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U.S. Dept. of Army

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

**ENGINE, ENGINE ACCESSORIES,
AND CLUTCH**

FOR LIGHT CARGO CARRIER T24

JULY 2, 1943

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**TECHNICAL MANUAL }
No. 9-1772A**

**WAR DEPARTMENT
Washington, 2 July 1943**

**ORDNANCE MAINTENANCE
ENGINE, ENGINE ACCESSORIES, AND CLUTCH
FOR LIGHT CARGO CARRIER T24**

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T.M. 9-1772A

1772A

Prepared under the direction of the
Chief of Ordnance
(with the cooperation of the Studebaker Corporation)



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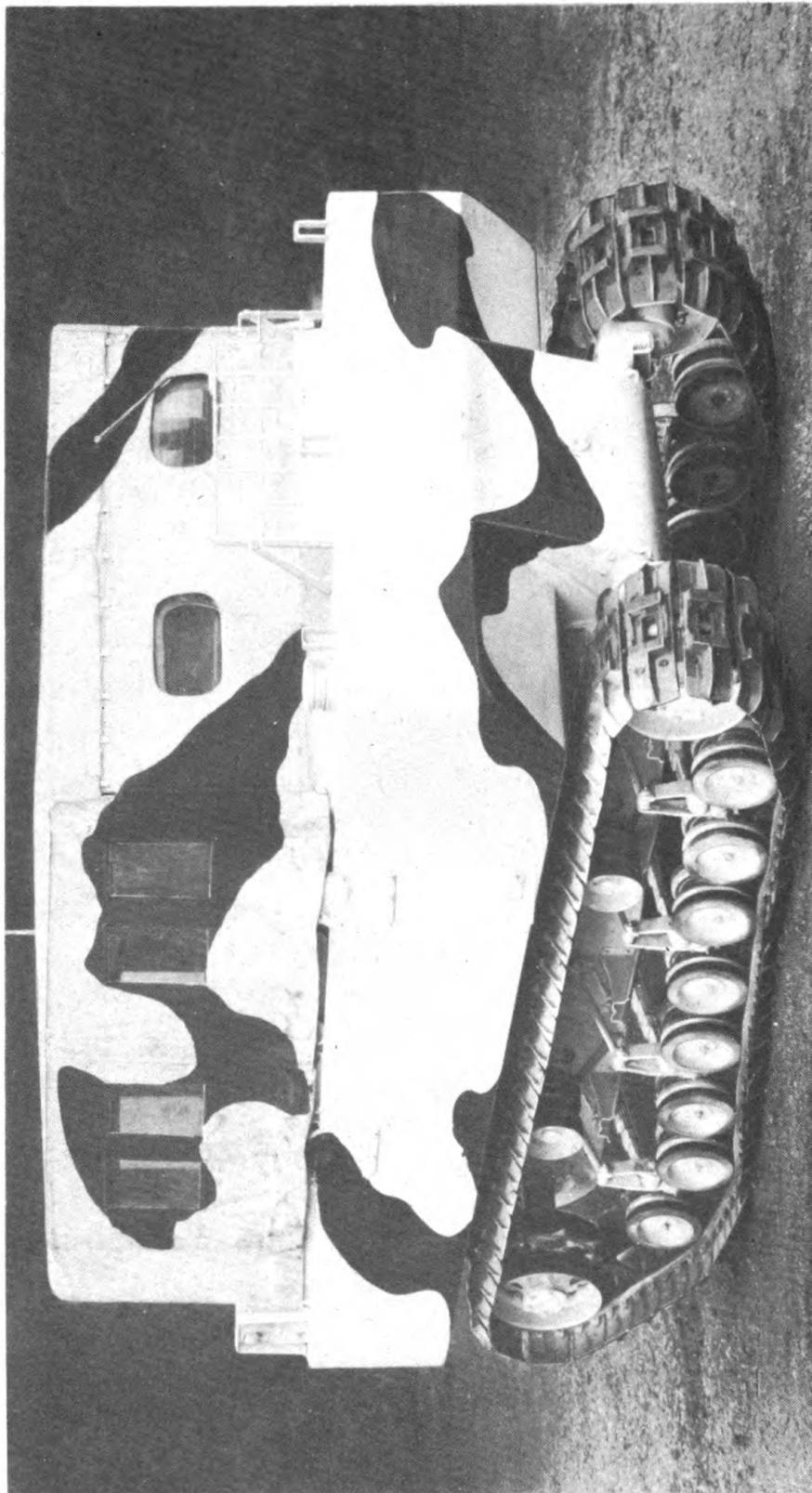
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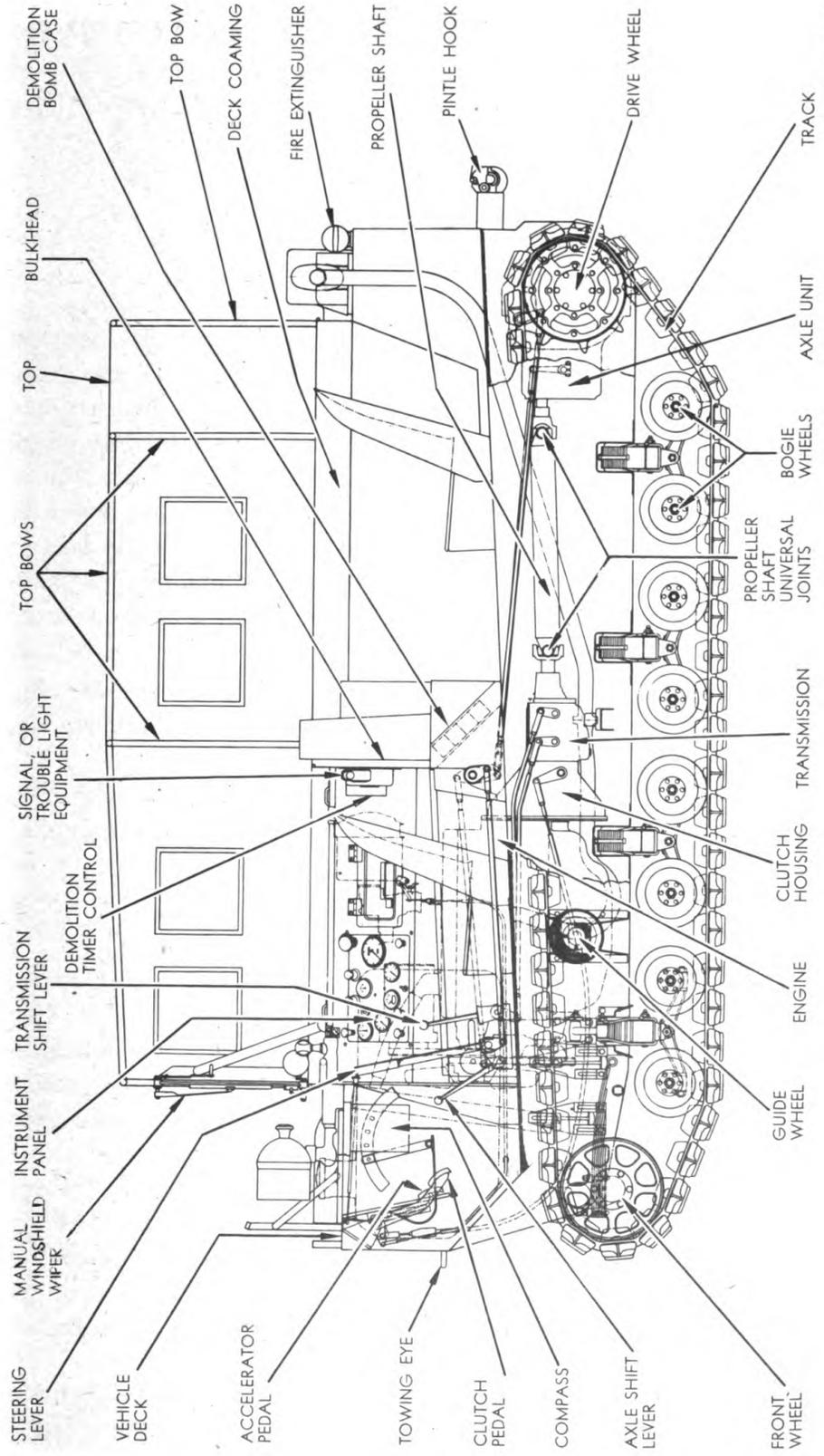
**ORDNANCE MAINTENANCE—ENGINE, ENGINE ACCESSORIES,
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RA PD 67092

Figure 1—Light Cargo Carrier T24—Right Three-quarter Front

INTRODUCTION



RA PD 67116

Figure 2—Light Cargo Carrier T24—Longitudinal Section

**ORDNANCE MAINTENANCE—ENGINE, ENGINE ACCESSORIES,
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CHAPTER 1

INTRODUCTION

	Paragraph
Scope	1
Arrangement	2
Maintenance allocation	3

1. SCOPE.

a. The instructions contained in this manual are for the information and guidance of personnel charged with the maintenance and repair of Light Cargo Carrier T24. Information on the detailed construction of the unit, disassembly and assembly procedure, inspection, maintenance and repair is contained in two Technical Manuals of the 1000-series, of which this is the first volume. These instructions are supplementary to those in the Field and Technical Manuals prepared for the using arm. This manual does not contain information which is intended primarily for the using arm, since such information is available to ordnance personnel in 100-series TM's or FM's.

b. This manual contains a description of, and procedure for removal, disassembly, inspection, and repair of the engine, engine accessories, and clutch.

c. TM 9-1772B contains a description of, and procedure for removal, disassembly, inspection, and repair of the various units comprising the power train, suspension, hull, and hull electrical system.

2. ARRANGEMENT.

a. The subject matter contained in this manual is grouped by chapter, the scope of each being as indicated under "Contents". Because of the complexity and length, a chapter is devoted to the engine and each system of the engine. Sections under certain chapters are numbered consecutively within each chapter. Paragraphs are numbered consecutively throughout the manual.

b. Illustrations of specific operations support and clarify the descriptive matter in the text. Exploded views of the component parts of units show the correct relation of related parts, and aid in identification. Figures are numbered consecutively throughout and located as near as possible to related text. Frequent references to applicable figures are made by number throughout the manual.

c. In this manual, all references to units or parts as to right or left, and front or rear, are made on the basis of the driver's right, left, front, and rear as he sits in the driver's seat facing ahead.

INTRODUCTION

3. MAINTENANCE ALLOCATION.

a. Scope. The scope of maintenance and repair by the crew and other units of the using arms 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. Many second echelon operations are often performed by ordnance personnel.

b. Allocation of Maintenance. 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 maintenance personnel, but may be performed by the using arm personnel when circumstances permit, within the discretion of the commander concerned. 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.
THIRD ECHELON:	Ordnance light maintenance companies, ordnance medium maintenance companies, ordnance divisional maintenance battalions, and post ordnance shops.
FOURTH ECHELON:	Ordnance heavy maintenance companies, and service command shops.
FIFTH ECHELON:	Ordnance base regiments, ordnance bases, arsenals, and manufacturer's plants.
SERVICE: (Including preventive maintenance) par. 23 a (1) and (2) AR 850-15.	Consists of servicing, cleaning, lubricating, tightening bolts and nuts, and making external adjustment of subassemblies or assemblies and controls.
REPLACE: Par. 23 a (4) AR 850-15.	Consists of removing the part, subassembly or assembly from the vehicles and replacing it with a new or reconditioned or rebuilt part, subassembly or assembly, whichever the case may be.
REPAIR: Par. 23 a (3) and (5) in part. AR 850-15.	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 alining or balancing.

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REBUILD: Consists of completely reconditioning
Par. 23 a (5) in and replacing in serviceable condition
part and (6) AR 850-15. any unserviceable part, subassembly, or
assembly of the vehicle, including weld-
ing, riveting, machining, fitting, alining,
balancing, assembling and testing.

	ECHELONS			
	2nd	3rd	4th	5th
CLUTCH				
Clutch—replace	E	X		
Clutch—repair		X		
Clutch—rebuild			E	X
Controls and linkage—service and/or replace	X			
Controls and linkage—repair		X		
Housing, clutch—replace		X		
Housing, clutch—rebuild			X	
COOLING GROUP				
Connections—replace	X			
Radiator assembly—replace	X			
Radiator assembly—repair		X		
Radiator assembly—rebuild			E	X
Shutter assembly—replace	X			
Shutter assembly—repair		X		
System, cooling—service	X			
DIFFERENTIAL ASSEMBLY				
Band assemblies, brake—service	X			
Band assemblies, brake—replace and/or repair (reline)		X		
Controls and linkage—replace	X			
Controls and linkage—repair		X		
*Differential assembly—replace	*	X		
Differential assembly—repair		X		
Differential assembly—rebuild			E	X
DRIVE, FINAL				
Bearings, sprocket wheel—service and/or replace	X			
Drive assembly, final—replace	X			
Drive assembly, final—repair		X		
Drive assembly, final—rebuild			E	X
Hub assemblies—replace	X			
Hub assemblies—repair		X		

*See Notes on page 13.

INTRODUCTION

ECHELONS

2nd 3rd 4th 5th

DRIVE, FINAL (Cont'd)

Hub assemblies—rebuild			E	X
Retainers, sprocket wheel grease—replace	X			
Shaft, axle—replace	X			
Sprocket and wheel assemblies—replace	X			
Sprocket and wheel assemblies—repair		X		
Sprocket and wheel assemblies—rebuild			E	X

ELECTRICAL GROUP

Battery—service, recharge and/or replace	X			
Battery—repair		X		
Battery—rebuild			E	X
Box, junction—replace	X			
Coil, ignition—replace	X			
Conduits and wiring—replace and/or repair	X			
Defroster assembly—replace	X			
Lamp assemblies—service and/or replace	X			
Lamp assemblies—repair		X		
Regulator, current and voltage—replace	X			
Regulator, current and voltage—service and/or repair		X		
Regulator, current and voltage—rebuild			X	
Switch assemblies—replace	X			
Switch assemblies—repair		X		

ENGINE

Bearings, crankshaft (inserts)—replace		E	E	X
Belt—service and/or replace	X			
Block, cylinder—rebuild (recondition)			E	X
Carburetor assembly—replace	X			
Carburetor assembly—repair		X		
Carburetor assembly—rebuild			X	
Cleaner, air—service and/or replace	X			
Cleaner, air—repair		X		
Condenser, distributor—replace	X			
Controls and linkage—service and/or replace	X			
Controls and linkage—repair		X		
Crankshaft—rebuild (recondition)			E	X
Distributor assembly—service and/or replace	X			
Distributor assembly—repair		X		
Distributor assembly—rebuild			X	
*Engine assembly—replace	*	X		
Engine assembly—repair		X		

*See Notes on page 13.

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	ECHELONS			
	2nd	3rd	4th	5th
ENGINE (Cont'd)				
Engine assembly—rebuild			E	X
Fan assembly—replace	X			
Fan assembly—repair		X		
Fan assembly—rebuild			X	
Filter assembly, oil—service and replace cartridge	X			
Filter assembly, oil—repair		X		
Flywheel—replace and/or repair		X		
Flywheel—rebuild (recondition)			E	X
Gaskets, cylinder head and manifold—replace	X			
Gear train, timing—replace		X		
Generator assembly—replace	X			
Generator assembly—repair		X		
Generator assembly—rebuild			X	
Head, cylinder—replace and/or repair		X		
Lines and connections, oil (external)—replace	X			
Lines and connections, oil (external)—repair		X		
Lines and connections, oil (internal)—replace and/or repair		X		
Manifolds—replace	X			
Manifolds—repair		X		
Motor assembly, starting—replace and/or repair		X		
Motor assembly, starting—rebuild			X	
Pan assembly, oil—service and replace gaskets		X		
Pan assembly, oil—repair and/or replace		X		
Pistons and rings—replace		E	E	X
Plugs, spark—service and/or replace	X			
Plugs, spark (two-piece)—repair		X		
Points, breaker, distributor—replace	X			
Pump assembly, fuel—replace and/or repair		X		
Pump assembly, fuel—rebuild			X	
Pump assembly, oil—replace and/or repair		X		
Pump assembly, oil—rebuild			X	
Pump assembly, water—replace	X			
Pump assembly, water—repair		X		
Pump assembly, water—rebuild			X	
Rods, connecting—replace		E	E	X
Thermostat—replace	X			
Valves—service		X		

See Notes on page 13.

INTRODUCTION

ECHELONS

2nd 3rd 4th 5th

ENGINE (Cont'd)

Ventilator, crankcase—service and/or replace X
 Wiring, ignition—replace X

EXHAUST GROUP

Muffler and exhaust pipes—replace X

EXTINGUISHER, FIRE

Extinguisher, fire (carbon tetrachloride CCl₄)—service
 (refill) and/or replace X
 Extinguisher, fire (carbon tetrachloride CCl₄)—repair X
 Extinguisher, fire (carbon tetrachloride CCl₄)—rebuild E X

FUEL GROUP

Filter assembly, fuel—service and/or replace X
 Filter assembly, fuel—repair X
 Lines and connections—replace X
 Lines and connections—repair E X
 Pump assembly, primer—replace X
 Pump assembly, primer—repair X
 Pump assembly, primer—rebuild X
 Tank—service and/or replace X
 Tank—repair X

HULL

Bows—replace X
 Bows—repair X
 Hull—repair X
 Hull—rebuild E X
 Pintle assembly—replace X
 Pintle assembly—repair X
 Pintle assembly—rebuild X
 Seats—replace X
 Seats—repair X
 Tarpaulin—replace X
 Tarpaulin—repair E X
 Windshield assembly—replace X
 Windshield assembly—repair X
 Wiper assemblies, windshield—replace X
 Wiper assemblies, windshield—repair E X
 Wiper assemblies, windshield—rebuild X

See Notes on page 13.

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ECHELONS

2nd 3rd 4th 5th

INSTRUMENTS

Instruments—replace	X			
Instruments—repair		X		
Instruments—rebuild			E	X

SHAFTS, PROPELLERS

Shaft assemblies, propeller (w/universal joints)— replace	X			
Shaft assemblies, propeller (w/universal joints)— repair		X		
Shaft assemblies, propeller (w/universal joints)— rebuild			E	X

SUSPENSION GROUP

Arm, idler—replace	X			
Arm, idler—repair		X		
Arm, idler—rebuild			E	X
Arm, idler support—replace	X			
Arm, idler support—repair		X		
Arm, idler support—rebuild			E	X
Bearings, idler wheel—service and/or replace	X			
Bogie, components—replace	X			
Bogie, components—repair		X		
Bogie, components—rebuild			E	X
Retainers, idler wheel grease—replace		X		
Roller assemblies, track support—replace	X			
Roller assemblies, track support—repair		X		
Roller assemblies, track support—rebuild			E	X
Spring assemblies, suspension—replace	X			
Spring assemblies, suspension—repair		X		
Spring assemblies, suspension—rebuild			E	X
Track assemblies—replace	X			
Track assemblies—repair		X		
Wheel assemblies—replace	X			
Wheel assemblies—repair		X		
Wheel assemblies—rebuild			E	X

TRANSMISSION

Controls and linkage—service and/or replace	X			
Controls and linkage—repair		X		

See Notes on page 13.

INTRODUCTION

ECHELONS

	2nd	3rd	4th	5th
TRANSMISSION (Cont'd)				
*Transmission assembly—replace		*	X	
Transmission assembly—repair			X	
Transmission assembly—rebuild				E X

VEHICLE ASSEMBLY

Carrier assembly—service				X
Carrier assembly—rebuild (with serviceable unit assemblies)			X	E

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.

NOTE: *The second echelon is authorized to remove and reinstall items marked by an 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 an asterisk may be removed from the vehicle by the second echelon *only after authority has been obtained from a higher echelon of maintenance.*

**ORDNANCE MAINTENANCE—ENGINE, ENGINE ACCESSORIES,
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CHAPTER 2

ENGINE

Section I

DESCRIPTION AND DATA

	Paragraph
Description	4
Data	5

4. DESCRIPTION.

a. The engine is a 4-cycle, 6-cylinder L-head type, with a 7 to 1 compression ratio, and is liquid-cooled. The crankshaft is of drop-forged construction with the counterbalancers forged as an integral part of the shaft. Four removable steel-backed bearings lined with micro-babbitt support the crankshaft. Connecting rod bearings are of spun babbitt, which is bonded to the steel of the rod. The camshaft is of one-piece construction with all wearing surfaces case hardened. Full-pressure lubrication is provided to all moving parts of the engine. Cast-iron, three-ring pistons are used. Valve tappet adjusting screws are self-locking, and do not require the use of a locking nut.

b. Engine cooling is provided by a cooling solution circulated through internal passages in the cylinder block. A water pump at the front of the engine circulates the solution. Valves of silichrome steel are cooled by solution in passages surrounding the valve seats. Engine temperature is controlled by a thermostat located in the cylinder head.

c. A thermostatically operated heat control valve is located in the manifold to provide the correct amount of heat for the fuel and air mixture before delivery to the cylinder. Full automatic spark advance is incorporated in the ignition distributor.

5. DATA.

Make	Studebaker
Model	6-170
Type	L-Head
Number of cylinders	6
Bore	3 in.
Stroke	4 in.
Firing order	1-5-3-6-2-4
Displacement	169.6 cu in.

DESCRIPTION AND DATA

Compression ratio	7 to 1
Horsepower (net)	75 at 3,800 rpm
Crankcase capacity	5 qt
Cooling system capacity	10½ qt
Piston material	Cast iron
Piston rings	2 compression, 1 oil
Camshaft gear	Fiber
Manifold heat control	Automatic
Engine number location	Stamped on machined pad on upper left side near front of cylinder block

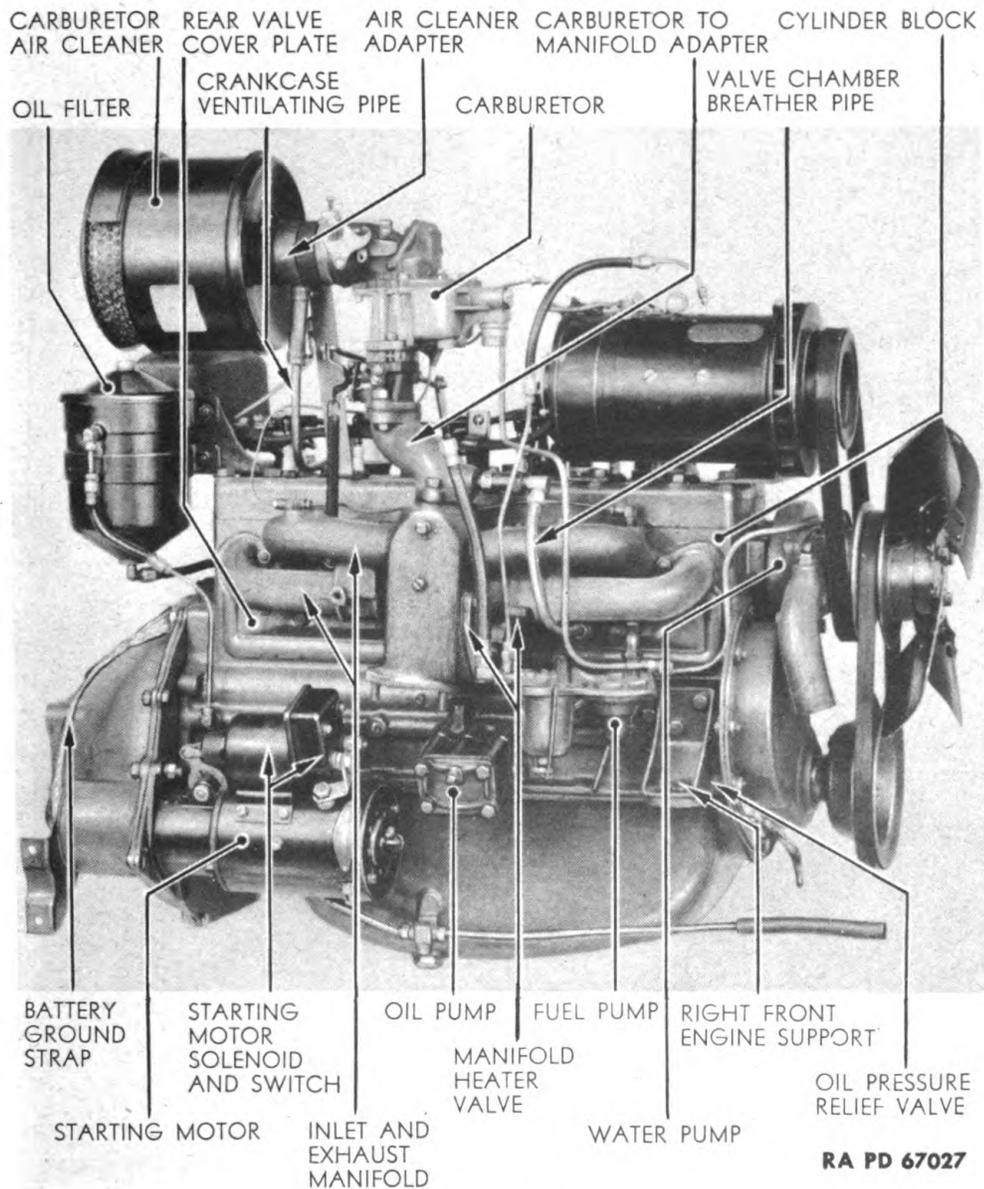
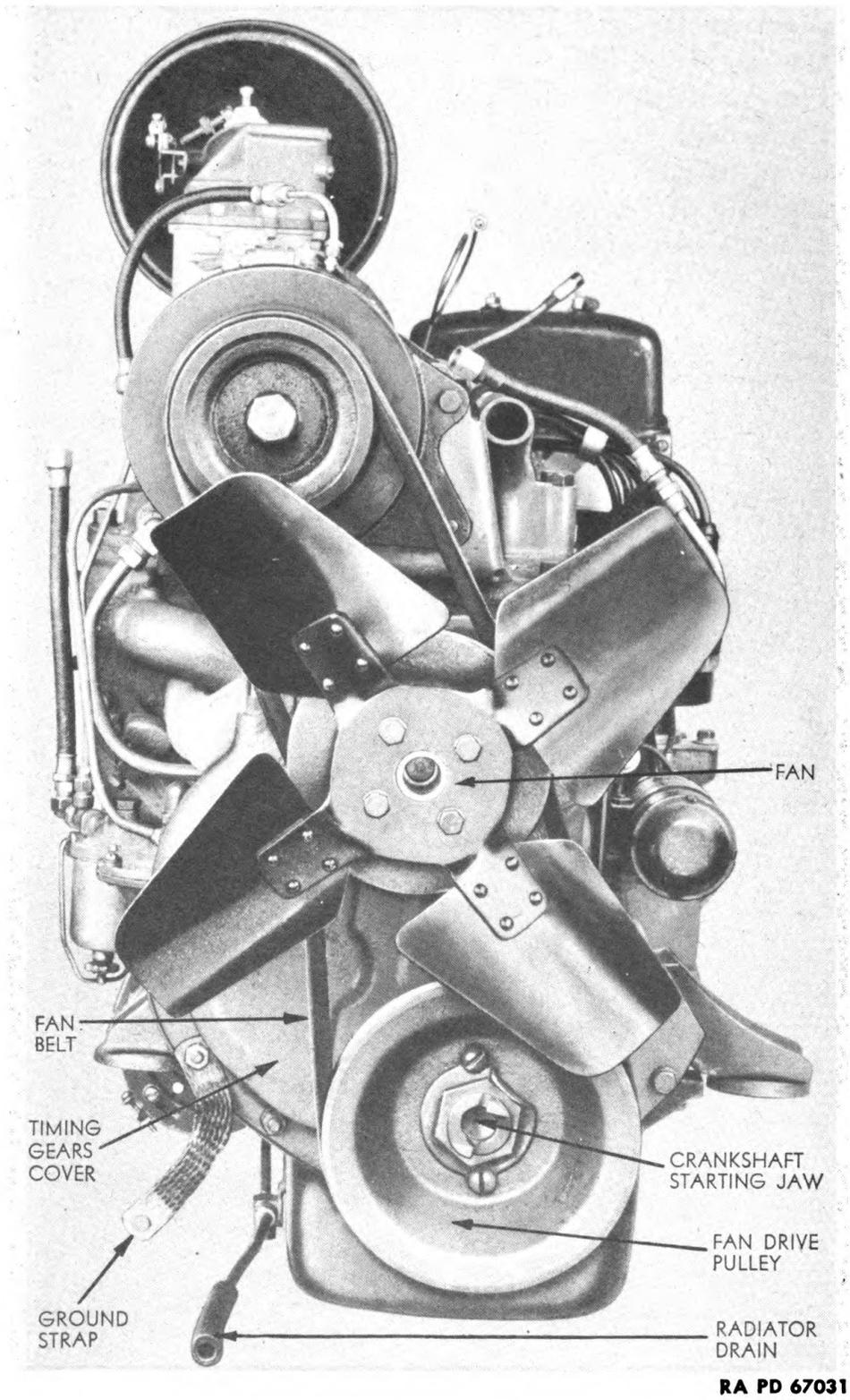


Figure 3—Engine—Right Side

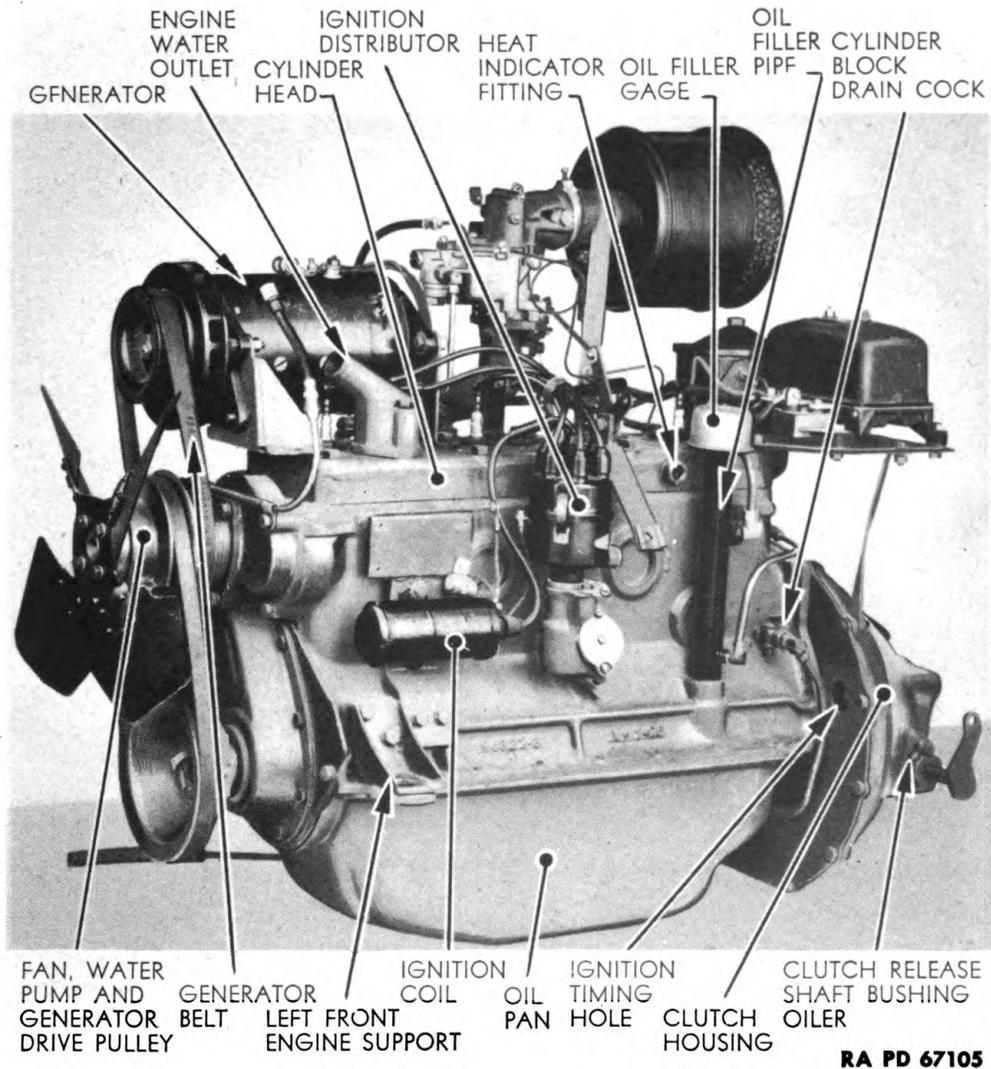
**ORDNANCE MAINTENANCE—ENGINE, ENGINE ACCESSORIES,
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RA PD 67031

Figure 4—Engine—Front

DESCRIPTION AND DATA



ENGINE WATER OUTLET CYLINDER HEAD IGNITION DISTRIBUTOR HEAT INDICATOR FITTING OIL FILLER GAGE OIL FILLER PIPE CYLINDER BLOCK DRAIN COCK

FAN, WATER PUMP AND GENERATOR DRIVE PULLEY GENERATOR BELT LEFT FRONT ENGINE SUPPORT IGNITION COIL OIL PAN HOLE IGNITION TIMING HOLE CLUTCH HOUSING CLUTCH RELEASE SHAFT BUSHING OILER

RA PD 67105

Figure 5—Engine—Left Side

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Section II

TROUBLE SHOOTING

Trouble shooting	Paragraph 6
------------------------	-----------------------

6. TROUBLE SHOOTING.

a. Engine Starts Hard.

Possible Cause	Possible Remedy
Intake manifold leaks.	Tighten or install new gasket (pars. 102, 105).
Battery low.	Recharge or replace battery.
Battery cable terminals loose or corroded.	Tighten, clean or replace cable.
Ignition out of time.	Set ignition timing (pars. 52, 122).
Condenser weak.	Replace condenser.
Distributor cover cracked.	Replace distributor cover (pars. 117, 120).
Ignition switch contacts loose.	Replace switch.
Lubricating oil too heavy or cold.	Drain and fill with proper grade of oil (refer to TM 9-772).

b. Poor Engine Compression and Loss of Power.

Valves leaking.	Adjust, recondition, or replace (pars. 44, 45).
Spark plug gaskets leak.	Tighten or replace gaskets.
Piston rings worn, stuck, or weak.	Replace rings (pars. 21, 45).
Cylinder head loose.	Tighten head cap screws (pars. 21, 45).
Cylinder head gasket leaking.	Replace gasket (pars. 21, 45).
Pistons worn.	Replace worn parts (pars. 21, 44, 45).
Cylinders worn.	Recondition cylinders (par. 44).
Valve springs weak or broken.	Replace springs (pars. 21, 45).
Cylinder head cracked.	Replace cylinder head (pars. 21, 45).

TROUBLE SHOOTING

c. Engine Misfires, Engine Temperature Normal.

Possible Cause	Possible Remedy
Intake manifold leaking.	Tighten or replace gasket (pars. 102, 105).
Valves leaking.	Recondition or replace (pars. 21, 45).
Piston rings leaking.	Replace (pars. 21, 44, 45).
Manifold heater valve shaft stuck.	Free or replace.
Water leaks into cylinders.	Determine cause and correct.

d. Knocking.

Excessive main bearing clearance.	Replace main bearings (pars. 21, 45).
Excessive crankshaft end play.	Adjust (par. 45).
Main bearing misalignment.	Aline main bearings (pars. 43, 45).
Insufficient oil supply.	Add oil.
Badly diluted oil.	Change oil.
Flywheel loose.	Tighten bolt nuts.
Crankshaft gear loose on shaft.	Tighten.
Excessive connecting rod bearing clearance (radial).	Replace rod (pars. 21, 45).
Connecting rod misaligned.	Aline rod (pars. 21, 36, 45).
Eccentric, out of round, or tapered crankshaft journals.	Replace crankshaft (pars. 21, 45).

e. Bearing Failures.

Bearing journal rough or out of round.	Replace crankshaft (pars. 21, 45).
Oil passages restricted.	Clean passages (par. 22).
Bearings loose or improperly fitted.	Replace main bearings or connecting rods (pars. 21, 45).
Connecting rod bent.	Replace rod (pars. 21, 45).
Improper grade or diluted oil.	Change oil.
Insufficient oil.	Add oil.
Excessive continuous engine speed.	Avoid continued operation at maximum speed.

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f. Piston Noises.

Possible Cause	Possible Remedy
Piston to cylinder bore clearance excessive.	Fit new piston (pars. 21, 37, 45).
Cylinders eccentric or tapered.	Recondition or replace (pars. 21, 42, 45).
Insufficient piston pin clearance.	Recondition or replace (pars. 21, 37, 45).
Connecting rod misalignment.	Align rods (pars. 21, 36, 45).
Piston striking ridge at top of cylinder.	Remove ridge (pars. 21, 44, 45).
Piston striking carbon accumulation at top of cylinder.	Remove carbon.
Broken piston rings.	Replace rings (pars. 21, 45).
Excessive ring clearance in ring groove.	Replace rings or pistons (pars. 21, 45).
Excessive pin clearances.	Replace pin (pars. 21, 45).
Locking pin loose in piston or rod.	Tighten or replace.

g. Valves and Valve Lifter Noises.

Excessive valve stem to lifter clearance.	Adjust.
Excessive clearance of lifter in guide.	Replace (pars. 21, 45).
Valve springs weak.	Replace (pars. 21, 45).
Valves sticking in guides.	Recondition (par. 44).

h. Spark Knock or Preignition.

Ignition timing too early.	Set timing (pars. 52, 122).
Excessive carbon deposits in engine.	Remove carbon.
Sharp metallic edges in combustion chamber.	Remove.
Cylinder head gasket projecting into combustion chamber.	Replace gasket (pars. 21, 45).
Excessive hot engine valves.	Determine cause and correct.

TROUBLE SHOOTING

i. Backfiring Through Carburetor.

- | | |
|-----------------------------------|--|
| Improperly seating intake valves. | Recondition or replace (pars. 21, 44, 45). |
| Incorrect valve timing. | Retime (pars. 52, 122). |
| Intake manifold air leaks. | Tighten or replace gaskets (pars. 102, 105). |
| Defective cylinder head gasket. | Replace gasket (pars. 21, 45). |

j. Vibration.

- | | |
|--|--|
| Unequal compression of engine cylinders. | Determine point of compression loss and correct. |
| Unbalanced or loose fan. | Tighten or replace (pars. 181, 186). |
| Loose engine mountings. | Tighten. |
| Unbalanced or sprung crankshaft. | Replace (pars. 21, 43, 45). |

k. Excessive Oil Consumption.

- | | |
|--|--|
| Loss from external leaks. | Locate leak and correct. |
| Improper grade or diluted oil. | Change oil (refer to TM 9-772). |
| Excessive quantity of oil in crankcase. | Drain to proper level. |
| Excessive piston to cylinder wall clearance. | Recondition or replace (pars. 21, 44, 45). |
| Worn or stuck piston rings. | Recondition or replace. |
| Cylinder block distortion. | Replace (pars. 21, 45). |
| Excessive valve stem to guide clearance. | Replace (pars. 21, 45). |

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Section III

ENGINE REMOVAL

Paragraph

Remove engine 7

7. REMOVE ENGINE.

a. Remove Vehicle Top and Bows. Unhook all lashings from attaching buttons on hull coaming and remove top and side curtains. Remove cotter pins from bows, loosen wing nuts at windshield and lift bows from vehicle.

b. Remove Driver's Seat Cushion and Back. Lift hold-down straps off the buttons and remove the cushion. Remove seat back hook from floor in back of seat. Tip seat back forward, unhook from slots, and remove from vehicle.

c. Remove Propeller Shaft and Disconnect Transmission and Clutch Controls. Remove hull floor pan cap screws and remove floor pan. Remove four U-bolt nuts with lock washers from rear universal joint. Move propeller shaft assembly backward off transmission mainshaft and remove from vehicle. Install dummy flange or pack rags around the transmission mainshaft to prevent lubricant leakage when transmission is removed. Disconnect clutch and transmission remote control linkage by removing the cotter pins and clevis pins. Unhook and remove clutch release shaft operating lever return spring.

d. Remove Engine Compartment Lid and Front Panel. Unscrew two wing nuts holding engine compartment lid to side panel. Move lid up until engaging tongues can be removed from slots in hull coaming and lift lid out of vehicle. Remove windshield wiper connections from sockets on front panel. Remove bolts, nuts, and washers holding front panel to inside of coaming and remove panel.

e. Remove Air Cleaner and Engine Compartment Heater Outlet Tube. Loosen air cleaner throat clamp screw and remove carburetor air cleaner assembly. Take out bolt and nut holding heater flexible outlet tube sleeve to heater, remove clamp holding tube to battery bed, and lift tube out of compartment.

f. Remove Battery and Disconnect Starter Solenoid Wires. Disconnect and remove both battery post clamps. Loosen battery retaining clamps and remove battery. Disconnect all wires from starter solenoid.

g. Drain Cooling System. Remove drain plate screws, plate, and gasket located on the bottom of hull near right center of engine compartment. Turn radiator cap to first stop to unseal cooling system, reach down through the air intake duct and open drain valve at radiator outlet pipe located on lower right corner of radiator. Also, open cylinder block drain valve on left side of the engine toward the rear. If anti-

ENGINE REMOVAL

freeze is in use, save the solution. After completely draining cooling system, close cylinder block and radiator drain valves.

h. Drain Engine Oil. With hull drain plate off, remove oil pan drain plug, allow oil to drain and reinstall plug securely. Reinstall hull plate gasket, plate, and screws. Apply joint and thread compound for positive seal.

i. Remove Fan Blades and Disconnect Hose Connections. Remove four cap screws holding fan blades to fan and water pump drive pulley hub. Lift blades off hub and out of engine compartment. Loosen radiator inlet and outlet hose clamp screws and pull hoses off. Loosen hose clamp screw and pull drain hose off drain valve in radiator outlet pipe.

j. Disconnect Engine Ground Strap, Engine Front Mountings, and Remove Current and Voltage Regulator. Disconnect engine ground strap from hull by removing bolt, nut, two flat washers, and lock washer. Take out cotter pins and remove two castellated nuts and flat washers from engine front mounting brackets. Disconnect all wires from voltage regulator, take out regulator mounting bolts, and remove regulator.

k. Disconnect Engine Heat Indicator, Oil Pressure Gage, and Ignition Coil. Uncouple heat indicator element from left rear side of cylinder head. Disconnect oil pressure gage pipe at flexible coupling above front of engine. Disconnect the ignition switch primary wire from ignition coil.

l. Remove the Fuel Filter. Remove fuel filter inlet and outlet pipes. Disconnect drain pipe from filter. Remove screws holding filter to coaming and remove filter.

m. Disconnect Primer Line. Disconnect primer inlet and outlet pipe connections from the primer.

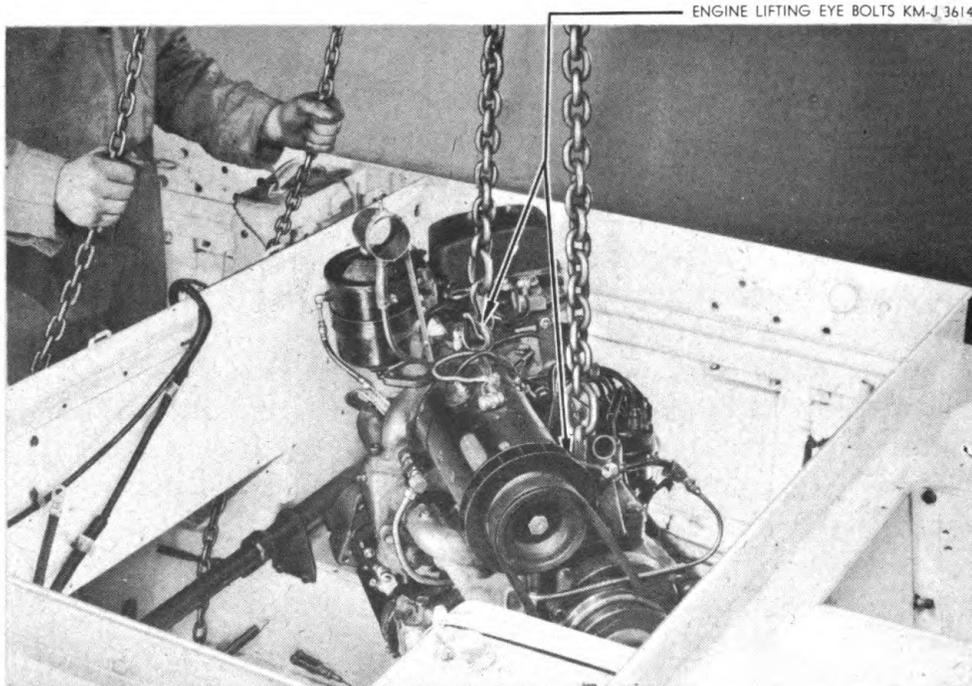
n. Disconnect Throttle and Choke Controls. Remove screw holding throttle cable conduit clip at the bracket near the oil filler pipe. Disconnect carburetor throttle valve control wire from bell crank mounted on cylinder head. Disconnect carburetor choke control after loosening choke valve lever swivel clamp screw and cable clamp screw at fastening bracket.

o. Remove Engine Compartment Side Panel and Instrument Panel. Disconnect wiring harness terminals from all instruments and switches. Disconnect speedometer cable from speedometer and remove wiring harness from clips. Remove spot light, defroster, and compass light wire connections from sockets on engine compartment side panel. Remove screws holding trouble light cable grommet to engine compartment side panel, disconnect cable at fuse connector, and remove fuse. Remove screws holding cross shaft cover and engine compartment side panel in position, and remove cover and panel.

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p. **Uncouple Exhaust Pipe.** Remove U-clamp, bolts, and nuts securing the front exhaust pipe to the support bracket on right side of clutch housing. Remove nuts holding front exhaust pipe flange to manifold flange, separate flanges and remove gasket.

q. **Remove Remote Control Shift Rods.** Remove engine transmission remote control shift rods by removing cotter and clevis pins from the front. Remove cotter pins and clevis pins from axle transmission front control rod and lift rod out of engine compartment.



RA PD 67104

Figure 6—Engine Removal

r. **Install Lifting Eyes.** Lower windshield to avoid windshield wiper body interference. Remove cylinder head screws No. 6 and No. 10 (fig. 48). Install engine-lifting eye bolts KM-J3614 in their place, and attach a suitable hoist.

s. **Remove Transmission.** Take out the screws holding engine rear mounting to hull cross member. Remove screws that fasten the transmission to clutch housing. Move transmission rearward away from clutch housing and lift out of vehicle.

t. **Remove Engine (Including Clutch).** Check to make sure all wires, cables, lines, and connections to hull or other units have been disconnected. Slowly lift weight of engine off engine support brackets and hull frame. Raise engine out of compartment, guiding it carefully to avoid catching uncoupled pipes, wires, and controls (fig. 6).

Section IV

CLEANING AND INSPECTION

	Paragraph
Cleaning	8
Inspection	9

8. CLEANING.

a. Clean the removed engine assembly thoroughly with SOLVENT, dry-cleaning. Any dirt or grease accumulations which cannot be readily washed off with solvent should be removed with a wire brush or putty knife. Dry the entire engine with compressed air.

9. INSPECTION.

a. Inspect the cylinder block and head for cracks which will be indicated by leakage of the cooling solution. Inspect the oil pan, timing gear cover, and valve cover plates for cracks or holes which will be indicated by evidence of oil leakage. Inspect the oil and fuel lines and connections for leakage of oil or fuel. Inspect the fuel pump to block gasket for evidence of oil leaks. Inspect the water pump and gasket for evidence of the cooling solution leaking. Inspect the cylinder head water outlet for evidence of leaks.

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Section V

REMOVAL OF ACCESSORIES

	Paragraph
Starter	10
Clutch	11
Generator	12
Ignition coil	13
Distributor with wiring	14
Water pump	15
Fuel pump	16
Carburetor	17
Manifold assembly	18
Oil filter assembly	19
Spark plugs	20

10. STARTER.

a. Remove the nuts, lock washers, and bolts holding the starter to the engine rear plate, and pull the starter away from engine.

11. CLUTCH.

a. Remove the screws, bolts, and nuts holding clutch housing to the engine rear plate and remove housing. Then remove the cap screws holding the clutch assembly to flywheel, relieving pressure on the cap screws evenly to prevent distortion of pressure plate cover, and remove entire clutch assembly.

12. GENERATOR.

a. Disconnect wires from generator terminals, and loosen the bolts that hold the generator to brackets. Lift generator drive belt out of generator pulley, take out the nuts, lock washers, and bolts, and remove generator from engine. Remove clips holding generator to voltage regulator wiring harness and lift harness from engine.

13. IGNITION COIL.

a. Disconnect coil to ignition switch primary wire, coil to distributor primary wire, and secondary wire from coil. Take out screws that hold the coil to cylinder block and remove coil.

14. DISTRIBUTOR WITH WIRING.

a. Disconnect the spark plug wires from the spark plug terminals. Take out the distributor control arm fastening screw and remove the distributor with spark plug wires from the engine.

REMOVAL OF ACCESSORIES

15. WATER PUMP.

a. Remove the three cap screws holding the water pump to the cylinder block, and remove water pump assembly and gasket.

16. FUEL PUMP.

a. Remove the fuel pump to carburetor pipe, the primer inlet pipe and coupling, and fuel pump inlet coupling. Take out the two cap screws holding fuel pump to cylinder block and remove pump and gasket.

17. CARBURETOR.

a. Disconnect and remove the crankcase ventilation pipe from carburetor air intake adapter and oil filler tube. Remove the cylinder head cap screw holding air intake adapter support. Disconnect throttle control rod from the throttle arm and unhook the return spring. Remove the bolts and nuts holding the carburetor to the intake manifold adapter and remove carburetor and gasket.

18. MANIFOLD ASSEMBLY.

a. Disconnect and remove the valve cover to intake manifold adapter ventilation pipe. Remove the nuts and holding clamps from the manifold studs and remove the manifold and gasket from cylinder block.

19. OIL FILTER ASSEMBLY.

a. Disconnect and remove the oil filter intake line from filter and crankcase connections, and the outlet pipe from bottom of filter and lower end of oil filler tube. Remove the cylinder head cap screws that anchor the filter bracket to cylinder head and remove the filter with bracket from the engine.

20. SPARK PLUGS.

a. Remove the spark plugs with a spark plug socket and handle, being careful not to crack porcelain body when removing.

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Section VI

DISASSEMBLY

	Paragraph
Disassembly	21

21. DISASSEMBLY.

- a. **Remove Flywheel.** Remove the bolt nuts and lock washers holding the flywheel to the crankshaft flange and remove the flywheel from the crankshaft flange.

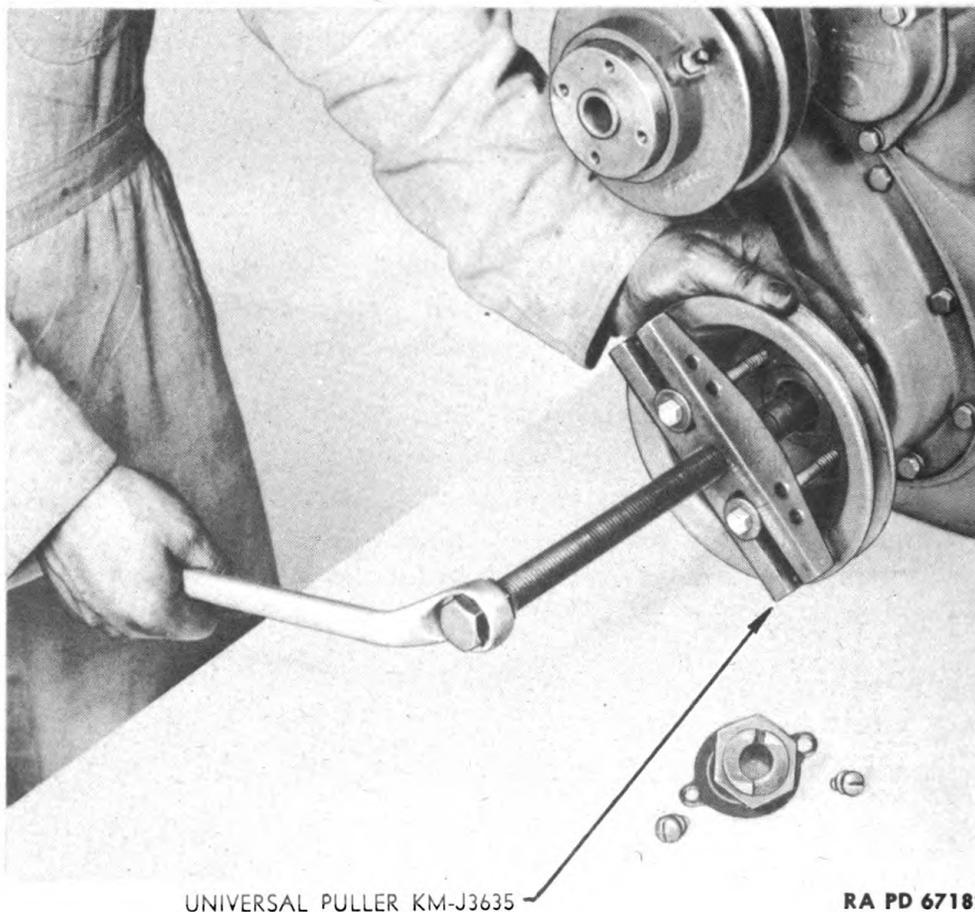


Figure 7—Crankshaft Pulley Removal

- b. **Remove Water Outlet and Thermostat.** Remove the two cylinder head cap screws holding the water outlet elbow to cylinder head. Remove the water outlet, thermostat, metal sleeve, and gaskets.

- c. **Remove Cylinder Head.** Remove all cylinder head cap screws and brackets. When removing the cylinder head from the cylinder block be careful to avoid damaging the valves.

DISASSEMBLY

d. **Remove Valves and Valve Springs.** Take out the valve cover screws and remove both valve cover plates. Pull out the valve lifter tension springs, compress the valve springs with a valve spring compressor, and remove the valve spring retainer seats. Remove the valves from guides and place in a suitable rack to keep them in proper sequence for installation. Pry or lift the valve springs and retainers up to clear the valve lifter screws and remove from valve spring chamber.

e. **Remove Crankshaft Pulley.** Unlock and remove crankshaft starting jaw. Take out screws and remove lock plate. Pull the crankshaft pulley with universal puller KM-J3635, or similar, and plug KM-J3644-5 (fig. 7) and remove the Woodruff key from crankshaft.

f. **Remove Timing Gear Cover.** Take out the screws, nuts, and bolts holding the cover to engine front plate and remove cover.

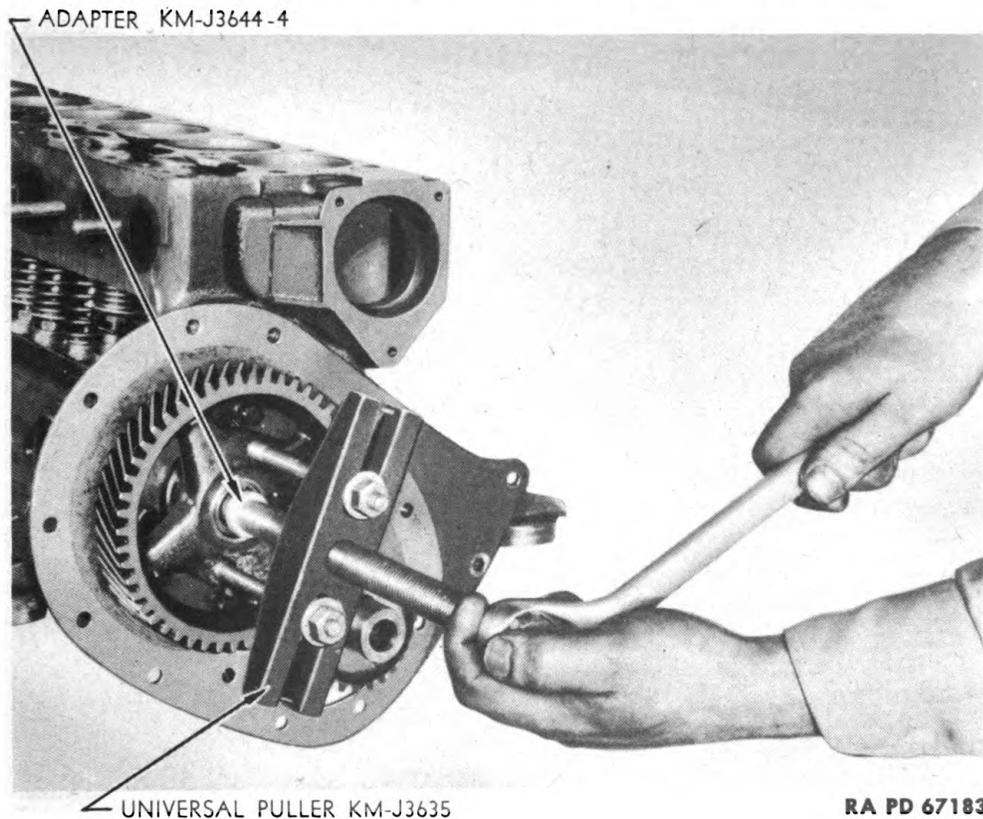
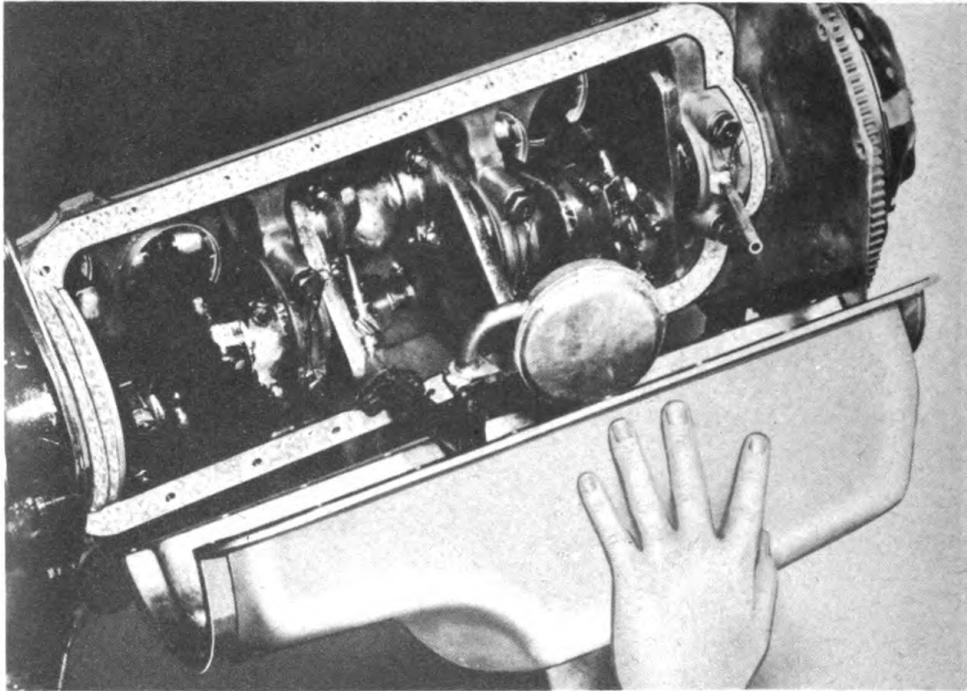


Figure 8—Camshaft Gear Removal

g. **Remove Timing Gears.** Check backlash of the timing gears before removing them. If backlash is in excess of 0.003 inch, replace the gears when reassembling. Pull crankshaft gear with universal puller KM-J3635 and plug KM-J3644-5, and remove the Woodruff key from crankshaft. Remove the screw, lock washer, and plain washer holding the camshaft gear to camshaft. Pull gear from camshaft with universal

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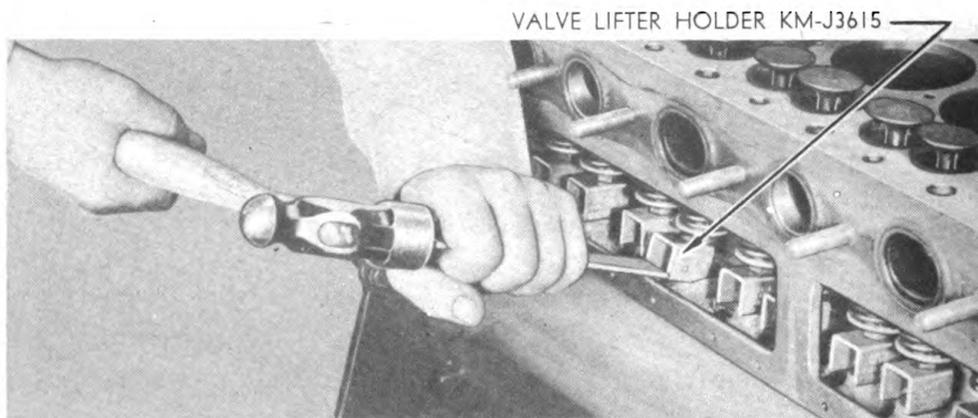


RA PD 66941

Figure 9—Oil Pan Removal

puller KM-J3635, or similar, and adapter KM-J3644-4 (fig. 8). Remove Woodruff key from camshaft.

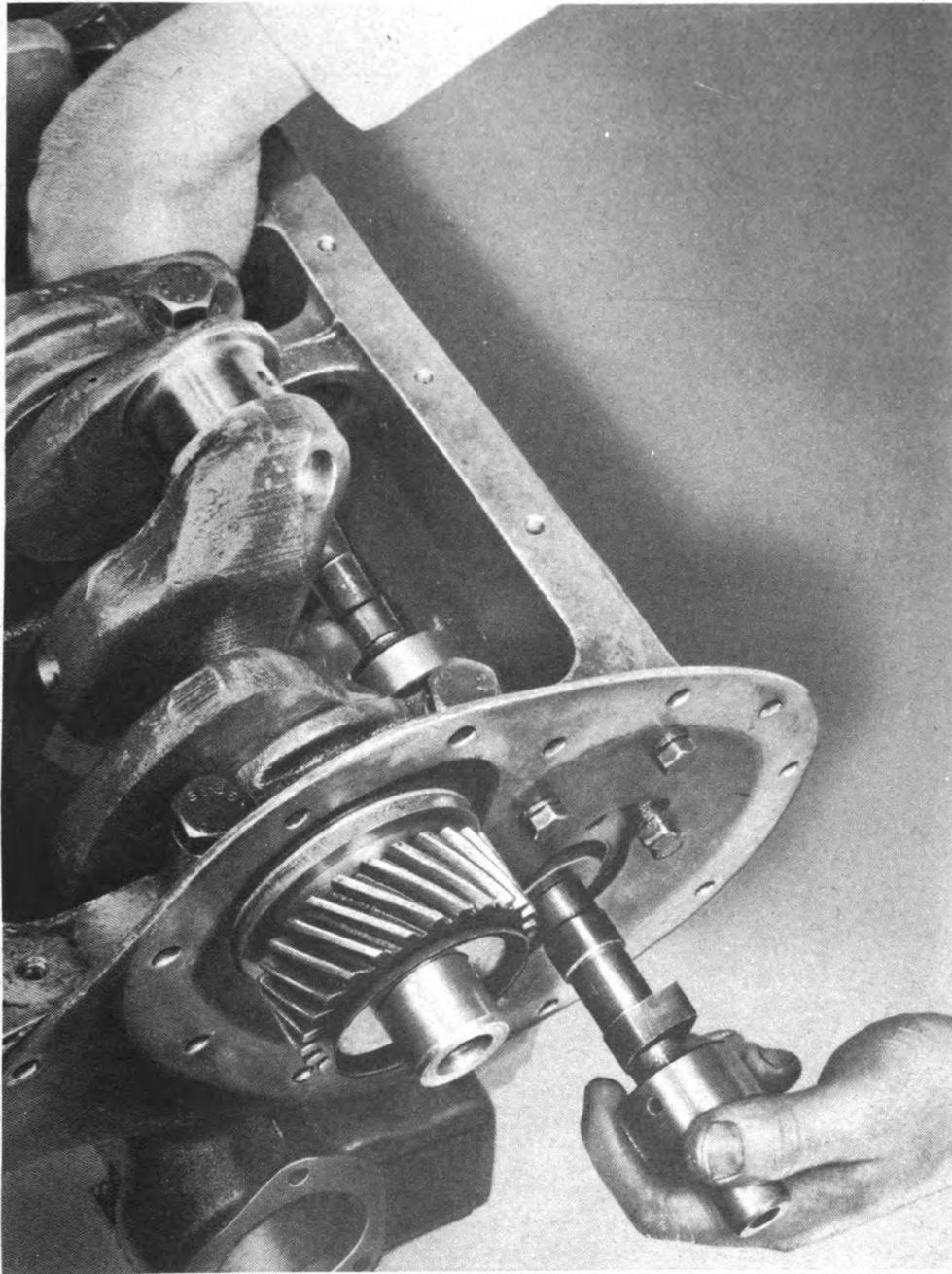
h. Remove Oil Pan and Oil Strainer. Take out screws holding the oil pan to cylinder block and remove oil pan and gasket (fig. 9). Remove screws holding the engine oil strainer support in position and remove support, oil strainer, and gasket from cylinder block. Take out cotter pin and remove strainer from support.



RA PD 67167

Figure 10—Installing Valve Lifter Holder

DISASSEMBLY



RA PD 66948

Figure 11—Camshaft Removal

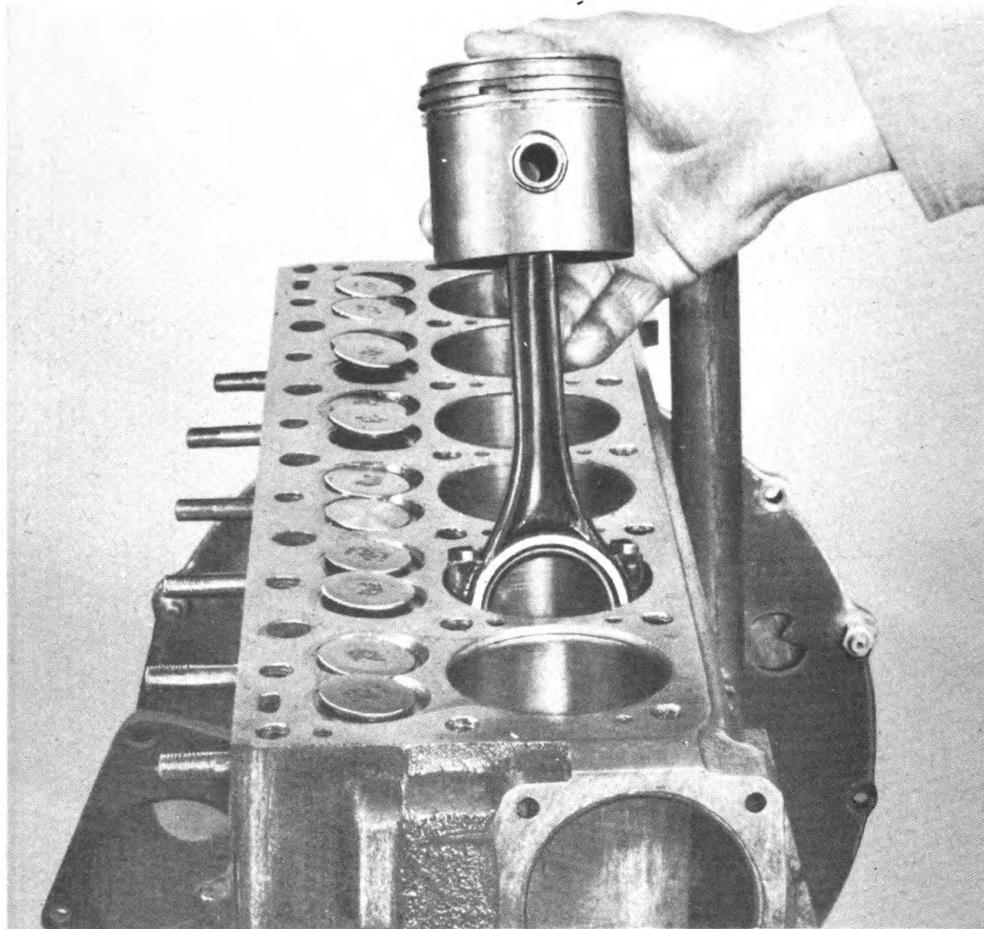
i. Remove Distributor Support and Drive Shaft. Take out screw holding the distributor support to cylinder block, and remove support with distributor drive shaft. Remove screws holding distributor support cover to support, lift cover and gasket from support, and pull the distributor drive shaft with gear out of support.

j. Remove Oil Pump. Remove screws holding oil pump to cylinder block, remove pump cover, and gasket. Pull both gears out of pump

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body and remove Woodruff key and "C" washer from pump drive shaft. Remove the pump body and gasket from outside of cylinder block and pump drive shaft from inside of cylinder block (fig. 23).

k. **Remove Camshaft and Valve Lifters.** Take out screws holding the camshaft thrust plate to cylinder block and remove plate and spacer. (If the camshaft is to be removed with valves and springs in position, use valve lifter holders KM-J3615 to raise lifters sufficiently



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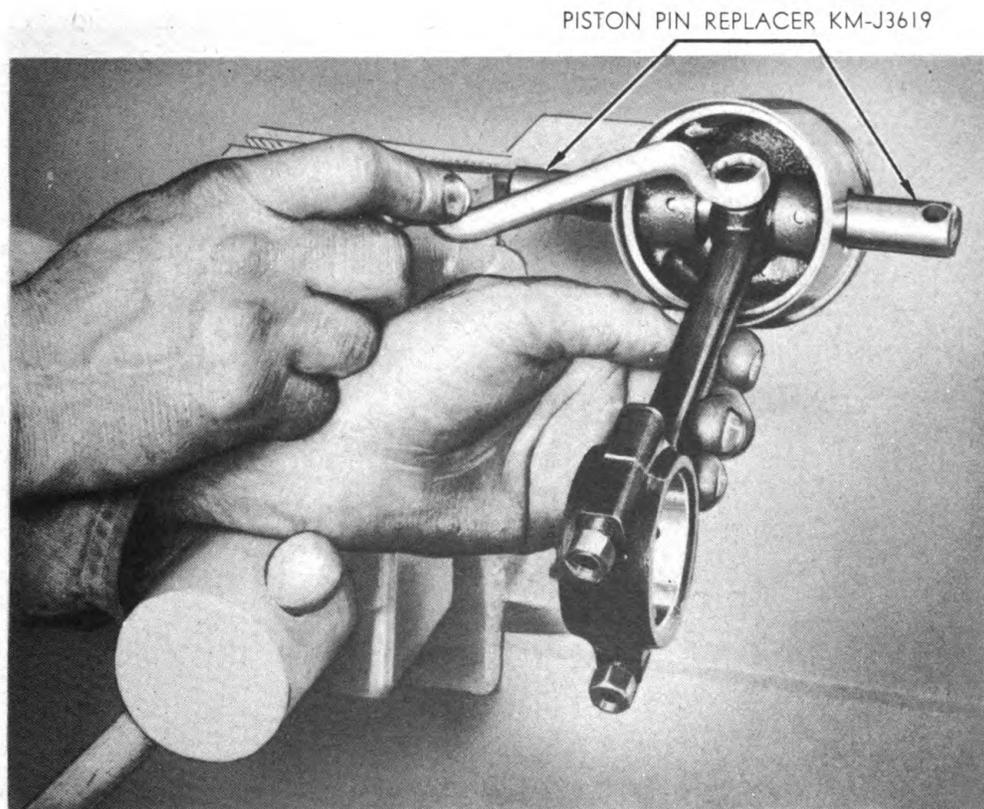
Figure 12—Connecting Rod and Piston Assembly Removal

to permit removal of camshaft.) Place the cylinder block in an inverted position, push the valve lifters away from camshaft lobes, and carefully remove camshaft from cylinder block (fig. 11). Pull valve lifters out of guides in cylinder block and place in a rack to retain proper sequence for installation in the same guides.

l. **Removal of Connecting Rods and Pistons.** Place the cylinder block in a vertical position, remove the palnuts, and connecting rod

DISASSEMBLY

bolt nuts. Carefully remove the connecting rod cap from each connecting rod and push the connecting rod and piston out through top of cylinder bore (fig. 12). Remove the piston rings from each piston with a suitable piston ring tool, being careful to avoid damaging the ring grooves in the piston. To remove the pistons from connecting rods, fasten piston pin replacer KM-J3619 in a vise. Remove the nut from shaft, slide piston pin over the end of shaft, reinstall the nut and tighten. Remove the lock nut from the tapered pin that retains the piston pin in the connecting rod, install the nut on other end of tapered pin and tighten it sufficiently to loosen the pin in connecting rod. While rocking connecting rod with one hand, pull the tapered pin out of connecting



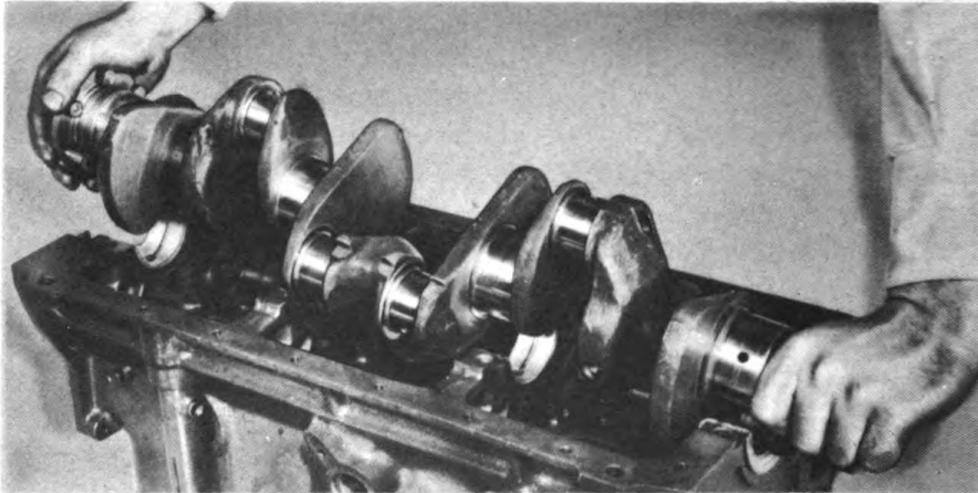
RA PD 67003

Figure 13—Piston Pin Removal

rod, remove the nut from piston pin shaft, slide the connecting rod and piston assembly off the end of tool (fig. 13). Push the piston pin out of piston and connecting rod.

m. Remove Engine Front and Rear Plates. Take out cap screws holding the front plate to cylinder block and remove plate and gasket. Remove cap screws holding the rear plate to cylinder block and pull plate away from block.

