WAR DEPARTMENT TECHNICAL MANUAL
TM 9-1827C

ORDNANCE MAINTENANCE

Hydraulic Brakes (Wagner Lockheed)

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

CONTENTS

CHAPTER 1
INTRODUCTION

1. SCOPE.

a. The instructions contained in this manual are for the information and guidance of personnel charged with the maintenance and repair of hydraulic brakes (Lockheed). These instructions are supplementary to field and technical manuals prepared for the using arms. This manual does not contain information which is intended primarily for the using arms, since such information is available to ordnance maintenance personnel in 100-series TM's or FM's.

b. The manual contains a description of, and procedure for disassembly, inspection, repair, and assembly of hydraulic brakes.

2. ARRANGEMENT.

a. Chapter 2 covers tests and adjustments of hydraulic brake assemblies. Chapter 3 discusses construction and operation, and procedures for disassembly, repair, and assembly of master cylinder assemblies. Chapter 4 covers wheel cylinder assemblies, and chapter 5 describes like procedures for wheel brake assemblies.

CHAPTER 2

TESTS AND ADJUSTMENTS

3. BRAKE INSPECTION.

a. Check fluid level in master cylinder, making sure that all dirt is removed from around filler plug to prevent entrance to cylinder reservoir. NOTE: *Level should be ½ inch from reservoir top or cover.* Check pedal to make certain it has free play before pressure stroke starts.

b. Check pedal for binding on pedal shaft; lubricate if necessary. A mixture of engine oil and graphite is usually satisfactory for pedal mounting and cable clevises. Be sure pedal returns sharply to "OFF" position; if not, replace pedal return spring. Check front and rear wheel bearing adjustment. Brakes cannot be adjusted properly when bearings are loose, as shoes will not remain centralized in the drum. Always pull at least one wheel for inspection of average condition of linings and drums. Backing plate must be tight to provide rigid support for the brakes. Loose or sprung backing plate will be evidenced by drum not being equally spaced to backing plate at all points around the drum, assuming axle shaft or spindle is not sprung, and wheel bearings are properly adjusted.

c. Inspect condition of front and rear grease retainers. Also check front wheel bearing lubricant, as an excessive amount will cause seepage through grease retainer, and make it necessary to replace lining. Inspect grease level in differential case for proper level as specified in vehicle Lubrication Guide.

d. Major adjustment should include pulling all wheels and drums. Clean drums thoroughly, using kerosene and flint paper. Clean entire brake assembly thoroughly.

e. If lining is loose, badly worn, or grease-soaked, it must be replaced. Lining is considered worn and replacement necessary when rivet heads are within $\frac{1}{32}$ inch of lining face. When assembling, lubricate all frictional contact points sparingly. Use lubricant recommended by vehicle manufacturer.

4. BRAKE PEDAL TESTS.

a. Introduction. If the hydraulic brake system, and the drum and brake shoe clearance are satisfactory, when brake pedal is depressed with sufficient force to set brakes firmly, the pedal will have a "solid" feel, with at least 2 inches of floorboard clearance. During the initial ¼ to ½ inch of pedal travel, the pedal should move freely

(if pedal clearance is correctly adjusted). The subparagraphs below furnish probable remedies for various behaviors of a defective brake system, based on the behavior of the brake pedal as a symptom.

b. Pedal Has Less than 2 Inches Floorboard Clearance. Adjust clearance between brake shoes and drums.

c. Pedal Has a "Springy" Feel. This is usually evidence that the brake shoes are improperly set, or have been relined with incorrect thickness of lining. Improper shoe setting would indicate need of a major brake adjustment. Before making a decision on this type of condition, road test the vehicle (or test it on a brake machine). This will indicate a "hard" pedal and a "poor" stop, if these conditions are present. After road or machine test, pull wheels, check lining thickness, contact, drum condition, fit of shoes to drum, and anchor adjustment, to determine exact cause of difficulty.

d. Pedal Has a "Spongy" Feel. Bleed air from hydraulic system.

e. Pedal Jams or Binds. Check for mechanical interference; also check for broken piston stop wire in master cylinder. Check master cylinder mountings and linkage, and if a booster is used, check mechanical linkage between master cylinder and booster.

f. Pedal Goes to Floorboard and Can Be Built Up by Pumping. If pressure can be built up, hold down hard to see if pressure will decrease. After holding ½ minute, reduce pressure on foot without releasing pedal, and press lightly to see if pedal moves down under light pressure. This test will reveal a master cylinder cup which is thin, permitting fluid to bypass within the master cylinder without showing signs of leaking on the outside of the master cylinder.

g. Pedal Goes to Floorboard and Cannot Be Built Up by Pumping. Check fluid level in master cylinder reservoir. If insufficient fluid is present, test brake pedal action and perform operations described under new symptom. If sufficient fluid is present, continue with operations described in this subparagraph. Where accessible, feel the master cylinder boot to determine if wet with brake fluid. Squeeze boot with fingers; if fluid is expelled around or through boot, it is an indication that the master cylinder is leaking and should be removed, inspected, repaired, or replaced. If no evidence of leaks is apparent at the master cylinder, inspect all fluid lines along the frame, all hose and hose connections, the bottom edges of all brake flanges, and the inner side wall of tires for signs of brake fluid leakage. If no external signs of leaks are found, but pedal still leaks off under pressure, pull all four wheels and inspect the wheel cylinders. If no external fluid losses are found, but pedal "eases down" under constant but light foot pressure, it is a good indication that pressure is bypassing within the master cylinder; in which case, remove and repair or replace.

TESTS AND ADJUSTMENTS

5. BRAKE PEDAL ADJUSTMENT.

a. Purpose. Proper pedal adjustment is important; otherwise, the compensating features of the master cylinder cannot function. Fluid cannot return from the lines. Brakes will drag after several applications if master cylinder bypass port is blocked. It is imperative that master cylinder piston be against its stop, and that pedal link rod be adjusted for clearance where it seats in master cylinder piston. There should be at least ¼- to ½-inch free play in pedal pad before the pressure stroke starts. Greater free play reduces the effective travel of master cylinder piston, which in turn reduces brake effectiveness. NOTE: *Some vehicles have a pedal stop adjustment.*

b. Method. Adjustment is made by loosening the lock nut, and removing clevis pin at pedal. Hold piston push rod link from turning, with wrench on large hexagonal surface, to avoid damage to boot. Adjust pedal rod to obtain desired setting. Tighten lock nut, and reconnect pedal by inserting clevis pin. Pedal adjustment is made as follows:

(1) Remove clevis pin from clevis on pedal rod at master cylinder end.

(2) Locate lever on outside of cylinder so that it crosses an imaginary vertical line at ⅔ of its actual stroke.

(3) Adjust pedal stop screw to provide ½-inch free play at pedal pad.

(4) Loosen lock nut at cylinder end of pedal connecting rod.

(5) Adjust length of rod so that the clevis connected to lever, pedal pad will have ½-inch free travel before pressure stroke starts. NOTE: *This provides the best pedal adjustment.*

6. BLEEDING THE SYSTEM.

a. Description. Since the proper operation of the hydraulic brake system requires a solid column of fluid (without air bubbles) at all points in the pressure system, it becomes necessary under certain conditions to bleed fluid from the system in order to expel air bubbles which have become mixed with the fluid. The necessity of bleeding is indicated by a soft or spongy pedal.

b. Reasons for Bleeding.

(1) When a wheel cylinder, master cylinder, hose, pipe line, or any part of the system has been broken or disconnected, allowing air to enter.

(2) When air has been drawn into some part of the system through neglect or misadjustment, such as: Air drawn into master cylinder around a worn master cylinder secondary cup; air drawn into rear wheel cylinders by emergency brake linkage being misadjusted; or, improper fluid level in master cylinder.

(3) When brakes have been adjusted too tight, or emergency

brake has been left on, causing overheating and boiling or gassing of the brake fluid.

(4) When, after proper mechanical adjustment of all brake shoes, the brake pedal feels spongy, indicating presence of air in the system.

(5) When it becomes necessary to replace fluid.

c. Bleeding Brakes.

(1) Remove cap screw from bleeder connection, and thread bleeder drain hose into this opening. Allow bleeder hose to hang in a clean container.

(2) Care must be taken not to drain the master cylinder reservoir during this operation; otherwise, air will enter and make rebleeding necessary. Reservoir must be full during the bleeding operation.

(3) Loosen bleeder screw one full turn, and depress the brake pedal slowly; then, allow pedal to return to the "OFF" position. Repeat this operation approximately 10 times, to provide a pumping action to force fluid through the line, and expel all air. This operation must be repeated at all four wheels to bleed the entire system.

(4) Watch flow from bleeder hose, keeping hose submerged in fluid in container. When air bubbles cease to appear, or when the stream is a clean, solid mass, close bleeder connection. CAUTION: *Fluid withdrawn during the bleeding operation should not be used again.*

d. Bleeding Equipment. Pressure bleeding equipment materially reduces the time required for the bleeding operation. Such equipment may also be used for cleaning and flushing the system. This unit connects to the master cylinder; fluid under pressure is introduced at this point. The mechanic then bleeds system at each wheel. Constant pressure is maintained, no fluid is lost or spilled, and the job is completed in minimum time.

CHAPTER 3
MASTER CYLINDER ASSEMBLIES

Section I
COMBINATION TYPE

7. DESCRIPTION (figs. 1 and 2).

a. The combination type is of one-piece construction, with the fluid reservoir or supply tank cast integral with the cylinder barrel. The cylinder barrel contains the following internal parts: Stop wire, stop washer, piston assembly, primary cup, return spring, and valve assembly. In some types, a removable head is used and in this design a valve seat is incorporated. NOTE: *Illustrations shown in this section do not refer to any particular cylinders.*

b. The combination-type master cylinders are manufactured in the following diameters: 1 inch, $1\frac{1}{16}$ inches, $1\frac{1}{8}$ inches, $1\frac{1}{4}$ inches, $1\frac{1}{2}$ inches, and $1\frac{3}{4}$ inches.

8. CONSTRUCTION AND OPERATION (figs. 1 and 2).

a. The piston is of the hour-glass type; namely, the ends are approximately the same diameter as the cylinder bore, and the center section is smaller. The one end is recessed to take the end of the push rod assembly. A rubber boot is used to cover the end of the cylinder assembly, and prevent dirt and grit from entering the cylinder. When the brake pedal is in the released position, the piston rests against the piston stop washer. This stop washer is held in place by the piston stop wire which fits into a recess machined into the end of cylinder barrel. The secondary cup is assembled on the outer end of the piston, and prevents fluid from leaking out into the boot. The primary cup fits against the flat inner face of the piston, is held in place by the return spring, and seals the system against loss of hydraulic pressure. A check valve is held in the closed end of the cylinder by the return spring. The function of this valve is to seal the system, and prevent air entering the system during the bleeding operation. The valve is constructed so that fluid may be displaced into the line at very low pressure. Fluid passing into the lines, as pressure is applied, raises the inner section of the valve from its seat. NOTE: *This applies to the one-piece valve.* When the two-piece valve is used, fluid passing into the lines flows through the drilled holes in the valve body and by the lip of the rubber valve cup inserted in the body. The two

