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WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE  
CHASSIS AND BODY FOR  
SCOUT CARS M3A1

September 22, 1942

**MICROFICHE  
AVAILABLE**

ORDNANCE MAINTENANCE

CHASSIS AND BODY FOR SCOUT CARS M3A1

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SECTION I

GENERAL

	Paragraph
Scope-----	1

1. **Scope.**—This manual is published for the information and guidance of ordnance maintenance personnel, and is one of a series of five maintenance publications on scout cars. It contains detailed instructions for inspection, disassembly, assembly, maintenance, and repair of the scout car M3A1 supplementary to those in the Field and Technical Manuals prepared for the using arm. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the matériel.

a. *The vehicle.*—Information concerning lubrication of the entire vehicle will be found in TM 9-705 and TM 9-1705.

*b. Chassis and body.*—Information is included in this manual concerning the detailed description, operation, inspection, and trouble diagnosis, disassembly, maintenance and repair, assembly, and test of major components of the chassis (exclusive of power train and power plant) and body, supplementary to that in TM 9-1705.

*c. Power train.*—Maintenance information concerning the power train will be found in TM 9-1705.

*d. Power plant.*—Maintenance information concerning the power plant and its accessories will be found in TM 9-1706, TM 9-1707, and TM 9-1708.

## SECTION II

## SERVICE MAINTENANCE

	Paragraph
General .....	2
Allocation of repair jobs .....	3

**2. General.**—The primary objective of organization maintenance personnel is the routine preventive care and adjustment necessary to maintain efficient operation of vehicles. The primary objective of ordnance maintenance personnel is the technical inspection and repairs beyond the authorized capacity of the using arm. The scope of maintenance repair operations is governed by weather, concealment, shelter, available equipment, tools and parts, and skill of personnel. Since these factors are variable, no rigid system of procedure can be prescribed.

**3. Allocation of repair jobs.**—The following operations augment those which may be performed by the using arm:

*a. Body.*—Replace.

(1) *Body plates and supports.*—Repair, replace, or rebuild.

(2) *Seats.*—Repair or rebuild.

(3) *Sheet metal.*—Repair, weld, or rebuild.

(4) *Tops.*—Repair, weld, or rebuild.

(5) *Upholstering.*—Repair or replace.

(6) *Windshield.*—Repair.

(7) *Windshield wipers.*—Repair or rebuild.

*b. Brakes.*—(1) *Brake cylinders.*—Repair and hone.

(2) *Brakeshoes.*—Reline.

(3) *Brake vacuum booster.*—Adjust, repair, and rebuild.

*c. Cooling system.*—(1) *Fan.*—Repair.

(2) *Fan bearings.*—Replace.

(3) *Radiator.*—Repair.

(4) *Water pump.*—Repair or rebuild.

- d. *Electric lighting system and accessories.*—(1) *Battery.*—Repair.
  - (2) *Heater.*—Repair.
  - (3) *Horn.*—Repair.
  - (4) *Lights.*—Repair.
- e. *Frame.*—(1) *Frame.*—Repair or straighten.
  - (2) *Pintle.*—Repair
  - (3) *Roller.*—Replace or repair.
- f. *Fuel system.*—(1) *Fuel gage components.*—Repair.
  - (2) *Fuel tanks.*—Repair.
  - (3) *Carburetor.*—Repair or rebuild.
  - (4) *Fuel pump.*—Repair or rebuild.
- g. *Instruments.*—(1) *Cluster.*—Repair.
  - (2) *Meters.*—Repair.
- h. *Springs and shock absorbers.*—(1) *Absorbers.*—Repair.
  - (2) *Springs.*—Repair or rebuild.
- i. *Steering gear.*—(1) *Drag link.*—Repair.
  - (2) *Steering gear.*—Repair or rebuild.
- j. *Wheels.*—(1) *Line casings and tube.*—Repair.
  - (2) *Wheels.*—Repair, weld, machine, and align.

### SECTION III

#### TECHNICAL INSPECTION

Description .....	Paragraph
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**4. Description.**—Technical inspections are a follow-up and check on organizational maintenance inspections and other maintenance functions and determine whether the vehicle should be continued in service or withdrawn from operation for overhaul. These inspections are covered in AR 850-15.

**5. Inspection form.**—W. D., Q. M. C. Form No. 260 (Technical Inspection Report of Motor Vehicles), is the standard and official form for recording the inspection of all motor vehicles. The extent to which use is made of this form or its modifications depends entirely on the technical ability of available personnel, the time factor, and the test and shop equipment available.

**6. Practical application.**—*a. External inspection of body and frame components.*—(1) *Bumpers.*—Examine for straightness; use wrench to test channel bolts for tightness; inspect brackets for breaks.

(2) *Tow hooks.*—Inspect for straightness and fractures; use wrench to test mounting bolts for tightness.

(3) *Front roller*.—Check freedom of rotation; inspect springs and supporting brackets for breaks.

(4) *Radiator shutters*.—Inspect for breaks in armor plate and loose screws; open right door and operate louver lever to check opening and closing of shutters.

(5) *Radiator*.—Examine underneath for leaks; inspect front of core for plugged air passages.

(6) *Headlight guards*.—Shake to determine looseness; inspect for

breaks and fractures.

(7) *Tires*.—Inspect for serviceability; examine for indications of improper inflation or use, cuts, blisters, breaks, uneven wear, etc.; record defects for each tire.

(8) *Toe-in*.—Check (see sec. V, TM 9-1705).

(9) *Caster and camber*.—Check (see sec. V, TM 9-1705).

(10) *Hood*.—Inspect for breaks in armor plate and loose screws; examine fasteners and hinges; inspect lacings for breaks; open and shut to check for fit.

(11) *Running boards and fenders*.—Examine for cracks and dents; shake up and down to test for looseness; use wrench to test mounting bolts for tightness; inspect support brackets for breaks.

(12) *Doors*.—Open and close to test for fit; shake up and down while open to test for loose hinges; turn handles and check locks and latches; inspect for loose and missing screws; check operation and securement of observation slot covers.

(13) *Glass*.—Inspect windshields for cracks and fit; check mounting detail; examine for leaks and defective seals.

(14) *Body*.—Inspect for breaks in armor plate and loose screws; examine under side for bent or broken frame, angles, battens, and welds; check for loosened floor plates; check securement of grab handles.

(15) *Paint*.—Inspect for chipped paint, rust spots, scratches, bright metal, gloss, peelings, and cracks.

(16) *Top and curtains*.—Inspect for breaks in material and indications of leaks; examine straps and keepers.

(17) *Pintle*.—Inspect towing device for securement; examine latch effectiveness; check operation; use wrench to test tightness of pintle hook retaining nut.

(18) *Lights*.—Inspect for broken glass and reflectors; check wire connections; use wrench to test tightness of headlamp mounting stud nuts; check securement of taillamps, turn on lights and check all bulbs for different positions of light switch; be sure to turn off lights.

(20) *Battery and compartment.*—Remove top housing plate; check level and specific gravity of electrolyte in each cell; check voltage drop across cells with tong tester; examine terminals for looseness and corrosion; inspect cables and ground straps; check vents and tighten plugs.

*b. External inspection of chassis components.*—(1) *Front axle.*—Inspect for straightness; shake wheels to check for “wobble”; inspect cross tube; check for oil leaks and cracked housings; test all nuts with wrench; inspect brush guards and universal joint dust shields; check presence of necessary plugs and lubrication fittings and evidence of proper lubrication; inspect breather.

(2) *Wheels.*—Check all wheel nuts with wrench; check lubrication of bearings.

(3) *Springs.*—Inspect for broken leaves, loose clips, worn or damaged shackles, and misalignment; check shackle lubrication; test all shackle bolts with wrench; use pry bar to check flexing of springs.

(4) *Shock absorbers.*—Check fluid level; examine linkage; inspect securement and lubrication.

(5) *Frame.*—Inspect frame side rails and cross members for distortion and fractures; examine front end for evidence of stress due to overhang of loads; inspect all rivets and especially those for the roller brackets, spring brackets, engine supports, and steering gear bracket; examine battery tray support rivets for corrosion.

(6) *Steering gear housing.*—Test all nuts with wrench; while someone turns steering wheel, observe housing for leaks, shimmy or looseness; check lubrication.

(7) *Steering gear linkage.*—Inspect drag link for straightness; check lubrication and presence of boots; test all nuts with wrench.

(8) *Transfer case.*—Inspect for leaks and cracked case; test all bolts with wrench; check presence of necessary plugs, lubrication of fittings and evidence of proper lubrication; inspect breather.

(9) *Transmission.*—Inspect for leaks and cracked case; test all bolts with wrench; check presence of necessary plugs and lubrication of fittings and evidence of proper lubrication; inspect breather.

(10) *Propeller shafts.*—Inspect for distortion and fractures; examine flanges; test all nuts with wrench; tighten dust caps; check lubrication and relief valves.

(11) *Brake linkage.*—Check all clevis pins for lubrication, presence of cotter pins, and looseness; inspect rods for straightness, cracks, rust, and corrosion.

(12) *Brake lines.*—Check for leaks, breaks, and loose connections; examine flexible tubing for cracks.

(13) *Vacuum booster.*—Examine linkage and securement.

(14) *Fuel lines*.—Check for leaks, breaks, and loose connections.

(15) *Rear axle*.—Check for oil leaks and cracked housing; test all nuts with wrench; check presence of necessary plugs and lubrication fittings and evidence of proper lubrication; inspect breather.

(16) *Muffler and tail pipe*.—Check for breaks, dents, and corrosion; examine and tighten supporting details; inspect for any obstacles in exhaust pipe.

*c. Engine compartment (engine stopped)*.—(1) *Radiator*.—Examine for leaks, rust, corrosion, and clear air passages; shake to observe if it is loose in the frame; tighten all stud nuts with wrench; check clearance of fan blades; check vent; check for presence of radiator cap and proper water level; test antifreeze solution with suitable hydrometer.

(2) *Fan*.—Inspect blades for breaks, looseness, and proper pitch; shake to test for looseness and worn bearings.

(3) *Fan belt*.—Inspect for matching of belts and play; examine for fraying, tears, and presence of grease or oil; check alinement of pulleys.

(4) *Shroud*.—Inspect for fit and securement; check clearance of fan blades; tighten screws.

(5) *Water pump*.—Check for end play of pulleys and alinement; inspect housing for cracks and leaks; examine securement of housing to engine.

(6) *Oil filter*.—Check for securement; examine cartridge.

(7) *Engine lubrication*.—Check oil level.

(8) *Fuel filter*.—Inspect for leaks; examine securement; examine bowl for sediment and water; check filter element.

(9) *Carburetor*.—Inspect for leaks; examine securement; check control linkage.

(10) *Air cleaner*.—Examine cleaning element and bowl for excessive dirt; check oil level; inspect hose to carburetor and connector to engine; examine securement.

(11) *Fuel pump*.—Inspect for fuel and oil leaks; examine securement; examine bowl for sediment; check screen.

(12) *Distributor*.—Examine cap for cracks, condensation, and dirt; inspect motor; separate and examine points for pits and burns; inspect cams; check shaft for “wobble”; examine insertion and connection of wires in cap.

(13) *Shielding*.—Examine conduit for breaks and securement; disconnect from spark plugs; examine and tighten latter; inspect interior of caps for condensation; check cable and terminals; tighten clamp nuts.

*d. Interior inspection (engine started).*—(1) *Switches.*—Check operation; examine securement; inspect wiring.

(2) *Meters.*—Check operation; examine securement; inspect connections.

(3) *Gages.*—Check operation; examine securement; inspect connections; feel tachometer and speedometer cables for excessive heat and vibration.

(4) *Windshield wipers.*—Check operation.

(5) *Panel lights.*—Check operation.

(6) *Horn.*—Check operation.

(7) *Fire extinguisher.*—Check securement; inspect for full charge.

(8) *Choke and ventilator controls.*—Check free operation and note movement of ventilator slides; have an assistant note movement of choke valve in carburetor.

(9) *Accelerator.*—Check for proper alinement and operation.

(10) *Pedals.*—Check for proper operation.

(11) *Brake fluid.*—Remove floor cover in front of driver's seat

and inspect master cylinder; examine fluid; check securement and connections.

(12) *Lower control lever.*—Operate lever to check movement and position of radiator shutters.

(13) *Seats.*—Inspect for breaks, damaged brackets, and upholstery.

(14) *Gun rail pads.*—Inspect.

(15) *Gun rail.*—Inspect for breaks, cracks, and rust; examine securement around entire circumference and operate gun carriage around each corner to check alinement.

(16) *Top bows.*—Inspect bows for breaks and securement.

*e. Engine compartment (engine running).*—(1) *Engine noises.*—Accelerate engine sharply and listen for knocks and unusual noises; listen for valve chatter.

(2) *Engine smoothness.*—Accelerate engine slowly to different speeds and check smoothness of running.

(3) *Engine mounting.*—Inspect front and rear supports for securement.

(4) *Gaskets.*—Inspect all cover, housing, and accessory mounting gaskets for oil and water leaks.

(5) *Fuel leaks.*—Inspect carburetor, fuel pump, and fuel lines for leaks.

(6) *Oil leaks.*—Inspect under vehicle and bottom of oil pan for evidence of oil drippings.



(7) *Water leaks.*—Inspect hose connections to radiator, water pump, and heater for leaks; feel hose for condition of fabric and flow of fluid; examine radiator for leaks.

(8) *Wiring.*—Inspect wires around engine and along frame; tug on wires to check for loose connections evidenced by sparking; examine terminal board connections.

(9) *Voltage regulator.*—Disconnect lead to battery and use voltmeter to check for correct cut-out and open-circuit voltages.

*f. Road test.*—(1) *Body noises.*—Listen for any unusual body noises, squeaks, or rattles, and identify location and cause.

(2) *Drive shaft brake.*—Test by pulling on hand brake lever and gently engaging clutch to stall the engine; note any unusual noises or signs of loose parts; do not attempt to stop rolling vehicle with this brake.

(3) *Service brakes.*—Test by applying pressure to foot pedal and observing results, including tendency of vehicle to swerve or stall.

(4) *Clutch.*—Check for smoothness of operation. Test for effectiveness by setting drive shaft brake, or using the service brakes, putting the vehicle in low gear, and releasing the clutch pedal gradually; if the clutch is efficient, the engine should stall.

(5) *Gear box.*—Listen to transmission and transfer case gears for a high pitched whine or squeal which indicates internal misalignment or improper adjustment. In shifting gears, it is usual for the two lower speeds to be much noisier in operation, than high gear; unusual noises in the transmission where operating in the high gears should be investigated immediately to avoid severe damages.

(6) *Gear shift.*—Check to see that the gear shift levers are firmly fastened in their retaining sockets and that the gear shift forks on the lower end of the levers move properly through all gear changes selected.

(7) *Speedometer and tachometer cables.*—Observe instruments to note registering. Feel cable; if hot, internal friction is developing due to improper adjustment or lack of lubricant; if a slight click or thump is heard, remove the cable and inspect for distortion, incorrect length or diameter, or breaks.

(8) *Steering mechanism.*—Note if steering wheel has a tendency to jerk; such action indicates a looseness in the steering mechanism connection from the front axle to the wheel, or an error in steering geometry. Note any tendency on the part of the vehicle to wander or drive to the right or left, indicating improper adjustment or an error in steering gear geometry. If a thump or knocking is felt in the steering wheel, a part is probably loose in the steering gear worm.

(9) *Engine noise.*—Light clicking or tapping noises usually indicate incorrect adjustment of valves; heavy thumping noises usually indicate engine bearing trouble; squeals and squeaks usually indicate loose fastenings or lack of lubrication in the generator, water pump, distributor, and similar accessories operating at high speed.

(10) *Engine smoothness.*—A balky engine can be detected by an experienced driver and is usually indicated by jerky motions of the vehicle or other signs that point to a misfiring cylinder. Have an assistant note exhaust gases.

(11) *Engine power.*—An engine not developing its power can be detected by driving the vehicle up a hill or under load, or by noting a frequent need to shift from the high range of speed gears to the lower range.

SECTION IV

BODY AND SHEET METAL

	Paragraph
Body-----	7
Sheet metal-----	8
Windshield wipers-----	9

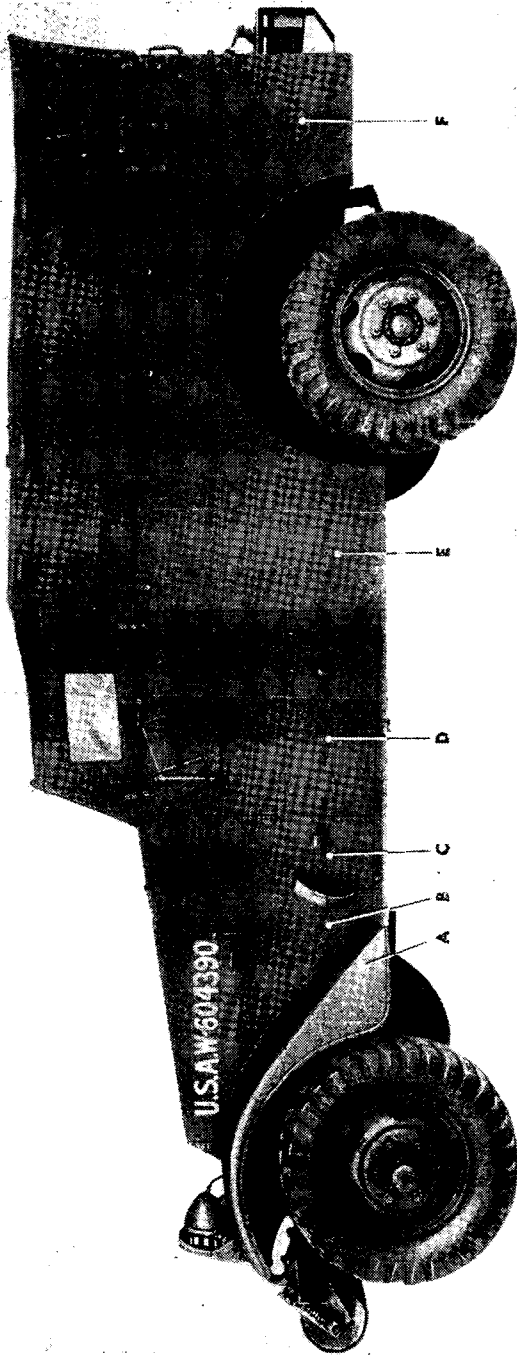
**7. Body** (figs. 1 to 12, incl.)—The vehicle body is made of ¼ inch thick armor plate, with the exception of the windshield plate and windshield porthole covers, which are ½ inch thick. The plates are bolted to the body framework with oval-head screws and safety (elastic stop) nuts. The entire body assembly is bolted to the chassis frame assembly. The floor plates are made of checkered aluminum and are bolted to the body framework.

*a. Disassembly.*—(1) The side doors, door shields, windshield plate, and side and top hood plates are all hinged and are dismantled by removing the oval-head screws or bolts and self-locking nuts with which the hinges are bolted to these units. To detach the porthole covers on the windshield plate and side doors, remove the oval-head bolts and self-locking nuts holding the brackets. For the covers of the ammunition racks, undo similar bolts and nuts holding the angle bars by which the hinges are secured to the sides of the body. An air wrench is usually necessary to remove the self-locking nuts.

(2) The remaining body plates and the floor plates are released by removing the screws and nuts holding them in place.

*b. Maintenance.*—(1) Replace all damaged bolts and screws as soon as practical.

(2) Remove bent armor plates and straighten by cold bending. Do not attempt to use heat for straightening, since this will change the hardness of the plates and their ability to resist penetration by gunfire.



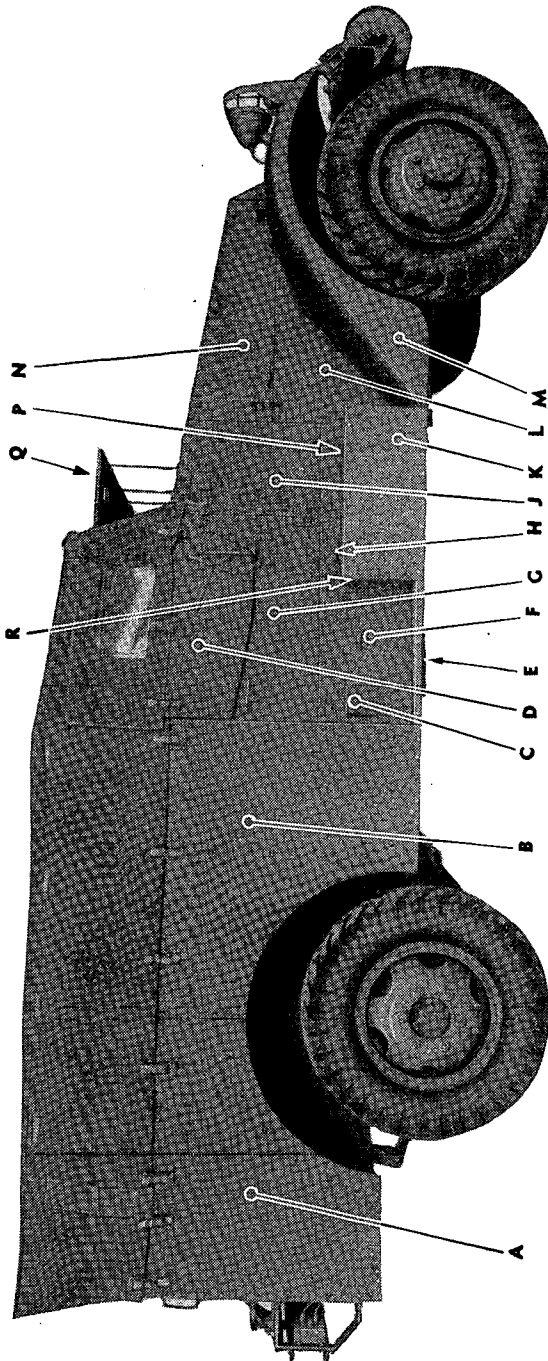
RA PD. 1854B

- E. Armor plate DS-PA-3079 (No. 74).
- F. Armor plate DS-PA-3080 (No. 77).

- C. Armor plate DS-PA-3043 (No. 65).
- D. Armor plate DS-PA-3042 (No. 67).

- A. Fender assembly (left-hand) WI-347335.
- B. Armor plate DS-PA-3043 (No. 57).

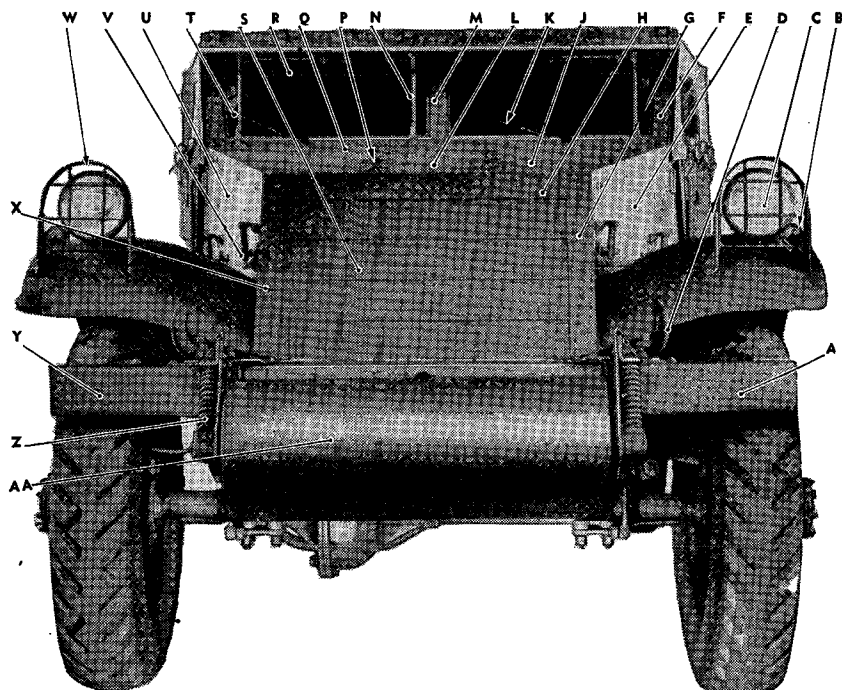
FIGURE 1.—Scout car M3A1, body—left side view.



- A. Armor plate DS-PA-3080 (No. 76).  
 B. Armor plate DS-PA-3079 (No. 78).  
 C. Bracket HB-33F.  
 D. Armor plate DS-PA-3046 (No. 74).  
 E. { Running board assembly (right-hand) DS-H-13109.  
 { Running board assembly (left-hand) DS-II-13069.  
 F. Armor plate DS-PA-3042 (No. 66).  
 G. Armor plate DS-PA-3044 (No. 62).  
 H. Bracket HB-16F.

- J. Armor plate DS-PA-3043 (No. 64).  
 K. Armor plate DS-PA-3053 (No. 73).  
 L. Armor plate DS-PA-3042 (No. 56).  
 M. { Fender assembly (right-hand) WI-347336.  
 { Fender assembly (left-hand) WI-347335.  
 N. Armor plate DS-PA-3042 (No. 54).  
 P. Armor plate DS-PA-3053 (No. 53).  
 Q. Armor plate DS-PA-3053 (No. 3).  
 R. Armor plate DS-PA-3053 (No. 71).

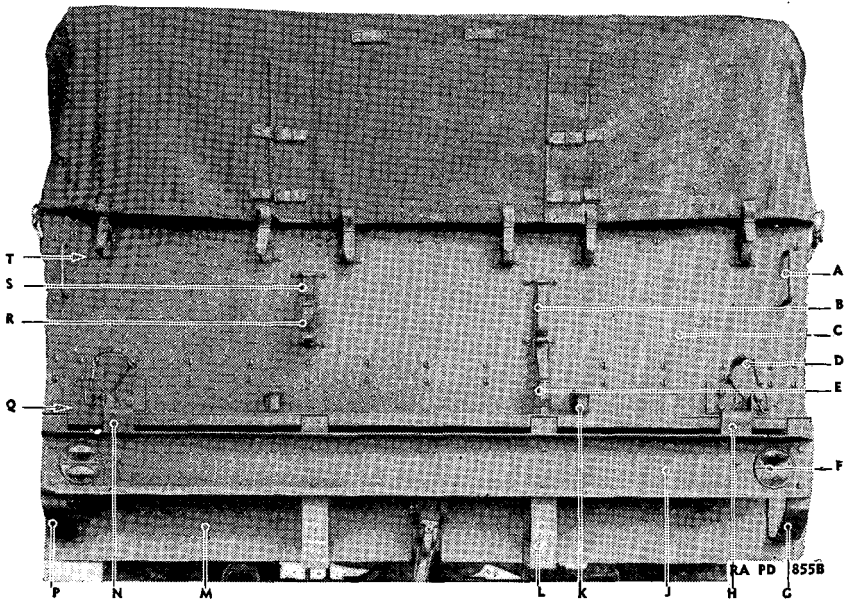
FIGURE 2.—Scout car M3A1, body—right side view.



- A. Bumperette (left-hand) WI-347321.
- B. Marker lamp GL-916388.
- C. Headlamp GL-917743.
- D. Hook { (right-hand) WI-C2418X.  
(left-hand) WI-C2419X.
- E. Armor plate DS-PA-3042 (No. 55).
- F. Support { (right-hand) DS-H-13167AR.  
(left-hand) DS-H-13167AL.
- G. Frame DS-H-11736AL.
- H. Frame DS-H-11736B.
- J. Armor plate DS-PA-3042 (No. 53).
- K. Wiper TRI-618A.
- L. Armor plate DS-PA-2752 (No. 13).
- M. Support DS-H-13167E.

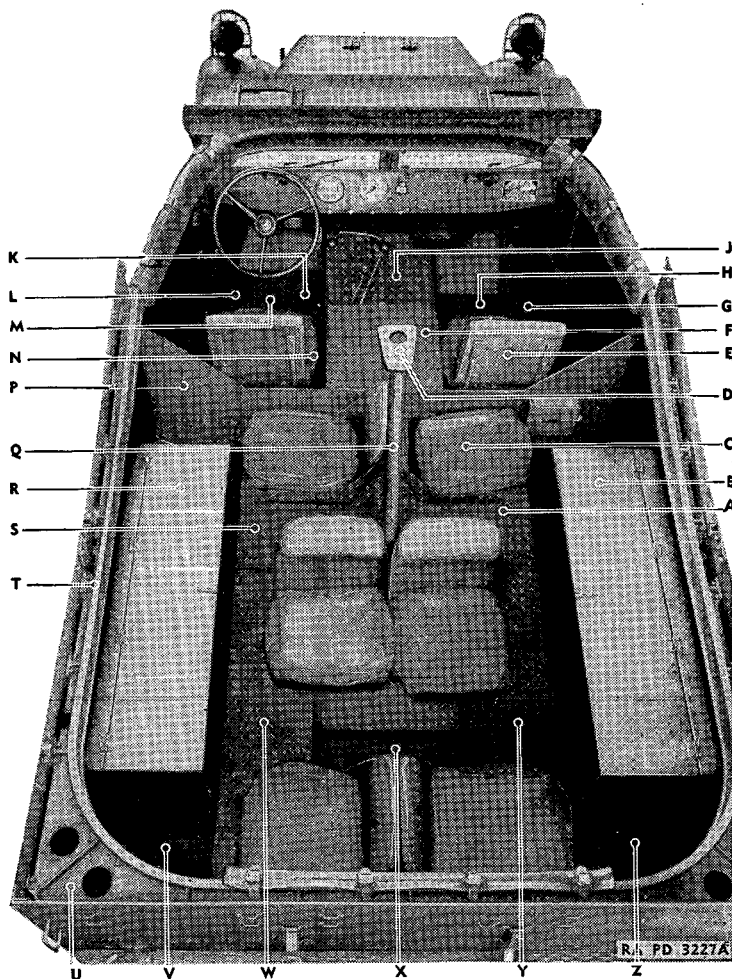
- N. Rod assembly DS-H-13181R.
- P. Leaf DS-H-13064.
- Q. Support DS-H-13167D.
- R. Support DS-H-13167.
- S. Louver assembly DS-PA-3055.
- T. Rod assembly { (right-hand) DS-H-13181R.  
(left-hand) DS-H-13181L.
- U. Armor plate DS-PA-3043 (No. 64).
- V. Bracket BA-B147.
- W. Guard assembly WI-347352.
- X. Frame DS-H-11736AR.
- Y. Bumperette (right-hand) WI-347322.
- Z. Spring WI-347345.
- AA. Roller assembly WI-347312.

FIGURE 3.—Scout car M3A1, body—front view.



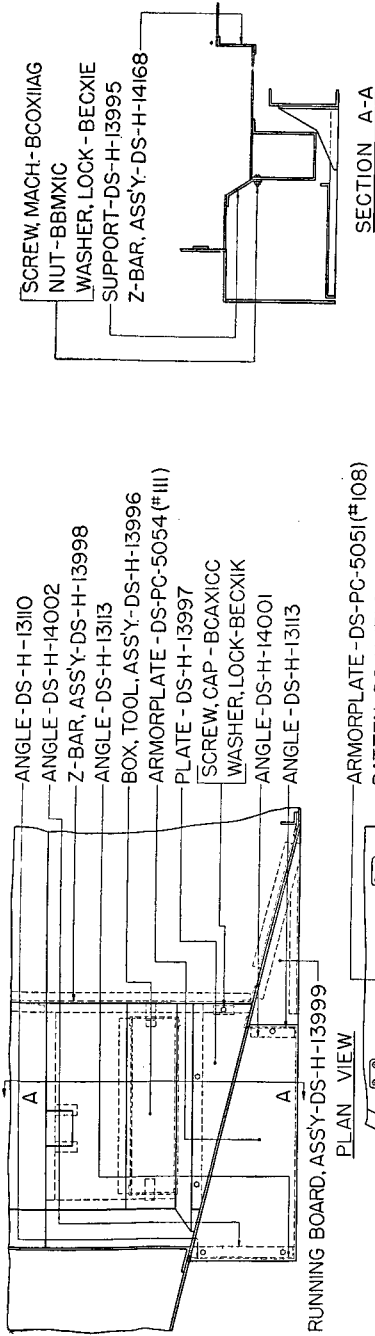
- |                                     |                                     |
|-------------------------------------|-------------------------------------|
| A. Handle DS-H-13161.               | K. Clamp assembly C69075.           |
| B. Strap assembly A165666.          | L. Support DS-H-13128.              |
| C. Armor plate DS-PA-3083 (No. 68). | M. Armor plate DS-PA-3083 (No. 69). |
| D. Strap assembly B158641.          | N. Bracket C69111.                  |
| E. Strap assembly A156672.          | P. Support DS-H-13129L.             |
| F. Tail lamp CB-647135.             | Q. Clamp A171945.                   |
| G. Support DS-H-13129R.             | R. Strap A165663.                   |
| H. Bracket assembly C69112.         | S. Strap A165666.                   |
| J. Bumper assembly DS-PA-3702.      | T. Loop EB-6400C.                   |

FIGURE 4.—Scout car M3A1, body—rear view.



- |   |  |
|---|--|
| <p>A. Plate DS-H-13070.</p> <p>B. Rack, ammu- } steel, DS-H-13184R.<br/>            nition.     } aluminum, DS-H-13191R.</p> <p>C. Seat DS-PA-3070.</p> <p>D. Plate DS-H-13169B.</p> <p>E. Seat DS-PA-3082.</p> <p>F. { Rack, ammu- } steel, DS-H-13183.<br/>            nition.     } aluminum, DS-H-13192.<br/>            Plate DS-H-13135.</p> <p>G. Plate DS-H-13120.</p> <p>H. Plate DS-H-13123.</p> <p>J. Plate DS-H-13101.</p> <p>K. Plate DS-H-13135A.</p> <p>L. Plate DS-H-13828.</p> | <p>M. Plate DS-H-13825A.</p> <p>N. Plate DS-H-13100L.</p> <p>P. Bulkhead assembly DS-H-13164.</p> <p>Q. Mast assembly DS-H-13169.</p> <p>R. Rack, ammu- } steel, DS-H-13184L.<br/>            nition.     } aluminum, DS-H-13191L.</p> <p>S. Plate DS-H-13070.</p> <p>T. Track assembly DS-H-13824.</p> <p>U. Gusset DS-H-13137.</p> <p>V. Plate DS-H-13075L.</p> <p>W. Plate DS-H-13073L.</p> <p>X. Plate DS-H-13072.</p> <p>Y. Plate DS-H-13073R.</p> <p>Z. Plate DS-H-13075R.</p> |
|---|--|

FIGURE 5.—Scout car M3A1, body—plan view.



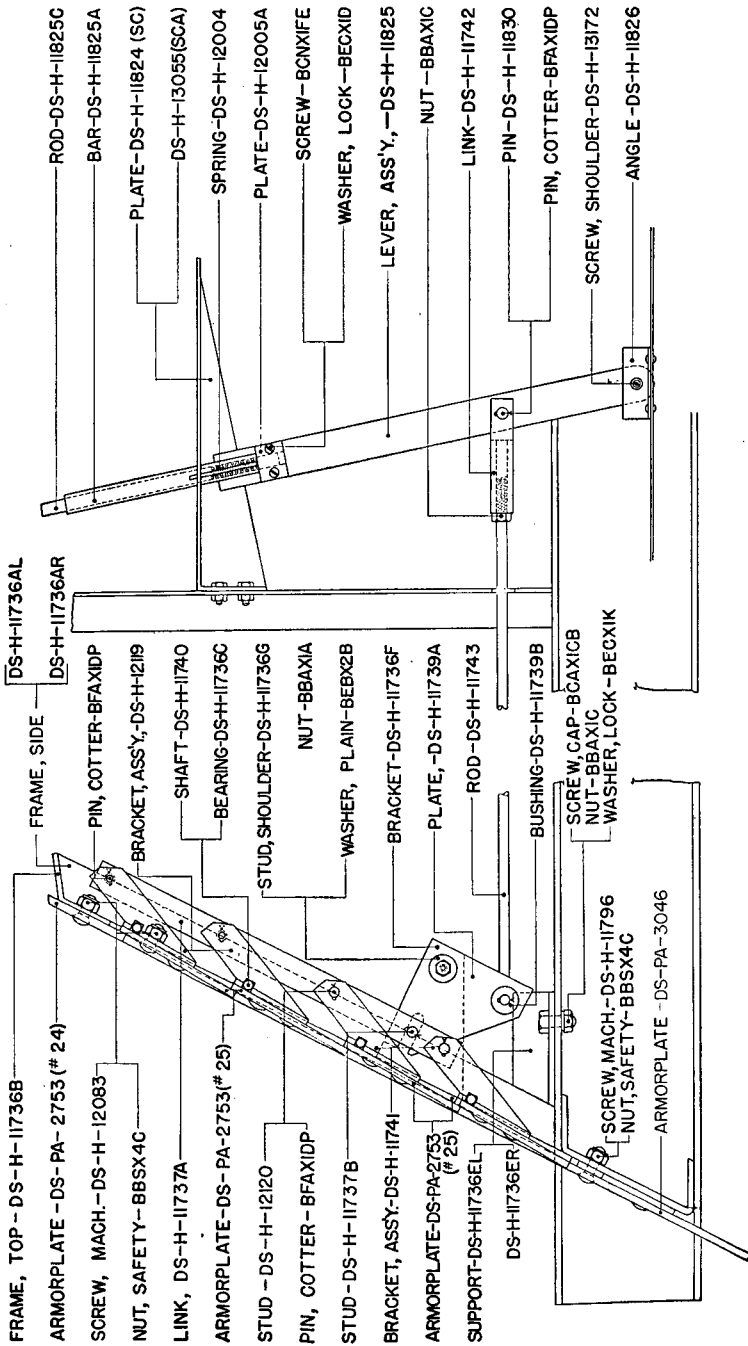
NOTE

SCOUT CAR, M3A1, LOT 2, W/ DIESEL ENGINE IS DUPLICATE OF SCOUT CAR M3A1, LOT 2, W/ GASOLINE ENGINE EXCEPT BATTERY COMPARTMENT IS REQUIRED ON BOTH SIDES OF CAR. REFERENCE DRAWING D 39610

RA PD 3253A

Figure 6.—Scout car M3A1, w/Diesels, body, left elevation.





RA FSD 1856B

FIGURE 7.—Radiator louver mechanism.

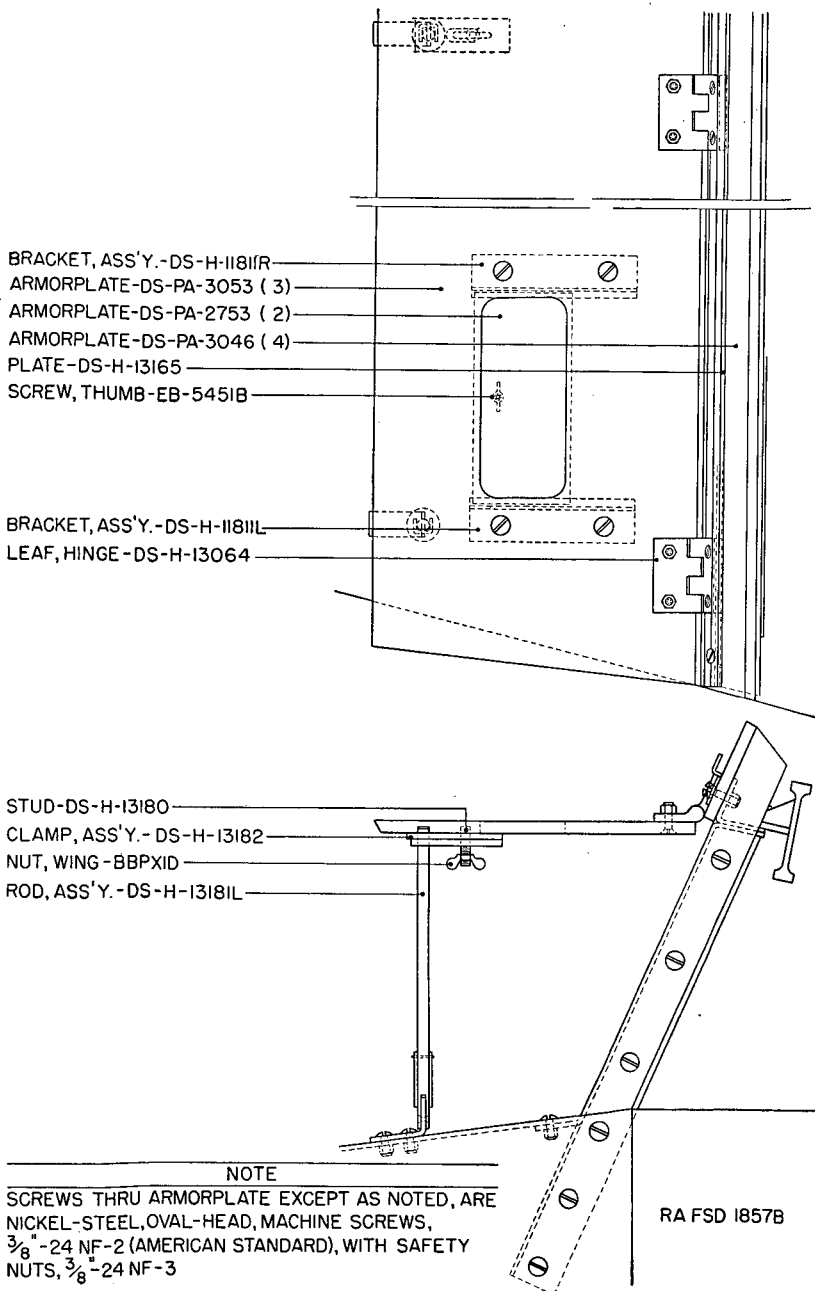
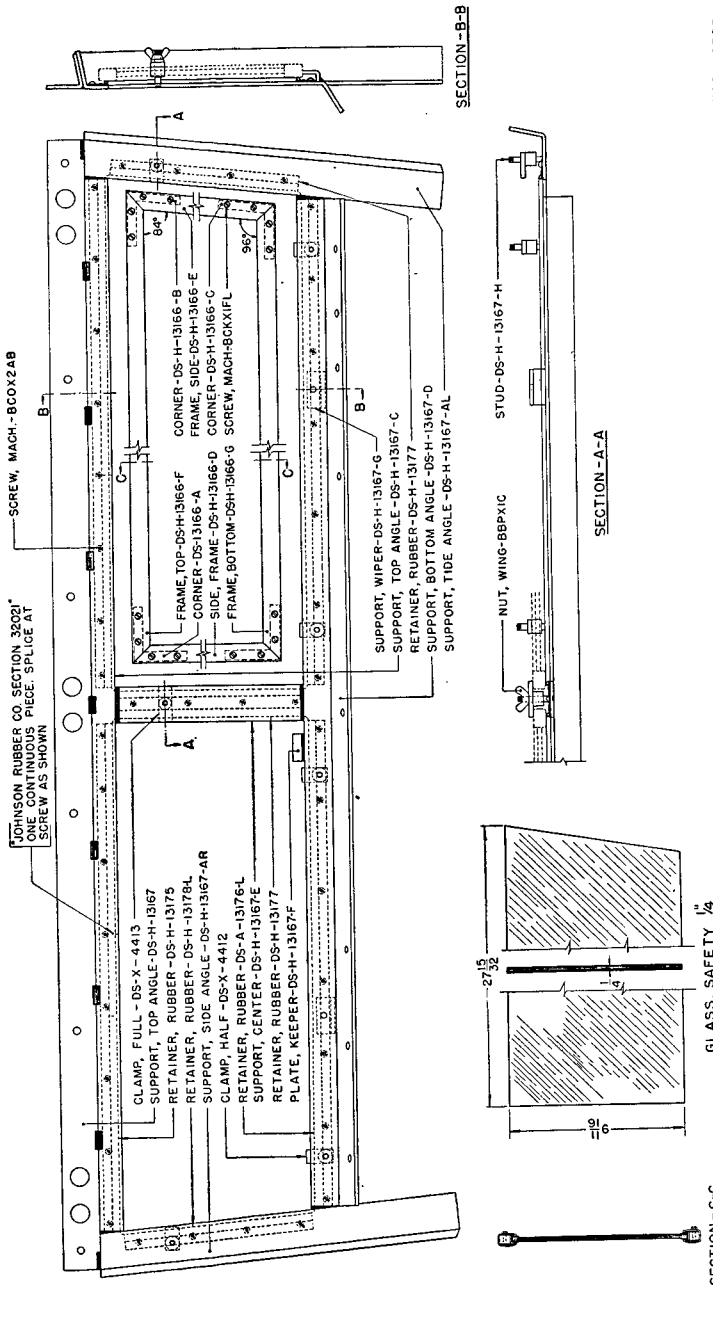


FIGURE 8.—Windshield armor details.



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FIGURE 9.—Windshield frame details.

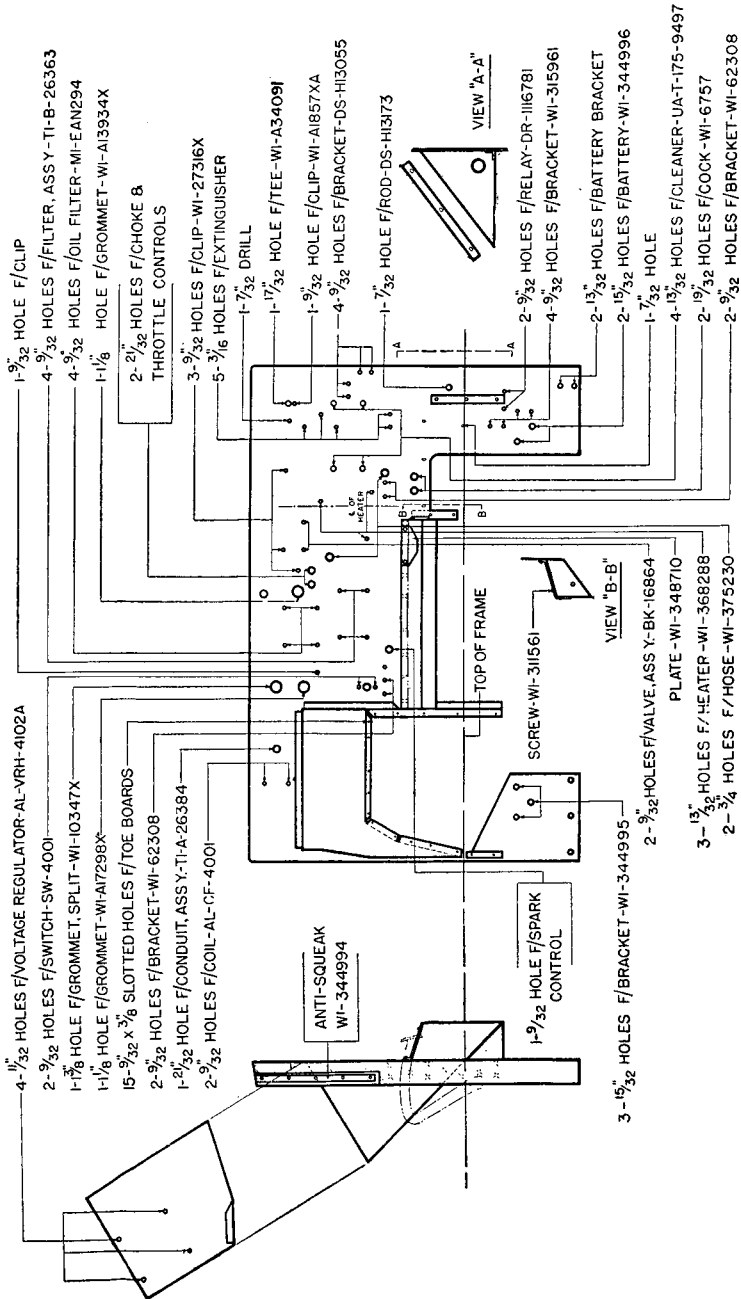
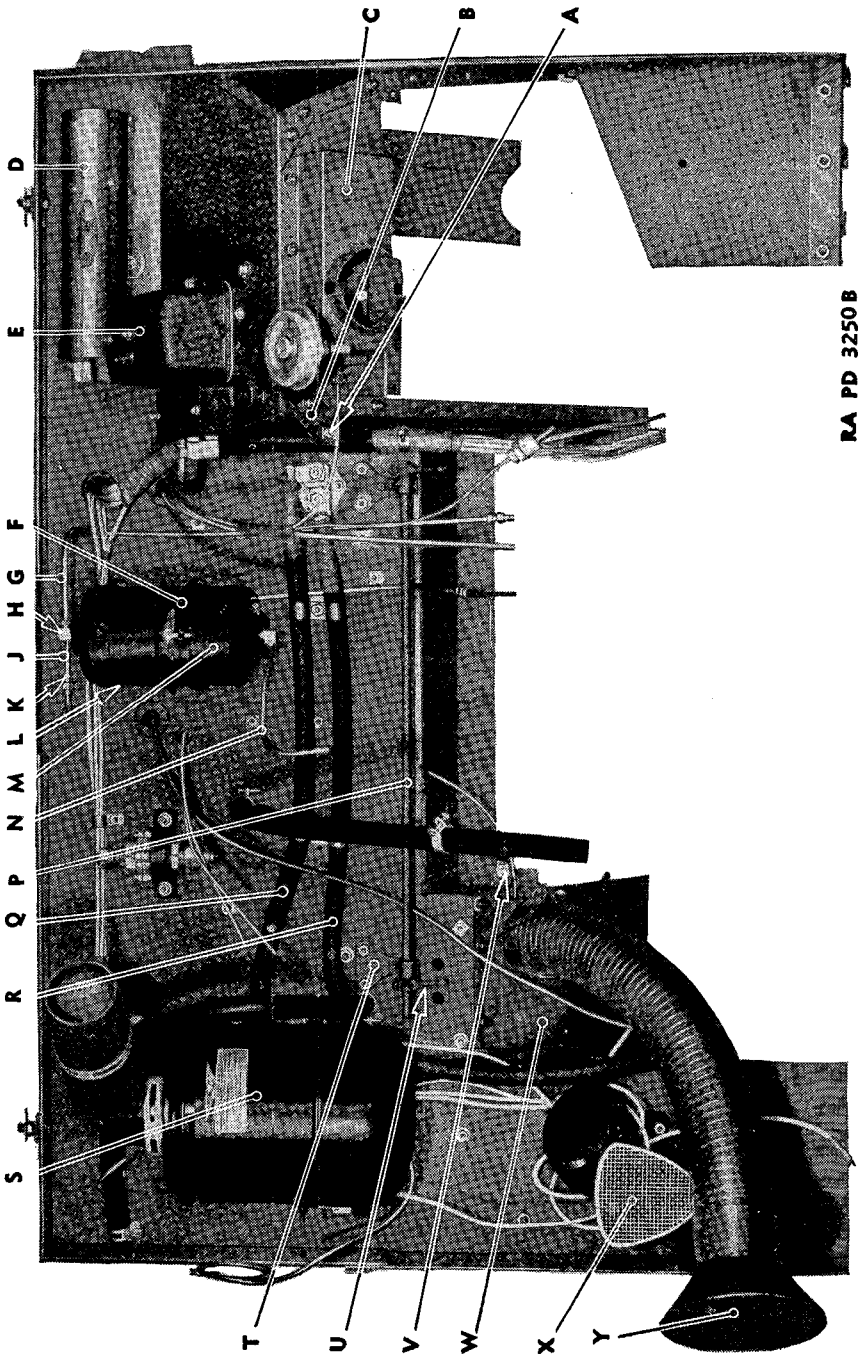


FIGURE 10-1

Figure 10.—Dash lay-out.

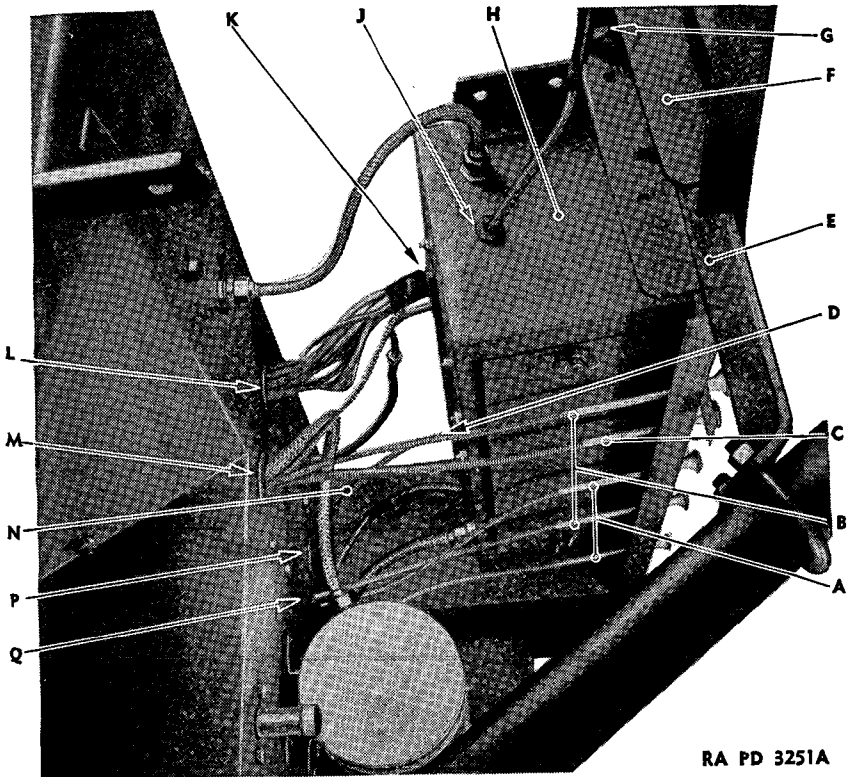
RAFSO 1879B



RA PD 3250 B

- |                                   |                                   |
|-----------------------------------|-----------------------------------|
| (Clip WI-56973.                   | P. Shaft WI-344329.               |
| Screw, machine, BCNX2CE.          | Q. Cable assembly WI-348740.      |
| A. } Nut BBX1A.                   | R. Cable assembly WI-348738.      |
| Washer, lock, BECX1G.             | S. Cleaner assembly UA-T175-9497. |
| B. Bracket WI-348705.             | {Bracket WI-62308.                |
| {Box assembly WI-347382.          | Screw, cap, BCBX1AB.              |
| Screw, cap, BCBX1AA.              | T. } Nut BBX1A.                   |
| Washer, lock, BECX1G.             | Washer, lock, BECX1G.             |
| C. } Nut BBX1A.                   | {Lever WI-312131.                 |
| Washer, lock, BECX1G.             | Screw, cap, BCBX1AC.              |
| D. Shield TI-C-26384.             | U. } Nut BBX1A.                   |
| {Regulator assembly AL VRH-4102A. | Washer, lock, BECX1G.             |
| Screw, cap, BCBX1BC.              | Clip WI-56973.                    |
| E. } Nut BBX1B.                   | Screw, cap, BCBX1AA.              |
| Washer, lock, BECX1H.             | Nut BBX1A.                        |
| {Clamp WI-379853.                 | Washer, lock, BECX1G.             |
| Screw WI-86350.                   | {Box assembly WI-348780.          |
| F. } Nut BBX1A.                   | Screw, cap, BCBX1AA.              |
| Washer, lock, BECX1G.             | Washer, lock, BECX1G.             |
| G. Line WI-357017.                | Nut BBX1A.                        |
| H. Elbow WH-400X4.                | {Horn assembly w/bracket WI-      |
| J. Line WI-368566.                | { 353753.                         |
| K. Coupling WI-327865.            | { 353754.                         |
| {Screw, cap, BCBX1AA.             |                                   |
| L. } Nut BBX1A.                   | Screw, cap, BCBX1AB.              |
| Washer BBX1G.                     | Nut BBX1A.                        |
| M. Filter assembly MI-EA-283.     | Washer, lock, BECX1G.             |
| N. Line assembly WI-368564.       | Cable assembly WI-348763.         |
|                                   | Y. Funnel assembly WI-348784.     |

FIGURE 11.—Dash—front view.



RA PD 3251A

- |  |  |
|--|--|
| <p>A. Control WI-334908.</p> <p>B. {<br/>Control WI-334907.<br/>Nut BBBX1C.<br/>Washer, lock, BECX1K.</p> <p>C. Control WI-348751.</p> <p>D. Grommet WI-A17298X.</p> <p>E. {<br/>Support WI-316216.<br/>Screw, cap, BCBX1CB.<br/>Nut BBBX1C.<br/>Washer, lock, BECX1K.</p> <p>F. Bracket WI-316215.</p> <p>G. {<br/>Screw, cap, BCBX1CB.<br/>Nut BBBX1C.<br/>Washer, lock, BECX1K.</p> | <p>H. Box, shielding, assembly WI-368514.</p> <p>J. Grommet WI-A10766X.</p> <p>K. Grommet WI-348796.</p> <p>L. Grommet WI-10347X.</p> <p>M. Grommet WI-17298X.</p> <p>N. {<br/>Shaft SW-95000-84.<br/>Clip WI-27593X.<br/>Screw, cap, BCBX1AA.<br/>Nut BBBX1A.<br/>Washer, lock, BECX1G.</p> <p>P. Grommet WI-A13934X.</p> <p>Q. Grommet WI-A17218X.</p> |
|--|--|

FIGURE 12.—Dash and instrument shielding box.

(3) Plates which are pierced by shells should be replaced with new ones. If necessary, temporary repairs can be made by bolting a section of plate over the shell hole. Armor plate can be repaired by welding according to instructions specified in TB 1852-1.

(4) Replace damaged springs on the radiator louver control lever ratchet rod and port hole bracket plunger; replace damaged hinges and any other worn or damaged parts.

**8. Sheet metal.**—*a. Fenders.*—(1) *Description.*—The front wheel fenders are made of pressed steel. The outside edges are turned over to form a bead for reinforcing purposes to prevent breaking or tearing. Each fender has two supports which are welded to the fender at their outer edges. The front support is bolted to the frame and the rear support is bolted to the engine side armor plate. The fenders are also bolted to the engine side plates and running boards. The headlamps and guards are bolted to the top of the fenders at the front. The headlamp cables are disconnected by turning and removing the terminal plugs at the rear of the lamps; and the blackout marker lamp wires are detached from the connectors under the fenders and pulled through grommets in the fenders below these lamps.

(2) *Disassembly.*—Tools:

1/2-inch socket wrench.	1/2-inch open-end wrench.
5/8-inch socket wrench.	3/4 1/8-inch open-end wrench.
3/4 1/8-inch socket wrench.	7/16-inch open-end wrench.
7/16-inch socket wrench.	

(a) Remove headlamp brush guard and marker lamp.

1/2-inch socket wrench.

1/2-inch open-end wrench.

Disconnect blackout marker lamp No. 14 cable from connector WI-331080 underneath fender. Remove four bolts BCBX1BB, nuts BBBX1B and lock washers BECX1H holding each guard assembly WI-347352 to fender.

(b) Remove headlamp.

5/8-inch socket wrench.

Disconnect headlamp wire at rear of lamp. Remove nut BBBX1D, lock washer BECX1L, and bearing washer WI-K12206 holding lamp to fender, and take off adapter A175422 and headlamp WI-368513.

(c) Remove fenders.

3/4 1/8-inch socket wrench.	3/4 1/8-inch open-end wrench.
1/2-inch socket wrench.	1/2-inch open-end wrench.
7/16-inch socket wrench.	7/16-inch open-end wrench.



Remove two nuts BBBX1C, lock washers BECX1K, screws BCBX1CB, and spacers WI-354112 or WI-354113 holding each fender iron (front and rear) in place; nine nuts BBBX1A, lock washers BECX1G and screws BCBX1AA holding fender to armor plate; and three nuts BBBX1A, lock washers BECX1G and screws BCBX1AA holding rear of fender to running board support, and lift off fender assembly WI-347335 (left-hand), WI-347336 (right-hand).

(3) *Maintenance*.—No maintenance is required on the fenders unless they are damaged in an accident or by shell fire.

(a) Bent or crushed fenders can be repaired by pulling and hammering into shape. (See sec. IV, TM 10-450 for more detailed information.)

(b) Torn or pierced fenders can be straightened by hammering and then welded.

(4) *Reassembly*.—Tools:

$\frac{7}{16}$ -inch socket wrench.

$\frac{1}{2}$ -inch socket wrench.

$\frac{9}{16}$ -inch socket wrench.

$\frac{5}{8}$ -inch socket wrench.

$\frac{7}{16}$ -inch open-end wrench.

$\frac{1}{2}$ -inch open-end wrench.

$\frac{9}{16}$ -inch open-end wrench.

(a) Replace fender.

$\frac{7}{16}$ -inch socket wrench.

$\frac{1}{2}$ -inch socket wrench.

$\frac{9}{16}$ -inch socket wrench.

$\frac{7}{16}$ -inch open-end wrench.

$\frac{1}{2}$ -inch open-end wrench.

$\frac{9}{16}$ -inch open-end wrench.

Set fender in position and replace bolts, lock washers, and nuts holding fenders to frame, armorplate and running board support.

(b) Replace headlamps.

$\frac{5}{8}$ -inch socket wrench.

Set adapter and lamp assembly upon fender and replace bearing washer, lock washer and holding nut. Reconnect wire at rear of lamp.

(c) Replace headlamp brush guards.

$\frac{1}{2}$ -inch socket wrench.

$\frac{1}{2}$ -inch open-end wrench.

Attach headlamp brush guard to fender with bolts, lock washers and nuts. Reconnect blackout marker lamp wire under fender.

*b. Instrument panel*.—The instrument panel requires no maintenance unless it is damaged in combat. When this occurs, the panel WI-368533 can be removed as an assembly in the following manner: Disconnect instrument wires and tubing, controls, instruments, switches, windshield wiper bosses, steering tube bracket, and instru-

ment shielding box. Remove holding bolts, nuts, and lock washers and pull out assembly. Mark wires and controls to facilitate reassembly.

*c. Tool boxes.*—In order to avoid accumulation of water in the tool box, drill a ¼-inch hole near the bottom of the tool box and countersink to remove the burrs. Then thoroughly clean the inside of the tool box and paint all exposed metal surfaces. After the paint is dry, apply a film of engine oil to the inside surface of the tool box.

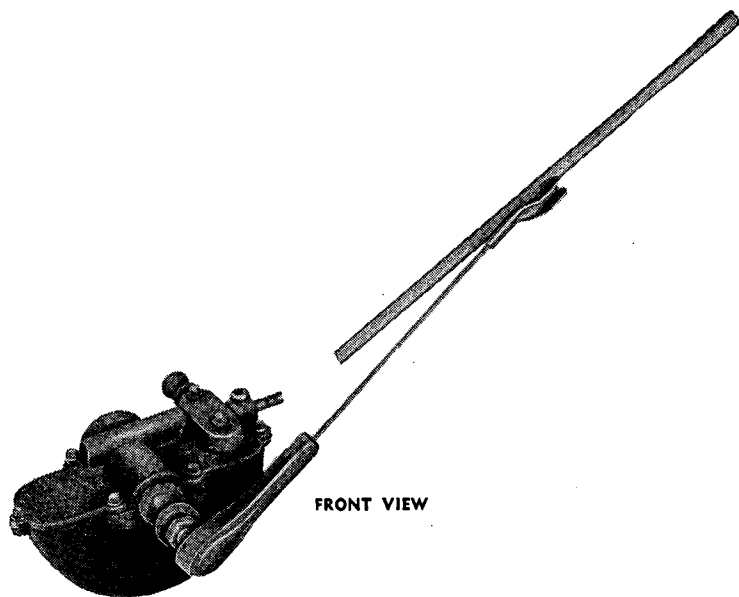
*d. Preservation of tools.*—Inspect the tools supplied with the vehicle for rust. Thoroughly clean tools to remove rust on the working surfaces and protect the surfaces by coating them with a thin film of engine oil.

**9. Windshield wipers** (fig. 13).—*a. Description.*—The windshield wipers are of the vacuum type and are mounted on the left- and right-hand side of the windshield frame over the instrument panel.

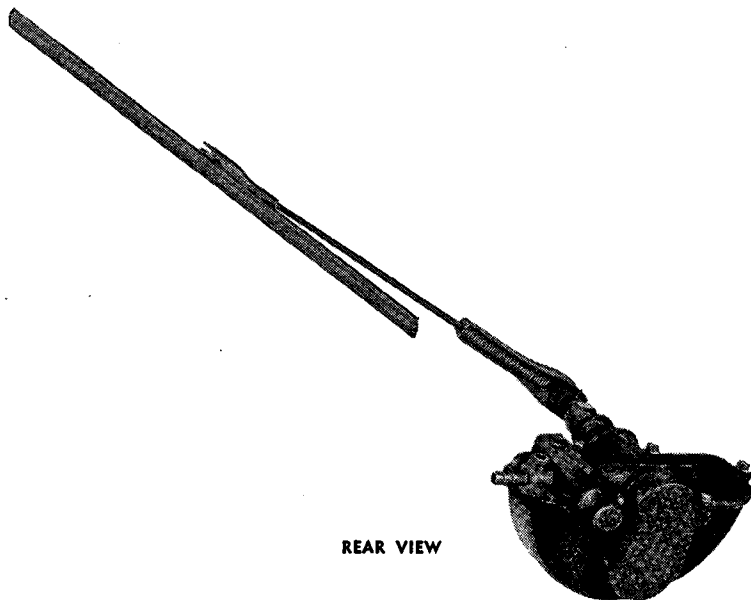
(1) *Construction.*—The body and cover of the wiper are aluminum die castings. The cover contains the vacuum and atmospheric pressure inlet, the exhaust ports and channels, and also the vacuum tube fitting, which is connected to the vacuum side of the fuel and vacuum pump by a flexible hose and pipe assembly. The cover is bolted to the body with sealing gaskets between them. The starting control is a flat plate with slotted holes. It seats on the motor cover, over the exhaust ports, and is held in place by a cover and flat springs. The body incloses the paddle and supports the paddle shafts. The paddle consists of two plates which are riveted together and carry the sealing rubber elements between them. The sleeve, for attaching the assembly to the windshield, fits over one shaft which also carries the wiper arm and blade assembly. The opposite shaft carries the valve and valve kicker. The kicker yoke sets into a slot in the top of the kicker and is held by a spring which is attached to a retainer at its opposite end. The entire valve mechanism is inclosed by a cap which snaps onto the body casting.

(2) *Functioning.*—(a) The vacuum is supplied by the fuel and vacuum pump and is always present when the engine is running. In the off position, the control button is pushed in so that the plate covers the exhaust ports to one side of the paddle. In this position, air can be exhausted only from one side of the paddle and atmospheric pressure on the opposite side forces the paddle to its “up” position and holds it there.

(b) When the control is pulled out to its “on” position, the control plate opens the ports leading to both sides of the paddle. The valve located at the side of the wiper is actuated by the kicker, which oscillates with the paddle shaft, and opens and closes the exhaust ports,



FRONT VIEW



REAR VIEW

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FIGURE 13.—Windshield wiper assembly.

first to one side of the paddle and then to the other side in the following manner: Air is drawn from the body of the wiper, causing a partial vacuum. The atmospheric pressure behind the paddle forces the paddle to move to the side of the case from which the air has been drawn. Just before the paddle reaches the top of its stroke, the kicker moves the valve so that it opens the atmosphere side of the body to the vacuum. Air is then drawn into the former vacuum side and hence the paddle reverses its direction. The wiper blade arm is attached to the paddle shaft and this makes the blades oscillate with the shaft and wipe the windshield.

(3) *Specifications.*

Make	Type	Model	Manufacturer's No.	Ordnance No.	White No.
Tribco-----	Vacuum-----	618A	KSB-443	B185193	376642

*b. Trouble shooting.*

*Symptoms and probable cause*

*Probable remedy*

(1) Wiper moves very slowly.

Poor vacuum.

Check lines for leaks and replace hose or tubing if necessary.

Check vacuum pump for leaks and tighten diaphragm screws.

Replace vacuum pump diaphragm, if necessary.

Clogged exhaust ports.

Clean ports.

Lack of lubricant.

Lubricate paddle lightly with oil, engine, seasonal grade.

Worn paddle seal (allowing air to pass by).

Replace paddle assembly.

Worn cover gaskets.

Replace gaskets.

(2) Wiper moves in one direction only.

One set of ports clogged.

Clean ports.

Lack of lubricant.

Lubricate paddle lightly with oil, engine, seasonal grade.

Kicker spring has permanent set or is damaged.

Replace spring.

*Symptoms and probable cause*

*Probable remedy*

(3) Wiper will not move.

Hose or pipe assembly split. Check and replace damaged part.

Worn pump diaphragm. Replace diaphragm.

Clogged ports. Clean ports thoroughly.

Worn or damaged cover gaskets. Replace gaskets.

Worn or damaged paddle seal. Replace paddle assembly.

Paddle frozen in one spot. Free and lubricate lightly.

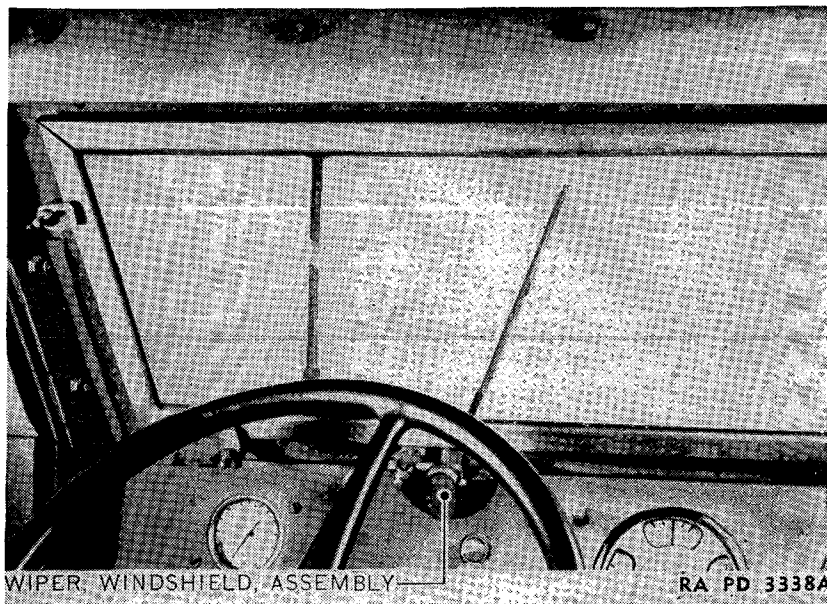


FIGURE 14.—Windshield wiper installed.

(4) Wiper streaking windshield.

Worn or damaged wiper blade. Replace blade assembly.

*c. Removal of assembly (fig. 14.)*

(1) Remove blade and arm assembly. None.

Lift blade arm and pull off spring clip. Then pull arm B185473 out of paddle shaft hole (fig. 15(a)).

(2) Remove motor assembly.  $\frac{7}{16}$ -inch open-end wrench.

Detach vacuum hose from nipple. Then remove paddle shaft sleeve nut and washer and dismount motor assembly from top of instrument panel.

*d. Disassembly.*—Tools:

Pliers.	Screw driver
Long nose pliers.	

(1) Remove arm and blade assembly and motor assembly. None.

Follow procedure given in steps *c*(1) and (2) above.

(2) Remove blade assembly. None.

Cock blade assembly slightly and slip it out of arm slot.

(3) Remove push button control. Pliers.

Pry off valve mechanism cover (figs. 15(b) and (c)). Then take out two screws from control cover and remove cover, springs, plate, pad, and button control (fig. 15(d)).

(4) Remove motor assembly cover. Long nose pliers.  
Screw driver.

Take out six screws holding motor cover to body and remove cover. Strip gaskets from cover (fig. 15(e)).

(5) Remove valve mechanism. None.

Release spring retainer and remove spring, kicker yoke, kicker, spring retainer, valve, and valve washer (fig. 15(f) and (g)).

(6) Remove paddle assembly. None.

