TM9-772

WAR DEPARTMENT TECHNICAL MANUAL

CARGO CARRIERS M29 AND M29C

WAR DEPARTMENT • 4 AUGUST 1945

WAR DEPARTMENT TECHNICAL MANUAL

TM 9-772

This TM supersedes TM 9-772, dated 5 Jul 44; WDTB 9-772-3, dated 6 Nov 44; WDTB 9-772-4, dated 6 Feb 45; WDTB 9-772-5, dated 19 Feb 45; WDTB 9-772-6, dated 30 Mar 45; and WDTB 9-772-7, dated 19 Apr 45. This TM supersedes portions of WDTB ORD 20, dated 24 Jan 44; WDTB ORD 74, dated 8 Jul 43; WDTB ORD 126, dated 19 Jul 44; WDTB ORD 130, dated 1 Aug 44; and WDTB ORD 172, dated 15 Jun 43, which apply to the matériel covered by this TM; however, these TB's remain in force until incorporated in all other affected TM's or specifically rescinded.

CARGO CARRIERS M29 AND M29C

WAR DEPARTMENT • 4 AUGUST 1945

United States Government Printing Office

Washington : 1947

WAR DEPARTMENT
Washington 25, D. C., 4 August 1945

TM 9-772, Cargo Carriers M29 and M29C, is published for the information and guidance of all concerned.

[A.G. 300.7 (1 Feb 45)
O.O.M. 461/Rar. Ars. (8-4-45)]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
EDWARD F. WITSELL,
Major General,
Acting The Adjutant General.

DISTRIBUTION: AAF (5); AGF (5); ASF (2); T of Opn (10); AAF Comd (2); Arm & Sv Bd (1); S Div ASF (1); Tech Sv (2); SvC (10); FC (1); BU (1); PE, Ord O (5); Dist O, 9 (5); Decentralized Sub-O, 9 (2); Reg O, 9 (2); Establishments, 9 (5) except Am Establishments (0); Gen & Sp Sv Sch (10); USMA (20); A (10); CHQ (10); D (2); AF (2); T/O & E 1-618 (2); 9-57 (3); 9-257 (3); 9-417 (3); 9-427 (3).

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

CONTENTS

PART ONE — INTRODUCTION

		Paragraphs	Pages
SECTION	I. General	1– 2	1– 3
	II. Description and data	3– 4	3– 15
	III. Tools, parts, and accessories	5– 8	15– 20

PART TWO — OPERATING INSTRUCTIONS

SECTION	IV. General	9	21
	V. Service upon receipt of equipment	10–13	21– 27
	VI. Controls and instruments	14–16	27– 36
	VII. Operation under ordinary conditions	17–18	36– 44
	VIII. Operation of auxiliary equipment	19–22	44– 48
	IX. Operation under unusual conditions	23–31	49– 59
	X. Demolition to prevent enemy use	32–34	59– 61

PART THREE — MAINTENANCE INSTRUCTIONS

SECTION	XI. General	35	62
	XII. Special organizational tools and equipment	36	62– 63
	XIII. Lubrication	37–38	63– 74
	XIV. Preventive maintenance services	39–45	74–104
	XV. Trouble shooting	46–64	104–123
	XVI. Engine description and maintenance in vehicle	65–73	124–143
	XVII. Engine removal and installation	74–76	143–152

PART THREE—MAINTENANCE INSTRUCTIONS (contd.)

		Paragraphs	Pages
SECTION XVIII.	Ignition system	77– 83	152–161
XIX.	Fuel, air intake, and exhaust systems	84– 93	161–192
XX.	Cooling system	94– 99	193–201
XXI.	Starting system	100–103	201–205
XXII.	Battery and generating system	104–108	205–212
XXIII.	Clutch	109–114	212–221
XXIV.	Transmission	115–119	221–226
XXV.	Propeller shaft and universal joints	120–122	226–228
XXVI.	Parking brake	123–127	229–235
XXVII.	Axle transmission, differential, and final drive assembly	128–133	236–251
XXVIII.	Tracks and suspension	134–140	251–285
XXIX.	Hull and attachments	141–155	285–301
XXX.	Lighting system	156–164	302–314
XXXI.	Instruments and gages	165–171	314–318
XXXII.	Equipment	172–174	318–328
XXXIII.	Radio interference suppression	175–179	328–333

PART FOUR—AUXILIARY EQUIPMENT

SECTION XXXIV.	General	180	334
XXXV.	Communications equipment	181–185	334–348

APPENDIX

SECTION XXXVI.	Shipment and limited storage	186–188	349–354
XXXVII.	References	189–191	354–357

INDEX 358–367

This TM supersedes TM 9-772, dated 5 Jul 44; WDTB 9-772-3, dated 6 Nov 44; WDTB 9-772-4, dated 6 Feb 45; WDTB 9-772-5, dated 19 Feb 45; WDTB 9-772-6, dated 30 Mar 45; and WDTB 9-772-7, dated 19 Apr 45. This TM supersedes portions of WDTB ORD 20, dated 24 Jan 44; WDTB ORD 74, dated 8 Jul 43; WDTB ORD 126, dated 19 Jul 44; WDTB ORD 130, dated 1 Aug 44; and WDTB ORD 172, dated 15 Jun 43, which apply to the materiel covered by this TM; however, these TB's remain in force until incorporated in all other affected TM's or specifically rescinded.

PART ONE — INTRODUCTION

Section I

GENERAL

1. SCOPE.

a. These instructions are published for the information and guidance of all concerned. They contain information on operation and maintenance of the equipment as well as descriptions of major units and their functions in relation to other components of these vehicles. They apply only to the Cargo Carriers M29 and M29C and apply to both M29 and M29C except where specifically designated. This manual is arranged in four parts: Part One, Introduction; Part Two, Operating Instructions; Part Three, Maintenance Instructions; Part Four, Auxiliary Equipment.

b. The appendix at the end of the manual contains instructions for shipment and limited storage, and a list of references including standard nomenclature lists, technical manuals, and other publications applicable to the vehicles.

c. The stock and part numbers which appear throughout the manual are extracted from ORD 7 SNL G-179, 15 June 1944.

2. RECORDS.

a. Forms and records applicable for use in performing prescribed operations are listed below with a brief explanation of each:

(1) W.D., A.G.O. FORM NO. 9-74 (OLD W.D., O.O. FORM NO, 7360), ARMY MOTOR VEHICLE OPERATOR'S PERMIT. This form will be issued by commanding officers of posts, camps, stations, or organizations to all operators of military vehicles who have passed the driver's examination (TM 21-300 and TM 21-301) and are qualified to drive the particular vehicles noted on the permit.

(2) WAR DEPARTMENT LUBRICATION ORDER. War Department Lubrication Order No. LO 9-772 prescribes lubrication maintenance for this vehicle. A lubrication order is issued with each vehicle and is to be carried with it at all times.

(3) STANDARD FORM NO. 26, DRIVER'S REPORT—ACCIDENT, MOTOR TRANSPORTATION. One copy of this form will be kept with

the vehicle at all times. In case of an accident resulting in injury or property damage, it will be filled out by the driver on the spot or as promptly as practicable thereafter.

(4) WAR DEPARTMENT FORM NO. 48 (OLD W.D., Q.M.C. FORM NO. 237), DRIVER'S TRIP TICKET AND PREVENTIVE MAINTENANCE SERVICE RECORD. This form, properly executed, will be furnished the driver when his vehicle is dispatched on non-tactical missions. The driver and the official user of the vehicle will complete in detail appropriate parts of this form. These forms need not be issued for vehicles in convoy or on tactical missions. The reverse side of this form contains the driver's daily and weekly preventive maintenance service schedule which is mandatory.

(5) W.D., A.G.O. FORM NO. 478, MWO AND MAJOR UNIT ASSEMBLY REPLACEMENT RECORD AND ORGANIZATION EQUIPMENT FILE. This form is designed for use with all motor vehicles. This form will be kept in the possession of second echelon personnel and will accompany vehicles upon transfer and evacuation to higher echelons. Personnel keeping modification or major unit assembly replacement records will record clearly description of work completed and will initial in column provided. When modification is completed, record date, hours, and/or mileage, and MWO number. When major unit assemblies (engine, transmission, axle unit, and tracks) are replaced, record date, hours and/or mileage, and nomenclature of unit assembly. Minor repairs, parts, and accessory replacements will not be recorded. All essential forms and records on vehicles will be filed in the jacket of Form No. 478.

(6) WAR DEPARTMENT FORM NO. 30 (OLD W.D. FORM NO. 39), REPORT OF CLAIMS OFFICER. This form is used by the claims officer in reporting his investigation of motor accidents.

(7) W.D., A.G.O. FORM NO. 9-69, SPOT CHECK INSPECTION REPORT FOR ALL FULL-TRACK AND TANK-LIKE WHEELED VEHICLES. This form will be used by all commanding officers or their staff representatives in making spot check inspections on full-track and tank-like wheeled vehicles.

(8) W.D., A.G.O. FORM NO. 9-73 (OLD W.D., O.O. FORM NO. 7358), DATA FOR REGISTRATION—MOTOR VEHICLE. All vehicles will be registered in the War Department Motor Vehicle Central Records Office, Office, Chief of Ordnance—Detroit, Michigan. Registration will be made by accomplishing this form in accordance with AR 850-10.

(9) W.D., A.G.O. FORM NO. 9-75 (OLD W.D., O.O. FORM NO. 7361), DAILY DISPATCHING RECORD OF MOTOR VEHICLES. This form will be used to keep a daily record of all vehicles dispatched.

(10) W.D., A.G.O. FORM NO. 9-81 (OLD W.D., O.O. FORM NO. 7370), EXCHANGE PART OR UNIT IDENTIFICATION TAG. This tag will be used when exchanging unserviceable parts, assemblies, subassemblies, or automotive tools for like serviceable items.

(11) W.D., A.G.O. FORM NO. 460 PREVENTIVE MAINTENANCE ROSTER (OLD W. D., A.G.O. FORM NO. 6, DUTY ROSTER). This form will be used for scheduling and maintaining a record of motor vehicle maintenance operations (monthly and semi-annually). It may be used for lubrication records.

(12) W.D., A.G.O. FORM NO. 462, PREVENTIVE MAINTENANCE SERVICE AND TECHNICAL INSPECTION WORKSHEET FOR FULL-TRACK AND TANK-LIKE WHEELED VEHICLES. This form will be used for all monthly and quarterly maintenance services and for all technical inspections of these vehicles.

Section II

DESCRIPTION AND DATA

3. DESCRIPTION.

a. Standard Cargo Carrier M29 (figs. 1, 2, 3, 4, and 8).

(1) The Cargo Carrier M29 is a low silhouette, full-track-laying vehicle, carrying adequate equipment for a crew of two, three, or four men. It is designed for use over difficult terrain and in combat zones. The vehicle is powered with a liquid-cooled, 6-cylinder engine located at the front center of the hull. Power is transmitted from the engine to the rear axle by a power train consisting of a single-plate clutch, conventional transmission, propeller shaft with two needle-bearing universal joints, and a 2-speed axle unit with combined planetary differential. The vehicle is fully suppressed for radio installation.

(2) The hull consists of a sheet steel welded structure, except for various covers which are easily removed to facilitate inspection and maintenance operations. Five plugs located on the left side of the hull, one plug on the right side, and one plate in the bottom of the hull, are provided for draining purposes.

(3) A track guard and step plates were added to both sides of hull on vehicles produced after serial 2102 and a heavier pintle hook was installed. The cargo partition for the rear compartment and the driver's hand grip were omitted from vehicles after serial 2102. On vehicles produced after serial 3102, the back curtain is separate from the top, and the starting crank hole is omitted from the front of the hull.

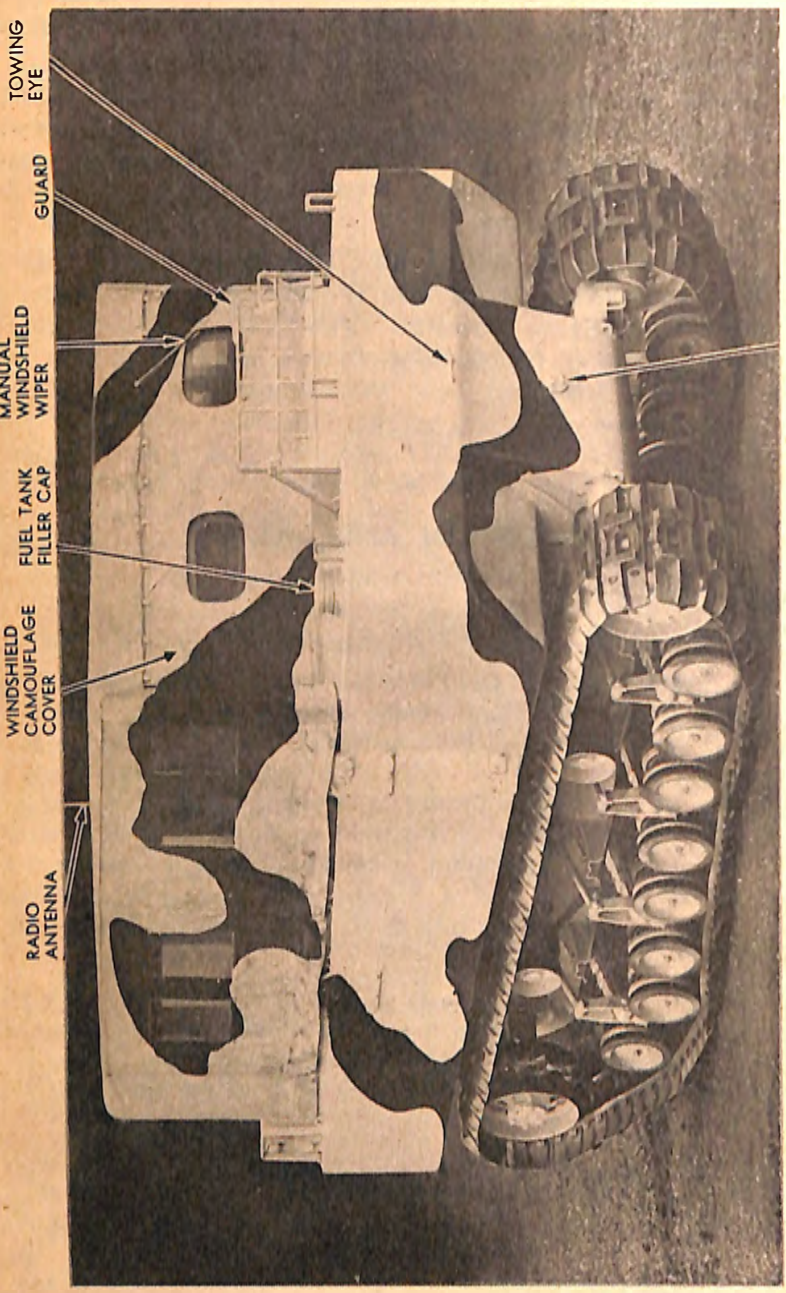
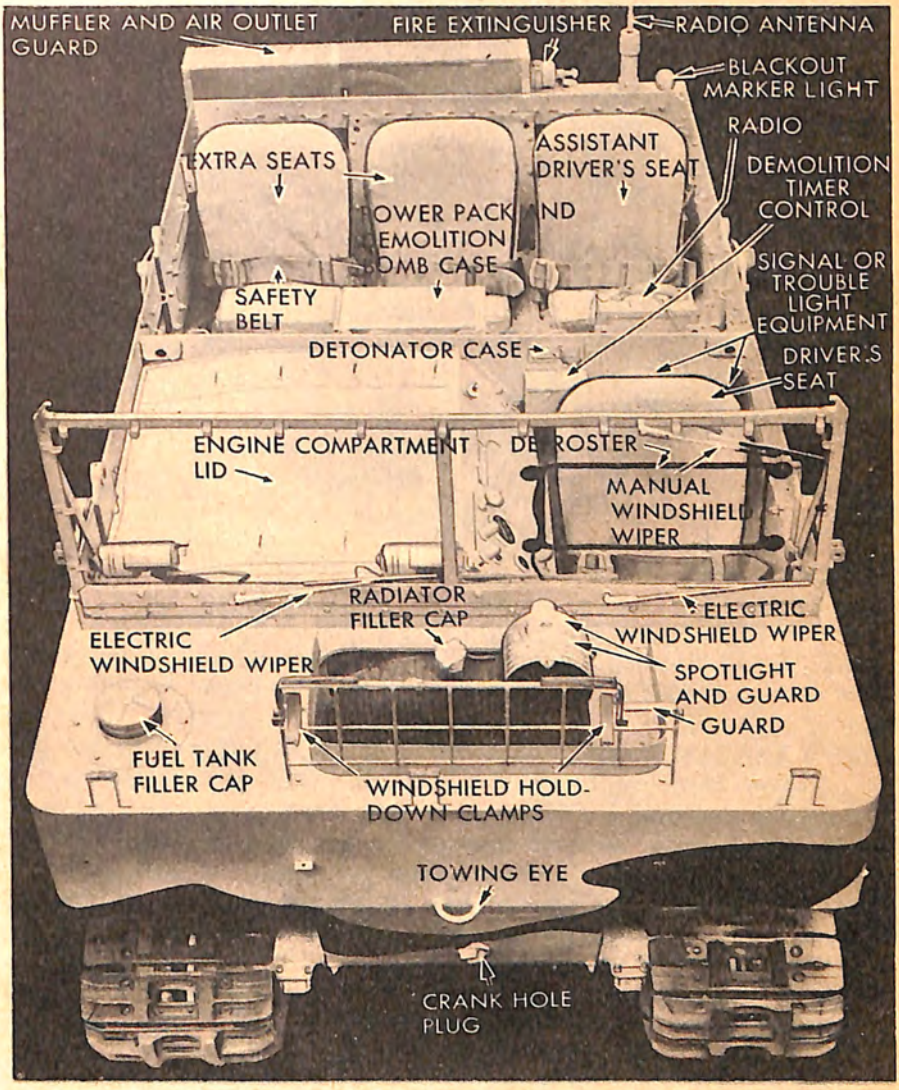


Figure 1 — Cargo Carrier M29 — Right Front (Before Vehicle Serial 3103)



RA PD 319403

Figure 2 — Cargo Carrier M29 — Front Top (Before Vehicle Serial 3103)

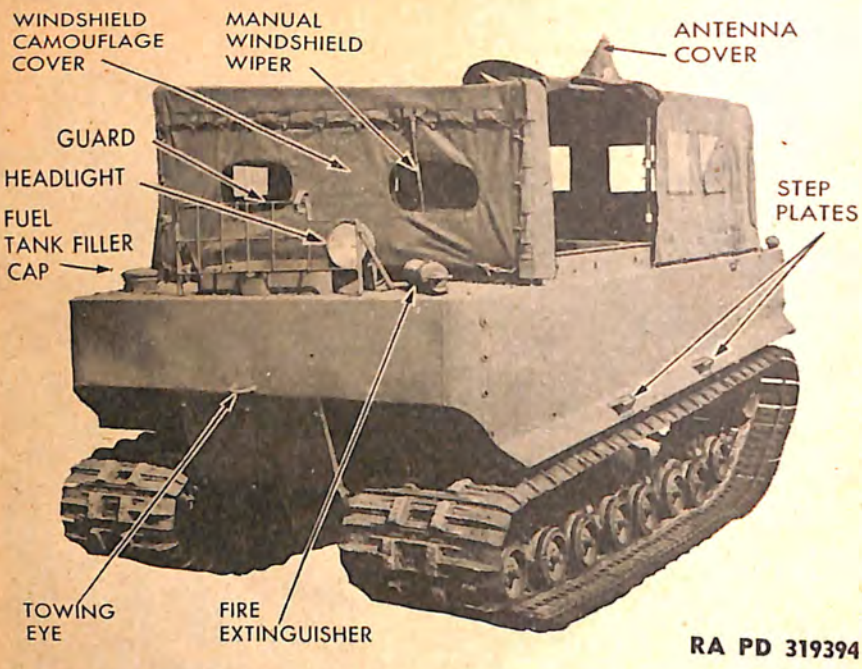


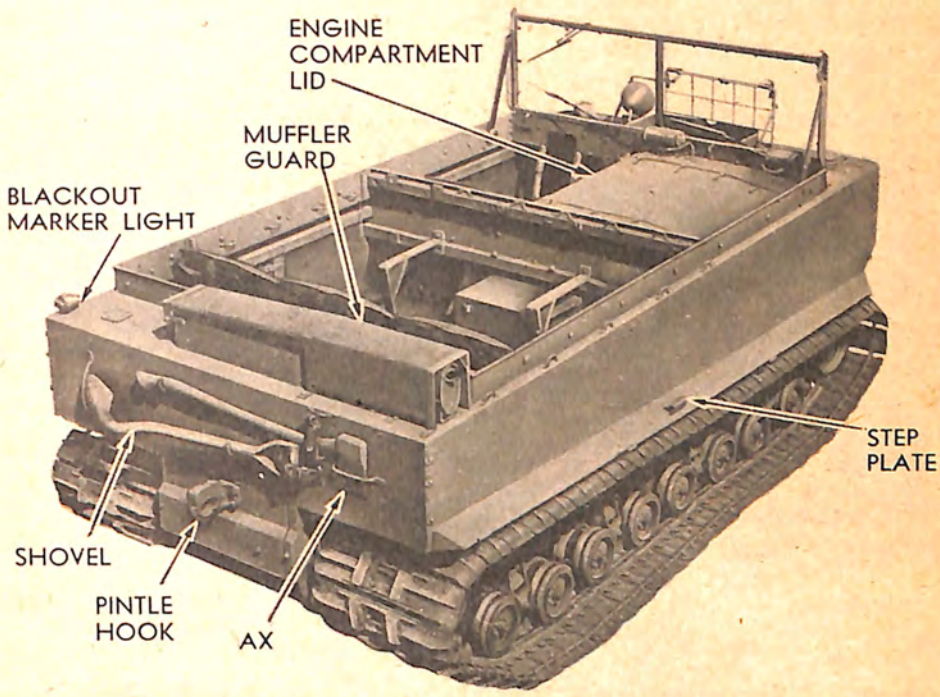
Figure 3 — Cargo Carrier M29 — Left Front (After Vehicle Serial 3102)

b. Amphibian Cargo Carrier M29C (figs. 5, 6, 7, and 9).

(1) In addition to the description in subparagraph a above, the cargo carrier M29C is designed for operation in water as well as on land.

(2) The bow (front) and stern (rear) cells fastened to the hull are of sheet steel, reinforced and welded. Openings in the top of cells permit pumping out bilge water with hand bilge pump while in water. Drain plugs are provided in the left side of these cells for draining out bilge water when halted on land. A surf guard is mounted on the forward edge of bow cell to reduce the possibility of shipping water. Aprons, fastened on each side of the hull, house the upper portion of the track and facilitate forward motion of the vehicle in water. Twin rudders at the rear are provided for steering the vehicle during amphibious operations. A vertical drum capstan is located in the center of the bow cell deck and is used to help free the vehicle if it becomes mired.

(3) A self-sealing fuel tank is used on vehicles after serial 13,560. Vehicles after serial 9502 are equipped with an electric fuel pump unit located within the fuel tank. A parking brake is provided on vehicles after serial 15,681 (approx.). After vehicle serial 14,999 (approx.), track tension is maintained by the use of a coil-type spring at the idler wheel carrier arms.



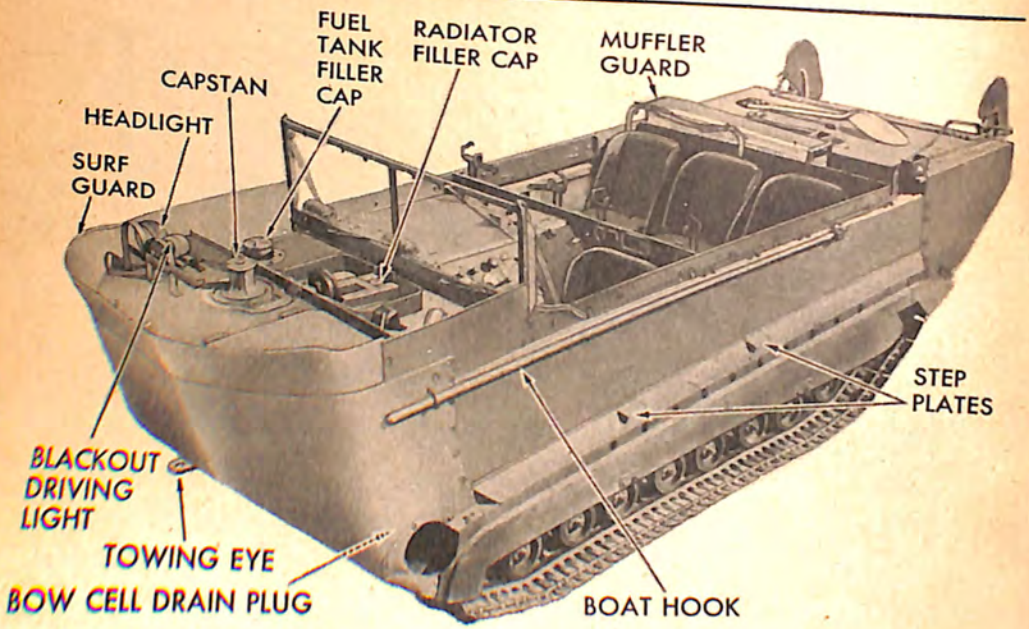
RA PD 319395

Figure 4 — Cargo Carrier M29 — Right Rear Top (After Vehicle Serial 3102)

4. DATA.

a. Vehicle Specifications.

	Cargo Carrier M29	Cargo Carrier M29C
Length, over-all (including pintle hook and towing eye)	10 ft 5¾ in.	
Length, over-all (less pintle hook)	10 ft ¼ in.	
Length, over-all (to end of rudders, surf guard lowered)		16 ft ⅛ in.
Length, over-all (to end of rudders, surf guard raised)		15 ft 8 11/16 in.
Length, over-all (to end of hull, surf guard lowered)		14 ft 9⅛ in.
Length, over-all (to end of hull, surf guard raised)		14 ft 5 11/16 in.
Width, over-all (with 15-in. track)	5 ft 1 in.	
Width, over-all (with 20-in. track)	5 ft 6 in.	5 ft 7¼ in.
Height, over-all (with top and bows)	5 ft 10 13/16 in.	5 ft 10 13/16 in.



RA PD 336652

Figure 5 — Cargo Carrier M29C — Left Front Top

	Cargo Carrier M29	Cargo Carrier M29C
Height (less top and bows, windshield folded)	4 ft 5 11/16 in.	4 ft 5 11/16 in.
Track size (with) before vehicle serial 2103	15 in.	
Track size (width) after vehicle serial 2102	20 in.	20 in.
Tread (center-to-center of tracks)	45 in.	45 in.
Crew	2 to 4	2 to 4
Weight of crew and equipment (two men) (approx.)	1,200 lb	1,200 lb
Weight of vehicle—empty (approx.) (15-in. track)	3,725 lb	
Weight of vehicle—loaded (approx.) (15-in. track)	4,925 lb	
Weight of vehicle—empty (approx.) (20-in. track)	4,077 lb	4,771 lb
Weight of vehicle—loaded (approx.) (20-in. track)	5,277 lb	5,971 lb
Length of track on ground	78 1/8 in.	78 1/8 in.
Ground contact area—0-in. penetration (15-in. track)	2,344 sq in.	
Ground contact area—0-in. penetration (20-in. track)	3,125 sq in.	3,125 sq in.

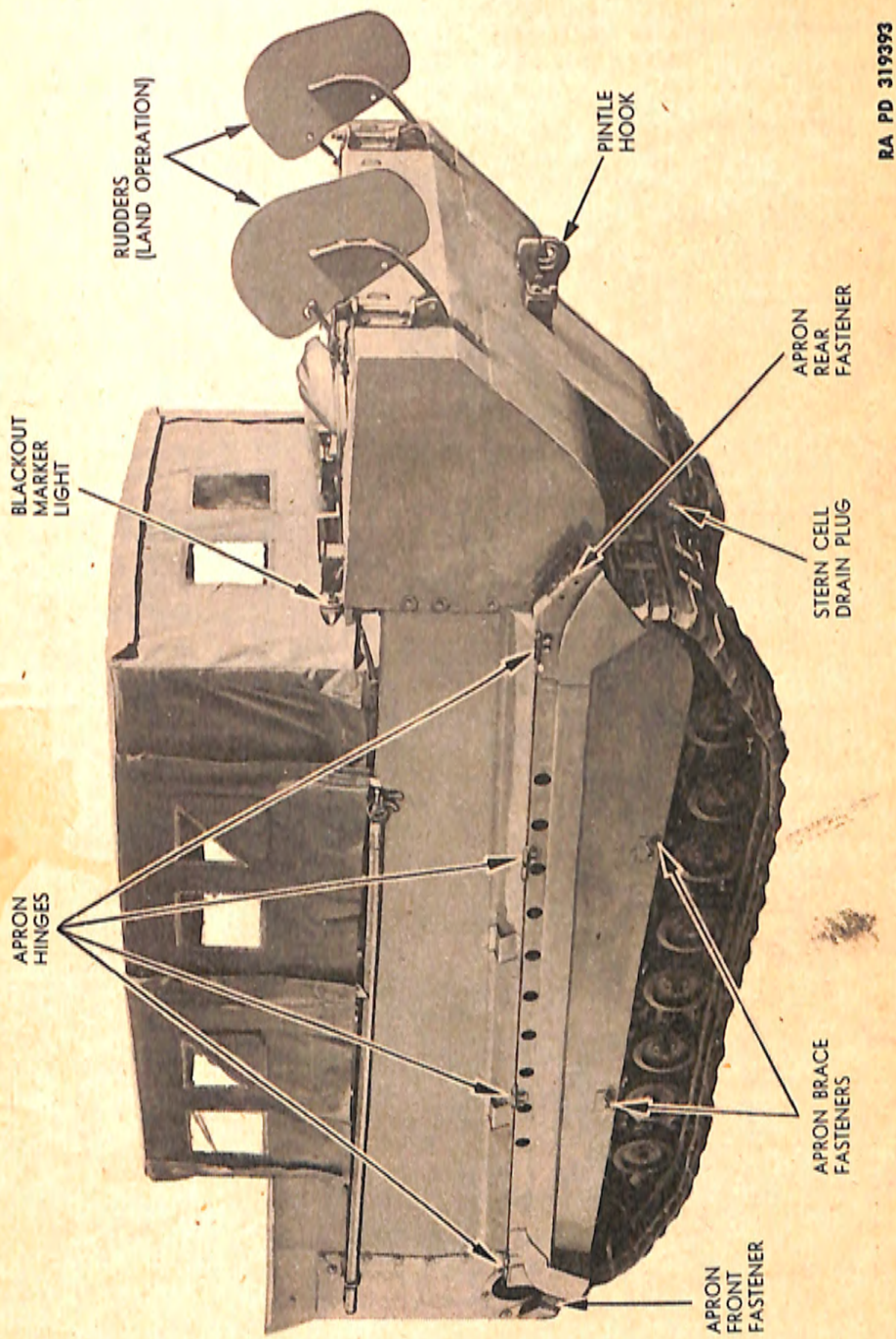
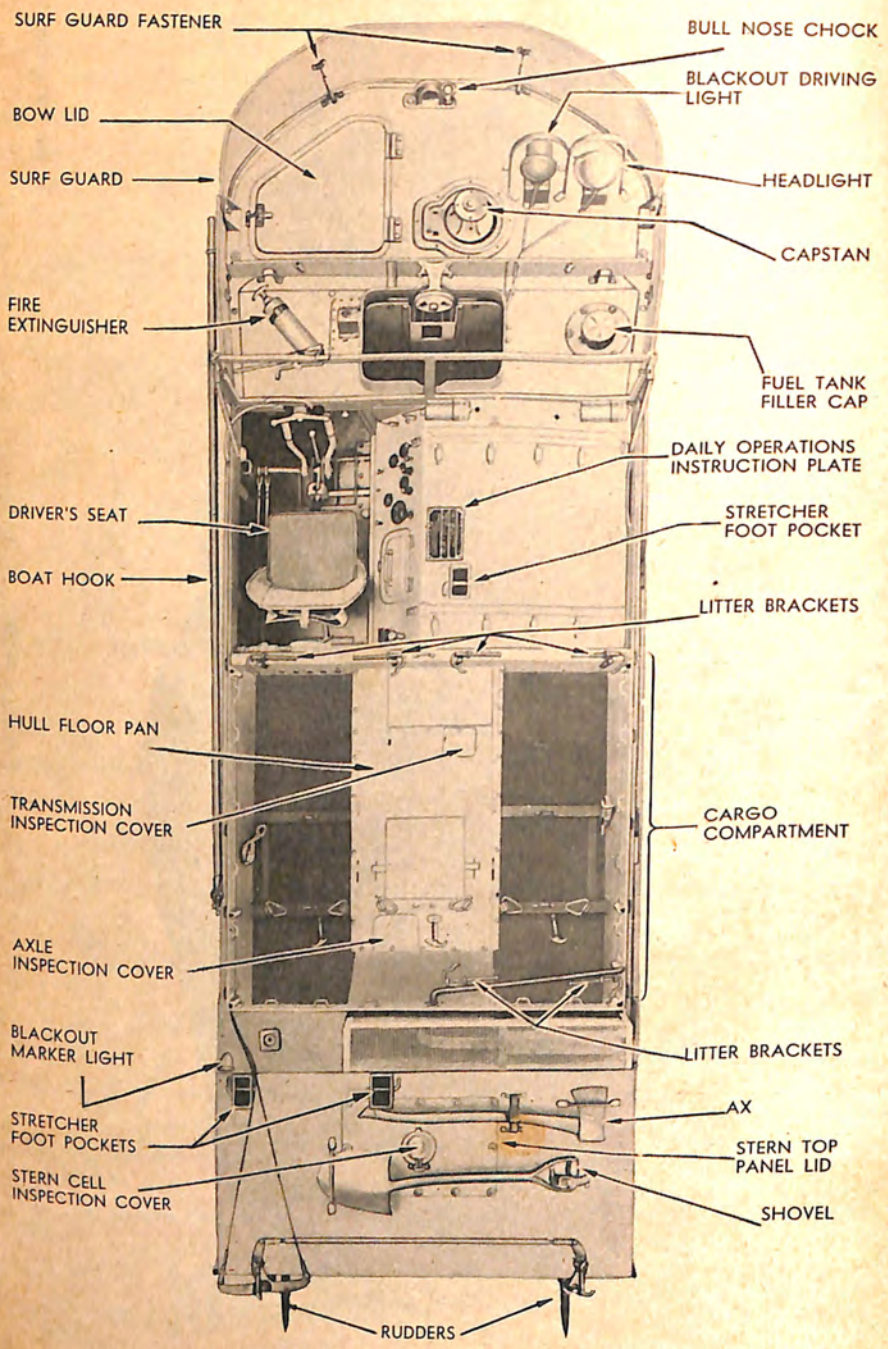


Figure 6 — Cargo Carrier M29C — Left Rear



RA PD 336653

Figure 7 — Cargo Carrier M29C — Top, Showing Cargo Compartment

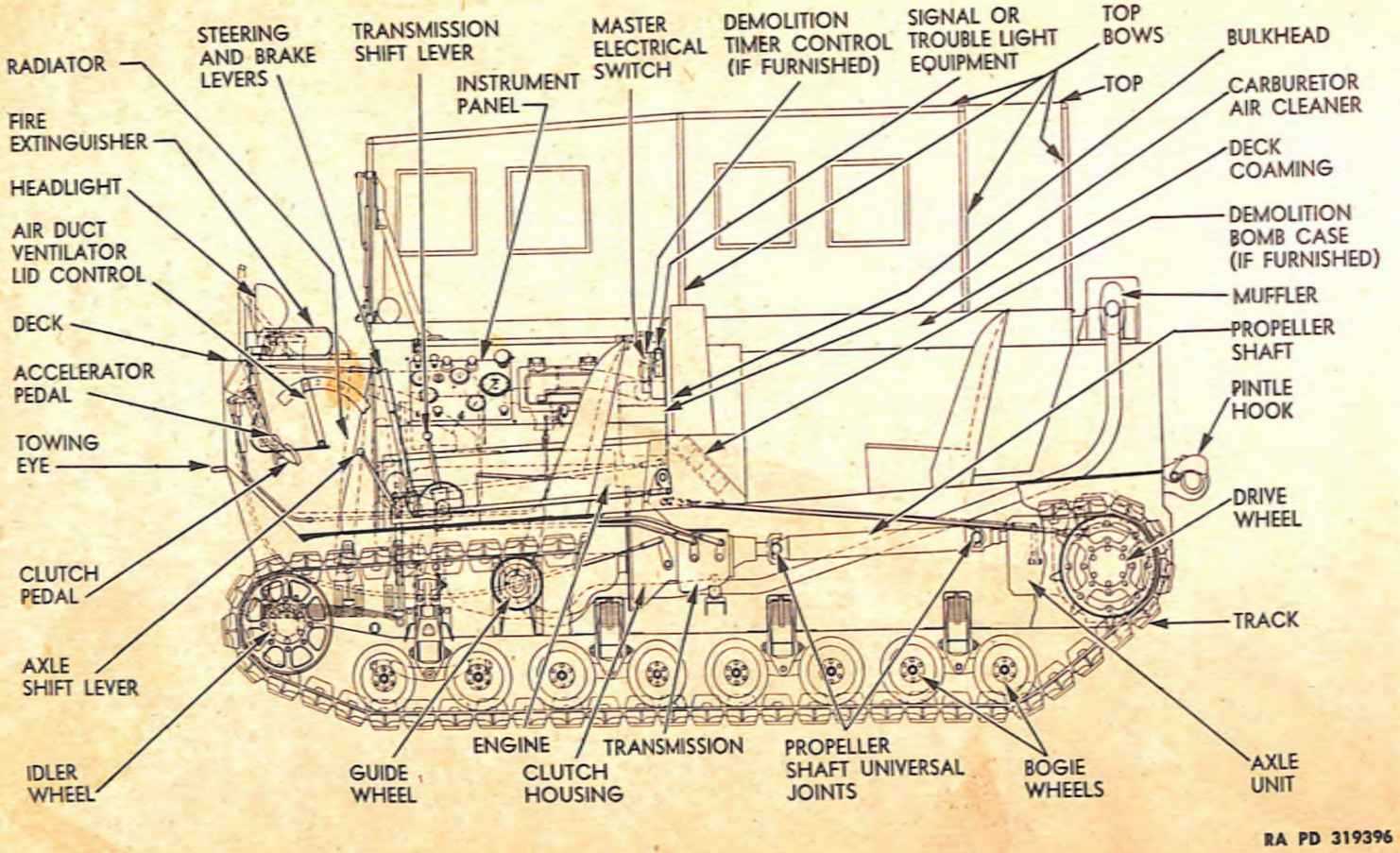


Figure 8 — Cargo Carrier M29 — Longitudinal Section (After Vehicle Serial 3102)

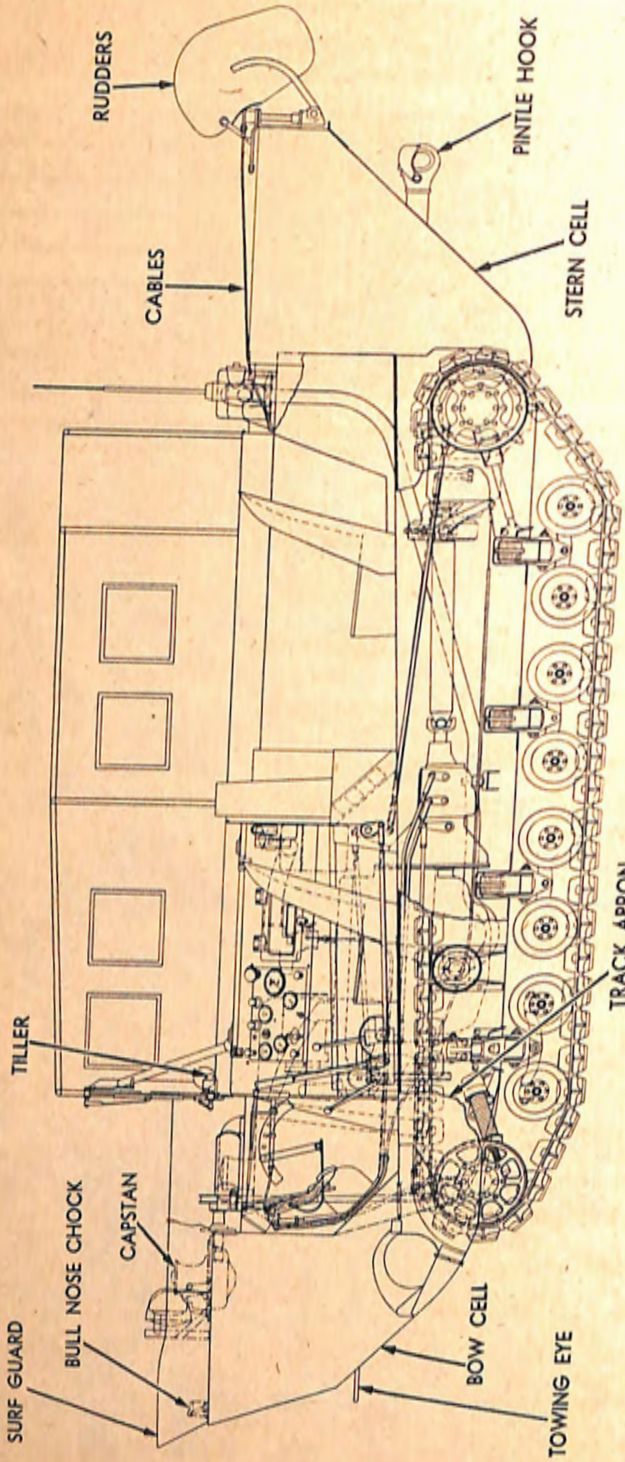
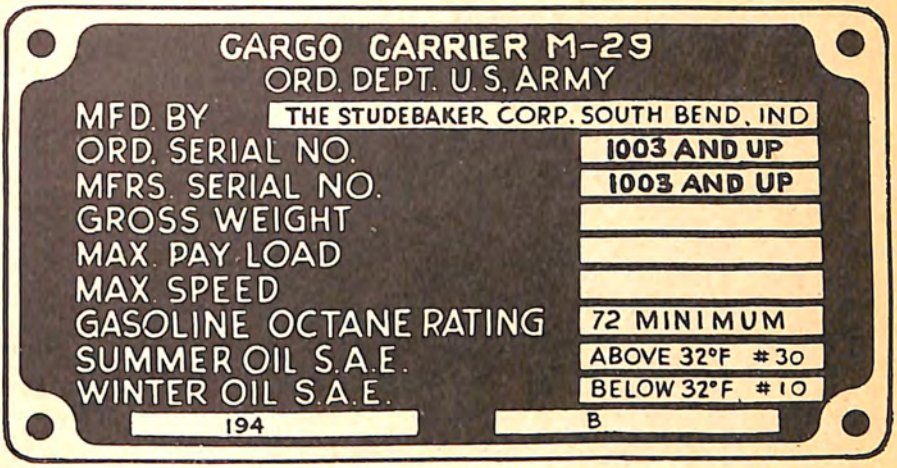


Figure 9 — Cargo Carrier M29C — Longitudinal Section



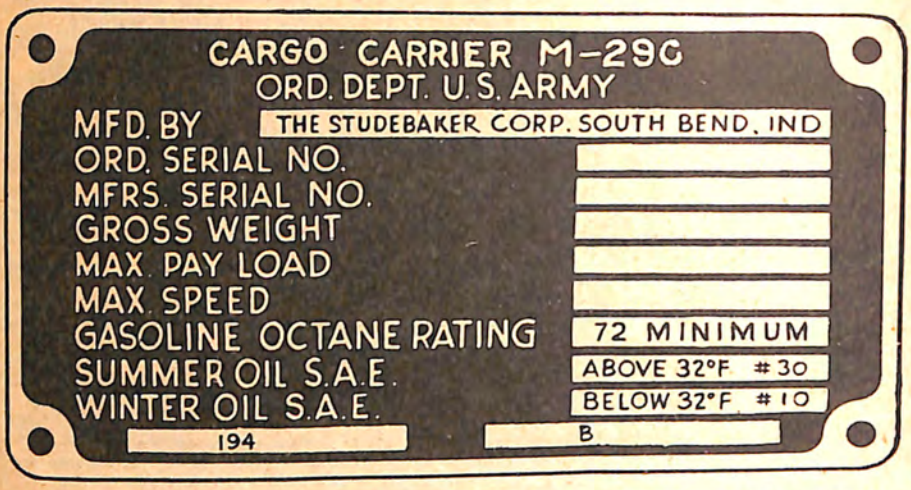
RA PD 336510

Figure 10 — Identification Plate — Cargo Carrier M29

	Cargo Carrier M29	Cargo Carrier M29C
Snow contact area—5-in. penetration (15-in. track)	2,812 sq in.	
Snow contact area—5-in. penetration (20-in. track)	3,750 sq in.	3,750 sq in.
Ground pressure (per sq in.) (15-in. track)	2.10 lb	
Ground pressure (per sq in.) (20-in. track)	1.69 lb	1.91 lb
Ground clearance	11 in.	10½ in.
Pintle hook height	27⅛ in.	27½ in.
Angle of approach (approx.)	90 deg	47 deg
Angle of departure (approx.)	60 deg	36 deg
Center of gravity above ground (loaded) (approx.)	24 in.	24 in.
Free board:		
at curb weight (bow)		12 in.
(stern)		13½ in.
at gross weight (bow)		10½ in.
(stern)		8 in.
Kind and grade of fuel	Gasoline	Gasoline
Octane rating (minimum)	72	72

b. Performance.

Propulsion	M29 Tracks	M29C Tracks
Speeds:	(Refer to Speed Caution Plate — fig. 12)	
land speeds		
in calm water (approx.)		4 mph



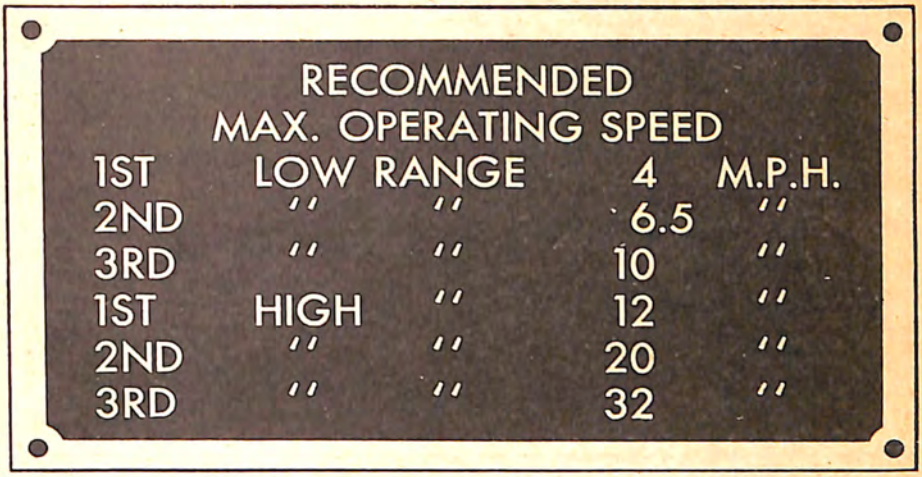
RA PD 336511

Figure 11 — Identification Plate — Cargo Carrier M29C

	M29 Tracks	M29C Tracks
Turning radius—on land (right) (approx.)	12 ft	12 ft
Turning radius—on land (left) (approx.)	12 ft	12 ft
Towing facilities (front)—on land	Towing eye	Towing eye
(front)—afloat		Bullnose chock
(rear)	Pintle hook	Pintle hook
Fuel consumption—on land (variable under load and terrain)	0.7 to 7 mpg	0.7 to 7 mpg
Fuel consumption—on water (2,000 rpm, wide-open throttle)		2.5 to 2.7 gph
Crusing range—on land at 5 mpg (before vehicle serial 14,000, approx.) (after vehicle serial 13,999, approx.)	175 miles	175 miles 165 miles
Maximum engine speed:		
Sustained	3,600 rpm	3,600 rpm
Short periods	4,000 rpm	4,000 rpm

c. Capacities.

Transmission	1 qt	1 qt
Axle transmission and differential assembly	6 qt	6 qt
Fuel:		
Metal tank (before vehicle serial 14,000, approx.)	35 gal	35 gal



RA PD 336482

Figure 12 — Speed Caution Plate

	M29 Tracks	M29C Tracks
Self-sealing fuel tank (after vehicle serial 13,999, approx.)		33 gal
Cooling system (before vehicle serial 1003)	10½ qt	
Cooling system (after vehicle serial 1002)	12¾ qt	12¾ qt
Crankcase	5 qt	5 qt
Capstan—M29C		1 qt
Air cleaner (oil-bath type)	½ qt	½ qt

d. Communications.

*Radio	Either SCR-510-610-694-714 or British Wireless No. 19

Section III

TOOLS, PARTS, AND ACCESSORIES

5. PURPOSE.

a. The lists in this section are for information only and must not be used as a basis for requisition. When ordering on-vehicle material, refer to the latest issue of ORD 7 SNL G-179.

*When required.

RA PD 352244

Figure 13 — Pioneer Tools

6. ON-VEHICLE TOOLS.

a. Pioneer (fig. 13).

Quantity per Vehicle	Item Name and Stock Number	Stowage Location
1	AX, chopping, 4-lb (41-A-1277)	Rear exterior
1	SHOVEL, D-handled, round point (41-S-3170)	Rear exterior

b. Vehicle (fig. 14).

1	BAG, tool (41-B-15)	In vehicle
1	HAMMER, ball peen, 16-oz (41-H-523)	In tool bag
1	HANDLE, jack, 9/16-in. opening (41-H-1251)	In vehicle
1	HANDLE, spark plug wrench (41-H-1510-500)	In tool bag
1	HOOK, boat (23-H-185-435) (M29C)	Left exterior
1	JACK, screw type, w/ special saddle (41-J-159-800) (Before vehicle serial 15,000, approx.)	In vehicle
1	PLIERS, combination, wire cutting, 6-in. (41-P-1650)	In tool bag
1	SCREWDRIVER, common, 3-in. blade (41-S-1101)	In tool bag
1	SCREWDRIVER, common, 6-in. blade (41-S-1104)	In tool bag
1	WRENCH, adjustable, auto-type, 15-in. (41-W-450)	In tool bag
1	WRENCH, adjustable, crescent, 12-in. (41-W-488)	In tool bag
1	WRENCH, engineer's, double-head, 3/8-in. and 7/16-in. (41-W-991)	In tool bag
1	WRENCH, engineer's, double-head, 1/2-in. and 19/32-in. (41-W-1003)	In tool bag
1	WRENCH, engineer's, double-head, 9/16-in. and 11/16-in. (41-W-1005-5)	In tool bag
1	WRENCH, engineer's, double-head, 5/8-in. and 25/32-in. (41-W-1008-10)	In tool bag
1	WRENCH, engineer's, double-head, 3/4-in. and 7/8-in. (41-W-1012-5)	In tool bag
1	WRENCH, 15-deg angle, single head, 1 1/8-in. (7324248) (After vehicle serial 14,999, approx.)	In tool bag
1	WRENCH, socket, spark plug and oil pan drain plug, 27/32-in. and 1 1/32-in. (41-W-3297-855) (After vehicle serial 2102)	In tool bag
1	WRENCH, socket, spark plug, 27/32-in. (41-W-2939) (Before vehicle serial 2103)	In tool bag
1	WRENCH, single hd., 15-degree, O.E., 1 1/8-in. (41-W-852)	In tool bag

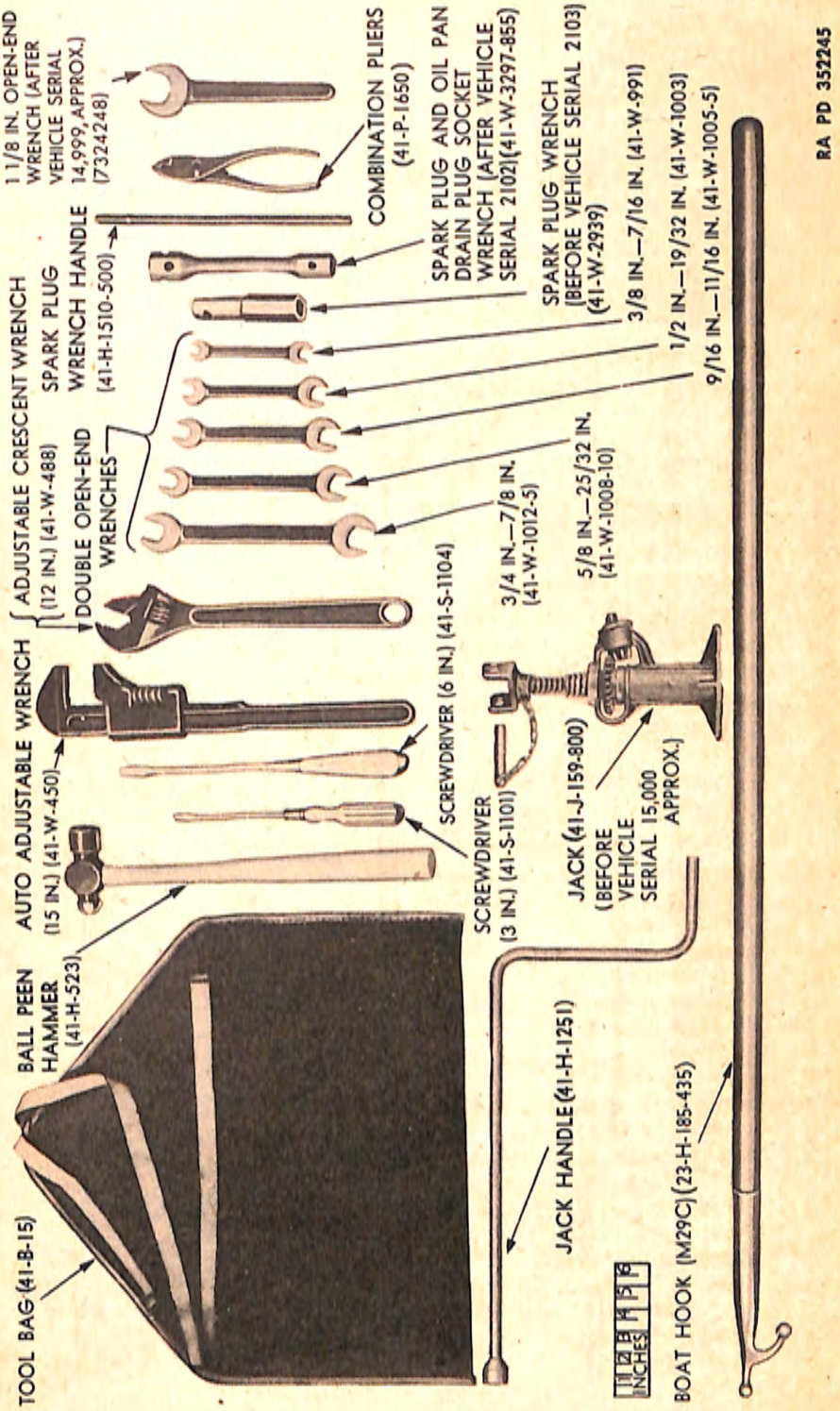


Figure 14 – Vehicle Tools

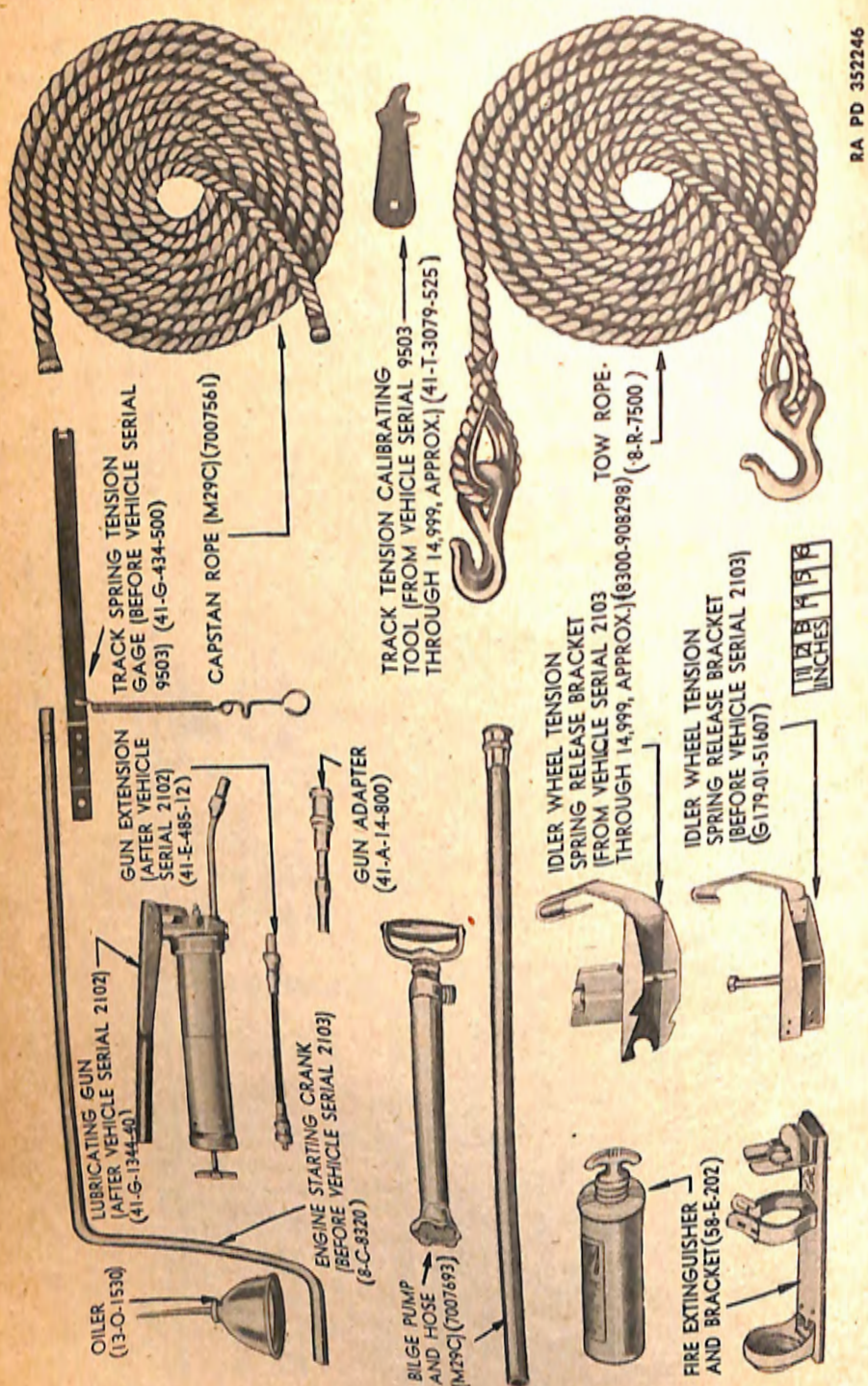


Figure 15 — On-vehicle Equipment

7. ON-VEHICLE EQUIPMENT.

a. Communications.

Quantity per Vehicle	Item Name and Stock Number	Stowage Location
*1	RADIO SET, either SCR-510, 610, 694, 714, or British Wireless No. 19	In cargo space

b. Equipment (fig. 15).

1	ADAPTER, lubricating gun, thin stem (41-A-14-800)	In tool bag
6	BATTERY (Two to be put in flashlight, 4 spares) (17-B-7210)	In tool bag
4	BELT, safety (7007440) (Discontinued after vehicle serial 8140)	On seats
1	BRACKET, release, idler wheel tension spring (G-179-01-51607) (Before vehicle serial 2103)	In vehicle
1	BRACKET, release, idler wheel tension spring (8300-908298) (From vehicle serial 2103 through 14,999, approx.)	In vehicle
1	CATALOG, standard nomenclature list SNL G-179	In map pocket rear of front seat
1	COVER, luggage (G-179-01-80375) (Before vehicle serial 3133)	In cargo space
1	COVER, luggage (7007468) (After vehicle serial 3132)	In cargo space
1	COVER, windshield (E8262) (Before vehicle serial 3133)	In cargo space
1	COVER, windshield (7010668) (After vehicle serial 3132)	In cargo space
1	CRANK, engine starting (8-C-8320) (Before vehicle serial 2103)	In vehicle
	NOTE: *After vehicle serial 2102, starting crank (8-C-8320) was discontinued. To prevent possible damage to radiator core, remove starting cranks from vehicles with serials previous to 2103 and dispose of in accordance with AR 35-6640.*	
1	EXTENSION, lubricating gun, hose-type (41-E-485-12) (After vehicle serial 2102)	In tool bag

*When required.

Quantity per Vehicle	Item Name and Stock Number	Stowage Location
1	EXTINGUISHER, fire, 1-qt w/ bracket (58-E-202)	Rear top exterior of hull (Before Vehicle Serial 3103) Front top exterior of hull (After Vehicle Serial 3102)
1	FLASHLIGHT (17-F-13205)	In tool bag
1	FORM NO. 478, W.D. A.G.O.	In map pocket rear of front seat
1	GAGE, tension, track spring (41-G-434-500 (Before vehicle serial 9503)	In vehicle
1	GUN, lubricating, hand lever operated (41-G-1344-40) (After vehicle serial 2102)	In vehicle
*1	KIT, detonator	In container on bulkhead
*1	KIT, windshield defroster (D-72961) (M29)	In vehicle
1	LAMP (spare for flashlight) (SC-LM-35A)	In tool bag
1	MANUAL, technical, vehicle (for operator) (TM 9-772)	In map pocket rear of front seat
1	OILER, hand, ½-pt (13-0-1530)	Mounting bracket — battery compartment
1	ORDER, lubrication, War Department (LO 9-772)	In map pocket rear of front seat
1	PUMP, bilge, w/hose (7007693) (M29C)	In bow cell
1	ROPE, capstan (7007561) (M29C)	In bow cell
1	ROPE, tow, 1 in.x20 ft, w/hooks (8-R-7500)	In vehicle
1	TOOL, calibrating, track tension (41-T-3079-525) (From vehicle serial 9503 through 14,999, approx.)	In tool bag

8. ON-VEHICLE SPARE PARTS.

3	GASKET, carburetor main body (7016435)	In tool bag
1	JET, carburetor main discharge (metering), w/gasket (A307200)	In tool bag
1	JET, carburetor main discharge (metering), w/gasket (A307559)	In tool bag
1	JET, carburetor main discharge (metering), w/gasket (A307560)	In tool bag

*When required.

PART TWO — OPERATING INSTRUCTIONS

Section IV

GENERAL

9. SCOPE.

a. Part Two contains information for guidance of personnel responsible for operation of this equipment. It contains information on operation of equipment with description and location of controls and instruments.

Section V

SERVICE UPON RECEIPT OF EQUIPMENT

10. PURPOSE.

a. When a new or reconditioned vehicle is first received by the using organization, it is necessary for second echelon personnel to determine whether the vehicle has been properly prepared for service by the supplying organization, and to be sure it is in condition to perform any mission to which it may be assigned when placed in service. For this purpose, inspect all assemblies, subassemblies, and accessories to be sure they are properly assembled, secure, clean, and correctly adjusted and/or lubricated. Check all tools and equipment against Section III (Tools, Parts and Accessories) to be sure every item is present, in good condition, clean, and properly mounted or stowed.

b. In addition, the using organization will perform a run-in test on all vehicles of at least 50 miles as directed in AR 850-15, according to procedures in paragraphs 10 through 13 which follow.

c. Whenever practicable, the first echelon personnel (crew) will assist in the performance of these services.

11. CORRECTION OF DEFICIENCIES.

a. Deficiencies disclosed during the course of these services will be treated as follows:

(1) Correct any deficiencies within the scope of the maintenance echelons of the using organization before the vehicle is placed in service.

(2) Refer deficiencies beyond the scope of the maintenance echelons of the using organization to a higher echelon for correction.

(3) Bring deficiencies of a serious nature to the attention of the supplying organization through proper channels.

12. SPECIFIC PROCEDURES.

a. Preliminary Service. Before the vehicle is moved to make the actual run-in test, certain inspections and services will be performed as follows:

(1) FIRE EXTINGUISHER. See that the portable fire extinguisher is present and in good condition. Test momentarily for proper operation, and mount securely, paragraph 19.

(2) FUEL, OIL AND WATER. CAUTION: *Follow instructions on tags attached to the filler cap or steering brake levers concerning the oil in the engine crankcase and air cleaner.* Fill the fuel tank and see that engine crankcase oil and radiator coolant supply is at correct operating levels. During freezing weather, check value of antifreeze and add as necessary to protect cooling system against freezing (par. 25).

(3) FUEL FILTER. On vehicles so equipped, remove sediment bowl and screen from fuel pump, wash bowl and screen in dry cleaning solvent to remove accumulated dirt and water, and install securely. Drain accumulated sediment and water from main fuel filter by removing drain plug. If any appreciable amount of sediment or water is present, remove and clean filter body and element. Drain water and sediment from bottom of fuel tank. CAUTION: *Do not allow drainage to drop into hull. Be sure hull drain plug is replaced securely.*

(4) BATTERIES. Make hydrometer test of the batteries and add clean water to correct level (par. 105 b).

(5) AIR CLEANERS AND VENTILATORS. Inspect the carburetor, air cleaners and ventilators to see that they are in good condition, secure, and not leaking excessively. Check the oil level of the oil bath-type cleaners and clean and service as necessary. Check the condition of the filters and the mesh-type breathers, clean and service as necessary (par. 37). Be sure waterproofing tape and corrosion preventive material has been removed from all units.

(6) ACCESSORIES AND DRIVES. See that all tape and corrosion preventive material has been removed from all accessories. Inspect accessible accessories such as carburetor, generator, regulator, starting motor, fan and capstan for looseness and damage. Be sure that fan, capstan, and generator drive belt adjustments are satisfactory (par. 72 and fig. 196). Be sure that all accessories are secure.

(7) ELECTRICAL WIRING. After seeing that all tape and corrosion preventive material has been removed, examine all accessible wiring and conduits. See that they are in good condition, securely connected, and properly supported.

(8) TRACKS. Examine tracks and guides for looseness or damage. Be sure rubber surfaces of all wheels have not separated from

the metal and that track rubber belts and rubber cross plate connectors are in good condition and secure. Be sure track tension is satisfactory (par. 135).

(9) WHEEL AND FLANGE NUTS. See that all track drive, bogie, idler and guide wheels and axle flange nuts or screws are present and secure.

(10) TOWING CONNECTIONS. Examine tow loop and pintle hook for looseness or damage. See that pintle operates properly and latches securely.

(11) HULL—TOP, DECK, LIDS, ATTACHMENTS AND APRON. Inspect entire hull for looseness and damage. See that all attachments and mountings are secure. Examine seats, windshield, engine cover and fasteners, top cover, curtains, and frame to see if they are in good condition, correctly and securely assembled and mounted. Look particularly for punctures and broken welds in hull; and on vehicles so equipped, in bow and stern cells, also see that all drain plugs are secure. Inspect deck plates to be sure they are in good condition and secure. Before operation in water, be sure lids and compartment covers fit properly and seal tightly against seals; that surf guard and track aprons are in place, securely fastened, and that windshield braces are tight.

(12) LUBRICATE. Perform a complete lubrication of the vehicle, covering all intervals, according to the instructions on the lubrication order (par. 37), except gear cases, wheel bearings, and other units previously covered. Check all gear case oil levels, and add oil as necessary to bring to correct level. Change only if condition of oil indicates the necessity, or if gear oil is not of proper grade for existing atmospheric temperature. NOTE: *Perform items 13 to 18 below during lubrication.*

(13) SPRINGS AND SUSPENSIONS. Examine track tension springs, transverse springs, and all bogie suspension units for looseness or damage. Look for shifted spring leaves, missing rebound clips, and excessive leaks at wheel bearing seals or axle flanges.

(a) Weed Cutters. On vehicles so equipped, see that weed cutters are clean, properly assembled, and securely mounted.

(14) STEERING BRAKE LINKAGE. Be sure all levers, arms, cross shafts, and rods are in good condition and securely mounted or connected.

(15) PROPELLER SHAFT. Examine propeller shaft and universal joints for damage. Be sure joints are secure and not leaking excessively.

(16) AXLE AND TRANSMISSION VENTS. Examine axle differential breather to see that it is in good condition and secure. Be sure both axle breather and engine transmission cover vent holes are not clogged.

(17) CHOKE AND PRIMER. Examine choke to be sure it opens and closes fully in response to operation of choke button. If primer is used in starting engine, note if its action is satisfactory, and check for fuel leaks at primer pump or connections.

(18) ENGINE WARM-UP. NOTE: *During subzero weather, start stand-by heater according to instructions in paragraph 20 a.* Start engine and note if starter action is satisfactory, and if engine has any tendency toward hard starting. Set hand throttle to run engine at fast idle during warm-up. Reset choke button during warm-up so engine will run smoothly, and to prevent overchoking and oil dilution.

(19) INSTRUMENTS.

(a) Oil Pressure Gage. Gage should register approximately 40 pounds pressure at normal operating speed.

(b) Ammeter. Gage may indicate charge (+) for a period after starting until generator restores to battery the current used in starting engine, then gage should indicate only slight charge if batteries are up and with lights and accessories turned off.

(c) Heat Indicator. Reading should increase gradually to normal operating range, 175° to 180° F. Maximum safe operating temperature, 200° F. CAUTION: *Do not move vehicle until engine temperature reaches 140° F.*

(d) Fuel Gage. Gage should register the approximate amount of fuel in tank. Ordinarily, tank will have been filled and gage should register "FULL."

(e) Voltmeter. On vehicles so equipped, place voltmeter switch in the "ON" position and check voltage of the electrical system (par. 104).

(20) ENGINE CONTROLS. Observe if engine responds properly to controls and if controls operate without excessive looseness or binding.

(21) WINDSHIELD WIPER. Test wipers to see that they operate properly; that blades and arms are in good condition, secure, and operate through their full stroke, and that blades contact glass evenly and firmly.

(22) GLASS. Clean windshield glass and curtain windows and inspect for damage.

(23) LAMP (LIGHTS). Clean the lenses, and inspect all units for looseness and damage. If tactical situation permits, open and close all light switches to see if lamps respond properly.

(24) LEAKS—GENERAL. Look under vehicle and within engine compartment for indications of fuel, oil, and coolant leaks. Trace any leaks found to source and correct, or report them to designated authority.

(25) TOOLS AND EQUIPMENT. Check tools and On-vehicle Stowage Lists to be sure all items are present, and see that they are properly mounted or stowed.

(26) AMPHIBIAN SERVICES.

(a) Bilges and Bilge Pump. Examine bilge compartments to see that all bulkheads, frame members and braces, and insulation pads are in good condition, and secure. Test hand bilge pump to be sure it is in good condition and will pump to capacity. Tighten all units securely.

(b) Rudder-Mountings, Control Arms, Cables, and Handle. On vehicles so equipped, inspect rudders to see if they are in good condition and that mounting and assembly nuts and screws are secure. Examine rudder control handle (tiller) and cable drum, cables, and control arms to be sure they are in good condition; see if cables operate freely in the conduits, and that conduits are securely mounted to hull. Apply a few drops of engine oil to cables where they enter the conduits, and to clevis pins, control arm fulcrum pins, and operating handle.

(c) Capstan—Clutch, Drive Shaft, U-joints, Mountings, and Drive Belt. On vehicles so equipped, examine capstan assembly and all operating and driving mechanism to see if each unit is adequately lubricated. Look particularly for loose mountings and U-joints, distorted drive shaft, frayed or oil-soaked drive belt. Be sure drive pulleys are not loose or damaged. Drive belt should have ⅝- to ¾-inch finger-pressure deflection (fig. 196).

13. RUN-IN TEST.

a. Procedures. Perform the following procedures (1) to (6) inclusive, during the road test of the vehicle. On vehicles which have been driven 50 miles or more in the course of delivery from the supplying to the using organization, reduce the length of the road test to the least mileage (or time, in case of amphibian water operation) necessary to make the observations following. CAUTION: *During the road test of the vehicle, continuous operation of the vehicle or engine at speeds beyond those recommended on the caution plates must be avoided.*

(1) DASH INSTRUMENTS AND GAGES. Do not move vehicle until engine temperature reaches 140° F. Maximum safe operating temperature is 200° F. Observe readings of ammeter, oil, temperature, and fuel gages to be sure they are indicating the proper function of the units to which they apply. Also see that speedometer registers the vehicle speed and odometer registers accumulating mileage.

(2) STEERING BRAKES. Test action of steering brake mechanism to see if it functions properly; that levers have about 1½ to 2½

inches of free travel (at top) before meeting resistance; that they stop vehicle effectively with levers even, and that they have a reserve of travel available when fully applied. Test operation of each steering brake separately to be sure vehicle steers properly.

(3) CLUTCH. Observe if clutch operates smoothly without grab, chatter, squeal on engagement, or slippage (under load) when fully engaged. See that pedal has 1-inch free travel before meeting resistance. CAUTION: *Do not ride clutch pedal at any time, and do not engage and disengage new clutch severely or unnecessarily until driven and driving disks have become properly worn in.*

(4) TRANSMISSION. Gearshift mechanism should operate easily and smoothly, and gears should operate without unusual noise and should not slip out of mesh.

(5) ENGINE. Be on the alert for any abnormal engine operating characteristics or unusual noise, such as lack of pulling power or acceleration, backfiring, misfiring, stalling, overheating, or excessive exhaust smoke. Observe if engine responds properly to all controls.

(6) UNUSUAL NOISE. Be on the alert during road test for any unusual noise from body and attachments, power train, or tracks and suspension units, that might indicate looseness, damage, excessive wear, or inadequate lubrication.

(7) Halt vehicle at 10-mile intervals or less during land test, for services (8) and (9) following:

(8) TEMPERATURES. Cautiously hand-feel each drive, idler, bogie, and guide wheel hub for overheating, and also examine final drive and rear axle for abnormal temperatures.

(9) LEAKS. With engine running and fuel, engine oil, and cooling systems under pressure, look within engine compartment and under vehicle for indications of leaks.

(10) TRACK TENSION. Check track tension and adjust if necessary, according to the instructions in paragraph 135.

(11) AMPHIBIAN SERVICES.

(a) In Water. While at halt in water, observe if there is any abnormal rise of water in bilges; if there are any leaks at cell lids or cover seals, and if vehicle rides on even keel. Pump out excessive water with hand bilge pump.

(b) On Land. Examine exterior of hull for damage, and remove all weeds from weed cutters, and/or other objects lodged in tracks and suspension units or wound around rudders and control mechanism. Tighten any loose drain plugs, lids, or compartment covers before again entering water.

b. Vehicle Publications and Reports.

(1) PUBLICATIONS. See that vehicle Operator's Manual, lubrication order, Standard Form No. 26 (Driver's Report-Accident, Motor Transportation), and W.D., A.G.O. Form No. 478 (MWO and Major Unit Assembly Replacement Record) are in the vehicle, legible, and properly stowed. NOTE: *U.S.A. registration number and vehicle nomenclature must be filled in on Form No. 478, for new vehicles.*

(2) REPORTS. Upon completion of the Run-in Test, correct or report any deficiencies noted. Report general condition of the vehicle to designated individual in authority.

Section VI

CONTROLS AND INSTRUMENTS

14. VEHICULAR OPERATING CONTROLS (figs. 16, 17, 18, 19, and 22).

a. Master Switch. This switch is located on the engine compartment side panel near the rear of the upper section. NOTE: *It is necessary for handle to be in the horizontal "ON" position before any of the electrical units will operate.*

b. Ignition Switch.

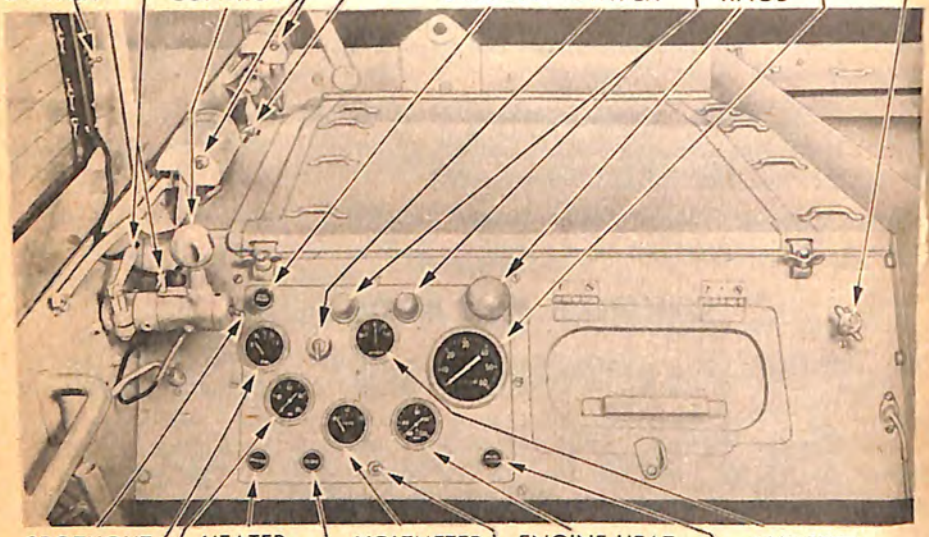
(1) IGNITION SWITCH (BEFORE VEHICLE SERIAL 1003). The ignition switch is mounted in the left upper center of the instrument panel. Moving the lever toward the front completes the circuit to the coil.

(2) IGNITION AND HEATER SWITCH (AFTER VEHICLE SERIAL 1002). The standby heater switch is combined with the ignition switch. When the lever on the combination "ignition and heater switch" is moved toward the rear, the electrical circuit to the heater is completed (on vehicles so equipped). This makes it impossible to start the heater while the engine is operating.

c. Starter Switch. The starter switch is located in the upper left corner of the instrument panel. Pushing in on the button energizes the starter solenoid switch which operates the starter to crank the engine.

d. Spark Control. The spark control is automatic and is varied to suit engine operating conditions by a governor with the ignition distributor.

e. Carburetor Throttle. If desired (as during engine warm-up), speed of the engine can be set by pulling out the carburetor throttle button located on coaming, in front and slightly to the right of the driver.



