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TM 9-1765B

WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

ENGINE, POWER TRAIN, BRAKING AND STEERING SYSTEMS FOR BOMB SERVICE TRUCK M6 (Chevrolet)

FEBRUARY 25, 1943

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FOR ORDNANCE PERSONNEL ONLY

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Prepared under the direction of the Chief of Ordnance

(with the cooperation of the Chevrolet Motor Division, General Motors Corporation)

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CHAPTER 1
INTRODUCTION

1. SCOPE.

a. This manual is published for the information of ordnance maintenance personnel. It contains detailed instructions for inspection, disassembly, assembly, maintenance, and repair of Bomb Service Truck M6 (Chevrolet), supplementary to those in the field and technical manuals prepared for the using arms. Additional descriptive matter and illustrations are included to aid in providing a complete working knowledge of the materiel.

2. ARRANGEMENT OF MANUAL.

a. The chapters of this manual cover the maintenance operations of the following main assemblies: engine, ignition system, fuel system, clutch, transmission, transfer case, brake system, steering gear, shock absorbers, frame, starting motor, and generator and controls. Each chapter is broken down into sections which cover the removal, disassembly, inspection, repairs, assembly, and installation of the main assemblies. The section index covers the paragraphs of the various operations within the section.

3. CHARACTERISTICS.

a. The bomb service truck is a 4-wheeled vehicle used to load, unload, and tow bomb carrying trailers. The chassis and engine are basically the same as on the regular Chevrolet 4-wheel drive truck, differing only for the installation of a special cab and bomb handling hoist.

CHAPTER 2

ENGINE

Section I

INTRODUCTION

4. GENERAL DESCRIPTION.

a. The heavy-duty engine shown in figures 1, 2, and 3 is a 4-cycle, 6-cylinder-in-line, valve-in-head type. The engine number is stamped on a machined surface on the right side of the block just back of the distributor. The cylinders are numbered from the fan, or front end of the engine. The engine turns in a clockwise direction, viewed from the front or cranking location.

b. It is often referred to as a 3-story engine; the oil pan, the cylinder block, and the cylinder head.

c. The pan is fitted with oil troughs, oil pipes for rod lubrication, and the oil gage rod.

d. The cylinder block assembly is the major section as it is fitted with the crankshaft, camshaft, timing gear plate, timing gears, pistons, piston rings, connecting rods, and other miscellaneous parts. In addition to the above parts which are serviced as part of the cylinder block assembly, the following units are attached to this assembly when in the truck: water pump, oil pump, distributor, starter, generator, flywheel, clutch housing, harmonic balancer, fuel pump, valve lifter, and other miscellaneous parts.

e. The cylinder head as installed on the truck includes the valve guides, valves, valve springs, water outlet, manifolds, carburetor, temperature indicator fitting, rocker arm assemblies, and push rod cover.

5. DATA.

Type ..... Valve-in-head
Number of cylinders 6
Bore ..... $3\frac{9}{16}$ in.
Stroke ..... $3\frac{15}{16}$ in.

INTRODUCTION

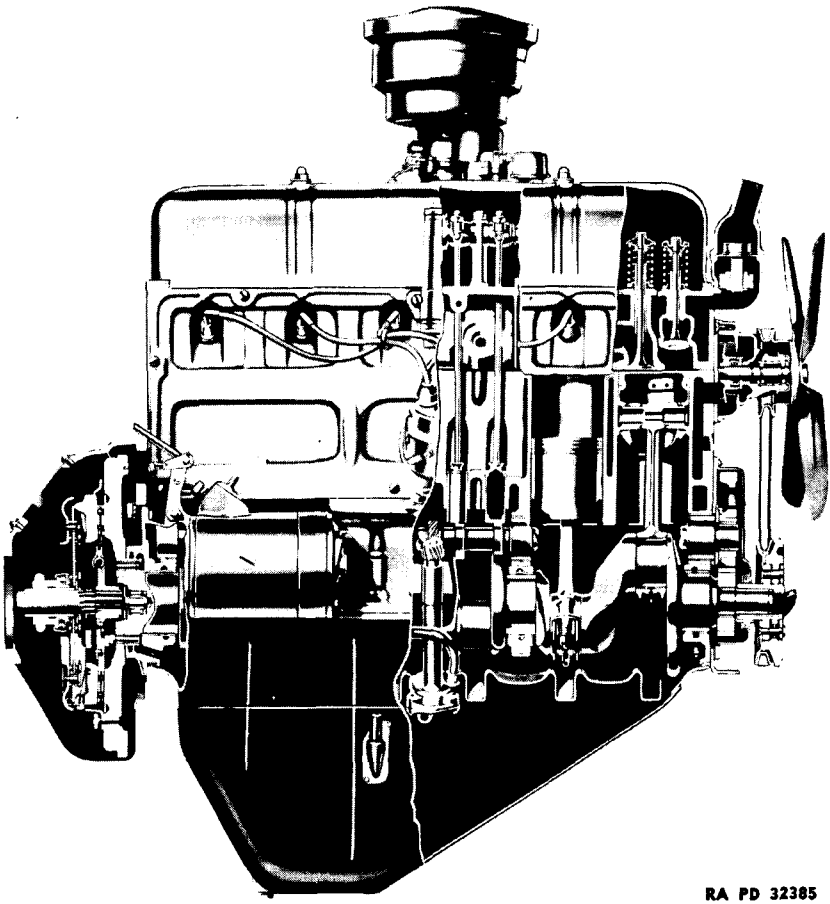

Figure 1 — Engine — Cross Section

Piston displacement	235.5 cu in.
Compression ratio	6.62 to 1
Horsepower	SAE 30.4
Horsepower (rated at 3,100 rpm)	93
Firing order	1-5-3-6-2-4
Maximum torque	192 ft-lb
Weight of engine and clutch	574 lb
Oil capacity	5 qt
Oil filling location	Breather, right side
Oil gage rod	Right side, back of distributor
Oil drain location	Bottom, rear of pan
Cylinder block drain	Left rear side of block

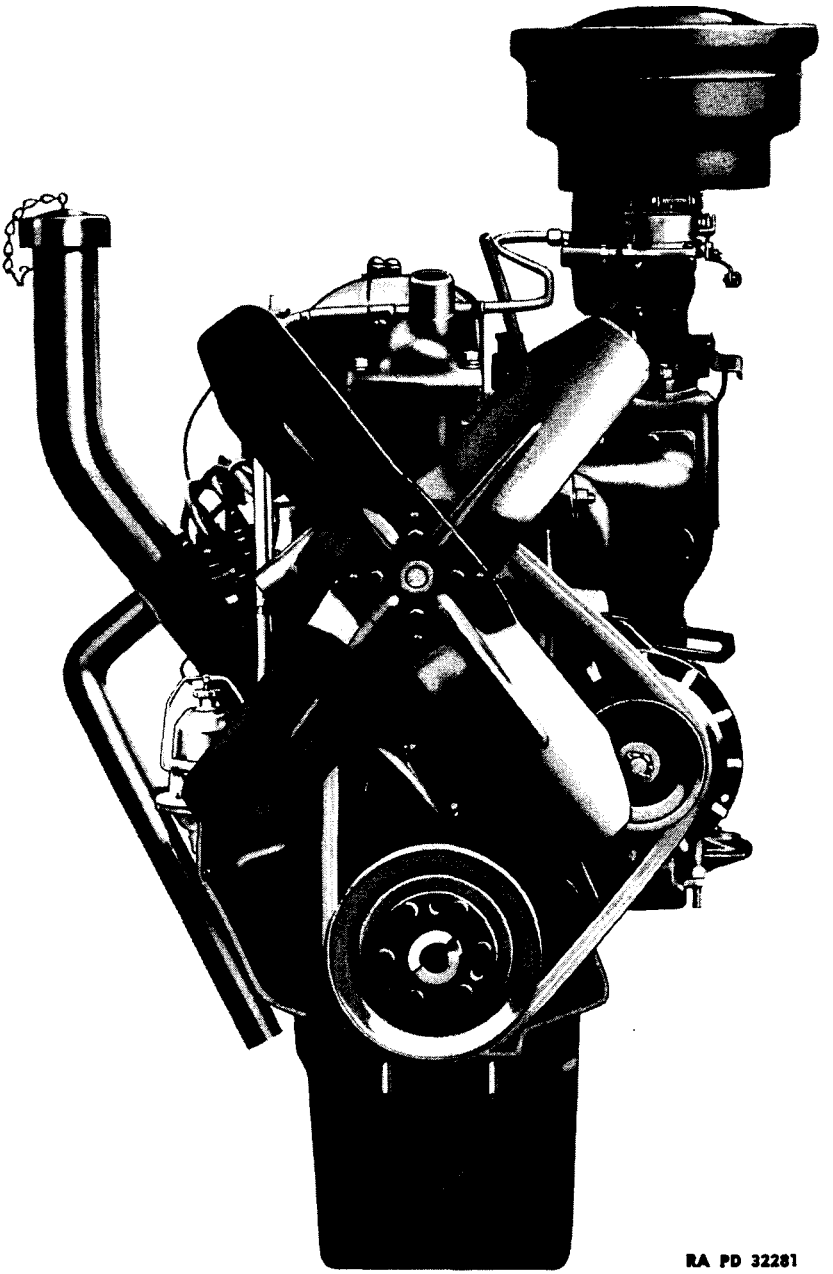

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Figure 2 — Engine — Front View

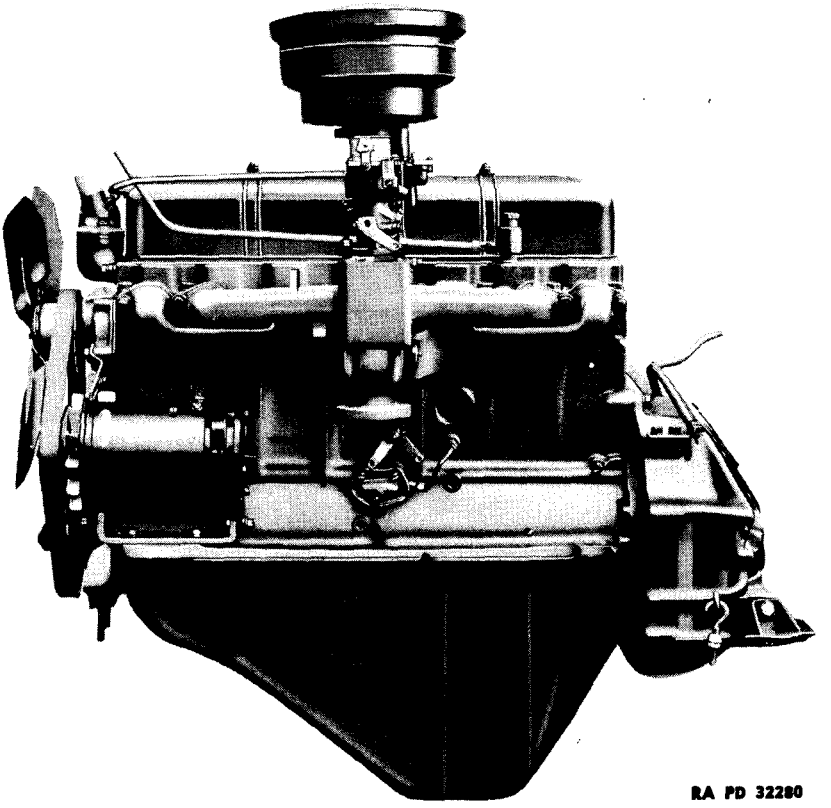

Figure 3 — Engine — Left Side View

6. REFERENCE TO OPERATOR'S MANUAL.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon operations not covered in this manual.

7. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

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

SECOND ECHELON: Line organization regiments, battalions, companies (first and second echelons).

THIRD ECHELON: Ordnance light maintenance companies, ordnance medium maintenance companies, ordnance divisional maintenance battalions, and post ordnance shops.

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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): Refer to AR 850-15, paragraph 23 a (1) and (2). October 6, 1942.	Consists of servicing, cleaning, lubricating, tightening bolts and nuts, and making external adjustment of subassemblies or assemblies and controls.
REPLACE: Refer to AR 850-15, paragraph 23 a (4). October 6, 1942.	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: Refer to AR 850-15, paragraph 23 a (3) and (5), in part. October 6, 1942.	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.
REBUILD: Refer to AR 850-15, paragraph 23 a (5), in part, and (6). October 6, 1942.	Consists of completely reconditioning and replacing in serviceable condition any unserviceable part, subassembly, or assembly of the vehicle, including welding, riveting, machining, fitting, alining, balancing, assembling and testing.

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.

	ECHELONS			
ABSORBERS, SHOCK AND LINKAGE	2nd	3rd	4th	5th
Absorber assembly, shock and linkage—replace...	X			
Absorber assembly, shock and linkage—repair....		X		
Absorber assembly, shock and linkage—rebuild...			E	X
AXLE, FRONT				
Alinement, wheel, toe-in—service (adjust).....	X			
Alinement, wheel, camber and caster.....			E	X
Arm, steering knuckle—replace.....	E	X		

INTRODUCTION

	ECHELONS			
AXLE, FRONT—Cont'd	2nd	3rd	4th	5th
*Axle assembly—replace		X		
Axle assembly—repair		X		
Axle assembly—rebuild			E	X
Bearing, wheel—replace	X			
Gear, bevel and pinion—adjust		X		
Retainer, grease, wheel—replace	X			
Rod, tie—replace	X			
Rod, tie—repair		X		
Seal, oil, trunnion housing—replace	E	X		
Shaft—replace	E	X		
Stop, steering knuckle—replace or adjust		X		
AXLE, REAR				
*Axle assembly—replace		X		
Axle assembly—repair		X		
Axle assembly—rebuild			E	X
Bearing, wheel—replace	X			
Gear, bevel and pinion—adjust		X		
Retainer, grease, wheel—replace	X			
Shaft—replace	X			
BODY				
Body assembly—replace			X	
Body assembly—repair		X		
Body assembly—rebuild			E	X
Cushion, seat—replace	X			
Cushion, seat—rebuild			X	
Glass—replace		X		
Hoist, bomb handling—repair	X			
Hoist, bomb handling—rebuild			X	
Seat—replace	X			
Seat—repair		X		
Tarpaulin, cab compartment and cover—replace	X			
Tarpaulin, cab compartment and cover—repair			X	
Upholstery—replace			X	
Windshield assembly—replace	X			
Windshield assembly—repair		X		
Windshield assembly—rebuild			E	X
Wiper assembly, windshield—replace	X			
Wiper assembly, windshield—rebuild			X	

*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.*

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	ECHELONS			
BRAKES, SERVICE (FOOT)	2nd	3rd	4th	5th
Brakes—adjust, replace	X			
Controls, brake (electric, trailer)—replace	X			
Controls, brake (electric, trailer)—rebuild			X	
Cylinder assembly, master—replace, service	X			
Cylinder assembly, master—repair		X		
Cylinder assembly, master—rebuild			X	
Cylinder assembly, power (Hydrovac)—replace	X			
Cylinder assembly, power (Hydrovac)—repair		X		
Cylinder assembly, power (Hydrovac)—rebuild			X	
Cylinder assembly, wheel—replace	X			
Cylinder assembly, wheel—repair		X		
Cylinder assembly, wheel—rebuild			X	
Hose, flexible—replace	X			
Shoe assembly—replace	X			
Shoe assembly—repair (reline)		X		
BRAKE (HAND OR PARKING)				
Band assembly—replace	X			
Band assembly—repair (reline)		X		
Controls—replace	X			
Controls—repair		X		
CASE TRANSFER				
*Case assembly—replace		X		
Case assembly—repair		E	X	
Case assembly—rebuild			E	X
Controls—replace	X			
Drum, brake, hand—replace	E	X		
CLUTCH				
Clutch—replace	E	X		
Clutch—repair		X		
Clutch—rebuild			E	X
Pedal, free travel—service (adjust)	X			
COOLING SYSTEM				
Belt, fan, generator and water pump—replace	X			
Blades, fan—replace	X			
Blades, fan—repair		E	X	

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INTRODUCTION

	ECHELONS			
COOLING SYSTEM —Cont'd	2nd	3rd	4th	5th
Hose—replace	X			
Pump, water—replace	X			
Pump, water—repair		X		
Pump, water—rebuild			X	
Radiator assembly—replace	X			
Radiator assembly—repair		X		
Radiator assembly—rebuild			E	X
ELECTRICAL SYSTEM				
Battery—service and recharge, replace	X			
Battery—repair		X		
Battery—rebuild			E	X
Box, apparatus assembly, generator regulator—replace	X			
Box, apparatus assembly, generator regulator—repair		X		
Box, apparatus assembly, generator regulator—rebuild			X	
Cables, battery—replace	X			
Horn—service and replace	X			
Horn—repair		X		
Lamps—service and replace	X			
Switch assemblies—replace	X			
Switch assemblies—repair		X		
Wiring—replace	X			
ENGINE				
Arm, rocker—replace	X			
Arm, rocker—repair		X		
Bearing, connecting rod—replace		E	E	X
Bearing, crankshaft, main—replace		E	E	
Block, cylinder—rebuild (recondition)			E	X
Carburetor assembly—replace	X			
Carburetor assembly—repair		X		
Carburetor assembly—rebuild		E	X	
Cleaner, air—replace	X			
Cleaner, air—repair		X		
Cover and gasket, pushrod—replace	X			
Cover and gasket, valve—replace	X			
Crankshaft—rebuild (recondition)			E	X
Engine—repair		X		
Engine—rebuild			E	X

ORDNANCE MAINTENANCE — ENGINE, POWER TRAIN, BRAKING AND STEERING SYSTEMS FOR BOMB SERVICE TRUCK M6 (Chevrolet)

ENGINE—Cont'd	ECHELONS 2nd	3rd	4th	5th
*Engine assembly—replace		X		
Filter assembly, oil—service, replace	X			
Flywheel—replace		E	X	
Gasket, cylinder head—replace	X			
Gaskets, manifold—replace	X			
Gears, timing—replace		E	X	
Generator assembly—replace	X			
Generator assembly—repair				
Generator assembly—rebuild			X	
Governor assembly—replace	X			
Governor assembly—rebuild			E	X
Guide, valve—replace		E	E	X
Head, cylinder—replace, repair		X		
Head, cylinder—rebuild			E	X
Lifter, valve—replace	X			
Line, oil, external—replace, repair	X			
Line, oil, internal—replace, repair		E	X	
Manifolds—replace	E	X		
Manifolds—repair		E	X	
Motor, starting—replace	X			
Motor, starting—repair		X		
Motor, starting—rebuild			X	
Pan assembly, oil—clean and replace gaskets	X			
Pan assembly, oil—repair and replace		X		
Pin, piston—replace		E	E	X
Piston and ring assembly—replace		E	E	X
Pulley, crankshaft, fan, generator, water pump—replace	X			
Pump assembly, fuel—service, replace	X			
Pump assembly, fuel—repair	E	X		
Pump assembly, fuel—rebuild		E	X	
Pump assembly, oil—replace	E	X		
Pump assembly, oil—repair		X		
Pump assembly, oil—rebuild			X	
Rod, connecting—replace			E	X
Rod, push—replace	X			
Seat, valve—reseat		X		

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ENGINE—Cont'd	ECHELONS 2nd	3rd	4th	5th
Springs, valve—replace	E	X		
Thermostat—replace	X			
Tube, steam relief—replace	X			
EXHAUST				
Muffler and exhaust pipes—replace	X			
EXTINGUISHER, FIRE				
Extinguisher, fire, carbon tetrachloride—replace, refill	X			
Extinguisher, fire, carbon tetrachloride—repair		X		
Extinguisher, fire, carbon tetrachloride—rebuild			E	X
FRAME				
Bumper—replace	X			
Bumper—repair		X		
Frame, assembly—repair		X		
Frame, assembly—rebuild			E	X
Guard, brush—replace	X			
Guard, brush—repair		X		
Pintle—replace	X			
Pintle—repair		X		
FUEL SYSTEM				
Filter and fuel lines—service, replace	X			
Lines—repair, replace	X			
Tank—service and replace	X			
Tank—repair		X		
GEAR, STEERING				
Arm (Pitman)—replace	X			
Gear assembly—replace	E	X		
Gear assembly—rebuild			E	X
Link assembly, drag—service and replace	X			
Link assembly, drag—repair		X		
IGNITION SYSTEM (ENGINE)				
Coil, ignition—replace	X			
Condenser, distributor—replace	X			
Distributor assembly—replace	X			
Distributor assembly—repair		X		
Distributor assembly—rebuild			X	
Plug, spark—replace	X			
Plug, spark—repair		X		
Points, breaker, distributor—replace	X			
Wiring, ignition—replace	X			

ORDNANCE MAINTENANCE — ENGINE, POWER TRAIN, BRAKING AND STEERING SYSTEMS FOR BOMB SERVICE TRUCK M6 (Chevrolet)

INSTRUMENTS AND GAGES (Not listed individually)	ECHELONS 2nd	3rd	4th	5th
Instrument and gages—replace	X			
Instrument and gages—rebuild			E	X
METAL SHEET				
Board, running—replace	X			
Board, running—repair		X		
Box, tool—replace	X			
Box, tool—repair		X		
Fender—replace	X			
Fender—repair		X		
Hood—replace	X			
Hood—repair		X		
Pan, splash—replace	X			
Pan, splash—repair		X		
MISCELLANEOUS				
Chain, tire—repair	X			
Head, speedometer—replace	X			
Head, speedometer—rebuild			E	X
Shaft assembly, flexible drive, speedometer—replace	X			
Shaft assembly, flexible drive, speedometer—repair		X		
Welding—heavy				X
Welding—light		X		
Welding—medium			X	
SHAFT, PROPELLER				
Shaft assembly, w/universal joints—replace	X			
Shaft assembly, w/universal joints—repair		X		
Shaft assembly, w/universal joints—rebuild			E	X
SPRINGS				
Shackle and bolt—replace	X			
Springs—replace	X			
Springs—repair		X		
Springs—rebuild			E	X
TIRES				
Casing—repair			X	
Casing and tube—replace	X			
Tube, inner—replace	E	E	X	

INTRODUCTION

	ECHELONS			
TRANSMISSION	**2nd**	**3rd**	**4th**	**5th**
Lever, shift—replace	X			
Lever, shift—repair		X		
*Transmission assembly—replace		X		
Transmission assembly—repair		X		
Transmission assembly—rebuild			E	X
TRUCK, BOMB SERVICE				
Vehicle—service	X			
Vehicle—rebuild (with serviceable unit assemblies)			X	E
WHEELS				
Wheels—replace	X			
Wheels—rebuild			E	X

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Section II

TROUBLE SHOOTING

8. GENERAL.

a. The following chart is provided as a guide to possible engine troubles, their causes, and probable remedy.

9. LACK OF POWER.

a. Poor Compression.

Probable Cause	Probable Remedy
Incorrect valve lash.	Adjust valve lash according to instructions under valve adjustment procedure (par. 21).
Leaky valves.	Remove cylinder head and grind valves (par. 20).
Valve stems or lifters sticking.	Free or replace.
Valve springs weak or broken.	Replace.
Valve timing incorrect.	Retime valves. See timing gear installation (par. 22).
Leaking cylinder head gasket.	Replace.
Piston rings broken.	Replace. See piston ring replacement (par. 24).
Poor fits between pistons, rings, and cylinders.	Overhaul engine (par. 35).

b. Ignition System Improperly Adjusted.

Ignition not properly timed.	Set ignition according to instructions under engine tune-up (par. 26).
Octane selector not adjusted for grade of fuel being used.	Set octane selector (par. 26).

TROUBLE SHOOTING

Probable Cause	Probable Remedy
Spark plugs faulty.	Replace or clean and test spark plugs (par. 26).
Distributor points not set correctly.	Set distributor points and time engine (par. 26).
c. Lack of Fuel.	
Dirt or water in carburetor.	Clean carburetor (par. 100).
Gas lines partly plugged.	Clean gas lines.
Dirt in gas tank.	Clean gas tank.
Air leaks in gas line.	Tighten and check gas lines.
Fuel pump not functioning properly.	Replace or repair fuel pump (par. 93).
d. Carburetor Air Inlet.	
Air cleaner dirty.	Clean air cleaner (par. 26).
Carburetor choke partly closed.	Adjust or replace choke mechanism.
e. Overheating.	
Cooling system troubles.	See section XVII, TM 9-795, for procedure.
Improper grade and viscosity of oil being used.	Change to correct oil.
Fuel mixture too lean.	See chapter 4 for corrections.
Restricted air cleaner.	Clean air cleaner (par. 26).
Valves not timed properly.	Retime. See timing gear replacement (par. 22).
Defective ignition system.	See engine tune-up (par. 26).
Transfer case in 4-wheel drive on hard surface roads.	Shift transfer case to 2-wheel drive.
Exhaust system partly restricted.	Clean or replace.
10. EXCESSIVE OIL CONSUMPTION.	
a. Leaking Oil.	
Oil pan drain plug loose.	Tighten drain plug.
Oil pan retainer bolts loose.	Tighten oil pan bolts.
Oil pan gaskets damaged.	Replace pan gaskets (par. 17).
Timing gear cover loose or gasket damaged.	Tighten timing gear cover or replace gaskets (par. 23).

Probable Cause	Probable Remedy
Oil return from timing gear case to block restricted, causing leak at crankshaft fan pulley hub.	Remove oil pan and clean oil return passages.
Push rod or rocker arm cover gaskets damaged or covers loose.	Tighten push rod and rocker arm covers, or replace gaskets (par. 16).
Fuel pump loose or gasket damaged.	Tighten fuel pump or replace gasket.
Rear main bearing leaking oil into clutch housing.	Adjust or replace main bearing (par. 19).
b. Burning Oil.	
Broken piston rings.	Replace rings (par. 24).
Rings not correctly seated to cylinder walls.	Give sufficient time for new rings to seat. Replace if necessary.
Piston rings worn excessively or stuck in ring grooves.	Replace piston rings (par. 24).
Piston ring oil return holes clogged with carbon.	Replace rings (par. 24).
Excessive clearance between piston and cylinder walls due to wear or their being improperly fitted.	Fit new pistons (par. 35).
Cylinder walls scored, tapered, or out-of-round.	Recondition cylinders and fit new pistons (par. 35).
11. POPPING, SPITTING, AND SPARK KNOCK.	
a. Overheated Intake Manifold.	
Manifold heat control spring not properly installed.	Adjust according to instructions under engine tune-up (par. 26).
Manifold heat control valve sticking.	Free heat control valve.
b. Ignition Trouble.	
Loose wiring connections.	Tighten all wire connections.
Faulty wiring.	Replace faulty wiring.
Faulty spark plugs.	Clean or replace spark plugs. See engine tune-up (par. 26).
c. Carburetion.	
Lean combustion mixture.	Clean and adjust carburetor (par. 100).

TROUBLE SHOOTING

Probable Cause	Probable Remedy
Dirt in carburetor.	Clean carburetor (par. 100).
Restricted gas supply to carburetor.	Clean gas lines and check for restrictions.
Leaking carburetor or intake manifold gaskets.	Tighten carburetor to manifold, and manifold to head bolts, or replace gaskets.
Carburetor metering rod hole cover not in place.	Replace metering rod hole cover (par. 99).
d. Valves.	
Valves adjusted too close.	Adjust valve lash (par. 21).
Valves sticking.	Lubricate and free. Grind valves if necessary.
Exhaust valves thin and heads overheating.	Replace valves (par. 20).
Weak valve springs.	Replace valve springs (par. 20).
Valves timed early.	Retime. See timing gear installation (par. 22).
e. Cylinder Head.	
Excessive carbon deposits in combustion chamber.	Remove head and clean carbon (par. 20).
Cylinder head water passages partly clogged causing hot spot in combustion chamber.	Remove cylinder head and clean water passages (par. 20).
Partly restricted exhaust ports in cylinder head.	Remove cylinder head and clean exhaust ports (par. 20).
Cylinder head gasket blown between cylinders.	Replace cylinder head gasket (par. 20).
f. Spark Plugs.	
Spark plugs glazed.	Clean or replace spark plugs (par. 26).
Wrong heat range plug being used.	Change to correct spark plugs.
g. Exhaust System.	
Exhaust manifold or muffler restricted causing back pressure.	Clean or replace manifold and muffler.
12. ROUGH ENGINE IDLING.	
a. Carburetor.	
Improper idling adjustment.	Adjust according to instructions in paragraph 26.
Carburetor needle valve not seating.	Clean or replace (par. 99).

b. Air Leaks.

Probable Cause	Probable Remedy
Carburetor to manifold gasket leaks.	Tighten carburetor to manifold bolts or replace gasket.
Manifold to head gasket leaks.	Tighten manifold to head bolts or replace gasket.
Air leaks in the windshield wiper vacuum line.	Check for leaks and repair.
Air leaks in the Hydrovac lines.	Check Hydrovac lines and correct leaks.

c. Valves.

Improper lash adjustment.	Check and adjust valves according to instruction in paragraph 26.
Valves not seating properly.	Grind valves (par. 20).

d. Cylinder Head.

Cracks in exhaust ports.	Replace cylinder head (par. 20).
Head gasket leaks.	Replace cylinder head gasket (par. 20).

13. ENGINE NOISE.

a. Crankshaft Bearing Loose.

Crankshaft journals out-of-round.	Replace crankshaft.
Crankshaft journals rough.	Polish or replace crankshaft; adjust bearings.
Oil passages in block restricted.	Clean passages. See oil line cleaning.
Bearings improperly fitted.	Readjust main bearings (par. 19).
Insufficient oil.	Adjust or replace bearings (par. 19). Replenish oil.
Improper grade and viscosity of oil being used.	Adjust bearings. Change to correct oil.
Oil pump failure.	Replace or rebuild oil pump. Replace or adjust main bearings (pars. 18 and 19).
Contaminated oil.	Wash motor thoroughly. Adjust or replace bearings, and other damaged parts.

TROUBLE SHOOTING

b. Connecting Rod Bearings Loose.

Probable Cause	Probable Remedy
Improperly adjusted bearings.	Adjust bearings (par. 19).
Crankshaft journals rough.	Polish or replace shaft. Adjust or replace rods.
Insufficient oil.	Adjust or replace rods. Replenish oil.
Oil pump failure.	Replace or overhaul oil pump. Replace or adjust rod bearings (pars. 18 and 19).
Connecting rod dipper broken or damaged.	Adjust or replace rod and dipper (par. 18).
Oil troughs or lines not adjusted properly or restricted.	Clean, adjust, or replace oil troughs and lines.
Improper grade and viscosity of oil used.	Adjust or replace rod bearings and use correct oil (par. 19).

c. Pistons or Pins Loose.

Excessive cylinder wear.	Hone cylinders and fit new pistons and rings. Make sure all abrasives that would cause cylinder wear are removed (par. 35).
Improperly fitted pistons or pins.	Replace pistons or pins (pars. 35 and 36).
Contaminated oil.	Make necessary replacements, flush oiling system, and use new oil.
Faulty fuel or ignition system causing unburned fuel to flush the oil from cylinder walls.	Make necessary repairs to fuel or ignition system, and replace worn parts.
Piston pin or bushing wear.	Ream bushings and install oversize piston pins (par. 36).

d. Engine Noise, General.

Bent connecting rod.	Replace rod (par. 24).
Excessive end play in camshaft.	Replace camshaft thrust plate, or correct end play by pressing gear on further (par. 42).
Excessive crankshaft end play.	Replace main bearings (par. 38).

ORDNANCE MAINTENANCE — ENGINE, POWER TRAIN, BRAKING AND STEERING SYSTEMS FOR BOMB SERVICE TRUCK M6 (Chevrolet)

Probable Cause	Probable Remedy
Broken piston ring.	Replace broken ring and check condition of cylinder wall (par. 24).
Loose timing gears.	Replace timing gears (par. 42).
Dry push rod sockets.	Polish and lubricate push rod sockets.
Bent oil gage rod.	Replace oil gage rod.
Improperly adjusted valve lash.	Adjust valve lash (par. 21).
Sticking valves.	Free or grind valves (par. 20).

Section III

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

14. GENERAL.

a. There are only a few major service operations that cannot be performed individually without removing the engine from the chassis; however, it is advisable to remove the engine for an overhaul as it is much easier to clean and service when removed. There are numerous individual operations in servicing an engine, many of which require identical disassembly operations.

b. In the service operations covered in this section, complete instructions for removing and replacing the manifold assembly, cylinder head, oil pan, push rod cover, and timing gear cover are given.

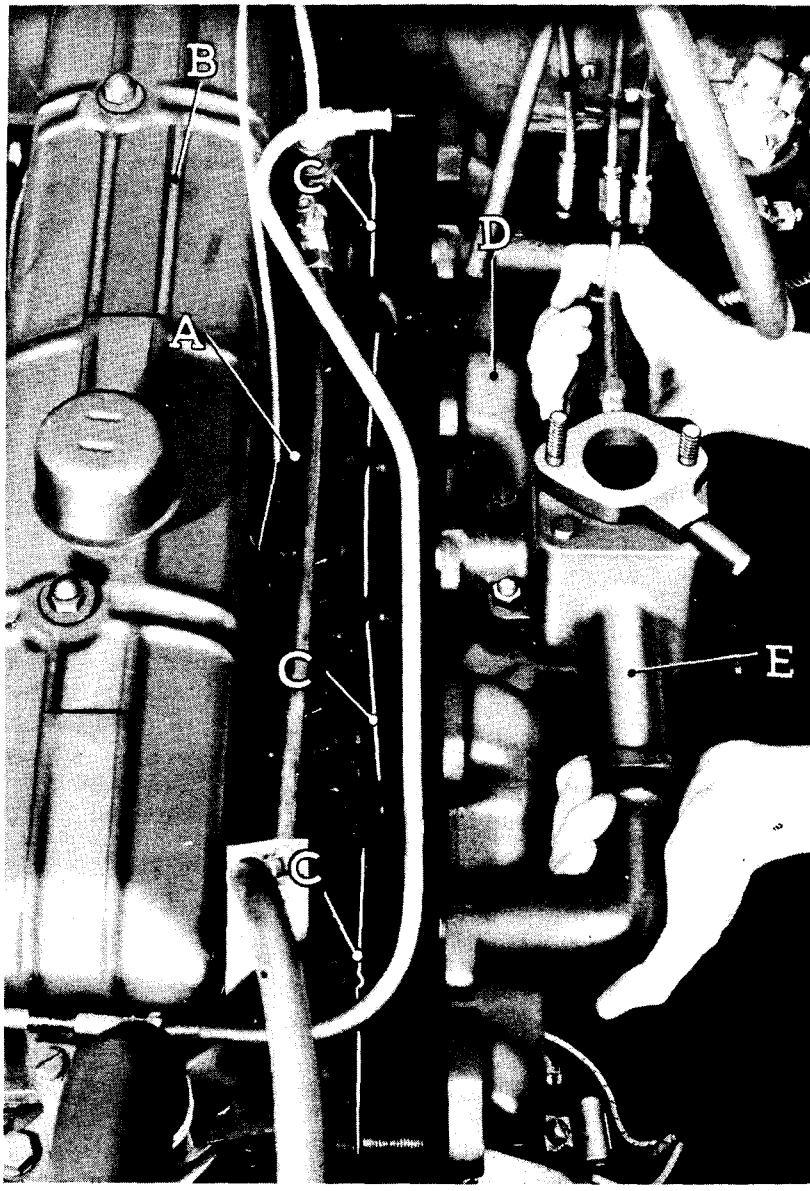
c. Follow the disassembly procedure given in this section and the cleaning and repair instructions given in sections V and VI for other service operations which might occasionally be required without engine removal.

15. MANIFOLD GASKETS, REPLACEMENT.

a. General. The manifold gaskets may be replaced as a separate operation without removing the carburetor and manifold completely.

b. Procedure.

(1) REMOVE AIR CLEANER. Loosen the air cleaner clamp screw and remove the air cleaner.



A—CYLINDER HEAD
B—ROCKER ARM COVER
C—MANIFOLD GASKET
D—EXHAUST MANIFOLD
E—INTAKE MANIFOLD

RA PD 32284

Figure 4 — Manifold Gasket Installation

(2) DISCONNECT GAS LINE. Disconnect the gas feed line at the carburetor end.

(3) DISCONNECT THROTTLE ROD. Disconnect the throttle rod at the lower end.

(4) LOOSEN MANIFOLD. Remove the 2 nuts and 6 cap screws which attach the manifold to the cylinder head.

(5) REMOVE GASKETS. Pull the manifold away from the cylinder head and remove the old gasket.

(6) INSTALL GASKET (fig. 4). Clean the gasket flanges on the manifold and cylinder head, install the new gaskets, and slide the manifold in place over the studs, making sure the gaskets are in place.

(7) TIGHTEN MANIFOLD. Install the 6 cap screws with lock plates or washers and the 2 nuts and tighten them securely.

(8) CONNECT THROTTLE ROD. Connect the lower end of throttle rod and install key.

(9) CONNECT GAS LINE. Attach the gas feed line to the carburetor and tighten securely.

(10) INSTALL AIR CLEANER. Install air cleaner on carburetor and tighten clamp screw.

c. Exhaust Pipe Packing Replacement Procedure.

(1) REMOVE PACKING. Remove the 2 nuts that retain the exhaust pipe to the manifold. Push exhaust pipe down to clear the manifold and lift out the old packing.

(2) INSTALL PACKING. Place new packing between the manifold and exhaust pipe and place flange in position over studs. Install the 2 nuts and tighten them alternately until the flange is secure.

16. PUSH ROD COVER GASKETS, REPLACEMENT.

a. Removal.

(1) Remove the rocker arm cover retaining nuts and remove the cover and gaskets.

(2) REMOVE COIL. Remove the 2 screws which attach the coil to the cylinder head and pull the high tension wire out of the coil. Lay the coil on the cowl out of the way.

(3) DISCONNECT GAS LINE. Disconnect the gas line at the carburetor end and remove the clamp screw at the front of the push rod cover.

(4) REMOVE SPARK PLUGS. Remove the wires from the spark plugs and remove the 6 spark plugs.

(5) REMOVE PUSH ROD COVER. Remove the remaining 9 push rod cover retaining screws, and remove the push rod cover and gasket.

(6) CLEAN GASKET SEATS. Clean the gasket seat on the push rod cover, cylinder head, and block. Check the push rod cover seals at the spark plug holes and if necessary, replace.

b. Installation.

(1) INSTALL COVER AND GASKET. Place the gasket on the push rod cover and carefully work it down in place. NOTE: Make sure the gasket is in place all the way around and that all 6 seals at the spark plug holes are in place before installing the retaining screws.

(2) INSTALL RETAINING SCREWS. Line up the bolt holes in the gasket with the cover and block. Install the 9 retaining screws loosely. Place the coil in position and replace the 2 screws through the coil bracket and push rod cover. Install the screw at the front which retains the gas line clip as well as the push rod cover. Tighten the 12 screws securely.

(3) INSTALL SPARK PLUGS. Set the spark plug gaps at 0.040. Place new gaskets on the 6 plugs and install them in the cylinder head finger-tight, then give from ½ to ¾ turns with the wrench. NOTE: Care must be used when installing these 10-millimeter plugs as it is very easy to strip the threads in the head or distort the plug which upsets the point setting.

(4) CONNECT GAS LINE. Connect the gas line to the carburetor connection. Replace spark plug wires.

(5) Connect the wires to the coil and spark plugs.

(6) INSTALL ROCKER ARM COVER. Install a new gasket and carefully seat the rocker arm cover on the gasket. Install the 2 retaining nuts and tighten them securely.

17. OIL PAN GASKETS, REPLACEMENT.

a. Drain Oil Pan.

(1) Place the drain pan under the engine and remove the drain plug. Allow pan to drain completely and replace drain plug.

(2) REMOVE OIL GAGE ROD TUBE. Remove the oil gage rod, loosen the tube clamp on right side of pan, loosen the clamp at the right side of the cylinder block, and remove the tube.

(3) REMOVE OIL PAN. Remove the 18 stove bolts and the 4 cap screws that attach the oil pan. Bump the oil pan to break it loose from the gaskets and lower the pan, being careful not to damage the oil screen or oil troughs in the pan.

(4) CLEANING. Clean the gasket flange on the oil pan and block, and the grooves for the 2 end corks. Wash the oil pan and blow out the oil lines.

(5) INSTALL GASKETS. Place a light coating of grease on gasket and place gasket on engine flange, leaving the oil pan free to install without hindrance to gasket. Grease the end corks and place them in the grooves in the bearing caps.

(6) INSTALL PAN. Place the oil pan in position against the engine flange and make sure the gaskets are in place. Start all the cap screws and bolts. NOTE: It may be necessary to use a taper punch to line up the gasket holes with the bolt holes in the pan. Tighten all bolts securely.

(7) INSTALL OIL GAGE ROD AND TUBE. Install lower end of the oil gage rod tube in the bracket on right side of oil pan and the upper end of tube in bracket at bottom of cylinder block. Tighten the clamp screws securely. Install the oil gage rod.

(8) REFILL OIL PAN. Make sure the oil pan drain plug is tight and refill the oil pan with the correct grade and quantity of new oil according to instructions in the lubrication section.

18. OIL PUMP, REPLACEMENT AND OVERHAUL.

a. Procedure.

(1) REMOVE OIL PAN. Follow procedure given in paragraph 17 a (1) to (3) inclusive.

(2) DISCONNECT THE OIL LINES. Disconnect the oil suction and feed lines from the oil pump.

(3) REMOVE PUMP. Loosen the oil pump retaining bolt lock nut and remove the lock bolt. Turn the oil pump slightly and pull it out of the bracket.

(4) DISASSEMBLE PUMP (fig. 5). Remove the 4 pump cover screws, remove the cover, gasket, idler gear and shaft with drive gear.

(5) CLEAN AND INSPECT PARTS. Wash all pump parts in cleaning solvent and inspect them for excessive wear or damage.

(6) REASSEMBLY OF PUMP. Replace any parts that are questionable. Install the drive shaft and gear, the idler gear, a new gasket, and the cover. Install the 4 screws and tighten them securely. NOTE: When assembling the pump make sure that the ground (smooth) side of the idler gear is toward the cover. Always use a new genuine Chevrolet gasket as the thickness of this gasket controls the clearance in the pump.

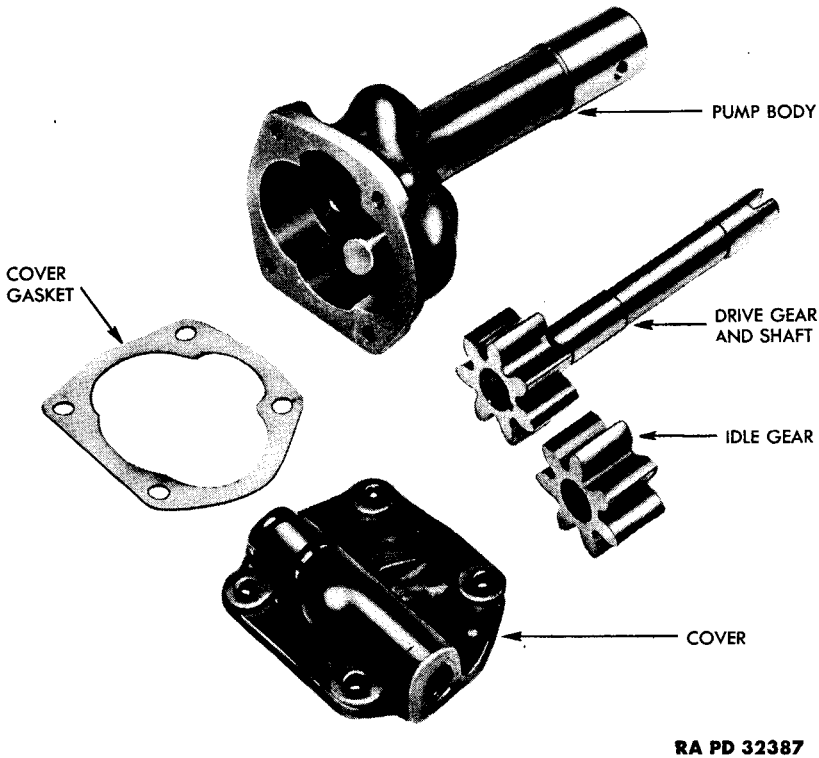


Figure 5 — Oil Pump Parts

(7) INSTALL PUMP. Work the pump up into the bracket. Start the lock bolt and move the pump slightly until it is certain that the lock bolt enters the hole in the pump. Tighten the clamp bolt securely and tighten the lock nut.

(8) CONNECT OIL LINES. Connect the oil pump suction and feed lines and tighten securely.

(9) REPLACE OIL PAN. Follow the procedure given in paragraph 17 **a** (4) to (8) inclusive.

19. MAIN AND CONNECTING ROD BEARINGS, ADJUSTMENT.

a. Adjust Main Bearings.

(1) Follow procedure given in paragraph 17 **a** (1) to (3) inclusive.

(2) REMOVE SPARK PLUGS. Disconnect the spark plug wires and remove the 6 spark plugs.

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

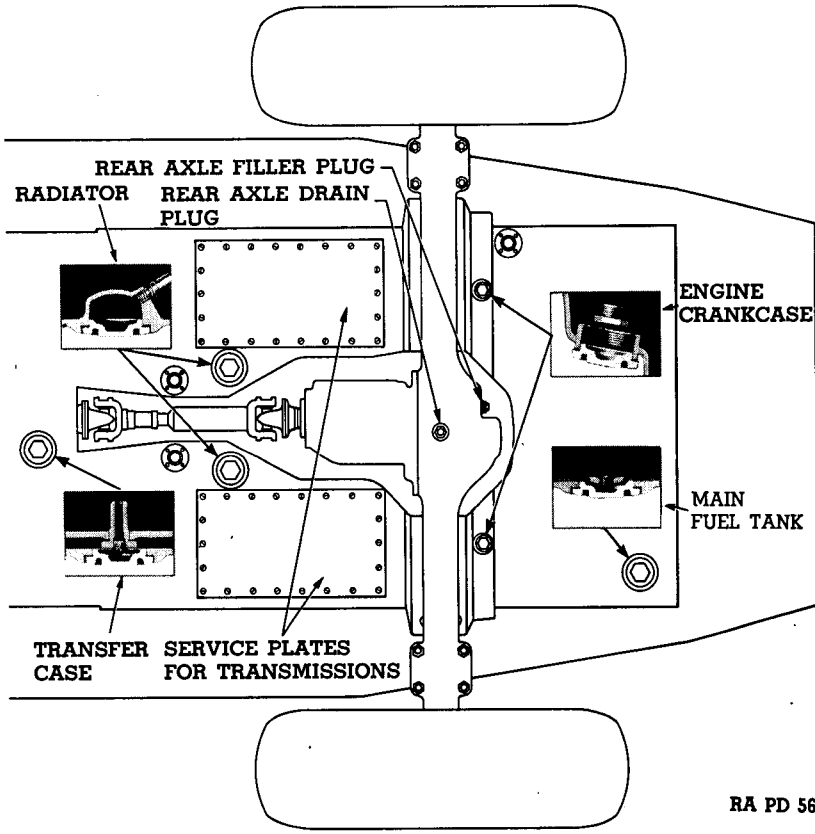


Figure 6 — Checking Connecting Rod Bearing Fit

(3) LOOSEN BEARING CAPS. Release the lock plate tabs at all 4 bearings and loosen the bolts one turn.

(4) CHECK CRANKSHAFT MOVEMENT. Turn the crankshaft a few turns to determine the amount of drag with all bearings loose.

(5) ADJUST REAR MAIN. Remove the 4 cap screws which retain the rear main bearing cap and remove the cap and shims. Remove one 0.002-inch shim from the side which has the most shims. Install the other shims, cap, locks, and bolts. Tighten bolts securely and check the bearing fit by turning the crankshaft and noting any pronounced drag. If no drag was felt, remove the cap and take a shim from the opposite side of bearing. Install cap and tighten securely. Continue this until a slight drag is felt. Install the last 0.002-inch shim which was removed, and install cap. Tighten securely and check to see that the drag is gone.

(6) ADJUST REMAINING BEARINGS. Adjust all remaining main bearings according to the procedure given for the rear main bearing. Work from the rear bearing to the rear intermediate, the front intermediate, and then the front bearing.

(7) TIGHTEN BEARING CAPS. Tighten all bearing caps securely and check to see that the crankshaft turns without a noticeable increase in drag.

(8) LOCK ALL MAIN BEARING CAPS. Bend the lock plates up against the flat of the cap screw on all main bearing bolts.

b. Connecting Rod Bearing Adjustment Procedure.

(1) REMOVE ROD BOLT NUTS. Remove the 2 "pal" nuts, bolt nuts, and oil dipper.

(2) ADJUST BEARING (fig. 6). Remove the bearing cap and remove a shim from the side that has the greater number, or if the same number of shims is on each side, remove a shim from the side opposite the camshaft. Install bearing cap, dipper, and nuts, and tighten securely Try snapping the rod back and forth on the journal. If the rod can be snapped back and forth, remove the cap and a shim from the opposite side and install the cap. Recheck by snapping the rod back and forth. When the rod cannot be snapped back and forth on the crank pin by hand but can be tapped back and forth with a light blow of an 8-ounce hammer, remove the cap and replace the last shim which was removed. NOTE: During all adjusting operations as well as final assembly it is important that the rod cap be installed correctly. The number on the face of rod bars of both rod and cap will be on the camshaft side. The dipper must be installed with the open side toward the camshaft.

(3) CHECK CONNECTING ROD BEARING SIDE CLEARANCE (fig. 7). Check connecting rod side clearance between the upper half of the connecting rod (not the rod cap) and the side of crank pin. This should be between 0.004 inch and 0.011 inch.

(4) TIGHTENING ROD (fig. 7). Install cap, dipper, and nuts. Tighten nuts securely and recheck rod fit. Install new "pal" nuts with the open side of the nut toward the end of the bolt. Tighten the "pal" nuts finger-tight and ½ turn more.

(5) ADJUST REMAINING RODS. Repeat above instructions on remaining rods until all rod bearings have been properly adjusted.

(6) INSPECTION. Make sure that all rod and main bearings have been properly adjusted, that the main bearing bolts are properly locked, that the rod oil dippers are properly installed, and that all "pal" nuts are tight.

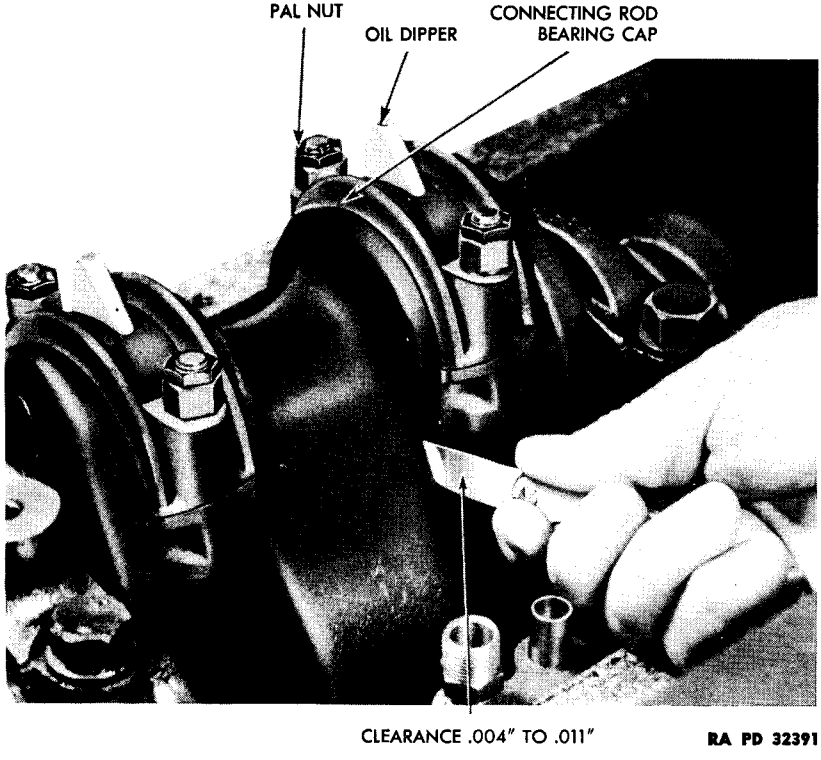


Figure 7 — Checking Connecting Rod Bearing Side Clearance

(7) INSTALL OIL PAN. Follow the procedure given in paragraph 17 a (4) to (8) inclusive.

20. CYLINDER HEAD ASSEMBLY CONDITIONING (VALVE GRINDING).

a. General. The condition of the cylinder head and valve mechanism, more than anything else, determines the power, performance, and economy of a valve-in-head engine. Extreme care should be exercised when conditioning the cylinder head and valves to maintain correct valve stem to guide clearance, correctly ground valves, valve seats of correct width, and correct valve adjustment.

b. Cylinder Head Removal Procedure.

(1) REMOVE AIR CLEANER. Loosen the clamp screw and remove the air cleaner.

(2) DRAIN RADIATOR. Place the drain pan below the drain cock at right side of radiator and open drain cock.

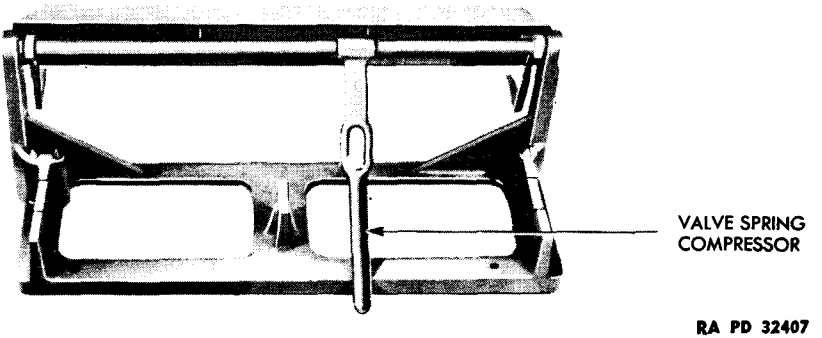


Figure 8 — Cylinder Head Holding Fixture

(3) DISCONNECT THROTTLE ROD. Remove the cotter key and disconnect the lower end of the throttle rod.

(4) DISCONNECT THE GAS LINE. Disconnect the gas feed line at the carburetor end.

(5) DISCONNECT MANIFOLD. Remove the 2 nuts and 6 cap screws which attach manifold to cylinder head. Pull the manifold away from the engine until it clears the manifold studs and block under the manifold to support its weight.

(6) REMOVE ROCKER ARM COVER. Remove the 2 nuts and washers that retain the rocker arm cover and remove the cover and gasket.

(7) REMOVE SPARK PLUGS. Disconnect the spark plug wires and remove the 6 spark plugs.

(8) REMOVE PUSH ROD COVER. Remove the high-tension wire from bottom of coil, remove the 2 screws that attach the coil and lay the coil back out of the way. Remove the remaining push rod cover screws, push rod cover, and gasket.

(9) REMOVE THERMOSTAT HOUSING. Disconnect radiator hose and remove the 2 bolts that retain the thermostat housing and remove the housing.

(10) REMOVE STEAM RELIEF TUBE. Disconnect the relief tube from the temperature indicator fitting and the hose.

(11) REMOVE TEMPERATURE INDICATOR FITTING. Disconnect the temperature indicator from the fitting and remove the fitting.

(12) DISCONNECT ROCKER ARM OIL LINE. Disconnect the oil line at the rocker arm connector.

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

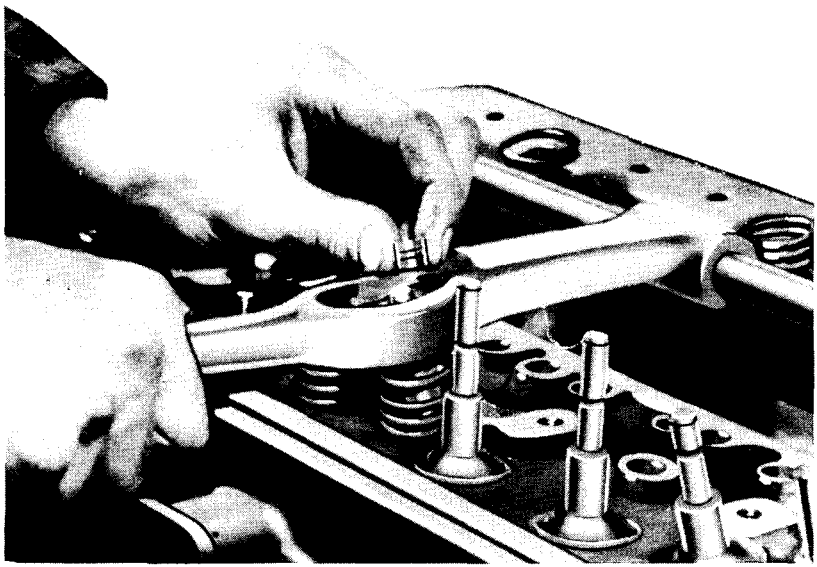


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Figure 9 — Valve Spring Compressor

(13) REMOVE ROCKER ARM ASSEMBLIES. Remove the 4 bolts and 2 nuts that retain the rocker arm shafts and supports to the cylinder head and remove the assemblies. Remove valve spring covers.

(14) REMOVE PUSH RODS. Remove the 12 valve push rods.

(15) REMOVE CYLINDER HEAD. Remove the 15 cylinder head bolts, cylinder head, and gasket.

c. Valve Removal (figs. 8 and 9). Using a cylinder head holding fixture KM-J982A clamp the valve rest on to the bottom of the cylinder head and place the head on the holding fixture KM-J982A and use the spring compressor to hold the springs while removing the valve locks. Remove the locks, valve caps, springs, seats, and valves.

d. Cleaning and Inspection.

(1) Clean the cylinder head externally.

(2) Clean any foreign material from the water passages in the cylinder head.

(3) Clean the carbon from the valve stems, valve heads, valve guides, valve ports, combustion chambers, and piston heads.

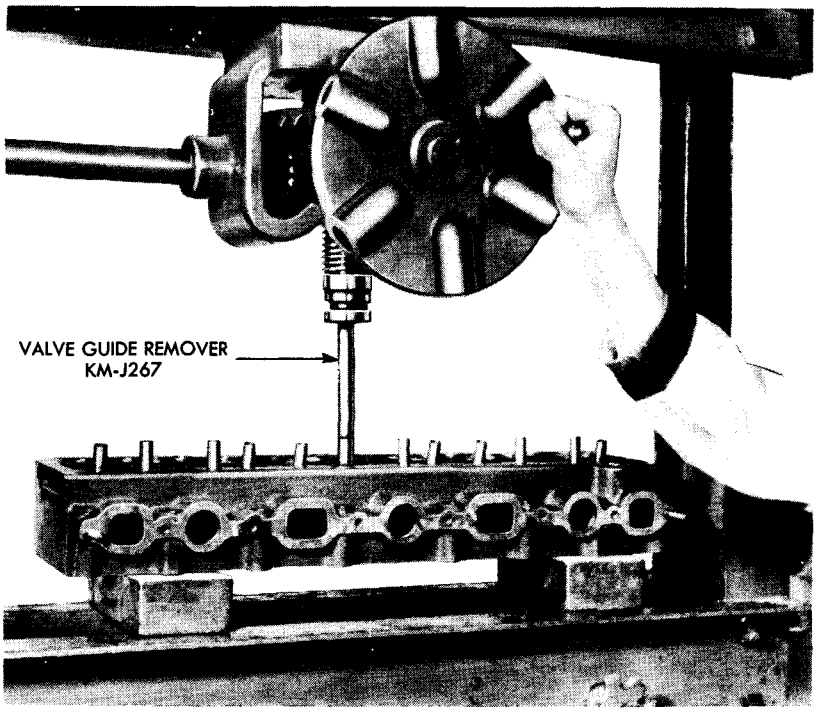

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Figure 10 — Valve Guide Remover

(4) Inspect the cylinder head for cracks in the exhaust ports or combustion chambers.

(5) Inspect the valves for checked or excessively warped heads.

(6) Check the fit of the valve stems in the valve guides. The intake valve stem clearance in the guides should be between 0.001 inch and 0.003 inch, while the exhaust valve to guide clearance should be 0.002 inch to 0.004 inch. If there is excessive clearance it will be necessary to replace either the valves or guides or both to get correct clearance. Excessive clearance will produce lack of power, rough idling, and noisy valves.

e. Valve Guide Replacement (figs. 10 and 11).

(1) REMOVE GUIDES. Place the cylinder head on an arbor press and press the 12 guides from the cylinder head, using valve guide remover KM-J267.

(2) INSTALL NEW GUIDES. The guides do not have a shoulder to determine the distance they would be pressed into the cylinder head;

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

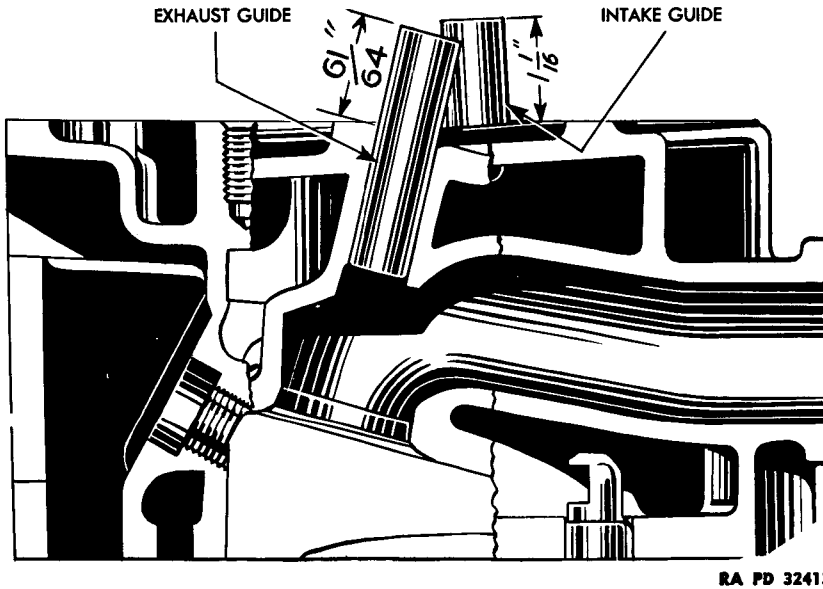

Figure 11 — Valve Guide Height

therefore, it is important that the special replacers KM-J1089 for intake and KM-J1090 for exhaust be used, as they have a shoulder to position the guides. Press the guides into the cylinder head and rough ream them with a 0.341-inch reamer and finish ream with a 0.343-inch reamer.

f. Reseat Valve Seats in Cylinder Head. Use valve seat grinder KM-KMO167C.

(1) Reconditioning valve seats on modern high compression engines is becoming more and more important, because the seating of valves must be perfect in order for the engine to deliver the power and performance that has been built into it.

(2) Another important factor is the cooling of the valve heads. Good contact between the valve and its seat is necessary if the heat in the valve head is to be properly dissipated.

(3) Various types of valve seat grinders and valve reseating equipment are on the market. When using them the instructions of the manufacturer should be followed.

(4) A grinder of the eccentric type for the reconditioning of valve seats is described in the following paragraphs.

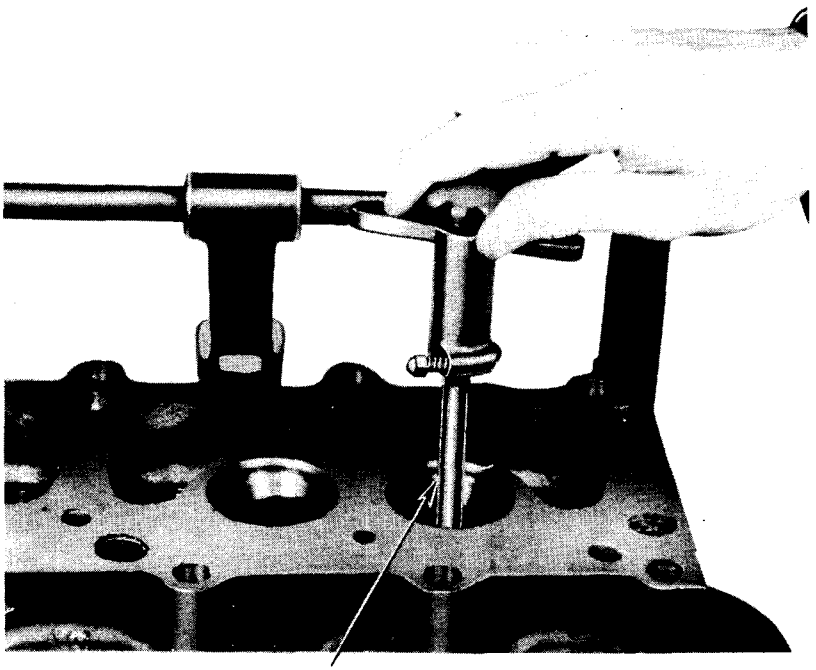

Figure 12 — Installing Expanding Pilot

(5) Before attempting to grind any valve seat, clean carbon thoroughly from the valve port; wipe seat with SOLVENT, dry-cleaning, removing any grease or foreign matter. Great care should be taken to clean the inside of the guide with a wire brush and make sure it is free from carbon and dirt. These precautions permit proper centering of the pilot in the guide.

(6) INSTALL EXPANDING PILOT (fig. 12). Install the expanding pilot in the guide, using the special wrench; expand the pilot with the knurled knob on the top of the wrench, and remove the wrench.

(7) DRESSING THE GRINDING WHEEL (fig. 13). The grinding wheel should be dressed before commencing any valve regrind job. Set the grinder over the 2 top pilots of the dresser stand. When the grinder is seated on these pilots, the wheel will pass over the stud projecting through "A" and the grinder will be in position to dress the wheel. Set the diamond dressing tool at the 30-degree angle. Turn on the switch

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

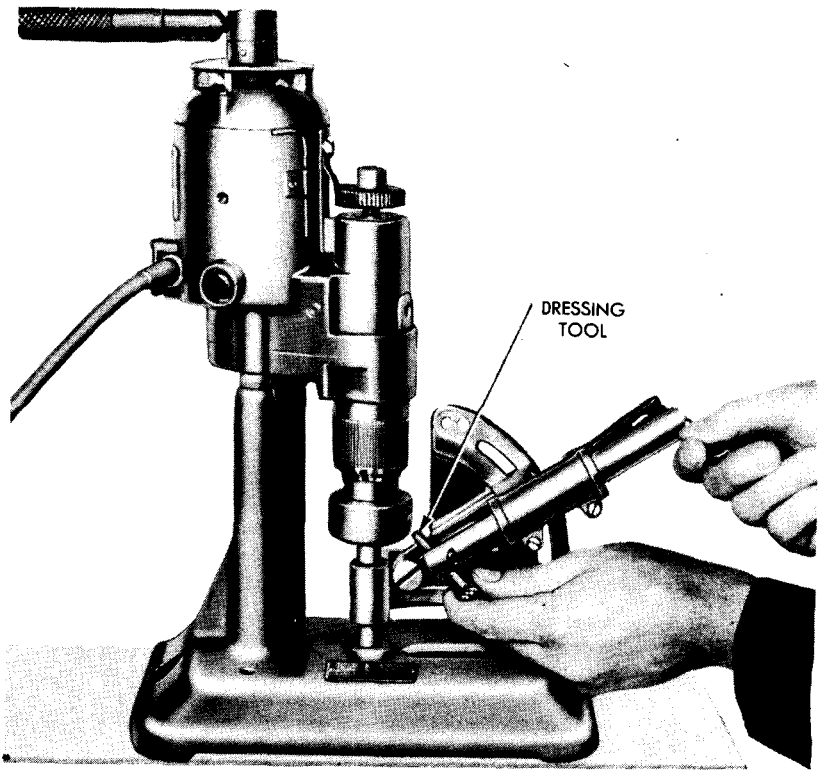

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Figure 13 — Dressing Grinding Wheel

and dress the grinding wheel. NOTE: Never let the grinding wheel become glazed or loaded as it will not grind freely or do accurate work.

(8) SETTING THE GRINDER (fig. 14). Place the grinder over the expanding pilot; then loosen the socket-head set screw and push down the adjusting rod against the top of the pilot. Then lock the set screw tightly. Turn the feed screw to the right until the grinding wheel just clears the seat. Balance the grinder with the compensating handle.

(9) GRINDING THE SEAT (fig. 15). Start the motor and feed the grinding wheel into the seat by turning the feed screw to the left, one notch at a time, until the wheel is grinding all around the face of the valve seat. Before shutting off the grinder, stop feeding the wheel into the seat and give it time to grind itself free. Turn off the switch and allow the grinder to come to a stop before lifting it from the pilot.

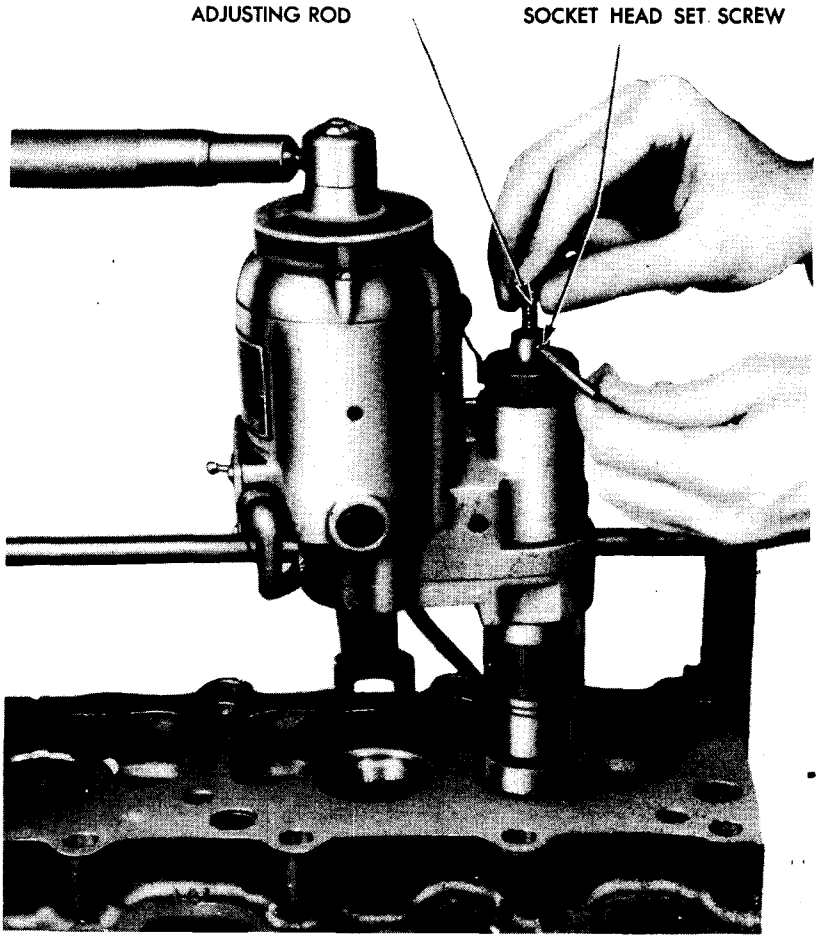

Figure 14 — Setting Adjusting Rod

(10) CHECKING THE SEAT (fig. 16). Mount the valve seat dial indicator on the stationary pilot; set the indicator at "ZERO" and turn the sleeve of the indicator with thumb and finger. When the seat is properly ground the indicator reading will be within 0.001 inch.

(11) NARROWING THE SEAT (fig. 17). Using valve seat cutter KM-KMO105-7, the valve seat may now be narrowed down to the proper width by machining both the port and top of the valve seat. A 70-degree grinding wheel may be used in the port, but a form cutter KM-KMO105-7 must be used to thin down the valve seat from the top, and

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

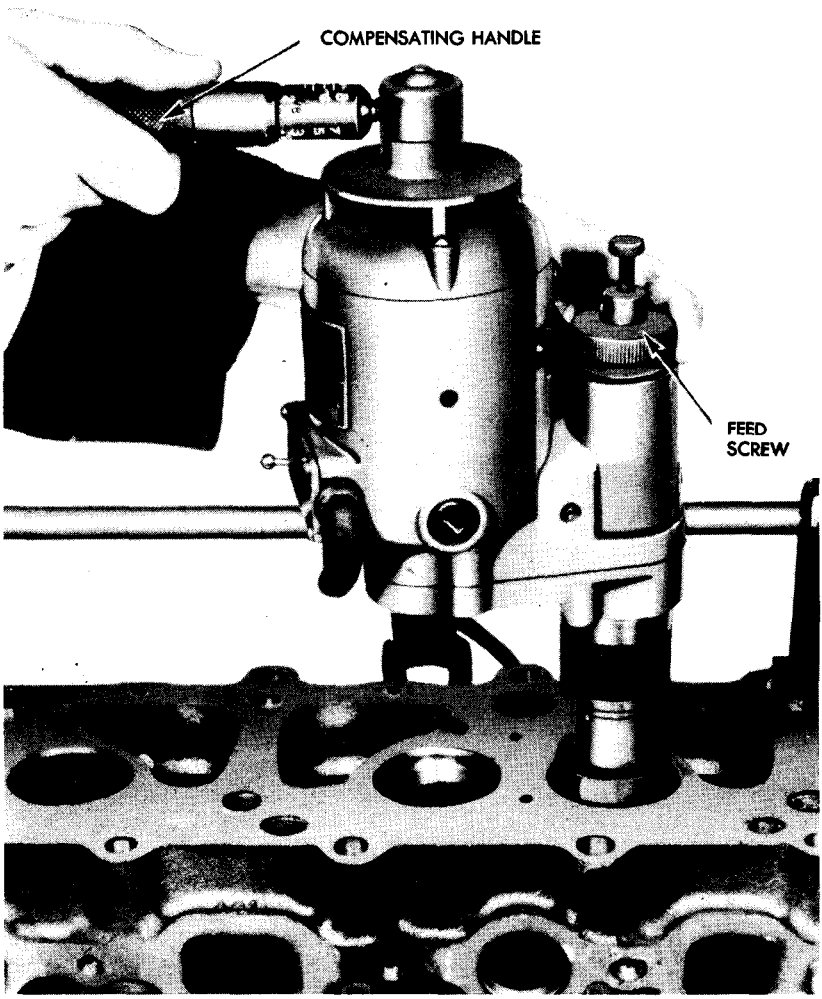

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Figure 15 — Grinding Valve Seat

at the same time machine the edge of the valve recess, thereby preventing restriction of free flow of the incoming gases. NOTE: Good judgment must be used when narrowing a valve seat to make sure the seat contacts the center of the valve face. The width of the intake valve seat should be from $\frac{3}{64}$ inch to $\frac{1}{16}$ inch and the exhaust valve seat from $\frac{1}{16}$ inch to $\frac{3}{32}$ inch. This is very important because the life of a valve grind job depends to a great extent upon the width of the valve and seat contact. If the valve seat is too narrow, heat cannot be dissipated

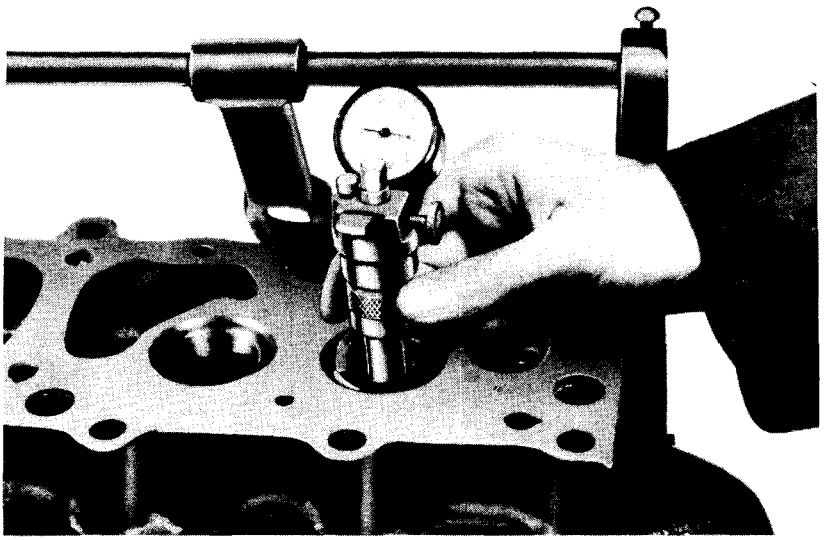

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Figure 16 — Checking Valve Seat

VALVE SEAT
FORM CUTTER
KM-KMO-105-7

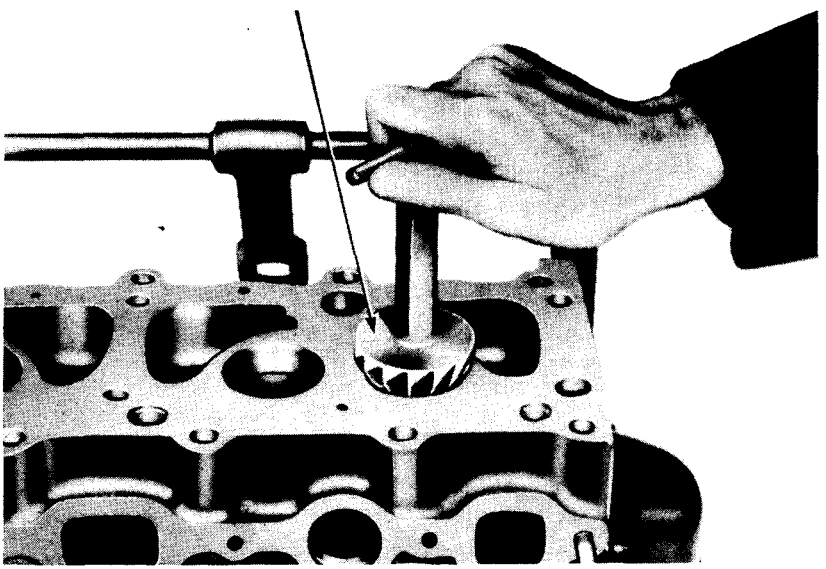

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Figure 17 — Narrowing Valve Seat

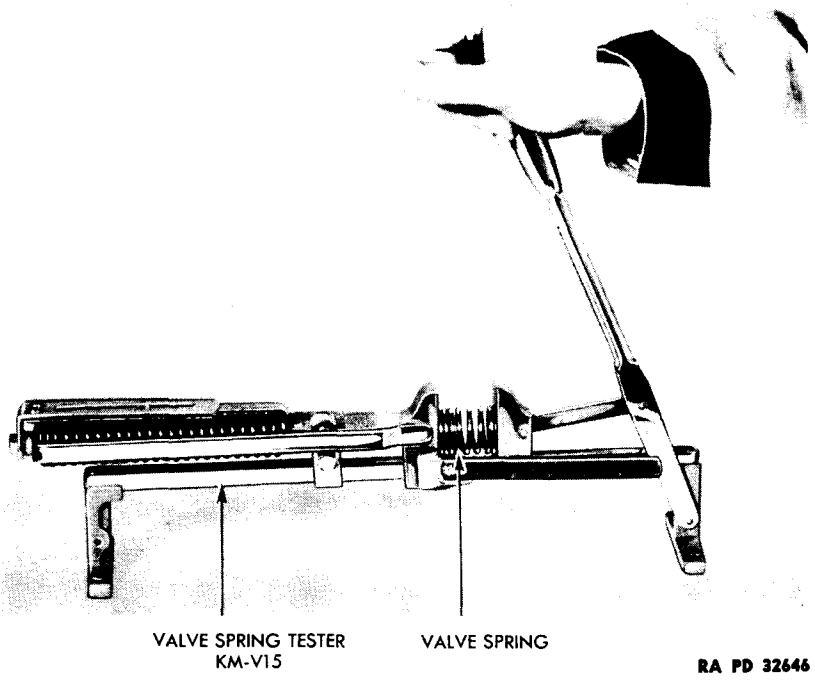

Figure 18 — Valve Spring Tension Gage

from the valve head fast enough. If the valve seat is too wide, carbon particles can be readily caught between the valve and the seat causing blow-by, that will soon burn both the valve and the seat.

g. Refacing Valves.

(1) ADJUST REFACING MACHINE. Valves that are pitted can be refaced to the proper angle, insuring correct relation between the head and stem, on a valve refacing machine. The grinding wheel on the valve refacing machine should be properly dressed to make sure it is true and smooth. The chuck must be set at the proper angle, which is 30 degrees.

(2) TEST FOR SEAT CONTACT. To test for perfect contact, mark lines with a lead pencil about ¼ inch apart on the beveled edge of the valve head and replace the valve. Give the valve one-half turn to the right and one-half turn to the left, using a little extra pressure on the valve. If all pencil marks are removed the grinding is perfect. If, on the other hand, one line or part of one remains untouched, this fact indicates

an uneven spot, and the valve must be reground until it seats properly. NOTE: Before replacing the valves in the cylinder head, clean the valves and the cylinder head. A good valve job is frequently ruined by failure to clean properly all of the parts.

h. Valve Springs and Caps.

(1) Weak valve springs affect the economy and power of the engine; therefore, each time the valves of an engine are ground, the valve springs should be checked to be sure they have not been weakened from the heat of the engine.

(2) TEST VALVE SPRINGS (fig. 18). Place the valve spring in the valve spring tester KM-U15 and compress it to a length of 1½ inches. At this length the spring tension should be from 125 to 133 pounds. Any springs that do not check within these limits should be replaced.

i. Valve Assembly (fig. 8).

(1) INSTALL VALVES. Place the valve in the cylinder head and install the valve holder; place the cylinder head on the cylinder head holding fixture KM-J982A.

(2) INSTALL SPRINGS AND CAPS (fig. 9). Place the valve springs on the valves with the closed coil end toward the cylinder head. Install the round valve caps on the intake valves and the hexagonal caps on the exhaust valves. With the compressor arm, which is a part of the head holding fixture, compress the springs and insert the keys.

j. Condition of Rocker Arm and Shaft Assemblies.

(1) Sludge and gum formation in the shafts and rocker arms may restrict the normal lubrication to the rocker arms and valves. Any time the rocker arm and shaft assemblies have been removed they should be disassembled and thoroughly cleaned.

(2) Remove the rocker arms from the shafts. Remove the hairpin locks, springs, supports, and rocker arms.

(3) CLEANING AND INSPECTION. Clean all the sludge or gum formation from the inside and outside of shafts. Clean the oilholes and passages in the shafts and rocker arms. Inspect the shafts and rocker arms and replace if necessary.