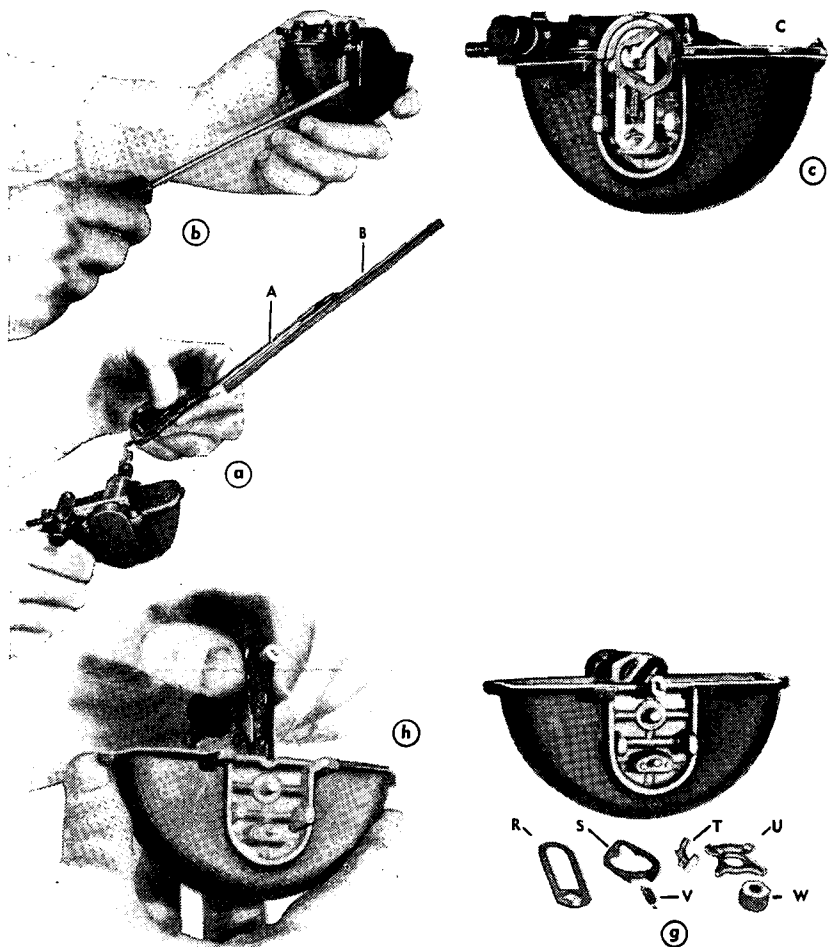
Lift paddle assembly straight out of body, being careful not to damage seal (fig. 15(h)).

*e. Maintenance.*—(1) When wiper blades become worn or damaged, remove the assembly from the arm without any further disassembly, and replace with a new unit.

(2) At the 6,000-mile check-up, disassemble the wipers, clean out the ports, and inspect all parts carefully. Replace any damaged or worn parts, lubricate the paddle, and use new gaskets for reassembling.

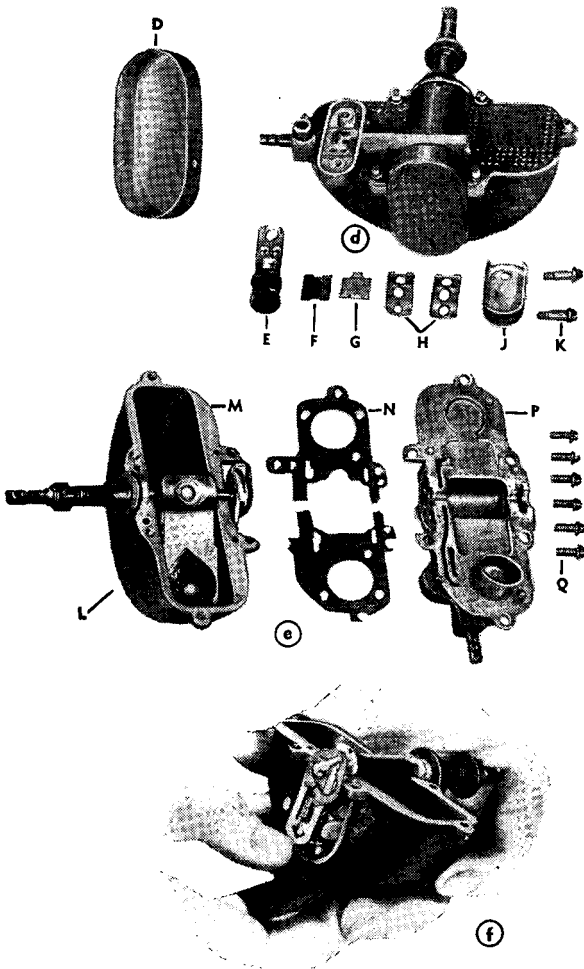
When replacing the paddle, slide it into the body vertically so that the seals will not be damaged.

(3) Inspect the leather washer on the inside of the windshield and replace if necessary.



- A. Rod w/retainer.
- B. Blade assembly.
- C. Motor assembly.
- D. Valve mechanism cover.
- E. Button control.
- F. Pad.
- G. Plate.
- H. Spring.
- J. Control cover.
- K. Screws.
- L. Paddle and shaft assembly.

FIGURE 15.—Windshield wiper assembly and disassembly.



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- M. Body.
- N. Cover gaskets.
- P. Cover.
- Q. Screws.
- R. Spring retainer.
- S. Kicker yoke.
- T. Valve kicker.
- U. Valve.
- V. Spring.
- W. Felt washer.

FIGURE 15.—Windshield wiper assembly and disassembly—Continued.



(4) Inspect the rubber hoses periodically and replace them if they show signs of cracking.

*f. Reassembly.*

(1) Replace the paddle assembly. None.

Slip paddle assembly into body vertically (*e*(2) above).

(2) Replace the valve mechanism. None.

Set valve washer in place. Then, in order named, replace valve, spring retainer, and kicker into paddle shaft. Set kicker yoke into slot at top of kicker, attach spring to bottom of yoke and retainer, and hook retainer to its holding pin.

(3) Replace motor cover. Long nose pliers.

Set gaskets on cover and replace cover and holding screws.

(4) Replace valve mechanism cover. None.

Hold cover in position and snap it in place by pushing on it.

(5) Replace push button control. Pliers.

Set control in position on top of motor cover and replace pad, plate and springs. Fasten entire assembly with control cover and screws.

*g. Installation.*

(1) Attach motor assembly to windshield.  $\frac{7}{16}$ -inch open-end wrench.

Push paddle shaft through windshield frame and fasten assembly by replacing shaft sleeve washer and nut.

(2) Attach wiper arm to paddle shaft. None.

Push hooked end of arm into paddle shaft hole. Then set narrow end of arm spring clip over spring, compress spring, and push wide end of clip into slot cut around end of paddle shaft.

(3) Replace wiper blade assembly. None.

Hook blade assembly into wiper arm slot.

SECTION V

BRAKE SYSTEMS

	Paragraph
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Service brake pedal linkage.....	12
Master cylinder.....	13
Vacuum power booster.....	14
Vacuum booster air cleaner and check valve.....	15
Hydraulic fluid lines and connections.....	16
Wheel brakes.....	17
Drive shaft brake.....	18

**10. Description.**—*a. General.*—The service brakes on the front and rear wheels are actuated under the control of a hydraulic system (fig. 16) which is comprised of pedal and linkage, master cylinder, vacuum power booster, air cleaner and check valve for booster, brake lines, wheel cylinders and brake shoes. The master cylinder is located behind the pedal linkage and the vacuum booster is located ahead of the linkage. Both are directly connected to the linkage. The booster check valve is attached to the dash on the engine side and is connected by tubing to the rear of the booster. The air cleaner is also attached to the engine side of the dash and is connected by tubing to the rear end of the booster. The brake lines connect the master cylinder to each of the four wheel cylinders. The wheel cylinders and brake shoes are inclosed by the brake drums. A disk type mechanical brake for parking only is mounted on a companion flange of the rear propeller shaft.

*b. Functioning.*—Pressure exerted on the brake pedal is transmitted by the linkage to the master cylinder. This pressure forces fluid out of the cylinder into the lines and thence to the four wheel cylinders. The wheel cylinder pistons are forced outward, thereby bringing the brake shoes in contact with the brake drums. The vacuum power unit starts to operate shortly after the pedal linkage begins to move and acts as a power or booster complement for the brake to actuate the master cylinder and reduce the amount of physical effort required to apply the brakes.

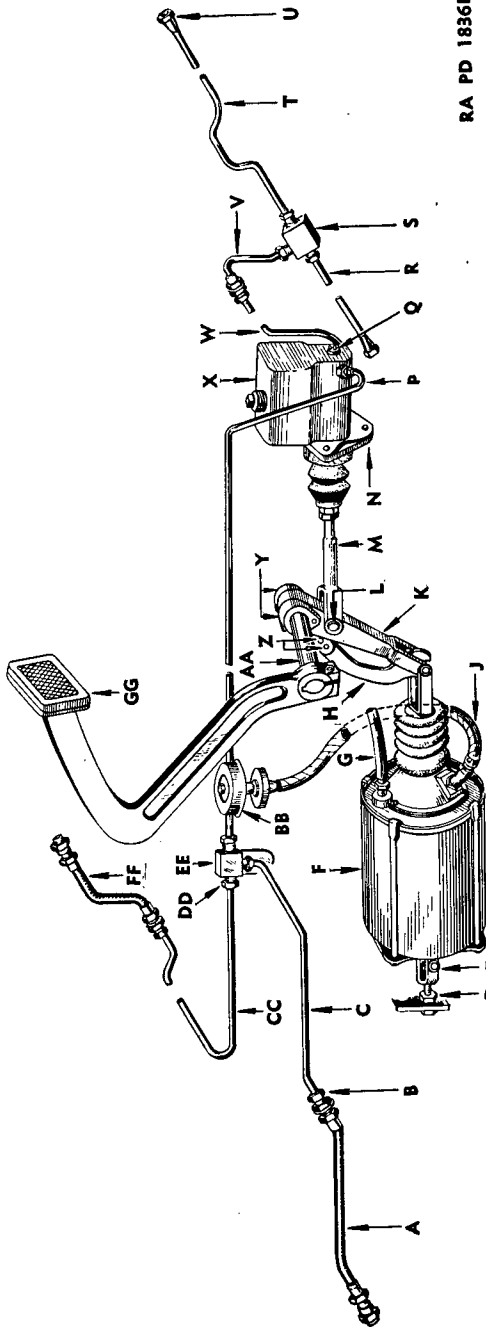
**11. Trouble shooting.**

<i>Symptom and probable cause</i>	<i>Probable remedy</i>
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*a.* Pedal striking floor board.

Linings worn.	Readjust upper ends of shoes only.
Incorrectly adjusted brake shoes.	Readjust shoes at both ends.

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- A. Hose LO-FC-3551B.
- B. Nut WI-A30828X.
- C. { Line assembly WI-S69X5.
- { Nut LO-FC-2577.
- D. { Nut BBBX1E.
- { Washer, lock, BECX1M.
- E. Yoke WI-312748.
- F. Booster, vacuum, assembly BK-16725.
- G. { Hose AQRX1.
- { Nipple BK-12989.
- H. { Clamp assembly, CMAX1F.
- { Fork, valve opening, WI-344966.
- I. Hose AQRX1.
- J. Nipple BK-10777.
- K. Elbow CPBX5BC.
- L. Pin BFFX1C.
- M. { Rod assembly WI-344974.
- { Nut BBBX2A.
- N. Bracket WI-344941.
- O. { Line assembly WI-S69X48.
- P. { Nut LO-FC-2577.
- Q. Switch FS-320-1.
- R. Line assembly WI-S72X9.
- S. Tee LO-FC-3048.
- T. { Line assembly WI-S72X37.
- { Nut LO-FC-2577.
- U. Nut WI-B17384X.
- V. Hose WI-B21615.
- W. { Line assembly WI-S70X60.
- { Nut LO-FC-2578-E.
- X. { Cylinder, master, assembly.
- { LO-FD-2705B.
  - { Screw, cap, BCBX1CD.
  - { Nut BBBX1C.
  - { Washer, lock, BECX1K.
- Y. Clamp { Outer, WI-344962.
- { Inner, WI-344964.
- Z. Screw, cap, BCAX1BA.
- AA. Washer, lock, BECX1H.
- BB. { Cleaner, air, assembly, BK-11871.
- { Adapter, BK-15419.
- CC. { Line assembly, WI-S69X56.
- { Nut, LO-FC-2577.
- DD. Nut, WI-A30828X.
- EE. Tee assembly, WH-210655.
- FF. Hose, LO-FC-3551B.
- GG. Pedal, brake, WI-344959.

FIGURE 16.—Hydraulic brake system—schematic diagram.

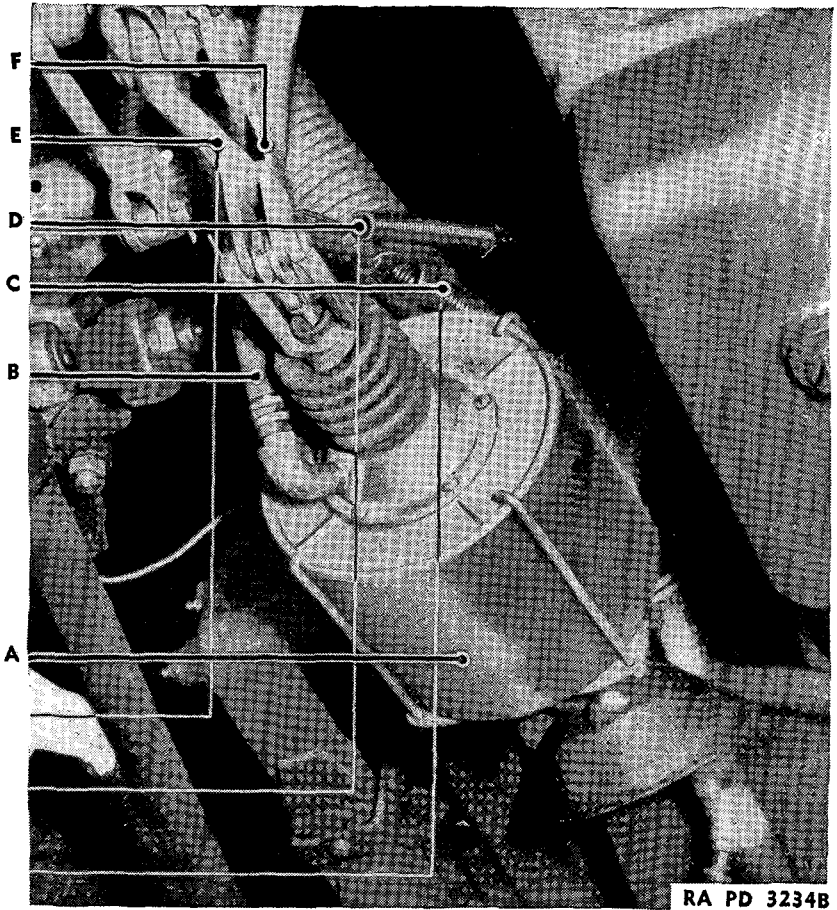
<i>Symptom and probable cause</i>	<i>Probable remedy</i>
Improperly adjusted pedal.	Readjust pedal linkage.
Leak in system.	Check system and repair.
Air in system (indicated by spongy pedal action).	Bleed lines.
Insufficient brake fluid.	Refill master cylinder.
<i>b. All brakes drag.</i>	
Insufficient brake shoe clearance.	Readjust shoes.
Mineral oil in system.	Flush system with alcohol and replace cylinder cups.
Improper pedal adjustment.	Readjust pedal and linkage.
Weak pedal return spring.	Replace spring.
<i>c. One brake drags.</i>	
Weakened or damaged brake shoe return spring.	Replace spring.
Wheel cylinder cups distorted.	Replace cups.
Shoe binding on anchor pin.	Free and lubricate pin.
Insufficient brake shoe clearance.	Readjust shoes.
Loose wheel bearings.	Readjust bearings to position drum correctly around brake shoes.
Grease on linings.	Replace linings. Replace wheel bearing grease seals, if leaking, to prevent recurrence of trouble.
Tubing obstructed.	Replace tubing.
<i>d. Pulling to one side.</i>	
Grease on linings.	Replace with new linings of the same type. Replace wheel bearing grease seals, if leaking, to prevent recurrence of trouble.
Shoes improperly adjusted.	Readjust and check with feeler gage.
Loose backing plate.	Tighten plate and readjust brake shoes.

<i>Symptom and probable cause</i>	<i>Probable remedy</i>
Different linings.	Replace linings until all are of the same make.
Worn linings.	Replace with new linings.
Scored drums.	Resurface or replace.
<i>e. Excessive pressure on pedal; poor stops.</i>	
Brake shoes incorrectly adjusted.	Readjust shoes.
Grease on linings.	Clean or replace linings. Check wheel bearing oil seals.
Improper linings.	Replace with best quality linings.
Partial contact between lining.	Dress down high spots on linings and adjust shoes at their ends.
Tubing obstructed.	Replace tubing.
<i>f. Light pressure on pedal, severe brakes.</i>	
Brake shoes incorrectly adjusted.	Readjust shoes.
Improper linings.	Replace with best quality linings.
Partial contact between lining and drum.	Dress down high spots on linings and adjust shoes at their ends.
<i>g. Noisy brakes.</i>	
Bent or distorted backing plate.	Straighten or replace with new plate.
Bent or distorted brake shoes.	Replace with new shoes.
Dirt in linings.	Remove any imbedded particles.
Loose lining rivets.	Replace loose rivets.
Drums distorted.	Replace or have reground.

**12. Service brake pedal linkage** (figs. 17 and 18).—*a. Description.*—The brake pedal linkage is installed in the vehicle on the inner left side of the frame directly behind the steering gear assembly.

(1) *Construction.*—(a) The brake linkage is mounted on the clutch and brake pedal shaft, the middle part of which rotates in a bearing in the left rear engine support bracket. The shaft is internally lubricated by means of a lubricating fitting and an oil channel and has a key slot and a cross groove near its left end to mount and lock the brake pedal. To the left of the brake pedal, the bronze bushed clutch pedal runs free on the shaft and is retained by a plain washer, slotted nut,

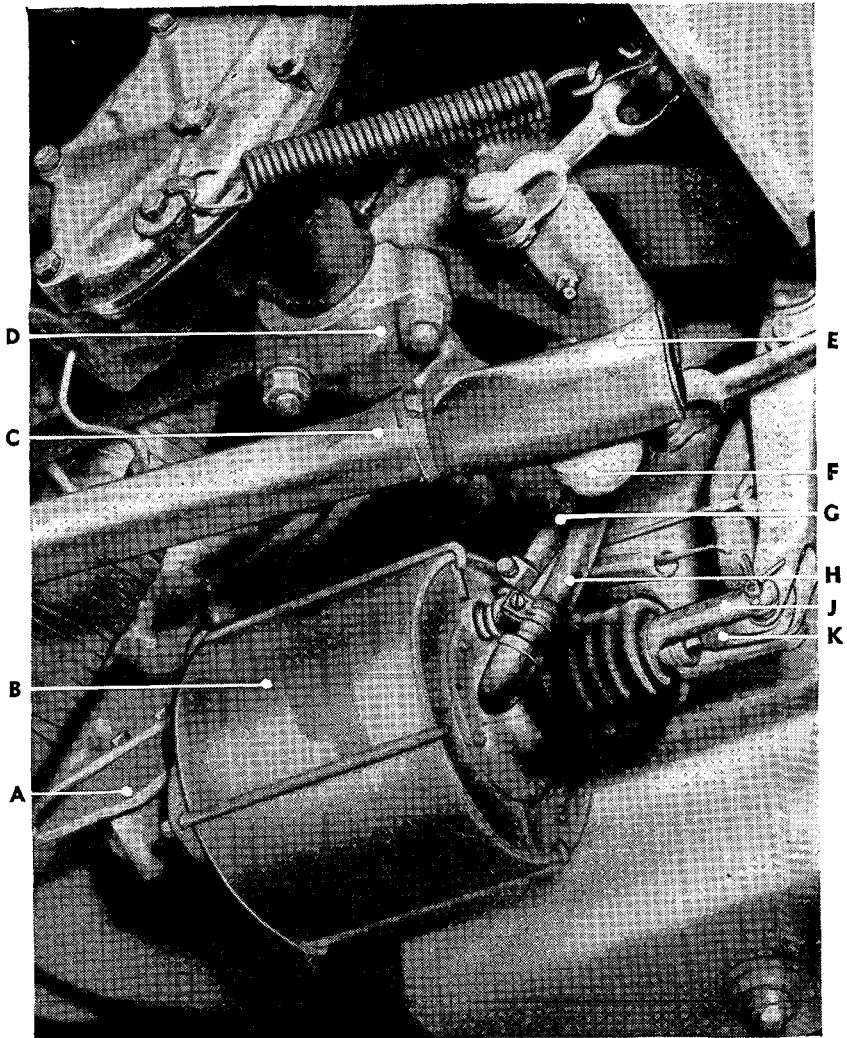
and cotter pin. The right-hand end of the shaft has two key slots and cross grooves for mounting and locking the inner and outer power lever clamps on either side of the power lever.



- |  |  |
|--|--|
| <p>A. Booster, vacuum, assembly BK-16725.</p> <p>B. Hose, rubber, AQRX1.</p> <p>C. { Spring WI-B17472X.<br/>Extension WI-A12084X.<br/>Spring WI-A27693X.</p> <p>D. { Extension WI-A23475X.</p> | <p>E. Lever WI-344965.</p> <p>F. { Fork WI-344966.<br/>Screw, cap, BCAX1BB.<br/>Nut BBBAX1B.<br/>Washer, lock, BECX1H.</p> |
|--|--|

FIGURE 17.—Brake linkage, installed—bottom view.

(b) The power lever is not bound to the shaft but is linked to both of its clamps by the power lever clamp lock pin. This pin has two cross grooves, and the same bolts which engage the pedal shaft grooves also engage the pin's grooves. Directly below this lock pin the power



- A. Bracket assembly WI-344942.
- B. Booster assembly BK-16725.
- C. Link, drag, WI-363757.
- D. { Bracket assembly WI-344951.  
Stud WI-A28584X.  
Nut BBBX24.  
Washer, lock, BECX1N.  
Fitting CLDX5A.
- E. { Boot WI-324634.  
Fitting CLDX5M.

- F. Arm assembly RG-502485.
- G. { Hose AQRX1.  
Clamp assembly CMAX1F.  
Elbow BK-12989.  
Hose AQRX1.  
Clamp CMAX1B.
- H. { Nipple BK-10777.  
Elbow CPBX5BC.
- J. Yoke BK-13703.
- K. End assembly BK-13761.

FIGURE 18.—Brake linkage, installed—side view.

lever is provided with a hole for the rod end pin which links it to the master cylinder rod assembly. The shaft hole in the power lever is oversized and the lever is free to turn on both the shaft and the clamp lock pin. The resulting loose action contributes some of the free play desired between starting the pedal lever forward and actuating the booster valve. The inner power lever clamp is provided with an arm drilled and tapped for the two cap screws that mount the booster valve operating fork. Oversize holes in the fork permit adjustment. When assembled, the valve operating fork fits inside the fork of the power lever and engages the yoke end assembly of the booster valve rod.

(c) A rod end pin connects the power lever to the booster piston rod yoke which fits around the integral yoke on the power lever. The booster valve operating fork and valve rod yoke end fit inside the power lever yoke.

(2) *Functioning.*—Forward motion of the brake pedal rotates the shaft and causes rearward motion of both power lever clamps. This motion is conveyed to the power lever, with slight free play, by the power lever clamp lock pin. When all its play is taken up, the power lever pushes the master cylinder piston push rod at its clevis and also pulls the yoke end assembly of the booster piston valve rod, operating the valve after the brake pedal has moved about 1 inch. The vacuum power action of the booster then takes over the application of the service brakes for as long as sufficient pedal pressure is applied to keep the booster piston valve at its operating position.

b. *Removal of assembly.*—The linkage cannot be removed as an assembly because the brake pedal shaft turns in a bearing integral with the left rear engine support bracket which is riveted to the chassis frame. The clutch and brake pedals and the power lever with its clamps must be disassembled from the shaft before the shaft can be removed.

c. *Disassembly of components.*—Tools:

- |                                       |   |
|---------------------------------------|---|
| Screw driver.                         | $\frac{1}{16}$ -inch socket wrench w/ratchet. |
| $\frac{1}{16}$ -inch open-end wrench. | $\frac{1}{16}$ -inch socket wrench.           |
| 1-inch open-end wrench.               | Drift.  |
| $\frac{3}{16}$ -inch open-end wrench. | Hammer.                                       |
| Pliers.                               |   |

(1) Remove floor plate under driver's seat. Screw driver.

Remove 16 self-tapping round head screws from steel floor plate under driver's seat. Remove plate.

(2) Release foot dimmer switch. Screw driver.



Remove two machine screws BCNX2CE and lock washers BECX1G, holding foot dimmer switch assembly DM-5530 to toe board and release switch.

(3) Release throttle control shaft bracket.  $\frac{9}{16}$ -inch open-end wrench.

Remove two bolts BAOX1AA and lock washers BECX1G holding left throttle control bracket WI-344332 to toe board and remove bracket.

(4) Remove toe board.  $\frac{9}{16}$ -inch open-end wrench.

Remove 19 lower toe board bolts BAOX1AA, BBBX1A, and lock washers BECX1G. Toe board now may be lifted off dimmer switch and off throttle control bell crank.

(5) Disconnect master cylinder. Pliers.

Remove cotter pin BFAX1DG and rod end pin BFFX1G holding rod assembly WI-344974 to power lever WI-344965. Push rod toward rear.

(6) Disconnect brake vacuum booster. Pliers.

Remove cotter pin BFAX1DK and rod end pin BK-13290, and release piston rod yoke end BK-13761 and valve rod yoke end BK-13762.

(7) Remove clutch and brake pedal pull-back springs. Pliers.

Unhook clutch pedal pull-back spring WI-B17472X from clutch relay lever. Unhook brake pedal pull-back spring extension WI-A23475X from power lever. Unhook vacuum booster pull-back spring WI-A27693X and extension WI-A12084X from booster valve fork. Remove springs.

(8) Disconnect clutch pedal to relay shaft double yoke. Pliers.

Remove cotter pin BFAX1DF and rod end pin BFFX1F to disconnect rod WI-A43922.

(9) Remove clutch and brake pedals. Pliers  
1-inch open-end wrench.

Remove cotter pin BFAX1DK and slotted nut BBHX2C from left end of clutch and brake pedal shaft. Remove nut BBBX1D and

lock washer BECX1L from brake pedal mounting bolt BAOX1DK, and remove bolt so that Woodruff key BCAX15A can slide in keyway. Tap shaft toward right side of car until stopped by Woodruff key. Slide clutch pedal WI-344955 off shaft and remove. Slide brake pedal to left, off key and shaft, and remove.

(10) Remove oil fitting.  $\frac{7}{16}$ -inch open-end wrench.

Screw out lubricating fitting CLDX5M.

(11) Remove inner power lever  $\frac{9}{16}$ -inch socket wrench w/ratchet. clamp.

Remove cap screw BCAX1DH and lock washer BECX1L from clamp. Detach booster valve fork by removing two cap screws BCAX1BB and lock washers BECX1H. Pull inner power lever clamp WI-344964 off shaft and off power lever clamp lock pin WI-344967. Remove key BCAX15A.

(12) Remove power lever. None.

Pull power lever WI-344965 off shaft and off power lever clamp lock pin WI-344967.

(13) Remove outer power lever  $\frac{9}{16}$ -inch socket wrench. clamp.

Remove cap screw BCAX1DH with lock washer BECX1L. Remove power lever clamp lock pin and pull clamp WI-344962 off shaft.

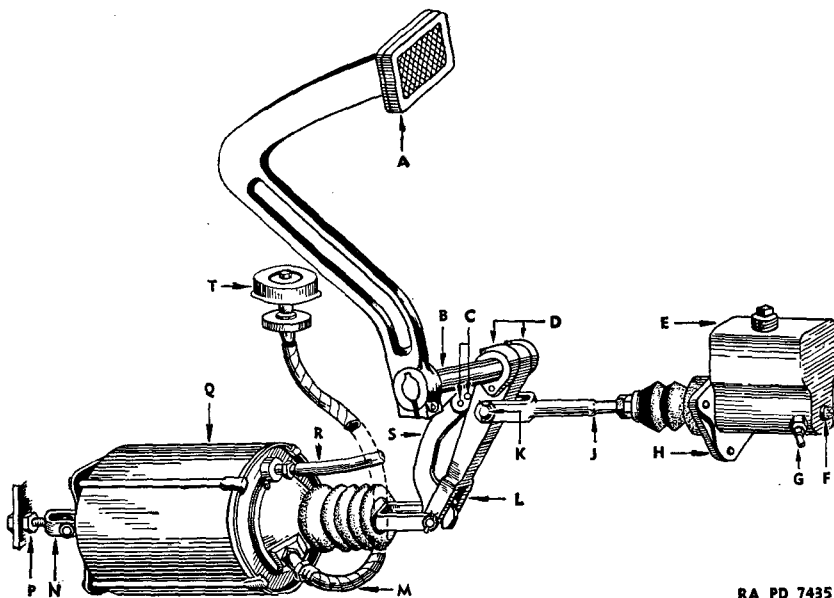
(14) Remove brake pedal shaft. Drift.  
Hammer.

With all keys removed, drive or pull shaft out toward left side of vehicle.

*d. Maintenance and adjustment.*—(1) *Maintenance.*—Keep linkage well lubricated and be sure that the system is clean and in correct alinement, with no binding of the levers or shaft.

(2) *Adjustment* (fig. 19).—(a) Loosen booster valve operating fork mounting screws. Remove master cylinder rod end pin and booster piston valve rod yoke end pin. Block the brake pedal in released position. Check clearance between power lever and pedal shaft at the clearance hole, making sure clearance is away from the driver's foot.

(b) Adjust length of master cylinder yoke end rod to permit  $\frac{1}{32}$ - to  $\frac{1}{16}$ -inch lost motion at its clevis before it operates the master cylinder piston rod. Replace rod end pin and cotter pin.



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- |   |   |
|---|---|
| <p>A. Pedal, brake, WI-344959.</p> <p>B. Shaft, WI-344973.</p> <p>C. { Screw, cap, BCAX1BA.<br/>Washer, lock, BECX1H.</p> <p>D. Clamp { outer, WI-344962.<br/>inner, WI-344964.</p> <p>E. { Cylinder, master, assembly LO-FD-2705B.<br/>Screw, cap, BCBX1CD.<br/>Nut BBBX1C.<br/>Washer, lock, BECX1K.</p> <p>F. Switch FS-320-1.</p> <p>G. { Line assembly WI-S60X48.<br/>Nut LO-FC-2577.</p> <p>H. Bracket WI-344941.</p> <p>J. { Rod assembly WI-344974.<br/>Nut BBBX2A.</p> <p>K. { Pin BFFX1G.<br/>Pin, cotter, BFAX1DG.</p> | <p>L. Lever, power, WI-344965.</p> <p>M. { Hose AQRX1.<br/>Nipple BK-10777.<br/>Clamp CMAX1B.<br/>Elbow CPBX5BC.</p> <p>N. Yoke WI-312748.</p> <p>P. { Nut BBBX1E.<br/>Washer, lock, BECX1M.</p> <p>Q. Booster, vacuum, assembly BK-16725.</p> <p>R. { Hose AQRX1.<br/>Nipple BK-12989.<br/>Clamp assembly CMAX1F.</p> <p>S. Fork, valve opening, WI-344966.</p> <p>T. { Cleaner, air, assembly BK-11871.<br/>Adapter BK-15419.</p> |
|---|---|

FIGURE 19.—Brake linkage adjustment.

(e) Push vacuum booster piston rod inward, until piston bottoms. Aline eyes of piston rod yoke end with eyes of power lever yoke by adjusting cylinder position at booster engine bracket mounting.

NOTE.—Always assume that valve positioning is correctly set during factory assembly and never alter it until a check and recheck of all other adjustments indicates its necessity.

(d) Check booster piston rod end to make sure it is against rear sidewall of bushing in end yoke of piston valve rod, then tighten adjusting screws on valve operating fork, being careful not to disturb position of the end yoke of the valve. Make sure the valve operating fork centers squarely on the bushing of the piston valve rod end yoke to avoid binding.

(e) If correct adjustment has been made, the valve rod should move  $\frac{1}{4}$  inch outward before any movement of the power lever occurs, with engine running. This can be checked by moving the brake pedal by hand.

(f) Check finally, to be sure cotter pins are in place, lock nuts are tightened, and cap screws are secure. The foregoing adjustments, correctly made, plus properly adjusted brake shoes, and a clean, well sealed, hydraulic system, assure satisfactory operation of the hydraulic service brakes.

e. Reassembly.—Tools:

- |                                      |                                       |
|--------------------------------------|---------------------------------------|
| 1-inch open-end wrench.              | $\frac{9}{16}$ -inch open-end wrench. |
| $\frac{5}{8}$ -inch open-end wrench. | Screw driver.                         |

(1) Replace clutch and brake pedals on pedal shaft. 1-inch open-end wrench.

Replace shaft in bracket bearing from left side of vehicle, replace key for pedal lever in its slot, raise pedal lever through toe board opening and slip it onto shaft over key. Push shaft toward right side of vehicle as far as key permits, raise clutch pedal lever through toe board opening and slide lever on shaft. Replace plain washer and slotted nut and cotter pin.

(2) Reassemble power lever with clamps on pedal shaft.  $\frac{5}{8}$ -inch open-end wrench.

Insert outer clamp key in its slot in shaft, slip clamp over key, insert clamp lock pin in clamp so groove registers and replace mounting bolt and lock washer. Push power lever onto shaft and onto lock pin. Insert inner clamp key and push clamp on shaft over key and onto lock pin. Replace mounting bolt and lock washer.

(3) Attach valve operating fork. None.

Position valve operating fork in fork of power lever, register holes with holes in inner clamp, insert screws with lock washers and set up lightly prior to adjusting.

(4) Link power lever to master cylinder and booster cylinder. None.

Seat booster valve rod yoke in valve operating fork, register bushing with eyes of power lever and eyes of piston rod yoke end, insert pin and cotter pin.

(5) Replace lower toe board.  $\frac{1}{16}$ -inch open-end wrench

Seat toe board so that foot dimmer switch and accelerator bell crank protrude through holes provided. Replace two screws and lock washers attaching foot dimmer switch. Replace two bolts, nuts and lock washers attaching accelerator bell crank bracket. Insert 19 toe board bolts, with nuts and lock washers.

(6) Replace floor plate under driver's seat. Screw driver.

Reset steel plate, insert 16 self-tapping roundhead screws and set up tight.

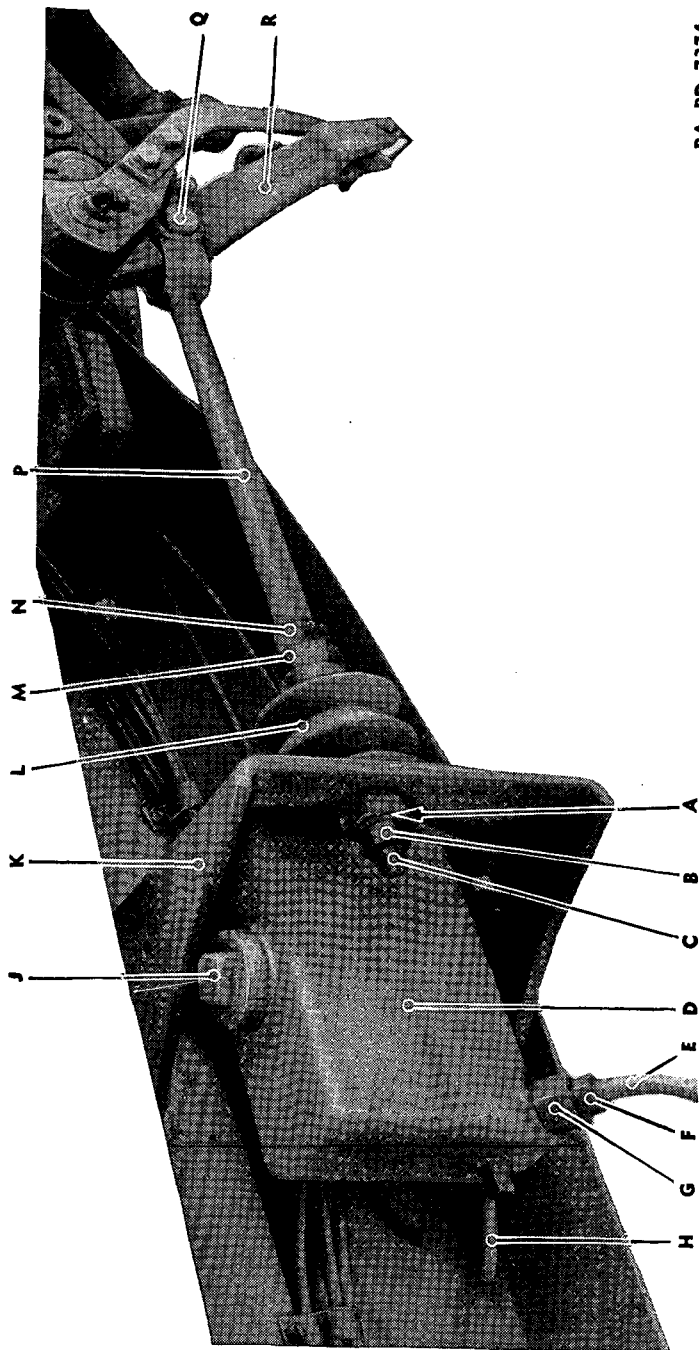
(7) Adjust brake linkage.

Proceed as outlined in *d*(2) above.

**13. Master cylinder** (figs. 20 and 21).—*a. Description.*—The master cylinder is a Wagner electric combination type unit with a reservoir or supply tank cast integrally with the cylinder barrel.

(1) *Construction* (fig. 22).—(a) The supply tank is above the cylinder barrel and has a threaded hole on top for the combination filler and breather cap which maintains atmospheric pressure on the brake fluid at all times. An expansion plug is used to close the hole at the rear end of the tank. A compensating and an intake port are provided for fluid flow between the supply tank and the cylinder barrel.

(b) On the rear left and right sides of the cylinder are two threaded holes for outlet fittings to which are attached the hydraulic brake lines leading to the front and rear wheel cylinders. A check valve, held in place by the piston return spring is installed in the rear end of the cylinder over the outlet port. On the front end of the return spring is the primary cup and piston. The cup face of the primary cup is against the spring, the flat face against the rear end of the piston. The secondary cup and its retaining ring are mounted on the front end of the piston and are parts of the piston assembly. A stop washer and its lock washer are installed to the front of the piston



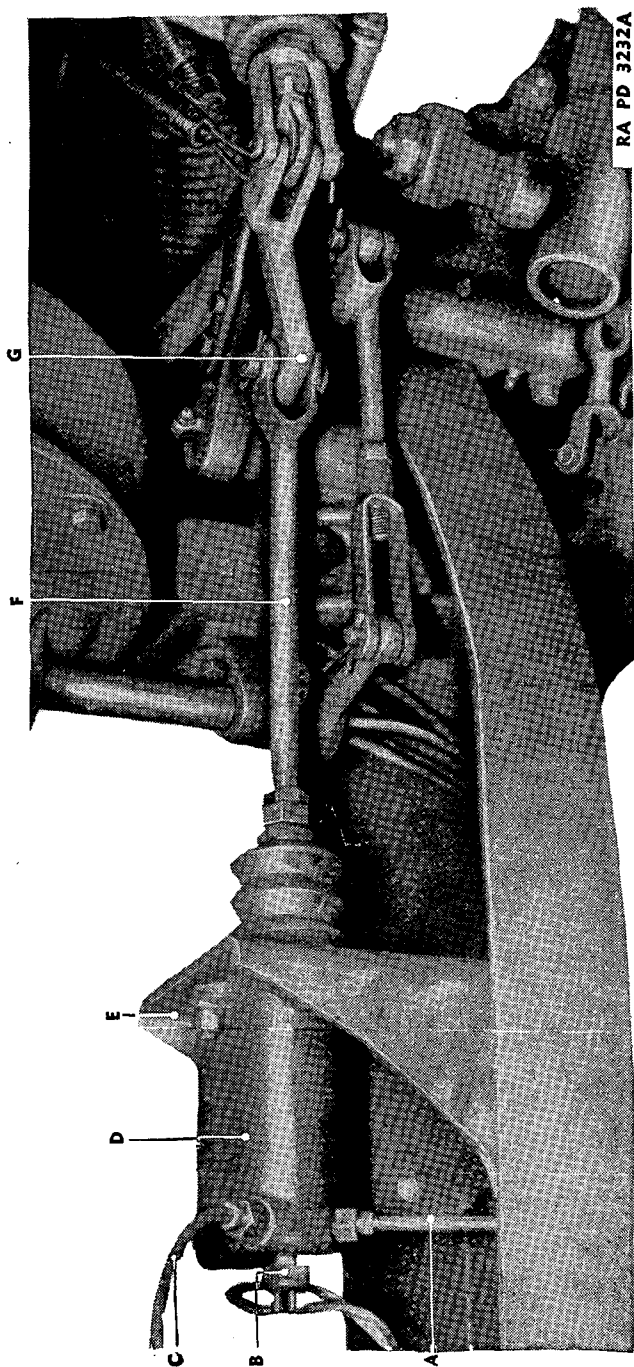
RA PD 7374

- N. Nut BBEX2A.
- P. Rod assembly WI-344974.
- Q. Pin BFPX1G.
- R. Lever WI-344965.

- G. Connector LO-FC-2892.
- H. Line assembly WI-S69X48.
- J. Plug LO-FC-4073.
- K. Bracket WI-344941.
- L. Root LO-FC-1331.
- M. Rod assembly LO-FC-1320.

- A. Washer, lock, BECX1K.
- B. Nut BBXX1C.
- C. Screw, cap, BCBX1CD.
- D. Master cylinder assembly WI-352445.
- E. Line assembly WI-S70X60.
- F. Nut WI-A30823X.

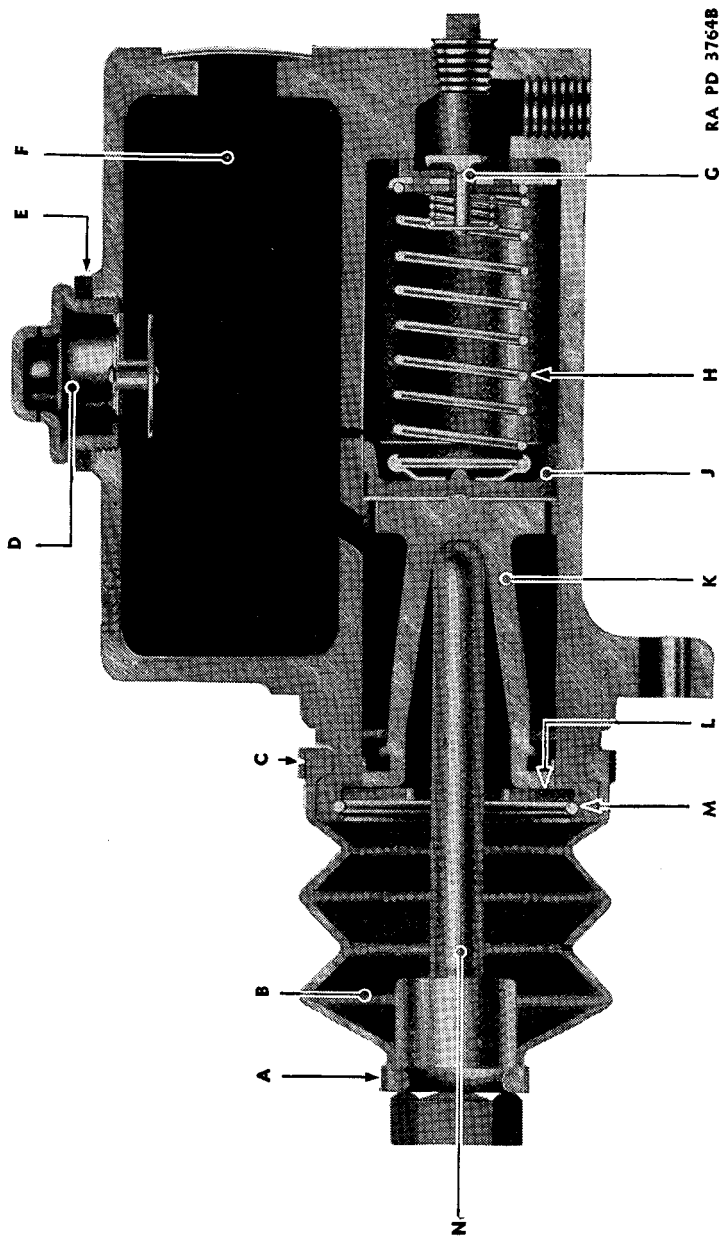
FIGURE 20.—Master cylinder assembly, installed.



RA PD 3232A

- A. { Line assembly WI-868X48.  
Nut LO-FC-2577.
- B. Switch stop light, FS-320-1.
- C. { Line assembly WI-S70X60.  
Nut LO-FC-2577.
- D. { Cylinder, master assembly LO-FD2705B.  
Screw, cap, BCBX1CD.  
Nut BBBX1C.
- E. Bracket WI-344941.
- F. { Rod assembly WI-344974.  
Nut BBBX2A.  
Pin BFFX1G.
- G. { Pin, cotter, BFXA1DG.  
Lever WI-344965.

FIGURE 21.—Master cylinder assembly, installed—bottom view.



C RA PD 3764B

- A. Strap LO-FC-1332.
- B. Boot LO-FC-1331.
- C. Strap LO-FC-1333.
- D. Plug assembly LO-FC-4073.
- E. Gasket LO-FC-2037.
- F. Tank assembly LO-FC-3964.
- G. Valve assembly LO-FC-1266.
- H. Spring, w/retainer, assembly LO-FC-1318.
- J. Cup LO-FD-962.
- K. Piston assembly LO-FC-1338.
- L. Stop LO-FC-1321.
- M. Wire LO-FC-1330.
- N. Rod assembly LO-FC-1320.

FIGURE 22.—Master cylinder assembly—sectionalized view.



in order to limit the piston travel on the return stroke. The piston is actuated by the push rod assembly whose rounded end sets into a recess provided in the piston and whose threaded end connects with the brake operating linkage. A rubber boot, retained by two straps, covers the push rod assembly.

(2) *Functioning.*—(a) The function of the master cylinder is to displace the fluid from a central source into the wheel cylinders. The master cylinder also maintains the correct volume of fluid in the system under all temperature conditions. The return action of the master cylinder after each brake application automatically supercharges the system and replaces fluid lost by seepage or slight leaks.

(b) The master cylinder push rod is connected to the brake operating pedal by an adjustable yoke and rod end pin. Depressing the brake pedal causes movement of the push rod, causing the master cylinder piston assembly to move toward the rear end of the cylinder. A very slight movement of the piston and cup closes the bypass port. When the port is closed the pressure stroke starts and as the piston travels toward the end of the cylinder, fluid is forced out through the inner part of the check valve into the hydraulic lines to the wheel cylinders.

(c) When the pedal is released, the fast return of the piston cup by the piston return spring and the relatively slower return of fluid from the wheel cylinders and lines creates a vacuum in the master cylinder barrel. This momentary vacuum pulls additional fluid from the reservoir through the piston intake port past the lip of the primary cup and supercharges the system. When the brakes are in the "off" position, surplus fluid can escape through the compensating port and normalize the pressure in the system. The secondary cup prevents fluid from leaking out of the master cylinder into the boot.

(d) With the piston against the stop washer, the primary cup is held against the piston by the piston return spring, and the compensating port should then be open. This port serves to prevent pressure building up in the system due to expansion of the fluid. It also serves to permit additional fluid to enter the cylinder to prevent shortening the pedal stroke due to contraction or loss of the fluid. It is important that this port be open when the pedal is in the release position.

(e) A double check valve, held in the closed end of the cylinder by the piston cup return spring, is used to seal the cylinder to prevent air entering the system during the bleeding operation. The construction of this valve is such that fluid may be displaced into the line at very low pressure. Fluid passing into the lines as pressure is applied raises

the smaller part of the valve from its seat and permits the fluid to flow to the lines. Fluid passing into the cylinder on the return stroke can return by raising the entire valve from its seat. When pressure on the returning fluid drops below 6 to 8 pounds the piston return spring pressure seats the valve and the system is held under slight pressure which serves as a seal to prevent seepage. The check valve has no relation to pedal movement.

(3) *Specifications.*

Make	Type	Manufacturer's No.	Ordinance No.	White No.
Wagner Lockheed----	Combination----	LO-FE-661	C74141	352445

*b. Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

Pedal striking floor board.

Leaks in cylinder.

Insufficient fluid.

Clogged ports.

Improper valve action.

Worn primary cup.

Worn piston.

Repair or replace housing and check fittings.

Refill cylinder.

Clean.

Replace valve.

Replace cup.

Replace piston.

*c. Removal of assembly (figs. 20 and 21).—Tools:*

Pliers.

1/2-inch open-end wrench.

Hammer.

7/16-inch open-end wrench.

Brass drift.

Screw driver.

7/16-inch open-end wrench.

(1) Disconnect master cylinder brake rod from linkage. Remove lines.

Pliers.

Hammer.

Brass drift.

7/16-inch open-end wrench.

1/2-inch open-end wrench.

Remove cotter pin BFAX1DG and rod end pin BFFX1G holding brake rod assembly WI-344974 to power lever WI-344965. Disconnect front and rear brake lines from master cylinder by removing front line flared tube nut LO-FC-2577 from fitting LO-FC-2832D and rear line flared tube nut LO-FC-2578-E from fitting LO-FC-2679.

(2) Disconnect stop light switch. Screw driver.  
wires.

Remove stop light switch wires from terminals on switch.

(3) Remove master cylinder.  $\frac{9}{16}$ -inch open-end wrench.

Remove three nuts BBBX1C lock washers BECX1K and cap screws BCAX1CD that attach master cylinder LO-FD-2705B to bracket WI-344941.

*d. Disassembly of components (fig. 23).—Tools:*

1-inch open-end wrench.  $\frac{7}{8}$ -inch open-end wrench.

$\frac{3}{4}$ -inch open-end wrench. Screw driver.

(1) Remove stop light switch. 1-inch open-end wrench.  
outlet fittings and filler cap.  $\frac{3}{4}$ -inch open-end wrench.

Remove stop light switch FS-320-1 from rear of cylinder. Remove front brake line fitting LO-FC-2832 and rear brake line fitting LO-FC-2679 from cylinder.

(2) Remove brake rod.  $\frac{7}{8}$ -inch open-end wrench.

Loosen lock nut BBBX2A and unscrew yoke rod WI-344974 from master cylinder push rod.

(3) Remove boot and push rod. Screw driver.  
assembly.

Remove small boot strap LO-FC-1332 and large boot strap LO-FC-1333 holding boot LO-FC-1331 to push rod and cylinder, and

(4) Remove working parts. Screw driver.

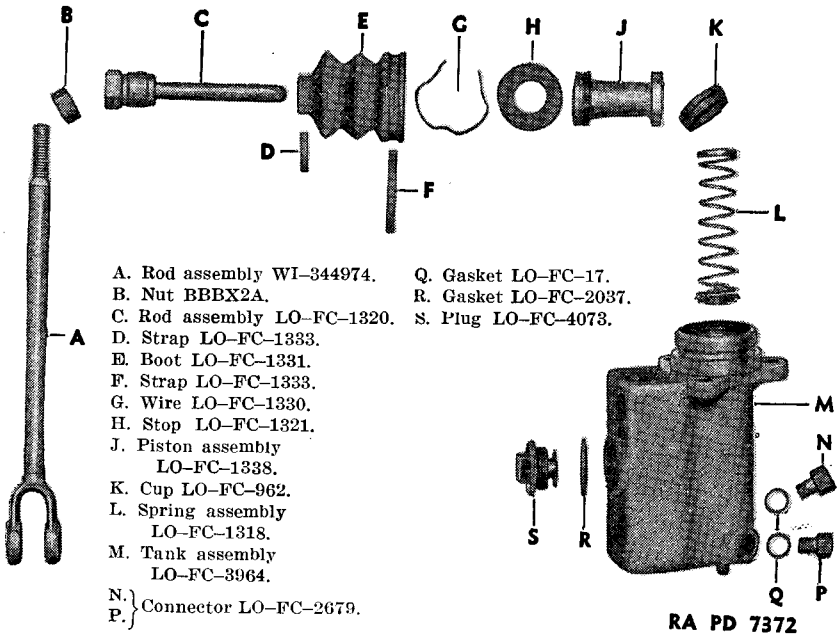


FIGURE 23.—Master cylinder—exploded view.

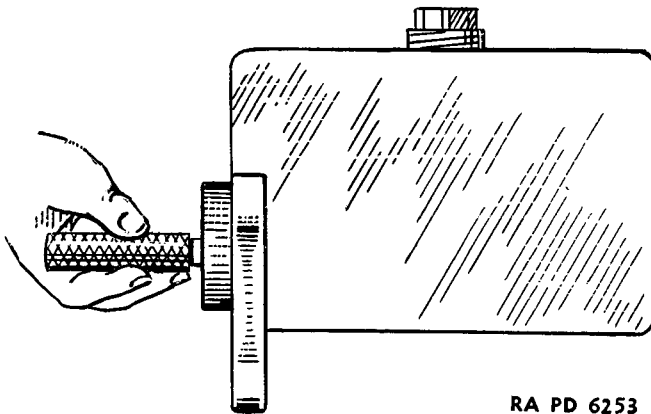


FIGURE 24.—Master cylinder “no-go” test.

(4) Inspect cylinder bore for pitting or scratching. Walls must be smooth; if pitted or scratched, they may be renewed by honing. After honing, check the diameter with a "no-go" gage to determine whether or not the diameter has been enlarged excessively (fig. 24). The gage should not enter the cylinder. If it does, discard the cylinder.

(5) Inspect all rubber parts. If mineral oil is present in brake system, the parts will be enlarged and very soft. Replace primary and secondary cups and check valve.

(6) Check piston fit in cylinder.

(7) Dip all parts in brake fluid before assembly.

(8) After assembly and installation of master cylinder in vehicle, bleed all brake lines as described in paragraph 16*d*(2). Check fluid level in supply tank. Level should be 1/2 to 3/4 inch from top of filler plug.

(9) Service data.

Cylinder diameter-----	1 1/2 inches
Piston clearance-----	0.001 to 0.004 inch
Piston return spring, pressure at 2 27/64 inches-----	12 pounds

*f. Reassembly of components* (figs. 22 and 23).—Tools:

Screw driver.	3/4-inch open-end wrench.
7/8-inch open-end wrench.	1-inch open-end wrench.

(1) Replace working parts. Screw driver.

Dip all parts in brake fluid. Install check valve, piston return spring, piston primary cup, piston, piston stop washer, and lock wire.

(2) Replace boot and push rod assembly. Screw driver.

Slip small end of boot over push rod and set push rod into piston recess. Slip large end of boot over cylinder flange and replace two straps on ends of boot. Allow approximately 1/8-inch clearance between end of push rod and master cylinder piston.

(3) Replace yoke rod. 7/8-inch open-end wrench.

Screw threaded end of yoke rod end nut into nut and into push rod. Number of turns to be made depends upon the length of pedal stroke required and will be determined after installation of master cylinder in vehicle.

(4) Replace filler cap, fittings, and stoplight switch. 3/4-inch open-end wrench. 1-inch open-end wrench.

Replace filler cap and gasket. Replace front and rear brake line fittings. Replace stop light switch.

*g. Installation of assembly.—Tools:*

$\frac{9}{16}$ -inch open-end wrench. Screw driver.

$\frac{1}{2}$ -inch open-end wrench. Pliers.

$\frac{7}{16}$ -inch open-end wrench.

(1) Replace master cylinder.  $\frac{9}{16}$ -inch open-end wrench.

Place cylinder in position. Replace three bolts, lock washers, and nuts holding cylinder to bracket and tighten nuts.

(2) Connect stop light switch wires. Screw driver.

Replace wires on stop light switch wire terminal.

(3) Connect brake lines to master cylinder.  $\frac{1}{2}$ -inch open-end wrench.  
 $\frac{7}{16}$ -inch open-end wrench.

Screw front and rear brake lines flared tube nuts into fittings on cylinder and tighten nuts.

(4) Connect yoke rod to linkage. Pliers.

Set yoke rod into position and insert rod end pin and cotter pin.

(5) Bleed brakes and replace fluid. See paragraph 16*d*(2).

(6) Adjust brake pedal. See paragraph 12*d*(2).

**14. Vacuum power booster** (fig. 25).—*a. Description.*—The brake vacuum booster is a sliding valve, reactionary cylinder, pusher type unit. A reaction type unit is so connected to the master cylinder and brake pedal that it supplies a maximum percentage of the power applied to the master cylinder. A definite proportion of the braking force is applied by the operator, giving him accurate control of the total braking force and permits him to “feel” the brake at all times.

(1) *Construction* (fig. 26).—(a) The vacuum booster cylinder or housing is provided with two end plates. The vacuum and atmospheric line fittings are connected to the rear plate.

(b) The booster piston and piston rod assembly are set in the front end of the cylinder unit when the booster is in the released position. The tubular piston rod is provided with ports in the front and rear end for passage of vacuum and air through the sliding valve mechanism.

(c) Within the tubular piston rod is a sliding plunger type valve having ports in the rear.

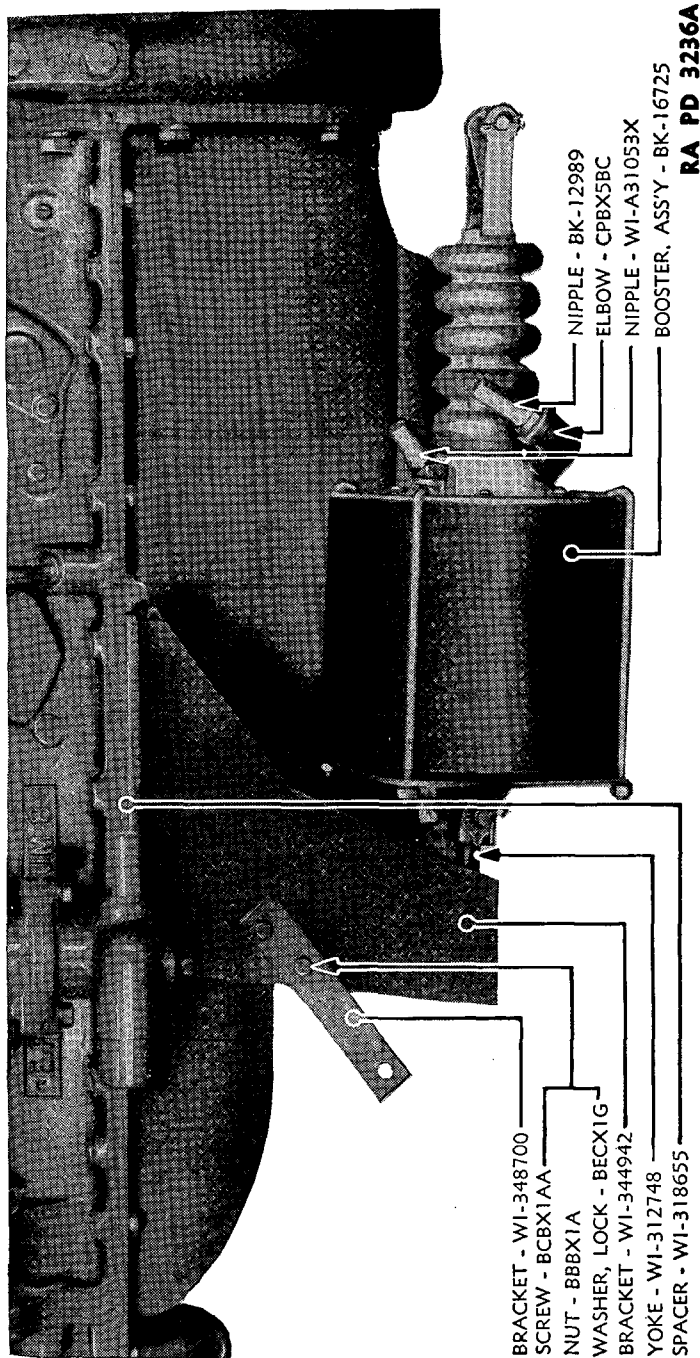


FIGURE 25.—Brake vacuum booster assembly, installed.

(d) Surrounding the piston rod, on the rear end, are a cover filled with hair for filtering the air and a rubber guard which serves to receive the air from the atmospheric inlet nipple and direct it toward the intake ports on the rear end of the piston rod.

(2) *Functioning.*—(a) With the brake in the released position and the engine running, the vacuum in the engine manifold draws the air from the booster through the check valve and creates a vacuum in the booster shell. This vacuum is present on both sides of the piston, because, in the released position, the sliding plunger type valve is in its extreme forward position and the front ports in the piston rod are so connected that air can be drawn from the front side of the piston as well as from the rear (fig. 27(A)).

(b) Air from the air cleaner at atmospheric pressure enters the piston rubber guard through the nipple in the rear end plate and enters the piston rod through the port holes in the rear end of the rod. With the brake pedal in the released position, the front end of the plunger is closed off by the piston rod cap and by the front flange on the plunger, thereby preventing flow of air to the front piston face.

(c) Depressing the brake pedal approximately 1 inch will move the valve rod about  $\frac{1}{4}$  inch toward the rear, pulling the plunger with it and sealing the portholes in the piston rod that lead to the front of the piston (fig. 27(B)). The vacuum will thereby be cut off from the front side of the piston. This position, with the front side of the piston cut off from the vacuum and the atmosphere stopped from entering against the front piston face, is termed the lap position. Any further depression of the brake pedal opens the front end of the plunger, through which the atmosphere can flow to the front side of the piston (figs. 27(C) and (D)). This differential in pressure between the vacuum on the rear face and the atmospheric pressure causes the booster piston to move toward the rear, pushing the end yoke and power lever toward the rear, and thereby applying pressure to the master cylinder push rod and actuating the hydraulic brake system.

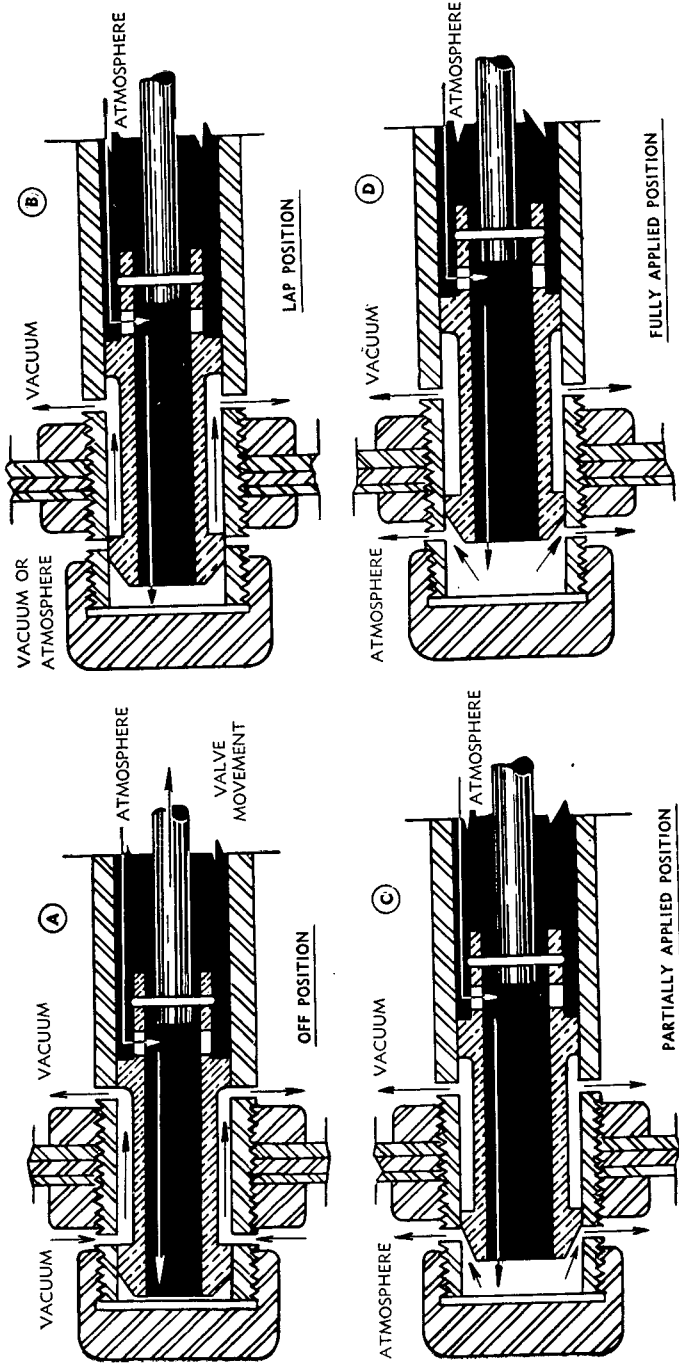
(d) The amount of brake application depends upon the position in which the operator stops the forward motion of the brake pedal. When the operator stops depressing the pedal, the booster valve rod remains in its assumed position and does not move farther, since the valve rod and pedal are directly connected by the brake linkage and do not move independently. The piston will continue to be pushed by the air being admitted until the piston rod has been moved toward the rear a sufficient amount to move the front portholes in the piston rod over the plunger flange, and thereby close off the piston front face from the atmosphere. The valve will then be in the lap position





- A. Plate BK-16744.  
 B. { Nut BBBX1A.  
   Washer, lock, BECX1G.  
 C. Stud BK-15511.  
 D. Cylinder assembly BK-16754.  
 E. Retainer BK-16739.  
 F. Plate BK-16740.  
 G. Plate BK-16742.  
 H. Washer BK-10031.  
 J. Spring BK-10033.  
 K. Seal BK-10550.  
 L. Plate assembly BK-16746.  
 M. Hair BK-11192.  
 N. Gasket BK-16734.  
 P. Cover BK-16800.  
 Q. { Screw BCNX2AC.  
   Washer, lock BECX1G.  
 R. Oil wick BK-16736.  
 S. Bushing BK-14678.  
 T. Pin, cotter, BFAX1CD.  
 U. Pin BK-13290.  
 V. End, yoke, BK-13762.  
 W. Yoke assembly BK-13761.  
 X. Nut BK-13706.  
 Y. Guard BK-15380.  
 Z. Felt BK-15400.  
 AA. Rod BK-15175.  
 BB. Nut BK-16735.  
 CC. Seal BK-14006.  
 DD. Cap BK-15176.  
 EE. Plug Q52E.  
 FF. Plunger BK-15253.  
 GG. Rod BK-15174.  
 HH. Retainer BK-13768.  
 JJ. Washer BK-13769.  
 KK. Felt BK-13770.  
 LL. Ring BK-13772.  
 MM. Spring BK-15255.  
 NN. Washer BK-15258.  
 PP. Staple BK-14710.  
 QQ. Ring BK-16751.  
 RR. Nut BK-14077.  
 SS. Guard BK-13866.

FIGURE 26.—Brake vacuum booster assembly—sectionalized view.



RA PD 7436

Figure 27.—Brake vacuum booster valve operation.

with both the vacuum and atmosphere cut off from the piston front face.

(e) When pressure is removed from the brake pedal, the valve rod is moved toward the front, admitting vacuum to the front side of the piston and cutting off the atmosphere. The vacuum balance on both sides of the piston is restored and the brakes are released.

(3) *Specifications.*

Make	Model	Manufacturer's No.	Ordnance No.	White No.
(Bragg-Kliesrath) Bendix.....	RP66	BK-16725	D33796	D17799

b. *Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

Excessive pedal pressure.	Replace end plates, cylinder packing ring, or piston felt and packing.
Leak in booster.	
Improper valve action.	Adjust.
Worn valve plunger.	Replace plunger.
Leaky check valve.	Replace check valve stem or gasket
Clogged air cleaner.	Clean.

c. *Removal of assembly (fig. 25).*

(1) Disconnect vacuum line. Screw driver.

Loosen screw in clamp CMAX1F holding hose WI-A43843X to booster and remove hose from nipple WI-A31053X.

(2) Disconnect air cleaner line. Screw driver.

Loosen screw in clamp WI-A29802 holding hose WI-348798 to booster and remove hose from nipple WI-A31053X.

(3) Disconnect front end of Pliers.

booster.

Remove cotter pin BFA11CD and rod end pin BFFX1G holding booster yoke to yoke WI-312748 on engine bracket.

(4) Disconnect rear end of Pliers.

booster.

Remove cotter pin BFA11CD and rod end pin BK-13290 holding booster yoke end assembly BK-13761 to power lever WI-344965. Remove booster assembly.

*d. Disassembly.* (fig. 28).—Tools:

$\frac{7}{16}$ -inch socket wrench.	1-inch open-end wrench.
$\frac{7}{8}$ -inch open-end wrench.	Screw driver.
$1\frac{1}{4}$ -inch open-end wrench.	Pliers.
$\frac{3}{8}$ -inch open-end wrench.	

(1) Remove front end stud  $\frac{7}{16}$ -inch socket wrench.  
plate.

Remove four nuts BBBX1A and lock washers BECX1G holding four hook studs BK-15511 to stud plate BK-16749, and remove studs and plate.

(2) Remove piston and rod None.  
assembly from booster.

Slide piston assembly BK-16750 and rear end plate and guard out of booster cylinder assembly BK-16754. Remove rear end plate gasket BK-16738.

(3) Remove piston from rod.	$\frac{7}{8}$ -inch open-end wrench.
	$1\frac{1}{4}$ -inch open-end wrench.

Set piston assembly in radius block or in vise and remove piston rod cap BK-15176, and seal BK-14006 from front end of piston. Remove nut BK-16735 holding piston to rod. In the order listed, remove following parts from piston rod: piston felt retainer BK-16739, ring BK-16751, felt assembly BK-16737, front plate BK-16740, oil wick BK-16736, rear plate BK-16742, and nut BK-16735.

(4) Remove rear end plate Screw driver.  
assembly.

Remove three machine screws BCNX2AC and lock washers BECX1G holding dust cover BK-16800 to rear end plate. Remove rear end plate w/bushing assembly BK-16746 by sliding off front end of piston rod. Remove cover gasket BK-16734.

(5) Disassemble rear end plate Screw driven.  
and seal.

Remove end plate spring BK-10033, washer BK-10031 and seal BK-10550 from end plate. If necessary, the end plate bushing BK-16744 can be pressed or driven out of the end plate.

(6) Remove dust cover.	None.
------------------------	-------

Slip end of rubber guard off flange on dust cover BK-16800 and slide cover off piston rod. Remove felt BK-15400 from piston rod.

(7) Remove piston rod rubber guard. None.

Slip end of guard BK-15380 off flange on end yoke and remove from piston rod.

(8) Remove valve rod yoke end.  $\frac{3}{8}$ -inch open-end wrench.

Note number of threads extending back of hexagon nut. Back off nut BK-14077 far enough to allow the trunnion holding clip BK-18768 to be slipped back off the trunnion. After the clip is removed, the two valve rod yoke ends BK-13762 can be removed from the side of the trunnion. Unscrew trunnion BK-13763 from valve rod and remove clip and adjusting nut. Slip off valve rod guard BK-13866.

(9) Remove piston rod end yoke and nut. 1-inch open-end wrench.

Note number of threads on piston rod extending through end yoke. Unscrew end yoke BK-13703 and remove nut BK-13706.

(10) Disassemble valve rod and plunger (fig. 29). Pliers.

After removal of the valve rod yoke end and adjusting nut, and the piston rod front cap and seal, the valve assembly can be slipped out of the piston rod. Remove plunger pin BK-13980 and detach plunger BK-15253 from valve rod BK-15174. Remove valve rod spring BK-15255 and spring washer BK-15258 from the rear end of the piston rod. Remove snap ring BK-13772, felt BK-13770, and felt retainer BK-13768.

*e. Maintenance and adjustments.*—(1) Inspect all rubber parts and replace if torn or swollen.

(2) Inspect piston felt and packing and replace if torn or shredded.

(3) Inspect rear end plate. Replace or rebush if sprung enough to cause leaks.

(4) Inspect piston plates and replace if bent.