RA PD 319401

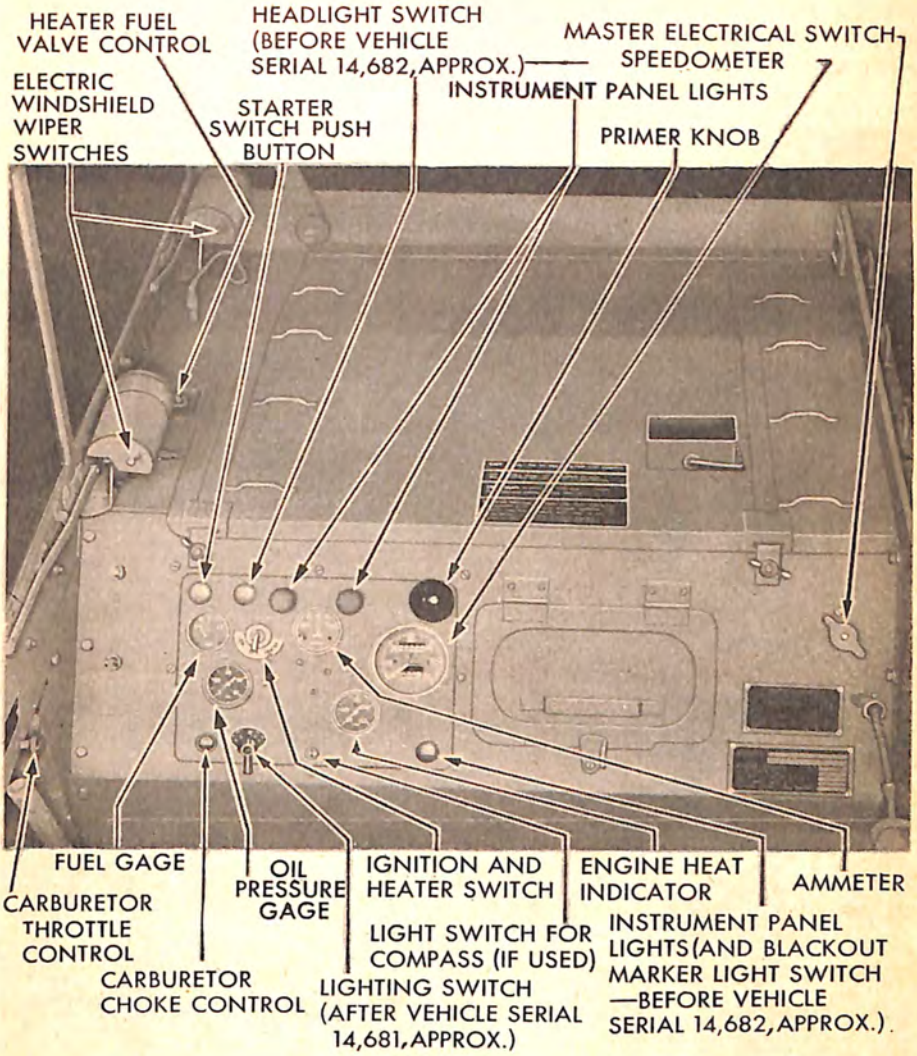
Figure 16 — Instruments and Controls (Before Vehicle Serial 2103)

f. Carburetor Choke. Choking of the carburetor for cold starts is accomplished by operating the carburetor choke control. The control button is mounted on the instrument panel at the lower left side. Refer to paragraph 17 c for additional information.

g. Primer Knob. The primer control knob is located in the upper right corner of the instrument panel. By pulling the knob outward and then pushing it in, a charge of fuel is injected into the intake manifold to assist in cold-weather starting.

h. Accelerator. The accelerator pedal, accessible to the driver's right foot, provides quick and positive control of engine speed.

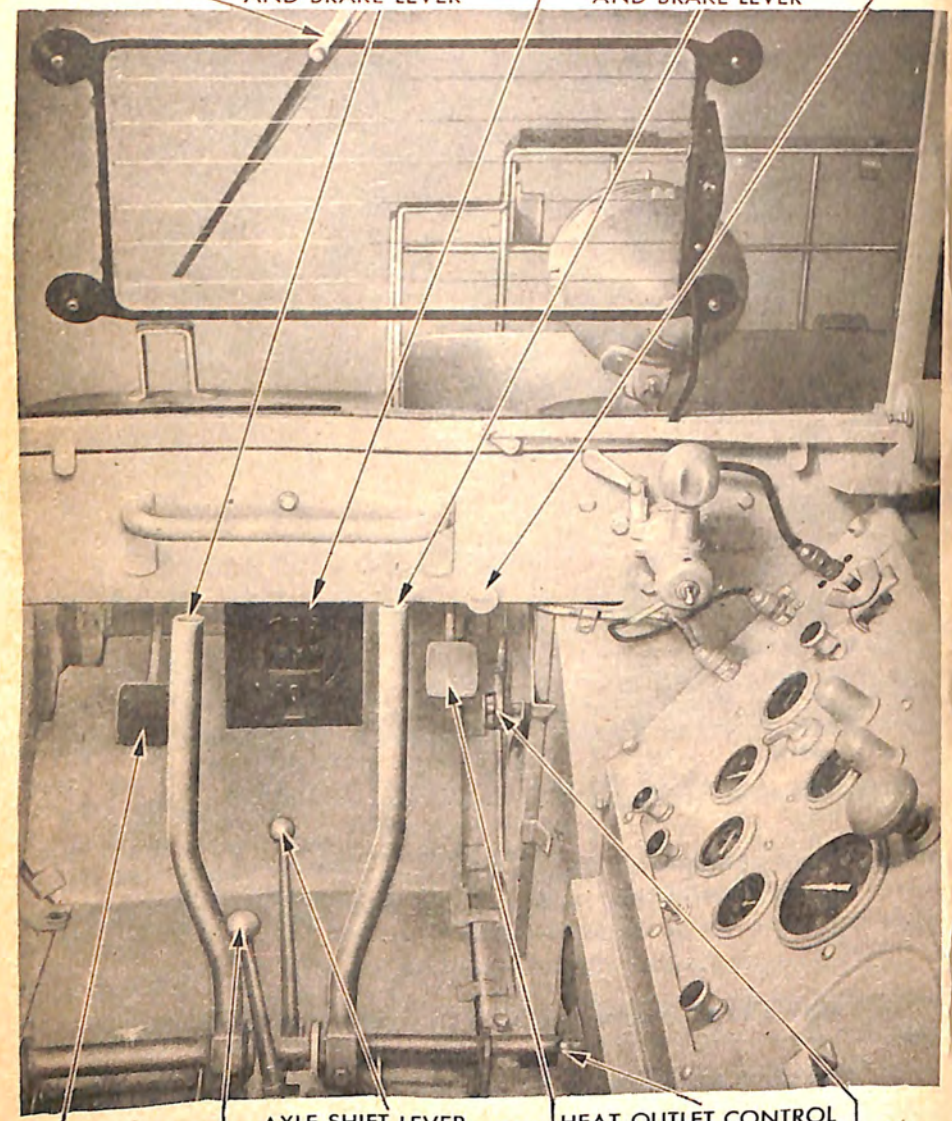
i. Clutch Pedal. The clutch is controlled by a pedal accessible to the driver's left foot. The pedal is connected by adjustable linkage to the clutch release shaft lever at the clutch housing.



RA PD 352247

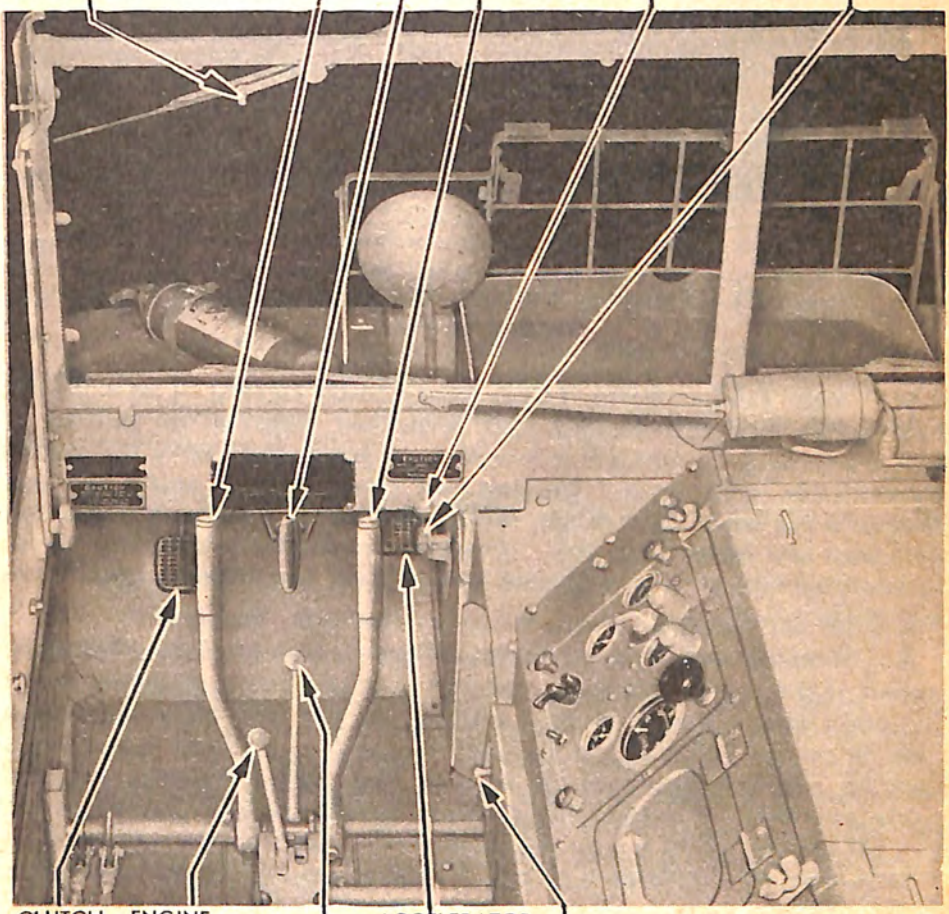
Figure 17 — Instruments and Controls (Late Production)

j. Engine Transmission Shift Lever. The transmission remote control shift lever, located in front of the driver, is connected by adjustable linkage to the transmission assembly mounted on the rear of the clutch housing. Moving the remote control lever from neutral (center) position to the left and rearward engages the first-speed position; to the left and forward, the reverse gear; to the right and forward, the second-speed position; and to the right and rearward, the third-speed position (fig. 20).



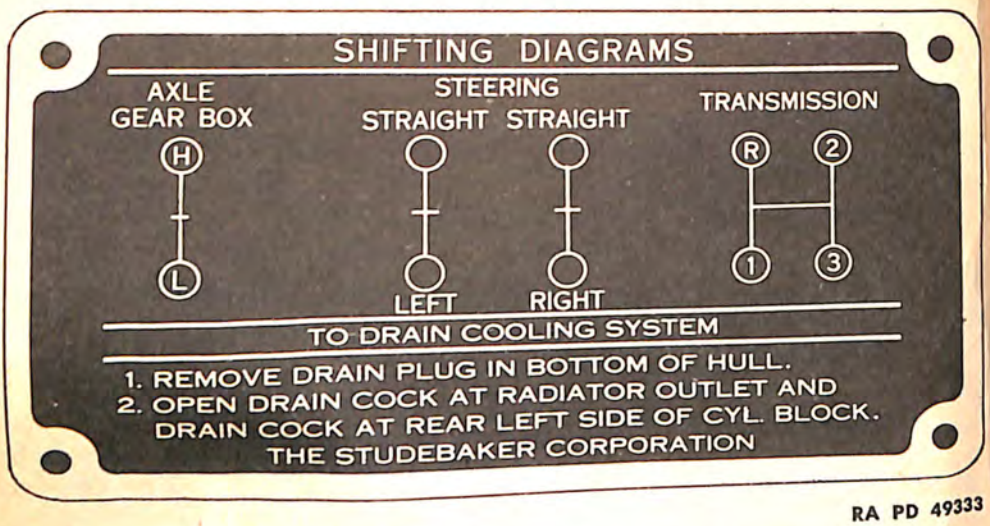
RA PD 319400

Figure 18 — Foot and Hand Controls (Before Vehicle Serial 3103)



RA PD 352248

Figure 19 — Foot and Hand Controls (Late Production)



RA PD 49333

Figure 20 — Steering, Shifting, and Cooling System Drain Instruction Plate

k. Axle Transmission (Gear Box) Shift Lever. The axle unit has two speeds, and the gearshift lever that controls the shifting of axle transmission into high or low range is located ahead of the engine transmission shift lever. Moving the lever forward shifts the axle transmission into high range, while moving it rearward shifts the axle into low range (fig. 20). Therefore, with the four engine transmission speeds, six forward gear speeds and two reverse speeds are available.

l. Steering and Brake Levers. These levers are located directly ahead of the driver and are connected to brake bands in the axle unit by cross shafts and linkage. Pulling on the left lever steers the vehicle to the left and on the right lever steers to the right when moving either forward or in reverse (fig. 20). Pulling rearward simultaneously on both steering levers retards the speed of the vehicle. If enough effort is applied, such action will stop the vehicle. The clutch must be disengaged to avoid stalling the engine when braking.

m. Parking Brake Handle (After Vehicle Serial 15,681, Approx.). The parking brake handle is located just below the coaming directly in front of the driver between the steering brake levers (fig. 19). Pulling rearward on the handle engages the parking brake. To lock handle in the "holding" position after it has been pulled out, turn handle 90 degrees to a horizontal position. To release the parking brake, turn handle to the vertical and push it forward to its "release" position. NOTE: *The parking brake is ineffective unless the axle transmission is in gear* (fig. 21).

RA PD 336657

Figure 21 — Parking Brake Caution Plate

n. Tiller (M29C). The tiller is mounted in front of the driver on the coaming below the windshield (fig. 22). It is connected by cables to twin rudders on the rear of the stern cell. The rudders control the course of the vehicle in water. Turning the tiller clockwise will steer the vehicle to the right and turning the tiller counterclockwise steers the vehicle to the left.

o. Capstan Clutch Control (M29C). This control is located on the floor of the vehicle at the right side of the driver's seat (fig. 22). Pull the control button up to engage the clutch and push the button down to disengage it.

15. MISCELLANEOUS CONTROLS AND EQUIPMENT (figs. 16, 17, 18 and 19).

a. Light Switches.

(1) SPOTLIGHT (BEFORE VEHICLE SERIAL 3103). The spotlight switch is located in the control handle.

(2) HEADLIGHT. The headlight switch (from vehicle serial 3103 through 14,681, approx.) is located on the instrument panel between the starting switch button and the front panel light. After vehicle serial 14,681 (approx.), the headlight switch is combined in the rotary switch on the lower left side of the instrument panel. Turning the rotary switch to its far right ("HDLTS") position operates the headlight. Located just above the rotary switch is a lock-out button which prevents turning on the headlight accidently. It is necessary to depress the lock-out button before the headlight can be turned on.

(3) BLACKOUT DRIVING LIGHT (AFTER VEHICLE SERIAL 14,681, APPROX.). The switch for this light is combined in the rotary switch on the lower left side of the instrument panel. Turning the rotary switch to its far left ("BODR") position operates the blackout driving light. The lock-out button must be depressed in order to turn the switch to the blackout driving-light position.

(4) SIGNAL AND TROUBLE LIGHT. The signal and trouble light switch is located in the pistol grip control.

(5) INSTRUMENT PANEL AND MARKER LIGHTS. The switch for these lights is located in the lower right-hand corner of the instrument panel. After vehicle serial 14,681 (approx.), the panel lights will not operate unless the headlight is turned on. The marker light is controlled by the rotary switch and operates when the headlight or blackout driving light is turned on. The marker light can be operated alone by turning the rotary switch to the "BOMK" position.

(6) VOLTMETER AND COMPASS LIGHT. The switch for these units is located in the center of the instrument panel near the lower edge.

b. Windshield Wiper Switch. The electric windshield wipers have individual switches on the electric motor assemblies. A manual wiper control is located directly in front of the driver and pivots on the windshield frame.

c. Defroster Switch. An electric heating element-type windshield defroster is supplied with some vehicles. It mounts on the windshield with rubber suction cups and is operated by a switch on the defroster frame.

d. Ventilator and Heating Controls.

(1) VENTILATOR. The air duct ventilator lid control is located on the right wall near the front of the driver's compartment.

(2) HEATING DRIVER'S COMPARTMENT. A sliding door, with handle, is provided to control the amount of heat that enters the driver's compartment through a hole in the engine compartment side panel.

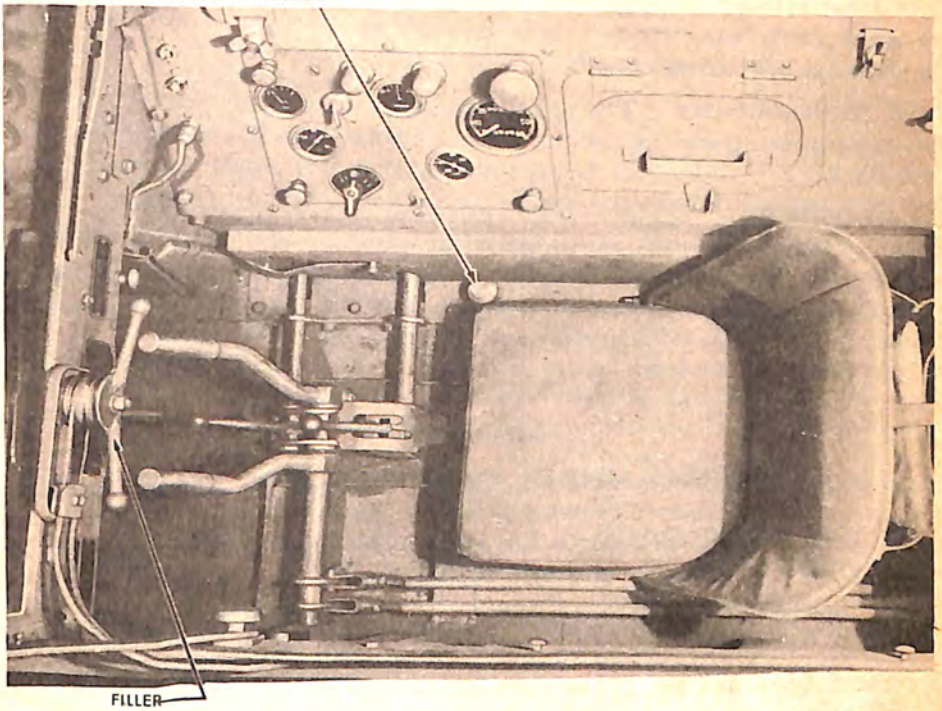
(3) STAND-BY HEATER (ON VEHICLES SO EQUIPPED).

(a) Fuel Valve Control. The heater fuel valve control is located on the engine compartment front panel. Turning the control to the rear opens a valve so gasoline will flow to the heater.

(b) Blower and Igniter Switch. The switch that controls these units is located in the lower left corner of the instrument panel on vehicles produced before serial 1003. On vehicles produced after serial 1002, the switch for these units was combined with the ignition switch (par. 14 b above).

16. INSTRUMENTS (figs. 16, 17, and 18).

a. Ammeter. The ammeter indicates the amount of charge (+) or discharge (−) of current to or from the battery. It is located in the upper center of the instrument panel. Normal readings during operation of vehicle will vary from several amperes discharge to 40 amperes charge. NOTE: *Radio equipment is not connected to ammeter.*



RA PD 336614

Figure 22 — Additional Controls on Cargo Carrier M29C

b. Compass. A sealed, liquid-type compass, located under the coaming and in front of the driver, was furnished on vehicles before serial 2103.

c. Fuel Gage. The fuel gage on the upper left portion of the instrument panel is connected to a unit in the fuel tank by an electrical circuit. When the ignition switch is turned to the "ON" position, the fuel gage indicates the approximate amount of fuel in the tank.

d. Heat Indicator. The heat indicator gage has a range of 100° to 220° F and is located on the instrument panel just below and to the left of the speedometer. The indicator element is located in the left side of the cylinder head near the rear. After the engine reaches normal operating temperature, the reading on the indicator will range from 175° to 200° F, depending on prevailing air temperature and type of operation.

e. Oil Pressure Gage. The oil pressure gage indicates pressure of engine oil being pumped to various moving parts of the engine. It is located on the instrument panel below and to the right of the

fuel gage. Normal pressure reading, with engine at operating temperature, will vary from a few pounds at idle speed to 40 pounds or more at operating speed.

f. Speedometer. The speedometer is located on the right side of the instrument panel below the primer knob. The speed of the vehicle is indicated in miles per hour, and provision is made for registry of trip and accumulated mileage.

g. Voltmeter. A voltmeter that permits checking the voltage present in the electrical system was furnished on vehicles before serial 2103. It is located in the lower left center of the instrument panel.

Section VII

OPERATION UNDER ORDINARY CONDITIONS

17. USE OF INSTRUMENTS AND CONTROLS IN VEHICULAR OPERATION.

a. Service Upon Receipt of Equipment. Before a new or reconditioned vehicle is placed in use, be sure that the services prescribed in paragraphs 10, 11, 12, and 13 have been performed.

b. Before-operation Service. Perform the services in items 1 to 6 in paragraph 41, before attempting to start the engine. Start and warm up the engine (subpar. c below) and complete the Before-operation Service.

c. Starting Engine. Open the air duct ventilator lid and place the engine transmission shift lever in neutral position. Push the clutch pedal forward to disengage the clutch; push the accelerator pedal forward about one-third of its normal travel, and set the throttle hand control to correspond. If the engine is cold, pull the carburetor choke control button outward to the full choke position. Place the master switch handle in horizontal position, turn the ignition switch on, and depress the starter manual switch button for about 30 seconds at a time or until the engine starts. CAUTION: *If the engine intermittently starts and stops firing, do not re-engage the starter until the engine has completely stopped. Failure to follow this precaution will result in damage to the flywheel. If the engine does not start promptly, investigate at once, because continued cranking of the engine will discharge the batteries and flood the engine cylinders with fuel.* After the engine starts, push the choke control button inward to a point where the engine runs smoothly, and release the clutch pedal. If oil pressure is not evident on gage in approximately 10 seconds,

stop the engine at once and investigate. Push the choke control button all the way in as soon as the engine will operate without stopping. "Throttle-down" the engine by pushing the hand throttle control all the way in.

d. Driving Instructions.

(1) ON LAND (M29 AND M29C).

(a) Shifting (fig. 20). Start the engine (subpar. c above). Ordinarily the vehicle will be operated with the axle transmission in high range (shift lever in forward position). If difficult terrain is to be encountered, shift the axle transmission into low range (lever in rear position). Push the clutch pedal forward to disengage clutch, shift engine transmission shift lever into first-speed position, and gradually release the clutch pedal while accelerating the engine. (Reversing the vehicle is accomplished in the same manner except that the engine transmission shift lever is moved into reverse position.) As the vehicle gains momentum and the engine ceases to labor, release the accelerator pedal as the clutch pedal is pushed forward, and move the engine transmission shift lever into the second-speed position. Release the clutch pedal and accelerate the engine. When the vehicle momentum has increased and the engine is not laboring, again release the accelerator pedal as the clutch pedal is pushed forward, and move the engine transmission shift lever into the third-speed position. Release the clutch pedal and accelerate the engine. NOTE: *Use a light touch when shifting gears.*

(b) Shifting Engine Transmission to Lower Speed. When it becomes necessary to shift the engine transmission from the third-speed position to the second-speed position in order to obtain more power, use the following procedure: Release the accelerator pedal as the clutch pedal is pushed forward, and move the engine transmission shift lever to neutral. Release the clutch pedal, accelerate engine momentarily to synchronize engine and vehicle speed, and move the engine transmission shift lever into the second-speed position as the clutch pedal is again pushed forward. Release the clutch pedal and accelerate the engine. CAUTION: *Do not under any circumstances shift the engine transmission into its first-speed position unless vehicle is stopped* (fig. 23).

(c) Shifting Axle Transmission to Low Range. Always stop vehicle before shifting axle control. Push the clutch forward and move the axle transmission shift lever into low range (lever in rear position). Release the clutch pedal and accelerate engine.

(d) Preferred Gearing Combination of Engine and Axle Unit Transmissions. Do not operate the vehicle over sustained periods in the gearing combination of axle unit high range and engine transmission first speed as this may cause overheating and rapid wear of the engine

RA PD 336641

Figure 23 — Clutch and Shifting Caution Plate (On Vehicles After Serial 10,921)

transmission parts. Instead, operate in axle unit low range and engine transmission third speed. No appreciable difference in vehicle speed or power results from this preferred gearing combination.

(e) Steering the Vehicle (fig. 20). Pull back on left steering lever for a left turn and on right steering lever for a right turn. The sharpness of a turn depends on the amount of pull exerted on the steering lever. Use a steady "finger-tip" pressure on the steering levers. Excessive force applied to the steering levers will merely bend or stretch the linkage and will not give additional steering or braking action. When the vehicle is to be turned, compensate for the extra power needed by accelerating the engine as the steering lever is pulled back. If the vehicle is turned too sharply, one of the tracks may be forced off.

(f) Prevention of Track Throwing. When the vehicle is driven in deep ruts and it is necessary to make a turn, reduce the speed of the vehicle, and steer it out of the ruts gradually while applying some power to the tracks. CAUTION: *A sharp, fast turn out of ruts will cause the tracks to tilt away from drive wheel sprockets and result in tracks running off.* When it is necessary to cross ditches, ruts, or other obstacles, cross them squarely if possible and drive vehicle slowly, with power applied to tracks. A heavy thumping noise indicates the track is coming off; therefore, stop the vehicle immediately. If the track is still in a tilted position, it can usually be run back into place on drive wheel sprockets by reversing the vehicle. When the track has run part way off the drive wheel sprockets, it will be necessary to use blocks, a bar, or some other leverage to tilt the track into a suitable position so it can be run back into place on the drive wheel. If the track is run completely off the drive wheel, relieve the track tension, and install track as outlined in paragraph 135 f.

(g) Observation of Instruments. Observe the action of the oil pressure gage, heat indicator, and ammeter frequently while operating vehicle. If any of these instruments become erratic or show an abnormal reading, stop the vehicle at once (if practical) and investigate to find the cause.

(h) Driving Over Rough Terrain. Make certain that cargo is lashed securely to prevent shifting and possible resultant damage during operation. Straps are provided on the deck coaming surrounding the cargo compartment for use in lashing and covering cargo. Drive slowly to avoid damage to vehicle. Whenever possible, drive around rather than straddle stumps, rocks, and other obstructions because low ground clearance invites hull damage and the chance of getting stuck. Keep clear of jagged rocks, sharp coral, and barbed wire to prevent damage to tracks and suspension system. Pitching action can be reduced by crossing small obstructions diagonally. Always negotiate full gage railway tracks slowly and at an angle.

(i) Steep Hill Driving. Before attempting to ascend or descend a steep hill or embankment, stop vehicle and shift axle transmission into low range and engine transmission into first-speed position. Maneuver vehicle to approach squarely. When negotiating a steep ascent, anticipate the power necessary to carry the vehicle to the crest. Just as vehicle reaches the crest, release the accelerator and allow the momentum to carry the vehicle. The front will then nose down easily and a crash landing will be avoided. CAUTION: *Never permit vehicle to coast with the clutch disengaged during steep hill driving* (fig. 23). *On vehicles before serial 15,682 (approx.), if the engine is stalled on a steep place (up or down), do not depress the clutch foot pedal.* Under steep hill conditions and with the clutch disengaged, the steering brakes do not have enough power to hold the vehicle. With the axle transmission in low range and the engine transmission in first-speed position, use the starter to move the vehicle. This will either restart the engine or power the vehicle to a reasonably level spot where it will then be possible to hold the vehicle with the steering brakes while starting engine with clutch disengaged. After vehicle serial 15,681 (approx.), if the engine is stalled on a steep place, set the parking brake, disengage the clutch and start the engine. CAUTION: *Do not attempt to shift the axle transmission with parking brake set as shifting necessitates going through neutral position. The parking brake will be ineffective when axle transmission is in neutral position* (fig. 21).

(2) IN WATER (M29C).

(a) Precautions—Deep Water Operation. This vehicle is designed to provide maneuverability in fording small bodies of relatively still yet deep water. Although specific operating limitations are diffi-

cult to define, use must not be extended to include operation in extremely turbulent waters such as high surf or very fast current. The severity of conditions under which successful operation is possible is dependent on the distance to be traveled. In general, do not attempt operation in waves over 1 foot in height; however, this is modified in near-shore surf travel where it is possible to go out against 2-foot waves or land in front of waves 3 feet in height. CAUTION: *Never attempt deep-water operation if the total load exceeds 1,200 pounds (personnel and cargo). Never attempt operation in currents of over 2½ miles per hour.* When afloat, the track aprons act to partially seal off the opposing drive of the upper half of the tracks, which would otherwise practically nullify the forward drive obtained from the bottom part of the tracks. Without the use of track aprons, maximum forward speed afloat is cut by one-fourth. It is impossible to achieve satisfactory steering when only one track apron is used because there is a marked increase in the amount of drive obtained from the covered track. The aprons, tracks, and entire suspension system must be kept clean and free from any obstructions which would act to prevent equal track rotation while the vehicle is afloat. The presence of an obstruction in one track system necessitates continual use of the steering brake on the opposite track with resultant overheating and premature wear of the axle unit.

(b) Preparation for Amphibious Operation. Lower rudders and check all parts of marine steering gear for proper operation. Secure surf guard to bow except in absolutely calm water when it need not be used. Check condition of hand bilge pump and place in a handy location for immediate use. Check for adequate supply of gasoline, oil, and water. Inspect the hull for damage that could cause leaks and *make sure that all five hull drain plugs, the bow cell plug, the stern cell plug, and the engine oil hull drain plate are in place and tight.* Close the bow lid and stern cell inspection cover tightly. Check the stern cell top panel lid to make sure it is tight. Cover cargo space with tarpaulin except in smooth water when cover is not necessary. Before entering surf or before a steep entry, temporarily close air intake cover.

(c) Entering Water. When it is possible to make a reasonably level entry into water, shift axle unit to high range and engine transmission into first-speed position. When it is necessary to enter the water from a steep embankment, shift axle unit to low range and engine transmission into first speed. Enter the water very slowly. A sudden-plunge entry might cause vehicle to ship sufficient water to swamp it or stall the engine. Due to the uncertainty of what may be below the surface, proceed cautiously by "feeling" the way into the water. Caution in entering the water will minimize the possibility of becoming entangled with or stuck on some underwater obstruction.

(d) Afloat Operation. When vehicle is fully afloat and tracks are clear of bottom, shift axle transmission into high range and engine transmission into second speed. These gear ratios will give maximum speed for water operation. To obtain maximum economy, operate the vehicle with engine transmission in third speed. Never operate in deep water with axle transmission in low range and engine transmission in first speed. If air intake duct lid was closed on entering the water, open ventilator lid as soon as vehicle is safely afloat. If operation is in rough water where waves occasionally break over the bow, open air intake lid during calmer intervals in order to keep engine operating temperature below 200° F. Engine temperature can be lowered by operating the vehicle temporarily at part throttle with axle unit in high range and engine transmission in first speed. Check for leakage in the engine compartment and by looking through exhaust air outlet and air intake duct. Return to shore immediately if there is evidence of serious leakage, using hand bilge pump through engine transmission or axle unit inspection holes. Avoid seaweed, lily pads, and other dense vegetation. If vegetation or other trash does accumulate in suspension system, it can often be removed by reversing operation of the tracks while still afloat. CAUTION: *Striking a submerged obstacle with a track that is driven at high speed will change the course of travel and may cause the vehicle to capsize.*

(e) Steering Afloat. Normal steering in deep water is accomplished by rudder action only. Turning the tiller in a clockwise direction will steer the vehicle to the right; and turning the tiller in a counter-clockwise direction will steer the vehicle to the left. For greater maneuverability, rudder action can be supplemented by use of the regular steering levers. Best steering is obtained with a high track speed. In shallow water, when tracks contact ground, steering should be done with the regular steering levers, supplemented as necessary by the rudders. When navigating against a current, head upstream sufficiently to compensate for counter-currents in making good a straight course.

(f) Landing. Operate with a slow track when approaching shore. Select the most promising spot, avoiding steep banks and heavily wooded sections if possible. Small vegetation will help traction. When landing in soft mud or on a steep grade, stop and shift engine transmission into second speed and axle transmission into low range; reduce the engine speed the instant the vehicle grounds. This will enable the vehicle to climb out without digging in. Where there is a solid shore with a gradual grade, stop, shift engine transmission into first speed (axle transmission in high range), and proceed at reduced throttle.

(g) After Landing. Stop the vehicle after landing (subpar. e (1) below), lift the rudders, and hook them in raised position (fig. 6) with

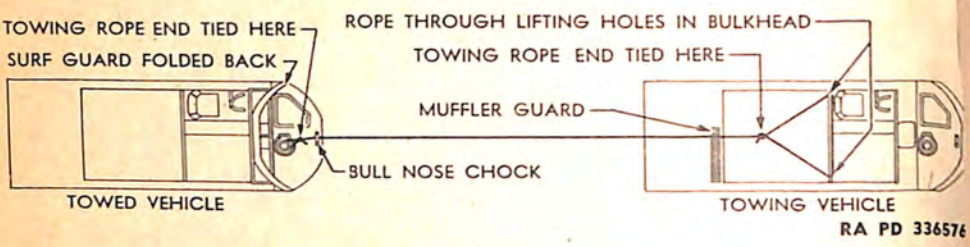


Figure 24 — Line Hook-up for Towing Afloat

fasteners provided. Unhook the surf guard fasteners, raise the guard which is pivoted at each side, push it rearward and down in front of windshield. Drain any water accumulations in hull and cells by removing drain plugs, as necessary, on left side of the vehicle. Be sure to reinstall all plugs and tighten them securely. Unhook track apron fasteners and raise aprons. Wash away any accumulation of mud and debris at track drive wheels, idler wheels, bogie wheels, and from entire suspension system. Remove any debris collected at the water spillway opening, ahead of each idler wheel. Lubricate all wheel bearings. Lower track aprons and secure with fasteners.

e. Stopping the Vehicle.

(1) ON LAND (M29, M29C). When bringing vehicle to a stop, release accelerator pedal and utilize the breaking effect of the engine to slow the vehicle until speed has been reduced to a few miles per hour. Pull back slowly on both steering levers and push the clutch pedal forward in one smooth action. In some cases, as when encountering heavy terrain or while ascending a grade, it will not be necessary to apply much, if any, braking effort on the steering levers to stop the vehicle unless the grade is steep enough to require holding the vehicle from rolling backward. Usually it can be held in position by shifting both the axle and engine transmissions into low-speed positions, stopping the engine, and allowing the clutch to engage. After vehicle serial 15,681 (approx.), set the parking brake by pulling out the parking brake handle (fig. 19) and turning it 90 degrees to the horizontal "holding" position.

(2) IN WATER (M29C). Shift engine transmission to reverse with axle transmission in high range. Because of gear reduction in reverse, relatively high engine speeds must be used. Caution must be taken not to overspeed the engine as tracks impose very little load. Steering maneuverability is limited in reverse. Best control is obtained with the steering brake levers as in land operation, but this can be supplemented by use of the rudders.

f. Stopping the Engine. Release the accelerator pedal so the engine operates at idle speed, and turn the ignition switch to the "OFF" position.

18. TOWING THE VEHICLE.

a. Towing to Start Vehicle.

(1) PRECAUTIONS. In towing another vehicle there are several precautions that the driver must take. Changes of direction should be accomplished by a series of short turns so that the vehicle being towed is, as nearly as possible, directly behind the one doing the towing. If a continuous short turn is attempted, the tow rope may become entangled in a track and damage the track or rope. When entering muddy areas or when operating on snow or ice, if possible avoid turns of any kind, and keep the speed below 12 miles per hour.

(2) OPERATION OF TOWING VEHICLE (ENGINE RUNNING). If possible, tow directly in front of the towed vehicle. Shift the axle transmission into low range and the engine transmission into the first-speed position. Gradually release the clutch pedal and open the throttle as required for the additional lead. Take up slack in rope gradually. Shift the engine transmission into second speed before signaling the other operator to engage the clutch of the towed vehicle. After sufficient momentum has been attained, signal for the driver to engage the clutch of the towed vehicle. After the engine in the towed vehicle starts, stop and unhook the tow rope.

(3) TOWED VEHICLE. Attach one end of tow rope to the towing eye on the front end of vehicle to be towed, and the other end to pintle hook on rear of towing vehicle. Pull the carburetor choke control button out as in regular starting. Shift the axle transmission into high range and the engine transmission into the third-speed position. Prime the manifold, if necessary, and turn on the master and ignition switches. Keep the clutch pedal held forward and signal to the operator of the towing vehicle to start. After the towing vehicle is well under way (wait for signal), gradually engage the clutch and depress the accelerator pedal. When the engine begins firing, disengage the clutch, adjust the carburetor choke and throttle controls, and signal to the driver of the towing vehicle to stop. Shift the engine transmission to neutral, allow the engine to warm up at idling speed, and unhook tow rope from towing eye and pintle hook.

b. Towing a Disabled Vehicle. When it is necessary to tow a disabled vehicle, make sure that the shift levers are placed in the "Neutral" position. Attach tow rope (subpar. **a** (3) above), and proceed as outlined in subparagraph **a** (1) above.

c. Towing Afloat (M29C) (fig. 24). On towing vehicle, feed th tow line through lifting holes near left and right ends of hull bull head; tie rope end to tow line at point midway back over cargo con partment; remove rear litter bracket from cargo compartment an D-handled shovel from top of stern cell; and lead tow line back ove muffler guard. On vehicle receiving tow, place surf guard in th folded-back position; feed tow line through bull nose chock at fron of bow cell; coil the line twice (counter-clockwise) around capstan and tie rope end to tow line.

Section VIII

OPERATION OF AUXILIARY EQUIPMENT

19. FIRE EXTINGUISHER.

a. Description. A 1-quart, pump-type fire extinguisher is carried in a bracket mounted on the rear deck before vehicle serial 3103 and on the front deck of all vehicles after serial 3102. A retaining strap that is easily unlatched keeps the fire extinguisher tight in its bracket.

b. Operation. To use the fire extinguisher, pull up on the catch o loosen the retaining strap; pull the extinguisher off its mounting bracket (fig. 25); turn the handle 90 degrees counterclockwise to unlock pump; and pull handle outward. Pushing in on the handle forces a stream of fire extinguishing chemical from the nozzle. By pumping the handle, a continuous stream will be forced from the nozzle. Direct the stream toward the base of the flame. After the blaze has been extinguished, continue to play a stream on the sur rounding area.

c. After Operation. After using fire extinguisher, always make sure the handle is pushed all the way in and turned clockwise 90 degrees to lock the handle in the head and close the nozzle valve If this is not done, the extinguisher will leak. The fire extinguisher can be used to put out a fire in the engine compartment even though the engine is running.

d. Refill. When the fire extinguisher has been used, refill it at the first opportunity with the proper fluid by removing the filler plug in the head. After filling, make sure it does not leak when the valve is completely closed. Replace, if leaking. To discourage tampering, seal the filler plug and check the seal during inspections.

20. STAND-BY HEATER (ON VEHICLES SO EQUIPPED).

a. Description. The stand-by heater, which is located back of the bulkhead under the hull floor pan, consists of a blower, carburetor, and combustion chamber. This heater serves to keep the engine and

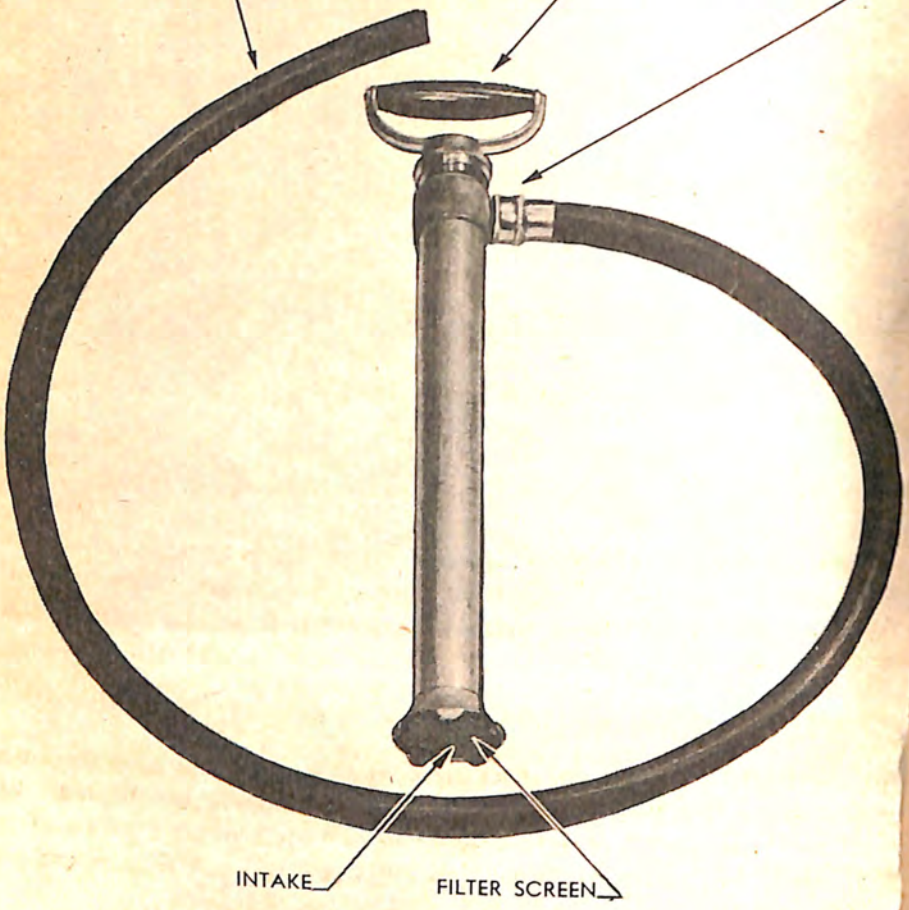
RA PD 336634

Figure 25 — Removing Fire Extinguisher

battery temperature from dropping so low that it would be impossible to start the engine in regions where extremely low temperatures prevail. If the surrounding atmospheric temperature drops without warning, the heater may be started and operated 1 to 3 hours to raise the temperature of engine and batteries. Fuel for operating the heater flows from the vehicle fuel tank to the heater carburetor, through a fuel line and filter when the shut-off valve is opened.

b. Operation. Open heater fuel valve with control handle on engine compartment front panel (figs. 16 and 17). Operate heater switch to complete electrical circuit to heater and allow 2 to 5 minutes for heater to start operating. When heater switch is on and igniter is heating, the ammeter will show approximately 12 to 14 amperes discharge. After the fuel mixture is ignited in the combustion chamber and the temperature reaches approximately 110° F, a thermostatic switch shuts off the current to the igniter. When the heater is operating, a roaring or hissing noise will be apparent. CAUTION: *If the heater has not started to operate within 5 minutes, investigate at once. Never start the engine while the heater is operating. Before starting the engine, close the fuel shut-off valve at the control handle, and*

755142 O - 47 - 4



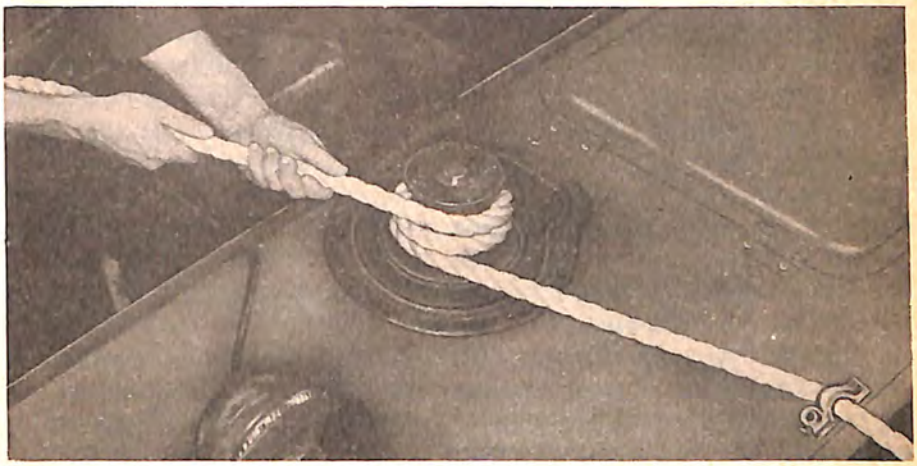
RA PD 31938

Figure 26 — Bilge Pump — Cargo Carrier M29C

shut off the heater switch. (On vehicles produced after serial 1002 the blower and igniter switch is combined with the engine ignition switch and is turned off as the engine ignition is turned on.)

21. BILGE PUMP (M29C).

a. Description (fig. 26). A portable, double-action bilge pump is provided with each vehicle for use while operating in water. The lower end of the pump cylinder is equipped with a screen to keep out foreign matter. A discharge hose is attached to a fitting at the upper end of the pump cylinder.



RA PD 336550

Figure 27 — Capstan in Use — Cargo Carrier M29C

b. Operation. Raise or remove cover from section where bilge water has accumulated. Place intake end of pump into the bilge water, hang discharge hose over the side of the vehicle, and hold the pump with one hand while operating the handle with the other.

22. CAPSTAN (M29C).

a. Description. A vertical drum-type capstan is mounted near the center of the bow (front) cell (fig. 5). Drive shafts with universal joints, pulleys, clutch, and a drive belt transmit power from the front end of engine crankshaft to the capstan. A maximum pull of 3,600 pounds can be exerted by use of the capstan.

b. Capstan Clutch Control (fig. 22). When conditions permit, stop engine by turning off ignition switch; then engage capstan drive by pulling up clutch control while "turning-over" engine with the starter. Where circumstances absolutely necessitate uninterrupted operation of the engine, reduce engine speed to slow idle; then engage capstan drive by pulling up clutch control. The clutch can be engaged or disengaged only when capstan is free of load. The capstan drive is disengaged by pushing down clutch control. Because the drive is direct from the engine, the capstan cannot be stopped by depressing the engine clutch foot pedal. In cases where it is not possible to release the load by slipping the rope off the capstan drum, stop the pulling by turning off engine at the ignition switch.

c. Operation. Place the bow surf guard in its folded-back po tion when using the capstan. With capstan clutch engaged and c end of tow rope secured to the most suitable fixed object ahead, fe the rope through the bull nose chock and wrap it one turn clockwi around the capstan. Pull in all slack in the rope. (At this stag using more than one turn of rope around capstan is very apt to cau a bad tangle due to slack rope.) As rope becomes tight, engag axle unit in low range and engine transmission in first speed; ther gradually engage engine clutch and slightly increase engine speed t start the tracks turning. Wrap a second clockwise turn of the rop around the capstan and pull the free end tight to stop rope from slipping on the capstan drum (fig. 27). As vehicle moves forward quickly throw off the second rope turn from around capstan and pull on free end to prevent any slack in the rope. (This is possible because a ratchet in the capstan head allows free clockwise rotation of the drum at all times.) When using capstan, always remember to have only one turn of rope when taking in slack and two turns when pulling on the taut rope. These instructions must be followed if bad rope tangles are to be avoided. If the rope becomes tangled while vehicle is stuck, it may be necessary to cut the line at the end secured to the fixed object ahead. Since the capstan has no pulling power in the reverse direction, certain situations might arise which necessitate cutting the rope to free it. When assistance of the capstan is n longer required, disengage jaw clutch by pressing down the contro Coil and stow the rope.

d. Pulling Vehicle Rearward. In an emergency, it is possibl to obtain some help by pulling the vehicle rearward with the aid c the capstan. In this situation, place surf guard in its forward positior fold windshield down, and lead tow rope to the capstan at the lowe angle possible. If this latter precaution is not taken, the rope wi cross up over itself and tangle badly as it winds onto the capsta drum. After engaging capstan drive, coil tow rope only one tur clockwise around the drum. With axle unit in low range and engin transmission in "reverse" position, slowly engage engine clutch. A the tow line tightens and the tracks take hold, increase the engin speed.

e. Use of "Deadman" Anchor. During operation in extremel barren regions, it is possible that the vehicle might become bogge down, necessitating a pull with aid of the capstan. Fasten the towin rope to the middle of a heavy log or plank when there is no vehicl tree, or large stationary object nearby to which the rope might b secured. Dig a trench at right angle to line of pull and bury the lo or plank. Cover and pack down "deadman" before applying loa on tow rope.

Section IX

OPERATION UNDER UNUSUAL CONDITIONS

23. INTRODUCTION.

a. Scope. Instructions are furnished in this section for vehicle are under five general types of unusual conditions. The conditions are: below 0° F; extreme heat; dusty conditions; mud, snow, ice, and, and flood conditions; and marsh or swamp land conditions.

24. COLD WEATHER FUEL AND LUBRICATION INSTRUCTIONS.

a. Effect of Low Temperatures Upon Vehicle. Shock resistance of metals, or resistance against breaking, is greatly reduced at extremely low temperatures. Since subzero temperatures affect both metals and lubricants, operation of the vehicle at subzero temperatures presents problems that demand special precautions.

b. Gasoline.

(1) PRESCRIBED FUEL. Winter grades of gasoline are designed to reduce cold weather starting difficulties; therefore, use winter grade fuel during cold weather operation. Use winter grade gasoline procured under U.S. Army Specification 2-103, grade C, latest revision.

(2) STORAGE AND HANDLING OF GASOLINE. Due to condensation of moisture from the air, water will accumulate in tanks, drums, and containers. At low temperatures, this water will form ice crystals that will clog fuel lines and carburetor jets unless the following precautions are taken:

(a) Strain the fuel through filter paper or any type of strainer that will prevent the passage of water. CAUTION: *Gasoline flowing over a surface generates static electricity that will result in a spark unless means are provided to ground the electricity. Always provide a metallic contact between the container and the tank, to assure an effective ground.*

(b) Keep fuel storage tank full, if possible. The more fuel there is in the tank, the smaller will be the volume of air from which moisture can be condensed.

(c) Add 1 quart of denatured alcohol (grade 3), to the fuel tank at the beginning of the winter season, and ½ pint at each refueling. This will reduce the hazard of ice formation in the fuel.

(d) Be sure all containers are thoroughly clean and free from rust before storing fuel in them.

(e) If possible, after filling or moving a container, allow the fuel to settle before filling fuel tank from it.

(f) Keep all openings of containers tight to prevent snow, ice, dirt, and other foreign matter from entering.

(g) Wipe all snow or ice from dispensing equipment and fr around fuel tank filler cap before removing cap to refuel vehicle.

c. Lubrication.

(1) ENGINE OIL. Use the grade of engine oil specified in t lubrication order (fig. 32) for +32° to 0° F, and follow instructio on lubrication order to keep the engine oil fluid if vehicle does n have stand-by heater or if a winterization kit is not available. F operation of standby heater to keep engine oil fluid, see paragraph 2 For a shut-down period up to 3 hours it will be unnecessary to us the heater.

(2) ENGINE TRANSMISSION, AXLE TRANSMISSION, AND DIFFER ENTIAL. The grade of engine oil specified on War Department Lubri cation Orders for use between +32° to 0° F is also satisfactory belov 0° F. When temperatures below 0° F are immediately anticipatec and if engine transmission and/or axle transmission and differentia does not already contain the specified grade of engine oil, drain engin transmission and/or axle transmission and differential immediately after use and while lubricant is still warm. Refill to proper level with engine oil of the specified grade.

(3) OTHER LUBRICATION POINTS.

(a) If vehicle has been operated 1,000 miles using general pu pose grease No. 0, for lubrication, no special precautions are nece sary for the suspension system wheel bearings. If general purpo grease No. 1 is in these bearings, it will be necessary to disassemb and wash in dry cleaning solvent, dry, and then relubricate with ge eral purpose grease No. 0, for satisfactory operation.

(b) All other places where general purpose grease No. 0, is pr scribed for temperatures +32° to 0° F shall be lubricated with th same lubricant below 0° F.

(c) When extremely low temperatures are encountered and ge eral purpose grease No. 0 is not satisfactory where specified abov O.D. grease No. 00, Ordnance Department Tentative Specificati AXS-1169 may be used.

(d) For oilcan points where engine oil is prescribed above 0° use preservative lubricating oil (special).

(4) SPEEDOMETER CABLE. Grease-lubricated cables should ope ate satisfactorily at all temperatures provided they are coated wit general purpose grease No. 0, and there is no excess grease in th housing. When extremely low temperatures are encountered and ge eral purpose grease No. 0 is not satisfactory, O.D. grease No. 00 ma be used.

25. PROTECTION OF COOLING SYSTEM BELOW +32° F.

a. Cooling System Cold Weather Instructions. The proper preparation and care of the cooling system to prevent freezing at temperatures below 32° F, as given in the following steps, is of prime importance for trouble-free operation of the vehicle.

(1) PREPARATION OF COOLING SYSTEM FOR COLD WEATHER OPERATION. Thoroughly clean the cooling system of all rust, scale, or oil and eliminate all leaks before using antifreeze compound. Clean cooling system (par. 95 d) unless it has recently been cleaned and needs only to be flushed (par. 95 f). Carefully inspect all hoses, tubes, gasketed joints, and radiator core for leaks. Remove all parts which are leaking and any hoses that have deteriorated and might leak, and install new parts or notify higher authority. Replace leaking radiator. All air or exhaust gas leaks into the cooling system must be eliminated or higher authority notified.

(2) INSTALLATION OF ANTIFREEZE COMPOUND. Use only antifreeze compound (51-C-1554-15) in sufficient quantity to protect the cooling system against freezing at a temperature of at least 10° F below the lowest anticipated temperature. Refer to the following antifreeze compound chart to determine the quantity of compound required:

ANTIFREEZE COMPOUND CHART

(For Cooling System Capacities

—Before Serial 1003, 10½ qt—After Serial 1002, 12¾ qt)

	Pints of Antifreeze Required	
Freezing Points	Before Vehicle Serial 1003	After Vehicle Serial 1002
+10° F	5	6½
0° F	6½	8½
−10° F	7½	10
−20° F	9	11½
−30° F	10	13
−40° F	11½	15
−50° F	12½	16

Under no circumstances use a solution consisting of more than 12½ pints of antifreeze in the 10½-quart system (before vehicle serial 1003) and 16 pints of antifreeze in the 12¾-quart system (after vehicle

serial 1002), as a more concentrated solution will merely raise t freezing point and decrease the protection. When the required qu tity of antifreeze compound has been determined, fill the cooli system about one-third full of water. Add the amount of antifree compound required for the capacity of the entire system and fill wi water to slightly below the filler neck. Start and run engine un normal operating temperature is reached to further thoroughly m solution. Inspect cooling system for leaks while engine is operatin Stop engine and test degree of protection of solution (step (3) below,

(3) TEST ANTIFREEZE SOLUTION. When operating at tempera tures below 32° F, test and record the degree of protection of the antifreeze solution at regular intervals, or more frequently if required Test only when solution is warm, using antifreeze solution hydromete (18-H-940) in accordance with instructions furnished with the instrument. If the accuracy of the hydrometer is questioned, test it with a sample solution of one part antifreeze compound and two parts water; if correct, the hydrometer will show a protection reading of 0° F. If it is necessary to add a considerable amount of antifreeze compound, drain a somewhat greater amount of solution from the cooling system into clean containers. Add the required amount o antifreeze compound as determined in step (4) below and fill system with drained solution until it is visible slightly below the filler neck Start and warm up the engine, and recheck the solution.

(4) ADDING ANTIFREEZE COMPOUND. To increase the protec tion of the antifreeze solution, refer to the proper desired antifreez protection chart following:

DESIRED ANTIFREEZE PROTECTION CHART

(For Cooling System on Vehicles before Serial 1003)

Present Solution Protects Against Freezing at:	Pints of Antifreeze Compound to Add to Protect Cooling System Against Freezing at:					
	+10° F	0° F	−10° F	−20° F	−30° F	−40°
+20° F	2¾	4	6	7¼	7¾	9
+10° F	—	2¾	4	5¼	6½	7
0° F	—	—	2	3¼	4½	6
−10° F	—	—	—	2	3¼	4
−20° F	—	—	—	—	2	2
−30° F	—	—	—	—	—	2

DESIRED ANTIFREEZE PROTECTION CHART
(For Cooling System on Vehicles after Serial 1002)

Present Solution Protects Against Freezing at:	Pints of Antifreeze Compound to Add to Protect Cooling System Against Freezing at:					
	+10° F	0° F	−10° F	−20° F	−30° F	−40° F
+20° F	3¼	4¾	7¼	8¾	9½	11¼
+10° F	—	3¼	4¾	6½	8	9½
0° F	—	—	2½	4	5½	7¼
−10° F	—	—	—	2½	4	5½
−20° F	—	—	—	—	2½	3¼
−30° F	—	—	—	—	—	—

For example, if the hydrometer reading indicates the system on a vehicle before serial 1003 is protected down to 0° F (left-hand column) and it is desired to increase protection to −20° F (fourth column), 3¼ pints of antifreeze compound must be added. These figures are approximate, and the solution must be checked with an accurate hydrometer after the indicated quantity has been added.

26. COLD WEATHER OPERATION.

a. Starting Engine and Warming Power Train.

(1) Open air duct ventilator lid and place engine transmission shift lever in neutral position.

(2) Pull the carburetor choke control button outward to the full choke position.

(3) Depress clutch and open throttle about one-third of its normal travel.

(4) Place the master switch handle in horizontal position, turn the ignition switch on, and press the starter manual switch button for a few seconds at a time or until the engine starts. If the engine does not start at once with a full choke on the carburetor, pull the primer knob outward and push it back in (while the engine is turning over) to inject a charge of fuel into the intake manifold. If the engine does not start in three or four attempts, investigate to determine the cause of failure to fire. With use of primer and addition of heat, the engine should start to fire within a few seconds. CAUTION: *Do not operate starter for more than 15 seconds continuously.* Do not "pump" accelerator pedal during starting.

(5) After the engine starts, push the choke control button in to a point where the engine runs smoothly, and release the clutch pedal.

b. Specific Gravity. Batteries operating in torrid climates shou have a weaker electrolyte than for temperate climates. Instead 1.300 specific gravity, the electrolyte should be adjusted to 1.210 1.230 for a fully charged battery. This will prolong the life of negative plates and separators. Under this condition, the batter should be recharged at a reading of 1.160. Where freezing conditio do not prevail, there is no danger with gravities from 1.230 to 1.0

c. Self-discharge. A battery will self-discharge at a greater r at high temperatures if standing for long periods. This must taken into consideration when operating in torrid zones. If necessa to park for several days, remove batteries and store in a cool pla

29. OPERATION UNDER DUSTY CONDITIONS.

a. General. When operating under dusty or sandy conditio special precautions must be taken to prevent excessive wear a damage to the moving parts of the engine, power train, and suspensi system.

b. Care of Carburetor Air Cleaner and Breathers. Under e tremely dusty conditions, the air cleaner oil reservoir or oil-coat element must be cleaned every 2 to 4 hours, or more frequently required; or whenever the trapped dirt exceeds ½ inch in depth the oil-reservoir type cleaner. Air cleaner element must be clean when inspection reveals that any appreciable quantity of dirt accumulated to restrict the free flow of air or whenever its capac to trap the dust has been reached. Continued operation of the eng with dirty or saturated air cleaner will cause damage to the eng which will continue and increase long after the air cleaner has b cleaned. The engine transmission breather hole and the axle tra mission and differential assembly breather must be cleaned as quently as required when operating under dusty conditions to prev premature wear and damage to these units. Clean the engine oil fi as frequently as required to maintain its efficiency. Carefully amine lubricating oil level indicator for evidence of discoloration gritty substance that would indicate oil has become contaminated must be changed.

c. Care of Suspension System. Lubricate track suspension s tem more frequently to cleanse bearings of any sand or dirt that m have worked into hubs or housings. Inspect track suspension syst parts for evidence of premature wear. Remove worn parts prompt and install new ones to prevent ultimate failure.

30. OPERATION IN MUD, SNOW, ICE, SAND, AND FLOO

a. Mud. Select a gear low enough to move vehicle steadily wi out digging in. When a convoy of vehicles is operating over s ground in territory where circumstances permit, it is desirable

operate the vehicles so the tracks overlap the trail of preceding vehicles to avoid rutting. If the vehicle becomes stuck, secure a tow out of the mud; do not attempt to free vehicle by spinning tracks. When a drop to below-freezing temperature is anticipated, make sure the vehicle is parked on solid ground or footing to prevent the tracks from being frozen in the mud. If the vehicle is an M29C, the capstan may be used in connection with the driving mechanism of the vehicle (par. 22 c) to help pull it out of the mud.

b. Snow.

(1) GENERAL. Operation over snow does not require any special driving technique; however, it is desirable to have knowledge of the various types of snow formations and the individual characteristics of each. The combination of such information with actual snow-driving experience will improve judgment on the selection of a trail and minimize the difficulties which might possibly be encountered.

(2) SELECT COURSE OF TRAVEL. Before proceeding, view the over-all terrain and snow formations. There are a number of factors to consider in selecting the best possible routing. Unless circumstances prevent, it is always preferable to travel around rather than up and down ridges, slopes, or hills. This is particularly true when operating in areas of heavy snowfall with accompanying high drifts and dangerous crevasses. Sometimes it is possible to detect drifts in deep wind-blown snow by variations in shading of the snow. Avoid traveling near trees and stumps because of the uncertain snow adjacent to them. Whenever the route involves an unavoidable grade, drive as nearly straight up and down as possible. This equalizes track load and prevents loss of traction from side-slip. Do not make abrupt turns. Where the course of travel involves unavoidable hill operation at an angle, and where traction and steering become impaired by the tracks on the low side breaking through the surface, reverse the vehicle for a short distance and maneuver into position to approach the grade at a slightly steeper angle. If necessary, repeat this procedure until proper traction is restored.

(3) SOFT OR FINE SNOW DRIVING. As in other types of driving, select the highest gear combination which gives good traction for satisfactory operation. At the moment any loss of traction is detected, reduce engine speed, and if operating in transmission third speed (axle unit in high range), shift down into engine transmission second speed. Whenever track slippage occurs, modify operation as required to obtain a slow, steady track speed involving the least possible disturbance to the snow bed.

(4) CRUSTED OR MELTING SNOW DRIVING. Snow operation may be encountered in areas involving freezing temperatures at night but higher melting temperatures throughout the course of the day. In regions of heavy snow, the crust may very likely support the weight

of the vehicle during the night and early morning hours; but by n the rising temperatures and melting snow may present the poss hazard of breaking through. If this occurs, do not speed up en in an attempt to climb back onto the surface of the crust. Inst reduce engine speed instantly and shift into engine transmission s ond speed to achieve very low track speed for forward move without slippage.

c. **Ice.** Skidding is the general hazard encountered on ice. Se the proper gear ratio to move the vehicle steadily, without impo undue strain on engine and axle. When skidding occurs, decele the engine and proceed with caution.

d. **Sand.** The main objective when driving in sand is to a the possibility of spinning the tracks on a hill. Reduce speed use a gear low enough to move vehicle steadily. Do not let the m labor.

e. **Flood.** When entering water that is deep enough, the will float and continue its forward motion very slowly. For opera of the M29C in water, refer to paragraph 17 c (2). Maximum sp in deep water is obtained with axle transmission in high range the engine transmission in second speed. Reduce the engine sp when approaching the shore after operating in deep water, and se a lower gear if necessary. Lubricated parts which have been affe by mud and water must be serviced at the earliest opportunity.

31. OPERATION UNDER MARSH AND SWAMP CONDITI

a. **General.** Driving over and through swamps, marshes, mu and quicksand calls for a high degree of operating skill. Most mechanized equipment will bog down in terrain of this type, and frequently impassable on foot. Therefore driving technique and vehicle will permit the otherwise impossible shifting of personnel supplies to such isolated areas.

b. **Overloading.** Loading in excess of the maximum limit (pounds—personnel and cargo) has a very detrimental effect on formance. The vehicle's ability to travel over soft ground dep on its low unit ground pressure and low center of gravity.

c. **Driving Instructions.** To put the vehicle in motion encountering marsh and swamp conditions, and if the axle trans sion is not in low range, stop the vehicle, shift axle transmission low range and engine transmission into first-speed position. Rel the clutch pedal while accelerating the engine enough to start ve moving. NOTE: *With the axle transmission in low range and engine transmission in first speed, it is possible to attain very engine speeds, and since sustained operation of this character ca rapid engine wear, shift to a higher speed as soon as possible.* If

vehicle becomes stuck, do not spin the tracks as this action only digs out the ground from under the tracks causing the vehicle to settle until the hull rests on the ground and all track drive is lost. Instead, get tow assistance or if vehicle is an M29C, make use of capstan to free the vehicle.

d. Select Course of Travel. Whenever a choice is possible, select a course covered with vegetation because better traction will be obtained. Avoid water covered ground as much as possible because it is difficult to ascertain the exact nature of the ground below the water. It is important to remember that a slow, steady track speed disturbs a soft mud bed very little and makes traction more certain. Stop the forward motion of the vehicle the instant it becomes apparent that the present course is impassable. Back up for a short distance and take a different route, or use a more advantageous gear combination. Since the vehicle has a low ground clearance, do not attempt to straddle a stump, log, or any other obstruction that can be avoided by driving around it. Shift the engine transmission into second speed or third speed when the footing is solid enough to permit operation at a higher speed. When a drop to below-freezing temperature is anticipated, make sure that the vehicle is parked on firm footing to prevent the tracks from being frozen in water or mire.

e. Avoid Sharp Turns and Deep Ruts. Make turns gradually on reasonably level and firm ground. Sharp turns have a tendency to choke up the sprockets on the drive wheels with mud and vegetation, and this may result in a track running off at the drive sprocket. When following other vehicles or traveling a course established previously, make a new path in order to avoid deep ruts which develop in repeated operation over soft ground.

f. Clean Tracks. It is very important that the tracks and suspension system be cleaned at every opportunity. Caked mud or vegetation must be removed before it accumulates to the extent of impeding steering and interfering with track drive. Temporarily reversing will help in keeping tracks clean.

Section X
DEMOLITION TO PREVENT ENEMY USE

32. GENERAL.

a. Destruction of the vehicle when subject to capture or abandonment in the combat zone will be undertaken by the using arm only when, in the judgment of the military commander concerned, such action is necessary.

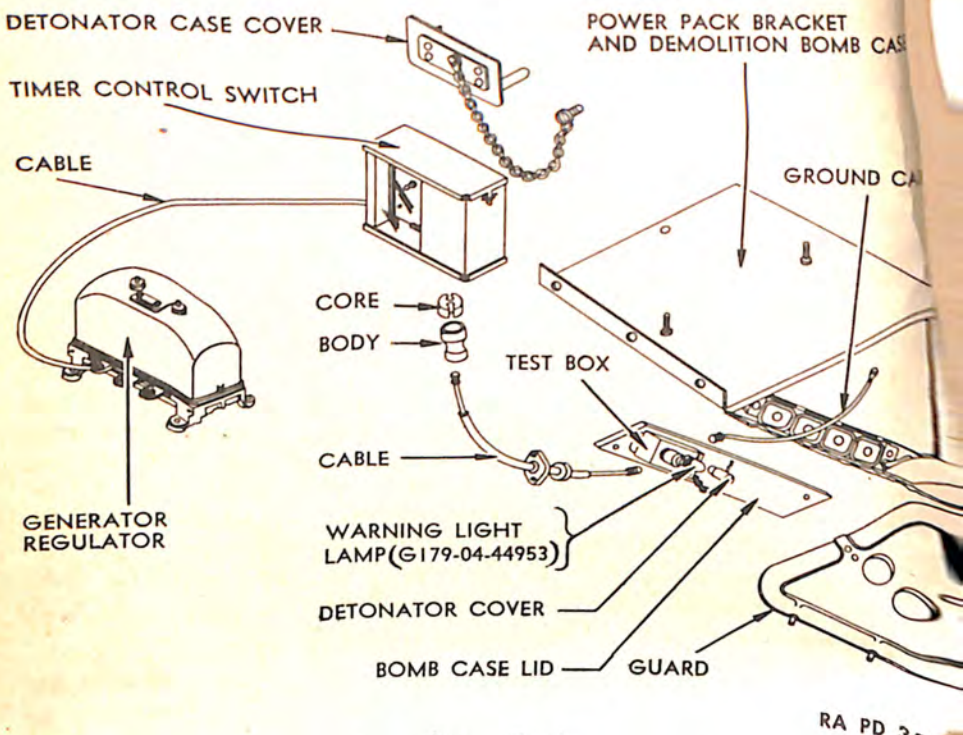


Figure 28 — Demolition Equipment and Wiring (Before Vehicle Serial 2103)

b. Vehicles before serial 2103 are wired for the demolition eq ment shown in figure 28, however, this equipment is not furni with the vehicle. For full information on equipment and its opera refer to higher authority.

c. The instructions which follow are for information only. T conditions under which destruction will be effected are comm decisions in each case, according to the tactical situation.

33. DEMOLITION REQUIREMENTS.

a. If destruction is resorted to, the vehicle must be so badly d aged that it cannot be restored to a usable condition in the com zone either by repair or cannibalization. Adequate destruction quires that all parts essential to the operation of the vehicle be stroyed or damaged beyond repair. Equally important, the s essential parts must be destroyed on all like vehicles so that t enemy cannot construct one complete operating unit from sev partially damaged ones.

34. DETAILED INSTRUCTIONS.

a. **Methods.** The following instructions apply to cargo carriers only. They do not account for destruction of loads which may be carried in the vehicles. Three methods for destroying the carriers are listed below in their order of effectiveness.

b. **Method No. 1—By Explosives.**

(1) Remove and empty portable fire extinguisher. Puncture the fuel tank.

(2) Prepare two 2-pound TNT charges with tetryl nonelectric caps and about 6 feet of safety fuze in each charge. Remove engine compartment cover and place one charge on top of the clutch housing. Place the other charge on the left side of engine as low down as possible. CAUTION: *If charges are prepared beforehand and carried to the vehicle, keep the caps and fuzes separated from the TNT charges until they are to be used.*

(3) If sufficient time and materials are available, additional 2-pound TNT charges prepared as instructed in step (2) above may be placed at the center of each tract assembly.

(4) Ignite the TNT charges and take cover.

c. **Method No. 2—By Gun Fire.**

(1) Remove and empty portable fire extinguisher. Puncture the fuel tank.

(2) Fire on the vehicle, using tank, antitank, or other artillery, or antitank rockets or grenades. Aim at the engine, suspension, and hull in the order named. If a good fire is started the vehicle may be considered destroyed.

d. **Method No. 3—By Fire.**

(1) Remove and empty portable fire extinguisher. Puncture the fuel tank.

(2) Using an ax, pick, sledge, or any other heavy object, smash all vital elements such as the distributor, carburetor, air cleaner, generator, spark plugs, lights, instruments, switches, and control levers. If time permits and a sufficiently heavy object is available, smash also the engine block, crankcase, and transmission.

(3) Pour spare gasoline or oil over the entire vehicle and ignite.

755142 O - 47 - 5

PART THREE — MAINTENANCE INSTRUCTIONS

Section XI
GENERAL

35. SCOPE.

a. Part three contains information for the guidance of the sonnel of the using organizations responsible for the mainten (first and second echelon) of this equipment. It contains infor tion for the performance of the scheduled lubrication and preven maintenance services, as well as description and maintenance of major systems and units and their functions in relation to other c ponents of the equipment.

RA PD 33

Figure 29 — Publications Reference Plate

Section XII
SPECIAL ORGANIZATIONAL TOOLS AND EQUIPMENT

36. LIST OF SPECIAL TOOLS.

a. **Purpose.** The list of tools in this section is for informa only. It is not to be used as a basis for requisition. When orde special tools, refer to the latest issue of ORD 7 SNL G-179.

b. **Tools** (fig. 30).

Tool-Set (41-E-3569-105), 2nd Echelon, Special, Set B, Ca Carriers, M29 and M29C.

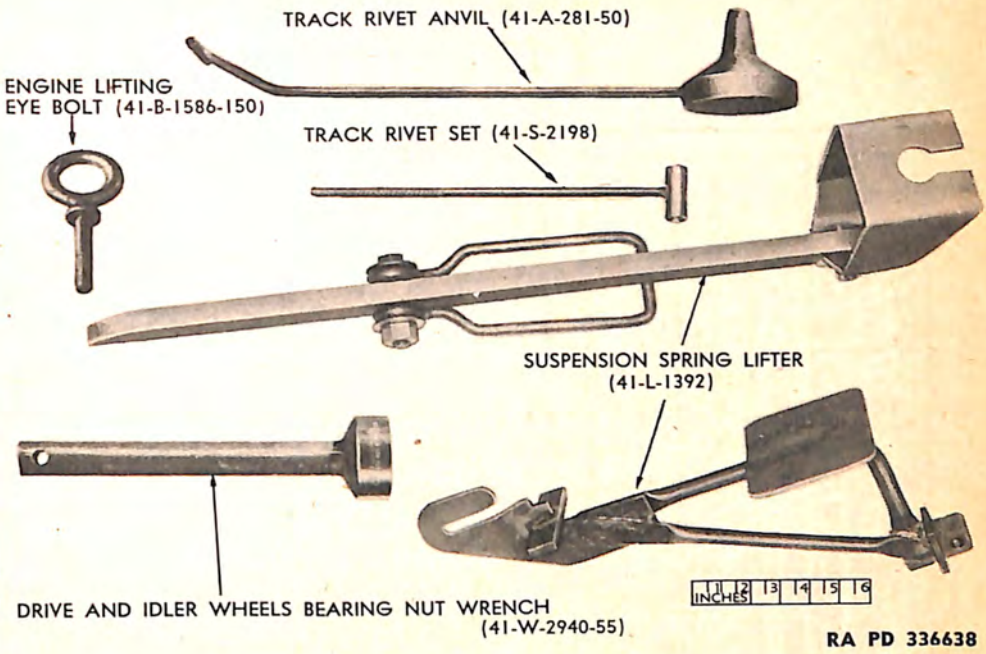


Figure 30 — Special Tools and Equipment

Name	Federal Stock Number	Mfr's. Tool Number	Tool Sets
ANVIL, rivet assembly, drive track	41-A-281-50	KM-J-3648	B
BOLT eye, engine lifting, 7/16-14NC-2 thread	41-B-1586-150	KM-J-3614	B
LIFTER, suspension spring	41-L-1392	TEC-50-11	B
SET, rivet, drive track	41-S-2198	KM-J-3647	B
WRENCH, socket, single-head, tubular, w/hole for pin handle, tubular hex opening, size 2 7/16 in.	41-W-2940-55	KM-J-3603	B

Section XIII
LUBRICATION

37. LUBRICATION ORDER.

a. Reproduction of War Department Lubrication Order 9-772 (figs. 31 and 32) prescribes first and second echelon lubrication maintenance. Lubrication to be performed by ordnance maintenance personnel is covered in paragraph 38.

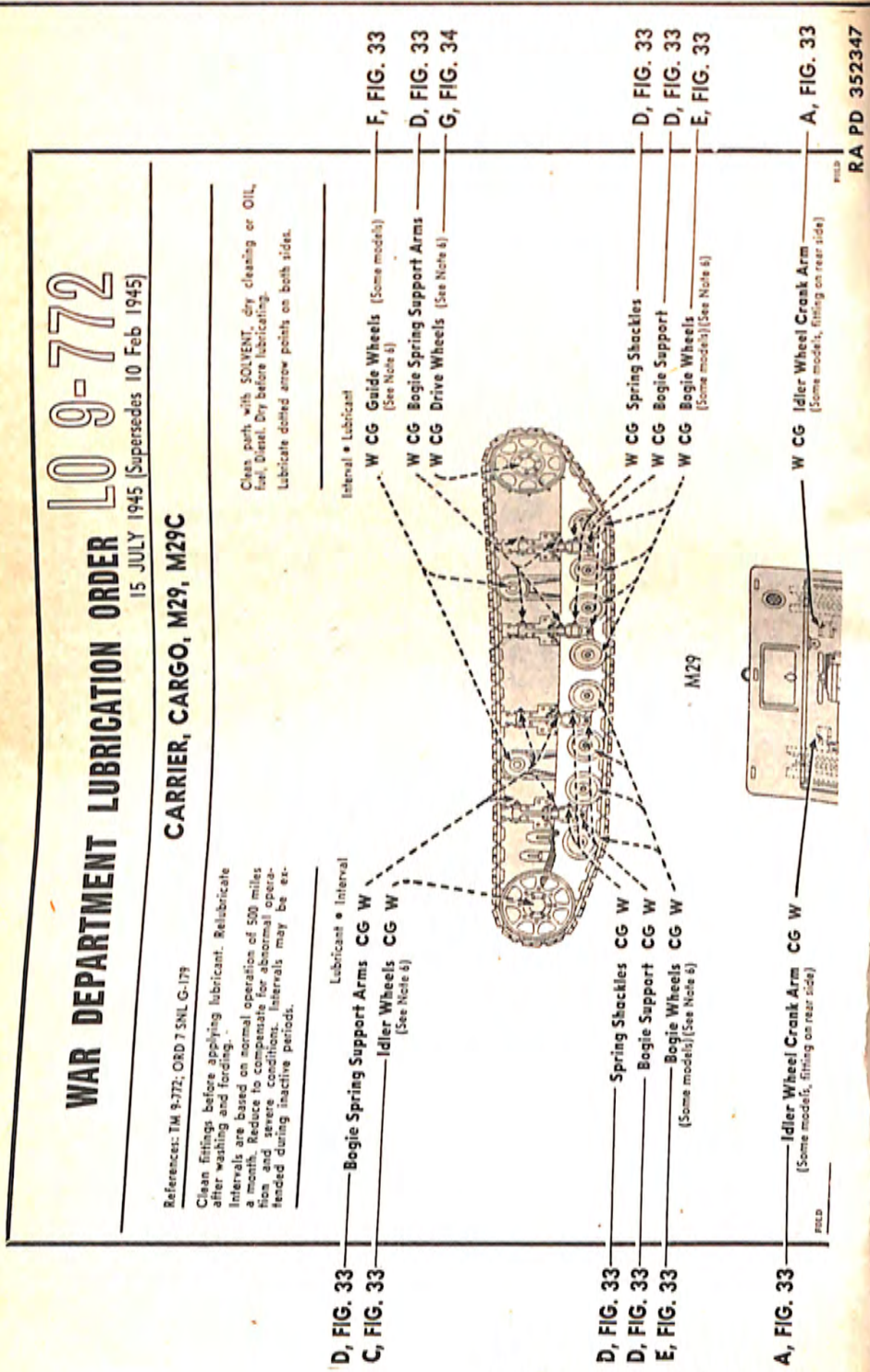
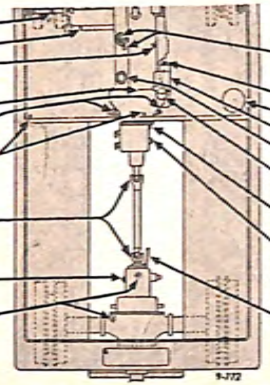


Figure 31 — Lubrication Ord

T, FIG. 36 — **Steering Lever** (Some models) OE W
T, FIG. 36 — **Shift Lever** (Some models) OE W
N, FIG. 35 — **Crankcase Drain** M
Drain and refill. Cap. 5 qt. (See Notes 3 & 4) (To reach, remove cover on bottom of hull)
Clutch Pilot Bearing CG
(See Note 2)
V, FIG. 36 — **Clutch Cross Shaft** OE W
(To reach, remove floor pan)
S, FIG. 36 — **Steering Cross Shaft** OE W
(Some models)(To reach, remove floor pan)
Y, FIG. 37 — **Universal Joints** CG W
Lubricate with hand gun sparingly—do not overfill (To reach, remove floor pan)
AA, FIG, 37 — **Differential Fill and Level** OE W
Check level. (To reach, remove inspection hole cover in floor pan)
AA, FIG. 37 — ***Differential Drains*** S
Drain and refill. Cap. 6 qt. (See Note 7) (To reach, remove inspection hole cover in floor pan) Use suction gun to drain if drain plugs not provided



Serviced From Engine Compartment

S — **Distributor** (See Note 5) — R, FIG. 35
M WB — **Distributor Shaft** Turn down cup 1 full turn, refill as required — Q, FIG. 35
OE — **Starter** 6 to 8 drops (See Note 9) — P, FIG. 35
D OE — **Air Cleaner** (Some models) Check level (See Note 1)
M OE — **Air Cleaner** (Some models) Clean and oil (See Note 1)
D OE — **Crankcase Fill and Level** Check level — M, FIG. 35
M — **Oil Filter** Drain sediment (See Note 8) — O, FIG. 35
S — ***Transmission Drain*** Drain and refill Cap. 1 qt. (See Note 7) (To reach, remove floor pan) — X, FIG. 37
W OE — **Transmission Fill and Level** Check level (To reach, remove floor pan) — X, FIG. 37
S CG — **Speedometer Cable** Remove and clean core, coat lightly with CG-0

NOTES

1. AIR CLEANERS—(Oil Bath Type) Fill to bead level. Monthly, remove and wash all parts. Replace and refill. (Mesh Type) Monthly, remove and wash cleaner, cleaning element and crankcase filler cap element. Dry and oil, drain excess oil and replace. Air cleaners and elements require used crankcase oil or OE above 0°F, or OE-10 below 0°F.
2. CLUTCH PILOT BEARING—When clutch is removed, clean and coat lightly with CG.
3. CRANKCASE—Drain only after operation. Refill to FULL mark. Run engine a few minutes, recheck level.
4. CRANKCASE BELOW 0°F.—If heated storage, winterization kit or heater are available or oil can be drained after operation, use OE-10 undiluted. Otherwise, dilute as follows: Add OE-10 to FULL mark. Then add 1½ qt. gasoline. Run engine 5 to 10 minutes. Mark new higher level on dipstick with file. CAUTION: Check level every 4 hours of operation, add OE-10 to regular FULL mark as required. After operation, check level. If level is below regular FULL mark, add OE-10 to regular FULL mark. Then add gasoline to new higher level mark. If level is at or above regular FULL mark, add gasoline to new higher level mark. Run engine 5 to 10 minutes to mix oil and diluent.
5. DISTRIBUTOR—Every 6 months, wipe breaker cam lightly with CG and lubricate breaker arm pivot and wick under rotor with 1 to 2 drops of OE.
6. DRIVE WHEELS, BOGIE WHEELS, GUIDE WHEELS AND IDLER WHEELS—Every 3 months, or more frequently if track is removed for repair, remove drive wheels, idler wheels, bogie wheels and guide wheels not equipped with fittings, clean and repack with CG. Replace seals if damaged or worn. CAUTION: When exposed to water operation, repack these bearings with CG every month.
7. GEAR CASES—Fill to plug levels before operation and after draining. Drain only after operation. In addition to drain plug in gear case, also remove proper drain plug on left side of hull. (Some models) Clean transmission and differential drain plugs before reinstalling. (Winch Gear Case) Fill models with dipstick to FULL mark, other models to 1 in. below fill plug.
8. OIL FILTER—Every 6 months, while crankcase is being drained, remove element, clean inside of case and install new element.
9. STARTER—When engine or starter is removed, lubricate through oiler with OE.
10. OIL CAN POINTS—Weekly, lubricate Transmission Shift Linkage, Engine Cover Hinges and Latches, Clutch and Steering Control Linkage, Pintle Hook, Accelerator Control Linkage, Radiator Shutter Control, Capstan Clutch Splines M29C only, Capstan Drive Shaft Universal Joints M29C only, Capstan Clutch Control Cable M29C only, Propeller Shaft Parking Brake Linkage and Cables (some models), with PM.
11. DO NOT LUBRICATE—Springs, Water Pump and Fan Bearings, Propeller Shaft Slip Joint, Clutch Release Bearing, Starter Rear Bearing, Tracks, Generator.
12. LUBRICATED AFTER DISASSEMBLY BY HIGHER ECHELON—Distributor Drive Gear Housing.

