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WAR DEPARTMENT

TECHNICAL MANUAL



ORDNANCE MAINTENANCE

CHASSIS, HULL AND TURRET FOR MEDIUM ARMORED CAR T17E1

18 OCTOBER 1943

DESIGN SECTION

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ORDNANCE MAINTENANCE

CHASSIS, HULL AND TURRET FOR

MEDIUM ARMORED CAR T17E1

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**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1****CHAPTER 1****INTRODUCTION**

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1. SCOPE.

a. This manual is published for the information and guidance of ordnance maintenance personnel. It contains detailed instructions for inspection, disassembly, assembly, maintenance, and repairs of the Chevrolet Medium Armored Car T17E1, supplementary to those in the field, and to Technical Manuals prepared for the using arms. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the materiel.

2. ARRANGEMENT OF MANUAL.

a. The chapters of this manual cover the maintenance operations on the following assemblies: axles, brakes, wheel bearings, shock absorbers, tire pump, hull, turret, and electrical wiring. Each chapter consists of sections which cover the removal, disassembly, inspection, repair, assembly, and installation of the main assemblies and their components. The paragraph index at the beginning of each section indicates the material which is covered in that section.

3. CHARACTERISTICS.

a. The Armored Car T17E1 is a four-wheeled, four-wheel drive vehicle, powered by two 97-horsepower, water-cooled engines. The vehicle is operated and controlled more in the manner of a four-wheel drive truck than that of a track-laying tank, which it resembles in outward appearance.

b. The two six-cylinder, valve-in-head engines are located side by side in the rear of the hull, with the fan end of the engine toward the rear. The engines can be operated simultaneously or individually.

c. The power from each engine is transmitted through its fluid coupling, Hydra-Matic transmission, gear reduction case, and propeller shaft to a single two-speed transfer case. Propeller shafts connect the transfer case to the double-reduction front and rear axles. The vehicle can be driven by the rear axle only, or by both front and rear axles.

d. The hull is constructed of heavy armor plate, and fitted with a 360-degree revolving turret.

e. The Armored Car T17E1 is designed for a five-man crew: the driver and assistant driver in the hull or front compartment, and the gunner, loader, and radio operator in the turret basket or rear compartment.

CHAPTER 2
FRONT AXLE

Section I

INTRODUCTION

	Paragraph
Description	4
Data	5
Reference to second echelon TM 9-741	6
Maintenance allocation	7

4. DESCRIPTION.

a. The front axle differential is a special double-reduction type. The power is transmitted through a hypoid drive pinion to the hypoid drive gear, and then through a herringbone drive pinion to which the hypoid drive gear is attached, thence to the large herringbone drive gear on the differential case; then to the front axle shafts (fig. 1).

5. DATA.

a. General.

Housing Banjo (no inspection plate).
Drive Through radius rods.

b. Differential.

(1) FIRST REDUCTION.

Gear ratio 3.70 to 1.
Drive type Hypoid (pinion and drive gear service in sets).
Hand spiral Drive gear—left hand.
Pinion—right hand.
Position of pinion Below drive gear.

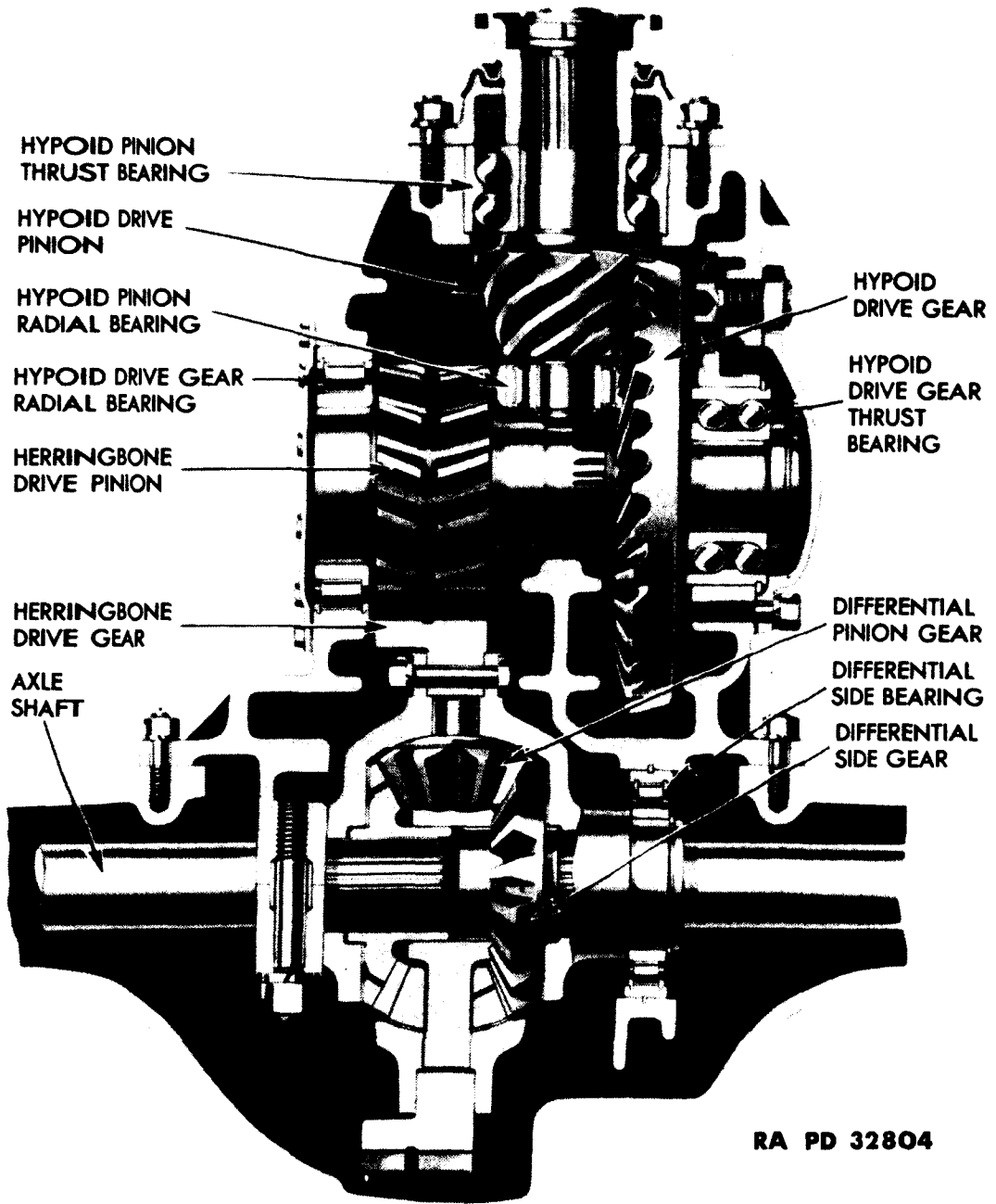
(2) SECOND REDUCTION.

Gear ratio 2.44 to 1.
Drive type Helical herringbone, self aligning (drive gear and pinion serviced separately).

(3) TOTAL REDUCTION.

Hypoid pinion to herringbone drive gear 9.02 to 1.

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RA PD 32804

Figure 1 – Front Axle Differential Carrier – Cross Section

c. Differential Carrier Bearings.

- | | |
|---|--|
| Case side bearings | Hyatt roller A-1216-TAS (no adjustment, side play controlled by lock rings). |
| Herringbone drive pinion radial bearing | Hyatt roller R-1219-TS. |

INTRODUCTION

Hypoid drive gear thrust bearing	New departure 45311-A.
Hypoid drive pinion inner bearing	Hyatt roller V-5207-TM.
Hypoid drive pinion outer bearing	New departure 5312.

d. Wheel Bearings.

Inner bearing cup	Timken 56650.
Inner bearing cone	Timken 56425.
Outer bearing cup	Timken 592A.
Outer bearing cone	Timken 594.

e. Steering Knuckle Trunnion Bearings.

Cone (4 used)	Timken 53177.
Cup (4 used)	Timken 53387.

Adjustment Shim both ends under trunnion caps to obtain 25 pounds to 30 pounds pull at tie rod yoke bolt hole on knuckle support to keep in motion. Use equal shims at top and bottom.

f. Steering Geometry.

Front wheel caster	$1\frac{3}{4}^{\circ}$.
Front wheel camber	$\frac{3}{4}^{\circ}$.
King pin inclination	0° .
Front wheel toe-in	0 inches to $\frac{3}{16}$ inches.

6. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often done by ordnance maintenance personnel, who should refer to the using troop TM for information.

7. MAINTENANCE ALLOCATION.

a. The scope of maintenance and repair by the crew and other units of the using arm is determined by the availability of suitable tools, availability of necessary parts, capabilities of the mechanics, time available, and the tactical situation. All of these are variable and no exact system of procedure can be prescribed.

b. Indicated below are the maintenance duties for which tools and parts have been provided for the using arm personnel. Other replacements and repairs are the responsibility of ordnance main-

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tenance personnel but may be performed by using arm personnel when circumstances permit, within the discretion of the commander concerned.

NOTE: Operations allocated will normally be performed in the echelon indicated by "X."

Operations allocated to the echelons as indicated by "E" may be accomplished by the respective echelons in emergencies only.

MAINTENANCE ALLOCATION

Echelons and words as used in this list of maintenance allocations are defined as follows:

- SECOND ECHELON:** Line organization regiments, battalions, companies, detachments, and separate companies (first and second echelons).
- THIRD ECHELON:** Ordnance light maintenance companies, ordnance medium maintenance companies, ordnance divisional maintenance battalions, and ordnance post shops.
- FOURTH ECHELON:** Ordnance heavy maintenance companies, and service command shops.
- FIFTH ECHELON:** Ordnance base regiments, ordnance bases, arsenals, and manufacturers' plants.
- SERVICE:** Consists of servicing, cleaning, lubricating, tightening bolts and nuts, and making external adjustments of subassemblies or assemblies and controls.
- REPLACE:** Consists of removing the part, subassembly or assembly from the vehicles and replacing it with a new reconditioned or rebuilt part, subassembly or assembly, whichever the case may be.
- REPAIR:** Consists of making repairs to, or replacement of the part, subassembly or assembly that can be accomplished without completely disassembling the subassembly or assemblies, and does not require heavy welding, or riveting, machining, fitting, and/or alineing or balancing.
- REBUILD:** Consists of completely reconditioning and replacing in serviceable condition any unserviceable part, subassembly or assembly of the vehicle, including welding, riveting, machining, fitting, alineing, balancing, assembling, and testing.

INTRODUCTION

c. Maintenance Allocation Chart.

	ECHELONS			
	2nd	3rd	4th	5th
AXLE, FRONT				
Arms, steering knuckle—replace		X		
*Axle assembly—replace		X		
Axle assembly—repair		X		
Axle assembly—rebuild			E	X
Bearings, wheel—service and/or replace	X			
Drums, brake—replace	X			
Gears, bevel and pinion—adjust		X		
Hub assemblies—replace	X			
Hub assemblies—repair		X		
Hub assemblies—rebuild			X	
Hub and drum assemblies—replace	X			
Retainers, wheel grease—replace	X			
Rod assembly, tie—replace	X			
Rod assembly, tie—repair		X		
Seals, trunnion housing, oil—replace		X		
Shafts, axle—replace		X		
Wheel alinement, toe-in—adjust	X			
Wheel alinement, camber and caster—check		X		
Wheel alinement, camber and caster—aline			E	X

**The second echelon is authorized to remove and reinstall engine transmission assemblies, transfer unit controlled differential assembly and other items marked by asterisk. However, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly or unit assembly, the assembly marked by asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.*

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CHAPTER 2

FRONT AXLE (Cont'd)

Section II

TROUBLE SHOOTING

	Paragraph
General	8
Trouble shooting	9

8. GENERAL.

a. In checking the front axle for trouble, practically all troubles can be located through a good visual inspection, and a thorough road test of the vehicle. In some cases it may be necessary to raise the front end of the vehicle with a suitable jack. This will take the load off the front system and make it easier to inspect the wheel bearings, tie rod, etc. In cases of misalignment of the front end, it will be necessary to check the caster, camber, and steering geometry with front end alinement equipment as instructed by the manufacturer of the equipment being used.

9. TROUBLE SHOOTING.

a. Hard Steering.

Possible Cause	Possible Remedy
Lack of lubrication.	Lubricate tie rod ends, steering gear and steering connecting rod, paragraph 23, TM 9-741.
Steering gear out of adjustment.	Adjust steering gear. See steering gear chapter 4, section VI, TM 9-1741B.
Improper toe-in.	Adjust toe-in at end of tie rod. See paragraph 11.
Low tire pressure.	Inflate tires to 70 pounds.
Incorrect front end alinement.	Aline front end. See limits in paragraph 30.
Power steering mechanism not working.	Check power steering mechanism.
Unevenly worn or cupped tires.	Aline front end. See limits in paragraph 30.
Spring leaf or leaves broken.	Repair springs.
Spring center bolt broken and spring shifted on axle.	Replace spring center bolt and line up spring with axle.
Bent axle housing.	Replace or straighten axle housing.

TROUBLE SHOOTING

b. Lubricant Leaks.

Possible Cause	Possible Remedy
Leak at steering knuckle support.	Replace housing outer end seal and gasket. See paragraph 17.
Leak between third member and banjo housing.	Replace gasket. See paragraph 21.

c. Shimmy and Wandering.

Tie rod bushings loose or worn.	Replace bushings. See paragraph 12.
Steering knuckle bearings worn or out of adjustment.	Adjust or replace bearings. See paragraph 16.
Incorrect front end alinement.	Aline front end. See limits in paragraph 30.
Improper tire inflation.	Inflate tires to 70 pounds.
Loose or worn wheel bearings.	Adjust or replace front wheel bearings.
Steering gear out of adjustment.	Adjust steering gear. See steering gear chapter 4, section VI, TM 9-1741B.
Spring center bolt broken and spring out of alinement with axle.	Replace spring center bolt and aline spring with front axle.
Bent axle housing.	Replace or straighten axle housing.

d. Axle Noisy on Drive.

Hypoid drive pinion and drive gear lash too tight.	Check pinion depth adjustment, (par. 49), or replace pinion and drive gear set, or replace carrier (par. 44).
Rear side of hypoid pinion (double row) thrust bearing rough.	Replace bearing. Check gear lash and pinion depth (par. 49).

e. Axle Noisy on Coast.

Excessive lash between hypoid pinion and drive gear.	Check pinion depth adjustment (par. 49) or replace pinion and drive gear set, or replace carrier (par. 44).
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Possible Cause	Possible Remedy
Front side of hypoid pinion (double row) thrust bearing.	Replace bearing. Check lash between hypoid pinion and drive gear, and pinion depth (par. 49).
End play in hypoid drive gear (double row) thrust bearing.	Replace bearing. Check lash between hypoid pinion and drive gear, and pinion depth (par 49).
f. Axle Noisy on Both Drive and Coast.	
Hypoid drive pinion too deep in drive gear.	Adjust pinion depth (par. 49).
Worn or damaged hypoid pinion bearings or drive gear thrust bearing.	Replace bearings which show damage (par 47).
Loose or worn wheel bearings.	Adjust or replace bearing as necessary (par. 47).
g. Backlash.	
Axle drive flange loose.	Replace terne plate gasket, retighten drive flange bolts using new lock plate (par. 39).
Worn differential side gear and pinion thrust washers.	Replace the gear showing most wear (gears serviced separately) (par. 45).
Worn universal joints.	Replace worn universal joint parts.

CHAPTER 2
FRONT AXLE (Cont'd)

Section III

**OPERATIONS THAT CAN BE PERFORMED WITH
FRONT AXLE IN VEHICLE**

	Paragraph
Introduction	10
Tie rod replacement and adjustment	11
Tie rod yoke bolt bushing replacement	12
Spindle	13
Axle shaft	14
Thrust washers	15
Steering knuckle support and/or trunnion bearings	16
Housing outer end seal	17

10. INTRODUCTION.

a. **General.** The following paragraphs cover the repairs that can be performed without removing the complete unit from the vehicle. Repairs can also be made on the brake system and hub of each wheel; these are outlined in the "Brake System" chapter and the "Wheel Bearings" chapter.

b. **Cleaning and Inspection of Component Parts.** The cleaning, inspection and repairing of component parts must be done with extreme care and cleanliness. All parts must be cleaned thoroughly and dried with clean rags and air pressure from an air blow gun. **CAUTION:** *Do not allow bearings to be spun by the air pressure.* As the parts are disassembled, they should be placed in a tank containing a cleaning solution, and permitted to soak. *Do not* allow rubber or leather parts to soak, as the cleaning solution will deteriorate the leather or rubber parts.

11. TIE ROD REPLACEMENT AND ADJUSTMENT.

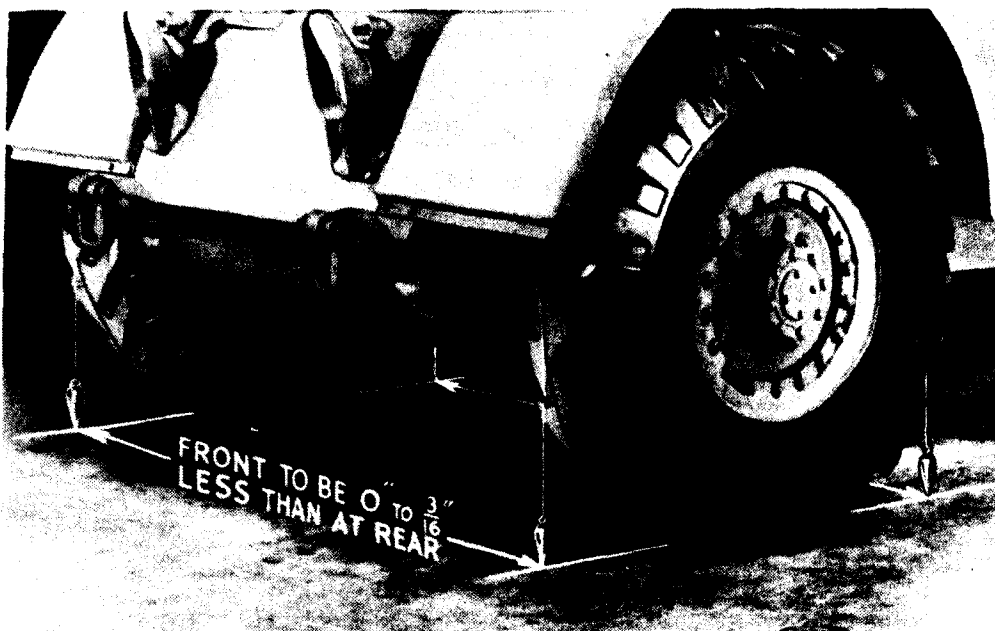
a. **Removal Procedure.** Remove the cotter pin from the bottom of the tie rod bolts, and remove the nuts and bolts. Lift the tie rod assembly off the steering knuckle supports.

b. **Repairing Procedure.**

(1) **REMOVE TIE ROD YOKES.** Loosen both bolt clamps on the right yoke, and unscrew the yoke from the rod. Loosen the outer clamp bolt, and remove the inner clamp bolt and lock from the left yoke. Unscrew the yoke from the rod.

(2) **CLEAN AND INSPECT PARTS.** Clean the parts thoroughly, and inspect the bolt for wear or other damage; check the fit of the bolt in the yoke and the fit of the yoke on the rod. Replace any worn or damaged parts.

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RA PD 32390

Figure 2 — Checking Toe-in

(3) **ASSEMBLE TIE ROD.** Screw both yokes on the tie rod approximately $3\frac{3}{16}$ inches on each side. Install the outer clamp bolt and the inner bolt and lock on the left yoke, and tighten the bolts securely. Do not tighten the clamp bolts on the right yoke until the toe-in is adjusted.

c. Installation Procedure.

(1) **INSTALL TIE ROD.** Place tie rod in position on the steering knuckle supports with the locked yoke to the left of the vehicle. Install both tie rod bolts, and install nut on the left-hand bolt. Tighten the nut snug, then back it off $\frac{1}{3}$ to $\frac{1}{2}$ turn and line up the cotter pin hole. Install the cotter pin and lock it securely.

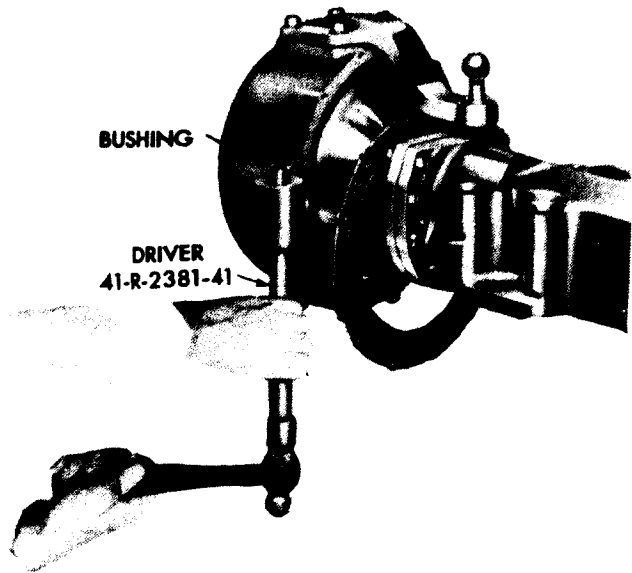
(2) **SCRIBE TIRES** (fig. 2). Jack up front of vehicle so that tires clear the ground, and set wheels in straight ahead position. Rotate the wheels and, with a pointed instrument, scribe a line in the center of the tire tread around the whole circumference of both tires. Lower vehicle and remove the jack.

(3) **MEASURE TOE-IN** (fig. 2). Use a plumb bob, and hold the plumb line against scribe line on tire at the center line of the axle. Mark a point on the floor where the bob touches the floor at the front and rear of each tire as shown in figure 2. Measure the distance between the marks on the floor; the front measurement should be between 0 and $\frac{3}{16}$ inch less than the rear measurement.

(4) **ADJUST TIE ROD (TOE-IN).** Remove the tie rod bolt from

OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE

Figure 3 — Removing Yoke Bolt Bushing



RA PD 317020

the right yoke, and turn the yoke to the right or left until the front measurement is between 0 and $\frac{3}{16}$ inch less than the rear measurement. Turning the yoke clockwise widens the distance at the front, and turning the yoke counterclockwise narrows the distance at the front. Be sure to have the tie rod bolt in place when taking the measurement.

(5) **INSTALL RIGHT TIE ROD BOLT AND NUT.** When the measurement is correct, install the nut on the right tie rod bolt and pull it up snug, then back it off $\frac{1}{3}$ to $\frac{1}{2}$ turn and line up the cotter pin hole. Install new cotter pin and lock it securely. Tighten both clamp bolts securely.

12. TIE ROD YOKE BOLT BUSHING REPLACEMENT.

a. **Remove Bushing (fig. 3).** Turn wheels to right or left to gain access to the left or right tie rod bolt. Remove the cotter pin from the bottom of the tie rod bolt, and unscrew the castellated nut. Drive out the bolt, and swing the tie rod away from the knuckle support. Drive out the bushing using bushing remover (41-R-2381-41).

b. **Install Bushing (fig. 3).** Place bushing in position and drive it in place with bushing replacer (41-R-2381-41). Ream bushing with bushing reamer (41-R-2253).

c. **Check Toe-in Adjustment (fig. 2).** Place tie rod yoke in position and install the tie rod bolt. Check the toe-in and adjust according to instructions in paragraph 11 c.

13. SPINDLE.

a. **Removal Procedure.**

(1) **DRAIN OIL.** Remove drain plug from bottom of housing, and drain oil into a drain pan.

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RA PD 32517

Figure 4 — Removing Brake Drum

(2) **REMOVE WHEEL AND TIRE ASSEMBLY.** Loosen the ten wheel stud nuts. *NOTE: The left hand wheel nuts have left hand threads and the right hand wheel nuts have right hand threads.* Raise front end of vehicle and support on suitable blocks. Remove the ten wheel nuts and lift the wheel off hub.

(3) **REMOVE DRUM** (fig 4). Remove the three screws that retain the drum to the hub, and screw them into the three tapped holes alternately to pull the drum loose from the hub. Lift the drum off the hub.

(4) **REMOVE HUB** (fig. 7). Remove the four bolts that attach the drive flange plate, and lift off the plate and gasket. Remove the eight bolts and lock that retain the drive flange, and pull out the drive flange and gasket. Bend the tang away from the slot in the adjusting lock nut and remove the lock nut, lock, and adjusting nut. Lift hub assembly off spindle.

(5) **DISCONNECT BRAKE HOSE.** Loosen nut on top of trunnion and remove the brake hose from the clip. Unscrew the bolt at bottom of fitting at inner end of hose, and pull hose out of fitting.

(6) **REMOVE SPINDLE** (fig. 15). Remove the ten nuts that retain

OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE

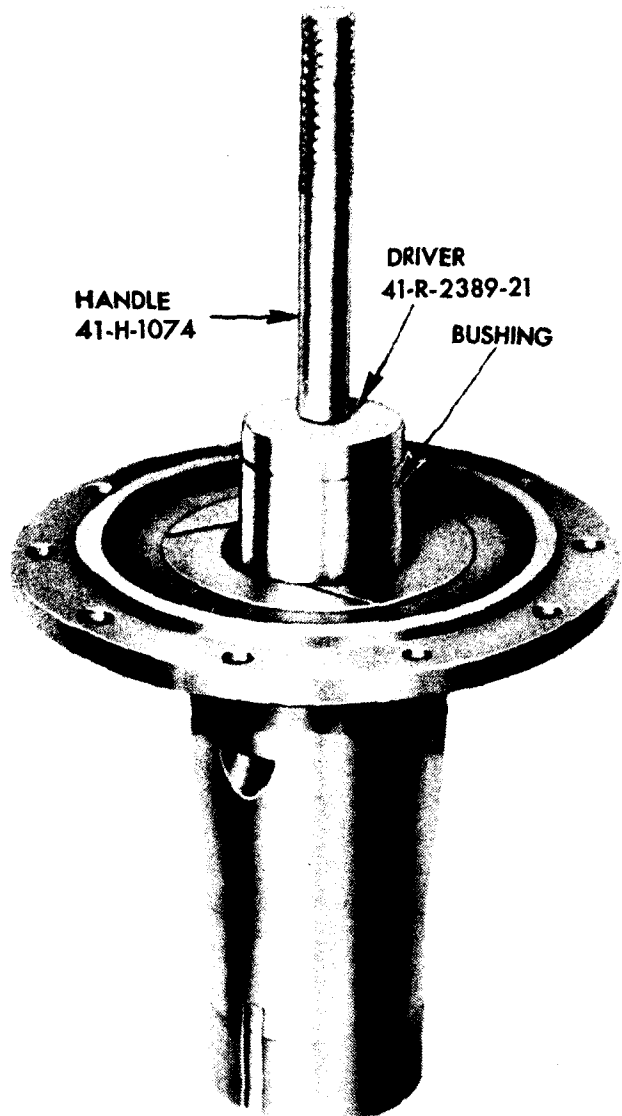


Figure 5 – Spindle Bushing Replacement

RA PD 317021

the brake flange plate and spindle to the steering knuckle support. Lift off the oil deflector, brake flange plate, and spindle.

b. Spindle Rebushing Procedure.

(1) **REMOVE BUSHING** (fig. 5). Insert bushing remover (41-R-2389-21) through outer end of spindle, and, using handle (41-H-1074), drive or press the bushing out of the spindle.

(2) **INSTALL BUSHING** (fig. 5). Place new bushing on driver, and press bushing into spindle until the inner edge of bushing is $\frac{5}{16}$ inch below the bottom of the thrust washer recess as shown in figure 6. Use bushing replacer (41-R-2389-21).

c. Thrust Washer Replacement Procedure.

(1) **REMOVE THRUST WASHER** (fig. 6). Pry out old washer, and clean staking burs out of recess.

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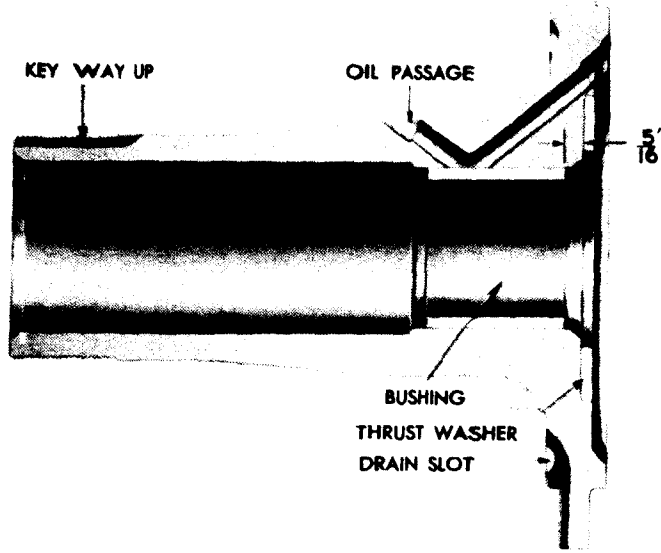


Figure 6 — Spindle
— Cross Section

RA PD 32778

(2) **INSTALL THRUST WASHER** (fig. 6). Place new thrust washer in position and stake in three places around outer edge of washer. Care must be used so as not to distort the washer, as it must seat flat against recess as shown in figure 6. Washers have right- and left-hand oil grooves. To determine right from left, hold washer in hand and if the oil groove angles to the right from the center, it is right-handed and must go in the right spindle. The washers are not interchangeable.

d. **Spindle Installation Procedure.**

(1) **INSTALL SPINDLE** (fig. 15). Place new gasket in position on knuckle support. Place spindle in position with keyway up, place brake flange plate assembly and oil deflector in position and install the ten bolts and lock washers. Tighten bolts securely.

(2) **CONNECT BRAKE HOSE.** Place hose on fitting and place new copper gaskets under head of bolt, and between the hose and connector. Install the bolt through connector and tighten securely. Place hose in clip on trunnion and tighten the retaining nut securely.

(3) **INSTALL HUB** (fig. 15). Check to see that wheel bearings are packed with grease. Place hub in position on spindle and push outer bearing and race in position. Install washer and adjusting nut.

(4) **ADJUST BEARING.** Screw adjusting nut up tight to make sure that hub and bearings are in place. Loosen the nut and tighten it again wrench tight. Then back it off $\frac{1}{8}$ turn (45-degree minimum). Install a new lock, matching one of the three short lugs with a slot in nut. Install the lock nut, tighten it securely, and bend a matching

OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE

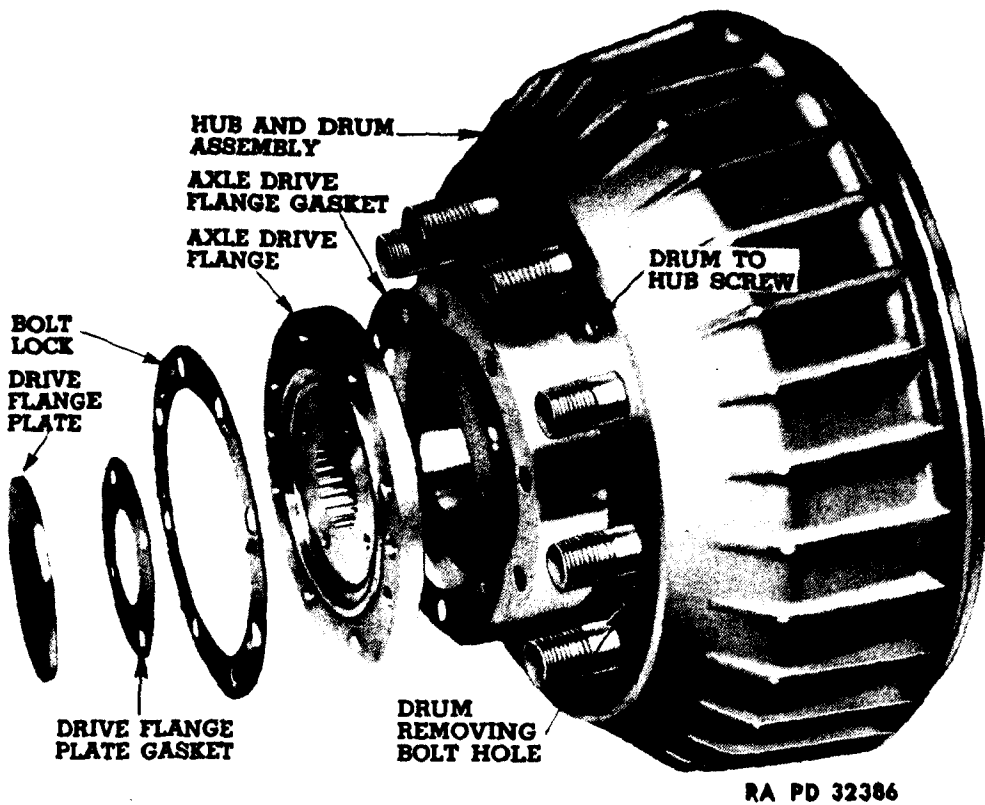


Figure 7 – Front Axle Drive Flange

lug in one of the slots in the lock nut. Rotate the hub to see that the hub turns freely. Place the drum in position and install the three retaining screws.

(5) **INSTALL DRIVE FLANGE** (fig. 7). Place a new drive flange plate gasket over the drive flange, and push the drive flange and gasket in place in the housing. Place bolt lock in position and install the eight bolts. Tighten the bolts securely and bend the lock tangs to lock the bolts.

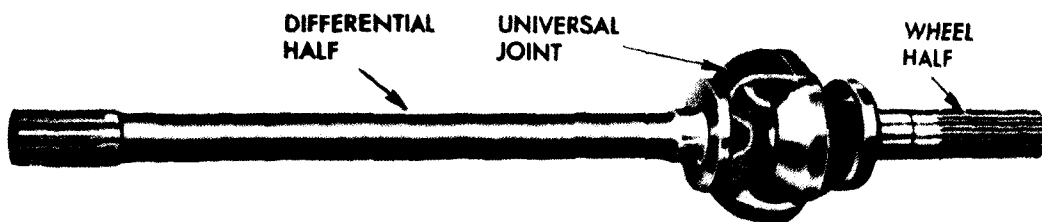
(6) **INSTALL DRIVE FLANGE PLATE** (fig. 7). Place new flange plate gasket in position, then place the plate in position and install the four bolts and lock washers. Tighten the bolts securely.

(7) **INSTALL WHEEL AND TIRE ASSEMBLY**. Place wheel and tire assembly in position and install the ten wheel nuts. Remove blocking and lower vehicle until tire rests on ground, and tighten the ten wheel nuts securely.

(8) **BLEED BRAKES**. Bleed the complete brake system as instructed in paragraph 72.

(9) **REFILL AXLE HOUSING WITH LUBRICANT**. Install drain plug in bottom of housing. Remove filler plug and inject enough universal gear lubricant to fill the housing to the filler plug level. Install filler plug and gasket. Road-test vehicle.

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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RA PD 32780

Figure 8 — Front Axle Shaft Assembly

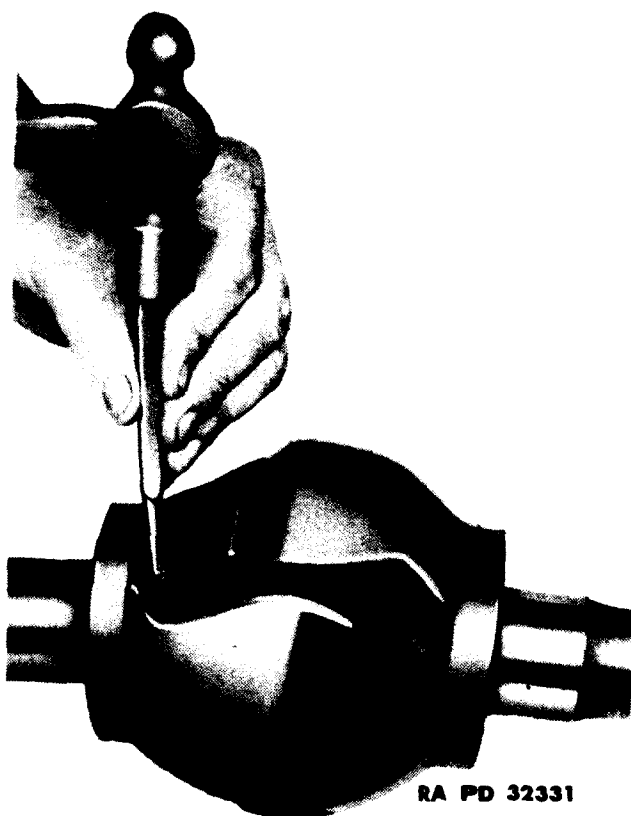


Figure 9 — Driving Out
Retainer Pin

RA PD 32331

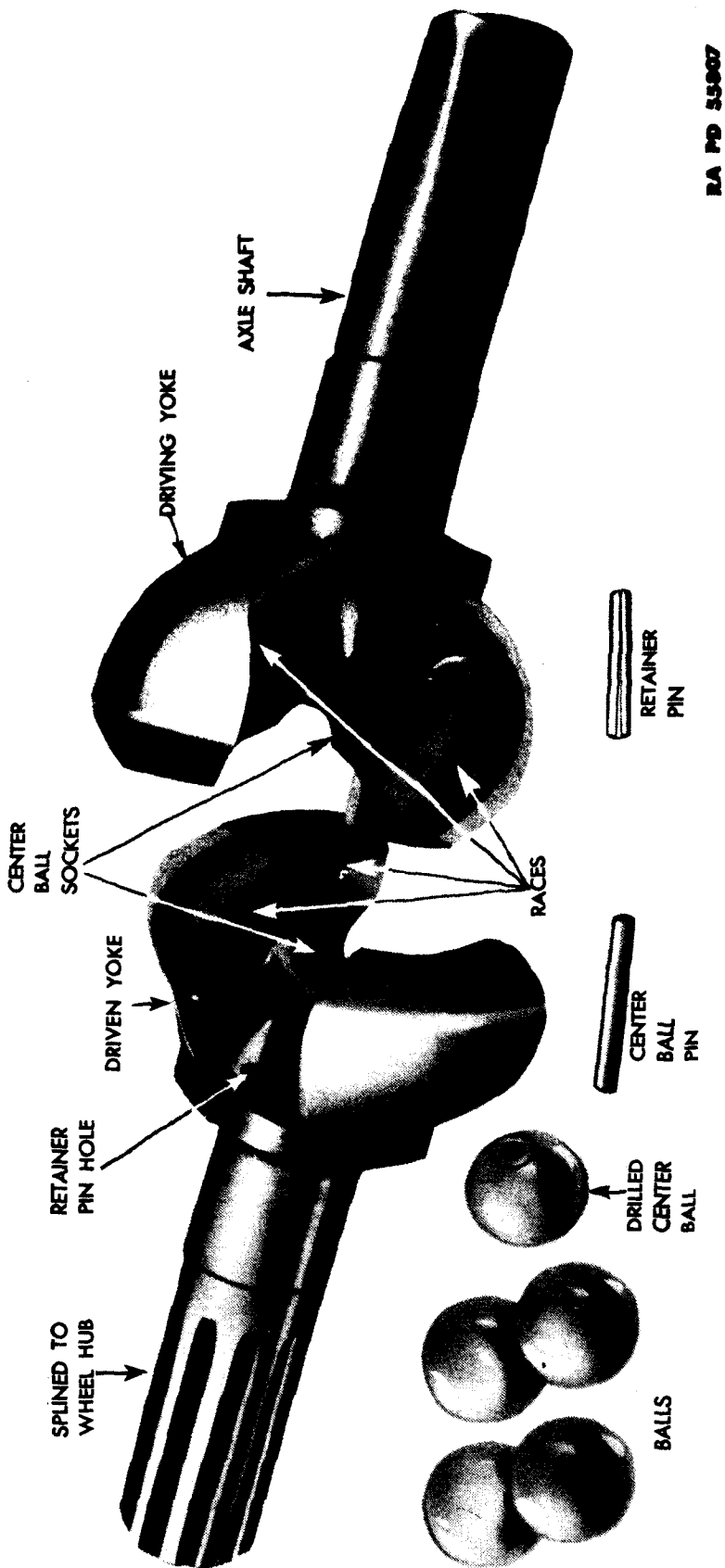
14. AXLE SHAFT.

a. **Removal Procedure** (fig. 8). Drain the oil from axle housing. Remove the wheel, drive flange and plate hub, brake flange plate assembly and spindle as instructed in paragraph 13. After spindle is removed, pull out the axle shaft.

b. **Axle Shaft Overhauling Procedure.**

(1) **DISASSEMBLE AXLE SHAFT** (fig. 9). Mark each yoke and all four driving balls, as they must be reassembled in the same relationship. Using a drift punch and hammer, drive out the retainer pin which locks the center ball pin (fig. 9). Bounce the wheel end of the shaft on a block of wood to cause the center ball pin to move

OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE



DA PD 55907

Figure 10 - Axle Shaft Universal Joint Disassembled

**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**



**Figure 11 — Installing
Center Ball Retainer Pin**

into the drilled passage in the wheel end of the shaft. Push one half of the joint down, and with the fingers turn the center ball until the groove in the center ball lines up with one of the other balls, then swing the joint to an angle to permit one of the driving balls to pass through the groove in the center ball. The remaining three driving balls and center ball will then drop out.

(2) **INSPECT PARTS** (fig. 10). Inspect the balls and ball races. If the center ball is scored or damaged, it should be replaced. If the four outer balls or races in the two halves of the shaft are damaged, it will be necessary to replace the complete axle shaft assembly. Inspect the bushing and thrust washer surfaces and, if they are scored or damaged, the complete shaft must be replaced.

(3) **ASSEMBLE AXLE SHAFT** (figs. 11 and 12). Drop the center ball pin into the drilled passage in the wheel end of the shaft. Place the differential half of the shaft in a bench vise. **NOTE:** *Ground portion of shaft should be above vise jaws.* Install center ball (one with groove and hole drilled in it) in its socket in the shaft, hole and groove facing operator. Place the wheel end of joint on the center ball. Then slip three driving balls into the races. Turn center ball until the groove in it lines up with the race for the remaining ball. The joint should now be tipped to extreme angle to slip the fourth driving ball into the race. Then straighten up the wheel end of shaft. Reach in with fingers and turn the center ball until the center ball pin drops in hole in the center ball. Install the retainer pin and prick punch both ends to securely lock it in place. Use a new retainer pin if available. This universal joint is designed to have a limited amount of end play after being installed in the axle. This end play is controlled by two bronze thrust washers, one in the end of the housing and the other in the spindle.

OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE

**Figure 12 – Installing Uni-
versal Joint Balls**



RA PD 32333

c. Installation Procedure.

(1) **INSTALL AXLE SHAFT.** Pack the universal joint with universal gear lubricant. Push the axle shaft into the housing, rotate the shaft slightly to pick up the splines in the differential side gear. Lubricate the shaft where it contacts the bushing and thrust washer in the steering knuckle.

(2) **ASSEMBLE OUTER END** (fig. 15). Install spindle, brake flange plate, deflector, hub, drum, flange, wheel and tire, etc., as instructed in paragraph 13 d.

(3) **REFILL HOUSING WITH LUBRICANT.** Remove the filler plugs from the housing and both spherical balls and inject enough universal gear lubricant to bring the level to the filler plug. Install filler plugs with gaskets.

15. THRUST WASHERS.

a. General. Thrust washers are located in the ends of the axle housing and also in each spindle. To gain access to the thrust washers, it is necessary to remove the axle shaft as instructed in paragraph 14.

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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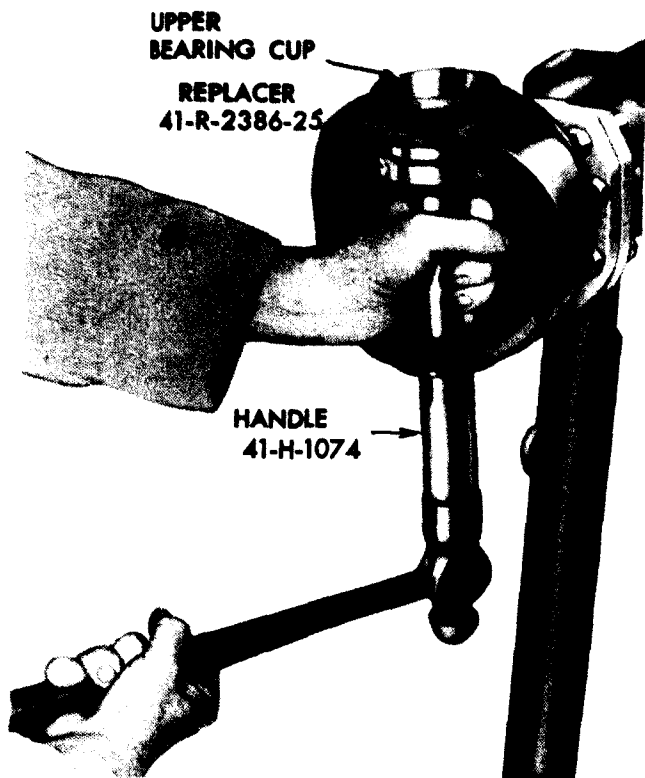


Figure 13 — Removing
Upper Trunnion Bearing
Cup and Oil Retainer

RA PD 317022

b. Replacement Procedure.

(1) REMOVE THRUST WASHERS (fig. 6). Pry out the old thrust washers and remove any burrs in the recess that were caused by the staking.

(2) INSTALL THRUST WASHERS (fig. 6). Place thrust washer in recess and stake in three places around the edge, using care not to distort the washer while staking. The washers are right- and left-hand; the right-hand washers must be used on the right side of vehicle and the left-hand washers must be used on the left side of vehicle. To determine right from left, look at the oil groove side of washer, and if the groove leaves the inner circle in a clockwise direction, the washer is a right-hand washer.

c. Assembly Procedure. Inspect all the parts for wear or other damage and replace all parts that are faulty. Install the axle shaft, spindle, brake flange plate, oil deflector, hub, drum, wheel and tire, lubricant, etc., as instructed in paragraph 14.

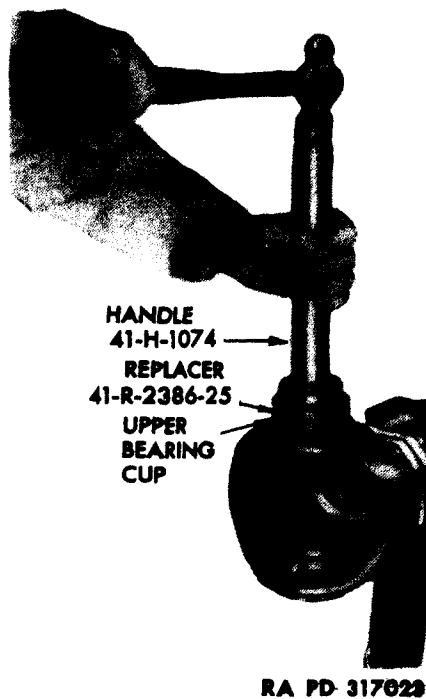
16. STEERING KNUCKLE SUPPORT AND/OR TRUNNION BEARINGS.

a. Removal Procedure.

(1) REMOVE DRAIN PLUG AND DRAIN OIL.

OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE

**Figure 14 – Installing
Upper Trunnion Bearing
Cup and Oil Retainer**



(2) **REMOVE THE AXLE SHAFT.** Remove the axle shaft as instructed in paragraph 14.

(3) **REMOVE STEERING KNUCKLE SUPPORT AND/OR TRUNNION BEARINGS** (fig. 15). Remove the 12 cap screws that attach the outer end seal retainer and pry the retainer off the support. Remove the four nuts and lock washers from each trunnion at the top and bottom of each steering knuckle support. Lift off the trunnions, shims, bearings and the steering knuckle support. **NOTE:** *Tie the shims to the trunnions from which they were removed, and mark the trunnions so that they can be replaced accurately.*

b. Trunnion Bearing Cup Replacement Procedure.

(1) **REMOVE CUPS** (fig. 13). Place the removing end of the trunnion bearing cup replacer (41-R-2386-25 and handle 41-H-1074) in position in the top cup as shown in figure 13, and drive out the top cup. Turn the tool upside down and drive out the lower cup in the same manner.

(2) **INSTALL CUPS** (fig. 14). Place oil retainer in top recess. Place top cup in position and drive it in until it bottoms against the oil retainer and the shoulder in the recess. Use replacer (41-R-2386-25). Place lower cup in position in lower recess, and drive it in until it bottoms against the shoulder in the recess.

c. Assembling Procedure. Inspect all the parts for wear or other damage, and replace all parts that are faulty. A layout of the parts is shown in figure 15.

ORDNANCE MAINTENANCE - CHASSIS, HULL, AND TURRET FOR
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RA PD 32777

Figure 15 - Front Wheel Hub and Steering Knuckle Parts

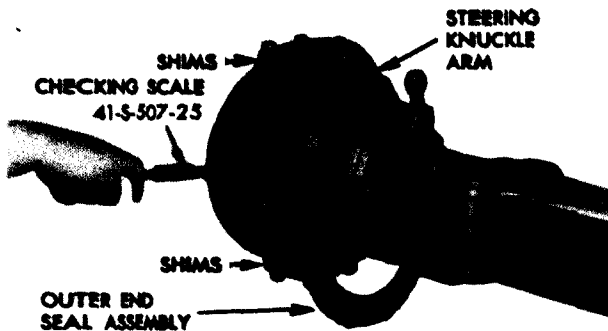
OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE

- A**—PLATE, FRONT AXLE DRIVE FLANGE
- B**—GASKET, FRONT AXLE DRIVE FLANGE PLATE
- C**—LOCK, AXLE SHAFT BOLT
- D**—FLANGE, FRONT AXLE DRIVE
- E**—GASKET, AXLE DRIVE FLANGE
- F**—NUT, WHEEL HUB ADJUSTING
- G**—LOCK, WHEEL HUB NUT
- H**—NUT, WHEEL HUB ADJUSTING
- I**—WASHER, WHEEL HUB NUT
- J**—CONE, OUTER WHEEL ROLLER BEARING
- K**—CUP, OUTER WHEEL ROLLER BEARING
- L**—DRUM, WHEEL HUB AND BRAKE ASSEMBLY
- M**—CUP, INNER WHEEL ROLLER BEARING
- N**—CONE, INNER WHEEL ROLLER BEARING
- O**—SEAL, WHEEL INNER BEARING OIL
- P**—DEFLECTOR, WHEEL HUB INNER OIL
- Q**—PLATE, FLANGE, AND BRAKE ASSEMBLY
- R**—SPINDLE, WHEEL
- S**—WASHER, FRONT AXLE UNIVERSAL JOINT THRUST
- T**—BUSHING, AXLE SHAFT OUTER END
- U**—GASKET, STEERING KNUCKLE SUPPORT
- V**—ARM, STEERING KNUCKLE
- W**—RING, STEERING KNUCKLE SUPPORT STUD DOWEL
- X**—TRUNNION, FRONT AXLE
- Y**—SHIMS, STEERING KNUCKLE BEARING
- Z**—SUPPORT, STEERING KNUCKLE
- AA**—BUSHING, TIE ROD YOKE BOLT
- BB**—TRUNNION, AXLE
- CC**—SHAFT, AXLE, AND JOINT, UNIVERSAL ASSEMBLY
- DD**—CONE, TRUNNION BEARING
- EE**—CUP, TRUNNION BEARING
- FF**—RETAINER, STEERING KNUCKLE TRUNNION BEARING OIL
- GG**—OUTER END, FRONT AXLE HOUSING ASSEMBLY
- HH**—GASKET, FRONT AXLE HOUSING OUTER END SEAL RETAINER
- II**—SEAL, AXLE HOUSING OUTER END ASSEMBLY
- JJ**—GASKET, FRONT AXLE HOUSING OUTER END FLANGE
- KK**—HOUSING, FRONT AXLE

RA PD 32777A

Figure 15 — Nomenclature for Fig. 15

**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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**Figure 16 — Checking Load
on Knuckle Support
Trunnion Bearings**

RA PD 317024

(1) **INSTALL STEERING KNUCKLE SUPPORT** (fig. 15). Fill upper trunnion bearing cups with universal gear lubricant, and place the bearings in the cups. Place the same shims and trunnion that was removed, on the right side, and the same shims and steering arm on the left side. Install the four lock washers and nuts on each side. Fill the lower trunnion cups with lubricant, then support the bottom of the knuckle support, and place in position the same shims and trunnions that were removed. Install the four lock washers and nuts. Tighten all 16 nuts securely.

(2) **CHECK AND/OR ADJUST TRUNNIONS** (fig. 16). Hook the end of the checking scale (41-S-507-25) in the tie rod bolt hole as shown in figure 16, and read the scale while moving the steering knuckle support. The scale should read between 25 and 30 pounds. Adjustment is obtained by adding or removing shims until a pull of 25 to 30 pounds is obtained. Shims are serviced in 0.002-inch, 0.005-inch, 0.010-inch, and 0.032-inch thicknesses.

(3) **ASSEMBLE OUTER END SEAL RETAINER** (fig. 15). Place a new gasket on the inner side of the knuckle support. Spread a coating of grease on the lips of the seal, and on the spherical ball. Place the seal and retainer in position on the knuckle support, and install the 12 cap screws and lock washers. Tighten the cap screws securely.

(4) **ASSEMBLE OUTER END** (fig. 15). Assemble axle shaft, spindle, brake flange plate, oil deflector, hub, drum, wheel, etc., as instructed in paragraph 14.

(5) **REFILL WITH LUBRICANT**. Remove drain plug in axle housing, and in both spherical balls, and fill the housing and spherical balls until the lubricant is level with the filler holes. Install drain plugs.

17. HOUSING OUTER END SEAL.

a. Removal Procedure.

(1) **DRAIN OIL**. Remove the drain plug in the axle housing and drain the oil into a drain pan.

OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE



RA PD 32785

Figure 17 – Separating Flanges

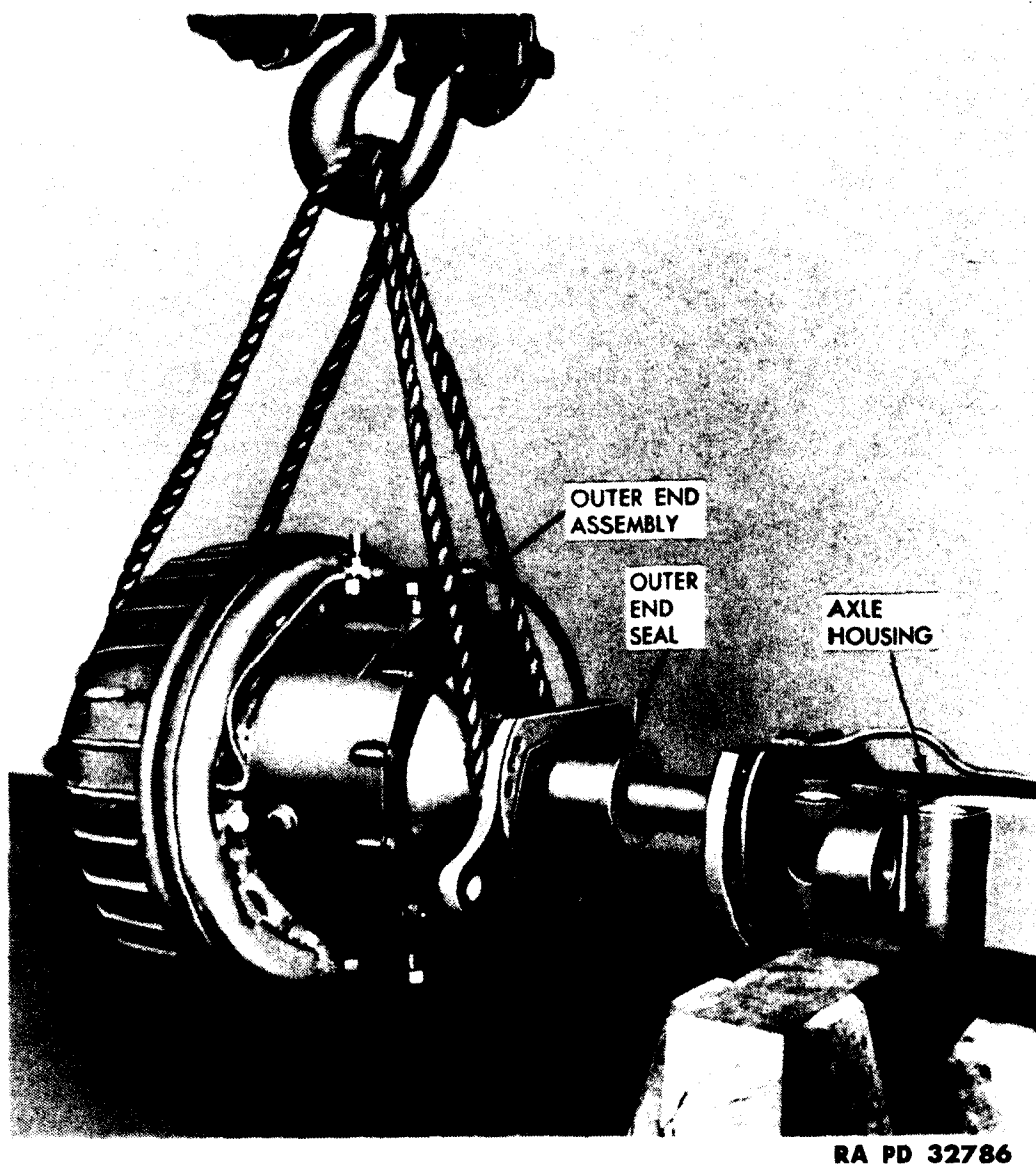
(2) **REMOVE WHEEL AND TIRE ASSEMBLY.** Jack up the front end of the vehicle and remove the wheel and tire assembly as instructed in paragraph 13.

(3) **SUPPORT AXLE HOUSING END ASSEMBLY** (fig. 17). Make a sling out of a suitable rope or chain, and use a chain hoist to support the outer end assembly as shown in figure 17.

(4) **REMOVE AXLE HOUSING END ASSEMBLY** (fig. 17) Unscrew the brake line fitting from the inner end of hose. Remove the nine bolts and nuts from the flange. Screw two of the bolts in the tapped holes as shown in figure 17 to separate the flanges, then slide the assembly out until the axle shaft clears the housing.

(5) **REMOVE OUTER END SEAL** (fig. 18). Lower the assembly to the floor and remove the sling. Remove the 12 cap screws that retain the seal and retainer to the knuckle support, and slide the retainer over the flange and off the axle shaft. **NOTE:** *If the retainer will not slip over the shock absorber bolt boss and axle shaft, it will be necessary to remove the drum, hub, brake flange plate, spindle and axle shaft as instructed in paragraph 13.*

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RA PD 32786

Figure 18 — Replacing Outer End Assembly

b. Assembly Procedure.

(1) **INSTALL SEAL AND RETAINER.** Place a new gasket on the retainer. Spread a coating of grease on the lip of seal and on the spherical ball. Slide the seal and retainer over the axle shaft and over the flange, and install the 12 cap screws and lock washers. Tighten the cap screws securely.

(2) **ASSEMBLING OUTER END.**

(a) **Assemble Outer End Assembly to Housing** (fig. 18). Place rope or chain sling around the assembly and raise the assembly so it can be slid into the housing. Place new gasket over axle shaft and into position on flange and slide the assembly into position in housing.

OPERATIONS THAT CAN BE PERFORMED WITH FRONT AXLE IN VEHICLE

Install the nine bolts, nuts and lock washers, and tighten them securely. Connect the brake hose to the fittings. Install the wheel with tire, and tighten the ten wheel nuts securely. Bleed the brake system as instructed in paragraph 72.

(b) *Assemble Outer End* (fig. 15). If the outer end was disassembled, install the axle shaft, spindle, brake flange plate, brake hose, spindle, hub, drum, flange, wheel and tire, etc., and bleed brakes as instructed in paragraph 13.

(3) **REFILL HOUSING WITH LUBRICANT.** Remove the filler plug and fill the housing with universal gear lubricant to the filler plug level. Install filler plug and road-test vehicle. If outer ends were disassembled, remove the filler plug in the spherical balls, inject lubricant until it is level with the filler hole, and install the filler plug.

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CHAPTER 2

FRONT AXLE (Cont'd)

Section IV

REMOVAL

Front axle assembly removal	Paragraph 18
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18. FRONT AXLE ASSEMBLY REMOVAL.

a. Block Wheels and Drain Oil. Block all four wheels securely. Remove drain plug and drain the oil into a drain pan.

b. Disconnect Radius Rods. Remove the cotter pin and castellated nut from the two radius rod ball studs at the housing and tap the tapered ball studs out of the bosses on the housing with a soft hammer.

c. Disconnect Shock Absorbers. Remove the cotter pin and castellated nut from the two shock absorber ball studs in the housing outer ends, and tap the tapered ball studs out of the bosses with a soft hammer.

d. Disconnect Steering Connecting Rod (fig. 30). Remove the cotter pin and unscrew the end plug from the axle end of the steering connecting rod until the spring tension is relieved, and the rod can be lifted off the ball. Lift the dust seal, spring, and retainer off the ball.

e. Lash Steering Arm to Housing. Using a heavy wire, lash the steering arm ball stud to shock absorber boss from both sides of the housing, to prevent the outer ends of the housing from turning in either direction. Wheels should be lashed in straight-ahead position.

f. Support Differential Carrier (fig. 37). Roll a floor jack under the differential carrier to support the weight of the differential carrier. Put a slight strain on the jack.

g. Disconnect Propeller Shaft Universal Joint. Remove the four bolts and nuts from the universal joint flanges at the axle end, and lower the end of the propeller shaft to the floor.

h. Raise Front End of Vehicle (fig. 20). Catch the hooks from two heavy (10-ton) chain hoists in the lifting rings at the front of the vehicle, and raise the front end of vehicle until the load is just off the front springs. Block up the hull with suitable blocking.

REMOVAL



Figure 19 — Pulling Spring Shackle Pin

i. **Disconnect Brake Hose.** Unscrew the connector bolt that retains the brake hose to the connector on the top of the tunnel alongside the assistant driver.

j. **Disconnect Vent Hose.** Unscrew the connector bolt from the block in the tunnel above the axle housing that retains the vent hose to the block. Remove the cap screw that retains the vent hose clip to the tunnel.

k. **Remove Front Shackle Pins** (fig. 19). Remove the nut and lock washer from the lock pins in each of the lower shackle pins, and drive out the lock pins. Remove the lubrication fitting adapters and install the shackle pin remover (41-R-2389-26) as shown in figure 19. Pull out both lower shackle pins.

l. **Remove Rear Shackle Pins** (fig. 19). Remove the nut and lock washer from the lock bolt on the lower shackle pin on the left side of the vehicle. Remove the nut and lock washer from the lock bolt on the upper shackle pin on the right side of the vehicle, and drive out the lock pins. Remove the lubrication fitting adapters from the

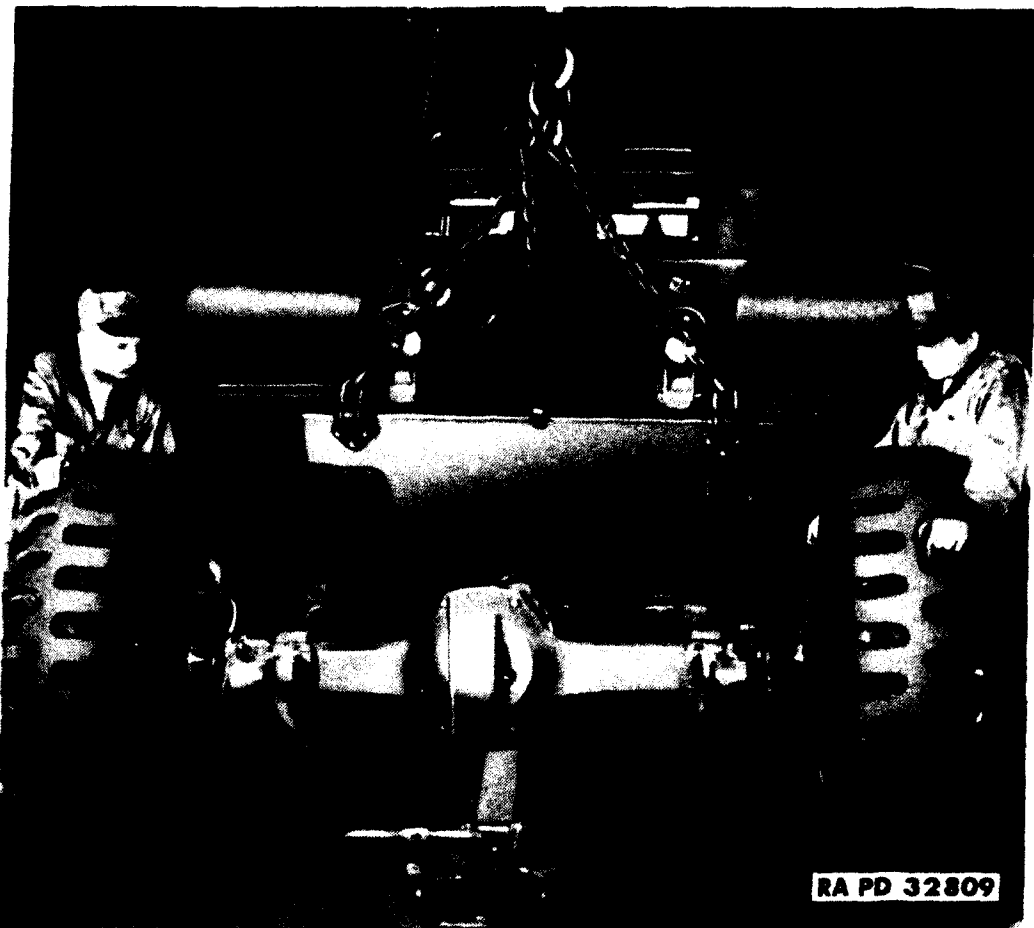
ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
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Figure 20 – Removing Front Axle Assembly

same shackle pins, install the shackle pin remover (41-R-2389-21 with handle 41-H-1074) as shown in figure 19, and pull out both shackle pins.

m. **Remove the Assembly** (fig. 20). Raise vehicle until it clears the axle housing, and roll out the assembly carefully so that the floor jack does not slip off the differential carrier assembly.

n. **Remove Front Springs**. When replacing the housing or complete assembly, remove the eight nuts and lock washers that retain the springs to the housing, and lift off the springs.

CHAPTER 2
FRONT AXLE (Cont'd)

Section V

DISASSEMBLY

	Paragraph
Cleaning	19
Disassembly of outer ends	20
Removal of differential carrier assembly	21
Disassembly of differential carrier assembly	22

19. CLEANING.

a. Clean the axle assembly thoroughly with cleaning solution and, as the parts are disassembled, they can be placed in a tank containing cleaning solution and permitted to soak so that they will be easier to clean. **CAUTION:** *Do not let leather or rubber parts soak in the solution as the solution will cause the rubber and leather to deteriorate.*

20. DISASSEMBLY OF OUTER ENDS.

a. **Block Up Assembly** (fig. 17). Loop a chain around the hypoid pinion drive flange. Hitch the chain to the hook of a chain hoist, and raise carrier into a vertical position above the axle housing. Jack up one end of the assembly and place it on a suitable block so that wheel is just clear of the ground. Then block up the other side in the same manner. **NOTE:** *Keep carrier in a vertical position above the housing.*

b. **Remove Axle Shafts** (fig. 15). Remove wheels with tires, drums, hubs, brake flange plate, spindle, axle shafts, etc., as instructed in paragraph 13.

21. REMOVAL OF DIFFERENTIAL CARRIER ASSEMBLY.

a. Remove the four through bolts and nuts and the eight nuts and lock washers that retain the carrier assembly to the housing. Use chain hoist to lift the carrier assembly out of the housing.

22. DISASSEMBLY OF DIFFERENTIAL CARRIER ASSEMBLY.

a. **Equipment** (fig. 32). A special puller has been designed for use in several different operations in rebuilding both the front and rear differential carrier assemblies. Figure 32 shows a layout of the different combinations in which the tool can be used. Additional special tools are listed at the start of each paragraph.

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RA PD 32776

Figure 21 — Front Axle and Differential Parts Layout

DISASSEMBLY

- A**—LOCK RING, BEARING RETAINING NUT
B—NUT, BEARING RETAINING
C—WASHER, PINION FLANGE
D—FLANGE, HYPOID PINION (WITH DEFLECTOR)
E—RETAINER, HYPOID PINION THRUST BEARING
F—GASKET, HYPOID PINION RETAINER
G—PACKING, HYPOID PINION BEARING
H—RETAINER, HYPOID PINION BEARING PACKING
I—SEAL, HYPOID PINION BEARING OIL
J—BEARING, HYPOID PINION THRUST
K—SHIM, HYPOID PINION THRUST BEARING
L—PINION AND SHAFT, HYPOID DRIVE
M—BEARING, HYPOID PINION RADIAL
N—LOCK RING, HYPOID PINION RADIAL BEARING
O—CARRIER, DIFFERENTIAL
P—RETAINER, HYPOID DRIVE GEAR THRUST BEARING
Q—GASKET, HYPOID DRIVE GEAR THRUST BEARING RETAINER
R—LOCK NUT, THRUST PAD SCREW
S—SCREW, THRUST PAD (WITH PAD)
T—OIL TRAP, THRUST PAD
U—COVER, DIFFERENTIAL CARRIER
V—DOWEL SLEEVES, DIFFERENTIAL CARRIER COVER
W—GASKET, DIFFERENTIAL CARRIER COVER
X—CAP, DIFFERENTIAL CARRIER BEARING
Y—DOWELS, DIFFERENTIAL CARRIER BEARING CAP
Z—LOCK RING, HYPOID DRIVE GEAR THRUST BEARING NUT
AA—NUT, HYPOID DRIVE GEAR THRUST BEARING
BB—BEARING, HYPOID DRIVE GEAR THRUST
CC—GEAR, HYPOID DRIVE
DD—PINION, HERRINGBONE DRIVE
EE—RACE, HYPOID DRIVE GEAR RADIAL BEARING INNER
FF—RACE, HYPOID DRIVE GEAR RADIAL BEARING AND OUTER
GG—GASKET, HYPOID DRIVE GEAR RADIAL BEARING RETAINER
HH—RETAINER, HYPOID DRIVE GEAR RADIAL BEARING
II—LOCK RING, DIFFERENTIAL BEARING
JJ—RACE, DIFFERENTIAL BEARING AND OUTER
KK—RACE, DIFFERENTIAL BEARING INNER
LL—CASE, DIFFERENTIAL (LONG HALF)
MM—WASHER, DIFFERENTIAL SIDE GEAR THRUST
NN—GEARS, DIFFERENTIAL SIDE
OO—PINIONS, DIFFERENTIAL
PP—WASHERS, DIFFERENTIAL PINION THRUST
QQ—SPIDER, DIFFERENTIAL PINION
RR—BOLT, DIFFERENTIAL CASE
SS—GEAR, DIFFERENTIAL HERRINGBONE
TT—CASE, DIFFERENTIAL (SHORT HALF)
UU—HOUSING, AXLE
VV—GASKET, DIFFERENTIAL CARRIER TO AXLE HOUSING

RA PD 32776A

Figure 21 — Nomenclature for Fig. 21

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
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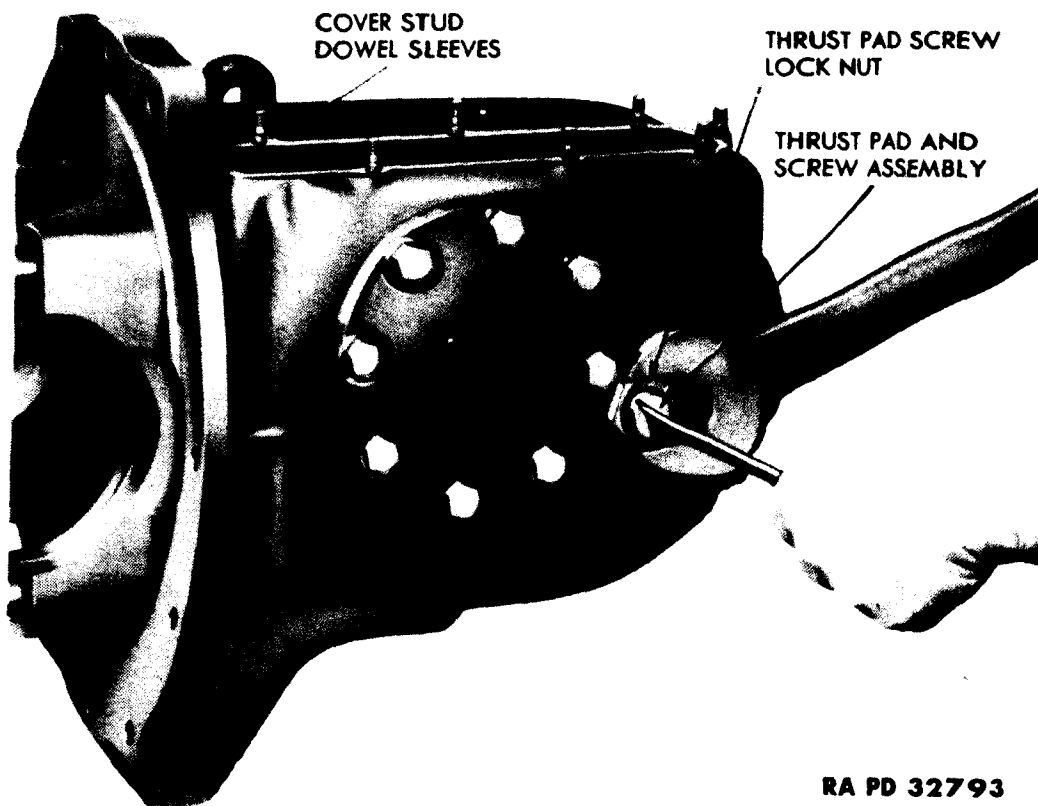


Figure 22 – Adjusting Hypoid Drive Gear Thrust Pad

h. Disassembly Procedure (fig. 21).

(1) **REMOVE HERRINGBONE DRIVE ASSEMBLY.** Place assembly on a suitable bench. Use a cold chisel and mark the differential carrier and bearing caps so that they can be reinstalled in the same position. Remove the two nuts and lock washers from each cap, and tap the caps off the studs with a soft hammer. Lift the dowel sleeves off the studs. Lift the herringbone drive assembly out of the carrier, being careful not to drop the differential case side bearings.

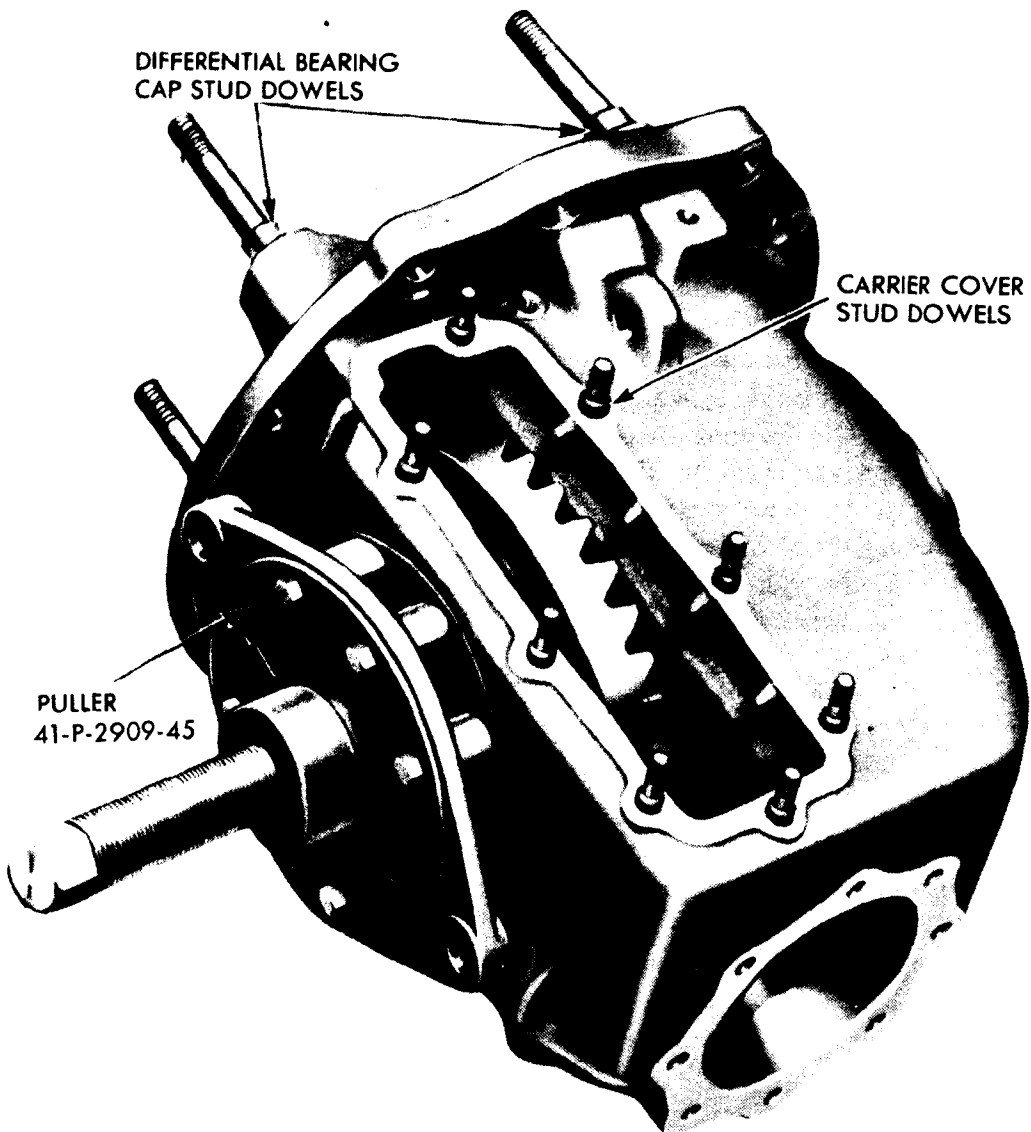
(2) **REMOVE DIFFERENTIAL CARRIER COVER (fig. 21).** Remove the eight nuts and lock washers that retain the cover, and lift off the cover, gasket, and dowel sleeves.

(3) **REMOVE DRIVE GEAR THRUST BEARING RETAINER (fig. 21).** Remove the eight cap screws and lock washers that attach the retainer, and lift off the retainer, gasket, and dowel sleeves.

(4) **REMOVE HERRINGBONE PINION RADIAL BEARING RETAINER (fig. 21).** Remove the 12 cap screws and lock washers that attach the retainer, and lift off the retainer and gasket.

(5) **REMOVE THRUST PAD SCREW (fig. 22).** Loosen the thrust pad screw lock nut and remove the screw with thrust pad.

DISASSEMBLY



RA PD 317026

Figure 23 – Removing Herringbone Drive Pinion

(6) REMOVE DRIVE GEAR BEARING RETAINER NUT (fig. 21). With a screwdriver, remove the hypoid drive gear thrust bearing retaining nut lock ring. Hold the differential and hypoid drive gear from turning by holding the hypoid drive pinion flange with a large wrench, or two punches and a bar, and unscrew the hypoid drive gear bearing nut, using retaining nut wrench (41-W-1624).

(7) INSTALL SPECIAL PULLER (fig. 23). Aline five of the six holes in the hypoid ring gear with five of the holes in the case. Install the special puller (41-P-2909-45) as shown in figure 23, using the

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
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five cap screws furnished with the puller. Tighten the cap screws alternately until the ring gear is pulled against the case.

(8) **REMOVE HYPOID DRIVE PINION.** Remove the eight nuts and lock washers that attach the hypoid drive pinion thrust bearing retainer to the carrier, pull out the pinion and bearing assembly, and lift out the shims.

(9) **REMOVE HERRINGBONE DRIVE PINION, RADIAL BEARING AND HYPOID DRIVE GEAR** (fig. 23). Turn the center bolt of the special puller in a clockwise direction to push the herringbone drive pinion and radial bearing out of the differential carrier and off the splines of the hypoid drive gear. Remove the five bolts from the puller, and lift the hypoid drive gear out of the differential carrier.