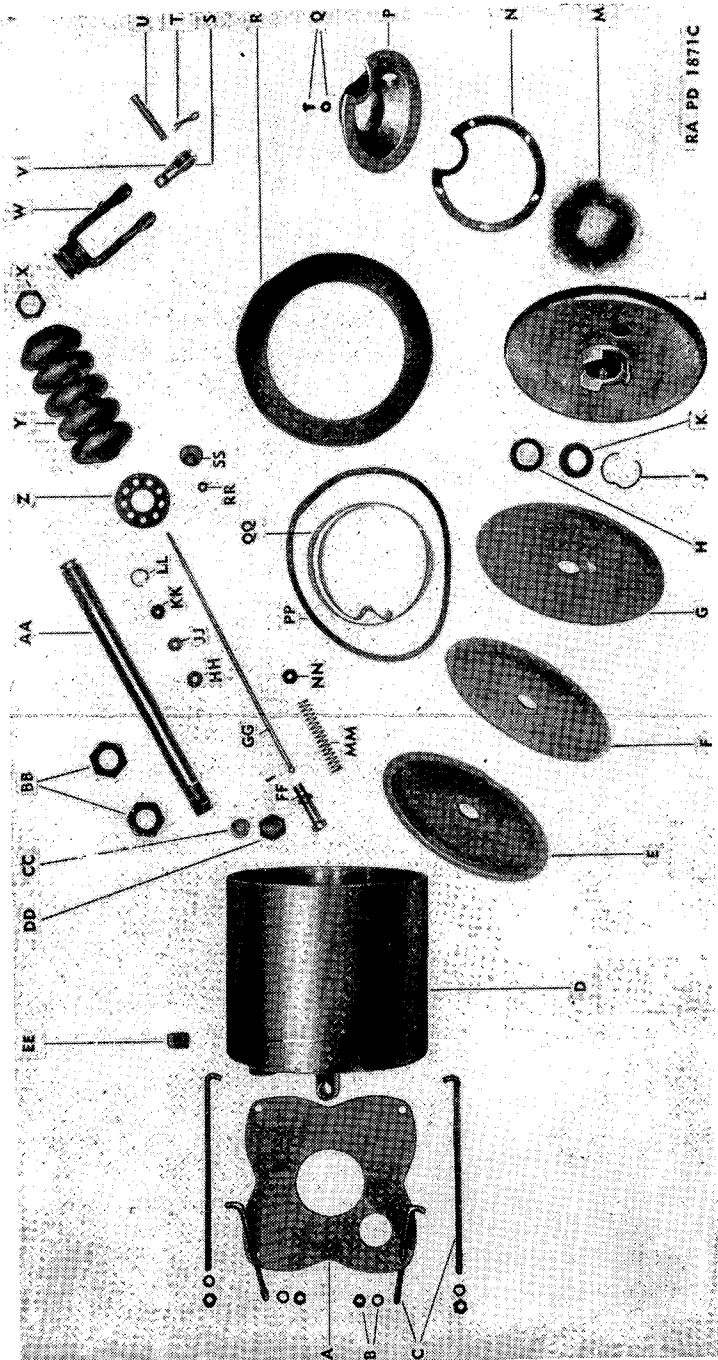
(5) Inspect rear end plate packing ring and replace if torn.

(6) Inspect piston rod seal and replace if worn.

(7) Inspect valve rod and plunger. If plunger is worn, replace with new unit.

(8) Lubricate piston felt before assembly.

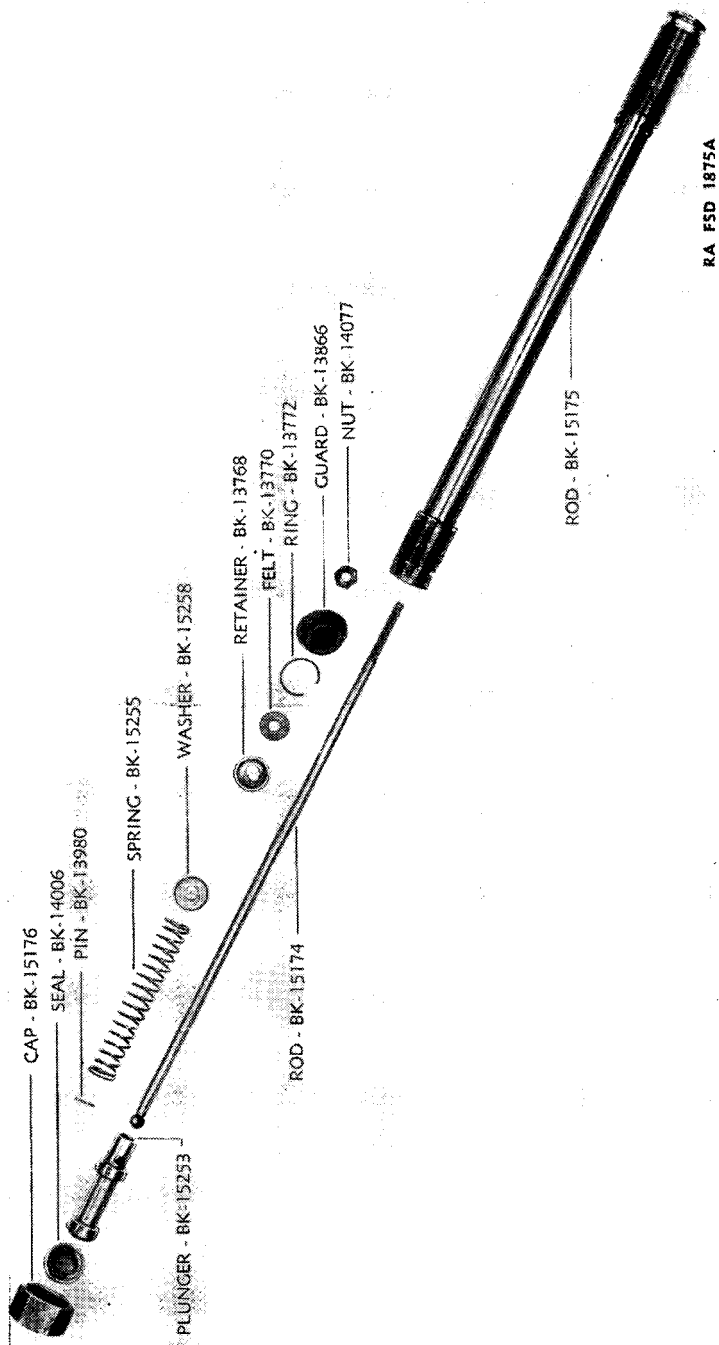
(9) Lubricate parts of valve rod which slip through valve rod guide before assembly.



- A. Plate BK-16754.  
 B. { Nut BBX1A.  
   Washer, lock BECX1G.  
 C. Stud BK-15511.  
 D. Cylinder assembly BK-16754.  
 E. Retainer BK-16739.  
 F. Plate BK-16740.  
 G. Plate BK-16742.  
 H. Washer BK-10031.  
 J. Spring BK-10033.  
 K. Seal BK-10550.  
 L. Plate assembly BK-16746.  
 M. Hair BK-11192.  
 N. Gasket BK-16734.  
 P. Cover BK-16800.  
 Q. { Screw BCN2AC.  
   Washer, lock, BECX1G.  
 R. Oil wick BK-16736.  
 S. Bushing BK-14678.  
 T. Pin, cotter, BFX1CD.  
 U. Pin BK-13290.  
 V. End, yoke, BK-13762.  
 W. Yoke assembly BK-13761.  
 X. Nut BK-13706.  
 Y. Guard BK-15380.  
 Z. Felt BK-15400.  
 AA. Rod BK-15175.  
 BB. Nut BK-16735.  
 CC. Seal BK-14006.  
 DD. Cap BK-15176.  
 EE. Plug Q52E.  
 FF. Plunger BK-15253.  
 GG. Rod BK-15174.  
 HH. Retainer BK-13768.  
 JJ. Washer BK-13769.  
 KK. Felt BK-13770.  
 LL. Ring BK-13772.  
 MM. Spring BK-15255.  
 NN. Washer BK-15258.  
 PP. Staple BK-14710.  
 QQ. Ring BK-16751.  
 RR. Nut BK-14077.  
 SS. Guard BK-13866.

FIGURE 28.—Brake vacuum booster—exploded view.





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FIGURE 29.—Brake vacuum booster valve mechanism.

(10) Lubricate booster with 2 ounces of oil, engine, SAE 10, after assembly.

*f. Reassembly* (figs. 28 and 29).—Tools:

Pliers.

1-inch open-end wrench.

$\frac{3}{8}$ -inch open-end wrench.

$\frac{1}{4}$ -inch open-end wrench.

$\frac{7}{8}$ -inch open-end wrench.

Press.

$\frac{7}{16}$ -inch socket wrench.

(1) Assemble valve rod.

Pliers.

Replace felt retainer, felt, and snap ring in rear end of piston rod. Replace valve rod washer in piston rod. Set ball of valve rod into plunger, replace plunger pin, and after setting valve rod spring on rod, replace entire assembly into piston rod.

(2) Replace piston rod end yoke and nut. 1-inch open-end wrench

Replace nut on rear end of piston rod. Screw end yoke on and note number of threads extending through yoke. After setting number of threads, tighten up nut against yoke.

(3) Replace valve rod yoke end.  $\frac{3}{8}$ -inch open-end wrench.

Replace valve rod guard. Screw adjusting nut on rear end of valve rod and replace trunnion holding clip. Screw trunnion on rod, set two valve rod yoke ends on sides of trunnion and move the clip forward to hold the ends on the trunnion. Tighten adjusting nut and check the number of threads extending back of the nut.

(4) Replace piston rod rubber guard. None.

Slip the end of the guard onto the front end of the piston rod and onto the piston rod end yoke flange.

(5) Replace dust cover. None.

Replace felt on piston rod. Replace dust cover on rod and slip piston rod guard over cover flange.

(6) Reassemble rear end plate and seal. Press.

Press bushing into end plate if it has been removed. Replace seal, washer and spring in end plate.

(7) Replace rear end plate. None.

Slip plate on piston rod and replace three machine screws that hold dust cover to end plate.

(8) Replace piston on rod.  $\frac{7}{8}$ -inch open-end wrench.  
 $1\frac{1}{4}$ -inch open-end wrench.

Replace piston nut on front end of rod. Replace rear piston plate, oil wick, front plate, felt, ring, and felt retainer. Replace piston nut and the piston rod front cap and seal.

(9) Replace piston and rod assembly. None.

Slide entire piston and rod assembly into booster cylinder.

(10) Replace front end plate.  $\frac{7}{16}$ -inch socket wrench.

Set four hook studs and end plate in position and replace four nuts and lock washers on studs.

*g. Installation of assembly.*

(1) Connect rear end of booster. Pliers.

Set booster in position and replace rod end pin and cotter pin holding booster end yoke to power lever.

(2) Connect front end of booster. Pliers.

Replace rod end pin and cotter pin holding booster to yoke on engine bracket.

(3) Connect vacuum end air lines. Screw driver.

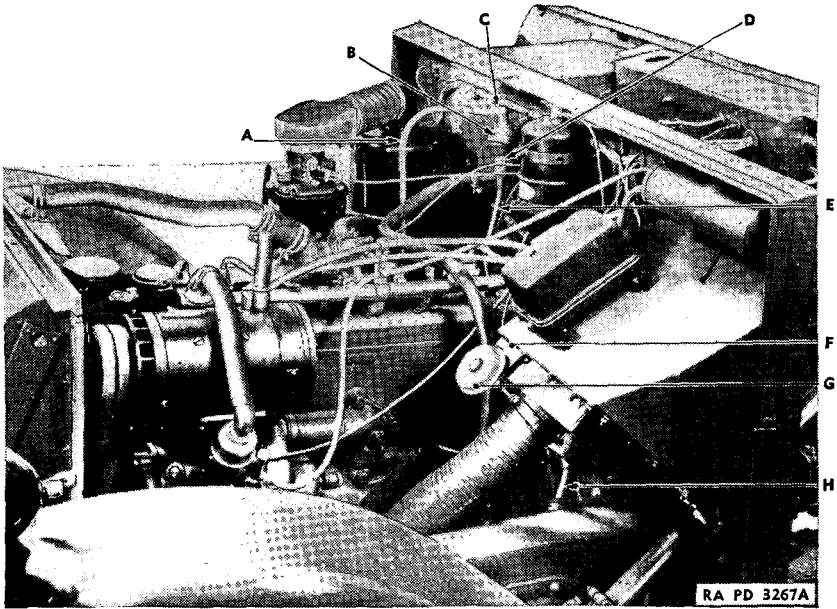
Replace hoses on nipples on booster and tighten hose clamps.

(4) Adjust linkage.

Proceed as outlined in paragraph 12*d*.

*h. Test.*—(1) Remove filler pipe plug in booster front end plate and connect in a vacuum gage.

(2) Start the engine and note the reading on the gage. It should show a vacuum of 17 to 20 inches. Stop the engine and note if vacuum is retained for a reasonable length of time. If the gage shows a rapid falling off (more than 10 inches in 10 seconds), it indicates a leak in the cylinder, vacuum line, check valve, or inlet manifold connector. Leakage in the vacuum booster may often be corrected by a thorough lubrication of the unit.



- |   |   |
|---|---|
| <p>A. Line assembly WI-352223.</p> <p>B. {<br/>         Valve assembly BK-16864.<br/>         Screw, cap, BCBX1AB.<br/>         Nut BBBX1A.<br/>         Washer, lock, BECX1G.</p> <p>C. Elbow WI-A23847X.</p> <p>D. {<br/>         Nipple WI-A33829X.<br/>         Plug WI-A9203X.<br/>         Pipe assembly WI-352225.<br/>         Clip WI-A14193X.</p> <p>E. {<br/>         Screw, cap, BCBX1AA.<br/>         Nut BBBX1A.<br/>         Washer, lock, BECX1G.</p> | <p>F. {<br/>         Bracket BK-16819.<br/>         Screw BCBX1AA.<br/>         Nut BBBX1A.<br/>         Washer, lock, BECX1G.<br/>         Cleaner assembly BK-11871.<br/>         Adapter BK-15419.<br/>         Screw, machine, BCNX2AE.</p> <p>G. {<br/>         Nut BBKX2C.<br/>         Washer, lock, BECX1E.<br/>         Hose AQRX1.<br/>         Clamp CMAX1B.</p> <p>H. {<br/>         Hose AQRX1.<br/>         Clamp CMAX1F.</p> |
|---|---|

FIGURE 30.—Brake vacuum booster check valve and air cleaner, installed.

15. Vacuum booster air cleaner and check valve (fig. 30).—  
*a. Air cleaner.*—

(1) *Description.*—The remote air cleaner is designed to filter the air entering the vacuum booster cylinder. It is mounted on the dash at the left side of the engine compartment and is connected to the booster cylinder air intake by a tube.

(2) *Specifications.*

Make	Manufacturer's No.	Ordinance No.	White No.
Bendix.....	BK-11871	A167685	A43905

(3) *Removal of assembly.*

Air cleaner removal. Screw driver.  
 $\frac{3}{8}$ -inch open-end wrench.

Loosen and remove two nuts BBKX2C, lock washers BECX1E, and screws BCNX2AE that attach adapter BK-15419 to bracket. Loosen hose clamp and slip off hose. Remove air cleaner assembly.

(4) *Disassembly of components.*

Disassemble air cleaner. Screw driver.  
 $1\frac{5}{16}$ -inch open-end wrench.

Pry off snap ring BK-11873. Lift off cover BK-11848. Take out hair BK-11192 and remove stud BK-11872 from cleaner BK-11391. Unscrew adapter BK-15419 from stud.

(5) *Maintenance.*—Wash hair thoroughly in solvent, dry-cleaning, dry and saturate with oil, engine, SAE 10. Clean out all holes before reassembly.

(6) *Reassembly of components.*

Reassemble air cleaner. Screw driver.  
 $1\frac{5}{16}$ -inch open-end wrench.

Screw stud into adapter and tighten. Place cleaner on stud. Replace hair. Put on cover and snap lock ring into place.

(7) *Installation of assembly.*

Replace air cleaner. Screw driver.  
 $\frac{3}{8}$ -inch open-end wrench.

Place adapter on bracket lining-up screw holes. Replace screws, lock washers and nuts and tighten. Replace hose and tighten hose clamp.

*b. Check valve* (fig. 30).—(1) *Description.*—A check valve mounted on the dash at the right side of the engine compartment is provided

in the vacuum line of the brake booster between the engine intake manifold and the power cylinder vacuum outlet. The function of the check valve is to seal the vacuum in the power cylinder when the engine stalls. If the engine should stall, the check valve will drop to its closed position, thereby holding a vacuum in the cylinder which will be sufficient to provide at least one maximum power brake application.

(2) *Specifications.*

Make	Manufacturer's No.	Ordinance No.	White No.
Bendix.....	BK-16864	A167374	A33439

(3) *Removal of assembly.*

Remove check valve.

$\frac{7}{8}$ -inch open-end wrench.

$\frac{7}{16}$ -inch open-end wrench.

Loosen and remove two flared tube nuts WI-S27X5 from check valve BK-16864 inlet and outlet fittings. Loosen and remove two bolts WI-S2BX2, lock washer WI-S4BX7, and nuts WI-S38X1 from bracket BK-16819; mount check valve to dash and remove valve.

(4) *Disassembly of components.*

Disassemble check valve.

Screw driver.

Remove elbow WI-A23847X and nipple WI-A33829X. Slide rubber bracket off valve. Remove four machine screws BK-61-S41 and lock washers BECX1E and remove valve cap BK-16645 and gasket BK-16640. Lift valve stem assembly WI-364629 out of valve body BK-16639.

(5) *Maintenance.*—Inspect valve stem and replace if bent or worn.

(6) *Reassembly of components.*

Reassemble check valve.

Screw driver.

Replace valve stem in body and replace gasket, cap, screw, and lock washers. Slip rubber bracket over body and replace flared tube fittings.

(7) *Installation of assembly.*

Replace check valve.

$\frac{7}{8}$ -inch open-end wrench.

Set valve in place and replace two bolts, nuts, and lock washers. Connect vacuum line flared tube nuts to fittings.

**16. Hydraulic fluid lines and connections** (fig. 16).—*a. Description.*—(1) Two main fluid lines for the hydraulic service brake

system start respectively from the left and right outlet fittings of the master cylinder, which is mounted inside of the frame rail on the master cylinder bracket. The  $\frac{1}{4}$ -inch pipe which feeds the front wheel brake lines starts from the left hand outlet fitting of the master cylinder, passes through the frame, and runs along the inside of the frame to the tee inlet fitting. The line is held by clips attached to the frame, as is the tee. The tee has two outlet openings, one facing forward and the other toward the rear. The inverted flared tube nut at the end of the left wheel cylinder pipe screws into the rear opening

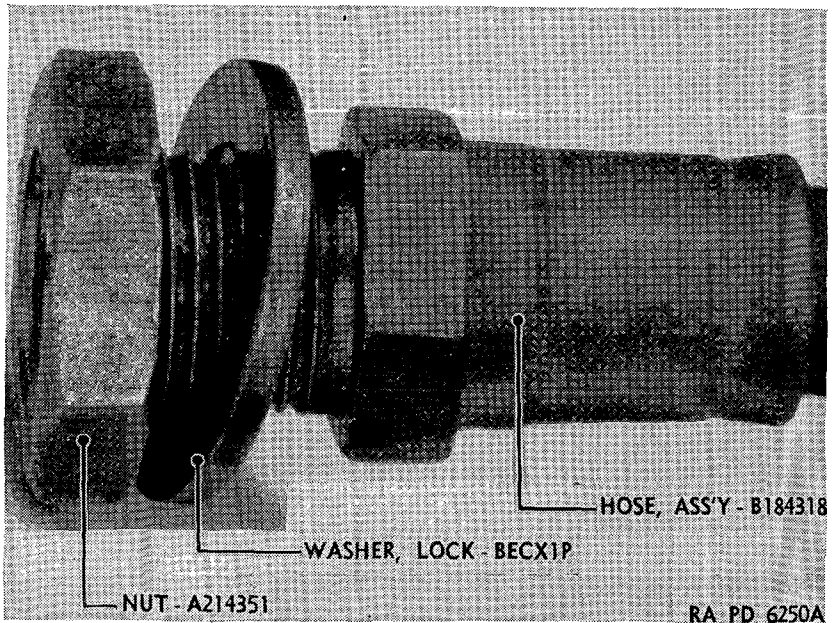


FIGURE 31.—Front wheel brake line connection at frame.

and connects the pipe to the tee. The pipe then runs backward along the inside of the frame rail until it is approximately opposite the wheel cylinder, at which point it is connected to the wheel cylinder flexible hose fitting by means of another inverted flared tube nut. The flexible hose fitting is a special type (fig. 31) which passes through the frame from the wheel side and is attached to the frame. The flexible hose completes the line from the tee to the left wheel cylinder, where it screws into the cylinder inlet fitting.

(2) The inverted flared tube nut at the end of the pipe leading to the right-hand wheel cylinder screws into the front end of the tee. After leaving the tee, the pipe crosses to the right-hand frame rail, along the

front cross member of the frame, and then runs backward along the inside of the frame rail to a point opposite the wheel cylinder. At this point it is connected to the wheel cylinder flexible hose fitting in the same manner as the left-hand pipe. The pipe is held by three clips bolted to the front cross member. It is connected to the right-hand wheel cylinder by a flexible hose similar to the one used on the left side.

(3) The  $\frac{5}{16}$ -inch feed pipe for the rear brakes is attached to the outlet fitting on the right side of the master cylinder. It then passes through two rubber grommets in the frame cross member gusset and runs back along the inside of the frame rail to the rear hose bracket, which is bolted on the frame. The pipe is secured by clips bolted to the frame rail. The pipe is connected to the rear flexible hose union by means of an inverted flared tube connector in the same manner used in connecting to front wheel cylinder hose fittings. The flexible hose fitting, in this case, passes through the bracket from the rear and is fastened to the bracket. The flexible hose connects to the rear tee by threading the hose nipple into the tee's top opening. The tee is bolted to the rear axle housing. The left- and right-hand outlet openings of the tee are connected to the left and right rear wheel cylinder inlet fittings by two  $\frac{1}{4}$ -inch pipes threaded into the tee by means of two inverted flared tube nuts. The ends of the pipes going to wheel cylinders are screwed on to their respective connectors by flared tube nuts.

*b. Trouble shooting.*

<i>Symptom and probable cause</i>	<i>Probable remedy</i>
(1) Loss of fluid in system.	
Loose connection.	Retighten.
Damaged flared tube end.	Straighten with flaring tool or replace tube.
Ruptured tube or hose.	Replace.
(2) Failure of one or more wheel brakes to operate.	
Plugged flexible hose.	Clear hose if possible, or replace.
Plugged tube.	Replace.

*c. Removal of assemblies.—Tools:*

- |  |                                       |
|--|---------------------------------------|
| $\frac{7}{16}$ -inch open-end wrench.  | $\frac{5}{8}$ -inch open-end wrench.  |
| $\frac{15}{16}$ -inch open-end wrench. | $\frac{3}{4}$ -inch open-end wrench.  |
| $\frac{1}{2}$ -inch open-end wrench.   | $\frac{9}{16}$ -inch open-end wrench. |

- |  |  |
|--|--|
| (1) Remove front wheel cylinder hose assemblies. | $\frac{7}{16}$ -inch open-end wrench.  |
|  | $\frac{15}{16}$ -inch open-end wrench. |



Disconnect flared tube nuts WI-30828X at frame ends of hoses. Disconnect each hose fitting from frame by removing holding nut and lock washer. Remove hose assemblies LO-FC-3551B from wheel cylinder inlet connector LO-FC-672 by unscrewing hose nipples WI-A-13620X.

(2) Remove line assembly,  $\frac{7}{16}$ -inch open-end wrench.  
(front tee to left-hand wheel).

Disconnect inverted flared tube nuts WI-30828X at tee LO-FC-3048 and at hose fitting and drop line assembly WI-S69X5.

(3) Remove line assembly,  $\frac{7}{16}$ -inch open-end wrench.  
(front tee to right-hand wheel).

Disconnect inverted flared tube nuts WI-30828X at tee and at hose fitting. Detach clips WI-A27593X, holding line assembly WI-S69X56 to frame, and lower assembly.

(4) Remove line assembly  $\frac{7}{16}$ -inch open-end wrench.  
(master cylinder to front tee).

Disconnect inverted flared tube connectors LO-FC-2832 (front), LO-FC-2679 (rear), at tee and master cylinder outlet fitting and lower line assembly WI-S69X48.

(5) Remove front tee.  $\frac{1}{2}$ -inch open-end wrench.

Take out bolt BCBX1BA, nut BBBX1B and lock washer BECX1H holding tee LO-FC-3048 to frame.

(6) Remove line assembly,  $\frac{1}{2}$ -inch open-end wrench.  
(master cylinder to rear hose connection).

Disconnect flared tube connectors LO-S-FB-1079B at master cylinder rear outlet fitting and at rear hose fitting. Detach clip WI-A27593X holding line assembly WI-S70X60 to frame, draw assembly through two rubber grommets WI-A10766X and remove.

(7) Remove hose assembly,  $\frac{5}{8}$ -inch open-end wrench.  
(rear connection to axle tee).  $\frac{3}{4}$ -inch open-end wrench.  
 $\frac{5}{16}$ -inch open-end wrench.

Remove nut WI-A28153X and lock washer BECX2P holding hose fitting to bracelet WI-344941. Disconnect hose assembly WI-A35814 at tee and lower assembly.

(8) Remove line assembly  $\frac{7}{16}$ -inch open-end wrench.  
(rear axle tee to left-hand wheel).  $\frac{9}{16}$ -inch open-end wrench.

Disconnect inverted flared tube nut WI-A308281X at tee and flared tube nut WI-B17384X at wheel cylinder and remove line assembly WI-S72X9.

(9) Remove line assembly  $\frac{7}{16}$ -inch open-end wrench.  
(rear axle tee to right-hand wheel)  $\frac{9}{16}$ -inch open-end wrench.

After removing bolt TD-3X82, nut BBBX1D, and lock washer BECX1L which hold pipe clip to differential housing, remove cap screw BANX1CA and lock washer BECX1K holding remaining pipe clip to axle housing and proceed as in (8) above.

(10) Remove rear tee.  $\frac{5}{8}$ -inch open-end wrench.

After removing line connections at tee, take out cap screw BANX1CC and lock washer BECX1K holding tee WI-A35811X to housing.

*d. Maintenance.—(1) Pipe assemblies.*—Very little maintenance is required on the hydraulic lines since damaged parts can usually be replaced as assemblies. However, if no pipe assemblies are available, they can be made as follows:

(a) Cut a straight piece of steel tubing to the required length, using cutter shown in figure 32. It is very important that the tubing be cut at right angles to its length, since it is to be flared.

(b) Remove the bur left inside the tubing. Use the reamer attached to the cutting tool or the reamer furnished with the flaring tool.

(c) Cut the pipe assembly which is to be replaced and remove the end fittings.

(d) Place each fitting on the end of the new tube which is to be flared and clamp the end of the tube in the flaring tool (fig. 33).

(e) Form the flare by using the mandrel.

(2) *Bleeding the line.*—Bleeding the line consists of displacing all the air which may have accumulated in the system with the fluid. It is done by forcing the fluid through the lines until it flows from the bleeder valve on each of the four wheel cylinders in a solid stream. This is necessary only when some part of the hydraulic mechanism has been disconnected or the fluid in the supply tank has become too low. For refilling, use only fluid, brake, hydraulic. Proceed as follows:

(a) Remove the two screws holding the floor plate over the master cylinder filler plug and remove plate.

(b) Unscrew the filler plug on top of the tank.

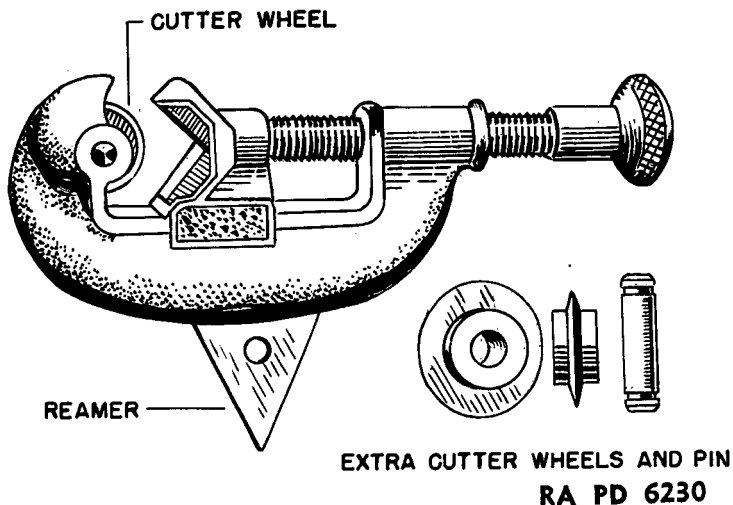


FIGURE 32.—Pipe cutter and reamer.

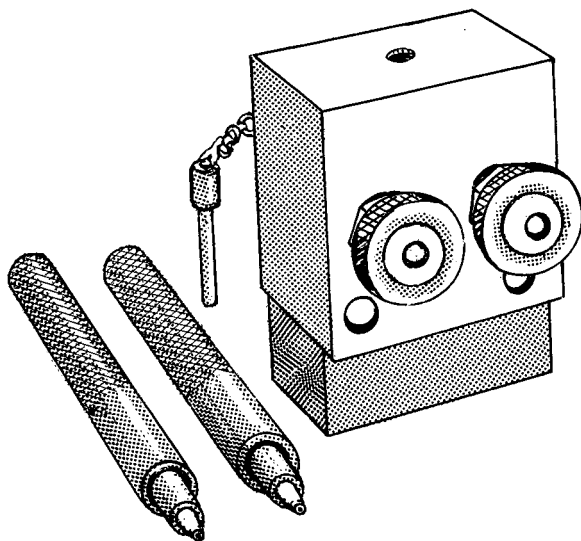


FIGURE 33.—Pipe flaring tool.

(c) Using a Wagner Lockheed fluid filler, insert nozzle into filler hole as shown in figure 34.

(d) Starting with the wheel cylinder farthest from the master cylinder, remove the bleeder valve cap screw. After this the nipple at the end of the rubber drain tube may be screwed in place (fig. 35).

(e) Slide the bleeder valve wrench over the rubber tube. Place the free end of the tube below the level of the brake fluid in a clean glass container comparable to a 1-pint jar.

(f) Open the valve three-quarters of a turn.

(g) Slowly depress the foot pedal a number of times until fluid

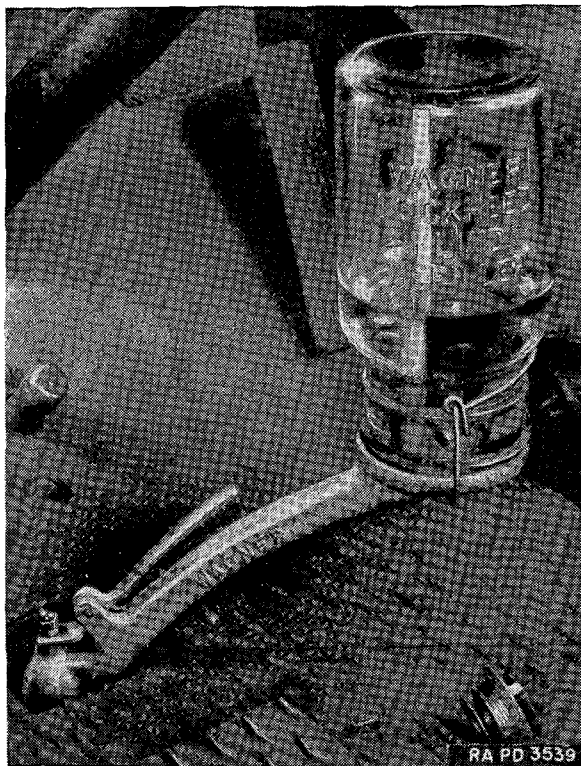


FIGURE 34.—Hydraulic brake system fluid replacement.

issues from the end of the tube in a solid stream without air bubbles. Allow the return spring to return the pedal to its release position.

(h) After a cylinder has been bled, do not again depress the brake pedal until the valve of the next cylinder is opened; otherwise air may be forced over from a line yet to be bled to a line on which this operation has been completed.

(i) Follow around all four brake cylinders and when this has been completed remove the fluid refiller from the supply tank and replace the filler plug and floor plate.

e. *Installation of assemblies.*—Tools:

- |  |                                      |
|--|--------------------------------------|
| $\frac{5}{8}$ -inch open-end wrench.   | $\frac{1}{2}$ -inch open-end wrench. |
| $\frac{9}{16}$ -inch open-end wrench.  | $\frac{15}{16}$ -inch socket wrench. |
| $\frac{7}{16}$ -inch open-end wrench.  | $\frac{7}{16}$ -inch socket wrench.  |
| $\frac{3}{4}$ -inch open-end wrench.   | $\frac{3}{4}$ -inch socket wrench.   |
| $1\frac{5}{16}$ -inch open-end wrench. |                                      |

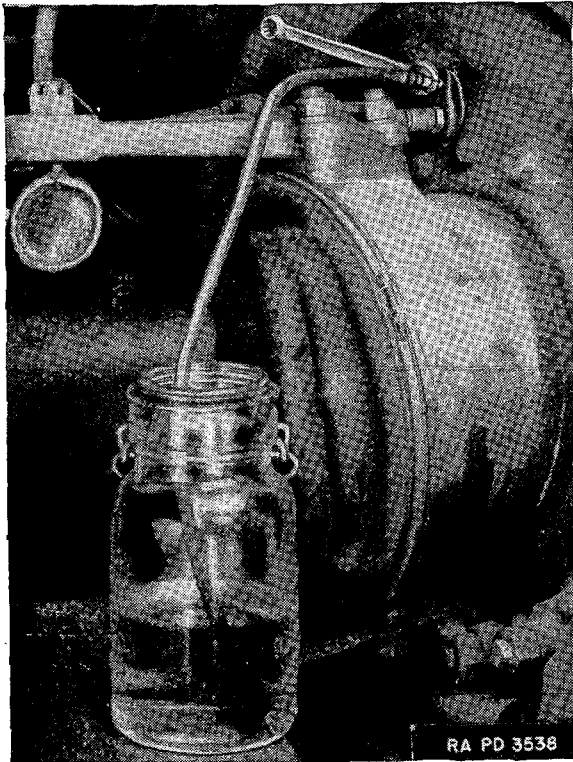


FIGURE 35.—Hydraulic brake system bleeding operations.

(1) Replace rear axle tee.  $\frac{5}{8}$ -inch open-end wrench.  
Secure tee to axle housing with lock washer and cap screw.

(2) Replace line assemblies to rear wheel brake cylinders.  $\frac{9}{16}$ -inch open-end wrench.  
 $\frac{7}{16}$ -inch open-end wrench.

Connect one end of each assembly to the tee by means of its inverted flared tube nut. Then connect opposite ends to wheel cylinder

fittings with the flared tube nuts. Fasten right-hand pipe clip to frame.

- (3) Replace rear flexible hose.  $\frac{5}{8}$ -inch open-end wrench.  
 $\frac{3}{4}$ -inch open-end wrench.  
 $\frac{15}{16}$ -inch open-end wrench.

Connect one end of hose to tee by means of its inverted flared tube nut and fasten fitting at opposite end to bracket with lock washer and nut.

- (4) Replace line assembly (master cylinder to rear hose connection).  $\frac{1}{2}$ -inch open-end wrench.

Pass line through grommets in frame. Connect one end of line to rear hose fitting and the opposite end to master cylinder fitting by means of its inverted flared tube nuts. Fasten pipe clip to frame.

- (5) Replace front tee. None.

Secure tee to frame with bolt and lock washer.

- (6) Replace line assembly (master cylinder to front tee).  $\frac{7}{16}$ -inch open-end wrench.

Connect one end of assembly to master cylinder outlet fitting and opposite end to tee. Fasten three pipe clips to frame.

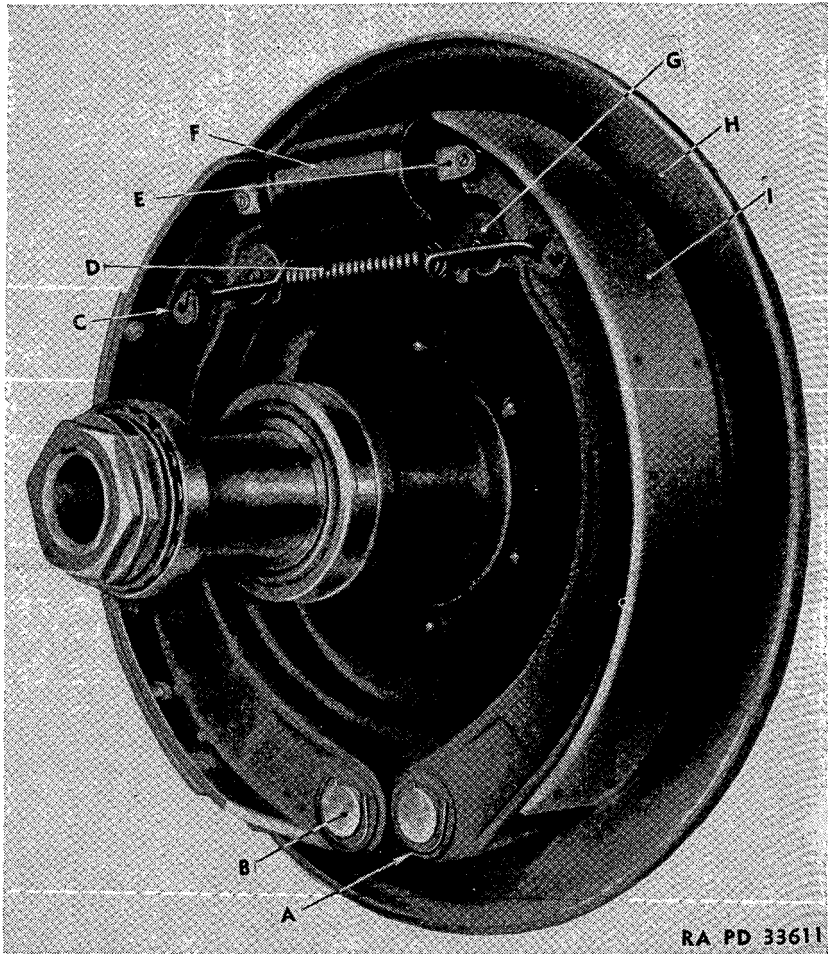
- (7) Replace front wheel brake flexible hose assemblies.  $\frac{15}{16}$ -inch socket wrench.  
 $\frac{7}{16}$ -inch socket wrench.  
 $\frac{3}{4}$ -inch socket wrench.

Connect assemblies to each front wheel cylinder inlet. Insert special fitting, at opposite end of each hose, through frame and secure it with lock washer and nut.

- (8) Replace line assemblies (tee to left- and right-hand wheel).  $\frac{7}{16}$ -inch open-end wrench.

Connect one end of each assembly to tee by means of its inverted flared tube nut. Then connect opposite end of each assembly to right- and left-hand wheel hose fitting in the same manner. Fasten the three right-hand pipe clips to frame.

**17. Wheel brakes** (fig. 36).—*a. Description.*—The wheel brakes, front and rear, are of the conventional, hydraulic, two-shoe, internal expanding type. They operate within brake drums of special gun iron which has high wear resistance.



- A. C-washer.
- B. Anchor pin.
- C. C-washer.
- D. Return spring.
- E. Link.

- F. Wheel cylinder.
- G. Cam.
- H. Backing plate.
- I. Brake shoe.

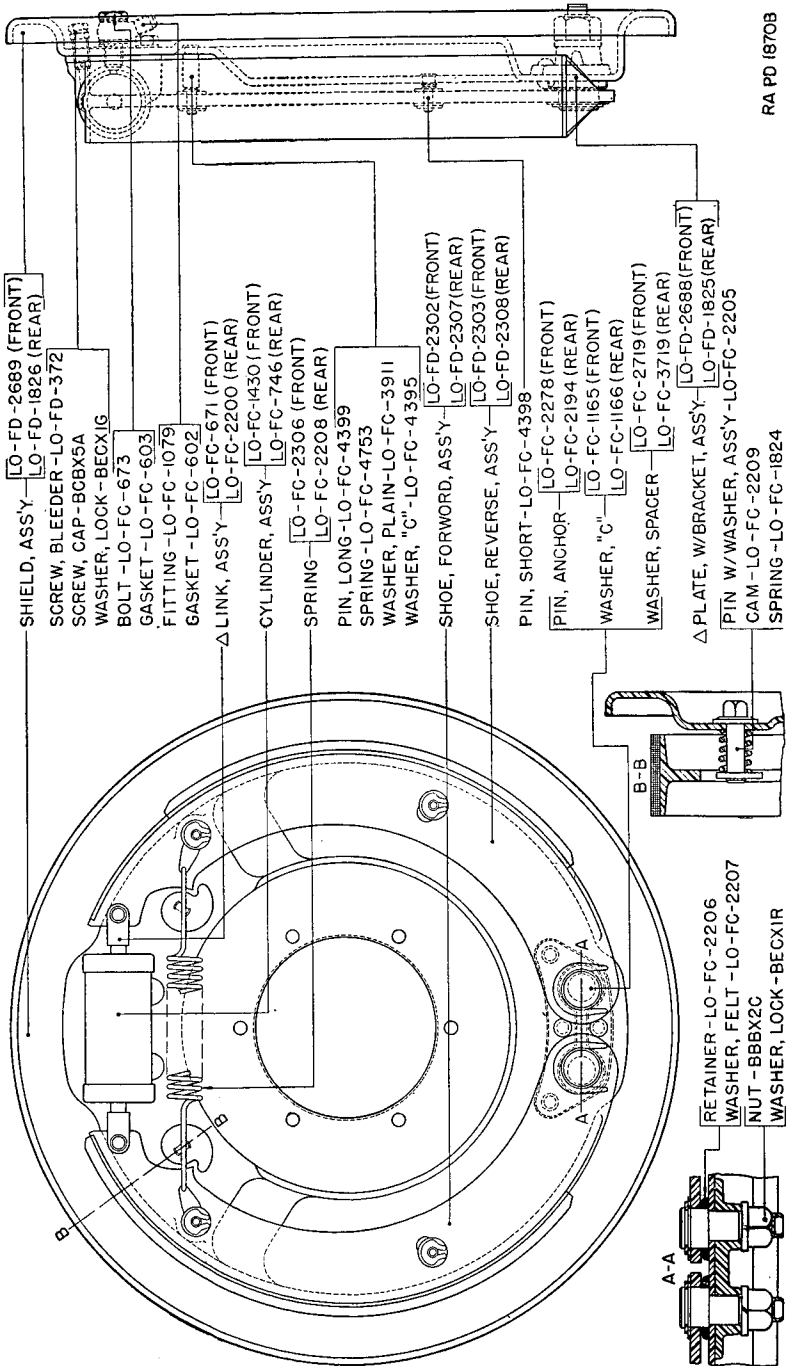
FIGURE 36.—Wheel brake assembly, installed.

(1) *Construction* (fig. 37).—(a) Each brake shoe is a T-sectioned steel casting with a lining riveted to the outside periphery. The shoes are anchored on the brake backing plate at the lower or “heel” end on eccentric anchor pins and are retained by plain washers and C-shaped washers which set into grooves in the pins. The anchor pins carry felt oil washers in retainers behind the shoes and the pins are locked by nuts and lock washers at the rear of the brake backing plate. Each shoe has two guide slots which fit over guide pins riveted into the brake backing plate. The shoes are supported on the pins by coil springs surmounted by plain washers. The shoes are held on the guide pins by plain washers and C-washers the same as on anchor pins. The upper or “toe” ends of the shoes are recessed to accommodate the clevis pins of the wheel cylinder connecting links. The shoes are held against adjusting cams by means of a return spring, the ends of which are hooked into the upper guide slots. The adjusting cams are riveted to their rotation pins, which are held, as placed, by friction coil springs between cams and backing plate. The cams are adjusted by means of the hexagon-head pins which are rotated from the rear of the backing plate.

(b) The wheel brake cylinder housings (fig. 38) are cast iron and each is bolted to the top of its respective brake backing plate by two cap screws and lock washers. A boss on the rear of each cylinder is drilled and tapped with one hole for the brake hose fitting and with another hole for the bleeder valve fitting. Each cylinder assembly consists of a piston spring, two rubber cups, two pistons, two rubber boots, and two connecting links with riveted yoke and pins. The spring is located in the center of the cylinder with a cup fitted over each end. The pistons are a close fit and are installed with their flat end against the cups. The rubber boots fit over the ends of the cylinder housing and snap into grooves cut around the outside of the housing. The connecting links pass through holes in the center of the boots and seat in a spherical cup in each piston. The yoke ends rest in the brake shoe recesses and are held there by brake shoe return spring pressure.

(2) *Functioning*.—Fluid forced out of the master cylinder passes through the lines into the brake cylinders and exerts its energy against the pistons. This causes the pistons and connecting links to move outward. The rods push the brake shoes at their upper ends, making them pivot on their anchor pins and causing brake linings to be forced against brake drums. When the pressure is released at the brake pedal, the brake shoe return spring pulls the shoes back to their original position. This forces the pistons back into the cylinder, which in turn forces fluid out of the cylinder and back through the lines to the master





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Figure 37.—Wheel brake assembly—sectionalized view.

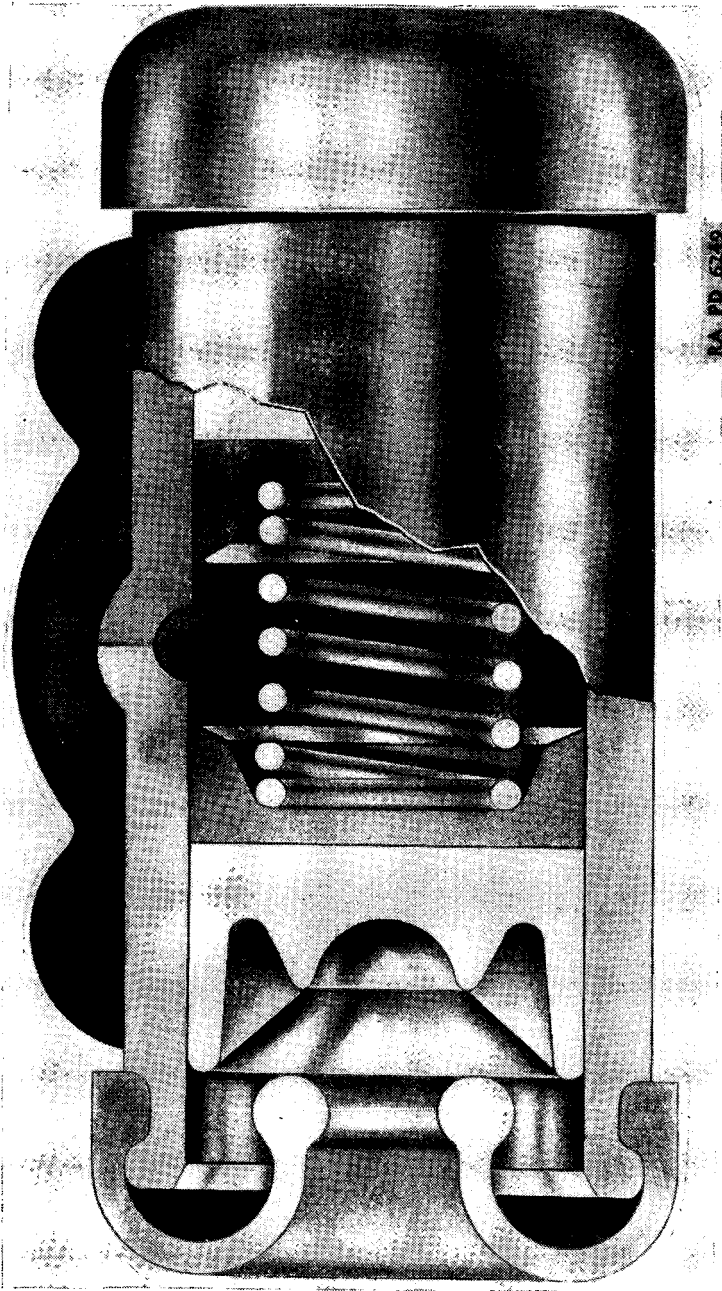


FIGURE 38.—Wheel cylinder—sectionalized view.

cylinder. Brake shoes can be set closer to or moved away from the drums by turning the adjusting cam bolts. Excess side play of the shoes is prevented by the guide pins.

(3) *Specifications.*

Make	Type	Model	Manufacturer's No.	Ordinance No.	White No.	
Wagner electric.	Internal expanding.	Hydraulic two-shoe.	LO-FF-913, front, left-hand.	D34136	326910	
			LO-FF-914, front, right-hand.			
			LO-FC-3378, rear, left-hand.			326911
			LO-FC-3379, rear, right-hand.			

Service brake type.....	Four drum hydraulic.
Wheel cylinder, front.....	1 $\frac{3}{8}$ inches
Wheel brake shoes, front:	
Size.....	15 x 2 $\frac{1}{4}$ inches
Lining area (square inch per axle).....	131 inches
Length (forward).....	16 $\frac{1}{16}$ inches
Length (rearward).....	13 $\frac{1}{16}$ inches
Width.....	2 $\frac{1}{4}$ inches
Thickness.....	$\frac{1}{4}$ inch
Wheel cylinder, rear.....	1 $\frac{1}{2}$ inches
Wheel brake shoes, rear:	
Size.....	15 x 2 $\frac{1}{4}$ inches
Lining area (square inch per axle).....	128 $\frac{1}{2}$ inches
Length (forward).....	16 $\frac{3}{8}$ inches
Length (rearward).....	12 $\frac{3}{16}$ inches
Width.....	2 $\frac{1}{4}$ inches
Thickness.....	$\frac{1}{4}$ inch

b. *Trouble shooting.*

*Symptoms and probable cause*

*Probable remedy*

- |                                |  |
|--------------------------------|--|
| (1) Pedal goes to floorboard.  |  |
| Normal wear of linings.        | Readjust upper ends of shoes only.                         |
| Brake not properly adjusted.   | Adjust shoes at both ends.                                 |
| (2) All brakes drag.           |  |
| Mineral oil in system.         | Flush system with alcohol and replace wheel cylinder cups. |
| Insufficient brake shoe clear- | Readjust shoes.  |

(3) One brake drags.

- Weak brake shoe return spring. Replace spring.
- Brake shoe binding on anchor pin. Free and lubricate pin.
- Brake shoe set too close to drum. Readjust shoes to proper clearance.
- Wheel cylinder cups distorted. Replace cups.

(4) Car pulls to one side.

- Worn linings. Replace with new linings.
- Grease soaked lining. Replace with new lining of same type.
- Loose backing plate. Tighten plate and readjust brake shoes.
- Shoes improperly adjusted. Readjust shoes to proper clearance.
- Different makes of linings. Replace those differing with lining of same make.
- Scored drums. Resurface or replace.

(5) Springy, spongy pedal.

- Brake shoes not properly adjusted. Readjust shoes.
- Air in system. Bleed system at wheel cylinders.

(6) Excessive pressure on pedal, poor stop.

- Brake shoes not properly adjusted. Readjust shoes.
- Improper lining. Replace with best quality lining.
- Grease on lining. Clean or replace lining.
- Lining making partial contact. Remove high spots.

(7) Light pressure on pedal, severe brakes.

- Brake shoes not properly adjusted. Readjust shoes to proper clearance.
- Grease soaked lining. Replace with new lining of same make.

*c. Removal of assembly.—(1) Brake shoes.—Tools:*

- |                             |                        |
|-----------------------------|------------------------|
| Wheel stud nut wrench.      | Chisel.                |
| Jack.                       | Puller.                |
| 5/8-inch socket wrench.     | Wheel cylinder clamp.  |
| 1 1/16-inch open-end wrench | Special spring pliers. |
| Wheel bearing nut wrench    | Screw driver.          |
| Hammer.                     |                        |

(a) Remove wheel and tire assembly. Wheel stud nut wrench.  
Jack.

Loosen wheel stud nuts BW-37889E (left-hand), BW-37888E (right-hand). Then jack up and block wheel assembly which is to be worked on, so that tire is just off ground. Remove wheel stud nuts and pull off wheel assembly. This may be made easier by slipping a greased board under tire and sliding assembly off studs onto board.

(b) Remove hub and drum assembly.

- |                              |         |
|------------------------------|---------|
| 5/8-inch socket wrench.      | Hammer. |
| 1 1/16-inch open-end wrench. | Chisel. |
| Wheel bearing nut wrench.    | Puller. |

Remove drive flange assembly TD-A-1-3870-B-2 from front axle or remove axle shaft assembly TD-A-1-3202-C-1255 from rear axle. Then remove wheel bearing lock nuts TD-T3564 (front), TD-1227-S-149 (rear), lock washers TD-1829-T-72, (front), TD-1229-X-700, (rear), and adjusting nuts TD-T3564 (front), TD-1227-S-149 (rear), and pull off hub and drum assembly with wheel bearings. (For more detailed information see pars. 15 and 22, TM 9-1705).

(c) Remove shoe retracting spring. Wheel cylinder clamp.  
Special spring pliers.

Clamp ends of wheel cylinder to hold pistons in place (fig. 39). Then remove spring LO-FC-2306 (front), LO-FC-2208 (rear), as shown in figure 40.

(d) Remove guide pin washers. Screw driver.  
Hammer.

Place screw driver against tang ends of C-washers LO-FC-4395 and drive them from pins LO-FC-4398 (short), LO-FC-4399 (long), by tapping screw driver. Then take off plain washers LO-FC-3911.

(e) Remove brake shoe assemblies. Screw driver.

Remove anchor pin C-washers LO-FC-1165 (front), LO-FC-1166 (rear) by forcing screw driver under end of washer and twisting.

Then remove spacer washers LO-FC-2719 (front), LO-FC-3719 (rear), and slip off shoe assemblies LO-FD-2302 (front wheel forward), and LO-FD-2303 (front wheel rearward), LO-FD-2307 (rear wheel forward), and LO-FD-2308 (rear wheel rearward). Remove guide pin washers LO-FC-3911 and guide pin springs LO-FC-4753.

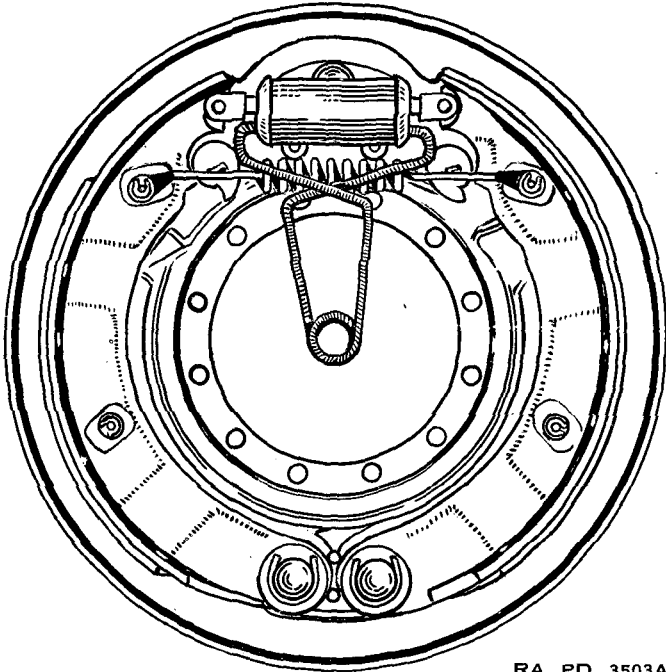


FIGURE 39.—Clamping wheel brake cylinder.

(2) *Wheel cylinder.*—Tools:

- |  |                                    |
|--|------------------------------------|
| $\frac{7}{16}$ -inch open-end wrench.  | Special spring pliers              |
| $\frac{3}{4}$ -inch open-end wrench.   | Cylinder clamp.                    |
| $\frac{15}{16}$ -inch open-end wrench. | $\frac{3}{4}$ -inch socket wrench. |

(a) Remove wheel and hub None.  
and drum assembly.

Follow steps outlined in *c*(1) (a) and (b) above.

(b) Disconnect inlet line to cylinder.  
 $\frac{7}{16}$ -inch open-end wrench.  
 $\frac{3}{4}$ -inch open-end wrench.  
 $\frac{15}{16}$ -inch open-end wrench.

Each front brake hose must first be disconnected at frame. Disconnect inverted flared tube connector from hose frame fitting. Remove frame fitting holding nut and turn hose assembly out of wheel

cylinder inlet fitting. Disconnect each rear wheel cylinder line by turning off flared tube connector from cylinder inlet fitting.

(c) Remove shoe retracting Special spring pliers.  
 spring. Cylinder clamp.

Clamp ends of wheel cylinder to hold pistons in place (fig. 39). Then remove spring as shown in figure 40.

(d) Remove cylinders.  $\frac{3}{4}$ -inch socket wrench.

Remove cap screws BCAX1EE and lock washers BECX1K and take out cylinder assembly LO-FC-1430 (front), LO-FC-746 (rear).

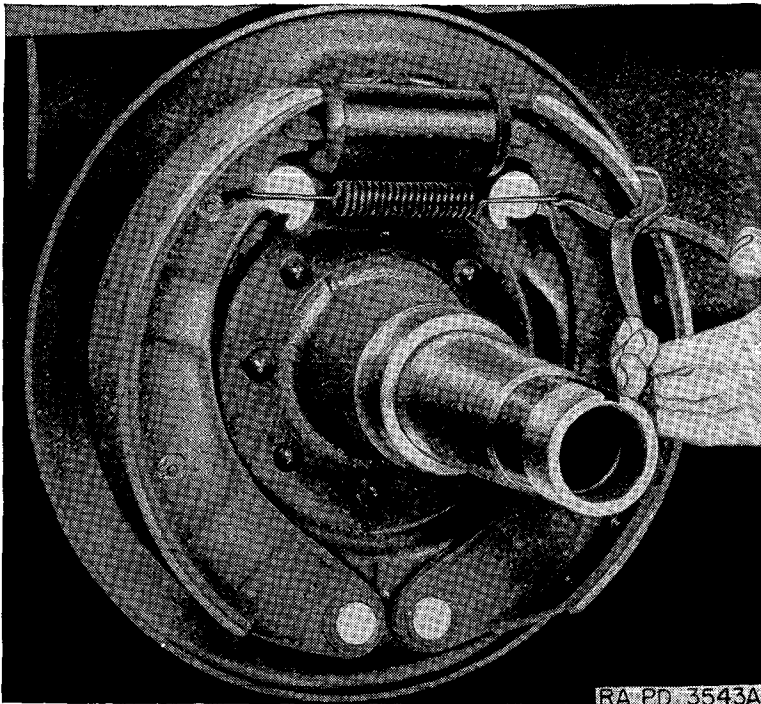


FIGURE 40.—Removing brake shoe return spring.

*d. Disassembly of components.*—(1) Brake shoes (fig. 41).

Remove linings. Punch.  
 Hammer.

Drive out rivets LO-FC-576 holding linings to shoes and remove linings LO-FD-2276 (front wheel forward), LO-FD-2277 (front wheel rearward), LO-FD-2281 (rear wheel forward), LO-FD-2282 (rear wheel rearward).

(2) *Wheel cylinder* (fig. 42).

(a) Remove working parts. None.

Pull out yoke end connecting links LO-FC-671 (front), LO-FC-2200 (rear), rubber boots LO-FD-368 (front), LO-FC-726 (rear), pistons LO-FC-1311 (front), LO-FC-723 (rear), cups LO-FC-857 (front), LO-FC-725 (rear), and piston return spring LO-FC-860 (front), LO-FC-724 (rear).

(b) Remove fittings.

Small pipe wrench.

$\frac{3}{4}$ -inch open-end wrench.

$\frac{7}{8}$ -inch open-end wrench.

$\frac{7}{16}$ -inch open-end wrench.

Remove rear inlet fitting bolt LO-FC-673 (rear), bolt gasket LO-FC-603, inlet fitting LO-FC-672 (front), LO-FC-1079 (rear), LO-FC-602 and fitting gaskets LO-FC-603. Take out bleeder screw cap screw BCBX5A, lock washer BECX1G and bleeder screw LO-FD-372.

*e. Maintenance and adjustments.*—(1) Inspect brake shoes for cracks and wearing of the anchor pin holes. If either are apparent, replace with new shoes.

(2) Inspect adjusting cam friction springs and shoe retracting springs for breaks or evidence of permanent set and replace with new ones, if required.

(3) Inspect anchor pins and their felt washers and replace any that show signs of wear.

(4) If a minor adjustment of the brakes is required for any of the reasons listed in *b* above, it may be done as follows:

(a) Without removing the wheels, raise the vehicle until the wheels are free of the ground.

(b) Rotate the cam at the top of the front shoe until the lining is pressed firmly against the drum and the wheel is locked.

(c) Then back off the adjustment slightly until the wheel rotates freely without drag.

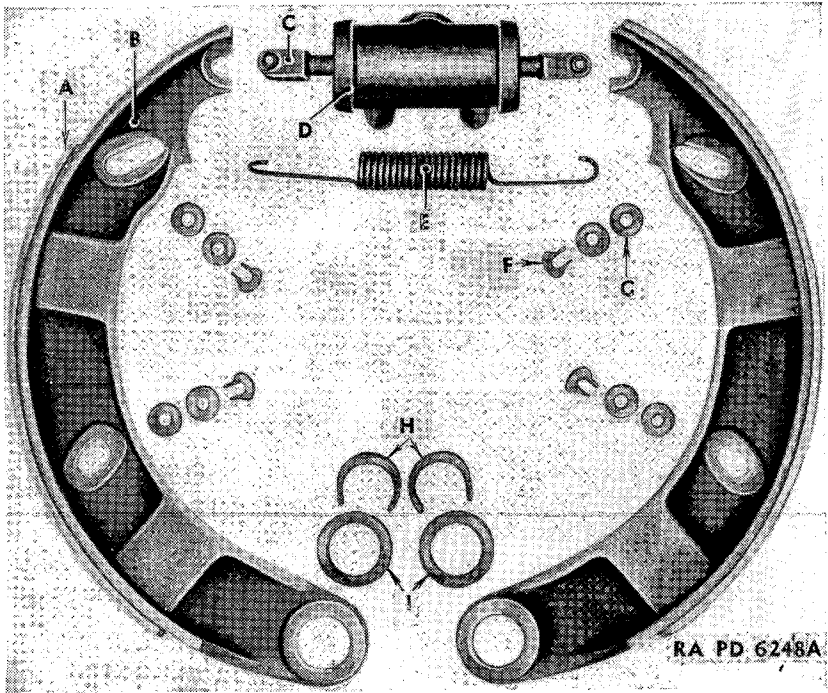
(d) Adjust all eight brake shoes in this manner. These cams are automatically locked in position by their friction springs.

(5) If upon inspection, the brakes require relining for any of the reasons listed in *b* above, proceed as follows:

(a) Remove the old linings by steps outlined in *c*(1)(a) to (d), inclusive, and *d*(1)(a) above.

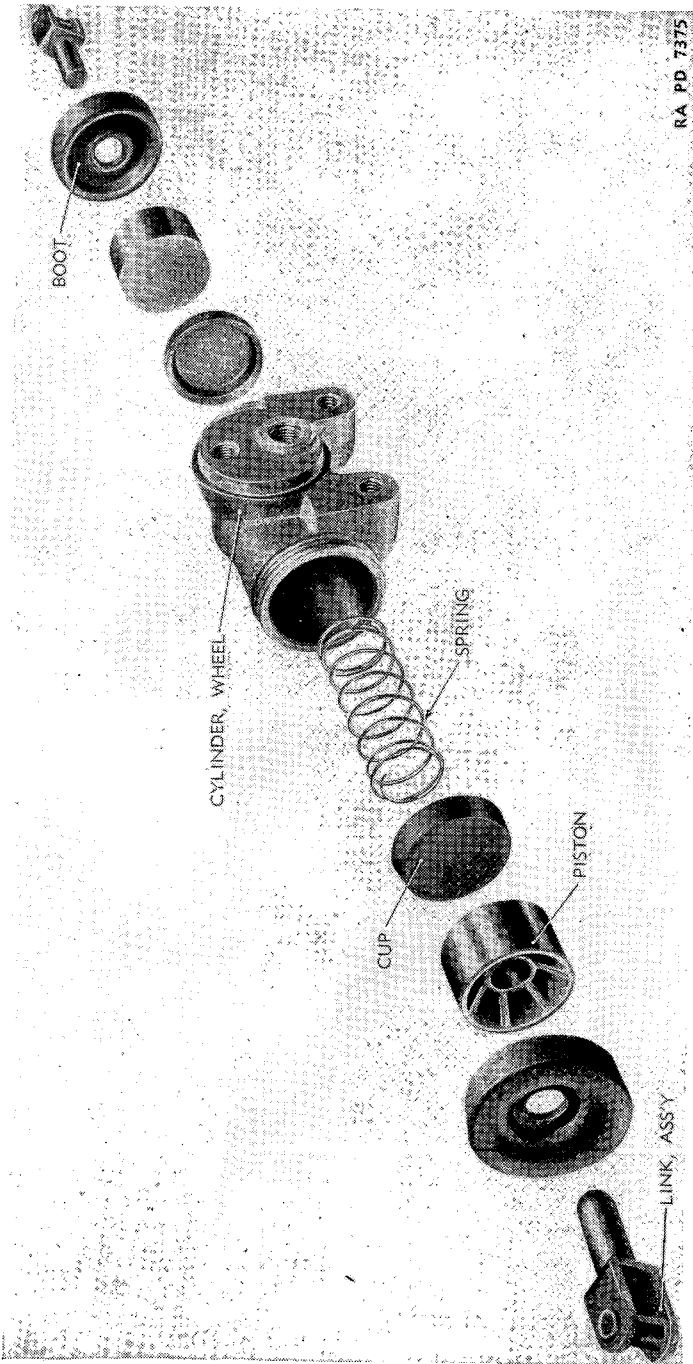
(b) Set the new linings on the brake shoes and hold them in place with a suitable clamp (figs. 43 and 44). If the lining is not replaced





- |  |   |
|--|---|
| <p>A. { Lining, front<br/>wheel { forward, LO-FD-2276.<br/>reverse, LO-FD-2277.</p> <p>      { Lining, rear<br/>wheel { forward, LO-FD-2281.<br/>reverse, LO-FD-2282.</p> <p>B. { Shoe, front,<br/>assembly { forward, LO-FD-2302.<br/>reverse, LO-FD-2303.</p> <p>      { Shoe, rear<br/>assembly { forward, LO-FD-2307.<br/>reverse, LO-FD-2308.</p> <p>C. Link assembly { front, LO-FC-671.<br/>rear, LO-FC-2200.</p> | <p>D. Cylinder assembly { front, LO-FC-1430.<br/>rear, LO-FC-746.</p> <p>E. Spring { front, LO-FC-2306.<br/>rear, LO-FC-2208.</p> <p>F. Washer LO-FC-4395.</p> <p>G. Washer LO-FC-3911.</p> <p>H. Washer { front, LO-FC-1165.<br/>rear, LO-FC-1166.</p> <p>I. Washer { front, LO-FC-2719.<br/>rear, LO-FC-3719.</p> |
|--|---|

FIGURE 41.—Wheel brake disassembled.



RA PD 7375

FIGURE 42.—Wheel cylinder—exploded view.

on all shoes, care must be taken to insure that the replacement lining is of the same type as the lining on the remainder of the shoes.

(c) Rivet the linings to the shoes with the correct type of rivets. Never use aluminum rivets.

(d) Countersink the rivet heads in the linings approximately two-thirds the thickness of the linings.

(e) Chamfer the ends of the linings back about  $\frac{3}{4}$  inch from the top and bottom, and remove high spots and burrs around the rivet holes with a grinding tool or a fine file (fig. 45). Do not use emery paper.

(f) Reinstall brake shoe assemblies as explained in *g* below.

(g) After the brakes have been relined or the brake drums resur-

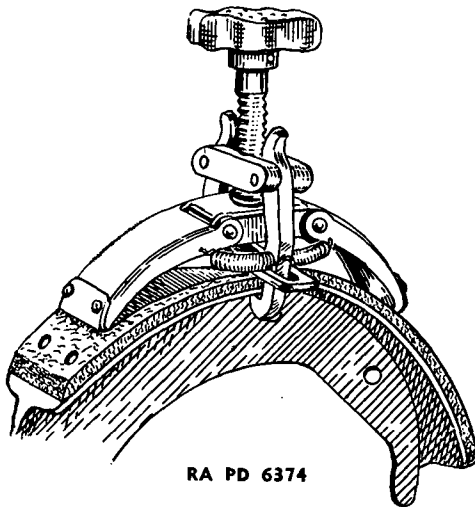


FIGURE 43.—Holding brake lining while riveting to shoe.

faced, a major adjustment of the shoes is necessary and should be done as follows:

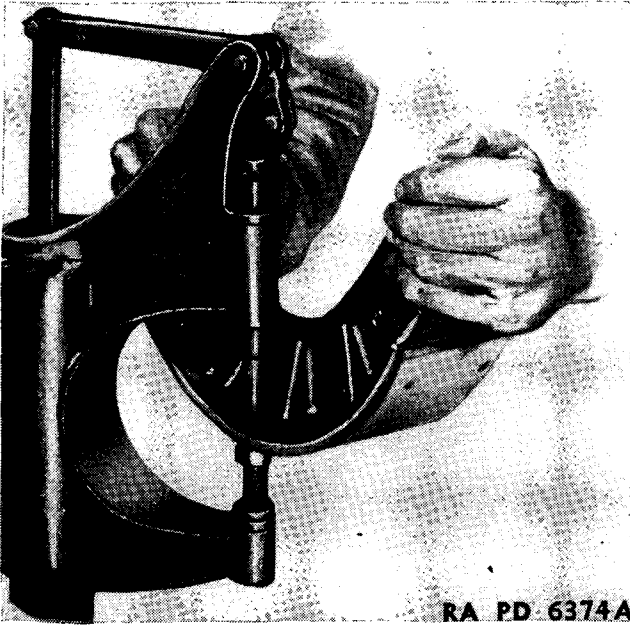
(a) With the wheels and drums in place and the vehicle raised, remove the inspection hole covers in the brake drums.

(b) Insert a thickness gage through the inspection hole between the lining and drum (fig. 46).

(c) Loosen the holding bolt at the rear of the backing plate, and turn the eccentric anchor pins at the “heel” or lower end of the brake shoe. At a distance of 1 inch from the end of the lining near this pin, the clearance between lining and drum should be 0.005 inch.

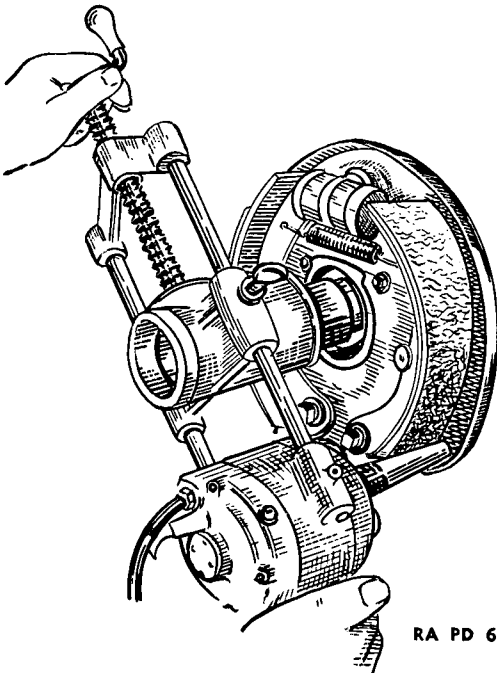
(d) Tighten the holding nut and recheck clearance.

(e) Turn the wheel and drum assembly until the inspection hole in the drum is at the “toe” or upper end of the shoe.



RA PD 6374A

FIGURE 44.—Riveting brake lining.



RA PD 6371

FIGURE 45.—Beveling edges of brake lining.

(f) Insert a gage between the lining and drum 1 inch from the end of the lining and turn the adjusting cam belt until the lining has a clearance of 0.010 inch (fig. 47).

(g) Remove the gage and replace the inspection hole cover.

(h) Check the pedal travel before and after these adjustments and tighten holding bolts. Repeat these operations on each shoe in each drum.

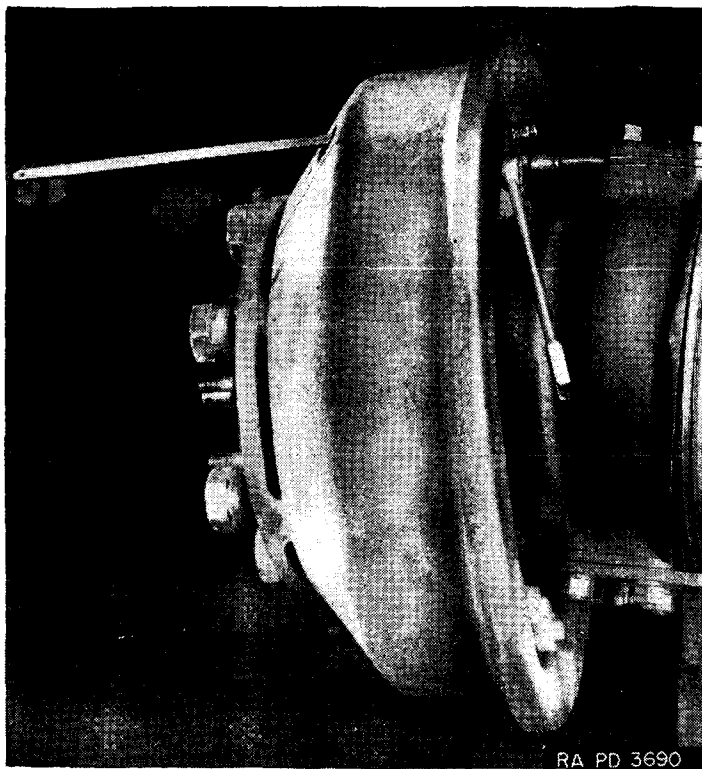


FIGURE 46.—Wheel brake shoe toe adjustment.

