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WAR DEPARTMENT

TECHNICAL MANUAL

ORDNANCE MAINTENANCE

ACCESSORIES FOR TANK ENGINE MODEL GAA V-8 (FORD)

23 AUGUST 1943

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TM 9-1731C

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TECHNICAL MANUAL
TM 9-1731C

WAR DEPARTMENT
Washington, 23 August 1943

ORDNANCE MAINTENANCE

ACCESSORIES FOR TANK ENGINE MODEL GAA V-8 (FORD)

Prepared under the direction of the
Chief of Ordnance
(with the cooperation of the Ford Motor Company)

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ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 1

INTRODUCTION

1. SCOPE.

a. The instructions contained in this manual are for the information and guidance of personnel charged with the maintenance and repair of the Ford Tank Engine Model GAA V-8. Information on the detailed construction of the unit, disassembly and assembly procedure, inspection, maintenance, and repair is contained in two volumes of the 1000-series technical manuals, of which this is the second volume. These instructions are supplementary to those in the field and technical manuals prepared for the using arm. This manual does not contain information which is intended primarily for the using arms, since such information is available to ordnance maintenance personnel in 100-series, TM 9-731G Gun Motor Carriage M10A1 and TM 9-759 Medium Tank M4A3, also other technical manuals covering materiel using the Ford Tank Engine Model GAA V-8.

b. This manual contains a description of, and procedure for disassembly, inspection, and repair of the engine accessory systems.

c. The first volume, TM 9-1731B, contains information on the detailed construction of the complete engine, disassembly and assembly procedure, inspection, and repairs, but does not include maintenance on the accessories other than their removal and installation on the engine.

2. ARRANGEMENT.

a. A chapter is provided for each of the engine accessory systems. The various components which make up a complete system are covered in individual sections. Whenever it is pertinent to the system covered in a particular chapter, a Fits and Tolerance Chart is also provided. Chapter 7 contains a list of special tools necessary for disassembling, inspection, repair, and assembly, of the various units of the accessory systems.

3. ILLUSTRATIONS.

a. Illustrations are included to support the text where required. Difficult operations and those that would otherwise require lengthy descriptions, as well as operations involving the use of special tools or equipment, are illustrated. Disassembled views of various assemblies are included to show the order of assembly, or disassembly. The disassembled views permit quick identification of parts, and avoid the necessity of lengthy description.

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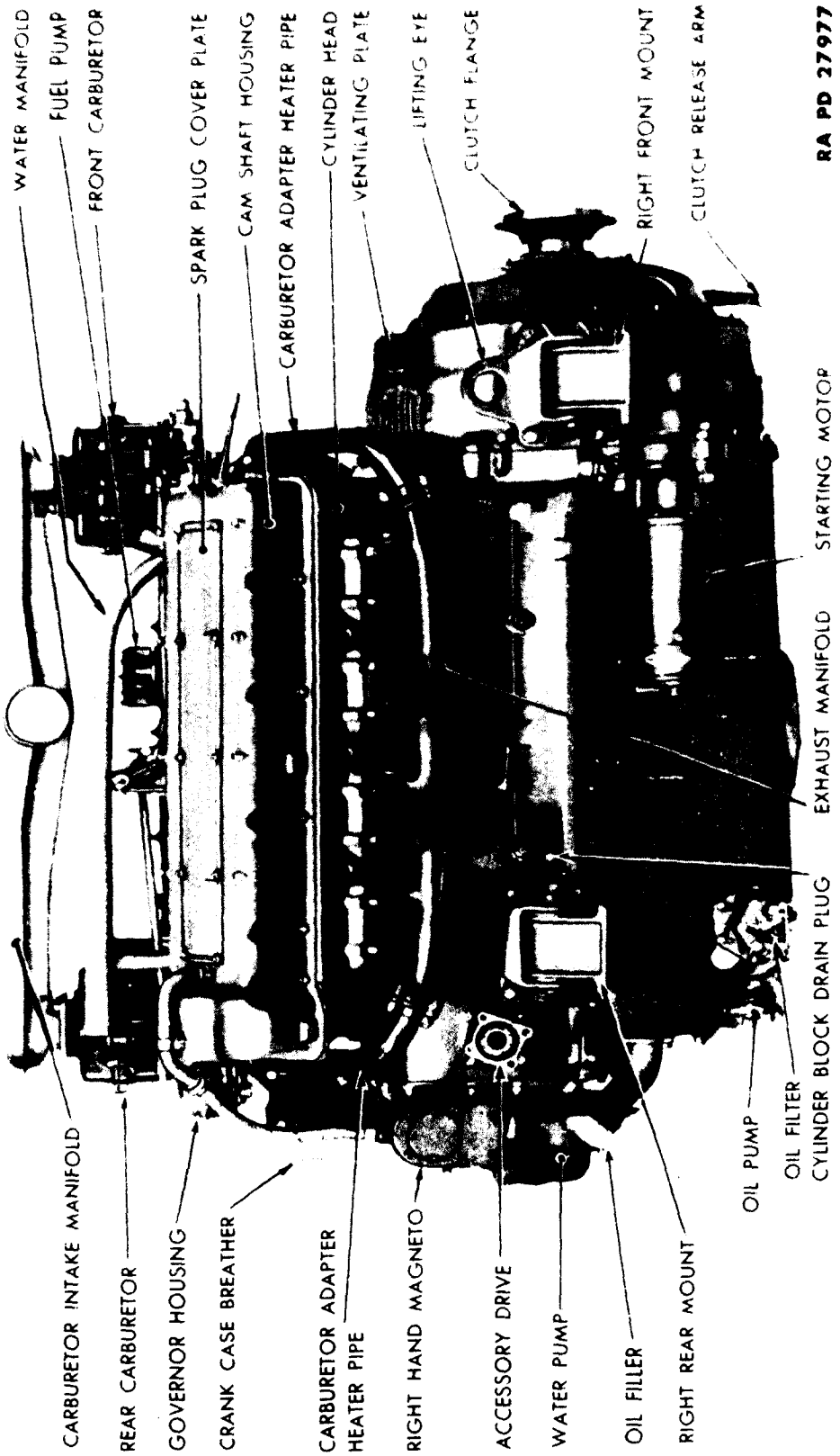

Figure 1—Right-hand Side of Engine

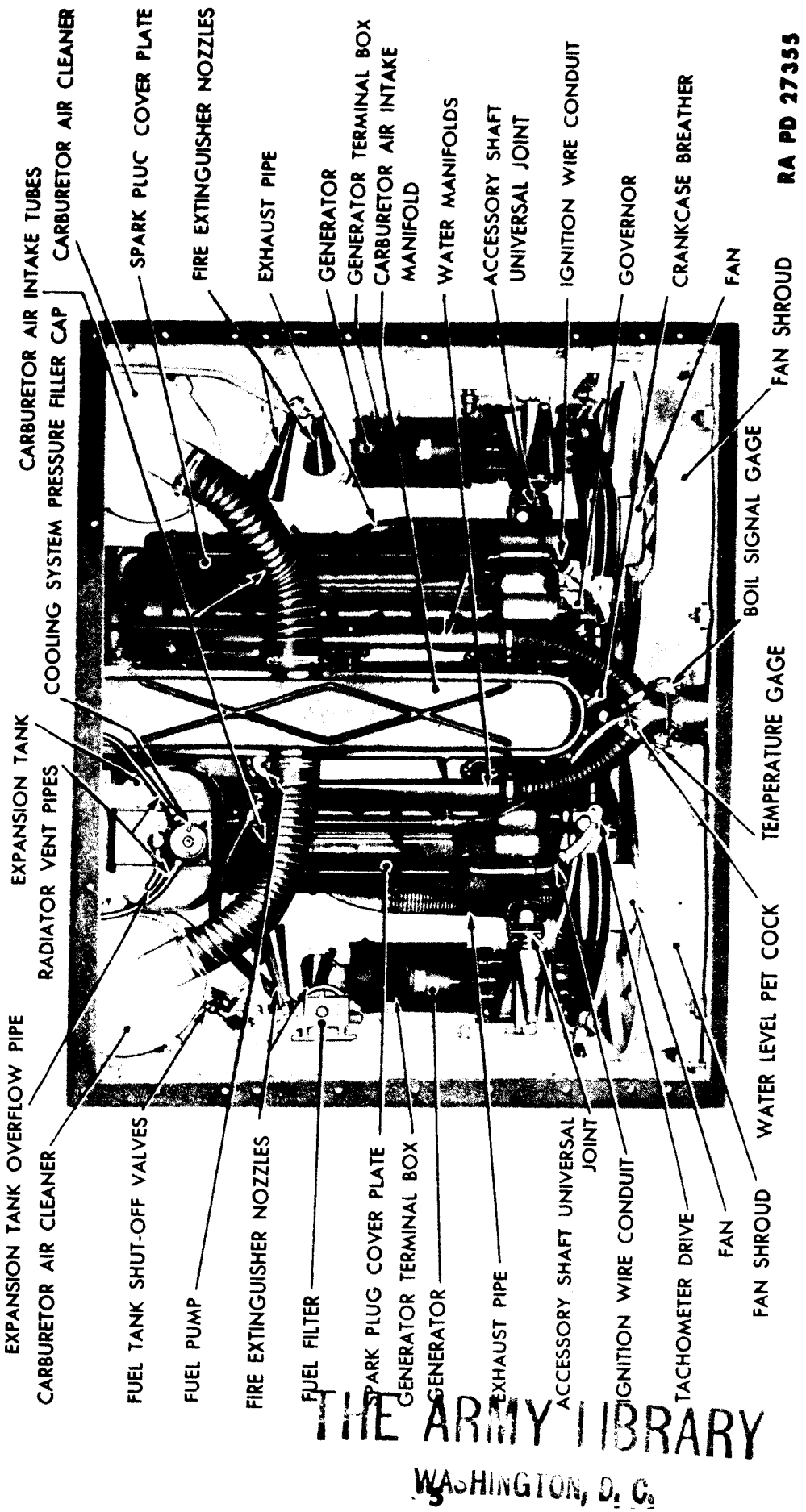

Figure 2—Engine Compartment from Above

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4. MAINTENANCE ALLOCATION.

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

b. Allocation of Maintenance. Indicated below are the maintenance duties for which tools and parts have been provided for the using arm and ordnance maintenance personnel. Replacements and repairs which are the responsibility of ordnance maintenance personnel may be performed by using arm personnel when circumstances permit, within the discretion of the commander concerned. Echelons and words as used in this list of maintenance allocations are defined as follows:

SECOND ECHELON:	Line organization regiments, battalions, companies, detachments, and separate companies.
THIRD ECHELON:	Ordnance light maintenance companies, ordnance medium maintenance companies, ordnance divisional maintenance battalions, and post ordnance shops.
FOURTH ECHELON:	Ordnance heavy maintenance companies, and service command shops.
FIFTH ECHELON:	Ordnance base regiments, ordnance bases, arsenals, and manufacturers' plants.
SERVICE (including preventive maintenance): Refer to AR 850-15, paragraph 23 a (1) and (2).	Consists of servicing, cleaning, lubricating, tightening bolts and nuts, and making external adjustments of subassemblies or assemblies and controls.
REPLACE: Refer to AR 850-15, paragraph 23 a (4).	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.	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.

INTRODUCTION

REBUILD: Refer to AR 850-15, paragraph 23 a (5) in part, and (6).	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: *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.*

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			
	2nd	3rd	4th	5th
STARTING SYSTEM				
Motor assembly, starting—replace	X			
Motor assembly, starting—repair		X		
Motor assembly, starting—rebuild			X	
Solenoids—replace	X			
Solenoids—repair		X		
IGNITION SYSTEM				
Magneto assemblies—replace	X			
Magneto assemblies—repair		X		
Magneto assemblies—rebuild			X	
Plugs, spark—service and/or replace	X			
Plugs, spark (two piece)—repair		X		
Regulator, current and voltage—replace	X			
Regulator, current and voltage—service and/or repair		X		
Regulator, current and voltage—rebuild			X	
Wiring and conduit assembly, ignition—replace	X			
Wiring and conduit assembly, ignition—repair		X		
FUEL SYSTEM				
Carburetor assembly—service and/or replace	X			
Carburetor assembly—repair		X		
Carburetor assembly—rebuild			X	
Cleaners, air—service and/or replace	X			
Cleaners, air—repair		X		

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	Echelons			
	2nd	3rd	4th	5th
FUEL SYSTEM (Cont'd)				
Filter—service and/or replace	X			
Filter—repair		X		
Lines, valves and fittings—replace	X			
Lines, valves and fittings—repair		X		
Pump assembly, fuel—service and/or replace	X			
Pump assembly, fuel—repair	E	X		
Pump assembly, fuel—rebuild		E	X	
Pump, priming—replace	X			
Pump, priming—repair		X		
Pump, priming—rebuild			X	
Screen assembly—replace	X			
Tanks, fuel—service and/or replace	X			
Tanks, fuel—repair		X		
COOLING SYSTEM				
Connections, radiator to engine—replace	X			
Fan assembly—replace	X			
Fan assembly—repair		X		
Fan assembly—rebuild			X	
Pump assembly, water—replace	X			
Pump assembly, water—repair		X		
Pump assembly, water—rebuild			X	
Radiator assemblies—replace	X			
Radiator assemblies—repair		X		
Radiator assemblies—rebuild			E	X
System, cooling—service	X			
Tank, surge—replace	X			
Tank, surge—repair		X		
Units, signal sending, oil and water—replace	X			
GENERATING SYSTEM				
Drive assemblies, generator and fan—replace	X			
Drive assemblies, generator and fan—repair		X		
Drive assemblies, generator and fan—rebuild			X	
Generator assembly—replace	X			
Generator assembly—repair		X		
Generator assembly—rebuild			X	
Generator assembly, auxiliary—replace	X			
Generator assembly, auxiliary—repair		X		
Generator assembly, auxiliary—rebuild			E	X

INTRODUCTION

LUBRICATION GROUP	ECHELONS 2nd	3rd	4th	5th
Cooler, transmission oil—replace	X			
Cooler, transmission oil—repair		X		
Cooler, transmission oil—rebuild			E	X
Filter, engine oil (absorbent type)—replace	X			
Filter, engine oil (absorbent type)—repair		X		
Lines, oil and fuel (external)—replace	X			
Lines, oil and fuel (external)—repair		X		
Lines, oil (internal)—replace and/or repair		X		

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 2

STARTER SYSTEM

Section I

DESCRIPTION AND DATA

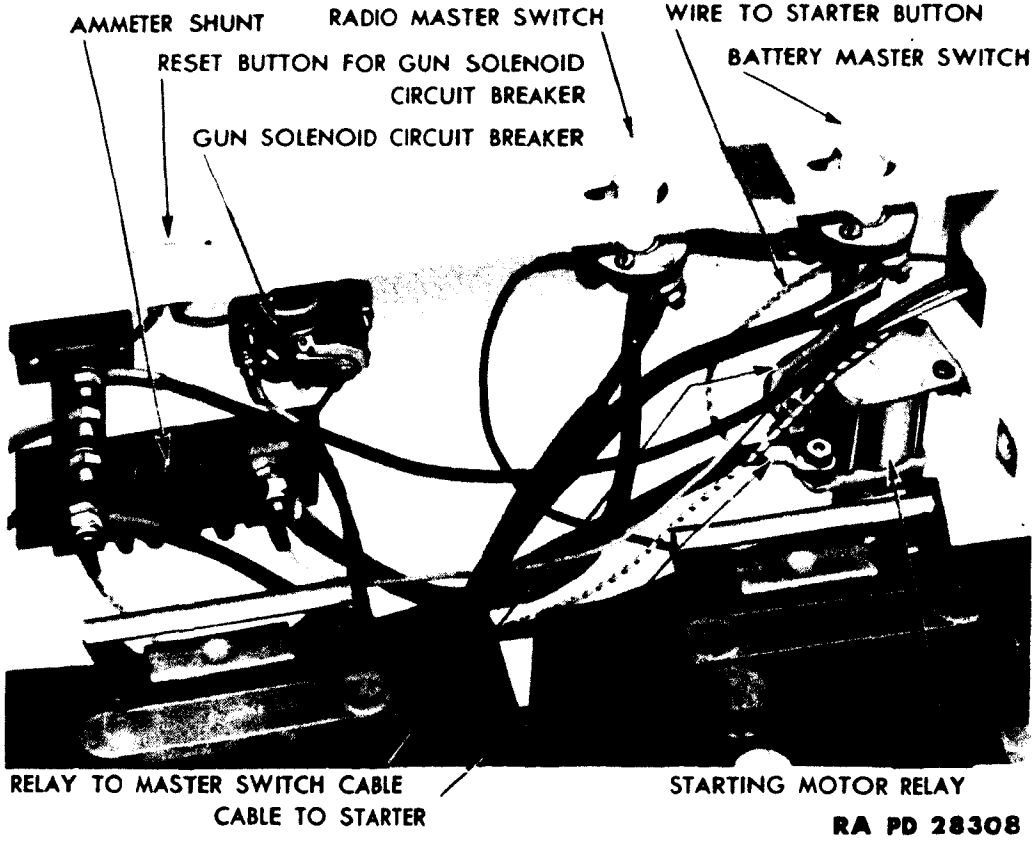

Figure 3—Starter Relay

5. DESCRIPTION.

a. **General.** The starter system consists of a 24-volt starter, two 12-volt batteries connected together in series, and a relay switch. Figure 4 shows the arrangement of the starting system on the M10A1 Gun Motor Carriage which installation is typical for all vehicles using the Model GAA V-8 engine. The starter is mounted on the right-hand side of the

engine flywheel housing, and its power is transmitted to the engine through an automatic drive.

b. Operation. Rotation on the starter motor shaft causes the pinion of the automatic drive to advance, and mesh with the flywheel ring gear. After the engine starts, and the speed of the flywheel exceeds that of the starter, the pinion releases from the flywheel automatically. The entire circuit from battery to starter requires heavy cables due to the large amount of current used. In order to avoid running heavy cables to the instrument panel, a relay switch is installed in the starter circuit. This relay switch closes automatically, when the starter button in the instrument panel is pushed in. The starter relay switch is mounted near the battery.

6. DATA.

a. Battery.

Voltage	12 volts, nominal
Capacity at 6-hour rate	168 ampere hours
Number of cells	6
Plates per cell	25
Grounded terminal	Negative
Width	$10^{15}/_{16}$ in.
Height	$10^{3}/_{8}$ in.
Length	$21^{1}/_{16}$ in.

b. Starter.

Maximum torque (stalled) at 0 speed	56 ft-lb
Load amperes at maximum torque	800 @ 60 rpm
Gear ratio to flywheel	10.33 to 1
Direction of rotation	Counterclockwise

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CHAPTER 2

STARTER SYSTEM (Cont'd)

Section II

STARTER

7. DESCRIPTION.

a. The starter motor has four dual brushes, two are contained in each of the four brush holders. The armature rotates in two bronze bearings, which are located at the ends of the motor frame. The rear bearing is porous, and is oiled from a fitting at the rear of the motor. The forward bearing is lubricant-impregnated, and requires no additional lubrication. A lubricant-impregnated bronze bearing is also provided in the housing, which supports the drive gear assembly.

8. REMOVAL FROM ENGINE.

a. To remove the starter from the engine, refer to TM 9-1731B Model GAA V-8.

9. CLEANING AND INSPECTION (EXTERNAL).

a. Cleaning. Clean the starter externally, using dry-cleaning solvent, and wipe dry with a clean cloth.

b. Inspection.

(1) VISUAL. Remove the inspection band. Measure length of the brushes. If the brushes are less than $\frac{3}{8}$-inch long, the starter is to be disassembled and overhauled. If the commutator is worn or burned, the starter is to be disassembled and overhauled.

STARTER

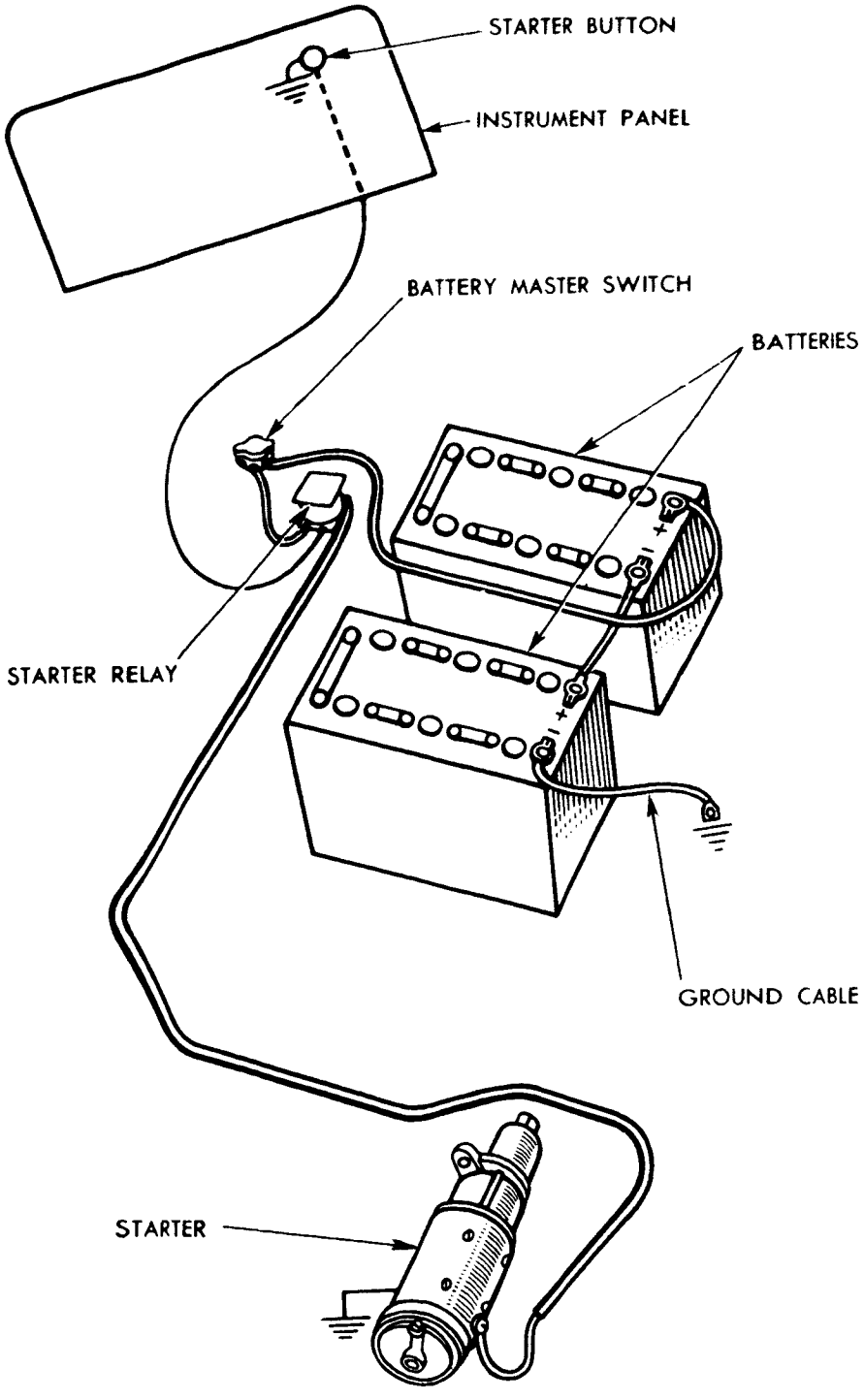

Figure 4—Starter System

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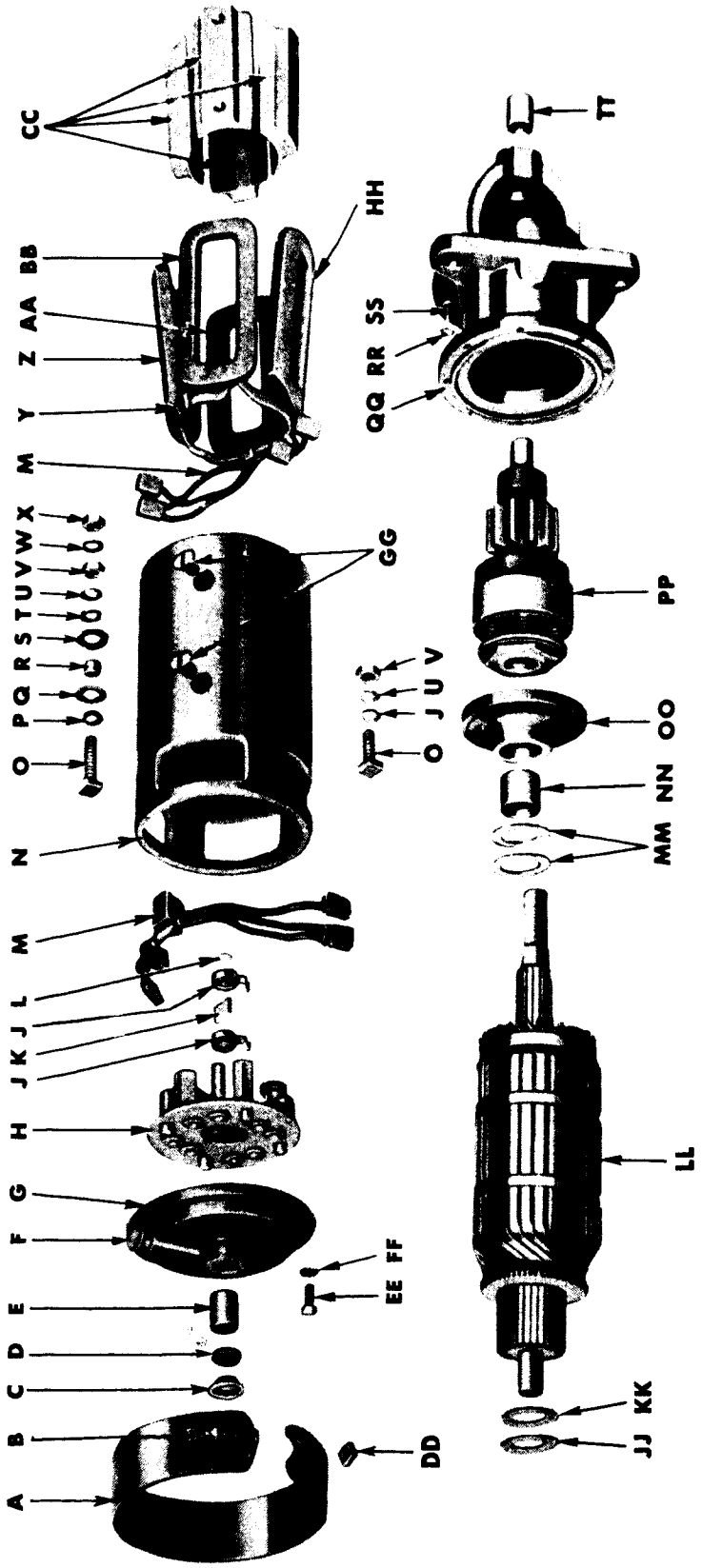

Figure 5—Starter disassembled

A—INSPECTION BAND
B—SCREW
C—PLUG
D—PAD
E—BEARING, REAR
F—OILER
G—END PLATE
H—BRUSH HOLDER PLATE ASSEMBLY
J—BRUSH SPRING
K—SPACER
L—HORSESHOE WASHER
M—BRUSH ASSEMBLY
N—STARTER FRAME
O—TERMINAL POST
P—WASHER
Q—WASHER
R—BUSHING
S—WASHER
T—WASHER
U—LOCKWASHER
V—NUT
W—LOCKWASHER
X—NUT
Y—TERMINAL
Z—FIELD COIL
AA—FIELD COIL
BB—FIELD COIL
CC—POLE PIECES
DD—NUT
EE—SCREW
FF—LOCKWASHER
GG—SCREWS FOR POLE PIECES
HH—FIELD COIL
JJ—WASHER
KK—WASHER
LL—ARMATURE
MM—WASHERS
NN—BEARING, INTERMEDIATE
OO—PLATE, INTERMEDIATE
PP—DRIVE ASSEMBLY
QQ—DRIVE HOUSING
RR—LOCKWASHER
SS—SCREW
TT—BEARING, FRONT

RA PD 27981 B

Legend for Figure 5

(2) CONTINUITY AND SHORTS. Test the field circuit (par. 12 i and j) and the armature (par. 12 c and d). If the field circuit or the armature is open or shorted, the motor is to be disassembled and overhauled. If the brushes and commutator are in good condition, and the continuity of the field circuit and armature are not open or shorted, the motor is satisfactory for further use.

10. DISASSEMBLY.

a. Remove Inspection Band (A, fig. 5). Remove the screw and nut (B and DD, fig. 5) from the band, and lift the band from the starter frame. NOTE: Always remove the screw from the band. Merely loosening the screw, and slipping the band off the frame, will damage the cork gasket under the band.

b. Check Brush Spring Tension. Brush spring tension must be measured, with the end of the spring resting on top of the brush, before the starter is disassembled. Hook the testing scale under the spring at the point where it contacts the brush. Spring tension of 40 ounces to 50 ounces is the correct tension for each spring. NOTE: *Worn brushes will show slightly less spring tension.* Weak springs must be discarded.

c. Remove and Disassemble End Plate. Lift all the brushes from the brush holders. This can best be done by lifting the spring with one hand, using a small hook made from wire, and removing the brush from the holder with the other hand. With a sharp tool scribe a mark across end plate and frame. Mark the drive housing and frame. These two marks will aid in reassembling these parts in their original position. Remove the four outer screws and lock washers (EE and FF, fig. 5) from the end plate and remove end plate assembly from the starter frame. With a sharp tool, scribe a mark on the brush holder assembly and one on the end plate opposite the mark on the brush holder. These marks are for proper location of the brush holder when reassembling the starter motor. Remove the four screws remaining in the end plate, and remove brush holder plate assembly (H, fig. 5) from end plate.

d. Remove Drive Housing (QQ, fig. 5). Loosen lock wire, take out the eight screws (SS, fig. 5) from the flange, and remove the housing assembly from starter frame.

e. Remove Starter Drive Assembly. With a brass drift, drive the end of the starter drive shaft; this will force the intermediate bearing (NN, fig. 5) from the housing. Lift the starter drive assembly from the housing.

f. Remove Armature from the Starter Motor. Lift the armature from the starter frame, and remove washers (JJ and KK, fig. 5) from the commutator end of the armature. Also remove two washers (MM, fig. 5)

from the other end of the armature. Do not remove field coils from the starter frame at this time (par. 12 i and j).

g. Remove Ground Brush Assembly. Remove the nut and washers (V, U, and T, fig. 5). Remove the terminal post (O, fig. 5) and the ground brush assembly.

11. CLEANING.

a. Clean all metal parts with dry-cleaning solvent. Dry with compressed air. All insulating parts, such as washers, bushings, and coil insulations, must be cleaned with a cloth dampened with dry-cleaning solvent, and dried with compressed air.

12. INSPECTION AND TEST.

a. Inspect Metal Parts. Inspect all metal parts for cracks, and inspect all tapped holes.

b. Inspect Insulated Parts. Inspect all insulating parts such as bushings and washers. Check wires and coil insulation for damage or bare spots.

c. Test Armature for Ground. Place one test prod of a test lamp on the armature, and the other prod on the commutator. If the test lamp lights, the armature is grounded and must be replaced. If the test lamp does not light, the armature is not grounded. Proceed to the next test.

d. Test Armature for Short Circuit. Place the armature on a growler, and with a hacksaw blade over the armature core, rotate the armature to test. If the saw blade does not vibrate, the armature is satisfactory. If the saw blade vibrates, the armature is short-circuited, and must be replaced.

e. Inspect Commutator. Inspect commutator for rough or burnt segments. Burnt segments are usually caused by excessively worn brushes, or an open-circuited coil. Open circuits, in most cases, are caused by the coil leads being loose in the commutator segments, and require resoldering. A rough or burnt commutator will require turning down on a lathe. See paragraph 13 **a**, **b**, and **c** covering repairs to the armature.

f. Check Brush Holder for Ground. Place a test lamp lead prod on one of the brush holders, and the other lead on the mounting plate. If test lamp lights, the brush holder is grounded and must be replaced. If the test lamp does not light, the brush holder is satisfactory. Repeat this test on the three other brush holders.

g. Check Brushes. Check the condition of the brushes. If the brushes are pitted or worn, they must be replaced. See "Fits and Tolerances," paragraph 18, for wear limit on brushes.

h. Check Wear of Armature and Drive Assembly Bronze Bearing. The armature shaft and the drive assembly shaft should fit snugly in the bearings. Worn or scored bearings must be replaced.

i. **Test Field Coils for Continuity of Circuit.** NOTE: Do not remove the field coils from the starter frame for testing. Place the test lamp lead prods on the field coil leads. If the test lamp lights, the field coils are not "open." If the test lamp does not light, there is an open circuit in one of the field coils.

j. **Test Field Coil for Ground.** Place one test lamp lead prod to the frame of the starter, and the other lead to one of the field coil leads. If the test lamp does not light, the field coils are not grounded. If the test lamp lights, one of the field coils is grounded.

k. **Inspect Starter Drive Assembly.** Examine the condition of the teeth on the gear, and the threads on the shaft. It is important that the assembly be free from grit and oil. Oil on the threaded shaft will cause dust and grit to accumulate, and prevent the gear from engaging with the flywheel gear.

13. REPAIRS.

a. **Install New Armature Shaft Bearing and/or Drive Assembly Bearing.** If preceding inspection showed any of the bearings (E, NN, and TT, fig. 5) to be unfit for further use, they are to be replaced. Using an arbor press, remove the faulty bearing, and press a new one in place.

b. **Solder Coil Leads to Commutator.** If preceding inspection showed loose wires on any of the commutator segments, they are to be soldered, using a resin flux. After soldering, the armature must be retested on a growler as described in paragraph 12 **d**.

c. **Turn Down Commutator if Required.** Set the armature in a lathe, and turn down the commutator until it is cleaned up. Undercut the mica between the segments of the commutator 1/32 inch. Sand the commutator until smooth.

d. **Field Coil Replacement and Repair.**

(1) REMOVAL AND REPAIR. If previous inspections and tests (par. 12 **i** and **j**) revealed any of the field coils to be faulty, the field coil assembly must be removed. Take out the terminal post (O, fig. 5). Remove the eight screws (GG, fig. 5), and slip the coil assembly and pole pieces from the frame. Melt the solder from the leads of the particular coils to be replaced, and separate the connections. Install new coils, and solder the leads to the leads of the adjoining coils. NOTE: Do not use an acid flux.

(2) INSTALLATION. Place a pole piece (CC, fig. 5) in each coil, and slip the assembly into the starter frame. Secure the pole pieces to the frame with eight screws (GG, fig. 5). The pole pieces must fit squarely in the frame. Tighten the screws securely and lock them by staking the heads. Install the terminal post (O, fig. 5) and bushing, washers, and

nuts (P, Q, R, S, T, U, V, W, and X, fig. 5) in the order shown. Retest the field coils (par. 12 i and j).

14. ASSEMBLY.

a. Install Terminal Post. Insert the terminal post in hole in the starter frame, with insulation washer (fig. 5) between the field coil terminal and the frame. Install insulation bushing, washer (fig. 5), flat washer, lock washers, and nuts in correct order.

b. Install New Field Brushes if Required. With a soldering iron, melt the solder, and remove the four brush leads from the field coil. Insert the leads of the new brushes in the clip of the field, and solder. The brushes with the long leads will project clockwise, and the brushes with the short leads will project counterclockwise, from the clip on the field coils.

c. Install New Ground Brush Assembly if Required (fig. 5). Clean the clip on the brush leads and clean starter frame at the ground bolt hole to provide a good ground. Insert the brush lead clip on the bolt (fig. 5), then insert the bolt through the hole in the starter frame. The brushes with the long leads will project clockwise, and the brushes with the short leads will project counterclockwise. Install washer, lock washer, and nut on bolt (T, U, and V, fig. 5). Lock the nut by staking.

d. Install New Brush Springs if Required. Remove the horseshoe washer (L, fig. 5), and remove the brush springs (J, fig. 5). Install new spring, and secure with a new horseshoe washer. This procedure applies to installation of any of the eight springs.

e. Install Starter Drive Assembly in Drive Housing. Install drive assembly (PP, fig. 5) in the housing (QQ, fig. 5), and insert the intermediate bearing assembly (NN, fig. 5) in the housing.

f. Install Armature and Drive Housing to Frame. Insert the splined end of the armature shaft into the drive assembly. Enter the armature in the starter frame, being careful not to damage the insulation on the field windings. Attach the drive housing to the starter frame with eight screws and lock washers. Lock screws with wire. NOTE: Observe mark scribed on housing and frame during disassembly procedure (par. 10 c) so that the housing will be assembled to the frame in proper relation to each other.

g. Install Brush Holder Plate Assembly (H, fig. 5) **to the End Plate** (G, fig. 5). Attach the brush holder plate to the end plate, secure with four screws and lock washers (EE and FF, fig. 5) and lock the screws with wire.

h. Install End Plate Assembly. Install end plate assembly, which includes the brush holder to the frame of the starter, secure with four screws and lock washers, and lock the screw with wire. NOTE: Observe

mark scribed on the end plate and starter frame during the disassembly procedure (par. 10 c). Assemble the end plate to the frame so that these marks line up with each other.

i. **Install Brushes in the Brush Holders.** Install the two field brushes, with the long leads in the brush holder, to the right of the oiler (viewing the starter from the commutator end). Install the two ground brushes, having the short leads, in the second brush holder to the right of the oiler. Install the two field brushes, having the short leads, in the third brush holder to the right of the oiler. Install two ground brushes, having the long leads, in the remaining brush holder. CAUTION: Be sure the brush springs rest on the top of each brush.

j. **Install Inspection Band** (A, fig. 5). If the cork gasket is damaged, cement a new gasket on the inside of the band. Install the band on the starter, and secure with screw and nut (B and DD, fig. 5).

k. **Install Plug and Pad** (C and D, fig. 5) **in End Plate.** If the plug has been removed, insert a new plug and pad, and press plug in place.

15. TEST.

a. Test the starter on the bench, using equipment capable of registering the torque of the starter (see tabulated data for starter torque, par. 6).

16. INSTALLATION ON ENGINE.

a. Install starter on engine as outlined in TM 9-1731B

CHAPTER 2

STARTER SYSTEM (Cont'd)

Section III

FITS AND TOLERANCES

17. DEFINITION OF FITS.

a. Refer to TM 9-1731B for definition of fits.

18. FITS AND TOLERANCES.

Fit Location and Name	Manufacturers' Fit Tolerances	Fit Wear Limit	Type of Fit
Rear bearing and armature shaft		0.005 in. max.	Running
Rear bearing and end plate			Press
Intermediate bearing and bearing plate			Press
Intermediate bearing and armature shaft		0.007 in. max.	Running
Front bearing and drive assembly shaft		0.007 in. max.	Running
Front bearing and drive housing			Press
Armature end play	0.020–0.030 in.		
Starter brush	¾ in.	⅜ in.	

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 3

IGNITION SYSTEM

Section I

DESCRIPTION AND DATA

19. DESCRIPTION.

a. The ignition system of the tank engine Model GAA V-8, consists of two magnetos (one for each block of four cylinders), aircraft-type spark plugs and the necessary connecting wires (fig. 20). The magnetos are turned OFF when the magnetos are grounded by means of an ignition switch in the instrument panel. In addition to the ON position for both magnetos, the ignition switch is provided with ON positions for either the left or right magneto. This arrangement permits the engine to be run on either block of four cylinders separately, for testing and checking engine performance. The numbering of the cylinders and the firing order is listed in paragraph 20.

20. DATA.

Type of ignition.....Two Bosch magnetos
Firing order.....1R, 2L, 3R, 1L, 4R, 3L, 2R, 4L
Numbering of cylinders from rear to front:
  Right bank.....1-2-3-4
  Left bank.....1-2-3-4
Spark setting (flywheel timing marks).....10° btc
Automatic advance:
  Make.....Bosch
  Starts to advance at.....600 rpm
  Full advance—18 degrees—at.....1400 rpm
  Magneto drive.....Mated worm gears

CHAPTER 3

IGNITION SYSTEM (Cont'd)

Section II

MAGNETOS

21. DESCRIPTION.

a. Two magnetos are used, one firing the cylinders in the right bank, and the other firing the cylinders in the left bank. The magnetos are right- and left-hand, and can be identified by the number plate on top of the magnetos. No. MJF4A-308 is the right, and No. MJF4A-307 is the left. Right and left throughout this book are determined when looking at the engine from the rear of the vehicle, toward the front. These magnetos employ the induction principle of current generation, the coil windings being stationary, and the magnet rotating between laminated pole shoes. The numbering of the cylinders, and the firing order, are listed in paragraph 20. The wires leading from both right- and left-hand magneto are identified by colors marked on the wires as follows: No. 1 red, No. 2 blue, No. 3 green, and No. 4 yellow.

