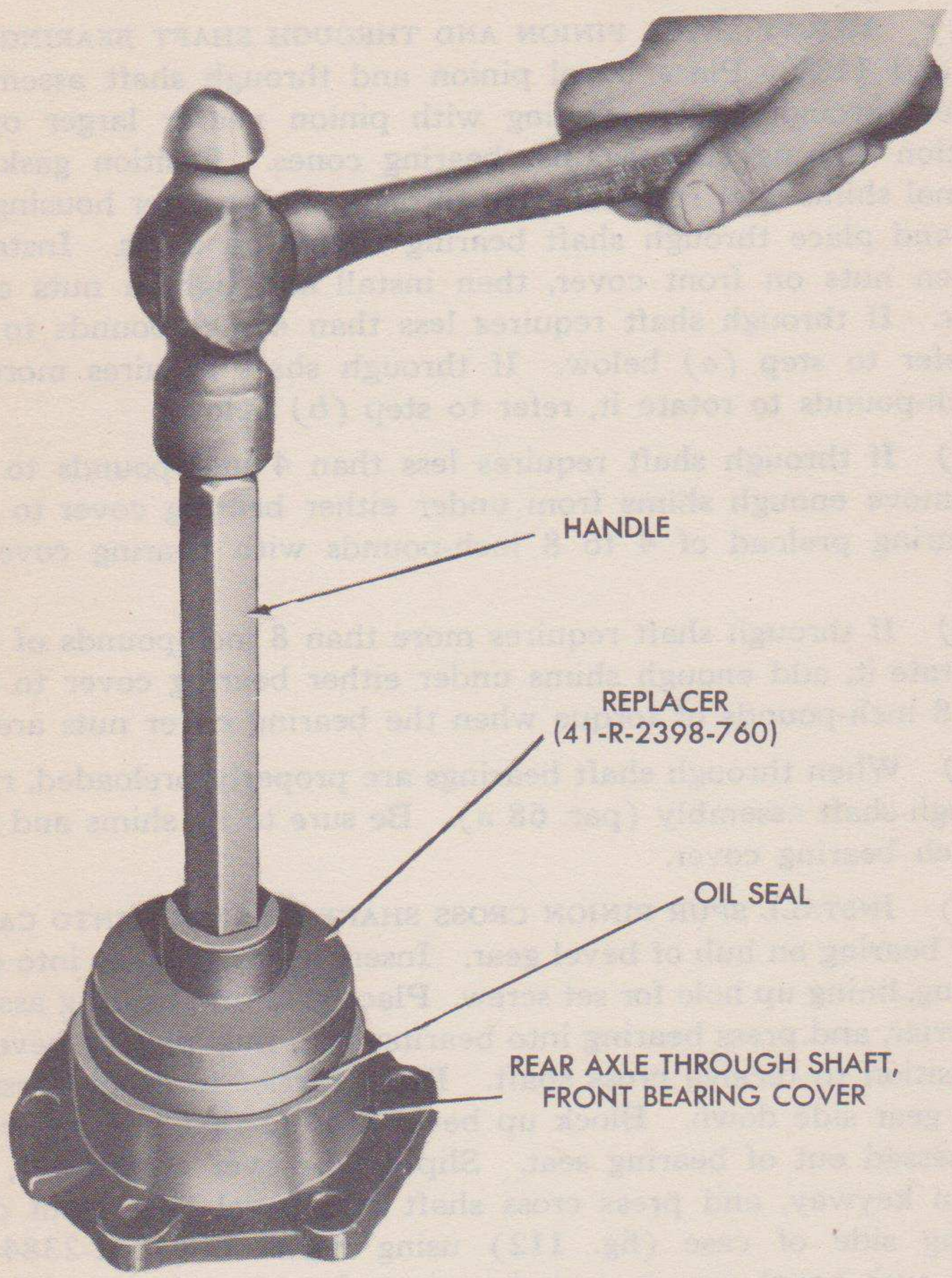
(1) ADJUST BEVEL PINION AND THROUGH SHAFT BEARINGS (figs. 105 and 113). Place bevel pinion and through shaft assembly in carrier through larger opening with pinion nearer larger opening. Position bearing cups against bearing cones. Position gasket and original shims over studs of each through shaft carrier housing opening, and place through shaft bearing covers on studs. Install and tighten nuts on front cover, then install and tighten nuts on rear cover. If through shaft requires less than 4 inch-pounds to rotate it, refer to step *(a)* below. If through shaft requires more than 8 inch-pounds to rotate it, refer to step *(b)* below.

(a) If through shaft requires less than 4 inch-pounds to rotate it, remove enough shims from under either bearing cover to obtain a bearing preload of 4 to 8 inch-pounds with bearing cover nuts tight.

(b) If through shaft requires more than 8 inch-pounds of torque to rotate it, add enough shims under either bearing cover to obtain 4 to 8 inch-pounds of torque when the bearing cover nuts are tight.

(c) When through shaft bearings are properly preloaded, remove through shaft assembly (par. 68 **a**). Be sure to tie shims and gasket to each bearing cover.

(2) INSTALL SPUR PINION CROSS SHAFT ASSEMBLY INTO CARRIER. Press bearing on hub of bevel gear. Insert bearing sleeve into carrier housing, lining up hole for set screw. Place gear and bearing assembly in carrier, and press bearing into bearing seat, thus placing bevel gear in position to receive cross shaft. Place carrier in arbor press with bevel gear side down. Block up bevel gear so that bearing will not be pressed out of bearing seat. Slip spacer over cross shaft, insert key in keyway, and press cross shaft into bevel gear from double bearing side of case (fig. 112) using replacer (41-R-2384-165). Make sure bevel gear is seated against shoulder of shaft. Position bearing cage original shims and gasket over studs of carrier housing. Press inner bearing cup into bottom of bearing cage. Place bearing cage in carrier housing. Support bevel gear end of cross shaft and press bearing cones onto cross shaft making sure inner bearing cone contacts inner bearing cup. Refer to figure 104 for position of bearing cones on cross shaft. Install outer bearing cup in bearing cage. Attach retainer plate to end of cross shaft with two cap screws (fig. 104). Bore a hole in the center of an old bearing cover large enough to permit a socket wrench to be inserted through this hole and engage the retainer cap screw when the cover is installed on the carrier housing studs. NOTE: *The measurements between the bearing contact and the flange, of both the regular cover and the cover used for making the adjustment, must be exactly the same. If there is any*



RA PD 349778

Figure 114 — Replacing Oil Seal in Rear Axle Through Shaft Front Bearing Cover

difference it will result in improper adjustment. This condition must be considered when selecting the cover which is to have the bored hole in it. Position bearing cover original shims and gasket over studs. Install and tighten cover attaching nuts. Use a torque wrench inserted through hole in cover and engaging retainer cap screw rotate cross shaft. If the cross shaft requires more than 8 inch-pounds of torque to rotate it, add enough shims between bearing cage and bearing cover (fig. 113) to obtain 4 to 8 inch-pounds of torque when the cover attaching nuts are tight. If the cross shaft requires less

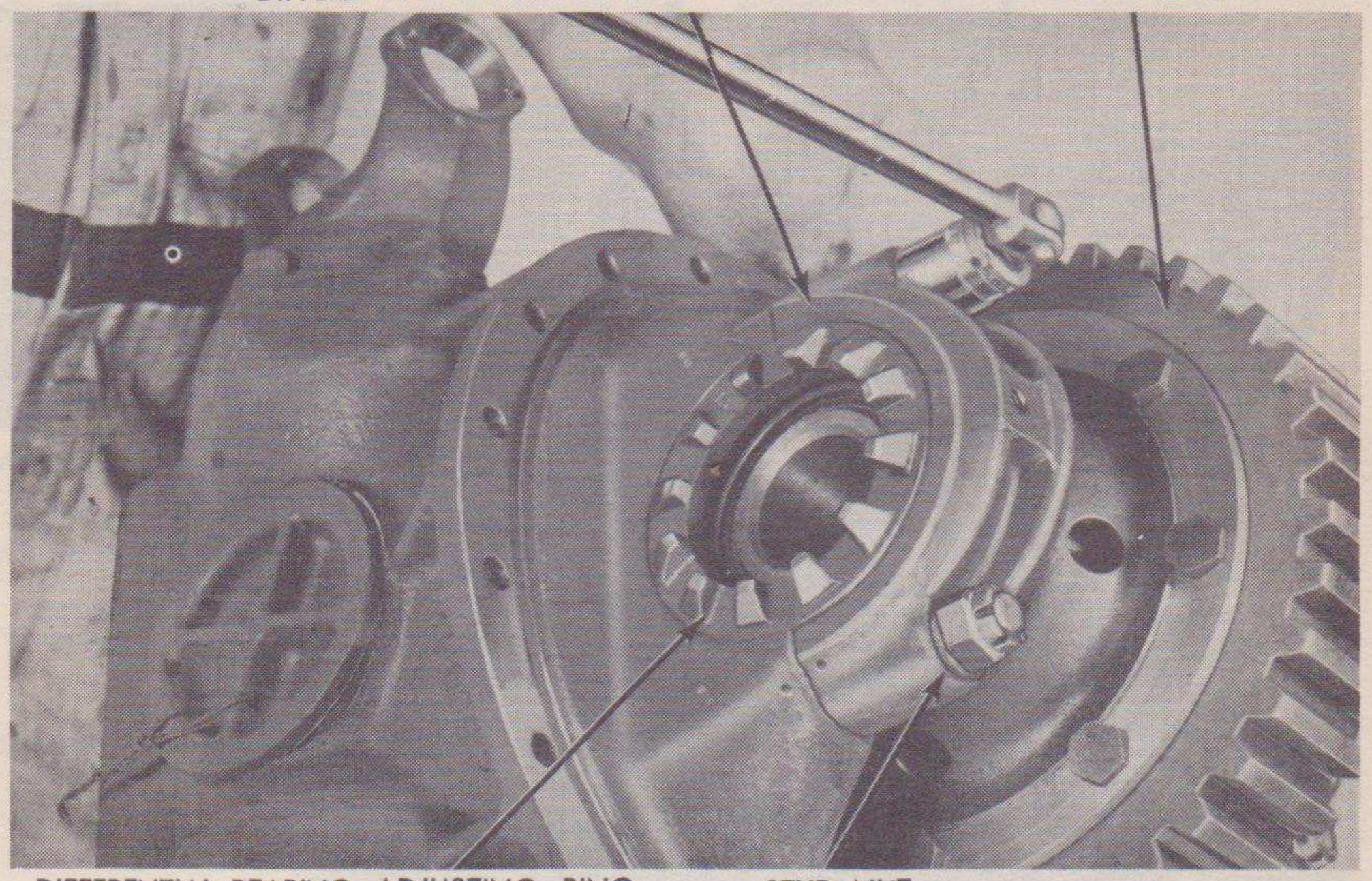


Figure 115 — Installing Bearing Cap Stud Nuts

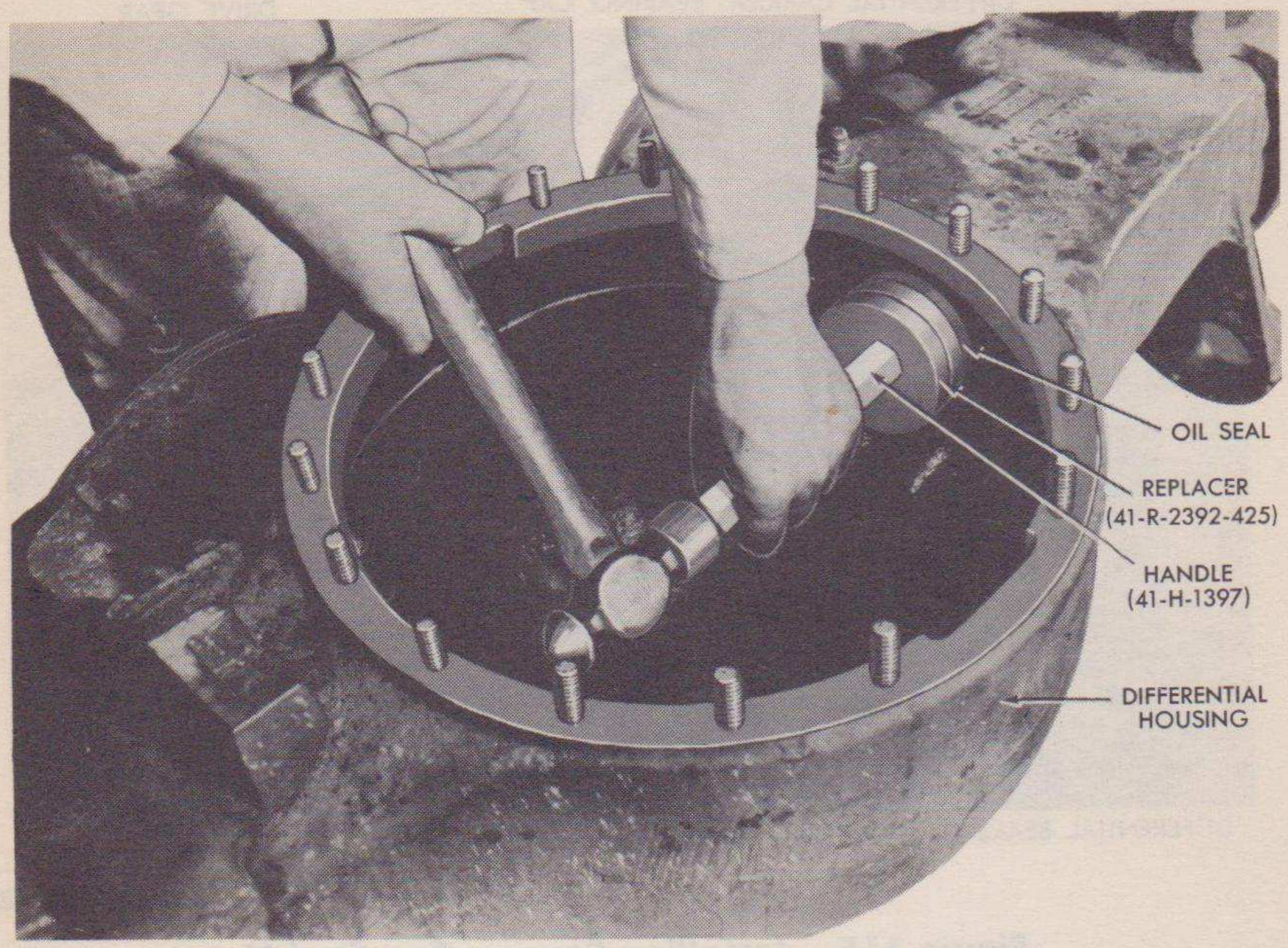
than 4 inch-pounds of torque to rotate it, remove enough shims between bearing cage and bearing cover to obtain 4 to 8 inch-pounds of torque when the cover attaching nuts are tight.

(3) ADJUST BEVEL GEAR AND BEVEL PINION TOOTH CONTACT.

(a) The adjustment of the bevel gear and bevel pinion tooth contact can be made without changing the preloading of either the through shaft bearings or the cross shaft bearings, providing the instructions in steps *1* and *2* below are followed.

1. In the case of the cross shaft bearings, this above statement is true, because the shim thickness between the bearing cover and bearing cage determines the bearing adjustment. The bevel gear may be moved toward the bevel pinion by decreasing the shim thickness between the carrier housing and bearing cage; and the bevel gear may be moved away from the bevel pinion, by increasing the shim thickness between the carrier housing and bearing cage. To change shims under bearing cage, remove cage (par. 69 **a**), position shims and install cage (par. 70 **b** (2)).

2. In the case of the through shaft bearings, their preload is determined by the total shim thickness under both bearing covers. Shims may be exchanged from one bearing cover to the other, and as long as the total thickness is the same, the bearings will stay in adjustment. To move the bevel pinion toward the bevel gear remove a



RA PD 349779

Figure 116 — Replacing Oil Seal in Differential Housing Assembly — Rear Axle

shim from beneath the bearing cover on pinion end of through shaft and install it beneath opposite bearing cover. To move bevel pinion away from bevel gear, remove shim from beneath bearing cover which is away from pinion, and install it beneath bearing cover at pinion end of through shaft.

(b) Install through shaft assembly (par. 68 **d**) and adjust position of bevel pinion so that the heels (thick end of teeth) are flush with heels of bevel gear teeth. Refer to step (3 *(a)* 2) above for positioning bevel pinion. Position bevel gear step (3 *(a)* *1*) so that 0.006 to 0.010 inch backlash is obtained between gears. Paint five of six teeth of bevel gear with prussian blue and rotate bevel gear one complete revolution. Compare teeth marking with figure 88 and adjust positions of bevel gear and bevel pinion to give correct tooth contact (fig. 88) while maintaining the necessary backlash of 0.006 to 0.010 inch. Figure 88 contains instruction for directions to move gears to obtain desired tooth contact pattern.

(4) INSTALL BEARING COVERS, OIL SEALS AND PROPELLER SHAFT YOKES. With bearing preloads and gear backlash adjustments completed, remove the old cross shaft bearing cover, with the bored hole

in it, and install the regular cover. Remove each of the through shaft bearing covers and install all oil seals with lip of the seal facing in (fig. 114) using replacer (41-R-2398-760). Install through shaft bearing covers. Install top cover and thread side cap and gasket. Secure the threaded side cap with locking wire.

(5) INSTALL DIFFERENTIAL ASSEMBLY. Install new gasket. Place differential and spur gear assembly in position in carrier assembly with differential case bolt heads next to the bevel gear. The gear teeth of the differential must mesh and be flush with the teeth of the spur pinion. Avoid injury to the teeth of either gear. Place the adjusting rings in position. Install carrier caps on studs. Check the position of the threads on the rings, so that they will fit perfectly with threads of caps. Install carrier caps and nuts (fig. 115). Tighten adjusting rings just tight enough to remove all end play, then turn adjusting rings in two more notches. Place adjusting ring locks in position and install cap screws and lock wire.

71. AXLE HOUSING.

a. Disassembly of rear axle housing (fig. 94). Using a pinch bar, pry out the axle housing sleeve oil seal. This is necessary only if new seal must be installed. NOTE: *There is seldom any need for removing the axle housing sleeve. However, if a new sleeve is required because of wear or damage, it is advisable to replace housing complete.* Remove axle housing, drain plug, and filler plug.

b. Clean and inspect. Clean the axle housing thoroughly with dry cleaning solvent, making sure all lubricant is removed from bearing surfaces and crevices. Clean drain plug and check for magnetism. If no longer magnetized, replace.

c. Assembly of axle housing. Start axle housing sleeve, oil seal in position (fig. 116), and drive to seat, using hammer handle (41-H-1397) and replacer (41-R-2392-425). Install drain plug and filler plug.

Section IV

ASSEMBLY, TEST, AND DATA

72. PRELIMINARY INSTRUCTIONS.

a. Clean housing interior and test all assemblies. Make sure all subassemblies are clean and free from dirt and chips. Coat all gears and bearings with light engine oil. Rotate to prove free operation.

73. ASSEMBLE REAR AXLE.

a. Install carrier assembly (fig. 99). Using a chain hoist, lift the differential carrier assembly and install the two differential carrier dowels. Install a new carrier gasket on the studs of the carrier. Lower the carrier assembly into position. Install the differential carrier lock washers and nuts, then tighten.

b. Install brake shoes and anchor pins (fig. 98). Install brake camshaft, tapping it in place with a soft-faced hammer. Insert two brake shoe anchor pins. Install lock washers and nuts. Install grease fittings in ends of anchor pins. Place brake shoes over anchor pins and tap into place. Install brake shoe return spring. Place anchor pin link over anchor pins. Install anchor pin nut and cotter pin.

c. Install slack adjuster, brake chamber, and bracket. Slip slack adjuster over inner end of brake camshaft. Install washer and cotter pin. Place brake chamber bracket on axle housing. Install four lock washers and cap screws. Place brake chamber on bracket and install four cap screws with lock washers. Insert pin through yoke or diaphragm rod and slack adjuster. Insert cotter pin.

d. Install hubs and drums. Refer to TM 9-813.

e. Install wheels and tires. Refer to TM 9-813.

f. Install rear axle shaft (figs. 95, 96 and 98). Loosen the axle shaft puller screws about eight threads. Tighten the nuts on the puller screws. Install new gaskets on the axle shaft studs. Slide the axle shafts in by hand. Install the taper dowels in axle shaft flange. Install lock washers and nuts. Tighten nuts.

g. Install lower torque rod assembly (figs. 94 and 101). Insert end of torque rod between prongs of axle housing. Insert lower torque rod pin from inside, slipping split bushing and washer over outer end of pin. Screw on nut. Install inner split bushing washer and nut. Tighten inner and outer nuts and insert cotter pins.

h. Install upper torque rod (figs. 94 and 101). Slip end of upper torque rod over pin. Install lock and nut. Tighten nut and bend over lock.

74. TEST.

a. Test. Fill rear axle with proper grade and quantity of lubricant (see lubrication order) and give rotary power test. Attach yoke to power source and test. Any undue noise will indicate faulty assembly, which must be checked step by step. If unit operates quietly and smoothly, install in vehicle.

75. DATA.

a. Backlash.

Bevel pinion	0.010 to 0.012 in.

b. Clearance between.

Pinion and spider	0.004 to 0.006 in.
Side gear and case	0.005 to 0.009 in.

c. New limits.

Side gear thrust washers	0.062 to 0.058 in.
Pinion gear thrust washers	0.625 to 0.0585 in.

d. Worn limits.

Pinion gear thrust washers	0.048 in.

e. Bearing adjustment method.

Differential	Each side
Through shaft bearing	Shims under front and rear cap
Bevel pinion bearing	Shims under front bearing cap
Spur pinion	Shims under side bearing cage
Bevel gear	Shims under front bearing cage

f. Bearing adjustment.

Differential	4 to 8 in.-lb torque
Through shaft bearing	4 to 8 in.-lb torque
Bevel pinion bearing	4 to 8 in.-lb torque
Bevel pinion to ring gear	0.006 to 0.010 in.

g. Run-out.

Bevel ring gear—not over	0.002 in.
Differential case—not over	0.002 in.
Axle shaft—not over	0.015 in.

h. Torque rods.

Upper	Adjustable
Lower	Fixed length

CHAPTER 8

SERVICE BRAKES

Section I

DESCRIPTION AND DATA

76. DESCRIPTION AND OPERATION.

a. Description (figs. 91 and 98). The service brakes are the internal-expanding type operating on all wheels, and actuated by air pressure. They are 2-shoe type, anchored at the rear and expanded at the front by means of a slack adjuster camshaft, and are released by means of return springs. The front shoes have eccentric anchor pins for adjusting purposes, and a single piece of molded lining riveted to the shoe. The rear shoes have concentric anchor pins and two pieces of molded lining mounted by means of bolts and nuts. All adjustments are made by means of slack adjusters. Each front brake assembly has but one return spring, while each rear brake assembly has two return springs.

b. Operation. The push rods in the brake chambers move the slack adjusters so that the camshaft is rotated, and the brake shoes are forced against the brake drums, applying the brakes. When the brake pedal is released, the brake shoe return springs return the brake shoes and slack adjusters to their normal position, releasing the brakes.

77. DATA.

a. Front brake.

Size	17¼ in. x 4 in.
Shoes per brake	2
Linings per brake	2
Method of mounting lining to shoe	Rivets
Type anchor pin	Eccentric

b. Rear brake.

Size	17¼ in. x 5½ in.
Shoe per brake	2
Linings per brake	4
Method of mounting lining to shoe	Machine screws and nuts
Type of anchor pin	Concentric

Section II
DISASSEMBLY

78. DISASSEMBLY OF BRAKES.

a. Preliminary instructions.

(1) REMOVE WHEELS, HUBS, AND DRUMS. Refer to TM 9-813 for instructions for removing wheels, hubs, and drums.

(2) CLEANING. Remove all foreign material from brake shoes, lining, and backing plate with a putty knife and wire brush.

b. Remove camshaft. Remove cotter and clevis pin from push rod clevis to loosen slack adjusters and free shoes in drum. Remove camshaft snap ring (cotter pin and washer on rear brakes) and remove camshaft (fig. 61).

c. Remove brake shoes (fig. 91 and 98). Using brake spring pliers, remove brake shoe return spring (two on rear brakes). Remove anchor pin link cotter pin and hex nut. Lift off anchor pin link. Slide off shoes.

d. Remove anchor pins and backing plate (figs. 91 and 98). Remove anchor pin, nut, and lock washer. Drive out anchor pins toward outside of vehicle with a soft hammer. Remove anchor pin link bolt.

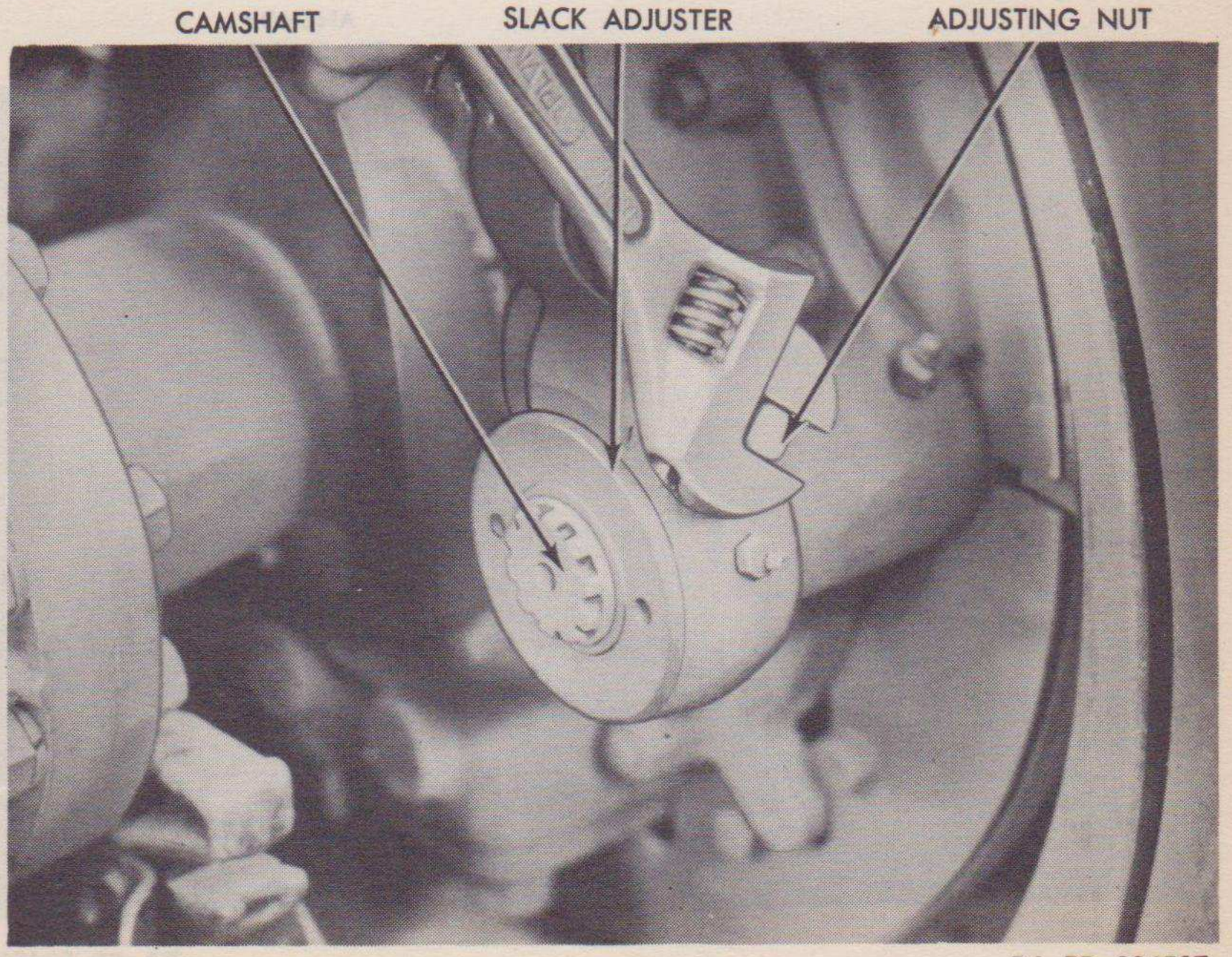


Figure 117 — Adjusting Slack Adjuster

Section III

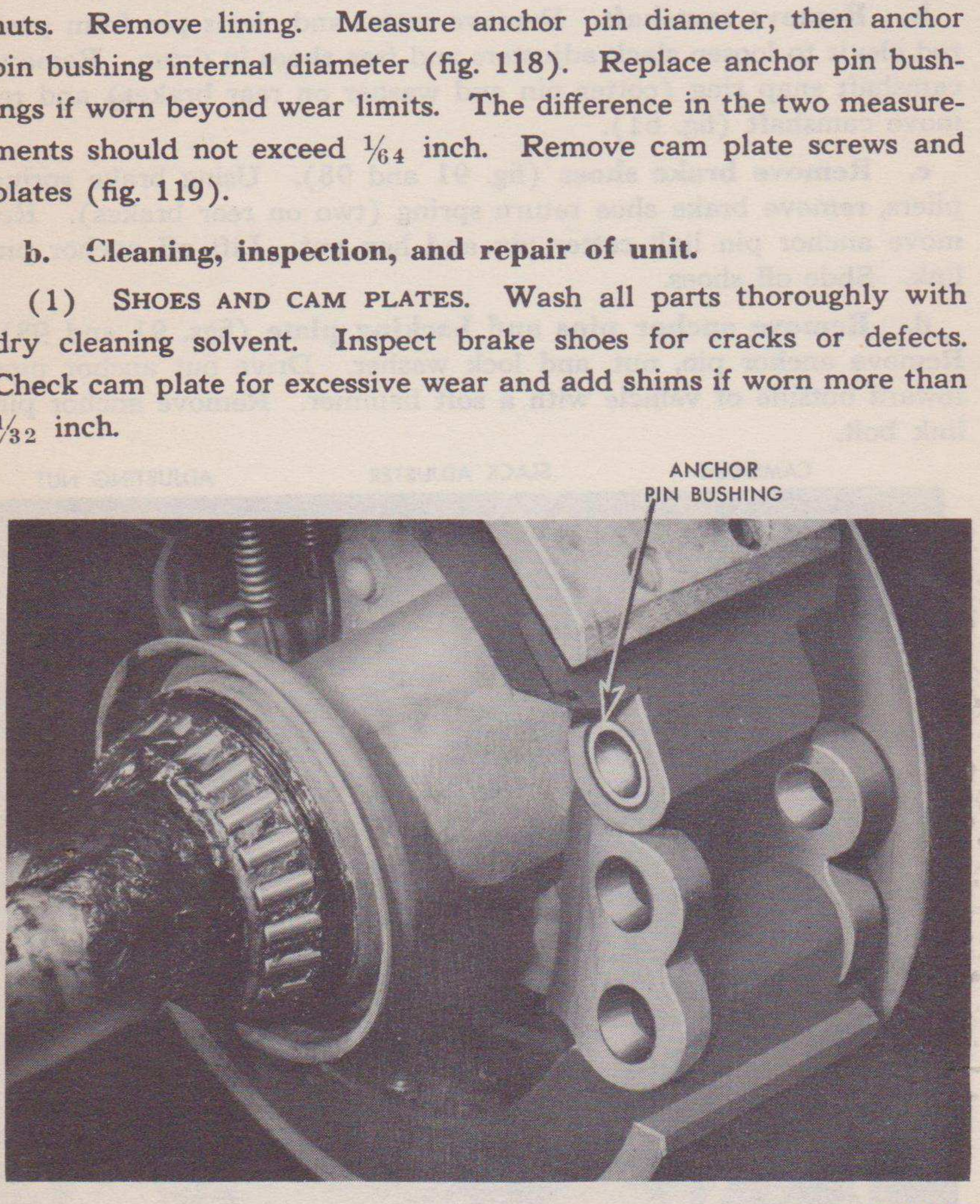
DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

79. BRAKE SHOE.

a. Disassembly, brake shoe. Drill out and remove brake lining rivets. On rear shoes, unscrew and remove screws, lock washers and nuts. Remove lining. Measure anchor pin diameter, then anchor pin bushing internal diameter (fig. 118). Replace anchor pin bushings if worn beyond wear limits. The difference in the two measurements should not exceed $\frac{1}{64}$ inch. Remove cam plate screws and plates (fig. 119).

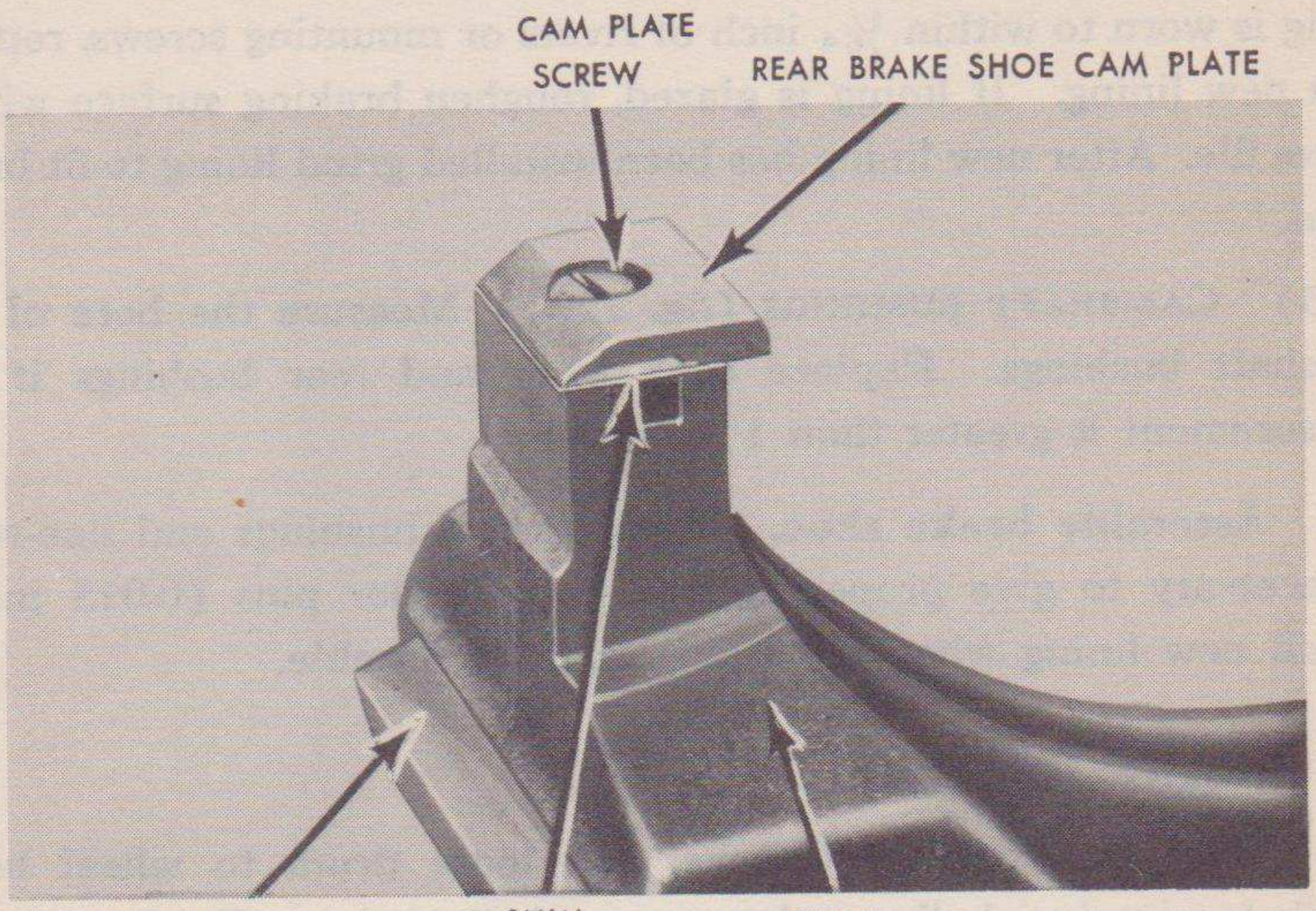
b. Cleaning, inspection, and repair of unit.

(1) SHOES AND CAM PLATES. Wash all parts thoroughly with dry cleaning solvent. Inspect brake shoes for cracks or defects. Check cam plate for excessive wear and add shims if worn more than $\frac{1}{32}$ inch.