Copy of this Lubrication Order will remain with the equipment at all times; instructions contained therein are mandatory and supersede all conflicting lubrication instructions dated prior to 15 July 1945.

[A.G. 300.8 (15 July 1945)]
BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL
Chief of Staff

OFFICIAL:
EDWARD F. WITSELL
Major General
Acting The Adjutant General

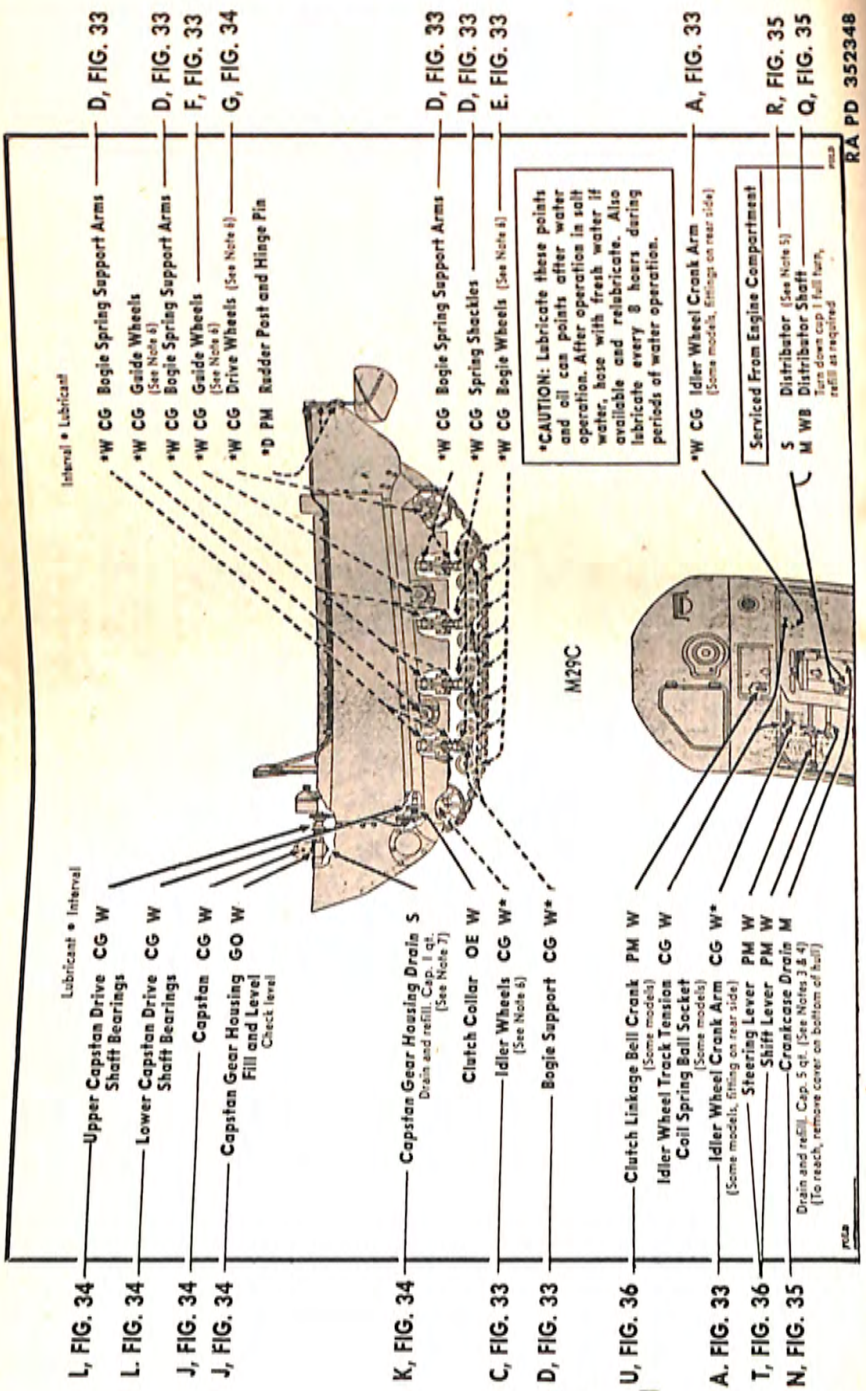
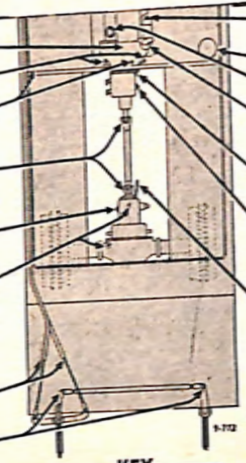


Figure 32 — Lubricati



Clutch Pilot Bearing CG
(See Note 2)

V, FIG. 36 — **Clutch Cross Shaft** PM W
(To reach, remove floor pan)

S, FIG. 36 — **Steering Cross Shaft** PM W
(To reach, remove floor pan)

Y, FIG. 37 — **Universal Joints** CG W
Lubricate with hand gun sparingly—do not overfill
(To reach, remove floor pan)

AA, FIG. 37 — **Differential Fill and Level** OE W
Check level
(To reach, remove inspection hole cover in floor pan)

AA, FIG. 37 — ***Differential Drains*** S
Drain and refill
Cap. 6 qt. (See Note 7)
(To reach, remove inspection hole cover in floor pan) Use suction gun to drain if drain plugs not provided

I, FIG. 34 — **Rudder Cables** PM D
Clean and oil

I, FIG. 34 — **Rudder Connecting Linkage** PM D*

P, FIG. 35 — OE **Starter**
6 to 8 drops (See Note 9)

D OE **Air Cleaner** (Some models)
Check level (See Note 1)

M, FIG. 35 — D OE **Crankcase Fill and Level**
Check level

O, FIG. 35 — M ***Oil Filter*** Drain sediment
(See Note 8)

X, FIG. 37 — S ***Transmission Drain***
Drain and refill
Cap. 1 qt. (See Note 7)
(To reach, remove floor pan)

X, FIG. 37 — W OE **Transmission Fill and Level**
Check level
(To reach, remove floor pan)

S CG **Speedometer Cable**
Remove and clean core, coat lightly with CG-0

KEY

LUBRICANTS	EXPECTED TEMPERATURE		
	above +32°F.	+32°F. to 0°F.	below 0°F.
OE—OIL, engine			
Crankcase	OE-30	OE-10	See Note 4
Transmission and Differential	OE-30	OE-10	OE-10
Other Points	OE-30	OE-10	PS
GO—LUBRICANT, gear, universal	GO-90	GO-90	GO-75
CG—GREASE, general purpose	CG-1	CG-0	CG-0

LUBRICANTS
WB—GREASE, general purpose, No. 2
PS—OIL, lubricating, preservative, special
PM—OIL, lubricating, preservative, medium (above +32°F.), PS (below +32°F.)

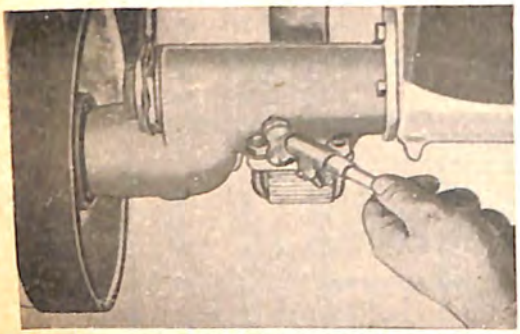
INTERVALS
D—Daily
W—Weekly
M—Monthly
S—6 months

LO 9-772, 15 July 1945

Requisition additional Lubrication Orders in conformance with instructions and lists in FM 21-6.

M-1789—SECOND REVISE—7-27-45—N-76

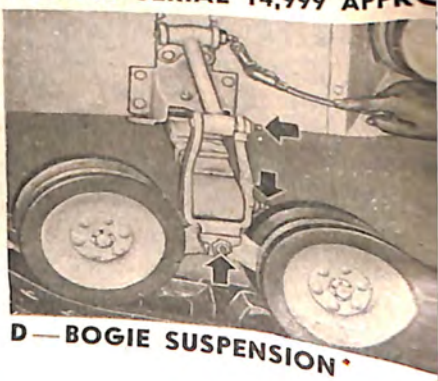
RA PD 352348B



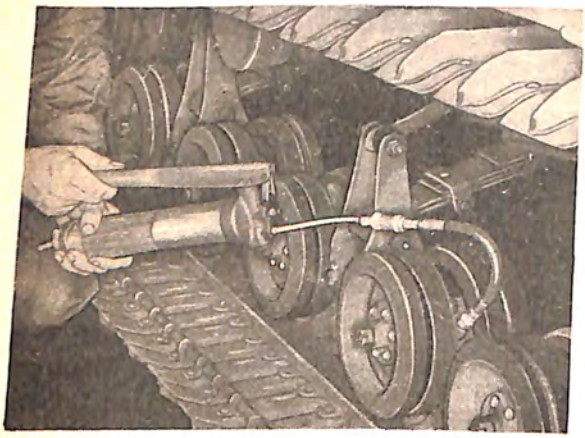
A — IDLER WHEEL CRANK ARM

B - TRACK TENSION SPRING (AF
VEHICLE SERIAL 14,999 APPRC

C — IDLER WHEEL
(AFTER VEHICLE SERIAL 5477)



D — BOGIE SUSPENSION



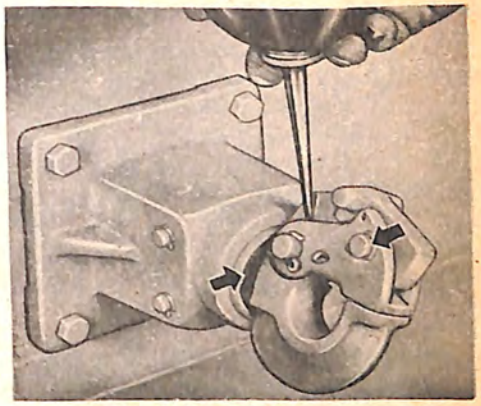
E — BOGIE WHEEL
(AFTER VEHICLE SERIAL 1002)

F — GUIDE WHEEL
(AFTER VEHICLE SERIAL 2

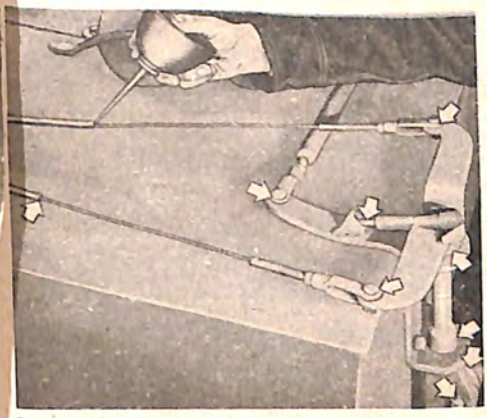
RA PD 35

Figure 33 — Localized Lubrication Views — A

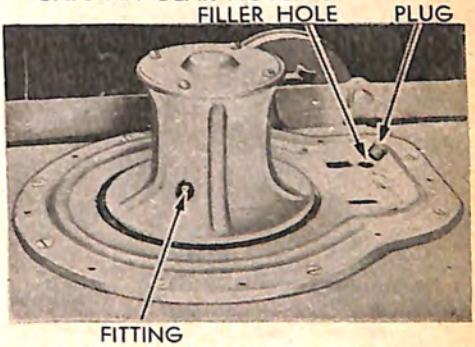
G—DRIVE WHEEL
(AFTER VEHICLE SERIAL 5477)



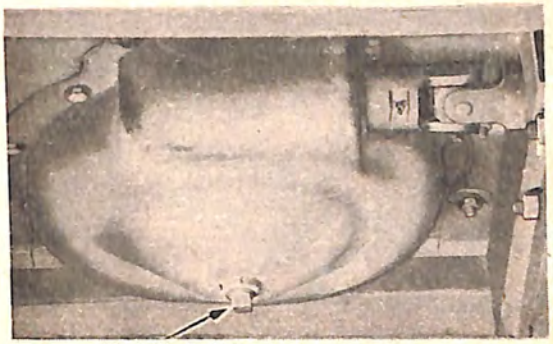
H—PINTLE HOOK



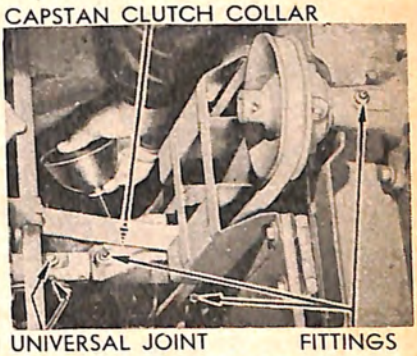
I—RUDDERS LINKAGE—M29C



J—CAPSTAN—M29C



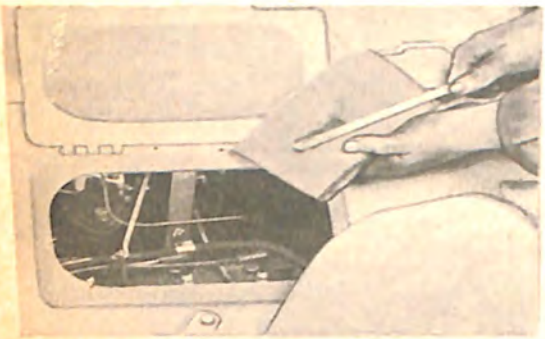
K—CAPSTAN DRAIN—M29C



L—CAPSTAN DRIVE—M29C

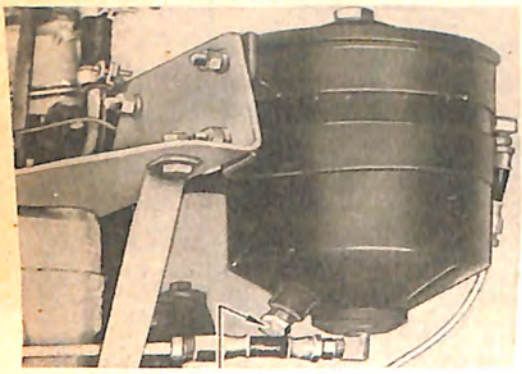
RA PD 336673

Figure 34 — Localized Lubrication Views — B



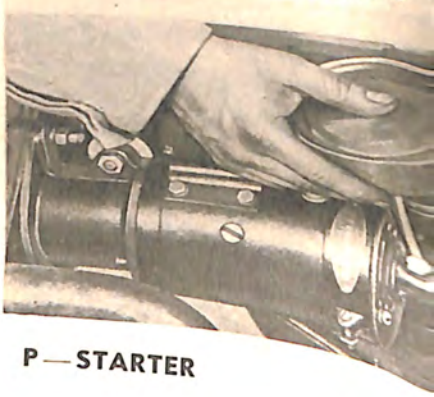
M — ENGINE OIL LEVEL

N — ENGINE OIL HULL DRAIN

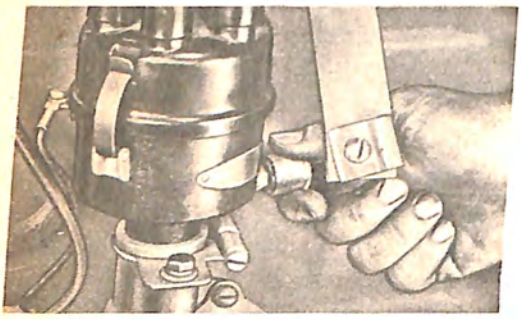


DRAIN PLUG

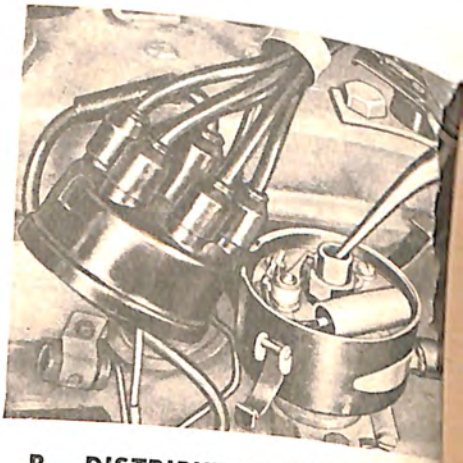
O — OIL FILTER DRAIN



P — STARTER



Q — DISTRIBUTOR SHAFT

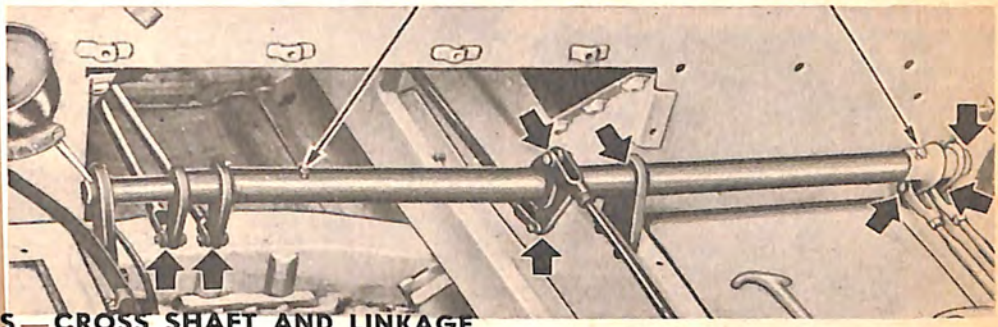


R — DISTRIBUTOR WICK

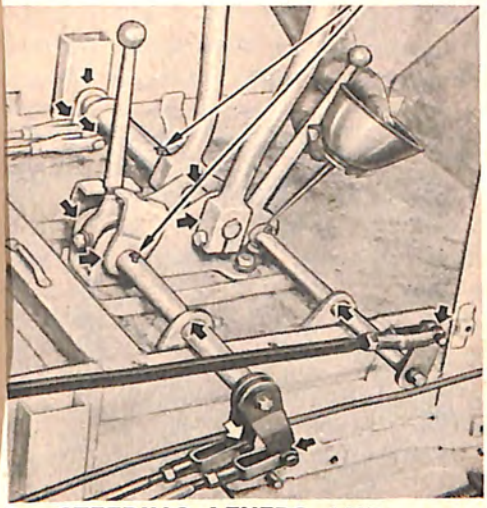
RA PD 349

Figure 35 — Localized Lubrication Views — C

OILERS (AFTER VEHICLE SERIAL 2102)

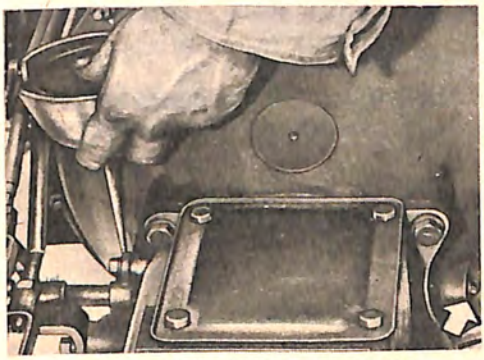


S—CROSS SHAFT AND LINKAGE
OILERS (AFTER VEHICLE SERIAL 2102)

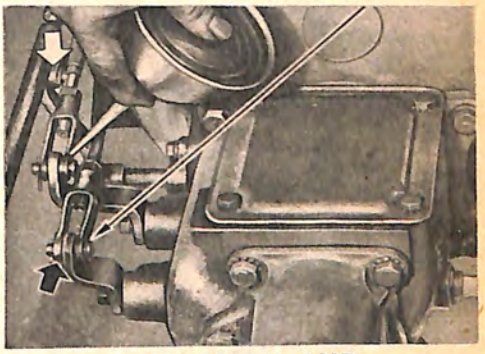


T—STEERING LEVERS AND SHIFT LINKAGE

U-CLUTCH PEDAL LINKAGE (AFTER VEHICLE SERIAL 13,562, APPROX.)
INSULATOR USED AFTER VEHICLE SERIAL 4935—DO NOT LUBRICATE



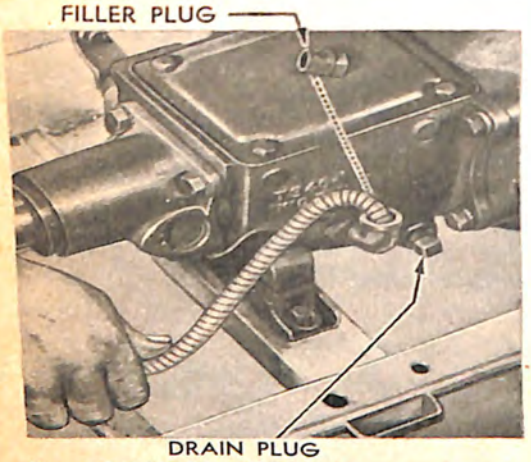
V—CLUTCH CROSS SHAFT BUSHINGS



W—TRANSMISSION AND CLUTCH LINKAGE

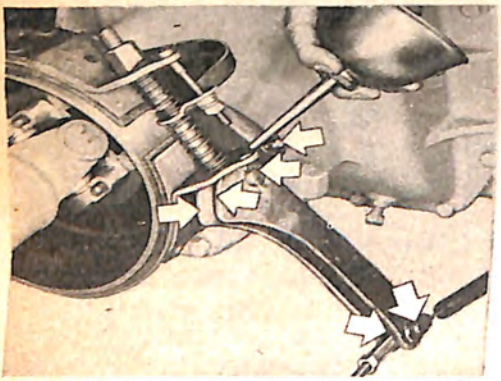
RA PD 352350

Figure 36 — Localized Lubrication Views — D



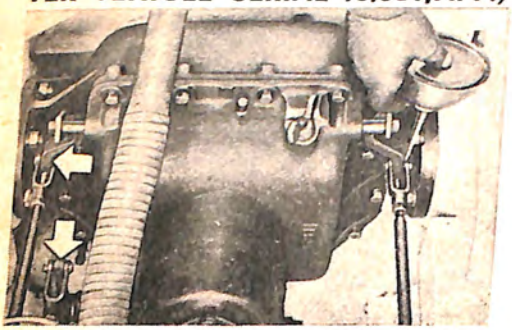
X — TRANSMISSION

Y — UNIVERSAL JOINT



Z — PARKING BRAKE LINKAGE (AFTER VEHICLE SERIAL 15,681, APP.)

AA — AXLE TRANSMISSION AND DIFFERENTIAL
DIFFERENTIAL DRAIN PLUG — (AFTER VEHICLE SERIAL 3449)



BB — AXLE TRANSMISSION AND DIFFERENTIAL LINKAGE

RA PD 352

Figure 37 — Localized Lubrication Views — E

b. A lubrication order is issued with each item of materiel and is to be carried with it at all times. In the event the materiel is received without a copy, the using arm shall immediately requisition a replacement in conformance with instructions and lists in FM 21-6.

c. Instructions on the lubrication order are binding on all echelons of maintenance and there shall be no deviations.

d. Service intervals specified on the lubrication order are for normal operation of 500 miles a month. Reduce to compensate for abnormal operation and extreme conditions such as excessively high or low temperatures, continued operation in sand or dust, or immersion in water, any one of which may quickly destroy the protective qualities of the lubricant. Intervals marked with an asterisk on the lubrication order will be serviced daily after water operation and when possible, every 8 hours during water operation. Intervals may be extended during inactive period.

e. Lubricants are prescribed in the "Key" in accordance with three temperature ranges, above +32° F, +32° F to 0° F, and below 0° F. When to change grades of lubricants is determined by maintaining close check on operation of the materiel during the approach to change-over periods, especially during initial action. Sluggish starting is an indication of lubricants thickening, and the signal to change to grades prescribed for the next lower temperature range. Ordinarily it will be necessary to change grades of lubricants only when air temperatures are consistently in the next higher or lower range.

38. DETAILED LUBRICATION INSTRUCTIONS.

a. **Lubrication Equipment.** Each piece of materiel is supplied with lubrication equipment adequate to maintain the materiel. This equipment will be cleaned both before and after use. Lubrication guns will be operated carefully, and in such manner as to insure a proper distribution of the lubricant.

b. **Points of Application.**

(1) Lubrication fittings, grease cups, oilers, and oilholes are readily located by reference to the lubrication order. Wipe these devices and the surrounding surfaces clean before lubricant is applied.

(2) Where relief valves are provided, apply new lubricant until the old lubricant is forced from the vent.

c. **Cleaning.** Dry cleaning solvent or Diesel fuel oil will be used to clean or wash all parts. Use of gasoline for this purpose is prohibited. After washing, parts will be thoroughly dried before applying lubricant.

d. Lubricated after Disassembly by Higher Echelon.

(1) DISTRIBUTOR DRIVE GEAR HOUSING. Annually or when engine is removed for inspection or overhaul, clean and repack distributor drive gears and housing with general purpose grease (No. 1 above +32° F or No. 0 below +32° F. Replace housing seal if damaged or worn.

e. Reports and Records.

(1) REPORTS. Unsatisfactory performance of materiel will be reported to the Ordnance Officer responsible for maintenance in accordance with TM 37-250.

(2) RECORDS. A record of lubrication may be maintained in the Preventive Maintenance Roster (W.D., A.G.O. Form No. 460).

Section XIV

PREVENTIVE MAINTENANCE SERVICES

39. GENERAL INFORMATION.

a. Responsibility and Interval. Preventive maintenance services as prescribed by AR 850-15 are a function of using organizations, echelons of maintenance, and their performance is the responsibility of the commanders of such organizations. These services consist generally of Before-operation, During-operation, At-halt, After-operation and Weekly services performed by the crew, and the scheduled services to be performed at designated intervals by organizational maintenance personnel.

b. Definition of Terms. The general inspection of each item applies also to any supporting member or connection, and is generally a check to see whether the item is in good condition, correctly assembled, secure, or excessively worn.

(1) The inspection for "good condition" is usually an external visual inspection to determine whether the unit is damaged beyond safe or serviceable limits. The term "good condition" is explained further by the following: Not bent or twisted, not chafed or burned, not broken or cracked, not bare or frayed, not dented or collapsed, not torn or cut, not deteriorated.

(2) The inspection of a unit to see that it is "correctly assembled" is usually an external visual inspection to see whether it is in its normal assembled position in the vehicle.

(3) The inspection of a unit to determine if it is "secure" is usually an external visual examination; a wrench, hand-feel, or a pry bar check for looseness. Such an inspection must include any brackets, lock washers, lock nuts, locking wires, or cotter pins used in assembly.

(4) "Excessively worn" will be understood to mean worn beyond serviceable limits, or to a point likely to result in failure if the unit is not replaced before the next scheduled inspection.

40. CREW MAINTENANCE (FIRST ECHELON).

a. Purpose. To insure mechanical efficiency, it is necessary that the vehicle be systematically inspected at intervals each day it is operated, and weekly, so defects may be discovered and corrected before they result in serious damage or failure. Certain scheduled maintenance services will be performed at these designated intervals. Any defects or unsatisfactory operating characteristics beyond the scope of first echelon to correct must be reported at the earliest opportunity to the designated individual in authority. The services set forth in paragraphs 41, 42, 43 and 44, are those performed by the crew Before-operation, During-operation, At-halt, and After-operation and weekly.

b. Use of W.D. Form No. 48. Driver preventive maintenance services are listed on the back of the "Driver's Trip Ticket and Preventive Maintenance Service Record," W.O., Form No. 48, to cover vehicles of all types and models. Items peculiar to this vehicle but not listed on W.D., Form No. 48, are covered in manual procedures under the items with which they are related. Certain items listed on the form that do not pertain to this vehicle are eliminated from the procedures as written into the manual. Every organization must thoroughly school each driver in performing the maintenance procedures set forth in this manual, whether they are listed specifically on W.D., Form No. 48 or not. The items listed on W.D., Form No. 48 that apply to this vehicle are expanded in this manual to provide specific procedures for accomplishment of the inspections and services. The services are arranged to facilitate inspection and conserve the time of the driver and are not necessarily in the same numerical order as shown on W.D., Form No. 48. The item numbers, however, are identical with those shown on that form.

41. BEFORE-OPERATION SERVICE.

a. Purpose. This inspection schedule is designed primarily as a check to see that the vehicle has not been damaged, tampered with, or sabotaged since the "After-operation Service" was performed. Various combat conditions may have rendered the vehicle unsafe for operation and it is the duty of the crew to determine whether the vehicle is in condition to carry out any mission to which it is assigned. This operation will not be entirely omitted, even in extreme tactical situations.

b. Procedures. Before-operation Service consists of inspecting items listed below according to the procedure described, and correct-

RA PD 336

Figure 38 — Daily Operations Plate — Cargo Carrier M29C

ing or reporting any deficiencies. Upon completion of the service results will be reported promptly to the designated individual in authority.

(1) ITEM 1, TAMPERING AND DAMAGE. Examine entire vehicle, accessories, and special equipment for injury, caused by tampering, sabotage, collision, falling debris, or shell fire since parking. Also look within engine compartment for evidence of these conditions and for loose or damaged engine accessories or drive belts, loose fuel, oil or coolant lines, or disconnected control linkage. If wet, dry the ignition parts to facilitate starting.

(2) ITEM 2, FIRE EXTINGUISHER. Be sure the extinguisher is fully charged, securely mounted, and that nozzle is not clogged.

(3) FUEL, OIL AND WATER. Check supply of fuel, oil, and coolant and add as necessary to bring to proper levels. If a large amount of coolant is needed during freezing weather, have value of antifreeze checked and solution added if necessary. Be sure that spare fuel, oil, or water cans are full. NOTE: *Any appreciable drop in fuel, oil, or water levels must be investigated and trouble corrected or reported.*

(4) ITEM 4, ACCESSORIES AND DRIVES. Inspect all accessible engine accessories for looseness and damage. Be sure fan belt and generator belt adjustment is satisfactory (½ inch finger-pressure deflection).

(5) ITEM 6, LEAKS—GENERAL. Look under vehicle and in engine compartment for indications of fuel, engine oil, gear oil, or coolant leaks. Trace any leaks found to source and correct or report them.

(6) ITEM 7, ENGINE WARM-UP. Start engine, noting any tendency toward hard starting. Observe if starter has adequate speed and engages and disengages without unusual noise. Set hand throttle to run engine at a fast idle during warm-up, and reset choke, as necessary for engine to run smoothly and to avoid overchoking and oil dilution. CAUTION: *If oil pressure is not evident in approximately 10 seconds, stop engine, and investigate or report condition.*

(7) ITEM 8, CHOKE OR PRIMER. When starting engine, as outlined in step (6) above, observe if operation of choke or primer is satisfactory, and note any leakage at primer pump or connections. Choke must open and close fully in response to operation of choke control.

(8) ITEM 9, INSTRUMENTS.

(a) Oil Pressure Gage. Gage should register approximately 40 pounds pressure at normal operating speeds.

(b) Ammeter. Gage may indicate a high charge (+) for a period after starting, until generator restores to battery the current used in starting engine, then should indicate only slight charge, if battery is up and with lights and accessories turned off.

(c) Heat Indicator. Reading should increase gradually to normal operating range, 175° to 180° F. Maximum safe operating temperature is 200° F. CAUTION: *Do not move vehicle until engine temperature reaches 140° F.*

(d) Fuel Gage. Gage should register the approximate amount of fuel in tank. Ordinarily, tank will have been filled and gage should register "FULL."

(e) Voltmeter. On vehicles so equipped, place voltmeter switch in the "ON" position and check voltage of the electrical system.

(9) ITEM 10, WINDSHIELD WIPERS. Test wipers to see that they operate properly, that blades and arms are in good condition, secure, and operate through their full stroke, and that blades contact glass evenly and firmly.

(10) ITEM 11, GLASS. Clean windshield glass and curtain windows, and inspect for damage.

(11) ITEM 12, LAMPS (LIGHTS). Inspect all lights for looseness and damage. If tactical situation permits, open and close all light switches to see if lamps respond properly.

(12) ITEM 13, WHEEL AND FLANGE NUTS. Examine all drive, idler, bogie and guide wheel mounting and flange nuts or screws to see that they are present and secure.

(13) ITEM 14, TRACKS. Examine tracks and guides for looser or damage. Be sure rubber surfaces of all wheels have not separa from the metal, and that track rubber belts and rubber cross pl connectors are in good condition and secure. Be sure track tens is satisfactory (par. 135).

(14) ITEM 15, SPRINGS AND SUSPENSIONS. On vehicles equipped, inspect transverse springs and rebound clips, tens spring, support yokes, arms, bumpers, weed cutters, and suspens brackets for looseness and damage.

(15) ITEM 16, STEERING BRAKE LINKAGE. Be sure all lev arms, cross shafts, and rods are in good condition and secu mounted or connected, and 1½ to 2½ inches of free travel (at to lever) is present before braking resistance becomes apparent. vehicles so equipped, inspect parking brake cable, conduit, and h control, to see that it is in good condition and operates properly.

(16) ITEM 18, TOWING CONNECTIONS. Inspect front tow and rear pintle hook for looseness and damage. Be sure pintle l operates properly and locks securely.

(17) ITEM 19, HULL, LOAD, AND TOP.

(a) Hull and Attachments. Examine entire hull for damag loose attachments. Be sure seats, safety straps, compartments, st ge boxes and covers, and floor plates are secure. Examine windsh frame and air duct guard for looseness or damage.

(b) Load. Be sure any cargo carried is properly distributed securely stowed.

(c) Top. Examine top and top bows to see that they are in goo condition and securely mounted or stowed. If top is in use, be su it is properly fastened at hull loops and at curtain fasteners.

(d) Bow and Stern Cells. On vehicles so equipped, be sure bow and stern cells are in good condition and securely attached.

(18) ITEM 17, TRACK APRONS. On vehicles so equipped, inspect apron and apron hinge mountings for looseness or damage. Apron hinges, and assembly should be clean of all foreign objects and secure.

(19) ITEM 20, DECONTAMINATOR. On vehicles so equipped, inspect decontaminator for full charge, looseness, or damage. Remove filler plug to check contents.

(20) ITEM 21, TOOLS AND EQUIPMENT. Be sure all items of vehicle tools and equipment are present, serviceable, and properly stowed or mounted.

(21) ITEM 22, ENGINE OPERATION. Before vehicle is put in motion, be sure engine temperature has reached 140° F and idles smoothly. Accelerate and decelerate several times, and observe any unusual noise or vibrations, unsatisfactory operating characteristics, or excessive exhaust smoke.

(22) ITEM 23, DRIVER'S PERMIT AND FORM NO. 26. The driver must have his operator's permit on his person. Check to be sure vehicle manuals, lubrication order, Accident-Report, Form No. 26, and MWO and Major Unit Assembly Replacement Report, W.D., A.G.O. Form No. 478, are present, legible, and properly stowed.

(23) ITEM 24, AMPHIBIAN SERVICES.

(a) Bilges and Bilge Pump. Be sure all bilges have been cleared of excessive water and refuse, and that the hand bilge pump operates properly and is securely stowed.

(b) Capstan and Drive. On vehicles so equipped, examine capstan assembly for looseness and damage. See that drive shaft, universal joints, drive pulleys, mounting brackets, and belt are in good condition and secure, and that drive belt tension is satisfactory. Belt should have approximately 5/8- to 3/4-inch finger-pressure deflection. Be sure that capstan drive clutch engages properly and that clutch control mechanism operates without excessive looseness or binding.

(c) Rudders and Controls. On vehicles so equipped, inspect rudders, mountings, control linkage, and cables for looseness and damage. Be sure rudder operating mechanism is adequately lubricated, and that it will operate without excessive looseness or binding. NOTE: *When not in water operation, rudders must be in raised position and secured by the spring hooks.*

(d) Hull, Deck, Lids, Covers, and Surf Guard. Examine hull for punctures and broken welds. See that hull drain plugs are secure. Be sure all deck plates are in good condition and secure. Before water operation, make sure lids and compartment covers fit properly and close and fasten securely against seals; that surf guard is in place and securely fastened, and that rudders are lowered to operating position.

42. DURING-OPERATION SERVICE.

a. Observations. While vehicle is in motion, listen for any sounds such as rattles, knocks, squeals, or hums that may indicate trouble. Look for indications of trouble in cooling system and smoke from any part of the vehicle. Be alert for odors indicating overheated components or units (such as generator, brakes, or clutch) leaks in fuel system or exhaust system, or other trouble. When brakes are used, gears shifted, or the vehicle turned, consider this a test and note any unsatisfactory or unusual performance. Watch the instruments constantly for unusual behavior indicating possible trouble in systems to which they apply.

b. Procedures. During-operation Services consists of observing items listed below according to the procedures following each item, and investigating any indications of serious trouble. Note minor

deficiencies to be corrected or reported at earliest opportunity, usual the next scheduled halt.

(1) ITEM 26, STEERING BRAKES. Before attaining appreciab speed, determine whether normal pull on steering levers will st and brake vehicle effectively. Continue to make similar tests dur operation.

(2) ITEM 28, CLUTCH. Clutch should operate smoothly, with drag, grab, chatter, or squealing on engagement, or slippage wh fully engaged, under load. Pedal should have 1-inch free travel bef meeting resistance.

(3) ITEM 29, TRANSMISSIONS. Both the engine and rear transmissions should shift easily and smoothly, operate without usual noise, and not slip out of mesh during operation.

(4) ITEM 31, ENGINE AND CONTROLS. The driver must be the alert for deficiencies in engine performance, such as lack of us power and acceleration, misfiring, backfiring, stalling, unusual n or vibration, or excessive exhaust smoke. Observe if engine respo to all controls and if controls are excessively loose or binding. radio noise, due to the operation of the engine, has been repor the driver will cooperate with the radio operator in locating the in ference. For proper procedures, see paragraphs 175 to 179.

(5) ITEM 32, INSTRUMENTS. Driver must watch ammeter, meter, fuel, engine temperature, and oil pressure gages very freque ly during operation to be sure they indicate or record the pro function of the units to which they apply. Also, during operation, sure the speedometer registers vehicle speed and odometer recor accumulating mileage.

(6) ITEM 34, RUNNING GEAR. Be on the alert during operati for any unusual noise or operating characteristics of track, drive, idl wheel, or bogie suspension units, that may indicate looseness, damag excessive wear, or inadequate lubrication.

(7) ITEM 35, HULL. During operation, note any indications hull looseness of plates, hatches, covers, or attachments, and any ex cessive rattles or shifting of cargo.

(8) ITEM 37, AMPHIBIAN SERVICES.

(a) *Bilges and Bilge Pump.* Note any excessive rise of water bilges that might indicate hull leaks from punctures, broken welds, o loose drain plugs, lids, or covers. If bilge pump is used, observe if it operates satisfactorily and pumps to capacity.

(b) *Capstan and Drive.* On vehicles so equipped, when in use observe if control engages clutch effectively, if capstan function properly, and if there is any indication of loose universal joints mounting brackets, or drive belt. Note any unusual noise or unsatis factory operating characteristics to be investigated at halt, or that should be reported.

(c) Rudder and Controls. On vehicles so equipped, observe if rudders operate to steer vehicle properly, if there is any indication of loose mountings, and if control handle (tiller), cables, and arms operate without excessive looseness or binding.

43. AT-HALT SERVICE.

a. Importance. At-halt Services may be regarded as minimum maintenance procedures, and should be performed under all tactical conditions even though more extensive maintenance services must be slighted or omitted altogether.

b. Procedures. At-halt Services consist of investigating any deficiencies noted during operation, inspecting items listed below according to the procedures following the items, and correcting any deficiencies found. Deficiencies not corrected should be reported promptly to the designated individual in authority.

(1) ITEM 38, FUEL, OIL, AND WATER. Check fuel, oil, and water supply to be sure it is adequate to operate vehicle to next scheduled halt, or replenish as spare supply and tactical situation permit.

(2) ITEM 39, TEMPERATURES. Feel by hand, hubs of bogie wheels, track upper guide wheels, track drive, and idler wheels for evidence of overheating.

(3) ITEM 40, AXLE VENT. Examine rear axle vent (located in rear air outlet duct), to determine whether opening is obstructed.

(4) ITEM 41, PROPELLER SHAFT. Inspect propeller shaft and universal joints for looseness or damage. Joints should be securely mounted and properly lubricated.

(5) ITEM 42, SPRINGS AND SUSPENSIONS. Examine transverse springs and all suspension units for looseness or damage. Investigate any unusual noise or unsatisfactory condition noticed during operation.

(6) ITEM 43, STEERING BRAKE LINKAGE. Inspect for looseness or damage, and investigate any unusual condition noticed during operation.

(7) ITEM 44, WHEEL AND FLANGE NUTS. Be sure all drive, idler, bogie, and track guide wheel assembly, mounting, and flange nuts or screws are present and secure.

(8) ITEM 45, TRACKS. Examine tracks for looseness and damage, and remove all foreign objects lodged in tracks or bogie units.

(9) ITEM 46, LEAKS—GENERAL. Look under vehicle and in engine compartment for indications of fuel, oil, or coolant leaks. Trace any leaks to source, and correct or report them.

(10) ITEM 47, ACCESSORIES AND BELTS. Examine all accessible units for looseness and damage. Be sure fan and generator belts are in good condition and have ½-inch finger-pressure deflection. If

radio interference, caused by operation of the engine, was obser
examine all wiring and radio noise suppression units in the en
compartment for loose connections or mountings, particularly
resistor-suppressors at spark plugs and distributor.

(11) ITEM 48, AIR CLEANER. If operating under extreme
ditions of dust or sand, examine carburetor air cleaner for exces
dirt and proper oil level; service as instructed in lubrication
(par. 37).

(12) ITEM 49, TRACK APRONS. On vehicles so equipped, ins
apron and apron hinge mountings for looseness or damage.
and hinge pins must be clean and secure.

(13) ITEM 50, TOWING CONNECTIONS. Examine front tow
and rear pintle hook for looseness or damage. See that pintle
operates properly and latches securely.

(14) ITEM 51, HULL, LOAD AND TOP. Look over hull an
attachments, top, and bows for evidence of loose mounting, loo
sembly nuts or screws, and for broken welds. Any cargo carried
be properly distributed and securely stowed.

(15) ITEM 52, GLASS. Clean all glass and inspect for dame

(16) ITEM 53, AMPHIBIAN SERVICES.

(a) In Water. While at-halt in water, observe if there
abnormal rise of water in bilges; if there are any leaks at lid or
seals, and if vehicle rides on even keel. Pump out excessive
with hand bilge pump.

(b) On Land. Examine exterior of hull for damage, and re
all weeds or other foreign matter lodged in tracks, weed cutters,
suspension units or wound around rudders and control mechan
Remove drain plugs and allow bilge water to drain out of hull
cells. Install plugs and tighten securely; also tighten any loose
or compartment covers before again entering water.

44. AFTER-OPERATION AND WEEKLY SERVICE.

a. Purpose. After-operation servicing is particularly import
because at this time the crew inspects the vehicle to detect any
ficiencies that may have developed, and to correct those they
permitted to handle. They should promptly report results of
inspection to the designated individual in authority. If this sched
is performed thoroughly, the vehicle should be ready to roll again
a moment's notice. The Before-operation Service, with few exce
tions, is then necessary only to ascertain whether the vehicle is in t
same condition in which it was left upon completion of the Afte
operation Service. The After-operation Service should never be e
tirely omitted, even in extreme tactical situations, but may be re
duced to the bare fundamental services outlined for the At-halt Ser
ices, if necessary.

b. Procedures. When performing the After-operation Service, the crew must remember and consider any irregularities noticed in the Before-operation, During-operation, and At-halt Services. The After-operation Service consists of inspecting and servicing the following items. Those items of the After-operation Service that are marked by an asterisk (*) require additional Weekly Services, the procedures for which are indicated in subparagraph *(b)* of each applicable item.

(1) ITEM 55, ENGINE OPERATION. Before stopping engine, accelerate and decelerate a few times, and observe if there is any unusual noise or vibration, excessive smoke from exhaust, or any tendency to stall. Engine should idle smoothly, with accelerator and choke fully released. Investigate any unusual or unsatisfactory characteristics noticed during operation.

(2) ITEM 56, INSTRUMENTS. Observe all pertinent instruments to be sure they register or indicate the proper operation of the units to which they apply. Stop engine and see that instruments are in good condition and securely mounted and connected.

(3) ITEM 54, FUEL, OIL, AND WATER. Fill fuel tank, check engine oil and coolant supply, and add as necessary to bring to correct levels. CAUTION: *Do not overfill radiator; leave room for expansion.* NOTE: *During freezing weather when antifreeze compound is in use, if any appreciable amount of coolant has to be added, have value of antifreeze checked, and add as necessary to protect cooling system against freezing.* Investigate any unusual loss of fuel, oil, or coolant.

(4) ITEM 57, WINDSHIELD WIPERS. Examine wiper motors, arms, and blades for looseness and damage. Test for proper operation.

(5) ITEM 58, GLASS. Clean all glass and curtain windows and inspect for damage.

(6) ITEM 59, LAMPS (LIGHTS). Inspect all lights, including spot signal light (if so equipped), for looseness or damage. If tactical situation permits, open and close all light switches to see if lamps respond properly.

(7) ITEM 60, FIRE EXTINGUISHER. Inspect unit for damage. Remove filler plug and see that it is fully charged, and be sure nozzle is not clogged. Mount extinguisher securely.

(8) ITEM 61, DECONTAMINATOR. On vehicles so equipped, inspect unit for damage. Remove filler plug to see if it is fully charged; be sure nozzle is not clogged. Mount unit securely.

(9) ITEM 62, *BATTERIES.

(a) Inspect batteries for damage, leaks, and loose connections or mountings.

(b) Weekly. Tighten battery mountings and connections. terminals are corroded, clean them thoroughly, and grease posts terminals lightly. If necessary, add clean water to bring electro to correct level. Be sure cell vents are not clogged, and install finger-tight.

(10) ITEM 63, ACCESSORIES AND BELTS. Examine all acces units, such as carburetor, generator, regulator, coil, distributor, st oil filter and radiator, for damage and loose connections or moun See that fan and generator drive belts are in good condition and ½-inch, finger-pressure deflection.

(11) ITEM 64, ELECTRICAL WIRING. Inspect all exposed ig and low-voltage wiring for damage, and see that all connection supports are secure. Look particularly for scorched, broken, or radio noise resistor-suppressors at spark plugs and distributor that filter unit, or condenser at regulator and capacitors at co generator, are securely mounted and connected.

(12) ITEM 65, AIR CLEANER AND OIL FILLER CAP. Ex carburetor air cleaner and crankcase filler cap for damage. Se all air cleaner mountings and connections are secure. If op under extreme conditions of dust or sand, check air cleaner for sive dirt and service as directed in lubrication order (par. 37

(13) ITEM 66, *FUEL FILTER.

(a) Inspect filter for damage and loose connections and ings. Drain off accumulated dirt and water.

(b) Weekly. If any great amount of dirt or water is prese move filter bowl and wash bowl and filter element in dry cle solvent. Extreme conditions of dirt or water must be reporte further cleaning of fuel system by higher echelon.

(14) ITEM 67, ENGINE CONTROLS. Examine choke and acce tor controls for looseness, binding, damage, excessive wear, and quate lubrication.

(15) ITEM 76, TRACK APRON. On vehicles so equipped, exa track apron, apron hinges and assembly for looseness or dam Assembly must be correctly mounted and secure. Left and r hinge pins must be removed and apron raised to perform operati under steps 16 and 17 (below).

(16) ITEM 68, *TRACKS.

(a) Examine tracks for damage and for loose assembly rivets plates and driving lugs. Inspect endless rubber belts and cables looseness or damage. Clean all mud and debris from tracks and fr between tracks and wheels.

(b) Weekly. Check track tension and, if necessary, adjust cording to instructions in paragraph 135.

(17) ITEM 69, *SPRINGS AND SUSPENSIONS.

(a) Clean all dirt and debris from suspension units. Inspect transverse springs and track tension springs for damage, loose or excessively worn mountings, shifted leaves, and loose or missing rebound clips.

(b) Weekly. Tighten securely all loose suspension assembly or mounting nuts or screws. On vehicles so equipped, clean excessive debris and foreign objects from weed cutter and see that it is adjusted for proper operation.

(18) ITEM 70, STEERING BRAKE LINKAGE. Examine levers and grips and all connections, rods, cross shafts, and mounting brackets for looseness and damage. Investigate any unsatisfactory steering or braking characteristics noticed during operation, and correct or report the trouble to proper authority.

(19) ITEM 71, PROPELLER SHAFT. Inspect propeller shaft and universal joints for looseness or damage. Joints should be securely mounted and properly lubricated.

(20) ITEM 72, AXLE VENT. See that rear axle vent is present, secure, and not clogged.

(21) ITEM 73, LEAKS—GENERAL. Examine interior of hull for evidence of fuel, oil, or water leaks. Inspect radiator, hose connections, and water pump. Examine oil lines and oil filter, fuel lines, fuel pump and fuel filter, transmission and axle unit for leaks. Trace all leaks to source and correct or report. Remove hull drain plugs on left side only, elevate right side, and drain hull.

(22) ITEM 74, GEAR OIL LEVELS. Check oil levels in transmission and in controlled differential (axle) and if necessary add to correct level. See lubrication order (par. 37) for correct quantity and grade of oil.

(23) ITEM 77, TOWING CONNECTIONS. Examine front tow loop and rear pintle hook for looseness or damage. See that pintle hook operates properly and latches securely.

(24) ITEM 78, HULL, LOAD AND TOP.

(a) Hull and Attachments. Examine entire hull for damage or loose attachments. See that hull drain plugs and plate are secure. Be sure seats, safety straps, compartments and covers, stowage boxes and covers, and floor plates are secure. Look for broken welds. Examine windshield frame and air duct guard for looseness or damage.

(b) Load. Be sure any cargo carried is properly distributed and securely stowed.

(c) Top. Examine top and top bows to see that they are in good condition and securely mounted or stowed. If top is in use, be sure it is properly fastened at hull loops and at curtain fasteners.

(25) ITEM 82, *TIGHTEN.

(a) Tighten all points of the vehicle where inspection has indicated the necessity.

(b) *Weekly.* Tighten all loose hull attachments, assembly mounting bolts, screws, or nuts, loose track rivets, suspension units or any other point where inspection or experience has indicated need on a weekly basis.

(26) ITEM 83, *LUBRICATE AS NEEDED.

(a) Lubricate any point where inspection has indicated oil can hand greasing is necessary.

(b) *Weekly.* Lubricate all points listed on lubrication order requiring attention on a weekly basis.

(27) ITEM 84, *CLEAN ENGINE AND VEHICLE.

(a) Clean out all refuse from engine compartment, and wipe all fuel, oil, or coolant drippings from within the compartment. exterior of engine. Wipe off exterior of entire vehicle, and clean driver's and stowage compartments.

(b) *Weekly.* Wash vehicle, if possible. If washing is impracticable, wipe off as clean as possible, looking for rough spots or polish places that might cause glare or reflection. See that all markings (unless covered for tactical reasons) are legible.

(28) ITEM 86, *AMPHIBIAN SERVICES.

(a) Examine entire interior and exterior of hull for damage, indications of punctures, broken welds, and loose attachments. Inspect compartment lids and covers for good condition, alinement, proper sealing, and proper operation of hinges and latches. Remove drain plugs and allow bilge water to drain out of hull and clean. Install plugs and tighten securely. Remove all weeds or other foreign matter from exterior of hull, from tracks and suspensions, and from rudders and rudder control mechanism. Apply a few drops of engine oil to capstan clutch collar and splines, and thoroughly lubricate all suspension system external fittings.

(b) *Weekly.* Remove drain plugs and drain all accumulated bilge water and loose dirt out of hull and cells. Remove all lids and compartment covers, and clean bilges thoroughly. Wipe up all fuel and oil drippings, and correct or report any fuel, oil, or coolant leaks. Investigate or report any unusual noise or unsatisfactory operating characteristics of rudders, capstan, or capstan drive mechanism noted during water operation. See that capstan drive belt has 5/8- to 3/4-inch, finger-pressure deflection.

(29) ITEM 85, *TOOLS AND EQUIPMENT.

(a) Be sure all vehicle pioneer tools and items of vehicle equipment are present (see Vehicle Stowage List, pars. 5, 6, 7, and 8) and see that they are in good condition and properly mounted or stowed.

(b) Weekly. Clean all tools and items of equipment, as necessary. Inspect tools with cutting edges to see if they are sharp. Tools with bright surfaces must be painted or otherwise treated to prevent glare and reflections. Mount or stow all items properly and securely.

45. ORGANIZATIONAL MAINTENANCE (SECOND ECHELON).

a. Frequency. The frequency of preventive maintenance services outlined herein is considered a minimum requirement for normal operation of vehicles. Under unusual operating conditions such as extreme temperatures, severe dust, sandy or extremely wet terrain, or amphibious operations, it may be necessary to perform certain maintenance services more frequently.

b. First Echelon Participation. The crews should accompany their vehicles and assist the mechanics while periodic second echelon preventive maintenance services are performed. Ordinarily, the vehicle should be presented for a scheduled preventive maintenance service in a reasonably clean condition; that is, it should be dry, and not caked with mud or grease to such an extent that inspection and servicing will be seriously hampered. However, the vehicle should not be washed or wiped thoroughly clean, because certain types of defects, such as cracks, leaks, and loose or shifted parts or assemblies, are more evident if the surfaces are slightly soiled or dusty.

c. Sources of Additional Information. If instructions other than those contained in the general procedure in paragraph **d**, or the specific procedures in paragraph **i**, which follow, are required for proper performance of a preventive maintenance service or for correction of a deficiency, they may be secured from other sections of this manual or from the designated individual in authority.

d. General Procedures. These general procedures are basic instructions which are to be followed when performing the services on the items listed in the specific procedures. NOTE: *The second echelon personnel must be thoroughly trained in these procedures so that they will apply them automatically.*

(1) When new or overhauled subassemblies are installed to correct deficiencies, care must be taken to see that they are clean, correctly installed, and properly lubricated and adjusted.

(2) When installing new lubricant retainer seals, a coating of the lubricant should be wiped over the sealing surface of the lip of the seal. When the new seal is a leather seal, it should be soaked in engine oil (OE 10) at least 30 minutes. The oil should be warm, if practicable. Then, the leather lip should be worked carefully by hand before installing the seal. The lip must not be scratched or marred.

e. Definition of Terms. Refer to paragraph 39 **b**.

f. Special Services. These are indicated by repeating the numbers in the columns which show the interval at which the serv are to be performed, and show that the parts or assemblies ar receive certain mandatory services. For example, an item num in one or both columns opposite a "TIGHTEN" procedure, means the actual tightening of the object must be performed. The sp services include:

(1) ADJUST. Make all necessary adjustments in accordance the pertinent section of this manual, special bulletins, or other cu directives.

(2) CLEAN. Clean units of the vehicle with dry cleaning s to remove excess lubricant, dirt, and other foreign material. the parts are cleaned, rinse them in clean solvent and dry thoroughly. Take care to keep the parts clean until reassembl be certain to keep cleaning solvent away from rubber or material which it will damage. Clean the protective grease from new parts since this material is usually not a good lubri

(3) SPECIAL LUBRICATION. This applies both to lubricatio ations that do not appear on the vehicle lubrication order, items that do appear on the order but should be performed nection with the maintenance operations if parts have to be di bled for inspection or service.

(4) SERVE. This usually consists of performing special tions, such as replenishing battery water, draining and refillin with oil, and changing or cleaning the oil filter, air cleaner, tridges.

(5) TIGHTEN. All tightening operations should be per with sufficient wrench torque (force on the wrench handle) to the unit according to good mechanical practice. Use a indicating wrench where specified. Do not overtighten, as thi strip threads or cause distortion. Tightening will always be stood to include the correct installation of lock washers, lock lock wire, or cotter pins provided to secure the tightening.

g. Special Conditions. When conditions make it difficu perform all preventive maintenance procedures at one time, the sometimes be handled in sections, planning to complete all opera within the week if possible. All available time at halts and in biv areas must be utilized, if necessary, to assure that maintenance op tions are completed. When time is limited by the tactical situa items with Special Services in the columns should be given first sideration.

h. Work Sheet. The members of the preventive maintena procedures that follow are identical with those outlined on W A.G.O. Form No. 462, which is the "Preventive Maintenance Serv

Work Sheet for Full Track and Tank-like Wheeled Vehicles." Certain items on the work sheet that do not apply to this vehicle are not included in the procedures in this manual. In general, the numerical sequence of items on the work sheet is followed in the manual procedures, but in some instances there is deviation for conservation of the mechanic's time and effort.

i. Specific Procedures. The procedures for performing each item in the semi-monthly and monthly maintenances procedures are described in the following chart. Each page of the chart has two columns at its left edge corresponding to the monthly and the semi-monthly maintenance respectively. Very often it will be found that a particular procedure does not apply to both scheduled maintenances. In order to determine which procedure to follow, look down the column corresponding to the maintenance due, and wherever an item number appears, perform the operations indicated opposite the number. NOTE: *Those procedures preceded by an asterisk (*) require additional services at each third monthly operation.*

MAINTENANCE		
Monthly	Semi-monthly	
		ROAD TEST
		NOTE: *When the tactical situation does not permit a full road test, perform those items which require little or no movement of the vehicle. When a road test is possible, it should be for preferably 3 and not over 5 miles.*
1	1	BEFORE-OPERATION SERVICE. Before vehicle is road tested, perform the Before-operation Service outlined in paragraph 41.
2	2	DASH INSTRUMENTS AND GAGES. *Oil Pressure Gage.* Engine oil pressure gage should register approximately 40 pounds pressure at normal operating engine speed and about 5 pounds at idle speed. *Ammeter.* Ammeter may show a high positive (+) charge, until generator restores to batteries current used in starting; then zero or slight charge with all lights and electrical accessories turned off. *Engine Heat Indicator.* Normal operating temperature range is 175° to 180° F. Maximum safe operating temperature is 200° F. CAUTION: *Do not move vehicle until engine temperature has reached 140° F.*

MAINTENANCE		
Monthly	Semi-monthly	
		Fuel Gage. Fuel gage reading should indicate the amount of fuel in fuel tank, when the ignition switch is in the "ON" position.
		Voltmeter. On vehicles so equipped, when voltmeter switch is in the "ON" position, the voltmeter should indicate voltage present in the electrical system.
		Compass. On vehicles so equipped, inspect compass to see that it is in good condition, securely mounted and that compass light responds to the compass light switch.
		Speedometer. Speedometer should indicate vehicle speed and odometer register accumulating mileage.
3	3	WINDSHIELD AND WINDSHIELD WIPERS. Examine windshield to see that it is in good condition and securely mounted. Test wipers to be sure they operate properly; that blades and arms are in good condition, secure, and operate through their full stroke. See that wiper blades contact glass evenly and firmly.
5	5	BRAKES (STEERING, PARKING, BRAKING ACTION). Steering levers (at top) should have 1½ to 2½-inches of free travel before meeting resistance, and should stop vehicle effectively with a reserve of lever travel available. Levers applied separately should steer the vehicle properly. Brakes should not grab, chatter or squeal. On vehicles so equipped, pull parking brake handle to be sure brake operates properly, that brake control handle has reserve travel available when fully applied and that brake control handle locks in applied position (par. 123).
6	6	CLUTCH (FREE TRAVEL, DRAG, CHATTER, SLIP). Clutch pedal free travel should be 1 inch (par. 114 (b)). Clutch should be fully released when pedal is fully depressed, and should not grab, chatter, or squeal on engagement or slip when engaged under load.
	7	TRANSMISSIONS (LEVER ACTION, NOISE, VIBRATION). Both engine and axle transmissions should shift smoothly, operate without unusual noise, and not slip out of mesh during operation.

MAINTENANCE		
Monthly	Semi-monthly	
9	9	ENGINE (IDLE, ACCELERATION, POWER). During road test, be on the alert for unsatisfactory engine operating characteristics, such as misfiring, backfiring and stalling; also watch for excessive exhaust smoke.
10	10	UNUSUAL NOISES (PROPELLER SHAFT AND U-JOINTS, DIFFERENTIAL, SPROCKETS, WHEELS AND TRACKS). Listen for any unusual noises in the above items, that might indicate looseness, damage, excessive wear, or inadequate lubrication.
14	14	NOISE AND VIBRATION (ENGINE, MOUNTINGS, ACCESSORIES AND DRIVES, CLUTCH). With vehicle stopped, and engine still running, accelerate and decelerate engine several times and note any noise or vibrations in engine, mountings, accessories or exhaust system, that may indicate looseness, damage, excessive wear, or inadequate lubrication. Depress clutch pedal and listen for any unusual noise in clutch or clutch throw-out bearing. Stop engine, and check to see if engine has consumed any unusual amount of oil.
15	15	TRACK TENSION (FINAL ROAD TEST). Determine whether track tension is within specified limits and vehicle travels straight ahead with both steering brake levers in the released position.
11	11	TEMPERATURES (TRANSMISSION, DIFFERENTIAL, HUBS, IDLERS, WHEELS AND ROLLERS). Hand-feel the hubs of all bogie and guide wheels, also drive and idler wheel hubs for overheating. Inspect transmission and differential units for abnormal temperatures.
13	13	LEAKS (FUEL, OIL AND WATER). Look under vehicle, in engine and driving compartments, also inside of hull for indications of fuel, oil, or water leaks.
17	17	CRANKCASE (LEAKS AND LEVELS). Inspect crankcase for leaks at gasket and oil lines. Check oil level and add as necessary. If condition of oil indicates the necessity, or if oil change is due, drain and refill as instructed in lubrication order (par. 37).
54	54	ENGINE OIL FILTER. Examine filter to see if it is in good condition, securely mounted, and not leaking.

MAINTENANCE		
Monthly	Semi-monthly	
54	54	CLEAN AND SERVE. Service filter according to instructions in lubrication order (par. 37).
16	16	ENGINE VACUUM AND FUEL PUMP TEST. Connect vacuum gage to intake manifold, and make vacuum test (item 69). Attach pressure gage to carburetor fuel line and after starting engine, see that fuel pump pressure is 2 to 4 pounds for mechanical fuel pumps, and 4 to 6 pounds for electric fuel pumps.
18	18	SIDE APRONS, BOW AND STERN CELLS GUARD, PAINT AND MARKINGS, TOWING EYE AND PINTLE HOOK. Examine the above items to see that they are in good condition and that all welds, nuts, and screws are secure. Inspect paint or camouflage pattern for rust spots or polished surfaces that may cause glare or reflections. Be sure that pintle hook operates properly and locks securely.
19	19	BOTTOM INSPECTION PLATES AND DRAIN PLUGS. Examine hull bottom for broken assembly welds, nuts, or screws and see that all inspection plates and drain plugs are in good condition and secure.
19	19	*Tighten.* Tighten all bottom inspection plates and plugs securely.
20	20	DIFFERENTIAL AND FINAL DRIVES. Inspect housings externally to see if they are in good condition, securely assembled, and mounted. Look for excessive oil leaks at seals and gaskets.
20		*Tighten.* Tighten all assembly and mounting nuts or screws securely.
21	21	TRACKS (CROSS PLATES, ENDLESS RUBBER BELTS, GUIDES AND CABLES). Inspect these items to see if they are in good condition, correctly assembled, and secure. Tighten loose assembly rivets and replace those missing. Check friction bands for broken cables.
	21	*Whenever tracks are removed for repair or replacement, or at each third monthly maintenance service, the related group items, 22 to 25 marked by an asterisk (*), should be performed as described below in the asterisk-marked procedures. CAUTION: *When*

MAINTENANCE		
Monthly	Semi-monthly	
		ever tracks are removed, do not replace them until services marked (*) in items 22 to 25 have been completed.
22	22	IDLER—FRONT WHEEL (CARRIER ARMS, TENSION SPRINGS, CARRIERS, AND BEARINGS). Inspect wheels, arms, springs, and carriers to see if they are in good condition, correctly assembled, secure, and not excessively worn. Look for grease leaks at wheel seals. Tighten assembly and mounting nuts or screws securely.
22		*At each third monthly service, or whenever tracks are removed for repair or replacement, remove the wheel bearings and seals, wash them thoroughly in dry cleaning solvent, and inspect them for damage and excessive wear. Replace if necessary, first lubricating according to lubrication order (par. 37), and adjust according to paragraph 135.
23	23	BOGIE (TRANSVERSE SPRING, YOKES, SUPPORT ARMS). Inspect these units to see if they are in good condition, correctly and securely assembled and mounted, and not excessively worn.
23		*Tighten.* Draw up all assembly and mounting nuts securely.
24	24	GUIDE WHEELS AND BOGIE WHEELS (MOUNTINGS, TIRES, SHAFTS, BEARINGS). Examine all guide and bogie wheels and tires to see if they are in good condition, securely assembled and mounted; that tires are not damaged or excessively worn and not separating from the rims. Check by hand-feel for excessive wear in shafts or bearings. Guide wheels should not have more than ⅜-inch end play.
24		*Tighten.* Draw up all assembly and mounting nuts and screws securely.
24		*At each third monthly service, or whenever tracks are removed for repair or replacement, remove wheels, clean shafts and bearings, and inspect them for excessive wear or damage. Replace as necessary. Lubricate according to instructions in lubrication order (par. 37), and adjust according to paragraph 136.

MAINTENANCE		
Monthly	Semi-monthly	
25	25	DRIVE WHEELS (SPROCKETS, TIRES, HUBS AND AXLE FLANGE, SHAFTS, AND BEARINGS). Examine sprocket wheels, tires, hubs, and carrier assemblies to see if they are in good condition and correctly assembled and mounted; look for excessive oil leaks from seals or gaskets. Be sure tires are not damaged or excessively worn and not separating from rims. Tighten all loose assembly or mounting nuts and screws securely.
25		*At each third monthly service, or whenever tracks are removed for repair or replacement, remove axle shafts and wheel bearings, wash in dry cleaning solvent and inspect for damage and excessive wear. Replace as necessary. Lubricate bearings and hubs according to lubrication order (par. 37), and adjust bearings according to paragraph 136.
26	26	TRACK TENSION. Test track tension with gage and readjust as necessary, paragraph 134. Inspect track idler wheel tension spring brackets for fractures and attaching bolts for stripped threads and tightness.
27	27	TOP AND HULL INTERIOR (TOP, BOWS AND CURTAINS, SEATS AND SAFETY STRAPS, FLOOR PLATES, WINDSHIELD, COMPARTMENT COVERS AND BRUSH GUARD). Inspect all above units to see if they are in good condition, correctly assembled, and securely mounted. Look for damage to paint and rust or polished surfaces on paint or camouflage pattern that might cause glare or reflections. Examine radio antenna mast and mounting for looseness or damage.
28	28	CAPS AND GASKETS (FUEL TANK AND RADIATOR). Inspect these caps and gaskets to see that they are in good condition, and that caps fit filler necks tightly and lock securely.
30		ENGINE REMOVAL (WHEN REQUIRED). Engine should be removed on monthly maintenance service only if inspections made in items 9 and 13 and a check of oil consumption indicate need. NOTE: *Cleaning and following service Items 31 to 59 inclusive, will be performed in best possible manner on all engines not requiring removal.*

MAINTENANCE		
Monthly	Semi-monthly	
31		VALVE MECHANISM. If engine is removed, adjust tappets to 0.016-inch cold (par. 67).
32	32	SPARK PLUGS (GAPS, DEPOSITS). Wipe off plugs and examine insulators for damage. Look for indications of oil, coolant, and compression leaks around seals and gaskets.
32		Remove and inspect for broken insulators, excessive carbon deposits, and burned electrodes. Adjust gap to 0.025 inch. Use new gaskets when installing, and tighten securely. Before installing plugs, make compression test, Item 33. Be sure radio noise suppressions are in good condition and secure.
33		COMPRESSION TEST (RECORD). With all spark plugs removed, and throttle valve wide open, test compression of each cylinder. Compression pressure at cranking speed is normally 125 to 135 pounds. There should not be more than 20 pounds variation between cylinders. Record compression pressures on back of work sheet, W.D. Form 462.
34	34	GENERATOR AND STARTER. Examine generator and starter to see that they are in good condition, securely mounted and that all wiring is securely connected. Be sure that radio capacitor on generator is in good condition, securely connected and mounted.
34		Remove commutator inspection covers, and check brushes for spring tension, free action, and wear. Clean commutator if necessary, according to instructions in paragraph 107.
36	36	DISTRIBUTOR (CAP, ROTOR, POINTS AND CONDENSER). Wipe all dust and dirt from distributor cap and inspect for cracks or corroded high tension sockets. Examine rotor for cracks, shorts, burns and cleanliness. Inspect points for alinement and pitting. If points are badly pitted, replace points and condenser. Condenser must be securely mounted and pig tail securely connected. Slightly pitted points may be dressed with a point stone or file to assure a square contact. Examine base plate for excess lubricant; if dirty or greasy, clean thoroughly. Holding clips must clamp cap securely.

MAINTENANCE		
Monthly	Semi-monthly	
36		*Adjust.* Adjust breaker point gap to 0.020 inch, according to instructions in paragraph 78.
38	38	IGNITION WIRING AND CONDUITS. Examine all exposed wiring to see if it is in good condition, clean, and securely connected and supported. Inspect radio noise resistor-suppressors at spark plugs and distributor for damage, scorching, and looseness.
39	39	COIL. Examine ignition coil and its radio noise capacitor to see if they are in good condition, clean, and securely connected and mounted.
42	42	OIL FILLER CAP AND VENTILATOR. Examine crankcase filler pipe cap and crankcase and valve chamber ventilator pipes to see if they are in good condition and secure.
42		Remove ventilator pipes, clean them thoroughly, and install them securely.
43	43	AIR CLEANER. Examine carburetor air cleaner unit to see if it is in good condition, secure, and not leaking. Clean and service according to lubrication order (par. 37).
44	44	CARBURETOR (CHOKE, THROTTLE, LINKAGE AND PRIMER). Inspect all of the above units to see if they are in good condition, correctly and securely assembled and mounted. See that throttle and choke mechanism and linkage, operate properly and are not excessively worn. Test action of primer and see that pump connections and mountings are secure.
45	45	MANIFOLD (INTAKE AND EXHAUST). Inspect manifold for good condition, holding lugs for tightness, and gaskets for leaks. Inspect heat control valve for damage or excessive wear, and for proper operation and action of bimetal spring.
46	46	CYLINDER HEAD AND GASKET. Examine cylinder head to see if it is in good condition and look for evidence of oil, coolant, or compression leaks from head or gasket. NOTE: *Cylinder head cap screws should not be tightened except in case of actual looseness or leaks. If tightening is necessary, use a torque wrench and tighten in proper sequence to 50 to 54 foot-pounds (fig. 53).*

MAINTENANCE		
Monthly	Semi-monthly	
48		CLUTCH ASSEMBLY. Examine clutch housing for indications of damage and leaks. Tighten all accessible housing studs and screws. NOTE: *At any time engine is removed, inspect all clutch components for damage and excessive wear. If unserviceable, entire clutch assembly must be replaced.*
49	49	WATER PUMP, FAN, AND SHROUD. Inspect these units to see that they are in good condition, correctly assembled, and securely connected or mounted. Be surt fan blades and shroud are alined so as not to interfere.
50	50	ACCESSORY DRIVES (BELTS AND PULLEYS). Examine fan and generator drive belts and pulleys to see if they are in good condition, that pulleys are secure and in alinement, and that belts do not bottom in pulleys. Adjust drive belts so they have approximately ½-inch, finger-pressure deflection (figs. 55 and 56).
52	52	ENGINE OIL (LINES AND FITTINGS). Examine all engine lines and fittings, including oil pressure gage line, for leaks and damage.
53	53	FUEL TANK (VENT, LINES, AND PUMP). Examine these items to see if they are in good condition, correctly mounted, connected, and supported. Be sure filler cap vent is not clogged. Clean pump sediment bowl and screen. See that drain cock and pipe are in good condition. Remove hull plug, and drain accumulated dirt and water from bottom of fuel tank (par. 85).
55	55	FUEL FILTER. Examine fuel filter, drain cock, and line to see if they are in good condition and securely connected and mounted. Remove hull plug (right side) and drain off accumulated dirt and water. Remove filter bowl and wash bowl and element in dry cleaning solvent, according to lubrication instructions in paragraph 87.
57	57	EXHAUST PIPES AND MUFFLER. Inspect pipes and muffler for rust or corrosion, cracks, leaks, and security of mountings and connections. Look for indications of blown gaskets. Inspect tail pipe for restrictions or clogging; be sure muffler guard is secure and not damaged.

MAINTENANCE		
Monthly	Semi-monthly	
57		*Tighten.* Draw up all assembly and mounting nuts and screws carefully and securely.
58	58	ENGINE MOUNTINGS. Examine all engine mountings for looseness and damage and tighten as necessary. Be sure bond straps are secure. NOTE: *When engine is removed, inspect mountings for deterioration.*
58		*Tighten.* Tighten all loose engine mountings securely.
61		ENGINE (INSTALL MOUNTINGS, LINES, WIRING, CONTROL LINKAGE; CHECK OIL SUPPLY). If engine was removed for repairs or replacement, install at this time, connect and tighten securely all mountings, lines, wiring, bond straps and controls securely. CAUTION: *Be sure oil supply is at proper level.*
62	62	RADIATOR (CORE, MOUNTINGS, HOSE, ANTI-FREEZE RECORD). Examine radiator core, all hose and connections, and overflow pipe to see if they are in good condition and securely connected or mounted. Be sure cooling fins are not bent so as to obstruct air flow, and that overflow pipe is not clogged. If anti-freeze is in use, check its valve and record on back of work sheet, Form No. 462. While solution is in hydrometer, examine it for contamination. If cleaning of cooling system is necessary, follow instructions in paragraph 95. Straighten bent fins, avoid damaging core. CAUTION: *Be sure to replenish coolant supply before starting engine.*
63	63	BATTERIES (CABLES, HOLD-DOWNS, CARRIER, GRAVITY AND VOLTAGE RECORD). Inspect battery mounting for security, case for cracks or leaks, and cables and terminal posts for corrosion. Clean, tighten, and grease terminals. Test specific gravity and voltage, and record cell readings on work sheet.
63		Perform high-rate discharge test according to instructions for a condition test which accompanies test instrument. Cell variation should not be more than 30 percent. NOTE: *To make test, specific gravity must be above 1.225.* Clean batteries and carrier; repaint carrier if corroded. Clean and grease lightly cables,

MAINTENANCE		
Monthly	Semi-monthly	
		terminals, bolts, and posts. Inspect bolts and nuts to see that they are in good condition. Carefully tighten terminals and hold-downs to avoid damage to battery.
63	63	*Serve.* Add clean water to bring electrolyte 3/8 inch above plates.
64	64	ACCELERATOR (LINKAGE). See that accelerator and all of its connections are in good condition and securely connected. If repaired or reconditioned engine has been installed, check to see that accelerator opens the carburetor throttle valve fully.
65	65	STARTER (PRIMER, INSTRUMENTS). Start engine, observing precautions in Item 1. Note whether or not the starter has sufficient speed and engages and disengages without unusual noise. Check pertinent instruments to be sure they indicate the proper functioning of the system or unit to which they apply. Set choke as necessary during warm-up period for engine to run smoothly and to prevent overchoking and oil dilution.
66	66	LEAKS (ENGINE OIL, FUEL AND COOLANT). With engine running and systems under pressure, recheck for leaks in oil, fuel, and cooling systems.
67	67	IGNITION TIMING. Check and set ignition timing according to instructions in paragraph 79.
68	68	REGULATOR UNIT. Inspect regulator and radio noise filter unit, or condenser, to see if they are in good condition and securely mounted and connected.
69	69	ENGINE IDLE AND VACUUM TEST. *Engine Idle.* After engine has reached normal operating temperature, adjusting carburetor, choke and idle screw according to instructions in paragraph 92. *Vacuum Test.* Connect vacuum gage to intake manifold at valve cover breather connection, and check vacuum reading. With engine at fast idle speed, gage pointer should register 16 to 18 inches. Accelerate and decelerate engine momentarily. If pointer fails to drop about 2 inches as throttle valve is opened, and advance to about 25 inches as throttle is closed, it may indicate poor piston ring sealing, diluted oil, or an abnormal

MAINTENANCE		
Monthly	Semi-monthly	
		obstruction in exhaust system, carburetor, or air cleaner. A needle, fluctuating badly between 10 and 15 inches, indicates a defective cylinder head gasket or valve. Extremely low reading may indicate a leak in intake system or gaskets.
74	74	CLUTCH PEDAL (FREE TRAVEL, LINKAGE). Inspect clutch pedal and all linkage to see if it is in good condition and securely mounted or connected. See that return spring has sufficient tension and that control cable is properly supported and that it works freely. Adjust pedal to provide 1-inch free travel.
75	75	STEERING BRAKES (LEVERS, LINKAGE AND SHAFTS). Examine levers and all shafts and linkage to see if they are in good condition, securely connected and mounted, and not excessively worn. Levers should have 1½ to 2½ inches of free travel at grip, before meeting heavy resistance and should have a reserve of travel available when fully applied.
75		*Tighten.* Draw up all assembly and mounting nuts or screws securely.
75		*Adjust.* Make minor or major brake band adjustments as necessary to get proper free travel according to instructions in paragraph 129.
77	77	DIFFERENTIAL AND BREATHER. Examine the accessible portion of axle differential and transmission housing externally, to see if it is in good condition, securely mounted, and not leaking at seals or gaskets.
77		*Tighten.* Draw up all accessible assembly and mounting nuts or screws securely.
77		*Clean.* Remove breather assembly, clean thoroughly, and install securely.
78	78	TRANSMISSION CONTROLS AND LINKAGE. Inspect both engine transmission and axle transmission unit shift levers and linkage to see that they are in good condition, correctly and securely assembled and mounted, and not excessively worn. Test operation of shift mechanism to see if it operates without looseness or binding.