(7) Inspect brake drums for scratches and scoring. Resurface, if necessary, by turning on drum lathe.

(8) After a wheel cylinder has been disassembled, wash the working parts in alcohol and inspect for the following:

(a) If any mineral oil has found its way into the system, the rubber cups will be enlarged and very soft. If this condition is apparent, replace the cups.

(b) Cylinder walls must be smooth (not pitted or scratched). The walls may be renewed by honing. If this is done, use a "no-go" gage to determine whether the diameter has been enlarged to a point where this casting cannot be used.

(c) Pistons must be free from burs. If any burs are apparent, remove them with a fine file.

(d) Occasionally, wheel bearing grease seals become worn and allow grease to leak through into the brake drum and come in contact with the cylinder rubber boots. When this occurs, the boots become soft and enlarged, and do not protect the cylinder from foreign

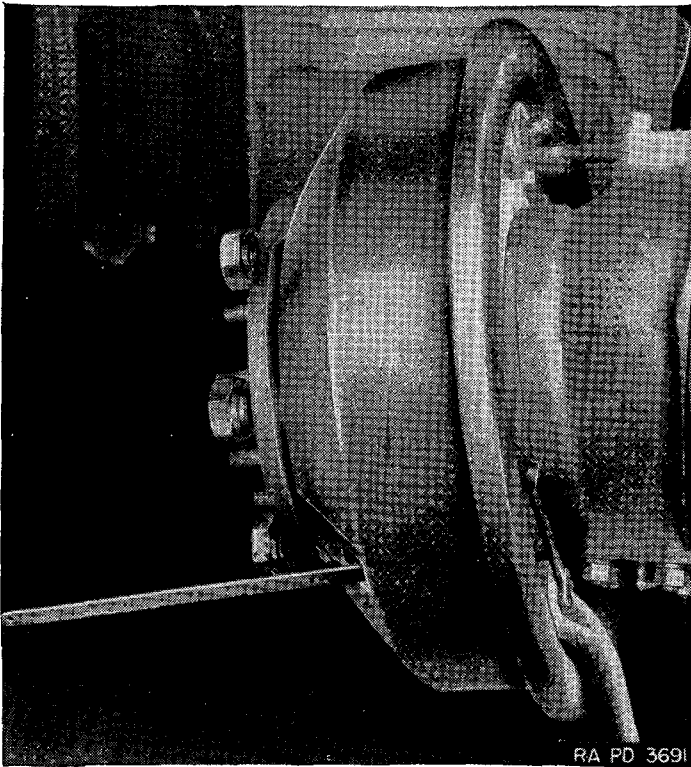


FIGURE 47.—Wheel brake shoe heel adjustment.

matter. If this condition is apparent, replace boots and grease retainers.

(e) Check the return spring for permanent set and if any is apparent, replace with a new spring.

NOTE.—Never wash cylinder or parts in gasoline, kerosene, oil, or solvent, dry-cleaning.

(9) Service data.

Wheel cylinders:

Piston clearance, front.....	0.001 to 0.005 in.
Piston clearance, rear.....	0.001 to 0.005 in.

Front and rear shoe adjustment:

Cam (top of shoe).....	0.010 in.
Eccentric (bottom of shoe).....	0.005 in.

Brake return springs:

Front cylinder piston:

Free length.....	2 $\frac{5}{8}$ in.
Pressure at 1 $\frac{3}{4}$ inch.....	1 to 1 $\frac{1}{4}$ lb.

Rear cylinder piston:

Free length.....	3 $\frac{1}{8}$ in.
Pressure at 2 inches.....	1 $\frac{1}{2}$ to 2 lb.

Shoe return springs:

Free length.....	7 $\frac{3}{16}$ in.
Pull at 8 $\frac{1}{4}$ inches.....	75 to 85 lb.

Brake drum:

Regrinding limits.....	0.030 in.
------------------------	-----------

*f. Reassembly of components.*—(1) *Brake shoes.*

Replace or renew linings.                      Clamp, grinder or file, and rivet punch.

Follow steps outlined in *e*(5)(*b*) to (*e*), inclusive, above.

(2) *Wheel cylinder.*

Replace working parts.                      Clamp.

Dip parts in brake fluid and then place piston spring in center of cylinder and install rubber cups on each end of spring with their flat faces out. Insert pistons into each end of cylinder, flat face first so that they butt against flat face of cups. Slip rubber boots over each end of cylinder and insert connecting links through holes in boots until they seat into pistons. Hold parts in place by clamping ends of cylinder.

*g. Installation of assembly.*—(1) *Wheel cylinder* (fig. 41).—Tools:

3/4-inch socket wrench.	1 $\frac{1}{16}$ -inch open-end wrench.
5/8-inch socket wrench.	Wheel bearing nut wrench.
Special spring pliers.	Hammer.
7/16-inch open-end wrench.	Wheel stud nut wrench.
3/4-inch open-end wrench.	Screw driver.
1 $\frac{5}{16}$ -inch open-end wrench.	Lockheed filler jar and nozzle.

(a) Replace cylinder.  $\frac{3}{4}$ -inch socket wrench.

Set cylinder links in shoe recesses and attach cylinder to brake backing plate with cap screws and lock washers.

(b) Replace shoe retracting spring. Special spring pliers.

Clip one end of spring onto upper guide pin slot of forward shoe, stretch spring with pliers, and clip other end of spring onto upper guide pin slot of reverse shoe (fig. 39).

(c) Attach inlet line to cylinder inlet fitting.  $\frac{7}{16}$ -inch open-end wrench.  
 $\frac{3}{4}$ -inch open-end wrench.  
 $\frac{15}{16}$ -inch open-end wrench.

Rear wheel cylinder lines are connected by screwing flared tube connector onto cylinder inlet fitting. Each front brake hose is connected by screwing one end into cylinder inlet fitting; then attach opposite end fitting to frame and reconnect line to hose fitting with inverted flared tube connector.

(d) Replace hub and drum assembly.  $\frac{5}{8}$ -inch socket wrench.  
 $\frac{11}{16}$ -inch open-end wrench.  
 Wheel bearing nut wrench.  
 Hammer.

Replace hub and drum assembly and outer wheel bearing assembly on axle. Then fasten assembly in position with wheel bearing adjusting nut, lock washer and locking nut, and adjust for correct bearing pressure. Replace drive flange assembly on front axle (or axle shaft assembly in rear axle) and fasten with lock washers and nuts. (For more detailed information see pars. 17 and 24, TM 9-1705.)

(e) Replace wheel and tire assembly. Wheel stud nut wrench.

Set assembly onto wheel studs and replace stud nuts. Lower vehicle to floor, remove jack and tighten nuts.

(f) Bleed lines. Screw driver.  
 Lockheed filler jar and nozzle.  
 $\frac{7}{16}$ -inch open-end wrench.

Follow steps outlined in paragraph 16d(2)(a) to (k), inclusive.

(2) *Brake shoes.*

(a) Replace shoes. Light hammer.

Set felt seals, retainers, and washers onto anchor pins and guide pin springs and washers onto guide pins. Then set shoes onto anchor pins and guide pins and lock them in position by replacing anchor



pin spacer washers and C-washers and guide pin plain washers and C-washers.

(b) Replace shoe retracting spring.

See (1) (b) above.

(c) Replace hub and drum assembly.

See (1) (d) above.

(d) Replace wheel and tire assembly.

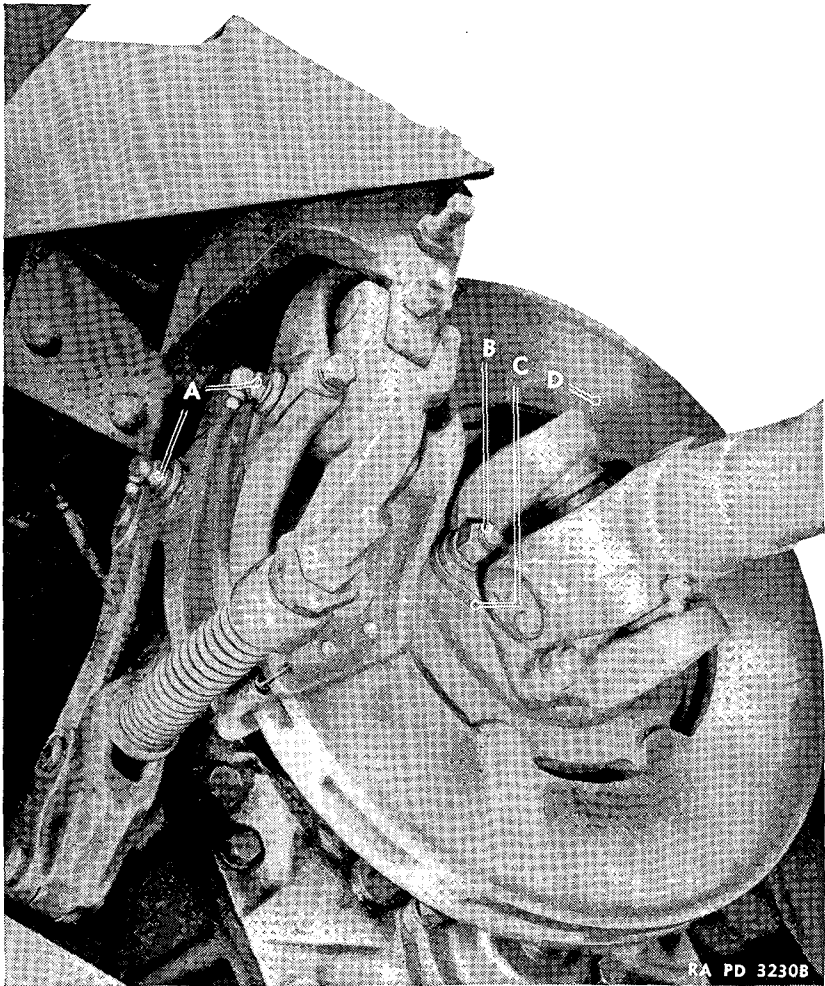
See (1) (e) above.

**18. Drive shaft brake** (figs. 48 and 49).—*a. Description.*—The drive shaft brake is a two-shoe, ventilated disk type. It operates on disks mounted on the companion flange of the propeller shaft at the rear of the transfer case.

(1) *Construction* (fig. 50).—(a) The polished steel brake disk assembly is mounted to the rear propeller shaft companion flange at the rear of the transfer case and is held in place by bolts, nuts, and cotter pins. The brake anchor bracket straddles the disk assembly at its upper left side and is bolted to the frame bracket by three cap screws and lock washers. The upper ends of the front and rear brake shoe lever arms are yokes which fit over the lower extremities of the anchor bracket and are held in place by anchor pins which pass through the yoke eyes and companion holes drilled through the bracket. The anchor pins are grooved at the center so that the lock screws, threaded into the anchor bracket at right angles to the pins, fit into these grooves and thereby lock the pins in place. The lever arms pivot on these pins and lubrication is obtained through fittings which are threaded into the anchor bracket just below the locking screws.

(b) The brake shoes straddle the lever arms and are held in place by pins which pass through the shoes and arms. The shoes swivel on these pins and are lubricated by grease fittings threaded into the ends of the pins. The pins are held in place by means of retainers which fit into grooves cut close to the outside ends of the pins. The retainers are bolted to the brake shoes by cap screws and lock washers. The brake linings are riveted to the shoes and are held parallel to the brake disk by a connecting spring at the bottom of the shoes and adjusting set-screws at the top.

(c) The operating lever tie rod is threaded at one end and has a flattened eye at the other. The eye sets into the upper clevis of the operating lever and is held by a clevis pin and cotter pin. The rod



RA PD 3230B

A. Fitting CLDX5M.

B. { Bolt WI-A6988X.

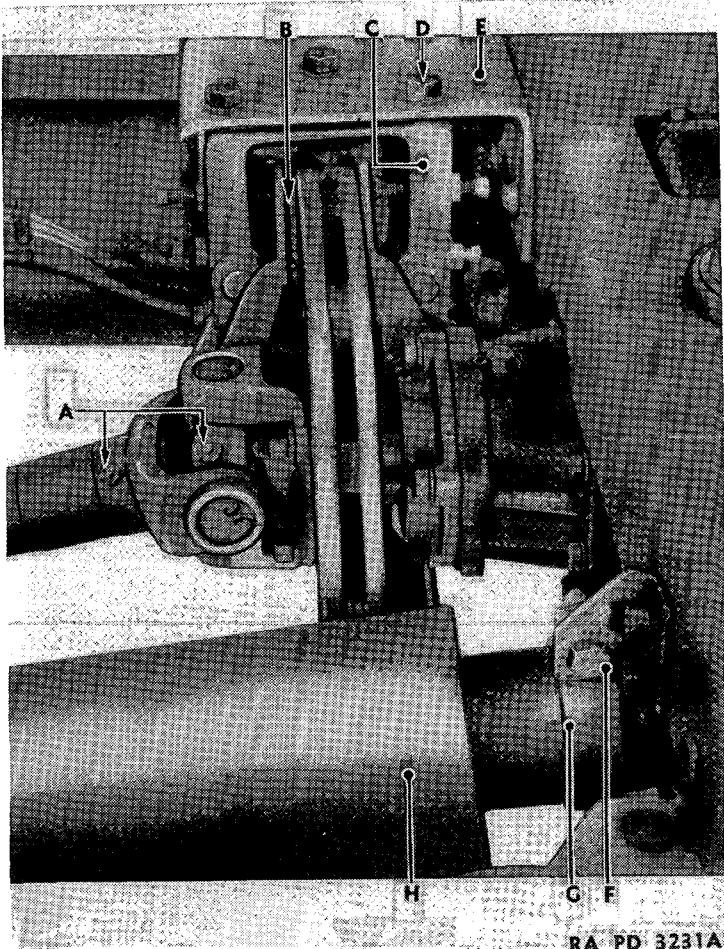
Nut BBBX1D.

Washer, lock, BECX1L.

C. Flange WI-94918.

D. Disk assembly TRU-C-20S-2A.

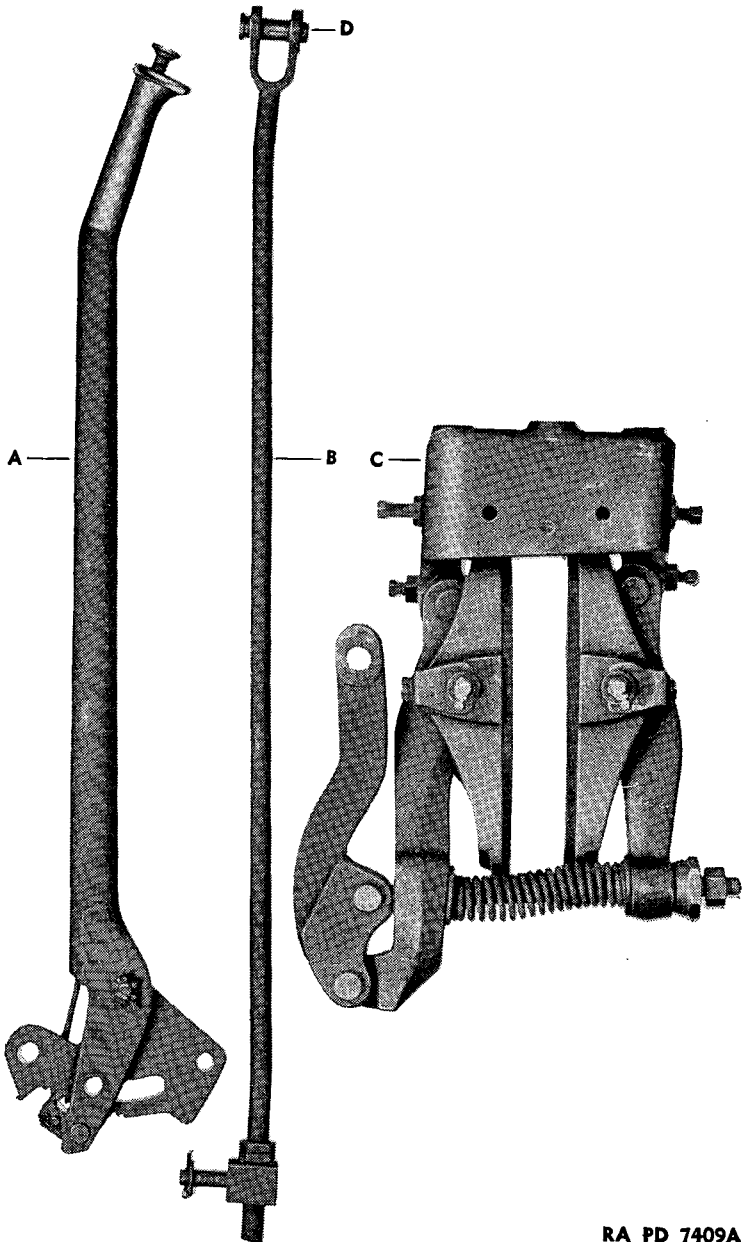
FIGURE 48.—Drive shaft brake assembly, installed—bottom view.



RA PD 3231A

- A. Fitting CLDX5A.
- B. Lining TRU-C-4.
- C. Bracket TRU-C-551.
- D. { Screw, cap, BCAX1EE.  
Washer, lock, BECX1M.
- E. Bracket WI-347309.
- F. { Support WI-347374.  
Screw, cap, BCBX1CA.  
Nut BBBX1C.  
Washer, lock, BECX1K.  
Clamp OM-C-8.
- G. { Screw, cap, BCBX1CD.  
Nut BBBX1C.  
Washer, lock BECX1K.
- H. Muffer assembly WI-353739.

FIGURE 49.—Drive shaft brake assembly, installed—top view.



**RA PD 7409A**

A. Lever assembly WI-347371.  
 B. Rod assembly WI-347363.

C. Brake, w/bracket, assembly TRU-20-5-00310.

D. Pin BFFX1F.

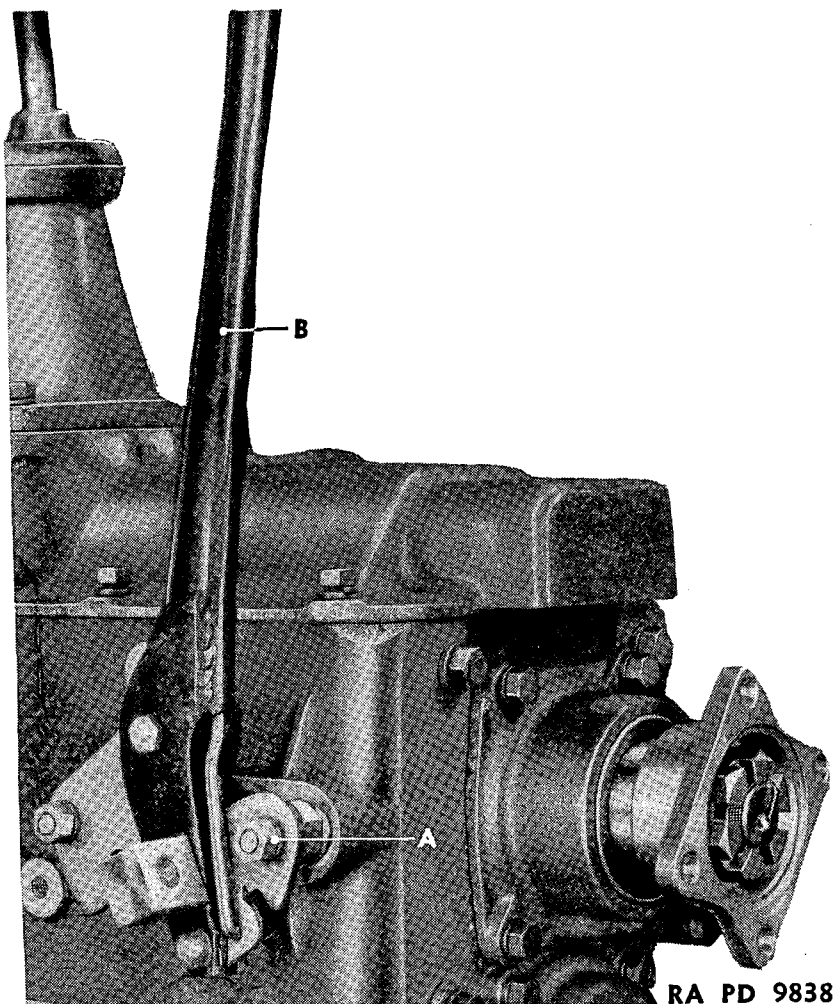
FIGURE 50.—Drive shaft brake assembly.

then passes through the slotted hole in the front brake shoe lever arm and through the rear lever arm and is held by a spherical nut and a lock nut. The brake lever arm release spring, with a thrust washer at each end, is carried by the tie rod between the front and rear brake lever arms.

(d) The clevis at the bottom of the operating lever straddles the tang at the bottom of the front brake lever arm and the lever is attached to the arm at this point by a clevis pin and cotter pin. The top of the operating lever sets into the brake pull rod yoke end and is held by a clevis pin and cotter pin. The opposite end of the pull rod is threaded into the brake lever block and is held fast by a lock nut. The lever block has a rod end which passes through the bottom of the lever and the slot in the quadrant and is held to the lever by a washer and cotter pin.

(e) The brake lever has a forked end at the bottom which straddles the quadrant and is bolted to it by means of a cap screw, castle nut, and cotter pin (fig. 51). The quadrant sits on two studs which are threaded into the left side of the transmission housing and are held by means of two nuts and lock washers. The bottom of the quadrant has teeth cut into it to mate with the pawl, which sits into the clevis at the bottom of the brake lever and is held by a clevis pin. The pawl is actuated by the pawl rod which is attached to it by a cotter pin. The pawl rod then passes up through the brake lever casting and is held by a spring, a button, and pin at the top of the lever.

(2) *Functioning.*—When the brake lever is in its released position, the lever arm release spring spreads the lever arms and holds the shoes away from the brake disks. When any braking is desired, the brake lever is pulled back at the top and the bottom moves forward. The pawl moves forward with the bottom of the lever arm, slipping over the quadrant teeth until the desired amount of braking is reached, at which time the brake lever is released and the pawl engages with the quadrant teeth and holds the brake lever in the desired position. The forward movement of the bottom of the brake lever carries with it the lever block and the pull rod which is held in the block. The pull rod pulls the top of the operating lever forward. This causes the lever to pivot at the point where it is attached to the front brake shoe lever arm and at the same time it pushes the arm toward the rear and pulls the operating lever tie rod forward against the resistance of the release spring. The rearward motion of the bottom of the front lever arm makes the arm pivot on the pin which holds it to the anchor bracket and it brings the front brake shoe in contact with the front



RA PD 9838

- A. { Stud WI-347369.  
Washer, lock, BECX1M.  
Nut BBBX1C.  
Washer, lock, BECX1K.  
B. Lever assembly WI-347371.

FIGURE 51.—Drive shaft brake hand lever, installed.

brake disk. At the same time, the forward pull of the tie rod causes the rear brake lever arm to pivot on its holding pin and bring the rear brake shoe in contact with the rear brake disk. In this manner, both brake shoes contact the disks at the same time and with an equal amount of pressure. To release the brake shoes, depress the pawl rod button at the top of the brake lever and at the same time apply a slight backward pressure on the lever to facilitate the pawl dropping away from the sector teeth. Push the top of the lever forward and this will release the mechanism back to the release spring.

(3) *Specifications.*

Make	Model	Type	Manufacturer's No.	Ordinance No.	White No.
American Cable Co.	20-S-00310	Two-shoe	TRU-20-S-00310	D33798	311908

Disk diameter-----inches-- 12  
 Hand brake shoe:  
     Size -----do----- 7.85 by 2  
     Lining area (total for both sides)-----  
     -----square inches-- 41½

*b. Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

- (1) Brake will not hold.  
     Shoes improperly mounted. Check shoes and connections and readjust.  
     Linings worn. Replace with new linings.  
     Shoes out of adjustment. Readjust.
- (2) Brake drags.  
     Release spring broken. Replace with new spring.  
     Release spring taken permanent set. Replace with new spring.
- Operating lever sticks. Lubricate pivot pin.
- (3) Brake lever will not hold in "on" position.  
     Worn or broken pawl tooth. Replace pawl.  
     Worn or broken quadrant teeth. Replace quadrant teeth.

*c. Removal of assembly.*—(1) *Disk brake.*—Tools:

- |                          |                          |
|--------------------------|--------------------------|
| Pliers.                  | 1¼-inch open-end wrench. |
| ⅜-inch open-end wrench.  | ⅝-inch open-end wrench.  |
| ¾-inch open-end wrench.  | ⅝-inch box wrench.       |
| 1⅜-inch open-end wrench. |                          |

(a) Disconnect pull rod at operating lever. Pliers.

Pull out cotter pin BFA11DG from rod end pin BFFX1F and remove rod end pin.

(b) Remove brake assembly without disk. Pliers.  
 ⅜-inch open-end wrench.  
 ¾-inch open-end wrench.  
 1⅜-inch open-end wrench.  
 1¼-inch open-end wrench.

Remove shoe springs TRU-C-514. Loosen shoe adjusting set screws TRU-C-520-1 and tie rod lock nut and adjusting nut. Then remove three cap screws BCAX1EE and lock washers BECX1M holding anchor bracket to frame bracket and lower brake assembly (fig. 50).

(c) Remove disk assembly. ⅝-inch box wrench.  
 ⅝-inch open-end wrench.

Remove four nuts BBBX1D, lock washers BECX1L and bolts WI-A6998X holding rear propeller shaft flange and brake disk to companion flange at rear of transfer case. Lower propeller shaft and disk assembly to floor.

(2) *Brake lever.*

(a) Disconnect pull rod at operating lever.

See (1) (a) above.

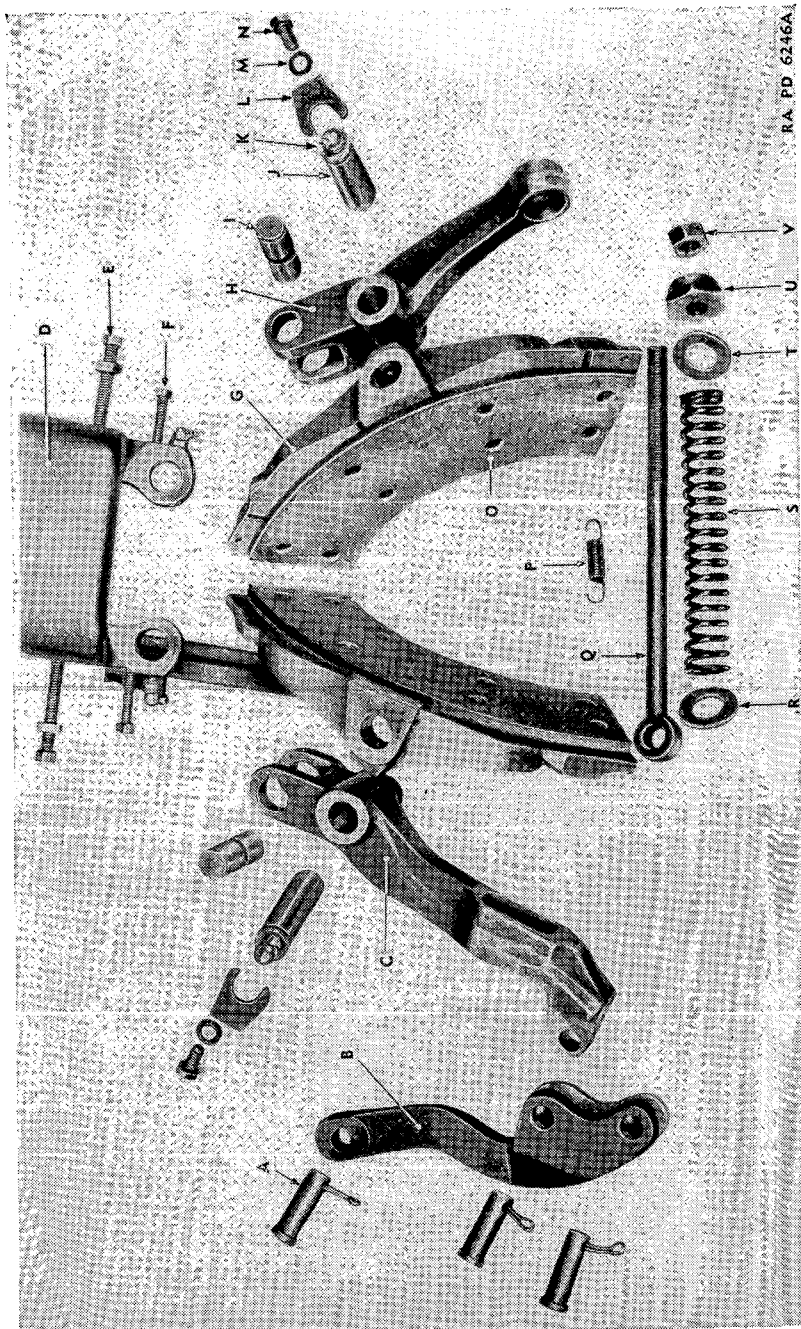
(b) Remove lever assembly with ⅜-inch open-end wrench. pull rod.

Remove two nuts BBBX1C and lock washers BECX1K holding sector CE-1577 to transmission housing and lower assembly to floor (fig. 50).

*d. Disassembly of components.*—(1) *Disk brake* (fig. 52).—Tools:

- |                          |                       |
|--------------------------|-----------------------|
| Pliers.                  | ½-inch socket wrench. |
| 1¼-inch open-end wrench. | Pivot punch.          |
| ⅜-inch open-end wrench.  | Hammer.               |
| ⅝-inch open-end wrench.  |                       |





RA. PD. 6246A

- A. { Pin BFX1F.  
 B. { Pin, cotter. BFAX1DF.  
 C. Lever TRU-C-552.  
 D. Arm TRU-C-545.  
 E. { Bracket TRU-C-551.  
 F. { Screw TRU-C-520-1.  
 G. { Nut TRU-C-541.  
 H. { Screw TRU-C-512-2.  
 I. { Nut BBX1B.  
 J. { Shoe TRU-C-505.  
 K. Arm TRU-C-548.  
 L. Pin TRU-C-507.  
 M. Pin TRC-C-509.  
 N. Fitting CLDX5M.  
 O. Retainer TRU-C-542.  
 P. Washer, lock, BECX1H.  
 Q. Screw, cap, BCAX3AB.  
 R. Lining TRU-C-4.  
 S. Spring TRU-514.  
 T. Rod TRU-C-479.  
 U. Washer BEBX1CP.  
 V. Spring TRU-513.  
 W. Washer BEBX1CP.  
 X. Nut TRU-C-483-A.  
 Y. Nut BBBX1E.

FIGURE 52.—Drive shaft brake—exploded view.

(a) Remove brake assembly from vehicle.

Follow steps outlined in *c*(1) (a), (b), and (c) above.

(b) Remove operating lever and Pliers.  
tie rod.  $1\frac{1}{4}$ -inch open-end wrench.

Remove tie rod lock nut BBBX1E and spherical nut TRU-C483-A. Then pull out cotter pins BFA X1DF and clevis pins TRU-RA-12-6 holding operating lever TRU-C-552 to front brake shoe lever arm. Remove operating lever, tie rod TRU-C-479, release spring TRU-C-513, and washers BEBX1M.

(c) Remove brake shoe assem-  $\frac{1}{2}$ -inch socket wrench.  
blies.

Remove brake shoe pin retainer cap screws BCAX3AB, lock washers BECX1H, and pin retainers TRU-C-542. Then pull out brake shoe pins TRU-C-509 and remove shoe assemblies.

(d) Disconnect brake shoe lever  $\frac{3}{8}$ -inch open-end wrench.  
arms from anchor bracket.  $\frac{5}{8}$ -inch open-end wrench.

Loosen setscrew lock nuts BBAX1B and turn adjusting screws TRU-C-512-2 out of anchor bracket TRU-C-551 until they are free of grooves in anchor pins. Pull out anchor pins TRU-C-507 and remove lever arms TRU-C-545 (front), TRU-C-543 (rear).

(e) Remove linings from brake Pivot punch.  
shoes. Hammer.

Punch out rivets BMCX1 holding linings TRU-C-4 to shoes TRU-C-505 and remove linings.

(2) *Brake lever.*—Tools:

$\frac{3}{4}$ -inch open-end wrench.	Drift.
$\frac{9}{16}$ -inch open-end wrench.	Hammer.
Pliers.	$\frac{9}{16}$ -inch socket wrench.
File.	Punch.

(a) Remove brake lever assem-  
bly from vehicle.

Follow steps outlined in *c*(2) (a) and (b) above.

(b) Remove yoke end pull rod.  $\frac{3}{4}$ -inch open-end wrench.

Mark position of lock nut BBDX2B on pull rod to facilitate reassembly. Then loosen nut and turn pull rod WI-347363 out of lever block WI-347370 (fig. 53).

(c) Remove lever block. Pliers.

Pull out lever block cotter pin BFAX1CG and remove washer BEBX1K and lever block (fig. 53).

(d) Remove pawl. Pliers.  
File.  
Drift.  
Hammer.

File end of clevis pin TRU-RA-12-6 and drive pin out of brake lever clevis and pawl CE-1543. Then pull out pawl rod cotter pin BFAX1BF and remove pawl from pawl rod.

(e) Remove sector.  $\frac{1}{16}$ -inch open-end wrench.  
 $\frac{1}{16}$ -inch socket wrench.  
Pliers.

Pull out castellated nut cotter pin BFAX1CG and remove nut BBFX1C and bolt WI-A3062X, holding sector to lever. Slip sector CE-1577 out of lever fork.

(f) Remove pawl rod. Punch.  
Hammer.

Drive out pin CE-1625, holding pawl rod button CE-1622 in lever handle, and remove button and spring WI-A35987X. Then pull pawl rod out of lever.

*e. Maintenance and adjustments.*—(1) Brake shoes normally must be parallel to and not touch the disk when the brake is in the released position. If they are found to be out of parallel, adjust by turning the top adjusting setscrews at the front and rear of the anchor bracket.

(2) Inspect linings and if they are worn close to the rivets replace with new linings of the same make, as follows:

(a) Remove old linings from shoes by following steps outlined in *d*(1)(a), (b), (c), and (e) above.

(b) Set the new linings on the brake shoes and hold them in place with a suitable clamp.

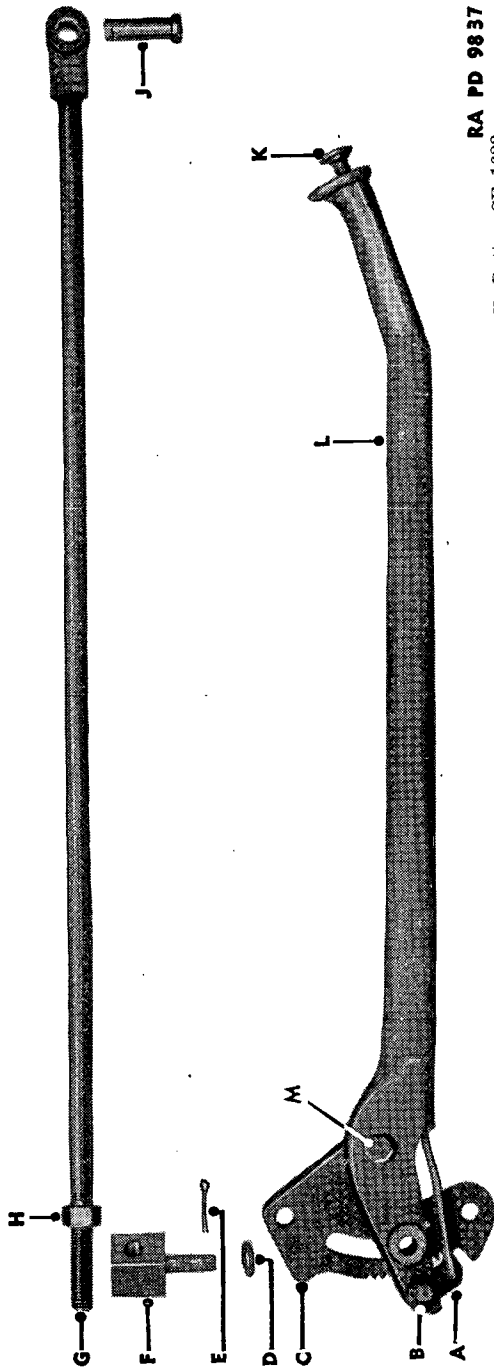
(c) Rivet the linings to the shoes with the correct type of rivets. Never use aluminum rivets.

(d) Remove the high spots and burs around the rivet holes with a fine file. Do not use emery paper.

(e) Replace the brake shoes as explained in *f* below.

(3) When the linings wear so that the brake will not hold, or after relining the shoes, adjust as follows:

(a) Release the hand brake lever fully and disconnect the pull rod at the operating lever by removing the cotter pin and clevis pin.



RA PD 9837

K. Button CE-1622.  
L. Lever assembly WI-347371.  
M. Bolt WI-A3062X.

G. Rod assembly WI-347363.  
H. Nut BBX1E.  
I. Pin BFFX1F.

D. Washer BEBX1K.  
E. Pin, cotter, BFAX1CD.  
F. Block WI-347370.

A. Pawl CE-1543.  
B. Rivet BMCX1.  
C. Sector CE-1577.

FIGURE 53.—Drive shaft parking brake lever.

(b) Tighten operating lever tie rod spherical adjusting nut so that the lever arm release spring on the tie rod will draw the operating lever firmly against the front brake lever arm.

(c) Insert a  $\frac{1}{32}$ -inch shim or feeler gage between the front shoe lining and disk (fig. 54).

(d) Adjust hand lever pull rod to maintain this clearance and reconnect pull rod to operating lever by replacing clevis pin and cotter pin.

(e) Adjust rear shoe for the same clearance with the disk and

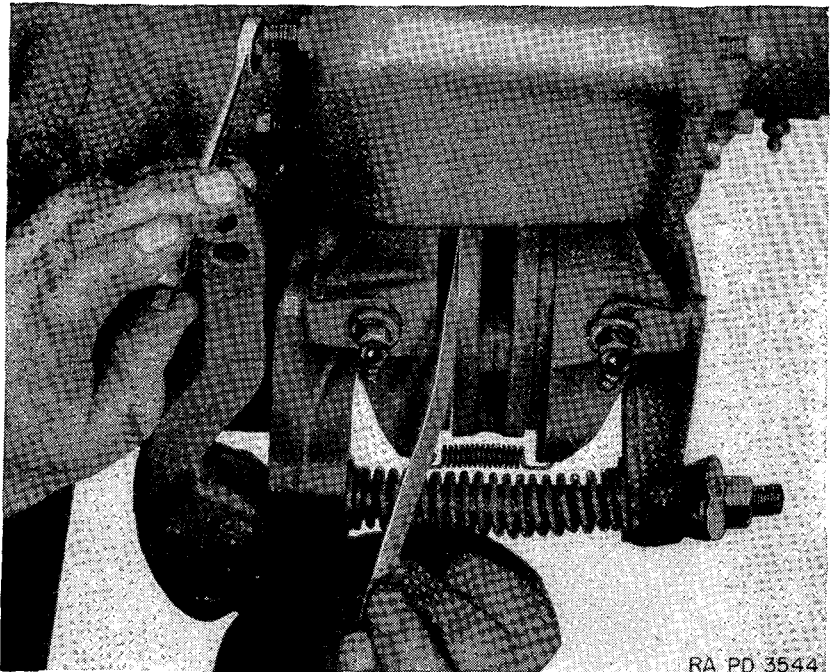


FIGURE 54.—Drive shaft brake front shoe adjustment.

tighten locking nut on rear end of tie rod to keep this spacing (fig. 55).

(f) Make sure that the spring connecting the lower ends of the brake shoes, is in place and adjust the top screws at the front and rear of the anchor bracket to make shoes and linings parallel to disk.

(g) Remove shims.

(4) Inspect all clevis and anchor pins and replace any that are badly worn or damaged.

(5) Check lever arm release spring, shoe connecting spring, and

pawl rod spring for breaks or signs of permanent set and replace if necessary.

(6) Inspect pawl and quadrant for worn or broken teeth and replace with new parts if required.

(7) Service data.

Brake adjustment:

Clearance, linings to disk-----	1/2 in.
Brake release spring:	
Free length-----	4 3/4 in.
Pressure at 4 3/16 inches-----	60 lb.

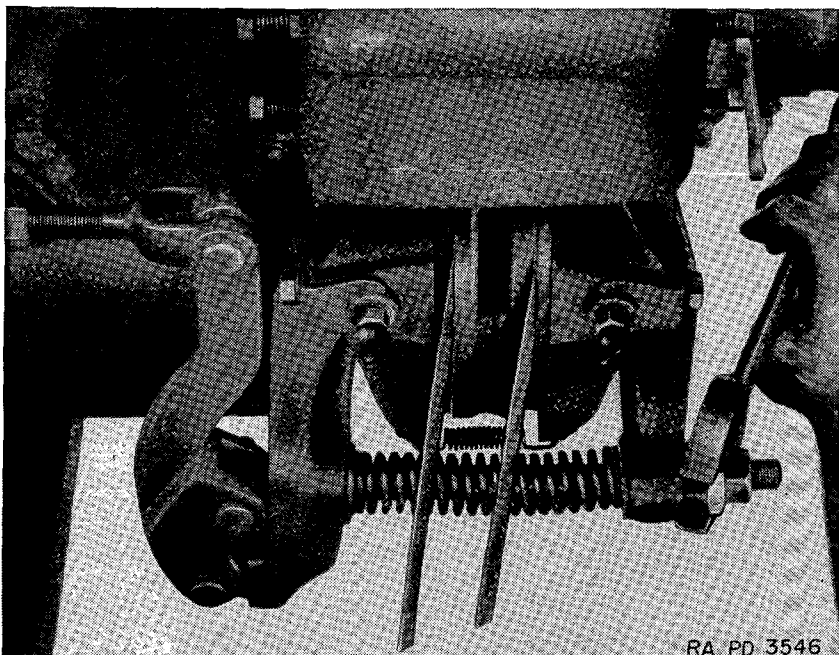


FIGURE 55.—Drive shaft brake rear shoe adjustment.

*f. Reassembly of components.*—(1) *Disk brake* (fig. 52).—Tools:

3/8-inch open-end wrench.	1 1/4-inch open-end wrench.
5/8-inch open-end wrench.	1/2-inch socket wrench.
3/4-inch open-end wrench.	Pliers.

(a) Fasten linings to shoes.

Follow steps outlined in *e*(2)(*b*), (*c*), and (*d*) above.

(*b*) Attach brake shoe lever arms to anchor bracket. 3/8-inch open-end wrench.  
5/8-inch open-end wrench.

Hold lever arms in position and replace anchor pins. Turn in set-screws until anchor pins are locked in place and tighten setscrew lock nuts.

(c) Attach brake shoe assemblies to lever arms.  $\frac{1}{2}$ -inch socket wrench.

Straddle lever arms with brake shoes and replace brake shoe pins. Then lock pins in place with pin retainers, retainer holding cap screws, and lock washers.

(d) Attach tie rod to operating lever. Pliers.

Slip tie rod eye into operating lever clevis and replace clevis pin and cotter pin.

(e) Replace operating lever w/tie rod.  $\frac{3}{4}$ -inch open-end wrench.  
 $1\frac{1}{4}$ -inch open-end wrench.  
 Pliers.

Slip tie rod through front lever arm and install release spring and washers on rod. Then push rod through rear lever arm and start spherical nut and lock nut on threaded section of rod. Attach lower part of operating lever clevis to front lever arm by replacing clevis pin and cotter pin.

(2) *Brake lever.*—Tools:

Hammer.	$\frac{3}{4}$ -inch open-end wrench.
Fine file.	$\frac{9}{16}$ -inch socket wrench.
$\frac{9}{16}$ -inch open-end wrench.	Pliers.

(a) Replace pawl rod. Hammer.  
 Fine file.

Insert pawl rod into lever handle, install spring and button, and stake assembly with button pin. File end of pin flush with handle.

(b) Replace sector.  $\frac{9}{16}$ -inch open-end wrench.  
 $\frac{9}{16}$ -inch socket wrench.  
 Pliers.

Slip sector into fork at bottom of lever and fasten in position with cap screw, castellated nut, and cotter pin.

(c) Replace pawl. Pliers.  
 Hammer.

Hook pawl on to bottom of pawl rod and fasten it into lever fork by inserting pin and peening over its inner end.

(d) Replace lever block. Pliers.



Insert lever block rod end through lever fork and slot in sector and replace holding washer and cotter pin.

(e) Replace yoke end pull rod.  $\frac{3}{4}$ -inch open-end wrench.

Turn threaded end of pull rod into lever block until mark made at disassembly is reached. Then lock rod in this position with its lock nut.

g. *Installation of assembly.*—(1) *Disk brake* (figs. 48 and 49).—

Tools:

$\frac{3}{4}$ -inch open-end wrench.  $1\frac{1}{4}$ -inch open-end wrench.

$\frac{5}{8}$ -inch open-end wrench.  $\frac{5}{8}$ -inch box wrench.

$\frac{3}{8}$ -inch open-end wrench. Pliers.

$\frac{1\frac{3}{16}}$ -inch open-end wrench.  $\frac{1}{32}$ -inch shims.

(a) Attach anchor bracket w/brake assembly to frame bracket.  $\frac{3}{4}$ -inch open-end wrench.

Hold anchor bracket assembly in position and replace cap screws and lock washers, holding anchor bracket to frame bracket.

(b) Replace disk assembly.  $\frac{5}{8}$ -inch box wrench.  
 $\frac{5}{8}$ -inch open-end wrench.

Slip disk assembly between brake shoes and hold it in its normal running position. Then bring propeller shaft into position and insert bolts through transfer case companion flange, disk spider, and propeller shaft flange. Fasten assembly with lock washers and nuts.

(c) Replace brake shoe spring. Pliers.

Hook one end of spring on to bottom of front shoe, stretch spring, and hook opposite end on to bottom of rear shoe.

(d) Adjust brake shoes.  $\frac{3}{8}$ -inch open-end wrench.  
 $\frac{5}{8}$ -inch open-end wrench.  
 $\frac{1\frac{3}{16}}$ -inch open-end wrench.  
 $1\frac{1}{4}$ -inch open-end wrench.  
 $\frac{1}{32}$ -inch shims.  
Pliers.

Follow steps outlined in e(3) (b) to (g), inclusive, above.

(2) *Brake lever.*

(a) Attach lever assembly to transmission housing.  $\frac{9}{16}$ -inch open-end wrench.

Push lever up through floor plate and set sector onto studs in side of transmission housing. Fasten assembly with lock washers and stud nuts.

(b) Connect pull rod yoke end Pliers.  
to top of operating lever.

Insert clevis pin through yoke end and lever and lock clevis pin in place with cotter pin. Check brake adjustment.

SECTION VI

COOLING SYSTEM

Description.....	Paragraph
Trouble shooting.....	19
Radiator.....	20
Water pump and fan assembly.....	21
	22

**19. Description.**—The water-cooling system (fig. 56) consists of the engine water jacket, water outlet fitting, radiator, centrifugal water pump, connecting pipes and hoses and shroud inclosed fan. The radiator is located in front of the engine and is connected to the engine water outlet and the water pump inlet by means of brass pipes with short rubber hose connections at both ends. The water pump is bolted on the left front side of the engine block and is connected to the engine water inlet by a short rubber hose. The pump is gear driven from the camshaft gear by means of the engine idler gear. The fan is bolted to the front of the pulley hub and the pulley is mounted on roller bearings on a stationary shaft. The shaft is carried by an adjustable bracket mounted on the engine timing gear cover. The shaft assembly can be adjusted vertically by means of the bracket handwheel and screw assembly so that the driving V-belts can be kept at the proper tension at all times. The system may be drained by removing the water pump discharge plug and opening drain cocks located in radiator outlet pipe and in the left rear side of the engine block. Vents sealed by plugs in the engine water outlet fitting and the water pump inlet fitting are provided for installing a heater.

*a. Functioning.*—The pump circulates cooled water from the radiator throughout the channels in water jacket and cylinder head. The warmer liquid which rises to the top of the water jacket is forced through the radiator inlet into the upper radiator tank, flows down the radiator tubes for cooling, and is redrawn from the lower tank into the pump to repeat the cycle. Air, rushing through the radiator fins and around the tubes, cools the liquid as it descends through

the tubes and is then blown back over the engine by the fan to help keep the engine cool.

*b. Specifications.*

- Cooling capacity----- 19 quarts.
- Water pump :
  - Type----- Impeller.
  - Make----- Hercules.
  - Model----- 40170-CS.
  - Location----- Left front side of cylinder block.
  - Drive----- Double V-belt.
  - Impeller location----- Pump body.
  - Bearings----- Bushings.
- Fan :
  - Make----- Schwetzer-Cummins Co.
  - Number----- A-105005.
  - Diameter----- 19 inches.
  - Number of blades----- 6.
- Fan belts :
  - Make----- Gates.
  - Type----- V.
  - Width----- 3/4 inch.
  - Length----- 52 1/2 inches.
- Radiator core :
  - Make----- Modine.
  - Number----- AD3583.
  - Type----- Fin and tube.
  - Frontal area----- 555 square inches.
  - Thickness----- 3/4 inches.

**20. Trouble shooting.**

<i>Symptom and probable cause</i>	<i>Probable remedy</i>
<i>a. Overheating.</i>	
Radiator dirty inside or out.	Clean radiator thoroughly.
Dirty water.	Drain and refill with clean water.
Engine timing wrong.	Time engine correctly.
Fan belts slipping on fan pulley.	Take up belt slack.
Thermostat not functioning correctly.	Replace with new one.
Restriction in system.	Clean system to remove restriction.
Air being drawn into system.	Tighten hose connections.

## b. Loss of cooling liquid:

Loose hose connections.	Tighten all connections.
Damaged hose connections.	Replace damaged hose.
Leaking water pump.	Replace pump.
Leaks in radiator core.	Remove core and repair leaks.
Loose or open drain cocks.	Check and tighten.

**21. Radiator (fig. 57).**—*a. Description.*—The radiator is of the two-tank, fin and tube type.

(1) *Construction.*—The radiator consists of two brass tanks with the core set in between the tanks and the tubes brazed into each tank at their ends. The assembly is reinforced by an angle framework around the outside. The inlet fitting is brazed into the right-hand side of the upper tank and the filler neck to the left side. The outlet fitting is brazed into the left side of the lower tank. The filler neck has an overflow pipe welded into it at the top. The shroud is held to the radiator frame by screws. The radiator mounting bolts are welded into the saddle, which in turn is spot-welded to the bottom reinforcing bar. The studs for the side bracing rods are welded into the reinforcing bar at each side of the radiator.

(2) *Functioning.*—The system is filled with fluid through the filler neck. The liquid comes into the upper tank through the inlet fitting, goes down through the tubes to the lower tank and out through the outlet fitting. Air rushing through the fins and around the tubes cools the liquid as it runs down through the tubes.

(3) *Specifications.*

Make	Type	Manufacturer's No.	Ordnance No.	White No.
Modine.....	Fin and tube.....	AD-3583	D38075	361046

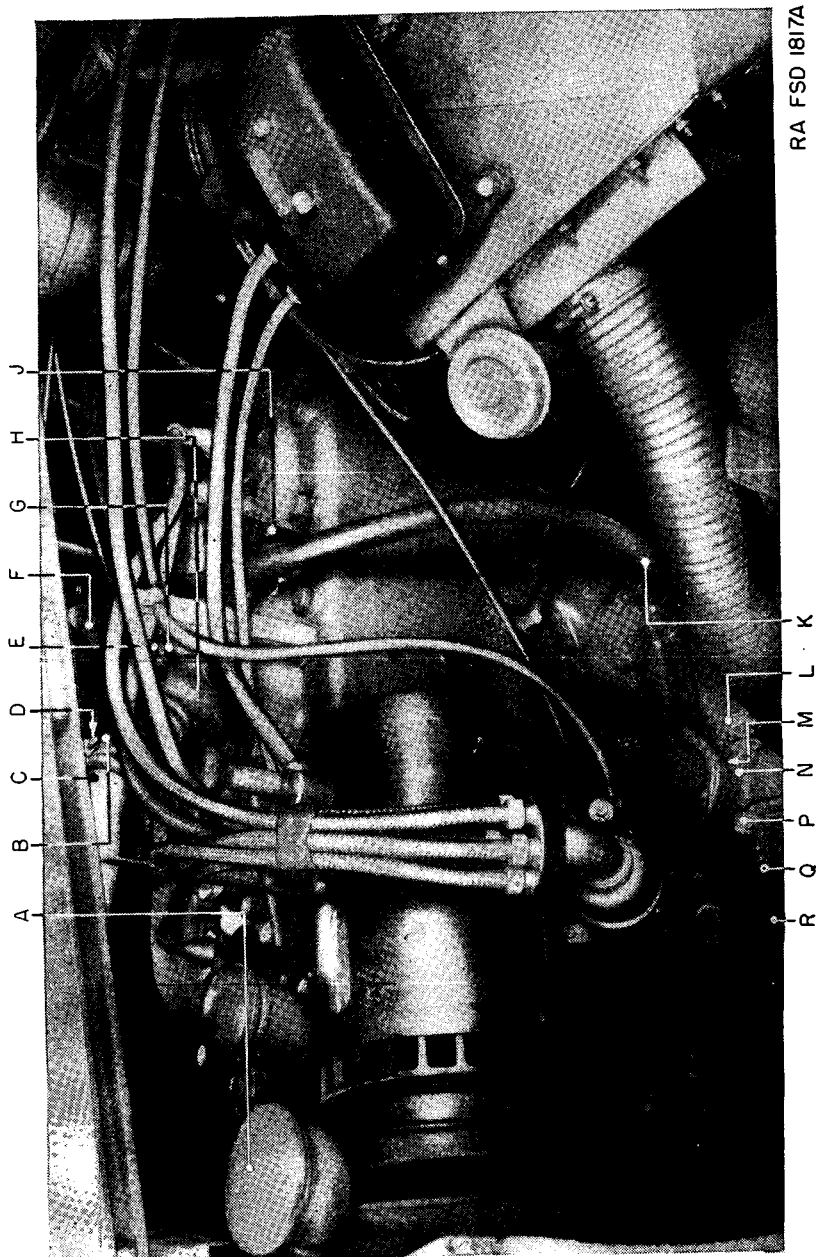
*b. Removal of assembly (fig. 58).*—Tools:

Pliers.	Screw driver.
Large pail.	$\frac{3}{4}$ -inch socket wrench.
$\frac{1}{16}$ -inch open end-wrench.	$\frac{7}{8}$ -inch socket wrench.
$1\frac{1}{16}$ -inch open-end wrench.	Hoist.
$\frac{3}{4}$ -inch open-end wrench.	

(1) Drain radiator. Pliers.  
Large pail.

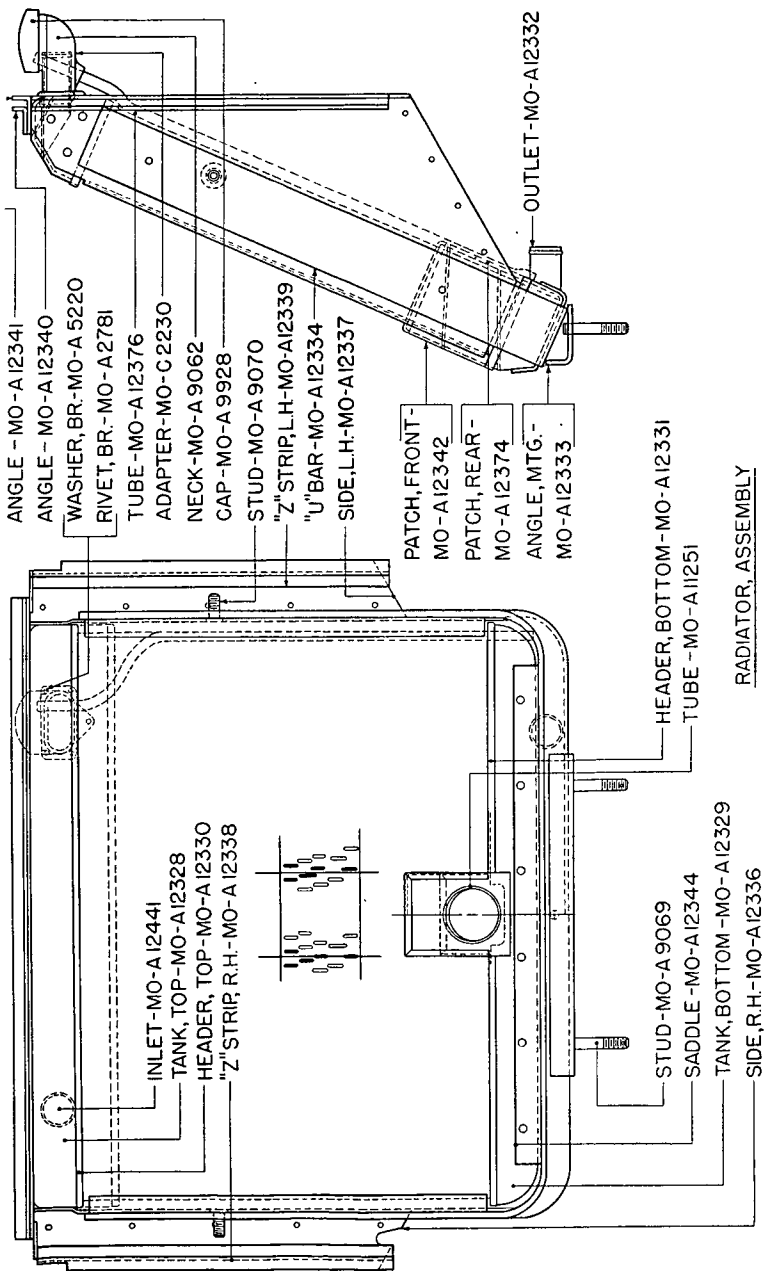
Open drain cock WH-140 in radiator lower tube assembly WI-326396 and drain liquid into pail or on ground.

RA FSD 1817A



- A. Cap MO-A-9928.  
 B. Hose WI-342576.  
 C. Tube WI-315186.  
 D. Clamp WI-A42751.  
 E. Clamp WI-375226.  
 F. Hose WI-324759.  
 G. Valve WI-375229.  
 H. { Connection WI-368401.  
   Gasket WI-A1949X.  
   Screw, cap, BCAX1CC.  
   Washer, lock, BECX1K.
- J. { Support WI-324759.  
   Clip WI-A10023X.  
   Screw, machine, BCNX2AF.  
   Nut BBKX2C.  
   Washer, lock, BECX1E.  
 K. Hose WI-324759.  
 L. Clamp WI-375226.  
 M. Gasket WI-10035.  
 N. { Connection WI-36840C.  
   Screw, cap, BCAX1CL.  
   Washer, lock, BECX1K.  
 P. Clamp WI-A42751.  
 Q. Hose WI-342756.  
 R. Tube assembly WI-326396.

FIGURE 56.—Cooling system, installed.



RADIATOR, ASSEMBLY

MODINE MFG. N<sup>o</sup> AD-3583

WHITE N<sup>o</sup> 361046

Figure 57.—Radiator assembly.—sectionalized view.

RA PD 3274





- (2) Remove hood.  $\frac{9}{16}$ -inch open-end wrench.

Remove six screws DS-H-12083, nuts BBSX4AE and lock washers BECX1E holding hood top plate DS-PA-2752-13 to top of shutter frame and cowl. (This procedure is for lot 1 cars. For lot 2 cars, remove three elastic stay nuts and bolts at rear of center panel of hood.) Remove nut and bolt on inside of shutter frame, near top, on both sides of frame. Hood can be lifted leaving top of lower frame on hood. Lift off hood with hoist and rope, or three men can slide it over front of car.

- (3) Remove fan assembly (fig. 59).  $1\frac{1}{16}$ -inch open-end wrench.  
 $\frac{3}{4}$ -inch open-end wrench.

Loosen fan belt by turning spindle jam nut and adjusting screw lock nut. Remove two screws and washers holding fan bracket. Remove fan belts. Remove fan assembly with bracket.

- (4) Disconnect upper and lower radiator hose connections. Screw driver.

Unscrew hose clamp bolts BAOX1CD, loosen clamps WI-A42751, and pull hoses AQRX1 from inlet and outlet fittings.

- (5) Disconnect bottom of radiator from frame.  $\frac{3}{4}$ -inch socket wrench.  
Pliers.

Remove radiator mounting stud cotter pins BFX1CG and castle nuts BFX1E and take off washers BEBX1CM, springs WI-A8596X and spring pads WI-376208.

- (6) Disconnect stay rods at each side of radiator.  $\frac{7}{8}$ -inch socket wrench.

Remove nuts BBBX2A and lock washers BECX1N holding stay rod WI-315138 (left) WI-315137 (right), to frame and pull stays free of studs.

- (7) Remove radiator assembly. Hoist.

Lift radiator assembly MO-AD-3583 out of frame by pulling up and slightly to front so that shroud clears fan (fig. 60).

*c. Disassembly.*—Tools:

$\frac{5}{16}$ -inch open-end wrench. Blow torch.  
Screw driver.

- (1) Remove radiator assembly.

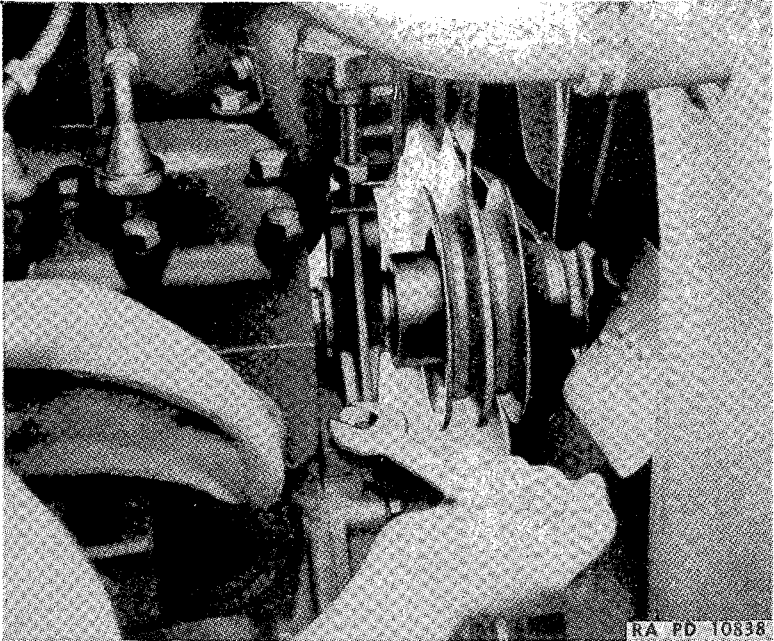


FIGURE 59.—Fan mounting bracket removal.

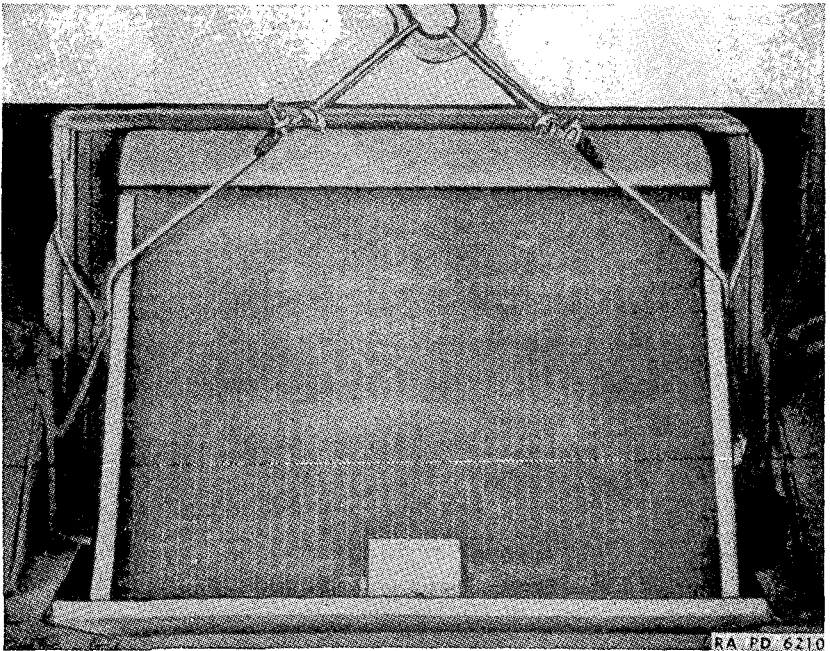


FIGURE 60.—Radiator removal.

Follow steps outlined in *b*(1) to (7), inclusive, above.

- (2) Remove shroud.  $\frac{5}{16}$ -inch open-end wrench.  
Screw driver.

Remove 18 nuts BBKX26, lock washers BECX1E, and screws BCNX2AG holding shroud WI-316765 (left), WI-316763 (right) (fig. 61).

- (3) Remove filler neck. Blow torch.

Heat section of filler neck MO-A-9062, at point of attachment, until solder runs, then pull off neck.

- (4) Remove inlet and outlet fittings. Blow torch.

Follow procedure used in (3) above.

*d. Maintenance and repairs.*—(1) Check the inlet and outlet fittings and the filler neck for damage or breaking away at the points where they are attached to tanks. If any is apparent, proceed as follows:

- (a) Remove fittings as explained in *c* above.

(b) If the fittings are damaged, replace with new ones. Otherwise, remove solder from old fitting.

- (c) Solder filler neck and inlet and outlet fittings to tanks.

(2) At least every 20,000 miles, remove radiator core and clean it inside and out with a cleaning solution. At the same time, examine core for leaks and bent tubes. Repair if necessary.

- (a) The leaks can usually be repaired by soldering.

(b) Bent tubes can be straightened by pushing a long steel bar through them. This will also clean them. All tubes should be subjected to this process.

(c) If the radiator core requires painting, spray with special radiator paint. Do not use paint mixed with oil, as this type will form an insulation on the core and prevent dissipation of heat.

(3) Inspect mounting studs. If they are bent or damaged, replace with new studs in the following manner:

- (a) Cut off old studs close to saddle.

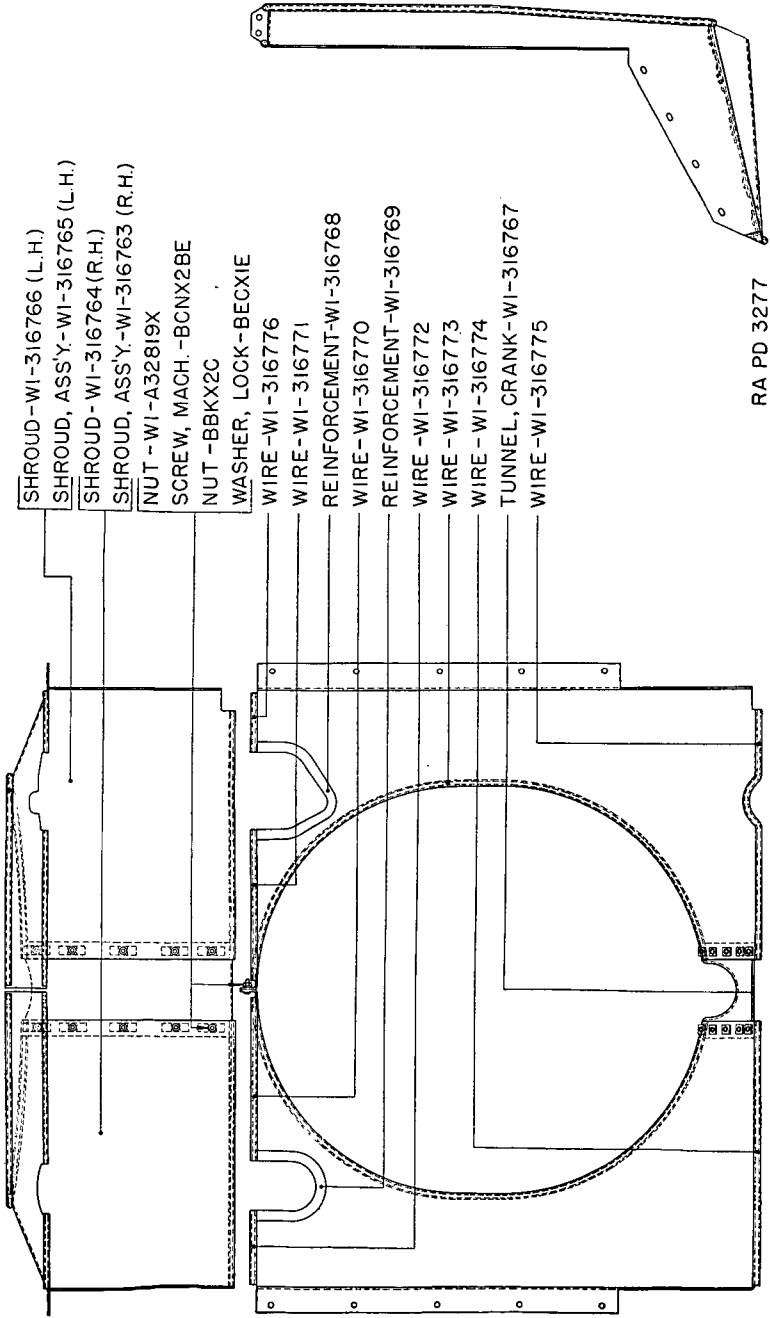
- (b) Drill remainder of studs out of saddle.

- (c) Insert new studs and weld them to top of saddle.

(4) Check mounting springs. If they have taken a permanent set or are damaged, replace them.

- (5) Inspect mounting pads and replace with new ones, if necessary.

- (6) Service data.



RA PD 3277

FIGURE 61.—Radiator shroud assembly.

Stay rod studs (each side of radiator) :

Size-----  $\frac{1}{2}$ -20 SAE threads (1 inch x  $1\frac{1}{4}$  inches.)

Bottom mounting studs :

Size-----  $\frac{1}{2}$ -20 SAE threads (1 inch x  $2\frac{7}{8}$  inches.)

(7) Check construction of radiator overflow pipe.

(a) All scout cars M3A1 are equipped with radiators in which the overflow tube begins just below the top of the radiator filler neck cap and passes downward through the bottom of the filler neck and along the left side of the radiator. On these vehicles the top opening of the overflow pipe will be restricted in accordance with the following instructions in order to prevent excessive loss of cooling fluid.

1. Remove radiator cap and insert a strip of shim stock  $\frac{1}{16}$  by  $\frac{3}{16}$  by 3 inches into top opening of overflow pipe.
2. Pinch sides of tube against shim stock.
3. Pull shim stock out of overflow tube and replace radiator filler cap.

(b) Be sure that the overflow tube is not entirely closed off. As the radiator gets hot, a completely blocked tube causes pressure to build up, and the radiator may burst. When inspecting the level of the cooling fluid, check to see that the overflow tube is open.

*e. Reassembly.*

(1) Replace inlet and outlet fittings and filler neck. Soldering iron. Rod and heating pot or furnace.

Clean fittings thoroughly with acid, hold them in place and solder, using correct type of soldering rod.

(2) Test radiator assembly for leaks.

See *f* below.

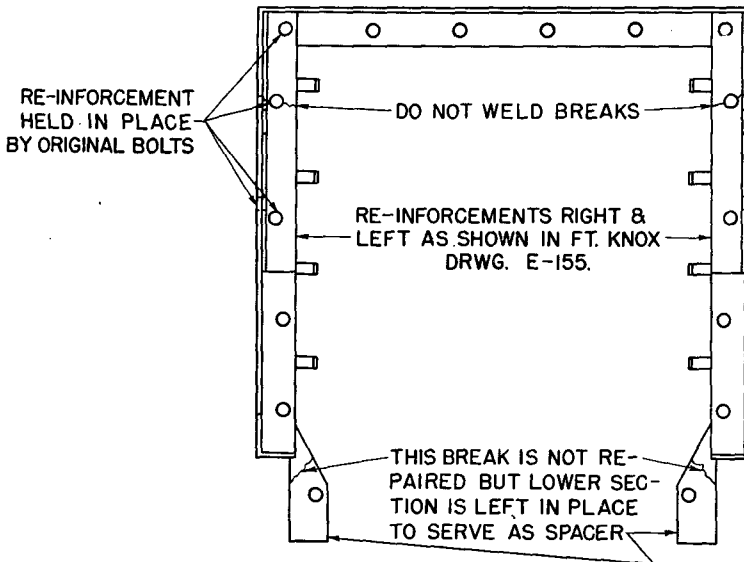
*f. Test.*—After the radiator has been repaired or a soldered fitting replaced, test the unit as follows :

- (1) Plug inlet and outlet fittings and filler neck.
- (2) Apply air, at a pressure of 6 to 7 pounds per square inch, to the radiator through the overflow pipe by slipping the rubber hose from the air line over the overflow pipe.
- (3) Immerse the radiator in a tank full of water and if there are no leaks, no air bubbles will appear at the surface of the water. If bubbles do appear, the leaky parts should be marked and repaired by soldering.