22. REMOVAL.

a. To remove the magnetos from the engine, refer to TM 9-1731B or TM 9-731G.

23. CLEANING AND INSPECTION (EXTERNAL).

a. **Cleaning.** Clean each magneto externally, using dry-cleaning solvent.

b. **Inspection.** Magnetos should be completely rebuilt at each engine overhaul period, or after every 600 hours (approximate) of service. Magnetos known to have less than 600 hours of service, are to be inspected

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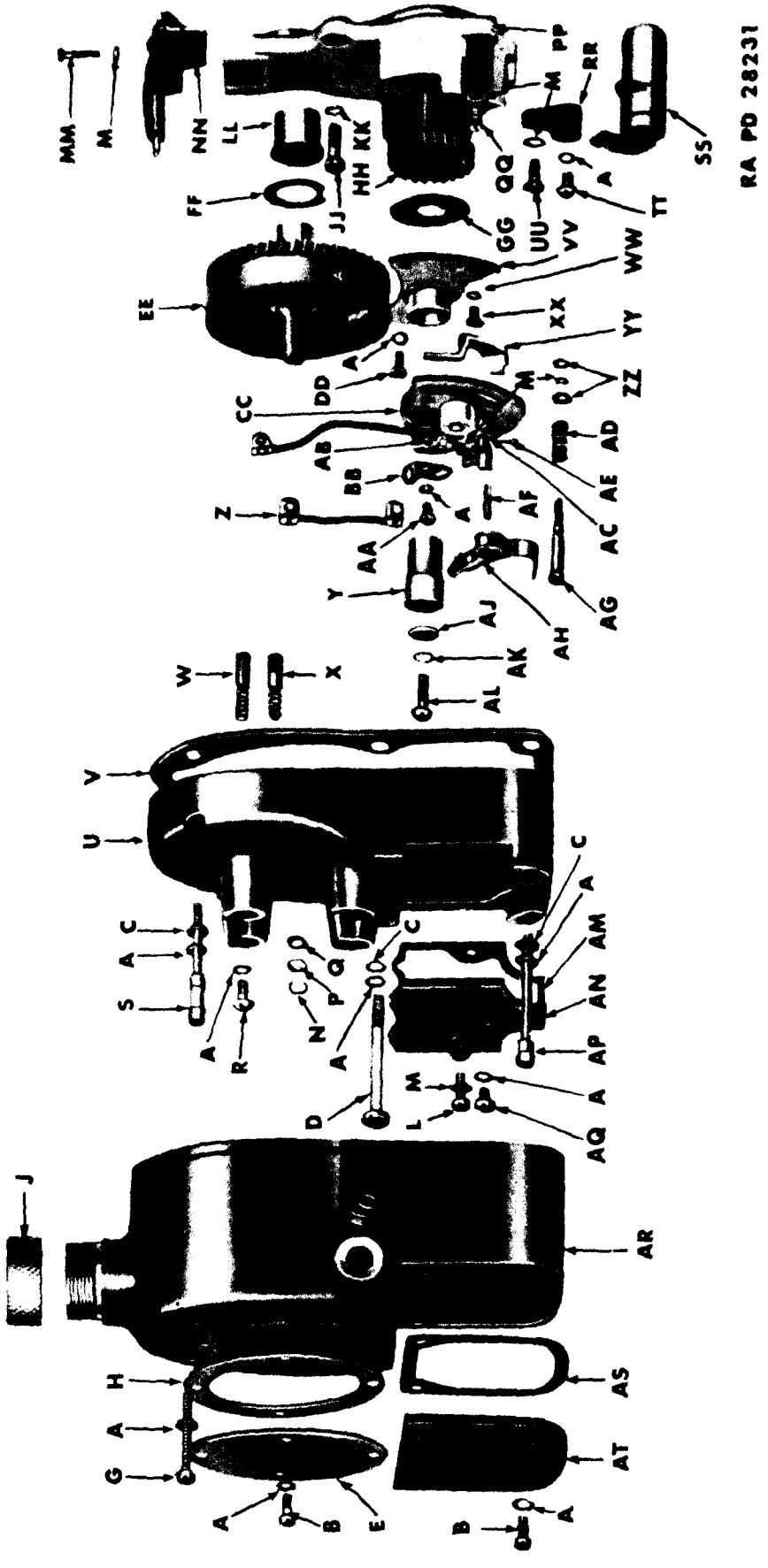

Figure 6—Magneto Distributor Plate Breaker Mechanism and Gears Disassembled

MAGNETOS

A—LOCK WASHER
B—INSPECTION COVER SCREW
C—FLAT WASHER
D—DISTRIBUTOR PLATE SCREWS
E—CIRCULAR INSPECTION PLATE
G—RADIO SHIELD SCREW
H—RADIO SHIELD GASKET
J—CONDUIT NUT
L—BREAKER CAP SCREW
M—LOCK WASHER
P—OBSERVATION WINDOW
Q—OBSERVATION GASKET
R—SPARK PLUG WIRE SCREW
S—DISTRIBUTOR PLATE SCREW
U—DISTRIBUTOR PLATE
V—DISTRIBUTOR PLATE GASKET
W—DISTRIBUTOR BRUSH WITH SPRING (OUTER)
X—DISTRIBUTOR BRUSH WITH SPRING (CENTER)
Y—BREAKER CAM
Z—GROUND WIRE ASSEMBLY
AA—SCREW FOR BREAKER POINT BRACKET
BB—BREAKER POINT BRACKET WITH CONTACT
CC—BREAKER PLATE ASSEMBLY
DD—BREAKER SUPPORT SCREW
EE—DISTRIBUTOR ROTOR AND GEAR SHAFT ASSEMBLY
FF—ROTOR WASHER
GG—INDICATING WASHER
HH—DISTRIBUTOR ROTOR DRIVE GEAR
JJ—GEAR BRACKET SCREW
KK—WASHER
LL—GEAR BRACKET BUSHING
MM—CONDUCTOR ASSEMBLY SCREW
NN—CONDUCTOR ASSEMBLY
PP—GEAR BRACKET
QQ—SCREW
RR—TERMINAL BLOCK
SS—CONDENSER
TT—TERMINAL BLOCK SCREW
UU—TERMINAL BLOCK SCREW
VV—BREAKER SUPPORT
WW—FLAT WASHER
XX—SCREW FOR BREAKER SUPPORT
YY—STOP PLATE
ZZ—FLAT WASHERS
AB—SCREW FOR BREAKER LEVER SPRING
AC—BREAKER LEVER WASHER
AD—BREAKER PLATE SPRING
AE—COTTER PIN
AF—GROUNDING BRUSH AND SPRING
AG—PHILIP HEAD STUD FOR GEAR BRACKET
AH—BREAKER LEVER WITH CONTACT
AJ—FLAT WASHER FOR CAM SCREW
AK—LOCK WASHER FOR CAM SCREW
AL—SCREW FOR CAM
AM—BREAKER CAP GASKET
AN—BREAKER CAP
AP—DISTRIBUTOR PLATE STUD
AQ—GROUND WIRE SCREW
AR—RADIO SHIELD
AS—BREAKER INSPECTION PLATE GASKET
AT—BREAKER INSPECTION PLATE

RA PD 28231 B

Legend for Figure 6

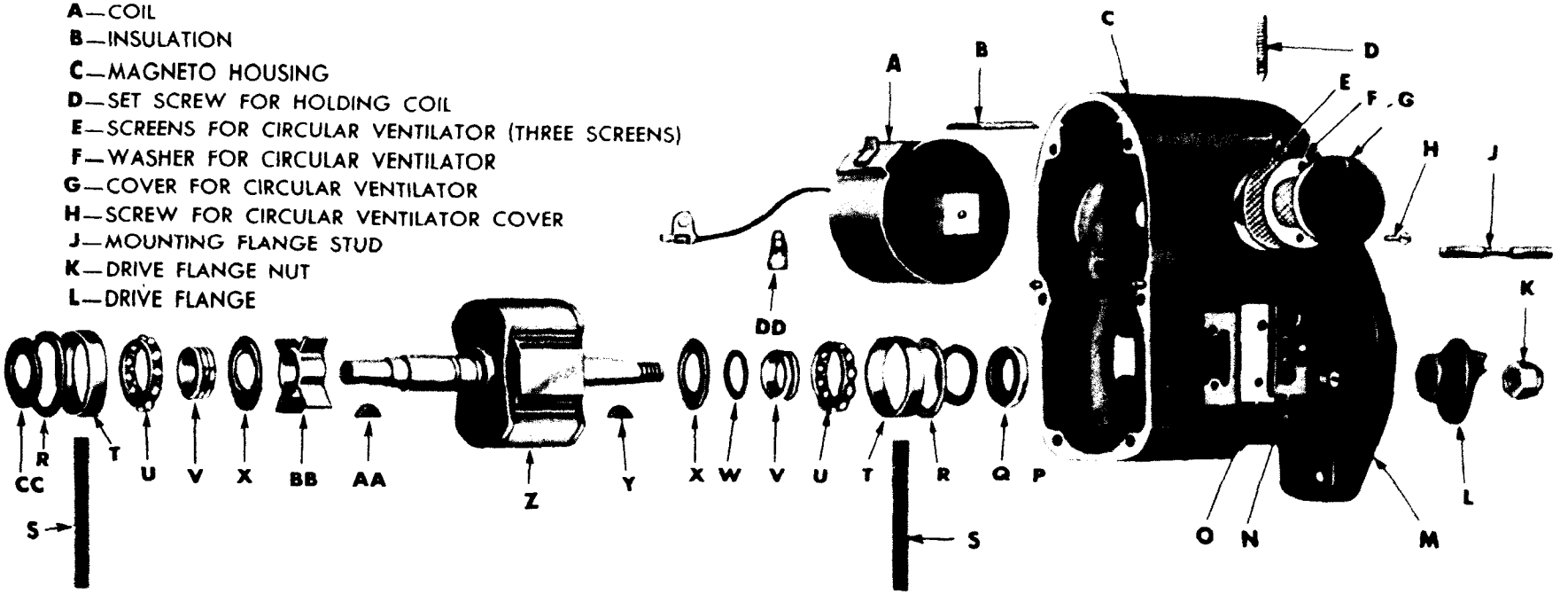

Figure 7—Magneto Housing and Magnet Rotor Shaft Disassembled

externally for damage of any kind. If found in good condition, the breaker points should then be inspected for the condition of the points and spacing. Adjust or replace the points if necessary (par. 28). Place the magneto on a test stand, and test its performance as outlined in paragraph 29. If the performance is found satisfactory from this test, the magneto may be considered satisfactory for further use. If the test does not show satisfactory performance, the magneto must be completely disassembled and rebuilt.

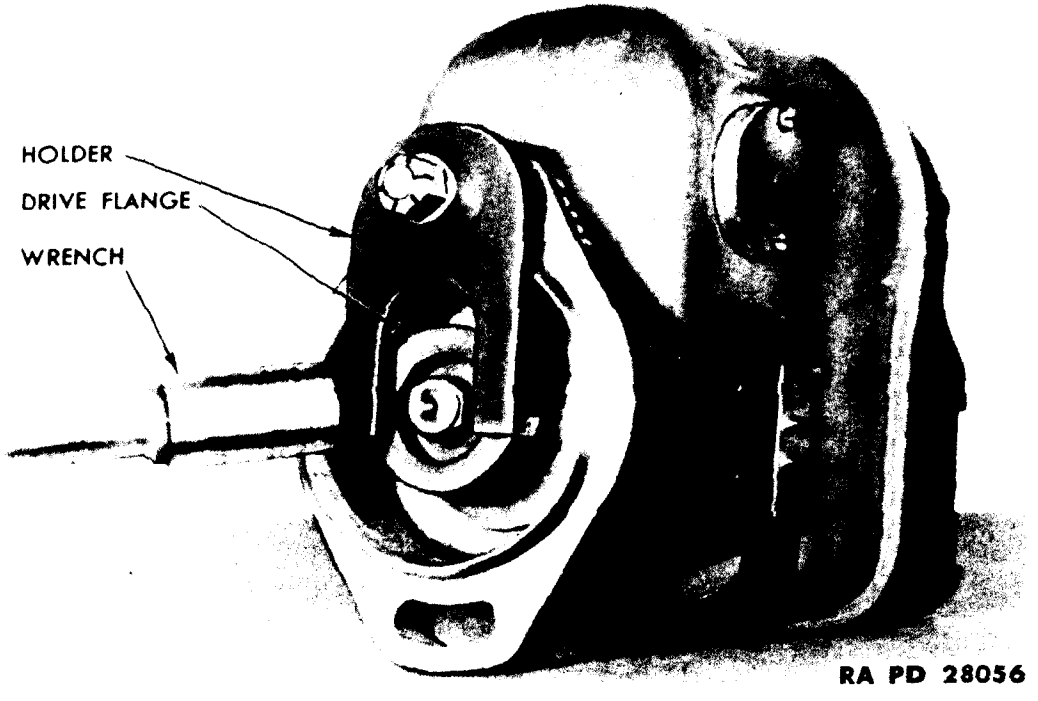

Figure 8—Magneto Drive Flange Holding Tool

24. DISASSEMBLY.

a. Remove Magneto Drive Flange. Attach holder 41-H-3350 (fig. 8) to the magneto drive flange. Remove the nut (K, fig. 7). Remove the holding tool and attach the drive flange puller 41-P-2941-750, to the drive flange (fig. 9), and pull the drive flange from the magneto shaft.

b. Remove Inspection Plates. Remove the four screws from the circular inspection plate (E, fig. 6) and remove the plate and gasket. Remove the four screws from the breaker inspection plate (AT, fig. 6), over the breaker points, and remove the plate.

c. Remove Radio Shield (AR, fig. 6). Remove the two screws (G, fig. 6), and remove the radio shield.

d. Remove Distributor Plate Assembly (U, fig. 6). Remove the two cap screws (L, fig. 6), lift breaker cap and gasket from the distributor plate. Remove studs (AP, fig. 6) and screws (D and S, fig. 6), and remove the distributor plate assembly. Pull out the four outer distributor plate

brushes with their springs, and the center brush with its spring (W and X, fig. 6).

e. **Remove Cam** (Y, fig. 6). Remove the cam fastening screw (AL, fig. 6) from the magnet rotor shaft, and withdraw the cam.

f. **Breaker Assembly.** Remove the stud and spring (AG and AD, fig. 6). Pull out grounding brush and spring (AF, fig. 6) from hollow stud. Take out the screw (AA, fig. 6) which loosens the end of ground

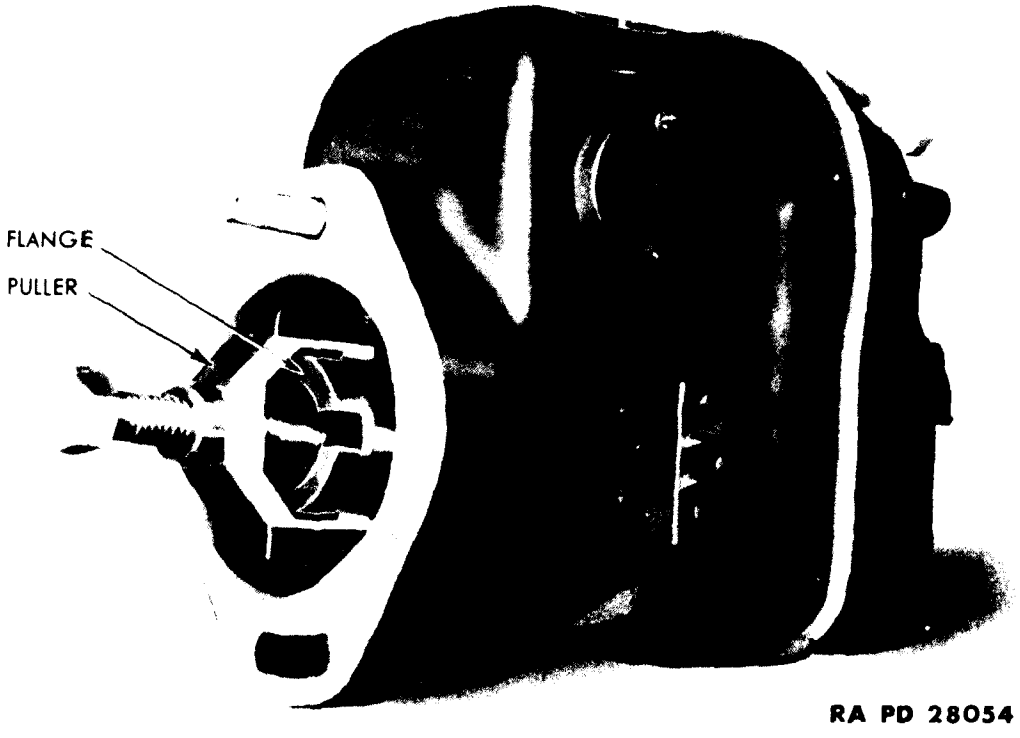

Figure 9—Pulling Magneto Drive Flange

wire and the contact bracket with contact (Z and BB, fig. 6), and remove the contact bracket. Pivot the breaker plate and take out the screw (XX, fig. 6) on the right-hand side. Pivot the breaker plate back to its original position and take out the screw (DD, fig. 6). This releases ground wire (Z, fig. 6). Loosen the screw (AB, fig. 6) which secures the breaker lever spring to the plate. Pull out cotter pin from breaker lever stud (AE, fig. 6), and remove the breaker lever (AH, fig. 6). Lift the breaker plate (CC, fig. 6) from the end of the magnet rotor shaft. NOTE: Do not break primary wire connection at this time.

g. **Remove Condenser** (SS, fig. 6). Remove screw (TT, fig. 6) from condenser wire. Remove the condenser fastening screw, and lift out the condenser.

h. **Remove Distributor Rotor and Gear Shaft Assembly** (EE, fig. 6). Lift out the distributor rotor and gear shaft assembly, at the same

time pulling indicating washer (GG, fig. 6) which projects into the edge of the distributor rotor. Be sure to keep them both even so that they will not bind.

i. **Remove Distributor Rotor Drive Gear** (HH, fig. 6). Remove the gear with gear puller 41-P-2918 (fig. 10). Remove the Woodruff key (Y, fig. 7) from the shaft.

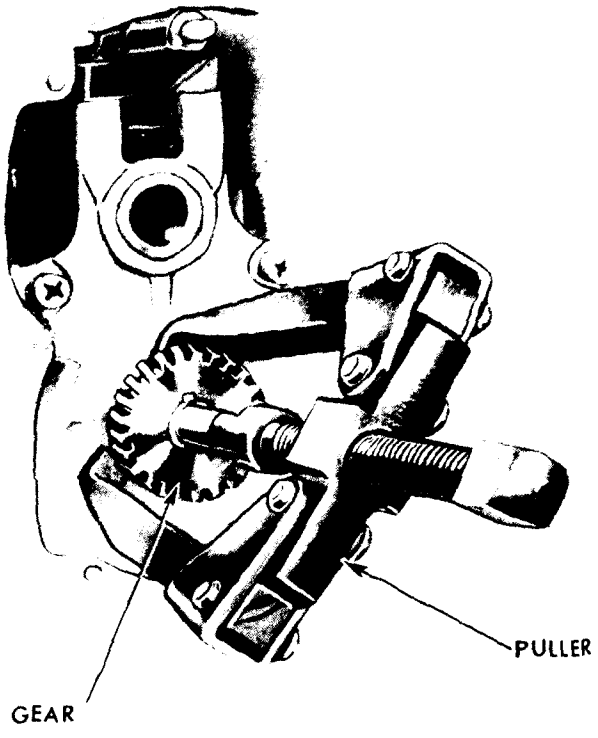

Figure 10—Distributor Rotor Drive Gear Puller

j. **Remove Gear Bracket Assembly** (PP, fig. 6). Remove screw (UU, fig. 6) and remove terminal block (RR, fig. 6). With a cross-recess head screwdriver take out four screws (JJ, fig. 6) and remove the gear and bracket assembly.

k. **Remove Conductor Assembly** (NN, fig. 6). Remove two screws (MM, fig. 6) and remove the conductor assembly from the edge of the gear bracket.

l. **Remove and Disassemble Magnet Rotor** (Z, fig. 7). Remove the Woodruff key (Y, fig. 7) from the drive end of the rotor. Remove the magnet rotor assembly from the housing by pressing on the drive end of the rotor. Pry off the ball cage and balls from the ball bearing inner race (U, fig. 7). Use the ball bearing inner race puller, and remove the inner race (fig. 11). If any equalizing washers have been used, they are

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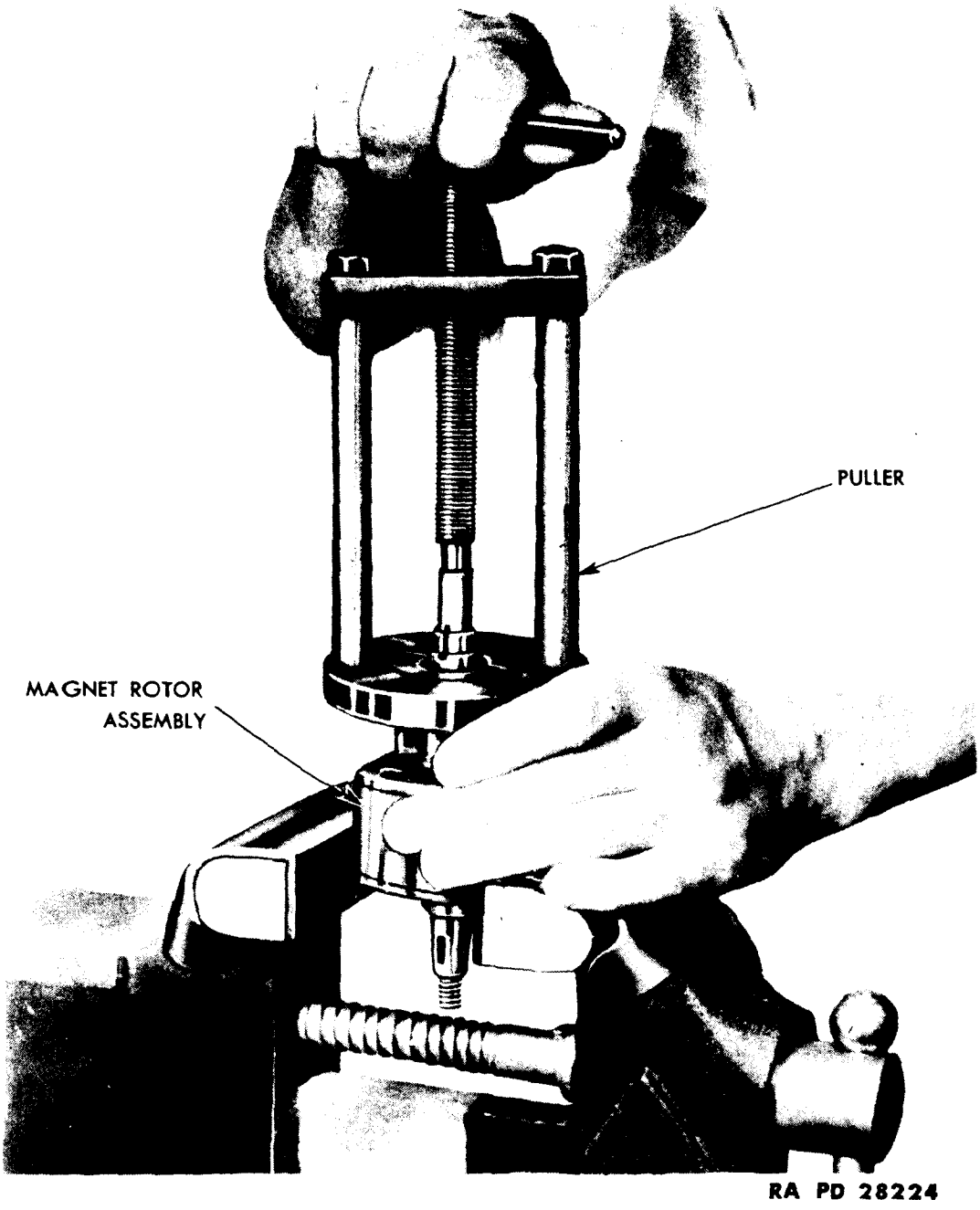

Figure 11—Removing Ball Bearing Inner Race

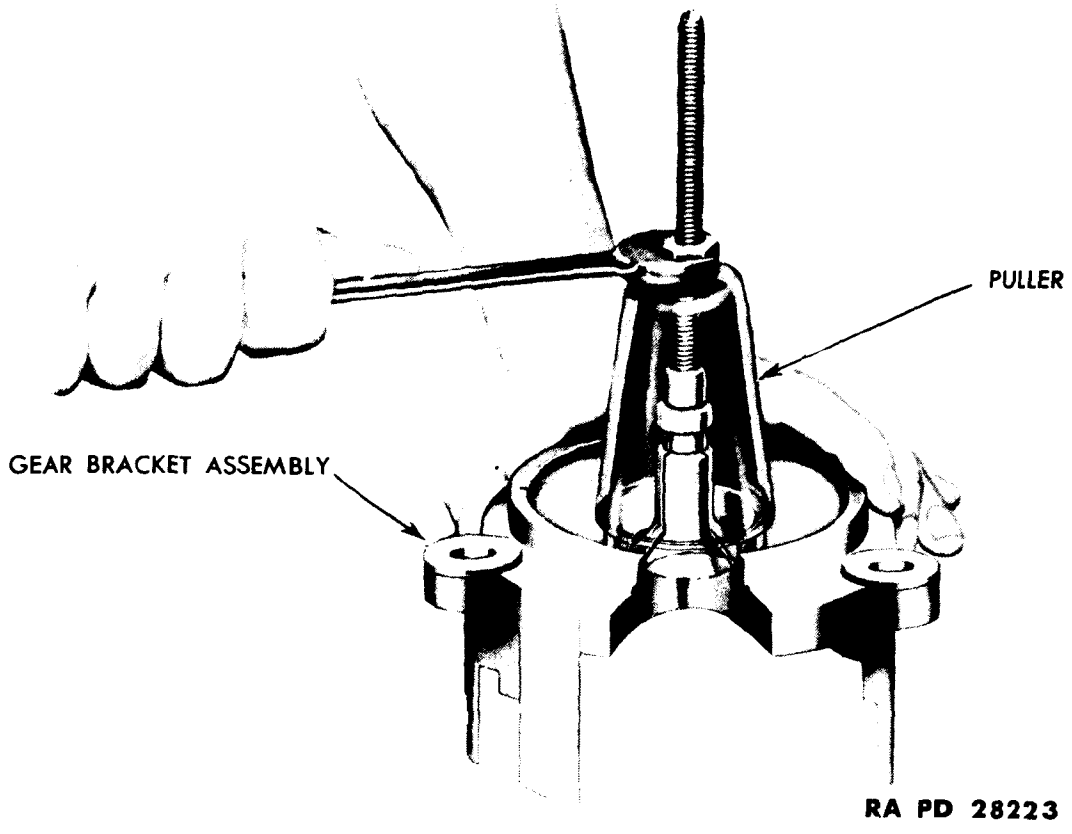

Figure 12—Removing Ball Bearing Outer Race

now taken from the end of the shaft along with grease retainer washers and fan or collar (X and BB, fig. 7). From the threaded end of the magnet rotor shaft, remove cage and balls from the inner race. Pull the inner race of the bearing (V, fig. 7), using inner race puller 41-P-2905-20 (fig. 11). The grease retainer washer is then slipped off.

m. Remove Coil Assembly (A, fig. 7). Loosen two set screws (D, fig. 7) from the top of the housing and remove the coil. NOTE: *The coil will still be fastened to the breaker plate by the primary wire and should not be disconnected at this time.* Pull the conductor insulation (B, fig. 7) from the housing.

n. Remove Magnet Rotor Outer Bearing Race from Housing (T, fig. 7). Pull outer ball bearing race from the housing, using puller 41-P-2905-21 (fig. 12). Remove insulating strip, and insulating washer (S and R, fig. 7) from the housing. If inspection of the oil seal (Q, fig. 7), proves it to be unfit for further use, remove the seal from the housing. A slight tap of a hammer, on a screwdriver placed behind the seal, will remove it. NOTE: This seal must be discarded after removal. Remove the washer under the seal.

o. **Remove Ventilator Plate Assemblies.** Remove the two screws, cover, washer, and screens (H, G, F, and E, fig. 7). Remove the two screws, the rectangular plate, and filter (N and O, fig. 7). Repeat the above procedure on the ventilators on the opposite side of the housing.

25. CLEANING.

a. **Inspect and Clean Metal Parts.** All metal parts must be washed in dry-cleaning solvent and dried with compressed air. All parts must be free from chips and foreign material. Examine magneto housing (C, fig. 7), and radio shield (AR, fig. 6), for cracks, loose inserts, and loose studs. Inspect all tapped holes.

26. INSPECTION AND TEST.

a. **Inspect Insulated Parts.** All insulations, such as distributor plate (U, fig. 6), distributor rotor (EE, fig. 6), conductor (NN, fig. 6), insulation (B, fig. 7), coil (A, fig. 7), terminal block (RR, fig. 6), and washers must be cleaned with a cloth dampened with dry-cleaning solvent. However, if the distributor plate has a carbonized track, the track should be scraped clean, and the entire plate wiped out with a cloth dampened with dry-cleaning solvent. Distributor plate should be checked for current leakage or damage.

b. **Inspect Coil Assembly.**

(1) VISUAL. Examine coil (A, fig. 7) for loose core and loose primary cable connections, and check all soldered connections.

(2) CHECK COIL PERFORMANCE. Using any approved test stand, provided with three electrode needle pointed test gaps, and a six-lobe cam, test the coil as follows: With a 2-volt input and cam speed of 150 to 175 revolutions per minute, the spark should jump 0.351-inch gap; with a 6-volt input and cam speed of 1000 revolutions per minute, the spark should jump 0.390-inch gap. Coil is suitable for further use if found satisfactory in the above tests.

c. **Inspect Ball Bearing and Oil Seal.** Inspect ball bearing inner and outer race rings for scores and excessive wear. Inner and outer race track and balls should not be discolored and should have a "mirror" finish. All bearings must be cleaned in dry-cleaning solvent. Rough, loose, or worn bearings must be replaced. Pack the bearings, immediately after cleaning, with special high temperature grease. If the oil seal shows signs of excessive wear or leakage, it must be discarded.

d. **Inspect Gears.** Examine both the rotor gear, and the distributor gear for burs, excessive wear or other defects. Discard if found unfit for further use.

e. **Inspect Breaker Assembly.** Thoroughly inspect and clean all component parts of the breaker assembly. Check contact points for pitting or wear. If point replacement is necessary, always replace both the breaker lever (AH, fig. 6) and breaker point bracket with contact assembly (BB, fig. 6) at the same time. Slightly pitted or worn points can be put in a satisfactory condition for further use, by dressing the face of the points with a suitable stone.

f. **Inspect Condenser.** Check the condenser (SS, fig. 6) for short circuit, leakage, open circuit, or damage on any approved testing device.

g. **Inspect Ventilators.** Clean circular wire screens and silk screens, of circular ventilator, with dry-cleaning solvent, and dry with compressed air. The felt filter, for the rectangular ventilator, is to be cleaned in this same manner, unless visual inspection indicates it unfit for further use, in which case it must be discarded.

27. REPAIRS.

a. **Hone Breaker Points.** Slightly pitted or worn breaker points can be dressed on a suitable stone, being sure a flat, square surface is obtained. CAUTION: Never use a file, flint paper, or emery cloth for dressing breaker points, as they will leave minute particles imbedded on the contact area of the points, which will cause greater than normal amount of pitting and arcing.

b. **Remove Carbon Tracks from Distributor Rotor.** Ordinarily a rotor containing visible carbon tracks should be replaced, as the condition often recurs after cleaning. However, temporary repairs can be made by cleaning all traces of the carbon track from the rotor with flint paper.

28. ASSEMBLY.

a. **Install Rectangular Ventilator Assembly.** Place the filter for the rectangular ventilator cover (O, fig. 7) in alinement with holes on the magneto housing slot provided for it, and mount the rectangular ventilator cover (N, fig. 7) on the filter with two screws, being sure that slots in rectangular ventilator face downward. Repeat the above procedure with the rectangular ventilator assembly on opposite side of the magneto.

b. **Install Circular Ventilator Assembly.** Place a wire screen, a silk screen, and a wire screen (E, fig. 7) over each other in the wall of the housing provided for them. Aline the holes on the screens with the holes in the housing. Apply a small amount of shellac in center bore before attaching circular ventilators. Install the circular ventilator washer and the circular ventilator cover (F and G, fig. 7) (cover slots facing toward bottom of magneto) in place over the screens, and secure the assembly to the housing with two screws and lock washers. Repeat the above procedure with the circular ventilator assembly on the opposite side of the magneto.

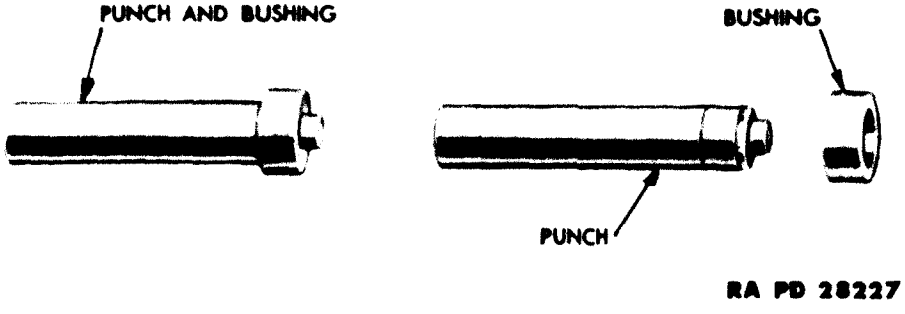

Figure 13—Magneto Housing Oil Seal Pressing Tool

c. **Install Oil Seal in Housing** (Q, fig. 7). If the oil seal has been removed, place the washer (P, fig. 7) in the bearing recess where oil seal is to go. Press the oil seal into place with chamfered side of leather washer toward inside of magneto, using replacer 41-R-2392-980 and an arbor press.

d. **Install Magnet Rotor Bearing Outer Race in Housing.** Place insulation washer for magnet rotor ball bearing race (R, fig. 7) into the bearing recess. Install the magnet rotor ball bearing insulation strip (S, fig. 7) around the inner edge of the ball bearing recess in the housing, overlapping the ends in the special groove provided in the bearing recess. Press the outer race of magnet rotor ball bearing (T, fig. 7) into the bearing recess, using replacer 41-R-2386-705 in an arbor press (fig. 14). Trim off the edge of insulation strip that projects over the edge of the outer race.

e. **Install Conductor Insulation** (B, fig. 7). Push conductor insulation into the slots in the top of the magneto housing, being sure that the straight edge of insulation fits into slots first. Leave the curved edge of insulation projecting over the edge of the housing.

f. **Install Coil Assembly** (A, fig. 7). Place the coil assembly, which is still fastened to the breaker plate by the primary coil cable, into the housing so that the countersunk holes in the core of the coil are toward the top of the housing, and the primary cable is to the left of the coil. Fasten the coil in place by the two set screws (D, fig. 7), on outside of magneto housing.

g. **Install Magnet Rotor Assembly** (Z, fig. 7). On the threaded end of the magnet rotor shaft, slide the grease retaining washer for the magnet rotor ball bearing (X, fig. 7). Press the inner race of the magnet rotor ball bearing (V, fig. 7) onto the shaft, using replacer 41-R-2386-705 (fig. 15) and an arbor press. Install the cage and balls on the inner race just pressed in place. Over the other end of shaft, slip the fan or collar (BB, fig. 7) until it is flush against the rotor. Place the grease retaining washer (X, fig. 7), and any equalizing washer that may have been removed, on the shaft. Press the inner race of magnet rotor ball bearing (V, fig. 7) on the shaft,

using replacer 41-R-2386-705 (fig. 15) and an arbor press. Mount the cage and balls on the race. Slip the magnet rotor felt washer (CC, fig. 7) over the same end of shaft. NOTE: *All ball bearings must be packed with special high temperature grease.* Push the magnet rotor assembly into the housing with the threaded end of shaft first until it bottoms. Install the

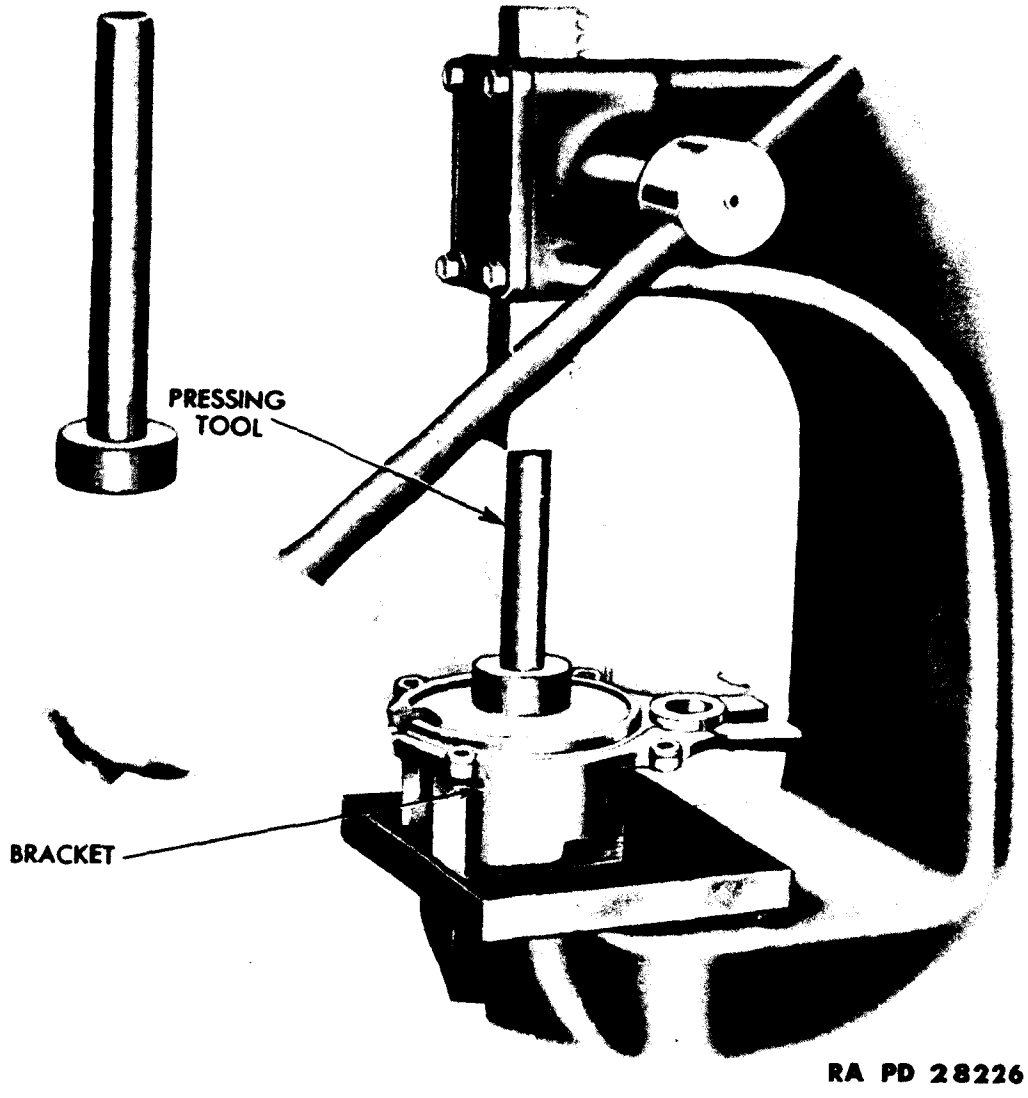

Figure 14—Pressing Ball Bearing Outer Race in Bracket (also used for pressing outer race in housing)

magnet rotor Woodruff key (AA, fig. 7) in the slot in the magnet rotor shaft.

h. Assemble Gear Bracket (PP, fig. 6). Place the magnet rotor ball bearing insulation washer (R, fig. 7) in ball bearing recess in gear bracket. Line the side of the ball bearing recess with the insulation strip (S, fig. 7), lapping the ends in the groove in the recess. Press the outer race of the magnet rotor ball bearing (T, fig. 7) into the recess, using replacer 41-R-2386-705 (fig. 14) and an arbor press. Make sure that bracket is sup-