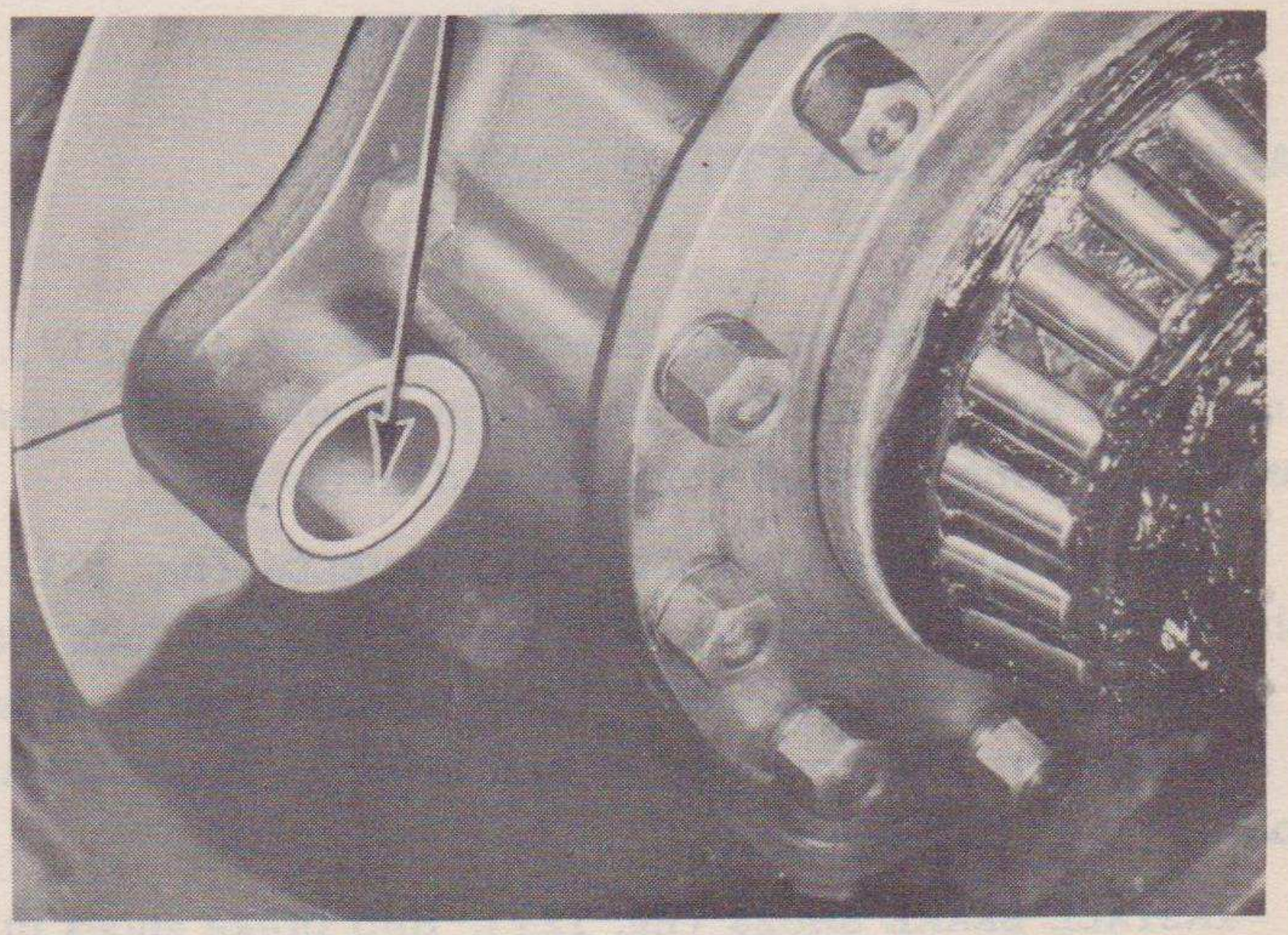
RA PD 334508

Figure 118 — Measuring Bore of Anchor Pin Bushing



RA PD 353088

Figure 119 — Brake Shoe Cam Plate Assembly — Installed



RA PD 334510

Figure 120 — Rear Brake Camshaft Bushing

(2) LININGS. Inspect lining for worn or glazed condition. If lining is worn to within $\frac{1}{64}$ inch of rivets or mounting screws, replace with new lining. If lining is glazed, roughen braking surface with a coarse file. After new lining has been installed grind lining to fit brake drum.

(3) CAMSHAFT BUSHINGS (fig. 120). Measure the bore of the camshaft bushings. Replace both front and rear bushings if the measurement is greater than $1\frac{9}{16}$ inches.

c. Assemble brake shoe. Press in new bushings and line-ream if necessary to give proper clearance to anchor pins (0.015 inch). Install new lining when old lining is unserviceable.

80. BRAKE DRUMS.

a. Examine drum for cracks, and loose drum to wheel bolts. Check for scoring, bell-mouth wear, and distortion. Replace drums if cracked or if bolt holes are elongated. If inspection shows machinery would remove enough metal to weaken drum, replace drum.

Section IV

ASSEMBLY ON VEHICLE

81. ASSEMBLY, ADJUSTMENT, AND DATA.

a. Assembly.

(1) INSTALL CAMSHAFT AND SLACK ADJUSTER (fig. 117). Slip brake camshaft into place. Slide slack adjuster over end of camshaft and install snap ring. Install yoke pin and cotter pin.

(2) INSTALL ANCHOR PINS AND DUST SHIELDS (fig. 121). Put dust shields in place and secure with cap screws and lock washers. Insert anchor pins (with eccentric portion toward center of wheel), install lock washers and nuts (upper and lower). Insert anchor pin link bolt.

(3) INSTALL BRAKE SHOES (fig. 121). Slip brake shoes in place over anchor pins. Slip anchor pin link over anchor pins and bolt, and secure with nut and cotter pin. Install return spring or springs on brake shoes.

(4) INSTALL WHEELS, HUBS, AND DRUMS. Refer to TM 9-813 for instructions for installing wheels, hubs, and drums.

b. Adjustment.

(1) REFER TO TM 9-813 FOR ADJUSTMENT PROCEDURE.

c. Data.

Shoe to drum clearance	0.016 in.
Slack adjuster push rod travel	
Front	5/8 in.
Rear	3/4 in.
Maximum permissible push rod travel	
Front	1 3/8 in.
Rear	1 3/4 in.
Minimum permissible lining thickness	
Front	1/8 in.
Rear	5/16 in.
Anchor pin-to-bushing clearance	
Front	0.002 in.
Rear	0.0015 in.

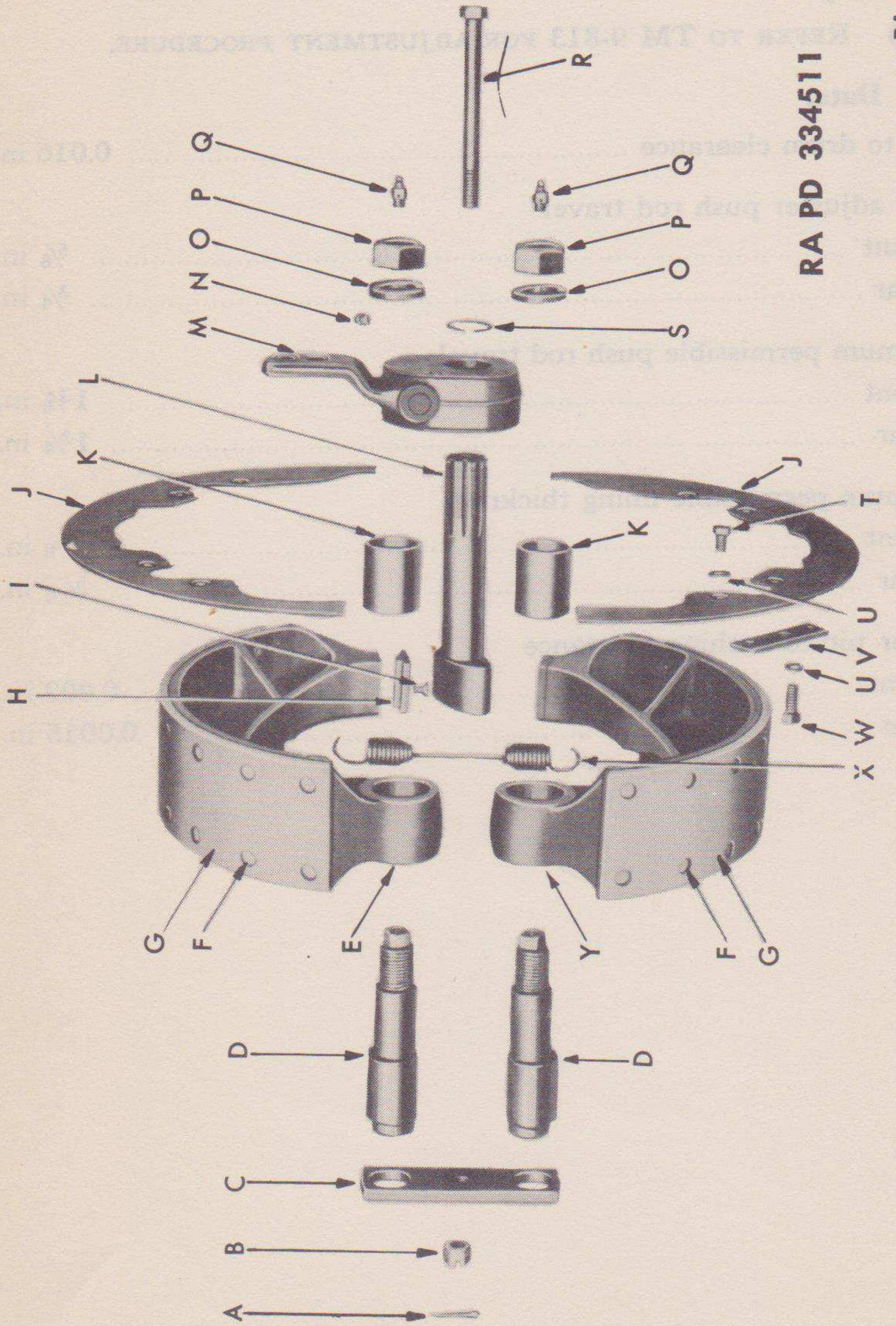


Figure 121 — Front Axle Brake — Disassembled

A—COTTER PIN

B—CASTLE NUT

C—ANCHOR PIN LINK

D—BRAKE SHOE ANCHOR PIN

E—UPPER LEFT BRAKE SHOE w/LINING ASSEMBLY

F—RIVET

G—BRAKE SHOE LINING

H—BRAKE SHOE CAM PLATE

I—PIN

J—DUST SHIELD ASSEMBLY

K—BRAKE SHOE BUSHING

L—CAMSHAFT

M—SLACK ADJUSTER ASSEMBLY

N—GREASE FITTING

O—ANCHOR PIN WASHER

P—ANCHOR PIN NUT

Q—GREASE FITTING

R—BOLT

S—CAMSHAFT SNAP RING

T—CAP SCREW

U—LOCK WASHER

V—DUST SHIELD PLATE

W—SCREW

X—BRAKE SHOE RETURN SPRING

Y—LOWER LEFT BRAKE SHOE w/LINING ASSEMBLY

RA PD 334511B

Legend for Figure 121

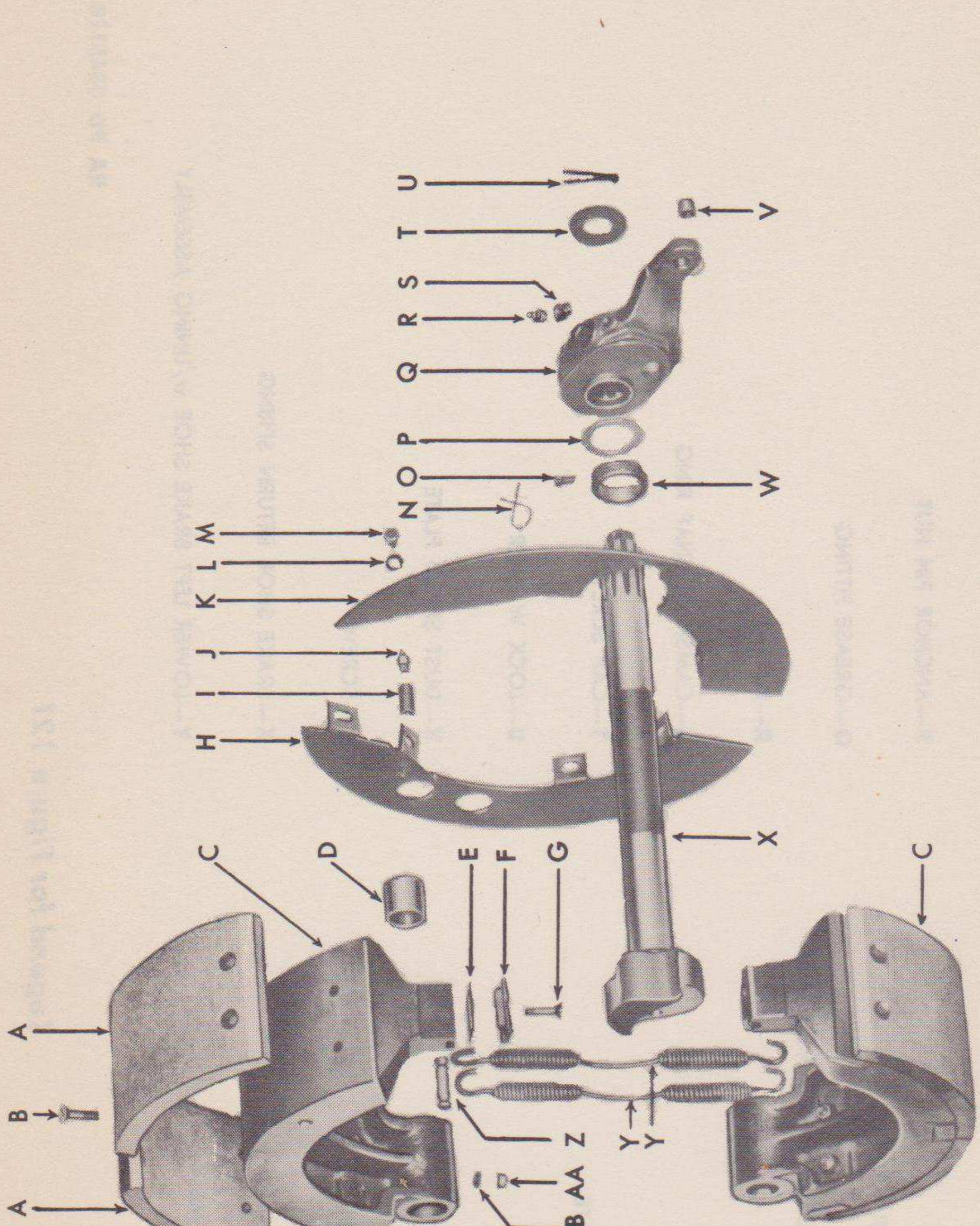


Figure 122 — Rear Axle Brake — Disassembled

A—BRAKE SHOE LINING
B—BRAKE SHOE LINING BOLT
C—BRAKE SHOE
D—ANCHOR PIN BUSHING
E—SHIM
F—BRAKE SHOE CAM PLATE
G—CAM PLATE SCREW
H — DUST SHIELD
I — REDUCING BUSHING
J — GREASE FITTING
K — DUST SHIELD
L—WASHER
M—CAP SCREW
N—LOCK WIRE
O—CAMSHAFT COLLAR SET SCREW
P—CAMSHAFT SPACING WASHER
Q—SLACK ADJUSTER
R—GREASE FITTING
S—REDUCING BUSHING
T—WASHER
U—COTTER PIN
V—SLACK ADJUSTER ARM BUSHING
W—CAMSHAFT COLLAR
X—BRAKE CAMSHAFT
Y—RETURN SPRING
Z—BRAKE SHOE RETURN SPRING PIN
AA—BRAKE SHOE LINING BOLT NUT
AB—WASHER
AC—BRAKE SHOE ANCHOR PIN
AD — BRAKE SHOE ANCHOR PIN LINK
AE — LOCK WASHER
AF — ANCHOR PIN LINK SCREW

RA PD 334512C

Legend for Figure 122

CHAPTER 9

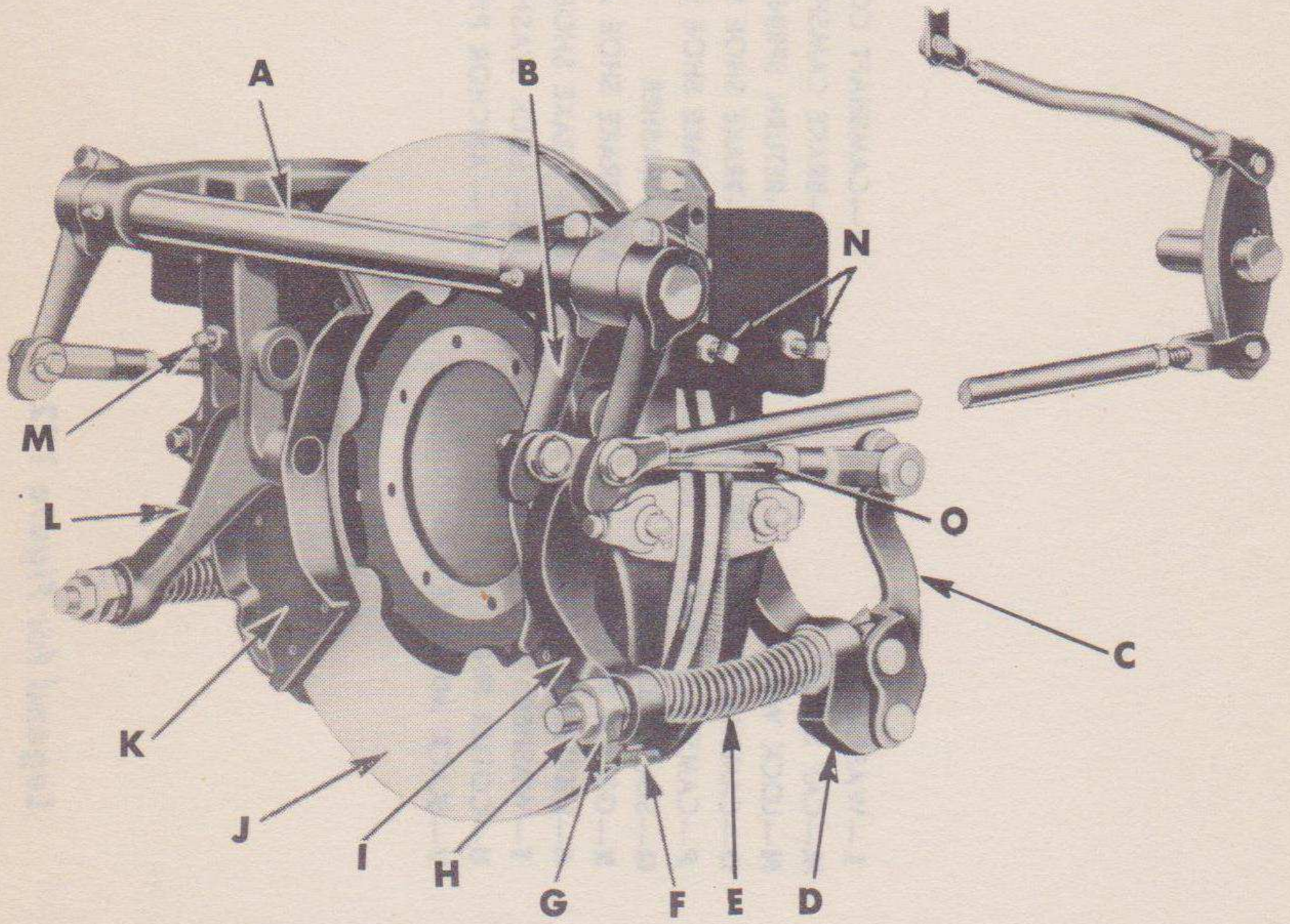
PROPELLER SHAFT BRAKE

Section I

DESCRIPTION AND DATA

82. DESCRIPTION AND OPERATION.

a. Description (figs. 123 and 124). The propeller shaft brake is a 4-shoe disk type, operating on a drop forged steel disk mounted on a companion flange of the propeller shaft. The disk revolves with the



A – BRAKE CROSS SHAFT
B – CROSS SHAFT LEVER
C – BRAKE OPERATING LEVER
D – BRAKE LEVER ARM (RIGHT FRONT)
E – BRAKE LEVER ARM RELEASE SPRING
F – BRAKE SHOE TENSION SPRING
G – BRAKE LEVER ARM TIE ROD ADJUSTING NUT
H – BRAKE LEVER ARM TIE ROD LOCK NUT
I – BRAKE LEVER ARM (RIGHT REAR)
J – BRAKE DISK
K – BRAKE SHOE
L – BRAKE LEVER ARM (LEFT REAR)
M – ANCHOR PIN LOCK SCREW
N – BRAKE SHOE ADJUSTING SET SCREW
O – ROD

RA PD 353089

Figure 123 – Propeller Shaft Brake Assembly

propeller shaft when the vehicle is in motion. The operating shaft and brackets are mounted on a frame crossmember. The shoes are lined with a heavy-duty molded lining .

b. Operation. The shoes are operated by bell cranks and rods connected to the hand brake lever. The disk is ventilated, drawing cool air from its center. This constant passage of air, when the brake is in operation, tends to carry off the heat generated when braking.

83. DATA.

Make	American Chain and Cable Co.
Model	L-5504
Type	Four-shoe disk
Diameter	16 in.
Type lining	Molded

Section II

DISASSEMBLY INTO SUBASSEMBLIES

84. DISASSEMBLY.

a. Preliminary instructions.

(1) REMOVE PROPELLER SHAFT BRAKE. Removal of the unit is necessary for disassembly. Refer to TM 9-813 for instructions on removing propeller shaft brake.

(2) CLEANING. Remove all foreign material from the propeller shaft brake with a wire brush and a putty knife. Place the unit in a container of dry cleaning solvent and wash thoroughly. Wipe dry with clean cloths.

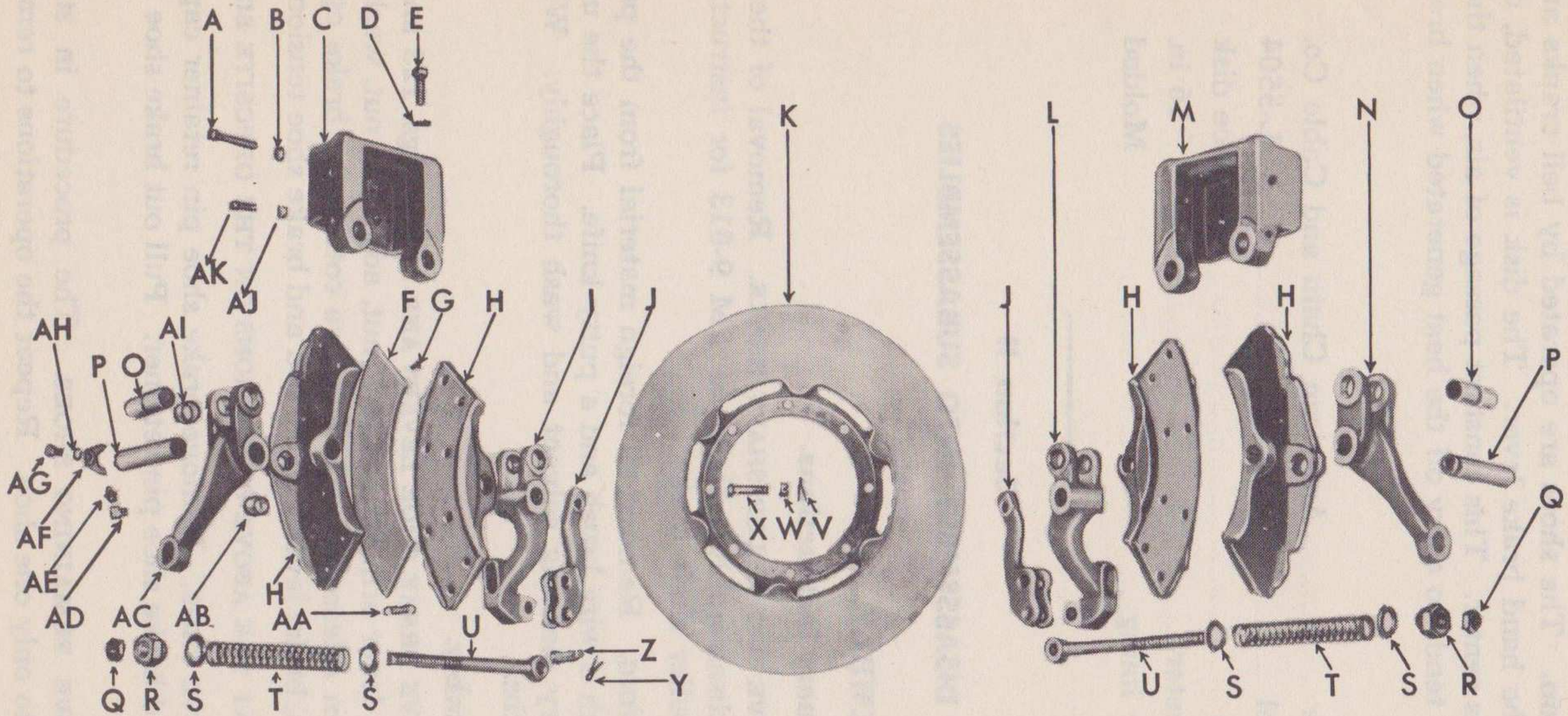
b. Disassembly.

(1) REMOVE BRAKE SHOE LEVERS AND ARMS (figs. 123 and 124). Remove brake lever arm tie rod lock nut, adjusting nut, washer, and brake lever arm release spring. Remove cotter pin, brake operating lever clevis pin, brake lever arm tie rod and brake shoe tension spring.

(2) REPEAT THE ABOVE OPERATIONS ON THE OPPOSITE SIDE.

(3) REMOVE SHOE. Remove brake shoe pin retainer cap screw, lock washer and brake shoe pin retainer. Pull out brake shoe pin and remove shoe.

(4) REMOVE REMAINING SHOES. The procedure in step (3) above applies to only one shoe. Repeat the operations to remove the other three shoes.



RA PD 334517

Figure 124 — Propeller Shaft Brake — Disassembled

A—BRAKE SHOE ADJUSTING SET SCREW
B—ADJUSTING SET SCREW NUT
C—BRAKE SHOE ANCHOR PIN BRACKET (LEFT)
D—WASHER
E—BOLT
F—BRAKE SHOE LINING
G—RIVET
H—BRAKE SHOE
I—BRAKE LEVER ARM (LEFT FRONT)
J—BRAKE OPERATING LEVER
K—BRAKE DISK
L—BRAKE LEVER ARM (RIGHT FRONT)
M—BRAKE SHOE ANCHOR PIN BRACKET (RIGHT)
N—BRAKE LEVER ARM (RIGHT REAR)
O—BRAKE LEVER ARM ANCHOR PIN
P—BRAKE SHOE PIN
Q—BRAKE LEVER ARM TIE ROD LOCK NUT
R—BRAKE LEVER ARM TIE ROD ADJUSTING NUT
S—WASHER
T—BRAKE LEVER ARM RELEASE SPRING
U—BRAKE LEVER ARM TIE ROD
V—COTTER PIN
W—NUT
X—BOLT
Y—COTTER PIN
Z—BRAKE OPERATING LEVER CLEVIS PIN
AA—BRAKE SHOE TENSION SPRING
AB—BRAKE SHOE BUSHING
AC—BRAKE LEVER ARM (LEFT REAR)
AD—BRAKE SHOE PIN FITTING BODY
AE—BRAKE SHOE PIN GREASE FITTING
AF—BRAKE SHOE PIN RETAINER
AG—BRAKE SHOE PIN RETAINER CAP SCREW
AH—WASHER
AI—BRAKE LEVER ARM BUSHING
AJ—BRAKE LEVER ARM ANCHOR PIN LOCK SCREW LOCK NUT
AK—ANCHOR PIN LOCK SCREW

RA PD 334517B

Legend for Figure 124

Section III

DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

85. BRAKE SHOE AND BRAKE DISK.

a. Brake shoe.

(1) DISASSEMBLE BRAKE SHOE. Drive out rivets with punch. Remove lining. Press out bushings if unserviceable. Remove grease fitting.

(2) CLEANING, INSPECTION, AND REPAIR. Wash all parts thoroughly with dry cleaning solvent. Inspect brake shoe, making sure face is flat and free from cracks.

(3) ASSEMBLE BRAKE SHOE. Press in new bushings if required, and line ream if too tight. Install new lining. Install grease fitting.

b. Brake disk.

(1) INSPECTION. Inspect disk for distortion, burs, or rough places on machined surfaces. If measurement of the distortion, or deep scores on braking surfaces shows that enough metal would be removed in the machining operation to impair the strength of the disk, replace disk.

(2) REPAIR. Remove small burs from machined surfaces with a hand stone. Remedy scores on the braking surface by resurfacing with a machine.

86. ARM ASSEMBLY.

a. Disassemble arm assembly. Press out bushings if unserviceable.

b. Cleaning, inspection, and repair. Wash arms in dry cleaning solvent. Check for cracks or misalinement.

c. Assemble arm assembly. Press in new bushings and line ream if too tight.

87. CROSS SHAFT.

a. Disassemble cross shaft (fig. 125). Remove three nuts (D), washers (C), and binder bolts (A). Remove two lubricating fittings (AB). Remove cross shaft lever (B), Woodruff key (AL), and bracket (AP) from end of shaft having one lever. Remove lever (AN), Woodruff key (AL), bracket (AP), and cross shaft lever (B) from other end of shaft.

b. Cleaning, inspection, and repair of cross shaft parts. Wash all parts with dry cleaning solvent. Inspect shaft for straightness and check for worn keyways. Check all levers and brackets for cracks and misalinement. Clean and oil all parts before assembly.

c. Assembly. Insert inside key in keyway on right-hand end of shaft. Slip lever (B) over shaft and key. Insert binder bolt (A), lock washer (C), and rim nut (D), but do not tighten. Slip bracket (AP) over cross shaft. Insert outside key in keyway on right-hand end of cross shaft. Slip cross shaft lever (AN) over end of cross shaft and insert binder bolt, lock washer, and rim nut but do not tighten. Slip bracket over left end of cross shaft. Insert remaining key in keyway. Install cross shaft lever on left-hand end of shaft. Install binder bolt, lock washer, and nut. Tighten all three rim nuts securely. Install two lubricating fittings (AB).

88. HAND LEVER.

a. Disassemble hand lever (fig. 125). Remove cotter pin (AF), latch pin (AD), and latch (AE). Unscrew latch rod button (Q) and withdraw latch rod (O) and remove button spring (P).

b. Cleaning, inspection, and repair (fig. 125). Wash all parts thoroughly with dry cleaning solvent. Inspect latch rod for kinks or bends. Check latch (AE). Inspect spring for tension. Clean and oil all parts before assembly.

c. Assemble hand lever. Insert latch rod into handle of lever. Slip spring into place. Screw on button. Slip latch over end of rod. Insert pin in lever and through latch. Install cotter pin.

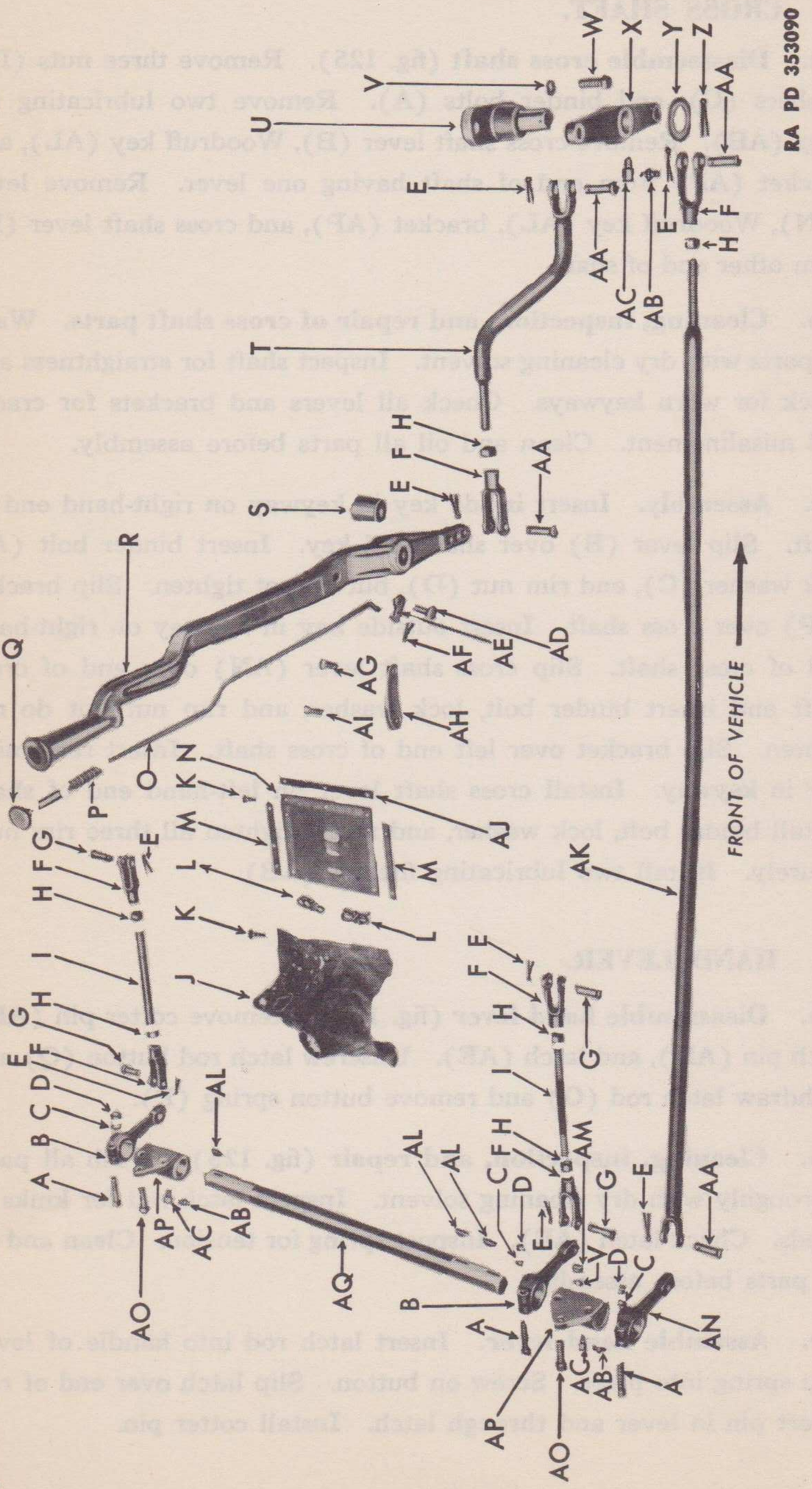


Figure 125 — Propeller Shaft Brake Lever and Linkage — Disassembled

A—BOLT
B—BRAKE CROSS SHAFT LEVER
C—WASHER
D—NUT
E—COTTER PIN
F—CROSS SHAFT LEVER ROD YOKE
G—CLEVIS PIN
H—NUT
I—BRAKE CROSS SHAFT LEVER TO OPERATING LEVER ROD
J—AUXILIARY LEVERS BOOT ASSEMBLY
K—SCREW
L—LACING
M—WINCH LEVER CLOSURE HOLD DOWN STRIP
N—CAB FLOOR WINCH LEVER CLOSURE
O—BRAKE HAND LEVER LATCH ROD
P—BRAKE HAND LEVER BUTTON SPRING
Q—BRAKE HAND LEVER LATCH ROD BUTTON
R—BRAKE HAND LEVER
S—HAND LEVER SPACER
T—BRAKE HAND LEVER TO RELAY LEVER ROD ASSEMBLY
U—BRAKE HAND LEVER RELAY W/SHAFT ASSEMBLY
V—WASHER
W—BOLT
X—BRAKE RELAY LEVER
Y—WASHER
Z—COTTER PIN
AA—CLEVIS PIN
AB—LUBRICATION FITTING
AC—LUBRICATION FITTING BODY
AD—LATCH PIN
AE—BRAKE HAND LEVER ROD LATCH
AF—HAND LEVER ROD COTTER PIN
AG—HAND LEVER SECTOR FLAT-HEAD CAP SCREW
AH—BRAKE HAND LEVER SECTOR
AI—HAND LEVER SECTOR SCREW
AJ—WINCH LEVER CLOSURE HOLD DOWN STRIP
AK—BRAKE CROSS SHAFT TO RELAY LEVER ROD ASSEMBLY
AL—CROSS SHAFT LEVER WOODRUFF KEY
AM—NUT
AN—BRAKE CROSS SHAFT LEVER
AO—BOLT
AP—BRAKE CROSS SHAFT BRACKET
AQ—BRAKE CROSS SHAFT

RA PD 353090B

Legend for Figure 125

Section IV

ASSEMBLY AND ADJUSTMENT

89. ASSEMBLY OF BRAKE.

a. Assemble arms, shoes, tie rods, and springs. Refer to figures 123 and 124 for correct position of parts in assembly.

(1) Attach the proper lever arm to each shoe with an anchor pin. Lock each anchor pin to a shoe with a retainer, cap screw, and washer.

(2) Connect a tie rod to each operating lever with a clevis pin, and install a cotter pin through each clevis pin.

(3) Slip a tie rod through each front lever arm, then pass the tie rod through a washer, release spring, and another washer in order mentioned.

(4) Attach each operating lever to a front lever arm with a clevis pin. Install cotter pin in each clevis pin.

(5) Insert end of tie rod through rear rear lever arm, and install adjusting nut and lock nut on end of each tie rod.

90. ADJUSTMENT.

a. General. Brake cannot be adjusted until it is assembled to frame crossmember and disk is installed on companion flange.

b. Procedure (fig. 123).

(1) Position brake hand lever in full release position. Tighten each tie rod adjusting nut until release spring exerts sufficient pressure to make each front lever arm rest solidly against each operating lever.

(2) Adjust the length of each rod (fig. 123) until the clearance between the lower portion of each front brake shoe and the brake disk is between 0.006 to 0.008 inch. CAUTION: *Make sure brake tension spring is in place.*

(3) Position the brake shoe adjusting set screw, which acts as a stop for the upper portion of the front brake shoes, so that 0.006 to 0.008 inch clearance is obtained between shoes and disk when the shoes are contacting the screw. NOTE: *On some models these screws are parallel with the disk, and on other models they are perpendicular to disk. Refer to figures 123 and 124, for location of screws.*

(4) Adjust the position of the rear brake shoes with the tie rod adjusting nuts and the adjusting set screws to make the shoes parallel with the disk, and have a clearance of 0.006 to 0.008 inch between disk and shoes.

CHAPTER 10

SPRINGS AND WALKING BEAM

Section I

SPRINGS

91. DISASSEMBLY.

a. Remove springs. Refer to TM 9-813 for procedure for removal of springs.

b. Disassemble springs.

(1) FRONT SPRINGS. Remove nut and bolt from inner and outer rebound clips and tap clips from springs. Remove nut from center bolt and tap bolt from spring leaves. If spring shackle or spring eye bushings are worn beyond limits (par. 95), press out with an arbor press.

(2) REAR SPRINGS. Follow procedures of subparagraph b (1) above. If the spring seat bushings are worn beyond limit (par. 95), press out with an arbor press.