(4) IDENTIFICATION OF ROCKER ARMS (fig. 19). There are 3 each of 4 different rocker arms used, right- and left-hand exhaust and right- and left-hand intake. It is important that these be installed in the correct positions. For identification each type rocker arm carries a

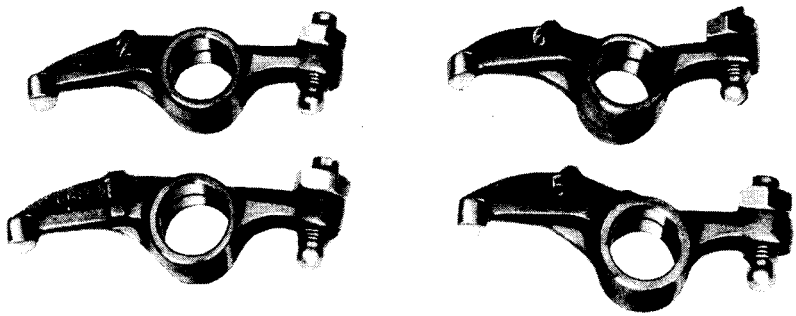

Figure 19 — Rocker Arm Identification

different number stamped on the side. The proper location of the rocker arms according to number are as follows:

No. on Rocker Arm	Type Rocker Arm	For Cylinder	Part No.
1	L.H. Exhaust	1-3-5 Exhaust	839459
2	R.H. Exhaust	2-4-6 Exhaust	839460
5	L.H. Intake	2-4-6 Intake	839463
6	R.H. Intake	1-3-5 Intake	839464

(5) IDENTIFICATION OF SHAFTS. One end of each shaft is plugged; the open end of the shafts should be placed at the center. The rear shaft has a stamped steel baffle in the forward end. This is to distribute evenly oil to both shafts.

(6) INSTALL ROCKER ARMS (fig. 20). Install the rocker arms, springs, and supports on the shafts in the correct position and install the hairpin locks.

k. Cylinder Head Installation Procedure.

(1) INSTALL GASKET (fig. 21). Install new cylinder head gasket with the markings, "THIS SIDE UP," up and on the camshaft side of the engine.

(2) INSTALL CYLINDER HEAD (fig. 21). Install the cylinder head guide pins KM-N344 in the front and rear holes on the manifold side to line up and hold the gasket in place while installing the cylinder head. Install the cylinder head and 15 cylinder head bolts.

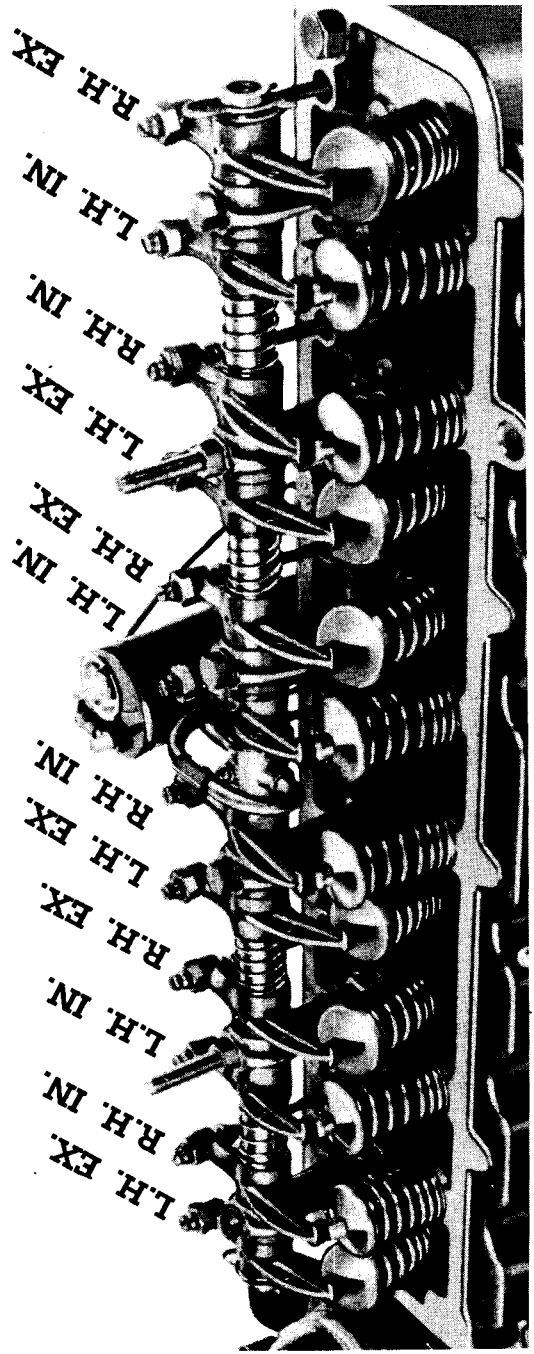

Figure 20 — Rocker Arm Installation Sequence

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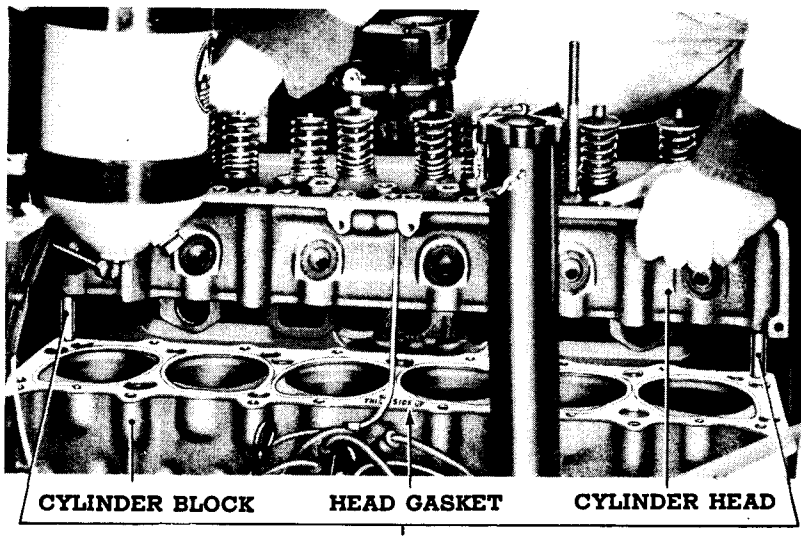

Figure 21 — Cylinder Head Installation

(3) TIGHTEN CYLINDER HEAD BOLTS (fig. 22). Using a cylinder head tension wrench KM-J1313, tighten the bolts evenly, a little at a time in the order shown in figure 22. They should be tightened to 75 to 80 foot-pounds. This sequence and correct tension is important to prevent water and compression leaks.

(4) INSTALL THE VALVE SPRING COVERS. Place the valve spring covers on the end of the valve stems.

(5) INSTALL VALVE PUSH RODS. Place the 12 valve push rods down through the openings in the cylinder head and into the lifters.

(6) INSTALL ROCKER ARM SHAFTS (fig. 23). Install the 2 studs in the cylinder head. Place the connector between the 2 shafts and install the assembly over the studs and down against the cylinder head. Install the 4 bolts and 2 nuts which retain the shaft assemblies and tighten them securely.

(7) CONNECT ROCKER ARM OIL LINE. Attach rocker arm oil line to connector assembly and tighten securely.

(8) INSTALL TEMPERATURE GAGE. Install fitting and tighten. Install gage and tighten.

(9) INSTALL STEAM RELIEF TUBE. Install steam relief tube and tighten. Connect the hose to front end of tube.

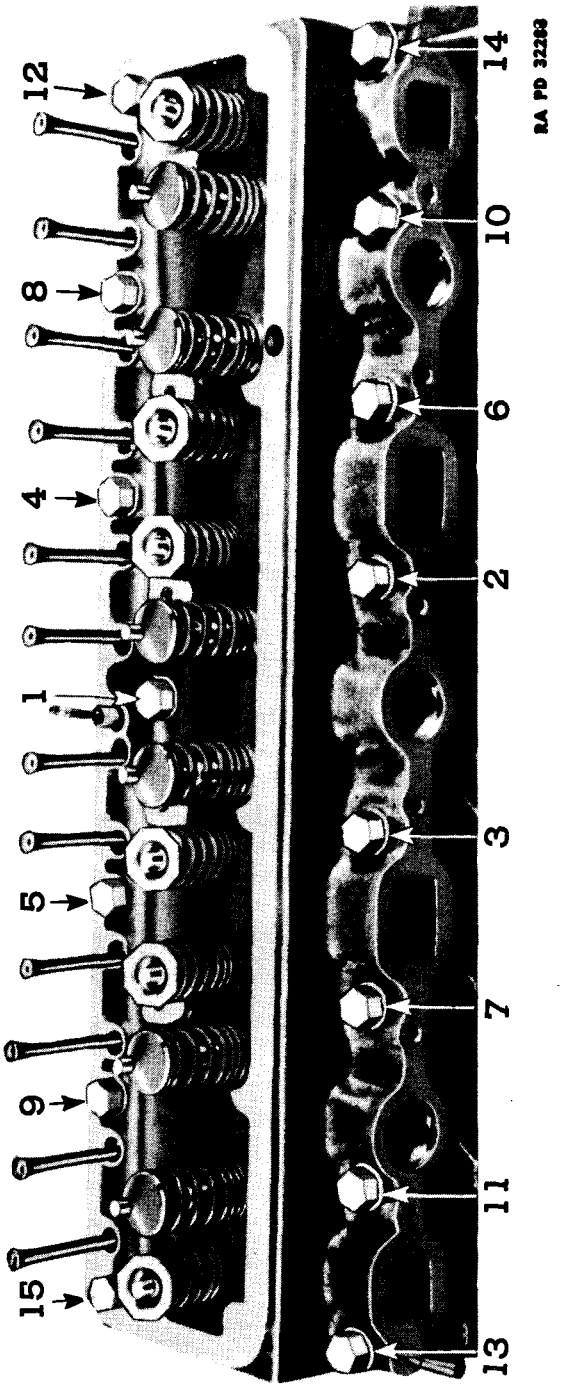

Figure 22 — Cylinder Head Bolt Tightening Sequence

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

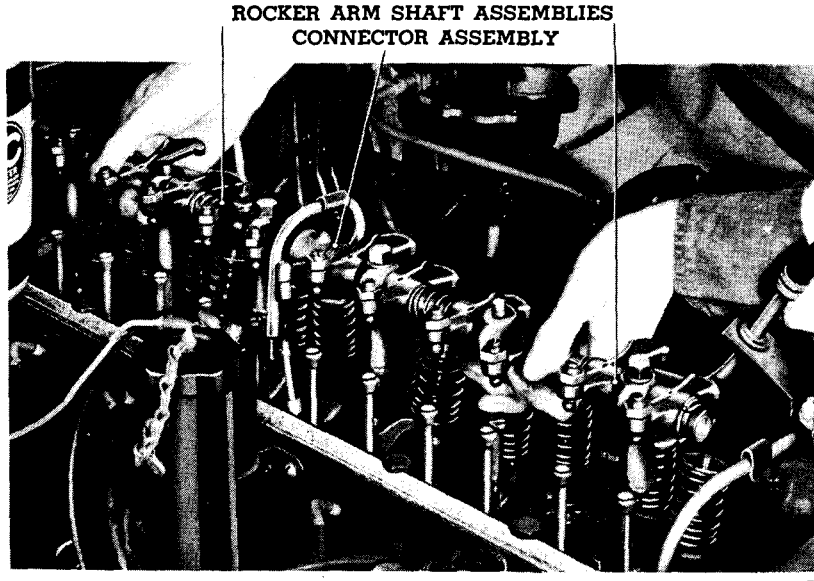

Figure 23 — Installing Rocker Arms and Shafts

(10) INSTALL THERMOSTAT HOUSING. Install the housing using a new gasket and tighten the 2 bolts securely. Connect radiator hose.

(11) INSTALL PUSH ROD COVER. Install push rod cover using a new gasket, and tighten the screws securely.

(12) INSTALL SPARK PLUGS. Set the spark plug gaps at 0.040 inch. Place new gaskets on the 6 plugs and install them in the cylinder head finger-tight, then from ½ to ¾ turn with wrench. NOTE: Care must be taken when installing these 10-millimeter plugs, as it is very easy to strip the threads in the head or distort the plugs, which upsets the point setting. Connect the high-tension wires to the plugs and coil.

(13) SET VALVE CLEARANCE. Roughly set the valve clearance to make sure that all valves will seat.

(14) INSTALL MANIFOLD (fig. 4). Clean the gasket flange on the manifold and cylinder head, install the new gaskets, and slide the manifold in place over the studs, making sure the gaskets are in place. NOTE: It is possible to install the 4 cap screws with clamps to hold the gaskets in place. Place the clamps in a vertical position and then install the manifold.

(15) TIGHTEN MANIFOLD. Install the 6 cap screws with lock plates or washers and the 2 nuts, and tighten them securely.

(16) CONNECT THROTTLE ROD. Connect the lower end of the throttle rod and install a new cotter key.

(17) CONNECT GAS LINE. Connect the gas feed line to the carburetor and tighten it securely.

(18) FILL COOLING SYSTEM. Fill the cooling system and check for leaks.

(19) INSTALL AIR CLEANER. Install the air cleaner and tighten the clamp securely.

(20) ADJUST VALVES. Adjust valves according to the procedure in paragraph 21.

21. VALVE ADJUSTMENT.

a. General.

(1) Before adjusting valve clearance, the engine must be thoroughly warmed up to normalize the expansion of all parts and stabilize the oil temperature. This is very important because during the warm-up period, the valve clearance varies considerably.

(2) Covering the radiator with a blanket will not materially hasten the warming-up process because, even with the water temperature quickly raised to 185 degrees, it does not change the rate at which the oil temperature increases.

(3) The actual temperature of the oil is not as important as the stabilization of the oil temperature. The expansion or contraction of the valves, rocker arm supports, push rods, cylinder head, and cylinder block are relative to this oil temperature. Hence, after the oil temperature is stabilized, these parts have stopped expanding and no change in valve adjustment takes place.

b. Procedure.

(1) NORMALIZE ENGINE. To normalize the engine remove the rocker arm cover, run the engine at a fast idling speed (approximately 600 revolutions per minute) and check the oil temperature with a thermometer at the overflow pipe on the valve rocker shaft connector. NOTE: When a constant oil temperature is attained for a period of 5 minutes, the engine is normalized and ready for valve adjustment.

(2) LUBRICATE VALVE STEMS. Lubricate all valve stems by squirting oil through the spring and onto the stem. Oil the rocker arms at the shaft, ball and socket joint, and valve cap end.

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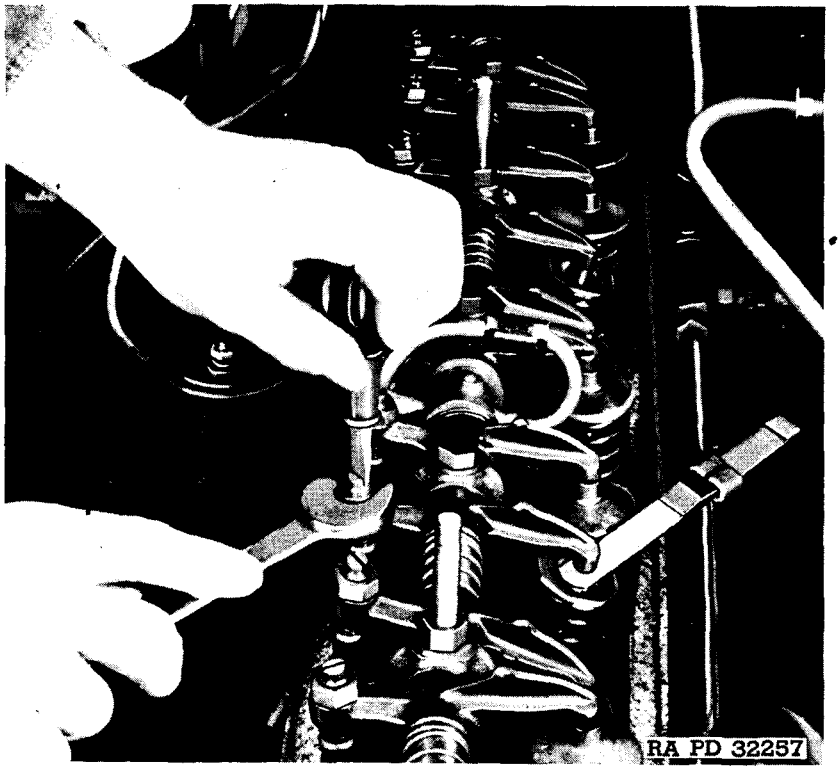


Figure 24 — Adjusting Valves

(3) ADJUST VALVES (fig. 24).

(*a*) Adjust the valves to the following clearance specifications:

	Normal Operation	Heavy Duty Operation
Intake	0.006 inch to 0.008 inch	0.010 inch
Exhaust	0.013 inch to 0.015 inch	0.020 inch

(*b*) On severe truck operation it is advisable to adjust the valve to the high setting.

(*c*) With the engine idling, place the feeler between the valve cup and the end of the rocker arm. If the clearance is not correct, loosen the adjusting screw lock nut and turn the screw slightly; tighten the lock nut and recheck; continue until all valves are adjusted correctly.

(4) REPLACE ROCKER ARM COVER. Install a new gasket and replace the cover. Make sure the cover seats on the gasket; install the nuts and tighten them securely.

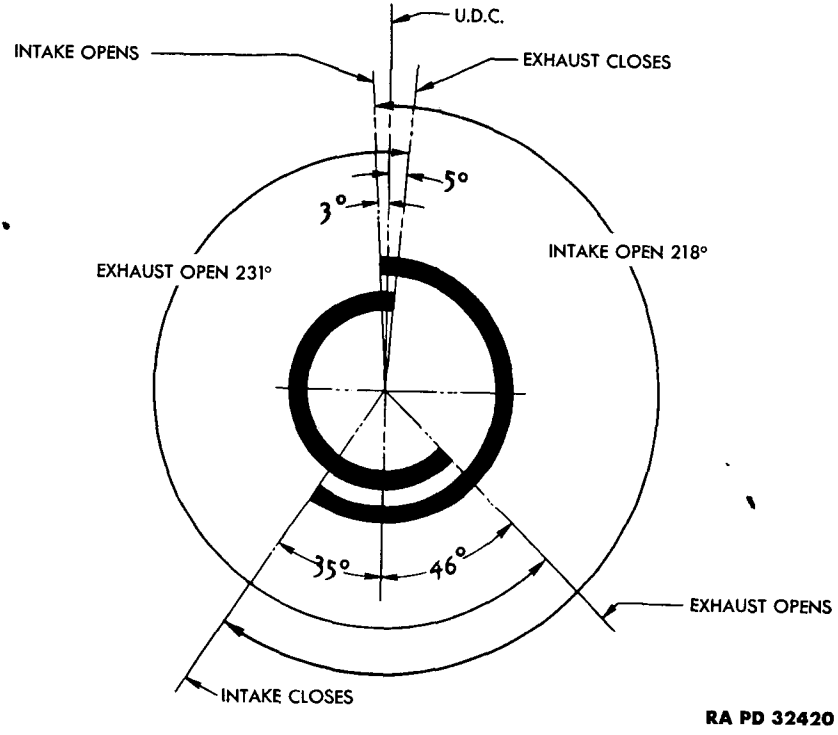


Figure 25 — Valve Timing

22. VALVE TIMING.

a. General.

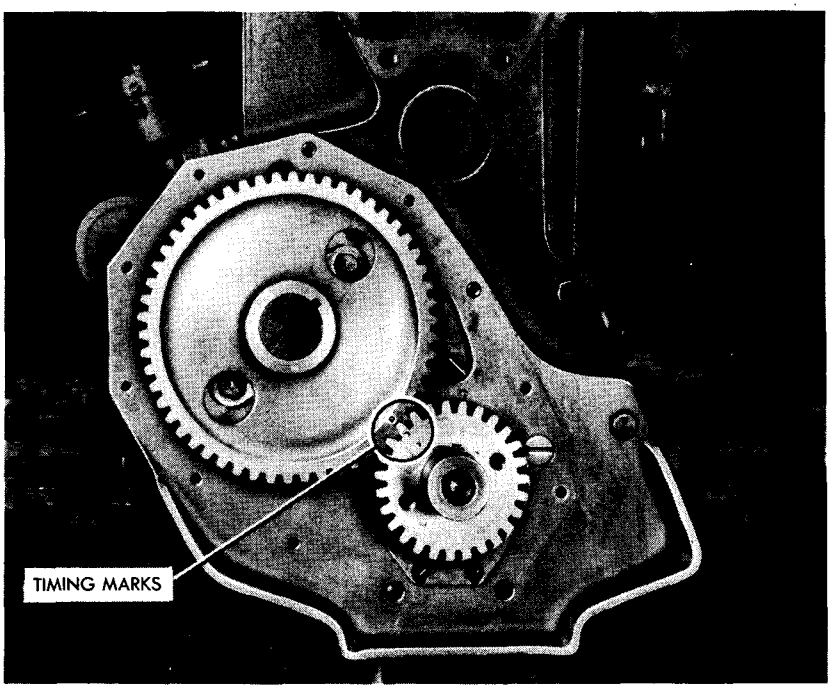
(1) The exhaust and intake valves must open and close at the correct time in relation to the piston position in order for the cylinders to get a full charge of fuel, properly compress it, burn it, and completely dispose of the exhaust gases.

(2) The intake valves start to open 3 degrees before the piston reaches top dead center and remain open 218 degrees, closing 35 degrees past lower dead center (fig. 25).

(3) The exhaust valves open 46 degrees before the piston reaches lower dead center and continue open for 231 degrees, closing 5 degrees past upper dead center (fig. 25).

(4) This is determined by correct installation of the timing gears. Both gears are marked for valve timing. They should be meshed as shown in figure 26. If for any reason the valve timing is questioned, the following method of checking will save considerable service work:

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE



RA PD 32421

Figure 26 — Timing Gear Markings

b. Checking Valve Timing.

(1) REMOVE VALVE COVER. Remove the 2 retaining nuts and remove the valve rocker arm cover.

(2) SET EXHAUST VALVE. Crank engine until No. 1 exhaust valve is closed; tighten the adjusting screw on No. 1 exhaust valve rocker arm just to remove all valve clearance.

(3) LOCATE TIMING MARK. Hand-crank the engine until No. 1 exhaust valve opens and just starts to close; continue cranking slowly and watch the flywheel, through the timing opening, for the triangle timing mark to line up with the pointer as shown in figure 27.

(4) MOUNT DIAL GAGE (fig. 27). Mount the dial gage on the rocker arm shaft support with the spindle of the indicator on top of No. 1 cylinder exhaust valve adjusting screw. Set the indicator at 0.036 inch.

(5) CHECK VALVE POSITION. Slowly crank the engine until the indicator hand just stops moving. The indicator should read "ZERO" plus or minus 0.003 inch.

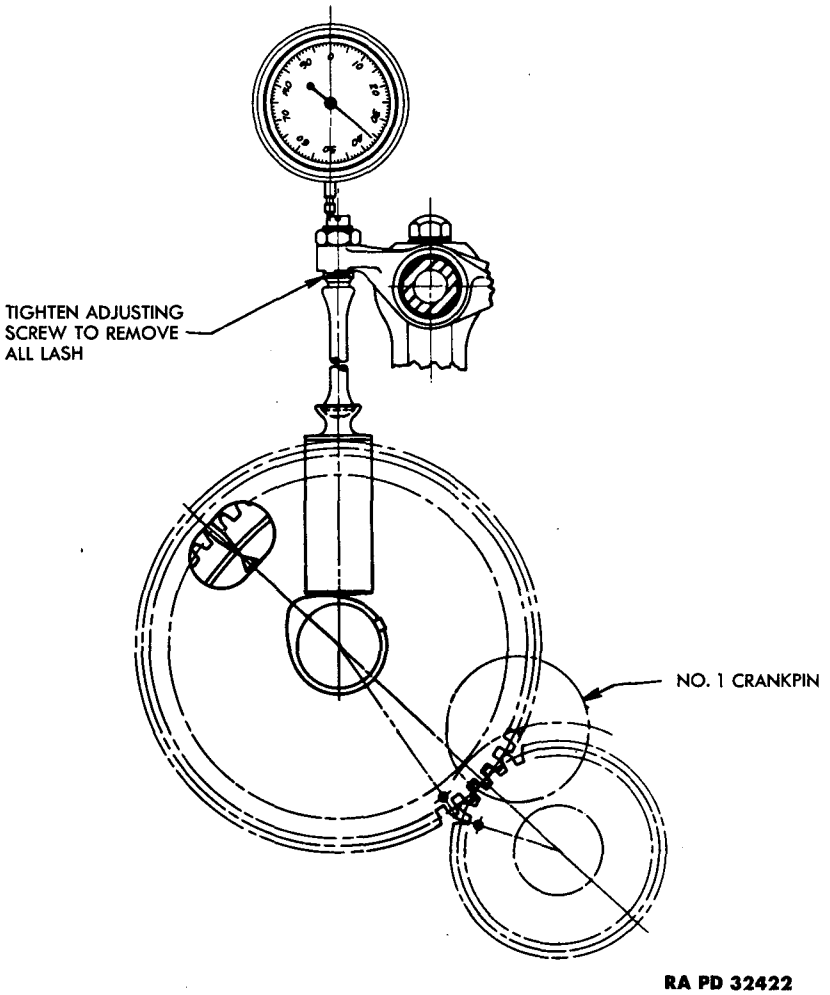


Figure 27 — Checking Valve Timing

(6) If the valve does not close within the above limits it is advisable to recheck.

(7) To correct valve timing it is necessary to remove the timing gear cover according to the procedure in paragraph 23 and change the gear teeth position or install a new timing gear. See timing gears and camshaft service instructions in paragraph 42.

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

23. TIMING GEAR COVER GASKET, REPLACEMENT.

a. General. To remove the timing gear cover it is necessary to remove the radiator and grille. The most practical and convenient method of doing this is to remove the front end sheet metal as an assembly.

b. Front End Sheet Metal Removal.

(1) REMOVE HOOD. Remove the hood brace rod anchor screws at the cowl and the hood hinge pins; then remove the hood.

(2) REMOVE HOOD SIDE PANELS.

(3) DISCONNECT RADIATOR BRACE ROD. Disconnect the radiator brace rod from the radiator support.

(4) DRAIN COOLING SYSTEM. Drain the cooling system and remove drain cock.

(5) DISCONNECT RADIATOR HOSE. Disconnect the radiator hose at top and bottom of radiator.

(6) DISCONNECT WIRING. Disconnect the electrical wiring at the junction block on each side and the blackout wires at bayonet connectors.

(7) REMOVE FENDER BOLTS. Remove the fender to running board and fender to cowl bolts on each side of vehicle.

(8) LOOSEN RADIATOR SUPPORT BRACE. Remove the bolts which attach the radiator support diagonal braces to the frame.

(9) REMOVE RADIATOR ANCHORAGE BOLTS. Remove the nuts from the lower radiator anchorage to frame cross member bolts and remove the bolts.

(10) REMOVE SHEET METAL. Slide the front end sheet metal assembly forward until the fan shroud clears the fan blades; then lift the assembly off the chassis.

c. Remove Timing Gear Cover.

(1) REMOVE HARMONIC BALANCER (fig. 28). Place the 2 puller screws in the tapped holes in the balancer and tighten them securely; turning the puller handle clockwise removes the balancer.

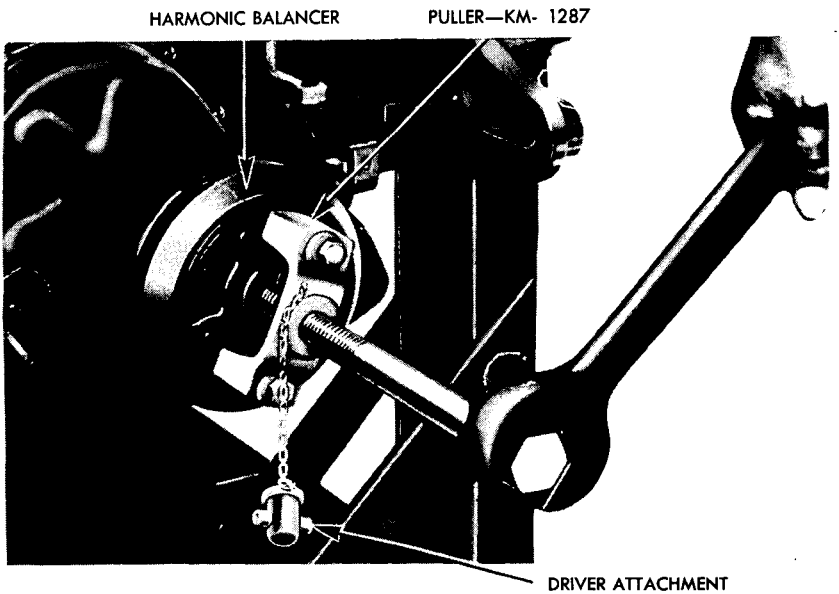


Figure 28 — Harmonic Balancer Removal

(2) REMOVE OIL PAN. This is necessary to remove the 2 lower timing gear cover bolts. Follow the procedure given in paragraph 17 a (1) to (3) inclusive.

(3) REMOVE TIMING GEAR COVER SCREWS. Remove the 10 stove bolts and 2 cap screws which attach the timing gear cover, and remove the cover and gasket.

d. Cleaning and Inspection.

(1) Clean the timing gear cover thoroughly.

(2) Clean the timing gears and plate.

(3) Clean the oil return passages between the timing gear case and crankcase.

(4) Inspect the oil seal in the cover and if necessary replace the seal.

(5) Inspect the timing gear oil nozzle.

(6) Inspect the timing gears.

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

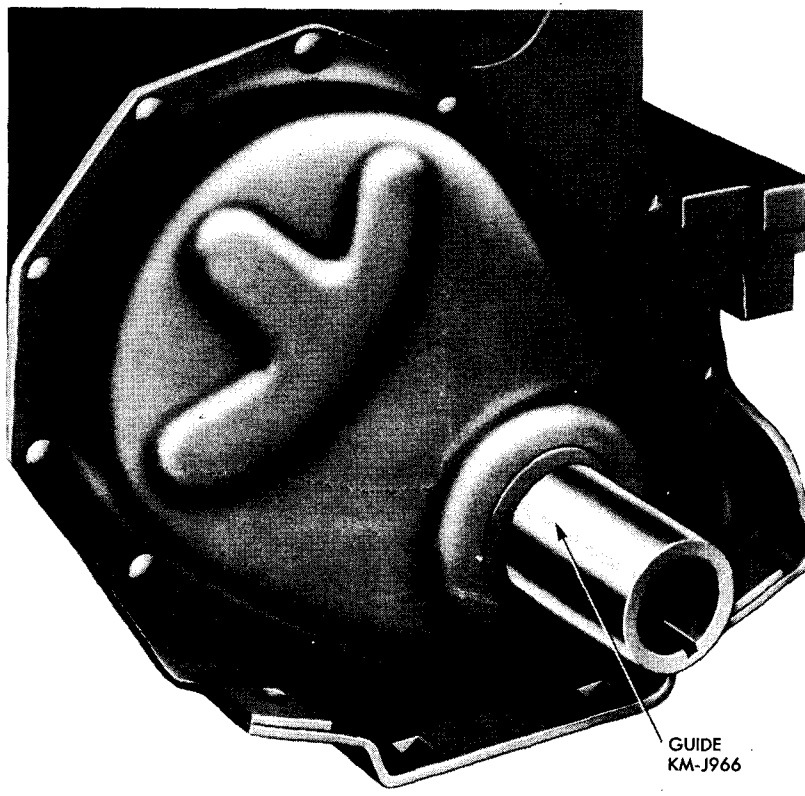


Figure 29 — Centering Timing Gear Cover

e. **Install Timing Gear Cover** (fig. 29).

Place the new gasket against the timing gear plate. Install the timing gear cover centering guide KM-966 through the oil seal; place the cover in position with the centering guide over the end of the crankshaft and install the 10 stove bolts and 2 cap screws which retain the timing gear cover. Tighten the cover bolts securely and remove the centering guide. NOTE: If this guide is not used the oil seal will be damaged when replacing the harmonic balancer.

f. **Install the Oil Pan.** Follow the procedure given in paragraph 17 a (4) to (8) inclusive.

g. **Install Harmonic Balancer.** Place the driver head in the starting crank jaws of the pulley; line up the keyway in the pulley with the

key in the shaft and drive the balancer into place using the puller screw as a driver (harmonic balancer puller KM-J1287).

h. Install Front End Sheet Metal.

(1) PLACE SHEET METAL ON CHASSIS. Place the sheet metal assembly on the frame and slide it back into position, making sure that the fan shroud clears the fan to prevent damaging the fan, shroud, or radiator core.

(2) INSTALL RADIATOR ANCHORAGE BOLTS. Line up the holes in the radiator anchorage, rubber mounting, and frame cross member. Install the bolts and nuts, and tighten securely.

(3) INSTALL FENDER BOLTS. Install and tighten the fender to cowl and fender to running board bolts on each side of vehicle.

(4) ATTACH WIRING. Attach the electrical wiring at the junction blocks and bayonet connections.

(5) ATTACH DIAGONAL BRACES. Install the bolts which attach the diagonal braces to frame and tighten them securely.

(6) INSTALL RADIATOR HOSE. Install the upper and lower radiator hose and clamps. Tighten the clamps securely. Install the radiator drain cock.

(7) FILL COOLING SYSTEM. Fill the cooling system and check for leaks.

(8) CONNECT RADIATOR BRACE ROD. Connect the radiator brace rod and tighten securely.

(9) INSTALL HOOD PANELS. Install and tighten the hood side panels.

(10) INSTALL HOOD. Install the hood; install the hood hinge pins and hood brace rod to cowl screws.

24. PISTON RINGS, REPLACEMENT.

a. Cylinder Head Removal Procedure. Follow the procedure given in paragraph 20 **b** (1) to (15) inclusive.

b. Oil Pan Removal Procedure. Follow the procedure given in paragraph 17 **a** (1) to (3) inclusive.

c. Piston Removal Procedure.

(1) REMOVE ALL CONNECTING ROD BOLT NUTS. Remove the "pal" nuts and retaining nuts from the 12 connecting rod bolts.

(2) REMOVE PISTON ASSEMBLIES. Remove the dipper and bearing cap; push the piston and rod up enough to clear the crank journal; install the cap, dipper, and nuts on the rod. Push the piston and rod

assembly up out of the cylinder bore. NOTE: It will be necessary to turn the crankshaft slightly so that the crank journal will be down on the rod that is to be disconnected from the crankshaft.

d. Remove Piston Rings. Remove the old rings by expanding them and working them over the head of the piston.

e. Cleaning and Inspection.

(1) Clean the pistons and rods carefully; remove all carbon from the ring grooves and drilled passages in the piston. Make sure that there are no nicks or burs on the ring lands that would cause the rings to bind in the grooves.

(2) Check the pistons, cylinder walls, and piston pin fit according to instructions given in paragraphs 29 and 30.

f. Fitting New Piston Rings.

(1) GENERAL. Two compression rings and an oil control ring are used on each piston. The 2 compression rings are used in the 2 upper grooves of the piston. The face of the ring is tapered 0.001 inch to assist in oil control during the break-in period. These rings must be installed on the piston with the word "TOP," cast in the upper side of the ring, toward the head of the piston. Piston rings are furnished in standard size and also in 0.020-inch and 0.040-inch oversizes.

(2) CHECK RING IN CYLINDER BORE. Slip the ring into the cylinder forcing it down the bore about 2 inches with the piston. This will square the ring in the cylinder. Check the gap between the ends of the ring with a feeler gage. This should be from 0.005 inch to 0.015 inch.

(3) CORRECT RING GAP. If the space between the end of the rings is less than 0.005 inch, remove the ring, and with a fine file, dress the ends until proper clearance is obtained. Fit each ring separately to the cylinder in which it is to be used. NOTE: If the space between the end of the ring is materially less than 0.005 inch or more than 0.015 inch, rings of the next smaller or larger size should be selected, as excessive filing of rings will not permit uniform ring contact to the cylinder wall. This will result in excessive oil consumption.

(4) CHECK RINGS IN PISTON (fig. 30). Slip the outer edge of a ring in the groove in which it is to be installed and roll it entirely around the piston to make sure that the ring does not bind at any point.

(5) CHECK RINGS INSTALLED IN PISTON (fig. 31). Place the rings in their respective grooves in the piston and check for clearance. The top ring should be very free on a 0.002-inch feeler but have a pronounced drag on a 0.003-inch feeler. The center ring should be free on a 0.002-inch feeler but lock on a 0.003-inch feeler. The bottom or oil control ring should produce a slight drag on a 0.002-inch feeler.

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Figure 30 — Checking Ring Fit In Groove

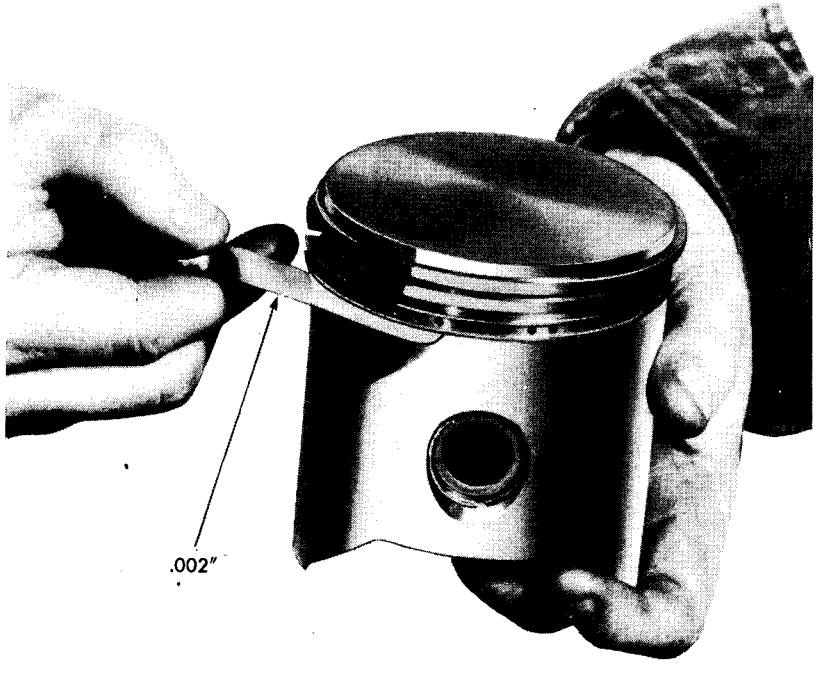
(6) CORRECT RING FIT. If the rings do not have sufficient clearance in the grooves, they may be dressed off by placing a piece of CLOTH, abrasive, aluminum-oxide, on a surface plate, placing the ring flat on the CLOTH, abrasive, aluminum-oxide, and work it back and forth to dress the ring evenly. NOTE: Fit and install all rings according to the above procedure. It is important that the rings be used in the piston groove and cylinder for which they were fitted.

g. Piston and Rod Installation Procedure.

(1) LUBRICATION. Lubricate the cylinder walls, pistons, and rod bearings.

(2) LOCATE RINGS. Turn the 3 rings on the piston to stagger the ring gaps and, at the same time, avoid having any of the gaps directly above the piston pin. This gives the best possible compression seal.

(3) PLACE THE PISTON AND ROD ASSEMBLIES IN CYLINDER. Place the connecting rod and piston assembly in the cylinder bore from which it was removed. Make sure the side of the rod with the cylinder number



RA PD 32488

Figure 31 — Checking Ring Clearance

on is toward the camshaft. Compress the rings with the piston inserter KM-KMO357, and force the piston down into the cylinder.

(4) INSTALL CONNECTING ROD ON CRANKSHAFT. Remove the dipper and rod cap; place the rod on the crankshaft journal; install the cap and oil dipper. Install all 6 piston assemblies according to this procedure.

(5) ADJUST CONNECTING ROD BEARINGS. Follow the procedure given in paragraph 19 **b** (1) to (6) inclusive.

h. Install Oil Pan. Follow the procedure given in paragraph 17 **a** (4) to (8) inclusive.

i. Install Cylinder Head and Adjust Valves. Follow the procedure given in paragraph 20 **k** (1) to (19) inclusive, and paragraph 21.

25. ENGINE MOUNTINGS, REPLACEMENT.

a. General. The engine is attached to the frame by 3 rubber cushioned mountings to prevent engine vibrations being transmitted to the cab. One of the mountings is placed at the timing gear plate and

attaches to the center of the frame front cross member. The other 2 mountings are located at the sides of the engine and attach to the clutch housing and to frame brackets.

b. Front Engine Mounting Replacement.

(1) DRAIN COOLING SYSTEM. Open the 2 drain cocks and drain the cooling system.

(2) REMOVE HOSE. Loosen the hose clamp screws and remove the upper and lower radiator hose.

(3) REMOVE FAN BLADES. Remove the 4 bolts and remove the fan blades.

(4) LOOSEN REAR MOUNTING BOLTS. Loosen the rear motor mounting bolts a few turns.

(5) REMOVE FRONT MOTOR MOUNTING BOLT NUTS. Remove the 2 nuts from the front motor mounting to frame cross member bolts and the 2 nuts from the front end plate to motor mounting bolts.

(6) JACK UP ENGINE. Jack up the front end of the engine using suitable blocking to avoid damaging the oil pan.

(7) REMOVE THE OLD MOUNTING. Pull the mounting off the retaining bolts.

(8) ASSEMBLE THE NEW MOUNTING. Place the 2 round head mounting bolts through the mounting top plate; place the mounting oil shield over the top plate and place the 2 pieces over the bolts in the engine front end plate.

(9) INSTALL MOUNTING. Place the rubber mounting over the bolts with the large end of the 2 bushings toward the engine front end plate. Install the nuts on the 2 center bolts which are attached to the engine front end plate. Tighten the nuts securely and install cotter pins.

(10) ATTACH TO FRAME MEMBER. Install mounting retainer and lower the front end of engine so that bolts pass through holes in frame front across member. Install the washers and nuts and tighten securely.

(11) TIGHTEN REAR MOUNTING BOLTS. Unless the rear mountings are to be replaced, the bolts should be tightened securely.

(12) INSTALL FAN BLADES. Place the fan blades against the pulley; install the 4 bolts and tighten them securely.

(13) INSTALL RADIATOR HOSE. Install the upper and lower hoses and tighten the clamps securely.

(14) FILL COOLING SYSTEM. Close the drain cock and fill the cooling system.

c. Rear Engine Mounting Replacement.

(1) REMOVE MOUNTING BOLTS. Remove the upper and lower mounting bolts on each side mounting.

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

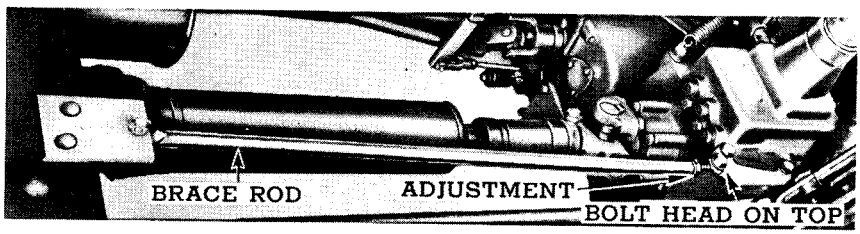


Figure 32 — Power Plant Brace Rod

(2) REMOVE MOUNTINGS. Place the jack under transmission and raise rear end of engine slightly. Remove the 2 mountings.

(3) INSTALL MOUNTINGS. Place the mountings in position with side having the wider plate toward the engine support bracket, and install the upper bolts. Lower the motor and at the same time line up the dowels in the mounting lower plates with the dowel holes in the frame brackets.

(4) INSTALL LOWER BOLTS. Install the lower spacers, lock washers, and bolts. Tighten the lower and upper bolts on each mounting.

d. Power Plant Brace Rod Adjustment (fig. 32).

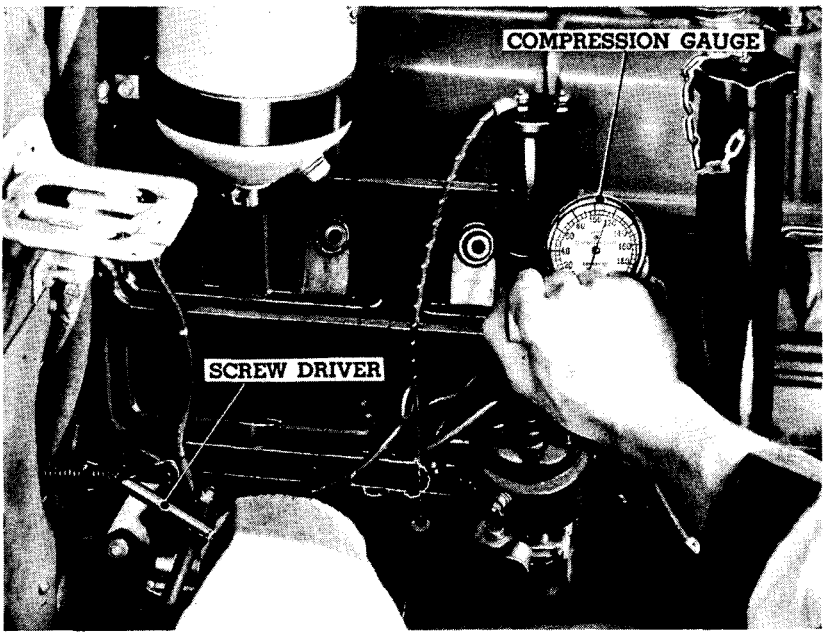
(1) GENERAL. To control the fore and aft movement of the power plant in its mountings, when the hand brake is applied, a brace rod is used between the transmission and frame second cross member, The rear end of the brace attaches to a bracket on the frame cross member while the front end is fitted with an adjustable eyebolt. The adjustable eyebolt attaches to a bracket mounted on the right side of the transmission by 2 cover bolts.

(2) LOCATE VEHICLE ON LEVEL FLOOR. The vehicle should be in a level place so that the power plant will not have a tendency to shift fore or aft in its mountings.

(3) LOOSEN ADJUSTING EYE. Loosen adjusting eyebolt lock nut and remove the brace rod to transmission bracket bolt.

(4) ADJUST ROD LENGTH. Turn the adjusting eyebolt to shorten or lengthen the rod so that the attaching bolt will just drop through the adjusting eye and transmission bracket. Install flat washer and nut. Tighten nut and install cotter pin.

(5) TIGHTEN LOCK NUT. Tighten adjusting eyebolt lock nut securely.



RA PD 32290

Figure 33 — Compression Check

26. ENGINE TUNE-UP.

a. General.

(1) One of the most important operations in the maintenance of an engine is proper engine tune. This operation, more than any other, determines whether or not the engine delivers the maximum in performance and economy. Only by accurately making the following checks and adjustments at regular intervals, will the engine produce performance and economy that has been built into it.

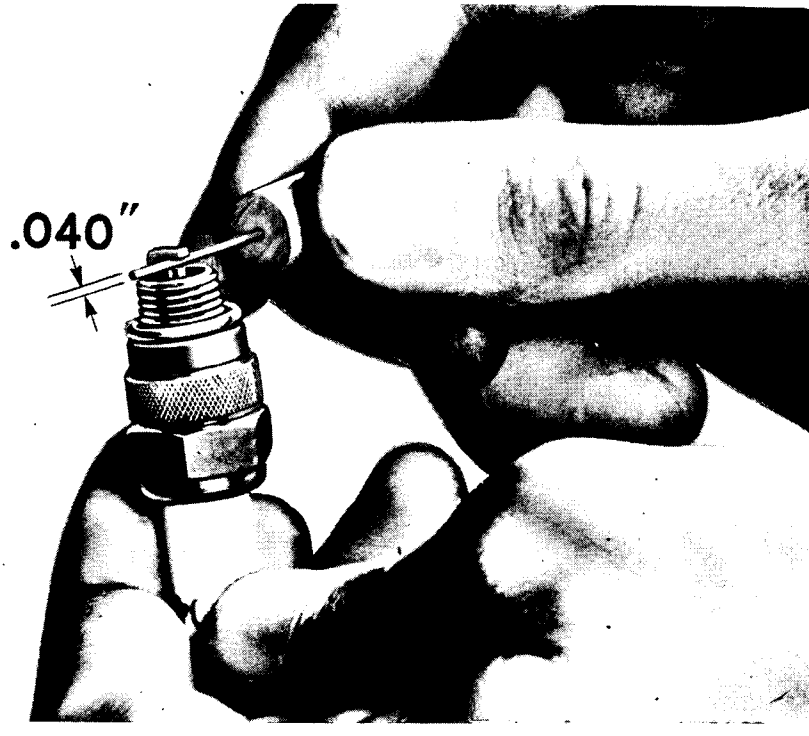
(2) Before making any checks on an engine it should be run for several minutes to warm it up and lubricate the valve mechanism. The compression of the engine should be checked first when tuning an engine, because an engine with uneven compression cannot be tuned successfully.

b. Compression Check.

(1) REMOVE SPARK PLUGS. Disconnect the spark plug wires; remove the 6 spark plugs, and open carburetor throttle.

(2) CHECK COMPRESSION (fig. 33). Insert the compression gage in No. 1 spark plug hole and hold it tightly. Crank the engine with the

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE



BA PD 32272

Figure 34 — Setting Spark Plug Gap

starting motor until the gage reaches its highest reading. This requires only a few turns of the engine. Repeat the test on all cylinders and make a note of the compression reading of each cylinder. NOTE: The compression on all cylinders should be 110 pounds or better, and all cylinders should read alike within 5 to 10 pounds for satisfactory engine performance.

c. Possible Cause of Uneven Compression.

(1) Low compression on 2 adjacent cylinders could be caused by a blown or leaky cylinder head gasket between the 2 cylinders.

(2) If the compression readings are low or vary widely it may be caused by leaky valves or compression loss past the pistons and rings. Check this by injecting a liberal supply of engine oil on top of the piston (or pistons) in the low compression cylinders, crank the engine over several times and recheck the compression. If the compression reading is much higher than the original check, it would indicate com-

RA PD 32268

Figure 35 — Distributor Point Adjustment

pression leak past the pistons, while if there was no change in the compression reading, it would indicate valve trouble.

(3) Naturally, the cause of low or uneven compression would have to be corrected before proceeding with the engine tune-up job.

d. Spark Plugs.

(1) CLEAN SPARK PLUGS. Clean the spark plugs with an abrasive-type cleaner. If the porcelains are badly glazed or blistered, the spark plugs should be replaced. NOTE: All spark plugs should be of the same make and heat range.

(2) ADJUST SPARK PLUG GAPS (fig. 34). Adjust the spark plug gaps to 0.040 inch, using a round feeler gage. CAUTION: Do not bend the center electrodes as this may crack the porcelain.

(3) INSTALL SPARK PLUGS. Install the 6 spark plugs, using new gaskets. Screw the plugs in finger-tight, and then tighten them ½ to ¾ turn with the wrench. If a tension wrench is available tighten the plugs

to 15 foot-pounds. NOTE: Care must be used when installing the 10-millimeter spark plugs, or the setting of the gap may be upset or threads may be stripped.

e. Battery Test.

(1) INSTALL TESTER. Connect the negative terminal of the voltmeter in the volt-ammeter tester to the starting switch terminal and the positive terminal of the voltmeter to a good ground.

(2) TEST PROCEDURE. Close the starting motor switch and crank the engine for 15 seconds. If the starting motor cranks the engine over at a good rate of speed, with the voltmeter reading 5 volts or better, it indicates a satisfactory starting circuit, which includes the condition of the battery, terminals, and cables. However, if the cranking speed is slow, or the voltmeter reading is under 5 volts, the starting motor, battery, and battery cable terminals should be checked individually to locate the source of the trouble.

f. Distributor and Wires.

(1) CLEANING AND INSPECTION.

(a) Remove the spark plug wires and coil to distributor wire (high-tension) and check for corrosion; clean if necessary. Inspect the wires for damaged or oil-soaked insulation and replace if necessary.

(b) Remove the distributor cap and clean it thoroughly. Check the cap and rotor for cracks or burned contacts.

(c) Check the automatic advance mechanism by turning the distributor cam in a clockwise direction as far as possible; then release the cam and see if the springs return it to its retarded position. If the cam does not return to the retarded position under spring tension, the distributor must be disassembled and the cause of the trouble corrected.

(d) Examine the distributor points. Dirty points should be cleaned, and pitted or worn points should be replaced. Check the points for alinement and aline if necessary.

(2) SET DISTRIBUTOR POINTS (fig. 35). Hand crank the engine until the cam follower rests on the peak of a cam and adjust the point gap to 0.018 inch. This is done by loosening the lock screw on the stationary point arm (the screw nearest the point) and turning the eccentric adjusting screw to the right or left to increase or decrease the point opening to 0.018 inch. Tighten lock screw and recheck point opening. NOTE: It is very important that the cam follower be on the peak of a cam while the points are being set, as the maximum point opening should be 0.018 inch to maintain correct coil efficiency.

(3) CHECK DISTRIBUTOR POINT SPRING TENSION. Hand crank the engine until the cam follower is located between the cams. Hook the

end of a distributor point check scale over the movable point and pull steadily on the spring scale until the points just start to open. At this point the reading on the scale should be between 17 and 21 ounces.

(4) SET OCTANE SELECTOR. Loosen the octane selector clamp screw and set the octane selector at "ZERO" on the scale. Tighten the clamp screw.

(5) REASSEMBLE DISTRIBUTOR. Install distributor rotor and cap. Install the high-tension wires in their respective terminal of the distributor cap and coil. Attach the spark plug wires to the spark plugs.

g. Coil and Condenser Inspection. Make sure that the low-tension terminals on the coil distributor and condenser are tight. Special equipment is required to make any test of the efficiency of these parts. The instructions furnished by the manufacturer of the equipment being used should be followed when making these tests.

h. Fuel Pump. Remove the filter bowl, and screen and wash them thoroughly in cleaning solvent. Clean the top of the fuel pump, replace the gasket, or make sure the old one is in good condition, and replace the fuel pump bowl. Make sure the bowl seats on the gasket, and tighten the bowl retaining nut securely. Tighten all fuel pump connections.

i. Air Cleaner.

(1) REMOVE AND DISASSEMBLE AIR CLEANER. Loosen the clamp screw and remove the air cleaner. Remove the wing nut from the top of the air cleaner and remove the cover. Remove the filter element. CAUTION: In case the filter element or cover should stick, avoid prying to get it loose, as this will damage the filter element flange and permit an air leak.

(2) CLEAN AIR CLEANER.

(a) Empty the oil out of the cleaner and clean the oil reservoir thoroughly.

(b) Wash the cleaner body with SOLVENT, dry-cleaning, and wipe dry.

(c) Wash the filter element by slushing it up and down in cleaning solvent. Dry thoroughly with air hose or by letting it stand until dry.

(3) ASSEMBLE AIR CLEANER. Fill the body with 2 pints of OIL, engine (crankcase grade). Install the filter element to the body of the cleaner, being sure that the flange sets flat against the top flange of the body. Install the cover making sure that the gasket is clean and in good condition over its entire surface so that a tight seal is obtained at this point. Install wing nut.

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

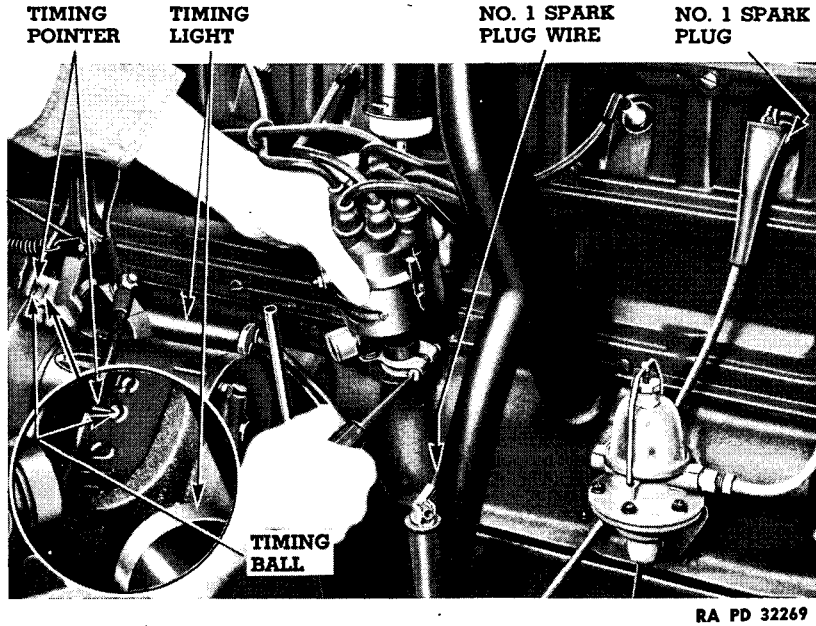


Figure 36 — Setting Ignition Timing

(4) INSTALL AIR CLEANER. Install the air cleaner on the carburetor, making sure it rests against the carburetor to assure a good seat. Tighten clamp screw.

j. Valve Cover Air Cleaner. Remove the air cleaner and wash it thoroughly by slushing it back and forth in clean gasoline. Dry it thoroughly and dip it in OIL, engine (crankcase grade). Allow the excessive oil to drain off, wipe body of cleaner dry, and reinstall on valve cover.

k. Manifold Heat Valve. Unhook the thermostatic spring from its anchor pin and check its adjustment. Proper adjustment requires only ½ turn of the spring to slip it over its anchor pin. Should the thermostatic spring be distorted, it should be replaced.

l. Ignition Timing (fig. 36).

(1) INSTALL TIMING LIGHT. With the octane selector set at "ZERO," attach one wire of the neon timing light to No. 1 spark plug and the other wire to No. 1 spark plug wire.

(2) SET TIMING. Start the engine and run it at idling speed. Loosen distributor clamp and rotate distributor body clockwise or counterclockwise until the steel ball in the flywheel lines up with the pointer on the flywheel housing. Tighten the distributor clamp screw.

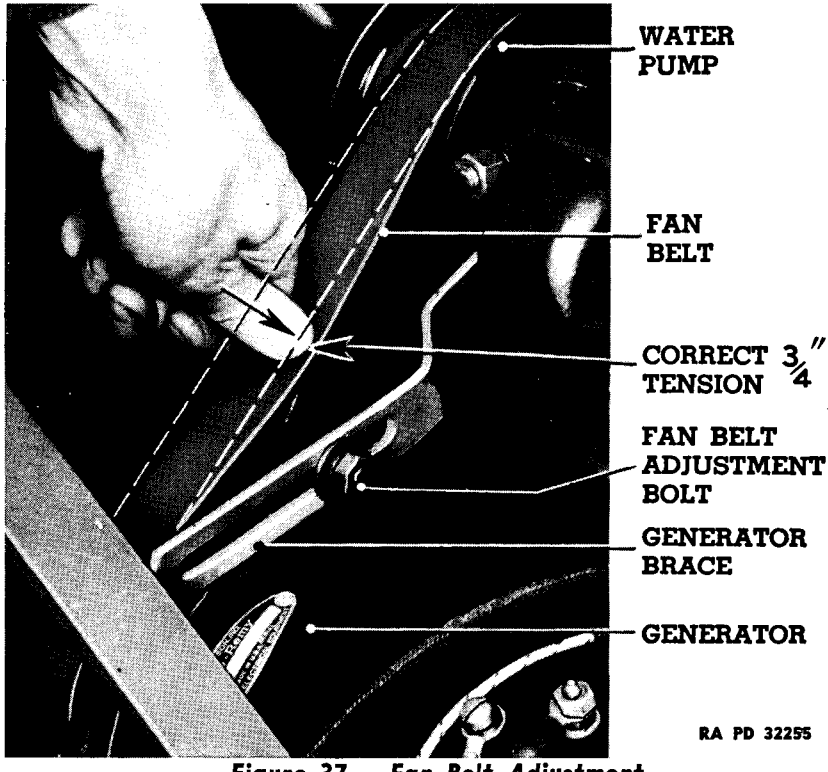


Figure 37 — Fan Belt Adjustment

m. Valve Adjustment.

(1) PRELIMINARY PROCEDURE. Using tension wrench KM-J1313 start the engine and while it is warming up, remove the rocker arm cover; tighten the cylinder head bolts, rocker arm, and manifold bolts and nuts. The cylinder head bolts should be tightened to 75 to 80 foot-pounds and the rocker arm shaft support bolts should be tightened to 25 to 30 foot-pounds.

(2) ADJUSTMENT. Normalize the engine and adjust the valves according to the procedure given in paragraph 21 **b** (1) to (4) inclusive.

n. Carburetor Adjustment.

(1) Adjust the carburetor idle and throttle stop screw in combination with each other to secure the best idling performance. The idling speed should be set between 500 and 550 revolutions per minute.

(2) If the carburetor does not respond to idling adjustment it would indicate trouble in the carburetor. It should be removed and overhauled according to instructions given in the carburetor section of this manual.

OPERATIONS PERFORMED WITHOUT REMOVING ENGINE FROM VEHICLE

o. Cooling System.

(1) Tighten all hose connections and examine the system for any indications of leaks.

(2) FAN BELT ADJUSTMENT (fig. 37). Check the fan belt for proper tension. If necessary adjust by loosening the bolt at the generator end of the slotted brace, moving the generator away from the engine, until the belt can be depressed ¾ inch, then tighten the bolt at the generator end of the brace and recheck the belt tension.

p. Road Test.

(1) GENERAL. After completing the motor tune-up the vehicle should be road-tested for performance.

(2) OCTANE SELECTOR. While road-testing the vehicle, the octane selector should be set for the grade of fuel being used. For peak performance and maximum economy, the octane selector should be set to produce a slight "ping" upon accelerating at wide-open throttle.

Section IV

ENGINE REMOVAL FROM VEHICLE

27. GENERAL.

a. The engine should be removed from the chassis for a motor overhaul as the equipment required for line-reaming main and camshaft bearings cannot be used with the engine in the vehicle.

b. The vehicle should be in a clean level place and some type of hoist provided that can be used for raising the engine out of the chassis.

28. ENGINE, REMOVAL.

a. Procedure.

(1) DRAIN RADIATOR AND CYLINDER BLOCK. Drain radiator by opening drain cock on right lower corner and cylinder block by opening drain cock on left side of block.

(2) REMOVE HOOD AND SIDE PANELS. Remove hood by removing brace rod anchor screws at the cowl and remove the hood hinge screws. Remove side panels by removing the attaching screws.

(3) REMOVE SHEET METAL. Remove the radiator, front end sheet metal, and fenders as a unit as described in paragraph 23 **b.**

(4) DISCONNECT BATTERY. Remove the battery cable and ammeter wire from the starter switch terminal. Tape the end of the battery cable wire to prevent the possibility of shorts.

(5) DISCONNECT IGNITION WIRE. Remove the ignition wire from the top of coil.

(6) DISCONNECT OIL LINES. Disconnect the 2 oil filter lines at the connectors.

(7) DISCONNECT GAS LINE. Disconnect the gasoline feed line from the fuel pump.

(8) REMOVE RIGHT ENGINE SIDE PAN. Remove the stove bolts which retain the pan and remove the pan.

(9) DISCONNECT WIRING FROM THE GENERATOR. Disconnect the generator wires at the generator.

(10) REMOVE HORN. Disconnect the wires from horn and remove the horn.

ENGINE REMOVAL FROM VEHICLE

(11) DISCONNECT CARBURETOR CONTROLS. Disconnect carburetor end of choke and throttle cables.

(12) REMOVE AIR CLEANER. Loosen the air cleaner clamp screw and remove the cleaner.

(13) DISCONNECT OIL PRESSURE GAGE LINE. Disconnect the oil gage line at the engine and swing the line around out of the way.

(14) DISCONNECT HYDROVAC VACUUM LINE. Disconnect the vacuum line at the carburetor end.

(15) DISCONNECT EXHAUST PIPE. Remove the 2 exhaust manifolds to pipe bolts and disconnect the pipe from manifold.

(16) REMOVE LEFT ENGINE SIDE PAN. Remove the retaining bolts and engine side pan.

(17) REMOVE FLOOR AND TOE BOARDS. Remove the retaining bolts and remove the floor and toe boards.

(18) DISCONNECT UNIVERSAL JOINT. Split the universal joint back of the transmission by removing the nuts and lock washers from the U-clamps which retain the trunnion bearings.

(19) DISCONNECT EMERGENCY BRAKE LEVER. Remove transfer case control levers and emergency brake lever attaching screws on right side of transmission.

(20) DISCONNECT POWER PLANT BRACE ROD. Disconnect power plant brace rod at transmission end.

(21) DISCONNECT BRAKE PEDAL PULL BACK SPRING. Disconnect pull back spring at left rear corners of transmission.

(22) DRAIN TRANSMISSION. Drain the transmission lubricant.

(23) DRAIN ENGINE OIL. Remove the oil pan, drain plug, and drain the oil. Reinstall the drain plug.

(24) DISCONNECT ACCELERATOR. Disconnect accelerator rod from the bell crank on left side of engine.

(25) REMOVE PEDAL SHAFT. Remove the 3 cap screws which attach the clutch and brake pedal shaft assembly to the clutch housing.

(26) REMOVE STARTER CROSS SHAFT. Remove the starting motor cross shaft by removing the bolts from the brackets and disconnecting the link and spring from the starting motor gear shifter lever.

(27) REMOVE TRANSMISSION COVER. Remove the transmission cover and place a piece of cardboard on top of the transmission to prevent dirt from falling into it during engine removal.

(28) DISCONNECT ENGINE MOUNTINGS. Remove the bolts from the rear engine mountings and remove the front engine mounting.

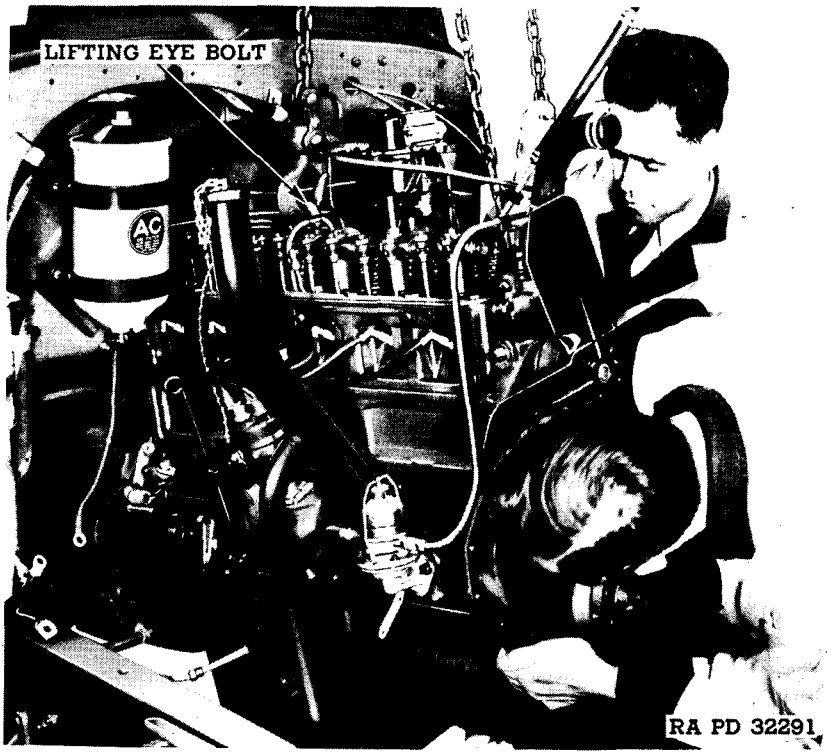


Figure 38 — Engine Assembly Removal

(29) INSTALL LIFTING EYEBOLTS (fig. 38). Remove the third cylinder head bolt from the rear on the left side and install the engine lifting eyebolt.

(30) REMOVE ENGINE (fig. 38). Connect a hoist to the eyebolt and raise the engine, clutch, and transmission assembly from the chassis, as a unit.

Section V

ENGINE DISASSEMBLY

29. GENERAL.

a. Suitable engine stand or dolly must be provided where the engine can be securely held for disassembly operations. Some of the parts must be removed from the top and some from the bottom; therefore, it is desirable to have a stand in which the engine can be turned either side up.

30. ENGINE DISASSEMBLY.

a. Procedure.

(1) PLACE ENGINE IN ENGINE STAND. Place the engine in an engine stand and clamp it securely so that the engine can be turned over when necessary.

(2) REMOVE TRANSMISSION. Remove the clutch housing underpan and the 4 bolts which attach the transmission to clutch housing. Remove the transmission. NOTE: Be sure to support properly the transmission so that the clutch gear splined end will not distort the clutch disk.

(3) REMOVE CLUTCH FORK. Remove the throwout bearing and remove the clutch fork by pressing it away from the mounting with a screwdriver until the fork snaps loose from the ball.

(4) REMOVE THROWOUT FORK MOUNTING BOLT. Remove the throwout fork mounting ball stud from the clutch housing.

(5) REMOVE CLUTCH ASSEMBLY. Install the clutch pilot tool KM-K411 to support the clutch during disassembly. Loosen the 9 clutch to flywheel bolts, one turn at a time (to prevent cover distortion), until the diaphragm spring pressure is released. Remove the pilot tool, clutch cover assembly, and disk from the clutch housing.

(6) REMOVE FLYWHEEL. Remove the 6 flywheel bolts and remove the flywheel.

(7) REMOVE STARTER. Remove the 2 starter motor bolts and remove the starting motor.

(8) REMOVE DISTRIBUTOR. Remove the octane selector retaining screw and remove the distributor.

(9) REMOVE COIL. Remove the 2 retaining screws and remove the coil.

(10) REMOVE FUEL PUMP. Disconnect the gas line from the fuel pump and remove fuel pump.

(11) REMOVE ROCKER ARM COVER. Remove the 2 retaining nuts and remove the rocker arm cover.

(12) REMOVE SPARK PLUGS. Remove the 6 spark plugs.

(13) REMOVE OIL FILLER AND VENT. Remove the clamp screw and remove the oil filler tube.

(14) REMOVE PUSH ROD COVER. Remove the retaining screws and remove the push rod cover and gasket.

(15) REMOVE OIL GAGE ROD TUBE. Loosen the 2 clamp screws and remove the oil gage rod and tube.

(16) REMOVE WATER OUTLET. Remove the 2 bolts and remove the water outlet.

(17) REMOVE WATER PUMP. Remove the water pump retaining bolts and remove the pump.

(18) REMOVE GENERATOR. Remove the generator and bracket by removing the 2 attaching bolts.

(19) REMOVE OIL LINE FITTINGS. Remove the oil gage and oil filter fittings from the left side of engine.

(20) REMOVE HARMONIC BALANCER (fig. 28). Remove the harmonic balancer by attaching the special harmonic balancer puller KM-J1287 securely to the pulley and turning the puller screw clockwise.

(21) REMOVE ROCKER ARM SHAFT ASSEMBLY. Remove the rocker arm shaft assembly. Disconnect the oil line, remove the 4 bolts and 2 nuts which retain the rocker arm shafts, and remove the shafts.

(22) REMOVE PUSH RODS AND VALVE LIFTER. Remove the 12 push rods and 12 valve lifters.

(23) REMOVE AIR CLEANER. Loosen the clamp screw and remove the air cleaner.

(24) REMOVE CARBURETOR. Disconnect gas feed line from the carburetor and disconnect and remove the throttle rod. Remove the carburetor to manifold nuts, and remove carburetor.

(25) REMOVE MANIFOLD. Remove the 2 nuts and 6 cap screws that attach the manifold to cylinder head, and remove the manifold and gasket.

(26) REMOVE STEAM RELIEF TUBE (fig. 39). Disconnect steam relief tube from the fitting, remove tube, and remove temperature indicator fitting.

ENGINE DISASSEMBLY

Figure 39 — Steam Relief Tube

(27) REMOVE CYLINDER HEAD. Remove the 15 cylinder head bolts and remove the cylinder head and gasket.

(28) REMOVE VALVES (figs. 8 and 9). Place the cylinder head on a holding fixture and use the fixture arm to compress the valve springs. Remove the valve locks, valve caps, valve springs and valves.

(29) REMOVE OIL PAN. Remove oil pan attaching screws and remove the pan and gaskets.

(30) REMOVE TIMING GEAR COVER. Remove the timing gear cover bolts including the two which are installed from the back, into the front main bearing cap. Remove the cover and gasket.

(31) REMOVE CAMSHAFT ASSEMBLY. Remove the 2 camshaft thrust plate screws by reaching through the holes in the camshaft gear. Remove the camshaft and gear by pulling it out through the front of the block. NOTE! Support the camshaft in such a manner that the camshaft or bearings will not be damaged when removing the shaft.

(32) REMOVE CRANKSHAFT GEAR (fig. 40). Pull the crankshaft gear with the special gear puller by attaching it to the gear and turning the puller handle.

(33) REMOVE CRANKCASE FRONT END PLATE. Remove the crankcase front end plate screws and remove the plate and gasket.

(34) REMOVE OIL SUCTION PIPE AND SCREEN. Disconnect the oil suction and feed lines from the oil pump and remove oil suction pipe and screen.

(35) REMOVE OIL PUMP. Loosen the oil pump retaining bolt lock nut and remove the bolt; turn the oil pump slightly and remove the pump.

(36) REMOVE PISTON AND CONNECTING ROD ASSEMBLIES. Remove the connecting rod bolt "pal" and retaining nuts; remove the connecting

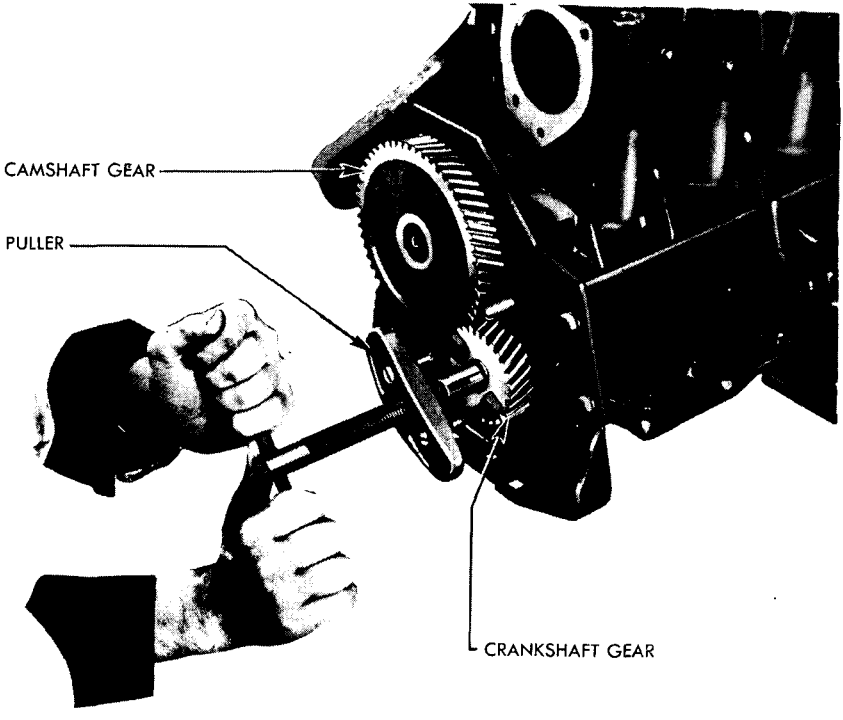


Figure 40 — Crankshaft Gear Puller

rod dippers and caps; disconnect the rods from the crankshaft; replace the caps, dippers, and nuts; push the rod and piston assemblies out of the top of the block. NOTE: It will be necessary to turn the crankshaft slightly to disconnect some of the rods and get clearance to push the rods out.

(37) REMOVE PISTON PINS (fig. 41). Clamp the piston in a piston vise, remove the connecting rod to piston pin clamp bolt, and remove the piston pin (all pistons).

(38) REMOVE PISTON RINGS. Remove the piston rings from all pistons by expanding the rings and sliding them off the piston.

(39) REMOVE MAIN BEARING CAPS. Remove the 10 main bearing cap screws and remove the main bearing caps and shims.

(40) REMOVE CRANKSHAFT. Lift the crankshaft out of the block and place it where it will not get damaged or sprung.

ENGINE DISASSEMBLY

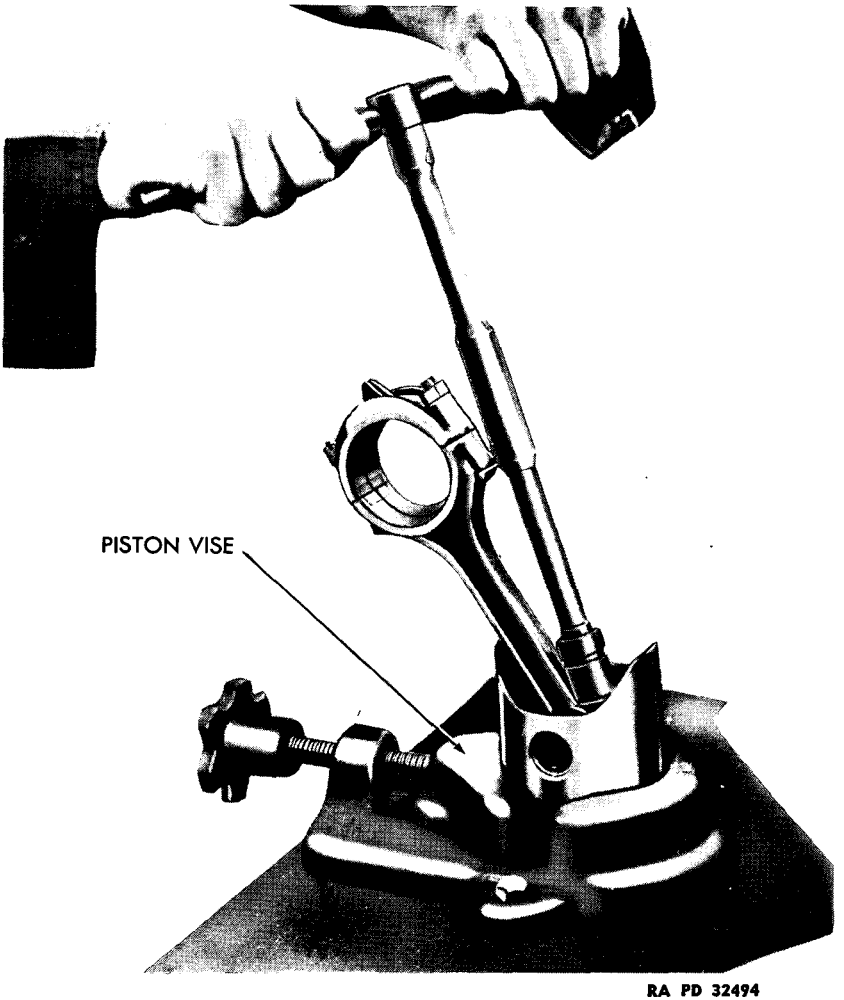


Figure 41 — Assembling Connecting Rod to Piston

(41) REMOVE MAIN BEARINGS. When new main bearings are to be installed, the old bearings should be removed from the bearing caps and cylinder block. The rear intermediate bearing may require a little pressure to remove it; however, the others are normally loose.

Section VI

CLEANING AND INSPECTION

31. GENERAL.

a. The component parts of the engine should be thoroughly cleaned and inspected to determine whether they are suitable for additional service or should be replaced.

32. CLEANING.

a. Wash Parts. Wash all parts in clean SOLVENT, dry-cleaning, and dry them thoroughly.

b. Clean Oil Passages in Block. Clean all oil passages in the cylinder block by blowing them out with compressed air. It is good practice to blow out each oil passage separately. This can be done by plugging the holes in three of the bearings and placing the nozzle of the air gun in the oil inlet of the cylinder block and blowing through the remaining bearing oil passage. Continue this until all passages have been blown out. Blow through the passages to the camshaft bearings.

c. Clean Oil Pipes in Pan. Blow out the pipes in the oil pan.

d. Clean Carbon. Clean the carbon from the pistons and cylinder head.

e. Clean Valves. Clean the carbon from the valves on a buffing wheel.

33. INSPECTION OF PARTS.

a. Inspect Block for Cracks. Check the cylinder block for cracks in the cylinder wall, water jacket, and the main bearing webs.

b. Inspect Cylinder Walls (fig. 42). Inspect the cylinder walls for taper, out-of-round condition, or excessive ridge at top of ring travel. This should be done with a dial gage. To check the cylinders set the gage so that the gage pin must be forced in to install the gage in the cylinder bore. After the gage has been worked carefully up and down in the cylinder the pointer will indicate the taper. By turning the gage at different points in the cylinder the out-of-round condition can be

CLEANING AND INSPECTION

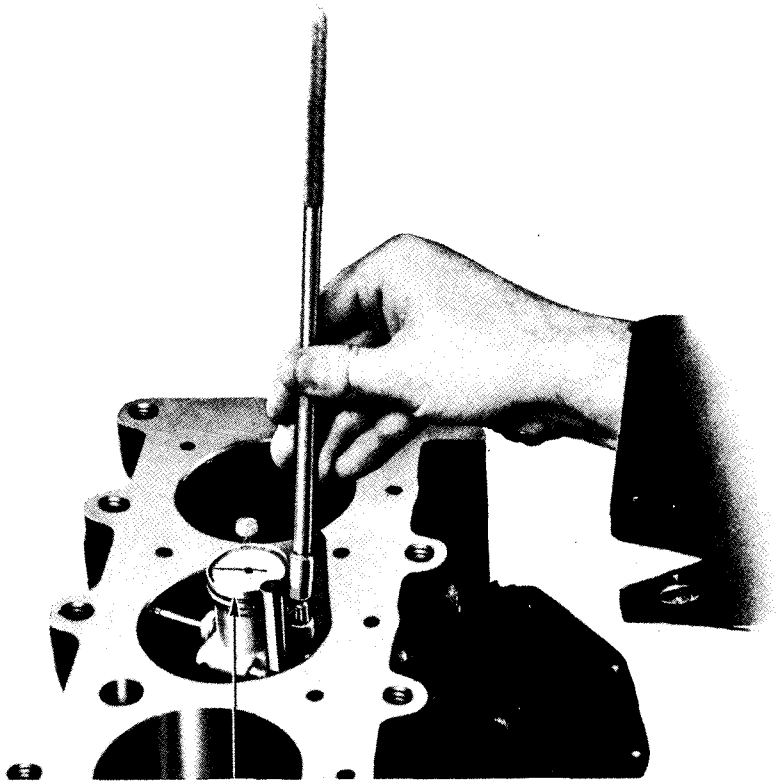


Figure 42 — Checking Cylinder Walls

determined. When a master gage, corresponding to the standard cylinder bore, is used to set the dial gage, it is easy to determine the oversize piston required as well as the amount of metal which must be removed from the cylinder walls to make them true. See paragraph 62 for specifications.

c. Inspect Main Bearings. Inspect the main bearings to determine whether or not they should be replaced.

d. Inspect Main Bearing Caps. Inspect the main bearing caps for cracks in the casting.

e. Inspect Camshaft Bearings. Inspect camshaft bearings for wear. The camshaft bearings should not be removed unless new ones are to be installed.

f. Inspect Crankshaft. Check the crankshaft journals and crank pins for roughness and out-of-round. See paragraph 62 for specifications. If the shaft is not up to specifications it should be replaced.

g. Inspect the Camshaft. Check the camshaft for damaged cams or bearing journals. See paragraph 62, for specifications.

h. Inspect Connecting Rods. Check the connecting rods for damaged bearings.

i. Inspect Pistons. Determine whether or not the pistons should be replaced. New pistons and rings are required when the cylinders are to be ground or honed. If the pistons are to be used again, the piston pin fit should be checked. If they are loose in the bushings, new oversize pins should be installed. See piston pin fitting.

j. Inspect Timing Gears. Inspect the timing gears for excessive tooth wear or loose hub in the camshaft gear.

k. Inspect Camshaft Thrust Plate. Inspect the camshaft thrust plate for excessive wear.

l. Inspect Cylinder Head. Inspect the cylinder head for being warped and for having clogged water passages, cracked valve seats, and worn valve guides.

m. Inspect Manifolds. Inspect the manifolds for excessive carbon in the ports. Check the operation of the heat control valve, and make sure the gasket between the manifolds is in good condition. If this gasket is good, it will not be necessary to disconnect the intake manifold from the exhaust manifold.

n. Inspect Oil Pump. Refer to paragraph 18.

o. Inspect Electrical and Cooling Systems, Etc. Inspection and repairs of the fuel pump, carburetor, air cleaner, generator, starting motor, distributor, clutch, water pump, and rocker arm assembly is covered under their respective sections in this manual and TM 9-765.

p. Miscellaneous. Inspect the remaining miscellaneous parts to determine whether they are fit for further service.

