

- A—NUT, SHAFT, 7/8-14-7411259
 B—FLANGE, W/DEFLECTOR AND SLEEVE, ASSY-7411353
 C—DEFLECTOR, FLANGE-7411390
 D—SEAL, OIL, SHAFT BEARING, ASSY-7411263
 E—RETAINER, SHAFT BEARING-7411260
 F—RING, SNAP (FRONT BEARING)-7411407
 G—BEARING, BALL, ASSY-710145
 H—BLOCK, PILLOW-YT-2265201
 J—STUD, 1/2-20-13x2-1/16-7411258
 K—SHAFT-7411262
 L—SCREW, CAP, 3/8-16x1-1/8-180123
 M—PLUG, PIPE, 1/8-IN-117243
 N—PLUG, OIL LEVEL-143935
 P—ELBOW, LUBRICATION FITTING-504202
 Q—FITTING, LUBRICATION-504208
 R—PLUG, INSPECTION HOLE-7376357

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Figure 155. Sectional view of pillow block assembly.

b. Inspection and Repair.

- (1) *Pillow block.*—Thoroughly examine pillow block (H) for cracks, stripped thread, or broken studs. If threads are stripped or if housing is damaged, replace with new part. If studs are damaged, replace. Driven height of each stud



Figure 156. Installing flange oil seal sleeve with replacer 41-R-2395-528.

is five-sixteenths of an inch from face of pillow block. Discard plug gasket (L) and replace with new part at assembly.

- (2) *Flange with deflector and sleeve assembly.*—Inspect splines of flange with deflector and sleeve assemblies (B) for distortion and chipped or excessively worn condition. Replace

assembly if these conditions exist. Examine surface of oil seal sleeve on flange for grooves, nicks, or worn condition. If oil seal sleeve is damaged, replace as described in (a) below. Inspect condition of deflector on flange. If loose or damaged, replace as described in (b) below.

- (a) *Oil seal sleeve replacement.*—Use ball peen hammer, and tap entire circumference of outer surface of flange sleeve (fig. 157). Peening of this surface will cause metal in sleeve to stretch until sleeve can be removed from flange. Install sleeve on flange using replacer 41-R-2395-528 (fig. 156).
- (b) *Deflector replacement.*—Deflector is pressed on flange as shown in figure 157. The deflector is either spot welded or peened in three or four places to flange. Remove old deflector. Install new deflector in place on flange. Peen or spot weld as shown in figure 157.

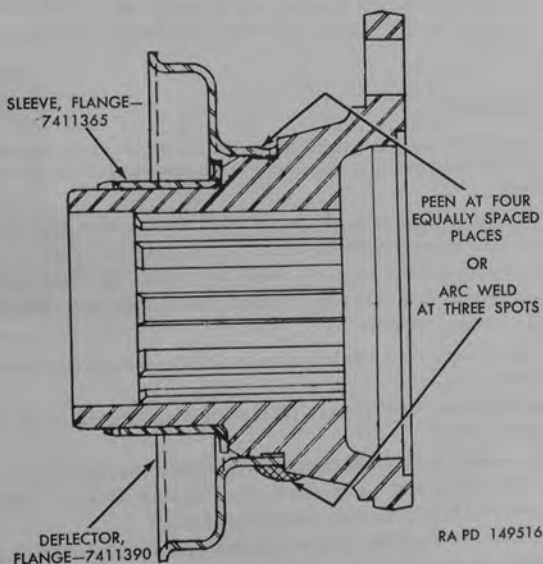


Figure 157. Sectional view of flange assembly.

- (3) *Shaft bearing retainer and oil seal.*—Inspect shaft bearing retainers (D) for damage. If shaft bearing oil seal assemblies (C) are damaged, replace with new parts. Press old seal assemblies out of retainers. Coat outer surface of oil seal assemblies with plastic type gasket cement. Make cer-

tain that cavity in the inside circumference of seal is lubricated with automotive and artillery grease (GAA). Press oil seal assembly into retainer with mark "OUTSIDE" on seal toward outer side of retainer. When pressing new oil seal into retainer, bear against outer edge of seal only. Discard bearing retainer gaskets (E) and replace with new parts at assembly.

- (4) *Ball bearing assemblies.*—Thoroughly inspect ball bearing assemblies (G) for rough balls, scored outer surface, or broken ball retainers. The ball bearing assembly which is used at front of pillow block assembly includes a snap ring (F). Use a new snap ring when replacing the ball bearing. The other bearing also has a snap ring groove but no ring is used.
- (5) *Shaft.*—Examine splines on each end of shaft for distortion, chipped condition, or excessively worn condition. If surfaces upon which bearings are mounted are scored or scuffed, replace shaft. Check condition of threads at each end of shaft.

225. Assembly

Note. Key letters noted in parentheses are in figure 154 unless otherwise indicated. The sectional view (fig. 155) shows the component parts in their assembled position.

a. Thoroughly lubricate all parts with automotive and artillery grease (GAA) during assembly.

b. Mount pillow block housing firmly in a vise. Position ball bearing assembly (G) into rear end of pillow block with snap ring groove of bearing toward outside.

Note. Do not use a snap ring in rear bearing. The snap ring is used only at front bearing.

c. Press ball bearing assembly (G), with snap ring in place, on one end of shaft (T).

d. Insert shaft, with front bearing assembled, through front end of pillow block (H), and press shaft into bearing at rear. Bearings must be pressed firmly against shoulders of shaft.

e. Position new bearing retainer gasket (E) to front end of pillow block; then install shaft bearing retainer (D), with shaft bearing oil seal assembly (C) in place, to pillow block, using four $\frac{3}{8}$ -16 x $1\frac{1}{8}$ cap screws (R) and $\frac{3}{8}$ -inch lock washers (S). Tighten cap screws firmly.

f. Install new bearing retainer gasket (E), shaft bearing retainer (D), and shaft bearing oil seal assembly (C) to rear end of pillow block in same manner described in *e* above.

g. Install flange with deflector and sleeve assemblies (B) on each end of shaft. Flange assemblies must be in the same plane. Install shaft nuts (A). Tighten to a torque of 175 to 225 pound-feet. Install new cotter pins and bend over flat of nuts.

h. Install pipe plug (J), inspection hole plug and gasket (K) and (L), oil level plug (M), 1/4-inch pipe plug (Q), and lubrication fitting elbow (N) and fitting (P).

i. Fill housing with automotive and artillery grease (GAA) through lubrication fitting until lubricant is level with bottom of oil level plug hole.

CHAPTER 10

SERVICE BRAKE SYSTEM

Section I. DESCRIPTION AND DATA

226. Service Brake System Description

a. General.—Service brake system is a combined air-hydraulic brake system comprised primarily of a manually-operated brake pedal which is interconnected to the hydraulic master cylinder to build up the initial hydraulic pressure; an air-hydraulic power cylinder to increase the hydraulic pressure; two hydraulic wheel cylinders at each wheel to transmit the hydraulic pressure to the brake shoes; a compressed air system which maintains a supply of compressed air for operation of the air-hydraulic power cylinder; and interconnecting air lines, hydraulic lines, and fittings.

b. Master Cylinder (fig. 170).—Master cylinder is integral tank type, with fluid reservoir and cylinder barrel cast in one piece. The functioning components of the master cylinder are the piston with secondary cup (H), primary cup (K), secondary cup (G), and piston return spring (M). Inlet port (J) and compensating port (L) connect the fluid reservoir with the cylinder bore. The filler cap assembly, comprised of a filler cap (S), vent line fitting (T), gaskets (V), and special bolt (U), is installed on top of the filler pipe (P), which is threaded into the top of the master cylinder reservoir. The special bolt in the filler cap is drilled to permit venting the fluid reservoir into the vehicle air vent system. Piston stop (E) is retained in end of cylinder bore by a retainer (snap ring) which fits into a groove in the cylinder bore.

c. Air-Hydraulic Power Cylinder.—The air-hydraulic power cylinder is a hydraulically-actuated, air-operated power cylinder which utilizes the energy in compressed air for displacing hydraulic fluid under high pressure into the wheel cylinders. Air-hydraulic power unit is comprised basically of three interconnected units, the control valve, the power cylinder, and the slave cylinder. The reactionary type control valve, actuated by hydraulic fluid pressure from the master cylinder, controls the flow of compressed air into and out of

the power cylinder shell. The power cylinder, comprised primarily of a cylinder shell and piston assembly, transmits the power of the compressed air to the hydraulic piston in the slave cylinder. The slave cylinder piston, when forced forward in the slave cylinder by the power cylinder piston, displaces hydraulic fluid from the slave cylinder through the hydraulic lines into the wheel cylinders at each wheel. Refer to paragraph 1 for number of technical manual which contains detailed information on the air-hydraulic power cylinder.

d. Wheel Cylinders.—Two dual-piston wheel cylinders (fig. 172), mounted between ends of brake shoes on each backing plate transmit the hydraulic pressure to the brake shoes through push rods. Detail parts of upper and lower wheel cylinders at each brake are identical, but the bleeder screw and the hydraulic line connector are assembled to opposite holes to provide topmost location of the bleeder screws when cylinders are installed in correct position on backing plate. Internal parts of each wheel cylinder (fig. 71) are two pistons, two piston cups, two piston cup expanders, and one piston return spring. The tapered outer edges of the piston cup expanders fit inside the bevelled lips of the piston cups and force the lips of the cups outward against the cylinder wall during brake application. The expanders also prevent lips of piston cups from collapsing during and after brake release. Rubber boot at both ends of each cylinder prevents entrance of water and dirt.

e. Brake Shoes and Attaching Parts (fig. 158).—Two brake shoes are mounted on each backing plate in conjunction with two anchor blocks. Anchor blocks serve as shoe stops and shoe centering points, and provide the fulcrums around which the shoes pivot during brake application. Four brake shoe return springs at each brake hold shoe ends firmly against anchors when brakes are released. Heel of each shoe anchors against steel pins which pivot in the anchor blocks; toe of each shoe anchors against adjusting screws which are threaded into the anchor blocks. Each anchor block is attached to backing plate by two cap screws threaded into tapped holes in anchor block from inner side of backing plate. Each adjusting screw has two grooves running lengthwise its entire length. Adjusting wheel, assembled in slot in anchor block, has two lugs on its inside diameter which engage the grooves in the adjusting screw. When adjusting wheel is turned by the adjusting stud and gear, it turns the adjusting screw in the anchor block, causing screw to move in or out of block, depending on the direction the adjusting wheel is turned. One-piece lining is attached to each brake shoe by 14 countersunk rivets. All brake shoes and attaching parts on one side of the vehicle, front and rear, are identical. All brake parts shown in figure 163 are interchangeable between right and left sides of the vehicle except the backing plate, anchor blocks, connecting lines, heat shields, and adjusting screws.

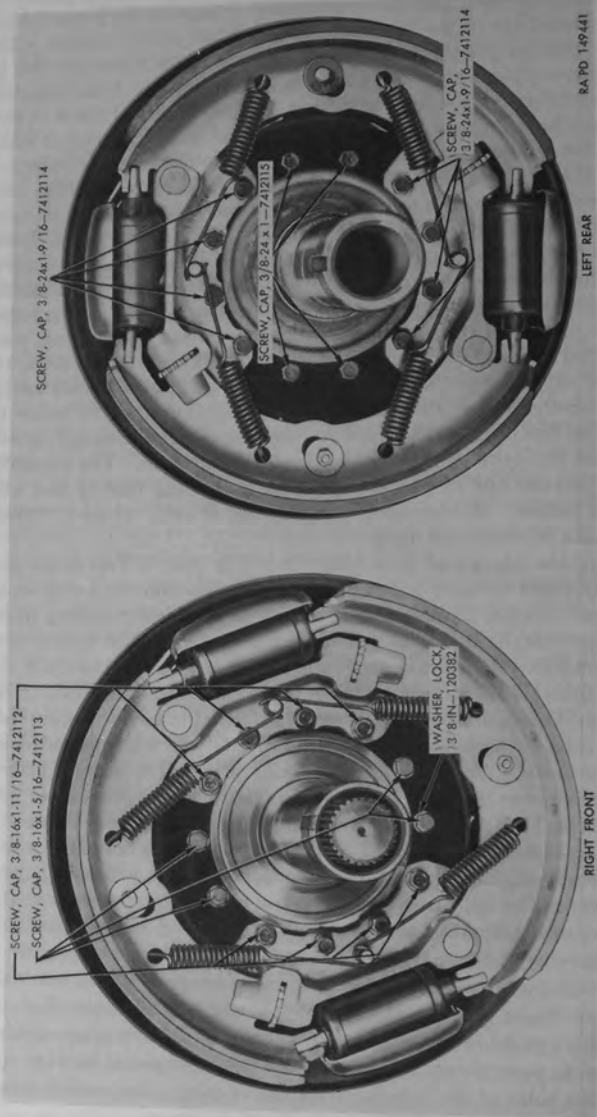


Figure 158. Front and rear brake assemblies installed on axles.

f. Brake Drums.—Brake drums may be either cast iron or of centrifuse construction. All brake drums on vehicle are identical. Brake drums are attached to hubs by means of brake drum backs which serve as brake drum adapters. Different drum backs are used at front and rear and for dual rear wheels to properly position brake drum over brake linings.

g. Compressed Air System.—Compressed air system comprises the air compressor and governor assembly, two air tanks, and interconnecting air lines and fittings. Refer to TM 9-819A and TM 9-1819AA for information on air compressor and governor assembly.

227. Service Brake System Data

a. Master Cylinder.

Type	integral tank
Bore	1 $\frac{3}{4}$ in.
Stroke	1 $\frac{1}{16}$ in.

b. Air-hydraulic Power Cylinder.

Manufacturer	Bendix Products Division
Model	A35-15-154
Cylinder shell diameter (inside)	4 $\frac{1}{2}$ in.
Power cylinder piston stroke	3 $\frac{3}{8}$ in.
Slave cylinder bore	1 $\frac{1}{8}$ in.
Slave cylinder piston stroke	3 $\frac{3}{4}$ in.
Control valve bore	1 $\frac{1}{16}$ in.

c. Wheel Cylinders.

Type	straight bore, dual piston
Bore	1 $\frac{1}{4}$ in.

d. Brake Lining.

Width	3 in.
Thickness	$\frac{3}{8}$ in.

e. Brake Drums.

Type	cast or centrifuse
Diameter	15 in.

Section II. REBUILD OF BRAKE SHOES AND DRUMS

228. General

Removal and installation of brake shoe and lining assemblies for replacement purposes are covered in TM 9-819A; however, for purposes of a complete brake overhaul, the complete brake assembly is removed from the axle and disassembly, cleaning, inspection, repair, and assembly procedures accomplished on a bench as described herein. Except for slight differences noted in the text, procedures for removal,

overhaul, and installation of right and left brake assemblies at front and rear axles are the same.

Note. Any painted parts from which the paint is removed during the process of cleaning and inspection must be repainted with metal primer as directed in TM 9-2851 after inspection is completed.

229. Removal of Brake Assembly

a. Remove Brake Drum.—Remove safety nuts and plain washers from 18 studs attaching brake drum to brake drum adapter. Tap brake drum to loosen from adapter; then lift drum off studs.

b. Remove Hub and Bearings.—Remove hub and bearings as directed in paragraph 256b.

c. Disconnect Brake Line.

- (1) *Front.*—Remove three cap screws and lock washers attaching brake line shield (fig. 159) to steering knuckle support and swing shield to one side. Disconnect axle brake line assembly from rubber brake line assembly at bracket on outer end of axle housing, remove end of rubber brake line assembly from bracket and pull line through bracket on shield; then unscrew rubber brake line assembly from distributor fitting at backing plate.

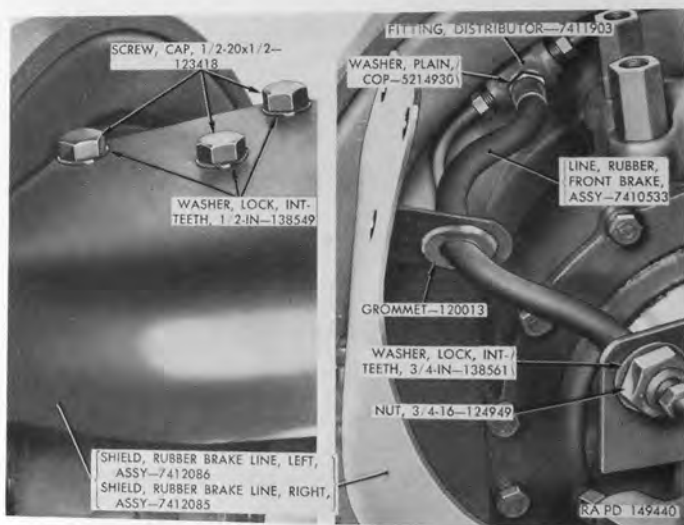


Figure 159. Front brake rubber line installed (left side shown).

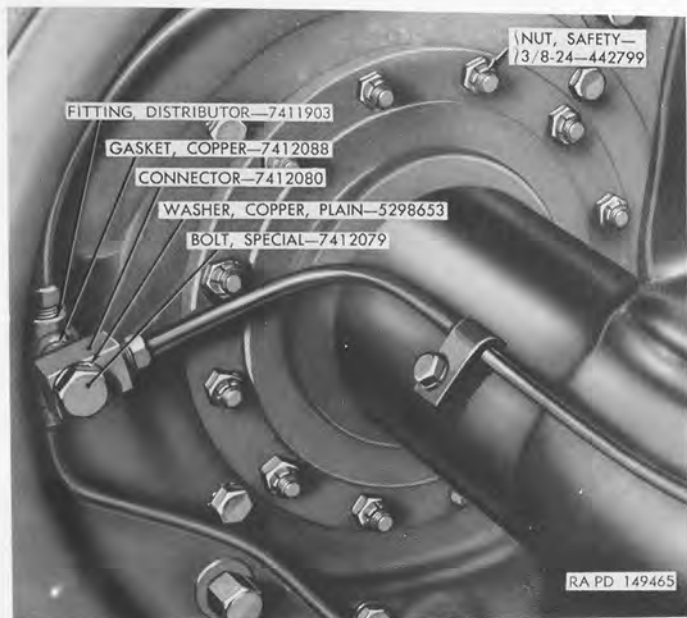


Figure 160. Inner view of rear brake assembly installed on axle.

- (2) *Rear*.—Disconnect axle brake line assembly from distributor fitting at backing plate by removing special bolt attaching axle brake line connector to distributor fitting (fig. 160).

d. Remove Brake Assembly.—Remove 12 cap screws and lock washers (fig. 158) attaching brake assembly to steering knuckle support (front), or remove 12 cap screws and safety nuts attaching brake assembly to flange on axle housing (rear). Lift brake assembly (fig. 161) off axle.

230. Disassembly of Brake Components

Note. Key letters noted in parentheses are in figure 163 unless otherwise indicated.

a. General.—The following procedure covers removal of brake components from backing plate after the brake assembly is removed from the axle.

b. Remove Brake Shoe Return Springs.—Using brake spring remover and replacer 41-R-2375-20, unhook brake shoe return springs (X) from return spring pins (JJ) as shown in figure 162; then remove springs from brake shoes.

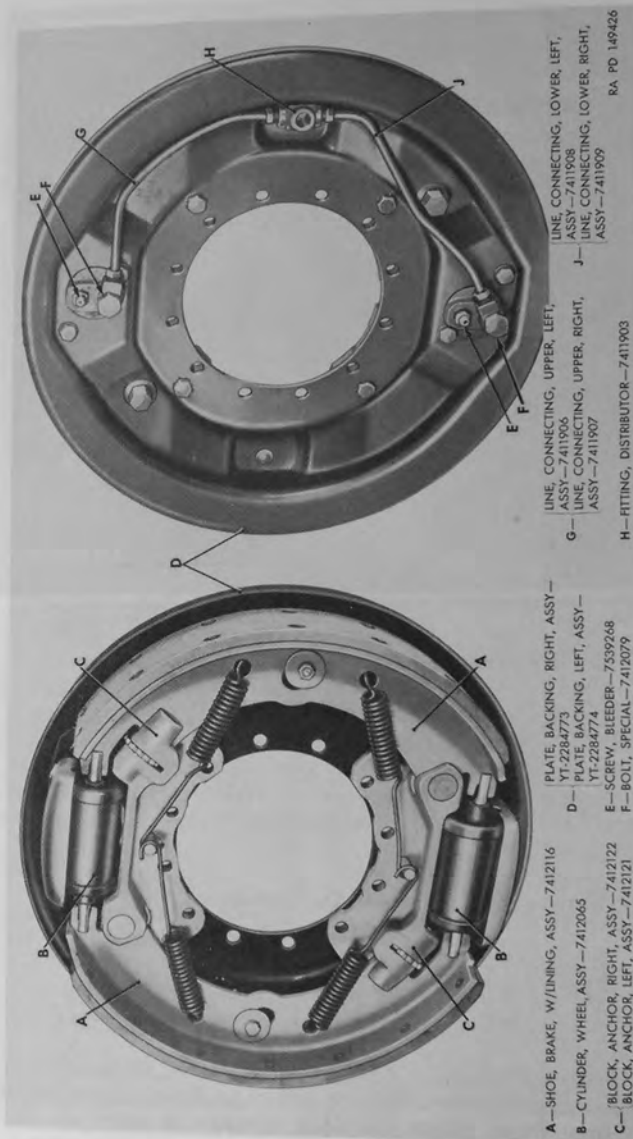


Figure 161. Brake assembly removed from axle.