92. CLEANING AND INSPECTION.

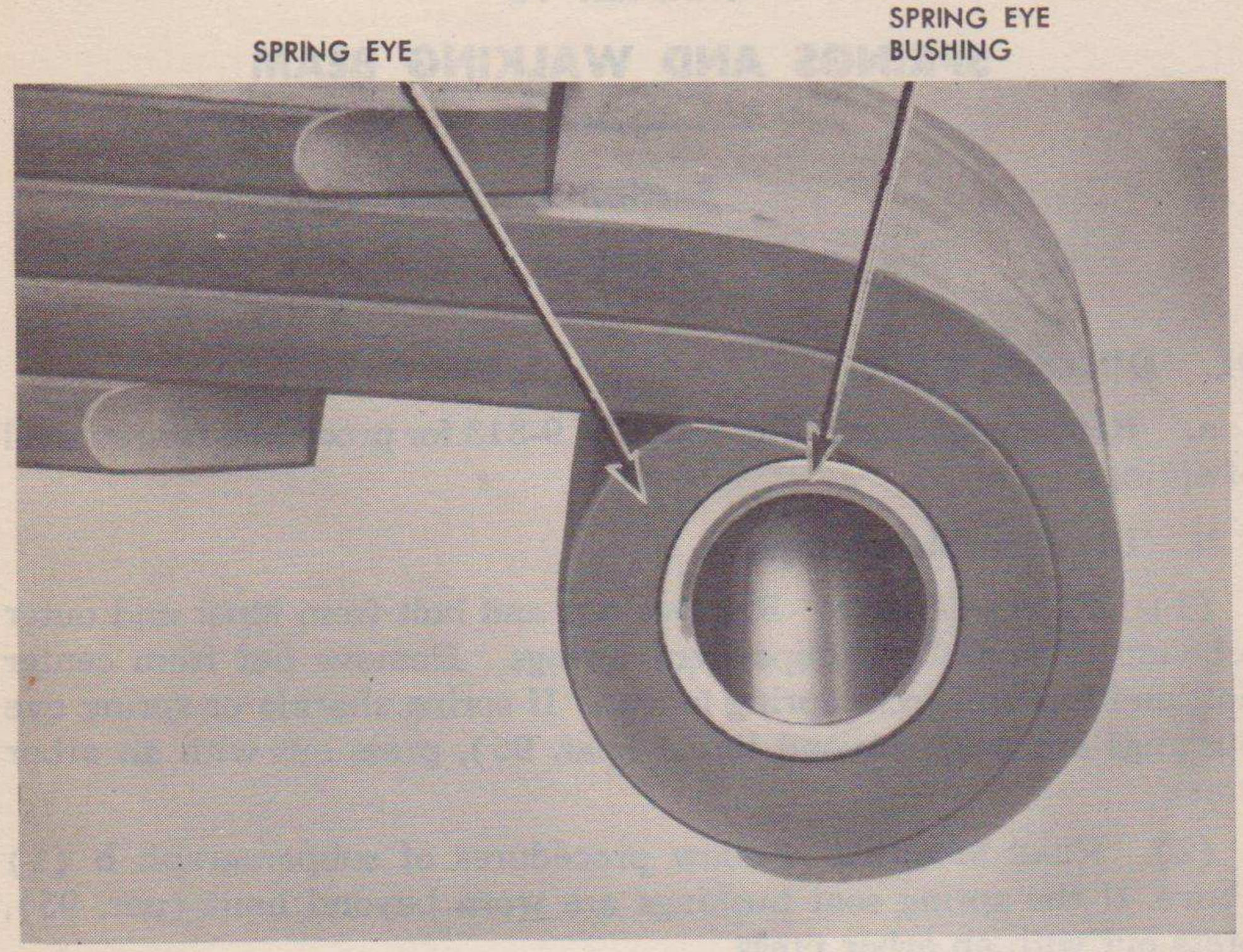
a. Clean and inspect spring assembly. Clean all spring leaves and parts thoroughly with a wire brush and cleaning solvent. Examine all leaves for cracks and distortion. Check U-bolt threads, and spring plates and clips, for proper condition. Examine spring shackles and shackle bolts for proper condition. Check the clamp bolts of the rear spring seat for operation and condition. Measure the bore of all spring, spring bracket, and spring seat bushings from both sides to check for excess wear (par. 95).

93. REPAIR.

a. Procedure. When pressing new bushings into the front spring eye (fig. 126), dress all rough spots with a fine file and clean all particles from bore of bushing before assembly. Press rear spring seat bushings (fig. 128) in from each side until flush with a housing. Dress all rough spots and burs with a fine file. Clean all particles from bore before assembly. If bore of bushing is not correct (par. 95) after installing, line ream to proper bore.

94. ASSEMBLY.

a. Assemble. Place leaves in position, insert center bolt, install nut and tighten. Place inner and outer rebound clips in position and install and tighten clip bolts and nuts.



RA PD 334546

Figure 126 — Spring Eye Bushing

RA PD 334545

Figure 127 — Front Spring Bracket Bushing

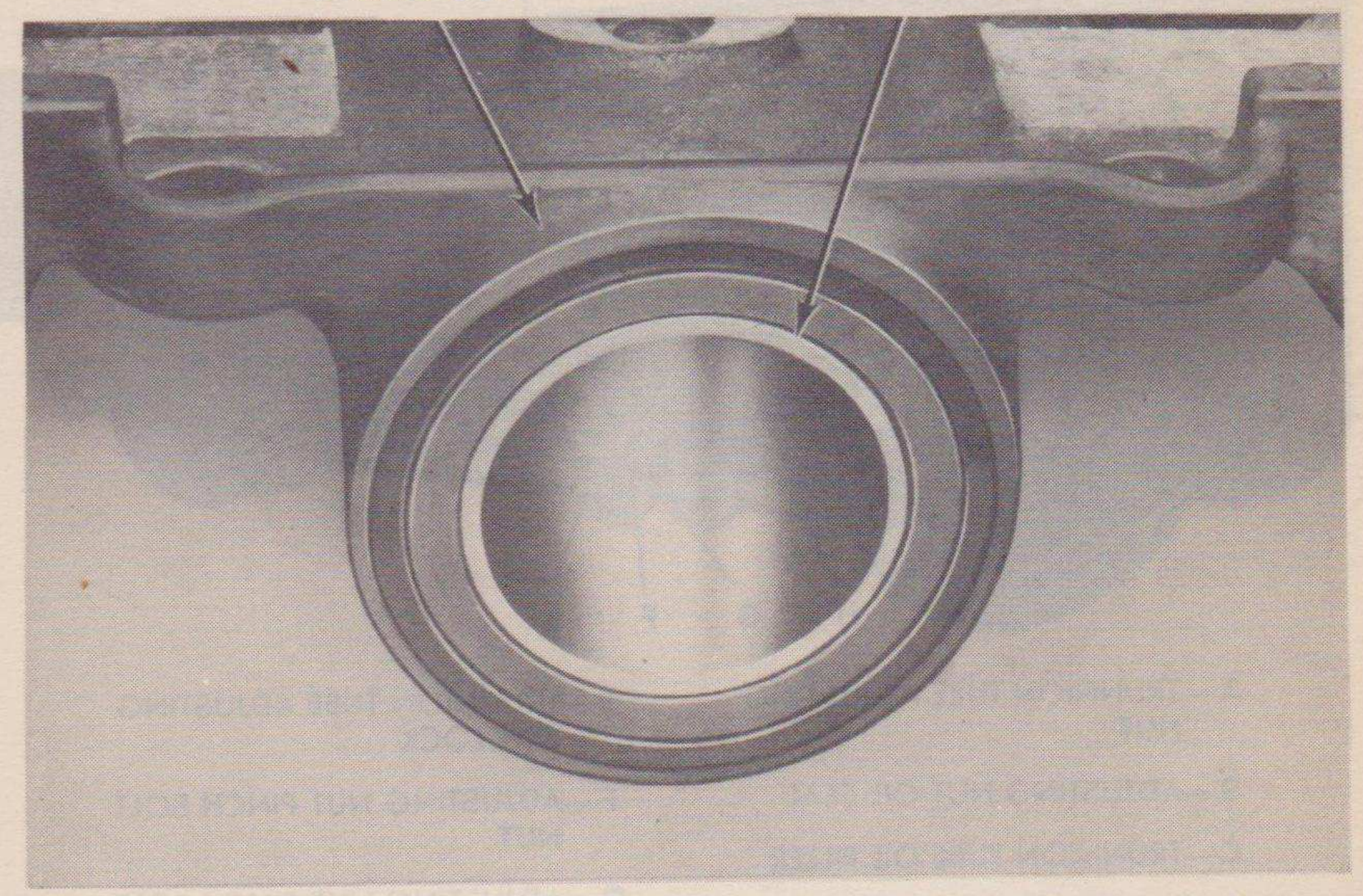


Figure 128 — Rear Spring Seat Bushing

95. DATA.

a. New dimensions.

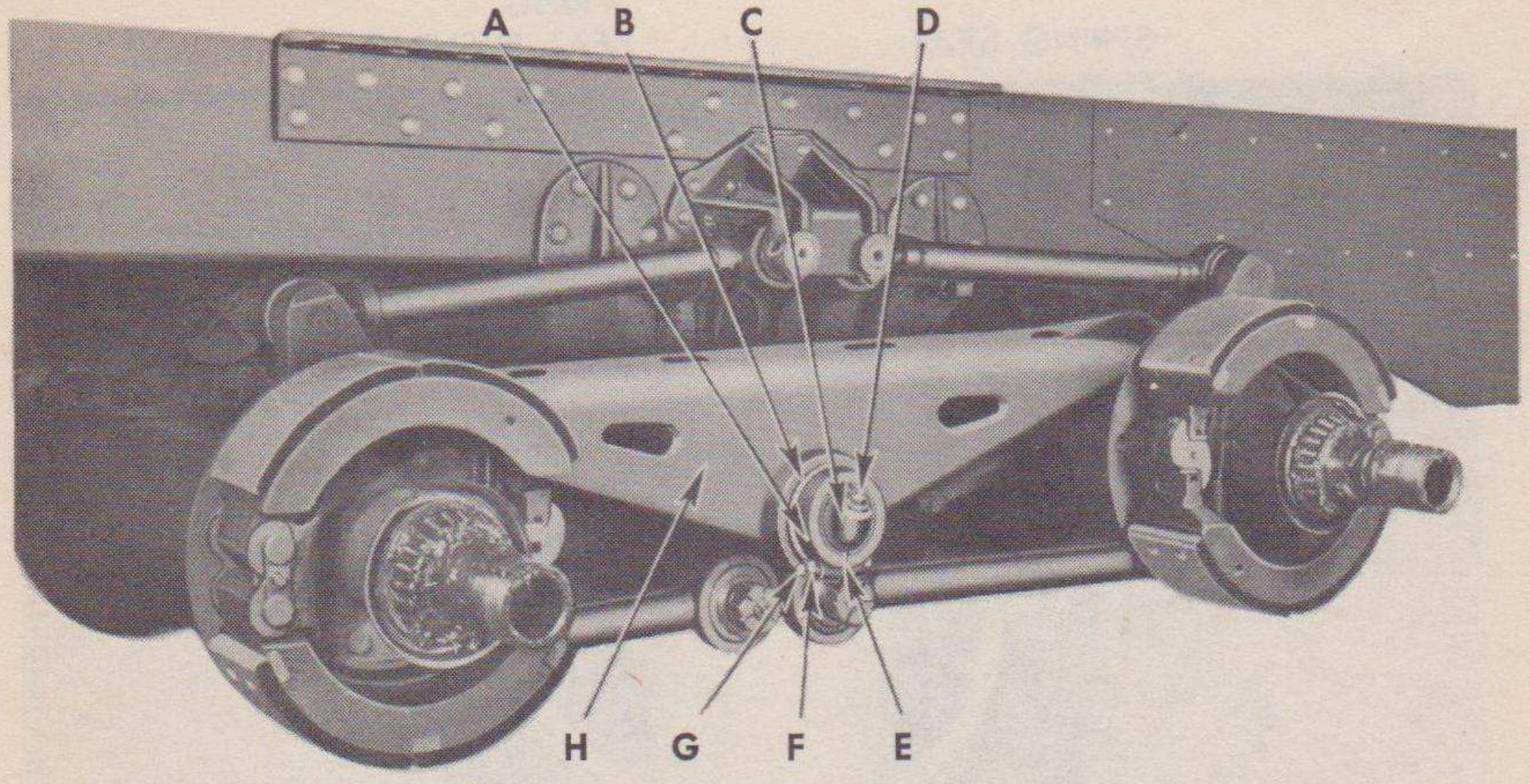
Front spring shackle pin—diameter	01.00 in.
Front spring bracket bolt—diameter	01.00 in.
Rear spring seat shaft—diameter	03.750 in.
Front spring bracket bushing—bore	01.015 in.
Front spring eye bushing—bore	01.015 in.
Rear spring seat bushings—bore	03.7656 in.

Section II

WALKING BEAM

96. DESCRIPTION (fig. 129).

a. The walking beam consists of a steel casting; this is used instead of a spring to give rigidity to the truck suspension on the crane and shovel trucks when under load. The beams are mounted on the trunnion tube which is stationary in its mounting. The walking beam permits the up and down movement of the rear axles in relation to



A—TRUNNION TUBE ADJUSTING NUT

B—ADJUSTING NUT OIL SEAL

C—TRUNNION TUBE OIL FILLER

D—TRUNNION TUBE OIL FILLER PLUG

E—TRUNNION TUBE ADJUSTING NUT LOCK

F—ADJUSTING NUT PINCH BOLT NUT

G—ADJUSTING NUT PINCH BOLT

H—WALKING BEAM

RA PD 344616

Figure 129 — Walking Beam — Installed

the chassis frame. The movement of the ends of the walking beams is limited by a bumper and extension arm on the axle housings. The trunnion tube hole of the walking beam has two pressed-in sleeve bushings, and the beam has a groove on each side for the oil seal rings, which retain the lubricant in the trunnion bushings.

97. REMOVAL (fig. 129).

a. Jack up vehicle. Attach hoist and chain to rear end of chassis frame and lift rear of vehicle far enough so ends of walking beams do not contact rear axles.

b. Remove propeller shafts. Remove the propeller shaft connecting the forward rear axle to the rearward rear axle (TM 9-813). Disconnect the propeller shaft between transfer case and forward rear axle at axle end.

c. Disconnect torque rods from axles. Disconnect air lines to axles (TM 9-813). Remove cotter pins from slotted nuts on the torque rod pins, which hold one end of each lower torque rod to the rear axle at each side of vehicle. Remove the slotted nuts from each end of the pins and drive out pins. Remove nuts and lock washers from pins holding one end of each of the upper torque rods to the

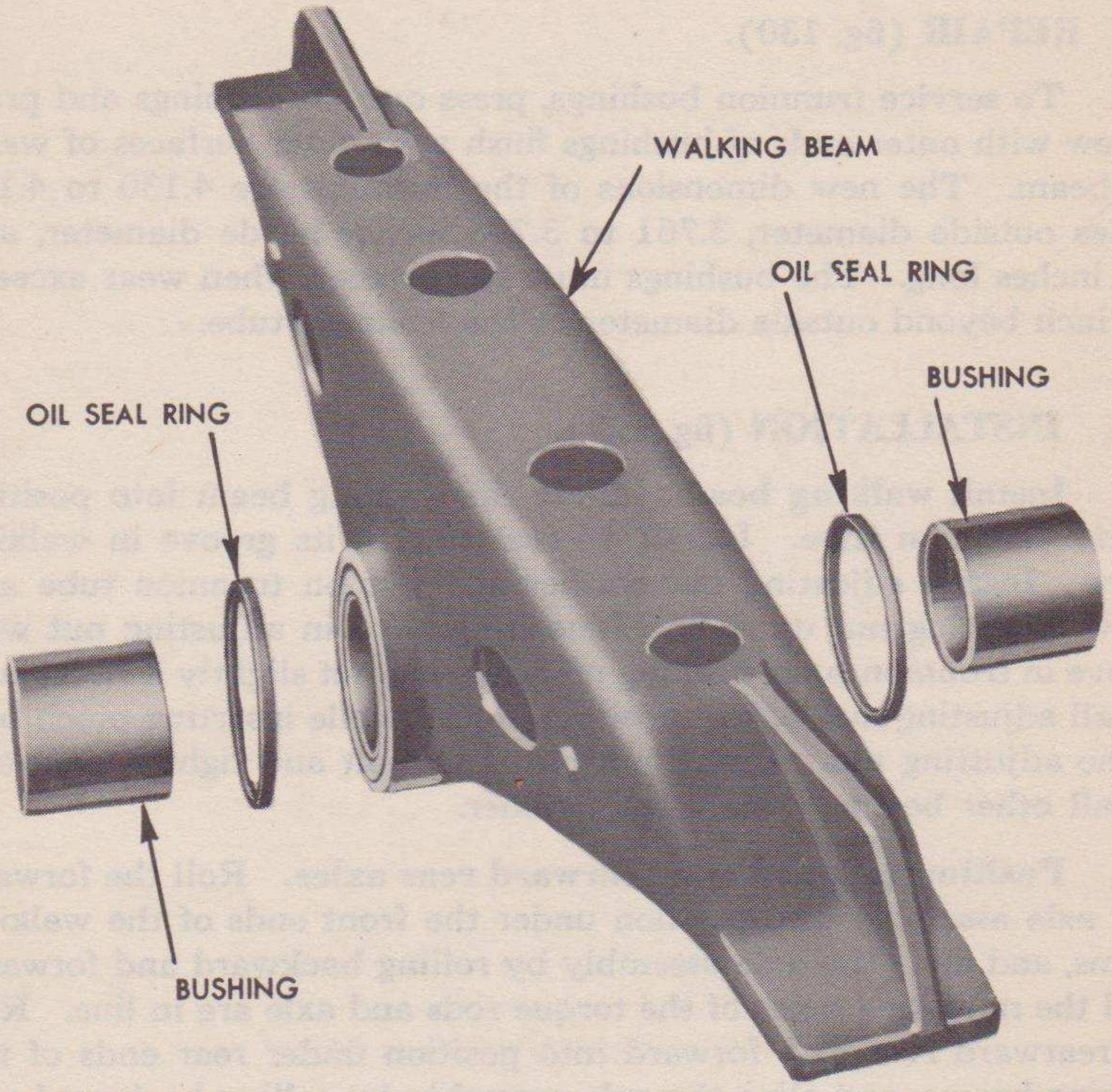


Figure 130 — Walking Beam — Disassembled

rear axles. Pry one end of each upper torque rod loose from the axles. Roll the forward rear axle assembly ahead enough to clear the front ends of the walking beams. Roll the rearward rear axle assembly back until it clears the rear ends of the walking beams.

d. Remove walking beam from trunnion tube. Remove the nut from the adjusting nut pinch bolt and pull out the pinch bolt. Back adjusting nut off the trunnion tube and remove the adjusting nut washer. Remove the oil seal from its groove in the walking beam and discard the seal. With chain and hoist attached to walking beam, slide walking beam off the trunnion tube.

98. INSPECTION.

a. Inspect walking beam oil seal rings at each end of the trunnion bore of beam, to make sure the seal protrudes slightly beyond machined ends of bore. If there is any evidence of oil leaking at ends of trunnion bore, either the oil seals are defective or the adjusting nut is not properly adjusted. Replace oil seal and adjust nut if necessary.

99. REPAIR (fig. 130).

a. To service trunnion bushings, press out old bushings and press in new with outer ends of bushings flush with outer surfaces of walking beam. The new dimensions of the bushings are 4.130 to 4.132 inches outside diameter, 3.761 to 3.763 inches inside diameter, and 3⅞ inches long. The bushings must be replaced when wear exceeds 3/32 inch beyond outside diameter of the trunnion tube.

100. INSTALLATION (fig. 129).

a. Install walking beam. Slide the walking beam into position on the trunnion tube. Install oil seal ring in its groove in walking beam. Install adjusting nut washer and nut on trunnion tube and screw adjusting nut up tight. Line up groove in adjusting nut with groove in trunnion tube, backing off adjusting nut slightly if necessary. Install adjusting nut lock in position in slot, while inserting pinch bolt in the adjusting nut. Install nut on pinch bolt and tighten securely. Install other beam in the same manner.

b. Position forward and rearward rear axles. Roll the forward rear axle assembly into position under the front ends of the walking beams, and aline the axle assembly by rolling backward and forward, until the mounting holes of the torque rods and axle are in line. Roll the rearward rear axle forward into position under rear ends of the walking beams, and aline the axle assembly by rolling backward and forward, until the mounting holes of the lower torque rods and axle are in line.

c. Attach axles to torque rods. Attach lower torque rods to axle by driving torque rod pins into position. Install lock washers and slotted nuts on torque rod pins, tighten nuts and secure with cotter pins. Slide the upper torque rods into position on the torque rod end pins on the axle. Install lock washers and nuts on the end pins and tighten securely. Detach hoist from rear of chassis.

d. Attach torque rod lengths to make axles level. With the truck on level ground adjust the upper torque rod length by turning rod tubes with a pipe wrench. The ends of the rods have right and left-hand thread. Turn the rods one way or the other as necessary, to shorten or lengthen each rod to hold the axles in a level position. Level position will be indicated by placing a level on the attaching screws of each of the axle differential carrier top covers. After correct position of axles is established, tighten upper torque rod end clamp bolts and nuts.

e. Install propeller shafts. Install propeller shafts and connect air lines to axles (TM 9-813).

CHAPTER 11

STEERING GEAR

Section I

DESCRIPTION AND DATA

101. DESCRIPTION AND DATA.

a. Description (fig. 131).

(1) The steering gear is a cam and twin-lever type. Both studs of the twin-lever gear engage the cam for normal straight-ahead driving. As the steering action moves away from the normal driving position into the parking range, one of the studs is disengaged from the cam. The effective leverage of the single stud increases so rapidly that, in full parking, the leverage is greater than with a single-lever type steering gear. Actually, the driver has at his disposal a dual-ratio gear which automatically changes from one ratio to another, to suit the requirements of steering stability at high speeds and easy wheel turn, for sharp turns in parking.

(2) The cam is a worm of variable ratio, with the thread ground slightly higher where the straight-ahead driving action usually takes place. This is to provide closer adjustment of the clearance between the studs and the cam at that point of the steering action. The cam is supported in a cast housing by two sets of ball bearings

(3) The lever shaft is mounted in two bronze bushings. An oil seal is provided on the shaft on the outer end.

(4) An antifriction bearing is used in the upper end of the jacket tube to support the upper end of the wheel tube.

(5) Turning the steering tube by means of the steering wheel rolls the tapered studs of the lever shaft through the groove of the cam, thus rotating the lever shaft and providing angular movement of the steering arm. The drag link, which is fastened to the ball end of the steering arm then carries the action to the knuckle arm and tie rod of the front axle.

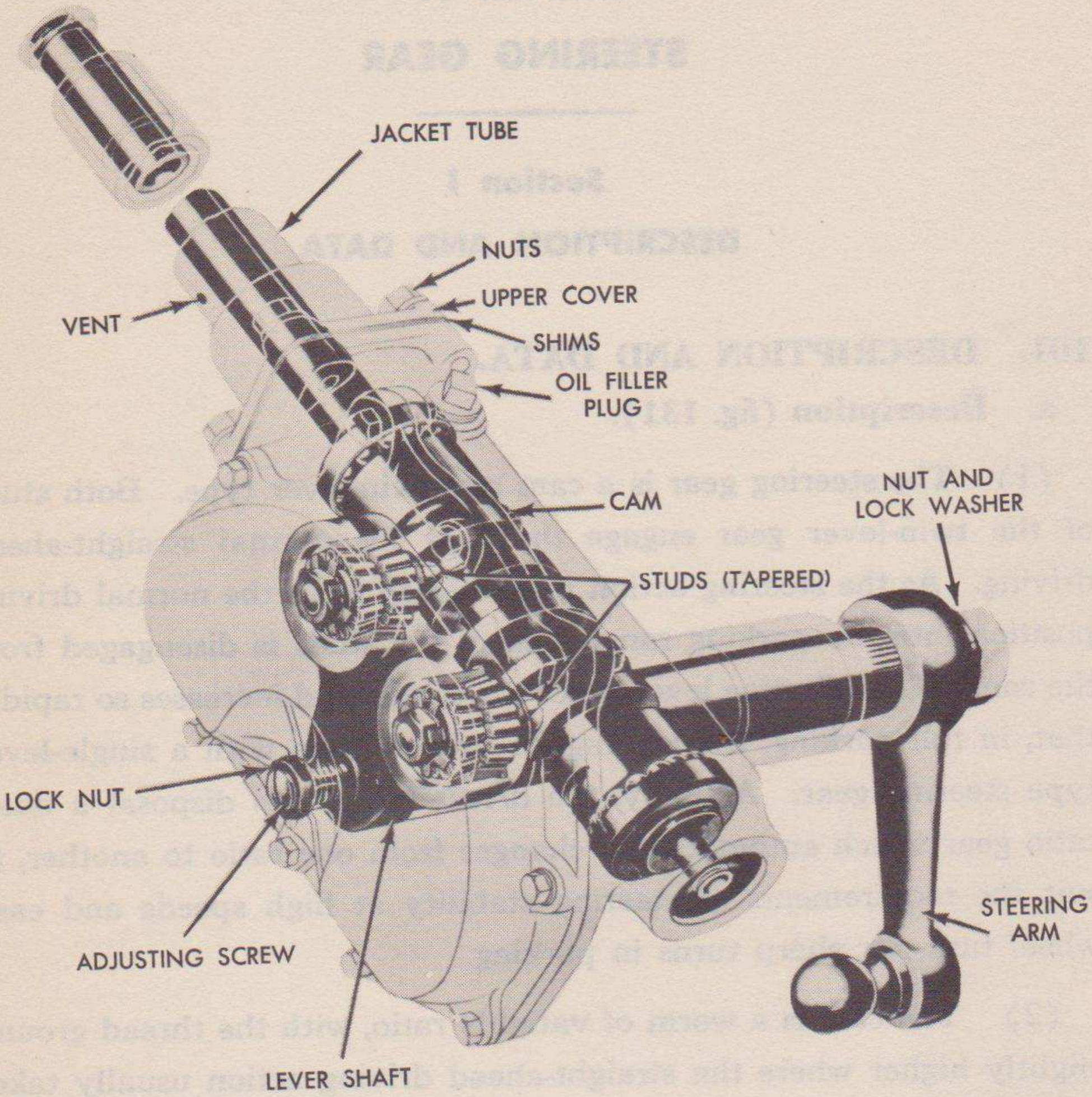


Figure 131 — Steering Gear Assembly — Phantom View

b. Data.

Make	Ross
Model	T-74
Type	Roller mounted twin lever
Gear ratio—straight-ahead driving	23 to 1
Gear ratio—parking	27 to 1
Lever shaft OD	1¾ in.
Housing extension (trunnion) OD	2¾ in.
Outer or jacket tube OD	2¼ in.
Wheel tube OD	1⅛ in.
Center to center of cam and lever shaft	4¼ in.
Steering wheel diameter	22 in.
Maximum travel of steering arm	100 deg
Steering arm ball diameter	1.728 - 1.723 in.

Section II

DISASSEMBLY INTO SUBASSEMBLIES

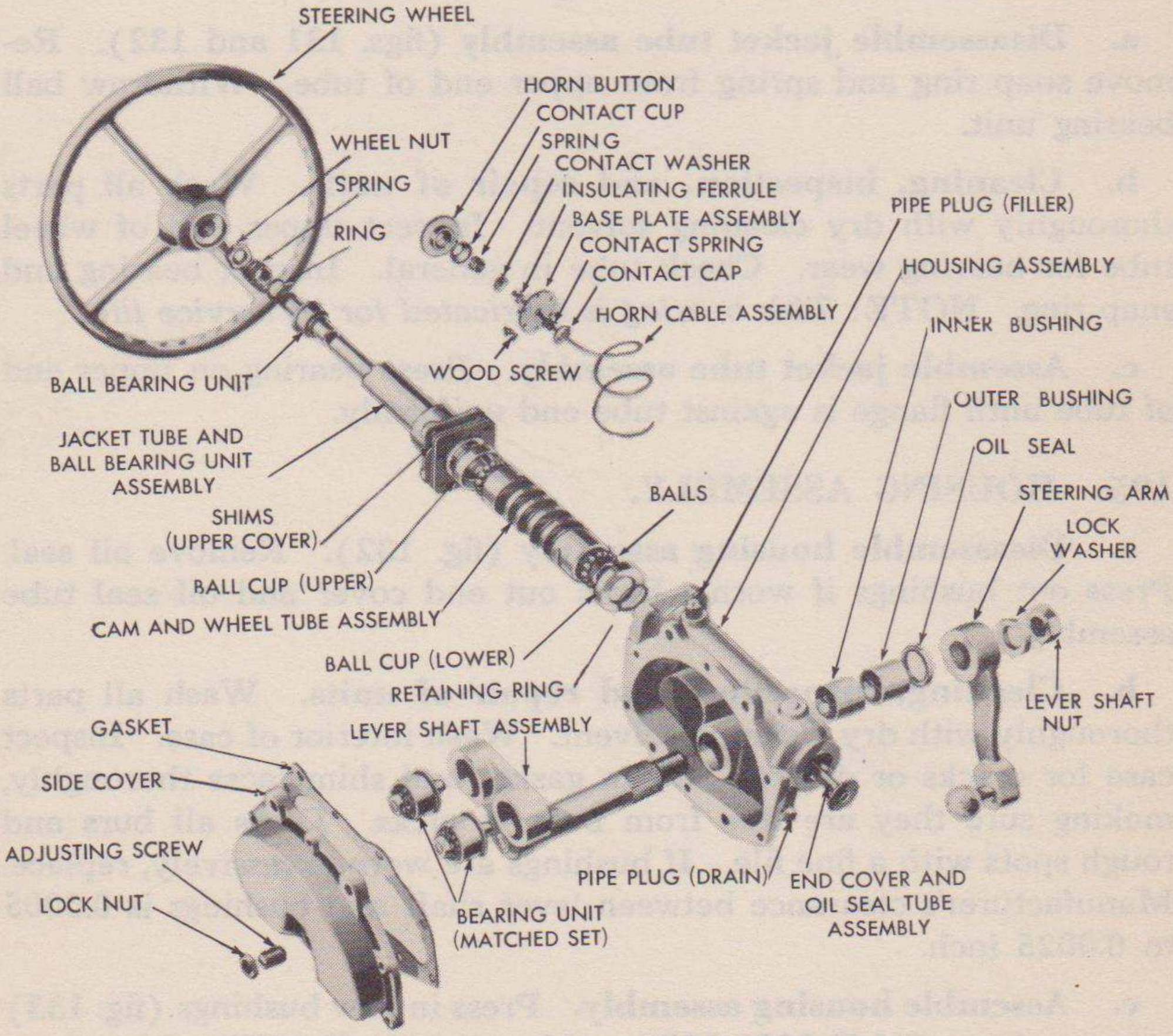
102. PRELIMINARY INSTRUCTIONS.

a. Remove steering gear. Refer to TM 9-813 for instructions for removing steering gear.

b. Cleaning. Remove all foreign material from the steering gear with a brush and a putty knife. Place the steering gear case end of the assembly in a container of dry cleaning solvent and wash thoroughly. Wipe dry with clean cloths. Keep all dirt or foreign matter from the case. Clean and wrap all parts in clean paper or cloth as disassembly proceeds.

103. DISASSEMBLY OF STEERING GEAR.

a. Remove steering gear arm (figs. 131 and 132). Remove nut and lock washer. Mark shaft and arm so that arm will be assembled in proper relation. Remove steering gear arm.



RA PD 353091

Figure 132 — Steering Gear Assembly — Disassembled

b. Remove lever shaft and bearing units. Remove filler and drain plugs, and drain lubricant. Loosen side cover adjusting screw lock nut, and release adjusting screw a few turns. Remove side cover-to-case cap screws and lock washers. Lift off side cover and gasket. Remove lever shaft assembly. Remove bearing units.

c. Remove cam and wheel tube assembly. Remove upper cover retaining stud nuts and lock washers. Remove upper cover and shims (tag shims to insure proper adjustment at assembly). Withdraw cam and wheel tube assembly. Remove thrust bearing retaining rings, exercising care to catch balls upon removal.

Section III

DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

104 JACKET TUBE ASSEMBLY.

a. Disassemble jacket tube assembly (figs. 131 and 132). Remove snap ring and spring from upper end of tube. Withdraw ball bearing unit.

b. Cleaning, inspection, and repair of units. Wash all parts thoroughly with dry cleaning solvent. Inspect upper end of wheel tube for bearing wear. Check tube in general. Inspect bearing and snap ring. NOTE: *This bearing is lubricated for its service life.*

c. Assemble jacket tube assembly. Press bearing on upper end of tube until flange is against tube end uniformly.

105. HOUSING ASSEMBLY.

a. Disassemble housing assembly (fig. 132). Remove oil seal. Press out bushings if worn. Press out end cover and oil seal tube assembly.

b. Cleaning, inspection, and repair of units. Wash all parts thoroughly with dry cleaning solvent. Wash interior of case. Inspect case for cracks or defects. Clean gasket and shim faces thoroughly, making sure they are free from burs or nicks. Dress all burs and rough spots with a fine file. If bushings are worn excessively, replace. Manufacturer's clearance between lever shaft and bushings is 0.0005 to 0.0025 inch.

c. Assemble housing assembly. Press in new bushings (fig. 133) using replacer (41-R-2377-275) and handle (41-H-1397). Line ream in place with a clearance of 0.0005 inch between lever shaft and bushing.

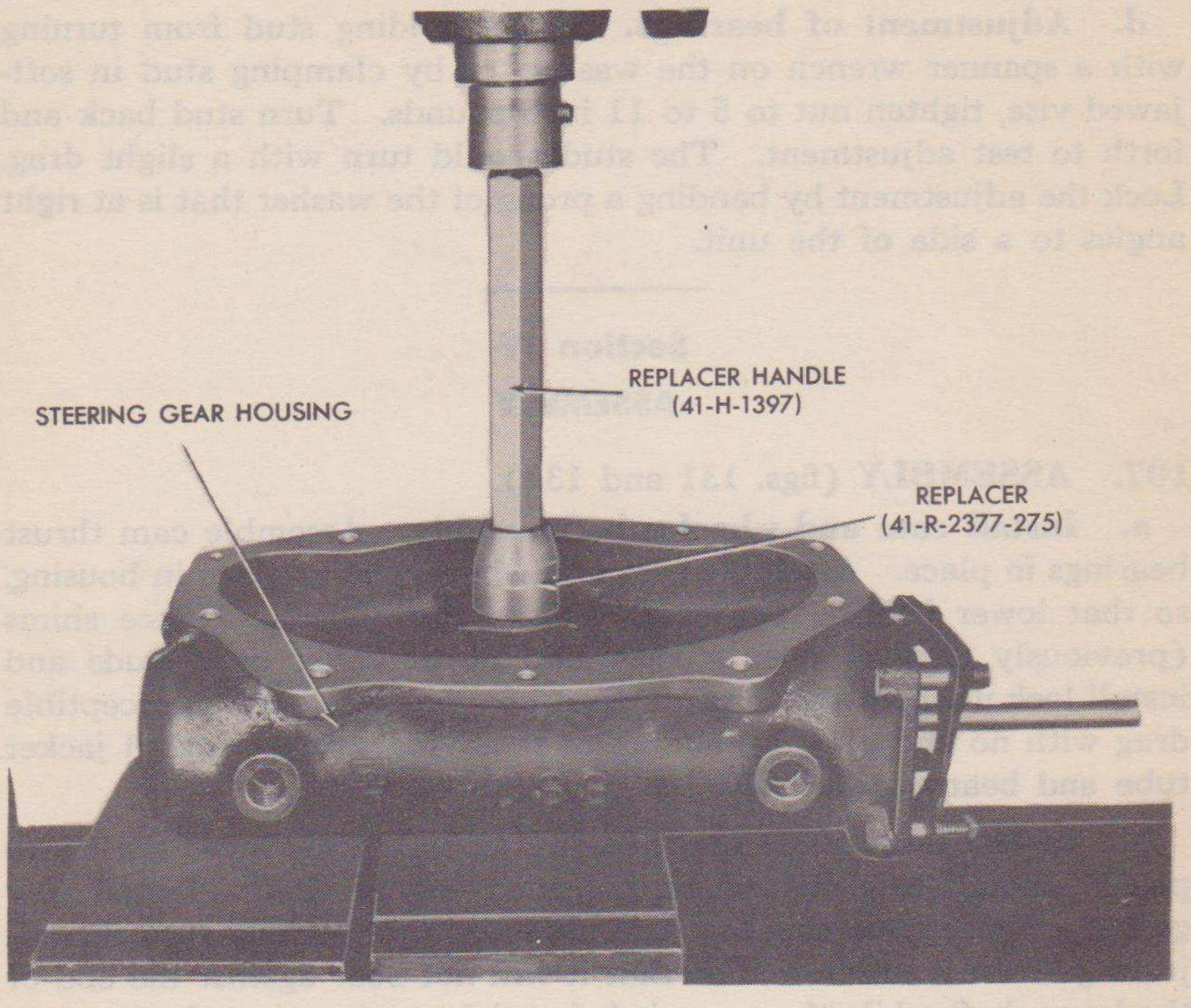


Figure 133 — Replacing Bushing in Steering Gear Housing

106. LEVER SHAFT AND BEARING UNIT.

a. Disassembly of lever shaft and bearing unit (fig. 132). NOTE: *Only the nut and washer are separately replaceable. If any of the other parts need replacing, a complete unit must be installed, preferably both units in a matched set.* To disassemble, press out bearing units, straighten out prong on lock washer, remove nut, and drive out stud. Remove rollers.

b. Cleaning, inspection, and repair of unit. Wash all parts thoroughly with dry cleaning solvent. Inspect rollers for galling, out-of-round, or rough spots. Dress all burs and rough spots with a fine file. Inspect lever shaft at bearing points for wear. Check the serrations at the end for twisted condition or wear from a loose steering arm. Inspect threads for stripping.

c. Assembly of lever shaft and bearing unit. Coat rollers and cone with light grease. Put rollers in place on cone on taper end of stud. Slip cup over assembly. Insert opposite set of rollers. Install lock washer and nut. Press bearing assembly into lever shaft.

d. Adjustment of bearings. While holding stud from turning with a spanner wrench on the washer, or by clamping stud in soft-jawed vise, tighten nut to 5 to 11 inch-pounds. Turn stud back and forth to test adjustment. The stud should turn with a slight drag. Lock the adjustment by bending a prong of the washer that is at right angles to a side of the unit.