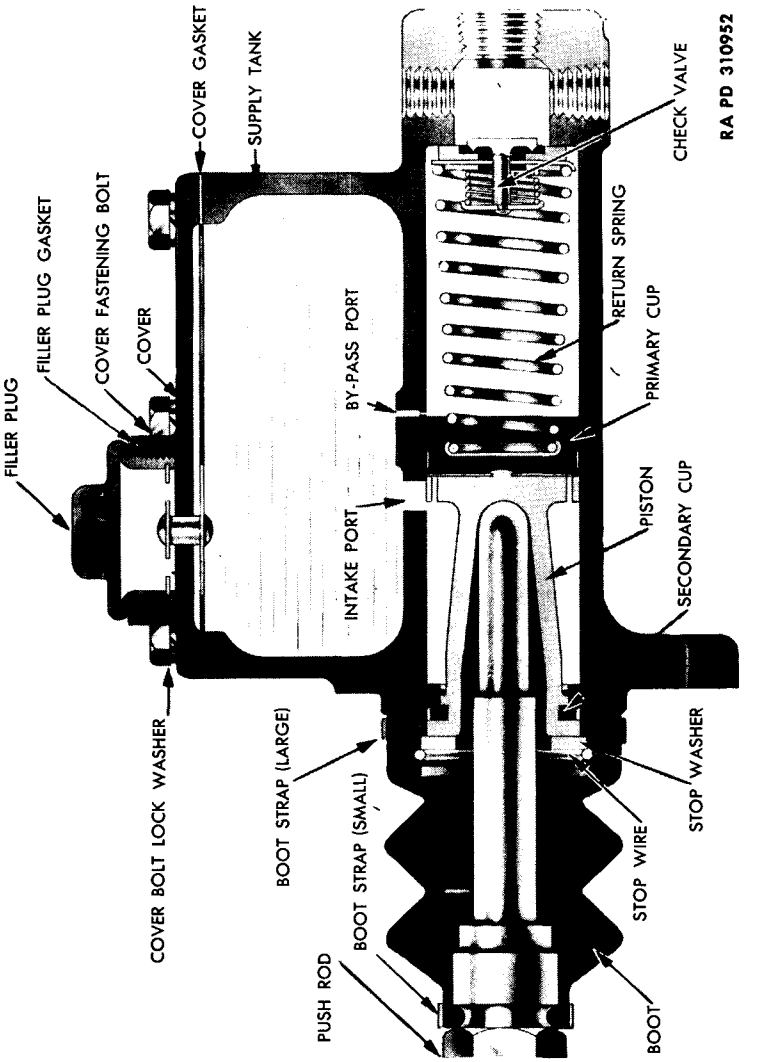

Figure 1 — Combination Type Master Cylinder with Fixed Head

MASTER CYLINDER ASSEMBLIES

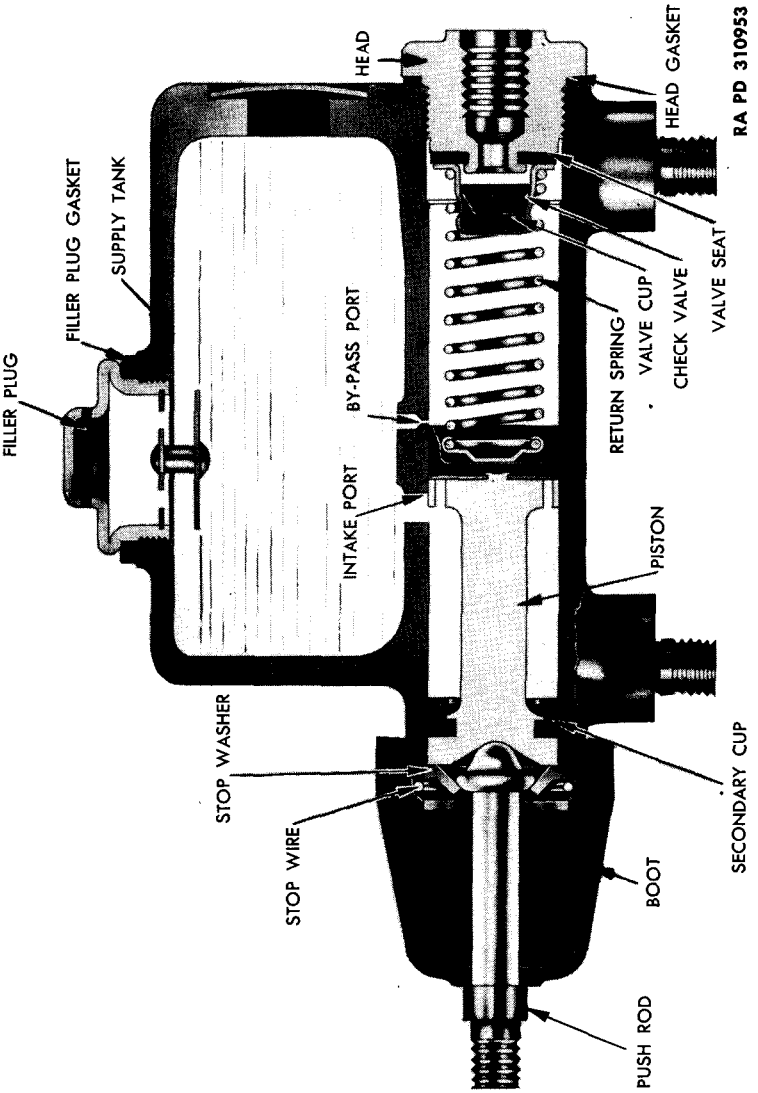

Figure 2 — Combination Type Master Cylinder with Removable Head

types of valves function the same when the fluid is returning to the reservoir. In both cases, the pressure of the returning fluid raises the complete valve from the seat, and the fluid passes around the valve and back into the master cylinder barrel.

b. Ahead of the rubber cap when the piston is in the "OFF" position is a drilled hole through the cylinder casting wall. This is the "port hole" through which excess fluid in the system returns to the fluid reservoir or supply tank. In addition, fluid lost through contraction or seepage is replaced through this port. Between the secondary cup and the primary cup is a drilled hole which serves as the "intake port." This hole is uncovered at all times; therefore, a supply of fluid is constantly maintained between the primary cup and secondary cup. When the pressure is released on the brake pedal, the piston assembly is returned to its "OFF" position by the return spring. The return of the piston is much faster than the return of the brake fluid from the wheel cylinder; therefore, a momentary vacuum is created which pulls this fluid through the drilled holes in the piston and past the lip of the primary cup. This action supercharges the system with fluid after each brake application. The excess fluid is bypassed into the fluid reservoir through the drilled port hole.

9. DISASSEMBLY (figs. 3 and 4).

a. Drain Cylinder. Remove filler plug and gasket and drain cylinder.

b. Remove Boot. Remove large and small boot straps. Remove boot and push rod assembly from cylinder, and separate boot from push rod.

c. Remove Piston Assembly. Remove the stop wire and stop washer, and remove piston assembly from cylinder. Remove the secondary cup from piston assembly.

d. Remove Check Valve. Remove the primary cup, return spring assembly, and check valve in the above mentioned order. If cylinder is of the removable-head type, separate the valve cup from check valve body. If cylinder is of the fixed-head type, do not disassemble check valve.

e. Remove Cylinder Head (Removable Type). Use special wrench and remove head and gasket from cylinder. Separate rubber check valve seat from head.

10. CLEANING, INSPECTION, AND REPAIR.

a. Clean Cylinder Casting and Parts. Wash the casting and all parts in clean denatured alcohol.

b. Inspection and Repair.

(1) If the cylinder bore is rough, scratched, or pitted, recondition

MASTER CYLINDER ASSEMBLIES

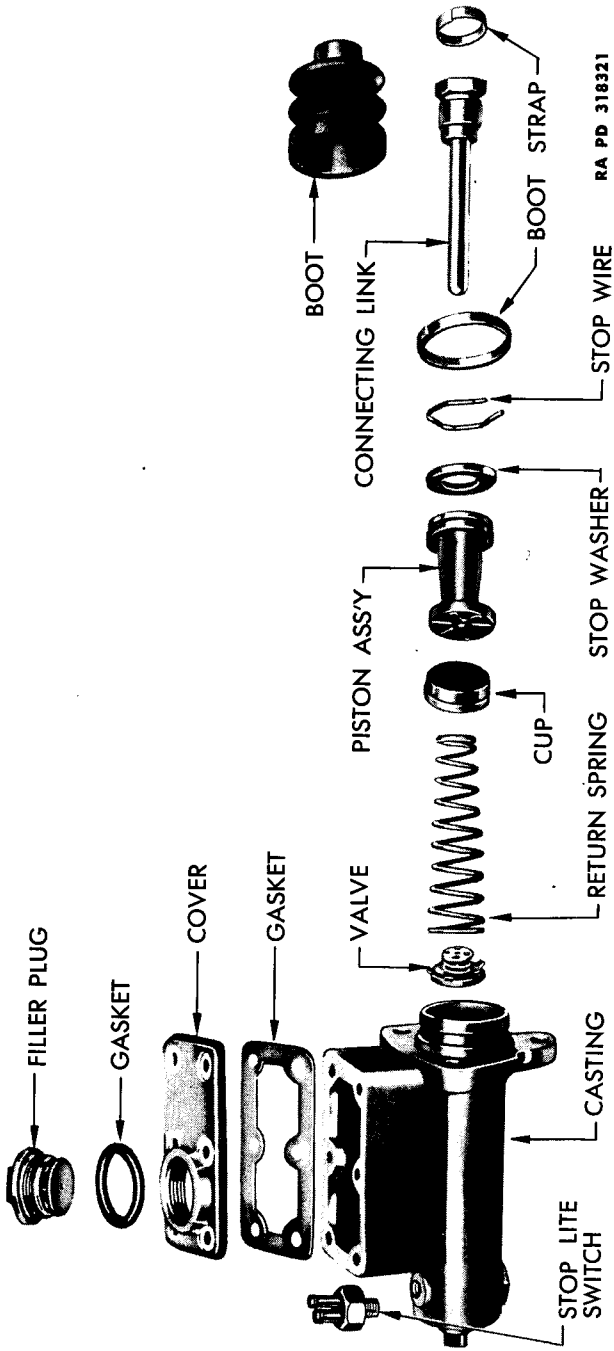

Figure 3 — Parts of Combination Type Master Cylinders with Fixed Heads

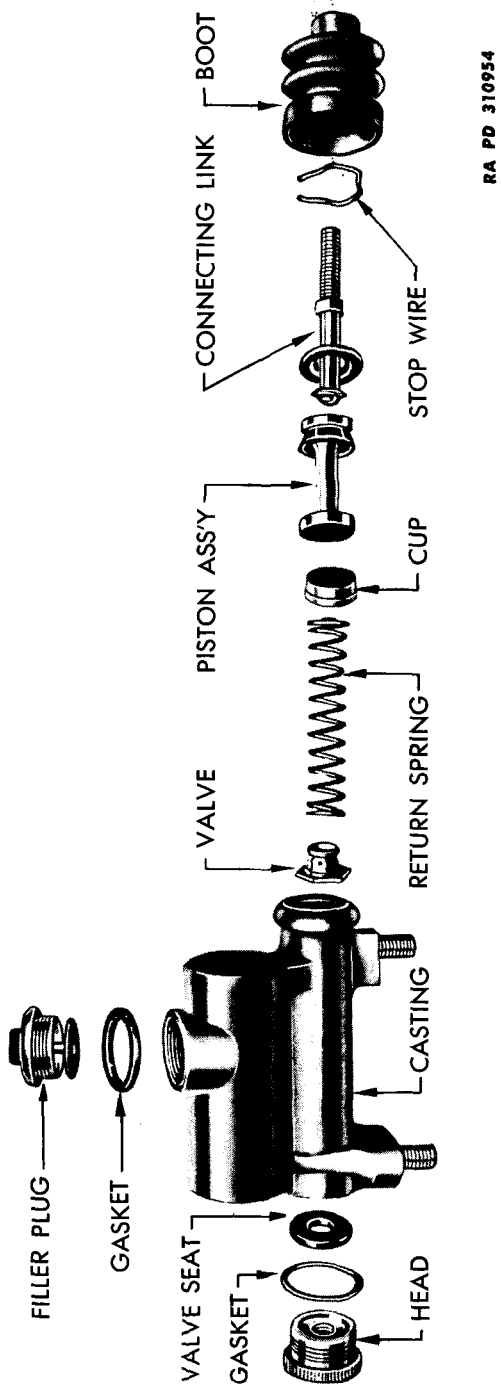

Figure 4 — Parts of Combination Type Master Cylinders with Removable Heads

it with a hone. The permissible maximum bore dimension for each cylinder size is shown in the following table:

Maximum Original Dimension	Maximum Allowable Oversize
1.003 in.	1.007 in.
1.0655 in.	1.0695 in.
1.128 in.	1.132 in.
1.253 in.	1.257 in.
1.503 in.	1.507 in.
1.753 in.	1.757 in.

If the cylinder does not clean-up according to the pertinent dimension shown in the above table, use a new cylinder.

(2) Use a new piston if the original is burred, cracked, or is not concentric.

(3) Use new rubber parts and gaskets. NOTE: *These items include the primary and secondary cups, boot, valve cup and seat, check valve, and filler plug gasket.*

11. ASSEMBLY (figs. 3 and 4).

a. Preparation. Dip cylinder and all internal parts in hydraulic brake fluid.

b. Assemble and Install Cylinder Head (Removable-head Type). Install new rubber check valve seat and gasket on cylinder head. Use special wrench and install cylinder head into cylinder.

c. Assemble and Install Check Valve (fig. 2). Install new check valve cup in check valve body. Install check valve with large diameter toward the removable head.

d. Install Check Valve (fig. 1). Use a new check valve, and install it in cylinder with spring toward open end of cylinder.

e. Install Return Spring and Primary Cup. Install spring with the metal retainer toward open end of cylinder. Install primary cup with flared end toward closed end of cylinder.

f. Assemble and Install Piston Assembly. Assemble the secondary cup to the piston. Install piston assembly with secondary cup toward the open end of cylinder. Install the stop washer and wire.

g. Install Boot. Slip large end of boot over push rod and work the push rod through small hole of boot until beads of boot are positional, as in figure 2.

h. Install Boot and Push Rod Assembly (fig. 1). Position boot on push rod with bead of boot resting in push rod groove, and rounded end of push rod toward large end of boot. Slip push rod into recess of piston and position bead of boot onto groove of cylinder. Install large and small straps to anchor boot to cylinder and push rod respectively.

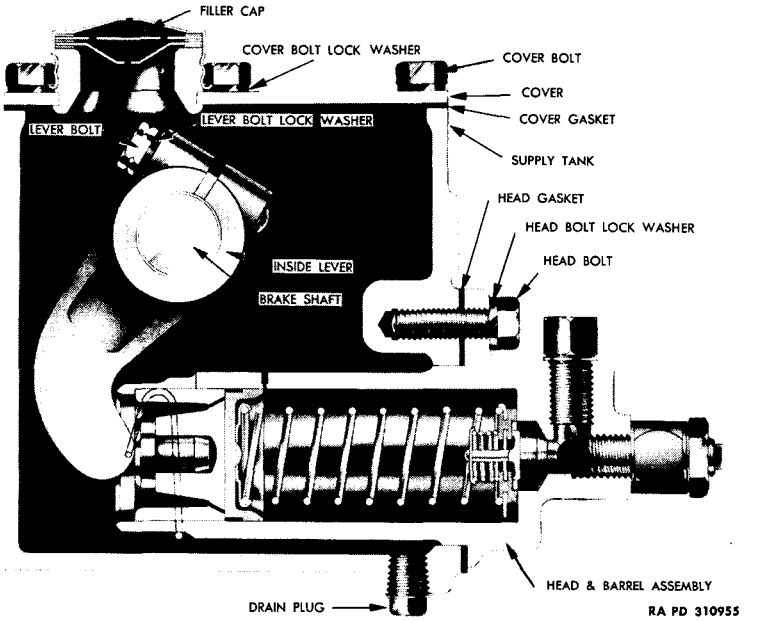

Figure 5 — Box Type Master Cylinder

i. Install Filler Plug and Gasket.

j. Tag and Seal Cylinder Assembly. Tag cylinder assembly and seal all external openings if cylinder is not placed in service immediately.

Section II
BOX TYPE

12. DESCRIPTION (figs. 5 and 6).

a. The box type is of two-piece construction: The fluid reservoir or supply tank is a separate subassembly, and the cylinder barrel assembly is bolted to this unit, making the complete assembly.

b. The unit is coupled to the brake pedal linkage through the brake shaft which extends into the supply tank, and is connected to a lever which actuates the master cylinder piston.