(10) **REMOVE HYPOID DRIVE GEAR THRUST BEARING** (fig. 21). Pilot head of bearing driver (41-R-2386-19) into position in the bearing through the opening in top of carrier. Pilot driver handle in place through the herringbone drive pinion side of the carrier. Drive against end of handle to remove the thrust bearing.

(11) **REMOVE PINION FLANGE AND RETAINER** (fig. 21). Place pinion flange in a vise and remove the lock ring with a screwdriver. Remove the bearing retaining nut with wrench (41-W-1624), tap off the flange, and lift off the retainer.

(12) **DISASSEMBLE DIFFERENTIAL CASE.** Remove the 12 differential case bolts, and tap the herringbone gear with a soft hammer to separate the two halves of the case. Lift off the gear, spider, pinions, side gears, and thrust washers.

CHAPTER 2
FRONT AXLE (Cont'd)

Section VI

CLEANING, INSPECTION, AND REPAIRING OF PARTS

	Paragraph
Cleaning	23
Inspection	24
Repairing	25

23. CLEANING.

a. Inspection and repairing of front axle component parts must be done with extreme care and cleanliness. All parts must be thoroughly cleaned, both inside and outside, and then dried with clean rags and air pressure from an air blow gun. **CAUTION:** *Do not allow bearings to be spun by the air stream; spinning the bearings with air pressure is liable to imbed small particles in the race and damage the bearings.* Individual damaged parts that are removed should be separated from the parts that are to be used again.

24. INSPECTION.

a. **Inspect Carrier and Housing** (fig. 21). Inspect the carrier and housings for cracks, scoring, or other damage. Tapping the case with a light hammer will sometimes divulge cracks that otherwise may not be discovered. If the case or housing are damaged in any way, replace them.

b. **Inspect Differential Case Halves.** Inspect the case halves for cracks, scoring, or other damage. Replace both halves if either half is damaged.

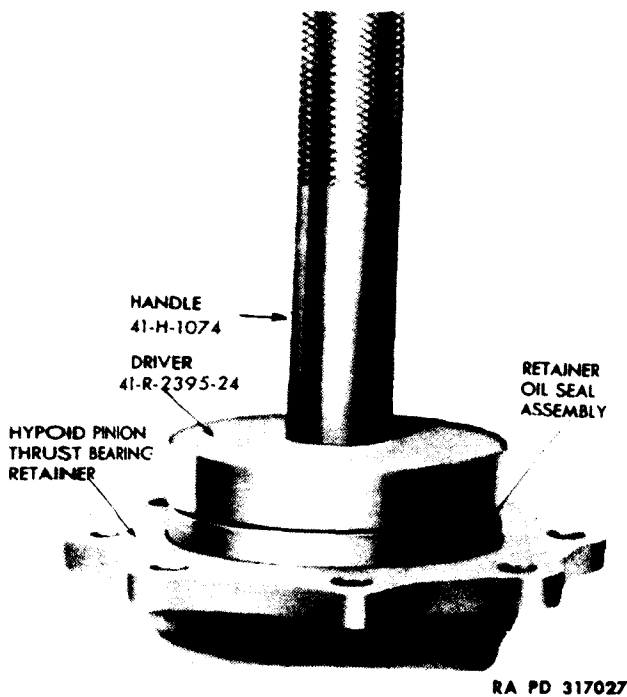
c. **Inspect Gears.** Inspect all gears for chipped or worn teeth, and scoring on bearing contact surfaces. Replace all gears that are damaged.

d. **Inspect Shafts and Splines.** Inspect the shafts and splines for excessive wear or other damage. Replace all parts that are damaged.

e. **Inspect Thrust Washers.** Inspect the thrust washers for wear, scoring, or other damage. Replace any damaged washers.

f. **Inspect Oil Seal.** Inspect the oil seal in the pinion drive bearing retainer. If it is damaged or worn, replace it. See paragraph 25.

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**Figure 24 – Installing
Hypoid Pinion Thrust
Bearing Retainer
Oil Seal**

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g. Inspect Bearings. Drop a few drops of light engine oil on the bearings, and turn the outer race slowly by hand, at the same time noting any roughness. Also check them for scoring, cracks, or other damage. Replace any damaged bearings.

25. REPAIRING.

a. Oil Seal Replacement Procedure.

(1) **REMOVE SEAL** (fig. 24). Pry out the oil seal from the hypoid pinion bearing retainer, and lift out the packing retainer and packing.

(2) **INSTALL NEW SEAL** (fig. 24). Place new packing in the recess and place packing retainer on top of packing. Place new oil seal in position in recess with open end of leather toward the top (toward transfer case), and drive the seal in until the outer edge is flush with the bottom edge of the chamfered inner edge of the recess. Use oil seal replacer (41-R-2395-24 with handle 41-H-1074).

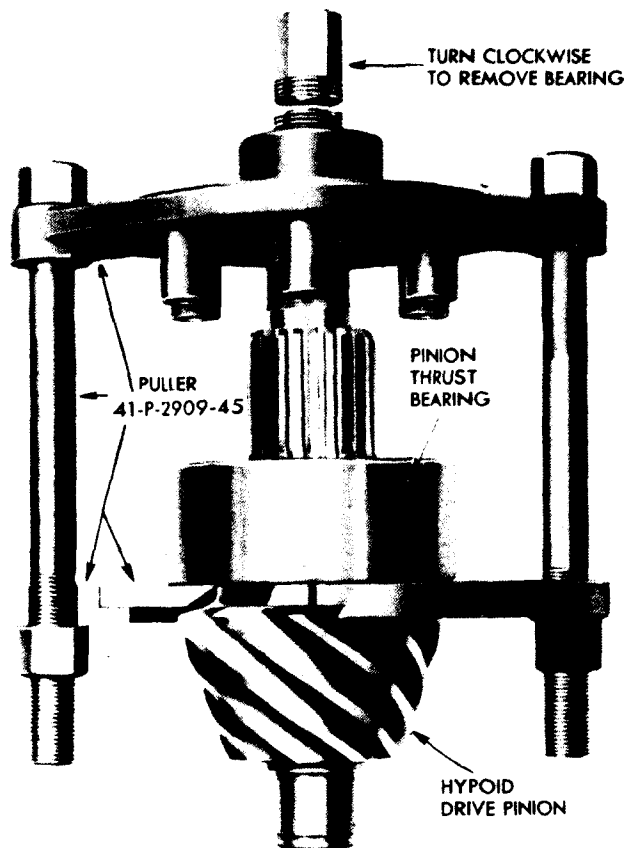
b. Hypoid Drive Pinion Shaft and/or Bearing Replacement.

(1) **REMOVE HYPOID PINION THRUST BEARING** (fig. 25). Place puller assembly (41-P-2909-45) over spline end of pinion shaft and place the two halves of the press plate under bearing as shown in figure 25. Turn center screw in a clockwise direction to push the shaft out of bearing.

(2) **REMOVE HYPOID PINION RADIAL BEARING** (fig. 44). Remove the lock ring with a screwdriver. Place puller assembly (41-P-2909-

CLEANING, INSPECTION, AND REPAIRING OF PARTS

Figure 25 – Removing Hypoid Pinion Thrust Bearing



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45) over the pinion end of shaft, and place the two halves of the press plate under the radial bearing. Turn the center screw of the puller in a clockwise direction to push the shaft out of the bearing.

(3) **INSTALL HYPOID PINION THRUST BEARING.** Place bearing on shaft and place replacer (41-R-2394-165) over end of shaft. Place the assembly in a press and press the bearing on the shaft until it bottoms against the shoulder on the gear.

(4) **INSTALL HYPOID PINION RADIAL BEARING** (fig. 26). Place the bearing on the small end of the shaft with the chamfered side of the inner race toward the pinion. Place the replacer (41-R-2394-150) over the inner race of the bearing and place the assembly in a press and press the bearing on the shaft until it bottoms against the pinion. Place new lock ring over the tapered part of the lock ring replacer (41-R-2394-155) and center the pin of the replacer in the center hole of the shaft. Place the outer part of the lock ring replacer over the tapered part and drive the outer part down until the lock ring seats itself in the groove.

c. Differential Bearing Inner Race Replacement Procedure.

(1) **REMOVE INNER RACE** (fig. 27). Remove the lock ring that retains the inner race with a screwdriver. Place the special puller (41-P-2909-45) in position on the case as shown in figure 27. Place

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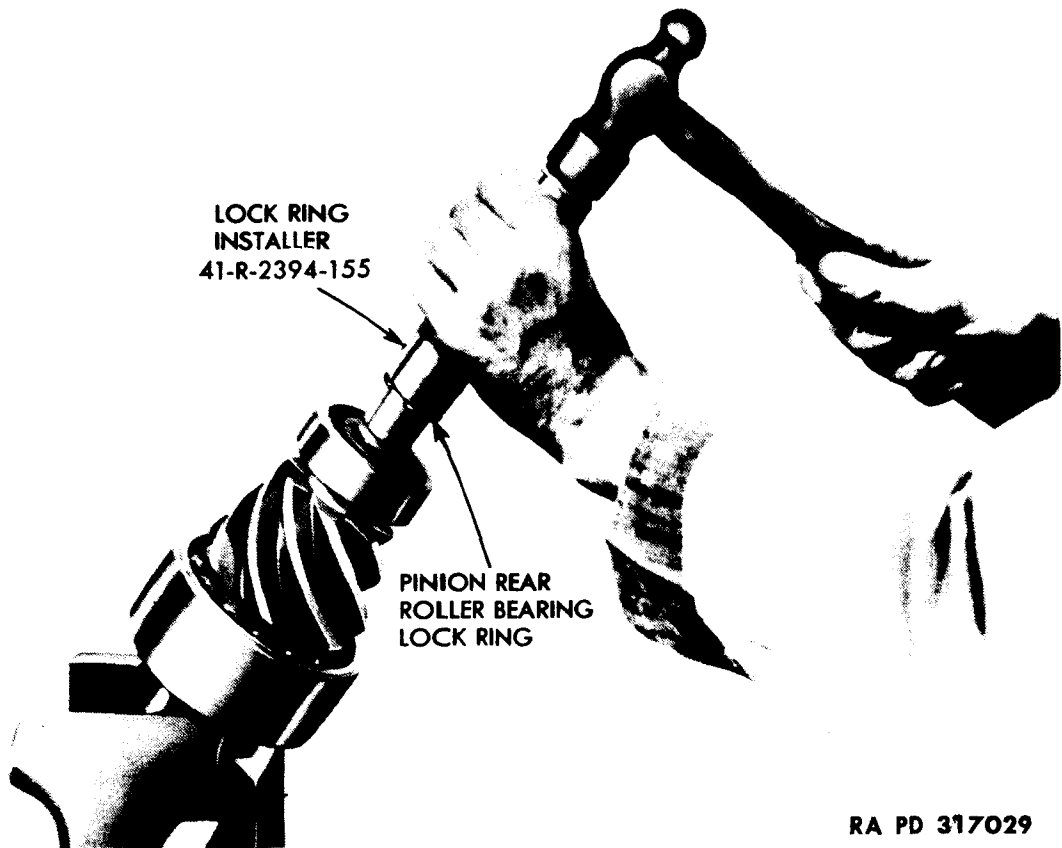


Figure 26 — Installing Lock Ring

the puller arms in the two notches in the case, and make sure that the puller arms fully engage the back surface of the race. Turn the center screw clockwise until the race is pulled off the case.

(2) **INSTALL INNER RACE** (fig. 21). Place race in position on case, and place the race replacer (41-R-2391-57) in position on the race. Press or drive the race on the case until it bottoms against the case. Install the lock ring and be sure it seats in the groove. One side of the inner bore has a chamfered edge, and the other side has a small radius; the side with the radius must be toward the case.

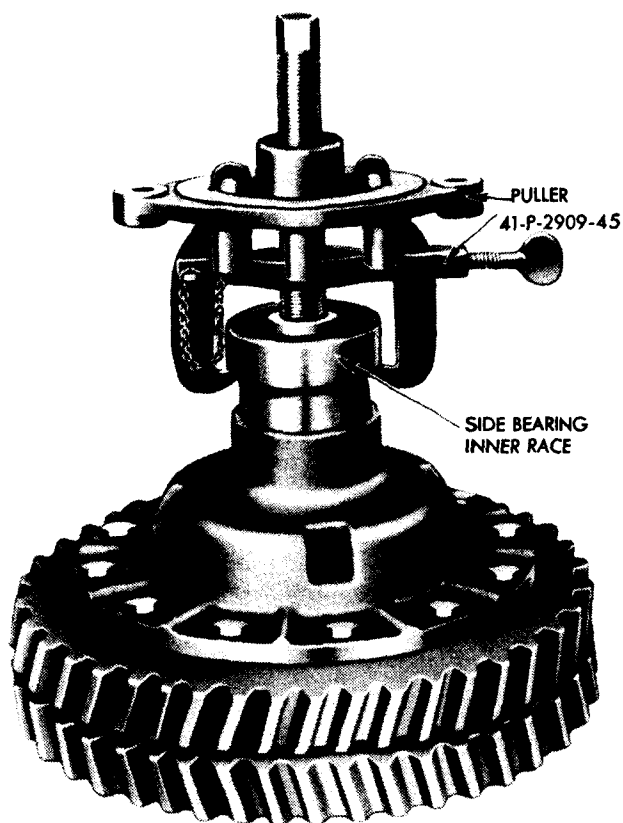
d. Herringbone Drive Pinion or Radial Bearing Inner Race Replacement Procedure (fig. 28).

(1) **REMOVE RADIAL BEARING INNER RACE.** Place puller assembly (41-P-2909-45) over end of pinion, and insert press plates under edge of race. Turn center screw clockwise to pull the race off the shaft.

(2) **INSTALL RADIAL BEARING INNER RACE** (fig. 21). Place race in position on shaft with wide edge of race toward the herringbone gear. Place race replacer (41-R-2394-77) on top of race, and press or drive the race on shaft until it bottoms against the gear.

CLEANING, INSPECTION, AND REPAIRING OF PARTS

*Figure 27 – Removing
Differential Side Bearing
Inner Race*



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ORDNANCE MAINTENANCE - CHASSIS, HULL, AND TURRET FOR
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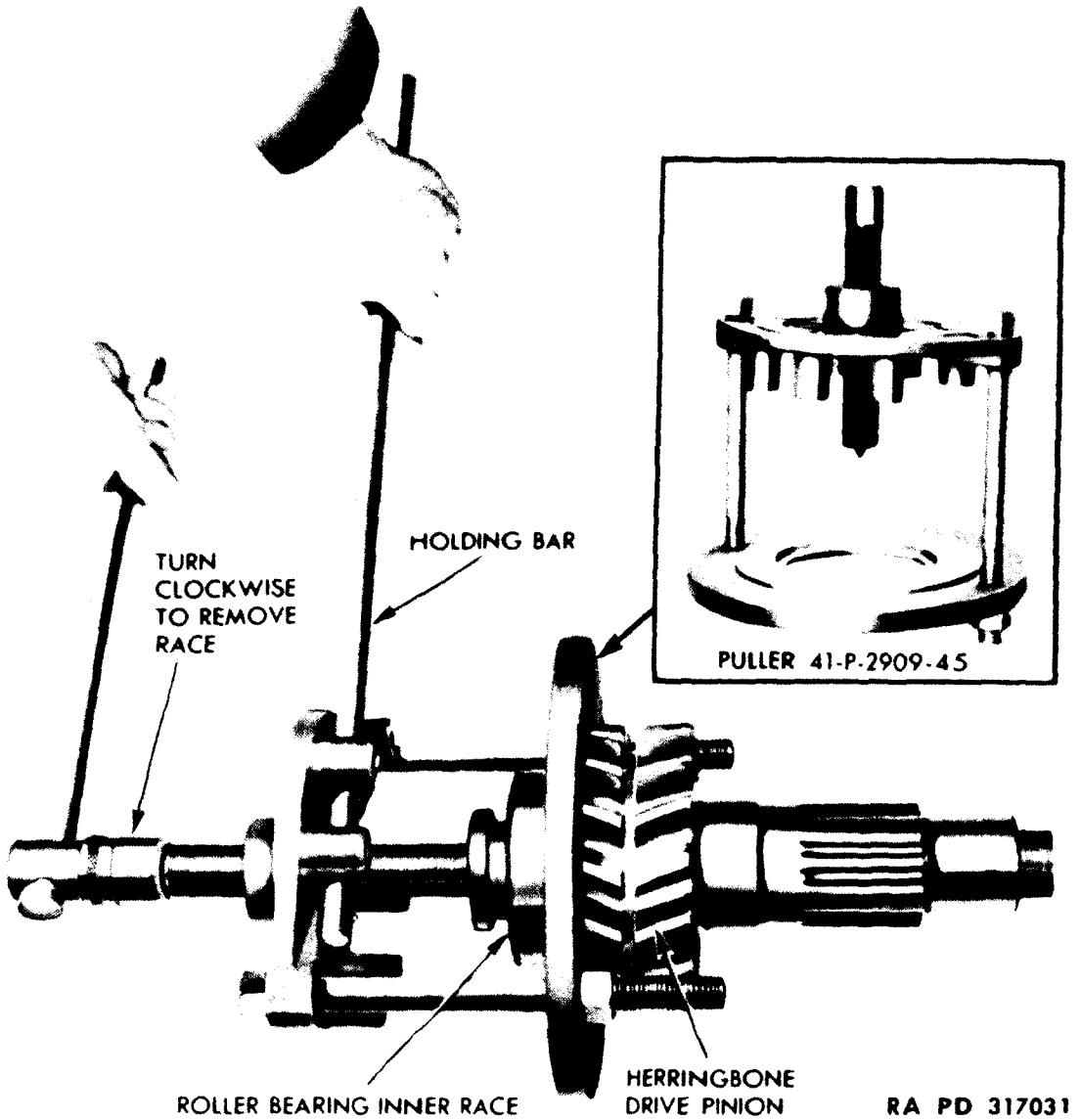


Figure 28 — Removing Herringbone Drive Pinion Radial Bearing Race

CHAPTER 2
FRONT AXLE (Cont'd)

Section VII
ASSEMBLY

	Paragraph
Assembling differential carrier assembly	26
Assembling carrier assembly to housing	27
Assembling outer ends	28

26. ASSEMBLING DIFFERENTIAL CARRIER ASSEMBLY.

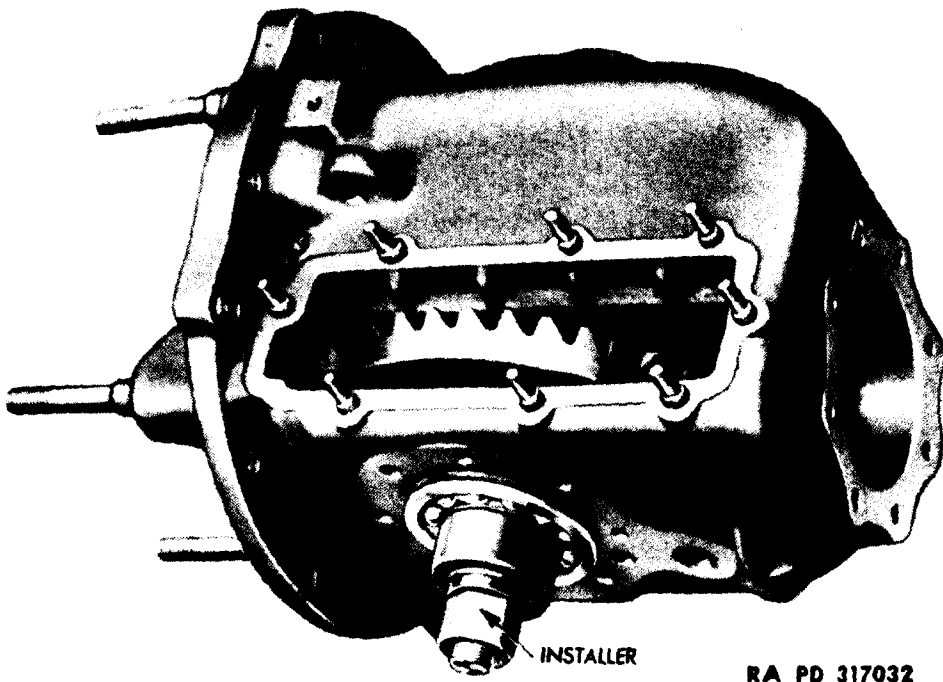
a. **Assemble Differential Case** (fig. 21). Spread a coating of grease on the side gears, pinion gears, spider, and thrust washers. Place the thrust washers in each half of the case, and place the side gears in each half of case. Place the pinion gears and thrust washers on the spider, and place the spider assembly in the long half of the case. Place herringbone gear on long half of case with recess side of gear up. Line up the gear holes with the holes in the long half of case and place the short half of case in position in gear, line up the holes in the short half of case with the other holes, and install the 12 bolts from the long to the short halves. Install the lock washers and nuts and tighten them to 95 to 115 foot-pounds.

b. **Assemble Hypoid Pinion Drive Assembly** (fig. 21). Place the hypoid pinion bearing retainer over the pinion shaft, then place the flange and washer on the shaft. Start the retainer nut and place flange in vise. Using wrench (41-W-1624), tighten nut securely at the same time lining up one of the lock ring holes in the nut with one of lock ring holes in the shaft. **NOTE: Do not back off the nut to line up the holes.** Install the lock ring.

c. **Install Hypoid Drive Gear Thrust Bearing.** Place the hypoid gear thrust bearing in case from the outside of case and using bearing replacer (41-R-2386-19), tap it in with a soft hammer until the stop ring seats on the machined surface of the case.

d. **Install Herringbone Pinion and Radial Bearing** (fig. 29). Place hypoid drive gear in carrier from the top. Slide herringbone drive pinion in from the left side of case engaging the tapered splines of the shaft in the splines of the drive gear hub. Place a suitable installer through bolt through the bore of the shaft from the radial bearing side, place the press plate, installer thrust bearing, and compression nut on the end of the bolt and turn the nut clockwise until it is fingertight. Slide the radial bearing and outer race over the inner race to keep the shaft in alignment with the bore while tightening the puller nut until it reaches a definite stop. **CAUTION: Hold**

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RA PD 317032

Figure 29 – Installing Herringbone Drive Pinion

the through bolt while tightening the nut, and keep the shaft in line with the bore.

e. Install Hypoid Pinion Assembly (fig. 21). Place new retainer gasket on flange face of transfer case. Place the same thickness of shims in pinion thrust bearing recess that were removed originally. Place the pinion shaft assembly in position in case and tap it in with a soft hammer until it bottoms. Install the eight retainer lock washers and nuts. Tighten nuts securely.

f. Install Herringbone Pinion Bearing Retainer Nut (fig. 1). Install herringbone pinion bearing retainer nut and tighten it securely while holding the hypoid pinion shaft flange. Line up a lock ring hole in the nut with a lock ring hole in the shaft. Do not back off the nut to line up the holes. Install lock ring.

g. Install Herringbone Pinion Radial Bearing Retainer. Place a new gasket on the retainer, and place retainer in position on case, then install the 12 retaining cap screws and lock washers. Tighten cap screws securely.

h. Install Hypoid Drive Gear Thrust Bearing Retainer and Adjust Pinion Depth (fig. 46).

(1) INSTALL HYPOID DRIVE GEAR THRUST BEARING RETAINER. Place a new gasket on the retainer and place the retainer in position on the case. Install the eight retaining cap screws and lock washers.

ASSEMBLY

Tighten the cap screws securely, and check adjustment as instructed in the following step.

(2) HYPOID DRIVE GEAR AND PINION ADJUSTMENT PROCEDURE.

(a) *Lash Adjustment.* There is no adjustment between the hypoid drive pinion and hypoid drive gear, as the lash is held between 0.005 inch and 0.008 inch in manufacturing. If the lash is less than 0.005 inch or more than 0.008 inch, it will be necessary to change the drive gear and pinion.

(b) *Pinion Depth Adjustment* (fig. 46). Spread a thin coating of Prussian blue or red lead on both sides of a few of the teeth on the drive gear. Apply pressure back of drive gear to secure better tooth contact while rotating the gears both forward and backward by turning the pinion flange. Note the position of the tooth contacts on the drive gear. Refer to the drive gear in the center of figure 46 for the correct contacting areas. The four outer cuts of the illustration show the wrong points of contacts and the remedies to correct them. The adjusting shims are serviced in 0.018-inch, 0.020-inch and 0.022-inch sizes.

i. *Install Thrust Pad Screw* (fig. 22). Screw the thrust pad screw in place inside of case, and place a long 0.004-inch feeler gage between the back of the ring gear and the thrust pad, tighten the screw until the pad touches the feeler gage, then tighten lock nut. The clearance between the pad and the ring gear must be between 0.003-inch and 0.006-inch.

j. *Install Carrier Cover* (fig. 21). Place the eight dowels over the cover studs. Place new gasket in position over the studs. Place cover over studs and install the eight lock washers and nuts. Tighten nuts securely.

k. *Install Differential Case Assembly.* Place the four dowels over the carrier cap studs. Place the side bearings on the races on each end of the case and place the assembly into position in the carrier. Assemble each cap in the same position from which it was removed, and install the four retaining nuts and lock washers. Tighten the nuts very securely to 130-150 foot-pounds.

27. ASSEMBLING CARRIER ASSEMBLY TO HOUSING.

a. Place new gasket on housing. Lift carrier assembly with chain hoist and place the assembly in position in the housing, install the four through bolts and the eight lock washers and nuts that retain the carrier assembly to the housing. Tighten the through bolts and all retaining nuts securely.

28. ASSEMBLING OUTER ENDS.

a. Assemble the axle shafts, spindles, brake flange plates, oil deflectors, hubs, drums, drive flanges, wheels and tires, lubricant, etc., as instructed in paragraph 13.

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CHAPTER 2

FRONT AXLE (Cont'd)

Section VIII

INSTALLATION

Installation of front axle assembly.....	Paragraph 29
--	------------------------

29. INSTALLATION OF FRONT AXLE ASSEMBLY.

a. **Roll Assembly in Position under Vehicle** (fig. 20). Remove the stand jacks so that wheels rest on the floor. Support the differential carrier on a floor jack so that the carrier is in a horizontal position. Roll the assembly under the vehicle carefully so that the floor jack does not slip off the differential carrier. Lower vehicle until the rear of springs and shackles are nearly in line.

b. **Connect Radius Rods.** Start the radius rod ball studs in the bosses on the housing, and start the retaining nuts.

c. **Install Rear Shackle Pins.** Line up the spring and shackles at the rear end of the springs and install the shackle pins and lock bolts. Be sure to line up the groove in the shackle pins with the lock bolt hole before driving the shackle pins in place.

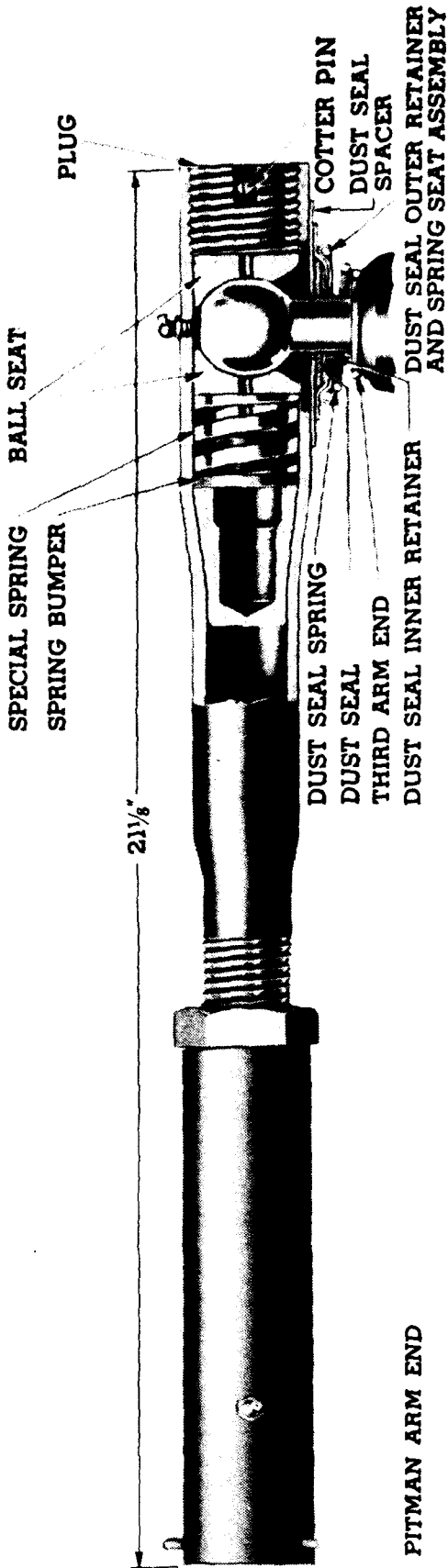
d. **Install Front Shackle Pins.** Lower the vehicle until the front springs line up with the shackles, and install the shackle pins and lock bolts. Be sure to line up the grooves in the shackle pins with the lock bolt holes before driving the shackle pins in place. Install the lubrication fitting adapters.

e. **Assemble Shock Absorber Links to Axle Assembly.** Remove the wire lashing, and start the tapered bolt at the end of each shock absorber link in the hole in the flange near the ends of the housing. Install the nuts and tighten them securely. Install the cotter pins and lock them securely.

f. **Assemble Brake Hose to the Connector.** Place the hose in position on the connector at the top of the housing and install the connector bolt. Be sure to use a new copper gasket under the head of the bolt, and between the hose and the connector. Tighten the bolt securely.

g. **Assemble Vent Hose to Housing.** Place the vent hose in position on the fitting in the tunnel, and install the connector bolt. Place the clip in position on the nut in the tunnel, and install the retaining cap screws. Tighten both bolts securely.

INSTALLATION



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Figure 30 — Steering Connecting Rod

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

h. Assemble Steering Connecting Rod to Steering Arm (fig. 30). Place dust seal assembly in position over ball joint on steering arm. Place end of steering connecting rod over the ball. **CAUTION:** *Be sure the spring bumper, spring, and the two ball seats are in the end of the rod, and that the ball is properly seated between the two seats as shown in figure 30.* Tighten the plug securely and back it off $\frac{1}{2}$ to 1 turn to line up the cotter pin hole. Install new cotter pin and lock securely.

i. Connect Universal Joint. Place the propeller shaft flange in position on the hypoid pinion flange, and install the four bolts, lock washers and nuts. Tighten the bolts and nuts securely. Lubricate the universal joint.

j. Tighten Radius Rod Nuts. Tighten the radius rod nuts securely and lock in place with cotter pins. Remove the chain hoist.

k. Bleed Brake System. Bleed the brake system as instructed in paragraph 72.

l. Check Toe-In Measurement. Check the toe-in measurement and adjust if necessary as instructed in paragraph 11. Road-test vehicle.

CHAPTER 2
FRONT AXLE (Cont'd)

Section IX

FITS AND TOLERANCES

Fits and tolerances	Paragraph 30
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30. FITS AND TOLERANCES.

a. Differential.

Hypoid drive gear to pinion backlash — controlled in manufacture	0.005 in. to 0.008 in.
Hypoid drive gear runout	0.001 in.
Herringbone drive gear to pinion backlash — controlled in manufacture	0.010 in. to 0.014 in.
Herringbone drive pinion runout	0.002 in.
Hypoid drive gear runout	0.001 in.
Clearance between differential pinion and spider shaft	0.004 in. to 0.008 in.
Clearance between spider gear pilot and spider hub	0.002 in. to 0.006 in.
Differential case end play (in bearings)	0.040 in.
Herringbone pinion shaft end play	0.000 in.
Side gear thrust washer thickness (limits new) ..	0.058 in. to 0.062 in.
Side gear thrust washer thickness (limits worn) ..	0.048 in.
Differential case side bearing adjustment	None—controlled by lock rings
Hypoid pinion adjusting shims	0.002 in., 0.005 in., 0.010 in., 0.032 in.
Thrust pad clearance	0.003 in. to 0.006 in.
Thrust pad thickness (limits new)	0.249 in. to 0.251 in.
Thrust pad thickness (limits worn)	0.165 in.

b. Spindles.

Spindle bushing (inside diameter)	2.334 in. to 2.336 in.
Spindle bushing to shaft clearance	0.022 in. to 0.025 in.

c. Tie Rod Yoke.

Yoke bolt bushing (inside diameter)	1.1245 in. to 1.2555 in.
Yoke bolt to bushing clearance	0.0005 in. to 0.0025 in.

d. Steering Geometry.

Caster (no service adjustment provided)	1 ³ / ₄ °
Chamber (no service adjustment provided)	3 ⁴ / ₄ °
King pin inclination (steering knuckle trunnion center line angle from vertical)	0°
Toe-in	0 in. to 3 ¹ / ₁₆ in.

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
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CHAPTER 2
FRONT AXLE (Cont'd)

Section X

SPECIAL TOOLS

Special tools	Paragraph 31
---------------------	-----------------

31. SPECIAL TOOLS.

a. Introduction. The following special tools manufactured by the Kent Moore Organization, or their equivalent, should be used as outlined in this chapter.

b. Identification of the Special Tools.

Nomenclature	Federal Stock Number	Mfr's Number
Handle for use on replacers	41-H-1074	KM-J1660-1
Puller, front and rear axle housing	41-P-2909-45	KM-J2251
Remover and replacer, tie-rod yoke bolt bushing	41-R-2381-41	KM-J2277
Reamer, tie-rod yoke bolt bushing	41-R-2253	KM-J2278
Remover and replacer, spindle (bushing used with 41H-1074 universal drive handle)	41-R-2389-21	KM-J2279
Remover and replacer, knuckle support bearing cup (used with 41-H-1074)	41-R-2386-25	KM-J2276
Remover and replacer, spring pin and bushing	41-R-2389-26	KM-J2274
Remover and replacer, hypoid drive gear thrust bearing, front and rear axle	41-R-2386-19	KM-J2268
Replacer, oil seal, hypoid pinion drive flange, front and rear axle	41-R-2395-24	KM-J2261
Replacer, hypoid pinion thrust bearing, front and rear axle	41-R-2394-165	KM-J2255

SPECIAL TOOLS

**SPRING PIN AND BUSHING.
REMOVER AND REPLACER 41-R-2389-26**

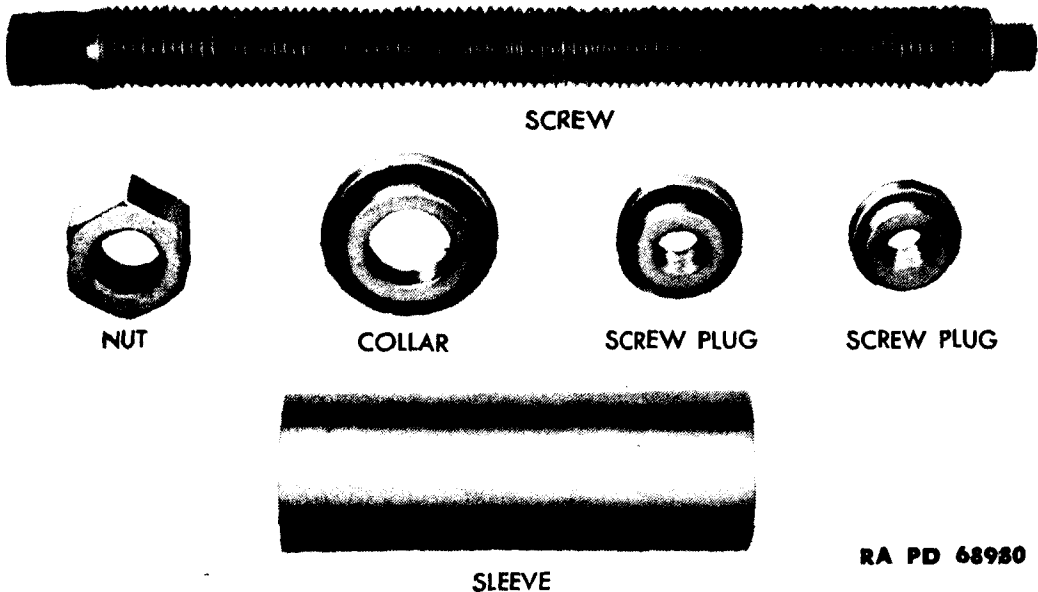


Figure 31 — Spring Pin and Bushing — Remover and Replacer

Nomenclature	Federal Stock Number	Mfr's Number
Replacer, hypoid pinion roller bearing, front and rear axle	41-R-2394-150	KM-J2257
Replacer, hypoid pinion roller bearing lock nut, front and rear axle	41-R-2394-155	KM-J2258
Replacer, differential case bearing inner race, front and rear axle	41-R-2391-57	KM-J2260
Replacer, herringbone drive pinion roller bearing inner race, front and rear axle	41-R-2394-77	KM-J2253
Scale, 0-40 pounds, adjusting knuckle support trunnion bearings	41-S-507-25	KM-J2293
Wrench, pinion nut, herringbone drive, front and rear axle	41-W-1624	KM-J2267

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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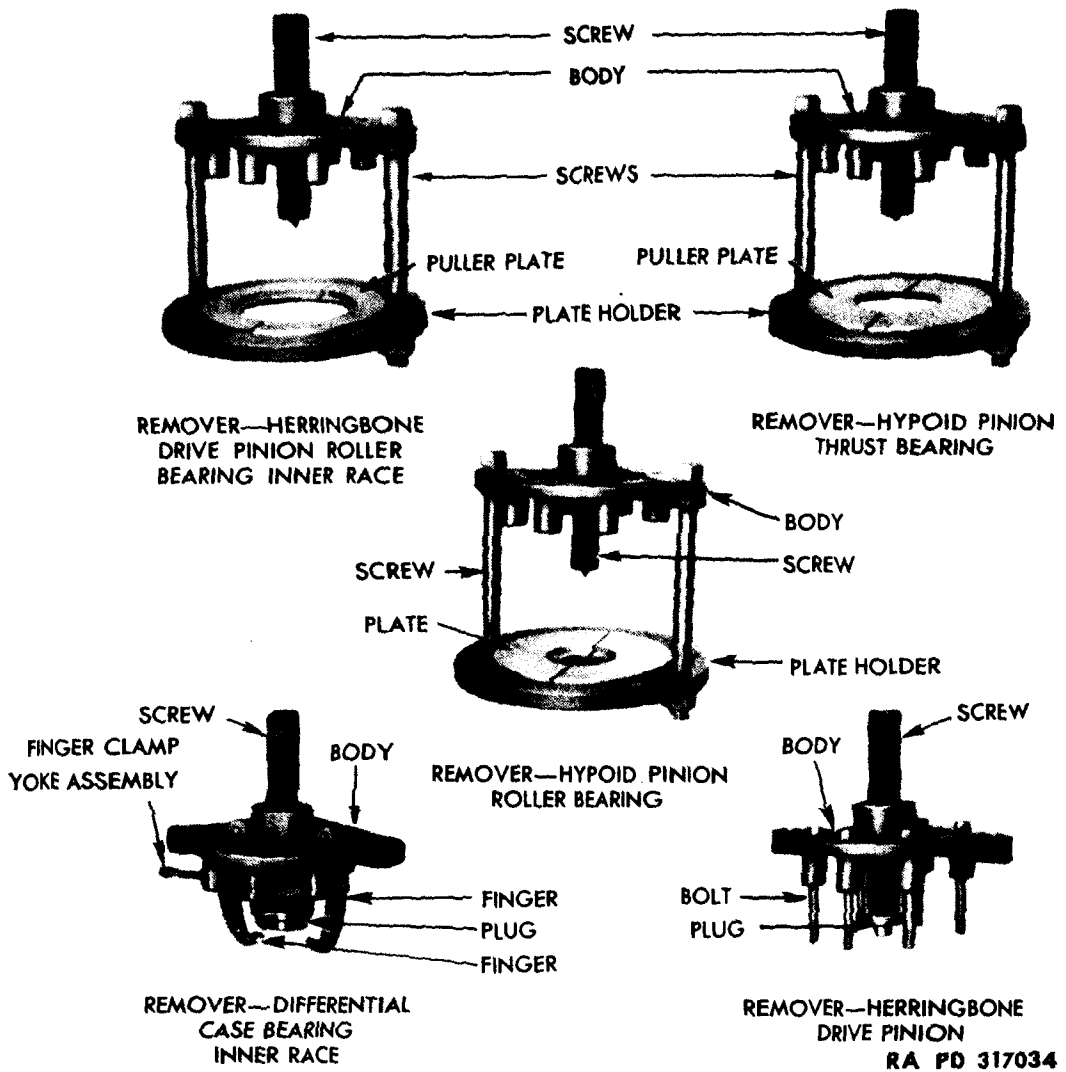
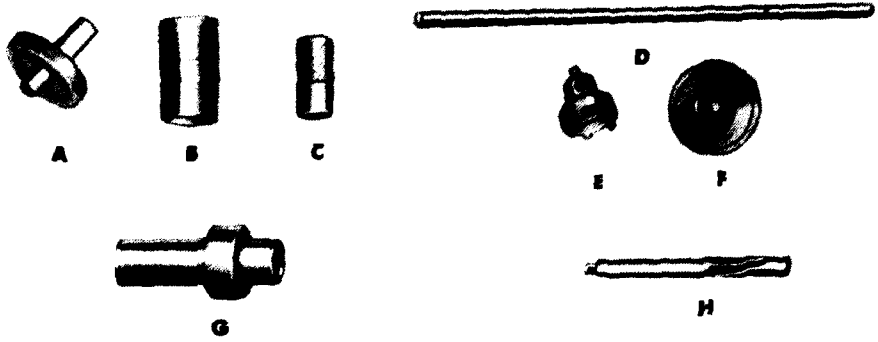


Figure 32 — Front and Rear Axle Housing Puller Set 41-P-2909-45

SPECIAL TOOLS



- | | |
|--|--|
| <p>A—41-R-2394-77 DRIVER—HERRINGBONE DRIVE PINION ROLLER BEARING INNER RACE</p> <p>B—41-R-2394-165 INSTALLER—HYPOID PINION THRUST BEARING</p> <p>C—41-R-2394-150 INSTALLER—HYPOID PINION ROLLER BEARING</p> <p>D } —41-W-1624 { HANDLE } HERRINGBONE DRIVE
 E } WRENCH } PINION NUT</p> | <p>F—41-R-2386-19 REMOVER AND REPLACER—HYPOID DRIVE GEAR THRUST BEARING</p> <p>G—41-R-2391-57 DRIVER—DIFFERENTIAL CASE BEARING INNER RACE</p> <p>H—41-R-2253 REAMER—TIE ROD YOKE BOLT BUSHING</p> |
|--|--|

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Figure 33 — Special Tools

**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

CHAPTER 3
REAR AXLE

Section 1

INTRODUCTION

	Paragraph
Description	32
Data	33
Reference to second echelon TM 9-741.....	34
Maintenance allocation	35

32. DESCRIPTION.

a. General (fig. 34). The rear axle differential is a special double-reduction type. The power is transmitted through a hypoid drive pinion to the hypoid drive gear, then through a herringbone drive pinion (to which the hypoid drive gear is attached), to the large herringbone drive gear on the differential case, and thence to the rear axle shafts in the same manner as the front axle differential. The rear differential carrier assembly is not interchangeable with the front carrier assembly; however, the parts that make up the differential carrier assembly, with the exception of the carrier, hypoid pinion, and hypoid drive gear, are interchangeable.

33. DATA.

a. General.

Housing	Banjo (no inspection plate)
Drive	Through radius rods

b. Differential.

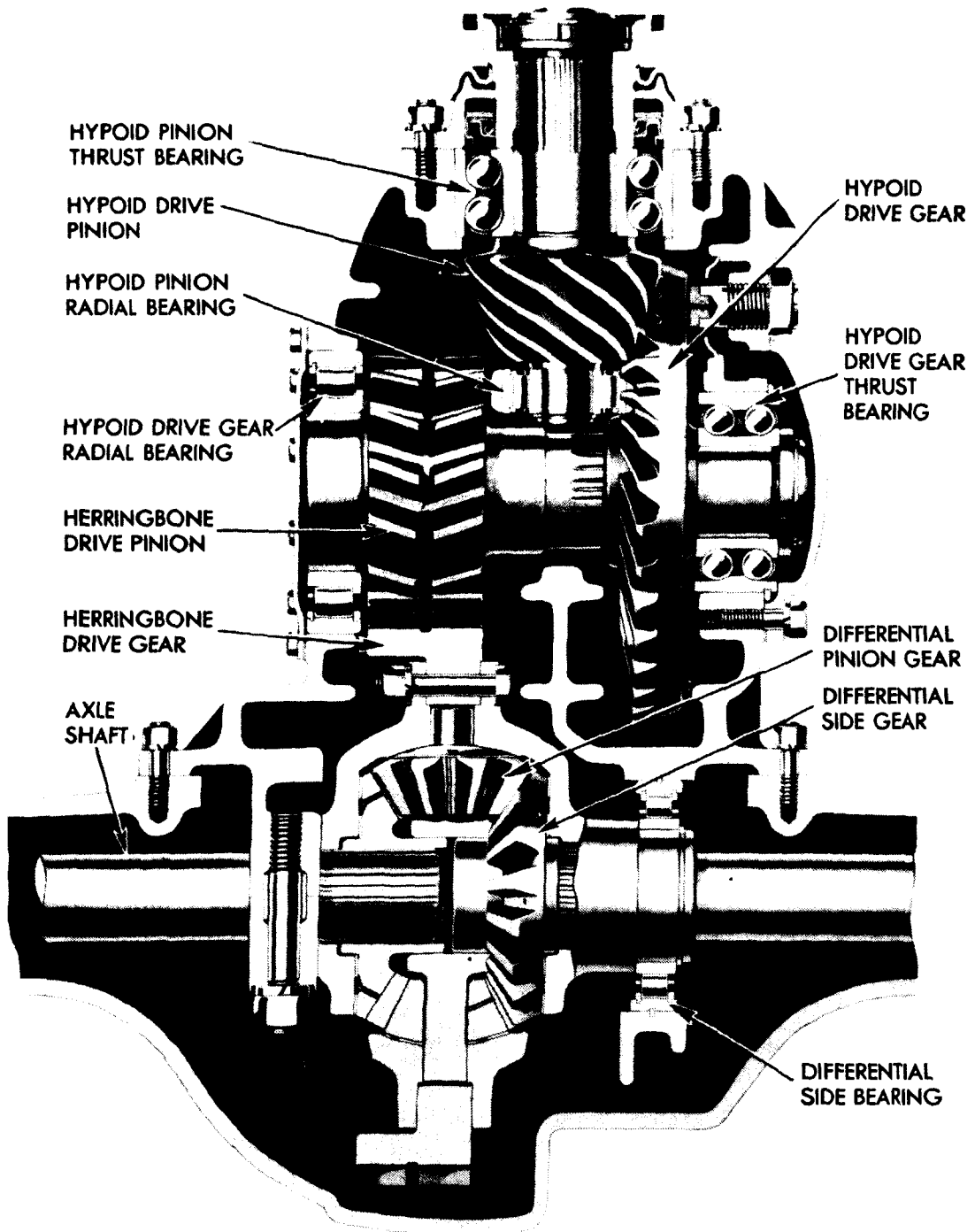
(1) 1ST REDUCTION.

Gear ratio	3.70 to 1
Drive type	Hypoid pinion and drive gear (serviced in sets)
Hand of spiral—Drive gear.....	Right-hand
Pinion	Left-hand
Position of pinion.....	Above drive gear centerline

(2) 2ND REDUCTION.

Gear ratio	2.44 to 1
Drive type	Helical herringbone, self-alin- ing (drive gear and pinion serviced separately)

INTRODUCTION



RA PD 32787

Figure 34 – Rear Axle Differential Carrier – Cross Section

TM 9-1741C

33-35

**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

(3) TOTAL REDUCTION.

Hypoid pinion to herringbone drive gear 9.02 to 1

c. Differential Carrier Bearings.

Side bearings Hyatt roller, A1216 — TAS
(no adjustment—side play controlled by lock rings)

Herringbone drive pinion radial bearing Hyatt roller R-1219-TS
Hypoid drive gear thrust bearing New Departure 45311-A
Typoid drive pinion bearings—Inner.. Hyatt roller U5207-TM
Hypoid drive pinion bearings—Outer.. New Departure 5312

d. Wheel Bearings.

Inner bearing cup Timken 56650
Inner bearing cone Timken 56425
Outer bearing cup Timken 592A
Outer bearing cone Timken 594

34. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often performed by ordnance maintenance personnel who should refer to the using troop TM for information.

35. MAINTENANCE ALLOCATION.

a. For scope of maintenance and repair by the crew and other units of the using arm refer to paragraph 7.

b. Maintenance Chart.

AXLE, REAR	ECHELONS			
	2nd	3rd	4th	5th
*Axle assembly — replace		X		
Axle assembly — repair		X		
Axle assembly — rebuild			E	X
Bearings, wheel — service and/or replace.....	X			
Drums, brake — replace	X			
Gears, bevel and pinion — adjust.....		X		
Hub assemblies — replace	X			
Hub assemblies — repair		X		
Hub assemblies — rebuild			X	
Hub and drum assembly — replace.....	X			
Retainers, wheel grease — replace.....	X			
Shafts, axle — replace	X			

**The second echelon is authorized to remove and reinstall engine transmission assemblies, transfer unit controlled differential assembly and other items marked by asterisk. However, when it is necessary to replace an item marked by an asterisk with a new or rebuilt part, subassembly or unit assembly, the assembly marked by asterisk will not be removed from the vehicle by the second echelon until authorization is received from a higher echelon.*

CHAPTER 3

REAR AXLE (Cont'd)

Section II

TROUBLE SHOOTING

	Paragraph
General	36
Trouble shooting	37

36. GENERAL.

a. In checking the rear axle for trouble, practically all troubles can be located by making a thorough road test of the vehicle with the vehicle in rear drive only.

37. TROUBLE SHOOTING.

a. Axle Noisy on Drive.

Possible Cause	Possible Remedy
Hypoid drive pinion and drive gear lash too tight.	Check pinion depth adjustment (par. 49), or replace pinion and drive gear set, or replace carrier (par. 44).
Rear side of hypoid pinion (double row) thrust bearing rough.	Replace bearing. Check gear lash and pinion depts (par. 49).

b. Axle Noisy on Coast.

Excessive lash between hypoid pinion and drive gear.	Check pinion depth adjustment (par. 49), or replace pinion and drive gear set, or replace carrier (par. 44).
Front side of hypoid pinion (double row) thrust bearing rough.	Replace bearing. Check gear lash and pinion depth (par. 49).
End play in hypoid pinion (double row) thrust bearing.	Replace bearing. Check lash between hypoid pinion and drive gear, and pinion depth (par. 49).
End play in hypoid drive gear (double row) thrust bearing.	Replace bearing. Check last between hypoid pinion and drive gear, and pinion depth (par. 49).

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Hypoid drive pinion too deep in drive gear. Adjust pinion depth (par. 49).

Worn or damaged hypoid pinion bearings or drive gear thrust bearing. Replace bearings which show damage (par. 47).

Loose or worn wheel bearings. Adjust or replace bearing as necessary (par. 47).

d. Backlash.

Axle drive flange loose. Replace terne plate gasket, re-tighten drive flange bolts, using new lock plate (par. 39).

Worn differential side gear and pinion thrust washers. Replace worn washers (par. 45).

Excessive herringbone drive gear to pinion lash. Replace the gear showing most wear. (Gears serviced separately) (par. 45).

Worn universal joints. Replace worn universal joint parts.

CHAPTER 3
REAR AXLE (Cont'd)

Section III

OPERATIONS THAT CAN BE PERFORMED WITH
REAR AXLE IN VEHICLE

	Paragraph
Introduction	38
Axle shaft replacement.....	39
Spindle	40

38. INTRODUCTION.

a. **General.** The following paragraphs cover the repairs that can be performed without removing the complete unit from the vehicle. Repairs can also be made on the brake system and hub of each wheel which are outlined in the "Brake System" chapter and the "Wheel Bearings" chapter.

b. **Cleaning and Inspection of Component Parts.** The cleaning, inspection, and repairing of component parts must be done with extreme care and cleanliness. All parts must be cleaned thoroughly and dried with clean rags and air pressure from an air blow gun. **CAUTION:** *Do not allow bearings to be spun by the air pressure.* As the parts are disassembled, they should be placed in a tank with cleaning solution and permitted to soak. **NOTE:** *Do not allow rubber or leather parts to soak as the cleaning solution will cause the leather or rubber parts to deteriorate.*

39. AXLE SHAFT REPLACEMENT.

a. **Removal Procedure.**

(1) **REMOVE LUBRICANT FROM BANJO HOUSING.** Remove drain plug from banjo housing and drain oil into a drain pan. Install drain plug and gasket when oil is drained.

(2) **REMOVE AXLE SHAFT (fig. 35).** Bend the axle shaft bolt lock tangs away from the bolts and remove the eight bolts and lock. Insert two of the bolts in the tapped holes in the flange and screw them in alternately until the shaft is loose. Pull out the shaft.

b. **Installation Procedure.**

(1) **INSTALL AXLE SHAFT (fig. 36).** Fasten a lever to the axle shaft flange with two bolts. This lever can be made from a piece of steel 1 inch thick, 2 inches wide, and about 20 inches long as shown in figure 36. Install new flange gasket over shaft and push shaft in housing, using care not to damage splines on end of shaft or in dif-

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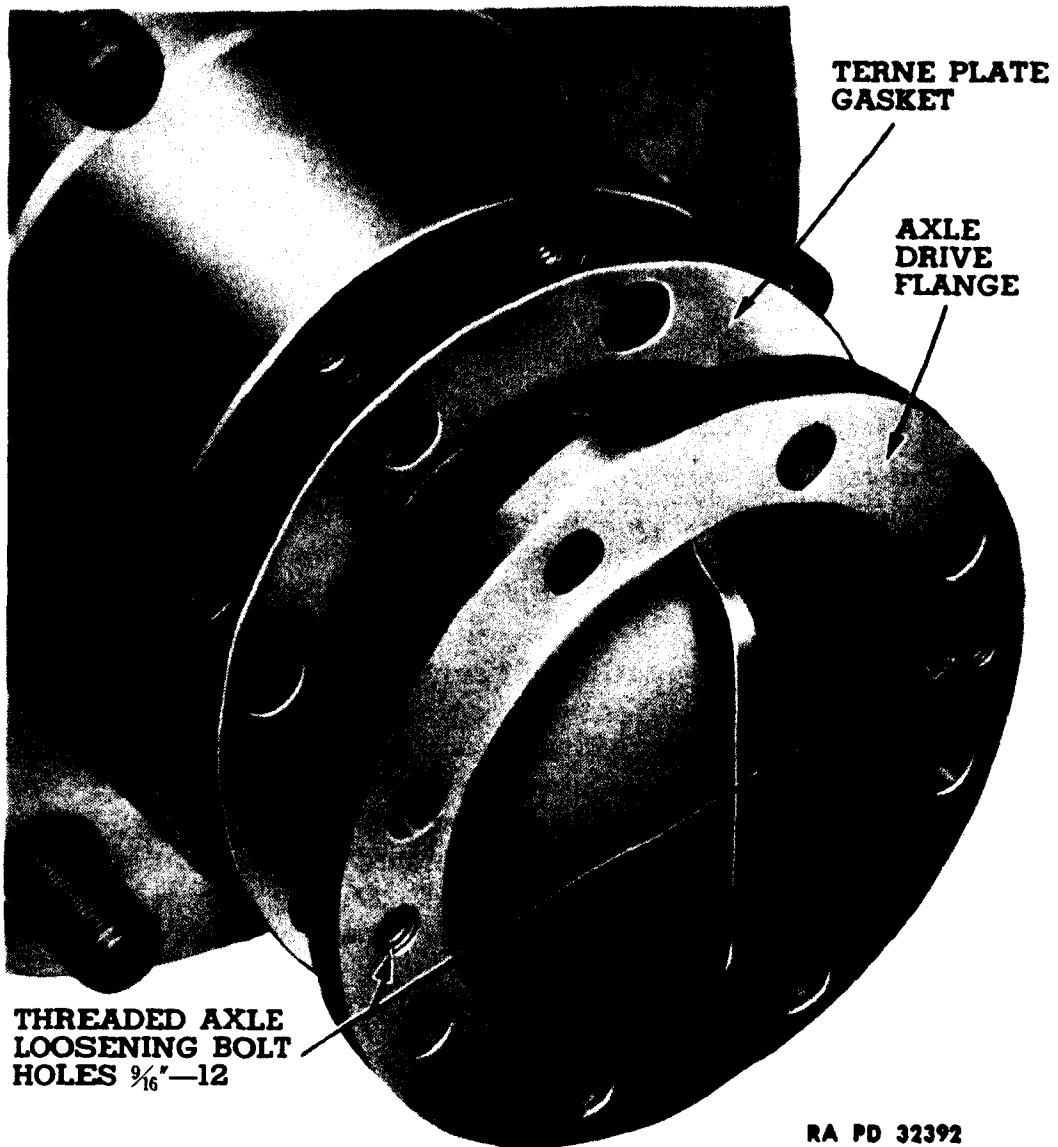
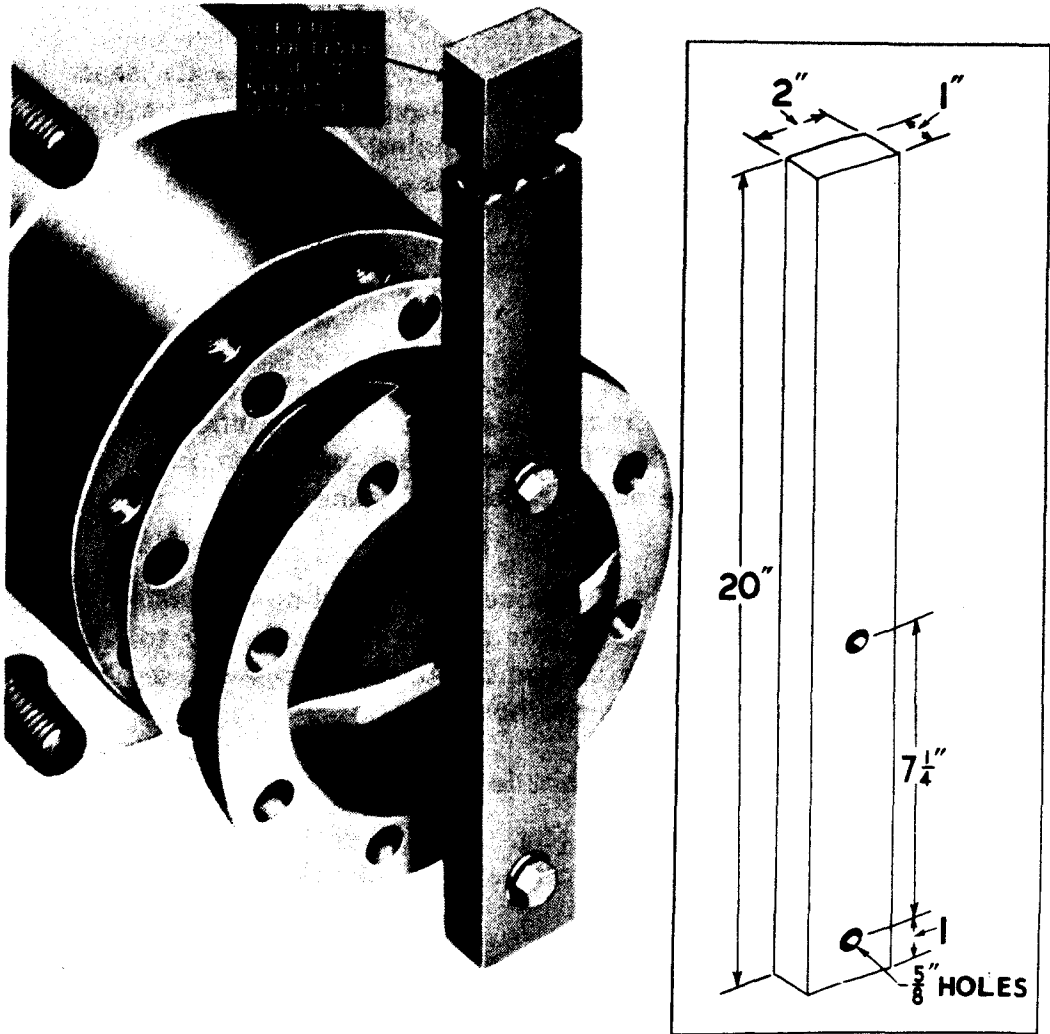


Figure 35 — Removing Axle Shaft

ferential case. When shaft contacts case, use lever to lift inside end of shaft and turn shaft slightly to line up the splines. Push shaft in case until flange is against hub. Remove the lever and line up the holes in hub, gasket, and axle shaft flange. Install a new bolt lock and install the eight bolts; tighten bolts securely and lock them by bending tangs against the bolts.

(2) **REFILL WITH LUBRICANT.** Remove the rear axle filler plug and inject enough universal gear lubricant, seasonal grade, to bring the grease level up to the filler plug. Install the filler plug with gasket.

OPERATIONS THAT CAN BE PERFORMED WITH REAR AXLE IN VEHICLE



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Figure 36 — Axle Shaft Installation

40. SPINDLE.

a. Removal Procedure.

(1) **DRAIN OIL.** Remove the axle housing drain plug and drain the oil in a drain pan.

(2) **REMOVE WHEEL AND TIRE ASSEMBLY.** Loosen the ten wheel studs. **NOTE:** *The left-hand wheel nuts have left-hand threads and the right-hand wheel nuts have right-hand threads.* Raise the rear end of the vehicle until the tires are clear of the ground and support the axle housing on suitable blocks. Remove the ten wheel nuts and lift the wheel and tire off of the hub.

(3) **REMOVE DRUM** (fig. 4). Remove the three screws that retain the drum to the hub, and screw them into the three tapped holes alternately to pull the drum loose from the hub. Lift the drum off of the hub.

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(4) **REMOVE AXLE SHAFT** (fig. 35). Bend the axle shaft bolt lock tangs away from the bolts, and remove the eight bolts and lock. Insert two of the bolts in the tapped holes in the flange and screw them in alternately until the shaft is loose. Pull out the shaft.

(5) **REMOVE HUB**. Bend the lock tang away from the adjusting lock nut and remove the lock nut, lock, and adjusting nut. Lift hub assembly off spindle.

(6) **DISCONNECT BRAKE PIPES**. Unscrew the fittings at each wheel cylinder and at the rear brake pipe elbow connector. Remove the cap screws which attach the rear brake extension pipe "T" connector assembly to brake flange plate, and remove the connector and pipes as an assembly.

(7) **REMOVE SPINDLE**. Remove the ten bolts, nuts, and lock washers that retain the flange plate and brake assembly to the housing and lift off the oil deflector and brake flange plate assembly. Tap the spindle out of the pilot in the housing.

b. Spindle Rebushing Procedure.

(1) **REMOVE BUSHING** (fig. 6). Insert bushing replacer (41-R-2389-21) through the outer end of spindle and drive or press the bushing out of the spindle.

(2) **INSTALL BUSHING** (fig. 5). Place new bushing on replacer and press bushing into spindle until the inner edge of bushing is $\frac{5}{16}$ inch below the bottom of the recess as shown in figure 6.

c. Installation Procedure.

(1) **INSTALL SPINDLE**. Place the spindle in position on the housing using a new gasket, and with the keyway up. Tap the spindle in position, at the same time lining up the holes. Place the brake flange plate assembly and oil deflector in position on the spindle and install the ten retaining bolts, lock washers, and nuts, and tighten them securely to between 50 and 60 foot-pounds with a torque wrench.

(2) **CONNECT BRAKE PIPES**. Place connector and pipe assembly in position on the brake flange plate and install the two retaining cap screws. Connect the pipe to the wheel cylinders and the elbow connector and tighten the fittings securely. **NOTE: Use permatex No. 2 or its equivalent on the connections.**

(3) **INSTALL HUB**. Check to see that bearings are packed with grease. Place hub on spindle and push the outer bearing and cone in position. Install the washer and adjust nut.

OPERATIONS THAT CAN BE PERFORMED WITH REAR AXLE IN VEHICLE

(4) **ADJUST BEARING.** Screw the adjusting nut up tight to make sure that hub and bearings are in place. Loosen the nut and tighten it again wrench tight. Then back it off $\frac{1}{8}$ turn (45 degrees maximum). Install a new lock, matching one of the three short lugs with a slot in the nut. Install the lock nut, tighten it securely, and bend a matching lug in one of the slots in the lock nut. Rotate the hub to see that the hub turns freely. Place the drum in position and install the three retaining screws.

(5) **INSTALL AXLE SHAFT AND REFILL HOUSING WITH LUBRICANT** (par. 39).

(6) **BLEED THE ENTIRE BRAKE SYSTEM** (par. 72).

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CHAPTER 3

REAR AXLE (Cont'd)

Section IV

REMOVAL

Rear axle assembly removal.....	Paragraph 41
---------------------------------	-----------------

41. REAR AXLE ASSEMBLY REMOVAL.

a. **Block Wheels and Drain Oil.** Block all four wheels securely. Remove the drain plug and drain the oil into a drain pan. Reinstall drain plug and gasket after oil is drained.

b. **Disconnect Radius Rods.** Remove the cotter pin and castellated nut from the two radius rod ball studs at the front end of the radius rods, and tap and pry the tapered studs out of the brackets with a hammer and crowbar.

c. **Disconnect Rear Universal Joint.** Remove the four bolts and nuts from the universal joint flanges, and lower the end of the propeller shaft to the floor.

d. **Support Differential Carrier (fig. 37).** Roll a floor jack under the differential carrier to support the weight of the differential carrier. Put a slight strain on the jack.

e. **Raise Rear End of Vehicle.** Catch the hooks from two heavy (10-ton) chain hoists in the lifting rings at the rear of the vehicle and raise the rear end of the vehicle until the load is just ready to leave the rear springs. Build up timbers tight between the floor and the hull of the vehicle.

f. **Disconnect Brake Line Main Hose.** Loosen the connector bolt at the top of the tunnel in engine compartment that retains the hose to the connector, and unscrew the hose from the fitting on top of the axle housing.

g. **Disconnect Vent Hose.** Unscrew the bolt that retains the vent hose to the fitting on the tunnel.

h. **Remove U-Bolt Nuts.** Remove the four U-bolt nuts and lock washers.

REMOVAL

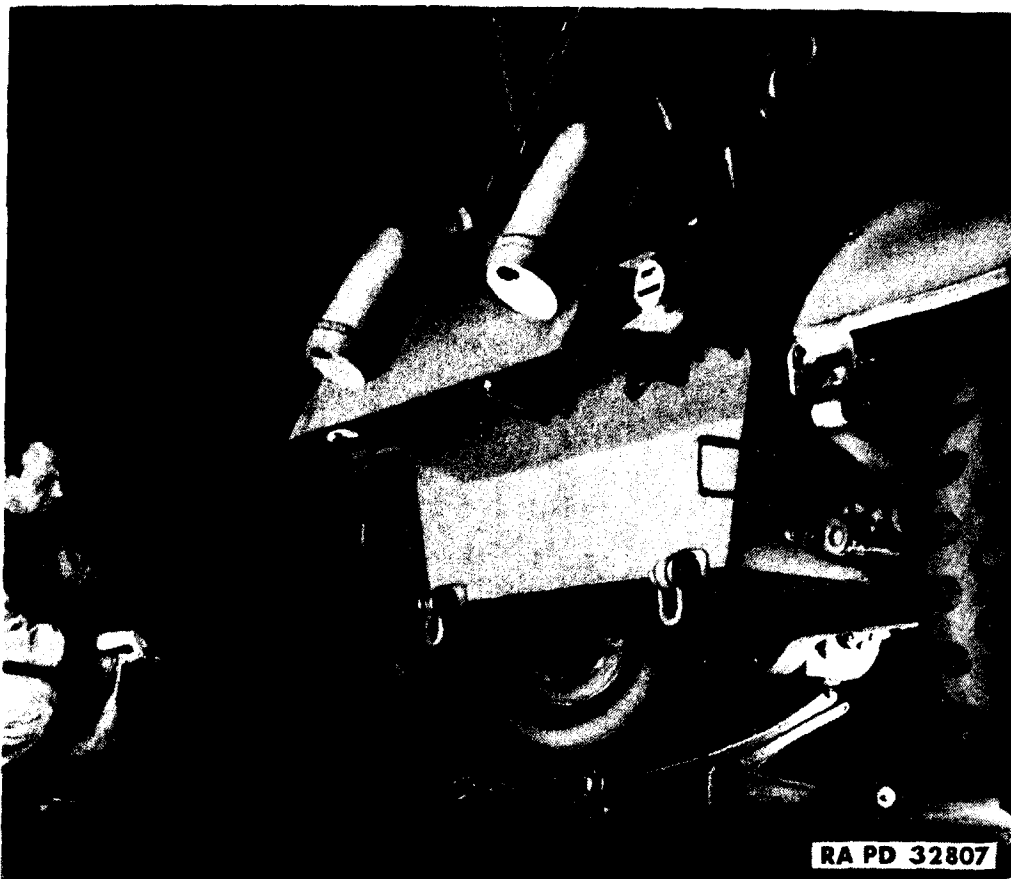


Figure 37 — Supporting Differential Carrier

i. **Remove Axle Assembly** (fig. 38). Raise vehicle until U-bolts and hull are clear of housing and support hull on suitable blocks. Lower floor jack slowly and carefully until the differential carrier assumes a vertical position. Roll the complete rear axle assembly out from under the vehicle.

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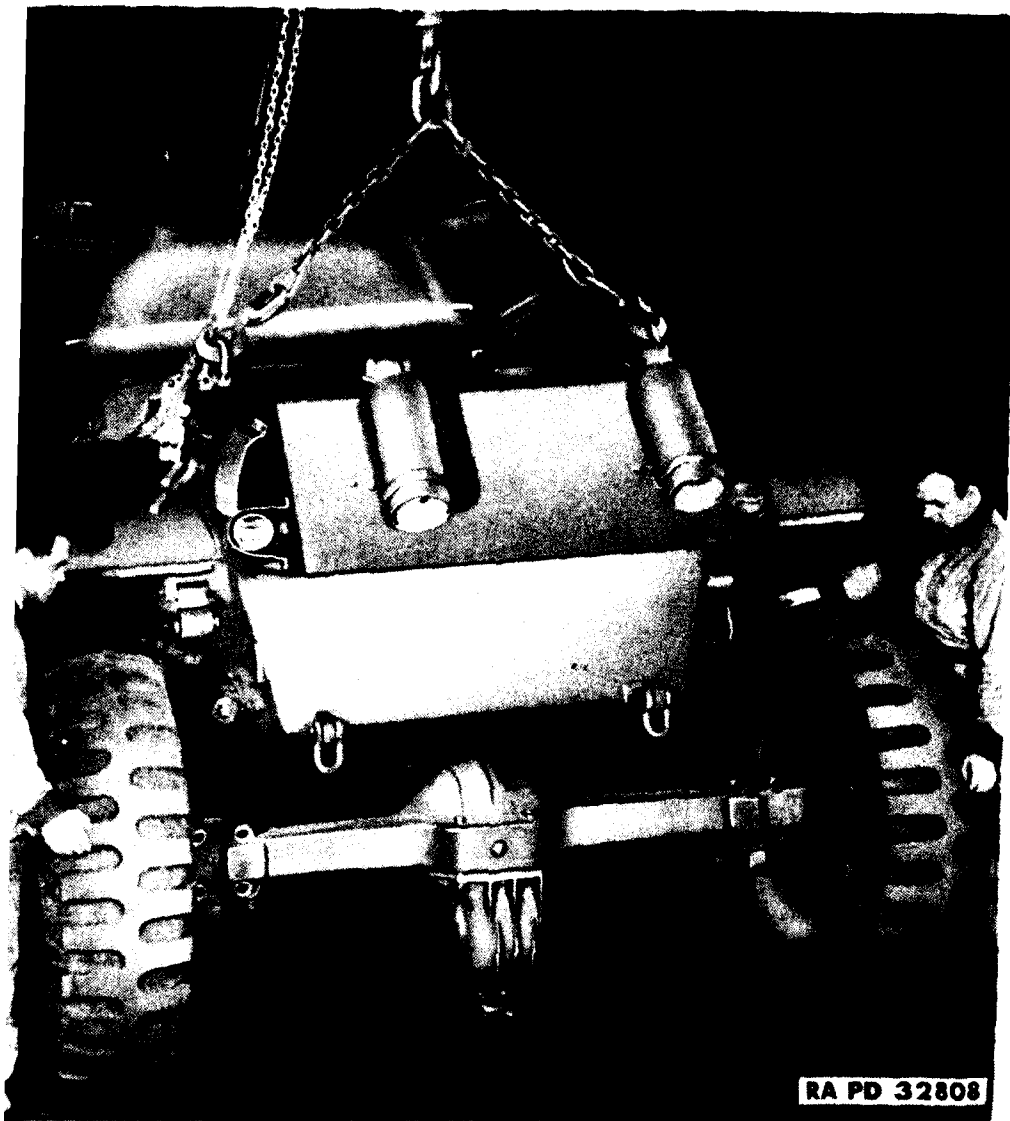


Figure 38 – Removing Rear Axle Assembly

CHAPTER 3
REAR AXLE (Cont'd)

Section V
DISASSEMBLY

	Paragraph
Cleaning of assembly.....	42
Disassembly of outer ends.....	43
Removal of differential carrier assembly.....	44
Disassembly of differential carrier assembly.....	45

42. CLEANING OF ASSEMBLY.

a. Clean the axle assembly thoroughly with dry-cleaning solvent and, as the parts are disassembled, they can be placed in a tank containing cleansing solution and permitted to soak so that they will be easier to clean. **CAUTION:** *Do not let leather or rubber parts soak in the solution, as the solution will cause the rubber and leather to deteriorate.*

43. DISASSEMBLY OF OUTER ENDS.

a. **Block Up Assembly** (fig. 39). Loop a chain around the hypoid pinion drive flange. Hitch the chain to the hook of a chain hoist and raise carrier into a vertical position above the axle housing. Jack up one end of the assembly and place it on a suitable block so that wheel is just clear of the ground. Then block up the other side in the same manner. Keep carrier in a vertical position above the housing.

b. **Remove Axle Shafts.** Remove wheels with tires, drums, axle shafts, hubs, brake flange plates, spindles, etc., as instructed in paragraph 39.

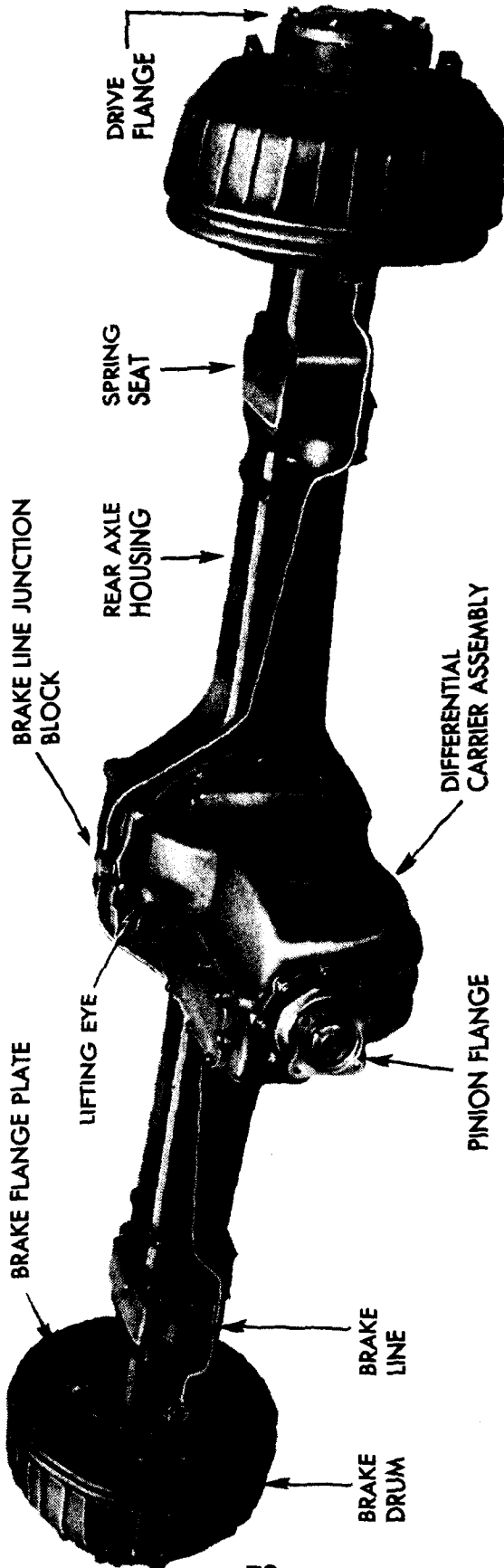
44. REMOVAL OF DIFFERENTIAL CARRIER ASSEMBLY.

a. Remove the four through bolts and nuts and the eight nuts and lock washers that retain the carrier assembly to the housing. Use chain hoist to lift the carrier assembly out of the housing.

45. DISASSEMBLY OF DIFFERENTIAL CARRIER ASSEMBLY.

a. **Equipment** (fig. 32). A special puller has been designed for use in several different operations in rebuilding both the front and rear differential carrier assemblies. Figure 32 shows a layout of the different combinations in which the tool can be used. Additional special tools are listed at the start of each paragraph.