Section IV
ASSEMBLY

107. ASSEMBLY (figs. 131 and 132).

a. Install cam and wheel tube assembly. Assemble cam thrust bearings in place. Assemble cam and wheel tube in place in housing, so that lower bearing cup seats well in the housing. Place shims (previously tagged) over studs. Slip upper cover over studs and install lock washers and nuts. Adjust bearings to a barely perceptible drag with no end play, by adding or removing shims. Install jacket tube and bearing assembly.

b. Install lever shaft and bearing units. Slide lever shaft into place. Install new oil seal on threaded end of shaft. Install new gasket, cover cap screws, and lock washers, first making sure the adjusting screw is unscrewed so that it will not bear against the end of the lever shaft while the cover is being tightened against the housing.

c. Install steering wheel. Install jacket tube spring and ring. Install steering wheel and nut. Tighten nut securely. Install horn cable and base plate assembly. Insert and tighten three wood screws. Install spring, contact washer, and contact plate. Twist horn button in place.

d. Install gear steering arm. Slip gear steering arm over serrated end of shaft, making sure arm serrations mesh as when previously assembled (this position was marked at disassembly). Install and tighten lock washer and nut. Install drain plug and fill housing with proper grade and quantity of lubricant (see lubrication order). Install filler plug.

Section V
ADJUSTMENTS

108. ADJUSTMENTS.

a. General. There are two adjustments, the adjustment of the ball thrust bearings on the cam, and the adjustment of the tapered studs in the cam groove for backlash. The cam in this steering gear is mounted between two ball bearings which are adjustable by means

of shims between the housing and upper cover plate. Backlash of the studs of the lever shaft in the cam groove is adjusted by means of a screw and lock nut on the inside cover. The cams are ground slightly higher in the mid-position range to provide close adjustment where the usual straight-ahead driving action takes place. The adjustments must be made in the order named. When making adjustments, free the steering gear of all load, preferably by disconnecting the steering gear drag link from the steering gear arm, and loosening the instrument panel dash backet clamp on the steering column.

b. Adjustments of ball thrust bearings on cam.

(1) Loosen the housing side cover adjusting screw lock nut, accessible through a hole in the frame side rail, working from inside. Loosen the adjusting screw.

(2) Unscrew the four cap screws from the upper cover of the steering gear. Remove, from the upper cover, the clamp bolt clamping the steering column tube. This will permit raising the cover for the removal of shims as necessary.

(3) To decrease bearing clearance, remove a 0.002-inch shim. NOTE: *Shims are 0.002, 0.003, and 0.010 inch thick.* Clip shim for removal.

(4) Reassemble cover, and tighten four cap screws. NOTE: *The cover should always be drawn down tightly against the shims to provide a tight assembly. Be careful, however, in the event that too much shim thickness has been removed, not to draw so tight as to break the ball races.*

(5) Adjust in the above manner through the addition or removal of shims until there is a barely perceptible drag, but the steering wheel turns freely, with the thumb and forefinger lightly gripping the wheel rim.

(6) When adjustment of ball thrust bearings is completed, install steering column upper cover clamp bolt, nut, and lock washer.

c. Adjust for minimum backlash of tapered studs in cam groove.

(1) Backlash of the studs in the cam groove appears as end play of the lever shaft, and backlash at the steering wheel and at the ball on the steering gear arm. Proper adjustment requires that a very slight drag be felt through the mid-position when turning the steering wheel slowly from one extreme position to the other.

(2) Count the number of revolutions of the steering wheel while turning from one extreme to the other. One-half this number denotes the mid-position (or straight-ahead position) of the gear. Always

make adjustment in this mid-position. Do not adjust in positions off mid-position, as backlash at these positions is normal and not objectionable.

(3) Tighten side cover adjusting screw until the adjustment is correct. A very slight drag should be felt through the mid-position when turning the steering wheel slowly from one extreme to the other. Tighten lock nut to hold this adjustment, and recheck.

(4) Tighten steering column clamp bolt at instrument panel.

(5) Place front wheels in straight-ahead position. With steering gear in mid-position, raise end of drag link and note whether ball of steering arm will connect at the drag link, without excess movement to one side or the other. If not, remove nut and lock washer from steering gear lever shaft, remove the steering arm with a puller, and reset arm on the lever shaft splines. Install and tighten lock washer and lock nut.

(6) Connect steering arm and drag link, and install drag link plug. Tighten plug until snug, then back off just enough to permit inserting cotter pin. Install dust seal and seal shield on drag link.

d. Drag link adjustment. Remove cotter pin at each end of drag link. Tighten each drag link end plug until snug, then back off adjustment about one-sixth turn or enough to permit inserting new cotter pins. It should be possible to move drag link on steering arm balls using full hand pressure.

CHAPTER 12

WINCH (CENTER MOUNTED)

Section I

DESCRIPTION AND DATA

109. DESCRIPTION AND OPERATION.

a. Description (figs. 134, 135, and 136). The winch is mounted at the rear of the cab on the frame side rails of prime mover only. It consists of a worm and gear operating within a cast malleable iron housing, a cat-head keyed to the main shaft, a cable drum mounted on the main shaft, a jaw clutch with shifting mechanism (controlled from the cab), and a drag brake to prevent drum from spinning when pulling cable off by hand. An inclosed automatic worm brake is mounted on the forward end of the worm shaft. This unit prevents the load from turning the winch backward. A cable roller is mounted on the frame side rails just behind the winch.

b. Operation (fig. 137).

(1) POWER. Power for operating winch is obtained from the engine and is transmitted from the transfer case through a power take-off unit and a roller chain and sprockets to the winch.

(2) LEVERS AND OPERATION. A lever for engaging and disengaging the winch power take-off is located in the cab at the extreme right of the driver. A lever for engaging and disengaging the winch clutch is located to the left of the power take-off lever. When the winch clutch is disengaged, the drum is free to turn on the shaft, being retarded only by the drag brake. The worm and gear must be operated by power both forward and in reverse.

(3) The cat-head extends to the right of the cab, and the winch drum and cable are located at the rear center of the cab. The cable operates on sheaves on the underside of the body, and is pulled out from the roller under the tool box at the rear of the vehicle.

A — TRANSVERSE SECTION

RA PD 353092

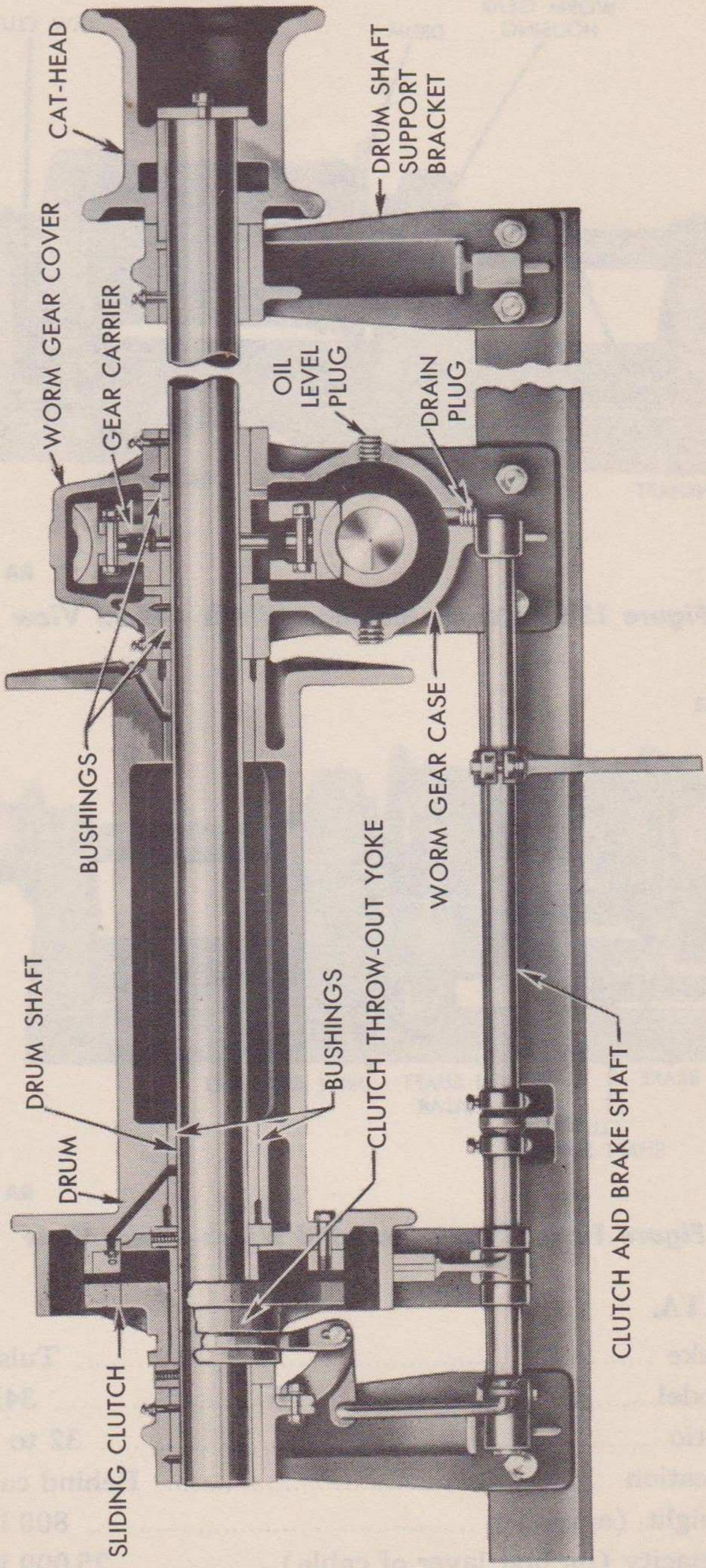
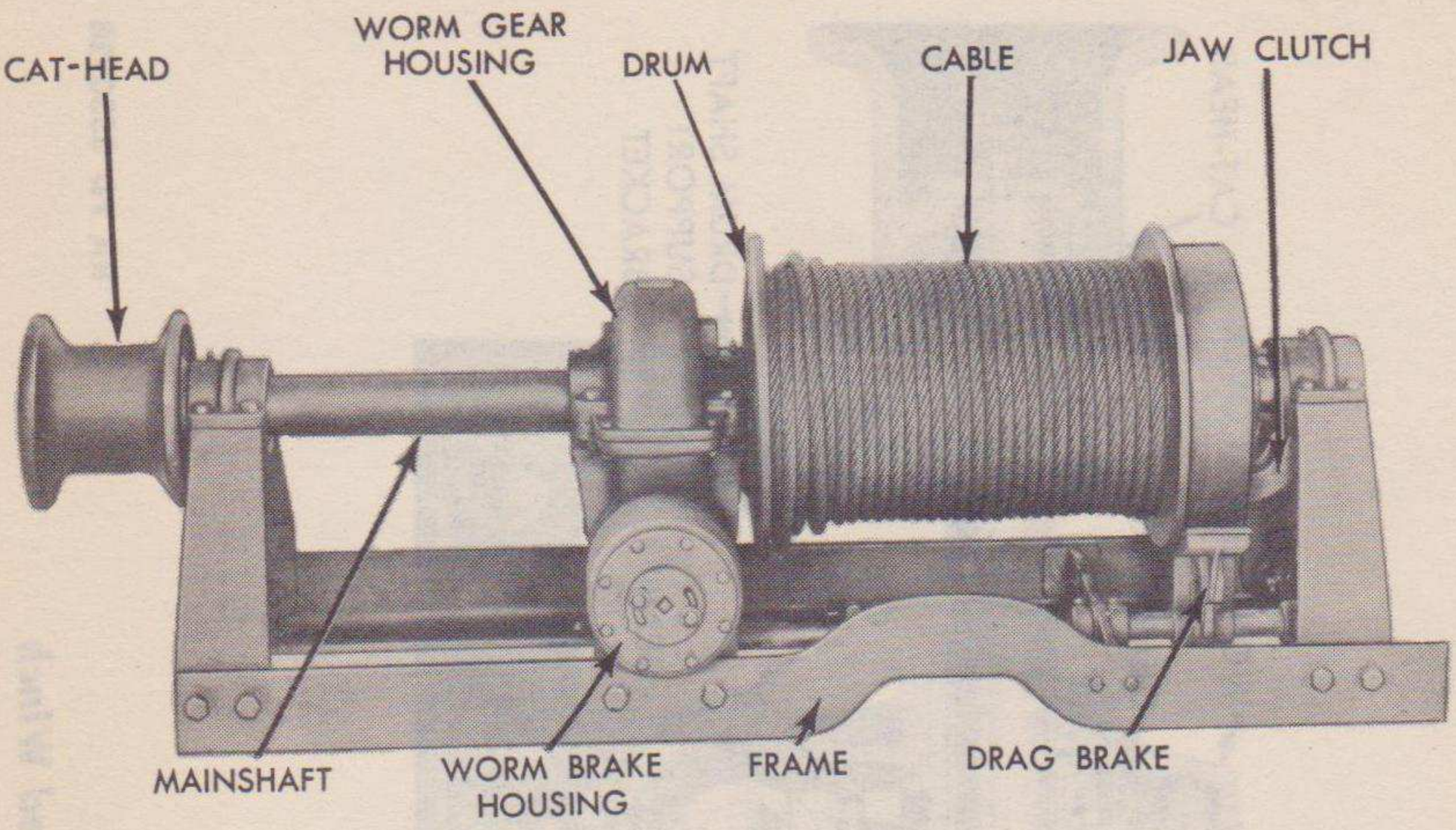
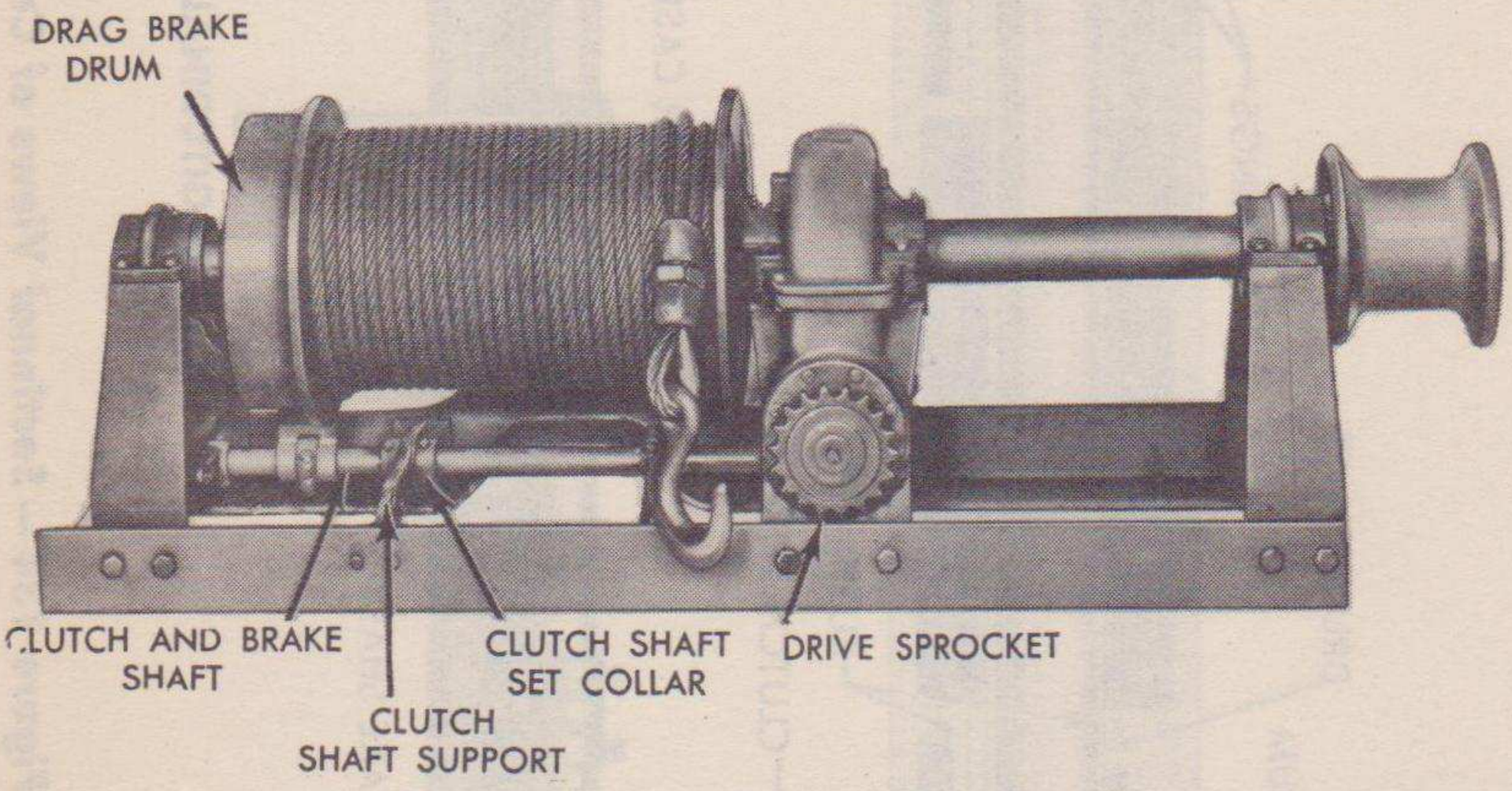


Figure 134 — Sectional Views of Center Mounted Winch



RA PD 353094

Figure 135 — Center Mounted Winch — Front View



RA PD 334521

Figure 136 — Center Mounted Winch — Rear View

110. DATA.

Make	Tulsa
Model	34L
Ratio	32 to 1
Location	Behind cab
Weight (approx.)	800 lb
Capacity (on first layer of cable)	25,000 lb

Drive	Power take-off on transfer case, roller chain and sprockets
Chain adjustment	Shims on frame side rail
No. of teeth on driven sprocket	18
No. of teeth on drive sprocket	17
No. of links in chain	57
Chain pitch	1 in.

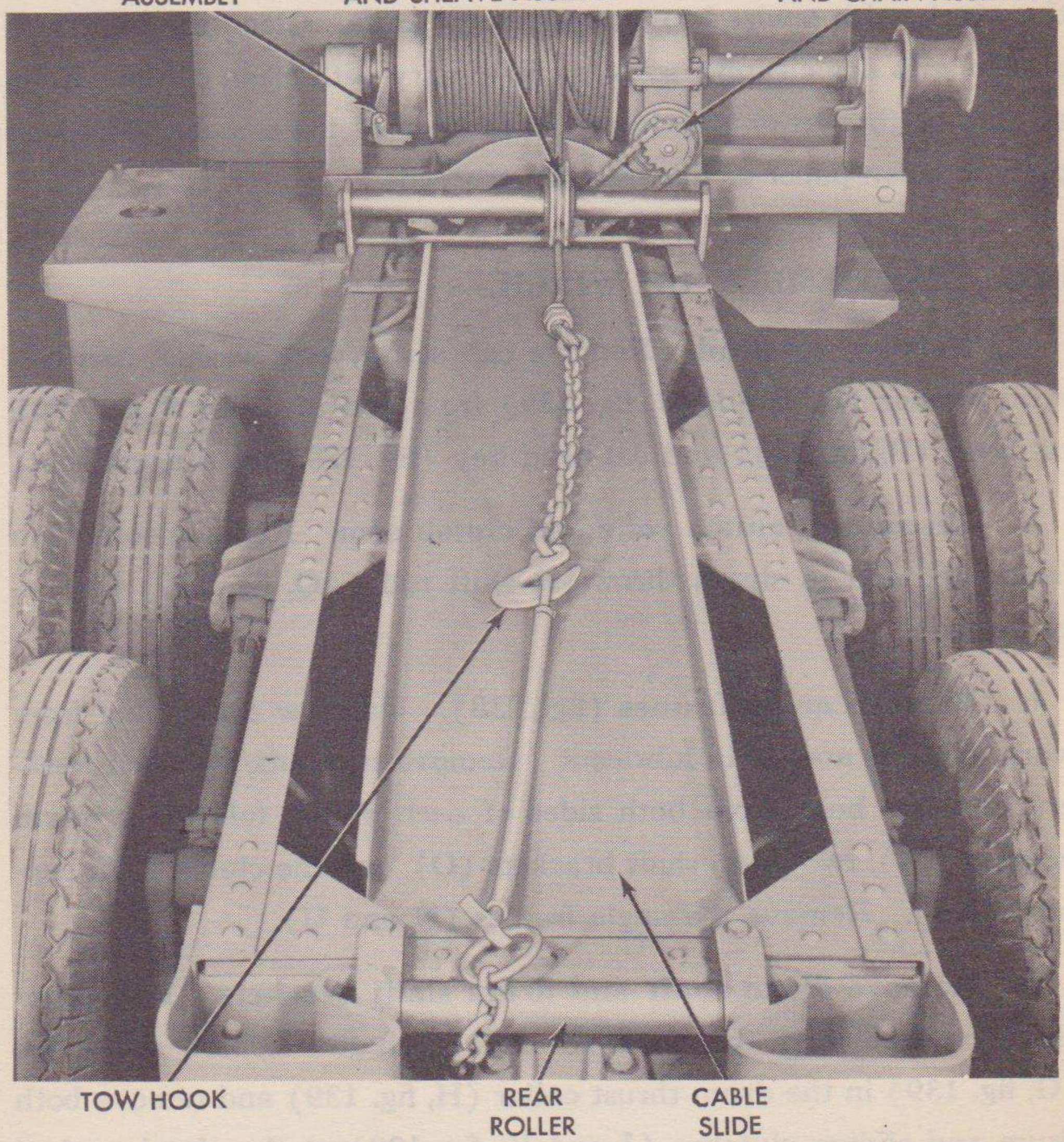


Figure 137 — Center Mounted Winch — Mounted on Chassis

Section II

DISASSEMBLY INTO SUBASSEMBLIES

111. PRELIMINARY INSTRUCTIONS.

a. Remove winch and winch drive. Refer to TM 9-813 for instructions on removing winch and winch drive.

b. Cleaning. Remove all foreign material from the exterior of the winch, with a wire brush and a putty knife. Clean the unit thoroughly with dry cleaning solvent. Wipe dry with clean cloths. Keep all dirt or foreign matter from the interior of the winch. Wrap all parts in clean paper as disassembly proceeds.

112. DISASSEMBLY OF WINCH.

a. Remove cat-head. Remove cap screw, lock washer, and cat-head washer (S, T, and U, fig. 139) from end of drum shaft. Pull cat-head (P, fig. 138) and cat-head key (fig. 139) from drum shaft.

b. Disconnect clutch yoke and clutch arm. Remove cotter pin from each end of clutch throw-out shift rod (AQ, fig. 139) and remove rod.

c. Remove angle frames (fig. 138). Unscrew drain plug from worm housing and drain lubricant. Remove two nuts, two lock washers, and two bolts from both sides of each of the following: worm housing (M), two drum shaft brackets (O), and the clutch shaft support (AA). Remove the angle frames (N and U).

d. Remove drum shaft and drum shaft brackets. Pull drum shaft bracket from the cat-head end of shaft. Loosen set screw (G, fig. 139) in the drum thrust collar (H, fig. 139) and remove both drum and sliding clutches (J and K, fig. 139) at the clutch end of the shaft. Remove two cotter pins (F, fig. 139) and yoke pin (AR, fig. 139) from clutch throw-out bracket (AS, fig. 139) and clutch

throw-out yoke. Remove clutch throw-out yoke (I, fig. 139). Remove three nuts, lock washers, and bolts from drum shaft bracket and clutch throw-out yoke bracket. Remove clutch throw-out yoke bracket. Loosen the set screw in the drum thrust collar (H, fig. 139). Pull drum from shaft. Remove six cap screws, and separate drum clutch from drum. Remove four bolts and lock washers from each drum shaft bracket cap (B, fig. 138), and lift off cap. Remove eight nuts, lock washers, and bolts from worm housing (M, fig. 138) and cover. Lift off cover and gaskets. Lift shaft and worm gear (M and Q, fig. 139) out of case.

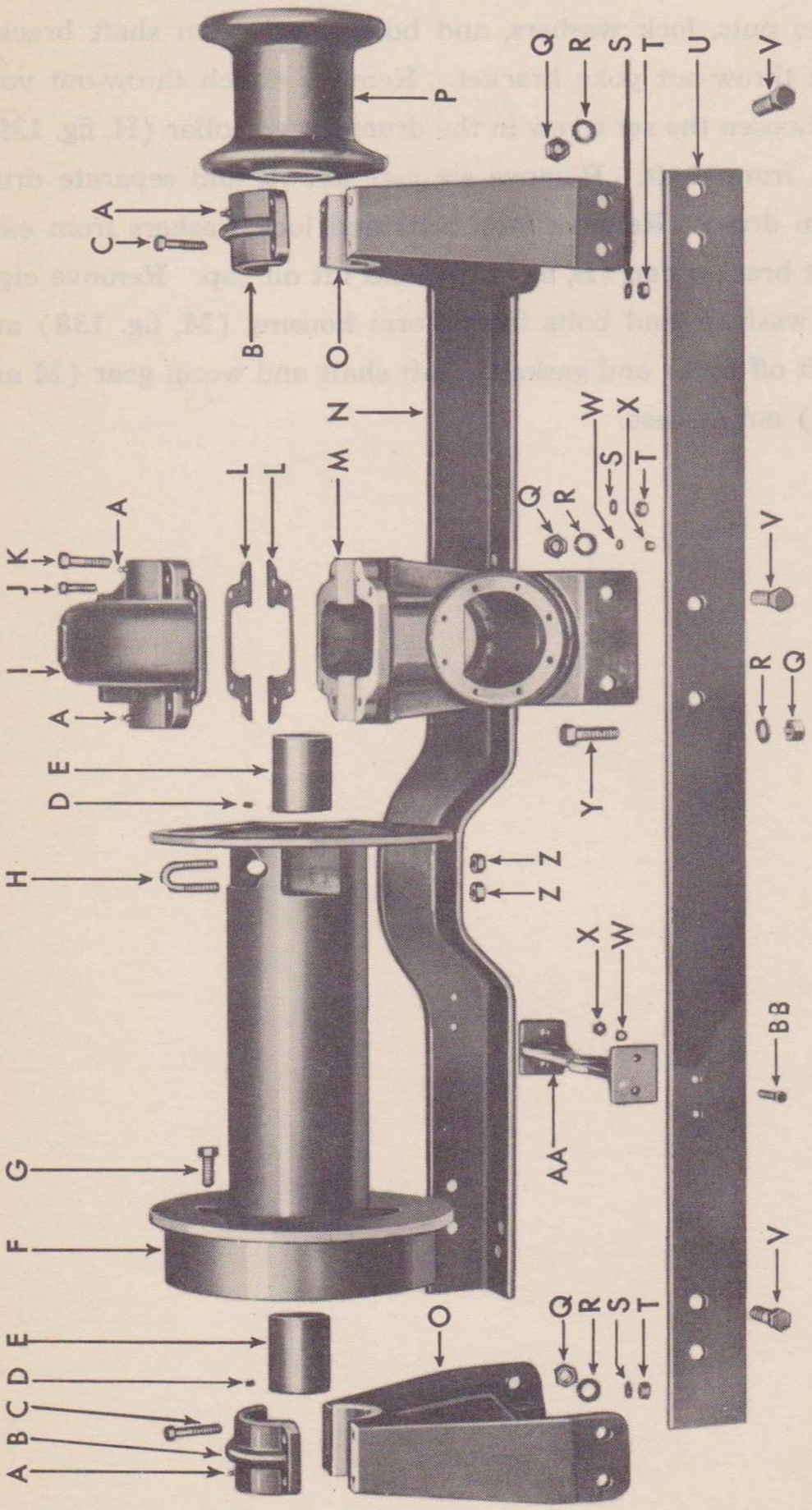


Figure 138 — Winch — Drum and Worm Housing — Disassembled

A—LUBRICATION FITTING
B—DRUM SHAFT BRACKET CAP
C—BOLT
D—DRUM BEARING PIN
E—WINCH DRUM BEARING
F—DRUM
G—CAP SCREW
H—U-BOLT
I—WORM HOUSING COVER
J—WORM HOUSING COVER CAP SCREW
K—DRUM THRUST COLLAR SET SCREW
L—WORM COVER GASKET
M—WINCH WORM HOUSING
N—KICK UP ANGLE FRAME
O—DRUM SHAFT BRACKET
P—WINCH CAT-HEAD
Q—NUT
R—WASHER
S—WASHER
T—NUT
U—ANGLE FRAME
V—CAP SCREW
W—WASHER
X—NUT
Y—BOLT
Z—NUT
AA—CLUTCH SHAFT SUPPORT
BB—SCREW

RA PD 334537C

Legend for Figure 138

Section III

DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

113. WORM GEAR AND SHAFT.

a. Disassembly of winch worm gear and shaft (fig. 139). Remove worm gear housing bearing (N), from shaft over cat-head end. Remove 10 nuts, lock washers, and bolts (O, P, and R), from worm gear and remove gear carrier over cat-head end of shaft. Remove worm gear (Q). Remove locating dowel from gear carrier locking ring and turn ring on shaft until keyways in the locking ring line up with the keys on the shaft. Remove ring. Remove other worm gear carrier. Remove ring carrier keys from shaft. Remove other worm gear housing bearing.

b. Cleaning, inspection, and repair. Wash all parts in dry cleaning solvent and dry thoroughly. Check bearings and shaft carefully for nicks, wear, or out-of-round condition. Check for loose keys in keyways. Remove all nicks or burs with a fine file. Clean and oil all parts before assembly.

c. Assembly of winch worm gear and shaft (fig. 139). The worm gear is located at the shorter keyways in the shaft. Slip a worm gear housing bearing (N), over the cat-head end of the shaft to a position just across the keyways, with the flanged end of the bearing toward the cat-head end of the shaft. Place the keys in the keyways with the slots to the outside. Press a worm gear carrier over the keys just across the slot in the keys with the ribbed side of the carrier facing the flange of the worm gear housing bearing. Place the locking ring on the shaft and over the slot in keys. Turn ring and insert dowel pin through ring and into worm gear carrier hub. Place worm gear on worm gear carrier. Press the second carrier over the keys with ribbed side of the carrier to the outside. Assemble worm gear carrier to worm gear with 10 bolts, lock washers, and nuts (R, P, and O). Place the other worm gear housing bearing (N), over the shaft with the flange of the bearing against the worm gear carrier.

114. BRAKE AND WORM HOUSING ASSEMBLY.

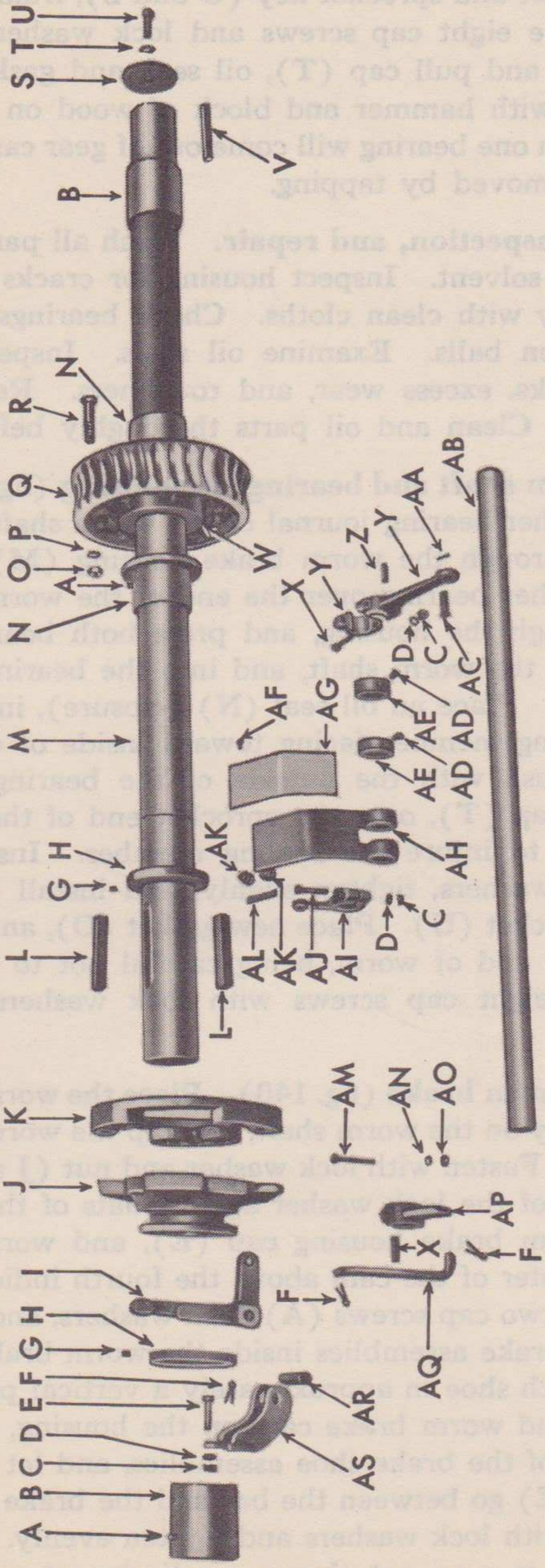
a. Disassembly of worm brake and brake drum (fig. 140). Remove eight cap screws and lock washers (AA and Z), from worm brake housing cap (E). Remove cap and worm brake cam (D). Lift out the worm brake assemblies (F), from worm brake drum (K). Straighten lug on lock washer (J), and remove nut (I), from end of worm. Remove drum with puller. Remove key (Q), from worm shaft (R). Remove brake lining (G), if unserviceable and install new lining.

b. Disassemble worm and worm shaft bearings (fig. 140). Remove drive sprocket and sprocket key (U and S), from sprocket end of worm. Remove eight cap screws and lock washers from worm housing front cap and pull cap (T), oil seal, and gasket (O), from worm end. Tap with hammer and block of wood on either end of worm. Worm with one bearing will come out of gear case. The other bearing can be removed by tapping.

c. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent. Inspect housing for cracks or distortion. Wipe all parts dry with clean cloths. Check bearings carefully for damaged or broken balls. Examine oil seals. Inspect worm and sprockets for cracks, excess wear, and roughness. Replace all unserviceable parts. Clean and oil parts thoroughly before assembly.

d. Install worm shaft and bearings in housing (fig. 140). Press one bearing on either bearing journal of the worm shaft (R). Place the worm shaft through the worm brake housing (M), from either end. Place the other bearing over the end of the worm shaft which is extending through the housing, and press both bearings in place on the journals of the worm shaft, and into the bearing housings of the worm housing. Place an oil seal (N) (closure), in each bearing cap with the sealing member facing toward inside of cap, and with the grease seal flush with the outside of the bearing cap. Place gasket (O), and cap (T), over the sprocket end of the worm shaft, being careful not to injure the sealing member. Insert eight cap screws with lock washers, tighten evenly, and install key (S), and press on drive sprocket (U). Place new gasket (O), and worm brake housing (M) over end of worm, being careful not to injure sealing member. Insert eight cap screws with lock washers and tighten evenly.

e. Assemble worm brake (fig. 140). Place the worm brake drum key (Q), in keyway on the worm shaft, and tap the worm brake drum (K), over the key. Fasten with lock washer and nut (J and I). Bend two opposite lugs of the lock washer against flats of the nut to lock. Assemble the worm brake housing cap (E), and worm brake cam (D), with the pointer of the cam above the fourth indicator notch of the cover. Insert two cap screws (A), lock washers, and flat washers. Insert two worm brake assemblies inside the worm brake drum (K), with the bar of each shoe in approximately a vertical position. Place the housing cap and worm brake cam on the housing, with the cam between the bars of the brake shoe assemblies, and let the fingers of the housing cap (E) go between the bar and the brake shoe. Install eight cap screws with lock washers and tighten evenly. If the worm brake lining (G) is new, set the cam adjustment pointer on the fourth notch and hold in position by tightening the two cap screws.