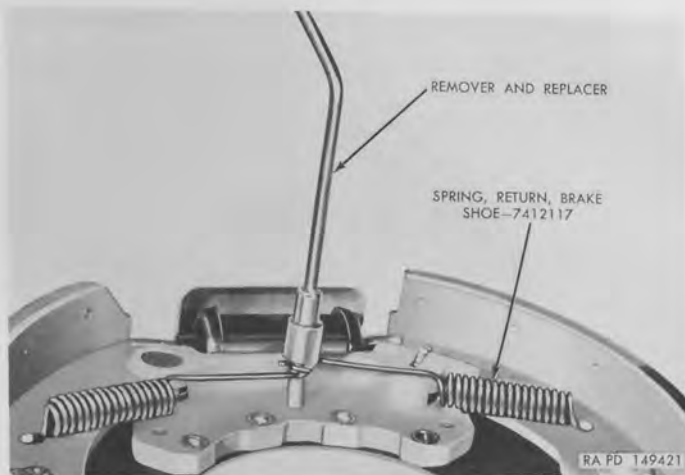


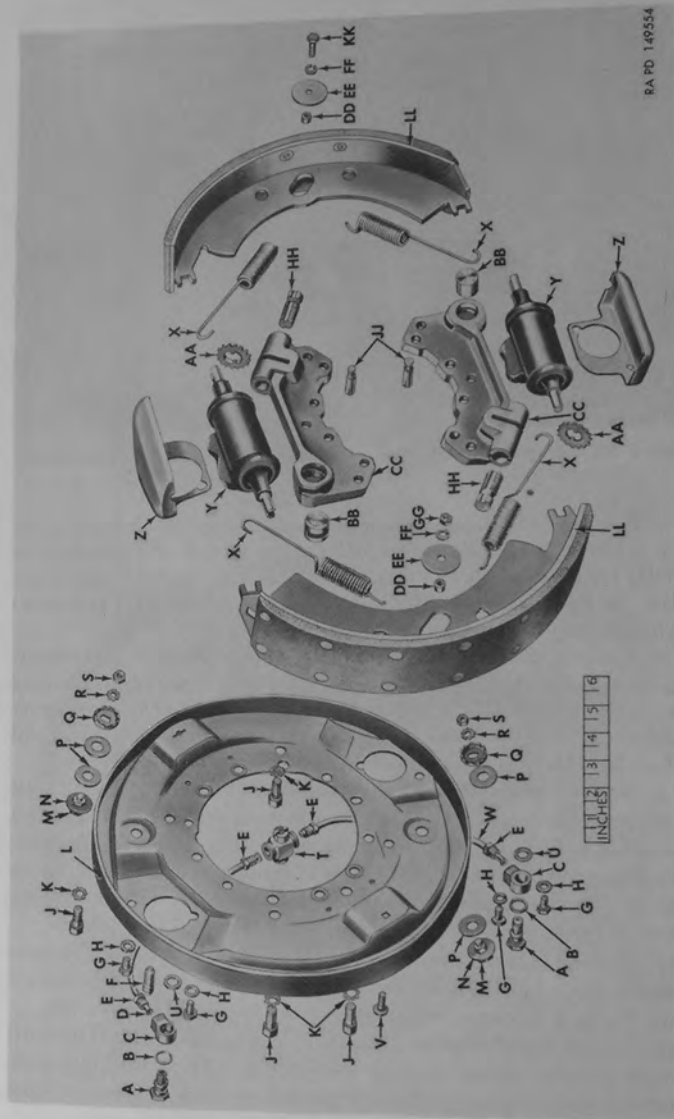
Figure 162. Removing brake shoe return springs with remover and replacer 41-R-2375-20.

c. Remove Front Brake Shoe and Lining Assembly.—Remove $\frac{1}{4}$ -28 nut (GG), $\frac{1}{4}$ -inch lock washer (FF), plain washer (EE), and sleeve (DD) from guide bolt (V) and remove bolt. Lift ends of front brake shoe and lining assembly (LL) out of anchor blocks (CC) and wheel cylinder push rods to remove.

d. Remove Rear Brake Shoe and Lining Assembly.—Unscrew $\frac{1}{4}$ -28 x 1 cap screw (KK) from distributor fitting (T) and remove cap screw $\frac{1}{4}$ -inch lock washer (FF), plain washer (EE), and sleeve (DD). Lift ends of rear brake shoe and lining assembly (LI) out of anchor blocks (CC) and wheel cylinder push rods to remove.

e. Remove and Disassemble Brake Lines.—Remove special bolts (A) and plain copper washers (B) attaching brake line fittings (C) to wheel cylinders. Remove upper connecting line assembly (D), lower connecting line assembly (W), fittings (C), and distributor fitting (T) as an assembly from backing plate (L). Unscrew tubing nuts (E) from fittings (C) and distributor fitting (T).

f. Remove Wheel Cylinder Assemblies and Heat Shields.—Remove bleeder screw (F) from each wheel cylinder assembly (Y). Remove two $\frac{5}{16}$ -18 x $\frac{5}{8}$ cap screws (G) and $\frac{5}{16}$ -inch lock washers (H) attaching each wheel cylinder assembly (Y) to backing plate (L). Lift wheel cylinder assemblies and heat shields (Z) off backing plate. Refer to paragraphs 239 through 241 for overhaul of wheel cylinder assemblies.



A-BOLT, SPECIAL-7412079
 B-WASHER, PLAIN, COPPER-5298653
 C-FITTING-5323092
 D-
 { LINE, CONNECTING, UPPER, LEFT, ASSY-7411906
 { LINE, CONNECTING, UPPER, RIGHT, ASSY-7411907
 E-NUT-142432
 F-SCREW, BLEEDER-7539268
 G-SCREW, CAP, $\frac{5}{16}$ -18 X $\frac{5}{8}$ -180075
 H-WASHER, LOCK, $\frac{5}{16}$ -IN.-120214
 J-SCREW, CAP, $\frac{3}{8}$ -24 X $\frac{5}{8}$ -181629
 K-WASHER, LOCK, EXT-TEETH, $\frac{3}{8}$ -IN.-138489
 L-
 { PLATE, BACKING, LEFT-7412111
 { PLATE, BACKING, RIGHT-7412110
 M-STUD, ADJUSTING-YT-2289512
 N-WASHER, SPRING-7412119
 P-WASHER, PLAIN-7412120
 Q-GEAR, ADJUSTING-7412104
 R-WASHER, LOCK, INT-TEETH, $\frac{1}{4}$ -IN.-138538
 S-NUT, $\frac{1}{4}$ -28-120368
 T-FITTING, DISTRIBUTOR-7411903
 U-GASKET, COPPER-7412088
 V-BOLT, GUIDE-7411760
 W-
 { LINE, CONNECTING, LOWER, LEFT, ASSY-7411908
 { LINE, CONNECTING, LOWER, RIGHT, ASSY-7411909
 X-SPRING, RETURN, BRAKE SHOE-7412117
 Y-CYLINDER, WHEEL, ASSY-7412065
 Z-
 { SHIELD, HEAT, LEFT-7412068
 { SHIELD, HEAT, RIGHT-7412050
 AA-WHEEL, ADJUSTING-7412123
 BB-PIN, ANCHOR-7412106
 CC-
 { BLOCK, ANCHOR, LEFT-YT-2284772
 { BLOCK, ANCHOR, RIGHT-YT-2284771
 DD-SLEEVE-7412103
 EE-WASHER, PLAIN-5323088
 FF-WASHER, LOCK, $\frac{1}{4}$ -IN.-120380
 GG-NUT, $\frac{1}{4}$ -28-121996
 HH-
 { SCREW, ADJUSTING, LEFT-7412108
 { SCREW, ADJUSTING, RIGHT-7412109
 JJ-PIN, RETURN SPRING-7412107
 KK-SCREW, CAP, $\frac{1}{4}$ -28 X 1-181568
 LL-SHOE, BRAKE, W/LINING, ASSY-7412116

Figure 163. Brake assembly components.

g. Remove and Disassemble Anchor Blocks.—Remove two $\frac{3}{8}$ -24 x $\frac{5}{8}$ -inch cap screws (J) and $\frac{3}{8}$ -inch external-teeth lock washers (K) attaching each anchor block (CC) to backing plate (L) and remove anchor blocks. Remove anchor pins (BB) from holes in anchor blocks. Unscrew adjusting screws (HH) from anchor blocks (CC) and remove adjusting wheels (AA).

h. Remove Adjusting Gears and Studs.—Remove $\frac{1}{4}$ -28 nut (S), $\frac{1}{4}$ -inch internal-teeth lock washer (R), adjusting gear (Q), and plain washer (P) from each adjusting stud (M). Remove adjusting studs (M) with plain washers (P) and spring washers (N) from backing plate (L). Remove spring washers (N) from adjusting studs (M).

231. Cleaning and Inspection of Brake Components

Note. Key letters noted in parentheses are in figure 163 unless otherwise indicated.

a. Cleaning.—Wash all parts except brake shoe and lining assemblies in dry-cleaning solvent or volatile mineral spirits and wipe or blow dry. Wipe brake shoes clean with a cloth dampened with cleaning solution. Use a wire brush if necessary to remove rust or dirt from backing plate and brake shoes. Do not wire-brush brake shoe linings.

b. Inspection.

(1) *Brake shoe and lining assemblies.*—Inspect lining on brake shoe with lining assemblies (LL). Linings which have been in use will have a glazed appearance; this is a normal condition and glazed surface should not be wire brushed. If linings are scored, rough, oil-soaked, or worn down close to rivet heads, they must be replaced (par. 232a). All brake shoes on an axle must be relined at the same time. Examine brake shoes for evidence of distortion, and for evidence of roughness or wear on ends of shoe webs where they contact the wheel cylinder push rods, adjusting screws, and anchor pins. Make sure shoe web is tight in table of shoe.

(2) *Anchor blocks, anchor pins, and adjusting screws.*—Examine all threaded holes in anchor blocks (CC) for damaged threads. Check action of adjusting screws (HH) in anchor blocks. Screws must turn freely in anchor blocks. (Adjusting screws and anchor blocks used on left side of vehicle have left-hand threads, and right-hand threads on right side of vehicle.) Inspect anchor pins (BB) and anchor pin bore in anchor blocks for evidence of wear (par. 348) or corrosion. Bore and anchor pin must be clean and smooth. Any worn or damaged parts must be replaced. Check return spring pins (JJ) which are pressed into anchor blocks. If damaged or loose, pins must be replaced (par. 232b).

- (3) *Backing plates.*—Examine backing plates (L) for distortion. Check flange at outer edge of backing plate for runout. Flange must run true within 0.010 inch total dial indicator reading. Raised rib at each guide bolt hole must be clean and smooth to permit free action of brake shoes. Replace backing plate if any damage is evident.
- (4) *Adjusting gears and wheels.*—Examine teeth on adjusting gears (Q) and adjusting wheels (AA) for wear or damage. If wear is evident or if damaged in any way, replace with new parts.
- (5) *Brake connecting line assemblies.*—Examine brake connecting line assemblies (D) and (W) for dents, sharp bends, or flattened condition. Blow through lines from both ends to make sure they are unobstructed. Make sure flared ends are smooth and well formed. Inspect nuts (E) on each line assembly for damaged threads. If any damage is evident, replace with new connecting line assembly.
- (6) *Brake shoe return springs.*—Check brake shoe return springs (X) for free length and loaded length (par. 348). Measurements must be taken at points shown on figure 164.

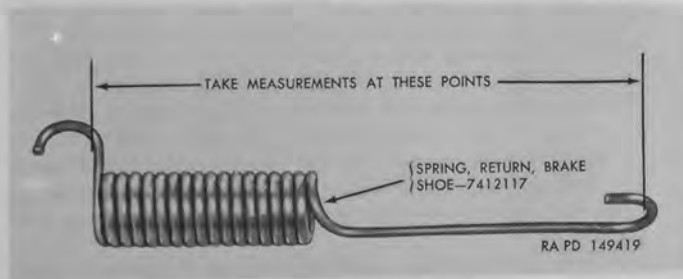


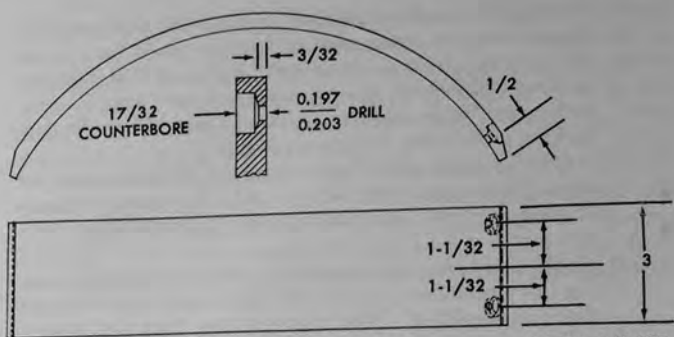
Figure 164. Brake shoe return spring showing points of measurement.

- (7) *Miscellaneous parts.*—Examine all bolts and nuts for damaged threads and replace with new parts as necessary. Make sure drilled passages through special bolts (A) are open. Discard all lock washers (H), (K), (R), and (FF), plain copper washers (B), and copper gaskets (U) and obtain new parts for assembly.

232. Repair of Brake Components

a. Brake Shoe Relining.

Note. When brake drums are refinished, shim stock must be installed between lining and brake shoe. Refer to paragraph 235.



NOTE: ALL DIMENSIONS ARE IN INCHES

RA PD 149487

Figure 165. Brake shoe lining dimensions and location of end rivet holes.

- (1) Remove rivets, using deliver punch on a conventional brake relining machine, and remove lining from brake shoe.
- (2) Remove all dirt and corrosion from brake shoe with a wire brush; then wash shoe in dry-cleaning solvent or volatile mineral spirits and dry thoroughly.
- (3) Locate two points at one end of lining as shown in figure 165, and drill through lining with a 0.197 to 0.203-inch (No. 8) drill.
- (4) Position lining on shoe with two drilled holes alined with two end holes in table of shoe. Insert two rivets through lining and shoe to hold lining in position, but do not upset rivets. Clamp lining securely to shoe with a conventional lining applier; then remove rivets used to aline lining and shoe.
- (5) Using brake relining machine, countersink the two drilled holes and drill and countersink two end holes at opposite end to dimensions shown in figure 165. Install $\frac{3}{16} \times \frac{7}{16}$ rivets in two holes at each end and upset rivets.
- (6) Remove lining applier; then drill and countersink balance of holes and install rivets. Make sure lining fits firmly against shoe and that rivets are properly upset.

b. Return Spring Pin Replacement.—Press return spring pin (JJ) out of anchor block (CC) from inner side. Press new pin into anchor block to position shown in figure 166 and stake in place at three points.

233. Assembly of Brake Components

Note. Key letters noted in parentheses are in figure 163 unless otherwise indicated.

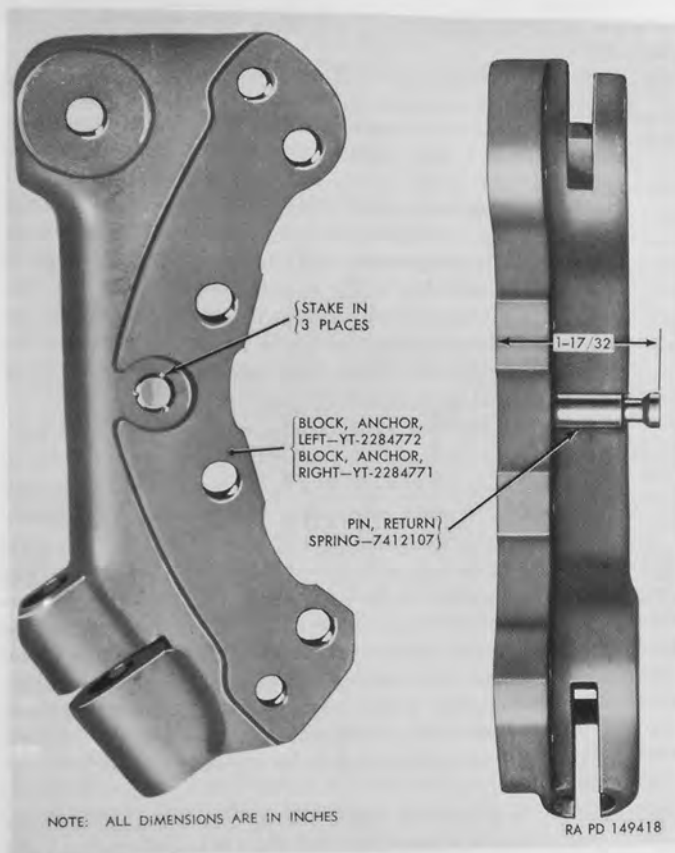


Figure 166. Return spring pin installed in anchor block.

a. General.—The following procedure covers assembly of brake components to the backing plate with the backing plate removed from the axle.

b. Install Adjusting Studs and Gears.—Press spring washer (N) onto shoulder on adjusting stud (M) with dished side toward threaded end of stud. Place one plain washer (P) over adjusting stud and insert adjusting stud through backing plate from inner side. At outer side of backing plate, place plain washer (P) and adjusting gear (Q) on adjusting stud and secure in place with a $\frac{1}{4}$ -inch internal-teeth lock washer (R) and $\frac{1}{4}$ -28 nut (S). Tighten nut firmly against

shoulder on stud. Install other adjusting stud and gear in same manner.

c. Assemble and Install Anchor Blocks.

- (1) Adjusting screws and anchor blocks used on right side of vehicle have right-hand threads and left-hand threads on left side of vehicle; parts must be assembled and installed accordingly.
- (2) Thread adjusting screw (HH) into anchor block (CC). As end of adjusting screw approaches slot in anchor block, position adjusting wheel (AA) in slot and engage lugs on inside of adjusting wheel in grooves in adjusting screw. Thread adjusting screw in until two threads on screw are exposed at threaded end of anchor block, or until plain end of adjusting screw is below unthreaded end of anchor block to a depth of approximately 1 inch.
- (3) Position assembled anchor blocks on backing plate in positions shown in figure 161, and attach each anchor block to backing plate with two $\frac{3}{8}$ -24 x $\frac{5}{8}$ cap screws (J) and $\frac{3}{8}$ -inch external-teeth lock washers (K). Tighten cap screws firmly.

d. Install Wheel Cylinders and Heat Shields.—Position heat shield (Z) over mounting base on each wheel cylinder assembly (Y) and position wheel cylinders on backing plate. Both wheel cylinders must be positioned with long end toward adjusting screw in anchor block, and right or left heat shields must be used, depending upon which side of vehicle brake assembly is to be used. Attach each wheel cylinder to backing plate with two $\frac{5}{16}$ -18 x $\frac{5}{8}$ cap screws (G) and $\frac{5}{16}$ -inch lock washers (H). Tighten cap screws firmly. Install bleeder screw (F) in upper opening in each wheel cylinder.

e. Install Brake Lines.

- (1) Refer to legend for figure 163 for identification of brake connecting line assemblies (D) and (W) to be used on right and left brakes. Assemble connecting line assemblies (D) and (W) to fittings (C) and distributor fitting (T), but do not tighten tube nuts (E).
- (2) Position assembled lines on inner side of backing plate with fittings (C) at lower openings in wheel cylinders. Place plain copper washer (B) over each special bolt (A), insert bolts through fittings (C), then place copper gasket (U) over each bolt and thread bolts into lower openings in wheel cylinders. Tighten bolts firmly.
- (3) Position lugs on distributor fitting (T) in slots in backing plate (L); then tighten four nuts (E) firmly, using care not to overtighten.

f. Install Rear Brake Shoe and Lining Assembly.

Note. Large portion of brake shoe web which engages slots in anchor blocks is curved at one end and flat at the other end. Shoes must be installed with curved end at adjusting screw and flat end engaging groove in anchor pin anchor block. Front and rear brake shoe and lining assemblies are identical and are interchangeable.

Place anchor pin (BB) in lower anchor block (CC) with slot in pin aligned with slot in anchor block. Position rear brake shoe with lining assembly (LL) at backing plate, with shoe web engaging slots in wheel cylinder push rods, anchor blocks, and anchor pins. Place $\frac{1}{4}$ -inch lock washer (FF), plain washer (EE), and sleeve (DD) on $\frac{1}{4}$ -28 x 1 cap screw (KK), insert cap screw through shoe web, and thread into distributor fitting (T). Tighten cap screw firmly, making sure lugs on distributor fitting are in place in slots in backing plate.

g. Install Front Brake Shoe and Lining Assembly.—Refer to NOTE under *f* above. Place anchor pin (BB) in upper anchor block (CC) with slot in pin aligned with slot in anchor block. Position front brake shoe and lining assembly (LL) at backing plate with shoe web engaging slots in wheel cylinder push rods, anchor block, and anchor pin. Insert guide bolt (V) through backing plate and brake shoe web, with square shoulder on bolt engaging square hole in backing plate. Install sleeve (DD), plain washer (EE), and $\frac{1}{4}$ -inch lock washer (FF) on guide bolt; then install $\frac{1}{4}$ -28 nut (GG) on guide bolt and tighten firmly.

h. Install Brake Shoe Return Springs.—Install brake shoe return springs (X), installing end of each spring in brake shoe web; then hooking springs onto return spring pins (JJ), using brake spring remover and replacer 41-R-2375-20 as shown in figure 167.

i. Adjust Brake Shoes.—Using a conventional ring type brake shoe gage, adjust brake shoes to a diameter of 14.870 to 14.885 inches before installing on axle. Adjustment is made by turning adjusting studs (M) at inner side of backing plate.

234. Installation of Brake Assembly

a. Install Brake Assembly.

- (1) *Front.*—Make sure steering knuckle is properly positioned against steering knuckle support with milled oil drain slot in flange at bottom. Position front brake assembly at steering knuckle support with wheel cylinders positioned in relation to vertical centerline as shown in figure 158. Attach brake assembly to steering knuckle support with 12 cap screws and lock washers as follows: Install eight $\frac{3}{8}$ -16 x $1\frac{1}{16}$ cap screws with $\frac{3}{8}$ -inch lock washers through anchor blocks and thread into steering knuckle support, and install four $\frac{3}{8}$ -16 x $1\frac{5}{16}$ cap screws with lock washers through backing



Figure 167. Installing brake shoe return springs with remover and replacer 41-R-2375-20.

plate between anchor locks and thread into steering knuckle support. Tighten cap screws evenly and firmly.

- (2) *Rear*.—Position rear brake assembly on flange on axle housing with wheel cylinders positioned at top and bottom as shown in figure 158. Attach brake assembly to flange on axle housing with 12 cap screws and safety nuts as follows: Install eight $\frac{3}{8}$ -24 x $1\frac{9}{16}$ cap screws through anchor blocks and flange on axle housing, and install four $\frac{3}{8}$ -24 x 1 cap screws through backing plate and flange on axle housing between anchor blocks. Install twelve $\frac{3}{8}$ -24 safety nuts on cap screws and tighten evenly and firmly.

b. Connect Brake Line.