Section VII

ENGINE REPAIR

34. GENERAL.

a. This section is devoted to the repairs and (where necessary) assembling of the component parts of the engine. Some of the repair operations listed here, such as camshaft bearing replacement and fitting, will not always be required when overhauling a motor. When the individual engine being repaired does not require certain services, the instructions pertaining to the individual service or services should be disregarded.

b. In paragraphs 14 to 26 many repair operations were covered which would also be required when overhauling an engine. Where advisable a reference will be made to these paragraphs rather than repeating the operation.

35. CONDITIONING CYLINDERS AND FITTING PISTONS.

a. General.

(1) If the cylinder walls are out-of-round, tapered, or scored, it will be necessary to condition the cylinders by boring and honing or, if only

a small amount of metal is to be removed, it may be done with a hone only. Rough stones may be used at first and fine stones for the polishing operation.

(2) Several different types of boring and honing equipment are available. The instructions furnished by the manufacturer of the equipment being used should be followed closely.

(3) In Chevrolet engines the piston clearance is allowed on the piston, that is, a standard piston is ground to give correct clearance in a standard cylinder. For example, a 0.020-inch oversize piston is ground to fit correctly in a 0.020-inch oversize cylinder.

(4) The pistons are cam ground (out-of-round). This compensates for uneven expansion due to the extra metal around the piston pin bosses. The piston is also smaller in diameter at the piston head due to the additional expansion caused by higher temperature.

(5) Pistons are available in standard size and also in 0.020-inch and 0.040-inch oversizes.

b. Procedure.

(1) CHECK PISTON SIZES. When it has been determined what oversize the cylinders are to be bored, the new pistons to be used should be checked with a micrometer, measuring just below the lower ring groove and at right angles to the piston pin.

(2) BORE CYLINDERS. Bore the cylinder to the piston size; this allows 0.0015 inch to 0.002 inch for polishing the cylinder with a hone. NOTE: If a micrometer is not available for checking the piston size, the cylinder should be bored 0.002 inch less than the oversize piston to be used. This provides for polishing with a hone.

(3) HONE CYLINDERS. The hone should be placed in the cylinder bore and expanded until it can just be turned by hand. The hone is then driven with a ¾-inch electric drill and at the same time worked up and down in the cylinder bore until it begins to run free. During this operation kerosene should be used as a cutting fluid to keep the stones of the hone clean. The hone should be expanded and the honing operation repeated until the correct bore diameter has been reached. Occasionally during the honing operation the cylinder should be cleaned and a check made for cylinder to piston fit.

(4) FITTING PISTONS (fig. 43). Correct piston fit is determined by placing a ½-inch width feeler vertically along the side of the piston, 90 degrees around the piston from the piston pin, and inserting the piston and feeler into the cylinder bore. The piston should pass on a 0.0015-inch feeler and lock on a 0.003-inch feeler. NOTE: When a piston has

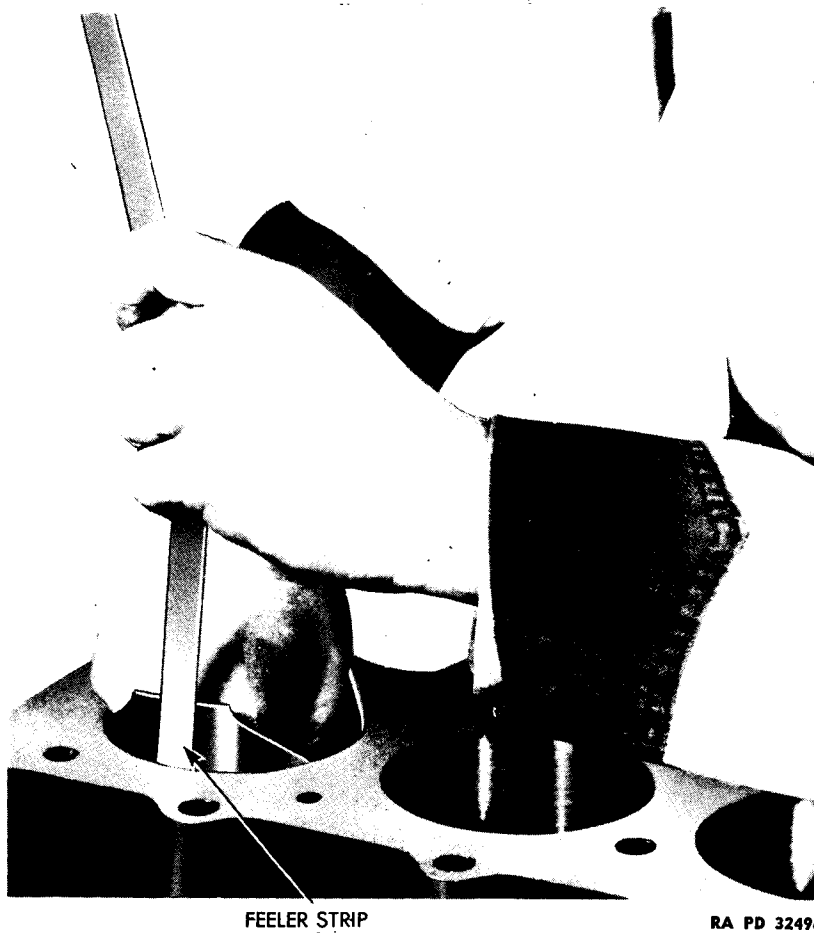


Figure 43 — Fitting Piston

been fitted to a given cylinder it should be permanently marked with the cylinder number in which it is to be used.

36. FITTING PISTON PINS.

a. General. All new Chevrolet pistons come complete with piston pins and bushings. Where the cylinder walls and piston fit justify use of the old pistons it may be desirable to install new piston pins which are available in standard size as well as 0.005-inch oversize.

b. Procedure.

(1) SET UP FIXTURES (fig. 44). Place the piston pin bushing reamer fixture in a bench vise. The purpose of this fixture is to make sure the

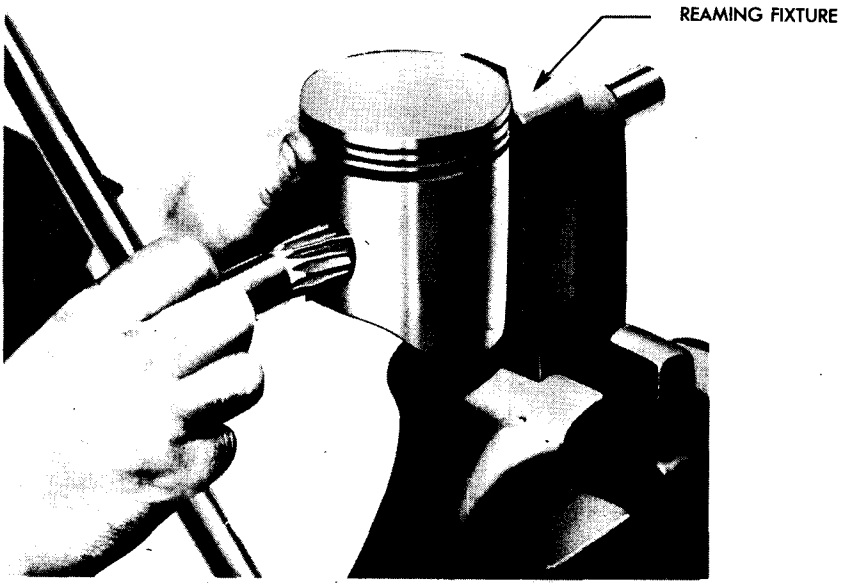


Figure 44 — Reaming Piston Pin Bushings

piston pin bushings will be reamed at right angles to the skirt of the piston, assuring proper alinement of the piston in the cylinder.

(2) REAM PISTON BUSHINGS (fig. 44). Adjust the expanding reamer for a light cut. Insert the reamer in the piston bushing and start the reamer pilot into the guide in the fixture. Hold the piston in the V-block of the fixture with one hand and turn the reamer handle with the other hand until the reamer has passed through both bushings.

(3) FIT PISTON PIN (fig. 45). Expand the reamer by easy stages and repeat the reaming operation until the pin can be pushed through the bushings with the thumb.

37. FITTING PISTON RINGS.

a. Refer to paragraph 24 **f** (1) to (6) inclusive.

38. FITTING MAIN BEARINGS.

a. General.

(1) Steel-backed babbitt-lined main bearings are used. The "spun-in" method of attaching the babbitt to the steel assures a good bond and prevents air pockets.

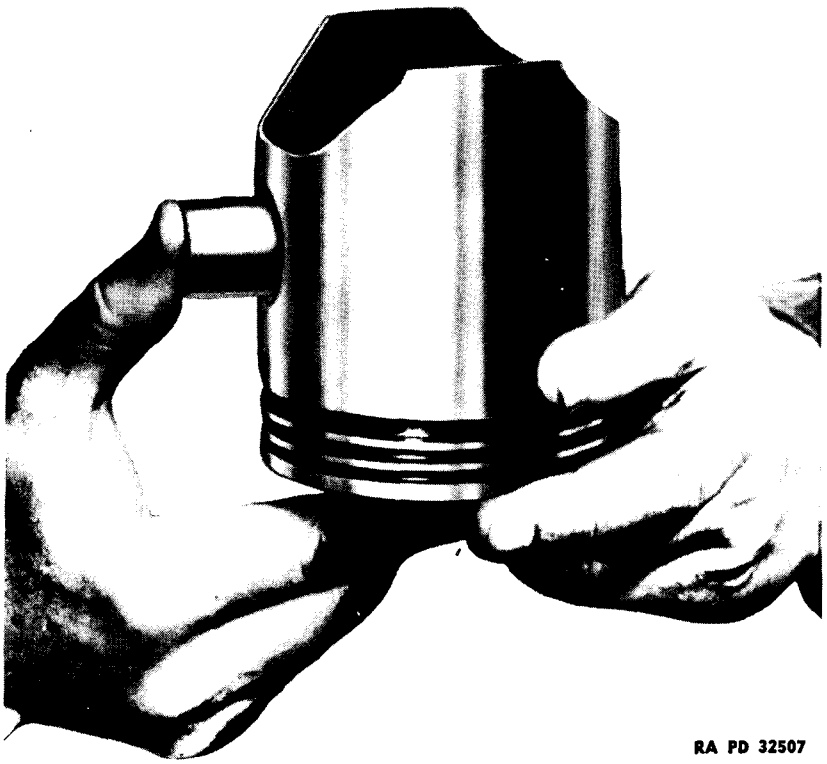


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Figure 45 — Checking Piston Pin Fit

(2) As the relative alinement of the crankshaft, clutch, and transmission is of prime importance, the clutch housing should never be removed unless the clutch housing, cylinder block, or camshaft bearings are to be replaced.

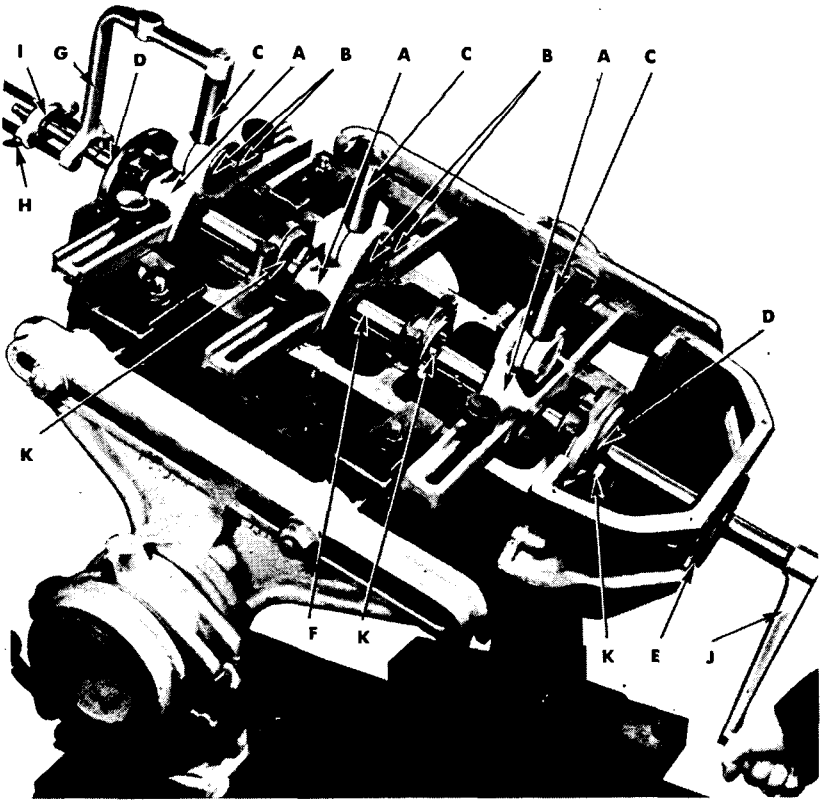
(3) If the clutch housing has been removed the bolting surface of the cylinder block and clutch housing should be cleaned carefully, and the housing reinstalled, as this is a part of the assembly in main bearing replacement.

(4) When a new clutch housing is being installed it must be tightened securely and checked for alinement, as explained below, before the bearings are installed.

b. Procedure.

(1) Support the crankcase in motor stand with bearing side of case up.

(2) REMOVE OLD BEARINGS. Remove the old bearing and clean the bearing bores in the block and caps.



A—SUPPORT BRACKET AND CLAMPS
B—UNIVERSAL CLAMP BOLTS
C—BORING BAR SUPPORTS AND BALL BEARINGS
D—BORING BAR CENTERING BUSHINGS
E—CLUTCH HOUSING CENTERING BUSHING
F—BORING BAR
G—BORING BAR FEED SUPPORT BRACKET
H—FEED NUT YOKE
I—FEED SCREW
J—TURNING HANDLE
K—BORING BAR CUTTERS

RA PD 32509

Figure 46 — Main Bearing Boring Machine

(3) INSTALL CENTERING BUSHINGS (fig. 46). Install centering bushings in the front and rear bearing bores. Install the bearing caps without shims and tighten them securely.

(4) INSTALL BORING BAR (fig. 46), KM-J100. Thread the boring bar through the bushings from rear to front.

(5) CHECK CLUTCH HOUSING ALINEMENT (fig. 47). Mount the dial indicator, KM-KMO30B, on the boring bar and check the alinement of the transmission pilot hole in the clutch housing. The runout must not exceed 0.015 inch. If it does, it will be necessary to replace the clutch

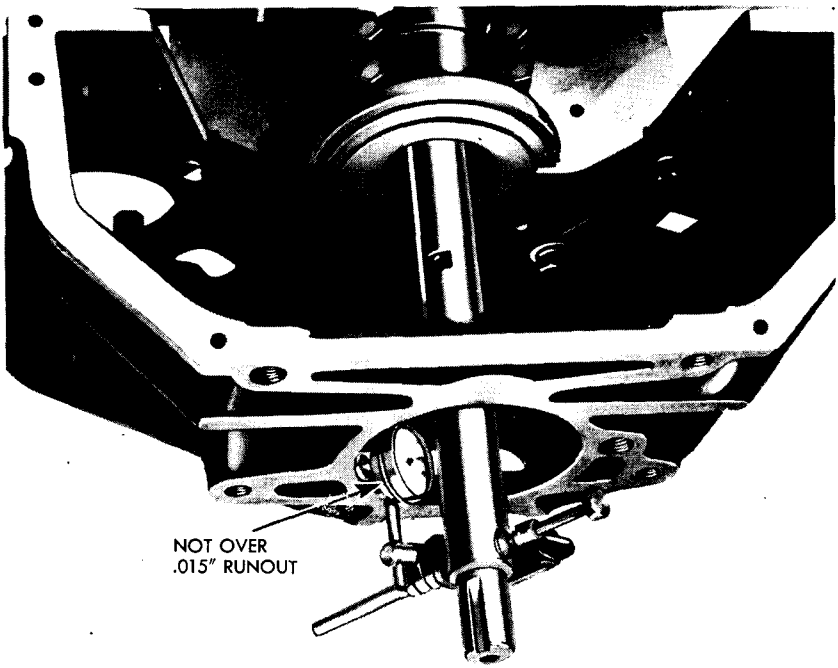


Figure 47 — Clutch Housing Alinement

housing before proceeding with the job of installing new main bearings. Remove the boring bar and the centering bushing from the rear bearing bore.

(6) INSTALL CLUTCH HOUSING CENTERING BUSHING (fig. 46). Install the clutch housing centering bushing in the transmission pilot hole of the clutch housing.

(7) INSTALL BORING BAR (fig. 46). Start the boring bar through the rear centering bushing and thread the boring bar support bearings over the bar, locating one support bearing in the space between each of the 2 bearings. Be sure to push the bar through the front centering bushing beyond the reduced diameter portion.

(8) INSTALL SUPPORT BRACKETS (fig. 46). Install the boring bar support brackets and line them up so there will be clearance between the bearing caps and support brackets for the installation and removal of cutters. Clamp the support brackets firmly to the pan rail of the cylinder block.

(9) TIGHTEN CLAMP BOLTS (fig. 46). Tighten the universal clamp bolts on each support bracket evenly. As the bolts are being tightened,

the boring bar should be turned by hand to make sure that a bind does not develop.

(10) INSTALL BEARINGS. Remove the boring bar and the front centering bushing. Install the bearings in the cylinder block and caps. NOTE: The front and front intermediate bearings are very similar in appearance, and it is possible to get them mixed. The front intermediate bearings are identified by the letter "I" in the bottom of the oil grooves. Should the intermediate bearings be installed in the front bearing bore, the sides of the bearing would be too high and would not permit the cap to seat firmly on the shims. The front bearing would be loose in the intermediate bearing bore. Make sure the dowels in the bearings fit the dowel holes in the block, and that the oilholes in the bearing line up with the oil passages in the block.

(11) INSTALL BEARING CAPS. Place four 0.002-inch shims on each side of each bearing and install the caps. The front intermediate cap has the word "FRONT" on the front side of the web, while the rear intermediate cap has the word "REAR" to the rear of the web, for identification. The rear intermediate bearing is flanged to take the end thrust of the crankshaft. Tighten the bearing cap bolts securely and evenly.

(12) INSTALL BORING BAR AND CUTTERS (fig. 46). Clean the cutter seats in the boring bar. Install the boring bar through the rear centering bushing and bearing supports. Clean the cutters and install them in the slots of the boring bar just behind each bearing. NOTE: The cutter marked "F" is for the front bearing, "FC" is for front center, "RC" for rear center, and "R" for rear bearing.

(13) INSTALL FEED SCREW AND SUPPORT (fig. 46). Mount the feed screw support bracket on the front boring bar support and mount the feed screw in its U-shaped yoke and install the screw in the end of the boring bar. Adjust the bar so that the cutters are about to enter the bearings; tighten the feed screw support thumb screws.

(14) BORE MAIN BEARINGS (fig. 46).

(a) Install the turning handle on the end of the boring bar and proceed with the boring operation. Use a liberal supply of kerosene to keep the cuttings washed out of the bearings. NOTE: It is important that the operator turn the bar steadily and slowly while cutting the bearing to prevent distorting the fixture and cutting the bearings unevenly.

(b) When the cutters have passed through all bearings, remove the turning handle and feed screw; blow all cuttings out of the bearings. Protect the boring bar support bearing to prevent blowing the cuttings into these bearings.

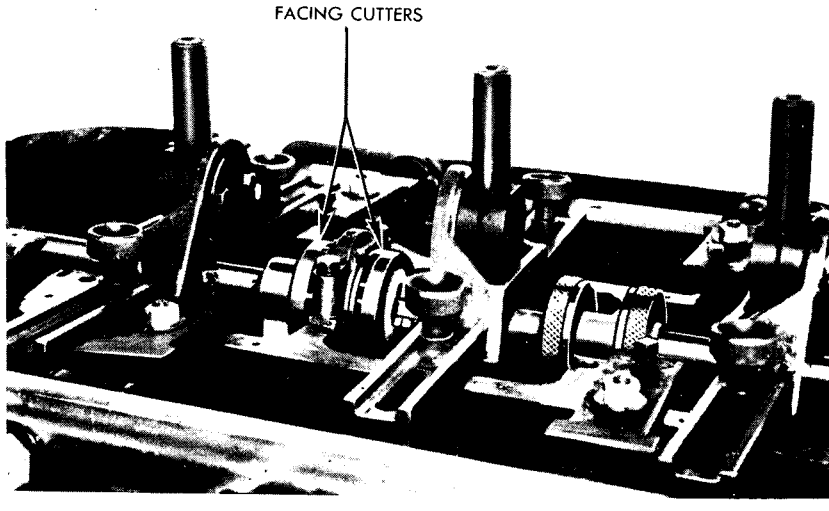


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Figure 48 — Facing Rear Intermediate Bearing

(c) Push the boring bar back until the cutters have passed through the bearings; then again install the feed screw and bore through the bearings a second time. This is important in order to obtain a perfectly smooth true bearing.

(d) Remove turning handle, feed screw, cutters, and boring bar. NOTE: Do not disturb the boring bar supports because they will be used when facing the rear intermediate bearing for crankshaft end clearance.

c. Face Rear Intermediate Bearing.

(1) INSTALL CUTTERS (fig. 48).

(a) Install the boring bar through the clutch housing centering bushing and the rear bearing support.

(b) Slip the facing cutters on the boring bar, one on each side of the rear intermediate bearing.

(c) Place the feed screw sleeve in the front intermediate bearing and push the boring bar through the sleeve.

(d) Install the feed screw drive key through the hole in the sleeve and into No. 2 cutter hole in the boring bar, locking the key in place with its screw.

(2) ADJUST CUTTERS.

(a) Adjust the feed screws for equal feed range on each side of the front intermediate bearing.

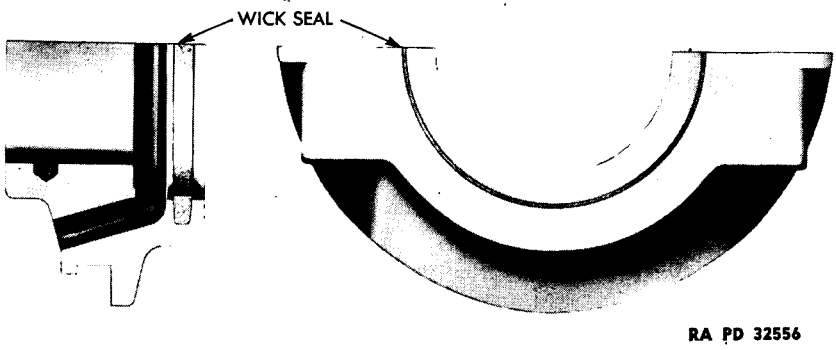


Figure 49 — Rear Main Bearing Oil Seal

(b) Adjust the facing cutters to provide about 0.015-inch clearance between the cutter face and the flange of the bearing.

(c) Caliper the width of the rear intermediate bearing journal on the crankshaft with the special inside-outside calipers KM-KMO964.

(3) CUT BEARING FRONT FACE.

(a) Install the turning handle on the end of the boring bar. Back off the front feed screw collar several turns, and tighten the rear feed screw collar until the front facing cutter contacts the bearing flange.

(b) Then proceed with the facing operation; tightening the feed screw is necessary to keep the cutter in contact with the bearing flange. NOTE: The front flange of the bearing should be machined just enough to clean up thoroughly the face. Proper installation of this tool is shown in figure 48.

(4) CUT BEARING REAR FACE.

(a) Back off the rear feed screw collar and tighten the front collar until the rear cutter engages the bearing rear flange.

(b) Then continue with the facing operation, checking the progress of the job every few turns with the special caliper that was set for the width of the crankshaft journal. Continue facing the bearing until the special caliper will pass over the bearing and a 0.004-inch feeler laid alongside the bearing flange.

(c) Remove the bearing cap and place it on the rear intermediate journal of the crankshaft. Check the end clearance with a feeler gage; the correct clearance is 0.004 inch to 0.007 inch.

(5) DISASSEMBLE CUTTER EQUIPMENT. Disassemble the facing cutters and boring bar from the cylinder block. All parts of this tool should be thoroughly cleaned and oiled to prevent rusting, and put away in the special boxes provided for this purpose.

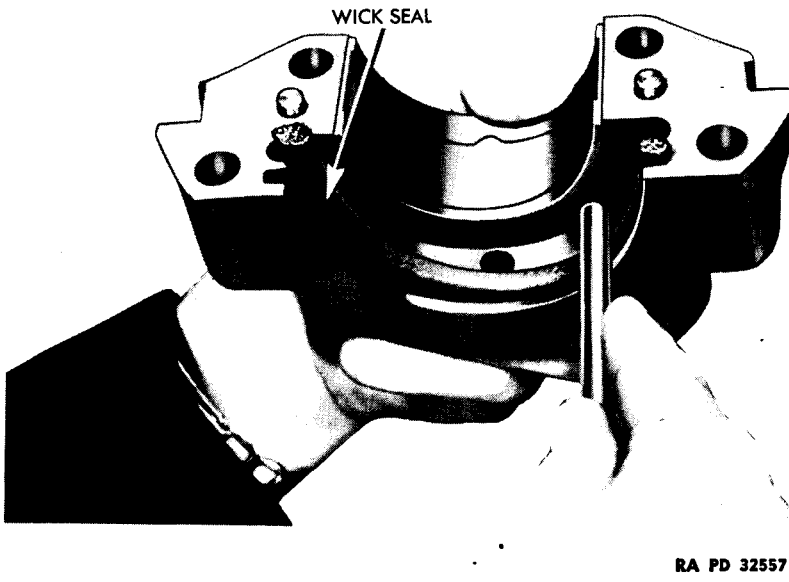


Figure 50 — Installing Rear Main Bearing Oil Seal

d. Crankshaft Rear Bearing Oil Seal (fig. 49).

(1) The rear main bearing is sealed by a wick-type seal installed in a groove machined in the block and cap.

(2) INSTALL NEW SEAL IN BEARING CAP (fig. 50).

(a) Remove the rear main bearing cap and insert the packing in the groove with the fingers.

(b) Using a rounded tool, roll the packing into the groove. When rolling the packing, start at one end and roll the packing to the center of the groove. Then starting from the other end, again roll toward the center. NOTE: By following the above procedure you are assured that the wick is firmly pressed into the bottom of the groove.

(c) The small portion of the wick which protrudes from the groove at each end should be cut flush with the surface of the bearing cap. To prevent the possibility of pulling the wick out of the groove while cutting off the ends, it is recommended that a round block of wood the same diameter as the crankshaft flange be used to hold the packing firmly in position while the ends are being cut off.

(3) INSTALL SEAL IN CYLINDER BLOCK. The procedure for installing the wick in the cylinder block is exactly the same as for installing it in the bearing cap.

e. Oil Seal Leak When Engine Does Not Require Overhaul.

(1) In case of an oil leak at the rear main bearing where the motor is not being completely overhauled, it is possible to install an oil seal in the bearing cap.

(2) Remove the oil pan according to procedure given in paragraph 17. Remove the rear main bearing cap and oil seal; then proceed as above for installing the seal and reassemble.

(3) It is necessary to remove the engine from the chassis and remove the crankshaft to replace the upper seal (in the engine block).

39. CRANKSHAFT INSTALLATION AND BEARING ADJUSTMENT.

a. Description.

(1) The four bearing crankshaft is heavily counterweighted to provide smooth engine operation.

(2) The four crankshaft journals are of different sizes, the smaller one at the front and the larger one at the rear. Refer to engine fits and tolerances (par. 62) for journal sizes.

b. Inspection.

(1) Inspection of the crankshaft was covered in paragraphs 31 to 33 inclusive; however, just before installing the crankshaft it should be checked for being sprung.

(2) Support the crankshaft at the front and rear bearing journals in V-blocks.

(3) With a dial indicator, check the runout at both intermediate bearing journals. If this exceeds 0.002 inch, the shaft must be replaced or straightened.

c. Crankshaft Installation.

(1) CLEAN COMPONENT PARTS.

(*a*) Clean the cylinder block oil passages by blowing them out with compressed air. This can be done by closing 3 passages and placing the nozzle of the air gun in the oil inlet of the cylinder block. Continue until all passages have been blown out.

(*b*) Blow through each of the passages between the main and camshaft bearings.

(c) Clean the crankshaft main bearing journals.

(*d*) Clean all bearings carefully. NOTE: Proper cleaning of all bearings and passages is very important and must be done thoroughly.

(2) INSTALL CRANKSHAFT. Lubricate all 4 bearings and carefully place the crankshaft in the bearings.

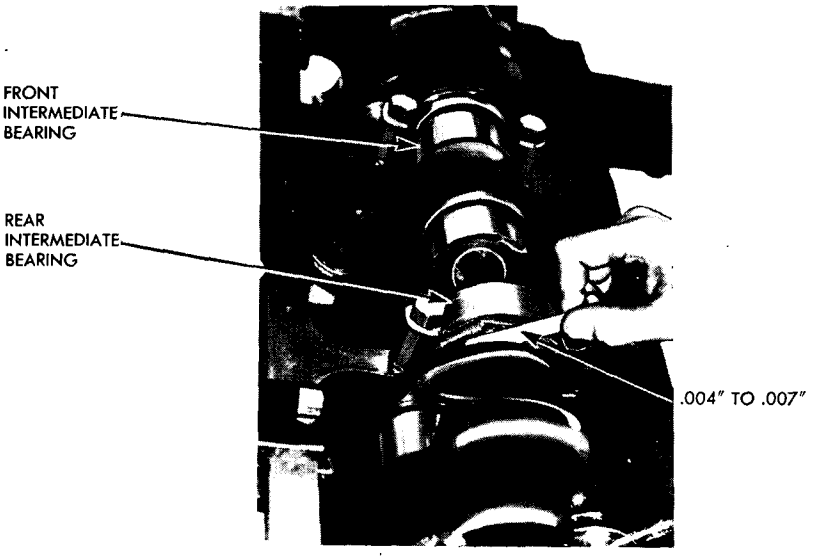


Figure 51 — Checking Crankshaft End Play

(3) CHECK SHAFT END PLAY (fig. 51). Check the crankshaft end play by forcing the crankshaft to its extreme rear position. Check at the rear side of the rear intermediate bearing with a feeler gage. This clearance should be from 0.004 inch to 0.007 inch.

(4) INSTALL BEARING CAPS. Install all 4 bearing caps with four 0.002-inch shims on each side and pull the bolts down snugly. NOTE: When installing the bearing caps and shims be sure the shims are in place and do not turn around over the bearings. The crankshaft will normally turn free with all caps tight.

d. Main Bearing Adjustment.

(1) LOOSEN BEARINGS. Loosen all bearing cap bolts about one turn.

(2) REAR MAIN ADJUSTMENT.

(*a*) Starting with the rear main bearing, remove a shim on one side; replace the cap; tighten bolts securely.

(*b*) Check for drag by turning crankshaft by hand. If no drag is felt remove one shim on the opposite side. Replace cap and tighten bolts securely.

(*c*) Check for drag. If no drag is felt remove a shim on the side from which the first shim was removed. Replace cap; tighten bolts and recheck.

(*d*) When a slight drag is felt by turning the shaft by hand, replace a shim on the side from which the last one was removed.

(*e*) The crankshaft should now roll freely with no indication of drag with the cap bolts tight.

(*f*) Loosen the bearing cap bolts on the adjusted bearing.

(3) ADJUST REMAINING BEARINGS. Adjust the remaining bearings according to the above procedure, being sure that all other bearing caps are loose while making the adjustments. NOTE: It is desirable to have the shims removed evenly from each side of the bearing, and if on the final adjustment an uneven number of shims have to be used they should be on the same side of the engine. By following the above procedure and always starting to remove shims on the same side of the engine, if an uneven number of shims result, the greater number would always be on the same side.

(4) FINAL CHECK. Tighten all bearing cap bolts securely and check the bearings by turning the crankshaft. The shaft should turn freely by hand.

40. CAMSHAFT BEARINGS REMOVAL, REPLACEMENT, AND REAMING.

a. Description.

(1) All 4 camshaft bearings are steel-backed, babbitt-lined, removable bearings.

(2) They are pressed into the crankcase and staked to prevent any movement. Then they are accurately line-reamed to assure correct camshaft fit and alinement.

(3) The camshaft bearings get their lubrication through holes in the bearings which line up with the oil passages from the main bearings.

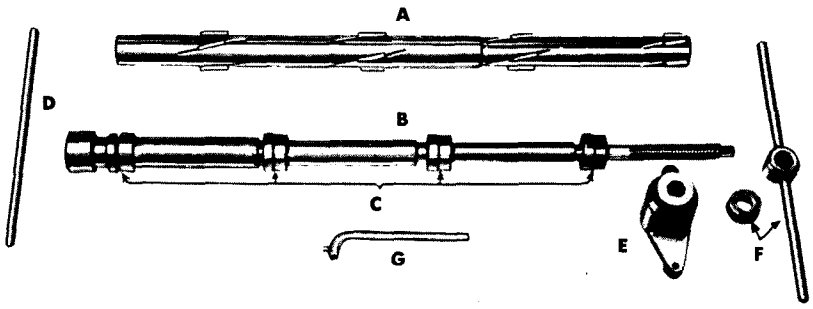
(4) Camshaft bearings seldom get loose enough to require any attention; however, they are not adjustable and the only remedy for loose camshaft bearings is replacement.

(5) Should it become necessary to change the camshaft bearings a special set of tools is required to remove, replace, and line-ream the bearings. These tools are pictured in figure 52. They can be secured under camshaft bearing service tool set KM-J1800-C.

b. Bearing Removal.

(1) REMOVE CLUTCH HOUSING. Remove the clutch housing bolts and tap the clutch housing off the cylinder block.

(2) REMOVE EXPANSION PLUG. Drive the expansion plug from the block at the rear of the rear camshaft bearing.



A—REAMER
B—REMOVING AND REPLACING BAR
C—REMOVING AND REPLACING SLEEVES
D—EXTENSION HANDLE
E—BRACKET
F—HANDLE AND THRUST BEARING
G—STAKING TOOL

RA PD 32559

Figure 52 — Camshaft Bearing Tools

(3) INSTALL BEARING PULLER. Use camshaft bearing service tool set KM-J1800C.

(*a*) Assemble the camshaft bearing remover bracket loosely to the rear of the cylinder block.

(*b*) Start the bearing puller bar through the front bearing and install the puller sleeve for each bearing over the bar before the bar has passed through that particular bearing. Then pass the bar through the hole in the bracket.

(*c*) Tighten the bolts that hold the bracket to the back of cylinder block.

(*d*) Install the thrust bearing and puller handle at the rear end of the block.

(4) REMOVE BEARINGS. Turn the pull handle until all 4 bearings are removed. NOTE: In some cases the bearings will start very hard due to corrosion and the fact that all bearings are staked to the bearing bore in the case.

c. Camshaft Bearing Installation.

(1) It is very important that the bearings be installed so that the oilhole in the bearings line up with the oil passage in the bearing bore. To facilitate the positioning of the bearings, mark the position of the oilhole in the bearing bore on the front of each bearing web.

(2) INSTALL BEARING PULLER.

(*a*) Place a new front camshaft bearing over the puller bar, start the bar through the front bearing bore, place the second bearing and sleeve on the puller bar, and enter the bar through the bearing bore.

(*b*) Place the third bearing and sleeve on the puller bar and enter the bar through the bearing bore in the block.

(c) Place the rear bearing and sleeve over the puller bar and push the puller bar through the rear bearing bore and puller bracket.

(*d*) Install the thrust bearing and turning handle.

(3) INSTALL BEARINGS.

(*a*) Line up the oilholes in each bearing with the oilhole location marks previously made.

(*b*) Turn the puller handle to pull the bearings into place.

(c) The bearings should be pulled in until the back edge of the front bearing is flush with the bearing bore in the block.

(4) REMOVE PULLER. Remove the puller bar and bracket.

(5) INSPECT AND STAKE BEARINGS.

(*a*) Check to see that the oilholes in all bearings line up with the drilled passages in the block.

(*b*) Stake all bearings into the hole provided in the bore for that purpose, using the special tool furnished with the bearing bar.

d. Camshaft Bearing Reaming.

(1) The sturdy camshaft bearing line reamer has all 4 cutters mounted on the one bar. This reams all four bearings in perfect alinement with each other.

(2) INSTALL REAMER. Carefully pass the reamer through the first, second, and third bearings and pilot it into the rear bearing. NOTE: Be careful not to damage the bearings or cutters while entering the reamer.

(3) REAM BEARINGS.

(*a*) Start the reamer cutters into their respective bearings and turn the reamer slowly.

(*b*) Use a liberal supply of kerosene on all bearings to keep the cuttings washed out of all bearings.

(c) Continue to turn the cutter, at the same time creating enough end pressure to provide a continuous cut.

(*d*) When the reamer has completed the cut, continue to turn it in the same direction and slowly pull out the reamer. NOTE: Never turn the reamer backwards, as it will damage the cutting edge.

(4) CHECK BEARING FIT.

(*a*) Blow all cuttings from the bearings with compressed air.

(*b*) Install the camshaft and check all bearing clearances with a narrow feeler gage.

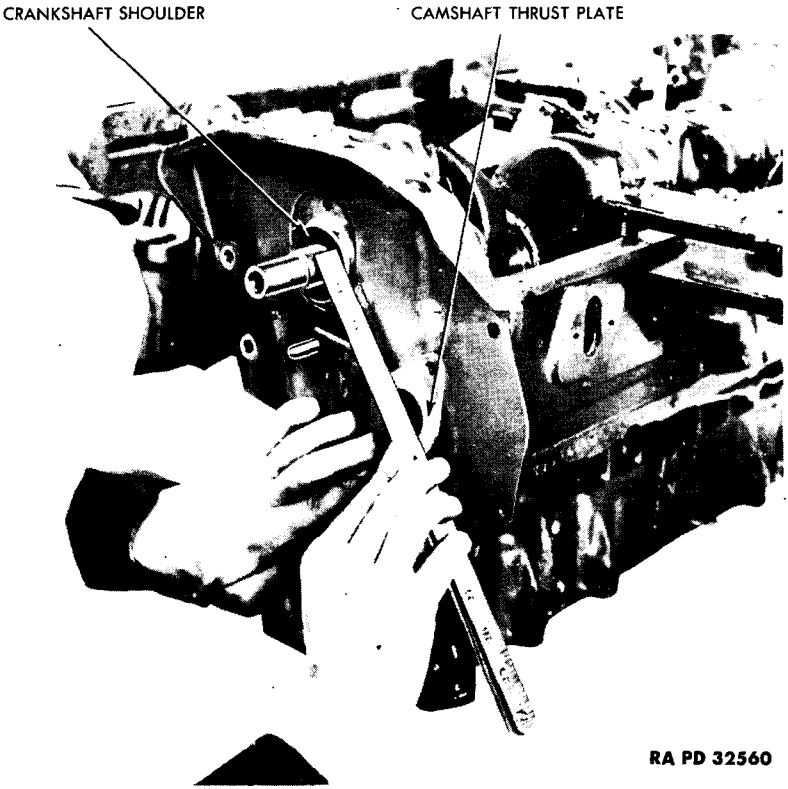


Figure 53 — Checking Timing Gear Alinement

(c) The proper clearance for all bearings is from 0.002 inch to 0.004 inch.

(*d*) Remove the camshaft and install a new expansion plug in the cylinder block at the back end of the rear bearing.

(5) INSTALL CLUTCH HOUSING. Clean the machined surfaces at the back end of the cylinder block and on the forward end of the clutch housing. Install the clutch housing and tighten the bolts securely.

41. CRANKCASE FRONT END PLATE.

a. From 1 to 3 gaskets are used between the crankcase front end plate and the crankcase. By removing or adding gaskets behind the front end plate, a means for alining the timing gears is provided.

b. Install Plate and Gaskets. Assemble the front end plate with 2 gaskets behind it, and attach it securely with 3 screws.

c. Check Alinement (fig. 53).

(1) Place a new camshaft thrust plate over the camshaft hole in the front end plate.

(2) Place the edge of a scale against the thrust plate and over to the shoulder of the crankshaft.

(3) If the scale strikes the edge of the crankshaft shoulder, it will be necessary to add a gasket. If it does not touch, it will be necessary to remove a gasket.

d. Tighten Front End Plate. When the proper number of gaskets have been installed between the plate and crankcase, assemble the screws and bolts. Tighten the bolts securely, tighten the screws, and stake them with a center punch.

42. TIMING GEARS.

a. Crankshaft Gear.

(1) DESCRIPTION. The crankshaft gear is cut from a solid piece of steel. It is a drive fit on the shaft as well as being keyed to prevent turning.

(2) CRANKSHAFT GEAR INSTALLATION. To install the gear, place the key in the crankshaft; line up the gear and, using a tubular driver, drive the gear on against the shoulder of the crankshaft.

b. Camshaft Gear.

(1) DESCRIPTION.

(a) The camshaft gear has a steel hub onto which is pressed the composition gear. The use of this composition gear with a steel crankshaft gear provides very quiet gear operation if the correct gear lash is maintained.

(b) The camshaft gear should not be removed from the camshaft unless it is necessary to replace the camshaft, thrust plate, or the gear.

(c) If the camshaft gear is to be removed a camshaft press plate to properly support the gear is necessary.

(2) REMOVE CAMSHAFT GEAR (fig. 54).

(a) Insert the camshaft through the press plate and, with a press, force the shaft out of the gear.

(b) The camshaft thrust plate will be damaged when pressing off the gear; therefore, a new plate must be used.

(3) REPLACE CAMSHAFT GEAR.

(a) Make sure that the Woodruff key is in place in the camshaft.

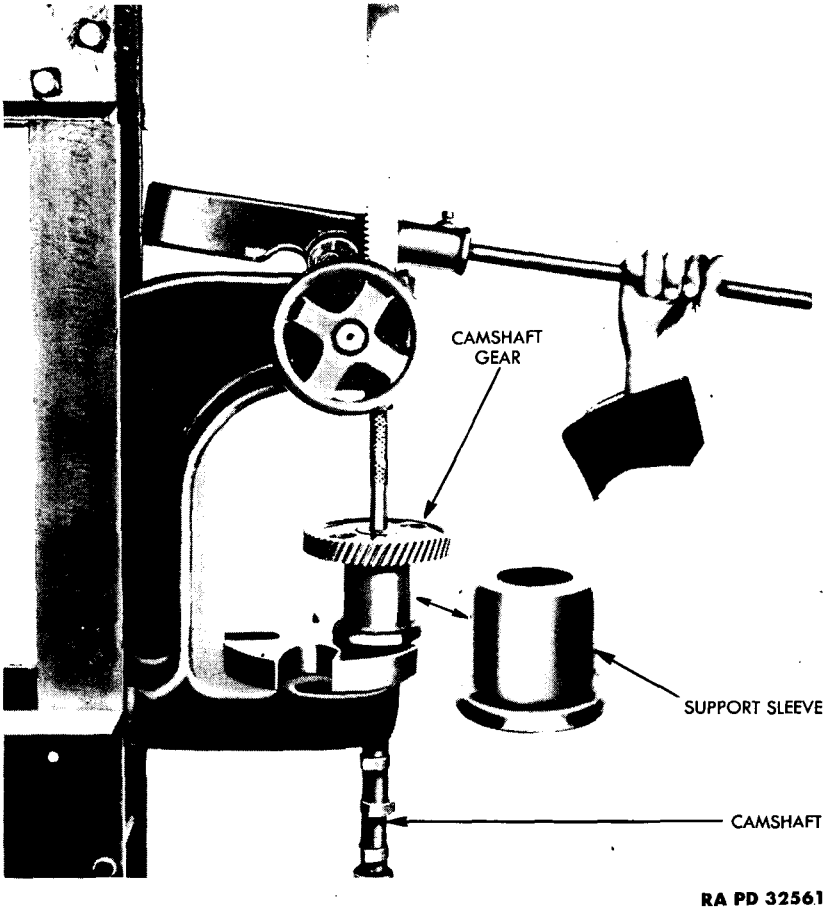


Figure 54 — Camshaft Gear Removal

(b) Support the back of the front camshaft bearing journal on an arbor press so that the shaft will not be damaged when pressing the gear on.

(c) Place a new thrust plate on the shaft and line up the keyway in the gear with the key in the shaft.

(d) Press the gear onto the shaft so that there is practically no clearance at the thrust plate, yet the plate turns freely.

(4) CHECK CAMSHAFT END PLATE (fig. 55).

(a) Check the clearance between the face of the thrust plate and the shoulder on the shaft. This should be from a free fit to 0.003-inch clearance. NOTE: When pressing the gear on the shaft it is important to

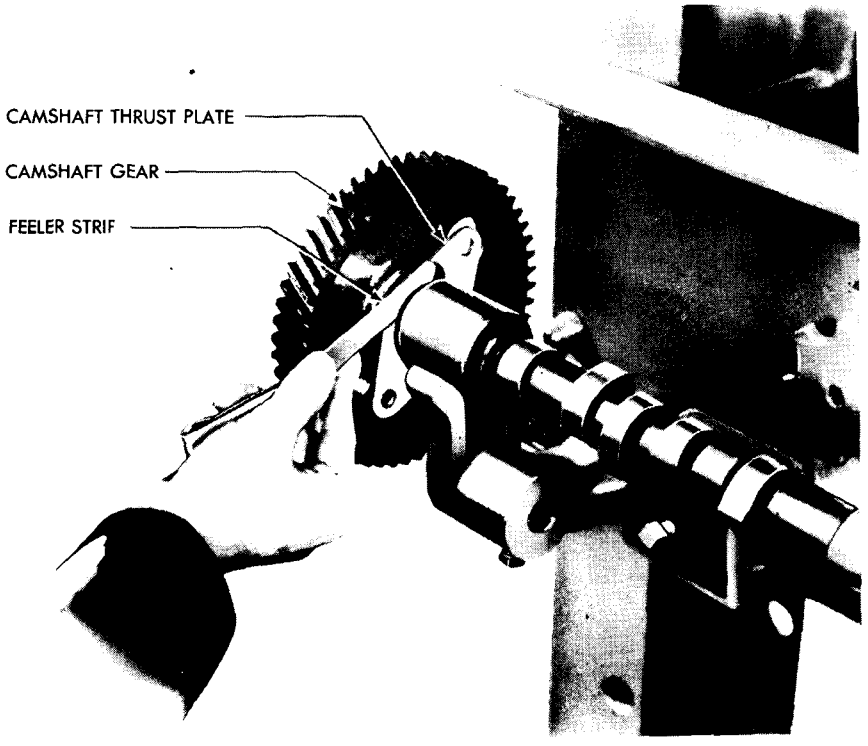


Figure 55 — Checking Camshaft End Play

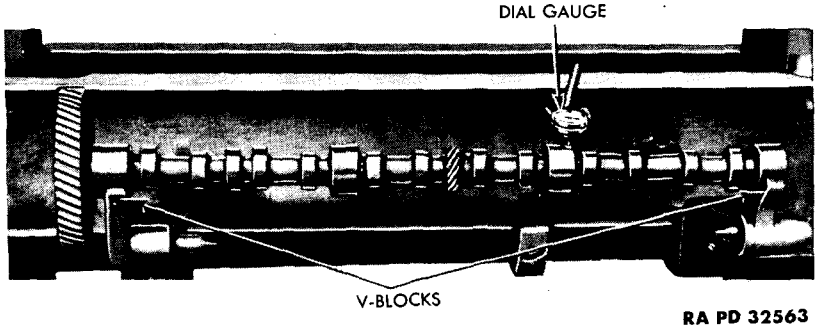


Figure 56 — Checking Camshaft Alinement

press on the metal hub; otherwise, the gear will be damaged. The thrust plate controls the end play of the camshaft, and therefore it is important that the camshaft gear be pressed on to allow only the above clearance.

(b) On any overhaul job where the camshaft gear is not being removed from the camshaft, the clearance between the thrust plate and front bearing journal should be checked, and if it exceeds 0.003 inch the gear should be pressed on to provide 0.003 inch or less clearance with the plate free to turn on the shaft without binding.

43. CAMSHAFT CHECKING AND INSTALLATION.

a. Description.

(1) The camshaft provides cams for operating the 12 valves and the fuel pump. It is also fitted with a special gear to drive the oil pump.

(2) The valve lifters which are operated by the camshaft cams are slightly off center line of the cams; consequently they rotate, materially increasing the life of the camshaft and valve lifters.

(3) See engine fits and tolerances for camshaft journal specifications.

b. Inspection.

(1) Inspection of the camshaft was covered in paragraphs 31 to 33 inclusive.

(2) The camshaft should always be checked for alinement just before installing.

c. Alinement (fig. 56).

(1) Place the camshaft on V-blocks and mount a dial indicator so as to check the alinement. Turn the camshaft slowly and note the indicator reading.

(2) Both intermediate bearing journals should be checked and the runout should not exceed 0.002 inch indicator reading at either journal. If it is out more than 0.002 inch, chalk-mark the shaft at the point of highest reading. This is the point where pressure should be applied when straightening. NOTE: During the straightening operation care should be taken to protect the bearing journals to prevent damage to their surfaces.

(3) Recheck the camshaft to make sure it is within the 0.002-inch limits.

d. Camshaft Installation (fig. 26).

(1) Turn the crankshaft so the timing mark on the crankshaft gear is on the camshaft side of the shaft.

(2) Install the camshaft, being careful not to damage the shaft or bearings.

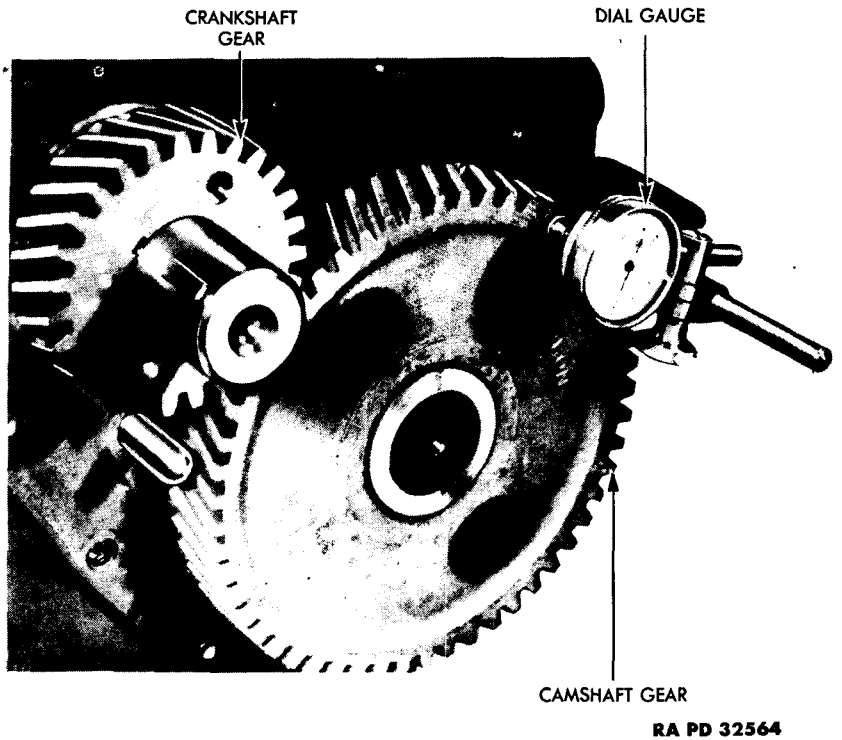


Figure 57 — Checking Runout of Camshaft Gear

(3) Line the mark on the camshaft gear with the mark on the crankshaft gear, and push the camshaft into place. NOTE: It is important that these 2 marks line up in order to time the valve action properly.

(4) Turn the shafts until the holes in the camshaft gear line up with the holes for attaching the thrust plate.

(5) Line up the thrust plate, install the 2 retaining screws, and tighten securely.

44. TIMING GEAR CHECKING AND LUBRICATION.

a. Checking.

(1) CHECK GEAR RUNOUT (fig. 57). Check the runout of the camshaft gear by mounting a dial indicator bracket on the timing gear plate with the indicator spindle against the side of the gear. This runout should not exceed 0.004 inch. Check the crankshaft gear in the same

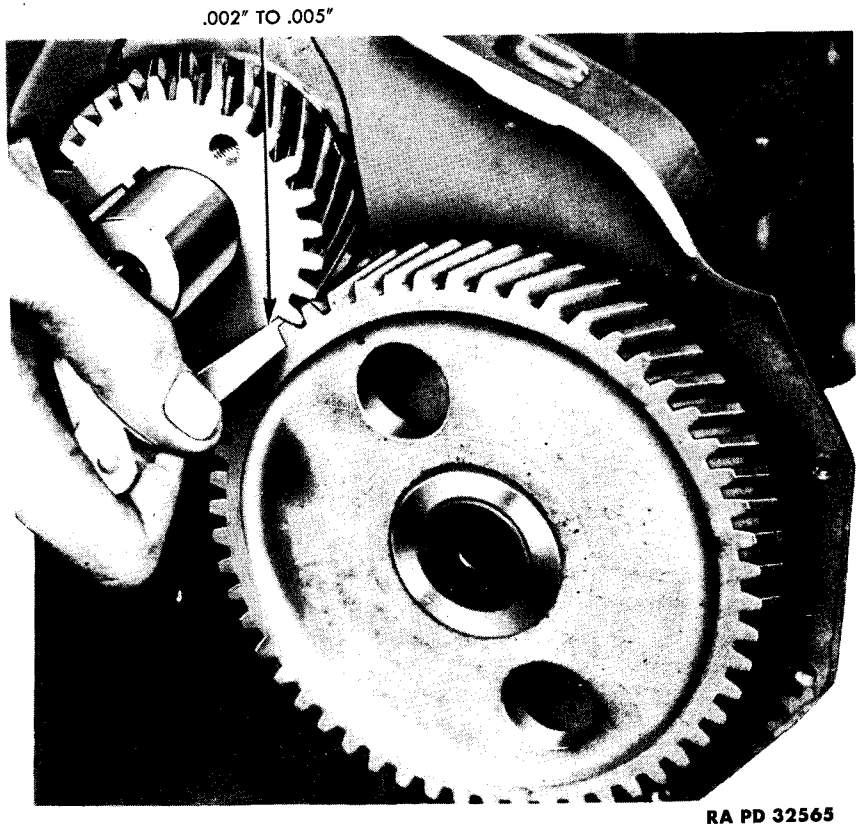


Figure 58 — Checking Timing Gear Backlash

manner. The allowable runout is 0.003 inch. If the runout exceeds the above limit the gears should be replaced.

(2) CHECK GEAR BACKLASH (fig. 58). Check the backlash between the teeth of the 2 gears with a narrow feeler. This should be from 0.002 inch to 0.005 inch.

b. Timing Gear Lubrication.

(1) In order to lubricate the timing gears properly, a timing gear oil nozzle with a metered hole is pressed into the crankcase front end plate. Oil is supplied to this nozzle, from the camshaft front bearing, through a milled slot in the rear surface of the front end plate.

(2) Surplus oil drains back into the oil pan through 2 holes in the front main bearing cap.

(3) If the oil nozzle is damaged, the plate must be replaced as it is impossible to install a new nozzle.

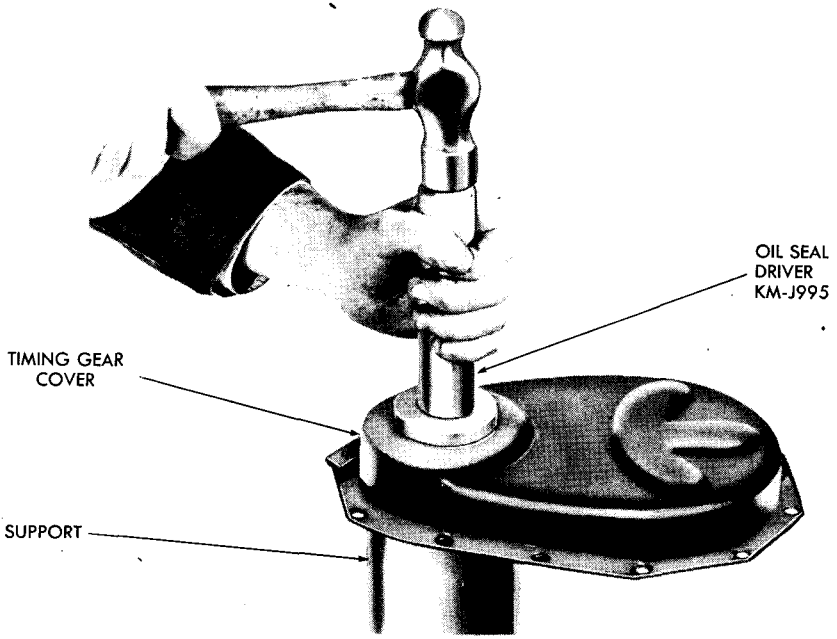


Figure 59 — Timing Gear Cover Oil Seal Installation

45. TIMING GEAR COVER AND OIL SEAL INSTALLATION.

a. General. The timing gear cover is a pressed steel stamping fitted with a spring loaded leather oil seal at the crankshaft opening. This seal rides on the hub of the harmonic balancer to prevent oil leak.

b. Oil Seal Removal. The oil seal can be removed from the cover by prying it out of the front of the cover with a large screwdriver.

c. Oil Seal Replacement (fig. 59).

To replace the oil seal, place it on the special timing gear cover oil seal driver KM-J995 with the free end of the leather toward the end of the driver. Support the cover and drive the seal in place. **NOTE:** The oil seal should be well saturated with engine oil before installing.

d. Cover Installation (fig. 29).

(1) It is essential that the timing gear cover be properly centered when installing in order that the harmonic balancer can be installed without damaging the seal and to provide uniform oil seal contact to the hub of the balancer.

(2) Work the timing gear cover centering gage KM-J966 through the oil seal; install a new gasket and slide the centering gage over the crankshaft.

(3) Install and tighten the timing gear cover screws and the 2 lower bolts and lock plate from the front main bearing cap. Bend up the lips of the lock plate.

(4) Remove the centering gage.

46. HARMONIC BALANCER.

a. Due to the construction of the harmonic balancer a special tool is required for removing and replacing the balancer. If this tool is not properly used the balancer will be damaged. The removal is explained under engine disassembly.

b. Installation.

(1) To install the harmonic balancer, bolt the puller body KM-J1287 securely to the balancer.

(2) Place the driver head in the end of the balancer with the pin resting against the crank jaw in the end of the balancer.

(3) Enter the undercut end of the puller screw through the puller body and line up the keyway in the balancer with the key in the crankshaft.

(4) Drive the balancer on until it hits the shoulder of the shaft.

(5) Remove the puller body.

47. FLYWHEEL.

a. The cast iron flywheel has a steel ring gear shrunk on its outer diameter. The starter meshes with this gear.

b. Three dowels on the crankshaft flange pilot into accurately reamed holes in the flywheel for correctly locating and balancing the flywheel.

c. Installation (fig. 60).

(1) Carefully clean the machined surface of the flywheel and crankshaft.

(2) Place the flywheel on the dowels and install the 6 bolts and 3 lock plates. Tighten the bolts and bend the locks up against the bolts.

d. Check for Runout (fig. 61). Check the face and the rim of the flywheel for runout with a dial indicator. The face and rim of the flywheel should not exceed 0.008-inch runout.

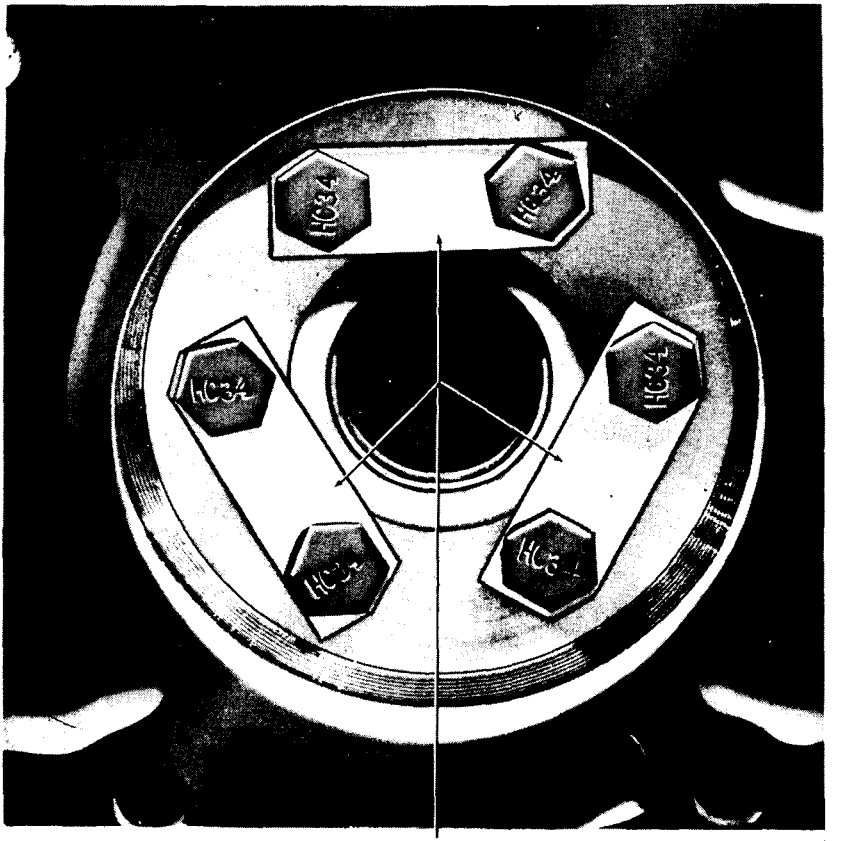


Figure 60 — Flywheel Bolt Locks

48. CONNECTING RODS AND PISTONS, ASSEMBLY AND ALINEMENT.

a. Connecting Rod Description.

(1) The connecting rods are drop-forged with an I-beam section for strength. The piston pin end is of the clamp type with a clamp bolt that locks the piston pin to the rod.

(2) The babbitt bearing in the crankshaft end is centrifugally cast or "spun-in" into the rod. This method aids in dissipating the heat and materially lengthens the bearing life.

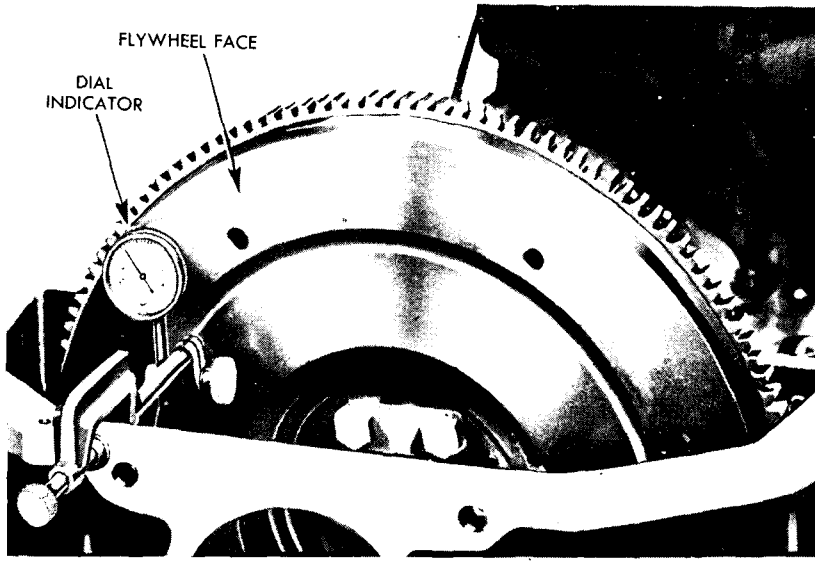


Figure 61 — Checking Flywheel Runout

b. Alinement.

(1) The alinement of connecting rods is very important. Whether new rods are being used or the old ones reinstalled, they must be checked for alinement.

(2) INSTALL PIN IN ROD. Place the piston pin in the eye of the rod and tighten the clamp bolt.

(3) INSTALL CONNECTING ROD ON ARBOR (fig. 62). Place the connecting rod on the aliner arbor KM-J874C, and tighten the connecting rod bolts.

(4) CHECK ALINEMENT (fig. 62).

(*a*) Place the V-block on the piston pin and move the rod and arbor toward the face plate until the pins on the V just engage the face plate. If all 4 pins touch the face plate, the rod is in perfect alinement.

(*b*) If either the top 2 or the bottom 2 pins touch the face plate but not the other 2, the rod is bent.

(*c*) If the 2 pins on the front or the 2 on the back side of the V-block touch and the others do not the rod is twisted.

(*d*) The fixture is sufficiently strong to hold the connecting rod while correcting a bend or a twist with a bending bar.

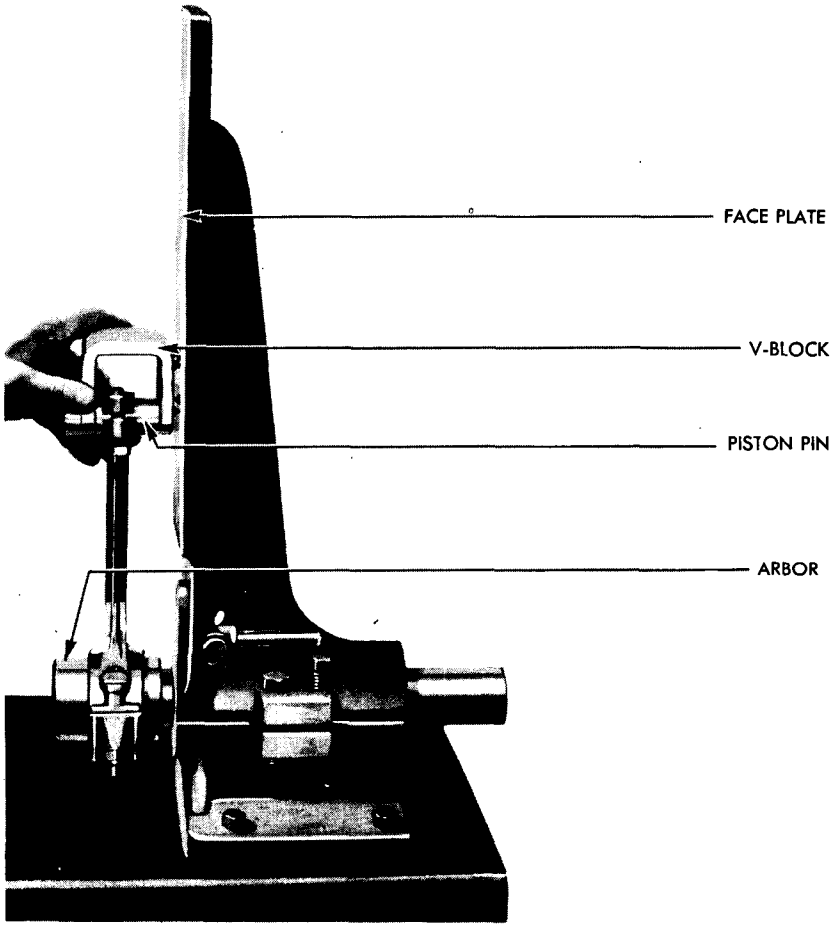


Figure 62 — Connecting Rod Alinement Fixture

c. Assemble Connecting Rods to Pistons.

(1) INSTALL PISTON PIN (fig. 41). Place the piston in a piston vise. Assemble the rod to the piston and install the pin. NOTE: All original rods have the cylinder number in which they were used stamped on the cap and rod section of the lower bearing journal. New rods should also be marked with the cylinder number.

(2) INSTALL CLAMP SCREW. Center the pin in the piston and the rod between the piston bosses. Install the clamp screw. Tighten it securely and move the piston, on the pin, from side to side, and check to make sure the pin does not extend outside the piston. NOTE: The

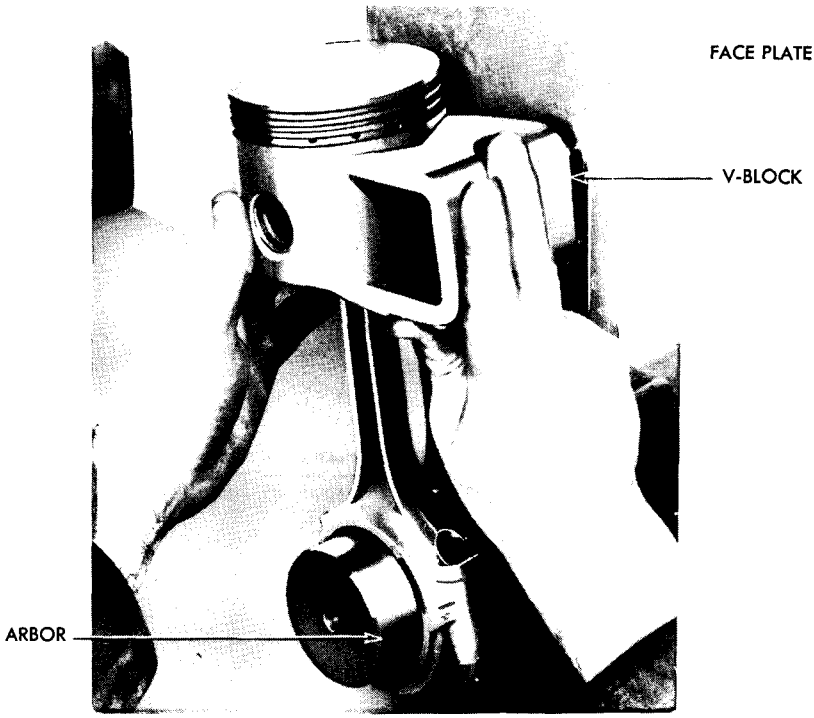


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Figure 63 — Checking Piston and Connecting Rod Alinement

connecting rod should never be clamped in a bench vise to loosen or tighten the piston pin clamp bolt as this will twist the connecting rod.

d. Alinement of Piston and Connecting Rod Assembly.

(1) INSTALL PISTON AND ROD ASSEMBLY ON FIXTURE (fig. 63). Assemble the piston and connecting rod to the alinement fixture.

(2) CHECK ALINEMENT (fig. 63). Place the V-block against the piston and face plate. If both pins of the V-block rest against the face plate, the assembly is in alinement. NOTE: The piston skirt should be parallel to the rod when this check is made.

(3) ROD ALINEMENT CHECK (fig. 64).

(*a*) If the repair operation being performed does not require disassembling the pistons from the connecting rods, a quick check of the connecting rod alinement can be made.

(*b*) The procedure explained in steps (1) and (2) above would indicate that the rod was not bent.

(*c*) Tip the piston first in one direction and then in the other as shown in the two positions of figure 64. If the pins on the V-block both

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Figure 64 — Checking for Twisted Connecting Rod

touch the face plate, the rod is not twisted; however, if one of the pins leaves the face plate when the piston is tipped in one direction and the other pin leaves the face plate when the piston is tipped in the other direction, the rod is twisted.

(*d*) Leave the rod on the arbor of the aliner and straighten the rod with a bending iron and recheck to make sure that both pins of the V-block contact the face plate.

49. CONNECTING RODS AND PISTONS, INSTALLATION AND ADJUSTMENT.

a. Complete instructions covering this operation will be found in paragraphs 19 and 24. As a final check of rod alinement, after the rod and piston assemblies are in the engine and the bearings adjusted, check the clearance between the piston pin end of the connecting rod and the piston pin bosses on the pistons. This should not be less than 0.025 inch.

ENGINE REPAIR

50. ENGINE OILING SYSTEM PRINCIPLE.

a. Lubrication for the engine is supplied by a positively driven gear pump that is equipped with a spring-loaded bypass valve which controls the maximum pressure at high speeds and when the engine oil is apt to be heavy and sluggish during cold weather starting.

b. The engine oiling system provides positive pressure lubrication to the main bearings and camshaft bearings. The connecting rod bearings are lubricated by means of dippers on the rods which dip into troughs in the oil pan at low speeds and by oil nozzles at higher speeds. Cylinder walls and piston pins are lubricated by the oil spray. Oil for the valve mechanism is pumped up the hollow rocker arm shafts.

c. Main and Camshaft Bearing Lubrication. The oil flow is from the pan, through screen and oil pump to the block fitting pipe, and then to the oil manifold, thence through drilled passages in the bearing support webs in the cylinder block, to the 4 main bearings. The oil then passes through grooves in the bearings to the drilled passages in the cylinder block webs and to the camshaft bearings. In this manner full pressure feed lubrication is supplied to all main and camshaft bearings.

d. Timing Gear Lubrication. Lubrication for the timing gears is supplied by conducting the oil from the front camshaft bearing, through a milled slot in the back of the engine front end plate, to a nozzle which is so aimed that the oil stream effectively lubricates the timing gears.

e. Connecting Rod Bearing Lubrication.

(1) Oil for the connecting rods passes from the cylinder block fitting to the oil manifold, through a drilled passage in the cylinder block and to the oil distributor. As the oil pressure builds up, the oil distributor valve opens and releases the oil into a drilled passage in the block; this passage connects with the short pipe that fits into the main supply pipe in the oil pan. From the main supply pipe the oil passes to the oil manifold in the oil pan, where it is distributed to the 6 oil nozzle pipes.

(2) The 6 oil troughs in the oil pan are adjusted to the proper height so that the connecting rod dippers will dip into the oil and supply lubrication for the lower speeds.

(3) As the engine speed is increased and the oil pressure is built up, the oil streams from the nozzles rise, and are intercepted by the dippers, forcing the oil into the connecting rod bearings under high pressure as shown in figure 65. The cylinder walls, pistons, and piston pins are lubricated by the oil spray thrown off by the connecting rods.

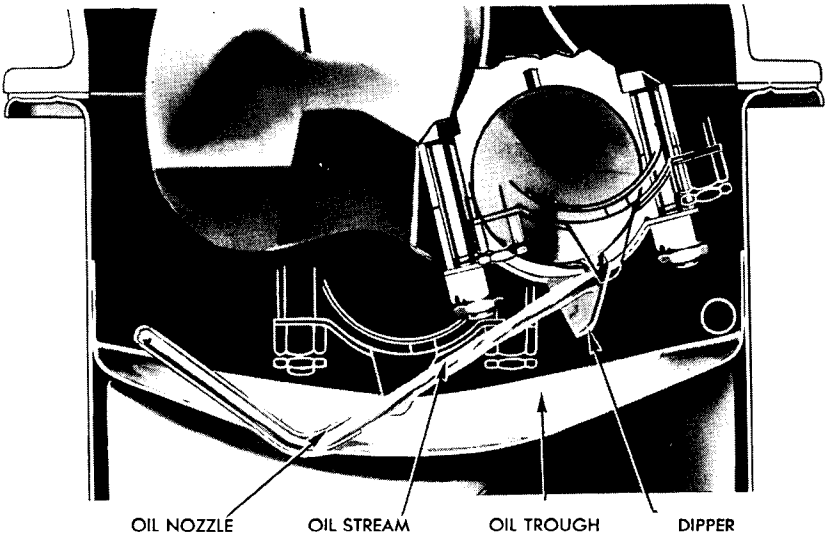


Figure 65 — Connecting Rod Bearing Lubrication

f. Valve Mechanism Lubrication. Oil for lubrication of the valve mechanism is tapped off at the oil manifold and is carried by a pipe which passes through the water jacket to a fitting between the 2 hollow rocker arm shafts, where it is distributed to all rocker arm bearings. A bleeder hole in each rocker arm supplies oil for lubrication of the valve stems and push rod sockets.

51. ENGINE OILING SYSTEM MAINTENANCE.

a. Proper functioning of the oiling system is dependent upon the proper adjustment of the connecting rod dippers, oil troughs and oil nozzles, as well as the oil pump and oil distributor.

b. Check Connecting Rod Dippers (fig. 66).

(1) Check the dippers to see that they are not loose.

(2) Clean the crankcase flange and place the 2 side pins of the oil trough depth and connecting rod dipper gage KM-J1646 against the flanges. With the rod turned to its lower position the end of the dipper should just touch the cross bar of the gage.

(3) If the dipper does not touch the gage, a new dipper must be installed.

(4) If the dipper is higher than the gage it can be bent down slightly by tapping on the end of the dipper.

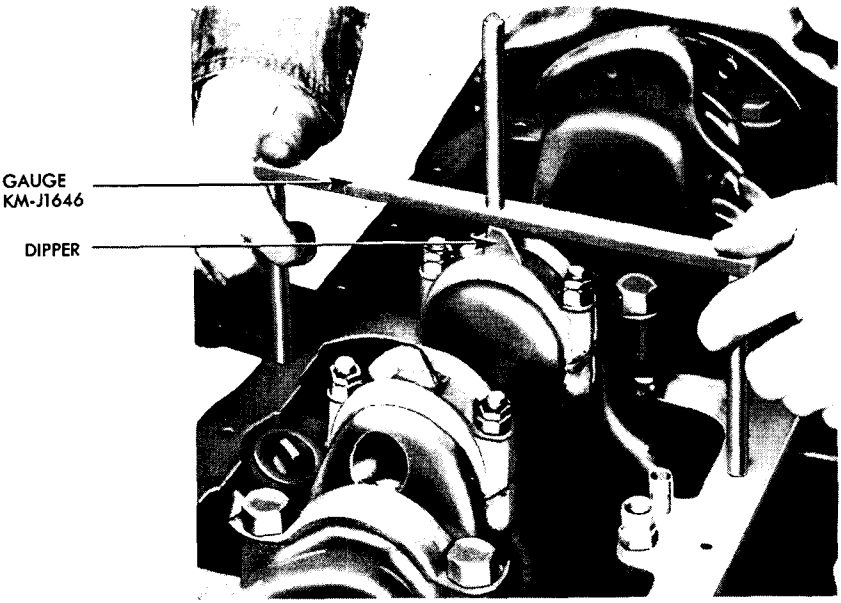


Figure 66 — Checking Connecting Rod Dipper Height

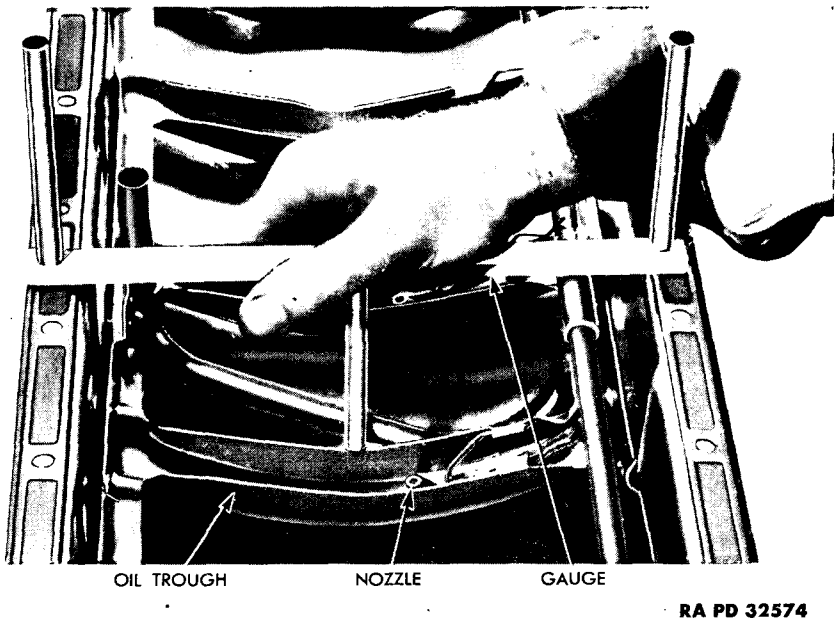


Figure 67 — Checking Oil Trough Depth

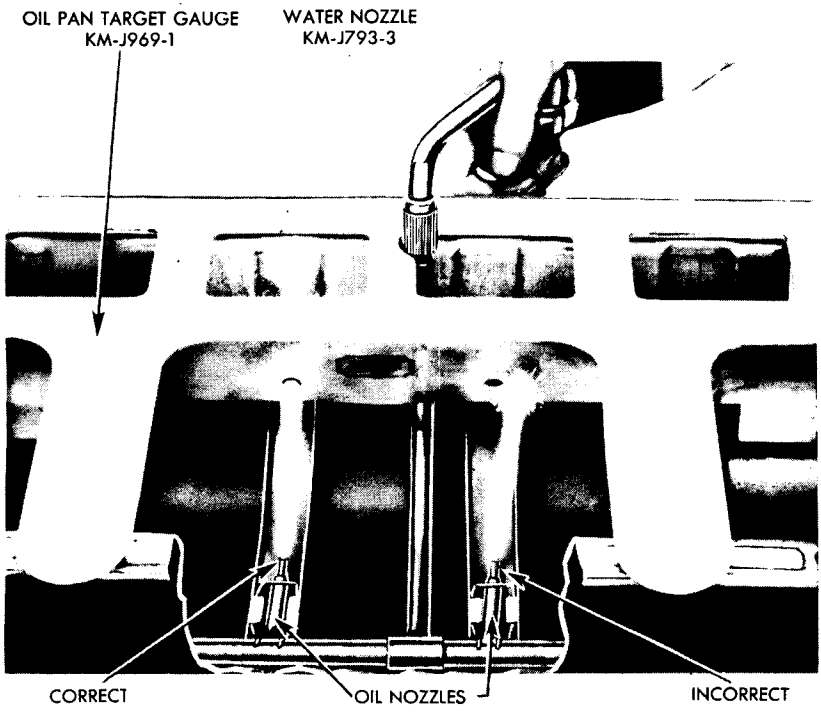


Figure 68 — Checking Aim of Oil Nozzles

c. Check Oil Pan (figs. 67, 68, and 69). Use faucet assembly KM-J793-3, oil line setting tool KM-J793-2, and oil nozzle checking tool set KM-J969.

(1) Remove the gasket from the flanges of the oil pan.

(2) Check the oil troughs with the oil trough depth gage KM-J1646 by placing the bar of the gage on the pan rail. The stem of the gage should just touch the edge of each of the 6 oil troughs (fig. 67).

(3) Place the oil pan target gage on the oil pan and locate the dowels of the gage in the screw holes in the oil pan.

(4) Insert the water nozzle in the main oil pipe. Tip the oil pan about 45 degrees to prevent the water from covering the ends of the oil lines.