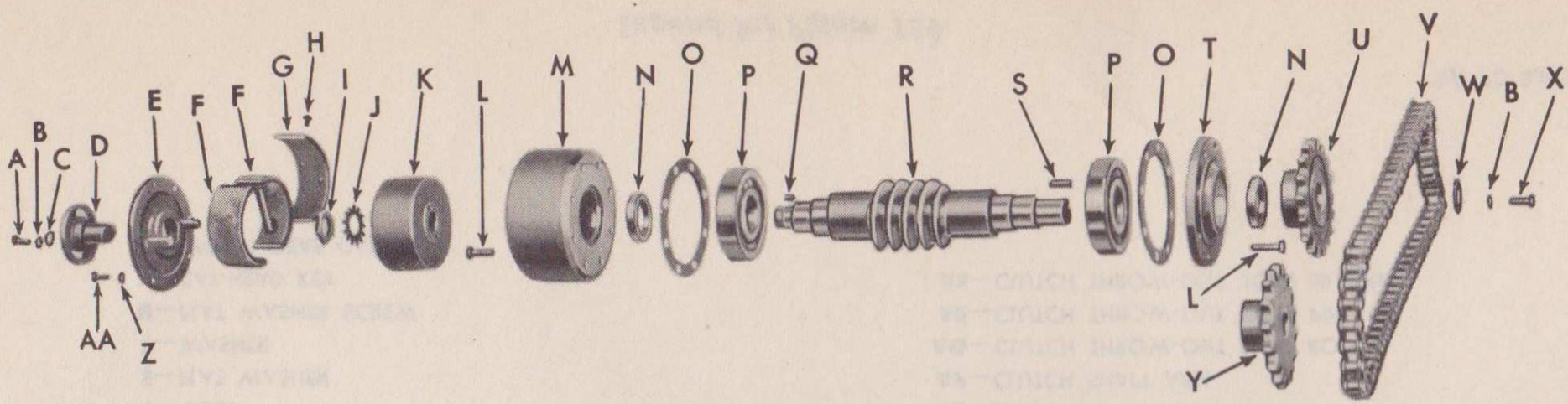
RA PD 334536

Figure 139 — Winch — Worm Gear and Shaft — Disassembled

A—DRUM BEARING PIN
B—DRUM SHAFT BRACKET BEARING
C—NUT
D—WASHER
E—THROW-OUT YOKE CAP SCREW
F—COTTER PIN
G—DRUM THRUST COLLAR SET SCREW
H—DRUM THRUST COLLAR
I—SLIDING CLUTCH THROW-OUT YOKE
J—DRUM SLIDING CLUTCH
K—DRUM CLUTCH
L—WINCH CLUTCH KEY
M—WINCH DRUM SHAFT
N—WORM GEAR HOUSING BEARING
O—NUT
P—WASHER
Q—WINCH WORM GEAR
R—BOLT
S—FLAT WASHER
T—WASHER
U—FLAT WASHER SCREW
V—CAT-HEAD KEY
W—WORM GEAR CARRIER
X—CLUTCH AND BRAKE SHAFT ARM BOLT
Y—CLUTCH AND BRAKE SHAFT ARM
Z—CLUTCH AND BRAKE SHAFT KEY
AA—COTTER PIN
AB—CLUTCH AND BRAKE SHAFT
AC—DRIVE CONTROL ROD PIN
AD—CLUTCH SHAFT COLLAR SET SCREW
AE—CLUTCH SHAFT SET COLLAR
AF—DRAG BRAKE SHOE LINING RIVET
AG—DRAG BRAKE SHOE LINING
AH—DRAG BRAKE SHOE
AI—DRAG BRAKE ARM
AJ—BOLT
AK—DRAG BRAKE SPRING
AL—DRAG BRAKE SHOE BAR
AM—CLUTCH SHAFT ARM CAP SCREW
AN—WASHER
AO—NUT
AP—CLUTCH SHAFT ARM
AQ—CLUTCH THROW-OUT SHIFT ROD
AR—CLUTCH THROW-OUT YOKE PIN
AS—CLUTCH THROW-OUT YOKE BRACKET

RA PD 334536D

Legend for Figure 139



A — WORM BRAKE CAM, CAP SCREW
B — WASHER
C — WASHER
D — WORM BRAKE CAM
E — WORM BRAKE HOUSING CAP
F — WORM BRAKE ASSEMBLY
G — WORM BRAKE SHOE LINING
H — WORM BRAKE SHOE LINING RIVET
I — WORM NUT
J — WORM NUT LOCK WASHER
K — WORM BRAKE DRUM
L — WORM HOUSING FRONT CAP BOLT
M — WORM BRAKE HOUSING
N — WORM BEARING OIL SEAL
O — WORM HOUSING GASKET
P — WINCH WORM BEARING
Q — WORM BRAKE DRUM KEY
R — WORM
S — WORM SPROCKET KEY
T — WORM HOUSING FRONT CAP
U — WINCH DRIVE SPROCKET
V — WINCH DRIVE CHAIN
W — DRIVE SPROCKET FLAT WASHER
X — DRIVE SPROCKET BOLT
Y — POWER TAKE-OFF SHAFT DRIVE SPROCKET
Z — LOCK WASHER
AA — WORM BRAKE HOUSING CAP, CAP SCREW

RA PD 353095

Figure 140 — Winch — Brake, Worm Shaft, and Driving Sprockets — Disassembled

115. CABLE GUIDE ASSEMBLY.

a. Disassembly (fig. 141). Remove two cap screws and lock washers (K and L), from cable sheave shaft lock plate (M). Remove lock plate. Remove cotter pin (H), and washer (I), from rod. Slip off cable sheave left shaft support (U). Remove nut, lock washer, and lever bolt (Q, P, and N), from lever (O). Remove lever (O), and opposite sheave shaft support. Slip sheave (D), off shaft.

b. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent and dry thoroughly. Check bushing for scores or excessive wear. Check shaft and rod for burs and bends. Replace if necessary. Clean and oil all parts before assembly.

c. Assembly (fig. 141). Slip sheave (D), over shaft (G). Insert shaft into left support (slotted end) (U). Install lock plate in slot in shaft and fasten to support with two cap screws and lock washers. Insert rod (J), through support (U), and slip washer over end of rod and install cotter pin. Slip opposite support (V), over sheave shaft and rod. Install lever (O), over rod and secure with lever bolt, lock washer, and nut.

116. CLUTCH AND BRAKE SHAFT ASSEMBLY.

a. Disassembly. Loosen binding bolts on clutch shaft arm and on drag brake arm (AP and AI, fig. 139). Loosen set screws on clutch shaft set collars, located on each side of clutch shaft support (fig. 136). Detach clutch throw-out shift rod from clutch shaft arm, move clutch shaft arm to right on shaft and remove key from shaft. Remove two bolts (X, fig. 139) from clutch and brake shaft arm, remove arm cap, and drive key (Z, fig. 139) off of shaft. Remove clutch and brake shaft (AB, fig. 139).

b. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent and dry thoroughly. Check shaft for nicks or bends. Replace all unserviceable parts. Clean and oil all parts before assembly.

c. Assembly. Start shaft through front hole in left drum shaft bracket (O, fig. 138) and assemble on shaft, clutch shaft arm (AP, fig. 139). Slip shaft through far enough to assemble drag brake arm (AI, fig. 139) and shoe assembly with arm extending above the shaft and lining facing drum (figs. 136 and 139). Assemble one clutch shaft set collar on shaft and slip shaft on through clutch shaft support (fig. 136) and assemble other set collar, and clutch and brake shaft arm (Y, fig. 139). Continue shaft on through into hole in winch worm housing (M, fig. 138). Assemble keys on shaft to secure the clutch shaft arm and also the clutch and brake shaft arm. Slide both arms into position on shaft and tighten all binding bolts and set screws after alining arms and set collars in their proper position.

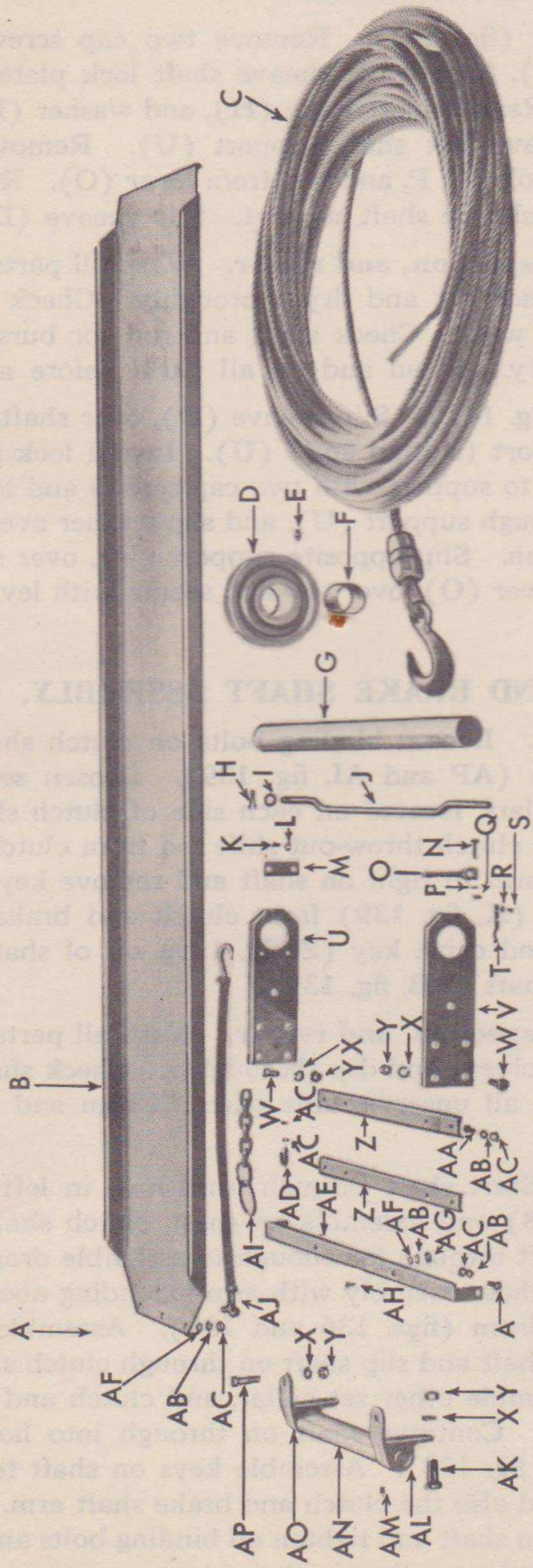


Figure 141 — Winch — Cable and Guide — Disassembled

A—CABLE TRAY FRONT SUPPORT BOLT
B—WINCH CABLE TRAY
C—WINCH CABLE ASSEMBLY
D—CABLE SHEAVE W/BUSHING ASSEMBLY
E—LUBRICATION FITTING
F—WINCH SHEAVE BUSHING
G—CABLE SHEAVE SHAFT
H—COTTER PIN
I—WASHER
J—CABLE SUPPORT ROD
K—SHEAVE SHAFT LOCK PLATE SCREW
L—WASHER
M—SHEAVE SHAFT LOCK PLATE
N—CABLE SUPPORT SHAFT LEVER BOLT
O—CABLE SUPPORT SHAFT LEVER
P—WASHER
Q—NUT
R—WASHER
S—NUT
T—WINCH SHAFT LEVER SPRING
U—SHEAVE SHAFT SUPPORT, LEFT
V—SHEAVE SHAFT SUPPORT, RIGHT
W—BOLT
X—LOCK WASHER
Y—NUT
Z—CABLE TRAY SUPPORT, FRONT
AA—BOLT
AB—WASHER
AC—NUT
AD—WINCH CABLE HOOK BOLT
AE—CABLE TRAY SUPPORT, FRONT
AF—WASHER
AG—NUT
AH—CABLE TRAY MACHINE SCREW
AI—CHAIN
AJ—WINCH LINE HOLDER
AK—BOLT
AL—WINCH ROLLER GUIDE BRACKET
AM—ROLLER TUBE PLUG
AN—ROLLER TUBE ASSEMBLY
AO—GUIDE W/BRACKET ASSEMBLY
AP—BOLT

RA PD 334534C

Legend for Figure 141

Section IV

ASSEMBLY

117. ASSEMBLE WINCH.

a. Clean all units thoroughly and check all parts. Wash all subassemblies thoroughly. Remove all traces of dirt or metal from inside of gear housing and cover. After coating all gears and bearings with a light oil as specified in lubrication order, rotate or slide on mating shafts to prove free operation.

b. Assemble shaft to housing. Place one pin in each hole next to the flange of the bronze bearing (B, fig. 139), leaving the beveled end of the pin to the outside. Place the worm housing cover (I, fig. 138) on the bronze bearings (N, fig. 139) so that the pins will locate in the gear case cover. Place two new gaskets (L, fig. 138) on the worm housing and lower the gear into the housing, with the cat-head end of the shaft extending to the right of the housing, when facing the sprocket end of the worm shaft. Fasten the cover (I, fig. 138) to the housing (M, fig. 138) with eight cap screws (J and K, fig. 138), lock washers, and nuts.

c. Assemble drum, clutch, and shaft brackets. Secure the drum clutch (K, fig. 139) to the drum (F, fig. 138) with six cap screws (G, fig. 138). Place the cap screws through the drum flange with cap screw heads on the inside of the drum flange. If new drum bearings have been installed, make sure the grease holes are in alinement. Place the drum (F, fig. 138) on the clutch end of the shaft (M, fig. 139) with the drum clutch to the outside. Place thrust collar (H, fig. 139) over shaft and against drum. Place the clutch keys (L, fig. 139) in the keyways, and using the keys to locate the thrust collar, tighten set screw (G, fig. 139) in collar. Assemble the clutch yoke (I, figure 139) on the clutch yoke bracket (AS, fig. 139) with clutch pin (AR, fig. 139) and two cotter pins. Place the control shaft in the correct position under the drum and slide the shaft through the drilled hole in the worm brake end of the housing. Assemble bracket caps (B, fig. 138) to brackets (O, fig. 138) with cap screws and lock washers. Place the sliding clutch (J, figure 139) and clutch throw-out yoke (I, fig. 139) thrust collar and shaft bracket on end of shaft. With the thrust collar against the clutch keys, tighten the set screw. Place the control shaft (AB, fig. 139) in the proper hole of the shaft bracket (O, fig. 138). Place the other shaft bracket on the cat-head end of the shaft with the grease fitting to the inside.

d. Assemble winch to angle frames. Place the kick-up angle frame (N, fig. 138) at the worm brake side of the winch, with the long flange of the angle in a vertical position and with the other

flange toward the inside. Place the straight angle frame at the sprocket side of the winch. Fasten with two cap screws, lock washers, and nuts in each side of worm housing, both shaft brackets and the control shaft bracket.

e. Adjust and tighten parts on control shaft (fig. 139). Make sure the clutch and brake shaft (AB), is supported in the brackets at each end. Place set collars (AE), against each side of the control shaft bracket and tighten set screw in each collar. Insert keys under the clutch arm (AP), and the shaft clutch and brake arm (Y). Connect the clutch yoke (I), to the clutch arm (AP), with rod (AQ), and insert cotter pin in each end of rod. Locate the clutch arm for clearance in operation, and tighten to shaft with bolt, nut, and lock washer. Place drag brake under drum brake flange. Adjust for sufficient drag with clutch thrown out, and tighten with set screw in drag brake arm.

f. Install cat-head (fig. 139). Place cat-head key (V), in keyway in shaft. Press cat-head over key on the drum shaft (M). Secure with washer, lock washer, and cap screw.

Section V

TEST, ADJUSTMENTS, AND DATA

118. TEST WINCH OPERATION.

a. Rotary and power test. Fill worm gear housing with proper grade and quantity of lubricant (see lubrication order). Install level plug and filler plug. Apply lubricant to all grease fittings and give rotary test. Attach worm shaft to power source and test. Any undue noise will indicate faulty assembly, which must be checked step by step. If unit operates quietly and smoothly, install in vehicle.

b. Automatic brake adjustment (fig. 142). The automatic brake should be adjusted periodically. Adjust sufficiently tight to hold a load suspended on the winch. This adjustment will be found on the outer end of the worm brake housing located on the end of the worm case. If adjustment is needed, loosen two cap screws in their slotted holes, and turn the adjusting cam, to tighten or loosen as indicated. Turn two notches and test. When the proper adjustment has been obtained, tighten cap screw.

c. Drag brake adjustment. The function of the drag brake is merely to prevent the drum from spinning when reeling off cable. To adjust, loosen nut (C, fig. 139) on binder bolt on brake bracket, force lining against drum, and tighten binder bolt nut.

926829 O - 51 - 13

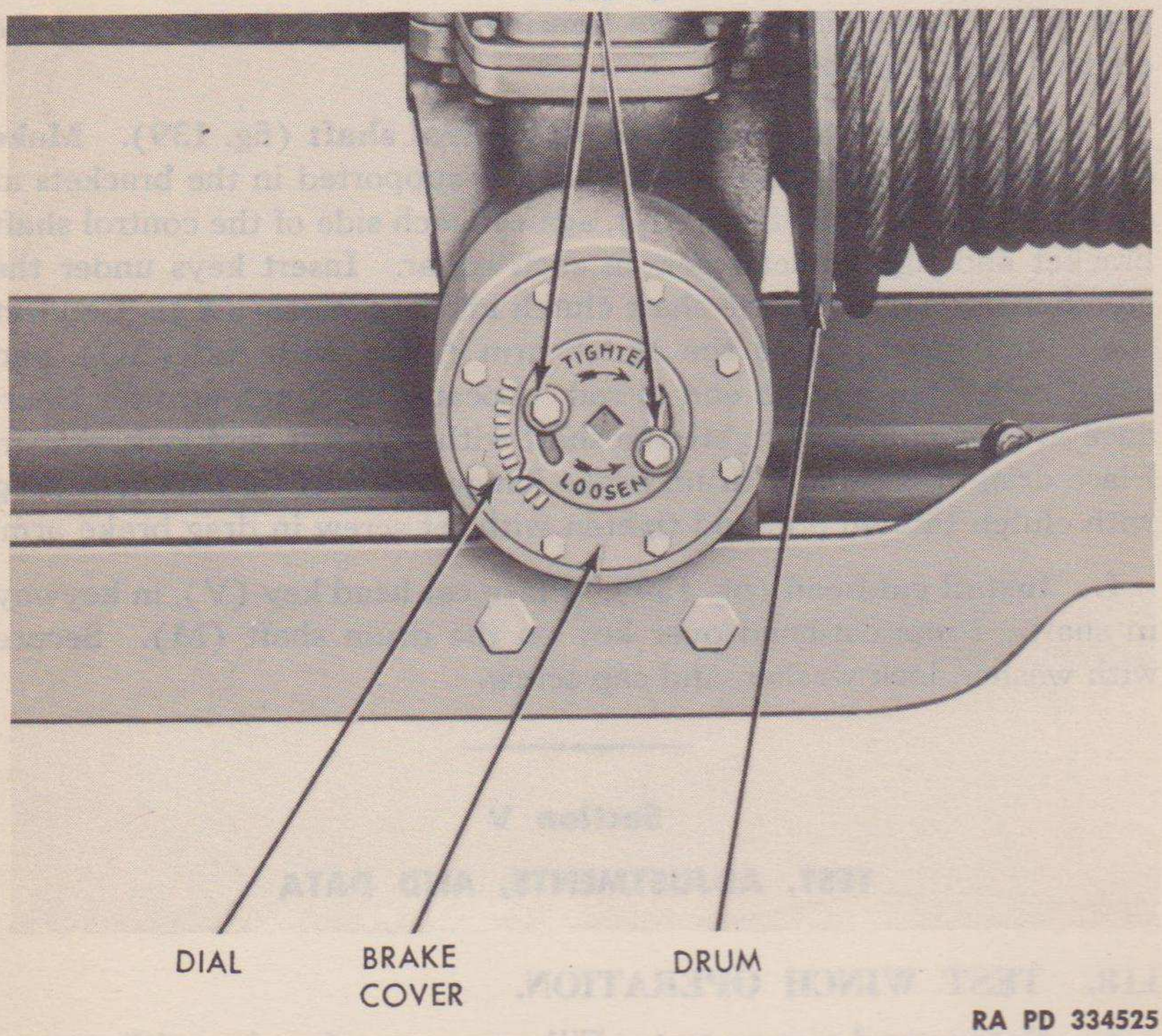


Figure 142 — Automatic Brake Adjusting Plate

d. Chain adjustment. In this type of chain (V, fig. 140), considerable slack is permissible, as the links will not slip over the teeth on the sprocket even when extremely loose. Adjust by adding or removing shims between winch base and chassis frame side rails.

119. DATA.

a. Winch drum shaft.

Length	63 1/16 in.
Diameter	2 7/8 in.

b. Ring gear.

Material	Bronze
Number of teeth	32

c. Worm.

Shaft length ..... 17 7/16 in.
Diameter at bearing ..... 1.9683 to 1.9688 in.

d. Drum shaft bearings.

(1) GEAR CASE (FLANGED) BEARINGS.

Number used 2
Material ..... Bronze
Length ..... 2¾ in.
OD ..... 3.377 to 3.375 in.
ID ..... 2.882 to 2.884 in.

(2) DRUM SHAFT BEARINGS.

Drum bearings
Number used 2
Material ..... Bronze
Length ..... 3⅞ in.
OD ..... 3.377 to 3.375 in.
ID ..... 2.902 to 2.905 in.

(3) SHAFT BEARINGS.

Number used 2
Material ..... Bronze
Length ..... 3⅞ in.
OD ..... 3.377 to 3.375 in.
ID ..... 2.887 to 2.889 in.

e. Ball bearings (worm).

Number used 2
Type ..... Ball
Make ..... SKF
Number 6410

f. Oil seals (worm gear).

Number used 2
OD ..... 2.756 in.
Width ..... ½ in.
Shaft size ..... 1¾ in.

g. Brake lining.

Automatic worm brake

Number used	2
Length	$7\frac{5}{16}$ in.
Width	$2\frac{1}{4}$ in.
Thickness	$\frac{3}{16}$ in.

Drag brake

Number used	1
Length	$3\frac{1}{2}$ in.
Width	3 in.
Thickness	$\frac{1}{4}$ in.

h. Winch drum.

Width	20 in.
Diameter	7 in.
Flange diameter	15 in.

i. Center line of winch to center line of worm.

Gear sprocket	$6\frac{1}{4}$ in.

CHAPTER 13

WINCH (FRONT MOUNTED)

Section I

DESCRIPTION AND DATA

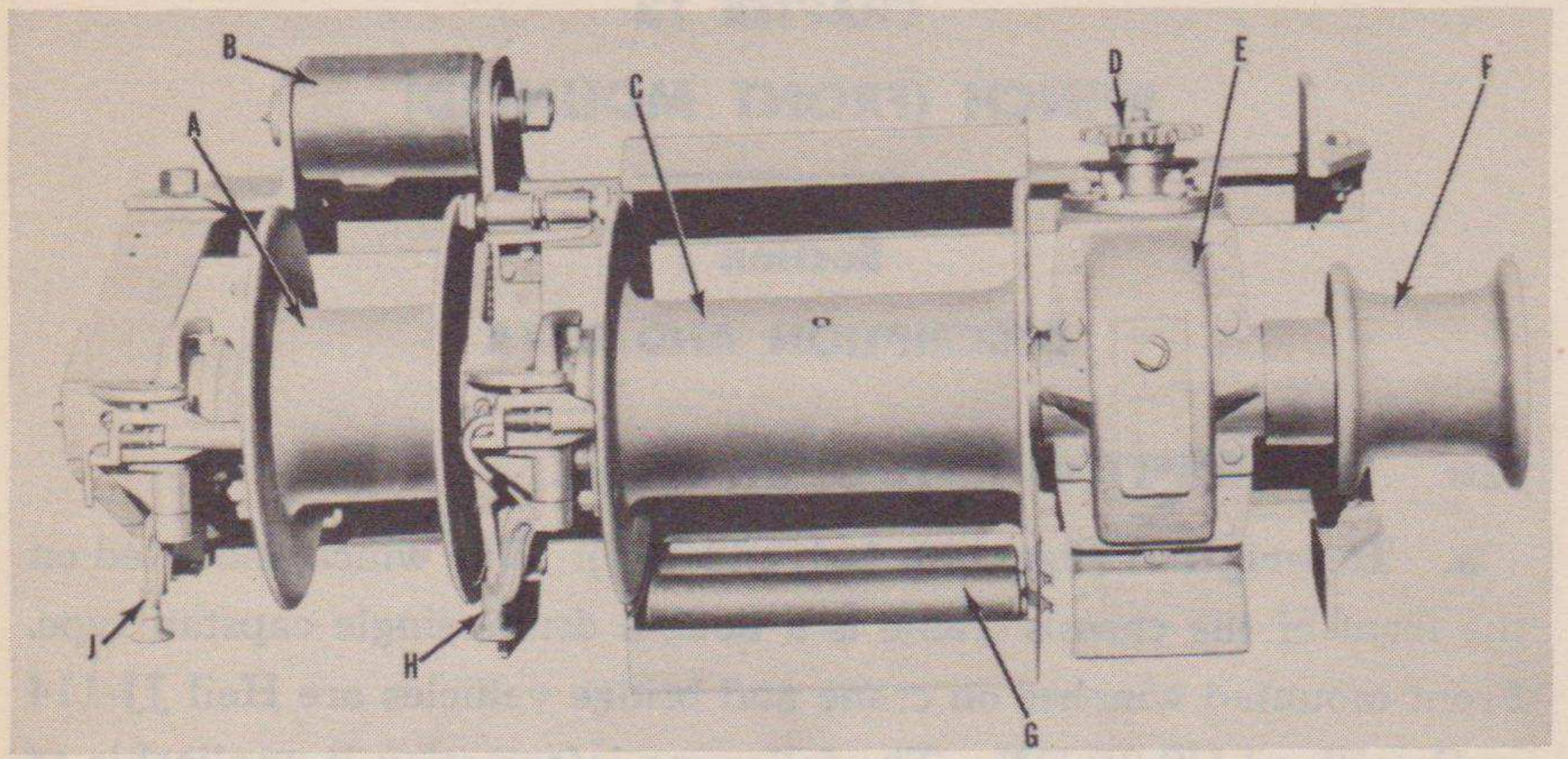
120. DESCRIPTION AND OPERATION.

a. Description (figs. 143, 144, and 145). The winch, mounted on the front of the chassis frame is a double drum, single capstan type. Front mounted winches on crane and bridge vehicles are Heil JJ-114 or Gar Wood US-25 DN. The following information is applicable to either model as both are alike. The assembly consists of a worm and gear operating within a housing, a capstan keyed to the mainshaft, and two cable drums mounted on the mainshaft. Jaw clutches are provided for each drum, with shifting mechanisms, drum locks, and drag brakes for control. An enclosed automatic worm brake is mounted on the end of the worm shaft. This automatic brake prevents the load from turning the winch backward. Rollers are provided for each drum to minimize cable damage when in use.

b. Operation.

(1) The drums may be operated individually or simultaneously. The large drum is designed so that the cable will operate from the front of the chassis. The smaller or outer drum is designed so that the cable can be operated from the rear of the vehicle. Power for operating the winch is supplied by the engine, through a power take-off mounted on the side of the transmission. Drive is accomplished by means of sprockets and chains through two lengths of propeller shafts, with three pillow blocks and universal joints. The center joint incorporates a shear pin.

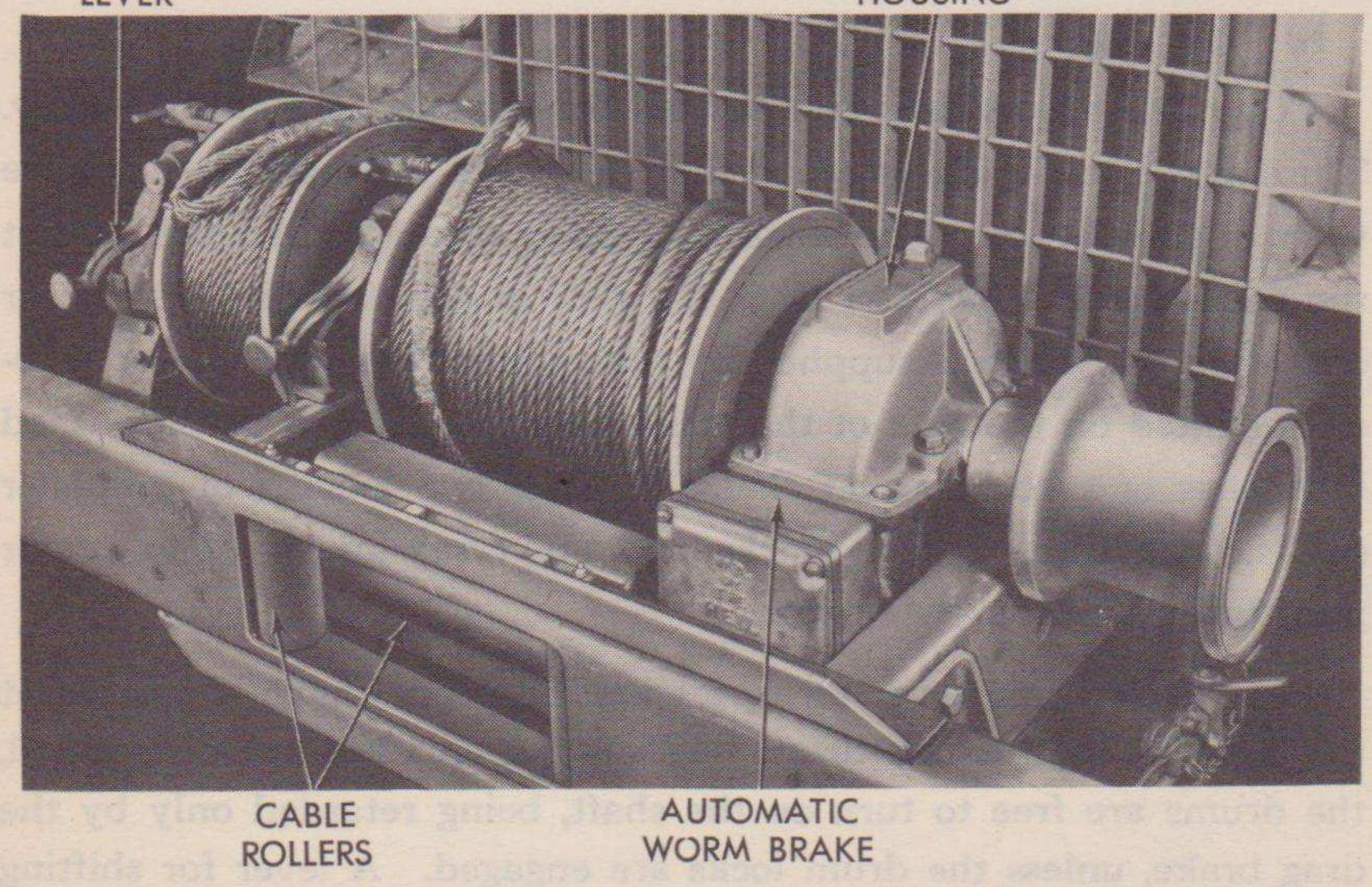
(2) A separate lever for operating the drum clutch is located at the right of each winch drum. When the clutches are disengaged, the drums are free to turn on the shaft, being retarded only by the drag brake, unless the drum locks are engaged. A lever for shifting gears of the power take-off is located in the cab. NOTE: *The winch must be operated by power, both forward and in reverse.*



A—SMALL DRUM
B—CABLE ROLLER
C—LARGE DRUM
D—DRIVE SPROCKET
E—GEAR HOUSING
F—CAPSTAN
G—CABLE ROLLER
H—LARGE DRUM CLUTCH LEVER
J—SMALL DRUM CLUTCH LEVER

RA PD 334524

Figure 143 — Front Mounted Winch — Top View



RA PD 353096

Figure 144 — Front Mounted Winch — Left Front View

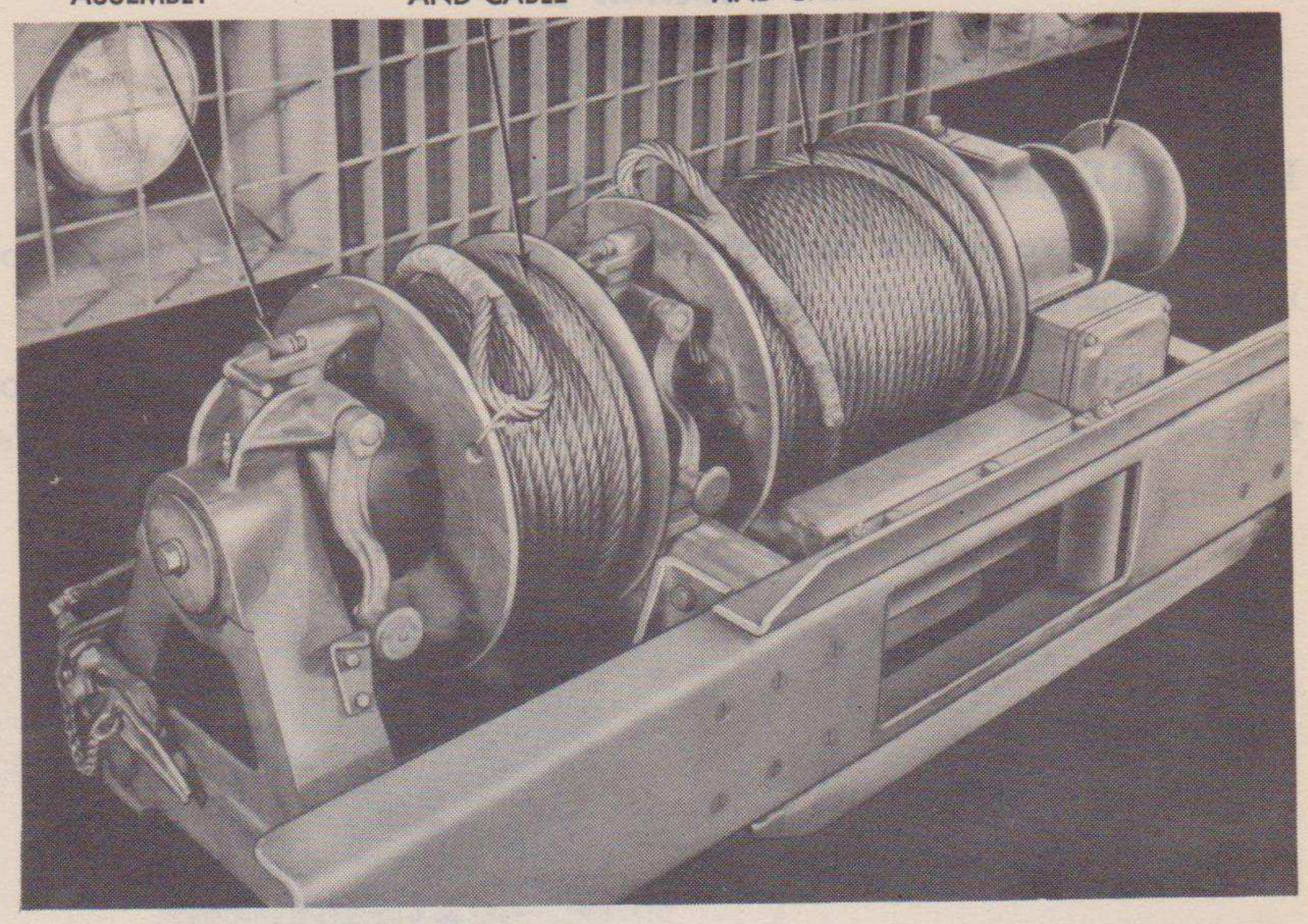


Figure 145 — Front Mounted Winch — Right Front View

121. DATA.

Makes	Heil and Gar Wood
Models	JJ-114 and US 25 D1
Ratio	34 to 1
Location	Front of chassis frame
Winch capacity (on first layer of cable)	25,000 lb
Drive	Power take-off on transmission, roller chain, sprockets, and propeller shaft
Chain adjustment	Shims under pillow blocks

No. of teeth on sprockets:

Worm shaft	15
Front pillow block	10
Rear pillow block	11
Power take-off	11

Propeller shaft bearing:

Adjustment method	Adjusting nuts
Adjustment	Bearings must turn freely without binding (no perceptible end play)

Section II

DISASSEMBLY INTO SUBASSEMBLIES

122. PRELIMINARY INSTRUCTIONS.

a. Remove winch and winch drive. Refer to TM 9-813 for instructions on removing winch and winch drive.

b. Cleaning. Remove all foreign material from the exterior of the winch and winch drive, with a wire brush and a putty knife.

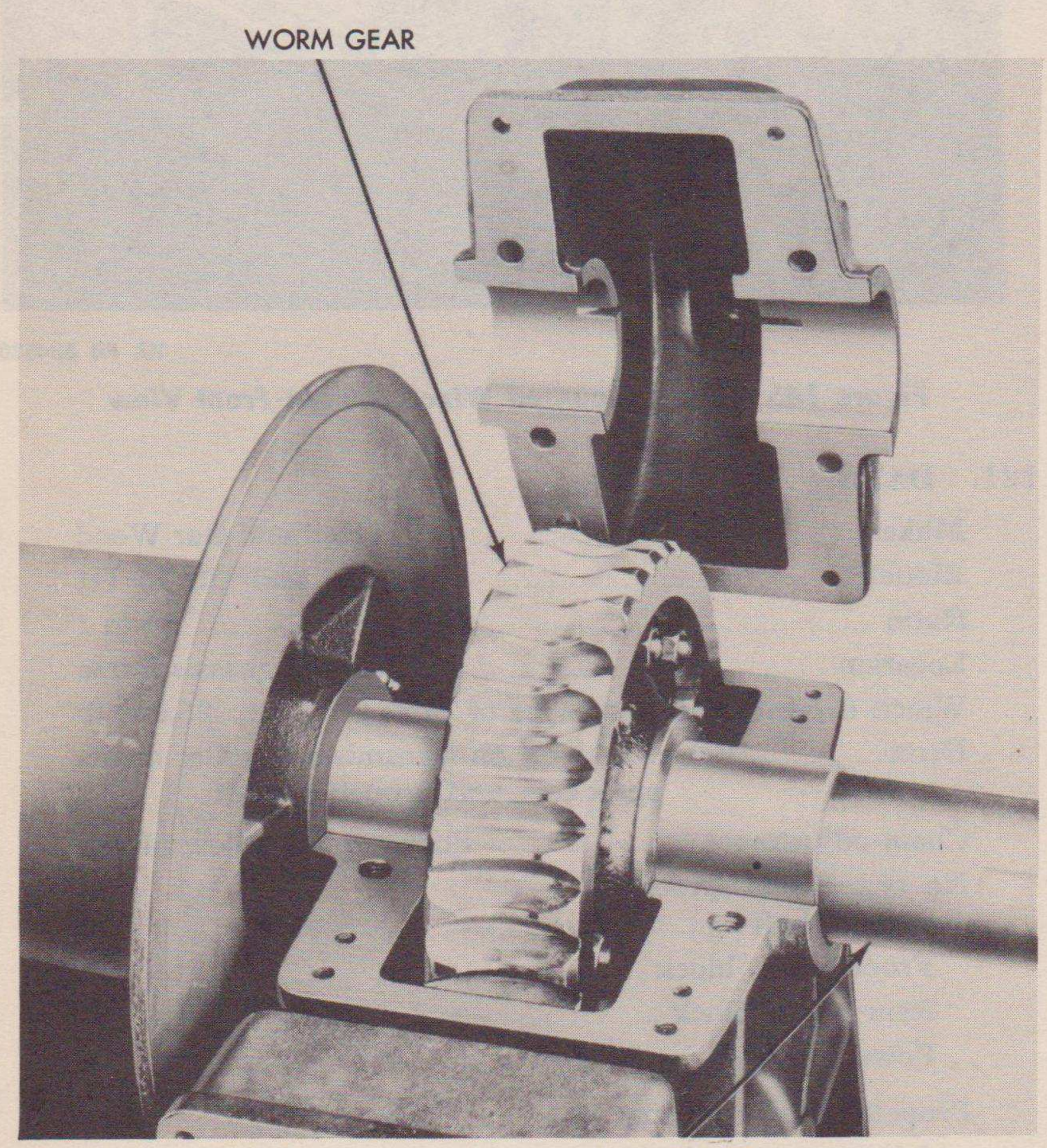


Figure 146 — Winch Worm Housing Cover — Removed

Place the unit in a container of dry cleaning solvent and wash thoroughly. Wipe dry with wiping cloths. Keep all dirt or foreign matter from the interior of the winch. As disassembly proceeds, clean and wrap all parts in clean paper.