- (1) *Front* (fig. 159).—Place plain copper washer on rubber brake line fitting, thread fitting into distributor fitting and tighten firmly. Insert fitting at other end of rubber brake line assembly through bracket on brake line shield and into bracket at axle housing, install $\frac{3}{4}$ -inch internal-teeth lock washer and $\frac{3}{4}$ -16 nut on fitting, and tighten firmly. Make sure grommet is properly positioned around rubber brake line in bracket on brake line shield. Thread axle brake line nut into rubber brake line fitting at axle bracket and tighten firmly, using care not to overtighten. Position brake line shield on three spacer nuts on top of steering knuckle support

and secure in place with three $\frac{1}{2}$ -20 x $\frac{1}{2}$ cap screws and $\frac{1}{2}$ -inch internal-teeth lock washers.

- (2) *Rear* (fig. 160).—Place plain copper washer over special bolt, insert bolt through axle brake line connector, place copper gasket on bolt, then thread bolt into distributor fitting and tighten firmly.

c. Install Hub and Bearings.—Install hub and bearings and adjust bearings as directed in paragraph 256 *e* and *f*.

d. Install Brake Drum.—Install brake drum on studs in brake drum adapter and attach with 18 plain washers and $\frac{3}{8}$ -24 safety nuts. Tighten nuts to torque of 20 to 27 pound-feet.

235. Brake Drums

a. Inspection.—Inspect brake drums for cracks, distortions, or scored braking surface. Place drum in brake drum lathe and check runout of braking surface. If drum is cracked or badly distorted, replace with new part. If braking surface is scored or out-of-round more than 0.005 inch, brake drum can be refinished (*b* below).

b. Refinishing Brake Drums.—Refinish braking surface of brake drum, using a conventional brake drum lathe. The maximum allowable removal of metal is 0.125 inch on the inside diameter. If necessary to go beyond this limit to obtain a true braking surface, replace with new part. After grinding or cutting drum, the braking surface must be honed to remove all traces of tool ridges. When drums are machined over 0.030 inch on the inside diameter, shim stock of a thickness corresponding to the amount of metal removed from drum must be installed between the brake lining and brake shoe (par. 232*a*) to maintain full lining-to-drum contact.

Section III. REBUILD OF MASTER CYLINDER

236. Disassembly of Master Cylinder

Note. Key letters noted in parentheses are in figure 168 unless otherwise indicated.

a. General.—Refer to figure 170 for sectional view of master cylinder assembly showing assembled position of parts.

b. Remove Filler Cap Components.—Unscrew special bolt (N) attaching vent line fitting (M) and filler cap (K) to filler pipe (G). Remove filler cap C-type washer (H) from special bolt (N), then remove filler cap (K), vent line fitting (M), and gaskets (L) from special bolt. Remove filler cap gasket (J) from filler cap (K).

c. Remove Filler Pipe.—Remove filler pipe (G) from top of master cylinder reservoir.



Figure 168. Master cylinder components.

d. Remove Piston Push Rod and Boot.—Pull push rod boot (C) out of groove on end of cylinder, then remove piston push rod (A) and boot (C). Pry push rod boot strap (B) off boot and push rod, then remove boot from push rod.

e. Remove Piston Stop, Piston, Primary Cup, and Return Spring.—Remove piston stop retainer (D) from groove in cylinder bore, then remove piston stop (V) from cylinder. Remove piston with secondary cup assembly (S), primary cup (R), and piston return spring with retainer assembly (Q) from cylinder bore.

f. Disassemble Piston.—Remove piston secondary cup lock ring (U) by working ring off over lip of secondary cup (T) (fig. 169).



Figure 169. Removal and installation of secondary cup lock ring.

Remove secondary cup (T) from piston; then remove lock ring from piston.

g. Remove Plugs.—Remove plug (E) and plain copper washer (F) from each side of cylinder to permit thorough cleaning of interior.

237. Cleaning, Inspection, and Repair of Master Cylinder

Note. Key letters noted in parentheses are in figure 168 unless otherwise indicated.

a. Cleaning.—Wash all parts of master cylinder in denatured alcohol to remove hydraulic brake fluid. Never use cleaning solutions which contain petroleum products for cleaning hydraulic brake parts. Blow inside of cylinder bore and reservoir dry with compressed air, and wipe small parts dry.

b. Inspection.

- (2) *Master cylinder body.*—Carefully examine cylinder bore for scored or rusted condition. If either of these conditions are evident, the cylinder bore must be reconditioned by honing (*c* below). Check for damaged threads in tapped holes. If any damage is evident, a new master cylinder body must be used. Make sure inlet port and compensating port (fig. 170) connecting reservoir to cylinder bore (fig. 170) are open.
- (2) *Piston.*—Examine piston for burrs or cracks, and for loose protector which is riveted to end of piston. If any damage is evident, replace with new piston with secondary cup assembly (S).
- (3) *Plugs, special bolt, vent line fitting, and filler pipe.*—Examine plugs (E), special bolt (N), vent line fitting (M), and filler pipe (G) for damaged threads and replace with new parts as necessary.
- (4) *Piston return spring and retainer assembly.*—Check piston return spring with retainer assembly (Q) for proper free length and compression (par. 349). Replace with new assembly if not within specifications. Make sure retainer is secure on end of spring.
- (5) *Piston push rod.*—Inspect piston push rod (A) for damaged threads in outer end for roughness at rounded inner end. Roughness on inner end may be honed off. If threads are damaged, replace push rod.
- (6) *Piston primary and secondary cups (R and T), plain copper washers (F), piston stop retainer (D), gaskets (J and L), and push rod boot (C).*—Always discard these parts when rebuilding master cylinder and obtain new parts for assembly.

c. Repair.

- (1) *Hone cylinder.*—Select hone of proper size and install in chuck of electric drill clamped in a vise. Slide cylinder

back and forth over revolving hone a few times; then inspect cylinder walls to see if they are cleaned up. Do not hone away any more than is required to remove scores and clean up cylinder. Use burring tool to remove burs which form around inlet and compensating ports. Do not remove more than 0.004 inch from original bore diameter. Refer to repair and rebuild standards (ch. 21) for bore diameters.

- (2) *Check piston fit in cylinder bore.*—Insert piston, with cups removed, into cylinder bore and check clearance between piston and cylinder wall with a feeler gage. If clearance is in excess of 0.005 inch, new master cylinder body must be used.

238. Assembly of Master Cylinder

Note. Key letters noted in parentheses are in figure 168 unless otherwise indicated.

a. General.—Refer to figure 170 for sectional view of master cylinder assembly showing assembled position of parts. Dip all parts in hydraulic brake fluid before assembling.

b. Install Plug.—Install plug (E) with plain copper washer (F) in opening in each side of cylinder and tighten firmly.

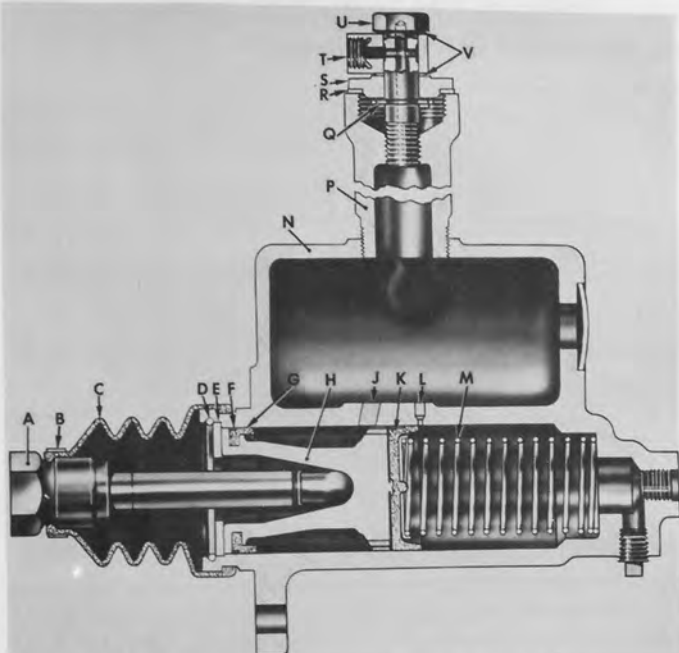
c. Assemble Piston.—Place piston secondary cup lock ring (U) over piston, install secondary cup (T) on piston; then install lock ring over secondary cup, working lock ring over lip of cup as shown in figure 169.

Caution: Do not use a tool with sharp edges, and use extreme care not to cut or damage lip of cup while installing lock ring.

d. Install Piston Return Spring, Primary Cup, Piston, and Piston Stop.—Insert piston return spring with retainer assembly (Q) in cylinder bore with retainer toward open end of cylinder. Install primary cup (R) in cylinder bore with lip of cup over the return spring retainer. Insert piston with secondary cup assembly (S) into cylinder bore with open end of piston toward open end of cylinder, carefully guiding lip of secondary cup into the cylinder. Push piston into cylinder, compressing piston return spring; then install piston stop (V) and secure in place with piston stop retainer (D). Make sure retainer is fully seated in groove in cylinder bore.

e. Install Piston Push Rod and Boot.—Install push rod boot (C) on piston push rod (A), with bead at small end of boot seated in groove next to hex end of push rod. Secure boot to push rod with push rod boot strap (B). Insert rounded end of piston push rod through piston stop into piston, and place bead at large end of boot into groove at end of cylinder.

f. Install Filler Pipe.—Thread filler pipe (G) into top of master cylinder reservoir and tighten to a torque of 75 to 80 pound-feet.



A—ROD, PUSH, PISTON—5330130
 B—STRAP, PUSH ROD BOOT—5167880
 C—BOOT, PUSH ROD—7539308
 D—RETAINER, PISTON STOP—5167878
 E—STOP, PISTON—5167877
 F—RING, LOCK, SECONDARY CUP—
 5276980
 G—CUP, SECONDARY—7735433
 H—PISTON, W/SECONDARY CUP, ASSY—
 A276977
 J—INLET PORT
 K—CUP, PRIMARY—B248003

L—COMPENSATING PORT
 M—SPRING, RETURN, PISTON.
 W/RETAINER, ASSY—5276981
 N—CYLINDER, MASTER, W/PLUGS, ASSY—
 YT-2284233
 P—PIPE, FILLER—LO-FD-15213
 Q—WASHER, C-TYPE—5323080
 R—GASKET, FILLER CAP—7415824
 S—CAP, FILLER—7415823
 T—FITTING, VENT LINE—5323092
 U—BOLT, SPECIAL—7415825
 V—GASKET—7373354

RA PD 149576

Figure 170. Sectional view of master cylinder assembly.

g. Install Filler Cap Components.—Install new filler cap gasket (J) in groove in filler cap (K). Place gasket (L), vent line fitting (M), and another gasket (L) over special bolt (N), insert bolt through filler cap (K); then install filler cap C-type washer (H) in groove in bolt. Place filler cap on top of filler pipe, thread special bolt into threads in filler pipe, and tighten to a maximum torque of 30 pound-feet.

Section IV. REBUILD OF WHEEL CYLINDERS

239. Disassembly of Wheel Cylinder

Note. Key letters noted in parentheses are in figure 171.

a. Pull piston rod (A) out of boot (B) at each end of cylinder body (G). Pull bead on large end of each boot (B) out of groove in ends of body (G) to remove boots.

b. Push pistons (C), piston cups (D), piston cup expanders (E), and piston return spring (F) out of body (G).



Figure 171. Wheel cylinder components.

240. Cleaning, Inspection, and Repair of Wheel Cylinder

Note. Key letters noted in parentheses are in figure 171.

a. Cleaning.—Wash all parts of wheel cylinder in denatured alcohol to remove hydraulic brake fluid. Never use cleaning solutions which contain petroleum products for cleaning hydraulic brake parts. Wipe parts dry with a clean cloth.

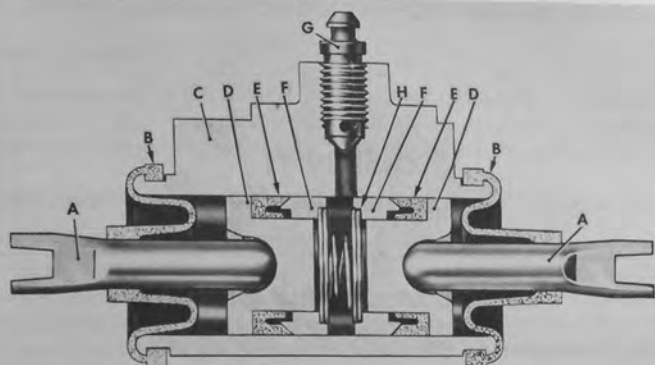
b. Inspection.—Carefully examine cylinder bore for scored or rusted condition. If either of these conditions is evident, the cylinder bore must be reconditioned by honing (*c* below). Examine pistons (C) and piston cup expanders (E) for burrs or cracks. Install new parts if damaged in any way. Check piston return spring (F) for free length and compression (par. 350); replace with new spring if not within specified limits. Always install new piston cups (D) and boots (B) when rebuilding wheel cylinders.

c. Repair.—Recondition wheel cylinder bore in same manner described for master cylinder (par. 237*c*).

241. Assembly of Wheel Cylinder

Note. Key letters noted in parentheses are in figure 171. Refer to figure 172 for sectional view of wheel cylinder showing assembled position of parts.

a. Dip all parts in hydraulic brake fluid before assembling. Install piston cup (D) and piston cup expander (E) on each piston (C). Insert one piston assembly into body (G) so that the expander is facing



A—ROD, PUSH, PISTON—7412067

B—BOOT—LO-FC-12054

C—BODY—LO-FD-10122

D—PISTON—LO-FC-14437

E—CUP, PISTON—LO-FD-14451

F—EXPANDER, PISTON CUP—LO-FC-14444

G—SCREW, BLEEDER—7539268

H—SPRING, RETURN, PISTON—LO-FC-14543

RA PD 149524

Figure 172. Sectional view of wheel cylinder assembly.

inward, install piston return spring (F) in body; then insert other piston assembly into other end of body. Make sure ends of piston return spring are seated in counterbore in piston cup expanders, and use care when guiding lips of cups into body not to damage cups.

b. Install boot (B) on each end of body (G), seating bead on large end of each boot in groove in each end of body. Insert rounded end of piston push rod (A) through small end of each boot until ends of rods extend approximately seven-eighths of an inch out of ends of boots. Plug tapped openings in body to prevent entrance of dirt prior to installation.

CHAPTER 11

PARKING BRAKE SYSTEM

Section I. DESCRIPTION AND DATA

242. Description

a. Mechanical Parking Brake.—Mechanical parking brake system comprises an external-contracting one-piece band type brake located at rear of transfer assembly, operated by a parking brake lever located in cab and connected to brake band through rods and a relay lever. The lever bracket and relay lever are equipped with replaceable bushings. A pilot pressed into center of brake drum web fits into counterbore in transfer drive flange to locate drum. Brake lining is secured to brake band by 26 tubular rivets.

b. Temporary (Electric) Parking Brake.—Temporary (electric) parking brake system comprises a solenoid valve connected into the master cylinder hydraulic outlet line, operated by a two-position switch on instrument panel. This parking brake is for emergency use only in the event of failure of the mechanical parking brake, and should not be depended upon to hold the vehicle for extended periods.

243. Data

a. Mechanical Parking Brake.

Type.....	external-contracting band
Location.....	rear of transfer
Brake drum diameter.....	9½ in.
Brake lining width.....	3 in.
Brake lining thickness.....	5/16 in.

b. Temporary (Electric) Parking Brake.

Switch:

Manufacturer.....	Delco-Remy
Model.....	1997889

Solenoid valve:

Manufacturer.....	Wagner Electric Corp
Model.....	FD-1501SH

Section II. REBUILD OF MECHANICAL PARKING BRAKE

244. General

Replacement of mechanical parking brake components is covered in TM 9-819A. Procedures which follow cover inspection and repair operations which are beyond the scope of the using organization.

245. Inspection of Mechanical Parking Brake Components

Note. Key letters noted in parentheses are in figure 173.

a. General.—Wash all parts except brake band and lining assembly in dry-cleaning solvent or volatile mineral spirits and dry thoroughly. Examine all small parts for distortion, evidence of wear, and damaged threads and replace with new parts as necessary. Check release spring (LL) and tension spring (PP) for free length and compression (par. 351). If not within specified limits, replace with new parts. Inspect major components of mechanical parking brake as directed in *b* through *f* below.

b. Lever Bracket and Bushings.—Examine lever bracket assembly (M) for cracks or visible distortion. Replace with new part if damaged in any way. Check bushings in bracket for wear (par. 351). If worn beyond specified limits, replace bushings (par. 246a).

c. Relay Lever and Bushings.—Examine relay lever assembly (W) for cracks or visible distortion. Make sure arms are securely welded to lever hub. If damaged in any way, replace with new part. Check bushings in hub for wear (par. 351). If worn beyond specified limits, replace bushings (par. 246b).

d. Brake Drum and Pilot.—Examine parking brake drum assembly (HH) for visible cracks or distortion and for rough or scored braking surface. Check runout of braking surface, which should not exceed 0.005-inch total dial indicator reading. If brake drum is cracked, or if runout is above specified maximum by an excessive amount, replace drum assembly. If braking surface is rough or scored or if runout is slight, drum can be refinished (par 246c). Check pilot in center of brake drum web for damage or looseness, and replace if necessary (par 246d).

e. Brake Band and Lining.—Inspect parking brake band with lining assembly (JJ) for distorted band and for loose or broken band anchor brackets. Replace if damaged in any way. Examine band lining for roughness, wear, or loose rivets. If lining is worn down close to rivet heads or if damaged in any way, replace lining (par. 246e).

f. Special Pin and Relay Lever Shaft.—Check special pin (N) and relay lever shaft (U) for wear at bearing contact area (par. 351). Replace with new parts if not within specified limits.

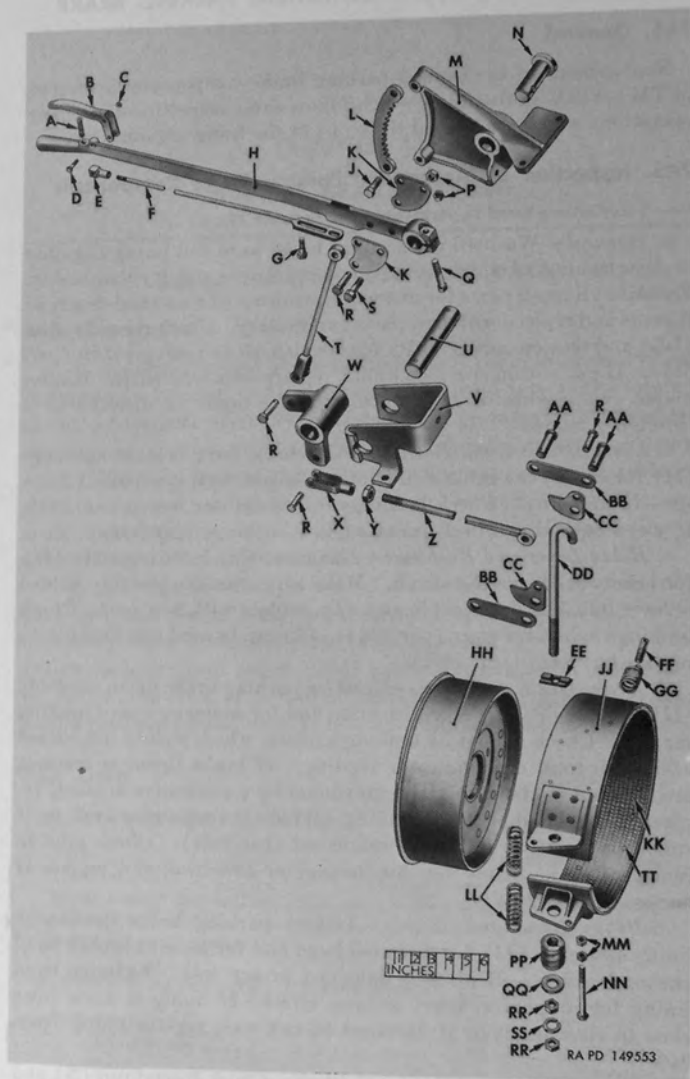


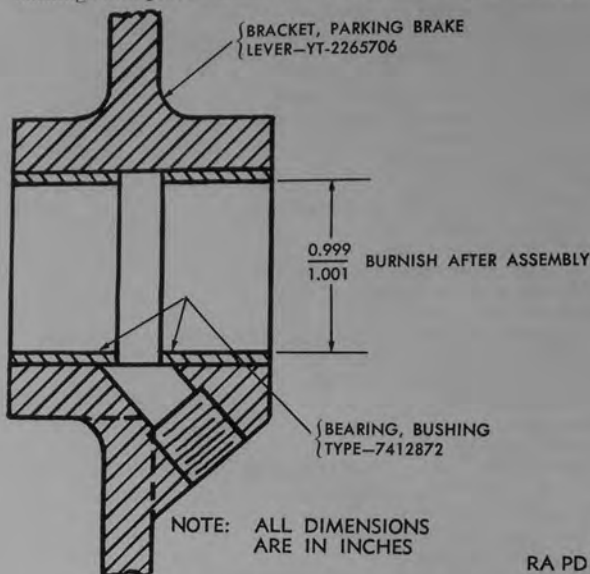
Figure 173. Mechanical parking brake components.