MAINTENANCE		
Monthly	Semi-monthly	
81	81	PROPELLER SHAFT (JOINTS, SEALS, ALINEMENT). Inspect propeller shaft and universal joints to see if they are in good condition, not leaking lubricant at seals, and in proper alinement.
81		*Tighten.* Draw up U-bolt nuts securely.
84	84	COMPASS. On vehicles so equipped, examine compass to see that it is in good condition, securely mounted, and that compass light responds to light switch.
85	85	LIGHTS AND SWITCHES. When tactical situation permits, operate switches and make sure that all lights operate properly. Include trouble and signal light. Inspect lights for cleanliness, broken lens or burnt out lamps, and loose mountings.
86	86	WIRING (FUSES, TERMINALS). Inspect all accessible low-voltage wiring, fuses and terminal blocks or boxes to see if they are in good condition, correctly assembled, and securely connected and supported. Clean dirt and grease from exposed wiring and connections.
88	88	RADIO BONDING (SUPPRESSORS, FILTERS, CONDENSERS AND SHIELDING). See that all units not covered in the foregoing specific procedures are in good condition and securely mounted and connected. Be sure all additional noise suppression bonds, with internal-external toothed lock washers listed in paragraph 175, are inspected for looseness or damage, and see that contact surfaces are clean. NOTE: *If objectionable radio noise from vehicle has been reported, check systems as outlined in section XXXIII.* If cleaning and tightening of mountings and connections and replacement of defective radio noise suppression units does not eliminate the trouble, the radio operator will report the condition to the designated individual in authority.
		ITEMS SPECIAL TO AMPHIBIANS
		NOTE: *The following items (a to d), covering the required minimum maintenance for amphibian vehicles are substituted since there are no item numbers assigned for these services on Form No. 462.*

MAINTENANCE		
Monthly	Semi-monthly	
a	a	HULL (BOW AND STERN CELLS, DECKS, LIDS AND COVERS, SURF GUARD, DRAIN PLUGS). Inspect entire hull to see that it is in good condition and that all drain plugs are secure. Examine bow and stern cells and hull for punctures and broken welds and be sure bow and stern cell attaching bolts are present and secure. See if deck plates are loose or damaged. also inspect covers, lids, and hinges to see if they open and close freely and that seals are in good condition and latches hold covers and lids securely against seals. Be sure surf guard and coaming is not loose or damaged.
a	a	*Tighten.* Tighten all hull attachment assembly and mounting nuts or cap screws securely.
a		*Special Lubrication.* Apply a few drops of engine oil to all hinge pins, latches, turnbuckles and thumb screws.
b	b	RUDDERS (MOUNTINGS, CABLES, CONTROL ARMS AND TILLER). Inspect rudders to see if they are in good condition, and that mounting and assembly nuts or screws are present and secure. Examine tiller, cables, control arms, and cable drums to be sure they are in good condition and operate freely.
b		*Tighten.* Tighten all rudder and control mounting and assembly nuts and cap screws securely.
b		*Special Lubrication.* Apply a few drops of engine oil to cables where they enter the conduits, to clevis pins, control arm pins, and tiller.
c	c	CAPSTAN (CLUTCH, DRIVE SHAFT, UNIVERSAL JOINTS, MOUNTINGS, AND DRIVE BELTS). Examine capstan and all operating and drive mechanism to see if each unit is in good condition, securely and properly assembled and adequately lubricated. Look particularly for loose mountings and U-joints, distorted drive shaft or frayed or oil soaked drive belt. Be sure drive pulleys are correctly alined and secure. Check drive belt for proper adjustment, see paragraph 172.

MAINTENANCE		
Monthly	Semi-monthly	
c		*Tighten.* Tighten all mounting and assembly nuts or screws securely and see that all assembly pins are present and securely locked.
c		*Special Lubrication.* Apply a few drops of engine oil to capstan dog clutch, splines and collar; also perform oilcan lubrication of universal joints.
d	d	BILGES AND BILGE PUMP. Examine bilge compartments to see that all bulkheads, frame members and braces, and insulation pads are in good condition and secure. Test hand bilge pump to be sure it is in good condition and will pump to capacity. Tighten all units securely.
		TOOLS AND EQUIPMENT
130	130	TOOLS, PARTS AND ACCESSORIES. After completion of the services, check tool list (paragraphs 5 through 8) to be sure all items are present, be sure they are in good condition, and that they are properly and securely mounted or stowed. Tools with cutting edges should be sharp and properly protected.
131	131	EQUIPMENT. See that all items of standard and special vehicle equipment listed in paragraphs 5 through 8, are present, in good condition, and properly stowed. Pay particular attention to radio equipment to see that it is properly connected and mounted.
134	134	DECONTAMINATOR. Examine for good condition, full charge, and secure attachment. Remove filler plug for charge inspection. Solution must be renewed every three months.
136	136	PUBLICATIONS AND FORM NO. 26. Check to see that vehicle manuals, lubrication order, Form No. 26 (Accident-Report), and Form No. 478 (MWO and Major Unit Assembly Replacement Record) are present, legible, and safely stowed.
138	138	MODIFICATIONS (MWO's COMPLETED). Inspect vehicle to determine if all MWO's have been completed and entered on Form No. 478. Enter any modifications or major unit assembly replacements made at time of this service.

MAINTENANCE	
Monthly	Semi-monthly
139	

FINAL ROAD TEST. Make a final road test, rechecking items 2 to 15 inclusive. Confine this test to the minimum distance necessary to make satisfactory observations. Recheck transmission, differential, and engine to determine that lubrication levels are correct and that no leaks exist. NOTE: *Correct any deficiencies found during the road test.*

Section XV
TROUBLE SHOOTING

46. GENERAL.

a. This section lists difficulties which might be encountered with this vehicle during operation in normal temperatures, with the possible common causes and remedies. Only such symptoms and causes as can be detected by the using arms are included, and the tests to determine the possible causes are listed in the order of their importance. A systematic test procedure must be used if the difficulty is to be located and corrected with a minimum of time and effort. Therefore, this section has been arranged, wherever possible, with the symptom listed first. The causes, tests, and suggested remedies for each symptom provide a process of elimination to determine what is responsible for the trouble, and what action must be taken to correct it.

47. ENGINE OIL SYSTEM.

a. **Excessive Oil Consumption.**

(1) CRANKCASE OIL LEVEL TOO HIGH. Check crankcase oil level and drain excess oil as necessary.

(2) EXTERNAL OIL LEAKS. Inspect all gaskets and oil seals for visible evidence of leaks. If leaks are discovered, tighten all holding nuts or cap screws, and if leaks are not stopped, report to higher authority.

(3) IMPROPER VISCOSITY OF OIL. Replace with oil of recommended viscosity.

(4) EXCESSIVE RING, CYLINDER, AND PISTON WEAR. This condition is usually indicated by loss of power, low cylinder compression, and smoking exhaust, in addition to excessive oil consumption. Refer to higher authority.

(5) LOOSE MAIN OR CONNECTING ROD BEARINGS. Loose main or connecting rod bearings will cause excessive oil consumption be-

cause the oil is thrown onto the cylinder walls in greater quantity than can be controlled by the piston rings. Refer to higher authority.

b. Low Oil Pressure.

(1) IMPROPER VISCOSITY OF OIL. Change to oil of proper viscosity.

(2) OIL PRESSURE RELIEF VALVE STUCK. Refer to higher authority.

(3) LOOSE MAIN OR CONNECTING ROD BEARINGS. Refer to paragraph 48 e (4) and (5) to identify. Refer to higher authority.

48. ENGINE.

a. Crankshaft Will Not Turn.

(1) SEIZURE DUE TO INTERNAL DAMAGE. Refer to higher authority.

(2) STARTER INOPERATIVE. See paragraph 52 a.

(3) STARTER PINION OR FLYWHEEL GEAR TEETH STRIPPED. Replace starter or refer to higher authority if teeth on flywheel are stripped.

b. Engine Crankshaft Turns but Engine Will Not Start.

(1) BATTERY DISCHARGED OR CHARGE VERY LOW. Test battery with hydrometer. When operating at ordinary temperatures, recharge or replace battery when the hydrometer reading is below 1.200. (Refer to par. 28 b as to reading in torrid climates.)

(2) STARTER SPEED TOO SLOW. See paragraph 52 c.

(3) NO SPARK AT PLUGS. Turn on ignition switch. Disconnect spark plug wire from plug terminal, crank engine with starter, and note whether spark is obtained while holding terminal about ⅛-inch from cylinder head. If no spark, trace defect by following steps (5) to (8) below. If spark is visible, perform step (4) following.

(4) SPARK PLUGS BROKEN OR DIRTY, OR GAPS INCORRECTLY SPACED. Replace plugs if porcelain is broken. If dirty, clean with accredited cleaner, and space electrode gaps to 0.025 inch before installation. Always check electrode gap, and space, if necessary, before installing.

(5) DISTRIBUTOR CAP OR ROTOR BROKEN. Replace rotor or cap.

(6) DISTRIBUTOR BREAKER POINTS INCORRECTLY SPACED, PITTED, OR EXCESSIVELY BURNED. Respace or install new points (par. 78 d).

(7) SPARK PLUG WIRES BROKEN OR IMPROPERLY CONNECTED (AT DISTRIBUTOR TOWERS OR PLUG TERMINALS). Inspect wires for breaks or broken or frayed insulation, corroded or dirty connections in distributor cap towers, or improperly seated terminals on plugs.

(8) IGNITION TIMING INCORRECT. Reset ignition timing (par. 79).

(9) FUEL SUPPLY EXHAUSTED. Replenish fuel supply.

(10) FUEL FILTER OR FUEL LINES CLOGGED. Disconnect fuel line from carburetor, operate starter, and observe if fuel is discharging. If not, refer to paragraphs 50 a (2) and (3).

(11) CARBURETOR CHOKE CONTROL WIRE LOOSE OR DISCONNECTED. Adjust choke control (par. 92 b (2)).

c. Engine Runs but Misfires.

(1) IGNITION INCORRECTLY TIMED. Retime (par. 79).

(2) FAULTY SPARK PLUGS. Locate faulty plug with suitable tester, and install new plug.

(3) DISTRIBUTOR CAP OR ROTOR BROKEN. Replace cap and/or rotor.

(4) DISTRIBUTOR POINTS WORN, PITTED, OR INCORRECTLY SPACED. Examine points; if worn or pitted, replace. Check point gap and space to 0.020-inch maximum opening.

(5) INCORRECT VALVE TAPPET ADJUSTMENT. If valves are not closing or opening to proper limits, adjust tappets to 0.016-inch clearance between valve lifter adjusting screw and end of valve stem, with valve in fully closed position.

(6) BROKEN VALVE SPRING. Remove valve cover plate and examine valve springs. If spring is broken, refer to higher authority.

(7) LEAKING CYLINDER HEAD GASKET. Examine cylinder head for evidence of leakage between head and gasket. If leaks are detected, tighten cylinder head cap screws to tension of from 50 to 54 foot-pounds with a torque wrench. If gasket is defective, install a new one.

(8) PARTIALLY PLUGGED FUEL LINE. Remove fuel lines and clean. If cleaning the lines does not correct difficulty, test fuel pump pressure.

(9) THERMOSTAT DEFECTIVE. Replace thermostat (pars. 99 b and c).

d. Engine Lacks Power.

(1) IGNITION TIMING INCORRECT. Reset ignition timing (par. 79).

(2) DETONATION FROM LOW OCTANE FUEL. Retard ignition timing slightly or refer to higher authority.

(3) ENGINE OVERHEATING. Inadequate cooling solution, fan belt slipping, improper grade or insufficient oil in crankcase. Add cooling solution, adjust fan belt, or change or replenish oil.

(4) CARBURETOR ADJUSTMENT INCORRECT. Adjust or replace complete assembly.

(5) LOW ENGINE COMPRESSION. If engine does not develop full power with fuel reaching combustion chambers, adequate ignition,

and sufficient oil in crankcase, the compression of each cylinder should be checked by removing spark plugs, inserting compression gage in spark plug opening, cranking engine two or three times (with throttle wide-open), and taking highest reading obtained. Gage should read 105 pounds for satisfactory compression. If reading is less, check valve tappets for 0.016-inch clearance and make necessary adjustment. If satisfactory compression is not restored, refer to higher authority.

(6) RESTRICTION IN EXHAUST SYSTEM. Inspect for bent exhaust pipes or muffler passages restricted by carbon formation. Straighten or replace bent pipes. Replace muffler.

(7) CLUTCH SLIPPING. See paragraph 54 a.

(8) STEERING LEVER BRAKES DRAGGING. Adjust band tension (par. 129 b).

(9) PARKING BRAKE DRAGGING (AFTER VEHICLE SERIAL 15,681, APPROX.). Check handle for complete release. Adjust linkage and band clearance (par. 124).

e. Engine Knocks.

(1) EXCESSIVE CARBON ACCUMULATION IN CYLINDER HEAD. In most cases, this condition will be apparent on acceleration or hard pull, and will sound like a rattle or ping. Remove cylinder head and clean out carbon.

(2) IGNITION TIMING TOO FAR ADVANCED. This condition will result in a noise very similar to excessive carbon accumulation except that the ping will be more pronounced. To correct, retard timing until the ping is not apparent when engine is pulling.

(3) LOOSE PISTON PIN. Loose piston pin knocks may usually be identified from other engine knocks as occurring intermittently and are of a sharper character than main bearing knocks. Refer to higher authority.

(4) LOOSE CONNECTING ROD BEARINGS. Knocks resulting from loose connecting rods occur at regular intervals, and are of a slightly deeper tone than piston pin knocks. Refer to higher authority.

(5) LOOSE MAIN BEARINGS. Main bearing knocks are more of a heavy thud than a knock, and are more apparent when the engine is accelerated. Refer to higher authority.

(6) EXCESS VALVE TAPPET CLEARANCE. Excess clearance between valve lifter adjusting screw and valve stem end will result in a sharp click occurring at regular intervals. Adjust tappets to 0.016-inch clearance.

f. Engine Overheats.

(1) COOLING SOLUTION LOW. Add sufficient coolant to bring solution to required level.

(2) THERMOSTAT DEFECTIVE. Test thermostat and replace if not operating within specifications (par. 99).

(3) FAN BELT SLIPPING. Test belt adjustment by pressing in on fan belt with thumb or finger. Belt has proper tension when finger-pressure deflection is ½ inch. Adjust tension if necessary (par. 72 a (1)).

(4) RADIATOR FINS CLOGGED. Remove restrictions from openings.

(5) ENGINE OIL LEVEL LOW. Check crankcase oil level, and add oil of correct viscosity as required.

(6) CLUTCH SLIPPING. See paragraph 54 a.

(7) STEERING LEVER BRAKES DRAGGING. Adjust band tension (par. 129 b).

(8) PARKING BRAKE DRAGGING (AFTER VEHICLE SERIAL 15,681 APPROX.). Check handle for complete release. Adjust linkage and band clearance (par. 124).

(9) VEHICLE DRIVEN IN GEAR RANGE TOO HIGH FOR LOAD OR TERRAIN. Shift to lower speed gear.

(10) IGNITION TIMING INCORRECT. Reset ignition timing (par. 79).

49. IGNITION SYSTEM.

a. No Spark at Plugs.

(1) BATTERIES DISCHARGED. Test batteries for state of charge. If discharged, replace with fully charged batteries.

(2) BATTERY CABLES LOOSE OR DISCONNECTED FROM BATTERY TERMINALS. Connect or tighten terminal connections.

(3) BATTERY GROUND STRAP LOOSE OR GROUND CONNECTION DIRTY. Clean and tighten ground connection.

(4) COIL TO DISTRIBUTOR WIRE DISCONNECTED. Examine wire at coil and distributor towers for tight, clean connection.

(5) DISTRIBUTOR ROTOR OUT OF CONTACT WITH DISTRIBUTOR CAP PLUNGER. Remove distributor cap, and examine plunger and spring. Replace if necessary.

(6) DISTRIBUTOR ROTOR OUT OF CONTACT WITH CAP TERMINALS. Examine for burned rotor or distributor cap terminals. Replace cap and/or rotor.

(7) DISTRIBUTOR TO CONDENSER WIRE DISCONNECTED. Examine for loose or disconnected terminals; connect and tighten if necessary.

(8) DISTRIBUTOR POINTS PITTED AND STUCK. Examine points for evidence of excessive pitting causing points to stick. This condition is usually the result of a defective condenser. Replace points, adjust gap to 0.020 inch, and replace condenser.

(9) DISTRIBUTOR POINT GAP INCORRECTLY ADJUSTED. If distributor point gap is adjusted so that points will not separate, or points are opening too wide, adjust point gap to 0.020 inch maximum opening.

(10) SPARK PLUG WIRES LOOSE AT DISTRIBUTOR OR PLUG TERMINALS. Examine wires at distributor cap towers and plug terminals for tightness. Push wires firmly into towers and down over plug terminals.

(11) SPARK PLUGS BROKEN OR ELECTRODE GAP INCORRECT. Examine plugs for broken porcelain or incorrectly spaced electrode gaps. Adjust all electrode gaps to 0.025 inch, and replace broken plugs.

(12) IGNITION SWITCH INOPERATIVE. Test switch by connecting a jumper wire across terminals and operate starter. If engine starts, replace switch (par. 82).

b. Weak Spark at Plugs.

(1) BATTERIES CHARGE LOW. Test batteries for charge. Starter may be draining most of battery energy to crank engine, leaving insufficient voltage for intense spark. Recharge, or replace with fully charged batteries.

(2) WEAK COIL. Coil may have deteriorated to such an extent that it fails to transform battery low voltage to high voltage necessary to jump spark plug gap. Replace coil.

(3) DISTRIBUTOR BREAKER POINT GAP INCORRECT. If gap is too little or too great, space points to 0.020 inch.

(4) COIL OR DISTRIBUTOR CAP COIL WIRE TOWER CORRODED OR DIRTY. Clean wire terminals and distributor cap and coil tower terminals.

(5) DEFECTIVE CONDENSER OR IGNITION COIL. Test condenser by disconnecting lead wire to condenser, leaving other wires in place. Normal operation indicates need for replacing condenser.

c. Ignition Timing Incorrect.

(1) ENGINE MISFIRES OR LACK OF POWER. Either condition may be the result of incorrect ignition timing. Retime as outlined in paragraph 79.

(2) ENGINE OVERHEATS. Check ignition timing and retime if necessary (par. 79).

(3) ENGINE KNOCKS. If pre-ignition knock has rattle or ping characteristics due to timing being too far advanced, retime ignition (par. 79).

50. FUEL, AIR INTAKE, AND EXHAUST SYSTEMS.

a. Insufficient or No Fuel to Cylinders to Start Engine.

(1) FUEL PUMP INOPERATIVE. Disconnect fuel pump to carburetor pipe from carburetor, operate pump hand lever (on vehicles

before serial 9503) and ascertain if pump delivers fuel. If not, perform steps (2) and (3) below, and again test pump. If no fuel is delivered when testing second time, replace pump (par. 86).

(2) FUEL FILTER CLOGGED. Service fuel filter (par. 87 b).

(3) FUEL TANK TO FILTER LINE CLOGGED OR RESTRICTED. Examine fuel line for restrictions, bends, kinks, dents, and foreign matter which might shut off flow of fuel. Clean or replace line if necessary.

(4) AIR LEAKS IN LINES. Examine all connections for evidence of leakage and for tightness.

(5) BROKEN FUEL PUMP ROCKER ARM (BEFORE VEHICLE SERIAL 9503). Disconnect fuel pump to carburetor line from carburetor fitting, crank engine with starter, and determine if pump delivers fuel while engine camshaft turns. If not, replace pump.

(6) CARBURETOR CHOKE CONTROL ADJUSTMENT INCORRECT. If insufficient fuel reaches cylinders to start engine when cool or cold, check choke control adjustment as outlined in paragraph 92 b (2).

(7) CARBURETOR THROTTLE CONTROL ADJUSTMENT INCORRECT. If throttle adjustment is incorrect and insufficient fuel reaches cylinders to start engine, adjust throttle control to provide full throttle valve opening when accelerator is depressed or throttle control is pulled outward.

(8) CARBURETOR FLOAT LEVEL INCORRECT. If fuel level in carburetor bowl is too low to provide sufficient fuel to start engine, refer to higher authority.

b. Fuel Pump Noisy (Before Vehicle Serial 9503).

(1) PUMP BODY LOOSE ON ENGINE. Tighten pump mounting cap screws.

(2) ROCKER ARM SPRING WEAK OR BROKEN. Remove pump and operate rocker arm, observing spring tension. Replace pump if spring is weak or broken.

(3) ROCKER ARM OR PIN WORN. With pump removed, examine arm, and by operating arm, determine if pin is worn. Replace pump if necessary.

c. Engine Backfires Through Manifold.

(1) CARBURETOR MIXTURE TOO LEAN. This usually occurs at high speed. Refer to higher authority.

(2) IGNITION TIMING INCORRECT. Adjust ignition timing (par. 79).

d. Engine Stalls or Lacks Power Due to Excess Fuel.

(1) CHOKE VALVE REMAINS PARTIALLY OR FULLY CLOSED. Adjust choke control linkage until choke valve in carburetor air horn is fully open when control button is against dash (par. 92 b (2)).

(2) CARBURETOR FLOAT INCORRECTLY ADJUSTED. Refer to higher authority.

(3) CARBURETOR MAIN METERING JET SIZE INCORRECT FOR OPERATING CONDITIONS. Install correct size main metering jet (par. 92 c).

e. Engine Falters on Acceleration.

(1) CARBURETOR ACCELERATING PUMP DEFECTIVE. Replace carburetor (par. 92).

(2) DIRT IN METERING JET ORIFICE. Clean or replace jet (par 92 c).

51. COOLING SYSTEM.

a. Engine Overheats.

(1) INSUFFICIENT COOLANT IN SYSTEM. Add coolant.

(2) FAN BELT LOOSE. Adjust belt to correct tension until ½-inch belt deflection can be obtained by finger pressure (par. 72 a (1)).

(3) FAN BELT OILY, GREASY, OR WORN. If belt is oily or greasy resulting in slippage, clean belt and if not satisfactory after cleaning, replace belt. If belt is worn enough to cause slipping, replace.

(4) WATER PUMP INOPERATIVE. Test pump action by filling radiator and observing if water is agitated with engine running, or by grasping upper radiator hose tightly to determine if pressure is indicated when engine is accelerated. If pump is inoperative, replace (par. 98).

(5) THERMOSTAT INOPERATIVE. If engine heats rapidly and temperature continues to rise after indicator reaches 175° to 200° F, remove thermostat and test for opening (par. 99). If defective, replace thermostat.

(6) RADIATOR CORE FINS CLOGGED. Clean radiator core openings of any mud, debris, or other foreign matter which would restrict air flow.

(7) RADIATOR UPPER OR LOWER HOSES COLLAPSED. Test both upper and lower hoses by appearance and by feel for pressure when engine is accelerated. If evidence of weak or collapsed hose is discovered, replace hose.

(8) RADIATOR CORE CLOGGED INTERNALLY. If thermostat and water pump action are determined to be satisfactory and both upper and lower hoses are in good condition, remove radiator cap and note degree of turbulence in upper radiator tank when engine is accelerated. If sluggish or no movement of solution is noticed, radiator core may be clogged internally. Reverse flush or replace radiator.

(9) IGNITION TIMING INCORRECT. Retime ignition (par. 79).

b. Engine Runs Too Cool.

(1) THERMOSTAT STICKING OPEN. This condition is indicated by the engine running consistently cool. Normally, the thermostat should remain closed until engine reaches normal operating temperature. Replace thermostat (par. 99).

c. Cooling System Leaks.

(1) HOSE CONNECTIONS LOOSE. Tighten upper and lower hose connections.

(2) HOSE BROKEN OR DETERIORATED. Replace hose.

(3) CYLINDER HEAD GASKET DEFECTIVE. Install new gasket.

(4) RADIATOR CORE LEAKING. Examine core for leaks and replace core if leaks are found.

52. STARTING SYSTEM.

a. Starter Will Not Operate.

(1) BATTERIES PARTIALLY OR COMPLETELY DISCHARGED. Test batteries with hydrometer for specific gravity. When operating at ordinary temperatures, recharge or replace with fully charged batteries if hydrometer reading is less than 1.200. (Refer to par. 28 b for hydrometer reading in torrid zones.)

(2) BATTERY TERMINALS LOOSE OR CORRODED. Examine terminals for tightness and corrosion. Clean and tighten as necessary.

(3) BATTERY GROUND STRAP NOT MAKING GOOD CONTACT. Examine ground strap for contact and tightness. Clean and tighten if necessary.

(4) STARTER MANUAL SWITCH DEFECTIVE. Remove one wire from terminal on switch and touch it to other switch terminal wire. If starter operates, replace switch (par. 82).

(5) WIRES LOOSE AT TERMINALS ON STARTER OR SWITCH. Tighten terminals as required.

b. Starter Operates But Does Not Crank Engine.

(1) STARTER PINION OR FLYWHEEL GEAR TEETH STRIPPED. Replace starter or refer to higher authority if teeth on flywheel are stripped.

c. Starter Speed Too Slow.

(1) IMPROPER GRADE OF ENGINE OIL. If there is too much drag or friction on engine parts, change to correct grade of oil.

(2) VOLTAGE DROP IN CIRCUIT DUE TO POOR BATTERY OR GROUND CONNECTIONS. Examine battery and ground connections for tightness and poor contact. Clean and tighten.

53. BATTERIES AND GENERATING SYSTEM.

a. Batteries Will Not Retain Charge.

(1) LOOSE, DIRTY, OR CORRODED CONNECTING TERMINALS. Batteries discharging current through loose, dirty, or corroded terminals. Check terminals; clean and tighten if necessary.

(2) LIGHT OR ACCESSORY SWITCHES DEFECTIVE OR NOT TURNED TO "OFF" POSITION. Inspect all light and accessory switches for "OFF" position; when turned off, observe ammeter reading for indication of current discharge. Locate any defective switches and replace or report to higher authority.

(3) WIRING SHORTED. Trace out short in wiring and replace wiring.

(4) GENERATOR REGULATOR CIRCUIT BREAKER POINTS STICKING. This condition will be indicated by discharge reading on the ammeter which cannot be eliminated by turning off all switches and after determining that no shorts exist in wiring. If difficulty cannot be eliminated by jarring regulator, replace (par. 108).

b. Batteries Do Not Take Charge.

(1) LOOSE CONNECTIONS AT BATTERY TERMINALS, GENERATOR, OR REGULATOR. Clean and tighten connections.

(2) BATTERY CELLS DRY. Replenish water in battery cells.

(3) BATTERY CELLS SHORTED OR OTHER INTERNAL DAMAGE. Replace battery or batteries.

(4) GENERATOR NOT CHARGING. Refer to subparagraph c below.

(5) DEFECTIVE GENERATOR REGULATOR. Replace regulator (par. 108).

(6) DEFECTIVE FILTER OR CONDENSER ON GENERATOR REGULATOR. A defective filter or condenser will prevent proper functioning of the battery charging circuit. Remove the filter or condenser and connect the wire to the terminal on regulator. If the ammeter indicates the charging circuit is restored, replace the filter or condenser.

(7) DEFECTIVE CONDENSER AT GENERATOR ARMATURE TERMINAL. If the condenser at the generator armature terminal is believed defective, check by disconnecting the lead wire from terminal and allowing other wires to remain in place. Normal operation indicates the faulty condenser should be replaced.

c. Generator Does Not Develop Charge.

(1) DRIVE BELT SLIPPING. Adjust belt to ½-inch, finger-pressure deflection.

(2) GENERATOR PULLEY LOOSE ON SHAFT. Tighten pulley.

(3) GENERATOR COMMUTATOR DIRTY. Remove cover band and clean commutator by placing a strip of 2/0 flint paper over a thin strip of wood and holding it against commutator while it is rotating slowly.

(4) GENERATOR BRUSHES WORN OR NOT SEATING PROPERLY. Examine brushes for evidence of excessive wear or weak brush springs that allow brushes to pull away from commutator. Replace generator if brushes are not making good contact with commutator due to wear or weak springs.

(5) HIGH MICA BETWEEN COMMUTATOR BARS. If commutator bars are worn to such an extent as to prevent brushes from contacting bars due to high mica separators, replace generator.

(6) LOOSE WIRING CONNECTIONS. Examine all wiring from generator to regulator, and regulator to ammeter and battery. Clean and tighten all connections if necessary.

(7) DEFECTIVE AMMETER. If generator is actually charging as indicated by a consistently charged battery, but if ammeter does not register charge, replace ammeter.

(8) FAULTY GENERATOR REGULATOR. If generator regulator is defective, replace regulator (par. 108).

54. CLUTCH.

a. Clutch Slips.

(1) OPERATOR "RIDES" CLUTCH PEDAL. Correct driving habits.

(2) CLUTCH FACINGS IMPREGNATED WITH OIL OR GREASE. Refer to higher authority and replace clutch driven plate (par. 111).

(3) CLUTCH PEDAL REQUIRES ADJUSTMENT. Adjust clutch pedal as specified in paragraph 114 b.

b. Clutch Grabs or Chatters.

(1) FACINGS LOOSE ON DRIVEN MEMBER. Refer to higher authority and replace clutch driven plate (par. 111).

(2) CLUTCH FACINGS IMPREGNATED WITH OIL OR GREASE. Refer to higher authority and replace clutch driven plate (par. 111).

(3) CLUTCH PRESSURE PLATE SCORED. Refer to higher authority.

55. TRANSMISSION.

a. Transmission Noisy.

(1) INSUFFICIENT OR INCORRECT GRADE OF LUBRICANT. Check lubricant level and add lubricant as required. Test grade of lubricant and change if necessary.

(2) CLUTCH HOUSING LOOSE ON ENGINE. Tighten cap screws that hold clutch housing to engine rear plate.

(3) TRANSMISSION LOOSE ON CLUTCH HOUSING. Tighten screws that hold transmission to clutch housing.

b. Transmission Slips Out of Gear.

(1) INTERNAL PARTS DAMAGED OR WORN. Refer to higher authority and replace transmission (par. 117 and 118).

(2) CLUTCH HOUSING OUT OF ALINEMENT. Refer to higher authority.

(3) SHIFT CONTROL RODS INCORRECTLY ADJUSTED OR BENT. Adjust rods (par. 119 b) or replace (par. 119 c, d).

c. Transmission Leaks Lubricant.

(1) MAINSHAFT OIL SEAL WORN OR DAMAGED. Refer to higher authority and replace transmission (par. 117 and 118).

(2) TRANSMISSION COVER LOOSE OR GASKET DAMAGED. Tighten cover and/or refer to higher authority and replace transmission (par. 117 and 118).

56. PROPELLER SHAFT AND UNIVERSAL JOINTS.

a. Noise or Vibration.

(1) BENT OR TWISTED SHAFT AND JOINTS. Inspect shaft for bent or twisted condition and replace shaft if unserviceable.

(2) DRY UNIVERSAL JOINT CROSS BEARINGS. Lubricate bearings as instructed in lubrication order (par. 38).

(3) WORN UNIVERSAL JOINT BEARINGS OR CROSS. Refer to higher authority.

57. PARKING BRAKE.

a. Parking Brake Will Not Hold Vehicle.

(1) IMPROPERLY ADJUSTED BRAKE BAND. Adjust brake band clearance (par. 124 a).

(2) BRAKE BAND LINING OIL-SOAKED OR EXCESSIVELY WORN. Replace brake band and lining assembly (par. 125).

b. Parking Brake Drags.

(1) IMPROPERLY ADJUSTED BRAKE BAND. Adjust brake band clearance (par. 124 a).

c. Inadequate Ratchet Tension on Hand Brake Control Shaft. Adjust tension of detent wire (par. 124 b).

d. Improper Linkage Adjustment. Adjust linkage (par. 124 b).

58. AXLE TRANSMISSION, DIFFERENTIAL, AND FINAL DRIVE ASSEMBLY.

a. Noisy.

(1) INSUFFICIENT, DIRTY, OR INCORRECT LUBRICANT IN AXLE

UNIT. Fill to recommended level or drain, and replace lubricant (par. 38).

(2) DEFECTIVE AXLE UNIT. Replace unit (par. 131).

b. Leaks Oil.

(1) LUBRICANT LEVEL TOO HIGH. Drain to proper level.

(2) DAMAGED, IMPROPERLY INSTALLED, OR MISSING GASKETS OR OIL SEALS. Replace axle unit (par. 131).

(3) AXLE UNIT HOUSING, CASE, COVER SCREWS, OR PLUGS LOOSE, MISSING, OR THREADS STRIPPED. Replace or tighten all screws and plugs.

(4) SAND HOLE OR CRACK IN HOUSING, CASE, OR COVERS. Replace axle unit (par. 131).

(5) USE OF LUBRICANT WHICH FOAMS EXCESSIVELY. Drain unit and refill with the proper lubricant (par. 38).

(6) BREATHER VENT PLUGGED. Remove vent and clean or replace vent.

c. Difficult to Shift Into Gear.

(1) SHIFT ROD LINKAGE IMPROPERLY ADJUSTED. Adjust linkage (par. 132 b).

(2) AXLE UNIT DEFECTIVE. Refer to higher authority and replace unit (par. 131).

d. Sticks In Gear.

(1) SHIFT ROD LINKAGE BENT OR IMPROPERLY ADJUSTED. Adjust linkage or replace (par. 132).

(2) AXLE UNIT DEFECTIVE. Replace unit (par. 131).

e. Slips Out of Gear.

(1) SHIFT LINKAGE IMPROPERLY ADJUSTED. Adjust linkage (par. 132 b).

(2) DEFECTIVE AXLE UNIT. Replace unit (par. 131).

f. Unsatisfactory Steering and Braking.

(1) BANDS IMPROPERLY ADJUSTED. Adjust band tension (par. 129 b).

(2) IMPROPER STEERING LINKAGE ADJUSTMENT. Adjust steering linkage (par. 133 b).

(3) WORN-OUT STEERING BRAKE BAND LININGS. Replace axle unit (par. 131).

g. Drive Wheels Noisy.

(1) EXCESSIVE DRIVE WHEEL END PLAY. Readjust drive wheel bearings (par. 130 c (2)).

(2) WHEEL BEARINGS EXTREMELY DIRTY OR ROUGH. Clean or replace bearings as required (par. 130 c).

(3) WHEEL BELT BANDS WORN-OUT. Replace wheel (par. 130 c).

(4) WHEEL DRIVE SPROCKETS DAMAGED OR CHIPPED. Replace drive wheel (par. 130 c).

h. Drive Wheel Will Not Rotate With Power Complete to Differential.

(1) AXLE SHAFT BROKEN. Replace axle shaft (par. 130 b).

(2) AXLE SHAFT FLANGE CAP SCREWS SHEARED OFF. Remove old screws and replace (par. 130 b).

59. TRACKS AND SUSPENSION SYSTEM.

a. Track Noisy.

(1) WORN TRACK BELT BANDS. Replace track (par. 135).

(2) BENT GROUSER PLATES. Straighten or replace track (par. 135).

(3) DAMAGED OR MISSING DRIVE WHEEL SPROCKET TEETH. Replace drive wheel (par. 130 c).

b. Track Slips or Runs Off Wheel.

(1) ICE OR FOREIGN BODY LODGED IN SUSPENSION SYSTEM. Remove the obstructions.

(2) INADEQUATE TRACK TENSION. Test tension (par. 135 b) and adjust (par. 135 c) or replace damaged and broken parts.

(3) BENT OR OTHERWISE DAMAGED GUIDE LUGS. Straighten lugs, install new rivets, or replace track (par. 135).

c. Vehicle Pulls to One Side.

(1) ROAD HIGH IN CENTER. If possible, steer vehicle in center or along side of road; adjustments will not compensate for this condition.

(2) IMPROPER OR UNEVEN TRACK TENSION. Adjust track tension (par. 135 c).

(3) BROKEN TRACK BELT BAND CABLES. Replace track (par. 135).

(4) BENT IDLER WHEEL CARRIER ARM SUPPORT TUBE. Refer to higher authority.

(5) EXCESSIVE END PLAY IN TRACK GUIDE WHEELS. Install additional thrust washers or refer to higher authority.

(6) DISTORTED OR DAMAGED DRIVE WHEEL. Replace drive wheel (par. 130 c).

(7) DAMAGED OR DISTORTED IDLER WHEEL. Replace idler wheel (par. 136 c (1) and 136 c (3)).

(8) BENT OR DAMAGED SPRING YOKE SUPPORT ARM. Replace spring yoke support arm (par. 138 g).

(9) DISTORTED OR DAMAGED SPRING YOKE. Replace spring yoke (par. 138 f).

(10) DAMAGED OR BENT BOGIE SPRING. Replace bogie spring (par. 138 h).

d. Idler Wheel and Carrier Arm Noise.

(1) SPRUNG OR DAMAGED WHEEL OR CARRIER ARM. Straighten or replace parts as required (par. 136).

(2) EXCESSIVELY WORN OR MISSING WHEEL RUBBER COVERING. Replace wheel (par. 136 c).

e. Improper Operation of Idler Wheel and Carrier Arm.

(1) EXCESSIVE WHEEL END PLAY ON CARRIER ARM. Adjust bearings (par. 136 b).

(2) WHEEL BEARINGS ROUGH, SEIZED, OR OTHERWISE DAMAGED. Install new bearings (par. 136 c).

(3) LOSS OF LUBRICANT. Install new oil seal or gaskets as required and fill or pack with proper lubricant (par. 38).

(4) EXCESSIVE CARRIER ARM END PLAY ON SUPPORT TUBE. Adjust carrier arm end play (par. 136 b (2)).

(5) WORN CARRIER ARM BUSHINGS. Refer to higher authority.

(6) BROKEN TENSION SPRING LEAVES (BEFORE VEHICLE SERIAL 15,000, APPROX.). Replace tension spring (par. 139).

(7) DAMAGED OR BROKEN STOP BRACKETS (BEFORE VEHICLE SERIAL 15,000, APPROX.). Replace brackets.

(8) BROKEN OR DAMAGED TENSION SPRING (COIL TYPE—AFTER VEHICLE SERIAL 14,999, APPROX.). Replace parts as required (par. 140).

f. Bogie Wheel Assembly Noise.

(1) WORN OR DAMAGED WHEEL BEARINGS. Replace bearings (par. 138 d).

(2) WHEEL RUBBER COVERING WORN EXCESSIVELY. Replace wheel (par. 138 b or c).

(3) EXCESSIVE WHEEL END PLAY. Adjust end play (par. 138 b or c (1)).

g. Improper Operation of Bogie Wheel Assembly.

(1) WHEEL SUPPORT ARM SEIZED IN SPRING YOKE. Disassemble and free or replace parts as required and lubricate (par. 138 e).

(2) SPRING YOKE SEIZED OR BOLT BROKEN. Disassemble and free or replace parts as required and lubricate properly (par. 138 f).

(3) SPRING LEAF OR PARTS DAMAGED OR BROKEN. Replace spring (par. 138 h).

(4) BOGIE SET OUT OF ALINEMENT WITH TRACK GUIDE LUGS. Straighten spring bumper support or replace parts as required.

h. Guide Wheel Noisy.

(1) EXCESSIVELY WORN OR MISSING RUBBER WHEEL COVERING. Replace wheel (par. 137).

(2) LOOSE WHEEL SUPPORT BRACKET. Tighten bracket or refer to higher authority.

i. Improper Operation of Guide Wheel.

(1) WHEEL BEARINGS WORN OR DAMAGED. Replace bearings or refer to higher authority.

(2) LUBRICANT LEAKAGE. Replace seal and gaskets as required and lubricate with proper lubricant (par. 38).

(3) SUPPORT SHAFT SHEARED, WELD BROKEN, OR RUBBER CUSHION WORN-OUT. Refer to higher authority.

(4) WHEEL OUT OF ALINEMENT WITH TRACK GUIDE LUGS. Straighten or refer to higher authority.

60. HULL AND ATTACHMENTS.

a. Hull Leakage.

(1) HOLES IN BOTTOM OF HULL. Refer to higher authority.

(2) DRAIN PLUGS LOOSE OR RUSTED. Tighten or replace.

(3) DRAIN PLATE GASKET MISSING OR DAMAGED. Replace the gasket.

(4) RADIATOR CAP LEAKING OR MISSING. Tighten or replace.

b. Hull Bracket Out of Alinement.

(1) TRACK TENSION EXCESSIVELY LOOSE. Straighten hull brackets, adjust track tension (par. 135 c), or report to higher authority.

(2) HULL CRACKED AT BRACKET WELD. Refer to higher authority.

c. Top Leakage.

(1) TOP TORN OR EXCESSIVELY WORN. Replace the top (par. 143 b).

(2) TOP INSECURELY LASHED. Tighten lashings.

(3) WINDOWS BROKEN. Replace top with curtains.

d. Seats Noisy.

(1) SEATS INSECURELY FASTENED. Tighten seat fastenings.

(2) SEAT BACK BRACKET BROKEN. Replace back or refer to higher authority.

(8) BENT OR DAMAGED SPRING YOKE SUPPORT ARM. Replace spring yoke support arm (par. 138 g).

(9) DISTORTED OR DAMAGED SPRING YOKE. Replace spring yoke (par. 138 f).

(10) DAMAGED OR BENT BOGIE SPRING. Replace bogie spring (par. 138 h).

d. Idler Wheel and Carrier Arm Noise.

(1) SPRUNG OR DAMAGED WHEEL OR CARRIER ARM. Straighten or replace parts as required (par. 136).

(2) EXCESSIVELY WORN OR MISSING WHEEL RUBBER COVERING. Replace wheel (par. 136 c).

e. Improper Operation of Idler Wheel and Carrier Arm.

(1) EXCESSIVE WHEEL END PLAY ON CARRIER ARM. Adjust bearings (par. 136 b).

(2) WHEEL BEARINGS ROUGH, SEIZED, OR OTHERWISE DAMAGED. Install new bearings (par. 136 c).

(3) LOSS OF LUBRICANT. Install new oil seal or gaskets as required and fill or pack with proper lubricant (par. 38).

(4) EXCESSIVE CARRIER ARM END PLAY ON SUPPORT TUBE. Adjust carrier arm end play (par. 136 b (2)).

(5) WORN CARRIER ARM BUSHINGS. Refer to higher authority.

(6) BROKEN TENSION SPRING LEAVES (BEFORE VEHICLE SERIAL 15,000, APPROX.). Replace tension spring (par. 139).

(7) DAMAGED OR BROKEN STOP BRACKETS (BEFORE VEHICLE SERIAL 15,000, APPROX.). Replace brackets.

(8) BROKEN OR DAMAGED TENSION SPRING (COIL TYPE—AFTER VEHICLE SERIAL 14,999, APPROX.). Replace parts as required (par. 140).

f. Bogie Wheel Assembly Noise.

(1) WORN OR DAMAGED WHEEL BEARINGS. Replace bearings (par. 138 d).

(2) WHEEL RUBBER COVERING WORN EXCESSIVELY. Replace wheel (par. 138 b or c).

(3) EXCESSIVE WHEEL END PLAY. Adjust end play (par. 138 b or c (1)).

g. Improper Operation of Bogie Wheel Assembly.

(1) WHEEL SUPPORT ARM SEIZED IN SPRING YOKE. Disassemble and free or replace parts as required and lubricate (par. 138 e).

(2) SPRING YOKE SEIZED OR BOLT BROKEN. Disassemble and free or replace parts as required and lubricate properly (par. 138 f).

(3) SPRING LEAF OR PARTS DAMAGED OR BROKEN. Replace spring (par. 138 h).

(4) BOGIE SET OUT OF ALINEMENT WITH TRACK GUIDE LUGS. Straighten spring bumper support or replace parts as required.

h. Guide Wheel Noisy.

(1) EXCESSIVELY WORN OR MISSING RUBBER WHEEL COVERING. Replace wheel (par. 137).

(2) LOOSE WHEEL SUPPORT BRACKET. Tighten bracket or refer to higher authority.

i. Improper Operation of Guide Wheel.

(1) WHEEL BEARINGS WORN OR DAMAGED. Replace bearings or refer to higher authority.

(2) LUBRICANT LEAKAGE. Replace seal and gaskets as required and lubricate with proper lubricant (par. 38).

(3) SUPPORT SHAFT SHEARED, WELD BROKEN, OR RUBBER CUSHION WORN-OUT. Refer to higher authority.

(4) WHEEL OUT OF ALINEMENT WITH TRACK GUIDE LUGS. Straighten or refer to higher authority.

60. HULL AND ATTACHMENTS.

a. Hull Leakage.

(1) HOLES IN BOTTOM OF HULL. Refer to higher authority.

(2) DRAIN PLUGS LOOSE OR RUSTED. Tighten or replace.

(3) DRAIN PLATE GASKET MISSING OR DAMAGED. Replace the gasket.

(4) RADIATOR CAP LEAKING OR MISSING. Tighten or replace.

b. Hull Bracket Out of Alinement.

(1) TRACK TENSION EXCESSIVELY LOOSE. Straighten hull brackets, adjust track tension (par. 135 c), or report to higher authority.

(2) HULL CRACKED AT BRACKET WELD. Refer to higher authority.

c. Top Leakage.

(1) TOP TORN OR EXCESSIVELY WORN. Replace the top (par. 143 b).

(2) TOP INSECURELY LASHED. Tighten lashings.

(3) WINDOWS BROKEN. Replace top with curtains.

d. Seats Noisy.

(1) SEATS INSECURELY FASTENED. Tighten seat fastenings.

(2) SEAT BACK BRACKET BROKEN. Replace back or refer to higher authority.

e. Lids Noisy.

(1) FASTENING SCREWS OR BOLTS LOOSE OR MISSING. Tighten or replace.

(2) HOLDING HAND SCREWS MISSING OR LOOSE. Replace or tighten.

(3) CARGO STRAPS LOOSE OR UNFASTENED. Tighten or fasten.

f. Windshield Noisy.

(1) FRAME FASTENING BOLTS LOOSE. Tighten frame fastening bolts.

(2) WINDSHIELD WIPER LOOSE ON FRAME. Tighten fastening screws.

(3) FRAME CRACKED OR HULL COAMING BROKEN. Replace or report to higher authority.

g. Rudders Hard to Operate (M29C).

(1) CABLES BIND IN CONDUIT. Free and lubricate properly (par. 38).

(2) RUDDER POSTS BENT OR DAMAGED. Replace mounting bracket assembly (par. 152 d).

(3) RUDDER SHAFTS OR POSTS BINDING, RUSTED, OR IMPROPERLY LUBRICATED. Free and lubricate properly (par. 38).

h. Rudders Inoperative (M29C).

(1) CABLE OR CABLES BROKEN. Replace tiller and cable assembly (par. 152 g).

(2) CABLES TOO LOOSE. Adjust tension (par. 152 b (2)).

(3) CROSS SHAFT BROKEN OR CLEVIS PINS SHEARED OFF. Replace cross shaft or install new clevis pins (par. 152 e).

61. LIGHTING SYSTEM.

a. Lights Inoperative.

(1) BATTERIES DISCHARGED. Recharge or replace with fully charged batteries.

(2) BATTERY TERMINALS LOOSE OR DIRTY. Tighten or clean terminals.

(3) BATTERY GROUND STRAP LOOSE OR MAKING POOR CONTACT. Clean and tighten.

(4) WIRING BROKEN OR SHORTED. Trace wiring, and repair or replace.

(5) LAMP BURNED OUT. Replace lamp.

(6) LIGHT SWITCH DEFECTIVE. Test switch by placing a jumper wire across terminals and noting if light burns. Replace switch if light burns.

(7) FUSE BLOWN. Examine fuses and replace if blown.

b. Insufficient Light.

(1) BATTERY CHARGE LOW. Recharge or replace with fully charged batteries.

(2) POOR GROUND CONNECTION. Clean and tighten connection.

(3) LOOSE WIRING TERMINALS. Tighten terminals.

(4) WIRES SHORTED. Trace wiring and repair or replace.

(5) INCORRECTLY AIMED HEADLIGHT (OR BLACKOUT DRIVING LIGHT AFTER VEHICLE SERIAL 14,681, APPROX.). Adjust light so it is aimed properly (par. 159 b (1)).

62. INSTRUMENTS AND GAGES.

a. Speedometer.

(1) FAILS TO REGISTER. Check cable for breakage and proper hook-up at connecting ends.

(2) NOISY. Inspect for proper fastening on instrument panel. Tighten if necessary. If due to internal defect, replace.

b. Oil Pressure Gage.

(1) DOES NOT REGISTER PRESSURE. If adequate oil is in crankcase and oil is circulating but no pressure is registered, make sure gage fittings are tight or replace gage.

c. Engine Heat Indicator.

(1) GAGE DOES NOT REGISTER OR STICKS AT ONE READING. Remove element or bulb from cylinder head and test gage action by immersing element in hot water. If gage does not register a change in reading, replace assembly (par. 168).

d. Fuel Gage.

(1) INCORRECT OR NO READING. Test gage for proper operation by connecting tank unit wires to new tank unit, then move float up and down by hand. Notice if gage registers. Check wiring terminals for good connection and if gage remains inoperative, replace dash unit. If reading obtained when testing with new tank unit indicates tank unit is faulty, replace tank unit (par. 89 c).

e. Ammeter.

(1) AMMETER INOPERATIVE. If ammeter fails to register when it is known that generator is charging and generator regulator is in good operating condition, replace ammeter (par. 165).

63. EQUIPMENT.

a. Capstan (M29C).

(1) CAPSTAN INOPERATIVE.

(a) Drive Belt Slipping. Adjust capstan drive belt tension (par. 172 b).

(b) Clutch Does Not Engage. Replace clutch (par. 172 g).

(c) Gears Damaged or Broken. Refer to higher authority and replace capstan (par. 172 c).

(d) Drive Shaft or Universal Joint Broken or Damaged. Replace (pars. 172 e and g), or refer to higher authority.

(2) CAPSTAN NOISY.

(a) Insufficient, Improper, or Dirty Lubricant. Fill or drain and refill with proper lubricant (par. 38).

(b) Gears Worn or Rough. Refer to higher authority and replace capstan (par. 172 c).

(3) DRIVE SHAFT NOISY.

(a) Universal Joint Worn Excessively. Replace universal joint assembly (par. 172 e or g).

(b) Drive Shaft Bent, Rough, or Otherwise Damaged. Replace shaft (par. 172 e or g).

(c) Drive Shaft Bearing Improperly Lubricated or Worn Excessively. Lubricate with proper lubricant (par. 38) or refer to higher authority.

(4) DRIVE BELT INOPERATIVE.

(a) Improper Tension. Adjust belt tension (par. 172 b).

(b) Grease-soaked Belt. Replace belt (par. 172 f).

(c) Belt Excessively Worn. Replace belt (par. 172 f).

64. RADIO INTERFERENCE SUPPRESSION SYSTEM.

a. Preliminary Instructions. When radio interference resulting from the operation of this vehicle is reported or experienced, the vehicle should be moved to a place which is comparatively free from high-tension lines or other vehicles or machinery which could be a source of interference. Turn on the radio and check the noise level with the engine and all vehicle equipment turned off. Notice the type of noise evident under this condition so that, when checking vehicle equipment, the presence of new noise or interference can be detected and also so that noise already present in the receiver will not be attributed to lack of vehicle suppression. If noise level without any of the vehicle equipment in operation is too high due to atmospherics or other outside causes, and if tactical situation will permit, delay further checking until such time as a moderate noise level prevails. NOTE: *If the vehicle to be checked for insufficient radio interference suppression is not radio-equipped, another vehicle which is radio-equipped and kept within 5 feet of the vehicle to be tested, may be used.* Disconnect radio terminal box condenser; if interference does not increase when this condenser is disconnected, replace it. If interference does not increase as it should, leave the radio terminal box condenser disconnected for the remainder of the tests until the defective equipment has been located, replaced, and

tested. Examine all shielded conduits and cables to make sure couplings are tight and conduits and cables are clamped or bonded tightly to hull at least every 2 feet.

b. Radio Interference When Vehicle is Not in Motion, But Engine is Running. Start the engine and operate at approximately 1,500 revolutions per minute with the vehicle standing still and windshield wipers turned off. If interference is apparent as a regular "pop" or click and varies in frequency with the engine speed, it may be attributed to faulty suppression in the ignition system. If noise persists, check all points where toothed lock washers are used in grounding to see that these connections are tight. Check connections of all secondary or high tension wires at ignition coil and distributor to make sure they are clean and tight. Replace spark plug and distributor suppressors. If interference is apparent in the form of an irregular "pop" or click that is not relative to engine speed, it may be attributed to the generator regulator circuit. Inspect the generator regulator mounting bolts and toothed washers to make sure these are tight. Check the wiring between generator regulator and generator, and the wiring to the trouble light reel to see that copper shielding is grounded at both ends. Replace condenser at battery terminal of generator regulator. If interference is in the form of a whining noise that varies in pitch with engine speed, it may be attributed to the generating system. Check the generator ground cable by using a jumper wire with sharp prods attached to each end to make connection between the generator frame and the generator mounting bracket. If a good ground connects the interference, clean and tighten connections at each end of the ground cable. If the interference does not cease when a good generator to bracket ground is established, replace condenser at armature terminal on generator. If the interference still persists, the generator brushes and commutator are in need of maintenance and/or adjustment. Clean the commutator with 2/0 flint paper. If there is still excessive arcing when the commutator rotates, replace generator (par. 107 **c** and **d**).

c. Radio Interference When Windshield Motors are Operating. Check mounting bolts and toothed lock washers for wiper assemblies to make sure of proper grounding. Check wiper plugs and see that they are clean and tight in their sockets and that copper braid is connected at both ends. Check bolts and toothed washers which fasten windshield hinge to front coaming to see that all are tight. If noise that is present when the windshield motors are operating stops as soon as one motor is turned off, replace motor condenser for that unit. If noise does not stop until both motors are turned off, replace both motor condensers. If noise still persists, replace one or both windshield wiper motors as necessary (par. 148 **b** and **c**).

Section XVI

ENGINE DESCRIPTION AND MAINTENANCE IN VEHICLE

65. DESCRIPTION AND DATA.

a. Description. The vehicle is powered with a 6-cylinder, L-head, liquid-cooled engine. The fan end of the engine will be referred to as the front of the engine, and the clutch end as the rear of the engine. The manifold side will be referred to as the right side, and the distributor side as the left side of the engine. The fan, drive belts, water pump, generator, fuel pump (before vehicle serial 9503), ignition system parts, oil filter, air cleaner, manifold and heat control valve, carburetor, batteries, and generator regulator are accessible after removing the engine compartment cover and division panel (on vehicles after serial 1002).

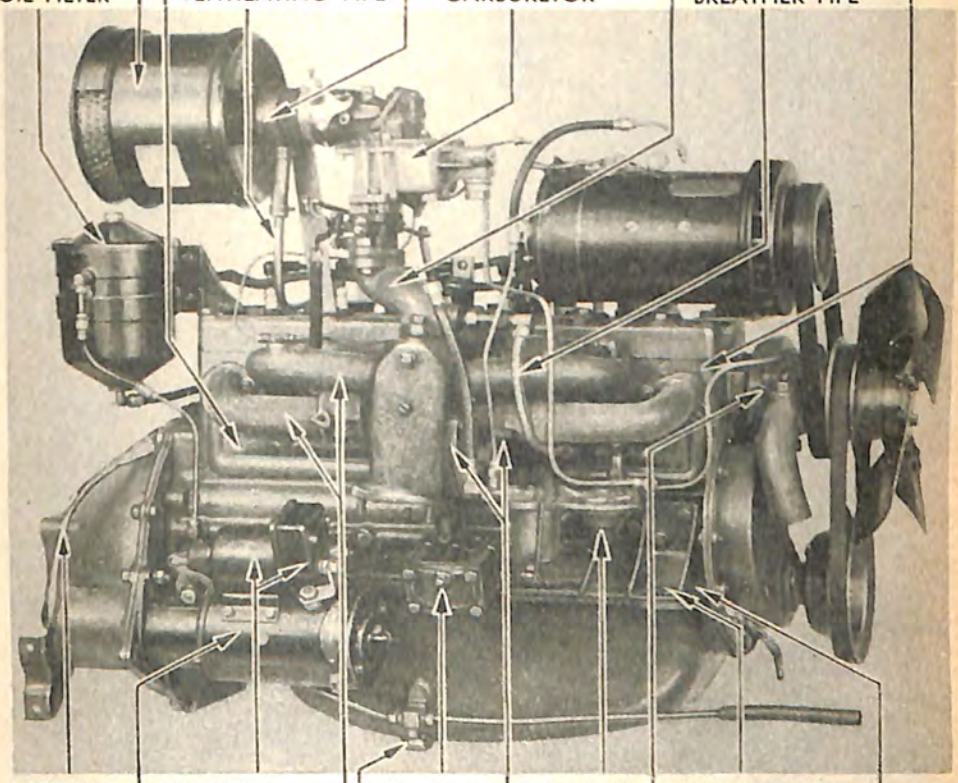
b. Data.

Make	Studebaker
Model	6-170
Type	L-head
Number of cylinders	6
Bore	3-in.
Stroke	4-in.
Displacement	169.6 cu in.
Compression ratio	7 to 1
Firing order	1-5-3-6-2-4
Horsepower (net) at sea-level	75 at 3,800 rpm
Horsepower (net) at 3,000-ft altitude	55 at 3,600 rpm
Crankcase capacity	5 qt
Oil pressure	40 lb
Weight (with accessories, and less transmission)	500 lb

66. INTAKE AND EXHAUST MANIFOLD.

a. Description. The intake and exhaust manifold are integral with an incorporated heat control valve. The manifold heater valve directs the flow of exhaust gases around the intake portion of the manifold to assist in the vaporization of fuel mixture until the engine is heated to efficient operating temperature. Action of the valve is automatic and is controlled by a thermostatic spring which opens and closes the valve as necessary.

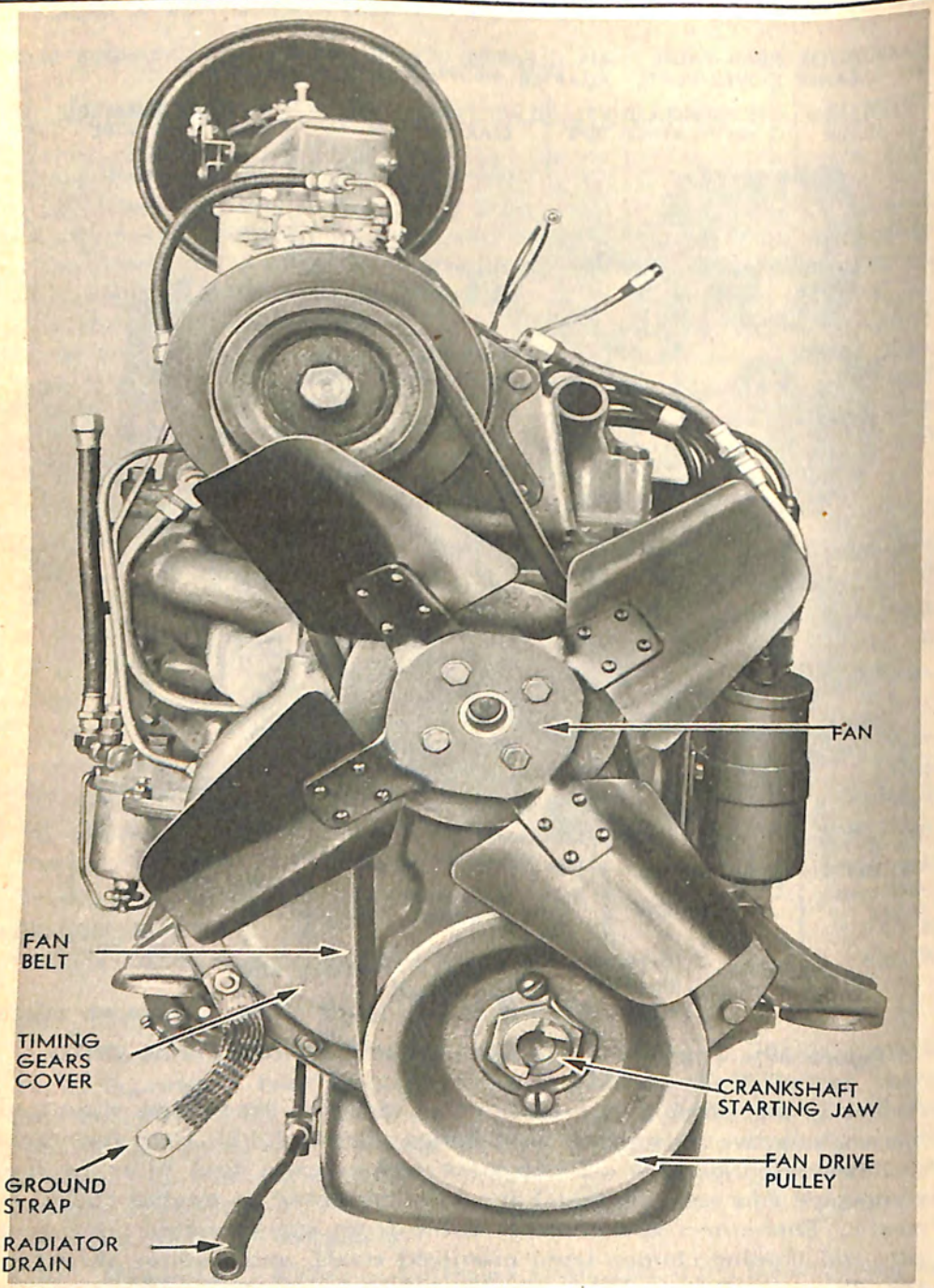
b. Removal. Remove batteries (par. 105 **d**). Remove engine compartment division panels (par. 75 **g**) from vehicles so equipped. Remove carburetor (par. 92 **e**), and remove carburetor to fuel pump pipe. Disconnect primer to manifold pipe at manifold fitting, and



RA PD 336623

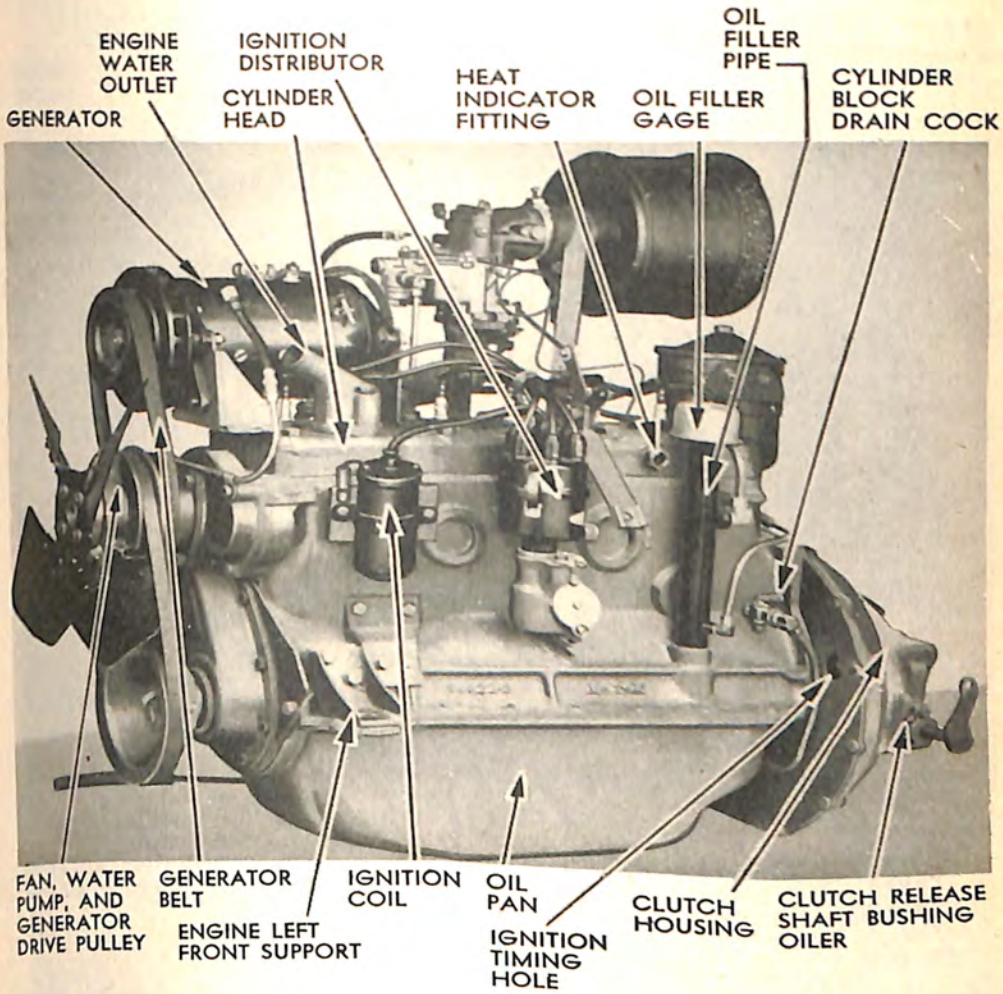
Figure 39.—Engine—Right Side (Before Vehicle Serial 3601)

remove primer inlet pipe. Disconnect exhaust pipe from manifold by removing two nuts which hold flange to manifold. Remove valve chamber breather pipe. Disconnect and remove fuel filter to fuel pump pipe (on vehicles that have filter mounted in engine compartment). Disconnect speedometer cable from speedometer. Remove nuts and holding clamps from manifold studs, and remove manifold (fig. 45) and gasket. When the manifold is off the engine, test the action of manifold heat control valve by working counterweight up and down to make sure that shaft is free to operate properly.



RA PD 319413

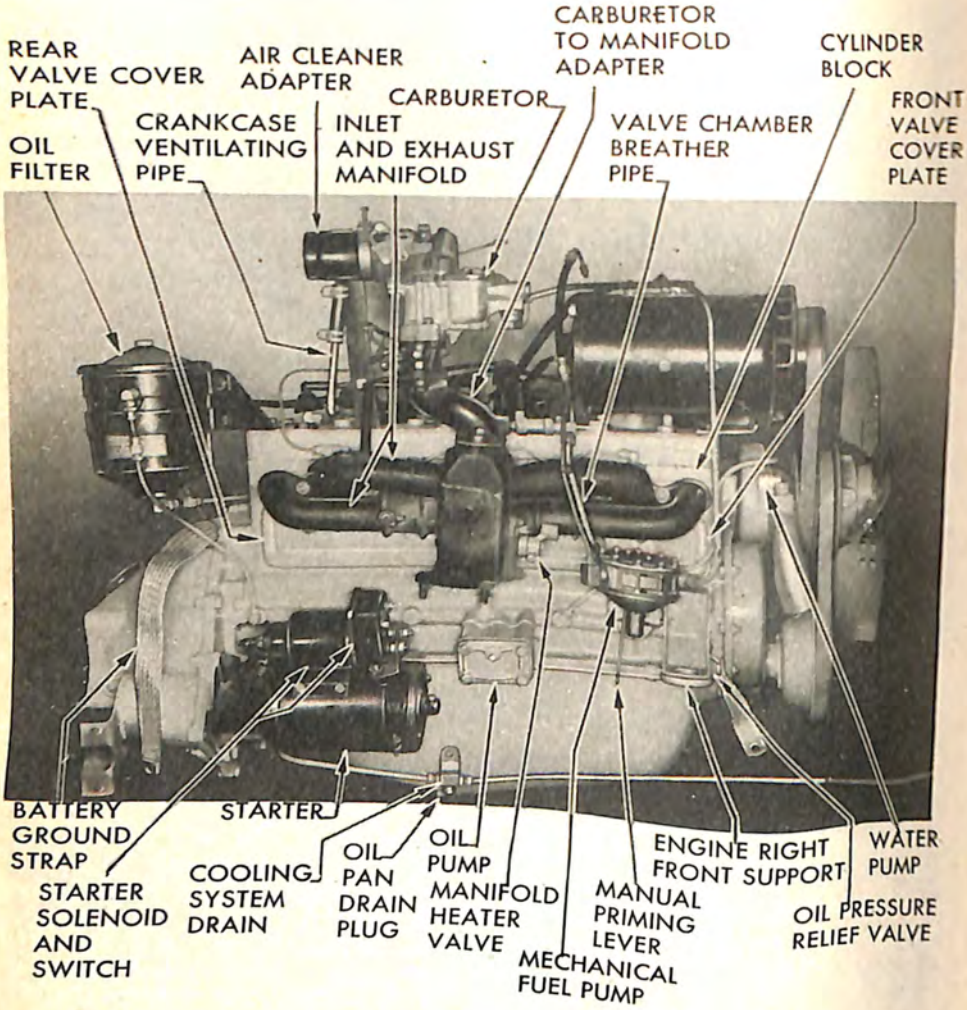
Figure 40 — Engine — Front (Before Vehicle Serial 3601)



RA PD 319412

Figure 41 — Engine — Left Side (Before Vehicle Serial 3601)

c. **Disassembly.** Remove the nuts that hold adapter to manifold and lift the adapter, gaskets, and baffle off the intake flange. Disconnect primer connector pipes and remove fittings from manifold. Take out the screws that hold the heat control valve cover to manifold, and remove the valve assembly and gasket. If the valve shaft does not operate freely in bushings, loosen set screw in counterweight and remove weight, thermostatic coil, and cover from shaft. Polish bearing surfaces of shaft with 2/0 flint paper to remove rust.



RA PD 336625

Figure 42 — Engine — Right Side (From Vehicle Serial 3601 Through 9502)

d. Assembly. Assemble heat control valve cover, thermostatic coil, and weight on shaft, and tighten set screw. Place a new gasket on valve cover, insert valve and shaft into manifold, install cover retaining screws, and tighten securely to manifold. Install a new gasket, the baffle, and new baffle gasket on intake flange. Place the carburetor to manifold adapter in position on intake flange, install nuts on studs, and tighten securely to manifold. Install primer connector pipe fittings in manifold and connect pipes to the fittings.

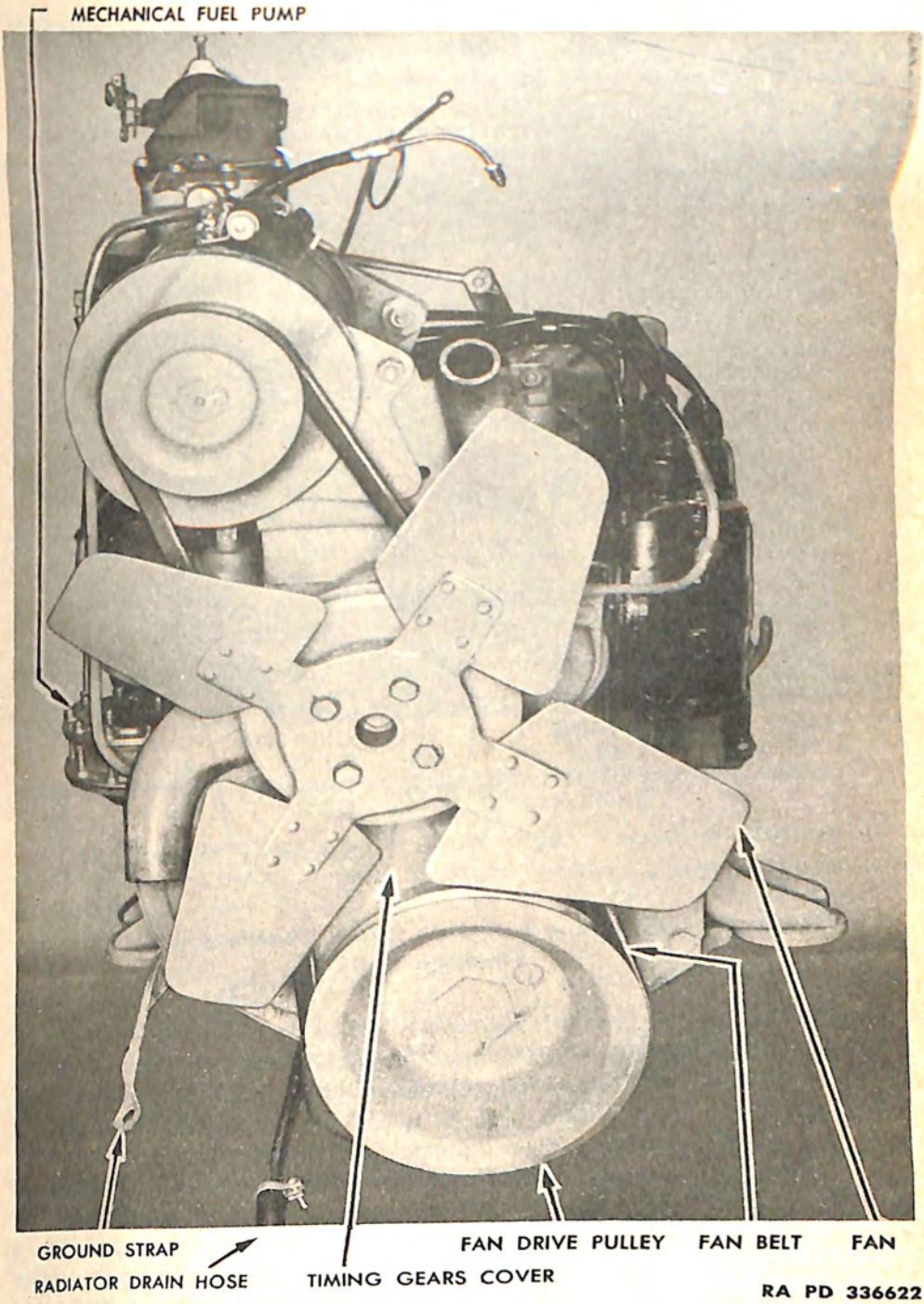
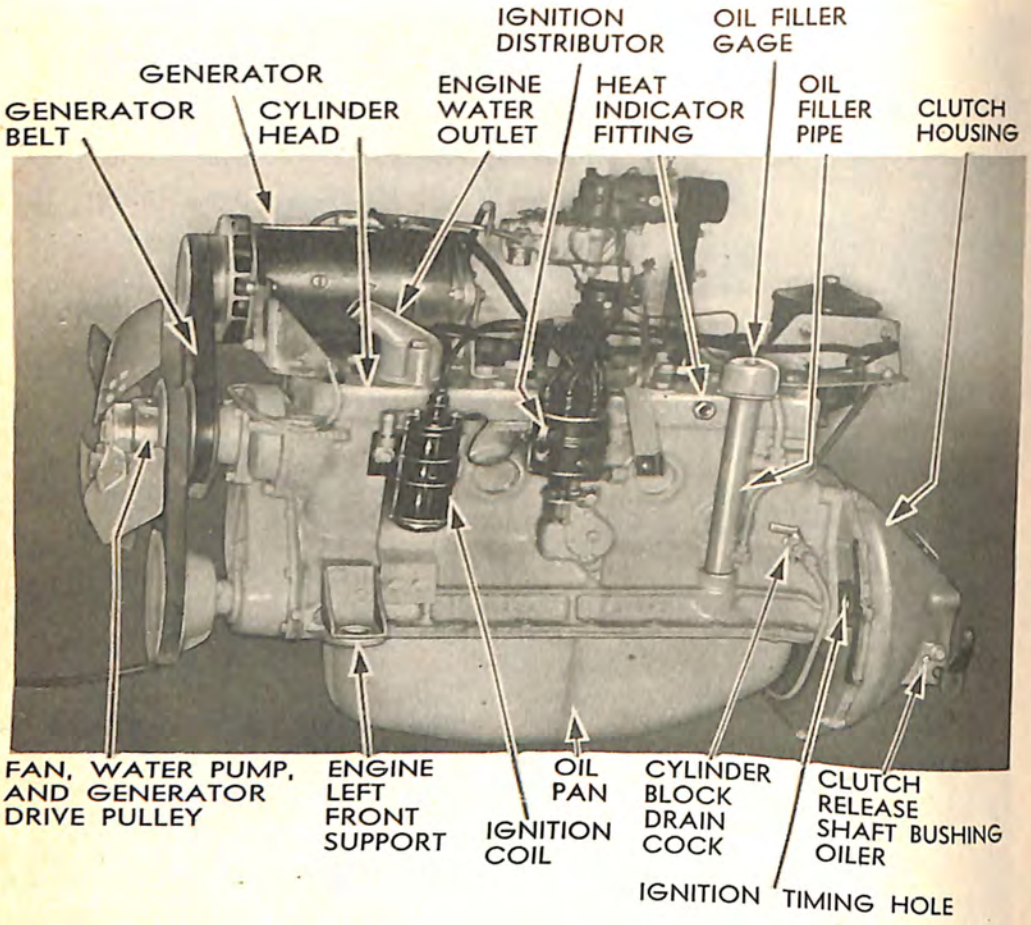


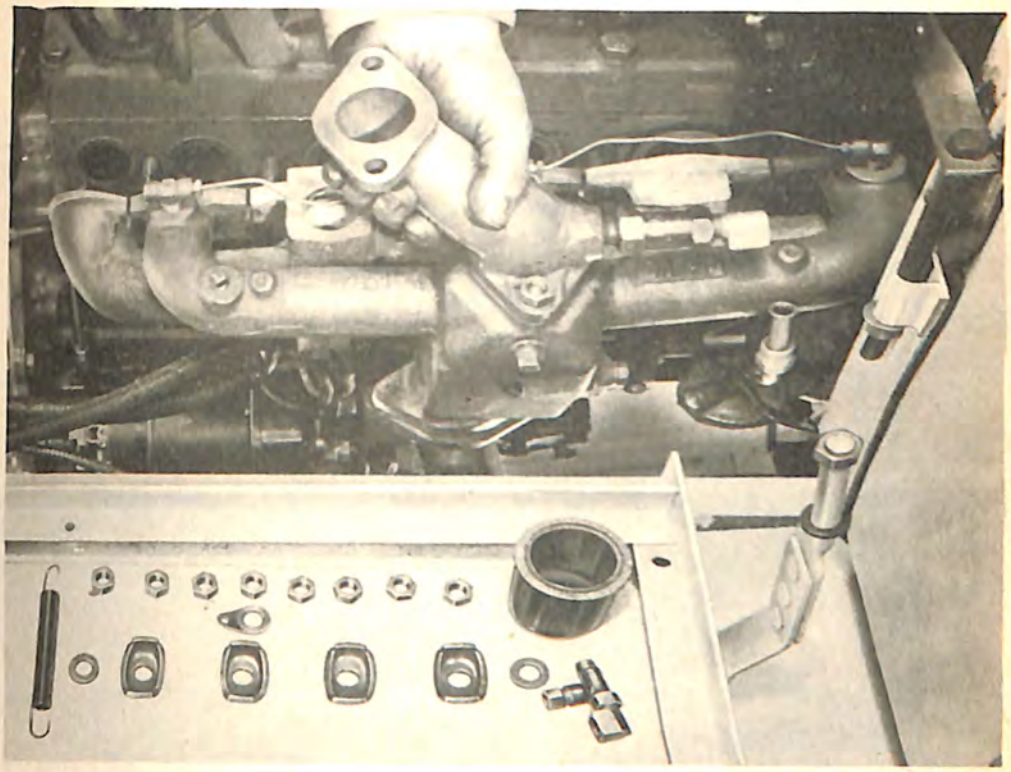
Figure 43 — Engine — Front (From Vehicle Serial 3601 Through 9502)



RA PD 336507

Figure 44 — Engine — Left Side (From Vehicle Serial 3601 Through 9502)

e. Installation. Clean thoroughly the area on cylinder block where manifold gasket contacts. Install a new manifold to block gasket over stud and against cylinder block so the raised rings on gasket are away from block (fig. 47). Place the manifold in position on studs, install holding clamps and nuts, and tighten securely to cylinder block. Connect speedometer cable to speedometer, and on vehicles that have filter mounted in engine compartment, install fuel filter to fuel pump pipe. Install valve chamber breather pipe. Place a new gasket on exhaust pipe flange, raise exhaust pipe so studs in manifold flange enter holes in pipe flange, install nuts on studs and tighten securely. Connect primer to manifold pipe to fitting on in-



RA PD 67030

Figure 45 — Removing Manifold (Before Vehicle Serial 3601)

take manifold, and install prime inlet pipe. Install carburetor (par. 92 f) and fuel pump to carburetor pipe. Install engine compartment division panels (par. 76 p) on vehicles so equipped. Install batteries (par. 105 e).