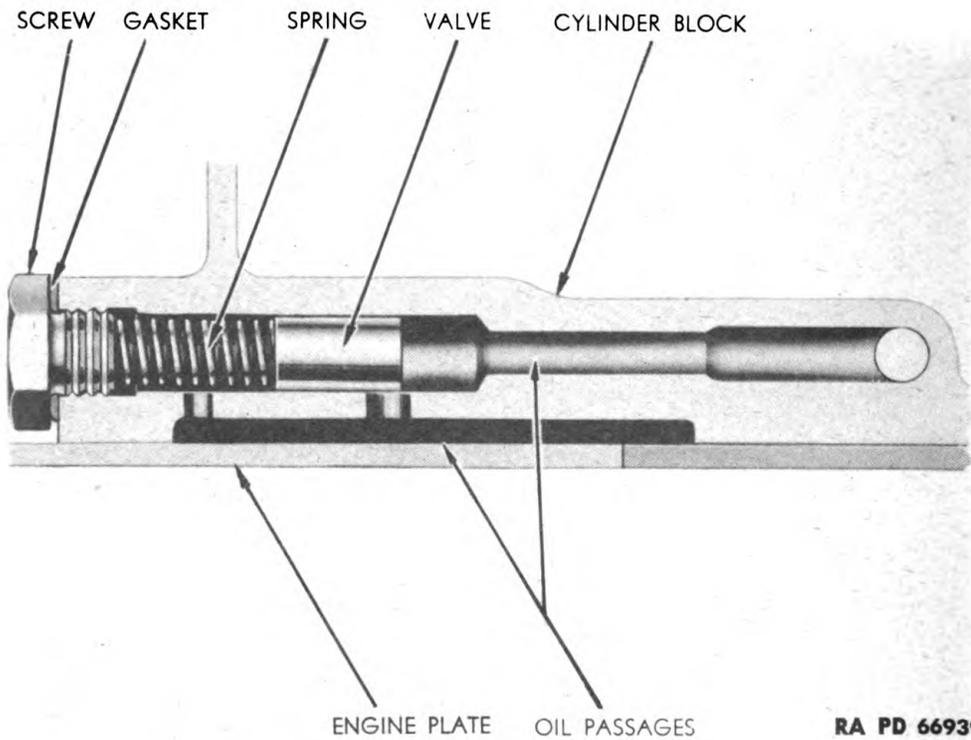
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RA PD 66944

Figure 14—Crankshaft Removal

n. **Remove Crankshaft.** Remove the locking wire from crankshaft main bearing cap screws, take out screws and remove main bearing caps with lower half of main bearing shells from cylinder block. Lift the crankshaft out of cylinder block (fig. 14) being careful to avoid damaging the journals. Remove main bearing shells from main bearing caps and cylinder block.



RA PD 66939

Figure 15—Oil Pressure Relief Valve Construction

DISASSEMBLY

o. Remove Engine Front Mounting Brackets. Take out the cap screws that hold the mounting brackets in position and remove from cylinder block.

p. Remove Oil Pressure Relief Valve. Remove plug and gasket that retain the oil pressure relief valve in cylinder block just below the engine right front mounting bracket pad. Pull the spring and valve (fig. 15) out of the passage for cleaning and inspection.

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Section VII

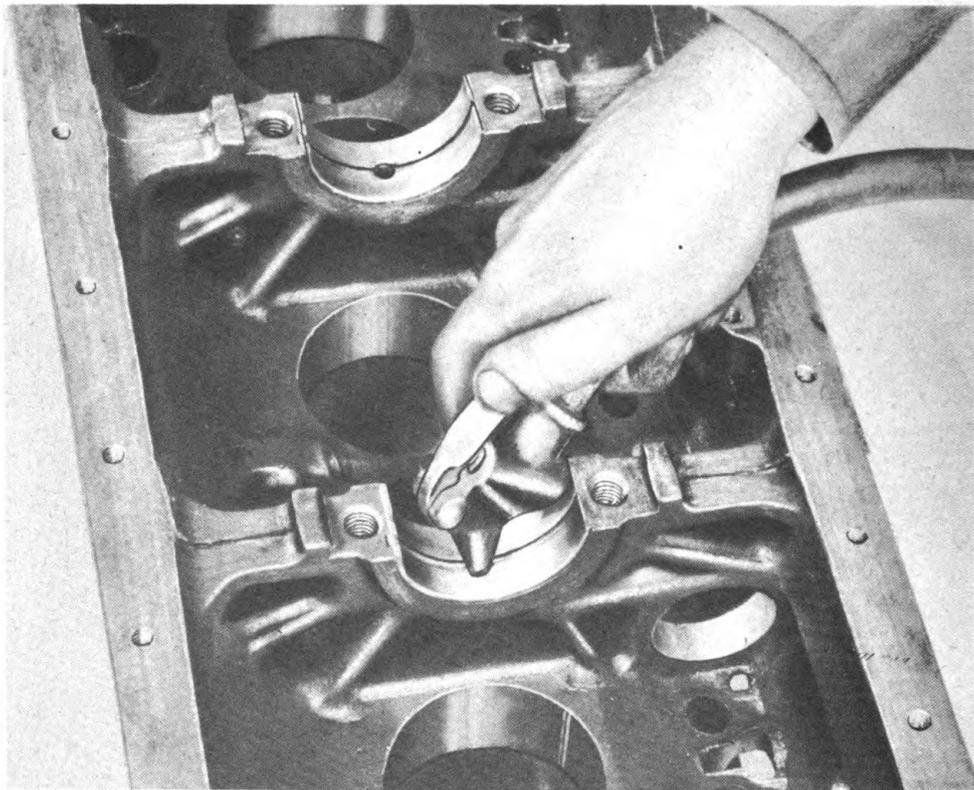
CLEANING ENGINE PARTS

Paragraph

Cleaning 22

22. CLEANING.

a. Clean all engine parts carefully in SOLVENT, dry-cleaning, to remove all grease, dirt, gaskets, and foreign matter. Use a putty knife to remove any gaskets or sealer remaining on the machined surfaces. Remove carbon formation from the valves and valve guides with a wire



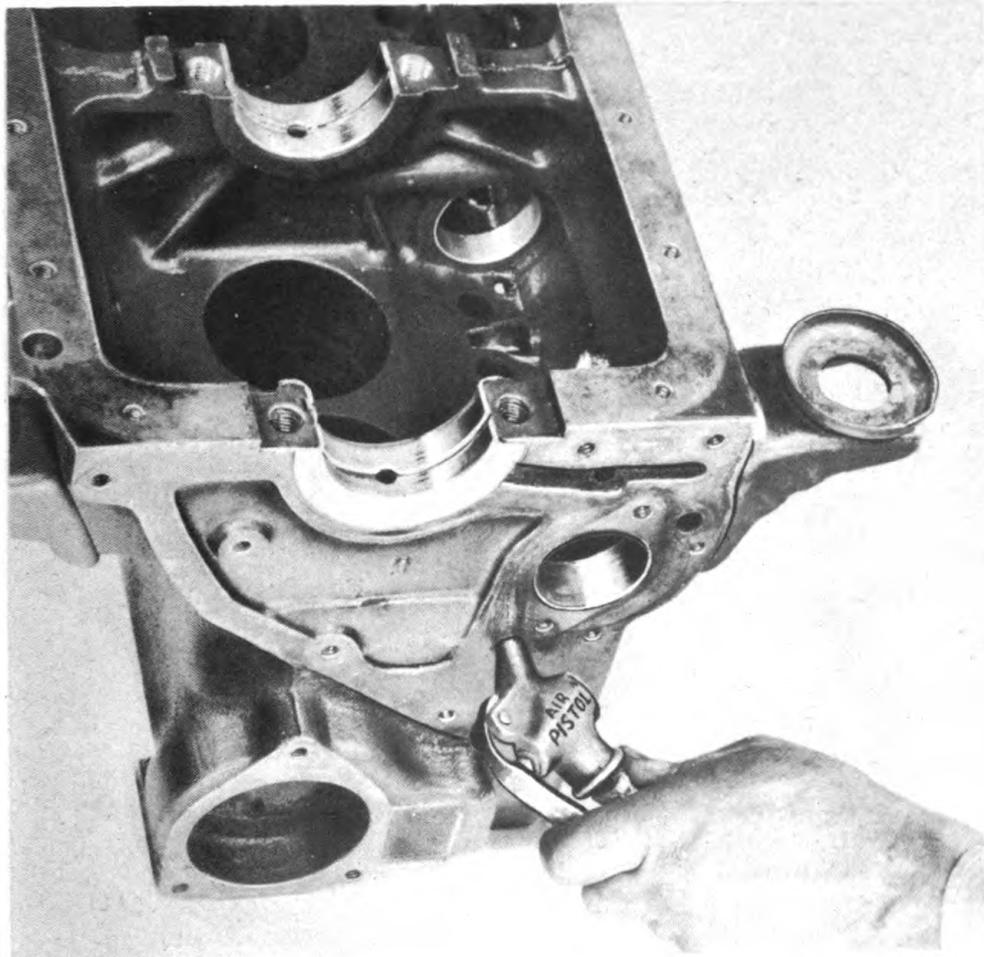
RA PD 309750

Figure 16—Cleaning Oil Passages in Crankcase Webs

brush. Reverse flush the water passages in the cylinder head and cylinder block to remove any loose sediment or rust. Clean all carbon formation from cylinder head and cylinder block with a wire brush. Clean the oil passages in crankcase webs (fig. 16) leading to the main oil gallery and camshaft bearings with compressed air. Remove the plugs from both ends of the main oil gallery and clean the gallery with compressed air (fig. 17). Blow through the oil pump and valve lifter

CLEANING ENGINE PARTS

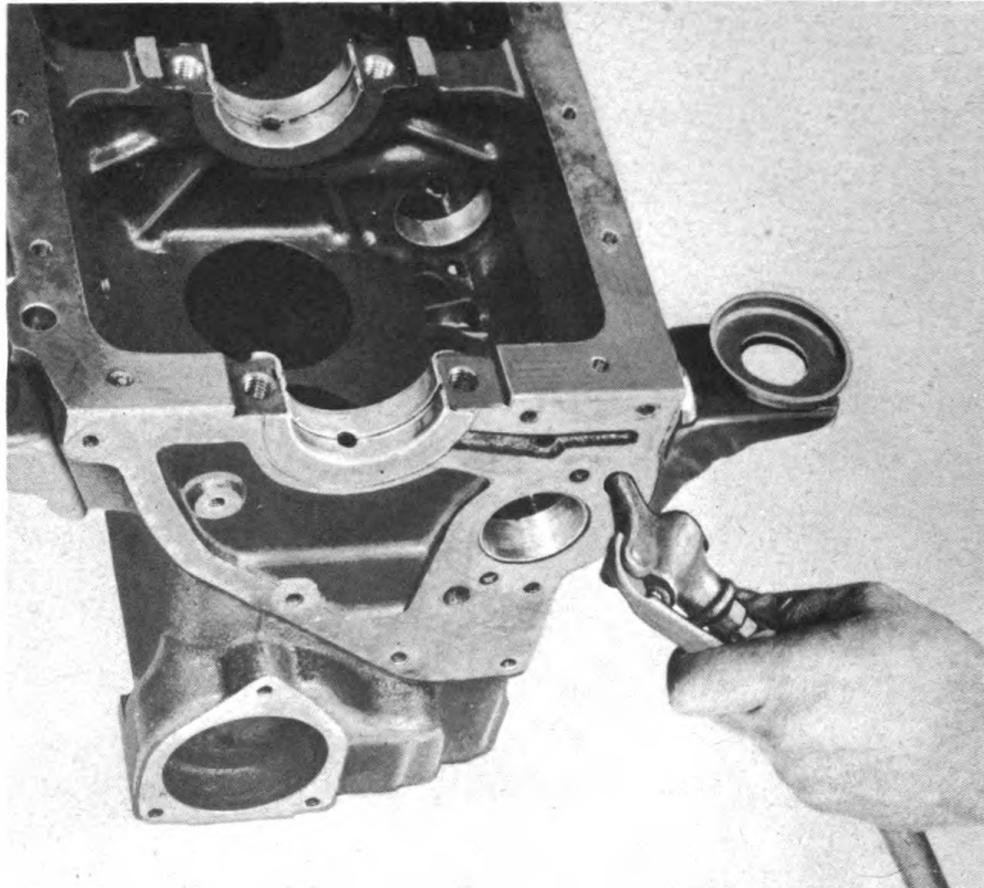
gallery with compressed air while alternately opening and closing the oil pump passage with the finger (fig. 18). Also make sure that the oil pressure relief passages are clean. Clean oil passages in the crankshaft, with compressed air.



RA PD 67011

Figure 17—Cleaning Main Oil Gallery

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Figure 18—Cleaning Oil Pump and Valve Lifter Oil Gallery

Section VIII

INSPECTION OF ENGINE PARTS

	Paragraph
Flywheel	23
Water outlet and thermostat.....	24
Cylinder head	25
Valves and valve springs	26
Drive pulley and starting jaw.....	27
Timing gear cover.....	28
Timing gears	29
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Oil strainer	31
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Camshaft	34
Valve lifters	35
Connecting rods	36
Pistons and rings	37
Engine front and rear plates.....	38
Crankshaft	39
Engine front mountings.....	40
Oil pressure relief valve.....	41
Cylinder block	42

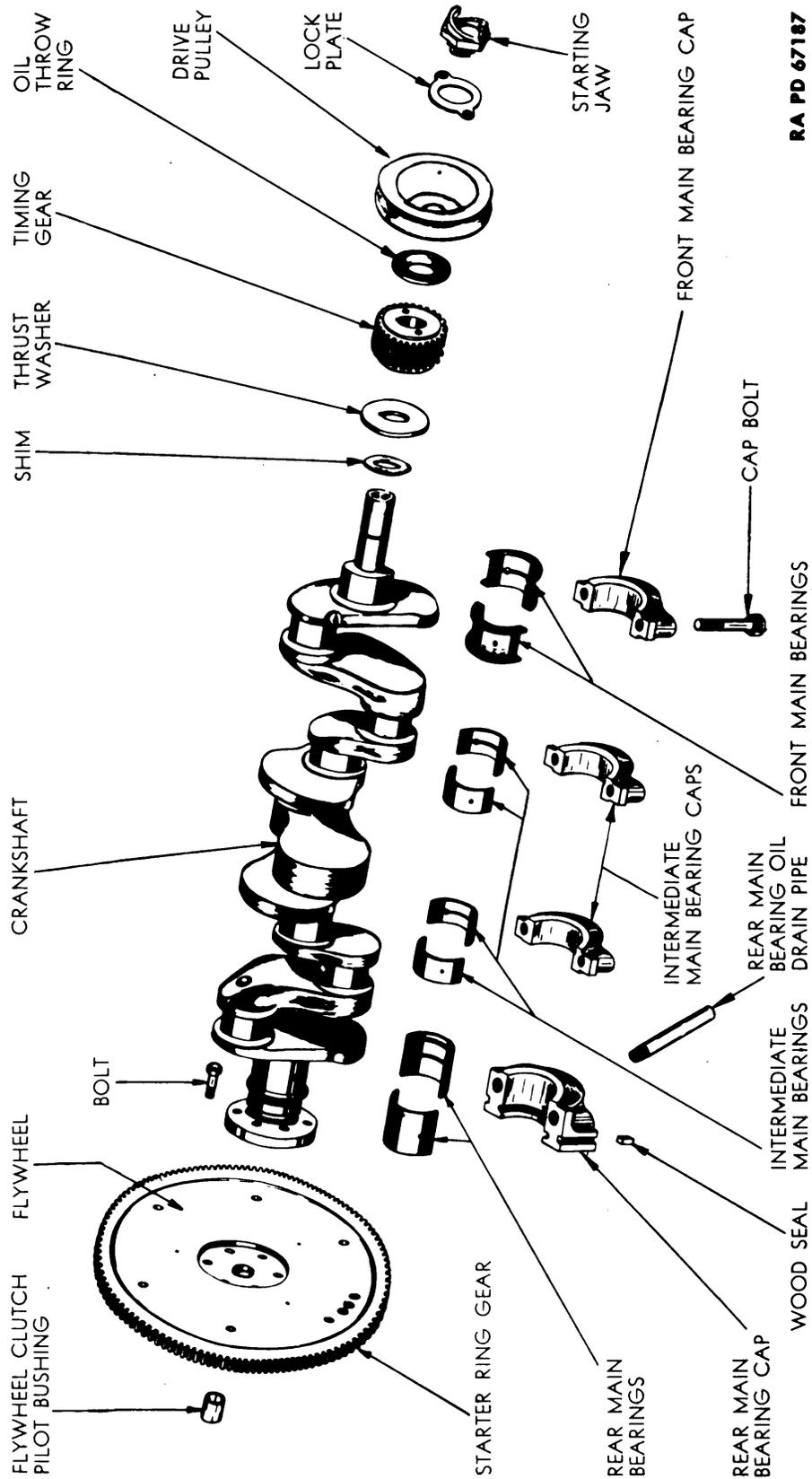
23. FLYWHEEL.

a. Inspect flywheel (fig. 19) for cracked and excessively worn or chipped ring gear teeth. Also examine the clutch pilot bushing for scores or other damage. If the flywheel is cracked, replace it. Replace the ring gear if the teeth are worn or chipped so they are not suitable for further service. If the clutch pilot bushing is scored or damaged, replace it, pressing the original bushing out and installing a new one with a suitable tool.

24. WATER OUTLET AND THERMOSTAT.

a. Inspect the water outlet for cracks, other damage, or sand holes. If damaged, replace with new part. Test the water thermostat by immersing it in water heated to the rated opening temperature (174 F) of the valve. Replace the thermostat if it does not start to open at a temperature of 174 F, or if it sticks in the fully open position.

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Figure 19—Crankshaft, Timing Gear, Main Bearings, Pulley, and Flywheel

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INSPECTION OF ENGINE PARTS

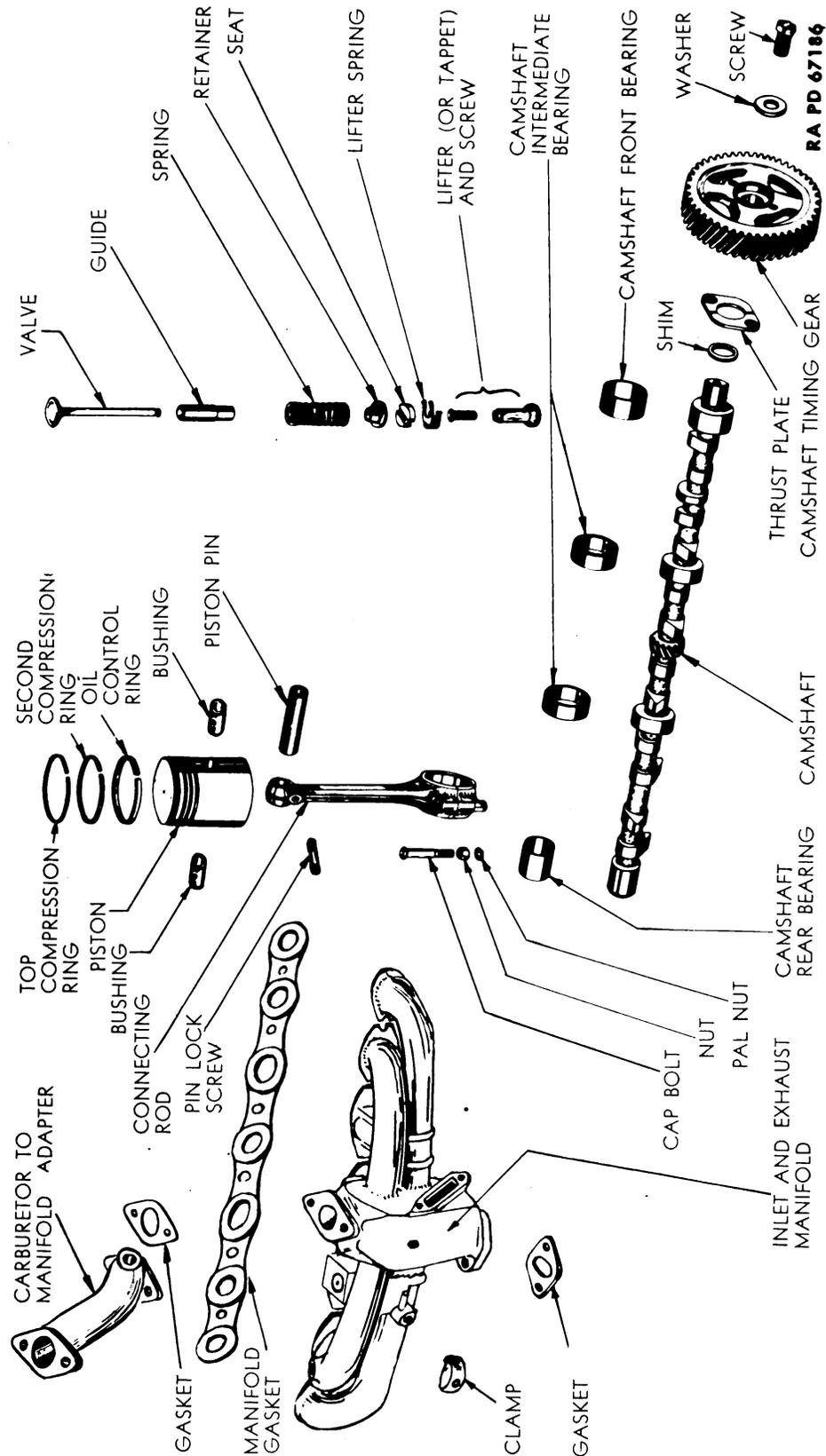


Figure 20—Manifold, Camshaft and Gear, Piston and Connecting Rod, and Valve Mechanism Parts

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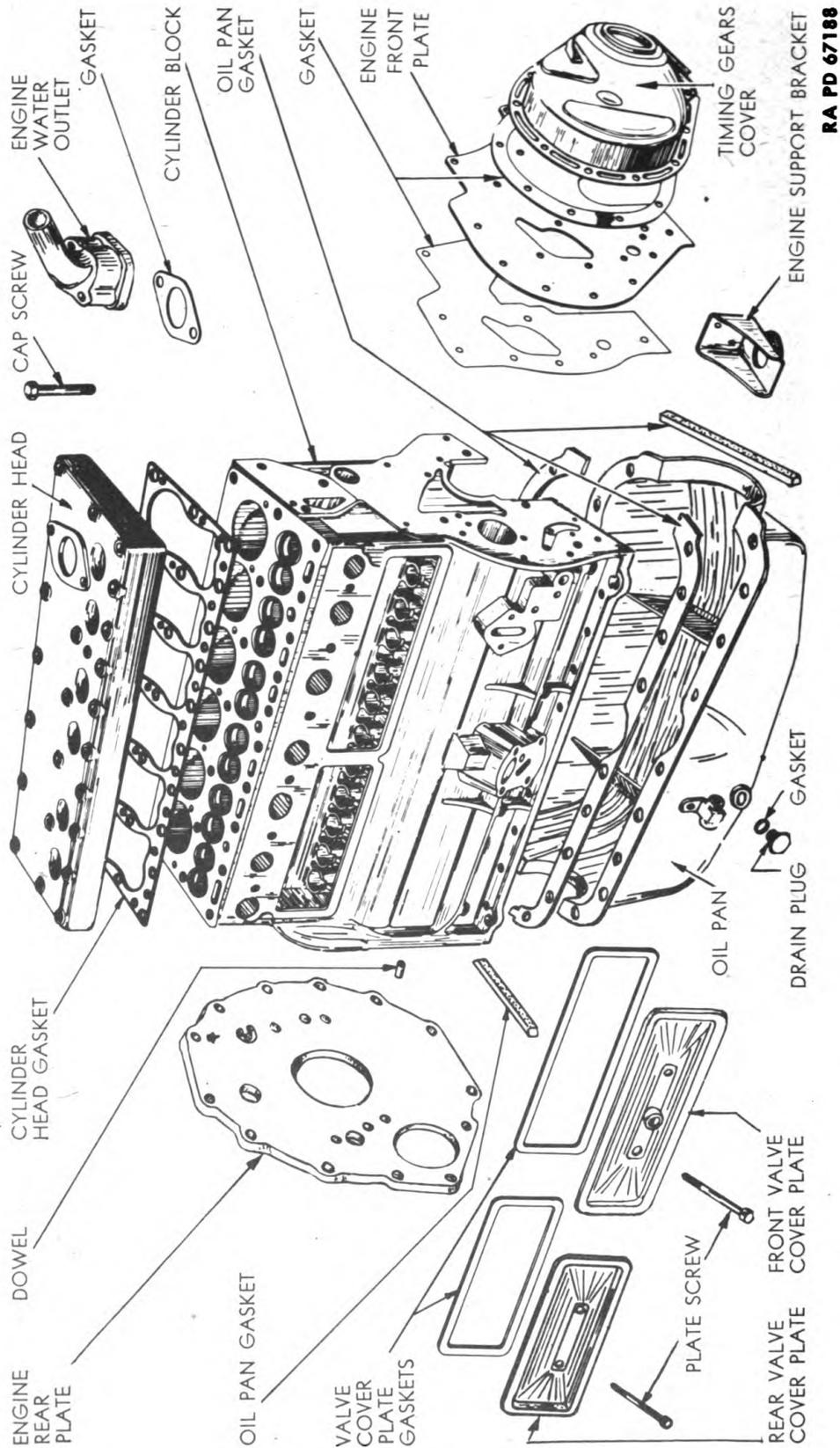


Figure 21—Cylinder Block, Head, Oil Pan, and Parts

INSPECTION OF ENGINE PARTS

25. CYLINDER HEAD.

a. Inspect the cylinder head (fig. 21) for cracks, distortion of more than $\frac{1}{64}$ inch, stripped threads in the spark plug holes, or other damage. Examine the cylinder head cap screws for stripped or damaged threads. If the cylinder head or cap screws are unfit for further service, replace them.

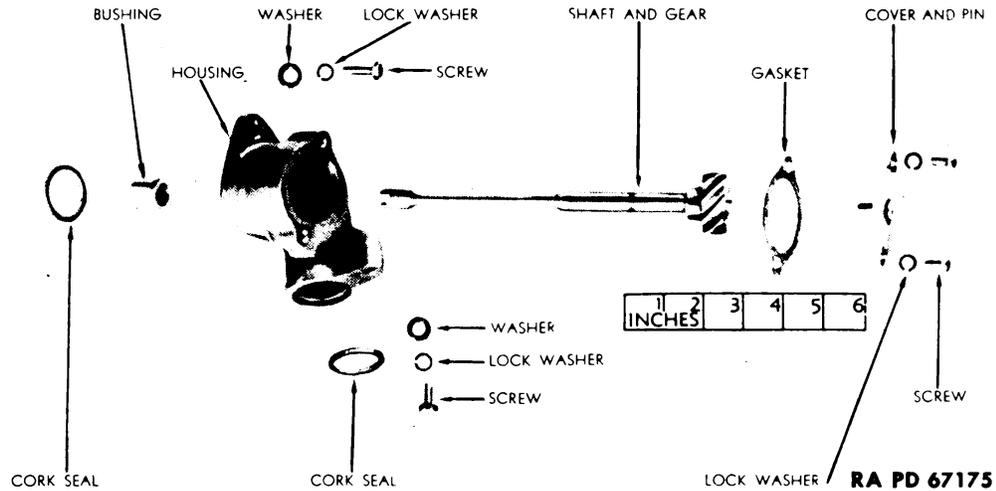


Figure 22—Distributor Drive Parts

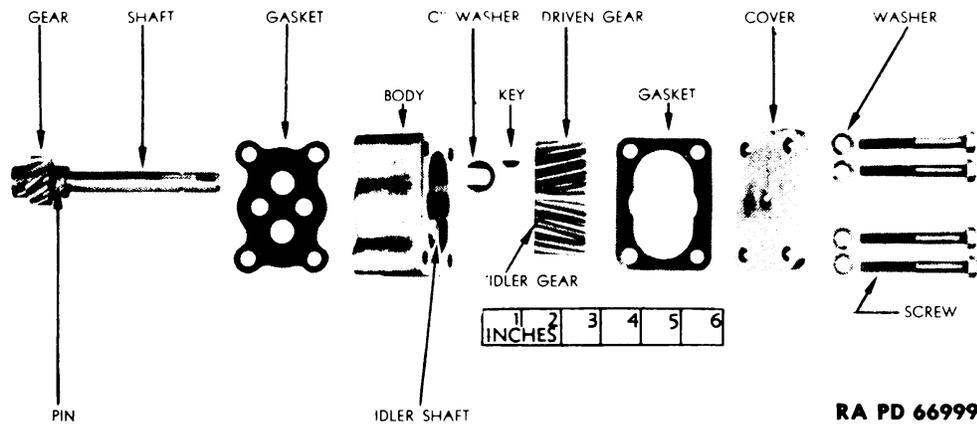


Figure 23—Oil Pump Parts

26. VALVES AND VALVE SPRINGS.

a. Inspect the valves (fig. 20) for burned, cracked, or warped heads and the stem ends for scored surfaces where they contact the valve lifter adjusting screw face. If not satisfactory for further service recondition or replace them. Compress valve springs with a suitable tester to a length of $1\frac{7}{16}$ inches. Satisfactory springs will require from 77 to 85 pounds pressure to compress. Replace springs that do not have the proper tension.

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27. DRIVE PULLEY AND STARTING JAW.

a. Inspect drive pulley (fig. 19) for bent or damaged flanges, cracked hub, or damaged keyway, and replace if not satisfactory for further service. Examine the starting jaw for damaged threads or breakage and replace if not fit for further service.

28. TIMING GEAR COVER.

a. Inspect the timing gear cover (fig. 21) for distortion, cracks, or breaks and the oil seal for damage. If distorted, cracked, or broken, replace it. If the cover oil seal is damaged, replace the seal.

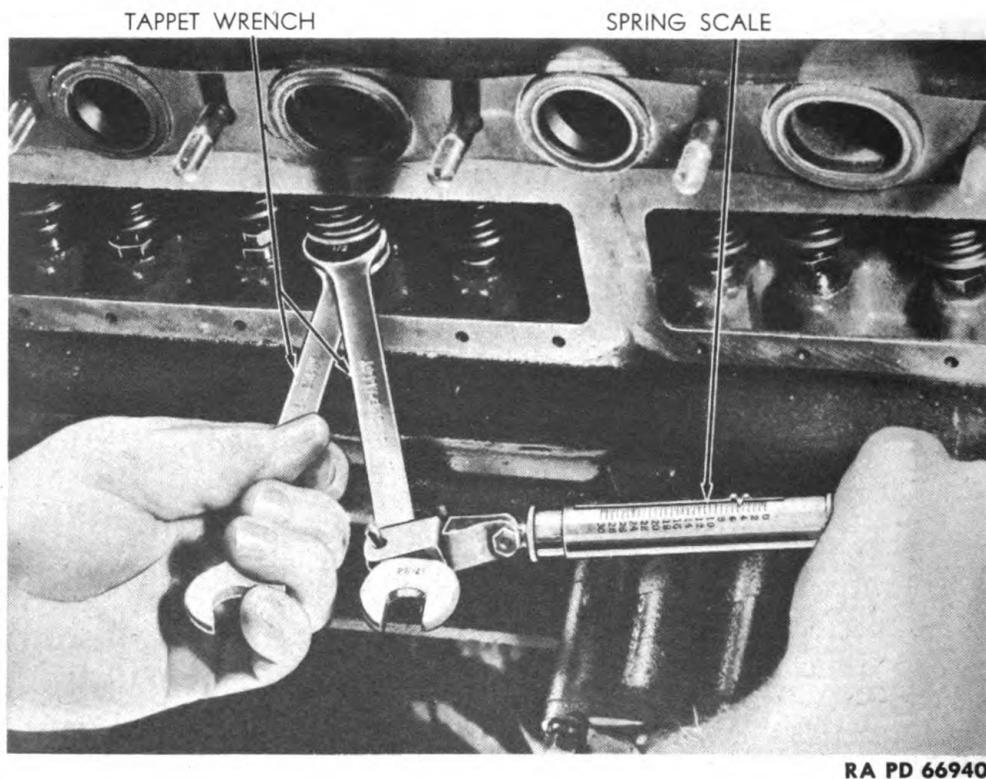


Figure 24—Checking Valve Lifter Adjusting Screw Tension

29: TIMING GEARS.

a. Inspect the timing gears (figs. 19 and 20) for cracks, or damaged teeth. Examine the keyways in both gears for damage. Replace the gears if found to be unfit for further service.

30. OIL PAN.

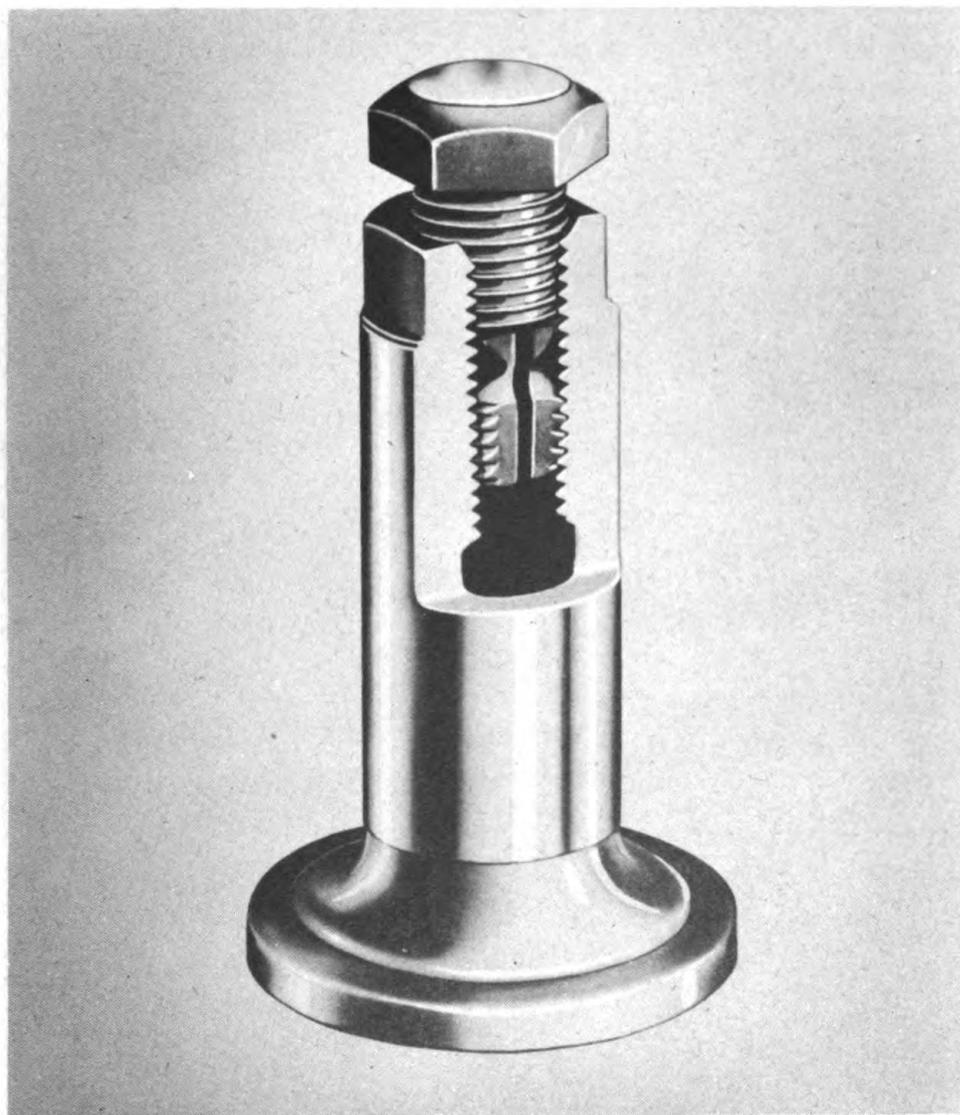
a. Inspect the oil pan (fig. 21) for loose baffle plates, drain plug reinforcing plate, and stripped or damaged plug threads as well as for

INSPECTION OF ENGINE PARTS

dents, cracks, and distortion. Replace the oil pan if it cannot be placed in a serviceable condition by repairs and welding.

31. OIL STRAINER.

a. Examine the oil strainer for breaks in the screen and leaks in the suction pipe or float. Inspect the stops on the lower end of the suction pipe to make sure they are not bent out of position. If the oil strainer cannot be placed in a serviceable condition, replace it.



RA PD 49325

Figure 25—Valve Lifter and Adjusting Screw

32. DISTRIBUTOR SUPPORT AND DRIVE SHAFT.

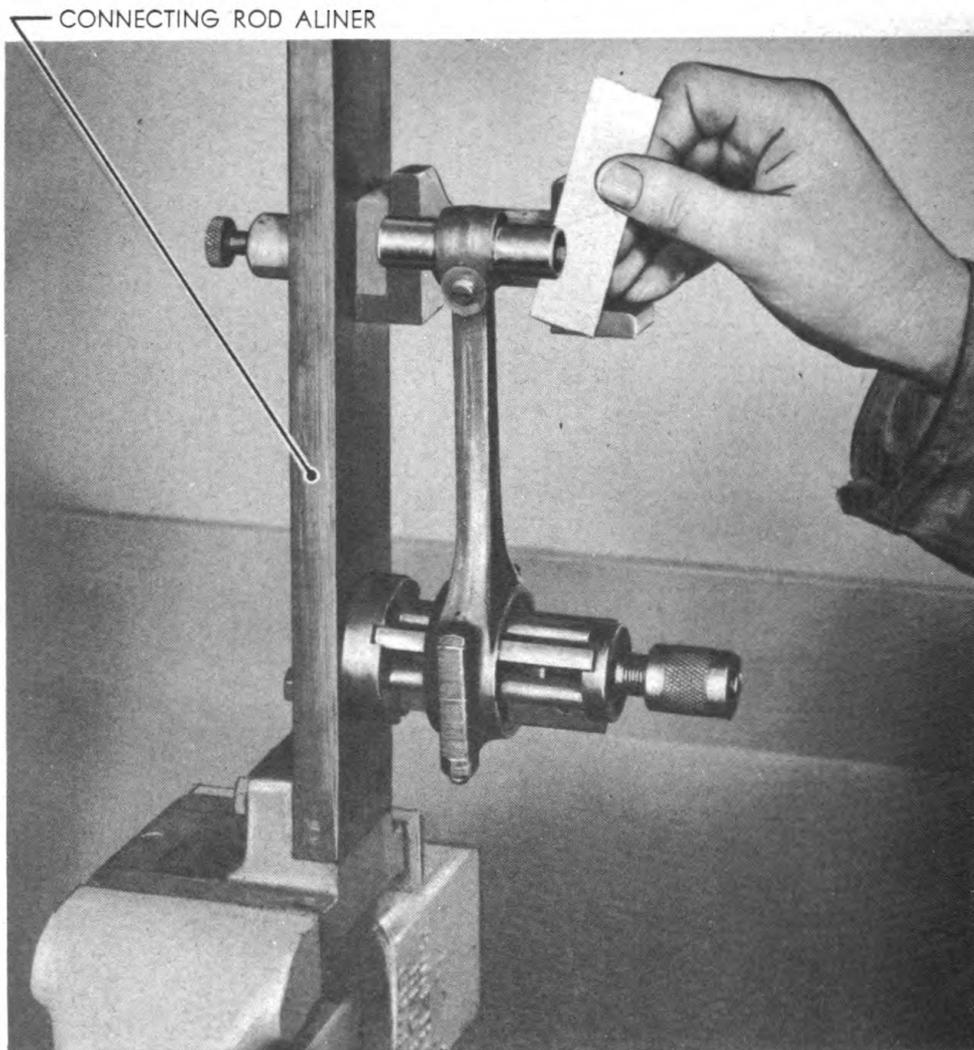
a. Inspect the distributor support (fig. 22) for cracks or other damage and the support bushing for scores. Examine the distributor drive shaft for a bent or twisted condition and the gear for looseness

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and broken or damaged teeth. Inspect the spacer plug in distributor support cover for looseness or damage. Replace any parts that are not satisfactory for further service.

33. OIL PUMP PARTS.

a. Inspect the oil pump body and cover (fig. 23) for cracks, distortion, or other damage. Examine the oil pump retaining screws for stripped or damaged threads. Inspect the oil pump gears for chipped or damaged teeth, and the keyway in the drive gear for damage. Ex-



RA PD 66989

Figure 26—Checking Connecting Rod for Twist

amine the oil pump drive shaft and gear for scores or damage and the keyway in the shaft for damage. Replace any parts found to be unfit for further service.

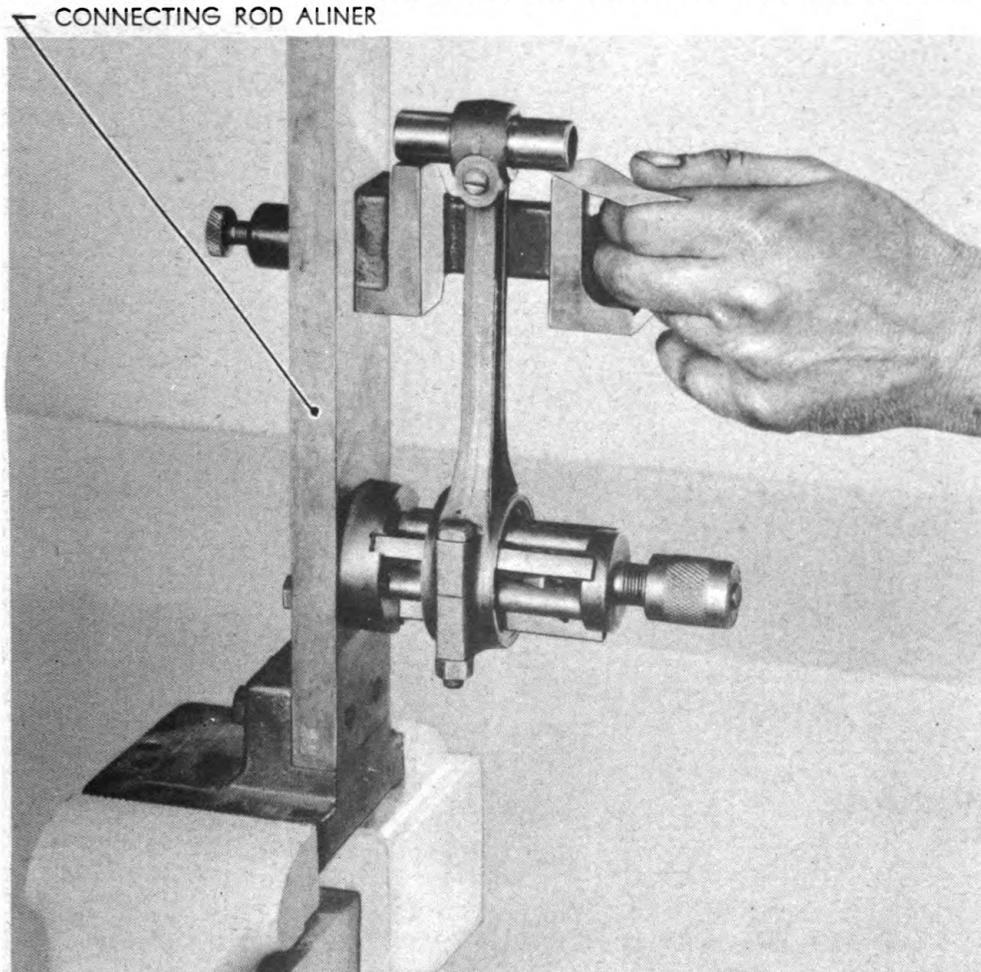
INSPECTION OF ENGINE PARTS

34. CAMSHAFT.

a. Inspect the camshaft (fig. 20) for scored or damaged journals or cam lobes and replace if unfit for further service. Place camshaft in V-blocks, and check alinement. If misalinement exceeds 0.006 inch, replace camshaft.

35. VALVE LIFTERS.

a. Inspect the valve lifters (figs. 20 and 25) for cracked or chipped condition on the lower surface that contacts the camshaft lobe. Test



RA PD 66988

Figure 27—Checking Connecting Rod for Bent Condition

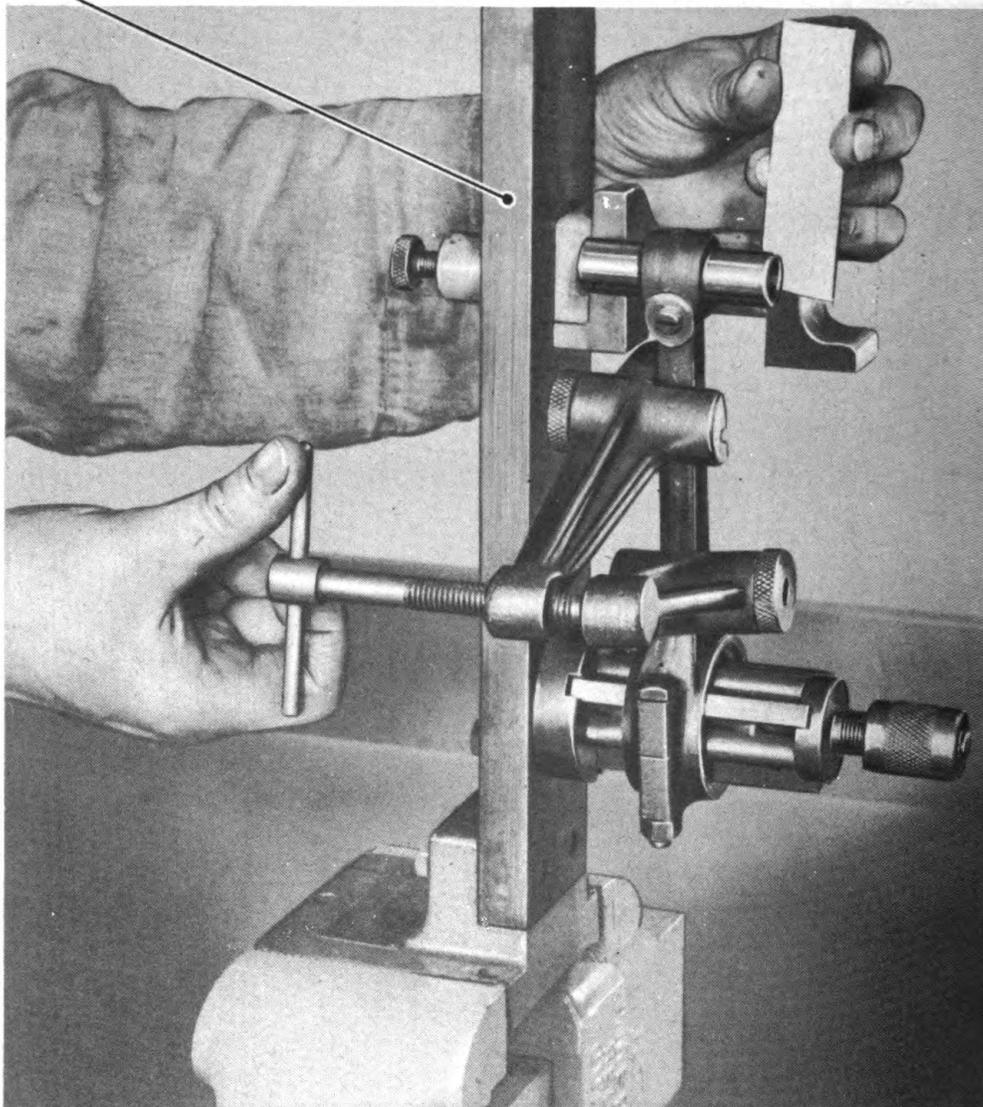
the valve lifter screw for proper tension required to turn screw in lifter. A force of at least 25 inch-pounds (4 pound pull with a spring scale attached to 6-inch tappet wrench is required), (fig. 24). Inspect for a chipped condition on the surface that contacts the end of valve stem. Replace parts as required that are not fit for further service.

36. CONNECTING RODS.

a. Inspect the connecting rods for scored or burned bearing surfaces, alinement (figs. 26 and 27), crank pin journal clearance, and end

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CONNECTING ROD ALINER



RA PD 66951

Figure 28—Alining Connecting Rod to Eliminate Twist

play. Aline the connecting rods if they are twisted (fig. 28) and replace them if bent. The connecting rod to crank pin journal clearance is from 0.0005 inch to 0.002 inch, and if the clearance is greater, replace the rod. Replace the connecting rods if the end play is greater than 0.009 inch. If the connecting rod bearing surfaces are burned or scored, replace connecting rod.

37. PISTONS AND RINGS.

- a. Inspect the pistons (fig. 20) for scores, carbon formation in the ring grooves, or other damage. Examine the piston pins for scores and

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proper fit in the pistons. The proper piston pin fit is obtained when the pin will just slide through the bore in the piston of its own weight (fig. 29). Clean any carbon formation out of the ring grooves, or replace the pistons if they are cracked or damaged. If the piston pins are scored or too loose, replace them.

38. ENGINE FRONT AND REAR PLATES.

a. Inspect the engine plates for cracks or distortion. If the plates cannot be placed in serviceable condition by welding or straightening, replace them.



RA PD 66962

Figure 29—Fitting Piston Pin

39. CRANKSHAFT.

a. Inspect the connecting rod crankpin journals for roundness, taper (fig. 30) or scores. If the journals are out of round or tapered in excess of 0.0015 inch or scored, recondition or replace the shaft. Place crankshaft in V-blocks and check alinement. If misalinement exceeds 0.006 inch, replace crankshaft.

40. ENGINE FRONT MOUNTINGS.

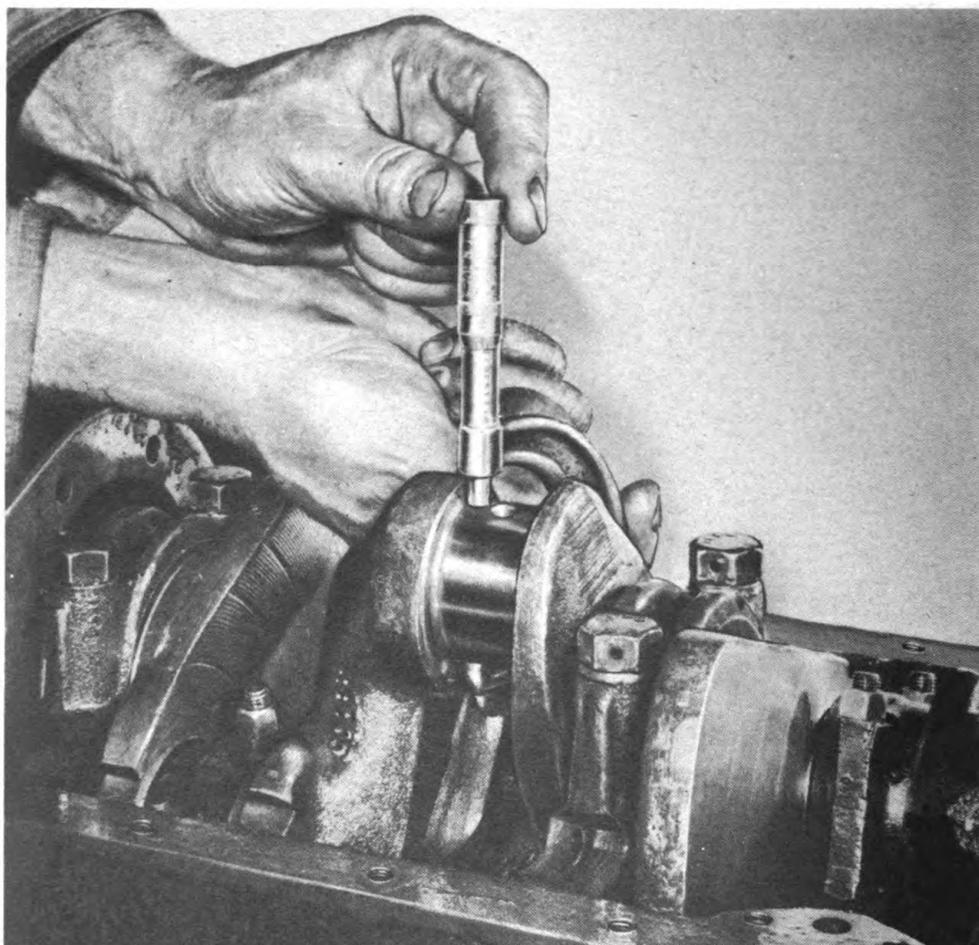
a. Inspect the engine front mounting cushions for signs of deterioration. Examine mounting brackets for cracks, distortion, or other damage. If the mounting cushions are deteriorated, replace them.

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Replace mounting brackets if they cannot be placed in serviceable condition.

41. OIL PRESSURE RELIEF VALVE.

a. Inspect the valve for scores, damage, and plugged metering orifice and replace if unfit for further service. Examine the valve spring for breakage and replace if broken.



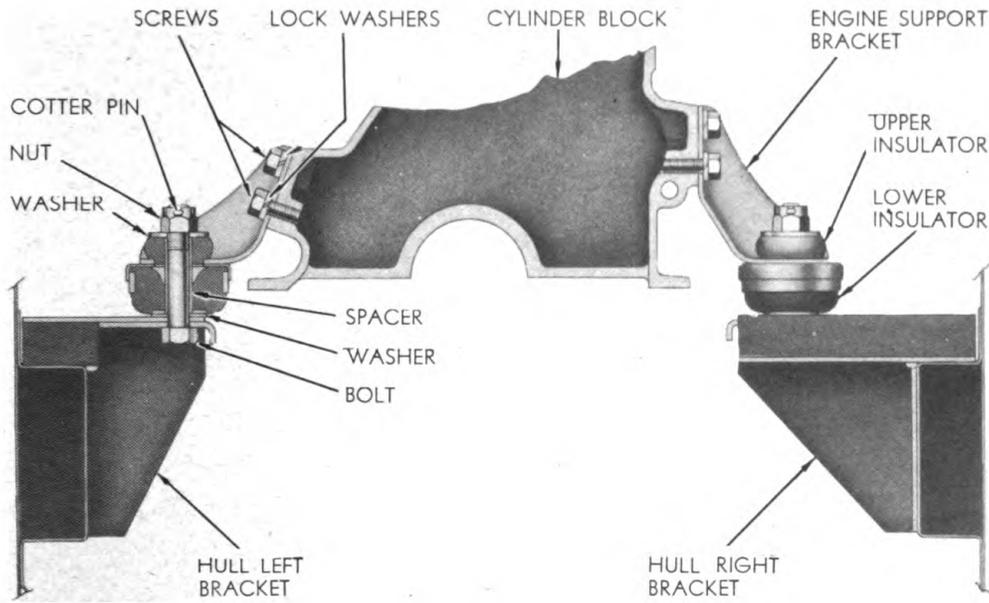
RA PD 67002

Figure 30—Measuring Connecting Rod Crank Pin Journal

42. CYLINDER BLOCK.

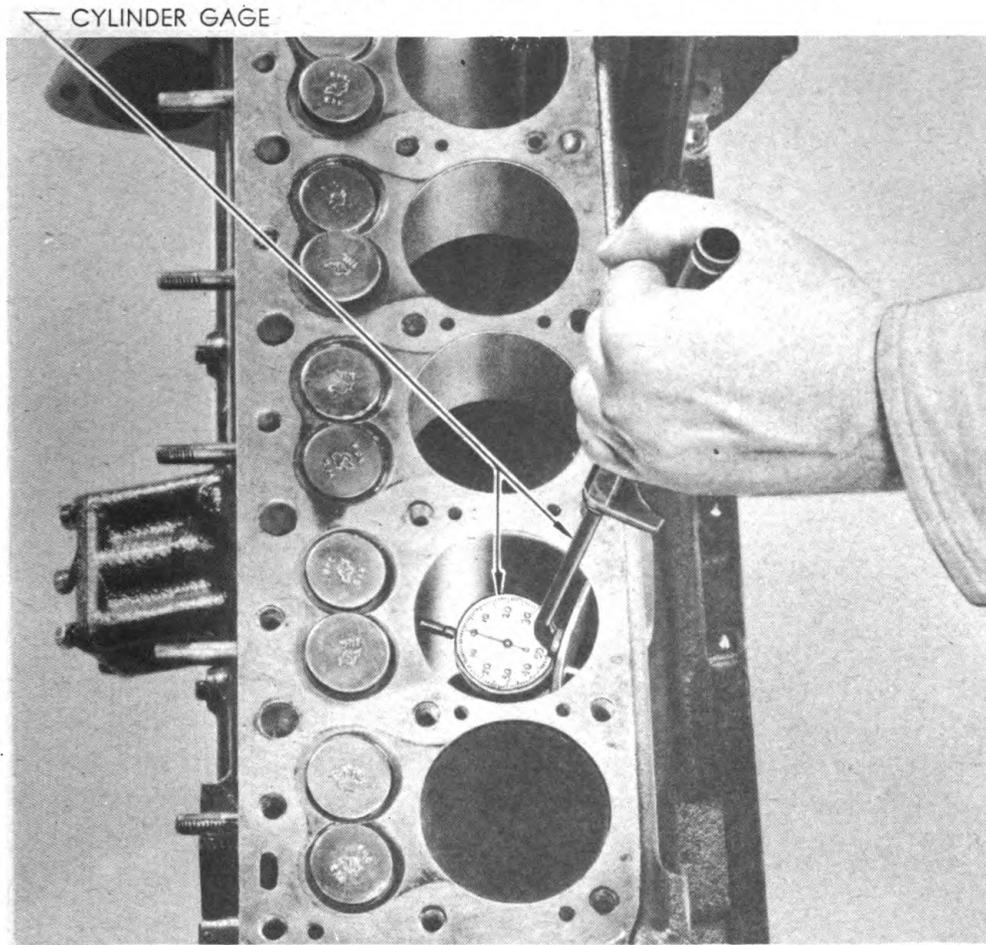
a. Inspect the cylinder block for cracks or indications of water leaks at expansion plugs. Examine valve seats for cracks or a burned and pitted condition. Inspect valve stem guides for breakage or other damage. Inspect cylinder bores for scores, taper, out-of-round condition (fig. 32) and ridge above ring travel. Examine the camshaft bearings for scores or other damage. Replace the cylinder block if it is

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RA PD 67238

Figure 31—Engine Front Mounting Construction



RA PD 66949

Figure 32—Checking Cylinder Bores

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cracked and cannot be placed in serviceable condition by welding or other repairs. If water leaks are evident at expansion plugs, replace the plugs applying white lead to them before installing. Recondition valve seats if burned or pitted. Replace broken or damaged valve stem guides. Recondition cylinder bores if scored, tapered, or out-of-

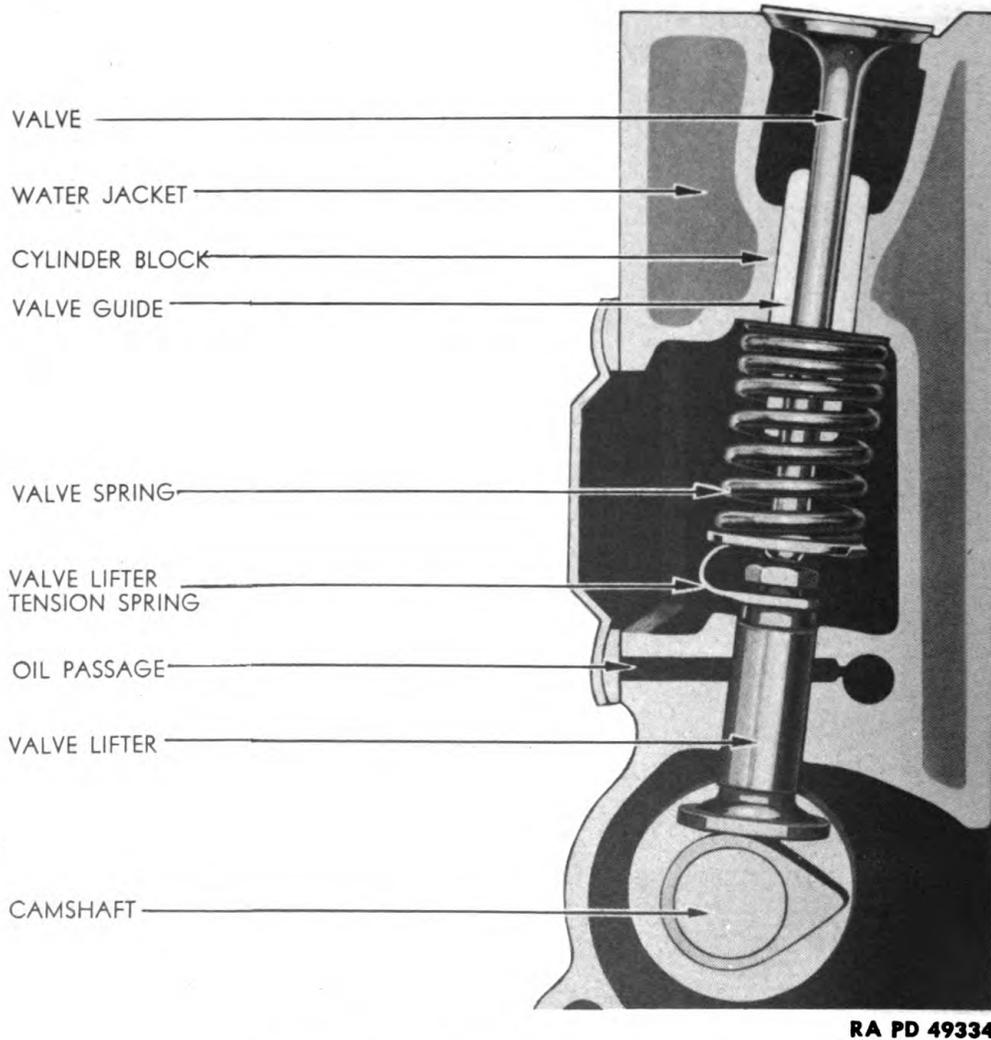


Figure 33—Valve and Related Parts

round in excess of 0.002 inch. If the cylinder bore has a ridge at the top, remove it before installing new pistons or rings. Replace the camshaft bearings if scored or damaged so they are not satisfactory for further service.

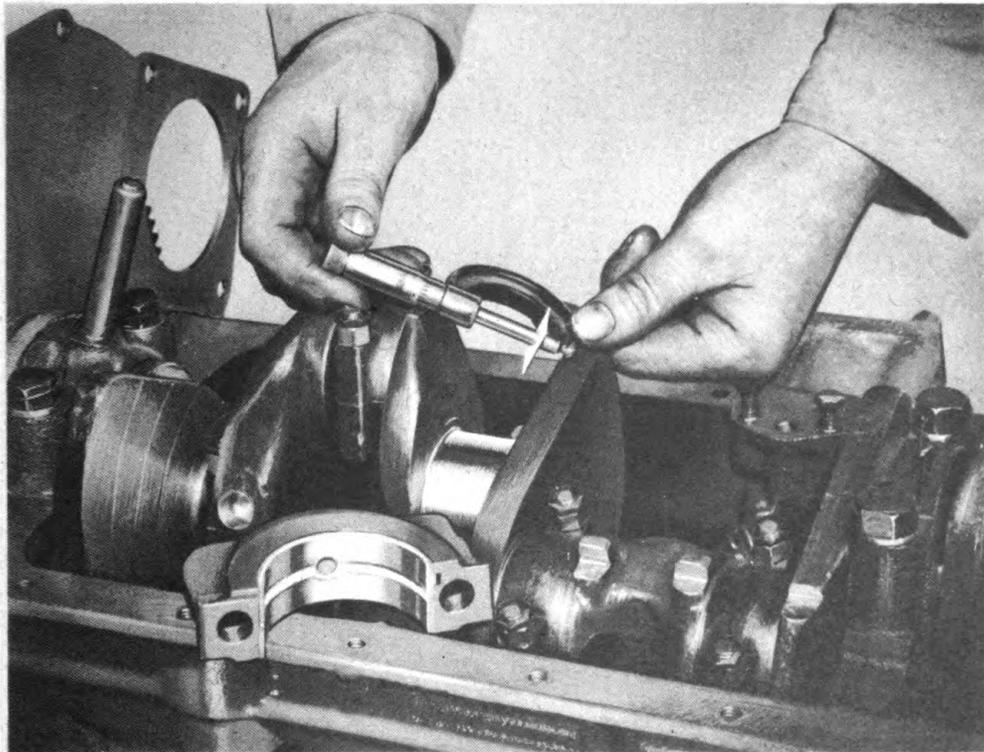
Section IX

REPAIR AND REBUILDING

	Paragraph
Crankshaft	43
Cylinder block	44

43. CRANKSHAFT.

a. Recondition crankshaft main bearing and crank pin journals to the next undersize and fit new main bearing shells to the main bearing journals. The proper main bearing clearance is from 0.0005 inch to 0.001 inch. Place the upper half of the main bearing shells in position in the cylinder block, carefully lower the crankshaft in place on the



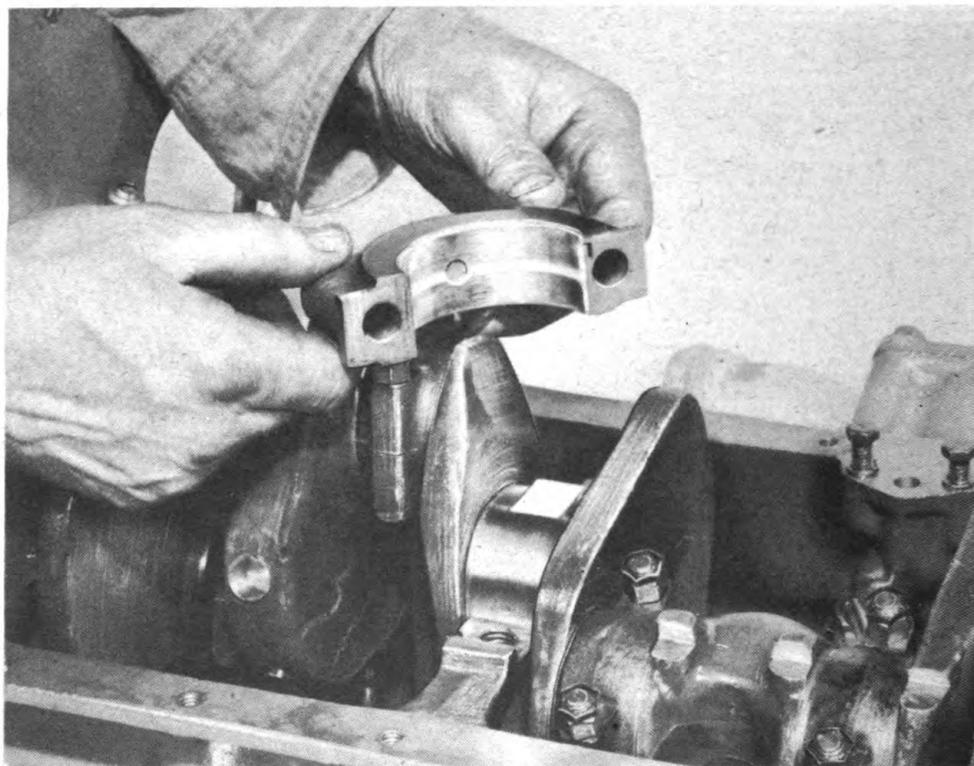
RA PD 66959

Figure 34—Selecting Shim to Check Main Bearing Clearance

shells in the block. Select a paper shim 0.001-inch thick (fig. 34), place on journal (fig. 35), install the lower shell with main bearing cap and tighten cap screws securely. A slight resistance will be evident when rotating crankshaft if the clearance is correct. After checking to make sure there is proper clearance between each crankshaft main bearing journal and shells, remove the crankshaft.

b. Fit new connecting rods to crank pin journals by reaming the bearing if necessary (fig. 36), to provide 0.0005-inch to 0.001-inch clearance. If necessary, dress off front and rear of connecting rod to

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RA PD 66957

Figure 35—Checking Main Bearing Clearance

provide correct end play of 0.005 inch. The connecting rods are offset, and are properly installed when the offset is away from nearest main bearing journal and the oil registry hole in the side of rod points toward the right or camshaft side of engine. Number the connecting rods and caps on side having the oil registry hole which sprays oil on thrust side of cylinder walls.

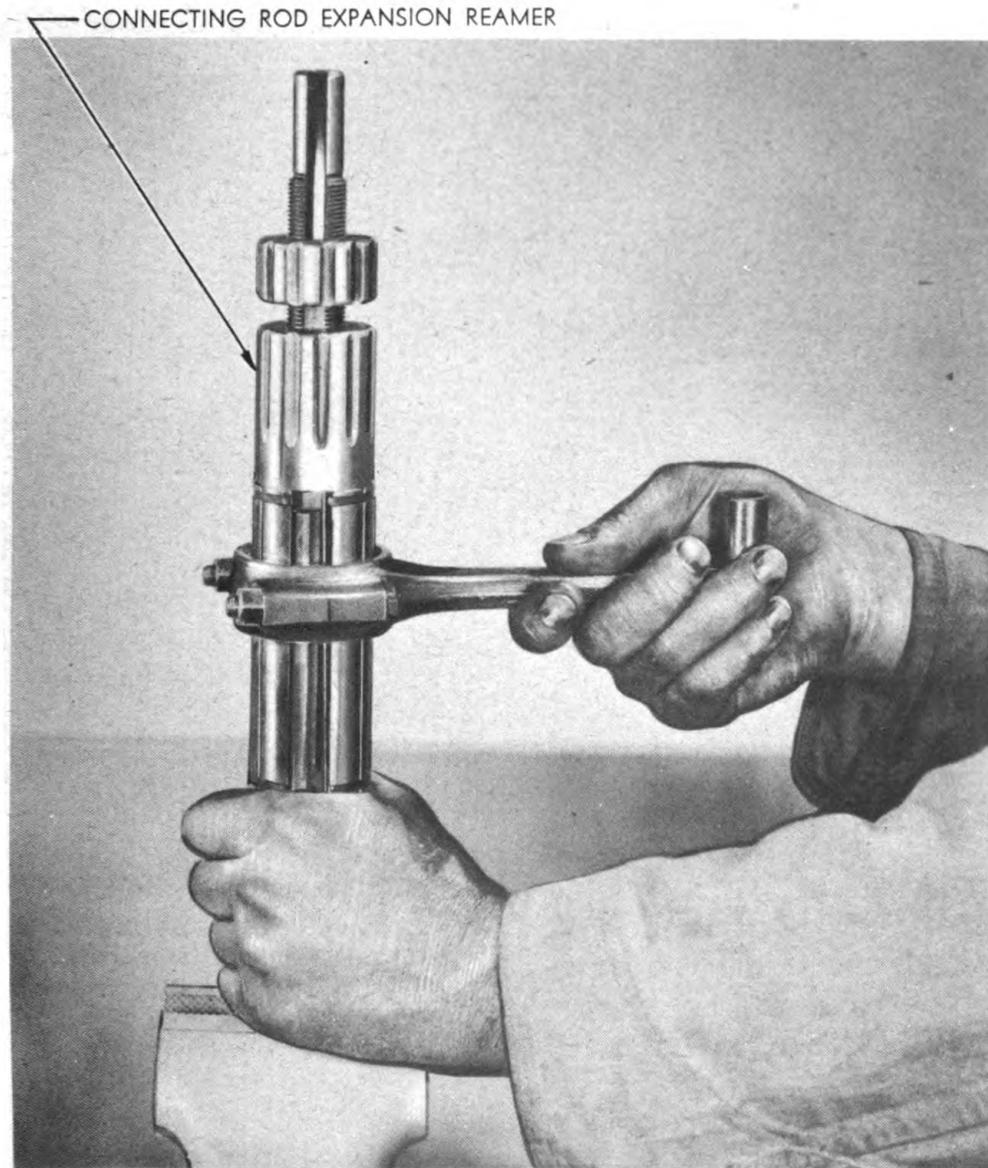
44. CYLINDER BLOCK.

a. **Valve Guides.** To replace valve guides that are broken or damaged, remove them with a suitable tool and install new guides.

b. **Valve Seats.** Recondition the valve seats to a 45-degree angle. Narrow the seat down to a $\frac{3}{32}$ -inch width with a 30-degree cutter at the top and a 70-degree or 75-degree cutter at the lower edge of the seat.

c. **Cylinders.** Recondition the cylinders to the next piston oversize and fit new pistons to the cylinders. Place a 0.002 inch feeler, 1 inch wide, 12 inches long, attached to piston fitting scale KM-J3642 (fig. 37)

REPAIR AND REBUILDING



RA PD 66960

Figure 36—Reaming Connecting Rod Bearing

in the cylinder on the camshaft (thrust) side, push piston (inverted) into the cylinder and pull the piston fitting scale to remove the feeler while checking the pounds pull required. The proper pounds pull to provide the correct piston to cylinder wall clearance is 15 to 20 pounds. Fit new piston rings to each cylinder so a gap of 0.007 inch to 0.017 inch is obtained.

d. Camshaft Bearings. If the camshaft bearings are scored or damaged, remove them with a suitable puller and install new bearings carefully to avoid distortion. If the bearings are distorted and bind on the camshaft journals it will be necessary to line ream the bearings to provide the proper clearance.