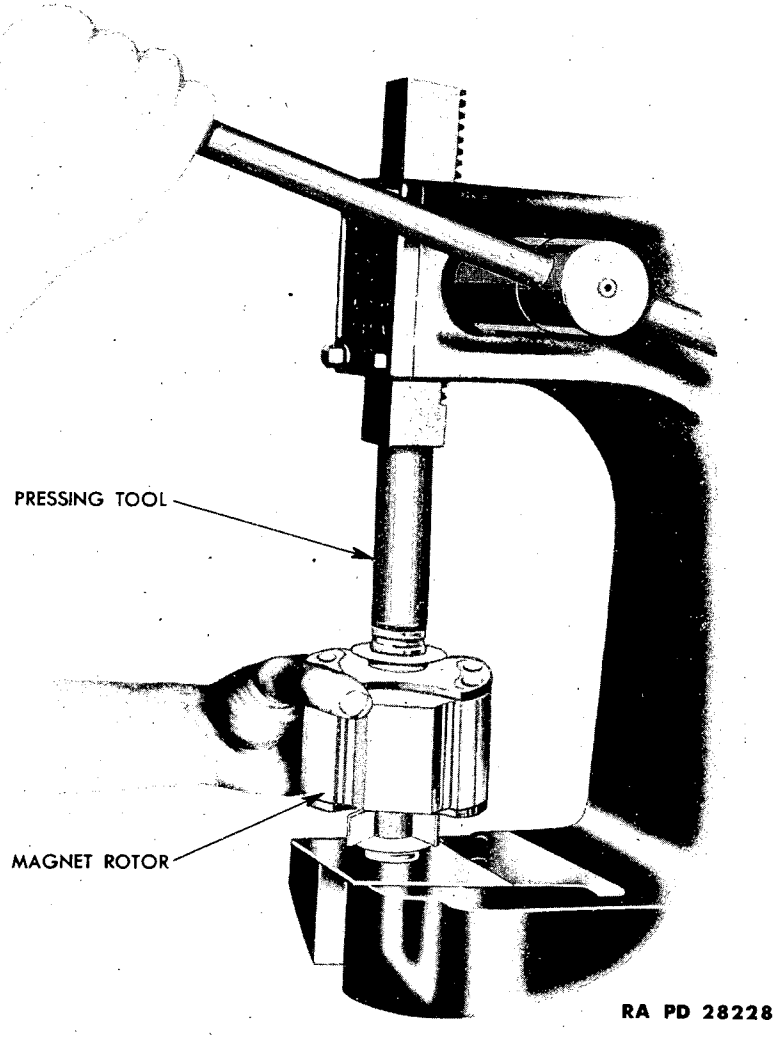

Figure 15—Ball Bearing Inner Race Pressing Tool (also used for pressing distributor plate drive gear on shaft)

ported by a wood block placed under recess (fig. 14) to prevent damage to bracket. Trim off the edge of insulation strip which projects over edge of outer ball race. If the bushing (LL, fig. 6) in the gear bracket has been removed, fill the lubricating groove (located in bushing receiving hole in gear bracket) with petrolatum. Press the new bushing into gear bracket with replacer 41-R-2386-705 and an arbor press. Place the conductor assembly (NN, fig. 6) on edge of gear bracket in the position shown in figure 6 and fasten with two screws and lock washers (MM and M, fig. 6).

i. **Install Gear Bracket Assembly Housing.** Place the gear bracket (PP, fig. 6) in the housing and fasten with four screws and lock washers (JJ and KK, fig. 6). Be sure that clip for retaining the coil wire is on left-hand upper screw facing the open end of the housing, as this clip holds down the coil wire. After installing magnet rotor, check for end play in the bearings. The bearing end play should be 0.002-inch minimum to 0.004-inch maximum. Add or remove washers to adjust end play. Mount the terminal block (RR, fig. 6) on the gear bracket so that the small stud on the terminal block fits into the "well" provided for it. Aline the screw hole in the block with the screw hole in the gear bracket, and fasten the block with a screw, lock washer and plain washer.

j. **Install Drive Gear** (HH, fig. 6). Place Woodruff key for the gear (AA, fig. 7) in the slot in magnet rotor shaft provided for it. Slide the drive gear over magnet rotor shaft (Z, fig. 7) with the letter A (C if magneto is clockwise) on gear upward and the slot in the gear fitting over the Woodruff key in magnet rotor shaft. Place replacer 41-R-2386-705 (fig. 15) over the end of the magnet rotor shaft, flush against top of the gear, and press the drive gear into place on magnet rotor shaft with an arbor press.

k. **Install Distributor Rotor and Gear Shaft Assembly** (EE, fig. 6). Apply approximately one-fourth ounce of special high temperature grease to the surface of the distributor gear teeth. Place the distributor rotor and gear shaft assembly into the housing, at the same time putting indicating washer (GG, fig. 6) over the end of the magnet rotor shaft. When the distributor rotor and gear shaft assembly meshes with the magnet rotor gear, the slot on the indicating washer must be in direct alinement with the mark on the edge of the distributor rotor. This is accomplished by slipping the indicating washer into the groove of the distributor rotor gear shaft assembly and sliding both the gear and washer over their respective holders at the same time. The long slot of the indicating washer must coincide with the mark on the edge of the distributor rotor and the small slot slides over the Woodruff key (AA, fig. 7).

l. **Install Condenser** (SS, fig. 6). Place the condenser in the "well" of the gear bracket provided for it, being sure that condenser lead is over the primary cable and under the clip. Fasten the clip and lead onto the terminal block (RR, fig. 6) with the condenser lead fastening the screw and lock washer. Fasten the condenser to the gear bracket, using a screw, lock washer, and plain washer. Tuck the primary cable running from the condenser clip and coil into the space between the housing and the gear bracket.

m. **Install Breaker Assembly.** Push the grounding brush with its spring (AF, fig. 6) into the hollow stud. Slide the stop plate (YY, fig. 6) into its slot in the breaker assembly. Place the breaker assembly into place on the gear bracket, and fasten the breaker support (VV, fig. 6) to the gear bracket with two screws (DD, fig. 6). Make sure the ground wire

assembly (Z, fig. 6) is fastened by the left screw directly under the adjustable bracket and the contact assembly slots in the bracket plate. Fasten the stop plate (YY, fig. 6) to breaker support plate with a screw, lock washer, and plain washer. Screw the stop plate stud assembly into the breaker stop plate so that the spring and washer are above the breaker plate. The lock washer and plain washer must be below the breaker plate and resting on the stop plate.

n. Install Breaker Points. Slip the breaker point bracket with contact assembly (BB, fig. 6) into the slots in the breaker plate provided for it. When the holes are alined, fasten to the breaker plate with a screw and lock washer (AA and A, fig. 6), making sure that the grounding wire (Z, fig. 6) is also fastened with the screw to the plate. Screw the breaker spring screw and lock washer (AB and M, fig. 6) part way into the breaker lever, holding bracket with an open-end wrench. Apply a liberal film of engine oil on the breaker lever stud, and slip the breaker lever with contact (AH, fig. 6) over it. Place the spring attached to lever behind the breaker lever bracket, so that the slot in the spring fits over the breaker lever spring fastening screw. This item was previously screwed part way into the breaker lever holding bracket. At this time the contact point of the breaker lever should be flush against the contact point in the breaker point bracket. Slip the washer over post and fasten with cotter pin.

o. Install Cam (Y, fig. 6). Slide the cam over the end of the magnet rotor shaft and into the hole provided for it in the breaker assembly. Note that the A (C if magneto is clockwise) on the cam lines up with the marking on the distributor rotor and gear shaft assembly (EE, fig. 6) and on the indicating washer (GG, fig. 6). Fasten the cam in place with the cam fastening screw, lock washer, and flat washer (AL, AK, and AJ, fig. 6).

p. Adjustment of the Contact Points. Breaker contacts are adjusted to an opening of from 0.014 to 0.018-inch when the breaker lever fiber rubbing block rests on the high point of the cam. Adjust the breaker point bracket (BB, fig. 6) by means of the eccentric adjusting screw (fig. 16) until the correct gap is obtained. Lock the bracket with the bracket lock screw (fig. 16). Contact points must be free from oil and grease and in proper alinement, so that the surfaces of both contacts meet squarely. When the breaker points have been set to the correct gap, set the position of the breaker plate to the correct relationship with the edge of the pole shoe in the magneto housing as outlined in paragraph 28 q (2).

q. Set Breaker Plate Position.

(1) EXPLANATION. From the standpoint of maximum efficiency, it is important that the primary circuit in the coil or winding is interrupted by the breaker points at the most favorable position of the rotor. This must be in relation to the pole shoe, for maximum disturbance or change of flux.

MAGNETOS

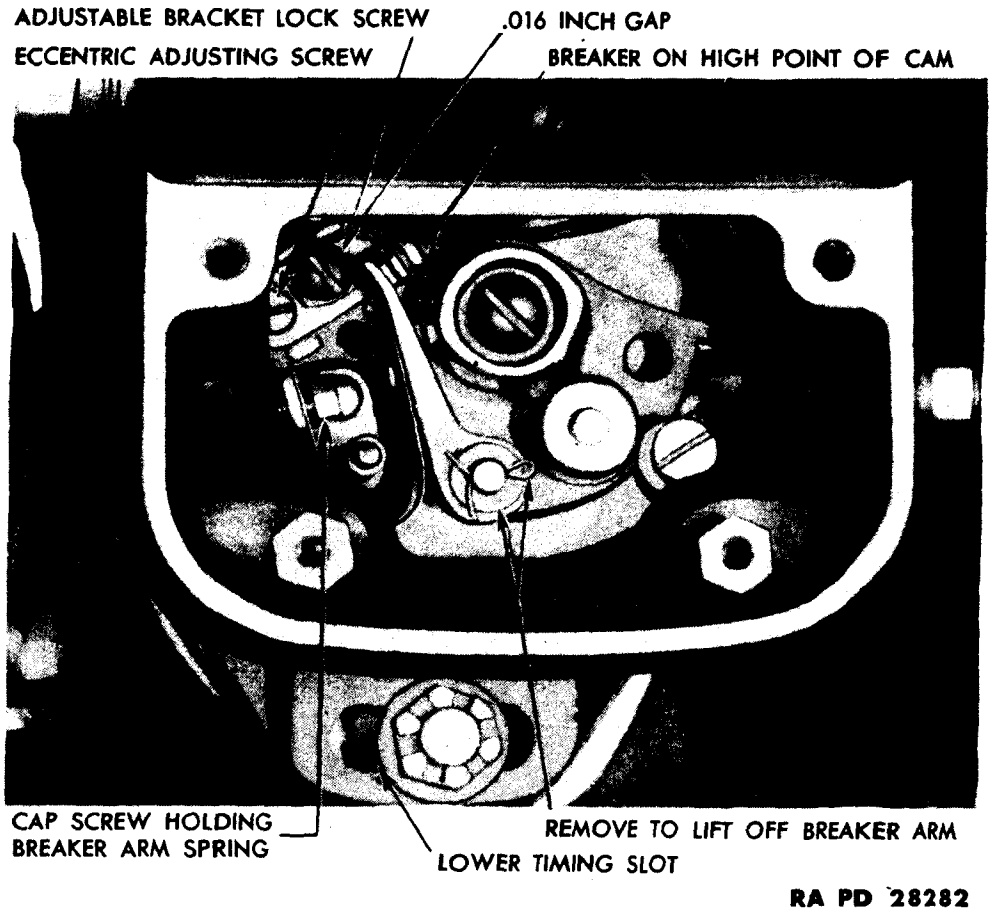

Figure 16—Magneto Breaker Assembly

This relationship is established when, with the magnet rotor leaving the pole shoe, the gap between the edge of the magnet rotor and the edge of the pole shoe is from 0.079 to 0.118-inch at the instant the breaker points start to open. This gap originally was referred to as the EDGE gap, which designation has been abbreviated to E gap by most magneto technicians. The E gap adjustment is established by setting the position of the breaker plate so that the points just start to open after mechanically fixing the relationship of the rotor magnet with the pole shoe as outlined in paragraph 28 q (2).

(2) E (EDGE) GAP ADJUSTMENT.

(a) Right-hand Magneto. NOTE: The direction of rotation of the right-hand magneto is clockwise, viewing the magneto from the drive end. It is important that the direction of rotation be kept in mind when setting the E gap. The E gap is determined as the magnet rotor leaves the pole shoes, never when the magnet rotor approaches it (fig. 17).

1. Set magnet rotor position. Turn the magneto bottom side up. Remove the small plug screw from the bottom left-hand side facing mag-

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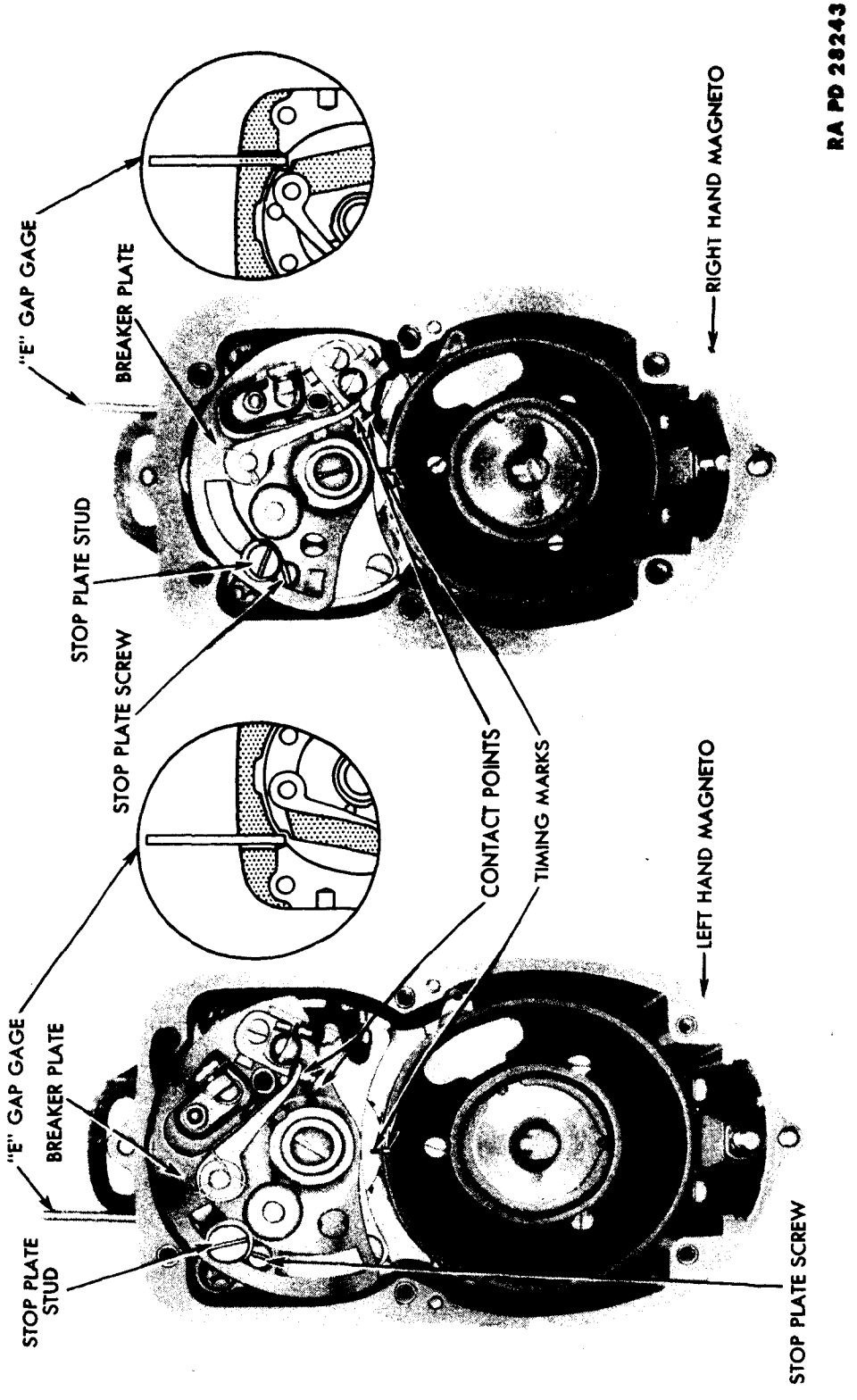


Figure 17—Setting "E" Gap

neto drive shaft end, and insert a gage in the hole from which the plug was removed, as shown in figure 17. The gage consists of a round rod measuring 0.080 to 0.115-inch in diameter. Turn the magneto rotor until the timing marks on the distributor rotor gear and the drive gear are alined (fig. 17). At this position, the magnet rotor is about to leave the pole pieces, then continue to turn the magnet rotor in direction of rotation. Do this until the gage leaves the curved surface of the rotor, and drops in the notch as shown in the insert in figure 17.

2. *Set breaker plate.* When the location of the magnet rotor has been established, the breaker plate should be adjusted so that the contact points will have just started to open. The opening of the points can be checked with a timing light, feeler gage, or similar device. To adjust the breaker plate, loosen the stop plate stud, the stop plate fastening screw, and turn the breaker plate in its slot until the contact points just break; then lock the breaker plate in this position by tightening the screw and stud. Reinstall the plug in the bottom of the magneto.

(b) Left-hand Magneto. The procedure for setting the E gap and breaker plate for the left-hand magneto is the same as for the right-hand, except the gage is inserted in the hole at the bottom left-hand side of the magneto as shown in figure 17. NOTE: The direction of rotation of the left-hand magneto is counterclockwise, viewing the magneto from the drive end.

r. **Install Distributor Plate Assembly** (U, fig. 6). Place the distributor plate gasket (V, fig. 6) on the edge of the gear housing with the smooth side of the gasket up, alining the holes in the gasket with the locating dowel pins on the edge of housing. Push the four outside plate brushes with their springs (W, fig. 6) into their respective holders, pushing springs in first and leaving the brushes projecting from the brush holders. Push the center brush with its spring (X, fig. 6) into center brush holder (spring first). The center brush is copper plated on the end toward the spring. The distributor plate (U, fig. 6) is now placed on distributor plate gasket, and fastened into place with four studs (long studs at the bottom), lock washers and flat washers and the two screws, lock washers and flat washers. Fasten the breaker cap and gasket to the distributor plate assembly with two screws, lock washers and plain washers.

s. **Install Radio Shield Assembly** (AR, fig. 6). Fasten the radio shield to the distributor plate (U, fig. 6) with two screws and lock washers. Place the breaker inspection plate gasket (AS, fig. 6) and the cover on the radio shield and fasten them with four screws and lock washers. Install the circular inspection plate and gasket (E and H, fig. 6) on radio shield with four screws and lock washers (B and A, fig. 6).

t. **Install Magneto Drive Flange.** Place the Woodruff key (Y, fig. 7) in the shaft and place the drive flange (L, fig. 7) on the shaft. Secure the

flange to the shaft with a self-locking nut (hug nut). Use holder 41-H-3350 (fig. 8) for holding the shaft from turning while tightening the nut.

u. Install Stud (J, fig. 7) in Magneto Mounting Flange.

29. TEST.

a. Using any standard, approved test stand, provided with pointed (three electrode) test gaps, run the magneto at each of the following speeds with the spark gap openings set as indicated for each speed:

Speed	Spark Gap
60 rpm	0.197-inch
150 rpm	0.295-inch
400 rpm	0.335-inch
1200 rpm	0.354-inch
2000 rpm	0.354-inch
3000 rpm	0.335-inch

During the run, 100 percent firing is required on all gaps. Only slight intermittent arcing of the contact points is allowable. Check the grounding brush circuit by grounding the low tension terminal while the magneto is running. If grounding brush circuit is functioning correctly, magneto will cease sparking when grounded.

30. INSTALLATION ON ENGINE AND TIMING.

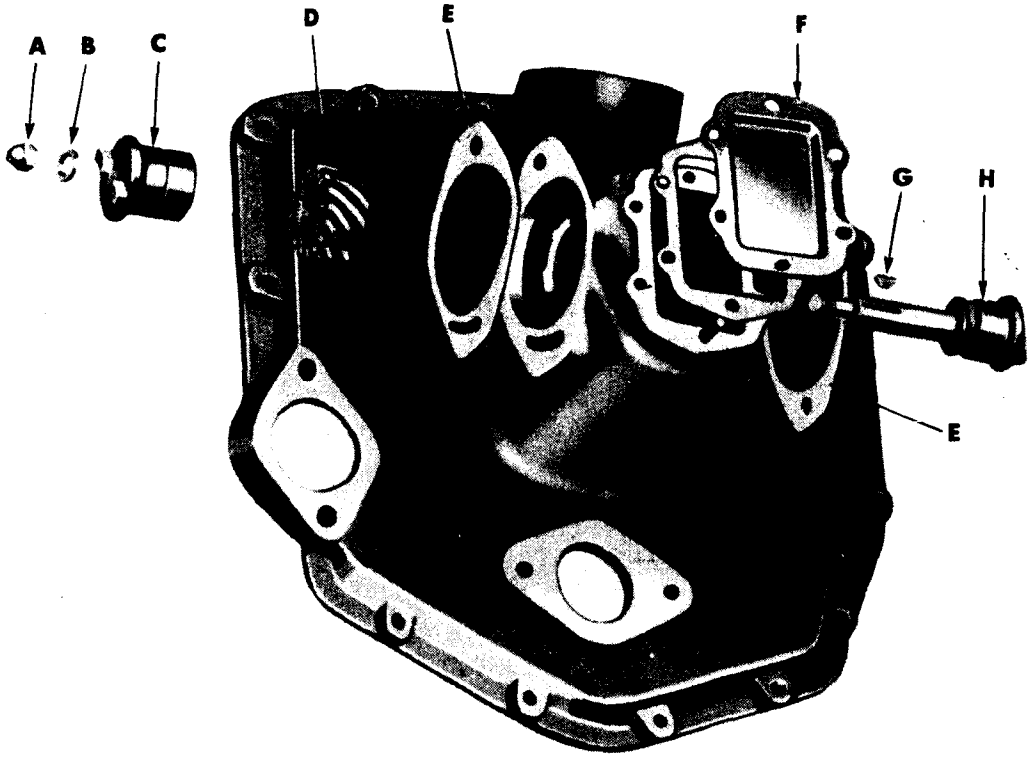
a. Install the magnetos on the engine and set the timing as outlined in TM 9-731G or TM 9-1731B.

CHAPTER 3

IGNITION SYSTEM (Cont'd)

Section III

MAGNETO GOVERNOR AND MAGNETO DRIVE GEARS



A—NUT
B—WASHER
C—MAGNETO DRIVE FLANGE
D—MAGNETO DRIVE GEAR
E—GASKETS
F—INSPECTION COVER
G—KEY
H—MAGNETO DRIVE SHAFT

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Figure 18—Magneto Drive Gear and Magneto Drive Shaft Disassembled

31. DESCRIPTION.

a. **Magneto Governor.** The spark advance is automatically controlled by a Bosch centrifugal governor, located inside of the accessory gear cover on the engine, and is driven by the end of the accessory gear pinion shaft. The spark advance governor as well as the magneto drive gears are covered in TM 9-1731B. They are not accessible for removal or installation until

other engine parts are first removed. The governor is nonadjustable and in case of improper operation, the governor must be replaced as an assembly.

b. Magneto Drive Gears. The magneto drive gear and driven gear are of the worm gear type and are supplied for service in matched sets. The drive gear is located inside the accessory cover on the engine. This is the accessory gear pinion shaft and is driven by driving lugs on the magneto governor weights. The driven gear is mounted on the magneto drive shaft and rotates in bronze bearings in the accessory gear cover (fig. 18).

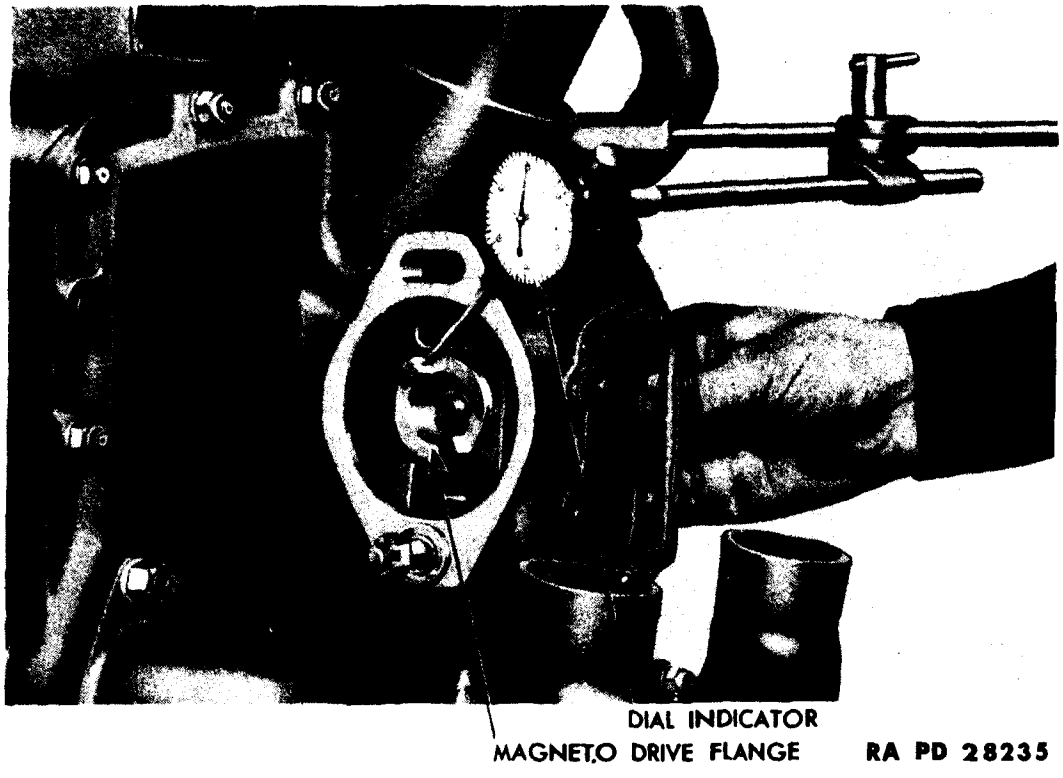

Figure 19—Checking Magneto Drive Gear Tooth Clearance

32. REPLACEMENT.

a. Removal and Installation. The removal and installation of the magneto governor or the drive gears is covered in Technical Manual 9-1731B. When new gears are installed, it is important that the tooth clearance between the gears be correct. The procedure for checking is shown in figure 19. This check is to be made after the magneto drive shaft, magneto driven gear, and magneto drive flange are installed in the accessory gear cover. Install a universal dial-type indicator (fig. 19) with its contact point resting on the drive flange lug at right angle to the lug. Rotate the magneto drive shaft both ways to measure the backlash. Backlash must be between 0.008 and 0.014-inch. If the reading is not within these limits, select and install another set of gears and recheck in the same manner.

CHAPTER 3

IGNITION SYSTEM (Cont'd)

Section IV

SPARK PLUGS, SPARK PLUG WIRES, AND CONDUITS

33. DESCRIPTION.

a. Spark Plugs. The spark plugs are the Champion Aircraft Type C-88-S. One plug is used for each cylinder.

b. Spark Plug Wires and Conduits. The spark plug wires are of the conventional automotive type, and are contained in a short conduit between the engine and the magnetos. The flexible portion of the conduits are connected to the magnetos by means of a knurled nut containing a gasket which prevents moisture getting to the wires. The spark plug wires for each bank of cylinders are marked RED, BLUE, GREEN, and YELLOW for identification when attaching them to the magnetos and spark plugs.

34. CONDUIT AND WIRES DISASSEMBLY.

a. Unscrew the knurled nut, and remove the flexible portion of the conduits from the rigid portion. Pull the wires out of the conduit. Remove the spark plug terminal fitting from the spark plug end of each wire (N, P, Q, and R, fig. 20).

35. CLEANING SPARK PLUGS.

a. Clean all spark plugs with a conventional sand blast cleaner.

36. INSPECTION.

a. Spark Plugs. Spark plugs must be replaced at each engine overhaul period. The spark plugs must also be replaced when their gaps increase in excess of 0.030-inch due to burning of the electrodes. Spark plug gaps are not adjustable.

b. Spark Plug Wires and Conduits. Spark plug wires having cracked or damaged insulation must be discarded. Examine the spark plug wire

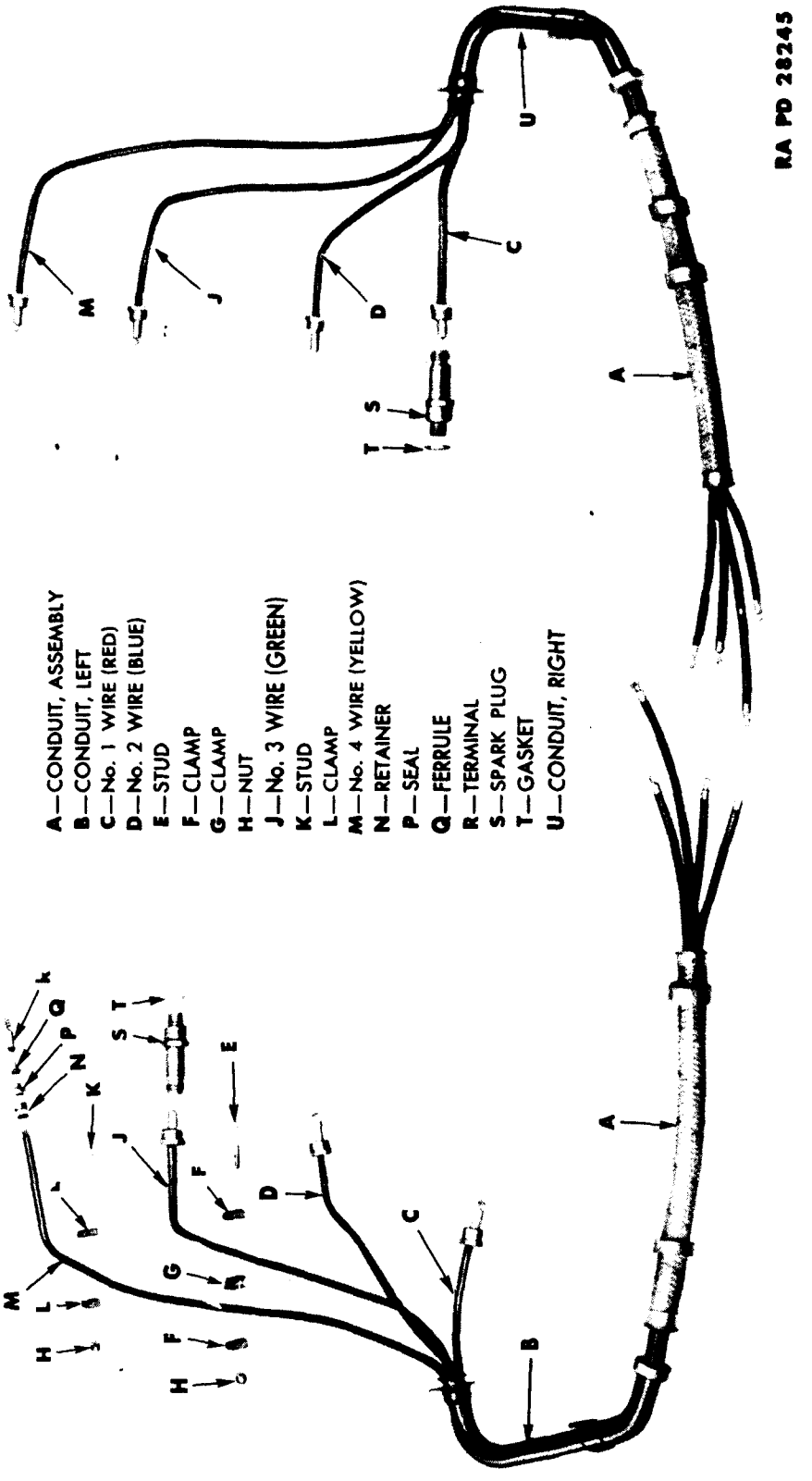

Figure 20—Spark Plug Wires and Conduits

terminal fittings (N, P, Q, and R, fig. 20). Discard any of the parts found damaged. If the flexible conduits are damaged or frayed, they must be discarded to avoid chafing the spark plug wires.

37. CONDUIT AND WIRES REPAIR AND ASSEMBLY.

a. Material that does not meet inspection requirements must be discarded. Assemble the four spark plug wires in each conduit and assemble the terminal (N, P, Q, and R, fig. 20) on each wire in the order shown.

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 4

FUEL SYSTEM

Section I

DESCRIPTION AND DATA

38. DESCRIPTION.

a. General. The 3-inch Motor Gun Carriage M10A1 fuel (gasoline) system shown in figure 21 is typical of the fuel system on other vehicles using the tank engine Model GAA V-8. The fuel system consists of two carburetors (equipped with degassers), a fuel pump, four fuel tanks with supply lines, a fuel filter, and a priming pump with lines running to the intake manifolds on the engine.

b. Carburetors. Two dual, down-draft Stromberg carburetors equipped with degassers are used. The carburetor control linkage is arranged so that the throttle plates of the rear carburetor start to open first (par. 38 h).

c. Fuel Tanks. The fuel lines from each of the four tanks terminate into one main line. An individual shut-off valve is provided for each tank with the controls in the fighting compartment.

d. Fuel Pump. Fuel is supplied to the carburetors by a mechanical fuel pump driven by the left-hand intake camshaft.

e. Fuel Filter. The fuel filter is located in the main fuel line between the fuel pump and the tanks.

f. Degassers. The degassers are vacuum-operated while the engine is running. They have an electrical control in the driver's compartment for positive shut-off of the idle fuel mixture when stopping the engine.

g. Throttle Governor. A throttle governor is driven by the right-hand intake camshaft. Additional throttle plates are located in the carburetor adapter housings and are connected to the governor arm by linkage.

h. Throttle Control Mechanism. The carburetor throttle control linkage (fig. 41) is arranged so that the throttle plates of the rear carburetor open to approximately half-throttle before the forward carburetor throttle plates start to open. The rate of opening of throttle plates in the forward carburetor is approximately twice as fast as for the rear carburetor, with the results that both reach the wide open point together.

DESCRIPTION AND DATA

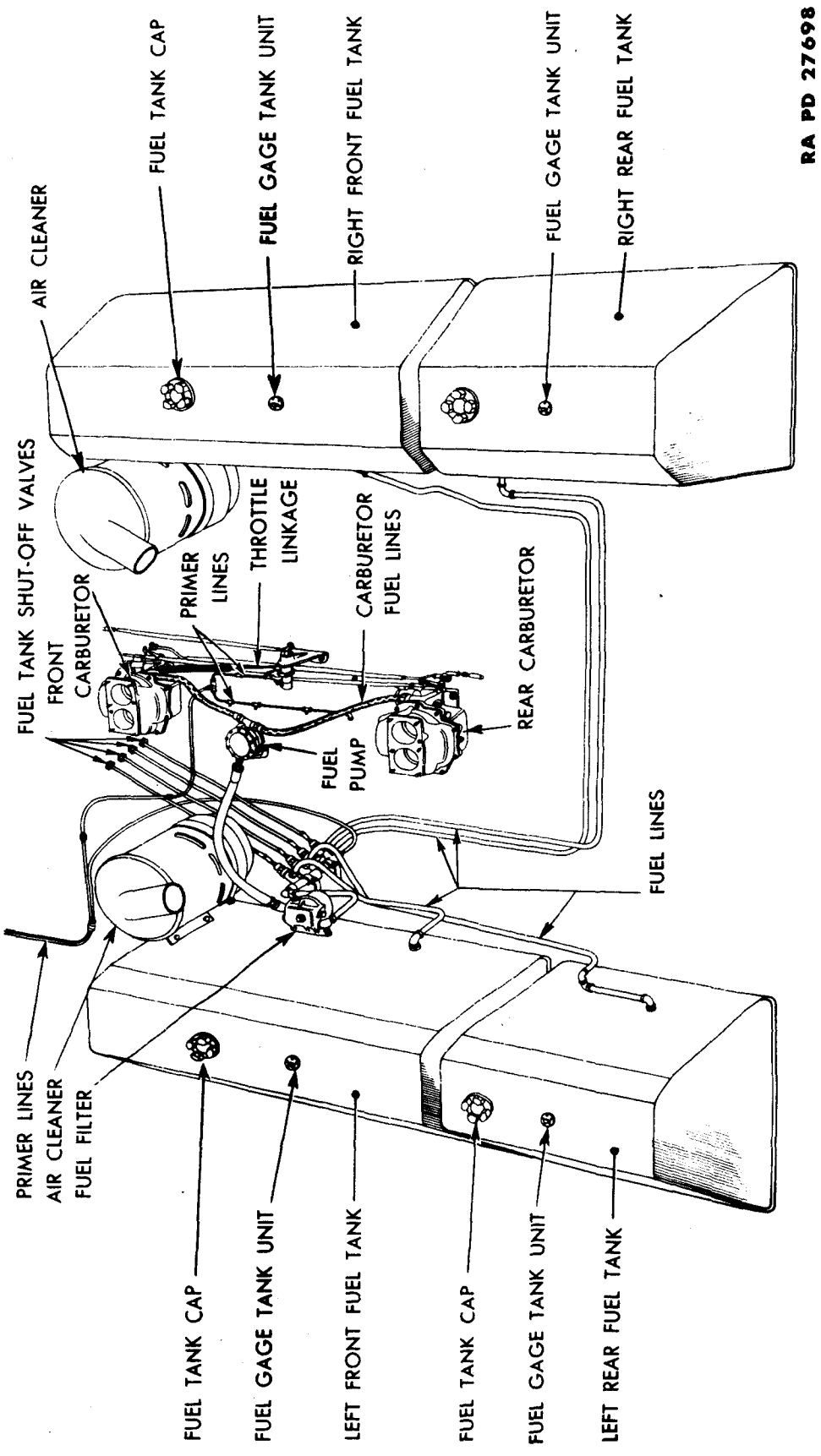

Figure 21—Fuel System

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

39. DATA.

Fuel tank capacity (M10A1) ..... 192 gal
Fuel pump:
  Pressure ..... 4½ to 6 lb
  Vacuum (inches of mercury) 10
Carburetor:
  Venturi ..... 1½-in.
  High speed bleeder ..... No. 70 drill size
  Main metering jet ..... No. 46 drill size
  Bypass jet ..... 0.080-in.
  Idle discharge holes at idle needle valves ..... No. 54 drill size
  Idle discharge holes at throttle valves ..... No. 53 drill size
  Idle restriction ..... No. 50 drill size
  Idle air bleed in main discharge jet ..... No. 70 drill size
  Idle air bleed in throttle barrel (secondary bleed) ..... No. 48 drill size
  Pump discharge nozzle ..... No. 58 drill size
  Throttle valve holes ..... No. 50 drill size

CHAPTER 4

FUEL SYSTEM (Cont'd)

Section II

CARBURETORS

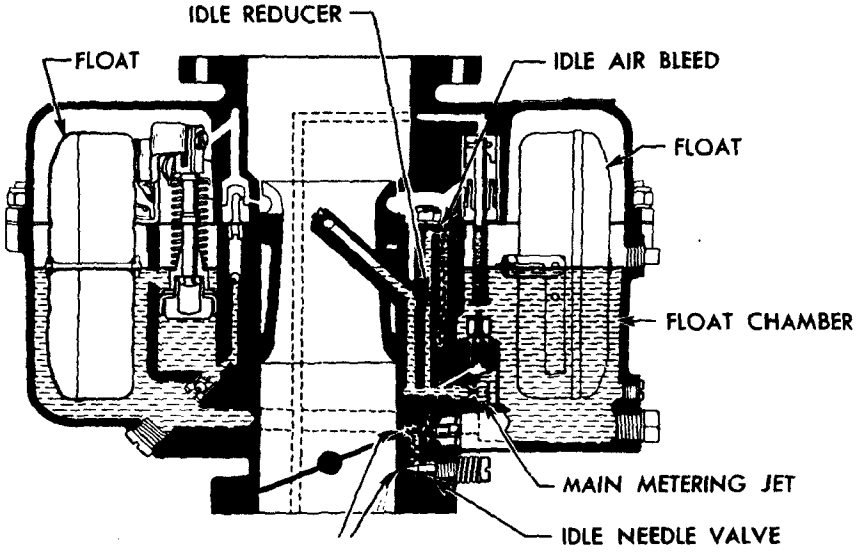

Figure 22—Idle System

40. GENERAL DESCRIPTION.

a. **General Description.** Two Stromberg NA-Y5G carburetors are used, mounted on two carburetor adapters (fig. 1) connecting the two intake manifolds at each end. The carburetors are dual (double-barrel) down-draft type.

b. **Float Chamber** (fig. 22). Fuel enters each carburetor at the gasoline inlet, through the float valve seat and needle valve, and enters the float chamber where it is maintained at a constant level by floats. The float

assembly in each carburetor consists of two stainless steel floats, connected by means of one lever operating on a needle valve.

c. **Idle System** (fig. 22). At closed throttle or low engine speeds, the fuel is delivered through the idle system. The fuel is taken from the main metering passage and flows through idle reducer, which meters all of the fuel that is used in the idle range. Air from the idle air bleeder mixes with the fuel, and flows down the channel where additional air from the secondary bleeder is added. The mixture of air and fuel is then discharged