A—SPRING, LATCH—A291252
 B—LATCH, GRIP—7350481
 C—NUT, MACH-SCREW, NO. 10—110924
 D—SCREW, HEX-HD, NO. 10-24 X $\frac{7}{8}$ —7415983
 E—END, LEVER ROD—7350480
 F—ROD, LEVER—7350485
 G—SCREW, SPECIAL, $\frac{1}{4}$ -28 X $\frac{7}{8}$ —A291224
 H—LEVER, PARKING BRAKE, ASSY—7350482
 J—BOLT, $\frac{3}{8}$ -24 X 2—181648
 K—ADAPTER, LEVER—7350476
 L—SECTOR—7413006
 M—BRACKET, LEVER, ASSY—YT-2265707
 N—PIN, SPECIAL—7350483
 P—NUT, SAFETY, $\frac{3}{8}$ -24—442799
 Q—BOLT, CLAMP, $\frac{3}{8}$ -24 X $1\frac{1}{4}$ —181646
 R—PIN, CLEVIS, $\frac{3}{8}$ X $1\frac{5}{16}$ —138084
 S—BOLT, $\frac{3}{8}$ -24 X $1\frac{1}{8}$ —181641
 T—ROD, PARKING-BRAKE-LEVER-TO-RELAY-LEVER, ASSY—7350486
 U—SHAFT, RELAY LEVER—7350512
 V—BRACKET, RELAY LEVER—7350477
 W—LEVER, RELAY, ASSY—7350484
 X—YOKE—144243
 Y—NUT, $\frac{3}{8}$ -24—120369
 Z—ROD, RELAY-LEVER-TO-CAM-LEVER, ASSY—7350510
 AA—PIN, CLEVIS, $\frac{1}{2}$ X $1\frac{13}{64}$ —138086
 BB—LINK, SPACER—7735388
 CC—LEVER, CAM—7411344
 DD—BOLT, ADJUSTING—6245684
 EE—SHOE, OPERATING, CAM LEVER—6245683
 FF—SCREW, ANCHOR—6245840
 GG—SPRING, ANCHOR—6245694
 HH—DRUM, PARKING BRAKE, ASSY—7411357
 JJ—BAND, PARKING BRAKE, W/LINING, ASSY—6248820
 KK—LINING, BRAKE BAND—YT-2196088
 LL—SPRING, RELEASE—5284008
 MM—NUT, $\frac{1}{4}$ -20—120375
 NN—BOLT, LOCATING, $\frac{1}{4}$ -20 X $3\frac{1}{4}$ —187068
 PP—SPRING, TENSION—6245692
 QQ—WASHER, PLAIN,—120396
 RR—NUT, $\frac{7}{16}$ -14—124834
 SS—WASHER, LOCK, $\frac{7}{16}$ -IN.—120383
 TT—RIVET, TUBE, $\frac{3}{64}$ X $\frac{3}{8}$ —136497

Figure 173.—Continued.

246. Repair of Mechanical Parking Brake Components

a. *Lever Bracket Bushing Replacement* (fig. 174). Press old bushings out of bracket. Press new bushing into each end of bracket until outer end of each bushing is flush with face of bracket. After pressing bushings into place burnish to diameter shown in figure 174.



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Figure 174. Sectional view of lever bracket and bushings.

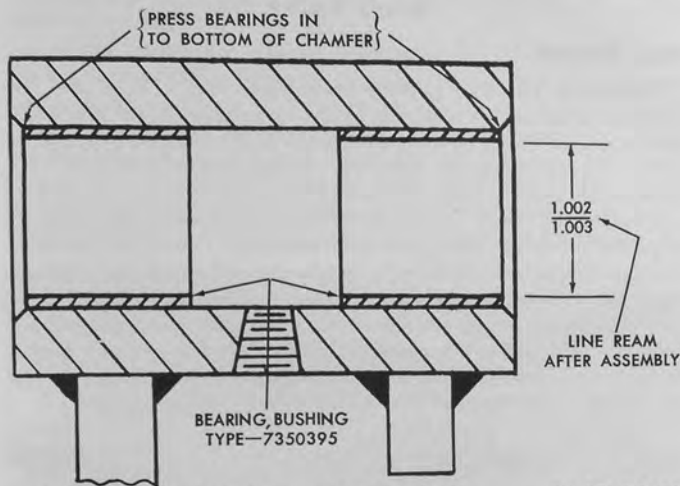
b. *Relay Lever Bushing Replacement* (fig. 175).—Press old bushings out of lever hub. Press new bushing into each end of hub until outer edge of each bushing is at bottom of chamfer in hub bore. After pressing bushings into place, line ream to diameter shown in figure 175.

c. *Refinishing Brake Drum*.—When refinishing brake drum, remove only enough metal to smooth up braking surface or to correct runout. A $\frac{1}{16}$ -inch radius must be maintained at brake drum flange.

d. *Brake Drum Pilot Replacement* (fig. 176).—Press pilot out of brake drum web. Press new pilot into brake drum web until it extends through the front (flanged) side to dimension shown in figure 176.

e. *Brake Band Lining Replacement*.

- (1) Remove rivets, using deliner punch in a conventional brake relining machine. Remove lining from brake band.

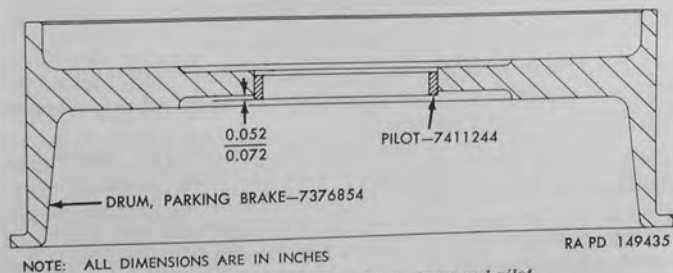


NOTE: ALL DIMENSIONS ARE IN INCHES

RA PD 149462

Figure 175. Sectional view of relay lever and bushings.

- (2) Thoroughly clean brake band, using a wire brush if necessary to remove corrosion.
- (3) Position new lining in brake band with two end holes alined, install two $\frac{9}{64} \times \frac{3}{8}$ tubular rivets, and upset rivets with a conventional brake relining machine. Install and upset balance of $\frac{9}{64} \times \frac{3}{8}$ tubular rivets (total of 26). Make sure lining fits firmly against band at all points and that rivets are properly upset.



RA PD 149435

NOTE: ALL DIMENSIONS ARE IN INCHES

Figure 176. Sectional view of brake drum and pilot.

Section III. REBUILD OF TEMPORARY (ELECTRIC) PARKING BRAKE VALVE

247. General

Temporary (electric) parking brake valve (fig. 177) is used for emergency parking by retaining hydraulic pressure in the brake system by means of a solenoid-actuated seal which is released by breaking the circuit supplying the solenoid. Valve consists primarily of a plunger and seal cup contained in a pressure-tight tube surrounded by a solenoid coil, which in turn is contained in a watertight case. A check valve cup and spring are also contained in outlet end of valve to allow hydraulic brake fluid to be introduced into the brake system when the solenoid is energized. Waterproof cables, equipped with bayonet type connectors and female connector shells, are provided for connecting the solenoid coil into the vehicle electrical system. A two-position switch, mounted on instrument panel in cab, is included in the circuit to energize and deenergize the solenoid as required.



Figure 177. Overall view of temporary (electric) parking brake valve.

248. Operation of Parking Brake Valve

Note. Key letters noted in parentheses are in figure 178.

a. Solenoid coil can be energized (switch turned "ON") either before or after applying the brakes, but must be energized before brakes are released to hold brakes applied.

b. When brakes are applied with solenoid coil (H) deenergized (switch turned "OFF"), hydraulic brake fluid from the master cylinder enters at the inlet plug (M), passes around the hexagon-shaped plunger (J), through the center hole in plunger stop (E), and check valve cup (P), and out the outlet plug (A) to the air-hydraulic power cylinder, applying the brakes. If solenoid coil (H) is now energized by turning switch "ON," magnetic field causes plunger (J) to seat

against plunger stop (E) and plunger cup (F) seats around center hole in plunger stop, preventing brake fluid from returning to master cylinder, holding brakes applied.

c. When brakes are applied with solenoid coil (H) energized (switch turned "ON"), hydraulic brake fluid from the master cylinder enters at the inlet plug (M) and passes around the hexagon-shaped plunger (J). Since the plunger cup (F) is sealing center hole in plunger stop (E), brake fluid passes through the small holes near edge of plunger stop and forces the check valve cup (P) away from plunger stop, then passes through center hole in cup and out the outlet plug (A) to the air-hydraulic power cylinder applying the brakes. As

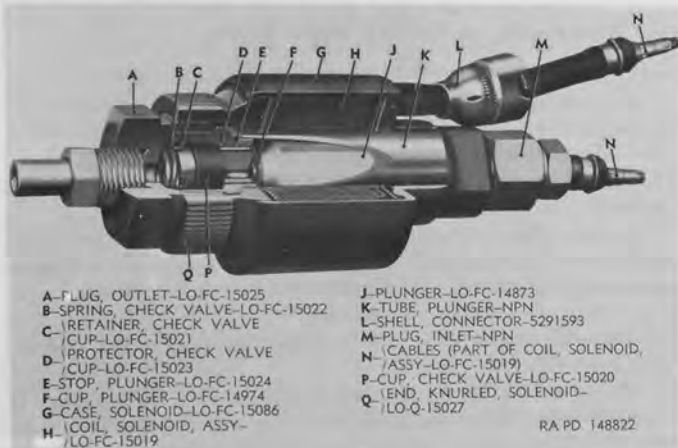


Figure 178. Cut-away section of temporary (electric) parking brake valve

soon as pressure is removed from brake fluid passing through valve (brake pedal released), check valve spring (B) seats check valve cup (P) against plunger stop (E), sealing the holes in edge of plunger stop against the return of brake fluid and holding the brakes applied.

d. When solenoid coils (H) are deenergized by turning switch "OFF," magnetic field around plunger collapses, releasing plunger. Hydraulic brake fluid pressure on outlet end forces plunger away from plunger stop (E) and returns through center holes in check valve cup (P) and plunger stop (E) through the inlet plug (M) to the master cylinder, permitting brakes to release.

Warning: Temporary (electric) parking brake valve is not designed to hold high pressures for an indefinite period, and its use should therefore be restricted to EMERGENCY parking only, and

for not over 1 hour at a time. Use the mechanical parking brake whenever possible.

249. Testing Parking Brake Valve

Connect inlet end of valve to source of hydraulic brake fluid pressure, and connect a hydraulic pressure gage to outlet end. Connect cables to source of 24-volt current. With 24 volts applied to the solenoid coil, valve must trap 1,100 p. s. i. hydraulic pressure which must not drop below 1,000 p. s. i. within 10 seconds. If pressure drops below 1,000 p. s. i. within 10 seconds, valve assembly must be rebuilt or replaced.

250. Disassembly of Parking Brake Valve

Note. Key letters in text refer to figure 178.

a. Suitable radius blocks with serrations on inside diameter to fit knurled end of solenoid should be used when clamping the parking brake valve in vise for disassembly.

b. With solenoid knurled end (Q) clamped in vise, remove outlet plug (A).

c. Remove check valve cup (P), check valve cup retainer (C), check valve spring (B), and plunger stop (E). Remove check valve cup protector (D) from plunger stop (E) by inserting a small wire through hole near edge of plunger stop.

d. Remove plunger (J) from plunger tube (K); then remove plunger cup (F) from plunger.

e. Do not attempt to further disassemble parking brake valve. If inspection (par. 251b) reveals any defects in solenoid case (G), solenoid coil (H), or plunger tube (K), the complete parking brake valve assembly must be replaced.

251. Cleaning and Inspection of Parking Brake Valve

Note. Key letters noted in parenthesis are in figure 178.

a. *Cleaning.*—Wash all parts except solenoid, case, and tube assembly in denatured alcohol. Never use cleaning solutions containing petroleum products for cleaning hydraulic brake parts. Wipe or blow hydraulic brake fluid out of inside of plunger tube (K).

b. *Inspection.*

- (1) *Plunger and plunger cup.*—Examine face of plunger (J) around cup bore; surface must be smooth, and edge of cup bore must be sharp and free of nicks and burs. Face of plunger cup (F) must be smooth and without transverse grooves; concentric grooves, if small, are not harmful. Install cup in plunger; cup must extend at least 0.012 inch and

not more than 0.018 inch from end of plunger. Best operation is obtained with cup extending 0.012 to 0.014 inch. Make sure small bleed hole in plunger at bottom of cup bore is open to permit air or fluid behind cup to escape so cup will seat in bottom of bore.

- (2) *Plunger stop*.—All surfaces of plunger stop (E) must be free of burrs and scratches. Make sure eight small holes near edge of stop are clean and open. Make sure tapered shoulder is perfectly smooth and will form a tight seal against seat at end of plunger tube (K).
- (3) *Check valve cup*.—Inspect check valve cup (P) for nicks or scratches at the sealing edges or other imperfections. Replace cup if any damage is evident.
- (4) *Check valve spring*.—Inspect check valve spring (B) for free length and compression (par. 352). Replace spring if not within specified limits.
- (5) *Outlet end plug*. Inspect outlet plug (A) for nicks or scratches on tapered tube seat and for damaged threads. Bottom of large bore in end plug must have concentric grooves without nicks or scratches, to provide a good seat for outer end of plunger stop when assembled.
- (6) *Solenoid, case, and tube assembly*.—Interior of brass plunger tube (K) must be smooth, and the tapered sealing face toward threaded opening must not be marred or scratched. Check circuit continuity through solenoid coil (H) and check coil for ground, using 24-volt battery current and test lamp. If coil tests satisfactory for circuit continuity and ground, test resistance of coil with ohmmeter; resistance must be between 75 and 90 ohms. Check condition of cables, terminals, and connector shells. Grommet, bushing, and shell can be replaced if damaged (par. 293). If any other damage is evident, replace complete parking brake valve assembly.

252. Assembly of Parking Brake Valve

Note. Key letters noted in parenthesis are in figure 178.

- a. Coat all internal parts with hydraulic brake fluid before assembling.
- b. Place plunger stop (E) in solenoid end, with check valve cup bore facing open end.
- c. Drop check valve cup protector (D) into check valve cup bore in plunger stop; then place check valve cup (P) in plunger stop with open end of cup facing outward.
- d. Place check valve cup retainer (C) inside of check valve cup, install check valve spring (B) inside of retainer; then position outlet

plug (A) over spring and plunger stop and thread into solenoid knurled end (Q).

e. Clamp solenoid knurled end in vise, using radius blocks (par. 250a) to prevent distorting unit or damaging serrations. Tighten outlet plug to a torque of 145 to 155 pound-feet torque.

CHAPTER 12

WHEELS AND HUBS

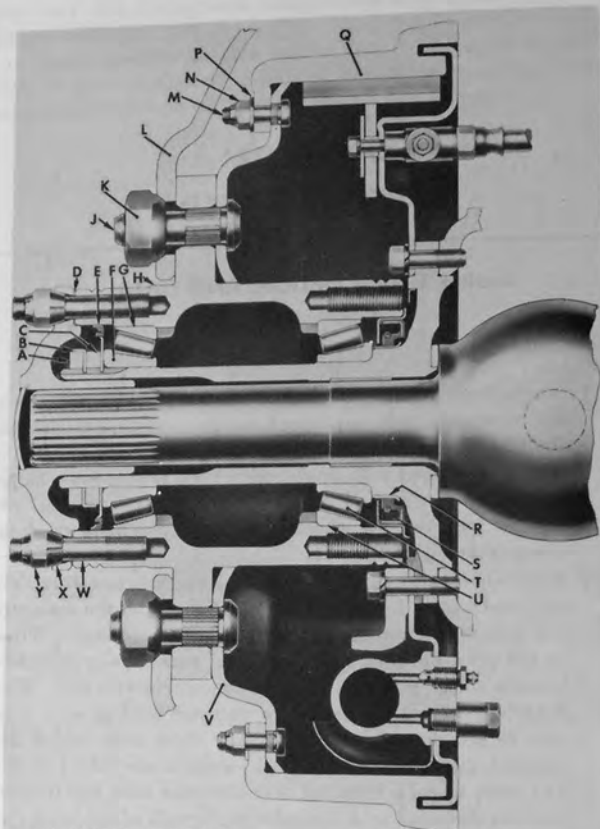
Section I. DESCRIPTION AND DATA

253. Description

a. Wheels.

- (1) Single front wheels are used on all truck models covered by this manual; single rear wheels are used on some models and dual rear wheels are used on other models. Wheels used on vehicles equipped with single rear wheels are not interchangeable with wheels used on models equipped with dual rear wheels; however, all wheels used on any vehicle are interchangeable with each other.
- (2) Each wheel consists of a riveted disk and rim assembly. One tire bead seat is formed by the rim flange and the removable tire retaining ring forms the other tire bead seat. Wheels do not pilot on hub; taper on wheel nuts engage chamfered holes in wheel, positioning wheel concentric with hub. When dual rear wheels are used, two nuts are used on each wheel stud to attach wheels to hub. The inner nuts, which have internal and external threads, secure inner wheel to hub. The outer wheel is installed over the inner nuts, and the outer nuts are threaded onto the external threads of the inner nuts. Front wheel installation is illustrated in figure 179, and both single and dual rear wheel installations are shown in figure 180.

b. Hubs.—Front and rear hubs are identical on all vehicles; however, different wheel studs and brake drum backs are used and drive flange studs must be installed in correct end of hub for right side, left side, front, single rear, and dual rear wheel application. Flange on hub is nearer one end than the other. When used at front on all vehicles and at rear when single rear wheels are used, the drive flange studs are installed in the short end of the hub. When dual rear wheels are used, the drive flange studs are installed in the long end of the hub. Refer to figure 182 for identification of brake drum back to

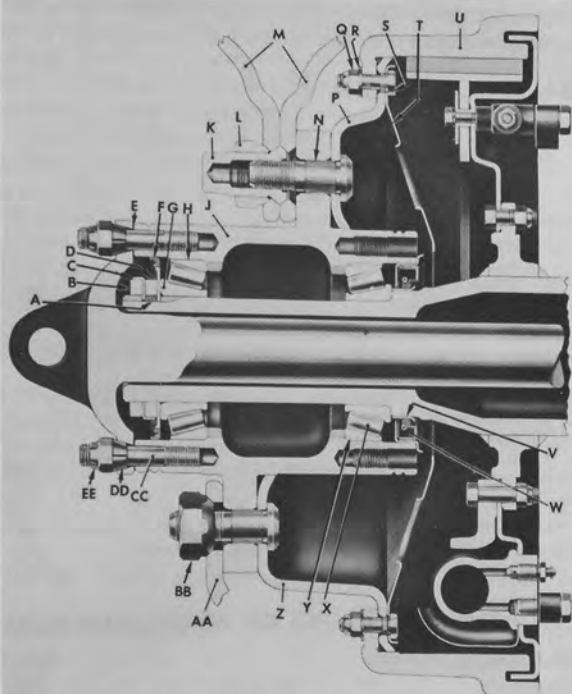


- A—NUT, ADJUSTING, WHEEL BEARING—7411379
 B—LOCK, ADJUSTING NUT—7411378
 C—NUT, ADJUSTING, WHEEL BEARING—7411379
 D—GASKET—7411265
 E—SEAL, OIL, OUTER, ASSY—7411430
 F—CONE, ROLLER BEARING, OUTER—712868
 G—CUP, ROLLER BEARING, OUTER—712869
 H—HUB, W/BEARING CUPS, ASSY—7411427
 J—STUD, WHEEL (RIGHT)—501245
 I—STUD, WHEEL (LEFT)—501246
 K—NUT, WHEEL STUD (RIGHT)—537803
 L—NUT, WHEEL STUD (LEFT)—537804

- M—WHEEL, ASSY (SINGLE WHEELS)—7389617
 N—WHEEL, ASSY (DUAL WHEELS)—7389620
 M—STUD—7411426
 N—NUT, SAFETY, 3/8-24—442799
 P—WASHER, PLAIN—120394
 Q—DRUM, BRAKE—7411425
 R—SLEEVE, INNER OIL SEAL—7411433
 S—SEAL, OIL, INNER, ASSY—7411429
 T—CONE, ROLLER BEARING, INNER—712868
 U—CUP, ROLLER BEARING, INNER—712869
 V—BACK, BRAKE DRUM—7413231
 W—STUD, 2-7/8-IN LONG—7411269
 X—WEDGE, DOWEL, TAPERED—7411264
 Y—NUT, SAFETY, 1/2-20—442801

RA PD 149593

Figure 179. Sectional view of front hub installed on axle.



- A—SEAL, OIL, ADJUSTING NUT—7411428
 B—NUT, ADJUSTING, WHEEL BEARING—7411379
 C—LOCK, ADJUSTING NUT—7411378
 D—NUT, ADJUSTING, WHEEL BEARING—7411379
 E—GASKET—7411265
 F—SEAL, OIL, OUTER, ASSY—7411430
 G—CONE, ROLLER BEARING, OUTER—712868
 H—CUP, ROLLER BEARING, OUTER—712869
 J—HUB, W/BEARING CUPS, ASSY—7411427
 K—NUT, WHEEL STUD, INNER, RIGHT (DUAL WHEELS)—537809
 L—NUT, WHEEL STUD, INNER, LEFT (DUAL WHEELS)—537810
 M—NUT, WHEEL STUD, OUTER, RIGHT (DUAL WHEELS)—537805
 N—NUT, WHEEL STUD, OUTER, LEFT (DUAL WHEELS)—537808
 P—WHEEL, ASSY (DUAL WHEELS)—7389620
 Q—STUD, WHEEL (RIGHT)—501245
 R—STUD, WHEEL (LEFT)—501246

- P—BACK, REAR BRAKE DRUM (DUAL WHEELS)—7413231
 Q—NUT, SAFETY, 3/8-24—442799
 R—WASHER, PLAIN—120394
 S—STUD—7411426
 T—SHIELD, OIL, REAR BRAKE DRUM—7411432
 U—DRUM, BRAKE—7411425
 V—SLEEVE, INNER OIL SEAL—7411433
 W—SEAL, OIL, INNER, ASSY—7411429
 X—CONE, ROLLER BEARING, INNER—712868
 Y—CUP, ROLLER BEARING, INNER—712869
 Z—BACK, REAR BRAKE DRUM (SINGLE WHEELS)—7413232
 AA—WHEEL, ASSY (SINGLE WHEELS)—7389617
 BB—NUT, WHEEL STUD, RIGHT (SINGLE WHEELS)—537803
 CC—NUT, WHEEL STUD, LEFT (SINGLE WHEELS)—537804
 DD—STUD, 2-7/8-IN LONG—7411269
 EE—WEDGE, DOWEL, TAPERED—7411264
 FF—NUT, SAFETY, 1/2-20—442801

RA PD 149594

Figure 180. Sectional view of rear hub installed on axle.

be used for a specific application, and for wheel studs to be used on right and left sides. Brake drum backs are secured to the hub flange by the fluted-shoulder wheel studs which are pressed into the hub flange.

254. Data

a. Wheels.