123. DISASSEMBLY (figs. 147, 148, and 149).

a. Remove shaft and drum assemblies. Unscrew drain plug from worm housing and drain lubricant. Remove filler plug, four 5/8-inch cap screws and lock washers from worm housing cover. Remove four 3/8-inch nuts, lock washers, and cap screws from worm housing cover. Remove worm housing cover and gaskets (fig. 146). Remove one 3/4-inch cap screw, lock washer, plate, and shims from each end of shaft. Tag shims to assure correct reassembly. Remove two 1 1/8-inch nuts, lock washers, and cap screws from base of outer clutch and bearing bracket. Lift out complete assembly. Using puller, remove capstan. Remove key and spacer collar. Remove outer support bracket, spacer, clutch, key, and small drum. Remove frame center bearing bracket assembly, spacer, second clutch and key, and large drum. Remove bushing from each side of gear. Mark shaft to insure installing gear in same location in assembly. Press off gear and remove key.

b. Remove gear housing. Remove two 1 1/8-inch nuts, lock washers, and cap screw from base of housing. Lift out gear housing.

c. Disassembly of propeller shaft (fig. 154). Slip rear universal joint off spline end of shaft. Remove socket-head set screw from rear end of rear universal joint and tap joint off pillow block shaft. Slip center pillow block off rear shaft. Remove cotter pin from shear pin and drive out shear pin. Pull front shaft out of center universal joint. Remove socket-head set screw from opposite end of center universal joint and tap joint off shaft. Remove socket-head set screw from front end of front universal joint, and tap joint off pillow block shaft. Remove set screw from opposite end of front universal joint and tap joint off shaft. Remove key from each shaft.

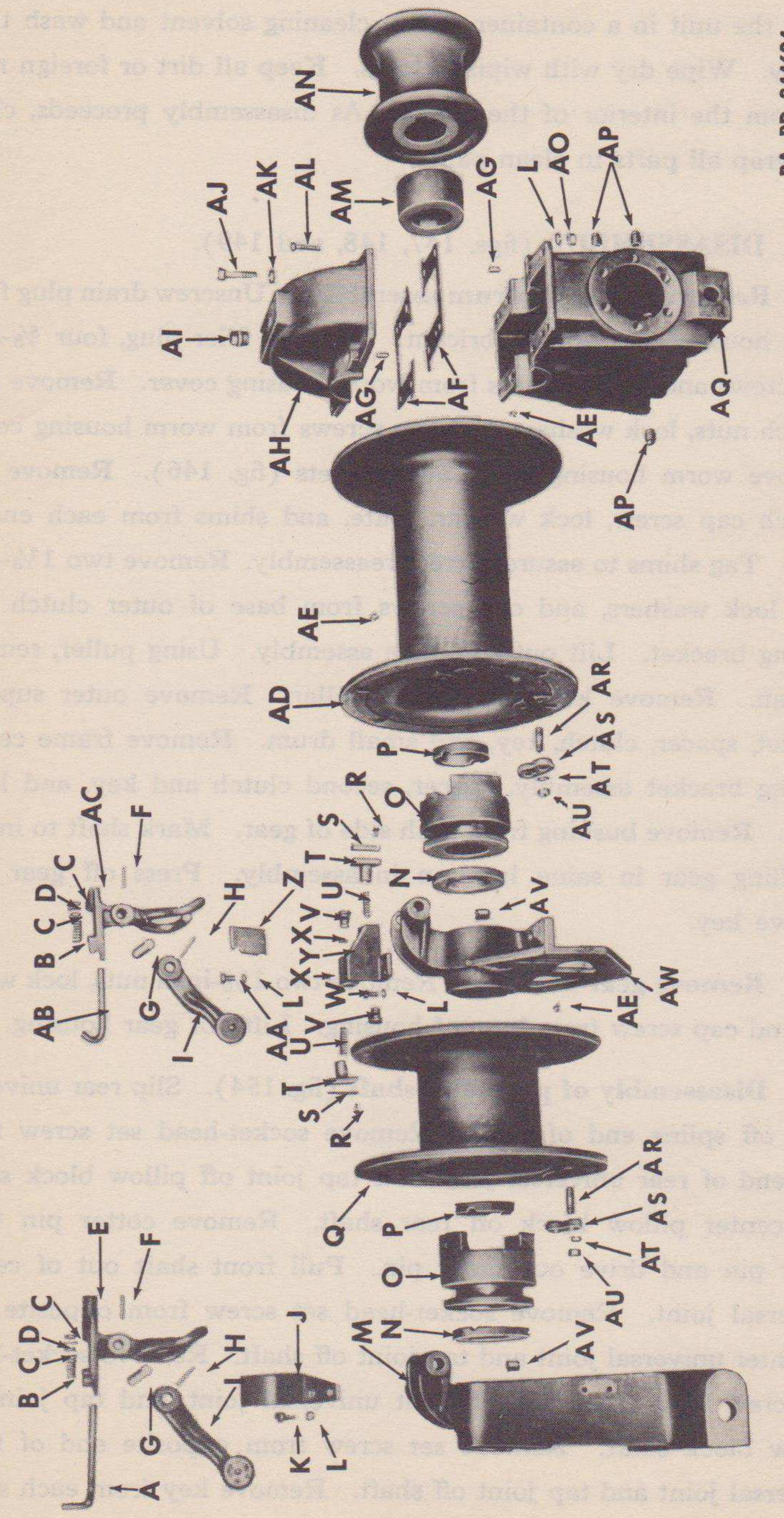


Figure 147 — Winch — Worm Housing, Drums, and Brackets — Disassembled

A—END BRACKET DRUM LOCK PIN
B—CENTER BRACKET DRUM LOCK PIN SPRING
C—WASHER
D—COTTER PIN
E—END BRACKET CLUTCH COLLAR SHIFTING YOKE
F—SHIFTING YOKE TAPER PIN
G—CENTER BRACKET SHIFT LEVER SHAFT
H—SHIFT LEVER TAPER PIN
I—END BRACKET SHIFT LEVER
J—END BRACKET SHIFT LEVER HANDLE STOP PLATE
K—STOP PLATE CAP SCREW
L—LOCK WASHER
M—BEARING END BRACKET
N—DRUM CLUTCH COLLAR RIGHT THRUST RING
O—DRUM CLUTCH COLLAR
P—DRUM CLUTCH COLLAR LEFT THRUST RING
Q—SMALL DRUM
R—RIVET
S—CENTER BRACKET BRAKE SHOE LINING
T—CENTER BRACKET BRAKE SHOE
U—CENTER BRACKET BRAKE SHOE SPRING
V—CENTER BRACKET BRAKE ADJUSTING SCREW
W—ADJUSTING SCREW BRACKET BOLT
X—WINCH DRIVE PIN
Y—CENTER BRACKET BRAKE ADJUSTING BRACKET
Z—CENTER BRACKET SHIFT LEVER STOP ANGLE
AA—SHIFT LEVER STOP ANGLE BOLT
AB—CENTER BRACKET DRUM LOCK PIN
AC—CENTER BRACKET CLUTCH COLLAR SHIFTING YOKE
AD—LARGE DRUM ASSEMBLY
AE—CABLE GUIDE ROLLER SHAFT LUBRICATION FITTING
AF—WORM HOUSING COVER GASKET
AG—WORM HOUSING DOWEL PIN
AH—WORM HOUSING COVER
AI—WORM HOUSING COVER PLUG
AJ—WORM HOUSING COVER CAP SCREW
AK—LOCK WASHER
AL—WORM HOUSING COVER BOLT
AM—WINCH HEAD SPACER COLLAR
AN—WINCH HEAD
AO—WORM HOUSING COVER NUT
AP—WORM HOUSING PLUG
AQ—WORM SHAFT HOUSING
AR—SMALL DRUM CLAMP STUD
AS—DRUM, RIGHT CLAMP
AT—LOCK WASHER
AU—DRUM CLAMP NUT
AV—DRUM SHAFT BRACKET BUSHING PIN
AW—BEARING CENTER BRACKET

RA PD 344624B

Legend for Figure 147

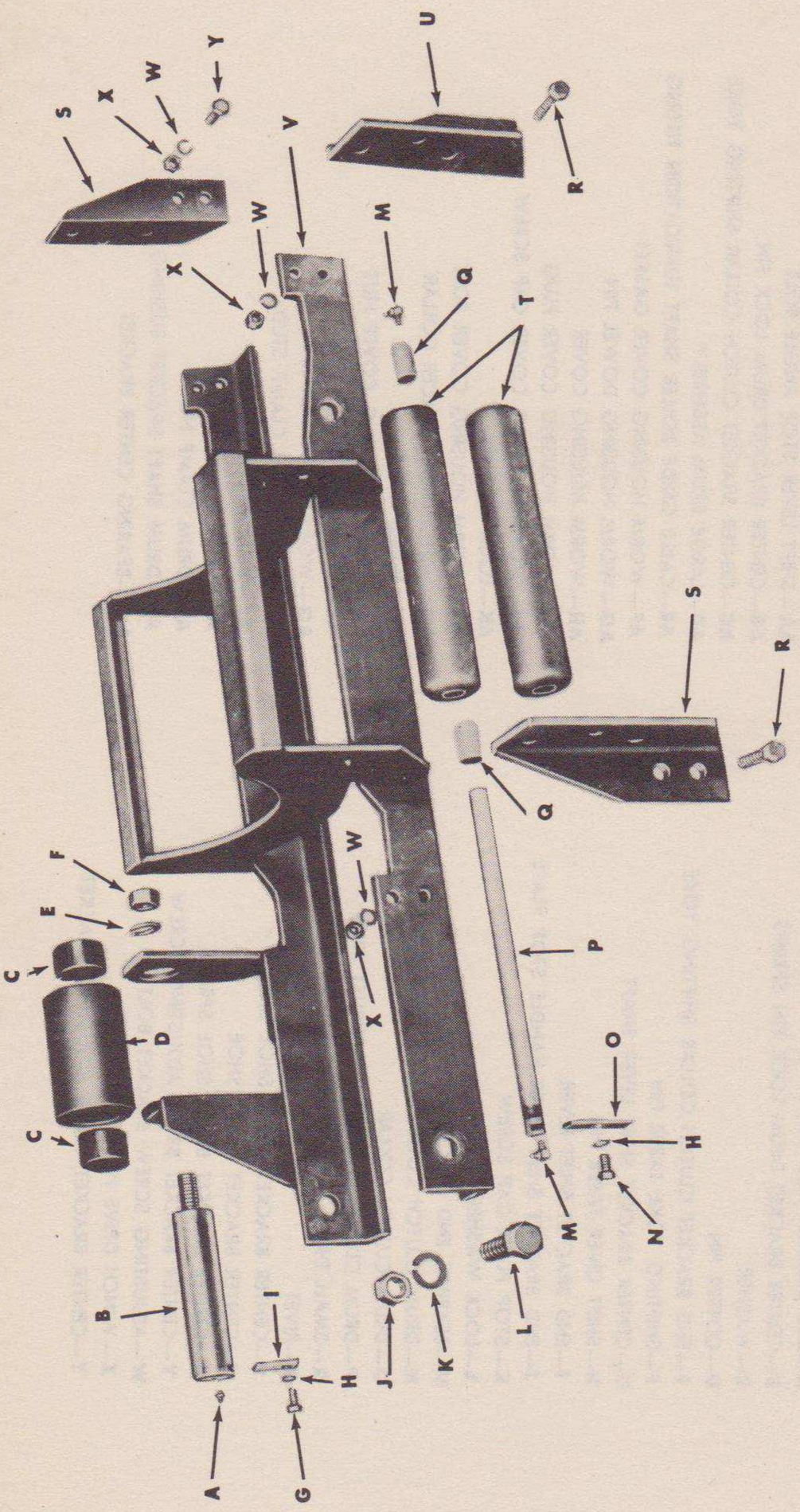
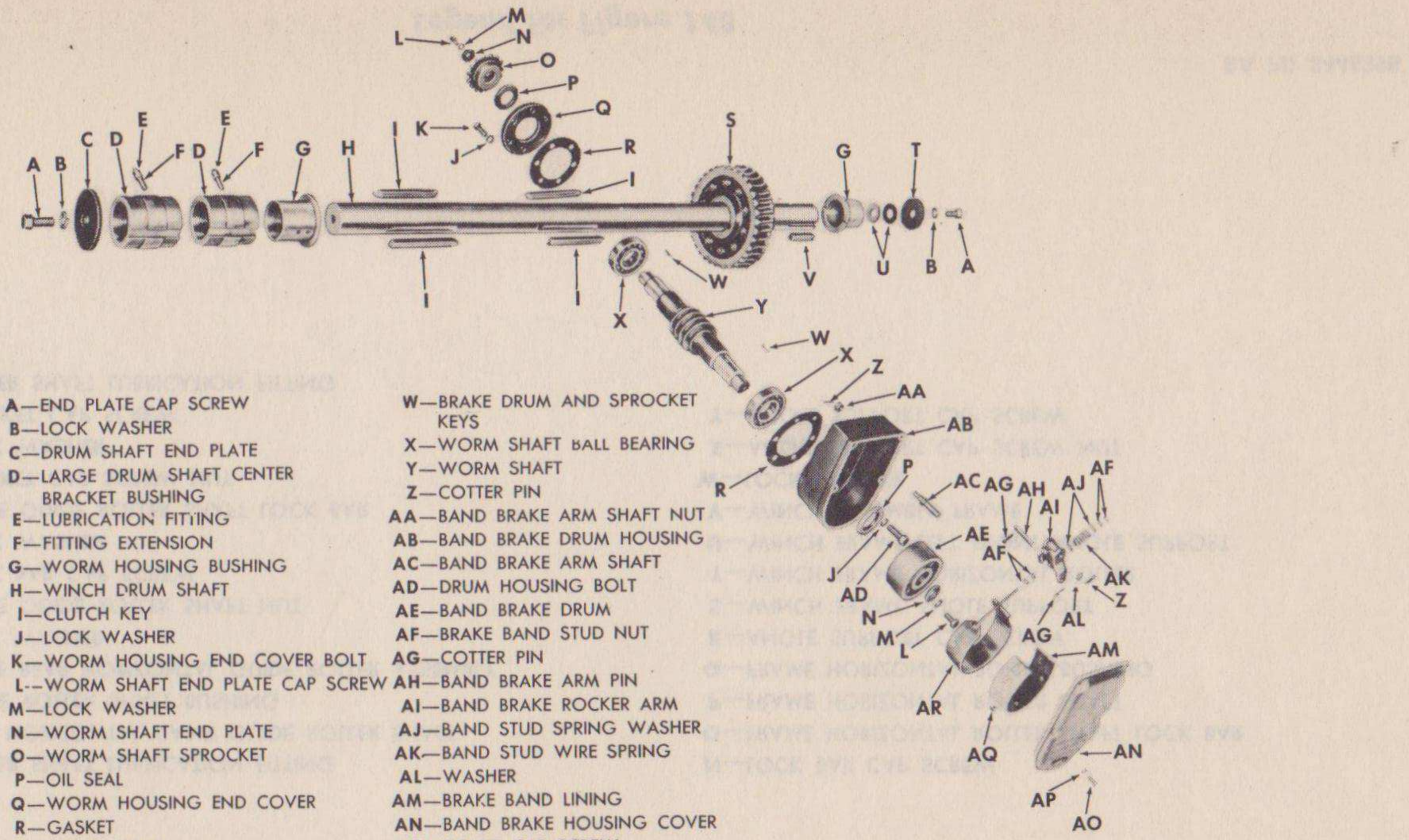


Figure 148 — Winch — Frame and Rollers — Disassembled

A—ROLLER SHAFT LUBRICATION FITTING
B—REAR HORIZONTAL CABLE GUIDE ROLLER SHAFT
C—GUIDE ROLLER SHAFT BUSHING
D—CABLE REAR HORIZONTAL GUIDE ROLLER ASSEMBLY
E—LOCK WASHER
F—CABLE GUIDE ROLLER SHAFT NUT
G—LOCK BAR CAP SCREW
H—LOCK WASHER
I—CABLE GUIDE ROLLER SHAFT LOCK BAR
J—BRACKET CAP SCREW NUT
K—LOCK WASHER
L—BRACKET CAP SCREW
M—ROLLER SHAFT LUBRICATION FITTING
N—LOCK BAR CAP SCREW
O—FRAME HORIZONTAL ROLLER SHAFT LOCK BAR
P—FRAME HORIZONTAL ROLLER SHAFT
Q—FRAME HORIZONTAL ROLLER BUSHING
R—ANGLE SUPPORT CAP SCREW
S—WINCH FRAME ANGLE SUPPORT
T—WINCH FRAME HORIZONTAL ROLLER
U—WINCH FRAME LEFT FRONT ANGLE SUPPORT
V—WINCH ASSEMBLY FRAME
W—LOCK WASHER
X—ANGLE SUPPORT CAP SCREW NUT
Y—ANGLE SUPPORT CAP SCREW

RA PD 344639B

Legend for Figure 148



A—END PLATE CAP SCREW
B—LOCK WASHER
C—DRUM SHAFT END PLATE
D—LARGE DRUM SHAFT CENTER BRACKET BUSHING
E—LUBRICATION FITTING
F—FITTING EXTENSION
G—WORM HOUSING BUSHING
H—WINCH DRUM SHAFT
I—CLUTCH KEY
J—LOCK WASHER
K—WORM HOUSING END COVER BOLT
L—WORM SHAFT END PLATE CAP SCREW
M—LOCK WASHER
N—WORM SHAFT END PLATE
O—WORM SHAFT SPROCKET
P—OIL SEAL
Q—WORM HOUSING END COVER
R—GASKET
S—WORM GEAR
T—WINCH HEAD END PLATE
U—SPACER SHIM
V—WINCH HEAD KEY
W—BRAKE DRUM AND SPROCKET KEYS
X—WORM SHAFT BALL BEARING
Y—WORM SHAFT
Z—COTTER PIN
AA—BAND BRAKE ARM SHAFT NUT
AB—BAND BRAKE DRUM HOUSING
AC—BAND BRAKE ARM SHAFT
AD—DRUM HOUSING BOLT
AE—BAND BRAKE DRUM
AF—BRAKE BAND STUD NUT
AG—COTTER PIN
AH—BAND BRAKE ARM PIN
AI—BAND BRAKE ROCKER ARM
AJ—BAND STUD SPRING WASHER
AK—BAND STUD WIRE SPRING
AL—WASHER
AM—BRAKE BAND LINING
AN—BAND BRAKE HOUSING COVER
AO—COVER CAP SCREW
AP—LOCK WASHER
AQ—LINING RIVET
AR—BRAKE BAND

RA PD 344882

Figure 149 — Winch — Worm Drive, Automatic Brake, and Drum Shaft Assemblies — Disassembled

Disassembly Into Subassemblies

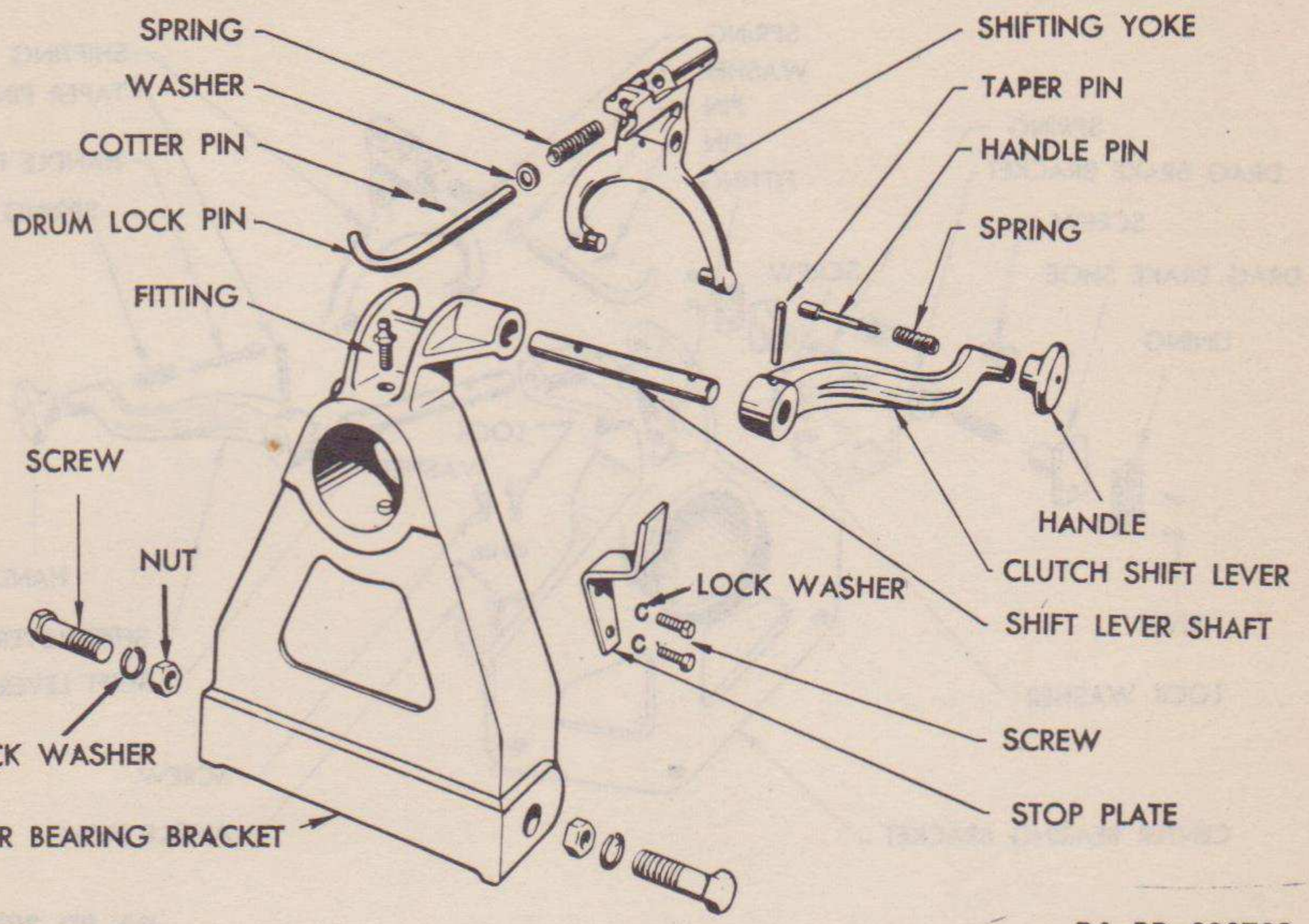


Figure 150 — Winch — Outer Clutch and Bearing Bracket — Disassembled

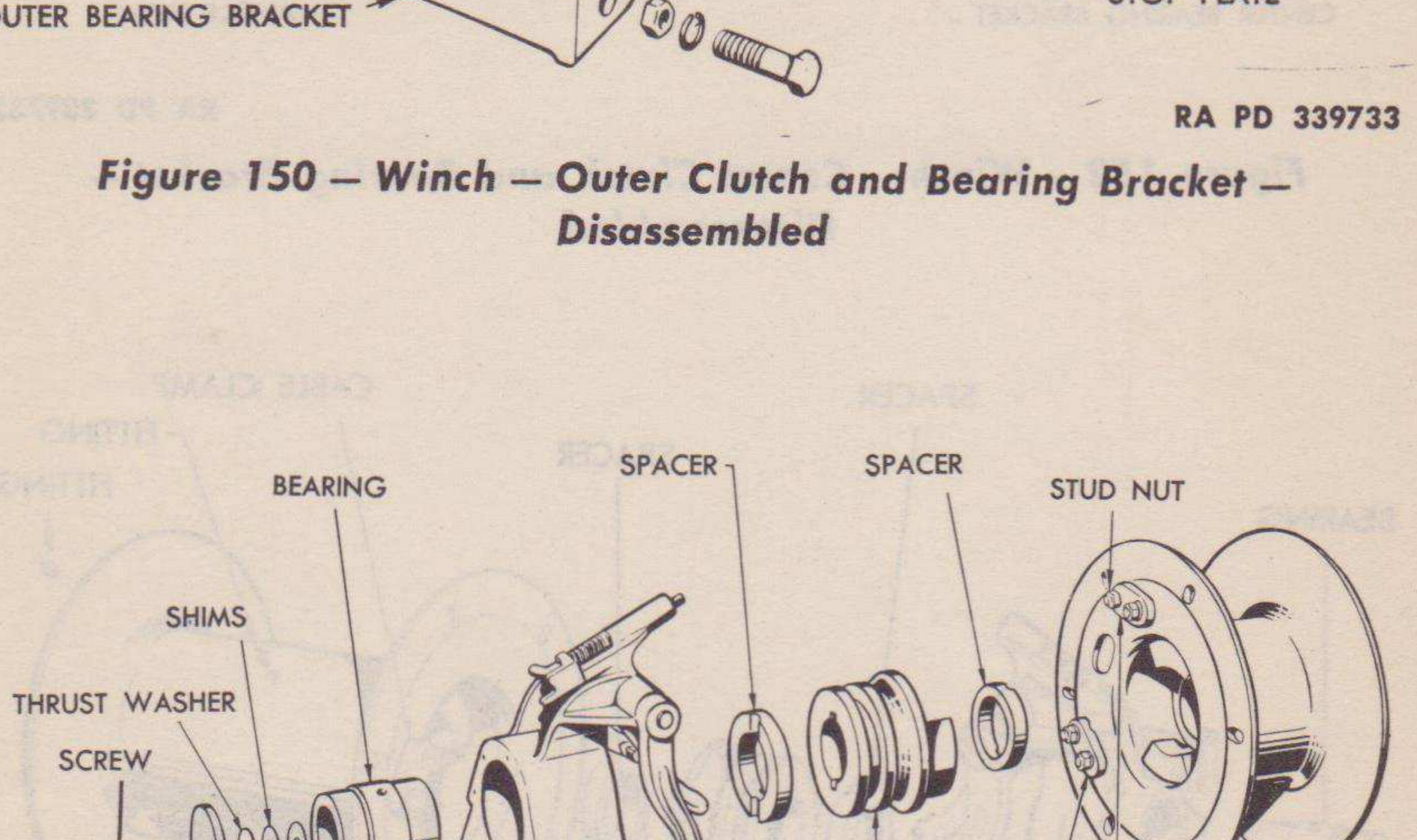


Figure 151 — Winch — Outer Bearing Bracket and Small Drum — Partially Disassembled

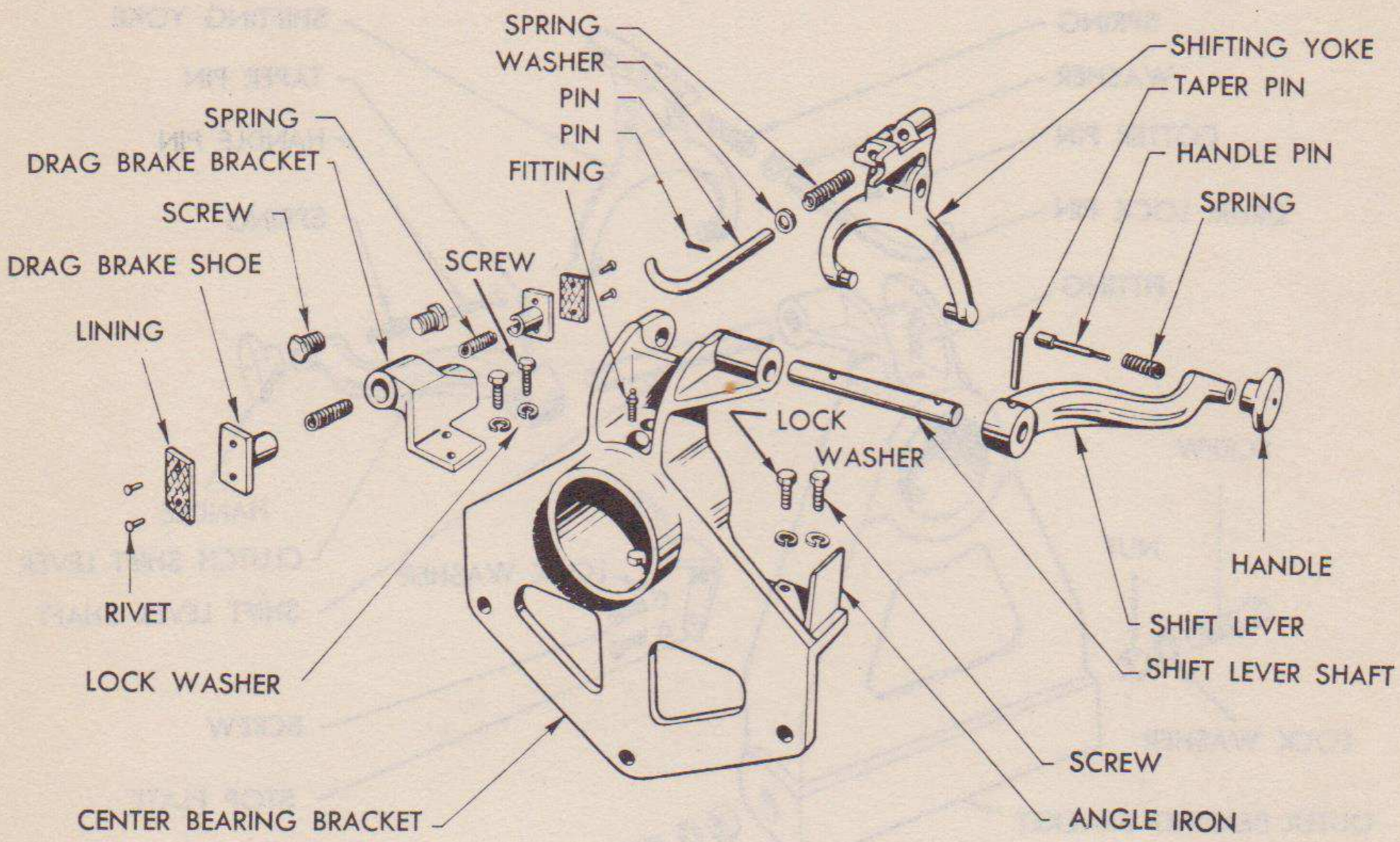


Figure 152 — Winch — Center Clutch and Bearing Bracket — Disassembled

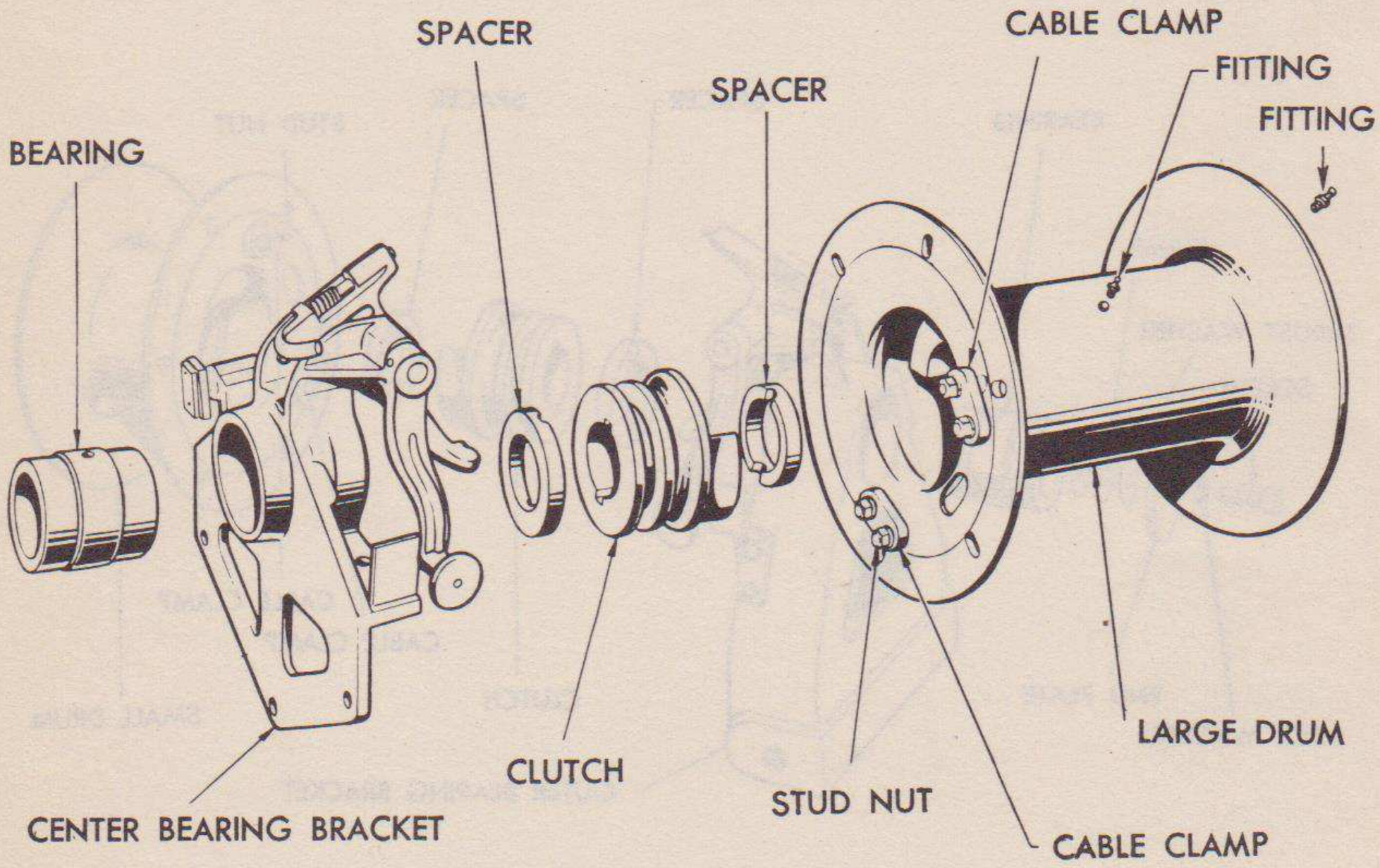
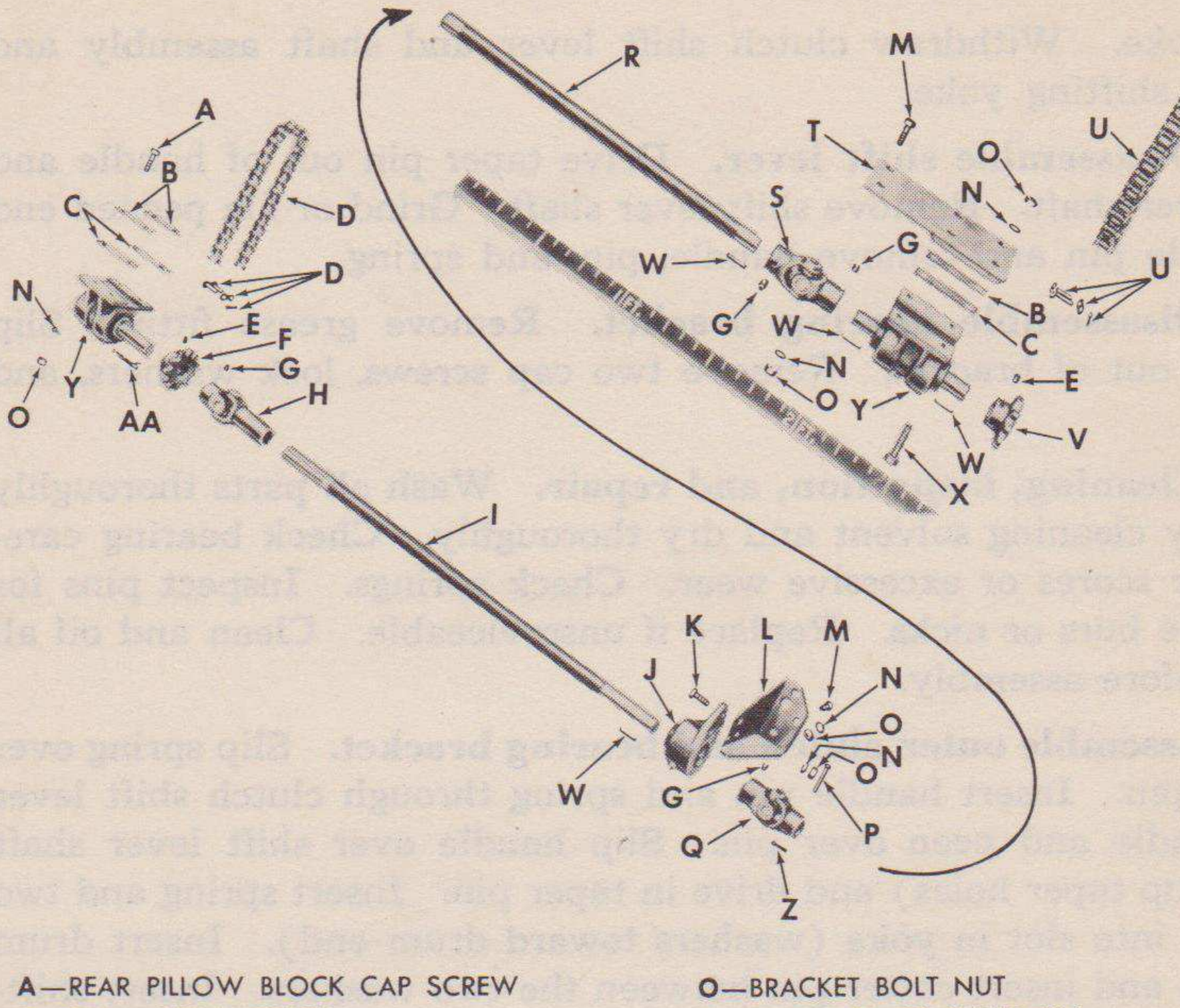


Figure 153 — Winch — Center Bearing Bracket and Large Drum — Partially Disassembled



A—REAR PILLOW BLOCK CAP SCREW
B—SHIM .052-IN. THICK
C—SHIM .031-IN. THICK
D—CHAIN (POWER TAKE-OFF TO REAR DRIVING SPROCKET)
E—REAR DRIVING SPROCKET SET SCREW
F—REAR DRIVING SPROCKET
G—REAR UNIVERSAL SLIP JOINT SET SCREW
H—REAR UNIVERSAL JOINT ASSEMBLY
I—REAR SHAFT
J—CENTER PILLOW BLOCK
K—BOLT
L—CENTER PILLOW BLOCK BRACKET
M—BRACKET BOLT
N—LOCK WASHER
O—BRACKET BOLT NUT
P—FRONT SHAFT SHEAR PIN
Q—CENTER UNIVERSAL JOINT ASSEMBLY
R—FRONT SHAFT
S—FRONT UNIVERSAL JOINT
T—FRONT PILLOW BLOCK SUPPORT
U—CHAIN (FRONT PILLOW BLOCK SPROCKET TO WINCH SPROCKET)
V—FRONT DRIVING SPROCKET
W—FRONT DRIVE SPROCKET KEY
X—FRONT PILLOW BLOCK CAP SCREW
Y—FRONT AND REAR PILLOW BLOCK ASSEMBLY
Z—COTTER PIN
AA—REAR SPROCKET KEY

RA PD 344641

Figure 154 — Winch — Propeller Shaft Drive Assembly — Disassembled

Remove socket-head set screw from front pillow block sprocket and pull off sprocket with puller. Remove key (repeat on sprocket on rear pillow block).