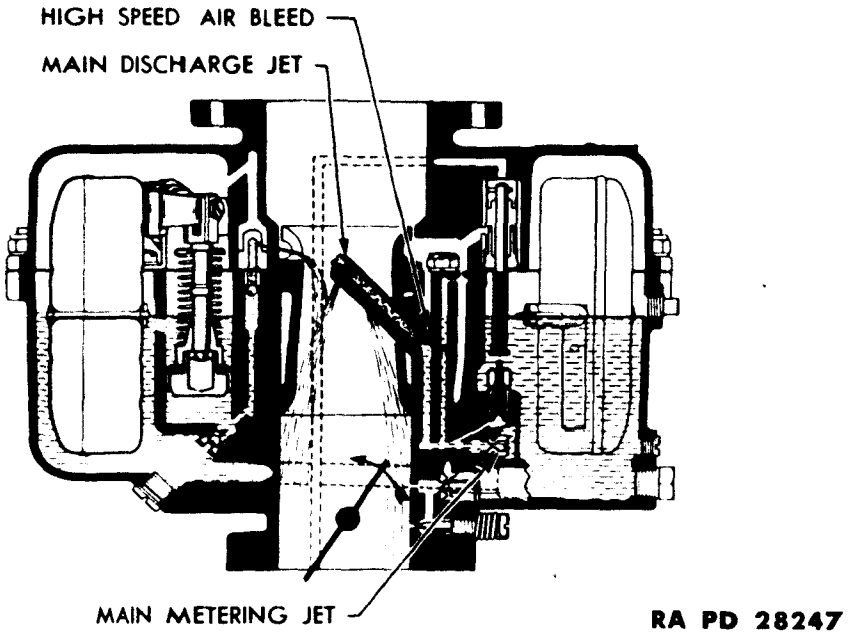

Figure 23—Main Metering System

through to the idle discharge holes. At closed throttle or idle speed, the fuel is delivered from the lower hole only. As the throttle opening is increased, the second hole is uncovered, and the fuel is discharged from both idle holes.

d. **Main Metering System** (fig. 23). The main metering jets are of the fixed type. They control the flow of gas during the intermediate or part-throttle position. From the metering jet, the fuel passes up a channel into the base of the main discharge jet where air from the high speed air bleeder (fig. 23) mixes with the fuel and the mixture is discharged from the jet into the carburetor barrel.

e. **Power System** (fig. 24). For maximum power or high speed running, a richer mixture is required than that necessary for normal throttle opening. Operation of the power bypass jet (fig. 24) is controlled by vacuum power piston (fig. 24), which is actuated by manifold vacuum. When the throttle valves are closed and a high manifold vacuum is pres-

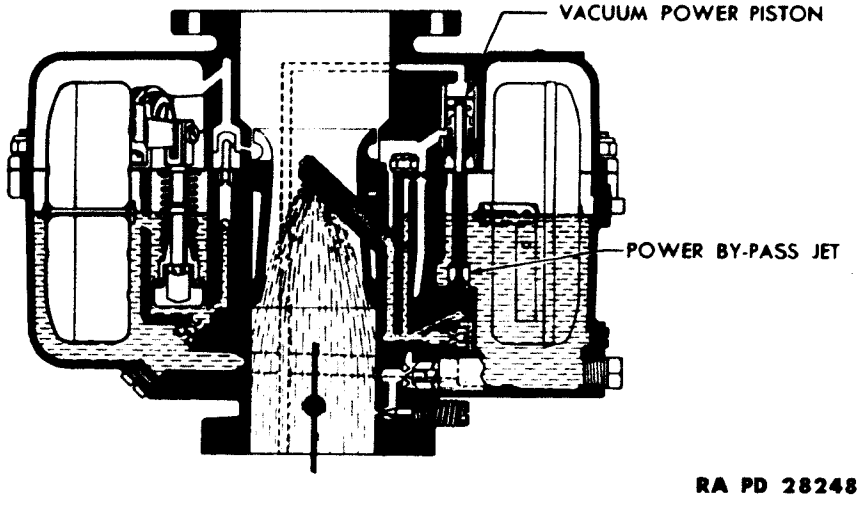

Figure 24—Power System

ent, the piston assembly is raised to its UP position compressing the spring. When the throttle is open to a point where additional fuel is required for high speed operation or pulling under load, the manifold vacuum decreases. This permits the spring to move the piston down, thereby opening the power jet to feed additional fuel ahead of the metering jets.

f. Acceleration (figs. 25 and 26). For smooth and rapid acceleration, it is necessary to momentarily supply an extra quantity of fuel as the throttle is opened. The accelerating pump is directly connected to the throttle

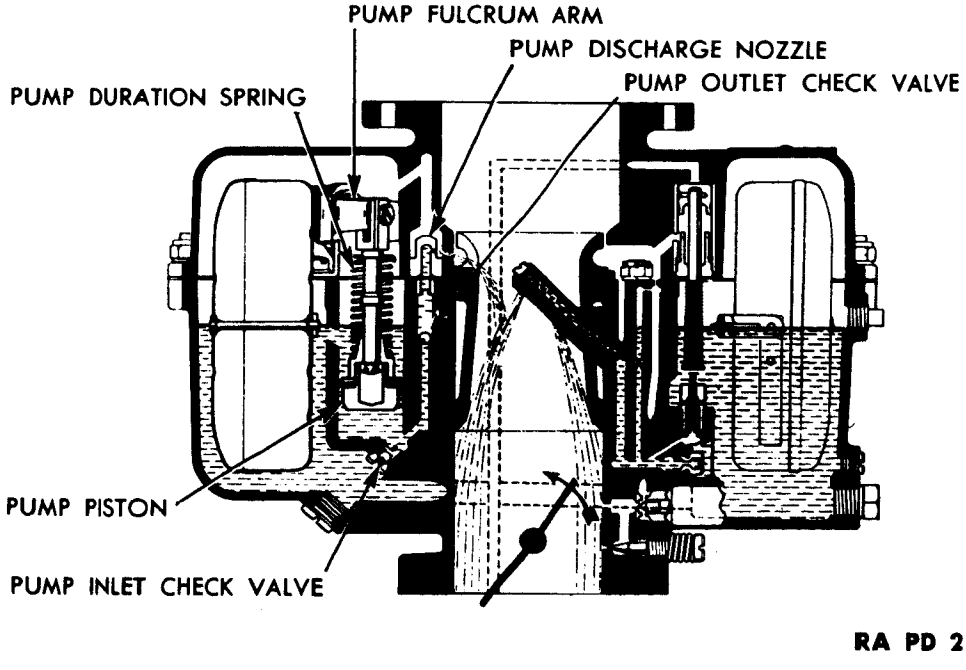

Figure 25—Accelerating Pump

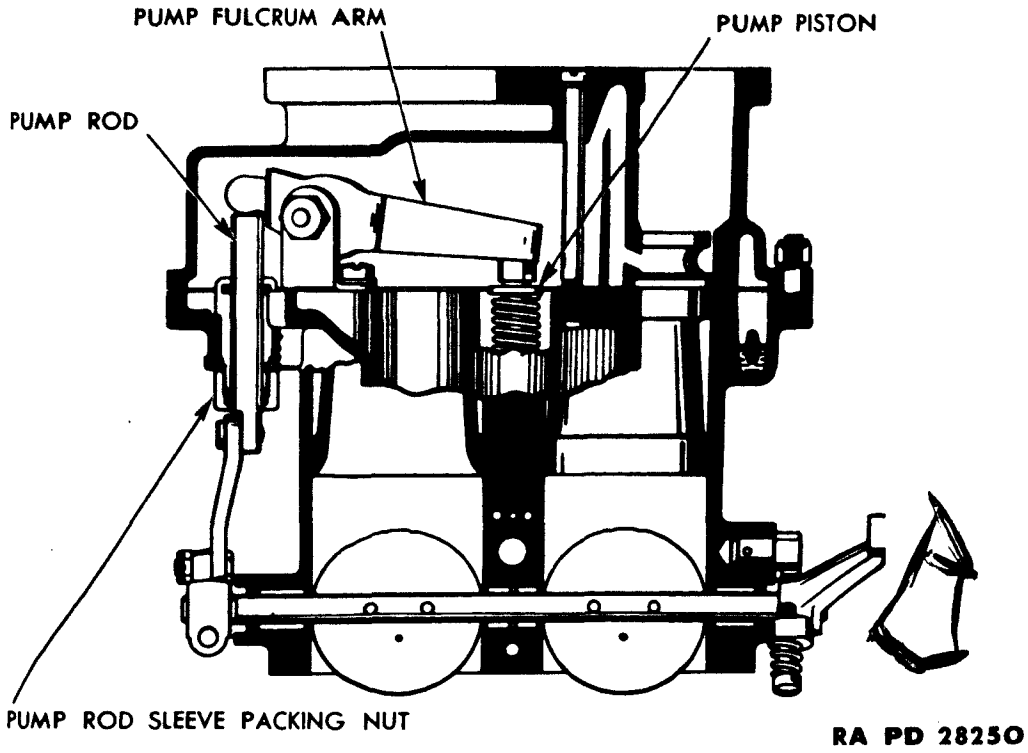

Figure 26—Accelerating Pump Linkage

and travels in proportion to the opening and closing of the throttle valves. On closing the throttle, the pump piston moves up, taking a supply of fuel into the pump cylinder from the float chamber through the inlet check valve. As the throttle is opened, the pump piston spring (shown as a part of E, fig. 30) is compressed and the piston moves down, pressing on the fuel in the accelerating pump cylinder, the check valve closes and a quantity of fuel is discharged through pump nozzle. The piston spring establishes the pump stroke duration, regardless of how much the throttle may be opened.

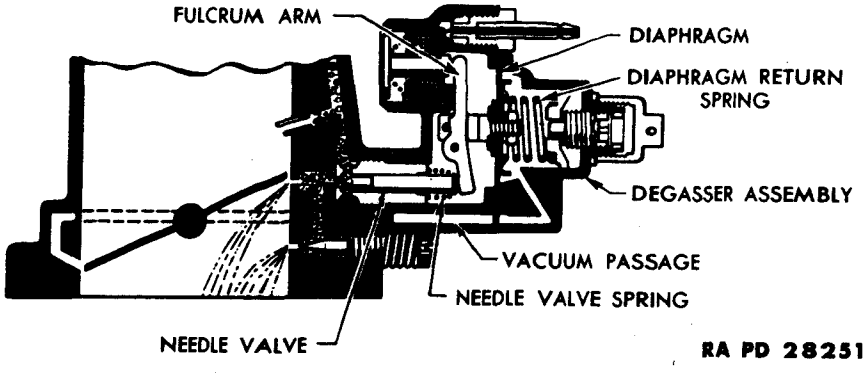

Figure 27—Degasser with Idle System in Operation

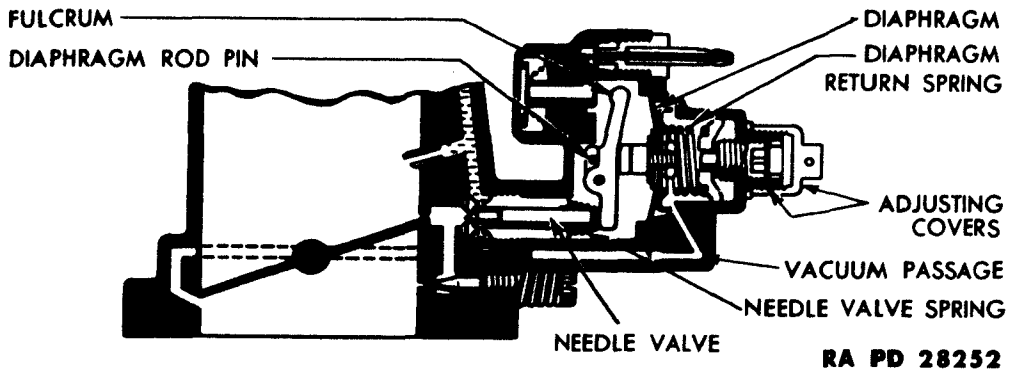

Figure 28—Degasser or Deceleration

g. Degasser Idle System in Operation. Both barrels of each carburetor have degassers incorporated in the idle system. All fuel flowing through the idle discharge holes must pass through the needle valve seat of the degasser (fig. 27). The purpose of the degasser is to shut off fuel supply when high manifold vacuum is present during decelerating periods. It is automatically controlled by manifold vacuum and also has an electric solenoid for positive shut-off of the fuel supply at the driver's option. With the engine running and the throttle open so that the manifold vacuum is less than 21 inches (of mercury), the diaphragm return spring moves the diaphragm assembly inward, providing free movement of the fulcrum arm. This permits needle valve spring to move the needle valve (fig. 27) off the seat, and allows fuel to flow through the idle discharge holes.

h. Degasser Operation on Deceleration. When the throttle valve is closed and the manifold vacuum is approximately 22½ inches (mercury) the vacuum pull on the diaphragm assembly, by means of pin, actuates the fulcrum arm so that the needle valve (fig. 28) is seated and shuts off the fuel supply to the idle discharge holes.

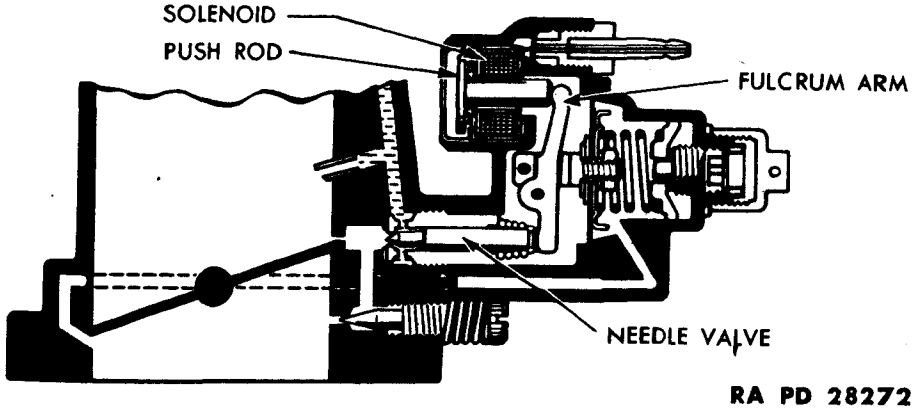

Figure 29—Degasser Electric Shut-off

ORDNANCE MAINTENANCE
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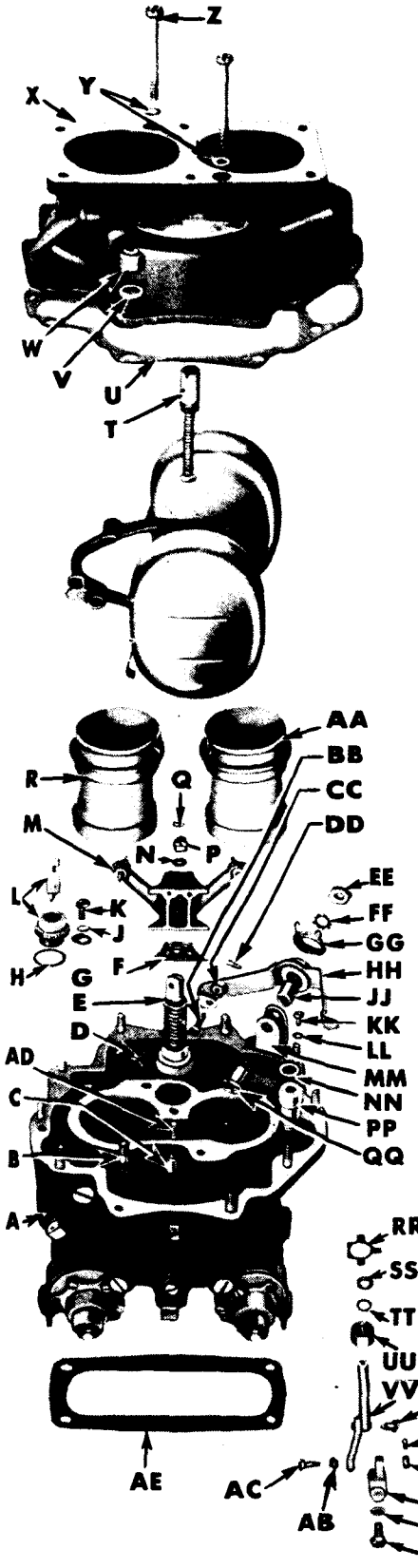
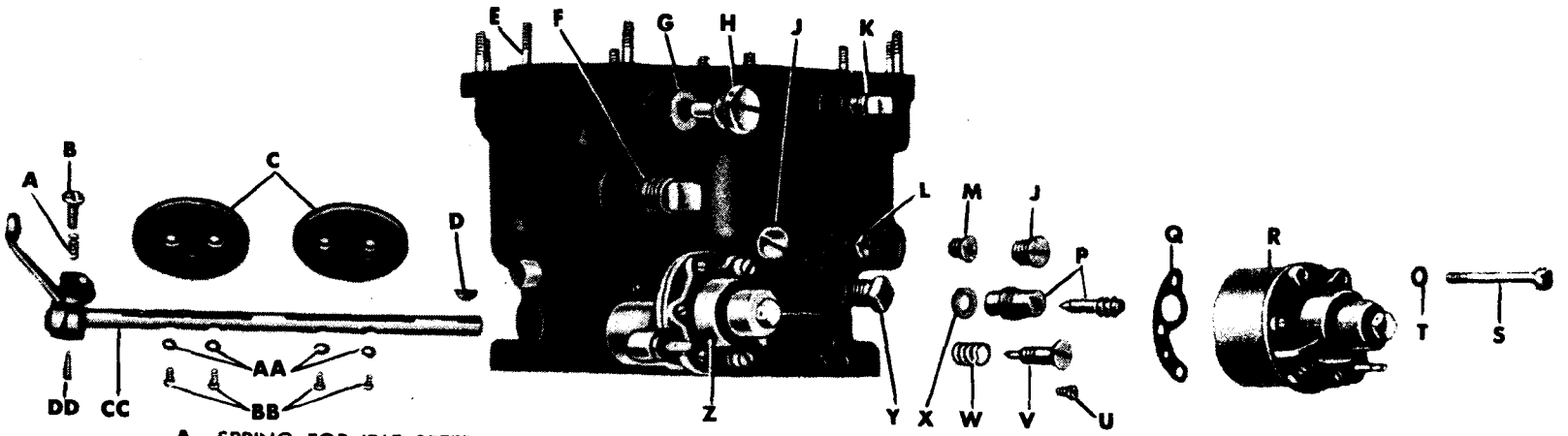


A—CARBURETOR BODY
B—CARBURETOR BODY STUD
C—POWER BY-PASS JET
D—PUMP OUTLET CHECK VALVE
E—PUMP PISTON ASSEMBLY
F—MAIN DISCHARGE JET GASKET
G—FLOAT NEEDLE VALVE SEAT LOCK
H—FLOAT NEEDLE VALVE SEAT GASKET
J—LOCK WASHER
K—SCREW FOR LOCK
L—FLOAT NEEDLE VALVE AND SEAT
M—MAIN DISCHARGE JET
N—FLOAT WASHER
P—NUT FOR MAIN DISCHARGE JET STUD
Q—COTTER PIN
R—VENTURI TUBE
S—FLOAT ASSEMBLY
T—VACUUM POWER PISTON
U—AIR HORN GASKET
V—FLAT WASHER
W—AIR HORN STUD NUT
X—AIR HORN
Y—LOCK WASHER
Z—AIR HORN SCREW
AA—VENTURI TUBE
BB—FULCRUM ARM SCREW
CC—NUT FOR FULCRUM ARM SCREW
DD—COTTER PIN
EE—NUT FOR FULCRUM ARM BEARING SCREW
FF—LOCK WASHER
GG—FULCRUM ARM SPRING
HH—FULCRUM ARM
JJ—FULCRUM ARM BEARING
KK—SCREW
LL—LOCK WASHER
MM—FULCRUM ARM BRACKET
NN—PACKING FOR PUMP ROD BUSHING
PP—PUMP ROD BUSHING
QQ—SCREW FOR FULCRUM ARM BEARING
RR—LOCK WASHER FOR PUMP ROD BUSHING
SS—PACKING FOR PUMP ROD BUSHING
TT—PACKING FOR PUMP ROD BUSHING
UU—NUT FOR PUMP ROD BUSHING
VV—PUMP ROD
WW—RIVET FOR PUMP ROD
XX—PUMP LEVER
YY—LOCK WASHER
ZZ—PUMP LEVER SCREW
AB—FLAT WASHER
AC—SCREW FOR PUMP LINK
AD—STUD FOR MAIN DISCHARGE JET
AE—GASKET FOR CARBURETOR MOUNTING FLANGE

RA PD 28233

Figure 30—Carburetor Lower Body and Air Horn Disassembled



A—SPRING FOR IDLE SPEED ADJUSTING SCREW
B—IDLE SPEED ADJUSTING SCREW
C—THROTTLE VALVES
D—KEY FOR THROTTLE SHAFT
E—STUD FOR CARBURETOR BODY
F—PLUG
G—GASKET FOR FLOAT FULCRUM PIN
H—FLOAT FULCRUM SCREW
J—PLUGS FOR ACCESS TO MAIN METERING JETS
K—FLOAT LEVEL INSPECTION PLUG
L—PLUG
M—MAIN METERING JETS
P—DEGASSER VALVE AND SEAT
Q—GASKET FOR DEGASSER

R—DEGASSER
S—SCREW FOR DEGASSER
T—LOCK WASHER
U—PLUG
V—IDLE FUEL ADJUSTMENT SCREW
W—SPRING FOR IDLE FUEL ADJUSTING SCREW
X—GASKET FOR DEGASSER VALVE SEAL
Y—PLUG
Z—DEGASSER
AA—LOCK WASHER
BB—THROTTLE PLATE SCREWS
CC—THROTTLE SHAFT
DD—THROTTLE LEVER PIN

RA PD 28234

Figure 31—Carburetor, Lower Body

i. **Degasser Electric Shut-off.** The degasser is provided with an electric solenoid for manual control of the needle valve. The solenoid is operated by a switch on the instrument panel and when it is desired to stop the engine, the switch should be depressed and held in the ON position until the engine ceases running. With this action, the coil is energized and plate actuates the fulcrum arm and seats the needle valve stopping the flow of fuel to the idle discharge holes. The ignition is then turned off.

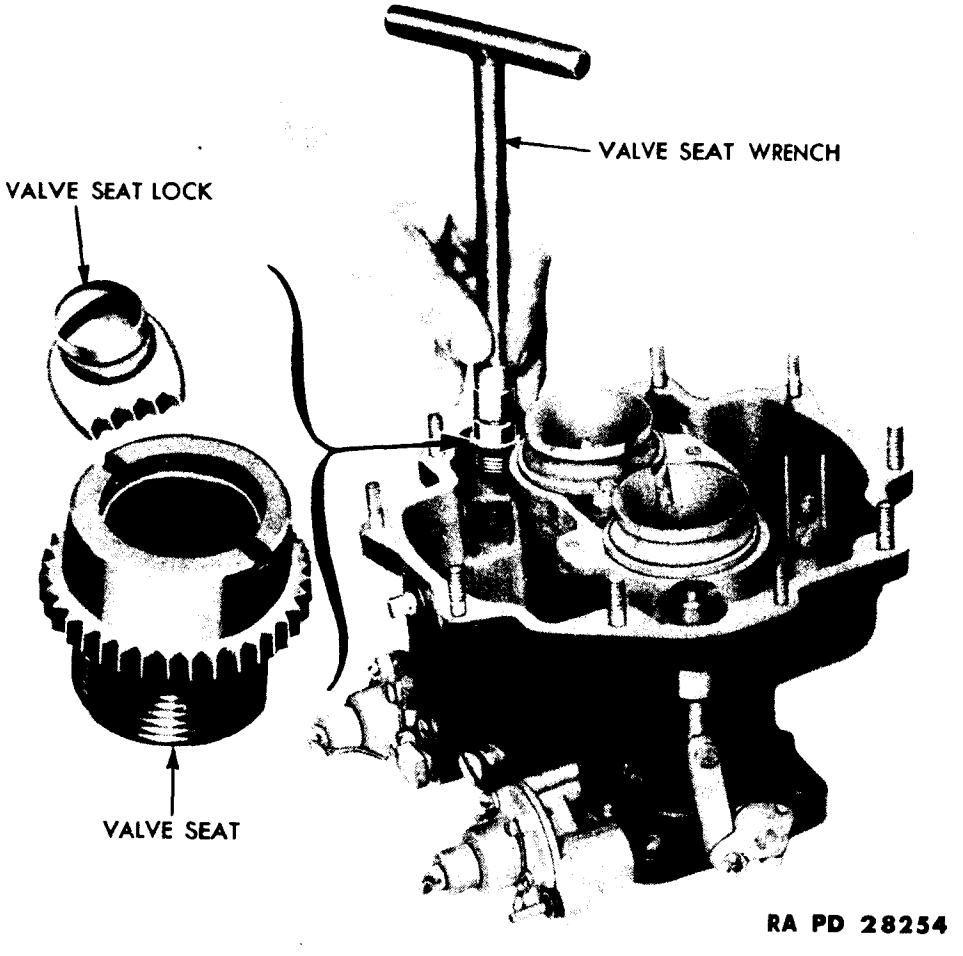


Figure 32—Removing Needle Valve Seat

41. REMOVAL OF CARBURETORS FROM ENGINE.

a. Refer to TM 9-1731B or TM 9-731G.

42. DISASSEMBLY.

a. **Remove Air Horn from Main Body.** Remove the two screws (Z, fig. 30) from the air entrance flange and 10 stud nuts (W, fig. 30) from the air horn. Remove the horn and gasket (X and U, fig. 30).

CARBURETORS

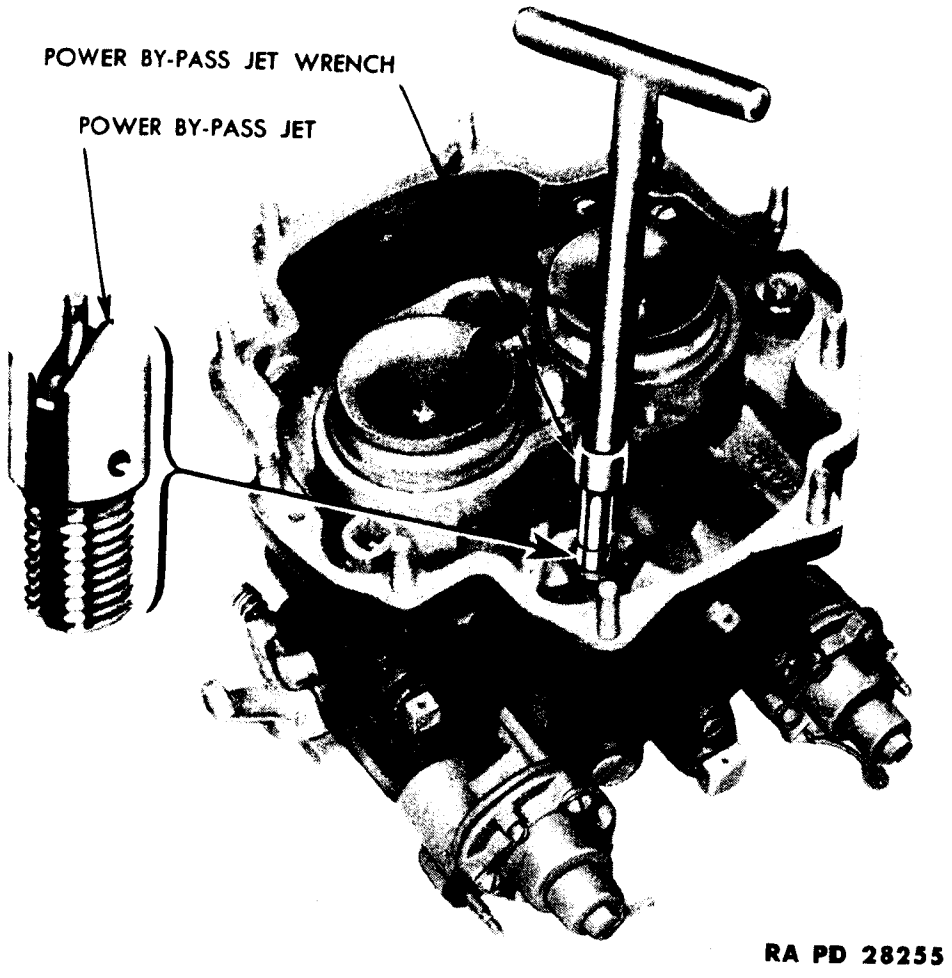


Figure 33—Removing Power Bypass Jet

b. Remove Float and Needle Valve from the Main Body. Remove the float fulcrum screws and gasket (H and G, fig. 31) and lift float assembly (S, fig. 30) and needle valve (L, fig. 30) from the main body.

c. Remove Venturi Tubes. Remove the venturi tubes from the main body.

d. Remove Pump Piston from the Main Body and Disassemble. Remove the pump fulcrum arm screw, nut, and lock washer (QQ, FF, and EE, fig. 30), and lift the fulcrum arm and pump piston from the main body. Remove the screw (BB, fig. 30) and remove the pump piston (E, fig. 30) from the fulcrum arm.

e. Remove Needle Valve Seat (fig. 32). Remove the float needle valve seat lock screw, and then remove washer and the lock. With wrench 41-W-1400 (fig. 32), remove the float needle seat and its gasket (L and H, fig. 30).

f. Remove Power Bypass Jet (fig. 33). With wrench 41-W-677 (fig. 33), remove power bypass jet.

g. **Remove Main Power Jet.** Remove cotter pin, nut, and washer (Q, P, and N, fig. 30) from the stud and lift the main discharge jet and gasket (M and F, fig. 30) from the stud.

h. **Remove Main Metering Jet.** Remove the metering jet plugs and the main plug (J and Y, fig. 31) from the main body. Remove the main metering jets (M, fig. 31) through the float chamber.

i. **Remove Idle Needle Valves.** Unscrew both idle needle valves and remove the valves and springs.

j. **Remove Degassers.** Remove three screws from each degasser (S, fig. 31), and remove the degassers (R and Z, fig. 31). Remove degasser needle valve and seat, and valve seal gasket (P and X, fig. 31) by unscrewing the seat from the main body.

k. **Remove Pump Rod and Link from Main Body.** Loosen the pump lever screw (ZZ, fig. 30) on the end of throttle shaft. Remove the cotter pin and nut from pump link screw (AC, fig. 30). Slide the pump lever from throttle shaft at the same time the link screw is being unscrewed. Remove the pump rod and link from the main body (VV, fig. 30). Unfold ears of packing nut lock (RR, fig. 30) and unscrew nut (UU, fig. 30). With a small piece of wire, remove the NEOPRENE washer from the top of the pump rod bushing.

l. **Remove Throttle Valves.** Remove key (D, fig. 31) from the end of the throttle shaft. Remove the throttle plate screws (BB, fig. 31), throttle valves (C, fig. 31) and shaft assembly (CC, fig. 31) from the body. With a scriber, make a location mark on the throttle valves and the corresponding barrels. Also scratch two lines along the edges of the shaft to serve as a guide in reinstalling the valves properly.

m. **Remove Pump Inlet Check Valve Plug and Pump Inlet Check Valve.** With an EASY-OUT tool, remove the pump outlet check valve stop from the top of main body. Invert the carburetor body and catch the ball check.

n. **Remove All Plugs Remaining in the Body.**

43. CLEANING.

a. All metal parts which are to be used again must be allowed to soak in dry-cleaning solvent for sufficient time to remove all traces of carbon, gum deposits, and any other foreign material which may have collected in the unit. It is particularly essential to make certain that the throttle barrels are entirely free of any carbon formation.

44. INSPECTION.

a. **Throttle Shaft.** Inspect for wear on bearing surfaces and make certain that the shaft is not bent. Check to see that throttle lever is pinned

securely to shaft. See that throttle valves are not bent and do not have any burs or sharp edges.

b. Main Body. Be sure that the throttle barrels and the idle discharge holes are clean of all carbon deposits. The idle discharge holes at the idle needle valves should be checked with a No. 54 drill. The upper idle discharge holes should be checked from the opposite side of barrel with a No. 53 drill. Pass a No. 48 drill through the secondary idle bleeds to clean the passage. Also make certain that all channels and passages of the entire body are thoroughly free of any foreign material.

c. Vacuum Piston Assembly. Make certain that the surface of the piston is thoroughly clean. Inspect for wear or damage. NOTE: Do not use any abrasive material for polishing the piston surface.

d. Air Horn. The vacuum cylinder should be free of any carbon or gum deposits which may have accumulated. Clean the pump discharge nozzle with a No. 53 drill.

e. Main Discharge Jet. Thoroughly clean and check idle air bleeds at top of the jet body with a No. 70 drill. Check idle reducer with a No. 50 drill at bottom of jet body. Check high speed bleeds with a No. 70 drill in base of main discharge passages.

f. Pump Fulcrum Arm. Wash the needle bearing and visually inspect for wear or damage when dry. If satisfactory for further use, apply light coating of ball and roller bearing grease.

g. Degasser Needle Valve and Seat. Wash thoroughly and inspect for wear. Discard if unsatisfactory for further use.

h. Pump Push Rod and Lever Link. Inspect the rivet for wear and replace if necessary.

45. REPAIR AND ASSEMBLY.

a. Instructions. In the assembly of the carburetor, use all the parts of the repair parts kit, and replace any additional parts that the inspection operations in paragraph 43 revealed.

b. Assemble Throttle Valves. Assemble the throttle shaft (CC, fig. 31) and valves (C, fig. 31) with each valve in the same barrel from which it was removed according to the markings previously made. Also line up the valves carefully with the scriber marks which were made along the edges of the shaft. Assemble screws and lock washers (BB and AA, fig. 31) loosely. With the valves held in closed position, hold the body assembly to the light, and check the amount of clearance between the valve and the body. If the clearance is excessive at any particular section of the valve, shift the valve in the shaft until it fits the barrel with the least amount of light showing around the edge. Tighten the screws securely.

c. Install Idle Needle Valves and Springs. Assemble new idle needle valves and springs. Seat the needle valves lightly with the fingers, then

back off one-fourth turn. When seating needle valve, care should be taken not to damage needle valve point.

d. **Install Pump Outlet and Outlet Check Valve.** Place the pump outlet ball check valve in the channel at the top of the body and install the stop, making certain that the stop is flush with gasket surface. Assemble the pump inlet check valve and plug.

e. **Install Power Bypass Jet.** With special tool (fig. 33) install a new power bypass jet (fig. 33).

f. **Install Main Metering Jet.** Assemble new main metering jet (M, fig. 31) and plugs (J, fig. 31).

g. **Install Main Discharge Jets.** Assemble main discharge jet gasket (F, fig. 30), main discharge jet (M, fig. 30), nut, washer, and cotter pin (P, N, and Q, fig. 30). Assemble all remaining screw plugs.

h. **Install Pump Push Rod and Linkage.** Place new round NEOPRENE washer in the groove in the top of pump rod bushing (PP, fig. 30) and install the bushing in the main body. Place the lock washer (RR, fig. 30) on the bushing. Place the nut (UU, fig. 30) on the pump rod. Place new packing (TT and SS, fig. 30) in the nut, inserting the felt packing first, then the NEOPRENE packing on top of the felt. Assemble rod into the pump bushing sleeve, using precaution not to crease the NEOPRENE washer. Tighten packing nut sufficiently, however, to avoid excessive drag on the push rod. Place the key (D, fig. 31) in the end of the throttle shaft. Hold the pump link screw and washer (AC and AB, fig. 30) in place and assemble the pump lever (XX, fig. 30) on the throttle shaft and the pump link screw at the same time. Assemble the fulcrum screw nut and cotter pin (CC, fig. 30). Fasten the pump lever screw securely (ZZ, fig. 30). Operate the throttle to make certain there is no sticking or binding of mechanism.

i. **Install Float Needle Valve Seat and Float Mechanism.** With the special tool (fig. 32), assemble the float needle valve seat and gasket (H and L, fig. 30). Assemble the float needle valve seat lock (G, fig. 30), lock washer and screw (J and K, fig. 30). Place the float needle valve (L, fig. 30) on the fulcrum pin of the float with the open end of the slot facing the float. Place the needle valve and float into the body. Assemble the float fulcrum screws and gaskets (H and G, fig. 31), making certain that the float assembly has sufficient end play.

j. **Set Fuel Level.** Allow fuel to enter the carburetor under 5-pound pump pressure. The fuel level should be at the bottom of threads of the fuel level inspection hole (three-fourths inch below the top gasket surface). If necessary to change the fuel level, it is adjusted by installing gaskets (H, fig. 30) of different thickness under the float needle seat. Ordinarily this gasket is of one thirty-second inch thick. A change one sixty-

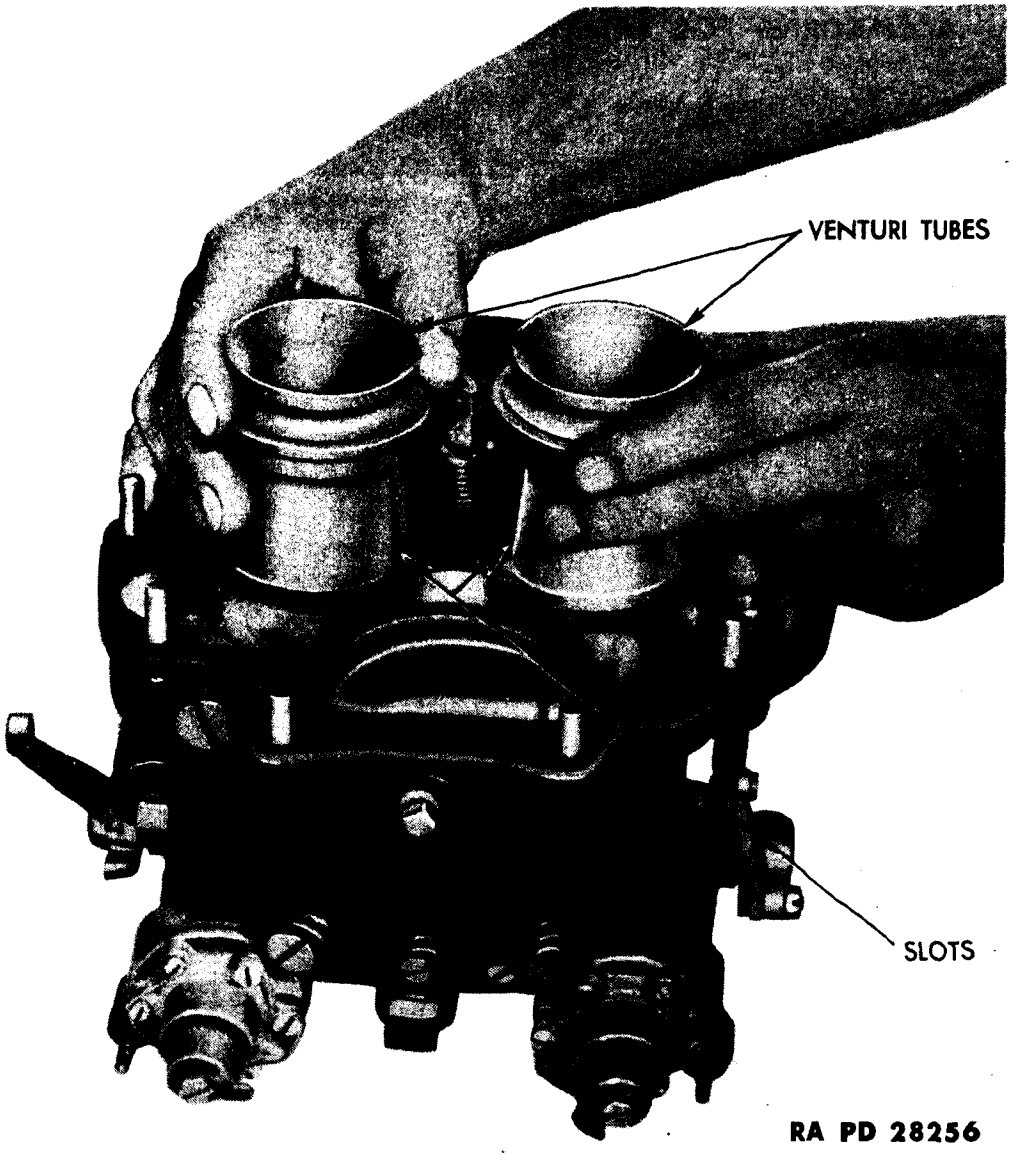


Figure 34—Installing Venturi Tubes Showing Position of Slots

fourth inch in gasket thickness will change the fuel level approximately five sixty-fourths inch. To raise the level, reduce the gasket thickness. To lower the level, increase the gasket thickness.

k. Install Pump Piston and Fulcrum Arm. Assemble a new pump piston (E, fig. 30) on the pump fulcrum arm (HH, fig. 30), using the screw, nut, and cotter pin (BB, CC, and DD, fig. 30). Place the fulcrum arm spring (GG, fig. 30) on the bushing of the fulcrum arm, and assemble the arm and piston into the body, using precaution not to crease the edge of the pump leather. Tighten the fulcrum screw lock washer and nut securely. Raise the pump fulcrum arm, and install the main body gasket.

l. Install Venturi Tubes. Place the venturi tubes (R and AA, fig. 30) in the main body, making certain to line up the slots of the venturi with the outlet ball check valve stop.