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Figure 39 — Rear Axle Assembly

DISASSEMBLY**b. Disassembly Procedure (fig. 40).**

- (1) **REMOVE HERRINGBONE DRIVE ASSEMBLY.** Place assembly on a suitable bench. Use a cold chisel and mark the differential carrier and bearing caps so that they can be reinstalled in the same position. Remove the two nuts and lock washers from each cap and tap the caps off the studs with a soft hammer. Lift the dowel sleeves off of the studs. Lift the herringbone drive assembly out of the carrier, being careful not to drop the differential case side bearings.
- (2) **REMOVE DIFFERENTIAL CARRIER COVER (fig. 40).** Remove the eight nuts and lockwashers that retain the cover and lift off the cover, gasket, and dowel sleeves.
- (3) **REMOVE DRIVE GEAR THRUST BEARING RETAINER (fig. 40).** Remove the eight cap screws and lock washers that attach the retainer, and lift off the retainer, gasket, and dowel sleeves.
- (4) **REMOVE HERRINGBONE PINION RADIAL BEARING RETAINER.** Remove the 12 cap screws and lock washers that attach the retainer and lift off the retainer and gasket.
- (5) **REMOVE THRUST PAD SCREW (fig. 22).** Loosen the thrust pad screw lock nut, and remove the screw with thrust pad.
- (6) **REMOVE DRIVE GEAR BEARING RETAINER NUT.** With a screwdriver, remove the hypoid drive gear thrust bearing retaining nut lock ring. Hold the differential and hypoid drive gear from turning by holding the hypoid drive pinion flange with a large wrench or two punches and a bar, and unscrew the hypoid drive gear bearing nut, using wrench (41-W-1624).
- (7) **INSTALL SPECIAL PULLER (fig. 41).** Aline five of the six holes in the hypoid ring gear with five of the holes in the case. Install the special puller (41-P-2909-45) as shown in figure 41 using the five cap screws furnished with the puller. Tighten the cap screws alternately until the ring gear is pulled against the case.
- (8) **REMOVE HYPOID DRIVE PINION.** Remove the eight nuts and lock washers that attach the hypoid drive pinion thrust bearing retainer to the carrier, pull out the pinion and bearing assembly, and lift out the shims.
- (9) **REMOVE HERRINGBONE DRIVE PINION, RADIAL BEARING, AND HYPOID DRIVE GEAR (fig. 42).** Turn the center bolt of the special puller in a clockwise direction to push the herringbone drive pinion and radial bearing out of the differential carrier and off the splines of the hypoid ring gear. Remove the five bolts from the puller and lift the hypoid gear out of the differential carrier.
- (10) **REMOVE HYPOID DRIVE GEAR THRUST BEARING.** Pilot head of replacer (41-R-2386-19) into position in the bearing through the opening in top of carrier. Pilot driver handle in place through the

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Figure 40 — Rear Axle and Differential Parts Layout

DISASSEMBLY

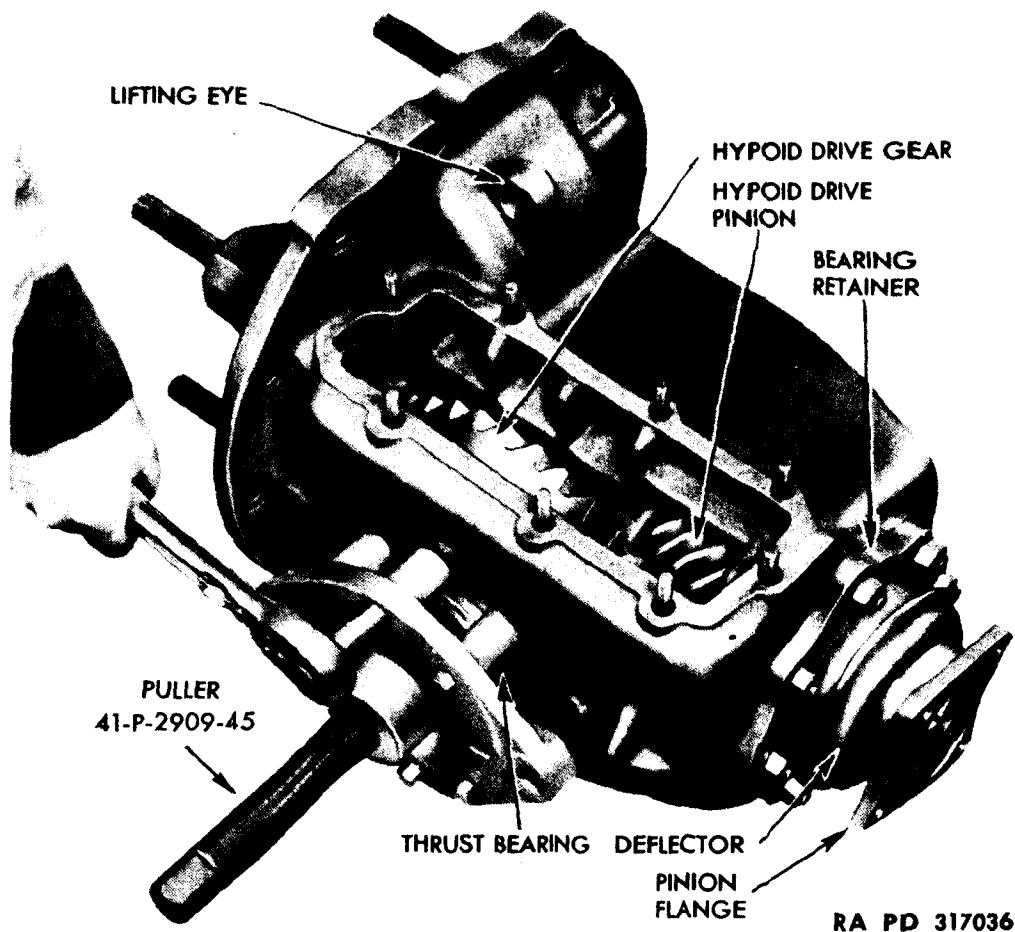
- A—LOCK RING, BEARING RETAINING NUT
- B—NUT, BEARING RETAINING
- C—WASHER, PINION FLANGE
- D—FLANGE, HYPOID PINION (WITH DEFLECTOR)
- E—RETAINER, HYPOID PINION THRUST BEARING
- F—GASKET, HYPOID PINION RETAINER
- G—PACKING, HYPOID PINION BEARING
- H—RETAINER, HYPOID PINION BEARING PACKING
- I—SEAL, HYPOID PINION BEARING OIL
- J—BEARING, HYPOID PINION THRUST
- K—SHIM, HYPOID PINION THRUST BEARING
- L—PINION AND SHAFT, HYPOID DRIVE
- M—BEARING, HYPOID PINION RADIAL
- N—LOCK RING, HYPOID PINION RADIAL BEARING
- O—CARRIER, DIFFERENTIAL
- P—RETAINER, HYPOID DRIVE GEAR THRUST BEARING
- Q—GASKET, HYPOID DRIVE GEAR THRUST BEARING RETAINER
- R—LOCK NUT, THRUST PAD SCREW
- S—SCREW, THRUST PAD (WITH PAD)
- T—OIL TRAP, THRUST PAD
- U—COVER, DIFFERENTIAL CARRIER
- V—DOWEL SLEEVES, DIFFERENTIAL CARRIER COVER
- W—GASKET, DIFFERENTIAL CARRIER COVER
- X—CAP, DIFFERENTIAL CARRIER BEARING
- Y—DOWELS, DIFFERENTIAL CARRIER BEARING CAP
- Z—LOCK RING, HYPOID DRIVE GEAR THRUST BEARING NUT
- AA—NUT, HYPOID DRIVE GEAR THRUST BEARING
- BB—BEARING, HYPOID DRIVE GEAR THRUST
- CC—GEAR, HYPOID DRIVE
- DD—PINION, HERRINGBONE DRIVE
- EE—RACE, HYPOID DRIVE GEAR RADIAL BEARING INNER
- FF—RACE, HYPOID DRIVE GEAR RADIAL BEARING AND OUTER
- GG—GASKET, HYPOID DRIVE GEAR RADIAL BEARING RETAINER
- HH—RETAINER, HYPOID DRIVE GEAR RADIAL BEARING
- II—LOCK RING, DIFFERENTIAL BEARING
- JJ—RACE, DIFFERENTIAL BEARING AND OUTER
- KK—RACE, DIFFERENTIAL BEARING INNER
- LL—CASE, DIFFERENTIAL (LONG HALF)
- MM—WASHER, DIFFERENTIAL SIDE GEAR THRUST
- NN—GEARS, DIFFERENTIAL SIDE
- OO—PINIONS, DIFFERENTIAL
- PP—WASHERS, DIFFERENTIAL PINION THRUST
- QQ—SPIDER, DIFFERENTIAL PINION
- RR—BOLT, DIFFERENTIAL CASE
- SS—GEAR, DIFFERENTIAL HERRINGBONE
- TT—CASE, DIFFERENTIAL (SHORT HALF)
- UU—HOUSING, AXLE
- VV—GASKET, DIFFERENTIAL CARRIER TO AXLE HOUSING

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Figure 40 — Nomenclature for Fig. 40



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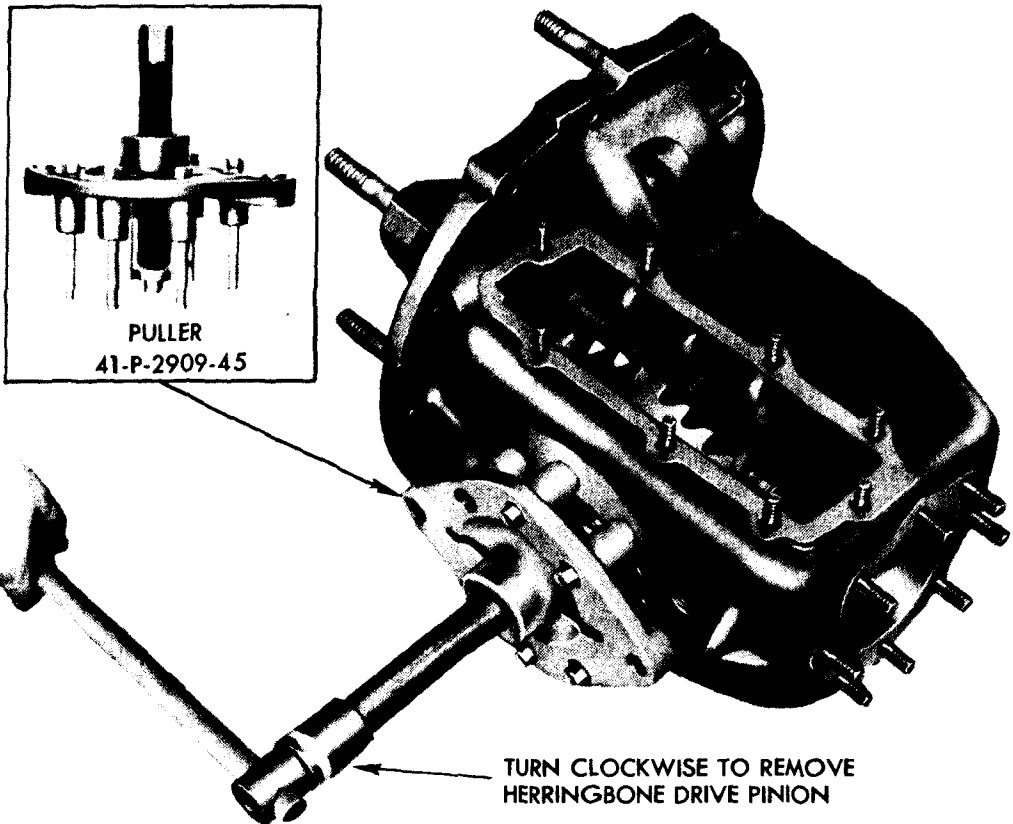
Figure 41 – Providing Clearance for Hypoid Drive Pinion Removal

herringbone drive pinion side of the carrier. Drive against end of handle to remove the thrust bearing.

(11) **REMOVE PINION FLANGE AND RETAINER.** Place pinion flange in a vise and remove the lock ring with a screwdriver. Remove the bearing retaining nut with wrench (41-W-1624), tap off the flange, and lift off the retainer.

(12) **DISASSEMBLE DIFFERENTIAL CASE** (fig. 40). Remove the 12 differential case bolts and tap the herringbone gear with a soft hammer to separate the two halves of the case. Lift off the gear, spider, pinions, side gears and thrust washers.

DISASSEMBLY



RA PD 317037

Figure 42 – Removing Herringbone Drive Pinion

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CHAPTER 3

REAR AXLE (Cont'd)

Section VI

CLEANING, INSPECTION, AND REPAIRING OF PARTS

	Paragraph
Cleaning	46
Inspection	47
Repairing	48

46. CLEANING.

a. The inspection and repairing of the rear axle parts must be done with extreme care and cleanliness. All parts must be thoroughly cleaned, both inside and outside, and then dried with clean rags and air pressure from air blowgun. **CAUTION: Do not allow bearings to be spun by the air stream; spinning the bearings with air pressure is liable to imbed small particles in the race and damage the bearings.** Individual damaged parts that are removed should be separated from the parts that are to be used again.

47. INSPECTION.

a. **Inspect Carrier and Housing (fig. 40).** Inspect the carrier and housings for cracks, scoring, or other damage. Tapping the case with a light hammer will sometimes divulge cracks that otherwise may not be discovered. If the case or housing are damaged in any way, replace them.

b. **Inspect Differential Case Halves.** Inspect the case halves for cracks, scoring, or other damage. Replace both halves if either half is damaged.

c. **Inspect Gears.** Inspect all gears for chipped or worn teeth, and scoring on bearing contact surfaces. Replace all gears that are damaged.

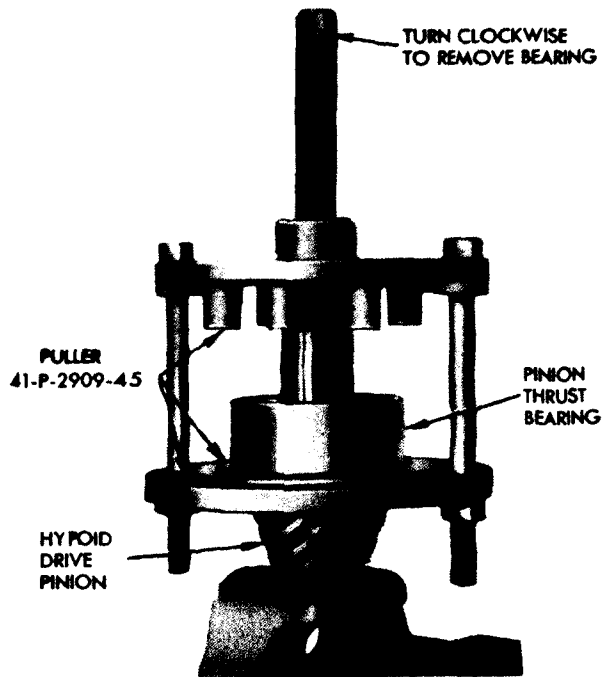
d. **Inspect Shaft and Splines.** Inspect the shafts and splines for excessive wear or other damage. Replace all parts that are damaged.

e. **Inspect Thrust Washers.** Inspect the thrust washers for wear, scoring, or other damage. Replace any damaged washers.

f. **Inspect Oil Seal.** Inspect the oil seal in the pinion drive bearing retainer; if it is damaged or worn, replace it, see paragraph 48.

CLEANING, INSPECTION, AND REPAIRING OF PARTS

Figure 43 – Removing Hypoid Pinion Thrust Bearing



RA PD 317038

g. Inspect Bearings. Drop a few drops of light engine oil on the bearings and turn the outer race slowly by hand at the same time noting any roughness. Also check them for scoring, cracks, or other damage. Replace any damaged bearings.

48. REPAIRING.

a. Oil Seal Replacement Procedure.

(1) **REMOVE SEAL.** Pry out the oil seal from the hypoid pinion bearing retainer and lift out the packing retainer and packing.

(2) **INSTALL NEW SEAL** (fig. 24). Place new packing in the recess and place packing retainer on top of packing. Place new oil seal in position in recess with open end of leather toward the top (toward transfer case) and, with replacer (41-R-2395), drive the seal in until the outer edge is flush with the bottom edge of the chamfered inner edge of the recess.

b. Hypoid Drive Pinion Shaft and/or Bearings Replacement Procedure.

(1) **REMOVE HYPOID PINION THRUST BEARING** (fig. 43). Place puller assembly (41-P-2909-45) over spline end of pinion shaft and place the two halves of the press plate under bearing as shown in figure 43. Turn center screw in a clockwise direction to push the shaft out of bearing.

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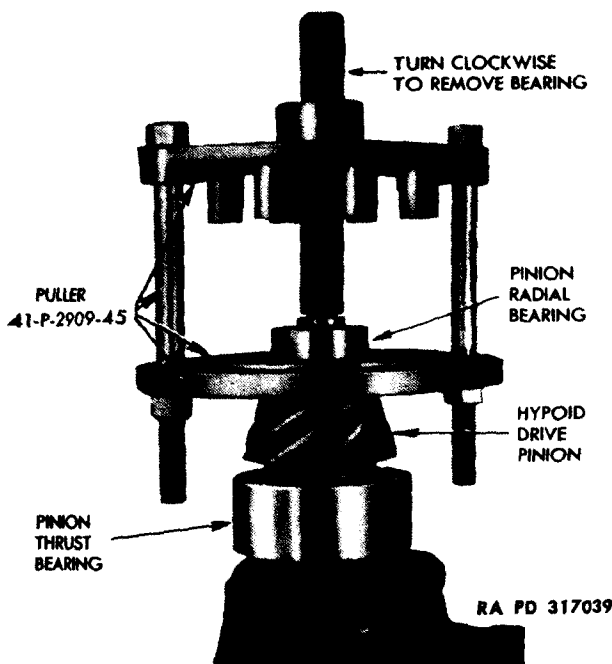


Figure 44 – Removing Hypoid Pinion Radial Bearing

(2) **REMOVE HYPOID PINION RADIAL BEARING** (fig. 44). Remove the lock ring with a screwdriver. Place puller assembly (41-P-2909-45) over the pinion end of shaft, and place the two halves of the press plate under the radial bearing. Turn the center screw of the puller in a clockwise direction to push the shaft out of the bearing.

(3) **INSTALL HYPOID PINION THRUST BEARING**. Place bearing on shaft and place replacer (41-R-2394-165) over end of shaft. Place the assembly in a press and press the bearing on the shaft until it bottoms against the shoulder on the gear.

(4) **INSTALL HYPOID PINION RADIAL BEARING** (fig. 26). Place the bearing on the small end of the shaft with the chamfered side of the inner race toward the pinion. Place the bearing replacer (41-R-2394-150) over the inner race of the bearing, place the assembly in a press, and press the bearing on the shaft until it bottoms against the pinion. Place new lock ring over the tapered part of the lock ring replacer (41-R-2394-150), and center the pin of the replacer in the center hole of the shaft. Place the outer part of the lock ring replacer over the tapered part, and drive the outer part down until the lock ring seats itself in the groove.

c. Differential Bearing Inner Race Replacement Procedure.

(1) **REMOVE INNER RACE** (fig. 27). Remove the lock ring that retains the inner race, using a screwdriver. Place the special puller (41-P-2909-45) in position on the case as shown in figure 27. Place

CLEANING, INSPECTION, AND REPAIRING OF PARTS

the puller arms in the two notches in the case, and make sure that the puller arms fully engage the back surface of the race. Turn the center screw clockwise until the race is pulled off the case.

(2) **INSTALL INNER RACE** (fig. 27). Place race in position on case and place the race replacer (41-R-2391-57) in position on the race. Press or drive the race on the case until it bottoms against the case. Install the lock ring, and be sure it seats in the groove. **NOTE:** *One side of the inner bore has a chamfered edge and the other side has a small radius. The side with the radius must be toward the case.*

d. Herringbone Drive Pinion or Radial Bearing Inner Race Replacement Procedure.

(1) **REMOVE RADIAL BEARING INNER RACE** (fig. 28). Place puller assembly (41-P-2909-45) over end of pinion, and insert press plates under edge of race. Turn center screw clockwise to pull the race off the shaft.

(2) **INSTALL RADIAL BEARING INNER RACE** (fig. 28). Place race in position on shaft with wide edge of race toward the herringbone gear. Place race replacer (41-R-2394-77) on top of race, and press or drive the race on shaft until it bottoms against the gear.

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CHAPTER 3

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Section VII

ASSEMBLY

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Assembling carrier assembly to housing.....	50
Assembling outer ends.....	51

49. ASSEMBLING DIFFERENTIAL CARRIER ASSEMBLY.

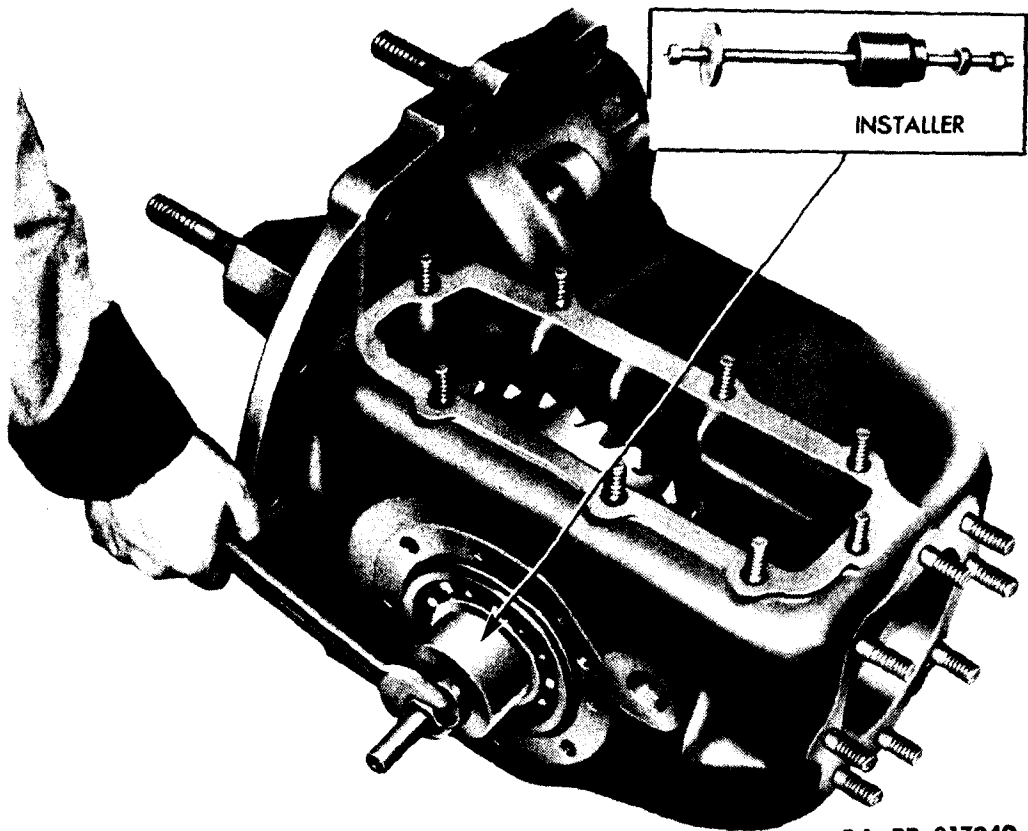
a. **Assemble Differential Case (fig. 40).** Spread a coating of grease on the side gears, pinion gears, spider, and thrust washers. Place the thrust washers in each half of the case and place the side gears in each half of case. Place the pinion gears and thrust washers on the spider, and place the spider assembly in the long half of the case. Place herringbone gear on long half of case with recess side of gear up. Line up the gear holes with the holes in the long half of case and place the short half of case in position in gear, line up the holes in the short half of case with the other holes, and install the 12 bolts from the long to the short halves. Install the lock washers and nuts, and tighten them to between 95 and 115 foot-pounds.

b. **Assemble Hypoid Pinion Drive Assembly.** Place the hypoid pinion bearing retainer over the pinion shaft, then place the flange and washer on the shaft. Start the retainer nut and place flange in vise. With wrench (41-W-1624), tighten nut securely, at the same time lining up one of the lock ring holes in the nut with one of lock ring holes in the shaft. *NOTE: Do not back off the nut to line up the holes.* Install the lock ring.

c. **Install Hypoid Drive Gear Thrust Bearing.** Place the hypoid drive gear thrust bearing in case from the outside of case and tap it in with a soft hammer until the stop ring seats on the machined surface of the case. Use bearing replacer (41-R-2386-19).

d. **Install Herringbone Pinion and Radial Bearing (fig. 45).** Place hypoid drive gear in carrier from the top. Slide herringbone drive pinion in from the left side of case, engaging the tapered splines of the shaft in the splines of the drive gear hub. Place a suitable replacing tool through bolt, through the bore of the shaft from the radial bearing side, place the press plate, installer thrust bearing, and compression nut on the end of the bolt, and turn nut clockwise until

ASSEMBLY



RA PD 317040

Figure 45 – Installing Herringbone Drive Pinion

it is fingertight. Slide the radial bearing and outer race over the inner race to keep the shaft in alignment with the bore while tightening the puller nut until it reaches a definite stop. **CAUTION:** *Hold the through bolt while tightening the nut, and keep the shaft in line with the bore.*

e. **Install Hypoid Pinion Assembly.** Place new retainer gasket on flange face of transfer case. Place the same thickness of shims in pinion thrust bearing recess that were removed originally. Place the pinion shaft assembly in position in case and tap it in with a soft hammer until it bottoms. Install the eight retainer lock washers and nuts. Tighten nuts securely.

f. **Install Herringbone Pinion Bearing Retainer Nut.** Install herringbone pinion bearing retainer nut, and tighten it securely while holding the hypoid pinion shaft flange. Line up a lock ring hole in the nut with a lock ring hole in the shaft. Do not back off the nut to line up the holes. Install lock ring.

g. **Install Herringbone Pinion Radial Bearing Retainer.** Place a new gasket on the retainer and place retainer in position on case, then install the 12 retaining cap screws and lock washers. Tighten cap screws securely.

ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
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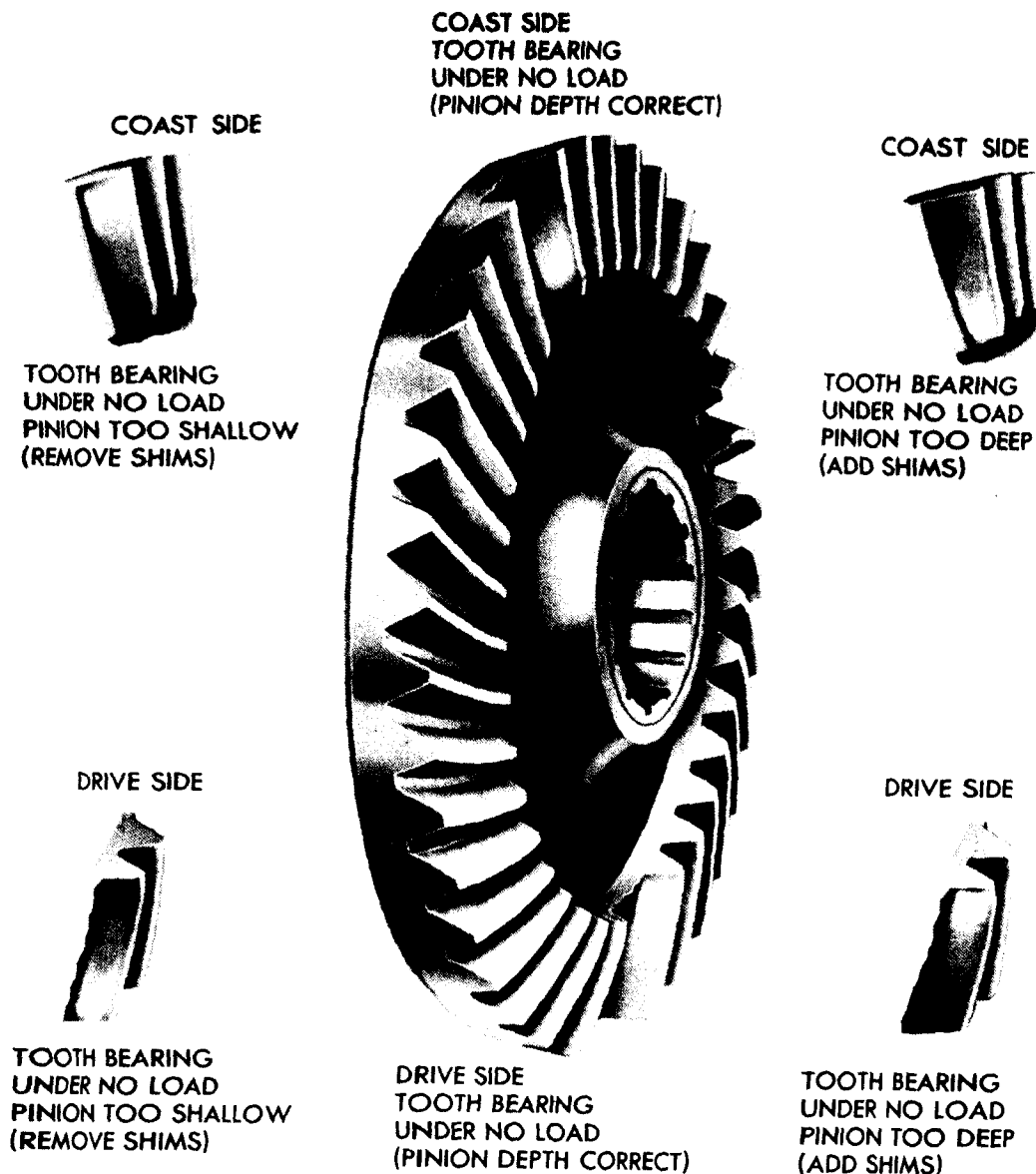


Figure 46 – Tooth Contact Patterns

RA PD 32800

h. Install Hypoid Drive Gear Thrust Bearing Retainer and Adjust Pinion Depth (fig. 46).

(1) **INSTALL HYPOID DRIVE GEAR THRUST BEARING RETAINER.** Place a new gasket on the retainer and place the retainer in position on the case. Install the eight retaining cap screws and lock washers. Tighten the cap screws securely and check adjustment as instructed in the following step.

(2) **HYPOID DRIVE GEAR AND PINION ADJUSTMENT PROCEDURE.**

(a) **Lash Adjustment.** There is no adjustment between the hypoid drive pinion and hypoid drive gear as the lash is held between

ASSEMBLY

0.005 inch and 0.008 inch in manufacturing. If the lash is less than 0.005 inch or more than 0.008 inch, it will be necessary to change the drive gear and pinion.

(b) *Pinion Depth Adjustment* (fig. 46). Spread a thin coating of Prussian blue or red lead on both sides of a few of the teeth on the drive gear. Apply pressure back of drive gear to secure better tooth contact while rotating the gears both forward and backward by turning the pinion flange. Note the position of the tooth contacts on the drive gear. Refer to the drive gear in the center of illustration 46 for the correct contacting areas. The four outer cuts of the illustration show the wrong points of contacts and the remedies to correct them. The adjusting shims are serviced in 0.018-inch, 0.020-inch and 0.022-inch thicknesses.

i. **Install Thrust Pad Screw** (fig. 47). Screw the thrust pad screw in place in side of case, and place a long 0.004-inch feeler gage between the back of the ring gear and the thrust pad; tighten the screw until the pad touches the feeler gage, then tighten lock nut. The clearance between the pad and the ring gear must be between 0.003 inch and 0.006 inch.

j. **Install Carrier Cover**. Place the eight dowels over the cover studs. Place new gasket in position over the studs. Place cover over studs and install the eight lock washers and nuts. Tighten nuts securely.

k. **Install Differential Case Assembly**. Place the four dowels over the carrier cap studs. Place the side bearings on the races on each end of the case, and place the assembly into position in the carrier. Assemble the caps in the same position on each side from which they were removed, and install the four retaining nuts and lock washers. Tighten the nuts securely to 130-150 foot-pounds.

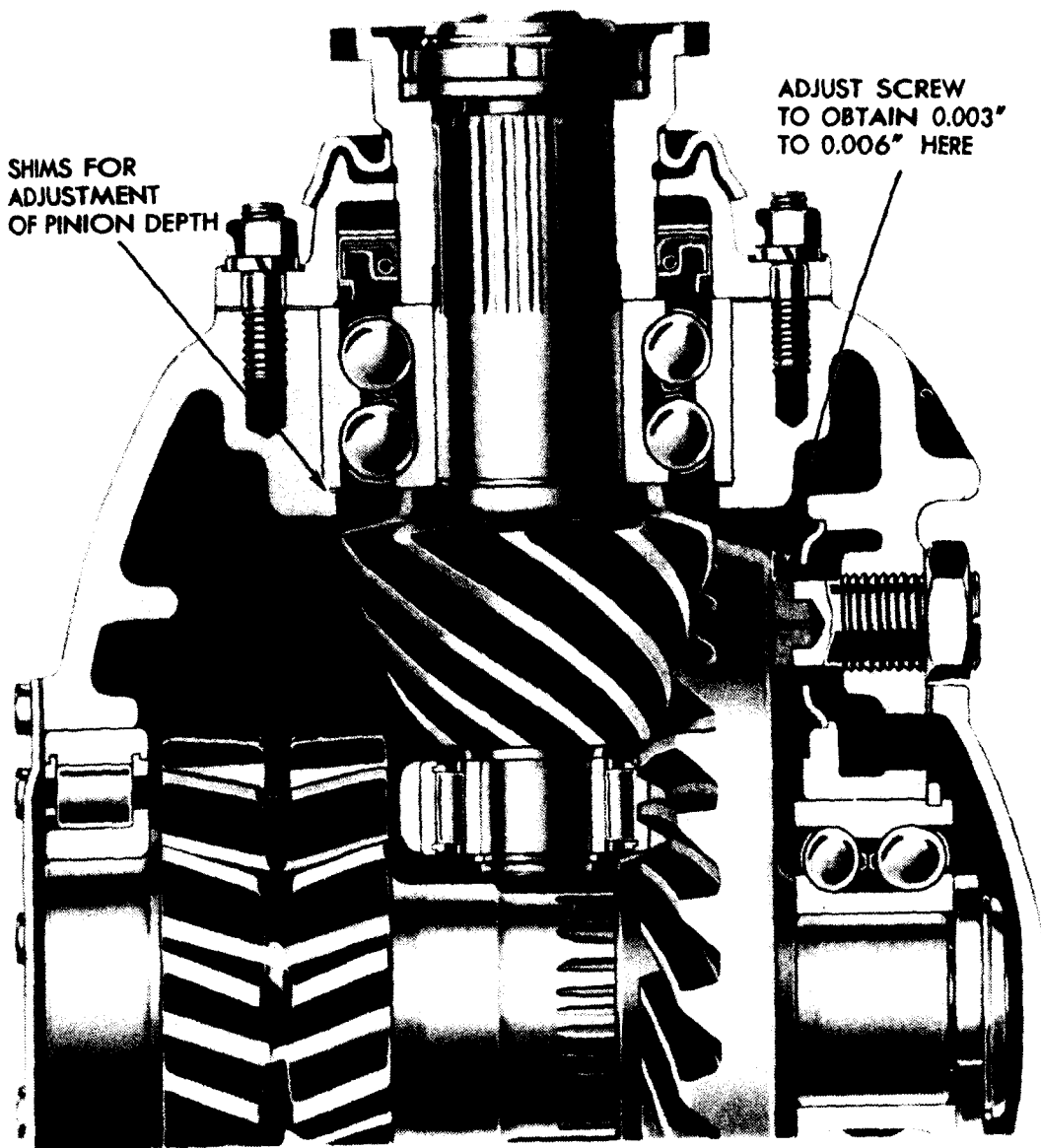
50. ASSEMBLING CARRIER ASSEMBLY TO HOUSING.

a. Place new gasket on housing. Lift carrier assembly with chain hoist and place the assembly in position in the housing. Install the four through bolts and the eight lock washers and nuts that retain the carrier assembly to the housing. Tighten the through bolts and all retaining nuts securely.

51. ASSEMBLING OUTER ENDS.

a. Assemble the spindles, brake flange plates, oil deflectors, hubs, drums, axle shafts, wheels and tires, lubricant, etc., as instructed in paragraph 39.

ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1



RA PD 317041

Figure 47 – Pinion Depth Shims and Thrust Pad Clearance

CHAPTER 3
REAR AXLE (Cont'd)

Section VIII

INSTALLATION

Installation of rear axle assembly.....	Paragraph 52
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52. INSTALLATION OF REAR AXLE ASSEMBLY.

a. **Roll the Assembly in Position Under Vehicle** (fig. 38). Roll the assembly in position under the vehicle and block the wheels. Use a floor jack to raise the carrier assembly to a horizontal position. Lower the vehicle so that the springs are just resting on the axle housing, at the same time centering the spring center bolts in the recess in the housing.

b. **Install U-Bolts.** Place the anchor plate in position on top of the spring center bolt, and install the two U-bolts on each side. Install the four U-bolt nuts and lock washers on each side and tighten securely.

c. **Connect Vent.** Connect the vent hose to the vent fitting and the brake hose to connector tee, using a new copper gasket under the bolt head and between the hose and the connector tee.

d. **Connect Brake Hose.** Screw the brake hose in the fitting on top of the axle housing securely. Tighten the connector bolt securely in the hull that retains the top end of hose to the connector block.

e. **Lower Vehicle.** Remove the blocking, and lower the vehicle so that most of the weight is on the rear axle assembly.

f. **Connect Universal Joint.** Lift propeller shaft and place the two universal joint flanges together and install the four flange bolts, nuts, and lockwashers. Tighten the bolts and nuts securely.

g. **Install Radius Rod Studs.** Place the radius rod ball studs in the brackets on the hull, and install the castellated nuts. Tighten the nuts securely and install a new cotter pin.

h. **Remove all Blocking.** Remove all blocking and the floor jack that was supporting the differential carrier.

i. **Bleed Brake System.** Bleed the entire brake system as instructed in paragraph 72, and road-test vehicle.

ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1

CHAPTER 3
REAR AXLE (Cont'd)

Section IX
FITS AND TOLERANCES

Fits and tolerances	Paragraph 53
---------------------------	-----------------

53. FITS AND TOLERANCES.

a. Differential.

Hypoid drive gear to pinion backlash.....	0.005 in. to 0.008 in. (controlled in manufacture)
Hypoid drive gear runout	0.001 in.
Herringbone drive pinion runout	0.002 in.
Herringbone drive gear to pinion backlash	0.10 in. to 0.014 in. (controlled in manufacture)
Clearance between differential pinion and spider shaft	0.004 in. to 0.008 in.
Clearance between pilot and spider hub	0.002 in. to 0.006 in.
End play in differential case (in bearings)	0.040 in.
End play in herringbone pinion shaft	0.000 in.
Side gear and pinion thrust washer thickness (limits new)	0.058 in. to 0.062 in.
Side gear and pinion thrust washer thickness (limits worn)	0.048 in.
Hypoid pinion bearing adjusting shims	0.002 in., 0.005 in., 0.010 in. and 0.32 in.

b. Ring Gear Thrust Pad.

Clearance, pad to gear.....	0.003 in. to 0.006 in.
Pad thickness (limits new)	0.249 in. to 0.251 in.
Pad thickness (limits worn)	0.165 in.

CHAPTER 3
REAR AXLE (Cont'd)

Section X

SPECIAL TOOLS

Special Tools	Paragraph 54
---------------------	-----------------

54. SPECIAL TOOLS.

a. **Introduction.** The following special tools manufactured by the Kent-Moore Organization or their equivalent should be used as outlined in this chapter.

b. **Identification of the Special Tools.**

Nomenclature	Federal Stock Number	Mfr's Number
Clamp, special hydraulic brake cylinder set of 4	41-C-1836	KM-J2280
Handle for use on replacers	41-H-1074	KM-J1660-1
Puller, front and rear axle housing	41-P-2909-45	KM-J2251
Remover, and replacer, hypoid drive gear thrust bearing, front and rear axle	41-R-2386-19	KM-J2268
Replacer, oil seal, hypoid pinion drive flange, front and rear axle	41-R-2395-24	KM-J2261
Replacer, hypoid pinion thrust bearing, front and rear axle	41-R-2394-165	KM-J2255
Replacer, hypoid pinion roller bearing, front and rear axle	41-R-2394-150	KM-J2257
Replacer, hypoid pinion roller bearing lock nut, front and rear axle	41-R-2394-155	KM-J2258
Replacer, differential case bearing inner race, front and rear axle	41-R-2391-57	KM-J2260
Replacer, herringbone drive pinion roller bearing inner race, front and rear axle	41-R-2394-77	KM-J2253
Remover, inner wheel bearing cup	41-R-2382-50	KM-J2275
Remover, outer wheel bearing cup	41-R-2384-39	KM-J2263

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

Nomenclature	Federal Stock Number	Mfr's Number
Remover and replacer, spindle (bushing used with 41-H-1074 universal drive handle)	41-R-2389-21	KM-J2279-1
Replacer, outer wheel bearing cup	41-R-2395-77	KM-J2264
Replacer, inner wheel bearing cup	41-R-2394-260	KM-J2266
Ring, lifting, turret top (set of 3)	41-R-2515	KM-J2294
Tube, brake bleeder	41-T-4169	KM-J2252
Wrench, pinion nut, herringbone drive, front and rear axle	41-W-1624	KM-J2267

CHAPTER 4
WHEEL BEARINGS

Section I

INTRODUCTION

	Paragraph
Description	55
Data	56
Reference to second echelon TM 9-741.....	57
Maintenance allocation	58

55. DESCRIPTION.

a. **General.** The wheel bearings, cups, and cones are all interchangeable, and can be used in either the front or rear hubs. The hub and drum assemblies are interchangeable on the same side of the vehicle, but the hubs on the left side of vehicle are not interchangeable with those on the right side of vehicle unless the proper wheel studs are used. The hubs on the left side of vehicle use wheel studs with left-hand threads, and the hubs on the right side of vehicle use studs with right-hand threads.

56. DATA.

Inner bearing cup.....	Timken 56650
Inner bearing cone.....	Timken 56425
Outer bearing cup.....	Timken 592A
Outer bearing cone.....	Timken 594

57. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often performed by ordnance maintenance personnel who should refer to the using troop TM for information.

58. MAINTENANCE ALLOCATION.

a. For scope of maintenance and repair by the crew and other units of the using arm, refer to paragraph 7.

b. Maintenance Chart.

	ECHELONS			
	2nd	3rd	4th	5th
TIRES				
Casings and tubes—replace.....	X			
Casings—repair			E	X
Tubes, inner—repair	X			

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1

CHAPTER 4
WHEEL BEARINGS (Cont'd)

Section II
REMOVAL

Removal Paragraph 59

59. REMOVAL.

a. **Remove Wheel and Tire.** Remove wheel and tire assembly as instructed in paragraph 152 a of TM 9-741.

b. **Remove Drum (fig. 4).** Remove the three screws that attach the drum to the hub, and screw them into the three tapped holes in the drum alternately until the hub is loose. Lift off the hub.

c. **Remove Hub (figs. 7 and 15).** Bend the lock tangs away from the axle flange bolts, and remove the eight bolts and lock. Screw two of the bolts in the tapped holes of the flange alternately until the flange or axle shafts is loose, then lift out the flange or axle shaft. Bend the lock tang away from the bearing adjusting lock nut and remove the lock nut, lock, and adjusting nut and washer. Pull off the hub with bearings.

d. **Remove Outer Bearing and Cup.** Lift out the outer bearing. Place the press plate of the outer cup remover (41-R-2384-39) against the cup from the inside of the hub. Install the handle (41-H-1074), and press or drive out the outer cup.

e. **Remove Inner Bearing, Cup, and Oil Seal (fig. 48).** Place the press plate of the inner cup remover (41-R-2382-50) against the inner cup from the inside of the hub. Install the handle and press or drive out the inner cup and oil seal.

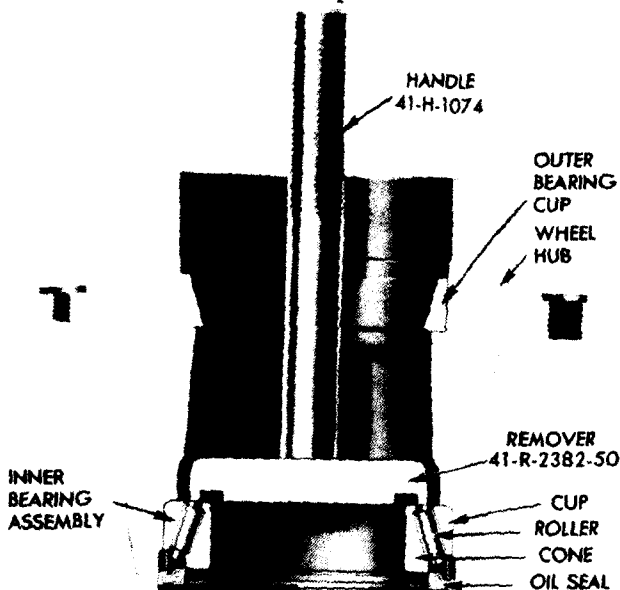


Figure 48 — Removing
Inner Bearing and
Seal Assembly

RA PD 317042

CHAPTER 4
WHEEL BEARINGS (Cont'd)

Section III

CLEANING AND INSPECTION OF PARTS

	Paragraph
Cleaning	60
Inspection	61

60. CLEANING.

a. Clean the hub thoroughly, both inside and outside, in dry-cleaning solvent and dry it with air pressure. Clean the outside of the spindle and dry it with air pressure. Use clean solution to wash the bearing and cups. Use extreme care in cleaning the bearings and cups and dry them thoroughly with air pressure. **NOTE:** *Do not let the bearings spin with the air stream.*

61. INSPECTION.

a. **Inspect Hubs.** Inspect the hubs for cracks, stripped threads, or other damage. Inspect the fit of the cups in the hub: they should be a drive fit. Replace the hub if it is damaged in any way.

b. **Inspect Bearings and Cups.** Inspect the bearings for scoring, cracked or broken roller, cones or cups. Drop a few drops of light engine oil on the rollers and cone, place the bearing in the cup, and turn the cup slowly, noting any roughness. Replace any damaged or rough parts.

c. **Inspect Spindle.** Inspect the spindle for scored surfaces at the bearing race contact points. Also inspect the bearing nut threads. If the spindle is damaged, replace it.

ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1

CHAPTER 4

WHEEL BEARINGS (Cont'd)

Section IV

INSTALLING BEARINGS AND CUPS

Paragraph

Installing bearings and cups 62

62. INSTALLING BEARINGS AND CUPS.

a. **Install Outer Cup (fig. 49).** Place cup in position in outer end of hub with wide side of race toward the hub. Place replacer (41-R-2395-77) against race, and press or drive the race in the recess until it bottoms against the shoulder.

b. **Install Inner Cup (fig. 50).** Place cup in position in inner end of hub with wide side of race toward the hub. Place replacer (41-R-2394-260) against race, and press or drive the race in the recess until it bottoms against the shoulder.

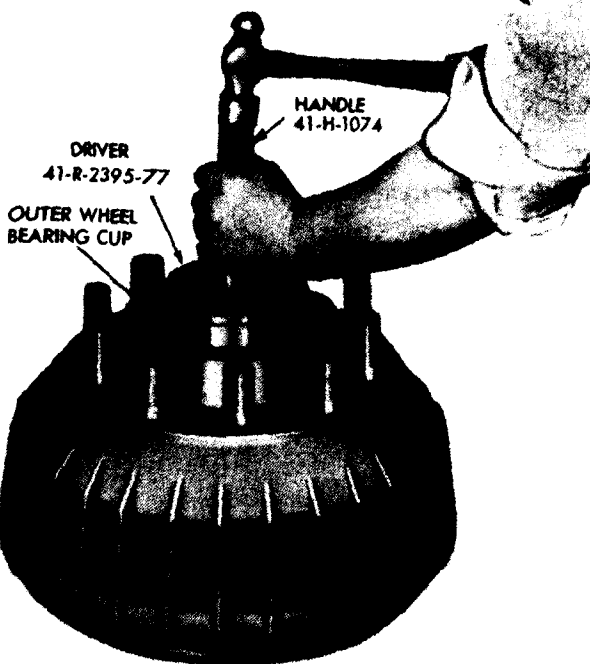
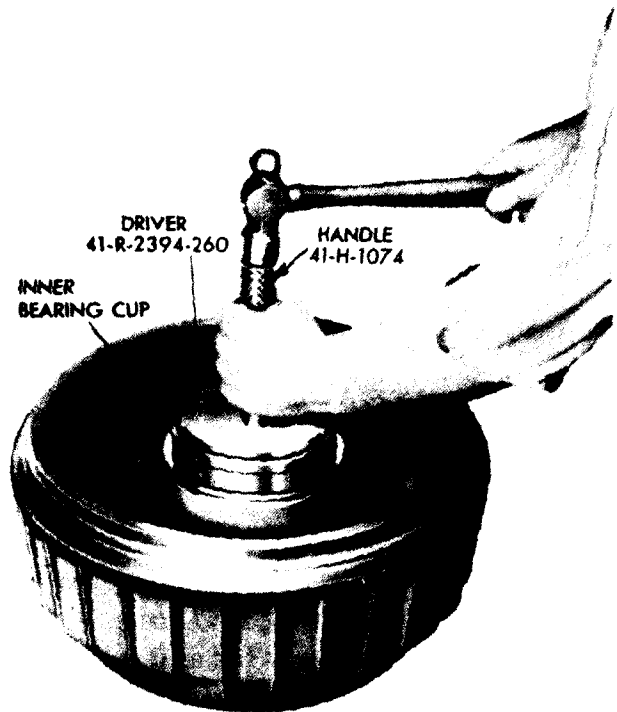


Figure 49 – Installing Outer Bearing Cup

RA PD 317043

INSTALLING BEARINGS AND CUPS

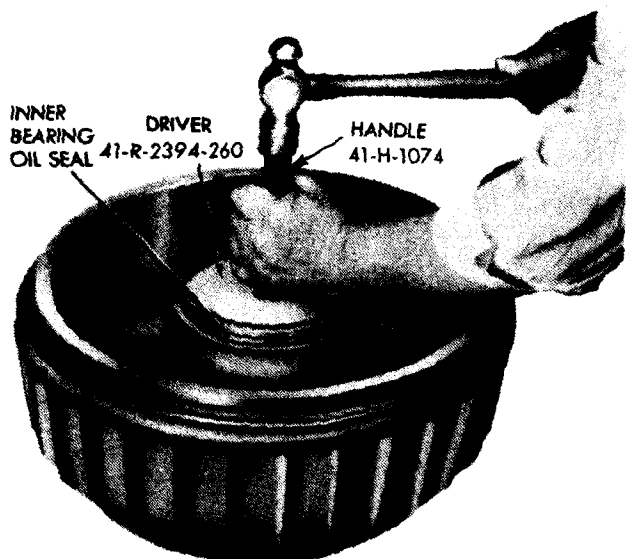
Figure 50 – Installing Inner Bearing Cup



RA PD 317044

c. **Install Oil Seal (fig. 51).** Pack the inner bearing and cone with wheel bearing grease, and place the bearing in the cup. Place the oil seal in position on the inner end of the hub, and place the replacer (41-R-2394-260) on the seal. Press or drive the seal in until it bottoms against the cup.

Figure 51 – Installing Inner Bearing Oil Seal



RA PD 317045

ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1

CHAPTER 4
WHEEL BEARINGS (Cont'd)

Section V

INSTALLING HUB, WHEEL, AND TIRE

Installing hub, wheel, and tire	Paragraph 63
---------------------------------------	-----------------

63. INSTALLING HUB, WHEEL, AND TIRE.

a. **Install Hub** (fig. 15). Spread a thin coating of grease on the spindle. Place the hub assembly on the spindle as far as it will go. Pack the outer bearing and cone with wheel bearing grease and push it in place in the hub as far as it will go. Place wheel nut washer on hub, and install the adjusting nut. Adjust bearings as instructed in the following step.

b. **Adjust Wheel Bearings** (fig. 52). Using the wheel bearing nut wrench in the vehicle tool kit, tighten the nut tight to make certain that the hub is seated properly on the spindle. Then back off the nut one-eighth of a turn (45-degree minimum). Install the wheel nut lock, alining one of the short lugs in one of the slots in the adjusting nut. If lug does not line up with one of the slots, back off the nut until the nearest lug lines up with the slot. Install the lock and lock nut and

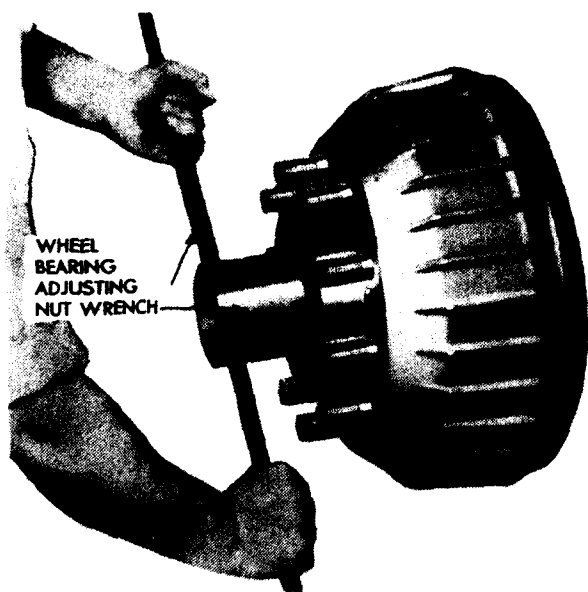


Figure 52 – Adjusting
Wheel Bearing

INSTALLING, HUB, WHEEL, AND TIRE

tighten the lock nut securely. Bend tang of lock in slot in lock nut. Rotate hub to see that it is free.

c. **Install Drum** (fig. 7). Place the drum on the hub so that the three retaining screw holes in the drum line up with the holes in the hub. Install the three retaining screws and tighten them securely.

d. **Install Flange or Axle Shaft** (fig. 7). Place a new drive flange gasket over the flange or axle shaft, and push the flange or axle shaft in place until flange is up against the hub. Line up the holes, and install the bolt lock and the eight retaining cap screws. Bend the tangs of the lock against the bolt heads. See paragraph 39 h for additional rear axle instructions.

e. **Install Wheel and Tire.** Place the wheel on the hub and install the ten retaining nuts; tighten them securely. Remove the blocking and lower vehicle to ground.

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

CHAPTER 4

WHEEL BEARINGS (Cont'd)

Section VI

SPECIAL TOOLS

	Paragraph
Special tools	64

64. SPECIAL TOOLS.

a. Introduction. The following special tools manufactured by the Kent-Moore Organization, or their equivalent, should be used as outlined in this chapter.

b. Identification of the Special Tools.

Nomenclature	Federal Stock Number	Mfr's Number	Figure No.
Remover, inner wheel bearing cup	41-R-2382-50	KM-J-2275	48
Remover, outer wheel bearing cup	41-R-2384-39	KM-J-2263	
Replacer, inner wheel bearing cup and oil seal	41-R-2394-260	KM-J-2266	50
Replacer, outer wheel bearing cup	41-R-2395-77	KM-J-2264	49

CHAPTER 5
BRAKES

Section I

INTRODUCTION

	Paragraph
Description	65
Data	66
Reference to second echelon TM 9-741	67
Maintenance allocation	68

65. DESCRIPTION (fig. 53).

a. Units used in the hydraulic system include brake shoes, master cylinder, master cylinder reserve tank, wheel cylinder, hydrovac unit (power cylinder, relay valve, and hydraulic slave cylinder), vacuum check valve, vacuum reserve tanks, vacuum and hydraulic lines. Two hand brake drums and linings are located at the front of the transfer case.

66. DATA.

a. General.

Type 4-wheel hydraulic

b. Parking Brake.

Type Mechanical linkage

c. Brake Master Cylinder.

Size 1½-in. diameter
(twin cylinders)

Fluid level Check level in reserve
tank periodically

Piston clearance 0.001 in.-0.005 in.

d. Equalizer Cylinder.

Size 1½-in. diameter

Piston clearance 0.001 in.-0.005 in.

e. Front and Rear Wheel Cylinders.

Size 1¾-in. diameter

Piston clearance 0.002 in.-0.005 in.

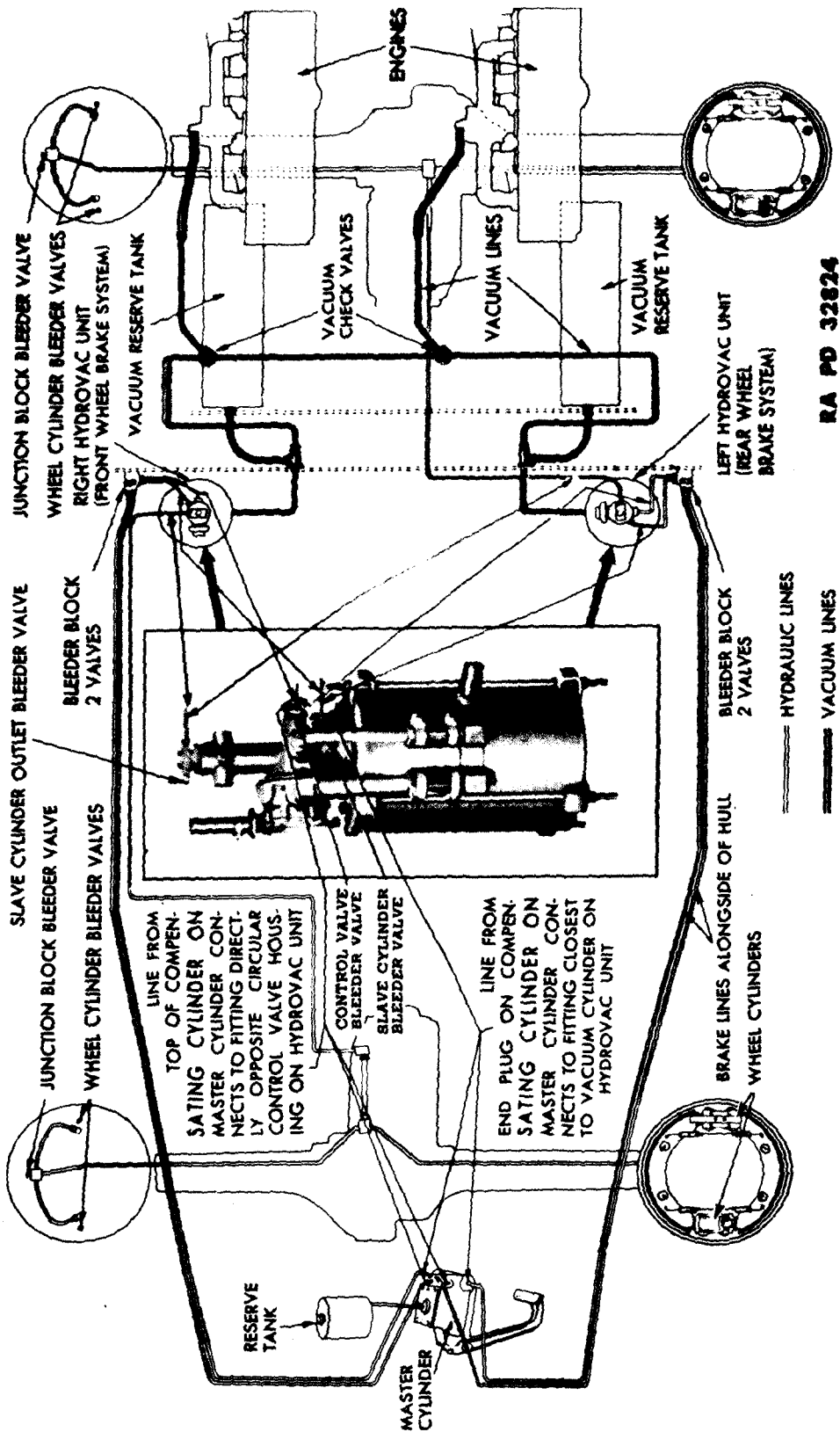
f. Front and Rear Brake Shoes.

Lining length (each lining) 17³/₁₆ in.

Lining width 5 in.

Thickness 0.392 in.-0.412 in.

ORDNANCE MAINTENANCE - CHASSIS, HULL, AND TURRET FOR
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RA PD 32824

Figure 53 - Layout of Brake System

INTRODUCTION

g. **Parking Brake Lining.**

Lining length	26 ³ / ₈ in.
Lining width	3 in.
Thickness	5 ¹ / ₁₆ in.

h. **Brake Return Springs.**

Master cylinder piston springs:

Free length	3 ³ / ₈ in.
Pressure at 2 ⁷ / ₁₆ in.	9 ³ / ₄ lb

Equalizer piston springs:

Free length	1 ⁵ / ₈ in.
Pressure at 2 ³ / ₃₂ in.	15 ¹ / ₂ lb

Check valve spring:

Free length	1 ¹¹ / ₁₆ in.
Pressure at 1 ³ / ₃₂ in.	9 ¹ / ₂ lb

Front and rear wheel cylinder piston springs:

Free length	3 ²³ / ₆₄ in.
Pull at 1 ⁵ / ₈ in.	1 lb plus or minus 1/4 lb

i. **Brake Shoe Retractor Springs.**

Free length	3 ²³ / ₆₄ in.
Pull at 3 ⁹ / ₁₆ in.	60 lb plus or minus 6 lb (each spring)

Brake pedal pull-back spring:

Free length	5 ⁷ / ₁₆ in.
Pull at 8 ⁵ / ₃₂ in.	36 lb plus 5 lb minus 0 lb

Parking brake pull back spring:

Free length	3 ⁵ / ₁₆ in.
Pull at 5 ¹ / ₂ in.	36 lb

Parking brake adjusting bolt spring:

Free length	1 ³ / ₈ in.
Pressure at 1 ¹ / ₂ in.	750-850 lb

Parking brake release spring:

Free length	6 ³ / ₈ in.
Pressure at 5 in.	30 lb plus or minus 5 lb

Hydrovac power cylinder piston return spring:

Free length	3 ³ / ₈ in.
Pressure at 2 ⁷ / ₁₆ in.	9 ³ / ₄ lb

Hydrovac slave cylinder piston return spring:

Free length	13 in.
Pressure at 5 ¹ / ₂ in.	7 ¹ / ₂ lb

**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

j. Brake Drums.

Front and rear drums:

Size 16-in. diam
Regrinding limits 0.125 in. on diam

Parking brake drums:

Size 8⁷/₁₆-in. diam

k. Hydrovac Unit.

Model H-25-10V-92
Vacuum cylinder displacement 47.2 cu in. per cylinder
Size 7³/₄ in. diam
Stroke (maximum) 3⁹/₃₂ in.
Slave cylinder displacement 2.45 cu in.
Size 1 in. diam
Stroke (maximum) 3¹/₈ in.

67. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often done by ordnance maintenance personnel, who should refer to TM 9-741 for information.

68. MAINTENANCE ALLOCATION.

a. For scope of maintenance and repair by the crew and other units of the using arm, refer to paragraph 7.

b. Maintenance Chart.

	ECHELONS			
	2nd	3rd	4th	5th
BRAKES, PARKING				
Band assemblies—service and/or replace.....	X			
Band assemblies—repair (reline)		X		
BRAKES, SERVICE (HYDRAULIC)				
Cylinder assembly, master—replace	X			
Cylinder assembly, master—repair		X		
Cylinder assembly, master—rebuild			X	
Cylinder assembly, power (hydrovac)—replace	X			
Cylinder assembly, power (hydrovac)—repair		X		
Cylinder assembly, power (hydrovac)—rebuild			E	X
Cylinder assembly, wheel—replace	X			
Cylinder assembly, wheel—repair		X		
Cylinder assembly, wheel—rebuild			X	
Hose, flexible, lines and connections—replace	X			
Hose, flexible, lines and connections—repair		X		
Shoe assemblies—service and/or replace	X			
Shoe assemblies—repair (reline)		X		

CHAPTER 5
BRAKES (Cont'd)

Section II

TROUBLE SHOOTING

Trouble shooting	Paragraph 69
------------------------	-----------------

69. TROUBLE SHOOTING.

a. Brake Pedal "Spongy".

Possible Cause	Possible Remedy
Air in lines.	Bleed brakes (par. 72).

b. All Brakes Drag.

Mineral oil in system.	Thoroughly wash out all lines and cylinder and replace all rubber parts (pars. 75 and 76).
Dirt in master cylinder compensating port.	Remove master cylinder and clean thoroughly (par. 75).

c. One Brake Drags.

Loose wheel bearing.	Adjust wheel bearing (par. 63 b).
Weak retractor spring.	Replace spring (par. 73).
Brake shoes adjusted too close to drum.	Readjust brakes according to instructions (par. 70).

d. Loose Brakes.

Normal lining wear.	Readjust brakes (par. 70).
Brake lining worn out.	Replace linings and readjust (par. 73).
Fluid low in master cylinder and reservoir.	Fill master cylinder and reservoir and bleed all brake lines (par. 72).

e. Brakes Uneven.

Oil on lining.	Thoroughly clean brake mechanism and install new lining (par. 73).
Tires improperly inflated.	Inflate tires.
Spring center bolt sheared and spring shifted on axle.	Replace spring center bolt, relocate spring on axle.

TM 9-1741C
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f. Excessive Pedal Pressure, Poor Brakes.

Possible Cause	Possible Remedy
Oil on lining.	Thoroughly clean brake mechanism and install new lining (par. 73).
Full area of lining not contacting drum.	Sand shoes so linings contact drum properly.
Scored brake drum.	Turn drum, or replace it. If lining is badly scored, it should also be replaced.

g. Hydrovac System Power Brakes Fail to Operate.

Vacuum line leaks.	Find location of leak and correct leak or replace line.
Vacuum valve sticking.	Remove and clean vacuum valve replacing worn or damaged parts.
Lack of lubricant in vacuum cylinder.	Lubricate vacuum cylinder in accordance with instructions (par. 78).
Worn parts in hydrovac unit.	Overhaul hydrovac unit (pars. 80 to 85).

CHAPTER 5
BRAKES (Cont'd)

Section III

**BRAKE ADJUSTMENT AND BLEEDING
HYDRAULIC SYSTEM**

	Paragraph
Brake adjustment	70
Parking brake adjustment	71
Bleeding hydraulic system	72

70. BRAKE ADJUSTMENT.

a. **General.** The brakes can be adjusted without the removal of the wheels, as the brake flange plates have openings with spring snap cover, through which the adjustment may be made.

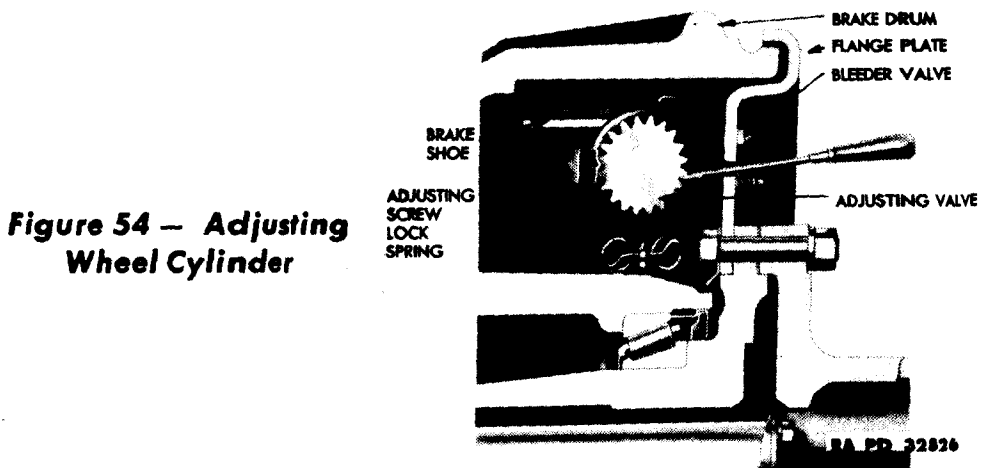
b. **Procedure.**

(1) **REMOVE ADJUSTING COVER** (fig. 54). Remove the adjusting hole cover from the flange plate, insert a screwdriver through the adjusting hole, and engage the teeth on the adjusting screw of the wheel cylinder.

(2) **TURN ADJUSTING SCREW.** Turn the adjusting screw until the shoe is snug in the drum, or until the adjusting screw can be turned no more. Turn the adjusting screw back six notches. Each notch backed off will be indicated by a faint click of the adjusting screw lock spring as the screw is turned. This backing-off of the adjusting screw moves the brake shoe away from the drum to insure proper running clearance of the shoes in the drum.

(3) **INSTALL COVER.** Install the adjusting hole cover.

(4) **ADJUST SHOES.** Adjust both shoes on all wheels according to the above procedure.



**Figure 54 - Adjusting
Wheel Cylinder**

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71. PARKING BRAKE ADJUSTMENT.

a. **General** (fig. 55). The parking brake adjustment should be checked each time the hydraulic service brakes are adjusted. Use the following procedure for the two parking brakes.

b. Procedure.

(1) **RELEASE BRAKE LEVER.** Set hand brake lever in fully released position.

(2) **ROTATE TURRET.** Rotate the turret until the trap door in the bottom of the basket is over the parking brakes. Working through this opening, break the short hose connection at the transfer case oil cooler.

(3) **ADJUST ANCHOR BOLT** (fig. 55). Release the lock wire from the head of the anchor bolt near the top of the brake band, and turn down the bolt until a 0.020-inch feeler gage will just pass between the brake band and the drum at the anchor bolt position.

(4) **TIGHTEN ADJUSTING NUT** (fig. 55). Tighten the self-locking adjusting nut on the adjusting bolt at the bottom of the brake until a 0.020-inch feeler gage will just pass between the two ends of the brake lining and drum.

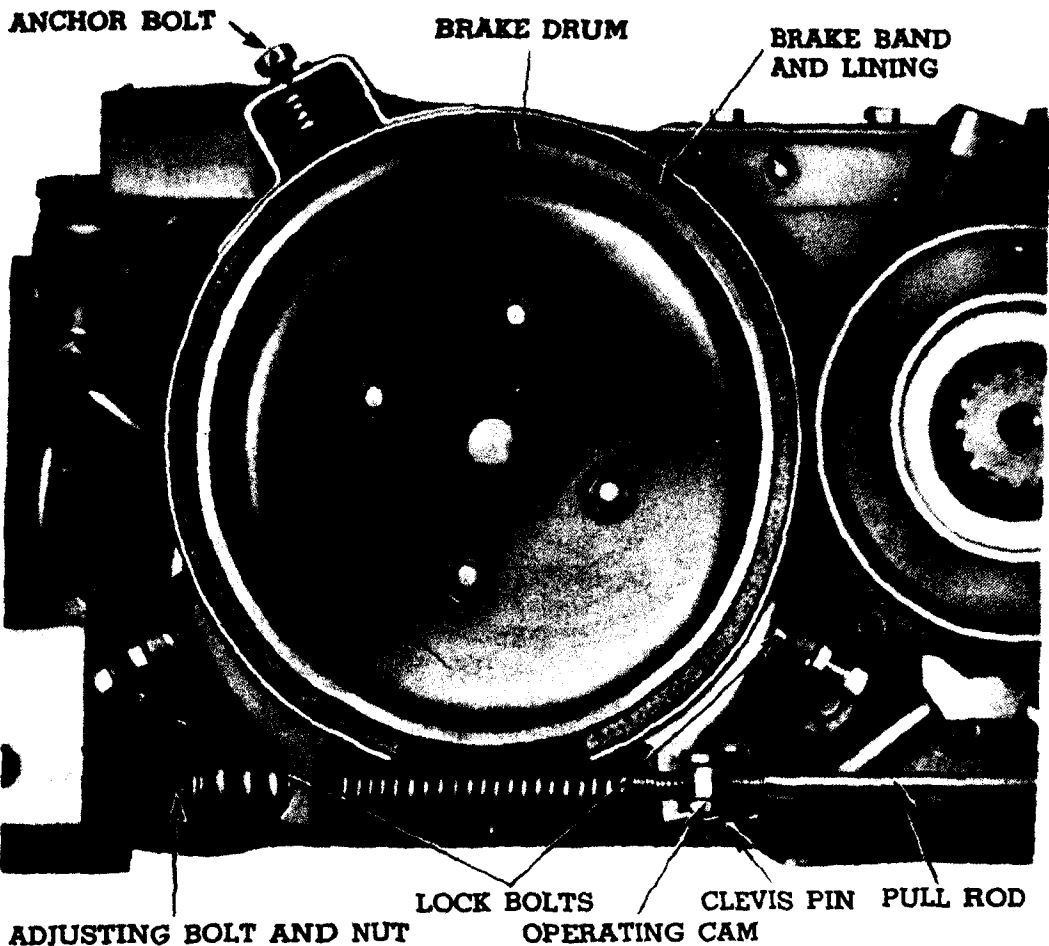
(5) **TIGHTEN ADJUSTING BOLT.** Remove service plate from the bottom of hull. **NOTE:** *Some of the early models did not have service plate.* Loosen the lock nuts on the two brake band lock bolts at each side of the adjusting bolt, and tighten the bolts until a 0.020-inch feeler gage will just pass between the brake band and the drum at these locations.

(6) **RECHECK CLEARANCE.** Recheck the 0.020-inch clearance at the end of the brake bands, and readjust the adjusting bolt at the bottom if necessary. Check the brake band to drum clearance around the entire surface of the drum with a 0.020-inch feeler gage. Readjust the adjusting bolt, lock bolts, and anchor bolt if necessary to obtain a minimum of 0.020-inch clearance between the brake lining and drum at any point. **IT IS VERY IMPORTANT THAT THIS CLEARANCE IS MAINTAINED.** At the high speed at which the parking brake drums revolve under operating conditions, even a slight drag of the linings would result in overheating and rapid wear of the linings, as well as serious overheating of adjacent parts, with possible damage resulting.

(7) **TIGHTEN LOCK NUTS** (fig. 55). Tighten the lock nuts on the lock bolts and install a new locking wire on the anchor bolt, using care in so doing that the adjustment is not disturbed. Replace service plate at bottom of hull.

(8) **LUBRICATE CONTROL LINKAGE.** Lubricate all frictional surfaces of the brake control linkage and anchor bolts with oil.

BRAKE ADJUSTMENT AND BLEEDING HYDRAULIC SYSTEM



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Figure 55 – Parking Brake

72. BLEEDING HYDRAULIC SYSTEM (fig. 53).

a. **General.** The hydraulic brake system must be bled whenever a pipeline has been disconnected, or when a leak has allowed air to enter the system. A leak in the system may sometimes be made apparent by a “spongy” brake pedal. Air trapped in the system is compressible, and does not permit all pressure applied to the brake pedal to be transmitted to the brake shoes. The system must be *absolutely* free from air at all times. If the disconnected pipe or leak affects only one of the two complete brake systems, that system *only* needs to be bled. Make sure that the master cylinder reservoir tank is nearly full of fluid. During all bleeding operations, the reservoir tank must be kept at least one-quarter full of hydraulic brake fluid. **NOTE:** *Before removing the filler plug from the reservoir, clean all dirt and foreign matter from around the plug so that none will fall into the reservoir.* Bleed at each of the bleeder valves listed below, and in the sequence listed, by performing the following operations:

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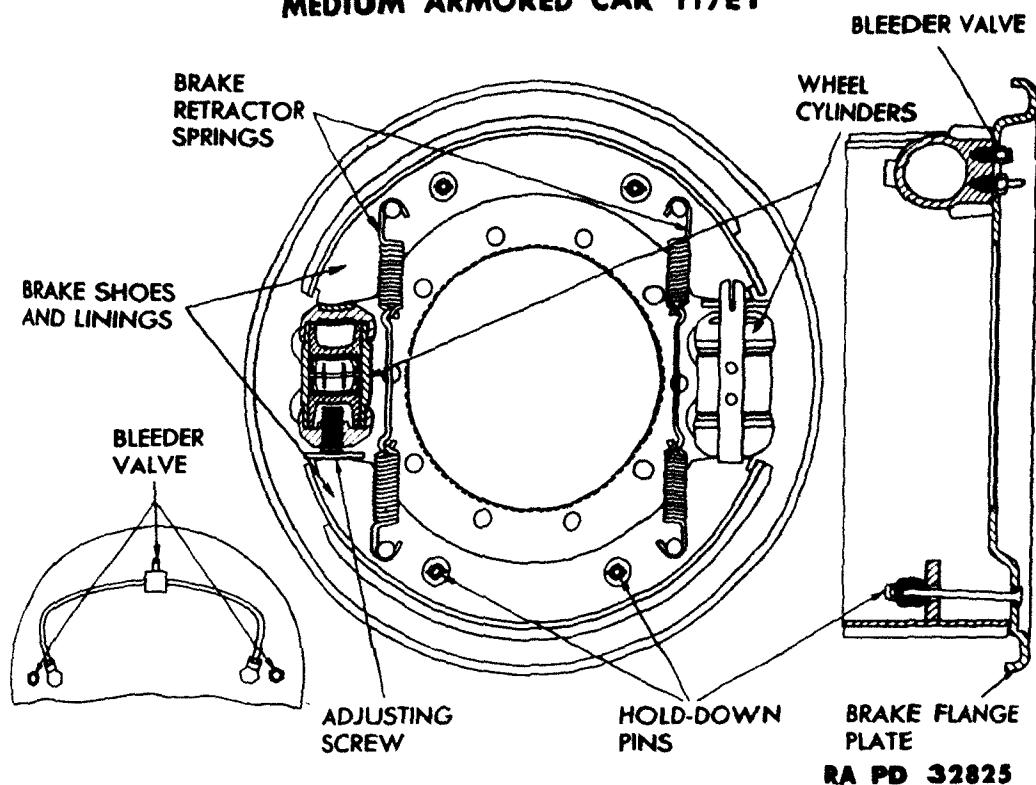


Figure 56 – Brake Construction

b. Procedure.

(1) REMOVE BLEEDER VALVE SCREW (fig. 56). Remove bleeder valve screw and attach brake bleeder hose (41-T-4169) in place of the screw. Place the free end of the tube in a glass jar partially filled with brake fluid so that the end of the tube is below the surface of the fluid in the jar.

(2) UNSCREW BLEEDER VALVE (fig. 56). Unscrew the bleeder valve one-half to three-quarter turn.

(3) DEPRESS BRAKE PEDAL. Depress the brake pedal and allow it to return slowly. Continuing this pumping action forces the fluid through the lines and out of the bleeder tube, carrying with it any air in that portion of the system, as may be noted by the bubbles from end of the bleeder tube.

(4) TIGHTEN BLEEDER VALVE. When bubbles cease to appear at the end of the bleeder tube, and the stream is a solid fluid mass, tighten the bleeder valve and remove the bleeder tube.

(5) INSTALL VALVE SCREW. Install and tighten the bleeder valve screw.

c. Bleeding Sequence. Referring to the schematic diagram in fig. 53, perform the above bleeding procedure at each of the following points in the order listed:

BRAKE ADJUSTMENT AND BLEEDING HYDRAULIC SYSTEM**(1) FRONT SYSTEM BLEEDING SEQUENCE (fig. 53).**

(a) *Bleed Main Cylinder to Hydrovac Lines.* Bleed at each of the two valves at the bleeder block on the right side of the hull near the top, and just ahead of the bulkhead.

(b) *Bleed Slave Cylinder.* Bleed at the slave cylinder bleeder valve on the right hand hydrovac assembly.

(c) *Bleed Control Valve.* Bleed the right-hand hydrovac assembly at the control valve bleeder.

(d) *Bleed Slave Cylinder Outlet Valve.* Bleed at the slave cylinder outlet bleeder valve at the connector block on outlet at upper end of the right-hand hydrovac assembly.

(e) *Bleed Left Front Wheel (fig. 56).* Bleed at left front wheel junction block bleeder valve at back of brake flange plate. Bleed at each of the two left front wheel cylinder bleeder valves at the back of front brake flange plate.

(f) *Bleed Right Front Wheel (fig. 56).* Bleed at right front wheel junction block bleeder valve at back of brake flange plate. Bleed at each of the two right front wheel cylinder bleeder valves at the back of front brake flange plate.

(2) REAR SYSTEM BLEEDING SEQUENCE (fig. 53).

(a) *Bleed Main Cylinder to Hydrovac Lines.* Bleed at each of the two valves at the bleeder block on the left side of the hull near the top and just ahead of the bulkhead.

(b) *Bleed Slave Cylinder.* Bleed at the slave cylinder bleeder valve on left-hand hydrovac assembly.

(c) *Bleed Control Valve.* Bleed at the control valve bleeder valve on left-hand hydrovac assembly.

(d) *Bleed Slave Cylinder Outlet Valve.* Bleed at the slave cylinder outlet bleeder valve at the connector block on outlet at upper end of left-hand hydrovac assembly.

(e) *Bleed Left Rear Wheel (fig. 56).* Bleed at left rear wheel junction block bleeder valve at back of brake flange plate. Bleed at each of the two left rear wheel cylinder bleeder valves at the back of left rear brake flange plate.

(f) *Bleed Right Rear Wheel (fig. 56).* Bleed at right rear wheel junction block bleeder valve at back of brake flange plate. Bleed at each of the two right rear wheel cylinder bleeder valves at back of right rear brake flange plate. After bleeding operations have been completed at each point listed above, fill the reservoir tank approximately full of new clean hydraulic brake fluid, and replace the filler plug. **NOTE:** *Fluid withdrawn in the bleeding operation must not be used again.*

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d. **Hydraulic Brake Fluid.** As there are several general classifications of hydraulic brake fluids available, care should be taken to make certain that the fluid being used will not injure the brake parts. Some brake fluids may have a rather severe action on the rubber parts, causing them to become sticky, preventing proper piston action or, due to expansion of the rubber parts, causing them to lose their sealing qualities. Other types of fluid may cause vapor lock or, due to extreme thinness, leak past the rubber cups in the wheel cylinders and saturate the brake linings. In the event that improper fluid has entered the system, it will be necessary to drain the entire system. Thoroughly flush out the system with clean alcohol, 188 proof, or a hydraulic brake cleaning fluid, known to the industry as Declene. Replace all rubber parts of the system. Refill with proper hydraulic brake fluid.

CHAPTER 5
BRAKES (Cont'd)

Section IV

BRAKE SHOE AND LINING REPLACEMENT

	Paragraph
Service brake shoe and lining replacement	73
Parking brake service procedure	74

73. SERVICE BRAKE SHOE AND LINING REPLACEMENT.

a. **General.** Brake shoes which have become unserviceable should be replaced in the following manner.

b. **Procedure.**

(1) **LOOSEN WHEELS.** Loosen the ten wheel nuts on each wheel two turns.