(5) Open the water nozzle just enough to straighten the water streams. If the oil lines are properly adjusted, the water streams will

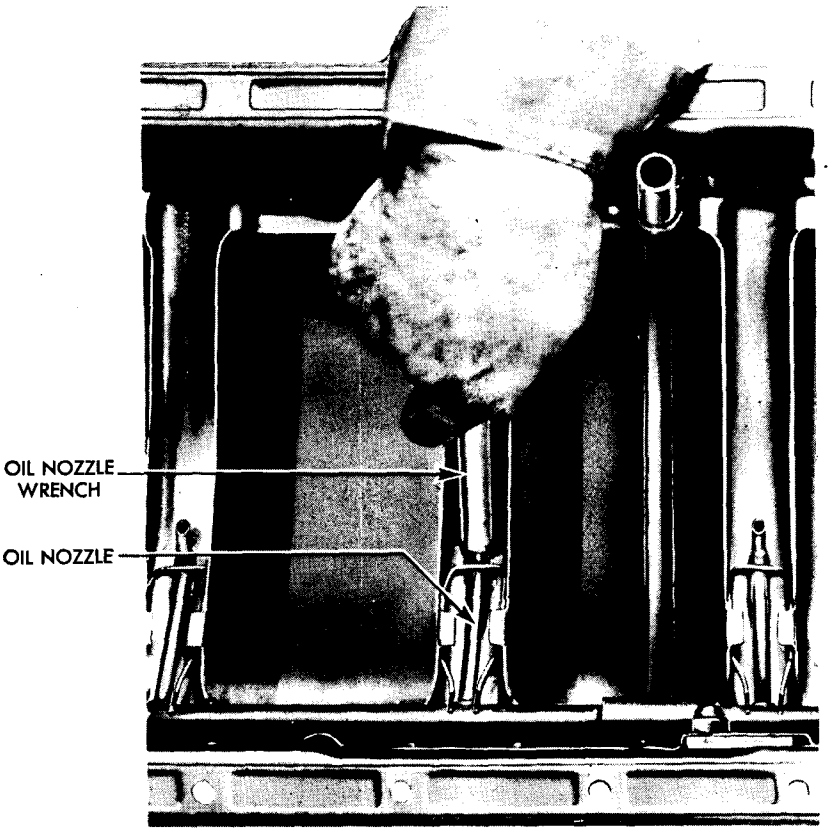


Figure 69 — Adjusting Oil Nozzles

pass through the centers of the target holes. Both the correct and incorrect aiming of the oil lines is shown in figure 68.

(6) Incorrectly aimed oil lines can be corrected by using the line setting wrench as shown in figure 69.

d. Oil Distributor.

(1) The oil distributor located in the left side of the block, at the oil manifold, consists of a cover, a cover gasket, distributor valve, and distributor valve gasket.

(2) INSTALLATION (fig. 70).

(*a*) Place the valve to block gasket against the block, then the valve, the cover gasket, and the cover.

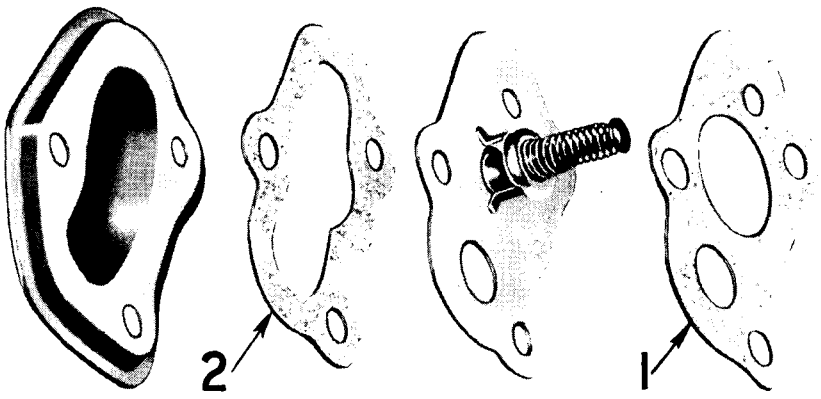


Figure 70 — Oil Distributor Parts

(*b*) Install the 3 cover screws and tighten them securely. NOTE: The 2 gaskets are not alike. The gasket marked "1" in figure 70 must be assembled between the valve and the block.

e. Oil Pump Assembly.

(1) The gear type oil pump is driven by the lower end of the ignition distributor shaft which is gear-driven from the camshaft.

(2) In operation, oil is drawn from the crankcase through a fine mesh screen and up through an oil line to the pump from which it passes through an oil line to the oil distribution system, as previously described.

(3) Disassembly, inspection, reassembly, and installation of the oil pump was covered in paragraph 18. Figure 5 shows the oil pump parts.

f. Oil Distributor to Rocker Arm Pipe.

(1) The pipe leading from the oil distributor to the rocker arm shaft passes directly through the water jacket of the cylinder block. This construction serves to stabilize the oil temperature.

(2) If the oil distributor to valve rocker oil pipe is removed for any reason, it must be discarded, and a new nipple and pipe assembly installed according to the following instructions:

(3) INSTALLATION PROCEDURE.

(*a*) Coat the threads of the nipple with white lead, thread the pipe through the block, and screw the nipple securely into the block.

(*b*) Install nipple and sleeve nut at the lower end of pipe on left side of block, coating threads of nipple with white lead, and tighten securely.

(*c*) Make bend in lower end of pipe and connect to fitting at oil distributor location.

(*d*) Bend pipe on right side of block so as to clear the push rod cover. Then bend the upper portion of pipe to pass through the hole in the cylinder head.

(*e*) Connect the pipe to the valve rocker shaft coupling.

g. Oil Filter.

(1) The oiling system is equipped with an oil filter as a further means of keeping the oil that is being pumped to the bearing surfaces of the engine from becoming contaminated.

(2) The filter unit is mounted on the dash on the right-hand side.

(3) The inlet pipe to the top of the filter is connected to the oil pressure gage fitting. This fitting taps the oil manifold which extends the full length of the cylinder block.

(4) The return line from the bottom of the filter is connected with the drilled passage from the oil distributor valve. This passage connects with the oil manifold in the oil pan which feeds the oil nozzles for the connecting rods.

(5) Unfiltered oil from the crankcase enters the filter through the inlet and flows into the space between the case and the filter element. The oil is then forced through the Igneonite filtering element into the collector tube. Filtered oil then passes from the collector tube into the annular passage which connects with the outlet fitting and is returned to the crankcase.

(6) The drain plug on the bottom of the filter should be removed every 1,000 miles to drain off any water or dirt trapped in the filter.

(7) See section II of TM 9-765 for frequency of changing filter element.

(8) FILTER ELEMENT REPLACEMENT. To replace the element, remove the top cover and remove the element. Remove the drain plug and drain the filter case. Wipe out inside of filter with a clean cloth. Install a new filter element and replace the cover and drain plug.

(9) When the engine oil is changed at the same time the filter element is replaced, it is necessary to use 7½ quarts of oil for crankcase refill in order to have the oil up to the "FULL" mark on the oil level gage after the filter has become filled and the element saturated.

52. CYLINDER HEAD AND VALVES, CONDITIONING.

a. Complete instructions covering the cylinder head and valve service will be found in paragraph 20.

Section VIII

ENGINE ASSEMBLY

53. CYLINDER HEAD, MANIFOLDS, AND CARBURETOR INSTALLATION.

a. Complete instructions covering cylinder head replacement will be found in paragraph 20.

54. MANIFOLD, CARBURETOR, AND FUEL PUMP INSTALLATION.

a. Install Gaskets and Manifold. Clean the gasket flanges on the manifold and cylinder head. Install new gaskets and slide the manifold in place over the studs, making sure the gaskets are in place. NOTE: It is possible to install the 4 cap screws with clamps to hold the gaskets in place. Place the clamps in a vertical position, and then install the manifold.

b. Tighten Manifold. Install the 6 cap screws with lock plates or washers and the 2 nuts, and tighten them securely.

c. Install Carburetor. Place a new gasket on the manifold flange and install the carburetor. Install the 2 nuts and tighten them evenly and securely.

d. Install Throttle Rod. Install the throttle rod and install the cotter pins at both ends.

e. Install Fuel Pump. Place a new gasket between the fuel pump and block; install the 2 cap screws and tighten them securely.

f. Install Gas Feed Line. Attach the gas line to the fuel pump and carburetor, and tighten the fittings and connector nuts securely.

g. Install Air Cleaner. Install the air cleaner and tighten the clamp screw.

ENGINE ASSEMBLY

55. ELECTRICAL EQUIPMENT INSTALLATION.

a. Generator Installation. Place the generator on the bracket and install the 2 attaching bolts. Tighten and lock the bolts. Loosely attach the generator brace.

b. Install Starting Motor. Install the starting motor and tighten the 2 retaining screws.

c. Install Distributor.

(1) Hand-crank engine until No. 1 intake valve (second from front) just closes.

(2) Crank engine about 180 degrees until the timing ball in the flywheel appears in the timing indicator opening in the clutch housing on the right-hand side of engine.

(3) Turn engine until steel ball is about ½ inch beyond the indicator and lines up with the U/C mark. This places No. 1 piston and No. 6 piston on top center with No. 1 in the firing position.

(4) Install spark plug wires on spark plugs and in distributor cap.

(5) Place distributor cap on distributor and mark distributor body directly below No. 1 spark plug wire terminal of cap.

(6) Remove distributor cap and turn distributor rotor to a point about ¼ inch to the right of the mark on distributor body.

(7) Install the distributor in cylinder block and push down until the gears mesh. This will turn distributor shaft until the contact point of rotor is in line with the mark on distributor which is the position of No. 1 spark plug wire terminal. NOTE: If the rotor does not line up with the mark on distributor wire, it may be necessary to raise the distributor and turn the rotor slightly to mesh the gears in a different tooth.

(8) Install distributor cap and make sure all high-tension wires are hooked up.

(9) Attach low-tension wire from coil to distributor.

56. CLUTCH AND TRANSMISSION INSTALLATION.

a. Refer to paragraphs 113 and 114 for instructions covering the installation of these units.

57. OIL PAN INSTALLATION.

a. Check to see that all rod and main bearing bolts are properly locked, that the oil dippers are installed correctly, that the oil pump and screen are attached securely, and that all connecting rod clamp bolts are tight.

b. Install Gaskets. Place a light coat of grease on the oil pan flange and install the gaskets. Grease the end corks and place them in the grooves in the bearing caps.

c. Install Pan. Place the oil pan in position against the engine flange and make sure the gaskets are in place. Start all the cap screws and bolts. NOTE: It may be necessary to use a taper punch to line up the gasket holes with the bolt holes in the pan. Tighten all bolts securely.

58. MISCELLANEOUS PARTS, INSTALLATION.

a. Replace Oil Gage and Oil Distributor Fittings. Attach the oil gage and oil distributor fittings to the connectors on the left side of motor.

b. Replace Oil Filler and Vent Assembly. Install the oil filler in the right side of motor and attach the clamp.

c. Replace Water Pump and Fan. Install a new gasket and the water pump; tighten bolts securely.

d. Install Fan Belt. Install the fan belt over the fan pulley, harmonic balancer, and generator pulley. Rock the generator away from the engine to obtain correct belt tension and tighten the brace clamp bolt.

Section IX

ENGINE INSTALLATION IN VEHICLE

59. CHECK OF UNIT BEFORE INSTALLATION.

a. General. When the rebuilt engine is not being replaced in the chassis by the third or fourth echelon shop that makes the repairs, the engine should be placed in a motor test stand to make the final adjustments and inspection.

b. Place Engine in Test Stand.

(1) Place the engine in a test stand and properly hook up the cooling system, the gas feed line, and the oil gage and oil filter lines. Plug up the windshield wiper and Hydrovac vacuum lines, and install a temperature indicator.

(2) Make the necessary battery connections, attach the ignition wire to the coil, and attach the regulator wires to the generator.

(3) Fill the cooling system and put oil in the oil pan.

(4) Check the valves to see that there is sufficient clearance at each valve when the valve is closed.

c. Set Distributor Points (fig. 35). Set the distributor points at 0.018 inch, with the cam follower resting on the peak of the cam.

d. Set Carburetor Adjustments.

(1) Screw the carburetor idling screw all the way in and back it off 1½ turns.

(2) Adjust the carburetor throttle stop screw to open the throttle slightly.

e. Start Engine. Start the engine and adjust the throttle screw for medium fast idle.

f. Check the oil gage to see that the oil pump is working.

g. Set Ignition Timing (fig. 36). With the octane selector set at "ZERO," attach a neon timing light to No. 1 spark plug and a good ground. Loosen the distributor clamp and rotate distributor body clockwise or counterclockwise until the steel ball in the flywheel lines up with the pointer on the flywheel housing. Tighten the distributor clamp.

h. Let the engine run until it is thoroughly warmed up. During this time watch the oil gage and temperature gage for any indications of overheating or lack of sufficient oil pressure.

i. Check for any indications of oil or water leaks.

j. **Tightening.** Tighten all manifold, cylinder head, carburetor flange, water pump, water outlet, and push rod cover bolts according to instructions in paragraph 26.

k. **Valve Adjustment.** Adjust the valves according to instructions in paragraph 21.

l. **Testing.** Test the engine for any indication of improperly fitted connecting rod or main bearings, loose pistons or piston pins, and timing gear noise. Adjust the carburetor idle and carburetor stop screw in combination with each other to secure a smooth idling speed at from 500 to 600 revolutions per minute.

60. ENGINE INSTALLATION.

a. **General.** The vehicle should be placed in a level clean spot where an overhead track or some type of hoist is available for swinging the engine above the vehicle and lowering it carefully into position.

b. **Procedure.**

(1) INSTALL LIFTING EYEBOLT (fig. 38). Remove the third cylinder head bolt from the rear on the left side and install the lifting eyebolt.

(2) INSTALL ENGINE (fig. 38). Connect a hoist to the eyebolt and raise the engine, clutch, and transmission assembly and swing it over the chassis; guide it into position and lower it down onto the motor mountings (par. 25).

(3) CONNECT ENGINE MOUNTINGS.

(*a*) Install and tighten the front engine mounting bolt nuts.

(*b*) Install and tighten the rear engine mounting bolt nuts.

(4) INSTALL TRANSMISSION COVER.

(*a*) Remove the piece of cardboard from top of transmission; clean the gasket flange, and install a new gasket.

(*b*) Place the transmission gears in neutral position.

(*c*) Place the cover in neutral and drop it into position.

(*d*) Install the cover bolts and tighten securely. NOTE: Place pull back spring clip on left rear bolt and power plant brace rod bracket to right cover bolts.

(*e*) Check the transmission in all gears to see that the forks are in position.

(5) INSTALL STARTER CROSS SHAFT. Attach the link and spring to the starting motor gear shift lever; place the brackets in position and bolt them securely.

ENGINE INSTALLATION IN VEHICLE

(6) INSTALL PEDAL SHAFT. Place the clutch and brake pedal shaft assembly in position and install the 3 cap screws securely.

(7) CONNECT ACCELERATOR ROD. Connect the accelerator rod to the bell crank on the left side of engine.

(8) CONNECT BRAKE PEDAL PULL BACK SPRING. Connect pull back spring to clip on left rear transmission cover bolt.

(9) CONNECT POWER PLANT BRACE ROD. Adjust power plant brace rod to correct length so that bolt will just drop through hole in transmission bracket; install bolt nut and cotter pin.

(10) CONNECT EMERGENCY BRAKE LEVER. Attach the emergency brake and transfer case shift lever bracket to right side of transmission and tighten the bolts securely.

(11) CONNECT UNIVERSAL JOINT. Place the joint in position with the trunnion bearings seating in the yoke. Install the U-clamps, washers, and nuts. Tighten securely.

(12) INSTALL FLOOR AND TOE BOARD. Install the toe board and tighten retaining screws. Install the floor board and tighten securely; install floor mat.

(13) INSTALL LEFT ENGINE SIDE PAN. Place the pan in position and bolt it to the frame and brackets.

(14) CONNECT EXHAUST PIPE. Place the exhaust pipe in position and install the pipe clamp to manifold flange bolts.

(15) CONNECT HYDROVAC VACUUM LINE. Connect the Hydrovac line to carburetor fitting.

(16) CONNECT OIL PRESSURE GAGE LINE. Connect the oil gage line to the fitting on the left side of cylinder block. NOTE: Make sure there are no short kinks in this line which would affect correct pressure reading.

(17) CONNECT OIL LINES. Connect the 2 oil lines to the oil filter connectors.

(18) CONNECT CARBURETOR CONTROLS. Push choke and throttle buttons "IN," connect the cables to the carburetor, and tighten the screws.

(19) INSTALL AIR CLEANER. Install the air cleaner with the shielded side forward and tighten the clamp screw securely.

(20) INSTALL HORN. Install the horn and tighten the bolts securely. Connect the horn wires.

(21) CONNECT GENERATOR WIRING. Connect the wires to the generator making sure that the wire from the field terminal on the voltage control attaches to the field terminal on the generator.

(22) INSTALL RIGHT ENGINE SIDE PAN. Place the side pan in position and install the attaching bolts.

(23) CONNECT GAS LINE. Connect the gas feed line to the inlet side of fuel pump.

(24) CONNECT IGNITION WIRE. Connect ignition wire to top of coil.

(25) CONNECT BATTERY. Connect the battery cable and ammeter wire to the starter switch terminal.

(26) INSTALL SHEET METAL. Install the radiator, front end sheet metal, and front fenders, as a unit, as explained in paragraph 23 **h.**

(27) FILL TRANSMISSION. Tighten the transmission drain plug, remove the filler plug, and fill the transmission to the level of the filler plug with lubricant, as specified in the lubrication section.

(28) INSTALL ENGINE OIL. Tighten oil pan drain plug and fill the oil pan with the oil, as specified in the lubrication section.

(29) ADJUST AND TEST ENGINE. Adjust and test the engine as instructed in paragraph 59.

61. PAINTING.

a. A new engine, before shipment by the manufacturer, is normally given a protective coating of paint; however, it will not be necessary to paint an engine assembly that has been rebuilt or repaired in service.

Section X

FITS AND TOLERANCES

62. FITS AND TOLERANCES.

a. Camshaft Bearing.

Diameter, line ream

Front ..... 2.0307 in.—2.0317 in.
Front, intermediate ..... 1.9682 in.—1.9692 in.
Rear, intermediate ..... 1.9057 in.—1.9067 in.
Rear ..... 1.8432 in.—1.8442 in.
Bearing clearance ..... 0.0015 in.—0.0035 in.

b. Intake Valve.

Lash, hot (normal operation) ..... 0.006 in.—0.008 in.
Lash, hot (heavy-duty operation) ..... 0.010 in.
Seat angle ..... 30°
Diameter head ..... $1\frac{41}{64}$ in.
Length, over-all ..... 6.205 in.—6.235 in.
Stem diameter ..... 0.3407 in.—0.3417 in.
Guide ream ..... 0.3427 in.—0.3437 in.
Stem to guide clearance ..... 0.001 in.—0.003 in.
Intake opens ..... 3° B.U.D.C.
Intake closes ..... 35° A.L.D.C.
Intake period ..... 218°
Width of seat (in head) ..... $\frac{3}{64}$ in. to $\frac{1}{16}$ in.

c. Exhaust Valve.

Lash, hot (normal operation) ..... 0.013 in.—0.015 in.
Lash, hot (heavy-duty operation) ..... 0.020 in.
Seat angle ..... 30°
Diameter head ..... $1\frac{15}{32}$ in.
Length, over-all ..... 4.839 in.—4.869 in.
Stem diameter ..... 0.3397 in.—0.3407 in.
Guide ream ..... 0.3427 in.—0.3437 in.
Stem to guide clearance ..... 0.002 in.—0.004 in.
Exhaust opens ..... 46° B.L.D.C.
Exhaust closes ..... 5° A.U.D.C.
Exhaust period ..... 231°
Width of seat (in head) ..... $\frac{1}{16}$ in.—$\frac{3}{32}$ in.

d. Valve Lifter.

Diameter ..... 0.989 in.—0.990 in.
Clearance, block to lifter ..... (Selective fit) 0 to 0.001 in.

e. Valve Spring.

Free length ..... 2 1/8 in.
Pounds pressure at 1 13/16 in. ..... 55 lb
Pounds pressure at 1 1/2 in. ..... 128 lb

f. Valve Rocker.

Rocker shaft diameter ..... 0.7910 in.—0.7917 in.
Rocker arm diamond bored (after granodizing) 0.7922 in.—0.7932 in.
Clearance, rocker arm to shaft ..... 0.0005 in.—0.0022 in.

g. Timing Gears.

Backlash ..... 0.003 in.—0.004 in.
Crankshaft gear:
  Material ..... Leaded steel
  Teeth 27
  Runout ..... 0.003 in.
Camshaft gear:
  Material, steel hub, gear bakelite, fabric composition
  Teeth 54
  Runout ..... 0.004 in.

h. Connecting Rod.

Center to center length ..... 6 13/16 in.
Upper bearing ..... Locked on pin
Lower bearing ..... Cast babbitt
Lower bore ..... 2.3130 in.—2.3135 in.
Connecting rod bearing, lower:
  Bearing clearance ..... 0.0004 in.—0.0009 in.
  End clearance
    (Controlled by upper half of bearing) 0.004 in.—0.011 in.
Connecting rod bolt nut:
  Torque wrench pull, with threads oiled ..... 40-45 ft-lb

i. Piston.

Diameter of piston at ring lands ..... 3.545 in.—3.550 in.
Clearance between piston and cylinder bore
  (Refer to fitting instructions in engine section) 0.0017 in.—0.0023 in.
Fit piston with feeler shim on
  thrust side at bottom and 90° opposite piston pin holes .... Pass on 0.0015 in. feeler 1/2 in. wide
    Hold on 0.003 in. feeler 1/2 in. wide

FITS AND TOLERANCES

Oversize pistons available ..... 0.020 in. and 0.040 in.
Piston pin hole ..... Slip fit
Ring groove width:
  Compression ..... 0.1255 in.—0.1265 in.
  Oil ..... 0.1885 in.—0.1895 in.

j. Piston Pin.

Diameter ..... 0.8645 in.—0.8650 in.
Oversize ..... 0.005 in.

k. Compression Ring.

Quantity 2
Type ..... Plain
Width ..... 0.1235 in.—0.1240 in.
Gap ..... 0.005 in.—0.015 in.
Ring and groove clearance ..... 0.0015 in.—0.0030 in.

l. Oil Ring.

Quantity 1
Type ..... Drilled
Width ..... 0.1860 in.—0.1865 in.
Gap ..... 0.005 in.—0.015 in.
Ring and groove clearance ..... 0.002 in.—0.0035 in.

m. Camshaft.

Number of bearings 4
Bearing journal diameter:
  Front ..... 2.0282 in.—2.0292 in.
  Front, intermediate ..... 1.9657 in.—1.9667 in.
  Rear, intermediate ..... 1.9032 in.—1.9042 in.
  Rear ..... 1.8407 in.—1.8417 in.
Runout at intermediate bearing ..... 0.002 in. max
Thrust taken ..... Front
Thrust plate thickness ..... 0.184 in.—0.189 in.
Camshaft end clearance ..... Free to 0.003 in.

n. Cylinder Block.

Bore size ..... 3.562 in.—3.564 in.
Bore out-of-round ..... 0.0005 in. max
Taper ..... 0.0005 in. in bore length

o. Cylinder Head.

Torque wrench pull ..... 75—80 ft-lb

p. Crankshaft.

Number of bearings 4
Bearing journal diameter:
  Front ..... 2.6835 in.—2.6845 in.
  Front, intermediate ..... 2.7145 in.—2.7155 in.
  Rear, intermediate ..... 2.7455 in.—2.7465 in.
  Rear ..... 2.7765 in.—2.7775 in.
  Conn. rod journal ..... 2.311 in.—2.312 in.
Thrust taken ..... Rear intermediate
End clearance ..... 0.004 in.—0.007 in.
Crank pin out-of-round ..... 0.001 in. max
Runout, at intermediate journal ..... 0.002 in. max

q. Crankshaft Main Bearing.

Bearing clearance ..... 0.0015 in.—0.0025 in.
Torque wrench pull, with threads oiled ..... 100—110 ft-lb

r. Oil Pump.

Pounds pressure at 2,000 rpm ..... 14 lb
Gear backlash ..... 0.002 in.—0.0085 in.
Gear width ..... 0.812 in.—0.814 in.
Diameter:
  Housing bore ..... 0.5585 in.—0.5605 in.
  Drive shaft ..... 0.5575 in.—0.5580 in.
  Driven gear shaft ..... 0.5565 in.—0.5570 in.
  Drive gear, bore ..... 0.556 in.—0.557 in.
  Driven gear, bore ..... 0.5575 in.—0.5585 in.
Clearance between:
  Drive shaft and housing ..... 0.0005 in.—0.0030 in.
Drive gear to shaft ..... 0.0005 in. press—0.0020 in. press
  Driven gear to shaft ..... 0.0005 in.—0.0020 in.
  Gear to housing, radial ..... 0.003 in.—0.008 in.
  Gear to housing lower edge ..... 0.002 in.—0.008 in.
  Relief valve to housing ..... 0.002 in.—0.009 in.

s. Pressure Relief Spring.

Free length ..... $5\frac{9}{64}$ in.
Pressure at $1\frac{9}{32}$ in. ..... 109 oz ± 5 oz
Valve opens at ..... 15 lb

Section XI

SPECIAL ENGINE TOOLS

63. SPECIAL TOOL LIST.

a. The following tools manufactured by the Kent-Moore Organization, or their equivalent, are recommended for use when performing the service operations covered in this section:

ADAPTER, torque wrench, KM-KMO187-1
ADAPTER, torque wrench, KM-KMO187-10
ARBOR, aliner, KM-J874C
ASSEMBLY, faucet, KM-J793-3
BAR, main bearing boring, KM-J1000
CALIPER, inside-outside, KM-KMO964
CLEANER, valve guide hole, KM-KMO122
CUTTER, valve seat, (set), KM-KMO105B
DRIVER, timing gear cover oil seal, KM-J995
FIXTURE, cylinder head holding, KM-J982A
GAGE, oil trough depth and connecting rod dipper, KM-J1646
GAGE, timing gear cover centering, KM-J966
GRINDER, valve seat, KM-KMO167C
INDICATOR, dial, KM-KMO30B
INSERTER, piston, KM-KMO357
LIGHT, neon timing
PIN, cylinder head guide, (set), KM-N344
PLATE, camshaft gear press, KM-J971
PULLER, cam and crankshaft gear, KM-T126R
PULLER, crankshaft pulley, KM-J967
PULLER, harmonic balancer, KM-J1287
REAMER and FIXTURE, piston, KM-J965
REAMER, valve guide, (finishing), KM-0.343
REAMER, valve guide, (roughing), KM-0.341
REMOVER, valve guide, KM-J267
REPLACER, valve guide, (exhaust), KM-J1090
REPLACER, valve guide, (intake), KM-J1089
TESTER, valve spring, KM-U15
TESTER, volt-ammeter
TOOL, camshaft bearing service, (set), KM-J1800C
TOOL, clutch pilot, KM-K411
TOOL, oil line setting, KM-J793-2
TOOL, oil nozzle checking, (set), KM-J969
WRENCH, cylinder head tension, KM-J1313
WRENCH, tension, KM-J1313
WRENCH, torque, KM-J1313

CHAPTER 3

ENGINE IGNITION SYSTEM

Section I

INTRODUCTION

64. DESCRIPTION (fig. 71).

a. When the ignition switch is closed, the current flows from the battery positive terminal to the starter switch, then to ammeter, ignition switch, through the primary winding of the coil to the distributor, across the breaker points to the ground, and back to the negative terminal on the battery (fig. 71).

b. Current flowing through this circuit builds up a magnetic field about the coil. When the breaker points open, the current tends to keep on flowing and surges into the condenser, attracting a positive charge on one side and a negative charge on the other. A fraction of a second after the breaker points open, the counter pressure in the condenser overcomes the surge pressure on the line and the condenser discharges from the positive charged side back through the primary winding of the coil in the opposite direction to the primary current, through the battery to the ground, and back to the grounded side of the condenser, equalizing the two sides of the condenser. The discharge current from the condenser passing over the primary winding tends to reverse the polarity of the coil and results in a very rapid demagnetizing of the coil. This rapid movement of the lines of force across the large number of turns of the secondary winding induces a current of very high voltage, which flows from the secondary winding to the high-tension terminal of the coil, then to the distributor, across the distributor, across the distributor rotor to the spark plug, across the gap between the plug points to the ground, and back to the other end of the secondary winding, completing the circuit.

65. DATA.

a. Distributor.

Make	Delco Remy
Model	1110136

INTRODUCTION

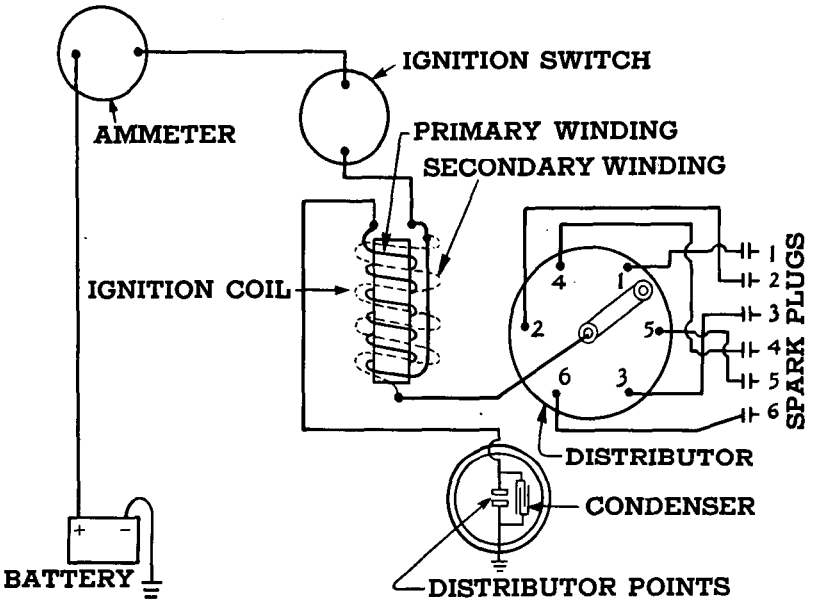


Figure 71 — Ignition Circuits

Type of advance ..... Centrifugal
Firing order 1-5-3-6-2-4
Breaker point gap ..... 0.018 in.
Breaker arm spring tension ..... 17 to 21 oz
Spark advance starts ..... 800 engine rpm
Spark advance at 2,600 rpm ..... 24 deg
Maximum spark advance at 3,500 rpm ..... 26 deg

b. Ignition Timing.

Initial setting ..... 5 deg before upper dead center

c. Spark Plugs.

Make ..... A.C.
Model 104
Size 10-mm
Plug gap ..... 0.040 in.

d. Ignition Coil.

Make ..... Delco Remy
Model 1115145

66. ECHELON REFERENCES.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon operations not covered in this manual.

67. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

68. TROUBLE SHOOTING.

a. Hard Starting.

Probable Cause	Probable Remedy
Distributor points burned or corroded.	Clean or replace points (par. 70).
Points improperly adjusted.	Adjust points to 0.018 in. (par. 69).
Spark plugs improperly gapped.	Set plug gap at 0.040 in. (par. 26).
Spark plug wires loose and corroded in distributor.	Clean wire and cap terminals.
Loose connections in primary circuit.	Tighten all connections in primary circuit.
Corroded battery terminal.	Clean terminals thoroughly.
Series resistance in condenser circuit.	Clean all connections in condenser circuit.
Low capacity condenser.	Install proper condenser (par. 71).

Section III

OPERATIONS PERFORMED WITHOUT REMOVING UNITS FROM VEHICLE

69. BREAKER POINT ADJUSTMENT (fig. 35).

a. Procedure. Release the 2 spring clips on the side of the distributor cap and lift off the cap and rotor. Hand-crank the engine until the breaker arm cam follower is on a peak of the cam. Loosen the lock screw in the stationary point (the screw nearest the point), and turn the eccentric adjusting screw to the right or left until the gap is 0.018 inch (fig. 35). Tighten lock and check the gap clearance.

70. BREAKER POINT REPLACEMENT.

a. Procedure.

(1) REMOVE POINTS. Release the 2 spring clips on the side of the distributor cap and lift off the cap and rotor. Loosen the nut on inside of housing that holds the point spring to the terminal and lift point with spring up and out. Remove the lock screw (screw nearest point) from the stationary point and lift out the point.

(2) INSTALL POINTS. Place the stationary point in position and start the lockscrew. Make sure stationary point is flat on distributor plate, so as to prevent shorting on movable point. Place movable point with spring in position and tighten the retaining nut. Adjust points as instructed in paragraph 69. Install the rotor and cap and spring clips.

71. CONDENSER REPLACEMENT.

a. Procedure.

(1) REMOVE CONDENSER. Release the spring clips on each side of the distributor cap and lift off the cap and rotor. Loosen the nut on inside of housing that retains the condenser lead to the terminal and lift off the lead. Remove the screw that retains the condenser to plate and lift out condenser.

(2) INSTALL CONDENSER. Place condenser in position and install the retaining screw. Place wire on terminal and tighten terminal nut. Install rotor and cap and the spring clips.

72. ROTOR REPLACEMENT.

a. Procedure.

(1) REMOVE ROTOR. Release the spring clips on the side of the distributor cap and lift off the cap. Pull out the rotor.

(2) INSTALL ROTOR. Place rotor in position on shaft and place distributor cap on housing. Install the spring clips.

73. DISTRIBUTOR CAP REPLACEMENT.

a. Procedure. Release the 2 spring clips on the sides of the distributor and lift off the cap. Remove one wire at a time and place the wire in the same terminal in the new cap until all wires are installed in the new cap. Place the cap in position and attach the spring clips.

Section IV

IGNITION UNITS, REMOVAL FROM VEHICLE

74. IGNITION SWITCH REMOVAL.

a. Procedure. Remove round retaining nut from switch on face of instrument panel. Push switch through hole in instrument panel and remove the 2 wires from the terminals on the back of switch.

75. IGNITION COIL REMOVAL.

a. Procedure. Pull out high-tension wire from bottom of coil. Remove the 2 wires on top of coil. NOTE: Tag each wire so they can be installed on the same terminals from which they were removed. Remove the 2 machine screws that attach the coil to the engine.

76. IGNITION DISTRIBUTOR REMOVAL.

a. Reference. The replacement and timing of the distributor is covered in TM 9-765.

77. SPARK PLUG REMOVAL.

a. Procedure. Pull the wire terminals off the spark plugs. Use spark plug wrench furnished with tool kit to remove the plugs.

A—HOUSING
B—OIL WICK
C—WICK SPRING
D—GREASE CUP
E—CAP SPRING
F—SPRING SUPPORT
G—BREAKER PLATE
H—STUD NUT
I—LOCKWASHER
J—PLAIN WASHER
K—BUSHING (INSULATING)
L—WASHER (INSULATING)
M—PLAIN WASHER
N—TERMINAL STUD
O—LOCKWASHER
P—STUD NUT
Q—CONDENSER
R—SCREW (CONDENSER MOUNTING)
S—BREAKER POINT (ADJUSTABLE)
T—LOCK SCREW (BREAKER POINT)
U—BREAKER POINT AND SPRING
V—DISTRIBUTOR CAP
W—GEAR PIN
X—DRIVEN GEAR (DISTRIBUTOR)
Y—SHAFT AND PLATE
Z—WEIGHT (SPARK ADVANCE)
AA—CAM (DISTRIBUTOR)
BB—WEIGHT SPRING
CC—WEIGHT STOP
DD—WEIGHT WASHER
EE—NUT
FF—ROTOR

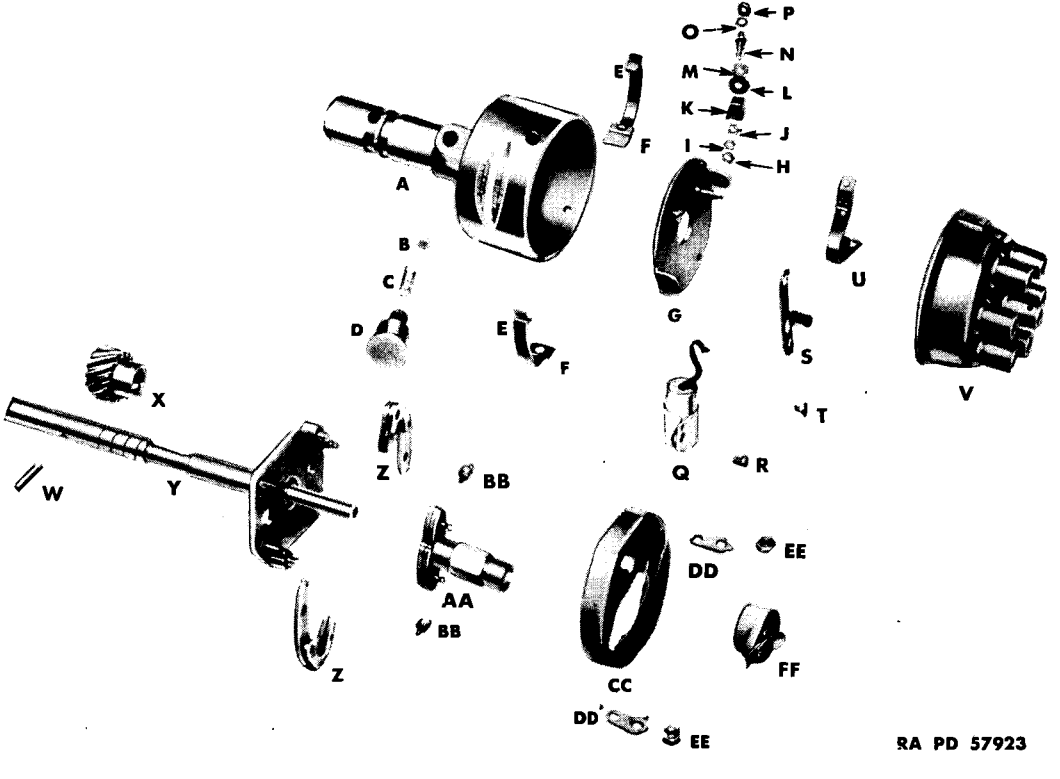


Figure 72 — Distributor Parts

Section V

IGNITION UNITS, DISASSEMBLY

78. DISTRIBUTOR DISASSEMBLY (fig. 72).

a. Procedure.

(1) REMOVE LUBRICATION CUP. The lubrication cup is threaded into the distributor housing and can be removed by turning in a counterclockwise direction. After the cup has been removed the wick spring and oil wick can be pulled out of the opening in the housing.

(2) REMOVE ROTOR. The distributor rotor can be removed by pulling it off of the distributor cam.

(3) REMOVE BREAKER POINTS. Loosen the stud nut retaining the movable contact point, and remove the movable breaker point and spring. Remove the adjustable breaker point lock screw, and remove the adjustable point. Remove the condenser lead from the primary terminal, and remove the terminal from the distributor body.

(4) REMOVE BREAKER PLATE. Remove the screws retaining the breaker plate in the distributor body, and remove the breaker plate.

(5) REMOVE DISTRIBUTOR SHAFT. Drive out the pin which retains the distributor gear on the shaft and remove the distributor and advance mechanism assembly from the distributor body.

(6) DISASSEMBLE ADVANCE MECHANISM. Remove the advance springs. Bend back the tangs on the lock plates and remove the 2 nuts which retain the advance mechanism cover, and remove the cover. Remove the cam and centrifugal weights.

Section VI

IGNITION SYSTEM PARTS, CLEANING, INSPECTION, AND REPLACEMENT

79. CLEANING OF PARTS.

a. Clean all parts thoroughly in SOLVENT, dry-cleaning, and dry them with air pressure from an air blow gun. Damaged parts that are to be replaced should be placed to one side to keep them separated from the parts that are to be used again.

80. COMPONENT PARTS, INSPECTION AND REPAIR.

a. Ignition Switch Inspection Procedure.

(1) TEST SWITCH FOR SHORT CIRCUIT. With switch in "OFF" position, connect one lead of the test lamp to one of the terminals on the back of the switch and the other test lamp lead to the other terminal. If the test lamp lights, the switch is shorted and should be replaced. If the test lamp does not light, the circuit is good.

(2) TEST SWITCH FOR OPEN CIRCUIT. Turn switch to "ON" position and connect the test lamp leads to the terminals. If the test lamp lights, the circuit is good. If the test lamp does not light, the switch has an open circuit and should be replaced.

b. Distributor Inspection Procedure.

(1) INSPECT DISTRIBUTOR PARTS. Inspect the shaft for wear, and check its fit in the distributor body; if the shaft or bearings are worn, the shaft or distributor body should be replaced. Mount the shaft in V-blocks and check the shaft alinement with a dial gage; the runout should not exceed 0.002 inch. Inspect the centrifugal weights for wear or burs and free fit on their pins. Inspect the cam for wear or roughness; then check its fit on the end of the shaft; it should be absolutely free without any looseness. Inspect the breaker points; dirty points should be cleaned with a fine cut ignition file and badly pitted points should be replaced. Test the condenser for series resistance, microfarad capacity, and insulation break-down; follow the instructions given by the manufacturer of the equipment used. Check distributor cap for cracks and burned or broken contact points. Cracked caps or those with burned or broken contact points should be replaced.

c. Ignition Coil Inspection Procedure. The ignition coil is filled with transformer oil and is hermetically sealed; it cannot be dis-

assembled. Coil tests can only be made on coil test equipment. Follow the instructions of the manufacturer of the equipment being used.

d. Spark Plug Inspection Procedure (fig. 34).

(1) CLEAN, INSPECT, AND ADJUST PLUGS. Check spark plugs for broken or cracked insulators and clean them on a special spark plug cleaner. Check the points and set the gap at 0.040 inch, using a round spark plug gage. Replace any plugs with broken or cracked insulators.

e. Wire Inspection Procedure. Check all primary and secondary wires to see that they are not broken and that the insulation is not worn away exposing any bare wire. Also check to see that none of the wires are oil-soaked. Replace all faulty wires.

Section VII

ASSEMBLING DISTRIBUTOR

81. ASSEMBLING DISTRIBUTOR.

a. Procedure.

(1) ASSEMBLE ADVANCE MECHANISM. Assemble the centrifugal weights over the pivot pins. Lubricate the top end of the shaft with light engine oil and install the cam and weight springs. Assemble the advance mechanism cover. Install the lock plates and nuts. After tightening the nuts securely, lock them by bending up the tangs on the lock plates.

(2) INSTALL DISTRIBUTOR SHAFT. Lubricate the shaft and install it in the distributor housing. Install the drive gear and pin.

(3) INSTALL BREAKER PLATE. Install the breaker plate in the distributor body and assemble the distributor cap retaining clips.

(4) INSTALL PRIMARY TERMINAL. Install the primary terminal insulation bushing in the housing. Thread the terminal through the bushing and install the insulation washer, flat washer, lock washer, and nut.

(5) INSTALL CONDENSER. Assemble the condenser to the breaker plate, making sure the connections are clean.

(6) INSTALL AND ADJUST POINTS. Install the movable point and set the gap at 0.018 inch.

(7) INSTALL LUBRICATION CUP, ROTOR, AND CAP. Install the oil wick, wick spring, lubrication cup, rotor, and distributor cap.

Section VIII

IGNITION UNITS, INSTALLATION IN VEHICLE

82. IGNITION SWITCH INSTALLATION.

a. Procedure. Connect the 2 wires to the terminals on the ignition switch and assemble switch to instrument panel with the retaining nut.

83. IGNITION COIL INSTALLATION.

a. Procedure. Place coil in position on side of engine and install the retaining screws. Connect the 2 wires to the same terminals from which they were removed on top of the coil. Push the high-tension wire in the terminal on bottom of coil.

84. DISTRIBUTOR INSTALLATION.

a. Reference. Whenever a distributor is installed on an engine, it is necessary that the engine be timed properly. Refer to TM 9-765 when installing distributor.

85. SPARK PLUG INSTALLATION.

a. Procedure. Use a new gasket and screw the plug in finger-tight, then ½ to ¾ turn with a wrench. If a used gasket is being reinstalled, screw plug in finger-tight, then ⅛ to ¼ turn more with a wrench. NOTE: If a tension wrench is used, the plugs should not be tightened over 15 foot-pounds maximum. Care must be used to prevent upsetting the spark plug gaps by over-tightening the plugs.

CHAPTER 4

FUEL SYSTEM

Section I

INTRODUCTION

86. UNITS INVOLVED.

a. The fuel system as covered in this section consists of a main gas tank, auxiliary gas tank, gas lines with control valve, fuel filter, fuel pump, carburetor, and air cleaner.

87. ECHELON REFERENCES.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon operations not covered in this manual.

88. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

89. TROUBLE SHOOTING.

a. Fuel Leaks.

Probable Cause	Probable Remedy
At gas tank seams or tank pierced.	Replace gas tank (par. 91).
At gas line fittings.	Tighten or replace fittings.
At control valve.	Tighten or replace valve.
Fuel pump bowl gasket damaged.	Replace gasket.
Fuel pump bowl retaining nut loose.	Tighten nut.
Fuel pump body to cover screws loose.	Tighten screws.
Fuel pump diaphragm leaks.	Overhaul or exchange fuel pump (par. 93).

b. Leaks Oil.

Fuel pump to block gasket damaged or bolts loose.	Replace gasket or tighten bolts.

c. Excessive Fuel Consumption.

Excessive idling.	Stop engine when vehicle is not being driven.
Fast idling.	Adjust idling speed according to instructions in paragraph 99.
Improper idling adjustment.	Adjust idling according to instructions in paragraph 99.
Restricted air cleaner.	Clean air cleaner (par. 102).
Fuel leaks.	Check entire fuel system for leaks.
Excessive use of choke.	Keep choke button in except when starting.
Choke valve sticking.	Free or replace choke valve.
Manifold heat control valve sticking or valve spring improperly installed.	See TM 9-765.
Dragging brakes.	See TM 9-765.
Engine improperly tuned.	See paragraph 26.

TROUBLE SHOOTING

d. Restrictions in Fuel System.

Probable Cause	Probable Remedy
Gas tank filler cap vent restricted.	Replace filler cap.
Ice, water, or foreign material in tank or lines.	Remove tank, and clean tank and lines thoroughly.

e. Lack of Fuel in Carburetor.

Air leaks in gas line.	Check for air leaks between tank and fuel pump.
No fuel in tank.	Replenish fuel supply.
Fuel pump valves not seating.	Overhaul or exchange fuel pump (par. 93).
Fuel pump diaphragm spring or link broken.	Overhaul or replace fuel pump (par. 93).
Fuel pump diaphragm leaks.	Overhaul or replace fuel pump (par. 93).

f. Fast Idling.

Throttle or accelerator linkage sticking.	Free throttle and linkage.
Improper throttle adjustment.	Adjust carburetor throttle stop screw (par. 99).

g. Engine Dies.

Improper idling adjustment.	Adjust idling (par. 99).
Low speed jet or idling passage plugged.	Overhaul carburetor (par. 100).
Carburetor flooding.	Clean or replace needle valve and seat (par. 99).
Air leaks.	Tighten carburetor to manifold and manifold to cylinder head stud nuts. Check for leaks in the windshield wiper or Hydrovac system.

h. Engine Misses on Acceleration.

Accelerator pump jet plugged or pump not working.	Overhaul carburetor (par. 100).
Engine valve trouble.	See paragraph 20.
Trouble in ignition system.	Check ignition system and tune engine.

Section III

FUEL TANK REMOVAL FROM VEHICLE

90. DESCRIPTION AND DATA.

a. Both fuel tanks are made of heavy sheet steel seam-welded and fitted with baffle plates to prevent surging of the gas and to re-enforce the tank.

b. The 30-gallon main tank is mounted between the frame members on 2 support brackets, and is held in place by 2 metal straps.

c. The 18-gallon capacity auxiliary tank is mounted under the driver's seat and held in place by 2 steel straps.

d. The selector valve is located at the front right corner of the driver's seat. For selector valve operation, refer to TM 9-765.

e. The fuel tank filler cap is of the pressure type. A cork gasket seals the joint between the filler cap and gas tank neck. This prevents loss of fuel on uneven terrain. Two spring-loaded valves are mounted in the cap to operate in opposite directions. When the fuel expansion caused by high atmospheric temperature creates a pressure within the tank of from 3½ to 4½ pounds, the pressure valve opens and the pressure is released. When, due to fuel consumption, the pressure drops from ¼ to ½ pound below atmospheric pressure, the atmospheric valve opens admitting air.

91. MAINTENANCE AND REPAIRS.

a. Main Fuel Tank Replacement.

(1) DRAIN TANK. Drain the gasoline from main fuel tank.

(2) DISCONNECT FILLER NECK. Disconnect the filler neck coupling by loosening clamp and working hose off from tank neck.

(3) DISCONNECT FUEL LINE AND GAGE WIRES. Disconnect the fuel tank to fuel pump gas line from the tank and disconnect the fuel gage wire from tank unit.

(4) REMOVE TANK. Remove the bolts which attach the tank braces to side rail of frame. Move the tank toward center of vehicle and lower the frame side of tank until it clears the frame.

FUEL TANK REMOVAL FROM VEHICLE

(5) REMOVE GAS GAGE. Remove the gas gage tank unit from tank.

(6) INSTALL GAS GAGE. Install gas gage in new tank using a new gasket.

(7) INSTALL NEW TANK. Place the tank in position and bolt the support brackets to frame side member.

(8) CONNECT FUEL LINE AND GAS GAGE WIRE. Connect the fuel line to tank and the gas gage wire to tank unit.

(9) CONNECT FILLER NECK. Install filler neck hose and tighten clamp securely.

(10) FILL FUEL TANK. Fill the fuel tank and check the system for leaks.

b. Auxiliary Fuel Tank Replacement.

(1) DRAIN TANK. Drain the gasoline from auxiliary tank.

(2) REMOVE SEAT CUSHIONS. Remove the 4 wing nuts from the seat adjuster bolts and remove the seat cushions.

(3) REMOVE SEAT RISER COVER. Remove the 14 metal screws which retain the seat riser cover panel and remove the panel.

(4) DISCONNECT FUEL LINE. Disconnect the fuel line from tank.

(5) DISCONNECT FUEL GAGE WIRE. Disconnect the wire from fuel gage.

(6) REMOVE TANK. Remove the nuts and lock washers from the bottom of hold-down straps and lift out tank.

(7) REMOVE FUEL GAGE. Remove the retaining screws and fuel gage.

(8) INSTALL FUEL GAGE. Install the fuel gage in new tank using a new gasket. Tighten the attaching bolts securely.

(9) INSTALL TANK. Place the tank in position and install the hold-down straps, washers, and nuts.

(10) ATTACH FUEL GAGE AND GAS LINE. Attach the wire to fuel gage and gasoline line to tank.

(11) INSTALL SEAT RISER. Place the seat riser in position and install the 14 sheet metal screws.

(12) INSTALL SEAT CUSHIONS. Place the seat cushions in position and install the 4 wing nuts.

(13) FILL FUEL TANK. Fill the tank and check for fuel leaks.

Section IV

FUEL PUMP, REMOVAL AND REPAIR

92. DESCRIPTION AND DATA.

a. Description. The diaphragm type fuel pump (fig. 73) is mounted on the right side of the crankcase and operated from an eccentric on the camshaft. The diaphragm is composed of several layers of specially treated cloth which is impervious to gasoline and benzol. The cloth material is held between 2 metal disks and is pushed upward by a pump spring, and downward by the pump arm operating on the camshaft. This diaphragm, in its downward movement, causes a vacuum in the pump chamber, and fuel is drawn in through the glass bowl and strainer to fill this vacuum. The upward movement of the diaphragm forces fuel to the carburetor. A lever and spring located on the rear side of the fuel pump body is used to fill the fuel pump and carburetor bowl in the event the truck should run out of gasoline.

b. Data.

Make ..... AC No. 1537272
Model ..... AF
Operating pressure ..... 3¾ lb (max)

93. MAINTENANCE AND REPAIRS.

a. Maintenance. The fuel pump requires no adjustment. It is lubricated by the engine oil which enters the pump through the opening in the crankcase. The mounting bolts, body screws, gas line connections, and filter bowl nut should be kept tight to prevent oil, fuel, or air leaks. The filter bowl should be removed and cleaned regularly. A new gasket should be used when the filter bowl is installed.

b. Removal.

(1) DISCONNECT FUEL LINES. Disconnect the 2 fuel lines from the fuel pump.

(2) REMOVE PUMP. Remove the 2 retaining bolts and remove the pump.

c. Disassembly.

(1) REMOVE FILTER BOWL. Loosen the filter bowl retaining nut; remove the bowl and screen.

(2) REMOVE COVER. Remove the retaining screws and remove the fuel pump cover.

FUEL PUMP, REMOVAL AND REPAIR

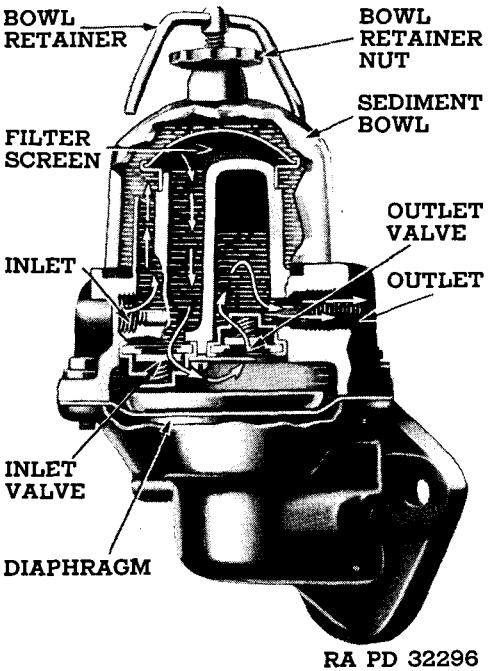


Figure 73 — Fuel Pump

(3) REMOVE DIAPHRAGM (fig. 74). Raise the edge of diaphragm and, using a thin bladed screwdriver, lift the spring and oil seal over the edge of body boss. Unhook the diaphragm push rod from the fuel pump link by holding up the link with a large screwdriver and pushing the diaphragm down and away from the fuel pump link.

(4) REMOVE VALVES (fig. 73). Remove the valve retainer screws, valve retainer, valves, and gaskets.

d. Cleaning and Inspection. Clean all parts thoroughly in cleaning solvent. Inspect the parts for wear or damage, and replace any parts which are not suitable for additional service.

e. Assembly.

(1) ASSEMBLE OIL SEAL (fig. 74). Assemble the oil seal spring, upper retainer, 2 leather seals, and the lower retainer with the convex side out on the diaphragm push rod.

(2) INSTALL DIAPHRAGM (fig. 74). Hold up the fuel pump link with a screwdriver, place the diaphragm in the body, compress the

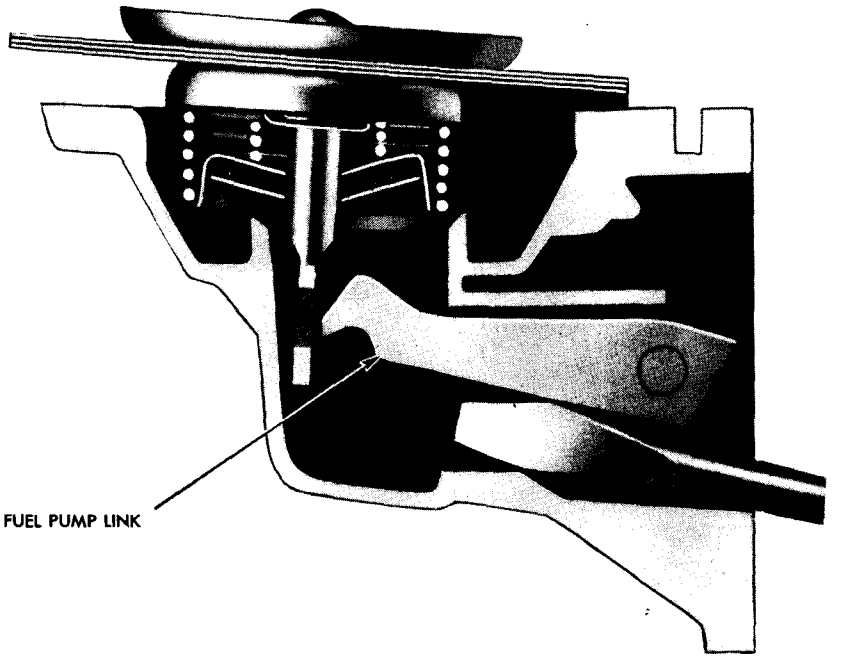


Figure 74 — Installing Diaphragm Spring

spring, and hook the diaphragm pull rod over the fuel pump link. Make sure the oil seal retainer is in position.

(3) ASSEMBLE VALVES (fig. 73). Assemble the intake valve in the cover opening next to the tapped passage marked "INT" so that the valve opens downward (fig. 73), and the outlet valve should be assembled so that the valve opens upward (fig. 73). Install the paper gasket and the valve retainer with the convex side up. Install the retaining screws.

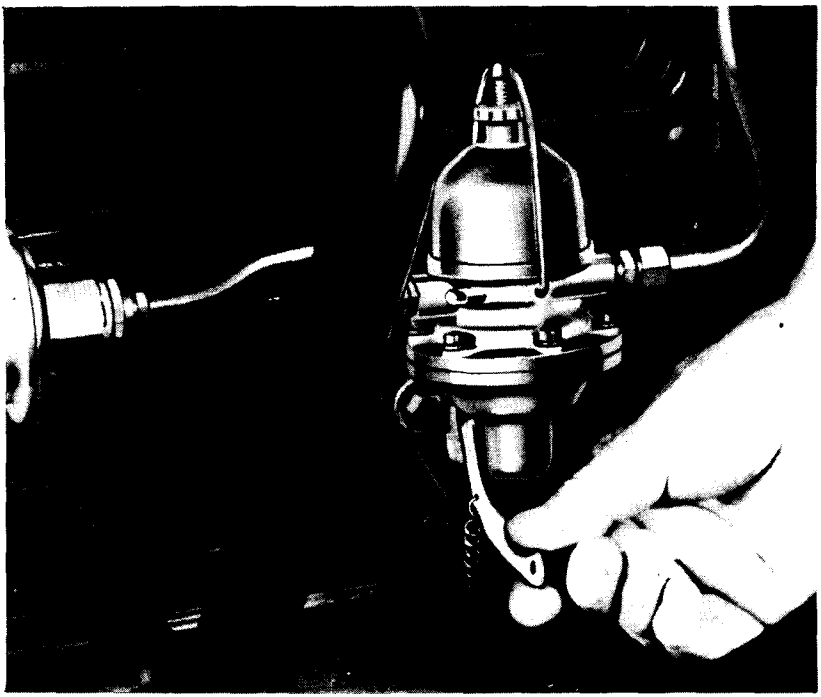
(4) INSTALL COVER (fig. 73). Place the cover in position and line up the bolt holes in the cover, body and diaphragm. Install the cover screws and tighten securely.

(5) INSTALL FILTER BOWL. Install a new filter bowl gasket, the filter screen, and the filter bowl. Tighten the bowl retaining nut securely.

f. Installation.

(1) INSTALL PUMP. Place a new gasket between the pump and engine, install the 2 cap screws, and tighten securely.

FUEL PUMP, REMOVAL AND REPAIR



RA PD 32297

Figure 75 — Filling Carburetor Bowl

(2) ATTACH GAS LINES. Attach the fuel pump intake and outlet gas lines and tighten securely.

(3) FILL FUEL PUMP (fig. 75). Operate the lever up and down until the fuel pump and carburetor are filled.

Section V

FUEL FILTER, REMOVAL AND REPAIR

94. DESCRIPTION AND DATA (figs. 76 and 77).

a. Description. The fuel filter is of the multiple disk type, having a drain plug in the bottom of the bowl for draining water or sediment. It is mounted on the outside of the right frame side rail in line with the driver's compartment floor boards. All gasoline from the fuel tanks must pass through this filter before reaching the fuel pump and carburetor.

b. Data.

Make ..... A.C.
Model T-2
Type ..... Disk

95. MAINTENANCE AND REPAIRS.

a. Draining Sediment Bowl (fig. 76).

(1) SHUT OFF GASOLINE SUPPLY. Close the valve located at the intake end of the fuel filter.

(2) DRAIN SEDIMENT. Remove the drain plug from bottom of bowl. When sediment has drained out flush the bowl by opening the valve momentarily to flush a little gasoline through the bowl.

(3) INSTALL DRAIN PLUG. Install the drain plug and tighten it securely. Open the shutoff valve.

b. Cleaning Fuel Filter (figs. 76 and 77).

(1) CLOSE SHUTOFF VALVE. Close the shutoff valve which is located at the intake end of fuel filter.

(2) REMOVE BOWL. Remove the cover bolt, bowl, and filter element.

(3) CLEAN PARTS. Wash all parts in cleaning solvent. Make sure the filter element is clean and free from any particles of dirt between the plates by slushing it back and forth in clean solvent.

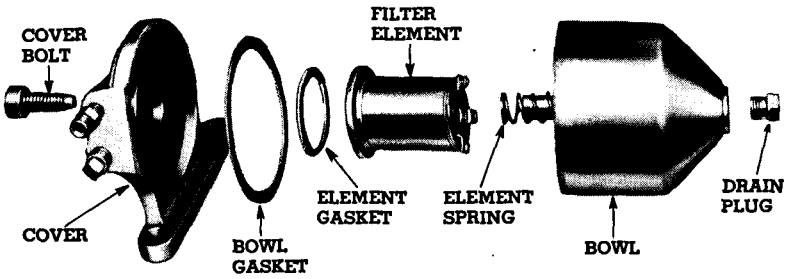
(4) REASSEMBLY. Assemble the filter using new bowl and element gaskets.

(5) TURN ON THE FUEL. Open the shutoff valve and check for leaks.

FUEL FILTER, REMOVAL AND REPAIR

RA PD 32298

Figure 76 — Fuel Filter



RA PD 32299

Figure 77 — Fuel Filter Parts

c. Replace Fuel Filter Assembly (fig. 76).

(1) DISCONNECT FUEL LINES. Close the shutoff valve and disconnect the fuel lines.

(2) REMOVE FILTER. Remove the 2 bolts which attach the fuel filter to the frame member and remove filter.

(3) INSTALL FILTER. Place the filter in position and bolt it securely to frame.

(4) CONNECT FUEL LINES. Connect the fuel lines to fuel filter, turn on the valve, and check for gasoline or air leaks.

Section VI

CARBURETOR, REMOVAL AND REPAIR

96. DESCRIPTION (fig. 78).

a. The Carter Model W1 downdraft carburetor used on this truck embodies a principle employing 3 Venturis, 1 located above and 2 below the level of the fuel in the float chamber. This triple Venturi has the effect of increasing the suction on the first or primary Venturi, causing the nozzle to start delivering fuel at very low air speeds. The nozzle enters the primary Venturi at an angle, discharging upwardly against the air stream. This angle secures an even flow of correctly proportioned and finely atomized fuel.

b. The fuel thus atomized in the primary Venturi is kept centrally located in the air stream by the surrounding blanket of air passing into the second Venturi, and this process is repeated by the air in the main Venturi. By this means, the fuel is carried to the cylinders in a more perfectly atomized condition. This insulated atomization results in increased smoothness of operation at both low and high speeds.

c. The mixture quality is controlled by a metering rod which operates within the metering rod jet, and is operated by the throttle lever. There are 2 steps of different diameters on this metering rod. The large diameter, or economy step, is tapered and controls the fuel flow to about ⅞ throttle, when the smaller diameter, or power step, becomes effective, giving full power for either high speed or hard low speed pulling. By this simple means, both maximum power and greater economy can be had without changing the carburetor adjustment.

d. This carburetor is of the "balanced" type which maintains proper air pressure ratio between the air intake and the fuel bowl. With this arrangement, the restriction of the air cleaner in various stages of cleanliness has a minimum of influence on the air fuel ratio. Figure 79 shows the balance passages in cross section.

e. The choke valve is connected to the choke lever through a light spring (fig. 79). This arrangement prevents overchoking.

A—THROTTLE CONNECTING ROD
B—ACCELERATING PUMP LEVER
C—SECONDARY VENTURI
D—PRIMARY VENTURI
E—AIR HORN
F—CHOKE VALVE
G—MAIN NOZZLE
H—BY-PASS
I—ECONOMIZER JET
J—METERING ROD
K—GASOLINE INTAKE NEEDLE SEAT
L—GASOLINE INTAKE NEEDLE
M—ACCELERATING PUMP CONNECTOR LINK
N—LEATHER PACKED PLUNGER
O—OUTLET CHECK VALVE
P—INLET CHECK VALVE
Q—STRAINER SCREEN
R—ACCELERATING PUMP JET
S—MAIN VENTURI
T—IDLE PASSAGE
U—THROTTLE VALVE
V—FLOAT
W—METERING ROD JET
X—MAIN GASOLINE PASSAGE
Y—LOW SPEED JET
Z—IDLE ADJUSTMENT SCREW
AA—IDLE PORT

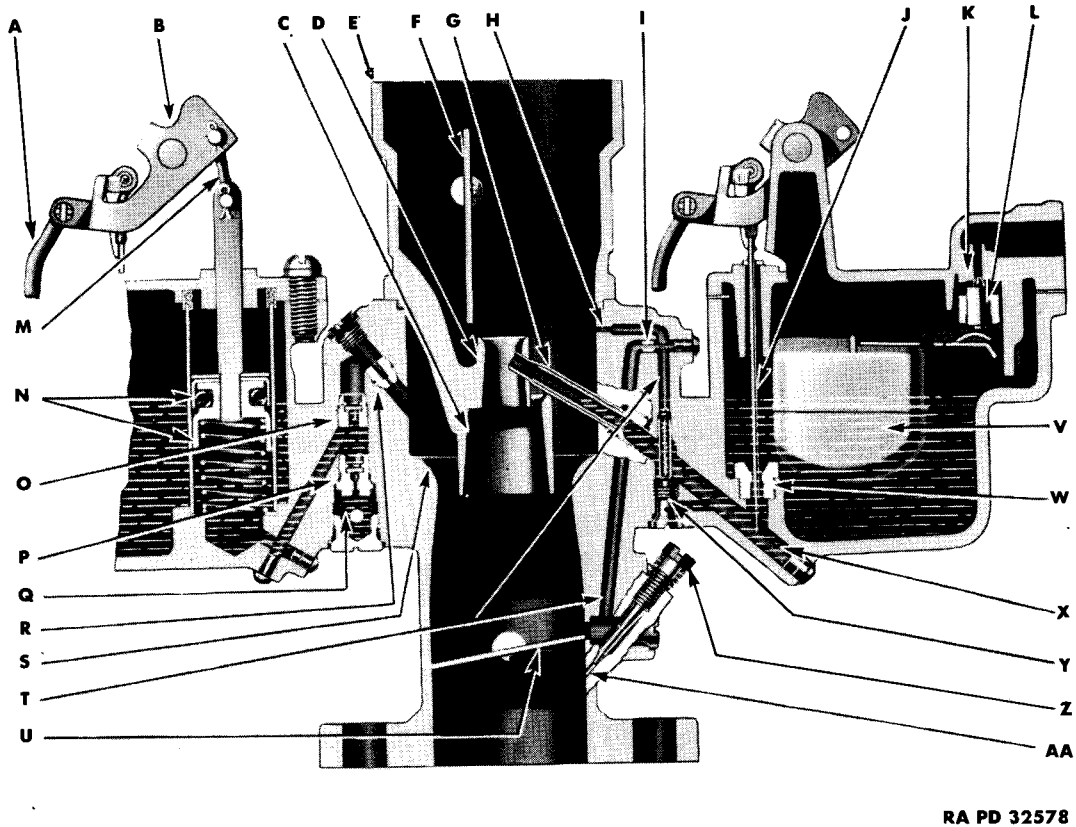
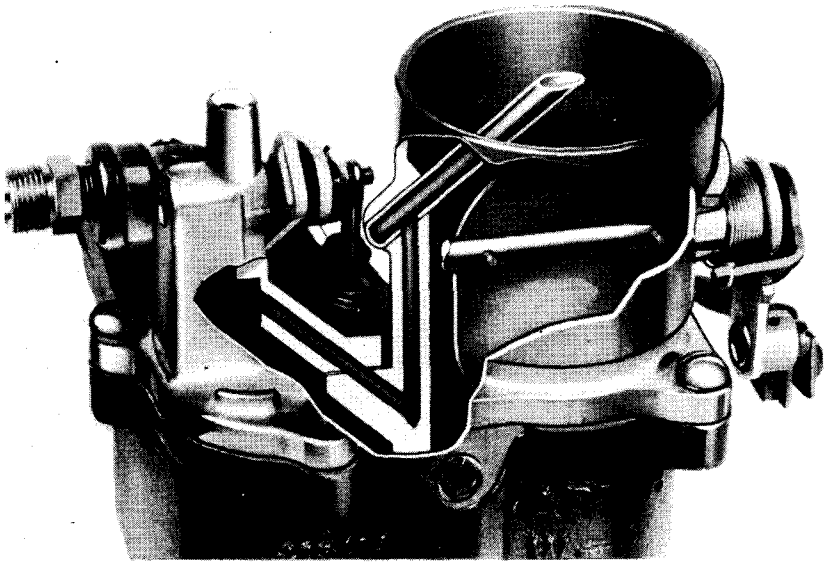


Figure 78 — Diagrammatic View of Downdraft Carburetor



RA PD 32579

Figure 79 — View Showing Balance Passages

f. The accelerating pump is of the pneumatic type, and consists of a cylinder with a plunger containing an air bell; and 2 check valves, one on the inlet and one on the outlet side.

97. DATA.

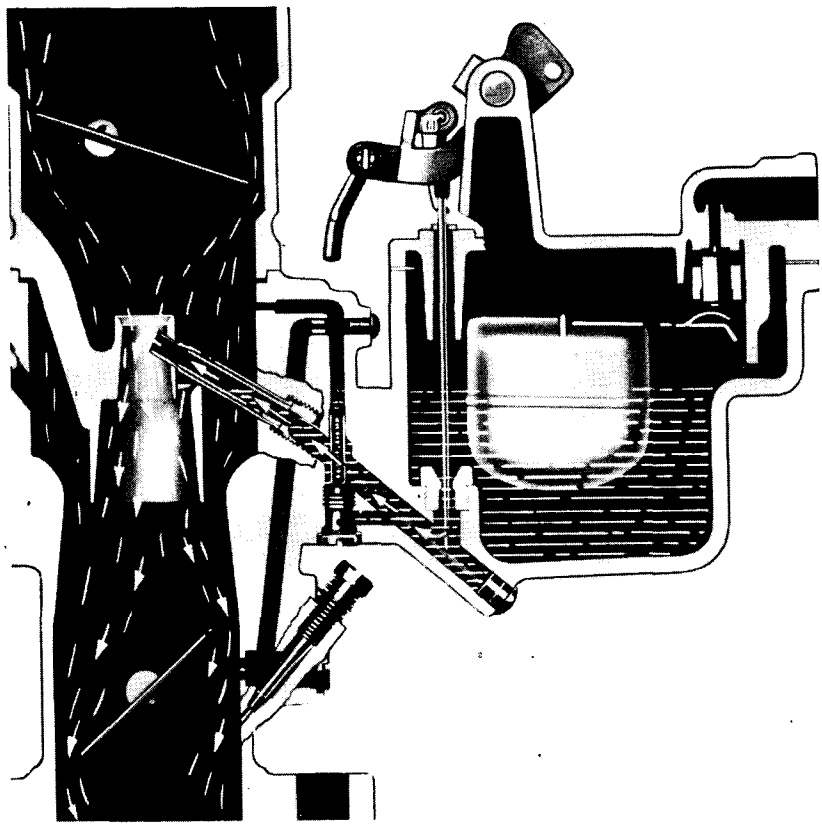
Type	Downdraft
Make	Carter No. W1-515-S
Model	W1
Pump jet (marked)	72
Needle (marked)	76
Low speed jet (marked)	35
Metering rod jet (marked)	93
Metering rod (marked)	67-46
Main Venturi	1¼ in.
Economizer jet	54
Float level	⅜ in.

98. OPERATION.

a. Starting (fig. 80).

(1) With the choke valve in closed position when starting, suction from the down stroke of the piston draws a small amount of air past

CARBURETOR, REMOVAL AND REPAIR



RA PD 32580

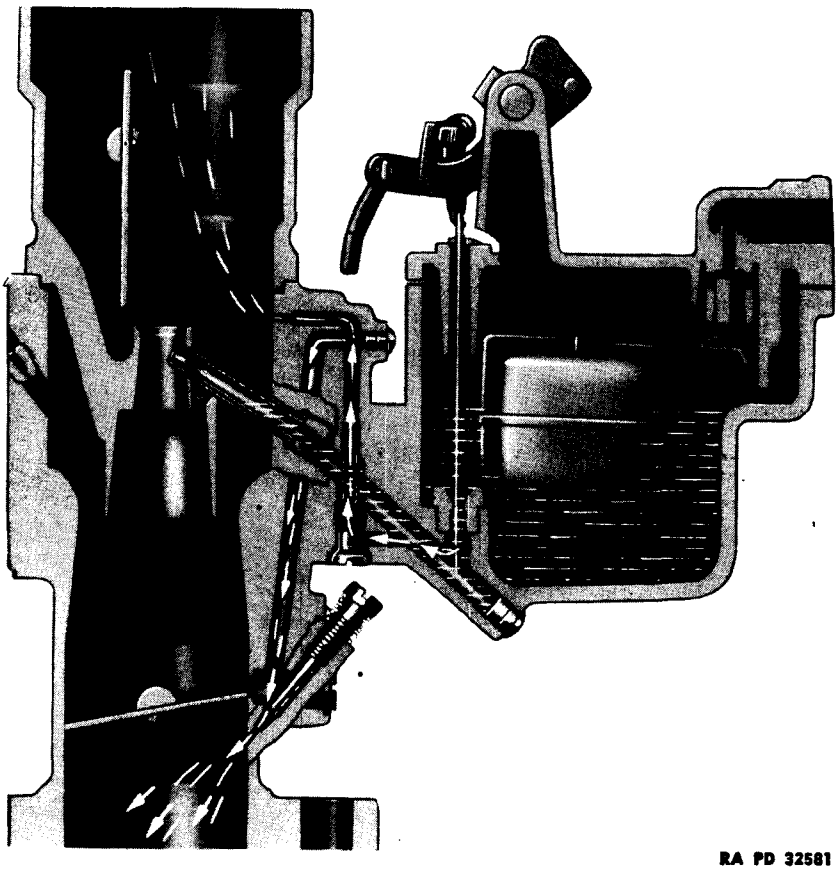
Figure 80 — Operation During Starting

the choke valve and it is mixed with the gasoline drawn from the main nozzle, forming a rich mixture for easy starting.

(2) When the engine starts, the incoming rush of air through the carburetor overcomes the tension of the light valve spring, and the valve automatically seeks the correct position to provide the proper mixture and prevent overchoking.

b. Idling (fig. 81).

(1) At idling speed the throttle valve is closed, and the suction from the down stroke of the piston is concentrated on the idling port. This suction is applied to the low speed passage in the carburetor body and results in air being drawn in through the bypass hole in the carburetor body. The air is then swept over the top of the low speed jet, lifting gasoline from the jet. The gas and air mixture then passes through the



RA PD 32581

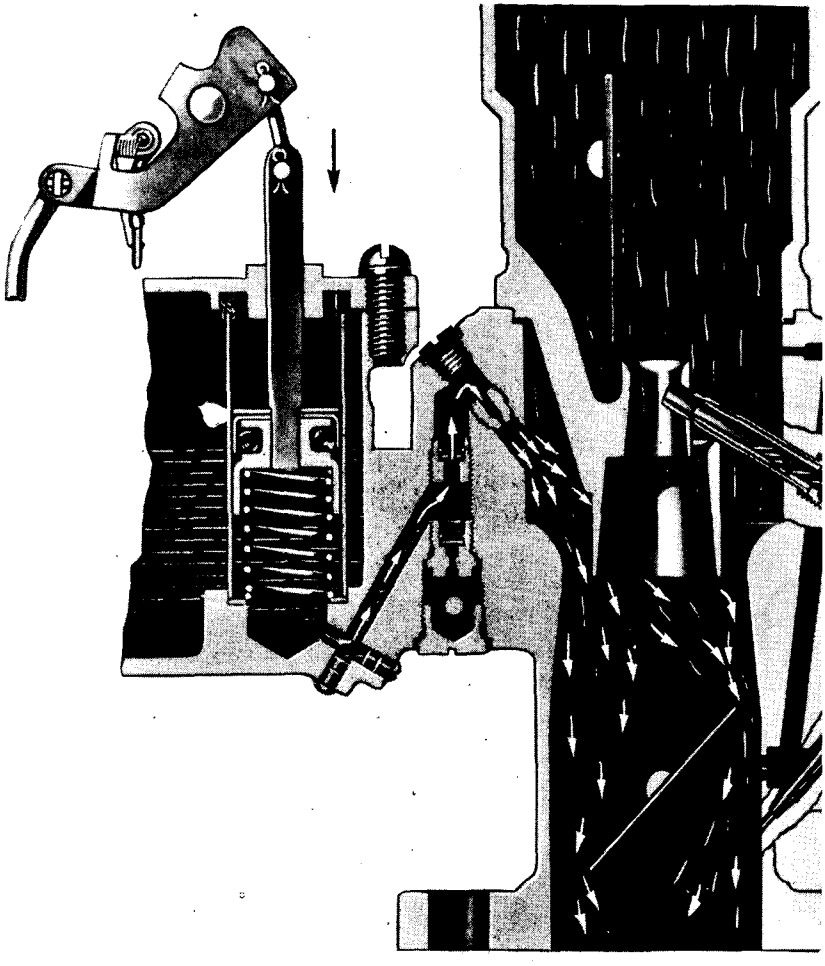
Figure 81 — Operation During Idling

economizer and down the low speed passage to the idling ports, where it is discharged in the throat of the carburetor and thence through the manifold to the cylinders. This operation is illustrated in figure 81.

(2) As the throttle valve starts to open, the idling port above the throttle valve is uncovered and increases the suction on the low speed circuit, permitting it to furnish the necessary fuel mixture for this speed.

c. Accelerating Pump (fig. 82).

(1) As the throttle is closed, the accelerating pump piston is drawn upward by the accelerating pump lever, creating a suction in the cylinder. This results in closing the outlet check valve and opening the inlet check valve. Gasoline then flows from the bowl through the inlet check valve and into the pump cylinder.

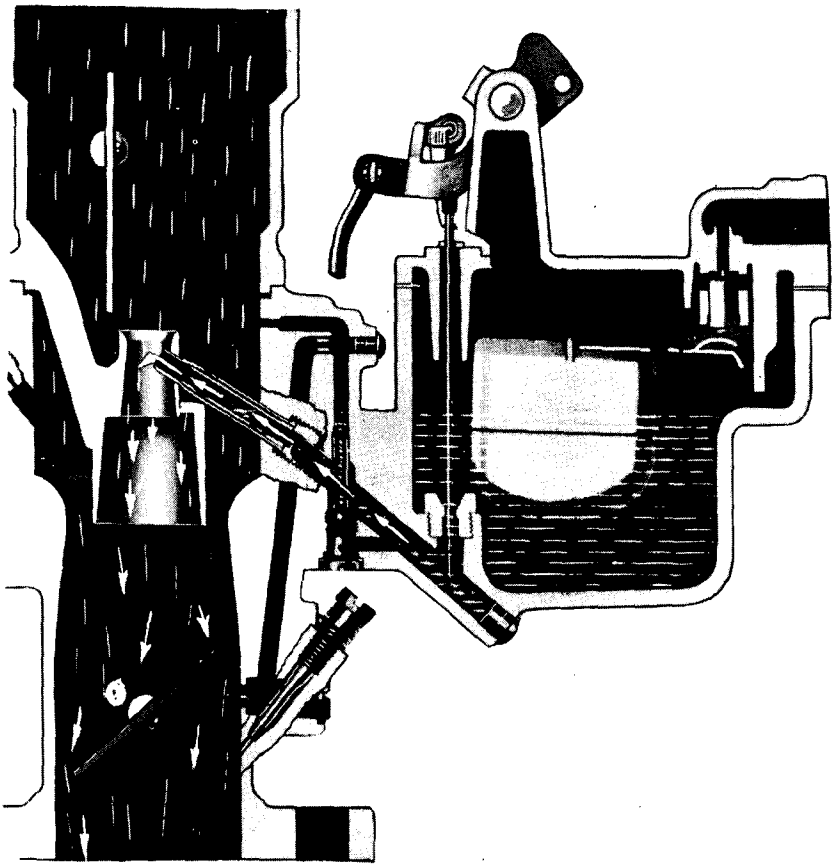


RA PD 32582

Figure 82 — Accelerating Pump Operation

(2) When the throttle is opened quickly, the pump plunger is pushed down in the cylinder by its link connection to the pump lever, compressing the air above the gasoline in the cylinder. This pressure closes the inlet check valve and opens the outlet valve.

(3) The gasoline then flows from the cylinder through the outlet valve and accelerating pump jet into the main Venturi where it meets and mixes with the air being drawn in through the air horn, forming the gas and air mixture for acceleration.



RA PD 32583

Figure 83 — Operation During Low Speeds

d. Low Speed (fig. 83).

(1) At low engine speed the throttle is partially open, and suction from the down stroke of the piston draws air in through the air horn. The air, in passing through the main Venturi, increases in velocity with the result that the suction is increased in the secondary Venturi.

(2) The increased air speed through the secondary Venturi in turn steps up the suction on the primary Venturi and thereby increases the air speed in the primary Venturi. The air, in passing through the primary Venturi, draws gasoline from the main nozzle where it is mixed with the air passing through the primary, secondary, and main Venturi, forming a finely atomized mixture which then passes to the manifold and cylinders.

CARBURETOR, REMOVAL AND REPAIR

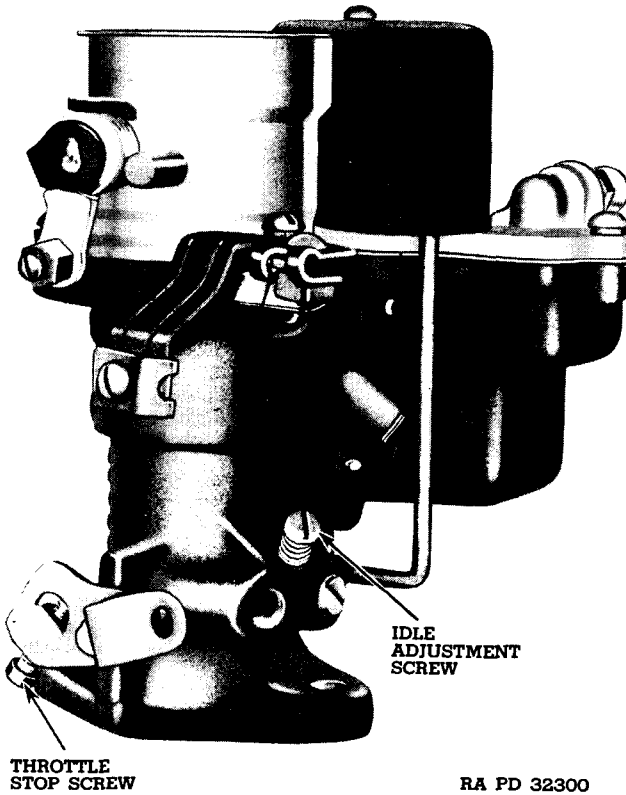


Figure 84 — Carburetor Idle Adjustment

e. High Speed. The operation at higher speeds is similar to the low speed operation with the exception of raising the metering rod in the metering rod jet. This is equivalent to increasing the size of the jet, and thereby furnishes the additional gasoline required for high speeds and wide-open throttle power operation.