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PISTON FITTING SCALE KM-J3642

RA PD 67184

Figure 37—Checking Piston Fit in Cylinder Bore

Section X

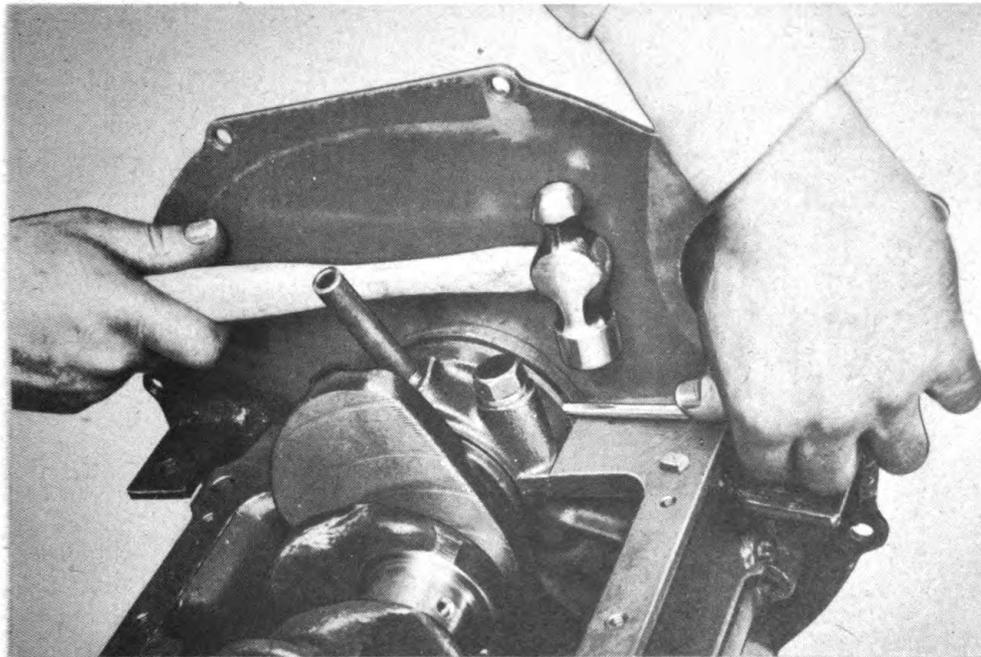
ASSEMBLY

Paragraph

Assembly 45

45. ASSEMBLY.

a. **Assemble Crankshaft to Cylinder Block.** With the cylinder block inverted place the main bearing upper shells in shell recesses in the crankcase webs. Apply SAE 10 engine oil to all moving parts during assembly. With the flywheel bolts in position in the crankshaft flange carefully place the shaft in position on the bearing shells. Install the main bearing caps with lower shells, making sure that they are correctly positioned, and tighten the screws that fasten the main bearing caps to the block evenly and snugly. Carefully install new specially



RA PD 66958

Figure 38—Rear Main Bearing Oil Seal Installation

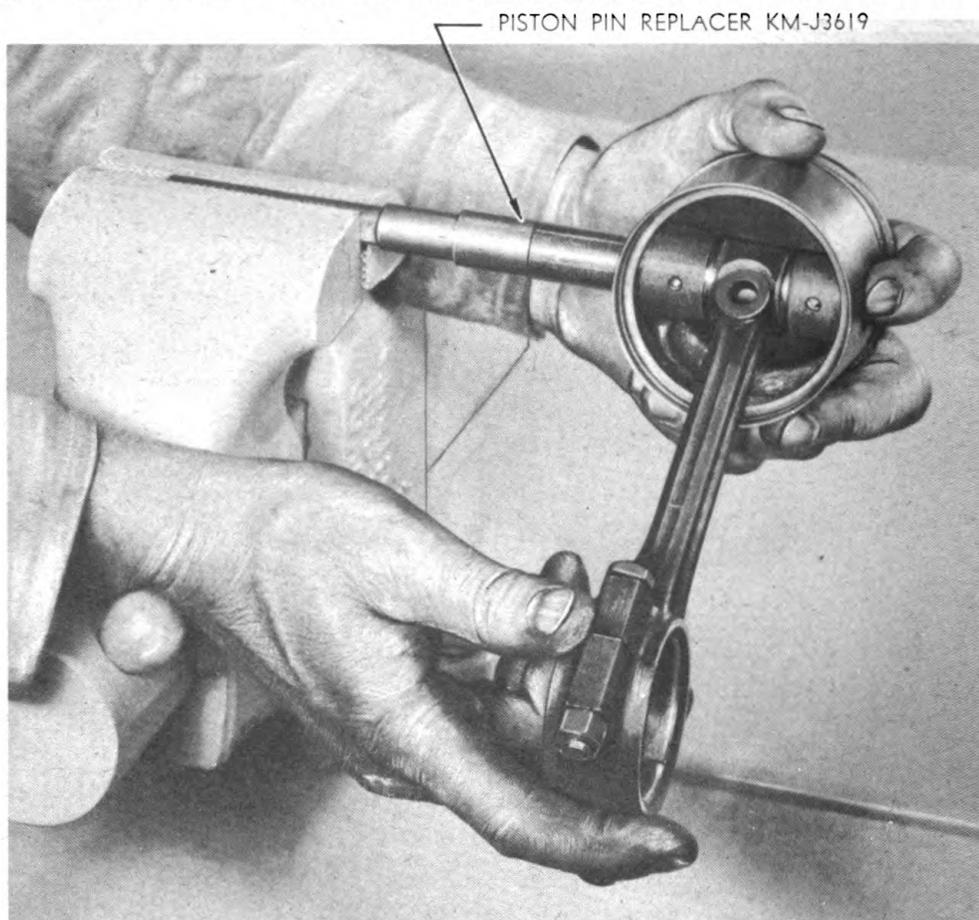
treated wood oil seals at the rear main bearing cap (fig. 38). Tighten all main bearing cap screws evenly to a tension of 1100 inch-pounds with a tension wrench. Wire together the screws holding each main bearing cap in position to prevent the screws from loosening.

b. **Assemble Engine Front and Rear Plates to Cylinder Block.** Install a new gasket on the front of cylinder block, place the engine front plate in position, install the screws and washers and tighten securely. Place engine rear plate in position on the rear of cylinder block, install the washers and screws and tighten securely.

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c. **Assemble Oil Pressure Relief Valve to Cylinder Block.** Insert the valve and spring in the oil relief passage, place a new gasket on the screw plug, install and tighten securely.

d. **Assemble Connecting Rods and Piston Assemblies.** Fasten piston pin replacer tool KM-J3619 in a vise, remove nut from shaft, slide piston pin over end of shaft, reinstall nut and tighten. Insert the small end of the connecting rod between the piston pin bosses making sure that the raised boss on inside of piston skirt is toward the numbered side of connecting rod. Slide piston and connecting rod over piston pin (held on replacer), insert the tapered lock pin through the connecting rod while rocking the rod to permit the flat side of the tapered pin to align with the flat on the piston pin. Install the internal



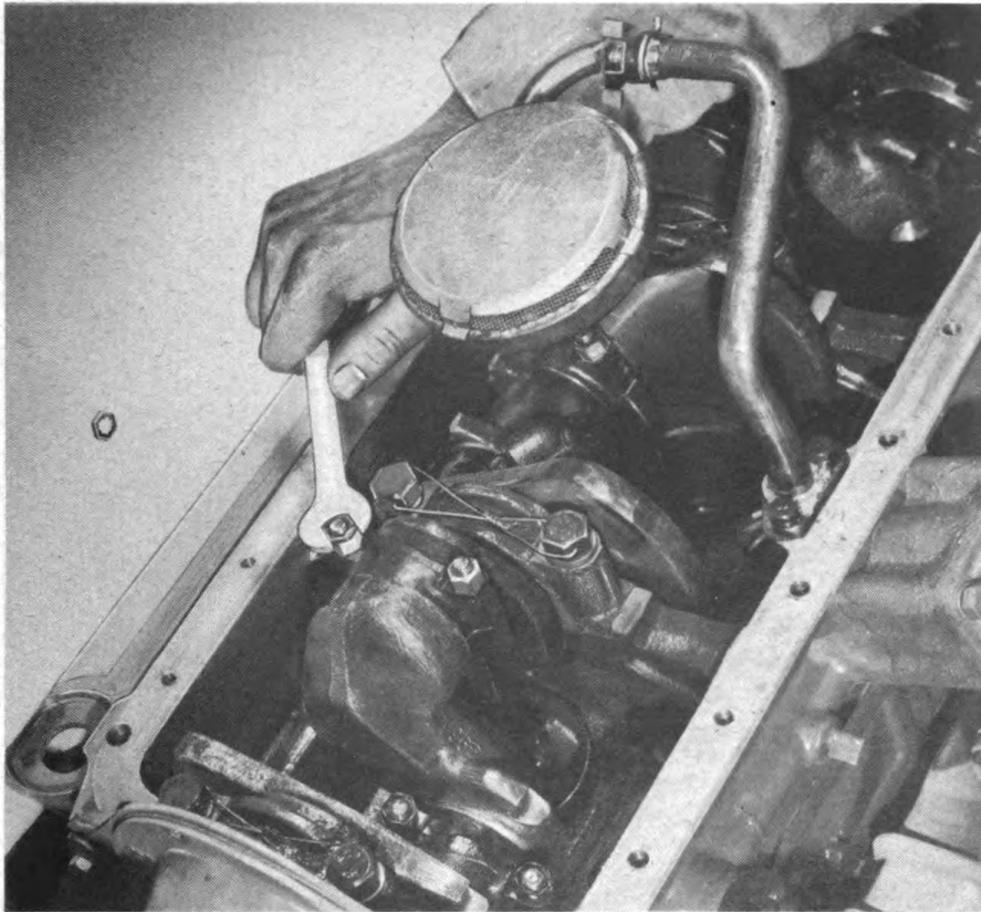
RA PD 66961

Figure 39—Piston and Pin Installation on Connecting Rod

lock washer, lock nut, and tighten securely (fig. 39). Install the oil control ring in the lower groove, $\frac{1}{8}$ inch compression ring with the step in the outer edge down in the center groove, $\frac{3}{32}$ inch wide compression ring with the step in the inner edge up in the top groove. **NOTE:** The shallow groove near top of piston does not require a ring.

ASSEMBLY

e. **Install Connecting Rods and Piston Assemblies.** Remove the connecting rod cap bolt nuts and cap. Apply engine oil to the outer surface of the piston and rings, compress the piston rings with a piston ring compressor, place the cylinder block in a vertical position and insert the large end of connecting rod into cylinder and start the lower portion of the piston into cylinder bore. Push on the top of piston until piston and rings have entered the cylinder bore, pull the large end of connecting rod to crank pin journal on crankshaft, install the connecting rod bearing cap, start the cap bolt nuts and tighten evenly



RA PD 66952

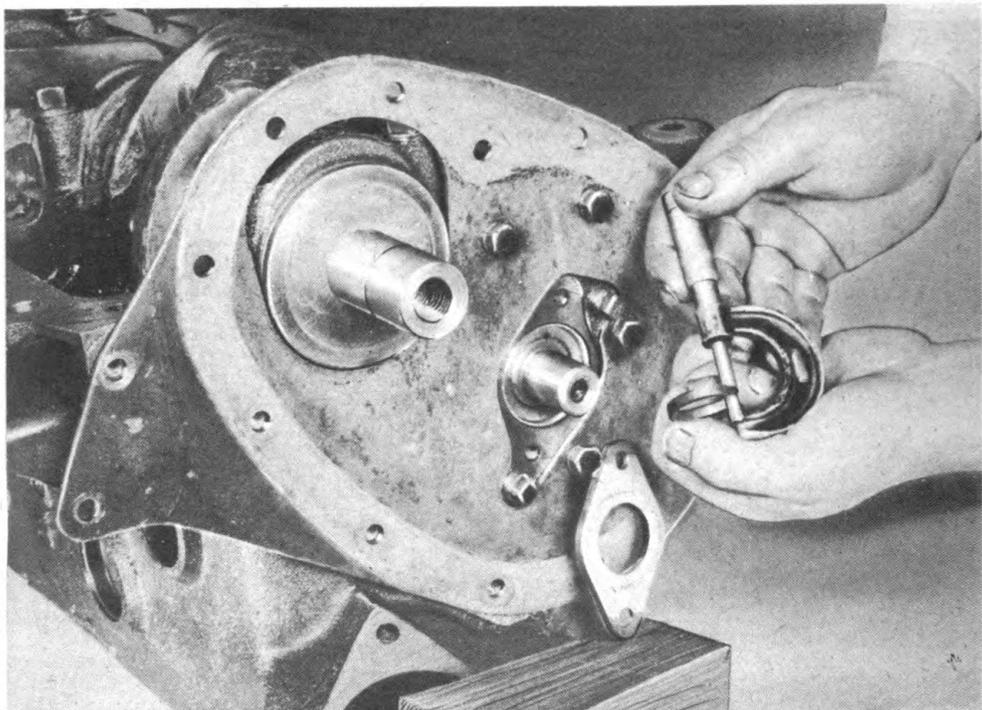
Figure 40—Palnut Installation on Connecting Rod Cap Bolt

and snugly. Make sure the numbered side of connecting rod and cap is toward the camshaft and tighten the rod bolt nuts to a tension of 300 to 325 inch-pounds. Install new palnuts with the open face away from rod bolt nut, tighten until it contacts the rod bolt nut and then tighten an additional $\frac{1}{3}$ turn to lock it securely (fig. 40).

f. **Assemble Engine Front Mounting Brackets to Cylinder Block.** Place the engine front mounting brackets in position, install screws, lock washers, and tighten brackets with cap screws securely.

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g. Install Valve Lifters and Camshaft in Cylinder Block. Place the cylinder block in an inverted position and install valve lifters in lifter guides. Push the camshaft into position in the cylinder block, being careful to avoid damaging the camshaft or bearings. The correct end play of the camshaft is from 0.004 inch to 0.008 inch. With a micrometer determine the measurement of both thrust spacer and thrust



RA PD 66945

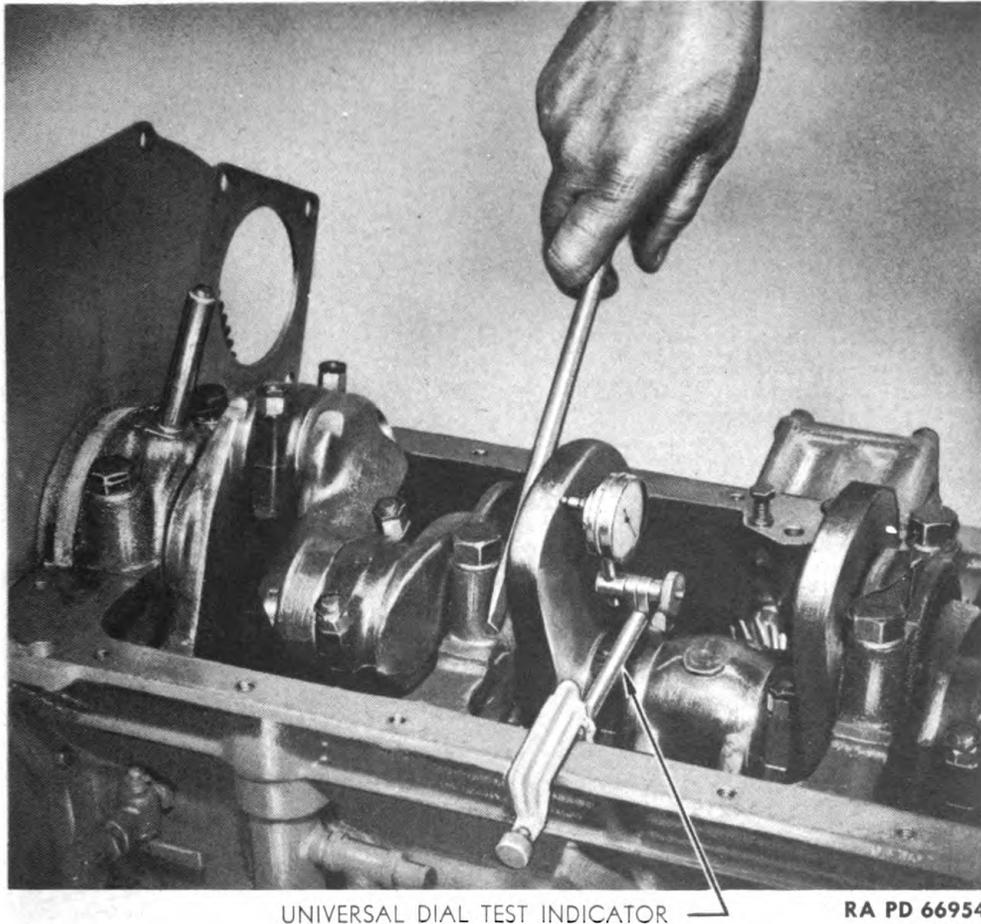
Figure 41—Checking Spacer and Plate Governing Camshaft End Play

plate (fig. 41). The spacer should be at least 0.004 inch but not more than 0.008 inch thicker than the thrust plate, because the end play is controlled by this difference in thickness. Machine the spacer or plate as required to give the correct end play. Place the camshaft thrust spacer and thrust plate in position, install the thrust plate retaining screws and tighten securely.

h. Assemble Crankshaft Gear to Crankshaft. Move the crankshaft forward until the front face of the crankshaft front counterweight contacts the rear face of front main bearing shell. Place a sufficient amount of shims over the front end of crankshaft to give approximately 0.006-inch clearance between rear face of the thrust washer and forward face of the front main bearing shell. Install Woodruff key in the keyway on crankshaft, apply white lead in the bore of crankshaft gear, start the gear over end of crankshaft with timing marks on the teeth to the front, and make sure the keyway in gear is alined with

ASSEMBLY

Woodruff key. Assemble gear pusher set KM-J3644 to the crankshaft and push gear into position. Remove gear pusher set, check the end play of crankshaft with a universal type dial indicator to determine if there is at least 0.003-inch end play and not more than 0.006 inch



UNIVERSAL DIAL TEST INDICATOR

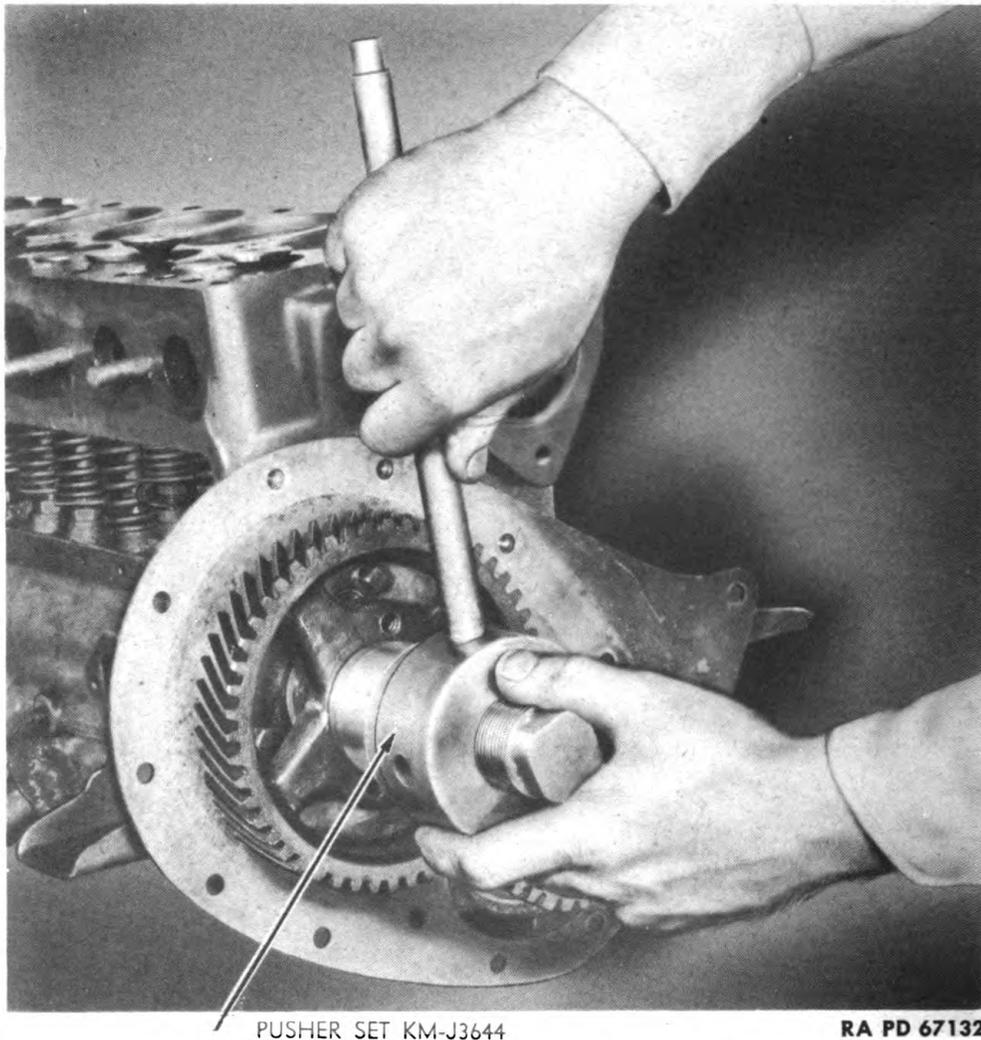
RA PD 66954

Figure 42—Checking Crankshaft End Play

(fig. 42). If the end play is less than 0.003 inch it will be necessary to remove the crankshaft gear and place additional shims between the thrust washer and the forward shoulder of the crankshaft.

i. Assemble Camshaft Gear to Camshaft. Turn the crankshaft until keyway in crankshaft gear is at the top. Install the Woodruff key in position on camshaft, turn camshaft until the key is away from crankshaft and aligned with the center of camshaft and crankshaft using a straight edge to check the alignment. Apply white lead to the bore of the camshaft gear, start the gear over end of camshaft so keyway in the gear is aligned with key and the tooth with mark enters between the two marked teeth on crankshaft gear. Assemble gear pusher set KM-J3644 to the camshaft and push gear into position against

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PUSHER SET KM-J3644

RA PD 67132

Figure 43—Camshaft Gear Installation

thrust spacer (fig. 43). Install plain washer, lock washer, fastening screw, and tighten securely.

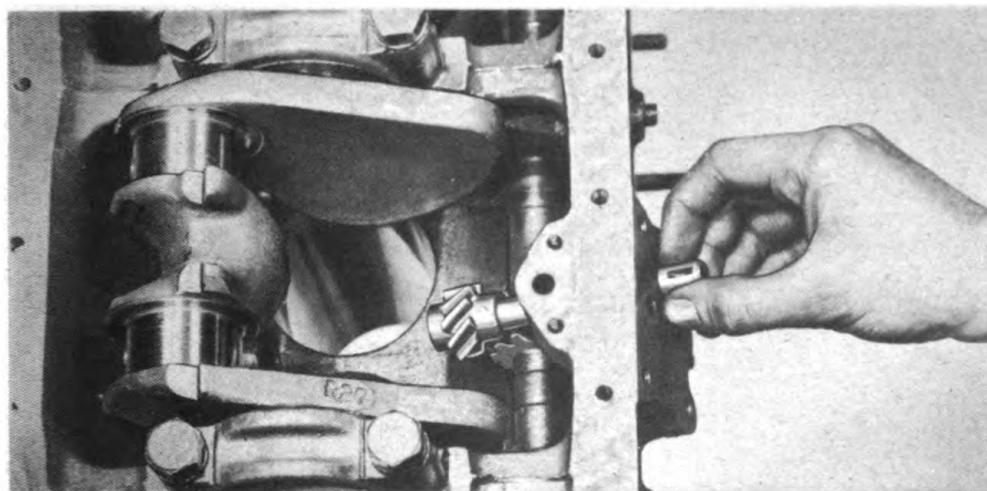
j. Assemble Flywheel to Crankshaft. Place the flywheel in position against the crankshaft flange on the flywheel bolts, install the lock washers, nuts, and tighten securely.

k. Install Valves and Valve Springs. Place the valve springs and retainers in position in the valve spring chamber. Install the valves in their proper location, compress the valve springs with a valve spring compressor, and install a retainer seat on each valve stem. Adjust the clearance between the upper face of valve lifter adjusting screw and lower face of valve stem to 0.016 inch. Install new valve cover gaskets with gasket sealer and place new gaskets on the valve cover fastening

ASSEMBLY

screws. Place valve covers in position, install the screws, and tighten securely.

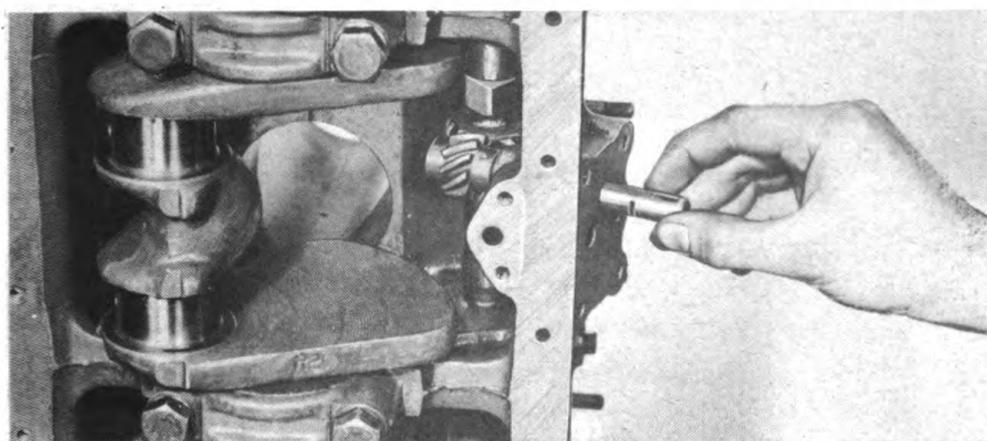
1. **Assemble Oil Pump to Cylinder Block.** Turn the crankshaft until the piston in No. 1 cylinder is in firing position. Insert the oil pump drive shaft through the bore in the side of the cylinder block



RA PD 67130

Figure 44—Oil Pump Drive Gear and Shaft Installation

from inside the block (fig. 44). When the teeth of oil pump drive shaft gear are fully meshed with the teeth of gear on camshaft make sure that the tongue at upper end of oil pump drive shaft is in a horizontal

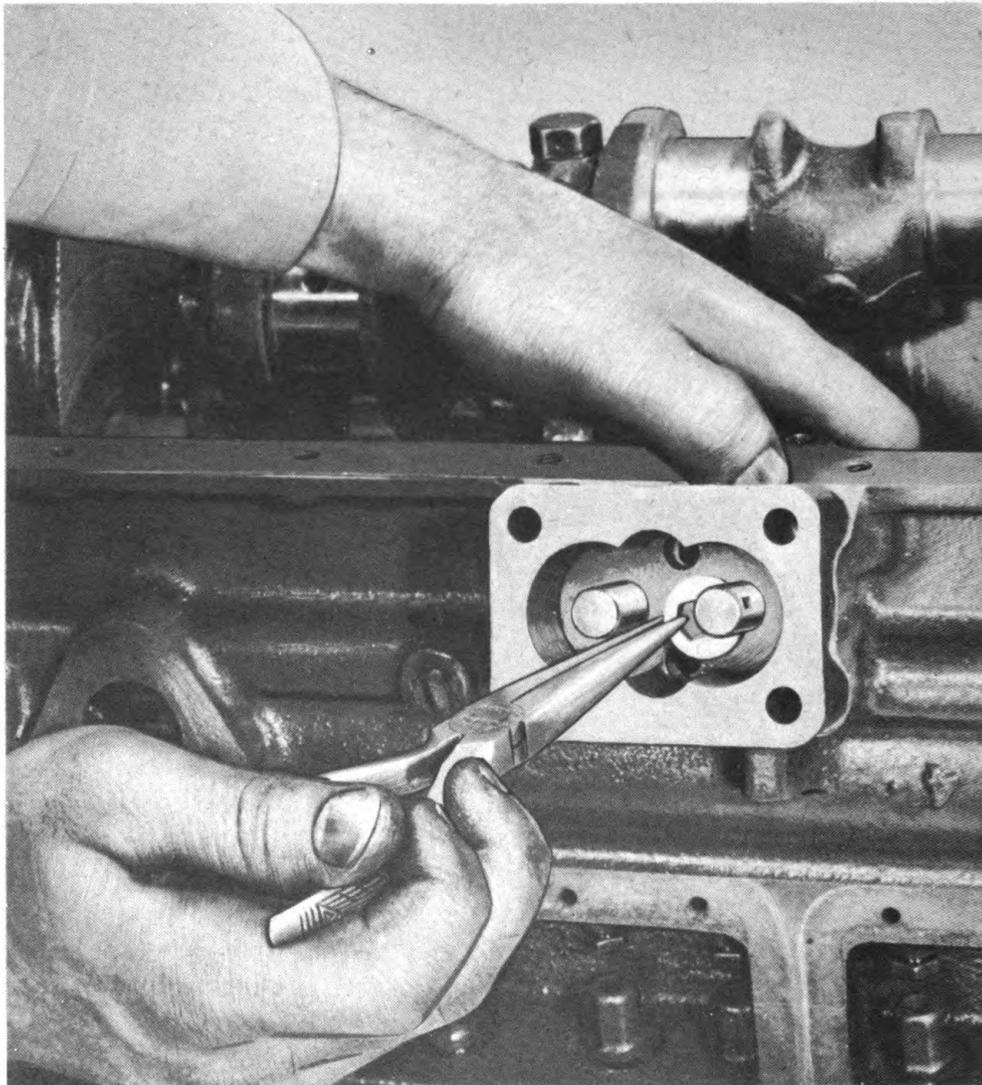


RA PD 67128

Figure 45—Oil Pump Drive Gear and Shaft In Position

position (fig. 45). The narrow offset must be toward bottom for proper ignition timing. Install a new pump body gasket on cylinder block, place pump body in position (fig. 46), and install the "C" washer into

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RA PD 67012

Figure 46—Oil Pump Body Installation

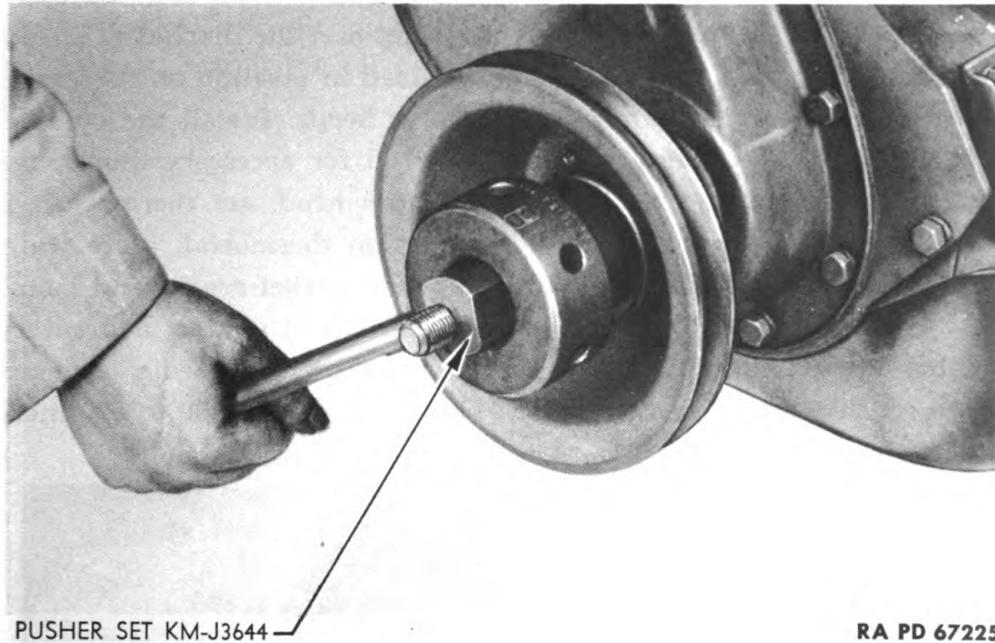
slots on oil pump drive shaft. Install Woodruff key and slide gear onto drive shaft with undercut side of gear toward "C" washer and slip the idler gear on the idler shaft. Install a new cover gasket on pump body, place cover in position, and fasten the cover and body securely with cap screws.

m. Install Distributor Support and Drive Shaft. Install a new distributor drive shaft seal in shaft bore in left side of cylinder block. Place a new distributor support gasket in recess around shaft bore in block. Install the distributor support and fasten in position with a cap screw. With No. 1 piston at the top of cylinder in firing position, insert the distributor drive shaft with gear through the drive support and

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engage slot in lower end of drive shaft with the tongue in upper end of oil pump drive shaft.

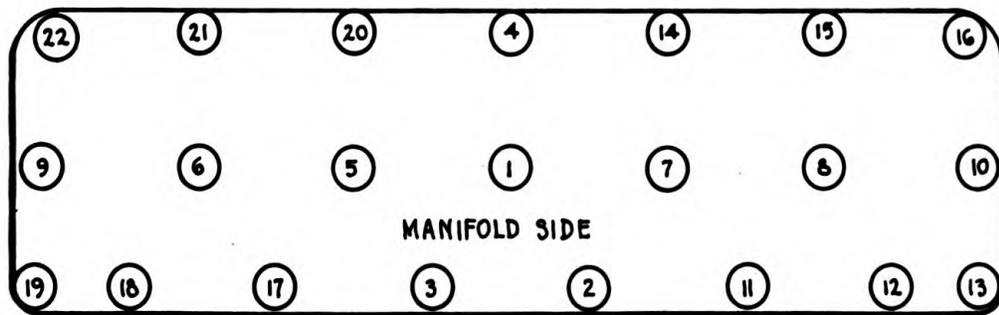
n. **Install Timing Gear Cover and Crankshaft Pulley.** Install a new gasket in position on the engine front plate after applying gasket sealer. Place the oil throw ring over end of crankshaft and against crankshaft gear, place timing gear cover in position, install screws, bolts,



PUSHER SET KM-J3644

RA PD 67225

Figure 47—Crankshaft Pulley Installation



RA PD 49276

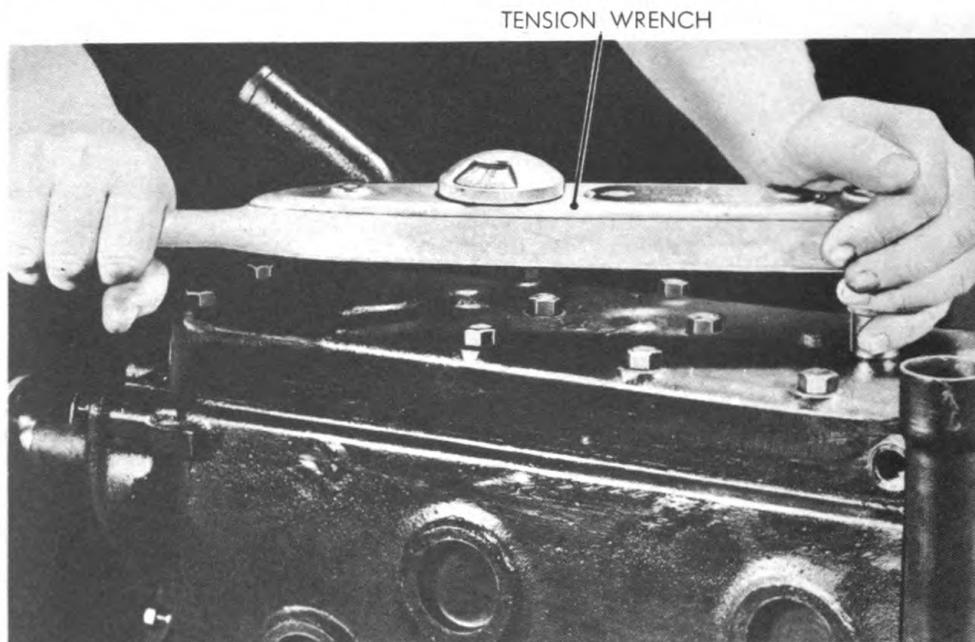
Figure 48—Cylinder Head Cap Screw Tightening Chart

lock washers, and nuts leaving the cover loose. Install fan pulley Woodruff key in keyway near front end of crankshaft, apply white lead in bore of pulley hub, aline keyway in pulley hub with Woodruff key in crankshaft, and push the pulley into position (fig. 47) with gear pusher set KM-J3644. Turn crankshaft several revolutions to aline timing gear cover oil seal with machined surface of the crankshaft pulley hub.

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Tighten timing gear cover screws, bolts, and nuts securely. Install starting jaw lock plate and fasten in position with screws. Screw the starting jaw into the end of crankshaft and bend a portion of lock plate over flat on starting jaw.

o. Assemble Cylinder Head to Cylinder Block. Install a new cylinder head gasket in position on the cylinder block after applying gasket sealer to the lower face of the gasket and the machined surface of the cylinder head. Place the cylinder head in position on the gasket being careful to avoid damaging the valve heads. Install the cylinder head cap screws with any brackets required for accessory mountings. Place the thermostat spacer in the cylinder head, set thermostat on spacer (with bellows down), install gasket on thermostat, place water outlet gasket on cylinder head after applying gasket sealer, and install the water outlet with cylinder head cap screws and tighten moderately. Tighten all cylinder head cap screws progressively in the sequence shown on the tightening chart (fig. 48) to a tension of 600 to 650 inch-



RA PD 66947

Figure 49—Tightening Cylinder Head Screws

pounds with a torque wrench (fig. 49). Check the cylinder head cap screws with a torque wrench after the engine has been installed and operated at normal operating temperature for a short time.

p. Assemble Oil Strainer Assembly. Assemble the oil strainer to support with the cover up, and fasten in position with a new cotter pin.

ASSEMBLY

Place a new gasket on machined surface of cylinder block, hold strainer support in position, install and tighten the screws securely.

q. Assemble Oil Pan to Cylinder Block. Apply gasket sealer to new oil pan gaskets and place them in position. A rubber band will be helpful in holding the filler block gasket to filler block. Aline filler block holes with holes in engine front plate by using a drift, install the timing gear cover to filler block screws and tighten securely. Install pilot screws in lower flange of the cylinder block to guide the oil pan into position, install the oil pan screws with lock washers and tighten securely.

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Section XI

INSTALLATION OF ACCESSORIES

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Ignition coil	53
Generator	54
Clutch and housing	55
Starting motor	56

46. MANIFOLD ASSEMBLY.

a. Install a new manifold to block gasket in position on the manifold studs (fig. 50) so the raised rings are away from cylinder block. Place the manifold in position, install the holding clamps and nuts, and tighten manifold securely to block. Install the intake manifold adapter to valve cover ventilation pipe and tighten the connections securely.

47. CARBURETOR.

a. Place a new carburetor flange gasket on the manifold adapter, set carburetor on the gasket, install bolts, lock washers, nuts, and tighten them evenly and securely. Remove cylinder head cap screw No. 17 and reinstall it after placing it through air intake adapter support, and tighten to the proper tension. Install the throttle arm return spring, connect the throttle control rod to the throttle arm, and install a new cotter pin. Connect crankcase ventilation pipe to carburetor air intake adapter and oil filler tube and tighten securely.

48. SPARK PLUGS.

a. Place a new gasket on each spark plug so the seam will be to the cylinder head, install them in the spark plug holes and tighten until the gasket is compressed.

49. OIL FILTER ASSEMBLY.

a. Remove the cylinder head cap screws that anchor the filter bracket to the cylinder head, and place the filter with bracket in posi-

INSTALLATION OF ACCESSORIES

tion, reinstall the cap screws and tighten to the proper tension. Install the oil filter intake line to filter and crankcase connections, and the outlet pipe to bottom of filter and lower end of oil filler tube and tighten securely to fittings.

50. FUEL PUMP.

a. Place a new fuel pump to block gasket on the machined pad at the right front side of the cylinder block, using gasket sealer to hold it

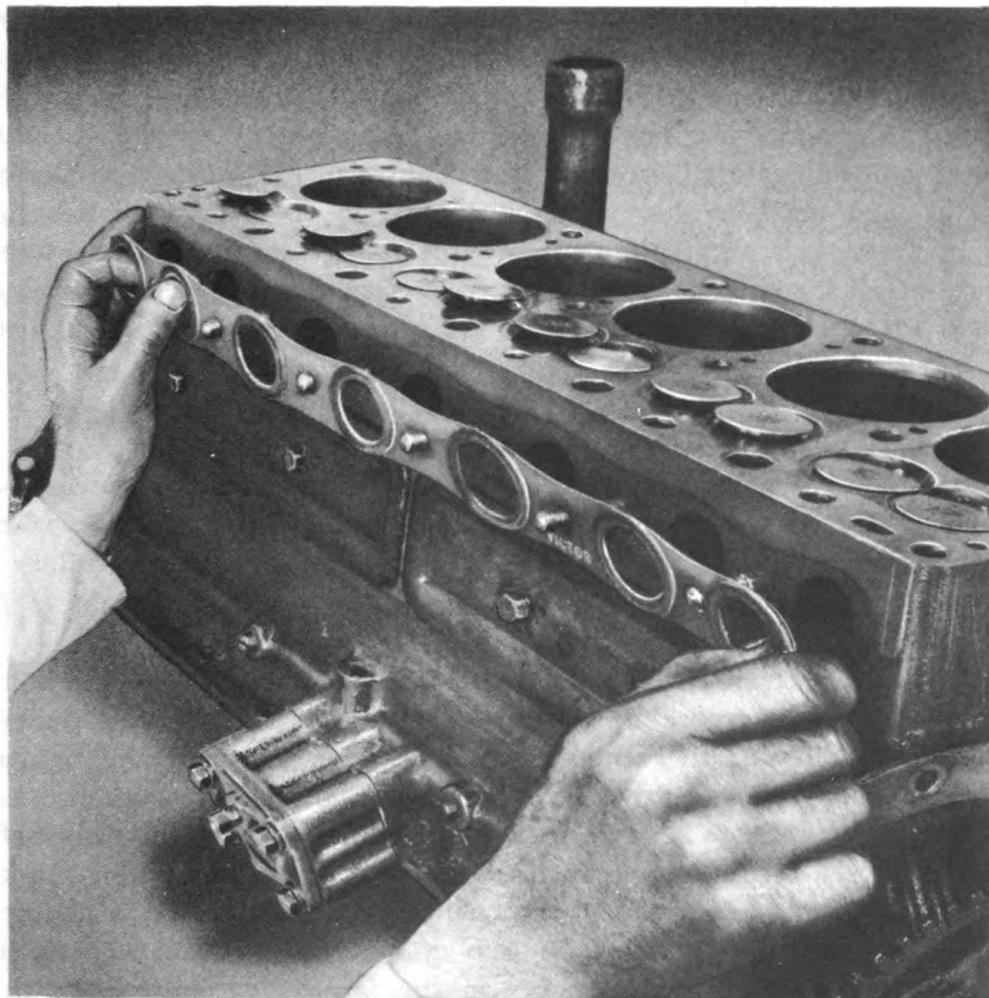


Figure 50—Manifold Gasket Installation

in position. Insert the pump operating arm through the opening in the block, making sure the lower side of the arm contacts the lobe on the camshaft. Install the cap screws and tighten securely. Connect fuel pump inlet coupling and primer inlet pipe and coupling to the fuel pump. Connect the fuel pump to carburetor pipe to the fuel pump and carburetor fittings, and tighten securely.

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51. WATER PUMP.

a. Install a new water pump to block gasket on the cylinder block using gasket sealer to hold it in position. Place the water pump assembly in position, coat the cap screw threads with white lead, install and tighten them securely.

52. DISTRIBUTOR AND WIRING.

a. Turn crankshaft until No. 1 piston is on compression stroke and continue until mark UDC1-6 on flywheel is directly under pointer. When installed, the distributor rotor must point as nearly as possible toward front of engine. In this position No. 1 cylinder is ready to fire. Install the clamp arm hold-down screw and tighten securely. Loosen clamp bolt and rotate distributor in a counterclockwise direction (looking at top) until breaker points just start to open. Pack distributor support reservoir with suitable grease, place a new gasket on the support, install the support cover and tighten securely. Connect spark plug wires to terminals on spark plugs and primary wire to terminal on distributor.

53. IGNITION COIL.

a. Place the coil in position on left side of cylinder block near the front with tower toward rear, install cap screw with internal lock washer and tighten securely. Connect primary and secondary wires to coil.

54. GENERATOR.

a. Place generator in position on brackets, and install fastening bolts and nuts. Install generator drive belt in position on generator pulley, and inner pulley on the water pump shaft, raise generator and tighten fastening bolt nuts so drive belt has $\frac{1}{2}$ -inch deflection when pressed with forefinger. Place fan belt in position on fan pulley and crankshaft pulley, loosen set screw and turn the outer flange of fan pulley clockwise until the fan belt has $\frac{1}{2}$ -inch deflection when pressed with forefinger. Tighten the set screw in hub of outer flange, making certain that it enters one of the grooves in the fan pulley hub. Place the generator to voltage regulator wiring harness in position, and fasten with clips provided. Connect the wires to the generator terminals and tighten securely.

55. CLUTCH AND HOUSING.

a. **Install Clutch Assembly.** Coat the clutch pilot bushing in the flywheel with suitable lubricant, place the clutch driven member with facings against the machined surface of the flywheel with the longest extension of the driven member hub toward rear. Insert the clutch

INSTALLATION OF ACCESSORIES

alining arbor KM-J3618-2 through the hub of the driven member and into the clutch pilot bushing in the flywheel. Place the pressure plate assembly in position against the rear facing on the driven member, install the cap screws through the pressure plate cover flange, and tighten them evenly and progressively about one-half turn at a time to avoid distorting the cover. Give the screws a final tightening to make certain that the pressure plate is securely fastened to the flywheel, and remove the alining arbor.

b. Install Clutch Housing. Place housing in position against engine rear plate and start a cap screw at the top to preserve general alinement. Move housing as required to line up right and left dowel bolt holes and tap dowel bolts into place from front. When installing a new housing do not place the dowel bolts in position until the housing has been properly alined. Install all bolts, lock washers, nuts, except the starting motor fastening bolts and nuts, and tighten moderately. Install all cap screws and tighten moderately. Insert the clutch alinement arbor KM-J3618 through the clutch housing bore until the pin enters the pilot bushing in flywheel, and move the housing as required until alining plate enters the transmission pinion flange bore in the clutch housing. Tighten the cap screws and bolt nuts alternately and progressively to preserve alinement.

56. STARTING MOTOR.

a. Place the starting motor flange in position against the engine rear plate, install bolts, lock washers, nuts, and tighten securely.

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Section XII

INSTALLATION AND TEST

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Install engine	57

57. INSTALL ENGINE.

a. Place Engine in Vehicle. Install engine mounting bolts, flat washers, lock washers and engine mounting insulators to engine mounting brackets in engine compartment. Use tape to hold the engine bolts and insulators in place while lowering engine in position. Raise the engine with a hoist, and slowly lower it into the engine compartment. Guide it carefully to avoid damaging uncoupled pipes, wires, and controls. Then move engine forward as required and lower into position on front engine mountings. Install nuts to front engine mounting bolts. Tighten nuts until firm contact is made between insulated mounting spacer tube and engine mounting bracket. Install new cotter pins.

b. Install Transmission. Place transmission into position so forward machined surface is against machined surface of clutch housing. Install the cap screws with lock washers and tighten securely. Lower engine until rear mounting rests on hull cross member, install screws with lock washers and tighten securely. Remove hoist, lift chain, and eyebolts. Install cylinder head cap screws and tighten to proper tension.

c. Install Remote Control Shift Rods. Place the engine transmission shift rods in position: the longer rod operating the low and reverse shift lever connects to the rear external lever on transmission. Install the clevis pins and new cotter pins. At the front, connect both shift rods to the control levers with clevis pins and new cotter pins. Connect the axle transmission front shift rod to the lever on axle transmission shift shaft and to the lever on the cross shaft by installing clevis pins and new cotter pins.

d. Connect Exhaust Pipe. Install U-clamp, bolts, lock washers, and nuts that secure the front exhaust pipe to support bracket at right side of clutch housing. Place a new gasket between front exhaust pipe flange and manifold flange. Install lock washers and nuts on manifold studs and tighten securely.

e. Connect Clutch Control Cable. Connect the clutch control cable clevis to the release shaft operating arm with clevis pin and new cotter pin.

f. Install Propeller Shaft. Start slip joint on transmission mainshaft splines. Lower rear end of propeller shaft and move shaft rearward until free bearings enter the recesses in axle unit driving flange.

INSTALLATION AND TEST

Use universal joint clamp KM-J3620 to compress the free bearing seals so that bearings will seat properly between the retaining lugs in the driving flange recesses. Install U-clips, nuts, and lock washers and tighten securely.

g. Install and Connect Fuel Filter. Fasten fuel filter to front coaming with cap screws. Connect drain pipe to connection in bottom of filter and install outlet and inlet pipes.

h. Connect Starting Motor Solenoid Wires and Engine Ground Strap. Fasten starting motor solenoid wires to switch. Connect engine ground strap to engine right front mounting bracket.

i. Install Voltage Regulator and Connect Ignition Coil Wires. Place voltage regulator in position with internal lock washers under regulator legs and install mounting bolts. Connect the wires to terminals on voltage regulator. Connect ignition switch to coil primary wire to terminal on coil.

j. Install Fan Blades and Hose Connections. Install fan blades to water pump pulley hub with cap screws and tighten securely. Apply liquid soap to inner ends of each hose, install, and tighten hose clamp screws.

k. Install Engine Compartment Side Panel with Instrument Panel. Place side panel with instrument panel in position, install screws and tighten securely. Install cross shaft cover and fasten securely. Connect speedometer cable to the speedometer and fasten the wiring harness in place with clips. Connect wiring harness terminals to instruments and switches. Insert trouble light cable through engine compartment side panel and fasten cable grommet to side panel. Install fuse in connector and connect cable to fuse connector. Install spotlight, defroster, and compass light wire connections in sockets on engine compartment side panel.

l. Connect Primer Lines, Engine Heat Indicator, and Oil Pressure Gage. Connect primer inlet and outlet pipe connections to primer. Install heat indicator element into adapter in cylinder head and tighten securely. Connect oil pressure gage pipe to flexible coupling.

m. Connect Choke and Throttle Controls. Fasten choke control conduit to bracket, connect choke control wire to choke valve lever and adjust to operate choke valve properly. Fasten throttle control conduit to bracket and connect throttle control wire to bell crank mounted on cylinder head.

n. Install Engine Oil. Fill crankcase to proper level with engine oil of the correct viscosity.

o. Install Liquid in Cooling System and Battery in Compartment. Fill cooling system to proper level. Place battery in engine compart-

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ment and fasten in position with battery retaining clamps. Connect both battery post clamps to battery posts.

p. Install Air Cleaner and Engine Compartment Heater Outlet Tube. Install air cleaner on carburetor air intake adapter and fasten securely. Place heater flexible outlet tube in position, fasten tube clamp to battery bed, install the tube sleeve over heater outlet, and tighten securely with bolt and nut.

q. Install Driver's Seat Cushion and Back. Place seat back ears in slots on hull floor and tip assembly rearward. Securely fasten in position by attaching seat back hook. Set the cushion in position on the hull floor, slip hold-down straps through eyelets on floor and over hold-down buttons.

r. Test Engine. Start engine, check the oil pressure gage. If oil pressure gage does not show pressure, stop engine immediately and investigate. Inspect engine for oil and water leaks, and if leaks are present, eliminate them at once. Test engine for proper operation after it reaches normal operating temperature. Adjust carburetor and linkage (par. 68). Set ignition timing (par. 52).

s. Install Engine Compartment Lid and Front Panel. Fasten front panel to coaming with bolts, washers, and nuts. Place engine compartment lid in position, install clamps and wing nuts, tighten securely. Install windshield wiper wire connections in sockets on front panel. Raise windshield and fasten in a vertical position.

t. Install Vehicle Top and Bows. Place bows in sockets on hull coaming and install cotter pins. Tighten front section of bow frame to top of windshield. Install top assembly in position over bows and lash securely with flexible cable.

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CHAPTER 3

FUEL SYSTEM

Section I

DESCRIPTION AND DATA

	Paragraph
Description	59
Data	60

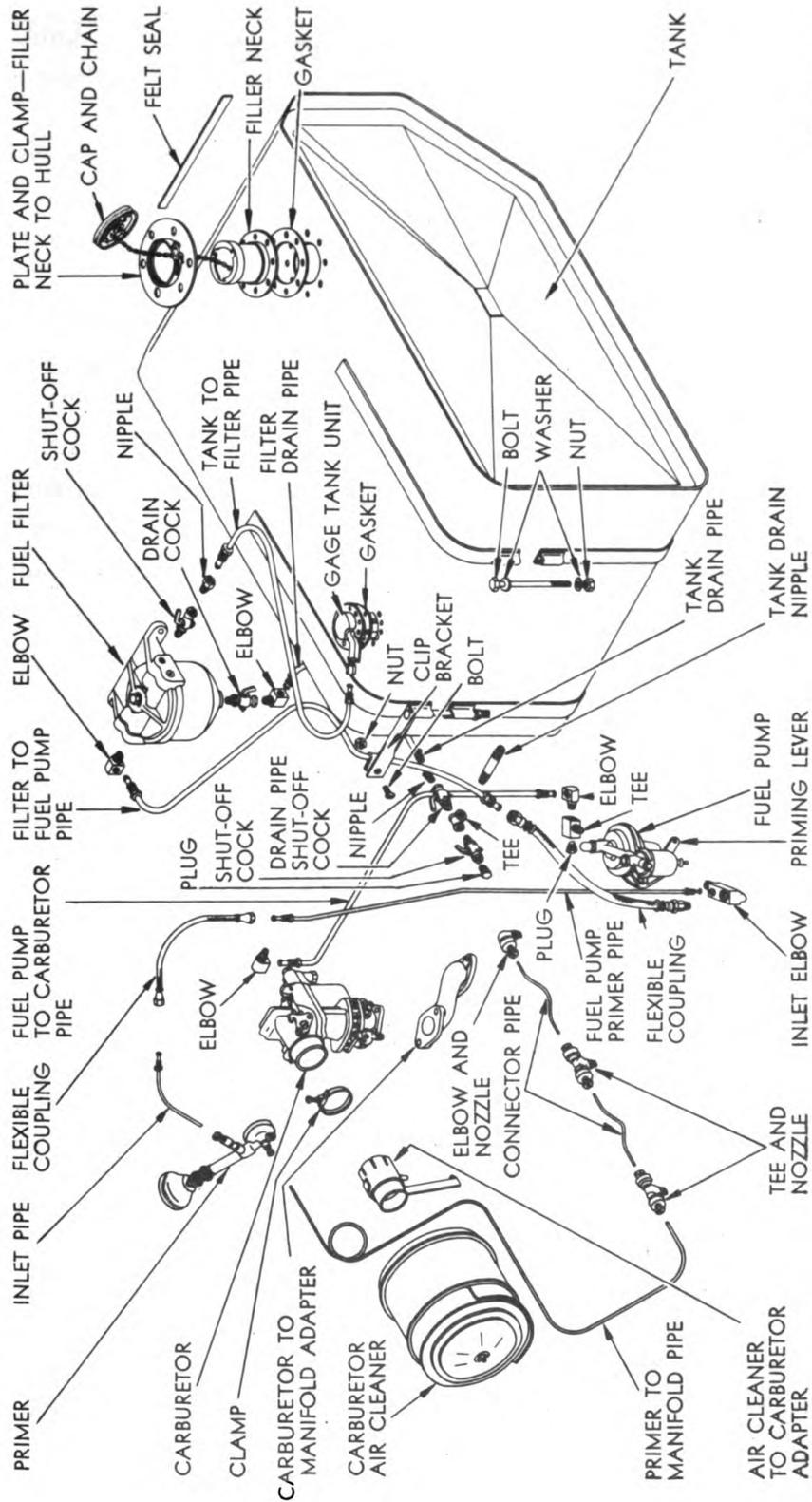
59. DESCRIPTION.

a. The fuel system is composed of a fuel tank, fuel filter, mechanically operated fuel pump, carburetor, carburetor air cleaner, and hand-operated primer (fig. 51).

60. DATA.

Tank	35 gallons
Gages	Electric
Filter	Replacement element
Pump	Diaphragm
Primer	Pump
Carburetor air cleaner.....	Oil-coated
Carburetor	Carter—BBT downdraft

DESCRIPTION AND DATA



RA PD 67124

Figure 51—Fuel System Parts

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AND CLUTCH FOR LIGHT CARGO CARRIER T24**

Section II

TROUBLE SHOOTING

Trouble shooting	Paragraph 61
------------------------	-----------------

61. TROUBLE SHOOTING.

a. Excessive Fuel Consumption.

Possible Cause	Possible Remedy
Poor carburetor adjustments.	Check jet sizes against factory specifications (par. 62).
Dirty air cleaner.	Clean and re-oil element.
Fuel leaks.	Check carburetor float, fuel pump diaphragm, and fuel line fittings.
Improper choke adjustment.	Inspect choke valve for full opening.

b. Fast Idling.

Carburetor throttle controls sticking.	Free controls.
Carburetor throttle improperly adjusted.	Adjust throttle stop screw and control button (par. 68).

c. Low Fuel Pressure.

Fuel pump diaphragm not operating properly.	Tighten housing holding screws.
Fuel pump diaphragm porous or torn.	Replace diaphragm (pars. 71, 74).
Air leak at filter bowl.	Install new bowl gasket (pars. 71, 74).
Gasoline supply line clogged.	Clean line with compressed air.

d. Lack of Fuel at Carburetor.

Empty fuel tank.	Fill tank with fuel.
Fuel pump inoperative.	Repair or replace pump (pars. 71, 72, 74).
Carburetor screen clogged.	Clean or replace (pars. 64, 65, 66).
Sticking carburetor float valve.	Clean, or replace valve and seat (pars. 64, 65, 66).
Fuel filter clogged.	Clean or replace unit (pars. 85, 87, 90).

TROUBLE SHOOTING

e. Carburetor Overflowing.

Possible Cause	Possible Remedy
Float leaking.	Replace float (pars. 64, 65, 66).
Float pin retainer clip broken.	Replace with new part (pars. 65, 66).
Float valve sticking.	Clean or replace valve and seat (pars. 64, 65, 66).
Excessive fuel pump pressure.	Repair or replace (pars. 71, 74).

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Section III

CARBURETOR

	Paragraph
Description and data.....	62
Removal	63
Disassembly	64
Cleaning and inspection.....	65
Assembly	66
Installation	67
Adjust carburetor and linkage.....	68

62. DESCRIPTION AND DATA.

a. **Description.** The carburetor used on this vehicle is a simply designed, five-circuit unit with two external adjustments, one for controlling the idle mixture, the other idling speed. The five circuits are: the float circuit, the idle circuit, the high speed circuit, the pump circuit, and the choke circuit.

b. Data.

Carburetor metering jets available:

Sea level to 4000 ft.....	Carter No. 159-59S
4000 ft. to 8000 ft.....	Carter No. 159-61S
8000 ft. to 12000 ft.....	Carter No. 159-58S
Over 12000 ft.....	Carter No. 159-66S

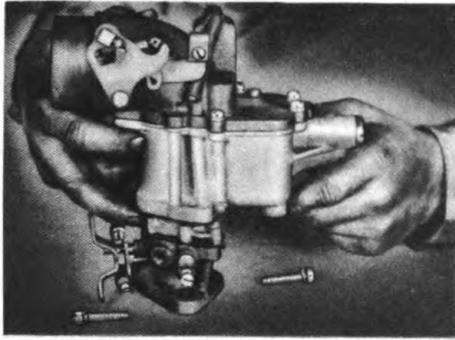
63. REMOVAL.

a. Loosen wing nuts and remove engine compartment lid. Loosen carburetor air cleaner clamp screw and remove carburetor air cleaner assembly. Disconnect throttle pull back spring, choke control wire from choke adjustment collar and conduit from bracket. Remove cotter pin and disconnect throttle control rod from throttle arm. Loosen carburetor air intake adapter clamp screw, push adapter and support away from carburetor. Disconnect fuel pipe from carburetor. Remove nuts, lock washers, and bolts that fasten carburetor to intake manifold adapter. Lift carburetor assembly and gasket from manifold adapter.

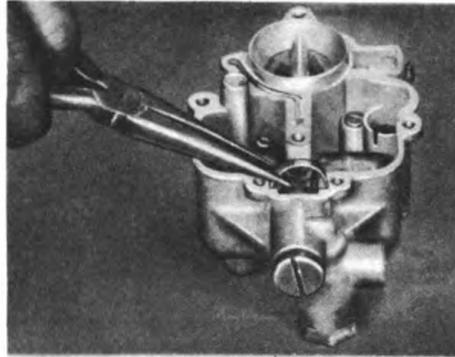
64. DISASSEMBLY.

a. Using the Carter tool kit, KM-J3649, disassemble the carburetor in accordance with the following illustrated procedure:

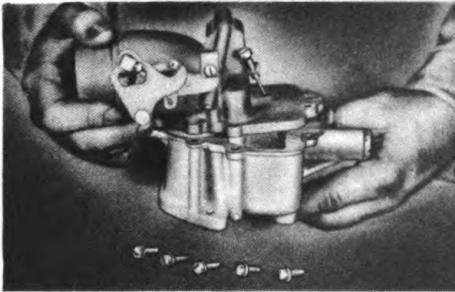
CARBURETOR



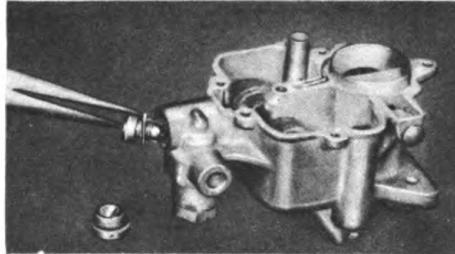
1. FLANGE ASSEMBLY REMOVAL FROM BODY CASTING



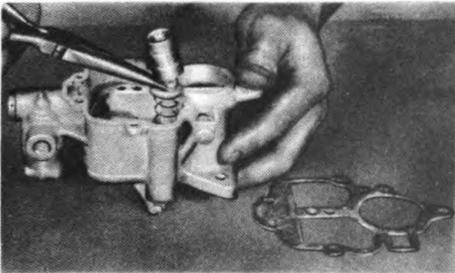
5. FLOAT PIN RETAINER SPRING REMOVAL



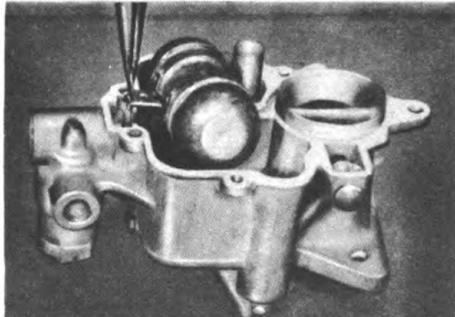
2. MAIN VENT TUBE, BOWL COVER AND GASKET REMOVAL



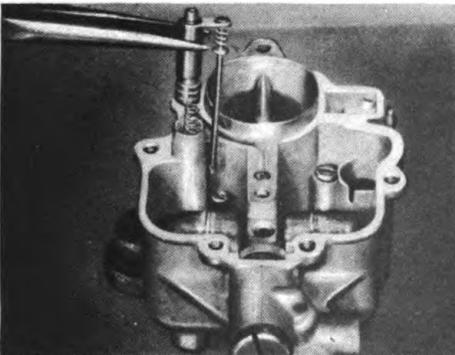
6. NEEDLE SEAT AND GASKET ASSEMBLY REMOVAL



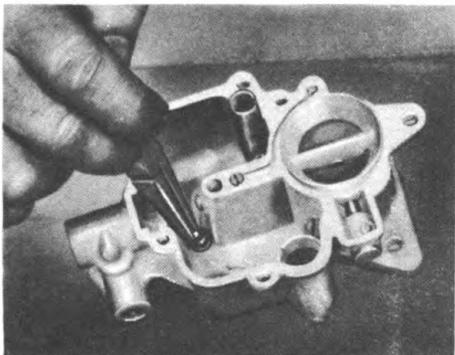
3. PUMP PLUNGER, PISTON, AND SPRING ASSEMBLY REMOVAL



7. FLOAT ASSEMBLY AND PIN REMOVAL



4. STEP-UP PISTON ASSEMBLY, SPRING, AND GASKET REMOVAL

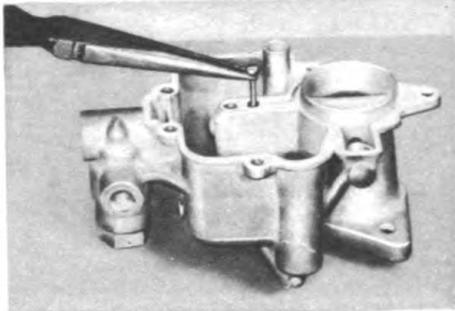


8. MAIN METERING JET AND GASKET ASSEMBLY REMOVAL

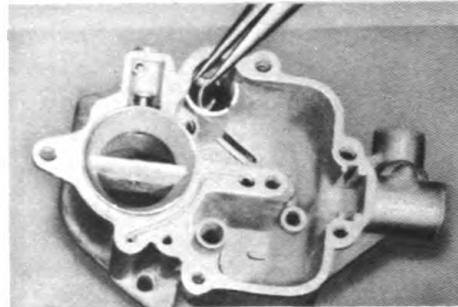
RA PD 67016

Figure 52—Carburetor Disassembly

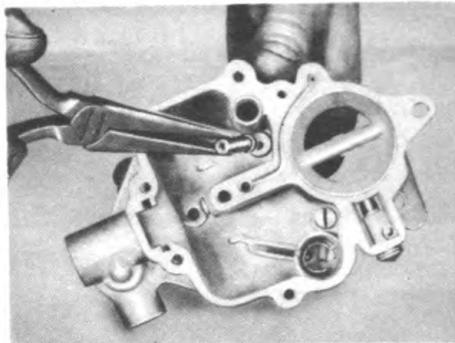
**ORDNANCE MAINTENANCE—ENGINE, ENGINE ACCESSORIES,
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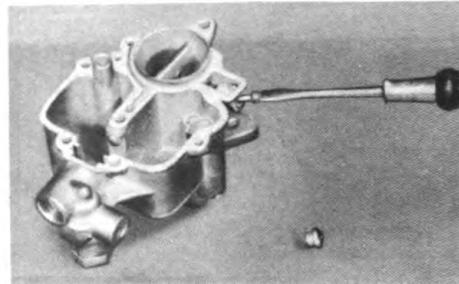
9. IDLE ORIFICE TUBE AND PLUG
ASSEMBLY REMOVAL



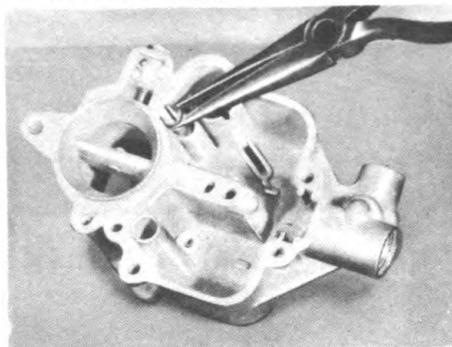
13. RETAINER RING AND INTAKE CHECK
BALL REMOVAL



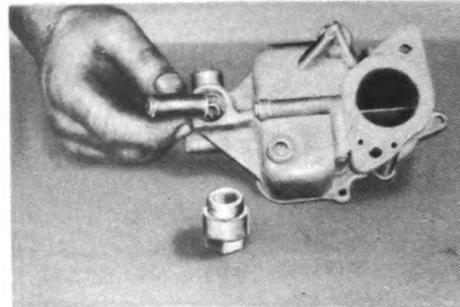
10. STEP-UP JET AND GASKET
ASSEMBLY REMOVAL



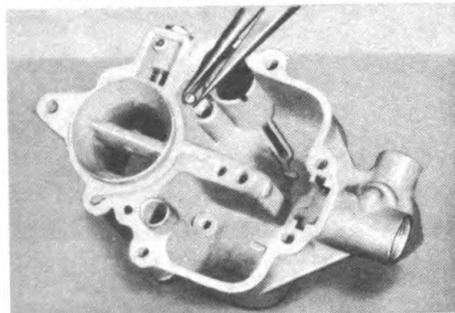
14. PUMP JET RIVET PLUG AND PUMP
JET REMOVAL



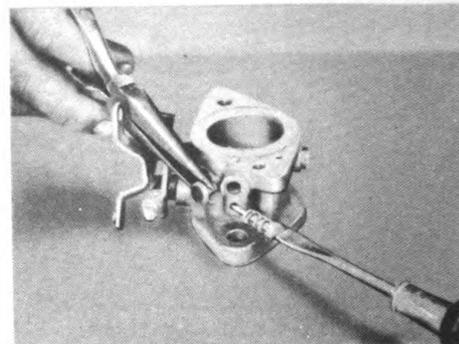
11. DISCHARGE BALL CHECK SPRING AND
PLUG REMOVAL



15. INLET STRAINER REMOVAL



12. DISCHARGE CHECK BALL REMOVAL

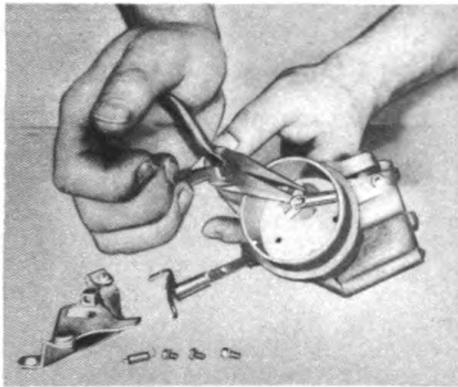


16. IDLE PORT RIVET PLUG, ADJUSTING
SCREW, AND SPRING REMOVAL

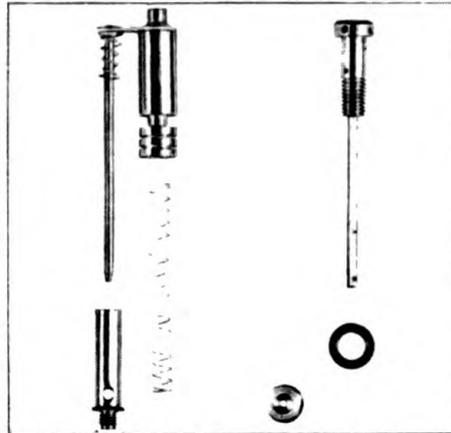
RA PD 66992

Figure 53—Carburetor Disassembly

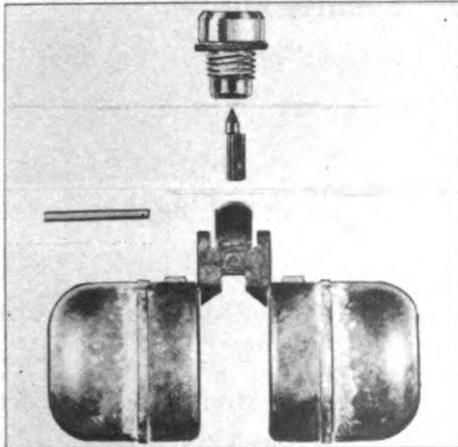
CARBURETOR



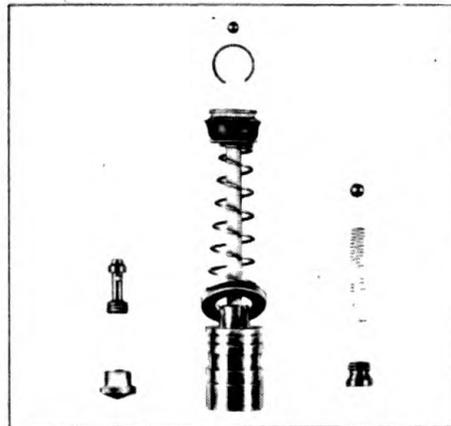
17. CHOKE VALVE AND SHAFT ASSEMBLY
REMOVAL FROM AIR HORN



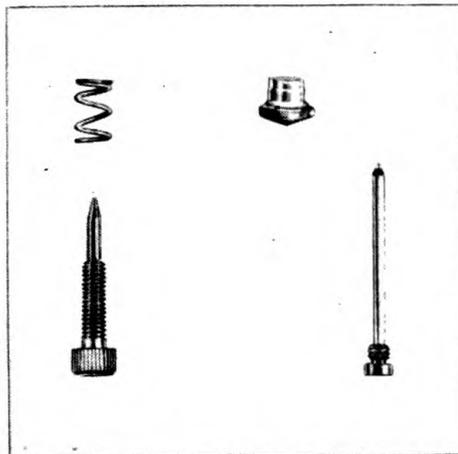
20. PARTS CONTROLLING HIGH
SPEED CIRCUIT



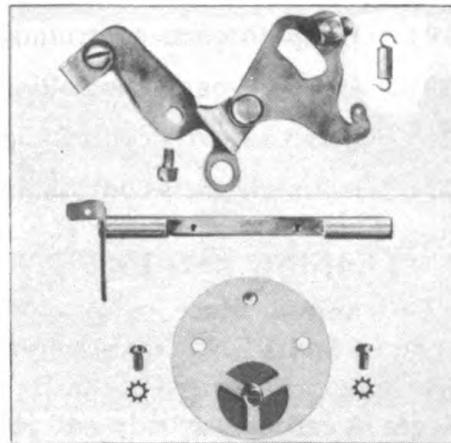
18. PARTS CONTROLLING GASOLINE LEVEL



21. PARTS CONTROLLING PUMP CIRCUIT



19. PARTS CONTROLLING IDLE CIRCUIT



22. PARTS CONTROLLING CHOKE CIRCUIT

RA PD 66997

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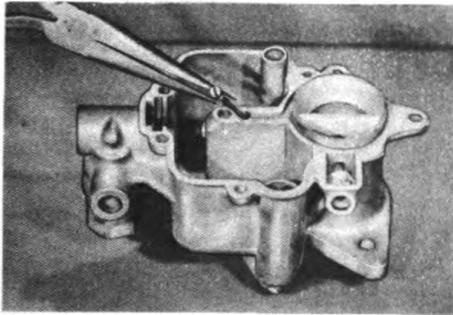
- (1) Remove flange assembly from body casting (1, fig. 52).
- (2) Remove main vent tube assembly, and bowl cover gasket (2, fig. 52). Slip needle seat bracket off bowl cover to facilitate removal.
- (3) Remove pump plunger, piston, and spring assembly (3, fig. 52).
- (4) Remove step-up piston assembly, spring and gasket (4, fig. 52).
- (5) Remove horseshoe shaped float pin retainer spring (5, fig. 52).
- (6) Remove needle seat and gasket assembly (6, fig. 52).
- (7) Remove float assembly and pin (7, fig. 52).
- (8) Remove main metering jet and gasket assembly (8, fig. 52).
- (9) Remove idle orifice tube and plug assembly (9, fig. 53).
- (10) Remove step-up jet and gasket assembly (10, fig. 53).
- (11) Remove discharge ball check spring and plug (11, fig. 53).
- (12) Remove discharge ball check (12, fig. 53).
- (13) Remove retainer ring and intake check ball (13, fig. 53).
- (14) Remove pump jet rivet plug and pump jet (14, fig. 53).
- (15) Remove inlet strainer screen (15, fig. 53).
- (16) Remove idle adjusting screw and spring and idle port rivet plug (16, fig. 53).
- (17) Remove choke valve assembly and choke shaft assembly from air horn (17, fig. 54). (Note position of levers so they can be reassembled in the same position.)
- (18) Group all parts controlling float circuit (18, fig. 54).
- (19) Group all parts controlling idle circuit (19, fig. 54).
- (20) Group all parts controlling high speed circuit (20, fig. 54).
- (21) Group all parts controlling pump circuit (21, fig. 54).
- (22) Group all parts controlling the choke circuit (22, fig. 54).