*g. Repair of radiator grille frame.*—Fractures may occur near the upper corners of the radiator grille or shutter frame. These fractures can be repaired as follows (fig. 62) :

(1) Prepare two angle iron reinforcements from 11-inch pieces of angle iron ( $1\frac{1}{2}$  by  $1\frac{1}{2}$  by  $\frac{3}{16}$  inches), as shown in figure 63. Install the two reinforcements on the radiator grille or shutter frame in the position indicated in figure 62, using the original bolts.

(2) Weld the cracks which develop at the junction between the individual shutter supporting brackets and upright part of the grille or shutter frame. Use either gas or electric welding. Grind the welding beads on the front surface of the grille or shutter frame to produce a smooth, flat front surface.



RA PD 9528

FIGURE 62.—Radiator louver frame.

(3) Do not weld the fractures which occur in the lower section of the radiator grille or shutter frame. Leave the broken off part in place, as shown in figure 62, to serve as a spacer. Welding of this member will not provide a satisfactory repair.

*h. Installation of assembly.—Tools:*

Hoist.

$\frac{7}{8}$ -inch socket wrench.

$\frac{3}{4}$ -inch socket wrench.

Pliers.

(1) Replace radiator.

Screw driver.

$\frac{1}{16}$ -inch open-end wrench.

Heavy duty screw driver.

Pail (or water hose).

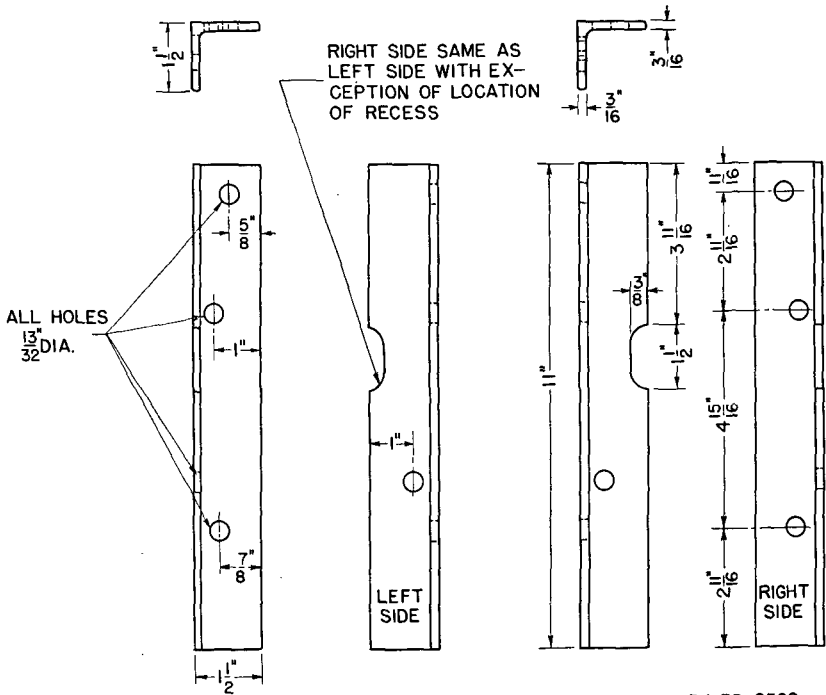
Hoist.

Set radiator in place so that mounting studs pass through holes in frame member.

- (2) Connect stay rods. 7/8-inch socket wrench.

Slip stay rods onto studs at each side of radiator and replace holding lock washers and nuts.

- (3) Replace mounting studs at- 3/4-inch socket wrench.  
taching parts. Pliers.



RA PD 9529

FIGURE 63.—Reinforcement for radiator louver frame.

Place mounting pads, springs, and washers on studs and fasten with nuts and cotter pins.

- (4) Replace upper and lower Screw driver.  
radiator hose connections.

Slide hoses onto fittings and tighten hose clamp bolts.

- (5) Replace fan assembly. 1 $\frac{1}{16}$ -inch open-end wrench.  
3/4-inch open-end wrench.

Set fan and bracket assembly in place and replace two screws, washers and belts. Tighten up adjusting screw and jam nut. (See TM 9-1706.)

- (6) Replace hood. 1/16-inch open-end wrench.  
Heavy duty screw driver.

Set hood in place on top of shutter frame and cowl. Fasten by replacing oval head screws and nuts.

- (7) Refill radiator. Pliers.  
Pail (or water hose).

Shut off drain cock and fill radiator to bottom of filler neck.

**22. Water pump and fan assembly.**—For complete maintenance information on these units, see TM 9-1706.

### SECTION VII

## ELECTRIC LIGHTING SYSTEM; BATTERY AND ACCESSORIES

	Paragraph
Introduction.....	23
Battery.....	24
Heater.....	25
Horn.....	26
Headlamps.....	27
Marker lamps.....	28
Taillamp.....	29

**23. Introduction.**—The electrical units covered include the battery, heater, horn, headlamps, marker lamps, and taillamps.

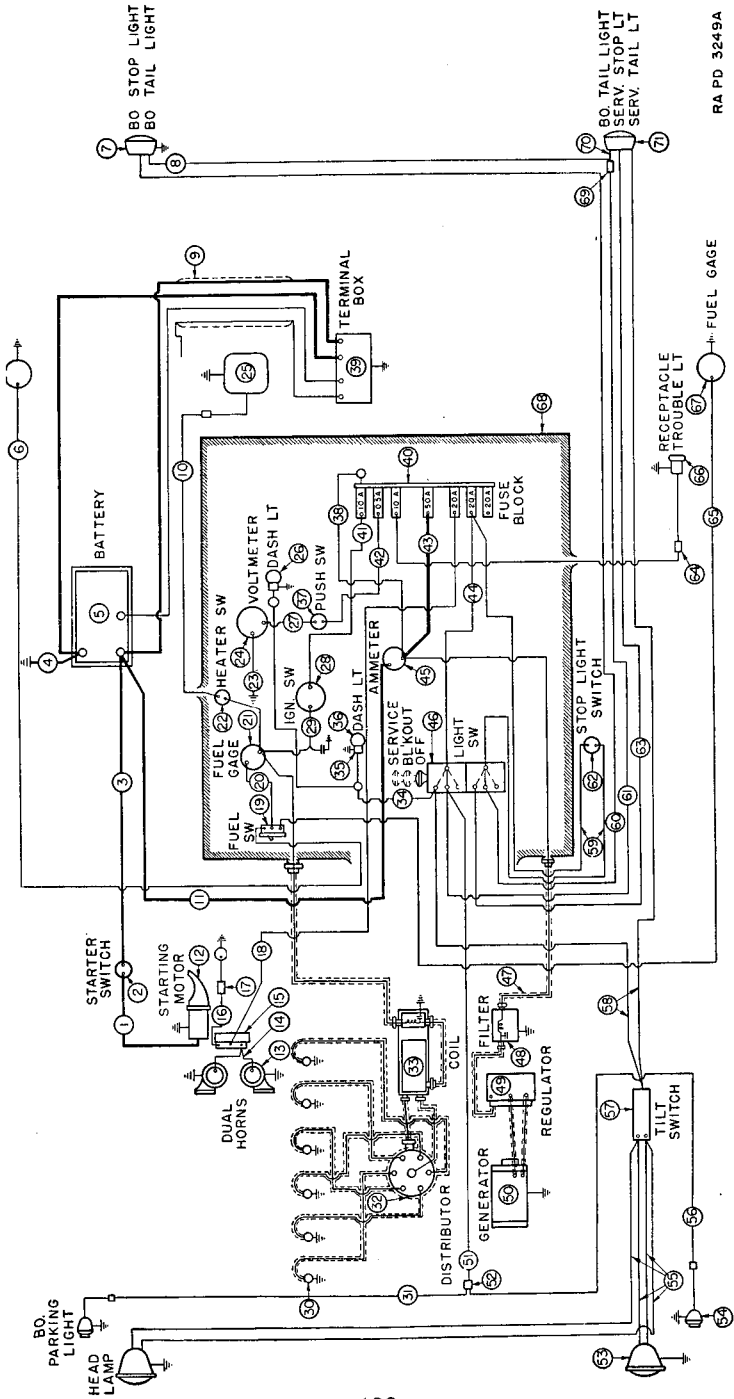
*a.* The entire vehicle wiring diagram (fig. 64), and the lighting system wiring diagram (fig. 65), are included in this manual to facilitate the tracing and repair of electrical cables and leads.

*b.* All electrical equipment installed in the scout cars that is related to the power plant (distributor, generator, starter motor, coil, etc.) is covered in TM 9-1706, TM 9-1707, and TM 9-1708.

**24. Battery** (fig. 66).—*a. Description.*—The battery is a Willard 6-cell, 12-volt model, with each cell containing 25 plates and generating 2 volts.

(1) *Construction.*—An acidproof container of rubber composition is used and the cells are formed by partitions dividing the interior. These cells are closed by hard rubber covers, sealed in place, with holes for cell poles. Each negative group of 13 plates is permanently connected at the top by a welded metal strap. The 12 positive plates, arranged alternately with the negative plates, are similarly connected

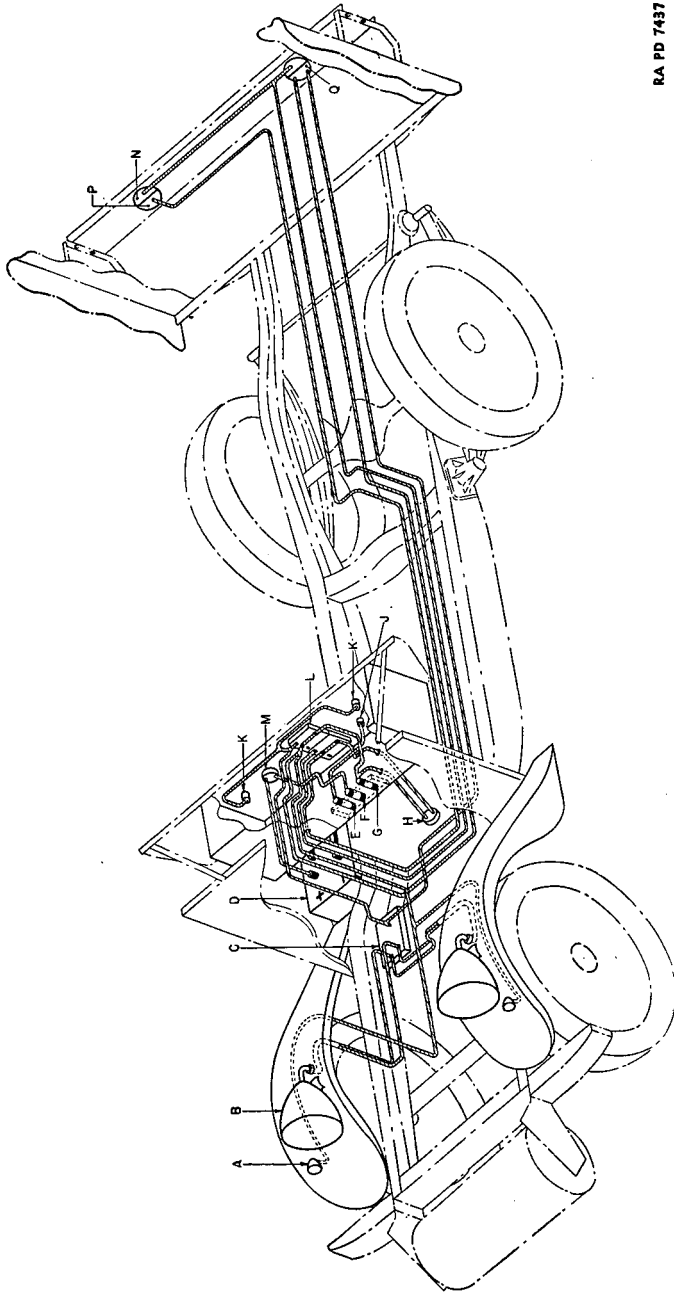




RA PD 3249A

1. Cable assembly WI-348740.
2. Switch, starter, SW-4001.
3. Cable assembly WI-348738.
4. Cable assembly WI-348739.
5. Battery WB-WH-25-6.
6. Cable assembly WI-348761
7. Taillamp, blackout assembly GL-9271170.
8. Cable assembly WI-368546.
9. Cable and conduit assembly WI-354010.
10. Cable assembly WI-368560.
11. Cable assembly WI-368535.
12. Motor assembly AL-MAU-4006.
13. Horn assembly WI-315958.
14. Cable assembly WI-348763.
15. Relay assembly DR-1116781.
16. Cable assembly RG-502484.
17. Connector DM-2321.
18. Cable assembly WI-348740.
19. Switch, fuel gage, CH-8100.
20. Cable assembly WI-348759.
21. Gage assembly SW-95622.
22. Switch, heater, assembly WI-375216.
23. Cable assembly WI-348759.
24. { Voltmeter WI-363725 (HICKOK)  
{ Optional WI-315188 (WESTON) }
25. Heater assembly WI-368288.
26. Light, w/switch, assembly WI-A8382.
27. Cable assembly WI-324756.
28. Switch, ignition, assembly DM-2980.
29. Cable assembly WI-368540.
30. Spark plug CP-J-10-14MM.
31. Cable assembly WI-368545.
32. Distributor assembly AL-1GW-4147.
33. Coil assembly AL-CF-4001.
34. Cable assembly WI-A10480.
35. Socket assembly WI-80454.
36. Light assembly WI-371622.
37. Switch, voltmeter, assembly WI-63113.
38. Cable assembly WI-371623.
39. Box, terminal, WI-348765.
40. Block, fuse, assembly WI-363733.
41. Cable assembly WI-324751.
42. Cable assembly WI-A32902.
43. Cable assembly WI-368537.
44. Cable assembly WI-A32166.
45. Ammeter SW-SG96047.
46. Switch, light, FC-7131.
47. Shielding assembly WI-368525.
48. Filter assembly TI-B-26363.
49. Regulator assembly AL-VRH-4102A.
50. Generator assembly AL-GD1-4802.
51. Cable assembly WI-361047.
52. Connector DM-2209.
53. { Headlamp, Mazda 1122.  
{ Assembly GL-925094.
54. Lamp, blackout, parking assembly GL-916388.
55. Cable assembly WI-324723.
56. Cable assembly WI-368544.
57. Switch, tilt-ray, DM-5530.
58. Cable assembly WI-368541.
59. Cable assembly WI-348753.
60. Cable assembly WI-368542.
61. Cable assembly WI-368548.
62. Switch, stoplight, assembly WI-A35947.
63. Cable assembly WI-368543.
64. Cable assembly WI-368536.
65. Cable assembly WI-348760.
66. { Receptacle WI-371618.  
{ (For lamp, inspection, assembly WI-368568. With lamp, Mazda 1142.)
67. Unit, gage, assembly WI-62431.
68. Box, shielding, assembly WI-368514.
69. Connector DM-2321.
70. Cable assembly WI-368547.
71. Taillamp, blackout, assembly GL-927181.

FIGURE 64.—Vehicle wiring diagram.



RA PD 7437

- N. Blackout stoplight.
- P. Blackout taillight.
- Q. Service stoplight.
- Q. Service taillight.

- J. Receptacle for trouble light.
- K. Dash light.
- L. Light switch.
- M. Ammeter.

- E. 10-ampere fuse.
- F. 50-ampere fuse.
- G. 20-ampere fuse.
- H. Stop light switch.

- A. Blackout parking light.
- B. Headlamp.
- C. Tilt switch.
- D. Battery.

FIGURE 65.—Lighting system—schematic diagram.

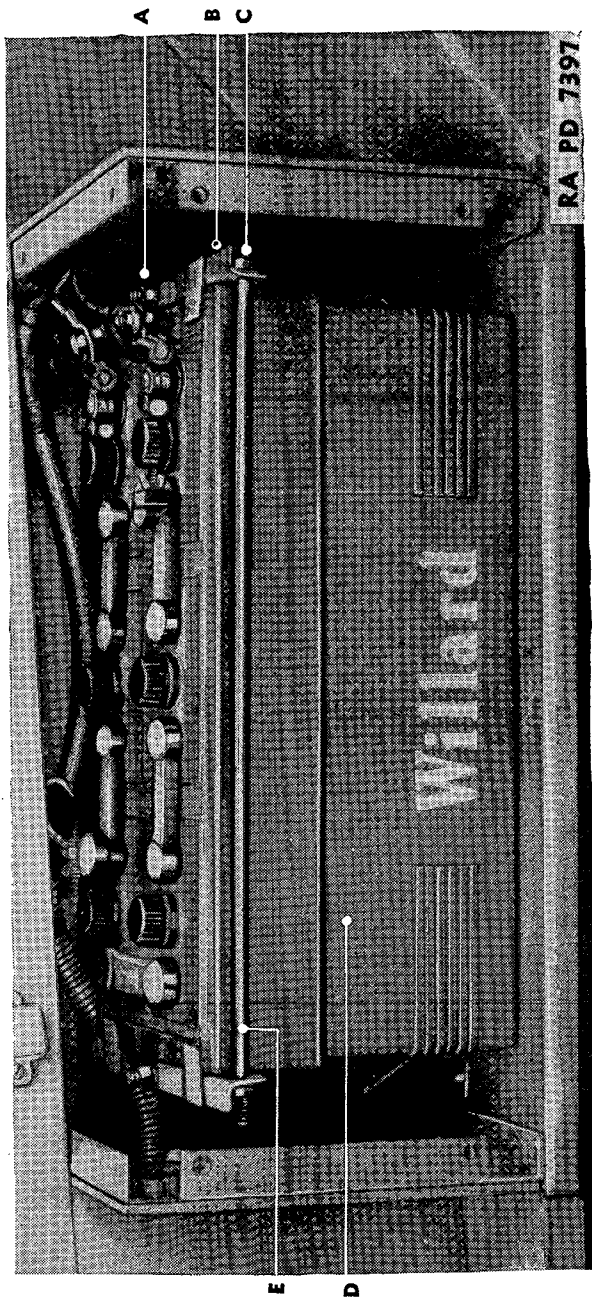
in one group by a strap carrying the projecting positive terminal. Between each two adjacent positive and negative plates is an insulator or separator of specially treated wood or rubber, in sheets, with vertical ribs on its face. The plates and separators are vertically installed on ribs molded in the bottom of the container, with a sediment space provided on the bottom. The exposed terminals of each cell are joined, positive to negative, by outside connectors welded to the terminals on the top battery, thereby connecting the cells in series. Vents, with screw-type closure plugs which have small openings for the escape of gas, permit inspection of the inside of the cells and replenishment of the electrolyte and water. Circular rubber gaskets around the posts in the covers make the terminals leakproof.

(2) *Functioning.*—The battery produces electricity by chemical action of dilute sulphuric acid on the plates. The capacity of the battery depends upon the size and number of the plates. The latter are of stiff lead-antimony alloy castings, mesh or grid-shaped, with the openings filled with a paste consisting chiefly of oxide of lead. The plates are “formed” by putting them through an electro-chemical process in tanks containing dilute acid, before mounting them in the cells, to convert the material on the positive plates into brown peroxide of lead and that on the negative plates into gray, spongy, metallic lead. With the plates so charged, immersing them in the dilute acid in the container will create a potential between positive and negative plates. In the discharge of the battery, the sulphuric acid is transformed into water, and both the lead peroxide and some of the metal of the plates are converted into lead sulphate. The discharge must be stopped and the battery recharged before all the metal of the plates has combined with the acid.

(3) *Specifications.*

Make	Type	Model	Manufacturer's No.	Ordinance No.	White No.
Willard	Lead-acid, commercial.	WH-25-6	WB-4376	B156032 (wet charged) A226016 (dry charged)	311936

Number of cells..... 6  
 Number of plates per cell..... 13 negative; 12 positive  
 Voltage (volts)..... 12  
 Terminal grounded..... Negative  
 Specific gravity fully charged..... 1.275 to 1.300



D. Battery storage, assembly WB-4376.  
E. Rod WI-A7657X.

C. { Nut BBEX1B.  
Washer, lock, BECX1H.

A. { Nut BBEX1C.  
Washer, lock, BECX1K.  
B. Clamp assembly WI-B8251.

FIGURE 66.—Battery, installed.

Recharge at 1,200.

Capacity (ampere hours at 20-hour rate)----- 204

Location----- right side of vehicle on running board, in metal compartment

Dimensions, over-all-----  $20\frac{7}{16} \times 10\frac{5}{16} \times 10\frac{1}{4}$

Radio take-off points provided at positive, negative, 6-volt terminals

*b. Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

(1) Failure of engine and starting motor to rotate when starting switch is closed.

Loose or dirty terminals at battery.

Clean and tighten terminals.

Add water to a depth of  $\frac{3}{8}$  inch above plates.

Defective starting switch.

Inspect, clean, repair, or replace.

Battery discharged.

Recharge battery. Check generator to make sure it is charging by inspecting and testing both generator and regulator (TM 9-1706).

One or more cells shorted.

Remove, dismantle, repair or replace battery.

(2) Slow starter speed.

Loose or dirty terminals.

Clean and tighten.

Cells dry.

Replace water and electrolyte.

Battery run down.

Recharge battery.

Defective starter motor.

Repair or replace (TM 9-1706).

(3) Inability of cell to hold charge on open circuit, undue heating, little or no rise in voltage or specific gravity, or failure to gas properly on charging.

Much sediment or defective insulation in cell causing short circuit.

Dismantle and rebuild, or replace battery.

*c. Removal of assembly.*

(1) Remove metal cover and side plates of battery compartment.  $\frac{5}{8}$ -inch open-end wrench.

Unscrew three screws BANX1CC with lock washers BECX1K in housing top plate DS-PA-3053-73 and four screws BANX1CC with lock washers BECX1K in side plate DS-PA-3053-72. Remove plates.

(2) Detach cables.  $\frac{5}{8}$ -inch open-end wrench.

Loosen one nut on each terminal, removing negative lead first (fig. 67).

(3) Release battery clamp.  $\frac{5}{8}$ -inch open-end wrench.

Unscrew two nuts BBBX1C with lock washers BECX1K attaching clamp assemblies WI-B8251 at middle of ends to hook bolts WI-344980 anchored at bottom of battery compartment.

(4) Remove clamp frame from  $\frac{5}{8}$ -inch open-end wrench around top of battery.

Loosen one or two of the nuts BBBX1B on horizontal clamp frame rods and take clamp frame off.

(5) Remove battery. None.

Lift battery out of compartment.

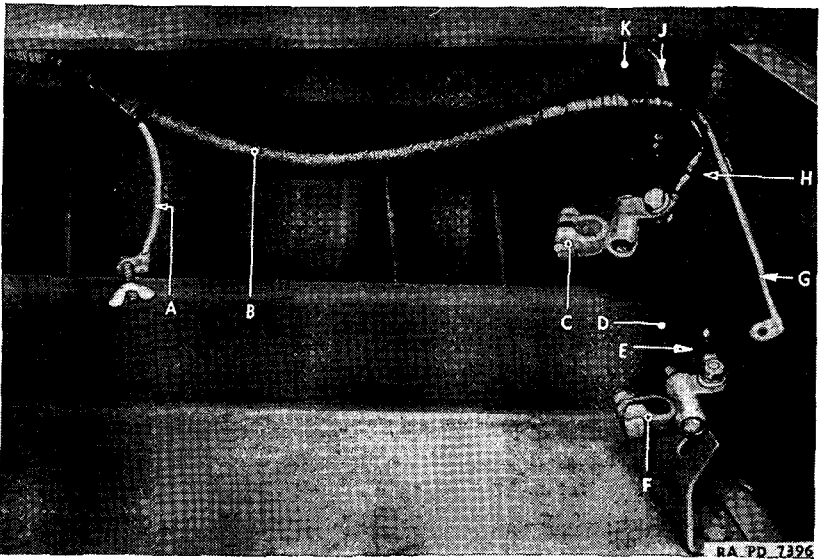
*d. Maintenance.*—(1) At least once a week inspect the hold-down frame and hook bolts, terminals, and electrolyte.

(2) Keep the level of the electrolyte  $\frac{1}{2}$  inch above the plates. Look for a leak in the container if the electrolyte appears too low in any cell. Add pure (preferably distilled) water. Do not use city, spring, or well water unless analyzed and approved. Boiling, filtering, and the use of "softening" materials or devices will not remove impurities which may injure the battery. Wipe off top of battery and terminals afterward. It is best to replenish just before a run when the battery will be working. Unmixed water will freeze in cold weather. Remove vent plugs and test each cell with an accurate hydrometer, inserting rubber tube into the electrolyte. The reading for a fully charged cell should be between 1.275 and 1.300. If any two cells are below 1.200 on two successive testing days, have the entire battery tested and fully charged.

(3) A partially discharged battery may freeze in winter. Therefore, in cold weather, the battery should be kept fully charged, particularly if the vehicle stands in a cold place for any length of time. The freezing point of the electrolyte depends on its specific gravity. When fully charged the specific gravity is highest, and at 1.300 the electrolyte will remain liquid down to far below zero.

	Specific gravity	Freezing temperature	
		Fahrenheit	Centigrade
Battery charged	1.285	-96°	-70°
Battery $\frac{1}{3}$ charged	1.255	-60°	-50°
Battery $\frac{1}{2}$ discharged	1.220	-31°	-30°
Battery $\frac{3}{4}$ discharged	1.185	-8°	-22°
Battery normally discharged	1.150	+5°	-15°
Battery completely discharged	1.100	+18°	-8°

(4) A fully charged battery, if it stands idle long enough, will discharge slowly to a point where freezing may ensue. If the vehicle is



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- A. Cable assembly No. 14.  
 B. Cable, w/conduit, assembly WI-354010.  
 C. Terminal assembly WB-Q-245.  
 D. Cable assembly WI-348739.  
 E. Cable assembly No. 6.  
 F. Terminal assembly WI-363747.  
 G. Cable assembly No. 14.  
 H. Cable No. 6.  
 J. Cable assembly WI-368535.  
 K. Cable assembly WI-348738.

FIGURE 67.—Battery cables and terminal, installed.

stored for a long time without heat in very cold weather, the battery should be lifted out and taken to a place where it can be serviced. In warm surroundings an idle battery will discharge much faster. After being idle for a time and put back into service, a battery may develop buckling of plates and have a shorter life and a much reduced capacity to recharge. A battery standing idle should be fully recharged every 30 days.

(5) Heating of the battery in service above 110° F. must not be permitted. Watch the battery in warm weather and feel the top



connectors. If these are warmer to the touch than the normal temperature of the human body, check the electrolyte with a thermometer. If the temperature reaches 130° F., the battery may be ruined, chiefly by buckling of plates, disintegration of the active material, and short-circuiting because of damage to the insulators. Whenever the battery is found to be getting too warm on a run, turn on some of the lights, or cut down the charging rate. If heating continues, check the whole electrical system as soon as possible.

(6) The battery should not stand discharged even if not needed for use, because the acid then attacks the plates and gives them a white sulphate coating. This coating is a poor conductor of electricity, reducing the capacity for charging and discharging, and lessening the effective area of the plates. Sulphation will also appear at the top of the plates if the electrolyte is not kept at the correct level ( $\frac{1}{2}$  inch above the plates). Whenever any evidence of sulphation is seen, remove the battery and recharge it. It may be restored to working efficiency by a low charging rate over a period of several days.

(7) Never add acid to the battery except when some of it has leaked out or spilled; never dilute the electrolyte with too much water. Putting in acid to raise the specific gravity will not increase the charge. It will render hydrometer readings of no value and shorten the life of the battery. When acid has been lost, add acid not above 1.400 specific gravity and charge battery or charge empty and then put in a new supply at 1.280 specific gravity. If the electrolyte is ever found to be too strong or too high, remove some of it and put in more water. If the battery is being charged and the acid shows too much strength, continue charging and correct in the same way.

(8) Check battery terminals and keep them tight. Clean them with ammonia or a solution of baking soda in water. Wash afterwards with warm water. Coat terminals with petroleum before tightening. Do not use cup grease. Inspect ground strap and motor cable and replace them if worn or corroded.

(9) If a new battery is received dry, fill it with electrolyte and before putting it into service give it an equalizing charge at half the regular charging rate until it gases freely. This step is necessary to assure correct specific gravity and voltage.

(10) (a) To mix acid and water, take only pure or distilled water and acid free from impurities. Ordinary commercial sulphuric acid is not suitable. Pour water into a lead-lined tank or glazed earthenware jar; or a vessel of rubber, stone, porcelain, or glass; then add acid, and stir with a glass rod or wood paddle (the latter coated with lead if acid of 1.865 specific gravity is used), until thoroughly inter-

mingled. Do not use any metal other than lead. *Never pour water into the acid*; spattering of the acid may cause injury.

(b) A good plan is to fill the hydrometer syringe with acid and discharge it into the water with the nozzle held under the surface. Rinse the syringe with water afterward so that no acid is left in it.

(c) Allow the mixture to cool, stir again, and test with hydrometer and thermometer. If not correct, add acid or water, stir, and check again. The temperature of the mixture should be 80° F. when readings are taken. Never fill battery with hot or cold acid. Cold acid is heavier than normal; warm acid lighter. For each 10° above 80° F., correct the reading by adding 0.004; for each 10° below 80° F., correct by subtracting 0.004 from the hydrometer indication. The dilute acid should not be over 90° F. or below 60° F. when poured into cells.

(d) When the electrolyte has a specific gravity that is too high (too much acid being present), the lead part of the plates will be attacked and the active material thereon, especially the negative plates, will be changed to sulphate when the battery is idle. Also the electrolyte will then show a tendency to attack wood separators and may carbonize or burn them. On the other hand, if the electrolyte contains too little acid, showing low specific gravity, the positive plates will be injuriously affected.

(e) The density of acid usually sold by supply houses and kept on hand by battery stations is 1.400. This can also be obtained by mixing enough water with sulphuric acid of full strength. This should be reduced to 1.345 specific gravity before using.

(f) The following table gives the proportions of water and acid to be used in mixing:

*Acid table (parts by volume)*

Water and 1.835 specific gravity sulphuric acid			Water and 1.400 specific gravity sulphuric acid		
Specific gravity	Parts water	Parts 1.835 acid	Specific gravity	Parts water	Parts 1.400 acid
1.200	13	3	1.200	13	10
1.225	11	3	1.225	10	10
1.250	13	4	1.250	15	20
1.275	11	4	1.275	11	20
1.290	8	3	1.290	9	20
1.300	5	2	1.300	4	10
1.345	2	1	1.345	1	7
1.400	3	2			

*e. Installation of assembly.*

- (1) Replace in compartment. None.

Lift battery into compartment with poles in position to receive cable terminals.

- (2) Replace clamp assemblies.  $\frac{5}{8}$ -inch open-end wrench.

Put clamp assemblies on top of battery; tighten nuts on horizontal clamp assembly rods.

- (3) Fasten battery in place.  $\frac{5}{8}$ -inch open-end wrench.

Engage two hook bolts with clamps at bottom of compartment. Push upper ends through two clamp assemblies. Attach one lock washer and one nut to each hook bolt and tighten.

- (4) Attach cables to poles.  $\frac{5}{8}$ -inch open-end wrench.

Tighten one nut on each terminal.

- (5) Put on top and side of compartment.  $\frac{5}{8}$ -inch open-end wrench.

Attach top plate with three screws and lock washers and side plate with four screws and lock washers.

**25. Heater.**—*a. Description.*—The heater is an Eaton hot-water unit installed on the inside of the dash under the instrument panel. The core is connected to receive water from the engine and the motor is controlled by a rheostat switch and operated by current from the battery. The fan is between the motor and the core. Air to be warmed is blown through the latter by the fan.

(1) *Construction.*—The heater housing contains the motor and blower of the fan assembly, and mounted on the front is the heater face which contains the core and the fan. The heater face is supported on a frame spaced away from the housing, leaving the heater open at the fan for admission of air to the core. Extending from the core through the dash are a pair of tubes connected by hose to the water pump and to the engine at the radiator outlet fitting. The outlet fitting contains a shut-off valve to control the flow of water from the engine to the heater.

(2) *Functioning.*—With the engine running and the water in the cooling jacket heated, some of the water is diverted through the core of the heater. To warm the vehicle, the rheostat switch on the instrument panel is turned to connect the motor to the battery and set the fan in motion. Air is circulated by the fan over the heated core and is warmed.

(3) *Specifications.*

Make	Type	Model	White No.
Eaton Manufacturing Co.-----	Hot water-----	Electric-----	368288

Model----- Motor fan.  
 Fan----- Six blades.  
 Controller switch----- Rheostat.  
 Operating voltage----- 12-13 volts.  
 Operating current----- 6 amperes (at battery).

*b. Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

(1) Failure of motor to run when switch is closed.

Broken lead or ground.

Check connections and switch.

Trouble in motor.

Check and adjust or repair motor.

(2) Failure to heat with fan running.

Obstructed hose or core.

Clean hose and flush core.

Shut-off valve closed.

Open valve.

*c. Removal of assembly.*

(1) Detach hose connections. Screw driver.

Close shut-off valve WI-375229 at top of engine. Loosen two hose clamps WI-375226 at heater tubes and disconnect hose WI-375230. Loosen two similar clamps at engine to remove hose for replacement purposes.

(2) Disconnect motor lead. None.

Remove cable from connector WI-331080.

(3) Remove heater from dash.  $\frac{9}{16}$ -inch open-end wrench.

Remove three nuts BBBX1B, three lock washers BECX1H, three plain washers BEBX1H, mounting heater to dash and remove heater WI-368288.

*d. Disassembly.*

(1) Detach heater front. Screw driver.

Remove four screws and remove heater case front WI-375215.

(2) Remove core and square spacer band. None.

Remove core WI-375213 and spacer band from heater by hand.

(3) Remove fan and motor.  $\frac{5}{16}$ -inch open-end wrench.

Remove two nuts WI-375218, two washers WI-375217, two plain washers and remove fan and blower assembly WI-375214, and motor assembly WI-375212.

(4) Detach fan and wheel assembly from motor. Screw driver.

Remove setscrew from hub of fan and remove fan and blower assembly WI-375214 from motor assembly WI-375212.

*e. Maintenance and adjustments.*

(1) When engine and radiator are flushed, disconnect heater hose from engine and wash core. Flush with air pressure if core seems clogged. Watch core and hose for possible leaks. Keep hose clamps at core and engine and nuts on mounting studs tight.

(2) Make sure fan is secured firmly to motor shaft and motor secured to housing.

(3) Take motor out of housing and lubricate bearings regularly.

(4) The commutator and brush should be kept clean and the motor otherwise inspected, tested, and repaired in the same way as the starting motor.

*f. Reassembly of components.*

(1) Attach fan. Screw driver.

Put hub on front end of motor shaft and fasten setscrew.

(2) Mount motor and fan.  $\frac{5}{16}$ -inch open-end wrench.

Insert motor in housing, pass ends of bolts through rear, and put on two plain washers, two lock washers, and two attaching nuts.

(3) Replace core and square spacer band. None.

Mount band in frame at front of housing; place core over it.

(4) Replace heater front. Screw driver.

Attach heater case front over core; insert and tighten four screws.

*g. Installation.*

(1) Mount heater on inside of dash.  $\frac{9}{16}$ -inch open-end wrench.

Pass tubes of core outward through holes in dash. See that spacers are on three attaching studs of housing; slip studs through holes in dash. Attach plain and lock washers and nuts at front of dash and tighten nuts.

(2) Connect heater to engine. Screw driver.

Slip hose ends on tubes in front of dash and replace hose clamps. Mount hose in supporting clips and tighten nuts on screws.

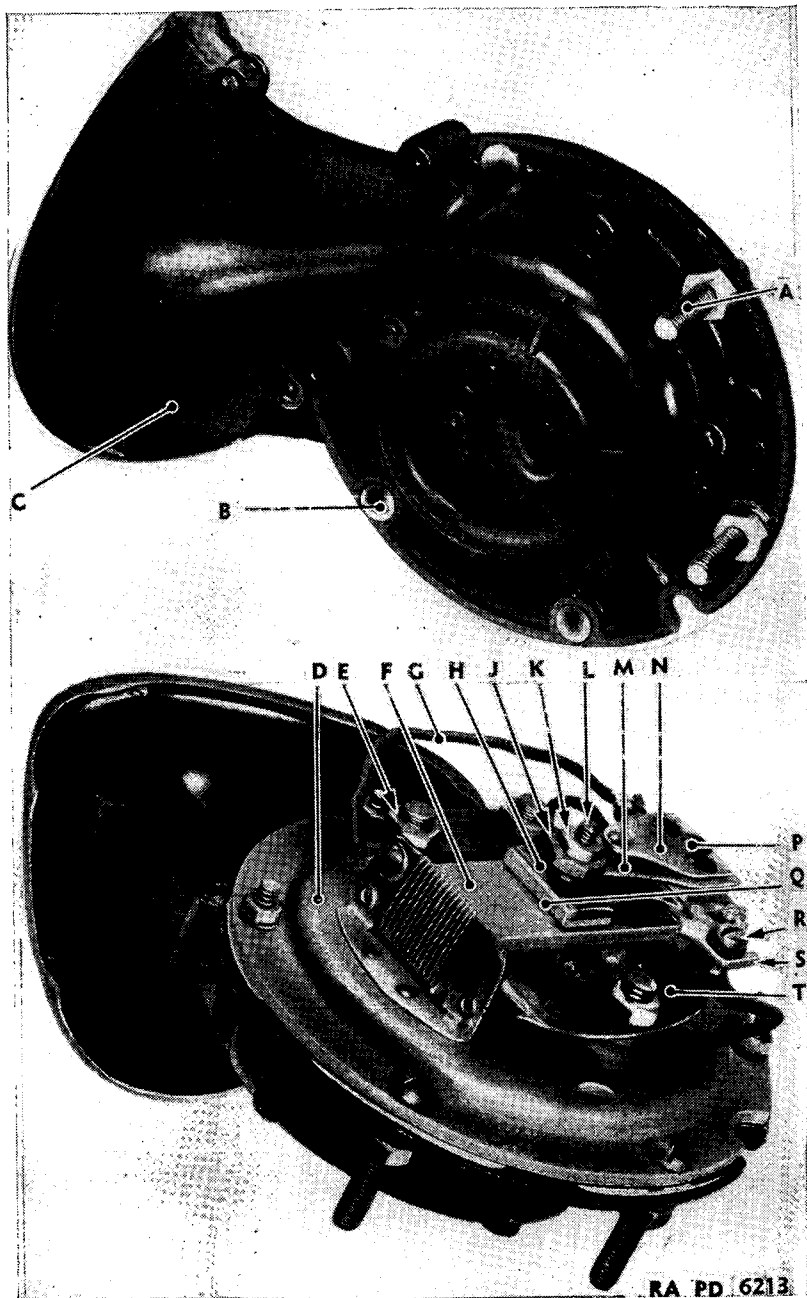
**26. Horn.**—*a. Description.*—The horn is a dual Delco-Remy vibrator type unit. It consists of two electromagnetic units, with one producing a high and the other a low note, mounted close together on separate brackets on the engine side of the dash below the air cleaner. The brackets, mounting screws, and component parts of the two units are interchangeable except for the diaphragm and collar assemblies.

(1) *Construction* (fig. 68).—(a) Each unit has a round base, shaped like a shallow inverted pan, with an out-turned rim to engage the edge of the diaphragm. The base and diaphragm are attached by screws to the top of the collar assembly to hold the diaphragm over the sound channels. The middle of the base has an opening in which are placed a pole-piece, an electromagnetic coil and a flat plate armature. The base and armature are parallel. The pole is E-shaped with three polar projections and three polar faces. The magnetic coil surrounds the middle one and is placed so that all three projections are presented to the armature. The middle projection has a bore for a stud to connect the armature and diaphragm together. The pole-piece has angle-shaped side plates, and is secured to the base by studs passing through holes in the side plates. Nuts on the studs hold the plates fast.

(b) Mounted on a bracket secured to the base is a fixed grounded contact support and point. Engaging it is a movable point on a flat insulated spring, which is also fixed to the bracket and is actuated by the armature, when attracted by the coil, to separate the electric contact points. The base also mounts a resistance in series with the coil, but the fixed and movable contact points from a shunt circuit to ground between the coil and the resistance. A "shell" or cover, fastened to a bracket spanning the top of the collar assembly, houses the electromagnetic coil and armature.

(c) The horns are controlled by an electromagnetic relay mounted on the front of the dash close to the horns. The relay consists of a coil having one terminal connected to the battery and the other to the horn button at the upper end of the steering column. Branch wires in parallel lead from a fixed and a movable terminal, controlled by the relay coil, to the two electromagnetic coils of the horn units.

(2) *Functioning.*—Pressure on the horn button closes the relay circuit, bringing the terminals of the relay together, and closing the circuit to both horns. Current passes through the magnetic coils, through the contact points adjacent the armatures, then to ground. The horn electromagnets are energized and attract the armatures,



- |    |                           |                          |                          |  |
|----|---------------------------|--------------------------|--------------------------|--|
| A. | {                         | Screw DR-1865938.        | H.                       | Nut, lock, DR-120614.                  |
|    |                           | Nut AZ14449.             | J.                       | Stud DR-1872634.                       |
|    |                           | Washer, lock, DR-103319. | K.                       | Insulation DR-1858675.                 |
|    |                           | Screw DR-1853970.        | L.                       | Support and point assembly DR-1861054. |
| B. | {                         | Washer, lock, 118874.    | M.                       | Rivet DR-1875430.                      |
|    |                           | Nut DR-1843521.          | N.                       | {                                      |
| C. | Collar assembly           | {                        | Low note DR-1878615.     | Screw DR-1864099.                      |
|    |                           | High note DR-1878618.    | Washer, lock, DR-802729. |  |
| D. | Nut DR-821204.            |                          | P.                       | Connector DR-1858677.                  |
| E. | Lead assembly DR-1885891. |                          | Q.                       | Coil assembly DR-1874660.              |
| F. | Armature DR-1864082.      |                          | R.                       | Nut DR-1872408.                        |
| G. | Nut DR-1842784.           |                          | S.                       | Plate DR-1874156.                      |
|    |                           |                          | T.                       | Base assembly DR-1880532.              |

FIGURE 68.—Horn assembly.



which break the direct shunt connections to ground, and include the resistances in the horn electrical circuit. As a result, the current falls off and the electromagnets are momentarily weakened. This make-and break-circuit causes the armatures to vibrate rapidly, imparting motion to the diaphragm and producing sound in both horns.

(3) *Specifications.*

Make	Type	Model	Manufacturer's No.	Ordnance No.	White No.
Delco-Remy	Electric vibrator	Dual	DR-1880566	A214451	353752
	High pitch		DR-1999526	C74054	353754
	Low pitch		DR-1999525	C74053	353753

Components:

DR-1999526 ..... 1 high note horn.

DR-1999525 ..... 1 low note horn.

Parts:

Interchangeable for both horns, except diaphragms and spiral air column collar assemblies.

Control.....Through outside relay coil and horn button switch.

Operating voltage..... 12 volts.

Current..... 23 amperes (at battery).

*b. Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

(1) Failure of horns to operate.

Horn button switch out of order. Repair or replace (See sec. XII).

Horn relay out of order. Repair or replace.

Horns out of order. Check armatures, springs, studs, and terminals. Make sure studs are properly fixed to diaphragms. Adjust nuts on base studs to raise or lower pole-pieces to correct armature air gaps. Adjust nuts on top of studs for correct operation of movable terminals.

Loose or open connections. Check cables and terminal screws at horn button, fuse block, horn relay and horns. Replace 20-ampere fuse if necessary.

- |  |   |
|--|---|
| Battery weak.  | Charge or replace.  |
| Ground between horns and relay, or at relay coil.                      | Check and repair cables and insulation.   |
| Grounded coil or terminals in horns.                                   | Check and clean terminals; remove and test coils.   |
| (2) Horns irregular or weak.   |   |
| Battery weak.  | Charge or replace.  |
| Amature air gap incorrect.   | Raise or lower pole and coils to correct gap.   |
| Worn or dirty terminals.   | Clean terminals of horn relay and horn button switch, and inside horns.   |
| Loose connections, grounded cable, or partial open circuit.            | Check wires and insulation and tighten terminal screws.   |
| Nuts on armature studs at diaphragms loose or out of correct position. | Adjust nuts and tighten.  |
| Obstruction in sound channels.   | Check screen at mouth of trumpets or collar assemblies. Clean inside sound channels, removing screens if necessary. |

*c. Removal of assembly (fig. 69).*

- (1) Remove horn units.  $\frac{7}{16}$ -inch open-end wrench.

Remove two nuts BBBX1A and two lock washers BECX1G holding each horn unit to bracket and remove units.

- (2) Disconnect cables from horns. Medium-sized screw driver.

Remove top screw DR-1853975 from shell and remove shell DR-1853944 from each horn. Remove terminal screw DR-1864099 and lock washer DR-802729 and remove cables.

*d. Disassembly of components (fig. 70).—Tools:*

- |                                       |                                      |
|---------------------------------------|--------------------------------------|
| Screw driver.                         | $\frac{3}{8}$ -inch open-end wrench. |
| $\frac{5}{16}$ -inch open-end wrench. | $\frac{1}{2}$ -inch open-end wrench. |
| $\frac{7}{16}$ -inch open-end wrench. | Soldering iron.                      |

- (1) Remove strap bracket from base. None.

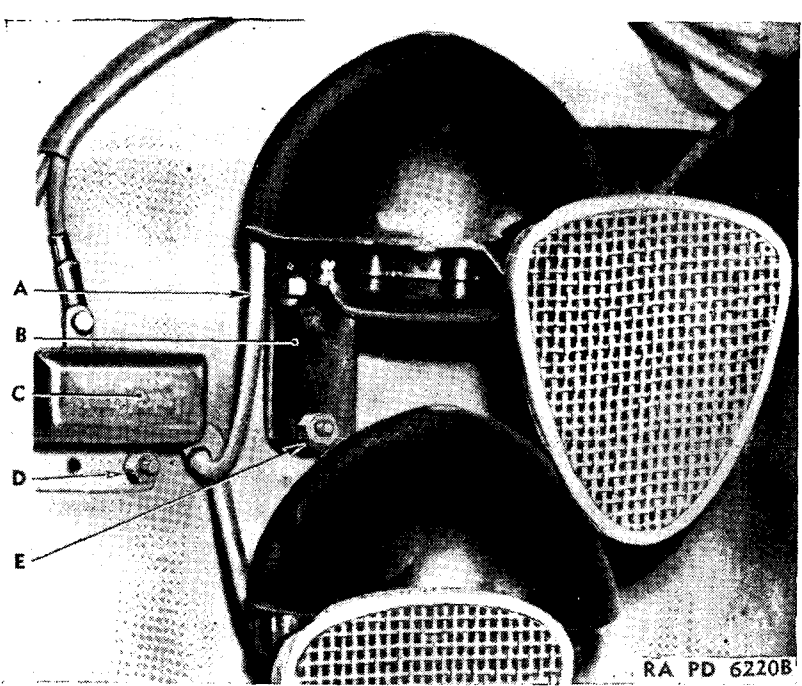
Disengage ends of bracket DR-1850660.

- (2) Remove base, stud, and bracket assembly and diaphragm from collar. Screw driver.  $\frac{5}{16}$ -inch open-end wrench.

Remove two mounting screws DR-1865938. Remove four nuts DR-1843521, four lock washers DR-118874, and after lifting off base assembly DR-1880532, remove four screws DR-1853920.

(3) Remove diaphragm from  $\frac{7}{16}$ -inch open-end wrench. aramature stud on base assembly.

Remove nut BBBX1A and lock washer BECX1G from armature stud. Remove washer DR-1865880, high note diaphragm DR-1878816



- |                       |   |   |
|-----------------------|---|---|
| A. Connector DM-2321. | D. { Bolt A225924.<br>Nut A225946.<br>Washer, lock, BECX1G. | E. { Bolt A225979.<br>Nut A215243.<br>Washer, lock, BECX1G. |
| B. Bracket WI-315961. |   |   |
| C. Relay DR-1116781.  |   |   |

FIGURE 69.—Horn assembly, installed.

or low note diaphragm DR-1878815 and two washers DR-1856598 and DR-1855396.

(4) Separate armature stud  $\frac{15}{16}$ -inch open-end wrench.  
from coil.  $\frac{3}{8}$ -inch open-end wrench.  
 $\frac{1}{2}$ -inch open-end wrench.

Remove lock nut and contact support nut. Remove stud DR-1872634 and remove clamp plate DR-1874156 and nut DR-1842784 from top of armature. Remove armature assembly DR-1864081.

(5) Remove coil assembly from  $\frac{7}{16}$ -inch open-end wrench base assembly.

Remove three nuts DR-821204 from studs on base and remove field coil w/pole DR-1874660. The leads remain connected to base assembly.

(6) Detach coil and pole-piece Soldering iron.  
from base.

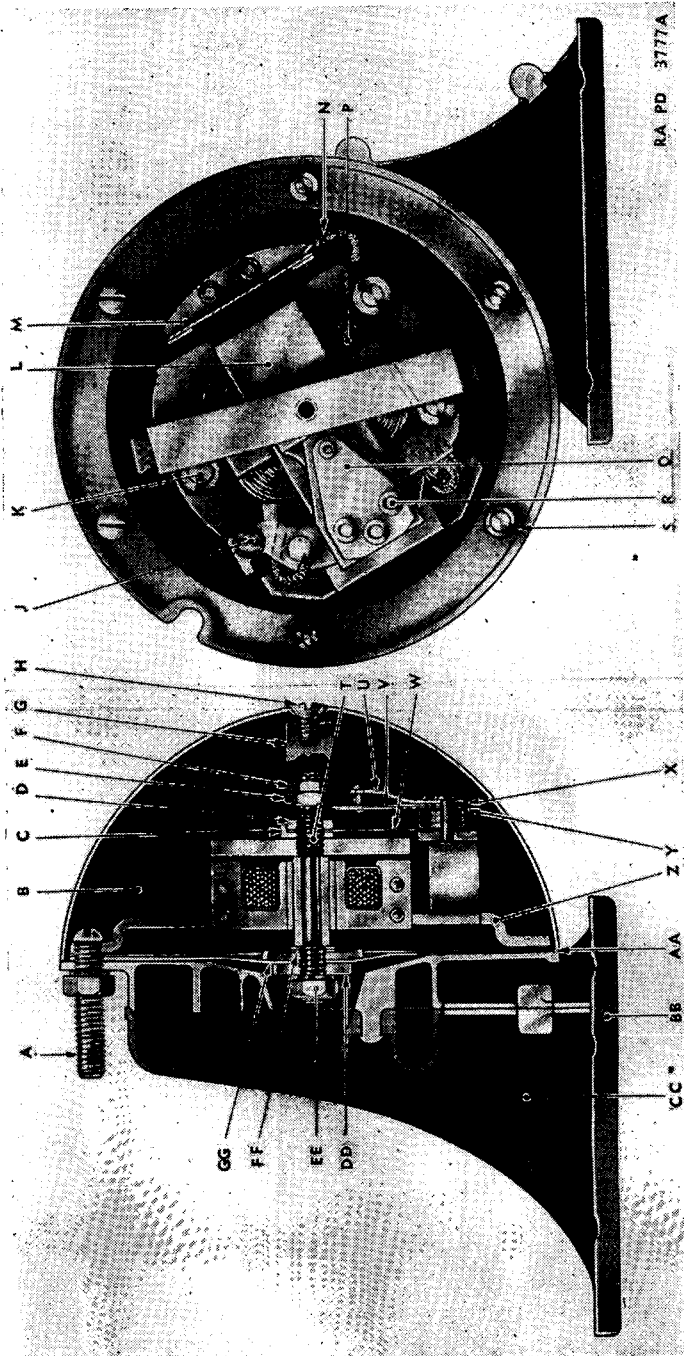
Melt solder at coil terminals.

*e. Maintenance and adjustments.*—(1) Mount armature securely. If loose over magnetic coil, turn armature stud from lower end to tighten nut above clamp plate, and bind nut, clamp plate, spring, armature, and top of stud closely together.

(2) If armature air gap is too small or large, set nuts on studs of base to hold pole assembly with three polar faces about  $\frac{1}{32}$  inch from armature (figs. 71 and 72). Keep these nuts tight so that pole-piece and coil are at all times firmly mounted on base.

(3) If armature stud has any play at diaphragm, the latter will not vibrate properly. Keep nut on lower end of armature stud tight to prevent this.

(4) When stud is tight at armature and diaphragm, the fixed end



- { Screw DR-1865938.  
 A. { Nut A214449.  
   Washer, lock, DR-103319.  
 B. Shell DR-1853944.  
 C. Plate DR-1874156.  
 D. Nut DR-1842784.  
 E. Nut DR-184270.  
 F. Nut, lock, DR-120614.  
 G. Bracket DR-1850860.  
 H. Screw DR-1853975.  
 J. { Screw DR-1864099.  
   Washer, lock, DR-802729.  
 K. Nut DR-821204.  
 L. Armature DR-1864081.  
 M. Resistor.  
 N. Lead, assembly DR-1885891.  
 P. { Screw DR-1853920.  
   Nut DR-1848521.  
   Washer, lock, DR-118874.
- Q. Coil, assembly, DR-1874660.  
 R. Insulation DR-1858675.  
 S. Rivet DR-1857430.  
 T. Spring DR-1853932.  
 U. Blade, assembly, DR-1861972.  
 V. Support and point, assembly, DR 1861054.  
 W. Connector DR-1858676.  
 X. Insulation DR-1858678.  
 Y. Stud DR-1872634.  
 Z. Base, assembly, DR-1880532.  
 AA. Diaphragm { Low note DR-1878815.  
   High note DR-1878816.  
 BB. Band DR-1880464.  
 CC. Washer DR-1865880.  
 DD. Washer, lock, DR-BECX1G.  
 EE. Nut BBBX1A.  
 FF. Washer DR-1855396.  
 GG. Washer DR-1856598.

FIGURE 70.—Horn assembly—sectionalized view.

(3) Assemble armature, stud  $\frac{5}{16}$ -inch open-end wrench. binding piece, and clamp plate with coil and pole.

Lay armature on upper faces of pole-piece under spring. Put clamp plate on top between armature and spring. Lay binding piece

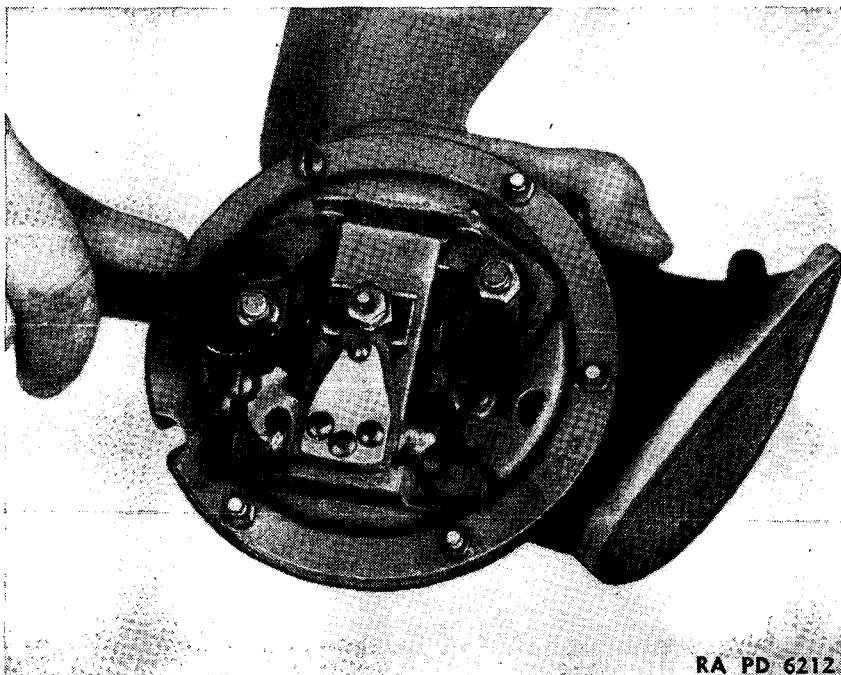


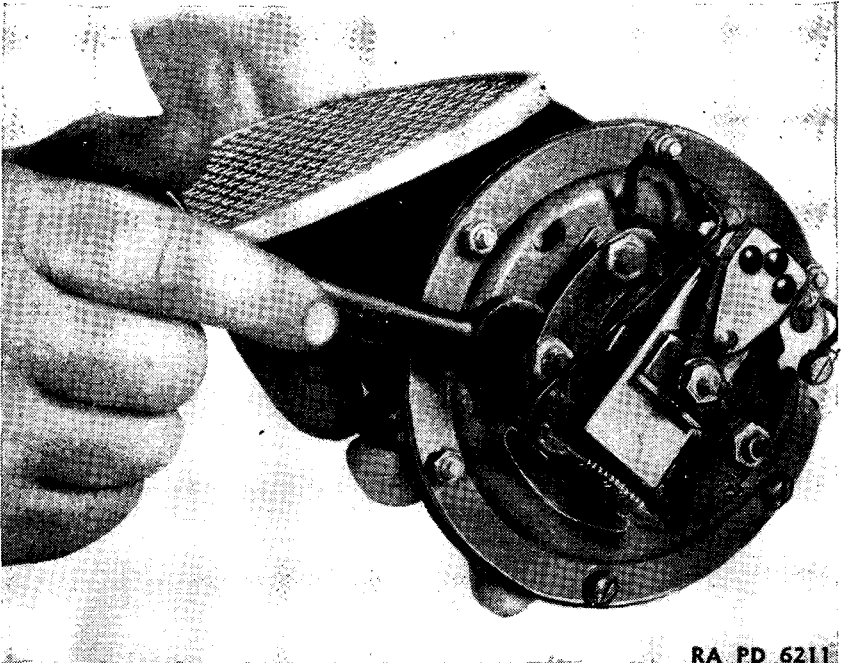
FIGURE 71.—Horn air gap adjustment.

on clamp plate. Pass armature stud from below through central hole in pole-piece, through hole in armature, holes in spring, and clamp plate into threaded hole of binding piece. Apply wrench to lower part of hexagonal surface of stud and tighten.

(4) Connect diaphragm to ar-  $\frac{7}{16}$ -inch open-end wrench. mature stud.

Slip plain washer upon lower end of stud against shoulder. Add diaphragm washer, then thrust end of stud through center hole in diaphragm. Put on remaining diaphragm washer and lock washer. Replace nut.

(5) Connect armature stud at  $\frac{3}{8}$ -inch open-end wrench. upper end to vibrator spring bear-  $\frac{1}{2}$ -inch open-end wrench. ing movable terminal point.



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FIGURE 72.—Horn air gap adjustment.

Put operating nut on upper end of armature stud. Screw down to engage terminal spring. Contact points must not be separated. Apply lock nut. Tighten both.

(6) Check position of pole faces for armature air gap. None.

Adjust pole assembly by setting nuts on base studs so that its three polar faces are about  $\frac{1}{32}$  inch below armature.

(7) Secure base assembly with pole-piece, coil, armature and diaphragm to collar assembly.  $\frac{5}{16}$ -inch open-end wrench.

Apply four screws, four lock washers, and four nuts and tighten.

(8) Replace screen and band over mouth of collar assembly. Pliers.

“Stake” or press band in six places over rim of collar assembly.

(9) Attach bracket to top of base. None.

Engage ends of bracket with notches in base.



*g. Installation of assembly (fig. 69).*

(1) Mount unit on support Screw driver.  
bracket.

Insert two mounting screws through holes in base and collar assembly and in bracket. Replace two lock washers and nuts.

(2) Connect cable. Screw driver.

Set terminal in place and replace screw and lock washer.

**27. Headlamps.**—*a. Description (fig. 73).*—The headlamps are

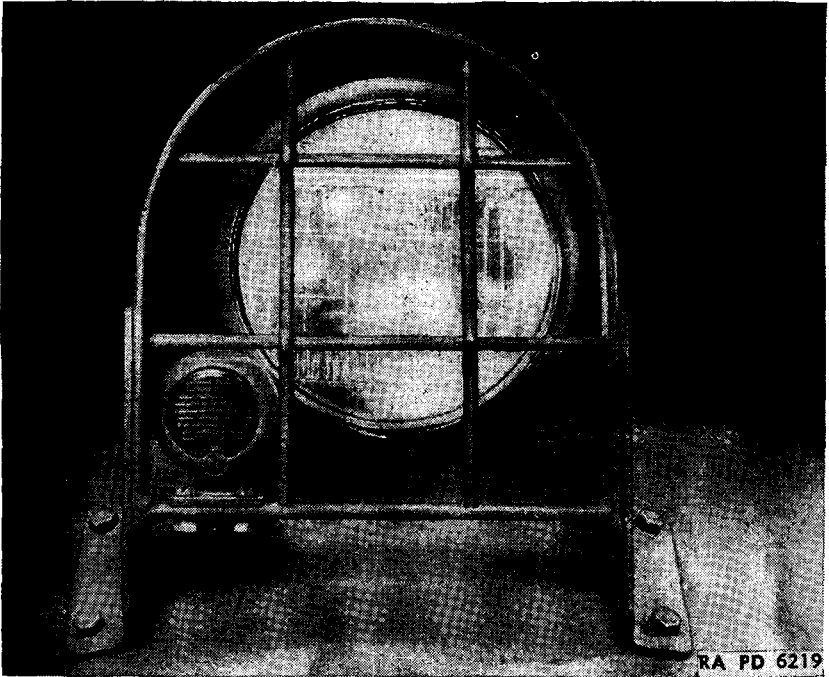


FIGURE 73.—Headlamp, installed.

mounted on the front fenders with separate brush guards to protect the lenses. Each lamp body houses a reflector and an electric lamp with two filaments, one for the upper beam and the other for the depressed beam. The controlling device for the depressed beam is a foot dimmer switch on the floor near the foot pedals of the vehicle.

(1) *Construction (fig. 74).*—(a) The casing or body has a threaded stud which enters an inclined adapter on top of the fender and is held in place by a nut with washer under the fender. Inside the

casing is a reflector, which carries a double-filament electric lamp at its center. The reflector fits into the front of the body, against the rim, with a "cyclcray" lens set in front. The lens is supported and held tight by retaining springs or clips in a split molding with a binding screw at the bottom. A clip in the door locates the lens in correct position.

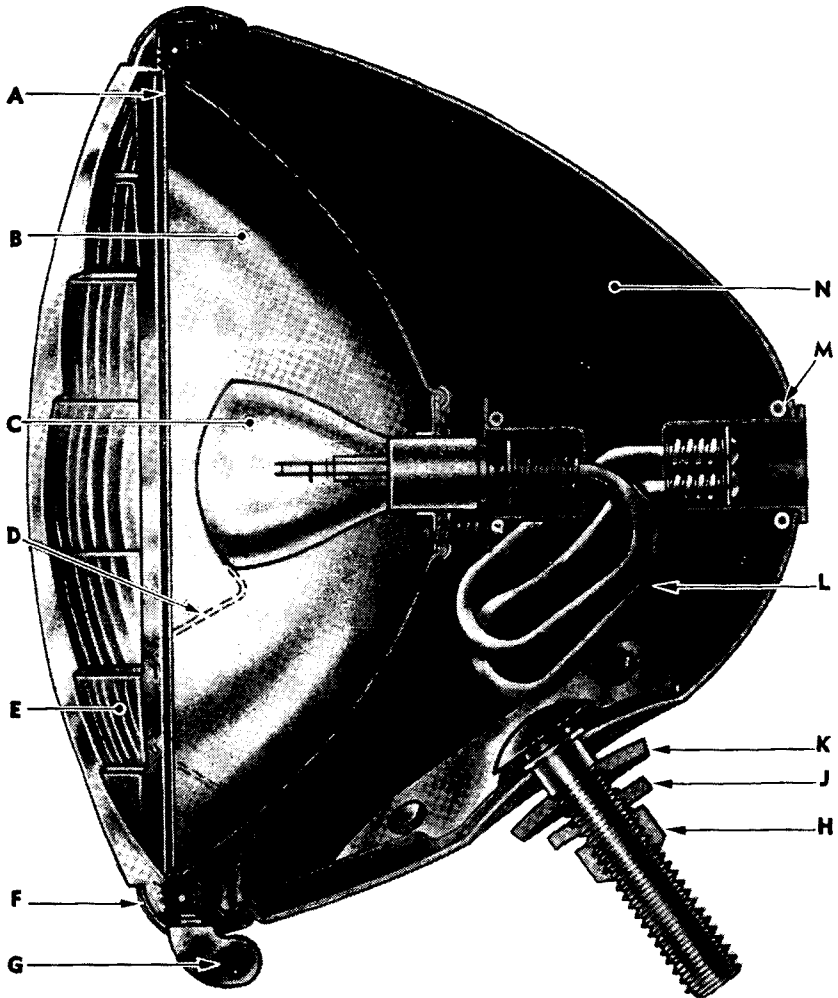
(b) Between the reflector and the back of the casing is the interior wiring assembly consisting of two sockets, one attached to the rear of the reflector in line with the lamp, and the other fastened in the rear end of the body, opening outward to receive the cable terminal plug. Each socket contains two contact points. In the socket on the reflector each point engages with a terminal of one of the filaments in the lamp, the remaining terminal of the filament being grounded. Two separate leads connect each contact point in this socket to one of the points in the rear socket, thus providing independent connections for the filaments to the supply circuit.

(2) *Functioning.*—When the lighting circuits are closed by movement of the main switch on the dash, the circuit is closed through lower filaments of the lamps. The upper beam is then projected from the lamps. This beam is for use on unlighted highways, outside of towns. When passing an approaching car or in towns or cities, the footswitch should be used to bring the depressed beam into play.

(3) *Specifications.*

Make	Type	Model	Manufacturer's No.	Ordnance No.	White No.
Guide lamp-----	Cyclcray-----	364-G	GL-925094	C85584	368513

- Operating voltage----- 12-16 volts.
- Current at lamp:
  - High beam----- 2.25.
  - Low beam----- 1.5.
- Electric lamp----- 2-filament double contact.
- Mounting----- Detachable.
- Candlepower----- 21-31.
- Size of lens----- 6¼ inches.
- Lens and retaining ring---- Removable.
- Reflector----- Removable.
- Wire assembly----- Nondetachable from casing unless wires are disconnected.



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- A. Gasket B167625.
- B. Reflector B184212.
- C. Lamp A186626.
- D. Spring B185237.
- E. Lens C74114.
- F. Molding assembly B167672.
- G. Screw A214596.

- H. Nut BBBX1D.
- J. Washer, lock, BECX1L.
- K. Washer B167623.
- L. Wiring assembly B167627.
- M. Spring B151373.
- N. Body assembly CS5606.

FIGURE 74.—Headlamp—sectionalized view.

*b. Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

(1) Failure to illuminate with main switch in service position.

Burned-out lamp.

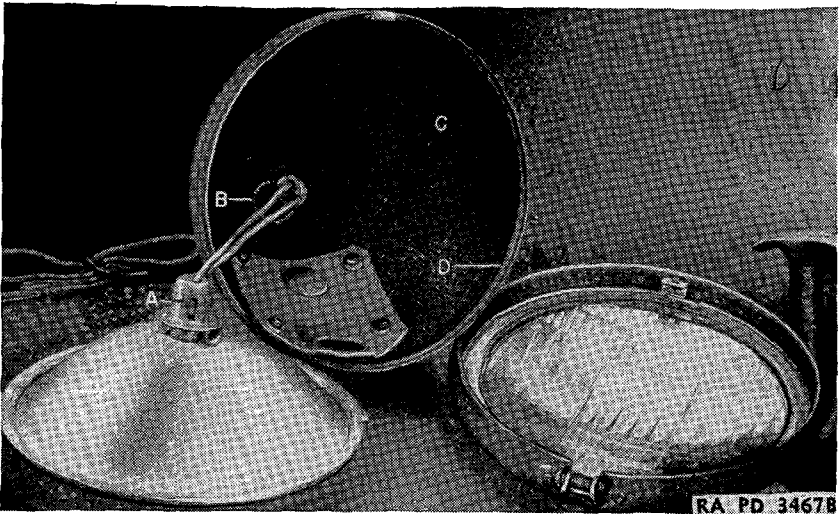
Replace lamp.

Battery disconnected or terminals corroded.

Check battery cables and repair or replace.

Battery exhausted.

Recharge battery.



A. Wiring assembly GL-5930332.  
B. Spring GL-912825.

C. Body assembly GL-5932226.  
D. Gasket GL-921789.

FIGURE 75.—Headlamp details.

- |                                    |   |
|------------------------------------|---|
| Dimmer switch inoperative.         | Check and adjust dimmer switch and make sure connections are correct.                 |
| Broken or grounded connection.     | Check insulation on wires in circuit to main switch and 20-ampere fuse on fuse block. |
| Main switch out of order.          | Repair or replace switch.   |
| Lamp turned in socket.             | Detach and reinsert with top uppermost.   |
| Generator brush connections loose. | Repair connections.   |

- (2) Faint illumination.
- |  |  |
|--|--|
| Lenses dirty.  | Remove and clean lenses.                               |
| Reflector tarnished.                                       | Remove and polish.                                     |
| Electric lamps blackened inside.                           | Replace lamps.   |
| Battery weak.  | Recharge battery.                                      |
| Low voltage at bulb socket.                                | Check with voltmeter and correct.<br>Check and repair. |
| Loose defective or corroded connection in wiring circuit.  |  |
| Corroded or loose battery terminals.                       | Check, clean, and tighten.                             |
| Defective connections and high resistance at light switch. | Clean and tighten all parts.                           |
| Generator brushes loose.                                   | Set brushes.   |
| Poor contact of lamps in sockets.                          | Insert bulbs into sockets correctly.                   |
- (3) Lamps going off and on or flickering.
- |                                  |  |
|----------------------------------|--|
| Loose wire or ground connection. | Check wires and insulation, repair, and tighten. |
|----------------------------------|--|
- (4) Lamps dimming as engine speeds up.
- |                              |                        |
|------------------------------|------------------------|
| Wires reversed at generator. | Check generator leads. |
|------------------------------|------------------------|
- (5) Illumination too bright and bulbs burning out.
- |  |   |
|--|---|
| Loose or corroded wire connection at generator, ammeter, or battery. | Check, clean, and tighten wire and terminals. |
| Faulty operation of current and voltage regulator.                   | Check and adjust regulator coil armatures.    |
- (6) Beams distorted or diverted.
- |                           |                           |
|---------------------------|---------------------------|
| Bent or sprung reflector. | Replace reflector.        |
| Lamps improperly mounted. | Adjust and aim correctly. |
- c. Removal of assembly.*
- |                   |       |
|-------------------|-------|
| (1) Detach cable. | None. |
|-------------------|-------|

Twist plug by hand and extract from socket at rear of casing.

(2) Dismount from fender.  $\frac{5}{8}$ -inch open-end wrench.

Remove one nut BBBX1D, lock washers BECX1L, and one bearing washer GL-912206 from stud on under side of fender, and lift off headlamp.

*d. Disassembly (fig. 74).*

(1) Remove molding. Screw driver.

Remove one screw GL-117108 at bottom of molding. Detach retaining molding GL-920370 and lens GL-918831.

(2) Separate lens from mold- None.  
ing.

Pull out two lens retaining springs GL-914255 and remove lens GL-918831 from molding.

(3) Remove electric lamp. None.

Turn and pull out electric lamp GL-125984.

(4) Remove reflector. None.

Take reflector GL-918834 and gasket GL-921789 out by hand.

(5) Liberate sockets. Cutting pliers.  
Screw driver.

Push wires out and cut terminals off wiring GL-5930332 in one socket, preferably the rear one. Withdraw wires at open end. Recover two springs GL-209572 and insulating socket washer GL-921092. With screw driver, loosen retaining spring GL-912825 on rear socket in casing and push socket out at rear. Pull front socket mounting pins by hand out of notches in edge of central opening of reflector and dismount from socket.

*e. Maintenance and adjustments.*—(1) Keep lenses clean and wiped and replace electric lamps when the bulbs begin to turn dark or black inside. Polish reflectors with a soft cloth and rub from rim to center. Do not use an abrasive. Replace reflector if it is sprung or bent.