Section III

DISASSEMBLY, CLEANING, INSPECTION, REPAIR, AND ASSEMBLY OF SUBASSEMBLIES

124. OUTER CLUTCH AND BEARING BRACKET (figs. 150 and 151).

a. Disassemble drum lock. Remove cotter pin from drum lock pin. Remove drum lock pin, spring, and washer. Drive taper pin

from yoke. Withdraw clutch shift lever and shaft assembly and remove shifting yoke.

b. Disassemble shift lever. Drive taper pin out of handle and shift lever shaft. Remove shift lever shaft. Grind or file peened end of handle pin and remove handle, pin, and spring.

c. Disassemble bearing bracket. Remove grease fitting. Slip bearing out of bracket. Remove two cap screws, lock washers, and plate.

d. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent and dry thoroughly. Check bearing carefully for scores or excessive wear. Check springs. Inspect pins for excessive burs or nicks. Replace if unserviceable. Clean and oil all parts before assembly.

e. Assemble outer clutch and bearing bracket. Slip spring over handle pin. Insert handle pin and spring through clutch shift lever and handle and peen over pin. Slip handle over shift lever shaft (lining up taper holes) and drive in taper pin. Insert spring and two washers into slot in yoke (washers toward drum end). Insert drum lock pin and insert cotter pin between the two washers. Insert shifting yoke into bracket and press in shift lever shaft (lining up taper holes) and drive in taper pin. Install stop plate to bracket with two ⅜-inch cap screws and lock washers. Insert bearing in bracket, lining up slot in bearing with pin in bracket, and install grease fitting.

125. CENTER CLUTCH AND BEARING BRACKET (figs. 152 and 153).

a. Disassemble drum lock. Remove cotter pin from drum lock pin. Remove lock pin, spring, and washers. Drive taper pin from shifting yoke, and withdraw shift lever and shaft assembly and remove shifting yoke.

b. Disassemble shift lever. Drive taper pin out of handle and shift lever shaft. Remove shift lever shaft. Grind or file peened end of handle pin and remove handle, pin, and spring.

c. Disassemble drag brake. Remove two ⅜-inch cap screws and lock washers holding drag brake bracket in place. Remove drag brake bracket and clamp in vise. Remove hex-head screw from each side of drag brake bracket and remove brake shoe assembly and lining. Drill out rivets and remove lining.

d. Disassemble bearing bracket. Remove grease fitting. Slip bearing out of bracket. Remove two ⅜-inch cap screws, lock washers, and angle iron.

e. Cleaning, inspection, and repair. Wash all parts with dry cleaning solvent and dry thoroughly. Check bearings carefully for

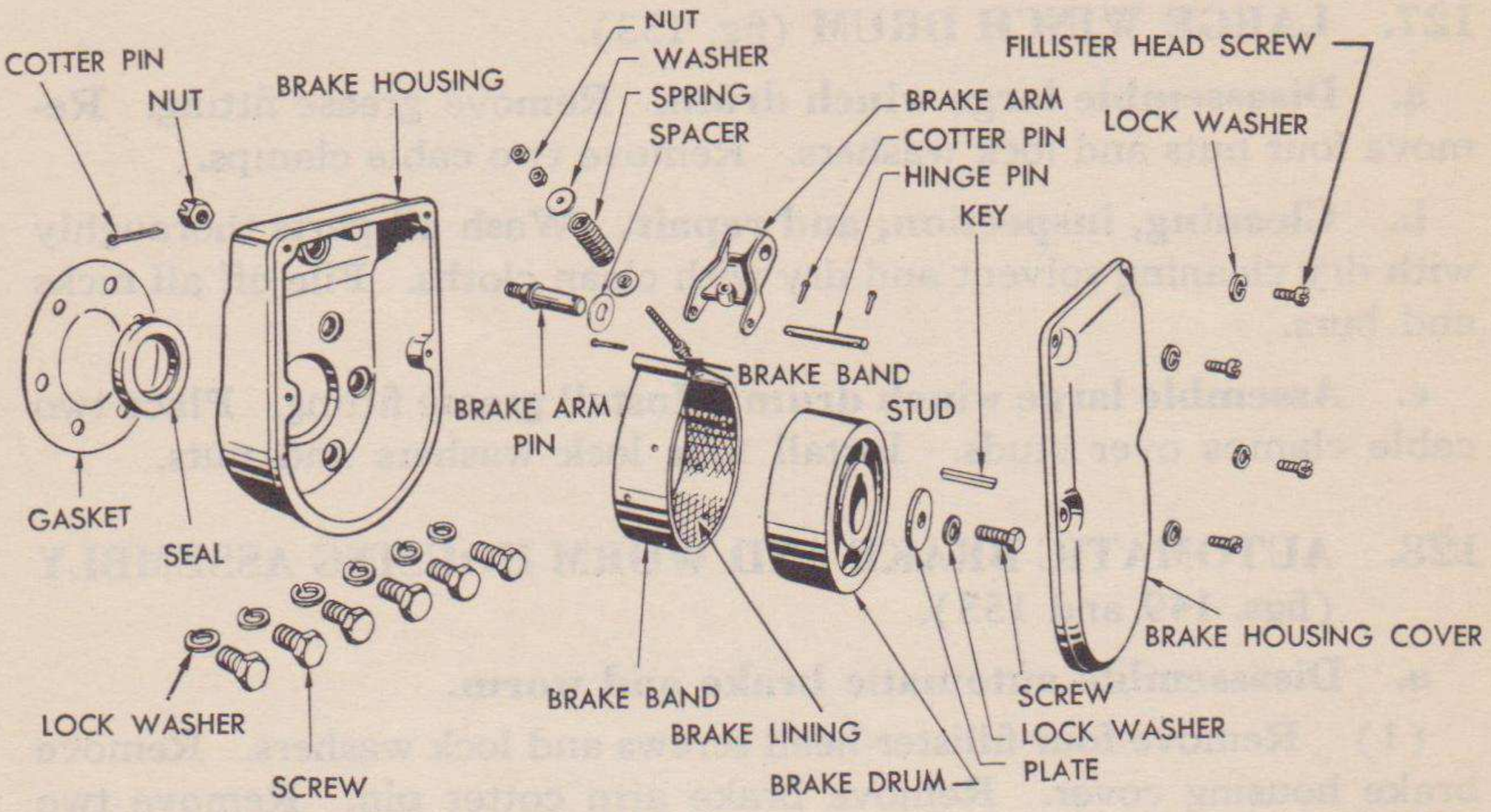


Figure 155 — Winch — Automatic Worm Brake — Disassembled

scores or excessive wear. Check springs. Inspect pins for excessive burs and nicks. Replace if unserviceable. Oil all parts.

f. Assemble center clutch and bearing bracket. Slip spring over handle pin. Insert handle pin and spring through shift lever and handle, and peen over end of pin. Slip handle over shift lever shaft (lining up taper holes), and drive in taper pin. Insert spring and two washers into slot in shifting yoke (washers toward drum end). Insert drum lock pin. Install cotter pin in hole between two washers. Insert shifting yoke into bracket and press in shift lever shaft (lining up taper holes) and drive in taper pin. Secure angle iron to bracket with two ⅜-inch cap screws and lock washers. Rivet new lining to each drag brake shoe. Insert spring into tubular end of each shoe. Insert assembly into bracket and install screw. Secure drag brake bracket to bearing bracket with two ⅜-inch cap screws and lock washers. Insert bearing in bracket, lining up slot in bearing with dowel pin in bracket. Install grease fitting.

126. SMALL WINCH DRUM (fig. 151).

a. Disassemble small winch drum. Remove four nuts and lock washers. Remove two cable clamps.

b. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent and dry with clean cloths. File off all nicks or burs.

c. Assemble small winch drum. Place two cable clamps over studs. Install four lock washers and nuts.

127. LARGE WINCH DRUM (fig. 153).

a. Disassemble large winch drum. Remove grease fitting. Remove four nuts and lock washers. Remove two cable clamps.

b. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent and dry with clean cloths. File off all nicks and burs.

c. Assemble large winch drum. Install grease fitting. Place two cable clamps over studs. Install four lock washers and nuts.

128. AUTOMATIC BRAKE AND WORM HOUSING ASSEMBLY (figs. 149 and 155).

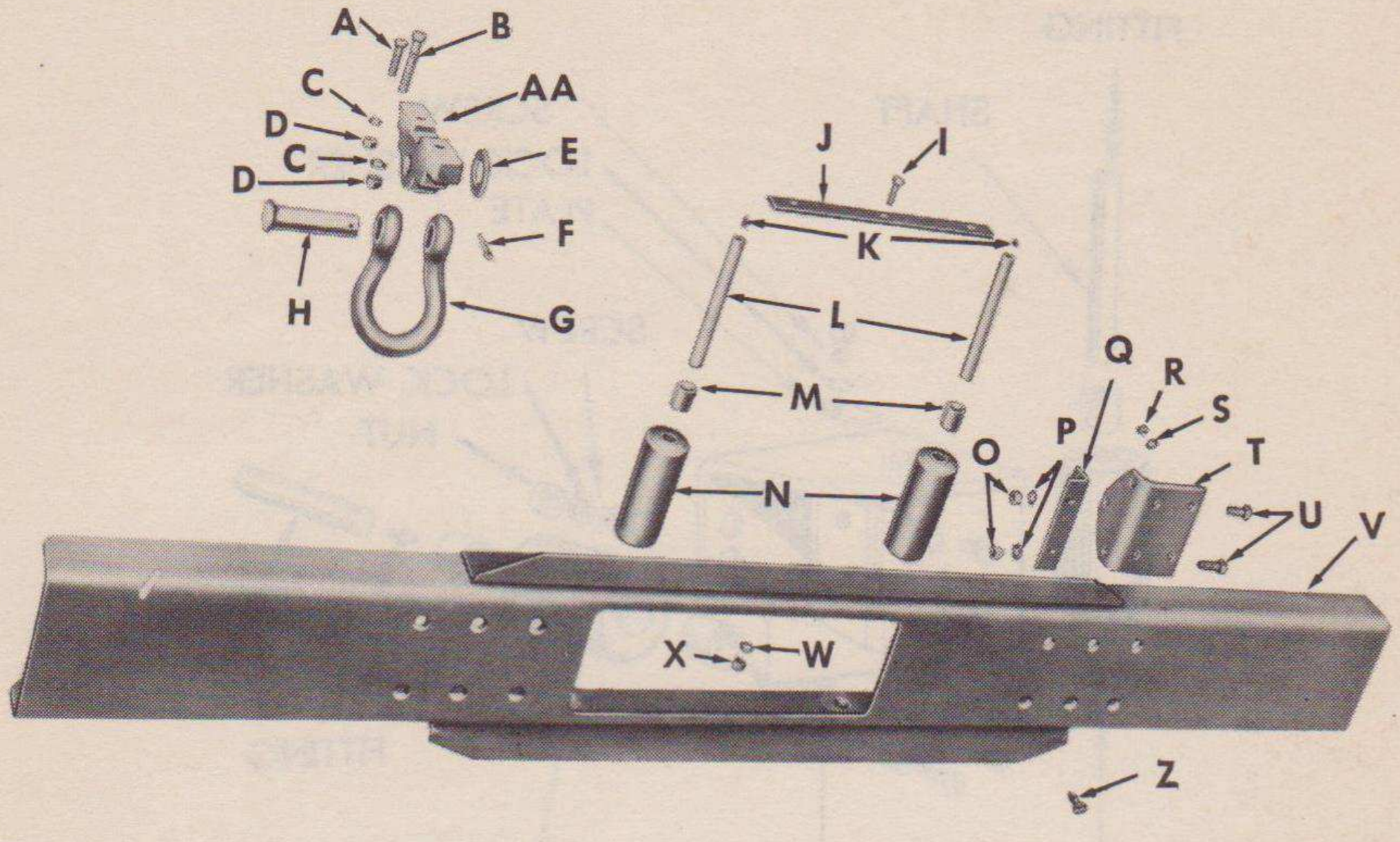
a. Disassemble automatic brake and worm.

(1) Remove four fillister-head screws and lock washers. Remove brake housing cover. Remove brake arm cotter pin. Remove two nuts, washers, and spring from brake band stud. Slide arm off shaft and brake band off drum. Remove two cotter pins and hinge pin from brake band and arm assembly. Slip band stud out of arm. Drill out rivets and remove brake lining. Mark position of remaining two nuts on brake band stud and remove nuts. Remove ½-inch cap screw, lock washer, and plate from end of worm gear shaft. Remove brake drum with puller. Remove brake drum key. Remove six ⅝-inch cap screws and lock washers from housing. Remove seal and gasket. Remove brake arm shaft pin, cotter pin and nut. Remove brake arm shaft.

(2) Remove socket-head set screw from sprocket. Remove ½-inch cap screw, lock washer, and plate from end of worm shaft. Remove sprocket with puller. Remove six ⅝-inch cap screws and lock washers, and remove end cover and gasket. Press out worm shaft and remove seal and pull off bearings. Remove oil level plug.

b. Cleaning, inspection, and repair. Wash all parts thoroughly with dry cleaning solvent. Inspect housing for cracks or distortion. Wipe all parts dry with clean cloths. Check bearings carefully for damaged or broken balls. Examine oil seals. Inspect spring. Inspect gears for cracks, excess wear, and roughness. Replace all unserviceable parts. Clean and oil all parts thoroughly before assembly.

c. Assemble worm gear housing. Press front bearing on worm shaft. Press rear bearing on worm shaft. Place new gasket on worm housing cover, insert seal in cover, and slip cover assembly over worm shaft. Insert key in keyway and press on sprocket. Install socket-head set screw. Insert shaft assembly into worm gear housing. Install six ⅝-inch cap screws and lock washers. Slip ½-inch lock washer and plate over cap screw and install cap screw in end of worm shaft. Install drain plug and level plug.



A—SCREW
B—SCREW
C—WASHER
D—NUT
E—SPACER
F—COTTER PIN
G—LINK
H—LINK PIN
I—SCREW
J—LOCK PLATE
K—FITTING
L—SHAFT
M—BUSHING
N—ROLLER
O—NUT
P—WASHER
Q—BRACKET
R—NUT
S—WASHER
T—BRACKET
U—SCREW
V—BUMPER
W—WASHER
X—NUT
Z—SCREW
AA—BRACKET

RA PD 334543

Figure 156 — Winch — Bumper and Roller Assembly — Disassembled

d. Assemble brake and brake housing. Press brake arm shaft pin into housing. Install hexagonal nut and lock with cotter pin. Insert new oil seal in brake housing. Place gasket in place on worm gear housing. Fasten brake housing to worm housing with six $\frac{5}{8}$-inch cap screws and lock washers. Insert key in keyway and press brake drum on shaft. Install plate, lock washer, and $\frac{1}{2}$-inch cap screw in end of worm shaft. Rivet new lining to brake band. Run two nuts on brake band stud to position marked at disassembly. Slip arm over stud. Insert hinge pin through brake band and brake arm. Install cotter pin in each end of hinge pin. Slip washer, spring, and washer over stud and start nut on stud. Slip brake arm and band assembly into place over shaft and drum. Tighten nut on brake band stud so that there is a slight tension on spring and install second nut, tightening against the first nut. Run two lower nuts up against brake arm and tighten against each other.

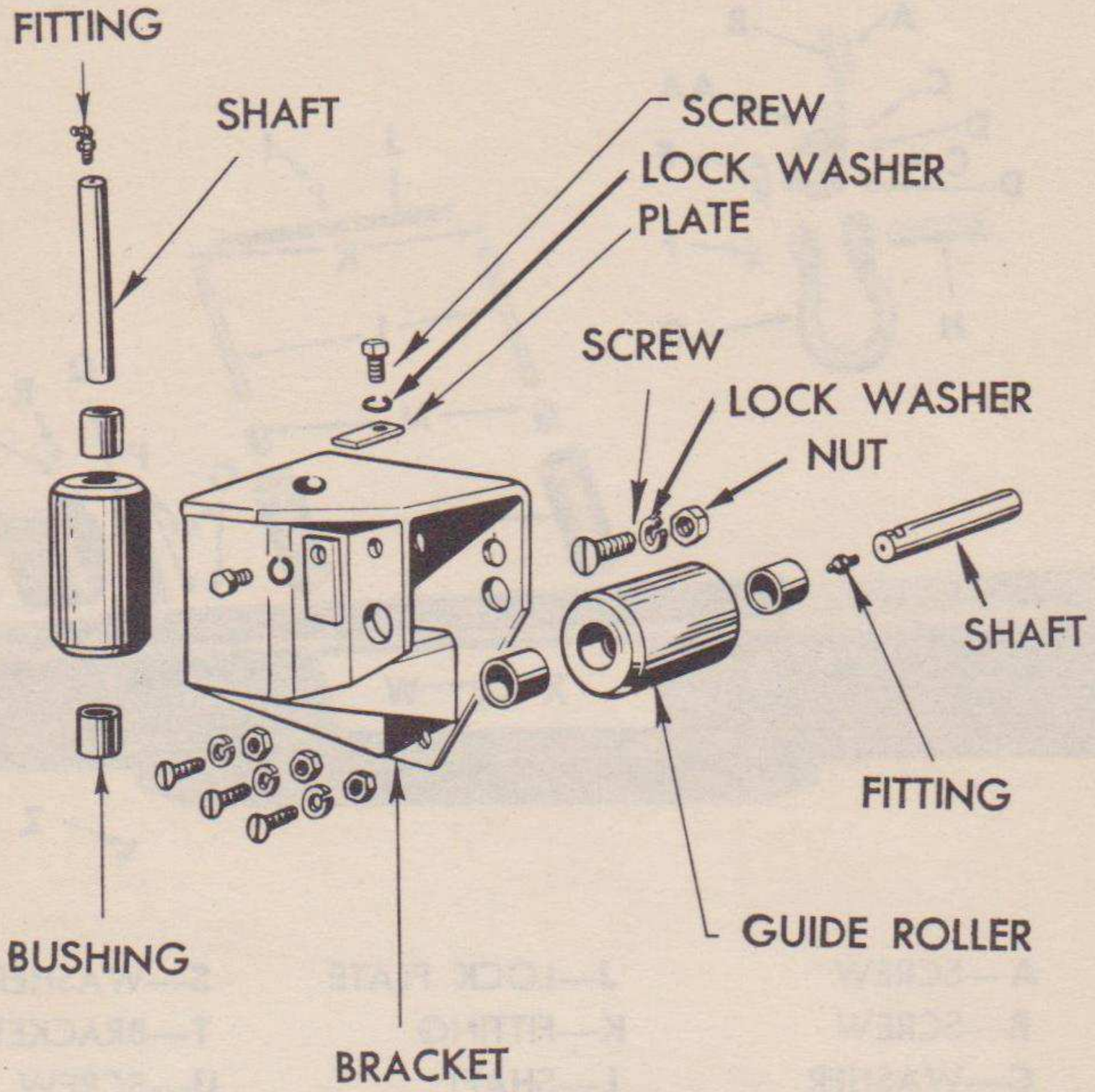


Figure 157 — Winch — Rear Cable Guide Roller Assembly — Disassembled

129. WINCH FRAME AND ROLLER ASSEMBLY (fig. 148).

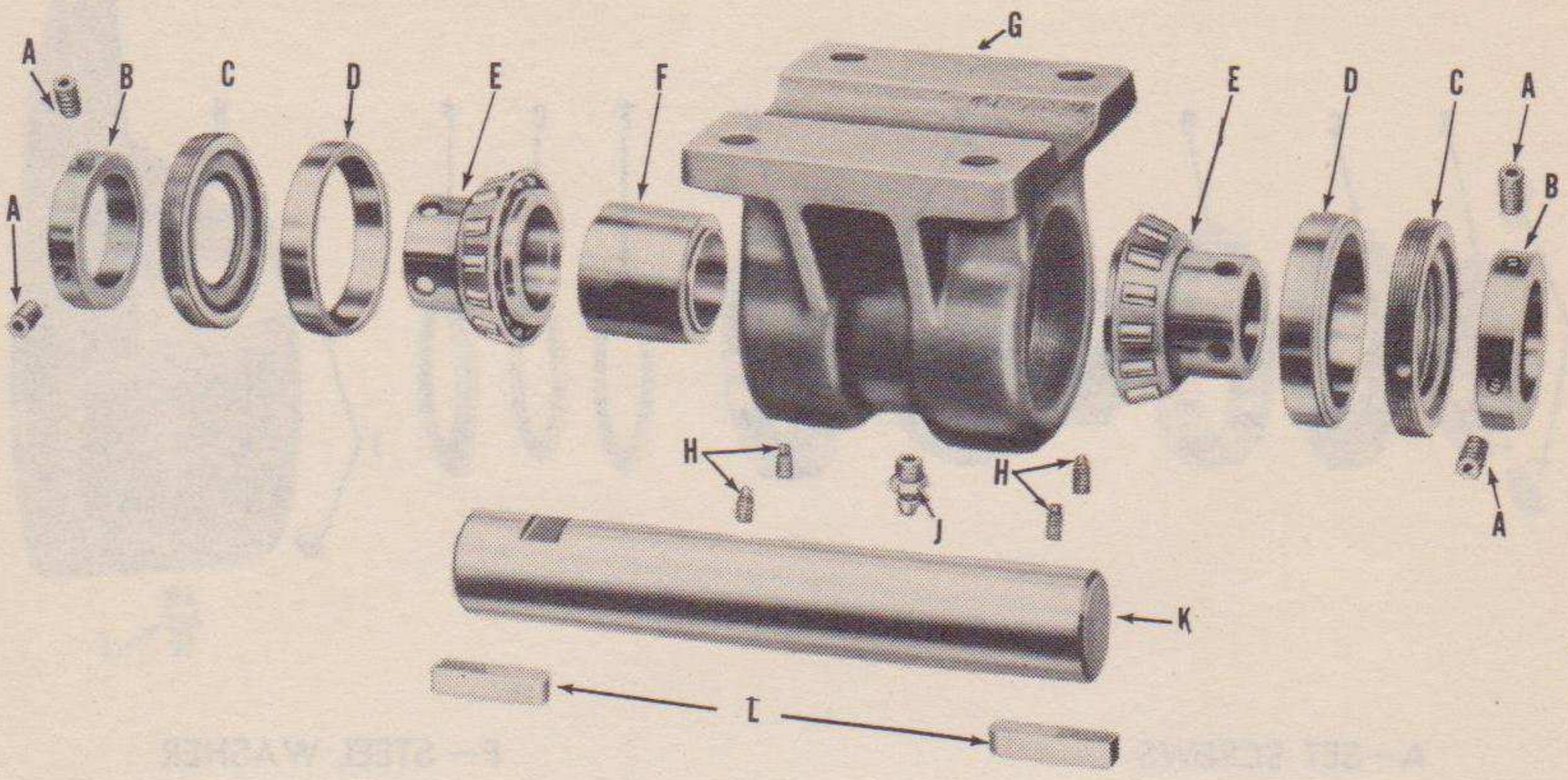
a. Remove angles. Remove six ⅝-inch nuts, lock washers, and cap screws holding angle irons to frame. Remove angle irons.

b. Remove front horizontal rollers. Remove ½-inch cap screw, washer, and plate from front of winch frame. Slide out shaft from upper and lower roller. Remove two grease fittings from each shaft. Press bushings out of rollers, if unserviceable.

c. Remove rear roller. Remove 1⅛-inch nut and lock washer. Remove ½-inch cap screw, lock washer, and plate. Remove shaft. Remove grease fitting. Press out bushings, if unserviceable.

d. Cleaning, inspection, and repair. Wash all parts in dry cleaning solvent and dry thoroughly. Check bushings, rollers, and shafts carefully for nicks, wear, or out-of-round condition. Remove all nicks or burs with a fine file. Clean and oil all parts before assembly.

e. Install rear roller. Press bushing (if required) into each end of roller. Insert grease fitting in end of shaft. Install 1⅛-inch lock washer and nut on opposite end of shaft. Insert roller assembly between ears of winch frame. Insert shaft with grease fitting toward



A—SET SCREWS
B—COLLAR
C—COVER
D—CUP
E—CONE AND ROLLER
F—SPACER
G—HOUSING
H—COVER SCREWS
J—LUBRICANT FITTING
K—PILLOW BLOCK SHAFT
L—KEYS

RA PD 334541

Figure 158 — Winch — Front and Rear Pillow Block — Disassembled

outside. With slot in shaft in horizontal position, install lock plate, lock washer, and cap screw.

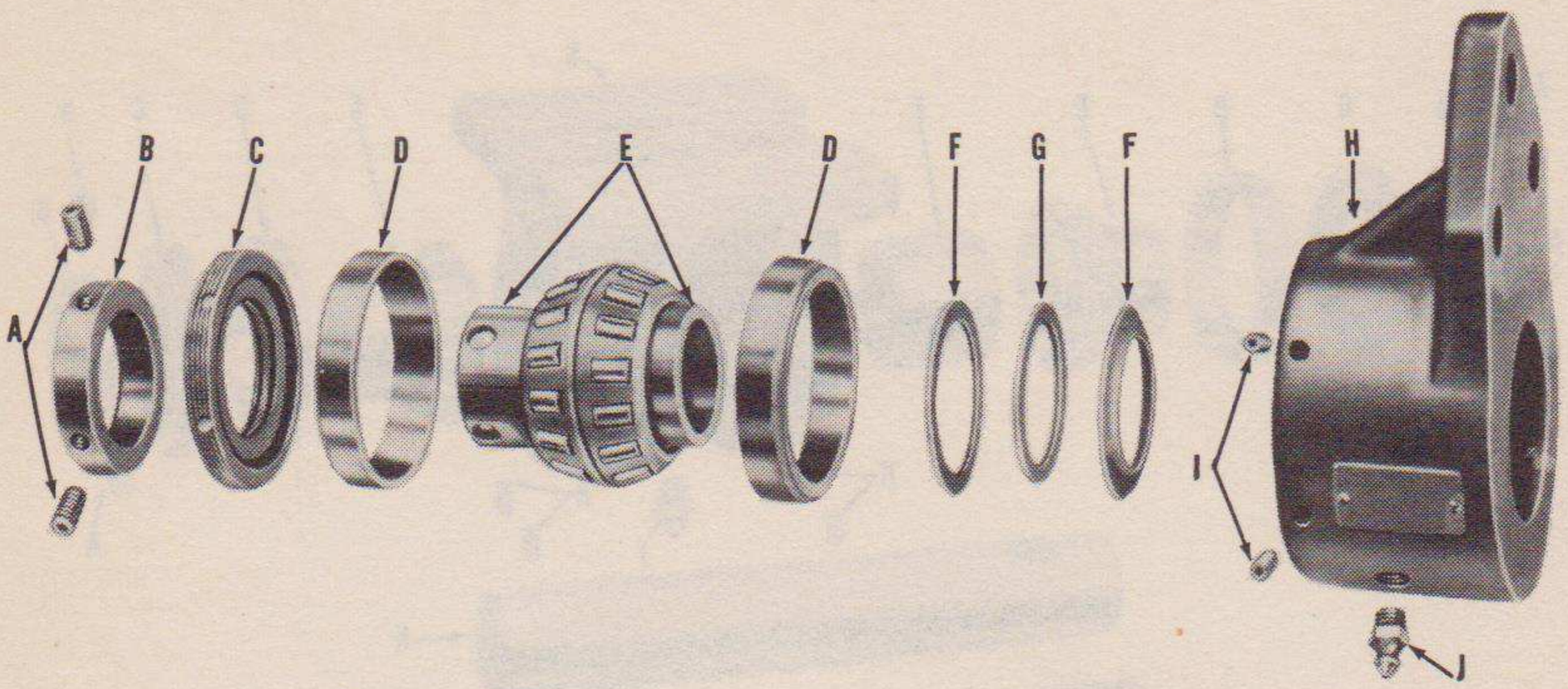
f. Install front horizontal rollers. Press one bushing in each end of each roller, if required. Insert one grease fitting in each end of each shaft. Put rollers in place and insert shafts through brackets and rollers so that slots in shaft are in horizontal position and facing each other. Insert lock plate, lock washer, and cap screw.

g. Install angles. With two 5/8-inch cap screws, lock washers, and nuts for each angle, install one angle on left rear corner of winch frame, one on left front corner of frame and one just to the right of front rollers (fig. 148).

130. BUMPER AND TOWING SHACKLE (fig. 156).

a. Disassemble towing shackles. Remove cotter pin and washer. Knock out pin and remove shackle (repeat on opposite shackle).

b. Disassemble front vertical roller. Remove three nuts, lock washers, and cap screws from top of bumper. Remove lock plate. Drive shaft out of each roller. Remove grease fitting from each shaft. Remove two rollers and press out bushings.



A—SET SCREWS
B—COLLAR
C—COVER
D—CUP
E—CONE AND ROLLER ASSEMBLY
F—STEEL WASHER
G—FIBRE WASHER
H—HOUSING
I—COVER SET SCREWS
J—LUBRICANT FITTING

RA PD 334540

Figure 159 — Winch — Center Pillow Block — Disassembled

c. Cleaning, inspection, and repair. Wash all parts in dry cleaning solvent and dry thoroughly. Check bushings, rollers, and shafts carefully for nicks, wear, or out-of-round condition. Remove all nicks or burs with a fine file. Clean and oil all parts before assembly.

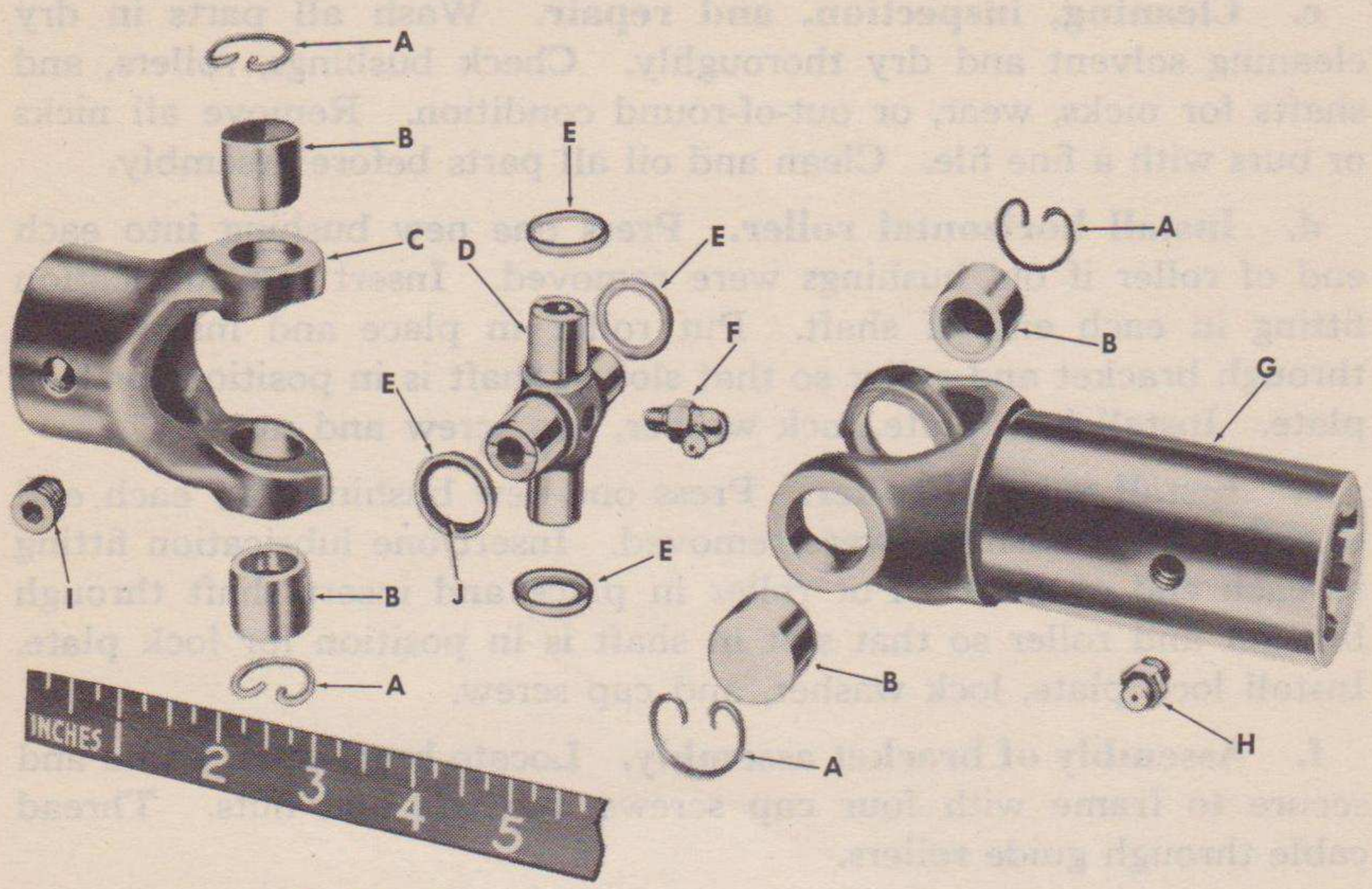
d. Assemble front vertical rollers. Press one bushing into each end of each roller. Insert grease fitting in end of shaft. Put rollers in place and insert shafts through bumper channel and rollers so that slots in shaft are parallel and facing each other. Insert lock plate, cap screws, lock washers, and nuts.

e. Assemble towing shackles. Slip shackle over block, insert shackle pin through both block and shackle. Slip washer over pin and insert cotter pin. Repeat on opposite shackle.

131. REAR CABLE GUIDE ROLLER ASSEMBLY (fig. 157).

a. Remove bracket assembly. Remove cable through guide rollers onto drum. Remove four nuts, washers and cap screws which secure cable guide roller assembly bracket to the frame located under the right front fender, immediately back of right front wheel of vehicle. Remove bracket assembly.

b. Remove rollers. Remove cap screws, washers and plates which secure roller shafts in place. Slide out shaft from horizontal and vertical roller. Remove lubrication fitting from each shaft. Press bushings out of rollers if unserviceable.



A—SNAP RING
B—BEARING
C—PLAIN YOKE
D—CROSS
E—CORK WASHER RETAINER
F—LUBRICATOR FITTING
G—REAR SPLINED YOKE
H—LUBRICATION FITTING
I—SET SCREW
J—CORK WASHER

RA PD 353093

Figure 160 — Winch — Universal Joint — Disassembled

133. CENTER PILLOW BLOCK (fig. 159).

a. Disassembly. Remove two socket-head screws from collar on end of pillow block. Remove collar. Remove two socket-head set screws from pillow block. With a spanner wrench, remove adjusting nut. Press out cup and bearing assembly. With a puller, remove remaining bearing cup. Remove spacers and seal. Remove grease fitting.

b. Cleaning, inspection, and repair. Wash all parts in dry cleaning solvent and dry thoroughly. Check bearings carefully for damaged or out-of-round rollers. Examine and clean up all threads on adjusting nuts. Clean and oil all parts before assembly.

c. Assembly. Install grease fitting. Insert seal and spacers in pillow block housing. Press bearing cup in place. Insert bearing cone assembly (short end of tube first). Press in second bearing cup. Screw adjusting nut into housing, and adjust bearings so that they turn freely with no perceptible end play. Install two socket-head set screws in pillow block. Slip collar over end of bearing tubing, lining up holes in each and install two socket-head set screws.

c. Cleaning, inspection, and repair. Wash all parts in dry cleaning solvent and dry thoroughly. Check bushings, rollers, and shafts for nicks, wear, or out-of-round condition. Remove all nicks or burs with a fine file. Clean and oil all parts before assembly.

d. Install horizontal roller. Press one new bushing into each end of roller if old bushings were removed. Insert one lubrication fitting in each end of shaft. Put roller in place and insert shaft through bracket and roller so that slot in shaft is in position for lock plate. Install lock plate, lock washer, cap screw and nut.

e. Install vertical roller. Press one new bushing into each end of roller if old bushings were removed. Insert one lubrication fitting in each end of shaft. Put roller in place and insert shaft through bracket and roller so that slot in shaft is in position for lock plate. Install lock plate, lock washer, and cap screw.

f. Assembly of bracket assembly. Locate bracket on frame and secure to frame with four cap screws, washers and nuts. Thread cable through guide rollers.