65. CLEANING AND INSPECTION.

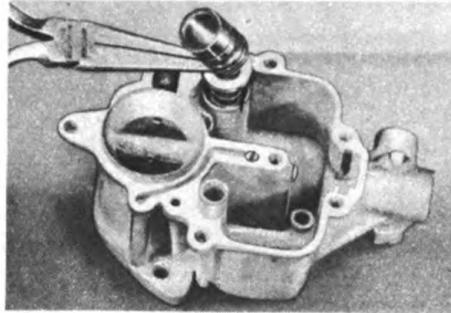
a. Cleaning. Place carburetor body and disassembled parts in a solution of SOLVENT, dry-cleaning. Allow them to soak until any substance remaining on parts can be easily removed. Blow out all drilled passages in carburetor body and jets with compressed air.

b. Inspection. Inspect float circuit parts to determine if float leaks, and the needle valve and seat for visual evidence of grooves worn in either. Inspect idle circuit parts for visual evidence of grooves worn in point of adjusting screw and idle speed jet for clogged passage or dam-

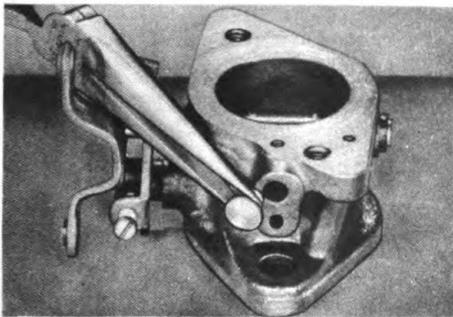
CARBURETOR



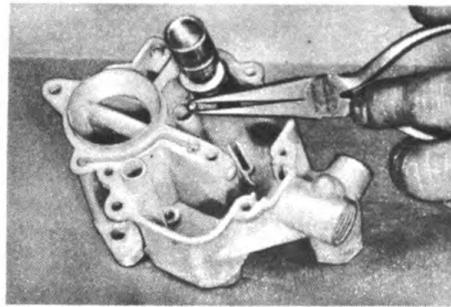
23. IDLE ORIFICE TUBE AND PLUG ASSEMBLY INSTALLATION



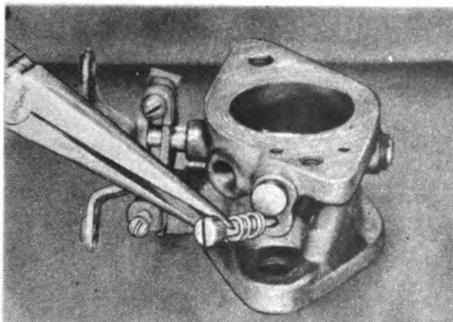
27. PUMP PLUNGER, SPRING, AND PISTON ASSEMBLY INSTALLATION



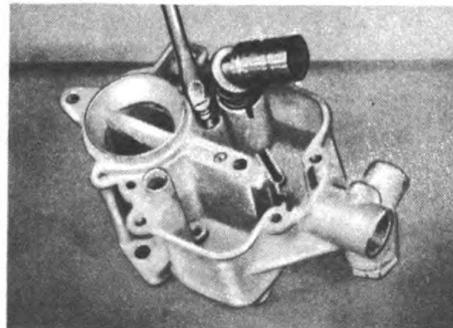
24. INSTALLING NEW IDLE PORT RIVET PLUG



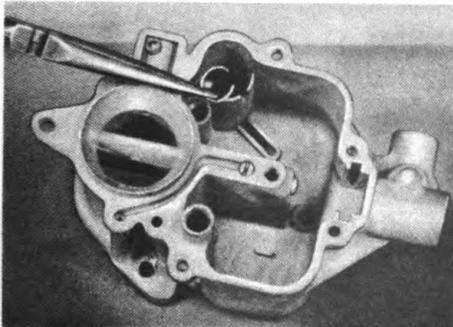
28. DISCHARGE CHECK BALL INSTALLATION



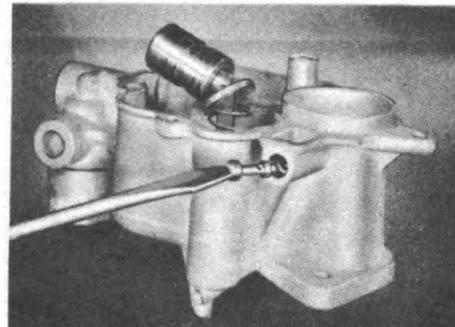
25. IDLE ADJUSTING SCREW AND SPRING INSTALLATION



29. DISCHARGE SPRING AND PLUG INSTALLATION



26. PUMP INTAKE CHECK BALL AND RETAINER INSTALLATION

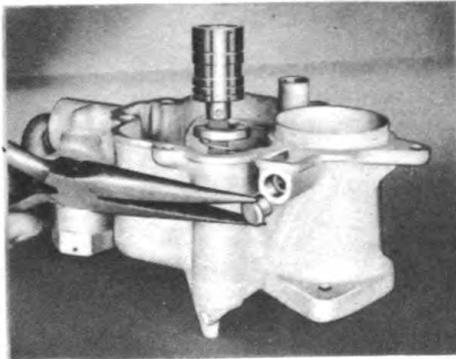


30. PUMP JET INSTALLATION

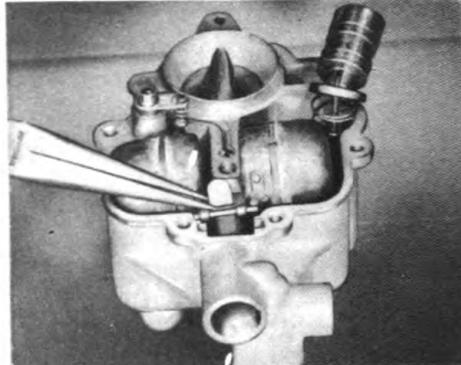
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Figure 55—Carburetor Reassembly

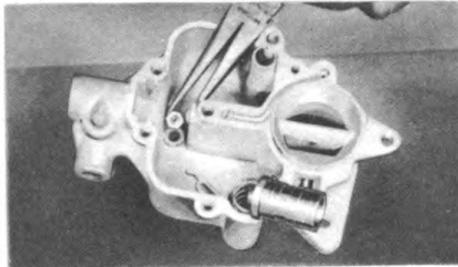
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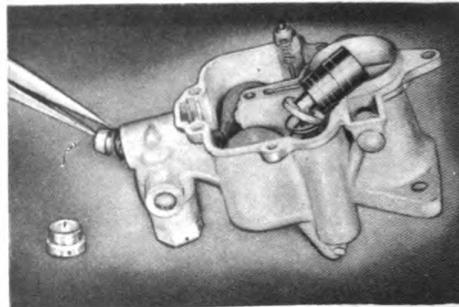
31. INSTALLING NEW PUMP JET RIVET PLUG



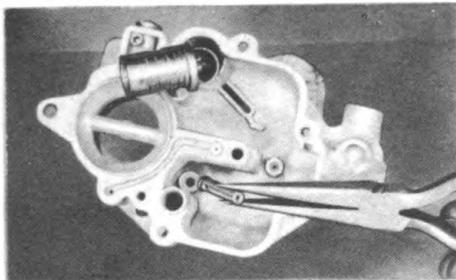
35. FLOAT ASSEMBLY AND
PIN INSTALLATION



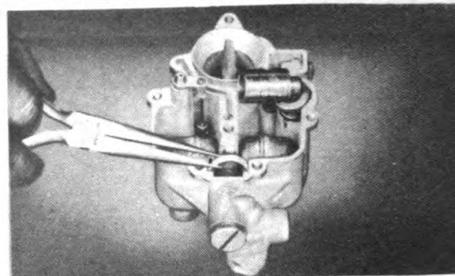
32. MAIN METERING JET AND
GASKET INSTALLATION



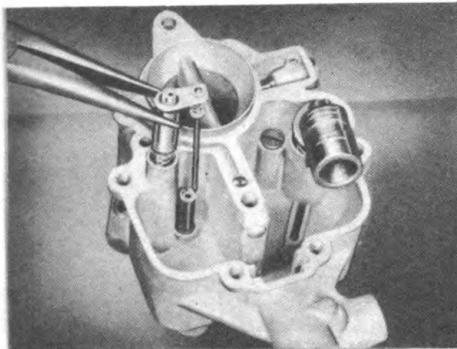
36. NEEDLE, SEAT, AND GASKET
ASSEMBLY INSTALLATION



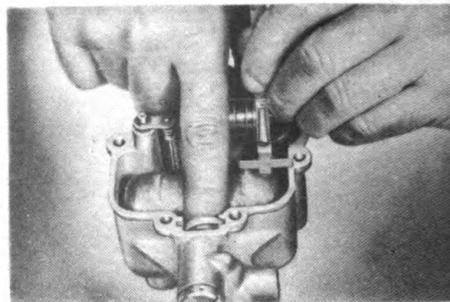
33. STEP-UP JET AND GASKET
ASSEMBLY INSTALLATION



37. FLOAT PIN RETAINER INSTALLATION



34. GASKET, SPRING, AND STEP-UP PISTON
ASSEMBLY INSTALLATION

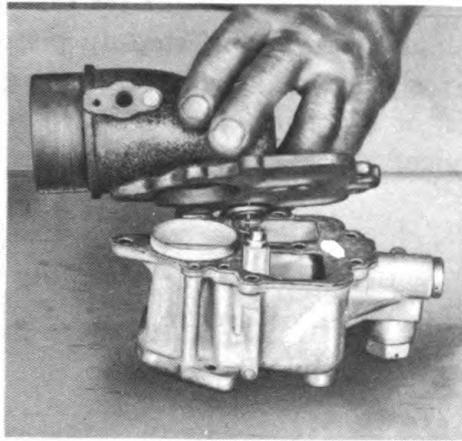


38. SETTING FLOAT LEVEL

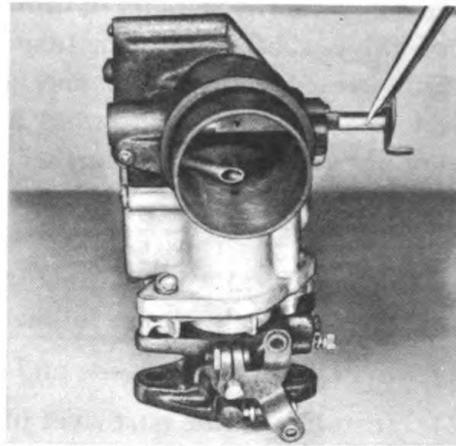
RA PD 66996

Figure 56—Carburetor Reassembly

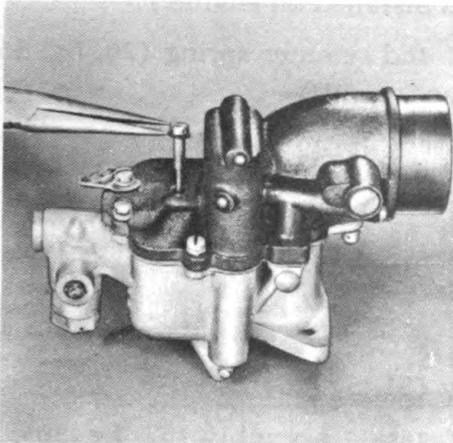
CARBURETOR



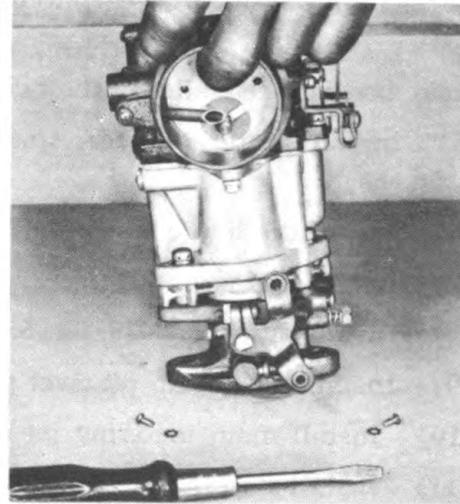
39. BOWL COVER AND GASKET
INSTALLATION



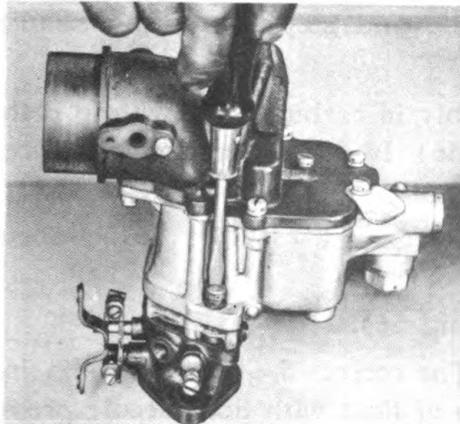
42. CHOKE SHAFT, SPRING, AND
LEVER INSTALLATION



40. FLOAT CHAMBER COVER AND MAIN
VENT TUBE INSTALLATION



43. CHOKE VALVE INSTALLATION



41. ATTACHING FLANGE TO BODY

RA PD 66993

Figure 57—Carburetor Reassembly

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age. Inspect pump circuit parts for tension of pump springs, condition of plunger, and check balls. Examine parts of choke circuit for distortion of valve, shaft, and arm. Inspect high speed circuit step-up piston and guide rod for distortion and jets for clogged passages or damage. Inspect castings for cracks, sand holes, or damage. Replace any parts that are not satisfactory for further service.

66. ASSEMBLY.

a. During assembly, use new gaskets throughout. The assembly is made in accordance with the following illustrated procedure:

- (1) Install idle orifice tube and plug assembly (23, fig. 55).
- (2) Install new idle port rivet plug (24, fig. 55).
- (3) Install idle adjusting screw and spring (25, fig. 55). (Adjust as outlined in par. 68 after carburetor is installed on engine.)
- (4) Install pump intake check ball and retainer spring (26, fig. 55). (Intake ball is the smaller of the two check balls.)
- (5) Install pump plunger, spring, and piston assembly as a unit (27, fig. 55).
- (6) Install discharge check ball (28, fig. 55).
- (7) Install spring and plug (29, fig. 55).
- (8) Install pump jet (30, fig. 55).
- (9) Install new pump jet rivet plug (31, fig. 56).
- (10) Install main metering jet and gasket assembly (32, fig. 56).
- (11) Install step-up jet and gasket assembly (33, fig. 56).
- (12) Install step-up gasket, spring, and step-up piston assembly (34, fig. 56).
- (13) Install float and lever assembly in carburetor bowl and install float pin and retainer spring (35, fig. 56). Install carburetor inlet screen (refer to illustration No. 15, fig. 53).
- (14) Install needle, seat, and new gasket (36, fig. 56). Be sure bakelite needle is not chipped.
- (15) Install float pin retainer (37, fig. 56).
- (16) Set float level (38, fig. 56). The correct float setting is $\frac{5}{64}$ inch as measured from top of bowl to top of float with float needle pressed firmly on its seat. To adjust, bend the float lip (not the float) up or down to obtain proper setting.
- (17) Install bowl cover and gasket (39, fig. 57). Be sure to install needle seat bracket before installing bowl cover attaching screws.

CARBURETOR

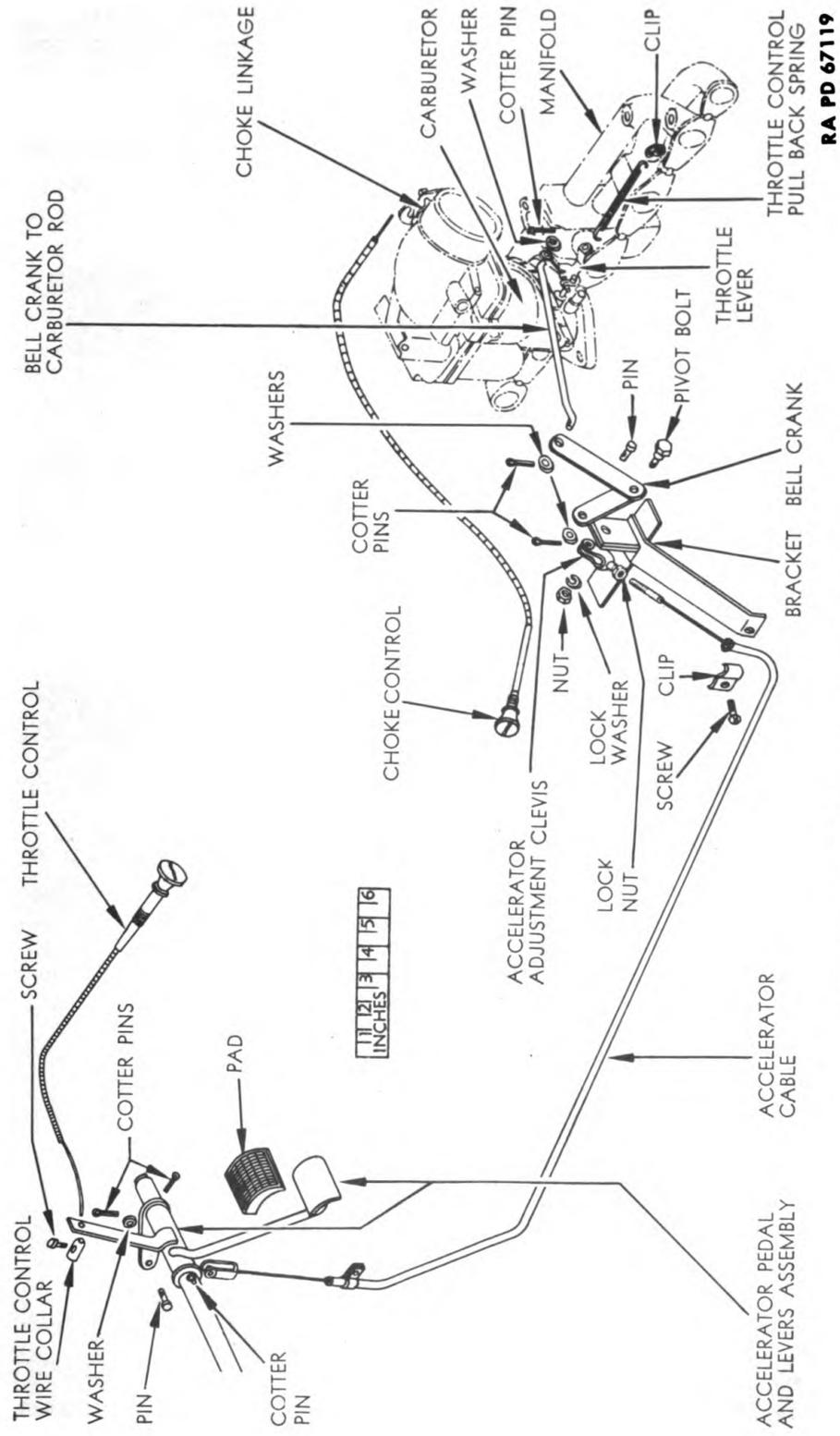


Figure 58—Carburetor Controls and Linkage

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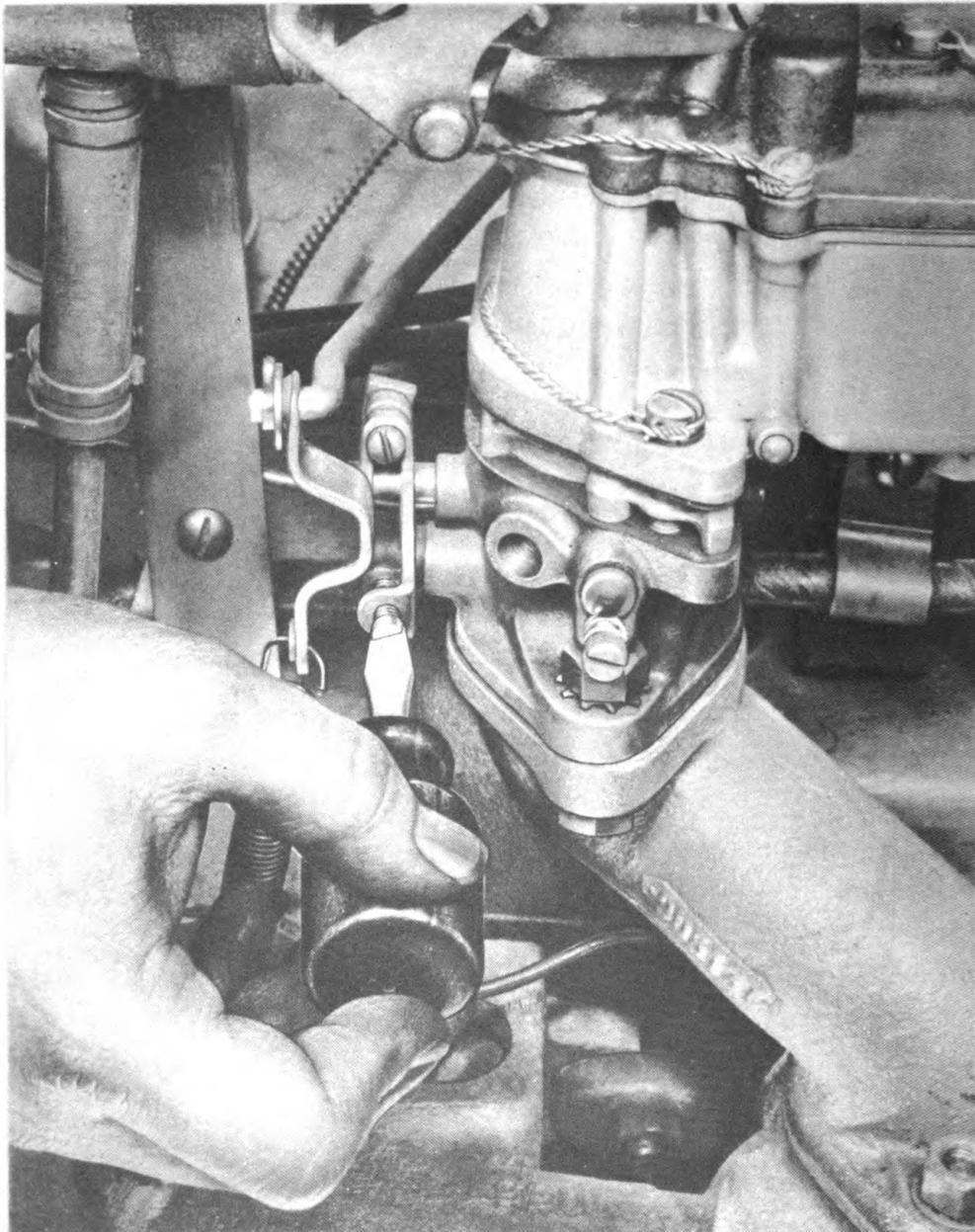
**ORDNANCE MAINTENANCE—ENGINE, ENGINE ACCESSORIES,
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(18) Start bowl cover screws, then install main vent tube and plug assembly and gasket (40, fig. 57). Tighten all screws securely.

(19) Attach flange assembly, insulator, and gaskets to body (41, fig. 57).

(20) Install choke shaft, spring, and levers (42, fig. 57).

(21) Install choke valve (43, fig. 57), (with relief valve to the bottom and away from incoming air). Always use new screws—don't forget external lock washers under heads of screws.



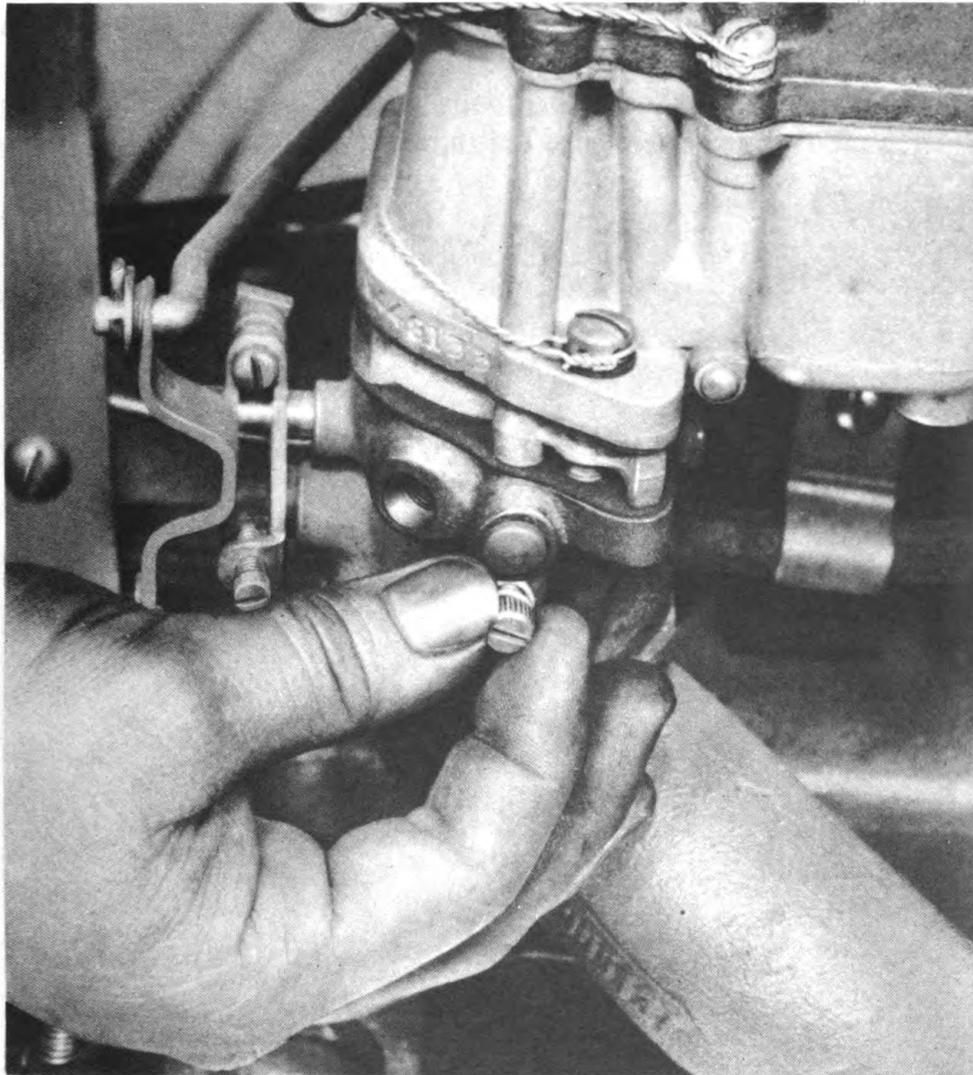
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Figure 59—Adjusting Carburetor Throttle Stop Screw

CARBURETOR

67. INSTALLATION.

- a. Place a new gasket in position on manifold adapter and set carburetor on gasket. Install bolts, lock washers, nuts, and tighten securely. Connect fuel pipe line to carburetor. Connect choke control wire to



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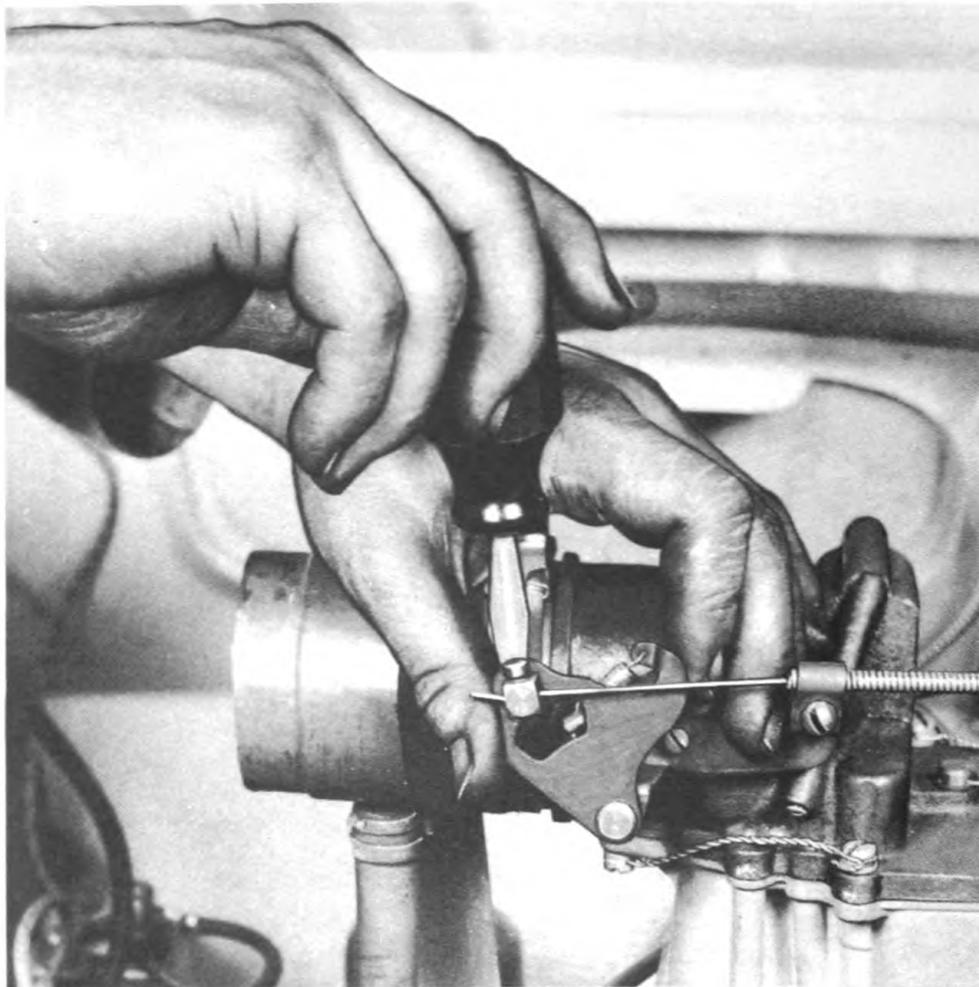
Figure 60—Carburetor Idle Mixture Adjustment

choke arm, fasten conduit to bracket, and tighten lock screw. Connect throttle pull back spring and attach throttle rod to throttle operating arm and install a cotter pin. Place carburetor air intake adapter over carburetor intake and tighten clamp screw securely. Install carburetor air cleaner on adapter and tighten clamp screw. Adjust carburetor and linkage (par. 68), and install engine compartment lid.

**ORDNANCE MAINTENANCE—ENGINE, ENGINE ACCESSORIES,
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a. **Idling Adjustment.** Operate engine until heat indicator on instrument panel registers 175 F (normal operating temperature). Turn throttle stop screw clockwise to increase idle speed, and counterclockwise to decrease idling speed of engine (fig. 59). Adjust idle mixture by turning adjusting screw in or out to obtain smoothest idle performance (fig. 60).

b. **Carburetor Choke Adjustment.** Loosen choke control wire collar screw and push choke valve all the way open. Push choke control



RA PD 67106

Figure 61—Carburetor Choke Control Adjustment

button on instrument panel all the way in and while holding valve fully open, tighten collar screw to lock control wire (fig. 61). Open and close choke valve to check operation.

c. **Carburetor Hand Throttle Adjustment.** With hand control

CARBURETOR

button in fully closed position, loosen throttle control wire screw. Hold control wire collar against accelerator upper arm and tighten screw.

d. Carburetor Accelerator Adjustment. To adjust accelerator throttle linkage, loosen throttle control wire collar and reset collar to assure full throttle opening at throttle stop screw on throttle shaft operating arm of carburetor. If throttle valve does not open completely as indicated by fixed stop on throttle shaft operating arm with accelerator fully depressed, loosen throttle control wire collar. Loosen the accelerator clevis lock nut, and remove the accelerator cable cotter pin and clevis pin. Turn clevis to change the effective length of cable to provide pedal travel required for full throttle opening. Install clevis pin, new cotter pin, and tighten clevis lock nut. Reset throttle control wire collar to obtain proper closed throttle idle position. Check linkage to make sure that with accelerator pedal fully depressed, throttle valve fixed stop on operating arm contacts boss on carburetor. Then when accelerator pedal is fully released, throttle stop screw fully contacts boss on carburetor.

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Section IV

FUEL PUMP

	Paragraph
Description and data	69
Removal	70
Disassembly	71
Cleaning	72
Inspection	73
Assembly	74
Testing	75
Installation	76

69. DESCRIPTION AND DATA.

a. **Description.** A diaphragm-type fuel pump (fig. 62) is attached to the cylinder block at the lower right side. The pump is mechanically operated by means of a rocker arm which contacts a lobe on the camshaft. It contains a strainer screen and metal sediment bowl. An external lever is provided on the pump to fill manually the fuel pump bowl and float chamber in carburetor. The lever is directly below pump body.

b. Data.

Make AC
Type Diaphragm, mechanically operated

70. REMOVAL.

a. Remove engine as outlined in paragraph 7. Disconnect inlet and outlet pipes from fuel pump. Remove cap screws holding fuel pump to cylinder block, remove fuel pump and gasket (fig. 63).

71. DISASSEMBLY.

a. Remove pump chamber cover screws and remove cover from pump body (fig. 64). Remove diaphragm assembly from the rocker arm by holding the rocker arm outer end down, push diaphragm assembly downward, unhook pull rod from inner end of rocker arm and remove diaphragm assembly. Take rocker arm pin out of arm (fig. 65), remove rocker arm and return spring. Remove sediment bowl by unscrewing bowl seat nut at bottom and remove the sediment bowl, screen, and gasket. Remove the intake and air dome plugs, tension springs, and fiber washers (fig. 66).

FUEL PUMP

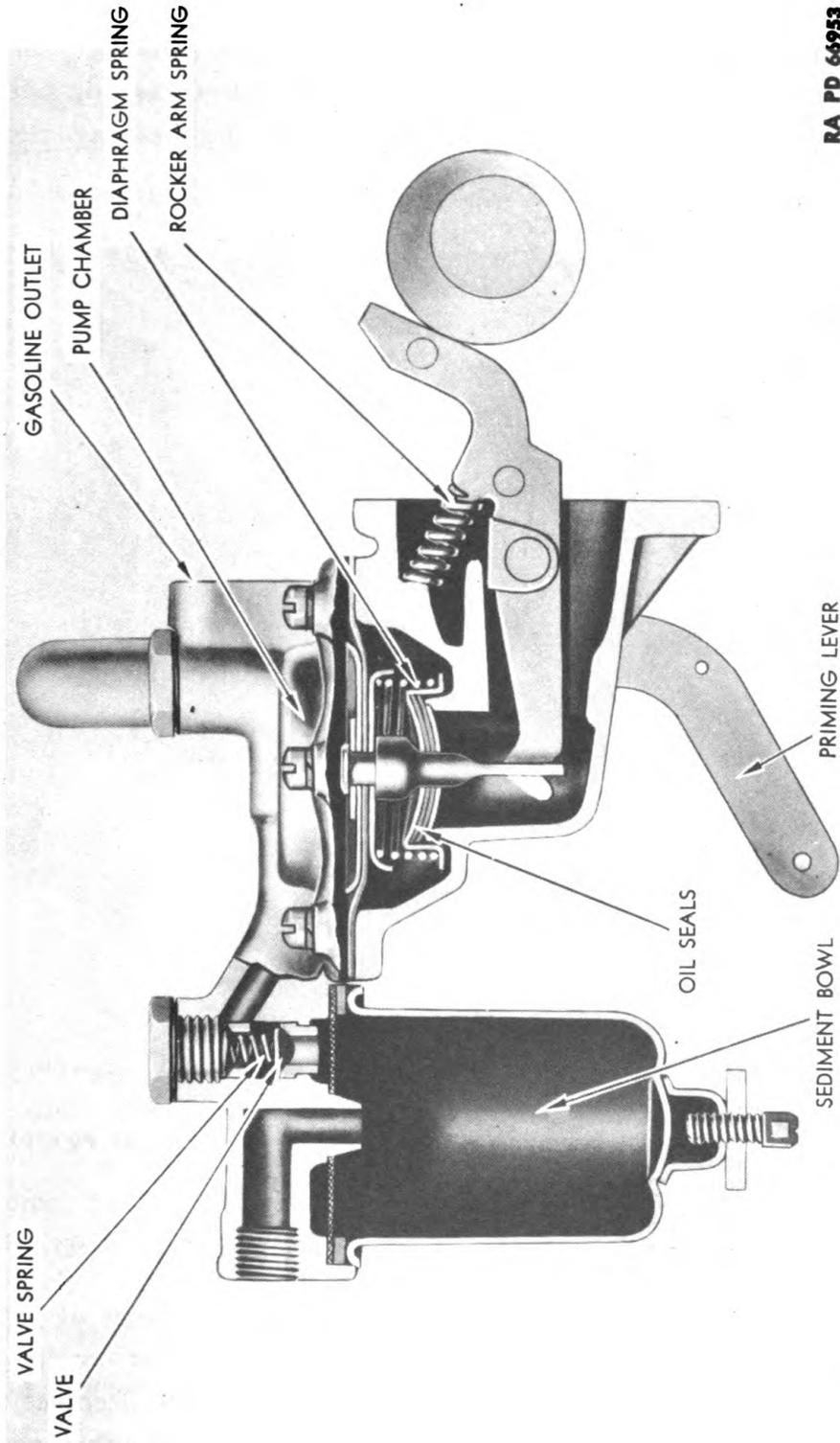
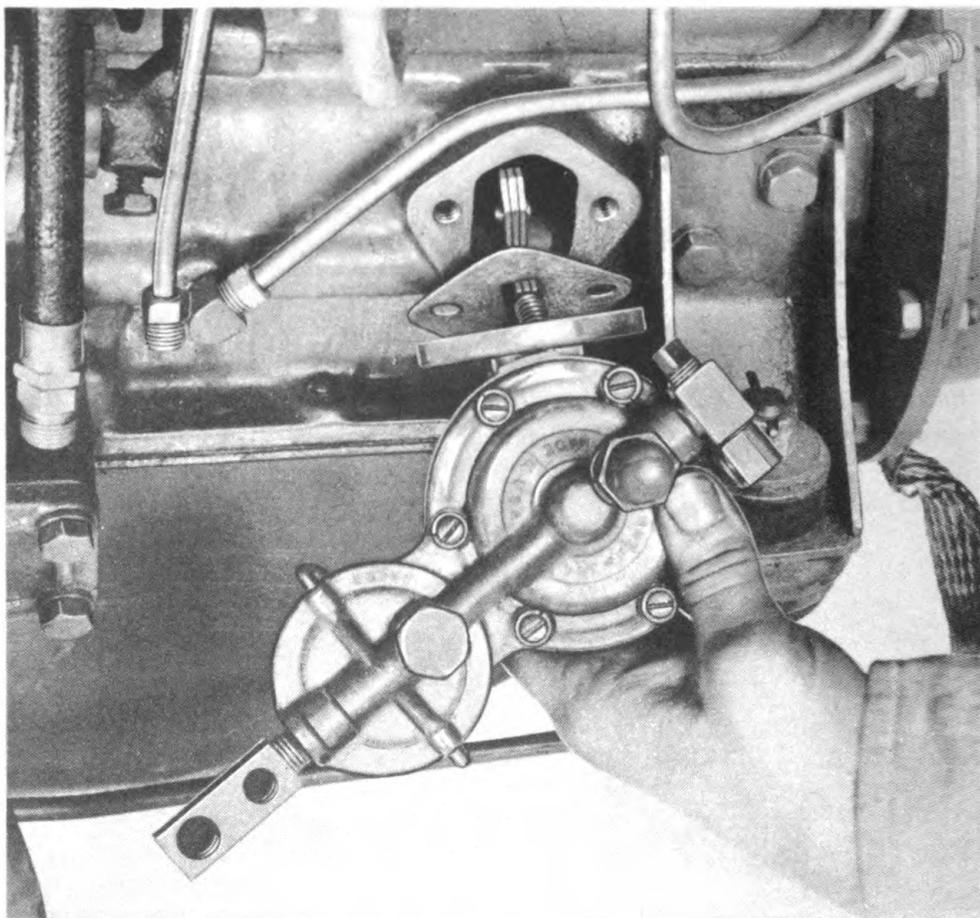


Figure 62—Fuel Pump Cross Section

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72. CLEANING.

a. Clean sediment bowl thoroughly and dry with a clean cloth. Clean strainer screen thoroughly in SOLVENT, dry-cleaning. Blow through strainer screen with compressed air to complete cleaning operation. Immerse all other metal parts in SOLVENT, dry-cleaning, clean thoroughly, and dry with compressed air.



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Figure 63—Fuel Pump Removal

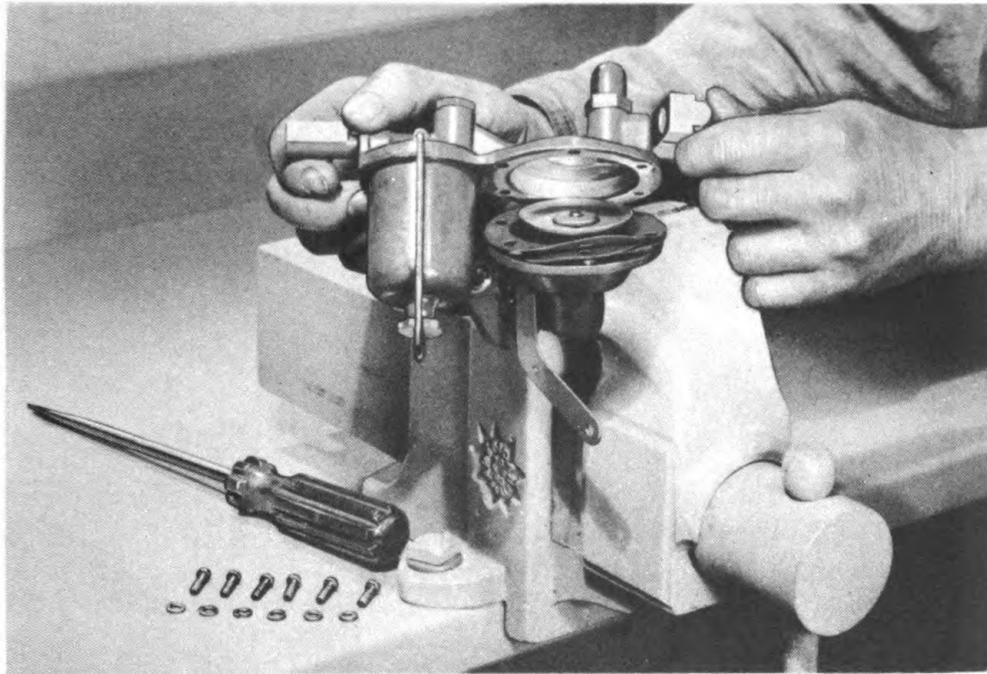
73. INSPECTION.

a. If rocker arm assembly is found to be excessively loose at pivot pin or linkage, replace it. Inspect diaphragm assembly for cracks, or damage and replace if not satisfactory for further service. Replace oil seals every time fuel pump is disassembled. Examine all other parts for breakage or other damage and replace any parts that are not satisfactory for further service.

FUEL PUMP

74. ASSEMBLY.

a. Install rocker arm spring and rocker arm in fuel pump body and install rocker arm pin. Assemble oil seal retainer, oil seals, diaphragm spring seat, and diaphragm spring to diaphragm pull rod. Install diaphragm assembly to rocker arm by holding arm outer end down, push diaphragm assembly downward and hook diaphragm pull rod on inner end of arm (fig. 67). Install chamber cover to pump body by holding



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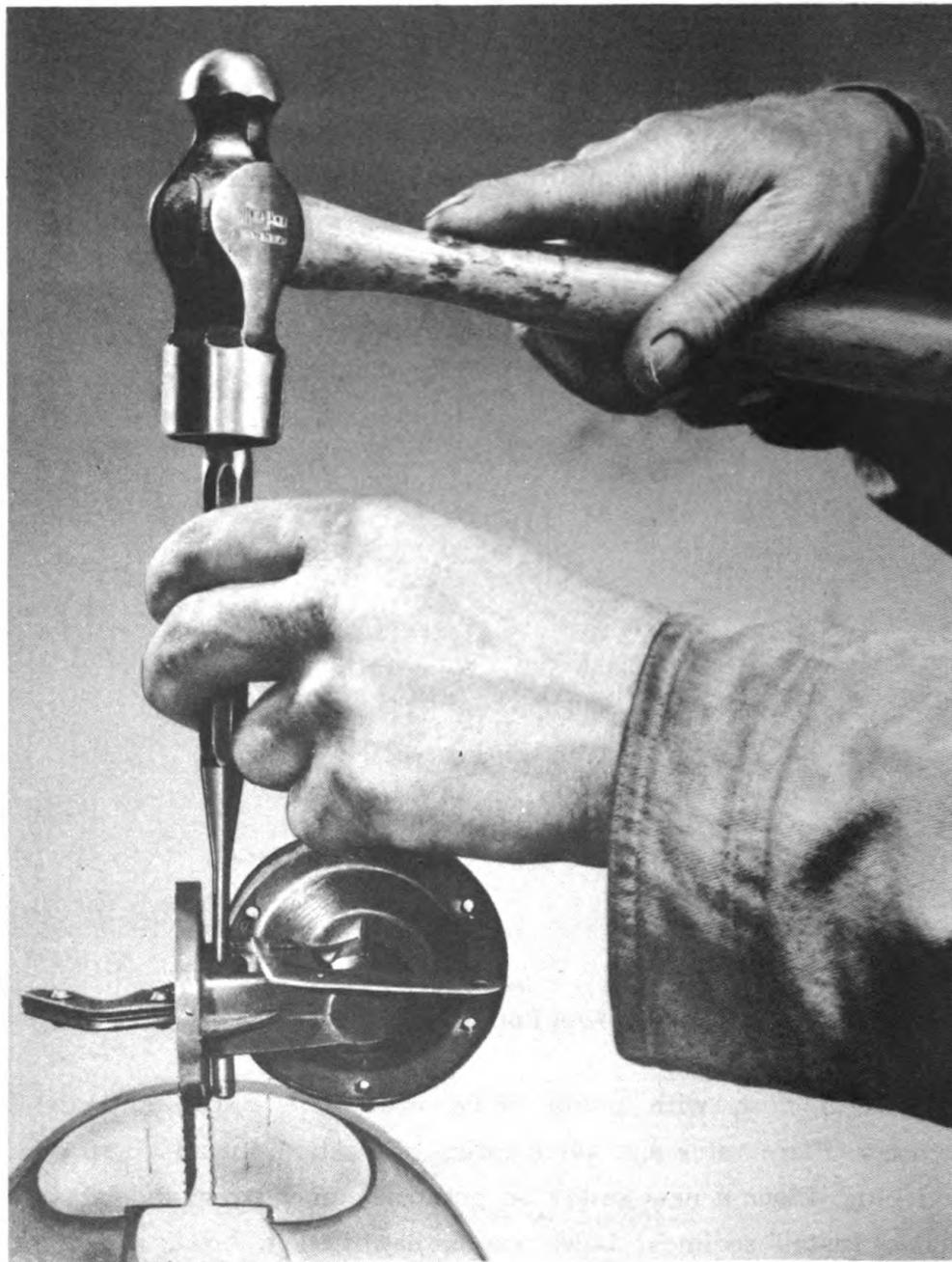
Figure 64—Fuel Pump Top Cover Removal

diaphragm flush with pump body, insert the screws and tighten securely. Place valve and valve spring in position, install a new gasket and plug. Place a new gasket on pump chamber cover and install air dome. Install sediment bowl screen, new gasket, bowl, and tighten securely.

75. TESTING.

a. Before installing fuel pump to cylinder block, make a bench test. Close both inlet and outlet openings, operate rocker arm and note results. The fuel pump pressure with recommended gage is 2 to 4 pounds. Test for leaks between diaphragm, cover, and body.

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RA PD 66943

Figure 65—Fuel Pump Anchor Pin and Arm Removal

76. INSTALLATION.

- a. **Install Fuel Pump.** Turn crankshaft until high side of camshaft lobe is away from pump mounting surface on cylinder block. Install new gasket to pump housing and insert cap screws with lock washers through pump flange. Place pump flange against mounting surface on

FUEL PUMP

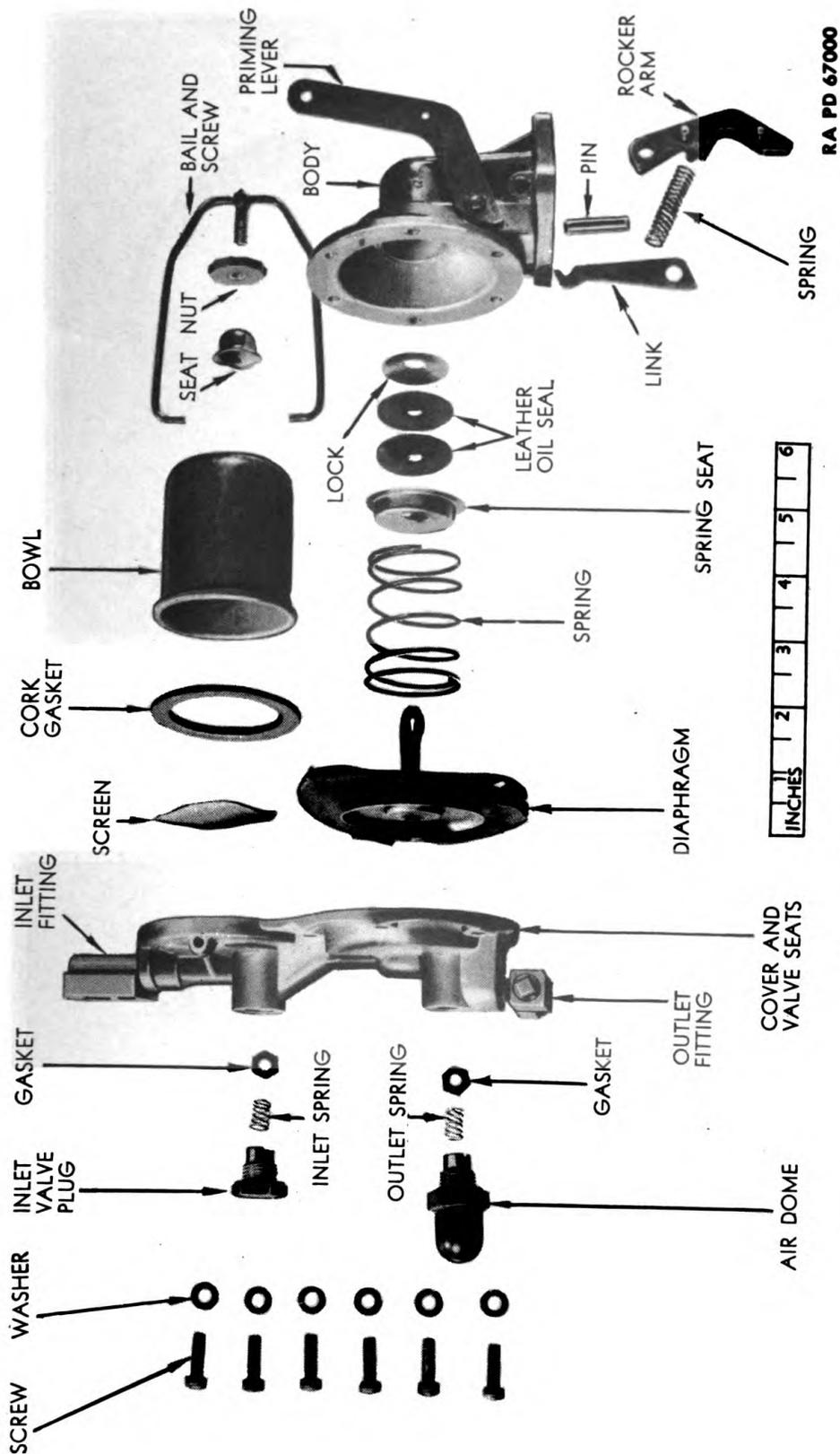


Figure 66—Fuel Pump Disassembled

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RA PD 66942

Figure 67—Assembling Diaphragm Parts

cylinder block so the lower side of rocker arm contacts lobe on camshaft and tighten the screws securely. Connect the pipes to fuel pump and tighten securely.

b. Install Engine in Vehicle. Install engine as outlined in paragraph 57.

Section V

FUEL TANK

	Paragraph
Description	77
Removal	78
Disassembly	79
Cleaning	80
Inspection	81
Assembly	82
Installation	83

77. DESCRIPTION.

a. The 35-gallon fuel tank is located to the right of the engine and held in position by two band clamps. A large filler neck having a sealed-type cap to prevent fuel loss when vehicle is being operated at extreme

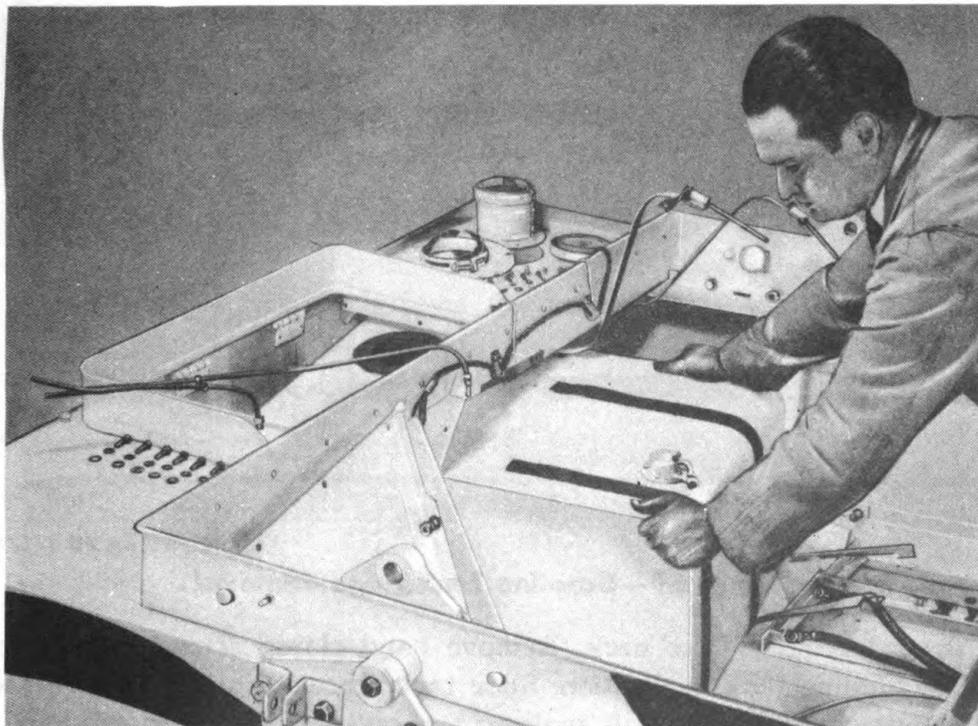


Figure 68—Fuel Tank Removal

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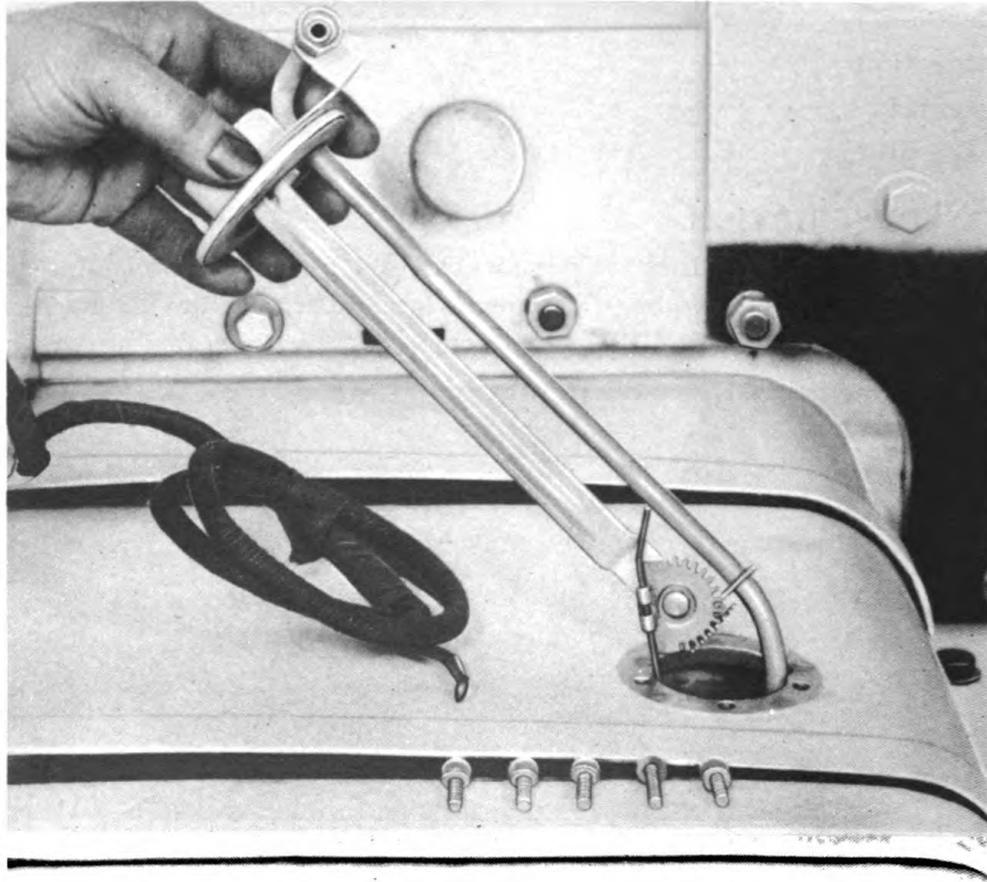
angles, extends up through the hull at the right front corner. The fuel gage tank unit is attached to the top of tank near left rear corner.

78. REMOVAL.

a. Remove engine as outlined in paragraph 7. Loosen tank filler cap, remove plug from right side of hull, open tank drain valve, and allow fuel to drain from tank. Disconnect engine compartment heater

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fuel line, and drain pipe from drain valve on tank. Disconnect fuel gage tank unit wires from tank unit. Remove cap screws with lock washers holding filler neck plate to hull and remove the plate. Remove cap screws with lock washers and copper washers holding filler neck to



RA PD 67174

Figure 69—Gasoline Tank Gage Removal

tank and remove filler neck. Remove band clamp screws and loosen bands holding tank in position. Slide tank rearward and then to center of engine compartment. Lift tank up and out of vehicle (fig. 68).

79. DISASSEMBLY.

a. Remove screws and copper asbestos washers that fasten fuel gage tank unit to top of tank and remove gage and gasket from tank (fig. 69). Remove valves and fittings from lower left rear corner of tank.

80. CLEANING.

a. When cleaning inside of fuel tank, use steam and hot water to remove all dirt and rust. Rinse inside of tank with SOLVENT, dry-

FUEL TANK

cleaning, to complete the cleaning operation. Clean outside of tank thoroughly with SOLVENT, dry-cleaning. Immerse valves and fittings in SOLVENT, dry-cleaning, clean thoroughly, and dry with compressed air.

81. INSPECTION.

a. Inspect fuel tank for leaks or damage, and repair or replace. Examine all fittings and valves for breakage or damaged threads and replace parts as necessary.

82. ASSEMBLY.

a. Place a new gage tank unit gasket on tank, insert unit float into opening in tank, install screws, new copper asbestos gaskets, and tighten securely. Install valves and fittings to lower left rear corner of tank.

83. INSTALLATION.

a. Apply grease to band surfaces on which tank rests, to facilitate sliding tank into position. Slide tank into position, and tighten band clamps moderately. Install a new filler neck to tank gasket, place neck in position on tank and fasten securely with cap screws and new copper washers. Install filler neck plate and seal to top of hull using cap screws with lock washers and tighten securely. Connect fuel gage wires to gage. Tighten the tank band clamps securely. Connect the drain and fuel pipe lines to tank connections. Install engine as outlined in paragraph 57. Close tank drain valve, install drain plug in right side of hull, and fill tank with fuel.

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Section VI

FUEL FILTER

	Paragraph
Description	84
Removal	85
Disassembly	86
Cleaning	87
Inspection	88
Assembly	89
Installation	90

84. DESCRIPTION.

a. The fuel filter contains a replaceable element to remove water and foreign material from the fuel before it reaches the fuel pump. The filter is mounted inside the engine compartment to hull coaming at left of fuel tank, directly above the right corner of radiator.

85. REMOVAL.

a. Loosen wing nuts and remove engine compartment lid. Remove drain plug from right side of hull, close filter inlet valve, open filter drain valve, and allow fuel to drain out of filter. Disconnect filter inlet and outlet pipes from filter fittings. Disconnect drain pipe from fitting in bottom of filter. Remove cap screws, with lock washers, and remove filter from coaming.

86. DISASSEMBLY.

a. Remove cover cap screw and gasket, holding filter shell to the cover, and remove filter cover and gasket. Carefully remove the filter element and gasket from filter shell. Remove the coil spring from inside of shell and drain valve from bottom of shell.

87. CLEANING.

a. Clean all parts of filter thoroughly with SOLVENT, dry-cleaning. Clean all passages in shell and cover with compressed air.

88. INSPECTION.

a. Inspect cover and shell for cracks or damage. Replace if not fit for further service. Examine all pipes and connections for cracks or damage and replace as necessary. Inspect filter element for broken or damaged segments and replace if not satisfactory for further service.

FUEL FILTER

89. ASSEMBLY.

a. Place coil spring over shell center pipe. Carefully place filter element in position over spring and center pipe. Install new gaskets on filter element and shell, place cover in position on shell, and fasten securely with cap screw after installing a new gasket on screw. Install drain valve in bottom of shell.

90. INSTALLATION.

a. Place filter in position on hull coaming, insert cap screws with lock washers and tighten securely. Connect inlet and outlet pipes and tighten securely. Connect and tighten drain pipe to drain valve, and open filter inlet valve. Place engine compartment lid in position and tighten wing nuts.

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Section VII

PRIMER

	Paragraph
Description	91
Removal	92
Inspection	93
Test	94
Installation	95

91. DESCRIPTION.

a. The primer circuit consists of a hand-operated pump with a system of inlet and outlet pipes. The pump handle is located in the upper right corner of instrument panel. When pump handle is pulled outward, the piston draws a charge of fuel into the cylinder. When the piston is pushed in, the charge is distributed through the outlet pipe to three connections on the intake manifold. It is not probable that the primer will require special service other than to keep the connections tight.

92. REMOVAL.

a. Remove engine compartment lid by unscrewing the wing nuts and lifting lid out of vehicle. Disconnect inlet pipe coupling and outlet pipe from primer. Remove primer operating button from face of instrument panel by turning counterclockwise while holding flat side of pump shaft. Loosen lock nut behind panel face and remove escutcheon nut from panel face. Slip primer out of panel. If it is necessary to remove the primer pipes, removal procedure will depend on pipe or pipes to be removed; however, no special instructions are needed.

93. INSPECTION.

a. Inspect primer for breakage or damage, and replace if not satisfactory for further service. Replace any pipes, couplings, or fittings that are broken or damaged.

94. TEST.

a. Place primer inlet fitting in a pan or bucket containing fuel and pull primer handle outward to draw a charge of fuel into cylinder. Push handle in while observing if fuel is forced out of the primer outlet fitting.

95. INSTALLATION.

a. Place primer into position on panel, install lock nut behind panel face but do not tighten. Install escutcheon nut on panel face and then tighten lock nut. Connect outlet and inlet pipes to primer, and make sure that all couplings are tight and no leakage exists. A very slight leak in system will render primer ineffective.

Section VIII

FITS AND TOLERANCES

Paragraph

Fuel system service data 96

96. FUEL SYSTEM SERVICE DATA.

a. Fuel Pump.

(1) PRESSURE: 2 to 4 lbs.

b. Carburetor.

(1) FLOAT SETTING: $\frac{5}{64}$ inch from top of bowl to top of float, with float needle against seat.

(2) IDLE MIXTURE SETTING: $\frac{1}{4}$ to $1\frac{1}{4}$ turns open.

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CHAPTER 4

MANIFOLD AND EXHAUST SYSTEM

Section I

DESCRIPTION AND DATA

	Paragraph
Description	97
Data	98

97. DESCRIPTION.

a. The one-piece manifold is made of cast iron and incorporates a heat control valve. Two exhaust pipes are used to carry the exhaust from the manifold exhaust outlet to the muffler which is mounted on the rear deck.

98. DATA.

Manifold	One-piece
Heat control valve	Automatic
Exhaust line	Two piece
Muffler	Straight through

Section II
TROUBLE SHOOTING

Trouble shooting	Paragraph 99
------------------------	-----------------

99. TROUBLE SHOOTING.

a. Exhaust Leaks.

Possible Cause	Possible Remedy
Manifold gaskets burned.	Replace gaskets (pars. 102, 106).
Manifold cracked.	Repair or replace (pars. 102, 106).
Exhaust pipe flange gaskets burned.	Replace gaskets (pars. 102, 106).
Exhaust pipe burned or rusted through.	Replace pipe (pars. 102, 106).

b. Engine Lacks Power.

Manifold heat control valve shaft stuck.	Free valve shaft.
Exhaust pipe or muffler partially clogged.	Remove restriction or replace as required.

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Section III

MANIFOLD

	Paragraph
Description	100
Removal	101
Disassembly	102
Cleaning	103
Inspection	104
Assembly	105
Installation	106

100. DESCRIPTION.

a. The manifold heat control valve shunts the exhaust gases around the center section of the intake manifold to preheat the fuel mixture before it enters the combustion chambers.

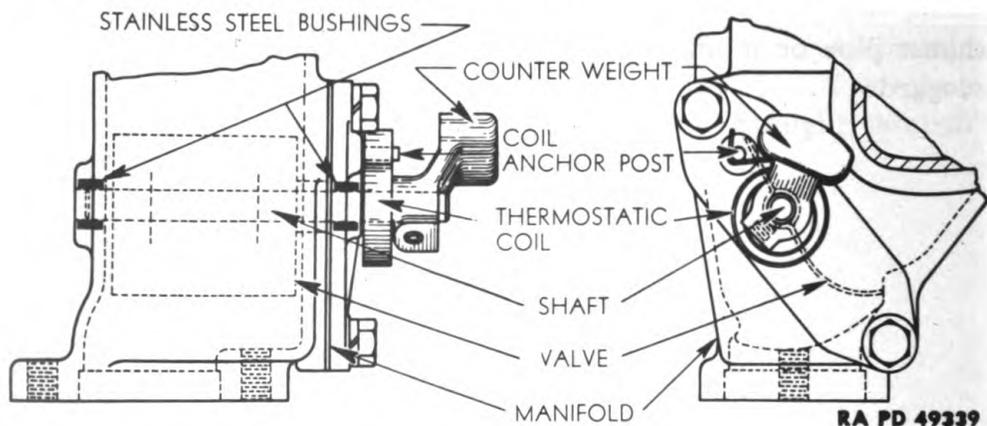


Figure 70—Manifold Heater Valve Construction

101. REMOVAL.

a. Remove carburetor (par. 63). Take out bolt and nut holding engine compartment heater outlet tube sleeve to heater, remove clamp holding tube to battery bed, and lift tube out of compartment. Disconnect and remove battery post clamps, remove retaining frame, and lift battery out of vehicle. Disconnect primer outlet pipe from fitting at rear of manifold. Remove nuts holding front exhaust pipe flange to manifold flange and separate the flanges. Disconnect and remove ventilation pipe from manifold adapter and valve cover. Remove nuts and clamps holding manifold to cylinder block, remove manifold and gasket from block.

MANIFOLD

102. DISASSEMBLY.

a. Remove nuts holding adapter to manifold, lift adapter and gasket from manifold. Disconnect primer pipes and remove fittings from manifold. Take out cap screws that hold heat control valve assembly (fig. 70) to manifold, remove valve assembly and gasket. Remove set screw from counterweight, pull weight off end of shaft, slip thermostatic spring off, and remove shaft from cover.

103. CLEANING.

a. Clean all parts thoroughly with SOLVENT, dry-cleaning, and dry with compressed air. Use a putty knife to remove any carbon formations, pieces of gaskets, or other foreign substance.

104. INSPECTION.

a. Inspect the manifold and adapter for cracks, sand holes, or other damage. Examine the primer pipes for damage and the connections for stripped threads. Inspect the heat control valve cover, and shaft for breakage or other damage. Examine the shaft counterweight and thermostatic spring for breakage. If the manifold and adapter cannot be placed in a serviceable condition, replace them. Replace any primer pipes or fittings that are not satisfactory for further service. If the heat control valve or cover are broken, replace them. Machine the bearing surfaces of the heat control valve shaft to make certain that it will operate freely in the bearings. Replace the shaft counterweight if it is broken, and the thermostatic spring if it is rusted or burned so the life is gone from the metal.