(2) **RAISE VEHICLE.** Place vehicle on level spot, jack up vehicle, and place on jack stands or suitable blocks.

(3) **REMOVE WHEELS.** Remove stud nuts and take off all wheels.

(4) **REMOVE DRUMS** (fig. 4). Remove the three drum retaining screws, install three screws in tapped holes in drum, and tighten alternately until drum is removed.

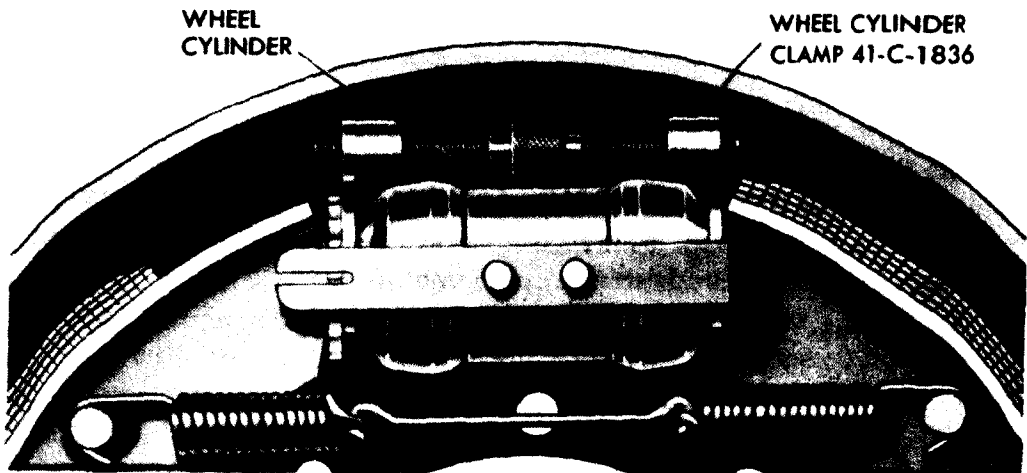
(5) **INSPECTION.** After removal of the brake drums and before disassembly of the shoes from the flange plate, all linings should be inspected for wear, improper alinement causing uneven wear, and oil or grease on linings. If any of these conditions exist, it will be necessary to replace the shoes. If in checking the lining it is noticed that they have the appearance of being glazed, this is a normal condition with the hard type of lining used. Do not use a wire brush or any abrasive on the lining to destroy this glazed surface, as it is essential for proper operation. Shoes should be changed in sets; both shoes on both front wheels, or both shoes on both rear wheels.

(6) **INSTALL WHEEL CYLINDER CLAMP** (fig. 57). Install wheel cylinder clamp (41-C-1836) to keep the wheel cylinder pistons in place, and to prevent leakage of brake fluid while replacing shoes.

(7) **REMOVE RETRACTING SPRINGS** (fig. 58). Remove brake shoe retracting springs by pulling the inner ends of the double springs together, using special brake spring pliers. Remove the connecting link.

(8) **REMOVE BRAKE SHOES** (figs. 56 and 59). Remove the cotter pins, retaining nuts, steel cups, and springs from the four hold-down pins. The brake shoe assemblies now can be slipped off the hold-down pins.

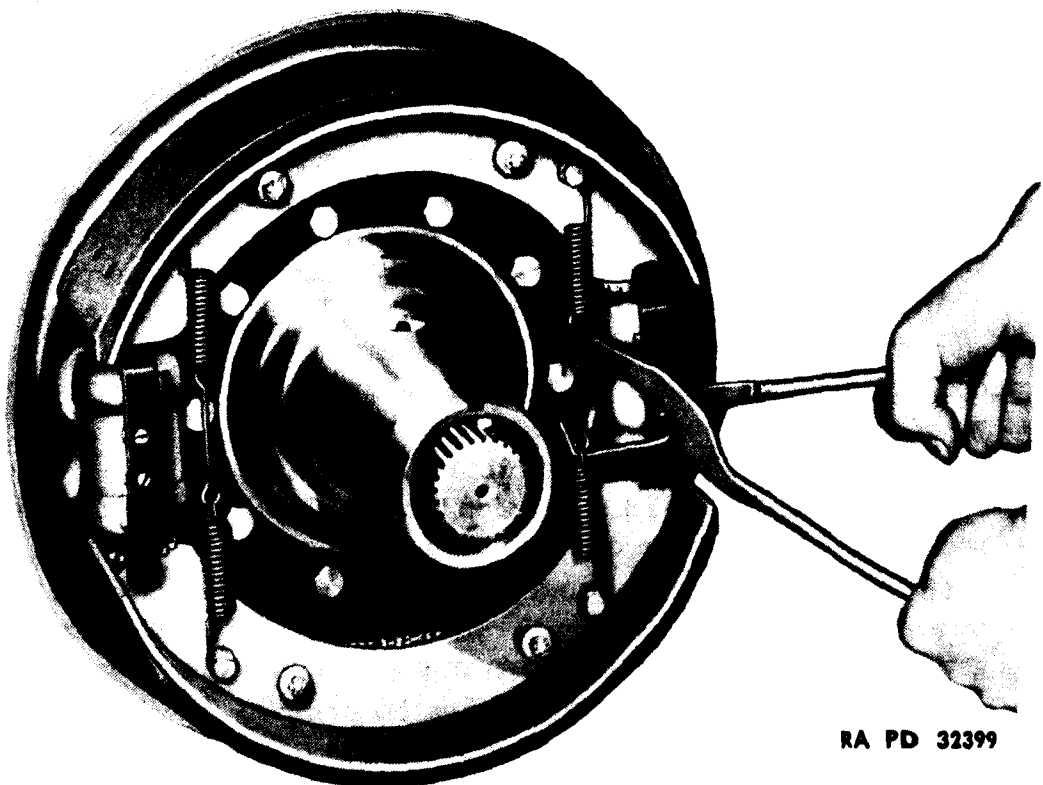
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Figure 57 – Installing Wheel Cylinder Clamp

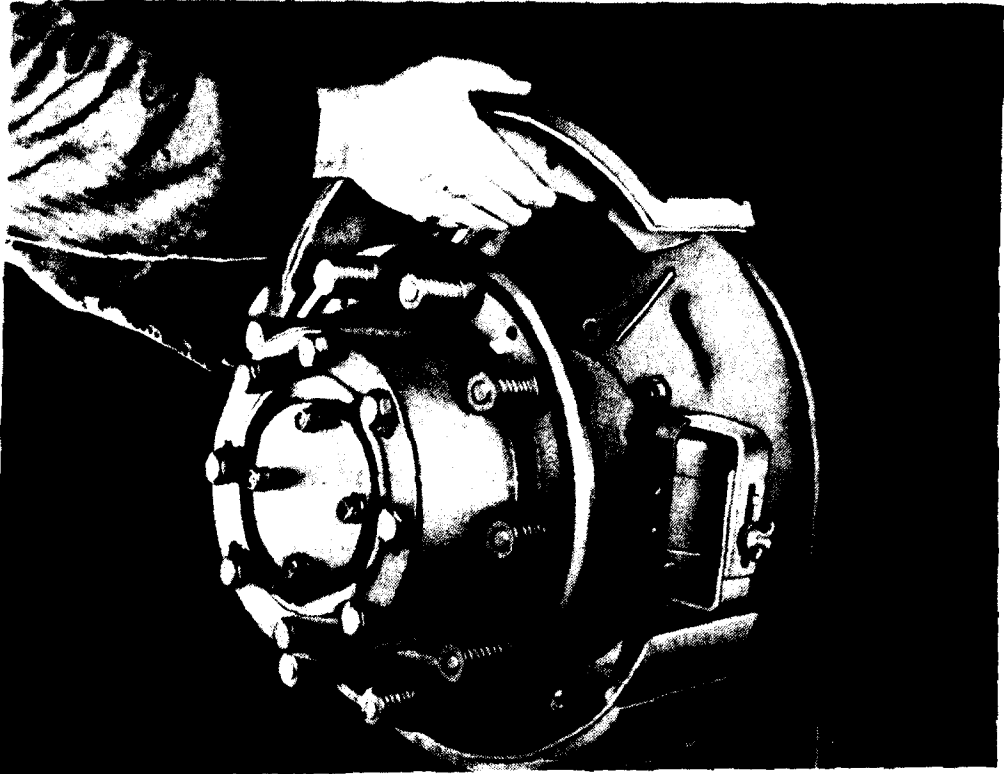
- (9) **REMOVE BRAKE SHOE LINING.** Remove the rivets, using the deliner punches in a brake shoe relining machine.
- (10) **CLEAN SHOES.** Wash the shoes in cleaning solvent, then buff them on a wire buffer.
- (11) **REPLACE LINING.** Install new lining in place on shoe and rivet two holes at center.



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Figure 58 – Removing Retracting Spring

BRAKE SHOE AND LINING REPLACEMENT



RA PD 32518

Figure 59 – Removing Brake Shoe

(12) **PLACE LINING CLAMP ON SHOE.** In order to eliminate air pockets between lining and shoe which might cause uneven contact or squeaky brakes, a brake shoe lining clamp should be used to force the lining against the shoe.

(13) **ALINE HOLES IN LINING AND SHOE.** After the end holes in the lining and shoe are in alinement, the rivets may be installed in both ends.

(14) **INSTALL SHOES (fig. 59).** Replace the brake shoe assemblies on the hold-down pins with the short end of the lining on the leading end of the shoe. **NOTE:** *Care must be taken to install the brake shoe and lining assembly in the proper position on the brake flange plate.* To determine the leading end, point a finger at the flange plate and rotate it in a circular path the same as the brake drum would rotate with the vehicle moving forward. That end of each shoe to which the finger points first in its rotation is the leading end of the shoe. If the wheel cylinders have not been removed, the adjustment screw end of the wheel cylinders will bear against the leading end of the shoe.

(15) **REASSEMBLE COMPONENT PARTS (figs. 56 and 58).** Reassemble steel cups, springs, and retaining nuts, using new cotter pins. Replace brake shoe retracting springs and connecting links, using spring pliers.

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- (16) **REMOVE CYLINDER CLAMPS** (fig. 57). Remove wheel cylinder clamps.
- (17) **INSTALL DRUMS**. Install drums and tighten securely.
- (18) **ADJUST BRAKES**. Adjust brakes as previously outlined in this section (par. 70).
- (19) **INSTALL WHEELS**. Install wheels and tighten retaining nuts securely. Remove jack and blocks.

74. PARKING BRAKE SERVICE PROCEDURE.

a. Parking Brake Lining Replacement.

(1) **GENERAL**. The parking brake band bears on its drum when applied by the hand brake lever. This brake is to be set after the vehicle is brought to a stop and not when the vehicle is in motion; therefore, the parking brake lining has long life.

(2) **BRAKE BAND REMOVAL** (fig. 55). Set hand brake lever in fully released position. Remove service plate from bottom of hull. Rotate the turret until trap door in bottom of the basket is over parking brakes. Working through this opening, break the short hose connection at the transfer case oil cooler. Remove lock wire from anchor bolt at top of brake and remove anchor bolt. Loosen lock nuts on the two brake band lock bolts at the lower sides of brake, and loosen the bolts until they are free of the slot in contact plate riveted to brake band. Remove cotter pin and clevis pin from operating cam and adjusting bolt eye. Remove the large bolt from center of brake drum. Slide the brake drum and band assembly off the end of transfer case drive shaft, using care to retrieve the anchor bolt spring at the anchor location. Remove drum and band through service plate opening.

(3) **RELINE BAND**. Cut off the lining rivet heads with a cold chisel. Buff band with a wire brush to remove any rust or corrosion. **NOTE:** *When relining the band, it is essential that the correct grade and thickness of lining be used.* If the lining is not already fabricated to fit the band, it should be cut to the required length and rivet holes drilled and counterbored at least one half the thickness of the lining in each end of the lining. Rivet the lining to the band at each end, then drill and counterbore the lining for all other rivet holes, and rivet the lining firmly in place. After relining, the brake band should be formed as necessary to conform to the shape of the drum.

(4) **ADJUST BRAKE AND REASSEMBLE**. Set the brake band to its approximate proper clearance around the drum as explained under "Parking Brake Adjustment" (par. 71), then reassemble the brake drum and band to its mounting by reversing the foregoing procedure. After reassembly, center the lining about the drum and adjust if neces-

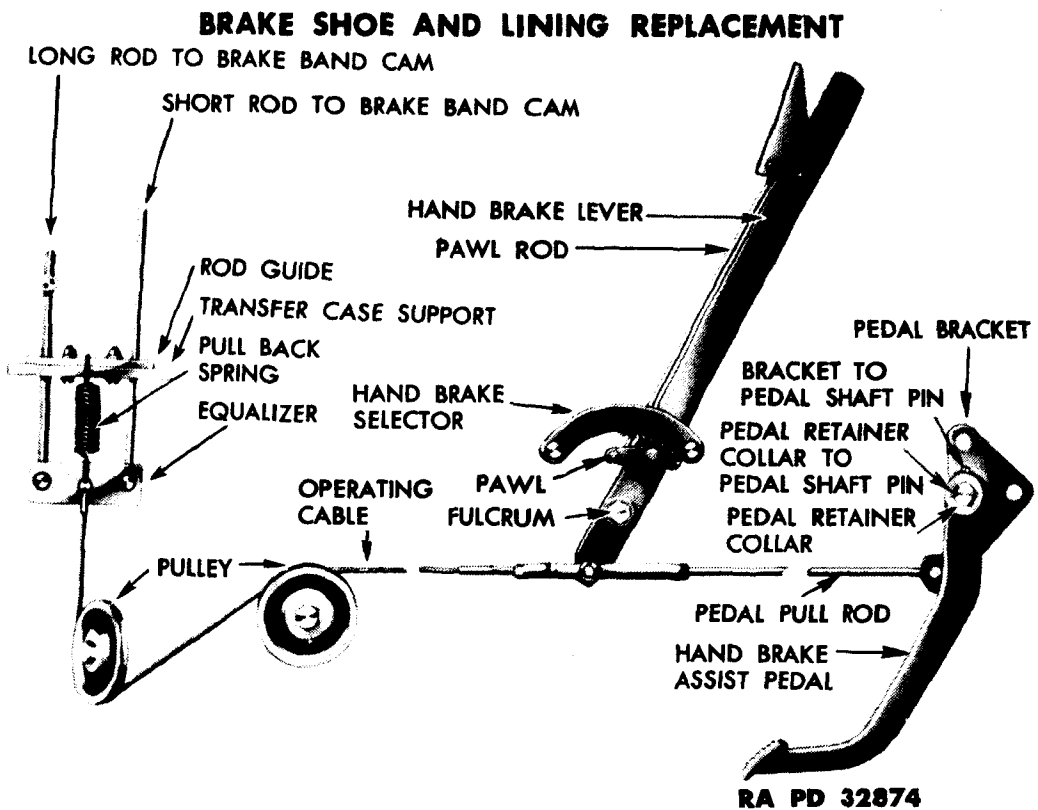


Figure 60 – Hand Brake Assist Pedal Linkage

sary according to instructions given under the heading, "Parking Brake Adjustment" (par. 71). Connect the short hose connection at oil cooler.

h. Hand Brake Assist Pedal.

(1) **GENERAL** (fig. 60). A hand brake assist pedal is connected to the parking brake linkage to give additional power in applying the brake. The pedal shaft is mounted on a bracket bolted to the left wall of the hull ahead of the steering gear location. The pedal extends down on the left side of the steering gear to the same level above the hull floor as the service brake pedal. The shaft bore at the top of the pedal is fitted with a bronze bushing which fits on the pedal support shaft. This shaft is a slip fit in the pedal support bracket, and is held in the bracket by a tapered pin driven through the bracket and shaft. The pedal is held on the shaft by a collar and a tapered pin which passes through the collar and the shaft. The link from the assist pedal to the hand brake lever is a solid pull rod. The rod has an eye at the pedal end which is pinned to a double boss on the pedal. There is a yoke at the lever to brake operating cam cable clevis and is held to the lever by a common clevis pin.

(2) **HAND BRAKE ASSIST PEDAL REMOVAL** (fig. 60). Remove the pull rod to pedal clevis pin with a punch and hammer. Let rod drop down. Drive out the collar to shaft pin. Remove collar and slip pedal off the shaft. Since the pedal pull rod is a solid piece, and not adjustable, it has no bearing on the adjustment of the parking brakes.

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(3) **REBUSHING ASSIST PEDAL.** Press old bushing out of pedal. Press new bushing into bore flush at both ends. Ream to size, 0.744-inch to 0.745-inch, with a conventional reamer, or ream to allow a free slip fit on the pedal support shaft. Lubricate shaft and bushing and reinstall pedal by reversing the removal procedure. Install pull rod in pedal double boss and install clevis pin and cotter pin.

c. Hand Brake Lever.

(1) **GENERAL** (fig. 60). The hand brake lever is mounted on the bracket welded to the left side of the hull just forward of the driver's seat. A pawl is located on each side of the lever and engages notches in the sectors which are bolted to the hull bracket. To release the brake press on the pawl lever (which disengages the pawls from the sectors) and move the lever forward.

(2) **HAND BRAKE LEVER AND SECTOR REMOVAL** (fig. 60). Remove the cotter pin and clevis pin that attaches the operating cable and pedal pull rod to lower end of brake lever. Remove the two bolts which attach the sectors to hull bracket and remove the sectors and spacers. Remove the fulcrum nuts and washers and lift the lever assembly off. The pawls can be removed from the lever by removing the cotter pins, clevis pins, and washers which attach the pawls to the brake lever and pawl rod.

(3) **HAND BRAKE AND LEVER INSTALLATION** (fig. 60). Place the pawls in position on each side of lever; install the pawl to lever clevis pin and cotter pin. Install the pawl rod to pawl clevis pin, washer, and cotter pin. Place the lever on the fulcrum and install the washer, nut, lock, and lock nut. Place the two sectors in position and install the retaining bolts and nuts. Place the operating cable adjusting eye and the pedal pull rod over the lower end of lever. Line up the clevis pin holes in the cable, pull rod, and lever. Install the clevis pin and cotter pin.

CHAPTER 5
BRAKES (Cont'd)

Section V

MASTER AND WHEEL CYLINDER OVERHAUL

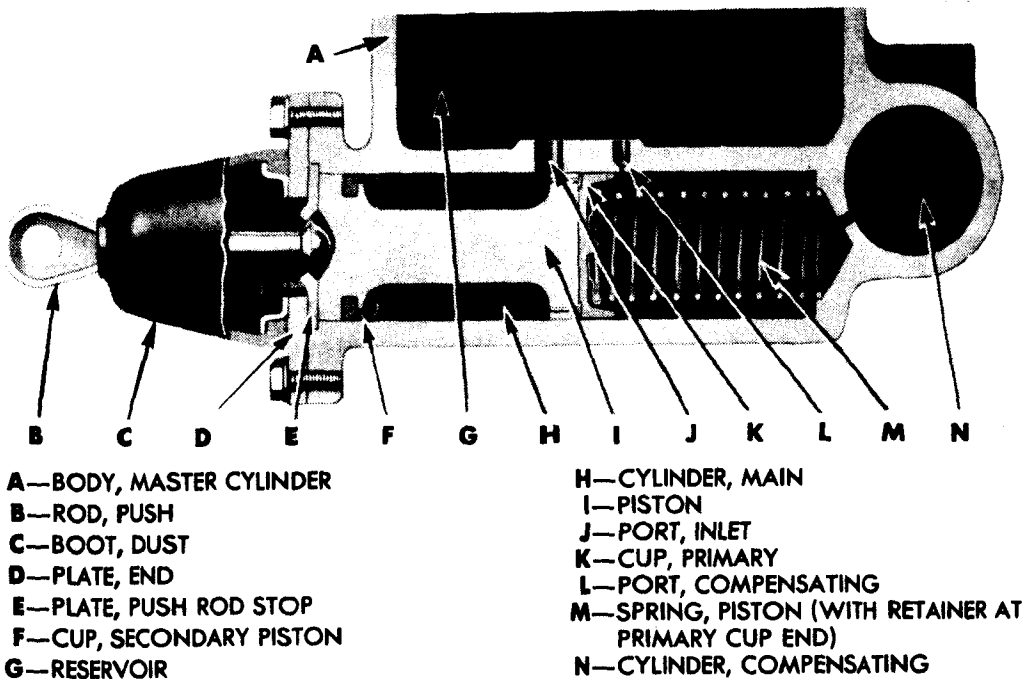
	Paragraph
Master cylinder overhaul.....	75
Wheel cylinder overhaul	76

75. MASTER CYLINDER OVERHAUL.

a. **General.** The function of the master cylinder is to displace fluid from a central source into lines and to wheel cylinders. The master cylinder includes two complete hydraulic cylinders, side by side, connected by a compensating cylinder. The master cylinder is mounted on the steering gear housing.

b. **Disassembly Procedure.**

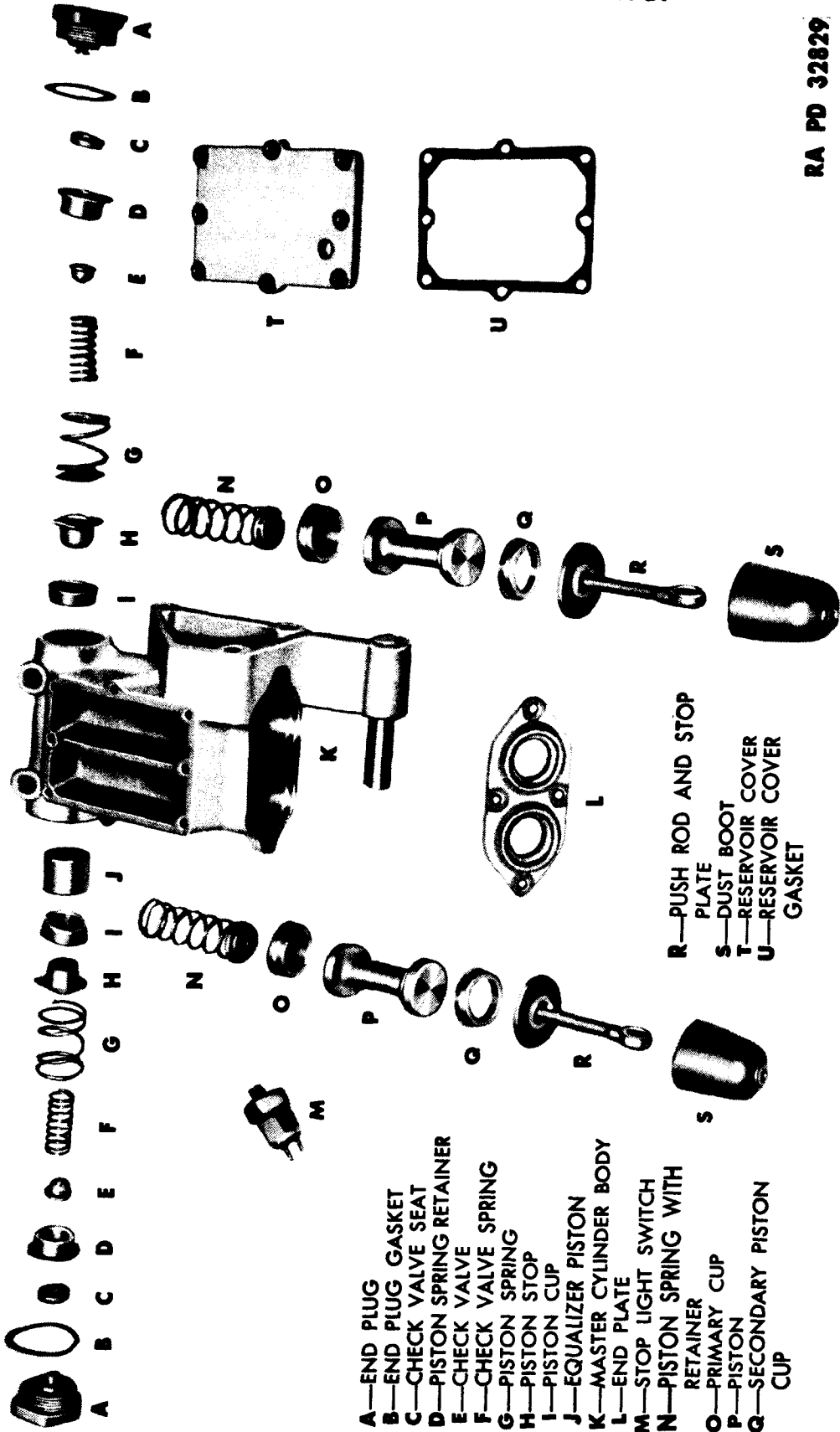
(1) **REMOVE MASTER CYLINDER.** Disconnect the four brake lines from the compensating cylinder and the tube from the reserve tank, and allow the fluid from these lines to drain into a suitable container. Disconnect the stop lamp switch wires and the brake pedal pull-back spring. Dismount the main cylinder assembly from the steering gear housing by removing the three attaching bolts. Remove link bolts and



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Figure 61 — Master Cylinder — Cross Section

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- A—END PLUG
- B—END PLUG GASKET
- C—CHECK VALVE SEAT
- D—PISTON SPRING RETAINER
- E—CHECK VALVE
- F—CHECK VALVE SPRING
- G—PISTON SPRING
- H—PISTON STOP
- I—PISTON CUP
- J—EQUALIZER PISTON
- K—MASTER CYLINDER BODY
- L—END PLATE
- M—STOP LIGHT SWITCH
- N—PISTON SPRING WITH RETAINER
- O—PRIMARY CUP
- P—PISTON
- Q—SECONDARY PISTON CUP
- R—PUSH ROD AND STOP PLATE
- S—DUST BOOT
- T—RESERVOIR COVER
- U—RESERVOIR COVER GASKET

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Figure 62 — Master Cylinder — Parts Layout

MASTER AND WHEEL CYLINDER OVERHAUL

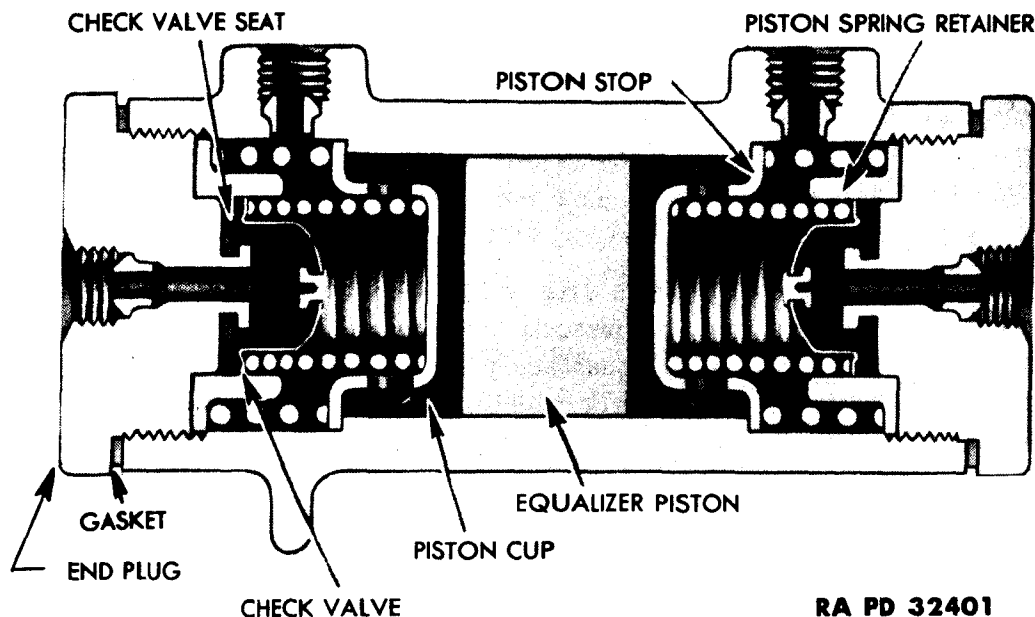


Figure 63 – Compensating Cylinder

nut which attach the master cylinder push rods to top of brake pedal. Drive pin out of pedal shaft collar and pedal shaft, and remove brake pedal. Remove stop lamp switch.

(2) **DISASSEMBLE MASTER CYLINDER** (figs. 61 and 62). Remove reservoir cover from top of body, and end plate from end of master cylinder. The two push rods, push rod stop plates, and dust boots will be removed with the end plate.

(3) **REMOVE PISTONS** (figs. 61 and 62). Remove the two pistons with secondary cups, primary cups, and piston springs and retainers from the cylinders.

(4) **REMOVE BOOT** (fig. 61). Remove dust boot from the end plate and push rod.

(5) **REMOVE END PLUGS** (fig. 63). Referring to figure 63, remove the end plugs from compensating cylinder and remove equalizer piston spring retainer, spring, check valve, and check valve spring from each end.

(6) **REMOVE EQUALIZER PISTON AND CUPS** (fig. 62). Using a hooked wire, remove the equalizer piston stop from one end, then from that end, push the equalizer piston, piston cups, and the opposite piston stop out of the other end of the cylinder.

(7) **REMOVE CHECK VALVE SEATS** (fig. 63). Remove the check valve seats (rubber washers) from end plugs. **NOTE: After all parts have been removed from the master cylinder, they should be washed in CLEAN ALCOHOL. BEFORE WASHING PARTS, HANDS MUST BE CLEAN. DO NOT WASH HANDS IN GASOLINE OR**

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OIL BEFORE CLEANING HYDRAULIC BRAKE CYLINDER PARTS. USE SOAP AND WATER TO CLEAN HANDS. Special care should be taken to make certain that the compensating ports in master cylinder body and the bleeder holes in the master cylinder pistons are clean.

c. Inspection.

(1) **INSPECTION OF PARTS** (fig. 62). Inspect the three cylinder bores for smoothness, and the pistons for scoring. Inspect the primary and secondary piston cups, equalizer piston cups, check valves, and check valve seats for damage or swelling. Replace when necessary. Swelling of the rubber parts is caused by the use of improper brake fluid or washing of parts in gasoline or kerosene. **CAUTION:** *The primary cup of each master cylinder has a brass support ring vulcanized in its face to prevent the cup from imbedding in the bleeder holes in the piston during brake operation. Do not disturb this ring.*

(2) **CHECK PISTON FIT.** Check the fit of the pistons in the cylinder bores by inserting a narrow feeler gage between piston and the bore. The clearance between both the master cylinder pistons and the equalizer piston and walls of their cylinders should be from 0.001 inch to 0.005 inch.

(3) **CHECK BRAKE TUBING SEATS** (fig. 63). Check the seats for the brake tubing in the two outlets on top of compensating cylinder and in each plug. If the surface on any seat is burred or scored, leakage of brake fluid may result. If this condition exists, it will be necessary to replace the part in which that seat is installed.

(4) **CHECK DUST BOOT.** Inspect the dust boot to see that the rubber has not deteriorated, and that a good fit is obtained on end plate and push rod.

d. Reassembly. Absolute cleanliness is the first requisite for a satisfactory master cylinder overhaul. All parts, tools, hands, and working space must be perfectly clean, and every precaution should be taken to prevent the entrance of dirt or foreign matter into the cylinder during reassembly.

(1) **INSTALL EQUALIZER PISTON** (fig. 63). Install the equalizer piston in compensating cylinder, then install the following parts in each end of cylinder in order indicated. Dip the piston cups in clean hydraulic brake fluid and install with the flat face of cup toward piston.

(2) **INSTALL EQUALIZER PISTON STOPS** (fig. 63). Install equalizer piston stops with open or flanged end of the stop toward end of cylinder.

(3) **INSTALL PISTON SPRINGS.** Install piston springs and check valve springs; also equalizer piston spring retainers so that they project between the two springs.

MASTER AND WHEEL CYLINDER OVERHAUL

(4) **INSTALL CHECK VALVES** (fig. 63). Dip check valves in clean brake fluid and install with cage projecting into the check valve spring.

(5) **INSTALL CHECK VALVE WASHERS** (fig. 62). Dip two new check valve seat washers in clean hydraulic brake fluid and assemble over button on end of end plugs. Assemble end plugs with new gaskets, using precaution to see that the boss on end plug engages the equalizer piston spring retainer properly. Tighten securely. Support master cylinder body so cylinders are vertical with open end at top, on each of the twin master cylinders.

(6) **PLACE PISTON SPRING AND RETAINER IN CYLINDER** (fig. 61). Dip the primary and secondary cups in clean brake fluid. Drop the piston, spring, and retainer in cylinder with retainer toward the top. Make sure that inner end of spring is seated in counterbore in the end of cylinder.

(7) **INSTALL PRIMARY PISTON CUP** (fig. 61). Insert primary piston cup in cylinder with flat face and brass ring toward open end of the cylinder. Be sure lip of cup extends around spring, then depress cup in cylinder with finger several times to engage button in center of cup with hole in the spring retainer.

(8) **ASSEMBLE SECONDARY CUP TO PISTON** (fig. 61). Assemble secondary cup to piston and install piston in cylinder with secondary cup end toward the open end of cylinder. Use care to prevent damage to secondary cup during this process.

(9) **ASSEMBLE COMPONENT PARTS** (fig. 62). Holding the two push rods in position on ends of pistons with stop plates engaged in counterbores provided in master cylinder body, assemble end plate over ends of push rods and attach it to the body with four cap screws and lock washers. Tighten cap screws securely. At this point, clearance between lip of primary cup and compensating port should be checked. Through the top of reservoir, insert a small wire through the compensating port of each cylinder as shown in figure 64. If the wire touches lip of cup, the cylinder must be disassembled and a new primary cup installed. If it is impossible to touch the cup, then remove wire, install reservoir cover, using a new gasket, and proceed with reassembly. *NOTE: The end of wire may contact the piston spring when making this check. Do not confuse this with interference with primary cup.*

(10) **INSTALL DUST BOOTS** (fig. 61). Assemble dust boots over ends of piston rods and engage the lips of boots under retainers on end plate.

(11) **LUBRICATE PEDAL BUSHING AND INSTALL PEDAL**. Apply a light coat of engine oil on bushing in brake pedal and assemble on pedal shaft with pedal facing the compensating cylinder. Install pedal shaft collar, using a new ground pin.

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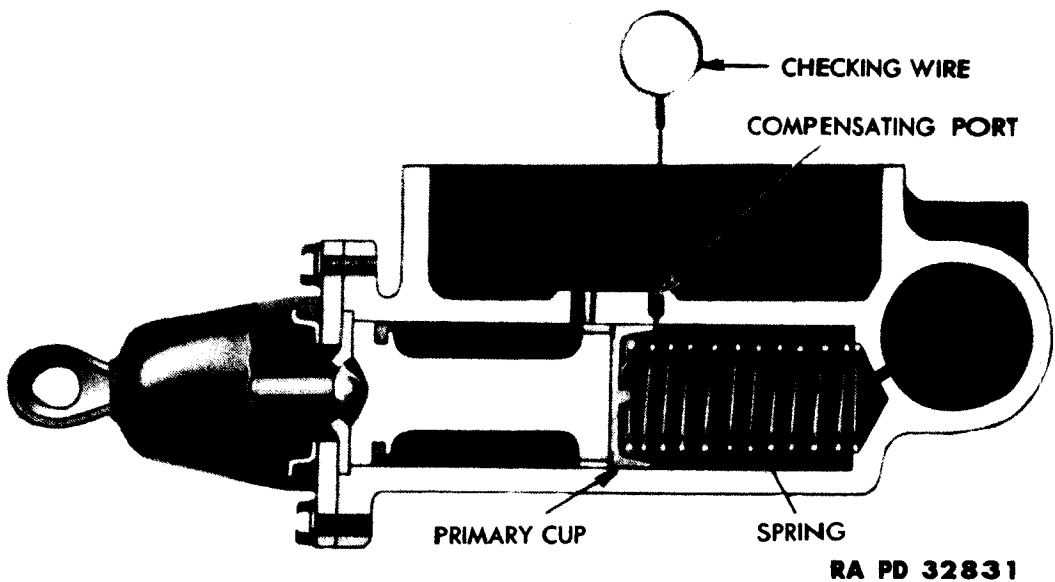


Figure 64 – Checking Clearance of Primary Cup

(12) **INSTALL LINK BOLT.** Install link bolt through the push rods and the end of pedal, and lock the nut with a new cotter pin.

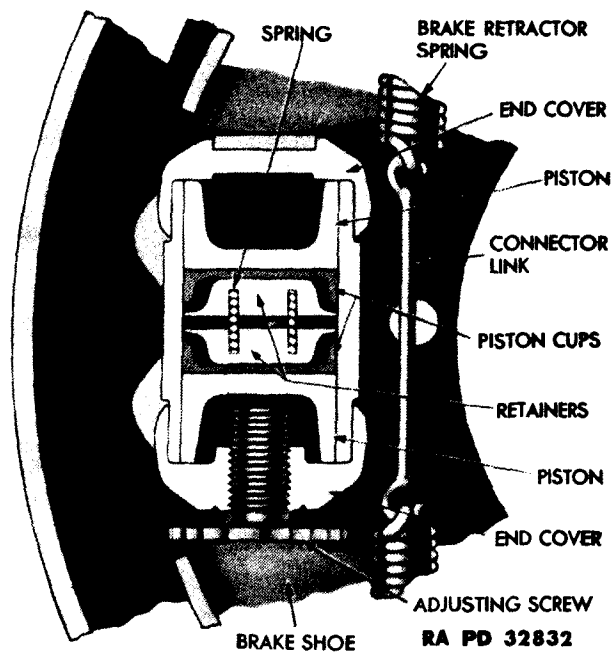
(13) **INSTALL MASTER CYLINDER.** Install stop lamp switch and brake pedal. Install the cylinder on the steering gear housing with the three attaching bolts. Connect the pipe from the reserve tank, and brake lines from the compensating cylinder to the hydrovac units, the brake pedal pull-back spring, and the stop lamp wires. **CAUTION:** *It is VERY important that the proper brake lines be attached to the correct outlets on the compensating cylinder.* Referring to figure 53, note that the lines from the outlet on each hydrovac unit which is nearest the large vacuum cylinder, connects to the end plugs on the compensating cylinder of the brake main cylinder. Also, the line from each hydrovac unit attached to the outlet which is *directly opposite* the circular control valve housing (having removable end plate) connects to the outlets at the top of the compensating cylinder on the brake master cylinder assembly. After all connections have been made to the master cylinder, the master cylinder and reservoir must be filled with new hydraulic brake fluid, and the hydraulic brake system bled in accordance with instructions given in paragraph 72.

76. WHEEL CYLINDER OVERHAUL.

a. **General.** (fig. 65). At each wheel two brake shoes are actuated by two wheel cylinders, each containing two pistons which bear against end covers that contact the end of the shoes and expand them outward against the drum when fluid under pressure is introduced between the pistons. Rubber piston cups at the head of each piston seal the cylinder and prevent leakage of fluid past the pistons. The rubber cups are held

MASTER AND WHEEL CYLINDER OVERHAUL

Figure 65 — Brake Wheel Cylinder — Cross Section



against the pistons by a coil spring between them which engages in suitable retainers. One end cup in each cylinder is provided with an adjusting screw that bears against the shoe and provides a means of adjusting the brake shoes to the proper drum clearance, since the shoes are held in contact with the pistons (even when at rest) by retractor springs.

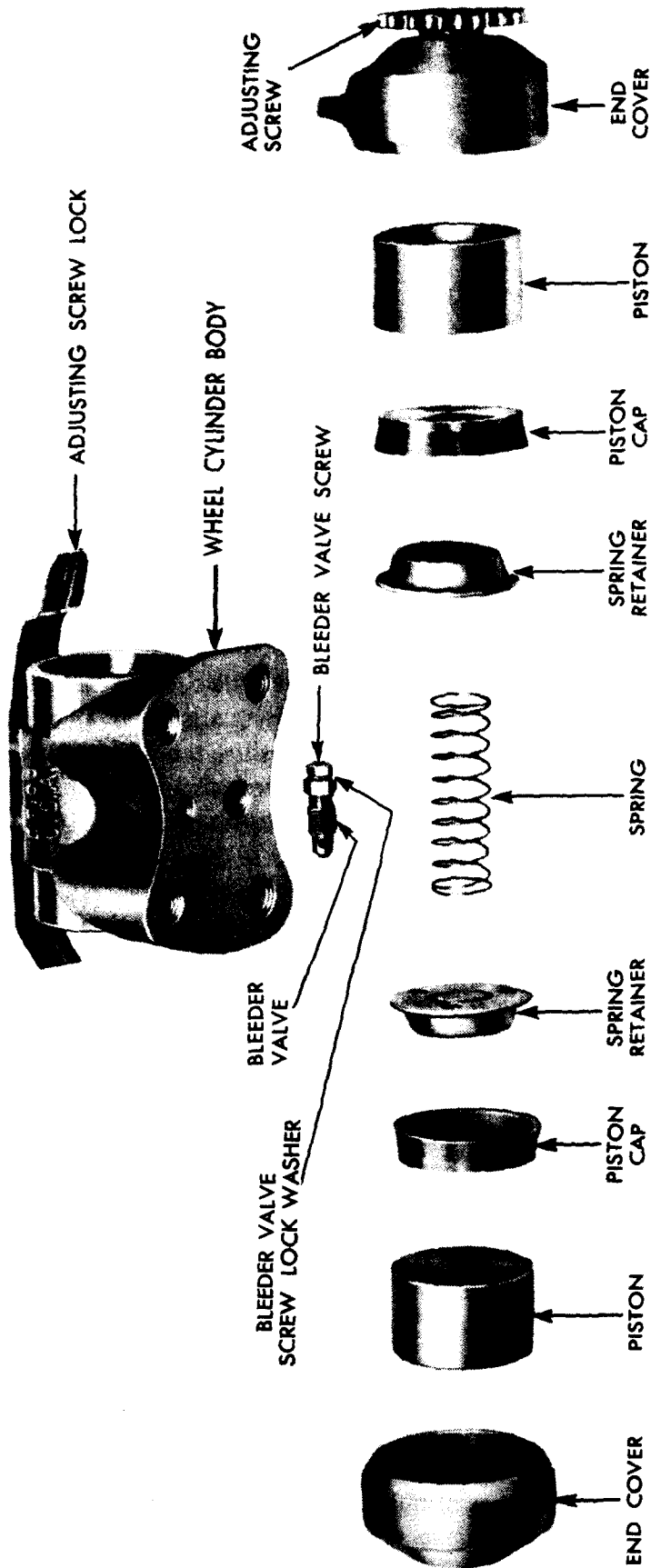
b. Procedure.

(1) **REMOVE WHEEL CYLINDERS.** In order to remove the hydraulic brake wheel cylinders, the vehicle must be jacked up, the wheel and brake drum removed (par. 73) and the hydraulic lines leading to the wheel cylinder disconnected at the back of the flange plate (fig. 56). Remove the brake retractor springs by pulling the inner ends of the springs together with special pliers and removing the connecting link. Remove the four cap screws per cylinder from the back side of the brake flange plate, and the wheel cylinders may be removed.

(2) **DISASSEMBLE WHEEL CYLINDER** (fig. 66). Remove the cylinder end covers, pistons, rubber cups, spring retainers, and spring. **CAUTION:** Wash hands with soap and water, then wash all parts in clean alcohol. Hands must be clean before washing parts.

(3) **INSPECTION.** Inspect the cylinder bore for smoothness. A scored or damaged cylinder must be replaced. Check rubber cups for damage or swelling due to improper brake fluid. Replace the cups if necessary. Check fit of piston in the cylinder bore, using a narrow feeler gage (fig. 67). This clearance should be from 0.002 inch to 0.005 inch. Inspect the hydraulic tubing seat insert in the back of body. If the surface

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RA PD 317047

Figure 66 - Wheel Cylinder - Parts Layout

MASTER AND WHEEL CYLINDER OVERHAUL

**Figure 67 – Checking Fit of
Piston in Cylinder Bore**



RA PD 32833

of seat is scored or burred, leakage may result. If this condition exists, it will be necessary to replace the cylinder body.

(4) **REASSEMBLE** (fig. 65). Dip pistons and rubber cups in brake fluid. Assemble spring and two retainers in the cylinder. Insert one piston cup in each end of cylinder with the flat face facing the open end of cylinder. Insert one piston in each end of cylinder with flat face facing the piston cup. Reassemble end covers.

(5) **INSTALL WHEEL CYLINDER**. Reassemble the cylinder to the flange plate, making sure that the bleeder valve on the back of the cylinder is toward the outer edge of the flange plate, and the adjustment screw end of the cylinder is toward the leading end of the brake shoe or the end having the lining cut short. If the brake shoes have been removed, see instructions headed, "Brake Shoe Replacement" in this section for the proper positioning of the shoes. If it is found that the end covers have been assembled backwards, they may be exchanged end for end.

(6) **REASSEMBLE COMPONENT PARTS**. Connect the brake shoe retracting springs and the hydraulic lines at the back of the flange plate. Replace the brake drum and wheel. **NOTE:** *After a wheel cylinder has been removed and replaced, THE ENTIRE HYDRAULIC BRAKE SYSTEM MUST BE BLED in accordance with instructions given in paragraph 72.*

(7) **ADJUST BRAKES**. Adjust brakes as instructed in paragraph 70.

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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CHAPTER 5

BRAKES (Cont'd)

Section VI

HYDROVAC

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77. GENERAL (fig. 53).

a. The hydrovac power brake system is installed in this vehicle to make available to the driver a greater pressure on the hydraulic brake system than he could possibly exert by foot pressure on the brake pedal. The hydrovac system includes two auxiliary power units which apply additional force to the hydraulic brake system, and which are controlled automatically by normal operation of brake pedal. This greatly increases the driver's ability to stop quickly from high speeds or on steep grades. One hydraulic unit is used in the front wheel brake system, and one in the rear wheel system as shown in figure 53. The function and servicing of the hydrovac unit is identical for each system. If one hydrovac is not functioning properly, it should be replaced or repaired.

78. LUBRICATION.

a. The hydrovac power cylinders should be lubricated every 20,000 miles or after six months' service (whichever occurs first) as specified in lubrication instructions. To properly lubricate the hydrovacs, remove them from vehicle by following the instructions in paragraph 80. Remove the pipe plugs from bottom of power cylinder and at atmospheric line connection at center plate (fig. 68) and inject ½ ounce of hydraulic oil at each opening. Install the pipe plugs and turn the assembly slowly so that the oil will lubricate the piston packing all the way around. Install the hydrovacs and bleed the brake system as instructed in paragraphs 84 and 72.

HYDROVAC

79. MAINTENANCE.

a. The outside of hydrovac unit should be cleaned thoroughly and inspected every six months. All hose connection clamps should be tightened, and all pipe fittings and hydraulic connections checked for looseness.

80. REMOVAL.

a. Remove Hydrovac.

(1) **ROTATE TURRET.** Rotate turret until one of the large holes in basket is opposite hydrovac unit to be removed. Working through this opening, disconnect the three hydraulic lines from upper end of hydrovac assembly.

(2) **DISCONNECT VACUUM HOSE** (fig. 53). Disconnect vacuum hose leading through the bulkhead at center of power cylinder.

(3) **DISCONNECT CONTROL VALVE PIPE** (fig. 68). Disconnect pipe at the control valve that leads to the air cleaner above hydrovac assembly.

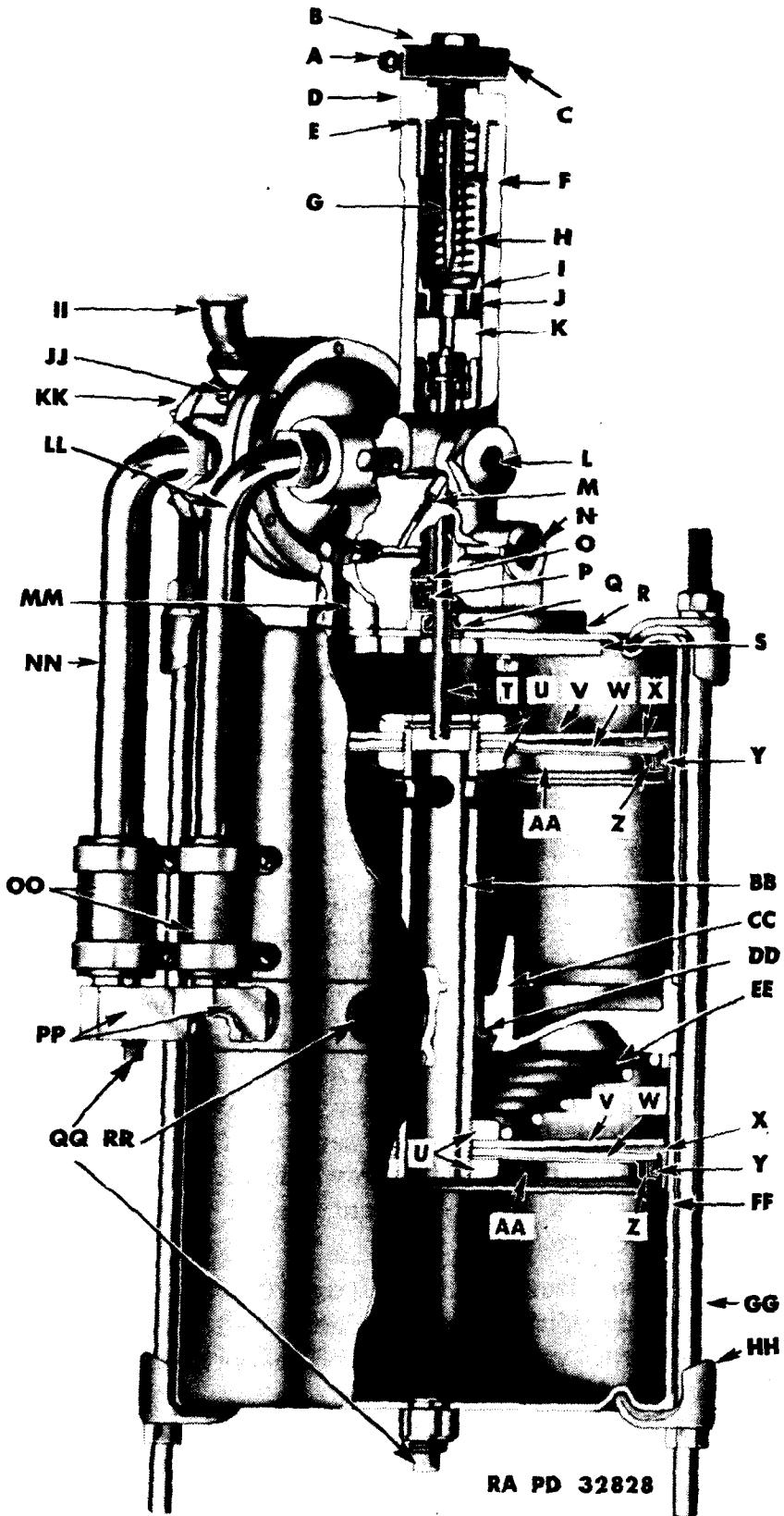
(4) **LOOSEN MOUNTING BRACKET NUTS.** Loosen lock nuts and screw the anchor nuts down on upper ends of the two power cylinder clamp studs that attach the hydrovac to upper mounting brackets on hull. This will allow the hydrovac assembly to be tipped away from hull and lifted up to disengage the lower ends of the two studs from the holes in lower mounting brackets. Remove the hydrovac.

81. DISASSEMBLY.

a. **Disassemble Power Cylinder** (figs. 68 and 69). Loosen the two hose connections in the vacuum and control lines, slide the hoses along the tubing toward control valve. Remove four clamp studs and clamps. This will permit the two shells to separate from the center plate and piston assemble. It is recommended that the cylinder shells and center plate be marked with a center punch before removing, so that these parts can be easily reassembled in their original position. If cylinder shells do not readily separate from center plate they can be loosened by tapping with a rawhide mallet. It is best to separate these shells over a pan to prevent the oil in cylinders from running out over work bench.

b. **Remove Slave Cylinder** (fig. 70). Take out four cap screws from the inside of the upper cylinder shell which hold the hydraulic slave cylinder to vacuum cylinder. Tip vacuum cylinder slightly, slip screwdriver in over push rod guide to prevent it from jumping out. The slave cylinder can now be removed. This will also release the reinforcing plate from inside of cylinder shell, the push rod guide and seal assembly, slave cylinder rubber seal, and spring from slave cylinder (fig. 70).

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Figure 68 – Hydrovac – Cross Section

HYDROVAC

A —VALVE, BLEEDER	W —PLATE, PISTON LOWER
B —CONNECTOR, END PLUG	X —PACKING, PISTON
C —CONNECTION, HYDRAULIC LINE TO WHEEL CYLINDER	Y —FELT, PISTON
D —END PLUG, SLAVE CYLINDER	Z —RING, PISTON PACKING
E —GASKET, END PLUG	AA —RETAINER, PISTON PACKING
F —BODY, HYDRAULIC SLAVE CYLINDER	BB —ROD, PISTON
G —ROD, STOP	CC —PLATE, CENTER
H —SPRING, PISTON RETURN	DD —SEAL SPRING AND WASHER, PISTON ROD
I —RETAINER, SPRING	EE —SPRING, PISTON RETURN
J —SEAL, PISTON	FF —CYLINDER, VACUUM POWER
K —PISTON AND VALVE ASSEMBLY, SLAVE CYLINDER	GG —STUD, CYLINDER
L —CONNECTION, CONTROL VALVE HYDRAULIC LINE FROM MASTER CYLINDER	HH —CLAMP, CYLINDER STUD
M —VALVE, SURGE RELIEF	II —ATMOSPHERIC INLET FROM AIR CLEANER
N —CONNECTION, SLAVE CYLINDER HYDRAULIC LINE FROM MASTER CYLINDER	JJ —HOUSING, CONTROL VALVE
O —RETAINER WASHER AND SNAP RINGS	KK —COVER, CONTROL VALVE HOUSING
P —SPRING, PUSH ROD SEAL	LL —VACUUM LINE FROM UPPER SIDE OF LOWER PISTON TO CONTROL VALVE
Q —SEAL AND GUIDE, PUSH ROD	MM —VACUUM PASSAGE TO UPPER SIDE OF UPPER POWER CYLINDER
R —GASKET, SLAVE CYLINDER	NN —AIR AND VACUUM LINE TO LOWER SIDE OF PISTONS
S —PLATE, REINFORCING	OO —CONNECTIONS, HOSE
T —PUSH ROD, POWER CYLINDER	PP —CONNECTORS
U —NUT, PISTON	QQ —PLUGS, LUBRICATION
V —PLATE, PISTON UPPER	RR —CONNECTION, VACUUM POWER LINE

RA PD 32828A

Figure 68 — Nomenclature for Fig. 68

c. **Disassemble Slave Cylinder End** (fig. 71). Screw out slave cylinder end plug and remove end plug and gasket, stop, rod, washer, piston return spring, spring retainer, slave cylinder rubber seal, and piston and valve assemble. Care must be taken during this operation to prevent parts from being ejected by the return spring which is under compression. For cleaning purposes, remove the two bleeder valves from the slave cylinder body and the one bleeder valve from end plug connector. Also remove the stop washer and two retaining snap rings from the slave cylinder.

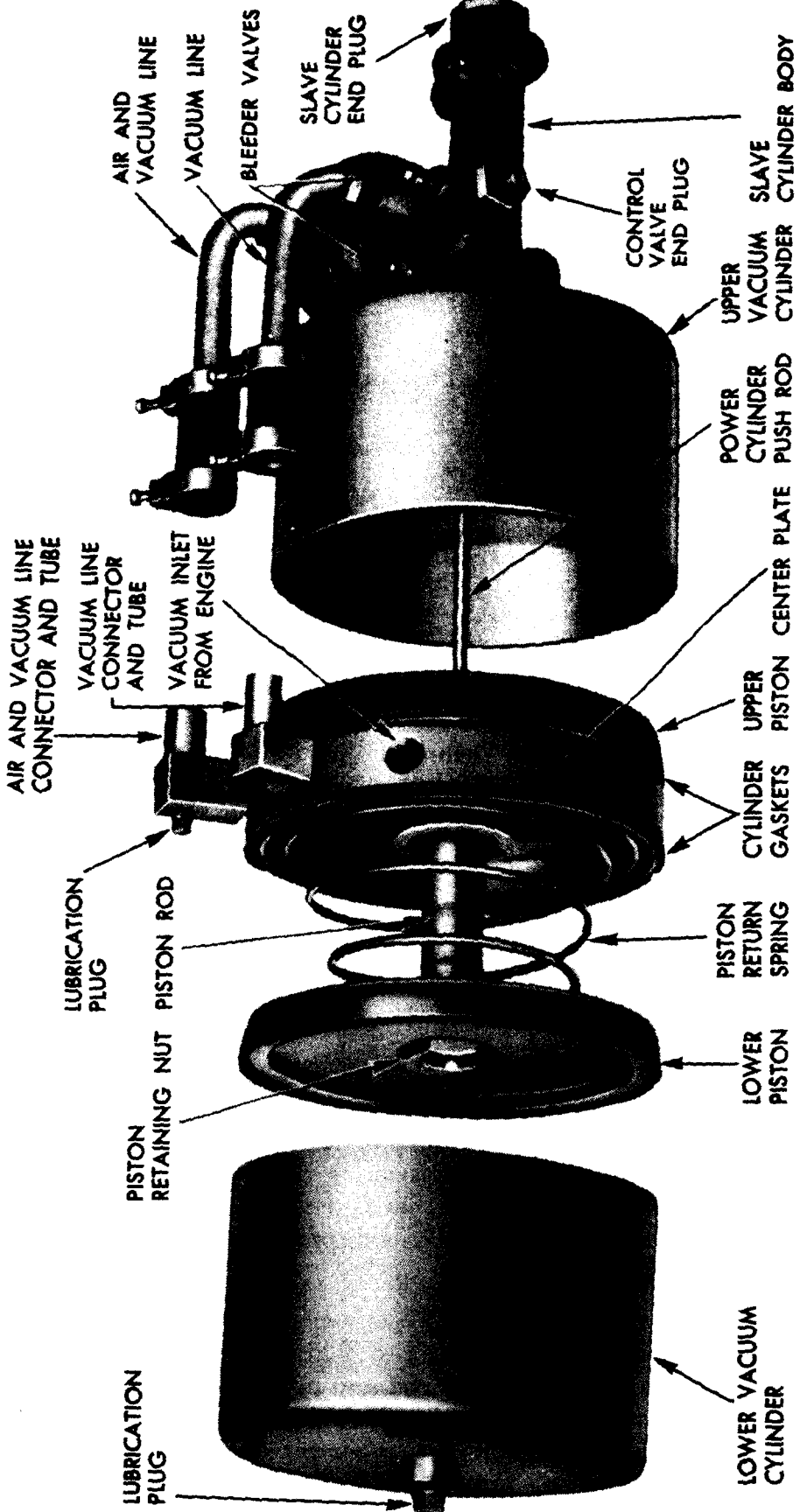
d. **Disassemble Center Plate and Piston Assembly.**

(1) **GENERAL.** When the hydrovac has been disassembled for cleaning and lubrication and there is no indication of excessive wear or damage, it will not be necessary to disassemble the pistons and center plate. When it is found that some of the component parts require replacement, disassemble as follows:

(2) **DISASSEMBLY PROCEDURE.**

(a) **Remove and Disassemble Upper Piston** (fig. 72). Clamp the lower nut of lower piston in a vise to hold the assembly upright. Force the center plate down on piston rod and insert a bolt or punch through the air ports in the piston rod to hold the center plate away from upper piston (fig. 72). Hold the upper piston lower nut and remove the upper piston upper nut. **CAUTION:** *Do not hold the assembly*

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Figure 69 - Hydrovac Center Plate Removal

HYDROVAC

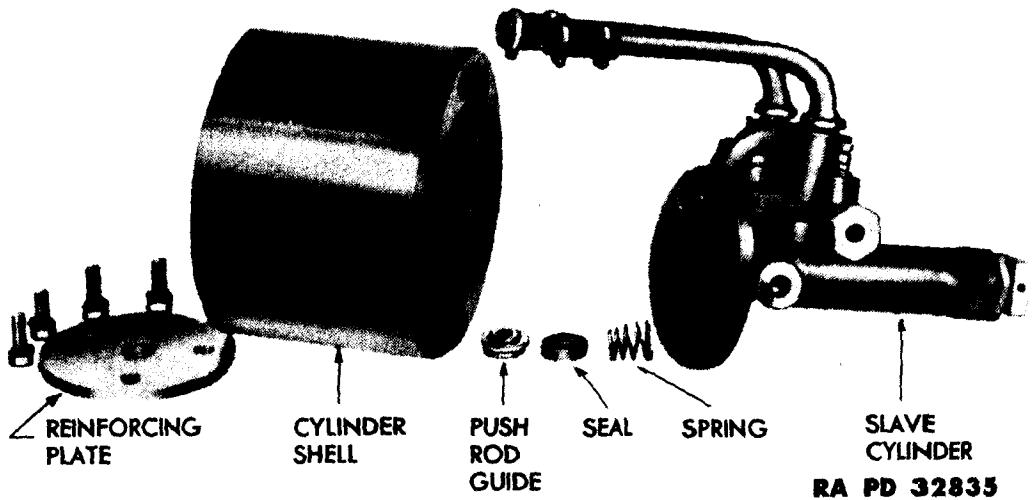
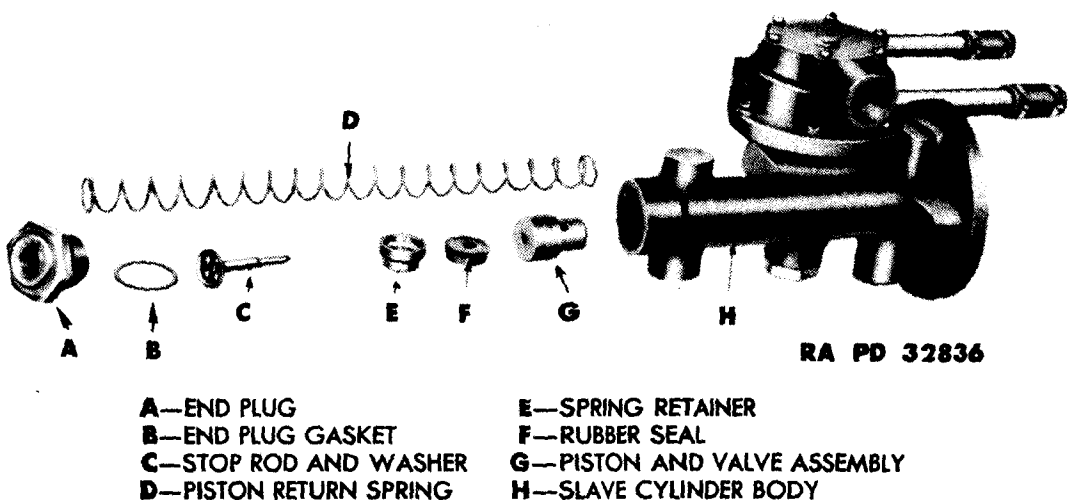


Figure 70 — Slave Cylinder Removal

with the punch in the air ports or damage to the piston rod may result. Remove the piston upper plate, piston packing, piston packing ring, piston expansion ring, piston lower plate, and packing retainer by hand. NOTE: The packing expansion ring will spring open, and care should be taken to prevent injury. Push the piston push rod retainer pin out of piston rod with a small punch or wire and remove push rod (fig. 80).

(b) Remove Center Plate (fig. 73). Remove the upper piston lower nut. Hold the center plate down, pull punch out of air ports in piston rod, and carefully allow return spring to push the center plate up. Remove center plate and return spring. Release the piston rod seal lock spring at hub of center plate and remove the lock spring, washer, and seal.



- | | |
|------------------------|-----------------------------|
| A—END PLUG | E—SPRING RETAINER |
| B—END PLUG GASKET | F—RUBBER SEAL |
| C—STOP ROD AND WASHER | G—PISTON AND VALVE ASSEMBLY |
| D—PISTON RETURN SPRING | H—SLAVE CYLINDER BODY |

Figure 71 — Slave Cylinder — Parts Layout

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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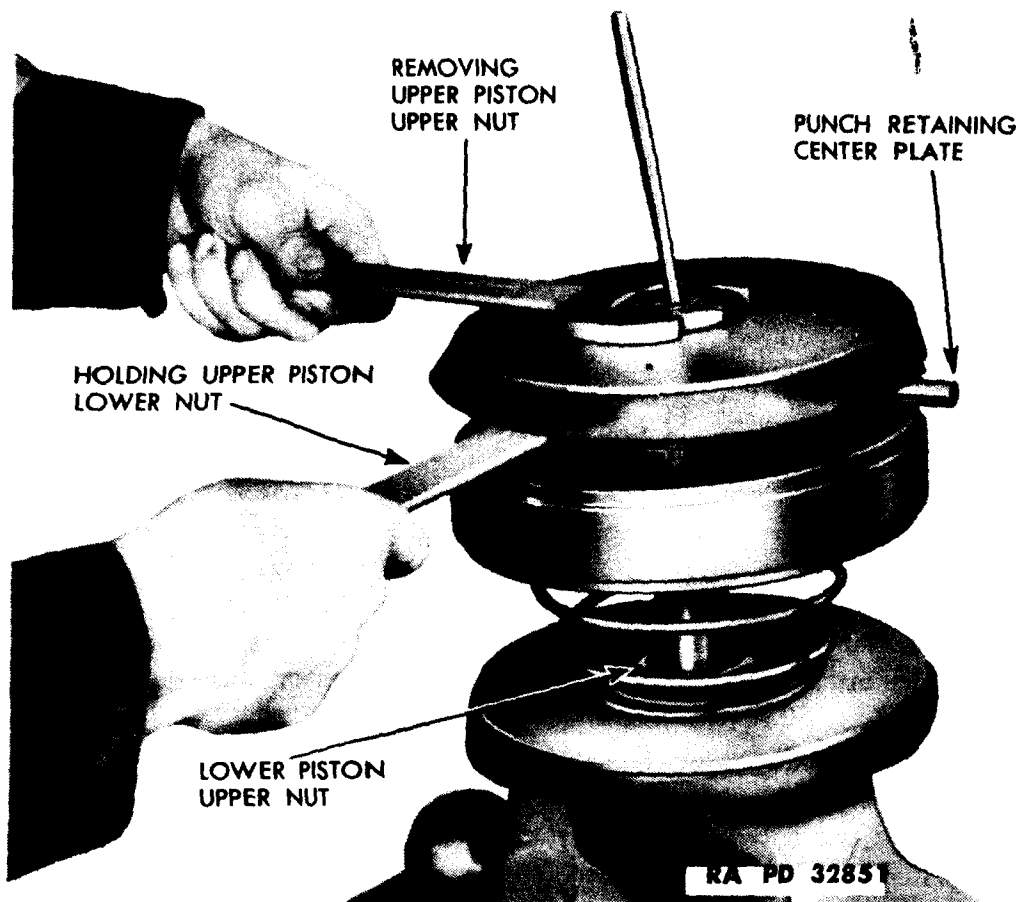


Figure 72 — Hydrovac Upper Piston Upper Nut Removal

(c) *Disassemble Lower Piston from Piston Rod.* Remove piston and rod from vise. Hold the lower piston upper nut with an end wrench and remove the lower nut. Remove the packing retainer, packing expansion ring, piston felt, piston lower plate, packing, and piston upper plate. **NOTE:** *The packing expansion ring will spring open and care should be taken to prevent injury.*

e. *Disassemble Control Valve (figs. 74 through 79).* Remove six screws that retain the control valve housing cover and remove control valve housing cover, spring and gasket (fig. 76). **CAUTION:** *A spring under compression is under this cover, so care should be exercised.* Remove one long and five short screws and remove control valve housing from slave cylinder (fig. 77). This will release the diaphragm spring that allows the diaphragm, diaphragm spacer or stop and gasket to be removed (figs. 75 and 78). **CAUTION:** *Spring is under compression, so care should be taken.* The vacuum line and vacuum air control line now may be removed. The line and coupling nut must

HYDROVAC

turn together, since the line is swaged into nut. Remove control valve end plug and gasket directly opposite to the diaphragm, and from diaphragm end insert a small rod or tool to push out small hydraulic piston, cup, and piston stop assembly (fig. 79). For cleaning purposes, remove snap ring and stop washer from control valve cylinder (fig. 75). Remove surge valve from passage at control valve end plug end of cylinder.

82. CLEANING AND INSPECTION.

a. **Cleaning.** The control valve and slave cylinder parts must be washed in clean alcohol. **CAUTION:** Before washing parts, hands must be clean. Do not wash hands in gasoline, kerosene, or oil. Use soap and water. Any contact with oil causes damage to hydraulic brake rubber parts. All other parts should be washed in dry-cleaning solvent. Dry all parts thoroughly and lay them out on clean rags or paper.

b. **Inspection.** Inspect condition of piston leathers, cylinders, vacuum line hose connections, surge relief valve, and piston seal. Any damaged parts should be replaced. If the walls of the power cylinder

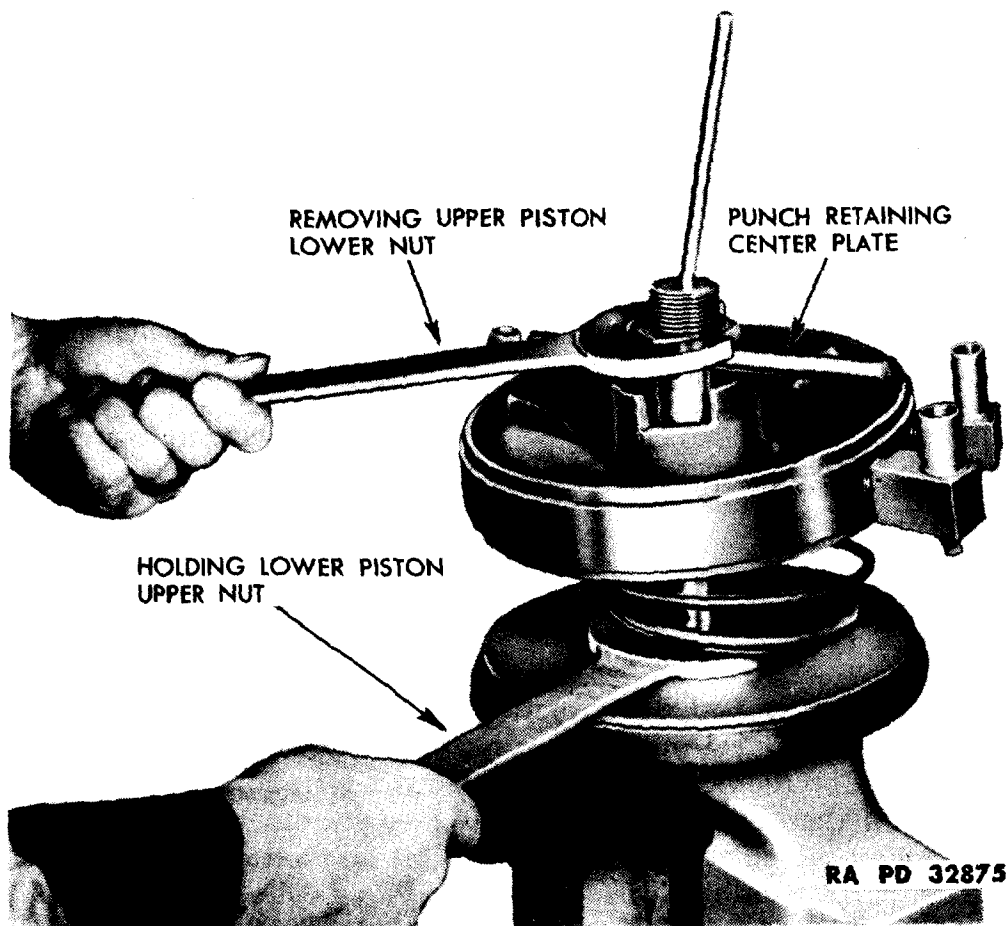
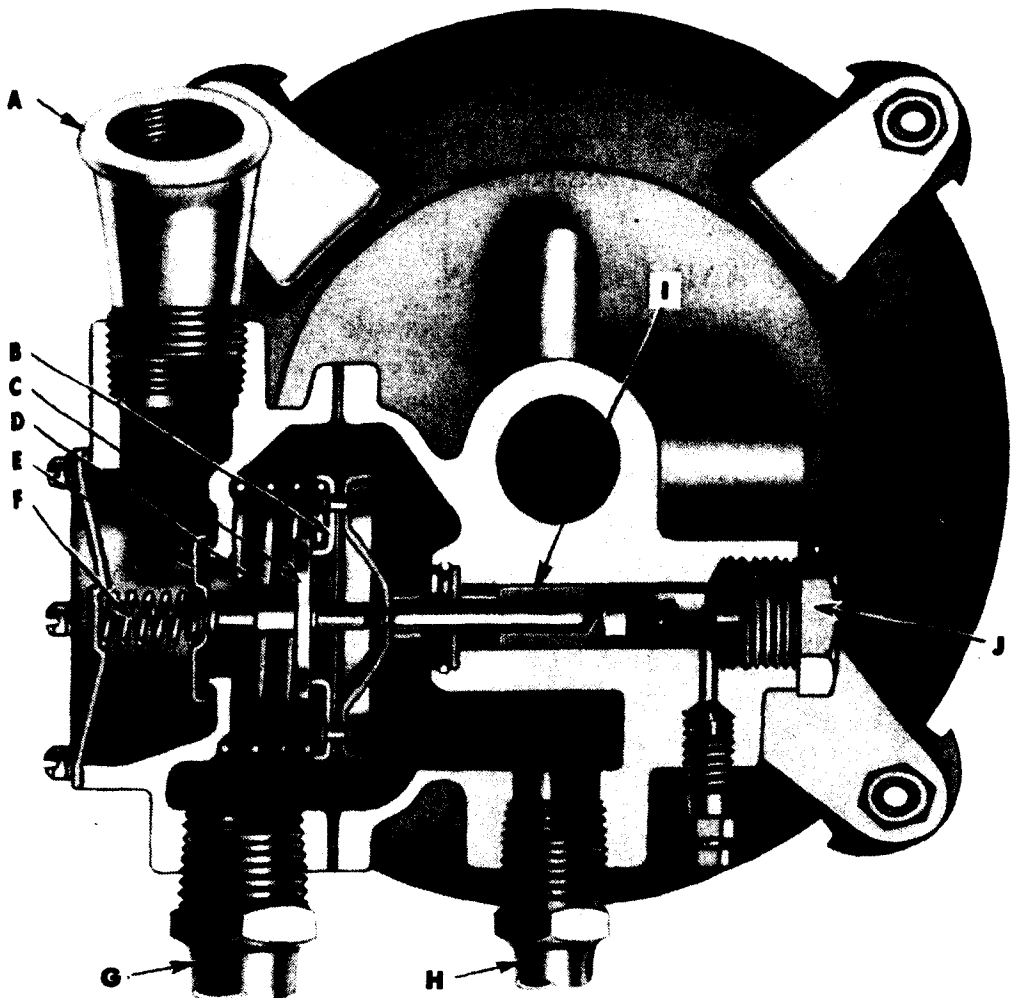


Figure 73 - Hydrovac Upper Piston Lower Nut Removal

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1



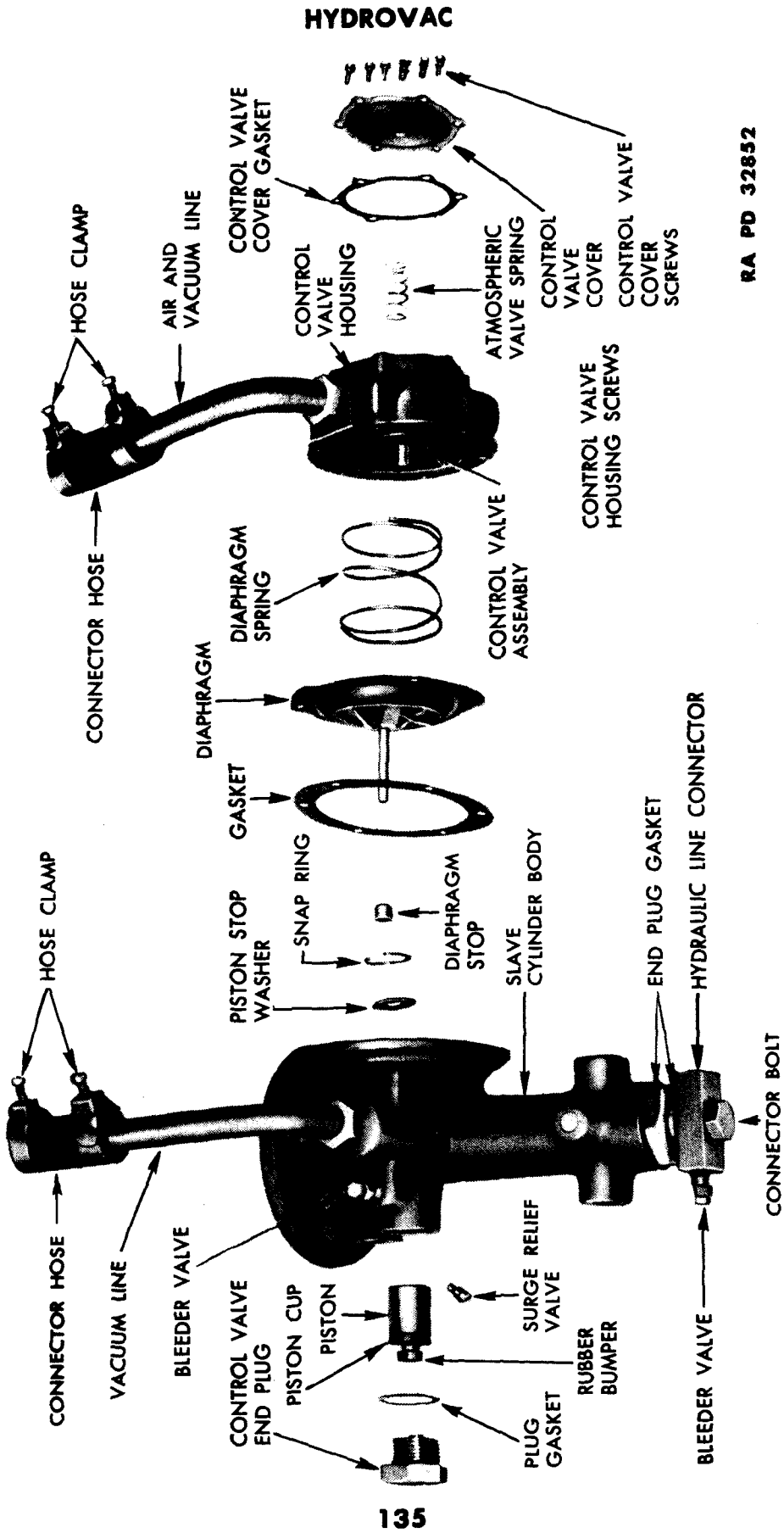
A—CONNECTION, TO AIR CLEANER
B—SEAT, VACUUM VALVE AND DIAPHRAGM
ASSEMBLY
C—VALVE, VACUUM
D—SPRING, DIAPHRAGM
E—VALVE, ATMOSPHERIC

F—SPRING, ATMOSPHERIC VALVE
G—LINE, VACUUM AND AIR TO LOWER
SIDE OF POWER CYLINDER PISTONS
H—LINE, FROM VACUUM SOURCE
I—PISTON, CONTROL VALVE HYDRAULIC
J—CONTROL VALVE HYDRAULIC LINE
CONNECTION

RA PD 32834

Figure 74 — Control Valve — Cross Section

shells are slightly rusted or corroded, they can be cleaned with fine emery cloth and steel wool. If the surfaces are badly pitted or scored, they should be replaced. Inspect slave cylinder and piston for scored surfaces; if these parts are damaged they should be replaced. It is good policy to replace the slave cylinder and piston seals any time cylinder is disassembled. Inspect control valve cylinder and piston for scored surfaces; if the rubber seal is swollen or distorted it should be replaced. Inspect control valve diaphragm for pinholes or torn mounting holes; if the diaphragm is damaged in any way it should be re-



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Figure 75 — Control Valve — Parts Layout

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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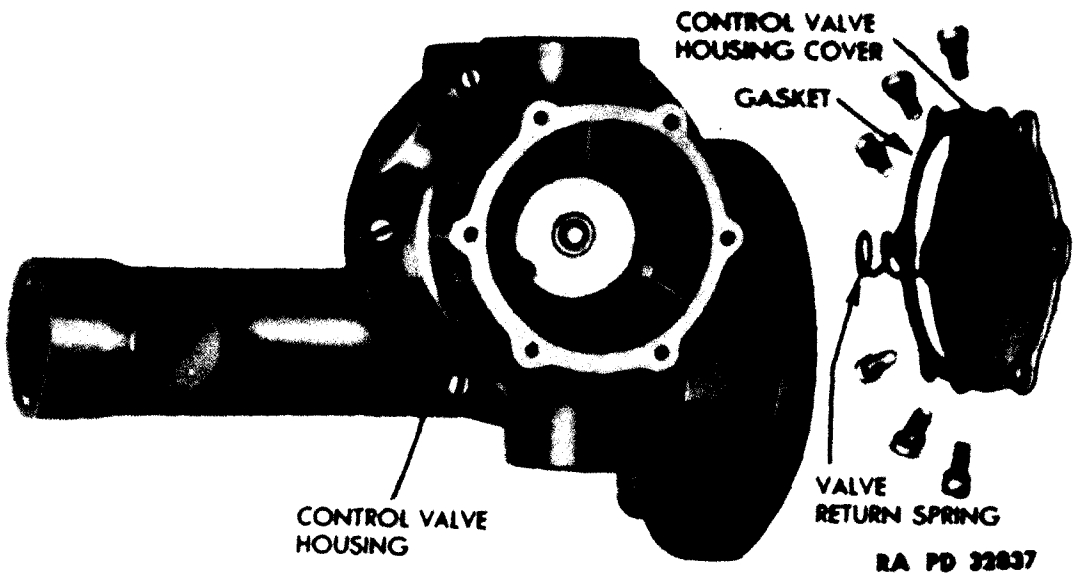


Figure 76 — Control Valve Housing Cover

placed. Inspect the vacuum and atmospheric valves and their seats for any indication of poor seating. Any damaged parts should be replaced.