(2) The focus of each headlamp is fixed. Adjustment of headlamps can best be made with headlamp tester. If no tester is on hand, place vehicle with headlamps 25 feet from a smooth vertical surface such as a wall or door, preferably of light color (fig. 76). The centerline of the vehicle should be perpendicular to this vertical surface. Draw a horizontal line on the vertical surface 3 inches lower than the height of lamp centers above the floor. Locate a midpoint on this horizontal line at which the projected centerline of chassis

intersects. Measure distance between lamp centers and divide this distance equally on the horizontal line at either side of midpoint. Then draw two vertical lines across the horizontal line directly ahead of each lamp center.

(3) The inclined adapter or bracket piece between the headlamp and the fender has a rounded top fitting against a concave seat on the

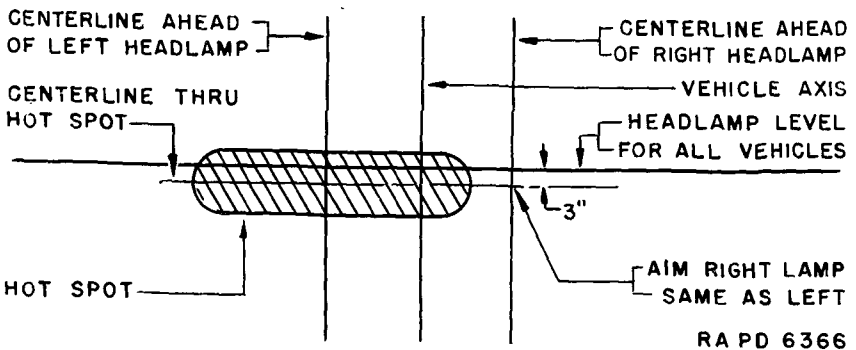
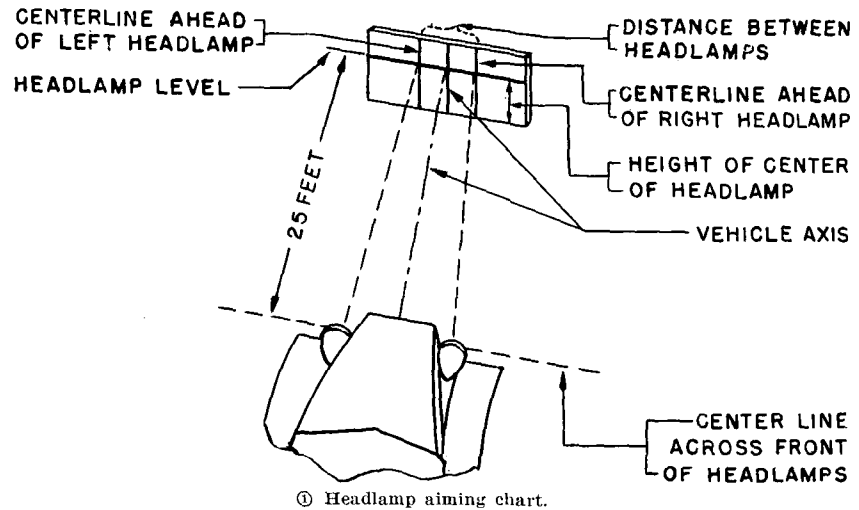


FIGURE 76.—Headlamp adjustment.

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bottom of the casing, and a bore larger than the outside diameter of the supporting stud affixed to the casing. Thus the adapter has a little play on the stud when loose. If the nut on the stud is unscrewed a bit, the adapter can be pushed back and forth so that the inclination of the headlamp is changed slightly when the nut is tightened again.

Switch on high beams in headlamps and cover one lamp while adjusting the other. Loosen nut on lamp supporting stud and aim lamp so that beam registers centrally with horizontal line at point of intersection of this line and the vertical line on that side. Then tighten nut securely, taking care not to change location of beam pattern on vertical surface. After lamp is alined cover its beam and proceed in same manner with opposite lamp.

(4) Lighting circuit test data (at battery).

Headlight and taillight:

High beam .....	12 volts, 4.75 amperes
Low beam.....	12 volts, 3.5 amperes
Blackout lights.....	12 volts, 1.5 amperes

f. Reassembly (fig. 74).—Tools:

Soldering iron.	Medium-sized screw driver.
Fine file.	

- |                             |                 |
|-----------------------------|-----------------|
| (1) Assemble wire assembly. | Soldering iron. |
|                             | Fine file.      |

Put rear socket into rear end of lamp. Attach circular retaining spring. Push wires through bottom of rear socket and out beyond open end. Put on encircling springs and insulation in socket washer, and solder ends of leads on disk. Smooth off with file to insure even level. Draw springs and insulator disk in. Attach reflector socket by pulling pins into notches in edge of hole at center of reflector.

- |                            |       |
|----------------------------|-------|
| (2) Replace electric lamp. | None. |
|----------------------------|-------|

Hold lamp with top uppermost, insert into opening at middle of reflector, and turn till narrow part of slots is behind spring-pressed heads on pins carried by front socket.

- |                        |       |
|------------------------|-------|
| (3) Replace reflector. | None. |
|------------------------|-------|

Fit reflector snugly into front of lamp.

- |                            |       |
|----------------------------|-------|
| (4) Put lens into molding. | None. |
|----------------------------|-------|

Place lens into molding and secure with two lens retaining springs.

- |                                     |                            |
|-------------------------------------|----------------------------|
| (5) Mount molding and lens on lamp. | Medium-sized screw driver. |
|-------------------------------------|----------------------------|

Put molding with lens on front of casing. Adjust with lens locator and secure with one screw.

g. Installation.

- |                                 |                           |
|---------------------------------|---------------------------|
| (1) Mount lamp on front fender. | 5/8-inch open-end wrench. |
|---------------------------------|---------------------------|



Push shank on lamp down through adapter. Replace bearing washer, lock washer, and nut.

- (2) Connect cable. None.

Insert terminal plug in lamp body socket at rear.

**28. Marker lamps.**—*a. Description* (fig. 77).—The two marker lamps are mounted on the head lamp brush guards on the front fenders.

(1) *Construction.*—A clear glass lens, a louver, and a blue filter are mounted in front of the electric lamp by a rubber gasket, door assembly, and retaining screw.

(2) *Operation.*—The marker lamps are lighted when the light switch is in its intermediate or blackout position. The louver directs the light downward, making it invisible from above.

(3) *Specifications.*

Make	Type	Model	Manufacturer's No.	Ordinance No.	White No.
Guide lamp.....	Blackout.....	5502-B	GL-916388	C85572	368518

Lens size.....	1 7/8 in.
Electric lamp.....	3 cp, S.C., Mazda
Operating voltage.....	12 volts
Current at lamp.....	0.4 ampere

*b. Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

(1) Failure to light when other lamps light.

Burned-out lamp.

Replace.

Broken or grounded lead.

Repair or replace lead.

Lamp loose.

Seat electric lamp properly.

(2) Lamps dim.

Lamps loose.

Seat electric lamp.

Electric lamp blackened.

Replace.

Poor connection at socket.

Repair.

Ground leak.

Repair.

(3) Flickering lamps.

Loose wire.

Repair or tighten.

Intermittent ground.

Repair.

*c. Removal of assembly.*

(1) Disconnect cable.

None.

Pull end of cable out of connector DM-2321 under front fender.

(2) Dismount lamp from head-  $\frac{1}{2}$ -inch open-end wrench.  
lamp guard.

Remove nut BBBX1B and lock washer BECX1H and remove lamp.

*d. Disassembly of components.*

(1) Remove door assembly. Screw driver.

Remove door screw BCFX2AH and dismount door GL-5932381.

(2) Remove rubber gasket, lens, None.  
filter, louver, and electric lamp.

Remove lens GL-5932167, louver GL-5932169, gasket GL-5932164,  
filter GL-5932165, and lamp GL-142303.

*e. Maintenance.*—Replace bulb if blackened or burned out, clean lens, filter, and louver. Check lead and make sure its terminal is engaged firmly in connector to circuit beneath fender.

*f. Reassembly of components.*

(1) Replace electric lamp. None.

Mount lamp in socket by hand.

(2) Remount gasket with lens None.  
filter and louver.

Replace parts by setting in place.

(3) Replace door assembly. Screw driver.

Set door in place, replace screw,  
and tighten.

*g. Installation.*

(1) Mount lamp on support  $\frac{1}{2}$ -inch open-end wrench.  
plate of headlamp guard.

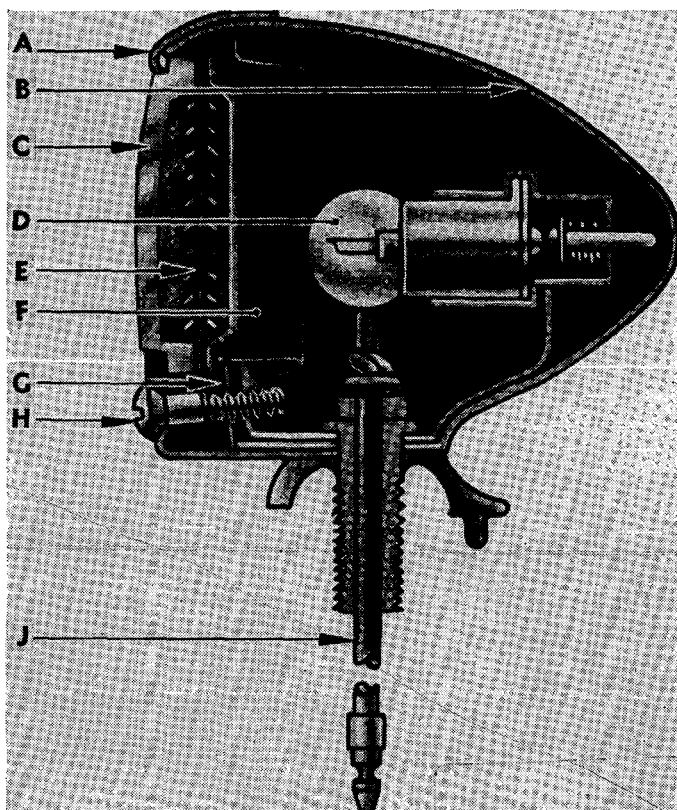
Set lamp in place and replace  
nut and lock washer.

(2) Reconnect lead in circuit. None.

Insert snap terminal on lead into connector beneath fender.

**29. Taillamp.**—*a. Description* (figs. 78 and 79).—The left-hand taillamp is the service stop light, service taillight and blackout taillight. The right-hand taillamp is the blackout stop light and blackout taillight.

(1) *Construction* (fig. 80).—(a) The body or casing of the left-hand lamp houses two electric lamps, the upper containing a single

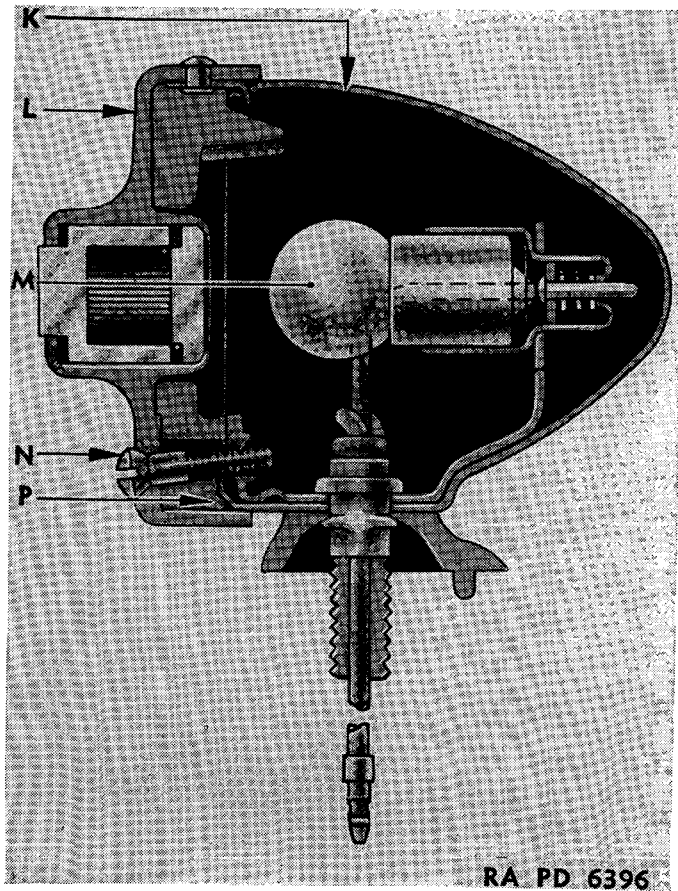


- A. Door assembly A214554.
- B. Body assembly A214556.
- C. Lens B184206.
- D. Lamp A214551.
- E. Louver assembly A214552.

- F. Filter A214550.
- G. Gasket A214553.
- H. Screw A214555.
- J. Wiring assembly A214594.

① Early model.

FIGURE 77.—Marker lamp—sectionalized view.



K. Body assembly GL-5932256.  
 L. Cover assembly GL-5933122.  
 M. Lamp GL-142450.

N. Screw GL-5932419.  
 P. Gasket GL-5933075.

② Late model.

FIGURE 77.—Marker lamp—sectionalized view—Continued.

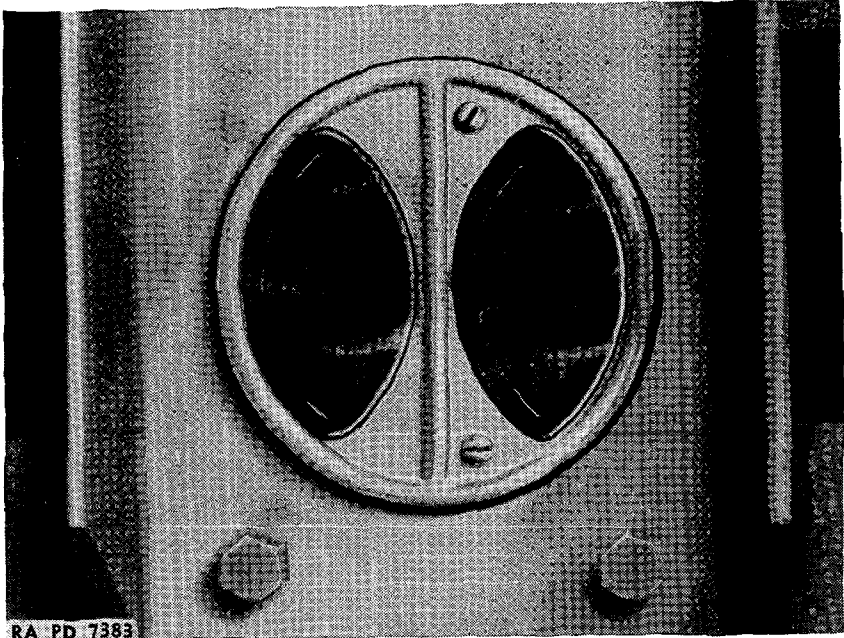


FIGURE 78.—Right taillamp installed.

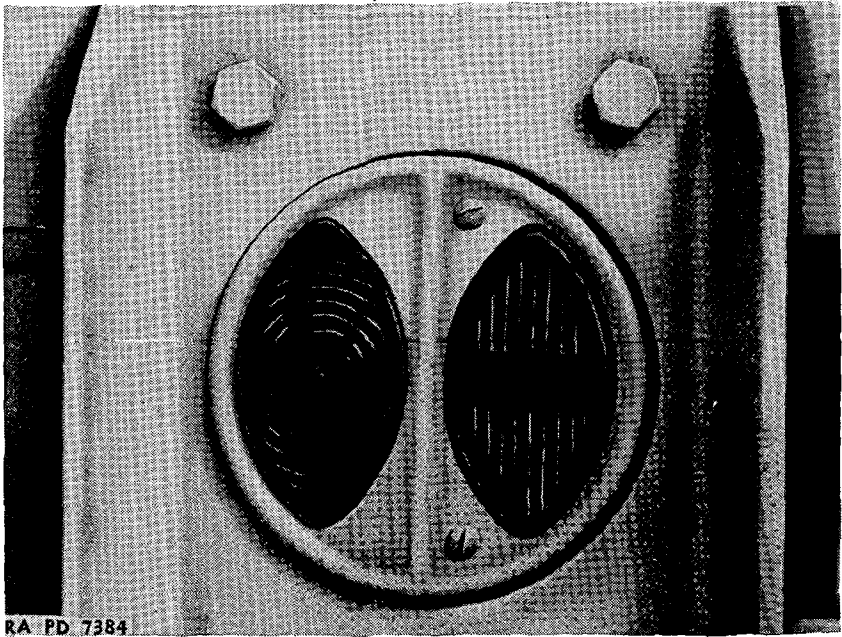


FIGURE 79.—Left taillamp, installed.

filament and being one of the blackout taillights, and the lower containing two filaments and being the combination service taillight and service stop light. The latter has a transparent ruby lens in front of it. The upper lamp projects its rays out through a clear lens having a central vertical black band across its face and a ruby filter behind it. Between the clear lens and the ruby filter is a louver plate or blackout screen arranged to prevent light from going in an upward direction. A horizontal partition in the casing between the two lamps separates the casing into two compartments. The upper is blackened over its whole inside surface.

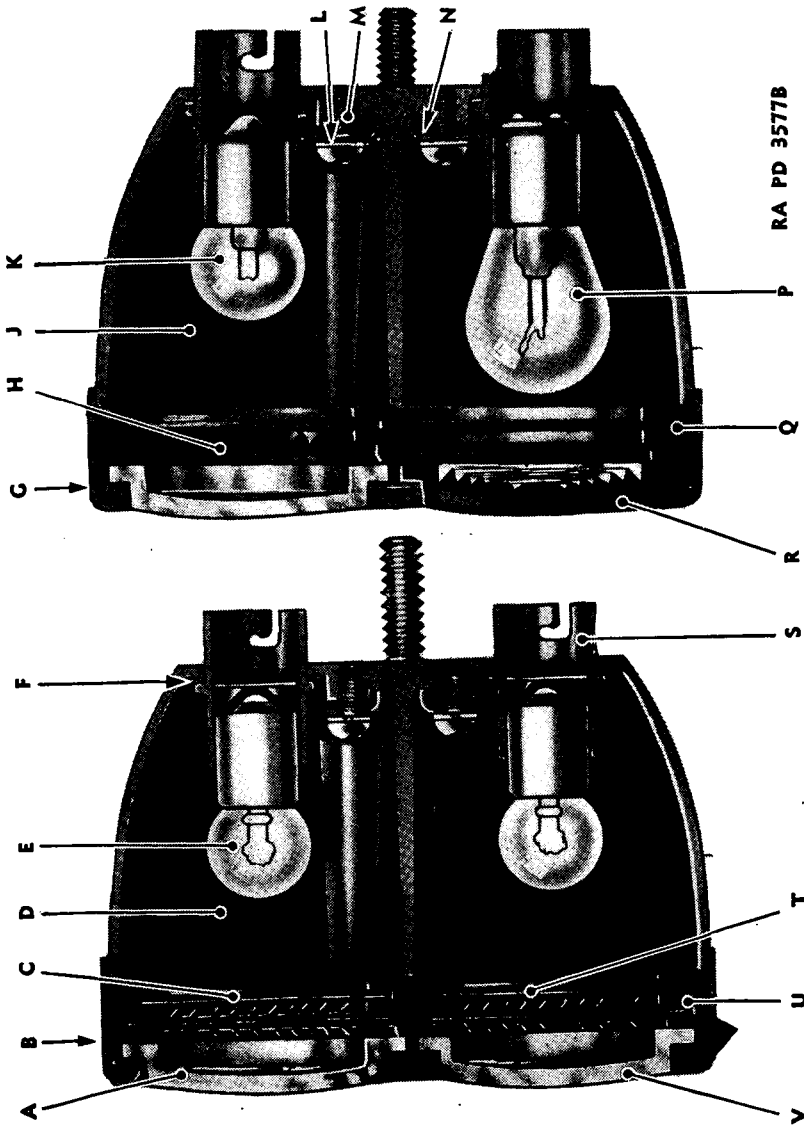
(b) The casing of the right-hand lamp mounts two electric lamps, one upper and one lower, each having a single filament. Between them is a partition dividing the casing into chambers, both of which are blackened on the interior. Over the upper lamp is a clear lens with vertical black band across it and a ruby filter behind it. The lens for the lower lamp is entirely clear with an amber filter behind it. Between the lamps and both filters is a blackout screen or louver plate to direct the light downward as it emerges. For both casings the lenses are mounted one above the other in a ring-shaped door for the casing. A round rubber holder carries the lenses, filters, and louver plates, and is pressed into the door so as to hold the lenses against their seats around the edges of the lens openings. Screws hold the doors in place.

(2) *Functioning.*—(a) When the headlamps are in circuit, the service taillamp is lighted in the lower part of the left-hand casing. The circuit is made through the dimmer filament of the lower lamp. When the brakes are applied, a circuit is completed to the other filament of the same lamp by means of the hydraulic stop light switch on the master cylinder of the brake system. The lower lamp then brightens, giving the stop signal.

(b) When the main switch is moved to blackout position, the headlamps and service taillight and stop light are cut out; and the marker lamps and the blackout taillamps in the upper compartments of both tail casings are connected in circuit. When the brake pedal is depressed, the stop light switch is actuated and circuit is completed to the blackout stop light in the lower compartment of the right taillamp.

(3) *Specifications.*

Make	Type	Model	Manufacturer's No.	Ordnance No.	White No.
Left-hand guide lamp.....	Blackout..	3006-C	GL-927181	C85533	368520
Right-hand guide lamp.....	Blackout..	3006-B	GI-927170	C85532	368519



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Ⓒ Left side.

Ⓒ Right side.

- A. Lens GL-5932361.  
 B. Door GL-5932129.  
 C. Filter GL-5932127.  
 D. Body assembly GL-5932130.  
 E. Lamp GL-142303.  
 F. Gasket GL-5932134.  
 G. Gasket GL-5932123.  
 H. Louver assembly GL-5931759.  
 J. Body assembly 5930826.  
 K. Lamp GM-142450.  
 L. Washer, lock, GL-121752.  
 M. Screw BCNX1FD.  
 N. Retainer FL-5932133.  
 P. Lamp GL-173029.  
 Q. Gasket GL-5932124.  
 R. Lens GL-5932135.  
 S. Sleeve GL-5932132.  
 T. Filter GL-5932126.  
 U. Louver assembly GL-5932186.  
 V. Lens GL-5932125.

FIGURE 80.—Taillamp, sectionalized view.



Left-hand taillamp and stop lamp:	
Lower electric lamp GL-173029.....	D. C. 21-6 cp
Upper electric lamp GL-142450.....	S. C. 3 cp
Right-hand taillamp and stop lamp:	
Electric lamp GL-142303.....	S. C. 3 cp
Operating voltage.....	12-16 volts
Both casings.....	Demountable
Ring-shaped doors.....	Removable
Lenses, filters, louver plates.....	Rubber
Holders and gaskets.....	Detachable
Electric lamps and sockets.....	Detachable

b. *Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

- |   |  |
|---|--|
| (1) Failure to illuminate when other lamps light. |  |
| Burned-out lamp.                                  | Replace.   |
| Break or ground in circuit.                       | Check connections back to switch.                        |
| Stop light switch impaired.                       | Check and replace if necessary.                          |
| Lamp loose or improperly mounted in socket.       | Make sure lamp terminals engage socket terminals firmly. |
| (2) Lamps dim.                                    |  |
| Lamps loose or incorrectly mounted in sockets.    | Push lamp fully into socket.                             |
| Electric lamp blackened.                          | Replace bulb.  |
| Poor connections at socket, or ground leak.       | Check socket, circuit and insulation.                    |
| (3) Lamps go out and then on again or flicker.    |  |
| Loose wire connection or intermittent ground.     | Check wires and insulation, repair and tighten.          |

c. *Removal of assembly.*

Detach right-hand and left-hand lamps from vehicle.  $\frac{7}{16}$ -inch open-end wrench.

Remove two nuts BBAX1A and two lock washers BECX1G holding each lamp GL-927170 (right-hand), and GL-927181 (left-hand), in place.

d. *Disassembly of components.*

- (1) Detach ring-shaped door from front of casing. Screw driver.

Remove two screws GL-5932417 at front. Take molding assembly

GL-5932655 off left-hand body assembly GL-5930826 and molding assembly GL-5932142 off right-hand body assembly GL-5932130.

(2) Remove filter holders and None.  
lenses from doors.

Push out with fingers lower ruby lens GL-5932135, upper clear lens GL-5932361, and gasket GL-5932124 from door GL-5932653 off left-hand lamp. Lower clear lens GL-5932361 and gasket GL-5932124 from door GL-5932129 of right-hand lamp.

(3) Remove gaskets from doors. None.

Take gaskets GL-5932123 out of doors by hand.

(4) Remove filters and louver None.  
plates from gaskets.

Push out by hand louver GL-5931759 and ruby filter GL-5932127 from gasket of left-hand lamp; louver GL-5932186, upper ruby filter GL-5932127, and lower amber filter GL-5932126 from gasket of right-hand lamp.

(5) Remove electric lamps from None.  
casings.

Turn and pull out by hand, upper and lower electric lamps GL-142303 from right-hand body assembly GL-5932130, upper electric lamp GL-142450 and lower electric lamp GL-173029 off left-hand body assembly GL-5930826.

(6) Remove lamp sockets from Medium-sized screw driver.  
casings.

Remove one screw BCNX1FD and one lock washer BECX1D at each socket; take out socket retainer GL-5932133.

*e. Maintenance.*—Replace electric lamp if blackened or burned out; clean lenses, filters, and louvers. Check leads and make sure plug and wire terminals are engaged firmly in sockets at casings, to connectors under body and to circuit points on switches and junction block. If stop lights do not illuminate in braking, first make sure electric lamps are good; then test stop light switch as follows: connect one lead of voltmeter to each terminal of switch. With brakes off, instrument should read battery voltage. With brakes on voltage should be zero. If either of these readings is not obtained, replace switch with new one.

*f. Reassembly of components.*

(1) Remount lamp sockets in Medium-sized screw driver.  
casings.

Insert two sockets in each casing and attach four retainers by means of four lock washers and four screws.

(2) Insert electric lamps in None. casings.

Push in and turn by hand upper and lower electric lamps of right-hand casing and upper electric lamp and lower electric lamp of left-hand casing.

(3) Place gaskets and lenses in None. door.

Turn doors so that the semicircular half bearing screw holes are in top position. Lay two gaskets in doors, making screw holes line up. Put in by hand right-hand lamp. Clear lens with vertical central dark band in upper opening and clear lens in lower opening. Put in left-hand lamps, ruby lens in lower opening, clear lens with vertical central dark band in upper opening.

(4) Assemble filters and louver None. plates in gaskets.

Turn gaskets so that semicircular half bearing screw holes are in top position. Put in by hand at rear face of holder. In right-hand lamp, insert ruby filter in upper opening and amber filter in lower opening. Place louver over filters, making screw holes line up. In left-hand lamp, insert ruby filter into upper opening. Place louver over filter, making screw holes line up.

(5) Assemble gaskets and None. doors.

Replace gaskets in doors by hand, with screw holes lining up with door screw holes. Present filters to rear of doors, lenses to front.

(6) Put doors and gaskets back Medium-sized screw driver. on front of casings.

Insert two screws into each door and attach doors to casings, door with red lens on casing having one blackened compartment, other door on casing having two blackened compartments.

*g. Installation.*

Mount casings on vehicle.  $\frac{7}{16}$ -inch open-end wrench.

Put lamp with red lens at left, other lamp at right. Attach two lock washers and two nuts to studs on each casing and tighten.

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rection. The measuring should be performed with the greatest accuracy. It can be done without removing any part of the body from the chassis by using a plumb bob and crayon or pencil.

(b) Place vehicle on a level floor with all tires properly inflated.

(c) Suspend a plumb bob successively at four points on the frame at the opposite ends of adjacent cross members (fig. 83). The plumb bob should hang down almost to the floor. When it becomes motionless, mark sharply the floor directly underneath it. Repeat for every other part of the frame between cross members.

(d) Move the vehicle and connect the marks with intersecting diagonals. Each pair of intersecting diagonals must connect corresponding points at the opposite sides of the frame.

(e) Measure the various diagonals. The length of each two intersecting diagonals should match to within  $\frac{1}{8}$  inch. Other crossed diagonals may be charted on the floor between different corresponding points and compared in the same way.

(2) *Straightening*.—Heat should not be used when straightening frames because it weakens the frame members; hence all straightening should be done cold. Replace frame members which are bent or buckled sufficiently to show strain after straightening.

(3) *Cutting, reinforcing, riveting, and welding*.—(a) Whenever it is necessary to cut the frame previous to welding, make the cut along a diagonal line about twice as long as the width of the rail. Use an ordinary ruler to measure and lay out the diagonal. This method distributes the weld over a greater area than a cut made straight across at right angles to the rail and makes the weld stronger.

(b) Reinforcements can be made with flat, channel, or angle stock, the latter being preferred for side rails. Wherever possible, the reinforcement should extend the entire length of the side rail or at least 18 inches beyond the driver's compartment cross member. This procedure may be impractical in some instances because of the position of the attached units and existing cross members. The reinforcement thickness should not exceed that of the side rail to be reinforced.

(c) Reinforcements should be securely riveted whenever possible. Hot rivets are preferred, but cold rivets may be used where tools of sufficient power to set the rivets properly are provided. The diameter of the reinforcement rivets depends upon spacing and the number of rivets used. Generally, rivets should be from 50 to 100 percent as heavy in diameter as the total thickness of the plates to be riveted.

(d) Electric metal arc-welding is recommended for all framework. Heat of the weld is localized and burning of the material is minimized



with this method. Outside edges of all reinforcements used to strengthen the frame should be welded to the frame after the reinforcements are riveted on. All unused holes should be filled with welding material. The welding rod should be of the same material as the frame.

**31. Pintle and tow hooks** (fig. 84).—*a. Towing facilities.*—Towing facilities are provided at the front of the vehicle by two tow hooks WI-C2419X (left-hand), WI-C2418X (right-hand), and at the rear by a standard pintle M7A2. The pintle WI-343632 is attached to the frame rear cross member with an additional supporting A-brace.

*b. Pintle removal.*—To remove pintle, pull out cotter pin BFA2AM and remove nut BBGX3C and thrust washer A135835. The assembly can then be pulled from the vehicle. To replace pintle, reverse order of removal.

**32. Roller.**—*a. Description* (fig. 85).—(1) *Construction.*—(a) The roller is made of steel plate rolled to form a tube, with the seam welded. Two reinforcing rings, evenly spaced in the roller, are welded along their edges to the inside of the roller. Two circular plates, each of which has a reinforced tube welded to it at the center, are welded into each end of the roller.

(b) A bushing is driven into each end tube, and the supporting shaft bearings are placed in these bushings. Each bearing has a square section at the outer end. This slides between guides which are riveted to the roller supports at each side of the slots in the front ends of the rollers. The roller supports, in turn, are riveted to the front of the chassis frame. Each support has a spring stop bracket riveted to it at the top and in line with the slot therein.

(c) The roller shaft passes through the bearings and the slotted holes in the supports and extends slightly beyond each support. Compression springs are carried by the guide rods and are compressed between a shoulder at the lower end of each guide rod and the spring stop brackets. The lower ends of the guide rod press upon the protruding ends of the roller shaft and are fixed to the shaft by means of tapered pins driven through the guide rod bearings and shaft. The upper ends of the guide rods are set into the spring stop brackets.

(2) *Functioning.*—(a) The roller is held in the lower extremities of the slots by compression springs which allow the roller to move upward and toward the rear when it strikes any obstruction. The square ends of the bearings slide in the guides, hence the upward motion of the roller is along a straight line. These ends also prevent the bearings from turning, so that the roller bushings can rotate on the bear-

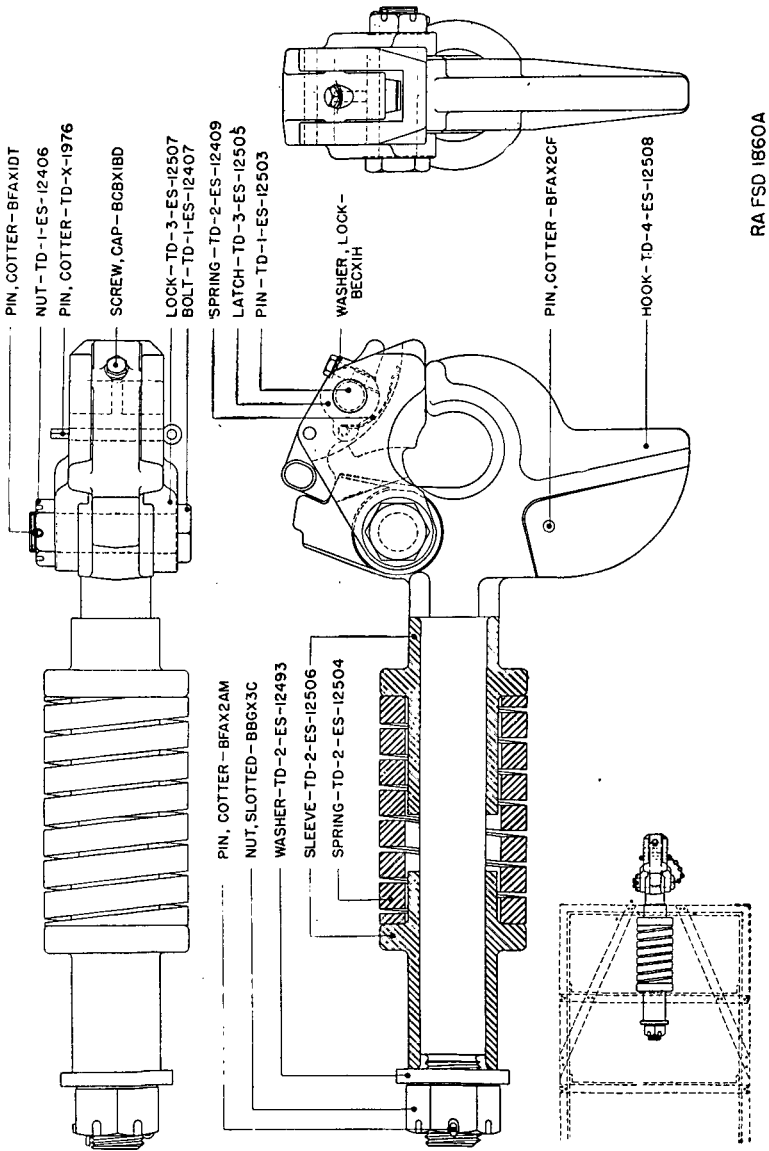


FIGURE 84.—Pintle assembly—sectionalized view.

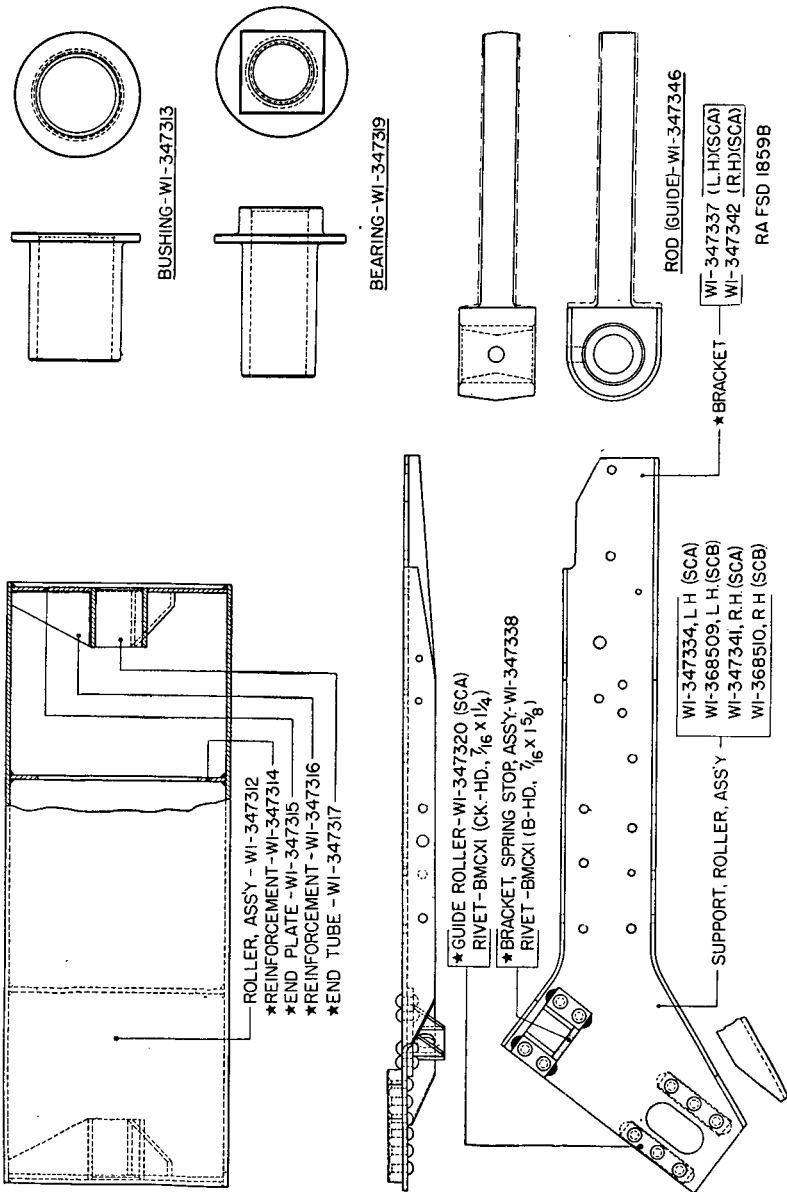


FIGURE 85.—Roller assembly- sectionalized view.

ings. The springs act as shock absorbers and cushion the frame against excessive strains.

(b) The roller is provided chiefly for use in passing over ditches and holes. It prevents the front end of the vehicle from digging into the farther side of the ditch or hole by striking the bank first and turning, thereby helping the vehicle to climb out.

b. *Removal of assembly* (fig. 86).—Tools:

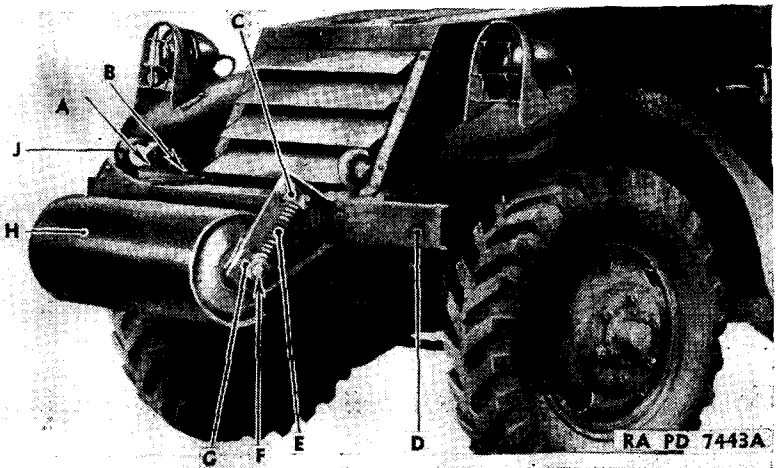
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|---------------------|------------------------|
| Steel drift.        | 1¼-inch socket wrench. |
| Hammer.             | Driving rod.           |
| Two special clamps. |                        |

(1) Remove tapered pins holding spring guides to shaft. Steel drift.  
Hammer.

Drive tapered pins BCFX1LK out of roller spring guides WI-347346.

(2) Compress roller springs. Two special clamps (fig. 87).  
1¼-inch socket wrench.

Set clamps upon supports WI-368510 (right-hand), WI-368509 (left-hand), and under lower ends of guide rods. Compress springs



- |   |                       |                                      |
|---|-----------------------|--------------------------------------|
| A | Screw BCBX-2CM.       | C. Bracket WI-347338.                |
|   | Nut BBBX2C.           | D. Bumperette (left-hand) WI-347321. |
|   | Washer, lock, BECX1R. | E. Spring WI-347345.                 |
|   | Spacer WI-347351.     | F. Shaft WI-347344.                  |
| B | Screw BCBX2BE.        | G. Rod WI-347346.                    |
|   | Nut BBBX2B.           | H. Roller assembly WI-347312.        |
|   | Washer, lock, BECX1P. | J. Hook (right-hand) C2418X.         |
|   | Spacer WI-347351.     |                                      |

FIGURE 86.—Roller assembly, installed.

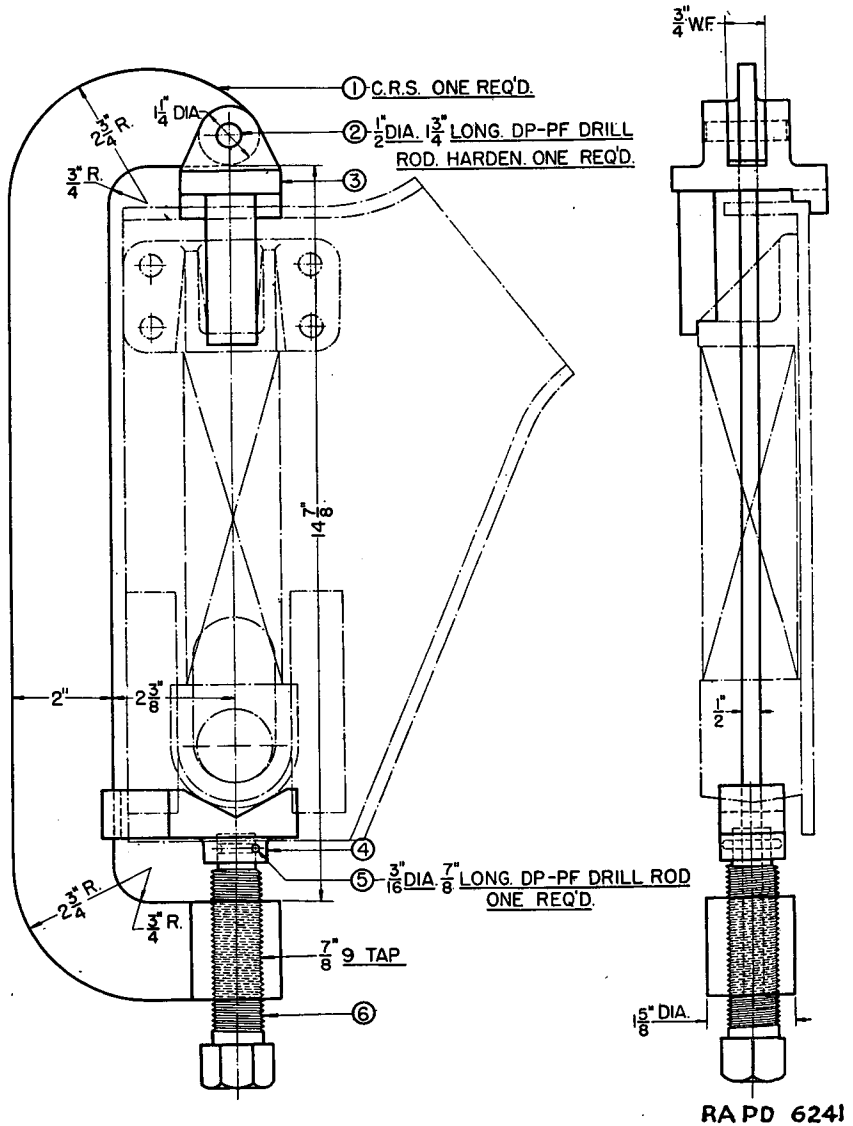


FIGURE 87.—Front roller spring compressing tool.

WI-347345 by turning clamp screws until roller shaft no longer rests at lower ends of slots in supports.

- (3) Remove roller. Driving rod.  
Hammer.

Support roller and then drive out shaft WI-347344. Lower roller WI-347311 with bearings and bushings to ground.

*c. Disassembly.*

- (1) Remove guide rods and 1¼-inch socket wrench.  
springs.

Turn clamp screws until compression is removed from springs. Remove guides WI-347346 and springs WI-347345.

- (2) Remove roller bushings and Puller.  
bearings.

Pull roller bearings WI-34719 out of bushings by hand and then, using puller, remove roller bushings WI-347313.

*d. Maintenance and repairs.*—(1) The roller requires little or no maintenance unless it is damaged. The bearings should be kept free of dirt and oiled during the 1,000-mile maintenance service; use oil, engine, seasonal grade.

(2) If the roller is pierced by shell fire, it can be repaired by welding plates over the holes.

(3) When the roller is damaged beyond repair, it should be removed as explained in *b* and *c* above and replaced with a new roller.

(4) If the roller is disassembled for any reason, check the compression springs for breaks or permanent set, and if any is apparent, replace with new springs. Check the bearings and if badly worn or damaged, replace.

*e. Reassembly.*

- (1) Replace bushings. Bushing driving tool.  
Hammer.

Drive bushings into roller end tubes.

- (2) Replace bearings. None.

Push bearings into bushings by hand.

*f. Installation of assembly.*—Tools:

Special clamp. Hammer.

1¼-inch socket wrench. Wood block.

- (1) Clamp springs and guide Special clamp.  
rods in position. 1¼-inch socket wrench.

Attach clamp to top of roller support. Place compression spring on guide rod and set rod into clamp in line with spring stop bracket hole. Turn clamp screws and compress spring until shaft hole in guide rod lines up with slotted hole in roller support. Follow this procedure for second rod and spring.

- (2) Replace roller assembly. Hammer.  
Wood block.

Lift roller into place between supports, making sure that square ends of bearings slide into roller guides and bearing holes line up with guide rod shaft holes. Push one end of shaft through guide rod. Holding wood block against opposite end of shaft, drive shaft through bearings and opposite guide rod.

- (3) Replace tapered pins. Hammer.

Drive pins through guide rods and shaft. Remove clamps.

**33. Bumpers.**—*a. Front bumperettes.*—Two bumperettes made of steel channel members are provided for the front end of the vehicle and are located to the left and right of the roller. Each bumperette is riveted to the frame rail and stiffened with gussets at the corners. The upper gussets are riveted to both the bumperettes and frame rails. The lower gussets are riveted to the bumperettes and bolted to the frame rails. No maintenance is required unless the bumperettes are badly damaged. In that case they should be replaced or straightened and new gusset plates added.

*b. Rear bumper.*—The rear bumper consists of a steel channel cross beam and is bolted in place at the rear of the body with its flat surface affixed to supports. It is treated as part of the body and no maintenance is required.

SECTION IX

FUEL SYSTEM

Description.....	Paragraph
Trouble shooting.....	34
Fuel tanks.....	35
Fuel lines.....	36
Fuel pump, carburetor, and air cleaner.....	37
	38

**34. Description.**—The air fuel system consists of two main fuel tanks, a tank fuel gage unit, which incorporates the fuel take-off pipe, fuel lines, a transfer shut-off cock, combined fuel and vacuum pump, carburetor with fuel filter, and an air cleaner. The tanks are located on the right and left side of the vehicle under the floor plate of the

driver's compartment. The filler spout and cap extend through a hole in the floor plate and are accessible for filling by opening the driver's compartment door. A plug is located at the bottom of the tank for draining. The fuel line assemblies extend from each tank to the transfer shut-off cock located on the lower right side of the engine dash, just below the instrument panel. (Each fuel tank has a length of flexible hose connected to the fuel tank take-off tube fitting and joining a copper tube line assembly, with a protector loom, which extends to the shut-off cock.) From the shut-off cock a flexible hose connects with the fuel pump, which is mounted on the lower, rear right side of the engine crankcase. A copper tube line assembly with a protector loom extends from the fuel pump to the carburetor fuel filter. The air cleaner is bolted on the right-hand engine side of the dash and is connected to the carburetor air intake by a rubber hose and air horn.

*a. Functioning.*—An eccentric on the camshaft actuates the fuel pump rocker arm and diaphragm. On the suction stroke the fuel is drawn from the tank, through the transfer shut-off cock, and into the fuel chamber. The return stroke of the pump forces the fuel into the carburetor float chamber. When the carburetor float chamber is filled, its float valve is closed, thus creating a pressure in the fuel pump chamber; this pressure holds the fuel pump diaphragm in the upward position where it will remain inoperative until the carburetor requires more fuel. Either tank can be selected to feed the system by simply opening or closing the individual shut-off cocks.

*b. Specifications.*

Fuel tanks:

Make---- White Motor Co.  
 Type---- Rectangular section.  
 Location.. Under driver's compartment floor plates.

Capacity- 15 gallons each.

Fuel and vacuum pump:

Make---- A. C. Spark Plug Co.  
 Model---- 1537105.  
 Type---- Mechanical.  
 Location- On right side of engine.

Carburetor:

Make---- Zenith.  
 Model---- IN-16755.  
 Type---- Down draft double venting.  
 Location- On intake manifold.

Air cleaner:

Make---- United Specialties Co.  
 Model---- T175-9497.  
 Type---- Oil bath.  
 Location- Right side of dash.



## Fuel filter:

Make\_\_\_\_\_ A. C. Spark Plug  
Co.  
Model\_\_\_\_\_ F291X2.  
Type\_\_\_\_\_ Metallic element.  
Location\_ Attached to carburetor.

## Three way shut-off cock:

Make\_\_\_\_\_ Weatherhead Co.  
Model\_\_\_\_\_ 210745A.  
Type\_\_\_\_\_ Three-way.  
Location\_ Driver's compartment.

**35. Trouble shooting.***Symptom and probable cause**Probable remedy***a. Excessive fuel consumption.**

Poor carburetor adjustment.

Dirty air cleaner.

Fuel leaks.

Excessive idling.

Excessive engine temperature.

Improper control adjusting.

Brakes dragging.

Tires underinflated.

Vehicle overloaded.

Check jet sizes against factory specifications.

Clean and renew oil bath.

Check carburetor float valve fuel pump, tanks, all lines and fittings.

Stop engine during long waits.

See section IV.

Inspect choke valve for fuel openings.

See section IX.

Inflate to recommended pressure.

Load only to rated capacity of vehicle.

**b. Fast idling.**

Carburetor controls sticking.

Carburetor throttle sitting.

Air leaks.

Free controls.

Adjust throttle stop screw and reset idling jet.

Inspect carburetor to manifold gasket; tighten flange nuts.

**c. Low fuel pressure.**

Fuel pump diaphragm not operating properly.

Air leaks.

Tighten holding screws or replace diaphragm.

Tighten vacuum line fittings, check.

NOTE.—For more detailed trouble shooting information on fuel system, carburetor, fuel pump, fuel filter, and air cleaner, see TM 9-1706.

**36. Fuel tank.**—*a. Description.*—Two tanks of 15-gallon capacity each are provided for the vehicle and are located under the floor plates of the driver's compartment.

(1) *Construction* (fig. 88).—The two fuel tanks are constructed of sheet steel with reinforced ends. On the bottom of the tank is a boss and threaded plug which is removed when draining the tank, and on the top is the filler spout and cap. In the cap are two small holes for venting the tank. Inserted in the top side of the tank is the electrically operated tank fuel gage, which incorporates the fuel take-off tube and fitting. The tanks are placed on two mounting brackets fastened one on each side of the frame and held in position by two steel clamping straps.

(2) *Functioning*.—Fuel is drawn from the tank through the fuel take-off tube, which is fastened on the flange of the tank fuel gage and extends down to within 1/2 inch of the bottom of the tank. Two small holes in the filler cap vent the tank to atmosphere. The tank is drained by removing the drain plug located at the bottom of the tank. The fuel tank gage float moves with the fuel tank level and is geared to a shaft that operates the arm on the rheostat, which controls the flow of current operating the dash fuel gage.

*b. Trouble shooting.*

<i>Symptom and probable cause</i>	<i>Probable remedy</i>
(1) Excessive fuel consumption.	
Loose fuel tank outlet fitting.	Tighten fittings.
Leak at outlet fitting threads.	Replace fitting.
Loose fuel tank drain plug.	Tighten plug.
Leak in fuel tank.	Repair or replace.
(2) Lack of fuel.	
Dirt in filler cap vent holes.	Remove cap and gasket and clean out holes.
Dirt in fuel tank.	Drain tank, filter fuel, and refill.
Incorrect or no fuel gage reading.	Inspect fuel tank gage, replace or repair.

*c. Removal of assembly.—Tools:*

3/16-inch open-end wrench.	3/4-inch open-end wrench.
1 1/32-inch open-end wrench.	
(1) Remove fuel line connection.	3/16-inch open-end wrench.

Disconnect flexible hose assembly held by fuel line flared nut WH-105X5 at tank.

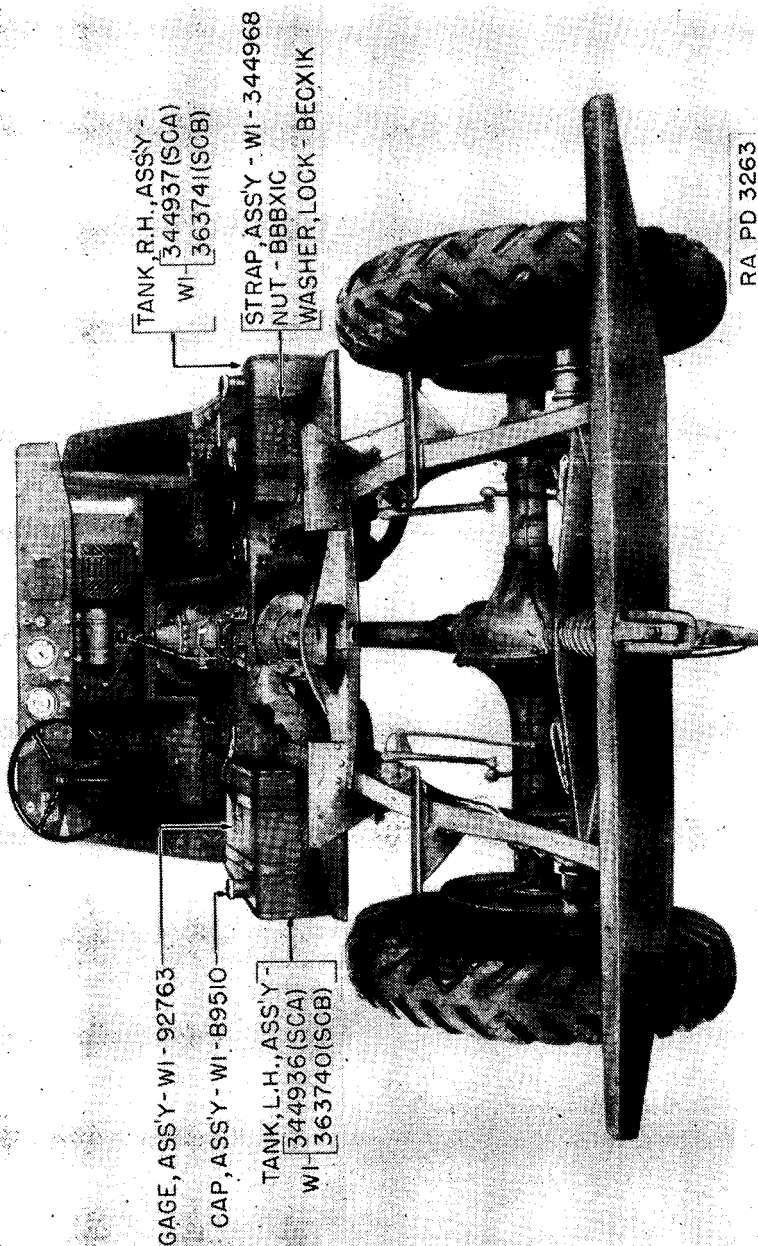


Figure 88.—Fuel tanks, installed.

(2) Disconnect fuel gage wire.  $1\frac{1}{32}$ -inch open-end wrench.

Loosen fuel tank gage terminal nut BBAX1A and remove wire.

(3) Remove fuel tank straps.  $\frac{3}{4}$ -inch open-end wrench.

Remove four nuts BBBX1C and lock washers BECX1K from straps WI-344968 and disconnect strap from tank.

(4) Remove fuel tank. None.

Lift fuel tank from bracket.

*d. Disassembly.*

(1) Remove tank fuel gage with Screw driver.  
fuel take-off tube assembly.

Remove five screws BCNX4AE and washer WI-00442A from gage flange and remove fuel gage assembly SW-92763 and gasket WI-A25051X.

(2) Remove filler cap. None.

Unscrew and remove cap WI-B9510 from tank.

(3) Remove drain plug.  $\frac{5}{8}$ -inch open-end wrench.

Unscrew drain plug WI-A9262X.

*e. Maintenance and repairs.—(1) Cleaning.—*The tanks should be removed and cleaned occasionally. Before attempting to repair any fuel tank, clean the tank thoroughly. This is absolutely necessary as a safety precaution against the explosion of gasoline or fumes remaining in the tank. The usual procedure is to fill the tank with a solution containing an alkaline cleaner (QMC Tentative Specifications ES-No. 542) and then flush it out with steam. While flushing, keep all the fittings open to drain the sediment and to avoid building up a steam pressure high enough to weaken or wreck the tank.

(2) *Soldering.—*The repair of fuel tanks is a soldering copper job; not a torch job, because of the danger of an explosion when an open flame is used. The soldering copper is safe and fast enough if skillfully used. *Never use a torch.* If there are leaks about a fitting, remove it, and clean and retin the joint before resoldering the fitting to the tank. Use half-and-half solder.

(3) Inspect filler cap vent holes and clean, if any dirt is present.

(4) After filling the tanks, replace the caps to prevent any dirt from entering.

(5) Inspect tank fuel gage float. If a leak has developed, it should be repaired by soldering after all traces of fuel and fuel vapor have

been removed. If for any other reason the gage is inoperative, the unit should be replaced.

*f. Tests (wet method).*—After the tank has been removed from the vehicle and disassembled, either the wet or air pressure method can be used to find any leaks before repairing and to test for leaks after repairing. The wet method is as follows:

- (1) Tightly plug all openings except the filler neck.
- (2) Dry entire outer surface of the tank thoroughly with compressed air and a clean rag.
- (3) Place tank on a bench on top of blocks so that the under side can easily be seen with the aid of an electric light.
- (4) Fill tank with water.
- (5) Insert end of air hose in the filler neck and cover remainder of the opening with the palm of the hand.
- (6) Apply air pressure against the water by opening the air valve with the other hand for a few minutes.
- (7) Examine entire tank for moist spots where the water was forced through.

*g. Tests (air pressure method).*—The air pressure method is as follows:

- (1) Plug all openings except the fuel outlet connection.
- (2) Attach loose end of air supply hose to the fuel outlet connection by a short-threaded tube.
- (3) Submerge fuel tank in a tank of clean water, or cover the tank with a soapy solution.
- (4) Turn on the air pressure, but not more than four pounds.
- (5) Draw a ring around each spot on the fuel tank where bubbles appear. The bubbles indicate leaks.

NOTE.—Some tanks stand considerable pressure, whereas others must be handled carefully. A maximum air pressure of four pounds with either method of testing is usually sufficient to indicate all leaks. If compressed air is not available, improvise a method of producing it, such as using an ordinary tire pump.

*h. Reassembly.*

- (1) Replace drain plug. 5/8-inch open-end wrench.  
Replace drain plug at bottom of fuel tank.
- (2) Replace filler cap. None.  
Screw on cap to tank filler spout.
- (3) Replace tank fuel gage Screw driver.  
unit.

Place gasket on gage flange. Insert gage into hole intake, line up hole and replace five screws.

*i. Installation of assembly.—Tools:*

$\frac{3}{4}$ -inch open-end wrench.  $\frac{9}{16}$ -inch open-end wrench.

$1\frac{1}{32}$ -inch open-end wrench.

(1) Replace holding straps.  $\frac{3}{4}$ -inch open-end wrench.

Place two straps over tank and into holes in bracket and replace four nuts and lock washers.

(2) Connect tank fuel gage wire.  $1\frac{1}{32}$ -inch open-end wrench.

Set wire on gage terminal post and tighten holding nut.

(3) Connect fuel line to tank.  $\frac{9}{16}$ -inch open-end wrench.

Connect flared tube nut to tank fuel take-off tube fitting.

**37. Fuel lines.—a. Description** (fig. 88).—The fuel lines connect the two fuel tanks with the three-way transfer shut-off cock which is mounted on the lower right, engine side, of the dash. A flexible hose extends from the shut-off cock to the fuel pump inlet connection.

*b. Construction.*—(1) The line assemblies connecting the tanks to the three-way shut-off cock are copper tubing covered with a protecting loom. The ends of the tubes are flared to take flared tube fitting nuts. Short lengths of metal-lined flexible hose connect the two lines to the outlet fittings of the tanks by means of fittings and nuts.

(2) The bronze three-way transfer shut-off cock has two threaded inlets to take the fuel line fittings from each tank and two valves that cut off fuel from the tank not in use (figs. 89 and 90). A single threaded outlet connects with the fuel pump line fitting. A flexible hose assembly connects the fuel pump inlet fitting to the shut-off cock outlet. A copper tube assembly with a protecting loom connects the fuel pump outlet to the carburetor fuel filter.

*c. Trouble shooting.*

*Symptoms and probable cause*

*Probable remedy*

(1) Leaking lines.

Split or fractured tube.

Loose fittings.

Replace line assembly.

Tighten or replace, if necessary.

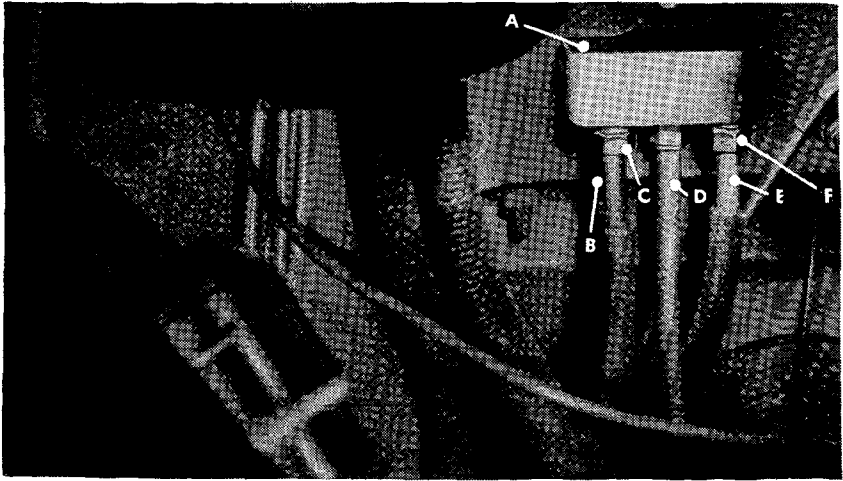
(2) Fuel line feeding slowly or not at all.

Dirt in lines.

Dirt in three-way shut-off cock.

Remove lines and clean.

Remove cock and clean.

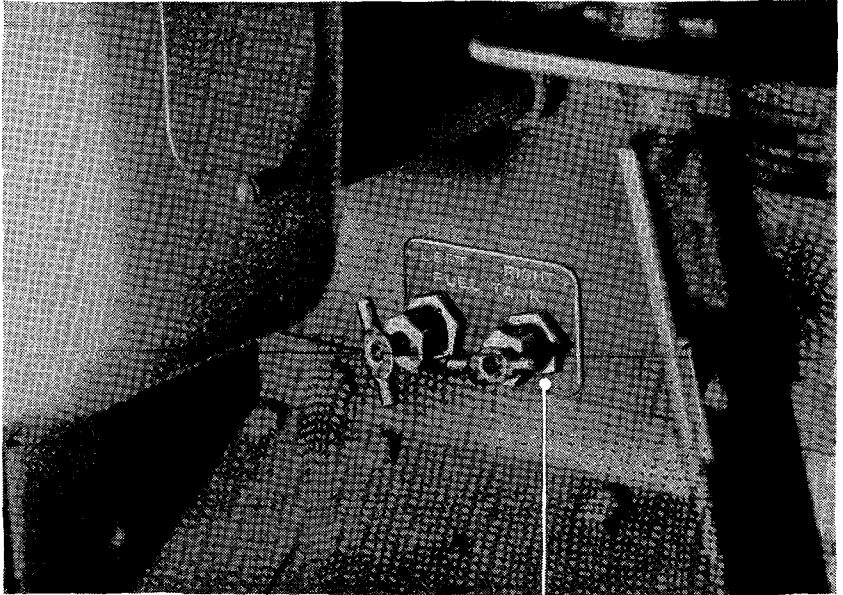


RA PD 7480

- A. Cock assembly WH-6756.
- B. Line assembly WI-348731.
- C. Nut WH-105X5.

- D. Hose assembly WI-348726.
- E. Line assembly WI-348730.
- F. Nut WH-105X5.

FIGURE 89.—Shut-off cock, installed (engine side).



COCK, ASS'Y - WH-6757 RA PD 7481

FIGURE 90.—Shut-off cock, installed (compartment side).

*d. Removal.*—Tools:

- |                                       |  |
|---------------------------------------|--|
| $\frac{9}{16}$ -inch open-end wrench. | $\frac{11}{16}$ -inch open-end wrench. |
| $\frac{1}{2}$ -inch open-end wrench.  | $\frac{13}{16}$ -inch open-end wrench. |
| $\frac{7}{16}$ -inch open-end wrench. | Screw driver.                          |

(1) Remove flexible hose assemblies at tanks.  $\frac{9}{16}$ -inch open-end wrench.

Disconnect flexible hose assemblies at right and left fuel tank outlet fitting. Then disconnect flared tube nuts WH-105X5 at copper line connections and remove hose assemblies WA-80029.

(2) Disconnect fuel line clips. Screw driver.

Remove nuts BBAX1A, lock washers BECX1G, and screws BCNX2CG holding clips WI-27593X and WI-A7047XA to frame and remove clips.

(3) Remove line assembly  $\frac{1}{2}$ -inch open-end wrench. (right-hand tank to shut-off cock).

Disconnect flared tube nut WH-105X5 at shut-off cock fitting and remove line assembly WI-348731.

(4) Remove line assembly (left-hand tank to shut-off cock).  $\frac{1}{2}$ -inch open-end wrench.

Disconnect flared tube nut WH-105X5 at shut-off cock and remove line assembly WI-329404.

(5) Remove flexible hose assembly (shut-off cock to fuel pump inlet).  $\frac{7}{16}$ -inch open-end wrench.

Disconnect flexible hose fittings at fuel pump inlet and shut-off cock outlet and remove hose assembly WI-348726.

(6) Remove line assembly (fuel pump outlet to carburetor filter inlet).  $\frac{1}{2}$ -inch open-end wrench.

Disconnect flared tube nuts WH-105X5 at fuel pump and filter and remove line assembly WI-348786.

(7) Remove three-way shut-off cock.  $\frac{11}{16}$ -inch open-end wrench.  $\frac{13}{16}$ -inch open-end wrench.

Unscrew shut-off cock packing nuts and remove cocks, packing, and nuts. Then remove attaching nuts and take out cock WH-6757.

*e. Maintenance and adjustments.*—Inspect lines and fittings for leaks, fractures, and worn spots. Tighten fittings and flared tube nuts.



If, after all fittings have been checked and tightened, the lines continue to leak, replace with new line assembly. If standard line assemblies are not available for replacement, assemblies can be made from standard tube stock as follows:

(1) Cut tubing to length required. Square ends and remove burs and dirt from tubing.

(2) Cut protector loom to length required and slide on to tubing.

(3) Place flared tube nut on each end of tubing and flare ends of tubing, using a flaring tool (fig. 33).

*f. Installation.—Tools:*

$1\frac{1}{16}$ -inch open-end wrench.  $\frac{7}{16}$ -inch open-end wrench.

$1\frac{3}{16}$ -inch open-end wrench.  $\frac{9}{16}$ -inch open-end wrench.

$\frac{1}{2}$ -inch open-end wrench. Screw driver.

(1) Replace shut-off cock assembly.  $1\frac{1}{16}$ -inch open-end wrench.  
 $1\frac{3}{16}$ -inch open-end wrench.

Set valve in position on dash and replace holding nuts. Then replace cocks, packing, and packing nuts.

(2) Replace line assembly (fuel pump outlet to carburetor filter inlet).  $\frac{1}{2}$ -inch open-end wrench.

Hold line assembly in position and connect flared tube nuts to pump and filter fittings.

(3) Replace hose assembly (shut-off cock outlet to fuel pump inlet).  $\frac{7}{16}$ -inch open-end wrench.

Connect hose assembly nuts to shut-off cock outlet fitting and fuel pump inlet fitting.

(4) Replace line assemblies (shut-off cock to left-hand and right-hand tank).  $\frac{1}{2}$ -inch open-end wrench.

Hold each copper tube line assembly in position and connect flared tube nuts to shut-off cock inlet fittings.

(5) Replace fuel line clips. Screw driver.

Place clips on lines and attach to frame with screws, lock washers, and nuts.

(6) Replace right-hand and left-hand tank flexible hose.  $\frac{9}{16}$ -inch open-end wrench.

Connect copper tube line flared tube nut to flexible hose fitting and then connect fitting flared nut, at opposite end of hose, to tank outlet fitting.

**38. Fuel pump, carburetor, and air cleaner.**—For complete maintenance information on these units, see TM 9-1706.

## SECTION X

### INSTRUMENT AND GAGES

	Paragraph
General .....	39
Instrument cluster .....	40
Voltmeter .....	41
Speedometer .....	42

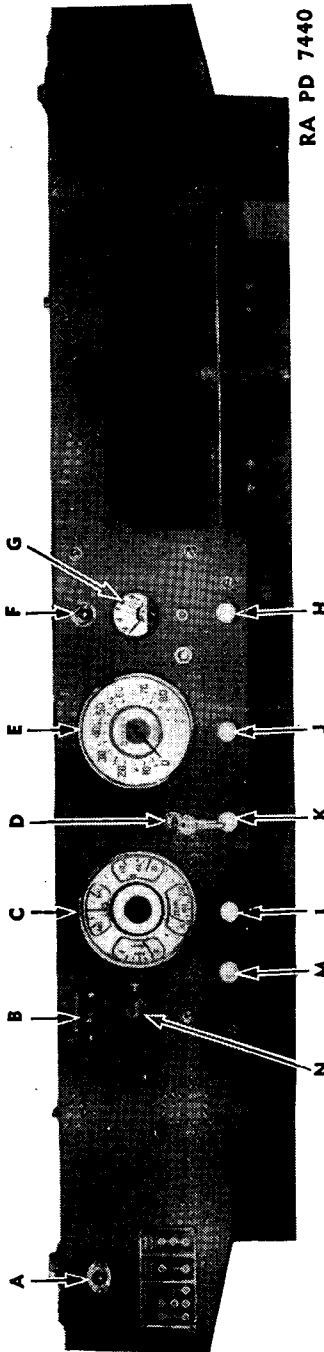
**39. General** (fig. 91).—The instruments mounted on the instrument panel consist of a four-unit instrument cluster, a voltmeter, and a speedometer. The indirectly lighted four-unit cluster assembly is mounted in a case at the left center of the panel and is composed of an ammeter, temperature gage, fuel gage, and the oil pressure gage. Located at the right center of the panel is the voltmeter. The speedometer is mounted approximately in the center of the panel just to the right of the cluster assembly. Attached to the back of the speedometer case is a bracket which holds the socket and lamp for the indirect lighting of both the speedometer and cluster assembly.

**40. Instrument cluster** (figs. 92 and 93).—*a. Description.*—The instruments of the cluster assembly are grouped in a circular case with the ammeter at the top and the temperature gage at the bottom. At the right is the oil gage and at the left is the fuel gage.

(1) *Construction.*—(a) The instruments of the cluster assembly are mounted on two semicircular plates attached to the case by four machine screws, two in each plate. Mounted on one plate are the oil and temperature gages, on the other plate are the fuel gage and ammeter. Two brackets with nuts, studs, and lock washers attach the case to the instrument panel.

(b) The ammeter, used in conjunction with a shunt, is of the magnetic type, with a permanent magnet operating the pointer. The dial is graduated to read +100 to 0 to -100 amperes. Two insulated terminal posts connect the generator and battery wires to the instrument. Two screws fasten the ammeter to the cluster case mounting plate.

(c) The electrically operated fuel gage is of the balanced coil type with a pointer dial graduated to indicate "empty- $\frac{1}{4}$ - $\frac{1}{2}$ - $\frac{3}{4}$ -full." The



- F. Light CS-C723.
- G. Voltmeter assembly WI-363725.
- H. Control, ventilator (right-hand), WI-334908.
- J. Control, choke, WI-334907.
- K. Control, throttle WI-334907.
- L. Control, spark WI-348751.
- M. Control, ventilator (left-hand), WI-334907.
- N. Switch HC-713L.