67. VALVE ADJUSTMENT.

a. **Removal.** Remove fuel tank (par. 85 c). Loosen air cleaner (oil-coated type) and clamp screw; then remove from adapter on vehicles so equipped. Disconnect choke control wire and tube from bracket on carburetor air horn. Loosen adapter clamp screw, and push adapter rearward away from carburetor. Disconnect rod and spring from throttle lever. Remove fuel pump to primer pipe, and disconnect primer to manifold pipe from fitting on manifold. Disconnect fuel pipe from carburetor and speedometer cable from speedometer. Remove breather pipe from fitting on manifold adapter and front valve spring chamber cover. Remove nuts from studs in manifold flange, and push exhaust pipe down away from manifold. Take

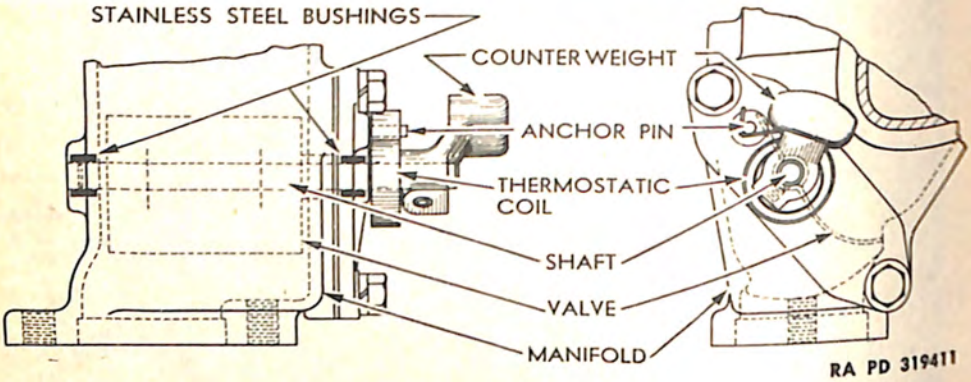


Figure 46 — Manifold Heater Valve Construction

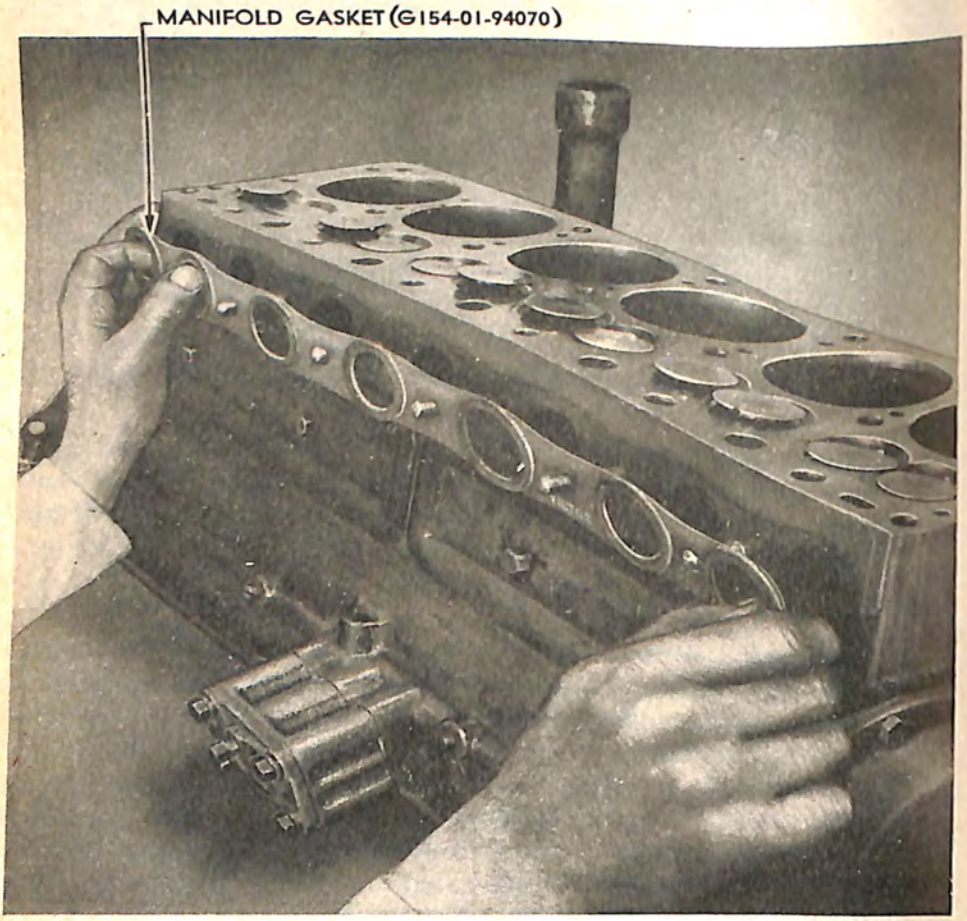
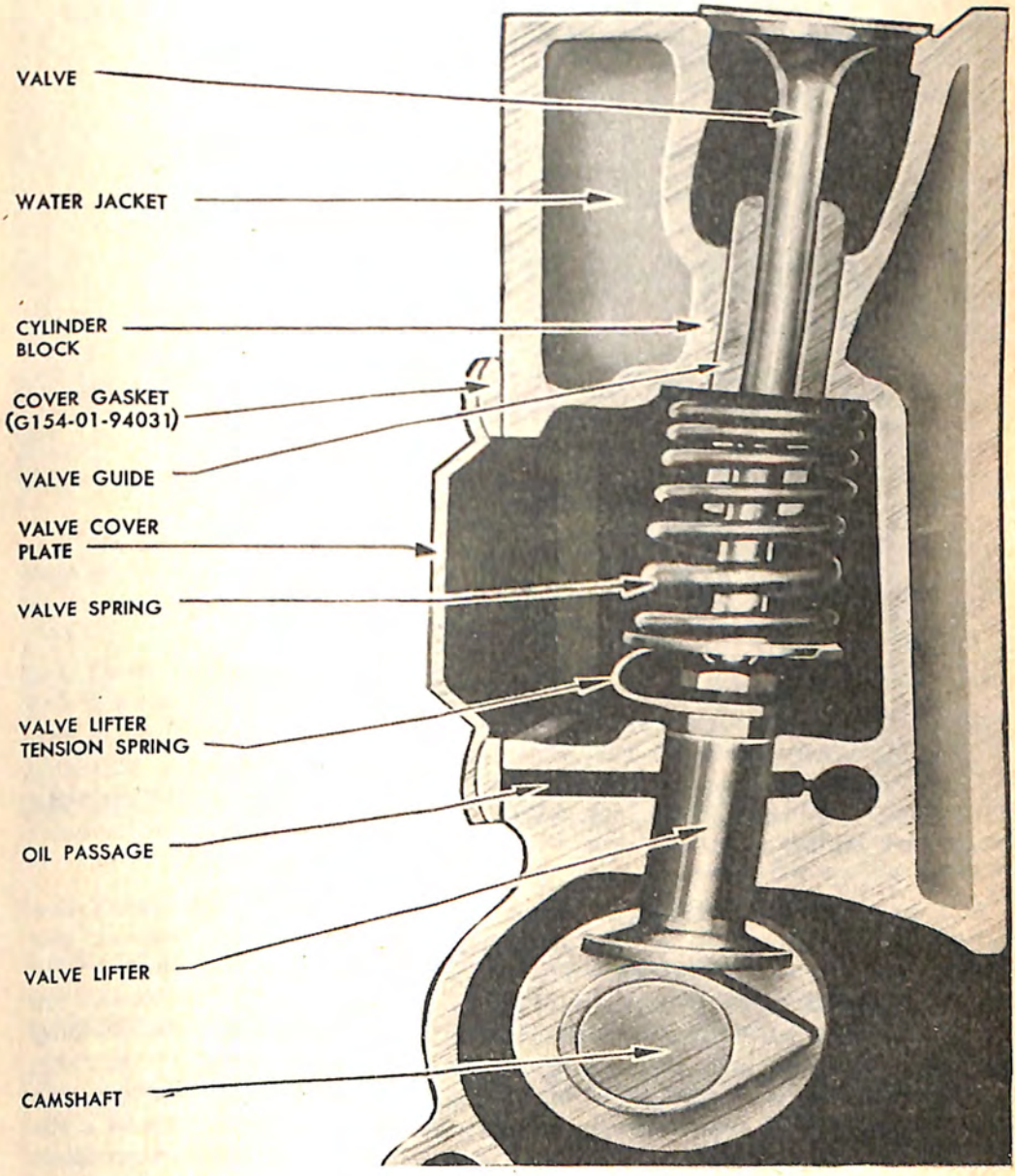
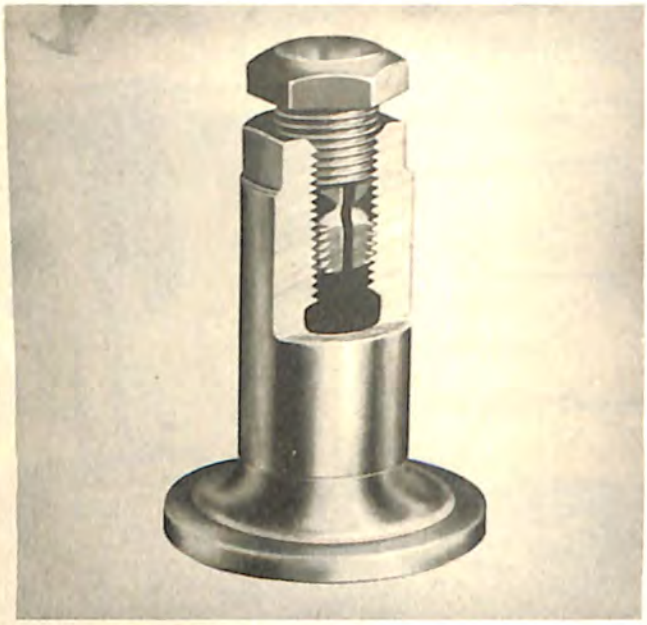


Figure 47 — Installing Manifold Gasket



RA PD 352252

Figure 48 — Valve and Related Parts

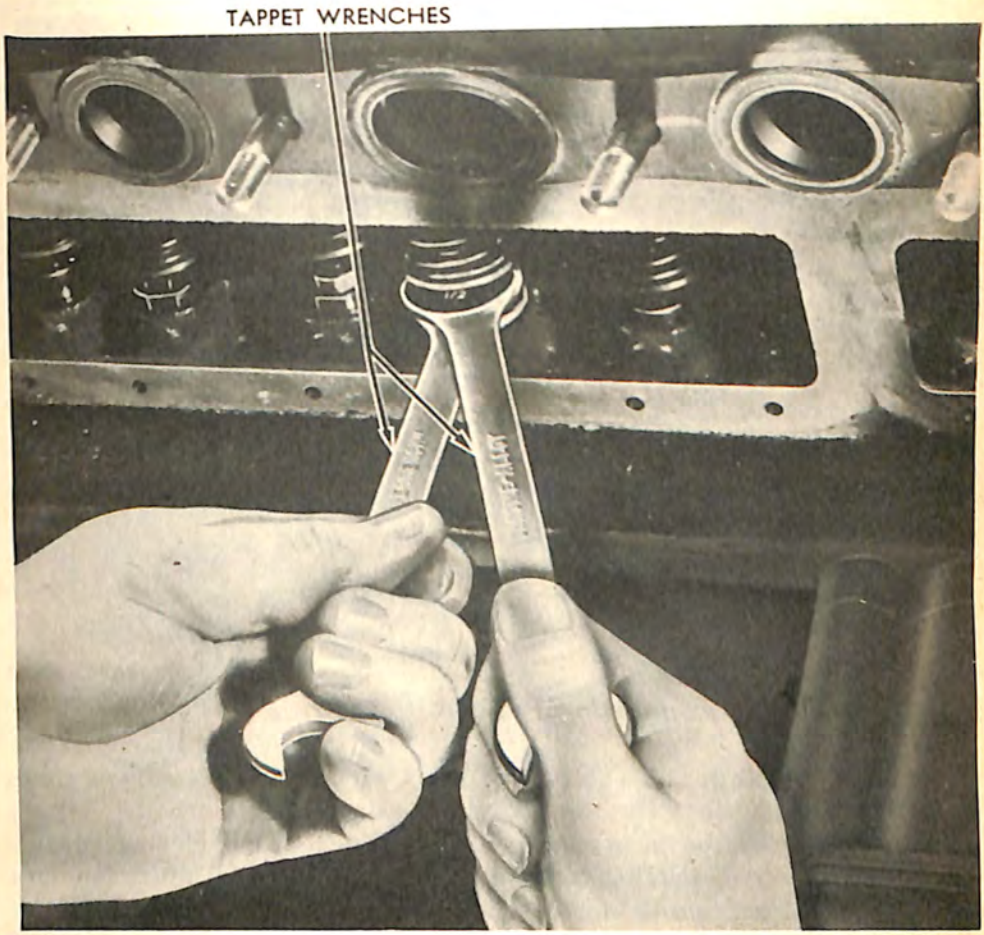


RA PD 49325

Figure 49 — Valve Lifter and Adjusting Screw

off the nuts and clamps that hold manifold to cylinder block and remove manifold with carburetor assembly. Remove valve spring chamber covers, take out the valve lifter tension springs, and adjust the clearance between the valve stems and top of lifter adjusting screws to 0.016-inch cold (fig. 50). The valve head must be resting on its seat in the engine block when making the clearance adjustment at each valve lifter screw.

b. Installation. Install valve lifter tension springs, install new valve spring chamber cover gaskets, place covers in position, and fasten securely with screws. Install a new manifold to block gasket over studs and against cylinder block so raised rings on gasket are away from block. Place manifold in position on studs, install holding clamps and nuts, and tighten securely. Connect speedometer cable to speedometer and fuel pipe to fittings on carburetor. Place a new gasket on exhaust pipe flange, raise exhaust pipe and flange so studs in manifold flange enter holes in pipe flange. Install nuts on studs and tighten securely. Connect breather pipe to fittings on manifold adapter and front valve spring chamber cover. Install primer inlet pipe and connect primer to manifold pipe at fitting on manifold. Connect rod and spring to throttle lever, and connect choke control wire and tube to bracket on carburetor air horn. Push adapter for-



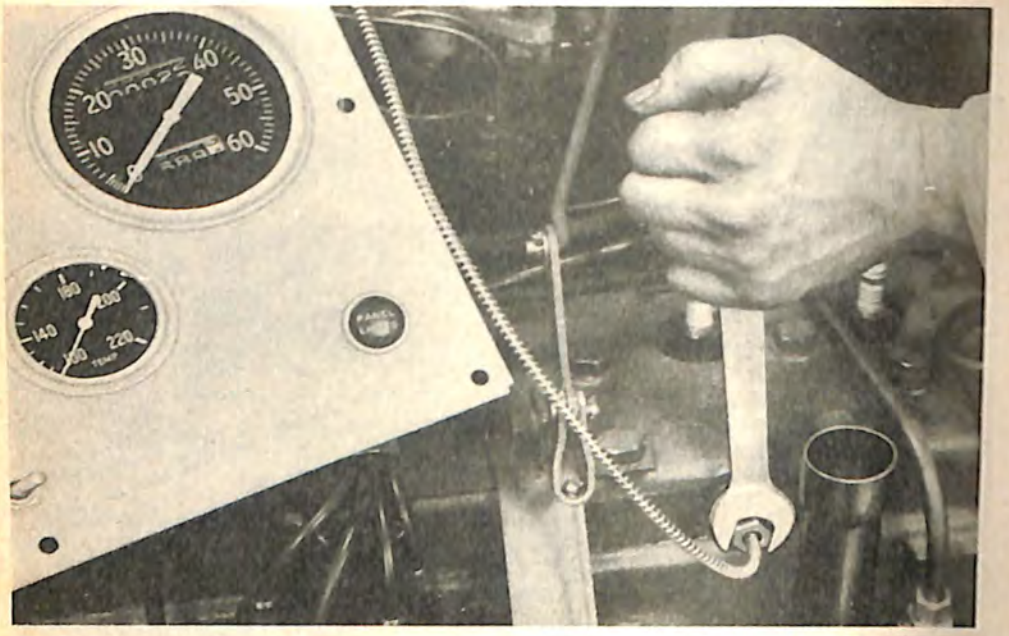
RA PD 336539

Figure 50 — Adjusting Valve Lifter Screw

ward over carburetor air horn and tighten clamp screw. Place air cleaner (oil-coated type) on adapter, and tighten clamp screw on vehicles so equipped. Install fuel tank (par. 85 **d**).

68. CYLINDER HEAD GASKET REPLACEMENT.

a. Removal. Remove batteries (par. 105 **d**). Remove engine compartment division panels (par. 75 **g**) from vehicles so equipped. Remove carburetor (par. 92 **e**) and drain cooling system (par. 96 **b** (1)). Loosen radiator upper hose clamp screws and remove hose. Pull high-tension wires from spark plugs. Disconnect primer inlet and outlet pipes and remove from vehicle. Remove heat indicator element from cylinder head (fig. 51), and disconnect speedometer

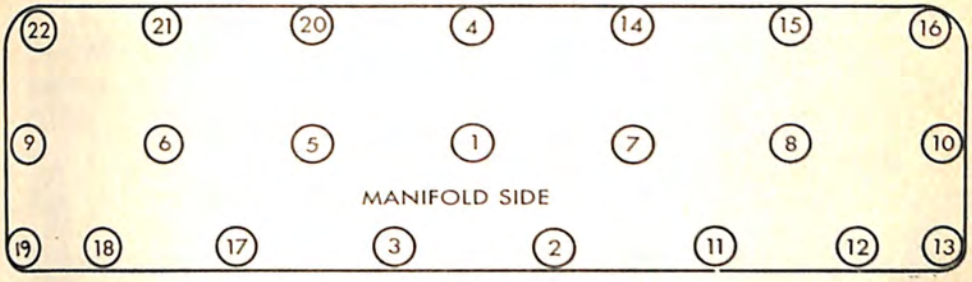


RA PD 67021

Figure 51 — Disconnecting Heat Indicator From Cylinder Head

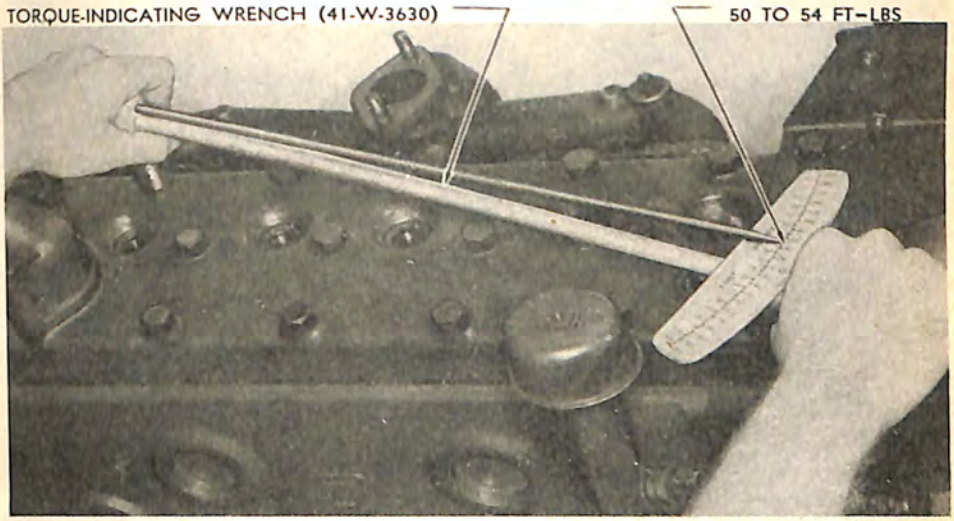
cable from speedometer. Remove generator (par. 107 c), and place generator to regulator wires over generator regulator. Disconnect crankcase ventilating pipe from oil filler pipe and air cleaner adapter and remove from vehicle. Disconnect pipes from oil filter, take out cylinder head screws that hold filter in position, and remove filter from engine compartment. Remove remaining cylinder head screws and place brackets where they will be convenient for installation. Make sure all pipes or wires that might interfere with removal of cylinder head are disconnected; then lift head out of engine compartment. Clean carbon from cylinder head and remove all traces of gasket or sealer from head and cylinder block. Clean all rust and dirt from threads on cylinder head cap screws and tapped screw holes in cylinder block.

b. Installation. Apply gasket cement (liquid-type) on lower face of cylinder head and bottom surface of head gasket. Place gasket in position on cylinder block, make sure that nothing has fallen on top of pistons, and set cylinder head on gasket. Apply white lead to threads of all cylinder head screws and install them. Place a water outlet gasket on cylinder head after applying gasket cement (liquid-type), and install water outlet with thermostat (par. 99 c). Install the oil filter with bracket and mounting brackets that were re-



RA PD 319406

Figure 52 — Cylinder Head Cap Screw Tightening Chart

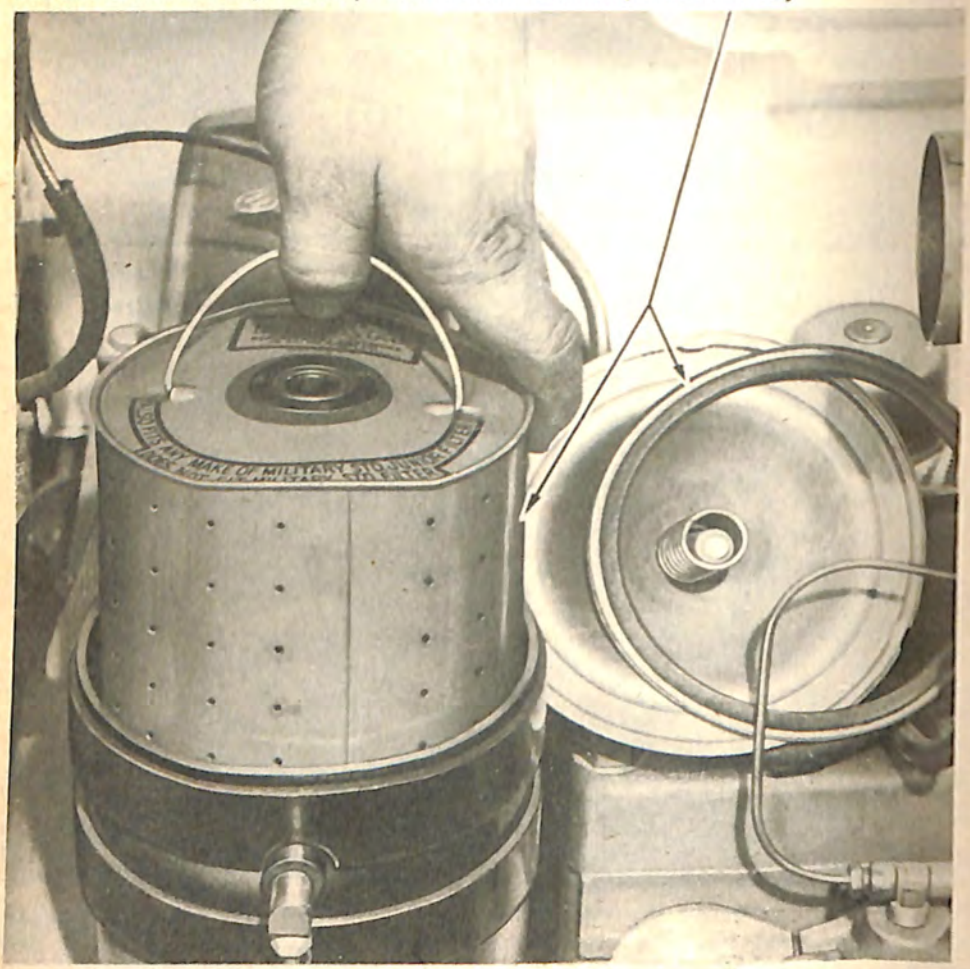


RA PD 352253

Figure 53 — Tightening Cylinder Head Screws With Torque-Indicating Wrench

moved. Tighten cylinder head screws with torque-indicating wrench (41-W-3630) in the sequence shown on tightening chart (fig. 52) to a tension of 50 to 54 foot-pounds (fig. 53). Connect crankcase ventilating pipe to oil filler pipe and air cleaner adapter and the speedometer cable to speedometer. Install generator (par. 107 **d**). Install heat indicator element in cylinder head, and connect primer inlet and outlet pipes. Connect high-tension wires to spark plugs. Install radiator upper hose and tighten clamp screws. Install carburetor (par. 92 **f**) and engine compartment division panels (par. 76 **p**) on vehicles so equipped. Install batteries (par. 105 **e**) and fill cooling system.

FILTER CARTRIDGE (ELEMENT) AND COVER GASKET (G154-01-31612)



RA PD 352254

Figure 54 — Removing Oil Filter Cartridge (Element)

69. CRANKCASE AND VALVE SPRING CHAMBER VENTILATORS.

a. Description. The engine used in this vehicle is equipped with ventilating pipes. These pipes conduct fumes and condensation from the crankcase and valve spring chambers to the intake manifold.

b. Removal.

(1) CRANKCASE VENTILATOR. Loosen wing nuts and remove engine compartment lid. Disconnect ventilating pipe from fittings on air cleaner adapter and oil filler pipe and remove it from engine compartment.

(2) VALVE SPRING CHAMBER BREATHER. Loosen wing nuts and remove engine compartment lid. Disconnect breather pipe from fittings on intake manifold adapter and from valve chamber cover and remove it from engine compartment.

c. Installation.

(1) CRANKCASE VENTILATOR. Place ventilator pipe in position and connect it to the fittings on air cleaner adapter and oil filler pipe. Install engine compartment lid and fasten in position with clamps and wing nuts.

(2) VALVE SPRING CHAMBER BREATHER. Place breather pipe in position and connect it to the fittings on intake manifold adapter and front valve spring chamber cover. Install engine compartment lid and fasten in position with clamps and wing nuts.

70. OIL FILTER.

a. Description. The standard military, replaceable, element-type engine oil filter is mounted on a bracket attached to the right rear corner of the cylinder head with cylinder head cap screws. Engine oil is piped from the main oil gallery to the filter and, after being filtered, is returned to the crankcase through a return pipe from the bottom of filter.

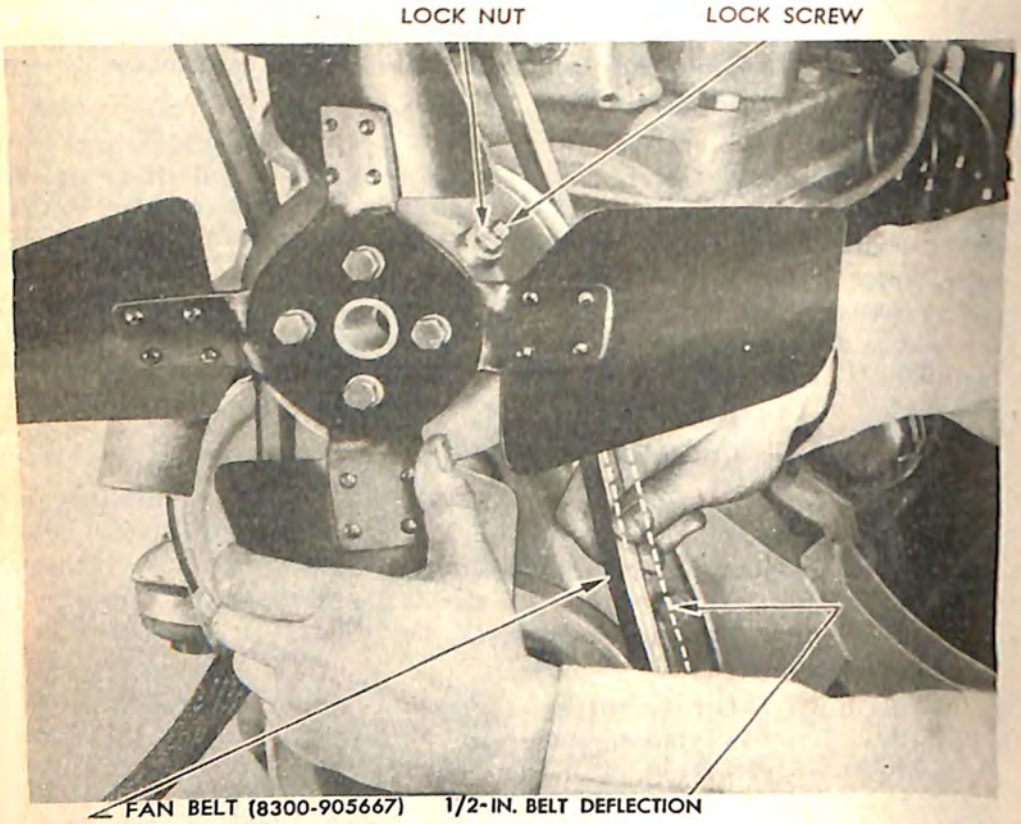
b. Removal. Loosen the wing nuts and remove engine compartment lid. Remove engine compartment division rear panel (par. 75 g) from vehicles so equipped. Disconnect filter intake and outlet pipes from flexible couplings. Remove the nuts, lock washers, and bolts that hold filter to bracket and lift the filter out of the engine compartment. If filter is to be replaced, remove flexible couplings and fittings from original unit and install on replacement filter.

c. Installation. Place filter in position on bracket and install bolts, lock washers, and nuts. Tighten the nuts securely and connect the outlet and inlet pipes to flexible couplings. Install the engine compartment division rear panel (par. 76 p) on vehicles so equipped. Install engine compartment lid and fasten in position with clamps and wing nuts.

d. Cartridge (Element) Replacement.

(1) REMOVAL. Loosen the wing nuts and remove engine compartment lid. Remove engine compartment division rear panel (par 75 g) from vehicles so equipped. Remove filter cover screw, cover with spring, gasket, and cartridge (fig. 54). Remove drain plug from filter body, allow oil to drain into a container, and clean body interior thoroughly.

(2) INSTALLATION. Install drain plug and tighten securely. Place a new cartridge in filter body and install a new gasket cover



RA PD 352255

Figure 55 — Adjusting Fan Belt Tension

and spring. Install the cover screw with a new gasket and tighten securely. Install engine compartment division rear panel (par. 76 p) on vehicles so equipped. Place engine compartment lid in position and fasten with clamps and wing nuts.

71. EXTERNAL OIL PIPES AND CONNECTIONS.

a. Description. There are three metal external oil pipes employed in the engine oiling system. A flexible coupling is used at the end of each pipe opposite the engine to minimize danger of breakage from vibration and shock. The oil filter inlet pipe extends from the right rear side of the engine to the flexible connection near the top of the oil filter; the oil return pipe extends from the lower end of the oil filler pipe to the flexible connection at the bottom of the oil filter; and the oil pressure gage pipe extends from the center right side of engine to the flexible connection at the oil pressure gage.

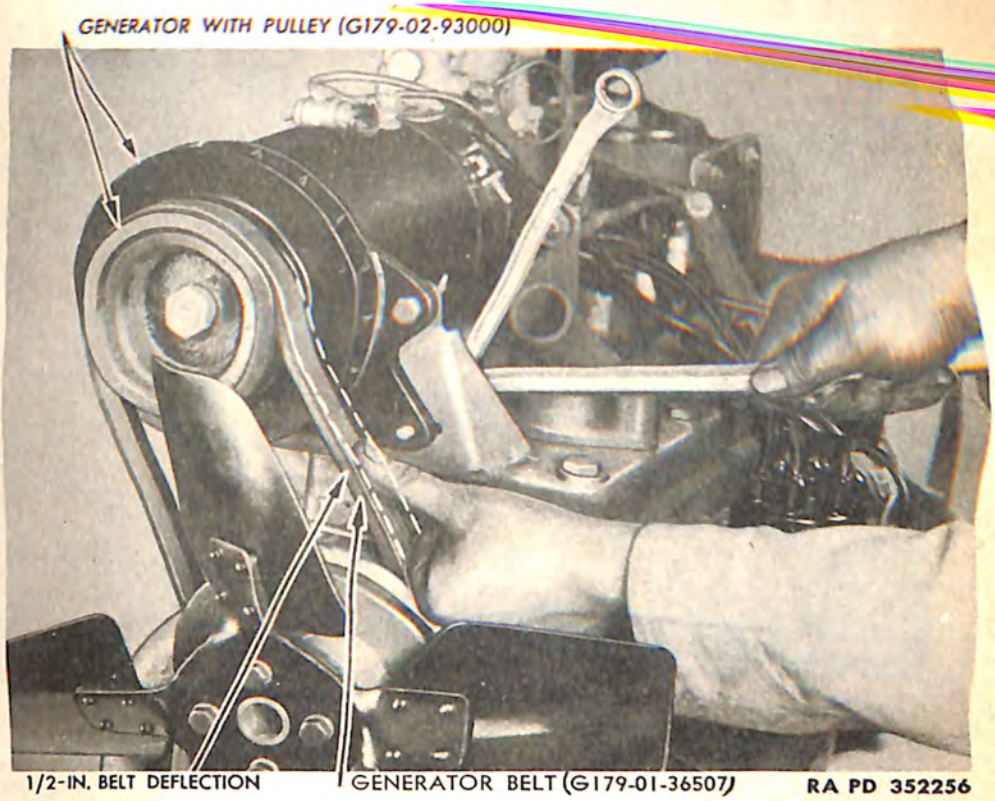


Figure 56 — Adjusting Generator Belt

b. Repair. If an oil pipe is broken near one of the connections, it can be repaired. Remove the affected pipe (subpar. c below) and slide the nut away from broken end. Cut off damaged end and file end of pipe to remove jagged edges. Anneal the end by heating it with torch until it is red in color and then cooling it immediately in water. Using flaring tool (41-T-3125-20), carefully flare the end. Tin both sides of flare. Install pipe (subpar. d below).

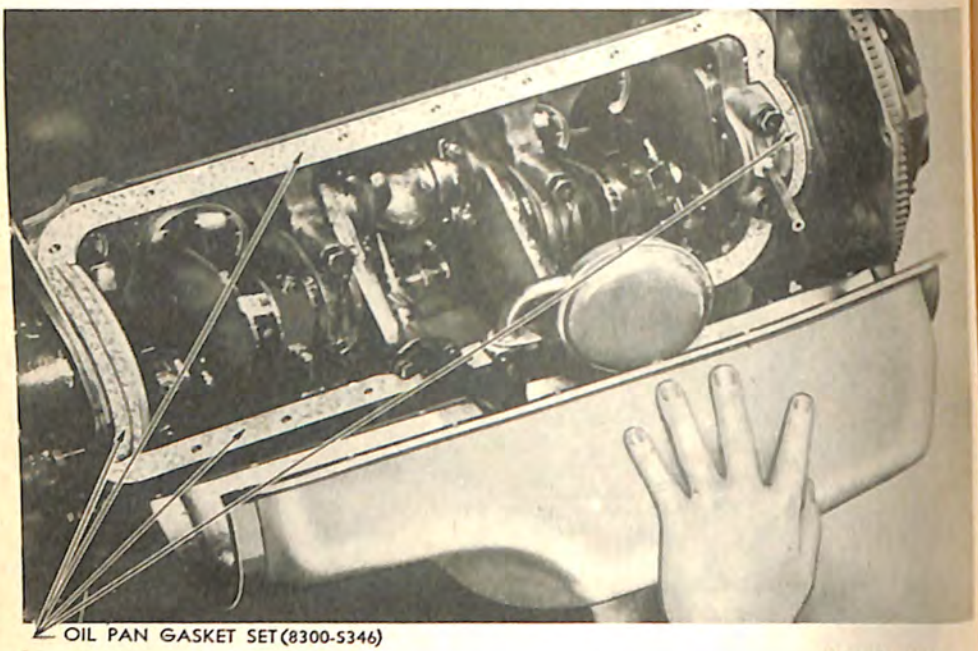
c. Removal. Disconnect couplings at end of oil pipe and remove pipe.

d. Installation. Place pipe in position and start coupling nuts by hand, screwing them finger-tight. Then tighten couplings at both ends with wrench.

72. DRIVE BELTS—ADJUSTMENT AND REPLACEMENT.

a. Fan and Water Pump Drive Belt.

(1) ADJUSTMENT. Loosen wing nuts and remove engine compartment lid. Loosen lock nut and lock screw in hub of fan pulley



RA PD 352257

Figure 57 — Removing Oil Pan

outer flange. Turn the fan pulley outer flange clockwise to increase belt tension and counterclockwise to decrease the tension. Adjust belt tension so there is approximately ½-inch deflection of belt with finger-pressure (fig. 55). Make sure that the lock screw is alined with one of the grooves in pulley hub, tighten lock screw, and lock securely with lock nut. Install engine compartment lid and fasten in position with clamps and wing nuts.

(2) REMOVAL. Loosen wing nuts and remove engine compartment lid. Loosen lock screw in outer flange of forward pulley, and turn flange counterclockwise. This will relieve tension on belt and it can be removed from the pulleys. NOTE: *On M29C, remove screws that hold stub shaft flange to fan drive pulley on crankshaft. Slide shaft forward and to one side so fan belt can be removed.*

(3) INSTALLATION. Install belt, turn outer pulley flange clockwise until belt can be deflected approximately ½ inch with finger-pressure, and tighten lock screw in pulley outer flange. Make sure that lock screw enters one of the grooves in the hub and lock it with lock nut. NOTE: *On M29C, place stub shaft flange in position against fan drive pulley on crankshaft, and fasten securely with screws.* Install engine compartment lid and fasten in position with clamps and wing nuts.

b. Generator Drive Belt.

(1) ADJUSTMENT. Loosen the wing nuts and remove engine compartment lid. Loosen generator fastening bolts, move generator outward and up to increase tension on belt so there is approximately ½-inch deflection with finger-pressure (fig. 56). Tighten generator fastening bolts securely, install engine compartment lid, and fasten in position with clamps and wing nuts.

(2) REMOVAL. Remove fan and water pump belt (subpar. a (2) above). Loosen the upper and lower generator fastening bolts which hold generator to the mounting brackets. Swing generator inward and down to relieve tension on belt so it can be removed.

(3) INSTALLATION. Install the generator belt on pulleys, and swing generator outward and up to tighten the belt until it can be deflected approximately ½-inch with finger-pressure. Tighten the generator fastening bolts securely to retain the belt adjustment. Install fan and water pump belt (subpar. a (3) above).

73. OIL PAN GASKET REPLACEMENT (ENGINE REMOVED).

a. Removal. After engine has been removed from vehicle (par. 75), take out screws that hold the oil pan to cylinder block and remove oil pan (fig. 57). Clean off any portion of gaskets that remain on cylinder block and on the oil pan flanges.

b. Installation. Apply gasket cement to new oil pan gaskets and place them in position. Install pilot screws in cylinder block flange to guide the oil pan into position. Install the oil pan screws with lock washers, remove the pilot screws, and tighten the oil pan screws securely. Procedure for installing engine in vehicle is described in paragraph 76.

Section XVII

ENGINE REMOVAL AND INSTALLATION

74. COORDINATION WITH HIGHER ECHELON.

a. Replacement of the engine with a new or rebuilt engine assembly is normally a third echelon operation, but may be performed in an emergency by second echelon, provided authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation which are not carried in second echelon may be obtained from a higher echelon of maintenance.

75. REMOVAL.

a. Remove Vehicle Top and Bows. See paragraph 143 b (1) and 143 c (1).

b. Remove Seat Backs and Cushions. See paragraph 144 b and 144 c.

c. Remove Propeller Shaft and Disconnect Transmission and Clutch Controls. See paragraph 121 for instructions on removal of propeller shaft. Disconnect clutch and engine transmission shift control rods by removing the cotter pins and clevis pins. Unhook and remove clutch release shaft outer lever return spring.

d. Remove Engine Compartment Cover. Loosen two wing nuts which hold engine compartment cover to side panel. Move cover up until engaging tongues can be removed from slots in hull coaming, and lift cover out of vehicle (fig. 58).

e. Remove Air Cleaner. See paragraph 91 c for carburetor air cleaner removal.

f. Remove Batteries. See paragraph 105 d.

g. Remove Front Panel and Engine Compartment Division Panels (After Vehicle Serial 1002) (fig. 59). Remove nuts, lock washers, and bolts that hold two sections of division panel together, and the nut, lock washer, and bolt that hold the rear panel to the bulkhead. On vehicles with oil-bath type air cleaner (after serial 3600), disconnect the flexible tube, and lift rear panel with tube out of the vehicle. Remove windshield wiper connections from sockets, take out screws that fasten sockets to front panel, and remove sockets from panel. Remove bolts, nuts, and washers that hold front panel to inside of coaming. On vehicles equipped with a stand-by heater, disconnect stand-by heater fuel valve control from shut-off cock, and remove front panel. Remove the cap screw and lock washer that hold the front division panel to the front coaming, and lift the panel up and out of the vehicle.

h. Remove Fuel Tank. See paragraph 85 c.

i. Remove Radiator. See paragraph 96 b. NOTE: *On M29C, after removing radiator, take out screws that fasten the stub shaft flange to fan drive pulley on crankshaft and remove shaft.*

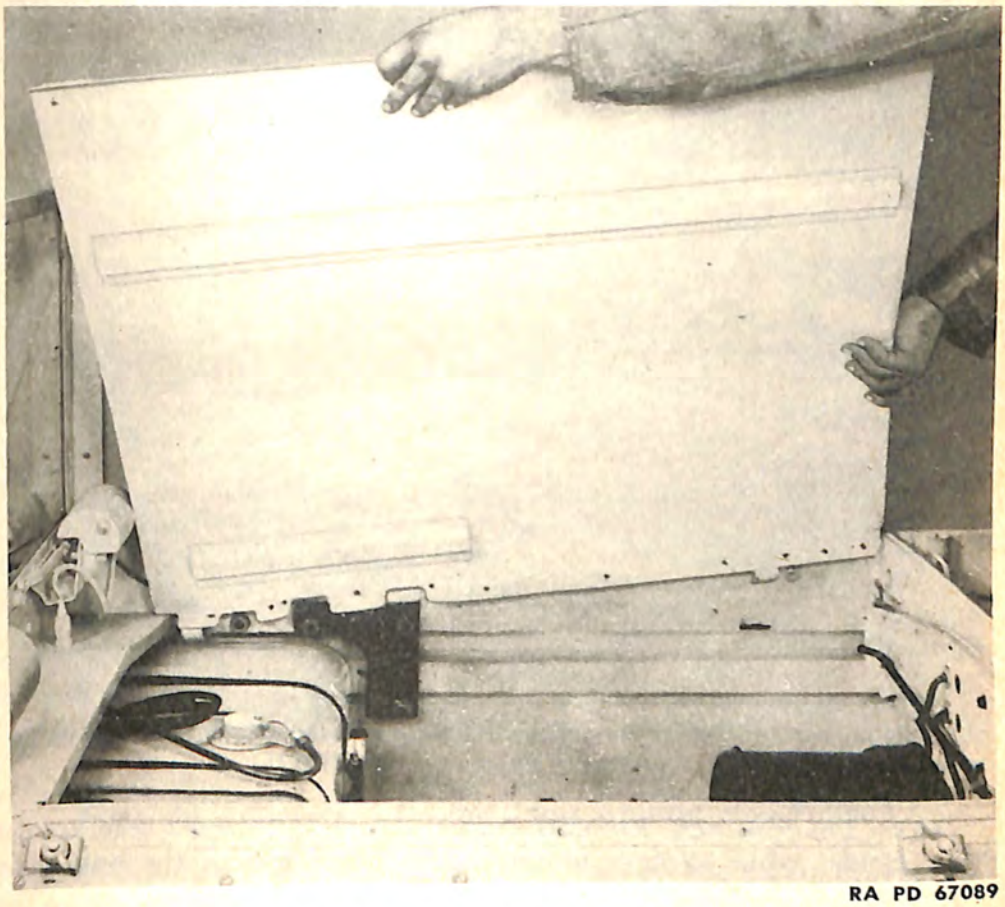
j. Remove Fan Blades. See paragraph 97 b (1).

k. Remove Fuel Filter (Before Vehicle Serial 1003). See paragraph 87 c.

l. Remove Generator Regulator and Mounting Bracket. Disconnect and tag all wires from the generator regulator, remove mounting bracket bolts, nuts and toothed washers, and lift mounting bracket and regulator out of vehicle.

m. Engine Compartment Side Panel and Instrument Panel Removal.

(1) DISCONNECT ENGINE HEAT INDICATOR, OIL PRESSURE GAGE, AND IGNITION COIL. Remove the heat indicator element from the



RA PD 67089

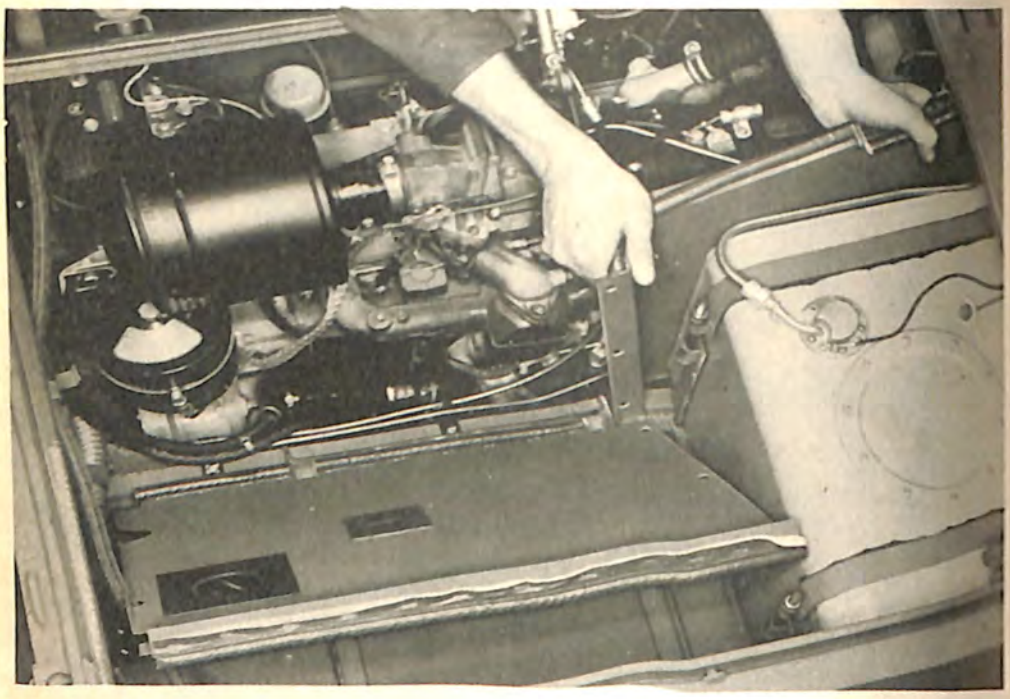
Figure 58 — Removing Engine Compartment Cover

fitting in the left rear side of cylinder head. Disconnect oil pressure gage pipe from the flexible coupling above front of engine. Remove the ignition switch primary wire from the terminal stud on the ignition coil.

(2) DISCONNECT PRIMER PIPES. Disconnect the primer inlet and outlet pipe connections from the fittings at the primer.

(3) DISCONNECT CHOKE CONTROL. Loosen the choke wire tube clip screw at bracket on carburetor air horn, loosen the swivel screw on choke wire, and pull the control away from carburetor.

(4) DISCONNECT WIRES FROM INSTRUMENT PANEL. Disconnect and carefully tag the wires from the instrument panel as required. Remove or loosen all clips that hold wiring harnesses or cables to panels.



RA PD 336520

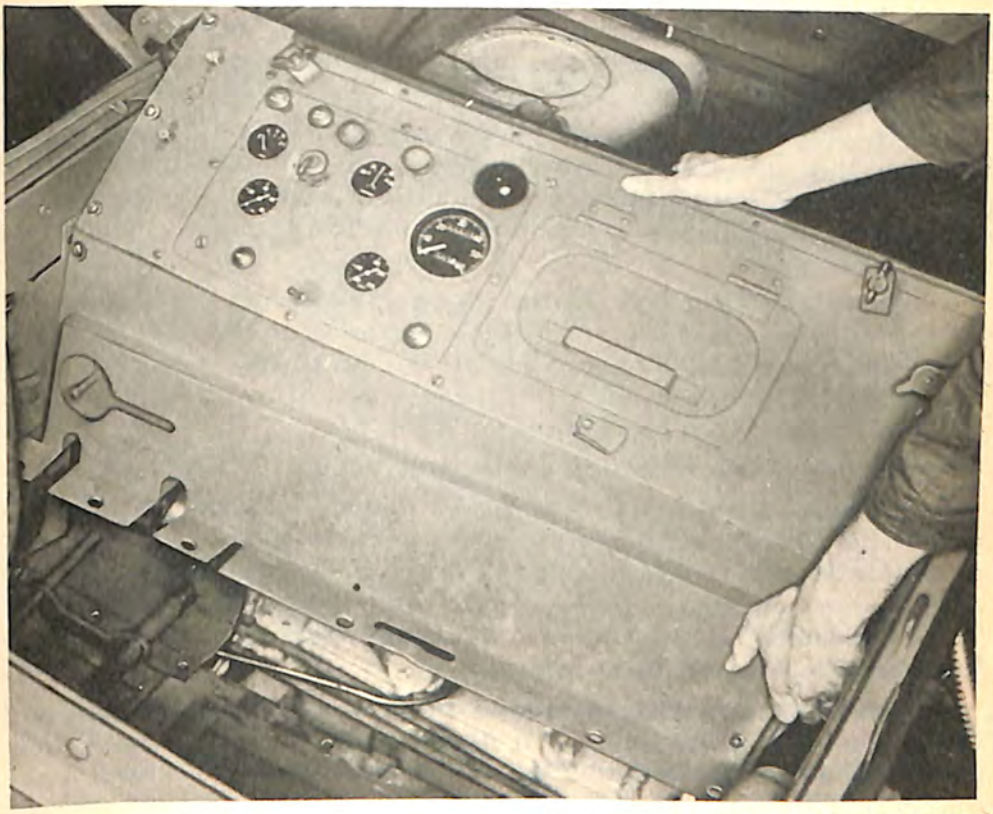
Figure 59 — Removing Engine Compartment Division Panels (After Vehicle Serial 1002)

(5) DISCONNECT SPEEDOMETER CABLE. Unscrew knurled nut that holds cable to speedometer and place out of the way along right side of hull tunnel.

(6) DISCONNECT CABLES FROM MASTER SWITCH. Remove nuts from stud terminals on the switch; remove cables and tag their positions for installation.

(7) DISCONNECT SIGNAL AND TROUBLE LIGHT REEL WIRE GROUND AND GROMMET FROM THE ENGINE SIDE PANEL. Remove the screws that hold the grommet and ground terminal to the side panel, disconnect fuse holder, pull wire through panel, and place out of the way over the reel or bulkhead.

(8) REMOVE SIDE PANEL AND INSTRUMENT PANEL. Remove the cap screws, bolts, nuts, toothed washers, and lock washers that hold the side panel and the cross shaft cover to the hull and lift the side panel with instrument panel up and out of the vehicle (fig. 60). NOTE: *On M29C, after raising the side panel slightly, loosen lock nut that fastens capstan clutch control knob to side panel and move the knob toward left side and out of slot.*



RA PD 336529

Figure 60 — Removing Engine Compartment Side Panel

n. **Disconnect Accelerator Control.** Loosen the screw that holds the accelerator cable tube clip to the bracket near the oil filler pipe. Disconnect the accelerator cable clevis from the bell crank mounted on the cylinder head. Place tube and cable assembly out of the way.

o. **Remove Transmission Control Shift Rods.** Remove cotter pins and clevis pins from the engine transmission control shift rod clevises. On vehicles after serial 2102, remove the clutch housing screws that hold the shift rod guide bracket. Lift the rods out of vehicle. On vehicles from serial 2103 through 13,562, disconnect clutch cable conduit anchor clip from guide bracket and place cable on floor of the vehicle tunnel. Remove cotter pins and clevis pins from axle transmission front shift rod and lift rod out of engine compartment. Disconnect linkage adjusting clevis from clutch release shaft outer lever by removing outer release spring, cotter pin, and clevis pin.

p. **Uncouple Exhaust Pipe.** Remove the bolts, nuts, washers, and clamp that secure the front exhaust pipe to the support bracket on

the right side of the clutch housing. Remove the nuts that hold front exhaust pipe flange to the manifold flange, separate the flanges, and remove the gasket.

q. Remove Engine Front Mounting Bolts and Ground Strap. Remove the nuts, lock washers, flat washers, and bolts that hold ground strap to right front engine mounting bracket. Remove cotter pins, castle nuts, flat washers, and upper insulators from mounting bolts.

r. Install Lifting Eye Bolts. Lower windshield to avoid interference at windshield wipers. Remove the Nos. 9 and 10 cylinder head cap screws (fig. 52) and install engine lifting eye bolts (41-B-1586-150). Hook the ends of lifting chain through the eye bolts and attach the chain to a suitable hoist.

s. Remove Transmission. See paragraph 117.

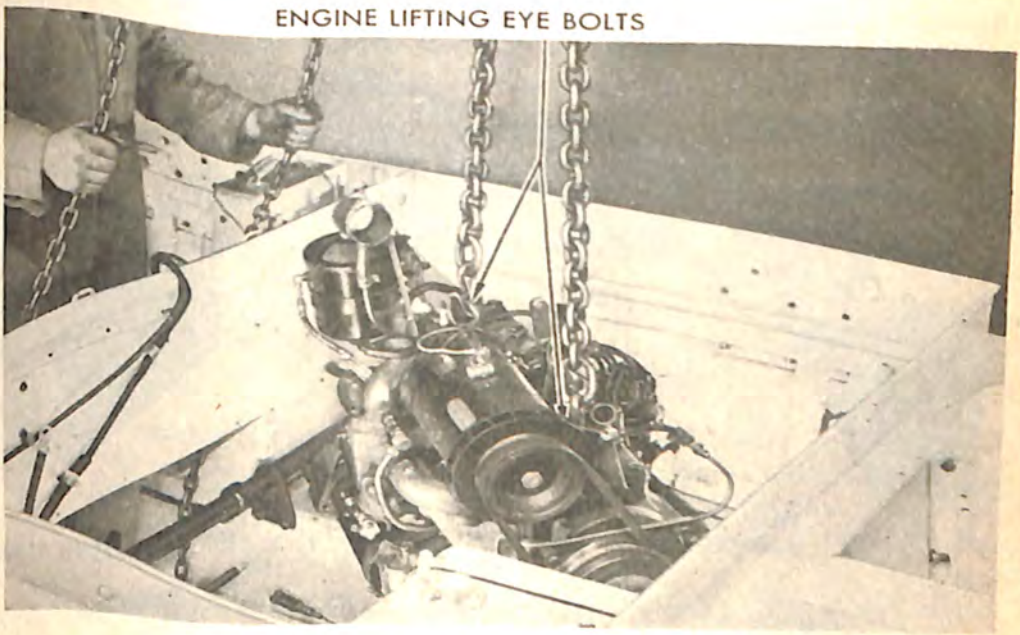
t. Remove Engine (Including Clutch). Lift engine slowly off the support brackets, check to make sure everything is clear, and raise slowly with the hoist (fig. 61). After engine is raised enough to give working space, remove and tag all wires from the starter solenoid switch. Raise engine out of compartment, guiding it carefully to avoid damaging any parts.

u. Drain Engine Oil. Remove the drain plug from the bottom of the oil pan and allow all oil to drain out of engine. Install drain plug with a new gasket and tighten securely.

76. INSTALLATION.

a. Place Engine in Vehicle. Install engine front mounting bolts, flat washers, lock washers, and engine mounting insulators to engine mounting brackets in engine compartment. Use tape to hold the engine bolts and insulators in place while lowering engine into position. Raise the engine with a hoist and slowly lower it into the engine compartment. Guide it carefully to avoid damaging uncoupled pipes, wires, and controls. Connect the starter solenoid wires to solenoid switch as tagged during removal. Maneuver engine as required and lower into position on engine front mountings. Install upper insulators, flat washers, and nuts on engine front mounting bolts, but do not tighten.

b. Install Transmission. Place tranmission into position so forward machined surface is against machined surfaces of clutch housing. Install the cap screws with lock washers and tighten securely. Lower engine until rear mounting rests on hull crossmember; install screws with lock washers and tighten securely. Tighten front mounting nuts until firm contact is made against spacer and install new cotter pins. Remove engine lifting chain and eye bolts; install cylinder head screws.



RA PD 336488

Figure 61 — Removing Engine Using Eye Bolts (41-B-1586-150)

c. **Install Transmission Control Shift Rods.** Place the engine transmission shift rods in position. The longer rod operating the first and reverse shift lever connects to the rear external lever on transmission, at which point an insulator is used on vehicles after serial 4935. On vehicles from serial 2103 through 13,562, fasten clutch cable conduit to shift rod guide bracket with anchor clip. On vehicles after serial 2102, install shift rod guide bracket with clutch housing bolts and tighten securely. Install the axle transmission front shift rod to the lever on the shift shaft and to the lever on the cross shaft by installing clevis pins and new cotter pins.

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

e. **Connect Clutch Control Linkage.** Connect the clutch control linkage clevis to the release shaft outer lever with clevis pin and new cotter pin.

f. **Install Propeller Shaft.** See paragraph 122.

g. **Install and Connect Fuel Filter (Before Vehicle Serial 1003).** Fasten fuel filter to front coaming with cap screws. Connect drain pipe to fitting in bottom of filter, and install outlet and inlet pipes.

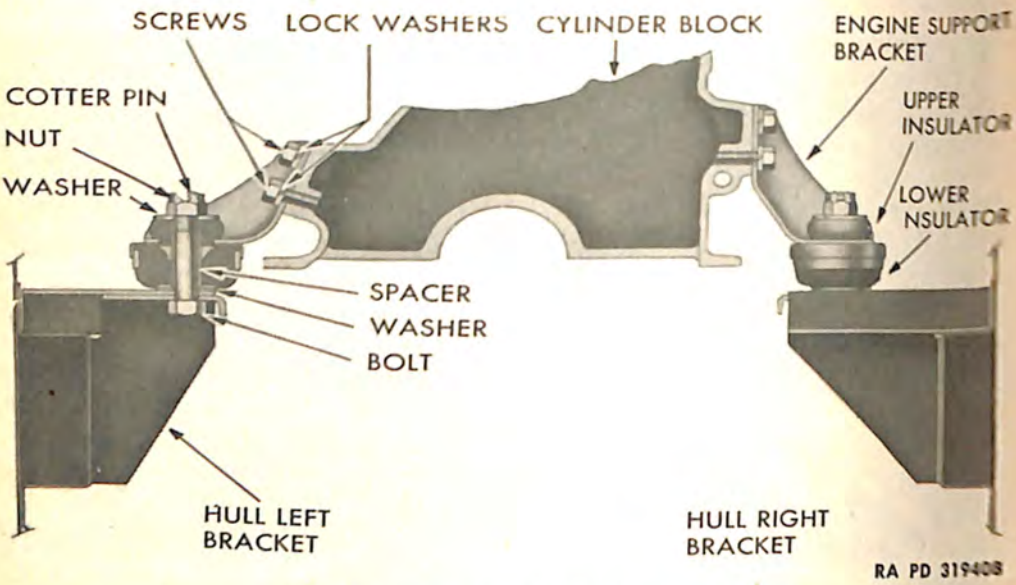


Figure 62 — Engine Front Mounting Construction

h. Connect Engine Ground Strap. Connect engine ground strap to engine right front mounting bracket with bolt, flat washer, lock washer, and nut.

i. Install Generator Regulator and Mounting Bracket. Place generator regulator and mounting bracket in position with toothed lock washers between bracket and bulkhead, and install mounting bolts and nuts. Connect the wires to terminals on regulator.

j. Install Fan Blades. Install fan blades to water pump hub with cap screws and tighten securely.

k. Connect Accelerator Control. Place accelerator cable tube into position in the clip at bracket near the oil filler tube and tighten clip screw securely. Connect the accelerator clevis to the bell crank on cylinder head and adjust (par. 92 **b** (4)), if necessary.

l. Engine Compartment Side Panel and Instrument Panel Installation.

(1) INSTALL PANELS. Place side panel assembly into position in vehicle and install cap screws, bolts, lock washers, toothed washers, and nuts. NOTE: *On M29C, before side panel is fastened in position, place capstan clutch control knob into slot in side panel and tighten lock nut securely.* Install cross shaft cover and tighten screws and nuts securely.

(2) CONNECT SIGNAL AND TROUBLE LIGHT WIRE GROUND AND GROMMET TO ENGINE SIDE PANEL. Run trouble light reel wire

through hole in side panel, position grommet and ground, and install screws. Install fuse in holder and connect the halves of holder.

(3) CONNECT CABLES TO MASTER SWITCH. Place cables over proper terminal studs on master switch, install washers and nuts on studs, and tighten securely.

(4) CONNECT SPEEDOMETER CABLE. Place speedometer cable up over the engine, insert end into speedometer, and tighten knurled nut. Be sure there are no kinks or sharp bends in the cable to impede operation.

(5) CONNECT WIRES TO INSTRUMENT PANEL. Connect all wires at the back of the instrument panel to the various terminals as marked during removal. If difficulty is experienced, refer to wiring diagrams.

(6) CONNECT CHOKE CONTROL. Place choke wire tube in position through clip at bracket on carburetor air horn, with wire going through the swivel on the choke valve lever. Tighten the clip screw securely, push choke button against instrument panel, open choke valve fully, and tighten swivel screw onto wire.

(7) CONNECT PRIMER PIPES. Place primer inlet and outlet pipes into position at the primer fittings and tighten the nuts securely. Be sure there are no leaks in the primer system; otherwise, it will be ineffective.

(8) CONNECT ENGINE HEAT INDICATOR, OIL PRESSURE GAGE, AND IGNITION COIL. Insert heat indicator element into the fitting in the left side of cylinder head and tighten the nut securely. Connect the oil pressure pipe at the front of engine to the flexible coupling on the gage and tighten securely. Connect wire from ignition switch to the coil terminal and tighten the stud nut securely.

m. Install Engine Oil. Fill engine crankcase to proper level with correct grade engine oil (par. 38).

n. Install Radiator. See paragraph 96 **c**. NOTE: *On the M29C, before installing radiator, place capstan drive connection and stub shaft in position and fasten shaft flange to fan drive pulley on crankshaft with screws.*

o. Install Fuel Tank. See paragraph 85 **d**.

p. Install Engine Compartment Division Panels (After Vehicle Serial 1002). Place front division panel in position, install cap screw with lock washer, and tighten to the front coaming. Install rear panel, bolt, lock washer, toothed washer, and nut through hull bulkhead; and install the bolts, washers, and nuts that hold the two panels together. On vehicles equipped with oil-bath type air cleaner (after vehicle serial 3600), install the flexible tube to the air cleaner adapter.

q. Install Batteries. See paragraph 105 **e**.

r. **Install Air Cleaner.** See paragraph 91 d.

s. **Install Seat Cushions and Backs.** See paragraphs 144 b and c.

t. **Test Engine.** Start engine, and check oil pressure gage and ammeter for proper operation. If oil pressure gage does not register pressure within 10 seconds, stop engine immediately and investigate. Inspect engine for oil and water leaks. If any leaks are found, eliminate them by tightening connections. Test engine for proper operation after it reaches normal operating temperature. Make adjustments as required.

u. **Install Engine Compartment Front Panel and Lid.** Fasten front panel to coaming with bolts, toothed washers, and nuts. On vehicles equipped with stand-by heater, connect heater fuel valve control to the fuel tank shut-off cock. Install windshield wiper sockets on front panel. Place engine compartment lid in position and tighten the wing nuts securely. Raise windshield and fasten in vertical position.

v. **Install Vehicle Top and Bows.** See paragraphs 143 b (2) and c (2).

Section XVIII
IGNITION SYSTEM

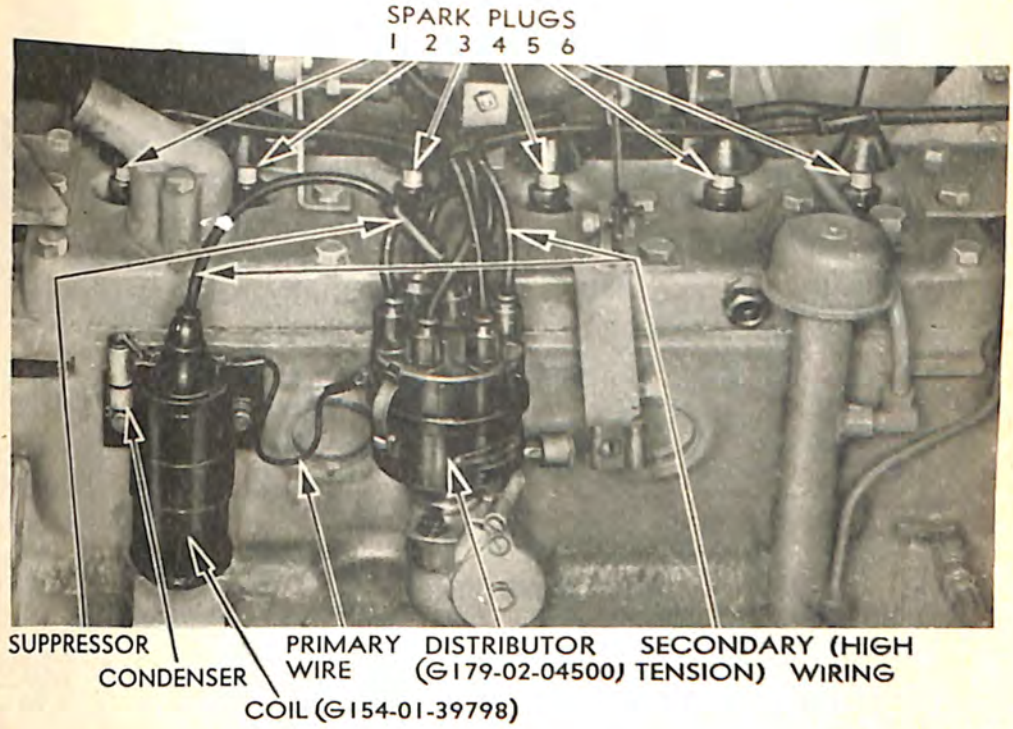
77. DESCRIPTION.

a. The ignition system on this vehicle is the conventional automotive type, employing storage batteries. Units making up the ignition system are: the coil, distributor, condenser, spark plugs, high-tension wires, related wiring, and the ignition switch.

78. DISTRIBUTOR.

a. **Description.** The distributor is the automatic advance type, with the condenser mounted inside the body. Ignition timing can be advanced or retarded by loosening the clamp screw and turning the distributor body.

b. **Removal.** Loosen wing nuts and remove engine compartment cover. Unlatch distributor cap retainer clips and move cap, with cables attached, to one side. Crank engine until the rotor is in the No. 1 cylinder firing position (on compression) and timing mark (UDC 1-6) on flywheel is directly under pointer at the left side of engine rear plate (fig. 68). Placing flywheel in this position will facilitate installation of distributor. Remove screw and lock washer to disconnect primary wire, take out screw that holds distributor assembly to support, and lift distributor out of support (fig. 64).



RA PD 352258

Figure 63 — Ignition System Units

c. Installation. With engine flywheel mark (UDC 1-6) exactly under pointer on engine rear plate (fig. 68), turn rotor to No. 1 cylinder firing position or as nearly toward front as gear teeth will permit, and install distributor. Oscillate rotor until distributor shaft driving gears engage with drive shaft gears and install screw that holds distributor to support. Loosen clamp bolt, turn distributor body clockwise until points begin to separate slightly, and tighten clamp bolt securely. Connect primary wire, install lock washer and screw, and tighten securely. Clean distributor cap, place in position with lug engaging recess in distributor body, and latch cap with retainer springs. Make sure all cables are pushed firmly into towers on distributor cap. Install engine compartment cover and fasten in position with clamps and wing nuts.

d. Contact Points.

(1) ADJUSTMENT. Remove distributor assembly (subpar. **b** above). Turn distributor shaft until fiber rubbing block on arm is exactly on one high point of cam lobe. Adjust gap between faces of breaker arm point and adjusting point to 0.020-inch clearance by

RA PD 35

Figure 64 — Removing Distributor

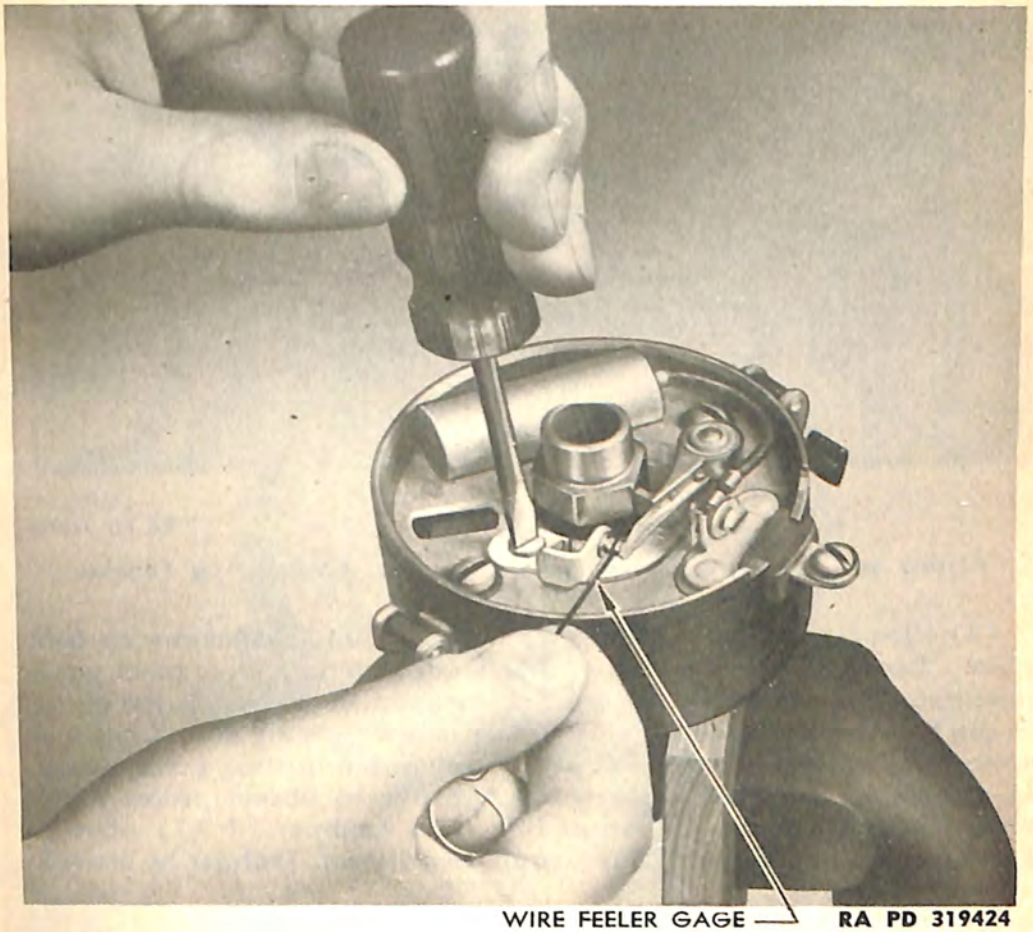
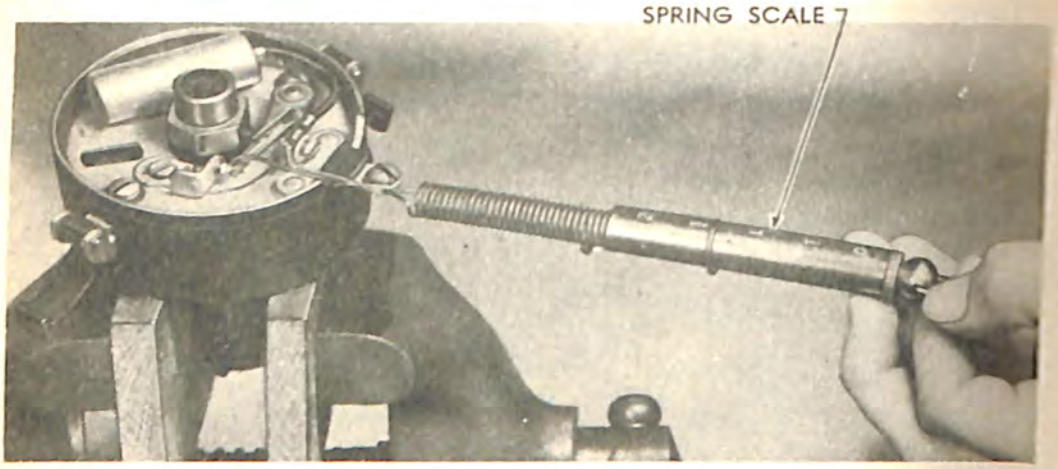


Figure 65 — Checking Gap at Distributor Contact Points

turning point adjusting screw until proper clearance is obtained. Tighten adjusting point lock screw and recheck gap (fig. 65). With points together, attach hook of spring scale near point end of breaker arm (fig. 66). A tension of 17 to 20 ounces should register on the scale when pulling at a right angle to arm until points just separate. If spring scale is not available, check tension by feel. Install distributor assembly (subpar. c above).

(2) REMOVAL. Remove distributor assembly as outlined in subparagraph b above. Pull rotor off distributor camshaft. Loosen the screw which holds condenser wire and breaker arm spring to base plate bracket. Pull arm up and off pivot pin in distributor base plate. Remove lock and adjusting screws and lift adjusting point out of distributor.



RA PD 319423

Figure 66 — Checking Distributor Breaker Arm Spring Tension

(3) INSTALLATION. Install adjusting point and screws on base plate. Leave lock screw loose. Place breaker arm over pivot pit in distributor base plate (place a small amount of grease on the pin or in the breaker arm bushing) and start screw holding end of flat arm spring and condenser wire. If arm point and adjusting point are not in alinement, bend adjusting point bracket to obtain proper alinement. Adjust point gap to 0.020 inch (subpar. d (1) above). Place rotor on camshaft and install distributor (subpar. c above).

e. Rotor.

(1) REMOVAL. Unlatch distributor cap retainer clips and move cap, with cables attached, to one side. Pull up and work off rotor from distributor camshaft.

(2) INSTALLATION. Fit rotor on distributor camshaft, with flat side of camshaft corresponding to flat inner boss of rotor, and work rotor down on camshaft. Replace distributor cap and fasten retainer clips.

f. Condenser.

(1) REMOVAL. Remove distributor cap (subpar. e (1) above) and take out screw holding condenser to distributor base plate. Remove screw that holds wire to bracket and lift out condenser.

(2) INSTALLATION. Clean condenser and area on base plate under condenser with 2/0 flint paper in order to establish the best possible ground. Install condenser, tighten screw securely, and connect wire to bracket. Install distributor cap (subpar. e (2) above).