MASTER CYLINDER ASSEMBLIES

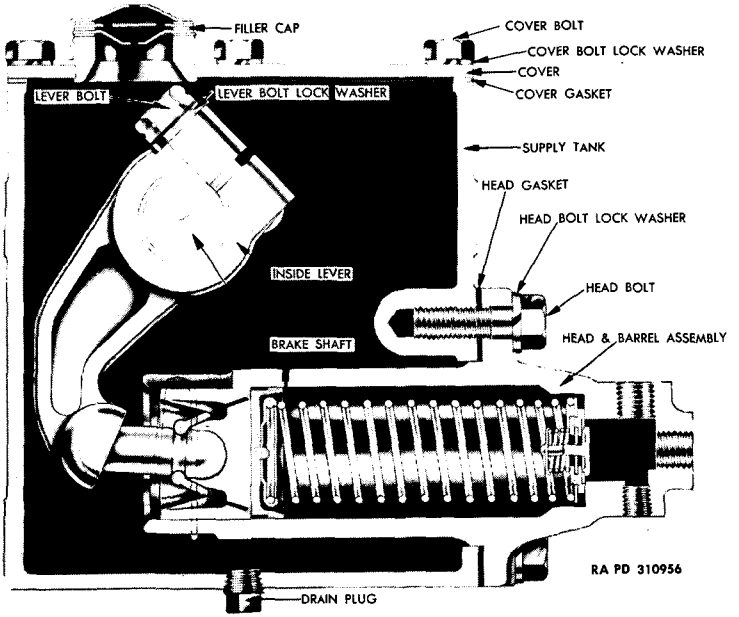

Figure 6 – Box Type Master Cylinder

c. The cylinder barrel contains the following internal parts: Stop wire, piston, primary cup, return spring, and valve assembly.

d. The box-type master cylinders are manufactured in the following diameters: 1¼ inches, 1½ inches, 1¾ inches, and 2 inches.

13. CONSTRUCTION AND OPERATION (figs. 5 and 6).

a. The box-type master cylinder employs a check valve held in the closed end of the cylinder by the piston return spring. The function of this valve is to seal the system, and prevent air entering the system during the bleeding operation. The valve is constructed so that fluid may be displaced into the line at very low pressure. Fluid passing into the lines, as pressure is applied, raises the inner section of the valve from its seat. When pressure on returning fluid drops to below 6 to 8 pounds, the return spring pressure seats the valve, and the system is held under a slight pressure which serves as a seal to prevent gravity seepage.

b. The piston assembly is the medium through which mechanical force, applied by the brake pedal, through the master cylinder brake shaft and lever, is transposed into hydraulic pressure. A stop wire is fastened into holes located in the end of the cylinder casting, and prevents the piston from sliding out of the cylinder barrel. As the brake pedal is depressed, the master cylinder piston moves toward the end of the cylinder, displacing fluid under pressure into the brake

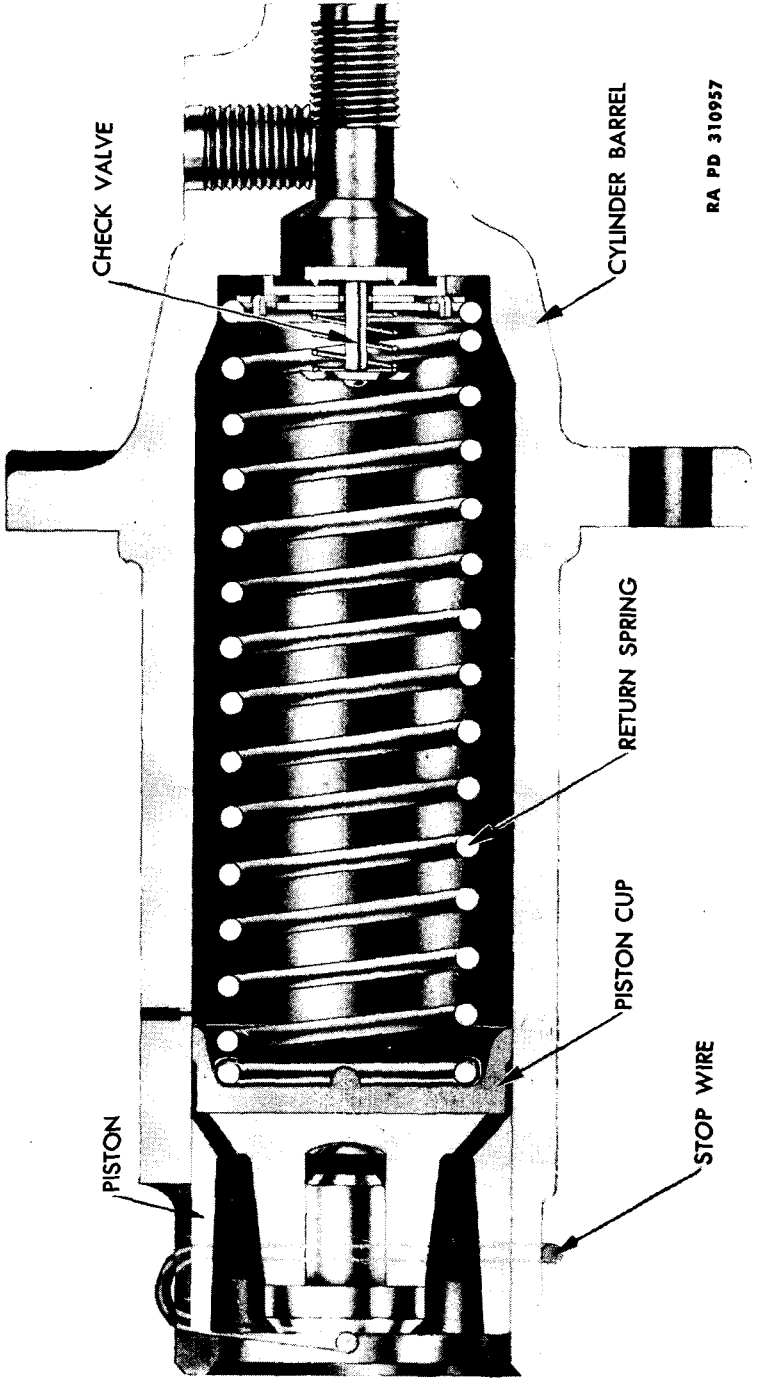

Figure 7 — Master Cylinder Head and Barrel Assembly

system. The rubber cup fits against the flat face of the piston, is held in place by the return spring, and seals the system against loss of hydraulic pressure.

c. Ahead of the rubber cup, when the piston is in the "OFF" position, is a drilled hole through the cylinder casting wall. This is the "port hole" through which excess fluid in the system returns to the fluid reservoir, or supply tank. In addition, fluid lost through contraction or seepage is replaced through this port. The end of the cylinder barrel is open, and since the cylinder barrel is submerged in fluid contained in the fluid reservoir or supply tank, it is surrounded by fluid. When the pressure is released on the brake pedal, the piston assembly is returned to its "OFF" position by the return spring. The return of the piston by the return spring is much faster than the return of the brake fluid from the wheel cylinders; therefore, a momentary vacuum is created which pulls fluid from the reservoir, or supply tank, through the drilled holes in the piston and past the lip of the rubber cup. This action supercharges the system with fluid after each brake application. The excess fluid is bypassed into the fluid reservoir, through the drilled port hole.

14. DISASSEMBLY (figs. 7 and 8).

a. Drain Cylinder. Remove drain plug, filler plug and gasket, and drain cylinder.

b. Remove Outside Lever. Remove outside master cylinder lever bolt and lock washer, and disassemble lever from master cylinder brake shaft.

c. Remove Master Cylinder Cover. Remove $\frac{5}{16}$-18 x $\frac{5}{8}$-inch cap screws fastening cover to supply tank, and remove cover and cover gasket.

d. Remove Head and Barrel Assembly (fig. 7). Remove four cap screws which fasten barrel assembly to supply tank, and remove head and barrel assembly and head gasket.

e. Remove Internal Parts (fig. 8). Remove stop wire, piston, piston cup, return spring assembly and check valve assembly.

f. Remove Piston Support Ring. NOTE: *Some box-type master cylinders employ a piston with a connecting link which seats in a recess in the end of the inside brake shaft lever. To service this type, separate rubber piston support ring from piston.*

g. Remove Inside Lever and Brake Shaft. Remove inside lever bolt and lock washer, and draw brake shaft through inside lever. Remove brake shaft oil seal rings.

15. CLEANING, INSPECTION, AND REPAIR.

a. Clean Cylinder Casting and Parts. Wash the casting and all parts in clean, denatured alcohol.

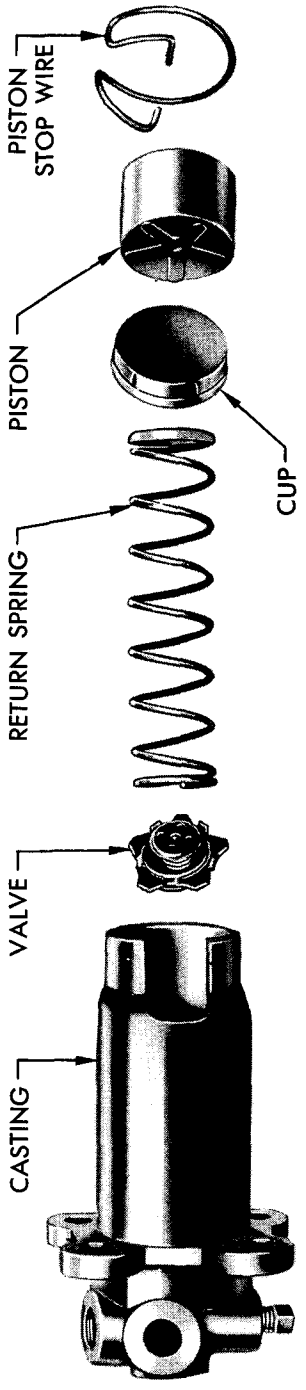

Figure 8 — Parts of Box Type Master Cylinder

b. Inspection and Repair.

(1) If the cylinder bore is rough, scratched, or pitted, recondition it with a hone. The permissible maximum bore dimension for each cylinder size is shown in the following table:

Maximum Original Dimension	Maximum Allowable Oversize
1.253 in.	1.257 in.
1.503 in.	1.507 in.
1.753 in.	1.757 in.
2.003 in.	2.007 in.

(2) If the cylinder does not clean-up according to the pertinent dimension shown in the above table, use a new cylinder.

(3) Use a new piston if the original is burred, cracked, or is not concentric.

(4) Use new rubber parts and gaskets. NOTE: *These items include the piston cup, piston support ring, check valve, brake shaft oil seal rings, head gasket, and supply tank cover gasket.*

16. ASSEMBLY (figs. 7 and 8).

a. Preparation. Dip cylinder and all internal parts in hydraulic brake fluid.

b. Assemble and Install Brake Shaft and Inside Lever. Install oil seal rings in supply tank. Hold inside lever in position, and install brake shaft through supply tank and inside lever. Fasten securely with lever bolt and lever bolt lock washer.

c. Assemble Piston Support Ring. Assemble piston support ring to piston. CAUTION: *Bead on support ring must be firmly seated in the recess in piston connecting link.*

d. Assemble Internal Parts (fig. 8). Install check valve with rubber portion toward closed end of cylinder barrel. Install return spring assembly with metal retainer toward open end of cylinder barrel. Install piston cup with flared end toward closed end of cylinder barrel. Install piston with flat face against piston cup. Install piston stop wire.

e. Install Head and Barrel Assembly (fig. 7). Assemble new head gasket over cylinder barrel and flat against cylinder head. Install head and barrel assembly into supply tank. Slot for inside lever must be on top. Fasten securely with head bolts and lock washers.

f. Install Master Cylinder Cover. Use new gasket and fasten securely with $\frac{5}{16}$-18 x $\frac{5}{8}$-inch cap screws and lock washers.

g. Install filler plug and gasket.

h. Tag cylinder assembly and seal all external openings if cylinder is not placed in service immediately.

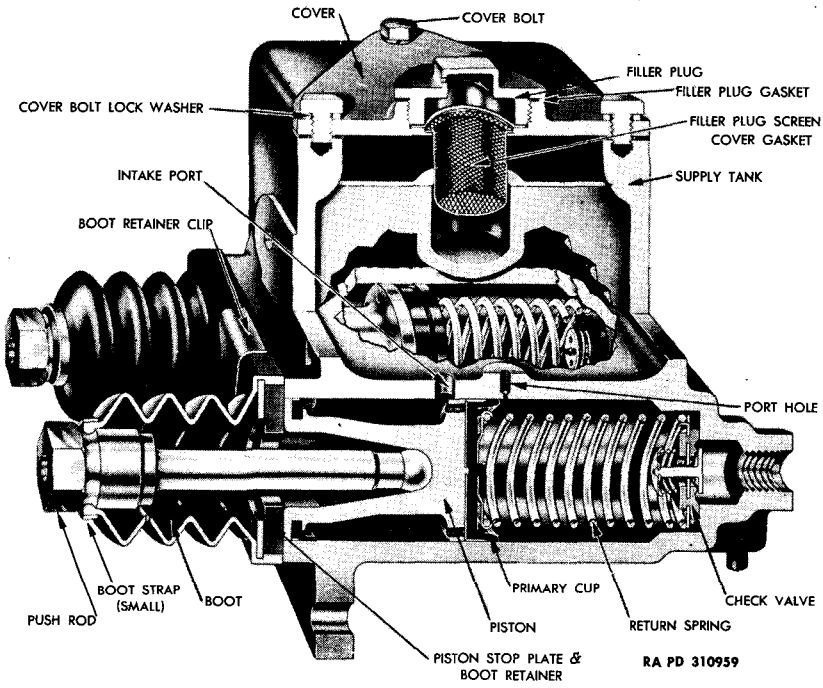

Figure 9 — Twin-bore Master Cylinder

Section III
TWIN-BORE TYPE

17. DESCRIPTION (fig. 9).

a. The twin-bore master cylinder is of the one-piece type; however, it contains two separate cylinder barrels both cast integral with the fluid reservoir or supply tank.

b. The cylinder barrels are identical and both contain the following internal parts: Stop plate, piston assembly, primary cup, return spring, and valve assembly. The push rods extend outward from the piston assembly, and are connected directly to the brake pedal linkage. A rubber boot is used to cover the push rods, and to seal the cylinder against dirt and extraneous substances.

c. The twin-bore master cylinder is manufactured in 1¾-inch diameter only.