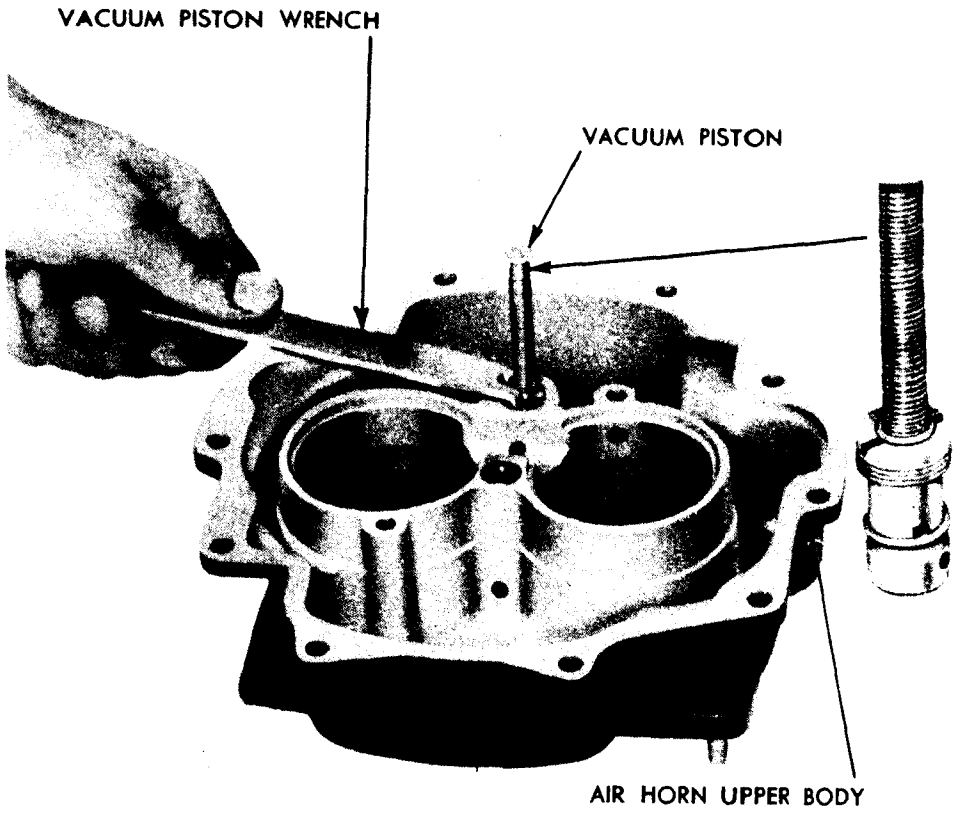


Figure 35—Removing or Installing Vacuum Piston

m. **Assemble Vacuum Piston (T, fig. 30) in Air Horn.** With wrench 41-W-3255-505, install the piston in the air horn (fig. 35). **NOTE:** lubricant must not be used on the piston or cylinder of the air horn.

n. **Install Air Horn.** Place the gasket and the air horn (U and X, fig. 30) on the body (A, fig. 30), and attach with two screws (Z, fig. 30), ten nuts and washers (W and V, fig. 30), and tighten securely.

o. **Install Degassers.** Place needle valve seat and gasket (P and X, fig. 31) in the main body. Assemble needle valve in the needle valve seat. Assemble the degasser gasket and degasser (Q and R, fig. 31) to the main body with three screws and lock washers (S and T, fig. 31). Also lock wire the heads of the screws.

46. ADJUSTMENTS.

a. **Set Fuel Level.** Remove the air horn as outlined in paragraph 42 a (1). The float is set to maintain the fuel level at three-fourths inch below the parting surface of the air horn and the main body when the fuel is delivered at 5-pound pressure. This dimension corresponds to the bottom of the threads in the fuel level inspection hole. The height of the fuel level is controlled by the thickness of the gasket under the float needle seat (H, fig. 30). Ordinarily the gasket used is one thirty-second-inch thick. A

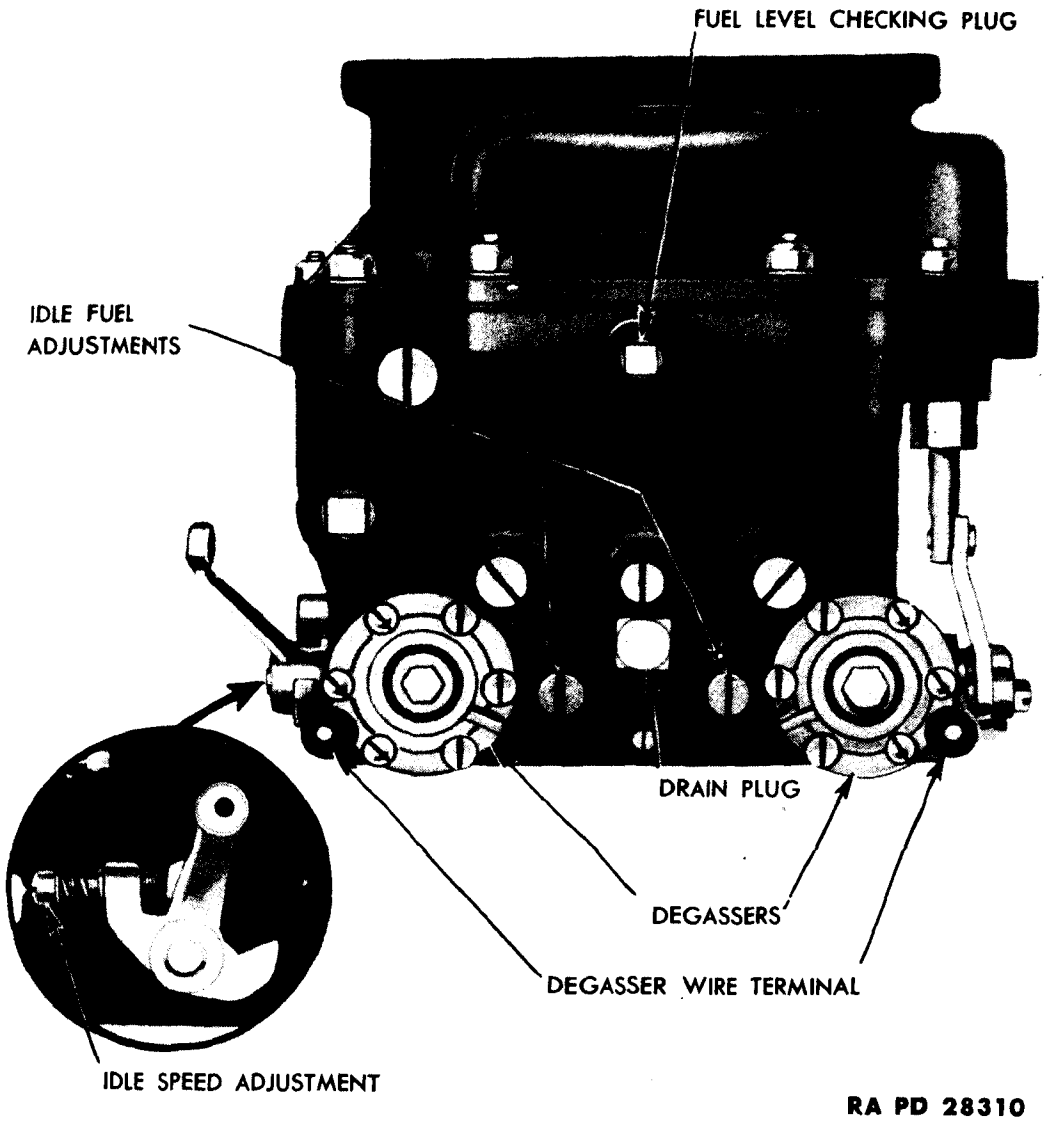


Figure 36—Carburetor

change of one sixty-fourth inch in gasket thickness will change the level approximately five sixty-fourths inch. To raise the fuel level, decrease the gasket thickness. To lower the level, increase the gasket thickness. To install new gaskets, remove the float assembly (par. 42 a (1) and (2)). Remove the needle valve seat (par. 42 a (1) through (5)). After installing the new gasket, assemble the parts and recheck level under normal (5 pounds) fuel pump pressure. The float needle valve must have at least five sixty-fourths inch travel.

b. Set Idle Fuel Adjustment. Two idle fuel adjustment screws are provided, one for each barrel (fig. 36). Turn each idle adjustment screw clockwise until it seats lightly and then turn out one-fourth turn from closed position.

47. INSTALLATION OF CARBURETORS ON ENGINE.

a. Refer to pertinent operator's manual or TM 9-1731B.

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 4

FUEL SYSTEM (Cont'd)

Section III

FUEL PUMP

48. DESCRIPTION.

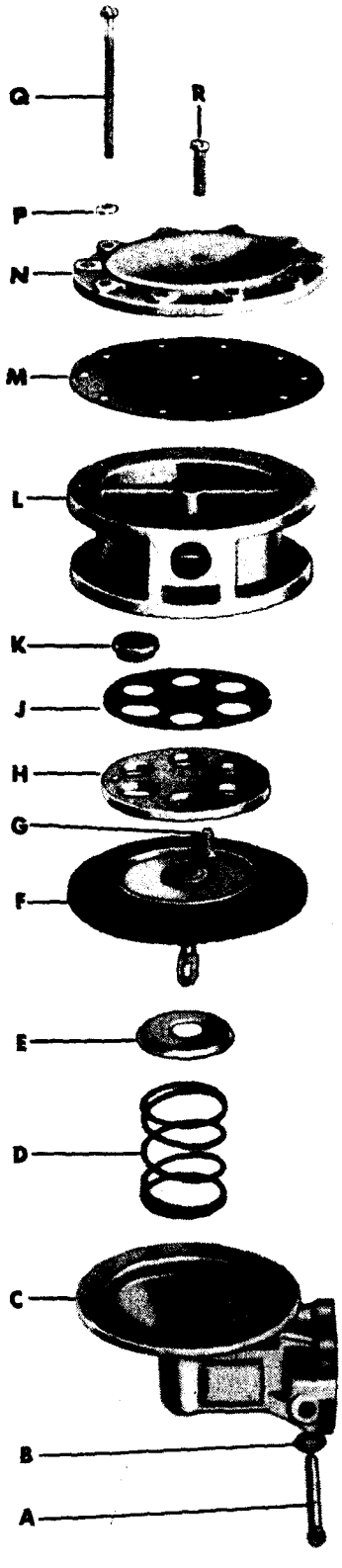
a. **General.** The AC mechanical fuel pump supplies an adequate amount of fuel from the supply tank to the carburetors to meet the engine requirements at all speeds.

b. **Pumping Action.** Power is applied to the rocker arm by an eccentric on the cam shaft. Rocker arm movement, through the link and rod, pulls the diaphragm away from the fuel chamber against spring pressure. Vacuum, created by the diaphragm movement, pulls gasoline from the supply tank, through inlet valves and into the fuel chamber. The return stroke (low point of cam) releases the compressed diaphragm spring, expelling fuel through the outlet valves into the carburetor bowl.

c. **Valve Action.** Intake and exhaust valve assemblies are actuated in opposite directions. This results in opening the valve in use and more tightly closing the one not being used.

d. **Flow Control.** After several diaphragm strokes, each carburetor bowl fills and its float mechanism rises. This seats the needle valve and stops further passages of fuel from the pump. With carburetor bowl filled and needle valve closed, back pressure is created on the diaphragm. With back pressure on the diaphragm, rocker arm movement continues, but is taken up by the linkage rather than being transmitted to the diaphragm. As pressure reduces in the fuel chamber because of the carburetor needing fuel, the diaphragm will take longer strokes. Fuel flow is maintained in accordance with the engine operating conditions.

FUEL PUMP



A—ROCKER ARM PIN
B—ROCKER ARM PIN WASHER
C—LOWER BODY
D—DIAPHRAGM SPRING
E—DIAPHRAGM SPRING RETAINER
F—DIAPHRAGM ASSEMBLY
G—VALVE PLATE SCREW
H—PLATE VALVE
J—VALVE PLATE GASKET
K—VALVE AND CAGE ASSEMBLY
L—PULSATOR COVER
M—PULSATOR DIAPHRAGM
N—PULSATOR COVER PLATE
P—LOCK WASHER
Q—COVER SCREW
R—CENTER COVER SCREW
S—ROCKER ARM SPRING
T—ROCKER ARM
U—ROCKER ARM PIN BUSHING
V—LINK

Figure 37—Fuel Pump Disassembled

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

49. REMOVAL OF FUEL PUMP FROM ENGINE.

a. Refer to pertinent operator's manual or TM 9-1731B.

50. DISASSEMBLY.

a. **Remove Pulsator Cover Plate, Gasket and Cover.** Loosen the 10 screws (Q, fig. 37) on the edge and the center screw (R, fig. 37) at the center of the pulsator plate. Back off these screws evenly until the diaphragm spring pressure is no longer effective and remove the screws. NOTE: Always file a mark across the edge of cover (L, fig. 37) and lower body (C, fig. 37) so the parts will be assembled in proper relation to each other.

b. **Unhook Diaphragm Assembly** (F, fig. 37) **from Link** (V, fig. 37). Hold the lower body (C, fig. 37) upside down. To unhook the diaphragm assembly, compress the spring by placing the palm of the hand on the diaphragm and tilt it slightly so the slot in the diaphragm pull rod can slip from the hook on the link.

c. **Remove Rocker Arm Link, Spring, and Bushing** (fig. 37) **from Lower Body.** File the "upset" from end of rocker arm pin (A, fig. 37). Use a drift for removal of the pin, and remove the rocker arm and related parts.

d. **Remove Valves** (K, fig. 37). Remove the three screws securing the valve plate (H, fig. 37) to the cover (L, fig. 37), and remove the valve plate, gasket and the six valves.

51. INSPECTION.

a. **Lower Body** (C, fig. 37). If the lower body is worn at the rocker pin holes, or warped at mounting, or diaphragm flange, it must be discarded.

b. **Link** (V, fig. 37). If the link is worn at the arm pin hole, or the pull rod connection, it must be discarded.

c. **Rocker Arm.** If the rocker arm is worn or scored at the camshaft pad, or the point of contact with the link, or at the pin hole, it must be discarded.

d. **Springs.** If diaphragm, spring, or rocker arm spring are out of shape, or corroded, they must be discarded.

e. **Replacement of Parts.** The diaphragm and all gaskets are to be replaced. If inspection of the above items indicates they are unfit for further use, replace them, using all the parts of the repair parts kit.

52. ASSEMBLY.

a. **Rocker Arm, Link and Bushing Assembly** (T, V, and U, fig. 37). Assemble the link to the rocker arm and insert the bushing through the

hole in the rocker arm and link. NOTE: In the assembly of the fuel pump, use all the parts of the repair kit, and replace any additional parts that the inspection (par. 51) revealed to be unfit for further use. Soak the diaphragm in dry-cleaning solvent while performing the following steps:

b. **Install Rocker Arm Assembly in Lower Body** (C, fig. 37). Enter the rocker arm assembly through the opening at the mounting flange of the lower body and insert a new rocker arm pin (A, fig. 37) through the hole in the body and through the bushing in the rocker arm. Install a washer on the end of the pin and "upset" the end of the pin slightly.

c. **Install Diaphragm Assembly** (F, fig. 37) **to Lower Body.** Install the spring retainer and spring (E and D, fig. 37) on the diaphragm pull rod in the order as shown in figure 37. Hold the lower body upside down, and insert the diaphragm push rod into the opening in the lower body. Compress the spring by placing the palm of the hand on the diaphragm and tilt it slightly so that the slot in the pull rod can be slipped on the hook at the end of the link.

d. **Install Check Valves** (K, fig. 37). The six check valves are identical. Three are installed in the recesses in the cover (L, fig. 37) with the springs up, the other three are installed in the recesses in the cover with the springs down. With the valves in place, attach the valve plate to the cover, using new gasket (J, fig. 37) and secure with three screws (G, fig. 37). Lock the screws by staking at least three places.

e. **Install Cover** (L, fig. 37). Set the cover on the lower body, and line up file marks which were made at the beginning of the disassembly procedure (par. 50) so they will be assembled in proper relation to each other. Line up the holes in the lower body. The reinforcement web under the pulsator plate, and the web in the pump cover must be alined. When this is done correctly, the arrow on the pulsator plate will be at right angles to the inlet and outlet in the pump cover. Place a new gasket and the pulsator cover plate (N, fig. 37) on top of the cover, and insert the 10 screws (Q, fig. 37) and lock washers. The diaphragm spring must be compressed slightly. Install the screws and lock washers loosely until the screws just engage the washers. Push the rocker arm in full stroke, hold in this position, and tighten all screws evenly. CAUTION: *If the rocker arm is not held in this position while tightening the screws, the pump will deliver excessive pressure.* Install the screw (R, fig. 37) in center of the pulsator plate.

53. TEST PUMP.

a. Connect a pressure gage to the pump outlet. A correctly repaired pump will temporarily hold pressure built up by a few strokes of the rocker arm. To test the fuel pump on the engine, see TM 9-1731B.

54. INSTALLATION OF FUEL PUMP ON ENGINE.

a. Refer to pertinent operator's manual or TM 9-1731B.

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 4

FUEL SYSTEM (Cont'd)

Section IV

FUEL FILTER

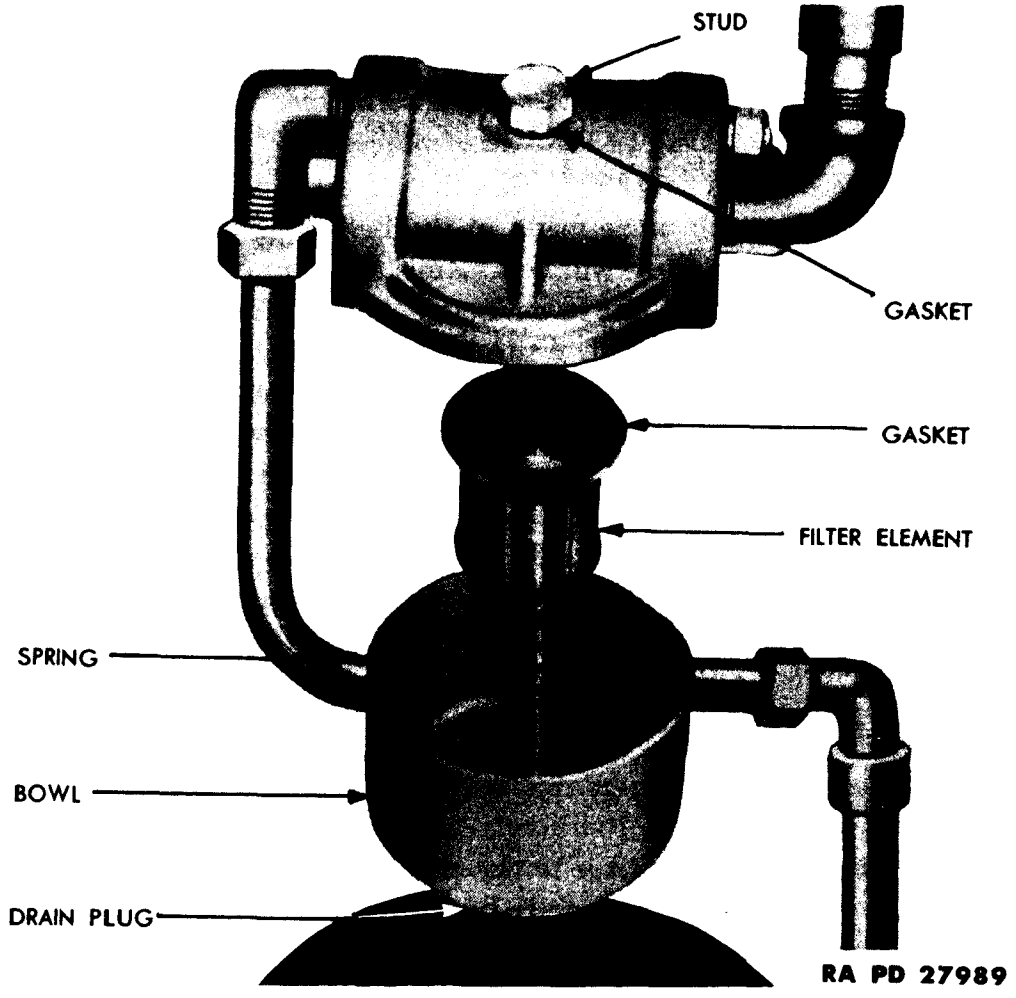


Figure 38—Fuel Filter

FUEL FILTER

55. DESCRIPTION.

a. The fuel filter assembly consists of a stack-type disk element and a metal filter bowl. The element consists of a large number of filter disks (0.020-inch thick) stacked and squeezed together (fig. 38).

56. REMOVAL FROM VEHICLE.

a. To remove the fuel filter from the vehicle, refer to the pertinent operator's manual.

57. DISASSEMBLY.

a. Remove the center stud at the top of the filter (fig. 38). Remove the filter bowl. Do not disassemble the filter element.

58. CLEANING.

a. Wash the filter bowl and the filter element in dry-cleaning solvent. Care must be taken to prevent damage to the disk. Do not scrape or scrub the disk.

59. INSPECTION.

a. Inspect all parts for rust, corrosion, or damage of any kind. If the filter element does not clean up satisfactorily, it should be discarded. Discard all gaskets and any parts which are damaged and unfit for further use.

60. REPAIR AND ASSEMBLY.

a. Replace all parts which previous inspection found unfit for further use. Use new gaskets and assemble the parts in correct order (fig. 38).

61. INSTALLATION ON VEHICLE.

a. To install the filter in the vehicle, refer to the pertinent operator's manual.

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 4

FUEL SYSTEM (Cont'd)

Section V

THROTTLE GOVERNOR

62. DESCRIPTION.

a. The speed of the engine is regulated and limited by the use of additional dual throttle plates located in each of the carburetor adapters direct-

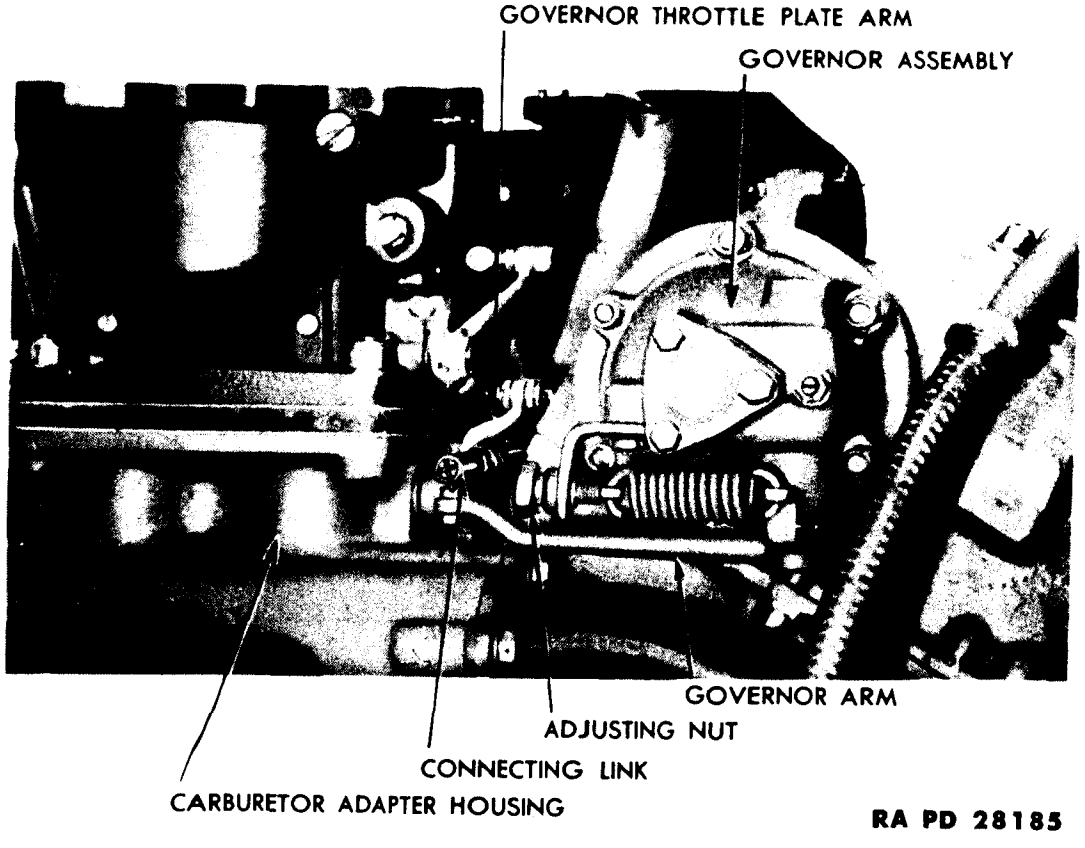
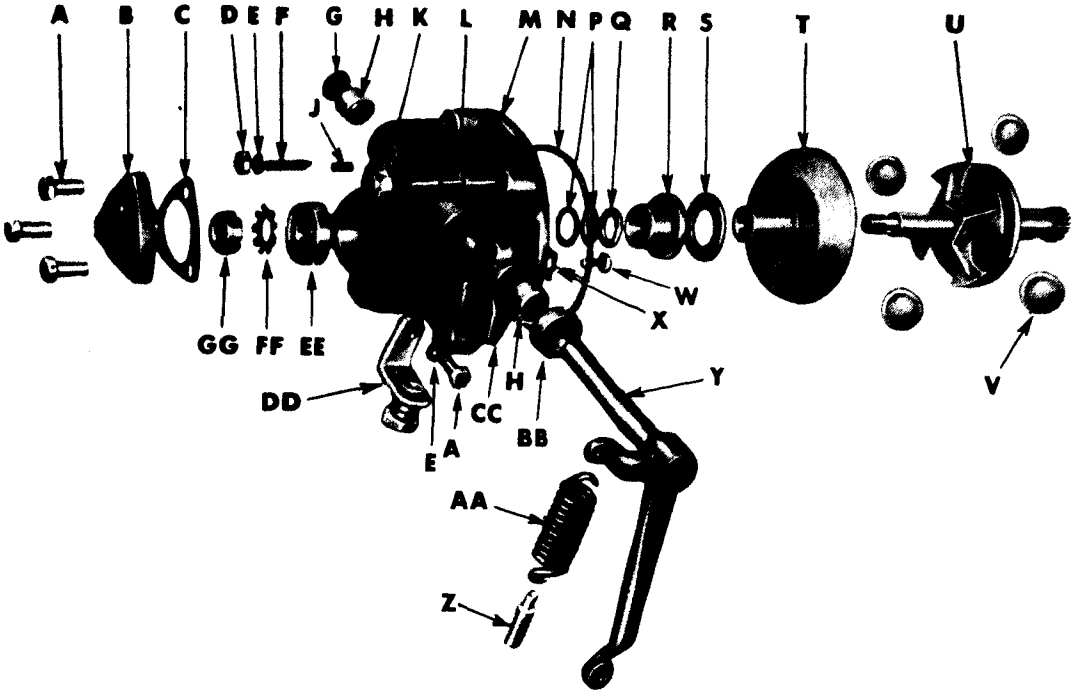


Figure 39—Throttle Governor

THROTTLE GOVERNOR



A—SCREW FOR BEARING CAP
B—CAP FOR BEARING
C—GASKET FOR BEARING CAP
D—LOCKNUT FOR ADJUSTING SCREW
E—LOCK WASHER
F—ADJUSTING SCREW
G—WELCH PLUG FOR GOVERNOR BODY
H—NEEDLE ROLL BEARINGS
J—SPRING
K—NUT
L—STUD
M—GOVERNOR BODY
N—GASKET
P—WASHER
Q—WASHER
R—HUB
S—THRUST BEARING
T—RACE ASSEMBLY
U—DRIVE SHAFT ASSEMBLY
V—BALLS
W—SCREW FOR FORK
X—LOCK WASHER
Y—LEVER ASSEMBLY
Z—EYE BOLT
AA—GOVERNOR SPRING
BB—OIL SEAL
CC—FORK
DD—BRACKET ASSEMBLY FOR ADJUSTING SCREW
EE—BALL BEARING
FF—LOCK WASHER
GG—BEARING NUT

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Figure 40—Throttle Governor as Viewed from Right-hand Bottom Rear

ly under each carburetor. These carburetor adapter throttles are connected together by a rod which, in turn, is connected to the governor located at the rear of the right-hand cylinder block (fig. 39). With the engine idling, these governor actuated throttles are in the wide open position. As the engine speed is increased, the action of the governor partially closes the throttles, thus limiting the maximum engine speed to approximately 2600 revolutions per minute under full load. The governor mechanism receives its lubrication from oil thrown from the camshaft gears.

63. REMOVAL OF GOVERNOR FROM ENGINE.

a. To remove the governor from the engine, refer to TM 9-1731B.

64. DISASSEMBLY.

a. **Remove Shaft Assembly** (U, fig. 40). Remove three cap screws (A, fig. 40) and remove the plate and gasket. Bend back the tab on the lock washer (FF, fig. 40) and remove the nut (GG, fig. 38) from the end of the shaft. With a brass drift, drive on the end of the shaft from which the nut was removed and drive the shaft assembly from the governor body. The washers (P and Q, fig. 40), hub, bearing, and race (R, S, and T, fig. 40) are now free to be slipped from the shaft.

b. **Remove Governor Spring.** Remove the seal and wire from the adjustment nut. Unscrew the adjustment nut and unlock the spring (AA, fig. 40).

c. **Remove Lever and Shaft Assembly** (Y, fig. 40). Bend back the tab on the lock washer (X, fig. 40) and remove the screw (W, fig. 40) from the fork (CC, fig. 40). Pull the lever and shaft assembly from the governor body.

d. **Remove Bearing from the Governor Body.** Drive out the welch plug (G, fig. 40) from the governor body. Press the needle roller bearings (H, fig. 40) from each side of the body. Press the ball bearing (EE, fig. 40) and the oil seal (BB, fig. 40) from the recess at the rear of the body.

65. INSPECTION AND REPAIR.

a. Clean and inspect all parts. All parts must be free from chips and foreign material. Inspect all bearings for scores and excessive wear. The link, connecting the governor arm to the throttle plates, should be inspected for wear at the ball and socket joints. All worn parts must be discarded.

66. ASSEMBLY.

a. **Install Bearing in Governor Body.** Pack the ball bearings and roller bearing with ball and roller bearing grease. Press the ball bearing

(EE, fig. 40) into the recess at the rear of the body. Install the needle roll bearings (H, fig. 40) in each side of the body. Drive welch plug in place on the governor body (G, fig. 40). Install oil seal (BB, fig. 40).

b. **Install Lever and Shaft Assembly.** Place the fork (CC, fig. 40) in the governor body in line with the lever shaft. Enter the lever shaft into the governor body and the fork (CC, fig. 40). Lock the fork to the lever shaft with the lock screw (W, fig. 40).

c. **Install Governor Spring.** Connect the spring (AA, fig. 40) to the lever (Y, fig. 40) and adjustment screw.

d. **Install Governor Shaft Assembly.** Slide the race assembly (T, fig. 40) on the drive shaft (U, fig. 40) and assemble the balls (V, fig. 40) in the race assembly. Assemble the races, bearings and hub washer to the drive shaft. Assemble the drive shaft assembly to the governor body (M, fig. 40). Install lock washer and nut (FF and GG, fig. 40), tighten the nut, and lock with lock washer (FF, fig. 40). Install end plate and gasket and secure with three cap screws.

67. INSTALLATION OF GOVERNOR ON ENGINE.

a. To install the governor assembly on the engine, refer to TM 9-1731B.

68. ADJUSTMENT.

a. The final adjustment of the governor must be made after the engine is installed in the vehicle. Instructions for adjusting are covered in TM 9-1731B.

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 4

FUEL SYSTEM (Cont'd)

Section VI

THROTTLE CONTROLS

69. DESCRIPTION.

a. The throttle control linkage (fig. 41) is arranged so that throttle plates of the rear carburetor open to approximately half-throttle before the forward carburetor throttle plates start to open. The rate of opening of the throttle plates in the forward carburetor is approximately twice as fast as for the rear carburetor. The result is that both reach the wide open point together.

70. REMOVAL FROM ENGINE.

a. Remove the four nuts securing the right-hand water manifold to the cylinder head and remove the water manifold. Remove the two nuts which secure the center throttle bracket to the cylinder head. Remove the ball joint studs from the carburetor throttle arm at each carburetor, and lift the throttle control assembly from the engine.

71. DISASSEMBLY.

a. Take out the cotter pins and remove the throttle control rods from the levers. Loosen the screws (C, fig. 42) and remove all levers. The shaft (H, fig. 42) can now be slipped from the bracket. Examine the bearings. If they require replacement, they can be pressed from the bracket. NOTE: These needle roller bearings seldom require replacement as their use is limited.

72. INSPECTION AND REPAIR.

a. Replace all parts which show excessive wear, such as the ball and socket joints, clevis, and clevis pins. Examine the condition of the needle

THROTTLE CONTROLS

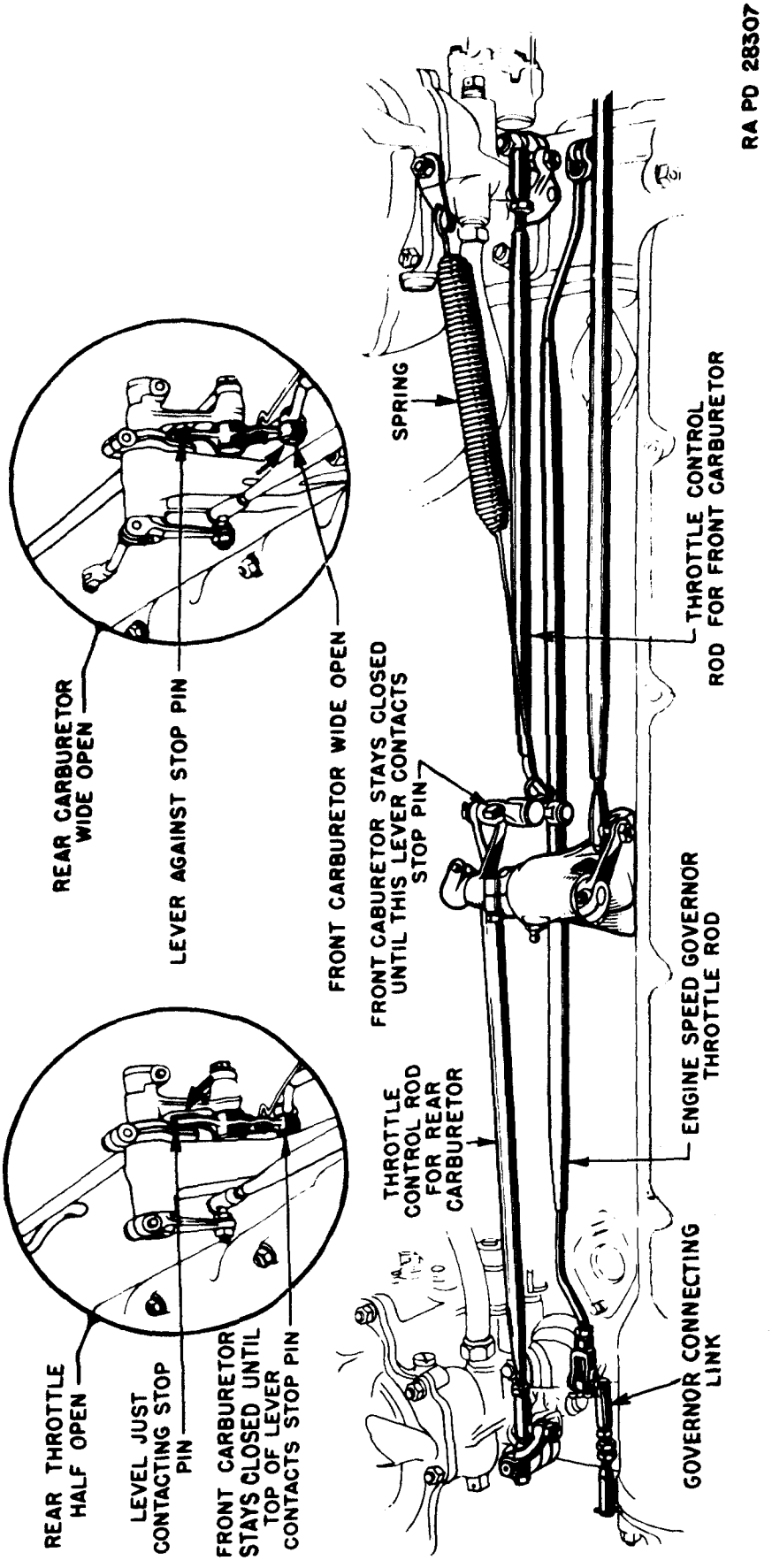


Figure 41—Carburetor Throttle Linkage

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

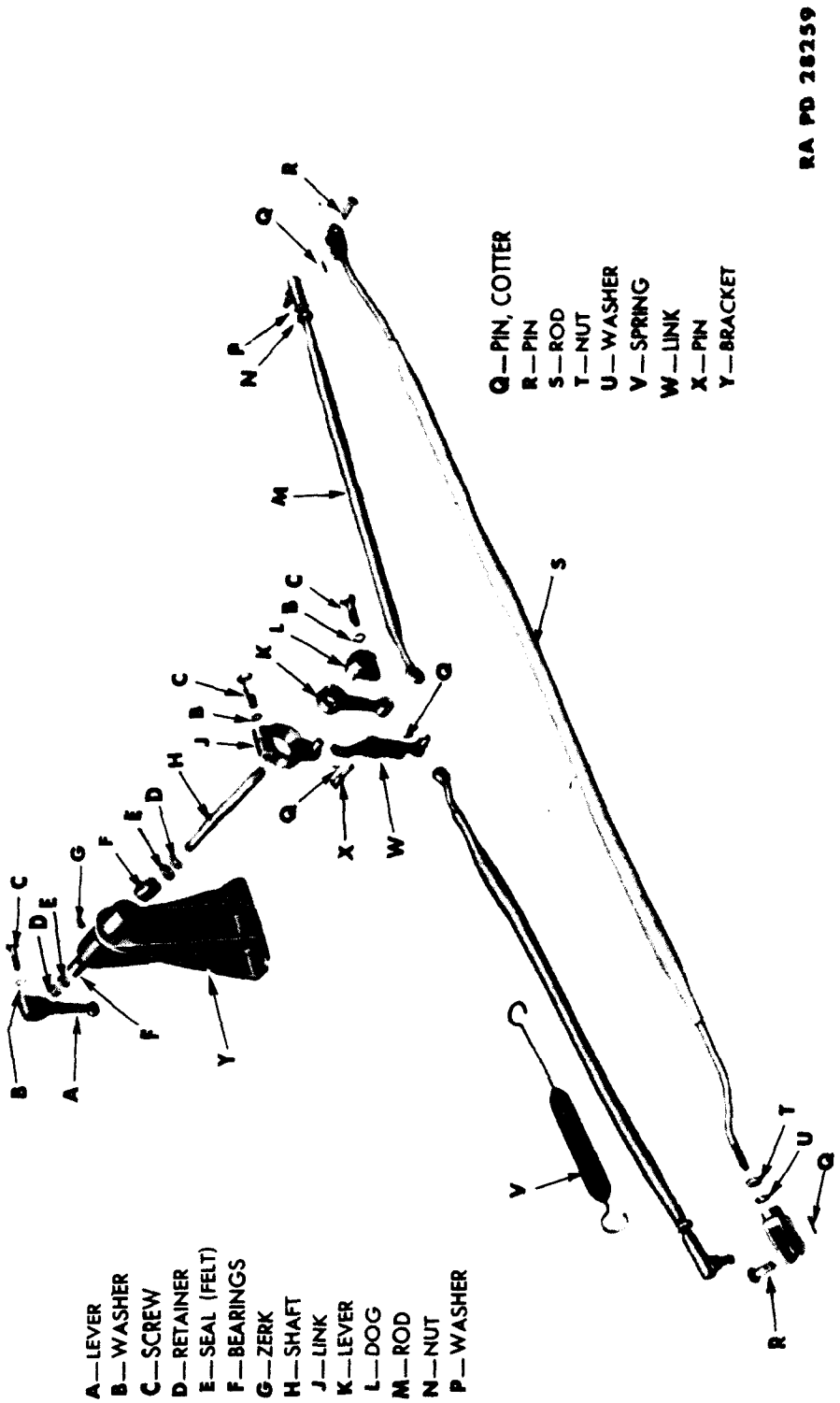


Figure 42—Carburetor Control Rods

roller bearings in the bracket (F, fig. 42). If they are found to be corroded or worn, new bearings should be pressed in the bracket, and the old ones discarded.