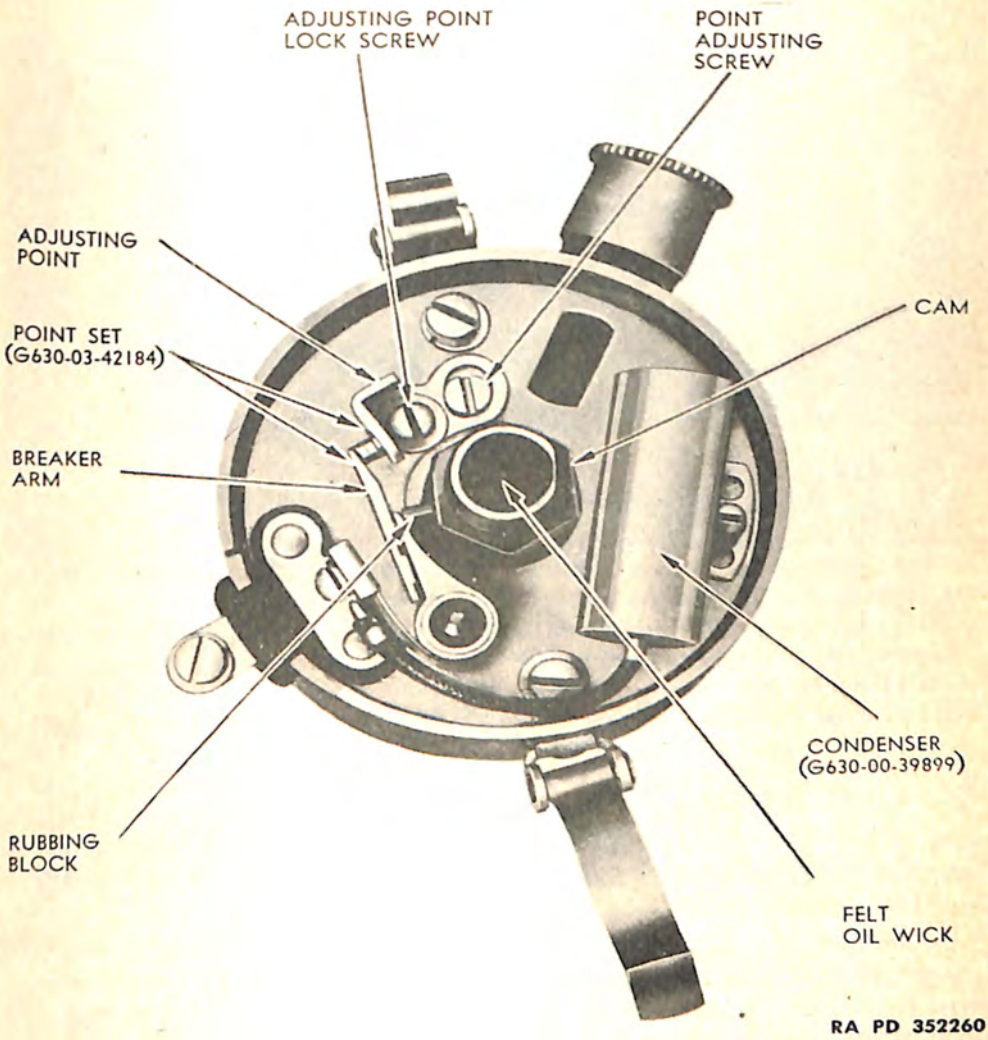
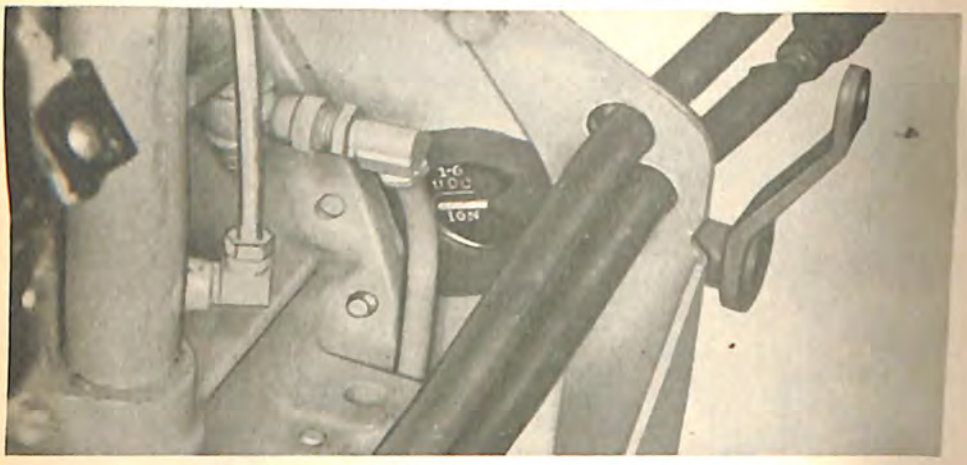


Figure 67 — Distributor — Cap and Rotor Removed

79. IGNITION TIMING.

a. Loosen wing nuts and remove engine compartment cover. Remove No. 1 spark plug and crank engine until No. 1 piston starts upon compression stroke. Place a light in engine compartment to illuminate marks on flywheel and pointer, open inspection door in engine compartment side panel, and continue to crank engine slowly until UDC 1-6 mark on flywheel (fig. 68) is directly under timing pointer on engine rear plate. At this point, No. 1 piston is in firing position. Place a piece of cellophane or a 0.001-inch feeler gage



RA PD 336501

Figure 68 — Ignition Timing Marks on Flywheel

between distributor points (points fully closed). Loosen clamp bolt and rotate distributor housing to a position where cellophane or 0.001-inch feeler, still supported by points, can be removed with only a slight drag. Tighten distributor clamping bolt. If further adjustment is necessary, move distributor clockwise to retard or counterclockwise to advance timing. Install No. 1 spark plug and engine compartment cover.

80. IGNITION COIL.

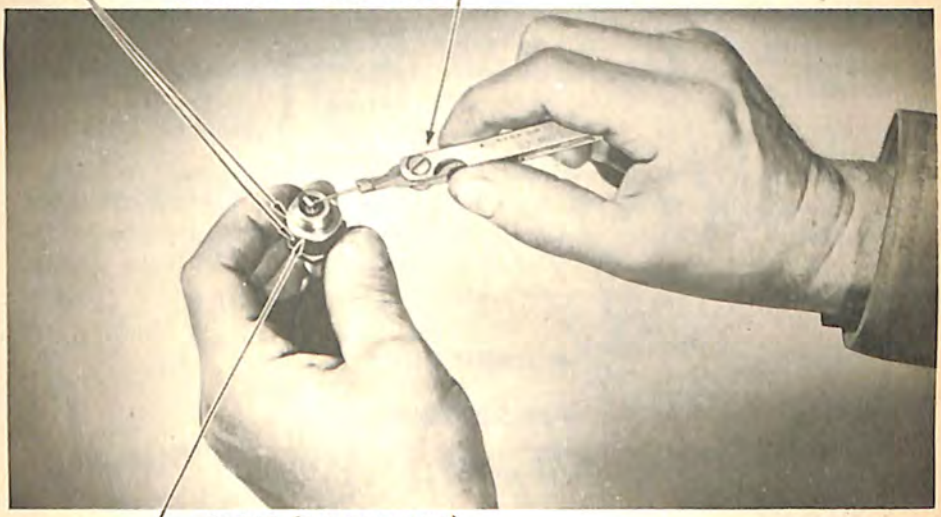
a. Description. The ignition coil, located at the left front side of the engine, is mounted by cap screws on a bracket secured to the cylinder block (fig. 63).

b. Removal. Loosen wing nuts and remove engine compartment cover. Pull high-tension wire out of coil tower; then disconnect wire from coil to ignition switch, wire from coil to condenser, and wire from coil to distributor. Remove cap screws and toothed washers that hold coil and condenser to bracket. Remove condenser and coil from vehicle.

c. Installation. Place coil in position and install cap screws and toothed washers that hold coil to mounting bracket. Connect wire from ignition switch to coil, and wire from distributor to coil. Push high-tension wire terminal into coil tower. Install engine compartment cover and fasten in position with clamps and wing nuts.

81. SPARK PLUGS.

a. Description. Six 14-mm spark plugs are used to provide the spark for igniting the gasoline-air mixtures in the combustion



RA PD 352261

Figure 69 — Checking Spark Plug Gap

chambers. Gaskets are used under the plug shoulder to prevent compression leakage past the spark plugs.

b. Removal. Remove the engine compartment cover and pull the L-shaped suppressor terminal and shield off the spark plug. Before removing the plug, blow all grit and dirt from spark plug recess and from area surrounding the recess; otherwise, foreign matter may enter the engine cylinder and cause damage. Unscrew and remove plug with gasket from cylinder head.

c. Adjustment of Gap. Spark plugs should be cleaned by sandblasting. (Do not clean the porcelain with anything that will scratch it.) To provide the proper gap (0.025 in.), bend the grounded (outer) electrode.

d. Installation. Place a new gasket over threaded end of plug, with seam toward cylinder head, and install spark plug. Using a torque wrench and spark plug socket, tighten to a tension of 30 foot-pounds. Push suppressor terminal onto plug until a "click," indicating positive connection, is heard. Install engine compartment cover and fasten with clamps and wing nuts.

82. IGNITION SWITCH.

a. Description. The ignition switch is located to the right of the fuel gage. After vehicle serial 2102, a dual-type switch is used for

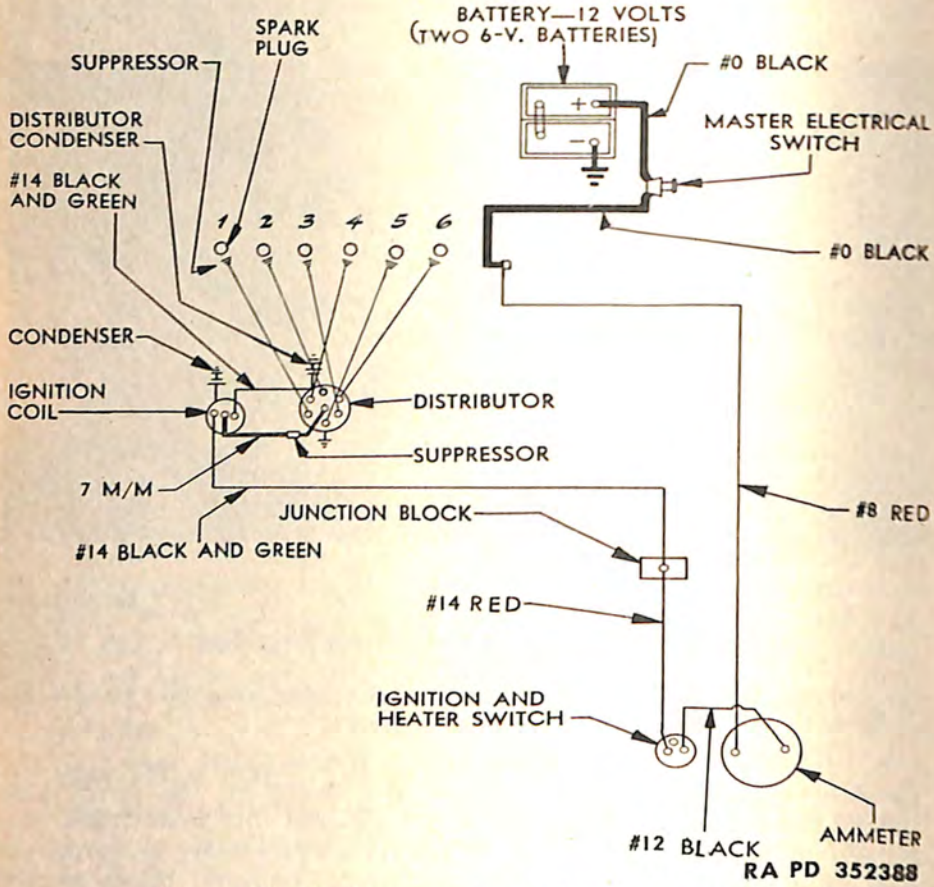


Figure 70 — Ignition System Wiring Diagram

ignition and the stand-by heater. Move the switch lever forward to turn on the ignition, and move lever rearward to operate the heater blower motor and igniter. This switch must be turned to its "ON" position (clockwise) before starting the engine. The fuel gage registers only when the ignition switch is in the "ON" position. On vehicles after serial 9502, the electric fuel pump operates only when the ignition switch is turned on.

b. Removal. Loosen the wing nuts and lift engine compartment cover out of vehicle. Disconnect the battery ground strap by removing the clamp stud nut and lifting off the cable terminal. Remove the wire from the terminal on the back of the switch, and disconnect and tag the leads from the switch to the circuit breaker and junction block for identification. Remove escutcheon nut from panel face and pull switch body from the instrument panel.

c. **Installation.** Place switch body on instrument panel and install escutcheon nut. Connect wire to switch terminal and the leads to circuit breaker and junction block as tagged. Install battery ground strap on clamp stud and fasten securely with nut. Install the engine compartment cover and tighten wing nuts securely.

83. HIGH-TENSION WIRING.

a. The distributor to coil and spark plug wires are heavily insulated to withstand wear and deterioration. All high-tension wiring is treated with a transparent liquid which establishes a waterproof coating when dry. This coating is a nonconductor of electricity. If faulty wires are discovered, install new cables of the same length and quality.

Section XIX

FUEL, AIR INTAKE, AND EXHAUST SYSTEMS

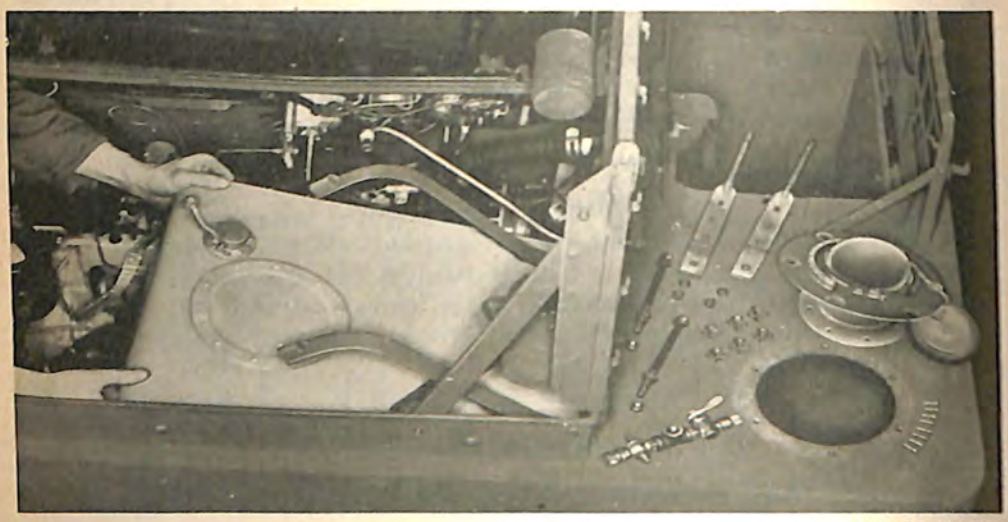
84. DESCRIPTION.

a. On vehicles before serial 9503, fuel is piped from the tank to a fuel filter, then to the fuel pump which is actuated by an eccentric forged on the camshaft. After vehicle serial 9502, the fuel is piped from an electric fuel pump within the tank to a fuel filter and from the filter to the carburetor. The fuel is strained before entering the carburetor float chamber. The carburetor is equipped with an air cleaner to filter dust out of the air before it enters the cylinders. The 2-piece exhaust pipe is connected to the exhaust flange on the manifold and to the muffler at the rear of the vehicle.

85. FUEL TANK.

a. **Description.** The fuel tank is located in the right front corner of the hull and is held in position by two metal straps. A large filler spout, having a sealed-type cap to prevent fuel loss when the vehicle is being operated at extreme angles, extends up through the hull front deck. Vehicles before serial 13,561 are equipped with a 35-gallon capacity metal fuel tank. After vehicle serial 13,560, the fuel tank is of the self-sealing type having a capacity of 33 gallons.

b. **Draining and Cleaning.** To drain the fuel tank for cleaning without removal, loosen the wing nuts and remove engine compartment cover. Loosen battery ground strap clamp and remove strap from battery post to reduce the possibility of fire caused by spark from the battery. Remove drain plug located in right side of hull on the outside (approximately 12 inches ahead of forward transverse spring). Open tank drain valve in engine compartment near rear

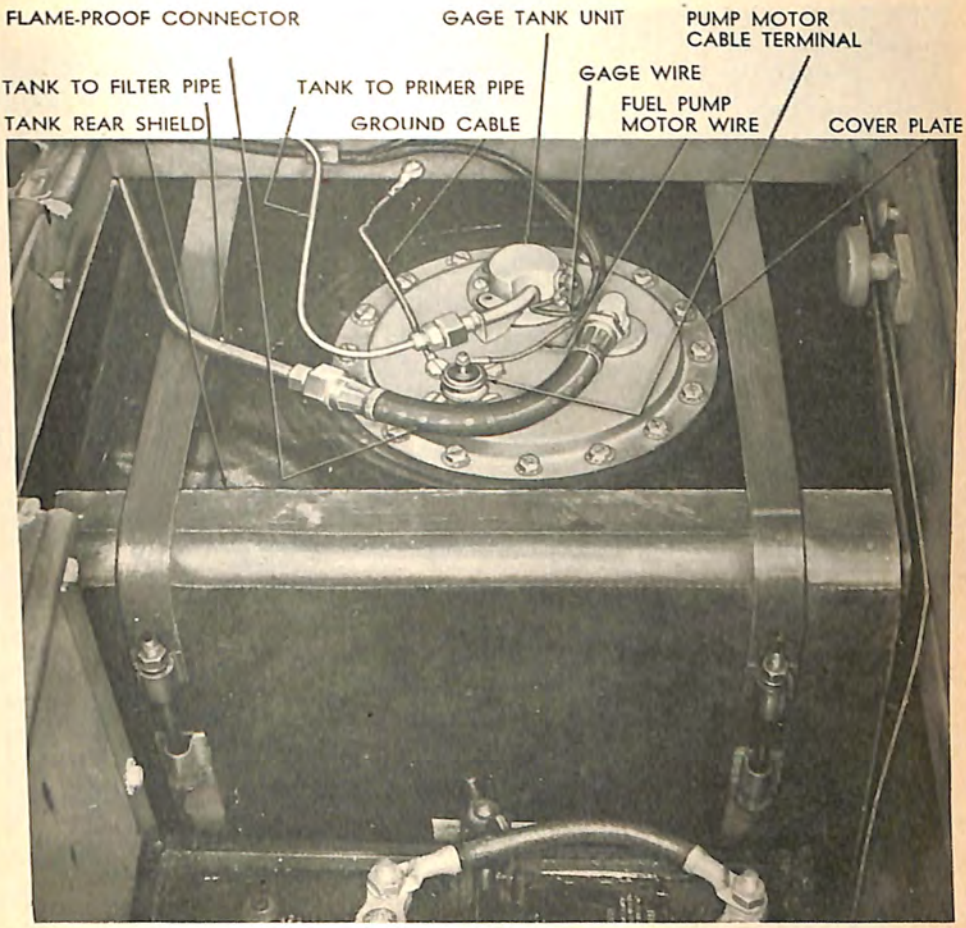


RA PD 336523

Figure 71 — Removing Fuel Tank

of tank, and allow fuel to drain out through opening in hull. Pour in a gallon or more fuel, and rock vehicle to dislodge any sediment which may have collected. Allow tank to drain, close drain valve, and install drain plug in right side of hull. Install engine compartment cover and fasten in position with clamps and wing nuts.

c. Removal. Drain the tank (subpar. **b** above). Take out batteries (par. 105 **d**), and remove screw and battery hold-down strap from forward side of battery cradle. Remove engine compartment front panel and division panel (par. 75 **g**), and the oil-bath-type carburetor air cleaner (par. 91 **c** (2)). Disconnect stand-by heater fuel pipe (on vehicles so equipped) from tank, fuel tank-to-filter pipe, and drain tube. Remove tee and valves (or valve and plug) with nipple from tank. NOTE: *On vehicles after serial 9502, disconnect the tank to primer pipe at gage tank unit, and disconnect pump motor wire from pump motor cable terminal. On vehicles after serial 13,560, disconnect ground cable from cover plate screw* (fig. 72). Disconnect fuel gage tank unit wire from tank unit. Loosen clamp screw on filler neck hole cover; remove cap screws, lock washers, and plain washers that hold filler neck hole cover to hull; and remove cover and clamp assembly. Remove cap screws, lock washers, and gasket holding filler neck to tank and remove filler neck. Remove nuts, lock washers, plain washers, and screws from straps holding fuel tank in position. Remove cap screws and lock washers holding lower straps

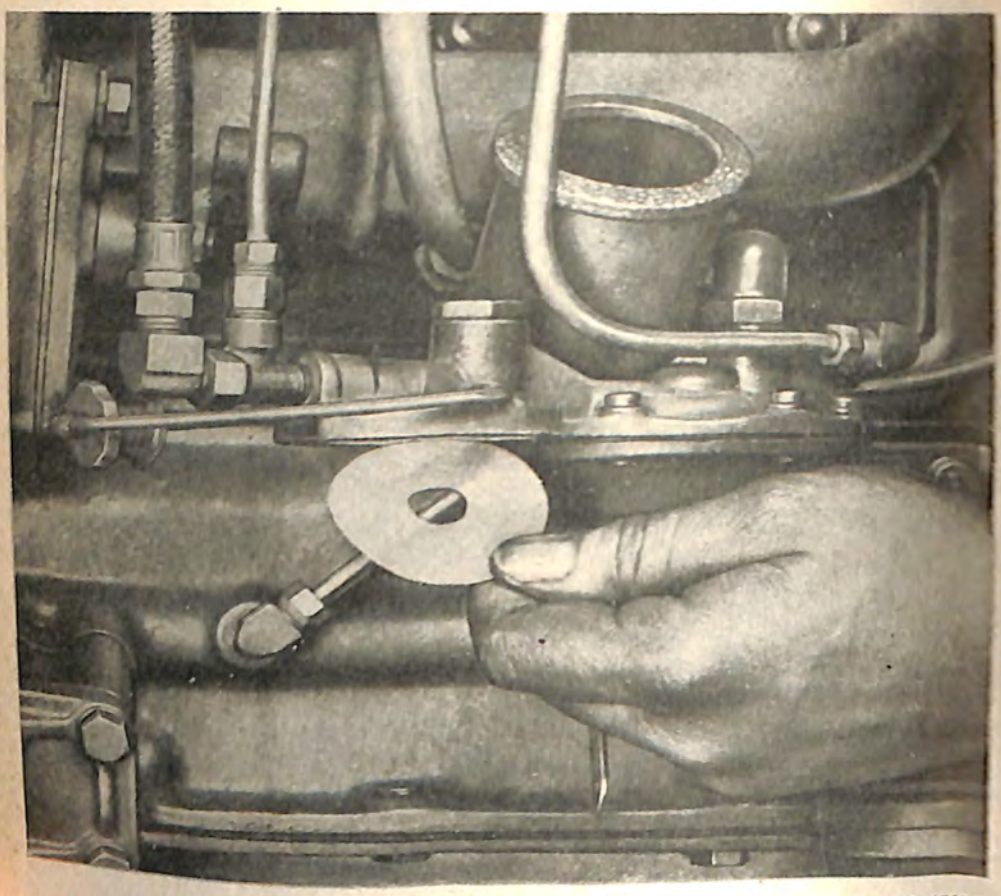


RA PD 336659

Figure 72 — Self-sealing Fuel Tank (After Vehicle Serial 13,560)

to hull and remove lower straps. NOTE: *On vehicles after serial 13,560, remove tank rear shield* (fig. 72). Lift tank and carefully move it rearward and out of vehicle (fig. 71).

d. Installation. To facilitate sliding fuel tank into position (on vehicles before serial 13,561, apply grease to straps on which tank is to be placed before installing it in vehicle. NOTE: *If fuel tank is to be replaced on vehicles after serial 9502, remove electric fuel pump unit (refer to par. 86 c (2) for removal instructions), install it in replacement (refer to par. 86 f (2) for installation instructions). Remove gage tank unit from old tank (par. 89 c (1)) and install it on replacement (par. 89 c (2)), using a new gasket to avoid possibility of leakage.* Slide fuel tank into position and connect lower holding straps



RA PD 67074

Figure 73 — Removing Fuel Pump Screen (Before Vehicle Serial 3601)

to hull with cap screws and lock washers. NOTE: *On vehicles after serial 13,560, install tank rear shield* (fig. 72). Install screws with plain washers through loops in upper and lower straps, install lock washers and nut but do not tighten at this time. Install a new filler neck to tank gasket, place filler neck in position on tank, and fasten with cap screws and screw gaskets. NOTE: *On vehicles after serial 13,560, no gasket is used between filler neck and tank, and toothed lock washers are used in place of the screw gaskets. Tighten screws around filler neck finger-tight; then using a suitable spring scale and wrench, make a final tightening round to tighten screws uniformly to a torque of not to exceed 2 foot-pounds.* CAUTION: *Excessive tightening of screws holding filler neck to tank on vehicles after serial 13,560 may loosen metal inserts in tank.* Position filler neck hole

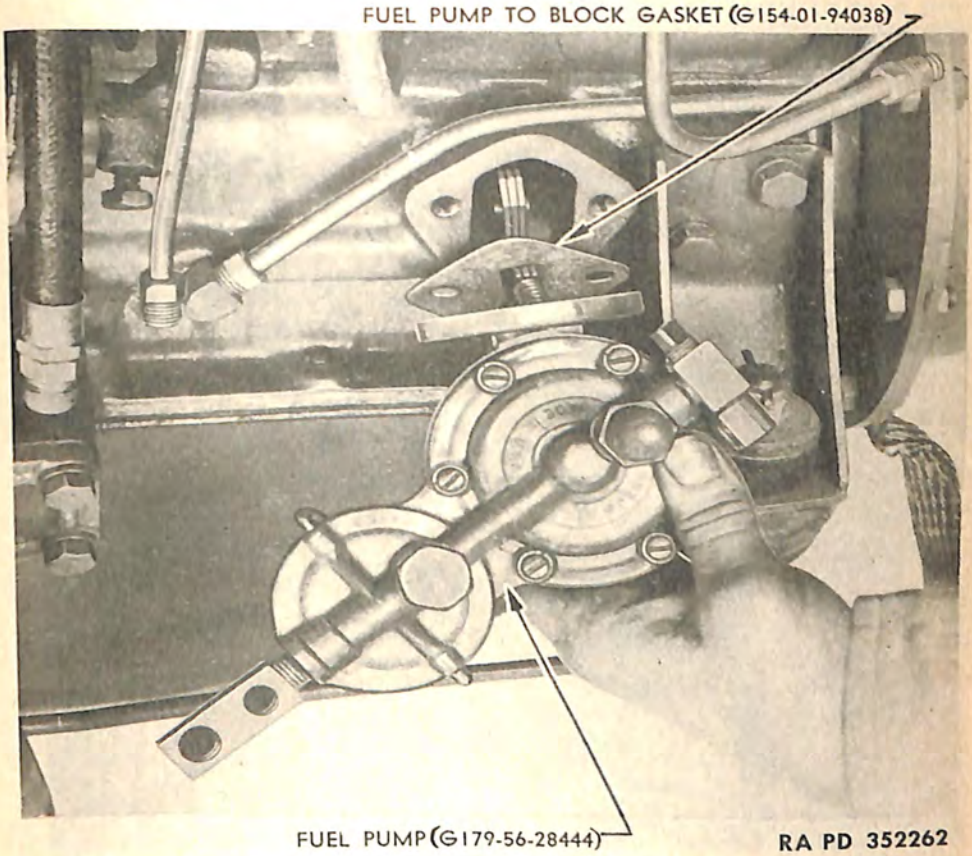
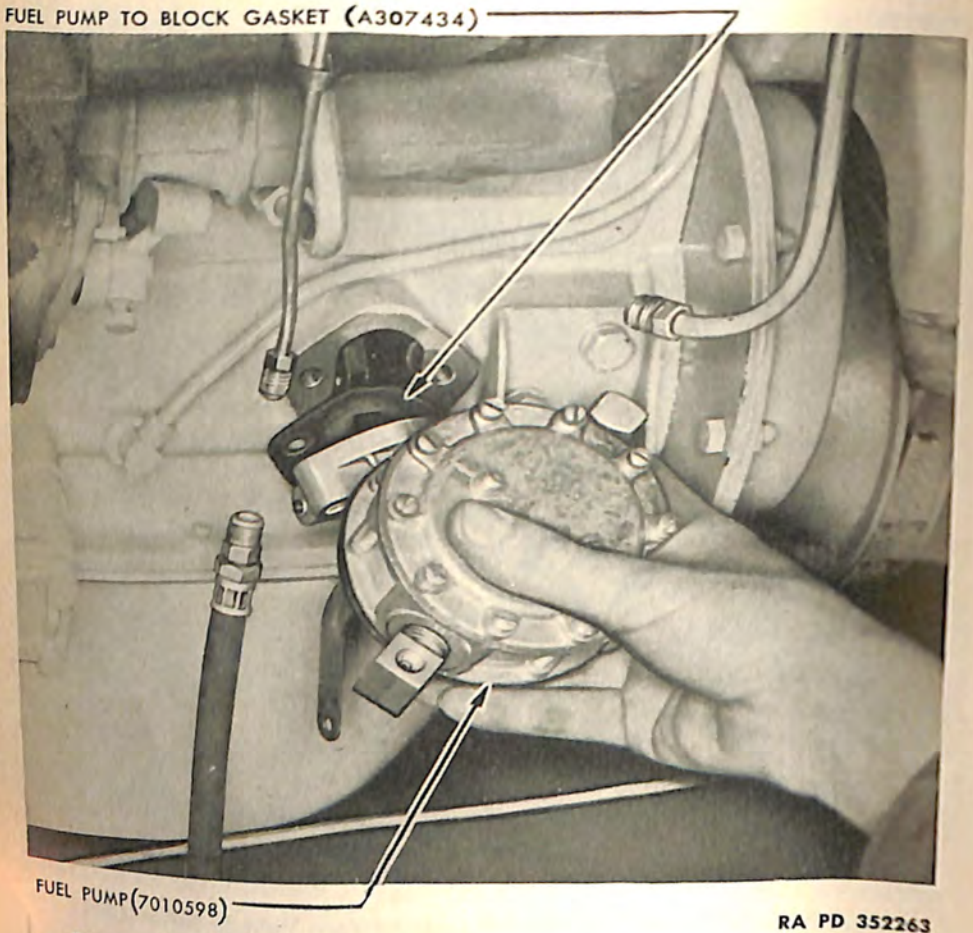


Figure 74 — Removing Fuel Pump (Before Vehicle Serial 3601)

cover over filler neck, install cap screws, plain washers and lock washers, and tighten. Install filler neck hole cover seal between clamp and filler neck and tighten clamp screw. Securely tighten the straps holding the tank in position. Install tee with valves (or valve and plug) on nipple in tank. Connect stand-by heater fuel pipe (if so equipped), fuel tank to filter pipe, and drain pipe at rear of fuel tank. NOTE: *After vehicle serial 9502, connect tank-to-primer pipe at gage tank unit, and connect pump motor wire to pump motor terminal. On vehicles after serial 13,560, connect ground cable to screw on cover plate* (fig. 72). Connect gage tank unit wire at gage tank unit. Install battery hold-down strap to battery cradle with screw, and tighten securely. Install oil-bath-type carburetor air cleaner (par. 91 **d** (2)). Install engine compartment division panel (par. 76 **p**) and front panel (par. 76 **u**). Install batteries (par. 105 **e**). Place engine compartment cover in position and tighten wing nuts.



RA PD 352263

Figure 75 — Removing Fuel Pump (From Vehicle Serial 3601 Through 9502)

86. FUEL PUMP.

a. **Description.** The fuel pump used before vehicle serial 3601 is a diaphragm-type pump with sediment bowl, screen, and hand priming lever. After vehicle serial 3600, a larger diameter fuel pump is used. This pump is also of the diaphragm type and has six valves and a hand priming lever. Either pump fastens to right side of cylinder block near the front, and the pump rocker arm is operated by a lobe on engine camshaft. After vehicle serial 9502, an electric fuel pump unit is used and is located within the gasoline tank. The pump itself consists principally of an impeller driven by an electric motor. A cylindrical strainer screen with cover and air vent tube fits over a support base to which the pump is mounted. The electric fuel pump unit operates whenever the ignition switch is turned on.

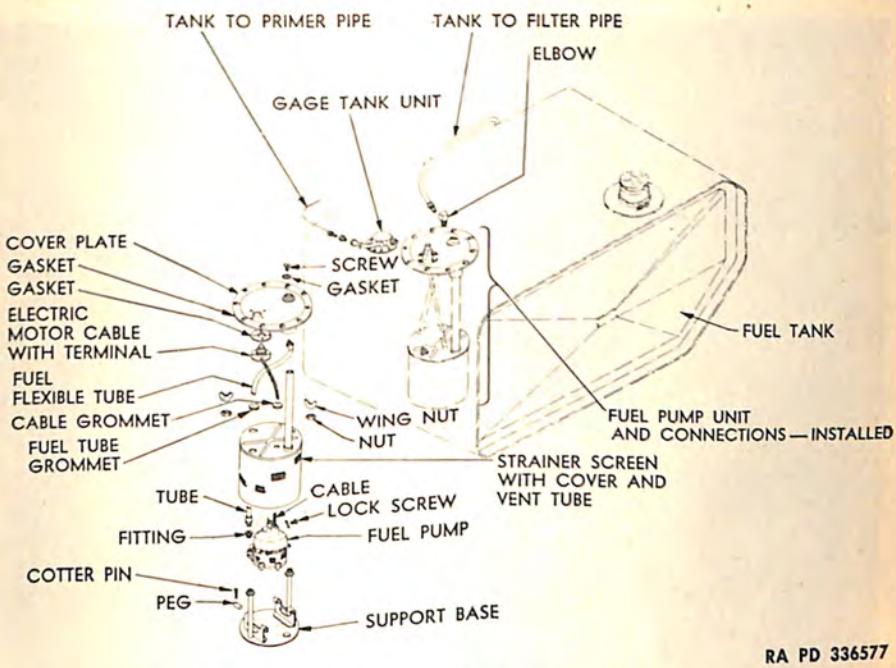
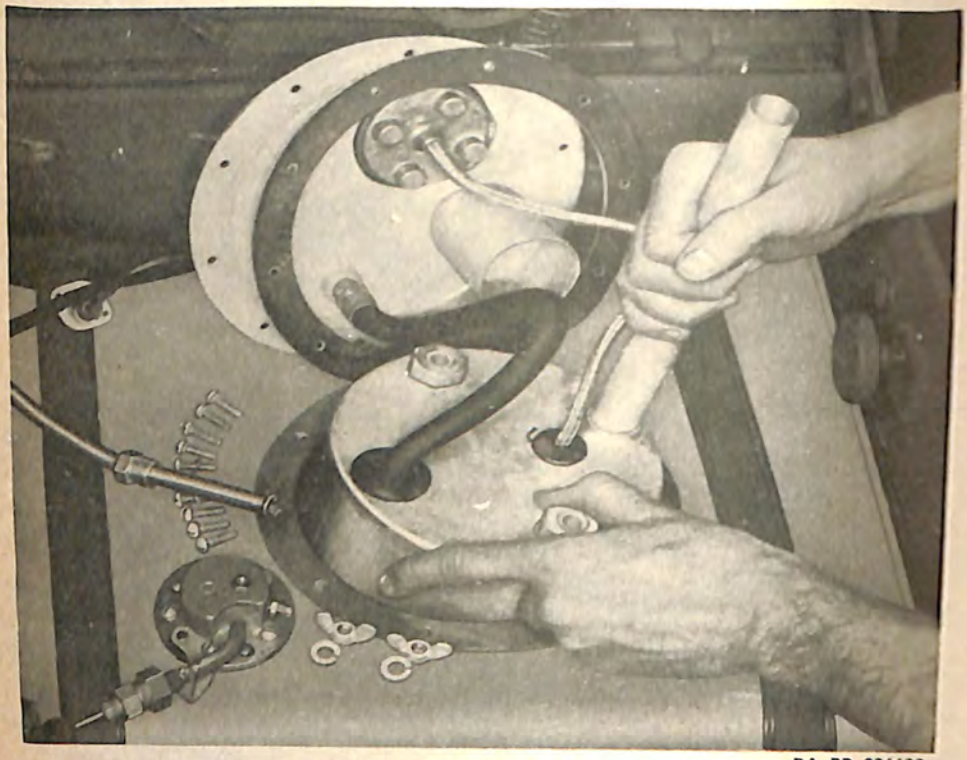


Figure 76 — Electric Fuel Pump Unit — Installed and Disassembled (From Vehicle Serial 9503 Through 13,560)

b. Cleaning Sediment Bowl and/or Strainer.

(1) BEFORE VEHICLE SERIAL 3601. Loosen wing nuts, remove engine compartment cover, and close inlet valve at top of fuel filter. Loosen fuel pump bowl retainer nut, swing yoke and nut out from under bowl, and remove bowl, gasket, and strainer (fig. 73). Empty bowl and clean strainer thoroughly with dry cleaning solvent. Blow through strainer with compressed air and wipe out bowl with a clean rag. Install strainer and make sure that end of pick-up pipe in center of bowl cover has entered center hole in strainer. Use a new gasket, place bowl in position with upper rim against gasket, swing yoke and clamp nut under bowl, and tighten nut securely. Open inlet valve at top of fuel filter and operate fuel pump hand priming lever to fill bowl. To determine that bowl is full, disconnect fuel pipe from carburetor and, as pumping continues, gasoline will flow from end of pipe when bowl and supply pipe are full. Connect pipe to carburetor, place engine compartment cover in position, and fasten lid with clamps and wing nuts.

(2) AFTER VEHICLE SERIAL 9502. Remove electric pump unit (subpar. c (2) below) and partially disassemble (subpar. d below).



RA PD 336633

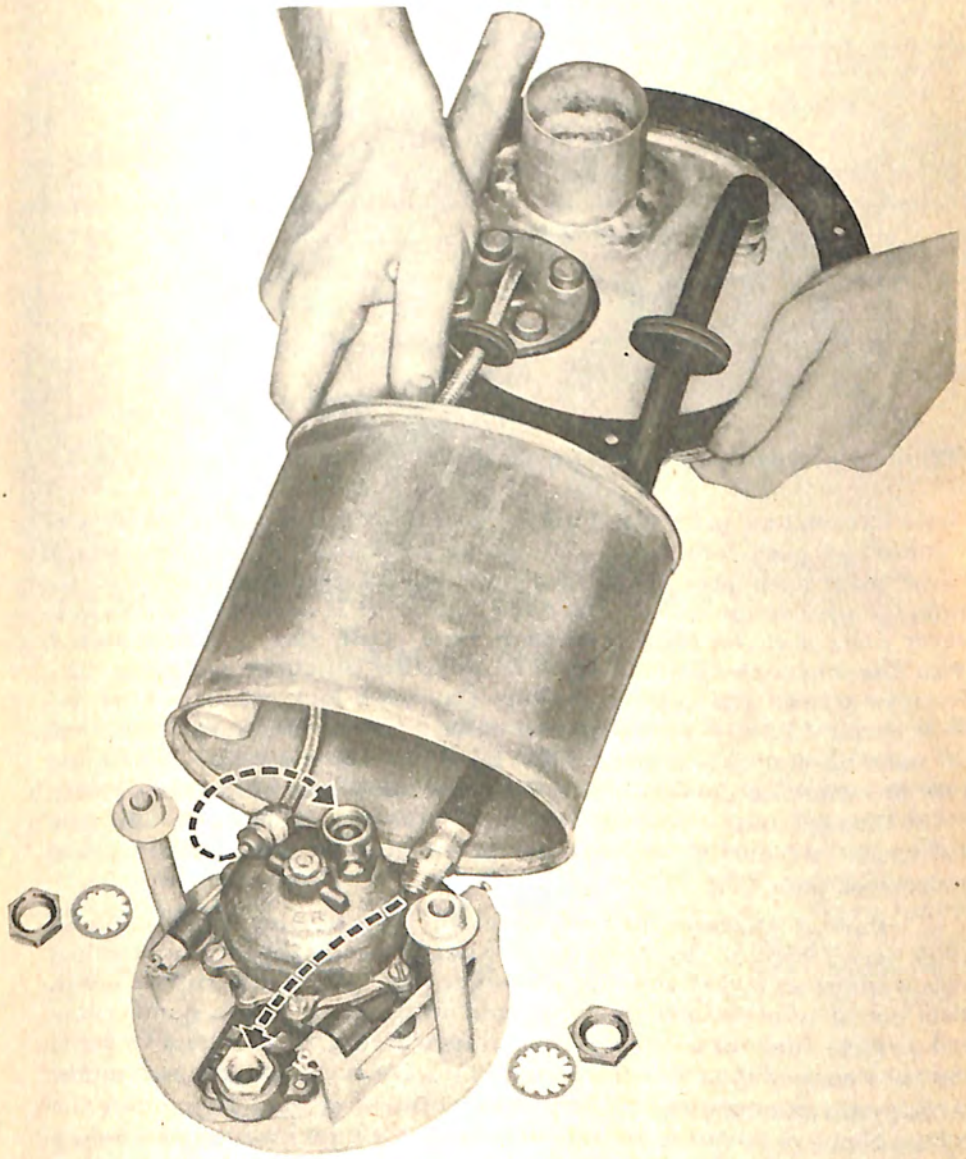
Figure 77 — Removing Electric Fuel Pump Unit From Tank (After Vehicle Serial 9502)

Wash screen thoroughly with dry cleaning solvent and blow through screen with compressed air. Assemble electric pump unit (subpar. e below), and install (subpar. f (2) below).

c. Removal.

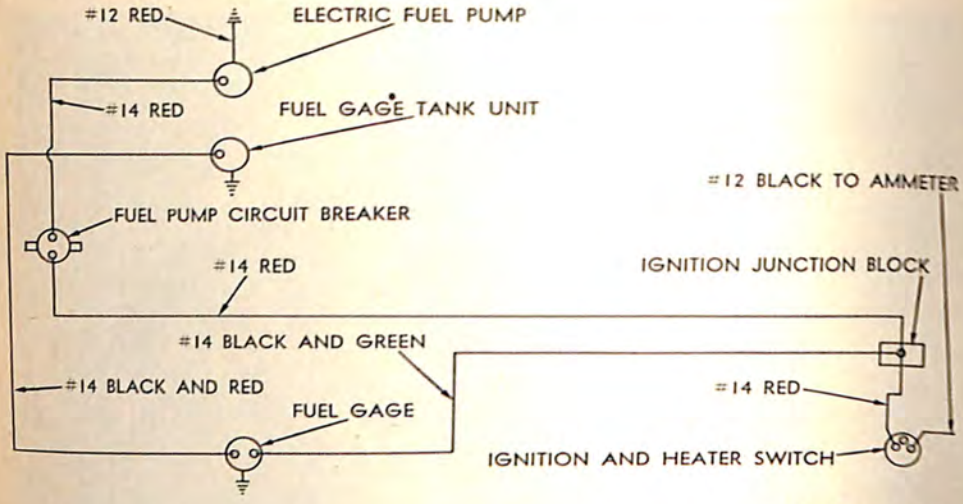
(1) MECHANICAL FUEL PUMP (ON VEHICLES BEFORE SERIAL 9503). Remove fuel tank (par. 85 c). Disconnect primer pipe, fuel inlet pipe, and outlet pipe from fittings at fuel pump. Take out cap screws that hold fuel pump to cylinder block and remove pump (fig. 74 or 75) and gasket. If pump is to be replaced, remove fittings from original pump and install on replacement unit.

(2) ELECTRIC PUMP UNIT (ON VEHICLES AFTER SERIAL 9502) (fig. 76). Loosen the fastener wing nuts and lift off engine compartment cover. Disconnect both electric windshield wiper motor cables at connector sockets, remove bolts, nuts, and washers holding front top panel to right front and side deck coaming, and lift off front panel. Remove terminal screw to disconnect pump motor wire at



RA PD 336636

Figure 78 — Removing Cover, Screen, and Connections From Electric Fuel Pump and Support Base (After Vehicle Serial 9502)



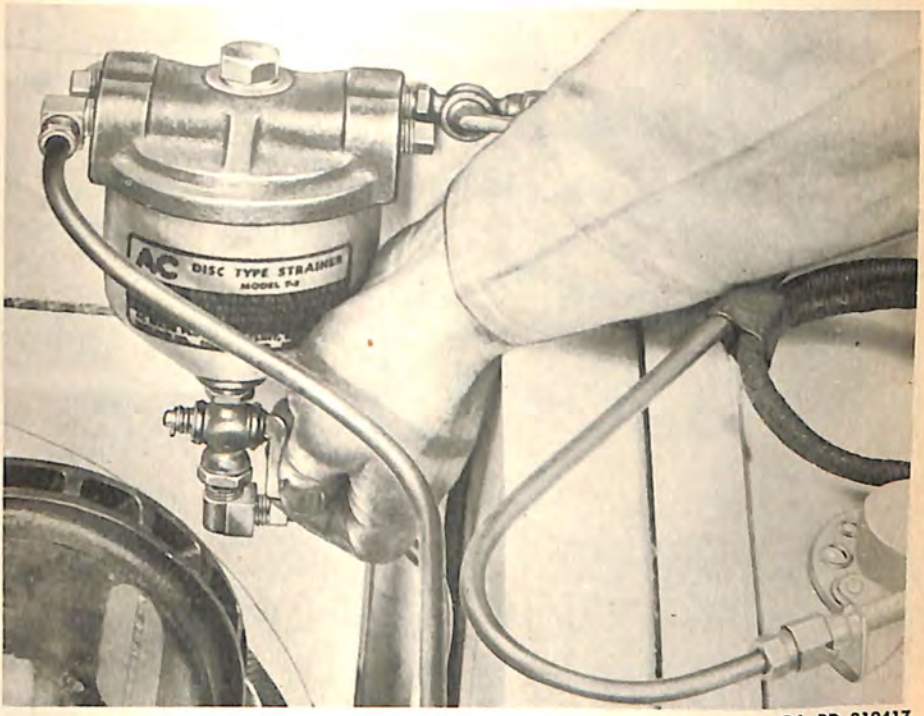
RA PD 336643

Figure 79 — Fuel System Wiring Diagram (After Vehicle Serial 9502)

cable terminal on tank cover plate, and disconnect fuel gage wire at terminal on gage tank unit. Uncouple tank to filter pipe from tank cover plate and carefully spring pipe out of the way. NOTE: *On vehicles after serial 13,560, the gage tank unit is mounted on the tank cover plate and the tank to primer pipe must also be disconnected. Also disconnect the ground cable from screw on cover plate* (fig. 72). Remove screws and copper gaskets (toothed lock washers after vehicle serial 13,560) which secure tank opening plate to tank; then lift plate up and to one side. NOTE: *After vehicle serial 13,560, use care in removing cover plate with gage tank unit attached.* Reach down through tank opening to remove the two wing nuts and lock washers at strainer cover and lift pump unit at vent tube, upward and out of tank (fig. 77).

d. Partial Disassembly of Electric Pump Unit (On Vehicles After Serial 9502). Remove the two hex nuts and the internal-toothed lock washers at top of strainer screen cover. Work the rubber grommets out of screen cover openings and upward on pump motor cable and flexible fuel tube. Lift screen upward to obtain access to cable and tube connections at pump (fig. 78). Loosen lock screw at motor cable pump connection. Disconnect cable and fuel tube from the pump. Remove cotter pins and rubber pegs which cushion and secure the fuel pump to the support base. Lift the pump off the support base.

e. Assembly of Electric Pump Unit (On Vehicles After Serial 9502). Position fuel pump on support base so that point of fuel tube



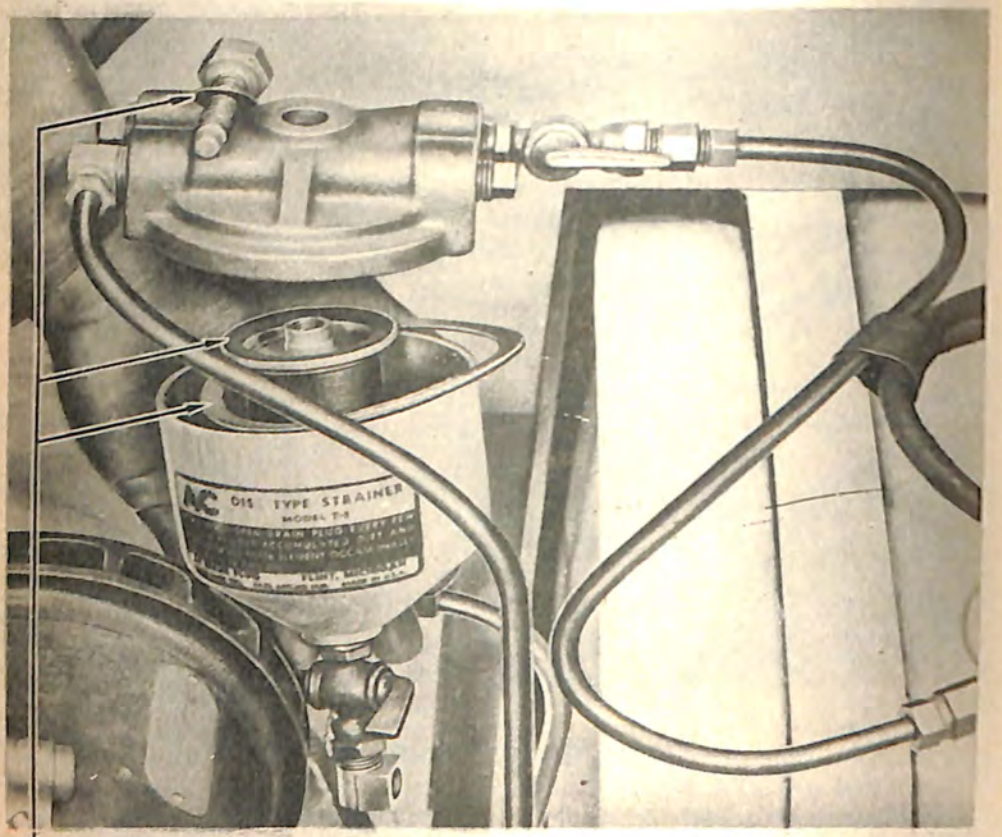
RA PD 319417

Figure 80 — Draining Fuel Filter

connection on pump is on the side opposite the boss in support base. Install rubber pegs and new cotter pins to the cushion and fasten the pump to the support base. Connect pump motor cable by screwing plug terminal end into pump; then tighten lock screw. Connect lower end of flexible fuel tube to pump and tighten tube coupling. Place strainer screen with cover and vent tube down over pump and support so that vent tube fits over boss in support base. Work rubber grommets down on motor cable and flexible fuel tube and into position in screen cover. Install the internal-toothed lock washers and two hex nuts at top of strainer screen cover to secure screen to pump and support base assembly.

f. Installation.

(1) MECHANICAL FUEL PUMP (ON VEHICLES BEFORE SERIAL 9503). Place a new gasket and the pump in position against cylinder block so the underside of rocker arm contacts eccentric lobe on engine camshaft. Install screws with lock washers and tighten pump securely to cylinder block. Connect fuel outlet pipe, inlet pipe, and primer pipe to fittings on fuel pump. Install fuel tank (par. 85 d).

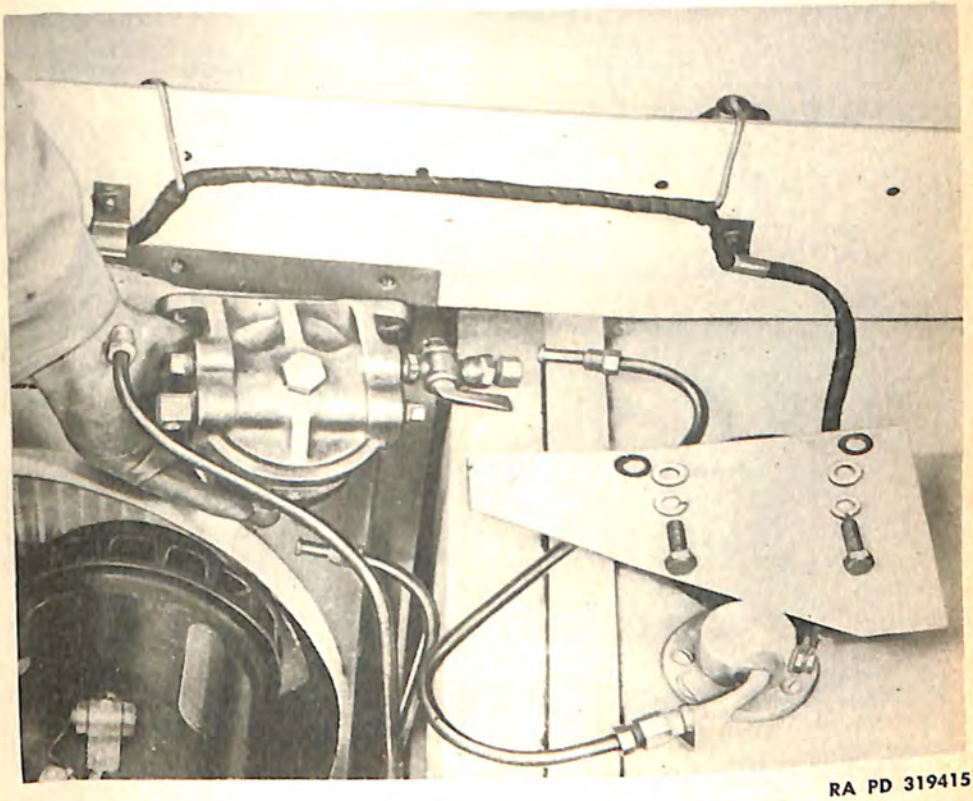


GASKET SET (G630-01-94018)

RA PD 352264

Figure 81 — Removing Fuel Filter Element for Servicing

(2) Electric Pump Unit (On Vehicles After Serial 9502). On vehicles before serial 13,561, lower pump unit through tank opening with air vent tube toward right side of vehicle and shift assembly as necessary to work two fastening studs in tank base up through the pump support base tubes. On vehicles after serial 13,560, place the gage float and primer outlet pipe through tank opening; then maneuver tank opening plate so that pump unit can be lowered in position as previously described. Install the lock washers and two wing nuts to fasten pump unit within the tank. Position tank opening plate and gasket over opening in tank, shifting it as necessary to fit plate over upper end of vent tube. Aline plate fastening screw holes and install copper gaskets and screws. NOTE: *After vehicle serial 13,560, the cover plate gasket is not used and the copper gaskets are replaced by toothed lock washers. Tighten screws around cover plate*



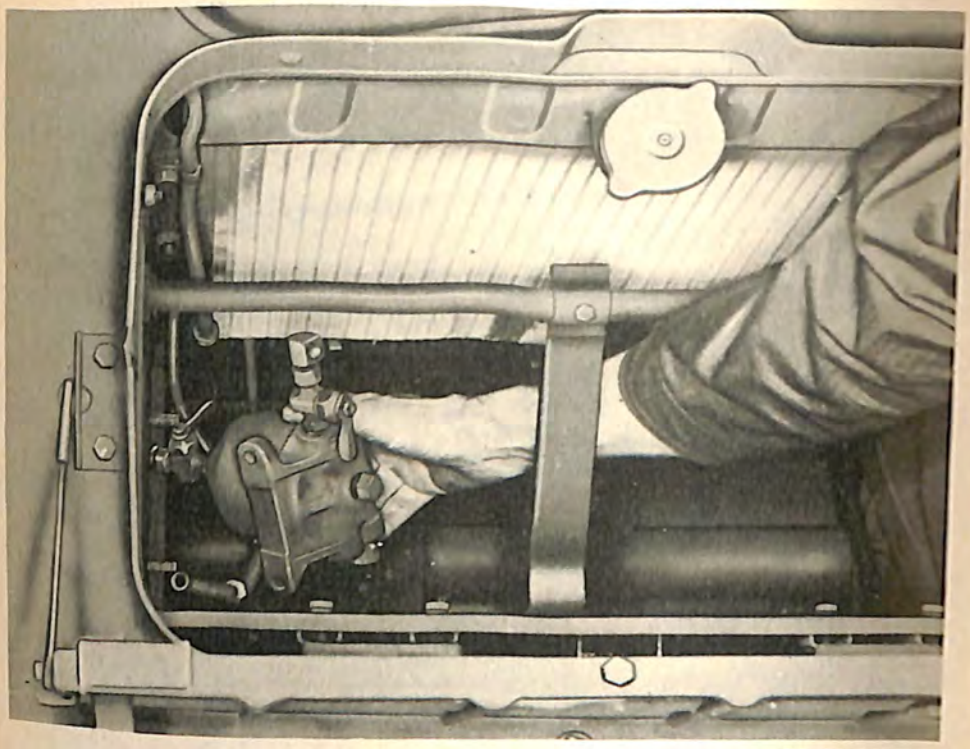
RA PD 319415

Figure 82 — Removing Fuel Filter (Before Vehicle Serial 1003)

finger-tight; then using a suitable spring scale and wrench, make a final tightening round to tighten screws uniformly to a torque of not to exceed 2 foot-pounds. CAUTION: *Excessive tightening of screws holding cover plate to tank on vehicles after serial 13,560 may loosen metal inserts in tank.* Connect tank to filter pipe end coupling to elbow on tank plate. Connect red wire to pump motor terminal on tank plate and fasten black wire with red tracer at fuel gage tank unit terminal post. NOTE: *On vehicles after serial 13,999 (approx.), connect ground cable to screw on cover plate.* Place engine compartment front top panel into position and install bolts, toothed lock washers, and nuts. Connect electric windshield wiper motor cables at connector sockets. Install engine compartment cover and secure by tightening cover fastener wing nuts.

87. FUEL FILTER.

a. Description. A fuel filter is used on the vehicle to remove water and foreign matter from the fuel before it reaches the carburetor.



RA PD 336516

Figure 83 – Removing Fuel Filter (After Vehicle Serial 1002)

On vehicles prior to serial 1003, the filter is mounted on the inside of coaming and to the left of the fuel tank, directly above the right corner of the radiator. After vehicle serial 1002, the filter is mounted on the right wall of the air intake duct at the front of the vehicle.

b. Draining and Cleaning. Remove drain plug from right side of hull near front. Open drain valve below filter to drain out fuel and sediment (fig. 80). To remove filtering element and bowl for cleaning, disconnect filter drain pipe from fitting on bottom of bowl. Take out filter to cover retaining screw from top of filter, remove bowl with element (fig. 81), and clean thoroughly in dry cleaning solvent. Dry with compressed air, if available, making sure all sludge and sediment are removed. Examine and, if necessary, install new parts. Assemble element and bowl with new gaskets, making sure that gaskets seat properly and that cover retaining screw is tightened securely. Connect drain pipe to filter valve, close drain valve, and install drain plug in right side of hull.

c. Removal (figs. 82 and 83). On vehicles before serial 1003 with filter mounted in engine compartment, remove engine compartment

cover. Disconnect filter inlet and outlet pipes from filter fittings. Disconnect drain pipe from filter valve. Take out fastening screws with washers and remove filter.

d. Installation. Place filter in position and install fastening screws with washers. Connect drain pipe to filter valve, and connect inlet and outlet pipes to fittings in filter. Install engine compartment cover on vehicles prior to serial 1003 with fuel filter mounted within engine compartment.

88. EXTERNAL FUEL PIPES AND CONNECTIONS.

a. Description. Rigid-type external pipes are used in the fuel system. Flexible connections are used where necessary to minimize danger of breakage from vibration and shock. The tank to filter pipe on vehicles having a mechanical fuel pump (vehicles before serial 9503) extends from the gage tank unit to fuel filter shut-off cock. After vehicle serial 9502, the tank to filter pipe extends from the fuel pump connection on the tank cover plate to the filter shut-off cock. On vehicles before serial 9503, the filter to fuel pump pipe extends from elbow connection on the filter to a flexible connection at the fuel pump. The fuel pump to carburetor pipe (before vehicle serial 9503) extends from an elbow connection at the fuel pump to an elbow connection at the carburetor. After vehicle serial 9502, the filter to carburetor pipe extends from the filter to a flexible connection and elbow at the carburetor. The tank drain pipe extends from drain cock at bottom of tank to drain outlet in hull. The filter drain pipe extends from drain cock at bottom of filter to drain outlet in hull. Before vehicle serial 9503, the fuel pump to primer pipe extends from elbow connection at fuel pump to a flexible connection which, in turn, connects to primer inlet pipe. After vehicle serial 9502, the tank to primer pipe extends from gage tank unit connection to the primer on back of instrument panel. The primer to manifold pipe extends from primer to the rear tee and nozzle connection on intake manifold. A connector pipe extends from the rear tee and nozzle on intake manifold to center tee and nozzle, and another connector pipe extends from the center tee and nozzle to the elbow and nozzle at front end of intake manifold. NOTE: *On vehicles after serial 13,560, flame-proof flexible connections are used at the tank end of the tank to filter pipe and at the carburetor end of the filter to carburetor pipe.*

b. Repair. To repair the external fuel pipes, follow the same procedure as given for repair of the external oil pipes (par. 71 b).

c. Removal. Disconnect couplings at ends of fuel pipe and remove pipe.

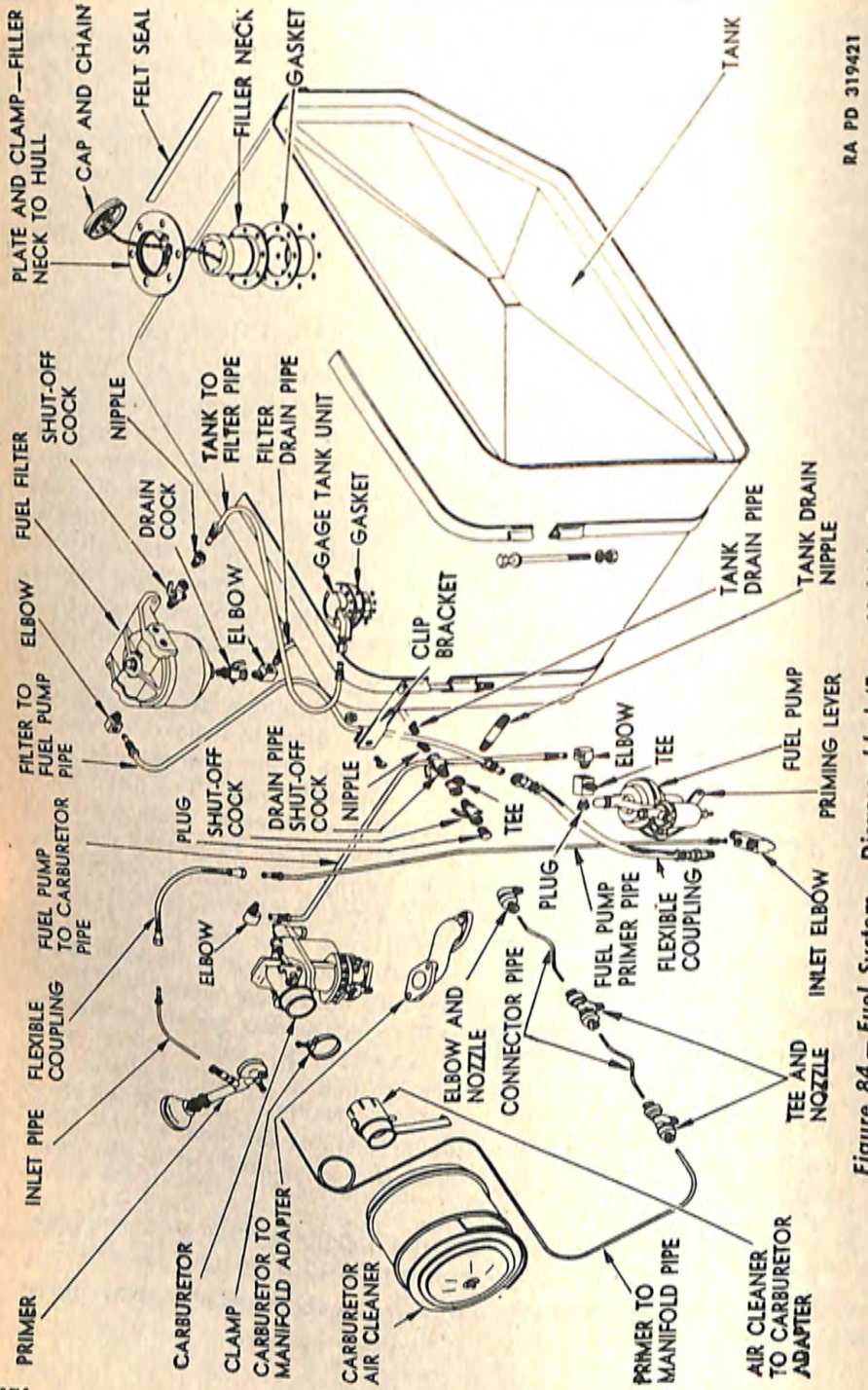


Figure 84 — Fuel System — Disassembled (From Vehicle Serial 1003 Through 3600)

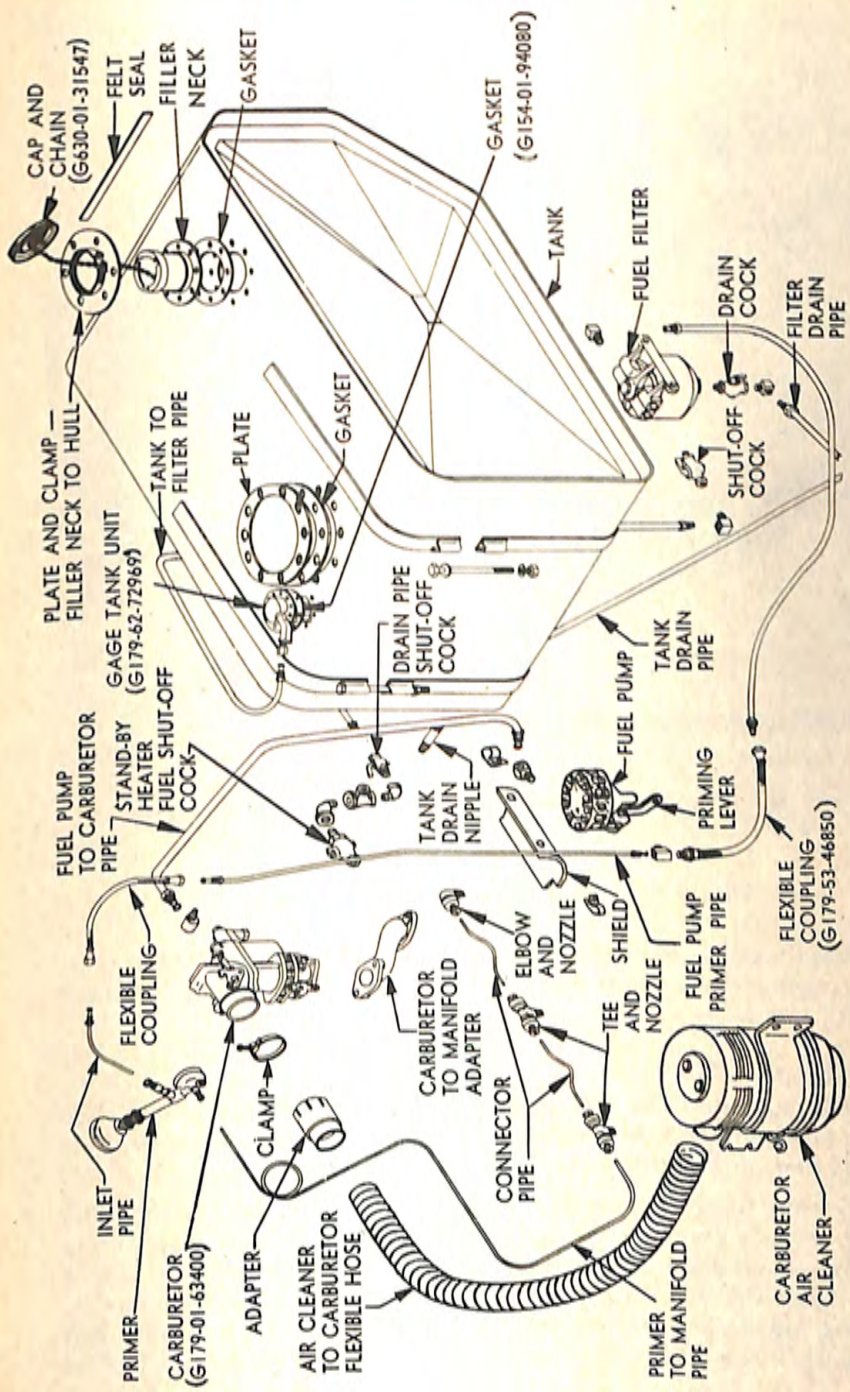
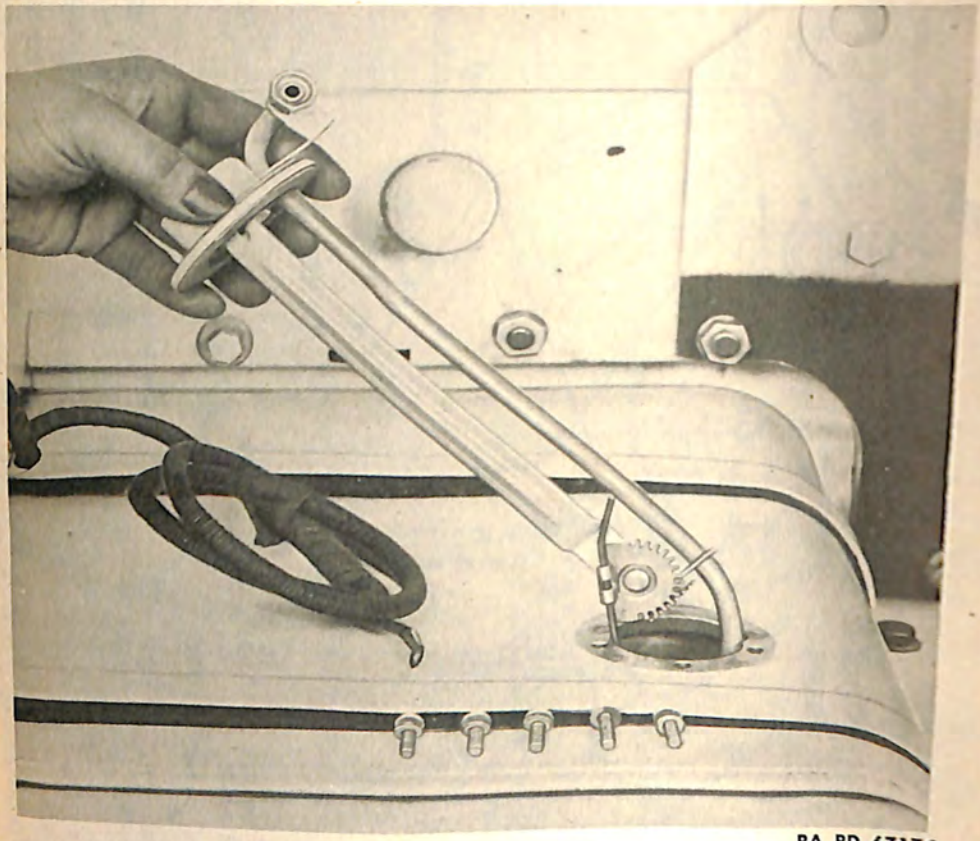


Figure 85 — Fuel System — Disassembled (From Vehicle Serial 3601 Through 9502)



RA PD 67174

Figure 86 — Removing Fuel Tank Gage

d. **Installation.** Place pipe in position and start coupling nuts by hand, screwing them finger-tight. Then tighten couplings at both ends with wrench.

89. FUEL GAGES.

a. **Description.** The electrical fuel gage, consisting of the dash unit, the tank unit, and the electrical circuit, registers the approximate supply of fuel in the tank.

b. **Testing Gages.** To ascertain whether the dash unit or tank unit is faulty, make a test with a tank unit that is known to be accurate by disconnecting gage wire from tank unit and attaching it to test unit. Ground the test unit onto vehicle and turn on ignition switch. Raise and lower float of test unit by hand. If, when raising and lowering float, the dash gage registers, the test indicates the tank is

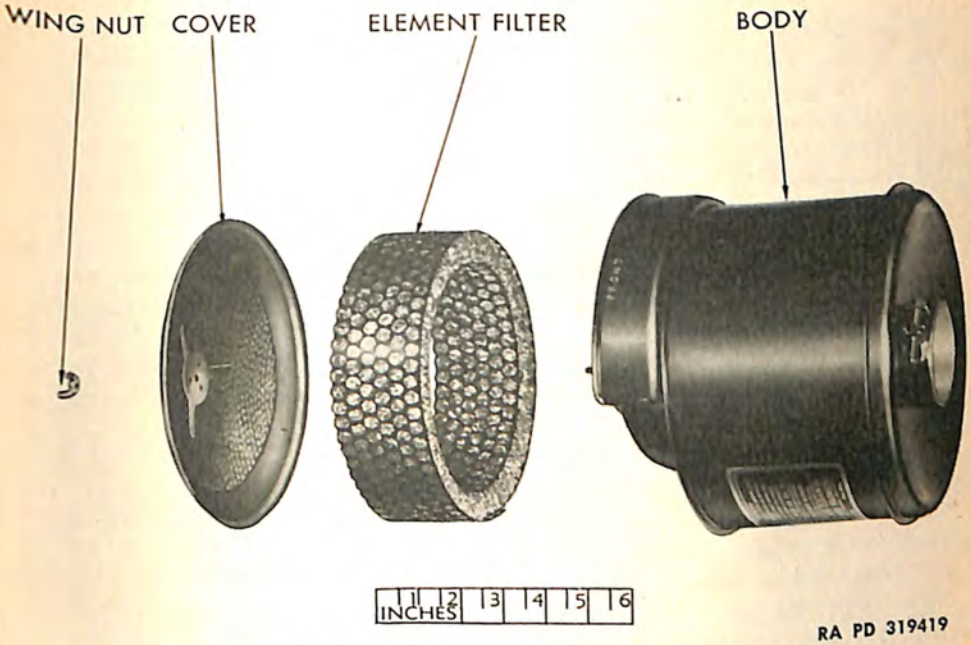


Figure 87 — Carburetor Air Cleaner — Disassembled (Before Vehicle Serial 3601)

faulty; replace tank unit. If, however, raising and lowering the float has no effect on the dash gage, the trouble is within the dash unit or circuit. Replace the dash unit (par. 167) unless a check indicates the wiring is the source of trouble.

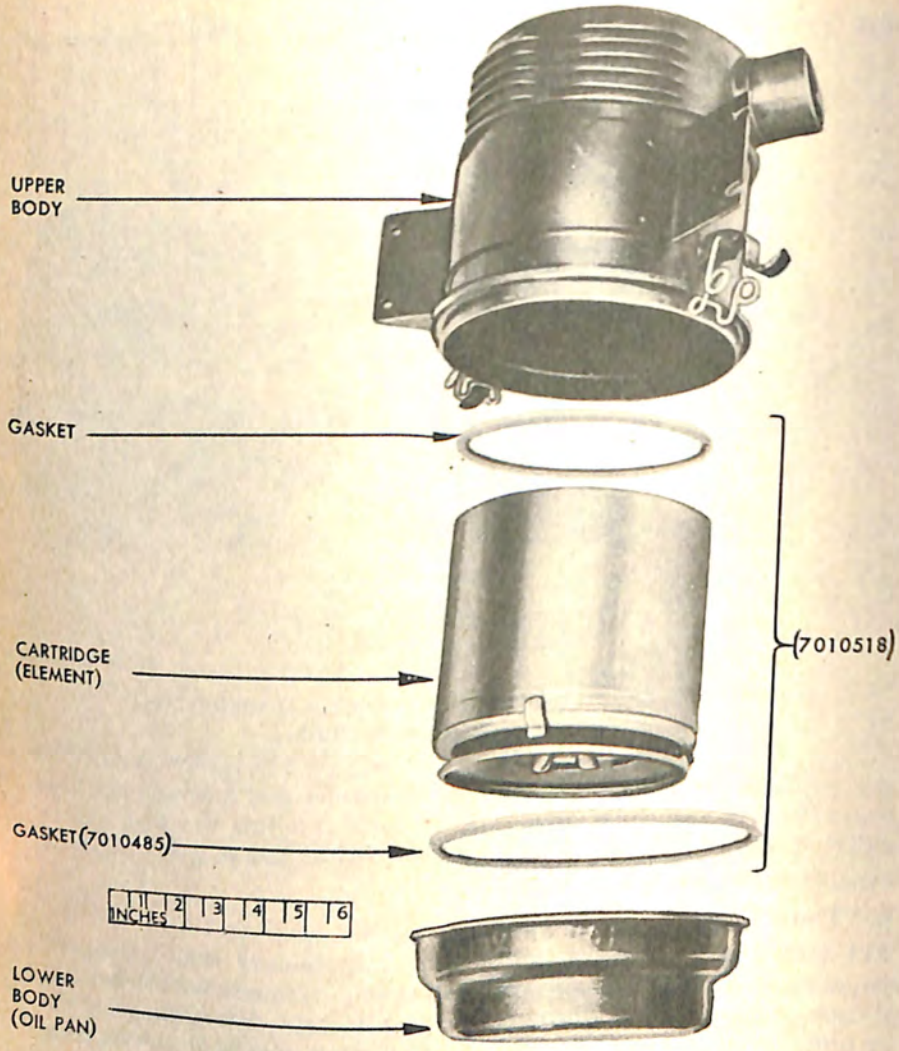
c. Tank Unit.

(1) REMOVAL. Loosen wing nuts and remove engine compartment cover. Remove tank unit electrical connection terminal nut and lock washer. Disconnect fuel outlet pipe from fitting on the tank unit. Remove screws and screw gaskets that hold unit to tank, and remove unit (fig. 86).

(2) INSTALLATION. Place a new gasket in position, install the tank unit, and fasten it securely in position on top of tank with screw gaskets and screws. Connect wire to terminal post and fuel pipe to fitting on tank unit. Install engine compartment cover and fasten with clamps and wing nuts.

90. PRIMER.

a. Description. The primer consists of a pump and a system of fuel inlet and outlet pipes. When the primer knob on instrument panel is pulled outward, a charge of fuel is drawn into the pump



RA PD 352266

Figure 88 — Carburetor Air Cleaner — Disassembled (After Vehicle Serial 3600)

cylinder. When the knob connected to pump piston is pushed in, the charge is distributed through the outlet pipe to three connections on the engine intake manifold. It is not probable that the primer will require special service other than to keep the connections tight.

b. Removal. Remove engine compartment cover by loosening the clip wing nuts and lifting cover out of vehicle. Disconnect inlet pipe coupling nut from primer and outlet pipe jam nut. Remove

primer knob from face of instrument panel by turning counterclockwise while holding pump shaft. Loosen lock nut behind panel face and remove escutcheon nut. Slip primer out of panel. If it is necessary to remove the primer pipes, removal procedure will depend on pipe or pipes to be removed; however, no special instructions are needed.

c. Installation. Install lock nut on primer and place in position on panel face, but do not tighten lock nut. Install escutcheon nut and tighten lock nut. Connect outlet and inlet pipes. Screw primer knob on pump shaft while holding flat side of shaft. Be sure that all couplings are tight and that no leakage exists. A very slight leak in system will render primer ineffective. Install engine compartment cover and tighten clip wing nuts.