MASTER CYLINDER ASSEMBLIES

18. CONSTRUCTION AND OPERATION (fig. 9).

a. The twin-bore master cylinder is practically the same as the combination type, except that two separate cylinder barrels are cast integral with the fluid reservoir or supply tank. Two identical sets of internal parts are used, and function in the same manner. The pistons rest against the stop plate, which is held against the end of the casting by two screws. This stop plate also serves as a mounting plate for the rubber boot. The rubber boot is held on the plate by a metal clip, and covers both push rods extending from the pistons. The boot protects the system from dirt and other foreign matter. The piston assembly includes a secondary cup on the outer end which prevents fluid from the fluid reservoir or supply tank from leaking out into the boot. Against the inside face of the piston and held in place by the return spring, is the primary cup. It seals the system against loss of pressure as the piston moves forward in the pressure stroke. Assembled in the closed end of the cylinder barrel is the check valve. As the piston moves forward on a brake application, the fluid unseats the center portion of the check valve, and passes into the lines. When the brake pedal is released and the brake fluid returns through the lines, the complete check valve is raised from the seat, the fluid passes around the outside of the valve, and back into the cylinder barrel.

b. Ahead of the primary cup when the piston is in the "OFF" position, is a drilled hole through the casting wall. This is the "port hole," through which excess fluid in the system returns to the fluid reservoir or supply tank. In addition, fluid lost through contraction or seepage is replaced through this port. Between the secondary cup and the primary cup is a drilled hole which serves as the "intake port." This hole is uncovered at all times; therefore, a supply of fluid is constantly maintained between the primary cup and the secondary cup. When the pressure is released on the brake pedal, the piston assembly is returned to its "OFF" position by the return spring. The return of the piston is much faster than the return of the brake fluid from the wheel cylinders; therefore, a momentary vacuum is created which pulls this fluid through the drilled holes in the piston and past the lip of the primary cup. This action supercharges the system with fluid after each brake application. The excess fluid is bypassed into the fluid reservoir through the drilled port hole.

19. DISASSEMBLY (fig. 9).

a. Drain Cylinder. Remove filler plug and gasket and drain cylinder.

b. Remove Master Cylinder Cover. Remove $\frac{5}{16}$-18 x $\frac{5}{8}$-inch cap screws fastening cover to supply tank and remove cover and cover gasket.

c. Remove Boots and Push Rod Assemblies. Remove boot retainer clip. Remove two 3/8-16 x 3/4-inch flat-head screws fastening boot retainer and piston stop plate to master cylinder casting. Remove boot and push rod assemblies, and separate boot from push rods by removing boot straps.

d. Remove Internal Parts. Remove piston assemblies, primary cups, return spring assemblies, and check valves. Remove secondary cups from piston.

20. CLEANING, INSPECTION, AND REPAIR.

a. Clean Cylinder Casting and Parts. Wash the casting and all parts in clean, denatured alcohol.

b. Inspection and Repair.

(1) If the cylinder bore is rough, scratched, or pitted, recondition it with a hone. The permissible maximum bore dimension is as follows:

Maximum Original Dimension	Maximum Allowable Oversize
1.753 in.	1.757 in.

(2) If the cylinder does not clean-up according to the dimension above, use a new cylinder.

(3) Use new pistons if the originals are burred, cracked, or are not concentric.

(4) Use new rubber parts and gaskets. NOTE: *These items include primary and secondary cups, boots, check valves, filler plug gasket, and supply tank cover gasket.*

21. ASSEMBLY.

a. Preparation. Dip cylinder and all internal parts in hydraulic brake fluid.

b. Install Check Valves. Install check valves with rubber portion toward closed end of cylinder barrels.

c. Install Return Spring and Primary Cup. Install springs with metal retainers toward open end of cylinder. Install primary cups with flared ends toward closed end of cylinder.

d. Assemble and Install Piston Assemblies. Assemble secondary cups to pistons. Install piston assemblies with secondary cups toward open end of cylinder.

e. Install Piston Stop Plate and Boot Retainer. Install piston stop plate and boot retainer, and fasten securely with two 3/8-16 x 3/4-inch countersunk head machine screws.

f. Assemble and Install Boot and Push Rod Assemblies. Place beads on small ends of boots into recesses in hexagon ends of push rod assemblies. Assemble small boot straps. Install boot and push rod assemblies by placing small ends of push rods into master cylinder pistons, and placing large end of boot over boot retainer.

g. Install boot retainer clip.

h. Install Cover and Gasket. Place gasket and cover in position and fasten securely with $^{5}/_{16}$-18 x $^{5}/_{8}$-inch hexagon-head cap screws.

i. Install Filler Cap and Gasket. Insert filler plug screen into filler opening and install filler plug gasket and filler plug.

j. Tag cylinder assembly and seal all external openings if cylinder is not placed in service immediately.

CHAPTER 4
WHEEL CYLINDER ASSEMBLIES

Section I
STRAIGHT-BORE OR STANDARD-TYPE

22. DESCRIPTION (figs. 10, 11, and 12).

a. The straight-bore or standard-type wheel cylinder is what the name implies; a cylinder casting bored to the same diameter throughout. The cylinder inlet is located in the center of the casting and the internal parts consist of: Return spring, two rubber cups, two metal pistons, and two rubber boots which fit over the ends of the cylinder and protect the internal parts from dirt or other foreign matter. A bleeder screw is provided for expelling air from the system.

b. Three designs of the straight-bore cylinder are used, the difference being in the pistons and boots.

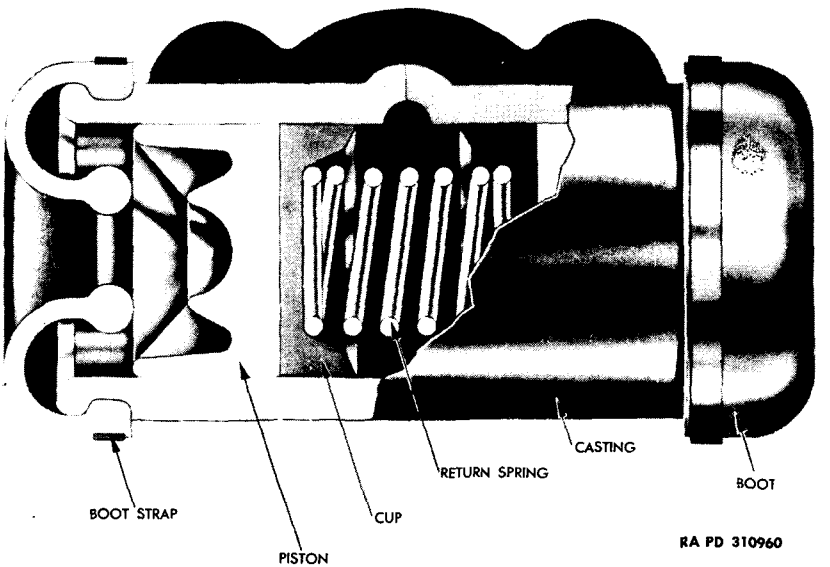

Figure 10 — Straight-bore Wheel Cylinder with Socket Type Piston

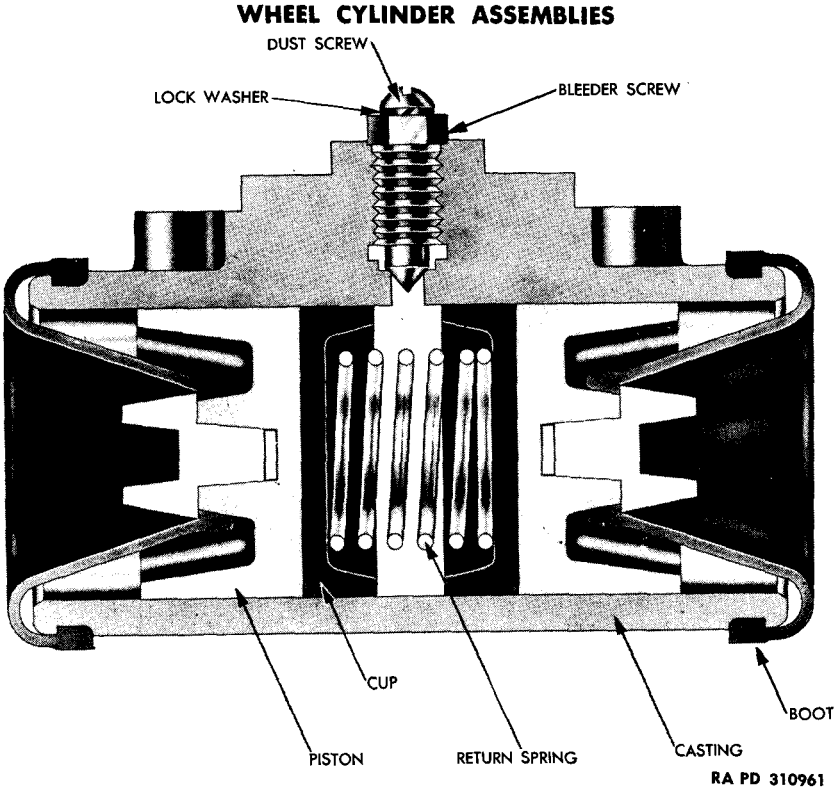

Figure 11 — Straight-bore Wheel Cylinder with Slotted-insert Type Piston

(1) One design incorporates a piston with a socket in which a connecting link is inserted, and provides the connection to the top or toe of the brake shoe. The rubber boot for this design can be identified by the round hole in the center.

(2) Another design incorporates a piston with a slotted metal insert in the center. The internal construction is the same as other straight-bore cylinders, except that no connecting link is used, as the top or toe of the brake shoe fits directly into the slotted metal insert. The rubber boot for this design can be identified by the rectangular slot in the center. NOTE: *It is important that the correct rubber boots be used with the above cylinders to insure proper protection for the internal parts.*

(3) The third straight-bore wheel cylinder is of entirely different construction. While the internal parts are identical with other straight-bore types, the boots are of metal, and slide along the outside of the cylinder body. These boots (gear and cover assemblies) also incorporate a notched gear through which a threaded connecting link is assembled. Rotation of the notched gear on the threaded con-

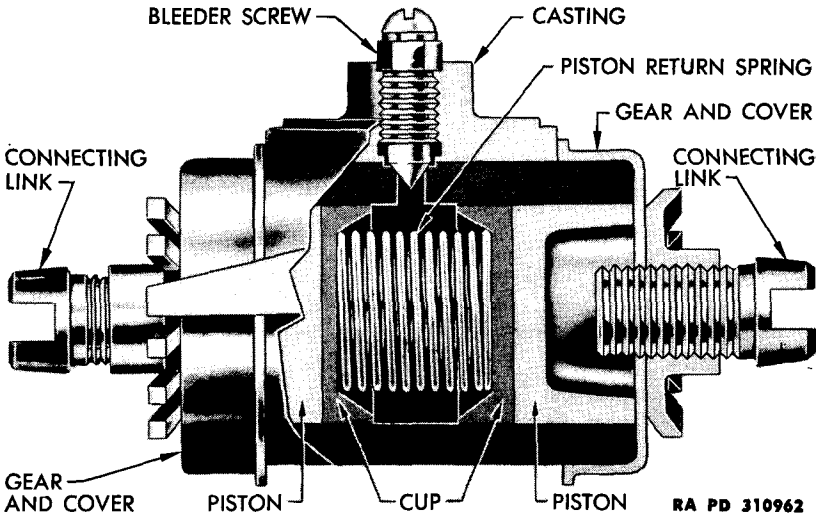

Figure 12 — Straight-bore Wheel Cylinder with Metal Boots

necting link provides the adjustment for the top or toe of the brake shoe. A flat spring is assembled over the outside of the cylinder, and this locks the notched gears.

c. The straight-bore or standard-type wheel cylinder with rubber boots is manufactured in the following diameters: 7/8 inch, 15/16 inch, 1 inch, 1 1/16 inches, 1 1/8 inches, 1 1/4 inches, 1 3/8 inches, 1 1/2 inches, 1 3/4 inches, and 2 inches.

d. The straight-bore wheel cylinder using metal boots is manufactured in the following diameters: 1 3/16 inches, 1 1/4 inches, 1 3/8 inches, and 1 1/2 inches.

23. CONSTRUCTION AND OPERATION.

a. All wheel cylinders operate in the same manner, although construction details vary. The cylinders are connected to the hydraulic system by either metal tubing or a flexible hose. Fluid enters the wheel cylinder through the inlet opening, between the pistons, and forces the pistons outward. Since the brake shoes are directly, or indirectly connected to the wheel cylinder pistons through connecting links, they in turn are expanded into contact with the brake drum. The rubber cups, assembled against the flat face of each piston and held in position by the return spring, seal the system against loss of pressure. A bleeder screw is located above the inlet opening, and is used to expel air from the system during the bleeding operation.

24. DISASSEMBLY (fig. 13).

a. Drain Cylinder. Remove fitting and bleeder screw and drain cylinder.

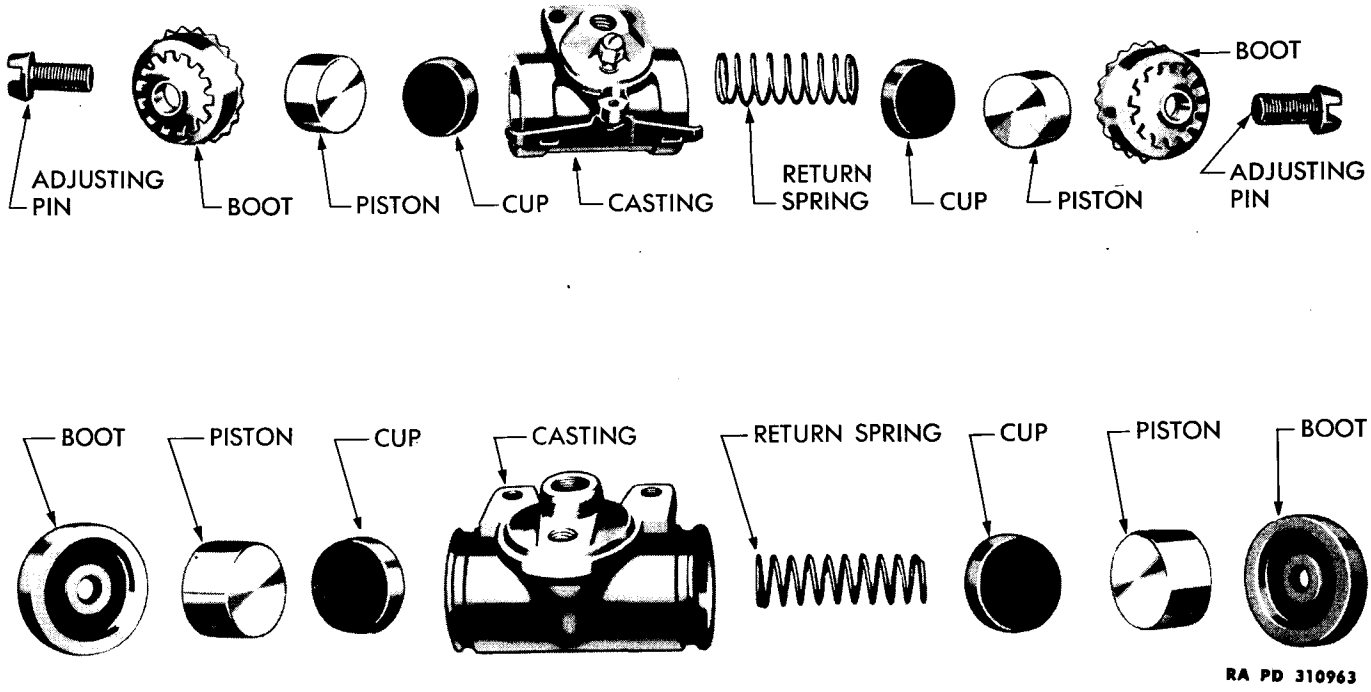

Figure 13 — Parts of Straight-bore Wheel Cylinder

b. Remove Boots.