73. ASSEMBLY.

a. If the needle roller bearings (F, fig. 42) were removed from the bracket (Y, fig. 42) in paragraph 70, press new bearings in the bracket. Lubricate the needle roller bearings with ball and roller bearing grease. Insert the shaft (H, fig. 42) through the bearings and attach all levers in the order shown in figure 41.

74. INSTALLATION ON ENGINE AND ADJUSTMENT.

a. Install Center Bracket. Install the center bracket (Y, fig. 42) on the studs at the top center of the right-hand cylinder head, and secure it in place with two safety nuts.

b. Adjust Length of Throttle Control Rods. Adjust the length of both throttle control rods (M, fig. 42) to 16⅝ inches long, measured from center of ball at the one end to the center of pin hole at the other end of the rod.

c. Attach Throttle Control Rods and Spring to Engine. Attach the ball joint stud on each rod to the throttle arm on each carburetor, and secure the stud to the arms with a lock nut. Attach the other end of the rods to the arm at the center bracket with clevis pins. Hook the spring as shown in figure 41. NOTE: The throttle rod between the engine and the cross shaft on the bulkhead is adjusted after the engine is installed in the vehicle. The levers at the center bracket are to be adjusted at the same time. The installation and adjustment of these parts are covered in TM 9-1731B.

CHAPTER 5

COOLING SYSTEM

Section I

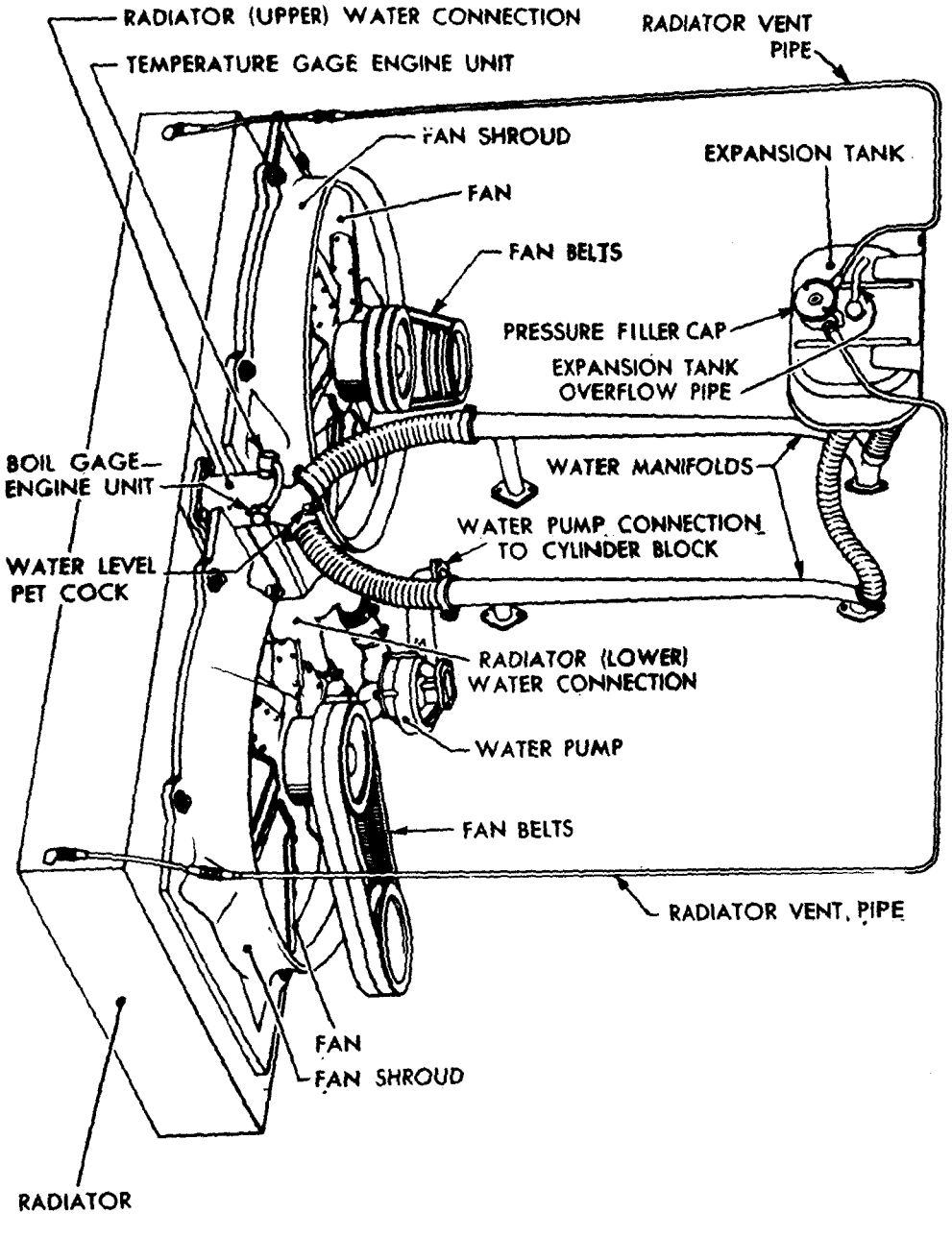
DESCRIPTION AND DATA

75. DESCRIPTION.

a. The cooling system (fig. 43) consists of a water pump, radiator, two fans, expansion tank, thermostat and various connections and fittings. The entire system is sealed by means of a pressure filler cap, which remains closed until a pressure of 12 pounds is reached. This results in the raising of the boiling point of the water or antifreeze. An expansion tank permits steam or antifreeze vapors to condense, and return to the cooling system, further reducing the loss of water or antifreeze. An accessory drive gear assembly is mounted on the hull on each side of the engine. These gear assemblies are driven by accessory drive shafts connected to the accessory drive hubs on the engine. Each fan is driven by two matched V-belts from pulleys on the accessory drive gear assembly.

76. DATA.

Cooling system capacity	17 gal
Fans (two) diameter	26 in.
Thermostat starts to open	140°F
Pressure cap valve opens at	12 lb



RA PD 27550

Figure 43—Typical Cooling System for Ford Tank Engine

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ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 5

COOLING SYSTEM (Cont'd)

Section II

RADIATOR

77. DESCRIPTION.

a. The radiator is of the cross-flow tube type, using flat horizontal tubes. The hot water flows through the tubes to which are attached thin vertical copper fins. Air forced between these fins by the fans carries the heat away, thus cooling the engine.

78. REMOVAL FROM VEHICLE.

a. To remove the radiator from the vehicle, refer to the pertinent operator's manual or TM 9-1731B.

79. CLEANING, NEUTRALIZING, AND FLUSHING.

a. Cleaning.

(1) Run the engine until operating temperature is reached, cover the radiator if necessary. Coolant shut-off cocks to heaters, or other accessories, should be open for complete circulation during cleaning, flushing and draining. Stop engine, remove radiator cap, and drain system by opening drain cocks in radiator and block. Save coolant containing ethylene glycol if still in usable condition.

(2) Allow the engine to cool, close drain cocks, disconnect radiator overflow return tank if vehicle is so equipped, and pour cleaning compound 51-C-1568-500 into radiator in the amount of two cans to every four gallons of cooling system capacity. Fill system with water.

(3) Place a drain pan to collect overflow and use to maintain level in radiator. CAUTION: Do not spill solution on vehicle paint.

(4) Replace radiator cap and run engine at moderate speed, covering radiator if necessary, so that radiator core reaches a temperature of 180°F

or above, but not boiling. Allow the engine to run at 180°F at least two hours so that cleaning solution may take effect. CAUTION: Do not drive vehicle or allow level in radiator to drop low enough to interfere with circulation. Stop the engine as often as necessary to prevent boiling.

(5) With the engine stopped, feel the radiator core with bare hands for cold spots, and watch temperature indicator. When there is no change in temperature for some time, drain the cleaning solution.

(6) If clogging of core is relieved but not fully corrected, allow the engine to cool, pressure flush the system (subparagraph c below) and repeat cleaning operation. If clogging of core is not relieved as indicated by low temperature spots on core, radiator core must be removed for mechanical cleaning. Mechanical cleaning may be accomplished by removing upper and lower tanks and rodding out the accumulated rust and scale from the water passage of the core.

b. Neutralizing.

(1) Allow engine to cool, close drain cocks, and pour neutralizer compound 51-C-1568-500 into radiator in the amount of two cans to every 4 gallons of cooling system capacity. Fill system with water.

(2) Run engine, radiator covered if necessary, until radiator reaches operating temperature

(3) Drain by removing cap and opening all drains.

c. Flushing.

(1) Remove thermostat and hose connection from engine block to radiator core.

(2) Clamp convenient length hose to radiator core outlet opening, and attach another suitable length hose to radiator inlet opening, to carry away flushing stream.

(3) Connect the flushing gun 40-G-540 to compressed air and water pressure, and clamp the nozzle of gun in the hose attached to the radiator outlet opening.

(4) With radiator cap on tight, fill core with water. Turn on air pressure in short blasts to prevent core damage.

(5) Allow radiator to fill with water and again apply air pressure as before. Repeat this process until the water comes out clear.

(6) Clamp flushing gun nozzle firmly to a hose attached securely to engine water outlet opening. Fill engine with water, partly covering engine water inlet opening to facilitate complete filling.

(7) Turn on compressed air to blow out water and loose sediment. Repeat filling with water and blowing out with air until flushing stream comes out clear.

(8) For most complete removal of sediment, repeat flushing of radiator core and engine block in opposite direction.

(9) For badly clogged engine water jackets that do not respond to regular pressure flushing, remove cylinder head studs, accessible water jacket covers, or core hole plugs and, with a suitable length of small copper tubing attached to flushing gun nozzle, flush jackets through jacket cover openings, stud, or core holes.

(10) When vehicle is equipped with a heater or other accessories such as overflow tank connected to the cooling system, flush heater, following same procedure as for the radiator core.

(11) After completing the flushing operation and before connecting cooling system hose, clean off all water connections of both radiator and engine block. Clean out radiator overflow pipe, inspect, if necessary, lubricate the water pump, clean thermostat and radiator cap control valves. Check thermostat for proper operation before installation.

(12) Blow insects and dirt from radiator core air passages, using water if necessary to soften obstructions.

80. INSPECTION.

a. Plug all radiator openings, using standard repair kit expansion plugs, one of which is equipped with a tire valve. Apply approximately 10 pounds air pressure through the expansion plug containing a tire valve. Submerge the radiator in a tank of water. If the radiator leaks, air bubbles will be observed at the point where the leak occurs. Mark the location of all leaks. NOTE: It is the duty of the inspector to determine the extent of a damaged or leaking radiator and make proper disposition, either by authorizing the necessary repairs or, if its condition shows damage beyond repairs, discarding.

81. REPAIR.

a. To repair radiator, follow the procedures of accepted practice. Radiators must be retested and reinspected as outlined in paragraphs 79 and 80, after completion of repairs.

82. INSTALLATION ON VEHICLE.

a. To install radiator on the vehicle, refer to the pertinent operator's manual or TM 9-1731B.

CHAPTER 5

COOLING SYSTEM (Cont'd)

Section III

FAN AND SHROUD ASSEMBLIES

83. DESCRIPTION.

a. The 3-inch Gun Motor Carriage M10A1 and the Medium Tank M4A3, which are typical installations, are equipped with two 26-inch diameter 6-blade blower or pusher type fans. These are mounted in front of the radiator. The fans draw air in through the openings in the engine compartment doors, and force the air through the radiator to the air baffles back of the radiator. Each fan is driven by two matched V-belts (fig. 43) from pulleys on the accessory drive gear assembly (mounted on the sides of the hull). Each pair of fan belts that are removed are to be kept paired so that the same belts can be used as a pair upon reassembly. NOTE: Never replace one fan belt; always use a matched pair together.

84. REMOVAL FROM VEHICLE.

a. To remove the fan and shroud assembly from the vehicle, refer to the pertinent operators manual.

85. DISASSEMBLY.

a. **Remove Pulley and Fan Blades.** Remove the six cap screws from the fan hub, and remove the pulley and the fan blades.

b. **Remove Hub from Fan Shaft.** Bend the ears of the lock washer away from the nut (U and V, fig. 44) and unscrew the nut from the shaft. The hub and bearing assembly can now be removed from the shaft.

c. **Remove Fan Shaft from the Shroud.** Bend the ears of the lock washer away from the nut (C and D, fig. 44) and remove the nut from the shaft. Use a hard wood block and hammer and tap the end of the shaft to remove it from the shroud.

d. **Remove Ball Bearings from the Hub.** Use a brass drift placed against the outer race of the bearings when tapping them from the hub.

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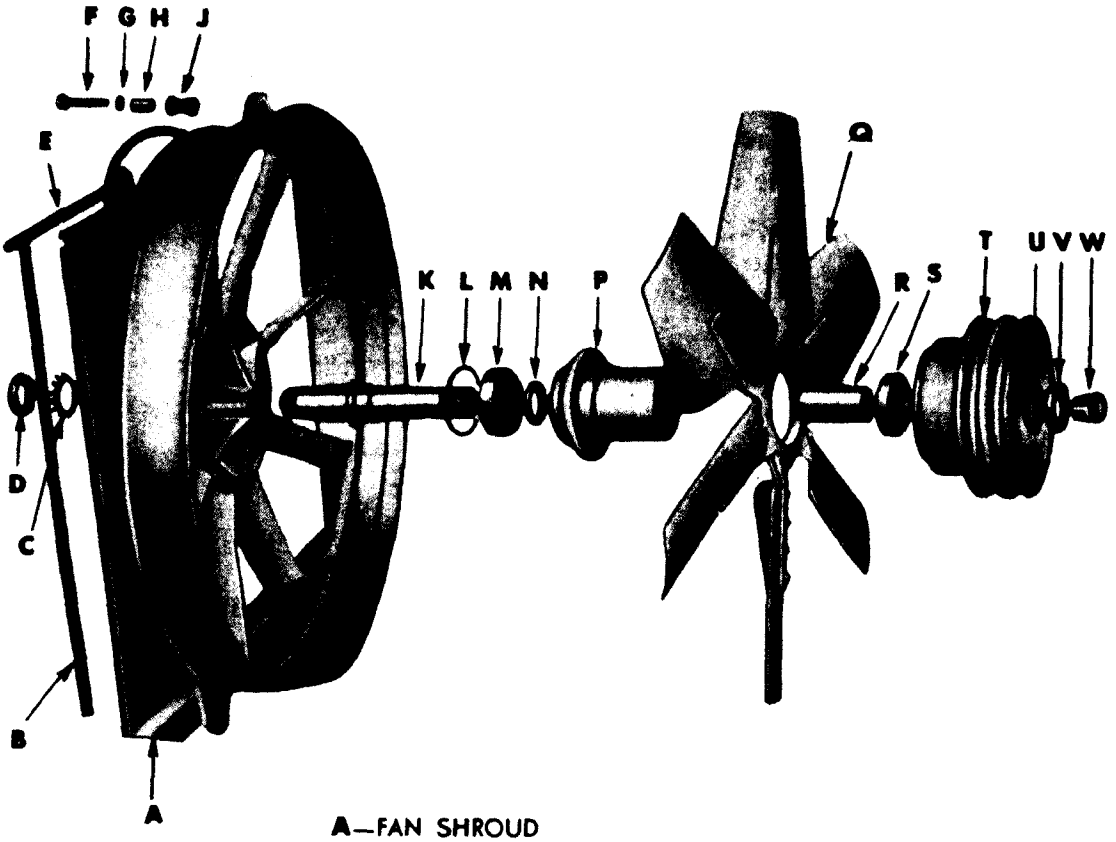

A—FAN SHROUD
B—FAN SHROUD GASKET
C—LOCK WASHER
D—NUT
E—FAN SHROUD GASKET
F—SCREW FOR FAN SHROUD
G—WASHER
H—SPACER
J—INSULATING BUSHING
K—SPINDLE FOR FAN
L—SNAP RING BEARING RETAINER
M—BALL BEARING
N—WASHER
P—FAN HUB
Q—FAN
R—SPACER
S—BALL BEARING
T—PULLEY
U—LOCK WASHER
V—NUT
W—GREASE FITTING

RA PD 28260

Figure 44—Fan and Shroud Disassembled

Tap the front bearing (S, fig. 44) from the hub and remove the spacers (R, fig. 44). Remove the snap ring bearing retainer (L, fig. 44) from the hub and tap out the rear bearing (M, fig. 44).

86. CLEANING.

a. Wash all parts with dry-cleaning solvent. A good method for cleaning the ball bearings is to dip them in a container of dry-cleaning solvent. The container must be free from metal chips and dirt. Rotate a bearing while immersed in the dry-cleaning solvent until all traces of lubricant have been removed. Oil the bearing immediately to prevent corrosion of the highly polished surfaces. Wrap each bearing in oiled paper unless it is to be used at once.

87. INSPECTION.

a. Inspect Fan Blades. Examine the fan blades for cracks in the blades and loose rivets. Also check for bent fan blades. Fan blades showing any of these conditions must be discarded.

b. Inspect Ball Bearings. The inspection of ball bearings can best be performed after the bearing is washed as outlined in paragraph 86, then dipped in light lubricating oil. The condition of a ball bearing can best be determined by the surface condition of the balls and races and the looseness in its races. Check for pits caused by corrosion. Check for discoloration of the balls, races, and retainers, as this is evidence of overheating. Bearings that have been overheated must be discarded. Spinning a ball bearing while holding it in the hands, is not an accurate check of its running qualities, although this test will indicate presence of dirt or foreign matter in the bearing. Bearings in this condition must be rewashed, lubricated, and rechecked.

88. ASSEMBLY.

a. Install Ball Bearing on Fan Shaft. The ball bearings are of the sealed type. Press the bearing (M, fig. 44) on the fan shaft with the sealed side facing the flange on the shaft. Use a driver which contacts the inner race of the bearing, and press it firmly against the flange on the shaft.

b. Install Fan Shaft and Bearing in Hub. Insert the fan shaft and bearing in the rear of the hub and press the bearing in the hub, using a driver which contacts the outer race of the bearing. Secure the bearing in the hub with snap ring bearing retainer (L, fig. 44).

c. Install Washer, Spacer and Rear Bearing in Hub. Place the washer (N, fig. 44) on the shaft and follow up with the spacer (R, fig. 44). Press the front bearing (S, fig. 44) in the hub with the sealed face outward. Use a driver which contacts both the inner and outer race of the

bearing, and press the bearing over the shaft and into the hub. Install lock washer and nut on the end of the shaft.

d. Install Pulley and Fan on Hub. Place the fan blade on the hub; then place the pulley over the hub, and secure the assembly together with six cap screws and lock washers.

89. INSTALLATION ON VEHICLE.

a. To install fan and shroud assembly on vehicle, refer to pertinent operator's manual.

CHAPTER 5

COOLING SYSTEM (Cont'd)

Section IV

ACCESSORY DRIVE GEAR ASSEMBLY

90. DESCRIPTION.

a. The accessory drive gear assemblies are located on the right and left side walls of the engine compartment. These gear assemblies are driven by accessory drive shafts connected to the accessory drive hubs on the engine. The drive pinion and the driven gear are spiral bevel gears mounted on ball bearings. The unit is lubricated by engine oil in the housing. A gage (dip stick) is attached to the oil filter plug for checking the oil level in the housing. The right and left hand units are the same and can be transferred from one side of the hub to the other by merely turning the unit over. However, the filter plug containing the oil gage (dip stick) must be installed in the top of the housing and the drain plug in the bottom.

91. REMOVAL FROM VEHICLE.

a. To remove the accessory drive gear assemblies from the vehicle, refer to the pertinent technical manual (TM 9-731G, TM 9-759, etc.).

92. DISASSEMBLY.

a. **Remove Pinion Gear and Bearing Carrier from Housing.** Remove the six nuts (LL, fig. 45) from the studs holding the bearing carrier (H, fig. 45) to the housing. Attach puller with adapter 41-P-2905-75 to the flange as shown in figure 46 and pull the assembly from the housing.

b. **Remove Flange from Pinion Gear Shaft.** Release the lock from the nut (B and A, fig. 45) and remove the nut. Attach puller with adapter 41-P-2905-75 (fig. 46), and pull the flange from the pinion gear shaft.

c. **Remove Pinion Gear from Bearing.** Use a brass drift and drive the pinion gear from the ball bearing.

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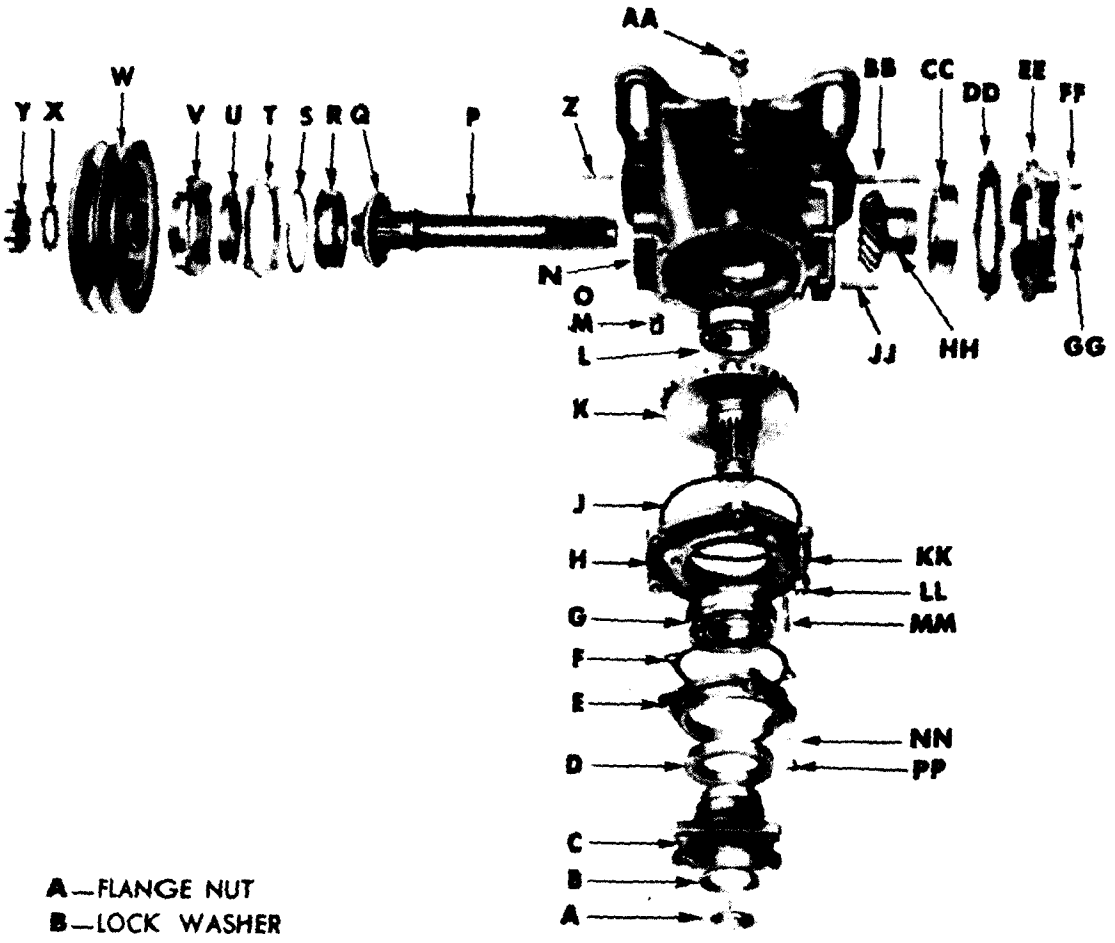

A—FLANGE NUT
B—LOCK WASHER
C—FLANGE
D—OIL SEAL
E—BEARING RETAINER
F—BEARING RETAINER GASKET
G—BALL BEARING
H—PINION GEAR BEARING CARRIER
J—SEAL
K—PINION GEAR
L—BEARING
M—DRAIN PLUG
O—SNAP RING
N—ACCESSORY DRIVE GEAR HOUSING
P—DRIVEN SHAFT
Q—OIL SLINGER
R—BEARING
S—BEARING SNAP RING RETAINER
T—GASKET
U—OIL SEAL
V—BEARING RETAINER

W—FAN PULLEY
X—LOCK WASHER
Y—NUT
Z—HOUSING STUD
AA—OIL GAGE (DIP STICK)
BB—HOUSING STUD
CC—BEARING
DD—GASKET
EE—GENERATOR ADAPTER
FF—NUT
GG—OIL SEAL
HH—BEVEL DRIVEN GEAR
JJ—HOUSING STUD
KK—HOUSING STUD
LL—NUT
MM—HOUSING STUD
NN—FLAT WASHER
PP—NUT

RA PD 28261

Figure 45—Accessory Drive Gear Disassembled

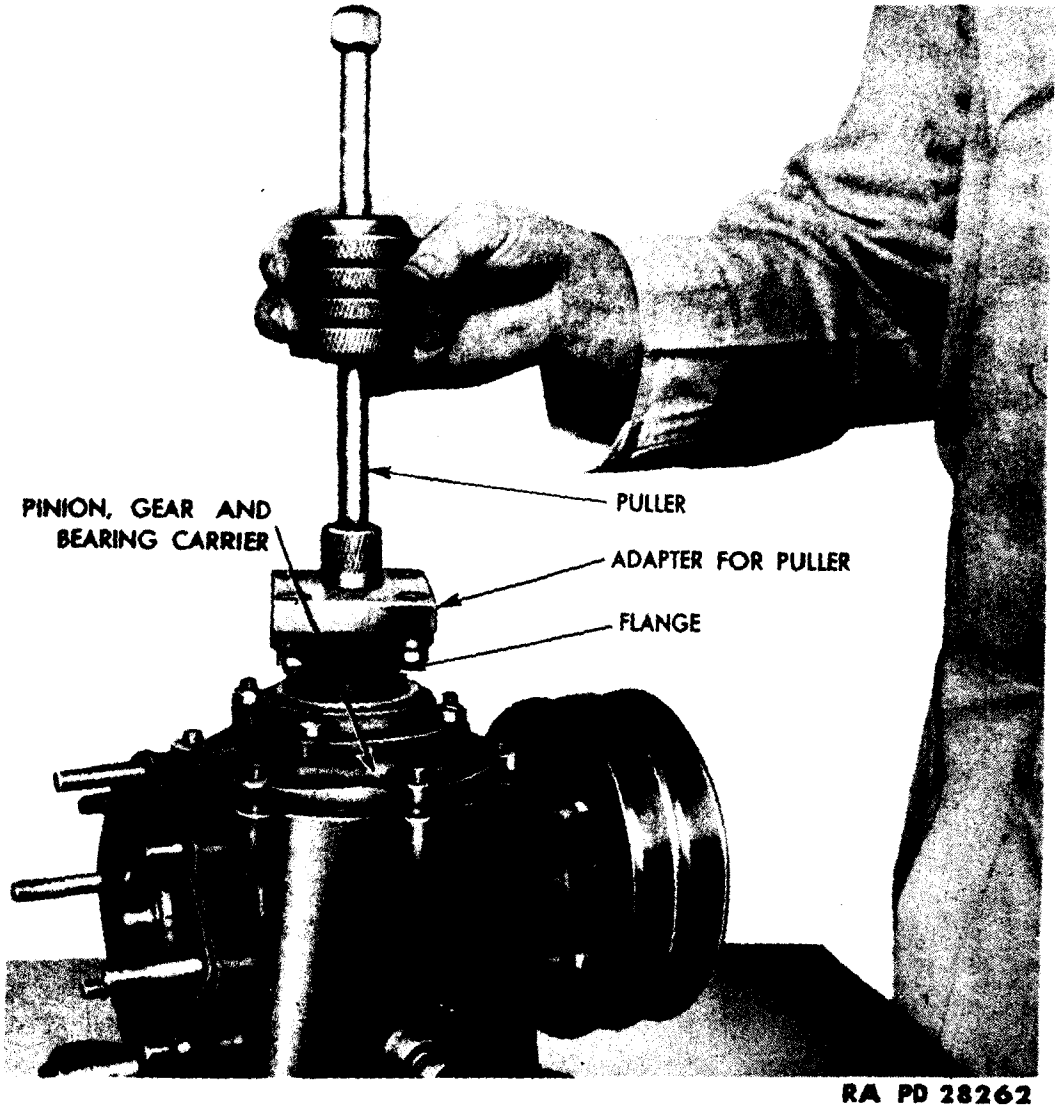

Figure 46—Pulling Pinion Gear and Bearing Carrier from Housing

d. Remove Ball Bearing from the Ball Bearing Carrier. Remove the four nuts from the bearing retainer (E, fig. 45) and remove the retainer from the bearing carrier. With a driver, drive the ball bearing from the carrier (G and H, fig. 45). Remove the oil seal from the bearing retainer (D and E, fig. 45).

e. Remove Pulley from Driven Shaft. Release the lock from the spanner nut and remove the spanner nut from the driven shaft. Pull the pulley from the shaft.

f. Remove the Driven Shaft from the Housing. Remove the four nuts from the bearing retainer (V, fig. 45) and remove the retainer from the housing. Remove the oil seal (U, fig. 45) from the retainer. With a brass drift, drive on the opposite end of the shaft from which the retainer was removed and drive the shaft (P, fig. 45) with the ball bearing (R, fig. 45) from the housing. Remove the ball bearing and oil slinger (Q, fig. 45) from the shaft.

g. Remove the Generator Adapter from Housing. Remove the four nuts from the studs which hold the adapter (EE, fig. 45) to the housing and remove the adapter from the housing.

h. Remove Bevel Driven Gear from Housing. With a brass drift, drive the bevel driven gear with bearing from the bearing recess in the housing.

i. Remove Ball Bearing from the Bevel Driven Gear. Release the lock from the spanner nut and remove the nut from the hub of the gear. Remove the ball bearing from the gear.

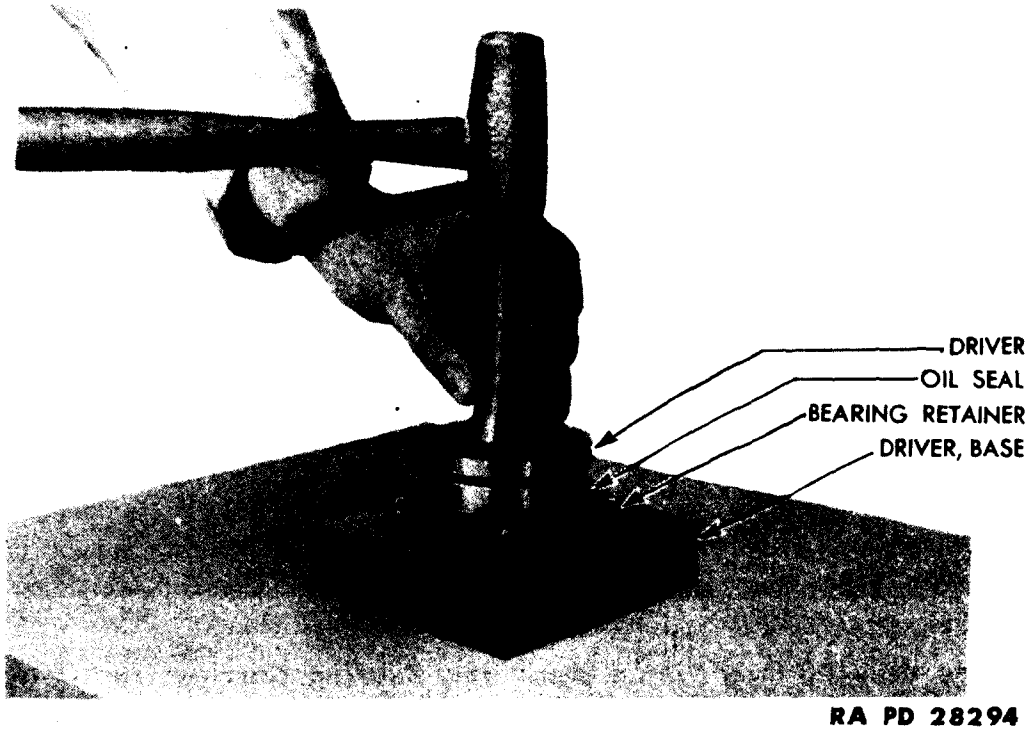

Figure 47—Installing Oil Seal in Bearing Retainer

93. CLEANING.

a. Clean the ball bearings as outlined in paragraph 86. Wash the housing and all other parts with dry-cleaning solvent.

94. INSPECTION.

a. Inspect Housing. Examine the housing for cracks and damaged studs. Remove and discard damaged studs.

b. Oil Seals. Remove and discard all oil seals throughout the accessory drive gear (only new seals are used in the assembly procedure).

c. Inspect Gears. Examine the gears for excessive tooth wear or damaged teeth. Excessively worn or damaged gears must be discarded.

d. Inspect Ball Bearing. The inspection of ball bearings can best be performed after the bearings are washed as outlined in paragraph 86, and dipped in light lubricating oil. The condition of a ball bearing can best be determined by the surface condition of the balls and race and its looseness in its race. Check for pits caused by corrosion. Check for discoloration of balls and races and retainers as this is evidence of overheating. Bearings that have been overheated must be discarded. Spinning a ball bearing while holding it in the hands is not an accurate check of its running qualities, although this test will indicate presence of dirt or foreign matter in the bearing. Bearings in this condition must be rewashed, lubricated, and rechecked.

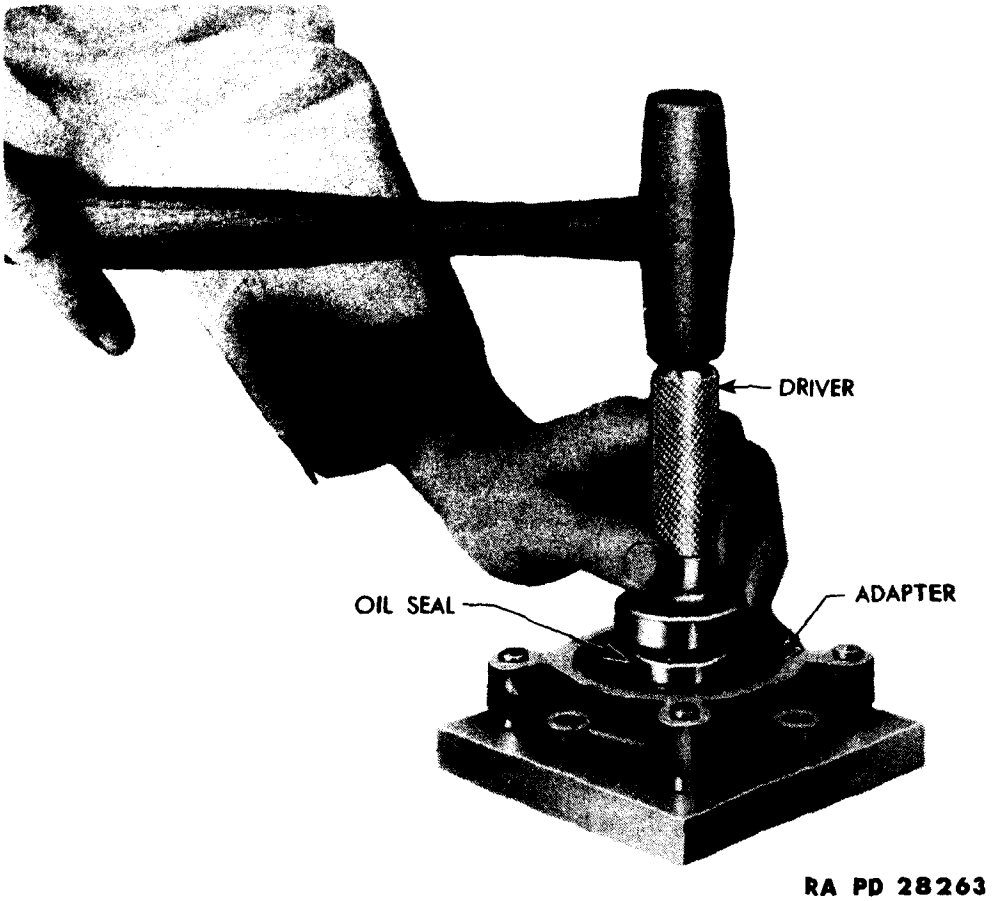

Figure 48—Installing Oil Seal in Generator Adapter

95. ASSEMBLY.

a. Install Oil Seal in Bearing Retainers. Use new oil seals (D and U, fig. 45) and press a seal in each of the bearing retainers (E and V, fig. 45). Use replacer 41-R-2392-81 as shown in figure 47.

b. Install Oil Seal in Generator Adapter. Use a new oil seal (GG, fig. 45) and press the seal in the generator adapter (EE, fig. 45). Use replacer (driver) 41-R-2393-660 as shown in figure 48.

c. **Install Driven Shaft and Bevel Driven Gear in Housing.** Press the bearing (CC, fig. 45) on the hub of the bevel gear (HH, fig. 45). Press the bearing and oil slinger (R and Q, fig. 45) on the threaded end of the shaft (P, fig. 45) until they are firmly seated against the flange on the shaft. Place the snap ring retainer (S, fig. 45) in the groove in the ball bearing. Insert the shaft with the bearing through the housing. Place the bevel driven gear (HH, fig. 45) and the bearing which has already been pressed on the hub of the gear, in the bearing recess in the housing. Start the bevel gear over the spline of the shaft. Attach replacer (driver) 41-R-2395-30 to the shaft as shown in figure 49 and pull the bearings into the recess at each end of the housing.

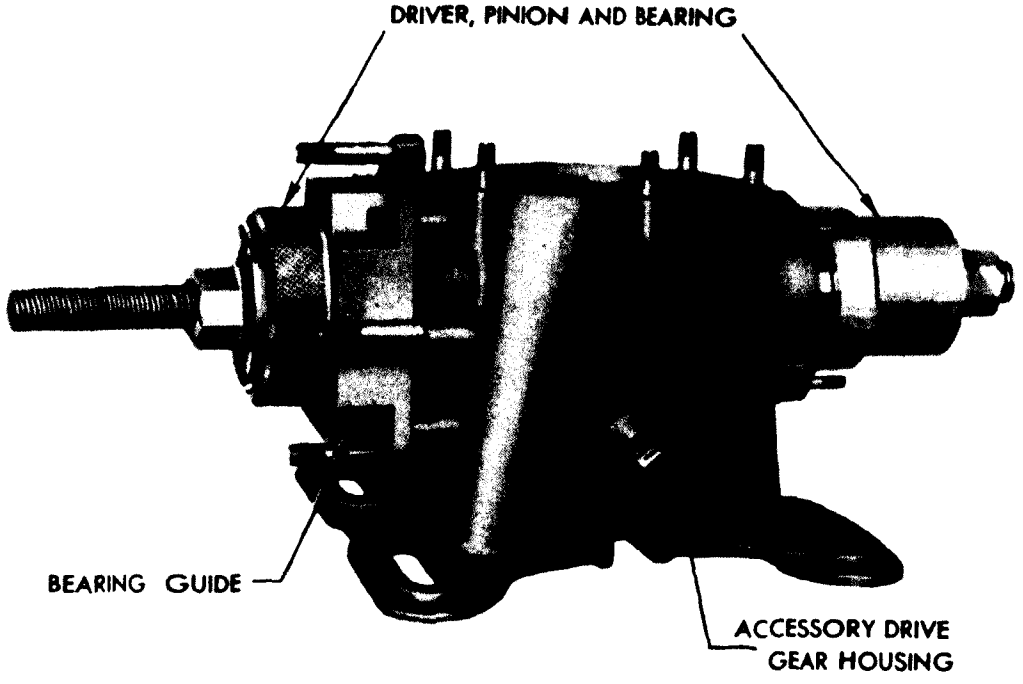

Figure 49—Pressing Bearings in Accessory Drive Gear Housing

d. **Install Generator Adapter to Housing.** Use a new gasket and place gasket and adapter (DD and EE, fig. 45) over the studs on the housing, and secure it to the housing with four safety nuts.

e. **Install Bearing Retainer on Housing.** Place the bearing retainer (V, fig. 45) with a new gasket over the studs on the housing, and secure it to the housing with safety nuts.

f. **Install Ball Bearing in Pinion Gear Bearing Carrier.** Press the ball bearing (G, fig. 45) in the recess in the pinion gear bearing carrier (H, fig. 45) and place the bearing retainer (E, fig. 45) with a new gasket over the studs on the carrier and secure it to the carrier with four safety nuts.

g. Install Pinion Gear and Flange in the Pinion Gear Bearing Carrier. Press the pinion gear shaft (K, fig. 45) through the ball bearing and place the flange over the spline of the pinion shaft. Secure flange to the shaft with a flange nut and lock washer (A and B, fig. 45). Bend the ears of the lock washer into the notches on the flange nut.

h. Install Ball Bearing on Pinion Gear. Press the ball bearing (L, fig. 45) on the pinion gear (K, fig. 45) until it is firmly seated against the gears.

i. Install Pinion Gear and Bearing Carrier on the Housing. Place the pinion gear and bearing carrier over the studs on the housing, using a new seal (J, fig. 45), and secure the carrier to the housing with six safety nuts.

j. Install Fan Pulley. Press the fan pulley (W, fig. 45) on the splines of the driven shaft and secure it to the shaft with a nut and lock washer (Y and X, fig. 45). Bend ears on lock washer in notches of the spanner nut.