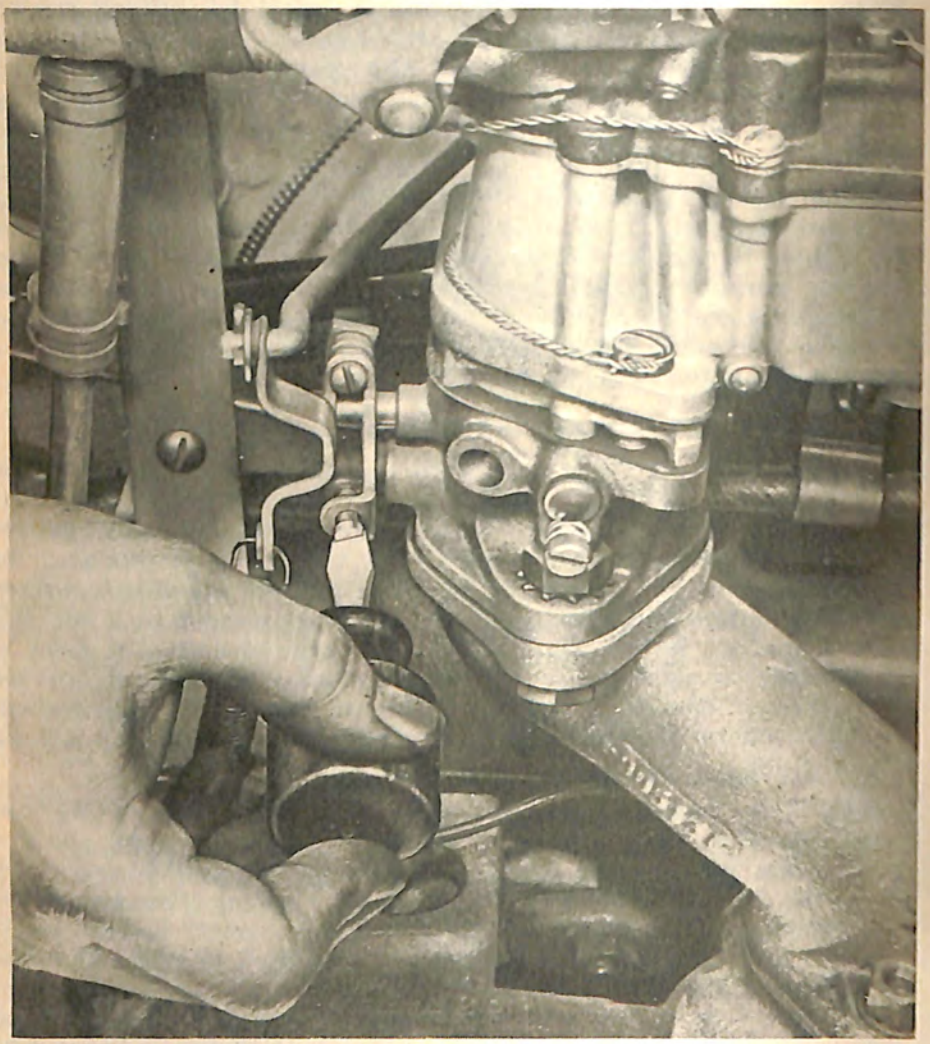
91. CARBURETOR AIR CLEANER.

a. Description. The carburetor air cleaner filters the air before it enters carburetor. The air cleaner on vehicles before serial 3601 has an oil-coated element; vehicles after serial 3600 are equipped with an oil-bath-type air cleaner. For top engine performance, the filter element must be serviced frequently to prevent abrasives entering the cylinders and causing premature and excessive wear of engine internal parts. The oil-coated, element-type cleaner is fastened to the carburetor air horn by use of an adapter and clamp. The oil-bath-type air cleaner is mounted in the battery compartment and is connected to carburetor air horn by a flexible hose and adapter.

b. Servicing Carburetor Air Cleaner.

(1) OIL-COATED ELEMENT TYPE (fig. 87). Loosen wing nuts and remove engine compartment cover. Unscrew wing nut that holds cover on cleaner and remove the cover and filter element. Clean the filter element thoroughly in dry cleaning solvent and allow the element to drain until dry. Then dip element in used crankcase oil or engine oil and permit the excess oil to drain off before installation. Place filter element and cover in position on air cleaner body, install wing nut, and tighten nut with fingers. Install engine compartment cover and fasten in position with clamps and wing nuts.

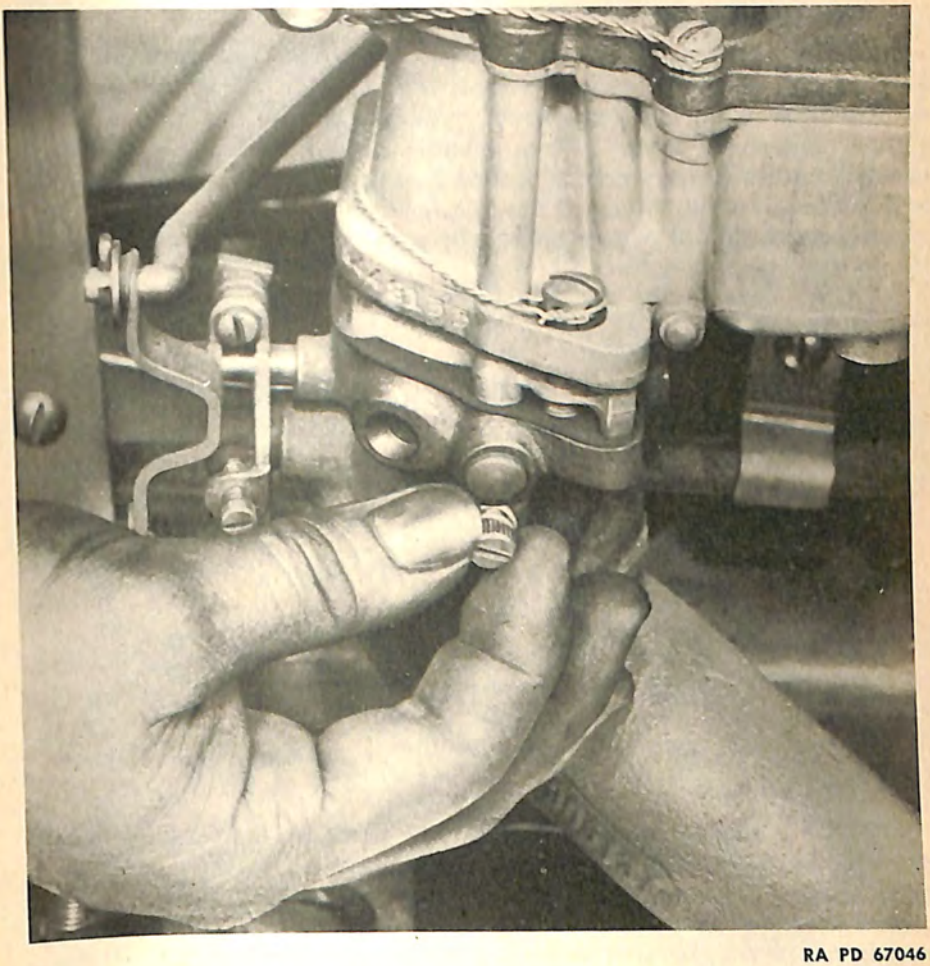
(2) OIL-BATH TYPE (fig. 88). Loosen wing nuts and remove engine compartment cover. Support oil pan (bottom of cleaner) with one hand, unsnap latches, lower the pan, and move it toward engine. Carefully maneuver oil pan up and out of compartment. Empty oil out of pan, clean thoroughly with dry cleaning solvent, and dry with a clean cloth. Install 1 pint of used crankcase oil or engine oil in pan, place pan into position on bottom of cleaner upper body, and fasten properly with the latches. Install engine compartment cover and fasten in position with clamps and wing nuts. NOTE: *When engine oil is changed, remove air cleaner assembly*



RA PD 67045

Figure 89 — Adjusting Carburetor Throttle Stop Screw

(subpar. c (2) below) from vehicle; remove oil pan, loosen wing screw that holds cartridge in upper body, and pull out cartridge. Clean cartridge thoroughly in dry cleaning solvent and allow it to drain until dry. Place cartridge in upper body and tighten wing screw. Clean oil pan, as outlined previously, attach pan to bottom of cleaner upper body, and install air cleaner assembly (subpar. d (2) below).



RA PD 67046

Figure 90 — Adjusting Carburetor Idle Mixture

c. **Removal.**

(1) OIL-COATED ELEMENT TYPE. Loosen the wing nuts and remove engine compartment cover. Loosen the clamp screw located at cleaner outlet and remove cleaner from adapter attached to carburetor.

(2) OIL-BATH TYPE. Loosen wing nuts and remove engine compartment cover. Loosen clamp screw that holds the flexible hose to air cleaner and pull hose away from cleaner. Remove nuts and lock washers from studs that hold the air cleaner to brackets in battery compartment and lift the cleaner assembly out of vehicle.

d. Installation.

(1) OIL-COATED ELEMENT TYPE. Position cleaner on the adapter and tighten the cleaner body clamp screw. Install engine compartment cover and tighten clip wing nuts.

(2) OIL-BATH TYPE. Place cleaner assembly in position on bracket studs in battery compartment, install nuts with lock washers, and tighten securely. Connect flexible hose to air cleaner and tighten clamp screw. Install engine compartment cover and fasten in position with clamps and wing nuts.

92. CARBURETOR.

a. Description and Data.

(1) DESCRIPTION. The Carter carburetor used on the vehicle is simple in design and rugged in construction. The only external adjustments required consist of one controlling idle mixture and one for the idling speed of the engine.

(2) DATA.

Type	Downdraft
Model	BBR1-577S
Main metering (discharge) jets	
Sea-level to 4,000 ft (A307199)	Carter No. 159-59S
4,000 ft to 8,000 ft (G154-02-43041)	Carter No. 159-61S
8,000 ft to 12,000 ft (G154-02-43038)	Carter No. 159-58S
Over 12,000 ft (G154-02-43039)	Carter No. 159-66S

b. Adjustments.

(1) IDLING. Run engine until heat indicator on instrument panel registers 175°F (normal operating temperature). Be sure that choke value is open (choke control on instrument panel all the way in). Loosen wing nuts and remove engine compartment cover. Adjust throttle stop screw (fig. 89) until ammeter just shows charge. Turning screw clockwise will increase engine idling speed; turning screw counterclockwise will reduce idling speed. Adjust idle mixture by turning adjusting screw (fig. 90) in or out with fingers or screwdriver to obtain smoothest engine idling performance.

(2) CHOKE. Loosen choke control wire at swivel screw on choke linkage at carburetor and push choke valve all the way open. Push choke control button all the way in at instrument panel and, while holding choke valve at carburetor in fully opened position, tighten linkage swivel screw to lock choke control wire (fig. 91). Operate choke and check adjustment.

(3) HAND THROTTLE. With hand throttle control button in fully closed position against forward coaming at driver's compartment, loosen throttle control wire collar screw. Hold control wire

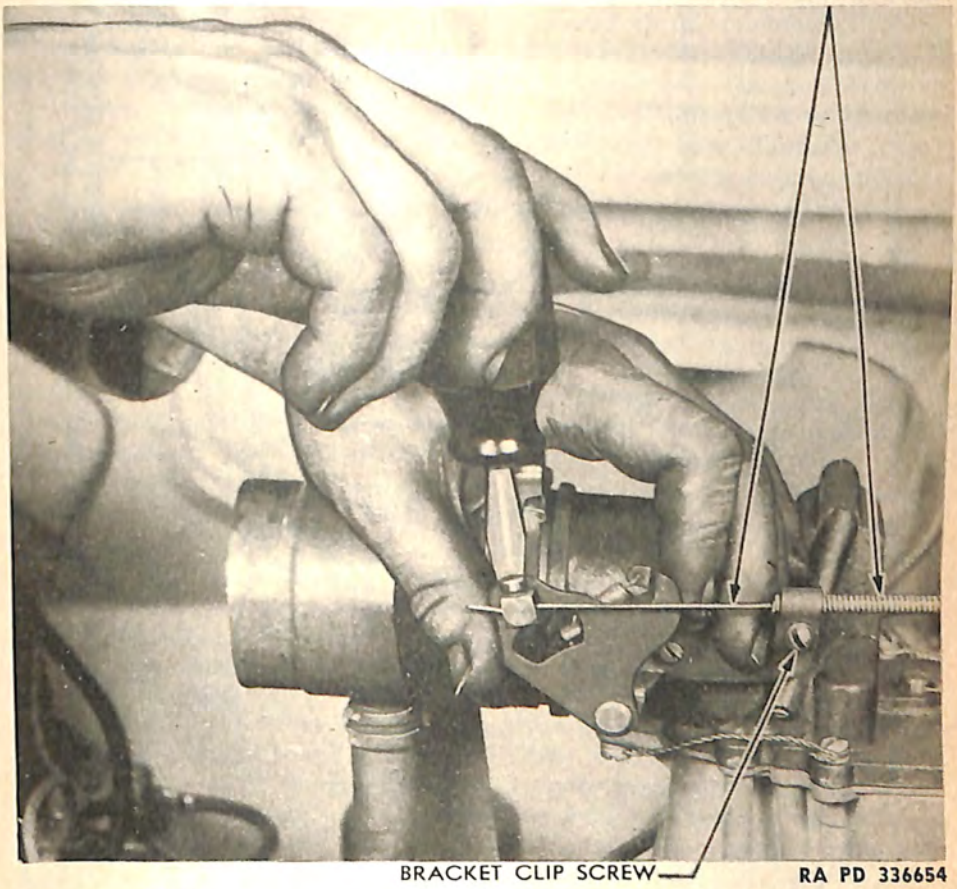


Figure 91 — Adjusting Carburetor Choke Control

collar against accelerator upper operating arm and tighten collar screw.

(4) ACCELERATOR. To adjust accelerator linkage, first adjust throttle stop screw so ammeter just registers charge with engine idling. Loosen throttle control wire collar screw (fig. 92) and reset collar to assure full throttle opening at throttle stop screw on throttle shaft operating arm of carburetor. If throttle valve does not open completely as indicated by fixed stop on the throttle shaft operating arm when accelerator is fully depressed (engine not running), loosen throttle control wire collar. Loosen the accelerator adjustment clevis lock nut and remove the accelerator cable clevis cotter pin and clevis pin. Turn clevis to change the effective length of cable to provide pedal travel required for full throttle opening. Install clevis

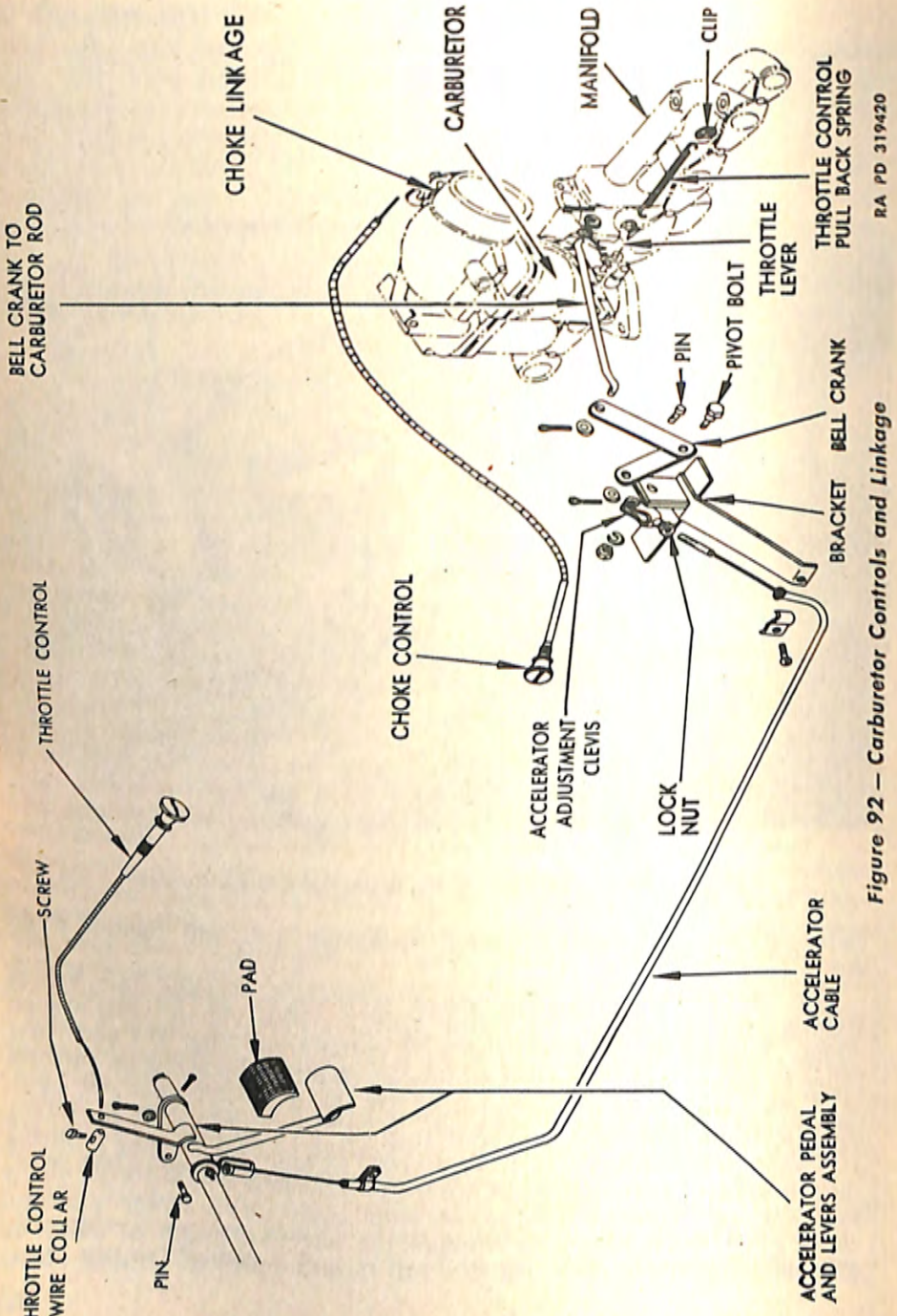


Figure 92 — Carburetor Controls and Linkage

pin, new cotter pin, and tighten clevis lock nut. Reset throttle control wire collar to obtain proper closed throttle idling position. Check linkage to make sure that, with accelerator pedal fully depressed, throttle valve fixed stop on operating arm contacts boss on carburetor; and that, when accelerator pedal is fully released, throttle stop screw fully contacts boss on carburetor. Install engine compartment cover and fasten in position with clamps and wing nuts.

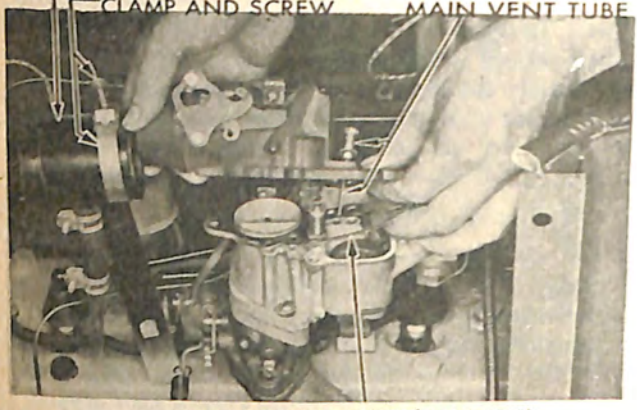
c. Use of Proper Main Metering (Discharge) Jet.

(1) OPERATION AT HIGH ALTITUDES. When a vehicle is operated at high altitudes and the carburetor is equipped with a low-altitude jet, flooding and excessive gasoline consumption will result. Therefore, install a main metering jet with the proper size orifices for the altitude range in which the vehicle is to be operated. The jets for various altitude ranges are listed in subparagraph a (2) above. The Carter number for each jet, as shown on the list, is stamped on the jet and will aid in identifying the proper jet required.

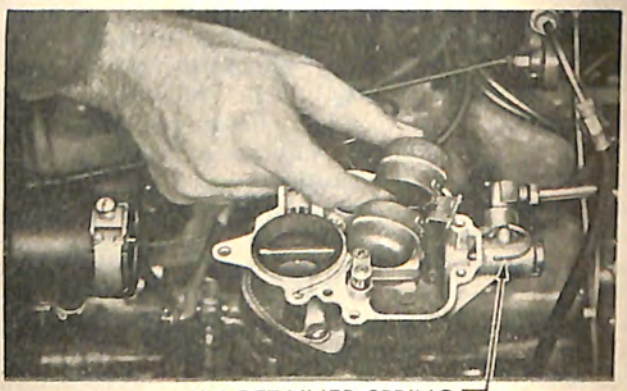
(2) REMOVAL. Loosen wing nuts and remove engine compartment cover. Disconnect choke control wire and tube from bracket on carburetor air horn (fig. 91). Remove air cleaner, or tube, from adapter (figs. 84 and 85). Loosen clamp screw that holds adapter to carburetor air horn, and push adapter rearward away from air horn (fig. 93A). Cut and remove the lock wires from screws that hold the bowl cover and air horn to the main body (fig. 95). Remove the screws that hold the bowl cover and air horn to the main body (fig. 95), and unscrew the main vent tube (fig. 93A). NOTE: *The cover screw in rear is installed from below and threads into the air horn.* Carefully remove the bowl cover with air horn, main vent tube, and gasket (fig. 93A). Remove float pin retainer spring and float assembly with pin (fig. 93B). Unscrew the main metering jet and remove it from float chamber (fig. 93C).

(3) INSTALLATION. Install the main metering jet of proper size with new gasket in bottom of float chamber and tighten securely. Place the float assembly with pin into position in float chamber and install float pin retainer spring. Install a new gasket on main body, carefully place the bowl cover with air horn in position on main body gasket, and make sure the pump plunger piston and step-up piston assembly are positioned properly. Install the cover screws and main vent tube, tighten securely to main body, and lock-wire the screws and vent tube. Move adapter forward over air horn and tighten clamp screw. Install air cleaner or flexible tube on adapter. Connect choke control wire and tube to bracket on air horn, and adjust choke (subpar. b (2) above). Install engine compartment cover and fasten in position with clamps and wing nuts.

d. Cleaning Strainer. Loosen the wing nuts and remove engine compartment cover. Cut the lock wire, pull it out of the strainer



A — REMOVING BOWL COVER AND GASKET

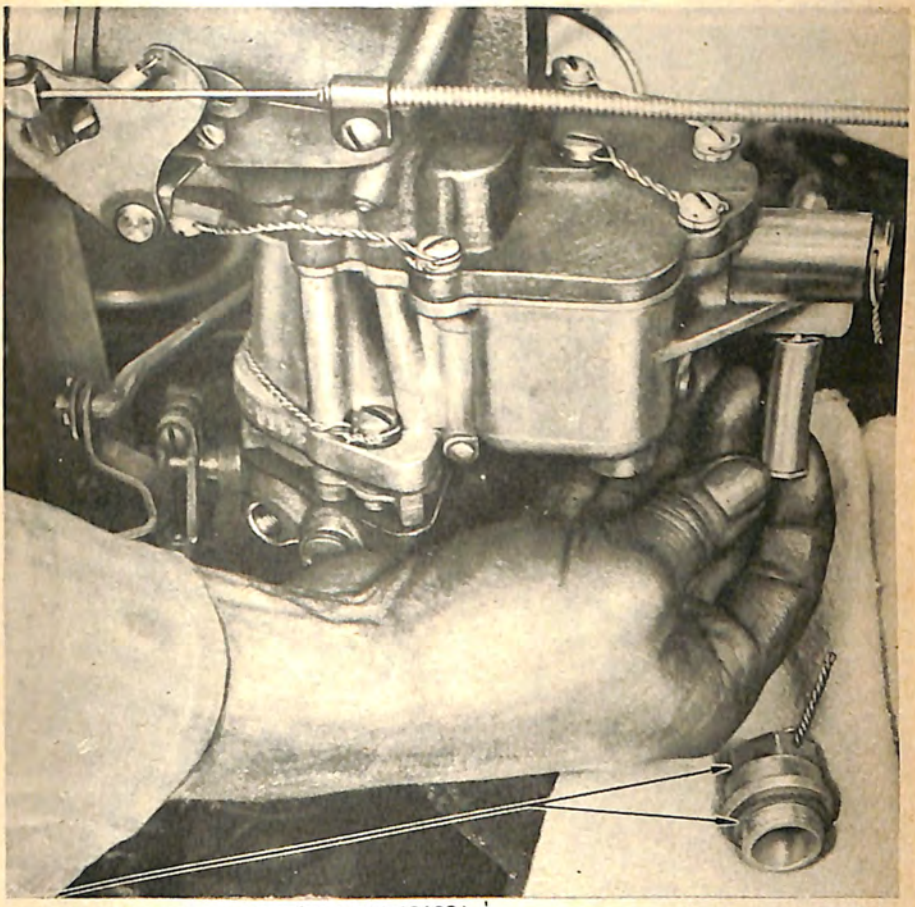


B — REMOVING FLOAT ASSEMBLY AND PIN

C — REPLACING MAIN METERING JET

RA PD 352267

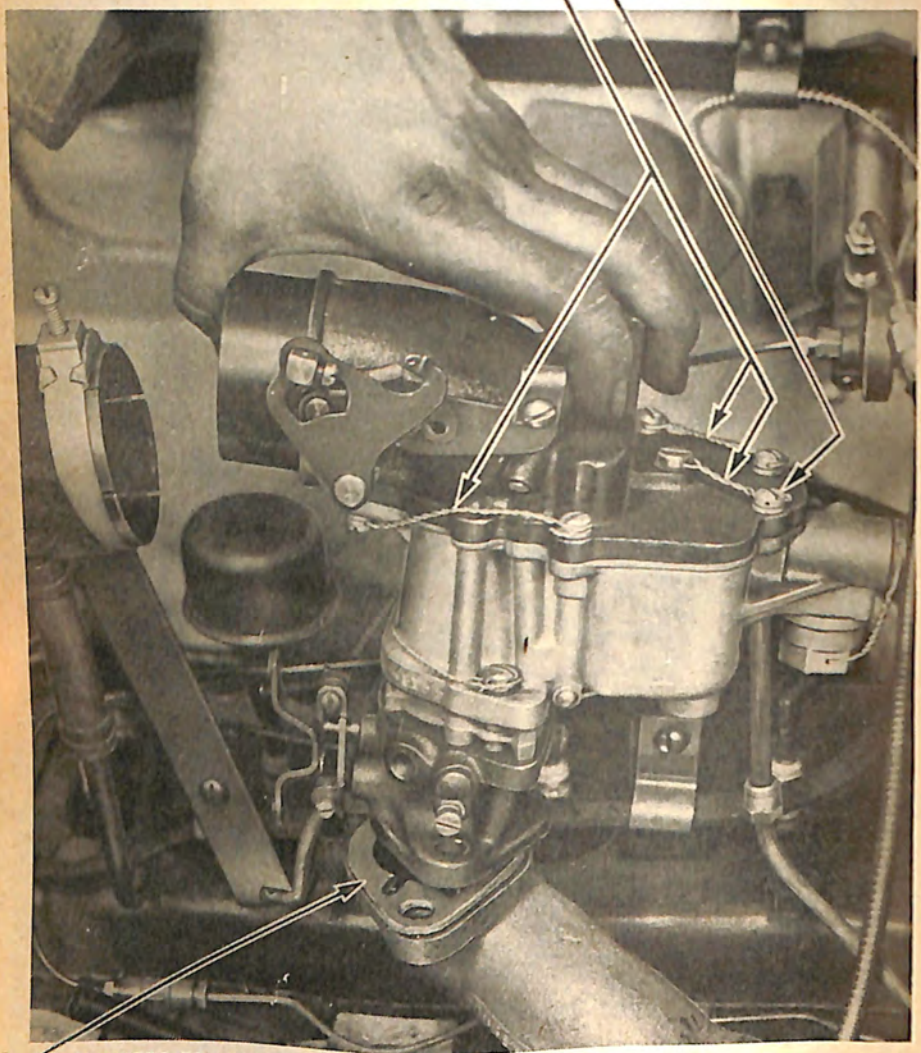
Figure 93 — Replacing Carburetor Main Metering Jet



RA PD 352268

Figure 94 — Removing Carburetor Strainer

plug, and remove the hex-head plug with gasket by turning plug clockwise. Remove the strainer from the carburetor (fig. 94), clean by immersing it in dry cleaning solvent, and dry with compressed air. Install the strainer, using a new gasket on the plug if necessary, and tighten. Lock-wire the strainer plug to float needle valve passage



RA PD 352269

Figure 95 — Removing Carburetor

plug at the rear of carburetor. Install engine compartment cover and fasten it in position with clamps and wing nuts.

e. Removal (fig. 95). Loosen the wing nuts and remove the engine compartment cover. Remove carburetor air cleaner adapter by loosening the clamp screw and pulling adapter off carburetor air horn. Unhook throttle pull-back spring. Disconnect bell crank to carburetor rod at carburetor after removing cotter pin. Loosen screw on choke swivel to disconnect choke control wire and loosen tube at linkage bracket screw. Disconnect fuel pipe from fitting on carburetor. Remove two nuts and lock washers that hold carburetor to manifold adapter. Lift off carburetor assembly and gasket.

f. Installation. Place a new gasket in position on adapter, place carburetor over studs, and install nuts and lock washers. Connect fuel pipe at fitting on carburetor. Connect choke control wire and adjust (subpar. **b** (2) above). Hook up throttle pull-back spring. Connect bell crank to carburetor rod at carburetor linkage, using a new cotter pin. Install carburetor air cleaner adapter on carburetor air horn and tighten clamp screw. Install engine compartment cover and fasten in position with clamps and wing nuts.

93. EXHAUST PIPES, MUFFLER, AND MUFFLER GUARD.

a. Description (fig. 96). The engine exhaust system consists of a muffler, with a short tail pipe, and 2-section exhaust pipe. The muffler is mounted on the rear deck and held in position by two brackets welded to the muffler. The rear exhaust pipe section consists of two solid pipe ends and a flexible center-section pipe. The front exhaust pipe is solid and flanged at both ends for attachment to the manifold flange and to the flange at the front of rear pipe.

b. Exhaust Pipes.

(1) REMOVAL. Remove rear seat backs. Take out the screws and remove hull floor pan. Loosen clamp bolt and nut clamping upper end of rear exhaust pipe to muffler. Remove bolts and nuts that hold the front and rear exhaust pipe flanges together, and remove rear pipe. Remove the clamp, bolts, nuts, and lock washers that hold front exhaust pipe to side of clutch housing. Loosen the wing nuts and remove engine cover. Remove engine compartment division rear panel from vehicles so equipped (par. 75 **g**). Remove the two nuts that hold the front exhaust pipe to the manifold and remove pipe.

(2) INSTALLATION. Place the front exhaust pipe in position, install a new gasket between front flange and manifold, start the stud nuts, and tighten them securely. Install engine compartment division panel (par. 76 **p**) on vehicles so equipped. Fasten the pipe to the side of clutch housing with clamp, bolts, nuts, and lock washers. Place the rear exhaust pipe in position and install a new gasket be-

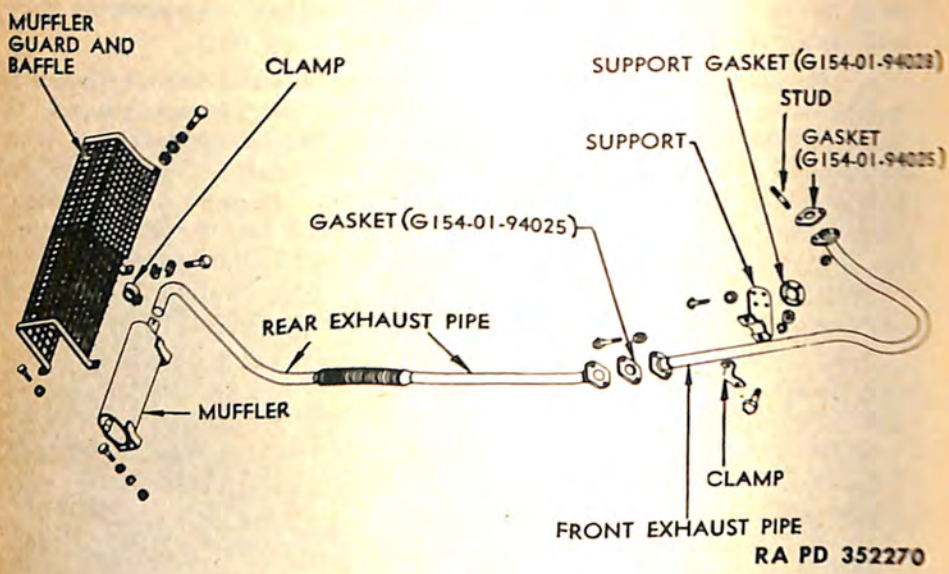


Figure 96 — Exhaust System — Disassembled

tween the flanges of the front and rear pipes. Insert the bolts through the flanges, install the nuts, and tighten them securely. Tighten the clamp bolt and nut that holds the upper end of the rear exhaust pipe to muffler. Place hull floor pan in position and fasten securely with screws. Install rear seat backs. Install engine compartment cover and fasten in position with clamps and wing nuts.

c. Muffler.

(1) REMOVAL. Remove bolts and nuts that hold muffler guard to hull and lift off the guard. Loosen the bolt and nut that holds rear exhaust pipe to muffler, remove the muffler bracket mounting screws, and lift muffler from rear deck.

(2) INSTALLATION. Place rear exhaust pipe in position over muffler intake pipe. Push clamp into position and tighten locking bolt and nut. Insert cap screws through muffler mounting brackets and fasten brackets securely to hull. Install muffler guard and fasten in position with bolts, washers, and nuts.

d. Muffler Guard.

(1) REMOVAL. Remove the bolts, nuts, lock washers, and flat washers that secure the muffler guard in position. Lift off the guard.

(2) INSTALLATION. Place muffler guard in position. Install fastening bolts, nuts, and washers, and tighten securely.

Section XX

COOLING SYSTEM

94. DESCRIPTION.

a. The liquid-type cooling system of this vehicle consists of the radiator, fan, pump, thermostat, and engine water jacket. When the engine is operated, the cooling system pump also operates. Circulation is set up within the water jacket of the engine only until the engine water thermostatic valve opens; the cooling fluid then flows unrestricted through the entire cooling system.

95. CLEANING OF ENGINE COOLING SYSTEM.

a. **General.** This paragraph provides instructions for the cleaning of the engine cooling system, which is to be performed by the second echelon of maintenance.

b. **Materials.** The materials required for this purpose are listed and are available under Federal Stock No. 51-C-1568-500. This cleaning compound consists of the cleaner compound and the neutralizer compound, packed in separate containers within a single package.

c. **Preventive Service.** The cooling system should be cleaned before the antifreeze compound is put into the system, and again after it is removed. Cleaning at the prescribed intervals will reduce clogging and overheating to a minimum, and will largely eliminate the necessity for corrective cleaning by a higher echelon. If the cooling system is very dirty or clogged so that overheating occurs, ordnance personnel should be notified. The entire cooling system should be examined for leaks, both before and after cleaning and flushing. NOTE: *The cleaning solution should never be mixed with antifreeze compound or other antifreeze solutions, or with inhibitors.*

d. **Cleaning.**

(1) Run the engine, with the air duct ventilator lid closed as necessary, until the temperature is within operating range. Stop the engine, remove the radiator cap, and drain the system (par. 96 b (1)). If necessary, use a wire to keep open the drain tee which might become clogged.

(2) Allow the engine to cool. Close the cylinder block and radiator drain cocks; pour water slowly into the radiator until the system is approximately half full; then run the engine at idling speed. Add the cleaning compound in the proportion of 1 container of cleaner to every 4 gallons of cooling system capacity. Then fill the system to the proper level with water. NOTE: *Never mix the water and the cleaning compound before putting them into the system.* CAUTION: *Do not spill the solution on skin, clothing, or painted portions of the vehicle.*

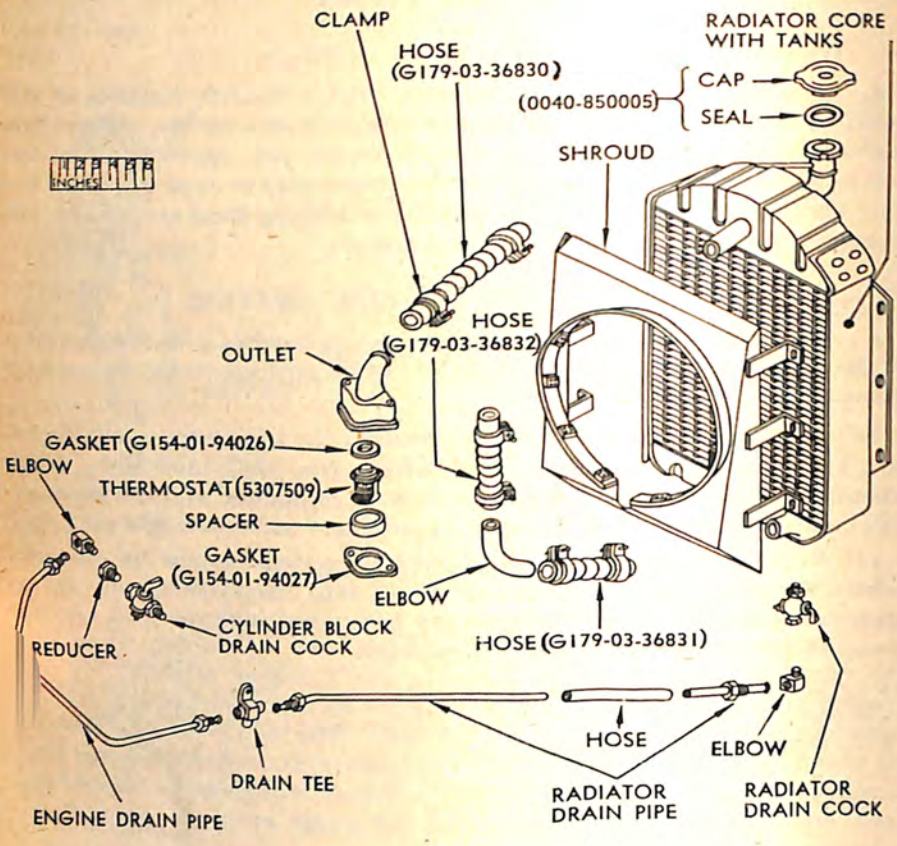


Figure 97 — Cooling System — Disassembled

(3) Place a clean drain pan in position to collect the overflow, using the overflow to maintain the level in the radiator if necessary.

(4) Replace the radiator cap and run the engine at fast idling speed, closing the air duct ventilator lid as necessary, until the coolant reaches a temperature above 180° F, but not over 200° F. Do not drive the vehicle. Continually check the level in the radiator.

(5) Stop the engine after it has run for 30 minutes at a minimum of 180° F, but not over 200° F. Then remove the radiator cap, open drain cocks, and drain the system completely.

e. Neutralizing.

(1) Allow the engine to cool. Close the drain cocks; pour water slowly into the radiator until the system is approximately half full;

then run the engine at idling speed. Add the neutralizer compound in the proportion of 1 container of neutralizer to every 4 gallons of cooling system capacity. Then fill the system with water.

(2) With the air duct ventilator lid closed, let the engine idle for at least 5 minutes at the normal operating temperature; then stop the engine.

(3) Drain the system completely by removing the radiator cap and opening the radiator and cylinder block drain cocks.

f. Flushing.

(1) Allow the engine to cool. Close the drain cocks. Pour water into the radiator until the system is approximately half full; then run the engine at idling speed and fill the system to the proper level.

(2) Run the engine, keeping the air duct ventilator lid closed as necessary, until the coolant is heated to the normal operating temperature.

(3) Drain the system by removing the radiator cap and opening the drain cocks. Repeat the flushing operation until the drain water is clear.

(4) Again allow the engine to cool. Clean all sediment from the radiator cap and overflow pipe. Blow insects and dirt from radiator core air passages with compressed air, blowing from the rear. If necessary, use water to soften obstructions.

g. Leaks. After completing the flushing operations, make certain that the engine has been allowed to cool again. Close the drain cocks. Pour water slowly into the radiator until the system is approximately half full; then run the engine at idling speed and fill the system completely. Stop the engine when the cooling system is completely full. Examine the entire cooling system for leaks. This is important because the cleaning solution uncovers leaks which already exist but have been plugged with rust or corrosion. Leaks which cannot be corrected by the using arms should be reported immediately to Ordnance maintenance personnel. Install plate on bottom of hull, using a new gasket, and fasten securely with screws.

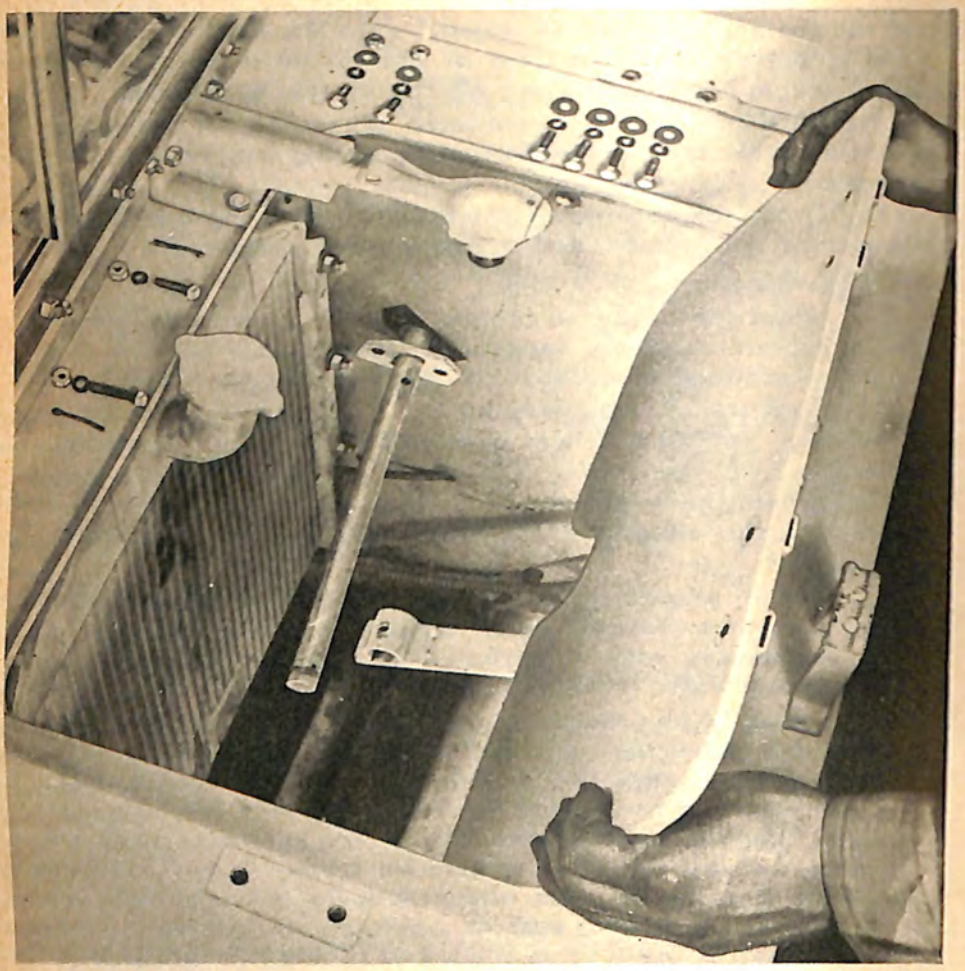
h. Coolant Service.

(1) When servicing the vehicle for the summer, fill the system nearly full with clean water. Add corrosion inhibitor compound (51-C-1600) in the proportion of 1 container of inhibitor to each 4 gallons of cooling system capacity. Then finish filling system to the proper level with water.

(2) When servicing for winter, refer to paragraph 25.

96. RADIATOR.

a. Description. The radiator is the conventional automotive type, equipped with a pressure-type cap. The cap prevents loss of cooling



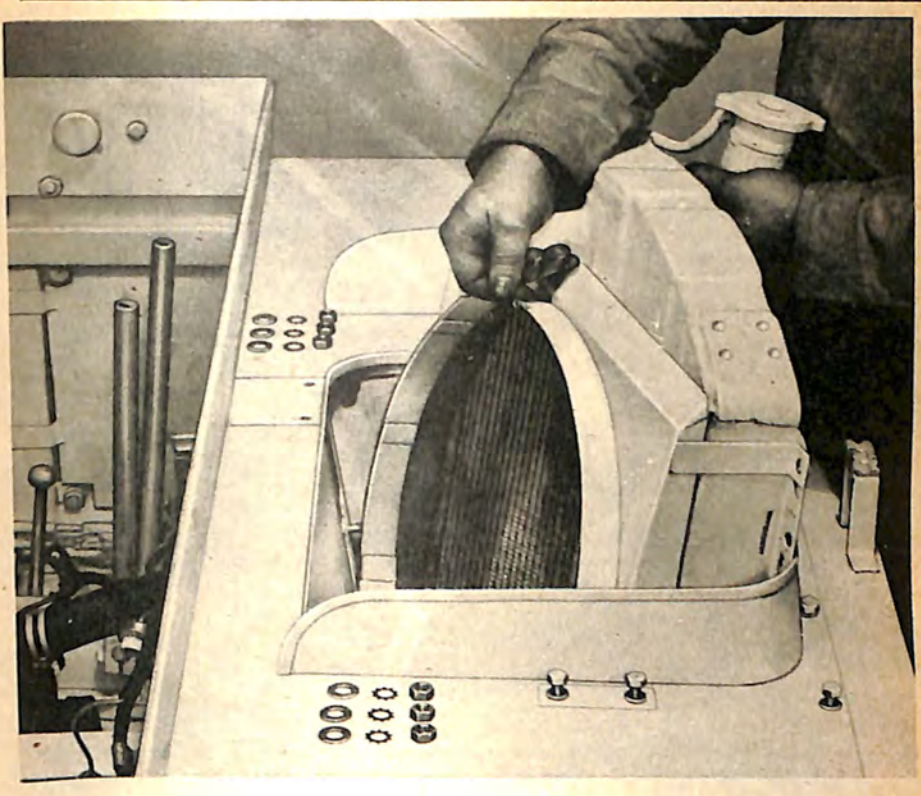
RA PD 67067

Figure 98 — Removing Air Duct Ventilator Lid

solution when vehicle is operated at extreme angles, or when the solution expands due to excessively high temperature.

b. Removal.

(1) DRAIN COOLING SYSTEM. Remove drain plate screws, plate, and gasket located on bottom of hull near right center of engine compartment. Turn radiator cap to first stop to unseal cooling system, reach down through air intake duct and open drain cock at the radiator outlet located below right corner of radiator. Loosen wing nuts and remove engine compartment cover. Open cylinder block drain cock located on left side of engine toward rear. If antifreeze is

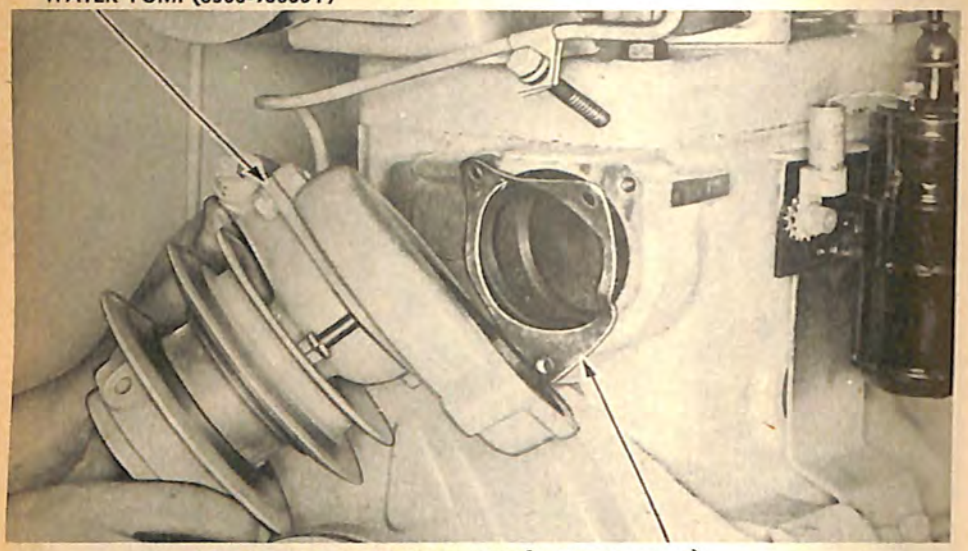


RA PD 67109

Figure 99 — Removing Radiator

in use, save the solution. After completely draining cooling system, close cylinder block and radiator drain cocks. Install a new drain plate gasket, plate, and screws, using sealing compound.

(2) REMOVE RADIATOR ASSEMBLY. Remove the air duct ventilator lid cross shaft by taking out cotter pins from each end of shaft, removing bolt and nut holding lid operating arm to shaft, and removing bolt and nut that hold control handle to inner end of cross shaft. Slip cross shaft through hole into driver's compartment far enough to slip lid control arm off shaft. Take out two bolts that hold shaft bracket to hull and remove shaft. Remove air duct lid after removing lid to hinge screws (fig. 98). Remove fuel filter (par. 87 c) after vehicle serial 1002. NOTE: *On M29C, remove lower drive pulley bracket cap screws and the cotter pin and front universal joint rear flange pin; disconnect capstan clutch control wire at operating lever swivel, and remove bracket with shaft and pulley assembly.* Loosen clamp screws on upper and lower radiator hoses, pull hoses off radiator

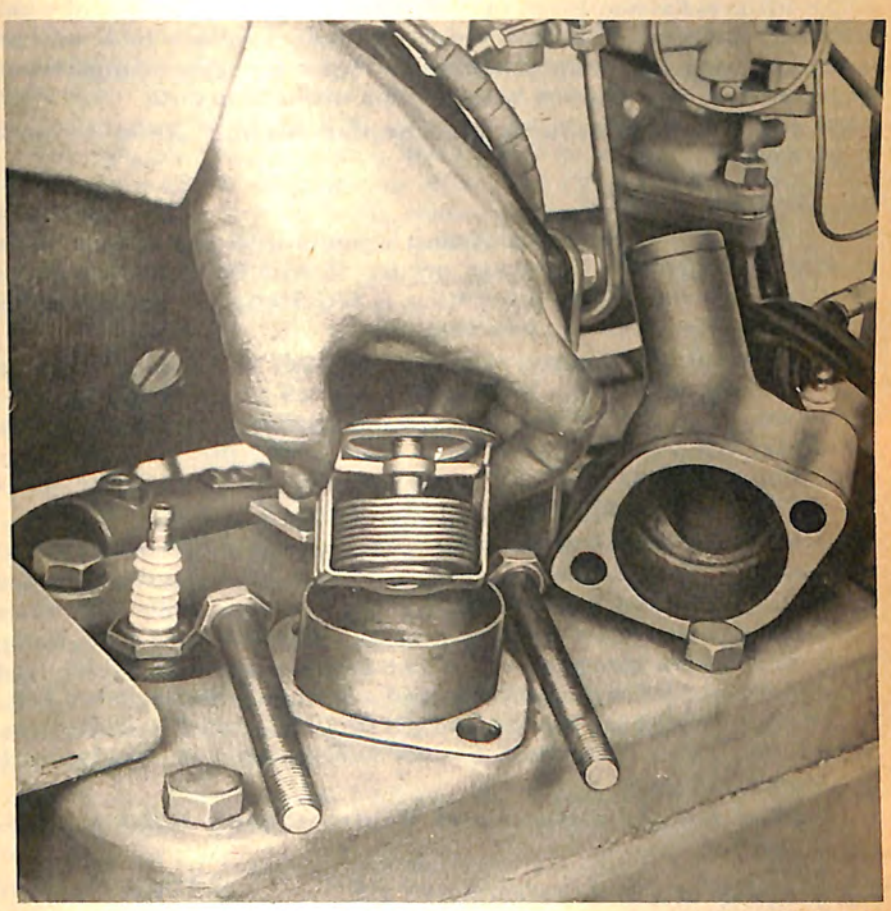


RA PD 352272

Figure 100 — Removing Water Pump

drain cock, and remove nuts with lock washers that hold radiator and fan shroud to hull inside air duct. Move radiator forward, and lift radiator and shroud out of vehicle (fig. 99).

c. Installation. Position fan shroud and radiator on studs, install nuts and lock washers, and tighten securely. Install upper and lower radiator hoses on connections and tighten hose clamps securely. Install radiator drain hose on drain cock. Install fuel filter (par. 87 **d**) in air duct on vehicles after serial 1002. NOTE: *On M29C, place capstan lower drive pulley and shaft with bracket assembly in air duct, slide universal joint flange on shaft, install pin and new cotter pin, and connect capstan clutch control wire to operating lever at swivel. Place drive belt around pulley and install cap screws with lock washers in pulley bracket. Adjust capstan drive belt tension (par. 172* **b**). Install air duct lid and cross shaft by slipping cross shaft through lid operating arm and fastening lid to hinges on hull. Slip shaft into position, with bracket on shaft, and fasten operating handle and lid operating arm to shaft with bolts and nuts. Install new cotter pins in both ends of shaft and fasten bracket into position with cap screws. Fill the cooling system so the solution is slightly below bottom of filler neck. Install engine compartment cover and fasten it in position with clamps and wing nuts.



RA PD 67023

Figure 101 — Removing Engine Thermostat

97. FAN.

a. Description. A 4-blade fan is mounted on the hub of the water pump and is driven by a V-type belt. The water pump and fan belt pulley inner flange is an integral part of the pump hub, and the pulley outer flange is threaded on the pump hub. Turning the outer flange clockwise will increase the belt tension and turning it counterclockwise will decrease the tension.

b. Fan Blades.

(1) REMOVAL. Loosen wing nuts and lift engine compartment cover out of vehicle. Take out cap screws that hold fan blades to water pump hub and remove blades.

(2) INSTALLATION. Place the fan blades in position on the water pump hub and install the cap screws. Be sure to place lock washers on the cap screws and tighten securely. Install engine compartment cover and fasten in position with clamps and wing nuts.

c. Drive Belt Adjustment and Replacement. Refer to paragraph 72 **b**.

98. WATER PUMP.

a. Description. The water pump is non-adjustable insofar as the packing is concerned. If leakage occurs, it will be necessary to replace pump assembly. No lubrication is required; the pump shaft is supported by prelubricated bearings.

b. Removal. Loosen the wing nuts and lift the engine compartment cover out of vehicle. Remove fan blades (par. 97 **b** (1)) and belts (par. 72 **b** (2)), and drain cooling system (par. 96 **b** (1)). Loosen the clamp screw and pull hose from water pump intake. Remove cap screws that hold water pump adapter to cylinder block and remove water pump assembly (fig. 100) and gasket.

c. Installation. When installing water pump, make sure shaft is free and that there is no scraping sound when pump hub is rotated by hand. Use a new gasket and apply grease to hold it in place while positioning pump on cylinder block. Install hose over pump intake and tighten clamp screw. Coat cap screws with white lead and install and tighten them evenly and securely. Install drive belts (par. 72 **b** (3)) and fan blades (par. 97 **b** (2)), and fill cooling system. Install engine compartment cover and fasten it in position with clamps and wing nuts.

d. Drive Belt Adjustment and Replacement. Refer to paragraph 72 **b**.

99. ENGINE WATER THERMOSTAT.

a. Description. The bellows-type thermostat is located in the cylinder head water outlet elbow. The thermostat begins to open at approximately 155° F. Constantly opening and closing the thermostat keeps the cooling solution in the engine at the most efficient temperature. NOTE: *A thermostat which opens at 175° F is used for cold weather operation.*

b. Removal. Drain cooling system as outlined in paragraph 96 **b** (1). Loosen hose clamp and remove cylinder head cap screws that hold water outlet elbow to cylinder head. Remove water outlet elbow, flange gasket, thermostat sleeve and gasket, and thermostat (fig. 101). NOTE: *If thermostat operation is known to be faulty, replace it. Do not attempt repairs.* To test unit, immerse in water which has been heated to rated opening temperature of thermostat valve. If valve does not start to open, or if it sticks in fully open position, replace it.

c. **Installation.** When installing thermostat, make sure coils (bellows) are downward and that small by-pass hole in the valve is open; otherwise, the valve action will be rendered useless and overheating will result. Fit new gaskets to the flange and sleeve bore, using grease to keep gaskets in place. Place water outlet elbow in position, insert the two cylinder head screws, and tighten to a tension of from 50 to 54 foot-pounds. Place hose on elbow and tighten clamp screw. Fill cooling system to proper lever, install engine compartment cover, and fasten in position with clamps and wing nuts.

Section XXI
STARTING SYSTEM

100. DESCRIPTION.

a. Starter action is controlled by a push-button switch on the instrument panel and a solenoid switch mounted on the starter. When the starter switch button is depressed, the electrical circuit from the batteries is completed to energize the solenoid coil which pulls the outer end of the starter clutch operating lever forward. The operating lever inner yoke moves rearward and engages the started pinion with the teeth on the flywheel. When the heavy copper segments in the solenoid come together, the circuit is completed to the starter and causes it to operate. As long as the starter switch button is pushed in, the starter will operate; therefore, release the starter switch button as soon as the engine starts.

b. Remove and discard all starting cranks on vehicles with serial numbers below 3103.

101. STARTER.

a. **Description.** The 12-volt starter is secured to the engine rear plate at the right side of the engine by fastening bolts extending through the engine plate and clutch housing. The starter is equipped with solenoid and over-running clutch. The over-running clutch is magnetically shifted by the starting solenoid switch and engages the flywheel before the starter armature begins to revolve.

b. **Removal.** Loosen wing nuts and lift engine compartment cover out of vehicle. Disconnect battery cable clamps and remove battery retaining frame and batteries. After vehicle serial 3600, loosen clamp screw and remove flexible hose from air cleaner; work hose through engine compartment division rear panel and position hose out of the way over engine. Remove engine compartment division rear panel (par. 75 g) on vehicles after serial 1002. Remove screw and clip holding speedometer cable near base of battery carrier and position cable out of the way. Remove the manifold screw and deflector

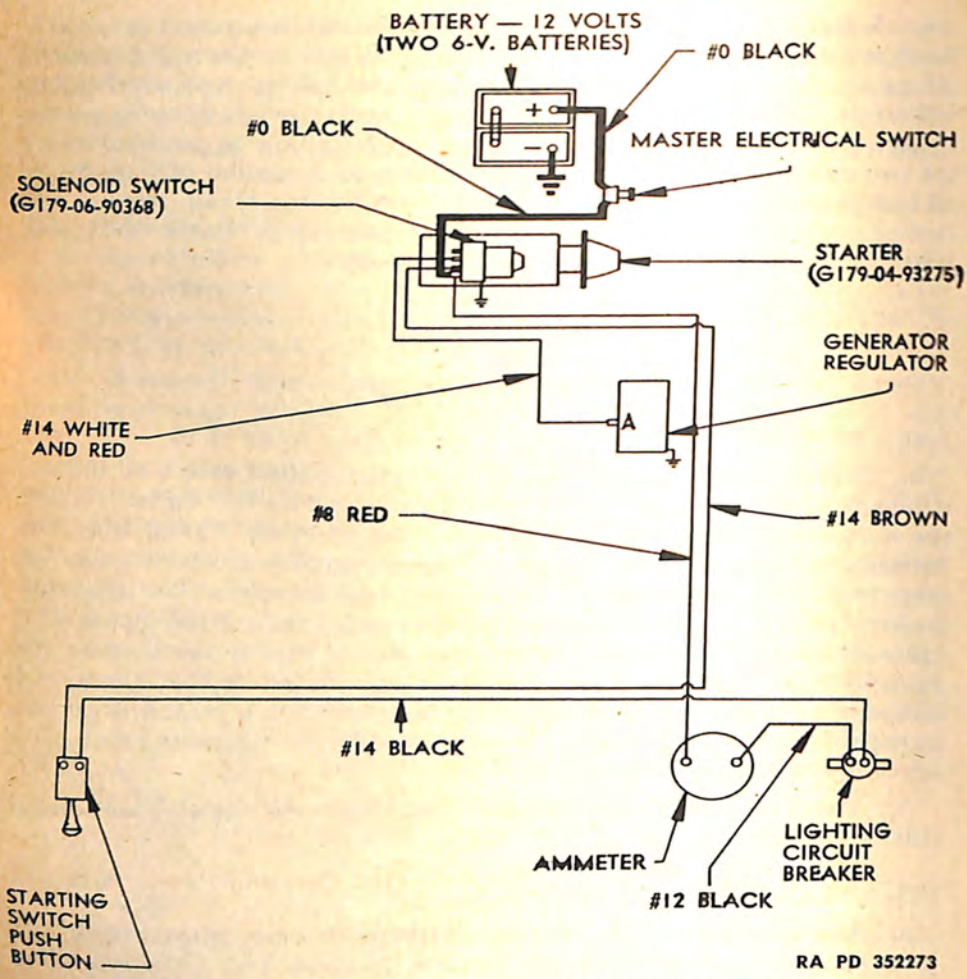
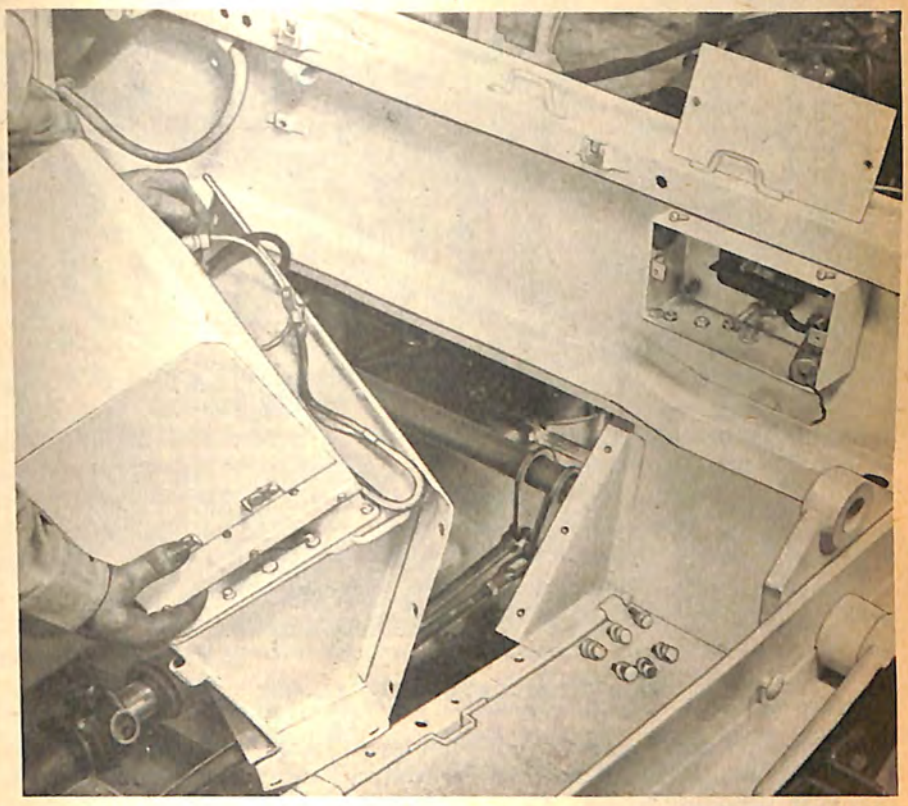


Figure 102 — Starting System Wiring Diagram

shields attaching screw and lift off starter upper heat deflector shield. Remove attaching screws in starter frame to allow lower heat deflector shield to drop down out of the way. Disconnect starter solenoid wires from solenoid. Take out hull floor pan screws and remove floor pan. Remove electrical connections and tag wires at radio power pack, demolition timer control, and radio terminal box, if vehicle is so equipped. Take out the screws that hold the air deflector pan in place over the transmission and remove the assembly (fig. 103). Remove cap screws holding transmission support bracket to hull cross-member and raise rear end of engine. Remove the bolts, nuts, and lock washers that hold the starter to the engine rear plate. Pull

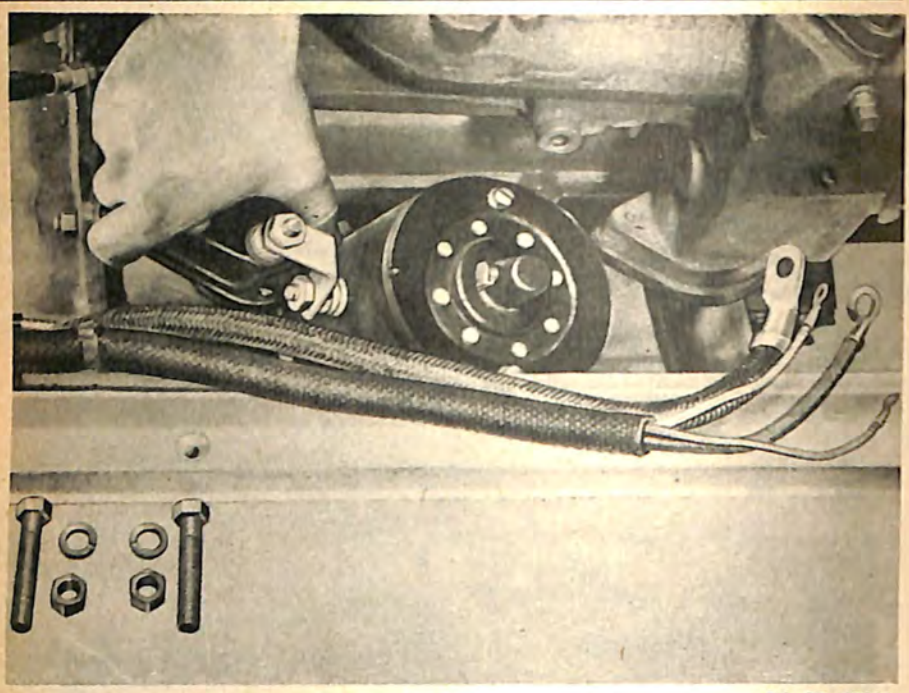


RA PD 67098

Figure 103 — Removing Air Deflector Pan and Power Pack

starter forward away from engine plate and remove it from the vehicle (fig. 104).

c. Installation. Raise rear end of engine and place it in position. Install bolts, nuts, and lock washer that hold starter to engine rear plate and tighten securely. Lower rear end of engine and install transmission support bracket cap screws to hull crossmember. Set air deflector pan in position over transmission, install screws, and tighten securely. Install wire connections previously tagged to radio power pack, demolition timer control, and radio terminal box, if vehicle is so equipped. Install hull floor pan and fasten it in place with screws. Connect wires to starter solenoid. Position lower heat deflector shield to starter and install screws in starter-frame. Fasten upper deflector shield in place at manifold and to lower shield. Install engine compartment division rear panel (par. 76 **p**) on vehicles after serial 1002. Locate flexible hose into position through division



RA PD 67082

Figure 104 — Removing Starter

panel opening and connect to air cleaner at clamp screw on vehicles after serial 3600. Place batteries in compartment and fasten in position with retaining frame. Connect battery cable clamps to battery posts. Place engine compartment cover in position and fasten it with clamps and wing nuts.

102. STARTER SOLENOID SWITCH.

a. Description. The starter solenoid is mounted on the starting motor. The solenoid coil is energized when the starter switch button on the instrument panel is depressed. When the solenoid coil is energized, the plunger in the solenoid is pulled forward and moves the outer end of the starting motor clutch yoke to engage the starter pinion with the teeth on flywheel for cranking the engine.

b. Removal. Loosen the wing nuts and lift engine compartment cover out of vehicle. Disconnect battery cable clamps, loosen battery retaining frame, and remove batteries. Remove engine compartment division rear panel (par. 75 g) on vehicles after serial 1002. Remove heat deflector shield, disconnect wires from solenoid, and remove cotter pin and clevis pin from solenoid link. Take out the screws that hold the solenoid to the starter and remove solenoid from the engine compartment.

c. **Installation.** Place the solenoid in position on the starter; install the screws and tighten them securely. Install clevis pin and cotter pin in solenoid link. Connect wires to solenoid and install heat deflector shield over solenoid. Install engine compartment division rear panel (par. 76 p) on vehicles after serial 1002. Set batteries in compartment and fasten in place with retaining frame. Connect battery cable clamps to batteries. Place engine compartment cover in position and fasten in with clamps and wing nuts.

103. STARTER MANUAL SWITCH.

a. **Description.** A starter manual switch of the push-button type is located in the upper left corner of the instrument panel.

b. **Removal.** Loosen wing nuts and lift engine compartment cover out of vehicle. Disconnect battery ground strap by loosening clamp bolt and remove clamp from post. Remove wires from terminals on switch and tag them for the purpose of installation. Loosen button set screw and remove button by turning it counterclockwise off the switch operating shaft. Remove the lock nut which holds the switch body to instrument panel and remove switch from panel.

c. **Installation.** Place switch in panel, with toothed lock washer between switch body and instrument panel. Install lock nut and tighten. Install switch button by turning it clockwise on operating shaft until tight; then back it off until the identification name is horizontal, and tighten the set screw in button. Connect wires to proper terminals on switch. Connect battery ground strap clamp to battery, install engine compartment cover, and fasten in position with clamps and wing nuts.

Section XXII

BATTERY AND GENERATING SYSTEM

104. DESCRIPTION.

a. The battery and generating system of this vehicle consists of a heavy-duty, 12-volt battery before vehicle serial 3103 (or two 6-volt batteries after vehicle serial 3102) with cables, a belt-driven generator, a generator regulator, generator to regulator wiring harness, and a master switch. Each vehicle is provided with proper ground where necessary for radio interference suppression.

105. BATTERY.

a. **Description.** Vehicles after serial 3102 are equipped with two 6-volt, 3-cell, 23-plate, 160-ampere-hour batteries connected in series. One 12-volt, 6-cell, 19-plate, 153-ampere-hour battery was used prior to vehicle serial 3103. The battery location is just back of the fuel

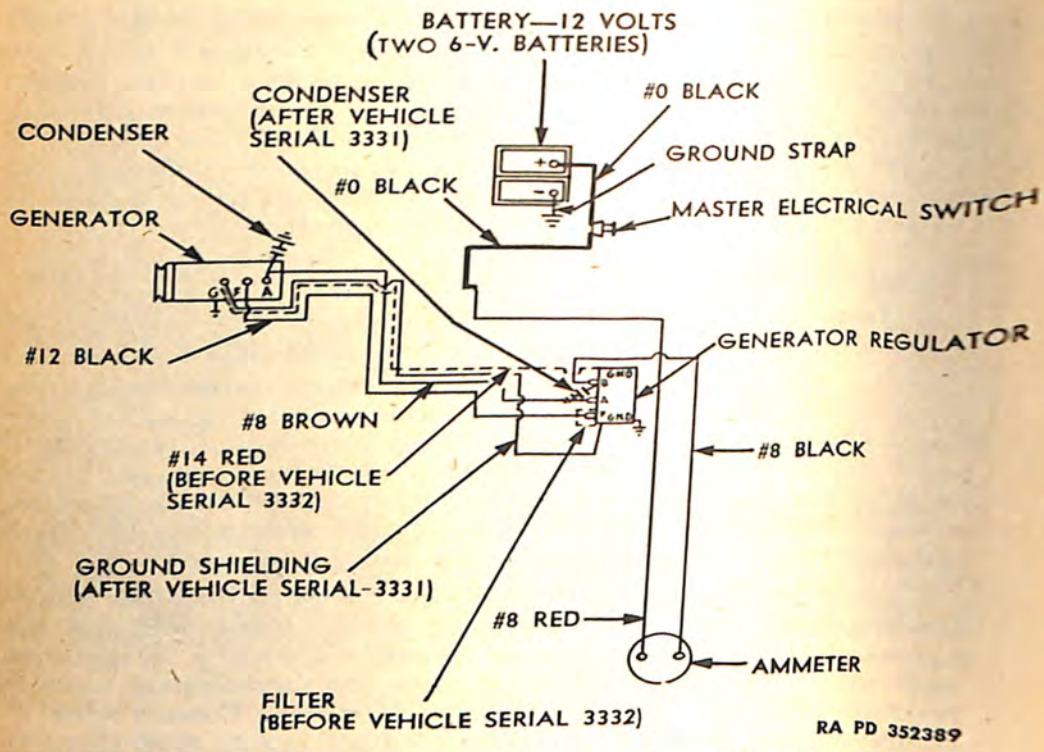


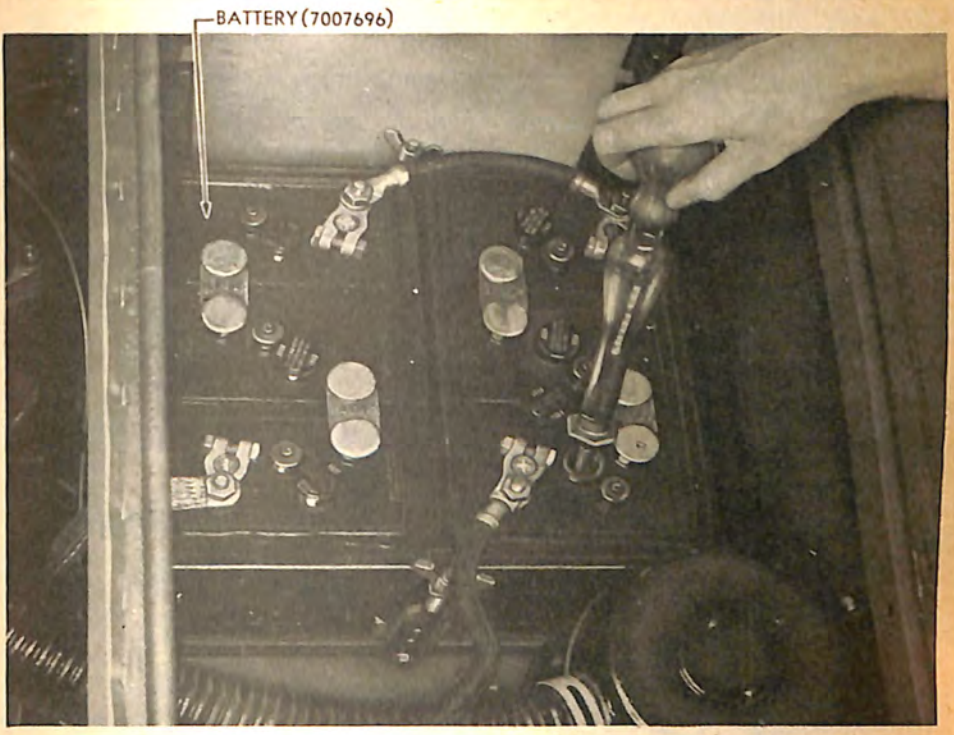
Figure 105 — Battery and Generating System Wiring Diagram

tank and to the right of the engine, and installation is with the open terminals to the rear. The negative post is grounded to the rear end of the engine by means of a flexible, braid-type strap.

b. Servicing Battery. The specific gravity of the battery electrolyte fluid should be checked weekly (fig. 106). If the reading is appreciably less than 1.280 (see par. 28 **b** for reading in tropical climates), replace with a new or fully charged battery. To avoid overfilling and to assure proper fluid level in the cells, press filler plug firmly on the cell vent directly opposite each filler hole (fig. 107). If distilled water is added until the fluid level reaches the filler opening throat, the level will be correct when the filler plug is removed from the vent and screwed into the filler hole. After filling battery, always wipe off any water and see that terminals are clean and tight.

c. Battery Cable Replacement.

(1) REMOVAL. Loosen wing nuts and remove engine compartment cover. Disconnect the positive cable from battery positive post clamp and from master switch terminal post and remove cable from vehicle. Disconnect the ground strap from battery negative post



RA PD 352274

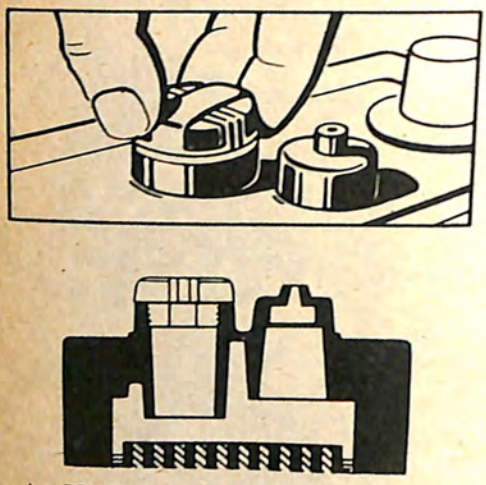
Figure 106 — Checking Battery With Hydrometer (After Vehicle Serial 3102)

clamp and from point of ground on engine, and remove strap from vehicle.

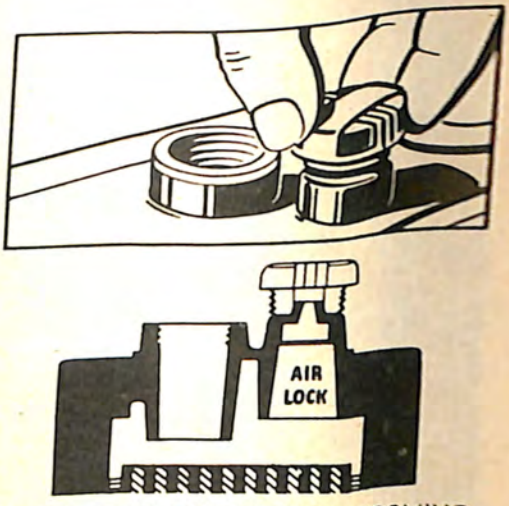
(2) INSTALLATION. Connect one end of ground strap to engine and the other end to battery negative post clamp and tighten securely. Place the positive cable in position, connect one end to the master switch terminal and the other end to the battery positive post clamp. Install engine compartment cover and fasten in position with clamps and wing nuts.

d. Battery Removal. Loosen the wing nuts and lift the engine compartment cover out of the vehicle. Loosen battery cable terminal clamp nuts, and remove both positive and negative battery cable terminals from battery posts; on vehicles using two 6-volt batteries, disconnect the jumper. Remove hold-down frame wing nuts, take out hold-down frame, and lift battery or batteries out of vehicle.

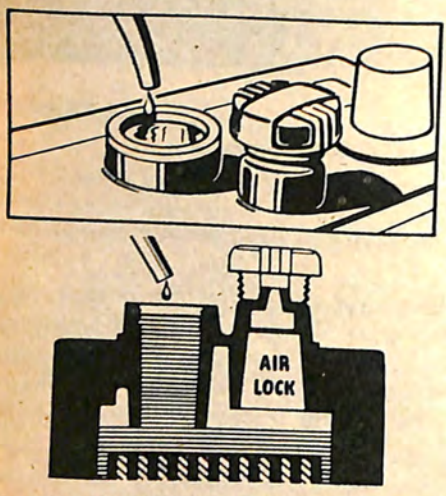
e. Battery Installation. Install battery or batteries in compartment, place hold-down frame into position, and tighten wing nuts only



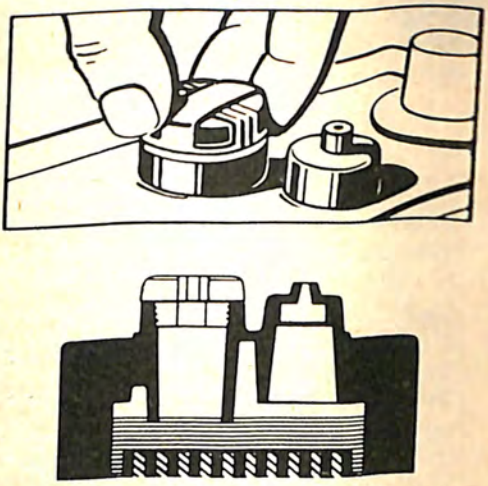
1. REMOVE FILLER-CAP.