(1) RUBBER BOOTS. Remove these boots by pulling beads on boots from grooves in casting.

(2) METAL BOOTS. Remove adjusting pin from gear and cover assembly. Remove boots by sliding them from ends of casting.

c. Remove Internal Parts. Remove pistons, cups, and return spring.

25. CLEANING, INSPECTION, AND REPAIR.

a. Clean Cylinder Casting and Parts. Wash the casting and all parts in clean, denatured alcohol.

b. Inspection and Repair.

(1) If the cylinder bore is rough, scratched, or pitted, recondition it with a hone. The permissible maximum bore dimension for each cylinder size is shown in the following table:

Maximum Original Dimension	Maximum Allowable Oversize
0.878 in.	0.882 in.
0.9655 in.	0.9695 in.
1.003 in.	1.007 in.
1.0655 in.	1.0695 in.
1.128 in.	1.132 in.
1.1905 in.	1.1945 in.
1.253 in.	1.257 in.
1.378 in.	1.382 in.
1.503 in.	1.507 in.
1.753 in.	1.757 in.
2.003 in.	2.007 in.

(2) If the cylinder does not clean-up according to the pertinent dimension shown in the above table, use a new cylinder.

(3) Use new pistons if the originals are burred, cracked, or not concentric.

(4) Use new rubber parts. NOTE: *These items include two cups and two boots.*

26. ASSEMBLY (fig. 13).

a. Preparation. Dip cylinder and all internal parts in hydraulic brake fluid.

b. Assemble Internal Parts. Install one boot, and hold cylinder with open end up. Install one piston, place in cylinder with socket or insert toward closed end of cylinder. Next install one cup with flared end toward open end of cylinder. Install return spring. Install other cup with flared end toward closed end of cylinder. Install other piston with socket or insert toward open end of cylinder. Install other boot.

c. Assemble Adjusting Pins. Assemble adjusting pins on cylinders using the metal boots.

d. Install Fitting and Bleeder Screw.

e. Tag and Seal Cylinder Assembly. Tag cylinder assembly and seal openings if cylinder is not placed in service immediately.

Section II

STEP-BORE OR COMPOUND TYPE

27. DESCRIPTION (figs. 14 and 15).

a. The step-bore or compound-bore cylinders are very similar to the straight-bore types. The exception is in the cylinder bore. Instead of a bore having the same diameter the entire length of the casting, the step-bore casting is divided into a large bore, which extends halfway into the casting, and a smaller bore in the other half. The purpose of this design is to vary hydraulic pressure to meet engineering requirements on individual types of automotive vehicles.

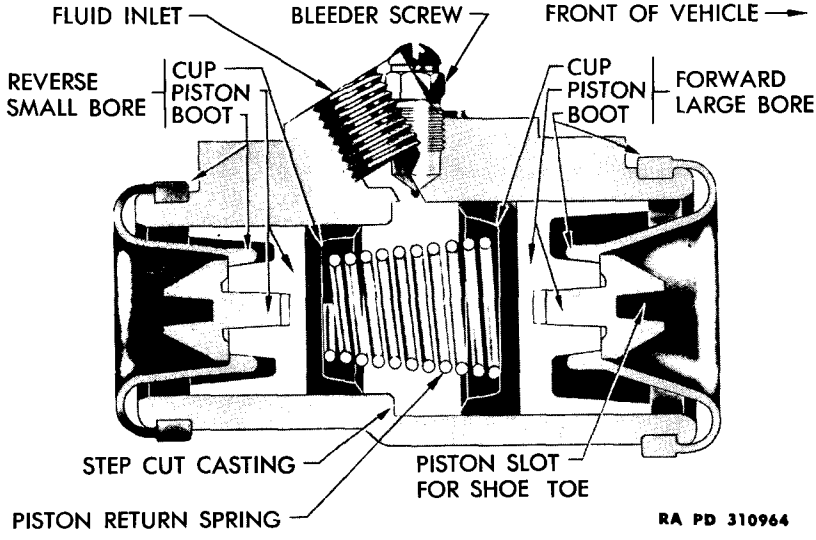

Figure 14 — Step-bore Wheel Cylinder with Slotted-insert Type Piston

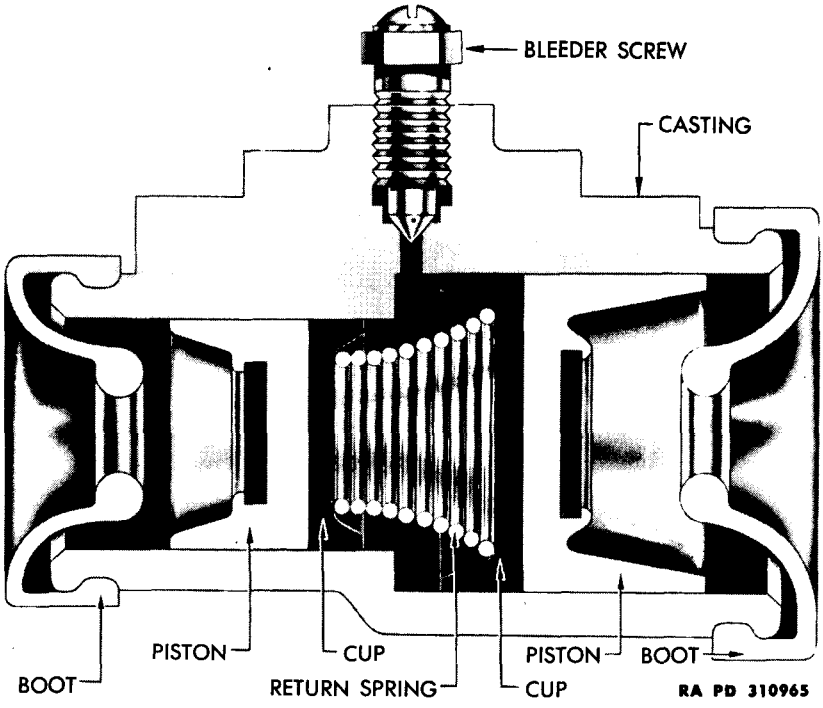

Figure 15 — Step-bore Wheel Cylinder with Disk Insert Type Piston

b. In this type as well as the straight bore, two designs are used, the difference being in the pistons.

(1) One design incorporates a piston with a disk on which the toe of the brake shoe rests.

(2) The other design incorporates a piston with a slotted metal insert in the center into which the top or toe of the brake shoe is directly inserted, eliminating the connecting link.

c. The step-bore or compound wheel cylinders are manufactured in the following diameters: 1-1⅛-inches, 1-1¼-inches, 1-1⅜-inches, 1⅛-1¼-inches, 1⅛-1⅜-inches, 1¼-1⅜-inches, 1¼-1½-inches, 1⅜-1½-inches, 1½-1¾-inches, 1¾-2-inches.

28. CONSTRUCTION AND OPERATION.

a. For an explanation of the construction and operation of this wheel cylinder, refer to paragraph 23.

29. DISASSEMBLY (fig. 16).

a. Follow disassembly procedure outlined in paragraph 24.

WHEEL CYLINDER ASSEMBLIES

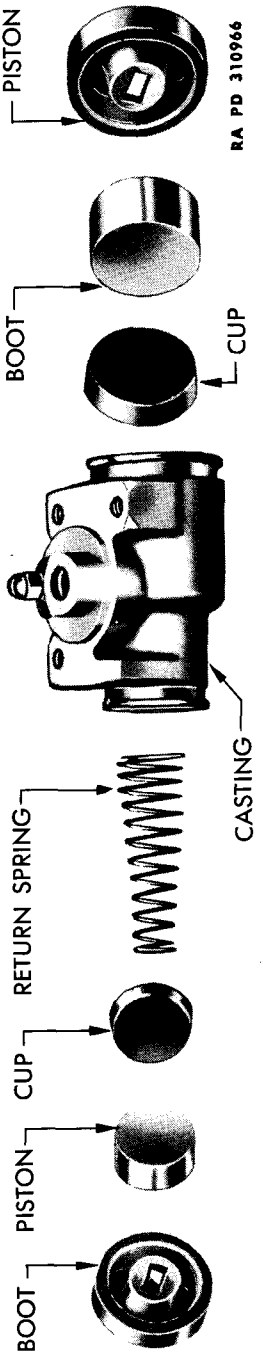

Figure 16 — Parts of Step-bore Wheel Cylinder

30. CLEANING, INSPECTION, AND REPAIR.

a. To perform these functions, follow procedures outlined in paragraph 25.

31. ASSEMBLY (fig. 16).

a. Preparation. Dip cylinder and all internal parts in hydraulic brake fluid.

b. Assemble Internal Parts. Install small diameter cup with flared end toward large diameter of casting. Install small bore piston with disk or insert toward open end of small diameter of casting. Install small boot. Place cylinder vertical with open end up. Install return spring with small end in small diameter of casting. Install large diameter cup with flared end toward small diameter of casting. Install large bore piston with disk or insert up.

c. Install Large Boot.

d. Install Fitting and Bleeder Screw.

e. Tag and Seal Cylinder Assembly. Tag cylinder assembly and seal openings if cylinder is not placed in service immediately.

Section III

L-TYPE

32. DESCRIPTION (fig. 17).

a. The L-type cylinder is used in conjunction with the Wagner "Hi-Tork" brakes. The pistons are at an angle to each other, and are not of the same diameter. The large piston, actuating the front brake shoe, is of the slotted-insert type and is directly in contact with the brake shoe. The smaller piston, actuating the rear brake shoe, is of the socket-type, and is connected to the brake shoe through mechanical linkage. The large diameter portion of the cylinder includes in addition to the piston, a rubber cup, a return spring, and a rubber boot over the end of the casting. The small or angular end of the cylinder has, in addition to the piston, a rubber cup which is of the collar-button type, and which snaps into a recess in the face of the piston. This eliminates the necessity of a return spring. A rubber boot of the accordian-type is used over the end of the casting.

WHEEL CYLINDER ASSEMBLIES

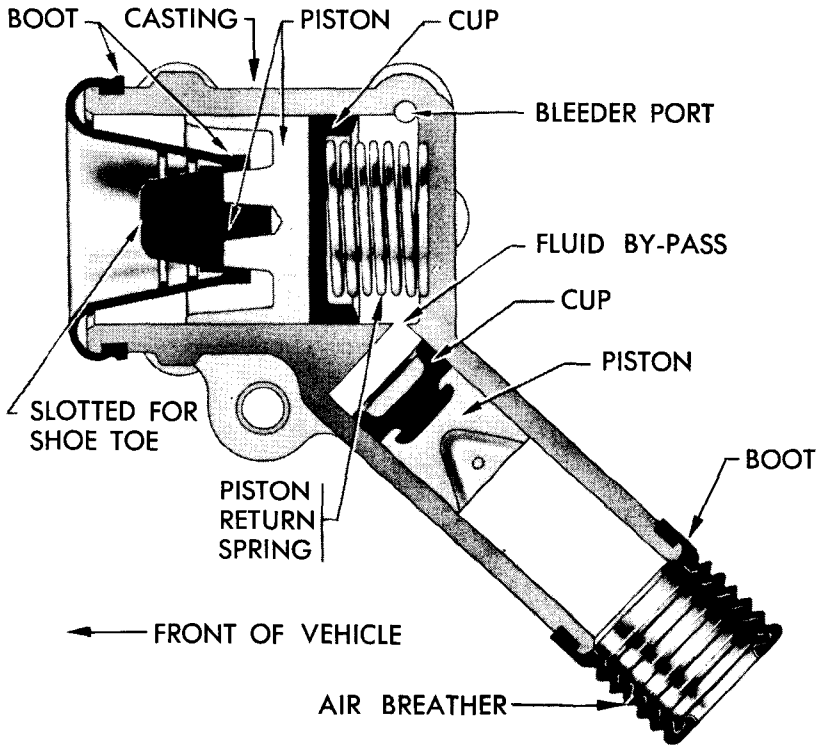

Figure 17 — L-type Wheel Cylinder

b. The L-type wheel cylinders are manufactured in the following diameters: 1⅜-1 1/16-inch, 1½-¾-inch, 1¾-⅞-inch.

33. CONSTRUCTION AND OPERATION.

a. The L-type cylinder is connected to the hydraulic system by a flexible hose. Fluid enters the wheel cylinder through the inlet opening between the pistons, and forces the piston outward. The large diameter piston is connected directly to the front brake shoe, and forces this shoe into contact with the brake drum. The cup seals the cylinder against loss of pressure. The return spring holds the cup in place against the flat face of the piston. The small diameter piston is connected to the rear brake shoe through a mechanical lever, which in turn forces the rear shoe into contact with the brake drum. Equalization of hydraulic pressure is obtained by proper relation between wheel cylinder bores and lever ratio. The pressure on the toes of both front and rear brake shoes is the same. The small rubber cap snaps into a recess in the piston; therefore, no return spring is necessary.