99. MAINTENANCE AND ADJUSTMENTS.

a. General (fig. 84).

(1) The carburetor must be kept clean and properly adjusted to maintain correct idling, desired economy, and maximum performance.

(2) The carburetor must be completely disassembled to clean the interior thoroughly.

(3) The engine should be thoroughly warmed up before attempting to adjust the carburetor.

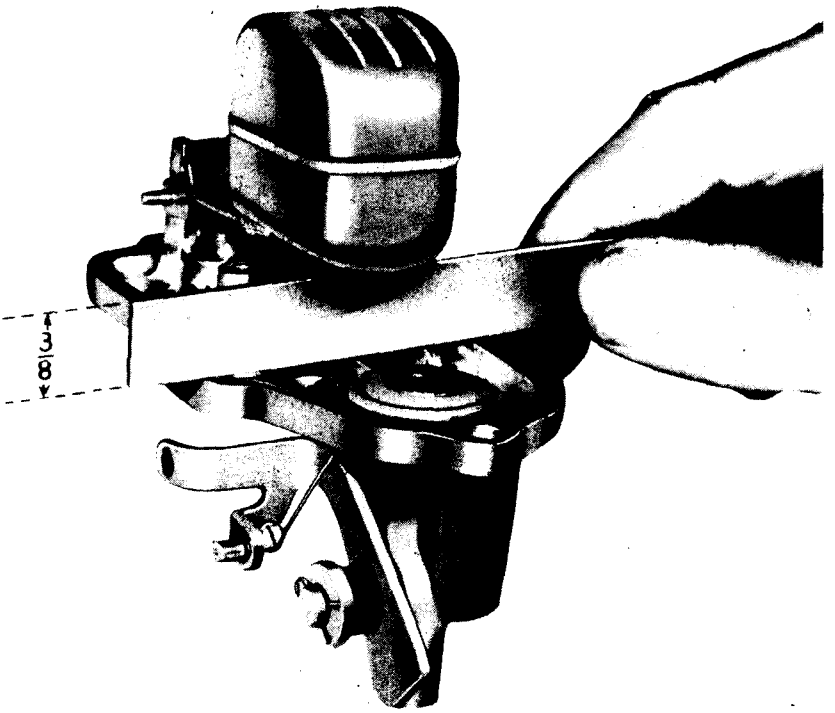


Figure 85 — Checking Float Level

(4) Remove the air cleaner and check the choke. When the choke button is against the dash panel, the choke valve should be open (vertical) and when the choke button is fully out, the choke should be fully closed. Adjust by having choke button clear in and loosening screw at choke valve to cable connector, placing valve in fully open position and tightening screw.

(5) Make sure that the trouble is in the carburetor before disturbing the carburetor adjustments. Too often carburetor adjustments are made when the valves, spark plugs, distributor, or manifold gaskets are causing the trouble.

(6) There are 2 external adjustments on the carburetor, one for idling mixture and the other for idling speed (fig. 84).

(7) The idling adjustments screw controls the amount of fuel mixture admitted through the idling port while the throttle stop screw

controls the amount of additional air being admitted. These 2 adjustments must be made in combination with each other.

b. Idling Adjustment (fig. 84).

(1) SET IDLING SCREW. Screw the idling adjusting screw all the way in; then back it off 1½ turns.

(2) ADJUST THROTTLE STOP SCREW. Start the engine and adjust the throttle stop screw for idling speed.

(3) FINAL ADJUSTMENT. Make final adjustment by adjusting the idling screw and the throttle stop screw in combination with each other to obtain a smooth idling speed at between 500 and 550 revolutions per minute.

c. Float Level General (fig. 85).

(1) In order to maintain a uniform fuel mixture, the gasoline in the float chamber must be held to a specific level. This is accomplished by the use of a float which controls the gasoline intake valve (needle valve).

(2) The gasoline level in the float chamber is controlled by the position of the float when the valve closes. The top of the float should be ⅜ inch below the cover flange.

d. Float Level Adjustment (fig. 85).

(1) REMOVE AIR CLEANER. Loosen clamp screw and remove air cleaner.

(2) REMOVE DUST COVER. Remove the dust cover from the carburetor body.

(3) DISCONNECT CONNECTOP ROD (fig. 86). With the throttle valve in the "OPEN" position, remove the stamped retainer from the accelerating pump end of the connector rod, by pushing in on the end of the retainer and turning it 90 degrees. Then remove the antirattle spring.

(4) REMOVE METERING ROD (fig. 78). Disconnect the metering rod spring and remove the metering rod.

(5) DISCONNECT GAS FEED LINE. Disconnect the gas feed line from the carburetor.

(6) REMOVE ACCELERATOR CONNECTING LINK (fig. 78). Remove the spring retainer from the accelerator pump connector link and remove the link.

(7) REMOVE BOWL COVER. Remove the 4 bowl cover screws and remove the bowl cover and gasket.

(8) REMOVE FLOAT. Remove the float hinge pin, float, and needle valve. Make sure the needle valve and seat are clean, and that the needle seat is tight in the cover.

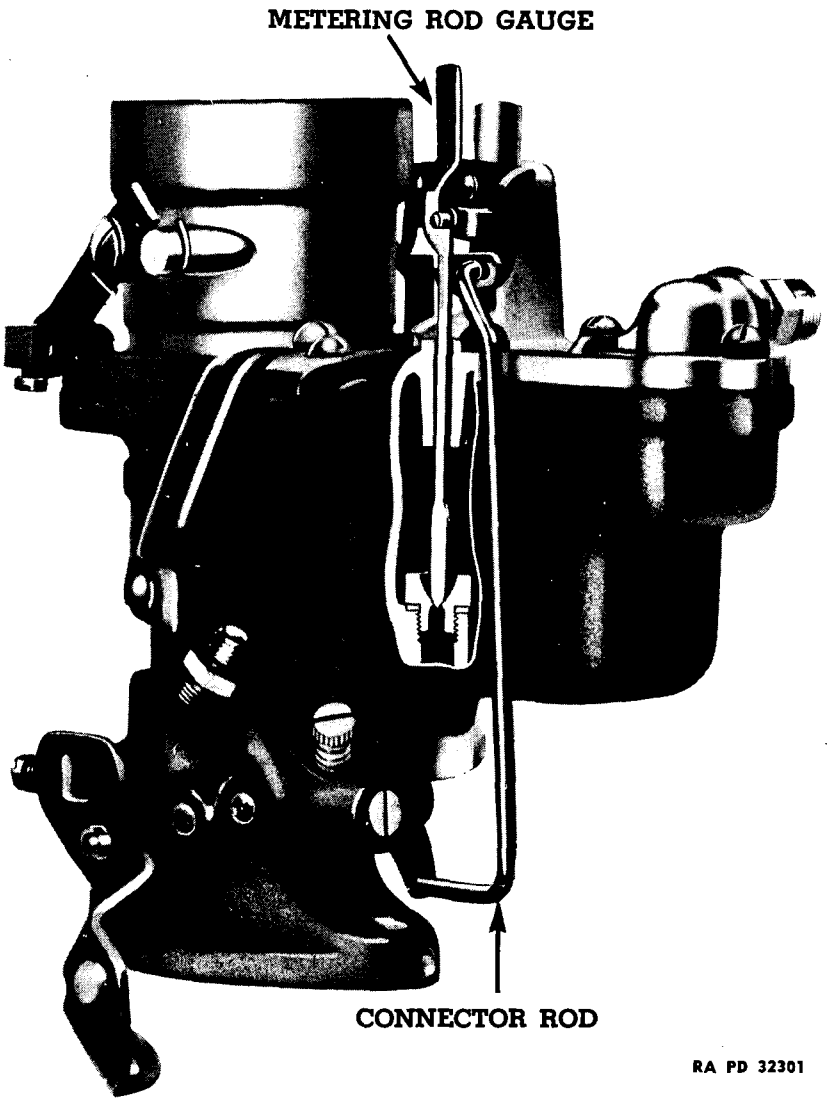


Figure 86 — Metering Rod Adjustment

(9) INSTALL FLOAT. Reassemble the needle valve float and float hinge pin.

(10) CHECK FLOAT SETTING (fig. 85). Measure the distance between the cover and float chamber (gasket removed) as shown in figure 85. This distance should be $\frac{3}{8}$ inch.

(11) SET FLOAT LEVEL. Bend the lip on the float arm that contacts the gasoline intake needle with a screwdriver. Bending up the lip will lower the float level, and bending it down will raise the float level. Only a slight bend changes the float level. CAUTION: When making float adjustments, *do not* press on the float itself as this may break the solder and cause a leak.

(12) SET LOW FLOAT POSITION. Turn the cover right side up and check the low position of the float. This should be 7/8 inch from the top of the float to the machined surface on the bowl cover. Bend the ears on the float arm to secure this measurement.

(13) INSTALL BOWL COVER. Install a new accelerating pump gasket to the bowl cover. Install a new cover gasket. Depress the accelerating pump plunger and install the bowl cover.

(14) INSTALL CONNECTOR LINK. Install the accelerating pump connector link and lock it in place with its spring retainer.

(15) CONNECT THE THROTTLE CONNECTOR ROD. Assemble the throttle connector rod to the accelerating pump arm, then install its antirattle spring and retainer.

(16) SYNCHRONIZE METERING ROD (fig. 86). Synchronize the metering rod with the throttle valve as explained in subparagraph f below.

(17) INSTALL METERING ROD. Install the metering rod hole cover on the metering rod and install the metering rod and antirattle spring.

(18) INSTALL THE DUST COVER. Install dust cover and tighten screw.

(19) CONNECT GAS LINES. Connect the gasoline feed line to the carburetor.

(20) INSTALL THE AIR CLEANER. Install the air cleaner and tighten clamp bolt securely.

e. Needle Valve and Seat. The needle valve and seat can be cleaned or replaced by following the float level adjustment procedure given above.

f. Metering Rod.

(1) GENERAL.

(*a*) The metering rod, which controls the amount of gasoline passing through the metering rod jet, is available in 2 sizes, standard and lean. Their sizes are marked on the rod just below the eye. The standard metering rod is marked "67-46" and the lean is marked "68-49."

(*b*) When installing a new metering rod or servicing the carburetor, the metering rod should be synchronized with the throttle valve.

(2) ADJUSTMENT.

(*a*) *Remove Air Cleaner and Dust Cover.* Loosen the air cleaner clamp bolt and remove the air cleaner. Remove the retaining bolt and remove the dust cover.

(*b*) *Remove Metering Rod* (fig. 78). Disconnect the metering rod spring and remove the metering rod.

(*c*) *Disconnect Connector Rod* (fig. 86). Disconnect the connector rod from the throttle valve lever.

(*d*) *Back Off Throttle Stop Screw* (fig. 84). Back off throttle stop screw until throttle valve is closed tightly.

(*e*) *Install Gage* (fig. 86). Install the metering rod gage (Chevrolet part No. 600996) allowing the metering rod pivot pin on the lever to rest on the gage.

(*f*) *Adjust Connector Rod* (fig. 86). Bend connector rod at the lower end until connector rod will enter hole in the throttle lever freely.

(*g*) *Assemble Metering Rod.* Remove metering rod gage, assemble metering rod and metering rod hole cover washer, and hook up the antirattle spring.

(*h*) *Adjust Throttle Stop Screw* (fig. 84). Install connector rod and readjust the throttle stop screw to open throttle valve slightly.

(*i*) *Install Dust Shield and Air Cleaner.* Install dust shield and retaining screw. Install air cleaner and tighten clamp securely.

100. CARBURETOR OVERHAUL (fig. 78).

a. Removal.

(1) REMOVE AIR CLEANER. Loosen the air cleaner clamp bolt and remove air cleaner.

(2) DISCONNECT CONTROLS. Disconnect accelerator rod, choke, and throttle cables.

(3) DISCONNECT FEED LINE. Disconnect fuel line from carburetor fitting.

(4) REMOVE CARBURETOR. Remove the 2 carburetor mounting stud nuts and remove the carburetor.

b. Disassembly (fig. 78).

(1) REMOVE DUST COVER. Remove the dust cover retaining screw and remove the cover.

(2) REMOVE CONNECTOR ROD (fig. 86). With the throttle valve in the "OPEN" position, remove the stamped retainer from the accelerating pump end of the connector rod by pushing in on the end of the retainer and turning it 90 degrees. Then remove the antirattle spring.

CARBURETOR, REMOVAL AND REPAIR

(3) REMOVE METERING ROD (fig. 78). Disconnect the metering rod spring and remove the metering rod.

(4) REMOVE ACCELERATOR CONNECTOR LINK. Remove the spring retainer from the accelerator pump connector link and remove the link.

(5) REMOVE BOWL COVER. Remove the 4 bowl cover screws and remove the bowl cover.

(6) REMOVE NEEDLE VALVE. Disassemble the float and needle valve from the cover.

(7) DISASSEMBLE ACCELERATOR PUMP (fig. 78). Remove the accelerating pump plunger, plunger spring, and metering rod jet. Place plunger in gasoline while proceeding with overhaul to prevent leather drying out.

(8) REMOVE MAIN NOZZLE (fig. 88). Loosen the 3 air-horn-to-carburetor body screws and remove the main nozzle passage plug. Remove the main nozzle screw plug. Then, using a screwdriver, reach down through the air horn and press on the "D" section of the main nozzle. This will force the main nozzle out of the "D" section in the primary Venturi. CAUTION: Do not press on the end of the main nozzle.

(9) REMOVE AIR HORN. Remove the air horn screws and air horn.

(10) REMOVE THE LOW SPEED JET (fig. 78).

(11) REMOVE ACCELERATING PUMP VALVES (figs. 82 and 88). Remove the passage plug and screen for the accelerating pump check valves. Then remove the inlet and outlet valves.

(12) REMOVE ACCELERATING PUMP JET (figs. 82 and 88). Remove the passage plug for the accelerating jet; then remove the jet.

(13) REMOVE IDLING ADJUSTMENT SCREW. Remove the idling adjusting screw and the idling port passage plug.

c. Inspection.

(1) WASH ALL PARTS. Wash all parts in clean gasoline or other cleaning solvent.

(2) CLEAN DRILLED PASSAGES. Check the idle ports and first bypass for carbon deposits. Then blow out all drilled passages with compressed air.

(3) INSPECT CHOKE AND THROTTLE VALVES. Check the operation of the choke and throttle valves. If necessary they may be disassembled by removing the 2 screws which retain each valve. NOTE: These screws are upset on the underside of the valve shaft to prevent them from loosening. Therefore, it is recommended the upset portion be filed off before attempting to remove them. When new screws are installed, the ends must be upset to prevent their loosening in service. Be careful not to bend the throttle or choke valve shaft when upsetting screws. The

choke lever and spring may be removed by first removing the snap ring which retains the lever to the boss on the air horn.

(4) INSPECT MAIN NOZZLE (fig. 88). Inspect the main nozzle for burs on the end of the nozzle and clean out any carbon deposits from the air bleed holes. Blow out the low speed jet and make sure the metering hole is clean.

(5) INSPECT THE ACCELERATOR VALVES AND JET. Check the operation of both the inlet and outlet check valves. Inspect the accelerating pump jet to make sure it is clean.

(6) INSPECT THE ACCELERATING PUMP. Inspect the accelerating pump plunger. If either the leather or its expanding spring is damaged in any way, the plunger assembly should be replaced.

(7) INSPECT METERING ROD. Inspect the metering rod jet and metering rod for wear or damage.

d. Reassembly.

(1) When reassembling the carburetor, it is recommended that all paper and copper gaskets be replaced.

(2) THROTTLE VALVE INSTALLATION (fig. 87). If the throttle valve has been removed, care must be used to make sure the letter "C" stamped on the valve is toward the idle port when reassembling, as shown in figure 87. Make sure throttle valve seats properly in the throat of the carburetor before tightening screws. Install the screws as instructed under "NOTE," subparagraph c (3) above.

(3) CHOKE VALVE INSTALLATION. If the choke valve assembly has been removed, the valve must be assembled to the shaft with the letter "C" stamped on the valve toward top of air horn. Install new screws as instructed under "NOTE," subparagraph c (3) above.

(4) INSTALL AIR HORN. Assemble the air horn loosely to the carburetor body, making sure the small paper gasket is in place at the balance passage.

(5) INSTALL MAIN NOZZLE (fig. 88). Assemble the copper gasket on the main nozzle (D, fig. 88). CAUTION: Be sure old main nozzle copper gasket has been removed from passage. Two copper gaskets would mislocate main nozzle in Venturi and air stream. Hold the carburetor with the air horn down, line up the flat part of the "D" section on the nozzle with that in the primary Venturi and drop the nozzle "E" into the opening. Install the nozzle screw, plug and gasket "A," "B," and "C," and tighten securely.

(6) TIGHTEN AIR HORN. Tighten the 3 air horn screws securely.

CARBURETOR, REMOVAL AND REPAIR

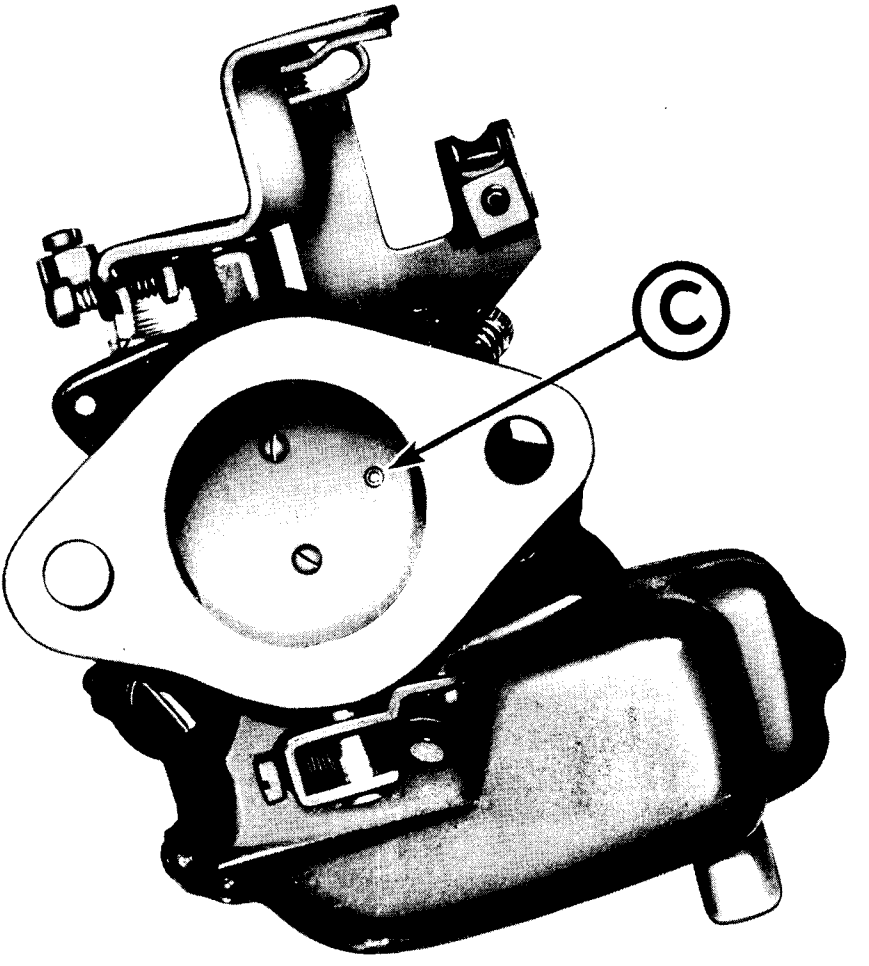


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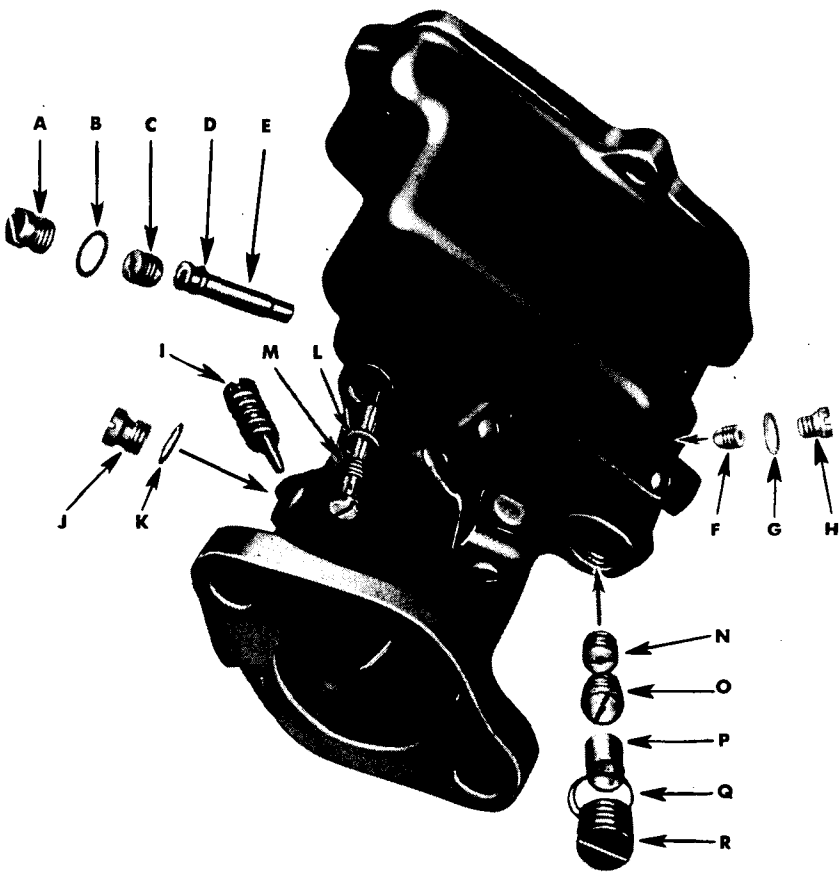
Figure 87 — Throttle Valve Assembly

(7) INSTALL LOW SPEED JET (figs. 88 and 89). Install the low speed jet "M" and gasket "L" in the carburetor body; then again remove the jet and check the bearing on the top end of the jet. If there is a complete bearing around the top of the jet indicating a full seat, it may be reinstalled. If the bearing is incomplete, a new jet should be installed.

(8) INSTALL ACCELERATING PUMP VALVES (fig. 88). Install the accelerating pump outlet and inlet check valves "N" and "O" in the carburetor body. Then install the screen "P," passage plug "R," and gasket "Q."



A—PASSAGE PLUG
B—PASSAGE PLUG GASKET
C—NOZZLE SCREW
D—MAIN NOZZLE GASKET
E—MAIN NOZZLE
F—PUMP JET
G—PASSAGE PLUG GASKET
H—PASSAGE PLUG
I—IDLE ADJUSTING SCREW AND TENSION SPRING
J—PASSAGE PLUG
K—PASSAGE PLUG GASKET
L—LOW SPEED JET GASKET
M—LOW SPEED JET
N—PUMP OUTLET CHECK VALVE
O—PUMP INLET CHECK VALVE
P—PUMP STRAINER SCREEN
Q—PASSAGE PLUG GASKET
R—PUMP SCREEN RETAINER AND PASSAGE PLUG

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Figure 88 — Carburetor Valves and Jets

(9) INSTALL ACCELERATING PUMP JET (fig. 88). Install the accelerating pump jet "F," plug "H," and gasket "G."

(10) INSTALL METERING ROD JET (fig. 78). Install the metering rod jet and gasket and tighten securely.

(11) ASSEMBLE ACCELERATING PUMP (fig. 78). Place the accelerating pump spring in the cylinder. Slip the accelerating pump plunger

CARBURETOR, REMOVAL AND REPAIR

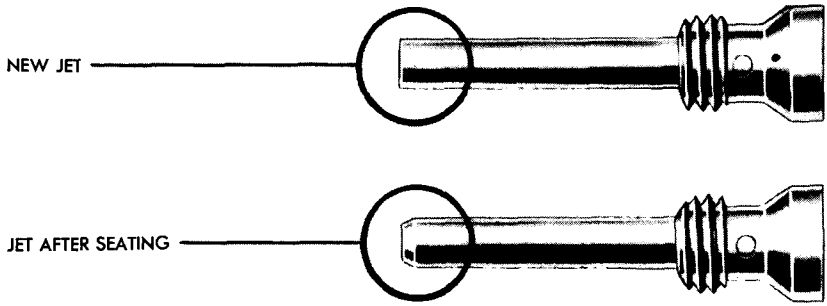


Figure 89 — Low Speed Jet

assembly sleeve (part of carburetor kit KM-KMO268G) over the leather; then with the assembly sleeve centered over the cylinder, push the pump plunger into the cylinder.

(12) ASSEMBLE FLOAT TO COVER. Install the intake needle valve seat and gasket in the bowl cover; then install the float and lever pin.

(13) SET FLOAT LEVEL (fig. 85). Turn the cover upside down, with cover gasket removed and check the float level by measuring from the cover to the float. This distance should be 3/8 inch. CAUTION: When making float level adjustments, do not press on the float itself. See float level adjustment instructions.

(14) SET FLOAT LOWER POSITION. Check the low position of the float by measuring from the cover to the top of the float. This distance should be 7/8 inch. Adjustment may be made by bending the 2 stops with a small pair of pliers.

(15) INSTALL COVER (fig. 78). Install a new accelerating pump cylinder gasket to the bowl cover. Depress the accelerating pump plunger; then install the cover on the bowl, using a new bowl cover gasket.

(16) INSTALL PUMP LINK. Install the accelerating pump connector link and lock it in place with its spring retainers.

(17) INSTALL CONNECTOR ROD (fig. 86). Assemble the throttle connector rod to the accelerating pump lever arm; then install its antirattle spring and retainer.

(18) SYNCHRONIZE METERING ROD. Synchronize the metering rod with the throttle valve as explained in paragraph 99 **f.**

(19) INSTALL METERING ROD (fig. 78). Install the metal metering rod hole cover washer on the metering rod; then install the metering rod and antirattle spring.

(20) INSTALL IDLING ADJUSTING SCREW. Install the idling adjusting screw. Turn in the screw until it seats, and then back it off 1½ turns. Install the idle port passage plug.

(21) INSTALL DUST COVER. Lubricate the felt washer on the accelerating pump lever shaft with a few drops of engine oil. Install the dust cover.

e. Installation.

(1) ATTACH TO MANIFOLD. Place a new gasket on the manifold carburetor flange, install the carburetor, and tighten the 2 nuts securely.

(2) CONNECT FUEL LINE. Connect the fuel line to carburetor fitting.

(3) CONNECT CONTROL LINKAGE. Connect the accelerator rod to throttle rod. Place the choke and throttle buttons against the instrument panel and enter the choke and throttle cables through the bracket and tighten the clamps. Place the throttle in closed position and tighten the clamp screw. Place the choke in "OPEN" position and tighten the clamp screw.

(4) INSTALL AIR CLEANER. Install the air cleaner and tighten clamp securely.

(5) ADJUST CARBURETOR (fig. 84). Adjust the carburetor as explained in paragraph 99 **b**.

Section VII

AIR CLEANER, REMOVAL AND MAINTENANCE

101. DESCRIPTION.

a. The oil-bath-type air cleaner is designed for unusually dusty operating conditions. It is mounted directly on the top of the carburetor.

b. The air enters the cleaner and must pass directly down toward the oil. At the oil level the air stream must reverse and go up through the oil-saturated copper filtering element and then down through the center of the cleaner to the carburetor. The quick reversal of the air stream deposits most of the dirt in the oil. Any other dirt is picked up by the filtering element.

102. MAINTENANCE.

a. Remove Air Cleaner. Loosen the clamp screw and remove air cleaner.

b. Remove Filter Element. Remove the wing nut from top of cleaner and remove cover. Remove the filter element assembly. CAUTION: In case the element sticks, it must not be pried loose or damage to the filter element flange will result. If this flange is damaged the efficiency of the cleaner will be impaired.

c. Clean Air Cleaner. Empty the oil out of the cleaner and wash it thoroughly with SOLVENT, dry-cleaning.

d. Wash Filter Element. Wash the filter element by slushing it up and down in SOLVENT, dry-cleaning. Dry thoroughly with air hose.

e. Fill Cleaner. Fill the cleaner with 2 pints of crankcase oil.

f. Install Filter Element. Install the filter element. CAUTION: Make sure that the flange seats on the top flange of the cleaner body.

g. Install Cover. Install the gasket and cover making sure that the gasket will make a tight seal between the cover and body. Install wing nut.

h. Install Cleaner. Install the cleaner on the carburetor and tighten the clamp bolt.

CHAPTER 5

CLUTCH ASSEMBLY

Section I

INTRODUCTION

103. DESCRIPTION (fig. 90).

a. The clutch is of the single plate dry disk type, designed around a diaphragm spring which has the shape of a dished washer with 18 tapering fingers pointing inward. The spring is made from a very high quality steel, carefully heat-treated and shot-blasted to assure long life. The action of the diaphragm spring may be compared to the flexing action of the bottom of an ordinary oil can. By depressing the clutch pedal, the throwout bearing is forced against the diaphragm spring fingers, causing the diaphragm spring to pivot on the pivot rings (fig. 91).

b. When the clutch is engaged, the fingers are flat while the entire rim of the diaphragm spring exerts pressure against the pressure plate (fig. 92). When the clutch pedal is depressed, pressure of the throwout bearing on the inner ends of the fingers causes a diaphragm action and the outer ends of the fingers near the rim pivot on the inner pivot ring (fig. 93). This action causes the rim of the spring and the pressure plate to move away from the clutch disk, disengaging the clutch. When the clutch pedal is released and the throwout bearing no longer contacts the fingers, the "spring" in this material causes the fingers to pivot about the rear pivot ring and the rim to bear against the pressure plate.

c. The clutch disk is a built-up assembly which incorporates cushion springs to pick up the torque load and a torsional vibration dampener built into the hub. The facings are riveted to the plate with 2 rows of rivets.

d. The dry disk type clutch requires very little care during its life. There is only one simple adjustment necessary to maintain clutch

INTRODUCTION

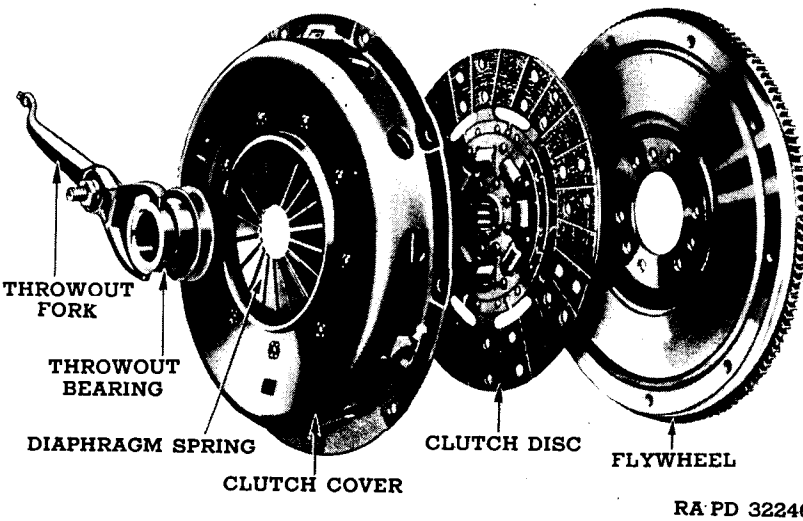


Figure 90 — Clutch Parts

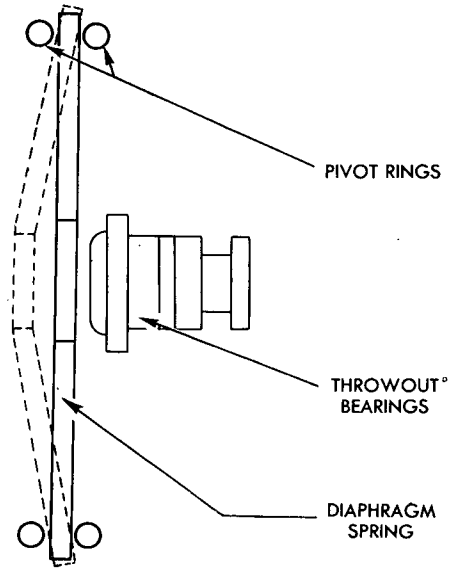


Figure 91 — Diaphragm Spring Action

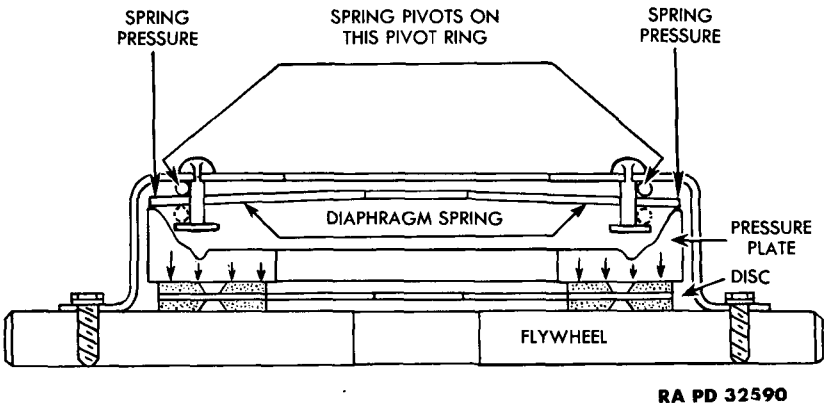


Figure 92 — Engaged Position

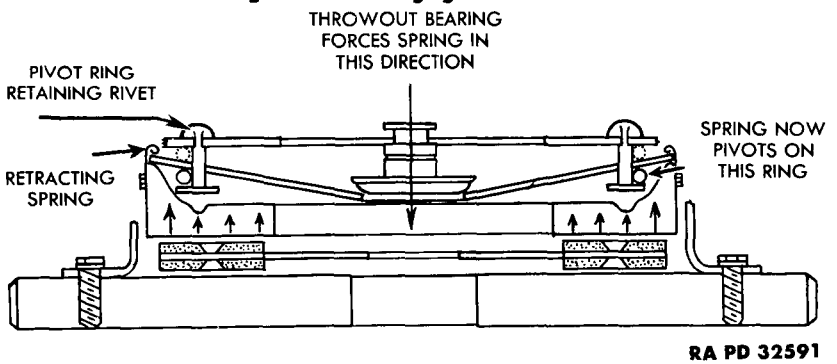


Figure 93 — Disengaged Position

efficiency and assure long life. This adjustment is for the amount of free clutch pedal travel before the throwout bearing contacts the clutch fingers.

e. The ball throwout bearing, in conjunction with the clutch spring, makes a simple construction and results in little friction and wear in the mechanism. The bearing is of the sealed type, and is packed with a high melting point lubricant which makes further lubrication unnecessary except for packing the inner and outer grooves of the throwout bearing collar when assembling.

104. DATA.

Type ..... Single dry disk
Facing outside diameter ..... 10¾ in.

Facing inside diameter.....7 in.
Facing area (total).....104.6 sq in.
Facing thickness .....0.137 in. to 0.143 in.
Spring .....Single diaphragm
Spring diameter .....9 in.
Throwout bearing, make.....New Departure No. CT-22
Throwout bearing, type.....Sealed ball bearing
Clutch pilot bearing.....Hyatt Roller No. 99004
Clutch pedal adjustment.....1-in. to 1¼-in. free travel before release bearing contacts clutch fingers
Pressure plate drive lugs to cover clearance.....0.002 in. to 0.006 in.
Splined hub to clutch shaft splines.....0.0005 in. to 0.0055 in.

105. SECOND ECHELON REFERENCES.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon duties not covered in this manual.

106. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

107. TROUBLE SHOOTING.

a. Slipping.

Probable Cause	Probable Remedy
Improper pedal adjustment.	Adjust pedal free travel (par. 108).
Disk oil-soaked.	Replace clutch disk.
Sticking pressure plate.	Check fit of drive lugs on pressure plate in slots in cover. (Replace pressure plate if necessary.)
Weak clutch spring.	Replace spring and cover assembly.
Torn disk facings.	Replace disk assembly.

b. Grabbing.

Oil on disk linings.	Replace disk.
Sticking pressure plate.	Check fit of pressure plate drive lugs in cover slots. (Replace pressure plate if necessary.)
Abnormally flat glazed.	Replace disk and facings.
Loose engine mountings.	Tighten engine mountings.

c. Rattling.

Weak retracting springs.	Replace retracting springs.
Excessive clearance at pressure plate driving lugs.	Replace pressure plate or cover.
Broken clutch disk cushion springs.	Replace clutch disk.
Throwout fork loose on ball.	Check ball stud and retaining spring. (Replace if necessary.)

d. Bearing Noise.

Noise when clutch pedal is slightly depressed.	Replace throwout bearing.
Noise when clutch pedal is fully depressed.	Replace throwout bearing or pilot bearing.

Section III

OPERATIONS PERFORMED WITHOUT REMOVING CLUTCH FROM VEHICLE

108. CLUTCH ADJUSTMENT.

a. General. The only repairs that can be made to the clutch, without removing the unit, is clutch pedal adjustment. Normal clutch facing wear permits the clutch pedal to return to a point closer to the pedal stop. The free travel of the clutch pedal before the throwout bearing contacts the diaphragm spring should be between 1 inch and 1¼ inches. NOTE: Check this free travel with finger on the pedal and not with the foot, as the adjustment is sensitive.

b. Procedure.

(1) LOOSEN LOCK NUT (fig. 94). Loosen the clutch pedal adjusting nut lock nut.

(2) ADJUST CLUTCH (fig. 94). Back off the adjusting nut to increase pedal free travel or tighten adjusting nut to decrease free travel of pedal. Continue this until between 1 inch and 1¼ inches free travel is obtained.

(3) TIGHTEN LOCK NUT. Tighten the lock nut securely.

109. CLUTCH AND BRAKE PEDAL SERVICE.

a. The clutch and brake pedals are mounted on a shaft which is attached to the left side of the clutch housing. The pedals are fitted with bronze bushings to provide longer life. The following instructions pertain to replacement of pedal assemblies or bushings.

b. Procedure.

(1) REMOVE FLOOR BOARDS. Remove the screws which attach the floor and toe boards and remove the boards.

(2) DISCONNECT PULL ROD. Disconnect the brake pedal pull rod from the brake pedal.

(3) DISCONNECT CLUTCH PEDAL LINK. Disconnect the clutch pedal adjusting link from the clutch pedal.

(4) REMOVE SHAFT AND PEDAL ASSEMBLY. Remove the 3 cap screws which attach the shaft to the flywheel housing (1 through the shaft and 2 through the sleeve), and remove the shaft and pedal assembly.

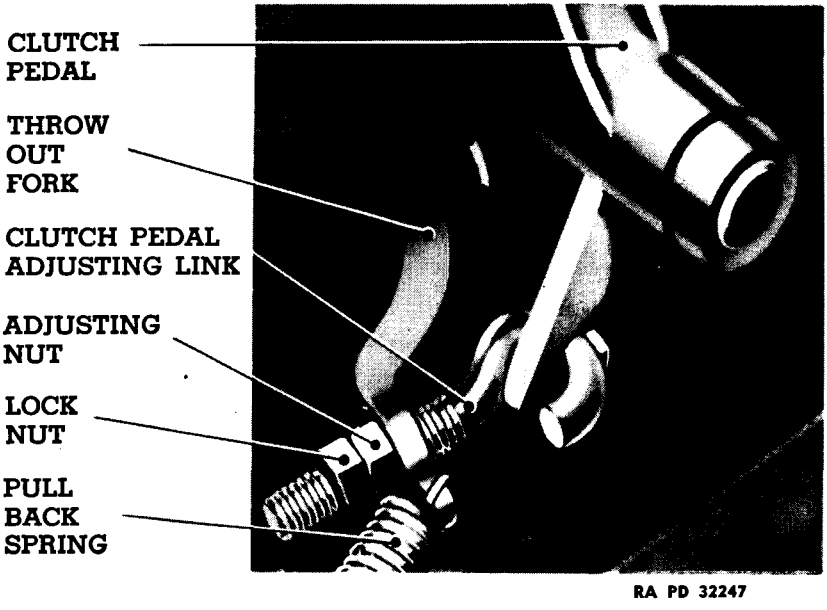


Figure 94 — Clutch Adjustment

(5) REMOVE PEDALS FROM SHAFT. Remove the 2 pedals from the flywheel housing end of shaft.

(6) REPLACE BUSHINGS. Press out the old bushings and press the new bushings into position.

(7) REAM BUSHINGS. Ream the bushings to provide 0.002 inch to 0.003 inch between the bushings and shaft.

(8) INSTALL PEDAL AND SHAFT ASSEMBLY. Place the respective pedals on the shaft and bolt shaft assembly securely to flywheel housing.

(9) ATTACH CLUTCH ADJUSTING LINK. Hook the clutch adjusting link to clutch pedal and make sure that clutch pull back spring is hooked up.

(10) ATTACH BRAKE PULL ROD. Attach the brake pull rod to the brake pedal.

(11) REPLACE FLOOR BOARDS. Replace the floor and toe boards and tighten the attaching bolts.

(12) CHECK CLUTCH ADJUSTMENT. Check the clutch pedal adjustment and, if necessary, make an adjustment according to instructions given in the above paragraph.

Section IV

CLUTCH DISASSEMBLY

110. CLUTCH DISASSEMBLY.

a. Procedure.

(1) REMOVE TRANSMISSION. Before the clutch can be removed, it is necessary to remove the transmission as outlined in paragraph 125.

(2) REMOVE ADJUSTING LINK. Disconnect the pull back spring and remove the clutch adjusting link from the fork.

(3) REMOVE CLUTCH FORK. Remove the throwout bearing and remove the fork by forcing it, with a large screwdriver, away from its mounting until the fork snaps loose from the mounting ball.

(4) REMOVE SPRING FORK RETAINER. Pry one end of the spring out of the groove in the fork and work the rest of the spring out, being careful not to damage the spring.

(5) Remove the throwout fork mounting ball stud from clutch housing.

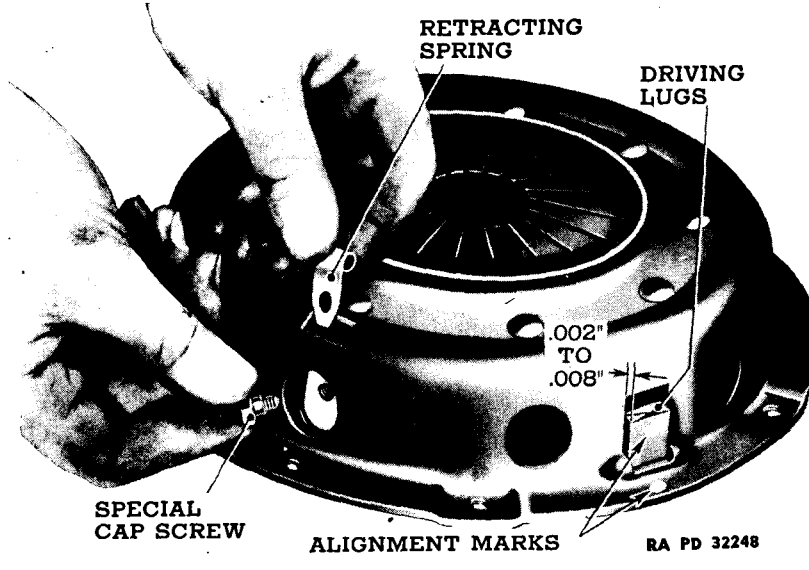


Figure 95 — Retracting Spring Removal

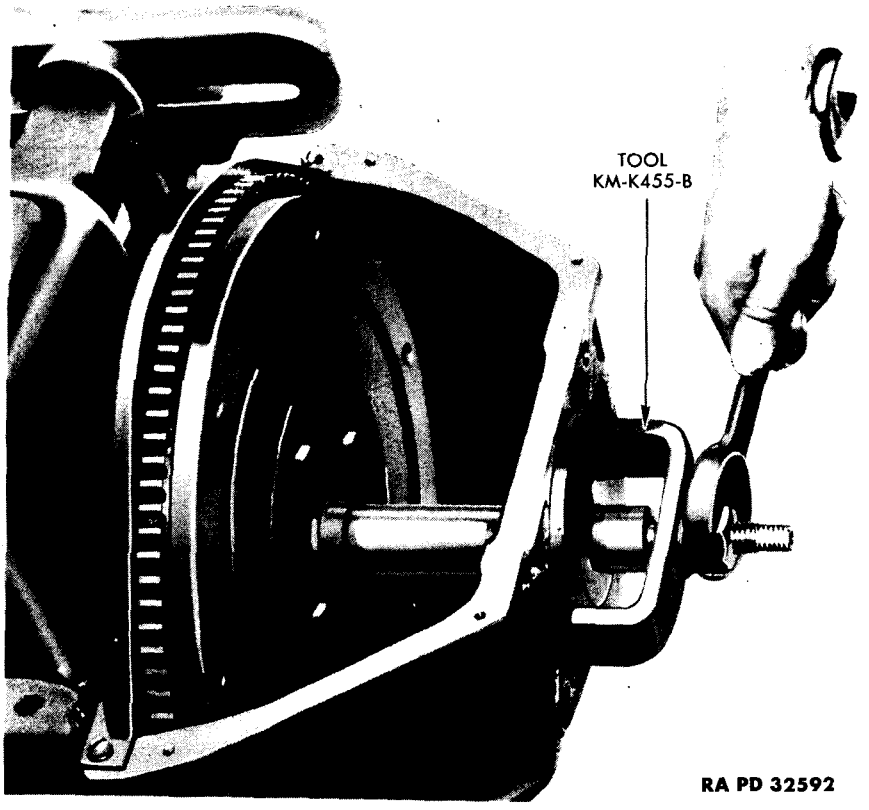


Figure 96 — Pilot Bearing Retainer Remover

(6) LOOSEN CLUTCH BOLTS. Install clutch pilot tool KM-K411 to support the clutch during disassembly. Loosen the 9 clutch-to-flywheel bolts, one turn at a time (to prevent cover distortion), until the diaphragm spring pressure is released.

(7) REMOVE COVER ASSEMBLY. Remove the 9 bolts, support the clutch, remove the pilot tool, and remove the cover assembly and disk through the bottom of clutch housing.

(8) REMOVE PRESSURE PLATE (fig. 95). Remove the 3 clutch pressure plate retracting springs and remove the pressure plate from the clutch cover assembly. The clutch cover, diaphragm spring, and 2 pivot rings are riveted together and serviced as one assembly.

(9) REMOVE PILOT BEARING (fig. 96). Install clutch pilot bearing puller KM-K445B through the pilot hole in clutch housing and enter alining bushing in clutch housing. Screw the puller into the retainer

2 full turns, hold the clamp against the clutch housing, and tighten the puller nut until the retainer is removed. Remove the pilot bearing.

111. CLUTCH HOUSING REMOVAL.

a. The clutch housing should not be disturbed when overhauling a clutch. However, if the housing has been damaged, it will be necessary to remove the clutch as explained above before starting to remove the clutch housing.

b. Procedure.

(1) DISCONNECT CLUTCH AND BRAKE PEDAL SHAFT. Remove the 3 bolts which retain the clutch and brake pedal shaft to clutch housing.

(2) REMOVE FLYWHEEL. Remove the retaining bolts and locks, and remove the flywheel.

(3) REMOVE REAR ENGINE MOUNTINGS. Jack up the rear end of engine just enough to remove weight from rear engine mountings and support engine securely. Remove rear engine mounting bolts and mountings.

(4) REMOVE CLUTCH HOUSING. Remove the cap screws which attach clutch housing to cylinder block, and tap the housing off the dowels with a soft hammer.

Section V

CLEANING AND INSPECTION

112. CLEANING AND INSPECTION.

a. Clean Parts. Wash all parts (except the disk and throwout bearing) in SOLVENT, dry-cleaning. NOTE: The throwout bearing is packed with a special lubricant in manufacture and cannot be relubricated; therefore, it must not be washed in cleaning solvent. Clean the bearing externally only.

b. Inspection.

(1) INSPECT FRICTION SURFACES. Inspect the pressure plate and flywheel friction surface for scores or cracks which would affect normal clutch operation or life.

(2) INSPECT THE PRESSURE PLATE LUGS. Check the 3 pressure plate lugs for excessive wear or burs. Check their fit in the clutch cover. There should be from 0.002-inch to 0.008-inch clearance.

(3) INSPECT THROWOUT BEARING. Inspect the throwout bearing for rough bearing and free fit of the sleeve on the extension of the transmission main drive gear bearing retainer.

(4) INSPECT THROWOUT FORK AND BALL STUD (fig. 97). Check the fit of the ball stud in the fork (this should be snug without side play) and the condition of the fork where it contacts the throwout bearing.

(5) INSPECT THE CLUTCH DISK. Inspect the clutch disk for worn, loose, or oil-soaked facings, loose hub to disk rivets, or broken disk

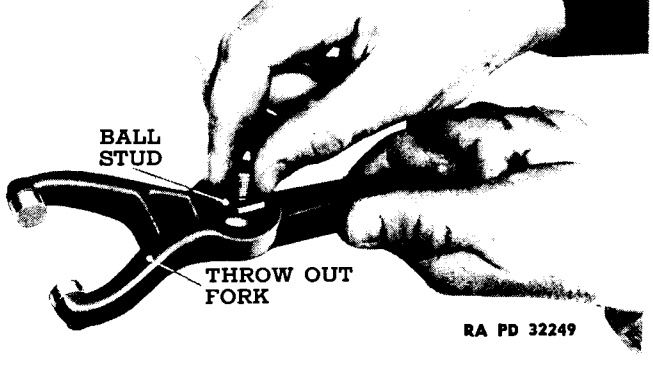


Figure 97 — Checking Fit of Ball in Throwout Fork

CLEANING AND INSPECTION

springs. Check the fit of the disk splines on the clutch shaft. If the splines are worn or bind on the shaft, the disk should be replaced.

(6) INSPECT THE PILOT BEARING FOR EXCESSIVE WEAR.

c. Replace Damaged Parts. All parts which show signs of damaged or excessive wear should be replaced with new parts.

Section VI

CLUTCH INSTALLATION IN VEHICLE

113. CLUTCH HOUSING INSTALLATION PROCEDURE.

a. Place Housing on Cylinder Block. Clean the machine surface on the cylinder block and clutch housing and place the housing on the dowels and tap the housing up against the block. NOTE: It is very important that the machined surfaces where the cylinder block and clutch housing bolt together be clean and free from foreign material to assure correct alinement.

b. Install Bolts. Install the bolts which attach the clutch housing to cylinder block and tighten securely.

c. Install Engine Mountings. Install the rear engine mountings and bolt them securely. Remove jack and blocking from under engine.

d. Install Flywheel (fig. 60). Install flywheel and bolt it securely. Bend the tangs of the flywheel bolt locks against the head of the bolts.

e. Attach Clutch and Brake Pedal Shaft. Place the clutch and brake pedal shaft in position and install the 3 retaining bolts.

114. CLUTCH INSTALLATION PROCEDURE.

a. Pack Pilot Bearing. Pack the pilot bearing with GREASE, ball and roller bearing. NOTE: It is important that only this grease be used as other lubricant will back into the clutch and affect its operation.

b. Install Pilot Bearing. Place the bearing in end of crankshaft.

c. Install Pilot Bearing Retainer (fig. 98).

Place clutch pilot bearing driver KM-K410 and centering collar in the clutch housing. Place a new retainer on the end of driver with the flat side toward the bearing, move the handle forward until the retainer enters the crankshaft and then drive the retainer into position.

d. Install Fork Mounting Ball. Place the ball in the clutch housing and tighten it securely.

e. Install Pressure Plate in Cover Assembly (fig. 95). Install the pressure plate in the cover assembly, making sure that the "O" mark on

CLUTCH INSTALLATION IN VEHICLE

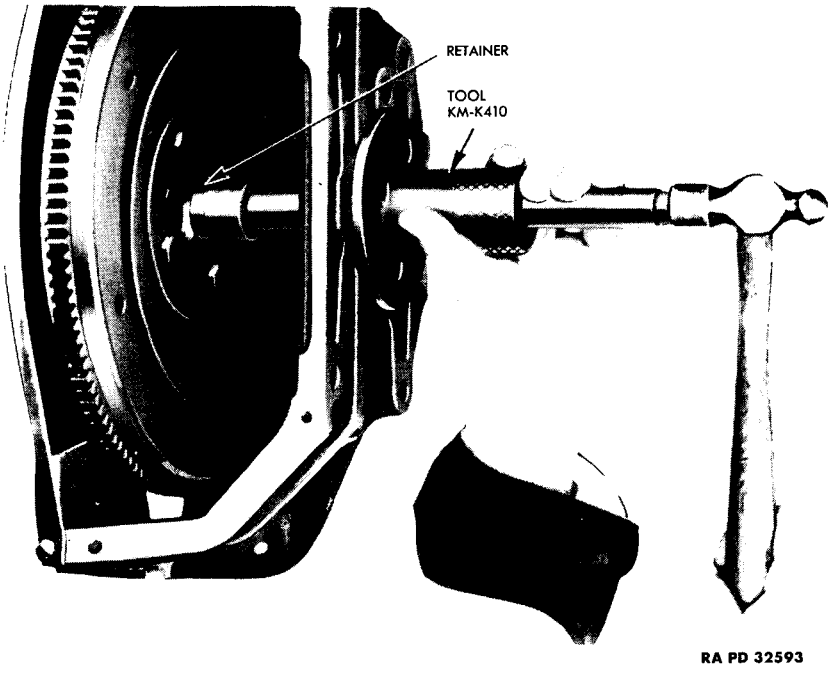


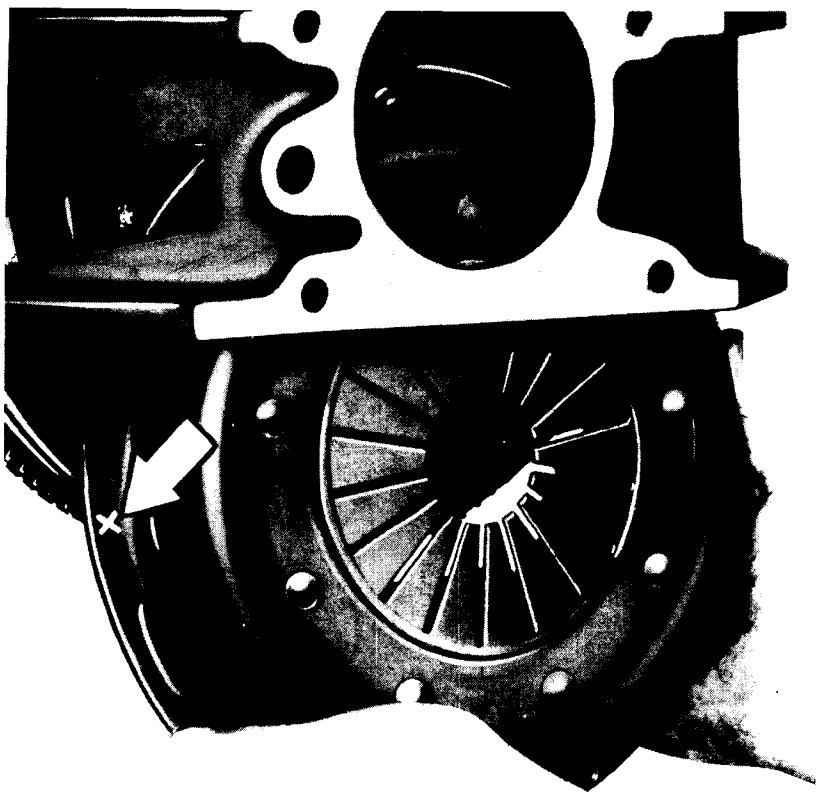
Figure 98 — Installing Clutch Pilot Bearing Retainer

the pressure plate lines up with the "O" mark on the cover. This is necessary to maintain proper balance. Install the 3 pressure plate retracting springs.

f. Install Clutch (fig. 99). Hand-crank the engine until the "X" mark on flywheel is down, install the clutch disk and cover assembly and support them on clutch pilot tool KM-K411; turn the cover assembly until the "X" mark on the cover lines up with the "X" mark on the flywheel.

g. Install Cover Bolts. Install the 9 clutch-cover-to-flywheel bolts and tighten each bolt a turn at a time, to avoid distorting the clutch cover, as the spring pressure is being taken up. Remove the pilot tool.

h. Install Clutch Fork Spring Retainer. Pack the ball seat in the fork with a small amount of high melting point grease and install the spring retainer in the groove in the clutch fork. NOTE: Make certain the retainer is installed with the high side of the retainer up, away from the ball stud, and the open end of the retainer on the horizontal.



RA PD 32250

Figure 99 — Alining Cover Assembly with Flywheel

i. Install Clutch Fork. Place the fork in position in the clutch housing and snap the fork onto the ball.

j. Install Throwout Bearing (fig. 100). Lubricate the recess on the inside of the throwout bearing collar and the throwout fork groove with a small amount of GREASE, ball and roller bearing. Install the throwout bearing assembly on the throwout fork. NOTE: Use only enough lubricant to protect the bearing surfaces, as excessive lubricant may get into the clutch.

k. Install the Adjustment Link. Install the adjustment link in the end of throwout fork and hook up pull back spring.

CLUTCH INSTALLATION IN VEHICLE

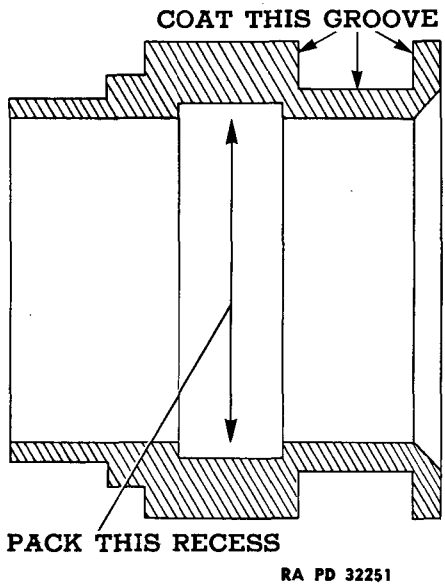


Figure 100 — Throwout Bearing Collar Lubrication

l. Install Transmission. Install the transmission, following the procedure given in paragraph 130.

m. Adjust Clutch. Adjust the clutch according to instructions given in paragraph 108.

Section VII

SPECIAL TOOLS

115. SPECIAL TOOL LIST.

a. The following tools manufactured by the Kent-Moore Organization, or their equivalent, are recommended for use when performing the service operations covered in the chapter.

DRIVER, clutch pilot bearing, KM-K410
KIT, carburetor, KM-KMO268G
PULLER, clutch pilot bearing, KM-K445B
TOOL, clutch pilot, KM-K411

CHAPTER 6

TRANSMISSION

Section I

INTRODUCTION

116. DESCRIPTION.

a. The selective sliding gear type transmission used in the bomb service truck incorporates 4 forward speeds and 1 reverse. Provision is made on the left side of the case for mounting a power take-off when a winch or hoist is to be used.

b. The transmission is bolted to the clutch housing and becomes a part of the unit power plant assembly. The emergency brake and transfer case shift levers are mounted on the right side of the transmission. The cross-sectional view (fig. 101) shows the transmission construction.

c. The front end of the clutch gear pilots into the clutch pilot bearing in the crankshaft, while the rear end is supported in a large ball bearing in the front end of the transmission case.

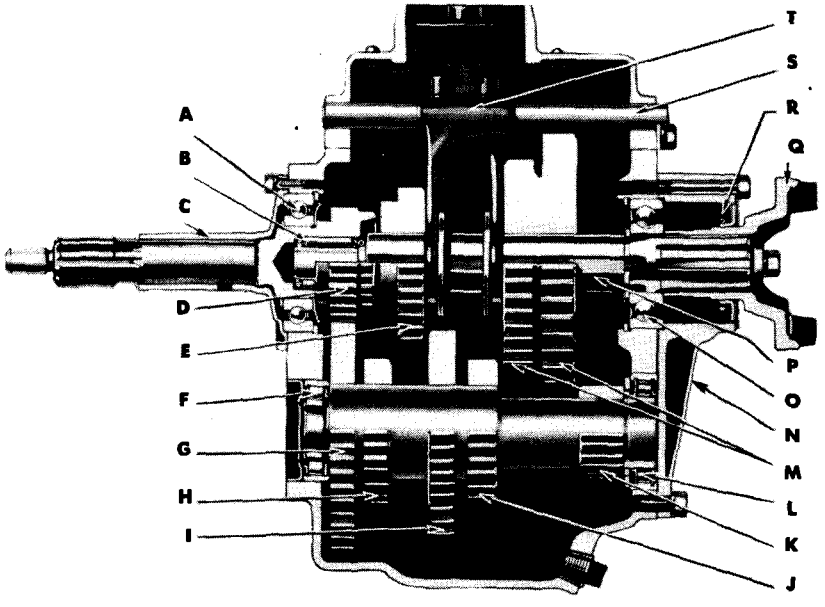
d. The main shaft (spline shaft) is mounted in a large ball bearing in the rear end of the transmission case, and the front end is supported in a roller pilot bearing in the back end of the clutch gear.

e. The countershaft is mounted in straight roller bearings, front and rear.

f. The reverse idler gear (not shown in fig. 101) is mounted on a stationary shaft in the right side of the transmission (fig. 102). The gear is fitted with a special bushing in each end. Due to the transmission design, this gear turns in *low* and *reverse* only.

g. The countershaft and low speed gear are forged integrally. The other 4 gears are pressed on and keyed to the shaft.

h. The low, reverse, and second sliding gear assembly is composed of a hub having a groove for the shifting fork and 2 gears which are pressed onto the hub and riveted to it.



A—CLUTCH GEAR BEARING
B—MAINSHAFT PILOT BEARING
C—CLUTCH GEAR BEARING RETAINER
D—CLUTCH GEAR
E—HIGH SPEED SLIDING GEAR
F—COUNTERSHAFT FRONT BEARING
G—COUNTERSHAFT DRIVE GEAR
H—COUNTERSHAFT REVERSE GEAR
I—COUNTERSHAFT THIRD SPEED GEAR
J—COUNTERSHAFT SECOND SPEED GEAR
K—COUNTERSHAFT LOW SPEED GEAR
L—COUNTERSHAFT REAR BEARING
M—LOW, SECOND AND REVERSE SPEED SLIDING GEAR
N—REAR BEARING RETAINER
O—MAINSHAFT REAR BEARING
P—MAINSHAFT
Q—UNIVERSAL JOINT FLANGE
R—OIL SEAL
S—GEAR SHIFTER SHAFT
T—SHIFTER FORKS

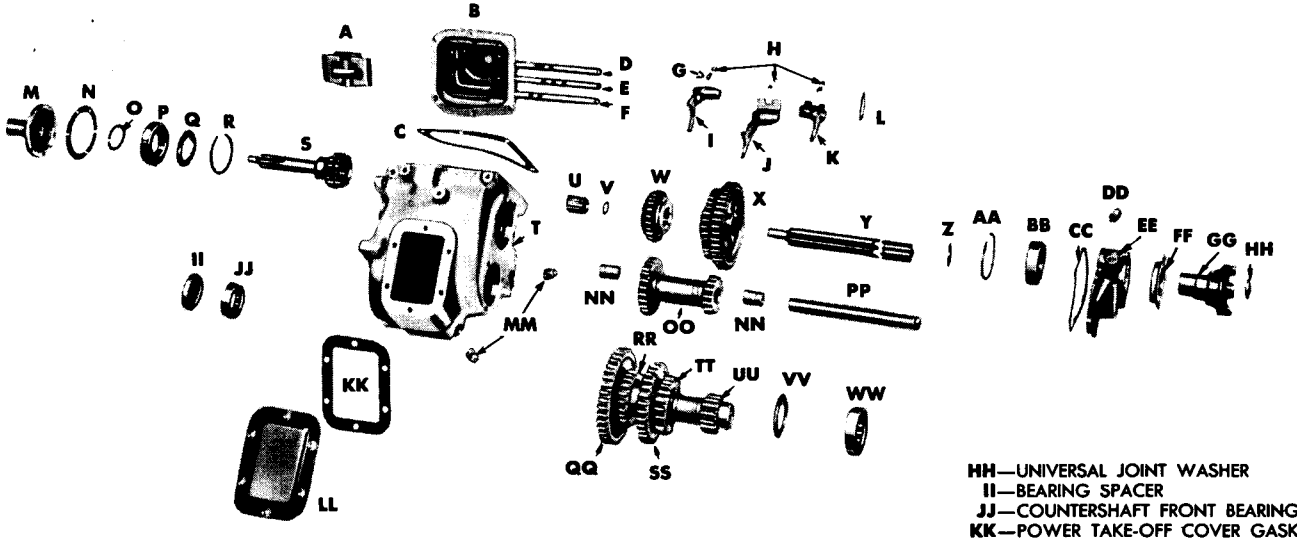
RA PD 32594

Figure 101 — Transmission Assembly

i. The third and high speed sliding gear is a one-piece gear having external teeth for third speed and internal teeth (or splines) which enter over the undercut section of the clutch gear for high gear (direct drive).

j. The high and third speed gear assembly and the low, reverse, and second speed gear assembly are splined to the main shaft and therefore must turn with the shaft; however, they can be shifted forward or backwards for the different gear positions.

k. The shifting mechanism is all mounted in the transmission cover. There are 3 shifter shafts and forks; the left shifter shaft and fork shifts



A—SHIFTER AND GUIDE PLATE
B—CASE COVER
C—COVER GASKET
D—3RD AND 4TH SHIFTER SHAFT
E—1ST AND 2ND SHIFTER SHAFT
F—REVERSE SHIFTER SHAFT
G—YOKE LOCK BALL SPRING
H—YOKE LOCK BALL
I—FORWARD SHIFTER YOKE
J—REVERSE SHIFTER YOKE
K—FORWARD SHIFTER YOKE
L—SHIFTER SHAFT RETAINER
M—BEARING RETAINER
N—BEARING RETAINER GASKET
O—BEARING LOCK
P—CLUTCH GEAR BEARING
Q—OIL SLINGER
R—BEARING LOCK
S—CLUTCH GEAR
T—CASE
U—MAIN DRIVE SHAFT PILOT BEARING
V—THRUST RING
W—3RD AND 4TH SPEED GEAR
X—1ST AND 2ND SPEED GEAR
Y—MAIN DRIVE SHAFT
Z—BEARING INNER SPACER
AA—BEARING LOCK
BB—REAR MAINSHAFT BEARING
CC—BEARING RETAINER GASKET
DD—SPEEDOMETER DRIVEN GEAR FITTING
EE—REAR MAINSHAFT BEARING RETAINER
FF—OIL SEAL
GG—UNIVERSAL JOINT FLANGE
HH—UNIVERSAL JOINT WASHER
II—BEARING SPACER
JJ—COUNTERSHAFT FRONT BEARING
KK—POWER TAKE-OFF COVER GASKET
LL—POWER TAKE-OFF COVER
MM—PLUG
NN—REVERSE IDLER GEAR BUSHING
OO—REVERSE IDLER GEAR
PP—REVERSE IDLER SHAFT
QQ—DRIVEN COUNTER GEAR
RR—REVERSE COUNTER GEAR
SS—3RD SPEED COUNTER GEAR
TT—2ND SPEED COUNTER GEAR
UU—COUNTER SHAFT
VV—THRUST WASHER
WW—COUNTERSHAFT REAR BEARING

RA PD 32595

Figure 102 — Layout of Transmission Parts

the high and third speed sliding gear; the center one shifts the low and second speed sliding gear, and the right one shifts the reverse idler gear.

l. The gear shift lever mounts in a ball and socket joint in the dome of the transmission cover.

117. OPERATION.

a. In order to diagnose transmission trouble efficiently, it is essential that a service man understand the transmission construction, know which gears are engaged in the various gears, and be able to trace the power in all gear positions.

b. **Low Gear.** The gearshift lever is pushed forward which slides the low, second, and reverse sliding gear back until the low and reverse gear meshes with the countershaft low speed gear. The path of power is from the clutch gear to the countershaft drive gear, to the countershaft low gear, to the low and reverse sliding gear, and through the splines to the main shaft (fig. 101).

c. **Second Gear.** The gearshift lever is pulled backward which places the forward gear of the second, low, and reverse sliding gear into mesh with the countershaft second speed gear. The path of power is from the clutch gear to the countershaft drive gear, to the countershaft second speed gear, to the second speed sliding gear, through the splines to the main shaft (fig. 101).

d. **Third Gear.** The gearshift lever is moved forward to neutral, across to the right, and forward to third position. This places the third and high sliding gear into mesh with the countershaft third speed gear. The path of power is from the clutch gear to the countershaft drive gear, to the countershaft third gear, to the third speed sliding gear, and through the splines to the main shaft (fig. 101).

e. **High or Direct Drive.** The gearshift lever is pulled back, which slides the high and third speed gear forward until the internal teeth on the gear slide over the undercut section of the clutch gear, locking the 2 gears together. The path of power is from the clutch gear, through the internal-external tooth connection to the high and third sliding gear, and through the splines to the main shaft. The countershaft turns in high but is not in the path of power (fig. 101).

f. **Reverse Gear.**

(1) The reverse idler gear is not shown in figure 101. Refer to item "OO," figure 102, to see the reverse idler construction. This gear is mounted on a shaft to the right of the other shafts and higher than the

countershaft. It does not engage any other gear or turn except in low and reverse.

(2) To shift into reverse the latch on the gearshift lever is raised and the lever shifted to the left and back. This shifts the forward gear of the reverse idler into mesh with the countershaft reverse gear and the rear gear of the reverse idler into mesh with the low and reverse sliding gear.

(3) The path of power is from the clutch gear to the countershaft drive gear, to the countershaft reverse gear, to the front gear of the reverse idler, to the back gear of the reverse idler, to the low and reverse sliding gear and through the splines to the main shaft.

118. DATA.

Type ..... Selective sliding gear
Speeds ..... 4 forward, 1 reverse
Mounting ..... Unit power plant
Bearings
  Clutch shaft, in crankshaft ..... Hyatt 99004
  Clutch gear ..... N. D. 3209
  Mainshaft, pilot ..... Hyatt 93424
  Mainshaft, rear ..... N. D. 3307
  Countershaft, rear ..... Hyatt C-1207
  Countershaft, front ..... Hyatt C-1206
  Reverse gear ..... Brass bushing
Gear ratio
  First speed ..... 7.06 to 1
  Second speed ..... 3.48 to 1
  Third speed ..... 1.71 to 1
  Fourth speed ..... 1.00 to 1
  Reverse speed ..... 6.98 to 1

119. ECHELON REFERENCES.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon duties not covered in this manual.

120. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

121. GENERAL.

a. Before deciding that major service will be required, an accurate check should be made to determine that the trouble is in the transmission. The vehicle should be driven at various speeds and special attention given to the speed, gear ratio, and power applied when the condition being investigated is most pronounced. If it cannot be definitely isolated in any one unit, it may be advisable to jack up the rear wheels and, with the transfer case in high and 2-wheel drive, reproduce the driving conditions which produced the most noise, and check the drive line to isolate the noise.

122. TROUBLE SHOOTING.

a. Noises.

Probable Cause	Probable Remedy
Insufficient lubricant.	Fill to correct level according to instructions in section IV of TM 9-765.
Bent shifter forks.	Replace fork.
Universal joint front yoke retainer screw loose.	Tighten securely.
Worn or broken bearings.	Overhaul transmission.
Badly worn gears.	Overhaul transmission.
Gear teeth chipped.	Overhaul transmission.
Worn reverse idler gear bushing.	Overhaul transmission.

b. Jumping Out of Gear.

Transmission to clutch housing bolts loose.	Tighten bolts.
Worn gears.	Overhaul transmission.
Shift lock springs weak or broken.	Replace shift lock spring.
Bent shifter fork.	Replace shifter fork.
Misalinement of transmission.	Shim to aline.

TROUBLE SHOOTING

c. Difficulty in Shifting to Low or Reverse.

Worn or bent gearshift in interlock guide plate.	Replace transmission cover guide plate.
Worn reverse lock sleeve on lower end of gearshift lever.	Replace gearshift lever or sleeve.

d. Lubricant Leaks.

Transmission case overfilled with lubricant.	Drain transmission to correct level.
Clutch gear bearing retainer loose.	Remove transmission, replace gasket, and tighten retainer.
Clutch gear bearing retainer body worn or broken.	Remove transmission and replace retainer.
Rear bearing retainer loose.	Tighten 7 retainer bolts.
Rear bearing retainer gasket damaged.	Replace gasket.
Rear bearing retainer oil seal damaged.	Replace oil seal.

Section III

OPERATIONS PERFORMED WITHOUT REMOVING TRANSMISSION FROM VEHICLE

123. SHIFTING LEVER REPLACEMENT.

a. Remove Lever (fig. 103). Install the gearshift lever remover KM-K353, over the shift lever cap and turn the remover until the lugs engage the slots in the shift lever cap; push down on the lever remover and turn it slightly to the left. This disengages the locks and the lever assembly can be raised out of the transmission cover.

b. Disassemble Lever. Remove the shift lever knob, drive the reverse latch lever pin out, and remove the shift lever cap, spring cap, spring reverse latch rod, and reverse latch.

c. Assemble Lever. Install the reverse latch rod, reverse latch spring, spring cap, shift lever cap, reverse latch lever, lever spring, lever pin, and gearshift lever knob.

d. Install Lever (fig. 103). Place the lever in the transmission cover and guide it down into position. Install the gearshift lever remover KM-K353 over the lever cap, force the cap down into the cover and turn the tool slightly to the right to lock the lever in position.

e. Check Transmission Operation. Check the transmission in all gears, including reverse, to make sure the lever is correctly installed.

124. TRANSMISSION COVER REPLACEMENT.

a. Cover Removal.

(1) REMOVE LEVER (fig. 103). Install the gearshift lever remover KM-K353 over the shift lever cap and turn the remover until the lugs engage the slots in the shift lever cap. Push down on the lever remover and turn it slightly to the left. This disengages the locks and the lever assembly can be raised out of the transmission cover. NOTE: Plug the top of cover with cloths to prevent dirt from entering.

(2) REMOVE FLOOR BOARDS. Remove the floor mat, the floor board screws, and the floor board.

(3) REMOVE COVER. Disconnect the brake pedal, pull back spring from transmission cover bolt clip, remove the 6 retaining bolts, and remove the cover.

OPERATIONS PERFORMED WITHOUT REMOVING TRANSMISSION FROM VEHICLE

RA PD 32237

Figure 103 — Removing Gearshift Lever

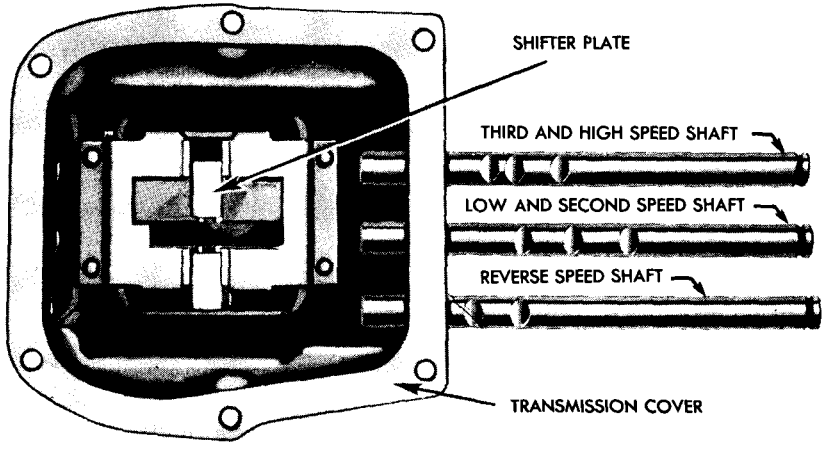


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Figure 104 — Shifter Shaft Assembly

b. Cover Disassembly (fig. 102).

(1) REMOVE SHIFTER SHAFT LOCK PLATE. Remove the 2 cap screws which retain the shifter shaft lock plate to cover, and remove the plate.

(2) REMOVE SHIFTER SHAFTS (fig. 104). Turn the shifter shafts one-half turn to raise the lock balls out of the notches in the shafts, and push the shafts out of the shifter forks and cover. NOTE: Be careful not to lose the lock balls and springs, which are located in the shifter forks, when removing the shafts.

(3) INTERLOCK GUIDE PLATE (fig. 104). The interlock plate is serviced with a new cover; however, the parts are also available. To replace the interlock guide plate, cut the heads from the 4 rivets which attach the plate to cover. Remove the interlock guide plate and shifter plate. Install the new guide plate and shifter plate, and rivet it securely to cover.

c. Inspection.

(1) SHIFTER SHAFTS. Inspect the shifter shafts for wear.

(2) FORKS. Check the forks for excessive wear or being bent.

d. Identification of Forks and Shafts.

(1) FORKS. The 2 forward speed shifter forks are alike and interchangeable. The reverse shifter fork is materially longer than the other 2 and must be placed on the shaft at the right side of cover.

(2) SHAFTS (fig. 104). The 3 shifter shafts are all different. The shaft with 2 notches is the reverse shifter shaft. The one with the 3 wide spaced notches is low and second. The shaft with the notches unevenly spaced is the high and third shifter shaft.

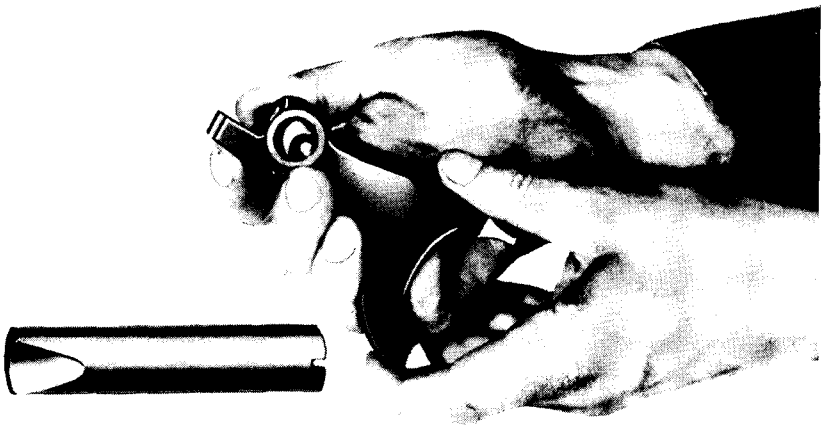
(3) COVER. The reverse shaft mounts in the right side of cover (this will be lower than the other two), the low and second speed shaft mounts in the center hole in cover, and the high and third speed shaft mounts in the left side of cover.

e. Cover Assembly.

(1) SPECIAL INSTALLING TOOL (fig. 105). To facilitate the assembly of the lock ball and spring, a tool similar to the one shown in figure 105 should be used. This tool can be made from an old shifter shaft or any piece of steel that is shaft size. It can have a tapered slot as shown, or about half the width of the shaft can be ground off about ½ inch back from the end.

(2) INSTALL REVERSE SHAFT AND FORK (fig. 104). Place the spring and ball in the reverse shifter fork; install the tool and force the ball up into the hole in the fork. Place the fork in position and install

OPERATIONS PERFORMED WITHOUT REMOVING TRANSMISSION FROM VEHICLE



RA PD 32600

Figure 105 — Depressing Fork Ball

the shaft from the back end of the cover; force the special tool out through in front of cover.

(3) INSTALL LOW AND SECOND FORK AND SHAFT. Place the spring and ball in the fork, install the special tool, place the fork in position, and force the shaft through from the rear of case.

(4) INSTALL HIGH AND THIRD FORK AND SHAFT. Place the spring and ball in the fork, install the special tool, place the fork in position, and force the shaft through from the rear of case.

(5) INSTALL SHAFT LOCK PLATE. Install the shaft lock plate and tighten the cap screws securely.

f. Cover Installation.

(1) PLACE TRANSMISSION IN NEUTRAL. Place the transmission gears in neutral (so that the engine can be turned without the vehicle moving).

(2) INSTALL COVER (fig. 106). Place the cover in neutral, install a new gasket, and lower the cover straight down on the transmission, being careful not to tip the cover. This places the shifting forks in the grooves of their respective gears. Tighten the bolts securely. Attach the brake pedal pull back spring to the cover bolt clip.

(3) INSTALL SHIFT LEVER (fig. 103). Place the shift lever in position in the cover. Install the gear shift lever remover KM-K353 over the lever cap, force the cap down, and turn the tool slightly to the right to lock the lever in position.

Figure 106 — Installing Transmission Cover

(4) CHECK TRANSMISSION OPERATION. Test the transmission in all gears including reverse to make sure that the forks correctly engage the sliding gears.

(5) INSTALL FLOOR BOARDS. Install the floor boards and the retaining screws.

Section IV

TRANSMISSION REMOVAL FROM VEHICLE

125. TRANSMISSION REMOVAL.

a. Remove Floor Boards. Remove floor board screws and floor board.

b. Drain Transmission. Remove transmission drain plug, drain transmission, and install plug.

c. Disconnect Transfer Case Shift Lever. Remove transfer case control levers and emergency brake lever attaching bolts on right side of transmission.

d. Disconnect Brace Rod (fig. 32). Disconnect power plant brace rod at transmission end.

e. Disconnect Brake Pull Back Spring. Disconnect pull back spring at left rear corner of transmission.