105. ASSEMBLY.

a. Insert the split end of the heat control valve shaft (with valve attached) through the cover, place the thermostatic spring in position on the shaft and hook the end of the spring on pin located in cover. Install a new heat control cover gasket on manifold and insert the other end of valve shaft through the opening in manifold and enter shaft in the bearing in rear side of manifold. Install the cap screws, lock washers, and tighten securely. With the heater valve held in the closed position by the thermostatic spring, place counterweight on the valve shaft so set screw is near the bottom and alined with slot in shaft. The counterweight should not be slid on the shaft too far, as it will restrict the end play of shaft.

b. Install the primer pipe fittings in manifold, and connect primer pipes to the fittings. Place a new manifold to adapter gasket on manifold, set adapter on gasket, install nuts on studs and tighten securely.

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a. Place a new manifold to block gasket against the cylinder block so the raised rings are away from block. Place manifold in position over studs and against gasket, install retaining clamps, and tighten nuts securely. Install the ventilation pipe to the manifold adapter and valve cover fittings and tighten the connections securely. Place a new gasket between manifold and exhaust pipe flanges. Install nuts on studs and tighten securely. Connect primer outlet pipe to fitting at rear of manifold. Install battery in compartment, fasten in position with retaining frame, and connect battery cable clamps to battery posts. Place the engine compartment heater outlet tube in position, fasten tube clamp to battery bed, install the tube sleeve over heater outlet, and tighten securely with bolt and nut. Install carburetor as outlined in paragraph 67.

Section IV

EXHAUST PIPES AND MUFFLER

	Paragraph
Description	107
Removal	108
Inspection	109
Installation	110

107. DESCRIPTION.

a. The exhaust system consists of two exhaust pipes and a muffler (fig. 71). The front exhaust pipe has a flange at each end and is sup-

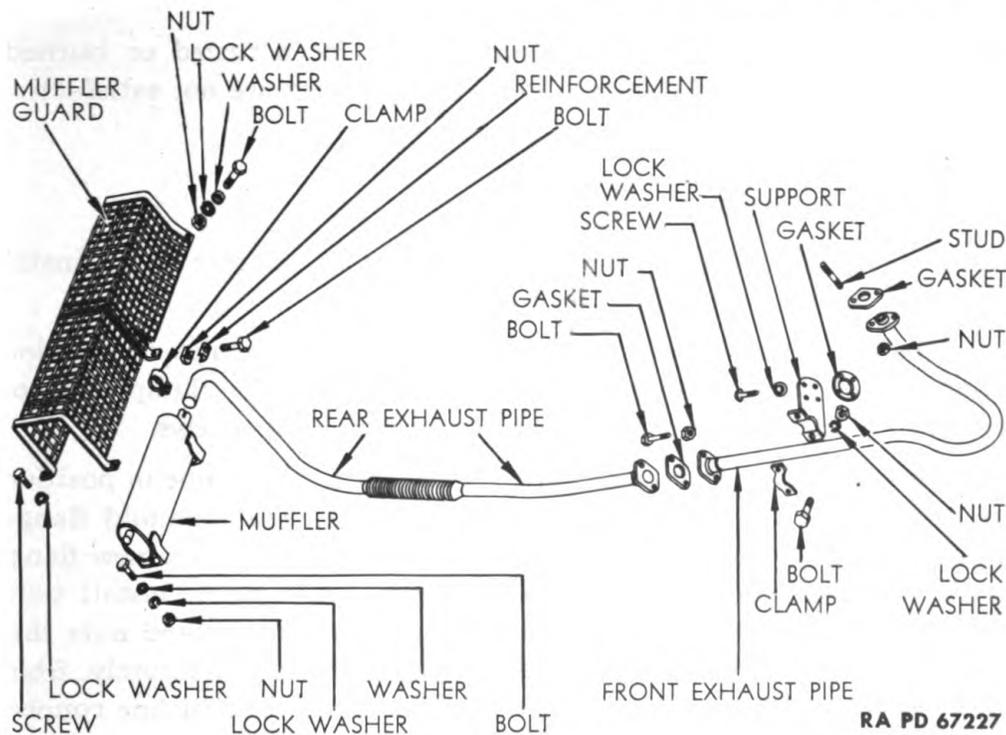


Figure 71—Exhaust System Parts

ported near the rear end by a clamp and bolts which attach it to clutch housing. The rear exhaust pipe has a flexible section between two tubular sections. A flange at front end attaches to a flange at rear end of front pipe, and rear end is fastened to muffler with a clamp. The muffler is mounted on rear deck of vehicle and is protected with a wire-mesh guard.

108. REMOVAL.

a. **Remove Front Exhaust Pipe.** Loosen wing nuts and remove engine compartment lid. Remove cap screws and lift hull floor pan out of vehicle. Remove nuts holding front exhaust pipe front flange to mani-

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fold flange and separate flanges. Remove bolts and nuts that fasten front and rear exhaust pipe flanges together and separate flanges. Take out bolts, nuts, and clamp that hold front exhaust pipe to clutch housing, and remove pipe from vehicle.

b. Remove Rear Exhaust Pipe. Take out cap screws holding muffler guard to hull and remove the guard. Loosen muffler clamp bolt and nut, pull pipe out of muffler, and remove from vehicle.

c. Remove Muffler. Remove muffler bracket mounting screws and lift muffler from rear deck.

109. INSPECTION.

a. Inspect the exhaust pipes and muffler for a rusted or burned-through condition, and damage. Replace parts that are not satisfactory for further service.

110. INSTALLATION.

a. Install Muffler. Place muffler in position on rear deck, install mounting screws, and tighten securely.

b. Install Rear Exhaust Pipe. Place rear exhaust pipe in position, insert rear end of pipe into muffler, and tighten muffler clamp bolt and nut. Install muffler guard and fasten securely with cap screws.

c. Install Front Exhaust Pipe. Place front exhaust pipe in position, insert a new flange gasket between front flange and manifold flange, install nuts on manifold studs, and tighten securely. Place a new flange gasket between flanges of front and rear exhaust pipes, install bolts and nuts, and tighten securely. Install clamp with bolts and nuts that fasten front exhaust pipe to clutch housing, and tighten securely. Start the engine and check for exhaust leaks. Check all exhaust line connections for tightness. Place hull floor pan in position, install cap screws, and tighten securely. Install engine compartment lid and tighten wing nuts.

Section V

FITS AND TOLERANCES

Paragraph

Manifold and exhaust system service data..... 111

111. MANIFOLD AND EXHAUST SYSTEM SERVICE DATA.

a. Manifold.

Heat control valve shaft: 0.005 in.

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CHAPTER 5

IGNITION SYSTEM

Section I

DESCRIPTION AND DATA

	Paragraph
Description	112
Data	113

112. DESCRIPTION.

a. **Description.** The ignition system incorporates the distributor, ignition coil, spark plugs and necessary high- and low-tension wires to

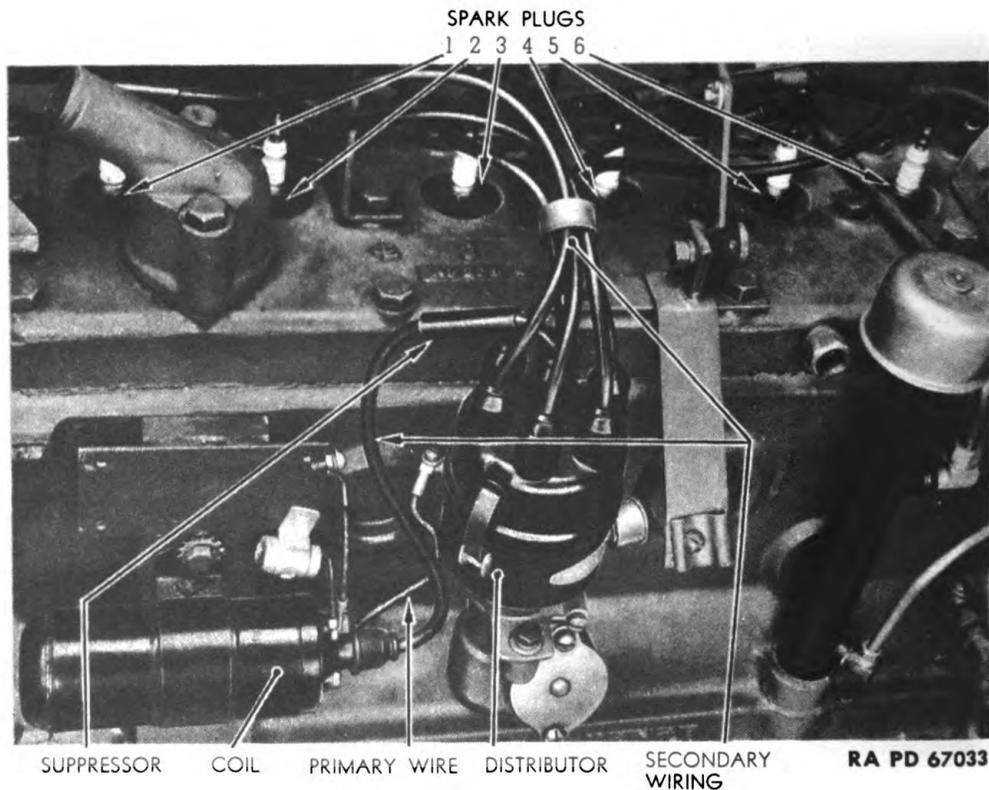


Figure 72—Units of the Ignition System

complete the circuit for these units of the ignition system (fig. 72). The complete ignition circuit is composed of a primary and secondary circuit. When the ignition switch is turned on and the distributor breaker points are closed, current flows through the primary winding of the ignition coil building up a strong magnetic field within. With

DESCRIPTION AND DATA

the opening of the distributor breaker points the circuit is broken and a high voltage is inducted into the secondary winding within the coil. This high voltage is then passed on through the distributor, and to the spark plugs by the high tension wiring. To prevent arcing across the distributor points as they open, a condenser is connected in parallel with the points. Its purpose is to provide a reservoir for the primary circuit until the points have separated far enough to prevent an arc across the points. Stopping the current flow, collapses the magnetic field and induces the high voltage necessary to provide the spark at the plugs.

113. DATA.

Distributor Fully automatic
Coil Shunt-wound
Spark plug Champion J-9, 14-mm.

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Section II

TROUBLE SHOOTING

	Paragraph
Trouble shooting	114

114. TROUBLE SHOOTING.

a. Engine Will Not Start.

Possible Cause	Possible Remedy
Incorrectly spaced spark plug electrodes.	Set plug gap (par. 127).
Worn or pitted distributor points.	Clean and file points or install new (pars. 117, 120).
Distributor incorrectly timed.	Correct timing (pars. 52, 122).
Defective coil.	Replace coil (pars. 124, 126).
Defective condenser.	Replace condenser.
Loose connection.	Tighten connection.
Faulty ignition switch.	Replace switch.
Breaker points not closing.	Check and adjust points (par. 120).
Point arm spring broken.	Replace and adjust distributor arm and point (pars. 117, 120, 121).
Breaker arm grounded.	Replace and adjust breaker arm (pars. 117, 120, 121).
Defective rotor or cap.	Replace rotor or cap (pars. 117, 120).

b. Engine Misfires in One or More Cylinders.

Defective distributor cap or rotor.	Replace with new parts (pars. 117, 120).
Defective spark plug.	Install new plug (pars. 128, 130).

c. Weak Spark at Plugs.

Moisture or dirt on porcelain.	Clean porcelain (par. 129).
Ignition coil weak.	Replace coil (pars. 124, 126).
Breaker contact points defective.	Install new points and adjust gap (pars. 117, 120, 122).
Condenser defective or disconnected.	Tighten connections or replace condenser.

TROUBLE SHOOTING

d. Spark Knocks.

Possible Cause	Possible Remedy
Timing incorrect.	Retime (pars. 52, 122).
Distributor governor springs weak.	Replace springs (pars. 117, 120).

e. Breaker Points Pitted or Burned.

Grease or dirt on points.	Clean points and adjust gap or replace (pars. 117, 118, 120, 122).
Defective condenser.	Replace condenser.

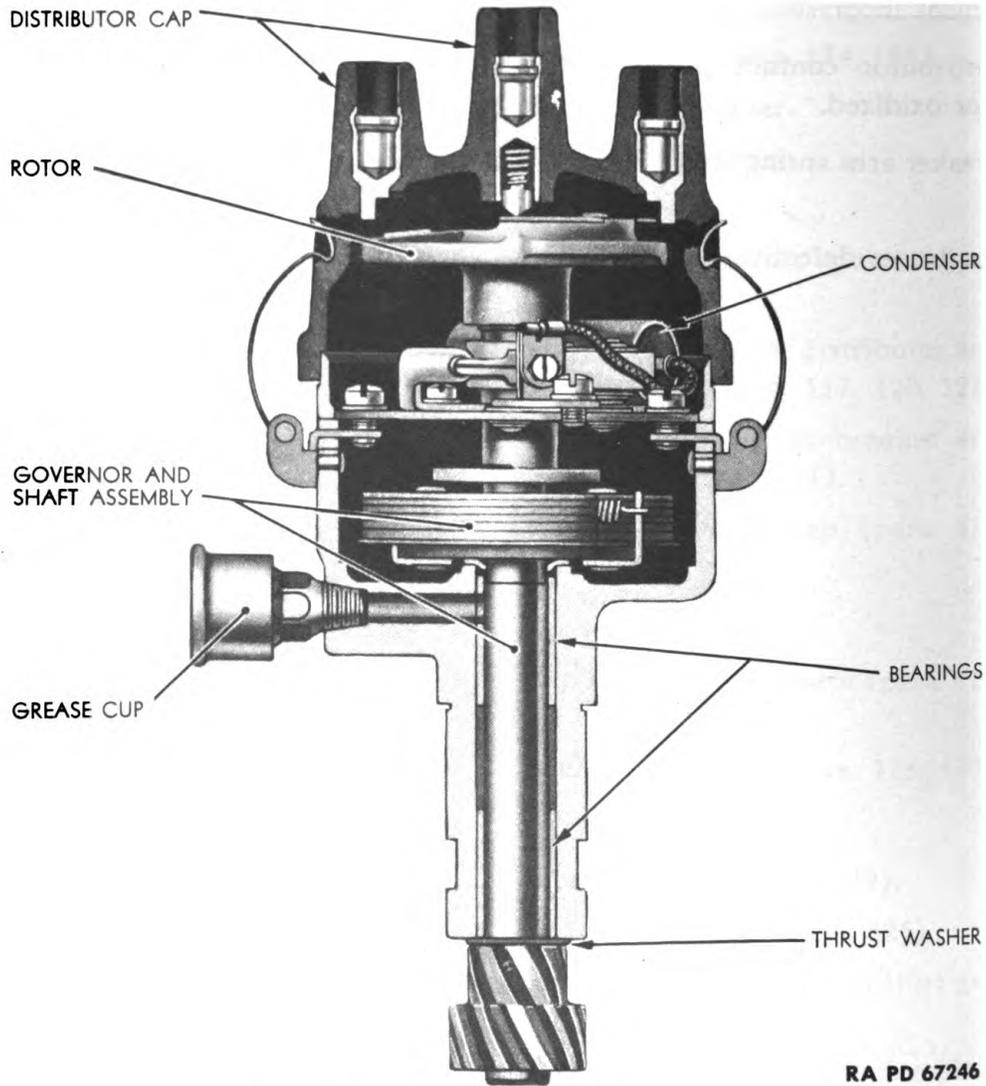
f. Engine Misses at All Speeds.

Distributor contact point adjustment incorrect.	Adjust gap (par. 122).
Distributor contact points pitted or oxidized.	Replace points and adjust gap (pars. 117, 120, 122).
Breaker arm spring weak.	Replace arm and spring (pars. 117, 120).
Condenser defective or wire loose.	Tighten connection or replace condenser.

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**Section III
DISTRIBUTOR**

	Paragraph
Description and data	115
Removal	116
Disassembly	117
Cleaning	118
Inspection	119
Assembly	120
Test	121
Installation	122



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Figure 73—Distributor Construction

DISTRIBUTOR

115. DESCRIPTION AND DATA.

a. **Description.** The main parts of the distributor are the base, camshaft and governor, breaker plate, cap, and rotor (fig. 73). The base supports and houses the distributor mechanism. The cam is in-



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Figure 74—Distributor Removal

tegral with drive shaft, and the centrifugal governor changes the breaker contact timing as the speed is increased. The breaker contacts are mounted on the breaker plate and are connected in the coil primary circuit, so the cam opens the coil circuit at the proper instant to pro-

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vide a spark at spark plug. A condenser is connected across the breaker contacts to protect the life of contacts and to increase the efficiency of ignition coil. The cap and rotor are arranged so the high-tension voltage is connected to the correct spark plug for firing each cylinder. The governor weights and springs are mounted on the drive shaft. The rate and amount of spark advance is automatic, and is controlled by the governor springs and weights.

b. Data.

Model Auto-Lite IGC-4902A
Type Automatic advance

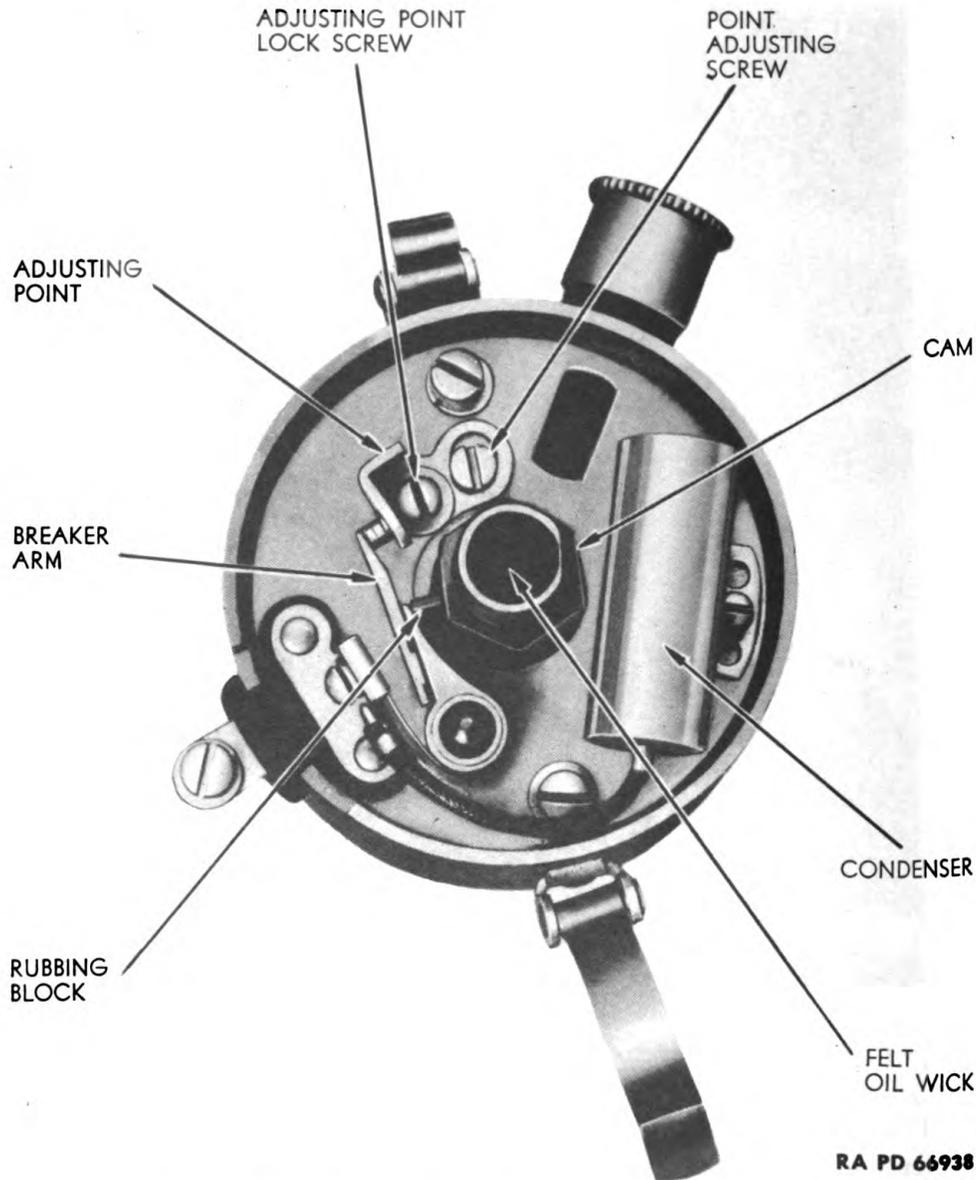


Figure 75—Distributor—Cap and Rotor Removed

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116. REMOVAL.

a. **Remove Distributor.** Loosen wing nuts and remove engine compartment lid. Disconnect the spark plug wires from the plug terminals. Remove the coil secondary wire from center tower of distributor cap. Disconnect primary wire from terminal on distributor. Loosen and remove the cap screw holding distributor control arm to support. Lift the distributor assembly complete from the support (fig. 74).

117. DISASSEMBLY.

a. Unsnap the two clamp springs, lift off the distributor cap, and pull rotor from shaft (fig. 75). Take out the two screws holding plate to distributor base and lift out the plate. Drive pin out of the distributor shaft gear, and slide gear off the shaft. Remove the lower thrust washer. Pull the shaft, governor and cam assembly out of distributor base. To disassemble cam from shaft, take felt wick out of cam, remove lock wire, and lift off the cam and spacer (fig. 76).

118. CLEANING.

a. Clean the base thoroughly inside and out with SOLVENT, dry-cleaning, then dry with compressed air. Immerse the cam, drive shaft, and governor parts in SOLVENT, dry-cleaning, clean thoroughly and dry with compressed air.

119. INSPECTION.

a. **Distributor Base or Housing.** Inspect the bearings for damage and replace if necessary. Assemble the shaft in base, and clamp a dial indicator on the base with plunger against upper part of shaft. With a spring scale apply a 5-pound pull against the shaft in line with the indicator plunger. If the side play exceeds 0.005 inch, replace the bearings or shaft. To replace use a drift or arbor that will rest on the bearing without gouging bearing bore, and press or drive bearings out. To install new bearings, use a bearing replacer that will not gouge or distort the bore and press lower bearing into the housing flush with the end of the casting. The upper bearing should be 0.094 inch below the upper face of bearing bore. Remove the grease cup from housing. With a $1\frac{5}{64}$ -inch drill, drill the oil hole through the new bushing. Remove all burs, being careful not to mar the inside of bearing. Reassemble the grease cup.

b. **Cam, Drive Shaft, and Governor.** Remove the weight springs and lift governor weights from pins. Inspect shaft and weight pivots for wear and replace if damaged. Inspect the weight pivot holes and slots for wear, and replace parts not satisfactory for further service. Inspect the springs for distortion and replace if any doubt exists as

DISTRIBUTOR

to their condition. Inspect the cam for damage and replace if not fit for further service.

c. Condenser. Remove the lead screw and lock washer. Remove condenser mounting screw and lift off the condenser. Inspect the condenser lead wire for breaks or frayed insulation. Check the condenser for grounds and measure its capacity on a condenser tester. The capacity of condenser is 0.18 to 0.26 microfarads. Replace the condenser if this test shows it to be defective.

d. Contact Points and Breaker Plate. Lift the breaker arm off its pivot pin. Take out the stationary contact clamp screw and lift off contact with plate. Clean the contact arm thoroughly, making sure no oil or residue is left on the contacts. If the contacts are a greyish color and are smooth and flat they need not be replaced. If the breaker arm copper ground strip is broken, replace the arm. Replace arm and spring if the spring is bent or distorted. Inspect breaker arm pivot pin for damage and replace plate if pin is not perpendicular to plate.

e. Distributor Cap. Inspect the cap for cracks, carbon runners, evidence of arcing and for corroded high tension terminals. If any of these conditions are found, replace the cap. Inspect the distributor cap inserts. After a distributor cap has had normal use the inside of the cap inserts will become slightly burned on the inside tip. If these inserts are badly burned replace the cap.

f. Rotor. If the rotor is cracked replace it. After a distributor rotor has had normal use the end of the contact will become burned. If this burning is not excessive and is found only on the end of the metal strip, the rotor need not be replaced. If burning is evident on the top of the strip it indicates that the rotor is too short; in this event, replace rotor. Usually when this condition obtains the distributor cap inserts will be burned on their horizontal face. Replace cap also.

120. ASSEMBLY.

a. Assemble Condenser and Contact Points to Breaker Plate. Assemble the condenser on plate and tighten mounting screw. Place the stationary contact on plate and install the lock screw and washer. Position the breaker arm on the pivot pin so the spring and ground strip are on the inside of spring bracket. Assemble the condenser lead on clamp screw and assemble spring clamp on inside of spring. Tighten the spring clamp screw. Apply one drop of oil only to the breaker arm pivot pin. Remove any excess oil.

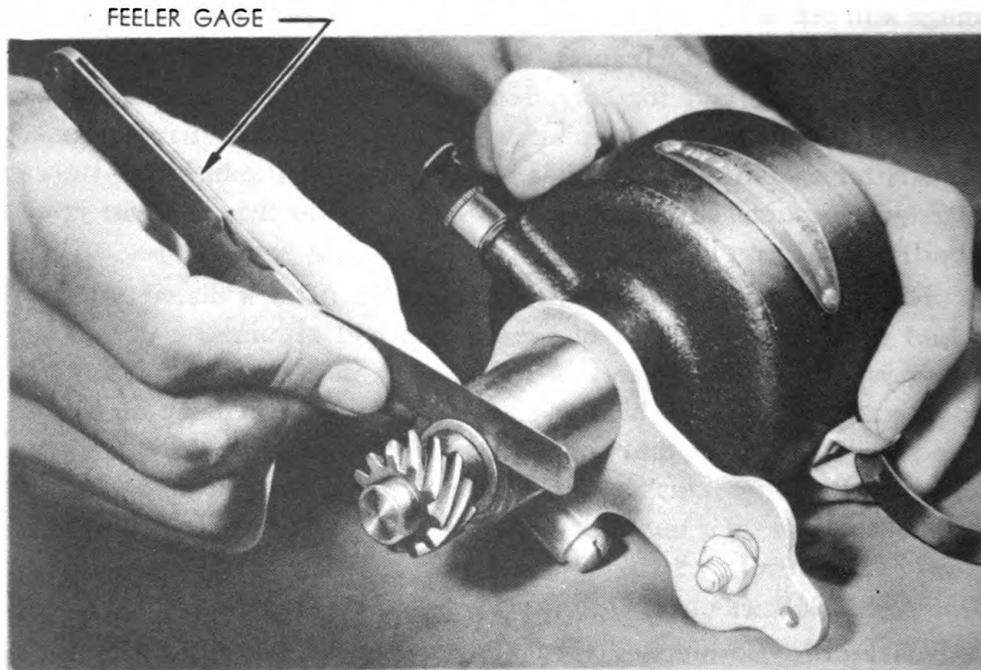
b. Assemble Cam and Governor on Shaft. Install the spacer on drive shaft with chamfered side down. Assemble cam and governor weights on the shaft and install weight pins in the slots. Assemble the anti-rattle spring with its working side against the weight pin. Place

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the lock ring in cam sleeve and press into place with a screwdriver. Place one drop of light engine oil on each of the weight slots.

c. **Assemble Drive Shaft in Base.** Give the drive shaft a light wipe of oil and assemble the upper thrust washer on shaft. Install the shaft in base, place lower thrust washer and drive gear on shaft and insert the pin through drive gear. If a new shaft has been installed it will be necessary to drill a new pin hole.

d. **Measure End Play of Drive Shaft.** Press on the upper end of drive shaft and determine end play between base and lower thrust washer. The correct end play is 0.003 inch to 0.010 inch. If the end play is in excess of 0.010 inch, examine to determine that both upper and lower thrust washers are in place. If both washers are properly positioned and the clearance still exceeds 0.010 inch, remove the gear and add



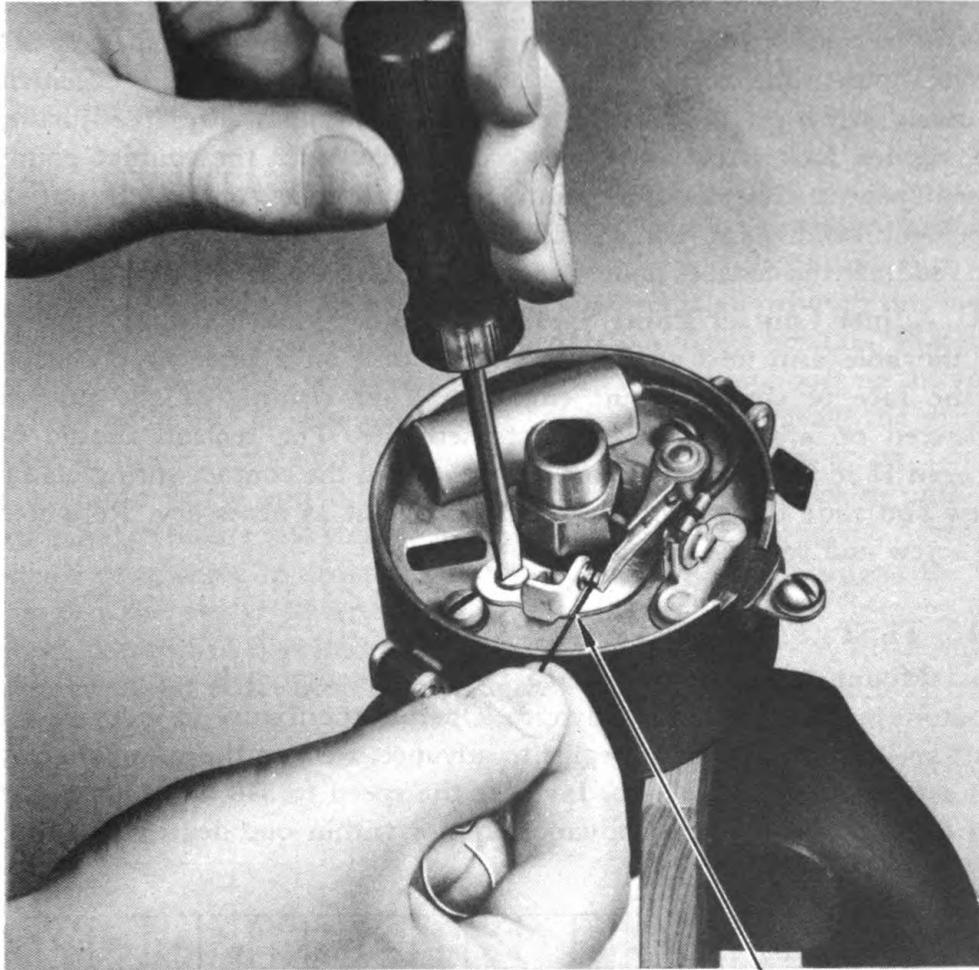
RA PD 67209

Figure 77—Measuring Distributor Shaft End Play

additional thrust washers. If the end play is less than 0.003 inch (fig. 77), check the upper and lower thrust washers for improper assembly. If the washers are assembled correctly tap lightly on lower end of shaft to free the shaft in base.

e. **Adjustments of Distributor Points.** Install breaker plate assembly and fasten securely with screws. Turn drive shaft so the breaker arm rubbing block is on a high point of the cam. Insert a 0.020-inch

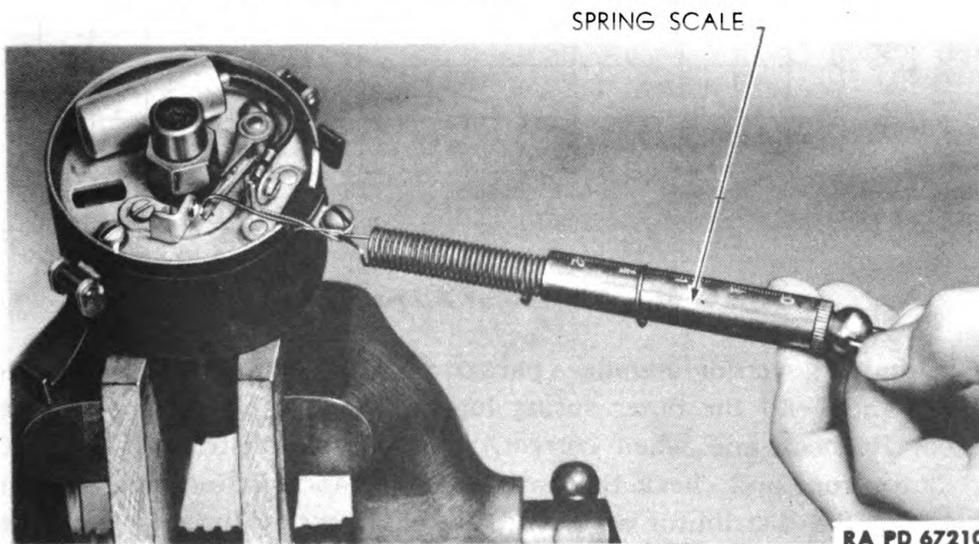
DISTRIBUTOR



WIRE FEELER GAGE

RA PD 67212

Figure 78—Checking Gap at Distributor Contact Points



SPRING SCALE

RA PD 67210

Figure 79—Checking Distributor Breaker Arm Spring Tension

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wire feeler gage between the points (fig. 78). If the clearance is not correct, loosen the contact plate clamp screw and turn the eccentric adjusting screw on the distributor plate to readjust. After readjusting gap, tighten lock screw and recheck clearance. With the contact points closed inspect alinement of points for a full face contact. If out of alinement, bend the stationary contact bracket until alinement is correct and readjust the contact point gap as previously described.

f. Adjust Contact Point Spring Tension. Hook a spring scale on the movable arm next to the point, and pull on a line perpendicular to the face of contact point (fig. 79). Take reading of the pull as registered on scale just as contacts separate. The tension should be between 17 to 20 ounces. If more or less, loosen the contact spring clamp screw and slide the end of the spring in or out as necessary. Retighten the screw and recheck the tension.

121. TEST (fixture test).

a. Mount the distributor on a test fixture that will show the distributor rpm and degree of advance. Operate the fixture to increase the shaft speed until the spark begins to advance. Reduce the speed slightly and set the indicator to zero. Increase the speed to 540 distributor rpm and check the amount of advance. If not within one degree of limits,

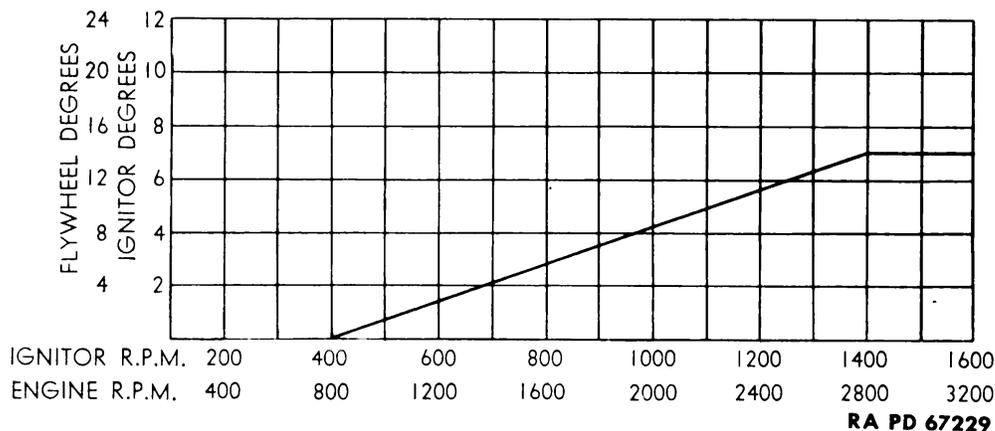


Figure 80—Distributor Advance Curve

shown under governor advance, paragraph 135 (fig. 80), stop the distributor and bend the outer spring lug on which a governor spring is located. Recheck and when correct, speed up the distributor to 1260 distributor rpm and check the amount of advance. If incorrect at this speed stop the distributor and bend the outer spring lug on which the outer weight spring is mounted. Recheck at both speeds and readjust if necessary. Check the degree of advance at the various speeds given under

DISTRIBUTOR

governor advance, and readjust if necessary to bring the degree of advance to within one degree of limits at various speeds. Check the degree of advance both up and down the speed range to determine if the governor action is correct.

122. INSTALLATION.

a. Assemble the rotor on the distributor shaft and make sure it is properly positioned on the cam. To install the distributor turn the crankshaft until UDC 1-6 marking on flywheel is alined with the engine rear plate timing pointer and No. 1 piston is in firing position. Place the distributor assembly in position on the distributor support so the rotor points as nearly as possible toward front of engine. Fasten the distributor in the support by tightening the arm hold down cap screw. Loosen the clamp screw and turn distributor body counterclockwise until the distributor points just start to open and retighten clamp screw. Assemble spark plug wires in order of firing rotation, 1-5-3-6-2-4. Insert the coil wire in the center tower of distributor cap. Connect the primary wire from the coil to distributor terminal and tighten securely. Place engine compartment lid in position and tighten wing nuts.

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Section IV

IGNITION COIL

	Paragraph
Description	123
Removal	124
Cleaning and inspection	125
Installation	126

123. DESCRIPTION.

a. The purpose of an ignition coil is to transform the low-voltage energy supplied by the battery into high voltage energy necessary to jump the spark plug gap. The ignition coil includes two windings, the primary and secondary. Whenever current is built up in the primary winding and the flow is interrupted, voltage is induced in the secondary winding. The coil is so designed that the induced current will be sufficient to produce a spark of high intensity at the spark plug.

124. REMOVAL.

a. Loosen wing nuts and remove engine compartment lid. Remove engine compartment side panel with instrument panel (par. 7). Remove the secondary or large wire from the coil tower. Remove the small or primary wires from coil terminals. Take out the cap screws that anchor the coil bracket to cylinder block and remove the coil from block.

125. CLEANING AND INSPECTION.

a. Clean the outside of coil body with a cloth. Inspect the secondary tower for corrosion or burned condition and clean if necessary. Examine coil for cracks or damage. Test for breakdown or shorting with a coil tester. Replace coil if it is not satisfactory for further service.

126. INSTALLATION.

a. Place the ignition coil in position on the left front side of cylinder block. Fasten the coil and bracket to the block with cap screws. Attach ignition switch wire to the coil terminal, primary wire from distributor to the coil, and fasten securely. Insert secondary wire in coil tower. Install engine compartment side panel with instrument panel (par. 57). Place engine compartment lid in position and tighten wing nuts.

Section V

SPARK PLUGS

	Paragraph
Description and data	127
Removal	128
Cleaning and inspection	129
Installation	130

127. DESCRIPTION AND DATA.

a. Description. Six spark plugs, one for each cylinder, located in the cylinder head, provide the spark necessary to fire the combustible mixture in the combustion chamber.

b. Data.

Champion	J-9
Gap025 inch

128. REMOVAL.

a. Pull the wires from spark plug terminals and remove the spark plugs and gaskets. Protect spark plug hole in the cylinder head to prevent any object from falling into the cylinders when the plugs are removed.

129. CLEANING AND INSPECTION.

a. Clean the spark plugs with a sandblast cleaner according to the cleaner manufacturer's directions, and test with a tester. Replace any plugs that are not satisfactory for further service.

130. INSTALLATION.

a. When installing spark plugs always use new gaskets and install with the seam down. Install the spark plugs and tighten with a spark plug wrench until gasket is compressed. Place the plug wire terminals on plugs.

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Section VI

HIGH-TENSION WIRING

	Paragraph
Description	131
Removal	132
Cleaning and inspection	133
Installation	134

131. DESCRIPTION.

a. The high-tension wiring is referred to as the secondary wiring or circuit, and consists of the spark plug wires and coil to distributor wire. These wires are heavily insulated and carry the current from the coil to distributor and from distributor to spark plugs. Radio interference suppressors are installed on the secondary wire from the distributor to the coil and on each spark plug wire at the spark plug terminal.

132. REMOVAL.

a. Pull the spark plug wires from the spark plug terminals. Remove the six spark plug wires from the distributor cap by pulling terminal ends out of the towers. Pull the wire from the center tower of distributor cap and coil tower.

133. CLEANING AND INSPECTION.

a. All grease and dirt should be removed from the wires with a cloth. If corrosion is present at the terminal ends and clips, sand until clean. If cracks or breaks appear in the insulation, replace wires and clips.

134. INSTALLATION.

a. Install spark plug to distributor cap wires in the cap towers in the following firing order, 1-5-3-6-2-4 and install clips on spark plugs. Install the secondary wire from coil tower to distributor cap center tower by pressing the wire terminals firmly into the towers.

Section VII

FITS AND TOLERANCES

Paragraph

Ignition system service data..... 135

135. IGNITION SYSTEM SERVICE DATA.

a. Distributor.

- Firing order 1-5-3-6-2-4
- Point setting 0.020-in. wire feeler
- Point pressure 17 to 20 oz
- Condenser capacity18 to .26 microfarads
- Cam angle 38°
- Governor advance
 - Start advance 0° at 400 rpm
 - Intermediate 1° at 540 rpm
 - Intermediate 4° at 975 rpm
 - Intermediate 6° at 1260 rpm
 - Full advance 7° at 1400 rpm
- Distributor shaft end play 0.003 in. to 0.010 in.

b. Spark Plugs.

- Gap 0.025-in. wire feeler

c. Suppressors.

- Capacity 10,000 Ohms plus or minus 10% breakdown

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136-137**

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CHAPTER 6

ELECTRICAL SYSTEM

(STARTING AND GENERATING EQUIPMENT)

Section I

DESCRIPTION AND DATA

	Paragraph
Description	136
Data	137

136. DESCRIPTION.

a. The electrical system of this vehicle is of the single-wire grounded type (fig. 81). It consists of a heavy-duty battery, generator, starting motor and solenoid, with overrunning clutch and voltage regulator.

137. DATA.

Battery Willard, 19 plate, 12 volt, 153 amp hr
Generator Auto-Lite, air cooled, shunt wound, 40 amp
Distributor Auto-Lite, full automatic
Current and voltage regulator Auto-Lite, automatic
Starting motor Auto-Lite, overrunning clutch

Section II

TROUBLE SHOOTING ON ELECTRICAL SYSTEM

Trouble shooting	Paragraph 138
------------------------	------------------

138. TROUBLE SHOOTING.

a. Starting Motor Fails to Operate.

Possible Cause	Possible Remedy
Battery discharged.	Recharge or replace battery.
Loose or dirty connections.	Clean and tighten connections.
Pinion gear jammed.	Free gear from flywheel.
Starting motor switch faulty.	Replace switch.
Solenoid faulty.	Replace solenoid.
Oil or glaze on commutator.	Clean commutator.

b. Starting Motor Turns Engine Too Slowly.

Battery weak.	Recharge or replace battery.
Loose or dirty connections.	Clean and tighten connections.
Commutator dirty.	Clean commutator.
Starting motor faulty.	Repair or replace starting motor.

c. Generator Noise.

Broken bearing.	Replace bearing.
Loose pulley.	Tighten pulley.
Loose pole piece.	Tighten pole piece.
Commutator damaged.	Repair or replace commutator.
Brushes not seated properly.	Reseat brushes.

d. Generator Inoperative or Not Charging Properly.

Drive belt slipping.	Adjust tension.
Armature shorted or damaged.	Repair or replace armature.
Commutator burned or damaged.	Repair or replace armature.
Brushes too short.	Replace brushes.
Field coils shorted, open, or burned.	Replace coils.
Current and voltage regulator not functioning properly.	Adjust or replace regulator.

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Section III

STARTER

	Paragraph
Description and data	139
Removal	140
Disassembly	141
Cleaning	142
Inspection	143
Assembly	144
Test	145
Installation	146

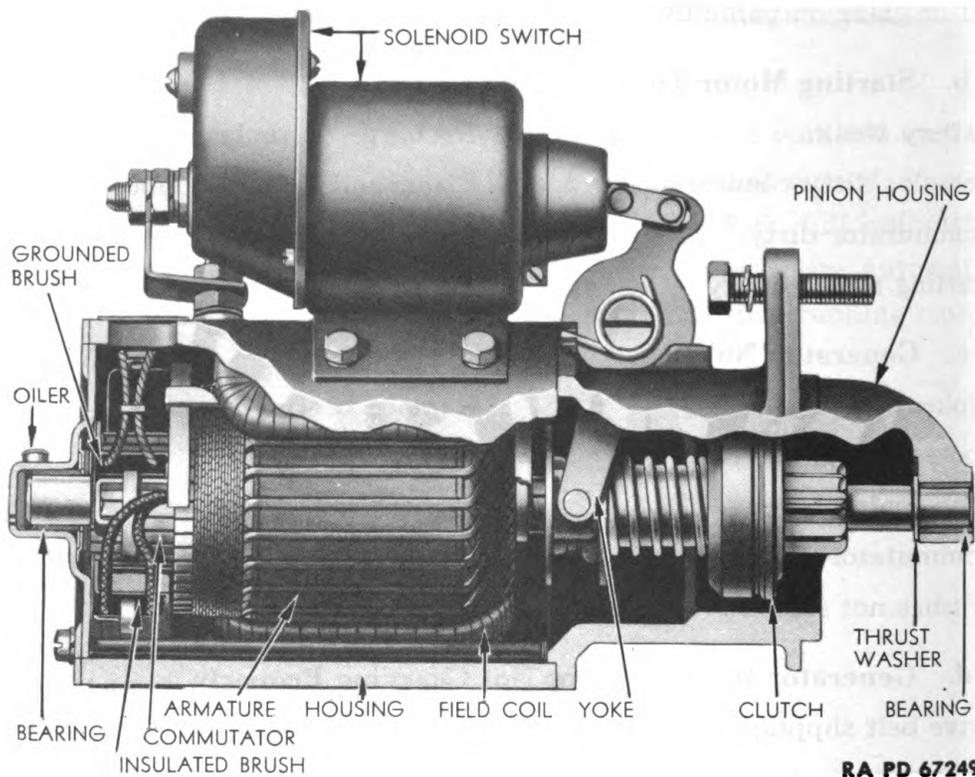


Figure 83—Starter Construction

139. DESCRIPTION AND DATA.

a. Description. The 12-volt starter (figs. 83 and 84) is secured to the engine rear plate at the right side of the engine by fastening bolts extending through engine plate and clutch housing. The starter is equipped with solenoid and overrunning clutch. The overrunning

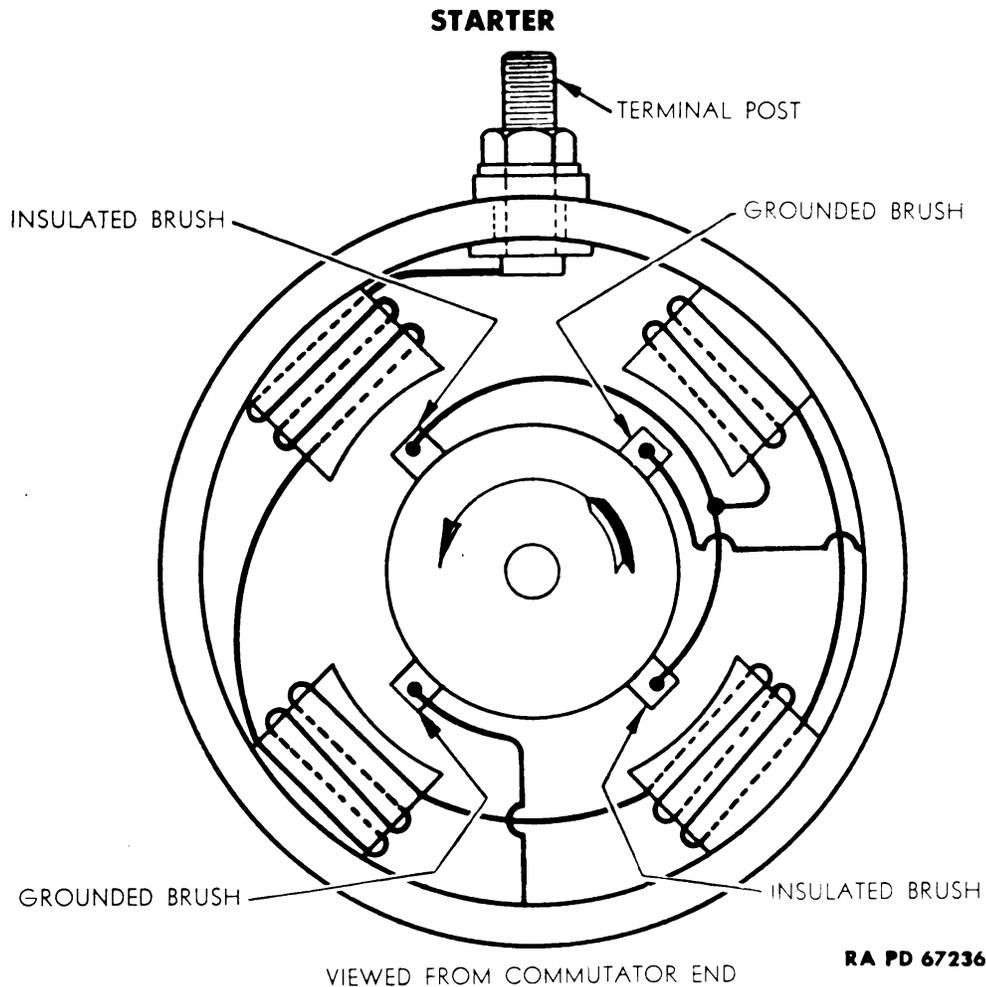


Figure 84—Starter Internal Wiring

clutch is magnetically shifted by the starting solenoid switch and engages the flywheel before the starter armature begins to revolve.

b. Data.

Make Auto-Lite
Type Overrunning clutch

140. REMOVAL.

a. Loosen the wing nuts and lift the engine compartment lid out of the vehicle. Take out the bolt and nut holding engine compartment heater outlet tube sleeve to heater, remove clamp holding tube to battery bed, and lift tube out of compartment. Disconnect the battery cable clamps, remove the battery retaining frame and remove the battery. Disconnect the motor solenoid wires from solenoid and tag to facilitate reassembly. Take out the hull floor pan screws and remove the hull floor pan. Remove the connections from the radio power pack, demolition timer control, and radio junction box. Take out the screws

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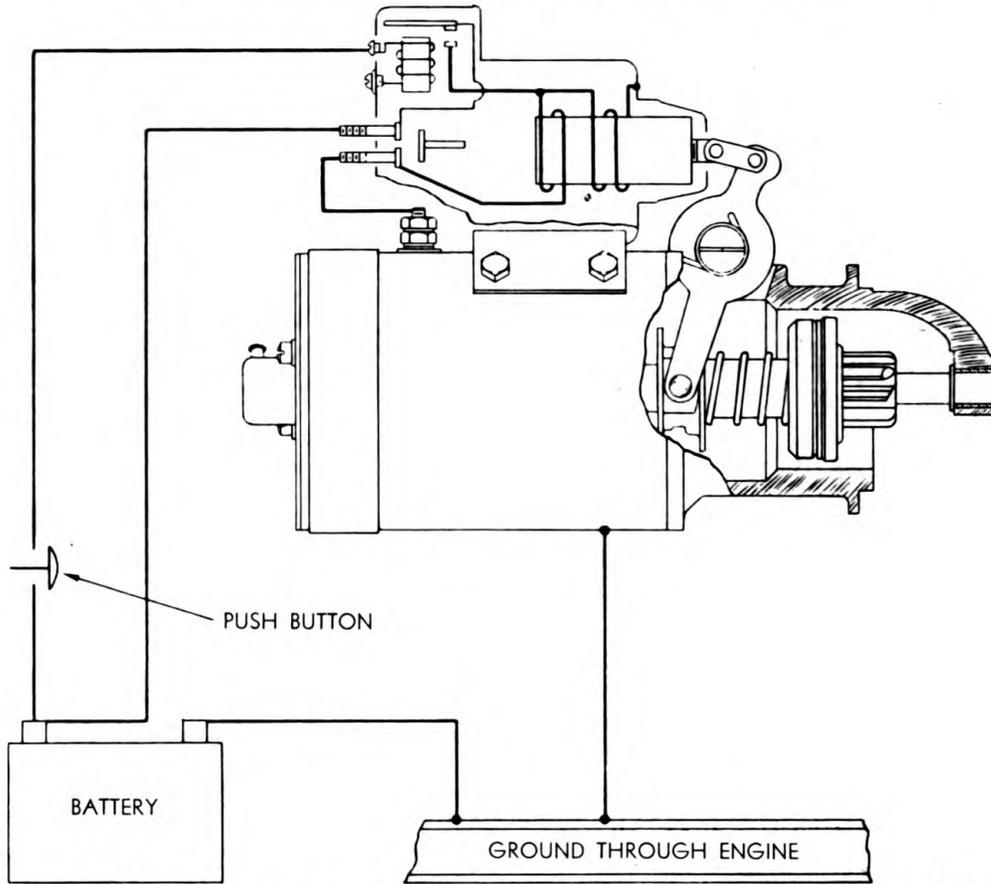


Figure 85—Starter Circuit Wiring Diagram RA PD 67234

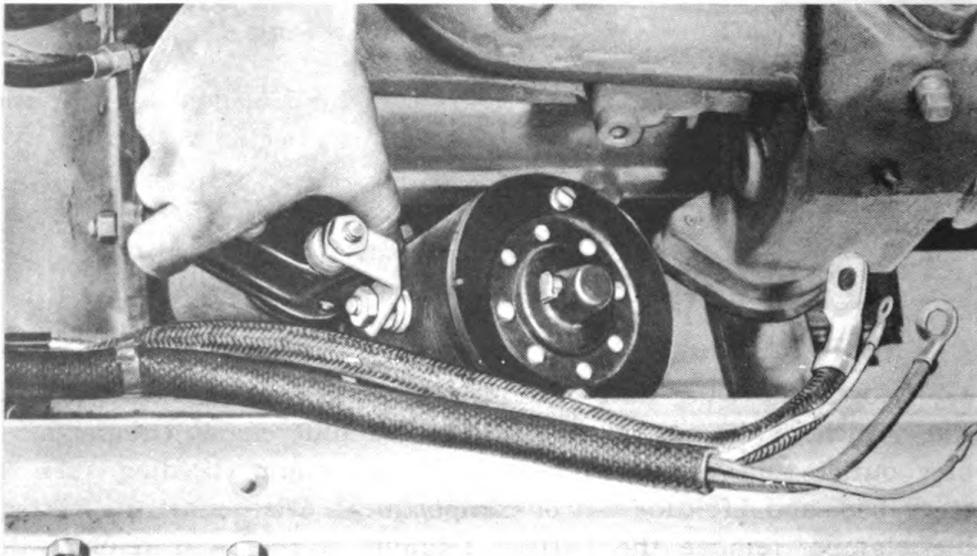
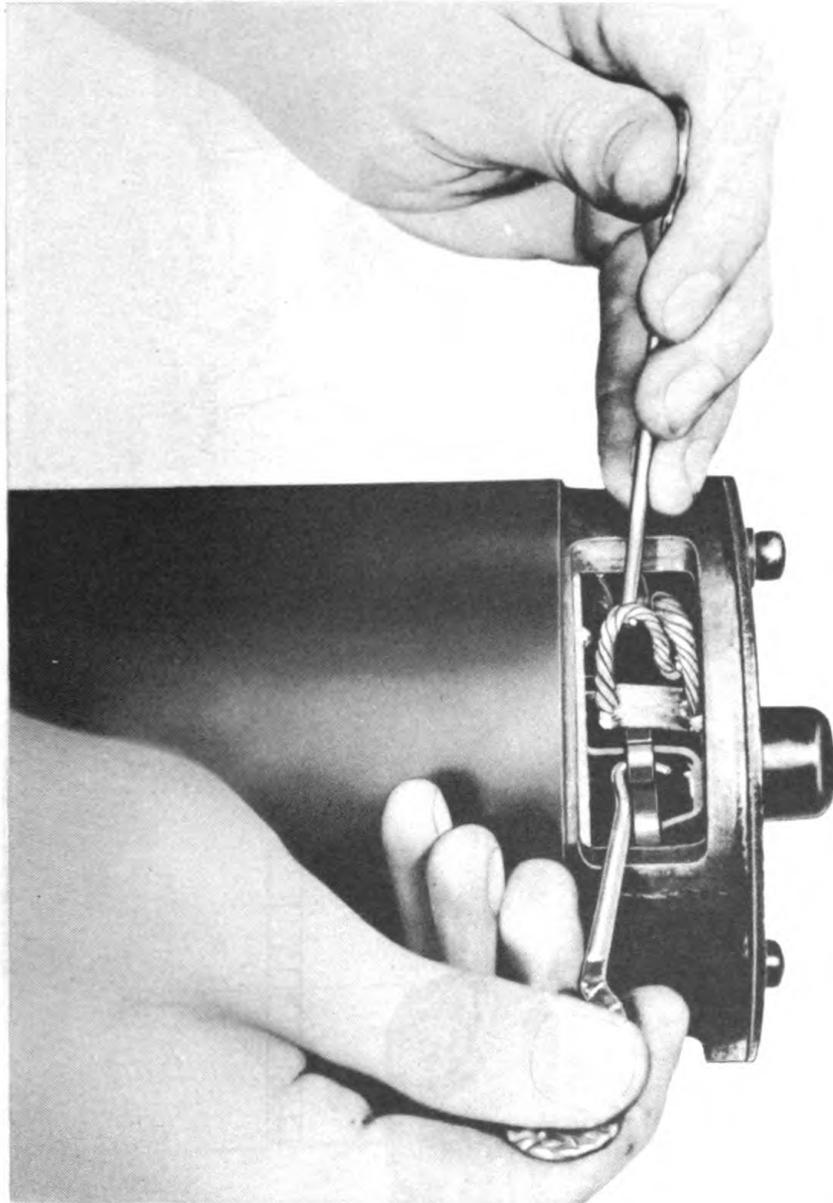


Figure 86—Starter Removal RA PD 67082

STARTER

holding the floor cover over the transmission on which the radio power pack is mounted, and remove the assembly. Remove the bolts, nuts, and lock washers holding the starting motor to the engine rear plate. While an assistant raises rear end of the engine with a pry bar, pull starter away from the engine plate and remove the starter from the vehicle (fig. 86).



RA PD 67220

Figure 87—Removing Starter Motor Brush

141. DISASSEMBLY.

- a. Remove head band screw and nut and take off head band. Remove cotter pin from yoke link pin and take out the link pin. Remove

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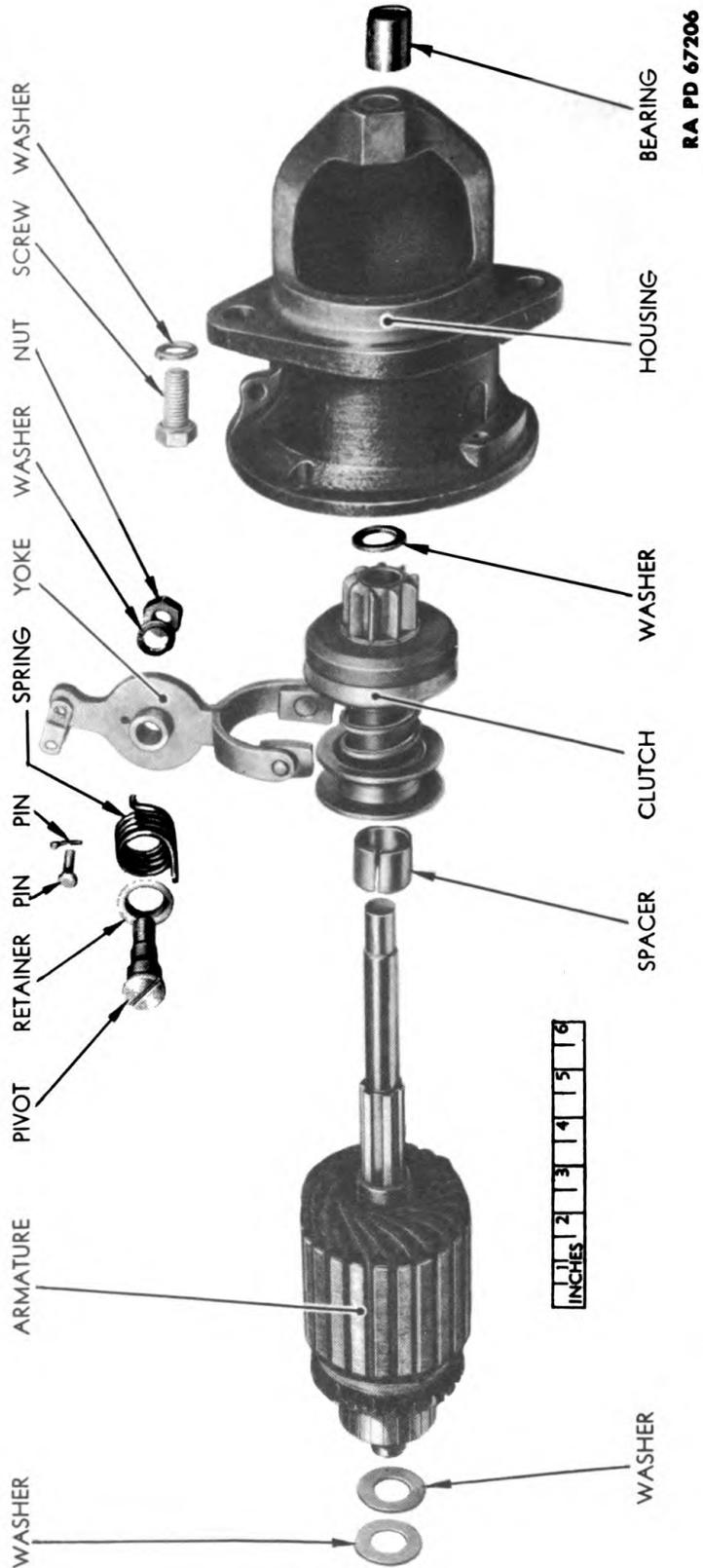
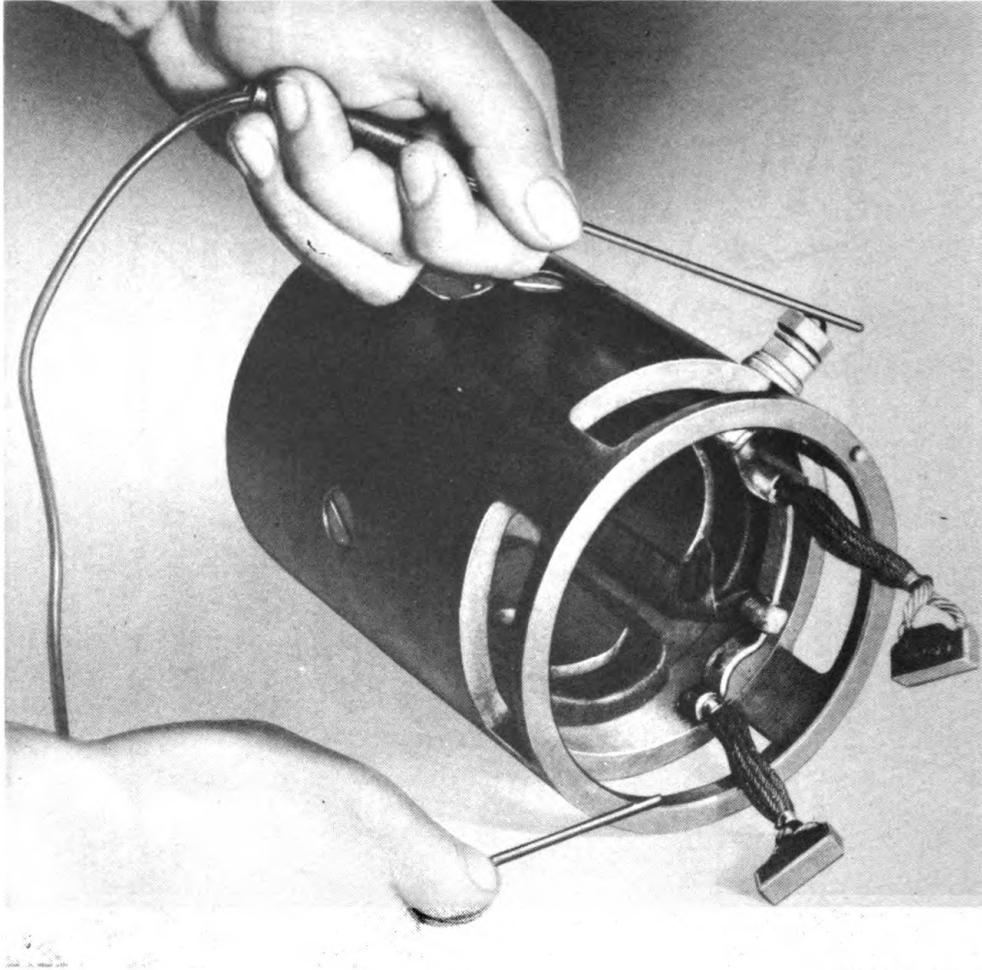


Figure 88 — Starting Motor Armature and Drive Parts

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solenoid mounting screws and lift solenoid from the motor. To remove the brushes, lift the brush spring and remove the brushes from the holders (fig. 87). Take off the hex nut and remove the lock washer, pivot screw, spring, and retainer to remove the yoke pivot. Remove the two frame screws from the commutator end, tap the pinion housing lightly and pull the housing from the motor, lift off the clutch yoke. To remove the commutator end head tap the head lightly and lift the head from the motor. Remove the armature from the frame and fields,



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Figure 90—Checking Starter Motor Field Coils for Grounds

and slide the overrunning clutch off the armature shaft (fig. 88). Do not lose the thrust washers at the ends of the shaft. Take out screws and remove pole pieces and field coils from frame (fig. 89).

142. CLEANING.

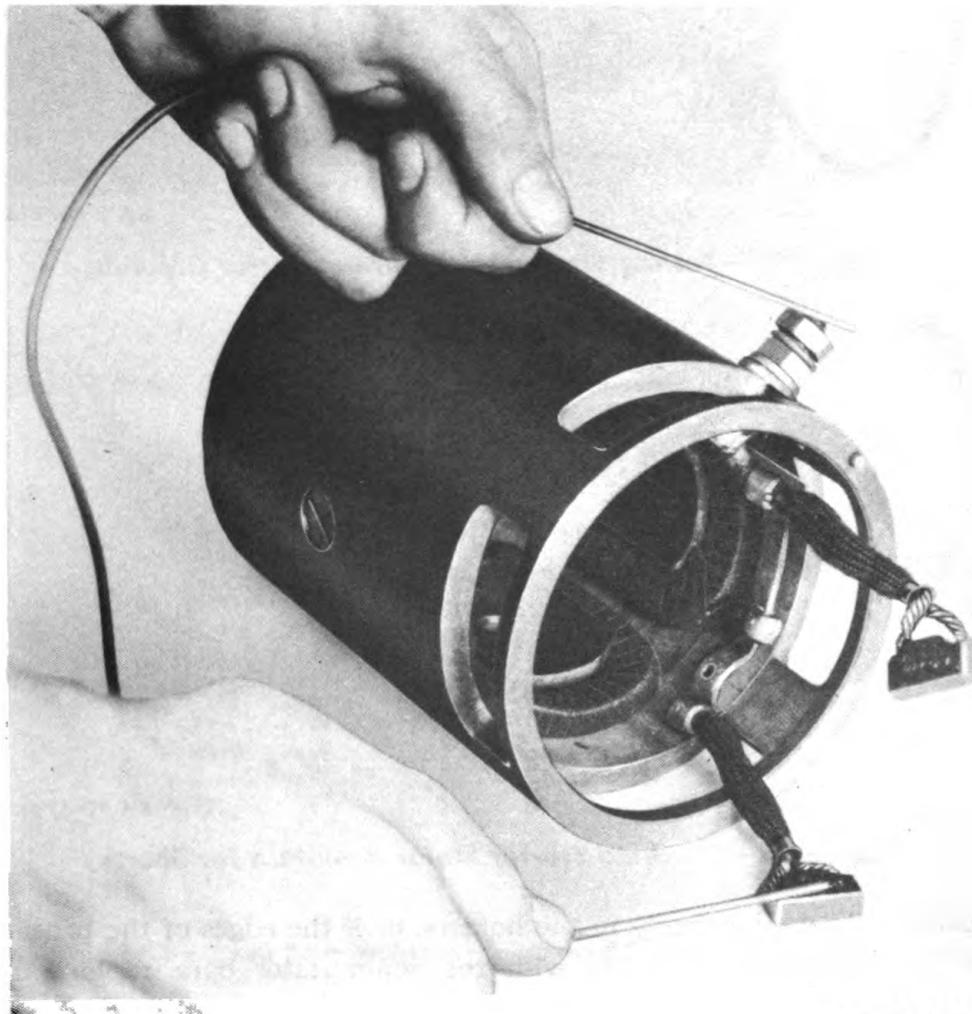
a. Clean the frame, fields, and armature with a cloth dipped in SOLVENT, dry-cleaning. Do not soak the coils and brushes in cleaning

STARTER

solvent. Clean the commutator end head and pinion housing thoroughly with SOLVENT, dry-cleaning. Clean the clutch thoroughly but do not soak in SOLVENT, dry-cleaning, as the clutch mechanism cannot be relubricated.

143. INSPECTION.

a. If the commutator is dirty or discolored it can be cleaned by holding a piece of 00 flint paper against it while turning the armature

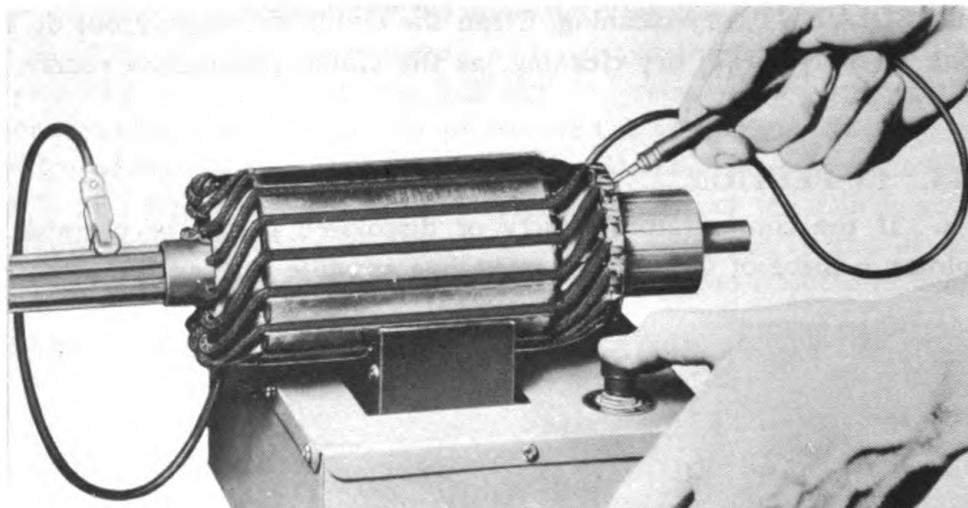


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Figure 91—Checking Starter Motor Field Coils for Open Circuit

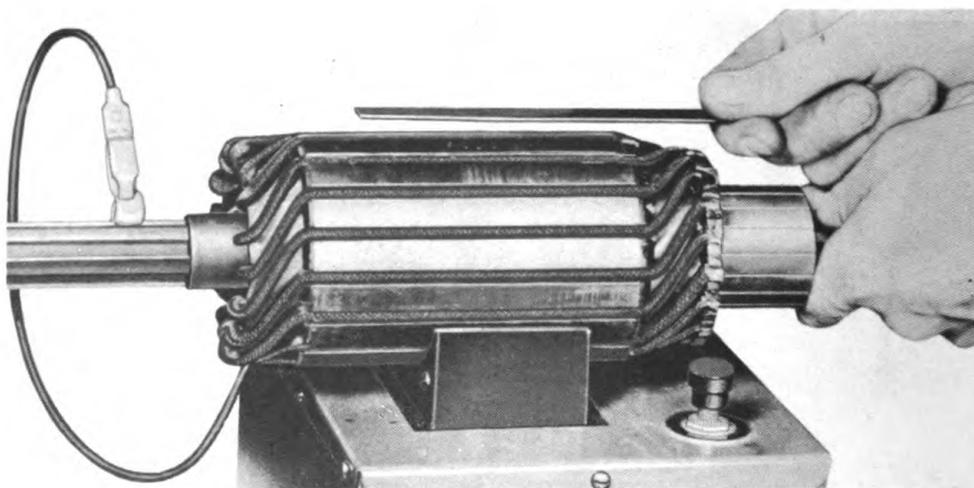
slowly, and clean out any sand or dust with compressed air. If the commutator is rough or worn, turn down commutator in a lathe. Inspect field coils for grounds or open circuit (figs. 90 and 91). Examine armature for grounds or shorts (figs. 92 and 93). If the brushes are oil-soaked, or are worn to less than $\frac{5}{16}$ -inch long, replace them. If the

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RA PD 67215

Figure 92—Testing Starter Motor Armature for Grounds



RA PD 67214

Figure 93—Checking Starter Motor Armature for Shorts

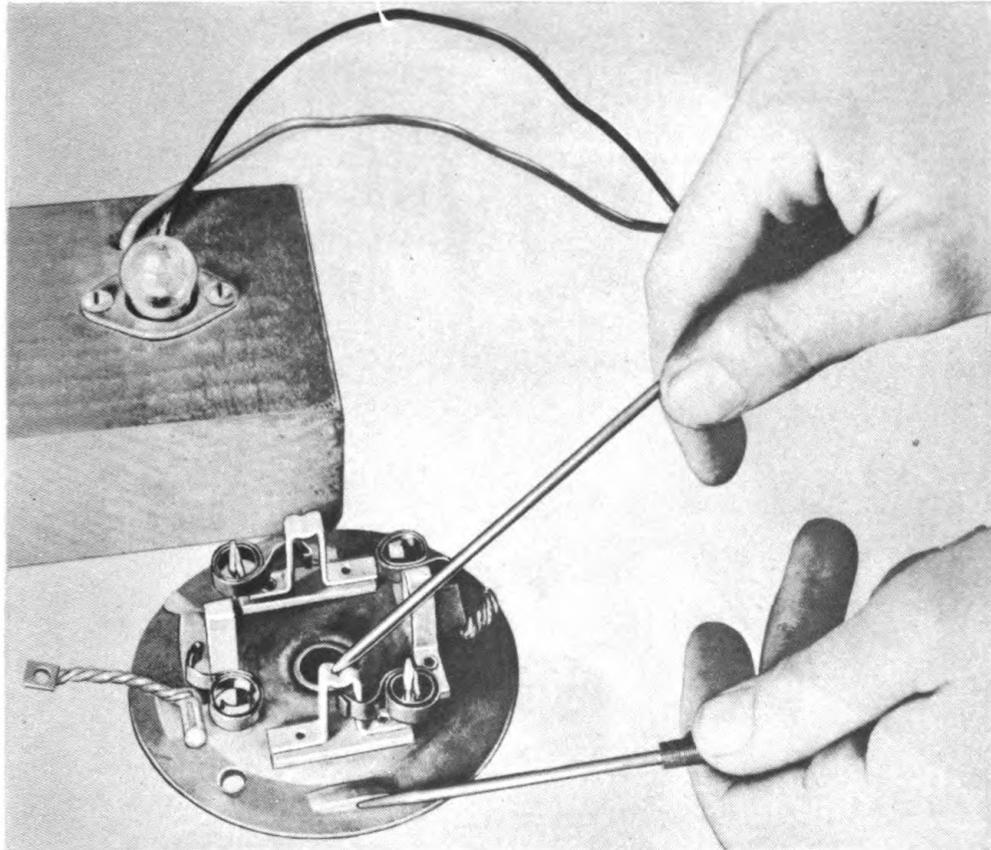
brushes do not slide freely in the holders, or if the edges of the brushes are not in perfect alignment with the commutator bars, replace the brushes and turn down commutator in a lathe to straighten the commutator bars. Inspect insulated brush holder for grounds (fig. 94) and brush spring for proper tension (fig. 95). Replace any parts that are not satisfactory for further service.