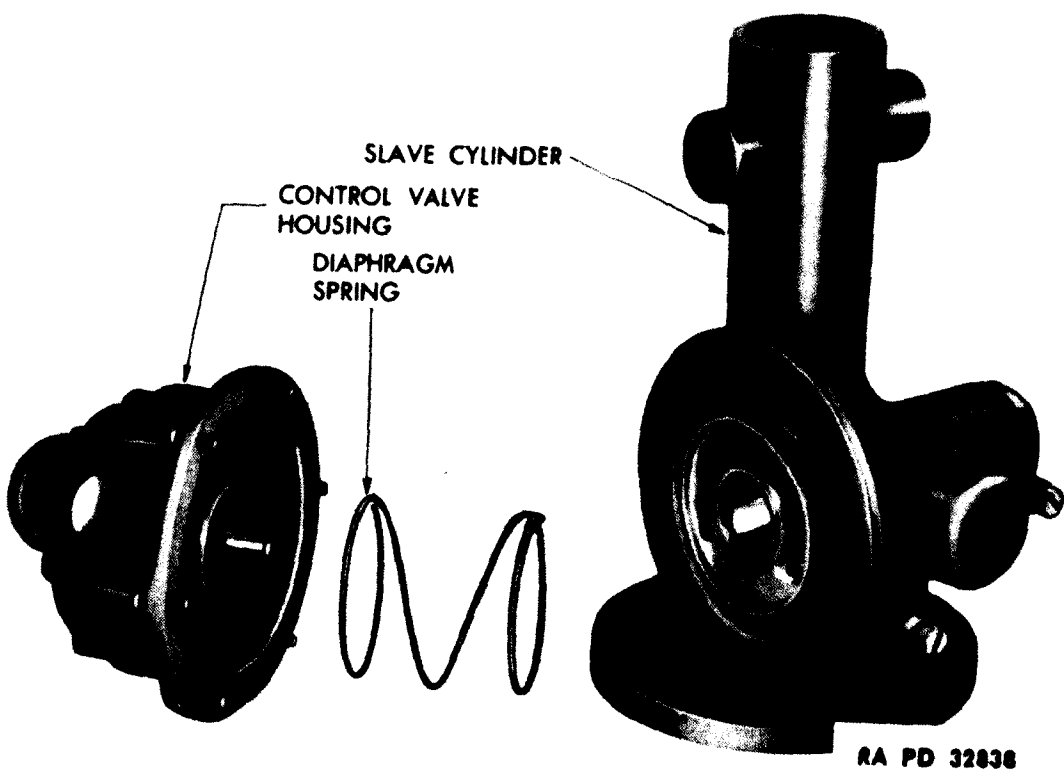
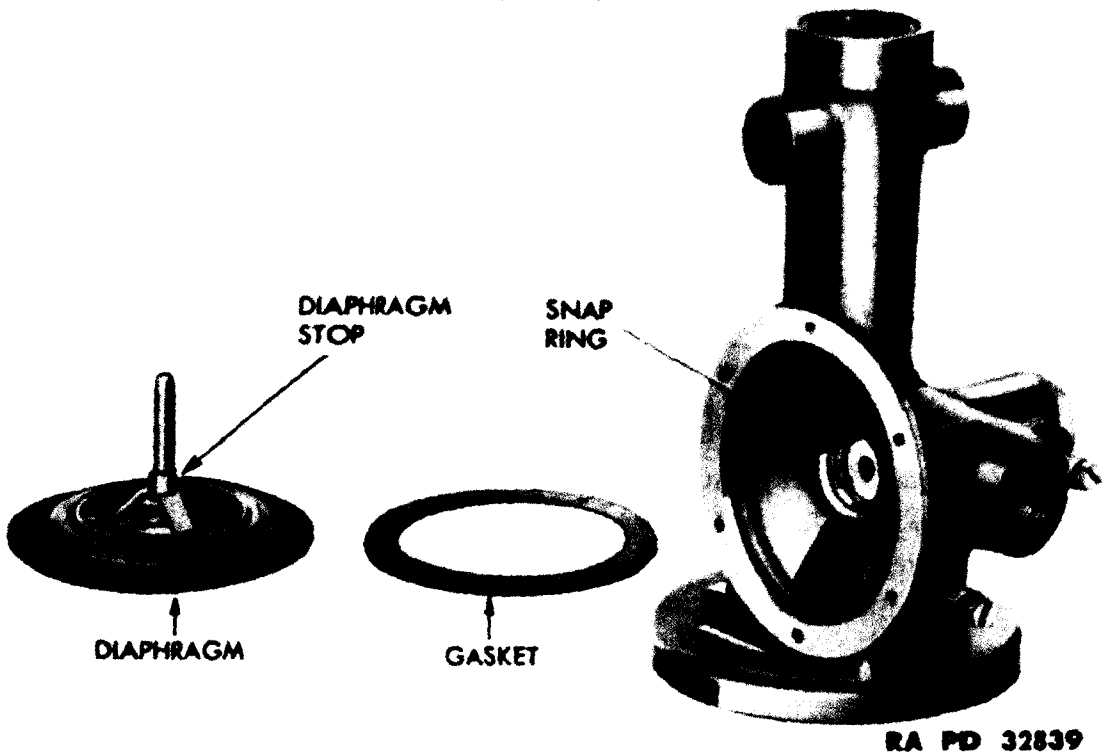


Figure 77 — Control Valve Housing Removal

HYDROVAC



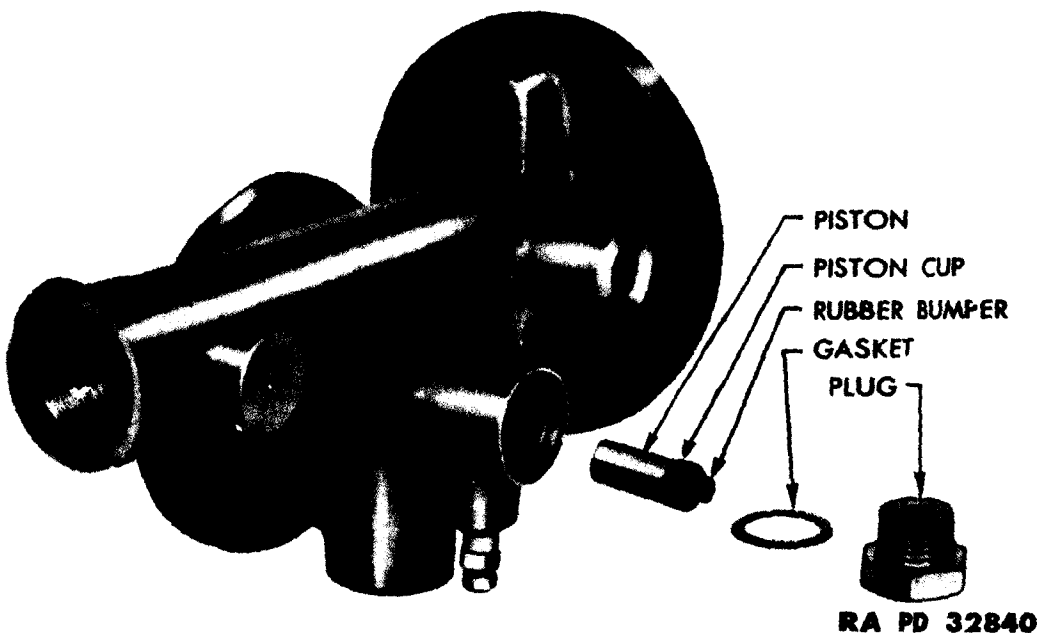
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Figure 78 - Control Valve Diaphragm Removal

83. REASSEMBLY.

a. Reassemble Control Valve.

(1) INSTALL HYDRAULIC PISTON (fig. 75). Install stop washer and snap ring in control valve body. Make sure the snap ring is properly seated. Insert small hydraulic piston, cup, and piston stop in the plug end opposite diaphragm opening, with cup and stop toward plug



RA PD 32840

Figure 79 - Control Valve Hydraulic Piston

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
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end. Install surge relief valve and control valve end plug, using a new copper gasket. If the two vacuum lines have been disassembled from slave cylinder body and control valve body, they should be reassembled at this point. Use sealing compound on threads and use a wrench on the hex of the connector fitting. **CAUTION:** *The connector fitting and pipe must rotate as a unit. Do not apply pressure on pipe to tighten the fitting.*

(2) **INSTALL DIAPHRAGM** (fig. 78). Insert push rod of diaphragm assembly through hole in stop washer in control valve cylinder with spacer collar in place and gasket on outside of diaphragm. Line up screw holes in diaphragm and gasket with holes in slave cylinder body.

(3) **INSTALL VALVE HOUSING** (fig. 77). Valve housing is now installed over the diaphragm with both ends of diaphragm spring properly fitted in position in recesses and elbow in line with elbow on slave cylinder body. Care should be exercised, in drawing up the six bolts, that diaphragm is not damaged.

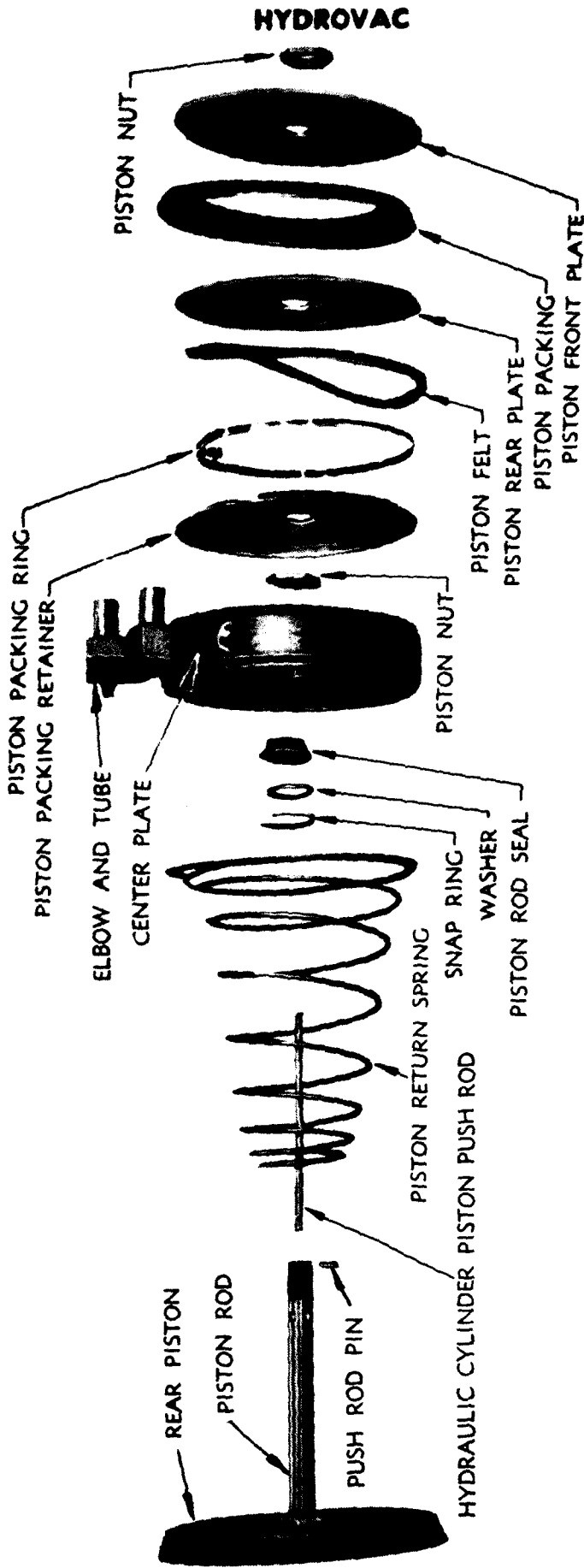
(4) **INSTALL VALVE COVER PLATE** (fig. 76). Install valve cover plate and spring, using sealing compound on both sides of a new gasket. Be sure spring is in recess of cover plate and valve.

b. Reassemble Slave Cylinder (fig. 71). Install one snap ring, stop washer, then the other snap ring in the grooves provided in slave cylinder. Make sure rings are properly seated. Through the upper end of slave cylinder (end plug end) insert slave cylinder piston and valve assembly (small end of piston and valve first), rubber seal with flat face toward piston, spring retainer with open end out, return spring, stop pin and washer assembly (with stop pin projecting into spring), and end plug with a new copper gasket, in that order. Make sure that stop pin washer and return spring engage in the counterbore in end plug, and that copper gasket engages in recess in end of slave cylinder body. Tighten end plug securely. Install the three bleeder valves, two in the slave cylinder and one in end plug connector.

c. Reassemble Center Plate and Piston Assembly.

(1) **ASSEMBLE BOTH PISTONS** (fig. 80). Dip piston packings in hydraulic oil. Place a small amount of shellac on piston plates at center holes. Assemble both pistons loosely on bench in the following order: piston upper plate; piston packing with lip up; piston lower plate with convex lip down against packing; place piston felt in packing on lower plate; make circle of piston packing ring with bent end facing inward and place inside of piston felt; straighten ring, making sure it fits against felt; place piston packing retainer on assembly with the bent end of packing ring in hole in retainer.

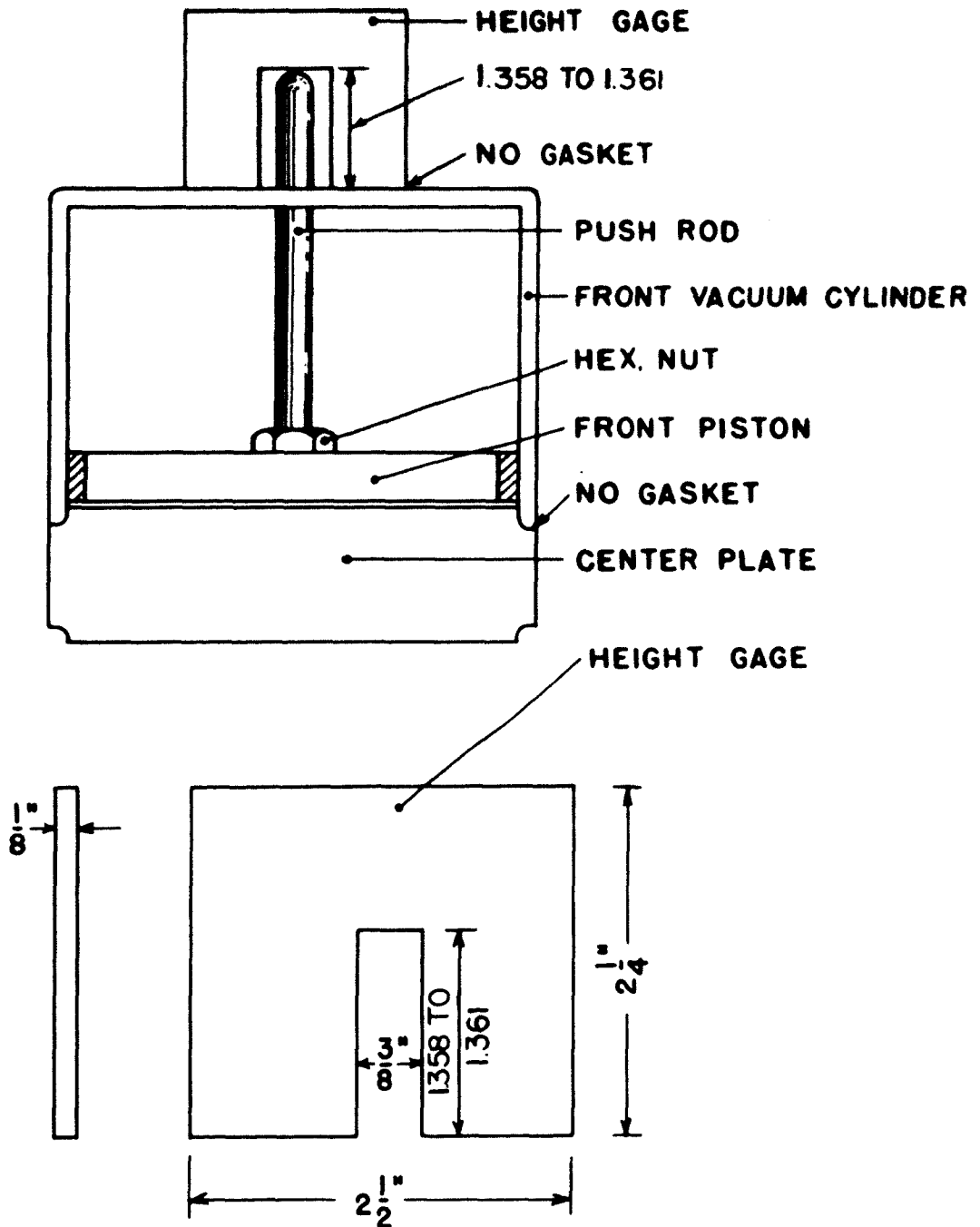
(2) **INSTALL LOWER PISTON ASSEMBLY** (fig. 80). Place a nut on lower end of piston rod (end farthest from air holes) and run the nut



RA PD 50644

Figure 80 — Hydrovac Center Plate and Piston Assembly — Parts Layout

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RA PD 55787

Figure 81 - Hydrovac Push Rod Height Gage

HYDROVAC

down to end of threads. Place a piston assembly on the rod with lip of piston packing down (away from nut); install the lower nut and tighten it until flush with end of piston rod. Tighten upper nut (first one installed) securely, check to see that end nut is still flush with end of rod, and stake end nut securely with a center punch.

(3) **INSTALL CENTER PLATE** (fig. 80). Set piston rod and lower piston on small block to prevent packing from becoming damaged. Install piston return spring with small diameter toward piston. Lubricate seal with hydraulic oil. Install seal, washer and snap ring in center plate. Place center plate (seal end first) on piston rod and push it down to compress the spring until a punch can be inserted in piston rod air ports to keep spring compressed.

(4) **INSTALL UPPER PISTON** (figs. 80 and 81). Install upper piston lower nut and turn it down to end of threads. Place the push rod in position in end of piston rod and push the pin into piston rod and push rod. Install upper piston assembly with lip of packing toward lower piston. Install upper nut and turn it down flush with top of piston rod. Tighten lower nut securely against piston. Remove punch from piston rod air ports. Measure from the gasket surface of the center plate to end of push rod; adjust the two upper piston nuts until the over-all length of 6.485 inch-6.504 inch is attained. A final check of this adjustment must be made by the use of a height gage (fig. 81) that can readily be made from scrap material. Place the upper vacuum cylinder (less slave cylinder assembly) over the piston and against center plate without a cylinder to plate gasket. Without the slave cylinder gasket on end of vacuum cylinder, set the gage in place to check the length of the exposed part of push rod which should be from 1.358 inch-1.361 inch. If the length is not within these limits, remove the vacuum cylinder and adjust as explained above and recheck. When correct adjustment is obtained remove the vacuum cylinder.

d. **Install Slave Cylinder on Upper Vacuum Cylinder** (figs. 82 and 83). Place a new slave cylinder body to power cylinder shell gasket (well covered with sealing compound) on upper cylinder shell in the proper position with holes match. Place slave cylinder and control valve assembly in a vise with plug end of slave cylinder downward, and insert through top the small spring (with wide end down), rubber cup, piston rod guide, and seal in their proper order with lip of cup downward. Care should be taken not to damage rubber cup. A rubber band gasket should be in place around shoulder on the piston rod guide. Hold piston guide and seal in position with a screwdriver, and assemble upper shell and reinforcing plate inside of shell, using care to line up the vacuum passage in slave cylinder body and cylinder shell. Install four cap screws with lock washers and tighten securely.

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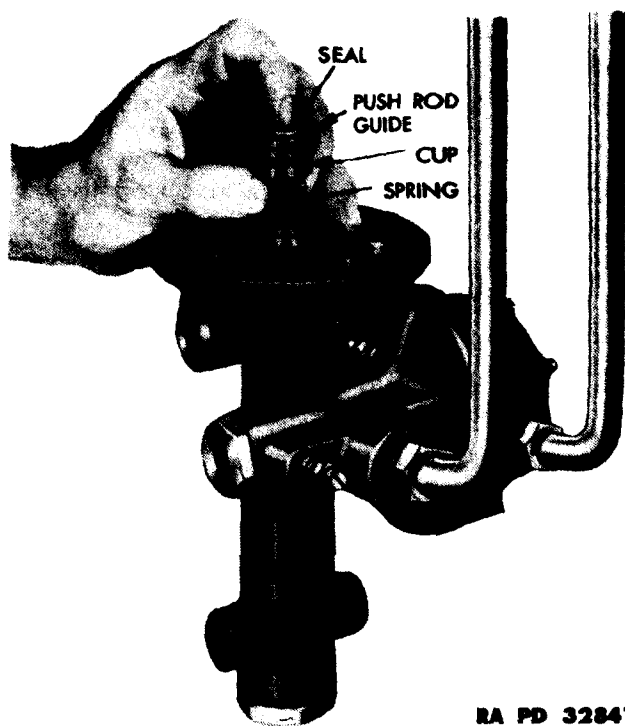


Figure 82 — Installing Slave
Cylinder End Seal Parts

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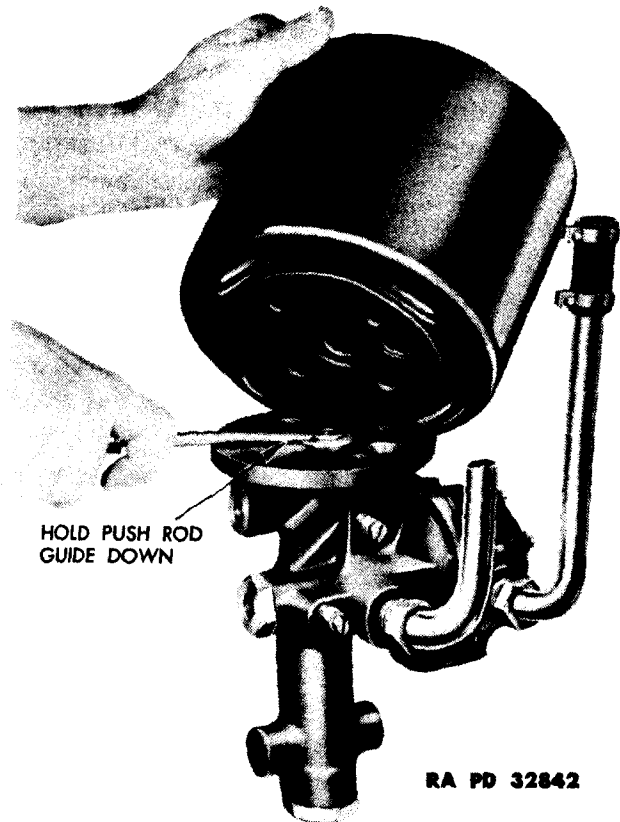
e. **Final Assembly of Hydrovac** (fig. 80). Dip the pistons in hydraulic oil. With cylinder to center plate gasket in position, insert piston push rod into guide of slave cylinder housing and install upper piston into upper cylinder, rotating center plate so that vacuum lines and connectors are alined, or so that center punch markings made when disassembling are alined. Using second shell to center plate gasket, install lower shell over piston and clamp assembly together with through studs and clamps, tightening securely. One of the two long studs must be installed at location directly under air cleaner line on control valve, and the other diametrically opposite. Both must be installed with threaded end toward slave cylinder. Slide the two rubber hoses back to center plate connection and tighten clamps.

84. INSTALLATION.

a. **Place Unit in Position** (fig. 68). Rotate turret until one of the large holes in the basket is opposite the corner of the hull in which the hydrovac unit is to be installed. Working through this opening, insert the hydrovac on an angle, bottom end first, and insert the unthreaded end of the long studs in the holes in lower mounting brackets welded to the hull; at the same time enter the vacuum hose on fitting at center of hydrovac. Straighten the hydrovac and raise it so that the upper end of the long studs protrude through the holes in the upper mounting brackets on the hull. Holding the assembly in this position, tighten the retaining nuts on the upper end of the long studs, and tighten the upper lock nuts.

HYDROVAC

**Figure 83 – Assembling
Upper Cylinder to Slave
Cylinder**



b. Connect Hydraulic Lines. Connect the hydraulic line from the end plug of the master cylinder to the lower connection on the slave cylinder (N, fig. 68). Connect the hydraulic line from the top of the compensating port on the main cylinder to the control (L, fig. 68). Connect the hydraulic line from the wheel cylinders to the top of the slave cylinder (C, fig. 68).

c. Connect Vacuum Hose and Air Cleaner Pipe. Connect the vacuum hose to the connector on the center plate. Reconnect the pipe at the control valve that leads to the air cleaner above the hydrovac assembly.

d. Bleed System. Bleed the entire brake system according to instructions given in paragraph 72.

85. TESTS.

a. General. The following tests can be made to determine the efficiency of the hydrovac systems and locate any leaks that might affect the efficiency of either the vacuum or hydraulic operation. Due to the hook-up between the two hydrovacs, the two vacuum reserve tanks, and the two engines, it is necessary to consider all lines and both hydrovacs in some of the tests.

b. Quick Test for Vacuum Leak. Start an engine and let it run for five minutes. Shut off the engine and wait one minute. Apply the

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
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brakes firmly and listen for the hydrovac piston action. If the hydrovac piston action can be heard, it indicates that the hydrovac system does not have vacuum leaks which will seriously affect its efficiency.

c. Hydrovac Efficiency Test.

(1) **MANIFOLD VACUUM CHECK.** Remove the engine compartment covers and radiator inlet grille. Disconnect the intake manifold to vacuum check valve line from engine on side of vehicle where hydrovac test is to be made, and attach a vacuum gage to engine manifold vacuum line. Start the engine and run at idling speed. Note the vacuum gage reading which should be 18 to 20 inches of vacuum. Shut off engine, remove vacuum gage, and connect vacuum line securely.

(2) **HYDROVAC VACUUM CHECKS.** Disconnect the vacuum inlet hose, remove the nipple from the hydrovac center plate (RR, fig. 68), and install a suitable T-type fitting. Connect vacuum line to one end of T and attach the vacuum gage to other end of T. Start the engine that was just tested, idle the engine a few minutes and note the vacuum reading on gage. The vacuum reading should be within one inch of the same as manifold vacuum if both hydrovac systems are satisfactory. If vacuum gage reading is below manifold vacuum, a leak is indicated at one or more of the following points: in the manifold to check valve line; at either vacuum check valve fitting or gasket; in the opposite check valve; in the lines to either hydrovac; the lines to either vacuum reserve tank; an external leak at either hydrovac, or faulty atmospheric valve at either hydrovac (fig. 53). To isolate the trouble in one hydrovac system, disconnect the line that connects the two vacuum check valves by loosening the connector nut on the check valve for unit being tested, the two bracket screws and pulling the check valve away from line; install a pipe plug in fitting on check valve. Recheck vacuum; if still low the trouble is in the unit being tested. (To check atmospheric valve, disconnect air cleaner to control valve line and seal air inlet by placing hand over inlet. If vacuum reading does not increase, valve is not leaking). Shut the engine off and note the drop in vacuum gage reading. If the gage reading drops quite rapidly it indicates a leak in the vacuum check valve or a slow leak in the hydrovac system that was not detected or corrected in the test with engine running. Tighten all connections, control valve housing, relay valve cover, and hydrovac stud nuts.

(3) **VACUUM CHECK (BRAKE APPLIED).** Start the engine, depress foot brake pedal, and observe vacuum gage reading which should be the same as the reading of gage when making the above test. If vacuum gage reading is low on this test it indicates a leak at the vacuum valve (fig. 74) or past the packings of one of the two pistons. In either event the hydrovac should be overhauled. Shut off engine.

HYDROVAC

(4) **HYDROVAC PRESSURE TEST.** Remove the bleeder valve from the end plug connector at top of hydrovac and connect a 2,000-pound pressure gage to the connector where the bleeder valve was removed. Depress the foot brake pedal several times to relieve any vacuum in the reserve tank. Depress the brake pedal until the pressure gage reads 220 pounds, and note the approximate pedal pressure required. Start the engine, apply as nearly as possible the same brake pedal pressure and note the pressure gage reading. If the hydrovac is functioning properly the pressure gage reading should be 1,200 to 1,500 pounds. (This reading verifies the efficiency of the vacuum pressure as covered by the vacuum checks). Hold even pressure on the pedal for several minutes. If the pedal gradually goes further down and the hydraulic pressure remains steady until the pedal reaches the bottom of stroke and then drops, it indicates internal leaks in the brake master cylinder, internal leaks from the slave cylinder to upper vacuum cylinder, or external fluid leaks in the hydraulic system. Check for fluid leaks all along the lines and at wheel cylinders. If the brake pedal and the pressure gage reading remain steady for a short time and then the pressure gage reading drops several hundred pounds it indicates a leak past the piston seal in the slave cylinder. The hydrovac must be overhauled to correct this. After the necessary tests and repairs have been made, remove the vacuum gage and pressure gage. Connect the vacuum line securely and install the brake bleeder valve. Remove the pipe plug from the vacuum check valve, connect the line between the check valves, and attach the valve body bracket to hull. Bleed hydraulic system as explained in paragraph 73.

86. VACUUM CHECK VALVES.

a. **General.** (fig. 84). The vacuum check valves are mounted on the bulkhead in the radiator compartment. The purpose of these valves is to trap the vacuum in the hydrovac and reserve tanks so that in the event the engines stall, several applications of the hydrovac braking system may be made after the engines stop. Ordinarily the valves require no attention; however, if the valves stick, there will be evidence of no reserve vacuum and the valve should be removed and cleaned. The repair procedure is as follows:

b. Service Operations.

(1) **REMOVE VACUUM VALVE.** Remove the eight cap screws that attach the radiator grille to the hull and remove the grille. Disconnect the vacuum lines from each end of the valve. Remove the valve from the support fittings.

(2) **DISASSEMBLE VACUUM CHECK VALVE** (fig. 84). Remove the four screws that attach the two halves of the valve, pull the two halves apart, and remove the valve and gasket.

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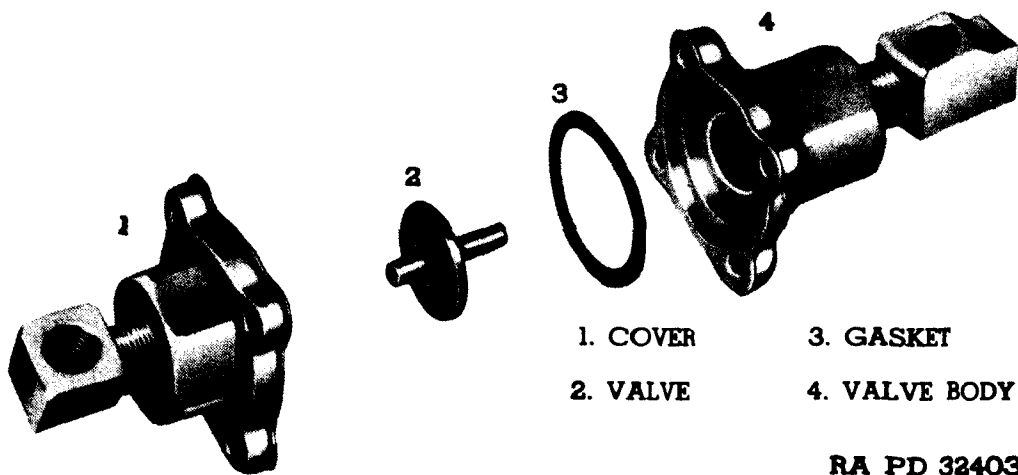


Figure 84 — Vacuum Check Valve

(3) **CLEAN AND INSPECT PARTS.** Wash all parts thoroughly in dry-cleaning solvent, and inspect the valve and valve seat for wear or other damage. Replace the damaged parts.

(4) **ASSEMBLE VALVE.** Install the valve and a new gasket. Place the cover in position and install the four screws. Tighten the screws securely.

(5) **INSTALL VALVE ASSEMBLY.** Mount the valve assembly in the support fittings so that the valve cover is toward the top. Connect the vacuum lines to the fittings at each end of the valve. Install the radiator inlet grille, and tighten the eight cap screws.

CHAPTER 6
SHOCK ABSORBERS

Section I

INTRODUCTION

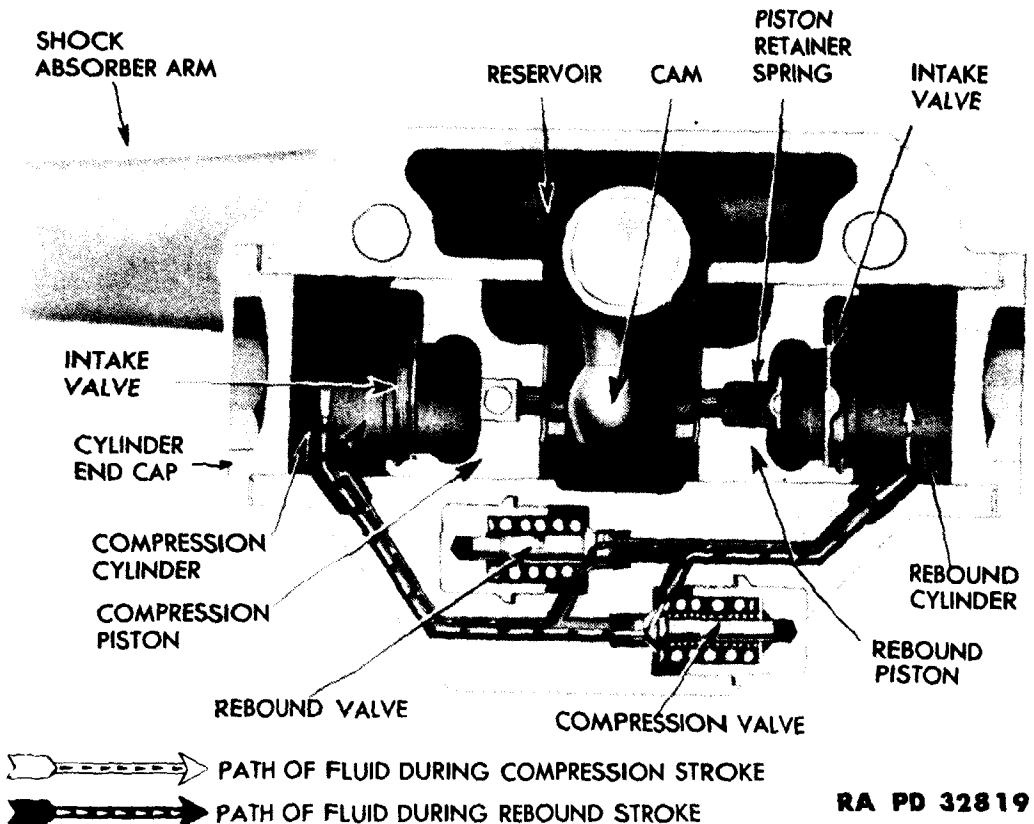
	Paragraph
Description	87
Data	88
Reference to second echelon TM 9-741	89
Maintenance allocation	90

87. DESCRIPTION.

a. **Description.** Shock absorbers provide a means of dampening the spring vibrations as the wheels of the vehicle pass over irregularities in the road or ground. Both front and rear shock absorbers on this vehicle are of the hydraulic double-acting type, which control or dampen the speed of both compression and rebound of the springs. Each shock absorber contains two pistons which are operated in tandem in opposed cylinders by a crank or cam between them. The cam is rotated by the shock absorber arm, which is attached to the end of the camshaft and is connected to either the front or rear axle by a shock absorber link. The cylinders are filled with shock-insulating fluid which passes between the two cylinders through passageways as the axle moves up and down and operates the pistons. The dampening action is obtained by controlling the flow of fluid through the passageways in each direction by spring-loaded valves. The calibration of these valves with respect to both spring loading and orifice size determines the degree of control obtained in the shock absorber. The valve and spring combinations used are denoted by code number and letter, which is stamped on both relief valve nuts of the shock absorber. The letter identifies the spring used and the number denotes the valve orifice.

b. **Operation** (fig. 85). The compression valve works only on the up stroke of the arm, or when the chassis spring is being compressed. The rebound valve works only on the down stroke of the arm, or when the chassis spring is returning to its normal position. When the wheel and axle move toward the hull, the spring deflects and the shock absorber arm moves upward which rotates the camshaft and cam clockwise. This moves the compression piston toward the head of the cylinder, which forces the fluid through the compression valve and orifice and into the rebound cylinder, as shown by the white arrow in figure 85. The two pistons are linked together by two spring-loaded retainer screws which keep both pistons in contact with the cam at all times. As the axle and spring return to their normal posi-

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RA PD 32819

Figure 85 – Shock Absorber – Cross Section

tion, the directions are reversed, and the fluid is forced through the rebound valve and orifice, as shown by the black arrow in figure 85. Any leakage of fluid between the pistons and cylinders is replenished from the reservoir through intake valves in the pistons.

88. DATA.

Make	Delco-Remy	
Model	{ Left front 1699B Right front 1699A Left rear 1699D Right rear 1699C	
Type	Hydraulic	
Control	Double action	
Mounting	On hull	
Link type	Solid	
Link connections	Spring mounted ball and socket	
Valve marking	Both front and rear	
	Early production	Late production
Compression	B4	0A
Rebound	6D	2F

INTRODUCTION

89. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often done by ordnance maintenance personnel, who should refer to the using troops TM for information.

90. MAINTENANCE ALLOCATION.

a. For scope of maintenance and repair by the crew and other units of the using arm refer to paragraph 7.

b. **Maintenance Chart.**

ABSORBERS, SHOCK	ECHELONS			
	2nd	3rd	4th	5th
Absorber assemblies, shock (w/linkage)—replace.....				X
Absorber assemblies, shock (w/linkage)—repair.....				X
Absorber assemblies. shock (w/linkage)—rebuild.....			E	X

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CHAPTER 6

SHOCK ABSORBERS (Cont'd)

Section II

TROUBLE SHOOTING

	Paragraph
Shock absorber noisy.....	91
Shock absorbers too flexible.....	92
Shock absorber leaks fluid.....	93

91. SHOCK ABSORBER NOISY.

Possible Cause	Possible Remedy
Loose or dry shock absorber link.	Adjust and lubricate (par. 96).
Arm loose on shaft.	Replace arm or overhaul shock absorber.
Cam or piston thrust plates broken or badly worn.	Overhaul shock absorber.
Shock absorber to hull plate bolts loose.	Tighten bolts.

92. SHOCK ABSORBERS TOO FLEXIBLE.

Lack of shock absorber fluid.	Fill with fluid and check for leak (pars. 94 and 95).
Cam broken.	Overhaul shock absorber.
Dirt in shock absorber valves.	Clean valves or overhaul shock absorber.

93. SHOCK ABSORBER LEAKS FLUID.

Valve nuts loose.	Tighten valve nuts.
Cylinder end caps loose.	Tighten cylinder end caps. Replace gasket if necessary (par. 95).
Cam shaft loose in housing.	Replace shock absorber if leak is excessive.
Filler plug loose.	Tighten filler plug.
Shock absorber body cracked.	Replace shock absorber.

CHAPTER 6
SHOCK ABSORBERS (Cont'd)

Section III

**REPAIRS THAT CAN BE MADE WITHOUT REMOVING
SHOCK ABSORBER FROM VEHICLE**

	Paragraph
Fill shock absorbers with fluid.....	94
Check for fluid leaks.....	95
Shock absorber link—overhaul.....	96

94. FILL SHOCK ABSORBERS WITH FLUID.

a. Clean the shock absorber around the filler plug carefully. Also remove any dirt that might drop down into filler opening. Inject enough fluid to fill the shock absorber up to the bottom of filler hole. This provides the necessary air space in the reservoir to permit expansion of the fluid. Install the filler plug, using new gasket.

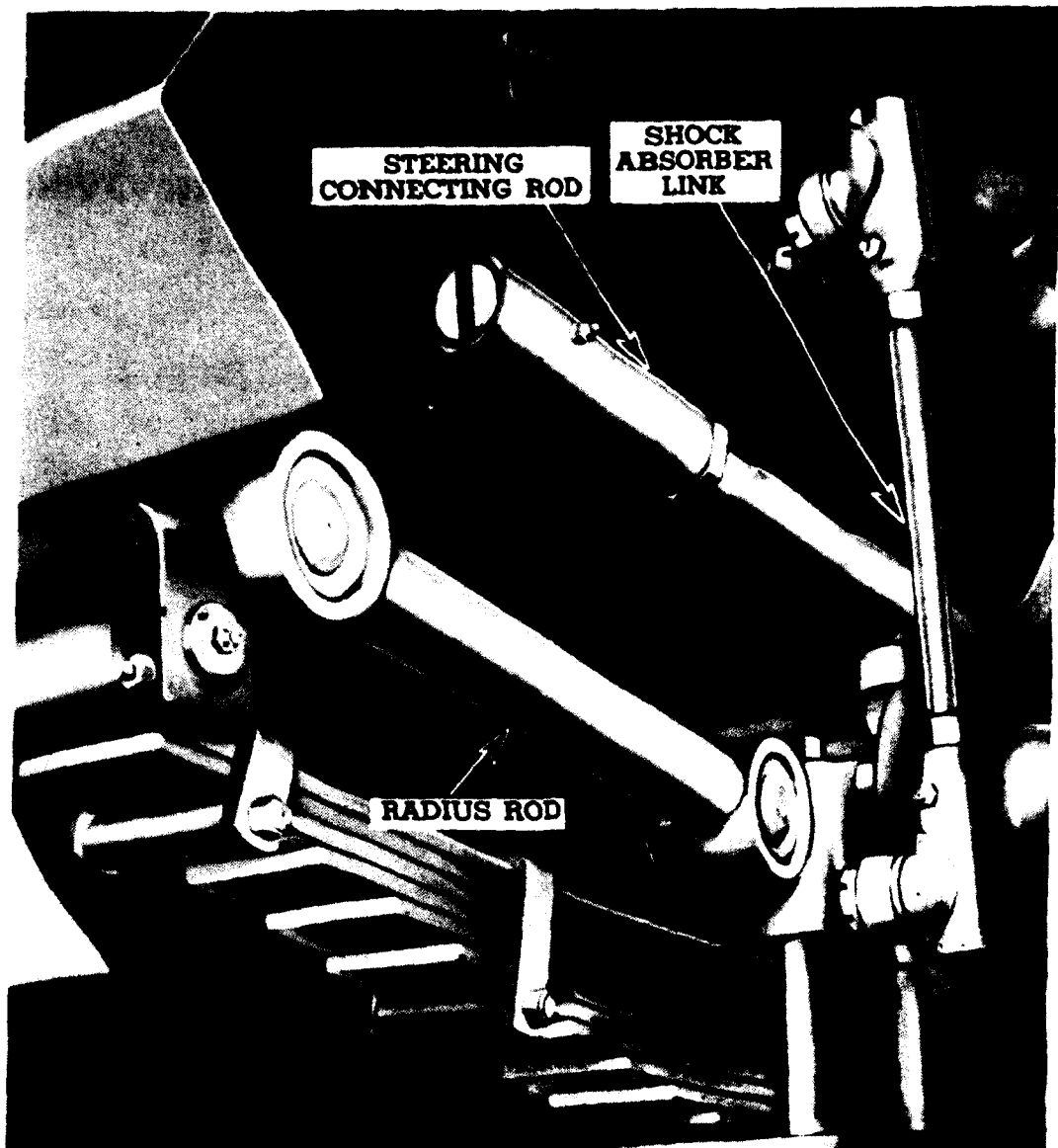
95. CHECK FOR FLUID LEAKS.

a. Fluid leak will leave a deposit of oil and dirt on the outside of shock absorber. Clean the shock absorber thoroughly with dry-cleaning solvent, and wipe dry. Remove the filler plug and fill shock absorber. Drive over rough roads for a few blocks. Inspect the shock absorber for any signs of leaks at the valve nuts, cylinder end caps, welch plugs, arm shaft packing, and filler plug gasket. A slight leak at the shaft packing may be caused by internal pressure after filling a shock absorber. The location of leak will determine whether it can be corrected by tightening, gasket replacement, or shock absorber overhaul.

96. SHOCK ABSORBER LINK — OVERHAUL.

a. **General.** The shock absorber links are of the spring-loaded ball and socket type. Dust seals are used at each ball and socket joint to prevent the entrance of foreign matter. The ball and socket joints can be checked for wear or looseness by removing the ball stud nut at the axle end, and driving the tapered ball stud out of the axle bracket. Check for looseness at the ball and socket joints and for the link rod jam nuts being loose. Loose jam nuts can be tightened; however, when there is looseness in the ball and socket ends, the shock absorber link should be removed and overhauled.

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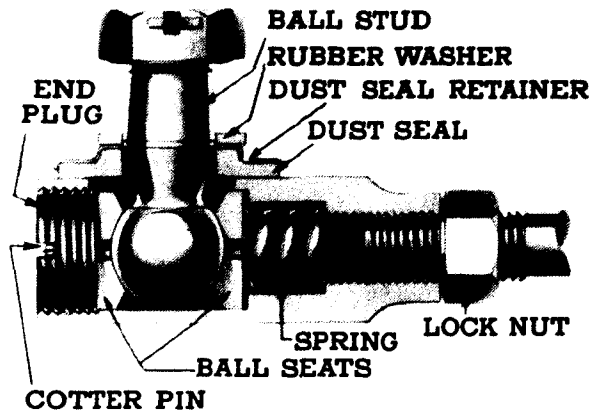
Figure 86 – Spring, Radius Rod and Shock Absorber Connections

b. Overhaul Procedure.

(1) **REMOVE AND DISASSEMBLE** (figs. 86 and 87). Remove the ball stud to shock absorber arm cotter pin and nut. Remove the ball stud to axle bracket cotter pin and nut, force the taper of ball stud out of shock absorber arm and axle bracket. Place the link in a bench vise, remove the end plug cotter pins, the end plugs, balls with dust seals, ball seats, and springs. Remove the rubber dust seals from the ball studs. Clean all metal parts in dry-cleaning solvent, wipe the rubber seal and washer with a dry rag. **CAUTION:** *Do not allow the rubber seal or washer to come in contact with cleaning sol-*

REPAIRS THAT CAN BE MADE WITHOUT REMOVING
SHOCK ABSORBER FROM VEHICLE

Figure 87 — Shock Absorber
Link End



RA PD 32554

yent. Inspect all parts for wear or damage. Replace all damaged or worn parts.

(2) ASSEMBLY AND INSTALLATION (figs. 86 and 87). Place a coil spring in one end of link and install a ball seat with the flat side against the spring. Place a new dust seal retainer, dust seal, and rubber washer on the ball stud. Enter the ball through opening in end of link, and seat it in the spherical surface of the ball seat. Install the other ball seat with the spherical side against the ball. Install the end plug and tighten it down tight, then back it off until slot in end plug lines up with nearest cotter pinhole. Install new cotter pin and spread the ends to lock it securely. Assemble the other end of link in the same manner. Lubricate both ends of link. Place the tapered end of ball studs in the axle bracket and shock absorber arm. Install the retaining nuts, tighten securely, and install new cotter pins.

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CHAPTER 6

SHOCK ABSORBERS (Cont'd)

Section IV

REMOVAL AND DISASSEMBLY

	<i>Paragraph</i>
General	97
Removal	98
Disassembly	99

97. GENERAL.

a. The type of shock absorber used on the T17E1 armored car requires very little service. Normally, if the fluid level is checked regularly and any leaks are corrected they will give trouble-free service. The presence of dirt or foreign material in the fluid will eventually affect the valve action. For this reason it is recommended that the shock absorbers be removed, disassembled, and thoroughly cleaned every 10,000 miles.

98. REMOVAL.

a. Remove the cotter pin and nut attaching the shock absorber link ball stud to the shock absorber arm. Force the tapered ball stud out of the shock absorber arm. Remove the four bolts attaching the shock absorber to hull and remove the shock absorber.

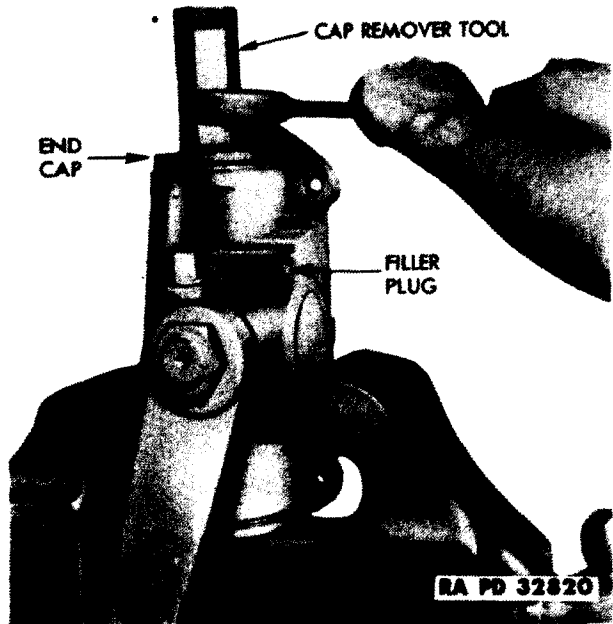
99. DISASSEMBLY

a. **Remove Control Valves** (fig. 89). Remove the filler plug and drain fluid from shock absorber. Remove one of the valve nuts and valve, hold the shock absorber over a container, and work the arm back and forth to pump the fluid out of absorber. Remove the remaining valve nut and valve, work the shock absorber arm back and forth to pump the fluid out of that end of absorber.

b. **Remove Cylinder End Caps and Intake Valves** (figs. 88 and 89). Place the end flange of the absorber in a bench vise. Do not clamp the cylinder of shock absorber in the vise, as this may distort the cylinder bore. Remove the cylinder end caps and gaskets as shown in figure 87. Move the shock absorber arm until one piston is at the outer end of the cylinder. Pry the intake valve spring retainer out of its seat with a screwdriver. Remove the valve'spring and valve. Remove the intake valve from the other piston in the same manner. If the shock absorber is to be cleaned only, it will not be necessary to remove

REMOVAL AND DISASSEMBLY

Figure 88 - Removing Shock Absorber Cylinder End Caps



the pistons or cam and shaft. Clean the partially disassembled shock absorber thoroughly with dry-cleaning solvent, inspect the removed parts, and reassemble according to instructions in paragraph 102.

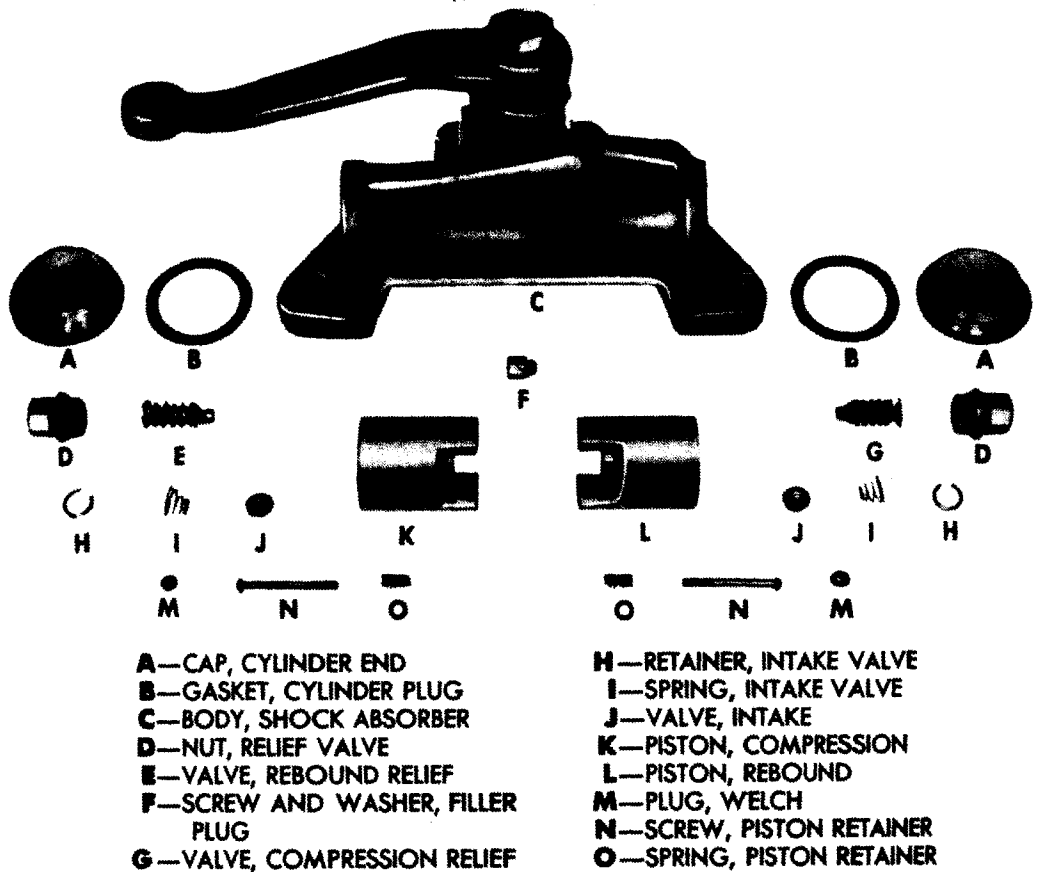
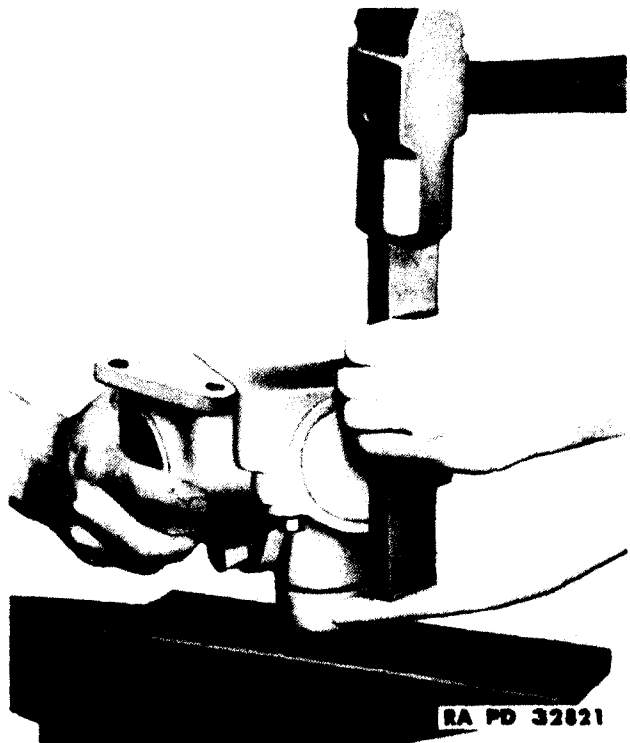


Figure 89 - Shock Absorber - Exploded View

**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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**Figure 90 — Removing
Shock Absorber Arm**



c. **Remove Piston** (fig. 88). Drive a sharp punch through the small welch plug over the piston retainer screw in each piston, and pry the plugs out. Remove the piston retaining screws and springs. Remove the pistons from the cylinder.

d. **Remove Arm, Cam and Camshaft** (fig. 90). Remove the lock nut which holds the shock absorber arm on the end of camshaft. Mark the shaft and arm for correct position when reassembling. If the cam and camshaft are to be removed, it will be necessary to move the arm to each end of the stroke and scribe an alignment mark on the body and arm in these positions. These marks will then be used in order to reassemble the arm in correct position in relation to cam position. Place the end of camshaft on an anvil or solid steel plate. Place a piece of steel stock on the arm as close to the shaft as possible, as shown in figure 90. Strike the piece of stock with a heavy hammer to force the arm off the shaft. It may be possible to pull the arm with a universal puller. Remove the large welch plug at top of shock absorber body and small plug at end of camshaft. Place the shock absorber in an arbor press with the arm end down. Press the shaft out of cam and body. Remove the cam through the large opening in top of shock absorber body. Drive the camshaft packing gland, cork packing, and retainer out of shock absorber body. If the cam and camshaft are known to be in good condition the camshaft packing and gland can be removed by prying them out with a pointed tool. Do not remove the cam and shaft unless the cam or shaft are damaged and must be replaced.

CHAPTER 6
SHOCK ABSORBERS (Cont'd)

Section V

CLEANING AND REPAIR

	Paragraph
Cleaning	100
Repair	101

100. CLEANING.

a. Wash all parts thoroughly in dry-cleaning solvent. Dry the parts with clean rags and place them on a clean paper.

101. REPAIR.

a. Inspect the pistons and cylinder for wear or roughness. Inspect the cam and thrust pads on ends of pistons for wear. Check the splines in the cam and shock absorber arm for fit on the shaft splines. Check the compression and rebound valves for correct number (par. 89). Select new gaskets for the end caps, control valves, and filler plug. New camshaft packings, packing glands, and retainer must be used.

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CHAPTER 6

SHOCK ABSORBERS (Cont'd)

Section VI

ASSEMBLY AND INSTALLATION

	Paragraph
Assembly	102
Installation	103

102. ASSEMBLY.

a. **Assemble Cam and Camshaft.** Hold the cam in position through the opening in top of body. Start the small end of the camshaft through the arm end of the shaft bore, and start it into cam, making certain the serrations on the shaft engage properly with those in the cam. Press the shaft through the cam using an arbor press until the shoulder on the shaft adjacent to the cam bottoms in the housing. Install a new cork packing, packing gland, and another cork packing over the shaft and into the bore provided in the housing. Start a new metal retainer in the bore with the open side of retainer toward the cork packing. Drive the retainer in place with a hollow driver that will drive against the outer edge of the retainer where it contacts the bore in the housing. (A driver may be made from a piece of pipe of suitable size by squaring one end and relieving the inside edge of hole.)

b. **Install Shock Absorber Arm.** Turn the camshaft in either direction as far as it will go, start the arm on the splines of the shaft with the scribed marks in the same relative position they were when marked for alinement during disassembly. Turn the arm to the other extreme position and check the alinement of the scribed marks. Place a piece of steel stock between the inner end of camshaft and body. Place the shock absorber on an arbor press, and with a tubular driver press the arm onto shaft. Maintain $\frac{1}{16}$ -inch clearance between the inside face of arm and the packing gland retainer. Install the arm lock nut, tighten securely, and stake it in notch provided in end of shaft. Place new welch plug gaskets and welch plugs in the openings at the top of body and at end of camshaft. Press the plugs into position and expand them with a steel drift of similar diameter.

c. **Install Pistons (fig. 89).** Place a piston in each end of the cylinder with the thrust pad against the cam and the two retainer screw holes in line. Install the two retainer screws with springs, tighten securely, and back off screws from 1 to $1\frac{1}{2}$ turns. Install new welch plugs over the retainer screws. Place the inlet valves on the seats in

ASSEMBLY AND INSTALLATION

pistons, install springs (small end toward valve), and force the lock rings down into their seats.

d. Install Control Valves and Plugs (fig. 89). Install the rebound valve (marked 6D or 2F) in the opening facing the arm end of the shock absorber. Place a new gasket on the valve nut and tighten the nut in housing. Install the compression valve, new gasket, and valve plug in the other opening. Place new gaskets on the end caps and tighten them securely.

e. Fill Shock Absorbers. Place the shock absorber in a horizontal position with the filler opening on the side, as it is when mounted in the vehicle. Fill the shock absorber up to the bottom of the filler plug hole with *shock-insulating fluid*, pump the shock absorber arm back and forth to work the fluid out into the cylinders and relieve any trapped air. Refill the shock absorber to the bottom of filler plug hole. **NOTE:** *It is necessary to have an air space in the reservoir of the shock absorbers to provide for expansion of fluid due to temperature changes. This space is provided by only filling the shock absorber to the level of the bottom of filler plug hole.* Install the filler plug, using a new gasket.

103. INSTALLATION.

a. Install Shock Absorber (fig. 86). Place the shock absorber in position on the side of hull. Install the four attaching bolts and tighten. Place the tapered end of the shock absorber link ball stud in the shock absorber arm and install the retaining nut. Tighten the nut securely and install a cotter pin.

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CHAPTER 7
TIRE PUMP

Section I

INTRODUCTION

	Paragraph
Description	104
Data	105
Reference to second echelon TM 9-741	106
Maintenance allocation	107

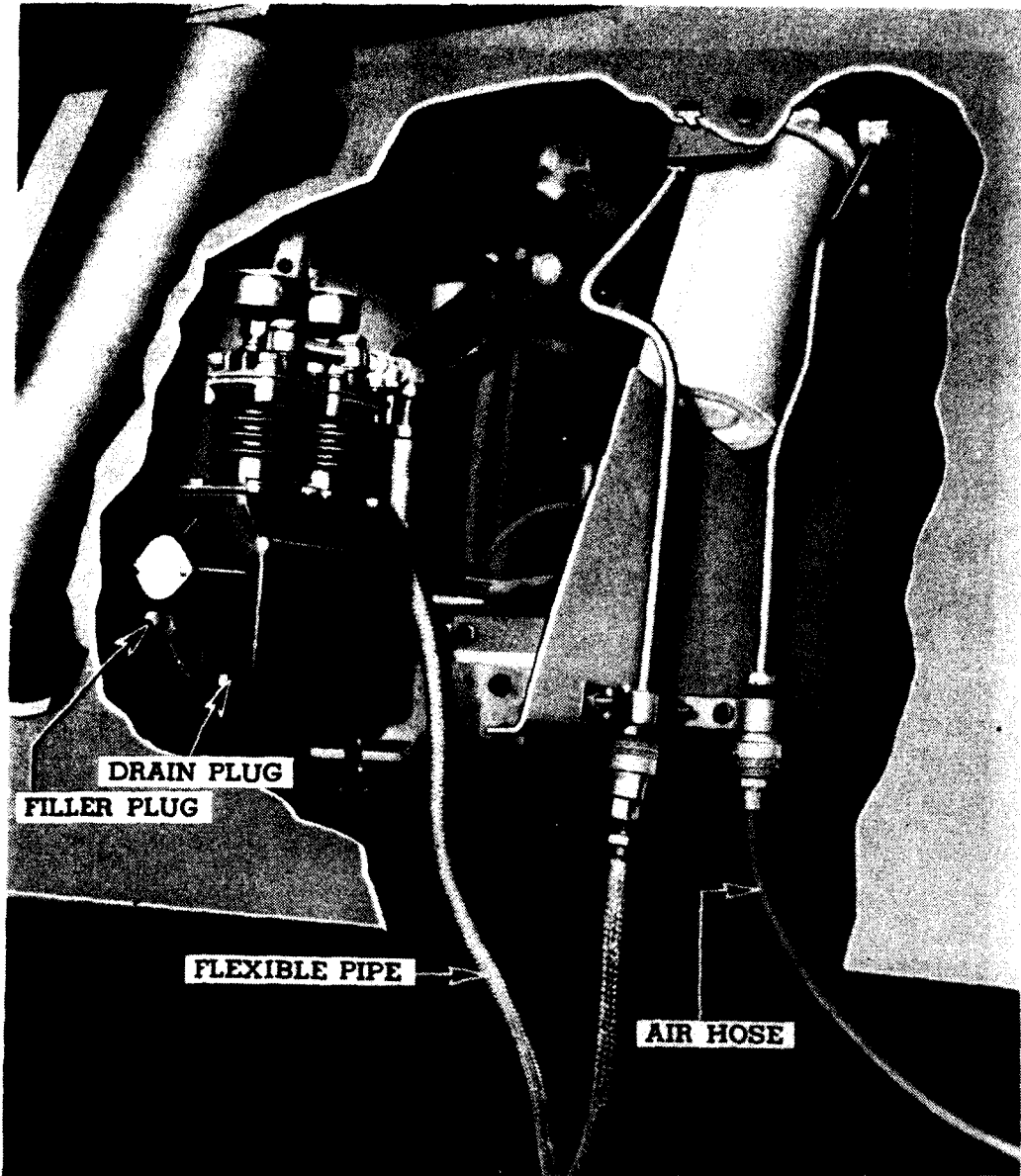
104. DESCRIPTION.

a. A power air pump is supplied with each vehicle for tire inflation (fig. 91). The pump unit consists of a two-cylinder pump, with necessary attaching clamps, drive shaft, flexible metal pipe for connecting the pump to the air filter, air filter which is permanently attached to the vehicle on the hull upper plate (fig. 92), and 22 feet of air hose for inflating tires. The pump hose and attaching parts are packed in a metal box stowed in one of the side luggage boxes. The pump construction is quite similar to the construction of a two-cylinder internal combustion engine. It is composed of a crankcase, crankshaft, cylinders, connecting rods, pistons, cylinder heads, inlet and outlet valves, air cleaners, and miscellaneous component parts (fig. 94). In operation the pump is driven through a coupling mounted to either engine crankshaft. Air is taken into the cylinders through the air cleaners and inlet valves on the down stroke of the pistons. As a piston starts its upward stroke the inlet valve closes, the air is compressed in the cylinder until it forces the spring-loaded outlet valve off its seat, allowing the compressed air to escape into the air line and filter. When the piston completes its upward stroke the spring closes the outlet valve, trapping the air in the line. The downward stroke of the piston creates a partial vacuum, opening the inlet valve, permitting additional air to be taken into the cylinder for the compression stroke.

105. DATA.

Type	Two cylinder vertical compressor
Source of power	Either vehicle engine
Drive connection	From coupling on end of engine crankshaft to compressor swivel shaft to coupling pin and compressor crankshaft.

INTRODUCTION

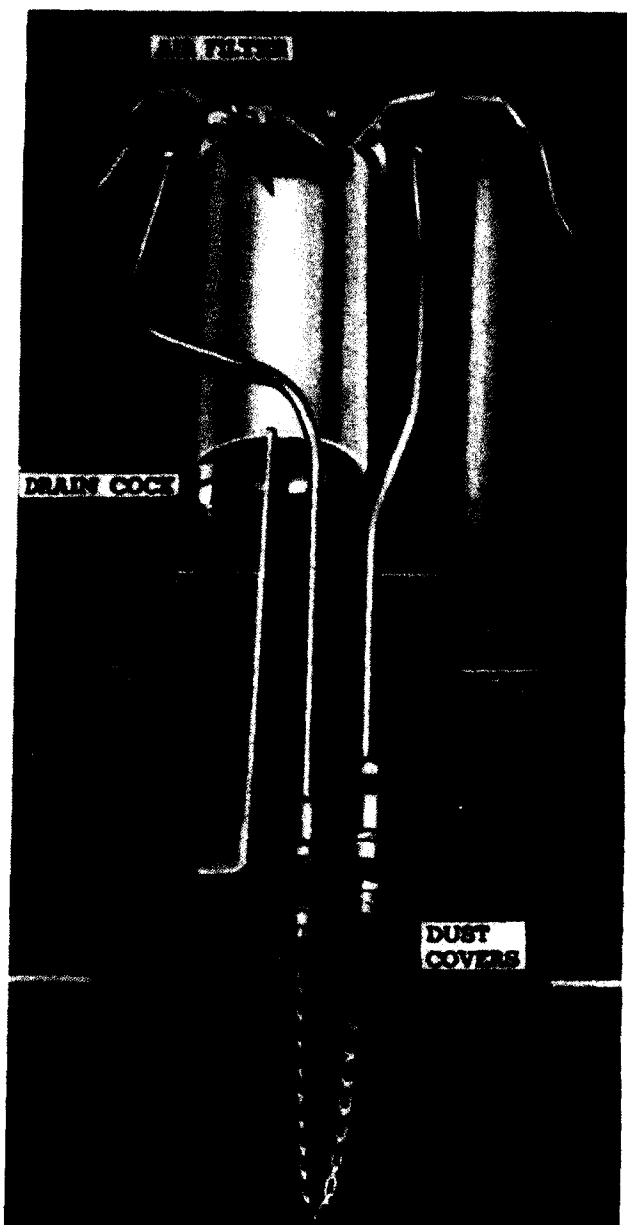


RA PD 32511

Figure 91 – Tire Pump Mounting

Bore	2 in.
Stroke	2 in.
Crankshaft mounting	Two seamless babbitt bushings
Connecting rod bearing type.....	Insert babbitt
Connecting rod bushing (pin end).....	Steel back babbitt
Piston pins	Locked in piston
Piston rings	Laminated steel (3 per piston)
Lubrication	Splash from crankcase

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**Figure 92 – Tire Pump
Air Filter**

RA PD 32512

Crankcase capacity	1¼ pints (engine oil specifications)
Operating speed	600 to 800 rpm (just above idling speed)
Rated pumping capacity at 760 rpm	Inflate 14.00 x 20 tire in 10 to 12 minutes

106. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often done by ordnance maintenance personnel, who should refer to the using troops TM for information.

INTRODUCTION

107. MAINTENANCE ALLOCATION.

a. For scope of maintenance and repair by the crew and other units of the using arm refer to paragraph 7.

b. **Maintenance Chart.**

	ECHELONS			
	2nd	3rd	4th	5th
Compressor, air — replace	X			
Compressor, air — repair		X		
Compressor, air — rebuild			E	X
Drive coupling, replace and/or repair	X			
Hose and connections — replace and/or rebuild	X			

**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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CHAPTER 7

TIRE PUMP (Cont'd)

Section II

TROUBLE SHOOTING

	Paragraph
Under capacity	108
Pump knocks	109
Excessive oil leak	110

108. UNDER CAPACITY.

a. Will not inflate a 14.00 x 20 tire in 10 to 12 minutes at 700 pump rpm.

Possible Cause	Possible Remedy
Air leaks in lines and connections.	Make sure the hose to tire valve, hose to air filter outlet pipe, outlet pipe to air filter, air filter to inlet pipe, inlet pipe to pump flexible pipe, and flexible pipe to manifold connections are airtight.
Air leaks at pump.	Check and tighten outlet manifold coupling, outlet manifold retainers, and cylinder head bolts. If necessary replace gaskets.
Slow compressor speed.	Make sure engine is running between 600 and 800 rpm.
Dirty air inlet filters.	Clean filters (paragraph 112).
Obstructed air lines.	Disconnect lines and check for obstructions.
Tire valve sticking.	Replace tire valve.
Valves in head sticking or not seating.	Remove cylinder heads and correct (par. 113).
Excessive blowby at pistons.	Overhaul compressor.

TROUBLE SHOOTING

109. PUMP KNOCKS.

Possible Cause	Possible Remedy
Loose connecting rod bearings.	Overhaul compressor.
Loose crankshaft bearings.	Overhaul compressor.
Loose piston pin bushings or pins loose in pistons.	Overhaul compressor.
Pistons loose in cylinders.	Overhaul compressor.

110. EXCESSIVE OIL LEAK.

Oil level high.	Drain oil and replace 1¼ pints.
Front cover oil seal worn.	Replace seal (check bearing for wear).
Front cover loose.	Tighten cover or replace gaskets.
Relief valve sticking.	Replace relief valve.
Crankcase rear cover loose.	Tighten cover or replace gaskets.
Excessive blowby at pistons.	Overhaul compressor.

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CHAPTER 7

TIRE PUMP (Cont'd)

Section III

MAINTENANCE AND MINOR REPAIRS

	Paragraph
Oil change	111
Air cleaner service.....	112
Compressor valve service.....	113
Operation test	114

111. OIL CHANGE (fig. 91).

a. Under normal conditions where the compressor is used for inflating the tire on the one vehicle, it will not be necessary to change the oil only, as it is changed spring and fall to the same SAE viscosity that is recommended for the engines. Remove the lower pipe plug at the rear end of crankcase. Drain oil thoroughly; if the oil is heavy the crankcase should be heated, drained and flushed with flushing oil. Install the drain plug, remove the upper pipe plug at rear of crankcase, refill case with 1¼ pints of same grade engine oil used in engine, and install filler plug.

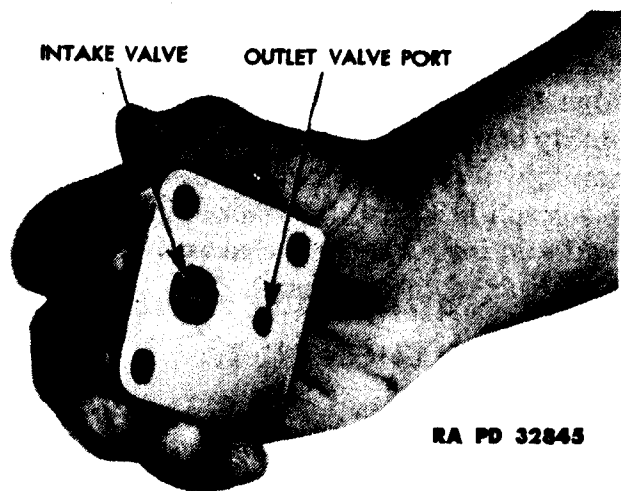
112. AIR CLEANER SERVICE (fig. 94).

a. Regular visual inspection should be made of the intake air cleaners. When the upper gauze and felt indicate formation of dirt the cleaners should be disassembled and cleaned. Unscrew the body cap, remove the upper gauze, both felts, and the lower gauze. If the upper felt is crusted over with dust or sand, a thin layer of the felt may be peeled off. Inspect the lower felt for dirt. If it is noticeably dirty the crankcase oil should be changed. Wash all air cleaner parts, especially the felts and gauze, in dry-cleaning solvent, and blow them dry with compressed air. Install the upper gauze, both felts, and the lower gauze in the air cleaner cap. Place the cap on the cleaner body and screw the cap down enough to make a good seat at the edge of felts.

113. COMPRESSOR VALVE SERVICE.

a. **Disassembly Procedure (fig. 94).** Turn the two air cleaner assemblies counterclockwise to remove them from reduction bushings. Remove the reduction bushings from the cylinder head. Remove the two outlet manifold retainers, the retainer gaskets, the manifold, and the manifold to head gaskets. Properly mark the cylinder heads and

MAINTENANCE AND MINOR REPAIRS



**Figure 93 – Cylinder Head
and Intake Valve**

RA PD 32845

cylinders for installation position. Remove the eight cylinder head bolts and lock washers, and remove both cylinder heads and gaskets. Remove the outlet valves, springs and balls.

b. **Clean and Condition Parts** (fig. 93). Wash the parts thoroughly in dry-cleaning solvent. Open and close the valve several times in order to clean the valve stem, the end of valve stem is peened over above the retaining nut; therefore, the valve cannot be removed. Dry the parts and inspect the inlet valve, inlet valve seat, outlet check spring, ball, and ball seat. Place a small amount of fine valve-grinding compound on the intake valve seat and lap the valve in to obtain a good seat. Use a tapered oilstone to smooth up the outlet valve ball seat. If either valve seat or the inlet valve on either cylinder head cannot be conditioned by the above methods the cylinder head should be replaced.

c. **Assembly Procedure.** Place new cylinder head gaskets on the cylinders and place the cylinder heads on their cylinders according to the markings made during disassembly. The intake valves are located on the left side of the cylinders when viewed from the rear. Install the four cylinder head to cylinder bolts and lock washers in each cylinder head. Tighten the bolts evenly and securely. Place a new outlet valve gasket over each of the outlet manifold retainers. Place the retainers in the manifold inlet holes with the threaded ends of retainers in the same direction as the hole in outlet pipe fitting on end of manifold.

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Place a new gasket over the end of each retainer and place the outlet valve balls and springs in the cylinder head. Install the manifold assembly on the cylinder head with the outlet fitting forward. Tighten the manifold retainers securely. Service the air cleaners as instructed in paragraph 112. Install the air cleaner reduction bushings in the cylinder head and install the air cleaners in the bushings. Test the compressor as instructed in paragraph 114.

114. OPERATION TEST.

a. **Attach Pump** (fig. 91). Attach the flexible metal pipe to the outlet manifold flexible pipe fittings by tightening the compression coupling nut. Drain the air filter by opening drain cock (fig. 92). Check the oil level in pump crankcase. Pass the pump unit up into the opening between the hull rear lower plate and the hull rear upper plate. Thread the pump swivel shaft through the guide plate and engage the drive pin extensions into the special drive coupling on engine crankshaft. Set pump on bracket as shown in figure 91 and engage cover clamp eyebolt in the slot in the lower edge of the tire pump mounting bracket. Tighten the cover clamp knob *tightly* against bracket. Snap flexible pipe coupling on air filter inlet pipe connector and air delivery hose coupling on air filter outlet pipe connector.

b. **Make Test.** Start vehicle engine and run at 600 to 800 rpm. Connect the hose to valve stem of deflated 14.00 x 20 tire and check time required to inflate tire to 90 pounds. Pump should inflate tire in from 10 to 12 minutes at 700 engine rpm. Check the pump for oil leaks at the cover oil seal, cover gasket, rear bushing cover gasket, and cylinder to crankcase gasket. Check for air leaks at cylinder head gasket, outlet valve gaskets, outlet manifold coupling, and flexible pipe coupling.

c. **Remove Pump.** Remove the pump by reversing the procedure in step a above. Place the dust covers on the air filter inlet and outlet connectors. Open the air filter drain cock and drain all water out of filter. Close drain cock. Pack the pump in metal box and place it in luggage box.