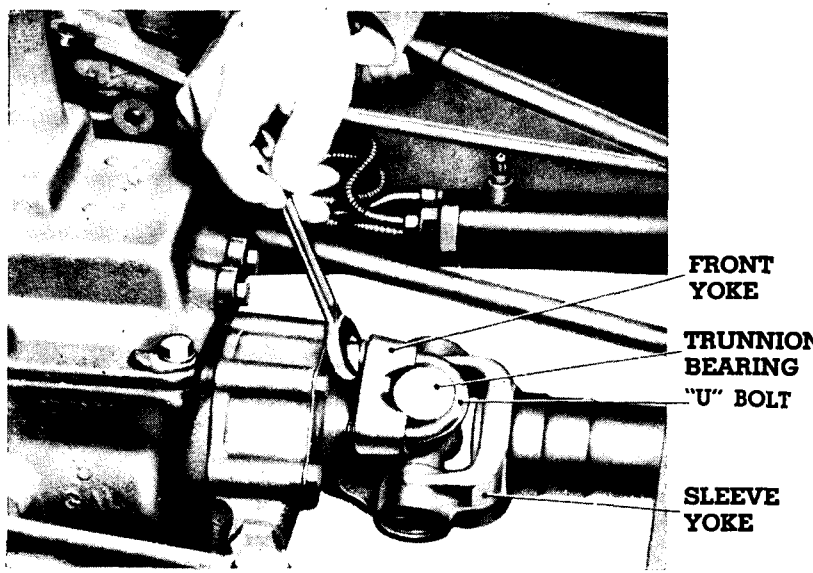


Figure 107 — Disconnecting Universal Joint

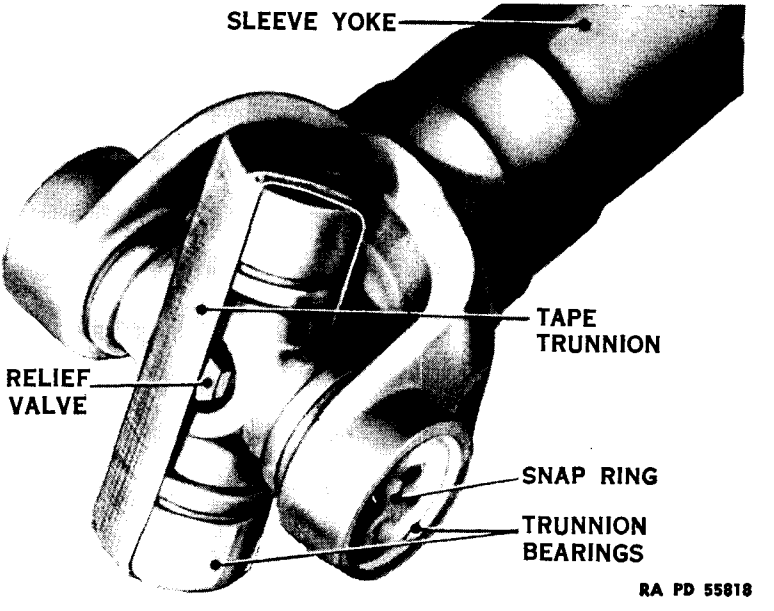


Figure 108 — Trunnion Bearings Held in Position with Tape

f. Disconnect Propeller Shaft (figs. 107 and 108). Remove the nuts and lock washers from the U-clamps which retain the trunnion bearings to the front yoke of the universal joint. Remove the U-clamps and slide the rear yoke of the joint back on the splines of the propeller shaft. NOTE: It is good practice when splitting these needle bearing universal joints to leave the bearings on the trunnions, holding them in place with a piece of tape wrapped endwise over the bearings. This prevents dirt getting into the bearings and keeps them in place.

g. Flywheel Underpan. Remove the screws which retain the flywheel underpan and remove the pan.

h. Remove Transmission (fig. 109). Remove the 2 bottom attaching bolts by reaching in through the bottom of the clutch housing. Remove the 2 upper attaching bolts. Slide the transmission back to clear the splines in the clutch disk and lower the transmission to the floor. NOTE: It is very important that the weight of the transmission be supported until the end of the clutch gear splines are out of the splines in the clutch disk.

TRANSMISSION REMOVAL FROM VEHICLE

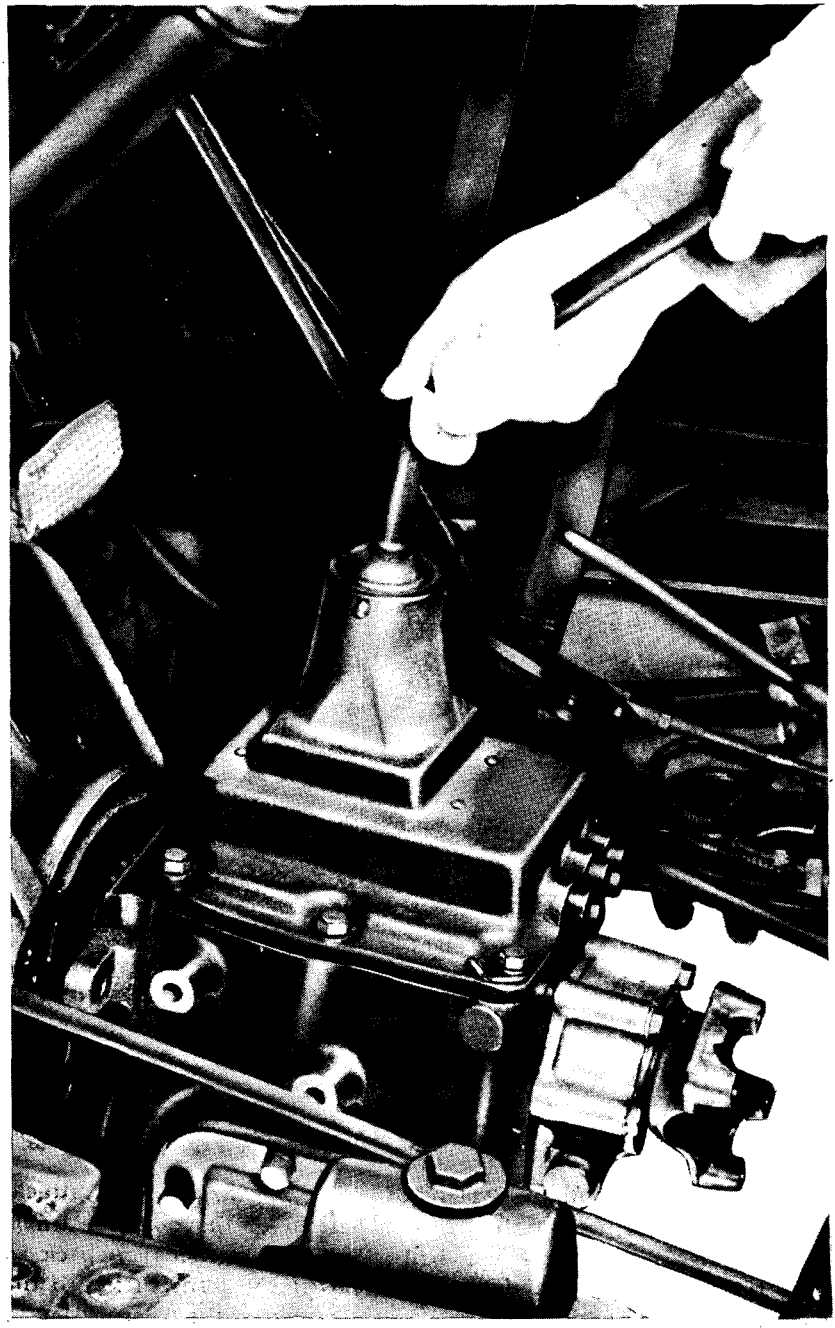


Figure 109 — Transmission Removal RA PD 32322

Section V

TRANSMISSION DISASSEMBLY AND INSPECTION

126. TRANSMISSION DISASSEMBLY.

a. Remove Shift Lever (fig. 103). Slide the open side of gearshift lever remover KM-K353 over the lever; engage the lugs in the tool in the open slot of the retainer. Then press down on the tool and turn it to the left to disengage the lugs on the retainer. Lift the lever out of the cover.

b. Remove the Transmission Cover. Remove the 6 retaining cap screws and remove the cover.

c. Remove Universal Joint Yoke. Place the transmission in 2 gears at once to lock the main shaft. Remove the cap screw and washer which retain the universal joint front yoke to the main shaft, and remove the yoke.

d. Remove Rear Bearing Retainer. Remove the 7 cap screws which attach the rear bearing retainer to the case and remove retainer.

e. Remove Clutch Gear. Remove the clutch gear bearing retainer and drive out the clutch gear and bearing, using a soft steel drift to avoid damaging the teeth of the gear.

f. Remove Spline Shaft. Remove the spline shaft pilot bearing and drive the spline shaft and bearing out through the rear end of the case.

g. Remove Sliding Gears. Remove the 2 sliding gears through the top of case.

h. Remove Reverse Idler Gear. Drive out the reverse idler gear shaft from the front to the rear and remove the reverse idler gear.

i. Remove Countershaft Assembly. Using a brass drift and hammer, drive the countershaft assembly to the rear to remove the rear bearing. Remove the countershaft assembly through the top of case.

j. Remove Countershaft Front Bearing. Drive out the countershaft front bearing and retainer by tapping lightly around the outer race of the bearing.

k. Remove Spline Shaft Bearing. The bearing can be removed from the spline shaft by supporting the inner race of the bearing on an arbor press and pressing on the end of the shaft until it is free of the bearing.

l. Remove Clutch Gear Bearing. The clutch gear bearing can be removed from the shaft by removing the retainer snap ring and supporting the outer race of the bearing on an arbor press and pressing on the end of the shaft until it is free of the bearing.

127. INSPECTION OF PARTS.

a. Clean Parts. Wash all parts in SOLVENT, dry-cleaning, and dry thoroughly.

b. Inspect Gear Teeth. Inspect all gears for worn or chipped teeth.

c. Inspect Sliding Gears. Inspect the sliding gears for spline wear and shaft fit.

d. Inspect Idler Gear Bushing. Inspect the bushings in the idler gear for wear or being loose in the gear.

e. Inspect Shafts. Inspect all shafts for excessive wear or damage at the bearing races.

f. Inspect Roller Bearings. Inspect the countershaft bearings for damaged rollers or races and check their fit in the case. (These bearings are a slip fit in the case.)

g. Check Pilot Bearing Fit. Inspect the main shaft pilot bearing and its fit on the main shaft and in the clutch gear.

h. Inspect Clutch Gear Splines. Check the clutch gear spline fit in the clutch disk.

i. Inspect Case. Inspect the transmission case for cracks or being damaged.

j. Inspect Ball Bearings. Wash the 2 ball bearings carefully and blow them out with compressed air. (Do not allow the air stream to spin the bearing.) Oil the bearings with engine oil and check them for excessive wear or roughness.

Section VI

TRANSMISSION REPAIR AND ASSEMBLY

128. REPAIR OPERATIONS.

a. Countershaft Gears.

(1) If one or more of the countershaft gears are found to be damaged it will be necessary to press the 4 removable gears from the countershaft.

(2) REMOVE COUNTERSHAFT GEARS. Support the second speed gear on an arbor press and press on the front end of the shaft. It may take as much as a 15-ton pressure to remove these gears.

(3) GEAR POSITIONING (fig. 110).

(a) All 4 gears must be pressed on at once. Care must be taken to get the gears and spacers in their correct positions, as well as having the chamfered end of the gear teeth face correctly for gear engagement.

(b) The chamfered side of the second speed gear faces the low speed gear, and the chamfered side of the third speed gear faces the chamfered side of the reverse speed gear.

(c) The ¼-inch spacer goes between the second and third speed gears; the ⅞-inch spacer goes between the third and reverse speed gears, and the 5/32-inch spacer goes between the reverse and countershaft drive gears. Figure 110 shows the correct position for the gears.

(4) ARRANGE GEARS AND SPACERS. Stack the gears and spacers by placing the second speed gear (chamfer down) on the bench; then the ¼-inch spacer; the third speed gear (chamfer up); the ⅞-inch spacer; the reverse gear (chamfer down), and the countershaft drive gear with the oil relief on the face of the hub up.

(5) START GEARS ON SHAFT. Place this assembly on the end of the shaft, line up the keyways in the 4 gears with the keyway in the shaft, and start the 4 keys into the keyways.

(6) PRESS GEARS INTO POSITION. Press the gears down on the shaft. It is important that the 4 keys be kept driven down about flush with the gears while they are being pressed on; otherwise the gears might creep slightly and it would be impossible to drive the keys into place.

(7) DRIVE KEYS INTO PLACE. Drive the keys in 1/32 inch below flush which locks the keys. Any burs which were set up should be filed down smooth.

TRANSMISSION REPAIR AND ASSEMBLY

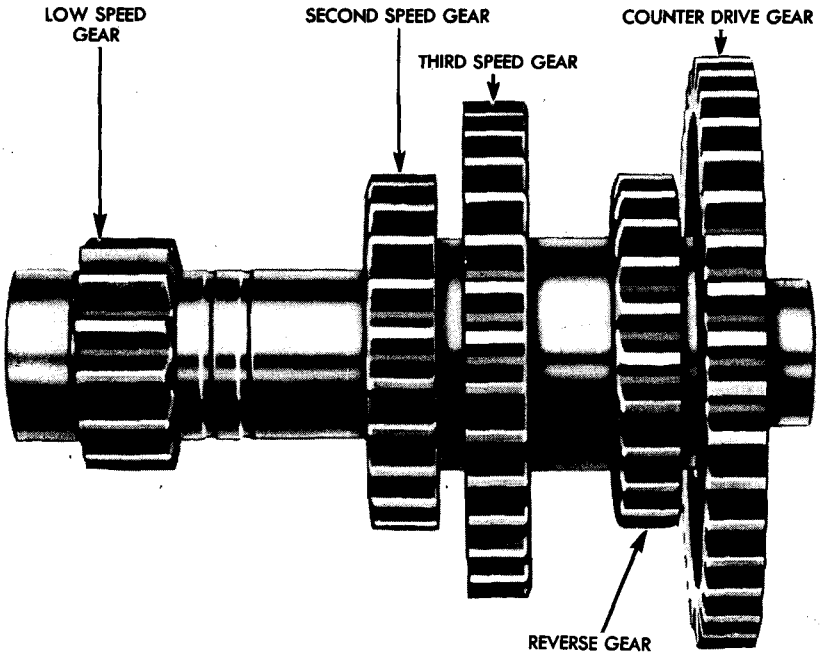


Figure 110 — Countershaft and Gears

b. Reverse Idler Gear.

(1) If the bushings in the idler gear show signs of wear, they should be replaced.

(2) REMOVE BUSHINGS. Press or drive the bushings out of the gears with the special tool J-1662.

(3) INSTALL BUSHINGS. Press the new bushings into the gear (one from each end) until they are about $\frac{1}{32}$ inch below flush.

(4) REAM BUSHINGS. Ream the bushings to size, using reamer KM-KMO349 as shown in figure 111. Check the shaft fit in the bushings which should be 0.002 inch to 0.004 inch.

c. Rear Bearing Retainer Oil Seal.

(1) If there was any indication of lubricant leak at the rear bearing retainer oil seal, it should be replaced.

(2) REMOVE OIL SEAL. Drive the old oil seal out of the retainer.

(3) INSTALL SEAL. Put a thin coat of sealing compound on the outer surface of the oil seal. Line up the bolt holes in the seal with the bolt holes in the retainer, and press the seal into the retainer. NOTE: The seal must be soaked in engine oil for some time before installing or the

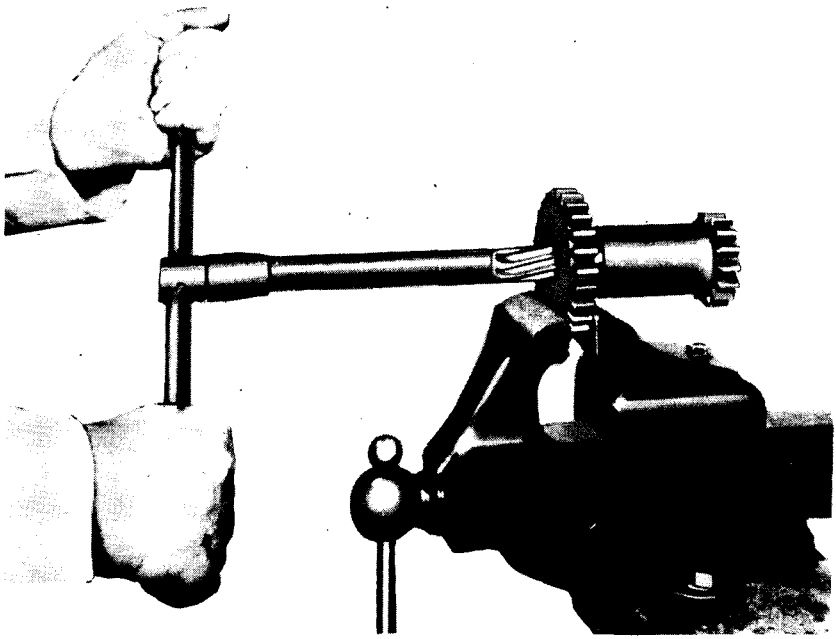


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Figure 111 — Reaming Idler Gear Bushings

friction of the leather on the yoke will burn the leather and ruin the new seal.

d. Transmission Cover. Any excessive wear or indication of trouble in the shifting mechanism requires disassembling the cover. See paragraph 124 for transmission cover service instructions.

e. Gearshift Lever. If the reverse latch sleeve on the lower end of the gearshift lever is worn or damaged it can be replaced by removing one of the rivets at the top of the lever and sliding the pull rod down the lever until the sleeve can be removed and a new one installed.

f. Any of the other parts, which the inspection revealed were not suitable for further use, should be replaced with new parts.

129. TRANSMISSION ASSEMBLY.

a. Install Countershaft Front Bearing (fig. 101). Assemble the countergear front bearing and retainer to the case. The open side of the retainer should be toward the outside and its edge flush with the case.

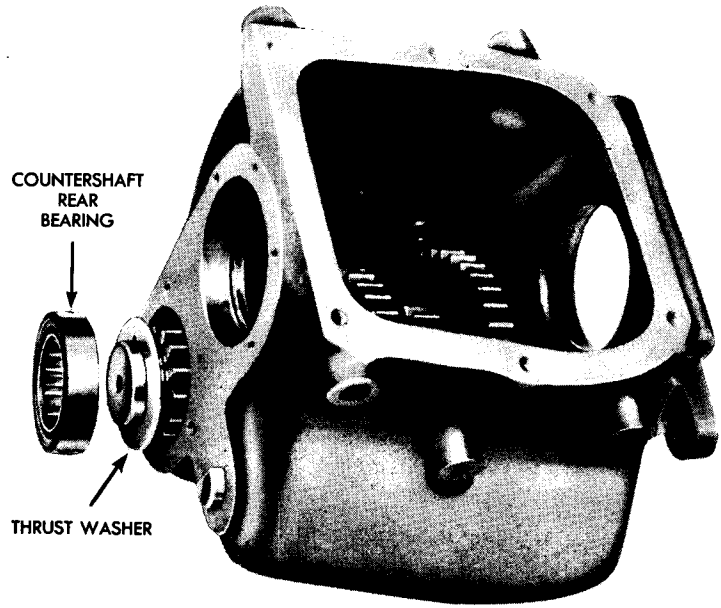

Figure 112 — Assembling Countershaft

b. Install Countershaft (fig. 112). Place the countergear and shaft in the transmission and assemble the thrust washer and rear bearing.

c. Check Countershaft End Play. For the purpose of checking the end play between the countergear and the case without further assembly of the transmission, install the rear bearing retainer and a new gasket to the rear face of the case and tighten the 7 cap screws. Check the end play between the thrust washer and the teeth on the countershaft low speed gear. This end play should be from 0.015 inch to 0.045 inch. If it exceeds 0.045 inch, shim between the front countershaft bearing and its retainer until the end play is within the above limits.

d. Install Idler Gear (fig. 112). Place the idler gear in the transmission case and drive the idler gear shaft into position from the rear to the front, being careful to have the flat machined surface on the end of the shaft in a vertical position, and toward the countershaft.

e. Install Clutch Gear. Assemble the clutch gear and bearing and bearing retainer to the case, using a new gasket. Install the lock plates and cap screws. Tighten the screws securely. Then bend up the edges of the lock plates against the hexagonal heads of the cap screws.

f. Install Pilot Bearing (fig. 101). Dip the main spline shaft pilot bearing in transmission lubricant and assemble it in the inside of the clutch gear.

g. Install Sliding Gears and Main Shaft (fig. 101). Place the sliding gears in the transmission with the shifter fork grooves toward each other, and assemble the spline shaft and bearing through these gears and into the pilot bearing.

h. Install Rear Bearing Cap. Assemble the rear bearing retainer and gasket to the case and tighten the 7 cap screws securely.

i. Install Universal Joint Yoke (fig. 101). Install the universal joint front yoke on the main shaft. Place the transmission in 2 gears at once to lock the main shaft. Install the special flat washer (with the indentations toward the yoke) and lock washer under the head of the cap screw which anchors the universal joint front yoke to the main shaft. Then tighten the screw securely.

j. Install Cover (fig. 106). Shift the gears in the transmission to neutral position (so that the clutch gear can be turned independent of the main shaft). Make sure the shifter forks in the cover are in neutral position. Install a new cover gasket and lower the cover straight down on the transmission so that the shifter forks will engage the shifter grooves on the gears. Install the cover screws and tighten them securely.

k. Install Gearshift Lever (fig. 103). Install the gearshift lever and lock it in place by pressing down and turning the retainer to the right with the special tool.

l. Test Transmission. Test the transmission in all gears by shifting the lever to the gear position and turning the clutch shaft.

Section VII

TRANSMISSION INSTALLATION IN VEHICLE

130. TRANSMISSION INSTALLATION.

a. Clean Bolting Flanges. Clean the machined surface of transmission and clutch housing.

b. Install Transmission. Place the transmission under the truck and raise the transmission until the main drive gear shaft lines up with splines in clutch. Work transmission forward into place, being careful not to release the weight of the transmission until it is up against the clutch housing.

c. Install Bolts. Install the 2 upper transmissions to clutch housing bolts. Install the 2 lower transmissions to clutch housing bolts, and tighten all bolts securely.

d. Install Underpan. Install the clutch housing underpan and tighten the screws securely.

e. Connect Universal Joint (fig. 107). Place the propeller shaft slip joint in position against the flange. Install the U-clamps, lock washers, and nuts. Tighten the nuts securely.

f. Connect Pull Back Spring. Hook the brake pedal pull back spring to the clip on transmission cover bolt.

g. Attach Power Plant Brace Rod (fig. 32). Attach the power plant brace rod and tighten the attaching bolt.

h. Install the Control Levers. Install the emergency brake lever and transfer case shift levers; install the retaining bolts and tighten them securely.

i. Fill Transmission. Fill the transmission case with 5½ pints of universal gear lubricant. Lubricate the universal joint which was disassembled.

j. Install Floor Boards. Install the floor boards and the retaining screws.

Section VIII

FITS AND TOLERANCES

131. FITS AND TOLERANCES.

a. Mainshaft and Gears.

Mainshaft, runout, not over.....0.004 in.

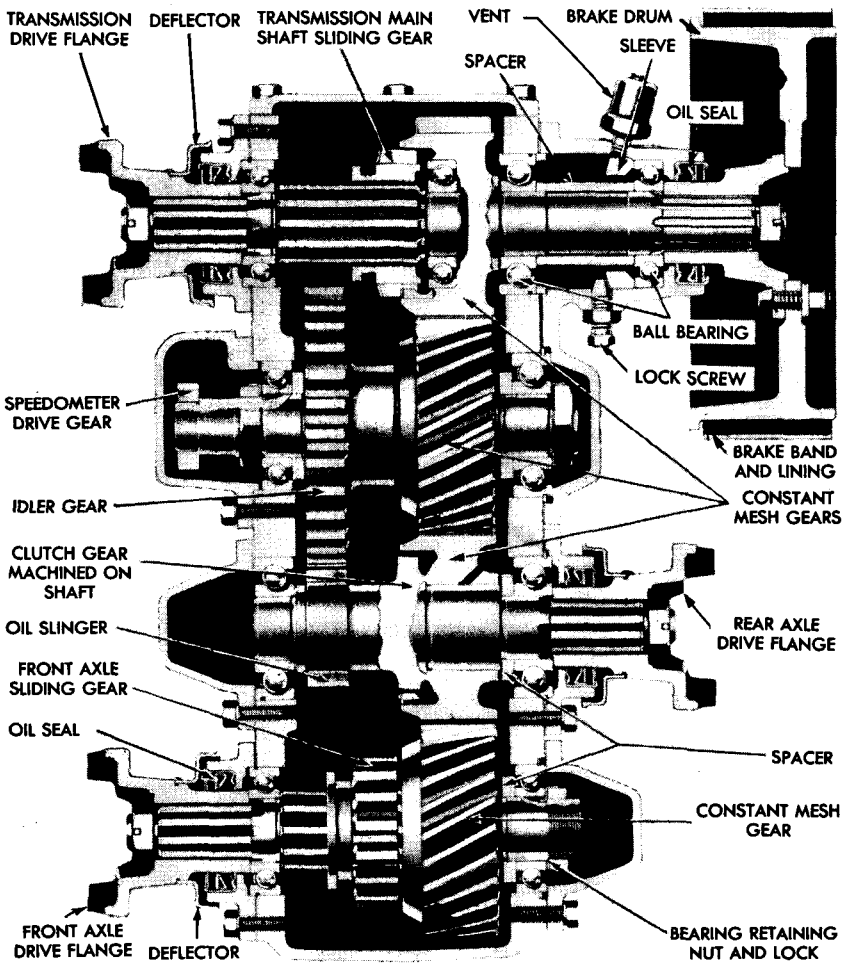

Figure 113 — Transfer Case — Cross Section

FITS AND TOLERANCES

b. Clearance Between.

Mainshaft and sliding gears.....0.0035 in.—0.0065 in.
Shifting fork and sliding gears.....0.009 in.—0.019 in.

c. Shifting.

Spring free length.....$1\frac{1}{32}$ in.
Closed length .....$\frac{19}{32}$ in.

d. Countershaft.

Rear bearing thrust washer thickness.....0.123 in. to 0.127 in.

e. Reverse Gear.

Reverse idler shaft diameter.....0.8737—0.8747
Reverse idler gear bushings.....0.8772—0.8782 in gear

CHAPTER 7

TRANSFER CASE

Section I

INTRODUCTION

132. DESCRIPTION (figs. 113 and 114).

a. The transfer case used in this truck is an auxiliary unit located between the transmission and rear axle.

b. The transfer case is essentially a 2-speed transmission unit which provides the means of connecting the transmission proper with both the front and rear axles.

c. A shifter mechanism is incorporated in the transfer case for engaging and disengaging the drive to the front axle, also for shifting into the high and low speeds. Each of the above controls is operated by levers in the driver's compartment within easy reach of the operator.

d. In the design of this unit, an effort has been made to make as many parts as possible interchangeable. There are only 2 sizes of ball bearings used on the 5 shafts and 2 sizes of spacers except the outboard bearing for the main shaft extension.

e. There are 4 constant mesh helical gears in the unit; the one on the transmission mainshaft is an integral part of the shaft extension, while the other three are the same except for the helical angle on the gear mounted on the rear axle drive shaft (fig. 113).

f. The 2 sliding gears and their shifter forks are the same.

g. The bearing caps on the front side of the rear axle shaft and on the rear side of the front axle shaft are the same.

h. The 4 oil seals are alike, and all 3 driving flanges are the same.

i. The transmission main shaft is free to roll on its bearings except when the sliding gear is in mesh with the constant mesh gear on the

main shaft extension, or low speed gear on the idler shaft, thereby engaging the transmission main shaft with the gear train in the transfer case (fig. 113).

j. Roller bearings (needle type) are used between the front axle drive shaft and the bearing bore in the constant mesh gear.

k. The idler gear train is keyed to the idler shaft by a pin located in the shaft which fits into a keyway in the idler gear. The constant mesh gear fits on the end of the shaft, and connects with the idler shaft low speed gear by the internal teeth of the constant mesh gear fitting over the external teeth of the idler shaft low speed gear. The speedometer gear is pressed on the front end of the idler shaft.

l. The rear axle drive shaft has a 17-tooth clutch gear machined on the shaft. The constant mesh gear fits over the shaft, and its internal teeth mesh with the clutch gear machined on the shaft.

m. The rear axle drive shaft has a paddle type oil slinger spot-welded to it. This oil slinger is located directly behind the drive shaft front bearing and in line with the idler shaft low speed gear. Under operating conditions, the slinger throws lubricant to the gears and bearings above the rear axle drive shaft.

n. A vent is located in the rear bearing retainer of the transmission shaft to relieve pressure created by lubricant expansion.

o. A hand brake assembly is mounted on the rear of the transfer case. The brake drum is mounted on the transfer case main shaft extension.

133. OPERATION.

a. In high ratio (1 to 1) drive to both the front and rear axles, the external teeth of the sliding gears, which are splined to the transmission main shaft and the front axle drive shaft, are in contact with the internal teeth of the constant mesh gears mounted on these shafts.

b. The flow of power from the transmission proper is through the 2 universal joints and short propeller shaft to the transmission main shaft in the transfer case, thence through the sliding gear, to the constant mesh gear, then to the constant mesh gear on the idler shaft, from this gear to the constant mesh gear on the rear axle drive shaft. (This constant mesh gear is connected to the shaft through the external tooth clutch gear which is an integral part of the shaft.) The drive for the rear axle is taken from this shaft. The constant mesh gear on the rear axle shaft in turn meshes with the constant mesh gear on the front axle shaft which provides the drive for the front axle. This path of power may be traced through on the illustration, figure 113.

c. Direct drive to the rear wheels only is accomplished by shifting the sliding gear on the front axle drive shaft out of mesh with the constant speed gear, permitting it to roll free on the shaft.

d. When using the low ratio (1.94 to 1) in the transfer case, the sliding gear on the transmission main shaft is disengaged from the constant mesh gear and engaged with the idler gear on the idler shaft. This reduces the speed by having the 17-tooth sliding gear meshing with the 33-tooth idler gear. The shifting linkage is so arranged that it is impossible to apply the increased torque due to the increased gear reduction to one axle only. In other words, when the sliding gear on the transmission main shaft is engaged with the idler gear, the sliding gear on the front axle drive shaft is automatically meshed with its constant speed gear providing the drive to the front axle.

134. DATA.

Type.....2-speed, with front axle declutching

Gear ratio
- High speed 1.1
- Low speed .....1.9411 to 1

Bearings

Main shaft (front)	New Departure 41208-XS-7
Main shaft (pilot)	New Departure 41208-XS-7
Main shaft extension (front)	New Departure 41308-XS-7
Main shaft extension (rear)	Chevrolet Part No. 901208
Idler shaft (front)	New Departure 41208-XS-7
Idler shaft (rear)	New Departure 41308-XS-7
Rear axle drive shaft (front)	New Departure 41308-XS-7
Rear axle drive (rear)	New Departure 41308-XS-7
Front axle drive shaft (front)	New Departure 41208-XS-7
Front axle drive shaft (rear)	New Departure 41208-XS-7

135. ECHELON REFERENCES.

a. Many second echelon operations are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon duties not covered in this manual.

136. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

137. GENERAL.

a. The most common abuses to which the transfer case is subjected are excessive use of 4-wheel drive and improper gear shifting.

b. The vehicle should normally be used in 2-wheel drive. Four-wheel drive should be used *only* when more power or traction is required than would be possible with 2-wheel drive. The operator should follow the gear shifting instruction given in TM 9-765.

c. Any unusual or abnormal noise which is traced to the transfer case should be investigated.

138. TROUBLE SHOOTING.

a. Noise.

Probable Cause	Probable Remedy
Transfer case loose in frame.	Tighten the 8 transfer case to frame bracket bolts and lock securely.
Insufficient lubricant.	Add lubricant.
Broken bearing caps.	Replace broken caps (par. 140).
Loose bearing caps.	Tighten bearing cap retaining screws (par. 139).
Front axle engaged on hard surface roads.	Shift into 2-wheel drive.
Worn bearings.	Overhaul transfer case.
Worn or damaged gears.	Overhaul transfer case.
Worn or loose speedometer gears.	Replace or tighten speedometer gears.

b. Lubricant Leaks.

Transfer case vent plugged up.	Replace vent.
Loose bearing retainer bolts.	Tighten bolts (par. 139).
Damaged bearing retainer gaskets.	Replace gaskets (par. 140).
Cracked transfer case.	Replace transfer case.
Filler or drain plug not properly installed.	Tighten filler and drain plugs.

Probable Cause	Probable Remedy
Cover bolts loose.	Tighten cover bolts.
Drive flange seals damaged due to improper installation or foreign material.	Replace seals (par. 140).
Drive flange retaining nuts not properly tightened.	Tighten nuts securely and install new cotter pins.
c. Slipping Out of Gear.	
Shift lock springs weak or broken.	Replace shift lock springs.
Shift lock balls sticking.	Replace shift lock balls and clean guides.
Improperly adjusted shifter shaft pull rods.	Adjust pull rods.
Misalinement of the main shaft extension.	Loosen all main shaft extension bearing retainer bolts and the 2 rear bearing lock sleeve taper bolts. Turn main shaft extension several turns by brake drum to allow shaft extension to center itself; then tighten all bolts evenly.

Section III

OPERATIONS PERFORMED WITHOUT REMOVING TRANSFER CASE FROM VEHICLE

139. TIGHTENING BEARING CAPS.

a. In case of a lubricant leak at the bearing caps, it is possible to tighten the cap screws, which retain the caps, without removing the transfer case or disconnecting the drive shafts.

140. OIL SEAL OR GASKET REPLACEMENT.

a. Front or Rear Axle Bearing Cap Gasket Replacement.

(1) DRAIN LUBRICANT. Remove the drain plug and drain the lubricant.

(2) REMOVE CAP. Remove the 4 cap screws which retain the cap and remove cap and gasket.

(3) INSTALL CAP. Install a new gasket on the cap, place the cap in position, and bolt it securely.

(4) FILL TRANSFER CASE. Fill the transfer case with 2 quarts of universal gear lubricant.

b. Front Axle Shaft, Rear Axle Shaft, or Main Shaft Front Bearing Retainer Oil Seal Replacement.

(1) DRAIN LUBRICANT. Remove the drain plug and drain the lubricant.

(2) DISCONNECT THE UNIVERSAL JOINT (figs. 107 and 108). Remove the nuts and washers from the U-clamps and remove the clamps. Slide the splined joint onto the shaft and swing the shaft away from drive flange. NOTE: It is good practice when splitting these needle bearings to tape the trunnion bearings to hold them in place.

(3) REMOVE DRIVE FLANGE. Remove cotter pin, retaining nut, and drive flange.

(4) REMOVE BEARING RETAINER. Remove the 4 retaining cap screws and remove the bearing cap and gasket.

(5) REMOVE SEAL. Support the bearing retainer in a bench vise and drive the old seal out.

(6) INSTALL NEW SEAL. Coat the outer edge of seal with sealing compound to prevent lubricant seepage around the seal. Place the seal in the cap with the free end of the leather toward the inside, and press the seal into position using a block of wood to distribute the pressure

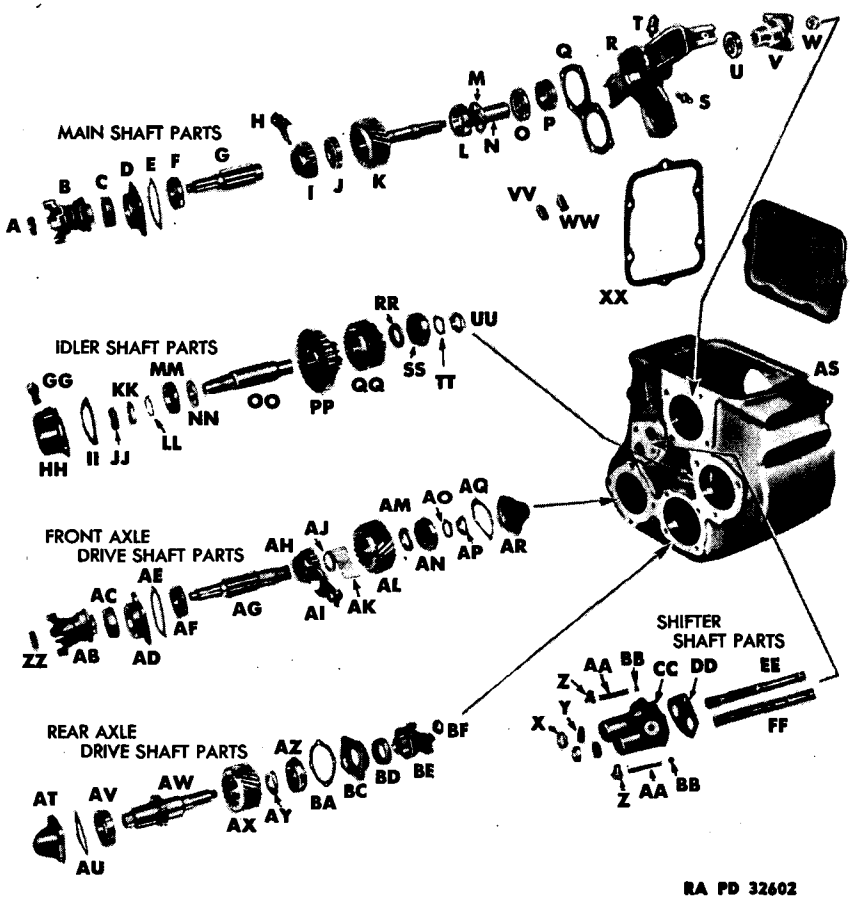

Figure 114 — Transfer Case Parts Layout

so that the seal will not be damaged. CAUTION: The seal must be soaked in engine oil until the leather is saturated before installing, or the seal will be damaged in operation due to friction on the flange.

(7) INSTALL BEARING RETAINER. Place a new gasket on the retainer, install the retainer, and tighten the 4 cap screws.

(8) INSTALL DRIVE FLANGE. Install the drive flange, retaining nut, and cotter pin. NOTE: Tighten the nut to a locking position but do not back it off to get the cotter pin in, as this may cause a grease leak along the spline.

OPERATIONS PERFORMED WITHOUT REMOVING TRANSFER CASE FROM VEHICLE

A—FLANGE NUT
B—UNIVERSAL JOINT FLANGE
C—OIL SEAL
D—BEARING RETAINER
E—GASKET (BEARING RETAINER)
F—BEARING (N.D. 41208-XS-7)
G—MAIN SHAFT
H—SHIFTER YOKE
I—SLIDING GEAR
J—BEARING (MAIN SHAFT PILOT N.D. 41208-XS-7)
K—MAIN SHAFT EXTENSION
L—BEARING (N.D. 41308-XS-7)
M—SPACER
N—BEARING RETAINER GUIDE
O—LOCK SLEEVE (BEARING)
P—BEARING
Q—GASKET (BEARING RETAINER)
R—BEARING RETAINER
S—LOCK SCREW (BEARING LOCK SLEEVE)
T—VENT
U—OIL SEAL
V—FLANGE (MAIN SHAFT EXTENSION)
W—FLANGE NUT
X—OIL SEAL RETAINER (SHIFTER SHAFT)
Y—OIL SEAL (SHIFTER SHAFT)
Z—BALL SPRING PLUG (SHIFTER SHAFT)
AA—BALL SPRING (SHIFTER SHAFT)
BB—BALL
CC—SHIFTER SHAFT SUPPORT
DD—GASKET (SHIFTER SHAFT SUPPORT)
EE—SHIFTER SHAFT (FRONT AXLE)
FF—SHIFTER SHAFT (LOW SPEED)
GG—DRIVEN GEAR (SPEEDOMETER)
HH—BEARING CAP
II—GASKET (BEARING CAP)
JJ—DRIVE GEAR (SPEEDOMETER)
KK—NUT (BEARING RETAINING)
LL—NUT LOCK (BEARING RETAINING)
MM—BALL BEARING (N.D. 41208-XS-7)
NN—BEARING SPACER
OO—IDLER SHAFT
PP—IDLER LOW SPEED GEAR
QQ—CONSTANT MESH GEAR (IDLER SHAFT)
RR—BEARING SPACER
SS—BALL BEARING (N.D. 41308-XS-7)
TT—NUT LOCK (BEARING RETAINING)
UU—NUT (BEARING RETAINING)
VV—DRAIN PLUG
WW—FILLER PLUG
XX—COVER GASKET
YY—CASE COVER
ZZ—FLANGE NUT
AB—UNIVERSAL JOINT FLANGE
AC—OIL SEAL
AD—BEARING RETAINER
AE—GASKET (BEARING RETAINER)
AF—BALL BEARING (N.D. 41208-XS-7)
AG—DRIVE SHAFT (FRONT AXLE)
AH—SLIDING GEAR
AI—SHIFTER YOKE
AJ—GEAR SPACER
AK—GEAR ROLLER
AL—CONSTANT MESH GEAR (FRONT AXLE DRIVE SHAFT)
AM—BEARING SPACER
AN—BALL BEARING (N.D. 41208-XS-7)
AO—NUT LOCK
AP—NUT (BEARING RETAINING)
AQ—GASKET (BEARING RETAINER)
AR—BEARING RETAINER
AS—TRANSFER CASE
AT—BEARING RETAINER
AU—GASKET BEARING RETAINER
AV—BALL BEARING (N.D. 41308-XS-7)
AW—DRIVE SHAFT (REAR AXLE)
AX—CONSTANT MESH GEAR (REAR AXLE DRIVE SHAFT)
AY—BEARING SPACER
AZ—BALL BEARING (N.D. 41308-XS-7)
BA—GASKET (BEARING RETAINER)
BC—BEARING RETAINER
BD—OIL SEAL
BE—UNIVERSAL JOINT FLANGE
BF—FLANGE NUT

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Legend for Figure 114 — Transfer Case Parts Layout

(9) CONNECT THE UNIVERSAL JOINT (figs. 107 and 108). Remove the tape from the trunnion bearings, place the bearings in position, install the U-clamps, washers, and retaining nuts.

(10) FILL TRANSFER CASE. Fill the transfer case with 2 quarts of universal gear lubricant.

c. Main Shaft Extension Bearing Retainer Oil Seal or Gasket. Due to the construction of the main shaft and extension, it is not advisable to attempt to change the main shaft extension bearing retainer or oil seal without removing the transfer case.

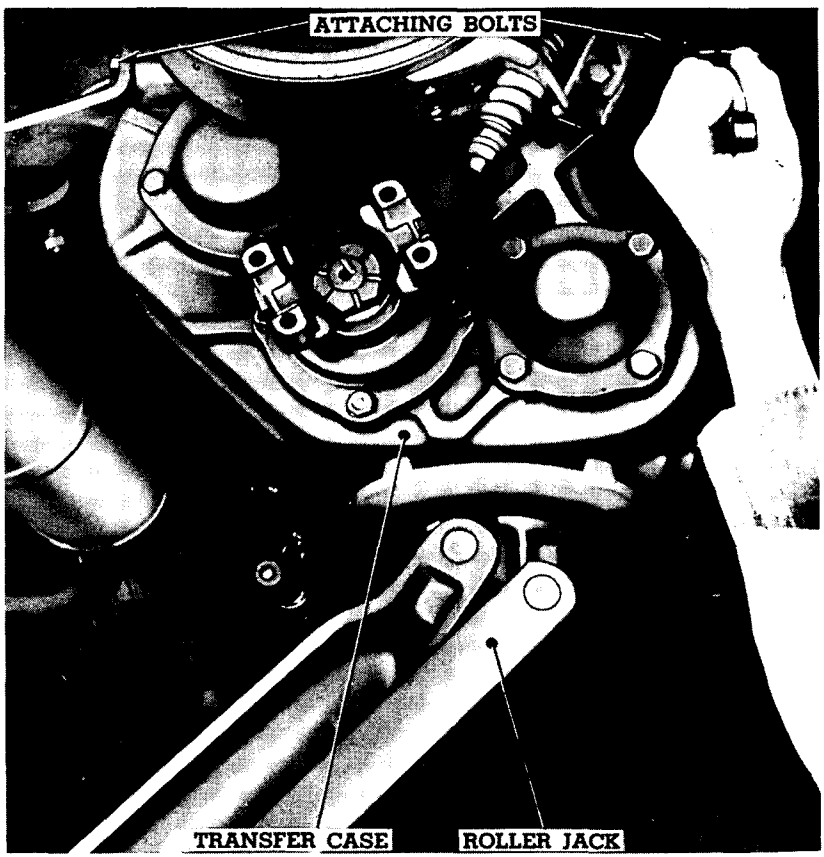
Section IV

TRANSFER CASE REMOVAL FROM VEHICLE

141. TRANSFER CASE REMOVAL.

a. Drain Lubricant. Remove the filler and drain plugs; when lubricant is drained, install filler and drain plugs.

b. Disconnect Three Universal Joints (figs. 107 and 108). Remove the nuts, lock washers, and U-clamps. Slide the slip joints back on the



RA PD 32320

Figure 115 — Transfer Case Removal

shaft and swing the shaft away from the drive flange. NOTE: It is good practice to tape the trunnion bearings to hold them in place and keep them clean (fig. 108).

c. Disconnect Shift Rods. Remove the cotter pins and clevis pins which attach the transfer case shift rods to the transfer case shifter shafts.

d. Disconnect Parking Brake Pull Rod. Remove the cotter pin which attaches the pull rod to brake cam.

e. Disconnect Speedometer Cable. Disconnect the speedometer cable from the speedometer driven gear.

f. Remove Transfer Case (fig. 115). Place a roller jack under the transfer case from the right side of the truck and raise the jack to support the unit. Remove the lock plates and remove the 8 cap screws which attach the transfer case to the frame brackets. NOTE: Two men should steady the transfer case while the jack is being lowered and the jack and case is pulled out from under the truck.

Section V

TRANSFER CASE DISASSEMBLY

142. TRANSFER CASE DISASSEMBLY.

a. Remove Parking Brake (fig. 124). Remove the 4 bolts which attach the parking brake bracket to the transfer case bearing retainer. Remove the brake band anchor bolt and pull the band assembly off the drum. Remove the 4 nuts which attach the drum to flange and remove the drum.

b. Remove Transfer Case Cover. Remove the 6 transfer case cover bolts, and remove the cover.

c. Remove Main Shaft Drive Flange. Remove the cotter keys which lock the 2 flange retaining nuts. Hold the flanges on the main shaft and main shaft extension with a heavy Stillson wrench and remove the retaining nuts. Tap the drive flanges off the shafts.

d. Remove the Shifter Fork. Reaching in through the top of the case, remove the bolt which attaches the transmission shaft sliding gear shifter fork to the shifter shaft and remove the fork.

e. Remove Main Shaft Bearing Retainer (fig. 113). Remove the cap screws which attach the main shaft front bearing retainer and remove the retainer.

f. Remove Main Shaft (fig. 116). Place the puller spacer over the main shaft ahead of the sliding gear; install main shaft pilot bearing puller KM-J1669 by screwing the puller shaft on the main shaft. Turning the puller handle will pull the main shaft out of the pilot bearing in the main shaft extension. Remove main shaft, puller spacer, and sliding gear. Remove puller from main shaft.

g. Main Shaft Pilot Bearing. The pilot bearing is a slip fit to a 0.0003-inch press fit in the shaft extension. If it is a slip fit remove it from the shaft extension; however, if the bearing is tight in the shaft extension, it should not be removed, as it can be thoroughly cleaned without removal.

h. Drive Main Shaft Extension Out of Outer Bearing. Drive the main shaft extension in toward the center of the case until the shaft is free of the outboard bearing in the retainer.

TRANSFER CASE DISASSEMBLY

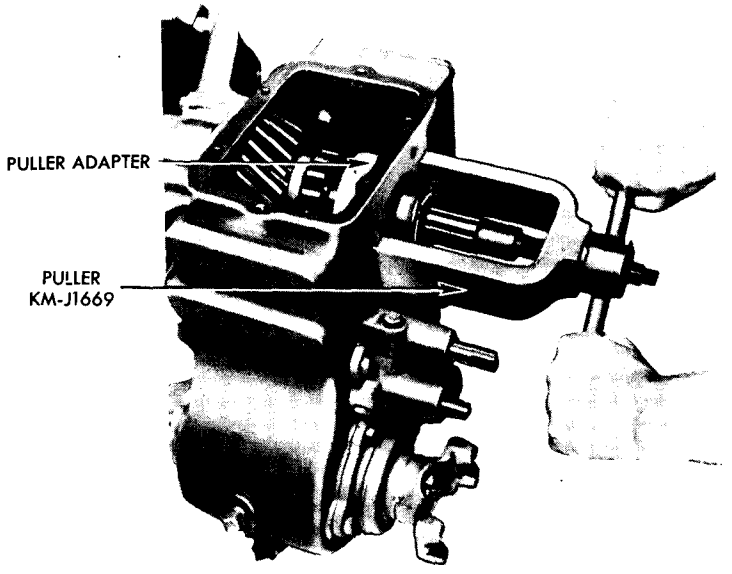


Figure 116 — Pulling Main Shaft Out of Pilot Bearings

i. Remove Main Shaft Extension Bearing Retainer (fig. 114). Remove the 8 cap screws, which attach the main shaft extension bearing retainer to the case, and remove the retainer.

j. Remove Main Shaft Extension. Remove the main shaft extension and constant mesh gear through the top of the case.

k. Remove Shaft Extension Rear Bearing. Remove the 2 lock screws which bear against the main shaft extension rear bearing lock sleeve, and remove the sleeve and bearing from the bearing retainer.

l. Remove Speedometer Driven Gear. Remove the speedometer-driven gear and shaft from the bearing cap.

m. Remove Bearing Caps (fig. 113). Remove the plain top bearing caps, 2 on the front and 1 on the rear side of the transfer cases.

n. Remove Bearing Lock Nuts (fig. 113). Raise the lip of the lock plates which retain the nuts on the rear end of the front axle drive shaft and the rear end of the idler shaft. Hold the propeller shaft drive flange with a large Stillson wrench and, using a 2-inch socket wrench, remove the bearing retaining nuts from the idler and front axle shafts.

o. Remove Drive Flanges. Remove the cotter pins, flange retaining nuts, and the drive flanges from the front and rear axle drive shafts.

p. Remove Bearing Retainer. Remove the cap screws which retain the rear axle and front axle bearing retainers, and remove the retainers. CAUTION: All shafts are removed from the front of the case.

q. Remove Idler Shaft Assembly. Drive the idler shaft out of the case (rear to front) until the shaft clears the bearing. Support the idler shaft gears and pull the shaft out of the case. Remove the idler gears, being careful that they do not fall apart as they are removed from the case.

r. Remove Front Axle Shifter Fork. Remove the bolt which attaches the shifter fork for the sliding gear on the front axle shaft to its shifter shaft, and remove the fork.

s. Remove Shifter Shaft and Support Assembly. Unscrew the 2 shifter lock plugs, and remove the springs and balls. Remove the 2 screws which attach the shifter shaft support to the case; then remove the support and shafts as an assembly.

t. Remove Shifter Shafts. Remove the shifter shafts from the support by pulling them out from the case side to prevent the notches in the shaft from damaging the cork seals.

u. Remove Front and Rear Axle Shafts. Remove the rear axle and front axle shafts in the same manner as described for the idler shaft. Remove the gears, roller bearings, and spacers from the case.

v. Remove Ball Bearings (fig. 113). Remove the ball bearings from the rear side of the case. These bearings are a slip fit and can be removed by hand, or if they bind slightly, tap them lightly with a hammer handle.

w. Remove Filler and Drain Plugs. Remove the filler and drain plugs. NOTE: The drain plug is a magnetic plug which attracts any small metal particles, such as a small chip off a gear, and thereby prevents metal particles from being circulated through the gears with the lubricant.

143. CLEANING AND INSPECTION.

a. Wash Parts (fig. 114). Wash all parts thoroughly in cleaning solvent and lay them out on a clean bench.

b. Clean and Inspect Bearings.

(1) Wash the bearings thoroughly in clean cleaning solvent.

(2) Blow out the bearings with compressed air, while turning the bearing by hand. CAUTION: Do not allow ball bearings to be spun by the air stream. Spinning bearings is liable to imbed small particles of grit in the races and damage the bearings.

(3) After making sure the bearings are clean, lubricate with light engine oil and check them for wear or roughness. Roughness may be determined by slowly turning the outer race by hand. Any damaged bearings should be replaced.

c. Inspection.

(1) Inspect the case for any indication of cracks; tapping with a light hammer will sometimes reveal small cracks between bearing bores that otherwise might be overlooked.

(2) Inspect all gears for worn, cracked, or chipped teeth.

(3) Inspect the bearing bores in the constant mesh gears for scoring.

(4) Inspect the sliding gears for worn splines and free fit on the splines of the main shaft. Any worn or damaged gears should be replaced.

(5) Inspect the front axle drive shaft for wear or scoring at the point where the roller bearings of the constant mesh gear engage the shaft. Damaged shaft should be replaced.

(6) Inspect the shifter shafts for wear or damage at the shift lock notches. Check the condition of the cork seals in the shifter shaft support.

Section VI

TRANSFER CASE REPAIR AND ASSEMBLY

144. REPAIR OPERATIONS.

a. Bearing Replacement.

(1) The bearings that are pressed on the transmission, rear axle, and front axle shafts can be removed and replaced in an arbor press.

(2) To remove the bearing from the idler shaft, first press off the speedometer drive gear in an arbor press. Then place the idler shaft in a vise equipped with copper jaws to protect the shaft. The keyway in the shaft should be against one of the vise jaws to prevent turning. Raise the lip of the nut lock and then remove nut. The bearing may then be removed and replaced in an arbor press.

(3) It will not be necessary to remove the bearing pressed on the main shaft extension unless the bearing or constant mesh gear which is a part of the shaft extension is damaged and requires replacement.

(4) When necessary, the bearing may be removed from the main shaft extension by using bearing remover KM-J1710. To replace the bearing, press it on the shaft in an arbor press.

b. Speedometer Gear Replacement (fig. 114). To replace a speedometer drive gear when the transfer case is disassembled, it is only necessary to press off the damaged gear and press on a new one.

c. Oil Seal Replacement (fig. 114).

(1) If there was no indication of lubricant leaks at the drive flange oil seals when the transfer case was being disassembled, there will be no need for replacement. On the other hand, if lubricant leaks were evident, the seals should be replaced.

(2) To remove a damaged seal from the bearing cap, place the cap in a bench vise and drive out the seal, using a punch and hammer. When installing a new seal, it should first be soaked in engine oil to prevent damage to the seal before the lubricant would reach it.

(3) Coat the outer edge of the seal with sealing compound to prevent lubricant seepage around the seal. Place the seal in the bearing cap with the free end of the leather toward the inside; then press it into the cap, using a block of wood to distribute the pressure on the seal.

TRANSFER CASE REPAIR AND ASSEMBLY

d. Shifter Shaft Support Seals (fig. 114). The shifter shaft support seals are made up of a cork ring and a stamped retainer and may easily be replaced by driving out the damaged seal and replacing it with a new one.

145. TRANSFER CASE REASSEMBLY.

a. Prelubrication. When reassembling the transfer case assembly, care should be taken to prelubricate all moving parts during the process of assembly. This is most important to avoid the possibility of scoring a bearing surface before the regular lubricant is circulated to all parts.

b. Gear Identification. Constant mesh gears having left-hand helix angle should be installed on the idler shaft and front axle shaft, while the constant mesh gear with the right-hand helix angle should be installed on the rear axle shaft. The main shaft constant mesh gear is an integral part of the main shaft extension.

c. Front Axle Drive Shaft Installation (figs. 117 and 118).

(1) Start the front axle drive shaft into the case from the front side; then thread the sliding gear on the shaft, shifter fork groove first. Then install a thin spacer.

(2) Coat the inner bearing surface of the constant mesh (left-hand angle) gear with cup lubricant and install the gear over the shaft; then push the shaft in place.

(3) Install 32 roller bearings between the shaft and inner diameter of the gear as shown in figure 117. Assemble a thick spacer on shaft through bearing opening in case.

(4) Support the splined end of the shaft on a block of wood; install the ball bearing with the snap ring toward the outside; drive the bearing in place, using transfer case bearing driver KM-J1857 shown in figure 118.

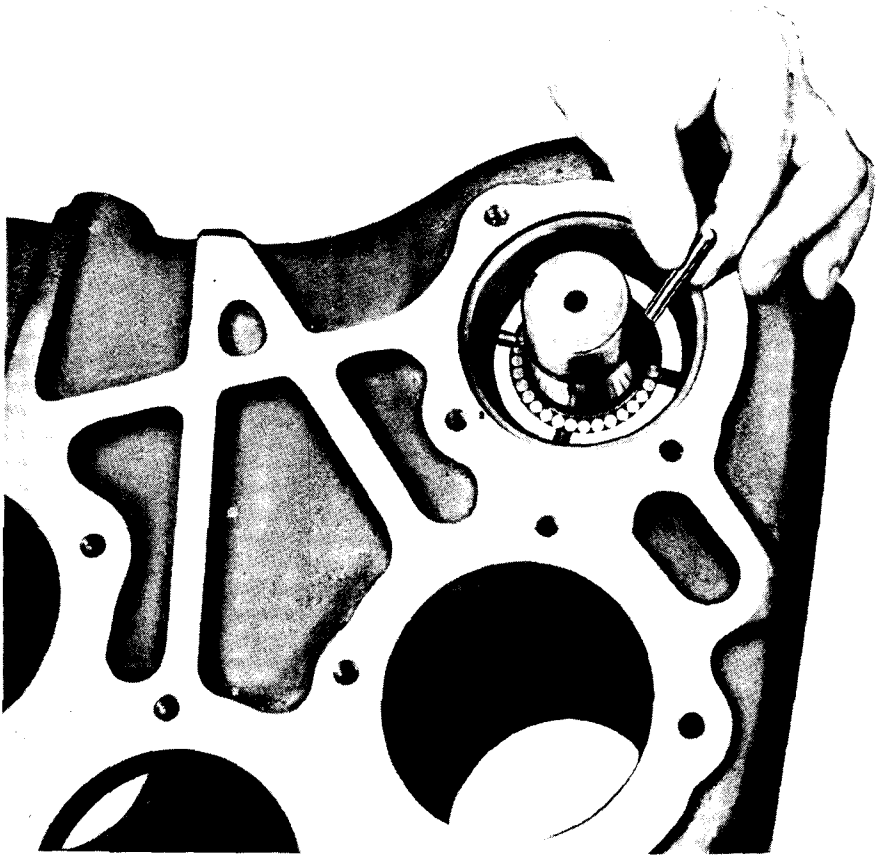
(5) Assemble the nut lock and nut on the shaft, and turn up the nut finger-tight.

(6) Install the front bearing retainer with oil seal, using a new gasket. Tighten the screws securely.

(7) Assemble the propeller shaft flange on the splined end of the shaft, making sure that the cotter pin hole in the shaft is at right angles to trunnion bearing seats in the flange.

(8) While holding the drive flange with a Stillson wrench, assemble the retaining nut and tighten it securely.

(9) Then tighten the nut on the rear end of the shaft using a 2-inch socket wrench and turn down one of the tangs on the lock against



RA PD 32604

Figure 117 — Installing Constant Mesh Gear Roller Bearings

the flat of the nut. NOTE: The tang that will bend over on the right-hand end of the flat on the nut should be used to prevent any possibility of the nut starting to loosen.

(10) Assemble the rear bearing cap, using a new gasket. Tighten the screws securely.

d. Rear Axle Drive Shaft Installation (figs. 113 and 118).

(1) Start the rear axle drive shaft in through the front of the case. Slide the constant mesh gear (right-hand angle) on the shaft and mesh the internal teeth of the constant mesh gear with the gear machined on the shaft.

(2) Install a thick spacer washer on the shaft through bearing bore in case.

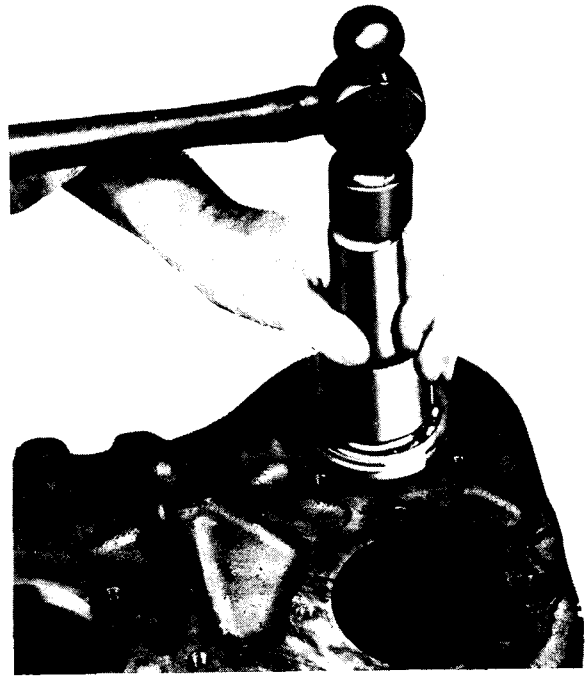


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Figure 118 — Installing Shaft Bearing

(3) Support the front end of shaft and drive the rear bearing in place, using transfer case bearing driver KM-J1857.

(4) Install the rear bearing cap and oil seal and the front bearing cap, using new gaskets.

(5) Assemble the propeller shaft flange on the splined end of shaft, making sure that the cotter pin hole is at right angles to trunnion bearing seats in flange. Assemble the retaining nut and tighten it securely.

e. Shifter Shaft Support Installation (fig. 114).

(1) Assemble the shifter shafts to the support from the case side, placing the shaft with the 3 shift lock notches in the upper hole.

(2) Assemble the support assembly to the case, using a new gasket. Tighten the bolts securely.

(3) Assemble the shifter yoke in the groove of the front axle shaft, sliding gear with the ribbed side of the fork toward the gear. Slide the shaft into the yoke; line up the notch in the shaft with the bolt hole in the yoke. Install the bolt and lock washer and tighten the bolt securely.

f. Idler Shaft Installation.

(1) Mesh the internal teeth of the constant mesh gear (left-hand angle) on the 17-tooth clutch gear machined on the idler gear, and place this assembly inside the case with the idler toward the front.

(2) Install the drive pin in the shaft and slide the shaft into the gears, being sure to mate the drive pin with the keyway in the idler gear.

(3) Install a thick spacer washer on the shaft through the bearing bore in the case.

(4) Support the front end of the shaft and drive the rear bearing in place using transfer case bearing driver KM-J1857.

(5) Assemble the bearing nut lock and nut on the shaft. Tighten the nut securely and lock it by bending down one of the tangs of the lock against one of the flat sides of the nut, as described in subparagraph c above.

(6) Install the front bearing retainer, using a new gasket. Tighten the bolts securely. NOTE: The teeth of the speedometer drive gear must be prelubricated.

(7) Lubricate and install the speedometer-driven gear and shaft.

g. Transmission Main Shaft Installation (fig. 113).

(1) Install the main shaft extension bearing in the bearing retainer; then install the bearing lock sleeve with its flat side toward the bearing. Install the 2 taper lock screws and tighten them alternately, until the bearing is firmly locked in the retainer. Then tighten the lock screw check nuts securely.

(2) Thread the main shaft extension in through top of case and enter bearing into opening in case. Install spacer over shaft.

(3) Assemble bearing retainer to case, using a new gasket. Install the 8 cap screws and tighten them securely.

(4) Using a soft steel drift punch, drive the main shaft extension into its outboard bearing.

(5) Install transmission main shaft pilot bearing in the main shaft extension.

(6) Start transmission main shaft in through front of case and thread the sliding gear over the shaft, shifter fork groove first. Then enter the pilot on shaft in bearing.

(7) Using transfer case bearing driver KM-J1857, drive main shaft into pilot bearing until it is seated as shown in figure 119. Install bearing retainer, using a new gasket. Tighten the bolts securely.

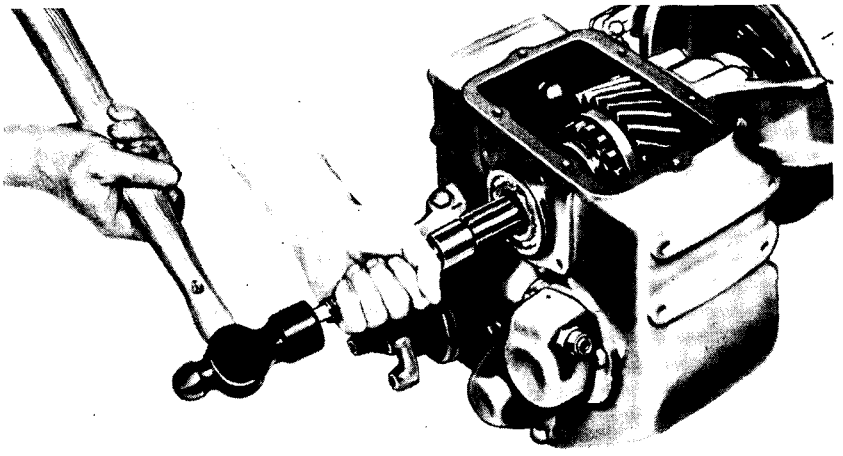

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Figure 119 — Assembling Main Shaft in Pilot Bearing

(8) Assemble the propeller shaft flanges on the splined end of the main shaft and main shaft extension, making sure that the cotter pin holes in the shafts are at right angles to the trunnion bearing seats in the flanges.

(9) While holding the drive flanges with a Stillson wrench, assemble the retaining nuts and tighten them securely.

h. Install Parking Brake.

(1) Install the 4-flange-to drum bolts in the flange, place the drum on the flange, and install the washers and nuts.

(2) Place the brake band assembly in position and install the 4 bracket bolts.

(3) Adjust the parking brake according to instructions in paragraph 183.

i. Transmission Main Shaft Sliding Gear Shifter Yoke Installation. Assemble the shifter yoke in the groove of the sliding gear with the ribbed side of the yoke toward the gear. Slide the shaft into the fork; line up the notch in the shaft with the bolt hole in the fork. Install the bolt and lock washer and tighten the bolt securely.

j. Install Shifter Lock Balls. Install the shift lock balls, springs, and plugs in the shifter shaft support.

k. Check the Operation of Transfer Case. Check the operation of the transfer unit in all operating positions, high, low, neutral, rear drive only, and dual drive.

l. Lock Drive Flange Retaining Nuts. Install cotter pins to lock the propeller shaft driving flange retaining nuts. **NOTE:** Do not back off the nuts to install the cotter pins.

m. Install Cover. Install the transfer case cover gasket and cover. Tighten securely.

Section VII

TRANSFER CASE INSTALLATION IN VEHICLE

146. TRANSFER CASE INSTALLATION.

a. Install Case (fig. 115). Place the unit on a roller jack and roll it under the vehicle from the right side. Raise the jack and guide the transfer case into position. Install the 8 retaining bolts and tighten securely. Install the 4 lock plates and 8 cotter pins.

b. Connect Speedometer Cable. Connect the speedometer cable to driven gear fitting on the idler shaft front cap.

c. Connect Shifter Rods. Connect the shifter rod to transfer case shifter shafts and install the clevis pins and cotter pins.

d. Connect Parking Brake Pull Rod. Connect the parking brake pull rod by installing the clevis pin and cotter pin which attaches the pull rod to brake operating cam.

e. Connect the Universal Joints (fig. 107). Connect the 3 universal joints to the drive flanges by removing the tape from trunnion bearings, placing the trunnion bearings against the drive flanges, and installing the U-clamps, lock washers, and nuts.

f. Lubricate Universal Joints. Lubricate the universal joints which were disconnected.

g. Fill Transfer Case. Fill the transfer case with 2 quarts of universal gear lubricant.

Section VIII

FITS AND TOLERANCES

147. FITS AND TOLERANCES.

a. Gear Backlash.

Helical .....0.010 in.—0.015 in. on 5-in. centers

Spur .....0.010 in.—0.015 in. on 5-in. centers

b. Idler Shaft.

Low speed gear to shaft clearance.....0.0003 in.—0.00023 in.

Constant mesh gear to shaft clearance.....0.0003 in.—0.0018 in.

c. Rear Axle Drive Shaft.

Constant mesh gear to shaft clearance.....0.0002 in.—0.0017 in.

d. Shifter Shafts.

Shifter shafts to support clearance.....0.0015 in.—0.0035 in.

e. Shifter Shaft Ball Springs.

Free length .....2 in. max

Pounds pressure at 1⅜ in., compressor spring length.....32 lb ± 2 lb

Section IX

SPECIAL TOOLS

148. SPECIAL TRANSFER CASE TOOL LIST.

a. The following tools manufactured by the Kent-Moore Organization, or their equivalent, are recommended for use when performing the service operations covered in this section.

DRIVER, transfer case bearing, KM-J1857

PULLER, main shaft pilot bearing, KM-J1669

REMOVER, main shaft extension bearing, KM-J1710

CHAPTER 8

BRAKE SYSTEM

Section I

INTRODUCTION

149. DESCRIPTION.

a. The brake system consists of main cylinder, wheel cylinders, brake shoes and attaching parts, brake drums, parking brake, and the necessary tubing and fittings. In addition, the system incorporates a Hydrovac system and a trailer electric brake control. The operation of the brake system is covered in TM 9-765.

150. DATA.

a. Service Brake.

Type ..... 4-wheel hydraulic

b. Hand Brake.

Type ..... Hand-operated mechanical linkage to brake at rear of transfer case.

c. Main Cylinder.

Mounting size ..... L. H. frame side rail 1¼ in.

d. Front Wheel Cylinder Size ..... 1¼ in.

e. Rear Wheel Cylinder Size ..... 1½ in.

f. Front Brakes.

Diameter ..... 14 in.
Width ..... 2 in.
Lining area (sq in. per shoe) ..... 56½ in.
Brake shoe length ..... 14⅛ in.
Brake shoe width ..... 2 in.
Brake lining thickness ..... 0.265 in. to 0.272 in.

INTRODUCTION

g. Rear Brakes.

Diameter ..... 16 in.
Width ..... 3 in.
Lining area (sq in. per shoe) ..... 105.1 in.
Brake shoe length ..... 17 37/64 in.
Brake shoe width ..... 3 in.
Brake lining thickness ..... 0.265 in. to 0.272 in.

h. Hand Brake Lining.

Lining length ..... 29½ in.
Width ..... 3 in.
Thickness ..... 5/16 in.

i. Master Cylinder.

Fluid level ..... Fill to top of reservoir
Brake fluid ..... Dupont or Delco Super No. 9

j. Brake Drums.

Diameter front drums ..... 14 in.
Diameter rear drums ..... 16 in.
Diameter parking brake drum ..... 9½ in.

k. Front Shoe Adjustment.

From slight drag on drum, back off 4 notches on adjusting screws at each end of wheel cylinder.

l. Rear Shoe Adjustment.

Back off ⅔ turn or 4 sides of hex. head of adjusting bolt from slight drag, at each end of wheel cylinder.

m. Brake Return Springs.

Master cylinder piston spring:
  Free length ..... 3½ in.
  Pounds pressure at 2 5/16 in. ..... 8½ to 10 lb
Front wheel cylinder piston spring:
  Free length ..... 2 13/64 in.
  Pounds pressure at 1¾ in. ..... 1 lb ± ¼ lb
Rear wheel cylinder piston spring:
  Free length ..... 2⅞ in.
  Pounds pressure at 1¾ in. ..... 1¼ lb ± ¼ lb
Front shoe return spring:
  Free length ..... 7 7/16 in.
  Pounds pull at 8 5/32 in. ..... 100 lb ± 8 lb

Rear shoe return spring:
Free length ..... 7 7/16 in.
Pounds pull at 8 3/8 in. ..... 125 lb ± 10 lb

Pedal return spring:
Free length ..... 6 1/8 in.
Pounds pull at 8 23/32 in. ..... 55 lb ± 5 lb

Hand brake pull back spring:
Free length ..... 6 5/16 in.
Pounds pressure at 8 5/16 in. ..... 50 lb ± 5 lb

n. Hydrovac Unit.

Make ..... Bendix
Model H-66-3.3
Stroke ..... 3 3/16 in.
Vacuum cylinder displacement ..... 2.505 cu in.

151. ECHELON REFERENCES.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon duties not covered in this manual.

152. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

153. TROUBLE SHOOTING.

a. Brake Pedal.

Probable Cause	Probable Remedy
Brake pedal "spongy."	Air in lines bleed brakes (par. 185).
Brake pedal hard.	Lubricate brake pedal shaft.

b. All Brakes Drag.

Wrong type of fluid in hydraulic system.	Thoroughly flush out all lines and cylinders and replace all rubber parts.
Improper toe board clearance.	Adjust toe board clearance.
Dirt in main cylinder.	Remove main cylinder and clean thoroughly (pars. 162 and 164).
Brake shoes adjusted too tight.	Adjust brakes (par. 186).

c. One Brake Drags.

Loose wheel bearings.	Adjust wheel bearings (TM 9-765).
Weak or broken retractor springs.	Replace springs.
Brake shoes adjusted too tight.	Adjust brakes (par. 186).

d. Loose Brakes.

Normal lining wear.	Adjust or reline brakes.
Fluid low in main cylinder.	Fill cylinder and bleed all brakes (par. 185).

e. Brakes Uneven.

Grease or brake fluid on lining.	Thoroughly clean brake mechanism and install new lining (TM 9-765).
Shoes tight on brake anchor.	Remove brake drum and free shoes on anchor.
Tires improperly inflated.	Inflate tires to 55 pounds.
Spring center bolt broken and spring shifted on axle.	Replace spring center bolt; relocate spring on axle.

f. Excessive Pedal Pressure, Poor Brakes.

Probable Cause	Probable Remedy
Grease or Brake Fluid on linings.	Thoroughly clean brake mechanism and install new lining.
Full area of lining not contacting drum.	Grind shoe to fit drum.
Scored brake drum.	Turn down or replace drum; check lining and replace if damaged (TM 9-1765A).

Section III

OPERATIONS PERFORMED WITHOUT REMOVING UNITS FROM VEHICLE

154. REPAIRS TO UNITS.

a. General. The brake system is made up of many different units and some of the units are made up of several parts that are alike. It is not necessary to remove all of the wheel cylinders or brake shoes if only one or two are at fault. The wheel cylinders which are used at each wheel, and brake shoes, two of which are used in each wheel, are alike. Therefore, the only operations that can be performed without removing the units from the vehicle are maintenance items which are as follows:

(1) Brake adjustment (par. 186).

(2) Brake bleeding (par. 185).

(3) Parking brake adjustment (par. 183).

Section IV

BRAKE SYSTEM UNITS, REMOVAL FROM VEHICLE

155. MAIN CYLINDER REMOVAL.

a. Procedure. Remove clevis pin from main cylinder link to idler lever. Disconnect brake pipe from main cylinder end plug. Remove wires from stop light switch. Remove the 2 nuts which attach the main cylinder to the frame bracket.

156. WHEEL CYLINDER REMOVAL.

a. Procedure. Loosen the 6 wheel nuts. Place jack under axle housing and raise vehicle until the wheel clears the ground. Remove the 6 wheel nuts and lift o the wheel with tire. Raise the tangs on the axle shaft flange bolt lock and remove the 8 cap screws that retain the flange; remove the flange or axle shaft. Raise the tang on the wheel bearing lock nut lock and remove the lock nut and lock. Remove the adjusting nut and pull off the hub and brake drum. Remove the brake shoe retracting springs. Disconnect the hydraulic pipe or hose from the wheel cylinder. Remove the 2 cap screws that attach the wheel cylinder to the brake flange plate and lift off the wheel cylinder.

157. BRAKE DRUM REMOVAL.

a. Procedure. Loosen the 6 wheel nuts. Place jack under axle housing and raise the vehicle until the wheel clears the ground. Remove the 6 wheel nuts and lift off the wheel with tire. Raise the tangs on the axle shaft flange bolt lock and remove the 8 cap screws that retain the flange; remove the flange on axle shaft. Raise the tang on the wheel bearing lock nut lock and remove the lock nut and lock. Remove the adjusting nut and pull off the hub and brake drum.

158. BRAKE SHOE REMOVAL.

a. Procedure (figs. 120, 121, and 122). Loosen the 6 wheel nuts. Place jack under axle housing and raise vehicle until the wheel clears the ground. Remove the 6 wheel nuts and lift off the wheel with tire.

BRAKE SYSTEM UNITS, REMOVAL FROM VEHICLE

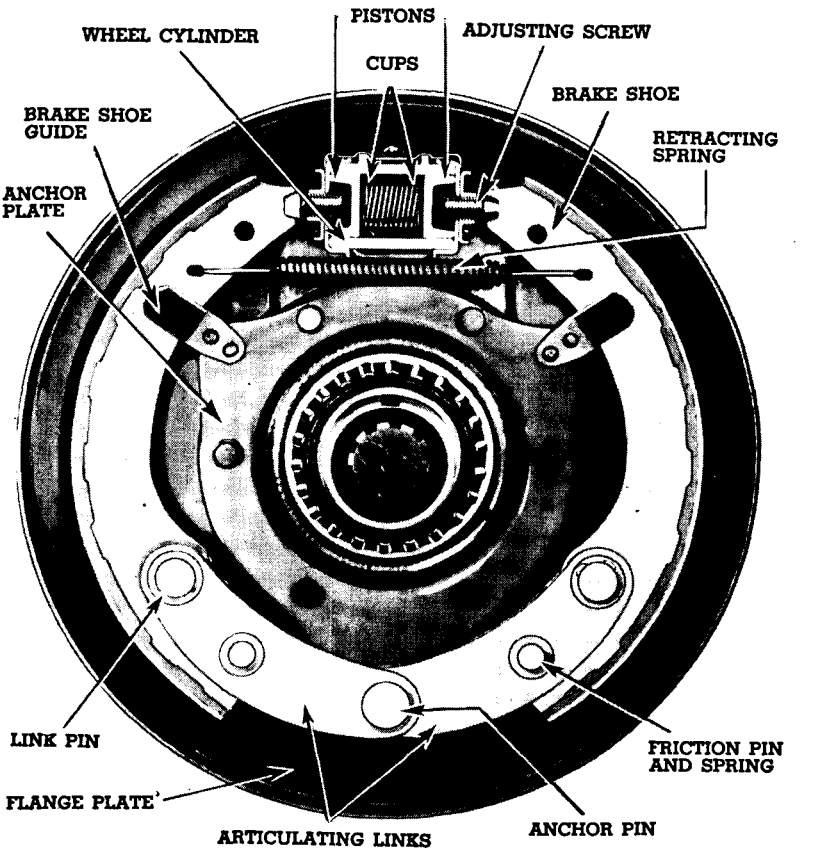
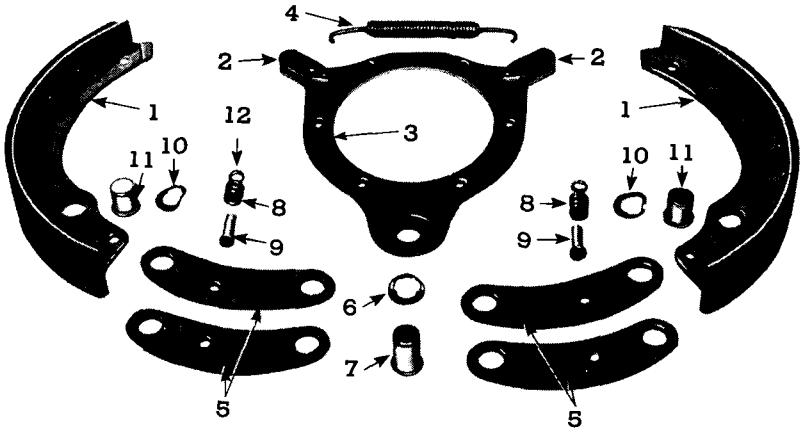


Figure 120 — Brake Construction — Front Wheel

Raise the tangs on the axle shaft flange bolt lock and remove the 8 cap screws that retain the flange; remove the flange or axle shaft. Raise the tang on the wheel bearing lock nut lock and remove the lock nut and lock. Remove the adjusting nut and pull off the hub and brake drum. Install wheel cylinder clamp as shown in figure 123, and remove the brake shoe retracting springs. Remove the friction pins and springs. Remove the link pins from each shoe and lift off the shoes (fig. 120).

159. PARKING BRAKE BAND REMOVAL (fig. 124).

a. Procedure. Remove the lock nut, lock washer, adjusting nut, flat washer, and spring from the large adjusting bolt. Remove cotter key



1 — BRAKE SHOE
2 — BRAKE SHOE GUIDE
3 — ANCHOR PLATE
4 — RETRACTING SPRING
5 — ARTICULATING LINKS
6 — ANCHOR PIN LOCK
7 — ANCHOR PIN
8 — ARTICULATING LINK FRICTION SPRING
9 — FRICTION SPRING PIN
10 — ARTICULATING LINK PIN LOCK
11 — ARTICULATING LINK PIN
12 — FRICTION SPRING PIN LOCK

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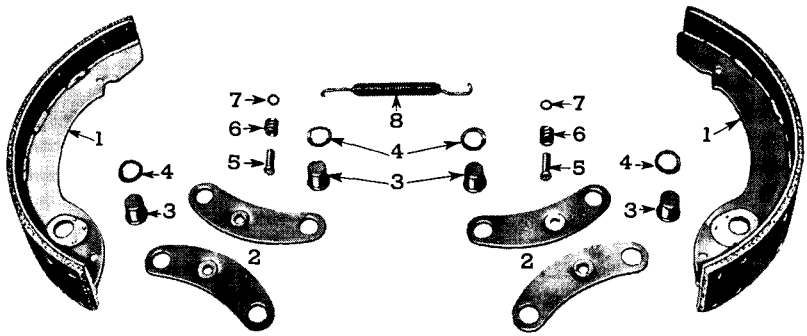
Figure 121 — Brake Parts — Front Wheel

and clevis pin from operating cam and adjusting bolt. Remove adjusting bolt and upper shoe spring. Remove nuts from lower shoe adjustment screw, and remove the screw and lower shoe spring. Remove rear anchor screw lock wire and remove the screw. Then slide the shoe assembly off the anchor.

160. HYDROVAC REMOVAL.

a. Procedure. Disconnect the hydraulic brake lines at the Hydrovac unit which lead to the main cylinder and wheel cylinders. Remove the hose connections to the air cleaner and the vacuum line. Remove the nuts which retain the Hydrovac unit to the frame side rail, and remove the unit.