144. ASSEMBLY.

a. Place the field coils and pole pieces with insulators in the frame, install pole piece screws and tighten securely. Stake the screws to avoid loosening. Install the starting clutch on the armature shaft and place

STARTER

the armature with clutch in the frame and fields. Slide thrust washer over the end of armature shaft, place pinion housing in position over end of shaft and engage the yoke in the shift collar as the housing is moved toward the frame. Turn pinion housing so the dowel pin in frame enters the hole in pinion housing. Install a thrust washer on the armature shaft at commutator end, install commutator end head, and aline screw holes in head with holes in frame. Install the frame screws and tighten securely. Insert yoke pivot, spring, retainer, lock washer and



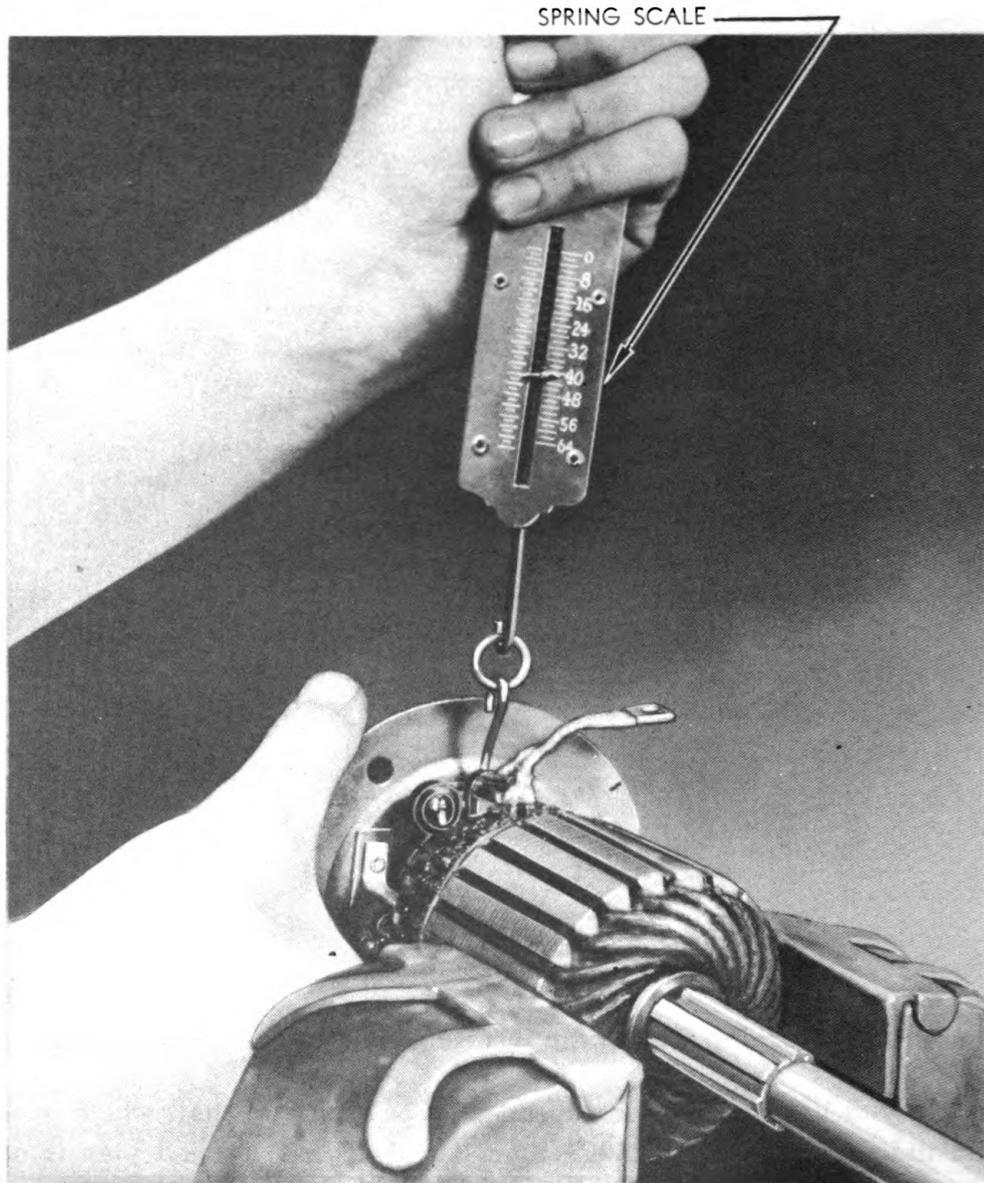
RA PD 67213

Figure 94—Checking Starter Motor Insulated Brush Holders for Grounds

fasten with hex nut. Check the end play of armature shaft which is not less than 0.005 inch nor more than 0.030 inch. If the end play is not within the limits, remove the commutator end head, and select and install a thrust washer of the proper thickness. Install brushes in holders making sure that insulated brush is in insulated holder. Place head band in position and tighten the bolt and nut. Place the solenoid in position on the starting motor and fasten securely with cap screws. Assemble the yoke link to yoke and install link pin. Press on the switch plunger (not on yoke) until the plunger bottoms. While holding plunger

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and clutch in this position measure clearance between pinion and thrust washer. The clearance is $\frac{1}{16}$ inch to $\frac{3}{32}$ inch, and is adjusted by removing link pin and turning the plunger screw in or out as required. After adjustments are completed install link pin and a new cotter pin.



RA PD 67211

Figure 95—Checking Starter Motor Brush Spring Tension

145. TEST.

a. Rotate armature by hand to determine if binding or tightness is present. Connect starting motor to a battery and test for free running and stall torque (fig. 96).

STARTER

146. INSTALLATION.

a. Place starting motor in position against engine rear plate, install bolts, lock washers, and tighten nuts securely. Set the radio power pack with mounting in position, install screws, lock washers, and tighten securely. Install connections to power pack, demolition timer control, and radio junction box. Install the hull floor pan with attaching screws and tighten securely. Connect solenoid wires to the proper terminals.

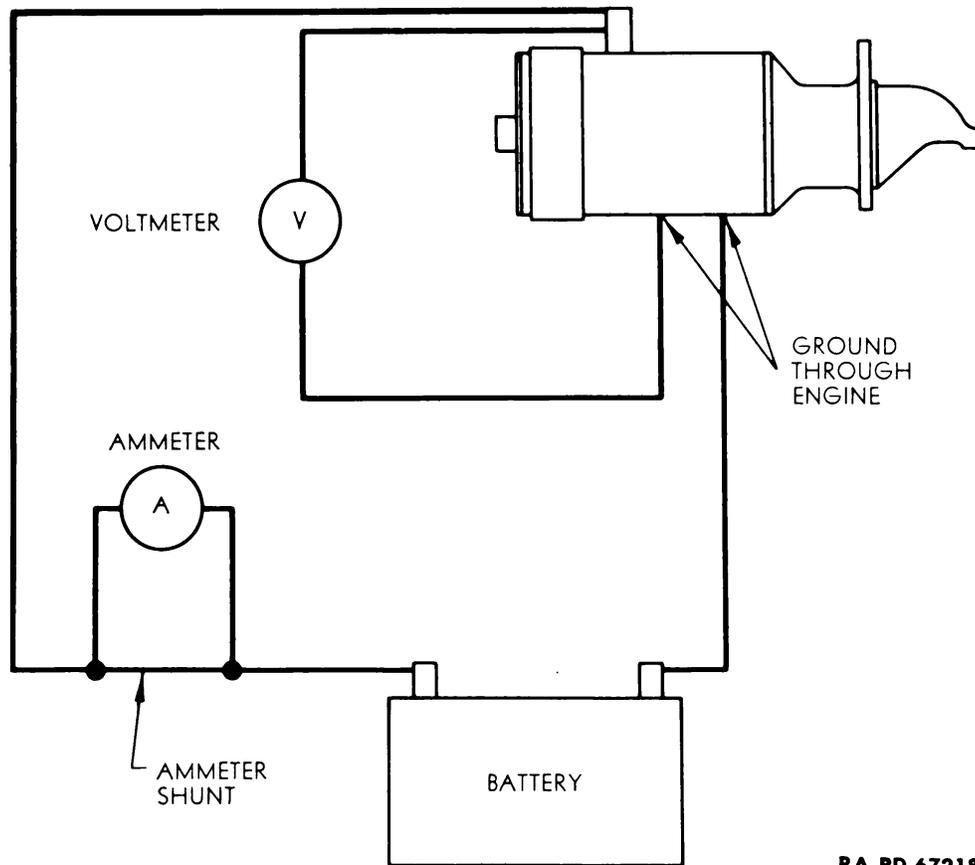


Figure 96—Wiring Diagram for Starter Motor Free-running and Stall Torque Tests

place the battery in position, install the battery hold-down frame, and connect the battery cable clamps to the battery posts. Press the starter switch button to check the operation of the starting motor. Place engine compartment heater outlet tube in position, fasten tube clamp to battery bed, install tube sleeve over heater outlet, and fasten securely with bolt and nut. Place the engine compartment lid in position and tighten wing nuts.

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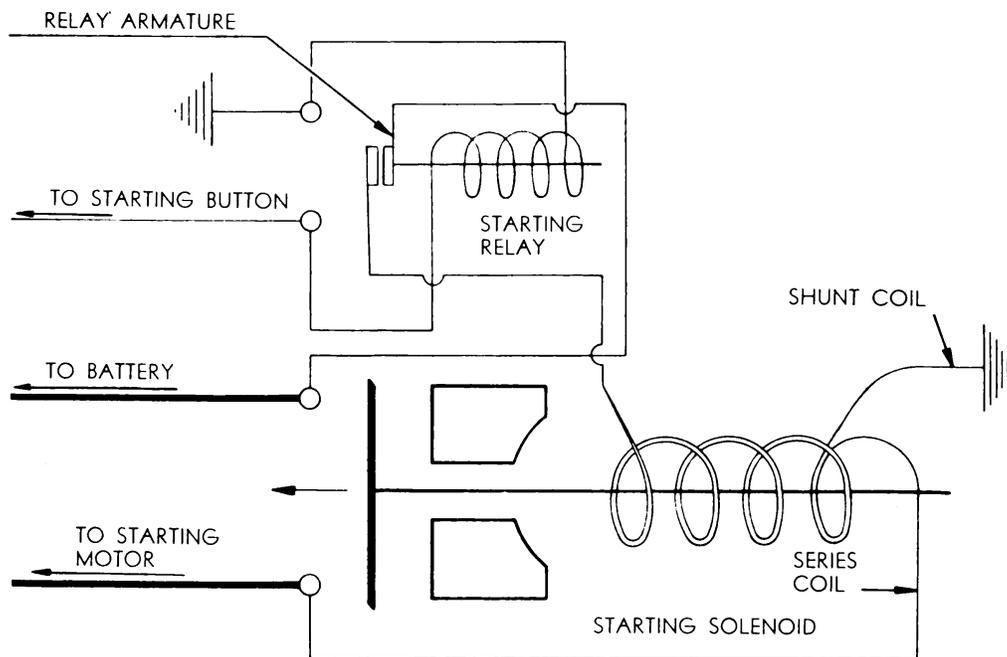
Section IV

STARTER SOLENOID SWITCH

	Paragraph
Description	147
Removal	148
Cleaning	149
Inspection	150
Test	151
Installation	152

147. DESCRIPTION.

a. Description. The starter solenoid is mounted on the starting motor and the solenoid coil is energized when the starter switch button



RA PD 67235

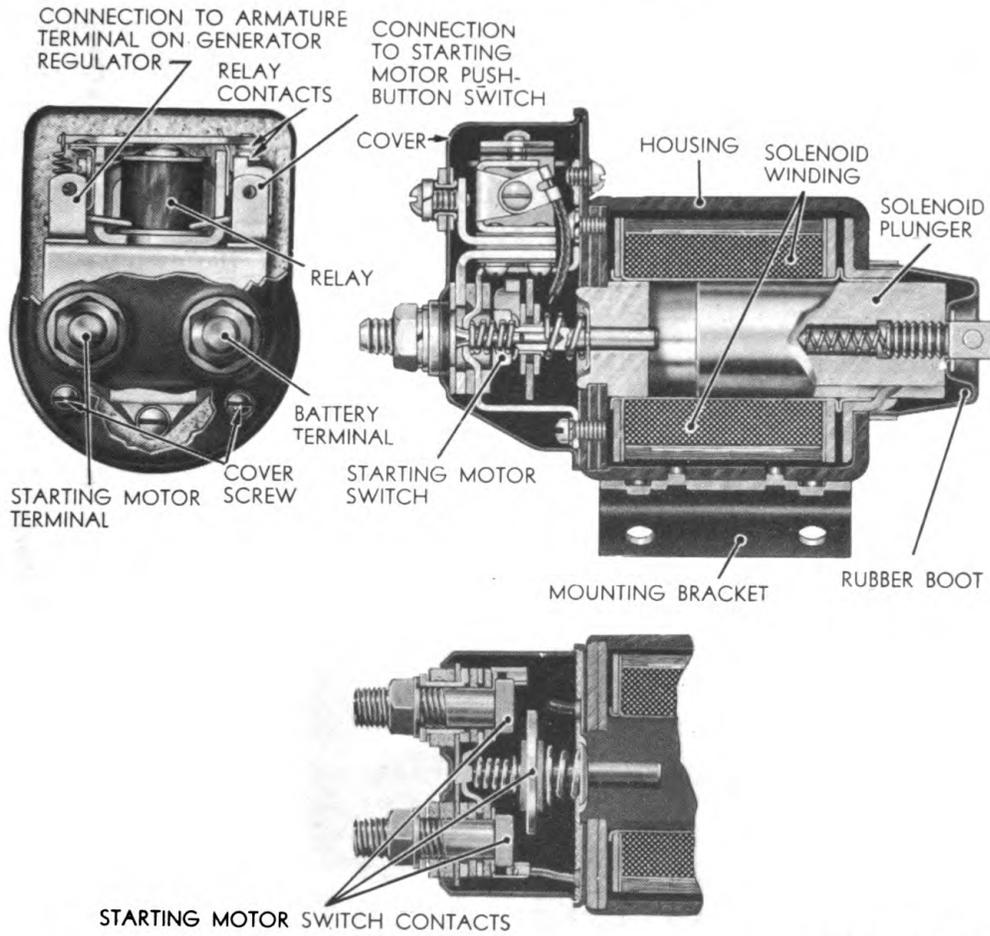
Figure 97—Internal Wiring Diagram of Starter Solenoid Switch

on the instrument panel is pressed (fig. 97). When the solenoid coil is energized, the plunger in the solenoid is pulled forward, which moves the outer end of the starting motor clutch yoke, and the starter pinion is moved into mesh with the teeth on flywheel to crank the engine.

148. REMOVAL.

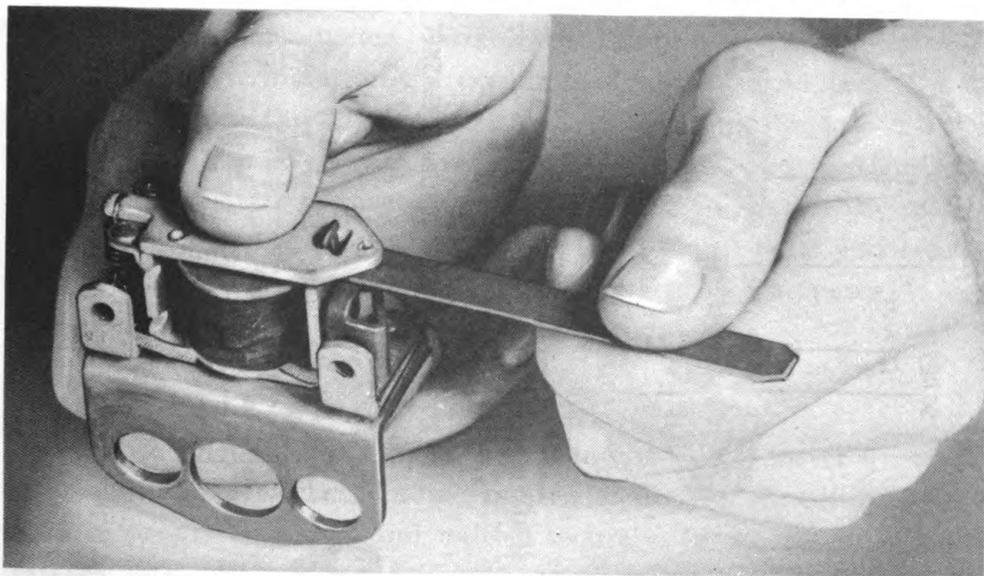
a. Loosen wing nuts and remove engine compartment lid. Take out bolt and nut holding engine compartment heater outlet tube sleeve to

STARTER SOLENOID SWITCH



RA PD 67248

Figure 98—Starter Solenoid Switch Construction



RA PD 67243

Figure 99—Filing Starter Motor Relay Contacts

STARTER SOLENOID SWITCH

heater, remove clamp holding tube to battery bed, and lift tube out of compartment. Disconnect battery cable clamps, remove battery hold-down frame, and remove battery. Remove solenoid wires from the terminals and tag wires to facilitate installation. Remove cotter pin and link pin from the yoke. Take out screws holding solenoid to starting motor and remove the solenoid switch from the motor frame.

149. CLEANING.

a. Clean the outside of the switch with SOLVENT, dry-cleaning, and wipe dry with a clean cloth. Remove any corrosion from terminals by using a wire brush or 00 flint paper.

150. INSPECTION.

a. Remove terminal screws and nuts from solenoid switch cover and remove cover. Inspect the contact points for burned condition and clean by filing (fig. 99) or replace parts as required. Make sure all terminal posts are secure in their mountings and tighten if necessary. Replace cover gasket when installing the cover. Repair or replace any terminal threads that are damaged. Inspect the switch blade for distortion and corrosion. If the switch blade is pitted or dirty it should be filed and sanded to provide a plain flat surface. If it is necessary to replace the blade, compress the spring on the switch blade plunger and remove the spring retainer. If a replacement is not available the blade can be reversed so as to bring the clean surface into use.

151. TEST.

a. Connect an ammeter, variable resistance and 12-volt battery in series with the terminal on the double lead and solenoid base. Connect a voltmeter from the terminal to base. Adjust the voltage to 5.0 volts. The ammeter should show a reading of 1.8 to 2.2 amperes. Change the series and voltmeter connections from the solenoid base to the terminal on the single lead. Again adjust the voltage to 5.0 volts and read the ammeter. This current reading should be 15.5 to 18.5 amperes. If either reading is outside the limits, replace the solenoid.

152. INSTALLATION.

a. Place solenoid switch on starting motor frame, insert the mounting screws with lock washers and tighten securely. Connect the solenoid wires to proper terminals and tighten securely. Insert the yoke link pin through link and yoke, and install a new cotter pin. Place battery in compartment, install hold-down frame, and connect battery cable

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clamps to battery posts. Press the starter switch button to check operation of solenoid and starting motor. Place the engine compartment heater outlet tube in position, fasten tube clamp to battery bed, install tube sleeve over heater outlet, and tighten securely with bolt and nut. Place engine compartment lid in position and tighten wing nuts.

Section V
GENERATOR

	Paragraph
Description and data	153
Removal	154
Disassembly	155
Cleaning	156
Inspection	157
Assembly	158
Test	159
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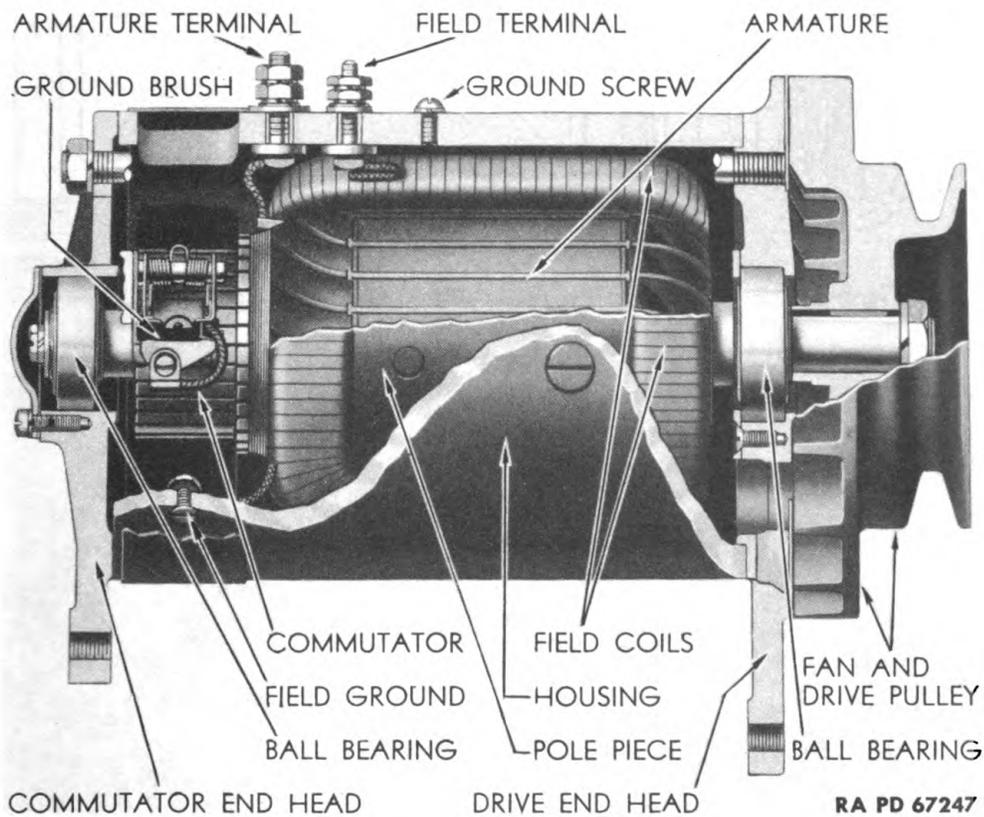
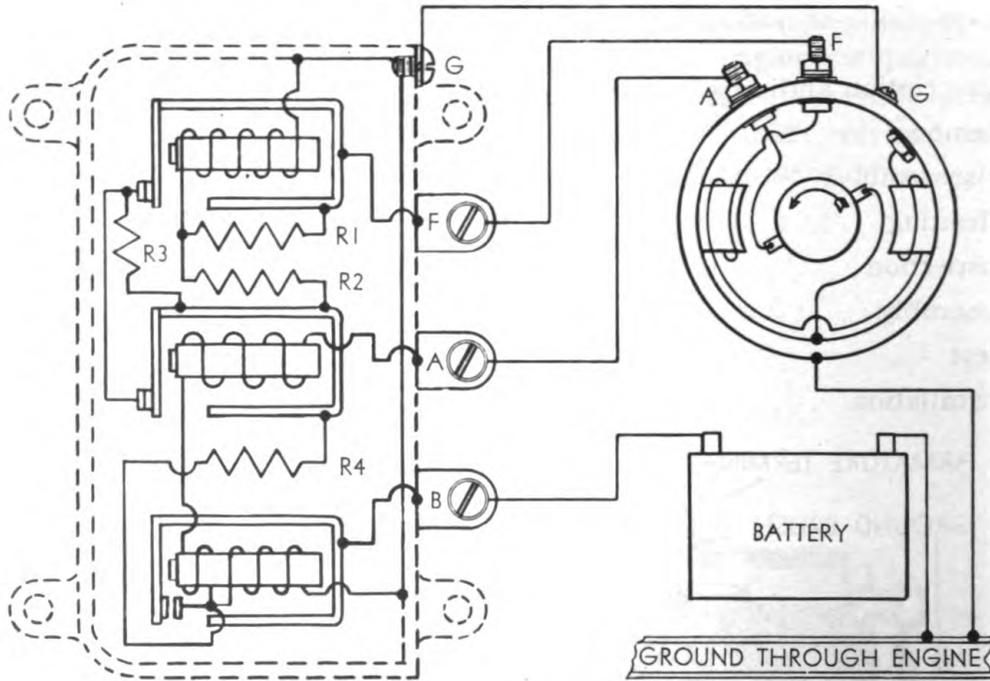


Figure 101—General Construction

153. DESCRIPTION AND DATA.

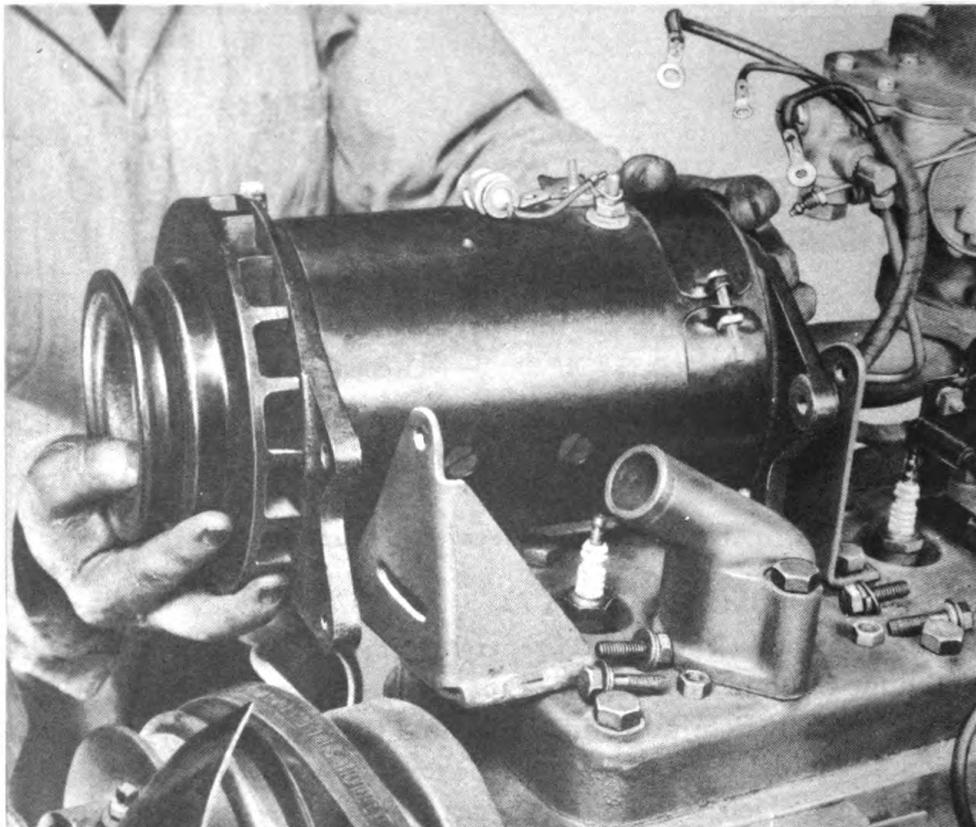
a. Description. The 12-volt generator (fig. 101) used in this vehicle is a shunt-wound, high-output type, fully controlled, having a 40-ampere capacity. Four adjusting bolts hold the generator in any desired position as limited by the length of the driving belt. It is equipped with a cooling fan which is an integral part of the drive pulley, and turns at armature speed. Two brushes are used in the generator. The generator output is controlled by the current and voltage regulator (fig. 102).

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RA PD 67228

Figure 102—Wiring Diagram of Generator and Regulator



RA PD 67073

Figure 103—Generator Removal

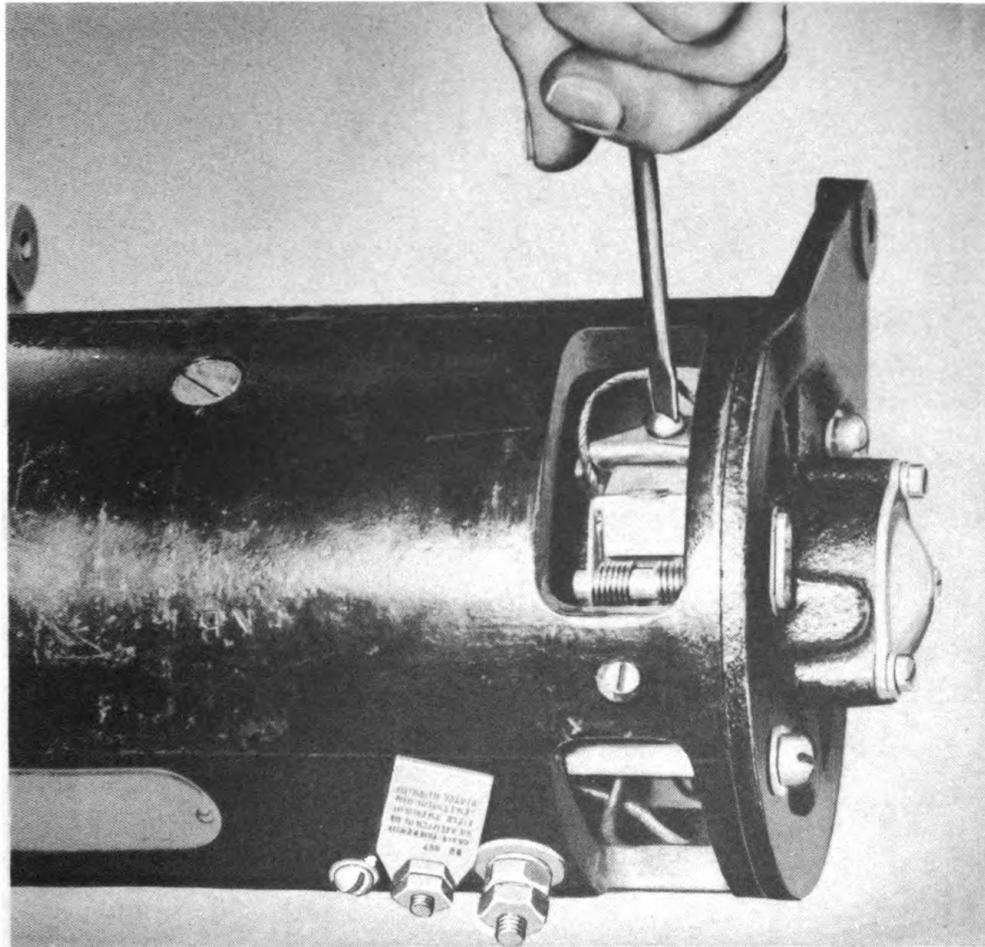
GENERATOR

b. Data.

Make Auto-Lite
Capacity 40 ampere

154. REMOVAL.

a. Loosen wing nuts and remove engine compartment lid from vehicle. Disconnect wiring assembly from generator, and tag to facilitate reassembly. Loosen the bolts holding generator in position. This will



RA PD 67135

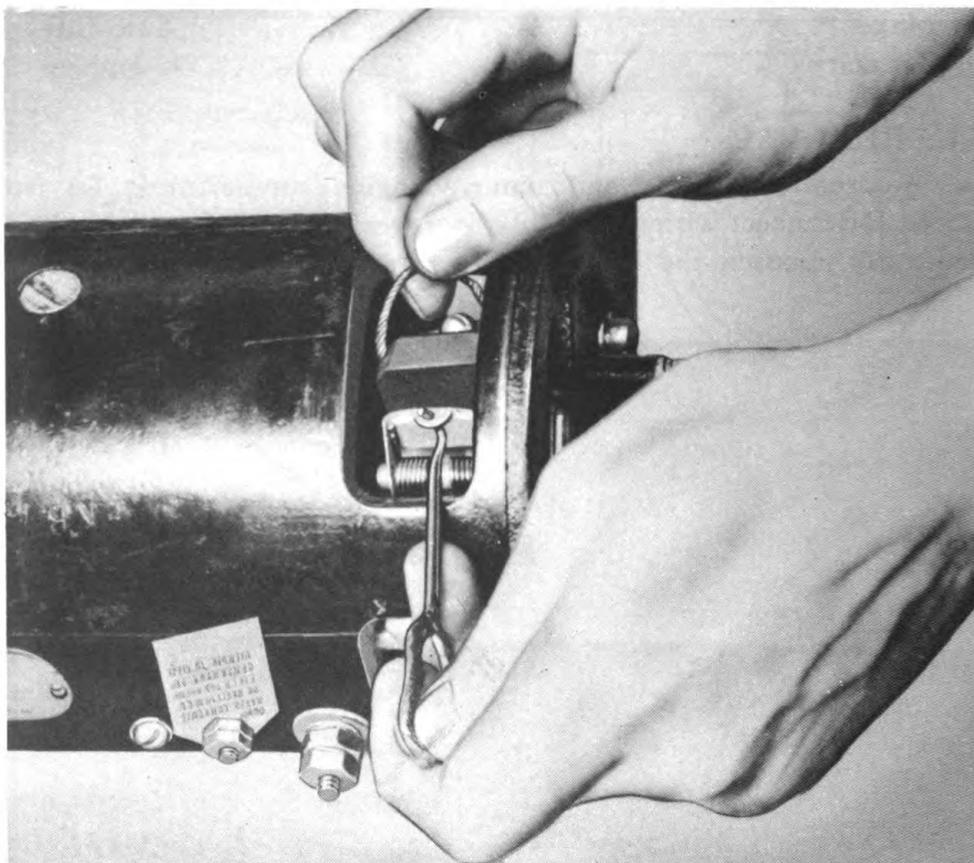
Figure 104—Disconnecting Generator Brush Lead Screw

relieve drive belt tension so drive belt can be removed. Remove the bolts and nuts with lock washers holding generator in position. Remove generator from mounting brackets (fig. 103).

155. DISASSEMBLY.

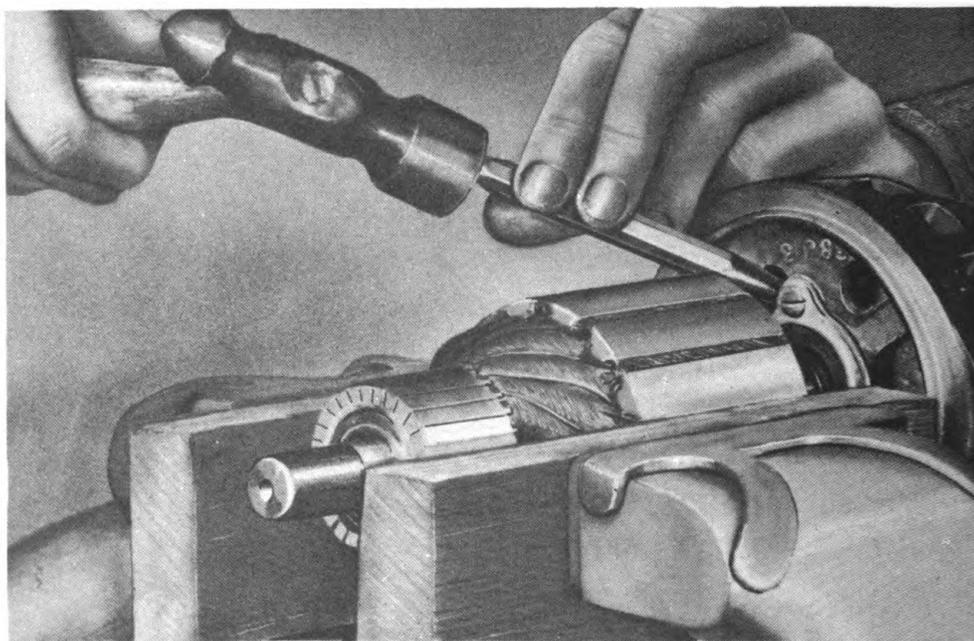
a. Take out band clamp screw and nut, and remove head band. Remove brush lead screws (fig. 104) and lock washers, lift brush arms

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RA PD 67142

Figure 105—Method of Lifting Generator Brush Arms



RA PD 67155

Figure 106—Removing Generator Pulley from Armature Shaft

GENERATOR



RA PD 67153

Figure 107—Pressing Generator Armature Out of Drive End Head

(fig. 105) and remove brushes from holders. Take out screws holding cover to commutator end head, and remove cover. Remove screw, lock washer, and plain washer from commutator end of armature shaft. Remove nuts and lock washers from frame screws, and remove commutator end head from generator frame. Pull the armature, drive end head, and pulley from generator frame. Remove pulley retaining nut and lock washer from armature shaft, press armature out of pulley (fig. 106), and remove Woodruff key from keyway. Press armature out of drive end head (fig. 107). Take out pole piece screws and remove field coils (fig. 108).

156. CLEANING.

a. Clean the frame and field thoroughly with SOLVENT, dry-cleaning, but do not soak the coils with the cleaning solution. Clean the

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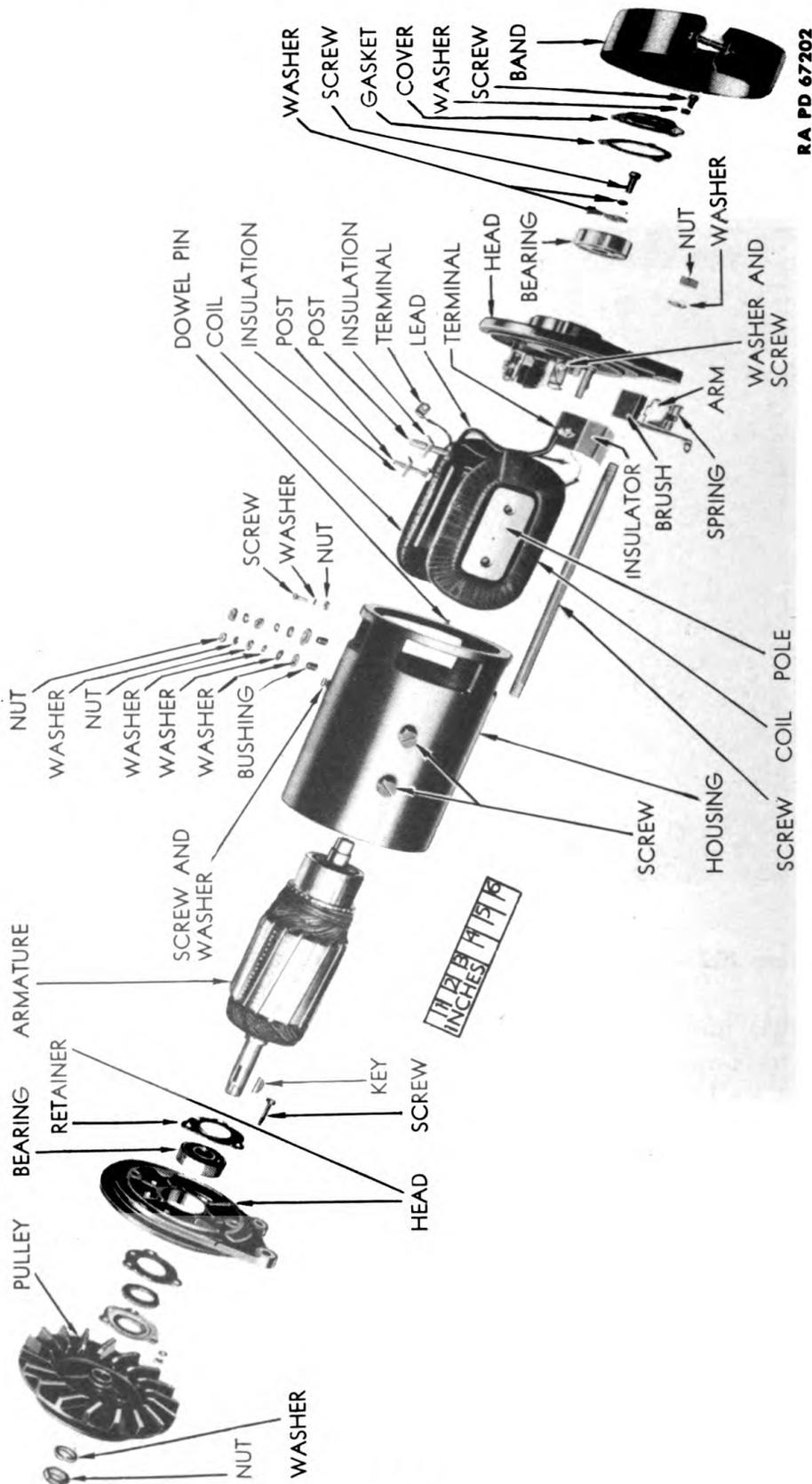


Figure 108 — Parts of the Generator

GENERATOR

armature thoroughly with a clean cloth dampened with SOLVENT, dry-cleaning. Remove bearings from the heads and wipe with clean dry cloth; do not use SOLVENT, dry-cleaning. Clean brushes with a dry cloth. Clean the heads, brush holders, and remaining parts with SOLVENT, dry-cleaning, and dry with clean cloth or compressed air.

157. INSPECTION.

- a. Inspect the insulation on leads and field coils for damaged or



RA PD 67154

Figure 109—Testing Generator Field Coils for Grounds

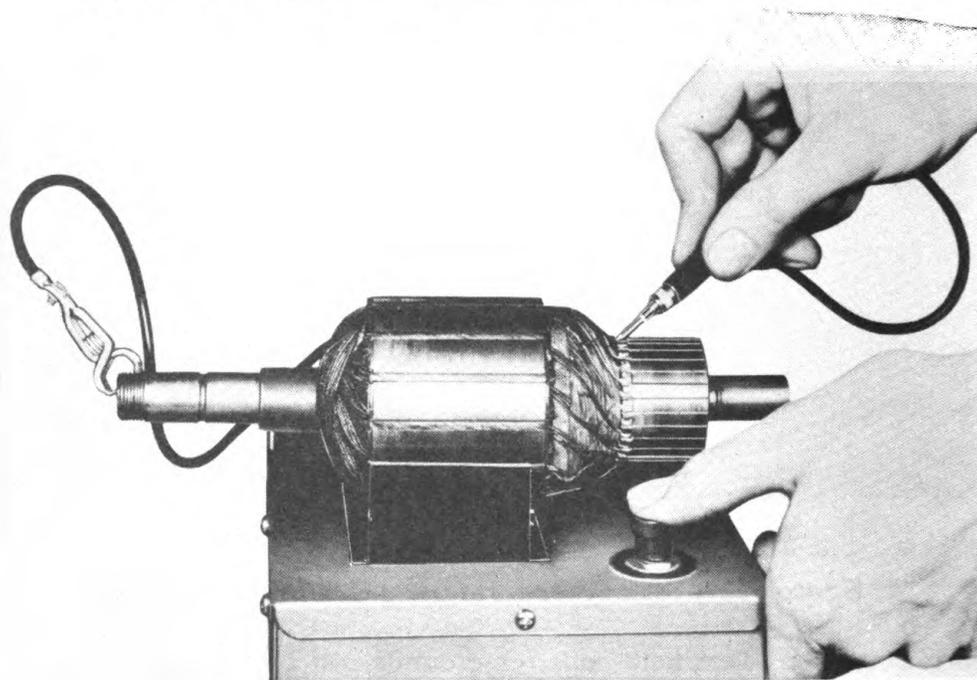
worn condition. Test field coils for grounds and open circuits (figs. 109 and 110). Inspect armature visually to make sure all coils are properly staked in the core slots and to commutator segments. Examine for

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RA PD 67194

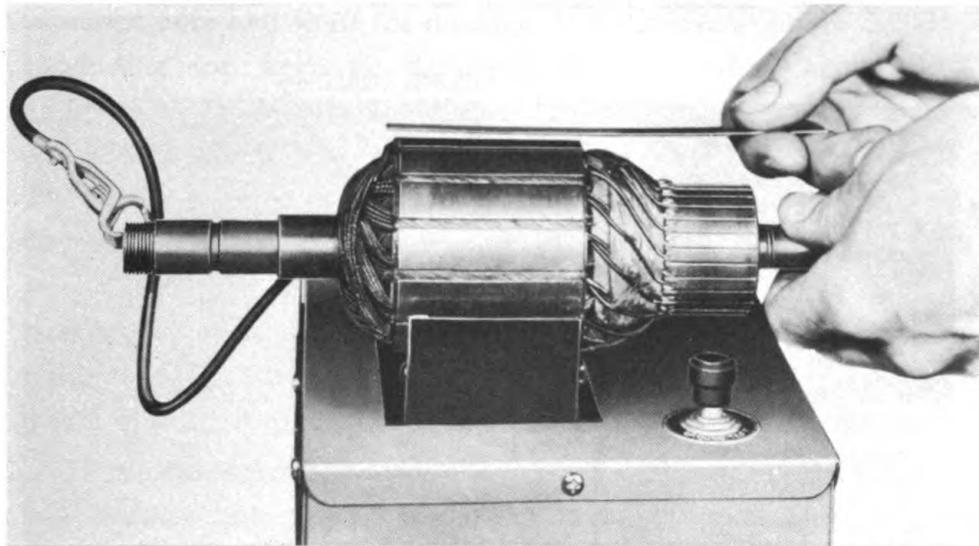
Figure 110—Testing Generator Field Coils for Open Circuit



RA PD 67201

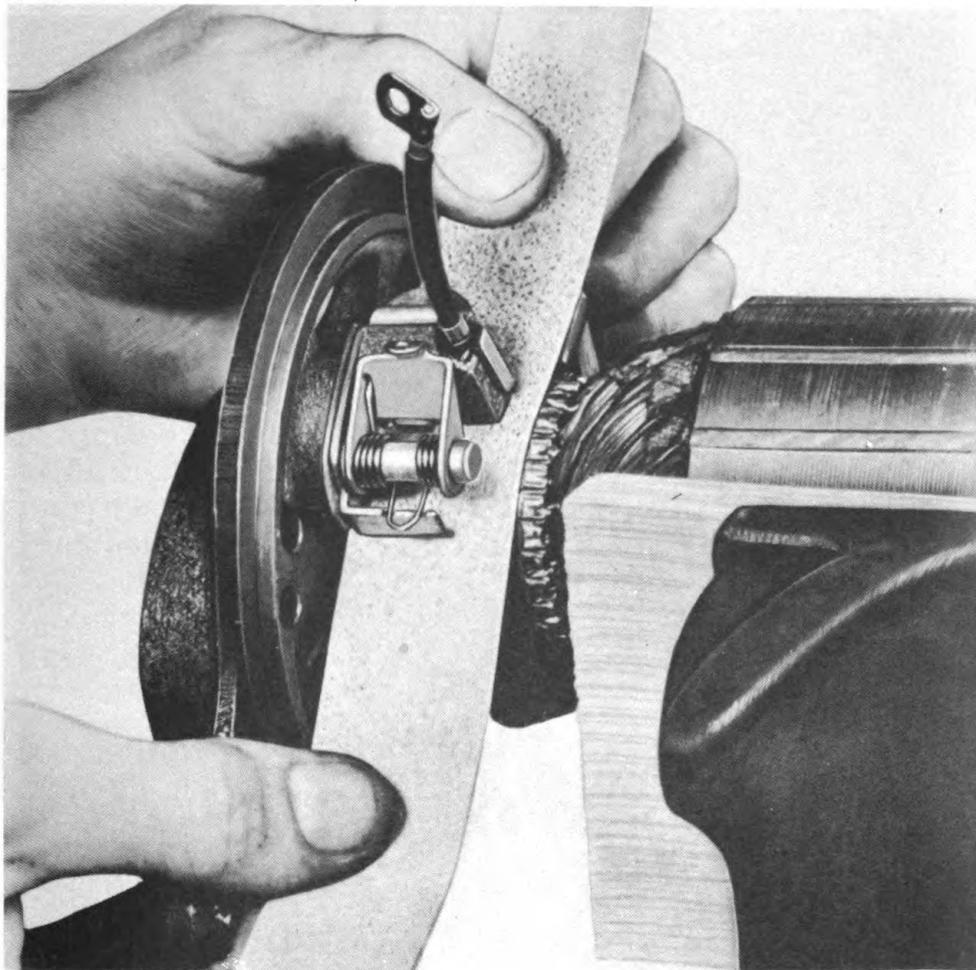
Figure 111—Testing Generator Armature for Grounds

GENERATOR



RA PD 67195

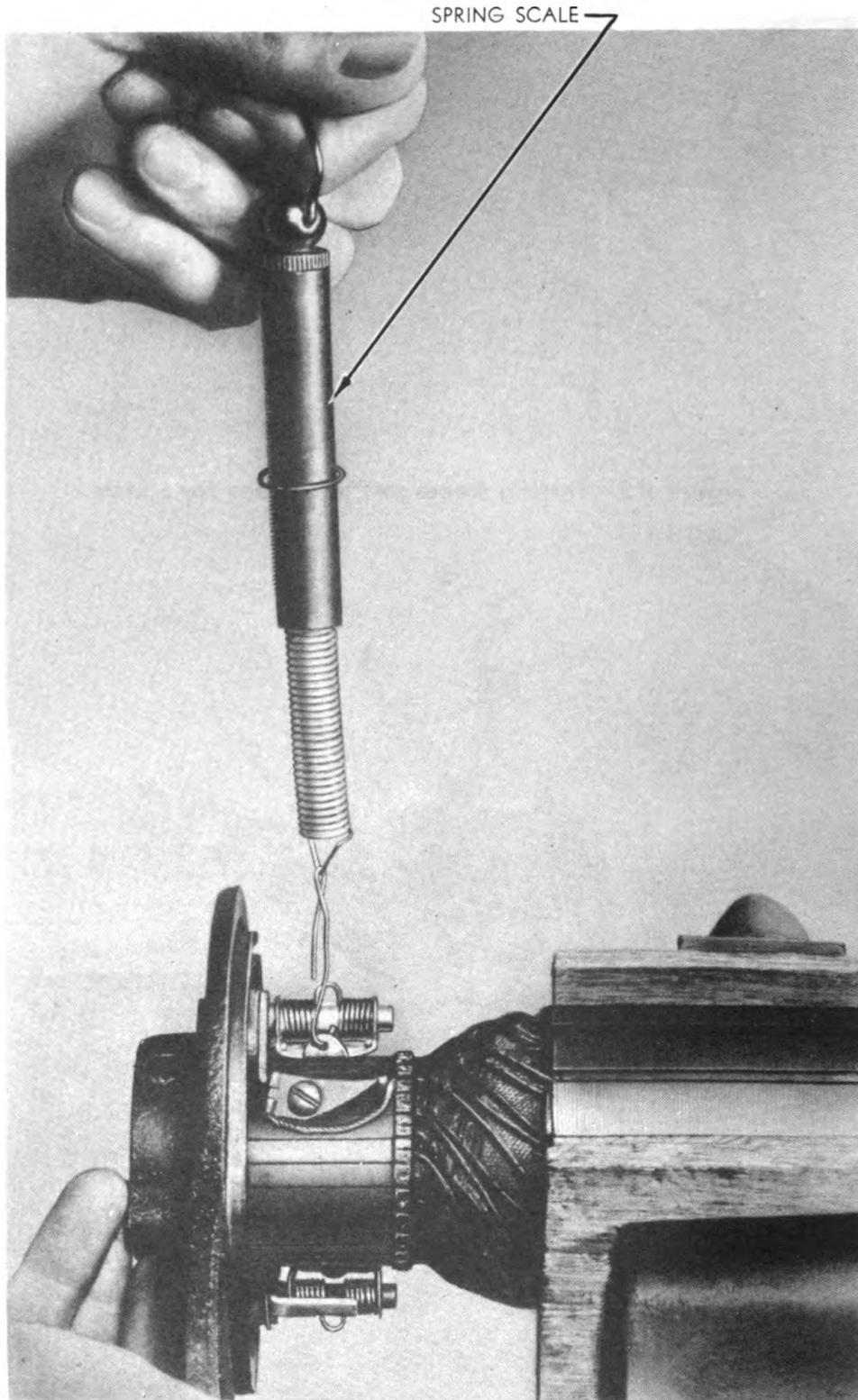
Figure 112—Testing Generator Armature for Shorts



RA PD 67199

Figure 113—Sanding Brushes—Generator Housing Off

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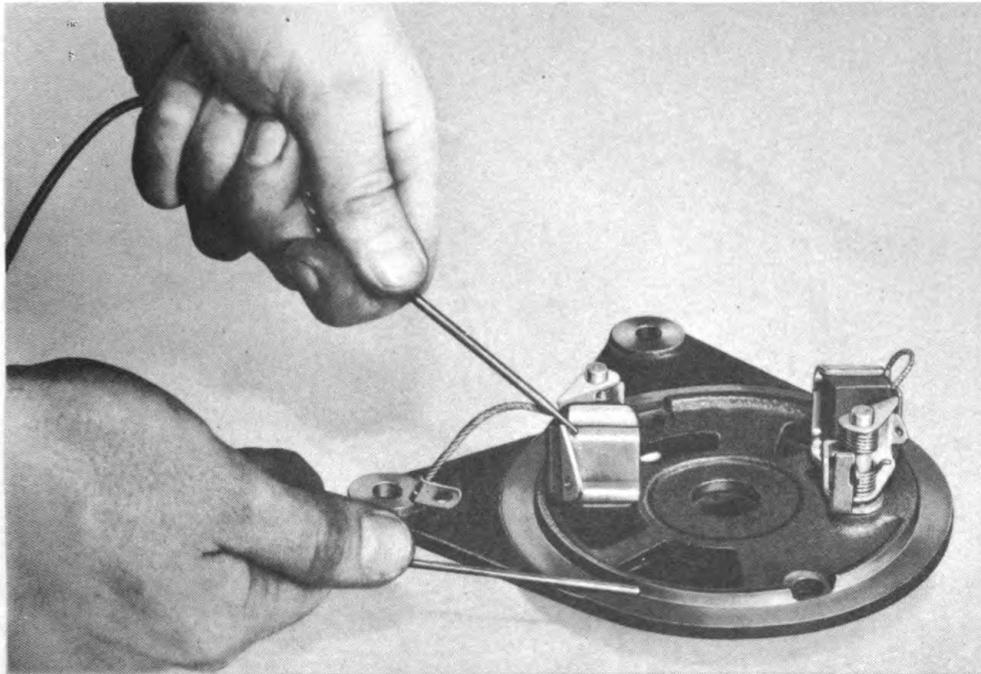
RA PD 67197

Figure 114—Checking Brush Spring Tension—Generator Housing Off

GENERATOR

loose solder, core and shaft for damage. Inspect insulation on the armature winding for worn or damaged condition. Test armature for grounds (fig. 111). Inspect commutator for damage or grooves and turn down on lathe if required. If dark brown in color and not damaged or grooved, clean with 00 or 000 flint paper. With test probes consisting of a light in series with two points and connected to battery, touch the probes of each pair of adjacent commutator bars. If the bulb fails to light a coil is open. Place armature on growler, hold thin steel strip over the core (fig. 112). Rotate armature slowly; if short is present steel strip will vibrate. Replace parts not satisfactory for further service.

b. If brushes are oil-soaked, cracked, or worn to less than $\frac{7}{16}$ inch, replace brushes. If the brush leads are damaged or broken install new brushes and sand to fit commutator (fig. 113). Check brush spring tension (fig. 114), and replace if not satisfactory. If brush holders are



RA PD 67196

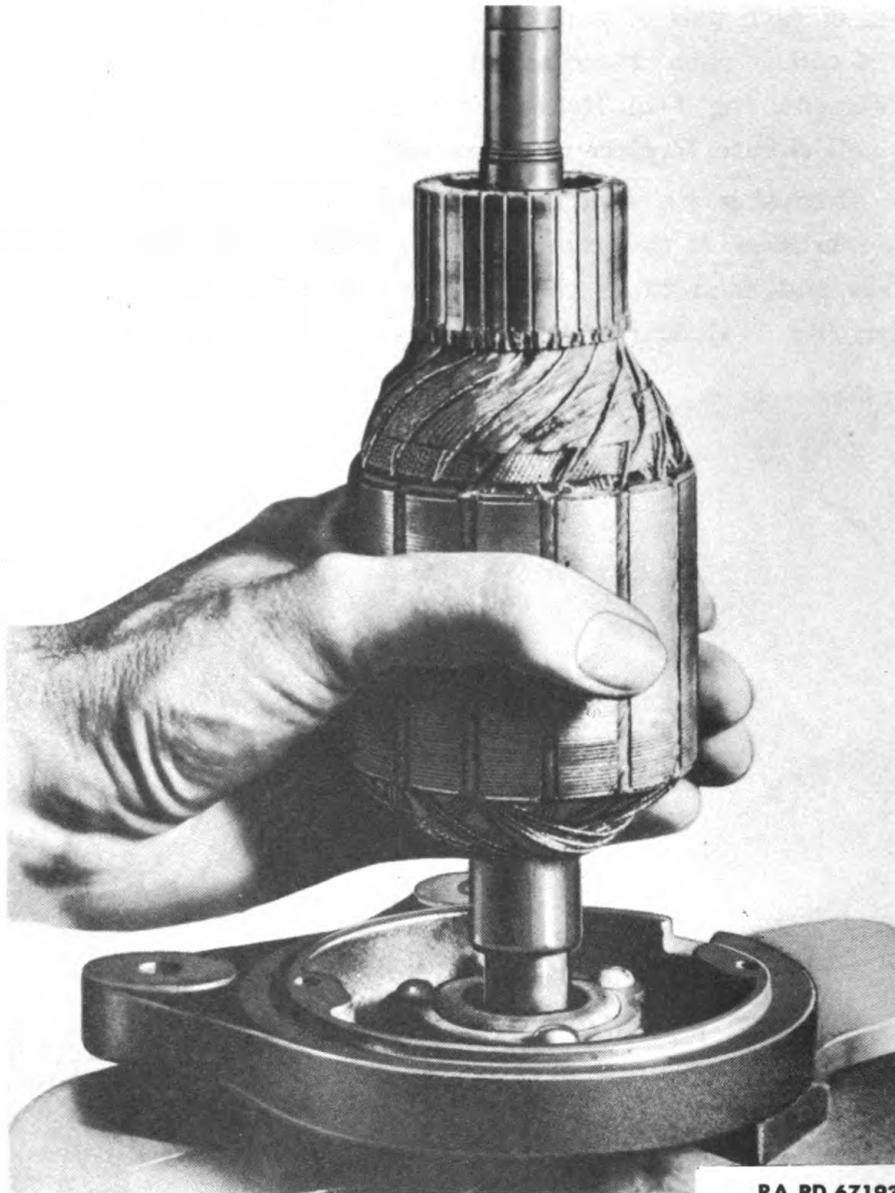
Figure 115—Testing Generator Insulated Brush Holder for Grounds

twisted or insulated holder is grounded (fig. 115), replace commutator end head. Inspect all wiring from generator to voltage regulator, from regulator to battery, and from battery to ground for worn or frayed insulation, broken wires, and loose or corroded connections. Repair or replace all defective wires. Examine end heads for cracks, and bearings for scores or damage. Replace bearings or end heads as required.

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158. ASSEMBLY.

a. Press armature shaft into drive end head bearing so the shoulder on shaft fits down tightly against bearings (fig. 116). Insert frame screws through drive end head and place Woodruff key in armature shaft keyway. Press pulley on shaft, install lock washer and nut, and tighten

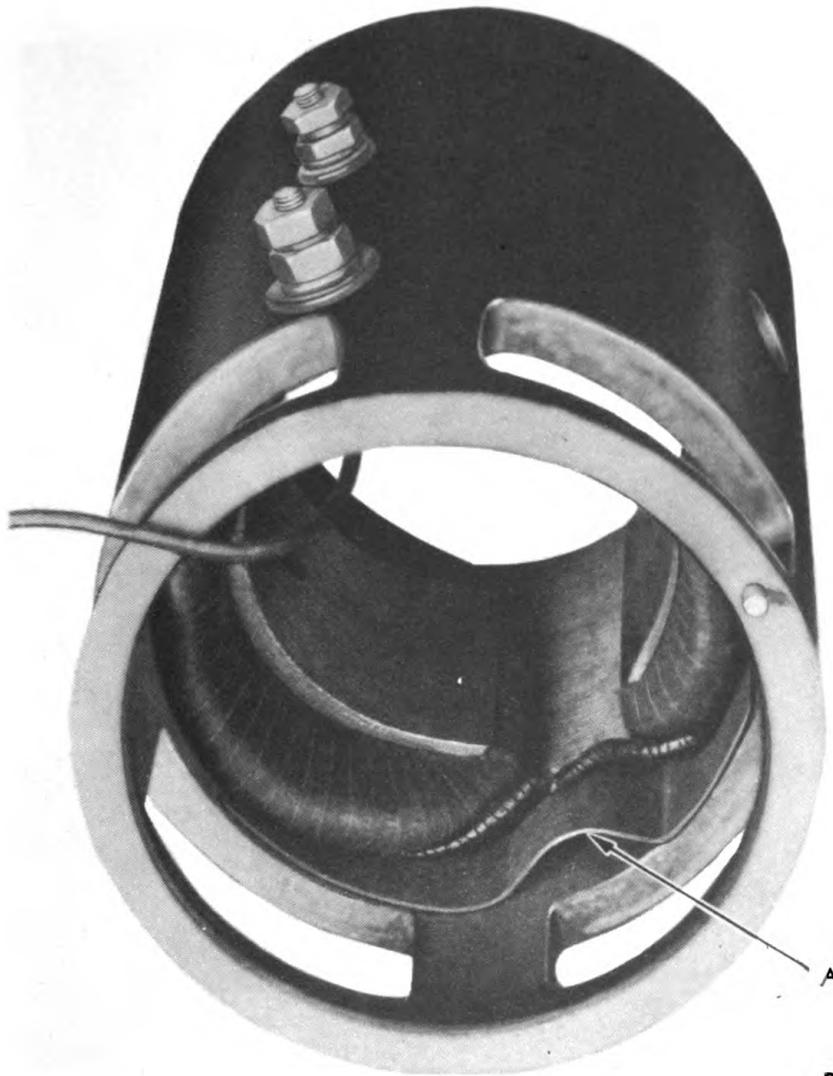


RA PD 67193

Figure 116—Pressing Generator Armature into Drive End Head

securely. Place field coils and pole pieces in frame with new bushings, fasten securely with pole piece screws, and stake screws. Assemble drive end head and armature to frame and fields, making sure the dowel pin is in place, and that one of the frame screws is under the field lead

GENERATOR



RA PD 67200

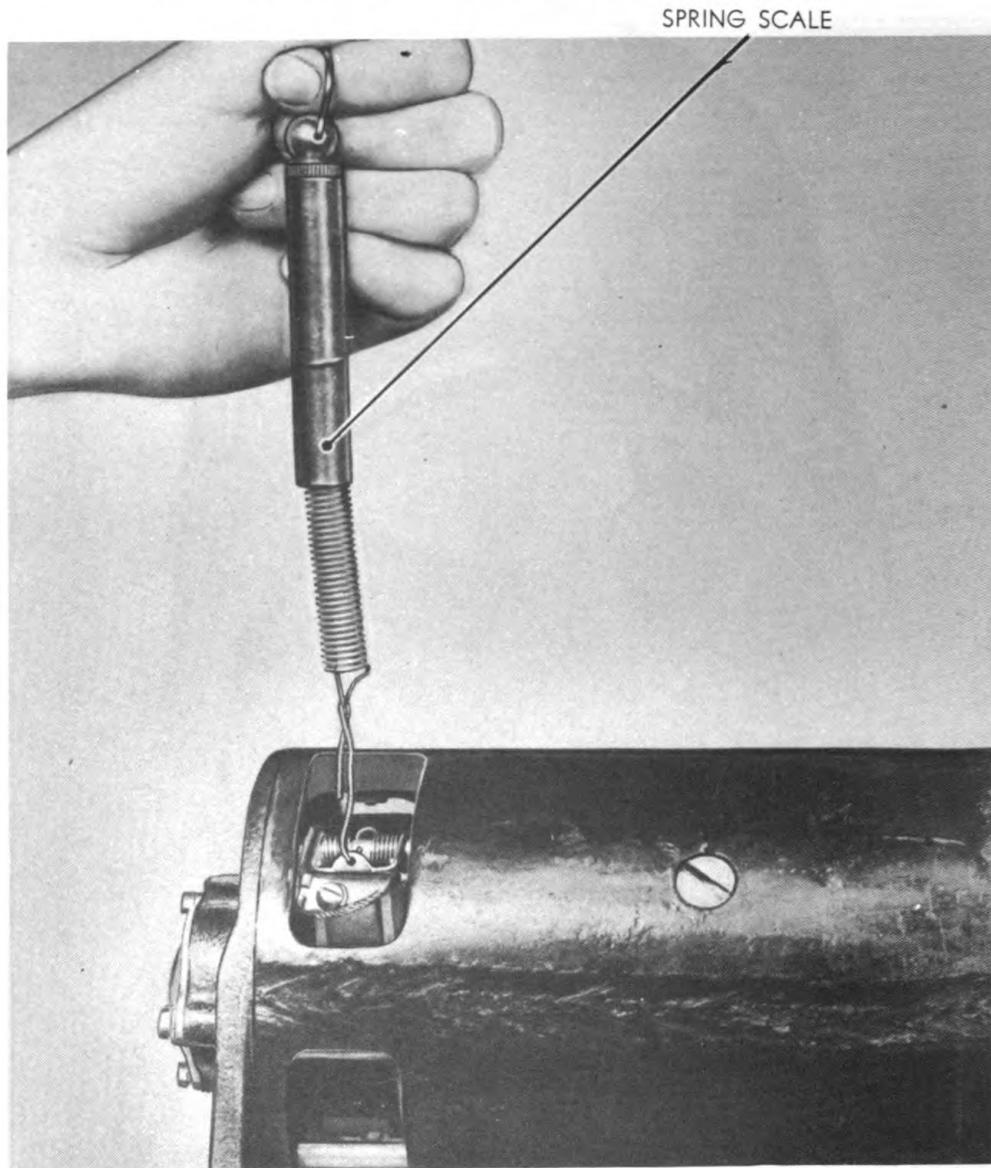
Figure 117—Generator Field Connection Insulation

insulation (fig. 117). Assemble commutator end head to frame making sure the dowel pin is in place. Install lock washers and nuts on frame screws and tighten securely. Assemble the bearing on armature shaft, install the plain washer, lock washer, and screw, and tighten securely. Lift the brush arm and install brushes in holders making sure they are turned so the beveled face fits the commutator. Connect brush leads to brush holders and connect the lead from the armature terminal post to the insulated brush holder, and tighten lead screws securely. Install commutator end cover and gasket on generator, install and tighten the screws and lock washers.

159. TEST.

- a. **Test Brush Spring Tension.** Hook a spring scale in the end of

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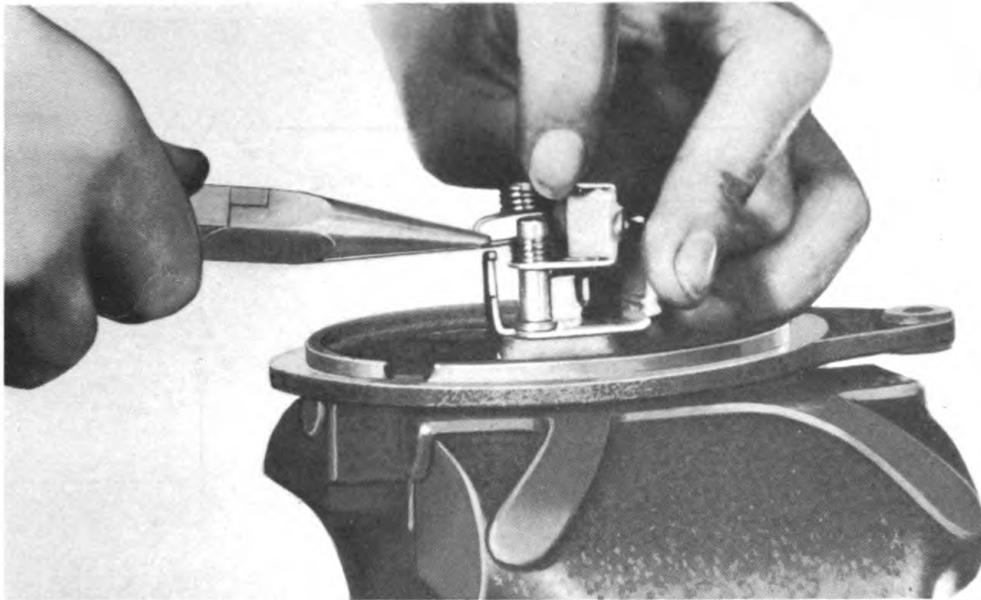
RA PD 67151

Figure 118—Checking Generator Brush Spring Tension

brush arm and pull parallel to face of brush (fig. 118). Note reading on scale just as arm leaves brush. The proper tension is between 30 to 37 ounces. If tension is not within these limits, remove arm and spring, bend spring where it rests on stop, install arm and spring (fig. 119) and check tension.