CHAPTER 7

TIRE PUMP (Cont'd)

Section IV

DISASSEMBLY

	Paragraph
General	115
Disassembly	116

115. GENERAL.

a. The end of the pump which is fitted with the swivel shaft for connecting to a vehicle engine will be referred to as the front end of pump. The component parts of the pump and their correct name are shown in figure 94 and the nomenclature below the picture. **CAUTION:** *All parts such as cylinder heads, cylinders, pistons, connecting rods, connecting rod bearings, and caps are to be punch-marked before disassembly, in order that they can be reassembled in the same location in relation to component parts.*

116. DISASSEMBLY.

a. **Remove Cylinder Heads and Cylinders** (fig. 94). Drain the oil from the crankcase by removing the lower pipe plug at rear of crankcase. Unscrew the air cleaner assembly and reduction bushing from each cylinder head. Unscrew the two outlet valve manifold retainers, remove the retainers, retainer gaskets, manifold, and manifold gaskets as an assembly. Remove the copper-asbestor gaskets and the retainers from the manifold. Clamp the manifold in a copper-jawed vise, and remove the flexible pipe fitting and coupling from manifold. Remove the eight cylinder head bolts and lock washers. Remove the cylinder heads and gaskets. Carefully remove the outlet valve springs and balls. Remove the eight cylinder to crankcase bolts and lock washers. Work the cylinders up off the pistons and remove the gasket.

b. **Remove Pistons** (fig. 94). The piston pins are held in place in the pistons by a cotter pin which goes through the piston boss and piston pin. The cotter pin is spread inside the piston pin to lock it in place. To remove the piston pin reach inside the piston pin with long-nose pliers to compress the cotter pin. Pull the cotter pin out from the bottom of piston. Properly support the piston and drive the pin out with a small brass drift. Remove the piston. Remove other piston in the same manner.

c. **Remove Crankshaft** (fig. 94). Place the swivel shaft drive pin over the open jaws of a vise and drive the pin out of the crankshaft, remove swivel shaft, thrust plug, and spring. Remove the crankcase

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- A—SHAFT, SWIVEL
- B—OIL SEAL, END COVER
- C—COVER AND BUSHING ASSEMBLY
- D—VALVE, CRANKCASE RELIEF
- E—PIN, SWIVEL SHAFT
- F—CAP, CONNECTING ROD
- G—BUSHING, CONNECTING ROD
- H—CRANKSHAFT
- I—ROD, CONNECTING
- J—NUT, CONNECTING ROD BOLT
- K—BOLT, CONNECTING ROD
- L—PIN, PISTON
- M—PISTON
- N—CAP, AIR CLEANER BODY
- O—GAUZE, AIR CLEANER
- P—FELT, AIR CLEANER
- Q—BODY, AIR CLEANER
- R—BUSHING, AIR CLEANER REDUCING
- S—RETAINER, OUTLET VALVE MANIFOLD
- T—SPRING, OUTLET VALVE
- U—VALVE, OUTLET
- V—FITTING, MANIFOLD FLEXIBLE PIPE

- W—COUPLING, OUTLET MANIFOLD
- X—MANIFOLD, OUTLET VALVE
- Y—GASKET, OUTLET VALVE
- Z—CYLINDER HEAD AND INTAKE VALVE ASSEMBLY
- AA—GASKET, CYLINDER HEAD TO CYLINDER
- BB—CYLINDER
- CC—GASKET, CYLINDER TO CRANKCASE
- DD—GASKET, CRANKCASE TO COVER
- EE—CRANKCASE AND BUSHING ASSEMBLY
- FF—GASKET, CRANKCASE BUSHING COVER
- GG—COVER, CRANKCASE BUSHING

- HH—SPRING, THRUST PLUG
- II—PLUG, THRUST

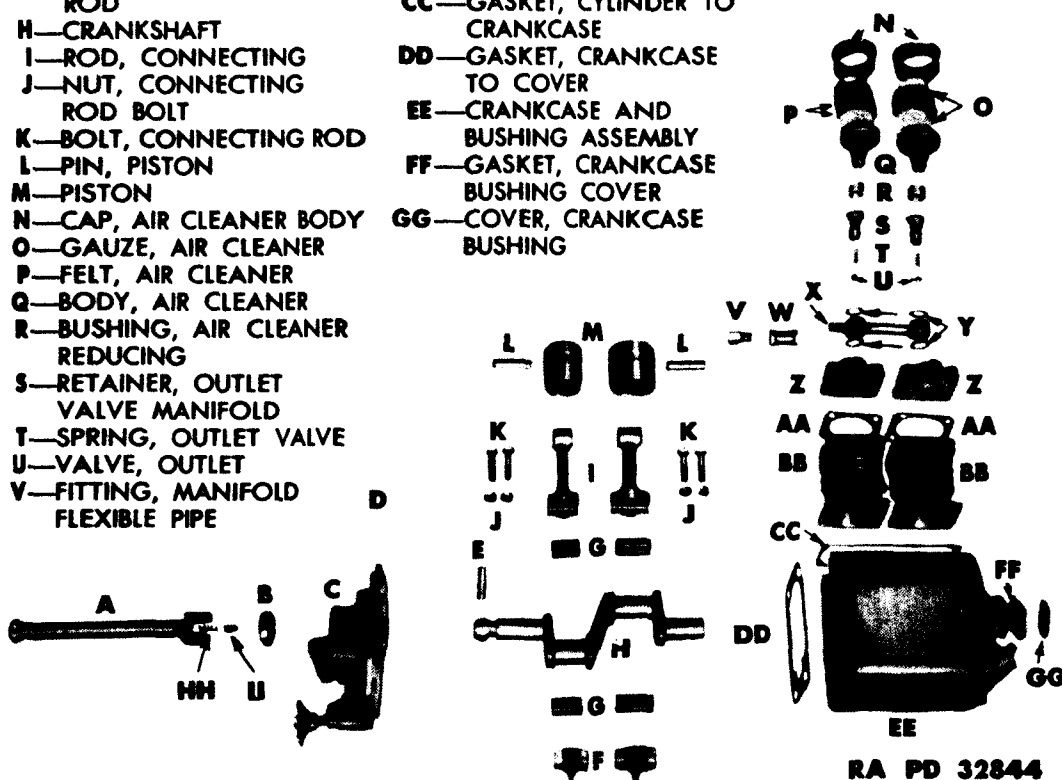


Figure 94 — Tire Pump — Parts Layout

relief valve from cover boss at top. Remove the four front cover to crankcase bolts and lock washers. Remove the front cover and gasket. Drive the oil seal out toward the front with a punch and hammer. **CAUTION: Do not damage crank bushing when removing seal.** Align the crankshaft throws in a vertical position with the front throw down. Work the crankshaft and connecting rods out of the crankcase. Remove the cotter pins, nuts, and bolts from the connecting rods. Remove the rod caps and rods from the crankshaft. Remove the two crankcase rear cover to crankcase attaching screws and remove the cover and gasket.

CHAPTER 7

TIRE PUMP (Cont'd)

Section V

REPAIRS

	Paragraph
Cleaning and inspection.....	117
Repairs before assembly.....	118

117. CLEANING AND INSPECTION (fig. 94).

a. Wash all parts with dry-cleaning solvent, and blow dry with compressed air. Inspect the crankshaft journals for wear or scores. If damaged the shaft should be replaced. Inspect the crankshaft bushings to make sure they are smooth. To check the bushing fit, place the crankshaft in the crankcase, install the front cover assembly and, using a narrow feeler gage, check between the shaft and bushings. This clearance should not exceed 0.010-inch. Inspect the connecting rod bearings for wear, being scored or pounded out. Check the piston pin fit in the bushings; if there is a noticeable looseness the connecting rod and pin should be replaced. Check the cylinder bores for taper and out-of-round with an inside micrometer. Excessively worn cylinders should be replaced. Check the piston pin fit in pistons; if loose the piston and pin must be replaced. Place the piston and ring assemblies in their respective cylinders and check the piston fit with a narrow feeler gage. If the pistons are more than 0.015-inch loose they should be replaced. Inspect and condition the cylinder heads and valves as instructed in paragraph 113. Inspect the swivel shaft coupling ends for wear. Make sure the swivel shaft thrust plug and spring are in good condition and free in the end of shaft. Replace all damaged or worn parts.

118. REPAIRS BEFORE ASSEMBLY.

a. **Crankshaft Bushing Replacement.** When the inspection indicates that the bushings should be replaced, press them out with a driver that will clear the crankcase and cover, but contact the face of bushing. Press the new bushings into cover and case, being careful not to damage the bearing area. They should be pressed in until they are $\frac{1}{8}$ inch below flush with the inside edge of castings to allow for the radius on each end of crankshaft. Assemble the front cover on the crankcase and ream the bushings with an expansion pilot reamer to 0.001 inch larger than shaft size. Remove reamer and cover. Install crankshaft and cover, and check the clearance between shaft and bushing with a narrow 0.001-inch feeler gage. When correct fit is obtained remove crankshaft and cover.

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b. Install Crankcase Cover Oil Seal. Coat the outer diameter of a new seal with a thin coat of permatex. Place the seal in the front side of front end cover with the open side of seal leather toward the cover. Drive the seal down against the shoulder in the bore with a tubular driver that will contact the outer edge of driver.

c. Piston Ring Replacement. Where the inspection indicated that the pistons are suitable for further service and the rings show signs of wear, they should be replaced. Remove the old rings from the pistons with a screwdriver. Clean the piston ring grooves carefully. Work new rings down over head of pistons into their respective grooves.

d. Air Cleaner Service. Service the air cleaner according to instructions in paragraph 112.

CHAPTER 7
TIRE PUMP (Cont'd)

Section VI
ASSEMBLY

	Paragraph
General	119
Assembly procedure	120

119. GENERAL.

a. Make sure all parts are clean, especially bearing surfaces. Pre-lubricate the pistons, cylinder walls, crankshaft, piston pins, bearings, bushings, oil seal, and valves before assembly. Use all new gaskets when assembling parts.

120. ASSEMBLY PROCEDURE.

a. **Assemble Connecting Rods to Crankshaft** (fig. 94). Clamp the crankshaft in a copper-jawed vise in a vertical position with the front end of shaft up. Do not clamp polished surface of crankshaft in vise jaws. Install connecting rods, caps, bolts, and nuts. Be sure to install rods on crankshaft journal from which they were removed and that the caps are installed according to the punch marks made when disassembling. Tighten the connecting rod bolt nuts with a torque wrench to 40 to 45 foot-pounds, and to a position for installing the cotter pin. Tap the rod at the bolt bosses with a soft hammer and check the rod fit on the shaft. They should be free, but not loose. If the rods are loose the caps may be dressed off with a file or with emery and a surface plate to secure the correct fit. If they are tight, 0.001-inch shims can be added, *one at a time*, between the cap and rod to secure a correct fit. Retighten the connecting rod bolts to 40 to 45 foot-pounds torque, install the cotter pins and bend them over to lock them in place.

b. **Install Front Cover and Crankshaft.** Extreme care must be exercised when installing front cover and seal assembly on the crankshaft or the seal will be damaged, which will cause subsequent leakage at this point. A suitable installation sleeve can be made from a strip of 0.006-inch feeler stock cut to the circumference of the crankshaft bearing surface. Roll the stock into a small roll and insert it in the cover oil seal, then let the roll open up against the leather of oil seal, spread the feeler stock ring until the two ends butt together. Push the stock down against the crankshaft bushing and start the cover over front end of crankshaft. Hold the feeler stock sleeve in position in the cover and work the cover down onto shaft. After the chamfered end of crankshaft is through seal and sleeve, the sleeve

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can be worked out of seal and removed. Remove the shaft, cover, and rod assembly from the vise. Install a new cover to crankcase gasket over the shaft and rods. Aline throws and rods vertically, front throw down and insert the assembly into crankcase. Install the four cover to case bolts and lock washers and tighten securely. Install the crankcase relief valve. Install a new crankcase rear bushing cover gasket, the cover, and two retaining screws with washers.

c. **Install Pistons and Cylinders** (fig. 94). Place No. 2 piston over No. 2 connecting rod in the same relative position as it was before disassembly. Line the lock pinholes in the pin with the lock pinholes in the piston. Support the piston and carefully drive the pin through piston and rod bushing until a new cotter pin can be inserted through piston boss and pin. Reaching in through end of pin with a sharp-pointed taper punch, spread the two halves of the cotter pin to lock it securely. Care should be used not to bend the cotter pin toward the center of piston, but only to spread the two halves. Install number one piston and pin in the same manner. Place a new cylinder to crankcase gasket on the crankcase. Place No. 1 cylinder (the lower end of which is chamfered to act as a ring compressor) on the No. 1 piston, and work it down over the rings. Place some good gasket compound on the top back face of the front cover and along the forward edge of the cylinder flange. Press the cylinder down against crankcase and forward against front cover. Install the four cylinder to crankcase bolts and lock washers. Tighten securely. Install the rear cylinder as instructed above, except that the gasket compound is placed between the two cylinder flanges.

d. **Install Cylinder Heads, Outlet Manifold and Air Cleaners** (fig. 94). Place new cylinder head gaskets on the cylinders. Place the cylinder heads on the proper cylinders according to the marks made during disassembly. The intake valves are located on the left side of the cylinder heads when viewed from the rear. Install the four cylinder head bolts and lock washers in each cylinder and tighten securely. Place the manifold in a copper-jawed vise, install the pipe coupling, and brass outlet pipe fitting. The openings in the flexible pipe fitting should be down from either face of the manifold inlet holes. Place a new outlet valve gasket over each of the outlet valve manifold retainers. Place the retainers in the manifold inlet holes, the threaded part of retainers pointing in the same direction as the hole in flexible pipe fitting. Place another gasket over each retainer, place the outlet valve balls and springs in their seats in the cylinder heads, and install the manifold assembly on the cylinder heads with the outlet coupling forward. Tighten the manifold retainers securely. Install the air cleaner reduction bushings in the cylinder heads and install the air cleaners.

ASSEMBLY

e. Install Swivel Shaft (fig. 94). Place the spring and thrust plug in crankshaft end of swivel shaft, place the drive yoke of swivel shaft over the ball on crankshaft, and start the drive pin through the yoke and into the ball by tapping lightly. Hold the entire assembly over a copper-jawed vise and drive the drive pin into crankshaft ball until it is equally spaced on both sides of the yoke.

f. Lubricate and Test. Remove the crankcase filler plug from back end of crankcase. Fill the crankcase with $1\frac{1}{4}$ pints of seasonal grade engine oil. Test the unit as instructed in paragraph 114.

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CHAPTER 7

TIRE PUMP (Cont'd)

Section VII

FITS AND TOLERANCES

	Paragraph
Fits and tolerances	121

121. FITS AND TOLERANCES.

Cylinder bore	1.9995 in. - 2.0005 in.
Maximum cylinder to piston clearance before replacement is necessary	0.015 in.
Crankshaft main and rod journal size.....	0.9980 in. - 0.9989 in.
Crankshaft bushings ream size	0.9991 in. - 1.000 in.
Connecting rod bearing size	0.9993 in. - 1.0002 in.
Piston diameter	1.9975 in. - 1.9985 in.
Piston pinhole ream	0.4998 in. 0.5001 in.
Piston ring groove width	0.095 in. - 0.096 in.
Piston pin diameter	0.4997 in. - 0.500 in.
Piston pin bushing ream diameter	0.4999 in. - 0.5002 in.
Connecting rod length (center of bushing to center of bearing)	3 ⁵ / ₈ in.

CHAPTER 8

HULL

Section I

INTRODUCTION

	Paragraph
Description	122
Data	123
Reference to second echelon TM 9-741	124
Maintenance allocation	125

122. DESCRIPTION.

a. The Medium Armored Car T17E1 hull is made of homogenous armor plate welded into an assembly. The armor plate is $\frac{3}{4}$ inch thick at the driver and crew compartments, and $\frac{3}{8}$ inch thick at the engine compartment.

b. The hull is divided into two sections by a bulkhead. The rear section is the engine compartment. The front section incorporates a mounting for the turret and basket which provides accommodations for three of the crew members. Accommodations for the driver and assistant driver, as well as all the vehicle controls, are in the front compartment forward of the turret and basket. Service instructions covering the turret and basket will be found in chapter 9.

c. A pronounced kick up or tunnel is provided for each of the two axles, and the two drive shafts between the transfer case and axle. This results in a materially lower floor and center of gravity than could otherwise be obtained. The spring shackle brackets and steering gear are attached directly to the hull rather than a separate frame which is not used due to hull construction.

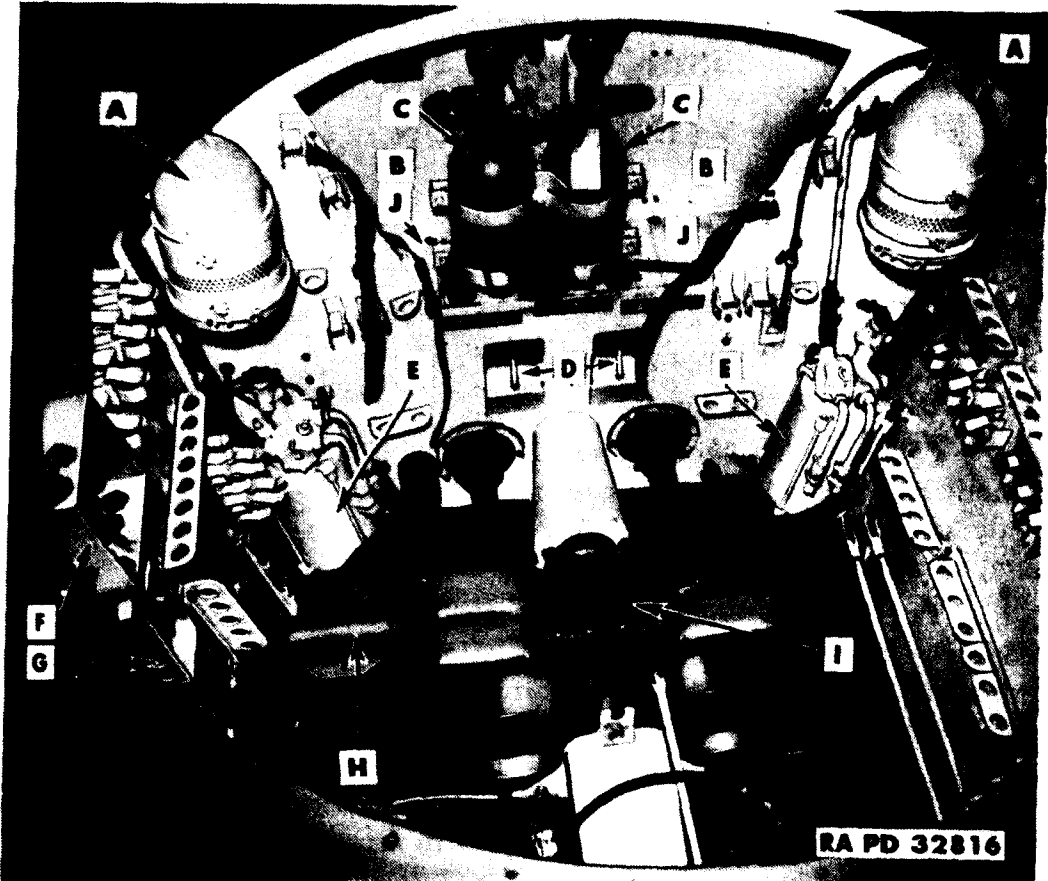
d. Brackets are attached to each side of the hull to support the two jettison gas tanks and two luggage boxes. Other clips and brackets on the outside of the hull provide a means of attaching certain tools and equipment. Heavy towing rings are attached to all four corners of the hull.

e. Two vision doors are mounted in the front of the hull to provide direct vision for the driver and assistant driver when not in combat. Windshield assemblies fitted with electric windshield wipers can be installed in the openings when vision doors are open.

f. Each side of the hull is fitted with a safety-type escape door. The door can be opened from the inside of vehicle only.

g. Three periscopes are mounted in the front top part of the hull, two for use of the driver and one for the assistant driver.

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- | | |
|------------------------------------|---------------------------------|
| A—AIR CLEANERS | F—MASTER SWITCH BOX |
| B—STORAGE COMPARTMENT | G—TURRET SLIP RING TERMINAL BOX |
| C—FIRE EXTINGUISHER CYLINDERS | H—TRANSFER CASE OIL COOLER |
| D—HULL DRAIN VALVE CONTROL HANDLES | I—TRANSFER CASE |
| E—HYDROVAC ASSEMBLIES | J—TRANSMISSION COVER PLATE |

Figure 95 - Hull - Interior View

123. DATA.

- Over-all length (hull less brackets) 204³/₁₆ in.
Over-all height (hull less brackets) 52 in.
Over-all width (hull less brackets) 70¹/₂ in.

124. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often performed by ordnance maintenance personnel who should refer to the using troops TM for information.

INTRODUCTION

125. MAINTENANCE ALLOCATION.

a. For scope of maintenance and repair by the crew and other units of the using arm, refer to paragraph 7.

b. **Maintenance Chart.**

	HULL	ECHELONS			
		2nd	3rd	4th	5th
Cable, towing — replace		X			
Clevis, towing — replace and/or repair		X			
Doors and cover plates — replace		X			
Doors and cover plates — repair			X		
Fenders and brackets — replace		X			
Fenders and brackets — repair			X		
Hull — repair			X		
Hull — rebuild				E	X
Periscopes — replace		X			
Periscopes — repair			X		
Periscopes — rebuild				E	X
Seats — replace		X			
Seats — repair				X	

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CHAPTER 8
HULL (Cont'd)

Section II

SERVICE OPERATIONS

	Paragraph
Periscope mounting	126
Spring hangers — replace	127
Hull brackets — replace	128
Hull doors — replace	129
Seats — replace, repair	130
Fenders — replace	131
Windshield wiper service	132

126. PERISCOPE MOUNTING.

a. **General.** (fig. 96). Three periscopes are used in the driver's compartment, two for the driver and one for the assistant driver. Each periscope is mounted in a retainer having a ball-shaped mounting section. The retainer has a hinge pin on each end that is mounted in bushings in the two-piece mounting plate, forming a socket that permits tilting of the periscope to raise or lower the line of vision. The round mounting plate assembly is mounted in a casting welded to the top of hull. The periscope and retainer can be turned in either direction, providing a wide range of vision through the periscope. When not in use the periscope can be lowered without removing it from the socket. This permits the spring-loaded cover to completely cover the periscope opening.

b. **Periscope Mounting — Service** (fig. 96).

(1) **REMOVE PERISCOPE FROM MOUNTING.** Slide the periscope mounting lock plate to one side. Loosen the periscope lock thumb screw at side of retainer and pull the periscope out of bottom of retainer.

(2) **REMOVE PERISCOPE RETAINER** (fig. 96). Remove the eight flathead screws that retain the two retaining plates inside of hull to the mounting plate, and remove the two retaining plates and periscope retainer.

(3) **REMOVE MOUNTING PLATE** (fig. 96). Push mounting plate up from bottom, and lift it off opening on top of hull.

(4) **CLEANING AND INSPECTION.**

(a) Clean all parts carefully, especially the ball and socket friction surface of the periscope retainer, hinge pins, bushings, mounting plates, and the mounting plate to hull friction surfaces.

SERVICE OPERATIONS

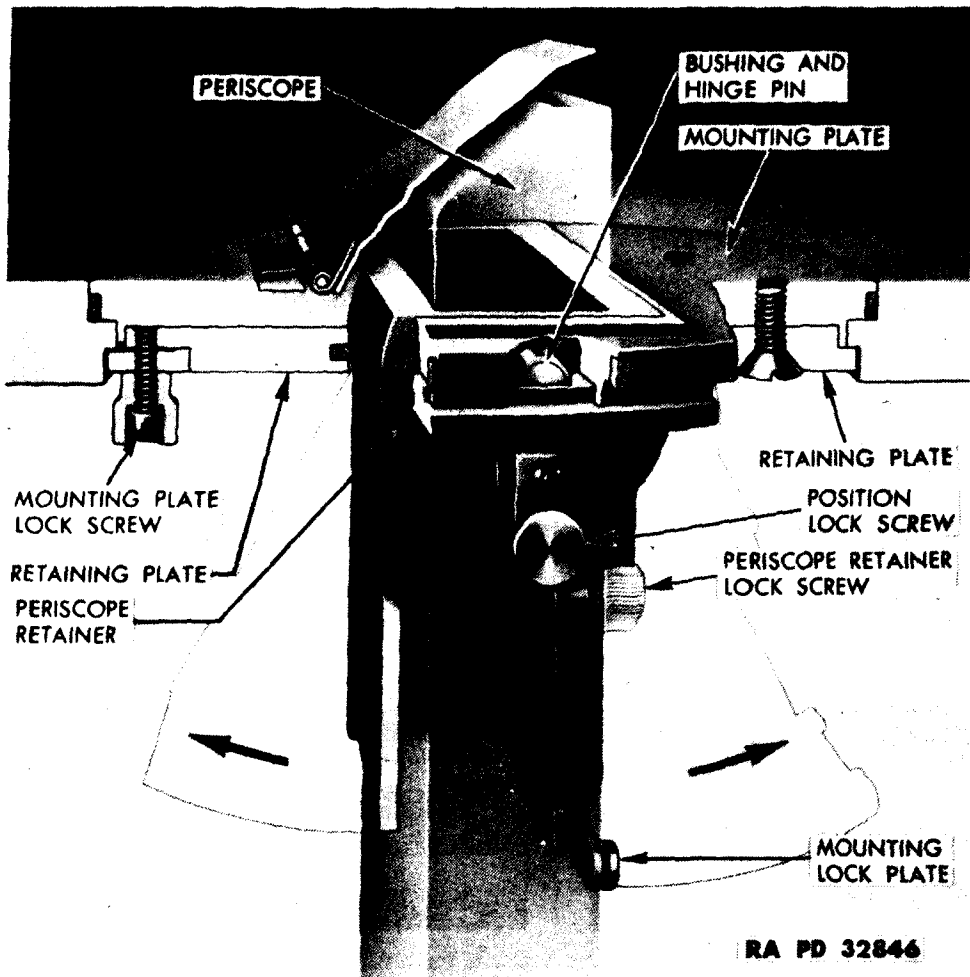


Figure 96 — Periscope Mounting

(b) Lubricate the ball and socket joint seal and the mounting plate to hull seal.

(5) **ASSEMBLE PERISCOPE MOUNTING AND INSTALL PERISCOPE** (fig. 96). Place the periscope mounting plate in the hull from the outside. Place the bushings on the hinge pins of periscope retainer, place the ball of periscope retainer in the seat of mounting plate from inside the hull, and position the two retainer plates. Install and tighten the eight flathead screws. Push the periscope up into position in the retainer and tighten the thumb screw on the side of retainer to lock the periscope in position. Slide the lock plate at bottom of mounting over into lock position.

127. SPRING HANGERS — REPLACE.

a. **General.** All spring hangers are riveted to the hull, and the peened end of the rivets are welded to the inside of hull. It is impos-

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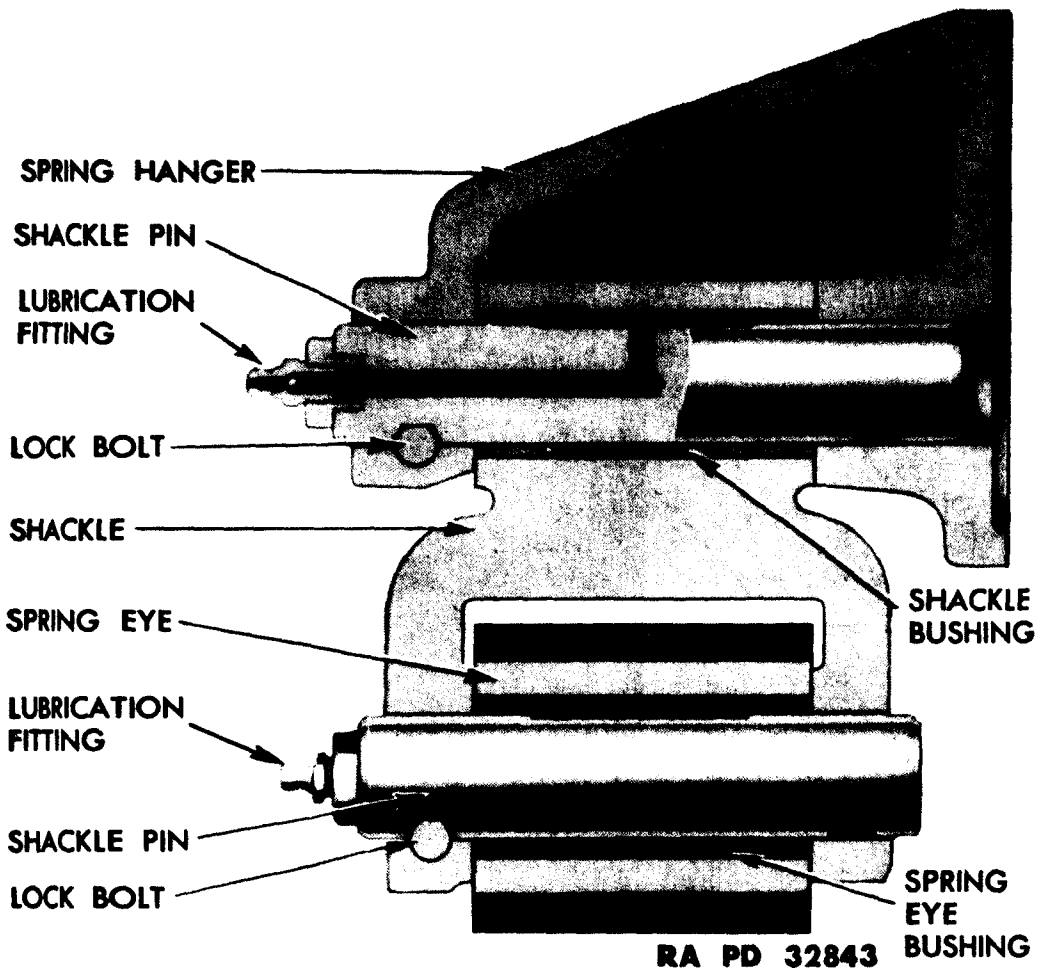


Figure 97 – Spring Shackle – Cross Section

sible to get to the peened end of some of the rivets due to the hull construction; therefore, the head will be cut from most of the rivets and the rivets left in hull.

b. Front Spring Front Hanger — Replacement.

(1) REMOVAL.

(a) *Disconnect Spring and Radius Rod* (fig. 86). Raise the front end of hull until the tire almost clears the floor, and support the hull with suitable stands. Remove the four nuts and lock washers from the spring to axle bolts and remove the bolts. Remove the nuts and washers from the ball studs which attach the radius rod to the axle and spring hanger. Tap the studs out of hanger and axle and remove the radius rod. Remove the lubrication fitting and adapter from the upper shackle pin. Remove the nut and washer from the spring shackle pin locking bolt and drive the locking bolt out of hanger. Place the puller collar and sleeve of spring pin and bushing

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remover and replacer (41-R-2389-26) (fig. 31) on the puller screw, and turn the puller screw into threads in end of shackle pin. Hold the puller screw with a wrench and turn the puller screw nut until shackle pin is removed (fig. 19). It will be necessary to jack up the axle to clear the spring and place it on a suitable stand; place a jack under the spring at axle, and raise it slightly to support the spring and remove the load from shackle while pulling the shackle pin.

(b) *Remove Hanger.* Remove the jack that was used to support the spring, and let the spring down out of the way. Cut the head from all seven rivets at the hanger end. Remove the hanger from the rivets by driving a chisel between the hull and hanger.

(2) HANGER INSTALLATION.

(a) *Fit and Aline New Hanger.* Dress off the seven rivets until the new hanger can be pushed over the rivets and up against the hull. Clean the mating surface of the hull and hanger and place the hanger on the rivets. Raise the spring and shackle until it is in position in the hanger and support the spring at the center. Line up the shackle pinhole in the hanger and shackle and install the shackle pin. Drive the hanger up against the hull and hit the hull, near the hanger, a sharp blow with a hammer to allow the hanger to come into alinement with the spring. Check between the hanger and hull with a feeler gage for alinement. If the hanger is not in alinement with hull, place correct thickness shims between the hull and hanger.

(b) *Weld Hanger to Hull.* Hold the hanger firmly in position against the hull and arc-weld the ends of all seven rivets securely to hanger. Weld the outer edge of hanger to hull all the way around.

(c) *Connect Spring and Radius Rod* (fig. 97). Line up the locking groove in the shackle pin with the lock bolt hole in hanger. Install the locking bolt, washer, and nut. Tighten the nut securely. Install the lubrication fitting and lubricate the shackle. Lower the axle down on the spring; install the axle to spring bolts lock washers and nuts. Tighten the nuts securely. Place the radius rod in position with the ball studs in their respective seats, install the washers and nuts. Tighten securely. Raise the hull, remove the stands and lower the hull.

c. Left Front Spring Rear Hanger — Replacement.

(1) REMOVAL.

(a) *Disconnect Spring from Hanger* (fig. 19). Raise the front end of vehicle until tires almost clear the floor and support the hull with suitable stands. Remove the four nuts and lock washers from the spring to axle U-bolts and remove the U-bolts. Jack up the axle to clear the spring and place a suitable stand under axle. Place a jack under spring to support its weight while removing shackle pin. Remove the lubrication fitting and adapter from the upper shackle pin. Remove the nut and washer from the spring shackle pin locking bolt and drive the locking bolt out of hanger. Place the puller collar and

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sleeve of (41-R-2389-26) spring pin and bushing remover and replacer (fig. 31) on the puller screw, and turn the puller screw into threads in end of shackle pin. Hold the puller screw with a wrench and turn the puller screw nut until shackle pin is removed (fig. 19). Remove the jack that was used to support the spring and let the spring down out of the way.

(b) *Remove Transfer Case Shift Lever Bracket.* Remove the cotter pins and washers from the two pull rods at bracket. Remove the three bracket attaching bolts and slide the lever and bracket out of the way.

(c) *Remove Hanger.* Cut or grind the inner end off the five rivets which attach the hanger to hull. Three of these rivets are on the top of ledge in front of transfer case shift lever bracket, and two are at end of ledge below lever bracket. Drive the rivets out of hull and hanger.

(2) INSTALLATION.

(a) *Line Up Hanger.* Make sure all welding metal around the rivet holes in hull is ground off smooth. Clean the mating flange of hanger and hull. Place the hanger in position and install two 1/2-inch bolts (one up through the top of ledge and one back through end of ledge) to hold the hanger in position. NOTE: *Do not tighten nuts.* Raise the spring and shackle until it is in position in the hanger and support the spring at center. Line up the shackle pin hole in the hanger and shackle, and install the shackle pin. Using a feeler gage check between the hanger and hull (top and rear inner and outer edges) for hanger alignment. If necessary shim between the hanger and hull. Tighten the nuts on the two pilot bolts.

(b) *Rivet Hanger in Position.* Remove shackle pin and drop spring down out of the way. Heat the rivets, install three rivets through the holes in hanger and hull, peen each rivet while hot. Remove the two 1/2-inch bolts and install the remaining two rivets. Weld the peened end of all rivets to the hull.

(c) *Connect Spring* (fig. 97). Place spring in position and install shackle pin. Line up the locking groove in the shackle pin with the lock bolt hole in the hanger. Install the locking bolt, washer, and nut. Tighten the nut securely. Install the lubrication fitting and lubricate the shackle. Lower the axle down on the spring, install the axle to spring attaching bolts, lock washers, and nuts. Tighten the nuts securely. Raise the hull, remove the stands, and lower the hull.

(d) *Install Transfer Case Shift Lever Bracket.* Place the bracket in position on the hull ledge and install the three retaining bolts. Connect the two pull rods and install washers and cotter pins.

d. **Right Front Spring Rear Hanger — Replace.** Follow the instructions given in step c above, except that pertaining to transfer

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case shift lever bracket which is not used on the right side of vehicle.

e. Rear Spring Hangers — Replace.

(1) **GENERAL.** The replacement instructions covering all four rear spring hangers are the same. Only one hanger should be removed at a time, as the one at the opposite end of spring holds the spring in position for checking the alinement of hanger being installed.

(2) REMOVAL.

(a) *Disconnect Spring* (fig. 19). Remove the two cap screws which attach the fender to each spring hanger, and the cap screw which attaches fender to hull. Remove fender. Remove the four nuts and lock washers from the spring to axle U-bolts and remove the U-bolts. Raise the back end of hull until the spring just leaves the seat on the axle housing and support the hull on suitable stands. Remove the lubrication fitting and adapter from the upper shackle pin at the shackle to be removed. Remove the nut and washer from the shackle pin locking bolt and drive the locking bolt out of hanger. Place the puller collar and sleeve of (41-R-2389-26) spring pin and bushing remover and replacer (fig. 31) on the puller screw, and turn the puller screw into threads in end of shackle pin. Hold the puller screw with a wrench and turn the puller screw nut until shackle pin is removed (fig. 19).

(b) *Remove Hanger.* Raise the back end of hull so that the spring shackle will drop down out of the way; properly support the hull. Cut the head from all six rivets at the hanger. Drive a chisel in between the hull and hanger to force the hanger off the rivets.

(3) HANGER INSTALLATION.

(a) *Fit and Aline New Hanger.* Dress off the six rivets until the new hanger can be pushed over the rivets and up against the hull. Clean the mating surface of the hull and hanger, and place the hanger on the rivets. Raise the spring and shackle until it is in position in the hanger and support the spring at the center. Line up the shackle pin-hole in the hanger and shackle and install the shackle pin. Drive the hanger up against the hull, and hit the hull a sharp blow with a heavy hammer to allow the hanger to come into alinement with the spring. Check between the hanger and hull with a feeler gage for alinement. If the hanger is not in alinement with hull, place shims of correct thickness between the hull and hanger.

(b) *Weld Hanger to Hull.* Remove the 25 screws which attach the engine compartment cover and remove the cover. Hold the hanger firmly in position against the hull, and arc-weld the ends of all six rivets to hanger. Arc-weld the outer edge of the hanger to hull all the way around hanger. **CAUTION:** *Do not apply excessive heat to side of hull when welding rear hangers as there is only a small space between gas tank and hull at this point.*

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(c) *Connect Spring* (fig. 97). Line up the locking groove in the shackle pin with the lock bolt hole in hanger and install the locking bolt washer and nut. Tighten the nut securely. Install the lubrication fitting and lubricate the shackle. Lower the hull until spring just touches the seat on axle housing. Install the U-bolts, lock washers and nuts. Tighten the nuts securely. Raise the end of hull, remove the stands and lower the hull. Place the fender in position, install the upper cap screw which attaches the fender to hull and the two cap screws which attach each end of fender to spring hanger. Place the engine compartment cover in position and install the 25 retaining bolts.

128. HULL BRACKETS — REPLACE.

a. **General.** Many of the brackets are riveted and welded or welded only to the hull. Due to their construction, their location or the service they render, it is quite unlikely that they will ever require replacement. Unless there is a reasonable possibility that brackets, which are riveted or welded, will require replacement, the replacement procedure will not be covered in this manual.

b. **Towing Ring Brackets.** The towing ring brackets at the rear of the hull are welded to the lower corners of hull. The front towing ring brackets are bolted to the outer ends of the front lower panel with three bolts. To remove a bracket remove the three bolt nuts, lock washers, and bolts. Remove the bracket. Reverse the above procedure for installation.

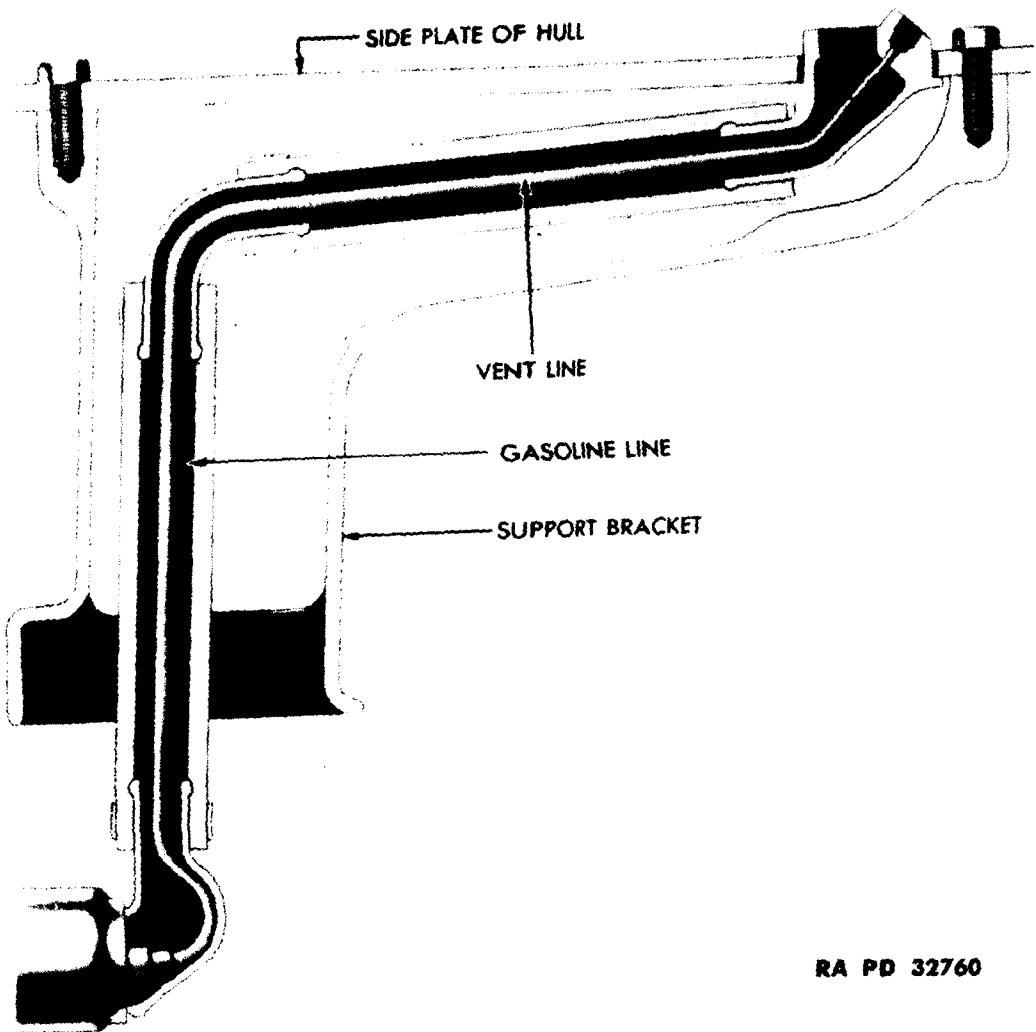
c. **Head Lamp Guards.** Each head lamp guard is bolted to light support with two bolts. To remove a guard remove the two nuts, lock washers, and bolts. Remove the guard. When installing the guard, place the cut-away section toward the hull and the bolt with the extension head at the bottom and toward the outside. This is necessary to provide a bracket for the tow cable.

d. **Tail and Stop Lamp Guards.** These guards are each attached to the corner of the hull by three bolts. The lower terminal box nut is on the lower guard bolt which is long enough to provide for attaching the terminal box. Remove the three nuts and washers which retain the guard and remove the guard. Reverse the above procedure for installation.

e. Jettison Tank Gas Line Guard — Replacement.

(1) **REMOVAL** (fig. 98). Reach in between the jettison tank and tool box and push the shut-off valve release lever up to release the valve. Remove the 25 engine compartment cover screws and remove the cover. Reach down along the radiator and remove the gas line guard rear bolt. Working from the turret basket, reach out into the side of storage compartment back of hull, remove the line guard center

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Figure 98 — Vent and Fuel Line Support

bolt, and loosen the front bolt. Lift the back end of guard up. Loosen the hose clamp which attaches gas line to connector at hull. Work the gas line off the connector. Be careful not to damage the tank vent hose which is inside of gas line. Pull the vent hose off the connector pipe at hull. Remove the remaining bolt which attaches the gas line guard to hull and remove the guard by working it off the gas line.

(2) **INSTALLATION** (fig. 98). Work the gas line through opening in guard, place the gas line guard in position against the hull, and start the gas line guard to hull front bolt. Carefully work the vent hose over the vent pipe in connector pipe at hull. Place the gas line clamp over line, work the line onto connector, and tighten hose clamp. Install the gas line guard to hull rear bolt and tighten securely. Install the center bolt, tighten the center and front bolts. Place the two halves of the shut-off valve in position by pushing yoke toward tank. Hold valve toward tank, reach under tank, pull spring-loaded push rod forward

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until pin is out of hole in support bracket, and push the lever down until pin comes against its stop. Hold the two valve halves together and pull back on the spring-loaded collar on outer valve half until the detent balls are free, then push collar toward tank until detent balls fall in the groove of tank half of valve. This completes the connection. Be sure there is gas in the jettison tank and check the valve and fuel line connections for leaks. Install the engine compartment cover and the 25 retaining bolts.

f. Jettison Tank Gas Line Connector — Replacement.**(1) REMOVAL.**

(a) *Remove Gas Line Guard.* Follow the instructions in step e (1) above.

(b) *Remove Connector* (fig. 98). Disconnect the fuel line and the tank vent line from the connector by reaching down between the radiator core and side of hull. Remove the two bolts which attach the connector to hull.

(2) INSTALLATION.

(a) *Install Connector* (fig. 98). Place the connector in position against the outside of hull, and install the two retaining bolts. Place the fuel and vent lines in position on the connector inside of hull at the side of radiator core, and tighten them securely.

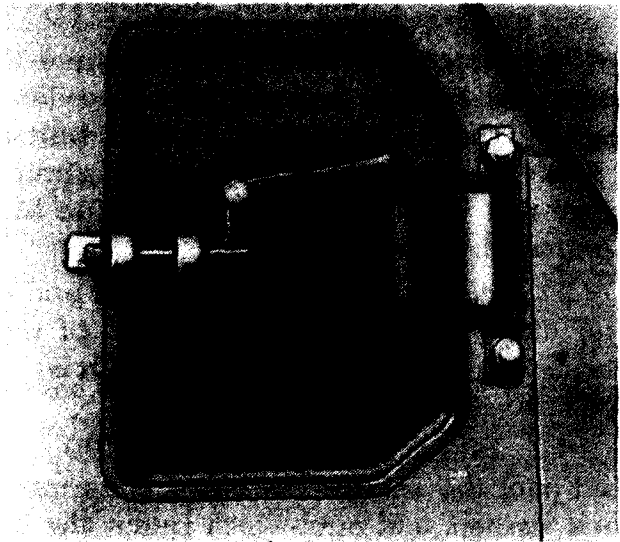
(b) *Install Jettison Tank Gas Line Guard.* Install the gas line guard and connect lines as instructed in step e (2) above.

g. Jettison Tank Bracket Replacement.

(1) **REMOVAL.** Properly support the jettison tank with a hoist or other equipment, release the jettison tank release lever, and remove the tank. Remove the dunnage from the tool box. Remove the three tool box to hull bracket bolts at each end of tool box. Support the tool box on a suitable jack, remove the twelve tool box to jettison tank bracket bolts, and remove the tool box. Remove the six nuts and lock washers which attach each bracket to the hull and remove the bracket or brackets.

(2) **INSTALLATION.** Place the bracket in position and install the six lock washers and nuts. Place the tool box in position and install the twelve tool box to jettison tank bracket bolts. Install the three tool box to hull bracket bolts at each end of tool box. Place the dunnage in tool box. Hoist the jettison tank into position on the brackets placing the filler cap up. Place the straps in position, loosen the turnbuckles at bottom of strap until links at top of strap will go over release pin on linkage, and then tighten turnbuckles. Place the two halves of the shut-off valve in position by pressing the yoke toward tank. Hold the valve toward tank, reach under tank, pull spring-loaded push rod forward until pin is out of hole in support bracket, and push the lever

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**Figure 99 - Hull Door -
Inside View**

RA PD 32482

down until pin comes against its stop. Hold the two valve halves together and pull back on the spring-loaded collar on outer valve half until the detent balls are free, then push push collar toward tank until detent balls fall in the groove of tank half of valve. This completes the connection.

129. HULL DOORS — REPLACE.

a. **General.** The hull vision doors in front of driver and assistant driver and the escape doors on each side of hull can be removed with very little difficulty. Due to the weight of the doors they must be properly supported during removal.

b. Vision Door Replacement.

(1) **REMOVE DOOR.** Open the vision door and support it in the open position on suitable blocks. Remove the two bolts which attach the door control arm to right side of door. Drive out the taper pin that locks the hinge pin to door. Using a long punch or drift drive the hinge pin out of door to hull hinge. Remove door.

(2) **INSTALL VISION DOOR.** Place the door in position, line up the hinge pinholes, and install the pin, making sure the lock pinhole in hinge pin lines up with the hole in door. Block the door in the open position and install the hinge pin locking pin. Install the two bolts which attach the door control arm to right side of door. Remove blocks and close vision door.

c. Escape (side) Door — Replacement.

(1) **REMOVE DOOR** (fig. 99). Raise the door handle and open door. Properly support the weight of door and remove the two door hinge nuts and washers from inside of hull. Remove the door.

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(2) **REMOVE HINGE PINS.** Remove the threaded plugs at end of hinge pins. Place a large socket or similar sleeve over the end of hinge opening, thread a $\frac{5}{16}$ -inch standard bolt through the sleeve and start it into threads in end of hinge pin. Tighten the $\frac{5}{16}$ -inch bolt to pull the hinge pin. When the pins are out, the hull half of the hinges can be removed from the door.

(3) **INSTALL HINGE PINS.** Clean and properly lubricate the hinges and hinge pins, place the hull half of the hinges in the door hinges, and line up the hinge pin opening. Drive the pins into position and install the end plugs.

(4) **INSTALL SIDE DOOR** (fig. 99). Raise the door into position and pilot the ends of the hinge bolts into openings in hull. Install the lock washers and nuts which retain the door to hull. Tighten the nuts securely.

130. SEATS — REPLACE, REPAIR.

a. **General.** The driver and assistant driver seats are attached to the hull kick-up at front axle. The back rests are separate from the seats. They are designed so that the outer side can be released and the seat back turned around parallel with the propeller shaft tunnel when the driver or assistant driver is entering or leaving the vehicle.

b. **Seat Back Repairs.**

(1) **REMOVE SEAT BACK.** Remove the cotter pin from bottom of seat back hinge support and lift the seat back up out of support bracket.

(2) **REMOVE TRIM.** Release the three snap fasteners at bottom of seat back and work the trim up off seat back frame. Work a knife between the pad and seat back to release the pad where it is cemented to seat back panel.

(3) **INSTALL TRIM.** Cement the pad to the seat back panel. Work the trim down over seat back frame and fasten the three snap fasteners.

(4) **INSTALL SEAT BACK.** Place the seat back in position with the hinge support in the support bracket on side of hull differential tunnel. Install the cotter pin to retain the seat back in position.

c. **Seat Cushion Repair.**

(1) **DISASSEMBLE SEAT CUSHION.** Release the four snap fasteners that attach the seat cushion to seat frame at the front and rear of seat. Remove the seat cushion. Release the five snap fasteners at the back edge of cushion and work the pad out of trim. The seat frame can be removed from the hull by removing the five clutch head bolts and nuts (six on assistant driver's seat) that attach the seat frame to brackets on the hull above the axle housing and the ledge at side of hull.

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(2) **ASSEMBLE SEAT CUSHION.** Work the pad down into cushion trim and smooth it out in the corners. Snap the five snap fasteners at the back of seat cushion. Place the cushion on the seat frame and attach the snap fasteners at the front and rear of cushion.

131. FENDERS — REPLACE.

a. **Front Fenders.** Remove the two bolts that attach the front end of fender and bracket to hull. Remove the two bolts that attach rear end of fender to hull. Support the fender, remove the bolt that attaches the top of fender to hull and remove the fender. Place the new or conditioned fender in position against the side of hull. Install the fender to hull upper bolt loosely. Line up the ends of the fenders and install the two bolts at the front bracket and the two at the rear bracket. Tighten the five bolts securely.

b. **Rear Fenders.** Remove the two bolts that attach the front end of fender to rear spring front hanger and the two bolts that attach the rear end of fender to rear spring rear hanger. Support the fender, remove the bolt that attaches the top of fender to hull, and remove the fender. To install, place the fender in position against the hull, start the upper bolt, line up the ends of fenders, and install two bolts that attach each end of fender to spring hanger. Tighten the five bolts.

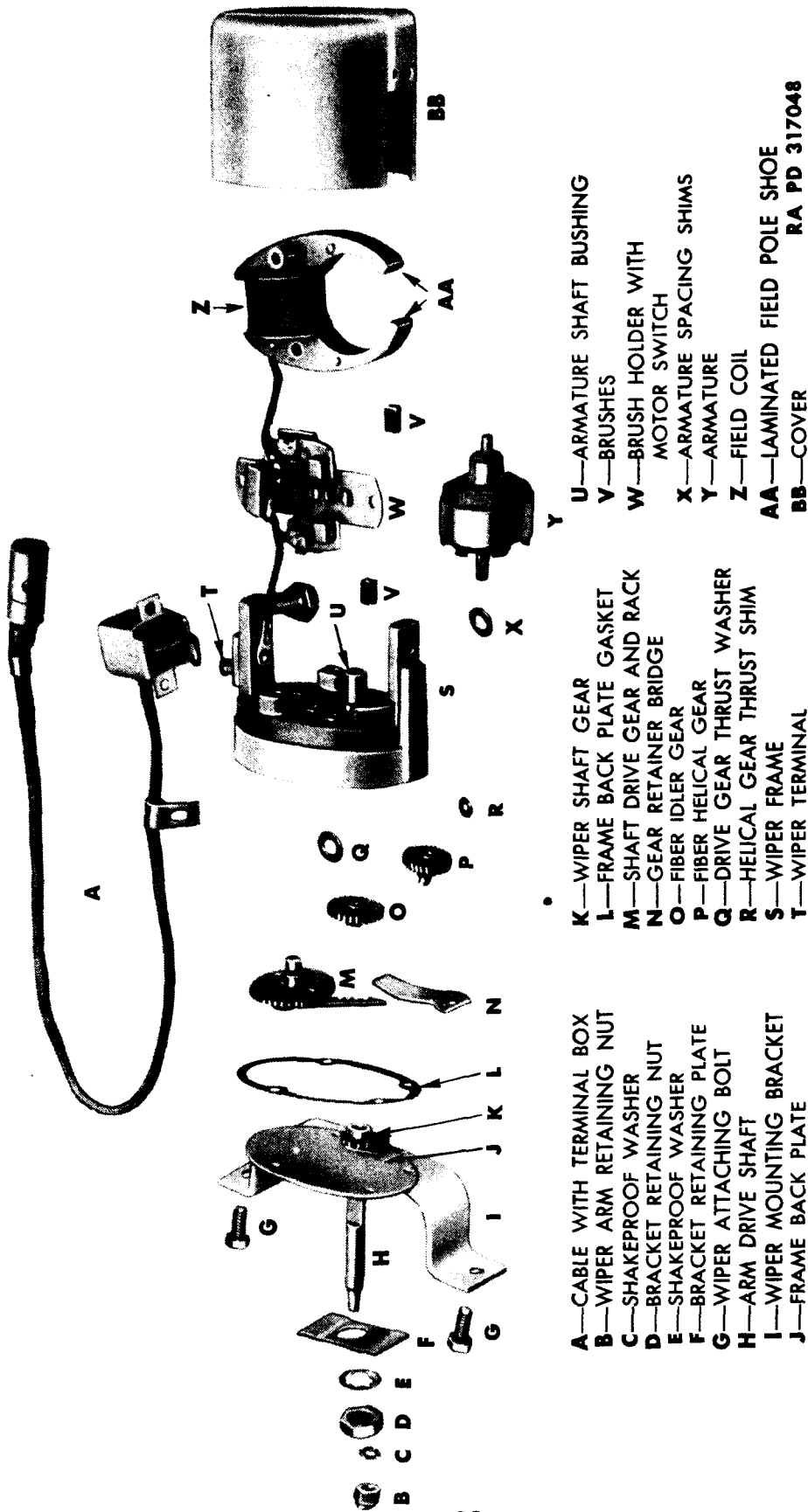
132. WINDSHIELD WIPER SERVICE.

a. **General (fig. 100).** The electric windshield wipers are American Bosch shunt-wound model WWA24-C187. The three-pole armature is mounted in an oilless composition bearing in the wiper frame which extends up inside of the armature. An additional support bushing is used in the brush holder to support the commutator end of armature. The field coil is wound on the crossbar of the laminated field pole shoe. One leg of the field pole is slightly longer than the other to assure starting of the motor. The brush holder forms an end plate and is attached to the wiper frame with two screws. The wiper switch is riveted to the brush holder. A series of steel and fiber gears provide correct gear reduction between the armature shaft and the rack drive gear. The rack is mounted on a journal pin in the side of the rack drive gear; it pilots through a guide on the frame back plate which holds the rack in mesh with the gear on the arm drive shaft. The stroke of the rack produces the oscillation of the arm drive shaft.

b. Disassembly and Inspection.

(1) **REMOVE WIPER AND BRACKET (fig. 100).** Remove the outside arm retaining nut shakeproof washer and wiper arm. Remove the two nuts, lock washers, and bolts which attach the wiper bracket to windshield and remove the wiper assembly. Remove the two screws which attach the inner wiper arm to shaft and remove the arm and plate. Remove the bracket retaining nut, shakeproof washer, bracket retaining plate, and bracket.

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- A—CABLE WITH TERMINAL BOX
- B—WIPER ARM RETAINING NUT
- C—SHAKEPROOF WASHER
- D—BRACKET RETAINING NUT
- E—SHAKEPROOF WASHER
- F—BRACKET RETAINING BOLT
- G—WIPER ATTACHING BOLT
- H—ARM DRIVE SHAFT
- I—WIPER MOUNTING BRACKET
- J—FRAME BACK PLATE

- K—WIPER SHAFT GEAR
- L—FRAME BACK PLATE GASKET
- M—SHAFT DRIVE GEAR AND RACK
- N—GEAR RETAINER BRIDGE
- O—FIBER IDLER GEAR
- P—FIBER HELICAL GEAR
- Q—DRIVE GEAR THRUST WASHER
- R—HELICAL GEAR THRUST SHIM
- S—WIPER FRAME
- T—WIPER TERMINAL

- U—ARMATURE SHAFT BUSHING
- V—BRUSHES
- W—BRUSH HOLDER WITH MOTOR SWITCH
- X—ARMATURE SPACING SHIMS
- Y—ARMATURE
- Z—FIELD COIL
- AA—LAMINATED FIELD POLE SHOE
- BB—COVER

RA PD 317048

Figure 100 — Windshield Wiper — Parts Layout

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(2) **REMOVE BACK PLATE AND GEARS** (fig. 100). Remove the four screws which retain the frame back plate and remove the plate with arm drive shaft, drive shaft gear, rack guide, rack, and rack drive gear. Wipe the surplus grease from the frame back plate and remove the gasket. Work the rack out of the guide until a tooth on the arm drive shaft gear is between the last two teeth on the rack. Properly mark this tooth. **NOTE:** *This is important for reassembly.* Remove the rack and gear. Remove the rack drive gear thrust washer. Remove the screw which retains the gear retainer bridge and remove the bridge. Remove the fiber idler gear, the fiber helical gear, and the helical gear shims.

(3) **CLEAN AND INSPECT GEARS** (fig. 100). Clean all gears, the rack, and back plate and the gear compartment. Inspect the gears for excessive wear; replace all damaged parts. **NOTE:** *If the trouble is all in the gear mechanism the unit can be reassembled by following the instructions in step d (5) through (9).*

(4) **REMOVE CABLE AND CHECK TERMINAL** (fig. 100). Remove the two screws which retain the cable terminal box to the wiper frame and pull the plug-in type connector out of terminal. Make sure the cable shielding is properly grounded to the terminal box. Make sure the terminal is tight in the frame.

(5) **REMOVE WIPER COVER AND CHECK CONNECTIONS** (fig. 100). Remove the screws which attach the cover to frame (one was removed for cable removal) and remove the cover. Check for broken wiring, loose solder connections, worn brushes, broken brush springs, and dirty or worn armature commutator. Make sure the armature turns free in its bearings. Make necessary repairs or replacements.

(6) **TEST UNIT ELECTRICALLY.** Connect a lead from a 24-volt battery to the wiper terminal and flash the other battery lead on the wiper frame. The motor should run. If the motor fails to run check the field coil. To test the field coil, remove the insulated brush, place an ammeter in the circuit of a 24-volt battery and connect one lead to the wiper terminal and touch the other lead to the wiper frame. If the field coil is satisfactory the ammeter will show a reading of between 0.3 and 0.6 amperes.

(7) **REMOVE BRUSH HOLDER, ARMATURE, AND FIELD.** Remove the two screws, lock washers, and flat washers which retain the brush holder assembly to the frame, and carefully lift the brush holder off. **CAUTION:** *Care must be exercised in this operation, or the brushes will be damaged or lost. Do not disconnect the terminals at this time.* Lift the armature out of the frame, being careful not to lose the spacing shims. If there is any question regarding the field coil or laminated field pole shoes they can be removed by removing the two retainer screws and lock washers. There is a toothed lock washer on the retaining screws between each field pole shoe and the frame.

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(1) **REPLACE FIELD COIL** (fig. 100). If the previous tests indicate that the field coil must be replaced, disconnect the solder joint which connects the old coil to brush holder, and solder the terminal of the new coil to brush holder securely.

(2) **INSPECT AND REPLACE BRUSH HOLDER** (fig. 100). Inspect the brush holder for damaged switch, poor insulation, or damaged brush holder clips. When the brush holder is to be replaced, disconnect the soldered terminals from the old brush holder, and solder them to the new brush holder. Install new brush springs or transfer the springs from the old unit. Do not stretch or bend the brush springs during this operation. Check the brushes in the brush holder to make sure they are free.

(3) **CLEAN AND TEST ARMATURE**. Clean the armature shaft bearing surfaces. Clean the commutator using No. 00 sandpaper, then clean the slots between the commutator bars, using a hacksaw blade that has been ground for this purpose. Test armature for ground with 110-volt line having 15-watt bulb in series. Place one test lead on commutator segment and the other lead on the core. If bulb lights, armature is grounded. Using a 2-volt battery with armature in circuit, check between commutator bars. The ammeter should show a reading of 0.2 to 0.4 amperes, if the reading is not within these limits the armature should be replaced.

d. Reassembly of Wiper.

(1) **INSTALL FIELD COIL AND POLE SHOES** (fig. 100). Place the field coil retaining screws with lock washers through the pole shoes, place a shakeproof washer over each screw, place the insulating paper over coil, and start the screws into frame. Place the armature in position and shift the laminated field poles to secure a uniform air gap between armature and field poles. Tighten the retaining screws securely.

(2) **INSTALL AND ALINE ARMATURE** (fig. 100). Make sure the armature turns freely in the bearing. Check to see that the armature ring is flush with or not more than 0.015 inch above the face of the laminated field pole shoes. Add or remove spacing shims to secure the correct position of the armature. Coat the armature shaft and bearing with ball and roller bearing grease, and install armature.

(3) **INSTALL BRUSH HOLDER AND BRUSHES** (fig. 100). Place the brush holder in position on the armature shaft and frame. Install the retaining screws with flat washers and lock washers. Tighten the screws securely and check to see that the armature turns free. Lift the brush springs out of their slots, and install the brushes, making sure they contact the commutator at both edges of their radius and are free in the brush holder. Place the springs in the notches of the

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brushes. **CAUTION:** *Do not bend or stretch the brush springs.* Check the brush spring tension which should be from 6 to 9 ounces.

(4) **CONNECT CABLE AND INSTALL COVER** (fig. 100). Push the cable connector securely into terminal, place the terminal box in position, and install the retainer screw at gear compartment end of frame. Install the wiper cover and screws.

(5) **INSTALL GEARS.** Lubricate the gears and shafts. Place the shims on the helical fiber gear shaft and install the gear. Place the fiber idler gear in position on its shaft. Place the gear retainer bridge over the shafts, and install the retainer screw. Pack the gears with one ounce of American Bosch US-509 grease.

(6) **ASSEMBLE AND INSTALL BACK PLATE** (fig. 100). Place the end of the rack in the guide so that the tooth which was marked during disassembly of the arm drive shaft gear will come between the first two teeth on rack. Slide the rack into position. Place the gasket in position on the plate and the drive gear thrust washer over the shaft. Line up the drive gear shaft with the bearing in the frame and position the back plate. Install the four retaining screws.

(7) **TEST UNIT.** Connect the unit to a 24-volt battery and place a low reading ammeter in the circuit. Turn on switch and allow unit to run without load. The amperage draw should be between 0.8 and 1.0 amperes.

(8) **ASSEMBLE WIPER TO WINDSHIELD** (fig. 100). Place the bracket in position, install the retaining plate, shakeproof washer and nut. Tighten nut securely. Place the inner wiper arm in position on the shaft so that the wiper blade faces away from the wiper. Install the wiper arm to shaft retaining plate and the two retaining screws. Place the wiper and bracket in position against the windshield and install the retaining bolts, washers, and nuts. Install the outer wiper arm, shakeproof washer and nut. Install the wiper blades.

(9) **CHECK WIPER OPERATION.** Place the windshield in position and plug in the wiper. Turn on the master switch and wiper switch. Watch blade action to see that the rack was properly installed to give wiper correct stroke.

TM 9-1741C
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**ORDNANCE MAINTENANCE - CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

CHAPTER 9

TURRET, BASKET, AND TRAVERSING SYSTEM

Section I

INTRODUCTION

	Paragraph
Description	133
Reference to second echelon TM 9-741	134
Maintenance allocation	135
Trouble shooting	136

133. DESCRIPTION.

a. **Turret.** The turret is a one-piece casting which incorporates a 37-mm. gun, a cal. .30 machine gun, three periscopes, two escape doors, and various racks to hold ammunition, canteens, gun parts, periscopes, etc. The maintenance of the armament and periscopes are outlined in technical manuals covering these particular units.

b. **Basket.** The basket is fastened to the ball race assembly by a ring of bolts around the top circumference of the basket. The turret, ball race, and basket are bolted together, and form an assembly which can be rotated in either direction by the use of a traversing mechanism.

c. **Turret Traversing System.** The turret traversing system (Logansport) incorporates the use of an electric motor, hydraulic pump, control valve, hydraulic motor, gear mechanism, and reservoir tank. The electric motor runs the pump which pumps the oil from the reservoir through the control valve to the hydraulic motor which drives the gear mechanism to rotate the turret. The description of each unit, trouble shooting data, maintenance, etc., of the traversing system is covered in TM 9-1750H. *NOTE: Disregard all electrical connection instructions pertaining to control handle in TM 9-1750H, as the firing and safety switches are not located in the control handle in this vehicle.*

134. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often done by ordnance maintenance personnel who should refer to the using troop TM for information.

INTRODUCTION

135. MAINTENANCE ALLOCATION.

a. For scope of maintenance and repair by the crew and other units of the using arm, refer to paragraph 7.

b. **Maintenance Chart.**

TURRET	ECHELON			
	2nd	3rd	4th	5th
Lock, turret — replace	X			
Lock, turret — repair		X		
Mechanism, turret traversing — replace	X			
Mechanism, turret traversing — repair		X		
Mechanism, turret traversing — rebuild			E	X
Motor assembly (electric) — replace	X			
Motor assembly (electric) — repair		X		
Motor assembly (electric) — rebuild			X	
Pads — replace	X			
Ring, turret — replace		X		
Seats — replace	X			
Seats — repair		X		
Turret and basket assembly — replace and/or repair ..		X		
Turret and basket assembly — rebuilt			E	X

136. TROUBLE SHOOTING.

a. **Reference.** The troubles and remedies of the operation of the turret and basket are directly related to the turret traversing system. Refer to TM 9-1750H for any information regarding the turret traversing system.

**ORDNANCE MAINTENANCE - CHASSIS, HULL, AND TURRET FOR
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CHAPTER 9

TURRET, BASKET, AND TRAVERSING SYSTEM (Cont'd)

Section II

**REPAIRS THAT CAN BE PERFORMED WITHOUT REMOVING
THE TURRET AND BASKET FROM THE VEHICLE**

	Paragraph
Turret	137
Turret doors	138
Pistol ports	139
Periscopes and mountings	140
Turret seats	141
Storage boxes and racks	142
Foot firing switch	143
Foot firing safety switch	144
Slip ring replacement	145

137. TURRET.

a. Inasmuch as the turret is a one-piece casting which is bolted to the ball race, repairs to the turret, other than physical damage, should never be necessary. However, certain repairs can be made to the doors, periscopes, periscope mountings, guns, and storage boxes.

138. TURRET DOORS.

a. **Escape Door Replacement Procedure.**

(1) **REMOVE DOORS.** Remove the four nuts and screws that retain the door to the hinges, and lift off the door.

(2) **INSTALL DOOR.** Place door in position in opening. Install the four screws and nuts through the hinges and door, and tighten them securely.

b. **Escape Door Lock Replacement Procedure.**

(1) **REMOVE LOCK.** Cut off the heads of the two rivets that retain the lock to the door, and drive out the rivets.

(2) **INSTALL LOCK.** Place lock in position on door, install two new rivets, and peen them securely.

**REPAIRS THAT CAN BE PERFORMED WITHOUT REMOVING THE
TURRET AND BASKET FROM THE VEHICLE**

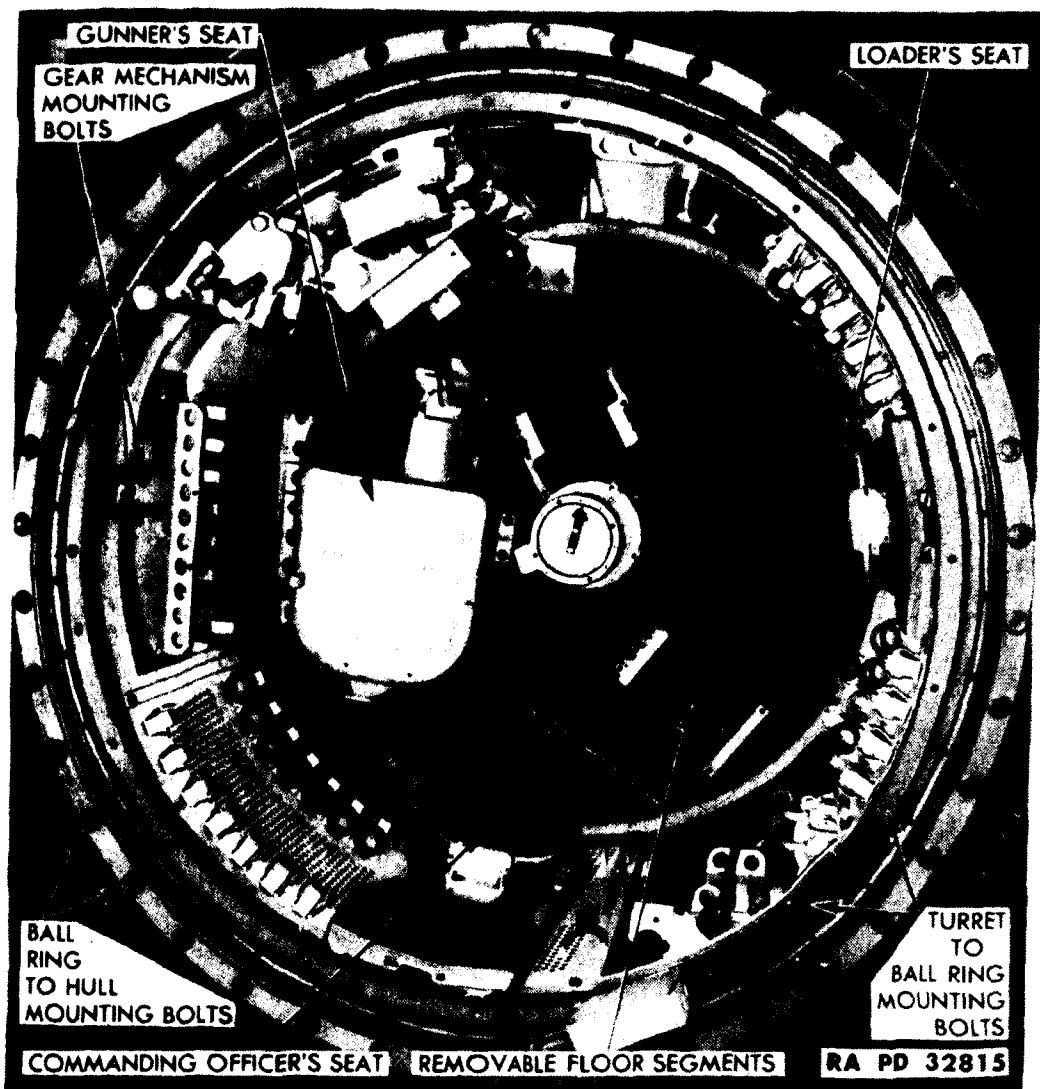


Figure 101 - Turret Basket - Top View

139. PISTOL PORTS.

a. Some of the earlier models were equipped with pistol ports on each side of the turret which could be opened or shut from inside the turret. It is suggested in the event the vehicle is equipped with pistol ports that they be welded shut and the handle on the inside removed.

140. PERISCOPES AND MOUNTINGS.

a. Periscope Replacement Procedure.

(1) **REMOVE PERISCOPE** (fig. 96). Loosen knurled nut on side of periscope retainer and pull periscope out of retainer from the bottom.

(2) **INSTALL PERISCOPE**. Push periscope up through bottom of retainer and tighten the knurled nut on side of retainer.

**ORDNANCE MAINTENANCE - CHASSIS, HULL, AND TURRET FOR
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b. Revolving Periscope Retainer Replacement Procedure.

(1) **REMOVE RETAINER** (fig. 96). Remove the eight flathead screws that retain the two halves of the retainer plate to the mounting plate on the inside of the turret, and lift out the retainer plates and periscope retainer.

(2) Place retainer in position from inside turret, place the two halves of the retainer plate around the retainer and against the mounting plate. Install the eight flathead screws.

c. Stationary Periscope Retainer Replacement Procedure.

(1) **REMOVE RETAINER**. Remove the eight flathead screws from the mounting plate on top of the escape door, and lift out the plate and periscope retainer.

(2) **INSTALL RETAINER**. Place periscope retainer in the mounting. Place retainer plate in position, install the eight flathead screws, and tighten them securely.

141. TURRET SEATS.

a. Folding Seat Replacement Procedure (fig. 101).

(1) **REMOVE SEAT ASSEMBLY**. Remove the four cap screws that retain the seat bracket to the basket, and lift off the seat assembly.

(2) **INSTALL SEAT ASSEMBLY**. Place seat in position in bracket, and install the four cap screws and lock washers.

b. Folding Seat Cushion Replacement Procedure.

(1) **REMOVE CUSHION**. Remove the two cap screws from the bottom of the seat that hold the cushion to the seat, and lift off the cushion.

(2) **INSTALL CUSHION**. Place cushion on seat, and install the two cap screws and lock washers.

c. Folding Seat Back Replacement Procedure.

(1) **REMOVE SEAT BACK**. Remove the two clutchhead screws at the top and the two at the bottom that retain the seat back to the basket.

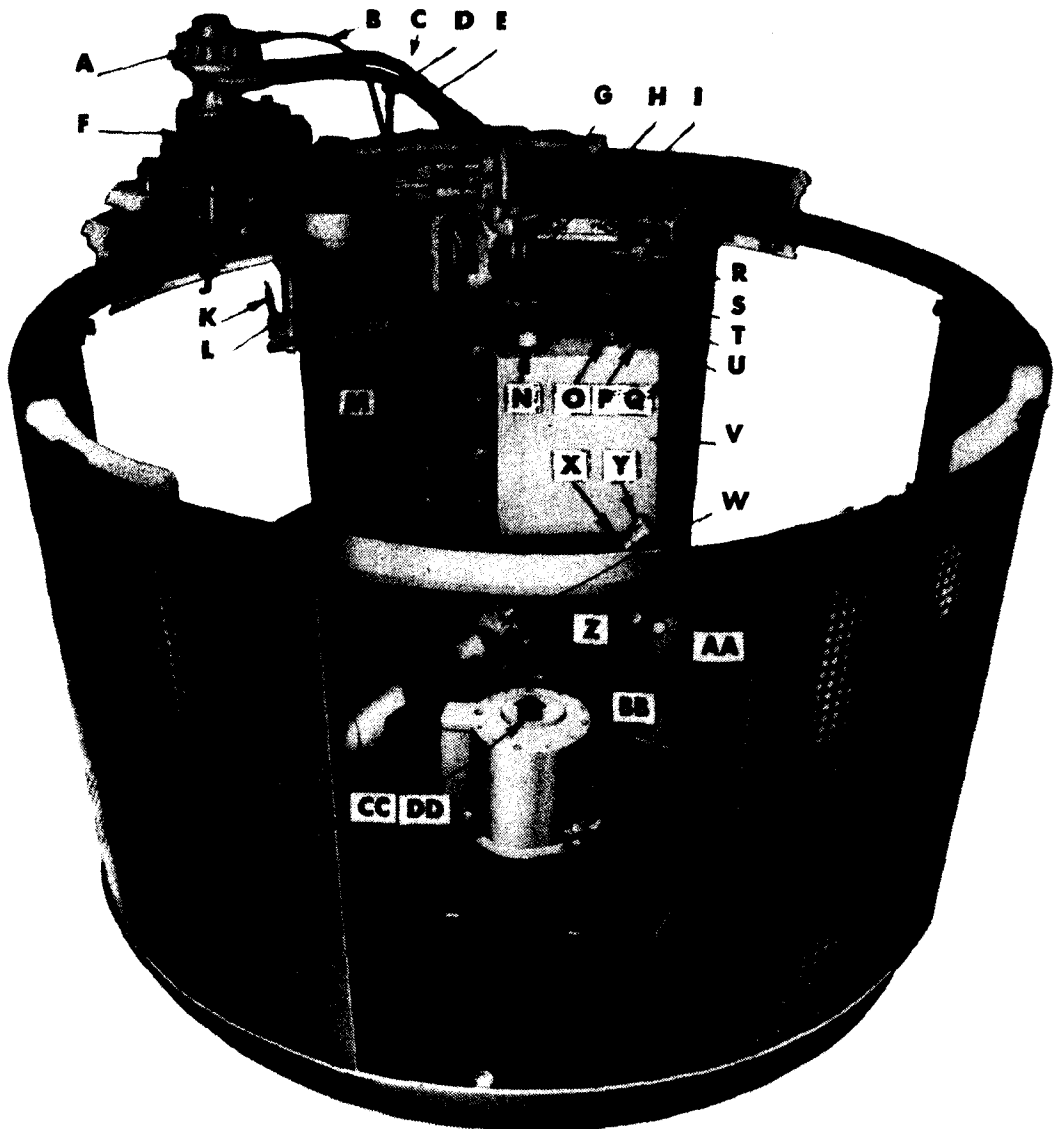
(2) **INSTALL SEAT BACK**. Place seat back in position, and install the four clutchhead screws.

d. Gunners Seat Replacement Procedure.

(1) **REMOVE SEAT ASSEMBLY**. Remove the four cap screws that fasten the seat bracket to the floor, and lift off the assembly.

(2) **INSTALL SEAT ASSEMBLY**. Place assembly in position over electric turret motor, and install the four cap screws and lock washers.

REPAIRS THAT CAN BE PERFORMED WITHOUT REMOVING THE
TURRET AND BASKET FROM THE VEHICLE



- | | |
|---|---|
| A — MOTOR, HYDRAULIC | P — CONNECTION, EXHAUST LINE |
| B — LINE, MOTOR DRAIN | Q — CONNECTION, DRAIN LINE |
| C — HOSE, LONG MOTOR | R — LOCK, TURRET |
| D — BREATHER, RESERVOIR | S — SWITCH, FOOT FIRING SAFETY |
| E — HOSE, SHORT MOTOR | T — SWITCH, DOME LAMP |
| F — BOX, TRAVERSING GEAR | U — SWITCH, TURRET MOTOR |
| G — VALVE, HYDRAULIC CONTROL | V — RESERVOIR, OIL |
| H — LINE, EXHAUST | W — PUMP, HYDRAULIC |
| I — INDICATOR SCALE, TURRET
DIRECTION | X — PLUG, DRAIN |
| J — LEVER, TRAVERSE SHIFT | Y — LINE, OUTLET |
| K — TRIGGER, HANDWHEEL BRAKE | Z — SWITCH, FOOT FIRING (37 MM.) |
| L — CRANK, HANDWHEEL | AA — SWITCH, FOOT FIRING (30 CAL.) |
| M — LINE, PRESSURE | BB — HOSE, SUCTION |
| N — CAP, OIL FILLER | CC — MOTOR, ELECTRIC |
| O — CONNECTION, BREATHER LINE | DD — INDICATOR, VEHICLE
DIRECTIONAL |

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Figure 102 — Turret Traversing System

**ORDNANCE MAINTENANCE - CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

e. Gunners Seat Back Replacement Procedure.