Ordinance number:	7389617
Single front and rear.....	7389620
Single front and dual rear.....	20 x 7.50
Rim size.....	
Offset:	
Single front and rear.....	5 $\frac{1}{8}$ in.
Single front and dual rear.....	6 $\frac{3}{16}$ in.
Bolt circle diameter.....	8 $\frac{3}{4}$ in.
Wheel bore diameter.....	6.469 to 6.473 in.

b. Hubs.

Wheel stud circle diameter.....	8 $\frac{3}{4}$ in.
Drive flange stud holes:	
Diameter of stud circle.....	5 $\frac{5}{16}$ in.
Hole threads.....	$\frac{1}{2}$ -13
Drive flange studs:	
Thread size.....	$\frac{1}{2}$ -13-20
Stud length.....	2 $\frac{7}{8}$ in.
Stud driven height (when tightened to 50 to 60 pound-feet).....	1 $\frac{5}{16}$ to 1 $\frac{7}{16}$ in.

Section II. REBUILD OF WHEELS AND HUBS

255. Wheels

a. *Inspection.*—Inspect wheel (disk and rim assembly) for visible distortion, loose rivets, or other damage. Mount wheel in a suitable

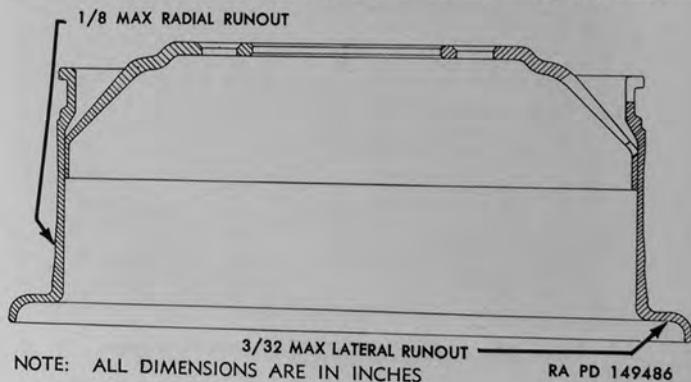


Figure 181. Wheel (disk and rim assembly) showing checking points.

fixture and check for lateral runout (wobble) and for radial runout (out-of-round) at points shown in figure 181. If wheel is only slightly distorted or if rivets are loose, wheel can be repaired (*b* below). If badly damaged, replace with new part.

b. Repair.—If adequate equipment is available, wheels that are slightly distorted can be straightened. Lateral and radial runout must not exceed maximum limits shown in figure 181. Tighten or replace any loose rivets attaching disk to rim.

a. General.—The procedures which follow cover removal, inspection, and repair of the hub, cups, studs, and brake drum back assembly, and installation and adjustment of the hub and bearings. Sectional views of these parts installed on the axle are shown in figures 179 and 180. Key letters in text refer to figure 182.

256. Hubs and Bearings

b. Hub and Bearing Removal.

- (1) Remove brake drum (par. 229*a*).
- (2) Remove eight nuts from drive flange studs. Strike hub drive flange (front axle) or axle shaft (rear axle) a sharp blow with a soft metal hammer to loosen tapered dowel wedges; then remove dowel wedges from studs. Remove hub drive flange (front axle) or axle shaft (rear axle). On front axles, two $\frac{1}{2}$ –20 puller screws may be used in tapped holes in hub drive flange if necessary to remove hub drive flange.
- (3) Bend tangs of adjusting nut lock (C) away from wheel bearing adjusting nuts (B and D). Remove wheel bearing adjusting nut (B), adjusting nut lock (C), wheel bearing adjusting nut (D), and outer oil seal assembly (F) from steering knuckle (front axle) or axle housing (rear axle). Pull hub and bearing assembly straight off steering knuckle or axle housing.
- (4) Lift outer roller bearing cone (G) out of outer end of hub. Using a suitable driver through outer end of hub to exert force on inner roller bearing cone, force inner roller bearing cone (L) and inner oil seal assembly (M) out of inner end of hub.

c. Inspection.

- (1) Inspect brake drum back (P) and brake drum oil shield (S) (used at rear only) for distortion and replace if this condition is found (*d*(2) below). Examine studs (R) which are pressed into brake drum back for damaged threads. If damaged, replace studs (*d*(1) below).
- (2) Examine right and left wheel studs (Q) for damaged threads. If damaged, replace studs (*d*(2) below).

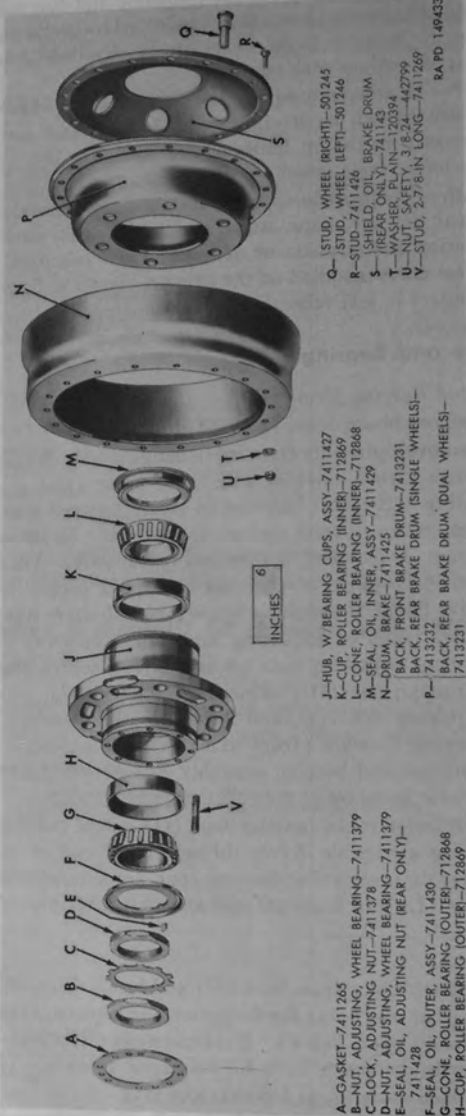


Figure 182. Hub, bearing, drum back, and stud components.

- (3) Inspect drive flange studs (V) for damaged threads or bent condition. If bent or if threads are damaged, replace studs (*d*(3) below).
- (4) Examine outer and inner roller bearing cups (H and K) for pitting, cracks, or evidence of wear. If any of these conditions are evident, replace bearing cups (*d*(4) below).

d. Repair.

- (1) *Drum back stud replacement.*—Press studs (R) out of brake drum back, supporting drum back near studs to prevent distorting drum back. Brake drum oil shield (S) (used at rear only) will be removed when studs are pressed out.

Note. Before installing studs and oil shield on rear hub, right and left wheel studs (Q) and brake drum back (P) must be replaced if necessary as indicated by inspection (*b* above).

Heads of wheel studs are not accessible after oil shield is installed. On rear hub only, position brake drum oil shield on drum back. Support drum back near outer edge to prevent distortion. Press studs into drum back until heads of studs seat firmly against drum back or oil shield.

- (2) *Brake drum back or wheel stud replacement.*—To remove brake drum back (P) or right and left wheel studs (Q), press wheel studs out of hub flange and brake drum back. Position drum back on hub flange, referring to figure 182 for identification of drum back to be used for front, single rear, or dual rear wheels and for wheel studs to be used on right and left sides. At rear only, brake drum oil shield (S) and studs (R) must be removed from drum back ((1) above) before wheel studs can be installed. Insert studs through brake drum back and hub flange as far as possible by hand; then support hub flange and press studs in until heads of studs bottom against brake drum back. At rear only, install brake drum oil shield (S) and studs (R) ((1) above).

- (3) *Drive flange stud replacement.*—Damaged studs (V) can be removed from end of hub with a stud remover and replacer. If all studs are removed, or when installing studs in a new hub and cup assembly, determine end of hub in which studs are to be installed (par. 253*b*). Make sure threads in tapped holes are not damaged and that holes are not partially filled with grease or dirt which would prevent driving studs to proper height. Tighten studs into hub, using a stud remover and replacer, to a torque of 50 to 60 pound-feet; then check stud height. Studs should extend from end of hub $1\frac{5}{16}$ to $1\frac{7}{16}$ inches after being tightened to above torque.

- (4) *Bearing cup replacement.*—Using a brass drift through opposite end of hub, drive out each bearing cup. Four knock-out notches are provided in each bearing flange on inside of hub. Alternately drive on opposite sides of bearing cup to prevent cocking bearing cup and damaging machined bore in hub. Install new bearing cups in hub, driving them into place with replacer 41-R-2392-635 as shown in figure 183. Make sure cups are driven in squarely and are fully seated against flanges on inside of hub.

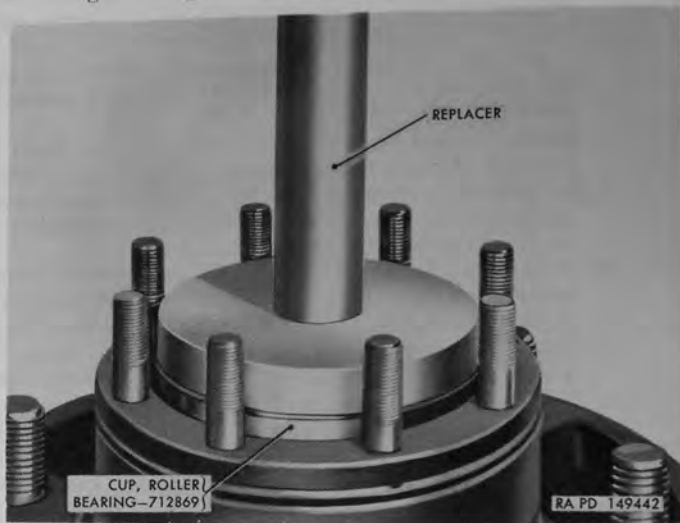


Figure 183. Installing bearing cups in hub with replacer 41-R-2392-635.

e. Hub and Bearing Installation.

- (1) Clean, inspect, and lubricate outer and inner roller bearing cones (G and L), inside of hub with bearing cups assembly (J), and steering knuckle or axle housing as directed in TM 9-819A.
- (2) Place inner roller bearing cone (L) in inner end of hub. Position new inner oil seal assembly (M) on inner end of hub and drive into place with replacer 41-R-2392-635 (fig. 184). Oil seal flange must seat against inner end of hub.
- (3) Install hub assembly on steering knuckle (front axle) or axle housing (rear axle), using care not to damage inner oil seal. Place outer rolling bearing cone (G) on steering knuckle or axle housing and press into outer end of hub with

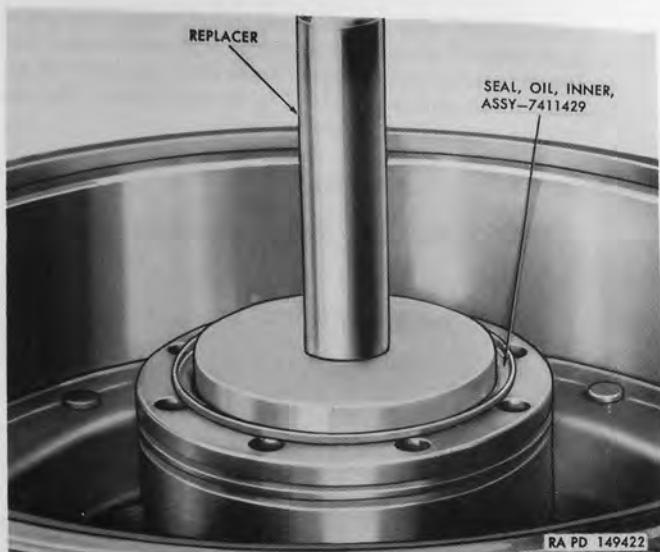


Figure 184. Installing inner oil seal with replacer 41-R-2392-635.

fingers. Install outer oil seal assembly (F) on steering knuckle or axle housing and press into hub against bearing. On rear axles only, install adjusting nut oil seal (E) in groove in axle housing.

- (4) Install wheel bearing adjusting nut (D) on steering knuckle or axle housing, using care not to dislodge adjusting nut oil seal (E) at rear axle. Adjust bearings, and complete the installation as directed in *f* below.

f. Bearing Adjustment.

- (1) Using wrench 41-W-3825-66 at front or 7950690 at rear with torque wrench 41-W-3634, tighten wheel bearing adjusting nut (D) to a torque of 60 to 75 pound-feet; then back nut off three-eighths of a turn. Lock adjusting nut in this position by installing adjusting nut lock (C) and bending two tangs of nut lock over flats of adjusting nut.
- (2) Install another wheel bearing adjusting nut (B) and, using same tools mentioned in (1) above, tighten nut to a torque of 100 to 150 pound-feet. Secure nut by bending two tangs of nut lock over flats of nut.
- (3) Place new gasket (A) on drive flange studs in hub. Install axle shaft (rear axle) or hub drive flange (front axle) and

- attach to hub with eight tapered dowel wedges and eight $\frac{1}{2}$ -20 nuts. Tighten nuts to a torque of 55 to 65 pound-feet.
- (4) Install brake drum on studs in brake drum adapter and attach with 18 plain washers and $\frac{3}{8}$ -24 safety nuts. Tighten nuts to a torque of 20 to 27 pound-feet.

CHAPTER 13

STEERING GEAR AND DRAG LINK

Section I. DESCRIPTION AND DATA

257. Description

Note. Key letters noted in parentheses are in figure 185 unless otherwise indicated.

a. General.—The steering system consists of a recirculating-ball type steering gear assembly, mounted on left frame side rail, interconnected from Pitman arm to front axle left steering arm with a drag link. Movement of the steering wheel is transmitted through steering gear mechanism and drag link to the axle steering arm. Both wheels are turned by means of a tie rod interconnecting the front axle right and left steering knuckles. Components of the tie rod and front axle are covered in chapter 7.

b. Steering Gear Assembly.

(1) *Construction.*

- (a) *Steering shaft.*—A worm is integrally welded to steering shaft assembly (G). The worm portion of the shaft is mounted between two roller bearings. The shaft lower bearing (J) is adjustable toward shaft upper bearing (C) by means of the worm bearing adjuster (K) for purpose of eliminating end play and maintaining suitable bearing preload. The steering shaft assembly extends through the column jacket with steering wheel mounted on upper end of shaft. A ball-type bearing assembly, mounted in upper end of jacket, takes the radial load on the upper end of the shaft.
- (b) *Worm ball nut.*—The worm ball nut (F) fits over the worm portion of the steering shaft. The bore of the ball nut is threaded with helical grooves corresponding with groove in shaft worm. Within the length of the ball nut, helical grooves are filled with steel worm balls (E). There are two separate circuits in the ball nut. To complete each circuit and to keep balls from running out at ends, ball

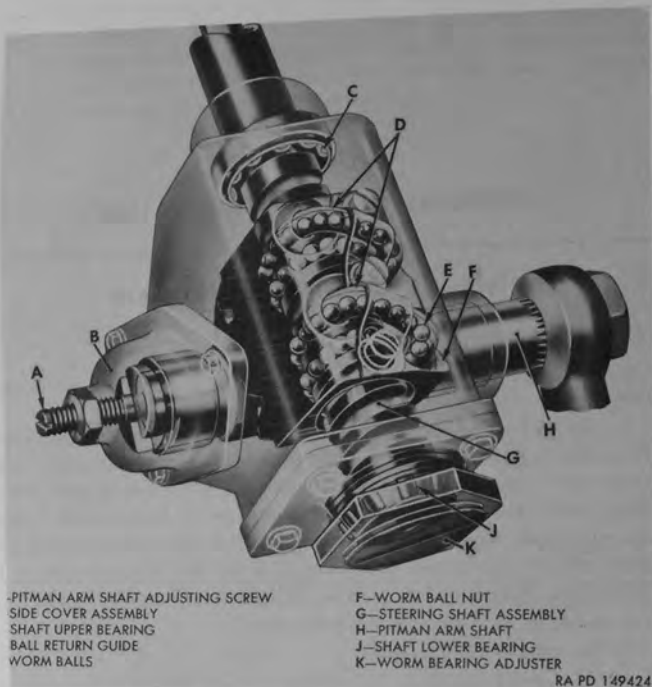


Figure 185. Phantom view of steering gear mechanism.

nut is fitted with ball return guides (D). Each guide deflects the balls from their helical path when they reach the end of the ball nut, thus returning the balls to the helical path in the ball nut at start of circuit.

(c) *Pitman arm shaft.*—The Pitman arm shaft (H) which is integral with sector gear, is mounted in bushings in steering gear housing and side cover assembly (B). The side cover supports the Pitman arm shaft adjusting screw (A) which permits lash adjustment by shifting Pitman arm shaft along its axis. The teeth on the sector gear mesh with similar teeth on worm ball nut.

(d) *Horn connections.*—The horn button contact cable assembly (M, fig. 198) is mounted on steering shaft assembly as shown on figure 197. The cable extends inside the shaft to the horn button contact assembly (X, fig. 198) in the

steering wheel center. The horn button (V, fig. 198) in center of steering wheel is depressed to make contact. The cable connector (K, fig. 198) is threaded to column jacket, and is sealed with cable connector seal (L, fig. 198) between connector nut and column jacket.

- (2) *Operation* (fig. 185).—As steering wheel turns steering shaft with integral worm, worm ball nut travels on worm as with an ordinary screw thread. Balls, circulating in helical grooves of ball nut and shaft worm, travel within their separate circuits. A screw action, with rolling instead of sliding contact, is obtained. The movement of worm ball nut teeth in contact with the sector teeth on Pitman arm shaft turns the Pitman arm shaft. The movement of the Pitman arm, attached to the arm shaft, turns front wheels by means of the interconnecting drag link.

c. *Drag Link*.—A tubular type drag link (fig. 204) is connected to Pitman arm and left steering arm of front axle with tapered ball studs and nuts. Ball studs are mounted in drag link ends in special bearing material which permits movement of the ball studs but requires no lubrication. A rubber dust seal is placed around taper of each stud to prevent dirt and water entering ball stud bearings.

258. Data

a. *Steering Gear Assembly*.

Manufacturer	Saginaw Steering Gear Div.
Model number	552-D-6
Ratio	28.14 to 1
Steering wheel diameter	20 in.

b. *Drag Link*.

Manufacturer	Saginaw Steering Gear Div
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Section II. REBUILD OF STEERING GEAR ASSEMBLY

259. Preliminary Procedures

Note. Key letters noted in parentheses are in figure 198 unless otherwise indicated.

Caution: Whenever necessary to turn the steering mechanism to extreme right or left, approach either extreme gently to avoid damage to ball return guides on worm ball nut.

a. *Cleaning Assembly*.—Clean exterior of entire steering gear assembly (fig. 186) with dry-cleaning solvent or volatile mineral spirits before attempting to disassemble the unit.

b. *Facilities*.—Mount steering gear assembly in a vise or holding fixture in a manner that will permit access to both the end and side

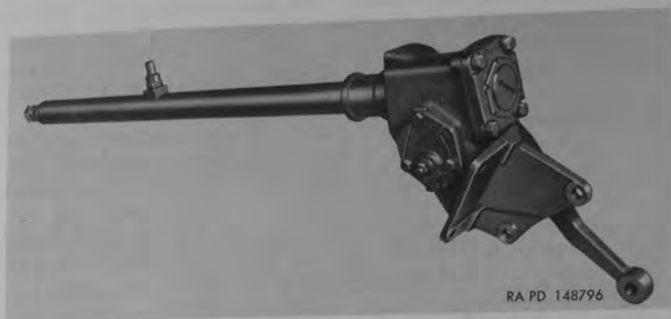


Figure 186. External view of steering gear assembly.

covers. Do not grip the steering gear housing tightly in vise. Grip the mounting flange with the vise. Disassemble steering gear on a clean bench and use clean receptacles to hold the parts.

c. Steering Wheel Removal.—Steering wheel may remain with steering gear when assembly is removed from vehicle. If so, remove steering wheel in following manner.

- (1) Remove four No. 10 x $\frac{7}{8}$ screws (U) which attach horn button retaining ring (T) to steering wheel assembly. Re-

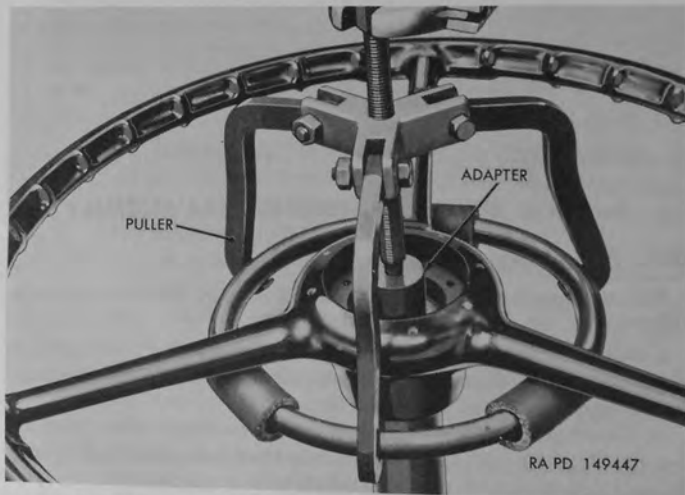


Figure 187. Removing steering wheel using adapter 41-A-27-430 with puller 41-P-2954.

move retaining ring, horn button (V), and horn button contact assembly (X).

- (2) Remove steering wheel nut (S).
- (3) Install adapter 41-A-27-430 with puller 41-P-2954 at steering wheel in manner shown in figure 187. Pull steering wheel from shaft.
- (4) Remove shaft bearing spring (Q) and shaft bearing spring seat (P).

260. Disassembly Procedures

Note. Key letters noted in parentheses are in figure 188 unless otherwise indicated. The sectional view (fig. 198) illustrates parts in their respective positions.

a. Remove cable connector (G) from column jacket (F). Discard cable connector seal (H).

b. If Pitman arm has not been removed from Pitman arm shaft (JJ), remove Pitman arm nut (L) and $\frac{7}{8}$ -inch lock washer (M); then install puller 41-P-2952 in manner shown in figure 189. Remove Pitman arm from shaft.