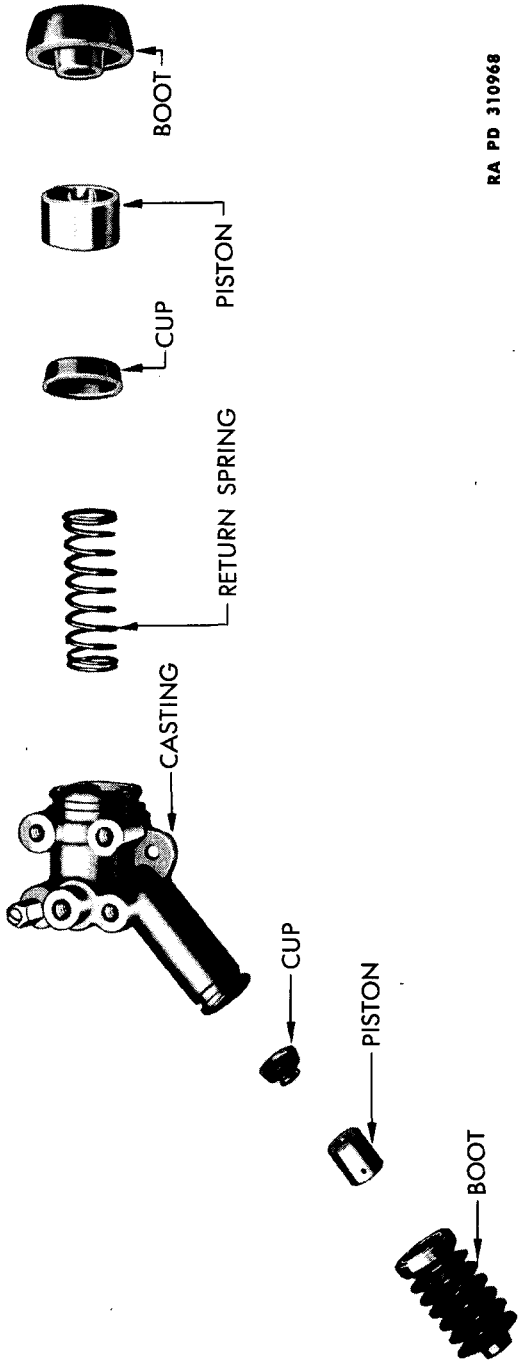

Figure 18 — Parts of L-type Wheel Cylinder

WHEEL CYLINDER ASSEMBLIES

34. DISASSEMBLY (fig. 18).

a. Drain Cylinder. Remove fitting and bleeder screw, and drain cylinder.

b. Remove Boots. The boots may be removed by pulling beads on boots from grooves in casting.

c. Remove Internal Parts. Remove pistons, cups, and return spring.

35. CLEANING, INSPECTION, AND REPAIR.

a. Clean Cylinder Casting and Parts. Wash the casting and all parts in clean denatured alcohol.

b. Inspection and Repair.

(1) If the cylinder bore is rough, scratched, or pitted, recondition it with a hone. The permissible maximum bore dimension for each cylinder size is shown in the following table:

Maximum Original Dimension	Maximum Allowable Oversize
0.690 in.	0.694 in.
0.753 in.	0.757 in.
0.878 in.	0.882 in.
1.378 in.	1.382 in.
1.503 in.	1.507 in.
1.753 in.	1.757 in.

(2) If the cylinder does not clean-up according to the pertinent dimension shown in the above table, use a new cylinder.

(3) Use new pistons if the originals are burred, cracked, or not concentric.

(4) Use new rubber parts. NOTE: *These items include two cups and two boots.*

36. ASSEMBLY.

a. Preparation. Dip cylinder and all internal parts in hydraulic brake fluid.

b. Assemble Internal Parts in Small Diameter. Assemble small cup into recess in small piston. Install piston assembly with cup toward large diameter of casting.

c. Assemble Internal Parts in Large Diameter. Install return spring. Install large cup with flared end toward closed end of casting. Install large piston with insert toward open end of casting. Install large boot.

d. Tag and Seal Cylinder Assembly. Tag cylinder assembly and seal openings if cylinder is not placed in service immediately.

Section IV

TWINPLEX TYPE

37. DESCRIPTION.

a. The twinplex cylinder is so named because there are two units per brake assembly. The assembly is comparable to the metal-boot type in that the adjustment for the shoe is made by rotating the gear assembly which forms part of the adjusting cap assembly. This adjusting cap assembly is used on one end only. Two assemblies are used per wheel brake, and the adjusting cap end is used on the toe end of the brake shoe. The other end of the cylinder has a plain cap assembly incorporating a hard metal insert in the center which bears directly against the heel end of the brake shoe. A spring lock-mounted with two screws across the front of the cylinder serves as a stop for the metal boots, and also to lock the adjusting cap assembly after an adjustment is made. No return spring is necessary as the pistons butt together when the brakes are released. The rubber cups are mounted in a recess in the piston and do not require a return spring to hold them in position. A bleeder screw is provided to expel air during the bleeding operation.

b. The twinplex wheel cylinder is manufactured in the 1½ inch diameter only.

38. CONSTRUCTION AND OPERATION.

a. The twinplex cylinder differs from other types of wheel cylinders in that no return spring is used. The cups are held in position by assembling the cup into a recess machined into the piston. In all other respects, the operations remain the same as for all other types of wheel cylinders.

39. DISASSEMBLY (fig. 19).

a. Drain Cylinder. Remove fitting and bleeder screw and drain cylinder.

b. Remove Adjusting Cap and Plain Cap. Remove two No. 10-24 x ¼ inch round-head machine screws and lock washers, and adjusting cap spring. Next remove the adjusting cap assembly and the plain cap.

c. Disassemble the Adjusting Cap Assembly. Remove set screw.

WHEEL CYLINDER ASSEMBLIES

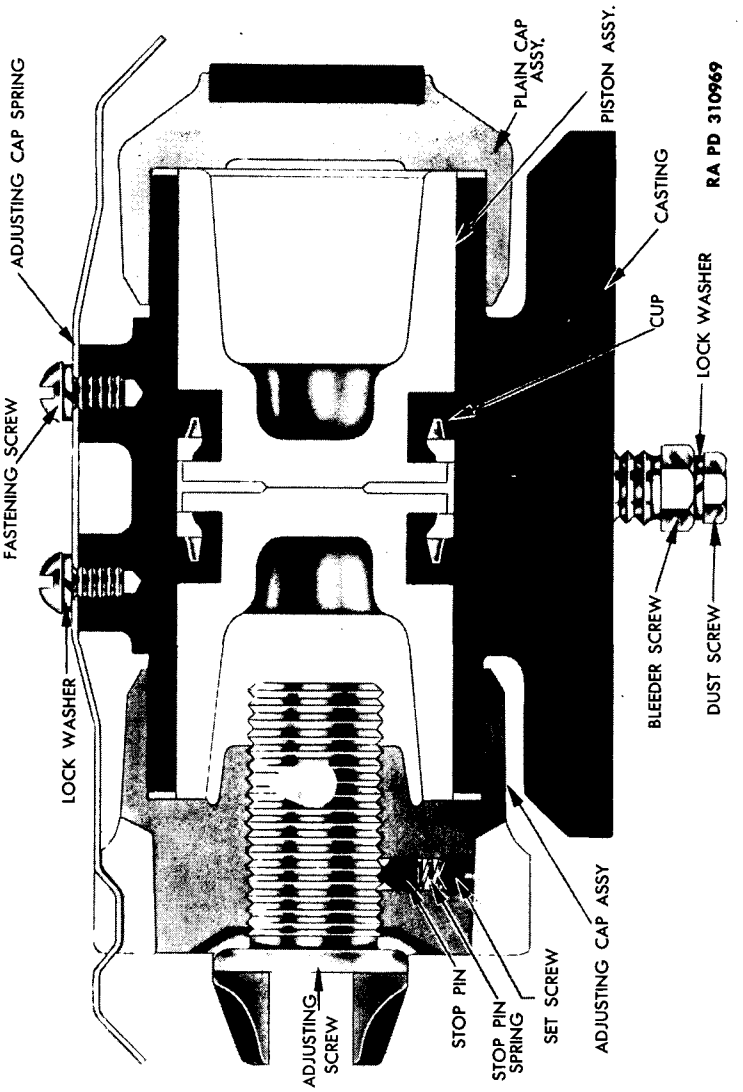

Figure 19 — Twinplex Type Wheel Cylinder

stop pin spring, and stop pin. Remove adjusting screw from adjusting cap assembly.

d. Remove Piston Assemblies. Remove piston assemblies from cylinder, and disassemble cups from pistons.

40. CLEANING, INSPECTION, AND REPAIR.

a. Clean Cylinder Casting and Parts. Wash the casting and all parts in clean denatured alcohol.

b. Inspection and Repair.

(1) If the cylinder bore is rough, scratched, or pitted, recondition it with a hone.

Maximum Original Dimension	Maximum Allowable Oversize
1.503 in.	1.507 in.

(2) If the cylinder does not clean-up according to the dimension above, use a new cylinder.

(3) Use new pistons if the originals are burred, cracked, or are not concentric.

(4) Use new rubber cups.

41. ASSEMBLY.

a. Preparation. Dip cylinder and all internal parts in hydraulic brake fluid.

b. Assemble Piston Cups. Cups are stretched over end of piston and placed in machined groove in pistons. Do not stretch cups beyond point necessary to clear end of piston. CAUTION: *Grooves in pistons must be free from grit, and cups must seat firmly.*

c. Install Piston Assemblies. Insert piston assemblies into cylinder casting with rubber cups toward center of casting.

d. Assemble Adjusting Cap Assembly. Assemble adjusting screw into adjusting cap. Assemble stop pin with conical point toward adjusting screw. Assemble stop pin spring on top of stop pin. Assemble set screw with conical point toward stop pin spring.

e. Install Adjusting Cap and Plain Cap Assemblies. With flat mounting face of casting toward mechanic, install adjusting cap assembly over left end of casting. The plain cap assembly is installed over right end of casting. Install adjusting cap spring, and fasten to casting with two lock washers and two No. 10-32 x ¼-inch round-head machine screws.

f. Install Fitting and Bleeder Screw.

g. Tag and Seal Cylinder Assembly. Tag cylinder assembly and seal openings if cylinder is not placed in service immediately.

CHAPTER 5
WHEEL BRAKE ASSEMBLIES

Section I
CHANNEL SECTION BRAKE

42. DESCRIPTION (fig. 20).

a. In the channel section shoe brake, each shoe is anchored and pivots on eccentric anchor pins. The return spring holds the shoes in released position and against the adjusting cam. Brake shoe guides, located at the upper or toe end of the shoes, keep shoes from weaving and chattering. Link yokes and connecting links constitute the linkage between the shoe and the wheel cylinder piston. Stop bracket rests on adjusting cam when brakes are in released position. C-washers are used on the anchor pins to hold shoes in position.

b. The channel section brake is manufactured in the following sizes: 12 x 1¾-inches, 14 x 1¾-inches, 15 x 2¼-inches, 16 x 2-inches and 16 x 2¼-inches.

43. CONSTRUCTION AND OPERATION.

a. The wheel brake assemblies using channel section, cast, and T-section shoes operate in the same manner although construction details vary. When the fluid enters the wheel cylinders the pistons move outward. The shoes which are directly or indirectly connected to the wheel cylinder pistons pivot on the anchor pins and move outward, contacting the brake drums. It is important to remember that different types of road surfaces vary the stopping distance of the vehicle. The pressures in the hydraulic system remain the same regardless of weather or types of road surfaces, yet the stopping ability of the vehicle varies with the type of road surface.

b. The guide pins keep the shoes in alinement and prevent chattering. The eccentric anchor pins serve a twofold purpose. One purpose is to form the assembly link between the brake shoes and the backing plate assembly. The other purpose is to permit the shoe to pivot around the eccentric shoulder in relation to the movement of the top, or toe end, of the shoe. This permits the shoe radius to remain constant with the brake drum radius, and full lining contact is maintained. The adjusting cams provide the method of adjusting the shoes outward as the lining wears. This operation holds the brake

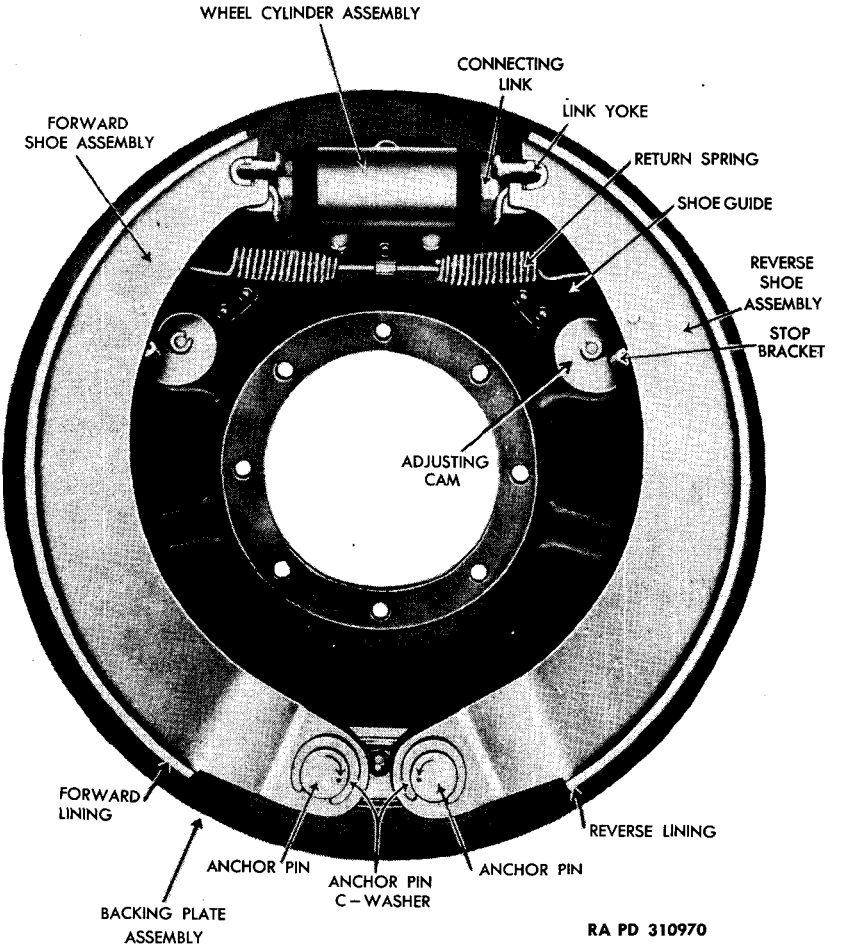

Figure 20 — Channel Section Brake Assembly

pedal travel to a minimum, and provides the brake pedal travel reserve necessary to counteract the expansion of the brake drums due to the heat generated in making a brake application. In the cast and T-section type of brake, the adjusting cam also serves as the brake shoe stop when the shoes are returning to the off position. In the channel section shoe brake a separate stop is provided.

c. The brake shoe return springs hold the brake shoes against the shoe stops when the brakes are off. After brakes are applied, and the foot is removed from the brake pedal, the brake shoe return spring pulls the brake shoes back to their off position. Since the brake shoes are directly or indirectly connected to the wheel cylinder pistons,

this action forces the wheel cylinder pistons together, and the fluid flows out of the wheel cylinders, through the lines, and back into the master cylinder.