(1) **REMOVE SEAT BACK.** Fold the seat back forward, and lift it off seat.

(2) **INSTALL SEAT BACK.** Place seat back in folding position and hook it on the seat, then raise the back to an upright position.

f. Gunners Seat to Floor Bracket Replacement Procedure.

(1) **REMOVE SEAT FROM BRACKET.** Remove the two screws and nuts at the rear of roller channel, hold the lock catch out and slide the seat off of the bracket.

(2) **INSTALL SEAT ON BRACKET.** Slide seat on bracket and install the lock screws and nuts in the end of the channel.

142. STORAGE BOXES AND RACKS.

a. The storage boxes and racks are attached to the turret and basket by cap screws, clutch-head screws, or rivets. The replacement of the parts are self-explanatory.

143. FOOT FIRING SWITCH.

a. Replacement Procedure.

(1) **REMOVE SWITCH** (fig. 102). Shut off main switch. Remove the four screws that retain the side plate on the switch box. Unscrew the pedal. Remove the two screws that retain the switch to the box. Pull switch out of box and remove the two wires from the terminals on the bottom of the switch.

(2) **INSTALL SWITCH.** Fasten the two wires to the terminals on the bottom of the switch and tighten the screws securely. Place switch in box and install the two mounting screws. Screw on the pedal. Install the side plate with the four screws and tighten them securely.

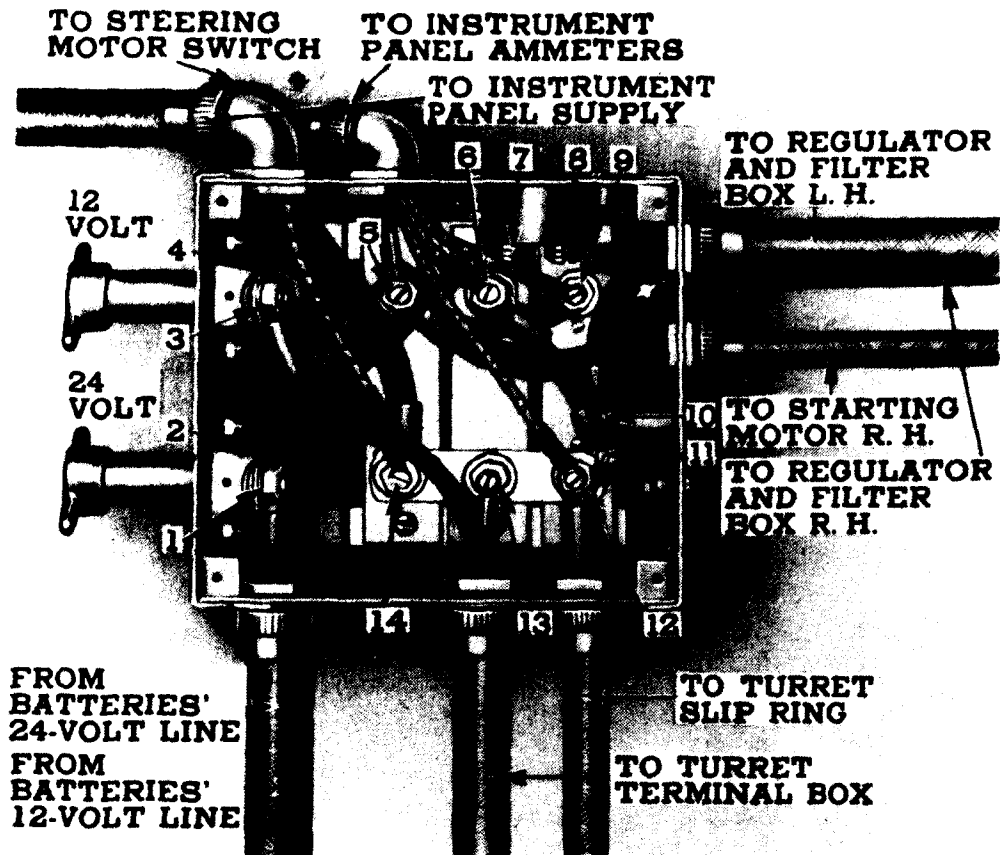
144. FOOT FIRING SAFETY SWITCH.

a. Replacement Procedure.

(1) **REMOVE SWITCH** (fig. 102). Shut off main switch. Remove the four screws that hold the panel in the box, and lift panel out of box. Unscrew the nut on face of panel that retains the switch and shield to the panel and pull switch out of panel. Remove the screws that attach the two wires to the terminals on the back of the switch.

(2) **INSTALL SWITCH** (fig. 102). Attach the two wires to the terminals on the back of the switch and tighten the screws securely. Place switch in position in panel so that the toggle lever is toward the top when the switch is "ON." Place the shield over the switch with hinge toward the top and install the nut that retains the switch in the panel. Place panel in position on box and install the four mounting screws.

REPAIRS THAT CAN BE PERFORMED WITHOUT REMOVING THE
TURRET AND BASKET FROM THE VEHICLE



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Figure 103 - Master Switch Box Connections

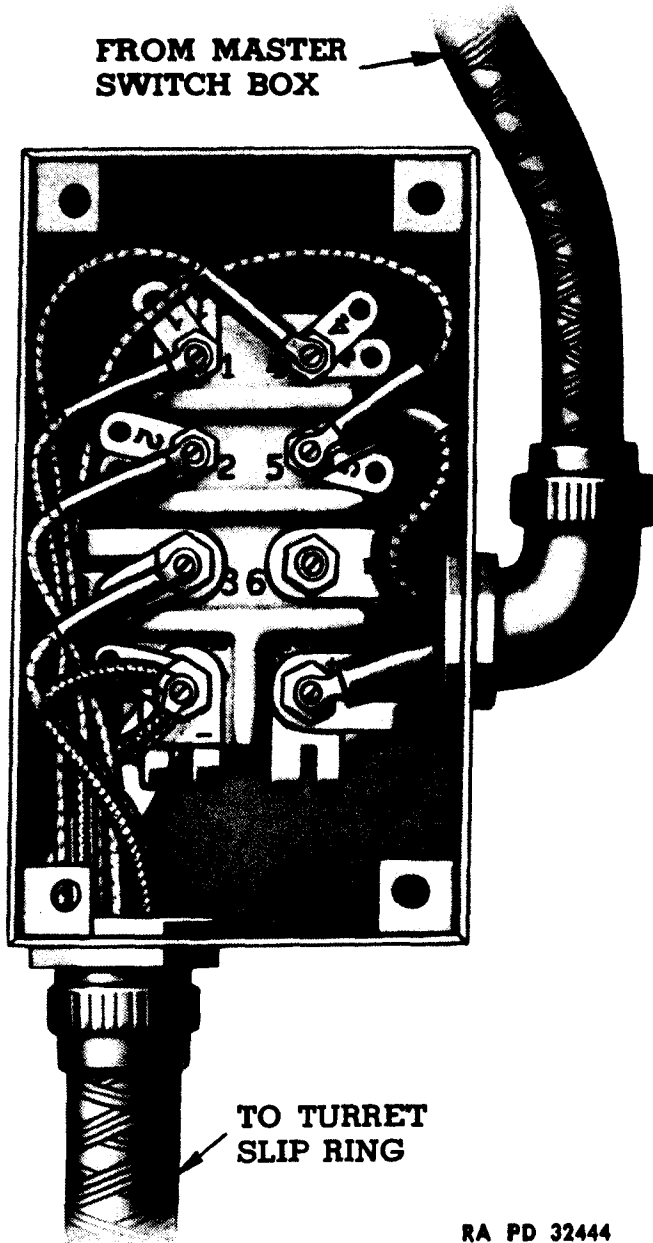
145. SLIP RING REPLACEMENT.

a. Removal Procedure.

(1) DISCONNECT SLIP RING LEAD AT MASTER SWITCH BOX (fig. 103). Remove the four clutch-head screws that retain the cover to the switch box, and lift off the cover. Remove the screw from the center of the lower right hand terminal and remove the wire. Remove the nut on the same terminal that retains the heavy cable, and lift off the cable. Unscrew the knurled nut on the outside of box and pull out the cable.

(2) DISCONNECT SLIP RING LEADS AT TERMINAL BOX (fig. 104). Remove the four screws from the cover of the slip ring terminal box, and lift off the cover. Remove the five nuts that retain the five wires to the terminals and the two nuts that retain the shielded cable leads to the terminals, and pull the seven wires off the terminal screws. Unscrew the knurled nut from the large cable at the bottom of the box on the outside, and pull out the cable with the five wires.

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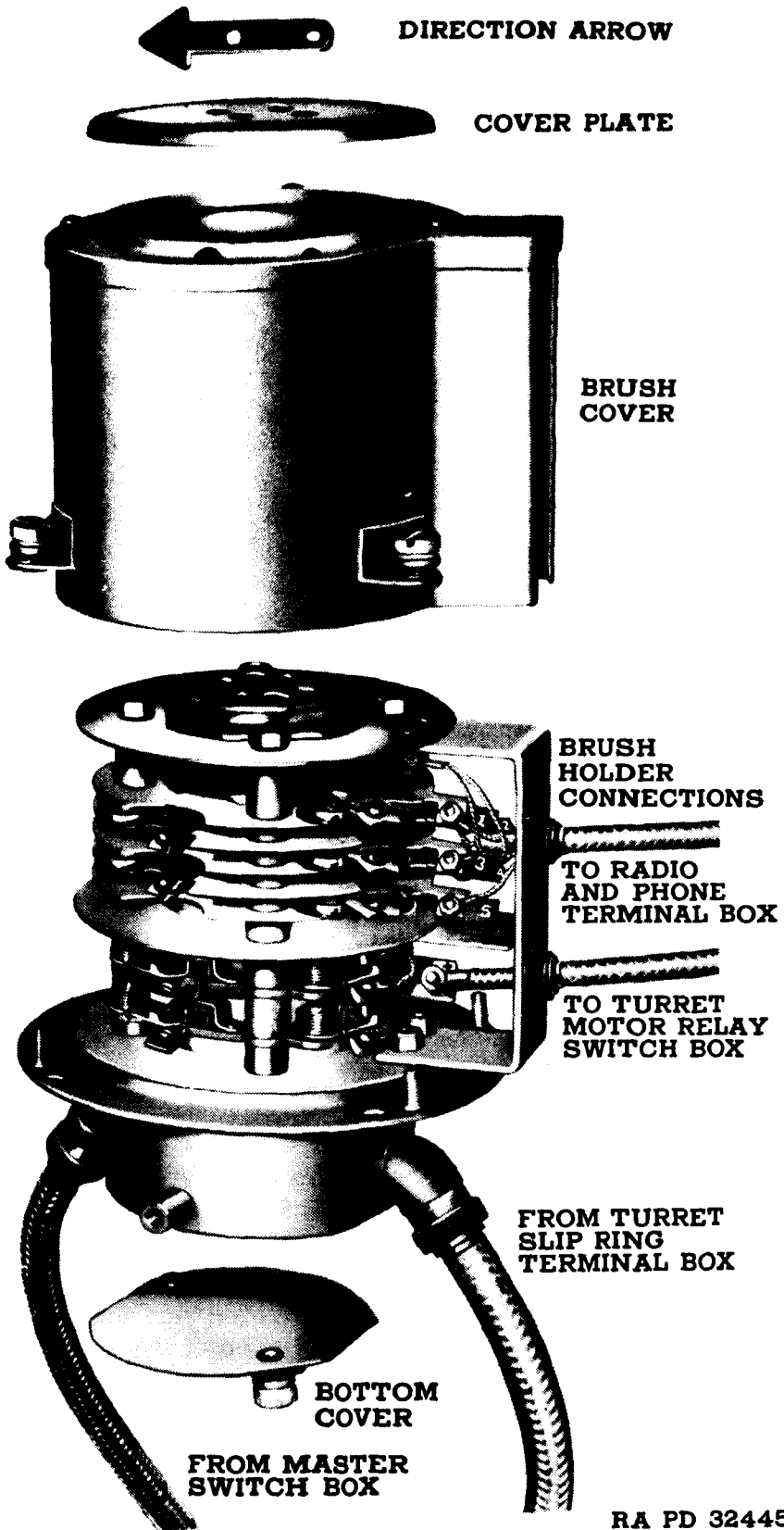
Figure 104 – Turret Slip Ring Terminal Box

(3) **REMOVE CABLES FROM CLIPS.** Remove the two clutch-head screws that retain the three cable hold-down clips to the hull, and lift off the clips.

(4) **DISCONNECT GROUND STRAP.** Remove the two floor plates in the basket and rotate the basket to gain access to the ground strap. Remove the cap screw that retains the ground strap to the hull.

(5) **REMOVE SLIP RING COVER** (fig. 105). Remove the four cap

REPAIRS THAT CAN BE PERFORMED WITHOUT REMOVING THE
TURRET AND BASKET FROM THE VEHICLE



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Figure 105 - Turret Slip Ring Brush Connections

**ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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screws from the cover plate, and remove the plate. Unscrew the four knurled nuts and lift off the cover.

(6) **DISCONNECT RADIO AND PHONE BOX LEADS** (fig. 105). Unscrew the five nuts that retain the leads to the terminals on the side of the slip ring and lift off the leads. Unscrew the knurled nut that retains the cable to the slip ring and pull out the cable with wires.

(7) **DISCONNECT MOTOR RELAY SWITCH BOX LEAD** (fig. 105). Unscrew the nut that retains the wire to the slip ring terminal on side of slip ring, and lift off the wire. Unscrew the knurled nut that retains the cable to the slip ring, and pull out the cable with wire.

(8) **REMOVE SLIP RING ASSEMBLY**. Unscrew the four screws that retain the slip ring to the floor of the basket. Turn slip ring assembly so that shielded cables below the floor line up with the elongated holes in the floor, and lift out the slip ring with the two cables attached.

(9) **REMOVE SHIELDED CABLES** (fig. 106). Turn slip ring upside down. Unscrew the two knurled nuts that retain the bottom cover, and lift off the cover. Remove the nut that retains the lead from the master switch box and the six nuts that retain the wires to the slip ring terminals. Pull the wires off the terminals, unscrew the two knurled nuts that retain the shielded cables to the slip ring, and pull out the cables with wires.

b. Installation Procedure.

(1) **INSTALL SHIELDED CABLES** (fig. 106). Push the terminal box lead wires through the fitting on bottom of ring and install the wires on the proper terminals. Install the retaining nuts and lock washers and tighten them securely. Screw the knurled cable retaining nut to fitting and tighten securely. *NOTE: The wires and terminals are numbered.* Push the master switch lead through the other fitting and install the wire on the positive terminal. Tighten the retaining nut and the knurled nut securely. Install the bottom cover.

(2) **INSTALL SLIP RING ASSEMBLY**. Feed cables through hole in floor, making sure that the cable with the five leads is on the left side and that the cable is led around the back of the slip ring so as not to interfere with the batteries. Place slip ring in position and install the four screws that retain the slip ring to the floor.

(3) **CONNECT LEAD TO MASTER SWITCH BOX** (fig. 103). Bring the cable with one wire, up to the master switch box and install wire on the terminal with the nut and lock washer. Tighten nut securely. Install the smaller wire on the same terminal and tighten the screw securely. Tighten the knurled nut to the side of the switch box. Install the cover and the four retaining screws.

(4) **INSTALL LEAD AT SLIP RING TERMINAL BOX** (fig. 104). Bring the cable with the five leads up to the terminal box and push the leads through the opening and install the leads on the proper terminals. *NOTE: The terminals and the leads are numbered.* Tighten the re-

**REPAIRS THAT CAN BE PERFORMED WITHOUT REMOVING THE
TURRET AND BASKET FROM THE VEHICLE**

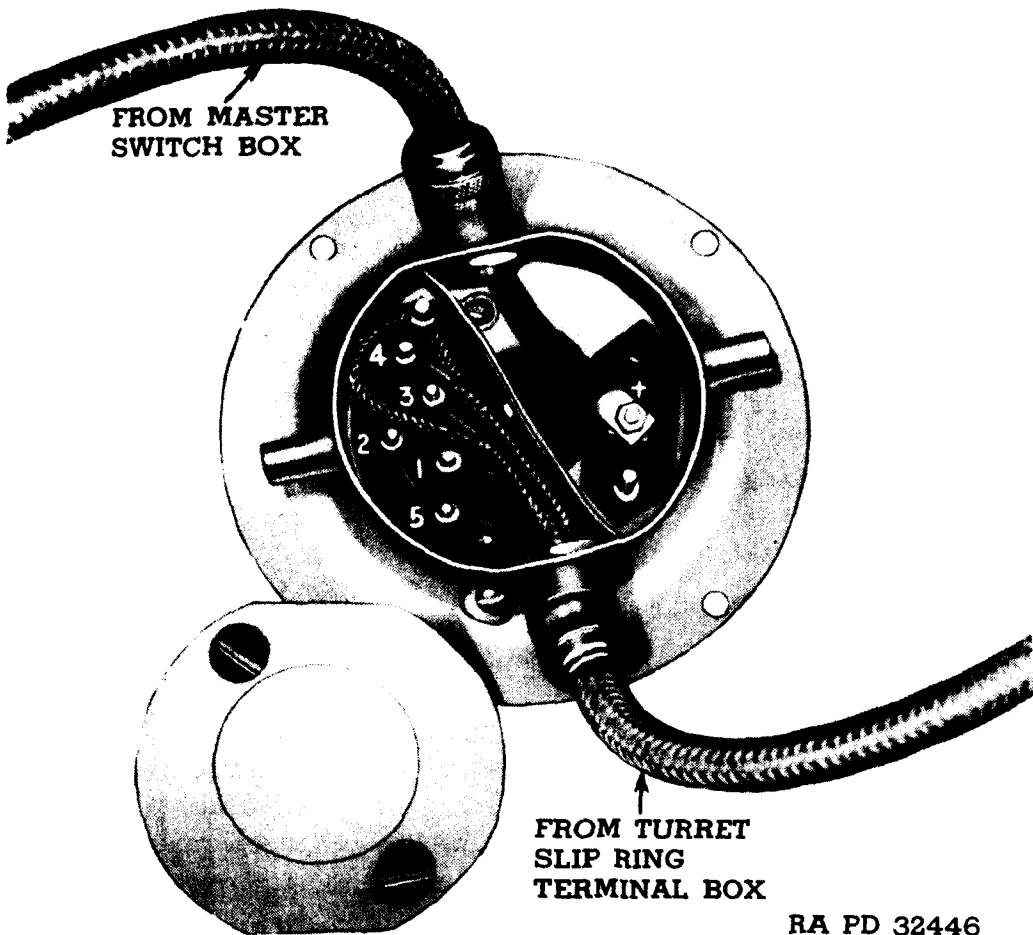


Figure 106 – Turret Slip Ring Armature Connections

taining screws securely and tighten the knurled nut to the fitting on the box. Install the cover and the four retaining screws.

(5) **INSTALL MOTOR RELAY SWITCH BOX LEAD TO SLIP RING** (fig. 105). Push wire through lower hole in side of slip ring and install the wire on the terminal. Tighten the retaining nut securely. Screw the knurled nut on the fitting and tighten it securely.

(6) **INSTALL RADIO AND PHONE BOX LEADS TO SLIP RING** (fig. 105). Push the wires through the upper hole in side of slip ring and install the wires on the proper terminals. **NOTE: The terminals and wires are numbered.** Tighten the retaining nuts securely. Screw the knurled nut on the fitting on the side of the slip ring and tighten it securely.

(7) **INSTALL COVER.** Place slip ring cover over the slip ring and tighten the four knurled retaining nuts. Place cover plate and directional arrow on top with arrow pointing to front of basket, and install the four retaining cap screws and lock washers.

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1**

CHAPTER 9

TURRET, BASKET, AND TRAVERSING SYSTEM (Cont'd)

Section III

REMOVAL OF TURRET AND BASKET

	Paragraph
Removal of turret	146
Removal of ball race and basket	147
Disassembly of ball ring	148
Removal of traversing system	149

146. REMOVAL OF TURRET.

a. **Disconnect Pressure Hose** (fig. 102). Hold fitting on end of hose with a wrench and unscrew the connection from the tubing that leads to the control valve.

b. **Drain Reservoir and Pump** (fig. 102). Place the end of the pressure hose in a three-gallon drain can. Start the electric motor and pump the oil from the reservoir and pump into the drain can. Shut off electric motor as soon as system is drained. Shut off main switch.

c. **Disconnect Long and Short Motor Hoses** (fig. 102). Hold fittings on end of hoses with a wrench, and unscrew the connections at the control valve.

d. **Disconnect Exhaust Hose from Tubing** (fig. 102). Hold the fitting on the hose with a wrench and unscrew the fitting from the exhaust line fitting at the tubing.

e. **Remove Control Valve Assembly** (fig. 102). Remove the three remaining cap screws that retain the control valve assembly to the race, and lift off the control valve.

f. **Remove Turret Lock** (fig. 102). Remove the two cap screws that retain the turret lock to the race, and lift off the lock.

g. **Remove Drain and Breather Tubes** (fig. 102). Unscrew the fitting on the hydraulic motor drain line at the reservoir and at the hydraulic motor. Unscrew the breaker tube fitting at the reservoir, and lift out the clips and tubes.

h. **Remove the Gear Mechanism** (fig. 102). Remove the two lower cap screws that retain the gear box and pinion guard to the inner race. Remove the two upper cap screws that retain the gear box to the turret, and lift off the gear mechanism.

REMOVAL OF TURRET AND BASKET

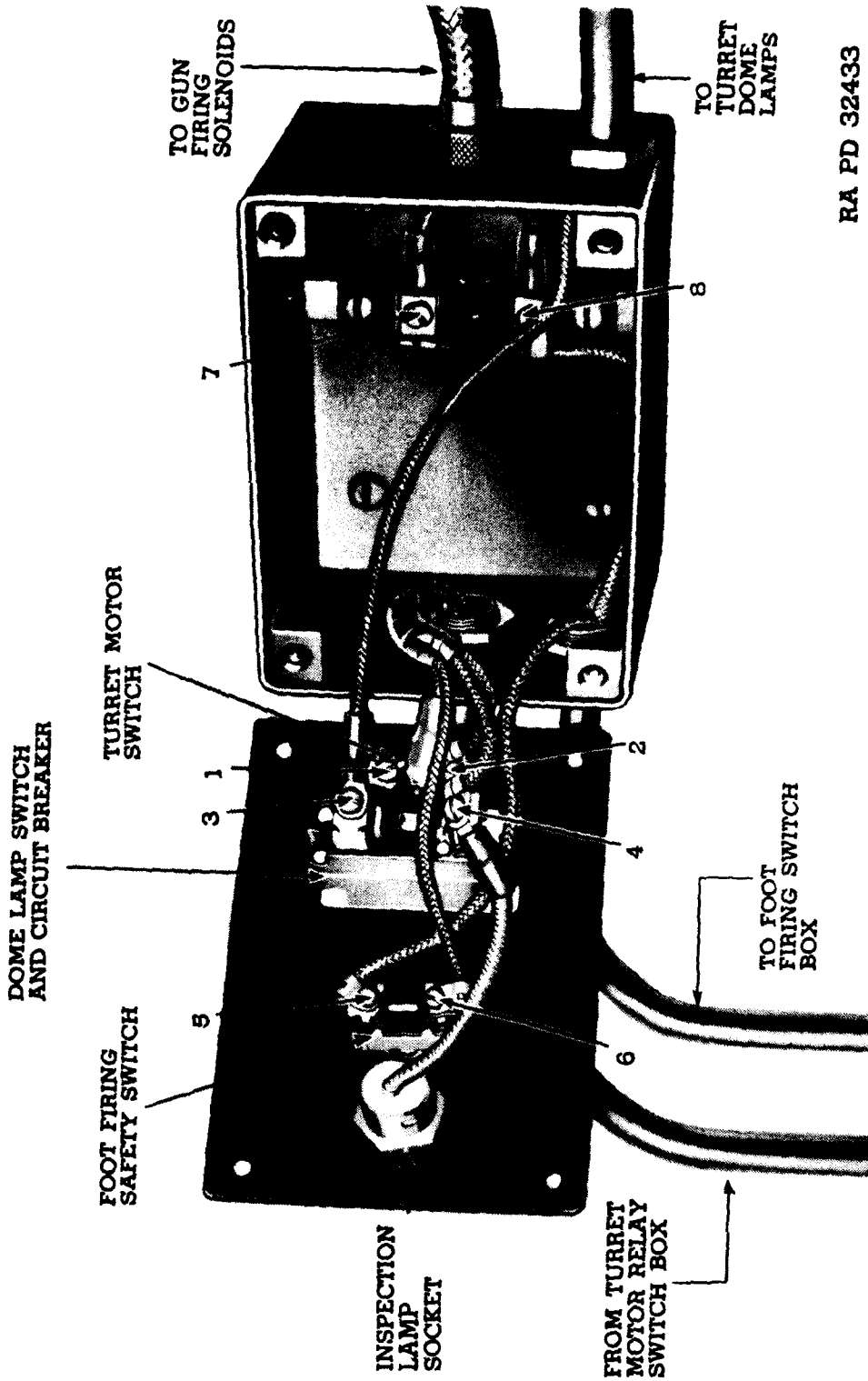


Figure 107 — Turret Control Switch Box

ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1

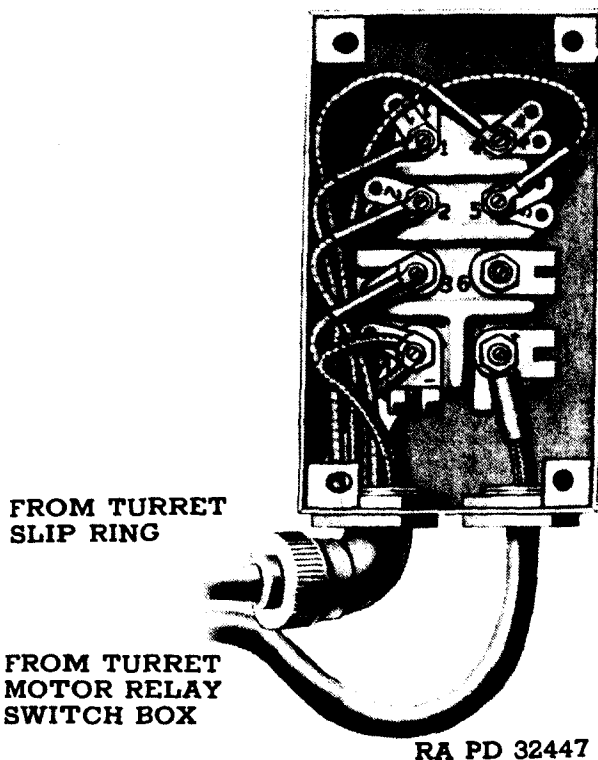


Figure 108 — Radio and
Phone Terminal Box

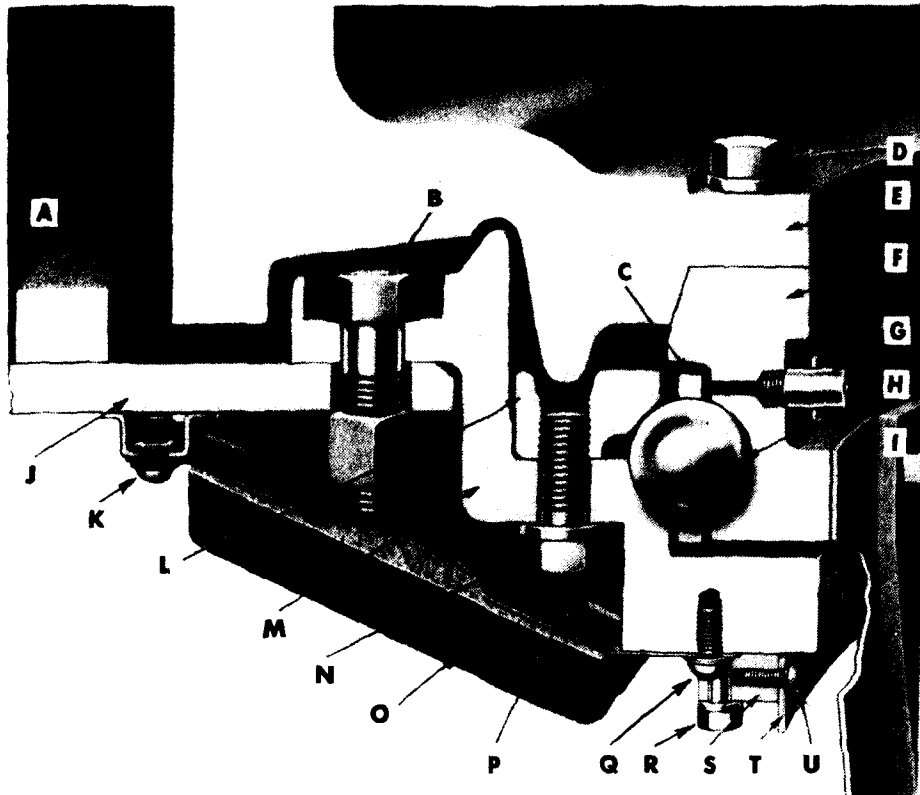
i. **Disconnect Wire to Solenoid Switch (fig. 107).** Remove the four clutch-head screws that retain the switch panel to the box, and lift out the panel. Unscrew the two screws that attach the two wires from the solenoid switches. Unscrew knurled nut from elbow on right side of box, and pull out the wires.

j. **Disconnect Dome Light Wire.** Unscrew knurled nut on flexible cable that leads from the dome lights to the connection at the inner race, and pull the connection apart.

k. **Disconnect Radio and Phone Terminal Box Leads (fig. 108).** Remove the four screws that attach the cover to the radio and phone terminal box at rear of turret, and lift off the cover. Remove the eight nuts on the terminals and lift off all the wires that lead to the two tubes that lead down to the floor of the basket. Unscrew the knurled nuts that retain these tubes to the outside of the box on the right side, and pull out the wires. *NOTE: Pull these tubes away from the edge of the turret when lifting off the turret.*

l. **Remove Turret Retaining Cap Screws (fig. 109).** With a chisel, make a mark on the inner race and the turret, so they can be installed in the same relative position. Remove the remaining 20 cap screws around inside of turret that retain the turret to the inner race.

REMOVAL OF TURRET AND BASKET



- | | |
|---|--|
| A — GUARD, HULL FRONT ROOF
PLATE TURRET RING | L — RING, BALL |
| B — BOLT, BALL OUTER RACE
ATTACHING | M — OUTER RACE AND RING GEAR |
| C — RETAINER, BALL | N — SCREW, BALL RING RETAINER |
| D — SCREW, TURRET RETAINER | O — PAD, BALL RING |
| E — TURRET | P — RETAINER, BALL RING PAD |
| F — RACE, BALL INNER | Q — SCREW, PROTECTIVE PAD
RETAINER |
| G — FITTING, LUBRICATION | R — SCREW, INDICATOR BLOCK
RETAINER |
| H — BALL | S — BLOCK, INDICATOR SCALE
MOUNTING |
| I — BASKET, TURRET | T — TURRET DIRECTION INDICATOR SCALE |
| J — HULL | U — SCREW, INDICATOR RETAINER |
| K — BOLT, PROTECTIVE PAD RETAINER | |

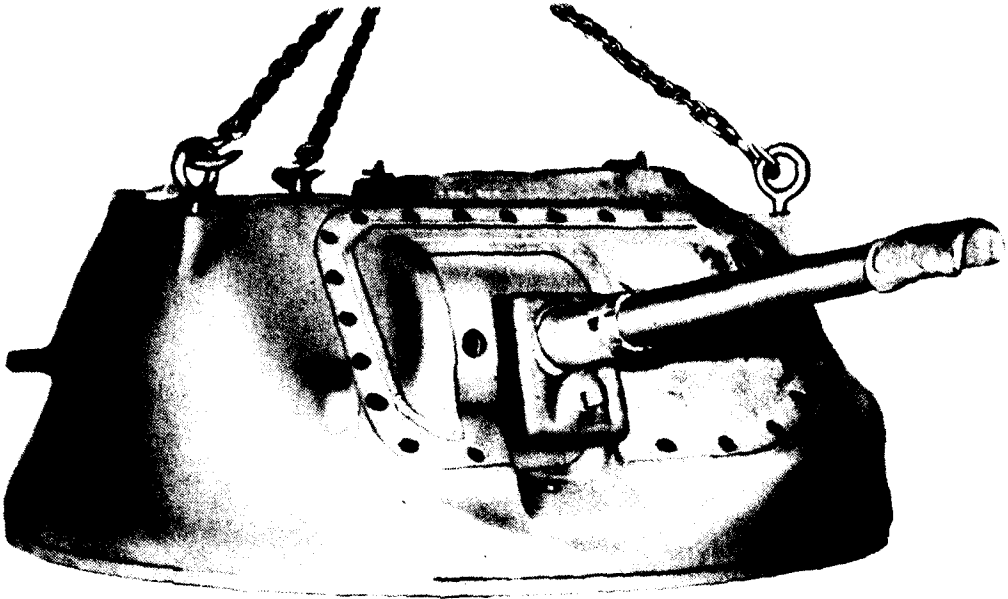
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Figure 109 — Turret Ball Ring Assembly

m. **Tighten Turret Lifting Bolts.** Tighten the three three-quarter bolts that remain around the inside of turret until the turret starts to lift off of the inner race.

n. **Install Lifting Rings** (fig. 110). Remove the two front corner cap screws and the cap screw in the middle of the rear on top of turret, and install the three lifting rings (41-R-2515).

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**Figure 110 – Turret Replacement, Using Lifting Rings
(Set of 3) – 41-R-2515**

o. Lift Off Turret. Hook three chains of equal length in the three lifting rings, hook the chains on a chain hoist, and lift the turret carefully straight up until it clears the vehicle.

147. REMOVAL OF BALL RACE AND BASKET.

a. Remove Turret as Instructed in Paragraph 146.

b. Disconnect Slip Ring Leads at Terminal Box (fig. 104). Remove the four screws from the cover of the slip ring terminal box and lift off the cover. Remove the nuts that retain the five wires to the terminals to the blocks, then pull the seven wires off the terminal screws. Unscrew the knurled nut from the large cable at the bottom of the box on the outside, and pull out the cable with the five wires.

c. Disconnect Slip Ring Lead at Master Switch (fig. 103). Remove the four clutch-head screws that retain the cover to the master switch box, and lift off cover. Remove the screw from the center of the lower right-hand terminal and remove the wire. Remove nut on the same terminal that retains the heavy cable, and lift cable off terminal. Unscrew the knurled nut on the outside of box and pull out the cable.

d. Remove Cables from Clips. Remove the two clutch-head screws that retain the three cable hold-down clips to the hull. The cables lead from the master switch box and slip ring terminal box to the slip ring. Tie the loose ends to the inside of the basket.

REMOVAL OF TURRET AND BASKET

e. **Disconnect Ground Strap.** Remove the cap screw that retains the slip ring ground strap to the hull.

f. **Remove Protective Pads** (fig. 109). Remove the six clutch-head screws that hold each protective pad to the hull and the outer race in the driver's compartment, and remove the two pads.

g. **Remove Ball Ring Assembly with Basket.** With a chisel, make a mark on the outer race and the hull so they can be reinstalled in the same relative position. Remove the 36 bolts and nuts that retain the race assembly to the hull. Install three lifting rings in the inner race and hook three chains of equal length in the lifting rings. Raise the race assembly with basket straight up with a chain hoist until it is clear of the hull. Support the race on suitable blocking, so that the basket does not support the weight of the race assembly.

h. **Remove Basket.** Remove the five cap screws and the 20 clutch-head screws that retain the basket to the race, and lower basket out of the race.

148. DISASSEMBLY OF BALL RING.

a. **Disassemble Race** (fig. 109). Support the outer race on suitable blocking. Remove the 39 bolts from the bottom of the outer race that holds the ball ring to the outer race. Lift out of the ball ring carefully, then lift the inner race carefully about 2½ inches and lift out the 12 ball retainers and the 120 steel balls. Remove the inner race.

b. **Disassemble Indicator Scale** (fig. 109). If necessary to replace the indicator scale, remove the ten screws that retain the two sections of the indicator scale to the mounting blocks. The eight mounting blocks are retained to the outer race by a cap screw in each block. When installing the indicator scale, leave screws loose and start in the middle of the scale to tighten them so the parts will align themselves.

149. REMOVAL OF TRAVERSING SYSTEM.

a. **General.** The hydraulic traversing system (Logansport) is the same traversing system that is outlined in TM 9-1750H, with two exceptions. The firing switches for the 37-mm. gun and the 30-cal. machine gun are located on the floor of the basket, and are operated with the foot instead of having toggle switches built into the control handle. The safety switch is in the panel at the right of the control handle with the turret motor switch, dome lamp switch and inspection lamp socket. The removal of the various units that make up the traversing system together with the disassembling, repairing, assembling, and installation of the units is covered in TM 9-1750H. **NOTE:** *Disregard all electrical connection instructions pertaining to the control handle in the TM 9-1750H, and refer to paragraphs 143 and 144 of this manual for instructions on replacing the switches.*

**ORDNANCE MAINTENANCE - CHASSIS, HULL, AND TURRET FOR
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CHAPTER 9

TURRET, BASKET, AND TRAVERSING SYSTEM (Cont'd)

Section IV

**INSPECTION, REPAIR, AND ASSEMBLING BALL
RACE AND BASKET**

	Paragraph
Cleaning and inspection	150
Assembling ball ring	151

150. CLEANING AND INSPECTION.

a. **Cleaning of Parts.** Clean the races, ring, balls, and ball retainers in dry-cleaning solvent very carefully, and dry the parts thoroughly with air pressure. Clean the turret and basket and dry them thoroughly, using care not to let the cleaning solvent get into the electric motor, guns, padded racks, etc.

b. **Inspection of Ball Ring.** Inspect the balls and ball races for scoring, cracks or other damage. Inspect the surfaces of the races that contact the hull and the turret. Replace any parts that are damaged.

c. **Inspection of Hull.** Inspect the area around the opening to which the ball ring is bolted. See that the bolting surface is flat all the way around, so that the ring will not be distorted when bolted to the hull. Correct any out-of-line condition.

151. ASSEMBLING BALL RING.

a. Spread a coating of grease around the surfaces in which the balls ride, on both the outer race and inner race. Lower inner race into position in the outer race until the balls and retainers can be inserted between the inner and outer races. Insert the balls and retainer, and lower the inner race at the same time, making sure that the balls and retainers are in place. Lower the ring in place, line up the holes and install the 39 cap screws and lock washers, tightening them securely. Turn the inner race to see that it revolves freely.

CHAPTER 9

TURRET, BASKET, AND TRAVERSING SYSTEM (Cont'd)

Section V

INSTALLATION OF TURRET AND BASKET

	Paragraph
Installation of basket	152
Installation of turret	153

152. INSTALLATION OF BASKET.

a. **Install Basket in Ball Ring.** Place basket in position in the inner race. Install the five cap screws and the 20 clutch-head screws that retain the basket to the inner race. Tighten the screws securely. **CAUTION:** *Be sure to match up the marks that were made with chisel at time of removal.*

b. **Install Ball Ring and Basket in Hull** (fig. 109). Lift ball ring and basket and place it in position in hull. Line up the holes in the outer race with the holes in the hull and install the 36 attaching bolts and nuts. Tighten the bolts and nuts securely. Turn basket to see that it rotates freely.

c. **Install Protective Pads** (fig. 109). Place the protective pads in position and install the six screws in each pad.

d. **Connect Ground Strap.** Fasten the end of the ground strap to the hull with the cap screw, and tighten it securely.

e. **Connect Slip Ring Lead at Master Switch** (fig. 103). Push cable wire through terminal opening on master switch box, and place the cable over the terminal. Install the retaining nut. Connect the small wire from the top of the box (natural with black tracer) to the terminal post with the screw, and tighten securely. Install cover and tighten the four screws securely, and tighten the knurled nut to the outside of the switch box.

f. **Connect Leads at Slip Ring Terminal Box** (fig. 104). Push leads through opening in box and connect the leads to the corresponding terminals. Each terminal is numbered, and each wire has a small band behind the terminal which is also numbered. Tighten the knurled nut to the outside of the terminal box and install the cover and four screws. Tighten the screws securely.

153. INSTALLATION OF TURRET.

a. **Install Turret** (fig. 110). Lift turret into position on inner race, line up the chisel marks and the holes, and install 20 of the retaining

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cap screws and lock washers. Leave the two cap screws out of the gear mechanism mounting holes. **CAUTION:** *Be sure to line up the marks that were made with chisel at time of removal.*

b. Connect Radio and Phone Box Terminal Leads (fig. 108). Push wires through the opening in the side of the terminal box and install the wires on the corresponding terminals. The terminals are numbered, and the wires have a small band behind the terminal which is also numbered. Tighten the knurled nuts on the outside of the box, and install the cover and the four mounting screws. Tighten the screws securely.

c. Connect Dome Light Wire. Push the plug in the terminal, and screw the knurled nut on the end of the tubing.

d. Connect Solenoid Switch Leads to Terminal Box (fig. 107). Push the wires through the opening in right side of turret control, switch box and connect the two wires to the terminals; tighten the screws securely. Place panel in position and tighten the four mounting screws securely.

e. Install Gear Mechanism (fig. 102). Place the gear mechanism in position and install the two upper mounting cap screws and the two lower cap screws with the pinion guard. Tighten all four cap screws securely. Place shifting lever in manual control and turn hand crank to see that the turret turns freely.

f. Install Drain and Breather Tubes (fig. 102). Place the breather tube in position, and screw the connection into the reservoir tank. Place the drain tube in position and screw the fittings in the hydraulic motor and the reservoir.

g. Install Turret Lock. Place the lock in position on the inner race, and install the two mounting cap screws and lock washers.

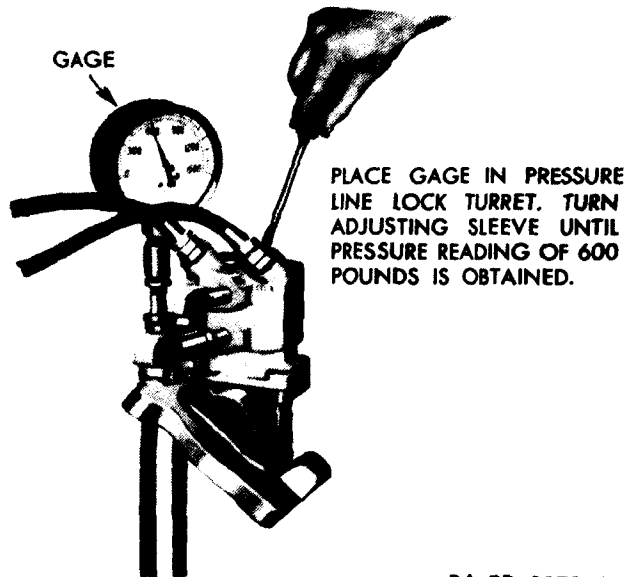
h. Install Control Valve Assembly (fig. 102). Place control valve assembly in position, and install the four mounting cap screws and lock washers. Install the drain and breather tube hold-down clip under the lower left-hand mounting screw. Tighten the four cap screws securely.

i. Connect Long and Short Motor Hose (fig. 102). Start the long motor hose fitting in the control valve port marked "Cyl. 2." Hold the fitting on the hose with a wrench and tighten the fitting securely. Start the short hose marked "Cyl. 1" in the valve assembly, hold the hose fitting and tighten connection fitting securely.

j. Connect Pressure and Exhaust Lines. Start the pressure and exhaust hoses in the fittings on the tubes. Hold the fittings on the hoses with a wrench, and tighten the fittings securely.

INSTALLATION OF TURRET AND BASKET

Figure 111 — Relief Valve Adjustment



k. **Fill Reservoir and Bleed System** (fig. 102). Install drain plug and gasket. Remove filler cap and fill reservoir with clean hydraulic fluid. Turn on master and turret traversing electric motor switch and let motor run about a minute. Shut off motor and refill reservoir. Start motor again and repeat the operation until the reservoir remains full.

l. **Check and Adjust Relief Valve** (fig. 111). Install a pressure gage (41-G-450) in the "Pressure" port and the valve assembly, using a short nipple to connect the gage tee to the valve body. Assemble the pressure hose to the other outlet of the tee. Lock the basket to ring gear. Start the electric motor and turn the control handle either way as far as it will go. The gage should read 600 pounds. If it does not, remove acorn nut and turn the adjusting screw until the gage reads 600 pounds. Install acorn nut and remove gage. Install the long hose in the "IN" port of the valve assembly. Revolve the turret both manually and hydraulically to see that it operates properly. Remove the three lifting rings from the top of turret and install the plugs.

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CHAPTER 10
ELECTRICAL WIRING

Section I

INTRODUCTION

	Paragraph
General	154
Data	155
Reference to second echelon TM 9-741	156
Maintenance allocation	157

154. GENERAL.

a. The electrical system controls the operation of the majority of the vital operating units in the vehicle. Therefore, it is of major importance that the system be checked at frequent intervals to insure the proper operation of these units. Two major factors must be kept in mind when making these inspections: first, all connections must be clean and tight. Loose or corroded connections will cause run-down batteries, hard starting, dim lights, or complete failure of the vital operating units in the vehicle. Second, all shielding, filters, condensers, and ground straps must be in good condition and properly grounded to ensure adequate radio noise suppression.

b. The electrical system in general consists of four batteries, two generators, two starting motors, ignition apparatus, lighting system, turret traverse motor, steering gear motor, siren, gun firing solenoids, and electric fuel pump. All of the units are connected by a system of wiring enclosed in flexible conduit to protect the wiring and to shield the system against radio interference. The wiring harnesses are adequately supported by clips to afford proper grounds for the conduit. All terminals are securely soldered to wires to provide good electrical connections. Switch boxes, switches, terminal boxes, and terminal plugs are located in points that allow proper checkings or replacement of harnesses without interference with other units. A turret slip ring allows transfer of current from the hull to the turret basket while permitting a 360-degree rotation of the basket.

155. DATA.

a. Circuit Breakers.

(1) LIGHTING SWITCH.

Type	Manual reset
Capacity	20 amp

INTRODUCTION

(2) GENERATOR.

Type Automatic reset
Capacity 70 amp

(3) FUEL PUMP.

Type Manual reset
Capacity 2 amp

(4) STEERING GEAR MOTOR

Type Manual reset
Capacity 120 amp

(5) SIREN

Type Manual reset
Capacity 15 amp

(6) TURRET LIGHT SWITCH

Type Toggle switch reset
Capacity 6 amp

(7) TURRET MOTOR RELAY SWITCH

Type Automatic
Capacity 100 amp

b. Engine Heat Indicators.

Number used (dash unit)..... 2
Number used (engine unit) 2
Make AC
Voltage 6
Adapter 24 to 6 volts

c. Engine Oil Gage.

Number used (dash unit)..... 2
Number used (engine unit)..... 2
Make AC
Voltage 6
Adapters 24 to 6 volts

d. Gas Gage.

Number (dash unit) 1
Number (tank unit) 1
Make AC

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e. Filters.

(1) IGNITION COIL FILTER.

Number used 2
Make Delco-Remy
Volts 30
Capacity 10 amp

(2) FIELD FILTER.

Number used 2
Make Delco-Remy
Volts 30
Capacity 10 amp

(3) BATTERY AND ARMATURE FILTERS.

Number used 4
Make Delco-Remy
Volts 30
Capacity 55 amp

f. Condensers.

(1) TURRET MOTOR CONDENSER.

Number used 4
Make Solar
Capacity (microfarad)10
Megohm condenser test (Voltage at which rated
capacity is established) 400

(2) STEERING MOTOR CONDENSER.

Number used 1
Make Delco-Remy
Capacity (microfarad)15

(3) FUEL PUMP CONDENSER.

Number used 1
Make Delco-Remy
Capacity (microfarad)28 to .34

(4) WINDSHIELD WIPER MOTOR CONDENSERS.

Number used (two motors) 2
Make Solar
Capacity (microfarad)001

g. Suppressors.

(1) SPARK PLUG AND HIGH TENSION WIRE SUPPRESSORS.

Number used 14
Make Delco-Remy
Resistance (ohms) 8,500–11,500

INTRODUCTION

h. Lamp Bulbs.

Lamp	Voltage	Candle Power	Contact	Number Used
Head Lamp (sealed beam)	24-28	(50 Watts)	Single	2
Blackout Driving lamp (sealed beam)	6-8	(10-15 Watts)	Single	1
Blackout market lamp	24-28	3	Single	2
Instrument panel	24-28	3	Single	4
Dome lamp	24-28	3	Single	2
Turret lamp	24-28	3	Single	2
Blackout tail lamp (sealed unit)	24-28	3	Single	2
Blackout stop lamp (sealed unit)	24-28	3	Single	1
Service stop lamp (sealed unit)	24-28	6-32	Double	1
Inspection lamp	24-28	15	Double	1
Spot lamp	24-28	50	Single	1

156. REFERENCE TO SECOND ECHELON TM 9-741.

a. Many second echelon operations described in TM 9-741 are often performed by ordnance maintenance personnel, who should refer to the using troop TM for information.

157. MAINTENANCE ALLOCATION.

a. For scope of maintenance and repair by the crew and other units of the using arm refer to paragraph 7.

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b. Maintenance Chart.

ELECTRICAL GROUP	ECHELONS			
	2nd	3rd	4th	5th
Battery — service, recharge and/or replace	X			
Battery — repair		X		
Battery — rebuild			E	X
Breakers, circuit — replace	X			
Breakers, circuit — repair		X		
Breakers, circuit — rebuild			X	
Cables, battery — replace	X			
Cables, battery — repair		X		
Conduit — replace and/or repair		X		
Filters — replace	X			
Filters — repair		X		
Lamps (all) — service and/or replace	X			
Lamps (all) — repair		X		
Motor assembly, steering pump (hydraulic) — replace	X			
Motor assembly, steering pump (hydraulic) — repair		X		
Motor assembly, steering pump (hydraulic) — rebuild			X	
Regulator, current and voltage — replace	X			
Regulator, current and voltage — service and/or repair		X		
Regulator, current and voltage — rebuild			X	
Ring assembly, turret slip — replace	X			
Ring assembly, turret slip — repair		X		
Ring assembly, turret slip — rebuild			X	
Siren — replace	X			
Siren — repair		X		
Siren — rebuild			X	
Solenoids — replace	X			
Solenoids — repair		X		
Switches — replace	X			
Switches — repair		X		
Switches — rebuild			X	
Wiper, windshield — replace	X			
Wiper, windshield — repair		X		
Wiper, windshield — rebuild			X	
Wiring — replace	X			
Wiring — repair		X		

CHAPTER 10
ELECTRICAL WIRING (Cont'd)

Section II

TRUBLE SHOOTING

Troubles and remedies	Paragraph 158
-----------------------------	------------------

158. TROUBLES AND REMEDIES.

a. Circuit Breakers Will Not Stay Closed.

Possible Cause	Possible Remedy
Short circuit in wiring.	Check circuit affected (par. 161).
Overload in circuit.	Check electric motor in circuit affected.
Faulty circuit breaker.	Replace circuit breaker.

b. No Current to Instrument Panel.

Dead batteries.	Recharge or replace batteries.
Corroded battery terminals.	Clean and tighten all battery terminals.
Master switch turned off.	Turn on master switch.

c. Lights Burn Dim.

Loose connection.	Clean and tighten connections.
Corroded terminals.	Clean and tighten connections.
Weak battery.	Recharge battery.
Faulty switch.	Replace switch.

d. Lamps Do Not Light.

Burned-out bulb.	Replace bulb or unit.
Broken wire.	Replace wire in circuit affected (par. 161).
Master switch not turned on.	Turn on master switch.

e. Heat Indicators.

Indicator reads "cold" at all times.	Check circuit (par. 165).
Indicator reads "hot" at all times.	Check circuit (par. 165).

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f. Electric Oil Gage.

Possible Cause	Possible Remedy
Indicator reads "full" pressure at all times.	Check circuit (par. 166).
Indicator reads no pressure at all times.	Check circuit (par. 166).

g. Electric Gas Gage.

Reads "full" at all times.	Check circuit (par. 167).
Reads "empty" at all times.	Check circuit (par. 167).

h. Electric Fuel Pump Does Not Operate.

Circuit breaker "off."	Reset circuit breaker.
• Broken wire.	Check circuit (par. 164).
Faulty motor.	Check circuit and replace motor (par. 164).

i. Turret Traversing Motor Does Not Operate.

Faulty relay switch.	Check circuit and replace switch (par. 173).
Slip ring brush stuck.	Free up brush.
Faulty turret motor switch.	Check circuit and replace switch (par. 173).

CHAPTER 10
ELECTRICAL WIRING (Cont'd)

Section III

WIRING HARNESES

	Paragraph
Introduction	159
Major wiring harnesses	160

159. INTRODUCTION (fig. 112).

a. The electrical wiring system in this vehicle is made up of various circuits consisting of the ignition circuit, starting circuit, generating circuit, turret traversing motor system, gun firing circuits, siren circuit, steering gear motor circuit, fire detector circuit, and various light circuits, all of which operate on 24 volts. The interphone circuit operates on 12 volts. The heat indicators, oil pressure gages and gasoline gage and their respective units are 6-volt instruments, the voltage being reduced from 24 to 6 volts by the use of adapters at the gages in the instrument panel. The blackout driving light circuit uses 24 volts to the resistor, located on the inside of the front of the hull between the steering gear and the front of the hull, which reduces the voltage to 6 volts from the resistor to the blackout driving lamp.

160. MAJOR WIRING HARNESES.

a. **Introduction.** The major wiring harnesses consist of the 24-volt supply harness that leads from the master switch box to the instrument panel, and then harnesses that lead out of the instrument panel. To assist the reader in understanding the various electrical circuits, these major harnesses are explained and illustrated, giving the name of the circuit, color of wire, and "AN" connector code.

b. **Instrument Panel to Master Switch Box Supply Harness (fig. 113).** The instrument panel to master switch box supply harness contains the 24-volt supply line which leads from the master switch box to the right side of the instrument panel. This lead supplies the current for all of the circuits in the instrument panel, except the ammeters.

c. **Instrument Panel to Master Switch Box Ammeter Harness (fig. 114).** The instrument panel to master switch box ammeter harness leads from the master switch box to the right side of the instrument panel. This harness contains the wires which connect the ammeters in the instrument panel to the ammeter shunts in the master switch box. *NOTE: A common negative wire is used for all three ammeters.*

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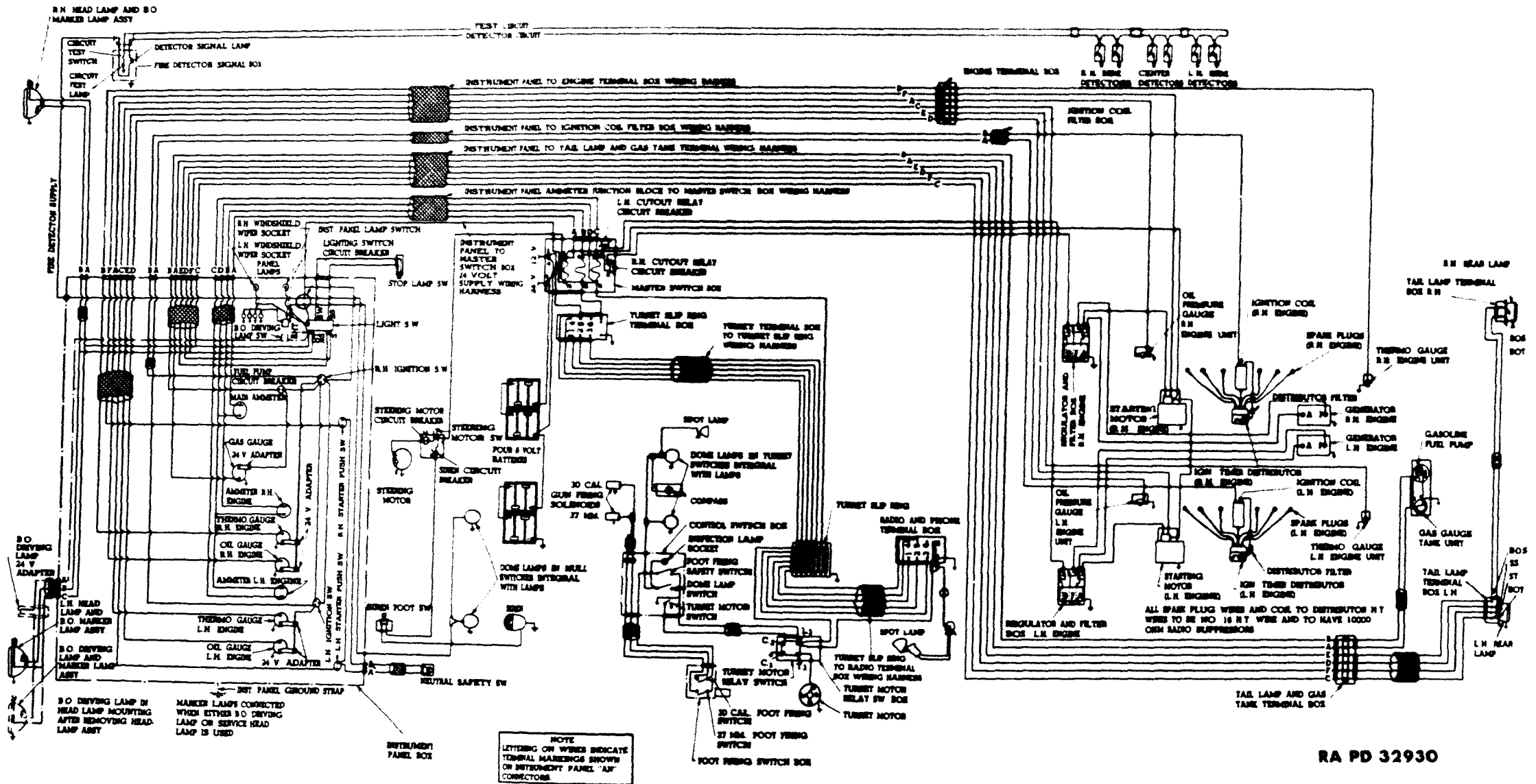


Figure 112 — Wiring Diagram

WIRING HARNESSES

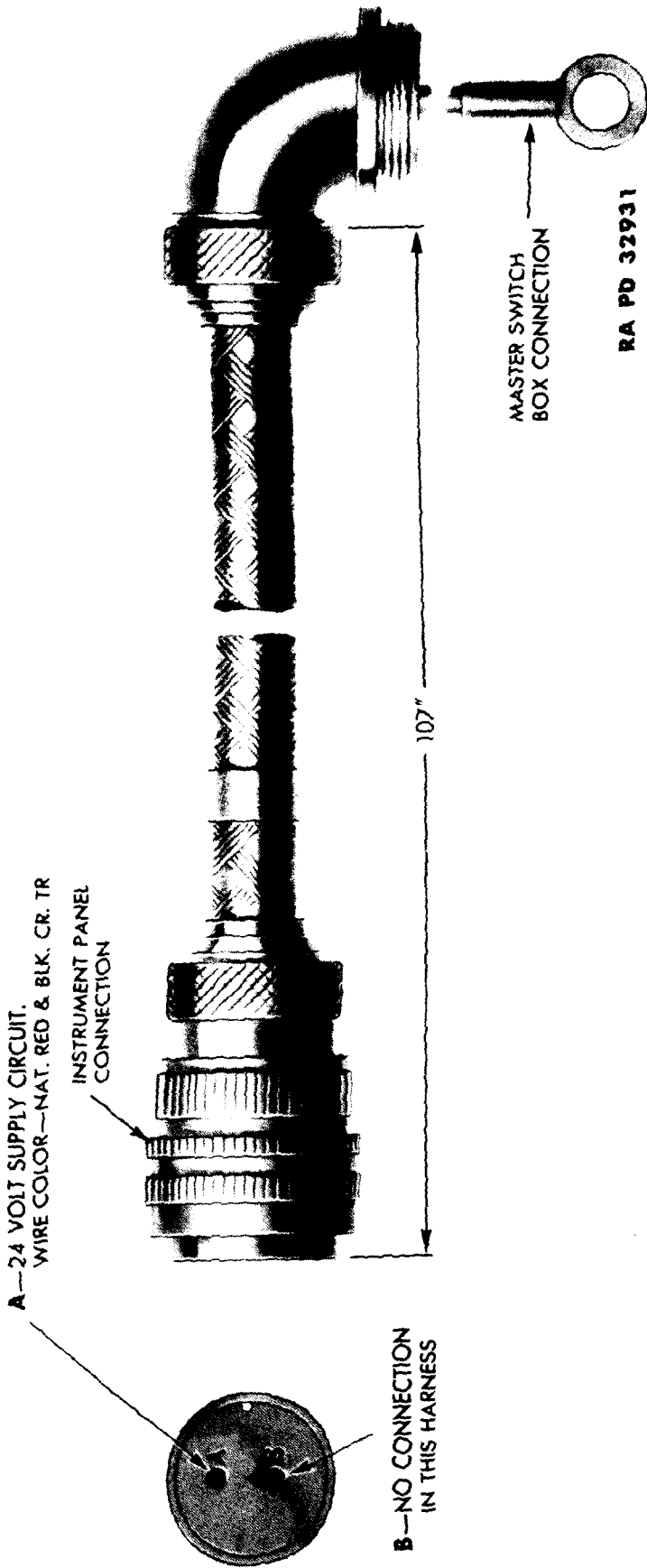
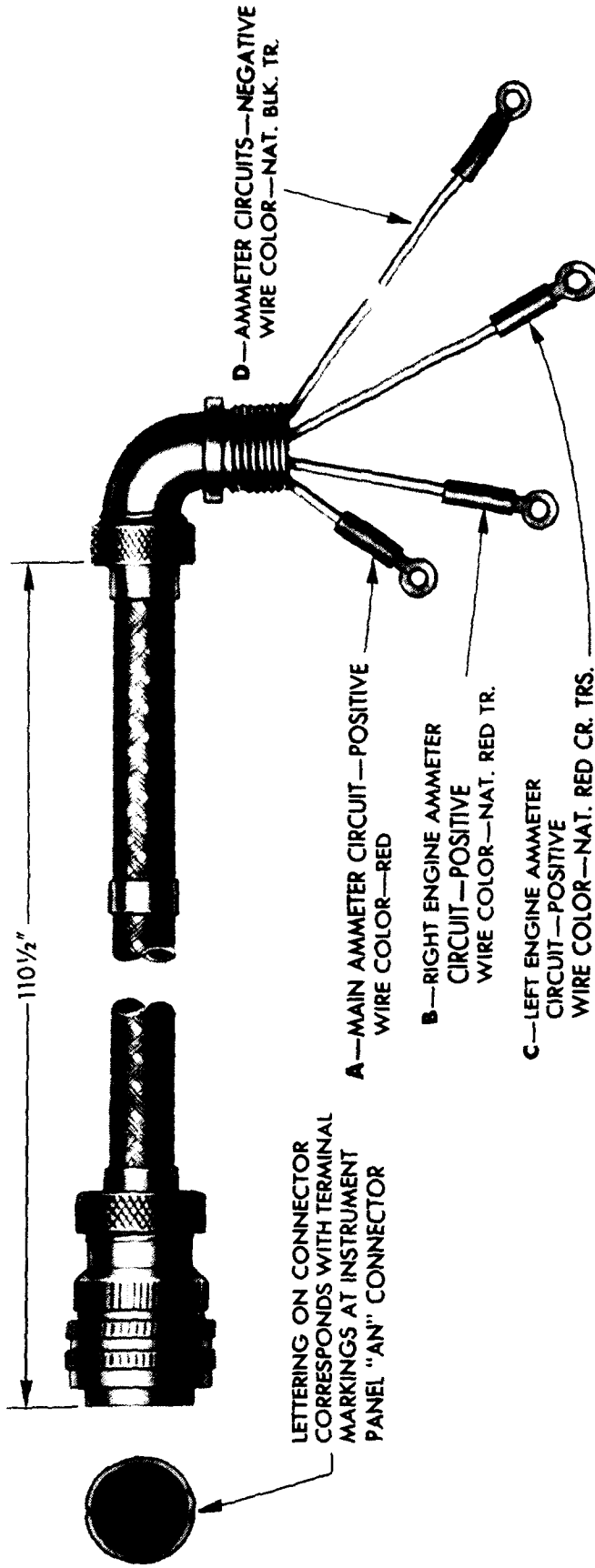


Figure 113 — Instrument Panel to Master Switch Box Supply Wiring Harness

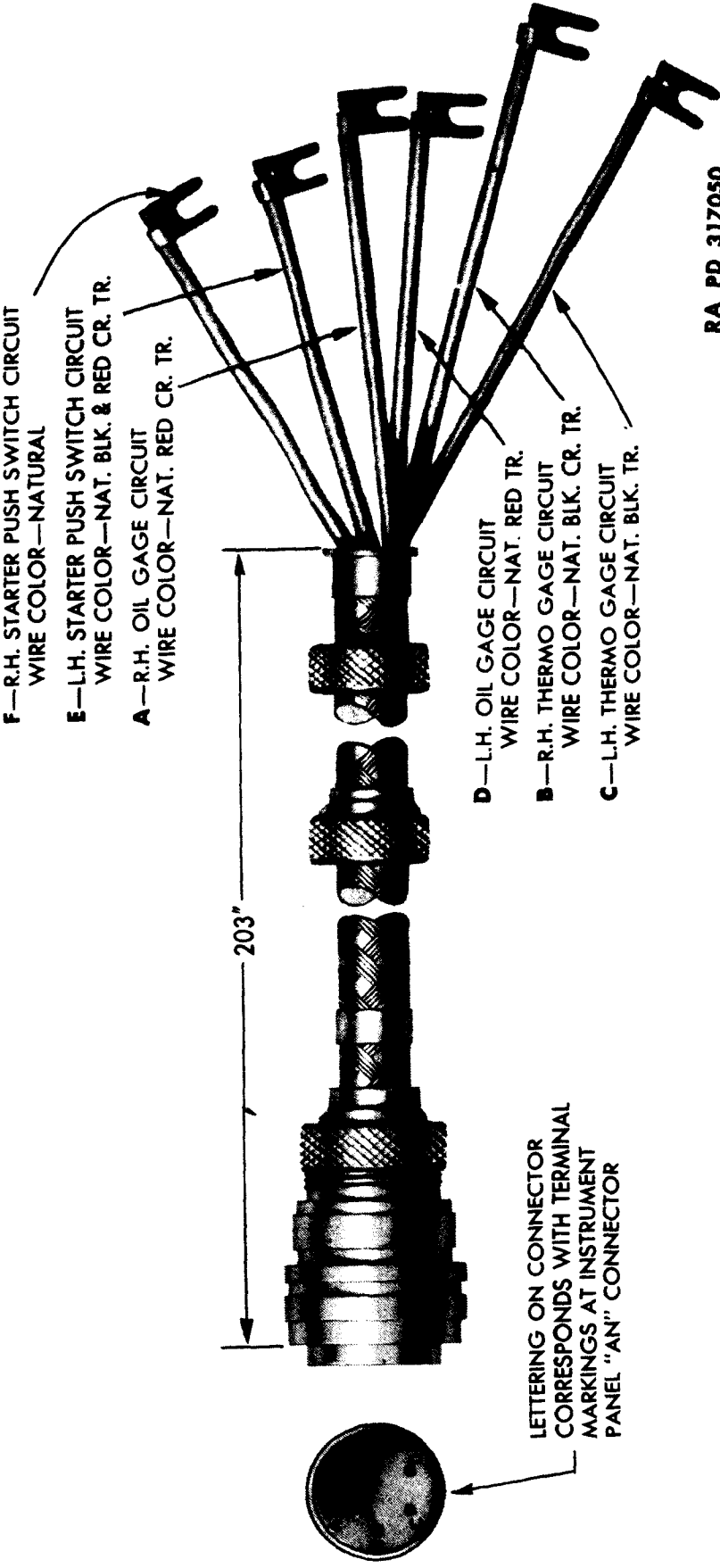
ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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RA PD 32925

Figure 114 — Instrument Panel to Master Switch Box Ammeter Wiring Harness

WIRING HARNESSES



F—R.H. STARTER PUSH SWITCH CIRCUIT
WIRE COLOR—NATURAL

E—L.H. STARTER PUSH SWITCH CIRCUIT
WIRE COLOR—NAT. BLK. & RED CR. TR.

A—R.H. OIL GAGE CIRCUIT
WIRE COLOR—NAT. RED CR. TR.

D—L.H. OIL GAGE CIRCUIT
WIRE COLOR—NAT. RED TR.

B—R.H. THERMO GAGE CIRCUIT
WIRE COLOR—NAT. BLK. CR. TR.

C—L.H. THERMO GAGE CIRCUIT
WIRE COLOR—NAT. BLK. TR.

203"

LETTERING ON CONNECTOR
CORRESPONDS WITH TERMINAL
MARKINGS AT INSTRUMENT
PANEL "AN" CONNECTOR

RA PD 317050

Figure 115 — Instrument Panel to Engine Terminal Box Wiring Harness

**ORDNANCE MAINTENANCE – CHASSIS, HULL, AND TURRET FOR
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d. **Instrument Panel to Engine Terminal Box Harness** (fig. 115). The instrument panel to engine terminal box harness leads from the right side of the instrument panel to the engine terminal box, which is located on the left side of the center partition in the engine compartment. This harness supplies the current to the engine oil gage units, the engine temperature indicator thermo units, and the starter solenoid relay switches located on top of the starting motors.

e. **Instrument Panel to Ignition Filter Box Harness** (fig. 116). The instrument panel to ignition filter box harness leads from the right side of the instrument panel to the ignition filter box, which is located on the right side of the center partition in the engine compartment. This harness supplies the current to the ignition coils.

f. **Instrument Panel to Tail Lamp and Gas Tank Terminal Box Harness** (fig. 117). The instrument panel to tail lamp and gas tank terminal box harness leads from the right side of the instrument panel to the tail lamp and gas tank terminal box, which is located on the left side of the hull in the engine compartment. This harness supplies the current to the gas tank fuel pump, gas gage, tank unit, tail and stop lamps.

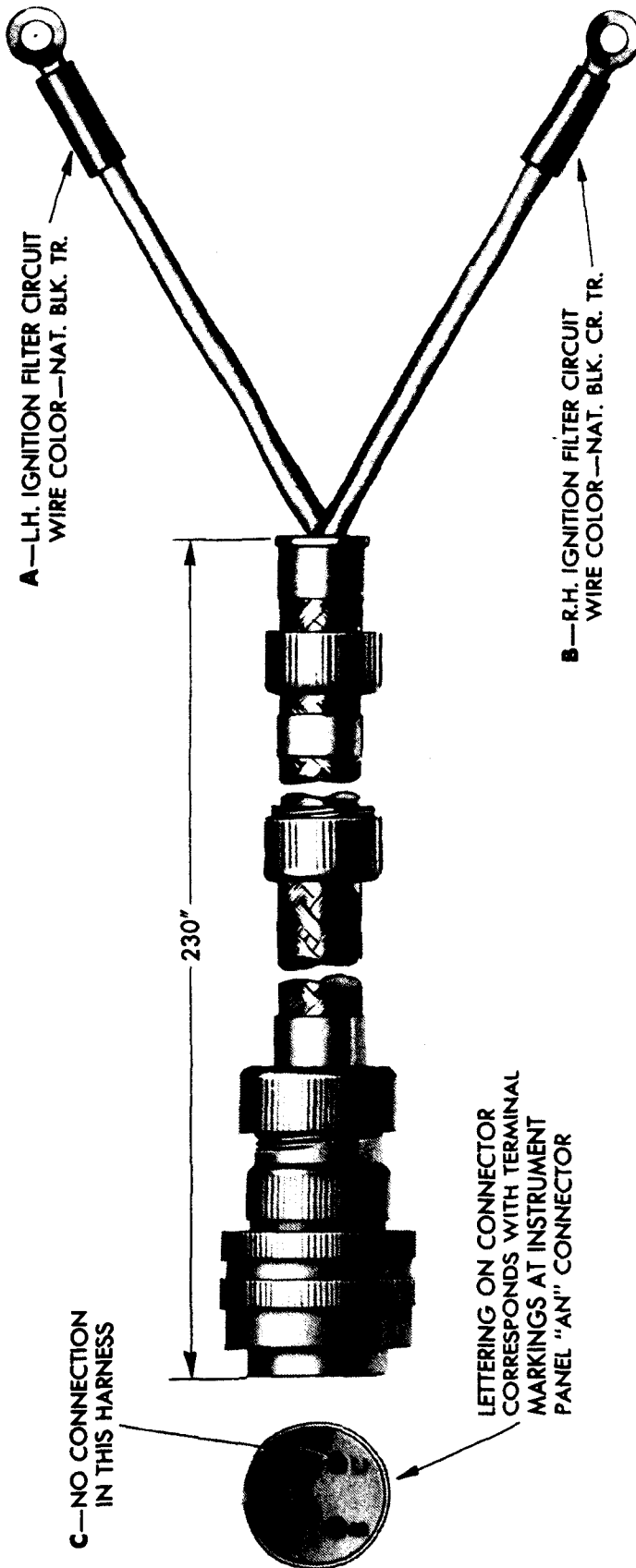
g. **Fire Detector Main Wiring Harness** (figs. 118, 119, and 120). The fire detector main wiring harness leads from the right side of the instrument panel to the detector signal box between the two windshield openings, and then to the jumper harness and the two side harnesses in the engine compartment. These harnesses supply the current to the six fire detectors in the engine compartments, and the detector lamp and test lamp in the detector signal box.

h. **Instrument Panel to Right-hand Head Lamp Harness** (fig. 121). The instrument panel to right-hand head lamp harness leads from the right side of the instrument panel to the right-hand head lamp mounting bracket. This harness supplies the current to the right-hand head lamp and marker lamp.

i. **Instrument Panel to Dome Lamp Harness** (fig. 122). The instrument panel to dome lamp harness leads from the upper left corner of the instrument panel to the two dome lamps in the driver's compartment, and supplies the current to these dome lamps.

j. **Neutral Safety Switch Shield and Cable Assembly** (fig. 123). The neutral safety switch shield and cable assembly leads from the double contact "AN" connection at the upper left corner of the instrument panel to the neutral safety switch which is located at the top of transmission manual control lever. The neutral safety switch is connected in series with the starter push buttons to prevent the starters from turning over when the transmission manual control lever is not in "neutral" position.