132. FRONT AND REAR PILLOW BLOCKS (fig. 158).

a. Disassembly. NOTE: *Front and rear pillow block construction is identical. Use same operation on rear pillow block.* Remove socket-head set screw from sprocket. Using puller, remove sprocket. Remove key. Remove two socket-head set screws from each collar on each end of pillow block. Remove two collars. Remove two set screws from each end of pillow block. With spanner wrench, remove adjusting nut from each end of pillow block. Remove propeller shaft and bearing assembly. Press bearings and spacer off propeller shaft. Remove lubricant fitting.

b. Cleaning, inspection, and repair. Wash all parts in dry cleaning solvent and dry thoroughly. Check bearings carefully for damaged or out-of-round rollers. Examine and clean up all threads on adjusting nuts. Clean and oil all parts before assembly.

c. Assembly. Install grease fitting. Press bearing cup into one end of housing. Press one bearing cone assembly on to shaft, with large end toward center of shaft. Slip spacer over opposite end of shaft, and press on second cone assembly. Insert assembly into pillow block. Press in second bearing cup, and balance assembly in housing. Screw in adjusting nut in each side of pillow block, and adjust bearings so that they turn freely with no perceptible end play. Install two socket-head set screws on each end of pillow block housing. Slip collar over each end of bearing tubing, lining up holes in each and install two socket-head set screws in each collar. Insert key in sprocket end of shaft. Press on sprocket so that flat on shaft lines up with hole in sprocket. Install socket-head set screw.

134. UNIVERSAL JOINT (fig. 160).

a. Disassembly.

(1) Pinch ends of snap ring together and remove with a pair of pliers. Repeat on all four snap rings. NOTE: *If a ring does not readily snap out of the groove, tap the end of the bearing lightly to relieve pressure against the ring.*

(2) Tap on the end of the yoke bearing assembly until the opposite bearing is pushed out of the yoke. Turn assembly over and drive the first bearing back out of its lug by driving on the exposed end of the journal. NOTE: *Use a soft round drift with a flat face about* $\frac{1}{32}$ *inch smaller in diameter than the hole in the yoke.*

(3) Repeat the above operation for the other two bearings. Lift out the journal assembly by sliding to one side and tilting over the top of the yoke lug. Remove four thrust collars (consisting of cork washer retainers and cork washers) from journal. Remove two grease fittings.

b. Cleaning, inspection, and repair. Wash all parts in dry cleaning solvent and dry thoroughly. Inspect journals carefully; remove all burs or rough spots on bearing surfaces and the end of journal trunnions. Check tension of snap rings. Clean and oil all parts before assembly.

c. Assembly. Insert grease fitting in journal cross and yoke. Slip one thrust collar over each trunnion of the journal cross. Insert one trunnion of the journal cross into the bearing hole in the lug of the yoke from the inside between the lugs, and tilt until journal trunnion will enter the opposite hole in the lug. Insert bearings from the outside of the yoke, pressing them into place or tapping with a soft drift. Repeat on opposite yoke. Install snap ring. NOTE: *If joint appears to bind when assembled, tap the lugs lightly with a hammer which will relieve any pressure of the bearing on the end of the journal.*

Section IV

ASSEMBLY, TEST, AND DATA

135. PRELIMINARY INSTRUCTIONS.

a. Clean all units thoroughly and check all parts. Wash all subassemblies with dry cleaning solvent and dry thoroughly. Remove all traces of dirt or metal from inside of gear housing and cover. After coating all gears and bearings with light oil, rotate or slide on shafts to prove free operation.

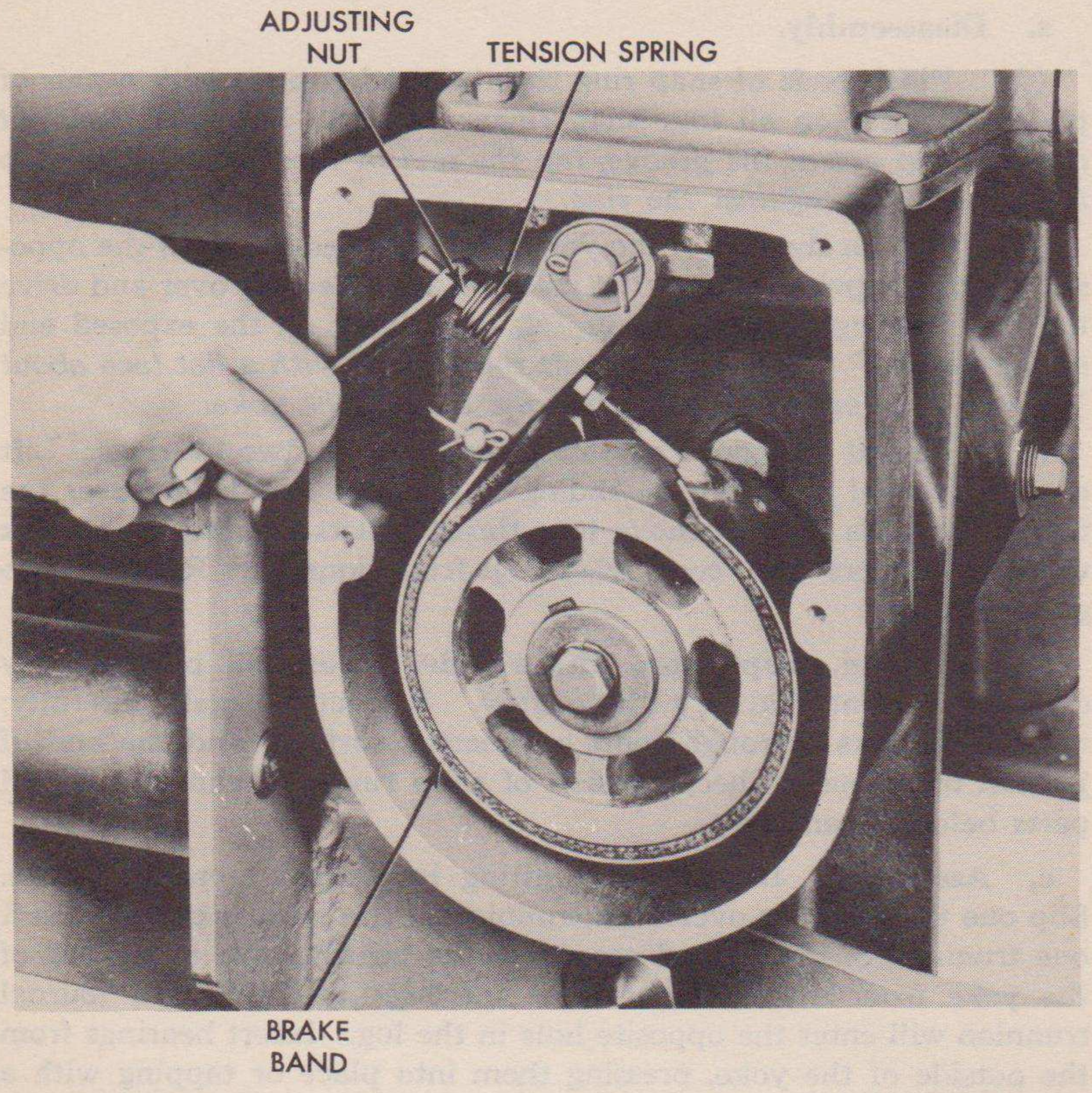


Figure 161 — Winch — Adjusting Automatic Brake

136. ASSEMBLY.

a. Assemble propeller shaft. Insert key in front pillow block shaft. Press front universal joint on pillow block shaft. Insert socket-head set screw. Insert key in front end of front propeller shaft and tap shaft into universal joint. Insert set screw. Slip front end of rear propeller shaft through center pillow block (hub end first). Install key and tap on center universal joint. Install set screw. Slip front yoke of center universal joint over rear end of front propeller shaft, lining up holes. Insert shear pin and cotter pin. Slip rear end of rear universal joint over shaft of rear pillow block. Install socket-head set screw.

b. Install gear housing. Set gear housing in place on winch frame. Insert two 1⅛-inch cap screws, lock washers, and nuts. Do not tighten nuts securely.

c. Install shaft and drum assemblies. Insert gear key in keyway on winch shaft. Press gear on shaft, noting original location. Slide bushing over each end of shaft with flange toward gear. Slip spacer over shaft. Place key in capstan keyway of shaft. Press capstan on shaft. Slip lock washer, plate, and spacer over cap screw and insert cap screw into tapped hole in capstan end of shaft. Slip large drum over shaft (cable clamp end last). Slip spacer over shaft with groove away from drum. Insert two clutch keys in shaft. With yoke engaged in slot of clutch, slip clutch, spacer, and center frame bearing bracket assembly over shaft and into place. Slip small drum over shaft (cable clamp end last). Slip spacer over shaft with groove away from drum. Insert two keys in left end of shaft. With yoke engaged in slot of clutch, slip clutch, spacer, and end bracket over shaft and into place. Insert two 1⅛-inch cap screws, lock washers, and nuts. Tighten nuts securely, also similar nuts on base of gear housing. Slip lock washer, plate, and spacers (spacers were tagged at disassembly) over cap screw. Install cap screw in end of winch shaft. Install two new gaskets on gear housing. Install cover by securing with four ⅝-inch cap screws and lock washers, and four ⅜-inch cap screws, lock washers, and nuts.

137. TEST.

a. Rotary and power test. Fill winch gear housing with proper grade and quantity of lubricant (see lubrication order), install level plug and filler plug. Apply lubricant to all grease fittings and give rotary test. Attach worm shaft to power source and test. Any undue noise will indicate faulty assembly which must be checked step by step. If unit operates quietly and smoothly, install in vehicle.

b. Automatic brake adjustment (fig. 161). The automatic brake should be adjusted from time to time and the tension on the spring controlling the brake band should be adjusted in accordance with the load being handled. The brake should have a slight tension on the spring, sufficiently tight to hold the load when suspended on the winch.

c. Chain adjustment. In this type of chain, considerable slack is permissible as the links will not slip over the teeth on the sprocket

even when extremely loose. Adjustments can be made by adding or removing shims between pillow blocks and frame.

138. DATA.

Diameter of propeller shaft	1¼ in.
Number of splines at slip joint	6
Shear pin diameter	⅜ in.
Automatic brake adjustment	Adjust to slight drag
Automatic brake adjustment (method)	Nut and lock nut on stud
Large Winch Drum	
Width	17¼ in.
Diameter	7⅝ in.
Flange diameter	16 in.
Small Winch Drum	
Width	8⅛ in.
Diameter	7⅝ in.
Flange diameter	16 in.
Center line of winch to center line of worm gear sprocket	9 3/16 in.
Center line of winch to center line of front axle	37 13/16 in.

CHAPTER 14

HOIST POWER TAKE-OFF

Section I

DESCRIPTION AND DATA

139. DESCRIPTION AND OPERATION.

a. The bridge erection vehicle is equipped with power take-off units, mounted to each side of the transmission. The left unit transfers power from the transmission to the winch, and the right unit transfers power to the hydraulic pump for the rear unloading derrick. The right unit differs from the left to the extent that the adapter gear and shaft assembly (as shown in figure 162, parts A, B, C, D, E, F, and G) is not included as part of this unit. The crane vehicle is equipped with the left power take-off unit only, which transfers power to the front mounted winch controlling the raising and lowering of the crane.

140. DATA.

Make	Heil
Model	B-356, B-357
Bearings	
Drive shaft (front) (ball)	N.D. 1207
Drive shaft (rear) (ball)	N.D. E207
Intermediate gear (straight roller)	Hyatt 94328
Double idler gear (straight roller)	Hyatt 94532
Adapter idler gear (straight roller)	Hyatt 94328

Section II

DISASSEMBLY INTO SUBASSEMBLIES

141. PRELIMINARY INSTRUCTIONS.

a. Remove power take-off. Refer to TM 9-813 for instructions in removing power take-off.

b. Cleaning. Remove all foreign material from the exterior of the power take-off with a wire brush and putty knife. Place the unit in a container of dry cleaning solvent and wash thoroughly. Dry with a clean cloth. NOTE: *As disassembly proceeds, clean all parts and wrap in paper or cloth.*

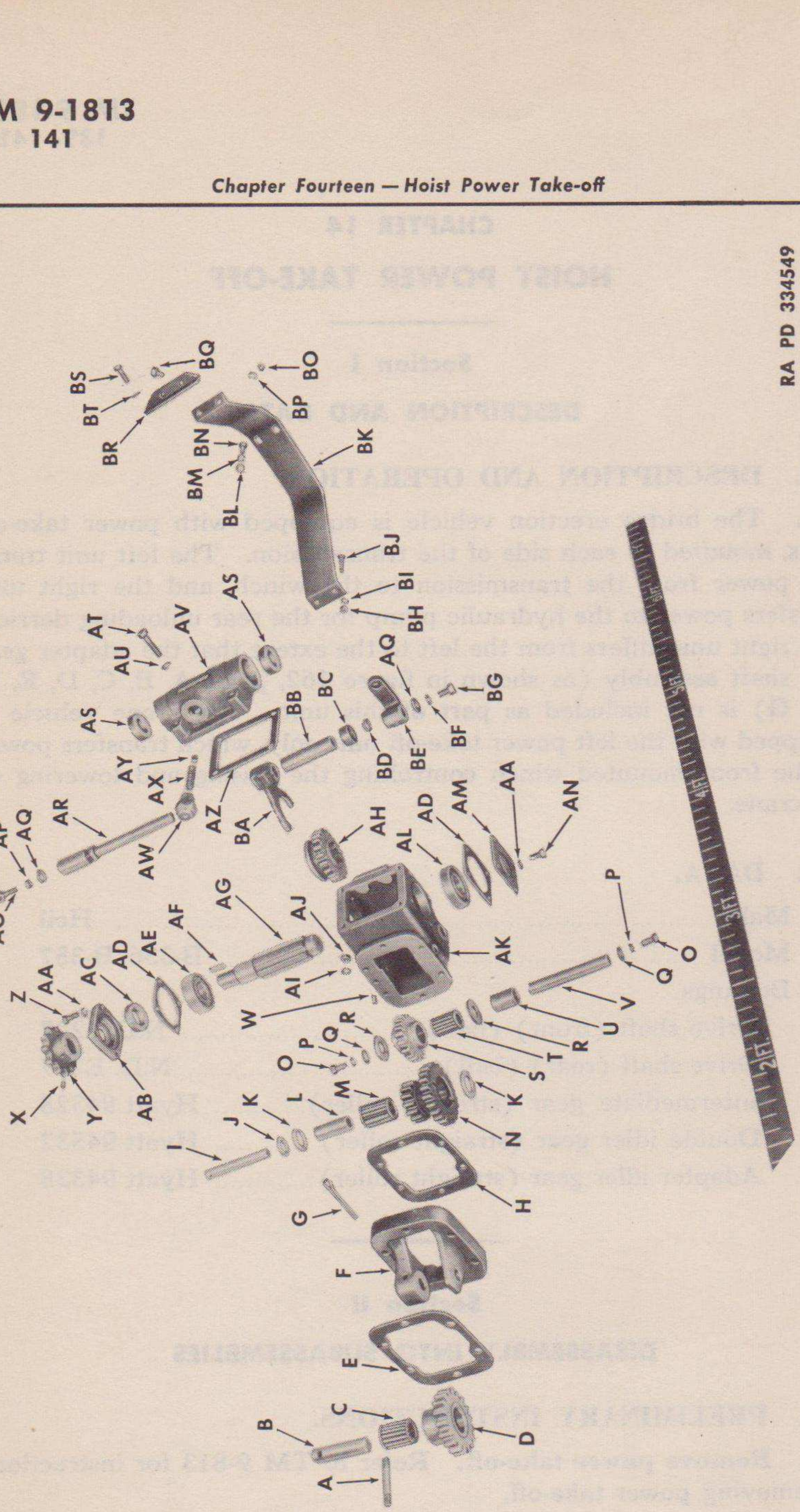


Figure 162 — Power Take-off (Left Unit) — Disassembled

A — ADAPTER STUD
B — ADAPTER IDLER GEAR SHAFT
C — ADAPTER IDLER GEAR ROLLER BEARING
D — ADAPTER IDLER GEAR
E — ADAPTER TO TRANSMISSION GASKET
F — ADAPTER HOUSING
G — ADAPTER IDLER GEAR SHAFT COTTER PIN
H — POWER TAKE-OFF TO ADAPTER GASKET
I — DOUBLE IDLER GEAR SHAFT
J — DOUBLE IDLER GEAR SLEEVE WASHER
K — DOUBLE IDLER GEAR BEARING SPACER WASHER
L — DOUBLE IDLER GEAR BEARING SLEEVE
M — DOUBLE IDLER GEAR ROLLER BEARING
N — DOUBLE IDLER GEAR
O — INTERMEDIATE GEAR RETAINING SCREW
P — INTERMEDIATE GEAR RETAINING SCREW LOCK WASHER
Q — INTERMEDIATE GEAR RETAINING SCREW FLAT WASHER
R — INTERMEDIATE GEAR BEARING WASHER
S — INTERMEDIATE GEAR
T — INTERMEDIATE GEAR ROLLER BEARING
U — INTERMEDIATE GEAR SPACER SLEEVE
V — INTERMEDIATE GEAR SHAFT
W — DOUBLE IDLER GEAR SHAFT SOCKET TYPE SET SCREW
X — DRIVE SHAFT SPROCKET SOCKET TYPE SET SCREW
Y — DRIVE SHAFT SPROCKET
Z — DRIVE SHAFT REAR BEARING COVER SCREW

AA — DRIVE SHAFT REAR BEARING COVER SCREW LOCK WASHER
AB — DRIVE SHAFT REAR BEARING COVER
AC — DRIVE SHAFT REAR BEARING SEAL
AD — DRIVE SHAFT BEARING COVER GASKET
AE — DRIVE SHAFT REAR BEARING
AF — DRIVE SHAFT SPROCKET KEY
AG — DRIVE SHAFT
AH — DRIVE SHAFT SLIDING GEAR
AI — TRANSMISSION ADAPTER STUD LOCK WASHER
AJ — TRANSMISSION ADAPTER STUD NUT
AK — WINCH POWER TAKE-OFF HOUSING
AL — DRIVE SHAFT FORWARD BEARING
AM — DRIVE SHAFT FORWARD BEARING COVER PLATE
AN — DRIVE SHAFT COVER PLATE SCREW
AO — SHIFTER SHAFT EYE BOLT
AP — SHIFTER SHAFT EYE BOLT LOCK NUT
AQ — SHIFTER SHAFT FLAT WASHER
AR — SHIFTER SHAFT
AS — SHIFTER COVER SEAL
AT — SHIFTER COVER CAP SCREW
AU — SHIFTER COVER CAP SCREW LOCK WASHER
AV — SHIFTER COVER
AW — SHIFTER YOKE LOCK SPRING CAP
AX — SHIFTER YOKE LOCK SPRING
AY — SHIFTER YOKE LOCK BALL
AZ — SHIFTER COVER ASSEMBLY GASKET

BA — SHIFTER YOKE
BB — SHIFTER SHAFT SLEEVE
BC — SHIFTER SHAFT SLEEVE SPACER COLLAR
BD — SHIFTER SHAFT SLEEVE SPACER PACKING RING
BE — SHIFTER SHAFT ARM
BF — SHIFTER ARM RETAINING SCREW LOCK WASHER
BG — SHIFTER ARM RETAINING SCREW
BH — POWER TAKE-OFF STRAP CONNECTING NUT
BI — POWER TAKE-OFF CONNECTING LOCK WASHER
BJ — POWER TAKE-OFF STRAP CONNECTING BOLT
BK — POWER TAKE-OFF STRAP
BL — POWER TAKE-OFF HOUSING FLAT WASHER
BM — POWER TAKE-OFF HOUSING LOCK WASHER
BN — POWER TAKE-OFF HOUSING CAP SCREW
BO — POWER TAKE-OFF STRAP BRACKET CONNECTING NUT
BP — POWER TAKE-OFF STRAP BRACKET CONNECTING LOCK WASHER
BQ — POWER TAKE-OFF STRAP ANGLE CONNECTING BOLT
BR — BINDING STRAP ANGLE
BS — ANGLE CAP SCREW
BT — ANGLE LOCK WASHER

RA PD 334549D

Legend for Figure 162

142. DISASSEMBLY OF POWER TAKE-OFF (LEFT UNIT) (fig. 162).

a. Remove gaskets. Remove any gasket which adheres to the mounting surfaces. NOTE: *If replacement gaskets are not available, do not destroy these gaskets. Their thickness determines the backlash of the gears.*

b. Remove shifter yoke assembly. Remove four cap screws (AT) and lock washers from shifter cover (AV). Remove shifter yoke assembly.

c. Remove double idler shaft and gear. Remove the set screw from the double idler gear shaft (I) and tap the shaft from the housing (AK) with a small drift. Remove sleeve and spacer washers. Remove the double idler gear (N), gear roller bearing (M), and bearing sleeve (L) from the housing.

d. Remove intermediate gear, shaft, and bearing. Remove retaining screws (O) and lock washers (P) from each end of the intermediate gear shaft (V). Tap the shaft from the housing with a drift. Remove the intermediate gear roller bearing (T), spacer sleeve (U), bearing washers (R), and the gear from the housing.

e. Remove drive shaft. Remove four cap screws and lock washers and remove drive shaft front bearing cover plate (AM). Remove four cap screws and lock washers and remove drive shaft rear bearing cover (AB). Tap the drive shaft from the bearings and housing with a drift. Tap out and remove drive shaft rear bearing (AE) and front bearing (AL) from the housing. Lift out drive shaft sliding gear (AH).

f. Remove shifter shaft assembly. Remove shifter shaft retaining screw and washers and pull shifter arm (BE) from shifter shaft (AR). Remove the shifter yoke poppet spring cap (AW) and remove the spring and poppet ball from the shifter cover (AV). Push the shifter shaft from the housing, being careful not to damage the oil seals. Remove shifter shaft sleeve (BB) and sleeve spacer collar (BC) from housing.

g. Remove adapter gear and shaft. Remove large cotter pin (G) from adapter housing and tap out adapter idler gear shaft (B). Remove adapter idler gear (D) and roller bearing (C).

Section III

ASSEMBLY

143. PRELIMINARY INSTRUCTIONS.

a. Clean all units thoroughly and check all parts. Wash all parts thoroughly. Remove all traces of dirt or metal from inside

housings. After coating all gears and bearings with a light oil, rotate or slide on mating shafts to prove free operation.

144. ASSEMBLE POWER TAKE-OFF (fig. 162).

a. Install adapter gear assembly. Place gear roller bearing (C) inside adapter idler gear (D) and hold between arms of adapter housing (F). Tap adapter idler gear shaft (B) through arms and bearing, alining hole in housing and shaft. Install and secure large cotter pin (G).

b. Install shifter bar assembly. Place shifter shaft sleeve (BB) and sleeve spacer collar (BC) in shifter cover. Push shifter shaft (AR) through assembly, being careful not to damage oil seals. Install lock ball, spring, and cap (AY, AX, AW). Place shifter arm in position on shifter shaft and secure shifter shaft with washers and cap screws (BF, BG).

c. Install drive shaft assembly. Place drive shaft sliding gear (AH) in housing. Push drive shaft (AG) through sliding gear and install front bearing (AL) and rear bearing (AE) on drive shaft and tap into housing bores. Install front bearing cover plate and gasket (AM, AD) and secure with four lock washers and cap screws. Install rear bearing cover (AB) and rear bearing seal (AC) and secure with four lock washers and cap screws.

d. Install double idler shaft and gear. Place bearing sleeve (L) inside roller bearing (M) and both inside double idler gear (N). Place gear in position in winch power take-off housing (AK) and push shaft (I) through housing and sleeve while assembling sleeve washer and spacer washers in position on shaft.

e. Install intermediate gear, shaft and bearing. Place spacer sleeve (U) in roller bearing (T) and both inside intermediate gear (S). Place assembly in position in housing and push shaft (V) through housing and sleeve. Install spacer washers (P, Q, R) and secure shaft at each end with washers and cap screw (O).

CHAPTER 15

SPECIAL TOOLS

145. PURPOSE.

a. The following list of special tools contains only those special tools necessary to perform the operations described in this manual. A complete list of special tools available for all maintenance operations on the 6-ton, 6 x 6 truck is contained in ORD 5 SNL G-27, section 1.

b. The following list of special tools is for information only. It is not to be used as a basis for requisition.

146. LIST OF SPECIAL TOOLS.

Name	Federal Stock Number	Mfg. Tool No.
BAR, socket wrench, sliding, length (approx) 22 in.	41-B-312-200	MTM-M3-16L
HANDLE, remover and replacer, length overall 8 1/8 in., size 3/4 in.	41-H-1397	TEC-4-223
HEAD, socket wrench, sliding bar, male, 1 in. square drive (Formerly 41-H-1779-50)	41-H-1845-50	MTM-M3-16E
REMOVER, bearing race, differential side and main drive gear (Formerly 41-R-2374-25)	41-R-2369-50	KM-J-1708
REMOVER AND REPLACER, bushing and oil seal, steering gear	41-R-2377-275	TEC-2-745
REPLACER, spigot bearing, drive pinion aux, spline shaft	41-R-2398-760	MAS-17-302
REPLACER, bearing cone, bevel pinion gear	41-R-2384-115	MAS-17-605
REPLACER, bearing cone, countershaft, rear, transmission	41-R-2384-128	MAS-13-310
REPLACER, bearing cones, differential side, right and left hand	41-R-2384-165	MAS-17-604
REPLACER, bearing cup, power take-off	41-R-2385-260	MAS-13-504
REPLACER, gear, crankshaft timing	41-R-2389-905	MAS-13-604
REPLACER, oil seal, differential housing	41-R-2392-425	TEC-6-422
WRENCH, socket, transfer case output shaft locknut, 1-in. square drive, 2 1/8-in. hexagon opening	41-W-2964-475	
WRENCH, socket (detachable), 1-in. square drive, 6-point opening, 2 3/8 in.	41-W-3058-450	MTM-M3-16H
WRENCH, tubular, pronged, single-end, handled, OD 2 3/4 in., wall thickness 5/16 in., two prongs	41-W-3739-925	SEV-1-315
WRENCH, wheel bearing nut, double-end, octagon opening, 4 7/16 in. x 4 15/16 in. (Formerly 41-W-3825-70)	41-W-3825-72	TD-3256-C-3
WRENCH, tubular, pronged, single-end, with two threaded handles, OD 3 1/4 in., two prongs	41-W-3739-975	TEC-6-215

APPENDIX

Section I

REFERENCES

147. PUBLICATIONS INDEXES. The following publications indexes should be consulted frequently for latest changes or revisions of references given in this section and for new publications relating to material covered in this manual:

a.	Ordnance Supply Catalog Index	ASF Cat ORD 2
b.	Ordnance Major Items and Combinations, and Pertinent Publications	SB 9-1
c.	List and Index of War Department Publications	FM 21-6
d.	List of War Department Films, Film Strips and Recognition Film Slides	FM 21-7
e.	Military Training Aids	FM 21-8

148. STANDARD NOMENCLATURE LISTS.

a. Vehicular.

Truck, 6-ton, 6 x 6, bridge erecting (White Model 666), tank, gasoline, 2,500 gallon
ASF Cat ORD (*) SNL G-690

Truck, 6-ton, 6 x 6 (Brockway and Ward La France), bridge erecting, w/winch, chassis, w/quickway crane, w/winch
ASF Cat ORD (*) SNL G-547

Truck, 6-ton, 6 x 6, prime mover, w/ or w/o winch (Corbitt 50SD6)
ASF Cat ORD (*) SNL G-512

Truck, 6-ton, 6 x 6, prime mover, w/winch, 2,000-gal. gas tank, chassis, van, 1942-43-44 (White Model 666) .... ASF Cat ORD (*) SNL G-514

b. Maintenance.

Antifriction bearings and related items
ASF Cat ORD 5 SNL H-12

Cleaning, preserving, and lubricating materials, recoil fluids, special oils, and miscellaneous related items ..... ASF Cat ORD 5 SNL K-1

Elements, oil filter ..... ASF Cat ORD 5 SNL K-4

(*) See ASF Catalog Ord 2 Index for published pamphlets of the Ordnance Supply Catalog.

Lubricating equipment, accessories, and related dispensers ..... ASF Cat ORD 5 SNL K-3
Miscellaneous hardware .... ASF Cat ORD 5 SNL H-2
Soldering, brazing, and welding materials, gases, and related items..... ASF Cat ORD 5 SNL K-2
Standard hardware ..... ASF Cat ORD 5 SNL H-1
Tires, tubes, tire valves, and patches, etc. ASF Cat ORD 5 SNL H-14
Tool-sets (special), motor vehicles ASF Cat ORD 6 SNL G-27 (Section 1)
Tool-sets (common), specialists' and organizational ..... ASF Cat ORD 6 SNL G-27 (Section 2)

149. EXPLANATORY PUBLICATIONS.

a. Fundamental principles.

Automotive Brakes ..... TM 10-565
Automotive Electricity ..... TM 10-580
Basic Maintenance Manual ..... TM 37-250
Care and Maintenance of Ball Bearings..... TM 37-265
Chassis, Body, and Trailer Units ..... TM 10-560
Cooling Systems: Vehicles and Powered Ground Equipment ..... TM 9-2858
Driver's Manual ..... TM 21-305
Driver Selection and Training ..... TM 21-300
Electrical Fundamentals ..... TM 1-455
Military Motor Vehicles ..... AR 850-15
Motor Vehicle Inspection and Preventive Maintenance Service ..... TM 37-2810
Ordnance Service in the Field ..... FM 9-5
Precautions in Handling Gasoline ..... AR 850-20
Standard Military Motor Vehicles ..... TM 9-2800
Storage Batteries—Lead-acid Type ..... TM 9-2857

b. Vehicular operation.

6-ton, 6 x 6, Truck (White, Corbitt, Brockway and Ward La France) ..... TM 9-813

c. Maintenance and repair.

Cleaning, Preserving, Lubricating, and Welding Materials and Similar Items Issued by the Ordnance Department ..... TM 9-850
Maintenance and Care of Pneumatic Tires and Rubber Treads ..... TM 31-200

Ordnance Maintenance: Carburetors (Zenith)	TM 9-1826C
Ordnance Maintenance: Electrical Equipment (Delco-Remy)	TM 9-1825A
Ordnance Maintenance: Fire Extinguishers	TM 9-1799
Ordnance Maintenance: Fuel Pumps	TM 9-1828A
Ordnance Maintenance: Hercules Engines	TM 9-1832A
Ordnance Maintenance: Power Brake Systems (Bendix-Westinghouse)	TM 9-1827A
Ordnance Maintenance: Speedometers, Tachometers, and Recorders	TM 9-1829A

d. Protection of materiel.

Camouflage	FM 5-20
Camouflage of Vehicles	FM 5-20B
Chemical Decontamination Company	FM 3-70
Chemical Decontamination, Materials, and Equipment	TM 3-220
Decontamination of Armored Force Vehicles	FM 17-59
Defense Against Chemical Attack	FM 21-40
Explosives and Demolitions	FM 5-25
Military Chemistry and Chemical Agents	TM 3-215
Preparation of Ordnance Materiel for Deep Water Fording	TM 9-2853

e. Storage and shipment.

Ordnance Company, Depot	FM 9-25
Ordnance Packaging and Shipping (Posts, Camps, and Stations)	TM 9-2854
Ordnance Storage and Shipment Chart, Group G—Major Items	SB 9-OSSC-G
Preparation of Unboxed Ordnance Materiel for Shipment	SB 9-4
Protection of Ordnance Materiel in Open Storage	SB 9-47
Registration of Motor Vehicles	AR 850-10
Rules Governing the Loading of Mechanized and Motorized Army Equipment, Also Major Caliber Guns, for the United States Army and Navy, on Open Top Equipment, Published by Operations and Maintenance Department of Association of American Railroads.	
Storage of Motor Vehicle Equipment	AR 850-18

INDEX

A

Page

Axle (See Front axle and universal joints *and* Rear axle and torque rods)
Axle housings 104, 133

B

Brakes
adjustment 141, 154
assembly
propeller shaft brakes 154
service brakes 140
assembly of subassemblies
arm assembly 150
brake housing 178, 207
brake shaft 183
brake shoes 139
cross shaft 151
hand lever 151
cleaning and inspection
arm assembly 150
brake disk 150
brake drums 140
brake housing 179, 206
brake shaft 183
brake shoes 138, 150
cross shaft 151
hand lever 151
data
propeller shaft brakes 147
service brakes 136, 141
description and operation
propeller shaft brakes 146
service brakes 136
disassembly
propeller shaft brakes 147
service brakes 137
disassembly of subassemblies
arm assembly 150
brake housing 178, 206
brake shaft 183
brake shoes 138, 150
cross shaft 151
hand lever 151
installation 105, 134, 140
maintenance 1
removal
brake chamber 112
brake shoe 75, 114, 137, 147
propeller shaft brake 147
repair
arm assembly 150
brake disk 150
brake housing 179, 206
brake shaft 183
brake shoe 138, 150
cross shaft 151
hand lever 151

C

Camshaft
installation 140
removal 137
Carburetor maintenance 1
Carrier assembly (differential)
assembly 99, 129
cleaning and inspection
carrier 95
housing 127
disassembly 83
installation 105
removal 78, 115
Clutch
adjustment 14
assembly and disassembly
clutch and brake shaft 183
driven disk 14
release assembly 35
winch clutches 203
description and data 4, 5
inspection and repair
clutch and brake shaft driven disk 14
pressure plate 8
release assembly 35
winch clutches 203
installation
adjusting plate 7
pedal shaft 36
pressure levers 11
pressure plate 12
operation 4
removal
adjusting plate 7
pressure plate 6
release assembly 19
shaft and drive gear 19

C — Contd. Page

Countershaft
assembly 33
cleaning and inspection 33
disassembly 29
installation 35
removal of assembly 21

D

Declutch assemblies (See Power take-off declutch assembly *and* Front axle declutching assembly)

Differential assembly
adjustment 103
assembly 87, 121
cleaning 86, 121
disassembly 86, 118
inspection and repair 86, 121
installation 101, 133
removal 83, 118

Differential carrier assembly (See Carrier assembly (differential))

Differential case 122

E

Engine maintenance 1

F

Forms 2

Front axle and universal joints
adjustments 70, 101, 103, 107
assembly 105
data 69, 107
description 69
disassembly 73
operation 69
removal of axle 72
test 107
(See *also* Axle housings)

Front axle declutching assembly 59, 67

Fuel pump, maintenance 1

G

Gearshift lever housing
assembly 18, 24

Generating system, maintenance.... 1

I Page

Idler gear 33, 35
Idler shaft assembly..... 64, 65, 67
Ignition system, maintenance..... 1

L

Lubrication Order 2

M

Main drive gear 34, 36
Mainshaft assembly
transfer case 60, 64, 65
transmission 20, 33, 34, 36

O

Operating instructions 1

P

Power take-off (hoist)
assembly 221
cleaning 217, 220
data 217
description and operation 217
disassembly
into subassemblies 217
of power take-off 220
removal 217
Power take-off declutch
assembly 54, 67
Propeller shafts and universal joints
assembly 214
cleaning and inspection 42
data 40
description and operation 39
disassembly 41
fits and tolerances 44
removal 158
repair 43
test 44

R

Rear axle and torque rods
adjustments 129, 131, 135
assembly 134
cleaning 111
data 110, 135
description and operation..... 109
disassembly 112
removal 111, 112
test 134
(See *also* Axle housings)

R — Contd. Page

Records and reports 2
Reverse gear 21, 33, 35
Reverse idler gear (See Reverse gear *and* Idler gear)

S

Speedometer, maintenance 1
Springs 155, 157
Spur pinion cross shaft
  assembly 126, 129
Starting system, maintenance..... 1
Steering gear
  adjustments 166
  assembly
    steering gear 167
    subassemblies 164
  cleaning 163, 164, 165
  data 162
  description 161
  disassembly
    into subassemblies 163
    of subassemblies 164
    removal 163
Steering knuckle
  assembly 81
  cleaning and inspection 81
  disassembly 80
  installation 105
  repair 81

T

Tachometer maintenance 1
Through shaft 123, 129
Tires 114, 134
Tools (special) 222
Torque rods
  assembly 117
  cleaning and inspection 117
  disassembly 115
  disconnecting 158
  installation 134
  removal 112
  repair 117
  (See *also* Rear axle and torque rods)

Page

Transfer case
  adjustments 47, 66
  assembly 65
  cleaning 52, 65
  data 45, 68
  description and operation 45
  disassembly 52
  inspection 65
  installations 67
  removal 47
  test 68
  (See *also* Mainshaft assembly)
Transmission
  assembly 35
  cleaning 17
  description and data..... 15
  disassembly 18
  fits and tolerances 38
  operation 15
  removal 17
  test 37
  (See *also* Mainshaft assembly)
Transmission case 35

U

Universal joints
  assembly
    front axle 43, 78
    winch 213
  cleaning and inspection
    front axle 78
    winch 213
  disassembly
    front axle 41, 78
    winch 213
  installation 105
  removal 76
  (See *also* Front axle and universal joints *and* Propeller shafts and universal joints)
  repair
    front axle 78
    winch 213

W

Page

Walking beam
- description 157
- inspection 159
- installation 160
- removal 158
- repair 160

Wheels 114, 134

Winch (center mounted)
- adjustments 187
- assembly
  - subassemblies 178
  - winch 186
- cleaning 174, 178
- data 172, 188
- description and operation 169
- disassembly
  - subassemblies 178
  - winch 174
- inspection and repair 178
- tests 187

Winch (front mounted)
- adjustments 215
- assembly
  - subassemblies 203
  - winch 214
- cleaning 194, 213
- data 193, 216
- description and operation 191
- disassembly
  - subassemblies 203
  - winch 195
- tests 215

☆U. S. GOVERNMENT PRINTING OFFICE : O—1951