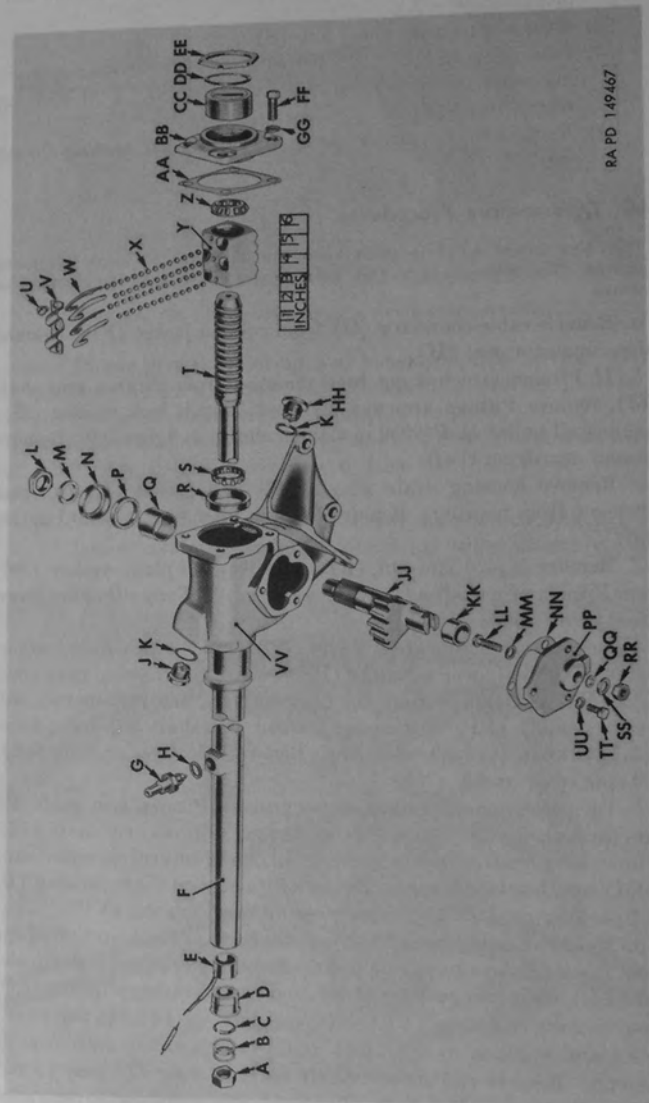
c. Remove housing drain plug (HH) and gasket (K) to drain lubricant from housing. Remove housing filler plug (J) and gasket (K).

d. Remove $\frac{7}{16}$ -20 jam nut (RR) and $\frac{15}{32}$ ID plain washer (SS) from Pitman arm shaft adjusting screw (LL). Turn adjusting screw a few turns counterclockwise.

e. Remove three side cover bolts (TT) and $\frac{3}{8}$ -inch lock washers (UU). Pry side cover assembly (PP) away from steering gear housing (VV). After lubricant has drained from housing, remove side cover assembly (PP) by turning Pitman arm shaft adjusting screw (LL) clockwise through side cover. Remove side cover packing (QQ) and side cover gasket (NN).

f. Turn steering shaft until sector gear on Pitman arm shaft will pass through housing opening; then remove Pitman arm shaft (JJ). Pitman arm shaft adjusting screw (LL) and adjusting screw shim (MM) can then be removed. Remove Pitman arm shaft packing (P) and packing retainer (N) from steering gear housing (VV).

g. Mount assembly horizontally on bench to prevent worm ball nut from running down to end of shaft. Remove worm bearing adjuster nut (EE), end cover packing (DD), and worm bearing adjuster (CC) from housing end cover (BB). Remove four $\frac{7}{16}$ -14 x $1\frac{1}{8}$ cap screws (FF) and $\frac{7}{16}$ -inch lock washers (GG) which attach end cover to housing. Remove end cover. Shaft lower bearing (Z) may remain with cover or on end of shaft. Remove bearing and end cover gasket (AA).



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A-NUT (STEERING WHEEL)—7376315
 B-SPRING, SHAFT BEARING—SSG-262250
 C-SEAT, SHAFT BEARING SPRING—7377383
 D-BEARING, ASSY—SSG-262251
 E-CABLE, HORN BUTTON CONTACT, ASSY—SSG-267898
 F-JACKET, COLUMN—7376355
 G-CONNECTOR, CABLE—SSG-5662809
 H-SEAL, CABLE CONNECTOR—7412926
 J-PLUG, HOUSING FILLER—7376357
 K-GASKET—120428
 L-NUT, PITMAN ARM—7000667
 M-WASHER, LOCK, $\frac{3}{8}$ -IN.—131047
 N-RETAINER, PACKING—7000688
 P-PACKING, PITMAN ARM SHAFT—7696444
 Q-BEARING, BUSHING TYPE, PITMAN SHAFT
 (HOUSING)—7000406
 R-RACE, ROLLER BEARING, OUTER—708617
 S-BEARING, SHAFT, UPPER—707690
 T-SHAFT, STEERING, ASSY—7376441
 U-SCREW, $\frac{1}{4}$ -28 x $\frac{5}{16}$ —187375
 V-CLAMP, BALL RETURN GUIDE—7000670
 W-GUIDE, BALL RETURN—7000671
 X-BALL, WORM, $\frac{3}{8}$ -IN.—SSG-266800
 Y-NUT, WORM BALL—SSG-267610
 Z-BEARING, SHAFT, LOWER—707690
 AA-GASKET, END COVER—7696441
 BB-COVER, HOUSING END—7696439
 CC-ADJUSTER, WORM BEARING—7376974
 DD-PACKING, END COVER—7696437
 EE-NUT, WORM BEARING ADJUSTER—SSG-267100
 FF-SCREW, CAP, $\frac{3}{16}$ -14 x $1\frac{1}{8}$ —180146
 GG-WASHER, LOCK, $\frac{3}{16}$ -IN.—120382
 HH-PLUG, HOUSING DRAIN—7376357
 JJ-SHAFT, PITMAN ARM—7376442
 KK-BEARING, BUSHING TYPE, PITMAN SHAFT (SIDE
 COVER)—7373532
 LL-SCREW, ADJUSTING, PITMAN ARM SHAFT—7376973
 (SHIM, ADJUSTING SCREW—0.063 THK—SSG-2668003
 SHIM, ADJUSTING SCREW—0.065 THK—SSG-2669005
 MM—{ SHIM, ADJUSTING SCREW—0.067 THK—SSG-2669007
 SHIM, ADJUSTING SCREW—0.069 THK—SSG-2669009
 NN-GASKET, SIDE COVER—7376353
 PP-COVER, SIDE, ASSY—7376352
 QQ-PACKING, SIDE COVER—7696438
 RR-NUT, JAM, $\frac{7}{16}$ -20—124929
 SS-WASHER, PLAIN, $\frac{15}{32}$ ID—120395
 TT-BOLT, SIDE COVER—7000401
 UU-WASHER, LOCK, $\frac{3}{8}$ -IN.—120382
 VV-HOUSING, STEERING GEAR—SSG-5662812

Figure 188. Steering gear assembly components.

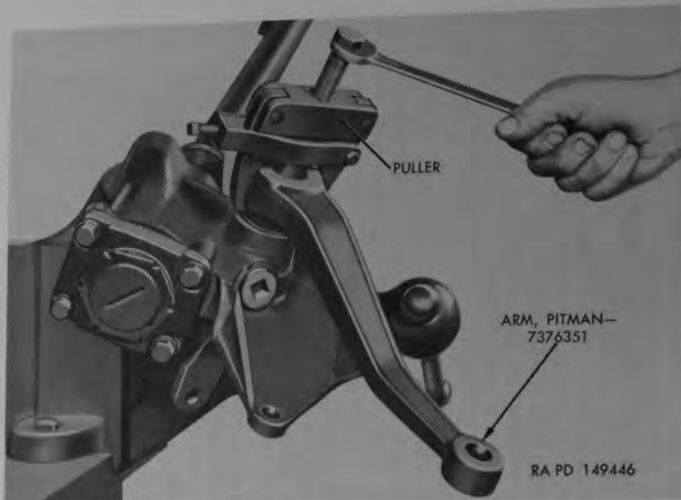


Figure 189. Removing Pitman arm with puller 41-P-2952.

h. Carefully withdraw steering shaft assembly (T) and worm ball nut (Y) as an assembly from housing and column jacket.

Caution: If the shaft with the ball nut is held in a vertical position, the ball nut will travel by its own weight to the end of the shaft. If ball nut sharply strikes either end of shaft worm, ball return guides will be damaged. Lay the assembly flat on a bench. Tape each end of shaft worm to prevent ball nut rotating to ends if the ball nut does not need to be disassembled. Make inspection of action of ball nut (par. 262) before disassembling.

i. To disassemble ball nut, remove three $\frac{1}{4}$ -28 x $\frac{5}{16}$ screws (U) which attach ball return guide clamp (V) to worm ball nut (Y). Remove clamp. Pull ball return guides (W) out of ball nut in manner shown in figure 190. Turn ball nut upside down, and rotate shaft back and forth until all $\frac{9}{32}$ -inch worm balls (X) have dropped out of ball nut into a clean pan. With the balls removed, pull ball nut endwise from shaft worm.

j. Remove bearing assembly (D) from upper end of column jacket in manner illustrated in figure 191.

k. Further disassembly of the steering shaft assembly, steering gear housing and column jacket, and side cover assembly may be deferred until inspection of parts (par. 262).

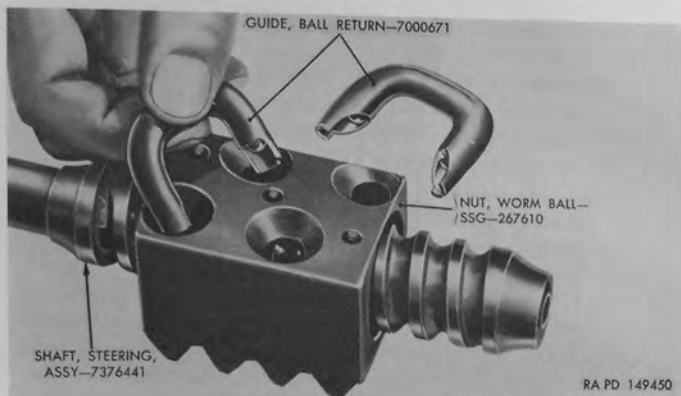


Figure 190. Removing or installing ball return guides.

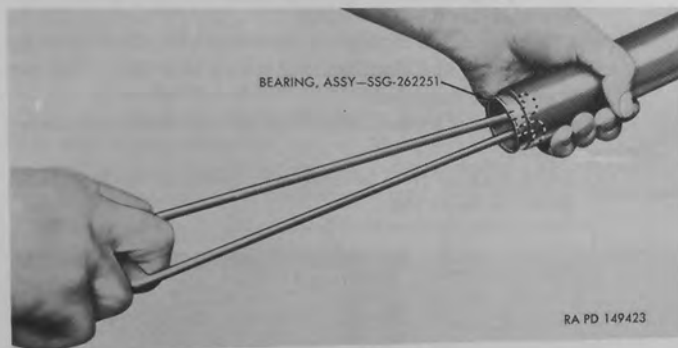


Figure 191. Removing bearing assembly from column jacket.

261. Cleaning Parts

All parts should be thoroughly cleaned with dry-cleaning solvent or volatile mineral spirits before inspection of the parts is made. Particular care should be taken when bearings are cleaned to make sure that all particles of grit and old lubricant have been removed. Dry all parts thoroughly; then place them in clean containers for inspection.

262. Inspection and Repair of Parts

Note. Key letters noted in parentheses are in figure 188 unless otherwise indicated.

a. Steering Gear Housing and Column Jacket.

(1) Inspection.

- (a)* Examine steering gear housing (VV) for cracks, and stripped threads in cover mounting surfaces. If column jacket (F) is damaged, replace both column jacket and steering gear housing (VV).
- (b)* Check clearance (par. 353) between Pitman arm shaft (JJ) and Pitman shaft bushing type bearing (Q) (in steering gear housing). If bushing is worn or scored, replace as described in (2) below.
- (c)* Check condition of outer roller bearing race (R) which is pressed into steering gear housing. If race is cracked, scored, or worn excessively, replace race. When installing race, seat race firmly against end of column jacket in steering gear housing.
- (d)* Check condition of housing filler plug (J) and housing drain plug (HH). Replace if plugs are damaged. Use new gaskets (K) at assembly.
- (e)* Check condition of bearing assembly (D), shaft bearing spring (B), and shaft bearing spring seat (C). Replace if parts are damaged.

(2) Replacement of Pitman shaft bushing type bearing in steering gear housing.

- (a)* Drive bearing from housing with remover 41-R-2370 as shown in figure 192.

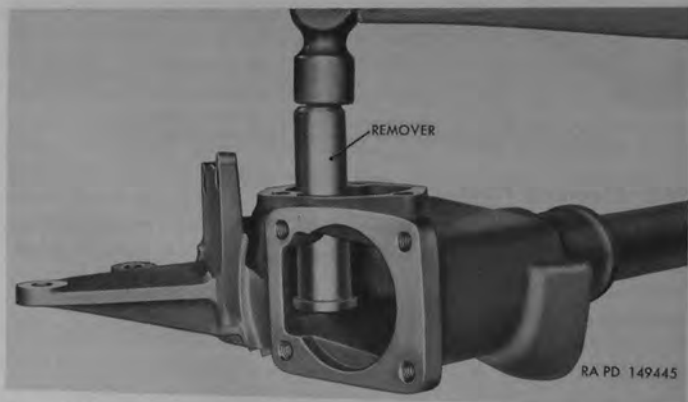


Figure 192. Remove Pitman arm shaft bearings from steering gear housing with remover 41-R-2370.

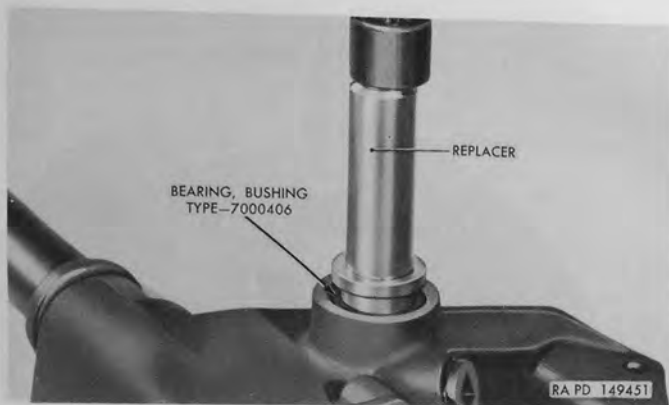


Figure 193. Installing Pitman arm shaft bearing into steering gear housing with replacer 41-R-2388-730.

(b) Install bearing with replacer 41-R-2388-730 as shown in figure 193. Tool will properly locate bearing in housing as shown in figure 194.

(c) Ream bearing to size shown in figure 194.

b. Side Cover Assembly.

(1) *Inspection.*—Examine side cover assembly (PP) for cracks or damage. Check clearance (par. 353) between Pitman arm

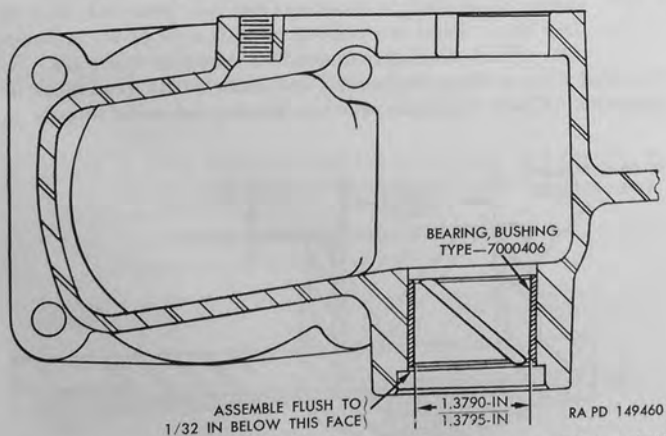


Figure 194. Sectional view of steering gear housing showing Pitman shaft bearing installed.

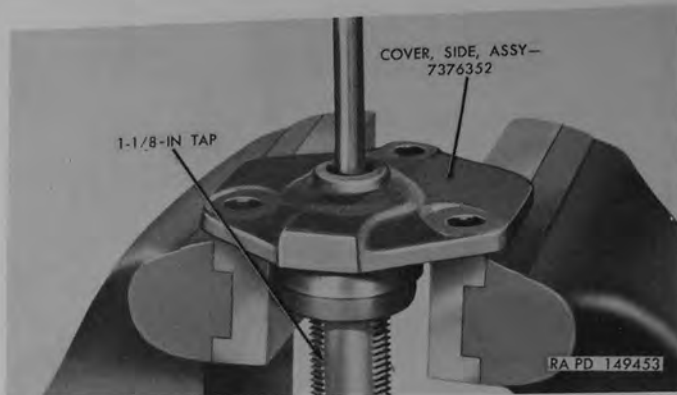
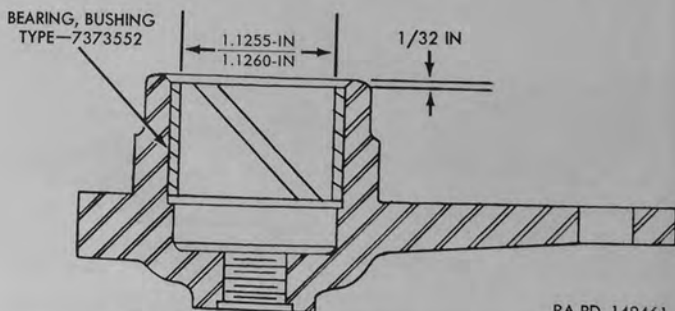


Figure 195. Method of removing bearing from side cover.

shaft (JJ) and Pitman shaft bushing type bearing (KK) in side cover. If clearance is not correct or if bearing is scored or otherwise damaged, replace bearing as described in (2) below. Side cover gasket (NN) must be replaced with new part at assembly.

- (2) *Replacement of bearing in side cover.*—Thread a $1\frac{1}{8}$ -inch tap into bearing the full length of bearing. Place cover in a press. With suitable driver or rod inserted through adjusting screw hole in cover against tap, press out bearing (fig. 195). Press new bearing into place as shown in figure 196. Finish bearing to dimensions shown in figure 196.

c. *End Cover.*—Examine housing end cover (BB) for cracks or distortion. Check condition of worm bearing adjuster threads in



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Figure 196. Sectional view of side cover assembly.

housing. Replace end cover if damage is apparent. End cover gasket (AA) must be replaced with new part at assembly.

d. Worm Bearing Adjuster.—Check condition of threads in worm bearing adjuster (CC). Examine inner end of adjuster for scores or roughness. The inner end of adjuster serves as an outer race for shaft lower bearing (Z). If adjuster is damaged as explained, replace with new part. Check condition of worm bearing adjuster nut (EE), and if damaged, replace. End cover packing (DD) must be replaced with new part at assembly.

e. Pitman Arm Shaft.

- (1) Inspect Pitman arm shaft (JJ) for damaged serrations and threads at Pitman arm end. Replace shaft if damaged.
- (2) Examine sector teeth on shaft for signs of scuffing, scoring, and other damage. Replace shaft if damaged.
- (3) Check outside diameter of shaft at housing and side cover ends. If wear is evident (par. 353), replace shaft.
- (4) Pitman arm shaft packing (P) and packing retainer (N) must be replaced at assembly. Check condition of Pitman arm nut (L) and $\frac{7}{8}$ -inch lock washer (M). Replace if parts are damaged.

f. Steering Shaft Assembly.

(1) *Inspection.*

- (a) Thoroughly inspect worm at end of steering shaft assembly for evidence of scoring and wear. Check action of assembled worm ball nut on worm. If worm ball nut rotates smoothly without evidence of binding or roughness, do not disassemble worm ball nut. Refer to paragraph 260j, if necessary, to disassemble worm ball nut. If shaft worm is damaged as explained, replace.
- (b) Check condition of shaft upper bearing (S) and shaft lower bearing (Z). If bearings are worn or damaged, replace.
- (c) If shaft upper bearing (S) is damaged and requires replacement, replace as described in (2) below.

(2) *Replacement of shaft upper bearing.*

- (a) Unsolder cable terminal (fig. 197) at upper end of shaft. Remove terminal and fiber insulator.



Figure 197. Construction of steering shaft assembly.

- (b) Pull horn button contact cable assembly (E) from shaft. Remove horn button contact cable assembly from shaft. Shaft upper bearing may then be removed from shaft.
- (c) Install new shaft upper bearing on shaft.
- (d) Install horn button contact cable assembly on shaft to dimension shown in figure 197. Insert wire through shaft; then install fiber insulator. Solder terminal to end of cable. Remove all surplus solder.

g. Worm Ball Nut Parts.

- (1) Examine rack teeth of worm ball nut (Y) for scuffing, scoring, or wear. Check holes and passages for obstructions. Thoroughly examine worm ball nut for external and internal damage. Replace worm ball nut if damage explained exists.
- (2) Check all of the $\frac{3}{32}$ -inch worm balls (X) for flat spots, checking, wearing, or damage. Balls should be the same size within 0.0001 inch.
- (3) Examine ball return guides (W) for distortion. Place two halves together and try action of balls in the two halves. Replace guides if any restriction exists. Replace ball return guide clamp (V) if distorted.

h. Pitman Arm.—Examine Pitman arm serrations and threads for damage. If Pitman arm is bent, replace. Do not attempt to straighten.

i. Steering Wheel.—Inspect wheel spokes and rim for damage or distortion. Replace wheel if these conditions exist.

Note. Do not attempt to repair any part of the steering gear assembly by welding or machining.

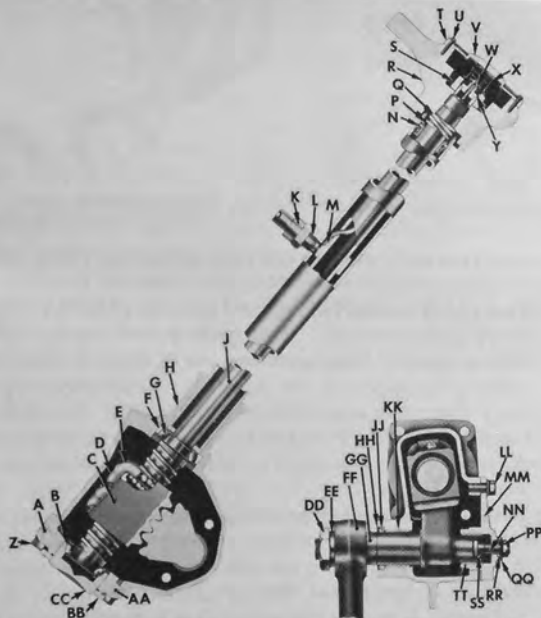
263. Assembly of Steering Gear

Note. Key letters noted in parentheses are in figure 88 unless otherwise indicated. Reference should also be made to the sectional view (fig. 198) which shows relative position of the assembled parts.