- (Receptacle HC-2614.
- Screw, machine, BCNN1FG.
- Nut BBKX2B.
- Washer, lock, BECX1D.
- Plate WI-A31729X.
- Screw, machine, BCNN1FG.
- Nut BBKX2B.
- Washer, lock, BECX1D.
- Cluster, gage, assembly SW-105500.
- Switch DM-2980.
- E. Speedometer assembly SW-585 AM.

FIGURE 91.—Instrument panel—front view.

gage has two insulated terminal posts, one for the wire from the fuel tank gage unit, and the other for the wire going to the ignition switch. The two terminal posts are also utilized for attaching the instrument to the cluster case mounting plate.

(d) The oil gage consists of a Bourdon tube which operates the pointer. An adapter for the oil line flared tube fitting is soldered to the Bourdon tube. The dial for reading the pressure is graduated for

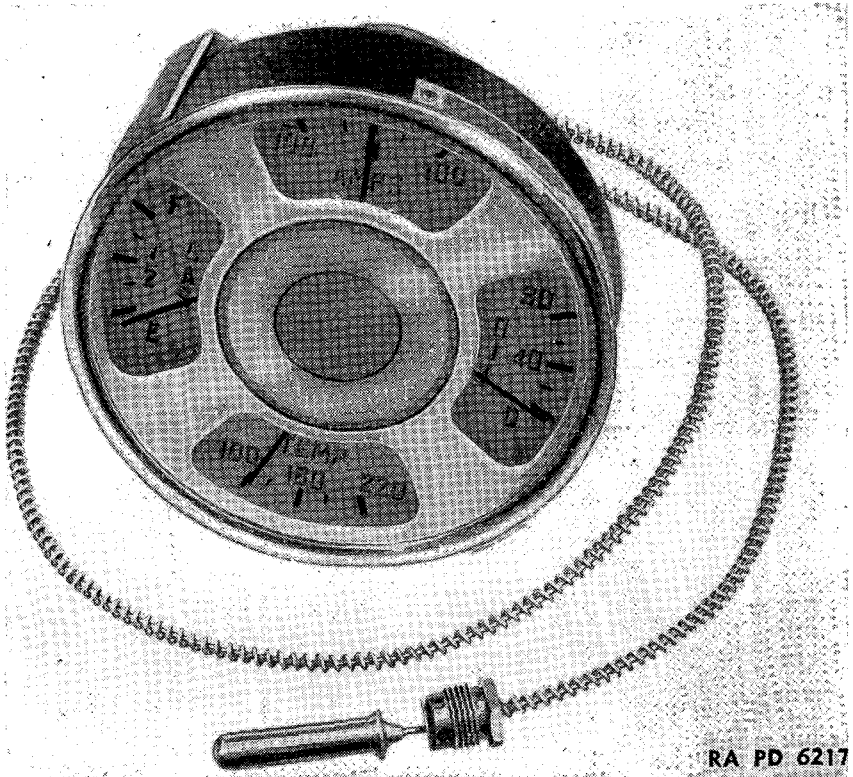


FIGURE 92.—Instrument cluster assembly—front view.

0-40-80 pounds. The instrument is attached to the cluster case mounting plate by means of a nut.

(e) The temperature gage consists of a Bourdon tube which operates the pointer and a dial which is graduated for 100°-180°-220° F. A liquid filled vapor bulb is attached to the cylinder head by an adapter nut and is connected to the Bourdon tube by means of a length of tubing. The tubing is soldered to the vapor bulb and Bourdon tube. The instrument is attached to the cluster case mounting plate by means of a nut.

(2) *Functioning.*—(a) *Ammeter.*—The ammeter indicates total current discharge (−) under any load when the generator is inoperative and the net charge (+) to the battery when generator is operating, regardless of auxiliary loads. The ammeter does not indicate total generator output, although it can be utilized to do so for test purposes by shifting the generator lead to the battery terminal of the ammeter. The generator begins charging when the vehicle reaches a speed of from 7 to 10 mph and shows a positive (+) reading on the ammeter.

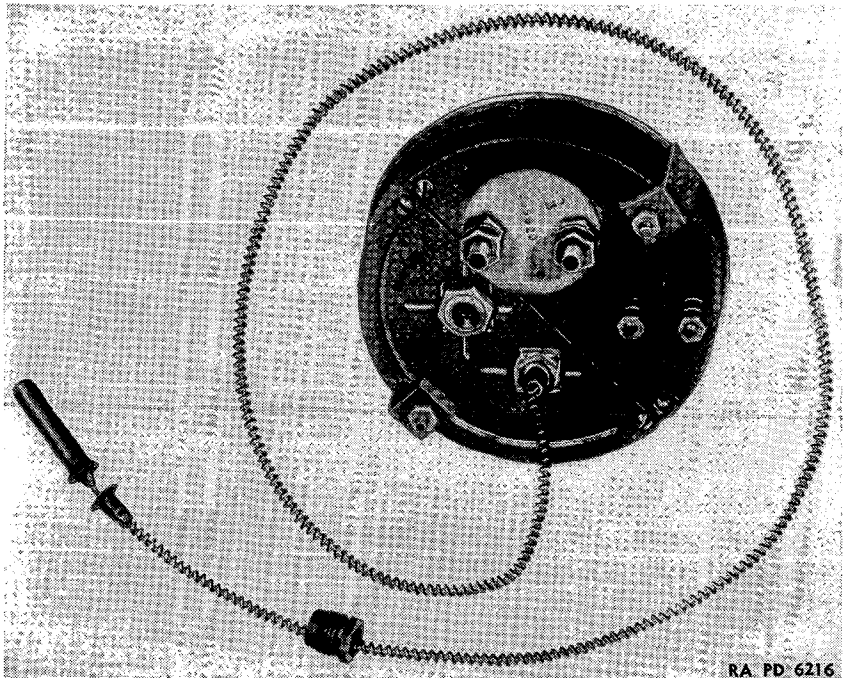


FIGURE 93.—Instrument cluster assembly—rear view.

The charging rate increases with the vehicle speed until a maximum rate is reached at approximately 25 mph. With a fully charged battery little or no charging rate will be indicated by the ammeter, due to the action of the voltage regulator unit.

(b) *Fuel gage.*—The gage indicates level of fuel in tank and is operative only when the ignition switch is turned on. The fuel gage is operated by the fuel tank unit, consisting of a rheostat and a float mechanism. The float element of this unit moves with the fuel tank level and is geared to a shaft which operates the rheostat arm. The rheostat controls the flow of current to the fuel gage coils, which move

the gage pointer in relation to the quantity of fuel in the tank. The fuel tank transfer switch permits the reading of either tank from one gage.

(c) *Oil gage.*—Attached to the oil gage Bourdon tube is a pipe with its opposite end connected to the delivery or pressure side of the oil pump. As the oil pressure increases, the air in the pipe is compressed; this pressure expands the Bourdon tube; as the oil pressure decreases, the reverse action occurs and the Bourdon tube contracts. This expansion and contraction of the Bourdon tube actuates the oil gage pointer. Oil pressure reading will vary according to operating conditions. The oil gage does not indicate the amount of oil in the crankcase.

(d) *Temperature gage.*—The temperature gage indicates the engine water temperature and is calibrated to read in degrees Fahrenheit. The normal operating range under average conditions should be between 140° F. to 180° F. The Bourdon tube unit of this instrument which actuates the dial pointer is controlled by a low boiling point liquid contained in the vapor bulb. As the engine water temperature rises the liquid forms a gas, creating pressure in the bulb. This pressure is transferred by the tubing to the Bourdon tube, which expands. As the water temperature lowers, the gas pressure is reduced, contracting the Bourdon tube. This expansion and contraction of the Bourdon tube actuates the gage pointer through a pair of gears.

(3) *Specifications.*

Unit	Make	Type	Manufacturer's No.	Ordnance No.	White No.
Ammeter	Stewart-Warner	Electromagnetic.	SW-105820	-----	373850
Fuel gage	Stewart-Warner	Electromagnetic.	SW-G-95622	A169293	K95622
Oil gage	Stewart-Warner	Pressure	SW-95614	A169292	-----
Temperature gage.	Stewart-Warner	Fluid expanding.	SW-G-95620	B157037	340115

b. *Removal of assembly.*—Tools:

- 5/8-inch open-end wrench.      1/16-inch open-end wrench.
- 7/16-inch open-end wrench.    3/8-inch open-end wrench.

(1) Remove instrument shield- None.

ing box cover.

Remove two wing nuts WI-16896X and take off cover WI-317274.

(2) Remove temperature gage  $\frac{5}{8}$ -inch open-end wrench. bulb adapter.

Loosen temperature gage bulb adapter nut SW-93844 and remove bulb from adapter at engine.

(3) Remove oil gage line.  $\frac{7}{16}$ -inch open-end wrench.

Remove oil line nut located on the back of cluster case.

(4) Remove ammeter wires.  $\frac{9}{16}$ -inch open-end wrench.

Loosen two ammeter wire terminal nuts BBAX1B and pull out wires.

(5) Remove fuel gage wires.  $\frac{3}{8}$ -inch open-end wrench.

Loosen two fuel gage wire terminal nuts and remove wires.

(6) Remove cluster assembly  $\frac{3}{8}$ -inch open-end wrench. and mounting bracket.

Remove two cluster assembly mounting stud nuts BBMX1C and lock washer BECX1E. Then remove two brackets SW-74074 and lift out cluster assembly SW-96385.

*c. Disassembly.*—Tools:

$\frac{1}{4}$ -inch open-end wrench.  $\frac{9}{16}$ -inch open-end wrench.

$\frac{11}{16}$ -inch open-end wrench. Screw driver.

$\frac{3}{8}$ -inch open-end wrench.

(1) Remove cluster from panel.

See *b* above.

(2) Remove instruments from  $\frac{1}{4}$ -inch open-end wrench. case. Screw driver.

Remove two case mounting studs SW-91889 and four backing plate screws SW-12389, and lift plates with instruments from case assembly SW-95668.

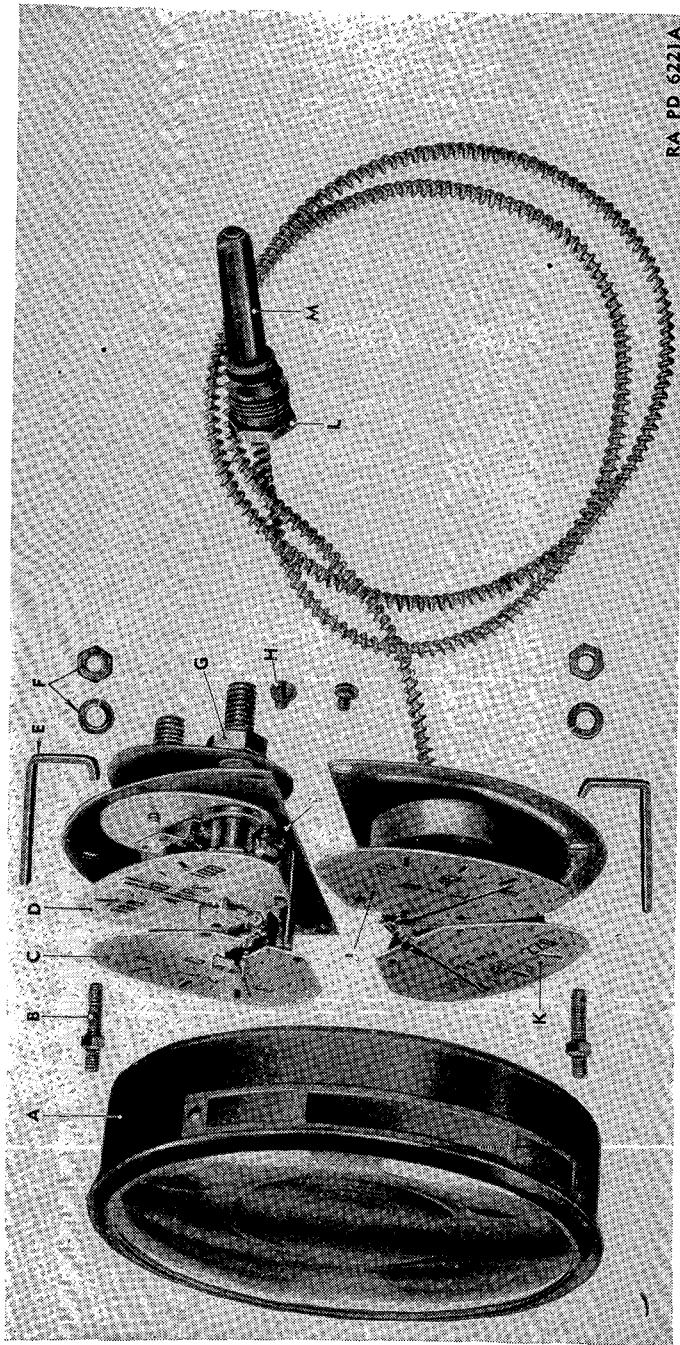
(3) Remove oil gage from  $\frac{11}{16}$ -inch open-end wrench. mounting plate.

Remove attaching nut SW-93844 and lift oil gage assembly SW-95614 from plate.

NOTE—Do not remove temperature gage from plate.

(4) Remove fuel gage from  $\frac{3}{8}$ -inch open-end wrench. mounting plate.

Remove two terminal stud nuts SW-64459, two lock washers SW-5052, and two plain brass washers SW-77875. Then remove insulator SW-91350 and fuel gage assembly SW-G-95622.



RA PD 6221A

- A. Case, w/bezel, assembly, SW-95668.
- B. Stud, SW-91889.
- C. Gage, fuel, assembly, SW-G-95622.
- D. Ammeter, assembly, SW-G-105820.
- E. Bracket, SW-74074.
- F. { Nut, BBMX1C.  
Washer, lock, BFCX1E.
- G. Nut, SW-77703.
- H. Screw, SW-12389.
- I. Plate, SW-S95076.
- J. Gage, oil, assembly, SW-95614.
- K. Gage, temperature, assembly, SW-95620.
- L. Adapter, SW-90389.
- M. Bulb, assembly, SW-95617.

FIGURE 94.—Instrument cluster assembly—exploded view.



(5) Remove ammeter from  $\frac{9}{16}$ -inch open-end wrench mounting plate.

Remove two terminal nuts BBAX1B and insulator SW-91350. Then remove three screws SW-75068 and lock washers BECX1C, and lift ammeter assembly SW-105820 from plate.

*d. Maintenance and adjustments.*—(1) *Ammeter.*—The ammeter requires no adjustments. If the ammeter does not function after the electrical system has been checked, replace it. Tests may be made to determine current at the ammeter terminal posts with a portable ammeter. If the ammeter pointer does not move to discharge (–) with the lights turned on and the engine not running a faulty ammeter is indicated.

(2) *Fuel gage.*—If the fuel gage does not register after the fuel tank gage unit has been checked and inspection shows current at the fuel gage terminals, replace fuel gage.

(3) *Temperature gage.*—The temperature gage requires no adjustments and once installed will become inoperative only by the loss of liquid caused by leaks, at which time the instrument should be replaced. Check accuracy of the temperature gage by submerging the vapor bulb in boiling water.

(4) *Oil gage.*—Check oil gage for proper readings. If the oil gage indicates improper pressure or no pressure at all this may be due to a faulty oil pump, oil line leakage, or to a stoppage. Replace the oil gage if it does not indicate proper oil pressure after the engine oiling system has been inspected and found in order.

*e. Reassembly.*—Tools:

$\frac{9}{16}$ -inch open-end wrench.	$\frac{1}{4}$ -inch open-end wrench.
$\frac{3}{8}$ -inch open-end wrench.	Screw driver.
$1\frac{1}{16}$ -inch open-end wrench.	

(1) Replace ammeter on  $\frac{9}{16}$ -inch open-end wrench mounting plate.

Insert ammeter terminal studs in plate holes and replace screws attaching ammeter to plate. Slide insulator on terminal studs and screw on terminal nuts.

(2) Attach fuel gage to mounting plate.  $\frac{3}{8}$ -inch open-end wrench.

Insert mounting terminal studs in plate holes and replace insulator, brass washers, lock washers and nuts.

(3) Replace oil gage.  $1\frac{1}{16}$ -inch open-end wrench.

Insert oil gage mounting fitting in plate hole and replace holding nut.

- (4) Replace instruments in case and bezel assembly.  $\frac{1}{4}$ -inch open-end wrench.  
Screw driver.

Place the two instrument mounting plates in position in case and replace screws and case mounting studs.

*f. Installation of assembly.*—Tools:

- $\frac{3}{8}$ -inch open-end wrench.  $\frac{7}{16}$ -inch open-end wrench.  
 $\frac{5}{8}$ -inch open-end wrench.  $\frac{9}{16}$ -inch open-end wrench.

- (1) Install cluster assembly on instrument panel.  $\frac{3}{8}$ -inch open-end wrench.

Place cluster assembly in hole on panel and replace bracket, nuts, and lock washers.

- (2) Attach temperature vapor bulb to engine.  $\frac{5}{8}$ -inch open-end wrench.

Insert bulb in adapter and screw on and tighten bulb adapter nut.

- (3) Connect oil line to gage.  $\frac{7}{16}$ -inch open-end wrench.

Place line in fitting and tighten flared tube nut.

- (4) Connect fuel gage wires.  $\frac{3}{8}$ -inch open-end wrench.

Connect wires to terminal posts and tighten nuts.

- (5) Connect ammeter wires.  $\frac{9}{16}$ -inch open-end wrench.

Place wires on terminal posts and replace washers and nuts.

**41. Voltmeter** (fig. 95).—*a. Description.*—The d-c voltmeter is an electromagnetic type with a range of 0 to 20 volts.

(1) *Construction.*—The d-c voltmeter consists of a magnet, coil, pointer, and dial, which is graduated from 0 to 20 volts. The voltmeter is mounted in a flanged case and a retaining clamp ring secures the voltmeter to the instrument panel.

(2) *Functioning.*—The voltage developed by the battery is measured by the voltmeter. A small amount of current passing through a high resistance coil, pivoted on the pointer axis, creates a magnetic field whose torque reaction operates the pointer. The voltmeter may be connected to or disconnected from the system by the push button switch located on the panel under the voltmeter. Once the generator is operating, checks of system voltage reflect the results of the potential generator output rather than that of the battery. The voltmeter does not substitute for battery hydrometer reading in determining the state of the battery charge.

(3) *Specifications.*

Make	Type	Manufacturer's No.	Ordnance No.	White No.
Hickok Electric	Electric		A190863	363725

*b. Removal of assembly.—Tools:*

$\frac{3}{8}$ -inch open-end wrench. Screw driver.

$1\frac{1}{32}$ -inch open-end wrench.

- (1) Remove voltmeter wires.  $\frac{3}{8}$ -inch open-end wrench.

Loosen two wire terminal nuts BBMX1C and pull out wires.

- (2) Remove voltmeter. Screw driver.

$1\frac{1}{32}$ -inch open-end wrench.

Loosen screw BCNX1FK on case clamp retaining ring holding screw nut BBKX2B with wrench. Slide ring off case. Remove voltmeter WI-363725.

*c. Disassembly of components (fig. 95).*

- (1) Remove voltmeter from instrument panel.

Refer to *b*(2) above.

- (2) Remove voltmeter mechanism. Small screw driver.

Remove three screws HK-BA86-1A that attach case to voltmeter base and separate mechanism from case assembly.

- (3) Dial and pointer stop. Small screw driver.

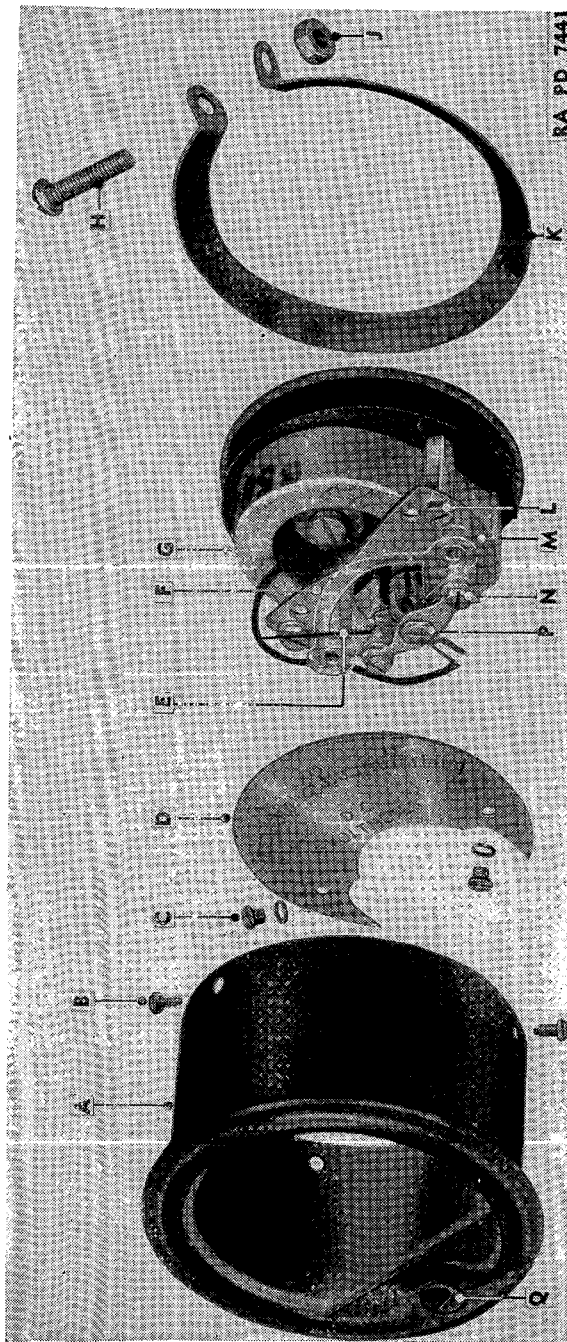
Remove two screws HK-BX15Y from dial HK-5607 and take off dial and pointer stop.

*d. Maintenance and adjustments.—(1) Replacements.—*If the voltmeter fails to give voltage readings after the push button switch and the electrical system have been inspected, replace voltmeter. Replace broken dial glass with case and glass assembly.

(2) *Adjustments.—*To set voltmeter pointer to zero, turn adjusting screw on face of instrument case until pointer is in line with the zero mark on the dial.

*e. Reassembly of components.*

- (1) Replace voltmeter dial and pointer stop. Screw driver.



- A. Case assembly.
- B. Screw HK-BAS6-1A.
- C. { Screw HK-BX15Y.
- { Washer, lock, HK-#3 (10:528-3)
- D. Dial HK-5607.
- E. Pointer HK-5611.
- F. Pointer stop HK-10105.
- G. Magnet assembly HK-5601-2.
- H. Screw BCNX1FK.
- J. Nut BBKN2B.
- K. Ring, clamping.
- L. { Screw HK-B49C.
- { Washer, lock, HK-#6 (10:528-6)
- M. Frame assembly HK-4685-22A.
- N. { Screw HK-B4E.
- { Washer, lock, HK-5639-N6.
- P. Movement, assembly HK-5684-1
- Q. Screw, pointer adjusting, HK-5609.

FIGURE 95. -Voltmeter assembly—exploded view.

Slide dial under pointer so that the two screw holes are in line, insert screws, and tighten.

(2) Replace voltmeter mechanism in case. Screw driver.

Insert voltmeter mechanism in its case so that the pointer adjustment screw arm on the face of the case meshes in the adjusting fork on the instrument. Put in three screws attaching case to instrument and tighten.

*f. Installation of assembly.*—Tools:

1 $\frac{1}{32}$ -inch open-end wrench. Screw driver.

$\frac{3}{8}$ -inch open-end wrench.

(1) Install voltmeter on instrument panel. 1 $\frac{1}{32}$ -inch open-end wrench. Screw driver.

Place voltmeter in hole on instrument panel so that the dial is in the proper reading position. Slide retaining clamp ring on case and tighten clamping screw.

(2) Connect voltmeter to system.  $\frac{3}{8}$ -inch open-end wrench.

Connect voltmeter wires to terminals and tighten terminal nuts.

**42. Speedometer** (figs. 96 and 97).—*a. Description.*—The speedometer is of the centrifugal magnetic type with a dial reading for 0 to 80 mph and an odometer unit for season and trip mileage.

(1) *Construction.*—The magnetic-type speedometer, mounted in a case, has a pointer and dial graduated to indicate 0 to 80 mph. The odometer unit of this instrument indicates total mileage (up to 99,999). Extending at the rear of the case is a boss, which contains the bearing and drive shaft, and the stem for resetting the trip mileage unit. The boss is internally threaded to take the flexible drive shaft fitting. Two studs are attached to the back of the case to mount the speedometer to the instrument panel.

(2) *Operation.*—(a) The speedometer is actuated by a positive driven revolving magnet exerting a drag on a circular metal speed cup which acts as a field. The speedometer pointer is attached to the field cup shaft. The field cup revolves in relation to the speed of the magnet, which is driven by a flexible shaft drive through a pair of gears located in the transfer case.

(b) The season odometer unit is driven from the magnet shaft by a series of worms and worm gears. The trip odometer is driven from the season odometer by a pair of spur gears. To reset the trip mileage to zero, push in the resetting stem and turn clockwise.



FIGURE 96.—Speedometer assembly—front view.

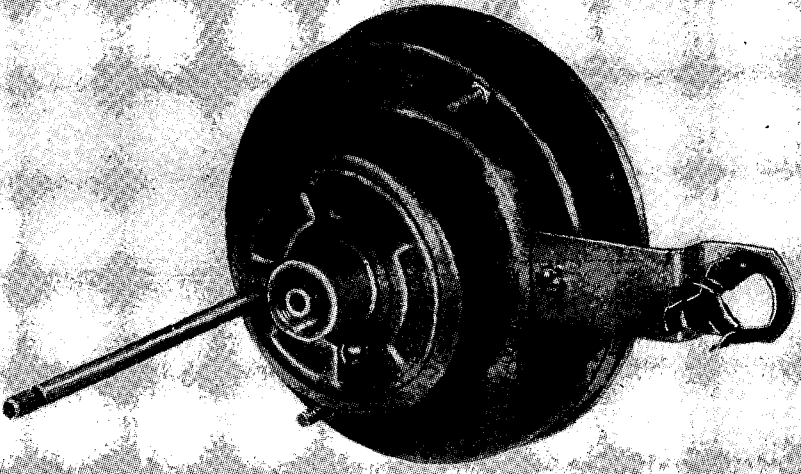


FIGURE 97.—Speedometer assembly—rear view.

(3) *Specifications.*

Make	Type	Manufacturer's No.	Ordnance No.	White No.
Stewart-Warner-----	Centrifugal-----	SW-585-AM	B156135	326390

*b. Removal of assembly.—Tools:*

Pliers. 3/8-inch open-end wrench.

Screw driver.

(1) Remove speedometer flex- Pliers.  
ible drive shaft connection.

Detach speedometer drive shaft SW-9500084 by breaking connection at speedometer head.

(2) Remove lamp bracket. Screw driver.

Remove one screw SW-12389 and shakeproof washer BEAX1E and detach bracket SW-G-74124.

(3) Remove speedometer and 3/8-inch open-end wrench.  
mounting brackets.

Remove two nuts SW-12372 and lock washers SW-5052 from mounting bracket studs. Then take brackets SW-74074 off mounting studs and lift out speedometer assembly SW-585-AM.

*c. Disassembly of components. (fig. 98).—Tools:*

Screw driver. Small screw driver.

Pliers.

(1) Remove speedometer assem-  
bly.

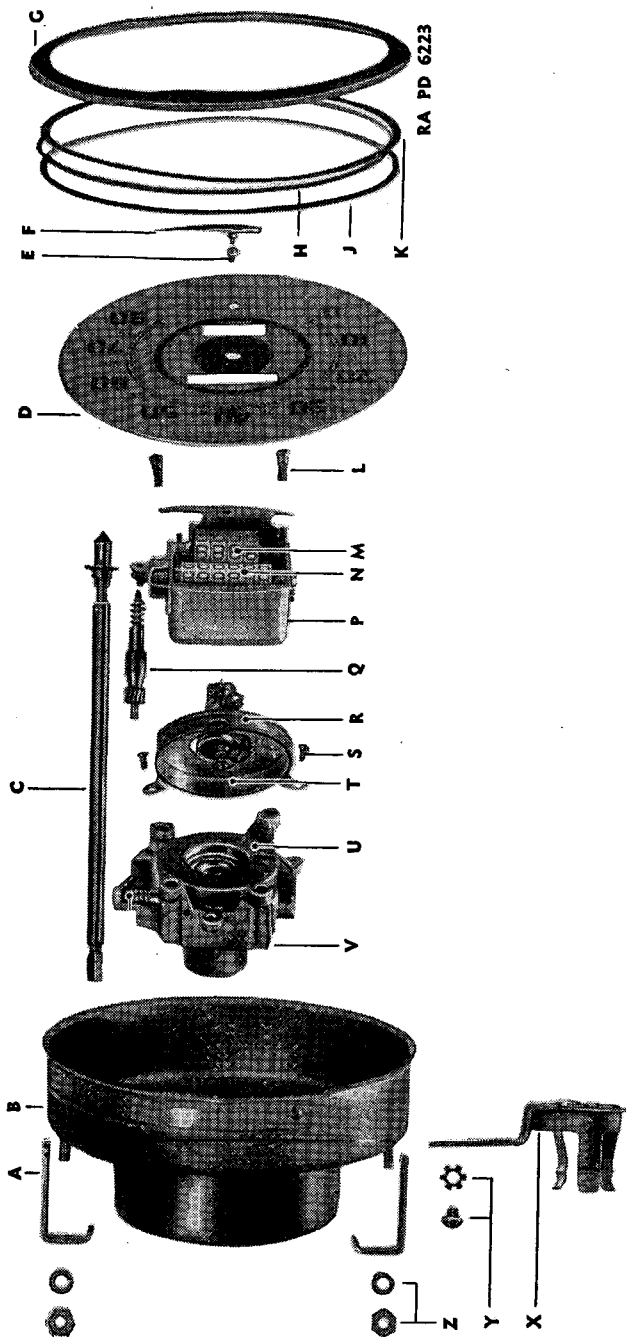
See *b* above.

(2) Remove rolled bezel glass Screw driver.  
and gaskets. Pliers.

Pry bezel SW-74067, loose with screw driver in two places about 1/2 inch apart, grab with pliers and tear section out (fig. 99①). Pull bezel off. Remove glass SW-74070 and two gaskets SW-74072.

(3) Remove pointer. None.

Turn pointer SW-G-7759 to the right as far as it will go. Hold pointer at axis, twist to the right, and carefully pull off pointer (fig. 99②).



- A. Bracket SW-740741.
- B. Case assembly, w/stud, SW-08473.
- C. Shaft SW-102977.
- D. Dial SW-08470.
- E. Screw SW-96051.
- F. Pointer SW-97759.
- G. Bezel SW-74067.
- H. Glass SW-74070.
- J. Ring SW-74071.
- K. Gasket SW-74072.
- L. Screw SW-64796.
- M. Odometer SW-71909.
- N. Odometer SW-08415.
- P. Frame SW-102794.
- Q. Gear SW-64787.
- R. Plate, w/bracket, assembly SW-91154.
- S. Screw SW-18035.
- T. Cup, w/shaft, assembly SW-91162.
- U. Magnet, w/shaft, assembly SW-64770.
- V. Frame SW-70873.
- X. Bracket SW-74124.
- Y. Washer BEMXIE.
- Z. Nut, BEMXIC.

FIGURE 98.—Speedometer—exploded view.



(4) Remove dial. Small screw driver.

Remove two screws SW-95051 and lift off dial SW-98470.

(5) Remove odometer assembly. Screw driver.

Remove three odometer frame screws SW-64796 and lift out odometer assembly (fig. 99③).

(6) Remove field plate with bracket assembly. Screw driver.

Remove three screws SW-18035, holding field plate bracket to frame and lift out assembly (fig. 99④).

(7) Remove speed-unit assembly with mounting frame. Screw driver.

Remove two screws SW-13395 and lock washers SW-5052 from back of case and lift out speed-unit assembly (fig. 99⑤).

*d. Maintenance and adjustments.*—(1) If speedometer is not registering the speed of the vehicle and the miles of travel, inspect flexible drive conduit. If found to be hot, internal friction is developing due to lack of lubrication or misadjustment. If a slight click or thump can be heard, remove speedometer cable and inspect for distortion, incorrect length or diameter, or for breaks and worn connections. A defective cable should be replaced.

(2) Remove cable conduit. Lubricate sparingly with grease, general purpose, seasonal grade, and reassemble.

(3) If speed unit is out of order, replace speed-unit assembly and bracket.

(4) If the odometer fails to register, replace odometer unit assembly and bracket.

(5) Inspect dial pointer; if loose on shaft, replace pointer.

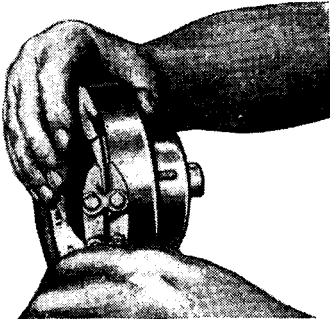
(6) Replace broken dial glass with new glass and bezel; and before replacing, inspect mechanism for dust and dirt. If necessary, disassemble and clean parts thoroughly.

*e. Reassembly* (fig. 98).

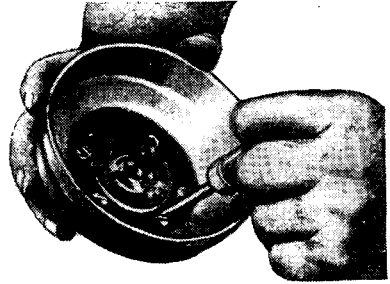
(1) Replace field plate with bracket assembly. Screw driver.

Place field plate bracket on frame. Insert three screws and tighten.

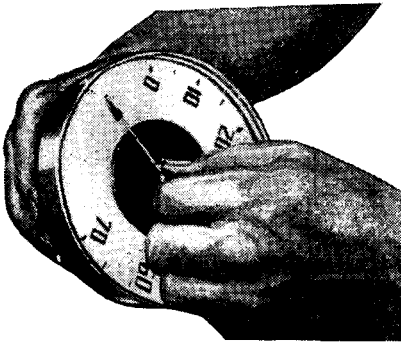
(2) Replace odometer assembly on speed-unit frame. Screw driver.



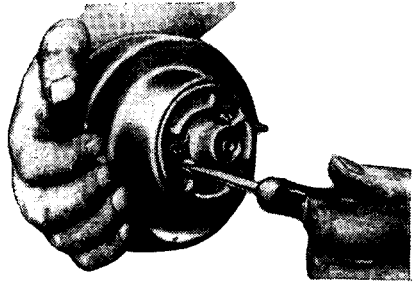
① Bezel removal.



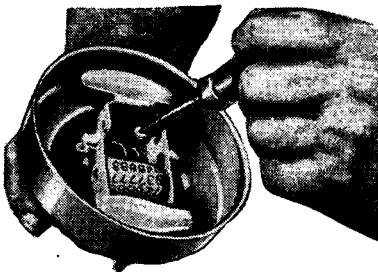
② Needle removal.



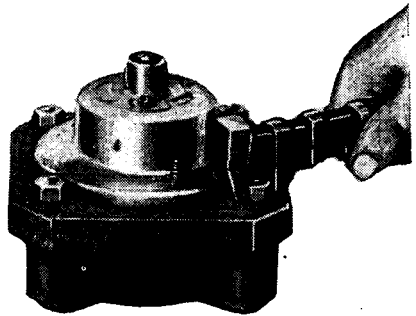
③ Odometer removal.



④ Speed unit removal.



⑤ Case removal.



⑥ Bezel replacement with special tool SW-T88972.

FIGURE 99.—Speedometer disassembly.

Place odometer assembly on speed-unit frame, meshing cross drive shaft worm with odometer gear. Insert three screws and tighten.

(3) Replace speedometer Screw driver.  
mechanism in case.

Place speedometer in case, lining up the trip reset stem with the hole in rear of case. Replace lock washers and screws and tighten.

(4) Replace dial. Screw driver.

Place dial on odometer frame so that the long slot in the dial is in line with the season mileage unit. Insert dial screws and tighten.

(5) Replace dial pointer. None.

Start pointer on shaft at about the 30-mile mark. Press it on as it is turned counterclockwise to zero.

(6) Replace glass and bezel. Bezel rolling tool SW-T88972.

Place new bezel, glass, and gasket in lower half of tool, face down, and place upper half of tool on lower half. Screw on tool stud nuts and tighten each nut a little at a time, to exert even pressure on bezel. After nuts are down tight, remove (fig. 99⑥).

*f. Installation.*

(1) Install speedometer on in-  $\frac{3}{8}$ -inch open-end wrench.  
strument panel.

Place speedometer in hole on instrument panel. Slide bracket on mounting studs. Put on two lock washers and stud nuts. Holding brackets in place, tighten nuts. Connect speedometer flexible drive to speedometer fitting and tighten.

(2) Install lamp bracket and Screw driver.  
socket assembly.

Place lamp bracket on rear of speedometer case in line with the screw hole. Insert screw and tighten.

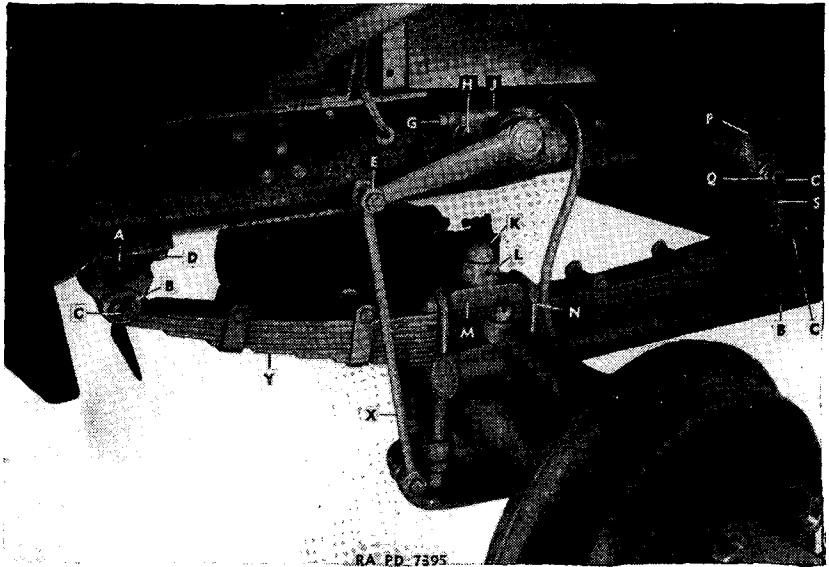
SECTION XI

SPRINGS AND SHOCK ABSORBERS

	Paragraph
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Rear springs-----	44
Shock absorbers-----	45

**43. Front springs.**—*a. Description.*—The front springs are semi-elliptical, twin-back type.

(1) *Construction* (figs. 100 and 101).—(a) Each spring is attached to the frame by means of an anchor and pin at the front end and a shackle and pins at the rear. They are attached at the center to the axle seat by means of U-bolts and nuts which also hold the bumper plates to the top of the springs. The front springs are mounted above the axle.



- |                               |  |
|-------------------------------|--|
| A. Bracket, WI-344904.        | J. Instrument, w/lever, assembly DR-5342368. |
| B. Fitting, CLDX5A.           | K. Block, WI-321388.                         |
| C. Pin, WI-55900.             | L. Screw, BCXIKE.                            |
| D. { Bolt, WI-A14619X.        | M. Spacer, WI-344905.                        |
| { Nut, BBBX1D.                | N. Clip (U-bolt), WI-344979.                 |
| { Washer, lock, BECXIL.       | P. Bracket assembly, WI-311962.              |
| E. Nut, DR-145009.            | Q. Shackle, WI-55901.                        |
| G. { Plug (screw), DR-045275. | S. Bracket, DR-5304693.                      |
| { Gasket, DR-045228.          | X. Link, assembly, 5352238.                  |
| H. Screw, cap, BCX2AN.        | Y. Spring assembly, EAT-32541.               |

FIGURE 100.—Front spring and shock absorber, installed.

(b) To prevent breakage at the ends of the spring, it is necessary to wrap both the first and second leaves around the bushings at the eyes. To permit movement of the first and second leaves as they bend and still maintain a tight strong wrap, the second leaf is made in three pieces. At the center is an H-shaped section, slightly thicker than the two other sections of the second leaf. Into the recesses formed by the H, the tang-ends of the end sections are allowed to slide. The joint formed between the center section and the two end

sections of the second leaf often gives the false impression of a broken spring leaf, and may lead to complaints. A thin wear plate is inserted between the H-section of the second leaf and the top leaf. The leaves are bolted together at the center and held by four clips along the length, two clips between the center and each end.

(2) *Functioning.*—The springs flex with every movement of the wheels and prevent the frame from taking the jolts. The second wrapper leaf is divided as explained above; the end sections slip

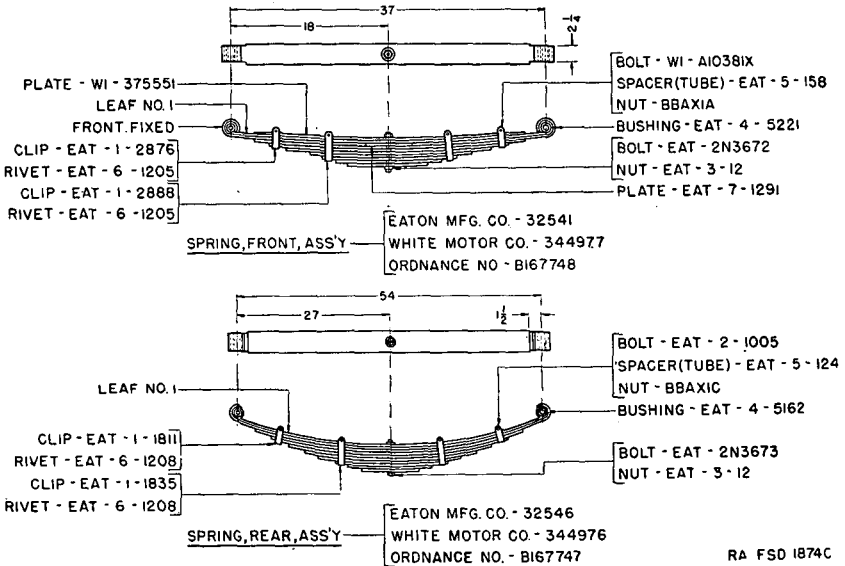


FIGURE 101.—Spring assemblies—sectionalized view.

back and forth with each flexing of the springs, and thus prevent excessive breaking of levers. When the wheels drop into a deep hole or hit a sharp bump, the shock absorbers may not be able to take the entire jolt, and the springs will flex until the bumpers on top of the springs hit the bottom of the frame, thus preventing further flexing of the springs which might break them.

(3) *Specifications.*

Make	Type	Manufacturer's No.	Ordnance No.	White No.
Eaton Manufacturing Co.	Twin-back	EAT-32541	B167748	344977

Front spring:

Center to center of eye -----	37 in.
Center of eye to seat center -----	18 in.
Width -----	2 $\frac{1}{4}$ in.
Rebound clips -----	4

Leaves:

Quantity—9 (plus one top rebound plate)	
Thickness-----	3 leaves 0.29 in.; 6 leaves 0.262 in.
Rebound plate -----	0.262 in.
H-plate thickness -----	0.323 in.
Wear plate thickness -----	0.031 in.
Total thickness of spring -----	2.847 in.

b. Trouble shooting.

<i>Symptom and probable cause</i>	<i>Probable remedy</i>
-----------------------------------	------------------------

- |  |                         |
|--|-------------------------|
| (1) Hard riding.                         |                         |
| Insufficient lubrication.                | Lubricate shackle pins. |
| Broken shackle pins.                     | Replace with new pins.  |
| Overloading or uneven load distribution. | Redistribute load.      |
| (2) Over flexibility.                    |                         |
| Broken spring leaves.                    | Replace broken leaves.  |

c. Removal of assembly (fig. 101).—Tools:

- |  |              |
|--|--------------|
| Hydraulic jack.                        | Brass drift. |
| $\frac{15}{16}$ -inch open-end wrench. | Hammer.      |
| $\frac{15}{16}$ -inch socket wrench.   | Pliers.      |

- |                      |                 |
|----------------------|-----------------|
| (1) Jack up vehicle. | Hydraulic jack. |
|----------------------|-----------------|

Place jack under frame just back of spring to be removed. Raise jack until all load is removed from spring.

- |                             |                                      |
|-----------------------------|--------------------------------------|
| (2) Remove U-bolts (clips). | $\frac{15}{16}$ -inch socket wrench. |
|-----------------------------|--------------------------------------|

Take off U-bolt nuts WI-A6151X and lock washers BECX1P and remove clips WI-344979 and spacer assembly WI-344978.

- |                             |  |
|-----------------------------|--|
| (3) Remove spring assembly. | $\frac{15}{16}$ -inch open-end wrench. |
|                             | Brass drift.                           |
|                             | Hammer.                                |
|                             | Pliers.                                |

Pull out shackle pin cotter pins BFA-1CC and remove nuts WI-A8371X. Drive shackle pins WI-55900 out of front bracket WI-344904 and rear shackle WI-55901 and lower spring assembly EAT-32541.

*d. Disassembly.—Tools:*

Drift.	$\frac{15}{16}$ -inch open-end wrench.
Hammer.	Brass drift.
$\frac{5}{8}$ -inch socket wrench.	Cold chisel.
$\frac{9}{16}$ -inch open-end wrench.	Pliers.

(1) Remove spring from vehicle.

Follow steps outlined in *c*(1), (2), and (3) above.

(2) Remove spring eye bushings. Drift.  
Hammer.

Drive bushings EAT-45221 out of spring eyes at ends of spring.

(3) Disassembly spring leaves.  $\frac{5}{8}$ -inch socket wrench.  
 $\frac{9}{16}$ -inch open-end wrench.  
Hammer.  
Drift.

Remove spring clip nuts BBAX1C, bolts WI-A10381X, and spacers EAT-5-158. Then remove center bolt EAT-2N-3672 and nut BBBX1C and separate leaves. Drive second wrapper leaf off first wrapper at eyes with a hammer and drift. The two small clips EAT-1-2876 and two large clips EAT-1-2888 come away with the leaves to which they are riveted.

(4) Separate clips from leaves. Hammer.  
Cold chisel.

If necessary to replace clips or the leaves to which they are riveted, cut rivets EAT-6-1205 holding clips EAT-1-2876 and clips EAT-1-2888 to leaves WI-375545 and WI-375549 and remove clips.

(5) Remove rear shackle from frame.  $\frac{15}{16}$ -inch open-end wrench.  
Brass drift.  
Hammer.  
Pliers.

Pull out shackle pin cotter pin and remove nut. Drive shackle pin out of shackle at frame and lower shackle.

*e. Maintenance and adjustments.—*(1) Check the U-bolts (clips) for breakage and their nuts for tightness; the nuts should be tightened periodically. Loose U-bolts permit the leaves to shift, thus shearing the center bolt. Consequently, misalignment of the axle with the frame occurs. This causes broken leaves and improper wheel alignment.

(2) Inspect spring eye bushings for wear and replace any which are oversize beyond the allowable tolerance (see (5) below).

(3) Check shackle pins for wear, breakage, and plugged lubrication passages. Replace broken or excessively worn pins and clean out any plugged lubrication passage.

(4) Inspect the rubber bumpers for indications of excessive bumping. If any is evident or if the bumpers are missing, check for broken leaves or leaves which have taken a permanent set. These should be replaced with new leaves.

(5) Service data.

Spring bushings (bronze)----- 0.003 in.  
 Inside diameter----- 1 in.-0.005 in.

*f. Reassembly.—Tools:*

$1\frac{5}{16}$ -inch open-end wrench.	Riveting hammer.
$\frac{9}{16}$ -inch open-end wrench.	Press.
Pliers.	$\frac{5}{8}$ -inch socket wrench.
Hammer.	$1\frac{5}{16}$ -inch open-end wrench.
(1) Replace shackle.	Pliers.
	Hammer.

Hold shackle in position and replace shackle pin. Replace shackle pin nut and cotter pin.

(2) Attach clips to their respective leaves. Riveting hammer.

Rivet clips to leaves and smooth down inner ends of rivets.

(3) Tie leaves together.	Press.
	$\frac{5}{8}$ -inch socket wrench.
	$\frac{9}{16}$ -inch open-end wrench.

Press second wrapper leaf eyes onto first wrapper leaf. Stack leaves together in their correct order and replace center bolt and nut. Replace bolts, spacers, and nuts in clips along length of spring and tighten entire assembly.

(4) Replace bushings.	Press.
Press bushings into spring eyes.	

*g. Installation of assembly.—Tools:*

$1\frac{5}{16}$ -inch open-end wrench.	$1\frac{5}{16}$ -inch socket wrench.
Pliers.	$1\frac{5}{16}$ -inch open-end wrench.
Hammer.	Pliers.

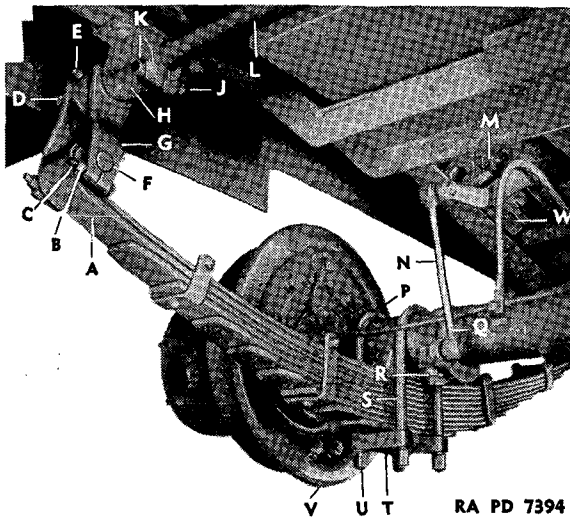
(1) Attach spring assembly to frame. Hammer.



Hold spring in position and tap shackle pins into shackle and bracket. Turn shackle pin nuts up tight and then back them off one-half turn to prevent any binding. Replace cotter pins in shackle pins. Always use new cotter pins for replacing.

(2) Attach spring to axle as-  $1\frac{5}{16}$ -inch socket wrench. ssembly.

Set spacer assembly on top center of spring straddle spacer and spring with U-bolts (clips) which then pass down through holes in



- |  |  |
|--|--|
| <p>A. Spring assembly EAT-32546.</p> <p>B. { Nut BBBX1C.<br/>Washer, lock, BECX1K.</p> <p>C. Screw, cap, BCBX1CG.</p> <p>D. Nut BBHX2A.</p> <p>E. Fitting CLDX5A.</p> <p>F. Pin WI-55848.</p> <p>G. Shackle assembly (left-hand) WI-33341.</p> <p>H. Bracket WI-311957.</p> <p>J. { Screw, cap, BCBX1CK.<br/>Nut BBBX1C.<br/>Washer, lock, BECX1K.</p> | <p>K. Same as J.</p> <p>L. Rod WI-44088.</p> <p>M. Nut BBBX2A.</p> <p>N. Link assembly DR-5352237.</p> <p>P. Clip (U-bolt) WI-62698.</p> <p>Q. Clip WI-62972.</p> <p>R. Nut BBBX1E.</p> <p>S. Same as P.</p> <p>T. Plate WI-62699.</p> <p>U. Nut WI-A6151X.</p> <p>V. Washer, lock, BECX1P.</p> <p>W. Instrument DR-5342365.</p> |
|--|--|

FIGURE 102.—Rear spring and shock absorber, installed.

projections on axle housing and shock absorber connecting link bracket. Replace U-bolt lock washers and nuts and tighten down assembly.

(3) Remove jack. None.

Lower jack until weight of car rests on spring then pull out jack.

44. Rear springs.—a. Description.—The rear springs are semi-elliptical, leaf type.

(1) *Construction* (figs. 101 and 102).—(a) Each spring is attached to the frame by means of a bracket and pin at the front end and a shackle and pin at the rear. The springs are below the axle and are fixed at the center to the axle seats by means of U-bolts and nuts. The brackets are attached directly to the frame and the shackles are bronze bushed and hang from the frame cross rod.

(b) To prevent breakage at the ends of the spring, it is necessary to wrap both the first and second leaves around the bushings at the eyes. The second leaf is tapered and thinned somewhat at its extremities, so that ends may yield a little as the springs are compressed and the first leaf approaches a straighter position. The leaves are bolted together at the center and held by four clips along the length, two clips between the center and each end.

(2) *Functioning*.—The springs flex with every movement of the wheels and prevent the frame from taking the jolts. The second leaf may give a little at its ends with each flexing of the springs, as explained above, and this reduces the risk of breakage. When the wheels drop into a deep hole or hit a sharp hump in the terrain the springs take any portion of the jolt that is too much for the shock absorbers. The use of the Hotchkiss drive, by which the vehicle is propelled directly through the springs, eliminates radius rods and all component parts.

(3) *Specifications.*

Make	Type	Manufacturer's No.	Ordnance No.	White No.
Eaton Manufacturing Co.	Semi-elliptical	EAT-32546	B167747	344976

Rear spring:

Center to center of eye	54 in.
Center of eye to seat center	27 in.
Width	2½ in.
Rebound clips	4

Leaves:

Quantity	10
Thickness of each	0.375 in.
Total thickness of spring	3.750 in.

*b. Trouble shooting.**Symptom and probable cause**Probable remedy*

## (1) Hard riding.

Insufficient lubrication.

Lubricate shackle pins.

Broken shackle pins.

Replace with new pins.

Overloading or uneven  
load distribution.

Redistribute load.

## (2) Over flexibility.

Broken spring leaves.

Replace broken leaves.

*c. Removal of assembly.—Tools:*

Hydraulic jack.

Chisel.

 $\frac{15}{16}$ -inch socket wrench.

Hammer.

 $\frac{9}{16}$ -inch socket wrench.

Brass drift.

 $\frac{9}{16}$ -inch open-end wrench.

## (1) Jack up vehicle.

Hydraulic jack.

Place jack under frame just back of spring to be removed. Raise jack until all load is removed from spring.

## (2) Remove U-bolts (clips).

 $\frac{15}{16}$ -inch socket wrench.

Take off four U-bolt nuts WI-A6151X and lock washers BECX1P. Then remove clip plate WI-62699 and bolts WI-62698.

## (3) Remove spring assembly.

 $\frac{9}{16}$ -inch open-end wrench. $\frac{9}{16}$ -inch socket wrench.

Chisel.

Hammer.

Brass drift.

Remove three nuts BBBX1C, lock washers BECX1K and cap screws BCBX1CG, clamping shackle pins WI-55848 in shackle assembly WI-333411 (left-hand), WI-333410 (right-hand), and front bracket WI-44081. Loosen pins in shackle and bracket by forcing chisel into split and then drive out pins. Lower spring assembly EAT-32546 to floor.

*d. Disassembly.—Tools:*

Drift.

 $\frac{9}{16}$ -inch open-end wrench.

Hammer.

Brass drift.

 $\frac{5}{8}$ -inch socket wrench.

Cold chisel.

## (1) Remove spring from vehicle.

Follow steps outlined in *c*(1), (2), and (3) above.

- (2) Remove spring eye bushings.      Drift.  
    Hammer.

Drive two bushings EAT-4-5162 out of spring eyes at ends.

- (3) Disassemble spring leaves.       $\frac{5}{8}$ -inch socket wrench.  
     $\frac{9}{16}$ -inch open-end wrench.  
    Hammer.  
    Brass drift.

Remove four nuts BBAX1C, spring clip bolts EAT-2-1005 and spacers EAT-5-124. Remove center bolt EAT-2N-3673 and nut BBBX1C and separate leaves. Drive second wrapper leaf off of first wrapper at eyes with hammer and drift. The two small clips EAT-1-1811 and two large clips EAT-1-1835 come away with the leaves to which they are riveted.

- (4) Separate clips from leaves.      Hammer.  
    Cold chisel.

If necessary to replace clips or the leaves to which they are riveted, cut rivets BCMX1 holding clips EAT-1-1811 and EAT-1-1835 to leaves WI-375531 and WI-375535 and remove clips.

*e. Maintenance and adjustments.*—(1) Check the U-bolts (clips) for breakage and their nuts for tightness. The nuts should be tightened periodically. Loose U-bolts cause the leaves to shift and shear the center bolt. Consequently misalignment of the axle with the frame occurs, and this results in broken leaves and improper wheel alinement.

(2) Inspect spring eye bushings for wear and replace any which do not fit the pins snugly (see (4) below).

(3) Check shackle pins for wear, breakage, and plugged lubrication passages. Replace broken or excessively worn pins and clean out any plugged lubrication passage.

(4) Service data.

Spring bushings (bronze)-----	0.003 in.
Inside diameter-----	$1\frac{1}{16}$ in.-.005 in.

*f. Reassembly.*—Tools:

- Riveting hammer.                               $\frac{5}{8}$ -inch socket wrench.  
 Press.     $\frac{9}{16}$ -inch open-end wrench.

(1) Attach clips to their respective leaves.      Riveting hammer.

Rivet clips to leaves and smooth down inner ends of rivets.

- |                          |                            |
|--------------------------|----------------------------|
| (2) Tie leaves together. | Press.                     |
|                          | 5/8-inch socket wrench.    |
|                          | 9/16-inch open-end wrench. |

Press second wrapper leaf eyes onto first wrapper leaf. Stack leaves together in their correct order and replace center bolt and nut. Replace bolts, spacers, and nuts in clips along length of spring and tighten entire assembly.

- |                       |        |
|-----------------------|--------|
| (3) Replace bushings. | Press. |
|-----------------------|--------|

Press bushings into spring eyes.

*g. Installation of assembly.—Tools:*

- |                            |                           |
|----------------------------|---------------------------|
| 9/16-inch open-end wrench. | 15/16-inch socket wrench. |
| 9/16-inch socket wrench.   | Hammer.                   |

- |                                      |                            |
|--------------------------------------|----------------------------|
| (1) Attach spring assembly to frame. | 9/16-inch open-end wrench. |
|                                      | 9/16-inch socket wrench.   |
|                                      | Hammer.                    |

Hold spring in position and tap pins into shackle and bracket. Replace cap screws, lock washers, and nuts, clamping pins in place.

- |                                     |                           |
|-------------------------------------|---------------------------|
| (2) Attach spring to axle assembly. | 15/16-inch socket wrench. |
|-------------------------------------|---------------------------|

Straddle axle housing with U-bolts (clips) at each side of spring. Set plate onto bolts at bottom of spring and fasten assembly with lock washers and U-bolt nuts.

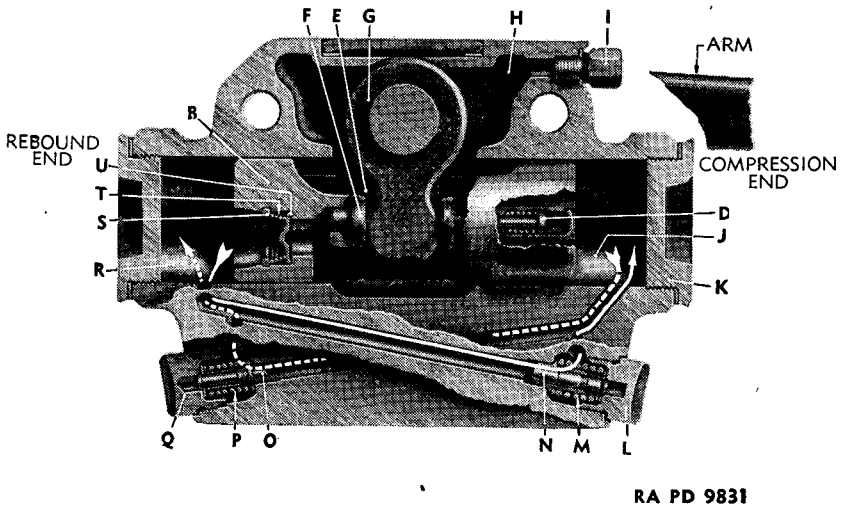
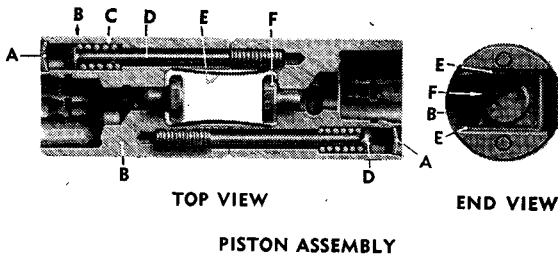
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|------------------|-------|
| (3) Remove jack. | None. |
|------------------|-------|

Lower jack until weight of car rests on spring and then pull out jack.

**45. Shock absorbers.—a. Description.**—The shock absorbers are of the double acting type. They control the compression and the speed of rebound of the front and rear springs.

(1) *Construction* (figs. 103 and 104).—(a) The shock absorber unit consists of a cast steel housing which incloses the operating mechanisms. The housing is separated into a reservoir section on top and a cylindrical piston chamber below the reservoir. The piston is inclosed by a cap, threaded into each end of the chamber and is actuated by a cam fastened to and actuated by the operating lever arm shaft. An antirotation spring prevents the piston from turning within the cylinder.

A spring-loaded valve is fixed into each end of the piston by a retainer clip and controls the flow of fluid from the reservoir to the

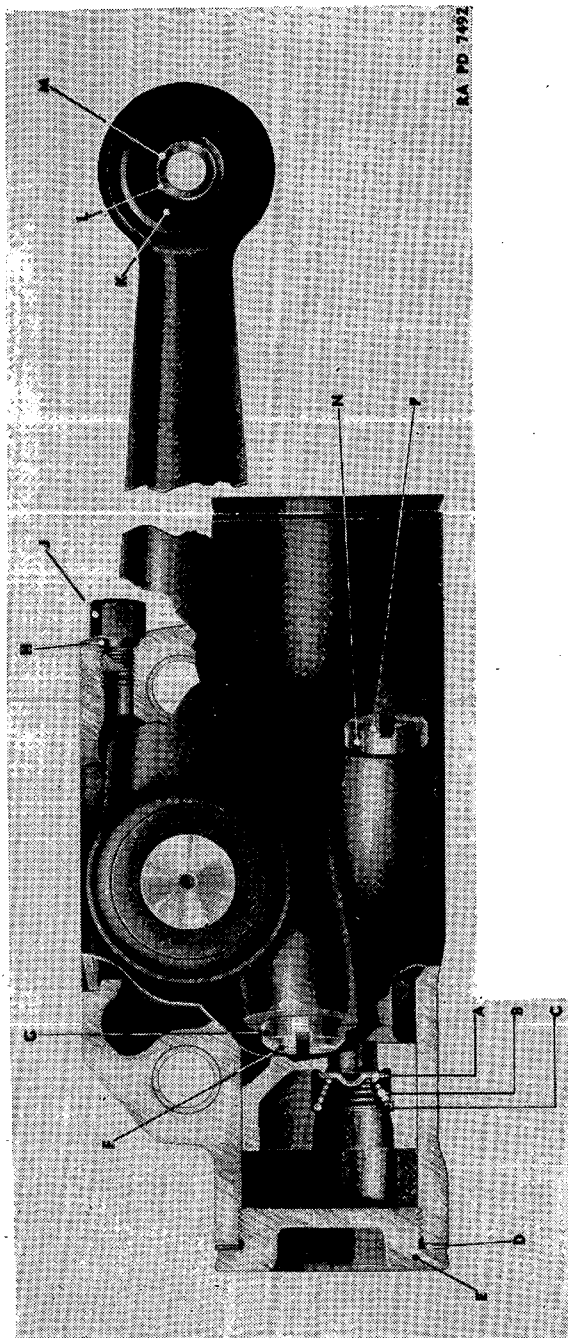


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————— COMPRESSION  
 - - - - - REBOUND

- |  |   |
|--|---|
| <p>A. Piston screw expansion plug.<br/>                 B. Piston.<br/>                 C. Piston screw spring.<br/>                 D. Piston screw.<br/>                 E. Antirotation spring.<br/>                 F. Cam button.<br/>                 G. Cam.<br/>                 H. Fluid reservoir.<br/>                 I. Filler plug.<br/>                 J. Compression end of shock absorber.<br/>                 K. End cap.<br/>                 L. Rebound valve nut.</p> | <p>M. Rebound valve spring.<br/>                 N. Rebound valve.<br/>                 O. Compression valve.<br/>                 P. Compression valve spring.<br/>                 Q. Compression valve nut.<br/>                 R. Rebound end of shock absorber.<br/>                 S. Valve spring retainer clip.<br/>                 T. Intake valve spring, rebound end (similar spring on compression end).<br/>                 U. Intake valve, rebound end (similar valve on compression end).</p> |
|--|---|

FIGURE 103.—Shock absorbers—sectionalized view.



A. Intake valve.  
 B. Intake valve spring.  
 C. Intake valve spring retainer.  
 D. End cap gasket.

E. End cap.  
 F. Compression relief valve nut and gasket.  
 G. Compression relief valve.  
 H. Filler plug gasket.

J. Filler plug.  
 K. Rubber bushing.  
 L. Bronze bushing.  
 M. Steel sleeve.

N. Rebound relief valve.  
 P. Rebound relief valve nut and gasket.

FIGURE 104.—Shock absorber instrument assembly.

space between the ends of the piston and cylinder. The casting below the cylinder has two passages drilled into it which interconnect the compression and rebound ends of the cylinder; one passage is in use during compression and the other during rebound. Each passage contains a spring-loaded valve, held in place by nuts, for controlling the flow of fluid between the cylinder ends. Each valve has a small orifice to take care of the fluid flow during small, slow movements of the lever arm.

(b) The unit is bolted to the vehicle frame above the springs, the upper end of each connecting link being held to the piston operating arm by a special bolt and nut (figs. 100 and 102). The lower ends of the front shock absorber connecting links are attached to the spring U-bolt clips at the bottom of the front axle spring seats by means of a bracket, and the rear connecting links are attached, by means of brackets, to clips fastened to the rear axle. The instrument filler plug screws into a threaded hole located in the upper lever arm end of the housing.

(2) *Functioning.*—(a) The flow of fluid is shown in figure 103. As the arm moves upward (compression stroke), the piston moves toward the arm or compression end of the shock absorber, thereby displacing the fluid in this end. In very slight or slow axle movements, the fluid flows only through the orifice of the compression valve and into the rebound end of the shock absorber cylinder. In rapid movements, the pressure lifts the valve from its seat by compressing the valve spring, thus letting a greater volume of fluid into the rebound end. At the same time, the intake valve at the rebound end of the piston opens, allowing fluid to flow from the reservoir into the rebound end of the cylinder. This is to compensate for any loss of fluid between piston and cylinder walls from the compression end into the reservoir.

(b) As the arm moves downward (rebound stroke) the direction of flow is reversed, the rebound valve opens, and the intake valve in the compression end of the piston opens.

(3) *Specifications:*

Make	Type	Manufacturer's No.	Ordnance No.	White No.
Delco Products....	Double acting...	DR-5342369 right front. ....	A190886 front.....	363760 right front.
		DR-5342368 left front. ....	.....	363750 left front.
		DR-5342364 right rear. ....	A190887 rear.....	363450 right rear.
		DR-5342365 left rear.....	.....	363449 left rear.



*b. Trouble shooting.*

*Symptom and probable cause*

*Probable remedy*

(1) Overflexibility.

Lack of fluid in shock absorbers.

Refill reservoirs with Delco fluid.

Damaged or worn internal parts.

Replace parts, if possible, or replace unit.

(2) Leakage.

Operating shaft packing worn or damaged.

Replace instrument assembly.

Defective casting.

Replace instrument assembly.

Gaskets at valve nuts or end caps worn or damaged.

Replace gaskets.

*c. Removal of assembly.—Tools:*

$\frac{3}{4}$ -inch socket wrench.

Soft metal hammer.

$\frac{13}{16}$ -inch socket wrench.

$\frac{13}{16}$ -inch open-end wrench.

(1) Disconnect link from bracket.

$\frac{3}{4}$ -inch socket wrench.

Soft metal hammer.

Remove nut DR-145009 and drive out the bolt holding lower end of connecting link to bracket WI-363758 (front left-hand), WI-62970 (rear left-hand), WI-62971 (rear right-hand).

(2) Remove instrument assembly from frame.

$\frac{13}{16}$ -inch open-end wrench.

$\frac{13}{16}$ -inch socket wrench.

Remove two nuts BBBX2A, lock washers BECX1N and screws BCBX2AN, holding each assembly to frame and lower assembly.

*d. Disassembly (fig. 106).—Tools:*

$\frac{3}{4}$ -inch socket wrench.

Screw driver.

Soft metal hammer.

Heavy duty screw driver.

Special holding fixture and wrench.

Sharp punch.

Hammer.

(1) Disconnect link from instrument arm.

$\frac{3}{4}$ -inch socket wrench.

Soft metal hammer.

Remove nut DR-145009 and drive out bolt holding link to instrument arm.

(2) Remove end caps.

Special holding fixture and wrench.

Place shock absorber in assembly fixture (fig. 105). *Do not* clamp instrument in vise. Then, using a special wrench (fig. 106), remove end caps DR-043215 and gaskets WI-373857.

- (3) Remove intake valves. Screw driver.

Pry out spring retainers WI-373860 with screw driver and lift out valves WI-373858.

- (4) Remove compression and rebound valves. Heavy duty screw driver.

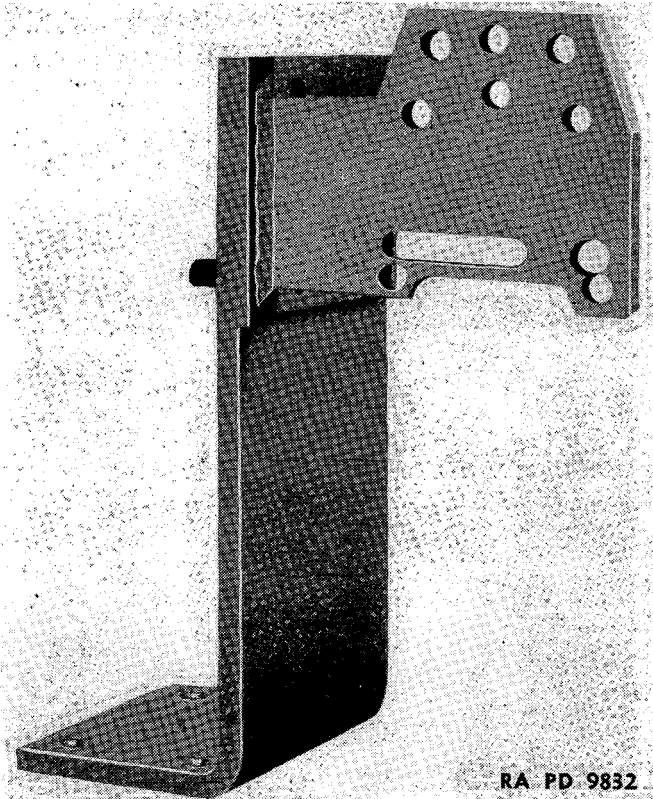
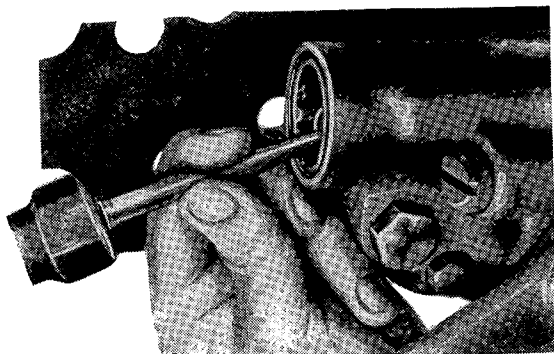


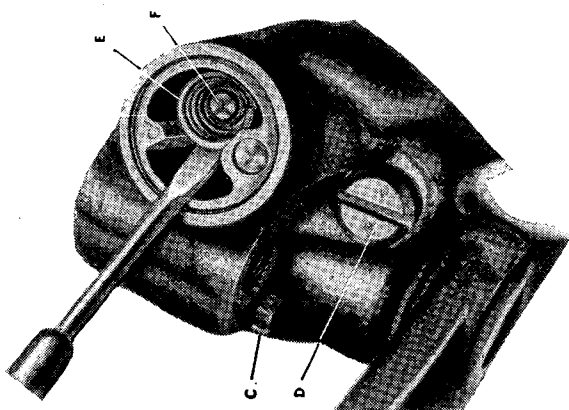
FIGURE 105.—Shock absorber disassembly fixture.

Remove valve nuts DR-043233 and gaskets WI-373862 and lift out compression valves WI-375685 and rebound valves WI-373882 (front shocks), WI-373881 (rear shocks) (fig. 107).