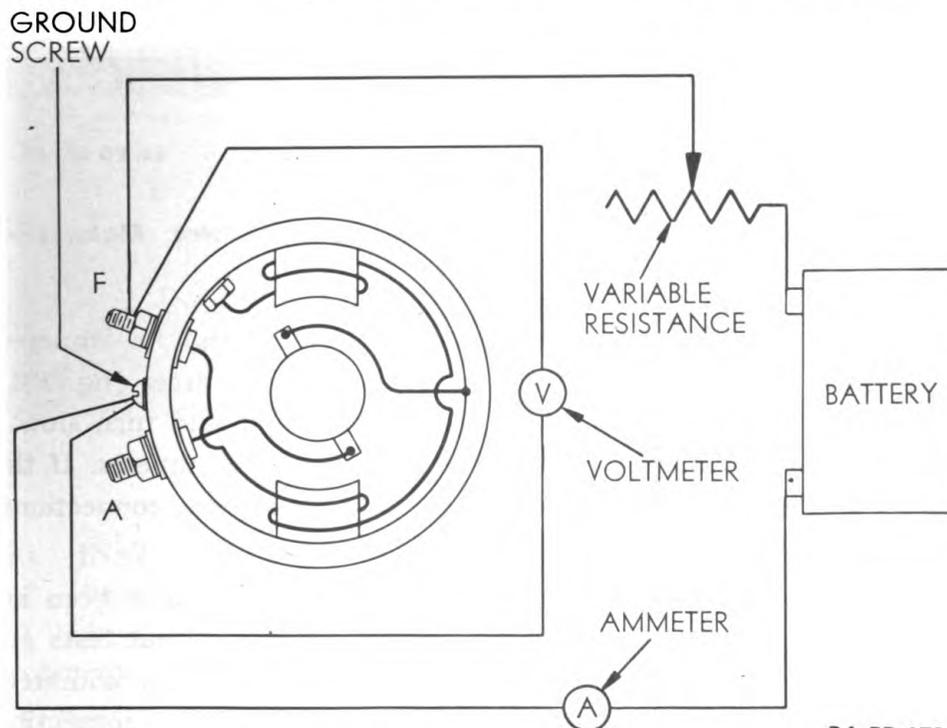
b. Armature End Play. Attach dial indicator on drive end head with indicator button resting against end of shaft. Move armature to its two extreme positions and note reading on indicator. End play should be between 0.003 inch and 0.010 inch. Adjust by installing thrust

GENERATOR



RA PD 67198

Figure 119—Assembling Generator Brush Arm and Spring



RA PD 67150

Figure 120—Wiring Diagram for Measuring Generator Field Coil Current Draw

washers on armature shaft just inside either end head. When installing thrust washers make sure brushes are correctly centered on commutator.

c. **Measure Field Coil Draw and Motorizing Draw.** Measure the field coil draw (fig. 120) with voltage adjusted to 13.0 volts and read

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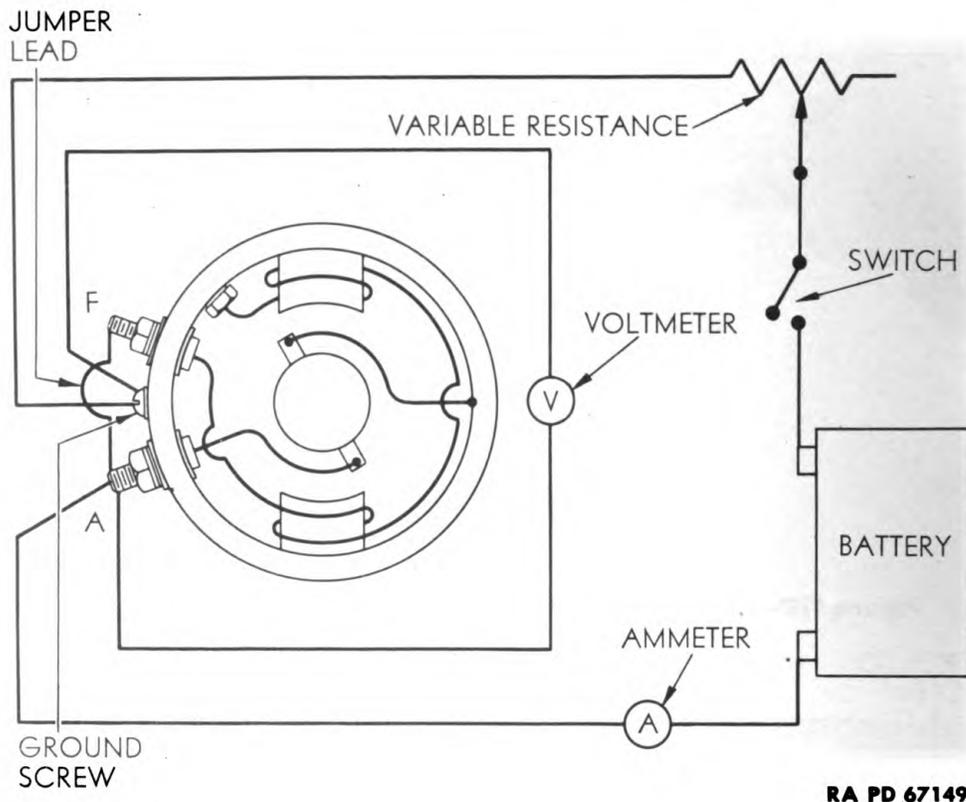
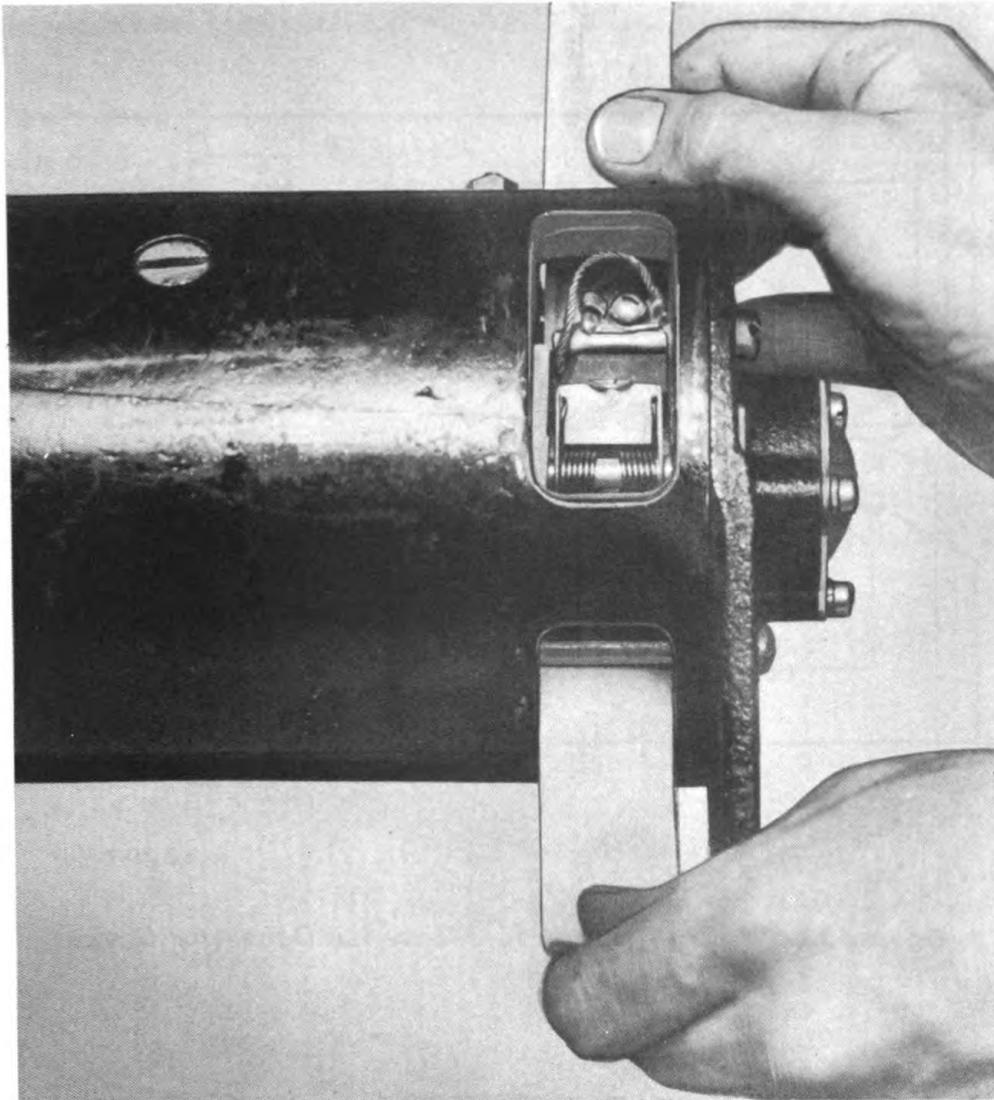


Figure 121—Wiring Diagram for Measuring Generator Motorizing Current Draw

the ammeter. If the current draw is not between 1.4 and 1.6 amperes, it indicates faulty field coils. Measure the motorizing draw (fig. 121) with voltage adjusted to 13.0 volts. The armature should turn slowly and the ammeter should show a reading of 3.2 to 3.6 amperes. If the current draw is not within these limits, high resistance connections, worn bearings, or poor brush contact is indicated.

d. Test Generator Charging Rate. If new brushes have been installed run them in on a test bench or vehicle before output tests are made. Operate generator at approximately 1000 rpm, approximately -10 rpm, so that output is 35 to 40 amperes. Operate until an inspection of brushes show perfect fit to commutator. If necessary sand brushes (fig. 122) until proper fit is obtained. The contact face of brushes should be shiny over entire surface. Adjust the output to 40.0 amperes at 15.0 volts (fig. 123). Do not operate at more than 40.0 amperes or 15.0 volts, as to do so may result in burned armature and fields. Place head band in position, install and tighten bolt and nut.

GENERATOR



RA PD 67152

Figure 122—Sanding Generator Brushes

160. INSTALLATION.

a. Place generator in position and install the retaining bolts, nuts, and lock washers. Install the drive belt in generator pulley and adjust the generator drive belt by moving the generator upward on the brackets to provide $\frac{1}{2}$ -inch deflection of belt when pressed with forefinger. When the adjustment is completed tighten all four bolts securely. Connect the wiring to proper terminals and tighten securely. Place engine compartment lid in position and tighten wing nuts.

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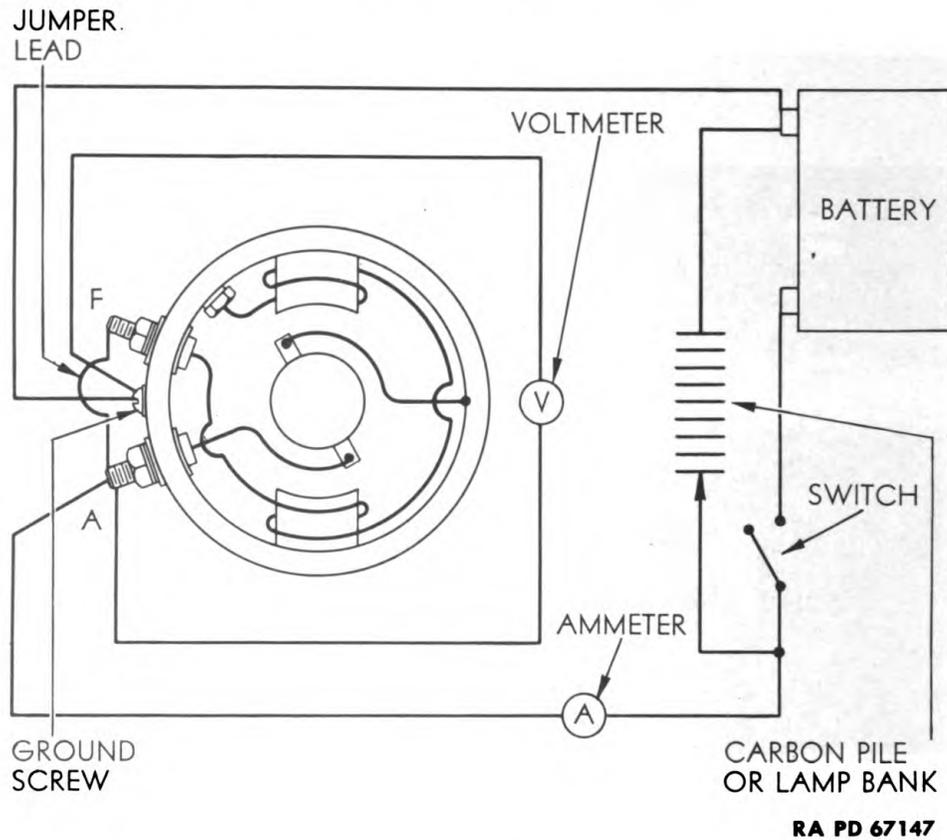


Figure 123—Wiring Diagram for Measuring Generator Output.

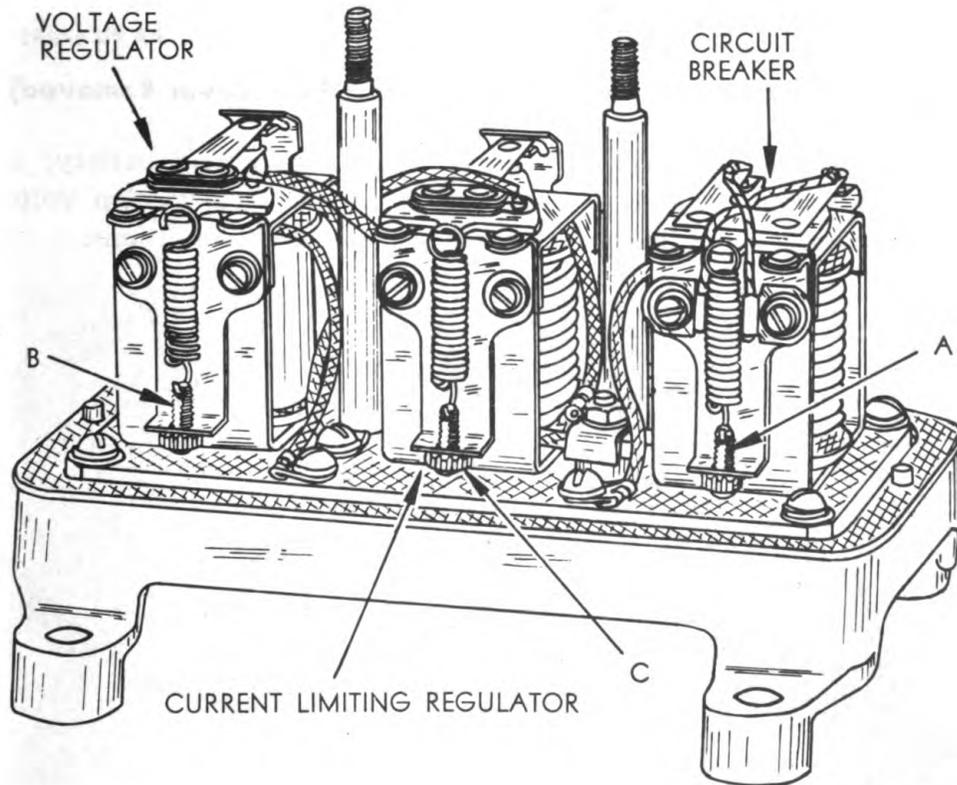
Section VI

GENERATOR CURRENT AND VOLTAGE REGULATOR

	Paragraph
Description	161
Removal	162
Cleaning and inspection	163
Installation	164
Test and adjust	165
Operation	166

161. DESCRIPTION.

a. Operating as one of the chief component parts of the electrical system is the current and voltage regulator. It consists of three independent units encased in a sealed moisture- and dirt-proof box. The

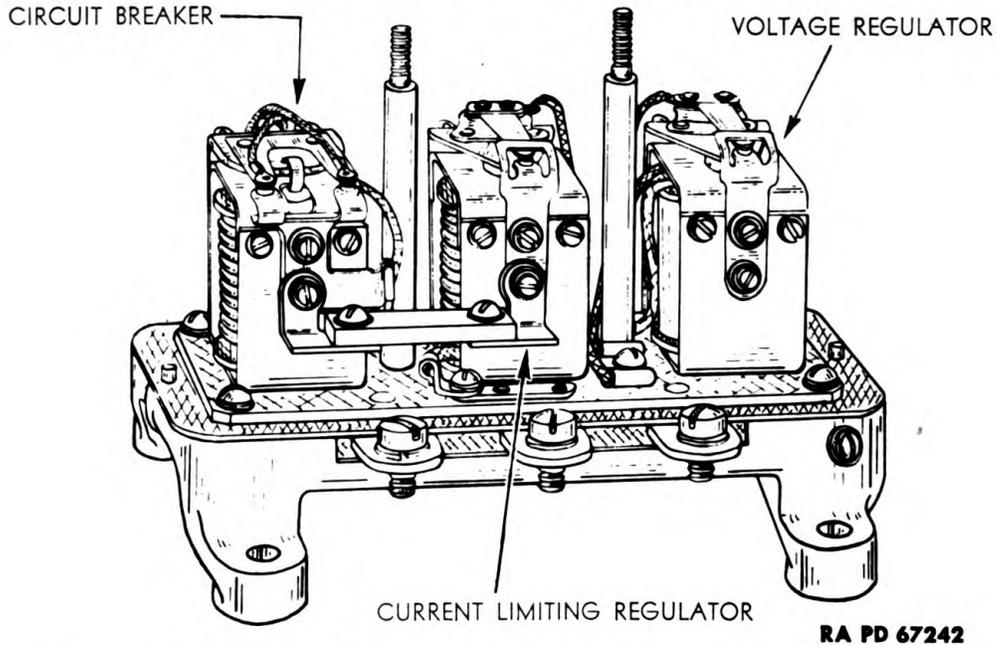


RA PD 67223

Figure 124—Generator Regulator—Coil Side (Cover Removed)

units within the box are: *first*, circuit breaker which closes and opens the circuit between the generator and battery to prevent the current from flowing back through the generator when engine is stopped; *second*, current-limiting regulator which controls the maximum output

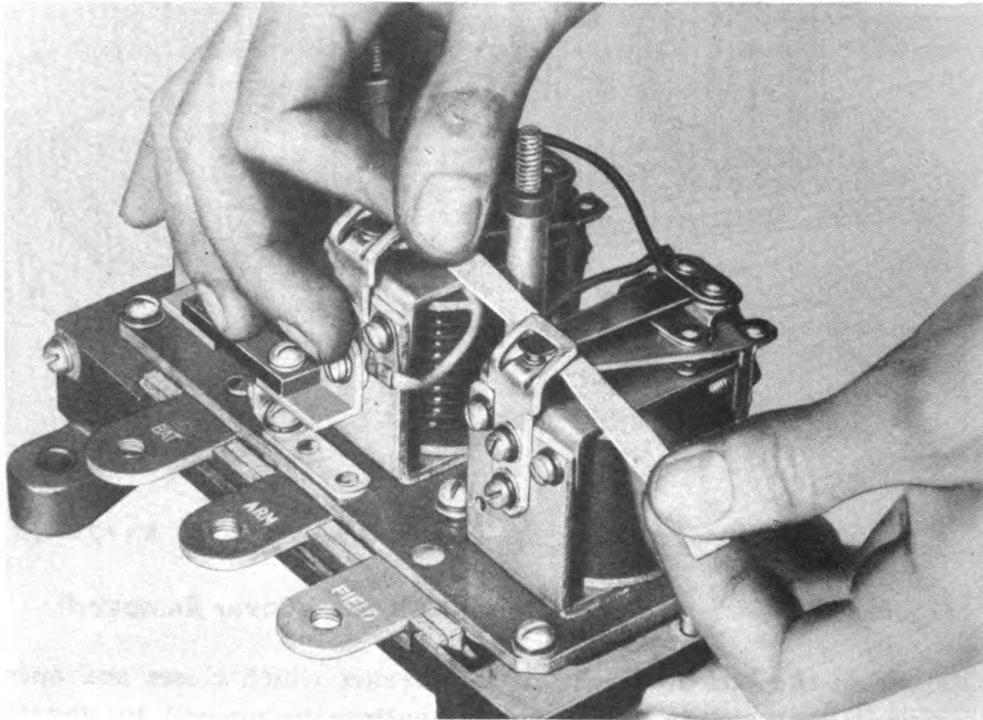
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RA PD 67242

Figure 125—Generator Regulator—Contact Side (Cover Removed)

of the generator and prevents damage to generator and battery; and *third*, the voltage regulator which holds the electrical system voltage constant within close limits under various operating conditions.



RA PD 67207

Figure 126—Cleaning Regulator Contacts

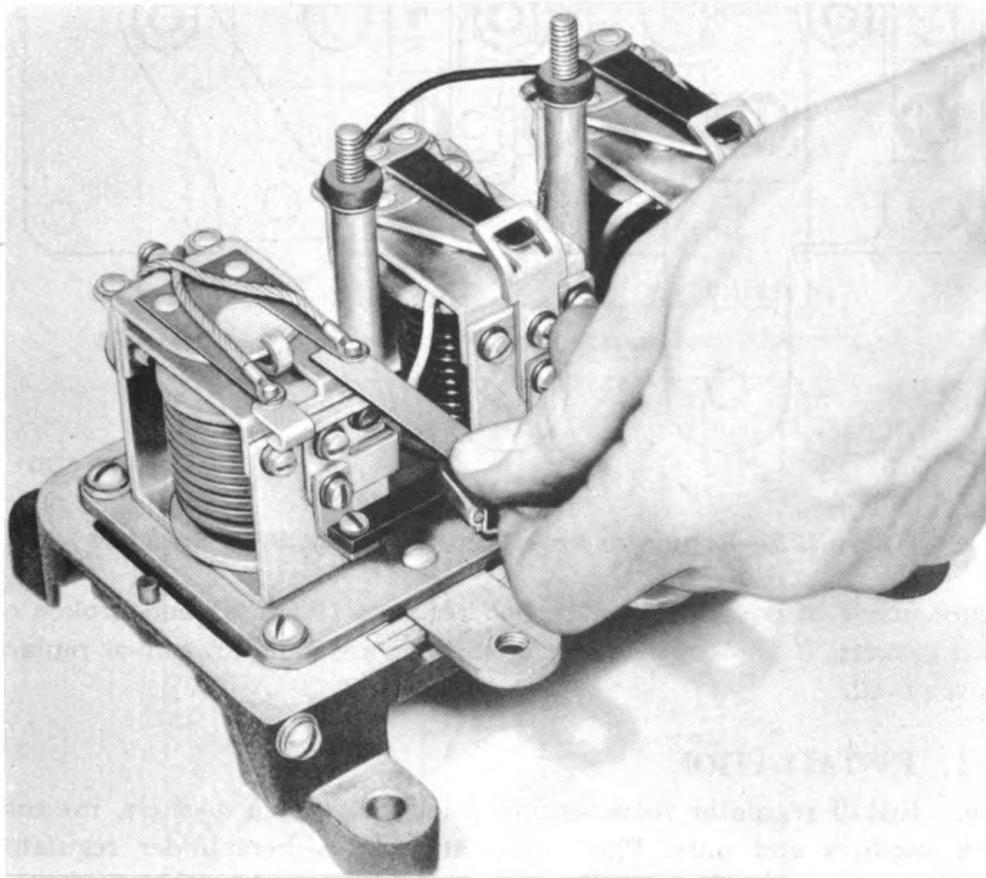
GENERATOR CURRENT AND VOLTAGE REGULATOR

162. REMOVAL.

a. Loosen wing nuts on engine compartment lid, lift lid from slots in coaming and remove from vehicle. Disconnect battery ground cable from battery terminal. Disconnect wires from regulator and tag wires to denote their location. Remove mounting bolts, nuts, flat washers, and internal lock washers, and lift regulator out of vehicle.

163. CLEANING AND INSPECTION.

a. **Cleaning of Regulator.** Remove regulator seal, take off cover nuts, and lift cover from regulator. Use compressed air to clean dust from cover and the three-unit assembly. Clean the points by drawing



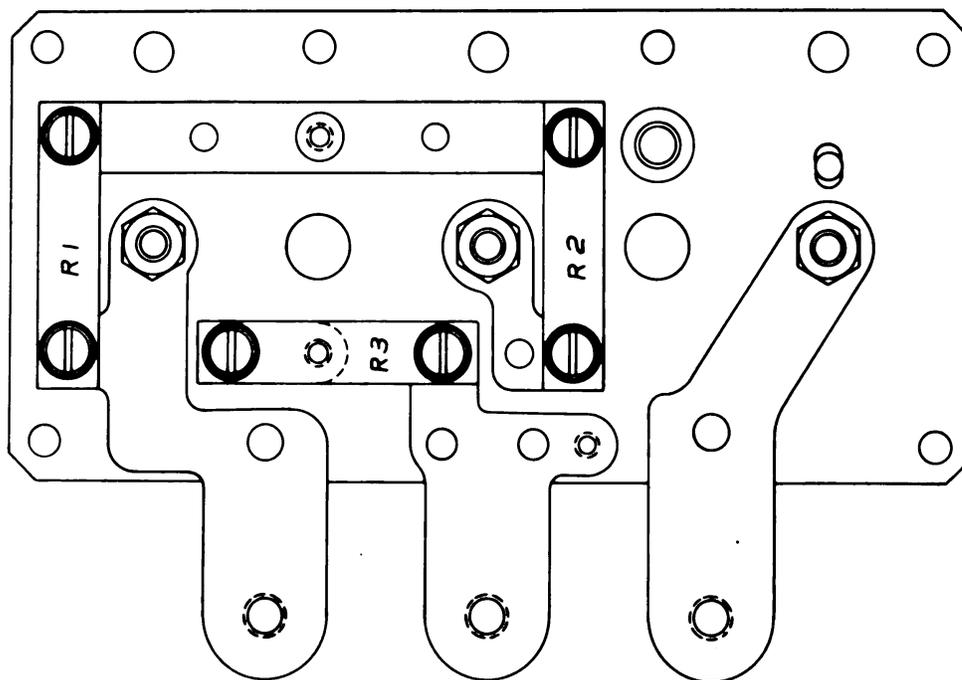
RA PD 67208

Figure 127—Filing Regulator Contacts

linen tape dampened with carbon tetrachloride between the contacts (fig. 126). Repeat this operation with a dry piece of linen tape. Use clean tape for each set of contacts. If contacts are burned or pitted clean them with a No. 6 American cut equaling file. File lengthwise and parallel to armature (fig. 127). File just enough so contacts have smooth flat surface. After filing, clean as outlined above.

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b. **Inspection of Regulator.** Inspect regulator for evidence of burning or abnormal high temperature at coils, wire insulation, and contacts springs. Examine for loose connections resulting from poor soldering, loose nuts at bottom of cores, misalignment of contact points, stripped or crossed threads on any screw or nut, corrosion, evidence of



RA PD 67221

Figure 128—Regulator Base Showing Location of Resistors

water inside of cover, broken carbon resistors (fig. 128) and broken or torn gaskets. If any of the above conditions are found, repair or replace as required.

164. INSTALLATION.

a. Install regulator to mounting using bolts, lock washers, internal lock washers and nuts. Place internal lock washers under regulator legs and tighten bolt nuts securely. Connect the white wire with red tracer, and brown wire to center terminal, three black wires to right terminal, small black wire to filter post, and red wire to ground screw in right side of regulator base.

165. TEST AND ADJUST.

a. **Circuit Breaker Air Gap.** With spring tension on armature and armature against the stop, insert a 0.0595- to 0.0625-inch gage between the armature core and the contact side next to the brass stop pin. The

GENERATOR CURRENT AND VOLTAGE REGULATOR

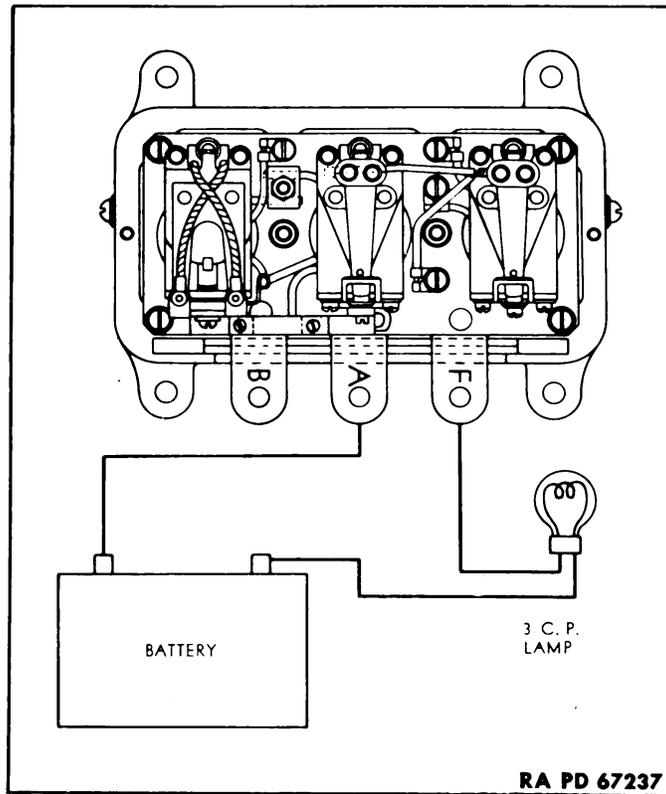


Figure 129—Regulator Contact Pressure Test Diagram

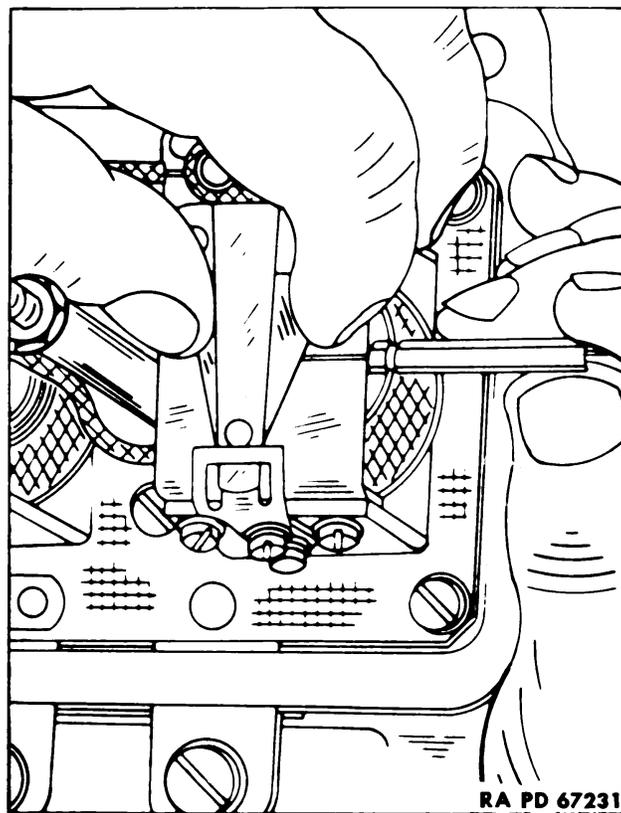


Figure 130—Checking Regulator Armature Air Gap

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0.0595-inch gage should fit easily; if it does not, adjust the contact points by bending the armature stop, using long-nose pliers.

b. Voltage Regulator Air Gap. Connect a light (3 candlepower) and battery in series with the "A" and "F" terminals (fig. 129). Insert a 0.040-inch to 0.042-inch pin gage between the core and armature (fig

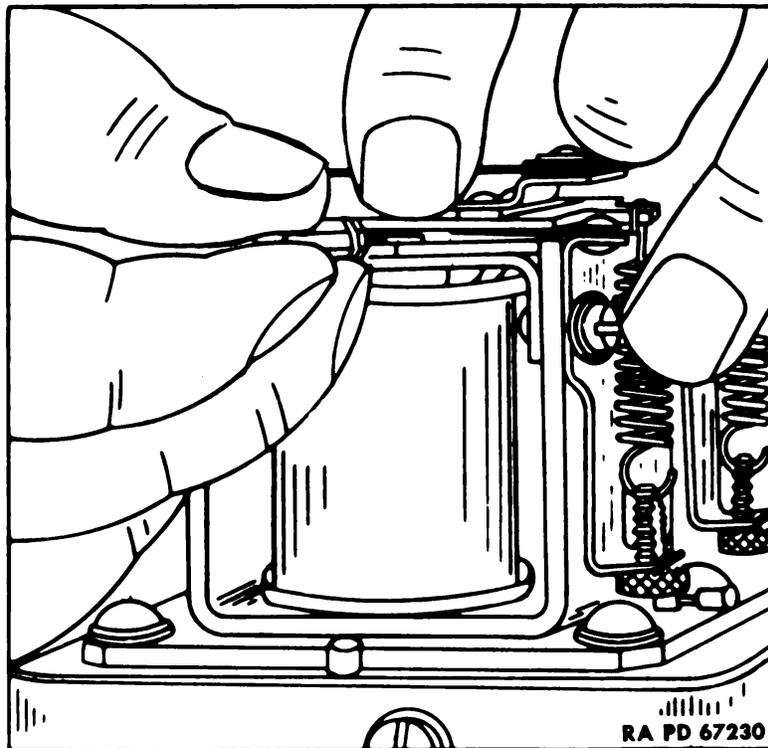


Figure 131—Gage Location in Checking Regulator Armature Air Gap

130), on the contact side of brass armature stop pin (fig. 131). Hold the armature down, being careful not to touch the contact spring. The light should burn brightly with the high-limit gage in place, and should go out or burn dim with low-limit gage in place. To adjust the gap, loosen the two screws holding the armature stop and raise or lower the stop. Tighten the screws and recheck the gap.

c. Current Regulator Air Gap. Connect a light (3 candlepower) and battery in series with the "A" and "F" terminals (fig. 129). Insert 0.047-inch to 0.049-inch pin gage between the core and armature (fig. 130) on the contact side of the brass armature stop pin (fig. 131). Hold armature down, being careful not to touch the contact spring. The light should burn brightly with the high-limit gage in place, and go out or dim with low-limit gage in place. To adjust the gap, loosen the two armature screws holding armature stop and raise or lower the stop. Tighten the screws and recheck the gap.

GENERATOR CURRENT AND VOLTAGE REGULATOR

d. **Circuit Breaker Contact Point Gap.** With spring tension on armature and with armature against the stop, measure the gap between both sets of contacts. This gap should be 0.025 inch minimum, but may be larger than this after adjustment. If necessary, bend the stationary contact bracket with long-nose pliers to secure the proper contact adjustment.

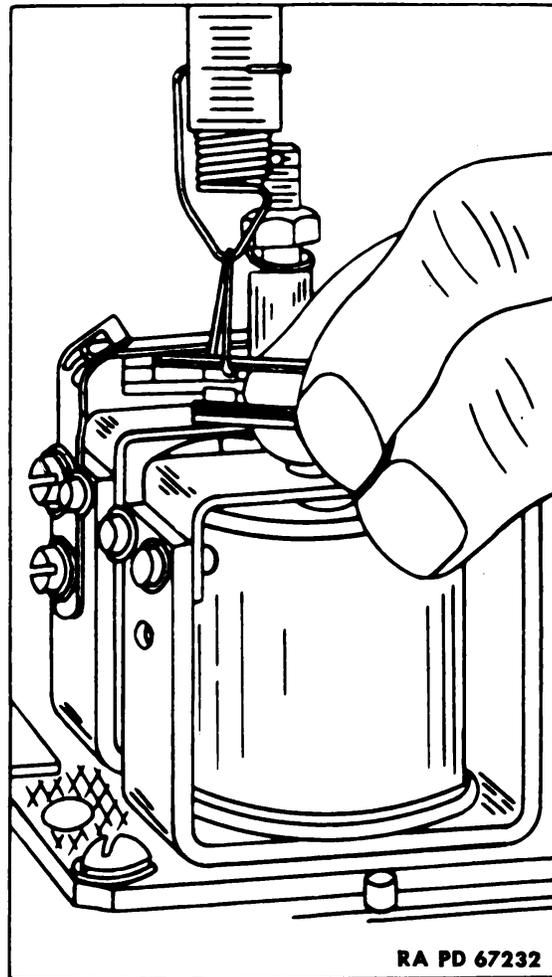


Figure 132—Checking Regulator Contact Pressure

e. **Voltage Regulator Contact Point Gap.** Hold the armature down against the stop, being careful not to touch contact spring. Measure the gap between the contacts. If this gap is not between 0.008 inch and 0.015 inch, inspect the bridge carrying the nickel iron magnetic shunt to make sure it has been pushed down and does not interfere with armature. Loosen the screws if necessary, and change position of the bridge. If gap is still outside the limits replace the unit or voltage regulator.

f. **Current Regulator Contact Point Gap.** This procedure is the

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same as that described for voltage regulator except the limits are 0.025 inch to 0.035 inch.

g. Current and Voltage Regulator Contact Pressure Test. Connect a battery and lamp bulb in series with regulator "A" and "F" terminals (fig. 129). Remove adjusting nut from armature spring and take off adjustable point stop. Hold armature firm, hook a spring scale to upper

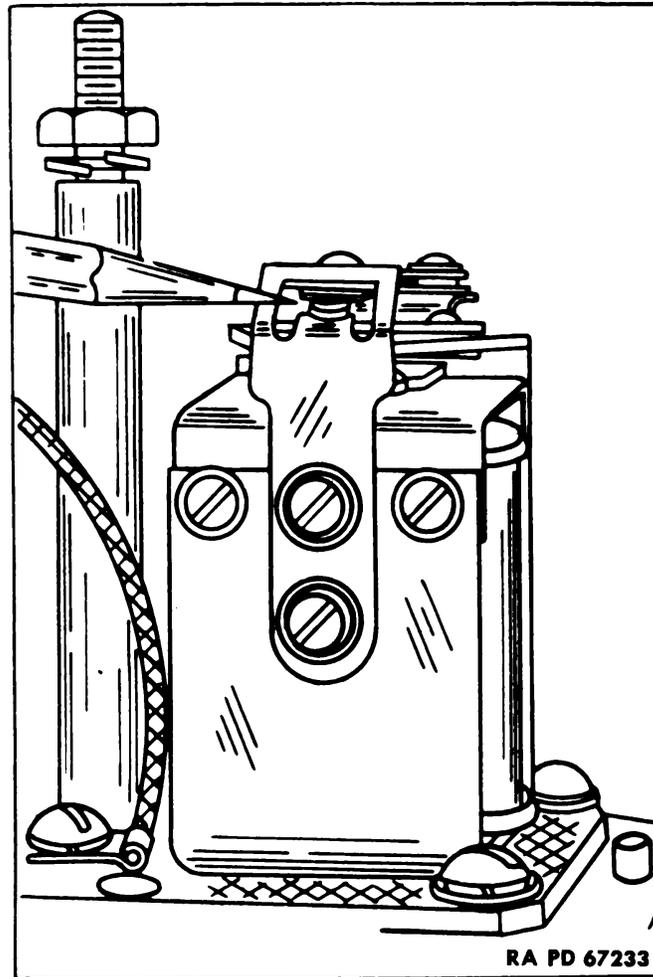


Figure 133—Regulator Fiber Bumper Block Location

contact, and pull contacts apart (fig. 132). Take reading on spring scale just as contacts separate, as indicated by light going out. If tension is not between 7 and 8 ounces, replace regulator armature. Reassemble the armature stop making sure the fiber bumper block is in place (fig. 133). Install armature spring and adjusting nut.

h. Regulator Final Test. Battery must read between 1.275 to 1.280, if not, recharge or replace battery. Before running engine, first polarize the generator with battery by making a momentary connection with

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a short lead from "armature" to "battery" terminals. Then run the engine for 15 minutes before taking meter reading. With generator charging 10 amperes the voltmeter should show a reading according to the specification figures given for the regulator under test. Place the cover and new gasket on voltage regulator and install nuts with lock washers and tighten securely. Place a seal wire through holes in studs, install a seal, and clamp securely to seal wire. Install engine compartment lid and tighten wing nuts.

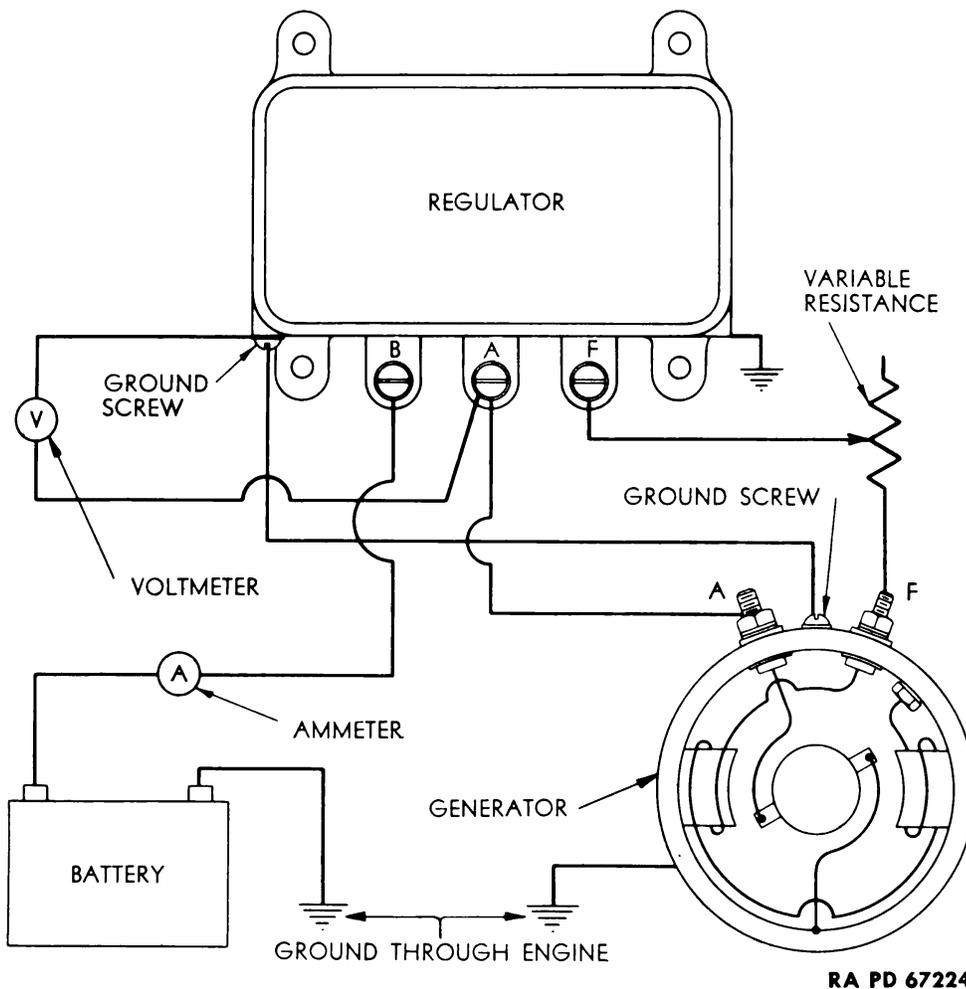


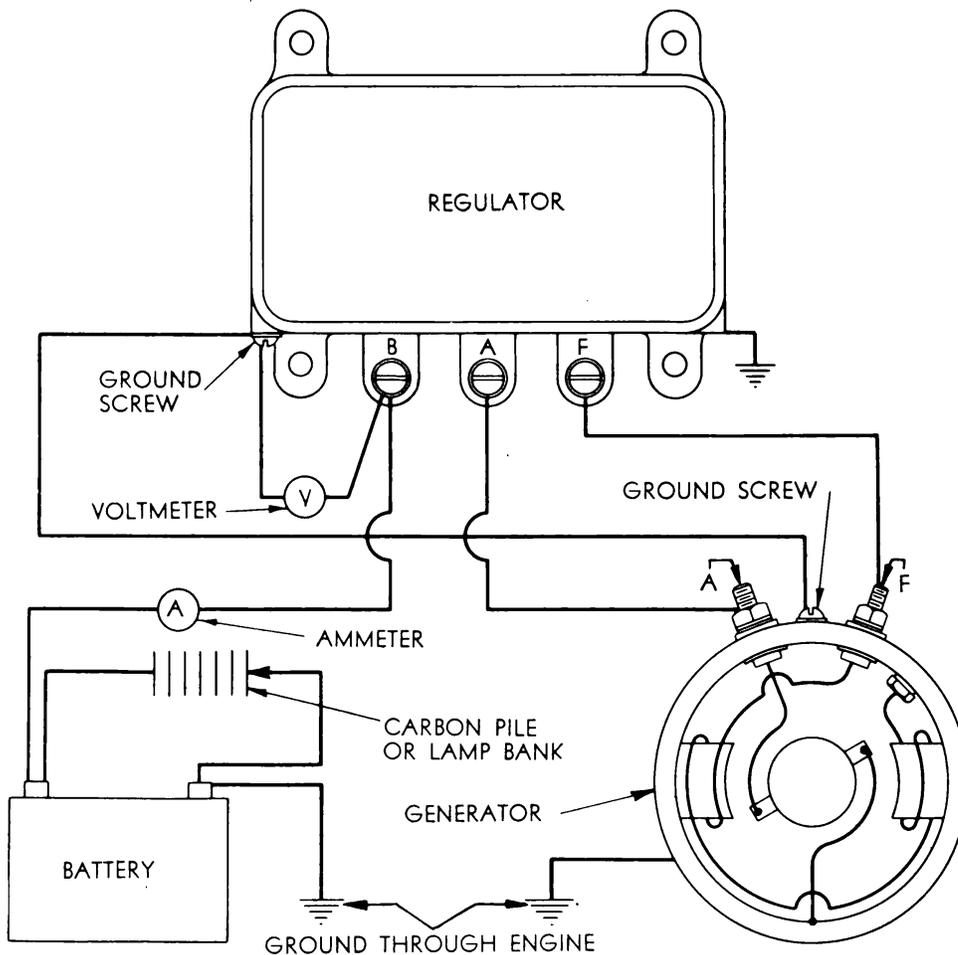
Figure 134—Wiring Diagram for Testing Regulator Operation

166. OPERATION.

a. Circuit Breaker Operation. Remove lead from regulator battery terminal, and connect an ammeter in series between regulator battery terminal and lead. Connect a voltmeter between regulator ground screw and regulator armature terminal. Disconnect lead from regulator field terminal, connect a variable resistance in series between regulator field

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terminal and lead removed from terminal (fig. 134). Run generator at 1000 rpm, place all resistance in field circuit, then slowly reduce resistance and note voltage reading just before it changes when circuit breaker closes. The circuit breaker closes at approximately 13.0 to 13.5 volts. Increase charging rate to 20 amperes, then reduce charging rate by placing resistance in field circuit. Note amperage discharge just before circuit breaker opens and ammeter reading drops to zero. The



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Figure 135—Wiring Diagram for Testing Voltage Regulator Operation

circuit breaker opens at approximately 0.5 to 6.0 amperes discharge. Adjust, repair, or replace regulator assembly if operation is not satisfactory.

b. Voltage Regulator Operation. Remove lead from regulator battery terminal, connect an ammeter in series between regulator battery terminal and lead. Connect a voltmeter between regulator battery ter-

GENERATOR CURRENT AND VOLTAGE REGULATOR

minal and regulator ground screw (fig. 135). Run generator and turn on lights or defroster so generator charges about 20 amperes. A carbon pile rheostat connected across battery terminals facilitates control of output. Warm regulator at this rate for 25 minutes and hang a thermometer about 2 inches from regulator. Reduce engine speed and then increase it to approximately 2500 generator rpm. Adjust output to 20 amperes and note voltmeter reading. The correct voltage for various temperatures is listed below (allowable variation plus or minus 0.25 volts).

Temp. F.—	50°	60°	70°	80°	90°	100°	110°	120°
Volts—	14.31	14.28	14.25	14.22	14.19	14.16	14.13	14.10

If the voltage is not within the limits, adjust, repair, or replace regulator assembly.

c. Current Regulator Operation. Remove lead from regulator battery terminal, connect an ammeter in series between regulator battery terminal and lead. Connect a voltmeter between regulator battery terminal and regulator ground screw (fig. 135). Run generator approximately 3000 generator rpm, turn on lights or defroster, or adjust load across battery terminals so voltage is 13.75 to 14.0 volts. The correct ammeter reading is 39.0 to 41.0 amperes. If the ammeter reading is not within the limits, adjust, repair, or replace regulator assembly.

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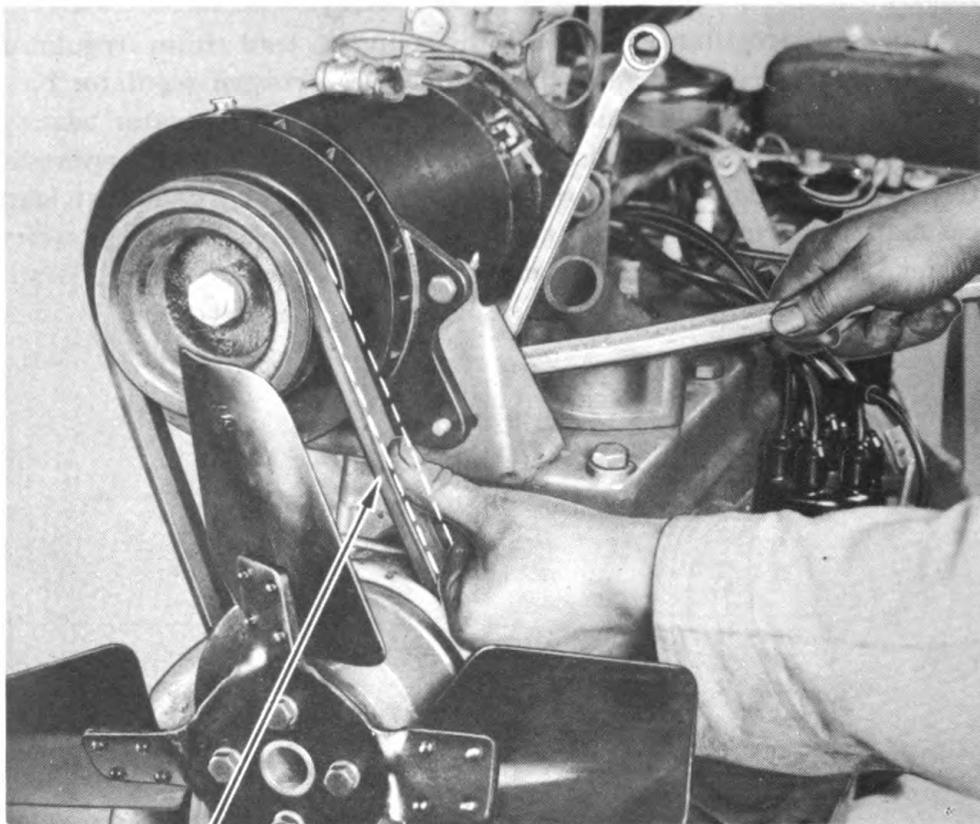
Section VII

GENERATOR DRIVE BELT

	Paragraph
Description	167
Removal	168
Inspection	169
Installation	170

167. DESCRIPTION.

- a. A V-type, thermoid belt is used to drive the generator. The belt is driven by the inner pulley on the water pump shaft.



1/2" BELT DEFLECTION

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Figure 136—Generator Belt Adjustment

168. REMOVAL.

- a. Remove engine compartment lid by loosening wing nuts, lift the lid from slots in coaming on right side and remove from vehicle. Loosen lock nut and cap screw on outer flange of water pump pulley, turn fan blades clockwise to reduce water pump and fan drive belt tension and remove belt from pulleys. Loosen bolt nuts holding generator in posi-

GENERATOR DRIVE BELT

tion, allowing it to move downward to relieve generator drive belt tension, and remove belt from pulleys.

169. INSPECTION.

a. Inspect belt for broken cords, or an oil-soaked condition. Replace belt if not satisfactory for further service.

170. INSTALLATION.

a. Place generator drive belt in position on pulleys. Lift generator until proper belt tension is obtained, and tighten bolt nuts holding generator in position. Adjust belt until it can be deflected $\frac{1}{2}$ inch, either up or down, with finger pressure (fig. 136). Turn fan blades counter-clockwise while holding fan pulley outer flange stationary until proper fan belt tension is obtained, tighten set screw on outer flange securely, making sure that the screw enters one of the grooves in pulley hub, and tighten lock nut. Install engine compartment lid and tighten wing nuts securely.

CHAPTER 7
COOLING SYSTEM

Section I

DESCRIPTION AND DATA

	Paragraph
Description	172
Data	173

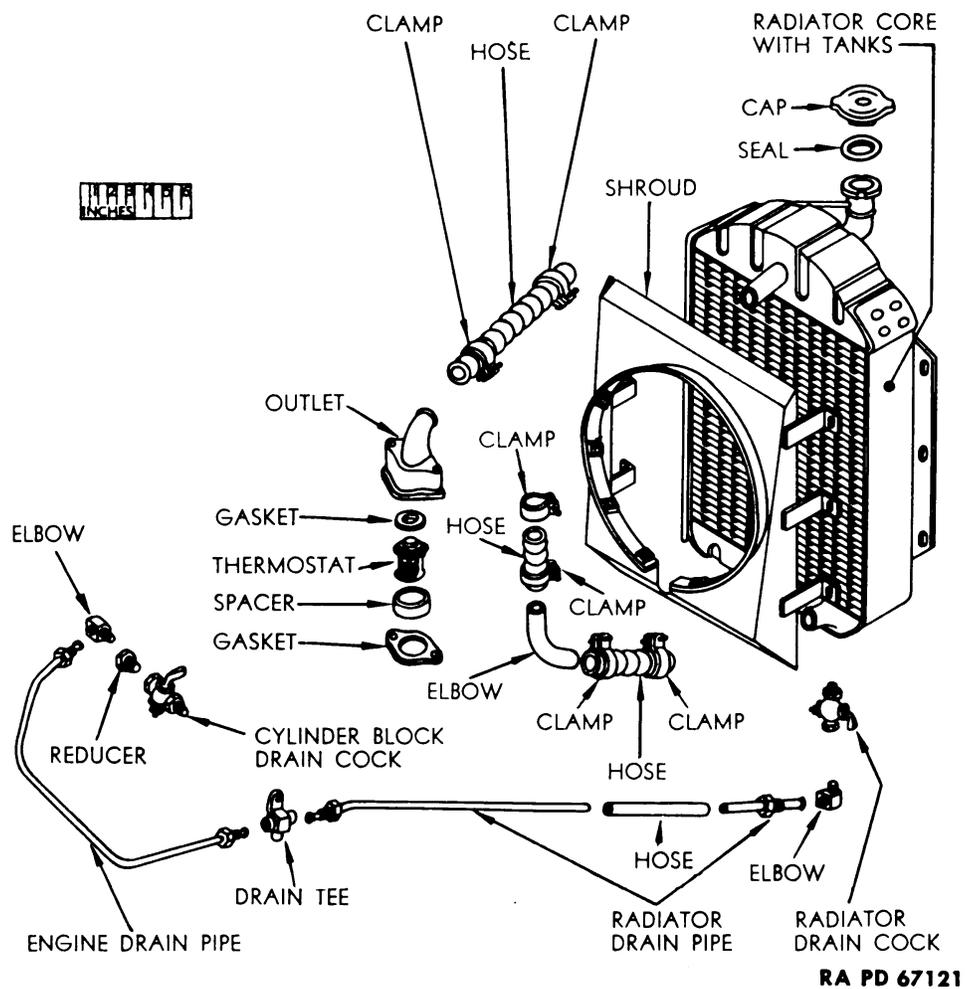


Figure 137—Cooling System Parts

172. DESCRIPTION.

a. The liquid-type cooling system of this vehicle consists of radiator, fan, water pump, thermostat and engine water jacket (fig. 137). Circulation of the solution is actuated by the water pump. When the engine is operated the water pump operates also. The solution temperature is

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controlled by a thermostat located on the cylinder head water outlet, and is closed at temperatures below 174 F. Circulation is not set up within entire cooling system until the thermostat valve opens.

173. DATA.

System	Pump-circulated and thermo- statically controlled
Water pump	Belt-driven from crank shaft pulley
Fan	4-blade conventional type
Capacity	10½-qt

Section II
TROUBLE SHOOTING

Trouble shooting 174

174. TROUBLE SHOOTING.

a. Cooling System Leaks.

Possible Cause	Possible Remedy
Radiator leaks.	Repair or replace.
Leaks at drain cocks.	Tighten or replace.
Water pump leakage.	Repair or replace.
Cooling system gasket leakage.	Install new gaskets.
Cylinder block or head cracked.	Repair or replace.
Loose radiator upper tank baffle plate.	Repair or replace.
Thermostat not operating properly.	Replace.
Engine overheating.	Determine cause and correct.

b. Engine Runs Cool.

Improper thermostatic action.	Replace (pars. 195, 197).
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c. Engine Overheats.

Fan belt slipping.	Tighten or replace (par. 185).
Cooling solution low.	Fill to proper level.
Thermostat inoperative.	Replace (pars. 195, 197).
Thermostat incorrectly installed.	Install properly (pars. 195, 197).
Deteriorated or collapsed inlet hose.	Replace (pars. 176, 179).
Pump impeller loose on shaft.	Repair or replace (pars. 189, 192).
Fan blades improperly installed.	Install properly (pars. 181, 186).
Air intake or outlet restricted.	Open.
Cargo or duffel restricting air intake.	Remove cargo.

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d. Noisy Fan.

Possible Cause	Possible Remedy
Loose fan blades.	Tighten (par. 186).
Bent or distorted fan blades.	Repair (pars. 181, 186).

e. Noisy Fan Belt.

Belt too tight.	Adjust (par. 185).
Belt too loose.	Adjust (par. 185).
Grease, rust or foreign matter on belt or pulley.	Clean or replace (par. 184).
Belt worn or frayed.	Replace (pars. 182, 185).
Fan pulleys misaligned.	Align.

f. Noisy Water Pump.

Pulley hub loose on pump shaft.	Replace parts as required (pars. 189, 192).
Impeller loose on shaft.	Replace (pars. 189, 192).
Impeller blades rubbing pump housing.	Repair or replace (pars. 189, 192).
Impeller pin sheared or broken.	Replace (pars. 189, 192).

Section III
RADIATOR

	Paragraph
Description	175
Removal	176
Cleaning	177
Test and inspection	178
Installation	179

175. DESCRIPTION.

a. The radiator is of the conventional tubular type. Cooling fins are used to assist in dissipating heat from the solution as it circulates through the radiator tubes to maintain normal solution temperature. The radiator is provided with a self-sealing cap.

176. REMOVAL.

a. **Remove Air Duct Lid and Shaft.** Remove nut, bolt and lock washer from air duct lifting arm. Remove nut and bolt from left side of cross shaft, slide lever assembly from driver's compartment. Remove the two bolts on cross shaft flange bracket, remove cotter pins from cross shaft and lift shaft out of air duct. Remove lid hinge screws from lid, lift lid and arm out of air duct.

b. **Drain Radiator.** Loosen wing nuts and remove engine compartment lid. Remove hull drain plate screws, plate, and gasket from bottom of hull near right center of engine compartment. Remove radiator cap to unseal cooling system and open drain valve at radiator outlet pipe on lower right corner of radiator in air duct. Close drain valve, install a new drain plate gasket after applying waterproof compound, plate, screws, and tighten securely.

c. **Remove Radiator and Fan Shroud.** Loosen clamp screws on inlet, outlet, and drain hoses. Remove cap screws, flat washers and lock washers (located inside of air duct) which attach radiator to hull frame. Remove radiator from vehicle through air duct (fig. 138). The fan shroud is held in position by the radiator core cap screws and can be removed after the radiator core is out of vehicle.

177. CLEANING.

a. With radiator out of vehicle thoroughly clean it by reverse flushing with cleaning solution until all evidence of rust and other foreign material is removed. To clean the outside of radiator use power washing equipment to remove any material lodged between tubes and cooling fins.

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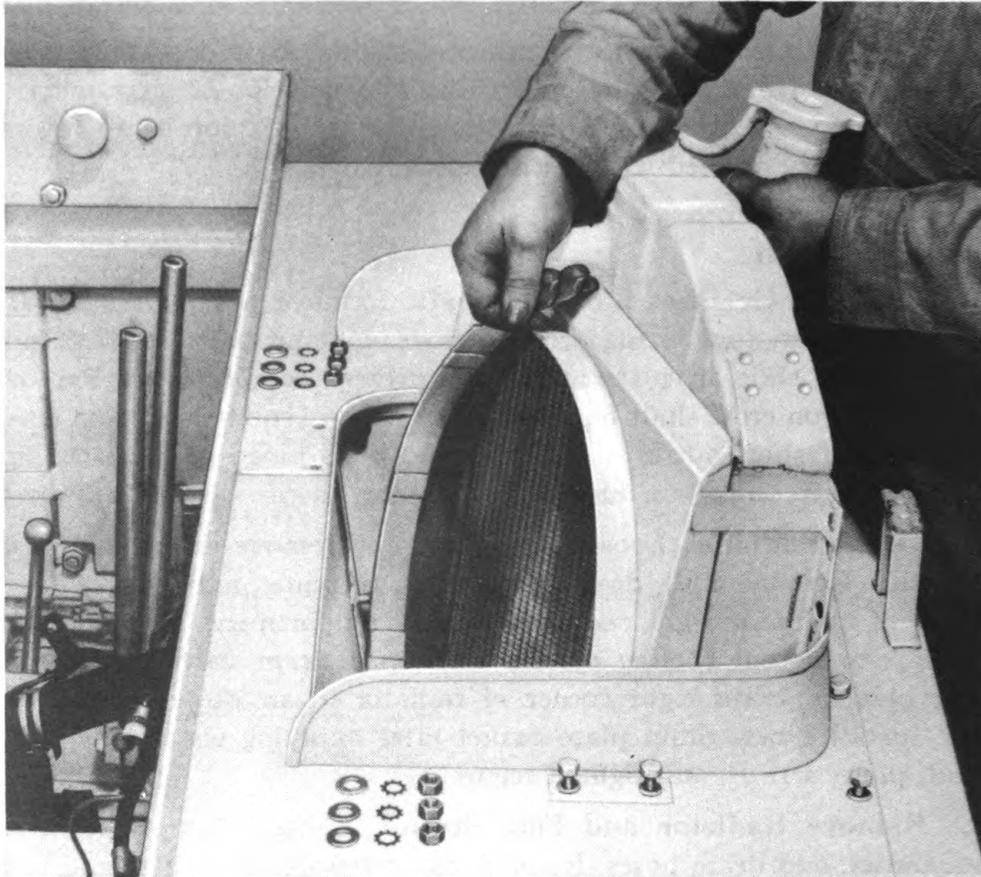
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178. TEST AND INSPECTION.

a. Pressure test the radiator to locate leaks and repair or replace. If repaired, test radiator again to determine if satisfactory for further service.

179. INSTALLATION.

a. **Install Radiator.** Place radiator and fan shroud in position, aline holes in the hull with those in fan shroud and radiator flange. Install



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Figure 138—Radiator Removal

bolts, flat washer, lock washers and nuts, and tighten securely. Use liquid soap when installing hoses to radiator and engine. Place hose clamps with bolt and nut on hose before installing to radiator. Tighten hose clamps securely. Close drain valve at lower right hand corner of radiator. When filling the cooling system, it will be found that as much as a gallon of solution can be added after the engine has been operated long enough to open thermostat and bleed off the air trapped in cooling system.

RADIATOR

b. **Install Air Duct Lid and Shaft.** Place the air duct lid in position, install hinge screws, and tighten securely. Slide shaft through left side of air duct, install bracket on shaft, slip shaft through lid operating arm, and into bracket on right side of air duct. Install a new cotter pin through right end of shaft, move bracket to left wall and start cap screws. Position lid arm properly on shaft, install bolt and nut, and tighten securely. Tighten bracket cap screws securely.

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Section IV

FAN AND BELT

	Paragraph
Description	180
Removal of fan blades	181
Removal of fan belt	182
Cleaning of fan blades	183
Inspection of fan blades and belt	184
Installation of fan belt	185
Installation of fan blades	186

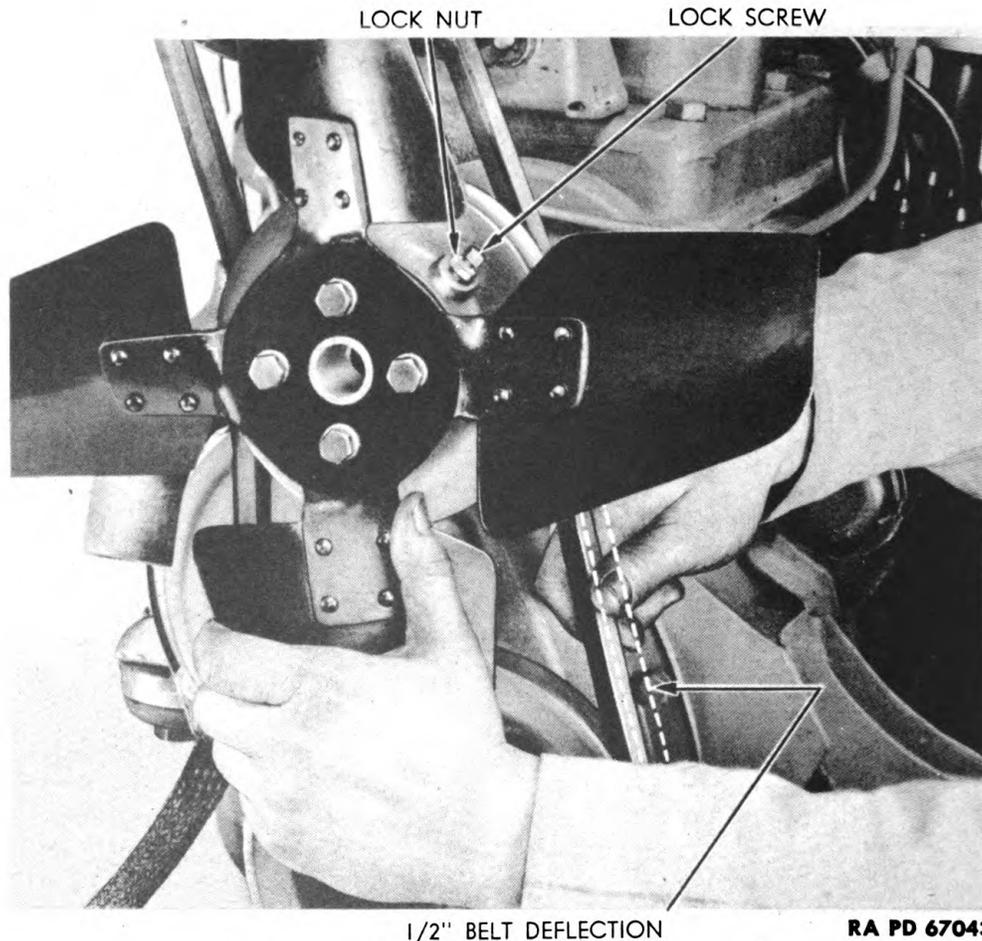


Figure 139—Fan Belt Adjustment

180. DESCRIPTION.

a. A four-blade fan is mounted on the hub of the water pump pulley, and is driven by a V-type belt. The water pump and fan belt pulley inner flange is an integral part of the pulley hub, and the pulley

FAN AND BELT

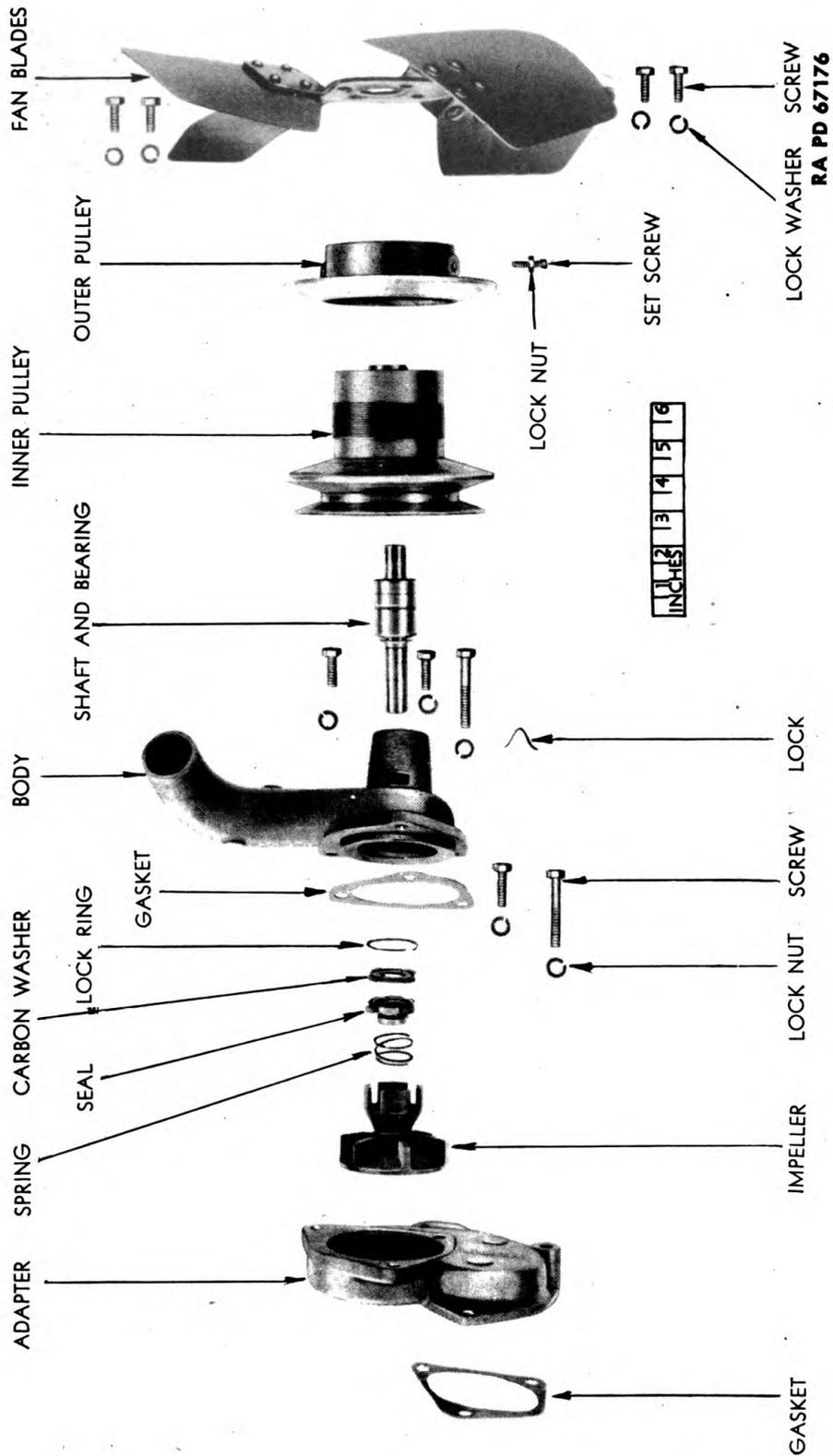


Figure 140—Water Pump, Pulley, and Fan Disassembled

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outer flange is threaded on the pulley hub. Turning the outer flange clockwise will increase the belt tension; turning it counterclockwise will decrease the belt tension.

181. REMOVAL OF FAN BLADES.

a. Loosen wing nuts on engine compartment lid and lift lid out of vehicle. Remove cap screws with lock washers holding fan blades to water pump pulley hub and remove the blades.

182. REMOVAL OF FAN BELT.

a. Loosen set screw in outer flange of forward pulley and turn flange counterclockwise. This will relieve belt tension, and belt can be lifted from crankshaft and water pump pulley.

183. CLEANING OF FAN BLADES.

a. Wash fan blades with SOLVENT, dry-cleaning, and dry with clean cloth or compressed air.

184. INSPECTION OF FAN BLADES AND BELT.

a. Inspect fan blades for proper pitch, cracks at mounting holes or other damage. Examine fan belt for broken cords or oil-soaked condition. Replace parts not satisfactory for further service.

185. INSTALLATION OF FAN BELT.

a. Place fan belt in position on crankshaft and water pump pulleys. Turn outer flange of water pump pulley clockwise to obtain proper belt tension, $\frac{1}{2}$ -inch deflection when pressed with forefinger (fig. 139), and tighten outer flange set screw securely. Make sure the set screw enters one of the grooves in pump pulley hub and lock set screw.

186. INSTALLATION OF FAN BLADES.

a. Place fan blades in correct position on water pump pulley hub and install lock washers with cap screws and tighten securely.

Section V
WATER PUMP

	Paragraph
Description	187
Removal	188
Disassembly	189
Cleaning	190
Inspection	191
Assembly	192
Installation	193

187. DESCRIPTION.

a. The water pump used on this vehicle is of the ball-bearing, pre-lubricated shaft type with a nonadjustable packing (fig. 140).

188. REMOVAL.

a. **Drain Radiator.** Drain radiator as outlined in paragraph 176.

b. **Remove Belts.** Take out cap screws and remove fan blades. Loosen set screw in outer flange of forward pulley, turn pulley outer flange counterclockwise to relieve fan belt tension and remove belt. Loosen generator retaining bolts and remove generator drive belt.

c. **Remove Radiator Hose.** Loosen hose clamp screws and remove hose from water pump, remove cap screws holding water pump to cylinder block, and remove water pump with gasket from block (fig. 141).

189. DISASSEMBLY.

a. Take out cap screws and remove impeller housing with gasket from pump body. Press pump shaft out of pulley hub and remove bearing lock ring from pump body. Press pump shaft with bearing out of impeller and pump body.