96. INSTALLATION IN VEHICLE.

a. To install the accessory drive gear assemblies in the vehicle, refer to pertinent technical manual (TM 9-731G, TM 9-759, etc.).

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CHAPTER 5

COOLING SYSTEM (Cont'd)

Section V

EXPANSION TANK AND THERMOSTAT

97. EXPANSION TANK.

a. Description. A cooling system expansion tank is located on the bulkhead, at the forward end of the engine compartment. The filler neck for the cooling system is located at the top of the expansion tank. A water level pet cock is located in the radiator inlet casting (fig. 51). Water is added to the cooling system when the level gets below this pet cock. Radiator vent pipes are attached to the filler neck. When sufficient pressure (12 pounds) is built up in the cooling system due to expansion of the coolant, the pressure valve in the filler cap opens, and the excess water or steam goes into the expansion tank. As the engine cools, a vacuum is formed in the radiator. The water that has been forced into, or has condensed in the expansion tank, is drawn back into the radiator again through a vacuum valve (fig. 50) in the pressure cap.

b. Drain Expansion Tank. To drain the expansion tank, remove the drain plug on the right-hand side of the tank (fig. 50).

c. Inspection. Plug all openings in the tank, fill with water, and observe for external leaks. Tanks found leaking should be replaced; however, emergency repairs can often be made by soldering. The pressure cap gasket must be carefully inspected. If the gasket is damaged, or has become hard or brittle, it must be replaced.

d. Replacement. To remove and install the expansion tank on the vehicle, refer to the pertinent operator's manual.

98. THERMOSTAT.

a. Description. A thermostat is located in the inlet opening of the radiator (fig. 51). It is of the bypass bellows type and is nonadjustable. The purpose of the thermostat is to prevent circulation of water in the radiator until the engine reaches normal operating temperature. The thermostat starts to open at 140°F.

EXPANSION TANK AND THERMOSTAT

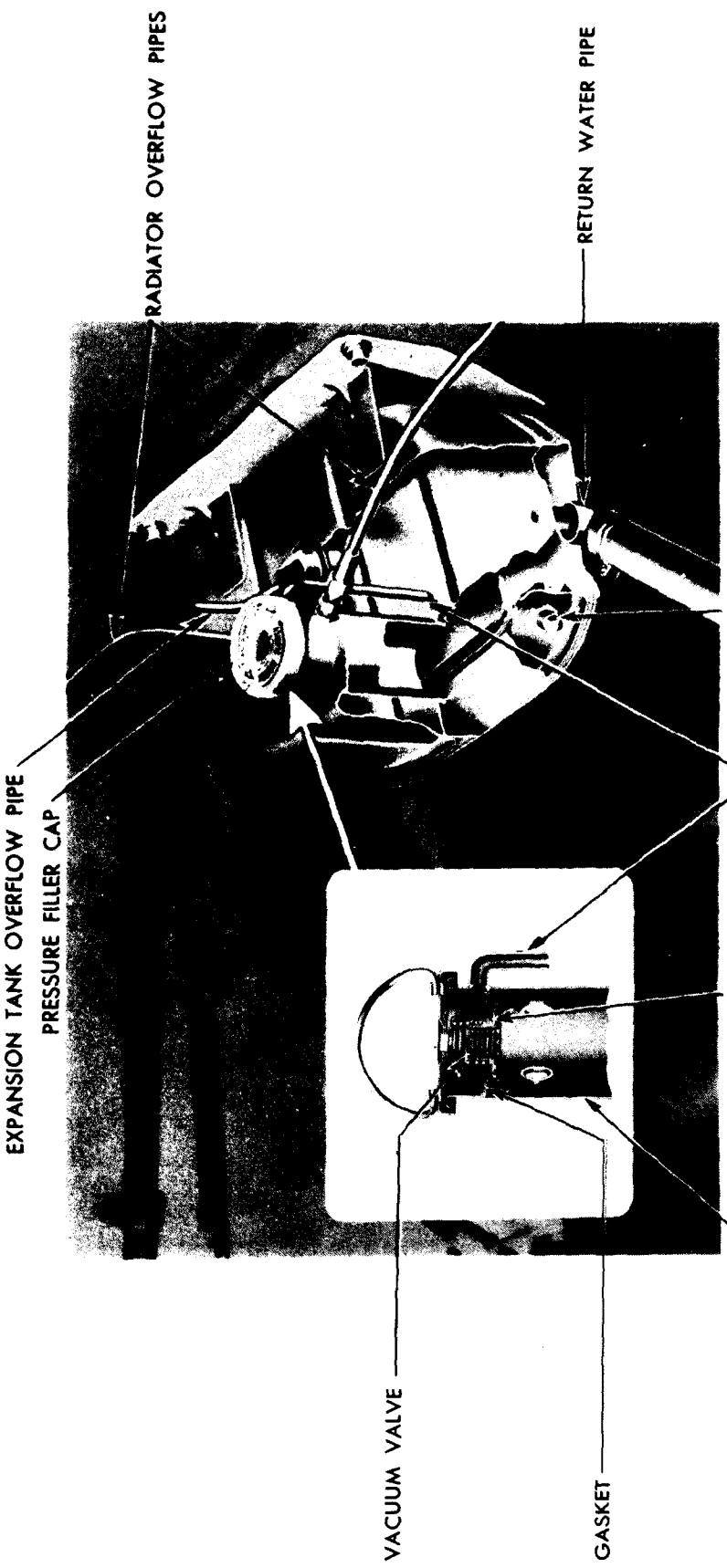

Figure 50—Expansion Tank

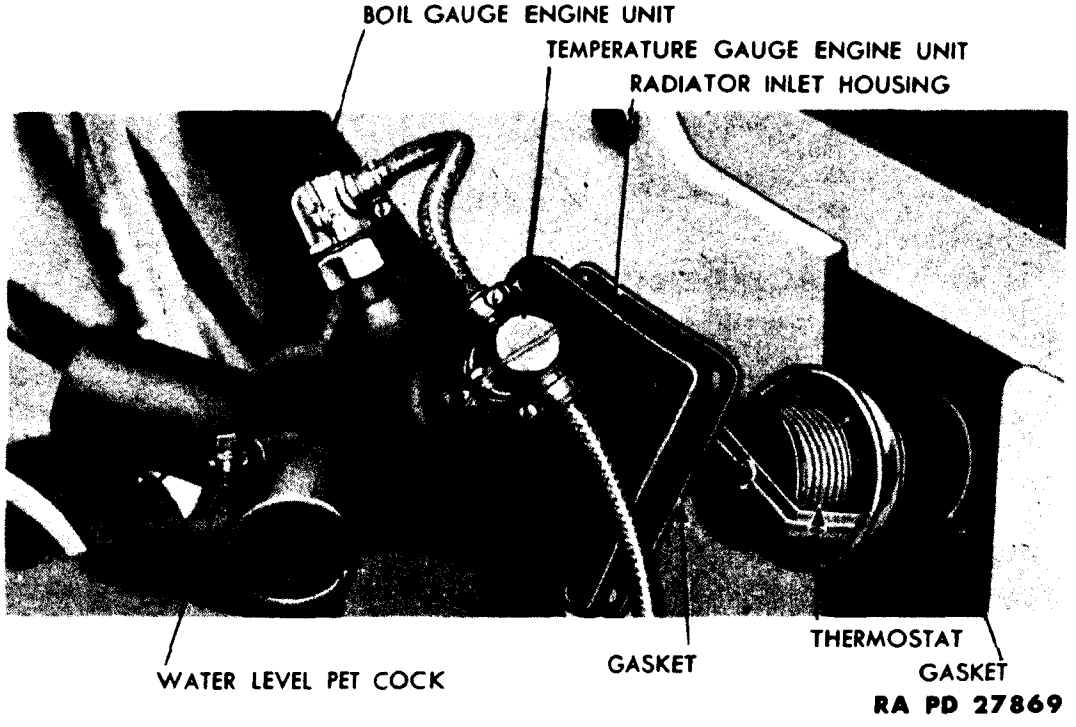

Figure 51—Thermostat

b. Replacement. To replace the thermostat in the vehicle, refer to the pertinent operator's manual.

c. Inspection. A thermostat which is badly corroded must be replaced. To test the opening of the thermostat, immerse it in water, gradually increase the temperature of the water. Check the temperature of the water when the valve in the thermostat starts to open. A normally operating thermostat opens at 140°F. Thermostats which do not open at this temperature, or open before the water reaches 140°F must be discarded.

CHAPTER 6

GENERATING SYSTEM

Section I

DESCRIPTION AND DATA

99. DESCRIPTION.

a. The generating system consists of two 30-volt generators, two generator regulators, two 12-volt batteries, and the various connecting wires. Figure 52 shows the arrangement of the generating system on the 3-inch Gun Motor Carriage M10A1. This installation is typical for all vehicles using the tank engine Model GAA V-8.

100. DATA.

Volts 30
Amperes 50
Watts 1500
Field current draw at 26½ volts 1.4
Output at 1860 rpm ..... 50 Amperes
Brush length ..... 1⅛ in.
Regulators:
  Make ..... Auto-Lite
  Model VAD-4106A
Cut-out (relay):
  Points close ..... 25.7 to 26.7 volts
  Points open ..... 15 to 28 amperes reverse current
Voltage regulation:
  Voltage setting (120°F) ..... 27.9 to 28.7
  Voltage setting (70°F) ..... 28.1 to 28.9
Current limitation:
  Ampere setting ..... 50 to 53

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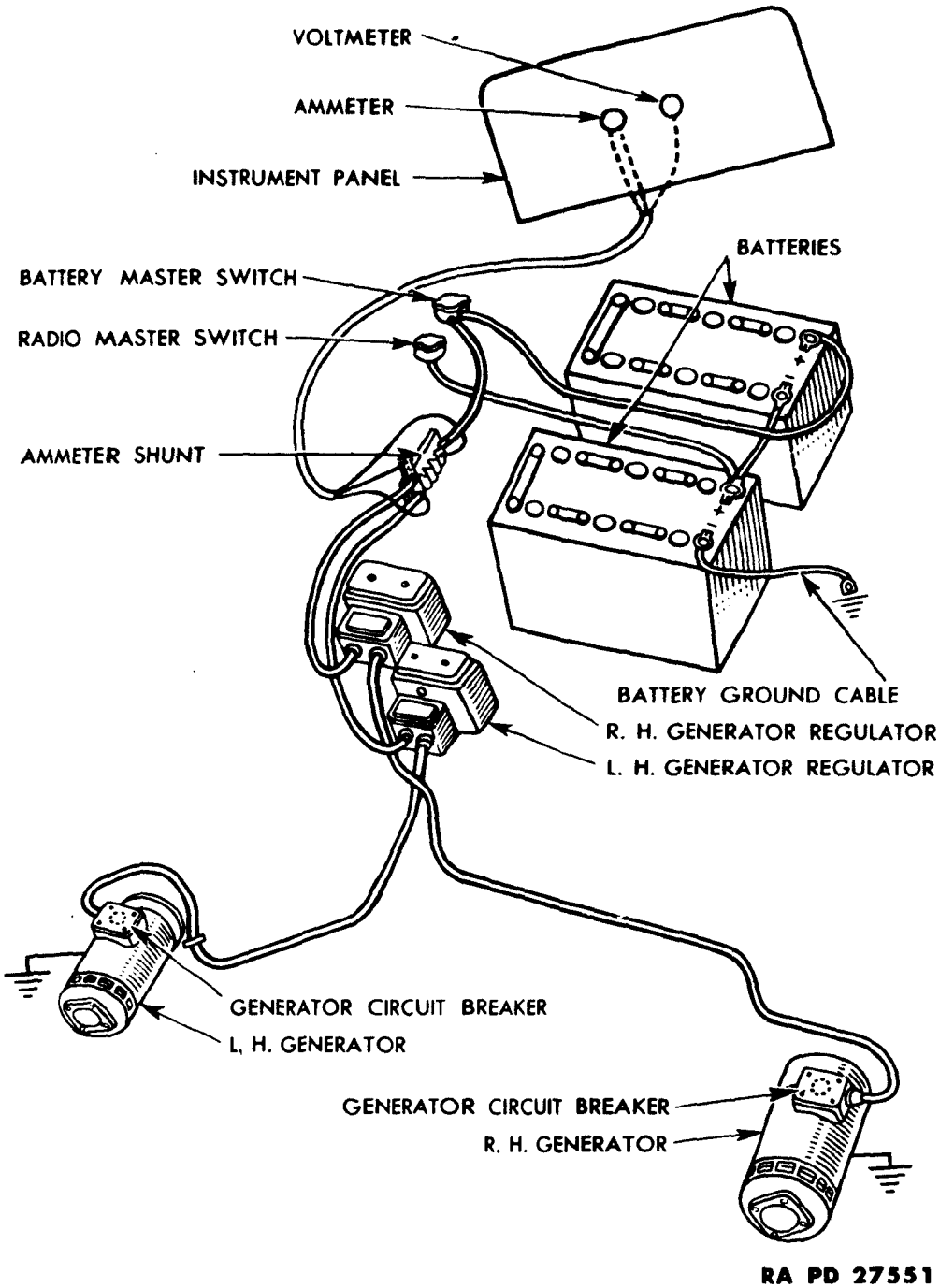

Figure 52—Generating System

CHAPTER 6

GENERATING SYSTEM (Cont'd)

Section II

GENERATING SYSTEM QUICK TESTS IN THE VEHICLE

101. DESCRIPTION.

a. Any tests of the generating system must start with a test of the battery to determine its state of charge. If the battery is fully charged and the charging rate is low, it can usually be assumed that the generating system is normal. However, the simple test outlined in paragraph 102 is more conclusive. If the charging rate remains high, even though the battery is fully charged, follow the procedure in paragraph 103. If the battery charge is low and there is a low or no charge rate, follow the procedure outlined in paragraph 104.

102. LOW CHARGING RATE WITH A FULLY CHARGED BATTERY TEST.

a. Turn the ignition switch to OFF position. Hold the starter button on, allowing the starter to run for 5 to 10 seconds. Turn the ignition switch on and start the engine. Operate the engine at a generator speed of 2500 to 3000 revolutions per minute. If the charging rate is increased to maximum charge, then gradually decreases to minimum charging rate as the battery becomes charged, the generator regulator operation is normal. If the charging rate is not increased, check the generator regulator as outlined in paragraph 104.

103. HIGH CHARGING RATE WITH A FULLY CHARGED BATTERY TEST.

a. General. High charging rate with a fully charged battery is usually an indication that the voltage regulator is not operating correctly. The high voltage will cause the battery to gas excessively and in general will have detrimental effect on all connected load.

b. Preliminary Steps. Disconnect the battery wire at the regulator "BAT" terminal. Connect an ammeter in series between the regulator "BAT" terminal and the wire that was removed from it. Run the gen-

erator at an approximate speed of 2500 revolutions per minute and perform the following operation.

c. Disconnect Field Lead at the Generator. If the output drops to 0, the field circuit in the regulator or the wiring harness is shorted. Reconnect the field lead at the generator and proceed as outlined in paragraph 103 d. If the output does not drop, the field circuit in the generator is shorted. Replace the generator.

d. Disconnect the Field Lead at the Regulator. If the output drops to 0, the field in the regulator is shorted. Replace the generator regulator. If the output does not drop, the wiring harness is shorted. Repair or replace the wiring harness.

e. Regulator Contact Points. Remove the regulator cover and hold the voltage regulator contact points (fig. 54) open. If the output drops to 0, either the regulator points are sticking, the regulator is out of adjustment or regulator is inoperative. Replace the regulator. If the output does not drop, the field circuit in the regulator is shorted. Replace the regulator.

f. Test Ground Circuit. Connect a voltmeter between the regulator base and the hull. Operate the units at a 10-ampere output and measure the voltage drop from the regulator base to the frame. If the voltage reading is below 0.03 volts, the ground circuit is satisfactory. If the voltage reading is above 0.03-volts, inspect the ground lead for breaks and poor connections and eliminate high resistance. Tighten all connections and replace damaged wires.

g. Regulator Test with Headphone. Connect a headphone from the regulator field terminal (fig. 54) to the base and hold the current regulator contact points (fig. 54) closed. A steady beat in the phone will indicate the voltage regulator is operating. If the beat is unsteady, the contact points are dirty or sticking. Clean the contact points (par. 103 h). If no beat is heard, the voltage regulator is inoperative. Replace the regulator.

h. Clean Generator Regulator Points. Clean the voltage regulator points. Wet a piece of lint-free linen tape with carbon tetrachloride and draw it between the points. Repeat the operation with a dry piece of lint-free linen paper. Reset the regulator as outlined in paragraph 119.

104. LOW BATTERY AND LOW OR NO CHARGING RATE TEST.

a. Test Generator. Check all wiring for loose connections, frayed insulation, and high resistance connections and replace or repair any fault. Remove the armature and battery leads from the "ARM" and "BAT"

terminals of the regulator (fig. 54) and connect an ammeter between them. Remove the field lead from the "FIELD" terminal of the regulator (fig. 54) and while operating at idle speed touch the field lead to the armature lead. Increase the speed noting the charging rate. Do not increase the output above 50 amperes. If the generator output builds up, reconnect the wires removed and proceed with paragraph 104 b. If the generator output will not build up, inspect the wiring harness for shorts and open circuit. If the wiring harness is satisfactory, replace the generator. Reconnect the generator regulator.

b. Test Generator Regulator.

(1) PRELIMINARY STEPS. Connect an ammeter between the battery lead and the regulator "BAT" terminal (fig. 54). Connect a voltmeter from the regulator "ARM" terminal (fig. 54) to the regulator base. Operate the generator at 2500 revolutions per minute and perform the following tests.

(2) TEST VOLTAGE REGULATOR. Read the voltmeter. If the voltage builds up, the series circuit is open (par. 104 b (3)). If the voltage does not build up, the regulator is either out of adjustment, field circuit is open or a field or series circuit is grounded. Replace the regulator.

(3) TEST CUT-OUT. Remove the regulator cover. Operate the generator at 2500 revolutions per minute and hold the cut-out points closed. If the ammeter shows charge, the cut-out shunt winding circuit is open or the cut-out points are incorrectly set. Replace the regulator. If the generator has no output with the points held closed, clean the cut-out points and repeat the test. If there is still no charge, replace the regulator.

(4) TEST WITH JUMPER WIRE BETWEEN TERMINALS, "ARM" AND "FIELD." Run the generator at idle speed and momentarily connect a jumper from the "ARM" to "FIELD" terminals. If the voltage builds up, the field circuit is open or the regulator is out of adjustment (par. 119). If the voltage does not build up, the field or series circuit is grounded. Replace the regulator. Remove the jumper wire.

(5) TEST VOLTAGE REGULATOR POINTS. Operate the generator at 2500 revolutions per minute. Hold the voltage regulator points closed (fig. 54). If the voltage builds up, the voltage regulator points are burned or dirty or the regulator is incorrectly set. Replace the regulator.

(6) TEST CURRENT LIMITATOR. Remove the regulator cover and hold the current limitator points (fig. 54) closed. If the voltage builds up, the current limitator points are burned or dirty or regulator is incorrectly set. Set the regulator. If the voltage does not build up, clean the points and repeat the test. If the voltage still does not build up, replace the regulator.

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

CHAPTER 6

GENERATING SYSTEM (Cont'd)

Section III

GENERATORS

105. DESCRIPTION.

a. The generators are of the four-brush, four-pole, shunt-wound, 30-volt type. The armature rotates on sealed, self-lubricated ball bearings, located at each end of the generator frame.

106. REMOVAL FROM VEHICLE.

a. To remove the generator from the vehicle, refer to the pertinent operator's manual.

107. CLEANING AND INSPECTION (EXTERNAL).

a. Cleaning. Clean the generator externally, using dry-cleaning solvent and wipe dry with a clean cloth.

b. Visual Inspection. Remove the inspection band. Measure the length of the brushes. If the brushes are less than seven-eighths inch long the generator is to be disassembled and overhauled. If the commutator is worn or burned, the generator is to be disassembled and overhauled.

c. Check Brush Spring Tension. Check the brush spring tension with the end of the spring resting on top of the brush. Hook a testing scale under each spring at the point where it contacts the brush. Spring tension of 25 to 30 ounces on each of the two springs on each brush is correct. The spring tension will be slightly less with worn brushes. Weak springs must be replaced.

d. Test Stand Inspection. If the generator brushes and commutator are in good condition, mount the generator in a generator test stand. Seat the brushes and polish the commutator. Test the output of the generator. If the output is in excess of 50 amperes at 24 volts, the generator is satisfactory for further use. If the output is less than 50 amperes at 24 volts, the generator must be disassembled and overhauled.

108. DISASSEMBLY.

a. Remove Terminal Box from the Generator Frame (GG, fig. 53). Remove the four screws from the cover and remove the cover. Take out the four screws securing the terminal box to the generator frame and remove the box.

b. Remove Generator End Plate Bearing Cap (C, fig. 53). Take out the three screws which hold the cap to the generator end plate and remove the cap and gasket.

c. Remove Drive Quill from Armature Shaft (UU, fig. 53). Remove the cotter pin and unscrew the nut from the end of the quill and withdraw the quill from the armature shaft.

d. Remove Bracket from the Generator Frame. Loosen the cover screw and remove the cover (AC, fig. 53) from the mounting end plate. Remove the three screws from the grease retainer and remove the retainer, seal and washer (SS, TT, and YY, fig. 53). Bend back the tabs on the lock washer and remove the nut from the armature shaft. Scribe a locating mark on the mounting end plate and generator frame with a sharp tool so the mounting end plate will be assembled to the frame in proper relation to each other. Take out the 12 screws from the mounting end plate and remove the mounting end plate from the frame. If the armature comes out with the bracket, the bracket can be removed from the armature shaft by tapping it lightly, using a brass drift. Take out the three screws from the inside grease retainer and remove the retainer, felt seal and washer. Remove the bearing from the mounting end plate. Pull the fan from the armature shaft.

e. Remove Brush Assembly End Plate (J, fig. 53). Loosen the screw and remove the cover (F, fig. 53) from the generator frame. Disconnect the field wire from the ground brush. Disconnect the armature connecting strap from positive brush. Take out the eight screws from the brush assembly end plate and remove the brush assembly end plate from the frame. Take out three screws from the grease retainer and remove the retainer, felt seal and plate (S, R, and Q, fig. 53) from the brush assembly end plate. Remove the bearing from the brush assembly end plate.

f. Remove Brushes and Spring from Brush Assembly End Plate. Disconnect the brush leads from the brush holders and remove the brushes. To remove the spring from the brush holders, use a small screwdriver and snap the springs off the notch on the support post.

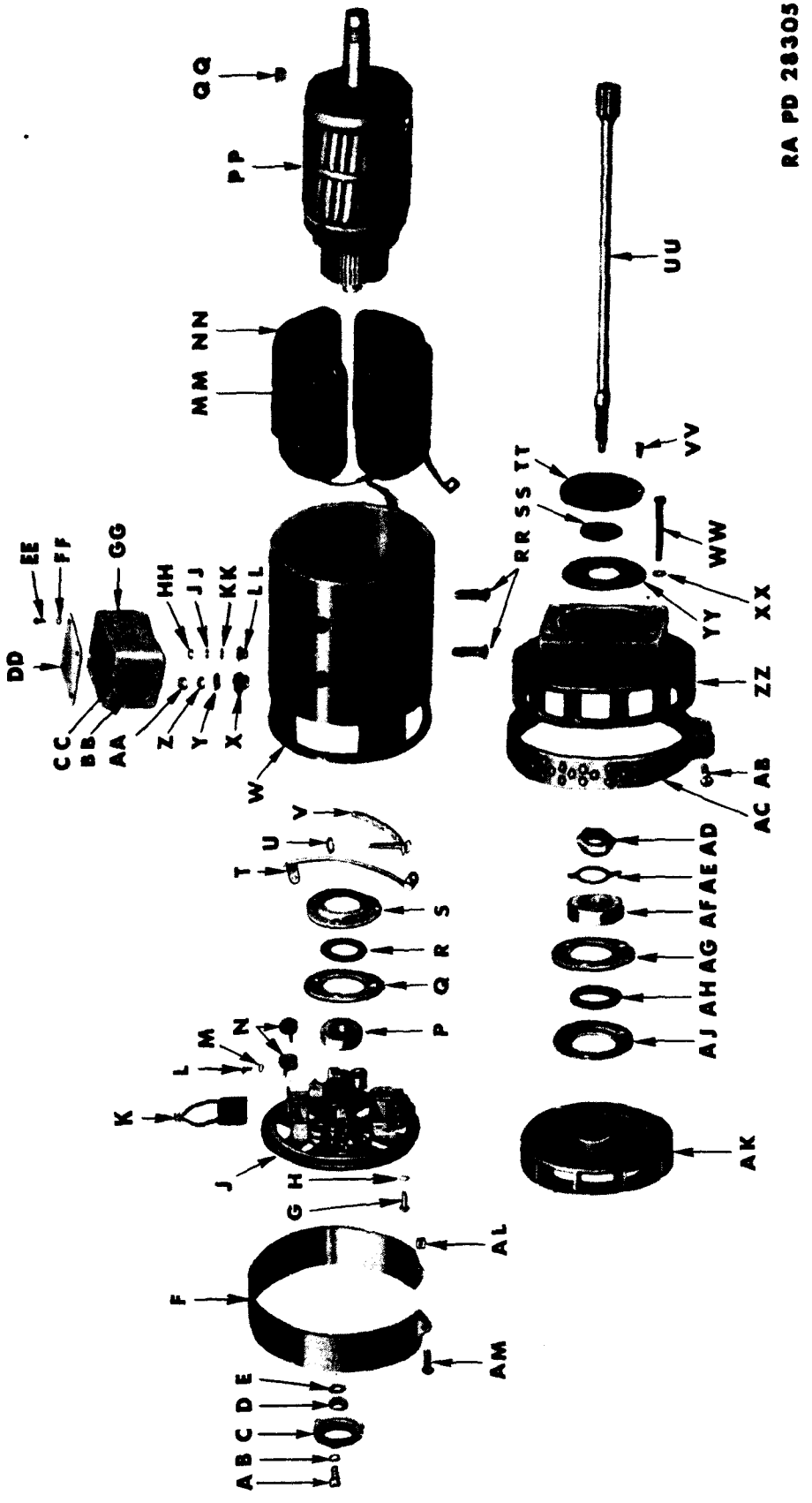

Figure 53—Generator Disassembled

A—SCREW
B—LOCK WASHER
C—END PLATE BEARING CAP
D—NUT
E—WASHER
F—COVER
G—SCREW
H—LOCK WASHER
J—END PLATE ASSEMBLY
K—BRUSH
L—SCREW
M—LOCK WASHER
N—SPRING
P—BEARING
Q—RETAINER PLATE
R—SEAL
S—RETAINER
T—CONNECTOR
U—WASHER
V—TERMINAL CONNECTOR
W—GENERATOR FRAME
X—INSULATOR BUSHING
Y—WASHER
Z—NUT
AA—NUT
BB—BUSHING
CC—LOCK NUT
DD—TERMINAL BOX COVER
EE—SCREW
FF—WASHER
GG—TERMINAL BOX
HH—NUT
JJ—WASHER
KK—WASHER
LL—INSULATOR
MM—FIELD POLES
NN—FIELD COILS
PP—ARMATURE
QQ—WOODRUFF KEY
RR—SCREWS
SS—SEAL
TT—RETAINER
UU—QUILL
VV—SCREW
WW—BOLT
XX—WASHER
YY—RETAINER PLATE
ZZ—MOUNTING END PLATE
AB—SCREW
AC—VENTILATING COVER
AD—NUT
AE—LOCK WASHER
AF—BEARING
AG—PLATE
AH—SEAL
AJ—RETAINER
AK—FAN
AL—NUT
AM—SCREW

RA PD 28305-B

Figure 53A—Legend for Figure 53

109. CLEANING.

a. Clean all metal parts, using dry-cleaning solvent. Dry with compressed air. Insulated parts must not be allowed to soak in the dry-cleaning solvent.

110. INSPECTION AND REPAIRS.

a. **Inspection of Parts.** Inspect all metal parts for cracks. Inspect all insulated parts such as washers, brushes, wire and coil insulation for wear, breaks or evidence of overheating. All worn or damaged parts must be discarded.

b. **Test Armature for Ground.** Using a 250-volt test lamp, place one prod on the armature core and the other prod on the commutator. If the test lamp lights, the armature is grounded and must be discarded. If the test lamp does not light, proceed with the next test.

c. **Test Armature for Short Circuit.** Place the armature on a growler and with a hacksaw blade over the core, rotate the armature and test. If the saw blade does not vibrate, the armature is satisfactory. If the saw blade vibrates, the armature is short-circuited and must be discarded.

d. **Inspect Commutator.** Inspect the commutator for burnt or rough segments. If the segments are burnt, the coil leads may be loose in the commutator segments and require resoldering (par. 110 e). Burnt or rough commutators must be turned down (par. 110 e (2)).

e. **Repair Commutator.**

(1) SOLDER COIL LEADS TO COMMUTATOR. Solder all loose coil leads at the commutator segments, using a resin flux. Never use an acid when soldering electrical connections. Recheck the armature (par. 110 b and c). If the armature is grounded, solder may be shorting the commutator segments. Clean the segments and retest.

(2) TURN DOWN COMMUTATOR. Turn the commutator down in a lathe until the segments are cleaned up and free of score marks. Undercut the mica one thirty-second of an inch. Polish the commutator.

f. **Check Brush Holder for Ground.** Using a 250-volt test lamp, place one prod on the positive brush holders and the other prod on the mounting plate. If the test lamp lights, the brush holder is grounded and the assembly must be discarded. If the test lamp does not light, the brush holder is satisfactory for further use.

g. **Check Ball Bearings.** Immerse the ball bearings in a container of dry-cleaning solvent, rotate the bearings until all trace of old lubricant is removed. Inspect the bearings for cracks, pits, discoloration and looseness in the races. If any of these conditions exist, discard the bearing. If the bearings are in good condition, repack with ball and roller bearing grease.

h. Test Field Coil for Continuity of Circuit. Using a test lamp, equipped with its own battery, place a prod on each of the field coil leads. If the test lamp lights, the continuity of the circuit is satisfactory. If the test lamp does not light, the field circuit is open and the field coil must be replaced (par. 110 k).

i. Test Field Coil for Ground. Using a 250-volt test lamp, place one test prod on the generator frame, and place the other test prod on the field terminal. If the test lamp does not light, the field coils are satisfactory. If the test lamp lights, the field coils are grounded. Replace the field coils (par. 110 k).

j. Field Coil Balancing Test. Connect an ammeter and a battery in series with each of the four field coil sections in turn and compare the current for each. If one coil has more current draw than the other coils, it must be replaced (par. 110 k). If the current draw is equal, the field coils are satisfactory for further use.

k. Field Coil Replacement. Disconnect the field coil leads. Remove the eight screws (fig. 53) that secure the field poles (MM, fig. 53) and field coils (NN, fig. 53) to the frame. Remove the field poles and coils from the frame. To install, insert the field coil and field poles in the generator frame and secure the coils to the frame with screws (RR, fig. 53). Attach the field leads to the terminals.

111. ASSEMBLY.

a. Assemble Mounting End Plate. Insert the ball bearing into the mounting plate (ZZ, fig. 53). Install the bearing seal and retainer plate to the mounting end plate and secure with three screws and lock washers. Lock the screws with wire. Install the fan on the armature shaft with key (QQ, fig. 53) in place. Assemble the mounting end plate on the armature shaft. Place flat lock washer and nut on the armature shaft and tighten the nut (AD, fig. 53). Lock the nut by bending the lock washer tabs against the nut. Install the mounting end plate on the generator frame. Line up the marks inscribed on the frame and end plate. Use care when inserting the armature through the frame so as not to damage the field coils. Secure the mounting end plate to the frame with 12 cap screws and lock washers. Lock the screws with wire.

b. Assemble Brush Assembly End Plate (J, fig. 53). Insert the ball bearing (P, fig. 53) in the brush assembly plate. Install the washer, felt seal and retainer and fasten with three screws with lock washers. Lock the screw heads with wire. Install the brush springs on the brush assembly end plate. Attach the brush assembly end plate to the generator frame with eight screws and lock washers. Lock the screws with wire.

c. Install Generator Drive Quill in Armature Shaft. Insert the drive quill (UU, fig. 53) through the armature shaft, and secure the quill to the shaft with a flat washer and castellated nut (D and E, fig. 53). Lock the

nut with a cotter pin. Attach the end plate bearing cap and gasket (C, fig. 53) to the end plate with three screws and lock washers. Lock the screws with wire.

d. Install Brushes in Brush Holder. Lift the brush springs and insert the brushes in the brush holders. Attach the brush leads to the brush holder brackets. Connect the two brushes which are insulated from the end plate with the connector wire (T, fig. 53). Attach the positive lead to the positive brush.

e. Install Covers (AC and F, fig. 53). Install the ventilating cover (AC, fig. 53) on the mounting end of the generator. Install the plain cover (F, fig. 53) on the commutator end of the generator.

f. Install Generator Terminal Box. Place the terminal box on the generator frame, and attach with four screws and lock washers. Attach the cover to the terminal box, and secure with four screws and lock washers.

112. TEST.

a. Install the generator on a test stand and test the generator as outlined in paragraph 107 d.

113. INSTALLATION.

a. To install the generator in the vehicle, refer to pertinent operator's manual.

CHAPTER 6

GENERATING SYSTEM (Cont'd)

Section IV

GENERATOR REGULATOR

114. GENERAL DESCRIPTION.

a. Auto-lite model VAD generator regulators have three units each with a separate function to perform. The cut-out unit prevents the battery from discharging through the generator when the generator is at rest or when it is not developing normal voltage. The voltage regulator unit maintains the output on the generator at a constant predetermined voltage. The current limitator unit limits the maximum current output of the generator.

115. CUT-OUT DESCRIPTION AND OPERATION.

a. The cut-out automatically closes (at 25.7 to 26.7 volts) and opens (at 15 to 22 amps. reverse current) the circuit between the generator and the battery. The two sets of contacts operate simultaneously and are connected in parallel to reduce voltage loss. They are mounted with the lower contact of each pair on a stationary bracket and the upper contacts on a movable armature, controlled by the electromagnet. The contacts are mounted on spring arms. As the contacts open and close, a slight wiping action between the contact points is produced. The electromagnet of the cut-out has two windings, one the shunt coil (fine wire) which is connected across the generator output (armature lead to ground like a voltmeter), and the other a series coil (heavy wire) connected in series in the generator to battery circuit (like an ammeter). These two coils

are wound in the same direction so that when the generator is charging the battery, the magnetism of the series coil increases the total magnetism. When the battery discharges back through the generator, the magnetism of the series coil is reversed and the magnetism of the two coils is opposed. This results in a decreased pull on the armature and spring action opens the contact points.

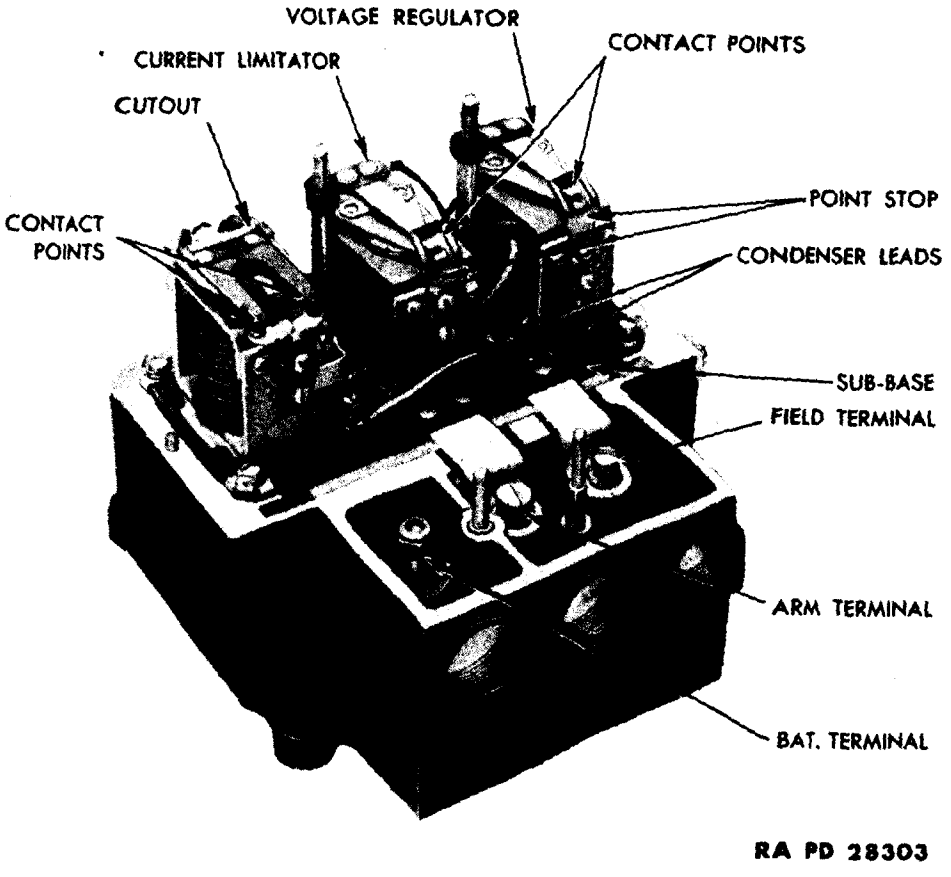

Figure 54—Generator Regulator, Three-quarter Front View

116. VOLTAGE REGULATOR DESCRIPTION AND OPERATION.

a. Function. The functions of the voltage regulators are to limit the voltage at which the generators will be operated to a predetermined voltage, and to vary the charging rate in proportion to the load on the electrical system or to the condition of the batteries.

b. Electromagnet. The electromagnet of the voltage regulator unit has a winding of many turns of fine wire. This unit is connected across the charging circuit so that the system voltage controls the amount of magnetism. A second winding, connected in the generator field circuit, acts as a radio frequency choke coil. The winding also minimizes the out-

GENERATOR REGULATOR

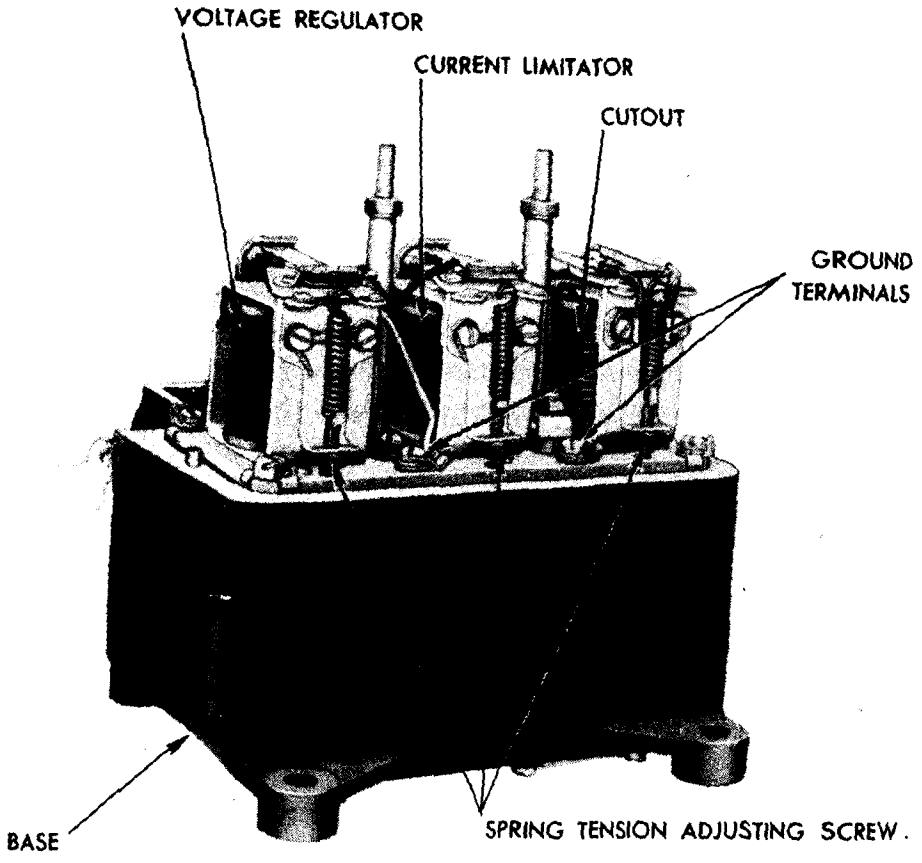

Figure 55—Generator Regulator, Rear View

put fluctuations by accelerating the action of the voltage regulator armature.

c. Opening and Closing of Contact Points. The contact points of the voltage regulator unit are connected in the generator field circuit so that the field circuit is completed through the contact points when they are closed, and through a combination of resistors when the contact points are opened. When the voltage rises to a predetermined value, there is sufficient magnetism created by the regulator winding to pull the armature down. This opens the contact points and inserts resistance in the field circuit of the generator, thus reducing the field current. The generated voltage immediately drops, which reduces the pull on the armature to the point where the spring closes the contact points. The output again rises and the cycle is repeated.

d. Frequency Winding. The frequency winding on the voltage regulators is connected in the field circuit so that the reduction of the field current directly affects the pull on the regulator armature. This direct effect is in addition to the effect of the lowered output causing the cycles to occur in higher frequencies. These cycles occur at high enough fre-

quencies to hold the generated voltage at a constant value and will continue as long as the voltage of the circuit is high enough to keep the voltage regulator unit in operation.

e. **Action with Increased Load.** With the addition of a current load great enough to lower the battery voltage below the operating voltage of the unit, the contact points will remain closed and the generator will maintain a charging rate as limited by its speed or the current limitator.

f. **Temperature Compensation.** Due to the effect of heat on the operating characteristics of regulator windings, it is necessary to compensate for the changes in coil resistance when the regulator is operating under varying temperature conditions. This is accomplished through the use of a nickel iron magnetic bypass on the voltage regulator unit. This shunt bypasses some of the magnetic flux when the unit is cold and allows most of the flux to act on the armature when the unit is hot. The magnetic shunt bypasses less of the flux at the higher temperatures which increases the flux through the armature and causes more vigorous vibration. The compensation is usually more than enough to offset the changes in regulator coil resistance due to heat. The excess compensation allows the regulator to operate at higher voltages under cold operating conditions than under hot conditions. This is necessary, as it requires a higher voltage to charge a battery with its internal resistance increased by low temperatures.