44. DISASSEMBLY (fig. 20).

a. Clean Brake Assembly. Remove dust and dirt by brushing with a wire brush. Place a wheel cylinder clamp across wheel cylinder.

b. Remove Anchor Pin C-washers.

c. Remove Brake Shoe Return Spring.

d. Remove Connecting Links. Remove link yokes from the toe end of brake shoes, also remove the connecting links by pulling from wheel cylinder boots.

e. Remove Brake Shoe Assemblies. Swing shoes outward away from the center of the brake, and pull them forward over the anchor pins.

f. Remove Shoe Stop Brackets.

g. Remove Wheel Cylinder Assembly. Disconnect hydraulic line on back side of brake assembly. Remove two hex head machine screws and lock washers, from back side of backing plate, which fasten wheel cylinder to backing plate. Remove wheel cylinder assembly.

h. Remove Anchor Pins. Remove two hex head anchor pin nuts and lock washers, from back side of back plate, which fasten anchor pins to backing plate. Remove anchor pins by pulling them forward from front side of backing plate.

45. CLEANING, INSPECTION, AND REPAIR.

a. Clean Brake Assembly. Clean backing plate and adjusting cams thoroughly with wire brush.

b. Clean Brake Shoes. If brake shoes are to be relined, remove old lining, and wash shoes in dry-cleaning solvent. Rinse in hot water and dry thoroughly. If brake shoes are not to be relined, brush with a wire brush.

c. Clean Brake Assembly Parts. Wash parts in dry-cleaning solvent, rinse in hot water, and dry thoroughly. *Do not wash wheel cylinder assembly.*

d. Clean Wheel Cylinder Assembly. See chapter 4 for instructions concerning wheel cylinder maintenance.

e. Inspection and Repair.

(1) Brake lining must be riveted securely to the brake shoe assembly. Lining face must be free from grease or brake fluid.

(2) Return spring must not have a permanent set. Spring ends must not be broken or cracked. If these conditions exist, replace return spring.

(3) Anchor pin bushings in brake shoe assemblies must be smooth and free from burs. NOTE: *Rough spots may be eliminated by rubbing with crocus cloth.* If bushing is cracked or worn eccentric, it must be replaced.

(4) Anchor pins must not be cracked, machined surfaces must be smooth and free from burs, threads must not be stripped. Replace if these conditions are found to exist.

(5) See chapter 4 for service instructions on wheel cylinder assemblies.

46. ASSEMBLY.

a. Lubricate. Lubricate bearing surface of anchor pins with a thin coat of high-temperature grease.

b. Replace Anchor Pins. Insert anchor pins through backing plate with threaded ends extending on back side of backing plate. Fasten with two hex head anchor pin nuts and lock washers. Punch marks on front end of anchor pins must be toward center of brake assembly.

c. Replace Wheel Cylinder Assembly. Mount wheel cylinder assembly into position, and fasten securely to back side of backing plate with two lock washers and hex head machine screws. Connect hydraulic line to wheel cylinder.

d. Replace Shoe Stop Brackets.

e. Replace Brake Shoe Assemblies. Place brake shoe assemblies over anchor pins, and rotate them into position.

f. Replace Connecting Links. Replace connecting link, making certain that end which goes through wheel cylinder boot is firmly seated in wheel cylinder piston. Replace link yokes into toe end of brake shoe assemblies.

g. Replace Anchor Pin C-washers. Use new anchor pin C-washers.

h. Replace Brake Shoe Return Spring.

i. Remove Wheel Cylinder Clamp.

Section II

CAST-SHOE BRAKE

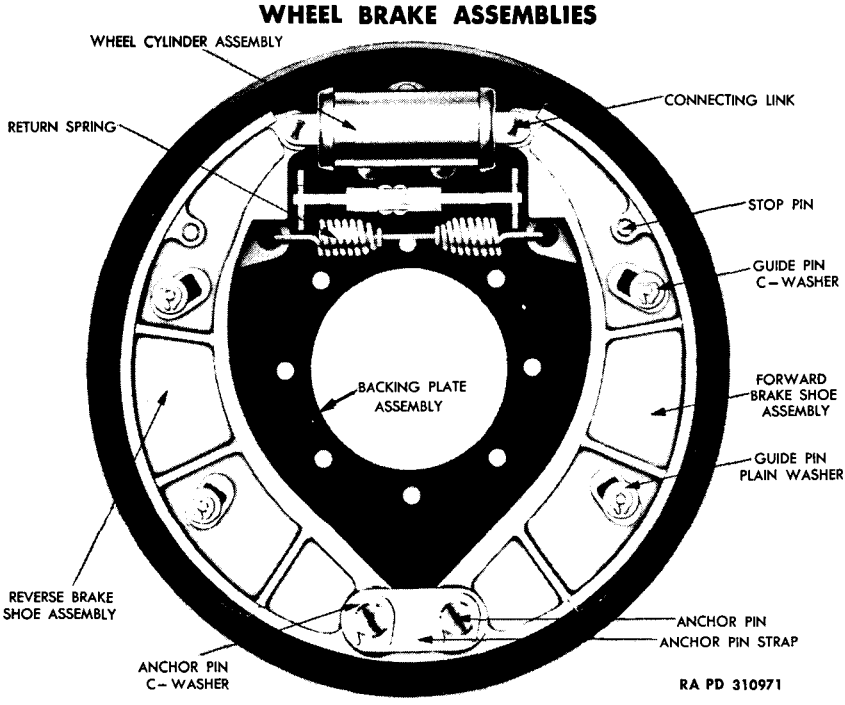

Figure 21 — Cast-shoe Brake Assembly

47. DESCRIPTION.

a. The cast-shoe type has each shoe anchored by and pivoting on an eccentric anchor pin. Guide pins ac' as supports, and serve to prevent shoes from chattering and weaving off-center. The return spring holds the shoes in contracted or released position. The connecting links are the linkage between the shoe and the wheel cylinder pistons. The stop pin supports the shoe against the adjusting cam in released position. C-washers are used on guide and anchor pins to hold shoes in position.

48. CONSTRUCTION AND OPERATION.

a. For construction and operation of brake assemblies, refer to paragraph 43.

49. DISASSEMBLY (fig. 21).

a. Clean Brake Assembly. Remove dust and dirt by brushing with a wire brush. Place a wheel cylinder clamp across wheel cylinder.

b. Remove C-washers. Remove guide pin and anchor pin C-washers. Also guide pin plain washers.

c. Remove Brake Shoe Return Spring.

d. Remove Wheel Cylinder Connecting Links.

e. Remove Brake Shoe Assemblies. Swing shoes outward away

from the center of the brake, and pull them forward over the anchor pins.

f. Remove Wheel Cylinder Assembly. Disconnect hydraulic lines on back side of brake assembly. Remove two hex head machine screws and lock washers, from back side of backing plate, which fasten wheel cylinder to backing plate. Remove wheel cylinder assembly.

g. Remove Anchor Pins. Remove two hex head anchor pin nuts and lock washers from back side of backing plate, which fasten anchor pins to backing plate. Remove anchor pins by pulling them forward from front side of backing plate.

50. CLEANING, INSPECTION, AND REPAIR.

a. Clean Brake Assembly. Clean backing plate and adjusting cams thoroughly with a wire brush.

b. Clean Brake Shoes. If brake shoes are to be relined, remove old lining, and wash shoes in dry-cleaning solvent. Rinse in hot water, and dry thoroughly. If brake shoes are not to be relined, brush with a wire brush.

c. Clean Brake Assembly Parts. Wash parts in dry-cleaning solvent, rinse in hot water and dry thoroughly. *Do not wash wheel cylinder assembly.*

d. Clean Wheel Cylinder Assembly. See chapter 4 for instructions concerning wheel cylinder maintenance.

e. Inspection and Repair.

(1) Brake lining should be riveted securely to the brake shoe assembly. Lining face must be free from grease or brake fluid.

(2) Return spring must not have a permanent set. Spring ends must not be broken or cracked. If these conditions exist, replace return spring.

(3) Anchor pin bushings in brake shoe assemblies must be smooth and free from burs. Rough spots may be eliminated by rubbing with crocus cloth. If bushing is cracked or worn eccentric, it must be replaced.

(4) Anchor pins must not be cracked, machined surfaces must be smooth and free from burs, threads must not be stripped. Replace if these conditions are found to exist.

(5) See chapter 4 for service instructions on wheel cylinder assemblies.

51. ASSEMBLY.

a. Lubricate. Lubricate bearing surfaces of anchor pins with a thin coat of high-temperature grease.

b. Replace Anchor Pins. Insert anchor pins through backing plate with threaded ends extending on back side of backing plate.

Fasten with two hex head anchor pin nuts and lock washers. Punch marks on front end of anchor pins must be toward center of brake assembly.

c. Replace Wheel Cylinder Assembly. Mount wheel cylinder assembly into position, and fasten securely to back side of backing plate with two lock washers and hexagonal head machine screws, connect hydraulic line to wheel cylinder.

d. Replace Brake Shoe Assemblies. Place brake shoe assemblies over anchor pins, and rotate them into position.

e. Replace Connecting Links. Replace connecting links, making certain that the end which goes through wheel cylinder boot is firmly seated in wheel cylinder piston

f. Replace C-washers. Replace guide pin plain washers, and anchor pin and guide pin C-washers. Use new washers and new C-washers.

g. Replace Brake Shoe Return Spring.

h. Remove Wheel Cylinder Clamp.

Section III
T-SECTION BRAKE

52. DESCRIPTION.

a. The T-section shoe type of brake assembly is similar in construction to the cast-shoe type. Each shoe is anchored by and pivots on an eccentric anchor pin. The anchor pins are provided with a felt and felt retainer. These are used to provide lubrication for the anchor pins, and to prevent shoes from chattering and weaving off-center. The return spring holds the shoes in contracted or released position. The connecting links are the linkage between the shoe and the wheel cylinder pistons. The web of the brake shoes is machined so that the lobe of the adjusting cam rests against the web of the brake shoe when the shoes are in a released position. C-washers are used on guide pins and anchor pins to hold shoes in position.

53. CONSTRUCTION AND OPERATION.

a. The construction and operation of brake assemblies is outlined in paragraph 43.

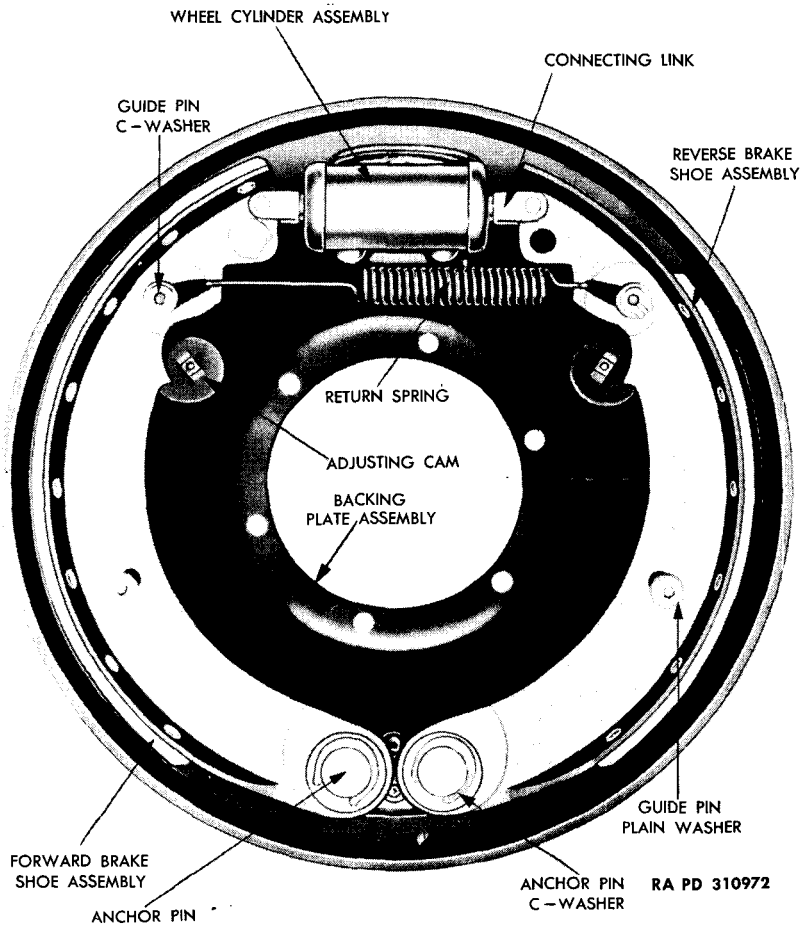

Figure 22 — T-section Brake Assembly

54. DISASSEMBLY (fig. 22).

a. Clean Brake Assembly. Remove dust and dirt by brushing with a wire brush. Place a wheel cylinder clamp across wheel cylinder.

b. Remove C-washers. Remove guide pin and anchor pin.

c. Remove Brake Shoe Return Spring.

d. Remove Wheel Cylinder Connecting Links.

e. Remove Brake Shoe Assemblies. Swing shoes outward away from the center of the brake, and pull them forward over the anchor pins.

f. Remove Anchor Pin Felts and Felt Retainers.

g. Remove Anchor Pins. Remove two hex head anchor pin nuts and lock washers from back side of backing plate, which fasten anchor pins to backing plate. Remove anchor pins by pulling them forward from front side of backing plate.

h. Remove Wheel Cylinder Assembly. Disconnect hydraulic lines on back side of brake assembly. Remove two hex head machine screws and lock washers from back side of backing plate which fasten wheel cylinder to backing plate. Remove wheel cylinder assembly.