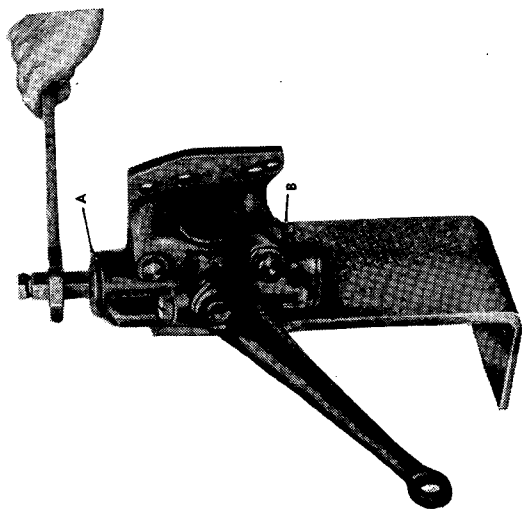
- (5) Disassemble piston. Screw driver.  
Sharp punch.  
Hammer.



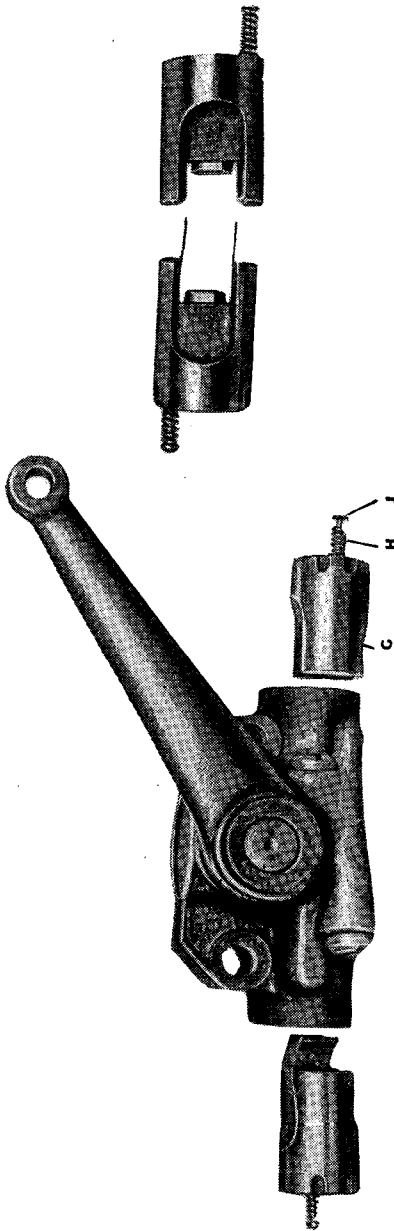
③ Removing piston screw plugs.



② Removing piston valves.



① Removing end caps.



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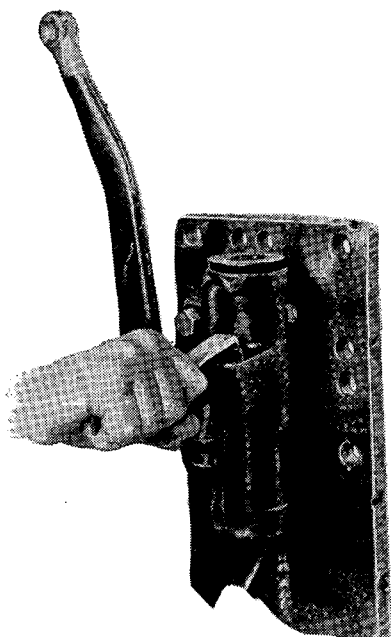
④ Removing pistons.

- A. { Cap DR-43215.
- { Gasket DR-43216.
- B. { Plug DR-45275.
- { Gasket DR-45278.

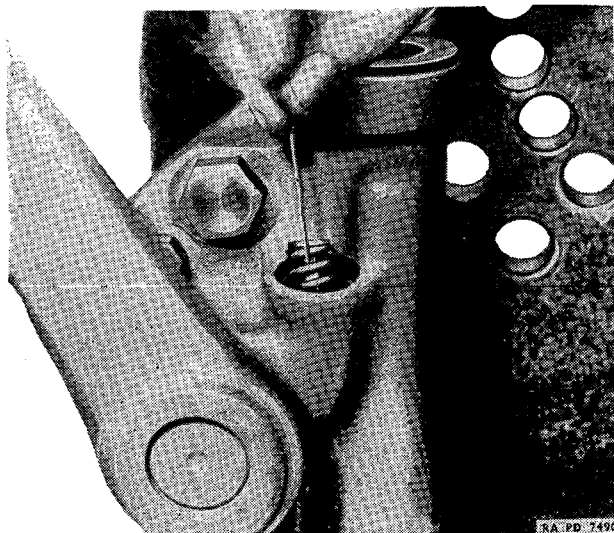
⑤ Pistons removed.

- F. Valve DR-5326269.
- G. Piston, assembly 5316451.
- H. Spring DR-46809.
- J. Screw DR-46808.

FIGURE 106.—Shock absorber disassembly.



①



②

FIGURE 107.—Compression and rebound valve removal.

Remove plugs DR-046810 over piston screws by piercing with punch and lifting out. Then remove piston screws WI-373888 and springs WI-373889 and disassemble piston DR-5316451.

NOTE.—The instrument assemblies cannot be disassembled beyond this point.

*e. Maintenance and adjustments.*—(1) Check connecting link, studs, and bushings for wear and damage and if any is evident, replace with new parts.

(2) Remove shock absorbers from the vehicle, flush out completely, overhaul and refill every 50,000 miles.

(a) After disassembly, wash shock absorber and all parts in kerosene and inspect for wear or defects. Blow out valve orifices with compressed air and make certain valves are clean.

(b) Check camshaft for wear in housing by moving shock arm sideways. If shaft is galled or worn, replace complete unit.

(3) Check shock absorbers, without removing from the vehicle, every 10,000 miles to be certain that they contain sufficient fluid. If necessary, refill them as follows:

(a) Disconnect link at lower end.

(b) Thoroughly clean the instrument around the filler plug and then remove plug. An ordinary paint brush, dipped in solvent, dry-cleaning, will remove most of the dirt, then use compressed air or a clean cloth to remove any remaining small particles of dirt.

(c) Use a fluid gun and refill units to capacity with light shock absorber fluid only. Work arm slowly up and down while adding fluid. When the instrument is properly filled, there will be uniform resistance and no rubbery feeling or lost motion.

(d) Replace the filler plug, using new gasket if necessary. Connect the link assembly.

(4) Compression and rebound valves of proper spring strength and orifice size are selected for the particular vehicle by the manufacturer to give the best possible ride under practically every riding condition. There should be no necessity for making valve changes unless extraordinary road or load conditions are met. In such cases valves for heavier or lighter resistance are available for replacement.

(5) To check for leaks fill the unit, clean the exterior with solvent, dry-cleaning, and blow dry with air. Drive over rough ground and then inspect the unit carefully.

(a) Note the condition around the shaft at the arm packings and also at the cover plates, valve nuts, and cylinder end caps. A slight leak at the arm packings around the shaft is of little consequence with a newly filled shock absorber; it is due to the initial expansion after filling. A severe leak at the arm packings around the shaft

is serious and the unit must be replaced, as these packings are impossible to service. If the instrument is leaking at any of the above-mentioned places, except the arm packings, install new gaskets.

(b) A leak at some part of the body denotes a defective casting and cannot be repaired. If this condition is found, replace the unit.

*f. Reassembly.*—Tools:

- |                          |                                  |
|--------------------------|----------------------------------|
| Screw driver.            | Special retainer replacing tool. |
| Special holding fixture. | Heavy duty screw driver.         |
| Drift.                   | Special end cap wrench.          |
| Hammer.                  | 3/4-inch socket wrench.          |
| (1) Reassemble piston.   | Screw driver.                    |
|                          | Special holding fixture.         |

Attach instrument housing to special fixture and then assemble piston with cam clearance up, and also with high arm of antirotation spring up. Replace piston screws and springs. Turn screws down tightly and then back off about one to one and one-half turns to prevent a bind between cam and cam buttons.

- |                                     |         |
|-------------------------------------|---------|
| (2) Install new piston screw plugs. | Drift.  |
|                                     | Hammer. |

Install new plugs over piston screws and expand in place.

- |                            |                                  |
|----------------------------|----------------------------------|
| (3) Replace intake valves. | Special retainer replacing tool. |
|                            | Hammer.                          |

Insert valves and replace valve spring retainers, using special tool (fig. 108).

- |   |                          |
|---|--------------------------|
| (4) Replace compression and rebound valves. | Heavy duty screw driver. |
|---|--------------------------|

Insert valves and fasten in place with valve nuts. Use new gaskets under nuts.

- |   |                         |
|---|-------------------------|
| (5) Replace end caps and refill instrument. | Special end cap wrench. |
|---|-------------------------|

Replace one end cap, using new gasket, and rotate fixture until open-end of instrument is up. Fill shock to capacity with new light shock absorber fluid. While filling, move shock arm through complete strokes to expel the air from the fluid. Replace other end cap and rotate fixture until shock absorber is in its normal operating position on vehicle. Remove filler plug and allow fluid to drain down to the level of the filler plug hole. This is to allow air space at the top of the instrument reservoir for the natural expansion of the fluid. Replace filler plug, using new gasket.

- (6) Attach link to instrument arm.  $\frac{3}{4}$ -inch socket wrench.  
Hammer.

Tap link bolt through link and arm and replace holding nut. Take care in replacing bolt that rubber bushing is not damaged.

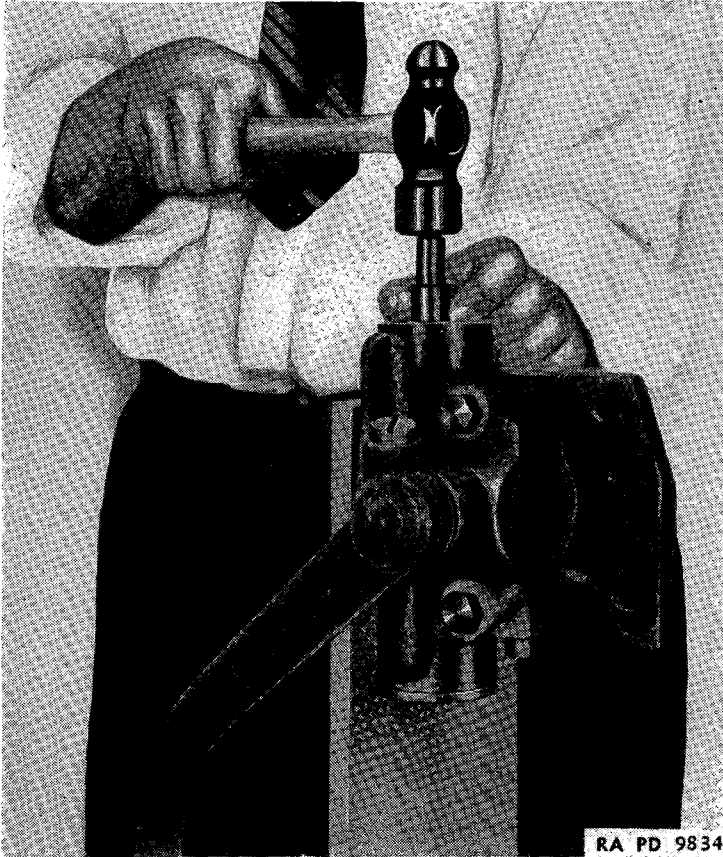


FIGURE 108. Shock absorber intake valve replacement.

*g. Installation of assembly.—Tools:*

- $1\frac{3}{16}$ -inch open-end wrench.  $\frac{3}{4}$ -inch socket wrench.  
 $1\frac{3}{16}$ -inch socket wrench. Hammer.

- (1) Attach instrument to frame.  $1\frac{3}{16}$ -inch open-end wrench.  
 $1\frac{3}{16}$ -inch socket wrench.

Hold assembly in position and replace holding screws, lock washers, and nuts.



(2) Attach connecting link to  $\frac{3}{4}$ -inch socket wrench.  
 bracket. Hammer.

Tap bolt through lower end of connecting link and bracket and replace holding nut.

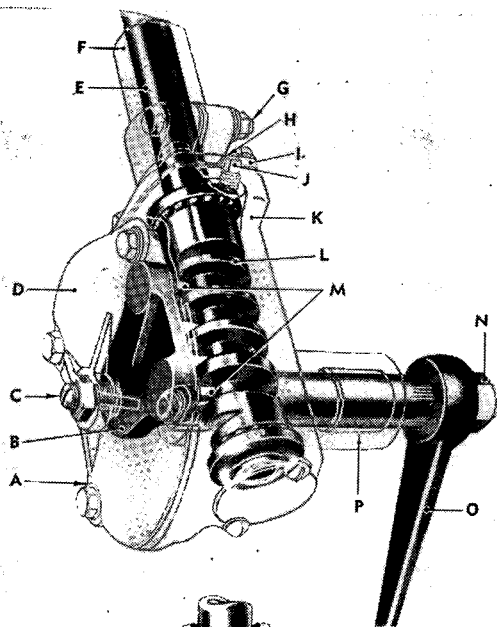
SECTION XII

STEERING GEAR AND DRAG LINK

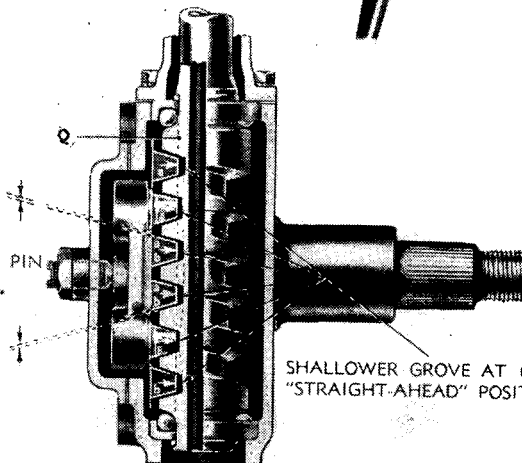
Description.....	Paragraph
Trouble shooting.....	46
Removal of assembly.....	47
Disassembly of components.....	48
Maintenance and adjustments.....	49
Reassembly of components.....	50
Installation of assembly.....	51
	52

**46. Description.**—*a. Construction.*—(1) *Steering gear* (fig. 109).—This is of the cam and lever design, twin-lever type. The cam is integrally welded to the steering wheel tube and is mounted between two ball bearings which are adjustable by means of shims between the housing and upper cover. The steering wheel tube is encased and supported by the outer jacket housing. The pitch of the cylindrical cam is not constant but is less at the center than it is at the ends, that is, the cam groove is cut at a smaller angle at the midway point between the ends than at the ends of the cam. This provides a variable gear ratio between the straight ahead driving position and turning or parking positions. The purpose of this construction is to obtain a larger gear reduction for the normal straight ahead positions, thereby reducing road shock, promoting easy steering, and preventing wander. The smaller gear reduction at the turning and parking range of the cam promotes quick and easy steering on turns. The cam groove is ground slightly higher in the normal straight ahead driving range to provide a closer adjustment of the clearance between the studs and cam at the point of steering action. Two studs, mounted on the lever shaft, engage the cam groove. The clearance between the cam and studs is adjustable by means of the screw and lock nut mounted on the housing side cover. The lever shaft is mounted in two steel backed babbitt bushings and the steering arm is attached to the splined end of the lever shaft and secured by a nut and lock washer. An oil seal is provided on the shaft at the outer end.

(2) *Drag link* (fig. 110).—This is of the tubular type, with adjustable spring loaded ball sockets. At the axle end, the spring and spacer



PERMISSIBLE LASH IN PIN  
POSITIONS (A) & (B),  
ON TURNS



SHALLOWER GROVE AT (A) & (B)  
"STRAIGHT-AHEAD" POSITION

- A. { Screw, cap, BANX1B1.  
Washer, lock, BECX1H.  
B. Lever, shaft, assembly RG-7569-6-1/2.  
C. { Screw RG-021065.  
Nut, jam, RG-025031.  
D. Cover RG-T265001.  
E. Vent.  
F. Tube, assembly RG-8446-38-1/4.  
G. { Bolt BAOX1BG.  
Nut BBBX1B.  
Washer BECX1H.

- H. Shim { (.002) RG-033042.  
(.003) RG-033036.  
(.010) RG-033037.  
I. Cover RG-T266000.  
J. Plug A175476.  
K. Housing, assembly RG-503138.  
L. Cam w/tube, assembly RG-7754-47  
-13/16.  
M. Lever shaft pins.  
N. { Nut, jam, RG-EG1P.  
Washer, lock, BECX2T.  
O. Arm, assembly RG-502485.  
P. Bushing (outer) RG-068003.

RA. PD 702C

FIGURE 109.—Steering gear—sectionalized view.

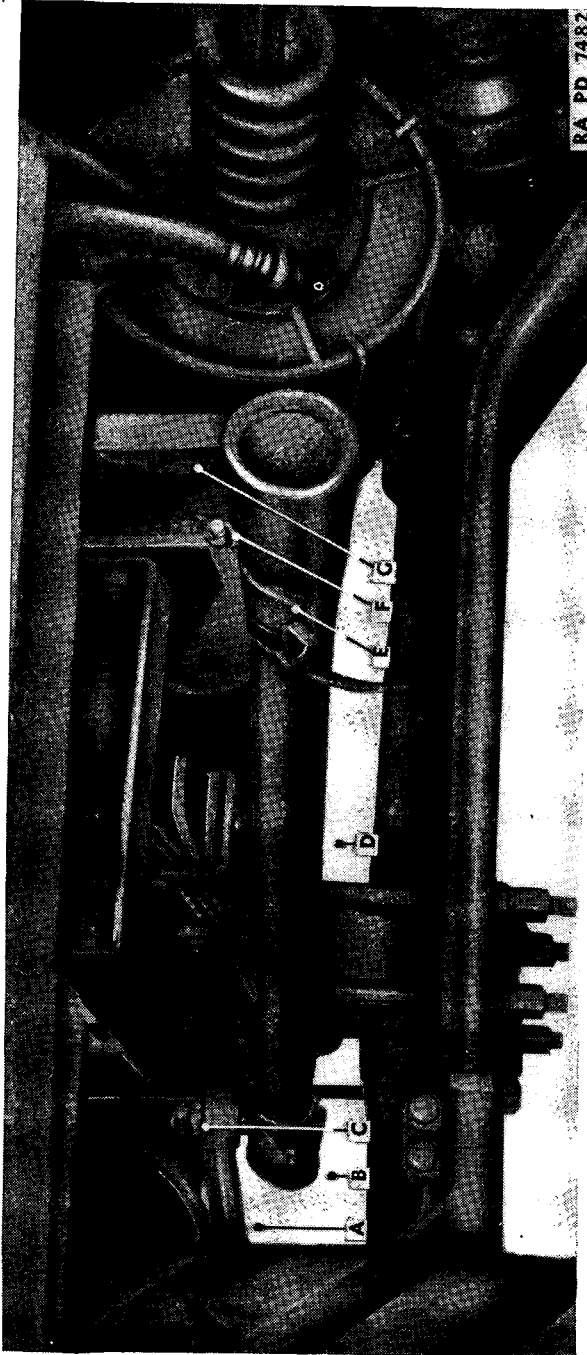
are assembled between the ball seat and rod end (bottom of socket). At the steering gear end the spring and spacer are between the ball seat and end plug. A leather boot is laced on to each end of the drag link to keep out dust and grime.

*b. Functioning.*—(1) *Steering gear.*—Turning the steering tube by means of the steering wheel moves the tapered studs of the lever shaft through the cam on the groove, thus rotating the lever shaft and providing angular movement of the steering arm. The two studs engage the cam for normal straight-ahead driving. The unit pressure on the studs and cam groove sides is therefore lower for this position where most of the steering action occurs. As the steering action moves into the parking range one of the studs disengages the cam (moves out of the end of the groove) and the other stud moves above the cam axis, thereby greatly increasing the effective leverage.

(2) *Drag link.*—This is the connecting link between the steering gear and the steering arm on the front axle steering knuckle. It is connected to and receives its forward and backward motions from the lever shaft arm. These motions are transmitted to the steering arm, which rotates the steering knuckles, and this in turn causes the wheels to turn.

*c. Specifications.*—(1) *Steering gear.*

Make.....	Ross Gear and Tool Co.
Model.....	Series T-26.
Number.....	T-27071.
Type.....	Cam and twin lever.
Ordnance No.....	E2140.
White No.....	344926.
Bearings:	
Cam .....	Ball.
Ball diameter.....	3/8 in.
Number of balls.....	28.
Lever shaft.....	Bushings.
Steering wheel:	
Diameter .....	18 in.
(2) <i>Drag link.</i>	
Make .....	Superior Universal Products.
Type .....	Spring loaded, tubular.
Number .....	SU-80P102.
Ordnance No.....	C74082.
White No.....	347385, 363757.



- A. Arm, TD-3933-X 50.
- B. Boot, WI-324635.
- C. { Stud, TD-2910-B-2.  
Nut, TD-13-X 36.
- { Pin, cotter, BFA11DK.

- D. Drag link assembly, SU-80P102.

- E. Boot, WI-324634.
- F. Fitting, CLDX5M.
- G. Arm assembly, KG-502485.

FIGURE 110. - Steering drag link, installed.

**47. Trouble shooting.**

<i>Symptom and probable cause</i>	<i>Probable remedy</i>
<i>a. Shimmy.</i>	
Tire or wheel out of balance.	Test and balance.
Drag link adjustment loose.	Readjust.
Improper steering gear adjustment.	Check and adjust.
Low or unequal tire inflation.	Check and inflate.
Improperly acting shock absorbers.	Adjust, repair or replace.
Weak or broken springs.	Replace springs.
Incorrect toe-in.	Adjust.
Worn lever shaft.	Replace.
Worn and scored steering gear housing bushings.	Replace.
Worn bearing in top end of steering gear jacket tube.	Replace bearing.
Upper end of wheel tube worn.	Replace.
Drag link ball seats worn.	Replace.
<i>b. Pull to one side.</i>	
Unequal camber.	See section V, TM9-1705.
Unequal caster.	See section V, TM9-1705.
Unequal tire inflation.	Check.
Dragging brake.	Adjust.
Tight wheel bearing.	Adjust.
<i>c. Wander or weaving.</i>	
Insufficient or reversed caster.	See section V, TM9-1705.
Excessive tightness in steering system.	Adjust.
Loose steering linkage.	Adjust drag link.
Worn steering gear lever shaft studs.	Replace or adjust.
Excessive play in steering gear.	Adjust.
Fit of lever shaft in housing bushings too loose.	Replace bushings.
Worn steering arm ball.	Replace arm.

*d. Road shock.*

- |                                   |                     |
|-----------------------------------|---------------------|
| Steering linkage too tight.       | Adjust.             |
| Misaligned drag link.             | Repair or replace.  |
| Excessive spring flexibility.     | Tighten or replace. |
| Improperly acting shock absorber. | Adjust or replace.  |

*e. Hard steering.*

- |   |   |
|---|---|
| Lack of lubrication.  | Lubricate tie rod yoke, steering gear, and drag link. |
| Excessive tightness in system.  | Adjust.   |
| Unequal or reverse caster.  | See section V, TM9-1705.                              |
| Steering gear cam thread brinelled from heavy blows, chipped or scored. | Replace.  |
| Ball races at ends of cam brinelled, pitted or worn.                    | Replace.  |
| Lever shaft studs chipped or worn.                                      | Replace lever shaft.                                  |

*f. Oil leaks.*

- |                 |          |
|-----------------|----------|
| Worn oil seals. | Replace. |
|-----------------|----------|

*g. Procedure.*—To locate the general source of trouble, whether in the front axle, wheels, or steering system, disconnect the drag link from the steering arm ball. If any difficulty is then had in spinning the steering wheel, or if end play of the steering gear cam and tube or lever shaft is found, the steering gear is at fault. However, check wheel alinement, wheel bearing adjustment, steering knuckle adjustment, and tire inflation.

**48. Removal of assembly.**—*a. Drag link* (fig. 110).—Tools:

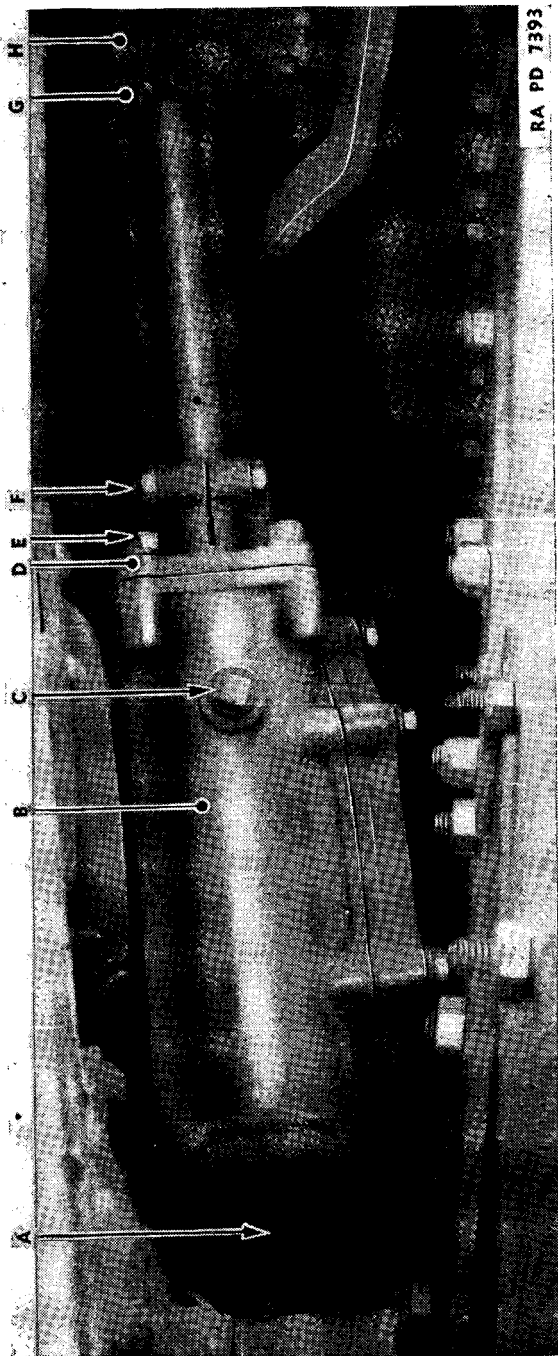
- Pliers.
- Plug wrench or large screw driver.

- |                         |         |
|-------------------------|---------|
| (1) Remove cotter pins. | Pliers. |
|-------------------------|---------|

Unlace drag link boots WI-324635, WI-324634, and remove. Pull out cotter pin BFA11DT at each end of drag link WI-347385.

- |                      |                                    |
|----------------------|------------------------------------|
| (2) Remove assembly. | Plug wrench or large screw driver. |
|----------------------|------------------------------------|

Loosen adjusting plugs SU-80PO6, slip link from front axle steering arm ball TD-2910-B2, and from steering gear arm RG-502485.



- A. Cable, assembly, RG-502484.
- B. Gear, steering, assembly, RG-T27071.
- C. Plug A175476.

- D. Cover RG-T266000.
- E. { Bolt BAOXLCC.  
Washer, lock, BECX1K.

- F. { Bolt BAOX1BG.  
Nut BBXX1B.  
Washer BECX1H.

- G. Clamp WI-A42751.
- H. Pad WI-62506.

FIGURE 111.—Steering gear assembly, installed.

b. *Steering gear* (fig. 111).—Tools:

Screw driver.

Wheel puller.

1¼-inch socket wrench.

Spring pullback pliers.

⅝-inch socket wrench.

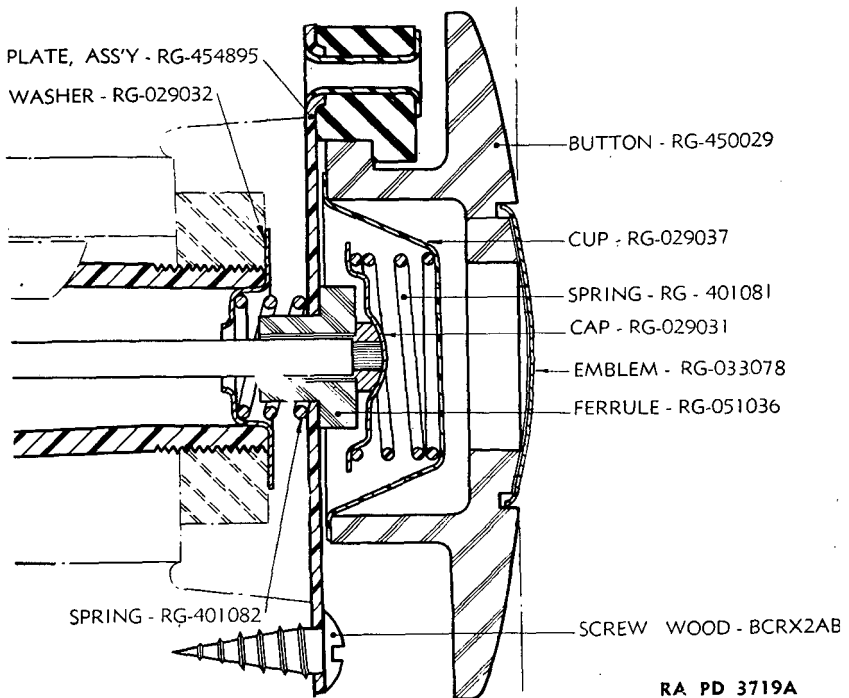
¾-inch open-end wrench.

⅞-inch socket wrench.

(1) Remove horn button (fig. 112).

None.

Disconnect horn button cable terminal RG-032053 at bottom of steering gear housing RG-XT-262020. Depress button and rotate one-sixth turn. This permits removal of horn button RG-450029,



RA PD 3719A

FIGURE 112.—Horn button—sectionalized view.

contact cup RG-029037, spring RG-401081, cap RG-029031, cable assembly RG-502484, and ferrule RG-051025.

(2) Remove steering wheel nut. Screw driver.

1¼-inch socket wrench.

Take out three screws BCRX2AB holding horn button base plate and remove plate RG-484884, contact spring RG-401082, washer RG-029032, and steering wheel nut RG-C-20.



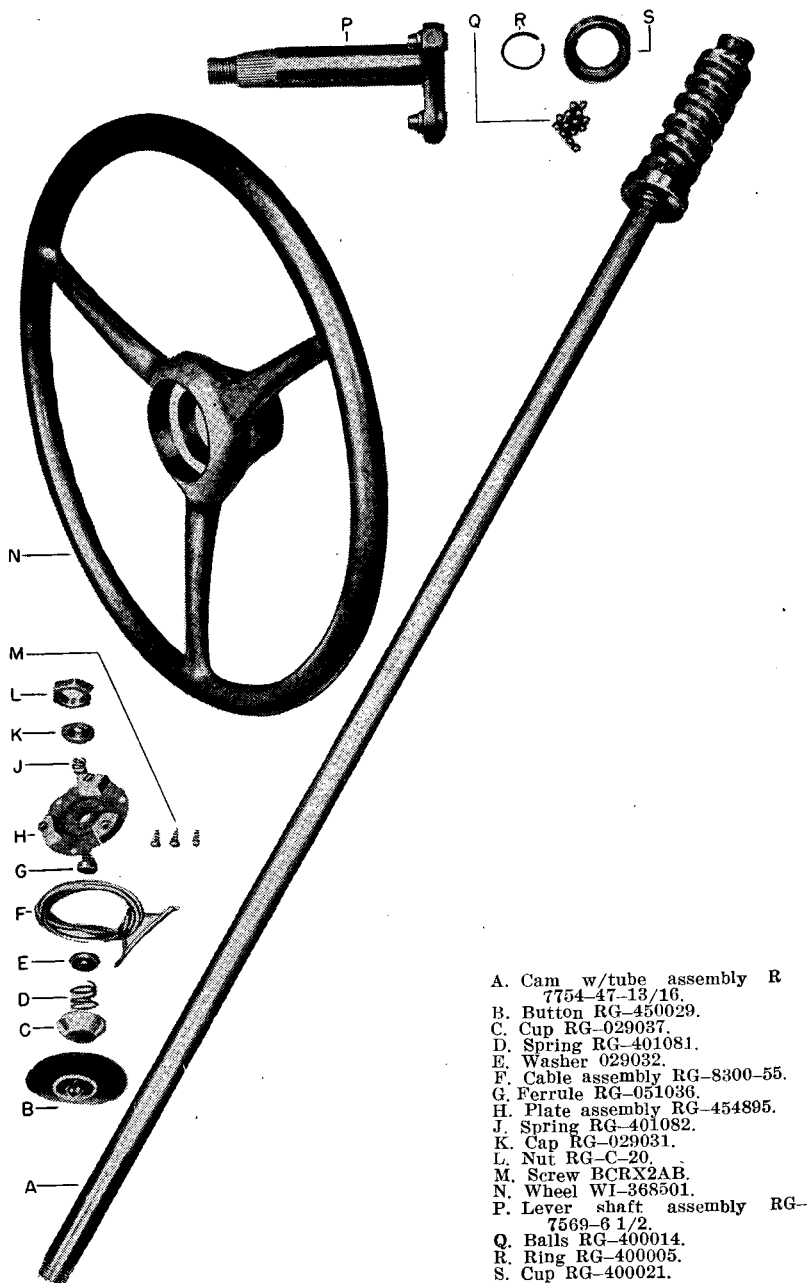
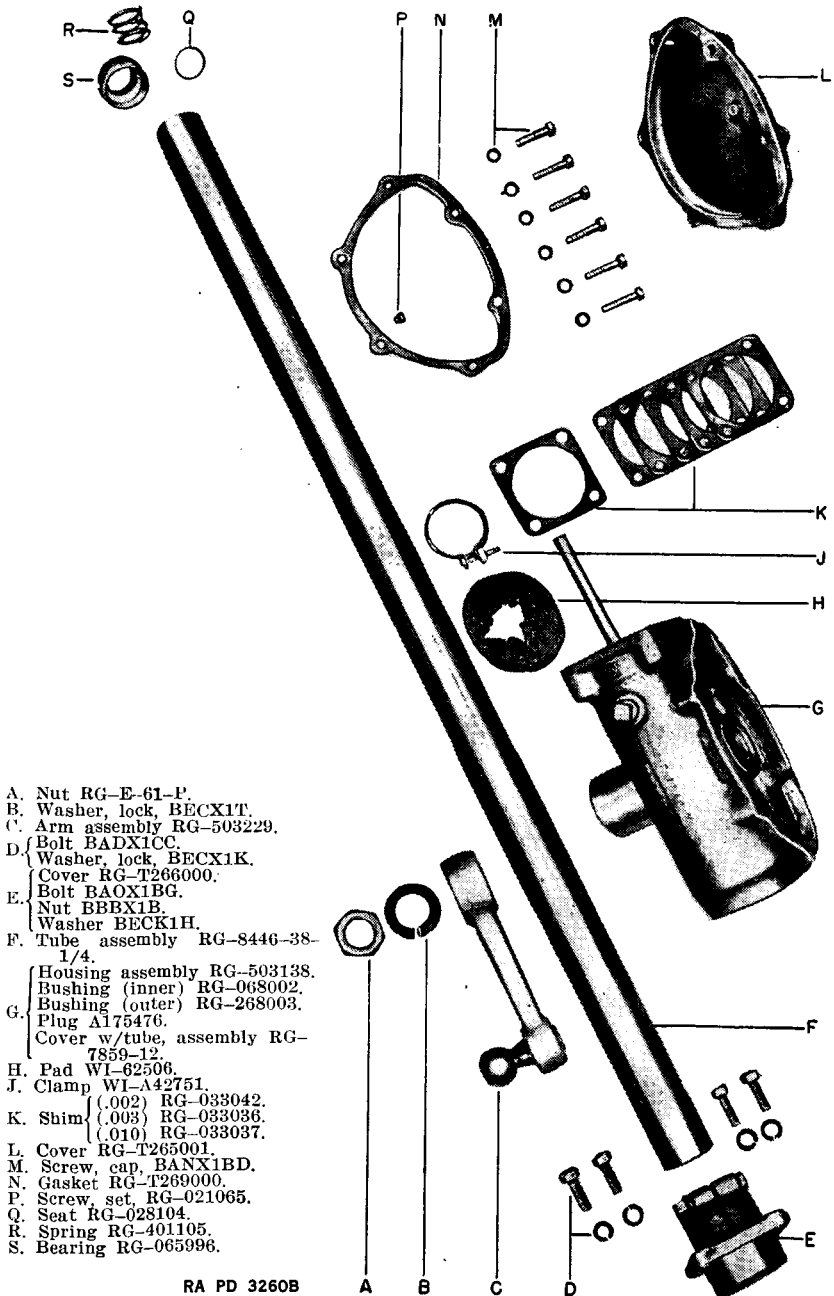


FIGURE 113.—Steering gear—Exploded view.



- A. Nut RG-E-61-P.
- B. Washer, lock, BECX1T.
- C. Arm assembly RG-503229.
- D. Bolt BADX1CC.
- E. Washer, lock, BECX1K.
- F. Cover RG-T266000.
- G. Bolt BAOX1BG.
- H. Nut BBBX1B.
- I. Washer BECK1H.
- J. Tube assembly RG-8446-38-1/4.
- K. Housing assembly RG-503138.
- L. Bushing (inner) RG-068002.
- M. Bushing (outer) RG-268003.
- N. Plug A175476.
- O. Cover w/tube, assembly RG-7859-12.
- P. Pad WI-62506.
- Q. Clamp WI-A42751.
- R. Shim {
  - (.002) RG-033042.
  - (.003) RG-033036.
  - (.010) RG-033037.
- S. Cover RG-T265001.
- T. Screw, cap, BANX1BD.
- U. Gasket RG-T269000.
- V. Screw, set, RG-021065.
- W. Seat RG-028104.
- X. Spring RG-401105.
- Y. Bearing RG-065996.

RA PD 3260B  
 FIGURE 113.—Steering gear—exploded view—Continued.

- (3) Remove steering wheel. Wheel puller.

Set up the wheel puller and remove steering wheel WI-344931 or WI-368501.

- (4) Remove springs and U-bolt. Spring pullback pliers.  
 $\frac{9}{16}$ -inch socket wrench.

Release clutch pullback spring from hook washer WI-A6227X on steering gear housing. Remove two nuts BBBX1B and lock washers BECX1H from U-bolt at instrument panel support WI-316216. Remove U-bolt WI-316213.

- (5) Remove steering gear.  $\frac{7}{8}$ -inch socket wrench.  
 $\frac{3}{4}$ -inch open-end wrench.

Remove cap stud nuts BBBX2A and lock washers BECX1H holding frame bracket cap, and remove cap. Then take out cap screw BCBX2AD, lock washer BECX1N and nut BBBX2A holding steering gear housing to frame bracket assembly WI-344951 and lower steering gear assembly to floor.

#### 49. Disassembly of components.

##### a. Steering gear (fig. 113).—Tools:

- |                                       |                   |
|---------------------------------------|-------------------|
| $\frac{1}{2}$ -inch socket wrench.    | Light file.       |
| $\frac{7}{16}$ -inch socket wrench.   | Small puller.     |
| $\frac{1}{2}$ -inch open-end wrench.  | Screw driver.     |
| $\frac{9}{16}$ -inch open-end wrench. | Long nose pliers. |
| Spring type bearing pullers.          | Hammer.           |
|                                       | Brass drift.      |

- (1) Remove jacket tube.  $\frac{1}{2}$ -inch socket wrench.  
 $\frac{1}{2}$ -inch open-end wrench.

Loosen upper cover cap screw BCBX1BG and nut BBBX1B and pull out jacket tube RG-7789-38 $\frac{1}{4}$ .

- (2) Remove bearing unit from tube. Spring type bearing pullers.

Take out spring RG-401105 and spring seat RG-028104 and pull out bearing unit RG-065996 (fig. 114).

- (3) Remove housing upper cover.  $\frac{9}{16}$ -inch open-end wrench.

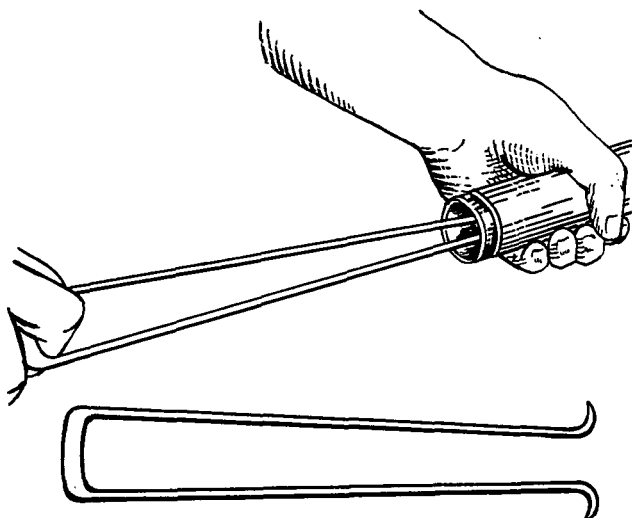
Remove  $4\frac{3}{8}$ -inch cap screws BCBX1CC and lock washers BECX1K from housing upper cover and take off cover RG-266000 and adjusting shims RG-033042, RG-033036 and RG-033037.

(4) Remove housing side cover. 1/2-inch socket wrench.

Take out 6 5/16-inch cap screws BCAX1BD and lock washers BECX1H and remove side cover RG-T265001 and gasket RG-T269000.

(5) Remove steering arm assembly and lever shaft. 7/16-inch socket wrench.  
Light file.  
Small puller.

Take off lever shaft nut BBDX2E and lock washer BECX2T. Dress end of lever shaft splines with a file to remove any burs and



RA PD 6373

FIGURE 114.—Steering gear jacket tube bearing removal.

pull off steering arm assembly RG-502485. Remove lever shaft assembly RG-7736-6-1/2 from opposite side of gear case.

(6) Remove cam and wheel tube assembly. None.

After lever shaft has been removed, the wheel tube assembly RG-7755-47-13/16 can be withdrawn from housing.

(7) Disassemble bearings. Screw driver.  
Long nose pliers.

Remove bearing retaining rings RE-400005, bearing cups RG-40021 and 28 balls CCAX1E.

(8) Remove housing bushings. Hammer.  
Brass drift.

Drive out inner bushing RG-068002 and outer bushing RG-068003 and oil seal RG-032077 from housing.

*b. Drag link (fig. 115).*

Remove working parts of link. Drag link adjuster or wide screw driver.

Turn out adjusting plugs SU-80P06 and shake out two bearings SU-12R2, and one seat SU-80P03, spacers SU-80P11, spring SU-80P10 from each end.

**50. Maintenance and adjustments.**—*a. Steering gear maintenance.*—(1) After disassembly, clean all parts thoroughly of grease, oil, and dirt.

(2) Check horn button and jacket tube springs for softness or breaks and replace if necessary.

(3) Check bearing races and balls and steering arm ball for wear, chipping, and scoring. Repair or replace if necessary.

(4) Replace housing bushings if excessive wear or scoring is visible and install a new oil seal if the old one is damaged.

(5) Inspect cam closely for wear or chipping and replace if necessary.

(6) Check lever shaft studs for misalignment, bending, and wear, and if necessary, replace with new shaft assembly.

*b. Drag link maintenance.*—(1) After disassembly, clean all parts thoroughly in solvent, dry-cleaning.

(2) Check ball seats for wear and scoring and replace with new parts if necessary.

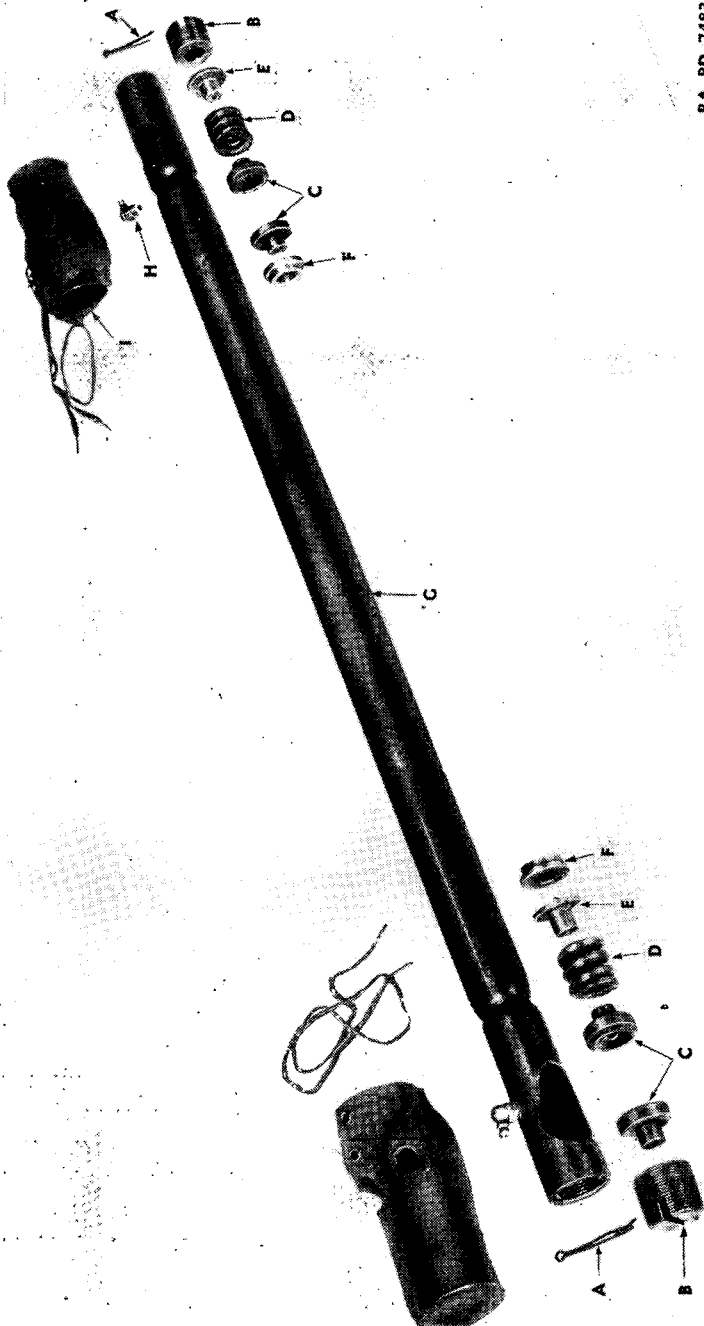
(3) If springs have become soft or broken, replace with new ones.

*c. Steering gear adjustments.*—After the steering gear has been reassembled, the adjustments given below can be made with the steering gear either installed in the vehicle or dismantled. With the steering gear installed it is necessary first to disconnect the drag link from the steering gear arm, and loosen the instrument panel bracket holding the steering gear jacket tube. Follow the specific instructions indicated in exactly the order given.

(1) *Cam end-play* (fig. 116).—End-play shows up as play in the steering wheel tube and cam ball bearings.

(a) Loosen housing side cover screw and lock nut to free the studs in the cam groove.

(b) Remove the four upper cover screws, and raise cover about  $\frac{1}{4}$  inch to permit removal of adjusting shims. A combination of 0.002-, 0.003-, 0.010- and 0.030-inch shims are used between paper gaskets.



RA PD 7483  
 I. Boot (front), WI-324635,  
 (rear) WI-324634.

G. Tube, SU-80TP102.  
 H. Fitting, CLDX5M.

E. Seat, SU-80P03.  
 F. Spacer, SU-80P11.

C. Bearing, SU-12R2.  
 D. Spring, SU-80P10.

A. Pin, cotter, BFAX10E.  
 B. Plug, SU-80P06.

FIGURE 115.—Steering drag link—exploded view.

(c) Clip and remove one 0.003-inch shim, or more, as required. Replace cover and tighten screws.

(d) Adjust side cover adjusting screw to a barely perceptible drag so that the steering wheel can be turned freely.

(e) Check adjustments and, if necessary, repeat operations to remove or replace more shims.

(2) *Lever shaft end-play* (fig. 117).—Backlash of the tapered studs in the cam groove shows up as end-play of the lever shaft and as backlash at the steering wheel and the steering arm ball. Adjustment is made within the high range through the midposition of the stud

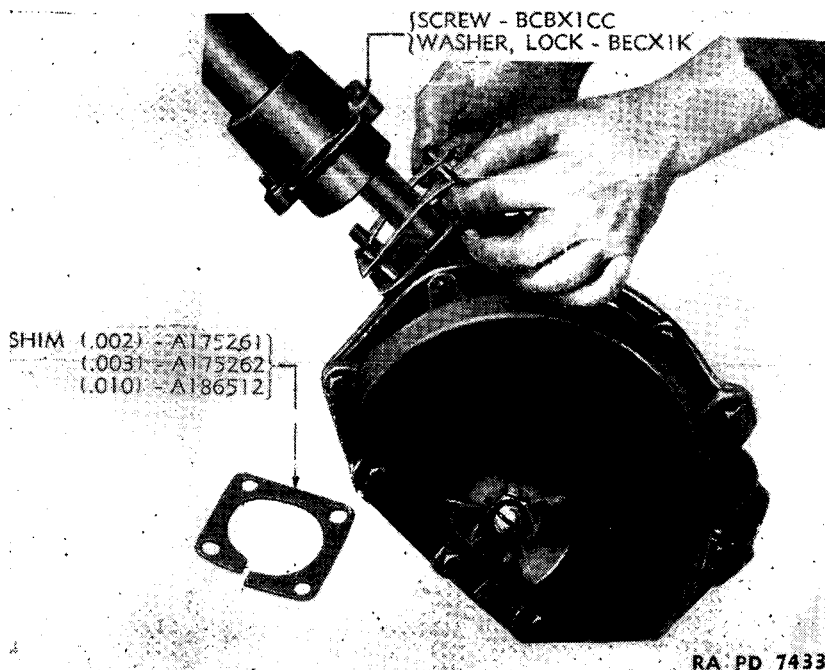


FIGURE 116.—Steering gear cam end-play adjustment.

travel. The cam groove is purposely cut shallower, therefore narrower, in the midposition range to provide close adjustment where the straight ahead driving action takes place. It also makes this close adjustment possible after normal wear occurs without causing binding elsewhere. Therefore, adjust through this midposition. Do not adjust in positions off midposition as backlash at these points is normal and not objectionable.

(a) Tighten the side cover adjusting screw until a very slight drag is felt through the midposition high range when turning the steering wheel slowly from one extreme to the other.

**Caution:** The gear must not bind at any place; only a very slight drag should be felt. A closer adjustment will not correct any steering condition, but will damage and wear the steering gear parts and impair operation.

(b) When proper adjustment has been made, tighten the lock nut and give the steering gear the final test.

(c) Make sure that the steering ball arm is tight on the splined shaft and that the lock washer and nut are also tight.

(3) *Precautions.*—The foregoing cam and lever shaft end-play

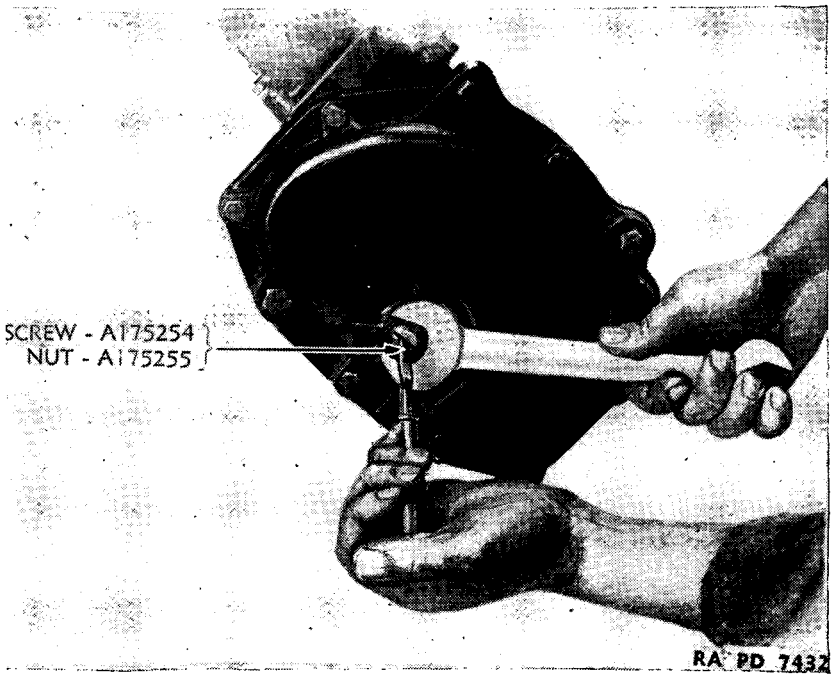


FIGURE 117.—Steering gear lever shaft end-play adjustment.

adjustments are usually all that are required unless there are worn parts that need replacing; in that case disassemble and inspect steering gear. Always adjust cam end-play first. Do not attempt to cure wander, shimmy, or road shock by tightening the steering gear to dampen out these difficulties. Adjust the steering gear only to remove play in it.



(4) *Column alinement.*—(a) Tighten the U-bolt at the instrument panel steering column support.

(b) Turn the steering wheel to see if stiffness or binding exists. If so, the gear has been adjusted too tight or the steering column is out of alinement. The steering column must not be sprung in any direction.

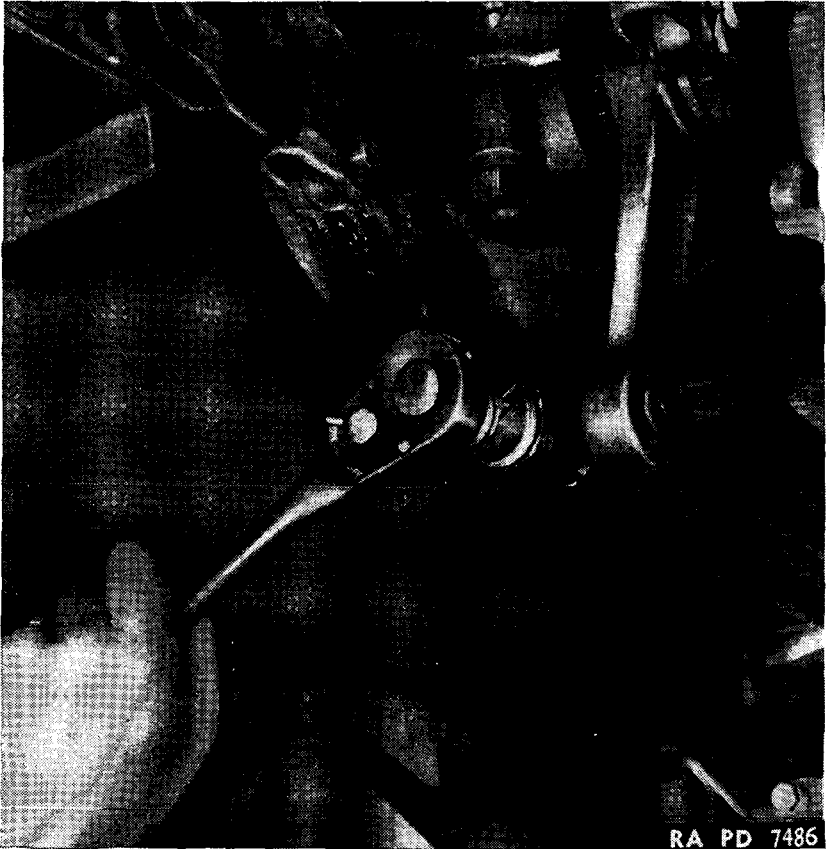


FIGURE 118.—Steering drag link adjustment.

(c) Check the steering gear frame bracket for tightness to the frame. It should hold the gear assembly rigidly and should not spring when the wheel is turned after the drag link is connected and the wheels are on the ground.

*d. Drag link adjustments.*—The only adjustment possible on the drag link is the adjustment of the end plugs. This is made after the link has been installed on the ear (fig. 118). Using a drag

link adjuster, tighten the plugs just enough to prevent excessive looseness of the steering arm ball in the ball seats but not enough to cause binding. Back off enough to enable cotter pins to be inserted in the drag link tube and end plugs to secure the plugs in position.

*e. Service data.*

Steering gear:

Steering post bearings----- No perceptible end play.

Lever shaft thrust adjust- Screw.  
ment-----

Lever shaft end play----- 0.002 to 0.003 in.

Clearance between lever shaft and bushings:

Outer ----- 0.0005 in.

Inner ----- 0.0025 in.

**51. Reassembly of components.**—*a. Steering gear.*—Before assembly, lubricate all parts thoroughly with wheel bearing grease. Tools:

- |                            |  |
|----------------------------|--|
| Hammer.                    | 1/2-inch socket wrench.                    |
| Bushing driving tool.      | 3/16-inch open-end wrench.                 |
| Screw driver.              | 1/2-inch open-end wrench.                  |
| Soft metal hammer.         | Tube of smaller diameter than jacket tube. |
| 1 7/16-inch socket wrench. |  |

(1) Replace bushings and oil seal. Hammer.  
Bushing driving tool.

Drive bushings into housing and then replace oil seal.

(2) Replace bearings. Screw driver.

Set balls on inner race, replace outer race (cup) and lock in place with retaining ring.

(3) Install cam and tube assembly. None.

Set cam into gear housing.

(4) Replace lever shaft and steering arm assemblies. 1 7/16-inch socket wrench.  
Soft metal hammer.

Insert lever shaft into housing until studs mesh with cam. Force steering arm on lever shaft splines and if necessary tap with hammer. Replace lock washer and nut and tighten assembly.

(5) Replace housing side cover. 1/2-inch socket wrench.

Place a new gasket between cover and housing and tighten down cover with cap screws and lock washers.

- (6) Replace housing upper.  $\frac{9}{16}$ -inch open-end wrench.

Set adjusting shims and cover on housing and replace bolts and lock washers.

- (7) Replace bearing unit in jacket tube. Tube of smaller diameter than jacket tube.

Push bearing and seat into place and then replace spring.

- (8) Replace jacket tube.  $\frac{1}{2}$ -inch socket wrench.  
 $\frac{1}{2}$ -inch open-end wrench.

Seat tube in housing upper cover and tighten cover clamp bolt and nut.

- (9) Adjust steering gear.

See paragraph 50c.

*b. Drag link.*

- (1) Replace components in axle end of link. Drag link adjuster or wide screw driver.

In the order named, set bumper seat, spacer, spring, and bearing seats into axle attaching end of link and turn up end plug enough to hold parts in place.

- (2) Replace components in steering gear end of link. Same as above.

Set bearing seats, spring, spacer, and bumper seat in order into steering gear end of link and replace end plug.

**52. Installation of assembly.—a. Steering gear.—Tools:**

- |                                     |                                      |
|-------------------------------------|--------------------------------------|
| $\frac{7}{8}$ -inch socket wrench.  | $\frac{3}{4}$ -inch open-end wrench. |
| $\frac{9}{16}$ -inch socket wrench. | Screw driver.                        |
| $1\frac{1}{4}$ -inch socket wrench. | Spring pullback pliers.              |

- (1) Attach assembly to car.  $\frac{7}{8}$ -inch socket wrench.  
 $\frac{3}{4}$ -inch open-end wrench.

Hold steering gear assembly in its running position and bolt housing to frame bracket with bolt, lock washer, and nut. Replace frame bracket cap and tighten it with lock washers and cap stud nuts.

- (2) Replace jacket supporting U-bolt.  $\frac{9}{16}$ -inch socket wrench.

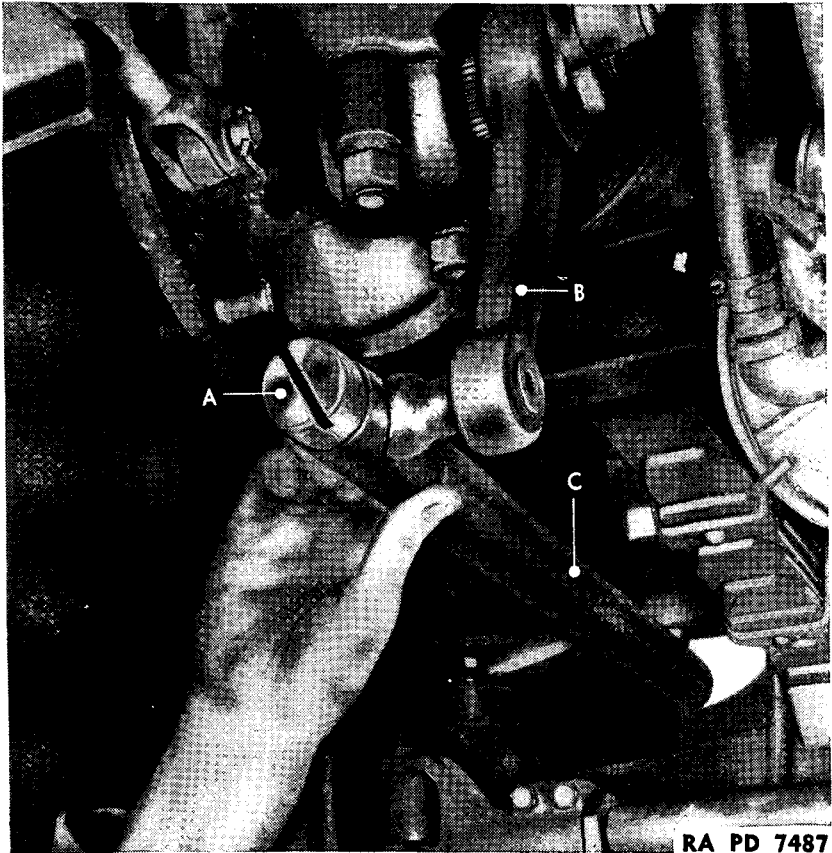
Line up steering column at instrument panel support bracket and replace U-bolt lock washers and nuts. Tighten nuts.

- (3) Replace steering wheel.  $1\frac{1}{4}$ -inch socket wrench.

Force steering wheel onto steering tube and fasten in place with wheel nut.

- (4) Replace base plate and Screw driver.  
horn button assembly.

Set base plate into wheels opening and tighten down with three



A. Plug SU-80P06.

B. Arm, w/ball, assembly RG-502485.

C. Drag link assembly SU-80P102.

FIGURE 119.—Steering drag link replacement.

screws. Place washer, spring, cup, and horn button in place in the order given and lock assembly by pushing down on button and rotating it one-sixth turn.

- (5) Connect horn button to Spring pullback pliers.  
electrical system.

Reconnect horn button cable terminal at bottom of steering gear housing and at the same time attach brake and clutch pullback springs to housing.

*b. Drag link.*—Tools:

- |  |  |
|--|--|
| Drag link adjuster or wide screw driver. | 3/4-inch open-end wrench.                |
| Screw driver.                            | 1/16-inch open-end wrench.               |
|  | 1/16-inch socket wrench.                 |
| (1) Replace link.                        | Drag link adjuster or wide screw driver. |

Set steering gear in midposition for straight ahead driving. Place wheels in straight ahead driving position and slip drag link into steering gear and axle steering arm balls (fig. 119). Turn up end plugs.

(2) Adjust drag link.

See paragraph 50*d*.

(3) Adjust steering gear.

- Screw driver.
- 3/4-inch open-end wrench.
- 1/16-inch open-end wrench.
- 1/16-inch socket wrench.

Check steering gear and if necessary, adjust assembly by following steps outlined in paragraph 50*c*(1) to (4), inclusive.

SECTION XIII  
CONSOLIDATED SERVICE DATA (FITS AND CLEARANCES)

	Paragraph
Master cylinder.....	53
Wheel brakes.....	54
Drive shaft brake.....	55
Radiator.....	56
Front springs.....	57
Rear springs.....	58
Steering gear.....	59

**53. Master cylinder.**

- Cylinder diameter..... 1 1/2 in.
- Piston clearance..... 0.001 to 0.004 in.
- Piston return spring, pressure  
at 2 7/64 inches..... 12 lb.

**54. Wheel brakes.**

Wheel cylinders:

Piston clearance:

Front ----- 0.001 to 0.005 in.

Rear ----- 0.001 to 0.005 in.

Front and rear shoe adjustment:

Cam (top of shoe) ----- 0.010 in.

Eccentric (bottom of shoe) - 0.005 in.

Brake return springs:

Front cylinder piston:

Free length -----  $2\frac{5}{8}$  in.

Pressure at  $1\frac{3}{4}$  inches. 1 to  $1\frac{1}{4}$  lb.

Rear cylinder piston:

Free length -----  $3\frac{1}{8}$  in.

Pressure at 2 inches ---  $1\frac{1}{2}$  to 2 lb.

Shoe return springs:

Free length -----  $7\frac{3}{16}$  in.

Pull at  $8\frac{1}{4}$  inches ----- 75 to 85 lb.

Brake drum:

Regrinding limits ---- 0.030 in.

**55. Drive shaft brake.**

Brake adjustment:

Clearance, linings to disk -  $\frac{1}{32}$  in.

Brake release spring:

Free length -----  $4\frac{3}{4}$  in.

Pressure at  $4\frac{3}{16}$  inches ---- 60 lb.

**56. Radiator.**

Stay rod studs (each side of radiator):

Size -----  $\frac{1}{2}$ -20 SAE threads (1 in. x  $1\frac{1}{4}$  in.)

Bottom mounting studs:

Size -----  $\frac{1}{2}$ -20 SAE threads (1 in. x  $2\frac{7}{8}$  in.)

**57. Front springs.**

Spring bushings (bronze) ---- 0.003 in.

Inside diameter ----- 1 in.-0.005 in.

**58. Rear springs.**

Spring bushings (bronze) ---- 0.003 in.

Inside diameter -----  $1\frac{1}{16}$  in.-0.005 in.

59. Steering gear.

Steering post bearings-----	No perceptible end play.
Lever shaft thrust adjustment_	Screw.
Lever shaft end play-----	0.002 in.-0.003 in.
Clearance between lever shaft and bushings:	
Outer -----	0.0005 in.
Inner -----	0.0025 in.

SECTION XIV

CARE OF UNITS IN EXTREME TEMPERATURES OR  
UNDER UNUSUAL CONDITIONS

	Paragraph
In extreme temperatures-----	60
After fording streams or in flood conditions-----	61
In muddy or sandy terrain-----	62

60. In extreme temperatures.—Temperatures ranging between  $-10^{\circ}$  F. and  $-30^{\circ}$  F. are designated as low, and temperatures below  $-30^{\circ}$  F. as extreme. OFSB 6-11 covers lubrication for temperatures below  $-10^{\circ}$  F.

a. *Brake system.*—After driving in sleet or deep snow, in temperatures below freezing, test brakes before making another trip. After a long stop, make certain that the linings are not frozen to the drums. If possible, leave vehicle in a warm garage until the ice has melted. If this is not possible, pour boiling water over the frozen drum, immediately before operation, and drive vehicle with brakes lightly applied until they dry out, taking care to prevent burning the brake linings.

b. *Cooling system.*—(1) Fill the cooling system with an antifreeze solution, employing either approved alcohol, or ethylene glycol. Alcohol may be used as antifreeze but it has the disadvantage of evaporating out of solution. Thoroughly clean and tighten the system before adding any antifreeze (see TM 9-705). The following table gives the amount of antifreeze necessary for various temperature conditions; however, an antifreeze solution hydrometer should be used as a check.

ANTIFREEZE CHARTS

Temperature	Denatured alcohol	Ethylene glycol (Prestone)	Temperature	Denatured alcohol	Ethylene glycol (Prestone)
	(Quarts)	(Quarts)		(Quarts)	(Quarts)
+20° F.	3½	3	-10° F.	8	7
+10° F.	5½	4½	-20° F.	9	8
0° F.	7	6	-30° F.	10	8½

(2) To prevent excessive cooling of the engine and poor combustion, the radiator shutters should be partly closed or the radiator core partly covered with a tarpaulin or other suitable material.

*c. Battery.*—(1) The freezing point of battery electrolyte depends upon its specific gravity. There is little danger of freezing except with a discharged battery. In order to avoid freezing of the electrolyte, always keep the battery in a fully charged condition. The following table shows the freezing points of electrolyte:

FREEZING POINTS OF ELECTROLYTE

Specific gravity	Freezing temperature	Specific gravity	Freezing temperature
1.120	+14° F.	1.225	-35° F.
1.150	+6° F.	1.250	-62° F.
1.200	-17° F.	1.275	-85° F.

(2) When it is necessary to add water to the battery in freezing weather always do it just before running the engine. If the temperature is extremely low, start the engine so that the battery is charging before water is added. The reason for this is that water, being lighter than electrolyte, will remain on the surface and freeze unless it is thoroughly mixed with the electrolyte.

*d. Fuel system.*—(1) In extreme temperatures, insulating the fuel lines with asbestos tape or other asbestos compound will help prevent ice from forming inside the lines.

(2) Small quantities of denatured alcohol, about ½ pint to a tank of fuel, will reduce difficulties from water in gasoline.

(3) Any arrangement for directing the heat from the exhaust manifold back over the fuel lines and tanks is beneficial.

**61. After fording streams or in flood conditions.**—After fording shallow streams it is not usually necessary to take any preventive



maintenance steps. However, if the units have been submerged for several hours or more due to fording deep streams or being in a flooded area, it is necessary to remove all foreign matter which may have accumulated. This is done by thoroughly dismantling units submerged, washing each part in solvent, dry-cleaning and then spreading a thin film of oil, engine, over the parts. In instances when emergency requirements make an immediate, complete, cleansing impossible, some damage may be prevented and the vehicle kept in service by the following procedure:

*a. General.*—Lubricate the steering gear and all pedals, shafts, and linkages beneath the hood and on the chassis.

*b. Brake system.*—(1) Remove the brake drums and wipe the linings and anchor pins clean. Lubricate the pins.

(2) Drain the brake lines, flush the system with alcohol, and refill with new brake fluid.

*c. Cooling system.*—If any grit or dirty water has seeped into the cooling system, drain out the liquid. Then flush the system thoroughly and refill with clean liquid. Clean the outside of the radiator case.

*d. Electric lighting system; battery and accessories.*—Wipe all wires and contact points clean and dry. Clean the battery terminals and check the battery for signs of discharging due to short-circuiting by the water or other foreign matter. Recharge battery, if necessary.

*e. Fuel system.*—If any part of the fuel system has been submerged, drain and flush the system thoroughly and refill with gasoline, using  $\frac{1}{2}$  pint of alcohol to each tank full of fuel to counteract the effect of the water. If any grit has found its way into the carburetor, it may be necessary to remove it and clean the jets and needle valve.

NOTE.—At the first opportune time, completely disassemble each unit and clean thoroughly.

**62. In muddy or sandy terrain.**—No data on care of units after traversing deep muddy terrain or care in sandy terrain and deserts is available at this time. This information will be furnished by field service maintenance division.

APPENDIX

LIST OF REFERENCES

1. Standard Nomenclature Lists.

- a. Cleaning, preserving, and lubricating materials..... SNL K-1.
  - b. Scout cars M3A1..... SNL G-67.
- Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the Ordnance Publications for Supply Index..... OPSI.

2. Explanatory publications.

- a. Automotive matériel.
  - Automotive brakes..... TM 10-565.
  - Cold weather operation of automotive equipment..... OFSB 6-G-3.
  - Fuels and carburetion..... TM 10-550.
  - Maintenance and care of pneumatic tires.... TM 31-200.
  - Military motor transportation..... TM 10-505.
  - Military motor vehicles..... AR 850-15.
  - Motor transport..... FM 25-10.
  - Motor transport circular 1-10..... QMC.
  - Motor transport technical service bulletins... QMC.
  - Scout cars M3; M3A1; and 4.2 mortar motor carriage M2..... TM 9-705.
  - Scout cars M3A1; power plant (Buda 6DT317 Diesel)..... TM 9-1708.
  - Scout cars M3A1; power plant (Hercules DJXD Diesel)..... TM 9-1707.
  - Scout cars M3A1; power plant (Hercules JXD gasoline)..... TM 9-1706.
  - Army Motors monthly (QMC motor transport school)..... QMC.
  - The internal combustion engine..... TM 10-570.
  - The motor vehicle..... TM 10-510.

b. Cleaning, preserving, and lubricating materials.....	TM 9-850.
c. Automotive electricity.....	TM 10-580.
d. Lubrication.	
Automotive lubrication.....	TM 10-540.
Car, scout, M3A1.....	OFSB 6-11.
Car, scout.....	TM 9-705.
e. Maintenance and repair.	
Automotive power transmission units.....	TM 10-585.
Echelon system of maintenance.....	TM 10-525.
Hand, measuring, and power tools.....	TM 10-590.
Inspection.....	TM 10-545.
Maintenance and repair.....	TM 10-520.
Sheet metal work, body, fender, and radiator repairs .....	TM 10-450.
f. Miscellaneous.	
Fire prevention, safety precautions, accidents.....	TM 10-360.
List of training publications.....	FM 21-6.
Loading of mechanized and motorized army equipment on open top railroad equipment.....	Association of American Railroads.
g. Storage of motor vehicle equipment.....	AR 850-18.

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