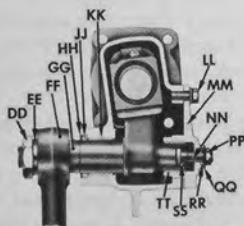
a. General.—One of the most important phases of assembling steering gear components is cleanliness. All parts must be kept clean. Any bits of abrasive material which may get inside of the housing during assembly will quickly damage the gear mechanism. Grease and oil used at assembly must be free from dirt. When handling parts, make certain that hands are clean, and that clean cloths are used. Prelubricate all bearings and moving parts (except bearing assembly (D)) at assembly with universal gear lubricant (GO).

b. Assembly of Worm Ball Nut.

- (1) Place steering shaft assembly (T) flat on bench. Place worm ball nut (Y) over shaft worm with ball return guide holes in ball nut in upper surface. Align grooves in worm and ball nut by sighting through bottom of ball return guide holes.



A—COVER, HOUSING END—7696439
 B—BEARING, SHAFT LOWER—707690
 C—NUT, WORM BALL—SSG-267610
 D—CLAMP, BALL RETURN GUIDE—7000670
 E—GUIDE, BALL RETURN—7000671
 F—RACE, ROLLER BEARING, OUTER—708617
 G—BEARING, SHAFT UPPER—707690
 H—HOUSING, STEERING GEAR—SSG-5662812
 J—SHAFT, STEERING, ASSY—7376441
 K—CONNECTOR, CABLE—SSG-5662809
 L—SEAL, CABLE CONNECTOR—7412926
 M—CABLE, HORN BUTTON CONTACT, ASSY—SSG-267898
 N—BEARING, ASSY—SSG-262251
 P—SEAT, SHAFT BEARING SPRING—7377383
 Q—SPRING, SHAFT BEARING—SSG-262250
 R—WHEEL, STEERING, ASSY—7376444
 S—NUT (STEERING WHEEL)—7376315
 T—RING, RETAINING, HORN BUTTON—7412927
 U—SCREW, NO 10 x 7/8—453084
 V—BUTTON, HORN—7412929
 W—TERMINAL, CABLE—SSG-268297
 X—CONTACT, HORN BUTTON, ASSY—7412928
 Y—INSULATOR—SSG-5663154
 Z—SCREW, CAP, 7/16-14 x 1-1/8—180146



AA—PACKING, END COVER—7696437
 BB—NUT, WORM BEARING ADJUST—SSG-267100
 CC—ADJUST, WORM BEARING—7376974
 DD—NUT, PITMAN ARM—7000667
 EE—WASHER, LOCK, 7/8-IN—131047
 FF—ARM, PITMAN—7376351
 GG—SHAFT, PITMAN ARM—7376442
 HH—RETAINER, PACKING—7000668
 JJ—PACKING, ARM SHAFT—7696444
 KK—BEARING, BUSHING TYPE, PITMAN SHAFT—7000406
 LL—BOLT, SIDE COVER—7000401
 MM—COVER, SIDE, ASSY—7376352
 NN—SCREW, ADJUSTING, PITMAN ARM SHAFT—7376973
 PP—NUT, JAM, 7/16-20—124929
 QQ—WASHER, PLAIN, 15/32-ID—120395
 RR—PACKING, SIDE COVER—7696438
 SS—SHIM, ADJUSTING SCREW—0.063 THK—SSG-266903
 SHIM, ADJUSTING SCREW—0.065 THK—SSG-266905
 SHIM, ADJUSTING SCREW—0.067 THK—SSG-266907
 SHIM, ADJUSTING SCREW—0.069 THK—SSG-266909
 TT—BEARING, BUSHING TYPE, PITMAN SHAFT—7373552

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Figure 198. Sectional view of steering gear assembly.



Figure 199. Installing worm balls into worm ball nut and return guides.

- (2) Count 53 or one-half of the total quantity of balls (106 total) into a clean container. This is the proper number of balls for one circuit. Drop balls into one of the ball return guide holes in the upper circuit (fig. 199). Gradually turn shaft away from that hole while inserting balls. Continue until the circuit is filled from bottom of one hole to the bottom of the other, or until stopped by reaching the end of the shaft worm.
- (3) In the event balls are stopped by reaching end of shaft worm, hold down the balls, already inserted, with a rod or punch in manner shown in figure 199. Turn shaft in the reverse direction a few turns. Filling of the circuit can then be continued. It may be necessary to work shaft back and forth, holding balls down first in one hole then in the other. This will close up spaces between balls, filling the circuit completely and solidly.
- (4) Lay one-half of ball return guide (W) with groove up, on bench. Place the remaining balls of the 53 selected into groove of guide. Close this half of guide with the other half. Hold the two halves together; then plug each open end with heavy chassis grease to prevent balls from dropping out.
- (5) Push ball return guide completely into holes in worm ball nut (fig. 190). This completes one circuit of balls.
- (6) Fill lower circuit in worm ball nut (fig. 199) in same manner described in (2) through (5) above).
- (7) Install ball return guide clamp (V) to ball nut using three $\frac{1}{4}$ -28 x $\frac{5}{16}$ screws (U). Tighten screws firmly.
- (8) Make certain that ball nut and balls are thoroughly lubricated. Test assembly by rotating ball nut on steering shaft worm. Do not rotate ball nut to end of worm threads. Assembly must move freely. If there is any bind in motion of

worm ball nut, remove and check condition of ball return guides. These guides must not be bent to restrict movement of balls. Tape shaft at both ends of ball nut until ready to install assembly into steering gear housing.

c. Roller Bearing Outer Race Installation.—With a suitable driver, install roller bearing outer race (R) into housing. Make certain that bearing seat is clean, permitting bearing to bottom squarely in housing.

d. Steering Shaft Assembly Installation.—Remove tape previously installed at each end of ball nut (b(8) above). Grasp steering shaft worm below and above ball nut to prevent nut from running to extreme ends. With shaft upper bearing (S) in place on shaft, insert steering shaft assembly through end cover opening in housing. Guide shaft carefully through housing and column jacket until shaft upper bearing (S) contacts roller bearing outer race (R) in housing.

e. End Cover Installation.

- (1) Place shaft lower bearing (Z) into place in housing end cover (BB).
- (2) Swab threads of worm bearing adjuster (CC) with plastic type gasket cement. Thread adjuster a few turns into housing end cover (BB). Place new end cover gasket (AA) over end cover. Install end cover to housing with four $\frac{7}{16}$ -14 x $1\frac{1}{8}$ cap screws (FF) and $\frac{7}{16}$ -inch lock washers (GG), dipping threads of cap screws in plastic type gasket cement before installing. Tighten cap screws securely.
- (3) Temporarily tighten worm bearing adjuster (CC) until all worm bearing end play is removed.
- (4) Install new end cover packing (DD); then install worm bearing adjuster nut (EE). Do not tighten at this time.

f. Adjusting Screw to Pitman Arm Shaft Clearance.

- (1) Place original adjusting screw shim (MM) on Pitman arm shaft adjusting screw (LL). Insert adjusting screw and shim into slotted end of Pitman arm shaft (JJ).
- (2) Check clearance between adjusting screw head and shaft in manner shown in figure 200. Clearance must not exceed specified amount (par. 353). If clearance is greater, select another thicker adjusting screw shim (MM). Four sizes of shims are available.

g. Pitman Arm Shaft Installation.

- (1) With Pitman arm shaft adjusting screw (LL) and correct shim in place in end of Pitman arm shaft, start side cover assembly (PP) over end of shaft.
- (2) Insert screw driver into hole in side cover to engage slot of adjusting screw. Turn adjusting screw into side cover to pull side cover and Pitman shaft bushing type bearing (KK) over shaft end.

- (3) Turn steering shaft until worm ball nut is in approximate center of steering shaft worm. Center tooth of sector gear on Pitman arm shaft must enter center rack teeth of worm ball nut.
- (4) With new side cover gasket (NN) in place on side cover, insert Pitman arm shaft into steering gear housing (VV), meshing center tooth of gear on shaft with center tooth of worm ball nut. Turn Pitman arm shaft adjusting screw (LL) to pull cover over end of shaft. Back off adjusting screw to permit backlash between sector gear on shaft and worm ball nut.
- (5) Install three side cover bolts (TT) with $\frac{3}{8}$ -inch lock washers (UU). Tighten bolts firmly.

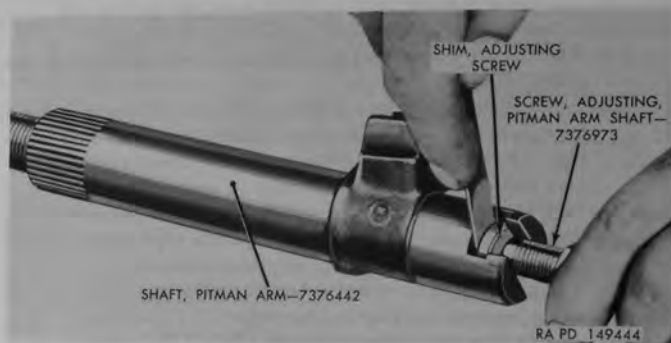


Figure 200. Method of adjusting Pitman arm shaft adjusting screw.

- (6) Install side cover packing (QQ) over Pitman arm shaft adjusting screw (LL). Install $\frac{15}{32}$ ID plain washers (SS) and $\frac{7}{16}$ -20 jam nut (RR) on adjusting screw.
- (7) Coat outside of packing retainer (N) with plastic type gasket cement. Install Pitman arm shaft packing (P) inside of retainer. Install retainer and packing in steering gear housing with suitable tool. Seat packing firmly against Pitman shaft bushing type bearing (Q) in housing.

h. Column Jacket Bearing Installation.—Pack recesses of bearing assembly (N, fig. 198) with automotive and artillery grease (GAA). Squarely install bearing assembly over shaft into column jacket. Install shaft bearing spring seat (C) and shaft bearing spring (B) on shaft.

i. Filler and Drain Plug Installation.—Install housing drain plug (HH) with new gasket (K). Tighten plug firmly. Fill housing with universal gear lubricant (GO) until lubricant is at level of bottom of

filler plug hole (with unit in operating position). Install housing filler plug (J) with new gasket (K). Tighten plug firmly.

j. Cable Connector Installation.—Place new cable connector seal (H) into recess of cable connector fitting on column jacket. Install cable connector (G) to column jacket. Tighten connector firmly. Place protective tape over the connector until unit is installed in vehicle.

k. Steering Wheel and Horn Button Installation.

Note. Installation of the steering wheel and horn button parts may be deferred until steering gear assembly is installed in vehicle. Steering wheel must be installed temporarily to accomplish adjustments as explained in paragraph 264. Key letters noted in parentheses are in figure 198.

- (1) Install steering wheel on shaft. Install nut (S), and tighten to a torque of 40 to 55 pound-feet.
- (2) Install horn button contact assembly (X) over terminal. Install horn button (V). Install horn button retaining ring (T) and attach with four No. 10 x $\frac{7}{8}$ screws (U). Tighten screws firmly.

l. Pitman Arm Installation.—Installation of the Pitman arm may be deferred until adjustments (par. 264) are made. Position Pitman arm (FF) on Pitman arm shaft (GG), matching blank serration on shaft with blank serration in arm. Install $\frac{7}{8}$ -inch lock washer (EE) and Pitman arm nut (DD). Tighten nut to torque of 115 to 155 pound-feet.

264. Steering Gear Adjustments

a. General.—The steering gear assembly is designed to provide for adjustments to compensate for normal wear at steering shaft bearings and at Pitman arm shaft and mating parts. These adjustments must be accomplished before assembly is installed in the vehicle, and further checked and adjusted in the same manner after unit is installed. The following sequence of adjustments must be followed. The unit must be mounted in stand or vise in operating position.

b. Preliminary Procedures.—Determine straightahead position of the steering mechanism by turning steering wheel to extreme right.

Caution: Approach extreme end cautiously. Worm ball nut must not strike end with any degree of force.

Turn wheel to opposite extreme in same manner, counting the number of wheel turns between extreme ends. Turn wheel back one-half number of wheel turns. Mark wheel with respect to column so that center position may readily be found during adjustment procedures.

c. Steering Shaft Bearing Adjustment.

- (1) Check tightness of housing end cover bolts. Back out Pitman arm shaft adjusting screw a few turns counterclockwise to

provide clearance between Pitman arm shaft gear and worm ball nut teeth.

- (2) Turn steering wheel gently until mechanism has reached one extreme. Turn wheel back one full turn. With scale 41-S-503 on spoke of steering wheel (fig. 201), measure pull required to keep wheel moving. Pull on scale should be made at right angle to wheel spoke.
- (3) If pull is not within the limits of $1\frac{1}{2}$ to 2 pounds, shaft bearings must be adjusted.

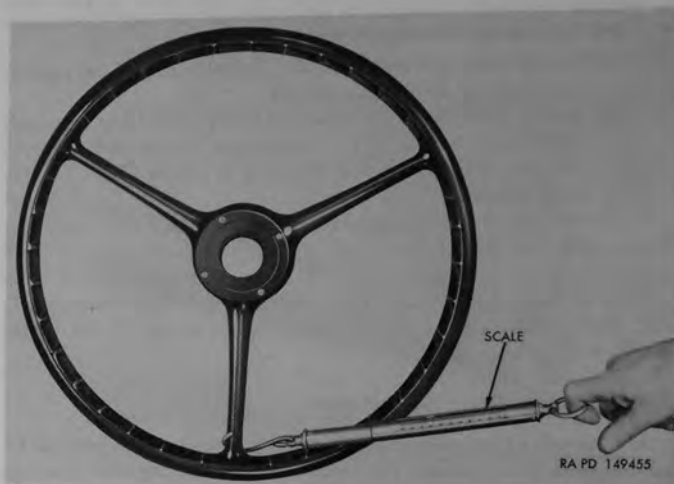


Figure 201. Use of scale 41-S-503 on steering wheel to check pull.

- (4) Loosen worm bearing adjuster nut (fig. 202); then turn worm bearing adjuster in or out to obtain correct pull. Tighten adjuster nut and recheck pull.
 - (5) After shaft bearings are adjusted, Pitman arm shaft lash adjustment must be made (*d* below).
- d. Pitman Arm Shaft Lash Adjustment* (fig. 203).
- (1) Check tightness of side cover bolts.
 - (2) Center steering mechanism as previously marked in *b* above.
 - (3) Turn Pitman arm shaft adjusting screw in to remove all lash between gear teeth. The amount of backlash can be determined by pushing backward and forward on Pitman arm. When all backlash has been removed, tighten adjusting screw jam nut.



Figure 202. Adjusting worm bearings.

- (4) Check pull of steering wheel with scale (c(2) above). Measure pull as wheel is pulled through center position.
- (5) If pull is not within $2\frac{1}{2}$ to 3 pounds, turn shaft adjusting screw in or out to obtain proper pull. Tighten jam nut and check pull again.

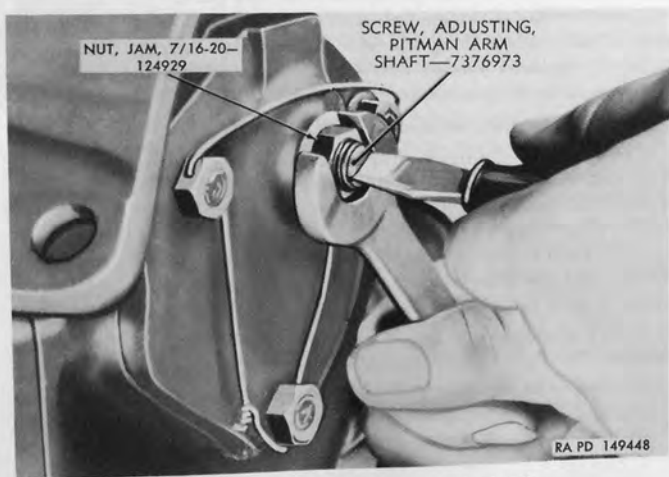


Figure 203. Adjusting Pitman arm shaft lash.

- (6) After adjustment is made, install lock wire through heads of side cover bolts as shown in figure 203.

Section III. REBUILD OF DRAG LINK

265. Description

Drag link assembly (fig. 204) is tubular-type with ball studs mounted in special bearing material. A rubber dust seal is placed around taper of each ball stud.

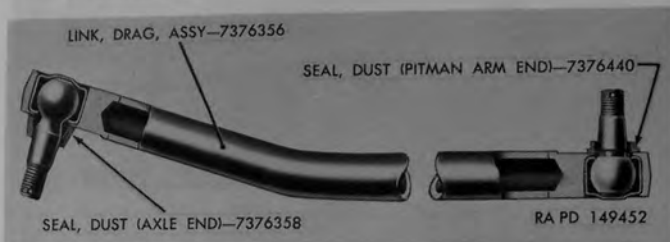


Figure 204. Sectional view of drag link.

266. Inspection and Repair

a. Dust Seal.—Inspect dust seal at axle end and Pitman arm end. If seals show signs of damage, replace with new parts.

b. Ball Studs.—Examine ball stud threads for damage. If movement of ball studs in drag link ends indicate that bearing material is damaged, replaced entire drag link. The end bearings and ball studs cannot be replaced in drag link ends.

Note. Do not lubricate ball stud bearings.

c. Drag Link.—Examine drag link for bent condition. Compare drag link with new part. If drag link is distorted in any manner, replace with new part.

CHAPTER 14

FRONT SPRING SUSPENSION

Section I. DESCRIPTION AND DATA

267. Description

a. General.—Front spring suspension system components comprise the front springs, spring shackles and brackets, torque rods, and shock absorbers. Front spring suspension components are illustrated in figure 205.

b. Front Springs, Shackles, and Brackets.—Semielliptic front springs carry only vertical and lateral loads and are attached to frame brackets at both ends through shackles. Shackles and spring eyes are equipped with replaceable bushing type bearings. Shackle bolts and pins are drilled and equipped with lubrication fittings for lubricating spring eye and shackle bearings. Front spring front brackets and upper torque rod brackets are riveted to frame side rails.

c. Torque Rods.—Three torque rods, two lower and one upper, transmit front axle driving and braking forces to frame. Lower torque rod frame brackets are integral with front spring rear brackets. Upper torque rod bracket is mounted inside right frame side rail ahead of front spring rear bracket. Frame ends of torque rods are equipped with bushing type bearings mounted in material which requires no lubrication. Axle ends of torque rods are equipped with tapered end pins which are mounted in material requiring no lubrication; end pin and bearing must be replaced as an assembly.

d. Shock Absorbers.—Shock absorbers, used at front axle, are hydraulic, double-acting, opposed-cylinder type. Filler plug is at top front end of shock absorber body. Shock absorber arms are connected to bumper blocks at axle through links which have tapered studs mounted in rubber at each end. Construction and operation of shock absorbers are described in paragraphs 273 and 274.

268. Data

a. Front Springs.

Length (center-to-center of spring eyes)	50 in.
Width	2½ in.
Number of leaves	11
Thickness of leaves:	
1 @	0.360 in.
4 @	0.323 in.
6 @	0.291 in.
Total thickness	3.398 in.

b. Shock Absorbers.

Manufacturer	Delco Products
Model:	
Right side	2009-H
Left side	2009-G
Valve code:	
Compression valve	G2
Rebound valve	2N

Section II. REBUILD OF FRONT SPRING SUSPENSION COMPONENTS

269. Inspection of Front Spring Suspension Components

Note. Key letters noted in parentheses are in figure 205.

a. *General.*—It is not necessary to disassemble front spring suspension components further than shown in figure 205 unless replacement of parts is necessary as indicated in the inspection procedures which follow. Clean all parts in dry-cleaning solvent or volatile mineral spirits to remove all dirt to facilitate inspection.

b. *Springs.*—Examine front spring assembly (Z) for broken leaves, broken center bolt, or broken rebound clips, and check bushing type bearings (W) in spring eyes for wear (par. 354). Nos. 1 and 2 spring leaves can be replaced if broken, and bearings in No. 1 spring eyes can be replaced (par. 270b) if worn beyond specified limits. If rebound clips or spring leaves other than Nos. 1 and 2 are broken, the complete spring assembly must be replaced.

c. *Spring Shackles.*—Examine spring shackle assemblies (T) for visible cracks or distortion. Check bushing type bearings (S) in shackles for wear (par. 354) and replace (par. 271) if worn beyond specified limits.

d. *Shackle Bolts and Pins.*—Examine front and rear shackle bolts (P and GG) for damaged threads and serrations, and check for wear at bearing contact surfaces (par. 354). If threads or serrations are damaged, or if worn beyond specified limits, replace with new parts. Check shackle pins (X) for wear at bearing contact surfaces (par.

354). Replace with new parts if worn beyond specified limits. Make sure drilled lubricant passages in bolts and pins are unobstructed.

e. Spring "U" Bolts.—Examine left and right inner and outer front spring "U" bolts (Y) for damaged threads, cracks, or visible distortion. Replace with new parts if any damage is evident.

f. Spring Bumper.—Examine bumper assembly (K) for evidence of deterioration. Inspect stud which is bonded into bumper for damaged threads and for looseness in bumper. If any damage is evident or if stud is loose, replace with new part.

g. Torque Rods.—Examine upper and lower torque rod assemblies (F and CC) for distortion, damaged threads on end pins, and for loose or damaged pin and bearing assemblies at axle ends and loose or damaged bushing type bearings at frame ends. If end pins or bearings are damaged or loose, replace (par. 272). On upper torque rod assembly (F), make sure brake and vent line shield (G) is securely welded to torque rod.

h. Torque Rod Bolts.—Examine bolts 1-14 x 5 $\frac{7}{8}$ (FF) and 14 x 7 $\frac{5}{16}$ bolts (HH) which attach torque rods to front spring rear brackets for damaged threads and serrations. Replace with new parts if damaged.