BRAKE SYSTEM UNITS, REMOVAL FROM VEHICLE



1 — BRAKE SHOE AND LINING
2 — BRAKE SHOE ARTICULATING LINK
3 — ARTICULATING LINK PIN
4 — ARTICULATING LINK PIN LOCK
5 — ARTICULATING LINK FRICTION SPRING PIN
6 — ARTICULATING LINK FRICTION SPRING
7 — ARTICULATING LINK FRICTION SPRING LOCK
8 — BRAKE SHOE RETRACTING SPRING

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Figure 122 — Brake Parts — Rear Wheel

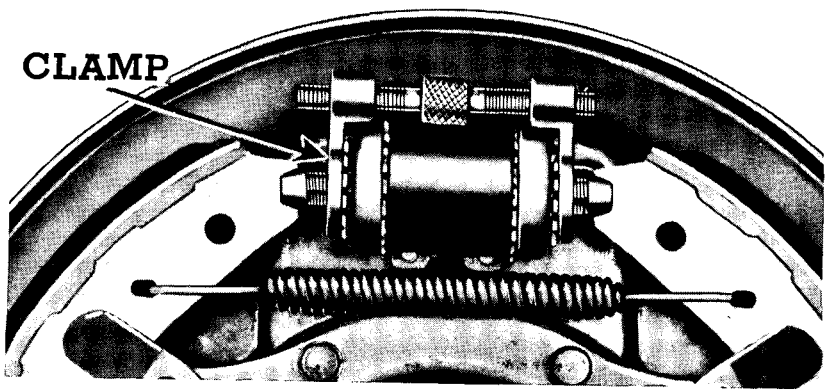

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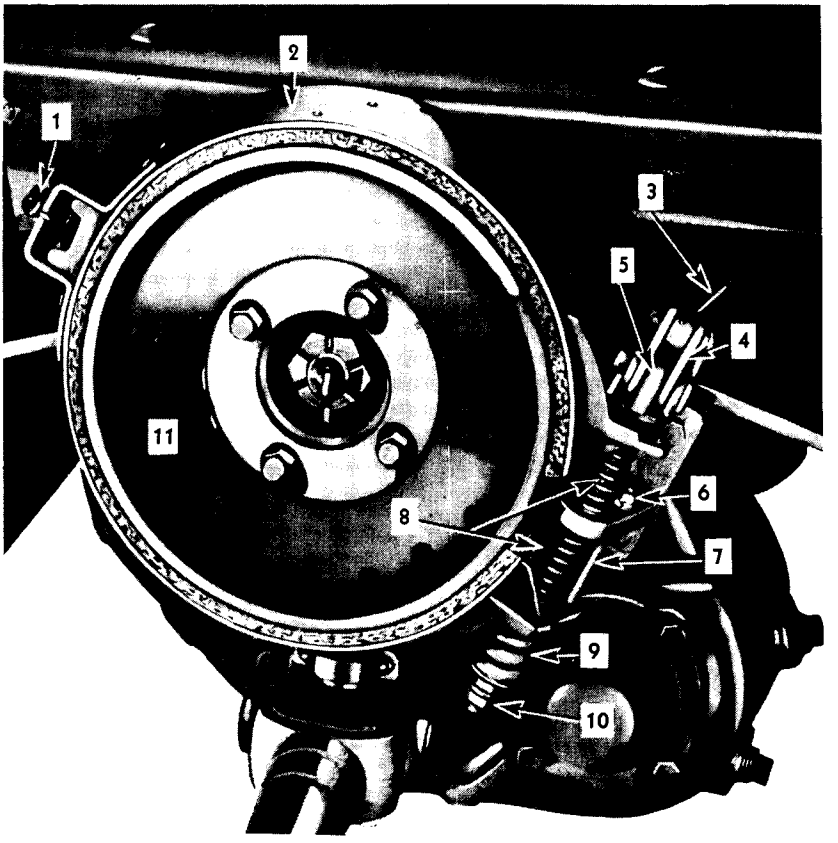
Figure 123 — Brake Wheel Cylinder Clamp



1 — BRAKE ANCHOR
2 — BRAKE BAND WITH LINING
3 — BRAKE PULL ROD
4 — OPERATING CAM
5 — ADJUSTING BOLT
6 — ADJUSTING SCREW LOCK NUTS (LOWER SHOE)
7 — ADJUSTING SCREW (LOWER SHOE)
8 — SPRINGS (SHOE RELEASE)
9 — SPRING (UPPER SHOE ADJUSTING)
10 — ADJUSTING BOLT NUTS (UPPER SHOE)
11 — BRAKE DRUM

RA PD 32228

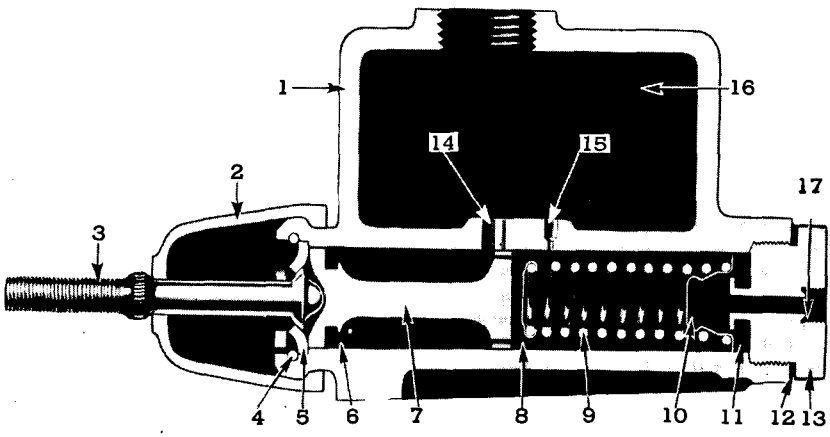
Figure 124 — Parking Brake Construction

Section V

BRAKE SYSTEM UNITS, DISASSEMBLY

161. PRELIMINARY PROCEDURE.

a. Extreme care must be used in handling hydraulic brake parts. The parts must be washed in clean alcohol as cleaning solutions will



1 — MASTER CYLINDER BODY
2 — DUST BOOT
3 — PEDAL LINK
4 — SNAP RING
5 — LINK RETAINER
6 — SECONDARY PISTON CUP
7 — PISTON
8 — PRIMARY PISTON CUP
9 — RETURN SPRING
10 — VALVE
11 — VALVE SEAT
12 — END PLUG GASKET
13 — END PLUG
14 — INLET PORT
15 — COMPENSATING PORT
16 — RESERVOIR
17 — OUTLET

RA PD 32236

Figure 125 — Main Cylinder — Cross Section

A—MAIN CYLINDER BODY
B—SECONDARY PISTON CUP
C—PISTON
D—PRIMARY PISTON CUP
E—RETURN SPRING
F—OUTLET VALVE
G—VALVE SEAT
H—END PLUG GASKET
I—END PLUG
J—FILLER PLUG GASKET
K—FILLER PLUG
L—PEDAL LINK
M—LINK RETAINER
N—SNAP RING
O—DUST BOOT
P—STOP LIGHT SWITCH

Figure 126 — Layout of Main Cylinder Parts

BRAKE SYSTEM UNITS, DISASSEMBLY

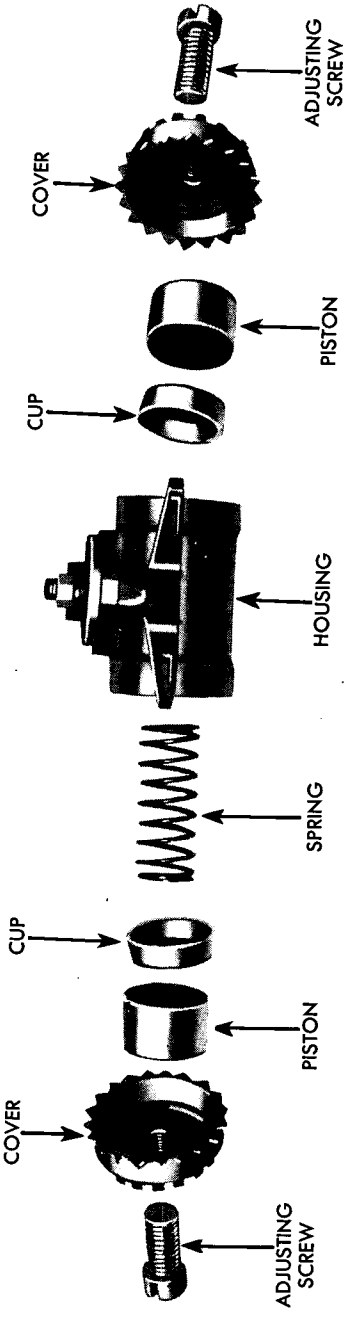


Figure 127 — Wheel Cylinder Parts

cause damage to the rubber parts. The repairman doing the work must wash his hands thoroughly with soap and water before attempting to work on hydraulic brake parts.

162. MAIN CYLINDER DISASSEMBLY (fig. 125).

a. Procedure. Remove filler plug and drain the brake fluid. Remove end plug with valve seat washer. Remove the valve assembly and spring. Remove the main cylinder boot. Remove the pedal stop snap ring with a screwdriver and remove the pedal stop assembly. Remove the piston with the secondary cup and primary cup. See figure 126 which illustrates the main cylinder parts.

163. WHEEL CYLINDER DISASSEMBLY.

a. Procedure. Pull off the cylinder adjusting covers. Push out the pistons, rubber cups, and spring. See figure 127 which illustrates the wheel cylinder parts.

Section VI

BRAKE SYSTEM PARTS, CLEANING, INSPECTION, AND REPAIR

164. CLEANING OF PARTS.

a. The cleaning and inspection of the hydraulic parts must be done with extreme care and cleanliness. All hydraulic parts must be washed in clean alcohol. The repairman must wash his hands in soap and water before handling hydraulic parts. Damaged parts that are to be replaced should be placed to one side to keep them separated from the parts that are to be used again.

165. MAIN CYLINDER INSPECTION.

a. Procedure.

(1) Inspect the cylinder bore to make sure that it is smooth. If it is scored, it should be smoothed up with a hone or replaced if the scoring is too deep.

(2) Inspect the primary and secondary cups, valve, and valve seat for damage or swelling. Replace the damaged parts. NOTE: Swelling of the rubber parts is due to the use of improper brake fluid, or the washing of the parts in gasoline or kerosene.

(3) Check the piston fit in the bore (fig. 128). The clearance between the piston and the wall of the cylinder should be from 0.001 inch to 0.005 inch.

(4) Check the clearance between the edge of the primary cup and the center of the compensating port (fig. 129). In order to check this clearance accurately, the main cylinder must be partially assembled as follows:

(*a*) Install pedal stop assembly and lock in place with snap ring.

(*b*) Assemble secondary cup on piston and install piston assembly in housing. Place the primary cup in the housing with the flat side of the cup against the housing.

(c) Push the piston and cup against the pedal stop and check for clearance between the edge of the primary cup and the compensating

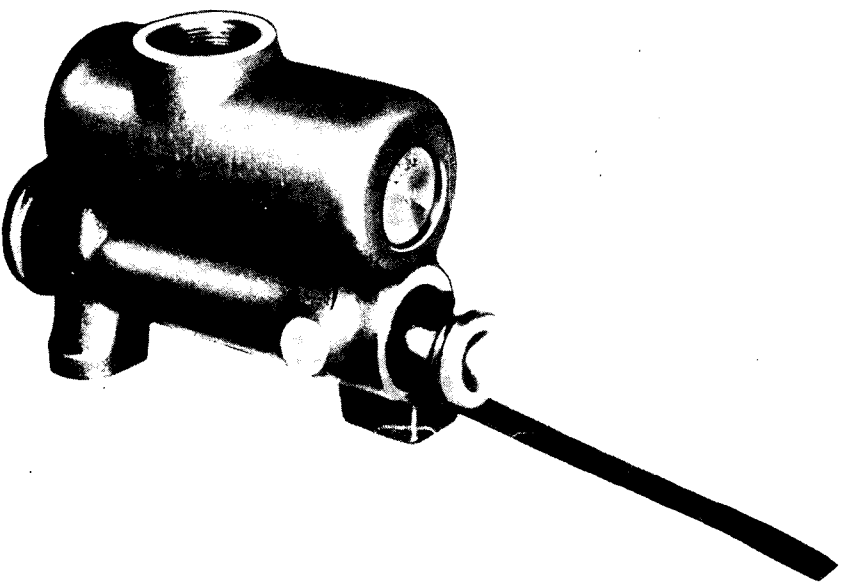


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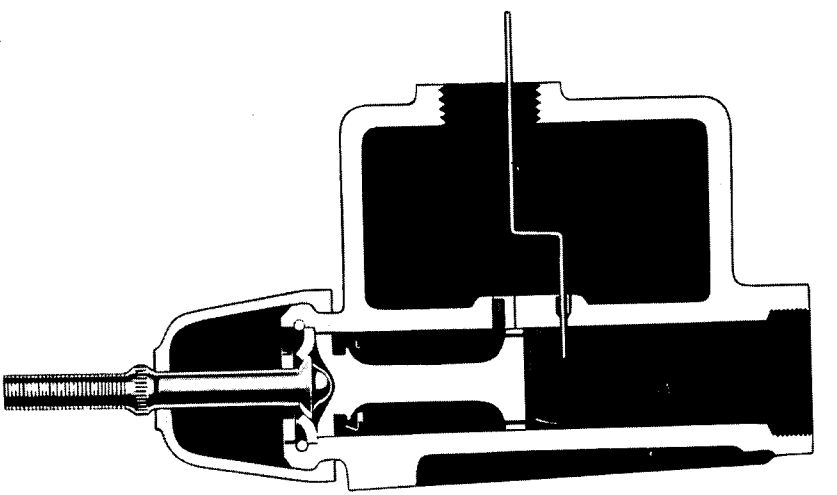
Figure 128 — Checking Main Cylinder Piston Fit



RA PD 32610

Figure 129 — Checking Clearance of Primary Cup

RA PD 32611

Figure 130 — Checking Wheel Cylinder Piston Fit

port by inserting a soft tag wire through the compensating port as shown in figure 129. There must be clearance between the primary cup and the compensating port for the brakes to release properly. If there is no clearance, the primary cup must be replaced with a new one.

(*d*) After this clearance has been checked, the main cylinder must be disassembled again and reassembled according to instruction in paragraph 170 of this section.

166. WHEEL CYLINDER INSPECTION.

a. Procedure.

(1) Inspect the cylinder bore to make sure that it is smooth. If it is scored, it should be smoothed up with a hone or replaced if the scoring is too deep.

(2) Check rubber cups for damage or swelling due to use of improper fluid or cleaning solution. Replace damaged cups.

(3) Check the piston fit in the cylinder bore, using a feeler gage, as shown in figure 130. This clearance should be from 0.002 inch to 0.005 inch. Replace all damaged or worn parts.

167. BRAKE DRUM INSPECTION AND REPLACEMENT.

a. Inspection. Inspect the brake drum for scoring, out-of-round, or other damage. If damaged, it must be replaced.

b. Brake Drum Replacement Procedure. The disassembling and assembling of the drums from the hubs is covered in the front and rear axle chapters of TM 9-1765A.

168. BRAKE SHOE INSPECTION AND RELINING.

a. Inspection. Inspect the brake lining, and if it is oil-soaked or worn, the lining should be replaced.

b. Brake Lining Replacement Procedure. The disassembling and assembling of the brake lining is covered in the front axle chapter of TM 9-1765A.

169. PARKING BRAKE INSPECTION AND RELINING.

a. Inspection. Inspect the parking brake band lining, and if it is oil-soaked or worn, it must be replaced.

b. Parking Brake Lining Replacement Procedure.

(1) REMOVE LINING. Remove rivets, using the deliner punches in a brake relining machine or a small chisel and hammer, and remove the lining. Wash the band in a cleaning solution, dry it thoroughly, and buff the face with a wire brush to remove any rust or corrosion.

(2) INSTALL LINING. Install new lining by drilling 2 holes in one end and counterboring the holes half the thickness of the lining and installing the 2 rivets. Hold loose end of lining against the band and lift the center of the lining to make a "hump" until the end of the lining is even with the band. Hold lining in that position and drill, countersink, and rivet the 2 end rivets. Using a light hammer, drive "hump" down so that lining conforms to the shape of the band; then drill, countersink, and rivet the remaining rivets.

Section VII

BRAKE SYSTEM UNITS, ASSEMBLY

170. MAIN CYLINDER ASSEMBLY.

a. Assembly Procedure (fig. 126).

(1) INSTALL END PLUG (fig. 131). Dip a new check valve seat in clean hydraulic brake fluid, and assemble over the button on the end of the plug. Assemble a new gasket on the plug and install the end plug into the main cylinder housing. Tighten plug securely.

(2) CHECK VALVE SEAT. Inspect the valve seat through the push rod end to make sure the washer is properly seated.

(3) INSTALL OUTLET VALVE. Dip the outlet valve in hydraulic brake fluid and install it with the open side toward end plug.

(4) INSTALL SPRING AND PRIMARY CUP. Install the piston spring so that it seats against the outlet valve cage. Dip the primary cup in brake fluid and install it with the flat surface facing out or away from the spring.

(5) INSTALL PISTON AND SECONDARY CUP. Dip secondary cup in brake fluid and install over solid end of piston. Install piston with bleeder holes facing flat side of primary cup.

(6) INSTALL PEDAL STOP. Install the pedal stop assembly and lock in place with snap ring. Install the rubber pedal stop boot, making sure this seal is tight on the housing and the vent hole in the boot is at the

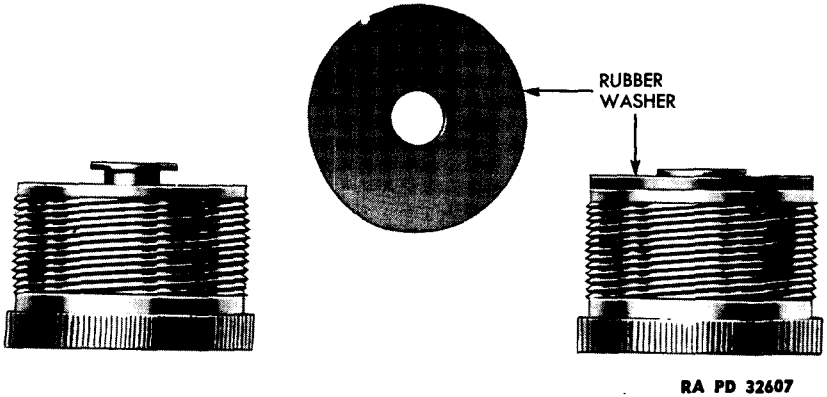


Figure 131 — Assembling Valve Seat Washer

bottom. NOTE: This seal must be tight to keep water and other foreign matter from entering the main cylinder through the pedal stop.

171. WHEEL CYLINDER ASSEMBLY.

a. Assembly Procedure (fig. 127).

(1) DIP RUBBER PARTS IN BRAKE FLUID. Dip pistons and rubber cups in clean hydraulic brake fluid.

(2) INSTALL SPRING. Place the spring in the center of the housing.

(3) INSTALL CUPS. Install the rubber cups at each end of the spring with the flat face toward the outside or away from spring.

(4) INSTALL PISTONS. Install pistons on each end with flat sides facing the cups.

(5) ASSEMBLE COVERS. Install the adjusting covers with screws in place.

Section VIII

HYDROVAC SYSTEM

172. TROUBLE SHOOTING.

a. System Fails to Operate.

Probable Cause	Probable Remedy
Dirty air cleaner.	Remove and clean air cleaner (TM 9-765).
Vacuum line leaks.	Find leak and correct trouble.
Vacuum valve sticking.	Remove and clean valve; replace worn or damaged parts (par. 174).
Lack of lubricant in vacuum cylinder.	Lubricate vacuum cylinder (par. 176 (e)).
Worn parts in Hydrovac system.	Overhaul Hydrovac system (par. 174).

173. HYDROVAC SYSTEM, REMOVAL FROM VEHICLE (fig. 132).

a. Procedure. Disconnect the hydraulic lines at the Hydrovac that lead to the main and wheel cylinders. Remove the hose connections to the air cleaner and vacuum line. Remove the nuts and lock washers that attach the Hydrovac to the frame brackets and lift off the Hydrovac.

174. HYDROVAC SYSTEM, DISASSEMBLY (fig. 133).

a. Procedure.

(1) DISASSEMBLE VACUUM CYLINDER. Remove hydraulic bypass tube from the slave cylinder and hydraulic adapter. See "O," figure 134 which illustrates the Hydrovac system parts. Scribe a line on both cylinders and the center plate to be used as a location aid when reassembling. Loosen the hose clamp screws on the vacuum line hose connection and slide hoses back on the lines far enough to clear the center connection. Unscrew the vacuum line from the vacuum valve seat in the relay valve. CAUTION: The line must turn with the coupling nut because it is swaged into it. Unscrew the relay valve assembly from the vacuum

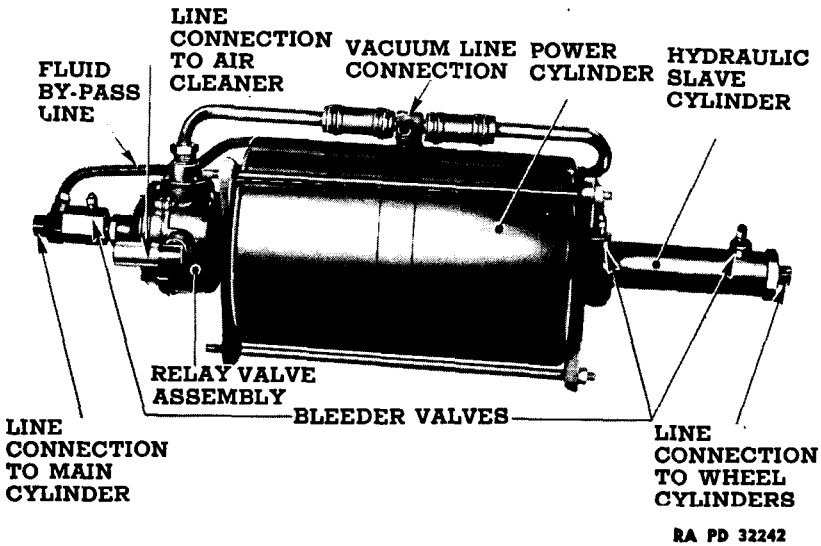


Figure 132 — Hydrovac Assembly

cylinder. Remove the nuts from the through bolts and remove the bolts. The 2 cylinders may now be removed from the center plate. Be careful not to damage the cylinder gaskets. NOTE: In most cases it will not be necessary to disassemble further the vacuum cylinder. However, should it become necessary to replace the piston leathers or the piston rod seal in the center plate, access to these parts can be had by removing the nuts on the piston rod.

(2) DISASSEMBLE RELAY VALVE. Place hydraulic adapter in bench vise and loosen lock nut on hydraulic adapter connection. Unscrew relay valve from hydraulic adapter. Remove the 4 screws which attach air cleaner cover to relay valve body and remove cover and gaskets. Remove the 4 screws which attach vacuum valve seat to relay valve body and remove seat and gasket. Remove the 6 screws which attach relay valve cover and spacer to the relay valve and remove cover, spacer, and gaskets. Raise edges of diaphragm, and with fingers raise spring retainer off supports in relay valve body, shift diaphragm assembly toward atmospheric valve, unhook toggle link from valve stems, and remove the diaphragm assembly. Remove the vacuum valve, compress the atmospheric valve spring, and remove the spring retainer; then remove the atmospheric valve.

(3) DISASSEMBLE HYDRAULIC ADAPTER. Place hydraulic adapter body in bench vise and unscrew hydraulic line fitting bolt; remove the

HYDROVAC SYSTEM

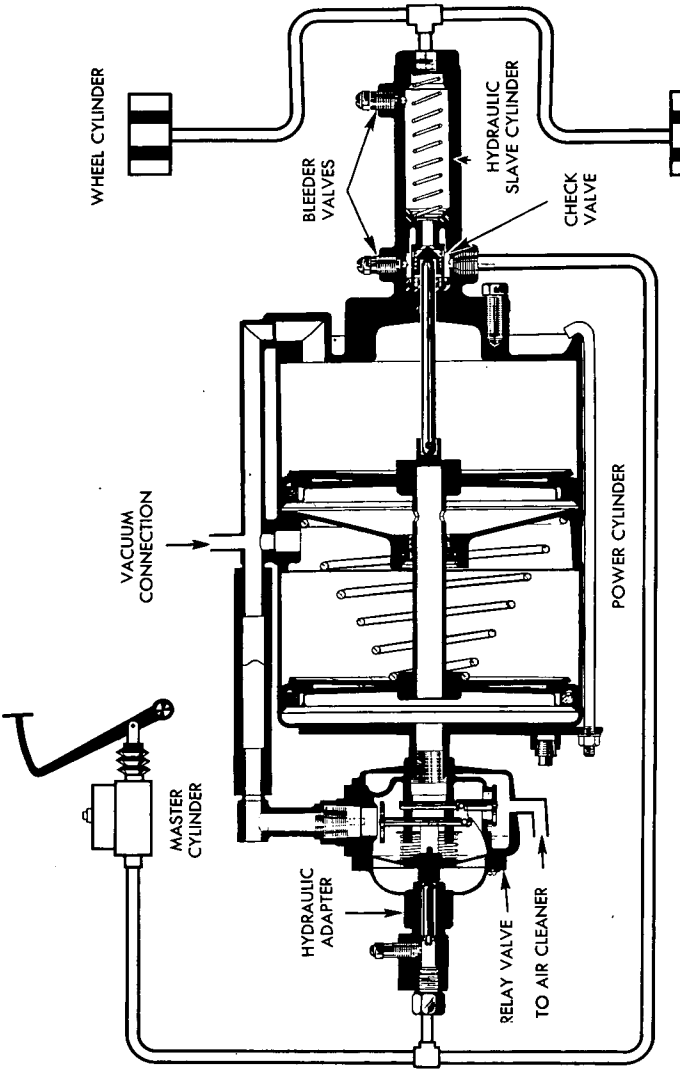


Figure 133 — Hydrovac System — Diagrammatic View

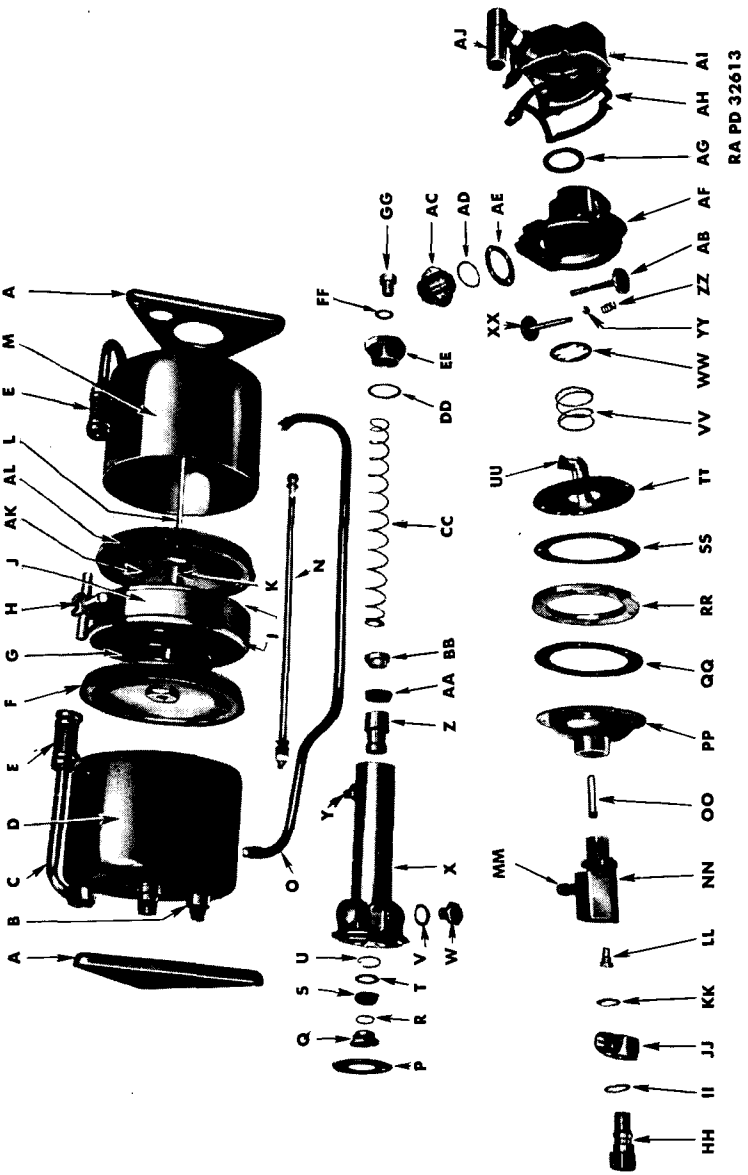


Figure 134 — Hydrovac Parts

A—STUD PLATE
B—LUBRICATING PLUG
C—PIPE ASSEMBLY
D—REAR CYLINDER
E—TEE CONNECTOR HOSE
F—PISTON SEAL
G—PISTON RETURN SPRING
H—TEE CONNECTOR
I—CENTER PLATE GASKETS
J—CENTER PLATE
K—PISTON ROD
L—PUSH ROD
M—FRONT CYLINDER
N—THROUGH BOLT
O—HYDRAULIC BY-PASS TUBE
P—HYDRAULIC SLAVE CYLINDER BODY GASKET
Q—PUSH ROD GUIDE
R—WASHER
S—HYDRAULIC SLAVE CYLINDER VALVE SEAL
T—GUIDE GASKET
U—SNAP RING
V—DRAIN PLUG GASKET
W—DRAIN PLUG
X—HYDRAULIC SLAVE CYLINDER BODY
Y—BLEEDER VALVE SCREW
Z—HYDRAULIC PISTON VALVE
AA—HYDRAULIC SLAVE CYLINDER PISTON CUP
BB—SPRING RETAINER
CC—HYDRAULIC PISTON RETURN SPRING
DD—END PLUG GASKET
EE—END PLUG
FF—ADAPTER GASKET
GG—PIPE FITTING ADAPTER
HH—ADAPTER CONNECTOR BOLT
II—ADAPTER FITTING GASKET
JJ—ADAPTER CONNECTOR
KK—CONNECTOR GASKET
LL—PISTON STOP
MM—BLEEDER VALVE SCREW
NN—RELAY VALVE ADAPTER BODY
OO—RELAY VALVE ADAPTER PISTON
PP—RELAY VALVE COVER
QQ—VALVE COVER GASKET
RR—VALVE COVER SPACER
SS—VALVE COVER GASKET
TT—RELAY VALVE DIAPHRAGM
UU—YOKE AND LINK
VV—RELAY VALVE SPRING
WW—SPRING RETAINER
XX—RELAY VALVE, UPPER (VACUUM)
YY—VALVE SPRING RETAINER
ZZ—VALVE SPRING
AB—RELAY VALVE, LOWER (ATMOSPHERIC)
AC—RELAY VALVE SEAT
AD—VALVE SEAT INNER GASKET
AE—VALVE SEAT OUTER GASKET
AF—RELAY VALVE BODY
AG—RELAY VALVE BODY GASKET (RUBBER)
AH—AIR CLEANER COVER GASKET (RUBBER)
AI—AIR CLEANER COVER
AJ—RELAY VALVE AIR CLEANER CONNECTION
AK—PISTON
AL—PISTON SEAL RETAINER

RA PD 32613A

Legend for Figure 134 — Hydrovac Parts

bolt, fitting and gaskets. Remove the piston stop and push out the piston with cup. Remove bleeder valve.

(4) DISASSEMBLE SLAVE CYLINDER. Place slave cylinder with the front half of the vacuum cylinder attached in a bench vise and remove the cylinder end plug, copper gasket, piston rod stop, spring, and spring retainer. Remove the 4 cap screws from the inside of the vacuum cylinder which attach the vacuum cylinder to the slave cylinder and remove the cap screws, anchor plate, vacuum cylinder, and stud plate. Remove push rod guide, rubber gasket, slave cylinder seal and push piston and bypass valve down to clear the snap ring; remove washer and snap ring. Then push piston and bypass valve and piston seal out through the flanged end of the slave cylinder. Remove the bleeder valves from the slave cylinder.

(5) DISASSEMBLE VACUUM LINE CHECK VALVE. Remove the 4 screws that hold the 2 halves of the valve together and remove the cover, cover gasket, valve, and gasket, and clean the parts thoroughly. Assemble the check valve in the reverse manner. NOTE: If any of the parts of the check valve need replacing, replace the complete unit.

175. INSPECTION OF PARTS.

a. Cleaning of Parts.

(1) CLEAN PARTS. Wash all parts thoroughly and dry them with air pressure from an air blow gun. CAUTION: The hydraulic adapter parts and the slave cylinder parts must be washed in clean alcohol. The repairman must wash his hands thoroughly in soap and water before handling the hydraulic adapter or slave cylinder parts.

b. Inspection.

(1) INSPECT PARTS. Inspect the piston leathers, cylinder, and vacuum line hose connections of the vacuum cylinder. Replace any damaged parts. Inspect the relay valve diaphragm for pinholes or torn mounting holes. If it is damaged in any way, replace it. Inspect the hydraulic adapter cylinder and pistons for scored surfaces; replace any damaged parts. Inspect the slave cylinder wall and piston for scored surfaces; replace any damaged parts.

176. ASSEMBLING HYDROVAC SYSTEM.

a. Procedure.

(1) ASSEMBLE SLAVE CYLINDER. Install snap ring and metal washer, dip a new rubber cup seal in brake fluid, and install the seal. Then install a new rubber gasket on the piston rod guide and set guide in place. Install new mounting gasket on end of slave cylinder and install

stud plate, vacuum cylinder, anchor plate, and cap screws with lock washers. NOTE: The bleeder valve holes should point toward the vacuum tube connection. Insert piston and bypass valve assembly in cylinder with small diameter end toward the flanged end of the cylinder. Dip a new piston rubber cup seal in brake fluid and install in cylinder with flat side toward piston. Install spring retainer in piston with small diameter toward piston and install return spring, piston rod stop, and end plug with new gasket. Tighten plug securely and install bleeder valves.

(2) ASSEMBLE HYDRAULIC ADAPTER. Dip piston with rubber cup in hydraulic brake fluid and install it in cylinder, and install piston stop. Install new copper gasket on each side of line fitting and install fitting bolt but do not tighten bolt. Install bleeder valve.

(3) ASSEMBLE RELAY VALVE. Install atmospheric valve and vacuum valve in guides and lubricate them. Assemble spring and retainer over toggle link attached to diaphragm and assemble toggle link in position, making sure that bypass holes in relay valve body and diaphragm are in line. Assemble new gaskets on vacuum valve seat and assemble it to the relay valve body. Push down on diaphragm and check the operation of the atmospheric and vacuum valves. Install 2 pilots made from No. 8 32- by 1-inch screws through the screw holes in diaphragm into relay valve body. Install new gasket, spacer, new cover gasket, and cover over the pilots, and hold diaphragm down while removing the 2 pilots and installing the cover screws. CAUTION: Make sure that the vacuum bypass hole in the spacer is lined up with the bypass holes in the diaphragm and body. Assemble rubber gaskets and air cleaner cover on relay valve body and tighten screws securely.

(4) ASSEMBLE HYDROVAC CYLINDER.

(a) Install new gaskets over pilot on center plate and assemble the 2 halves of the cylinder over the pistons, lining up the scribe marks that were made in disassembling. Assemble atmospheric end stud plate and place assembly on bench with slave cylinder on the right-hand side and install the 2 long through bolts in the holes nearest the operator (fig. 132), and the other through bolt through the remaining hole. Tighten bolts evenly and securely.

(b) Place hydraulic adapter in bench vise, coat threads on hydraulic adapter with white lead, and screw the relay valve assembly on the hydraulic adapter, lining up the bleeder valve with the vacuum tube connection. Tighten lock nut securely (fig. 134).

(c) Coat threads of vacuum cylinder nipple with white lead and screw vacuum cylinder on the relay valve assembly. Then coat thread of vacuum tube fitting with white lead and screw in place on relay valve body. Line up the relay valve assembly so that the vacuum tube lines

up with the connection on the center plate. Slide the hose connections in place on the vacuum tubes and tighten hose clamps.

(d) Screw the fittings on the bypass line in the connections on the slave cylinder and the connection on the end of the hydraulic adapter. Hold hydraulic adapter with a wrench and tighten connector bolt; install clamp over the bypass line and install the screw in the center plate. CAUTION: Make sure that the 3 bleeder valves are on the same plane on the top of the Hydrovac when it is assembled.

(e) Remove the pipe plug in the relay valve end of the vacuum cylinder and the ⅛-inch pipe plug in the center plate and inject 2 ounces of OIL, hydraulic, in each opening and replace the plugs.

177. INSTALLATION OF HYDROVAC SYSTEM ON VEHICLE.

a. Procedure. Place Hydrovac in position on frame and install the retaining nuts and lock washers. Connect the air cleaner and vacuum line connections. Connect the hydraulic lines from the main cylinder and wheel cylinder. Tighten the connections and connector bolts securely.

Section IX

BRAKE SYSTEM UNITS, INSTALLATION IN VEHICLE

178. INTRODUCTION.

a. Whenever any of the hydraulic units have been disconnected, it will be necessary to bleed the entire hydraulic system. The system cannot be bled until all the units have been installed and all the hydraulic lines connected. Instructions for bleeding the system are given in paragraph 185.

179. MAIN CYLINDER INSTALLATION.

a. Procedure. Place the main cylinder in position on the frame bracket and install the 2 retaining nuts and lock washers. Connect the stop light wires to the stop light switch. Connect the hydraulic pipe to the main cylinder end plug. Connect the clevis from the idler lever to the main cylinder link. Check the toe board clearance of the pedal and adjust the clevis until ¼-inch clearance is obtained.

180. WHEEL CYLINDER INSTALLATION.

a. Procedure.

(1) INSTALL WHEEL CYLINDER. Place wheel cylinder in position on brake flange plate and install the 2 retaining cap screws and lock washers. Connect the hydraulic pipe or hose to the wheel cylinder. Connect the brake shoe retracting spring to the 2 brake shoes.

(2) INSTALL BRAKE DRUM. Place the hub and drum in position on the axle housing and install the outer race, washer, and adjusting nut. Tighten the adjusting nut until it is snug; then back it off a quarter turn. Install lock and, if necessary, turn the adjusting nut slightly to aline the short tang on the lock with one of the slots in the nut. Install lock nut and tighten securely. Bend one of the tangs up to lock in a slot in the lock nut. Install the axle shaft or drive flange and the lock and 8 cap screws. Tighten screws securely and lock in place.

(3) INSTALL WHEEL AND TIRE. Place wheel with tire on hub and install the 6 wheel nuts. Remove the floor jack and tighten the wheel nuts securely.

181. BRAKE DRUM INSTALLATION.

a. Reference. Install the brake drum with hub and adjust the bearings as instructed in paragraph 180 a (2).

182. BRAKE SHOE INSTALLATION (fig. 120).

a. Procedure.

(1) INSTALL BRAKE SHOES. Place shoes in position and install the lockpins and friction pins and springs. Install the brake shoe retracting spring. Install the hub with drum and bearing, and adjust the bearing as instructed in paragraph 180 a (2). Adjust brakes as instructed in paragraph 186.

183. PARKING BRAKE BAND INSTALLATION.

a. Procedure.

(1) INSTALL BAND. Place the brake band in position on the drum and install the rear anchor screw. Tighten screw until there is between 0.010-inch and 0.015-inch clearance between the drum and band at the rear anchor. Lock the screw in place with a piece of wire. Install the lower spring and start the adjusting nut on the bolt. Loosen the lock nut on adjusting screw between the ends of the brake band and adjust the screw until the clearance is 0.020 inch between the end of the lower band and the drum, and tighten the lock nut. Adjust the nut on the end of the bolt until the clearance is 0.020 inch between the end of the brake band and the drum. Install and tighten the lock nut. Lubricate all frictional surfaces and anchor bolt with light engine oil.

184. HYDROVAC INSTALLATION.

a. Procedure. Place Hydrovac in position on frame and install the retaining nuts and lock washers. Connect the air cleaner and vacuum line connections. Connect the hydraulic lines from the main cylinder and wheel cylinder.

185. BLEED BRAKE SYSTEM (figs. 135, 136, and 137).

a. Procedure. Remove the filler plug and install the adapter and main cylinder filler. Open automatic valve on filler (fig. 135). Remove the bleeder valve screw from the hydraulic adapter on the Hydrovac cylinder and install the bleeder hose. Place other end of hose in bleeder

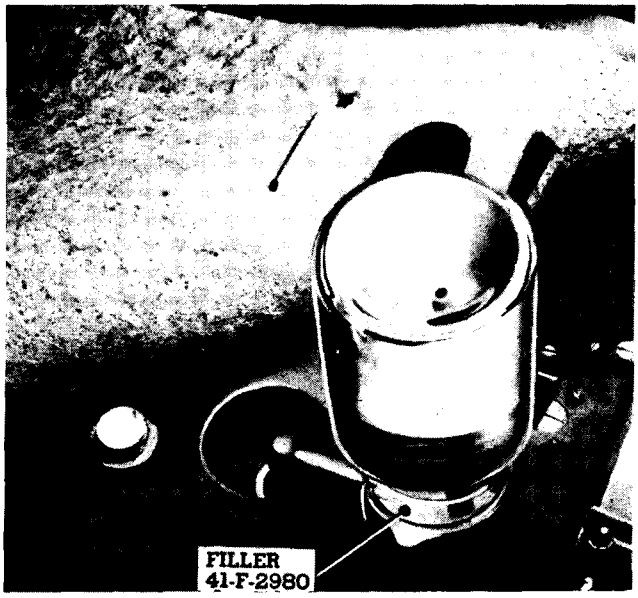


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Figure 135 — Main Cylinder Filler

jar with about one inch of clean brake fluid. Open bleeder valve ½ to ¾ turn, depress foot pedal slowly, and allow it to return slowly. Continue this action of the pedal until all air bubbles disappear in the jar while pumping. Then close the bleeder valve, disconnect the hose, and install the screw. Repeat the bleeding operation at the 2 valves on the slave cylinder. Then repeat the operation at all 4 wheel cylinders beginning with the left rear wheel, then the left front wheel, then the right rear wheel and last, the right front wheel. NOTE: Be sure to follow the above sequence when bleeding brakes and keep the main cylinder at least half full of fluid during the operation. Remove the filler jar and adapter, and install the filler plug. Start the engine and operate the Hydrovac several times by depressing the brake pedal. Stop the engine and again bleed the No. 3 bleeder valve near the outer end of slave cylinder.

186. BRAKE ADJUSTMENT.

a. Procedure.

(1) ADJUST FRONT BRAKES (fig. 138). Raise front of vehicle until tires are clear of ground. Remove the adjusting hole covers from the front flange plates and insert a screwdriver through the adjusting hole;

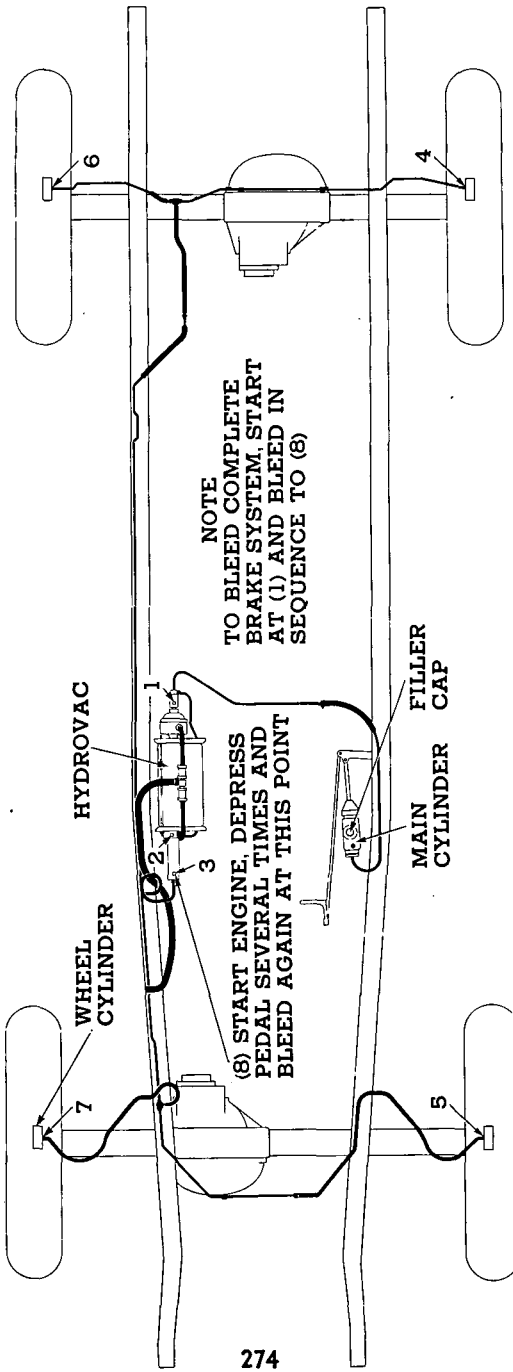
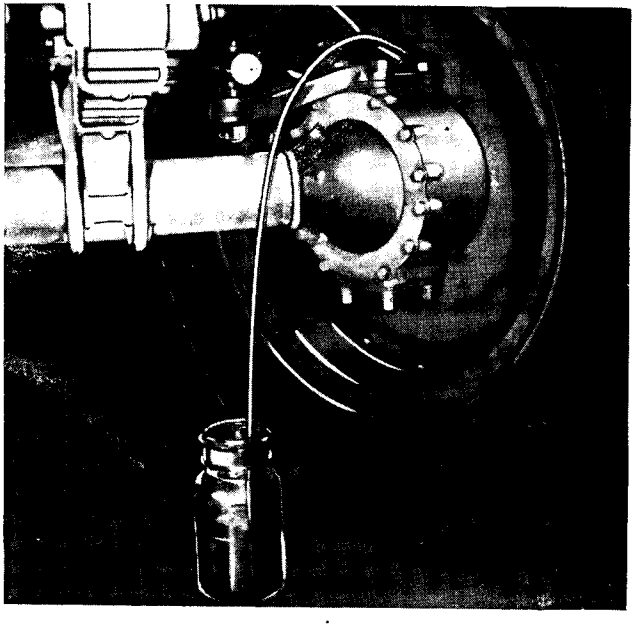


Figure 136 — Brake Bleeding Diagram

BRAKE SYSTEM UNITS, INSTALLATION IN VEHICLE



RA PD 32230

Figure 137 — Bleeding Wheel Cylinder

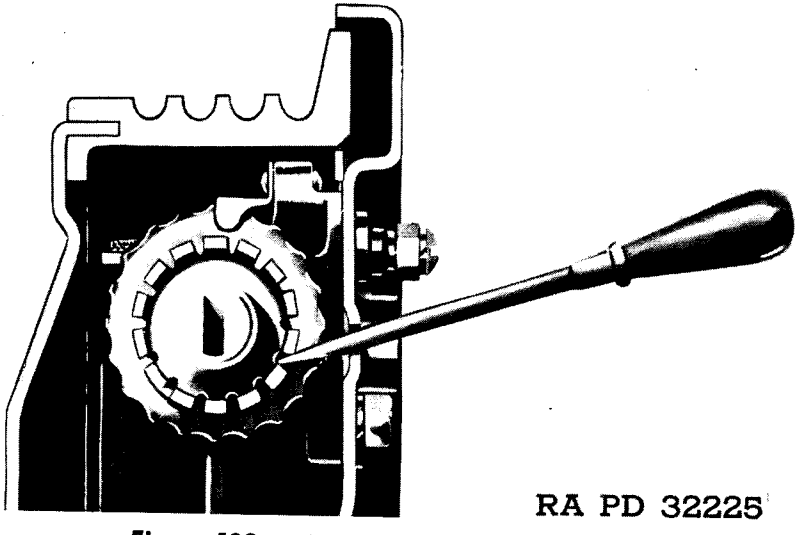


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Figure 138 — Adjusting Brakes — Front Wheel

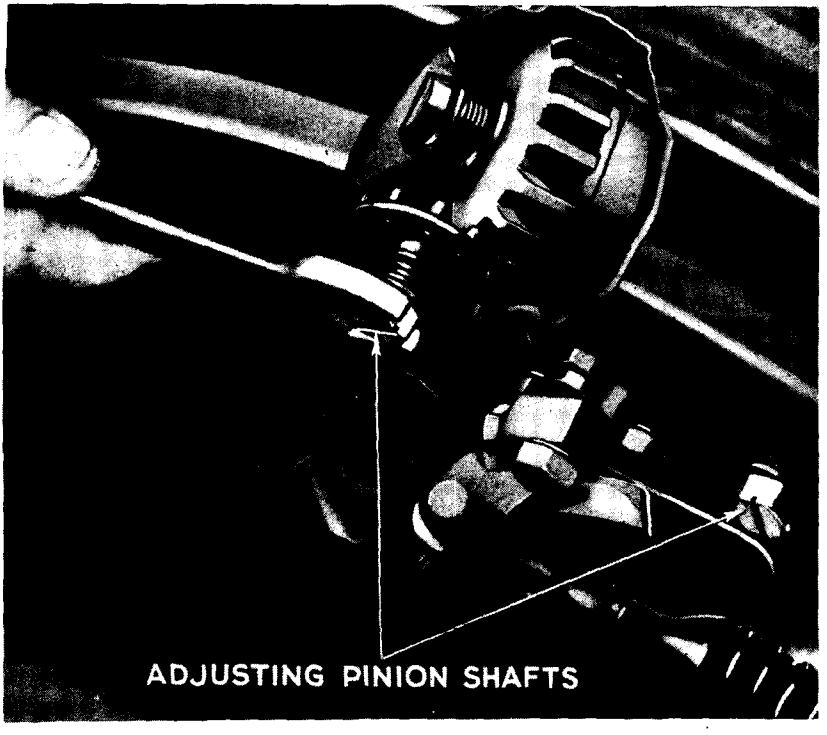

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Figure 139 — Adjusting Brakes — Rear Wheel

engage the teeth on the adjusting cover of the wheel cylinder. Turn the adjusting cover in clockwise direction, looking at the end of the cylinder, until the shoes cause a slight drag on the drum. Turn the adjusting cover back 4 notches. Install the adjusting hole covers and lower vehicle.

(2) ADJUST REAR BRAKES (fig. 139). Raise rear of vehicle until tires clear the ground. Turn the adjusting pinion shafts in a clockwise direction until the shoe causes a slight drag on the drum. Turn the adjusting pinion shaft back two-thirds of a turn and lower vehicle.

Section X

FITS AND TOLERANCES

187. FITS AND TOLERANCES.

a. Master Cylinder.

Piston clearance .....0.001 in.—0.005 in.

b. Wheel Cylinders.

Piston clearance, front cylinders .....0.002 in.—0.005 in.
Piston clearance, rear cylinders .....0.003 in.—0.006 in.

c. Pedal Adjustment.

Pedal to toe board clearance.....¼ in.

CHAPTER 9

STEERING GEAR

Section I

INTRODUCTION

188. DESCRIPTION.

a. The steering gear in this vehicle is known as the recirculating ball type. The principal working parts of the gear are the steering worm, the ball nut, and pitman shaft and sector. The worm is integrally welded to the steering main shaft and is mounted between 2 barrel roller bearings. The lower bearing is adjustable so as to eliminate end play in the main shaft. The ball nut is bored to clear the outside diameter of the worm. Within the length of the nut are 2 sets of helical grooves which are filled with steel balls. The balls within the helical paths constitute a thread between the worm and nut. The nut moves along the worm as with an ordinary screw thread. At the same time the balls roll freely between the worm and nut circulating within their closed circuits, so that the screw motion is obtained with rolling instead of sliding contact between the parts. The up and down movement of the nut moves the sector which is integral with the pitman shaft. The gear teeth are purposely cut in such a way that when the gears are in the center of travel and adjusted without any backlash, there will be enough backlash at each end of travel to permit freedom of operation.

189. DATA.

Type ..... Ball sector type
Gear ratio ..... 23.6 to 1
Model 548-D-2
Bearings
  Worm ..... Barrel roller
  Worm nut ..... Ball
  Ball diameter (nominal) ..... $\frac{9}{32}$ in.
  Quantity of balls 106
  Sector shaft ..... Bushings

INTRODUCTION

Steering wheel
Diameter ..... 20 in.
Steering connecting rod
Type ..... Spring-loaded
Adjustment ..... Threaded plug

190. ECHELON REFERENCES.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon duties not covered in this manual.

191. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

192. TROUBLE SHOOTING.

a. Hard Steering.

Probable Cause	Probable Remedy
Lack of lubrication.	Lubricate steering gear, tie rod ends, and steering connecting rod ball joints.
Tie rod and bolts too tight.	Readjust (TM 9-1765A).
Underinflated tires.	Inflate to proper pressure (55 pounds).
Improper steering gear adjustment.	Readjust steering gear (par. 204).
Improper caster, camber, or toe-in.	Check and correct.

b. Loose Steering.

Improper steering gear adjustment.	Adjust steering gear (par. 204).
Loose ball joints.	Readjust ball joints.
Worn steering arm bushings.	Replace bushings.

c. Shimmy.

Loose steering.	See subparagraph b above.

d. Side Pull.

Improper camber or caster.	Check and correct.
Unequal tire inflation.	Inflate to correct pressure (55 pounds).
Dragging brakes.	Adjust brakes (TM 9-765).
Improper tracking.	Check spring to axle mounting.

e. Wander or Weaving.

Loose steering or ball joints.	Check and adjust steering and ball joints (par. 204 c).
Excessive tightness in system.	Check and readjust or lubricate.

f. Road Shock.

Improper steering connecting rod adjustment.	Readjust end plugs.
Incorrect shock absorber action.	Check shock absorbers.
Steering gear improperly adjusted.	Readjust steering gear (par. 204 c).

Section III

STEERING GEAR REMOVAL

193. INTRODUCTION.

a. Whenever it is necessary to do any repair work on the steering gear other than adjusting, it is recommended that the complete assembly be removed so that the proper repairs can be performed in a satisfactory manner.

194. STEERING GEAR REMOVAL.

a. **Procedure.**

(1) REMOVE STEERING WHEEL. Remove the 2 screws that retain the horn button to the steering wheel and remove the button and spring.

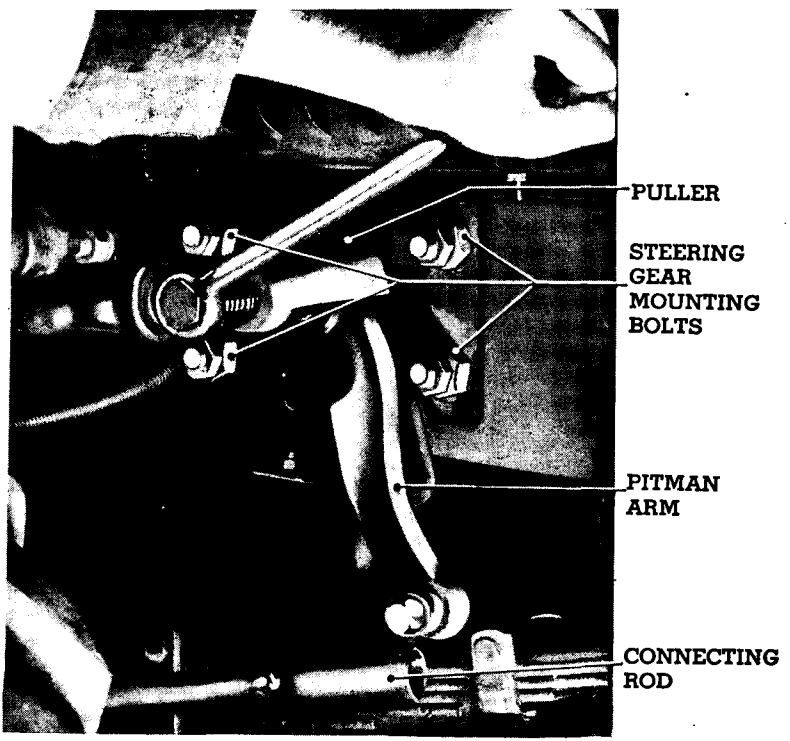

Figure 140 — Pitman Arm Removal

Figure 141 — Steering Gear Parts

STEERING GEAR REMOVAL

Remove the nut that retains the steering wheel on the shaft. Screw the steering wheel puller adapter on the end of the shaft and screw the 2 screws on the steering wheel puller KM-J1618 into the tapped holes in the steering wheel. Turn the center screw bolt, in a clockwise direction until the steering wheel comes off the shaft. Remove the Woodruff key and upper bearing tension spring.

(2) REMOVE CLAMPS AND FLOOR BOARDS. Remove the 2 nuts from the mast jacket to instrument panel clamp and remove the clamps. Remove the screws from the floor and toe boards and remove the floor boards. Remove the clevis pin from the brake pedal pull rod at main cylinder and pull pedal back out of the way.

(3) REMOVE PITMAN ARM (fig. 140). Remove the nut from the end of the pitman shaft and install pitman arm puller KM-J1376G, as shown in figure 140, and turn bolt to right to remove pitman arm.

(4) REMOVE STEERING GEAR. Remove the 2 screws that attach the horn wire terminal plate to the mast jacket and remove the terminal. Remove the 4 steering gear to frame mounting bolts and remove the steering gear through the left door of the vehicle.

Section IV

STEERING GEAR DISASSEMBLY

195. PRELIMINARY PROCEDURE.

a. Before the steering gear is disassembled, it should be thoroughly cleaned so that it can be inspected for external damage or cracks. As the parts are disassembled, they should be placed in a cleansing tank with solution so that the parts can soak and be thoroughly cleaned. Do not let rubber or leather parts soak in the cleaning solution, as this will deteriorate the rubber and leather. Never attempt to overhaul the steering gear in dirty surroundings as cleanliness is a very important part of satisfactory repairs.

196. STEERING GEAR DISASSEMBLY (fig. 141).

a. **Procedure.** Place steering gear in vise, clamp jaws on mounting flange, and set steering gear in approximately the same position it was in when in vehicle. Place a drain pan under gear housing to catch the oil. Loosen lock nut (P, fig. 141), and turn lash adjusting screw counterclockwise several turns. Loosen lock nut (A, fig. 141), and loosen worm adjuster several turns. Remove the 4 bolts that attach the side cover (R, fig. 141). If pitman shaft will not push out, turn steering shaft until sector lines up with hole; then remove the pitman shaft. Unscrew lash adjuster from cover. Remove the 4 bolts that retain the housing end cover (C, fig. 141), and remove cover, gasket, and lower bearing. Grasp lower end of main shaft and draw shaft with ball nut out of lower end of housing. CAUTION: Do not let ball nut rotate on shaft until it reaches the end of the threads, as it will damage the ball guides. Lay main shaft with ball nut flat on bench to prevent worm from rotating.

197. BALL NUT DISASSEMBLY.

a. **Procedure.** Remove the 3 screws from the guide clamp and lift out both ball guides. Turn nut upside down and rotate shaft until all of the 106 steel balls fall out.

STEERING GEAR DISASSEMBLY

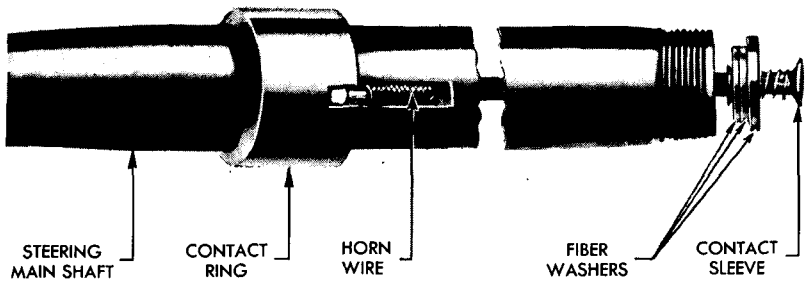

Figure 142 — Horn Wire and Contact Construction

198. MAST JACKET BEARING.

a. Introduction. The mast jacket bearing located at the top of the mast jacket is a spring-loaded ball bearing contained in a metal retainer. It will rarely require attention but it should be checked whenever the steering gear is overhauled. It is necessary to disassemble the steering gear to replace the bearing. Check the bearing by turning the race with the fingers, and if it is rough, it should be replaced.

b. Bearing Replacement Procedure.

(1) REMOVE BEARING. Insert long bar through bottom of steering gear housing and drive out bearing assembly.

(2) INSTALL BEARING. Place bearing in position in end of mast jacket and tap in place with a light hammer, using a block of wood between the bearing and the hammer.

199. HORN WIRE AND CONTACT RING (fig. 142).

a. General. The horn wire is soldered to a contact ring which is pressed on the main shaft and insulated from the shaft. The wire passes up through the tubular shaft and is soldered to a contact sleeve which is insulated from the shaft by 3 fiber washers. To replace the horn wire or contact ring, it is necessary to disassemble the steering gear because the mast jacket is pressed into the housing.

b. Horn Wire Replacement Procedure.

(1) REMOVE HORN WIRE. Unsolder and disconnect wire at upper and lower solder connections and pull out wire.

(2) INSTALL HORN WIRE. Push one end of wire through slot in shaft and out the end of shaft. Solder one end to the contact ring and the other end to the terminal connection.

c. Contact Ring Replacement Procedure.

(1) REMOVE CONTACT RING. Unsolder wire from contact ring and drive ring off shaft.

(2) INSTALL CONTACT RING. Press ring into position on shaft (fig. 142). Solder wire to ring (fig. 142).

Section V

STEERING GEAR PARTS, CLEANING, INSPECTION, AND REPLACEMENT

200. CLEANING OF PARTS.

a. The cleaning and inspection of the steering gear component parts must be done with extreme care and cleanliness. All parts must be thoroughly cleaned, both inside and outside, and then dried with clean cloths and air pressure from an air blow gun. Damaged parts that are to be replaced should be placed to one side to keep them separated from the parts that are to be used again.

201. COMPONENT PARTS, INSPECTION AND REPAIRING.

a. Steering Gear Inspection. Inspect the guides, balls, races, and gear teeth in the ball nut for scoring or other damage. Inspect the worm and bearing races on the main shaft for scoring or other damage. Inspect the bearings that fit on each end of the worm for roughness, scoring, or other damage. Assemble the lash adjuster with shim in the slot in the end of the pitman shaft and check the clearance, which should be 0.002 inch. If clearance is more or less, try one of the 4 different shims that are available until the clearance of 0.002 inch is obtained. Inspect the pitman shaft bushings in the housing for scoring, looseness, or other damage. Replace the bushings if they are worn or damaged. Inspect the seal in the housing, and if damaged or worn, it should be replaced.

(1) REMOVE SEAL AND BUSHING. Pry out seal and retainer. Place bushing driver KM-J1316 against bushing and drive out the bushings.

(2) INSTALL BUSHINGS AND SEAL. Start new inner bushing in housing and drive it into position (fig. 144). Start new outer bushing in housing and drive it into position (fig. 144). Start new seal and retainer in end of housing and drive it in until it bottoms against the housing. NOTE: It is not necessary to ream the bushings.

Section VI

ASSEMBLING STEERING GEAR

202. PRELIMINARY PROCEDURE.

a. General. Although the various parts of the steering gear were thoroughly cleaned as the steering gear was being disassembled and inspected, it is necessary again to wash and dry all of the parts that are to be used in rebuilding the steering gear, as the parts have been exposed to dust and dirt while the work was going on, and a small amount of dirt in the steering gear will seriously affect its operation.

b. Precautions. Observe the following precautions:

(1) In assembling the steering gear, use only the parts that possess the required specifications.

(2) All parts must be thoroughly cleaned and dried before starting to assemble them.

(3) As the assembling work proceeds, the parts should be kept covered to protect them from dust, dirt, etc.

(4) Always use new gaskets when assembling the units.

203. ASSEMBLING STEERING GEAR.

a. Procedure.

(1) ASSEMBLE WORM AND NUT (fig. 143). Place shaft and worm in horizontal position on bench and slip the nut on the worm with ball guide holes up until the nut is centered on the worm. Aline the ball guide holes with the threads in the nut. Divide the steel balls into 2 piles of 53 each and drop 42 balls into each circuit in the nut. It will be necessary to hold the balls in the hole with a punch or blunt instrument and rotate the shaft a turn or two to get all of the 42 balls in the circuit. Pack the inside of the ball guides with grease to hold the balls in position and install 11 balls in each guide (fig. 143). Place guides with balls in the nut (fig. 143), and rotate the shaft back and forth until the guides fit into the nut. Place clamp in position and install the 3 screws and lock washers.

(2) ASSEMBLE MAIN SHAFT IN HOUSING. Hold nut on shaft so that it cannot turn and push the shaft into mast jacket and housing

ASSEMBLING STEERING GEAR

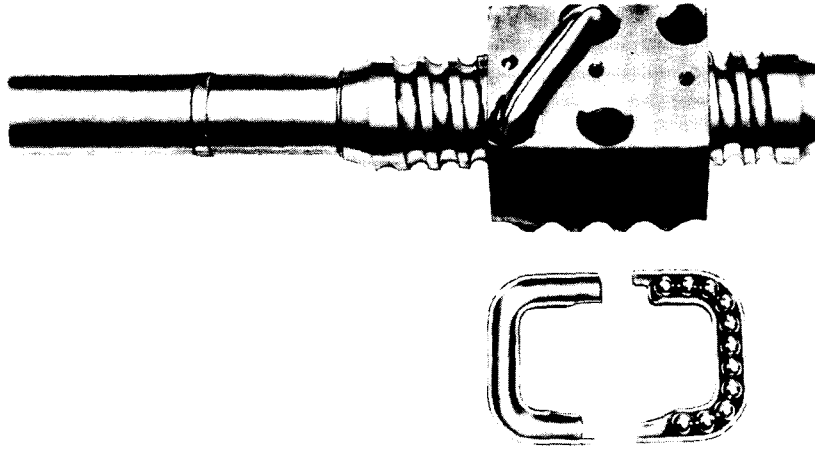

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Figure 143 — Installing Balls in Nut and Guide

from bottom of housing. Place the lower bearing, end cover and new gasket in position and install the 4 cap screws and lock washers. NOTE: Be sure that worm bearing adjuster is loose.

(3) ASSEMBLE PITMAN SHAFT IN HOUSING (fig. 144). Insert lash adjuster with shim in slot in pitman shaft and check clearance which should be 0.002 inch. Start pitman shaft in position in housing, matching the center tooth of sector with the center thread in the worm nut. Then place a new gasket and the side cover in position and turn the adjusting screw counterclockwise until it pulls the pilot into the bushing. NOTE: Make sure the adjusting screw is loose and that there is end play in the pitman shaft. Install the 4 cap screws and lock washers. Adjust steering as outlined in the following paragraph.

204. STEERING GEAR ADJUSTMENT.

a. Introduction. Correct adjustment of the steering gear is very important. While there are but 2 adjustments to be made, the procedure *must* be followed step by step.

b. Steering Gear Adjustment Made With Unit in a Bench Vise.

(1) ADJUST WORM SHAFT. Make sure that lash adjuster (fig. 145) is loose and that there is end play in the pitman shaft. Tighten worm thrust screw (fig. 146) until there is no perceptible end play in the steering shaft assembly. Place steering wheel on shaft with Woodruff key in position and tighten steering wheel nut finger-tight. Hook end

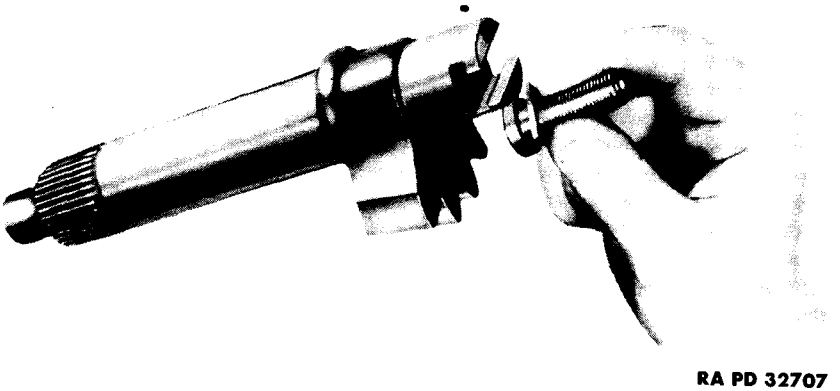


Figure 144 — Installing Lash Adjuster

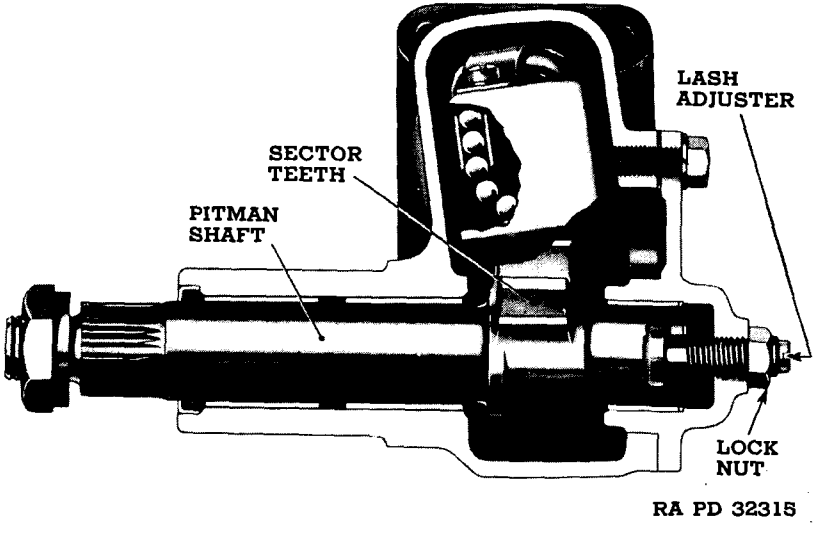


Figure 145 — Pitman Shaft Adjustment

ASSEMBLING STEERING GEAR

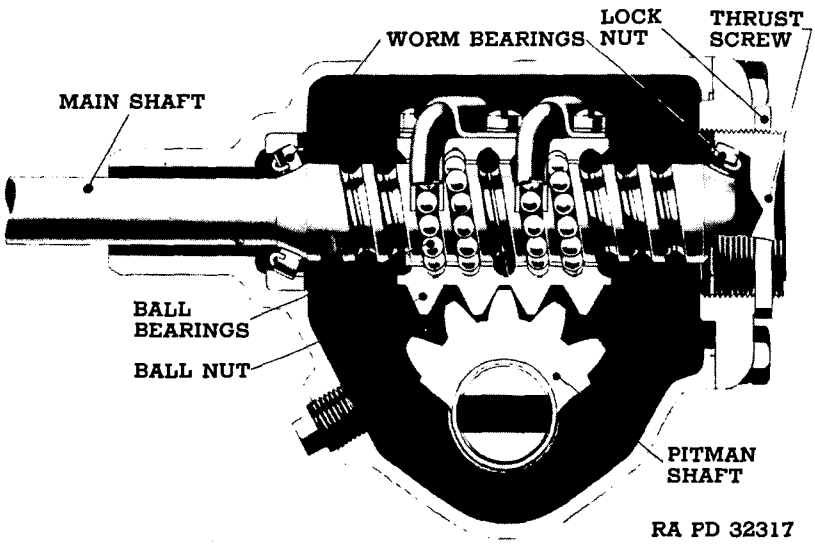


Figure 146 — Worm Shaft Adjustment

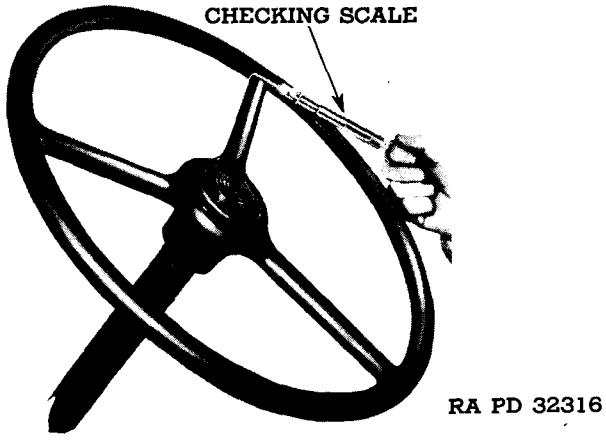


Figure 147 — Checking Steering Gear Adjustment

of checking scale KM-J544 over spoke of wheel (fig. 147). Pull on the end of the scale and note the amount of pull required to keep the wheel in motion. This should be from 1 to 1½ pounds. Adjust the worm thrust screw until the scale reads 1 to 1½ pounds and tighten lock nut (fig. 146).

(2) ADJUST LASH (fig. 145). Turn steering wheel gently until it stops; then turn it in the other direction gently until it stops, counting the number of turns required to move it from one stop to the other. Turn the wheel back exactly half way between the 2 stops to obtain the center position. Mark wheel at top or bottom center with a piece of tape. Turn lash adjusting screw until there is no perceptible end play. Hook end of checking scale KM-J544 on one of the spokes and note reading on scale as the wheel is pulled with the scale. The reading should be between 2 and 2½ pounds when the wheel passes through the center of travel. Adjust the lash adjuster until a reading of 2 to 2½ pounds is obtained. Tighten the lock (fig. 145). Check scale reading again. Remove steering wheel.

c. Steering Gear Adjustment Made With Unit in Vehicle. When the steering gear is adjusted in the vehicle it is necessary to remove the connecting rod from the pitman arm and loosen the instrument panel bracket and the mounting bolts.

(1) DISCONNECT CONNECTING ROD. Remove the cotter pin from the end plug at the pitman arm end of the connecting rod and unscrew the end plug. Pull end of connecting rod off of pitman arm.

(2) LOOSEN MOUNTINGS. Loosen the mast jacket to instrument panel bracket bolt nuts until the mast jacket is free from the instrument panel. Loosen the check nuts and nuts that retain the steering gear to the frame.

(3) ADJUST STEERING GEAR. Adjust the steering gear as instructed in paragraph 204 **b** (1).

Section VII

STEERING GEAR ASSEMBLY INSTALLATION IN VEHICLE

205. PRECAUTION.

a. When installing the steering gear in the vehicle, it is imperative that the assembly does not bind at the instrument panel or at the mounting bracket at the frame. The upper front hole in the mounting bracket and side rail is a pivot bolt. The other 3 holes have sufficient clearance to provide for alining the assembly with the instrument panel to eliminate any binding. Therefore, the pivot bolt must be installed first.

206. STEERING GEAR INSTALLATION.

a. Procedure.

(1) INSTALL ASSEMBLY AND MOUNTING BOLTS. Work the steering gear in through the left door and over the clutch and brake pedals into position on the frame. Install the upper front mounting bolt and tighten the nut finger-tight. Install the instrument panel clamp and tighten the nuts securely. Install the remaining 3 mounting bolts at the frame and install the 2 plates. Install the inner nuts with the chamfer toward the plates. Tighten all 4 nuts securely and install and tighten the lock nuts. Place horn cable connector in position and install the 2 screws.

(2) INSTALL STEERING WHEEL. Place Woodruff key in slot in shaft and install the steering wheel. Install the lock washer and nut and tighten nut securely. Place horn button, spring, and horn button in position and install the 2 retaining screws.

(3) INSTALL PITMAN ARM. Turn the steering wheel until the mark on the end of the pitman shaft lines up with the mark on the pitman arm, and push the pitman arm on the shaft. Install the lock washer and nut and tighten the nut very securely. Check the steering connecting rod to see that it is tight on ball joints.

(4) CONNECT BRAKE ROD AND INSTALL FLOOR BOARDS. Connect the brake rod to the brake pedal and install the clevis pin and cotter pin. Place floor and toe boards in position and tighten securely. Road-test vehicle to check steering.

Section VIII

FITS AND TOLERANCES

207. FITS AND TOLERANCES.

a. Steering Gear.

Worm shaft adjustment	Tighten adjusting nut to obtain 1- to 1½-pound rim pull with steering connecting rod disconnected.
Sector shaft thrust adjustment	Tighten adjusting screw to obtain 2- to 2½-pound rim pull at steering wheel through center of travel with steering connecting rod disconnected.
Sector shaft end play	0.000 in.—0.002 in.

b. Clearance Between.

Sector shaft and bushing	
Outer	0.0035 in.—0.0045 in.
Inner (in cover)	0.0015 in.—0.0025 in.
Sector shaft bushing bore	
Outer	1.2495 in.—1.2500 in.
Inner (in cover)	1.1255 in.—1.1260 in.

Section IX

SPECIAL TOOLS

208. SPECIAL TOOL LIST.

a. The following tools manufactured by the Kent-Moore Organization, or their equivalent, are recommended for use when performing the service operations covered in this chapter.

DRIVER, bushing, KM-J1316

PULLER, pitman arm, KM-J1376G

PULLER, steering wheel, KM-J1618

SCALE, checking, KM-J544

CHAPTER 10

SHOCK ABSORBERS

Section I

INTRODUCTION

209. DESCRIPTION (fig. 148).

a. The shock absorbers provide a means of dampening the spring vibrations as the wheels of the vehicle pass over irregularities in the road. The front and rear shock absorbers on this vehicle are of the

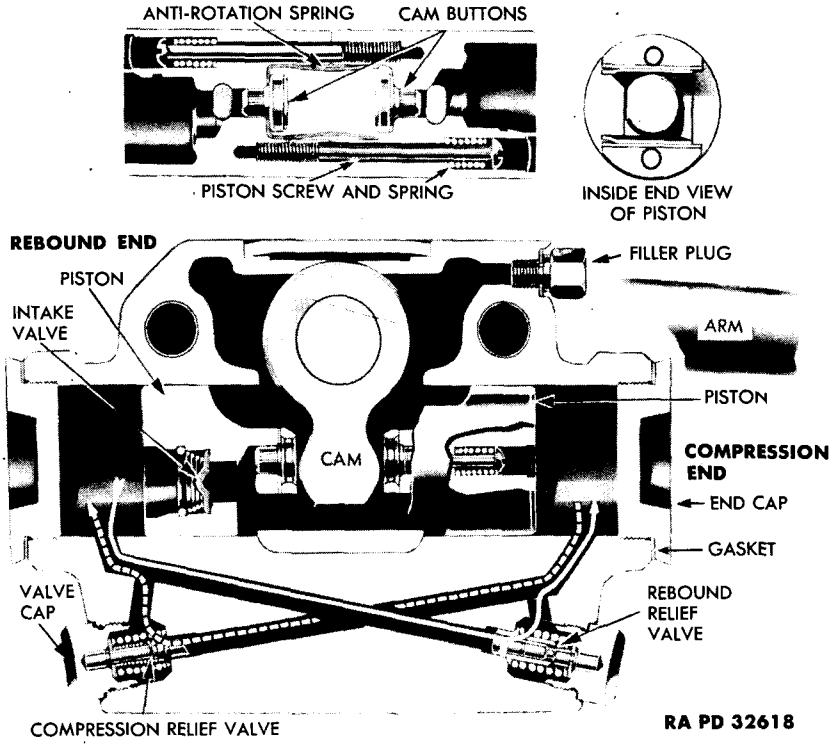


Figure 148 — Shock Absorber — Cross Section

INTRODUCTION

hydraulic double acting type which control or dampen up and down motion of the springs. Each shock absorber contains 2 pistons which are operated in tandem in opposed cylinders by a cam between them. The cam is rotated by the shock absorber arm which is attached to the end of the cam shaft and connected to the axle by a shock absorber link. The cylinders are filled with fluid which passes between the 2 cylinders through passageways as the springs move up and down.

210. DATA.

Make ..... Delco (front and rear)
Type ..... Hydraulic (front and rear)
Action ..... Double (front and rear)
Valve markings:
Rebound ..... 2R (front)
2J (rear)
Compression ..... LO (front)
G2 (rear)

211. ECHELON REFERENCES.

a. Many second echelon operations are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon duties not covered in this manual.

212. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

SHOCK ABSORBER REMOVAL FROM VEHICLE

213. INTRODUCTION.

a. Inasmuch as special equipment is needed to perform maintenance operations on shock absorbers, it is necessary to remove them from the vehicle when performing maintenance operations.

214. SHOCK ABSORBER REMOVAL.

a. **Procedure.** Remove the nut and lock washer from the bottom of the link and lift out the link from the anchor plate. Remove the 2 bolts that attach the shock absorber to frame and lift off the shock absorber.

Section III

SHOCK ABSORBER DISASSEMBLY

215. DISASSEMBLE LINK FROM SHOCK ABSORBER.

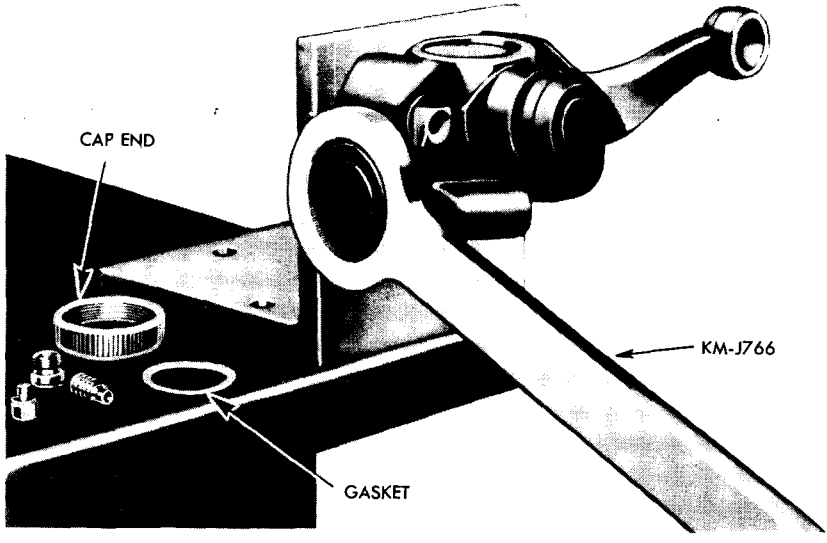
a. Procedure.

(1) REMOVE LINK. Remove the cotter pin from the clevis pin and remove the clevis pin.

216. DISASSEMBLE SHOCK ABSORBER.

a. Preliminary Procedure. Clean the shock absorber thoroughly in cleaning solution and dry it with air pressure from an air blow gun. Remove the filler plug and drain the oil from the shock absorber; work the arm up and down until completely drained.

b. Disassembling Shock Absorber. Mount the shock absorber on a fixture on the bench (fig. 149). Remove the end caps. NOTE: When removing the end caps from the front shock absorbers, special wrench KM-J766 is necessary. When removing the caps from the rear shock



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149 — Removing End Cap

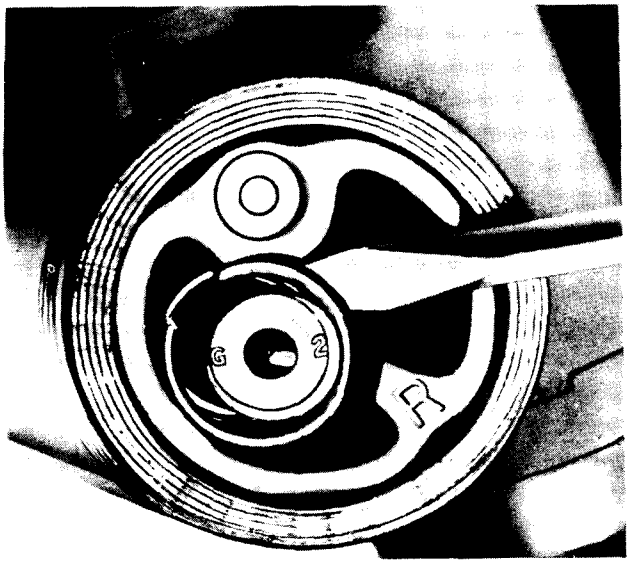

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Figure 150 — Removing Valve Spring Retainer Clip

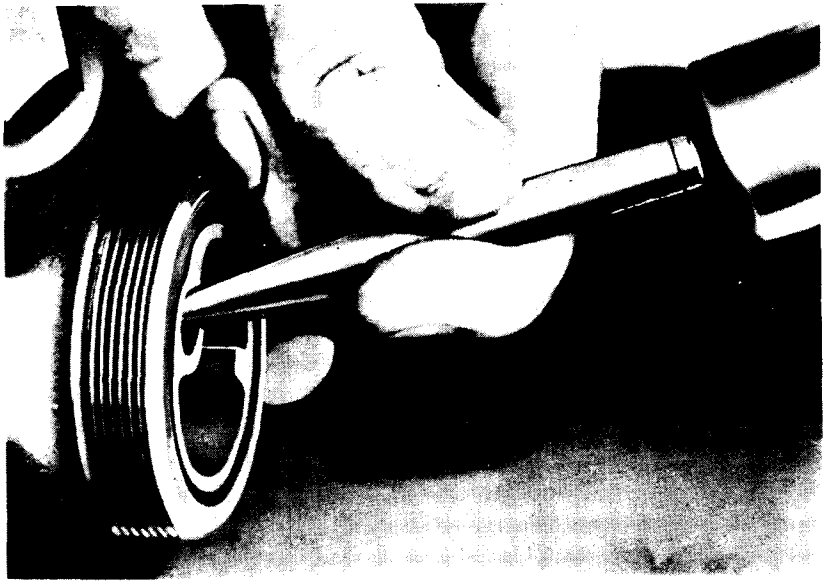

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Figure 151 — Piercing Piston Screw Plug

SHOCK ABSORBER DISASSEMBLY

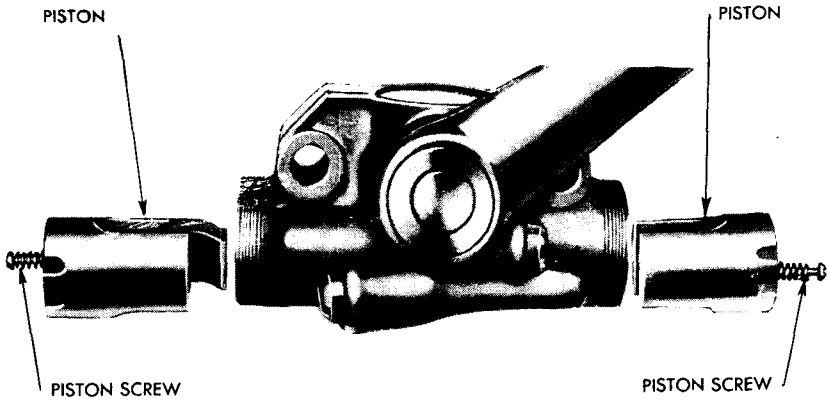

Figure 152 — Pistons and Piston Screws

absorbers, special wrench KM-J767 is necessary (fig. 149). Remove the valve retaining springs from each piston (fig. 150) and remove the valves. Pierce the plugs in the ends of piston with a sharp tool (fig. 151), and remove the plug and screw. Pull out the pistons (fig. 152). Remove the valve cap (front shock absorber) or both valve caps (rear shock absorber) and remove the valves.