55. CLEANING, INSPECTION, AND REPAIR.

a. Clean Brake Assembly. Clean backing plate and adjusting cams thoroughly with wire brush.

b. Clean Brake Shoes. If brake shoes are to be relined, remove old lining and wash shoes in dry-cleaning solvent. Rinse in hot water, and dry thoroughly. If brake shoes are not to be relined, brush with a wire brush.

c. Clean Brake Assembly Parts. Wash parts in dry-cleaning solvent, rinse in hot water, and dry thoroughly. *Do not wash wheel cylinder assembly.*

d. Clean Wheel Cylinder Assembly. See chapter 4 for instructions concerning wheel cylinder maintenance.

e. Inspection and Repair.

(1) Brake lining should be riveted securely to the brake shoe assemblies. Lining face must be free from grease or brake fluid.

(2) Return spring must not have a permanent set. Spring ends must not be broken or cracked. If these conditions exist, replace return spring.

(3) Anchor pins must not be cracked, machined surfaces must be smooth and free from burs, threads must not be stripped. Replace if these conditions are found to exist.

(4) Use new C-washers, plain washers, and anchor pin felts.

(5) See chapter 4 for service instructions on wheel cylinder assemblies.

56. ASSEMBLY.

a. Lubricate. Lubricate bearing surfaces of anchor pins with a thin coating of high-temperature grease.

b. Replace Anchor Pins. Insert anchor pins through backing plate with threaded ends extending on back side of backing plate. Fasten with two hex head anchor pin nuts and lock washers. Punch marks on front end of anchor pins must be toward center of brake assembly.

c. Replace Anchor Pin Felts and Retainers. Use new anchor pin felts and retainers. Anchor pin felts are placed over anchor pins,

and against the backing plate. The cup-shaped side of the felt retainers is placed toward the backing plate, and over the anchor pin felts.

d. Replace Wheel Cylinder Assembly. Mount wheel cylinder assembly into position, and fasten securely to back side of backing plate with two lock washers and hexagonal head anchor pin nuts. Connect hydraulic line to wheel cylinder.

e. Replace Brake Shoe Assemblies. Place brake shoe assemblies over anchor pins, and rotate them into position.

f. Replace Connecting Links. Replace connecting links, making certain that the end which goes through wheel cylinder boot is firmly seated in the wheel cylinder piston.

g. Replace C-washers. Replace guide pin plain washers, and anchor pin and guide pin C-washers. Use new plain washers and new C-washers. Clinch points of C-washers together.

h. Replace Brake Shoe Return Spring.

i. Remove Wheel Cylinder Clamp.

Section IV

HI-TORK BRAKE

57. DESCRIPTION (fig. 23).

a. The Hi-Tork brake assembly is designed to take advantage of brake drum energization on both front and rear brake shoes when the vehicle is being braked while traveling in a forward direction. When the vehicle is moving backward, the rear shoe only is energized. The L-type wheel cylinder is used with this brake design. The top or toe end of the front brake shoe is inserted directly into the slotted metal insert in the wheel cylinder piston. The rear shoe is connected to the wheel cylinder piston by a push rod and lever. In all other types of Lockheed hydraulic brake assemblies the toe end of the shoes are located on each side of the wheel cylinder at the top of the brake assembly. The heel end of the shoes are located at the bottom of the brake assembly. In the Hi-Tork brake, the heel of the rear shoe is located at the top of the brake assembly adjacent to the wheel cylinder. The toe end of the rear shoe is located at the bottom end

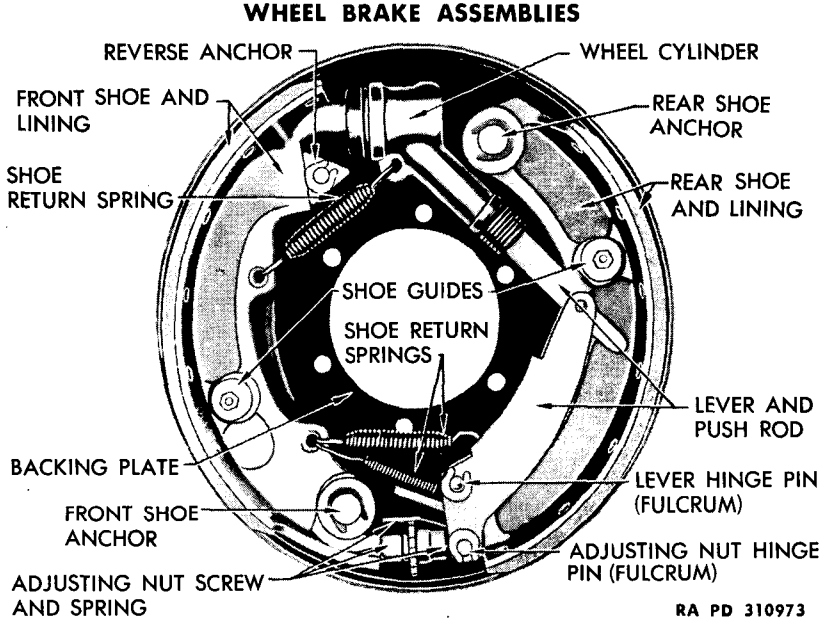

Figure 23 — Hi-Tork Brake Assembly

of the brake assembly. These locating points are reversed on the front brake shoe. Eccentric anchor pins are used. The rear shoe is anchored in a fixed position at the heel end of the shoe, by an anchor pin located near the wheel cylinder.

58. CONSTRUCTION AND OPERATION.

a. The operation of the Hi-Tork brake assembly is somewhat different than other hydraulic wheel brake assemblies due to its own particular design. The brake has been designed to take advantage of the features of the standard hydraulic wheel brake assembly, and at the same time to produce a higher torque output than a hydraulic brake of corresponding size. This is done by applying the brake drum energization to both front and rear shoes while the vehicle is making a stop in the forward direction. When the vehicle is braked and is traveling in a backward direction, the brake operates in the conventional manner; that is, one shoe only receives drum energization. As fluid enters the wheel cylinder on a brake application, the pistons are forced outward, and since the toe or top end of the front shoe is directly connected to the large diameter piston, the front shoe is forced into contact with the brake drum. The small diameter piston is connected to the rear shoe by a lever and push rod assembly, located at the bottom of the rear shoe. The brake is designed so that the output of the small diameter piston, plus the mechanical advantage of the push rod and lever assembly, is equal to the output of the

large diameter piston. Thus, hydraulic pressure is applied to the toe end of the front brake shoe, and the drum energization is applied to both shoes. Both shoes pivot on an eccentric anchor pin; therefore, the shoe radius remains concentric with the brake drum radius, and full lining contact is maintained.

b. Eccentric anchor pins are used. The rear shoe is anchored, in a fixed position at the heel end of the shoe, by an anchor pin located near the wheel cylinder. The front shoe heel anchor, opposite the wheel cylinder, is not located in a fixed position. When the vehicle is moving in reverse direction, the shoe pivot point changes. The triangular cam, or reverse anchor, at the top of the shoe now becomes the pivot point, and the lower tip of the shoe now becomes the toe. The front shoe is actuated by the small diameter wheel cylinder piston, through the push rod and lever linkage, when the vehicle moves in reverse.

c. A star wheel, or adjusting nut, located opposite the wheel cylinder, floats between the heel of the front shoe and the toe of the rear shoe.

d. When the vehicle is moving forward, pressure on the brake pedal causes the wheel cylinder pistons to push the toe of the front shoe into contact with the brake drum, and through linkage to push the toe of the rear shoe against the brake drum. The front shoe seats on the anchor located opposite the wheel cylinder, and both shoes receive energization from the rotation of the drum.

e. When the vehicle is moving backward, the smaller wheel cylinder piston, through its linkage, forces the rear shoe against the drum, where it serves as a helper shoe, and also forces the heel of the front shoe away from its anchor and into contact with the drum. The shoe then anchors on the cam located at the toe end, and the front shoe receives energization from the drum.

59. DISASSEMBLY (fig. 23).

a. Position Clamp. Place a wheel cylinder clamp across wheel cylinder assembly.

b. Remove Brake Shoe Return Springs.

c. Remove Anchor Pin C-washers.

d. Remove Anchor Pin Plain Washers.

e. Remove Brake Shoe Guide Bolts. Loosen ¼-28 jam nuts and remove nuts. Remove guide bolt plain washers. Remove shoe guide bolts.

f. Remove Front Brake Shoe.

g. Remove Rear Brake Shoe. Press lever connected to push rod firmly against the web of the brake shoe, rotate the brake shoe outward until the push rod is out of the small diameter of the wheel cylinder.

Pull brake shoe forward over the anchor pin. CAUTION: *Care must be exercised in removing the lever actuating push rod from the wheel cylinder, to eliminate scoring the wheel cylinder wall.*

h. Remove Lever and Push Rod Assembly. Remove C-washers and hinge pins. Remove adjusting nut, screw, and spring assembly. Remove push rod and lever assembly.

i. Remove Wheel Cylinder. Disconnect hydraulic line to wheel cylinder. Remove three hex head machine screws and lock washers, from back side of backing plate, which fasten wheel cylinder to backing plate. Remove wheel cylinder assembly.

j. Remove Anchor Pins. Remove three hex head anchor pin nuts and lock washers, from back side of backing plate, which fasten anchor pins to backing plate. Remove anchor pins and anchor pin swivel.

60. CLEANING, INSPECTION, AND REPAIR.

a. Clean Brake Assembly. Brush backing plate thoroughly with wire brush.

b. Clean Brake Shoes. If brake shoes are to be relined, remove old lining and wash shoes in dry-cleaning solvent. Rinse in hot water, and dry thoroughly. If brake shoes are not to be relined, brush with a wire brush.

c. Clean Brake Assembly Parts. Wash parts in dry-cleaning solvent, rinse in hot water, and dry thoroughly. *Do not wash wheel cylinder assembly.*

d. Clean Wheel Cylinder Assembly. See chapter 4 for instructions concerning wheel cylinder maintenance.

e. Inspection and Repair.

(1) Brake lining must be riveted securely to the brake shoe assemblies. Lining face must be free from grease or brake fluid.

(2) Return springs must not have a permanent set. Spring ends must not be broken or cracked. If these conditions exist, replace springs.

(3) Anchor pins must not be cracked, machined surfaces must be smooth and free from burs, threads must not be stripped. Replace if these conditions are found to exist.

(4) Use new C-washers and plain washers.

(5) See chapter 4 for service instructions on wheel cylinder assemblies.

61. ASSEMBLY.

a. Lubricate. Lubricate bearing surfaces of anchor pins with a thin coat of high-temperature grease.

b. Replace Anchor Pins. Insert anchor pins through backing plate with threaded ends extending on back side of backing plate. Use new lock washers and fasten securely.

c. Replace Wheel Cylinder Assembly. Mount wheel cylinder into position, and fasten securely to backing plate.

d. Replace Lever and Push Rod Assembly. Assemble adjusting ing nut, screw, and spring assembly to lever and push rod. Replace lever and push rod assembly. Use new C-washers on hinge pins.

e. Replace Rear Brake Shoe. Press lever and push rod against web of brake shoe. Place brake shoe over anchor pin, and push shoe outward away from center of brake until push rod will enter small diameter of wheel cylinder. CAUTION: *Care must be exercised in replacing the push rod into the wheel cylinder, or the wheel cylinder bore will be scratched and the wheel cylinder will leak.*

f. Replace Front Brake Shoe.

g. Replace Brake Shoe Guide Bolts. Place a 0.010-inch feeler gage between the guide bolt washer and the machined boss on the brake shoe, and tighten guide bolt nut. Lock in place with guide bolt jam nut.

h. Replace Anchor Pin Plain Washers.

i. Replace Anchor Pin C-washers. Use new C-washers, and clinch points together securely.

j. Replace Return Springs.

k. Remove Wheel Cylinder Clamp.

REFERENCES

PUBLICATIONS INDEXES.

The following publications indexes should be consulted frequently for latest changes or revisions of references given below and for new publications relating to materiel covered in this manual.

a. Ordnance Publications for Supply Index (index to SNL's) ..... ASF Cat. ORD-2 OPSI

b. Index to Ordnance Publications (listing FM's, TM's TC's, and Tb's of interest to ordnance personnel, FSMWO's, BSD, S of SR's, OSSC's, and OFSB's; and includes Alphabetical List of Major Items with Publications Pertaining Thereto) ..... OFSB 1-1

c. List of publications for Training (listing MR's, MTP's, T/BA's, T/A's, FM's, TM's, and TR's concerning training) ..... FM 21-6

d. List of Training Films, Film Strips and Film Bulletins (listing TF's, FS's and FB's, by serial number and subject) ..... FM 21-7

e. Military Training Aids (listing Graphic Training Aids, Models, Devices, and Displays) ..... FM 21-8

STANDARD NOMENCLATURE LISTS.

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

Soldering, brazing and welding materials, gases and related items ..... SNL K-2

Pipe and hose materials ..... SNL H-6

Pipe, tubing, and hose ..... SNL H-7

Interchangeability chart of ordnance maintenance tools for combat vehicles ..... SNL G-27 Vol. 2

Ordnance maintenance sets ..... SNL N-21

Tools, maintenance, for repair of automotive vehicles ..... SNL G-27 Vol. 1

Tool sets for ordnance service command, automotive shops ..... SNL N-30

Tool sets — motor transport ..... SNL N-19

EXPLANATORY PUBLICATIONS.

General.

List of publications for training ..... FM 21-6

Military motor vehicles ..... AR 850-15

Standard military motor vehicles ..... TM 9-2800

ORDNANCE MAINTENANCE — HYDRAULIC BRAKES (WAGNER LOCKHEED)

Related Technical Manuals.

Automotive brakes	TM 10-565
Automotive electricity	TM 10-580
Basic maintenance manual	TM 38-250
Electrical fundamentals	TM 1-455
Fuels and carburetion	TM 10-550
Motor vehicle inspections and preventive maintenance service	TM 9-2810

Decontamination.

Chemical decontamination materials and equipment	TM 3-220
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