270. Repair of Spring Assembly

Note. Key letters noted in parentheses are in figure 205.

a. General.—If only the bushing type bearings in spring eyes require replacement, replacement can be made (*b* below) without disassembling the spring assembly.

b. Spring Eye Bearing Replacement.—Press old bushing type bearing (W) out of spring eye, using a suitable bearing driver and arbor press. Make sure spring eye is clean; then press new bearing into place and burnish to a diameter of 0.749 to 0.754 inch.

c. Disassembly of Spring.—Remove nuts from three rebound clip bolts, then remove bolts and spacers. Clamp spring leaves firmly together, using one "C" clamp on each side of center bolt or using an arbor press. Remove nut from center bolt and remove bolt. Release "C" clamps or arbor press slowly to avoid personal injury.

d. Assembly of Spring.

- (1) Clean all dirt and corrosion from spring leaves, using a wire brush if necessary, then wash in dry-cleaning solvent or volatile mineral spirits. Coat each spring leaf with a thin film of soft graphited grease (GG); grease must cover entire contact area.
- (2) Stack spring leaves in correct order with center bolt holes aligned, then compress spring leaves using "C" clamps or arbor press. Install center bolt and nut with nut at top and tighten

A—SCREW, CAP, $\frac{1}{4}$ —20 X $\frac{5}{8}$ —180018
 B—BRACKET, SUPPORT, FRONT BRAKE RUBBER LINE,
 ASSY—7410802
 C—NUT, 1—14—454334
 D—WASHER, PLAIN—7412849
 E—SEAL, DUST—7411373
 F—ROD, TORQUE, UPPER, ASSY—7411369
 G—SHIELD, BRAKE AND VENT LINE—YT—2265451
 H—SEAL, DUST—7411374
 J—[ABSORBER, SHOCK, LEFT, ASSY—7350540
 [ABSORBER, SHOCK, RIGHT, ASSY—7350539
 K—BUMPER, ASSY—7412911
 L—NUT, $\frac{3}{8}$ —24—442799
 M—LINK, ASSY—7350541
 N—NUT, $\frac{1}{2}$ —20—442801
 P—BOLT, FRONT SHACKLE—7350406
 Q—BRACKET, FRONT SHACKLE, ASSY—7410567
 R—NUT, $\frac{3}{4}$ —16—442804
 S—BEARING, BUSHING TYPE—7410889
 T—SHACKLE, ASSY—7350455
 U—NUT, $\frac{5}{16}$ —24—442798
 V—SCREW, CAP, $\frac{5}{16}$ —24 X $1\frac{1}{8}$ —181619
 W—BEARING, BUSHING TYPE—7412851
 X—PIN, SHACKLE—7350457
 Z—SPRING, FRONT, ASSY—7350460
 {BOLT, "U", LEFT FRONT SPRING—7410657
 Y—{BOLT, "U", RIGHT FRONT SPRING INNER—7410656
 {BOLT, "U", RIGHT FRONT SPRING OUTER—7350461
 {BLOCK, BUMPER, LEFT—YT—2286276
 AA—{BLOCK, BUMPER, RIGHT—YT—2286275
 BB—NUT, $\frac{5}{8}$ —18—7348692
 CC—ROD, TORQUE, LOWER, ASSY—YT—2277031
 DD—LEAF, NO. 1, ASSY—7350455
 EE—LEAF, NO. 2—7350456
 FF—BOLT, 1—14 X $\frac{5}{8}$ —7411370
 GG—BOLT, REAR SHACKLE—7350407
 HH—BOLT, 1—14 X $\frac{7}{16}$ —7411371
 JJ—WASHER—7412849
 KK—BRACKET, FRONT SPRING, REAR ASSY—YT—2278214
 LL—BRACKET, UPPER TORQUE ROD—YT—2285514

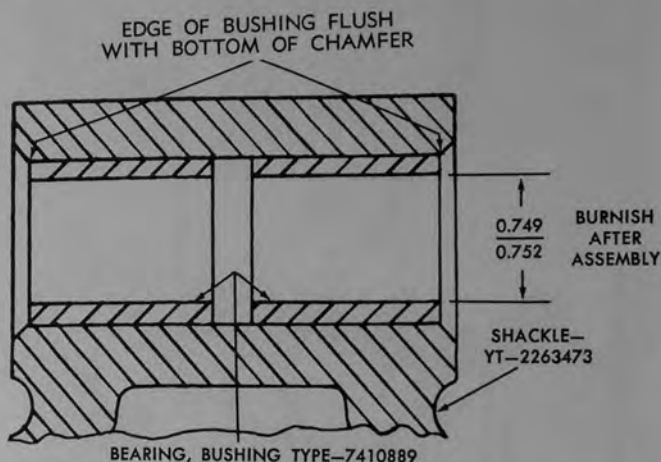
Figure 205. Front spring suspension components.

firmly. Install rebound clip spacers and $\frac{3}{8}$ -16 x $\frac{3}{8}$ bolts and secure with $\frac{3}{8}$ -16 nuts. Tighten nuts firmly, pulling ends of rebound clips against ends of spacers. Remove "C" clamps or remove spring assembly from arbor press.

271. Repair of Spring Shackles

a. Bearing Removal.—Press old bushing type bearings (S) out of shackle assembly (T), using a suitable bearing driver and arbor press.

b. Bearing Installation.—Press a new bushing type bearing into each side of shackle until outer ends of bearings are at bottom of chamfer in shackle. After pressing both bearings into place, burnish to dimension shown in figure 206.



NOTE: ALL DIMENSIONS ARE IN INCHES RA PD 149437

Figure 206. Bushing type bearings installed in spring shackle.

272. Repair of Torque Rods

a. Bearing Removal.—Using a driver to exert force on rounded edge of bearing case at point shown in figure 207, press bushing type bearing assembly out of torque rod end.

b. Bearing Installation.—Press new bushing type bearing assembly into torque rod end, using a driver which will exert force on rounded edge of bearing case at point shown in figure 207. Press bearing in until it is centered in torque rod end.

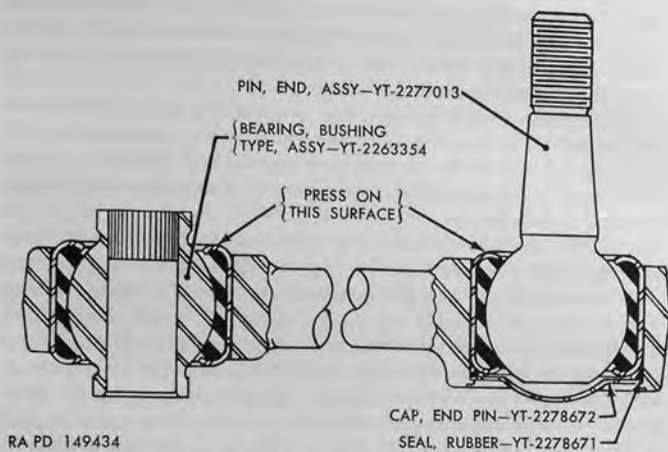


Figure 207. Sectional views of front torque rod ends.

c. End Pin Removal.—Using a small sharp chisel, cut off eight staked lugs which secure end pin cap in torque rod end. Using a driver over end pin which will exert force on rounded edge of bearing case at point shown in figure 207, press end pin assembly, rubber seal, and end pin dust cap out of torque rod end. File stake marks back flush with inner circumference of torque rod end.

d. End Pin Installation.—End pin assembly (fig. 207) must be installed in torque rod end with tapered end pin opposite the side having the stake marks. Press new end pin assembly into torque rod end, using a driver over end pin which will exert force on rounded edge of bearing case at point shown in figure 207. Press in to approximate position shown in figure 207; then install rubber seal and end pin cap and secure in place by staking at eight places. Press end pin assembly in further to compress rubber seal between bearing case and end pin cap, using care not to force cap past the stake marks.

Section III. REBUILD OF SHOCK ABSORBERS

273. Construction

a. Shock absorber shaft is mounted in body on two bushing type bearings. Shaft bore at one end is sealed with an expansion plug and gasket. Shaft extends out of body on one side and is sealed by means of a packing washer and packing gland. A cam, which extends down into piston assembly, is welded to shaft inside of body. Shock absorber arm is pressed onto end of shaft which extends out of body.

Due to the welded construction of the cam and shaft, these parts cannot be disassembled; any wear or damage to the shaft, body, bearings, packing gland and washer, and arm necessitates replacing the complete shock absorber assembly.

b. The piston assembly consists of two piston halves, held together by two screws and springs. Intake valve and spring is secured in outer end of each piston half by a snap ring type retainer. Intake valves may be replaced individually, but the piston is serviced only as a complete assembly.

c. The fluid reservoir consists of the space around the shaft and cam, with the filler plug located at the top of this chamber. An end cap, with fibre gasket, is threaded into each end of body; these end caps must be removed for replacing intake valves or piston assembly.

d. Rebound and compression valves, which control the flow of fluid in the shock absorber, are installed in drilled passages in the shock absorber body and retained by nuts with soft aluminum gaskets. Valve identification code numbers are stamped on nuts and on valve washers as shown in figure 213. Valves having the same code number as stamped on the retaining nuts must always be used.

274. Operation of Shock Absorbers

a. General.—The flow of fluid within the shock absorber during operation is schematically illustrated in figure 208. Two separate actions take place, compression and rebound. Each phase of operation is described separately under *b* and *c* below.

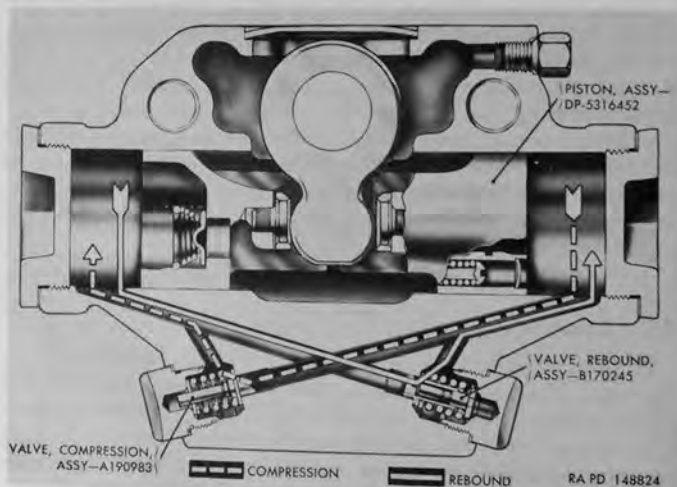


Figure 208. Schematic sectional view of shock absorber showing operation.

b. Compression.—As the shock absorber arm moves upward (compression stroke), the cam forces the piston toward the arm end of the cylinder, displacing fluid from the compression end of the cylinder. On very slight or slow axle movements, the fluid flows only through the small opening provided by compressing the small inner spring of the compression valve and into the rebound end of the cylinder. On rapid movements, the pressure overcomes the large outer spring, lifting the valve further from its seat, permitting more rapid flow of fluid into the rebound end of the cylinder. At the same time, the intake valve in the rebound end of the piston opens, permitting fluid to flow from the reservoir into the rebound end of the cylinder, compensating for any loss of fluid between compression end of piston and cylinder wall.

c. Rebound.—During the rebound stroke, or as the arm moves downward, the direction of flow is reversed. The cam forces the piston away from the arm end of the cylinder, displacing fluid from the rebound end of the cylinder. For slow action, the fluid flows only through the orifice in the rebound valve into the compression end of the cylinder. During rapid action, the rebound valve is lifted from its seat and the fluid passes, at a pressure controlled by the rebound valve spring, into the compression end of the cylinder. At the same time, the intake valve in the compression end of the piston opens, allowing fluid to pass from the reservoir into the compression end of the cylinder, compensating for any loss of fluid between rebound end of piston and cylinder wall.

275. Disassembly of Shock Absorber

Note. Key letters noted in parentheses are in figure 210.

a. Removal of Rebound and Compression Valves.

- (1) Remove filler plug and gasket (G and H) and drain fluid from shock absorber. Work arm up and down to expel most of the fluid.
- (2) Mount shock absorber assembly on shock absorber rebuilding stand 41-S-4977-5. Stand must be secured to bench or clamped in a vise.
- (3) Remove rebound and compression valve nuts (N), using an offset or "L" shaped screw driver; then remove rebound valve assembly (R) and compression valve assembly (P) from shock absorber body, using a piece of wire with hooked end to lift valves out.

b. Removal of Intake Valves.

- (1) Mount shock absorber on shock absorber rebuilding stand 41-S-4977-5 with the cylinder in a vertical position. Using a short length of $1\frac{1}{16}$ -inch hex tool stock as an adapter for

a box end wrench, remove end plug (A) and end plug gasket (B) from upper end.

- (2) Move shock absorber arm to position piston at top of cylinder. Pry intake valve spring retainer (M) out of groove in piston; then remove intake valve spring (L) and intake valve (K) from piston.

- (3) Turn shock absorber over to position other end upward and repeat (1) and (2) above.

c. Removal of Piston Assembly.

- (1) With shock absorber mounted in vertical position on shock absorber rebuilding stand 41-S-4977-5 (fig. 209), and with piston at top of cylinder use a sharp pointed punch to pierce expansion plug (C) and pry plug out of piston. Remove piston screw (D) and piston screw spring (E) from upper end of piston.



Figure 209. Removing piston screw expansion plug with shock absorber mounted in stand 41-S-4977-5.

- (2) Turn the assembly over to position other end upward and remove expansion plug (C), piston screw (D), and piston screw spring (E) in same manner as in (1) above.
- (3) Remove half of piston from each end of cylinder.

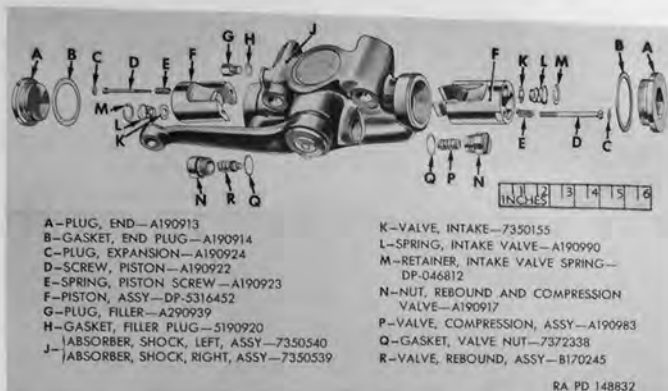


Figure 210. Shock absorber components.

276. Cleaning and Inspection of Shock Absorber

a. Cleaning.—Wash all shock absorber parts in dry-cleaning solvent or volatile mineral spirits. Wipe small parts dry, and blow inside of cylinder and internal passages in body dry with compressed air. Make sure internal passages are thoroughly cleaned. Shock absorber components are shown in figure 210.

b. Inspection.

- (1) *Body.*—Check shaft and bushings in body for wear by moving shock absorber arm sideways. Inspect cam on shaft for galled or worn condition. Examine cylinder bore for roughness or scoring. If any of the above conditions are evident, replace the complete shock absorber assembly.
- (2) *Piston.*—Insert each piston half in cylinder in operating position (cam clearance at top) and check clearance between piston and cylinder wall. If clearance is not within limits specified (par. 354), a new piston assembly must be selected which will provide clearance within these limits. Examine piston for evidence of scoring or other damage. Check thrust button at inner end of each piston half for roughness or evidence of wear. Make sure antirotation spring installed under thrust button on rebound half of piston is not bent. If any wear or damage is evident, replace piston assembly.
- (3) *Rebound and compression valves.*—The only inspection that can be made on rebound and compression valves is to make a visual inspection to see that valves are securely assembled and appear to be in good condition. If there is any doubt as to whether valve springs have become weakened, replace with new valve assemblies. When obtaining new valves, make

sure valve code stamped on outer spring retainer washer on each valve is the same as the code stamped on the valve nuts (fig. 213).

277. Assembly of Shock Absorber

Note. Key letters noted in parentheses are in figure 210 unless otherwise indicated.

a. General.—Coat all internal parts with petroleum base hydraulic oil (OHA) before assembling shock absorber.

b. Installation of Piston Assembly.

- (1) Mount shock absorber body on shock absorber rebuilding stand 41-S-4977-5. File a $\frac{1}{16}$ -inch chamfer on inner edges of compression half of piston at points indicated in figure 211 to permit ends of antirotation spring to enter piston when assembling.
- (2) Insert piston halves in cylinder, with the half having antirotation spring opposite the arm end of the shock absorber, and with cam clearance side of piston halves toward top of shock absorber.
- (3) Install piston screws (D) and piston screw springs (E) in piston. Tighten screws; then back off each screw 1 to $1\frac{1}{2}$ turns to prevent binding between cam and thrust buttons. Install new expansion plug (C) in screw hole in outer end of each piston half.

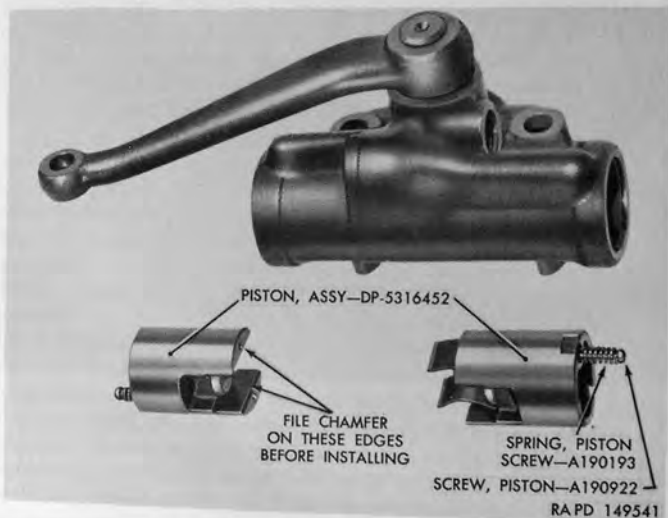


Figure 211. Piston assembly removed.

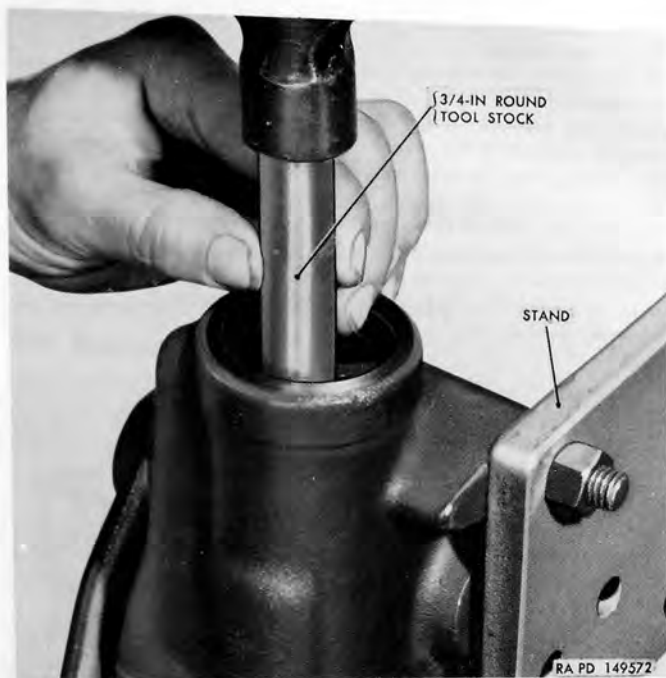


Figure 212. Installing intake valve spring retainer with shock absorber mounted in stand 41-S-4977-5.

c. Installation of Intake Valves.

- (1) Mount shock absorber body on shock absorber rebuilding stand 41-S-4977-5 in vertical position. Move shock absorber arm to position piston at top.
- (2) Drop intake valve (K) into piston with raised side up, and place intake valve spring (L) on top of valve with small end of spring next to valve. Place intake valve spring retainer (M) in piston; then using a piece of 3/4-inch round tool stock (fig. 212) as a driver, drive retainer down until it seats in groove in piston. Make sure retainer is fully seated in groove and is not driven down beyond the groove.
- (3) Turn shock absorber body over and position other end of piston at top; then install the other intake valve, spring, and retainer as in (2) above.
- (4) Install end plug (A) with new end plug gasket (B) in each end of shock absorber body and tighten firmly, using a short-

length of $1\frac{1}{16}$ -inch hex tool stock as an adapter for a box end wrench.

d. Installation of Rebound and Compression Valves.—Compression valve assembly, marked "G-2" (fig. 213), must be installed in opening opposite the arm end of the shock absorber, and the rebound valve assembly, marked "2 N," in other end. Place each valve assembly in body, making sure guide at inner end of valve enters passage at bottom of valve bore. Secure in place with rebound and compression valve nuts (N) and valve nut gaskets (Q). Nut marked "G 2" must be installed over the compression valve, and nut marked "G 2 N" over the rebound valve. Tighten nuts firmly.

Note. If rebound and compression valve nuts are replaced, stamp new nut with proper marking.

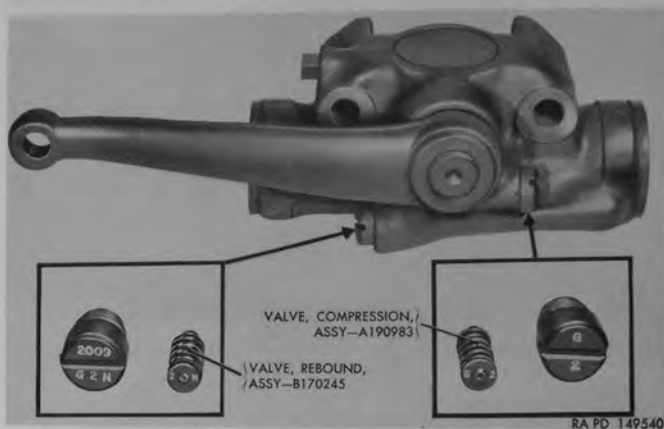


Figure 213. Shock absorber valve identification.

e. Filling Shock Absorber.—Mount shock absorber assembly on shock absorber rebuilding stand 41-S-4977-5 in operating position. Fill with petroleum base hydraulic oil (OHA), pumping shock absorber arm up and down while adding oil to expel air and to pump oil into internal passages. After all air is expelled and oil remains at level of filler plug hole, install filler plug (G), using a new filler plug gasket (H), and tighten firmly. Remove shock absorber assembly from rebuilding stand.