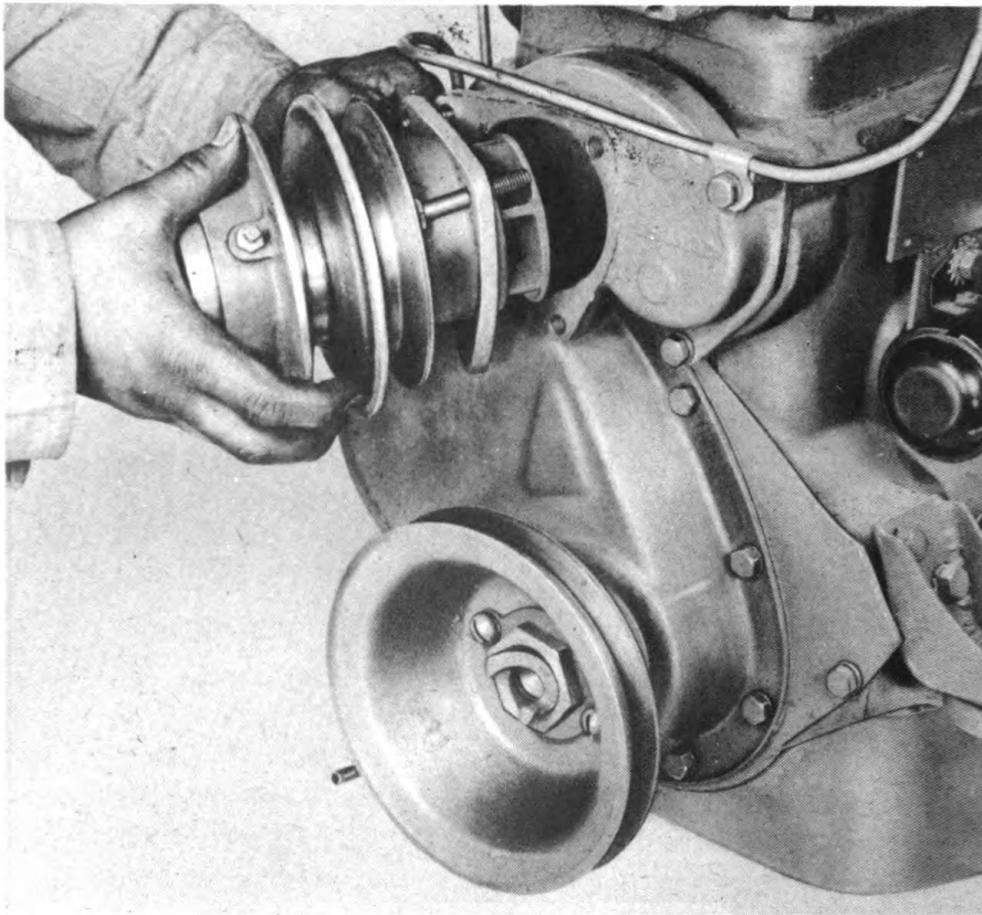
190. CLEANING.

a. Clean the impeller housing and pump body thoroughly with SOLVENT, dry-cleaning, and dry with compressed air. Clean pump shaft, using a cloth dampened with SOLVENT, dry-cleaning, and dry with a clean cloth.

191. INSPECTION.

a. Inspect the impeller housing and pump body for cracks, sand holes, or damage, and replace if not satisfactory for further service. If the thrust seal surface in pump body is rough or pitted, reface it with

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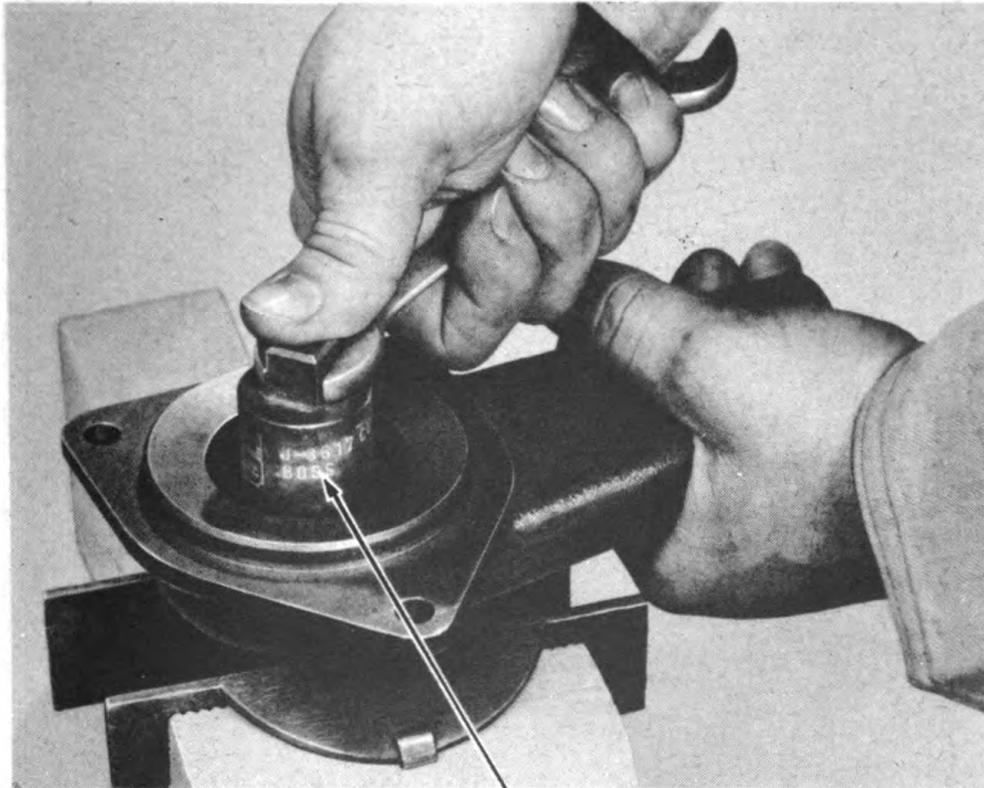
Figure 141—Water Pump Removal

water pump facing cutter KM-J3617 (fig. 142). If prelubricated bearing is dry or the shaft is scored, replace it. Examine seals for roughness or other damage and replace if not fit for further service. Inspect the impeller for cracks or damage and replace if required. Examine the seal spring for pits or distortion and replace if not satisfactory for further service.

WATER PUMP

192. ASSEMBLY.

a. Press the pulley hub on pump shaft until outer end of hub is flush with end of shaft. Install shaft with bearing and pulley hub in pump body and insert lock ring. Install spring, seals, and retaining ring in impeller. Press impeller on shaft until there is $\frac{1}{32}$ -inch clearance between impeller and body. Test assembly before installing to cylinder



WATER PUMP FACING CUTTER KM-J3617

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Figure 142—Refacing Water Pump Seal Surface

block to make sure there is no scraping noise, and that shaft rotates freely. Place a new gasket on pump body, install impeller housing to pump body with cap screws and tighten securely.

193. INSTALLATION.

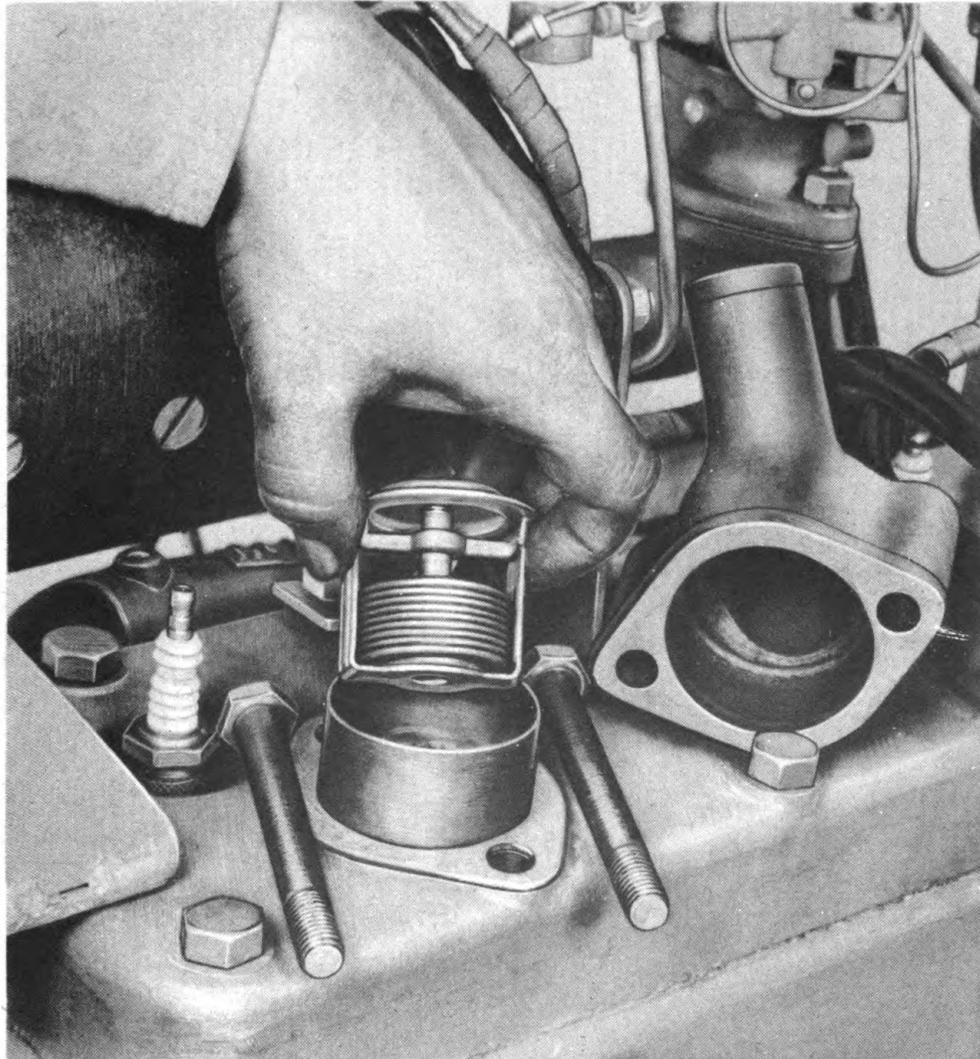
a. Install a new gasket on cylinder block, place pump in position on block, install lock washers, cap screws, and tighten securely. Lubricate inside of hose with liquid soap, install hose and tighten clamp screws securely. Place generator drive belt in position on pulleys, raise generator, and tighten retaining bolts so the drive belt has proper tension. Install fan belt on outer pulley, turn flange clockwise to tighten

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fan belt to proper tension. Tighten set screw securely in one of the grooves in pulley hub. Close drain valve at lower right hand corner of radiator. When filling cooling system it will be found that all the solution will not go in. Start engine, allow it to operate long enough to open thermostat and bleed off the air trapped in cooling system, then fill radiator to proper level. Place engine compartment lid in position and tighten wing nuts.

Section VI
ENGINE WATER THERMOSTAT

	Paragraph
Description	194
Removal	195
Inspection and test	196
Installation	197



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Figure 143—Engine Thermostat Removal

194. DESCRIPTION.

a. The thermostat used in this vehicle is of the bellows type and is mounted in the cylinder head water outlet. It is set to start opening at approximately 174 F and is fully opened at 177 F. By constantly open-

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ing and closing, it holds the solution in the engine at the most efficient operating temperature.

195. REMOVAL.

a. Drain the cooling system as outlined in paragraph 176. Loosen hose clamp screws and remove outlet to radiator hose, remove cylinder head cap screws holding water outlet to cylinder head. Remove water outlet, gaskets, thermostat sleeve, and thermostat (fig. 143).

196. INSPECTION AND TEST.

a. If the thermostat is known to be faulty, replace it. The best known method of testing the thermostat is to immerse it in water heated to a temperature of 174 F. If valve does not start to open or if it sticks in the fully open position, replace it.

197. INSTALLATION.

a. When installing the thermostat make sure that the bellows are downward and small bypass hole in valve is open. If not installed in this manner the thermostat will be entirely useless, resulting in overheating of solution and engine. Install new gaskets to the flange and sleeve bore. Place water outlet in position, insert cap screws, and tighten to 600 to 650 inch-pounds with a tension wrench. Place hose on water outlet and radiator connection and tighten clamp screws. Fill cooling system to the proper level. Place engine compartment lid in position and tighten wing nuts.

Section VII
FITS AND TOLERANCES

	Paragraph
Cooling system service data	198

198. COOLING SYSTEM SERVICE DATA.

Impeller to pump body clearance	1/32 in.
Fan belt adjustment	1/2 in.
Thermostat starts opening	174 F
Thermostat fully open	177 F

ANTIFREEZE SOLUTION CHART

Temperature—	+20 F	+10 F	0 F	-10 F	-20 F	-30 F	-40 F	-50 F
Antifreeze compound—								
U. S. qt	2	2	3.5	4	4.5	5	6	6.5

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CHAPTER 8

CLUTCH

Section I

DESCRIPTION AND DATA

	Paragraph
Description	199
Data	200

199. DESCRIPTION.

a. The clutch is a single-plate, dry-disk type. A driven member, with suitable facings, contacts the flywheel face and clutch pressure plate. The clutch cover assembly consists of a pressure plate, six pressure springs, release levers, and clutch cover, which is enclosed in the clutch housing bolted to the engine rear plate (fig. 144).

200. DATA.

Make	Borg and Beck
Type	Single-plate, dry-disk
Vibration damper	Yes
Number driving members	Two
Number driven members	One
Number facings	Two
Number of pressure springs	Six
Release bearing	Prelubricated

DESCRIPTION AND DATA

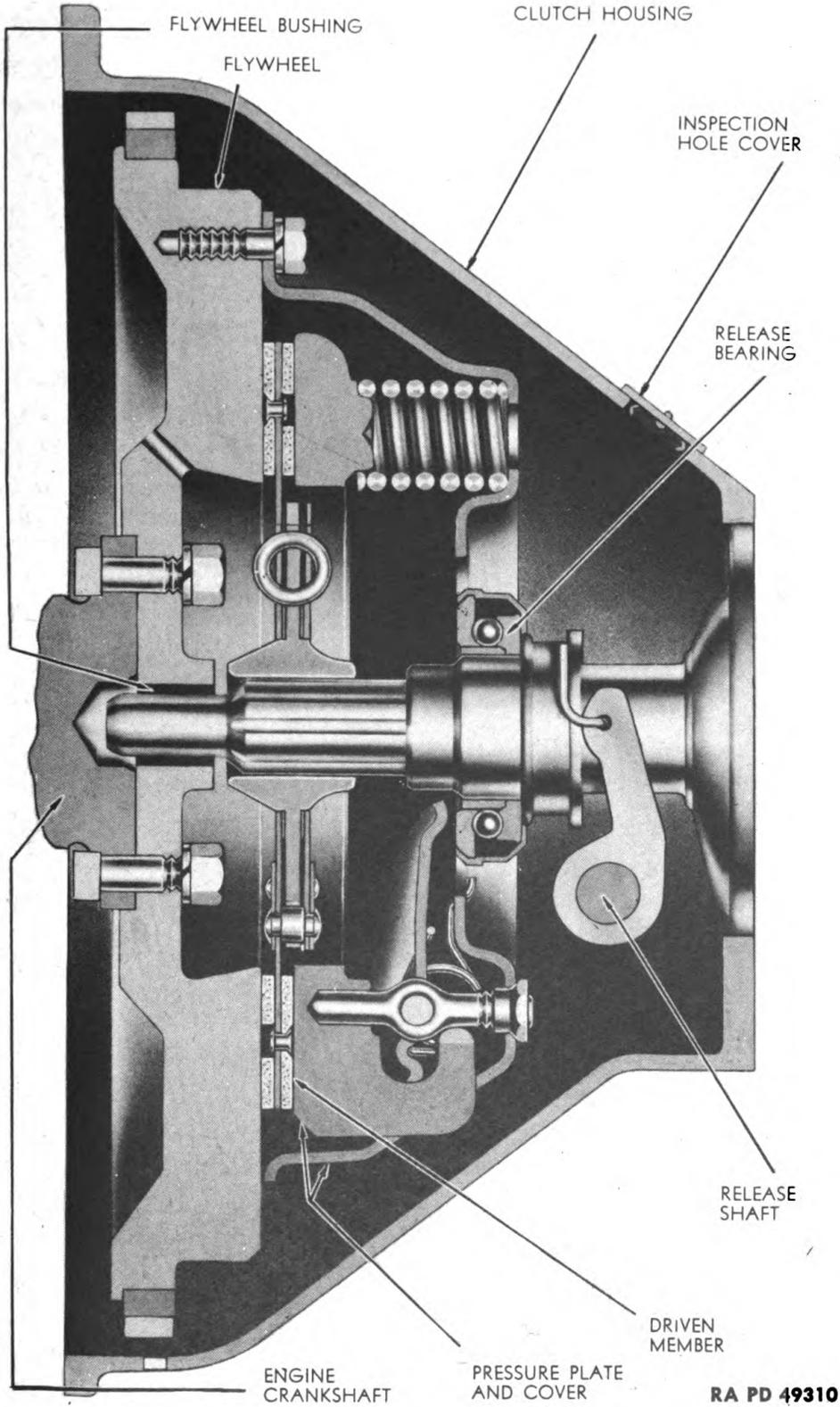


Figure 144—Clutch Assembly Cross Section

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Section II

TROUBLE SHOOTING

Trouble shooting	Paragraph 201
------------------------	------------------

201. TROUBLE SHOOTING.

a. Slipping.

Possible Cause	Possible Remedy
Insufficient clutch pedal clearance.	Adjust clutch pedal clearance (par. 225).
Weak pressure plate spring action.	Replace springs (pars. 210, 213).
Torn clutch facings.	Replace facings (pars. 217, 220).
Grease on clutch facings.	Replace facings (pars. 217, 220).
Worn facings.	Replace facings (pars. 217, 220).
Clutch parts binding.	Clean and lubricate (refer to TM 9-772).

b. Chatter.

Weak springs.	Replace springs (pars. 210, 213).
Oil on facings.	Replace facings (pars. 217, 220).

c. Dragging.

Insufficient clutch pedal travel.	Adjust clutch pedal travel (par. 225).
Driven member splines sticking on pinion.	Clean splines.

d. Noise.

Release bearing noisy.	Replace bearing (pars. 204, 206).
Release bearing worn.	Replace bearing (pars. 204, 206).
Splines of driven member worn.	Replace driven member (pars. 217, 220).

Section III

CLUTCH HOUSING

	Paragraph
Description	202
Removal	203
Disassembly	204
Inspection	205
Assembly	206
Installation	207

202. DESCRIPTION.

a. **Description.** The clutch housing is a bell-shaped casting with machined surfaces at engine and transmission mountings. It is fastened to the engine rear plate and encloses the clutch pressure plate, driven member, flywheel, clutch release shaft, and bearing.

203. REMOVAL.

a. **Support Engine Weight at Rear.** Unhook all lashings from attaching buttons on coaming and remove top and side curtains. Drain radiator as outlined in paragraph 176. Remove cylinder head cap screw (between two rear spark plugs) and install engine lifting eyebolt KM-J3614. Attach a lifting chain and hoist to support weight of engine at rear.

b. **Remove Radio Power Pack.** Disconnect battery ground strap. Take out hull floor pan screws and remove pan. Remove connection from radio power pack, demolition timer control, and radio junction box. Take out screws holding the floor cover over the transmission on which the radio power pack is mounted and remove the assembly.

c. **Remove Transmission.** Disconnect remote control shift rods from transmission shift levers. Remove nuts, lock washer and U-bolt from rear universal joint. Lift rear joint out of axle unit driving flange, pull propeller shaft back and remove from vehicle. Take out cap screws holding engine rear mounting to hull cross member. Remove cap screws and lock washers holding transmission to clutch housing and remove from vehicle.

d. **Remove Clutch Housing.** Disconnect clutch pedal pull back spring. Remove cotter pin and clevis pin from clutch operating linkage at clutch operating shaft lever. Remove bolts holding starting motor to engine rear plate. Remove housing dowel bolts and nuts, and tap dowels forward out of engine rear plate. Remove balance of screws and bolts, remove housing from vehicle.

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204. DISASSEMBLY.

a. Remove the bearing from clutch release shaft assembly by disengaging spring which holds bearing to shaft inner levers. Remove external lever on left end of release shaft by taking out cotter pin, retaining pin, and pull lever off the shaft. Take out cap screw that holds bushing and retainer assembly to housing and remove from housing and end of shaft. Remove shaft assembly through transmission end of housing.

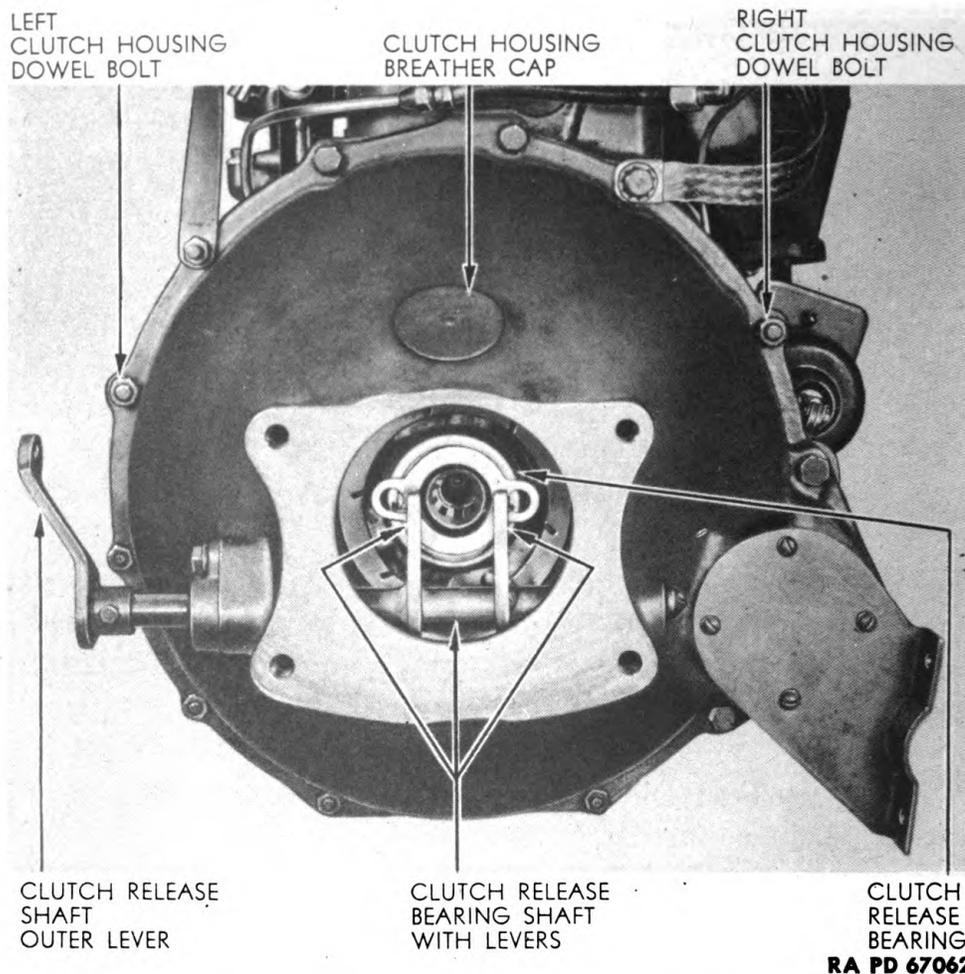


Figure 145—Clutch Release Mechanism

205. INSPECTION.

a. Clean the housing thoroughly with SOLVENT, dry-cleaning. Examine housing carefully for cracks, and machined surfaces for burrs or other damage. Inspect the release shaft for scores or loose levers. Examine release bearing for roughness or damage. Inspect bushings for scores or looseness. Replace any parts not fit for further service.

CLUTCH HOUSING

206. ASSEMBLY.

a. Insert left end of shaft and lever assembly into clutch housing and through hole in left side. Then slip right end of shaft through bushing in right side of housing, place retainer and bushing over right end of shaft, and fasten in position on housing with cap screw. Hook ends of spring (which holds bearing and collar in position) on levers. Place operating lever on release shaft, install retaining pin, and a new cotter pin (fig. 145).

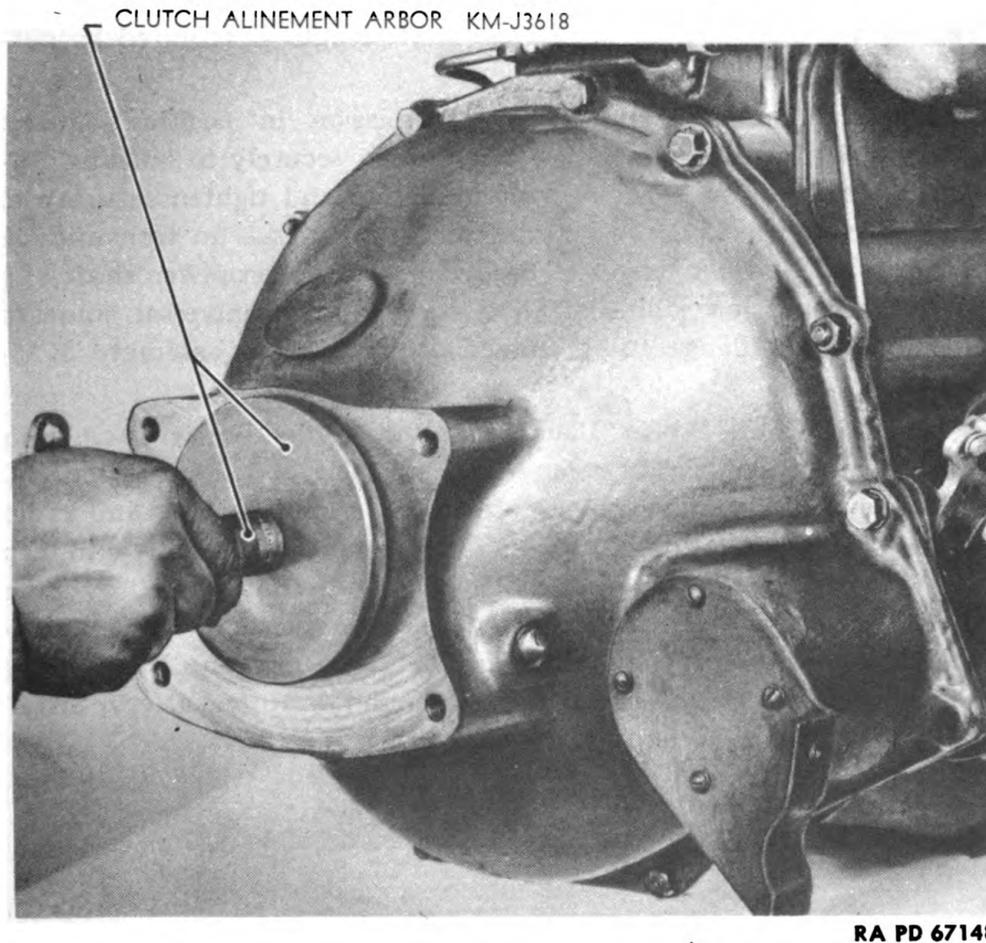


Figure 146—Alining Clutch Housing Using Arbor

207. INSTALLATION.

a. **Install Housing.** Place housing in position against engine rear plate and start a cap screw at the top to preserve general alinement. Move housing as required to line up right and left dowel bolt holes and tap dowel bolts into place from front. When installing a new housing do not place the dowel bolts in position until the housing has been properly alined. Install all bolts, lock washers, nuts, except the starting motor fastening bolts and nuts, and tighten moderately. Install all cap

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screws and tighten moderately. Insert the clutch alinement arbor KM-J3618 through the clutch housing bore until the pin enters the pilot bushing in flywheel, and move the housing as required until alining plate enters the transmission pinion flange bore in the clutch housing (fig. 146). Tighten the cap screws and bolt nuts alternately and progressively to preserve alinement.

b. Connect Clutch Operating Linkage. Install clutch pull back spring to operating lever, connect cable clevis to operating lever with clevis pin and new cotter pin. Adjust cable length if required as outlined in paragraph 225.

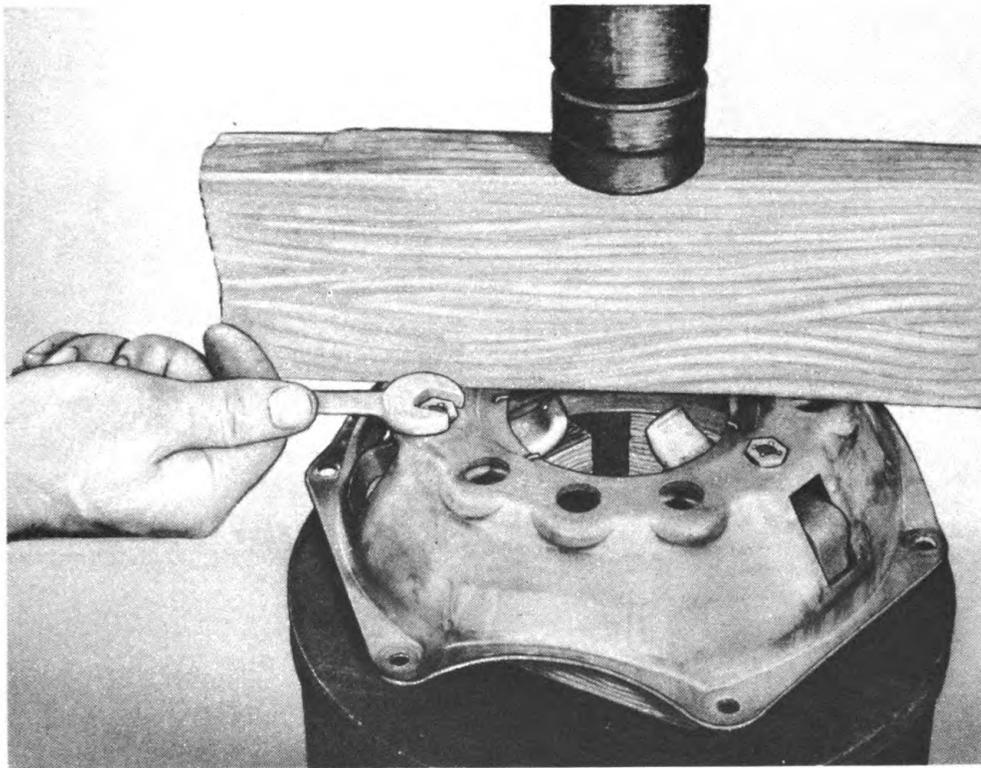
c. Install Transmission. Place transmission in position against clutch housing, install cap screws, and tighten securely to housing. Install cap screws through engine rear mounting and tighten securely to hull cross member. Connect remote control shift rods to transmission shift levers and adjust length if necessary. Install propeller shaft slip joint on transmission mainshaft and connect rear universal joint to axle unit driving flange using universal joint clamp assembly KM-J3620.

d. Install Radio Power Pack. Place the radio power pack with mounting in position, install screws, lock washers, and tighten securely. Install connections to power pack, demolition timer control, and radio junction box. Install hull floor pan and fasten in position with cap screws. Disconnect lift chain and hoist, remove eyebolt, install cylinder head cap screw and tighten with a tension wrench to 600-650 inch-pounds. Install top with side curtains and lash securely. Fill cooling system to proper level. Connect battery ground strap to battery, install engine compartment lid and tighten wing nuts.

Section IV

CLUTCH COVER WITH PRESSURE PLATE

	Paragraph
Description and data	208
Removal	209
Disassembly	210
Cleaning	211
Inspection	212
Assembly	213
Installation	214



RA PD 67004

Figure 147—Compressing Cover Springs

208. DESCRIPTION AND DATA.

a. **Description.** The clutch pressure plate assembly consists of cover with release levers, pressure springs, and pressure plate proper.

b. Data.

Make Borg and Beck
Number of pressure springs Six

209. REMOVAL.

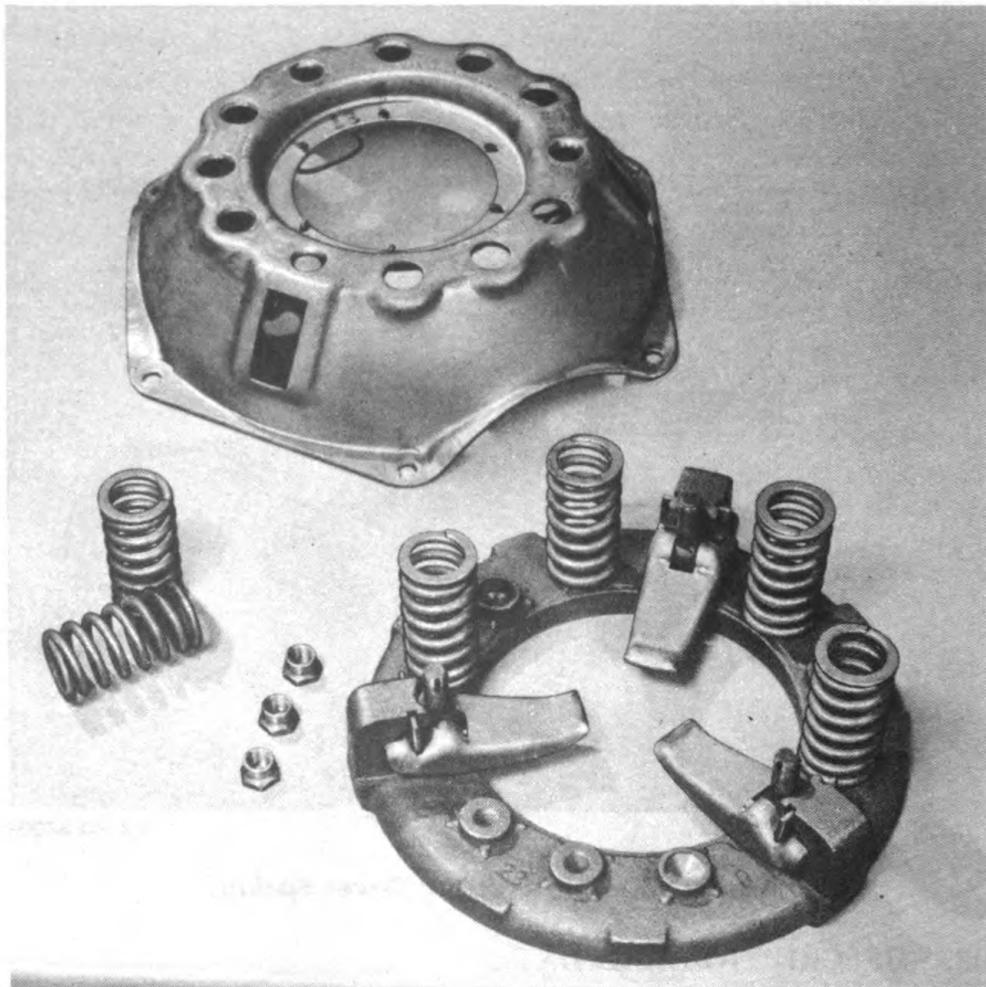
a. Remove clutch housing as outlined in paragraph 203. Loosen,

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progressively each of the pressure plate cover to flywheel cap screws by turning only $\frac{1}{2}$ turn at a time, to prevent clutch springs from distorting cover flange. After loosening cap screws until all pressure has been relieved, remove cap screws and pressure plate assembly.

210. DISASSEMBLY.

a. To disassemble the clutch pressure plate, use a hacksaw to break away the seal of the release lever nuts. Place pressure plate assembly on

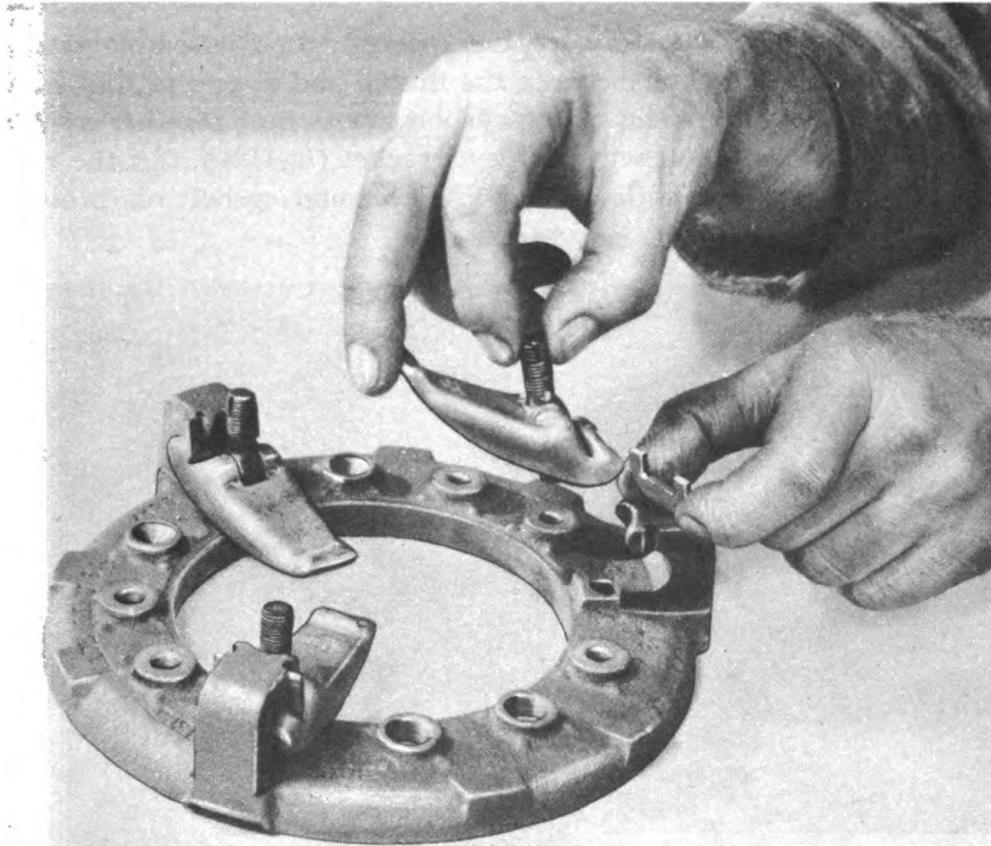


RA PD 67007

Figure 148—Cover Removed from Pressure Plate Assembly

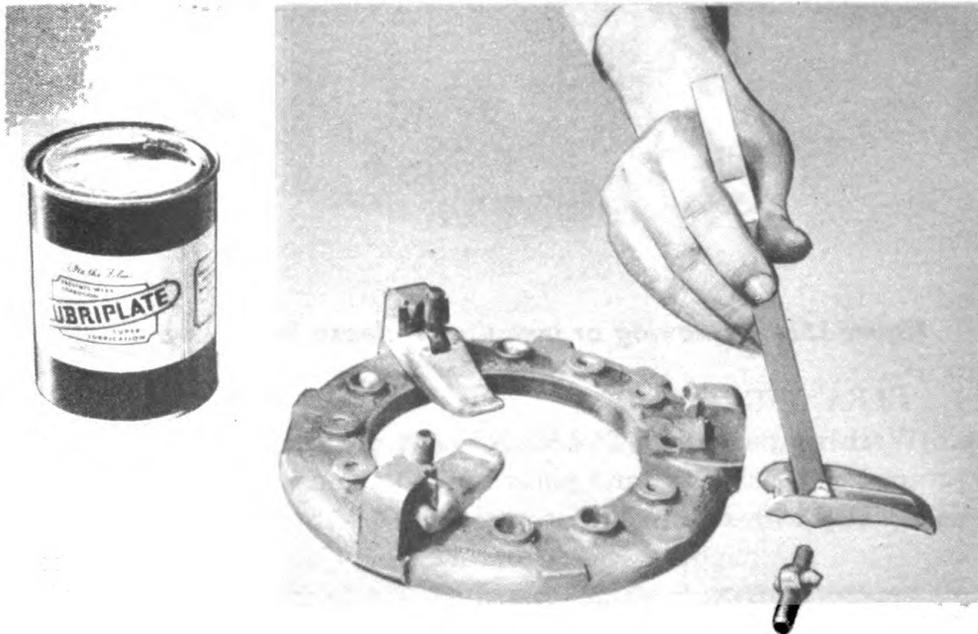
bed of an arbor press with a block of hardwood under pressure plate, so clutch cover is free to move up and down. Place a block of hardwood across top of cover, resting on spring bosses. Compress assembly with arbor press (fig. 147) and back off adjusting nuts. Release the arbor press pressure slowly to prevent springs from flying out, and lift

CLUTCH COVER WITH PRESSURE PLATE



RA PD 67005

Figure 149—Release Lever and Eyebolt Removal



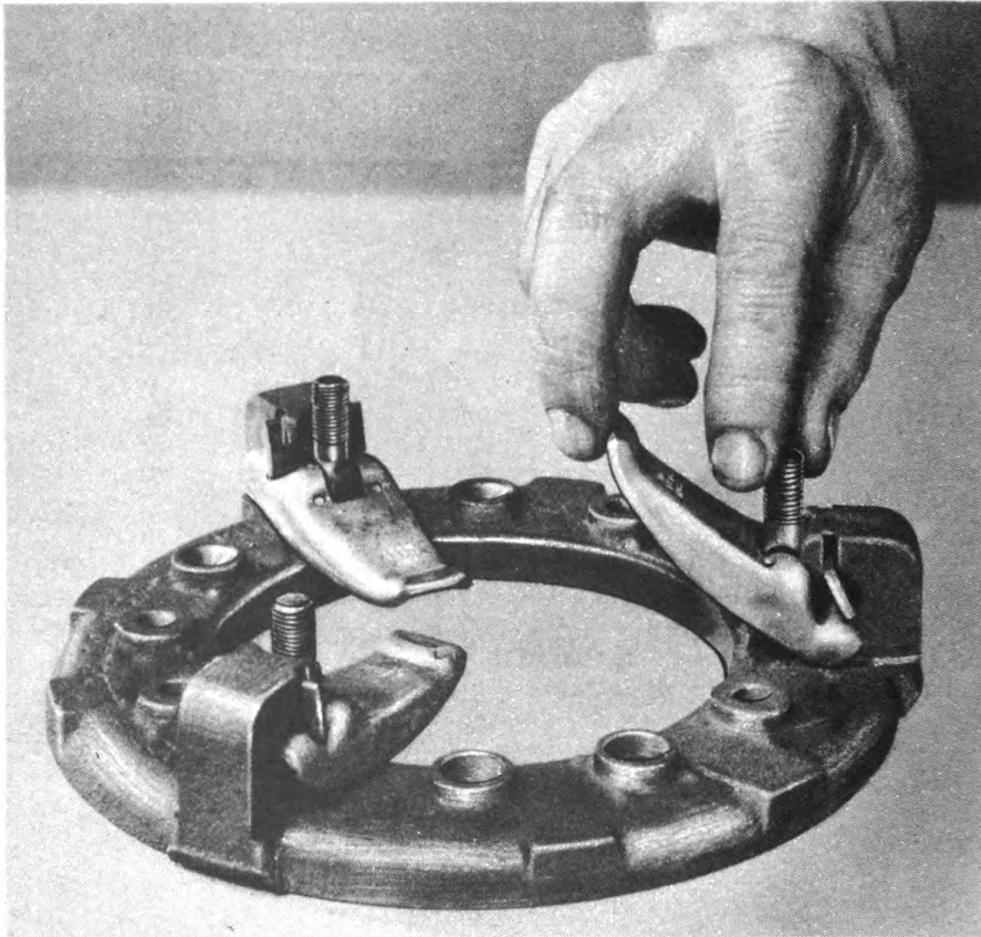
RA PD 67006

Figure 150—Lubricating Pressure Plate Lugs

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210-212

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off the cover (fig. 148). Remove the springs and disassemble release levers by grasping eyebolt between the thumb and fingers so that inner end of lever and upper end of the eyebolt are as near together as possible, keeping the eyebolt seated in lever socket (fig. 149). Lift the strut over the ridge on end of lever and lift lever and eyebolt off pressure plate.



RA PD 66965

Figure 151—Removing or Installing Release Lever in Eyebolt

211. CLEANING.

a. Wash all parts with SOLVENT, dry-cleaning. Any grease should be scraped or brushed off and parts washed again with SOLVENT, dry-cleaning. Dry with clean cloth or compressed air.

212. INSPECTION.

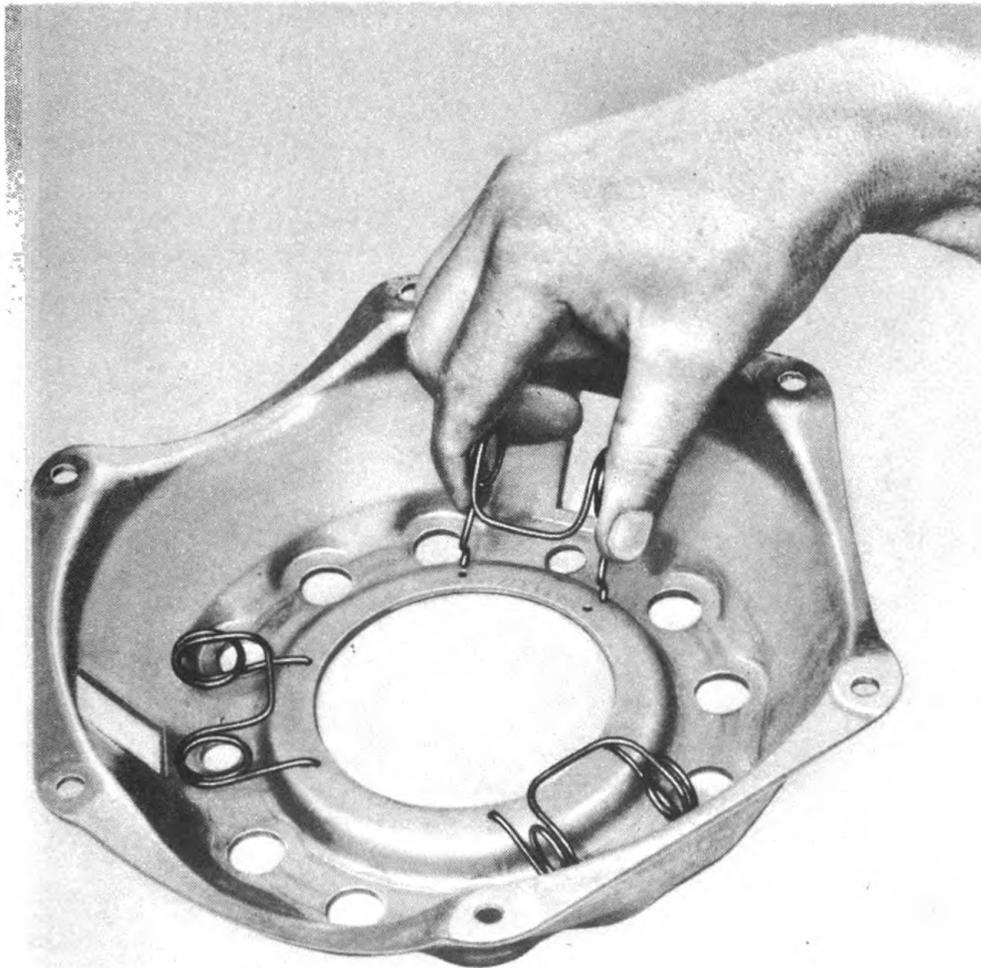
a. Inspect for cracks or distortion of cover: cracks, breaks, scores, or distortion of pressure plate, damaged release fingers, eyebolts and struts. Compress pressure springs with a suitable tester to a length of

CLUTCH COVER WITH PRESSURE PLATE

1½ inches. Satisfactory springs will require from 135 to 145 pounds pressure to compress. Replace any parts not satisfactory for further service.

213. ASSEMBLY.

- a. Insert lower end of eyebolt in hole in pressure plate and lubricate lug (fig. 150). Assemble release lever and eyebolt, holding lever and



RA PD 67009

Figure 152—Installing Release Lever Return Springs in Cover

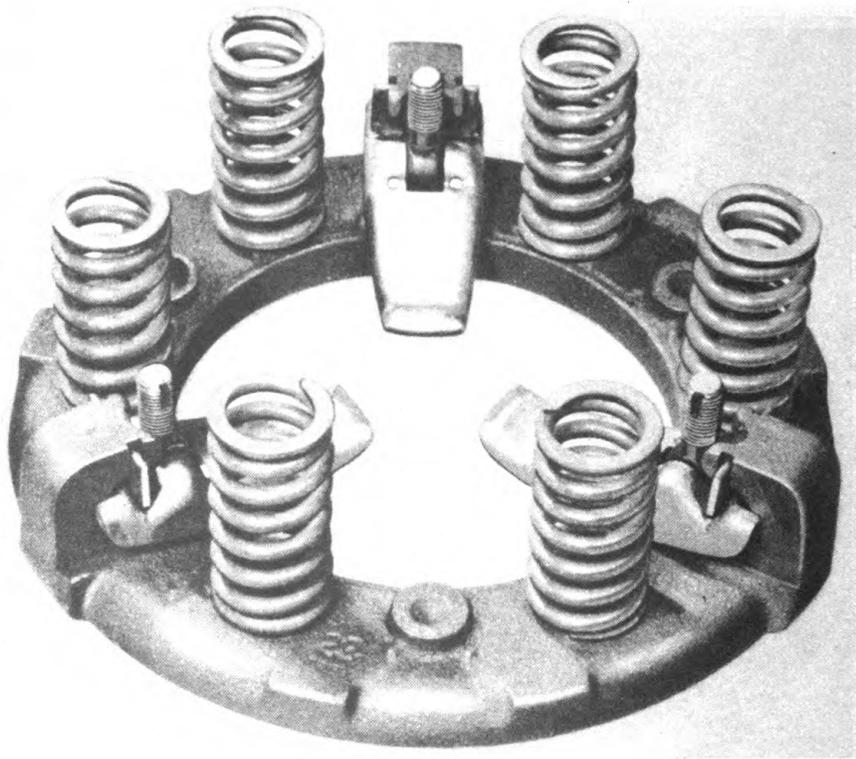
eyebolt as close together as possible (fig. 151). Insert strut in slots of pressure plate lug, drop slightly and tilt lower edge until it touches the vertical milled surface of lug. Slide strut upward in slots of lug, lift over ridge on short end of lever, drop into groove in lever.

- b. Assemble pressure springs (fig. 152) on pressure plate (fig. 153). Place cover on top of pressure plate. Mount driven member and pres-

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sure plate assembly on holding fixture and slowly compress cover, making sure eyebolts and pressure plate lugs are guided through holes in cover. Hold clutch under compression and tighten the adjusting nuts until flush with top of eyebolts. Depress levers several times with a hammer handle to settle parts into position (fig. 154).

c. Adjust the levers until bearing contact surfaces are $1\frac{1}{16}$ inch down from outer surface of cover. This measurement is taken by placing



RA PD 67008

Figure 153—Pressure Plate Springs and Release Levers Installed

a straight edge across spring bosses on cover, and measure to the lever from lower surface of straight edge to determine height of lever. Set clutch finger setting gage KM-J3800 to first lever height and adjust other levers to the same height (fig. 155). After adjusting lever height, stake the nuts with a dull punch by driving the nut metal into grooves in eyebolt to provide a secure lock (fig. 156). Remove assembly from fixture.

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CLUTCH FINGER SETTING GAGE KM-J3800

RA PD 66963

Figure 154—Depressing Release Levers to Settle Parts

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214. INSTALLATION.

a. Coat clutch pilot bushing in flywheel with suitable lubricant and place driven member against machined surface of flywheel with longest extension of hub toward rear. Insert clutch alining arbor KM-J3618-2 through hub of driven member and into clutch pilot bushing. Place pressure plate assembly (fig. 157) in position against driven member,

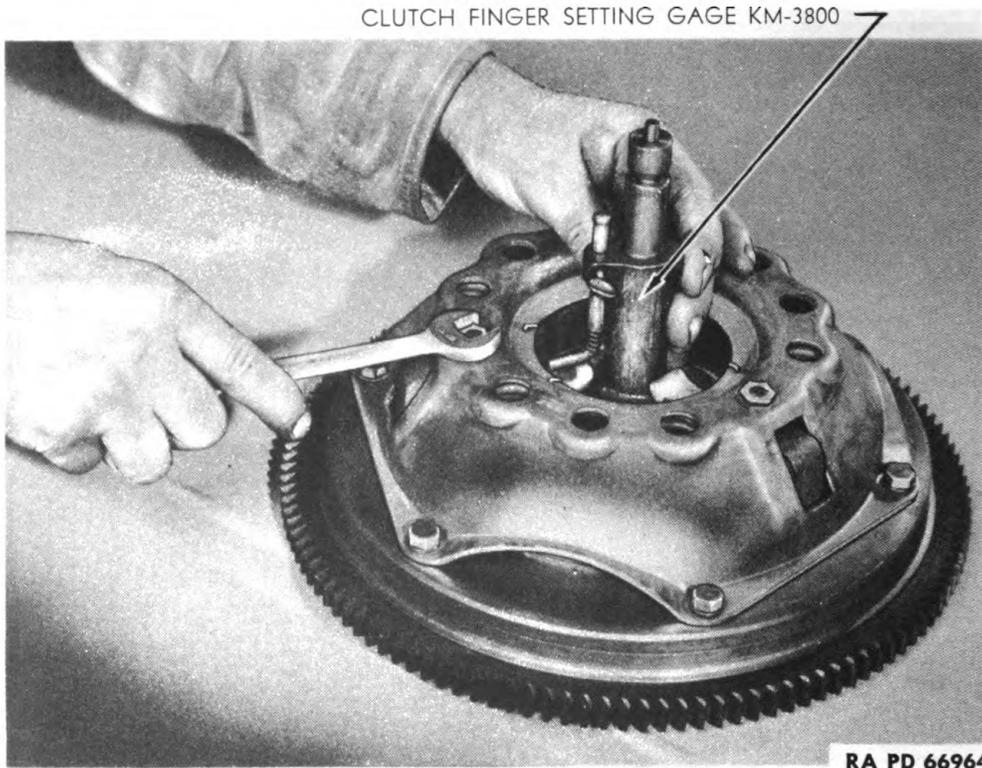


Figure 155—Adjusting Release Levers

install cap screws through cover flange, and tighten them evenly and progressively about $\frac{1}{2}$ turn at a time to avoid distorting cover. Give screws a final tightening to make sure the assembly is securely fastened to flywheel and remove alining arbor. Install clutch housing as outlined in paragraph 207.

CLUTCH COVER WITH PRESSURE PLATE



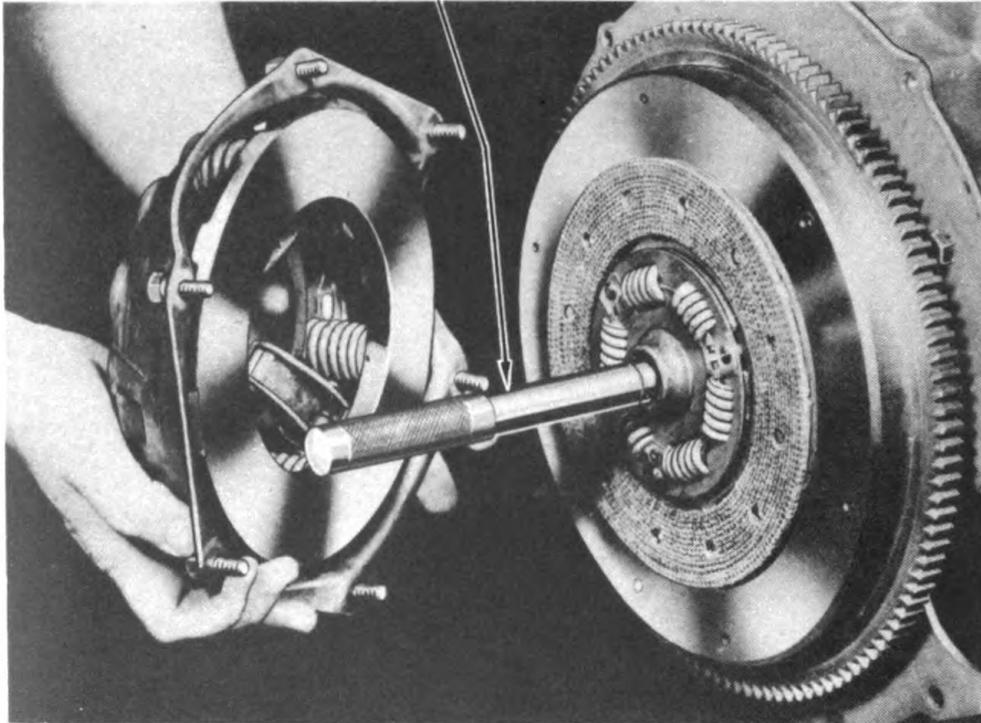
RA PD 66956

Figure 156—Locking Release Lever Adjusting Nut

TM 9-1772A
214

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CLUTCH ALINEMENT ARBOR (PIN) KM-J3618-2



RA PD 66937

Figure 157—Installing Clutch Pressure Plate Assembly

Section V

CLUTCH DRIVEN PLATE WITH FACINGS

	Paragraph
Description and data	215
Removal	216
Disassembly	217
Cleaning	218
Inspection	219
Assembly	220
Installation	221

215. DESCRIPTION AND DATA.

a. **Description.** The clutch driven plate consists of a spring loaded disk mounted on a splined hub and faced on both sides with special facing material held in position by suitable rivets.

b. Data.

Make Borg and Beck
 Type Single-plate, dry-disk
 Vibration dampened Yes
 Number of facings Two

216. REMOVAL.

a. Remove clutch cover with pressure plate as outlined in paragraph 209. Remove the clutch driven plate with facings.

217. DISASSEMBLY.

a. Other than to replace the friction facings no disassembly of the clutch driven plate should be attempted. To remove the old facings, the rivets must be drilled out using a $\frac{3}{16}$ -inch drill. Do not punch them out, as in doing so the driven plate may be damaged or distorted.

218. CLEANING.

a. Wash the driven plate with SOLVENT, dry-cleaning. Dry with clean wiping cloth or compressed air.

219. INSPECTION.

a. Inspect driven plate for distorted or warped condition, loose rivets at the plate hub, and damaged splines in the hub. Other than replacing the facings no reconditioning of driven plate is to be attempted. Replace the plate if not satisfactory for further service.

TM 9-1772A
220-221

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220. ASSEMBLY.

a. Place the facing on flywheel side of driven plate so countersunk holes are alined with rivet holes in cushion spring and resting on cushion spring which is convex at this point. Insert rivet head in counterbore of facing and roll rivet, not split, against cushion spring. Rivet each cushion spring to this facing before installing the other facing. Turn driven plate over and aline countersunk holes of pressure plate facing with the holes in the cushion spring. Insert rivet head in counterbore of facing and roll rivet, not split, against cushion spring. The rivet holes for this facing are nearest the edge of cushion spring. Each rivet goes through one facing only.

221. INSTALLATION.

a. Install clutch driven plate and cover assembly as outlined in paragraph 214.

Section VI

CLUTCH CONTROL AND LINKAGE

	Paragraph
Description	222
Removal	223
Inspection	224
Installation	225

222. DESCRIPTION.

a. The clutch is controlled by a foot pedal and arm located in the extreme forward end of driver's compartment on the left side. The pedal arm operates a shaft, which is connected to a flexible cable running through engine compartment to clutch release shaft lever at clutch housing.

223. REMOVAL.

a. Loosen wing nuts and remove engine compartment lid. Remove engine compartment side panel with instrument panel as outlined in paragraph 7. Take out cap screws holding air duct lid to hinges and tip lid toward radiator. Remove cotter and clevis pin from pedal shaft operating arm (in air duct). Remove nut from J-bolt holding cable conduit to hull cross member bracket in air duct. Remove nut from J-bolt holding rear end of cable conduit to hull in engine compartment. Disconnect adjustable clevis from clutch release shaft lever by removing cotter and clevis pin. Pull cable toward rear and remove from engine compartment.

b. Disconnect throttle control wire and throttle cable from pedal shaft. Take out cap screw and remove cable operating lever from end of pedal shaft. Take out cap screws holding pedal shaft left bracket to forward wall in driver's compartment, and remove pedal shaft assembly from vehicle.

224. INSPECTION.

a. Inspect cable for broken or frayed wires and loose connections at clevises. If damaged, replace entire assembly. Inspect clevis pins for damage and replace as necessary. Inspect clevises for cracks, distortion or other damage and replace parts as required. Examine the pedal shaft assembly for distortion or other damage and replace if not fit for further service.

225. INSTALLATION.

a. Place pedal shaft assembly in position in driver's compartment, install left bracket cap screws, and tighten securely. Install cable operating lever on end of pedal shaft and tighten securely with cap screw.

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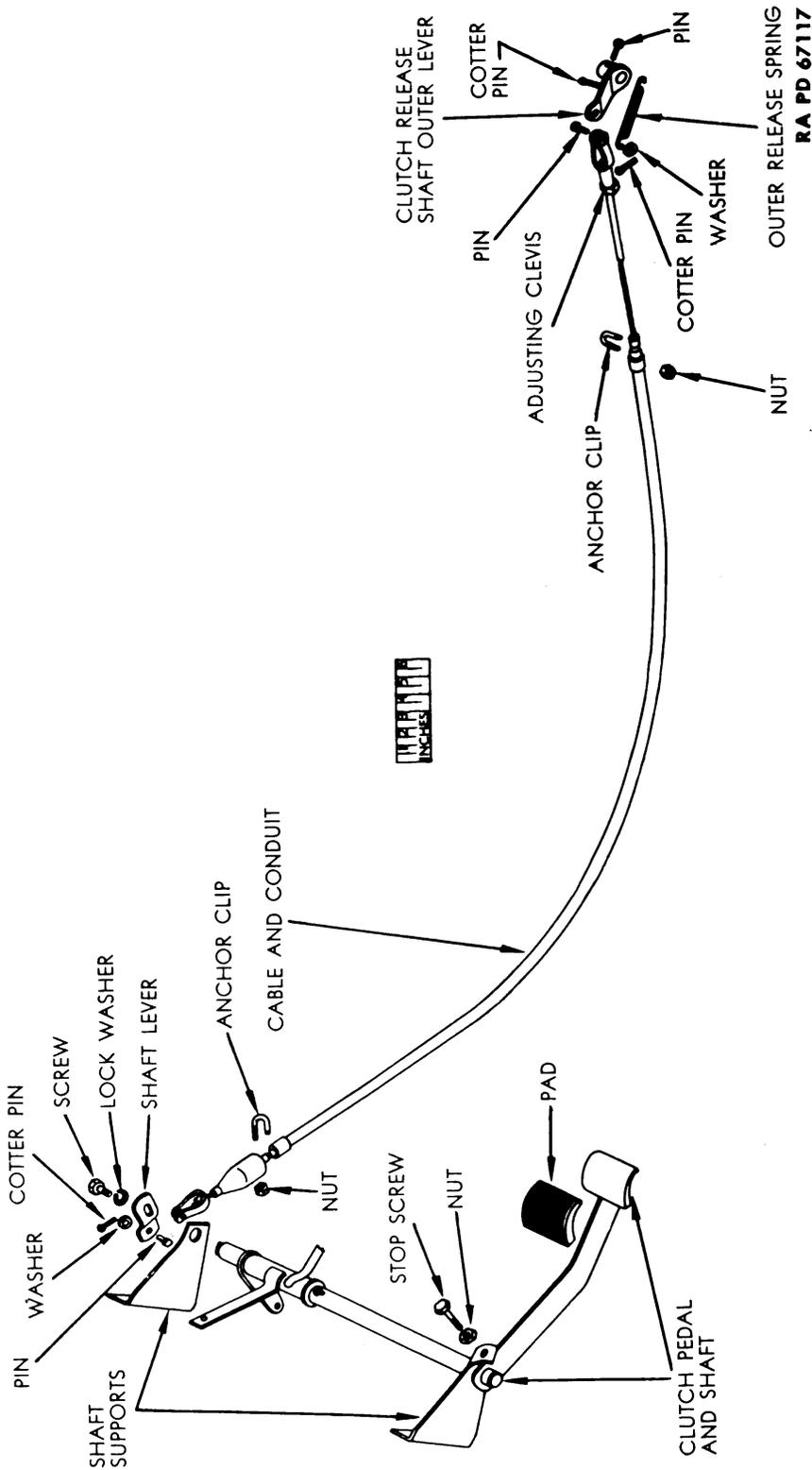


Figure 158—Clutch Release Linkage

CLUTCH CONTROL AND LINKAGE

Connect throttle control wire and throttle cable to pedal shaft and adjust as outlined in paragraph 68.

b. Place cable and conduit in position along left side of engine compartment and push front end into air duct. Connect cable clevis to cable operating lever on pedal shaft with clevis pin and new cotter pin. Fasten cable conduit to hull bracket in air duct with J-bolt and nut. Place air duct lid in position and fasten to hinges with cap screws. Fasten rear end of cable conduit to hull in engine compartment with J-bolt and nut. Connect adjustable clevis to clutch release shaft operating lever with clevis pin.

c. Loosen pedal stop screw lock nut (fig. 158) and turn stop screw in until it bottoms on lock nut. Remove clevis pin from rear clevis, loosen clevis lock nut, and turn clevis to shorten or lengthen cable until no slack or pull exists on release shaft operating lever when clevis holes are alined with hole in lever. Back off pedal stop screw until one inch of free pedal travel is present before clutch disengagement starts. Lock stop screw with lock nut. Install engine compartment side panel with instrument panel as outlined in paragraph 57. Place engine compartment lid in position and tighten wing nuts.

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Section VII

FITS AND TOLERANCES

	Paragraph
Clutch service data	226

226. CLUTCH SERVICE DATA.

Facing—inside diameter	5 $\frac{3}{8}$ in.
Facing—outside diameter	8 in.
Facing—thickness	$\frac{1}{8}$ in.
Facing—required	2
Free pedal travel	1 in.
Spring pressure on plate	1300 lb
Spring pressure	135 to 145 lb @ 1 $\frac{1}{2}$ in.

CHAPTER 9
SPECIAL TOOLS AND REFERENCES

Section I

SPECIAL TOOLS

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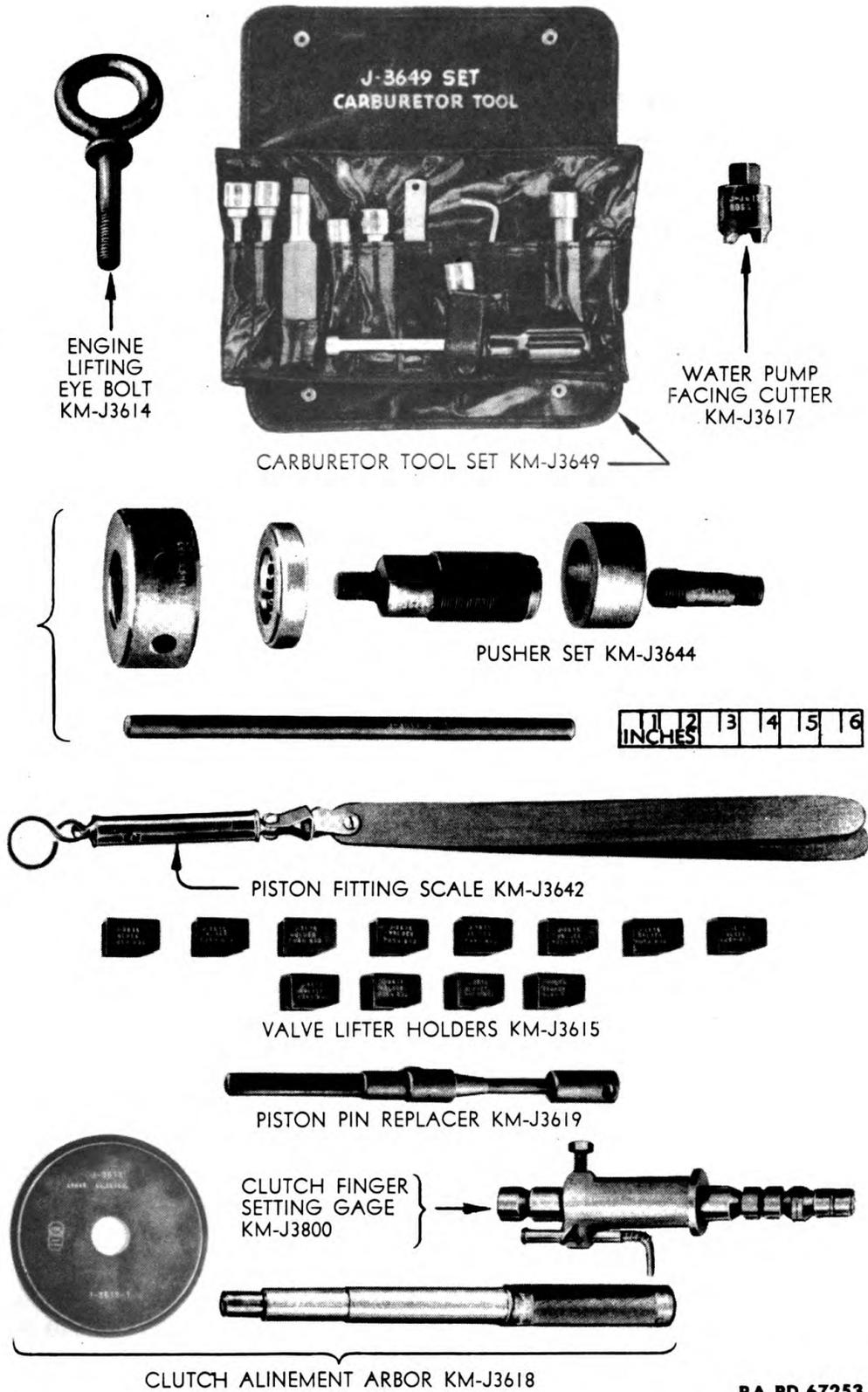
227. SPECIAL TOOLS.

Tool Name	Number	Quantity Required
Arbor, clutch alinement	J-3618	
Plate	J-3618-1	1
Pin	J-3618-2	1
Cutter, water pump facing	J-3617	1
Eyebolt, engine-lifting	J-3614	2
Gage, clutch finger setting	J-3800	
Body	J-3800-1	1
Sleeve	J-3800-2	1
Pull rod assembly	J-3800-3	1
Sleeve (large)	J-3800-4	1
Cones (large)	J-3800-5	2
Rings	J-3800-6	2
Sleeve (small)	J-3800-7	1
Finger	J-3800-8	1
Screw	J-3800-9	1
Nut	J-3800-10	1
Spring	J-3800-11	1
Washers	J-3800-12	2
Tube	J-3800-13	1
Pull rod	J-3800-14	1
Cone (small)	J-3800-15	1
Screw, 10-32 x 1/4	1
Thumb Screw, 10-24 x 1/2	1
Holder, valve lifter	J-3615	12
Clip, valve lifter holder	J-3615-1	1
Replacer, piston pin	J-3619	
Shaft	J-3619-1	1
Nut	J-3619-2	1
Set, carburetor tool	J-3649	
Set, crankshaft gear, camshaft gear, and crankshaft pulley pusher	J-3644	

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Tool Name	Number	Quantity Required
Body pusher	J-3644-1	1
Screw pusher	J-3644-2	1
Collar pusher	J-3644-3	1
Adapter assembly	J-3644-4	1
Plug	J-3644-5	1
Plug	J-3644-6	1
Collar	J-3644-7	1
Handle	J-3644-8	1
Scale, piston fitting with feelers 0.002 and 0.003	J-3642	
Instrument	J-3642-1	1
Clips	J-3642-2	2
Piston fitting feeler	J-3642-3	1
Piston fitting feeler	J-3642-4	1
Screws, 8-32 x 1/4	2
Screw, 8-32 x 3/8	1
Nuts, 8-32	3

SPECIAL TOOLS



RA PD 67253

Figure 159—Special Tools and Equipment
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REFERENCES

STANDARD NOMENCLATURE LISTS.

Carrier, cargo, T24 (Studebaker)	SNL G-179
Cleaning, preserving and lubrication materials, re- coil fluids, special oils, and miscellaneous related items	SNL K-1
Soldering, brazing, and welding materials, gases, and related items	SNL K-2
Tools, maintenance for repair of automotive vehicles	SNL G-27
Tool Sets—motor transport	SNL N-19
Current Standard Nomenclature Lists are listed above. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index"	OPSI

EXPLANATORY PUBLICATIONS.

List of publications for training	FM 21-6
Light Cargo Carrier T24	TM 9-772
Ordnance Maintenance: Engine, engine accessories and clutch for Light Cargo Carrier T24	TM 9-1772A
Ordnance Maintenance: Power train, suspension, hull and related components for Light Cargo Car- rier T24	TM 9-1772B

Automotive Materiel.

Automotive electricity	TM 10-580
Electric fundamentals	TM 1-455
Fuels and carburetion	TM 10-550
The internal combustion engine	TM 10-570
The motor vehicle	TM 10-510
Tune-up and adjustments	TM 10-530

Care and Preservation.

Automotive lubrication	TM 10-540
Cleaning, preserving, lubricating, and welding ma- terials and similar items issued by the Ordnance Department	TM 9-850

REFERENCES

Detailed lubrication instructions for ordnance materiel	OFSB 6-Series
Explosives and demolitions.....	FM 5-25
Fire prevention, safety precautions, accidents.....	TM 10-360
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

Maintenance and Repair.

Automotive power transmission units.....	TM 10-585
Echelon system of maintenance.....	TM 10-525
Maintenance and care of pneumatic tires and rubber treads	TM 31-200
Maintenance and repair.....	TM 10-520
Ordnance maintenance procedure: materiel inspection and repair.....	TM 9-1100
Sheet metal work, body, fender, and radiator repairs	TM 10-450

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-6

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(A.G. 300.7 (23 June 43))

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