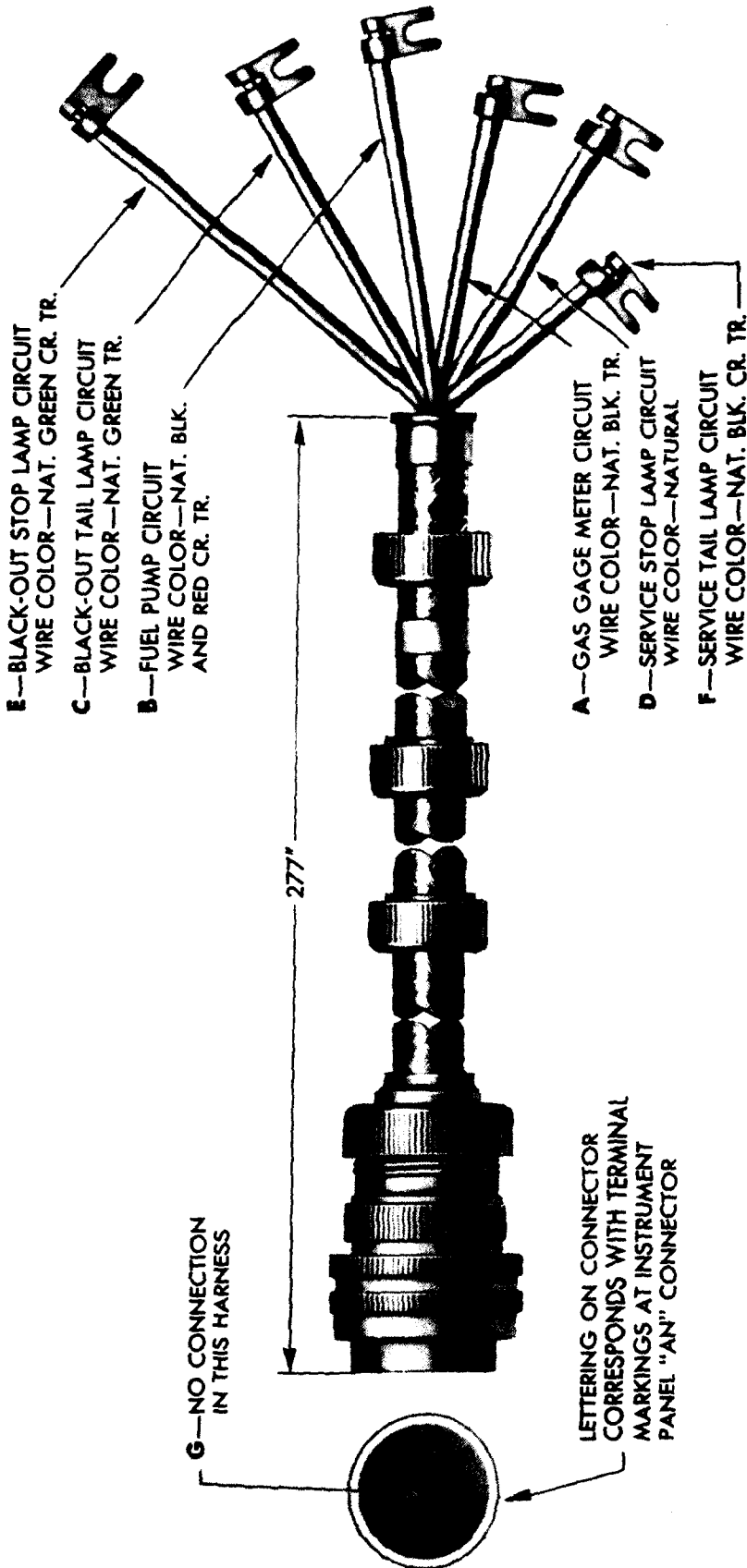
WIRING HARNESSES



RA PD 32926

Figure 116 — Instrument Panel to Ignition Filter Box Wiring Harness

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RA PD 317046

Figure 117 — Instrument Panel to Tail Lamp and Gas Tank Terminal Box Wiring Harness

WIRING HARNESSES

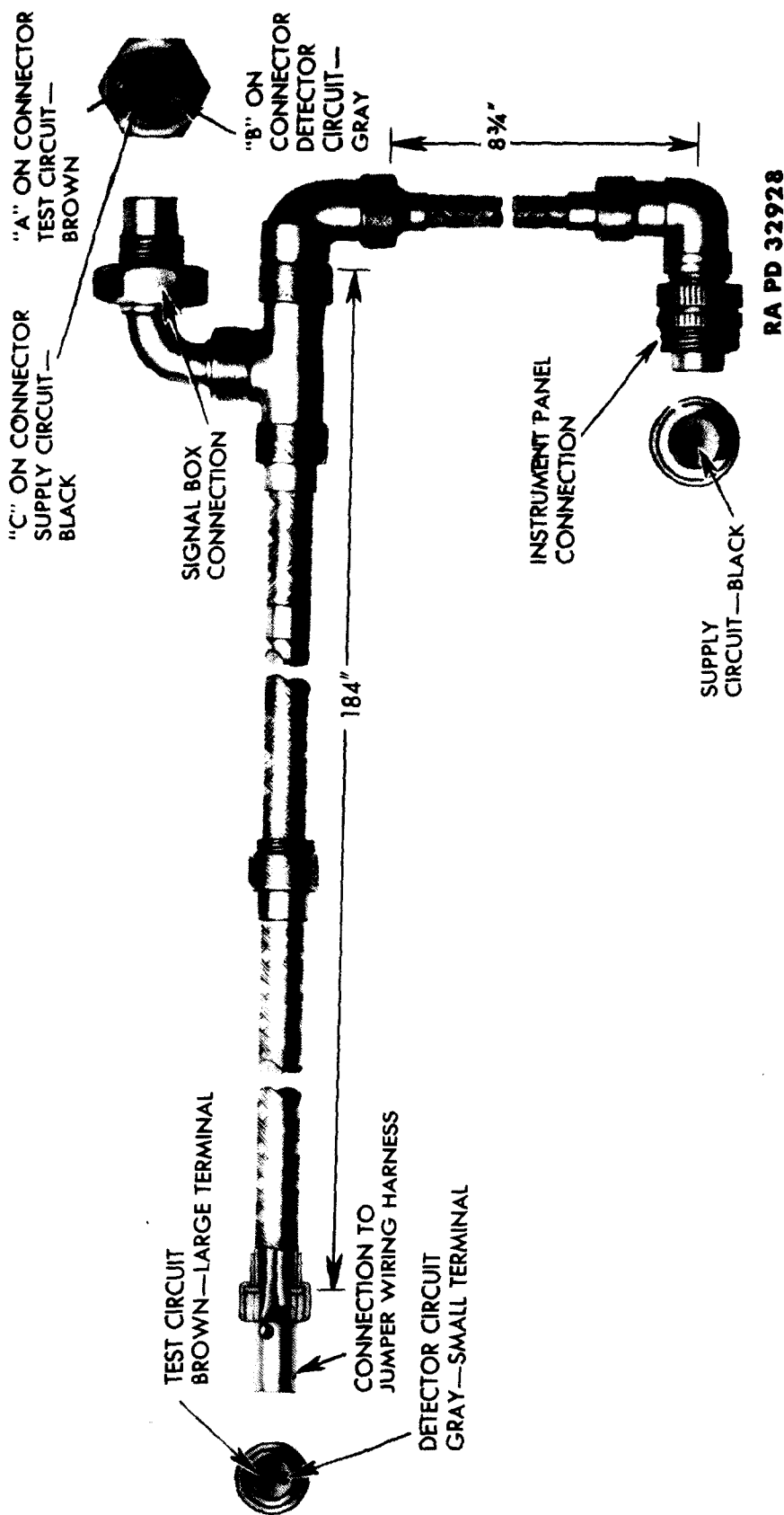


Figure 118 — Fire Detector Main Wiring Harness

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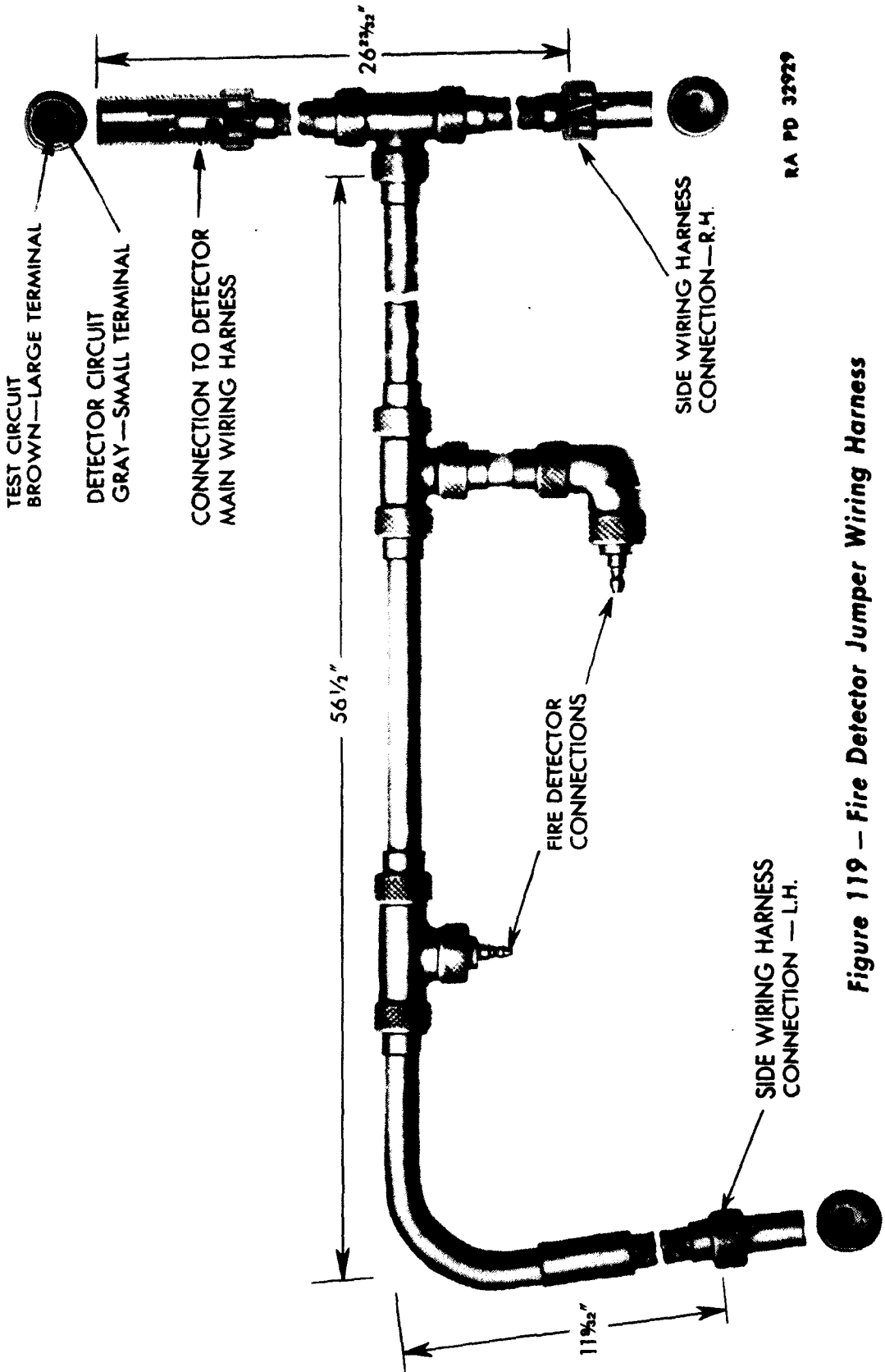
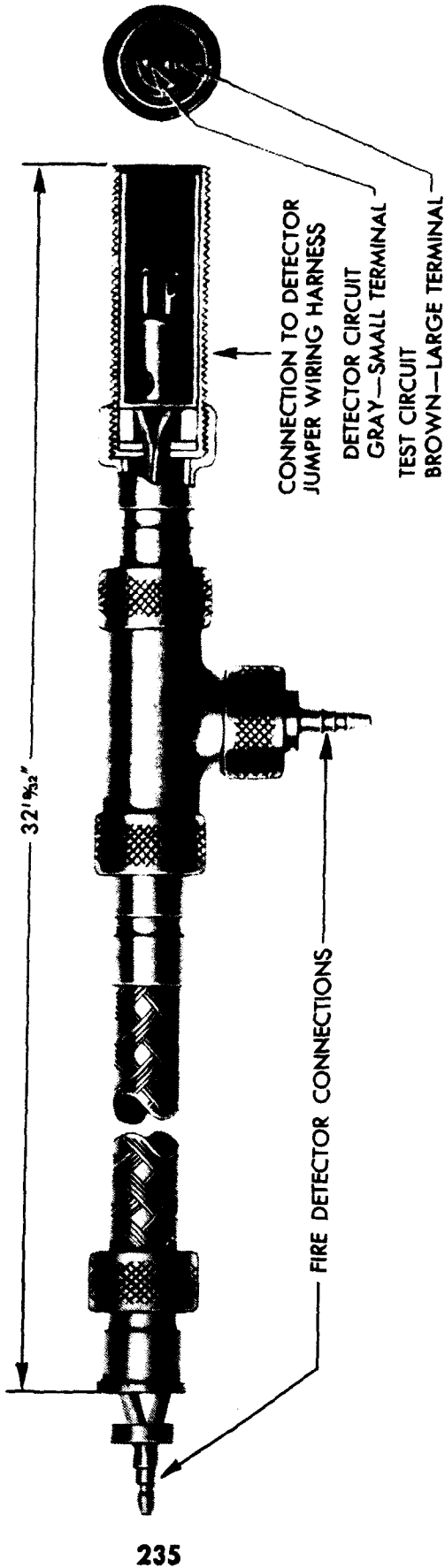


Figure 119 — Fire Detector Jumper Wiring Harness

WIRING HARNESES



RA PD 32924

Figure 120 — Fire Detector Side Wiring Harness

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k. **Instrument Panel to Left-hand Head Lamp Harness** (fig. 124). The instrument panel to left-hand head lamp harness leads from the bottom of the instrument panel to the left-hand head lamp mounting bracket. This harness also has a tee connector which leads to the resistor located on the inside of the front of the hull between the steering gear and the front of the hull. This harness supplies the current to the left-hand head lamp and marker lamp, also to the blackout driving lamp, through the resistor which reduces the voltage to the blackout driving lamp to 6 volts.

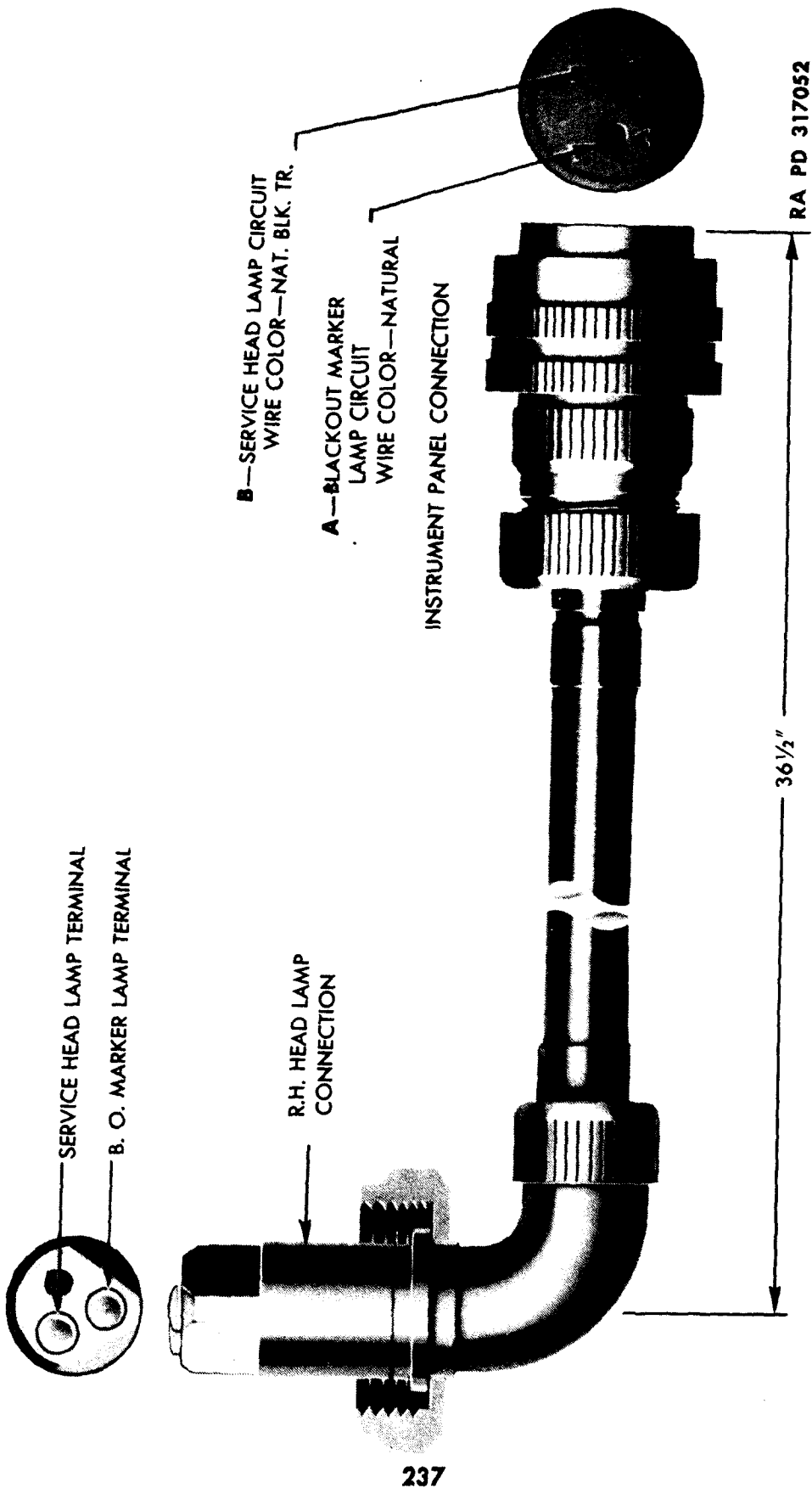
l. **Instrument Panel to Stop Lamp Switch Harness** (fig. 125). The instrument panel to stop lamp switch harness leads from the "SS" and "SW" terminals on the main light switch to the stop lamp switch located on the brake master cylinder. The connectors on the stop lamp switch end of the wires are sleeves which push over the terminals on the stop lamp switch.

m. **Turret Slip Ring Terminal Box to Turret Slip Ring Harness** (fig. 126). The current to the turret terminal box is supplied through a short harness leading from the master switch box. This harness contains two wires, one wire carrying the 24-volt supply to the positive terminal in the terminal box, and the other the 12-volt supply to the No. 5 terminal in the terminal box. The turret slip ring terminal box to turret slip ring harness (fig. 126) leads from the turret terminal box to the five upper rings in the turret slip ring, located in the center of the floor in the basket.

n. **Turret Slip Ring to Radio and Phone Terminal Box Harness** (fig. 127). The turret slip ring to radio and phone terminal box harness leads from the upper five slip ring brushes to the radio and phone terminal box, located at the top and rear of the basket. The wires and terminals are numbered 1, 2, 3, 4, and 5, and are used to connect the interphone system and radio connections between the turret slip ring terminal box and the phone and radio terminal box. The No. 5 terminals are the 12-volt supply. These circuits do not have any effect on the operation of the vehicle.

o. **Master Switch Box to Turret Slip Ring and Radio and Phone Box 24-Volt Supply Cables.** A cable leads from the lower right-hand corner of the master switch box to the next to the lowest slip ring in the center of the basket, and another cable leads from the brush lead on the slip ring to the traversing motor relay switch box, located alongside of the traversing motor. This cable feeds the current to the traversing motor. Another cable leads from the traversing motor relay switch box to the radio and phone terminal box and is connected to the positive terminal in the terminal box.

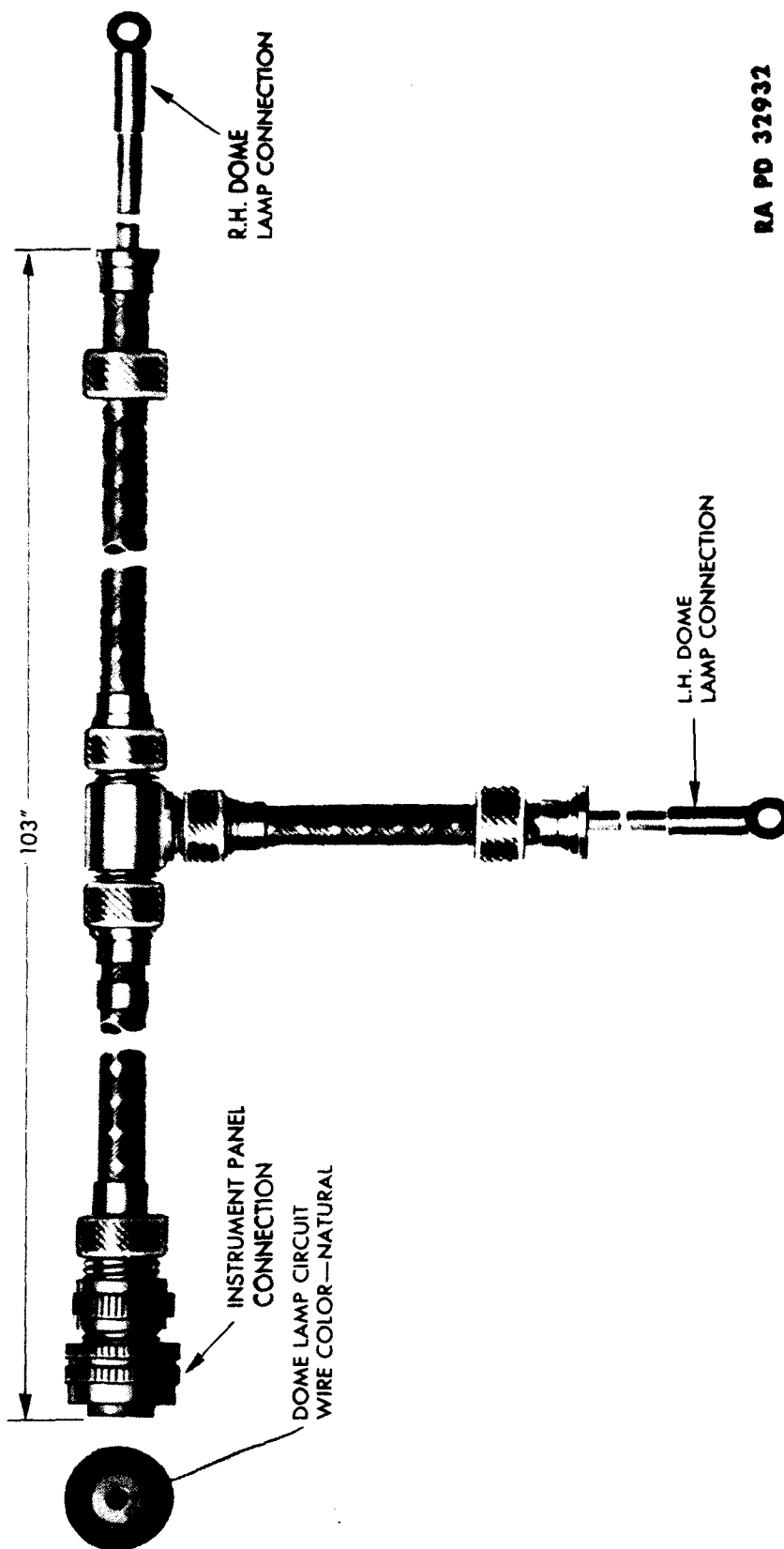
WIRING HARNESSES



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Figure 121 - Instrument Panel to Right Hand Headlamp Wiring Harness

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Figure 122 — Instrument Panel to Dome Lamp Wiring Harness

WIRING HARNESSES

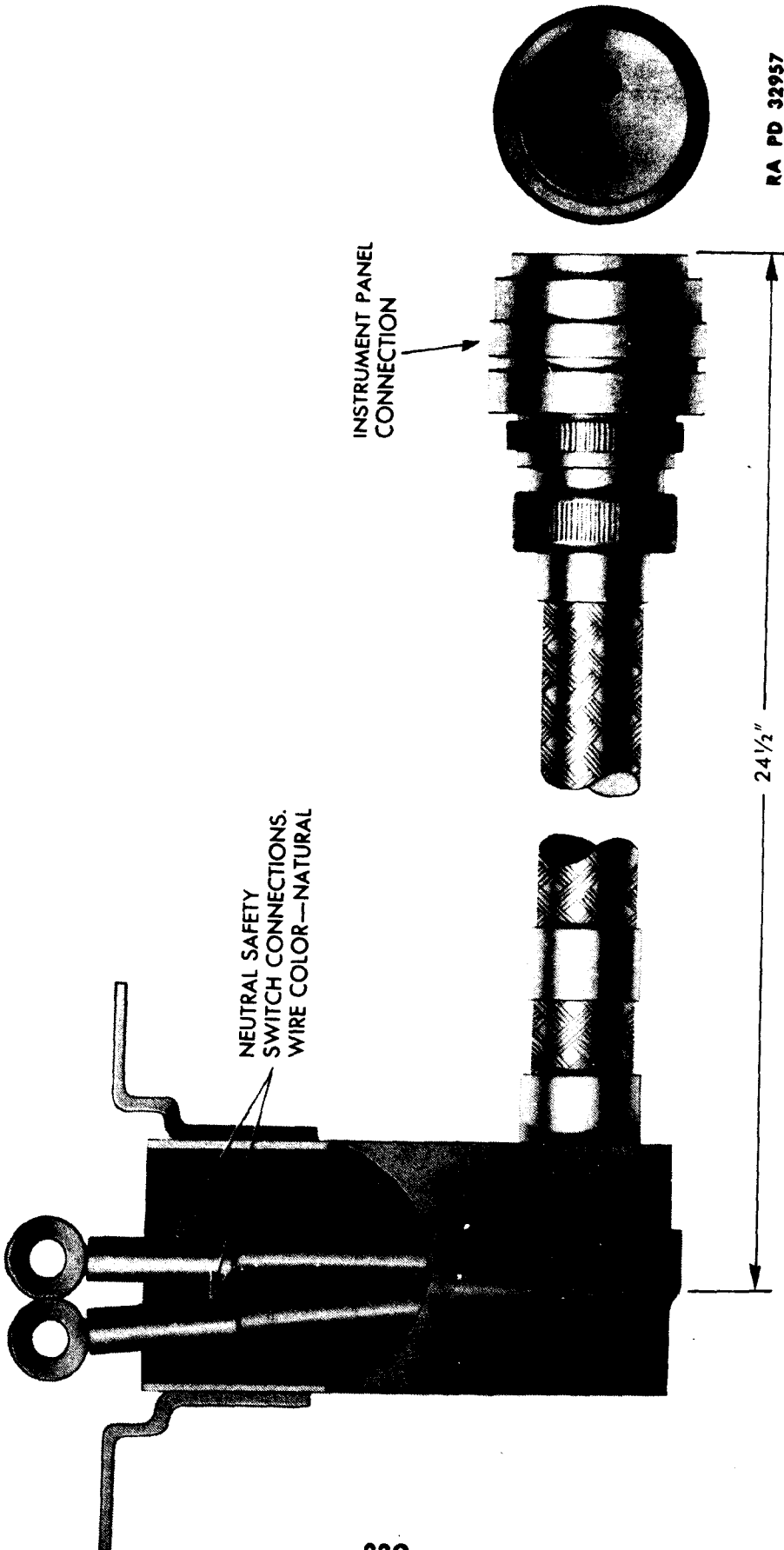
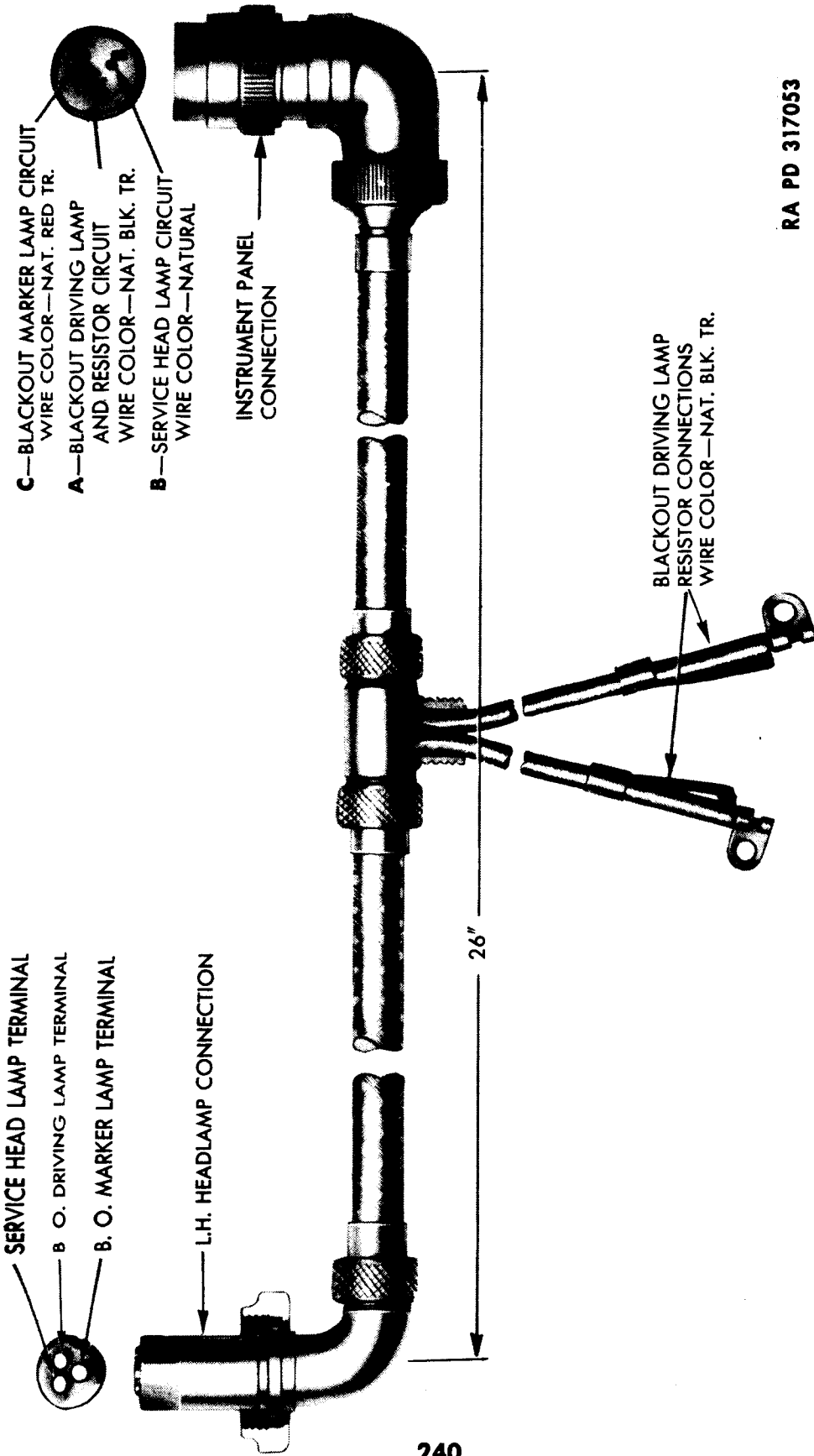


Figure 123 — Instrument Panel to Neutral Safety Switch Wiring Harness

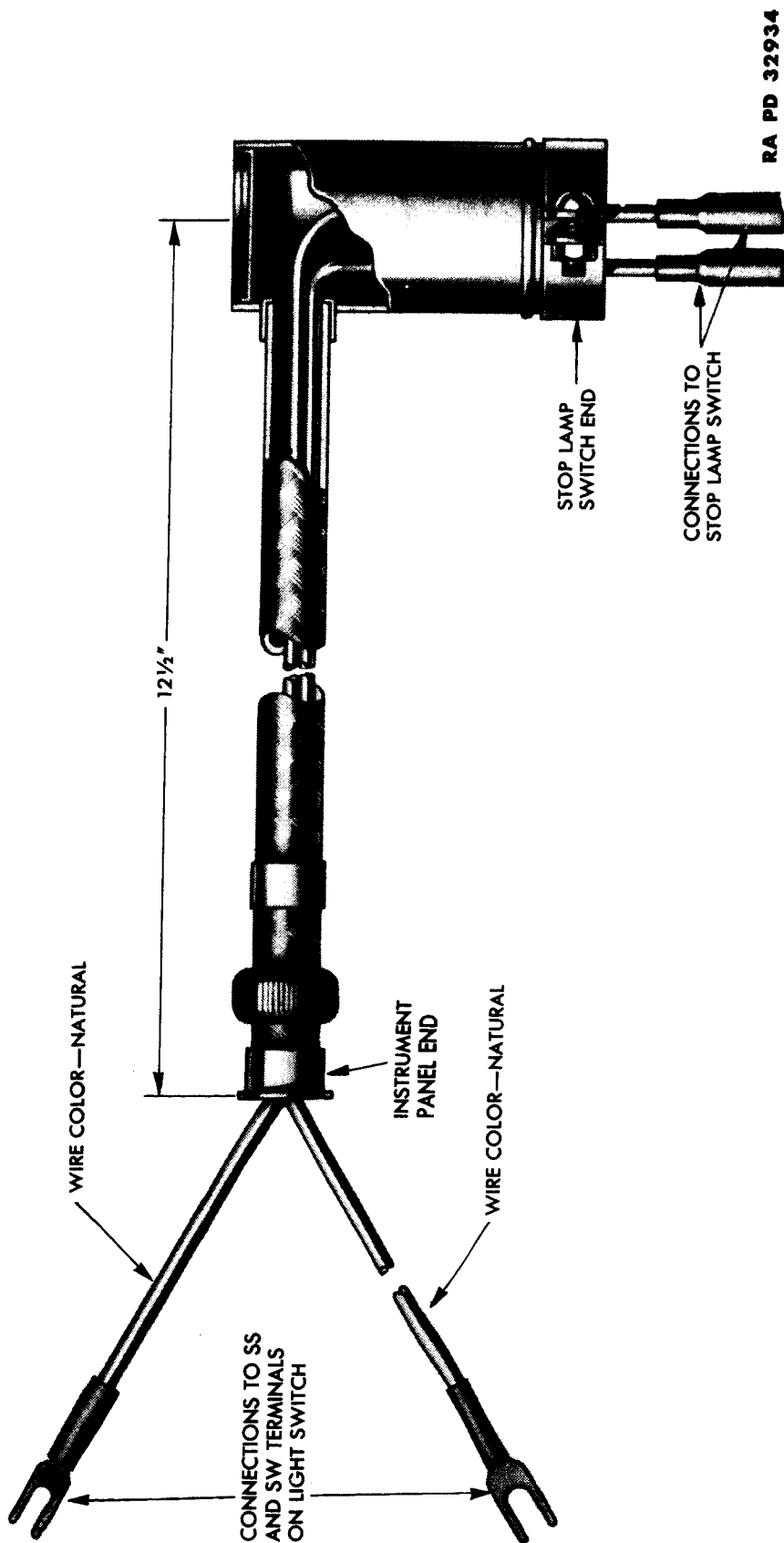
ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
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RA PD 317053

Figure 124 — Instrument Panel to Left Hand Headlamp Harness

WIRING HARNESES



RA PD 32934

Figure 125 — Stop Lamp Switch and Cable Assembly

TM 9-1741C
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ORDNANCE MAINTENANCE — CHASSIS, HULL, AND TURRET FOR
MEDIUM ARMORED CAR T17E1

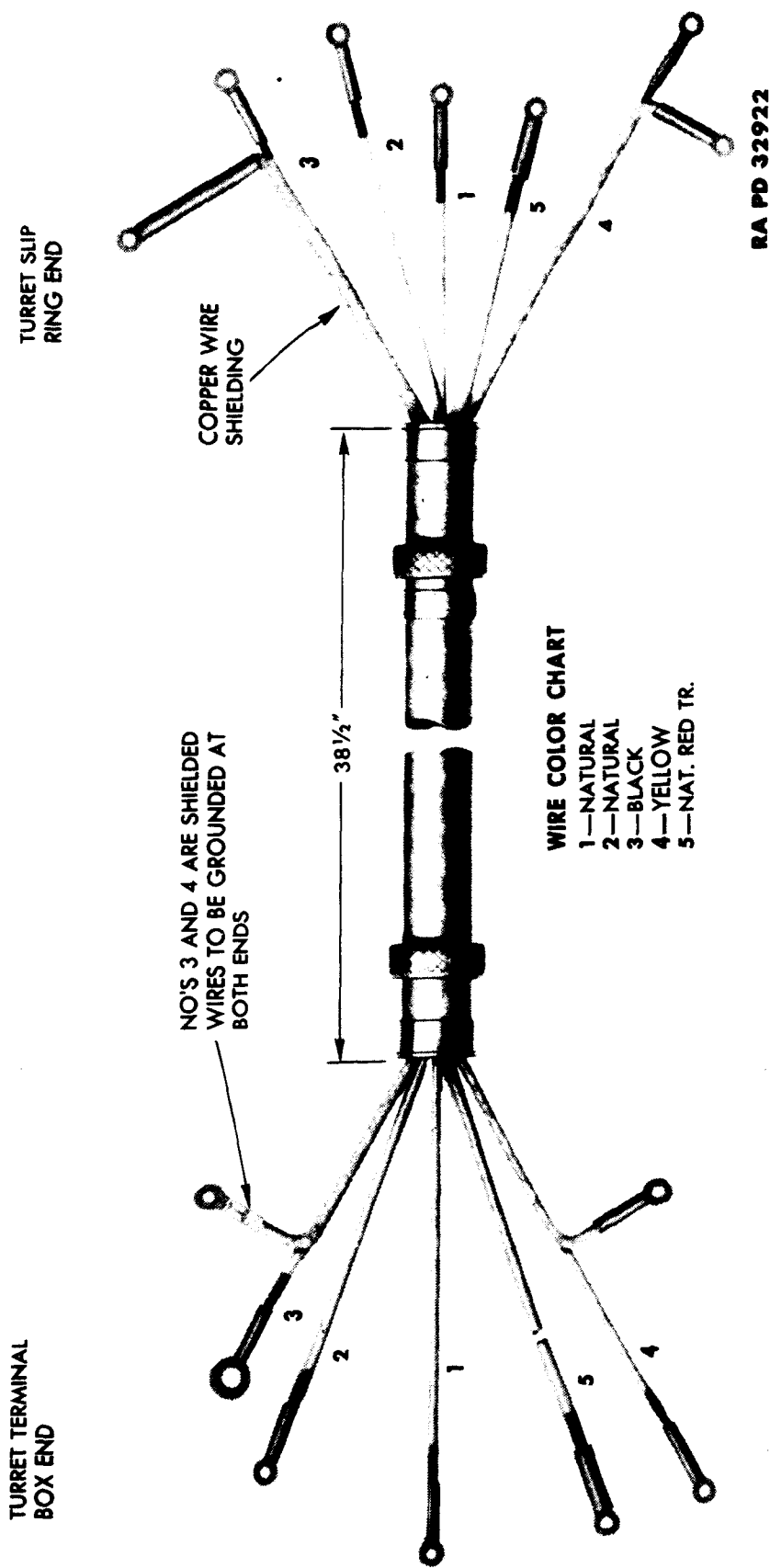


Figure 126 — Terminal Box to Turret Slip Ring Wiring Harness

WIRING HARNESSES

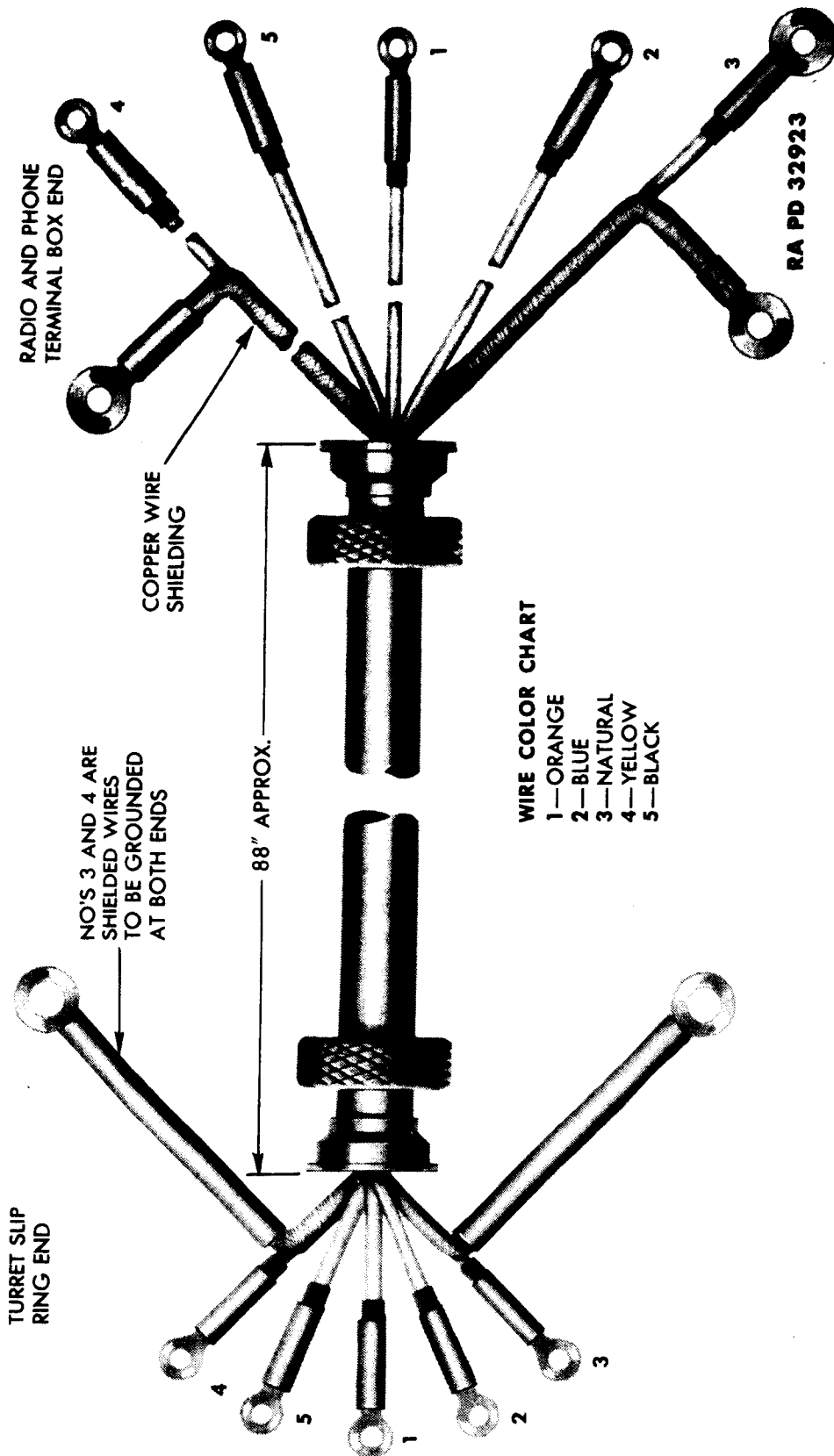


Figure 127 — Turret Slip Ring to Radio and Phone Terminal Box Wiring Harness

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CHAPTER 10

ELECTRICAL WIRING (Cont'd)

Section IV

CHECKING ELECTRICAL CIRCUITS

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161. INTRODUCTION.

a. Before checking any of the electrical circuits the reader should familiarize himself with the various harnesses and circuits. Paragraphs 159 and 160 explain and illustrate the wiring diagram and the major wiring harnesses. The following methods for checking individual circuits outline a simple procedure requiring a minimum of test equipment.

162. PRELIMINARY CHECK.

a. The current to the various circuits leading from the instrument panel is furnished to the instrument panel through the 24-volt supply harness (fig. 113). To determine if the current is available at the instrument panel, turn on the instrument panel lights. If the panel lights operate, it would indicate that current is supplied to the instrument panel, and the circuits leading from the instrument panel can be checked individually. Check the specific gravity of the battery electrolyte in each battery. If the gravity is below 1.250, replace or recharge the batteries. Check the battery terminals to see that they are not corroded, and that the terminals are tight.

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163. CHECKING STARTER CIRCUITS.

a. **Right-hand Engine.** Place the transmission manual control lever in neutral to close the safety switch, and turn on the 24-volt master switch; then push the right-hand engine starter button. If the starter fails to crank the engine, remove the cover from the engine terminal box in the engine compartment and connect the positive lead of a voltmeter (30-volt capacity) to the terminal that retains the natural-colored wires to the terminal block, and connect the negative lead of the voltmeter to a good ground. Then, while pressing the right-hand engine starter button, note the reading of the voltmeter. The voltmeter should read 24 volts. This would indicate that the circuit is in good condition up to the engine terminal box. The next step in checking is to remove the two natural-colored wires from the terminal block in the engine terminal box, and connect the positive lead of an ammeter (30-ampere) to the wire from the instrument panel, also the negative lead to the wire leading to the starter relay, then push the right starter switch button and check the ammeter reading, which should be 30-amperes. If the ammeter reads zero, check the terminals at the relay switch, armature terminal on voltage regulator and generator positive terminal for looseness; should they be found tight the trouble is in the starter assembly, and it should be replaced. If when checking with the voltmeter at the engine terminal box the voltmeter reading was zero, the first step is to disconnect safety switch wiring harness from the instrument panel, then connect the "A" and "B" terminals on the instrument panel with a jumper wire; push the starter switch button and check the voltmeter reading. If the reading is now 24 volts the trouble is in the safety switch and it should be replaced. If the reading is still zero, connect the safety switch wiring harness to the instrument panel and disconnect the heat indicator, oil pressure, and starter relay wiring harness from the instrument panel by unscrewing the "AN" connector, then make a check with a voltmeter at the terminal marked "F" while pressing on the right starter switch button. If the reading is 24 volts, the trouble is in the wiring harness, and it will have to be replaced or a new wire pulled into the conduit. On the other hand, if the voltmeter should read zero, the trouble is in the instrument panel, and it will be necessary to remove the panel and locate the trouble within the panel with a test lamp.

b. **Left-hand Engine.** To locate the reason for the starter failing to crank the left engine, make the same checks as outlined in paragraph 163 a with the following exceptions: The *left* starter switch button must be used. The color of the wires at the engine terminal box is *natural with black and red cross tracer*. The code letter for the left starter relay circuit at the instrument panel "AN" connector is "E".

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a. **Short Circuit.** Turn on the 24-volt master switch and turn on both ignition switches, then push on the fuel pump circuit breaker reset button located on the right side of the instrument panel. If the circuit breaker kicks out immediately upon releasing the reset button, either the fuel pump or the circuit is shortened. To locate the trouble proceed as follows: Remove the fuel pump and gas gage terminal cover on the gas tank, and disconnect the black and red cross tracer wire from the fuel pump. Again push on the circuit breaker reset button. If the circuit breaker now stays in, the trouble is in the wiring harness which leads from the tail lamp and gas tank terminal box to the fuel pump; in this instance, the black and red tracer wire should be replaced. However, if the circuit breaker kicks out with the wire disconnected from the pump, the next step in checking is to remove the cover from the tail lamp and gas tank terminal box, and disconnect the black and red cross tracer wires from the terminal block. Then, again, push on the circuit breaker reset button. If the circuit breaker now stays in, the trouble is in the wiring harness between the tail lamp and gas tank terminal box, and the fuel pump and the black and red cross tracer wire should be replaced. On the other hand, if the circuit breaker still kicks out, disconnect the instrument panel to tail lamp and gas tank terminal box wiring harness at the instrument panel by unscrewing the "AN" connector. Again push in on the circuit breaker reset button. If the circuit breaker now stays in, the black and red cross tracer wire is shorted in the harness. In this case, either replace the harness or pull in a new wire in the flexible conduit. The fuel pump circuit wire is connected to the "B" terminal on the "AN" connector. However, if the circuit breaker still kicks out, it will be necessary to remove the instrument panel and check the fuel pump circuit in the instrument panel with a test lamp.

b. **Open Circuit.** With the 24-volt master switch and the ignition switches turned on, remove the fuel pump and gas gage terminal cover on the gas tank, then connect the positive lead of a voltmeter to the fuel pump terminal, and the negative lead to ground. Check the voltmeter reading. If the voltmeter reads 24 volts, the fuel pump is open circuited and should be replaced. However, if the voltmeter reads zero, the next step in checking is to remove the tail lamp and gas tank terminal box cover. Then connect the positive lead of the voltmeter to the terminal to which the black and red cross tracer wires are connected, and connect the negative lead to ground. If the voltmeter now reads 24 volts, the wire from the tail lamp and gas tank terminal box and fuel pump is open circuited, and a new wire should be pulled into the flexible conduit. On the other hand, if the voltmeter still reads zero, disconnect the instrument panel to tail lamp and gas tank terminal

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box wiring harness at the instrument panel by unscrewing the "AN" connector. Then connect the positive lead of the voltmeter to the "B" terminal of the "AN" connector on the side of the instrument panel, and connect the negative lead to ground. If the voltmeter now reads 24 volts, the trouble is in the wiring harness, and it will be necessary to either replace the harness or pull a new wire into the flexible conduit. If the voltmeter still reads zero when making the foregoing test, the trouble is in the instrument panel, and it will be necessary to remove the panel and locate the open circuit with a test lamp. NOTE: *The fuel pump should run with only one of the ignition switches turned on.* If the fuel pump does not run when one of the ignition switches is turned off, it will be necessary to remove the instrument panel and check the circuit through the switch that does not turn on the fuel pump.

165. CHECKING HEAT INDICATOR CIRCUITS.

a. **Indicator Reads "Hot" at All Times — Right-hand Engine (caused by short circuit).** Turn on the 24-volt master switch and the right-hand ignition switch; then disconnect the heat indicator wire from the thermo unit on the engine water outlet. If the indicator on the instrument panel now drops back to "cold," the trouble is in the thermo unit on the engine and it must be replaced. If the indicator did not drop to "cold" when the wire was removed from the thermo unit, the next step in checking is to remove the cover from the engine terminal box and disconnect the wires having the black cross tracer from the terminal box. Again check the indicator reading on the instrument panel. If it has now dropped back to "cold," the wire between the engine terminal box and the thermo unit is short-circuited, and a new wire should be pulled into the flexible conduit. However, if the indicator still shows "hot," it will be necessary to remove the instrument panel to engine terminal box wiring harness from the right side of the instrument panel by unscrewing the "AN" connector. Again check the heat indicator reading. If it now shows "cold," the heat indicator wire is shorted in the wiring harness and it will be necessary to either replace the harness or pull in a new black cross tracer wire in the flexible conduit. If, after disconnecting the wiring harness from the instrument panel, the heat indicator still reads "hot," it will be necessary to remove the instrument panel and locate the short in the panel with a test lamp.

b. **Indicator Reads "Cold" at All Times — Right-hand Engine (caused by open circuit).** Turn on the 24-volt master switch and the right-hand ignition switch, disconnect the heat indicator wire from the thermo unit on the engine water outlet, and ground the terminal on the end of the wire on a clean metal surface. Check the heat indicator reading on instrument panel. If it now reads "hot," the thermo unit on the engine water outlet is open-circuited and should be replaced. However, if the indicator still shows "cold," the next step in checking is to remove the cover from the engine terminal box, and,

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using a screwdriver, short from the side of the terminal box to the terminal to which the black cross tracer wires are connected, and again check the heat indicator reading on the instrument panel. If the indicator now shows "hot," the wire between the engine terminal box and the thermo unit is open-circuited, and a new wire should be pulled into the flexible conduit. However, if the indicator still reads "cold," the next step is to remove the instrument panel to engine terminal box wiring harness from the instrument panel by unscrewing the "AN" connector. Then, using a screwdriver, short from the side of the "AN" connector to the "B" terminal in the connector in the instrument panel. If the indicator now reads "hot," there is an open circuit in the wiring harness between the instrument panel and the engine terminal box, and it will be necessary to either replace the wiring harness or pull in a new black cross tracer wire in the flexible conduit. On the other hand, if the indicator still reads "cold" it will be necessary to remove the instrument panel and check for an open circuit in the panel with a test lamp.

c. Checking Heat Indicator Circuits — Left-hand Engine. When checking the heat indicator circuit for the left-hand engine use the same procedure as outlined in paragraph 165 a and b with the following exception: Turn on the *left-hand* ignition switch. The color of the wires at the engine terminal box is *natural* with *black tracer* and the code letter at the "AN" connector is "C".

166. CHECKING OIL PRESSURE GAGE CIRCUITS.

a. Oil Pressure Gage Reads Zero at All Times — Right-hand Engine (caused by short circuit). The first step in checking this condition is to make sure that there is sufficient oil in the engine oil pan by checking the oil level. Turn on the 24-volt master switch and the right-hand ignition switch. Remove the wire from the right-hand engine oil gage unit on the right side of the engine, then check the oil gage reading on the instrument panel. If the gage now shows full pressure, the engine oil gage unit is short-circuited and must be replaced. However, if the oil gage on the instrument panel still shows zero, the next step in checking is to remove the cover from the engine terminal box, and disconnect the red cross tracer wires from the terminal block. Again check the oil gage reading. If it now shows full pressure, the wire between the engine terminal box and the engine oil pressure unit is short-circuited, and a new wire should be pulled into the flexible conduit. If the gage on the instrument panel still shows zero, the next step is to disconnect the instrument panel to engine terminal box wiring harness by unscrewing the "AN" connector at the instrument panel. If the gage now shows full pressure, it will be necessary to either replace the wiring harness or pull in a new red cross wire in the

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flexible conduit. On the other hand, if the gage on the instrument panel still shows zero, it will be necessary to remove the instrument panel and check the circuit with a test lamp.

b. **Oil Pressure Gage Shows "Full" Pressure at All Times — Right-hand Engine (caused by open circuit).** Turn on the 24-volt master switch and the right-hand ignition switch, remove the wire from the engine oil pressure unit, and ground the terminal on the end of the wire on a clean metal surface. Now check the reading on the oil pressure gage on the instrument panel. If the gage now shows zero, the engine oil pressure unit is open-circuited and should be replaced. However, if the oil gage still shows "full" pressure, the next step in checking is to remove the cover from the engine terminal box, and, using a screwdriver, short between the side of the terminal box and the terminals to which the red cross tracer wires are connected. Again check the oil gage, and if it shows zero pressure, the wire between the engine terminal box and the engine oil pressure unit is open-circuited, and a new wire should be pulled into the flexible conduit. If the oil gage still shows full pressure, the next step in checking is to disconnect the instrument panel to engine terminal box wiring harness by unscrewing the "AN" connector at the right side of the instrument panel. Then ground between the side of the "AN" connector and the terminal marked "A" in the connector in the instrument panel. If the pressure gage now reads zero, it will be necessary to either replace the wiring harness or pull in a new red cross tracer wire. If the gage still shows full pressure it will be necessary to remove the instrument panel and locate the open circuit in the panel with a test lamp.

c. **Checking Oil Pressure Gage Circuit — Left-hand Engine.** To check the oil pressure gage circuit for the left-hand engine, proceed in exactly the same manner described in paragraph 166 a and b with the following exceptions: Turn on *left-hand* ignition switch. The color of the wires at the engine terminal box is *natural* with *red tracer* and the code letter at the "AN" connector at the instrument panel is "D".

167. CHECKING GASOLINE GAGE CIRCUITS.

a. **Gasoline Gage Shows "Empty" at All Times (caused by short circuit).** Turn on the 24-volt master switch and the ignition switches, and remove the cover from the fuel pump and the gasoline gage terminals on the gas tank. Then remove the wire from the gasoline gage tank unit. Now check the gasoline gage reading on the instrument panel. If it now shows "full," the gasoline gage tank unit is short circuited and should be replaced. However, if the gage on the instrument panel still shows "empty," the next step in checking is to remove the cover from the tail lamp and gas tank terminal box and disconnect the black tracer wires from the terminal box. Again check

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the gasoline gage reading on the instrument panel. If it now shows "full," the wire between the tail lamp and gas gage terminal box and the gasoline gage tank unit is short-circuited, and a new wire should be pulled into the flexible conduit. On the other hand, if the gage still shows "empty," it will be necessary to disconnect the instrument panel to tail lamp and gas tank terminal box wiring harness from the instrument panel by unscrewing the "AN" connector at the right side of the instrument panel. Again check the gasoline gage reading on the instrument panel. If it now shows "full," the gasoline gage wire is short-circuited, and it will be necessary to either replace the wiring harness or pull in a new black tracer wire. However, should the gage still show "empty," it will be necessary to remove the instrument panel and locate the short circuit in the panel with a test lamp.

b. **Gasoline Gage Shows "Full" at All Times (caused by open circuit).** Turn on the 24-volt master switch and both ignition switches, and remove the cover from the fuel pump and gasoline gage tank unit terminals on the gas tank, and remove the wire from the tank unit terminal. Then ground the terminal on the end of the wire on a clean metal surface, and check the gasoline gage reading on the instrument panel. If the gage now shows "empty," the tank unit is open-circuited and it should be replaced. However, if the gage still shows "full," the next step in checking is to remove the cover from the tail lamp and gas tank terminal box, and, using a screwdriver, short between the edge of the terminal box and the terminal to which the black tracer wires are connected. If the gasoline gage on the instrument panel now reads "empty," the wire between the tail lamp and gas tank terminal box and tank unit is open-circuited, and a new wire should be pulled into the flexible conduit. On the other hand, if the gage still shows "full," it will be necessary to disconnect the instrument panel to tail lamp and gas tank terminal box wiring harness by unscrewing the "AN" connector at the right side of the instrument panel. Then short between the edge of the "AN" connector and "A" terminal in the connector in the instrument panel with a screwdriver. If the gasoline gage now reads "empty," the gas gage wire in the wiring harness is open-circuited, and it will be necessary to either replace the wiring harness or pull in a new black tracer wire. However, if the gasoline gage still shows "full," it will be necessary to remove the instrument panel and locate the open circuit between the gasoline gage and the "AN" connector. The gasoline gage should register with only one of the ignition switches turned on. If the gasoline gage does not work when one of the ignition switches is turned off, it will be necessary to remove the instrument panel and check the circuit through the switch that does not turn on the gasoline gage.

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168. CHECKING BLACKOUT MARKER LAMP AND BLACK-OUT TAIL LAMP CIRCUITS.

a. **Blackout Marker Lamp Fails to Light (caused by short circuit).** Turn on the 24-volt master switch and pull out lighting switch button to blackout position. Push on lighting switch circuit breaker reset button. If the circuit breaker kicks out immediately, this indicates a short circuit in either the blackout head lamp circuit, or the blackout tail lamp circuits. In order to locate the shorted circuit proceed as follows: Remove the right head lamp assembly by pulling release button located just ahead of the assistant driver on the forward bulkhead and lift out the assembly. Again push in on the circuit breaker reset button. If the button now stays in, the trouble is in the right head lamp assembly. However, if the circuit breaker again kicks out, remove the left head lamp assembly by pulling the release button located just ahead of the driver on the forward bulkhead and lift out the assembly. Again push in on the circuit breaker reset button. If the button now stays in, the trouble is in the left head lamp assembly. Should the circuit breaker again kick out, remove the right head lamp wiring harness from the instrument panel by unscrewing the "AN" connector. Again push in on the circuit breaker reset button. If it now stays in, the short is in the right head lamp wiring harness and it should be replaced. If the circuit breaker still kicks out, make the same checks on the left head lamp circuit by disconnecting the left head lamp wiring harness at the instrument panel. If the circuit breaker still kicks out after disconnecting both head lamp wiring harnesses from the instrument panel, the trouble must be in the blackout tail lamp circuit or the blackout stop lamp circuit to the stoplight switch. The next step in locating the short circuit is to remove the connector from the right tail lamp and then push in the circuit breaker reset button. If it now stays in, the trouble is in the right tail lamp assembly. However, if the circuit breaker still kicks out, remove the connector from the left tail lamp assembly. Again push in on the circuit breaker reset button. If it now stays in the left tail lamp is short circuited. If, after removing both connectors, the circuit breaker still kicks out, it will be necessary to remove the cover from the tail lamp terminal box and disconnect the green tracer wires from the terminal block. Again push in on the circuit breaker reset button. If the button now stays in, the short circuit is in the wires from the tail lamp terminal box and tail lamps and it should be replaced. On the other hand, if the circuit breaker still kicks out, remove the cover from the tail lamp and gas tank terminal box, and remove the green tracer wires from the terminal. Again push in the circuit breaker reset button. If it now stays in, the wire between the tail lamp and gas tank terminal box and the tail lamp terminal box is short circuited and should be replaced. However, if the circuit breaker still kicks out, it will be necessary to disconnect the instru-

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ment panel to tail lamp and gas tank terminal box wiring harness from the instrument panel by unscrewing the "AN" connector at the right side of the instrument panel. Again push in the circuit breaker reset button. If it now stays in, the short is in the instrument panel to tail lamp and gas tank terminal box wiring harness and the harness should be replaced or a new green tracer wire should be pulled into the conduit. However, if the circuit breaker still kicks out, disconnect the two leads from the stop lamp switch at the brake master cylinder. Again push in the circuit breaker reset button. If it now stays in, the trouble is in the stop lamp switch and it must be replaced. **NOTE:** *It will be necessary to bleed the entire brake system whenever the stop lamp switch is replaced.* However, if the circuit breaker still kicks out, disconnect the instrument panel to stop lamp switch harness at the bottom of the instrument panel. Again press in on the circuit breaker button; if it now stays in, the trouble is in the wires in the instrument panel to stop lamp switch harness and it will be necessary to pull new wires in the conduit. If the circuit breaker still kicks out, the trouble is in the instrument panel, and it will be necessary to remove the panel and locate the short in the panel with a test lamp.

b. Right-hand Blackout Marker Lamp Fails to Light (caused by open circuit). Turn on the 24-volt master switch and pull the light switch out to the blackout position. If one blackout marker lamp or blackout tail lamp fails to light, the trouble more than likely will be in the sealed units themselves; therefore, the first step would be to replace the unit in the lamp that fails to light and see if this corrects the trouble. If the lamp still fails to light, remove the right head lamp assembly by pulling the release button located just ahead of the assistant driver in the forward bulkhead and lifting out the assembly. Connect the positive lead of a voltmeter to the blackout terminal in the head lamp socket and negative lead to ground. If the voltmeter reads 24 volts, this indicates that the circuit is complete up to the head lamp socket. Examine the contacts on the end of the connector and in the head lamp socket. Sometimes these are worn down, and make poor contact with the contacts in the head lamp socket. This condition may be corrected by building up the contacts with a drop of solder. If the contacts are in good condition, the trouble will be in the lamp assembly and it will be necessary to disassemble the lamp to locate the open circuit. If when checking with the voltmeter the reading was zero, the next step in checking is to disconnect the instrument panel to right head lamp wiring harness from the instrument panel by unscrewing the "AN" connector. Then connect the positive lead of the voltmeter to the "A" terminal on the "AN" connector on the side of the instrument panel and the negative lead to ground. If the voltmeter now reads 24 volts it will be neces-

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sary to either replace the right head lamp wiring harness or pull in a new wire in the flexible conduit. On the other hand, if the voltmeter reads zero while making the above check, the open circuit is in the instrument panel and it will be necessary to remove the panel and locate the open circuit with a test lamp.

c. **Left-hand Blackout Marker Lamp Fails to Light (caused by open circuit).** The procedure for locating an open circuit to the left marker lamp is exactly the same as the procedure given in paragraph 168 a and b, with one exception. The code letter on the "AN" connector terminal is "C" instead of "A."

d. **Blackout Tail Lamp Fails to Light (caused by open circuit).** Turn on the 24-volt master switch, pull the lighting switch out to the blackout position, and disconnect the harness from the tail lamp that does not light. Connect the positive lead of a voltmeter to the terminal in the harness that connects to the lower terminal in the lamp, and connect the negative lead to ground. If the voltmeter reads 24 volts, this indicates that the circuit is complete up to the tail lamp socket. Examine the contacts on the terminal and in the tail lamp socket; sometimes these contacts are worn down and make poor connections. This condition may be corrected by building up the contacts with a drop of solder. If the contacts are in good condition, the trouble is in the lamp assembly and it will be necessary to disassemble the lamp to locate the open circuit. If when checking with the voltmeter, the reading was zero, remove the cover from the tail lamp terminal box and connect the positive lead from a voltmeter to the terminal to which the green tracer wires are connected, and connect the negative lead to ground. If the voltmeter now reads 24 volts, the trouble is in the tail lamp terminal box to tail lamp harness and it should be replaced or a new wire pulled into the conduit. On the other hand, if the voltmeter reads zero when checking at the tail lamp terminal box, remove the cover from the tail lamp and gas tank terminal box and connect the positive lead of a voltmeter to the terminal to which the green tracer wires are connected, and the negative lead to ground. If the voltmeter now reads 24 volts, the wire between the tail lamp and gas tank terminal box and the tail lamp terminal box is open circuited, and it will be necessary to either replace the wiring harness or pull in a new wire in the flexible conduit. However, if the voltmeter still reads zero, the next step in checking is to disconnect the instrument panel to tail lamp and gas tank terminal box wiring harness by unscrewing the "AN" connector. Then connect the positive lead of a voltmeter to the "C" terminal of the "AN" connector on the side of the instrument panel, and the negative lead to ground. If the voltmeter now reads 24 volts, the blackout tail lamp wire is open circuited in the wiring harness, and it will be necessary to either replace the wiring harness or pull in a new green tracer wire in the flexible conduit. If when making the above check the volt-

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meter reading was zero, it will be necessary to remove the instrument panel and locate the open circuit in the panel with a test lamp.

169. CHECKING BLACKOUT STOP LAMP CIRCUIT.

a. **Stop Lamp Fails to Light (caused by short circuit).** Turn on the 24-volt master switch and pull the lighting switch button out to the blackout position. Push in lighting switch circuit breaker reset button to make sure the circuit breaker is closed. Step on the brake pedal to apply the brakes. If the lighting switch circuit breaker kicks out when applying the brakes, the first step in checking is to disconnect the instrument panel to tail lamp and gas tank terminal box from the instrument panel by unscrewing the "AN" connector. Again push in on the light switch circuit breaker reset button, and step on the brake pedal. If the circuit breaker immediately kicks out, the short is more than likely in the stop lamp switch, and it will be necessary to disconnect the stop lamp switch wiring harness and replace the stop lamp switch on the brake master cylinder. *NOTE: After replacing the stop lamp switch it will be necessary to bleed the entire braking system.* On the other hand, if the circuit breaker stays in when applying the brakes with the instrument panel to tail lamp and gas tank terminal box wiring harness disconnected, the short circuit lies beyond the instrument panel, and the next step in checking is to connect the wiring harness to the instrument panel and then remove the cover from the tail lamp and gas tank terminal box and disconnect the green cross tracer wires from the terminal block. Push in on the circuit breaker reset button, and again apply the brakes). If the circuit breaker kicks out, the blackout stop lamp wire in the instrument panel to tail lamp and gas tank terminal box wiring harness is short-circuited, and it will be necessary to either replace the wiring harness or pull in a new green cross tracer wire in the flexible conduit. On the other hand, if the circuit breaker stays in with the green cross tracer wire disconnected at the terminal block, the next step is to install these wires back on the terminal block. Then remove the cover from the tail lamp terminal box and disconnect the wires from the terminal block. Again apply the brakes. If the circuit breaker kicks out immediately, the wire between the tail lamp and gas tank terminal box and tail lamp terminal box is short circuited, and it will be necessary to either replace the wiring harness or pull in a new green cross tracer wire. However, if the circuit breaker does not kick out, install the green cross tracer wires back on the terminal block in the tail lamp terminal box, and then disconnect both blackout stop lamp connectors at the stop lamp. Then again push in the circuit breaker reset button and apply the brakes. If the circuit breaker kicks out immediately, it will be necessary to replace the wires from the tail lamp terminal box to the

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blackout stop lamps. On the other hand, if the circuit breaker stays in, connect one stop lamp connector at a time, push in the circuit breaker reset button and apply the brakes. This procedure will locate which blackout stop lamp is short-circuited.

b. Stop Lamp Fails to Light (caused by open circuit). Turn on the 24-volt master switch, pull the lighting switch button out to the blackout position, and push in on the lighting switch circuit breaker reset button to make sure the circuit breaker is closed. Replace the blackout tail lamp units to make sure that the cause for open circuit is not burned-out bulbs. Then remove the cover from the tail lamp terminal box, connect positive lead of a voltmeter to the terminal to which the green cross tracer wires are connected, and connect the negative lead to ground. Apply the brakes and check the voltmeter reading. If the voltmeter reads 24 volts, the circuit is complete up to the tail lamp terminal box, but the wires between the tail lamp terminal box and the blackout tail lamps are open circuited and should be replaced. On the other hand, if the voltmeter reading is zero, the next step in checking is to remove the cover from the tail lamp and gas tank terminal box, and connect the positive lead of the voltmeter to the terminal to which the green cross tracer wires are connected, and the negative lead to ground. Again apply the brakes and check the voltmeter reading. If the voltmeter now reads 24 volts, the circuit is open between the tail lamp and gas tank terminal box and the tail lamp terminal box and it will be necessary to either replace the wiring harness or pull in a new green cross tracer wire in the flexible conduit. However, if the voltmeter still reads zero, disconnect the instrument panel to tail lamp and gas tank terminal box wiring harness by unscrewing the "AN" connector at the instrument panel. Then connect the positive lead of the voltmeter to the "E" terminal in the "AN" connector on the side of the instrument panel, and the negative lead to ground. Again apply the brakes; then check the voltmeter reading. If the voltmeter now reads 24 volts, the blackout stop lamp circuit is open between the instrument panel and the tail lamp and gas tank terminal box, and it will be necessary to either replace the wiring harness or pull in a new green tracer wire in the flexible conduit. On the other hand, if the voltmeter reading is zero, the next step in checking for the open circuit is to slide the shield back on the instrument panel to stop lamp switch wiring harness. Then, using a screwdriver, short the two stop lamp switch terminals together and apply the brakes. Check the voltmeter reading, and if it now reads 24 volts, the stop lamp switch is open circuited and should be replaced. *NOTE: After replacing the stop lamp switch in the brake master cylinder, it will be necessary to bleed the entire braking system.* However, if the voltmeter still reads zero, the trouble is in the instrument panel and it will be necessary to remove the panel and locate the open circuit with a test lamp.

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170. CHECKING SERVICE STOP LAMP CIRCUIT.

a. The procedure for checking the service stop lamp circuit for short or open circuits is identically the same as the procedure for checking the blackout stop lamp circuit, paragraph 169, with the following exceptions: Pull the lighting switch button out all the way to the service stop lamp position. The color of the wires for this circuit at the tail lamp and gas tank terminal box and the tail lamp terminal box is *natural*. The code letter for this circuit at the "AN" connector is "D."

171. CHECKING SERVICE HEAD LAMP AND TAIL LAMP CIRCUITS.

a. The procedure for checking the service head lamp and tail lamp circuits is the same as the procedure for checking the blackout marker lamps and tail lamp circuits, paragraph 168, with the following exceptions: The lighting switch is pulled out to the head lamp bright position. The color of the right head lamp wire is *natural* with *black tracer* and the "AN" connector code letter is "B." The color of the left head lamp wire is *natural* and the "AN" connector code letter is "B." The color of the service tail lamp wire is *natural* with *black cross tracer* and the "AN" connector code letter is "F."

172. CHECKING DOME LAMP CIRCUITS.

a. **Dome Lights in Driver's Compartment Fail to Light (caused by short circuit).** Turn on the 24-volt master switch and then push in on the lighting switch circuit breaker reset button. If the circuit breaker kicks out immediately, this indicates a short-circuit in the dome lamp circuit. To locate the short-circuit, disconnect the instrument panel to dome lamp harness from the instrument panel by unscrewing the "AN" connector at the top left corner of the instrument panel. Again push in on the circuit breaker reset button. If the button now stays in, the trouble is in the wiring harness, and it should be replaced or a new wire should be pulled into the flexible conduit. However, if the circuit breaker still kicks out with the dome lamp harness disconnected, the trouble is in the instrument panel, and it will be necessary to remove the panel and locate the short-circuit within the panel with a test lamp.

b. **Dome Lights in Turret Fail to Light (caused by short circuit).** Turn on the 24-volt master switch and then turn on the dome lamp switch in the turret control switch box. If the switch kicks out immediately, this indicates a short-circuit between the switch and the dome lamps. **NOTE:** *The dome lamp switch is a combination switch and circuit breaker.* It will be necessary to install a new wire in the flexible conduit.

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c. **Dome Lights in Driver's Compartment Fail to Light (caused by open circuit).** Turn on the 24-volt master switch and the dome lamp switches. Remove the dome lamp lenses and bulbs and connect the positive lead of a voltmeter to the terminal in the bulb socket and the negative to ground and make sure that the switches on the dome lamps are turned on. If the voltmeter reads 24 volts, the bulbs are burned out and must be replaced. If the voltmeter reads zero, disconnect the dome lamp harness "AN" connector at the instrument panel and connect the positive lead of a voltmeter to the terminal in the connector in the instrument panel. If the voltmeter reads 24 volts, the trouble is in the harness or the dome lamp switches, and they should be disconnected and tested with a test lamp. However, if the voltmeter reads zero, the trouble is in the instrument panel, and the panel should be removed and the circuit within the panel checked with a test lamp.

d. **Dome Lights in Turret Fail to Light (caused by open circuit).** Turn on the 24-volt master switch and the dome lamp switch on the turret control switch box. Then remove the dome lamp lens assembly and make sure that the switch in the dome lamp is turned on. Remove the bulb, connect the positive lead of a voltmeter to the terminal in the bulb socket, and the negative lead to ground. If the voltmeter reads 24 volts, the bulb is burned out and must be replaced. If the voltmeter reads zero, remove the turret control switch box cover and connect the positive lead of a voltmeter to the top terminal of the dome lamp switch. If the voltmeter reads 24 volts, the trouble is in the harness leading to the dome lamps, and a new wire should be pulled into the flexible conduit. However, if the voltmeter reads zero, connect the positive lead of the voltmeter to the lower terminal on the switch. If the voltmeter reads 24 volts, the combination switch and circuit breaker is open-circuited and should be replaced.

173. CHECKING TURRET MOTOR CIRCUIT.

a. **Circuit Breaker Kicks Out (caused by short circuit).** Turn on the 24-volt master switch, then turn on the turret motor switch located on the turret control switch box. If the circuit breaker kicks out, this indicates a short in the circuit. To locate the short, remove the cover plate from the back of the turret motor and disconnect the power input lead from the turret motor, making sure the wire does not touch any metal while it is disconnected. Then turn on the turret motor switch again and if the circuit breaker does not kick out, the short is in the motor and it should be removed and repaired. If the circuit breaker still kicks out, remove the cover from the turret motor relay switch box and disconnect the wire from the "TI" terminal. Turn on the switch again, and if the circuit breaker stays in, the trouble is in the conduit leading from the relay switch to the turret

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motor. However, if the circuit breaker still kicks out, the trouble is in the relay switch, and it should be replaced.

b. Turret Motor Fails to Operate (caused by open circuit). Turn on the 24-volt master switch, then remove the cover from the motor relay switch box and connect the positive lead of a voltmeter to the "LI" terminal and the negative lead to ground. If the voltmeter reads zero, the trouble is probably in the slip ring which should be checked for worn, stuck or dirty brushes. However, if the voltmeter reads 24 volts, this indicates that the circuit from the battery to relay switch box is complete. Then connect the positive lead of a voltmeter to the "C2" terminal in the relay switch box, and connect the negative to ground; then hold the motor switch "on" and note the reading on the voltmeter. If the voltmeter reads 24 volts, the circuit through the motor switch on the turret control switch box is complete. However, if the voltmeter reads zero, the trouble is in the motor switch or the wires leading to the switch. If the voltmeter reads 24 volts when connected to the "C2" terminal, connect the positive lead of the voltmeter to the "TI" terminal and hold the motor switch "on" while reading the voltmeter. If the voltmeter reads zero, the relay switch or the circuit breaker is open-circuited, and the unit should be replaced. However, if the voltmeter reads 24 volts, remove the cover plate from the back of the motor and connect the positive lead from the voltmeter to the power input terminal on the motor, and the negative lead to ground. If the voltmeter reads zero, the wire from the relay switch to the motor is open-circuited and should be replaced. However, if the voltmeter reads 24 volts, the motor is open-circuited and it should be removed and repaired.

174. CHECKING GUN FIRING SWITCH CIRCUITS.

a. Preliminary Procedure. Before attempting to check the gun firing circuits, as a precautionary measure, make sure that both the 37-mm. gun and the caliber .30 machine gun are not loaded.

b. Gun Solenoids Fail to Operate (caused by short circuit). Turn on the 24-volt master switch, then turn on the foot firing safety switch on the turret control switch box. If either or both of the solenoids operate without stepping on the foot firing switches, this would indicate a short-circuit in the wires leading to the foot firing switches, or in the switches themselves. Turn off the safety switch. To locate the short, remove the cover from the foot firing switch box with the foot firing switches attached. Then remove the black wire from the terminal on the right-hand switch, making sure that the wire does not touch any metal. Then turn on the safety switch again, and if neither of the gun firing solenoids operate, the trouble is in the foot firing switch itself, and it should be replaced. However, if either

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of the solenoids still operate, the short is in the wires leading from the safety switch to the gun foot firing switch, and new wires should be pulled into the metal conduit.

c. **Gun Solenoids Fail to Operate (caused by open circuit).** Turn on the 24-volt master switch and the foot firing safety switch on the turret control switch box. Unscrew the connections on the gun solenoids on the two guns. Connect the positive lead of a voltmeter to the terminal on the end of the wire that was connected to the 37-mm gun, and the negative lead from the voltmeter to ground. Hold down the left foot firing switch and note the reading of the voltmeter. If the voltmeter reads 24 volts, the solenoid is open-circuited and must be replaced. Then make the same test on the terminal that was connected to the caliber .30 gun and hold down the right foot firing switch while reading the voltmeter. If the voltmeter reads zero in either case, remove the cover from the turret control switch box and connect the positive lead of the voltmeter to the terminal that has the red wires connected to it on the terminal block in the box. Hold down the left foot firing switch and note the reading on the voltmeter. If the voltmeter reads 24 volts, the wire from the terminal block to the solenoid is open-circuited and a new wire should be pulled into the conduit. Then make the same test on the terminal to which the yellow wires are connected, and press on the right foot firing switch. If the voltmeter reads zero in either case, remove the cover from the foot firing switch box with the switches attached, and connect the positive lead of the voltmeter to the terminal to which the red wire is connected. Hold down the foot firing switch and note the reading on the voltmeter. If the voltmeter reads 24 volts, the wire from the foot firing switch to the terminal block is open-circuited and a new red wire should be pulled into the conduit. Then make the same test on the terminal to which the yellow wire is connected. If the voltmeter reads zero, connect the positive lead of the voltmeter to the terminal on the other side of the left-hand switch. If the voltmeter reads 24 volts, the switch is open-circuited and must be replaced. Then make the same test on the other switch. However, if the voltmeter reads zero, connect the positive lead of the voltmeter to the upper terminal of the safety switch. If the voltmeter reads 24 volts, the wire from the safety switch to the foot firing switches is open-circuited and a new wire should be pulled into the conduit. However, if the voltmeter reads zero, connect the voltmeter to the lower terminal of the safety switch. If the voltmeter reads 24 volts, the safety switch is open-circuited and must be replaced. If the voltmeter reads zero when connected to the lower terminal of the safety switch, remove the cover from the turret motor relay switch box and connect the positive lead of the voltmeter to the "LI" terminal and the negative lead to ground. If the voltmeter reads 24 volts, the wire from the relay switch to the safety switch is open-circuited, and a

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new wire should be pulled into the conduit. However, if the voltmeter reads zero, the trouble is probably in the slip ring, caused by worn, stuck or dirty brushes.

175. CHECKING IGNITION CIRCUIT.

a. **Right-hand Engine.** Before making any checks on the ignition system first make sure that there is gasoline in the tank and that the fuel pump is operating. Then turn on the 24-volt master switch and the right-hand ignition switch. A quick check of the ignition system should be made by removing a spark plug wire from the spark plug and holding it about one-quarter of an inch from the engine block. Push the starter switch button and check the spark at the end of the spark plug wire. If the ignition system is in good condition, a good healthy spark will jump from the end of the wire to the engine block, and the trouble will be either in the fuel system, ignition timing or valve adjustment. If no spark occurs during the above test, remove the distributor cap and dust shield, and hand crank the engine by turning the fan blades until the distributor arm cam follower is on a peak of the cam. Remove the high-tension wire from the center of the distributor cap, and hold the terminal end approximately one-quarter inch away from the cylinder block. Then, using a screwdriver, make and break an electrical contact between the distributor housing and the breaker arm. If a spark now occurs, the trouble is in the distributor points and they should be either cleaned or replaced. If the distributor points are badly burned, this will be an indication that the condenser has lost some of its capacity, and it should also be replaced. If no spark occurs, the primary circuit should be checked progressively with a voltmeter. Connect the positive lead of a voltmeter to the distributor arm, and the negative lead to ground. If the voltmeter reads 24 volts, it proves that the primary circuit is complete up to the distributor points, and a faulty coil is indicated. On the other hand, if the voltmeter reads zero, connect the positive lead of the voltmeter to the primary terminal on the side of the distributor housing. If the voltmeter now reads 24 volts, the trouble is in the distributor (more than likely the insulation is broken down). Should the voltmeter still read zero, the next step in testing is at the screw in the center of the resistance unit on top of the coil. If the voltmeter reads 24 volts, the primary winding in the coil is open-circuited and the coil should be replaced. If the voltmeter reads zero, move the positive lead of the voltmeter to the primary terminal on the coil resistance unit. Should the voltmeter now read 24 volts, the coil resistance unit is burned out and it must be replaced. If the voltmeter reads zero, the next step in testing is to connect the positive lead of the voltmeter to the filter terminal in the ignition filter box located on the right side of the center partition between the two

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engines. If the voltmeter now reads 24 volts, the wire between the filter box and coil is open-circuited and should be replaced. On the other hand, if the voltmeter reads zero, remove the cover from the filter box and connect the positive lead of the voltmeter to the filter terminal to which the black cross tracer wire is connected and the negative lead to ground. If the voltmeter now reads 24 volts, the filter is open circuited and should be replaced. However, should the voltmeter still read zero, it will be necessary to disconnect the instrument panel to ignition filter box wiring harness from the instrument panel by unscrewing the "AN" connector. The next step in testing is to connect the positive lead of a voltmeter to the terminal marked "B" on the instrument panel half of the "AN" connector and the negative lead to ground. If the voltmeter now reads 24 volts, the wire in the harness is open-circuited, and it will be necessary to either replace the wiring harness or pull in a new black cross tracer wire in the flexible conduit. If the voltmeter still reads zero, the trouble is in the instrument panel and it will be necessary to remove the panel and locate the open circuit with a test lamp.

b. **Left-hand Engine.** The procedure for checking the ignition circuit on the left-hand engine is identically the same as that described in paragraph 175 for the right-hand engine, with the following exceptions: The color of the wire in the wiring harness is *natural* with *black tracer* and code letter on the "AN" connector is "A".

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REFERENCES

STANDARD NOMENCLATURE LISTS.

Car, armored, T17E1 (Chevrolet)	SNL G-122
Cleaning, preserving and lubrication materials, recoil fluids, special oils, and miscellaneous re- lated items	SNL K-1
Soldering, brazing, and welding materials, gases and related items	SNL K-2
Tools, maintenance for repair of automotive ve- hicles	SNL G-27
Tool-sets, motor transport	SNL N-19
Tool-sets, for ordnance service command auto- motive shops	SNL N-30
Current Standard Nomenclature Lists are listed above. An up-to-date list of SNL's is main- tained as the "Ordnance Publications for Sup- ply Index"	OPSI

EXPLANATORY PUBLICATIONS.

Military motor vehicles	AR 850-15
List of publications for training	FM 21-6

Related Technical Manuals.

Car, armored, T17E1 (Chevrolet)	TM 9-741
Ordnance maintenance: Engines, engine acces- sories and fuel system, Medium Armored Car T17E1	TM 9-1741A
Ordnance maintenance: Transmission, transfer case, and steering systems for Medium Ar- mored Car T1E71	TM 9-1741B
Ordnance maintenance: Hydraulic traversing mechanism (Logansport) for medium tank M3 and modifications	TM 9-1750H

Automotive Material.

Automotive electricity	TM 10-580
Electric fundamentals	TM 1-455
The Motor vehicle	TM 10-510

REFERENCES

Care and Preservation.

- Automotive lubrication TM 10-540
- Cleaning, preserving, lubricating, and welding materials and similar items issued by Ordnance Department TM 9-850
- Explosives and demolitions FM 5-25
- Motor transport inspections TM 10-545
- Product guide OFSB 6-2

Decontamination.

- Chemical decontamination materials and equipment TM 3-220
- Decontamination of armored force vehicles FM 17-59
- Defense against chemical attack FM 21-40

Storage and Shipment.

- Registration of motor vehicles AR 850-10
- Rules governing the loading of mechanized and motorized army equipment, also major caliber guns, for the United States Army and Navy, on open-top equipment published by Operations and Maintenance Department of Association of American Railroads.
- Storage of motor vehicle equipment AR 850-18
- Ordnance, field service storage and shipment chart—group G—major items OSSC-G

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