Section IV

SHOCK ABSORBER PARTS, CLEANING, INSPECTION, AND REPLACEMENT

217. CLEANING OF PARTS.

a. Wash all parts in SOLVENT, dry-cleaning, and dry them thoroughly with air pressure from an air blow gun. Be sure to blow out the valve orifices.

218. SHOCK ABSORBER PARTS, INSPECTION AND REPLACEMENT.

a. Housing Unit and Pistons. Inspect the bore, cam, and pistons for scoring or other damage. Check the fit of the piston in the bore; if loose, replace the piston. If the new piston does not fit, or if the housing, cam, shaft, or packing gland are faulty, it is necessary to replace the housing with cam, cam shaft, and packing gland as an assembly.

b. Valve Assemblies. Check the valve springs, valves, and seats; replace the valve assemblies if any damage is found.

219. SHOCK ABSORBER LINK INSPECTION AND REPAIR.

a. Inspection. Check the link pins and bushings for wear or elongated holes in the link. If the holes in the link are elongated, replace the link. If the bushings are worn or damaged, replace them.

b. Link Bushing Replacement Procedure.

(1) REMOVE BUSHING AND GROMMET (fig. 153). Press out the bushing and rubber grommet, using special bushing remover and replacer KM-J899 and support KM-J903.

(2) INSTALL BUSHING AND GROMMET (fig. 154). Coat a new rubber grommet with liquid soap for easy installation, and press it into the shock absorber arm, using bushing depth spacer KM-J901. Place a new bronze bushing on the pilot of the bushing replacer and press the bushing into the grommet, using remover and replacer KM-J899 and support KM-J903.

SHOCK ABSORBER PARTS, CLEANING, INSPECTION, AND REPLACEMENT

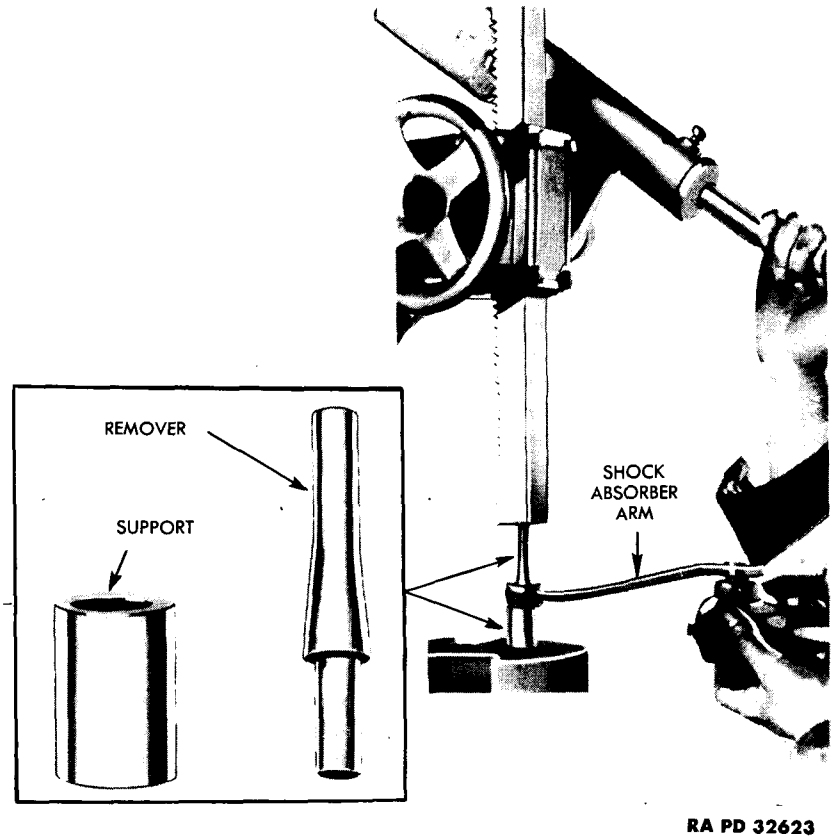

Figure 153 — Removing Link Bushing

(3) INSTALL PIN IN LINK. NOTE: The pinholes at the end of the link are of different diameters, and the knurled end of the pin should be inserted through the large diameter. Press the pin into the link, using link pin setting tool KM-J902. This tool limits the depth that the pin can be pressed through the link, preventing damage to the link. After installing the pin, strike the link against the press plate of the arbor press; a sharp blow on the head of the pin will properly seat the large hole on the shoulder of the pin.

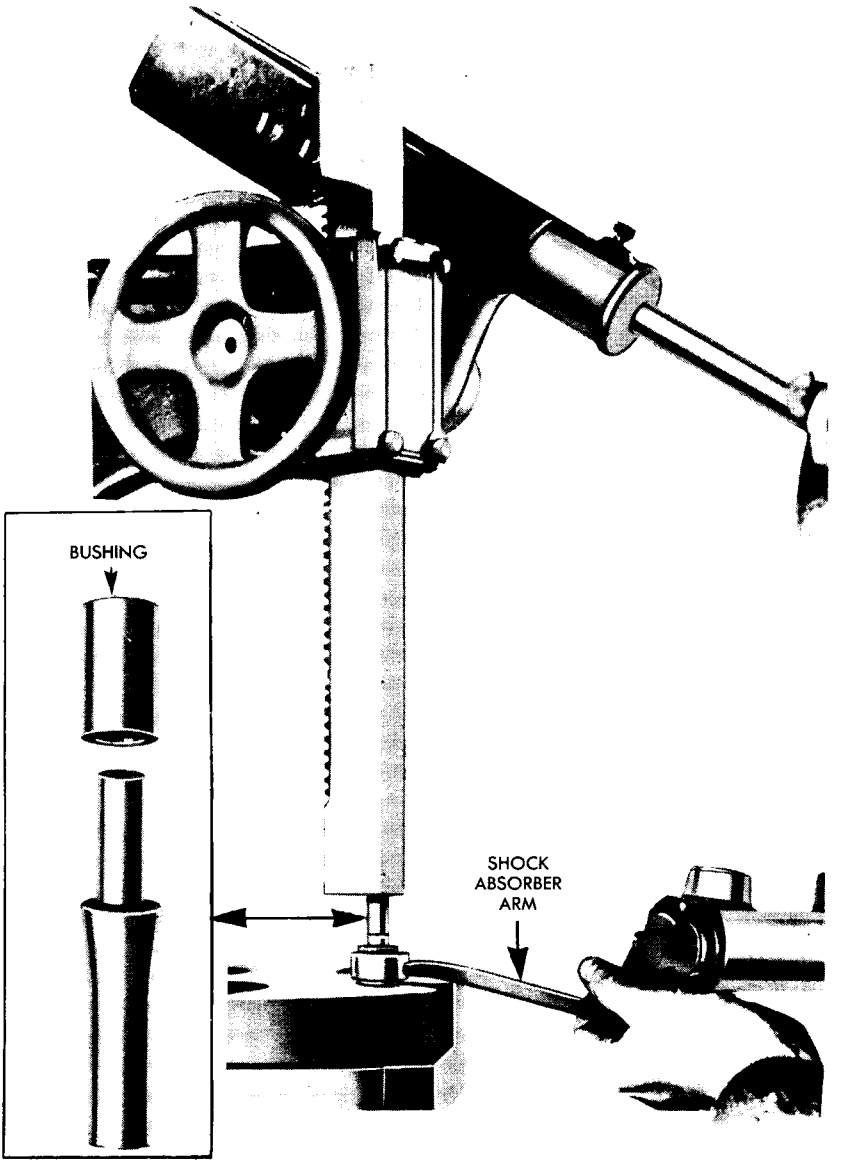

Figure 154 — Replacing Link Bushing

Section V

ASSEMBLING SHOCK ABSORBERS

220. PRELIMINARY PROCEDURE.

a. Before assembling the pistons, a chamfer must be filed on the rebound piston (which is the piston without the antirotation spring) at the point indicated in figure 155. This is necessary to allow the antirotation spring to enter the other piston during assembly.

221. ASSEMBLING SHOCK ABSORBERS.

a. Procedure.

(1) ASSEMBLE SHOCK ABSORBERS. Assemble piston with cam clearance up, and also with high arch of antirotation spring up. Insert piston screws tightly; then back off from 1½ turns to prevent a possible bind between cam and cam buttons. Install new plugs over piston screws and expand in place. Install new valve and snap ring, using special driver J896A (fig. 156). The open side of the snap ring should be installed as shown in figure 157. If it is installed in any other position, it is very difficult to remove. After the valves have been installed, flip the valve with a screwdriver to make sure that the valve and spring are free. Replace one end cap, using new gasket, and rotate fixture until open end of absorber is up. When assembling end cap, place a small amount of grease between end cap and steel spacer. Fill absorber to capacity with FLUID, shock-absorber, light. While filling, move arm through complete strokes to expel the air from unit. Replace other end cap and rotate fixture until arm is in same position as it is mounted on car. Remove filler plug and allow fluid to drain down to the level of the absorber reservoir to allow for normal expansion of the fluid. Replace filler plug, using new gasket.

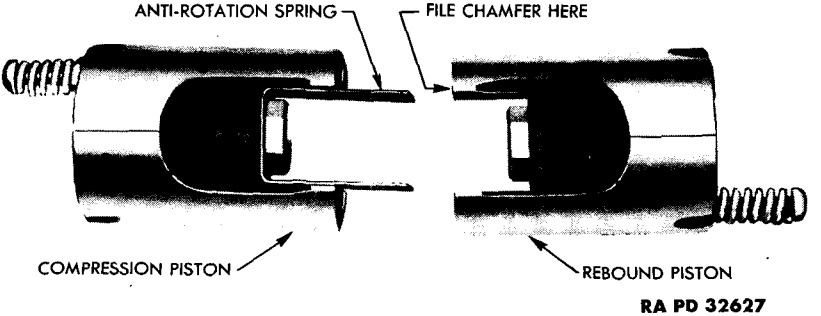

Figure 155 — Arrow Indicating File Point on Piston

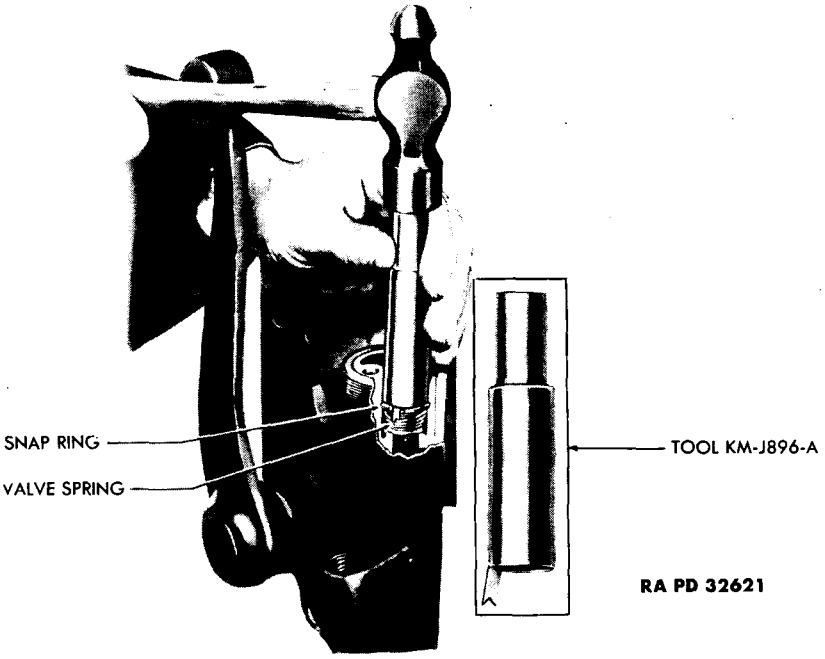

Figure 156 — Installing Valve and Snap Ring

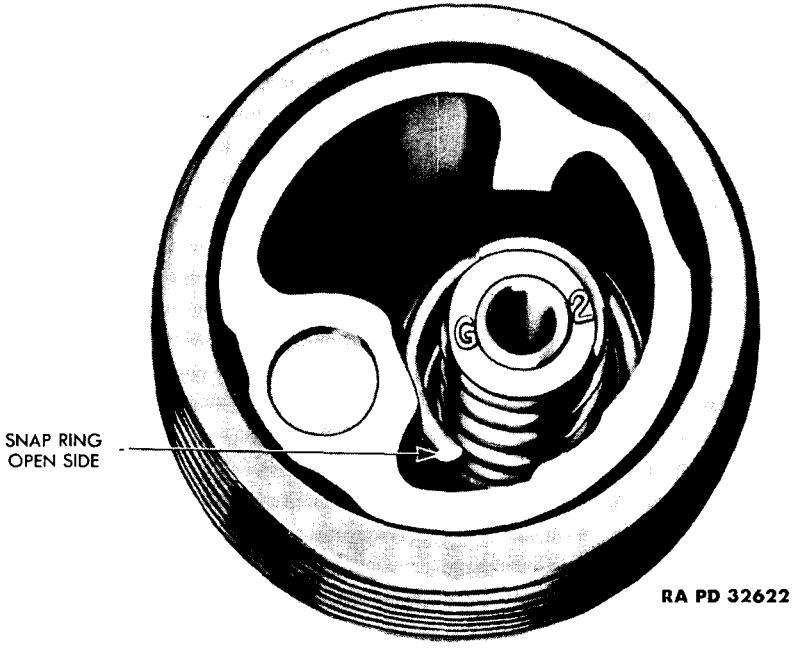

Figure 157 — Correct Position of Compression Valve

Section VI

INSTALLING SHOCK ABSORBER ON VEHICLE

222. SHOCK ABSORBER INSTALLATION.

a. Procedure. Place shock absorber in position on frame and install the 2 retaining bolts. Place lower end of link in anchor plate and install the nut and lock washer.

Section VII

SPECIAL TOOLS

223. SPECIAL TOOL LIST.

a. The following tools manufactured by the Kent-Moore Organization, or their equivalent, are recommended for use when performing the service operations covered in this chapter.

DRIVER, KM-J896A

REMOVER and REPLACER, bushing, KM-J899

SPACER, KM-J901

SUPPORT, KM-J903

TOOL, link pin setting, KM-J902

WRENCH, KM-J767

WRENCH, KM-J766

CHAPTER 11

STARTING MOTOR

Section I

INTRODUCTION

224. DESCRIPTION.

a. General. The starting motor is designed to incorporate a manual shift drive mechanism which assures positive engagement of the starting motor pinion with the flywheel until the engine is started (fig. 158). In this design the starter pinion in conjunction with an overrunning clutch (or roller clutch), a compression spring, and a pulley-like sheave are mounted as an assembly on the splined part of the armature shaft. The sheave and spring are mounted to rotate freely on the outer diameter of the tube portion of the assembly. A lever bolted at its fulcrum to the starting motor housing has a yoke at its lower end which straddles the sheave; integral bosses on its inner sides engage the sheave grooves. The upper end of the lever connects to the starter pedal through linkage.

b. Operation. When cranking the engine, depressing the starter pedal causes the lever to shift the pinion gear into mesh with flywheel teeth. Further pedal movement brings an offset portion of the lever into contact with the button on the starter switch, thereby closing the switch contacts. In case the pinion gear is stopped when engaging the flywheel teeth, the compression spring allows the sheave to move along the sleeve, permitting the lever to close the starter switch contacts. The instant the armature starts to rotate, the compression spring pushes the pinion gear into full mesh with the flywheel (fig. 158). After the engine fires, and before the pinion can be withdrawn from the flywheel teeth, the overrunning clutch allows the pinion to spin freely on the armature shaft. The tension of the starter pedal return spring holds the pinion out of mesh with the flywheel while the engine is operating.

225. DATA.

Make ..... Delco-Remy
Model 1107055

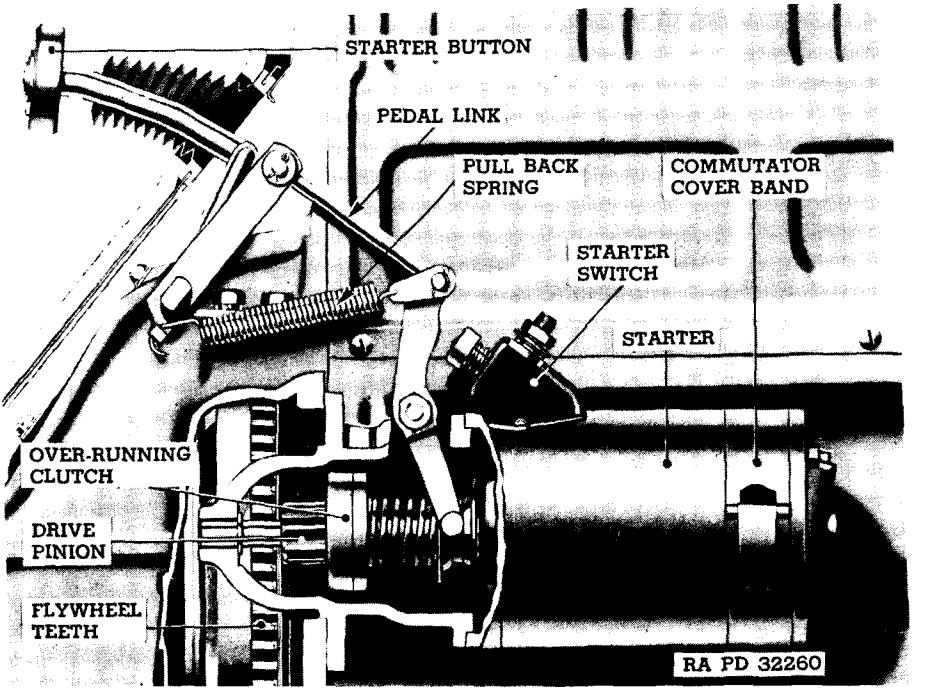

Figure 158 — Starting Motor — Cross Section

Lock test:	
Amperes	525
Volts	3.4
Torque	12 ft-lb
No load test:	
Amperes	65
Volts	5
Revolutions per minute	5,000
Brush spring tension	24 to 28 oz

226. ECHELON REFERENCES.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon duties not covered in this manual.

227. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

228. TROUBLE SHOOTING (fig. 159).

a. Discharged Battery.

Probable Cause	Probable Remedy
Loose or dirty terminals.	Clean and tighten terminals.
Generator not charging.	Inspect and test generator and regulator as instructed in TM 9-765.
Leak in wiring.	Check wiring for short circuit.
Excessive use of starting motor, due to hard starting.	Tune engine completely as instructed in TM 9-765.

b. Slow Starting Motor Speed.

Discharged battery.	Recharge battery.
Loose or dirty terminals.	Clean and tighten terminals.
Worn brushes.	Replace brushes (par. 232).
Sticking brushes.	Free brushes; check brush spring tension.
Dirty commutator.	Clean commutator with sandpaper.
Worn drive end bushing.	Replace bushing (par. 232).
Burned starter switch contacts.	Replace starter switch (TM 9-765).

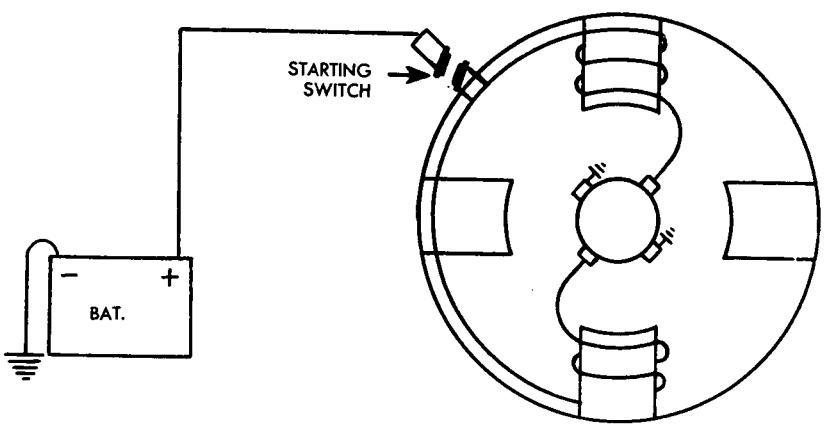

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Figure 159 — Starting Motor Circuit

Section III

STARTING MOTOR REMOVAL

229. STARTING MOTOR ASSEMBLY REMOVAL.

a. Procedure (fig. 160). Remove the cotter pin and clevis from the top of the fulcrum lever. Disconnect the starter cable and ammeter wire from starter switch terminal. NOTE: Wrap a cloth around the end of cable to prevent a short circuit, should the end of cable contact any metal. Remove the 2 cap screws that attach the starting motor to the flywheel housing and lift out starting motor assembly.

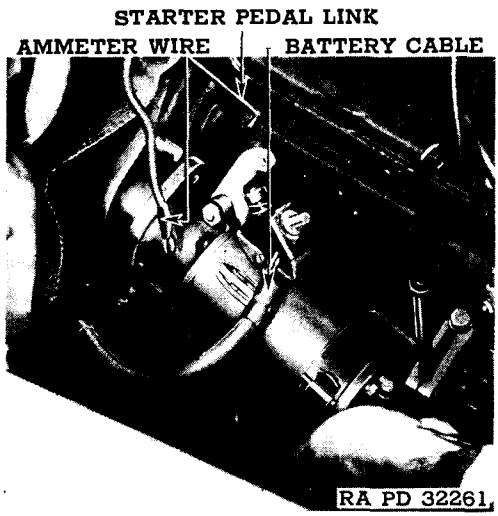

Figure 160 — Starting Motor Removal

STARTING MOTOR REMOVAL

Figure 161 — Starting Motor Parts

Section IV

STARTING MOTOR DISASSEMBLY

230. STARTING MOTOR DISASSEMBLY (fig. 161).

a. Procedure. Remove the 2 screws that attach the starting motor switch and remove the switch. Remove the commutator band. Remove the 2 machine screws that attach the field leads to the insulated brush holders. Remove the 2 through bolts that hold the starting motor together. Pull off the brush holder frame and drive housing with drive mechanism, and pull out the armature. Remove the 2 machine screws that attach the ground brushes and remove all 4 brushes. Remove the nut and bolt on which the shift lever pivots, and remove the lever and drive mechanism.

Section V

STARTING MOTOR PARTS, CLEANING, INSPECTION, AND REPAIR

231. CLEANING OF PARTS.

a. The cleaning, inspection, and repair of the starting motor parts must be done with extreme care and cleanliness. All parts must be thoroughly cleaned both inside and outside with SOLVENT, dry-cleaning, and then dried with air pressure from an air blow gun. Parts that are to be replaced should be placed to one side to keep them separated from the parts that are to be used again. NOTE: *Do not* wash starter drive mechanism in cleaning solution.

232. COMPONENT PARTS, INSPECTION AND DISASSEMBLY.

a. Inspection. In order to inspect completely the starting motor component parts, it is necessary to make various electrical tests on some of the parts.

(1) TEST FIELD COIL FOR CONTINUOUS CIRCUIT. Place the test prod leads on the field coil leads. If the test lamp lights, the field coils are good. If the test lamp does not light, there is an open circuit in one or both of the field coils, and the coil should be replaced.

(2) TEST FIELD COIL FOR GROUND.

(*a*) Place one test prod lead to frame and the other to the field coil lead. If the test lamp does not light the field coils are good. If the test lamp lights, one or both field coils are grounded.

(*b*) If coils are grounded they can be tested individually to determine which one is grounded. Break soldered connection between the 2 field coils and test each one separately, replacing the field coil that is grounded.

(3) TO DISASSEMBLE FIELD COILS. Remove the screws that attach the frame pole shoes to the housing and remove the frame pole shoes and fields.

(4) TEST FIELD COIL LEADS. Inspect the field coil leads where they are soldered at the starting switch terminal to be sure that they are tight.

(5) TEST ARMATURE FOR GROUND. Place one test prod on the armature and the other on the commutator. If the test lamp lights, the armature is grounded and should be replaced. If the test lamp does not light, the armature is good.

(6) TEST ARMATURE FOR SHORT CIRCUIT. Place the armature on the growler and, with a hack saw blade over the armature core, rotate the armature and test. If the saw blade does not vibrate, the armature is good. If the saw blade vibrates the armature is short-circuited and should be replaced.

(7) INSPECT COMMUTATOR. Inspect the commutator for roughness or burned bars; burned bars usually indicate open-circuited coils which in most cases is caused by coil leads being loose in the commutator riser bars. If bars are rough, the commutator should be turned down on a lathe. If the leads are loose, they should be resoldered, using a rosin flux. Then turn the commutator down on a lathe and sand.

(8) TEST INSULATED BRUSH HOLDERS FOR GROUND. Place one test prod lead to the cover and the other on the brush holder. If the test lamp lights, brush holder is grounded and should be replaced. If the test lamp does not light, the brush holder is good.

(9) REPLACE SPRING AND/OR BRUSH HOLDER. Remove brush holder and spring by lifting lower arm of spring out of the groove in the pin with pliers and hold it out while lifting brush holder off pivot pin. CAUTION: Do not remove more than one brush holder until it is reinstalled on the frame. By doing it this way, you can refer to the other brush holders so as to mount the spring and brush holder in the proper position.

(10) INSPECT BRUSHES. Check the condition of the brushes and if they are pitted or worn, they should be replaced.

(11) TEST BRUSH SPRING TENSION. Place brush holder frame in position on commutator end of armature and, with checking scale, hook end of checking scale over brush holder and read the scale while lifting the brush holder. The scale should read between 24 and 28 ounces. If the reading is less, the springs should be replaced.

(12) INSPECT END BUSHINGS.

(*a*) Check the fit of the armature in the bushing in the end of the housing. If it is loose, it should be replaced.

(*b*) Check the fit of the commutator end of the armature in the frame end for looseness. If it is too loose, replace the frame end.

(13) REMOVE END BUSHING. Drive out old bushing.

(14) INSPECT SWITCH. Check starter switch to see that the spring is not broken; also to see that the contact pad is not burned, worn, or broken. If the switch is faulty, replace it.

(15) INSPECT DRIVE MECHANISM. Inspect the drive mechanism for wear or other damage. If faulty, replace the complete unit.

STARTING MOTOR PARTS, CLEANING, INSPECTION, AND REPAIR

233. COMPONENT PARTS, REPAIR AND ASSEMBLY.

a. End Bushing.

(1) INSTALL END BUSHING. Place new bushing in position and press it in until it is flush with inside of housing. NOTE: It is not necessary to ream this bushing. Check shaft fit in bushing.

b. Field Coils.

(1) INSTALL FIELD COILS. Place frame pole shoes in position in coils and place coils with shoes in position in the housing. Install the screws that retain the shoes and tighten them securely. Stake screws at each end of slot with a center punch. Solder the end of each coil to the terminal on the housing.

Section VI

ASSEMBLING STARTING MOTOR

234. PRELIMINARY PROCEDURE.

a. Although the various parts were thoroughly cleaned previously, it is advisable to wipe the parts off with a clean rag as they are being assembled.

235. ASSEMBLING STARTING MOTOR.

a. Procedure.

(1) ASSEMBLE DRIVE MECHANISM. Start the shift lever through the slot in the rear housing, at the same time engaging the bosses on the inner end of the lever in the sheave grooves of the drive mechanism. Then slide the lever and the drive into the housing together, and assemble the pivot bolt through the shift lever to the housing.

(2) INSTALL ARMATURE. Place commutator end frame in position on the armature and place armature with end frame in housing.

(3) INSTALL DRIVE HOUSING TO ARMATURE HOUSING. Place drive mechanism with housing in position over other end of housing while holding commutator end frame in place. NOTE: Be sure to install the thrust washer between the end of drive mechanism and the drive housing. Install the 2 through bolts and lock washers and tighten them securely.

(4) INSTALL SWITCH. Place the 2 insulation pieces in the starting switch and place switch in position on housing; install the 2 mounting screws.

(5) INSTALL BRUSHES. Install the 2 ground brushes in the brush holders and attach the pigtails to the brush holders with the machine screws. Install the other 2 brushes and attach the field wires to each of the insulated brush holders together with a pigtail from the brushes with the machine screws. Tighten the 4 screws securely.

(6) LUBRICATE AND CHECK. Oil the drive end bushing and fill the commutator end bushing oil cup with light engine oil. Turn armature to see that it turns freely. Install cover band.

Section VII

STARTING MOTOR INSTALLATION IN VEHICLE

236. STARTING MOTOR INSTALLATION.

a. Procedure. Place starting motor in position in housing and install the mounting cap screws and lock washers and tighten them securely. Install the battery cable and ammeter lead on the starting switch and tighten the nut securely. Connect the starting pedal link with spring and install the clevis pin and cotter pin. Step on starter pedal to test the operation of the starting motor.

Section VIII

FITS AND TOLERANCES

237. STARTING MOTOR.

Armature end play.....0.005 in.—0.050 in.
Commutator out-of-round .....0.003 in.

CHAPTER 12

GENERATOR AND CONTROLS

Section I

INTRODUCTION

238. DESCRIPTION (fig. 162).

a. Generator. This vehicle is equipped with a 40-ampere generator with a negative ground system. The generator is a 2-brush, shunt-wound unit, controlled by a generator regulator. The 2 commutator bearings are sealed and permanently lubricated.

b. Generator Regulator. The generator regulator is comprised of 3 separate units to control the output of the generator.

(1) The voltage regulator controls the maximum voltage of the generator and keeps it from exceeding a predetermined value fixed by the setting of the regulator. The actual charging rate to the battery varies, depending on the state of charge in the battery.

(2) The current regulator controls the maximum amperage output of the generator, and prevents it from exceeding 40 amperes, which is the setting of the current regulator, thereby preventing damage to the generator due to overload.

(3) The cutout relay keeps the battery from discharging through the generator when the engine is not running.

c. Note. The older vehicles were equipped with a 25-ampere generator with a positive grounded system. The generator has a bronze bushing at the rear of the armature and a ball bearing at the front which require lubrication. NOTE: These 2 generators are not interchangeable unless the entire system is changed.

(1) GENERATOR REGULATOR. To replace the 25-ampere generator with a 40-ampere generator, it is also necessary to change regulators to prevent excessive pitting of the regular points.

(2) WIRING. New battery cables are necessary when the ground system is reversed, because of the difference in size of the positive and negative terminals on the battery. When the ground system on any

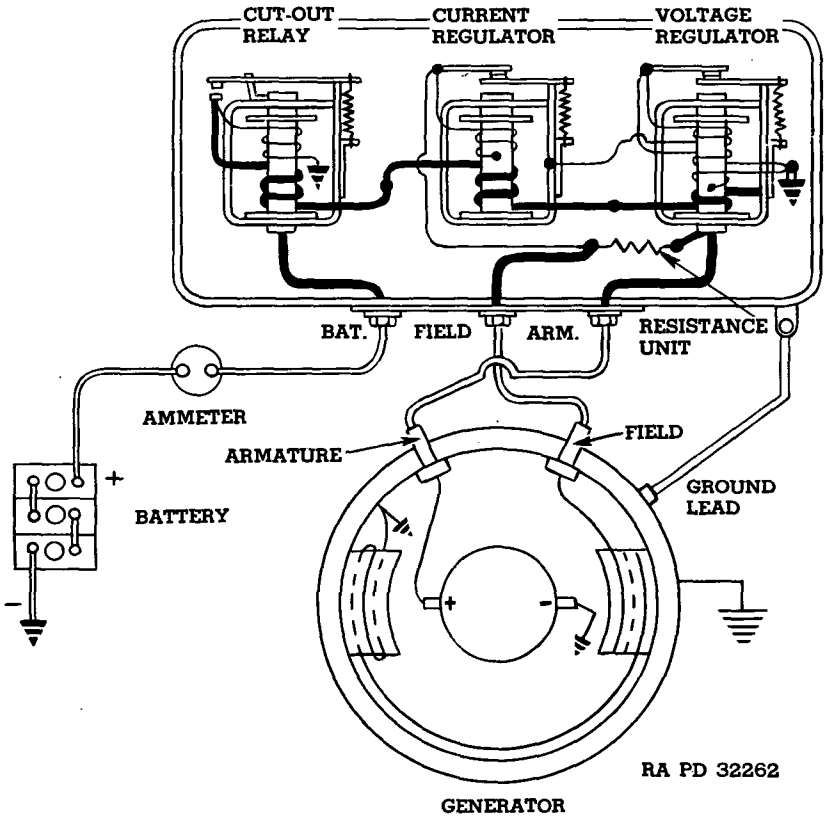

Figure 162 — Generator Circuit Diagram

vehicle is reversed, it will be necessary to reverse the connections on the ammeter and also on the primary connections of the ignition coil.

(3) AMMETER. It is not absolutely necessary to change ammeters when installing 40-ampere system, but advisable. The 30-ampere ammeter will carry the full output of the 40-ampere generator, although the ammeter hand will occasionally read off the scale on the ammeter.

(4) NOTE. It is a good practice, after replacing a generator on the car, to use a jumper lead momentarily to connect the battery terminal of the regulator with the generator terminal. This sends a current through the generator windings, assuring that it will build up in the proper polarity.

INTRODUCTION

239. DATA.

a. 40-Ampere, Negative Grounded System.

(1) GENERATOR.

Make ..... Delco
Model 1105860
Voltage 6

(2) REGULATOR.

Make ..... Delco
Model 1118461
Type ..... Current and voltage vibrating type

b. 25-Ampere, Negative Grounded System.

(1) GENERATOR.

Make ..... Delco
Model 1105854
Voltage 6

(2) REGULATOR.

Make ..... Delco
Model 005628
Type ..... Current and voltage vibrating type

240. ECHELON REFERENCES.

a. Many second echelon operations described in TM 9-765 are often done by ordnance maintenance personnel. Reference should be made to TM 9-765 for lower echelon duties not covered in this manual.

241. ALLOCATION OF MAINTENANCE DUTIES BY ECHELONS.

a. Refer to paragraph 7.

Section II

TROUBLE SHOOTING

242. TROUBLE SHOOTING.

a. Discharged Battery.

Probable Cause	Probable Remedy
Loose or dirty terminals.	Clean and tighten terminals.
Generator not charging.	Inspect and test generator and controls as instructed in TM 9-765.
Leak in wiring.	Check wiring for short circuit.
Excessive use of starting motor due to hard starting.	Tune engine completely as instructed in TM 9-765.

b. Low Generator Charging Rate.

Dirty commutator.	Clean commutator.
Fan belt loose.	Adjust fan belt (TM 9-765).
Voltage regulator improperly adjusted.	Adjust regulator according to instructions in paragraph 244.
High resistance in charging circuit.	Clean and tighten battery terminals and check circuit for loose connections.
Brushes worn.	Replace brushes.
Weak brush tension springs.	Replace springs.

c. Too High Generator Charging Rate.

Current regulator improperly adjusted.	Adjust current regulator according to instructions in paragraph 244.
Battery dry.	Fill battery with water.

Section III

OPERATIONS PERFORMED WITHOUT REMOVING UNITS FROM VEHICLE

243. GENERATOR REPAIRS.

a. Introduction. The only repair that can be made to the generator without removing it from the vehicle is to clean the commutator.

b. Commutator Cleaning Procedure. Remove the cover band, run engine at idling speed, and clean commutator with a piece of No. 00 sandpaper. Blow out the dust and install the cover band.

244. REGULATOR UNIT ADJUSTMENTS.

a. Introduction. It is not necessary to remove the regulator to adjust the units. Should the regulator be removed from the vehicle, the adjustments should be made under actual operating conditions, that is, the regulator should be mounted in the same position as when mounted in the truck, and allowed to operate until it attains operating temperature. When checking and adjusting a regulator unit, it is essential that reliable instruments be used.

b. Voltage Regulator Adjustment.

(1) TEST VOLTAGE REGULATOR (fig. 163). Disconnect the battery wire from the terminal on the regulator. CAUTION: Wrap a piece of cloth around the end of the wire to prevent a short circuit, should the end of the wire touch any metal. Connect the positive lead of a reliable voltmeter to the armature terminal and the negative lead to a good ground. Run the engine at a speed equivalent to about 30 miles per hour and check the voltmeter reading which should be 7.5 volts.

(2) ADJUST VOLTAGE REGULATOR (fig. 164). Remove cover and check the point opening by holding the armature down against the case and by measuring the distance between the points. This distance should be 0.015 inch in the 40-ampere system. Adjust the gap by loosening the lock nut and turning the contact screw on the upper point (fig. 164). NOTE: The spring holding the upper contact screw should rise slightly above the fibre insulator when the points come together; this provides a wiping action which improves their operation. After the point opening has been adjusted, the voltage may be set by loosening the lock screw and turning the eccentric screw on the side plate

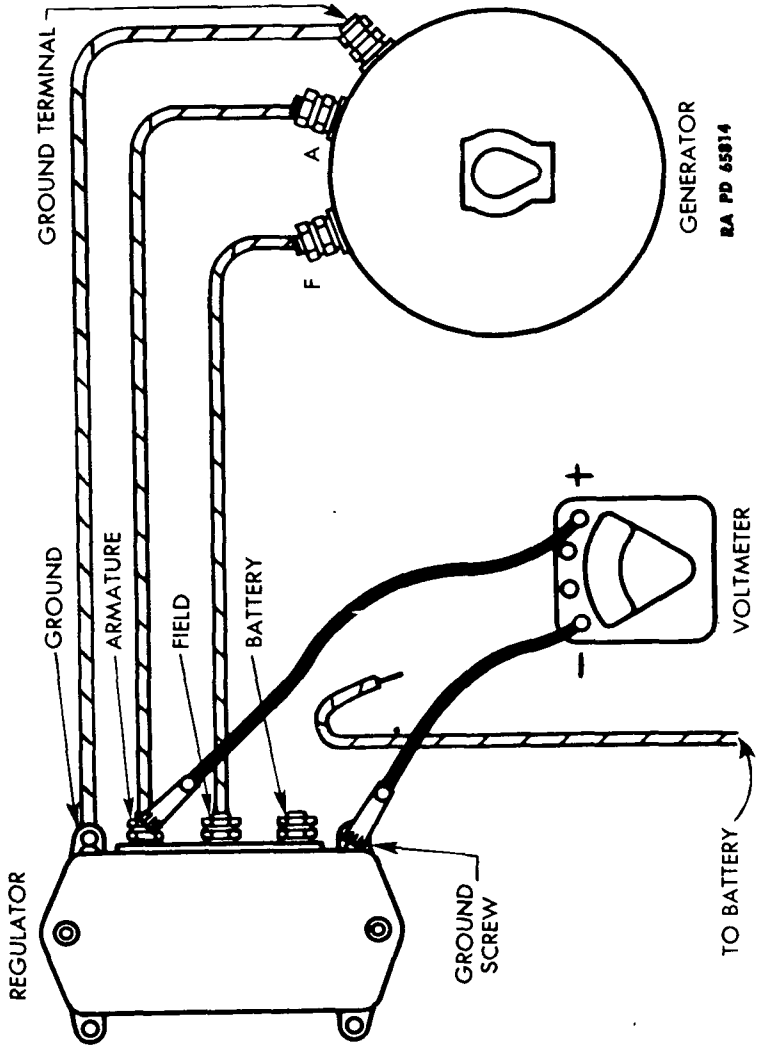

Figure 163 — Voltage Regulator — Checking Voltage Adjustment

OPERATIONS PERFORMED WITHOUT REMOVING UNITS FROM VEHICLE

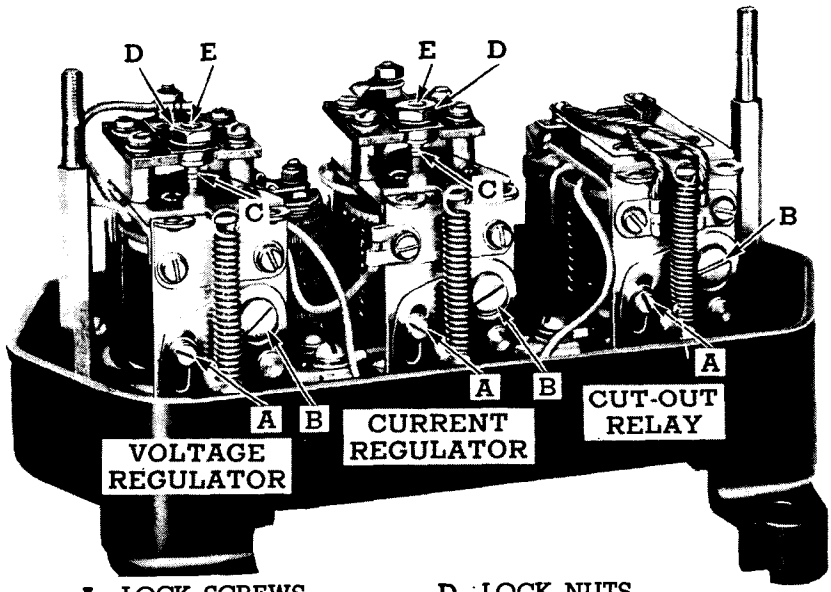

Figure 164 — Generator Circuit Regulator

to increase or decrease the spring tension until the voltmeter reading of 7.5 volts is obtained (fig. 164). Then tighten the lock screw securely. Recheck the operation. If the voltage regulator cannot be adjusted properly, it should be replaced (par. 249).

c. Current Regulator Adjustment.

(1) TEST CURRENT REGULATOR (fig. 165). Remove the regulator cover and connect a jumper lead from the voltage regulator upper point to the armature (fig. 165). This connection shorts the voltage regulator points and prevents them from operating while the current regulator is being checked. Remove the battery wire from the terminal and connect the positive lead of an ammeter to the battery terminal of the regulator, and the negative lead to the battery wire. Turn on the lights and other electrical accessories, start the engine, and increase the engine speed until the output remains constant. The ammeter reading with the regulator at operating temperature should be 40 amperes. If not, adjust as follows:

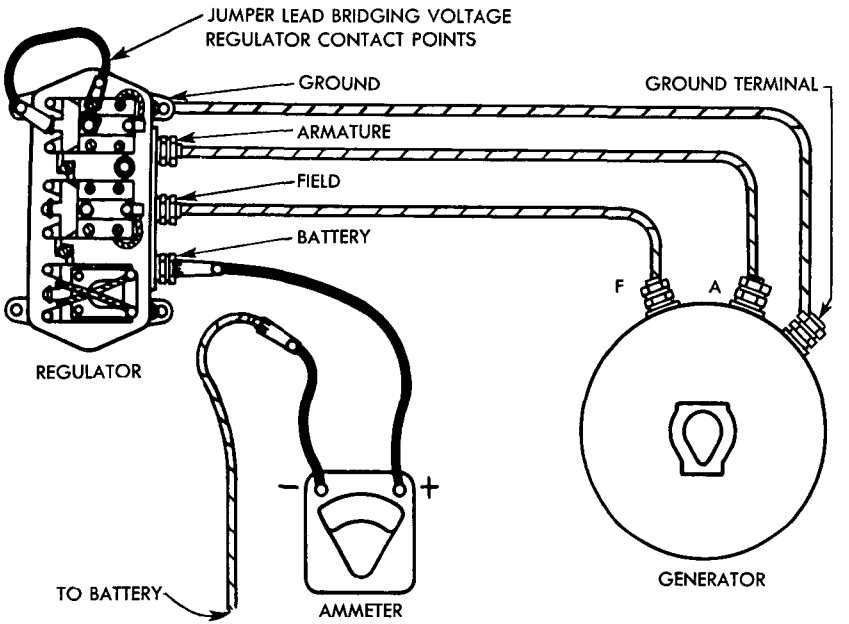

Figure 165 — Current Regulator — Checking Current Output

(*a*) *Adjust Current Regulator* (fig. 164). Hold the armature (with lower point) down against the core and measure the distance between the points. This distance should be 0.015 inch. Adjust the gap by loosening the lock nut and turning the adjusting screw (fig. 164). NOTE: The spring holding the upper contact screw should rise slightly above the fibre insulator when the points come together; this provides a wiping action which improves their operation. Recheck the operation. If the current regulator cannot be adjusted, it should be replaced (par. 249).

d. Cutout Relay Adjustments.

(1) TEST CUTOUT RELAY (fig. 166). Disconnect the battery wire from the battery terminal and connect the positive lead of an ammeter to the battery terminal and the negative lead to the battery wire. Connect the positive lead of a voltmeter to the armature terminal of the regulator and the negative lead to a good ground. Start the engine, and gradually increase the engine speed, noting the voltage at which the points close. This should be 6.7 volts. Slowly decrease the engine speed, noting the discharge current necessary to open the points. This should be from 0 to 4 amperes.

OPERATIONS PERFORMED WITHOUT REMOVING UNITS FROM VEHICLE

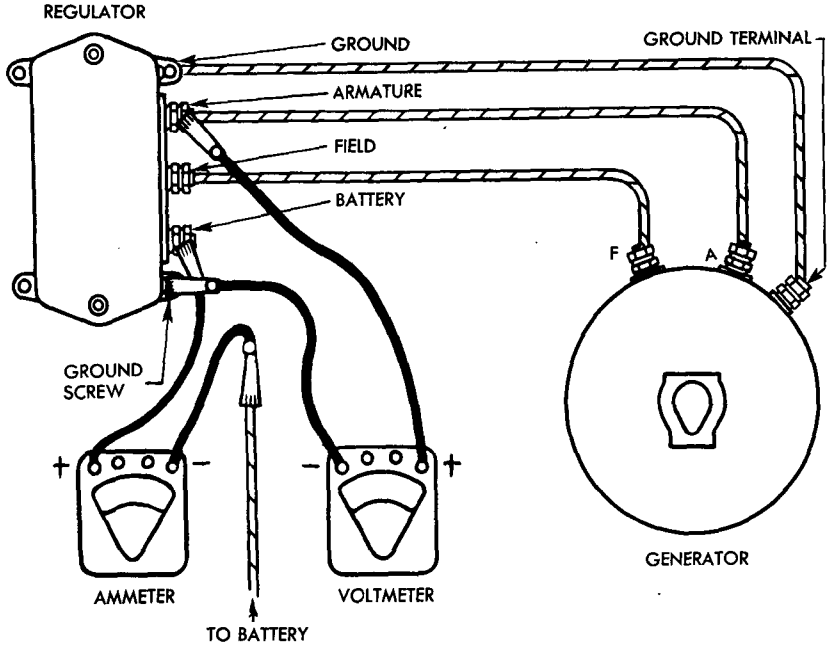

Figure 166 — Cutout Relay — Checking Closing Voltage

(2) ADJUST CLOSING OF CUTOUT RELAY POINTS (fig. 164). Loosen the lock screw and turn the eccentric screw to increase or decrease the spring tension until they close at 6.7 volts. NOTE: If adjustment is impossible to obtain, check and adjust the voltage regulator first; then adjust the cutout relay. After making the above adjustments, if the reverse current necessary to open the points is not within the limits of 0 to 4 amperes, the air gap should be adjusted. If correct adjustment cannot be obtained, replace the cutout relay unit (par. 249).

(3) ADJUST OPENING OF CUTOUT RELAY POINTS (fig. 167).

(*a*) *Check Air Gap.* Disconnect the battery wire, close the points manually and measure the distance between the underside of armature and the core (not between brass pin in armature and core). This distance should be 0.057 inch.

(*b*) *Adjust Air Gap* (fig. 167). Loosen the 2 adjusting screws and raise or lower the contact bracket until the gap is 0.057 inch.

(*c*) *Test Point Opening.* With a feeler gage, measure the distance between the points. This opening should be 0.020 inch in the 40-ampere circuit.

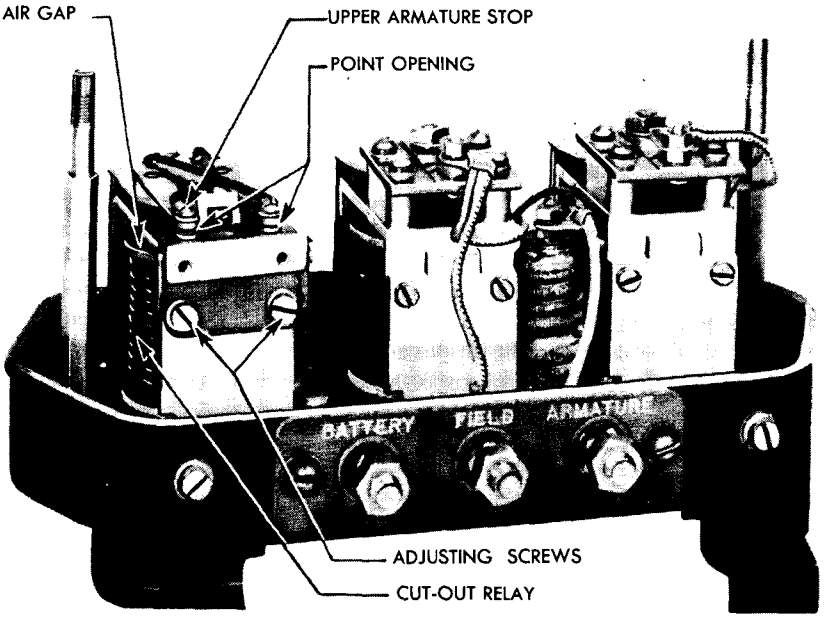

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Figure 167 — Cutout Relay Adjustment

(*d*) *Adjust Point Opening.* Bend the upper armature stop until the opening is 0.020 inch. Recheck the operation of the unit and readjust until points close at 6.7 volts and open at 0 to 4 amperes discharge.

245. REGULATOR POINTS, CLEANING AND REPLACEMENT.

a. Introduction. When the points become burned or oxidized, they can be cleaned with a fine cut ignition file, providing they are not burned excessively. CAUTION: Do not use file excessively on the smaller point.

b. Cleaning Procedure.

(1) CLEAN POINTS. Remove the upper contact support and file each point separately. Install the upper contact point and readjust as instructed in previous paragraph. If the points are burned excessively, they should be replaced.

c. Cutout Relay Point Replacement Procedure.

(1) REMOVE POINTS. Remove the spring on side of cutout body and remove the 2 screws that attach the armature or lower point. Unsolder the ends of the series and voltage windings from the clip which is a

part of the lower point assembly and remove the armature. Remove the 2 screws which mount the upper point and remove the point.

(2) INSTALL POINTS. Place the upper point in position and install the 2 screws. Place the lower point in position and install the 2 screws. NOTE: Line up the points before tightening the 4 mounting screws. Solder the 2 leads to the clips and install the spring. Adjust the points as instructed in paragraph 244.

d. Current and Voltage Regulator Point Replacement Procedure.

(1) REMOVE POINTS. Unhook the lower end of spring and remove the 2 screws that attach the armature to the body and remove the armature. Loosen lock nut on upper point screw and unscrew the adjusting screw with point attached.

(2) INSTALL POINTS. Start the upper point with lock nut and lock washer in place. Place the lower point in position and install the 2 screws. NOTE: Line up the points before tightening the screws. Attach the spring. Adjust the points as instructed in paragraph 244.

Section IV

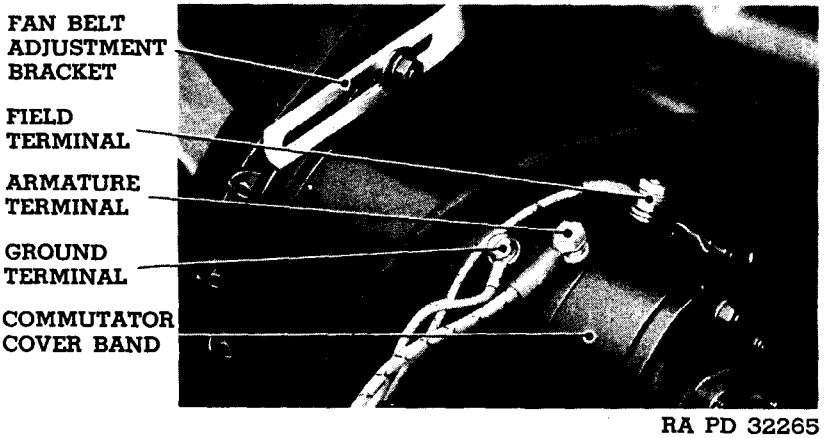
REMOVAL OF GENERATOR AND CONTROLS FROM VEHICLE

246. GENERATOR REMOVAL (fig. 168).

a. Procedure. Disconnect the field, armature, and ground wires from the generator terminals. NOTE: Identify each wire with a tag so that they can be put back on the same terminals from which they were removed. Remove the cap screw from the generator end of the slotted brace. Push generator toward the engine and remove the fan belt from the generator pulley. Remove the 2 bolts from each end of the bracket at bottom of generator and lift out the generator.

247. REGULATOR REMOVAL.

a. Procedure. Disconnect the 3 wires from the terminals on the bottom of the regulator. NOTE: Do not let the end of the battery wire touch any metal, as this would cause a short circuit. Identify each wire with a tag so that they can be put back on the same terminals they were removed from. Remove the 4 bolts that attach the regulator to the dash and lift off the regulator.



RA PD 32265

Figure 168 — Generator Assembly

REMOVAL OF GENERATOR AND CONTROLS FROM VEHICLE

Figure 169 — Generator Parts

Section V

GENERATOR AND REGULATOR DISASSEMBLY

248. GENERATOR DISASSEMBLY (fig. 169).

a. Place the generator in a bench vise; use the vise as a holding fixture only; do not pinch the generator frame. Remove the cotter key and nut that attaches the pulley to the armature and tap off the pulley with a soft hammer and remove fan. Remove the cover band and brush lead machine screws and lift out the generator brushes. Remove the through bolts and commutator end frame with bearing. Slide the space collar off and remove the drive end frame with armature. Press the armature out of the end frame. Remove the 3 screws from the bearing inner retainer on the drive frame end, and remove the retainer and gasket and tap out the bearing with a brass drift and hammer. Remove the felt washer and felt washer retainer.

249. REGULATOR DISASSEMBLY.

a. Introduction. Before disassembling the regulator, it is necessary to determine which unit it faulty. This can only be done by making tests as outlined in TM 9-765, and adjustments as instructed in paragraph 244 of this manual. Therefore, it will be necessary to connect the regulator in a generator circuit as it is in the vehicle. When it is found that any of the regulator units are faulty, they should be replaced.

b. Removal of Unit Assembly from Base.

(1) REMOVE BAKELITE BLOCK WITH ASSEMBLIES. Remove the 3 screws near the outside side terminals in the bakelite block. Remove the machine screw that attaches the 2 leads to the terminal between the center and right-hand screws previously removed. Remove the 4 screws from the opposite side of the block and lift up the block.

c. Cutout Relay Unit Removal Procedure. Remove lead from current regulator. Loosen screw on terminal block between the relay and current regulator and remove lead to relay. Remove nut from center of relay on bottom of bakelite block and remove the relay unit.

d. Current Regulator Unit Removal Procedure. Remove the screws that connect the voltage regulator and cutout relay leads (small wires). Loosen screws on the terminal blocks between each unit and

remove the leads (heavy wire). Remove the nut and lock washer from the center of the unit on the bottom of the bakelite block and lift off the current regulator.

e. Voltage Regulator Unit Removal Procedure. Loosen screw on terminal block between the voltage and current regulator and remove the voltage regulator lead (heavy wire). Remove the screw from the lead wire from the voltage and current regulator and remove the wire (small wire). Remove the unit and lock washer from the center post of the voltage regulator unit on the bottom of the bakelite block and lift off the voltage regulator unit.

f. Series Resistance Unit Removal Procedure. Disconnect the wire from the terminal on top of the unit. Remove the screw and lock washer that attaches the unit to the block. Lift off the unit.

Section VI

GENERATOR AND CONTROL PARTS, CLEANING, INSPECTION, AND REPLACEMENT

250. CLEANING OF PARTS.

a. Clean all generator parts thoroughly in cleaning solution and dry them thoroughly with air pressure from an air blow gun. CAUTION: Do not soak any parts with electrical connections attached in cleaning solution.

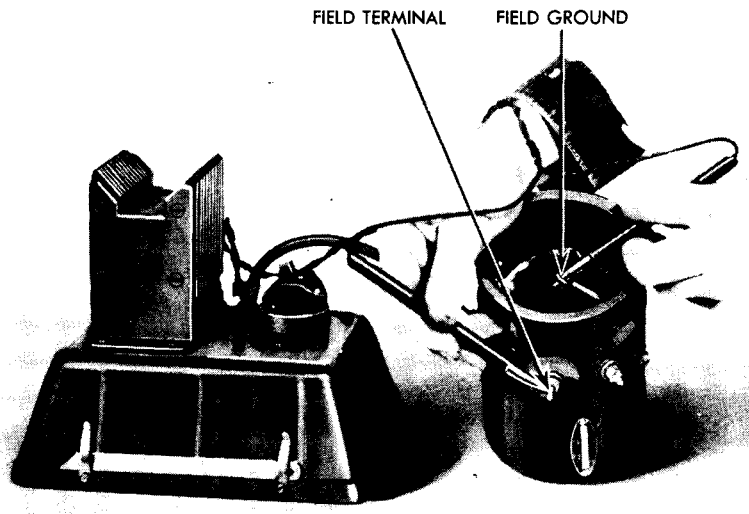
251. FIELD COIL INSPECTION.

a. Test Coils For Open Circuit (fig. 170). Disconnect grounded end of field winding from generator frame. Place the test lamp leads on the field coil leads (fig. 170). If the test lamp lights, the circuit is good. If the test lamp does not light, the circuit is open and the coil must be replaced.

b. Test Field Coils For Ground (fig. 171). Place one test prod on the generator frame and the other on the field terminal. If the test lamp lights, the field is grounded and should be replaced. If the test lamp does not light, the field is not grounded.

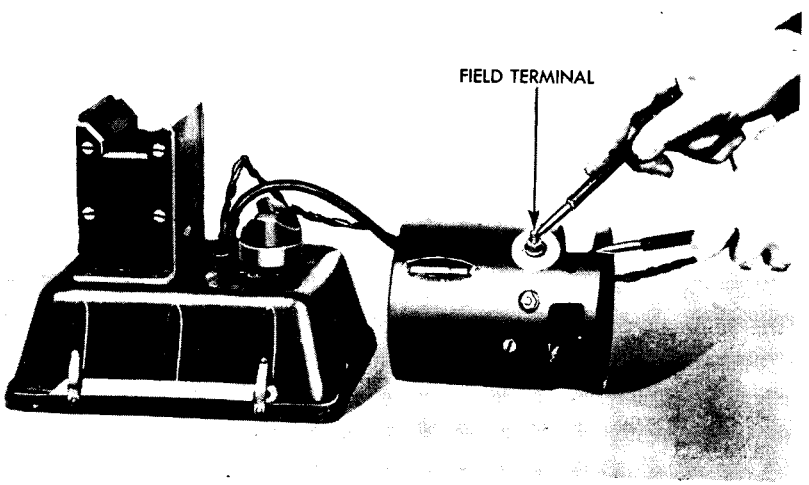
c. Test Field Coils For Balance (fig. 172). Slide the insulation off the soldered connection between the 2 field coils; then connect a lead from the positive post on the battery to the connection between the 2 field coils. Connect the positive lead from the ammeter to the lead on one of the coils and the negative lead from the ammeter to the negative lead on the battery (fig. 172). Read the number of amperes registered on the meter. Now remove the ammeter lead from the lead on the field coil and place it on the lead on the other field coil. Read the number of amperes registered on the ammeter. If the ampere reading

GENERATOR AND CONTROL PARTS, CLEANING, INSPECTION, AND REPLACEMENT



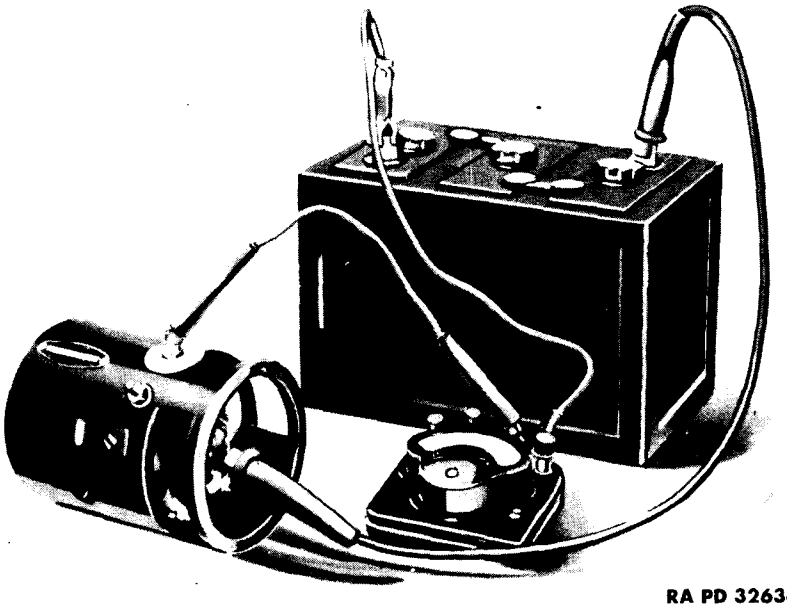
RA PD 32632

Figure 170 — Field Coil Test for Continuous Circuit



RA PD 32633

Figure 171 — Field Coil Test for Ground



RA PD 32634

Figure 172 — Field Coil Test for Internal Short

is higher on one coil than on the other, replace the coil that draws the largest amount of amperes.

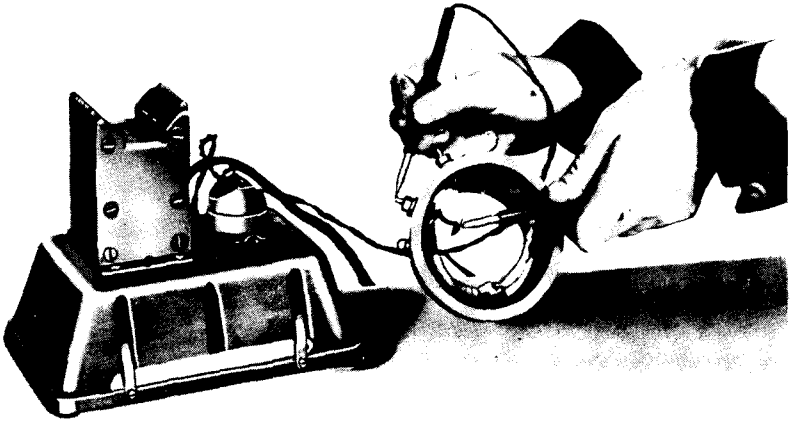
252. FIELD COIL REPLACEMENT.

a. Removal Procedure. Separate the connection between the 2 coils. Remove the lock nut from the field terminal and push terminal through to inside of housing. Remove the screw from each pole shoe and pull out the field coils.

b. Installation Procedure. Place pole shoe in each coil and slide coil and shoe in position in housing and install the mounting screws. Tighten screws securely and stake the ends of the slots with a center punch. Solder the ends of the coils together and cover the connection with insulating tape. Place terminal in position in housing and install terminal lock nut. NOTE: Be sure insulating washers are on the terminal screw.

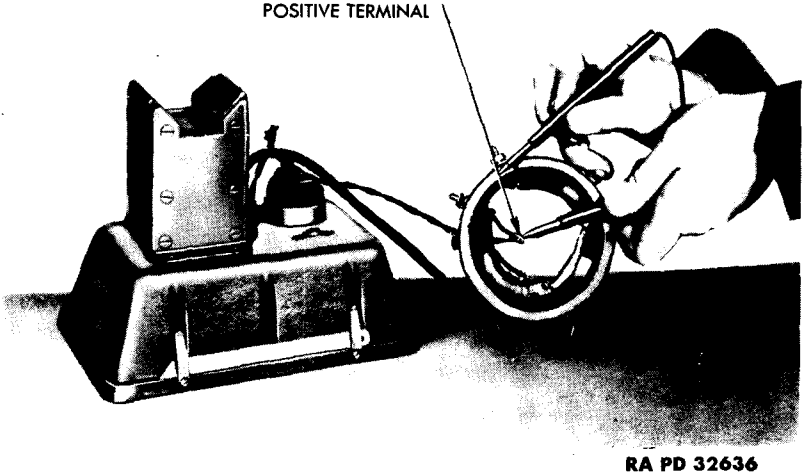
253. BRUSH LEAD WIRE INSPECTION.

a. Test Brush Lead to Generator Negative Terminal For Continuous Circuit (fig. 173). Place one test lamp lead on the end of the



RA PD 32635

Figure 173 — Brush Lead to Positive Terminal Test for Continuous Circuit



RA PD 32636

Figure 174 — Positive Terminal Test for Ground

wire, and the other test lamp lead on the terminal (fig. 173). If the test lamp lights, the wire is good. If the test lamp does not light, the wire is open circuited and should be replaced.

b. Test Generator Positive Terminal For Ground (fig. 174). Place one test lamp lead on the terminal and the other lead on the generator frame (fig. 174). If the test lamp lights, the terminal insulation is

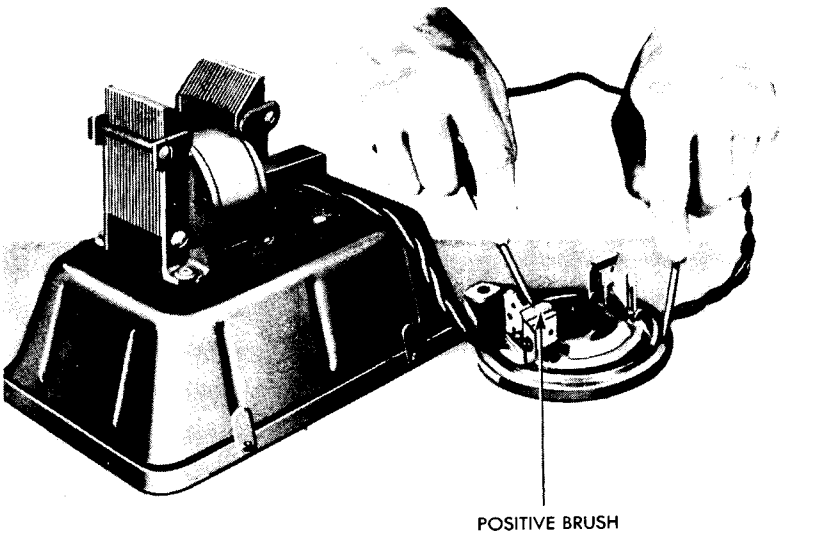


Figure 175 — Positive Brush Holder Test for Ground

broken down and the insulation should be replaced. If the test lamp does not light, the insulation is good.

254. BRUSH LEAD WIRE REPLACEMENT.

a. Procedure.

(1) REMOVE WIRE. Remove the lock nut and push the terminal through to inside of housing and pull out wire.

(2) INSTALL WIRE. Place wire terminal in position in housing and install the lock nut. NOTE: Be sure the insulating washers are in place on the terminal screw.

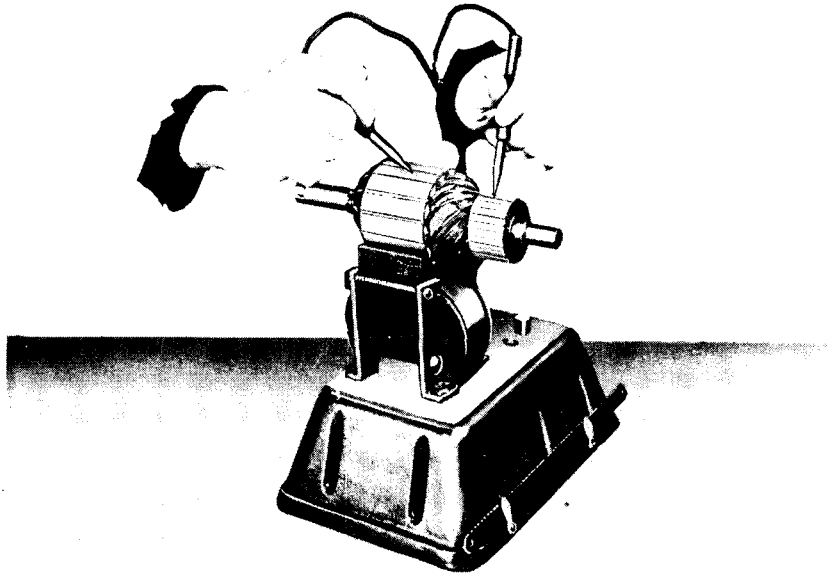
255. BRUSH SPRING TENSION INSPECTION.

a. Test Brush Spring Tension. Place the commutator end frame in position on the armature and, with checking scale, hook end of scale over spring tension arm and read the scale while lifting the arm off the brush. The scale should read from 24 to 28 ounces. If the reading is less, replace the spring.

256. BRUSH SPRING AND/OR BRUSH HOLDER.

a. Brush Holder Inspection (fig. 175).

(1) TEST BRUSH HOLDER. Place one test lamp prod on the positive or insulated brush holder and the other test lamp prod on the frame.



RA PD 32638

Figure 176 — Armature Test for Ground

If the test lamp lights, the positive brush is grounded and the end frame with brush holder must be replaced. If the test lamp does not light, the brush holder is good.

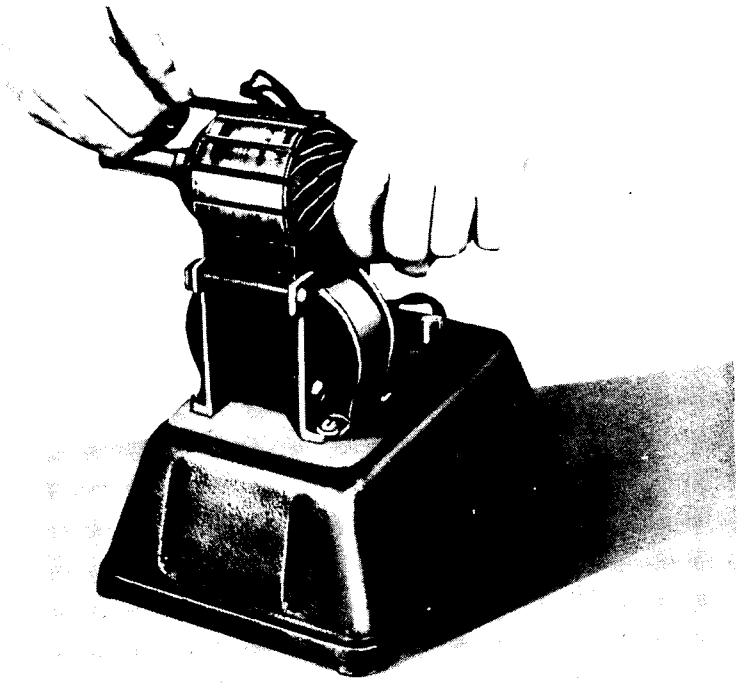
b. Brush Spring and/or Holder Replacement Procedure.

(1) Remove spring and brush holder by lifting lower arm of spring out of the groove in the pin with pliers and hold it out while lifting brush holder off of pivot pin. CAUTION: Do not remove more than one brush holder until it is reinstalled on the frame. By doing it this way, you can refer to the other brush holder so as to mount the spring and brush holder in the proper position.

257. BEARINGS.

a. Inspection.

(1) INSPECT DRIVE END BEARING. Check drive end bearing by turning the outside race slowly and checking for roughness. If bearing is rough, it must be replaced.



RA PD 32639

Figure 177 — Armature Test for Short

b. Commutator End Bearing Replacement Procedure.

(1) REMOVE BEARING. Remove the 3 screws from the retainer on outside of end plate and remove the retainer and gasket. Press the bearing out of the end frame.

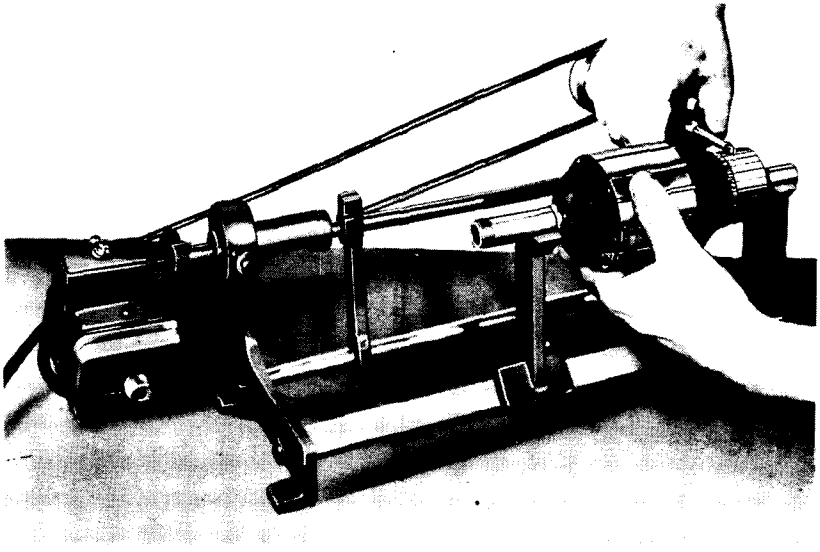
(2) INSTALL BEARING. Place new bearing in position in end frame and press it into recess. Install a new gasket and retainer and tighten the 3 screws securely. NOTE: The new bearings are prelubricated and will not need any further lubrication.

258. ARMATURE.

a. Inspection Procedure. In order to test an armature it is necessary to use a growler and test leads.

(1) TEST ARMATURE FOR GROUND. Place one test lamp lead on the armature core and the other lead on the commutator (fig. 176). If the

GENERATOR AND CONTROL PARTS, CLEANING, INSPECTION, AND REPLACEMENT



RA PD 32640

Figure 178 — Undercutting Mica

test lamp lights, the armature is grounded and must be replaced. If the test lamp does not light, the armature is not grounded.

(2) TEST ARMATURE FOR SHORT. Place the armature on the growler and hold a hack saw blade on the core and rotate the armature slowly (fig. 177). If the hack saw blade does not vibrate, the armature is not shorted. If the hack saw blade does vibrate at one or more points while rotating the armature, the armature is shorted and must be replaced. NOTE: To determine whether the armature windings or the commutator is shorted, clean out between the commutator bars and test the armature again.

(3) CHECK WINDING LEADS. Check to see that the armature winding leads are properly soldered to the commutator. Loose leads should be resoldered, using rosin flux. CAUTION: Never use acid flux when soldering electrical connections.

(4) Check the commutator for roughness and if it is rough, turn it down on a lathe until it is thoroughly cleaned up; then sand it off with No. 00 sandpaper. Undercut the mica as shown in figure 178, and check the armature again in a growler.

(5) CHECK BRUSHES. Inspect the brushes for uneven or excessive wear. It is usually a good policy to install new brushes when rebuilding a generator.

Section VII

ASSEMBLING GENERATOR AND REGULATOR

259. ASSEMBLING GENERATOR.

a. Procedure. Assemble felt washer retainer, felt washer, and bearing in drive end frame, and assemble gasket and inner retainer with the 3 screws. Place drive end plate in position on end of armature shaft and press armature into bearing until it seats against the shoulder. Place armature in housing and place commutator end plate into position on armature. Be sure that dowel pins on both end frames fit into the dowel pin holes in the housing. Install through bolts and tighten them securely. Insert brushes and connect the pigtails and leads with the machine screws and install cover band. Install spacer collar, Woodruff key, fan, and pulley on drive end of shaft and tighten nut securely. Lock the nut with cotter key.

260. TESTING GENERATOR.

a. Procedure. Test the generator as a motoring generator; connect a battery and an ammeter in the circuit (fig. 179). Connect the field and armature terminals with a jumper lead; place one lead on the generator terminal and the other to the ground. This will operate the generator as a motor. The ammeter reading with the generator running should be from 4 to 6 amperes.

261. ASSEMBLING REGULATOR.

a. Resistance Unit Installation Procedure. Place the resistance unit in position on the bakelite block and install the retaining screw. Attach the wire to the terminal on top of unit with lock washer and nut.

b. Cutout Relay Unit Installation Procedure. Place unit in position on block and install the lock washer and nut. NOTE: Be sure that dowel pin on unit is in hole in bakelite plate. Connect lead to terminal block between the relay and current regulator. Tighten screw securely.

c. Current Regulator Unit Installation Procedure. Place unit in position on block and install the lock washer and nut. NOTE: Be sure that dowel pin on unit is in hole in bakelite block. Connect the leads

ASSEMBLING GENERATOR AND REGULATOR

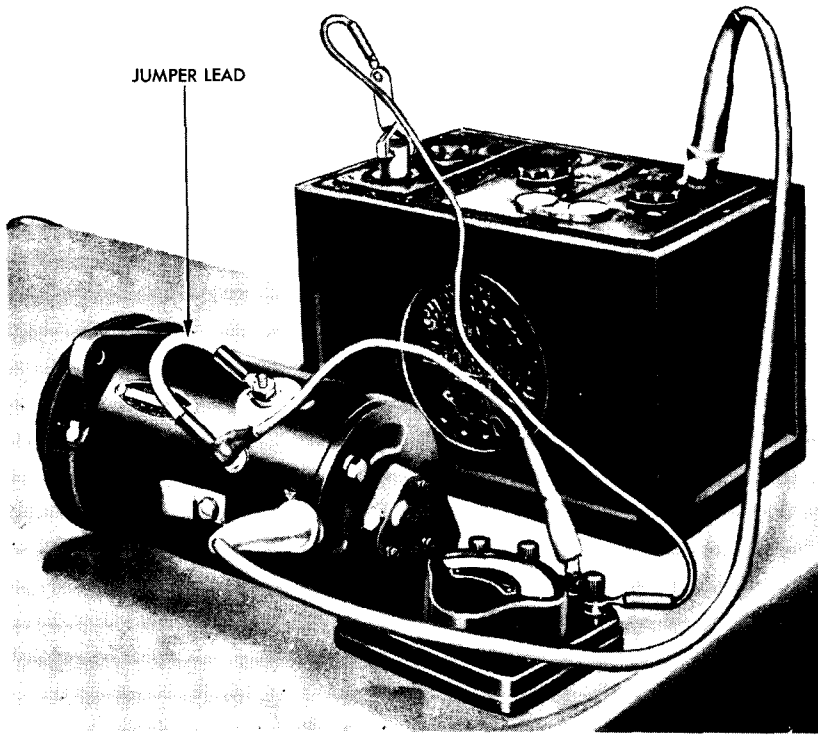


Figure 179 — Motoring Generator

to the terminal blocks and tighten screws securely. Connect the voltage regulator and cutout relay leads and tighten the screws securely.

d. Voltage Regulator Unit Installation Procedure. Place the unit in position on block and install the lock washer and nut. **NOTE:** Be sure that dowel pin on unit is in hole in bakelite block. Connect the lead from the current regulator and tighten the screw securely. Connect the current and voltage regulator leads to the terminal block and tighten the screw securely. Place block assembly in position and install the 7 mounting screws and the 2 leads with the attaching screw.

Section VIII

GENERATOR AND CONTROLS, INSTALLATION IN VEHICLE

262. GENERATOR INSTALLATION.

a. Procedure. Place generator in position on bracket and install the 2 bolts, nuts, and cotter keys. Start the bolt through the slotted brace and into the generator. Adjust the fan belt as instruced in TM 9-765. Connect the 3 wires to the terminals from which they were removed.

263. REGULATOR INSTALLATION.

a. Procedure. Place regulator in position on dash and install the 4 mounting bolts. Connect the 3 wires to the same terminals from which they were removed and tighten the nuts securely.

264. INSPECTION AND ADJUSTMENT AFTER INSTALLATION.

a. Inspection. Make the following checks before starting the engine:

(1) Check to make sure that all the wires are connected to the proper terminals.

(2) Use a jumper lead to connect momentarily the battery terminal of the regulator with the generator terminal. This sends a current through the generator windings, assuring that it will build up in the proper polarity.

(3) Step on the starter pedal and hold it down for 15 to 20 seconds before turning on the ignition switch. This will drain enough current from the battery so that the regulator will permit the generator to charge at a higher rate.

b. Adjustment. Start engine and run it at approximately 1,500 revolutions per minute for a few minutes to bring the generator and controls to operating temperature. Then test and adjust the regulator as instructed in paragraph 244.

Section IX

FITS AND TOLERANCES

265. FITS AND TOLERANCES.

a. Generator.

Armature end play ..... 0.005 in.
Commutator out-of-round ..... 0.002 in.
Brush spring tension ..... 24-28 oz

b. Voltage Regulator.

Voltage setting (open circuit) ..... 7.5 volts (hot)
Point opening ..... 0.015 in.

c. Current Regulator.

Amperage setting ..... 40 amp (hot)
Point opening ..... 0.015 in.

d. Cutout Relay.

Points close, volts (hot) 6.7
Points open, amperes, reverse current ..... 0 to 4
Air gap ..... 0.057 in.
Point opening ..... 0.020 in.

CHAPTER 13

REFERENCES

266. STANDARD NOMENCLATURE LISTS.

a. Bomb service truck M6 (Chevrolet)..... SNL G-85 Vol. IV

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

Current Standard Nomenclature Lists are as tabulated here. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index" ..... OPSI

267. EXPLANATORY PUBLICATIONS.

a. Automotive Materiel.

Automotive power transmission units..... TM 10-585
Bomb service truck M6 (Chevrolet)..... TM 9-765
Heavy wrecking truck M1 (Series 1 and 2)..... TM 9-795
Ordnance Maintenance: Axles, propeller shafts and wheels for bomb service truck M6 (Chevrolet) ..... TM 9-1765A
The internal combustion engine..... TM 10-570

b. Maintenance and Inspection.

Automotive lubrication ..... TM 10-540
Detailed lubrication instructions for ordnance materiel ..... OFSB 6-series
Echelon system of maintenance..... TM 10-525
Hand, measuring, and power tools..... TM 10-590
Maintenance and repair..... TM 10-520
Motor transport inspections ..... TM 10-545
Tune-up and adjustment ..... TM 10-530

c. Miscellaneous.

List of publications for training..... FM 21-6
Military motor vehicles ..... AR 850-15

d. Storage of motor vehicle equipment..... AR 850-18

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