117. CURRENT LIMITATOR DESCRIPTION AND OPERATION.

a. **Function.** The function of the current limitator is to limit the output of the generator to its maximum safe output.

b. **Operation.** The electromagnet of the current limitator unit consists of a winding of heavy wire connected in series with the generator output. When the generator output reaches a predetermined value, the current in the winding produces enough magnetism to overcome the spring tension and pull the armature down. This opens the contact points and inserts resistance in the field circuit of the generator. With the field current reduced by the resistance, the generator output falls and there is no longer enough magnetism to hold the contacts open. As soon as the spring closes the contact points, the output rises and the cycle is repeated. These cycles occur at high enough frequencies to limit the output to a minimum fluctuation.

118. REMOVAL FROM VEHICLE.

a. To remove the generator regulators from the vehicle, refer to the pertinent operator's manual.

GENERATOR REGULATOR

119. ADJUSTMENT.

a. Equipment. Generator regulator adjustments are made either in the vehicle or on a test bench, equipped with all of the units of the entire generating system plus a means of providing an electrical load.

b. Preliminary Visual Inspection. Before making any of the following tests or adjustments, make a close visual inspection of the regulator with special emphasis being paid to the following points:

(1) Broken regulator seal.

(2) Evidence of burning or abnormal high temperature at the coils, contacts, insulation, contact springs, external terminals, or any other point. Use a magnifying glass in making this inspection.

(3) Loose connections which result from poor soldering.

(4) Loose nuts on bottom of the magnet cores, loose rivets or screws. All nuts and screws must have lock washers.

(5) Loose contacts.

(6) Misalinement of contacts.

(7) Armature stops rubbing against, or interfering with, the circuit breaker armature.

(8) Bent armature either at the contact or hinge end. The armature must be perfectly straight from one end to the other.

(9) Field yoke bent.

(10) Bent or distorted armature hinges.

(11) Reversed bi-metal hinges on the circuit breaker unit. When correctly installed, the brass side must be up.

(12) Stripped or crossed threads on any screw or nut.

(13) Corrosion due to salt or acid.

(14) Evidence of water having been inside of cover.

(15) Incorrect, bent, or distorted armature springs. In case of doubt, it is recommended that the spring be replaced.

(16) Broken or altered carbon resistors.

(17) Broken gaskets.

(18) Incorrect wiring connections between units.

c. Cut-out Adjustment.

(1) PRELIMINARY. Disconnect the battery lead from the regulator battery terminal. Connect a reliable ammeter in series with the regulator battery terminal (fig. 54) and the lead just removed from the terminal. Connect an accurate voltmeter from the regulator "ARM" terminal (fig. 54) to the regulator ground screw. Hang a reliable thermometer about 2 inches from the regulator cover but not touching the regulator. Disconnect the field lead from the regulator "FIELD" terminal, (fig. 54) and

insert a variable resistance (3 amp. to 50 ohm capacity) between the lead and the regulator terminal.

(2) ADJUST CUT-OUT CLOSING. Run the generator at about 2000 generator revolutions per minute. Insert all the resistance of the variable resistance in the field circuit; then slowly reduce the resistance, noting the voltage reading just before the change caused by the closing of the cut-out points. The reading should be 25.7 to 26.7 volts. If the reading is above 26.7 volts, turn the spring tension adjusting screw (fig. 55) counterclockwise to decrease the voltage. If the reading is below 25.7 volts, turn the nut clockwise to increase the voltage.

(3) ADJUST CUT-OUT OPENING. Run the generator to charge 25 amperes, then reduce the charging rate by inserting resistance in the field circuit. Note the amperage reading just before the cut-out points open and the ammeter drops to zero. The points should open at between 15.0 to 22.0 amperes discharge. If the reading is above 22 amperes discharge, lower the stationary points, keeping the points perfectly alined. If the reading is below 15 amperes discharge, raise the stationary points to increase the amperage. Do not adjust the gap between the points to less than 0.025 inch. Disconnect the voltmeter, ammeter, and resistance, and connect the generator regulator leads.

d. Voltage Regulator Adjustment.

(1) PRELIMINARY. Disconnect the battery lead from the regulator battery terminal. Connect the ammeter in series with the regulator battery terminal and battery lead. Connect the voltmeter between the regulator battery terminal and the regulator ground screw.

(2) CHECK OPERATING VOLTAGE. Run the generator at a 25-ampere output until normal operating temperature is reached. The cover must be on the unit during the warm-up. Increase the generator speed to approximately 3000 revolutions per minute. Adjust the current to 25 amperes by introducing a load in the circuit and note the voltmeter reading. The reading should be between 28.5 and 28.9 at 70°F ambient. If the reading is above or below these limits, adjust the voltage regulator unit (step (3) below).

(3) ADJUST OPERATING VOLTAGE. Replace the voltage regulator unit (par. 122) if the points are not flat, if they are burned excessively, or if they are not alined to make a full-faced contact. Clean the contact points (par. 103 **h**). Tighten the adjusting screw (fig. 55) to increase the voltage. Loosen the adjusting nut to decrease the voltage. To test the adjustment, place the cover on the unit and run the generator at approximately 3000 revolutions per minute. Readjust until the correct voltage is obtained, stopping and restarting the generator, and having the regulator cover in place while taking each reading.

(4) TEST WITH HEADPHONE. Connect a headphone (2,000 ohms or higher) between the "FIELD" terminal and ground to pick up the sound of the opening and closing of the points. The clicks should be regular and clear. If the tone is not regular and clear, replace the voltage regulator unit (par. 122).

e. Current Limitator Adjustment.

(1) ADJUST OPERATING AMPERAGE. Replace the current limitator unit (par. 123) if the points are burned excessively, are not flat, or if they are not alined to make a full-face contact. Clean the points (par. 103 h). Connect the regulator and instruments as outlined in paragraph 119 d (1). Run the generator at approximately 3000 revolutions per minute. Introduce a load in the circuit, so that the generator will be charging at the maximum rate. If the ammeter reading is not between 50 and 53 amperes, adjust the current limitator. Tighten the adjusting screw (fig. 55) to increase the amperage, and loosen the adjusting nut to decrease the amperage. To test the adjustment, place the cover on the unit and run the generator at approximately 3000 revolutions per minute. Readjust until the correct amperage is obtained, stopping and restarting the generator. Have the regulator cover in place while taking each reading.

(2) TEST WITH HEADPHONE. Connect a headphone (2000 ohms or higher) between the regulator field terminal and ground to pick up the sound of the opening and closing of the points. The clicks should be clear and regular. If the clicks are not clear and regular, replace the current limitator unit (par. 123).

120. INSPECTION AND REPAIRS IF REGULATOR CANNOT BE ADJUSTED.

a. General. Remove the terminal cover, regulator cover, and bottom plate from the unit. Disconnect the lead from the "IN" terminal of the filter and also the two condenser leads (fig. 54) where they are fastened to the current and voltage regulator yokes. Remove the six screws holding the sub base to the casting, and lift off the sub base.

b. Resistance Tests.

(1) TEST RESISTORS. Remove the resistors (fig. 62), one at a time, and check them with an ohmmeter. Replace any that are cracked, or that are not within the following limits:

R1 (carbon type) marked 100, resistance 95 to 105 ohms.

R2 (carbon type) marked 70, resistance 68 to 72 ohms.

R3 (wire type) marked 135, resistance 130 to 140 ohms.

R4 (radio type) resistance 100 ohms.

Make sure the resistors are correctly reinstalled. Any interchanging would make the regulator inoperative.

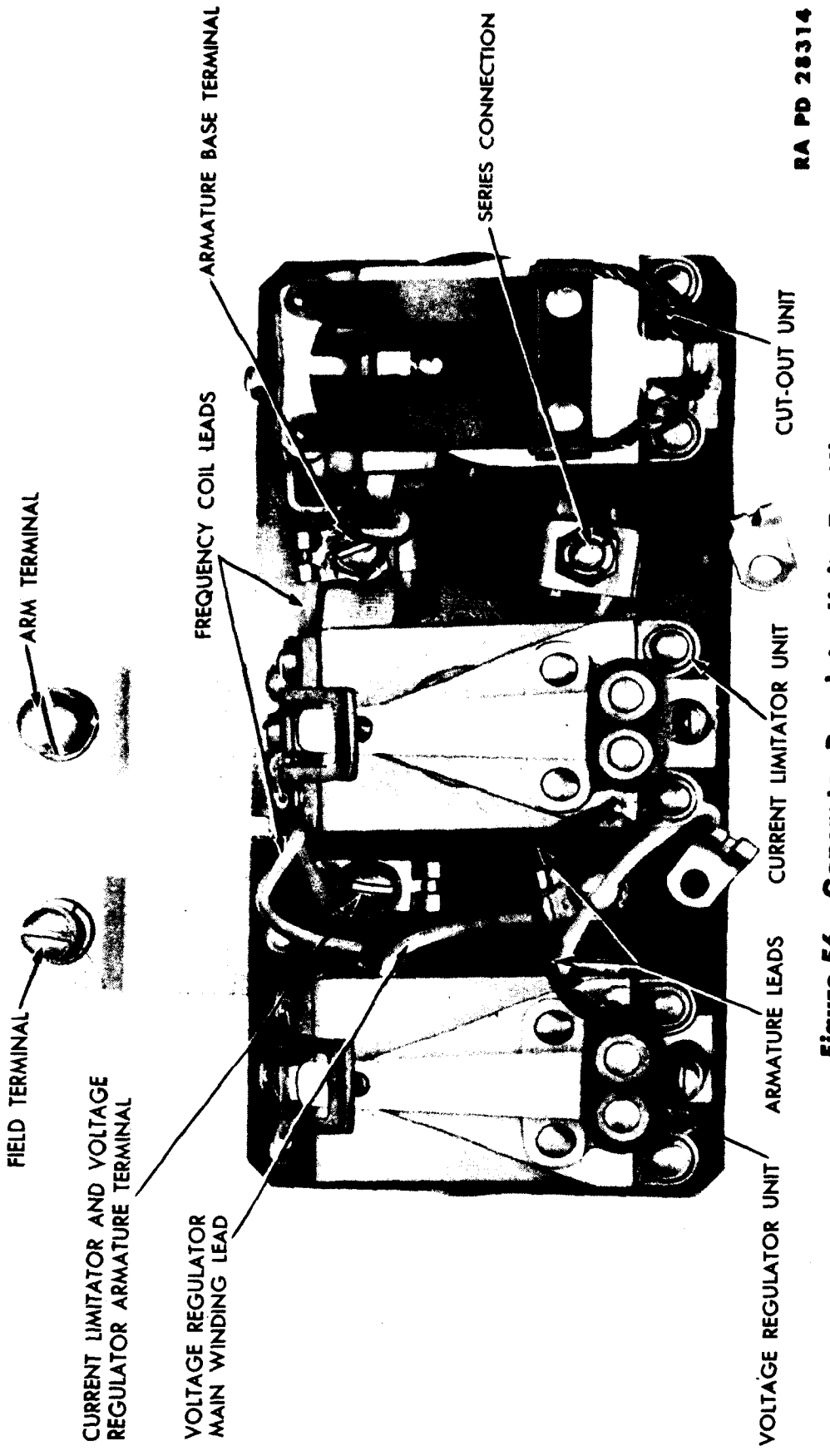

Figure 56—Generator Regulator Units, Top View

(2) TEST CUT-OUT SHUNT COIL. Using an ohmmeter, measure the resistance from the shunt coil terminal to the stationary point. This terminal was grounded to the base by the sub base mounting screw. This is located between the circuit breaker and current regulator unit. If the resistance is more than 360 ohms or less than 320 ohms, replace the cut-out unit (par. 121).

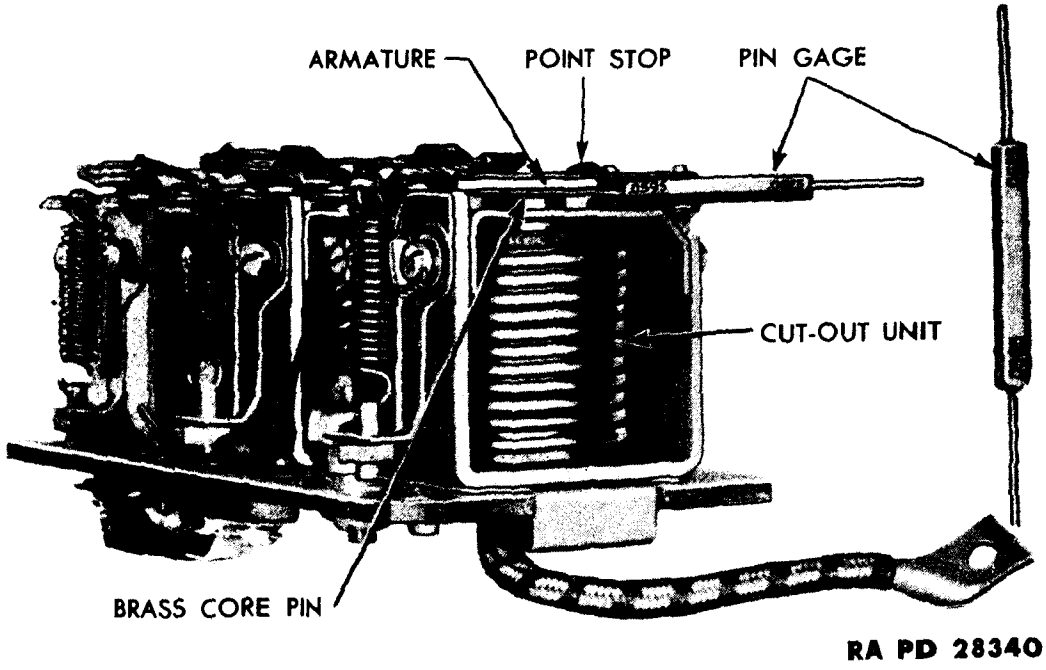

Figure 57—Measuring Cut-out Air Gap

(3) TEST VOLTAGE REGULATOR COIL. Unscrew the two coil leads from the sub base (fig. 56). Using an ohmmeter, measure the resistance between the leads. Replace the voltage regulator unit if the resistance is not between 63.6 and 70.4 ohms. Make sure the leads are reconnected exactly as they were. Interchanged leads would reverse the polarity of the windings and make the unit inoperative.

(4) TEST VOLTAGE REGULATOR FREQUENCY WINDING. Disconnect the lead where it is fastened to the armature terminal through the base (fig. 56). Using an ohmmeter, measure the resistance from this lead to the current limitator yoke. If the resistance is not betweeen 0.065 and 0.071 ohms, replace the voltage regulator unit (par. 122).

c. **Condenser Tests.** Remove the condensers, one at a time. Using a condenser tester, check for capacity and shorts. Replace if shorted or

if the capacity of the C1 (automotive type) is not from 0.15 to 0.19 microfarad or if the C2 (radio type) is not 0.006 microfarad.

d. Test Voltage Regulator Point Pressure. Connect a battery and a lamp bulb in series with the regulator "ARM" and "FIELD" terminals. Remove the adjusting screw from the armature spring (fig. 55), and take off the adjustable point stop (fig. 54). Hold the armature firm, and using a spring scale, hook the upper points and pull the points apart. Take the

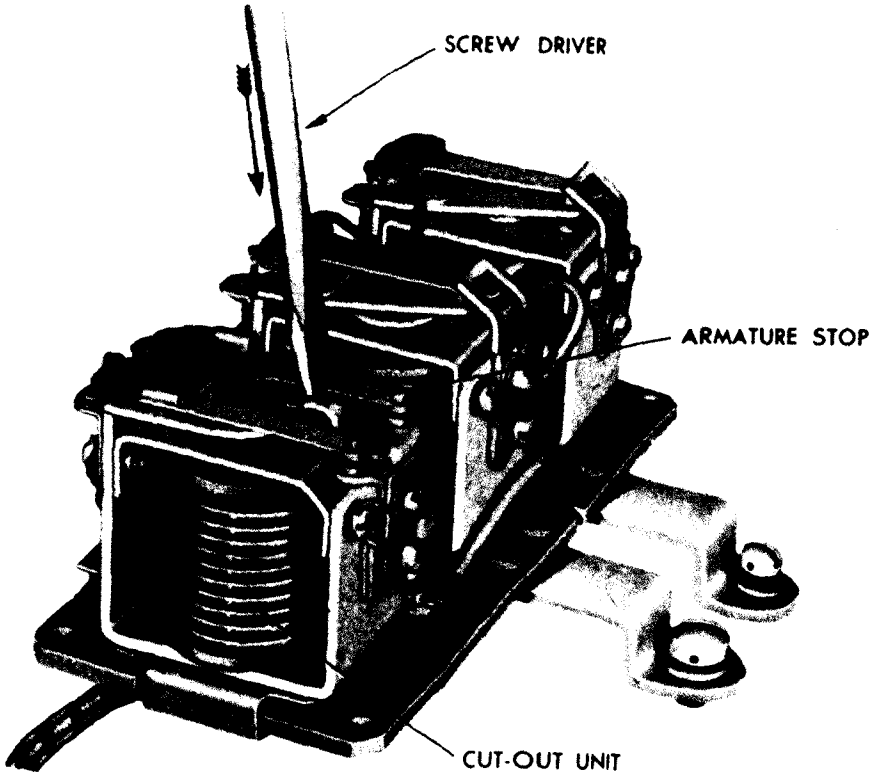

Figure 58—Decreasing Cut-out Air Gap

reading just as the contacts separate as indicated by the light going out. If the tension is not between 7 and 8 ounces, replace the regulator armature. When reassembling the armature stop, make sure the fiber bumper block is in place.

e. Test Current Limitator Point Pressure. Follow the same procedure for the voltage regulator (par. 120 d), making sure the springs are not interchanged.

f. Check and Adjust Cut-out Air Gap. Use a 0.0595-inch to 0.0625-inch pin gage inserted between the armature and core (fig. 57) next to and

on the contact side of the brass pin in the core. Adjust by bending the armature stop (figs. 58 and 59), making sure the stop does not interfere with the armature movement.

g. Check and Adjust Voltage Regulator Air Gap. To indicate when the contacts are closed or open, connect a test light in series with the "FIELD" terminal, "ARM" terminal, and a battery. The light will burn

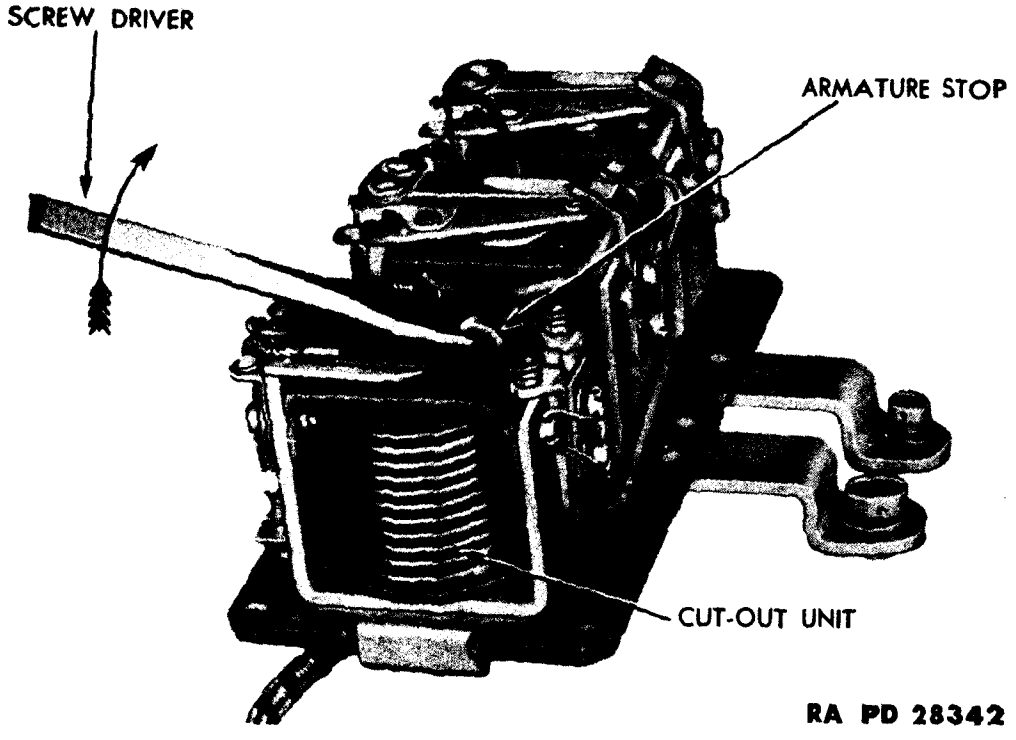

Figure 59—Increasing Cut-out Air Gap

brightly when the contacts are closed and will go out or dim when open. Use a 0.040-inch to 0.042-inch pin gage inserted on the contact side and next to the brass pin in the core (fig. 60). The contacts must be closed when the high limit gage is in place, and open when the low limit gage is in place. Apply pressure near the center of the armature when measuring the air gap, being careful that the contact spring is not touched. Adjust the gap by raising or lowering the contact spring stop.

h. Check and Adjust Current Limitator Air Gap. Follow the same procedure as for the voltage regulator (par. 120 g), using a 0.047-inch to 0.049-inch pin gage (fig. 61).

i. Check Voltage Regulator Armature Stop. Hold the armature against the core stop pin. Using a feeler gage, measure the gap between

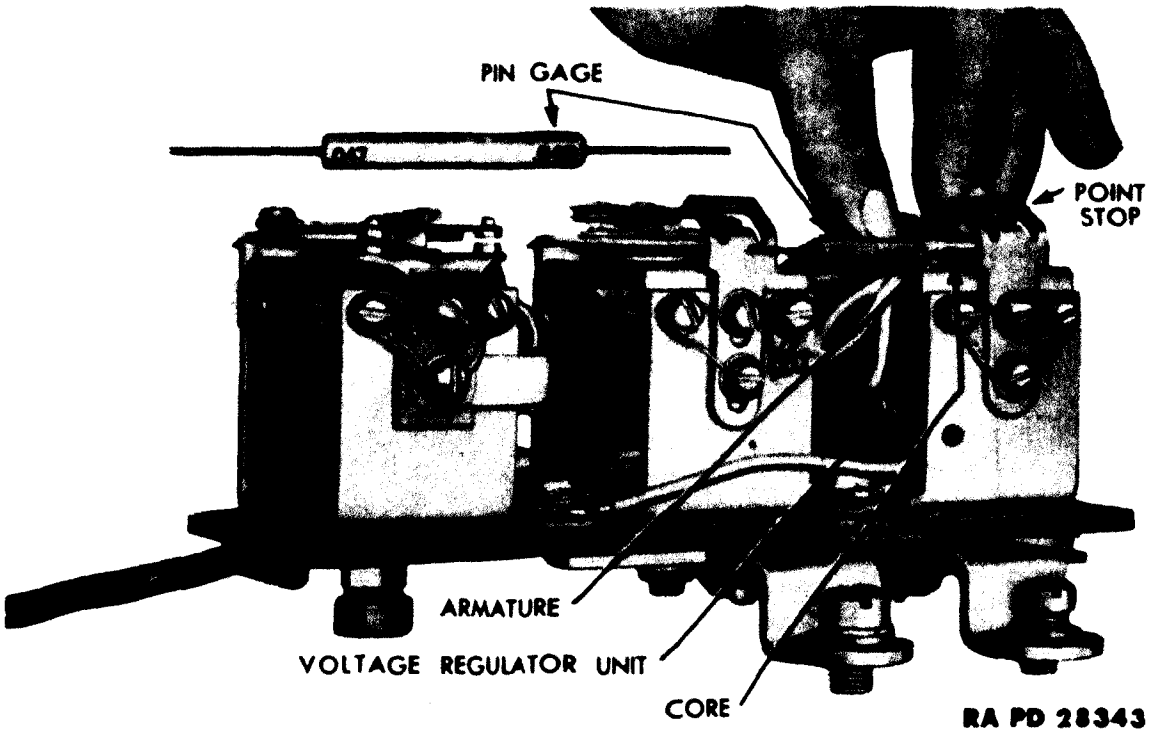

Figure 60—Measuring Voltage Regulator Air Gap

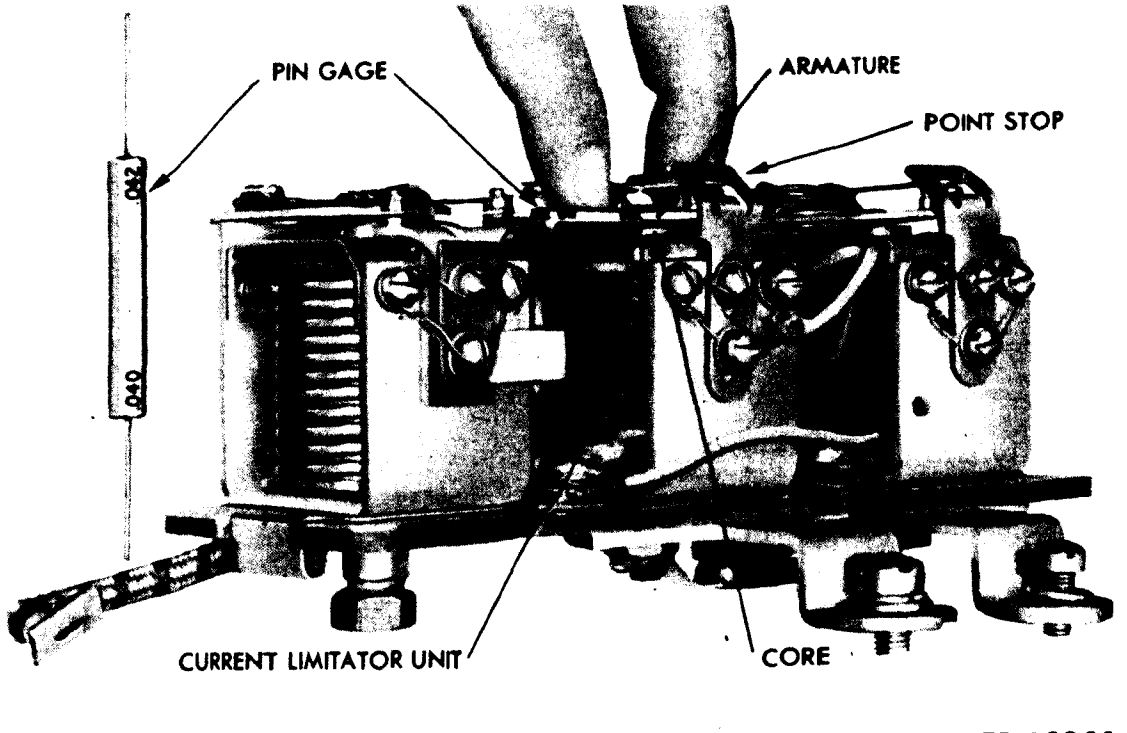

Figure 61—Measuring Current Limitator Air Gap

the upper contact spring and the armature stop. If the gap is less than 0.010-inch or more than 0.016-inch, inspect the bumper block for damage or for improper assembly. Inspect the armature stop for distortion or incorrect adjustment. If the bumper block is damaged, replace the unit (par. 122).

j. Check Current Regulator Armature Stop. Follow the same procedure as for the voltage regulator (par. 120 i).

k. Check Cut-out Point Gap. With spring tension on the armature, and with the armature against the stop, measure the gap between the

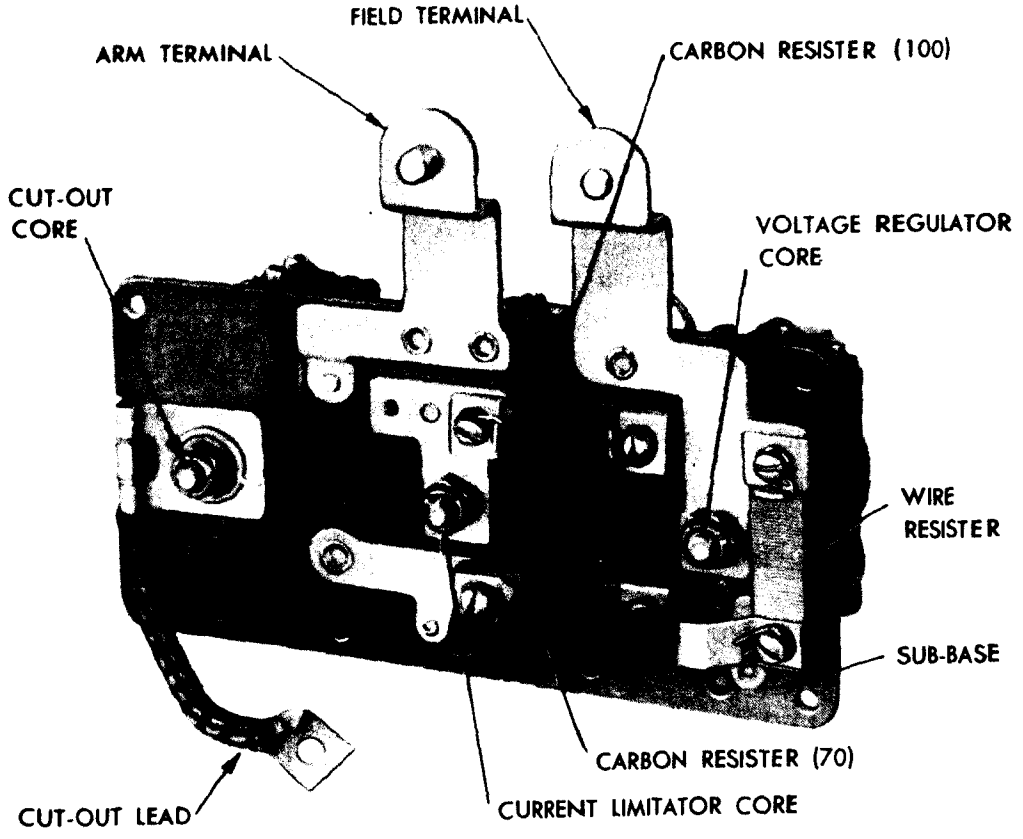

Figure 62—Generator Regulator Sub-base Bottom View

points with a flat feeler gage. This gap should be 0.025-inch minimum but may be larger than this after completing the adjustment of the circuit breaker opening amperage. Adjust the contacts so that both sets make and break contact at the same instant.

121. CUT-OUT UNIT REPLACEMENT.

a. Remove the nut and clamp on the series connection between the cut-out and the current limitator (fig. 56). Remove the nut, washer, and lead, from the cut-out core (fig. 62), and lift the unit off the base. To install,

place the unit on the base and assemble the lead, washer and nut on the core (fig. 62). Make sure the alining lug enters the hole in the base and tighten the nut on the core. Assemble the clamp, lock washer, and nut, on the series connection (fig. 56) and tighten the nut. Tighten the screws and lock with wire.

122. VOLTAGE REGULATOR UNIT REPLACEMENT.

a. Removal. Disconnect the main winding lead at the base (fig. 56). Disconnect the frequency coil leads connected to the current limitator yoke and coil winding. Remove the screw which connects the leads from the current limitator and voltage regulator armature. Remove the core nut (fig. 62) from the underside of the base, and lift off the unit.

b. Installation. Assemble the voltage regulator unit on the base, and install the core nut (fig. 62). The lug on the regulator unit must enter the base. Tighten the nut. When installing a new unit, solder a new contact lead to the contact spring. Connect the inside main winding lead at the base (fig. 56) and the outside main winding lead (fig. 56) to the ground at the base mounting screw. Connect the frequency coil leads to the regulator yoke and the "ARM" terminal (fig. 56) through the base. Connect the contact spring leads to the base between the regulator unit (fig. 56). Tighten screws and lock with wire.

123. CURRENT LIMITATOR UNIT REPLACEMENT.

a. Disconnect the two series coil leads (fig. 56) and the voltage regulator frequency coil lead at the current limitator yoke. Remove the resister screws (fig. 62) and remove the resister. Remove the core nut (fig. 62) and lift off the unit. To install, assemble the current regulator unit to the base, and install core nut. Make sure the lugs on the yoke and connector enter the holes in the base. Tighten the core nut. Install the resistor (fig. 62). Connect the two series coil leads and also the frequency coil lead (fig. 56). Tighten screws and lock with wire.

124. ASSEMBLE BASE.

a. Install the base attaching screws, and connect the two ground leads from the circuit breaker and voltage regulator units. Tighten and lock wire all six screws. Connect the lead from the automotive type condenser to the current limitator yoke (fig. 54). Also connect the lead from the radio type condenser to the voltage regulator yoke (fig. 54). Connect the lead from the circuit breaker yoke to the IN terminal of the filter. Assemble the bottom plate on the regulator. Lock wire the cover and lead screws. After the regulator is completely reassembled, its base should be struck sharply on the bench several times to be sure all parts are settled in place. Be sure to strike the base equally and do not damage the mounting lugs.

GENERATOR REGULATOR

125. TEST.

a. Test the generator regulator as outlined in paragraph 120 b.

126. INSTALLATION.

a. Install Regulator. Place the generator regulator in the vehicle and secure with four screws. Connect the generator field wire to the regulator "FIELD" terminal and the generator armature wire to the regulator "ARM" terminal. Connect the battery lead wire to the regulator "BAT" terminal. Connect the wire conduits to the regulator terminal box and install the terminal box cover.

b. Polarization. After the regulator is connected to the generator and battery, and before any runs are made, the generator should be polarized with the battery. Make a momentary connection with a jumper from the battery terminal to the generator "ARM" terminal. If the generator is not polarized after having been disconnected, it may cause the cut-out armature to vibrate and burn the points.

CHAPTER 7

SPECIAL TOOLS

Section I

SPECIAL OVERHAUL TOOLS FOR ENGINE ACCESSORIES

127. SPECIAL OVERHAUL TOOLS FOR ENGINE ACCESSORIES.

a. Listed below are the special tools used in the overhaul of this materiel.

Name	Manufacturer's Symbol and Tool Number	Federal Stock Number	LOCATION		
			3rd Echelon Set for Light, Medium and Heavy Maint. Companies or Post Shops	4th Echelon Set for Heavy Maint. Co. and Ordnance Service Command Shops	5th Echelon Base Shop Set
Holder, magneto drive flange	KRW-T-31	41-H-3350	1	1	1
Puller, bearing race (inner) magneto	TSE-5265	41-P-2905-20	—	1	1
Puller, bearing race (outer) magneto	TSE-76101	41-P-2905-21	—	1	1
Puller, camshaft, drive shaft	KRW-T-7	41-P-2905-75	1	1	1
Puller, gear and coupling, magneto	ST-425-1	41-P-2918	—	1	1
Puller, magneto bracket bearing	KRW-T-43	41-P-2941-750	1	1	1
Replacer, bearing race (outer) magneto	TSE-5269	41-R-2386-705	—	1	1
Replacer, drive seal blower bearing retainer	KRW-T-33	41-R-2392-81	1	1	1
Replacer, gear box, adapter cover, seal	KRW-T-41	41-R-2393-660	1	1	1
Replacer, oil seal, magneto	TSE-527	41-R-2392-980	—	1	1
Replacer, pinion and bearing in fan and generator drive case	KRW-T-48	41-R-2395-30	—	1	1
Wrench, float seat	BS-T-19276	41-W-1400	1	1	1
Wrench, spanner carburetor piston nut	KRW-T-60	41-W-3255-505	1	1	1
Wrench, 3/8 in. socket by-pass jet	BS-T-20138	41-W-677	1	1	1

REFERENCES

STANDARD NOMENCLATURE LISTS.

Tank, medium, M4A3 (Ford) ..... SNL G-104
Carriage, 3-in. gun, motor, M10A1 (Tank, medium, M4A3, chassis) (Ford) ..... SNL G-170
Cleaning, preserving and lubrication materials, recoil fluids, special oils, and miscellaneous related items ... SNL K-1
Soldering, brazing, and welding materials, gases, and related items ..... SNL K-2
Tools, maintenance for repair of automotive vehicles .. SNL G-27
Tool sets—motor transport ..... SNL N-19
Tool sets for ordnance service command, automotive shops ..... SNL N-30
Current Standard Nomenclature Lists are listed above. An up-to-date list of SNL's is maintained as the "Ordnance Publications for Supply Index" ..... OPSI

EXPLANATORY PUBLICATIONS.

Military motor vehicles ..... AR 850
List of publications for training ..... FM 21-6

Related Technical Manuals.

Medium Tank M4A3 ..... TM 9-759
3-Inch Gun Motor Carriage M10A1 ..... TM 9-731G
Ordnance Maintenance: Ford tank engine model GAA V-8 ..... TM 9-1731B

Automotive Materiel.

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

Care and Preservation.

Automotive lubrication ..... TM 10-540
Cleaning, preserving, lubricating, and welding materials, and similar items issued by the ordnance department ..... TM 9-850
Detailed lubrication instructions for ordnance materiel ..... OFSB 6-Series
Explosives and demolitions ..... FM 5-25
Fire prevention, safety precautions, accidents ..... TM 10-360
Motor transport inspections ..... TM 10-545
Product guide ..... OFSB 6-2

ORDNANCE MAINTENANCE
ACCESSORIES FOR TANK ENGINE—MODEL GAA V-8 (FORD)

Decontamination.

Chemical decontamination materials and equipment. TM 3-220
Decontamination of Armored Force vehicles. . . . . FM 17-59
Defense against chemical attack. . . . . FM 21-40

Maintenance and Repair.

Echelon system of maintenance. . . . . TM 10-525
Maintenance and repair. . . . . TM 10-520
Ordnance maintenance procedure: materiel inspection and repair. . . . . TM 9-1100

Storage and Shipment.

Registration of motor vehicles. . . . . AR 850-10
Rules governing the loading of mechanized and motorized army equipment, also, major caliber guns, for the United States Army and Navy, on open top equipment published by Operations and Maintenance Department of Association of American Railroads.
Storage of motor vehicle equipment. . . . . AR 850-18
Ordnance field service storage and shipment Chart —group G major items. . . . . OSSC-G

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(A.G. 300.7 (6 August 1943))

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION: R9 (4); Bn9 (2); C9 (8).

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