2. PLACE CAP ON SAFETY-VENT FORMING AIR LOCK IN BREATHER-CHAMBER.



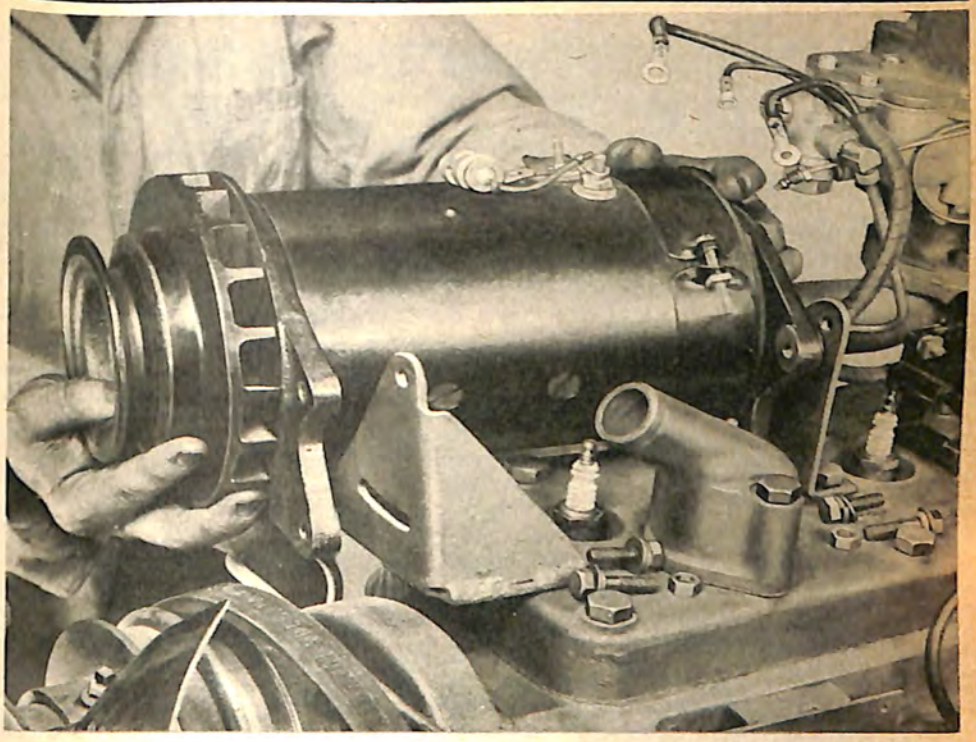
3. FILL WELL WITH DISTILLED WATER. AIR LOCK PREVENTS SOLUTION RISING ABOVE BOTTOM OF WELL.



4. REMOVE CAP FROM SAFETY-VENT AND SOLUTION DROPS TO CORRECT LEVEL. REPLACE CAP IN FILLER HOLE.

RA PD 49337

Figure 107 — Procedure for Adding Battery Water



RA PD 319432

Figure 108 — Removing Generator

enough to prevent battery movement. Spread a film of grease over battery posts and cable terminals to prevent corrosion. Install cables (and jumper as used with two batteries) and tighten nuts securely. Install engine compartment cover and tighten wing nuts.

106. MASTER SWITCH.

a. Description. The master switch is located on the rear upper section of the engine compartment side panel. This switch completes the circuit from the battery to all electrical units when in the "ON" position (handle horizontal).

b. Removal. Loosen wing nuts and lift engine compartment cover out of vehicle. Disconnect battery and starter cables from terminal studs on switch. Take out the screw which holds the handle on the switch, remove nuts, lock washers, and bolts that hold switch to panel, and remove switch.

c. Installation. Insert switch through engine compartment side panel from inside engine compartment. Install bolts, lock washers,

and nuts, and tighten securely. Connect battery and starter cables to switch terminal studs and tighten nuts firmly. Place handle on switch, install screw, and tighten. Install engine compartment cover and tighten wing nuts.

107. GENERATOR.

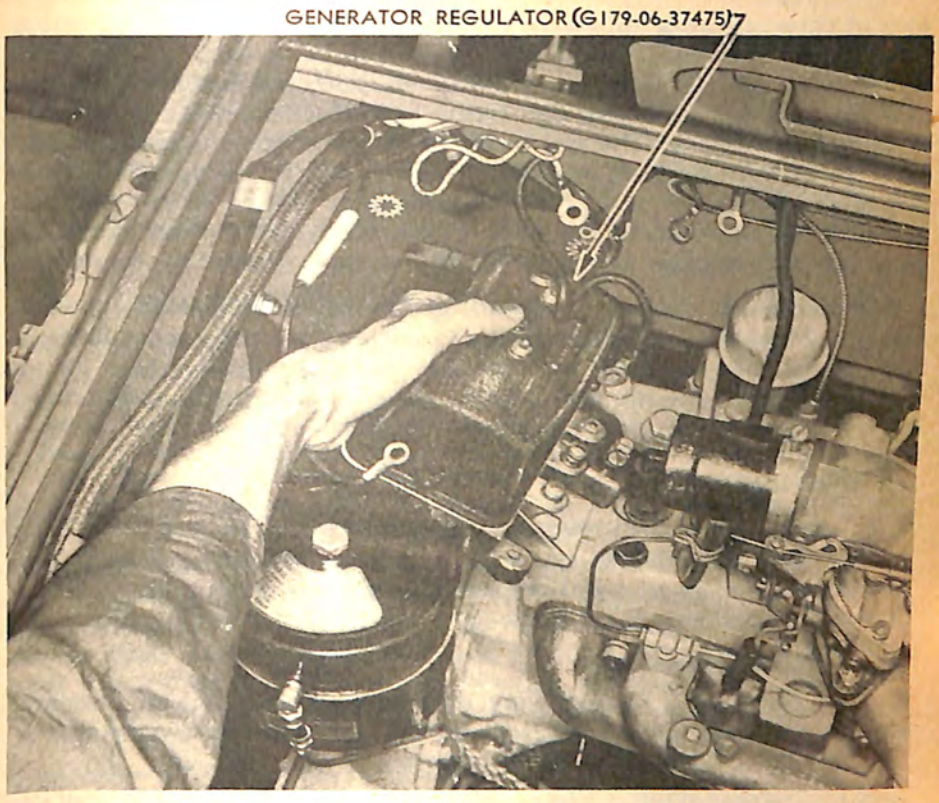
a. Description. The 12-volt generator used in this vehicle is a high-output, fully controlled, shunt-wound type, having a 40-ampere capacity. It is fastened to brackets that are mounted on top of the engine cylinder head near the front on the right side. Four adjusting bolts hold the generator in any desired position to provide proper tension on the driving belt. The generator is equipped with a cooling fan which is integral with the drive pulley and turns at armature speed. Two brushes are used in the generator; one ground and one field. The generator regulator controls the current and voltage produced by the generator.

b. Cleaning Commutator. Periodically, remove cover from rear end of generator by removing cover clamp screw and slipping the cover away from generator. When cover has been removed, commutator and brushes can be examined. Brushes should seat firmly on the commutator bars, with a minimum of arcing during operation. If commutator appears black, greasy, or pitted, if brushes are worn badly and uneven, or if there is excessive arcing when commutator rotates, replace generator. If the commutator is only dirty, it may be cleaned in the field by placing a strip of 2/0 flint paper over a thin strip of wood about ⅛ inch thick and holding paper against commutator while rotating it slowly. Incline the top of stick so it has a trailing action on the commutator. After the commutator has been cleaned, install the cover in position and tighten the clamp screw securely.

c. Removal. Loosen the wing nuts and lift the engine compartment cover out of the vehicle. Disconnect the wires from terminals and tag them for identification. Loosen the bolts that hold the generator to the bracket on the cylinder head. Move generator down, remove drive belt from pulley, take out bolts, and lift generator out of engine compartment (fig. 108).

d. Installation. Place generator in position, install mounting bolts, and position drive belt on pulley. Adjust belt tension to ½-inch finger-pressure deflection, and tighten bolts. Connect wires to the proper terminals. When generator is being replaced, remove condenser from original generator and install on replacement. Install engine compartment cover and fasten it in position with clamps and wing nuts.

e. Drive Belt. Refer to paragraph 72 b.



RA PD 352381

Figure 109 — Removing Generator Regulator

f. Generator to Regulator Wiring Harness.

(1) REMOVAL. Loosen wing nuts and remove engine compartment cover. Remove terminals from studs on generator, tagging them for identification. Remove the fasteners which hold harness in place, disconnect terminals from generator regulator, and tag the wires to identify for installation.

(2) INSTALLATION. Connect wires to generator regulator terminals as tagged during removal. Place harness in position, install fasteners, and connect wires to studs on generator as tagged during removal. Install engine compartment cover and fasten in position with clamps and wing nuts.

108. GENERATOR REGULATOR.

a. Description. The generator regulator operates as one of the chief component parts of the battery and generating system. It con-

sists of three entirely independent units encased in a sealed, moisture-proof and dirtproof container mounted on a bracket. The units within are: First, the circuit breaker which closes and opens the circuit between the generator and batteries to prevent the current from flowing back through the generator when the engine is stopped; second, the current-limiting regulator which controls the maximum output of the generator and prevents damage to the generator and batteries; third, the voltage regulator which holds the voltage produced, constant within close limits under the various operating conditions.

b. Removal. Loosen wing nuts, lift the engine compartment cover out of the vehicle, and disconnect the battery ground strap. Disconnect wires from regulator and tag the wires to identify them for installation. Remove mounting bolts, nuts, flat washers, and toothed lock washers which attach regulator to bracket (note that toothed lock washers are installed under the regulator legs). Lift regulator out of vehicle (fig. 109).

c. Installation. Attach regulator to bracket with mounting bolts, and see that toothed lock washers are placed between regulator legs and bracket. Connect wires to proper terminals on regulator. Place engine compartment cover in position and tighten wing nuts.

d. Filter Replacement.

(1) REMOVAL. Loosen wing nuts and remove engine compartment cover. Disconnect wire from terminal on filter and remove filter from regulator on vehicles so equipped.

(2) INSTALLATION. Fasten filter to generator field terminal on regulator and connect wire to terminal on filter. Install engine compartment cover and fasten it in position with clamps and wing nuts.

Section XXIII
CLUTCH

109. DESCRIPTION (fig. 110).

a. The clutch consists of a driven plate and cover (pressure plate assembly) which is attached to the engine flywheel. A bell-shaped housing, which covers both clutch and flywheel, is fastened to the engine rear plate. The clutch release mechanism is within this housing. The clutch release bearing operates on the transmission pinion flange and is a prelubricated ball type. The clutch itself cannot be adjusted to compensate for wear. The clutch control consists of a pedal and adjustable connecting linkage.

110. COORDINATION WITH HIGHER ECHELON.

a. Replacement of the clutch with a new or rebuilt clutch assembly is normally a third echelon operation. However, it may be performed in an emergency by second echelon, provided authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation which are not carried in second echelon may be obtained from a higher echelon of maintenance.

111. CLUTCH DRIVEN PLATE.

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

b. **Removal.**

(1) REMOVE CLUTCH HOUSING. Remove the transmission as outlined in paragraph 117. Take out the screws which hold the air deflector pan in position, disconnect the radio power pack (if so equipped), and lift the assembly out of the vehicle. Remove exhaust pipe clamp, bolts, nuts, and washers from side of housing. Remove pin to disconnect release spring and pedal linkage adjusting clevis at release shaft outer lever on left side of clutch housing. Remove the bolts which hold starter to clutch housing and engine rear plate. Remove clutch housing dowel bolt nuts and tap dowel bolts forward out of engine rear plate. Remove the remaining nuts and bolts which hold housing to engine plate and remove housing.

(2) REMOVE DRIVEN PLATE ASSEMBLY. Loosen each of the pressure plate cover to flywheel cap screws progressively by turning them only one-half turn at a time to prevent clutch springs from distorting flange of cover. After loosening screws until all tension has been relieved, take out screws, and remove both pressure plate (cover) and driven plate from vehicle.

c. **Installation.**

(1) INSTALL DRIVEN PLATE ASSEMBLY. Before assembling the clutch driven plate, lubricate the clutch pilot (transmission pinion) bushing in flywheel hub (refer to lubrication order). Place clutch driven plate in position against flywheel, with the longer hub extension of driven plate toward the rear. Insert clutch plate alining tool through hub of driven plate and into bore of pilot bushing. Place pressure plate assembly against driven plate and flywheel (fig. 111), and install and tighten cover flange cap screws until spring tension is detected. Tighten cap screws progressively by turning them one-half turn at a time to avoid distortion of flange. Make a final complete tightening round to make certain that each pressure plate cap screw is tightened securely.

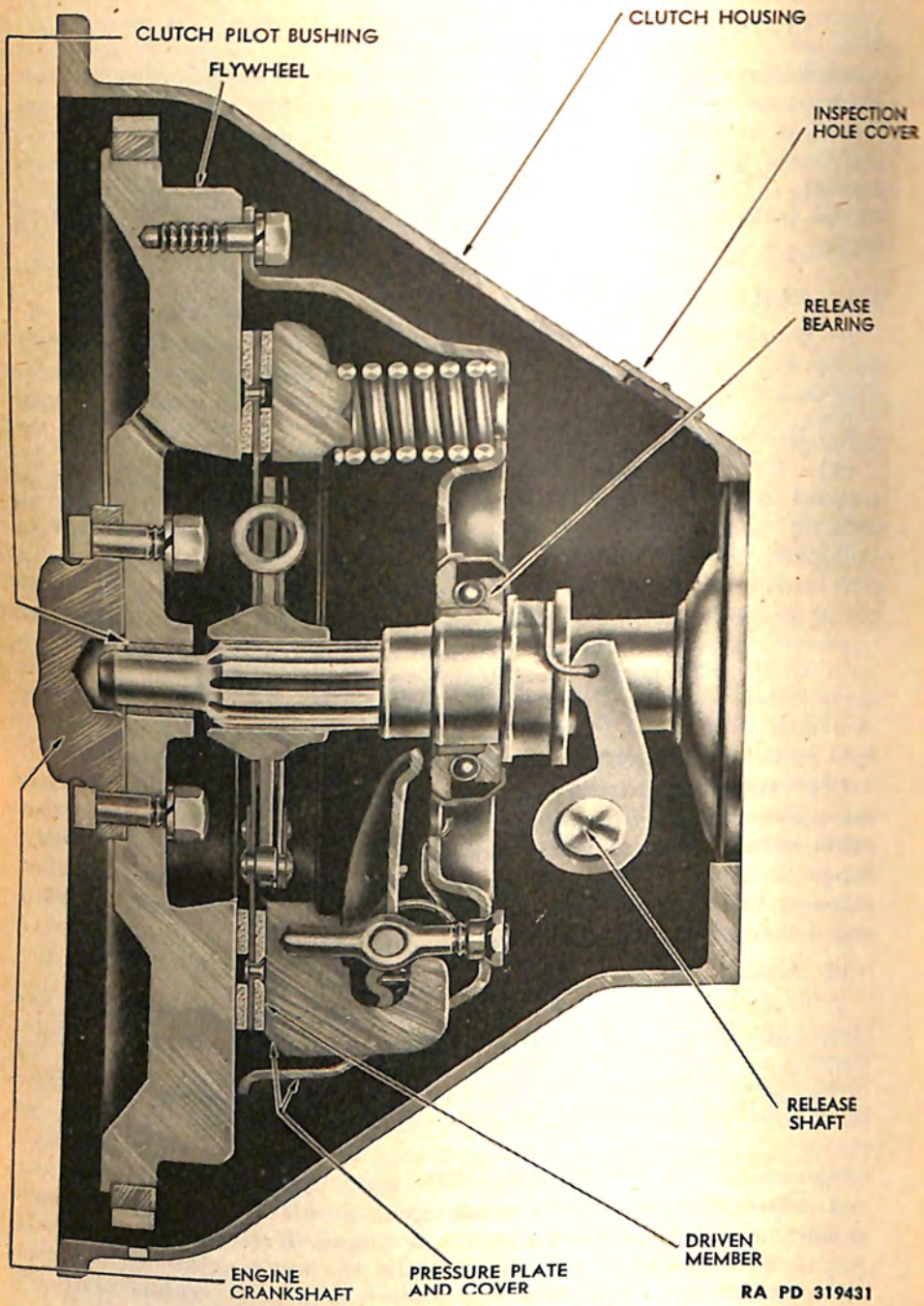
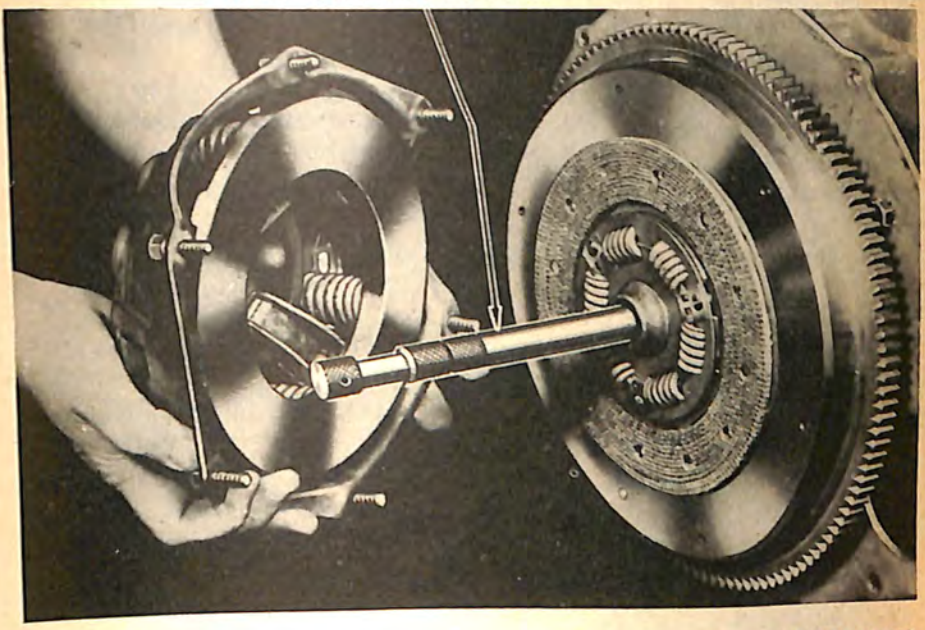


Figure 110 — Clutch Assembly Cross Section

CLUTCH PLATE ALINING TOOL



RA PD 336495

Figure 111 — Installing Clutch Pressure Plate Assembly

(2) INSTALL CLUTCH HOUSING. Place housing in position and start one cap screw to preserve general alinement. Move the housing as required to aline left and right dowel bolt holes, and tap dowel bolts in place from front if installing the housing previously removed. NOTE: *If a new housing is to be installed, refer to higher authority.* Install lock washers and nuts on dowel bolts and tighten moderately. Then install remaining cap screws, as well as starter bolts and nuts, tightening screws and bolt nuts moderately. Tighten nuts and cap screws alternately to preserve alinement and avoid distortion. Place air deflector pan in position, install screws, and tighten securely. Connect wires to radio power pack (if so equipped). Install transmission as outlined in paragraph 118, and adjust clutch pedal free travel (par. 114 **b**).

112. CLUTCH RELEASE BEARING.

a. Description. The bearing is held in place by a spring, the ends of which are hooked to the levers or fingers, fastened to release shaft. As the clutch pedal is pushed forward, the linkage fastened to clutch release shaft lever operates the shaft to which the release bearing is connected. Oilers are provided at both ends of clutch release shaft

for lubrication of the shaft bushings. The clutch release bearing is packed at assembly with high melting point lubricant and does not require supplementary lubrication.

b. Removal. Remove transmission assembly (par. 117). Disconnect the bearing from shaft assembly by disengaging spring ends which hold bearing to shaft levers.

c. Installation. Hook ends of spring into levers to hold bearing and collar in position. Install transmission assembly (par. 118). Check clutch pedal free travel and adjust if necessary (par. 114 b).

113. CLUTCH PILOT BUSHING.

a. Description. A bronze bushing, mounted in center bore of flywheel, is used to support the front end of transmission drive pinion.

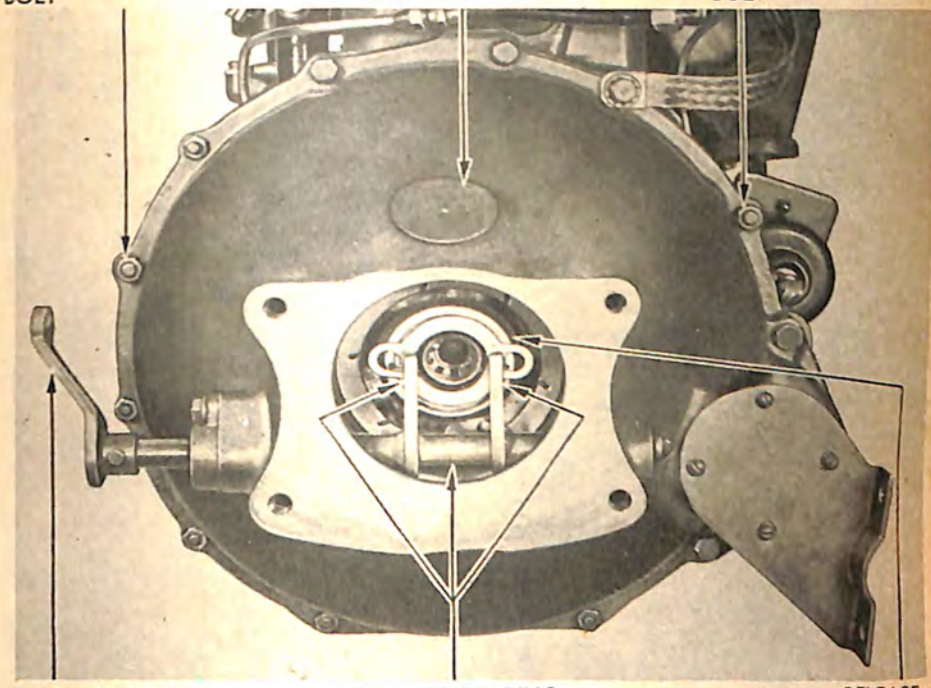
b. Removal. Remove clutch driven plate (par. 111 b). Remove bushing, with clutch pilot bearing puller, from center bore of flywheel.

c. Installation. Drive bushing carefully into center bore of flywheel. Lubricate inner surface of bushing and fill recess behind bushing with proper lubricant (refer to lubrication order). Install clutch driven plate (par. 111 c).

114. CLUTCH CONTROL LINKAGE.

a. Description. Clutch operation is accomplished by a foot pedal located in extreme forward end of driver's compartment on left side. The foot pedal operates a lever on the pedal shaft. On vehicles before serial 13,561, a cable with clevises on each end connects pedal shaft lever to clutch release operating shaft lever (fig. 113). After vehicle serial 13,560, the clutch pedal shaft lever is connected to the release lever at the clutch housing by means of vertical and horizontal rods, with adjustable clevises at each end (fig. 114). The vertical rod is located at left side of air intake duct and connects to a bell crank, to which is also fastened the horizontal rod running to the clutch release shaft outer lever.

b. Adjustment. In order for the clutch to operate properly and give maximum service, the pedal must have approximately 1 inch of free travel before the pressure of clutch mechanism is detected. To obtain the correct adjustment, loosen pedal stop screw lock nut, and turn the stop screw clockwise until it bottoms on lock nut. Remove hull floor pan cap screws and lift the pan out of vehicle. Disconnect release spring, take out adjusting clevis cotter pin, and remove pin that connects linkage to release shaft lever at left side of clutch housing. Loosen clevis lock nut and turn clevis clockwise to shorten, or counterclockwise to lengthen, until no slack or pull exists on clutch release shaft lever when clevis eye is in line with the hole in lever. Insert clevis pin, tighten lock nut, install new cotter pin, and



RA PD 319430

Figure 112 — Clutch Release Mechanism

connect release spring. Place the hull floor pan in position, install the cap screws, and tighten securely. Returning to clutch pedal at front of the vehicle, back off pedal stop screw (by turning counterclockwise) until 1 inch of free pedal movement is present before pressure of clutch mechanism is detected. Tighten stop screw lock nut.

c. **Removal** (Before Vehicle Serial 13,561). Take out cap screws that hold air duct lid to hinges and tip lid toward radiator. Remove cotter and clevis pin from pedal shaft operating lever (in air duct). Remove nut from anchor clip that holds cable conduit to hull crossmember bracket in air duct. Take out screw and remove panel with insulation near lower left corner of radiator. Remove hull floor pan cap screws and lift pan out of vehicle. Take out screws that hold air deflector pan in position, disconnect radio power pack (if so equipped), and lift assembly out of vehicle. Attach length of guide wire or string to cable and clevis where disconnected from clutch pedal shaft operating lever. Remove nut from anchor clip that holds rear

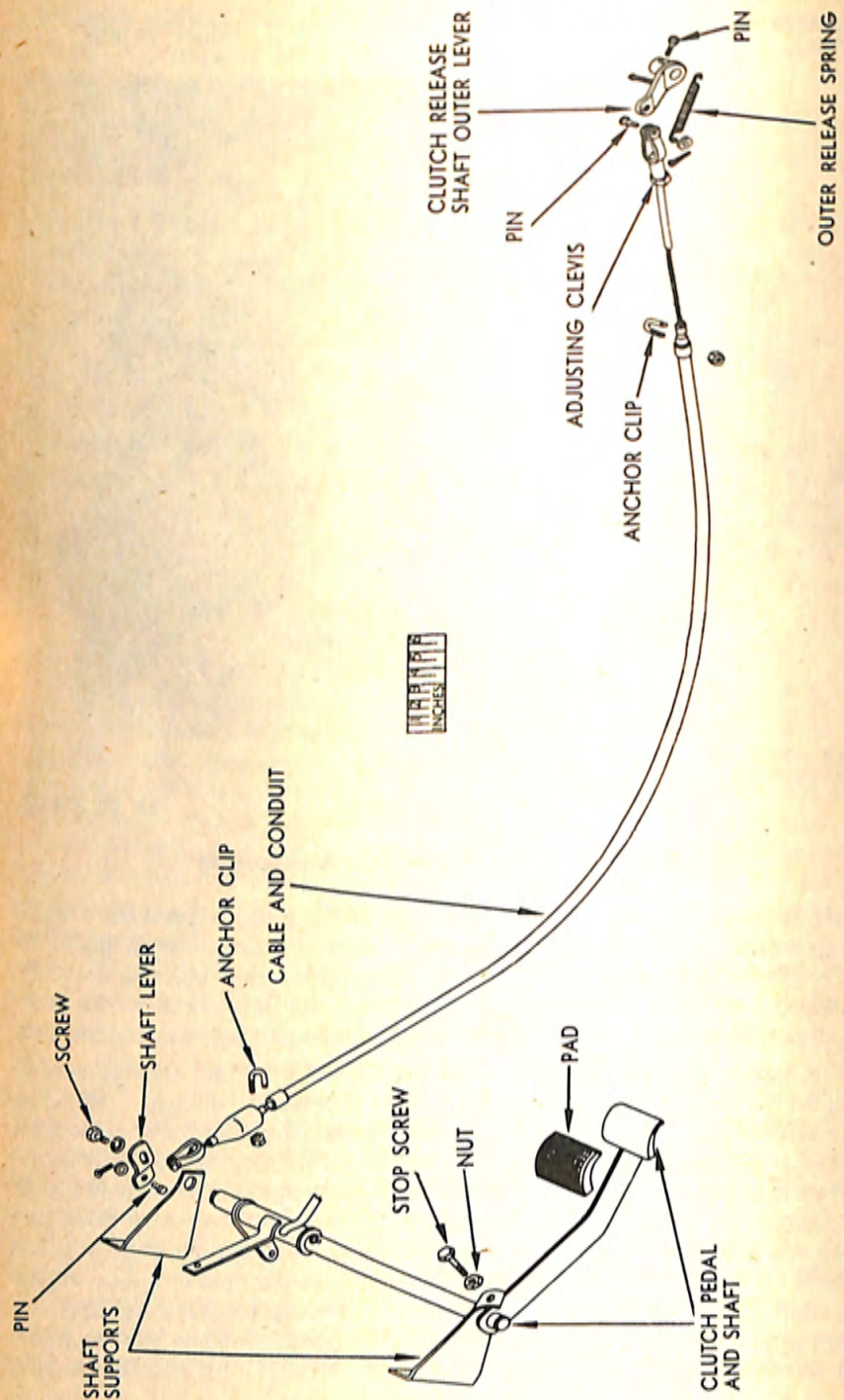


Figure 113 — Clutch Release Linkage (Before Vehicle Serial 13,561)

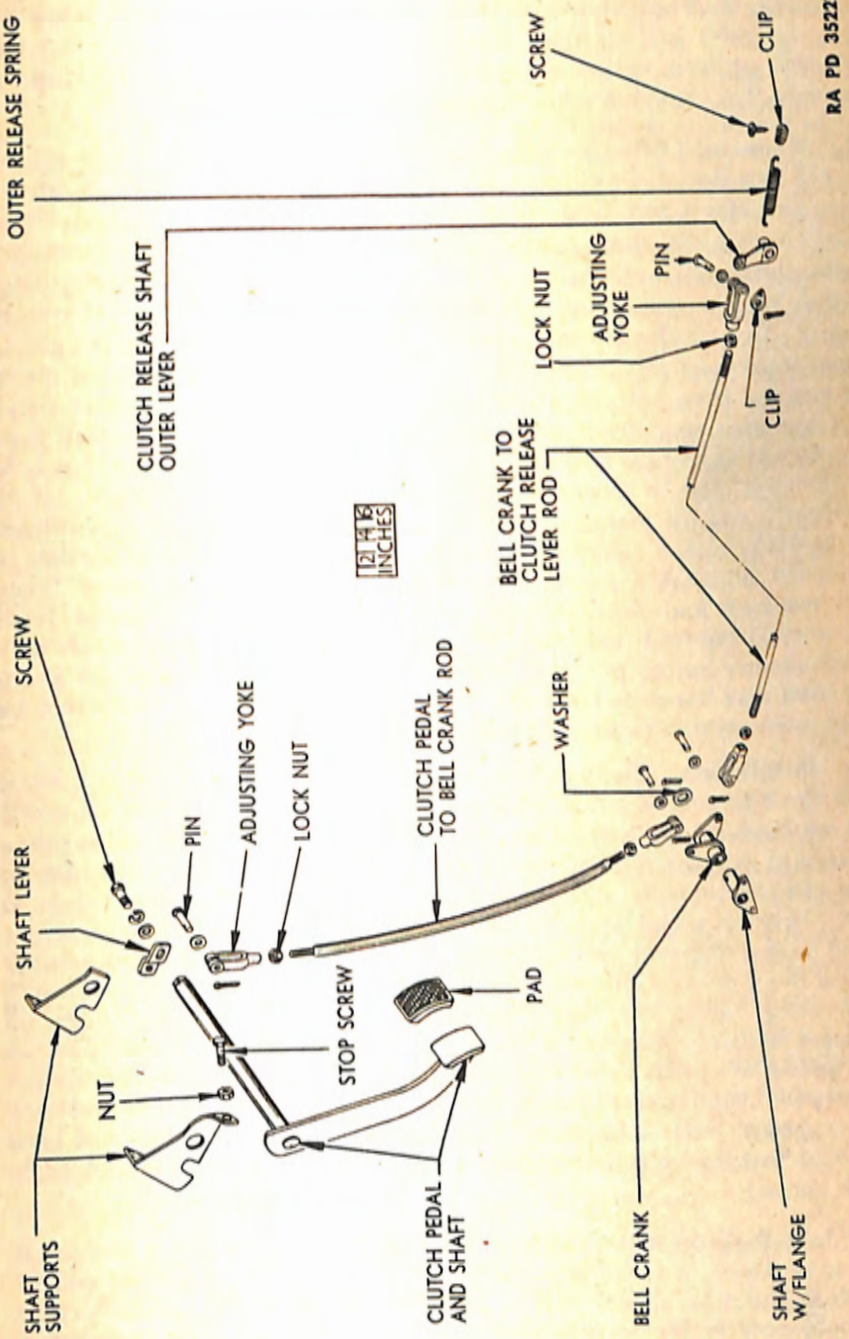


Figure 114 — Clutch Release Linkage (After Vehicle Serial 13,560)

end of cable conduit to hull in engine compartment. Disconnect release spring and adjustable clevis from clutch release shaft lever by removing cotter pin and clevis pin. Pull cable and conduit to rear (drawing guide wire or string through from air duct), disconnect guide wire, and remove cable and conduit from vehicle.

d. **Removal** (After Vehicle Serial 13,560). Take out cap screws that hold air duct lid to hinges and tip lid toward radiator. Remove cotter pin, clevis pin, and washer to disconnect vertical rod clevis (yoke) from pedal shaft operating lever (in air duct). Remove cotter pin, clevis pin, and washer at point where vertical rod lower clevis attaches to bell crank and lift pedal shaft-to-bell crank rod out of air duct. In a similar manner, disconnect horizontal rod clevis (yoke) at bell crank near left bottom of air duct. Remove adjustable clevis and lock nut from horizontal rod. Take out screw and remove panel with insulation near lower left corner of radiator. Remove hull floor pan cap screws and lift pan out of vehicle. Take out screws that hold air deflector pan in position, disconnect radio power pack (if so equipped), and lift assembly out of vehicle. Unhook clutch release spring from clip and remove cotter pin, clip, clevis pin, and washer to disconnect adjustable clevis from clutch release shaft outer lever. Pull rearward and remove bell crank-to-release shaft outer lever (horizontal) rod from vehicle. To remove bell crank from shaft with flange, remove cotter pin and washer and pull bell crank off shaft. The shaft with flange is removed by taking out the two support tube flange screws which secure it to the hull.

e. **Installation** (Before Vehicle Serial 13,561). Attach front cable clevis to end of guide wire or string at clutch, and draw guide wire out through air duct to locate cable and conduit in place along left side of engine. Install anchor clip and nut that holds rear of cable conduit to hull. Disconnect guide wire from cable clevis at front. Position panel with insulation in air duct and tighten screw. Install anchor clip and nut holding cable conduit to hull crossmember bracket in air duct. Connect cable end clevis to pedal shaft operating lever, using clevis pin and new cotter pin. Fasten air duct lid to hinges with cap screws. Connect cable adjustable clevis and release spring at clutch release shaft operating lever. Position air deflector pan, install screws, and connect wires to radio power pack (if so equipped). Adjust linkage so that clutch pedal will have at least 1 inch of free travel before pressure of mechanism is detected (subpar. b above).

f. **Installation** (After Vehicle Serial 13,560). Position bell crank shaft with flange in place near left bottom of air intake duct and install flange screws, lock washers, and nuts. Coat bore of bell crank with lubricant (refer to lubrication order, par. 38), and install bell

crank and end washer on shaft, using new cotter pin. Place horizontal rod into position along left side of engine. Insert front end of rod through opening at left bottom of air duct so that offset in rod is toward left side of vehicle. Install panel with insulation over front end of rod and install fastening screw near lower left corner of radiator. Install adjustable clevis and lock nut at front end of horizontal rod and connect to bell crank lever nearest shaft flange, using clevis pin, washer, and new cotter pin. Check and readjust if necessary, threaded clevis (yoke) at ends of vertical rod until operating length of rod measures 21½ inches between clevis eyes. Position vertical rod in air duct so that bow in rod is forward and down. Connect vertical rod lower clevis to other bell crank lever using clevis pin, washer, and new cotter pin. In a similar manner, connect vertical rod upper clevis to pedal shaft operating lever. Install air deflector pan in position with cap screws and connect wires at radio power pack (if so equipped). Adjust linkage so that clutch pedal will have at least 1 inch of free travel before pressure of mechanism is detected (subpar. b above). Connect adjustable clevis on rearward end of horizontal rod to clutch release shaft operating lever by installing clevis pin, washer, release spring clip, and new cotter pin. Connect release spring to clip.

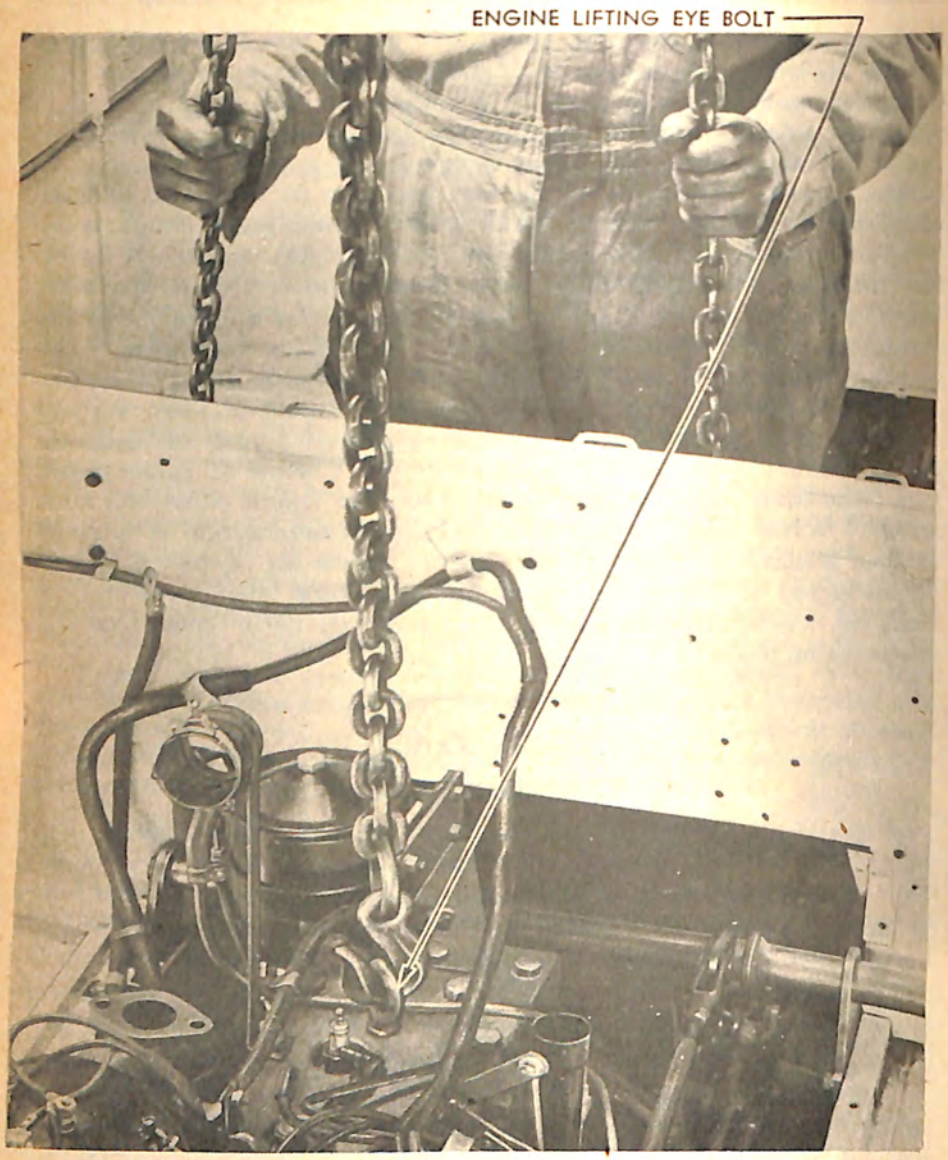
Section XXIV
TRANSMISSION

115. DESCRIPTION.

a. The transmission is the conventional automotive type with synchronizer. The splined rear end of the mainshaft is connected to the propeller shaft through a splined slip joint and a yoke which is free to move forward or backward to compensate for the movement of the engine on its cushioned supports. The outer machined surface of the slip joint bears against a spring-loaded leather seal which prevents oil leakage at the rear end of the transmission case. After vehicle serial 2197, the transmission housing cover is provided with a breather hole. This hole must be checked periodically to make certain it is not plugged. On vehicles after serial 13,199 (approx.) the transmission drain plug is magnetized for the purpose of collecting and holding any metal particles in the lubricant.

116. COORDINATION WITH HIGHER ECHELON.

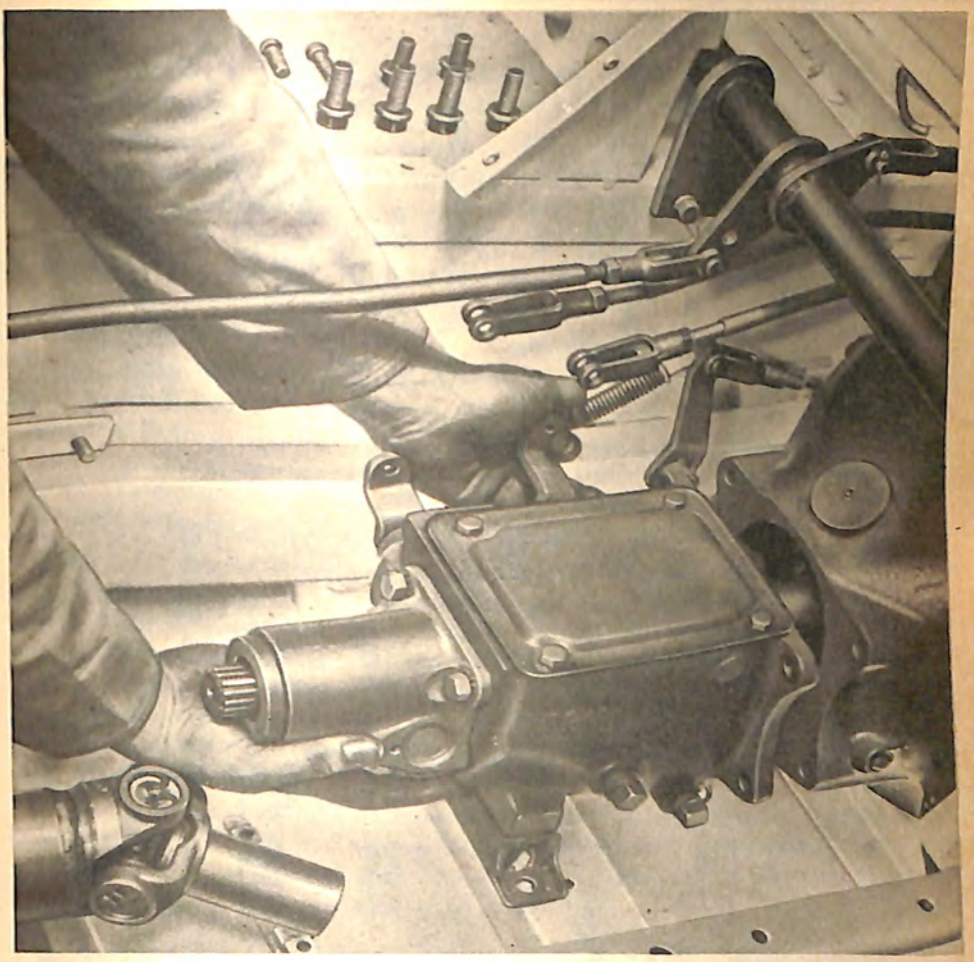
a. Replacement of the engine transmission with a new or rebuilt engine transmission is normally a third echelon operation. However,



RA PD 336489

Figure 115 — Supporting Rear of Engine Using Eye Bolt (41-B-1586-150)

it may be performed in an emergency by second echelon, providing authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation which are not carried in second echelon may be obtained from a higher echelon of maintenance.



RA PD 67047

Figure 116 — Removing Transmission

117. REMOVAL.

a. Remove Propeller Shaft. Remove propeller shaft as outlined in paragraph 121.

b. Disconnect Transmission Control Shift Rods. Remove cotter pins and clevis pins from clevises, and disconnect the control shaft rods from transmission external shift levers.

c. Support Rear of Engine. Loosen wing nuts that hold the engine compartment cover, lift cover up to disengage opposite side, and lift cover out of vehicle. Remove cap screws that hold the transmission support bracket to the hull crossmember. Drain the cooling

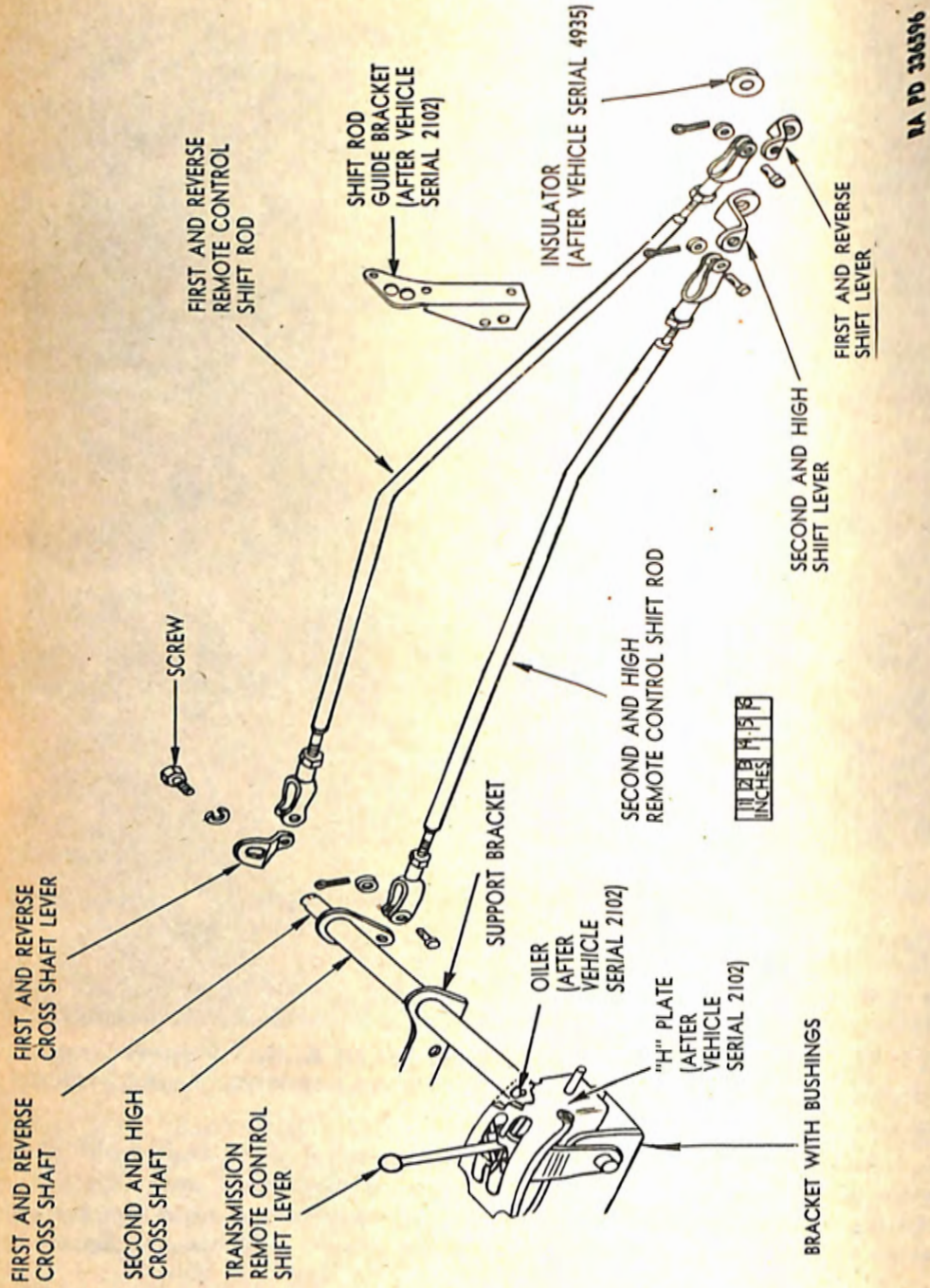


Figure 117 — Transmission Shift Linkage

system (par. 96 b (1)). Remove center, rearward, No. 6 cylinder head cap screw (fig. 52), install engine lifting eye bolt, attach a suitable lifting chain, and raise rear end of engine slightly (fig. 115).

d. Remove Transmission. Remove cap screws that hold the transmission to clutch housing; pull transmission toward rear and away from clutch housing (fig. 116). (Do not move clutch release shaft lever so that clutch releases during this operation because it will necessitate re-alining the clutch driven plate.)

118. INSTALLATION.

a. Install Transmission to Clutch Housing. When installing the transmission, be sure that it is correctly lubricated; and, before placing it in position, lubricate the transmission pinion (clutch pilot) bushing (refer to lubrication order). Place transmission into position with transmission pinion pilot in clutch pilot bushing; install the cap screws with lock washers, and tighten securely.

b. Remove Support from Rear of Engine. Lower the rear end of engine so the rear mounting rests on the hull crossmember. Install cap screws and lock washers that hold transmission mounting bracket to hull crossmember and tighten securely. Remove eye bolt, apply white lead to cylinder head cap screw threads, install cap screw, and tighten to proper tension (50 to 54 foot-pounds). Fill cooling system, place engine compartment cover in position, and tighten wing nuts.

c. Connect Transmission Control Shift Rods. Connect the control shift rods to the external levers on the transmission with clevis pins and install new cotter pins. Adjust, if necessary, as outlined in paragraph 119 b.

d. Install Propeller Shaft. Install propeller shaft (par. 122).

119. TRANSMISSION SHIFT MECHANISM AND LINKAGE (fig. 117).

a. Description. The transmission shift lever is located directly in front of the driver in a bracket mounted on the floor of hull. The shift forks and shafts are also held to this bracket. Starting with vehicle serial 2103, an H-plate was added to prevent shifting the transmission into two gear speeds at the same time. The shift rods are connected to the shift shaft levers and the shift levers at transmission. Adjustable clevises are provided for adjusting the length of rods to obtain proper shifting of gears in transmission.

b. Adjustment. Take out the screws and remove the hull floor pan. Disconnect shift rods from the transmission external shift levers, and move transmission shift lever and external levers at transmission

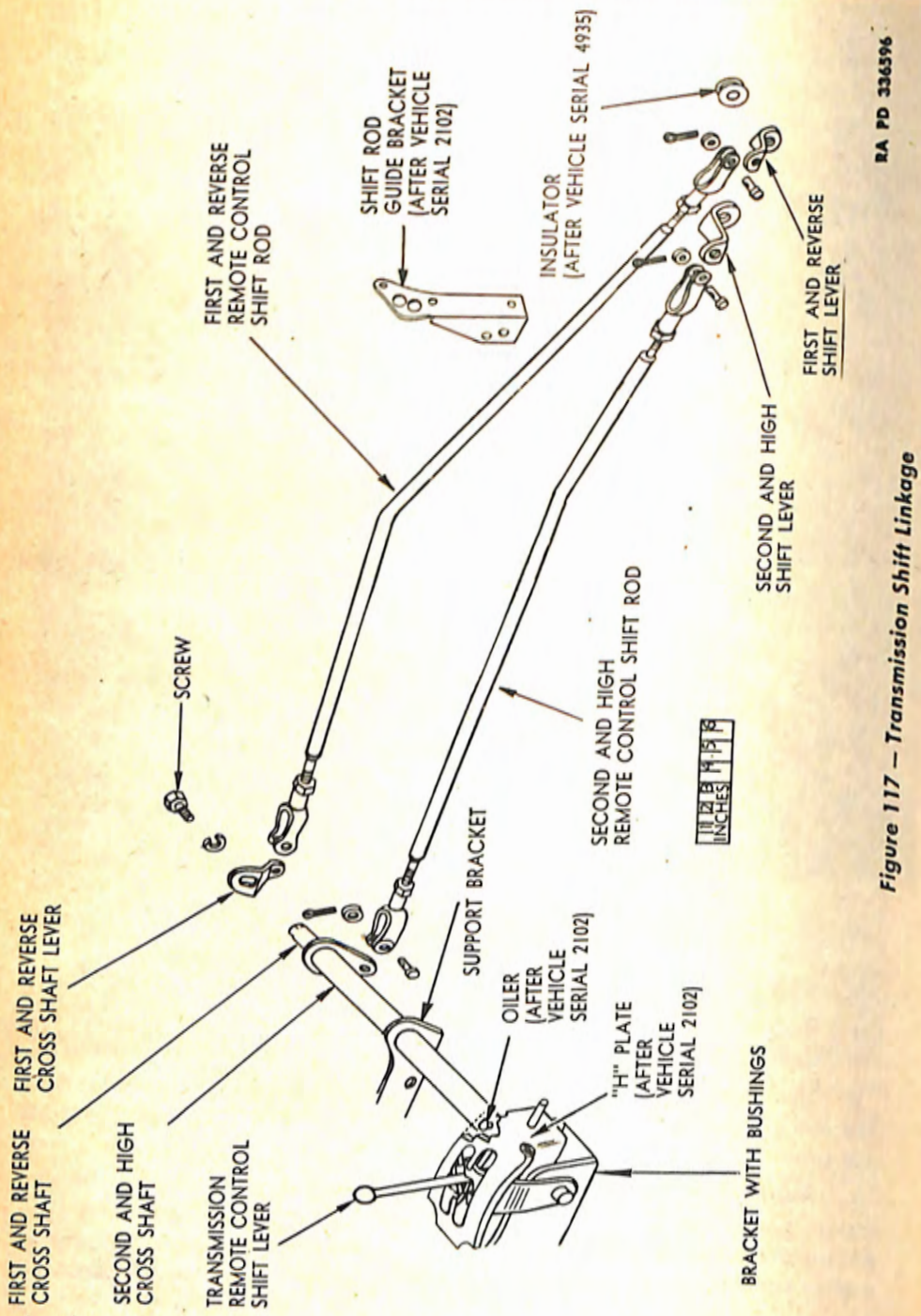


Figure 117 — Transmission Shift Linkage

system (par. 96 b (1)). Remove center, rearward, No. 6 cylinder head cap screw (fig. 52), install engine lifting eye bolt, attach a suitable lifting chain, and raise rear end of engine slightly (fig. 115).

d. Remove Transmission. Remove cap screws that hold the transmission to clutch housing; pull transmission toward rear and away from clutch housing (fig. 116). (Do not move clutch release shaft lever so that clutch releases during this operation because it will necessitate re-alining the clutch driven plate.)

118. INSTALLATION.

a. Install Transmission to Clutch Housing. When installing the transmission, be sure that it is correctly lubricated; and, before placing it in position, lubricate the transmission pinion (clutch pilot) bushing (refer to lubrication order). Place transmission into position with transmission pinion pilot in clutch pilot bushing; install the cap screws with lock washers, and tighten securely.

b. Remove Support from Rear of Engine. Lower the rear end of engine so the rear mounting rests on the hull crossmember. Install cap screws and lock washers that hold transmission mounting bracket to hull crossmember and tighten securely. Remove eye bolt, apply white lead to cylinder head cap screw threads, install cap screw, and tighten to proper tension (50 to 54 foot-pounds). Fill cooling system, place engine compartment cover in position, and tighten wing nuts.

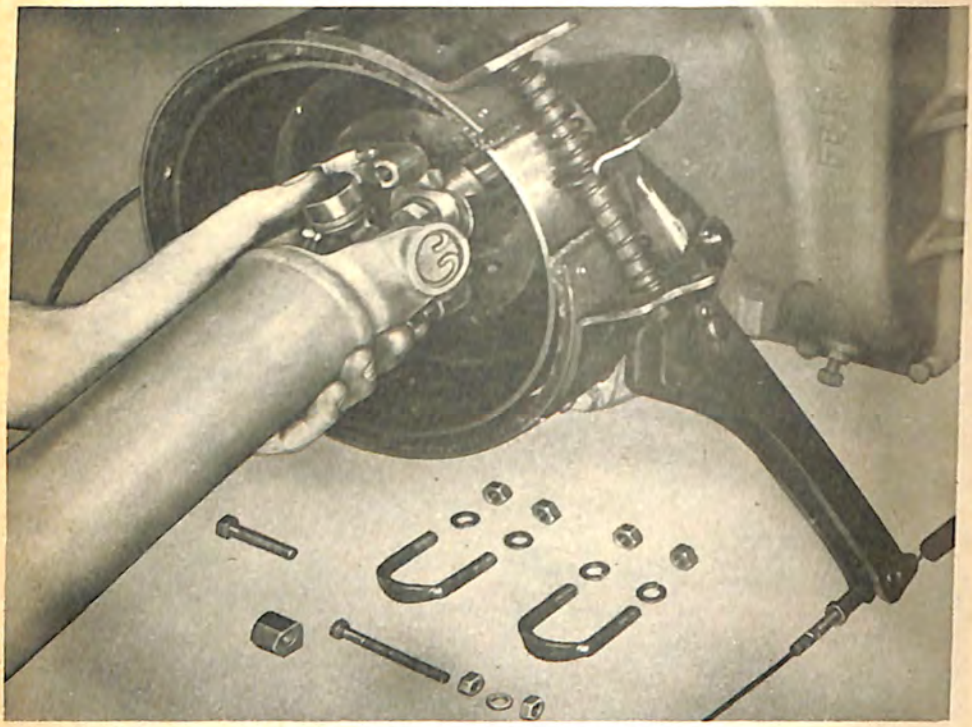
c. Connect Transmission Control Shift Rods. Connect the control shift rods to the external levers on the transmission with clevis pins and install new cotter pins. Adjust, if necessary, as outlined in paragraph 119 b.

d. Install Propeller Shaft. Install propeller shaft (par. 122).

119. TRANSMISSION SHIFT MECHANISM AND LINKAGE (fig. 117).

a. Description. The transmission shift lever is located directly in front of the driver in a bracket mounted on the floor of hull. The shift forks and shafts are also held to this bracket. Starting with vehicle serial 2103, an H-plate was added to prevent shifting the transmission into two gear speeds at the same time. The shift rods are connected to the shift shaft levers and the shift levers at transmission. Adjustable clevises are provided for adjusting the length of rods to obtain proper shifting of gears in transmission.

b. Adjustment. Take out the screws and remove the hull floor pan. Disconnect shift rods from the transmission external shift levers, and move transmission shift lever and external levers at transmission



RA PD 336671

Figure 120 — Installing Propeller Shaft Assembly

propeller shaft and pull rearward to disengage the front slip joint from the transmission mainshaft splines. Lift the propeller shaft assembly out of the vehicle.

122. INSTALLATION.

a. Install the front slip joint on the transmission mainshaft splines. Lower the rear end of shaft, pull the shaft rearward, and engage the free bearings of the rear joint with the lugs of the axle unit driving flange. NOTE: *On vehicles after serial 15,681 (approx.), tilt upper portion of parking brake band and drum rearward to allow the rear end of propeller shaft to be placed into position at axle unit driving flange (fig. 120).* Place the U-bolts in position over the bearings and install the lock washers and nuts. See that the bearings are inside the lugs on the axle unit flange and tighten the U-bolt nuts securely. NOTE: *After vehicle serial 15,681 (approx.), install parking brake adjusting link nut, the adjusting screw with adjusting nut, lock washer, and lock nut, and the anchor screw. Adjust the parking brake (par. 124).* Place the hull floor pan in position, install screws, and tighten securely.

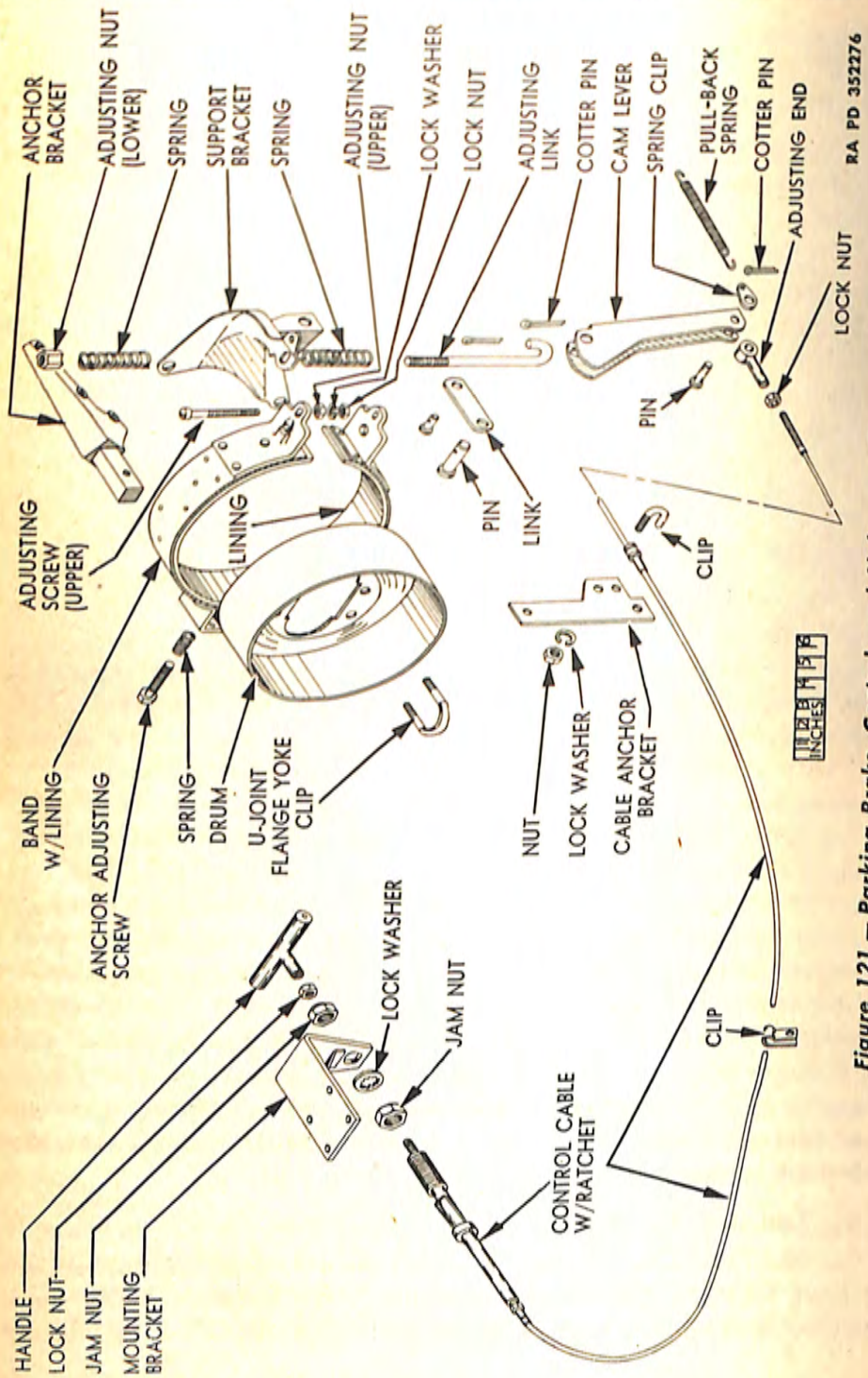
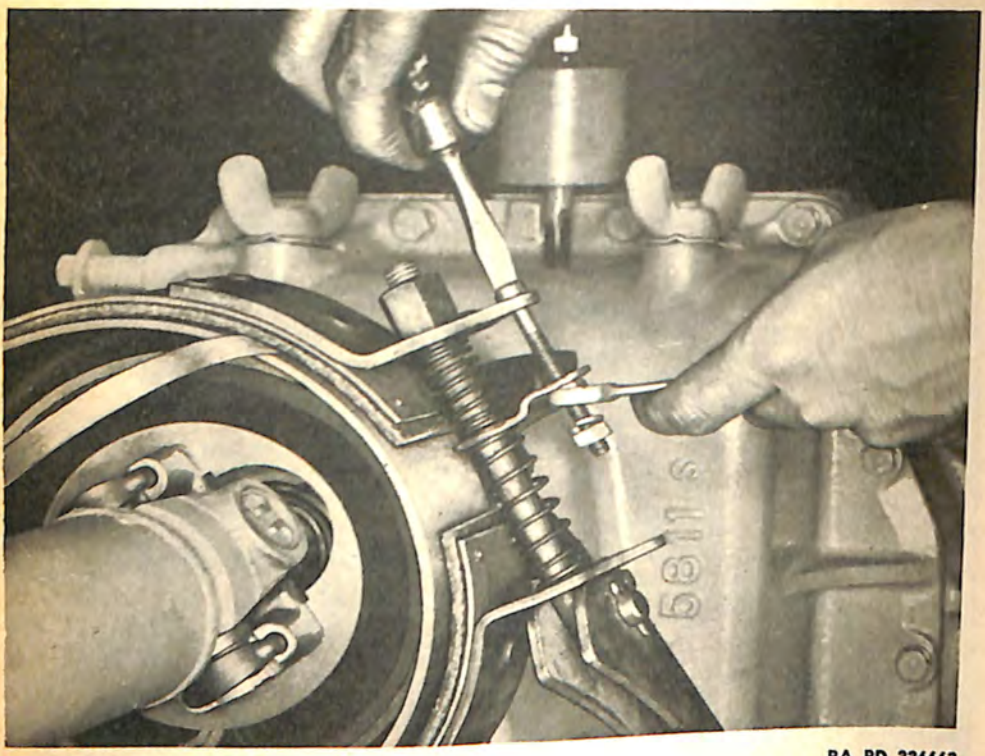


Figure 121 — Parking Brake, Control, and Linkage — Disassembled

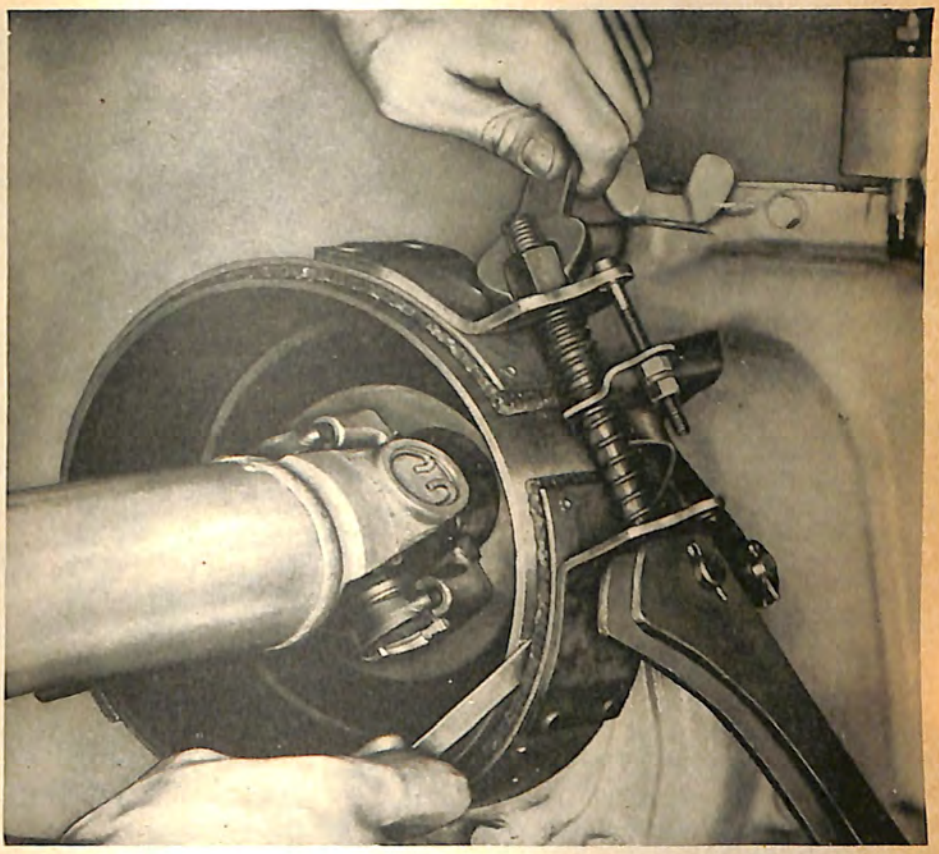


RA PD 336663

Figure 123 — Adjusting Parking Brake Band at Top

adjusting link, and springs. Cut the anchor screw lock-wire, take out anchor screw and spring, and remove brake band (fig. 125).

b. Installation. Slide brake band into position around drum so anchor bracket on band is over anchor support; and with anchor screw spring in recess on support, install anchor screw. Place cam lever in position against underside of lower band bracket, and install link springs between band brackets and support. Insert the adjusting link at top of cam lever and through band lower bracket; install lower spring on adjusting link; insert upper end of adjusting link through support bracket hole; insert adjusting link through upper spring and band upper bracket hole. Install nut on adjusting link. Insert the band adjusting screw through band upper bracket and band support; install adjusting nut, lock washer, and lock nut. Adjust parking brake (par. 124). Place floor pan in position, install cap screws, and tighten.



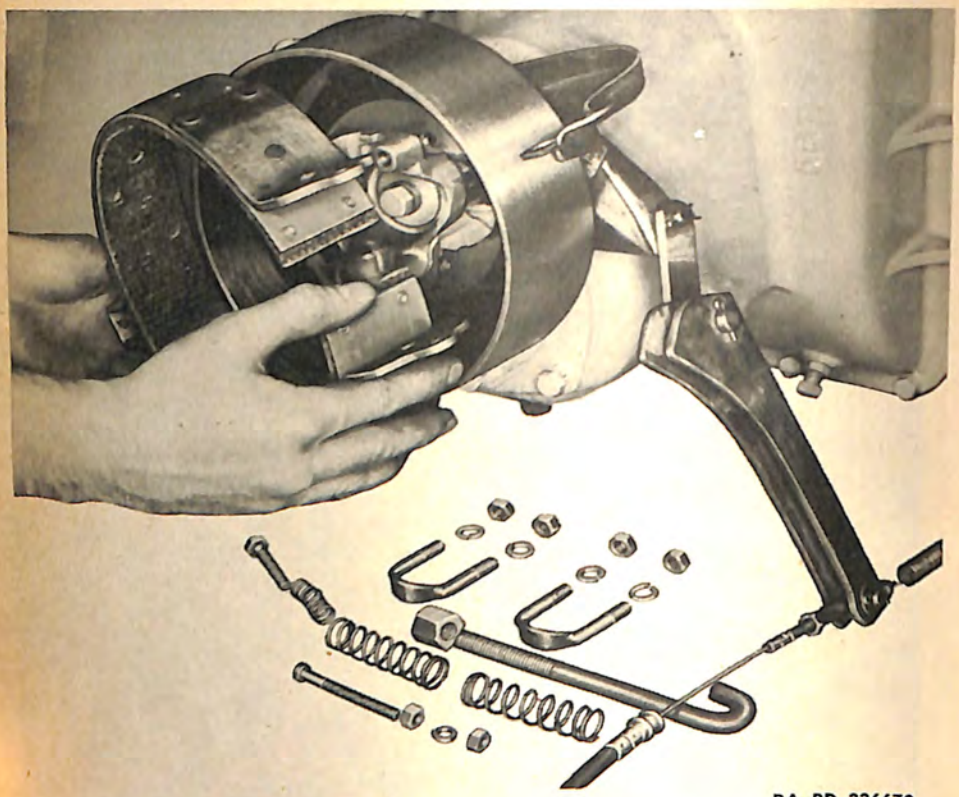
RA PD 336665

Figure 124 — Adjusting Parking Brake Band at Bottom

126. BRAKE DRUM.

a. Removal. Remove propeller shaft (par. 121). Remove adjusting link and springs, and remove brake band and anchor spring. Turn brake drum to slip it over axle unit driving flange and remove drum from vehicle (fig. 126).

b. Installation. Slip brake drum over axle unit driving flange and turn 90 degrees to place drum into position for attachment to driving flange. Install anchor spring and position brake band around drum; connect lower end of adjusting link at cam lever and install upper end of link and springs at band brackets. Install propeller shaft (par. 122).



RA PD 336670

Figure 125 — Removing Parking Brake Band

127. BRAKE CONTROL AND LINKAGE (fig. 121).

a. Removal. Remove floor pan by removing cap screws that hold floor pan to hull. Unhook pull-back spring and remove cotter pin, spring clip, and pin to disconnect adjusting end at rear of hand brake cable from cam lever. Remove nut, lock washer, and clip at cable anchor bracket. Remove nut and lock washer at screw which also holds accelerator cable control tube clip, and remove brake cable clip. Loosen handle lock nut and remove handle. Remove handle lock nut and other jam nut. Push handle shaft through bracket, and remove control linkage from vehicle.

b. Installation. With inner jam nut and toothed lock washer installed on handle shaft, insert shaft through mounting bracket from the rear and install outer jam nut. Tighten jam nut to secure front

RA PD 336667

Figure 126 — Removing Parking Brake Drum

end of control cable. Install handle lock nut and handle, and tighten lock nut against handle. Thread control cable below accelerator control tube and locate cable along left side of hull. Install clip on cable at the accelerator cable control tube and fasten with nut and lock washer on screw supporting accelerator cable tube clip. Fasten anchor clip with nut and lock washer over cable thrust sleeve at cable anchor bracket. Connect cable adjusting end to cam lever by installing pin, spring clip, and new cotter pin. Connect pull-back spring. Adjust parking brake (par. 124). Place floor pan in position, install cap screws, and tighten.

Section XXVII

AXLE TRANSMISSION, DIFFERENTIAL, AND FINAL DRIVE ASSEMBLY

128. DESCRIPTION.

a. The axle unit is located in the extreme rear of hull and transmits power to driving wheels and tracks. The unit is composed of a 2-speed transmission, a differential with planetary gears, and two brake drums and bands with operating levers for power steering as well as braking. The final drive assemblies consist of two wheel carriers with track drive wheels and axle shafts. The speedometer is driven from a gear on the front end of axle transmission pinion. The differential is of the type commonly known as a "controlled differential."

129. ADJUSTMENT OF STEERING BRAKE BANDS.

a. **Description.** Two adjustments are provided for the brake bands. The adjustment most frequently used is controlled by the large wing nuts on the upper portion of the axle transmission case proper.

b. **Adjustment.**

(1) BRAKE BAND WING NUTS. To adjust bands at wing nuts, turn clockwise until band lining tightens on drum. The wing nuts are notched to engage with stop ribs on the locking plate and should be adjusted in one-half turns, or until notches engage with stop ribs. Do not tighten bands excessively, and make sure the steering levers have from 1- to 2½-inches free travel at upper end of levers before resistance is detected.

(2) BRAKE BAND SET SCREWS. To maintain proper steeling band contact around each drum, two additional points of adjustment are provided. One is located in the lower portion of axle transmission case, the other on the differential housing. The adjustments are made by set screws held in a fixed position by locking nuts. To adjust set screws, loosen locking nuts and turn adjusting screws clockwise until ends of the screws can be felt to contact steering bands. Continue turning clockwise until steering band lining is felt to contact drum, then back off the screws two flats, or one-third turn. This will establish approximately 0.020- to 0.025-inch clearance between drum and steering band lining. Perform same operation at the adjusting screws on opposite band. After obtaining proper adjustment, fasten screws in position with lock nuts. NOTE: *Whenever set screws require adjustment, it is always advisable to make set screw adjustments before making wing nut adjustment.*

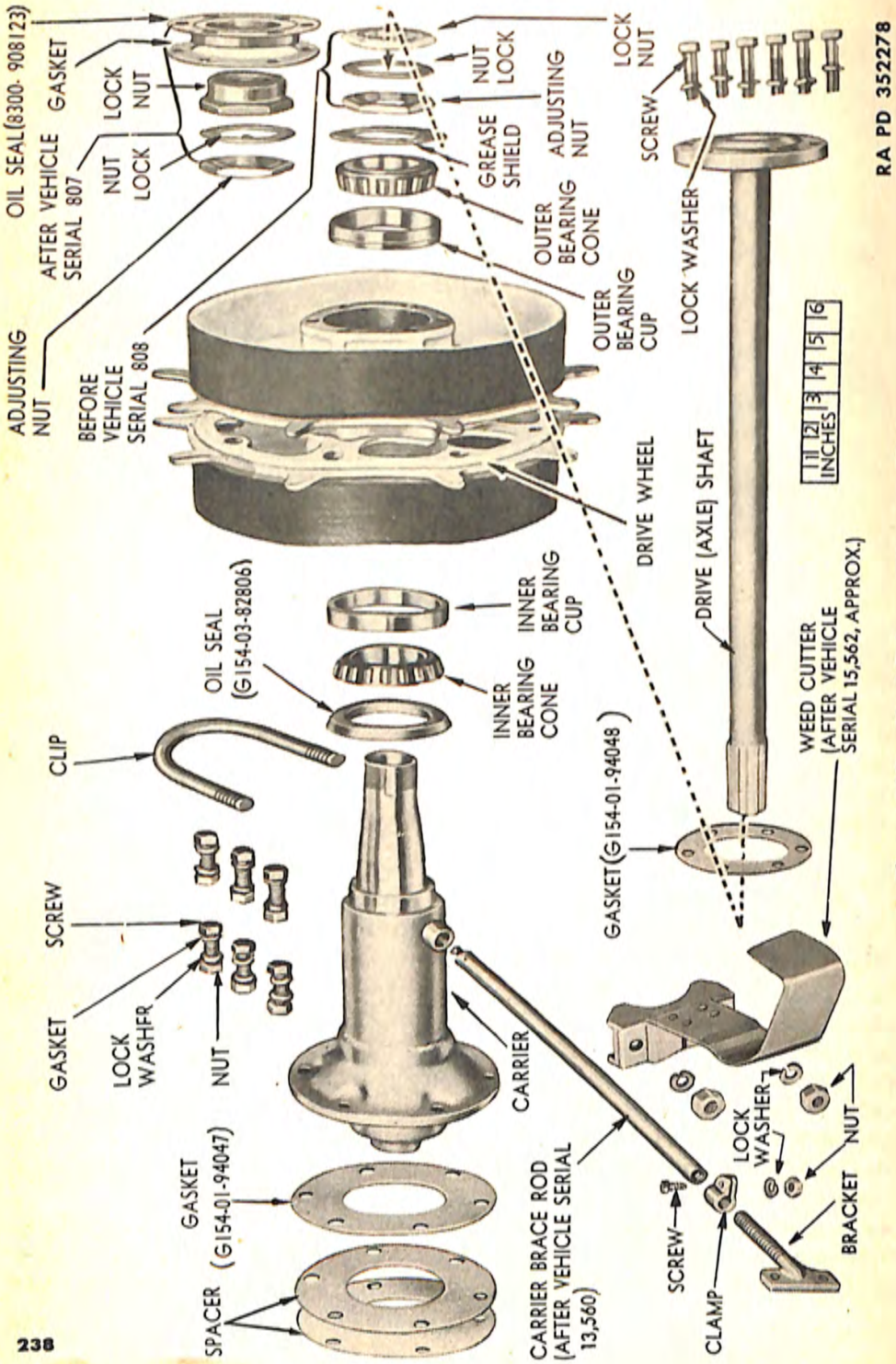


Figure 128 — Final Drive — Disassembled

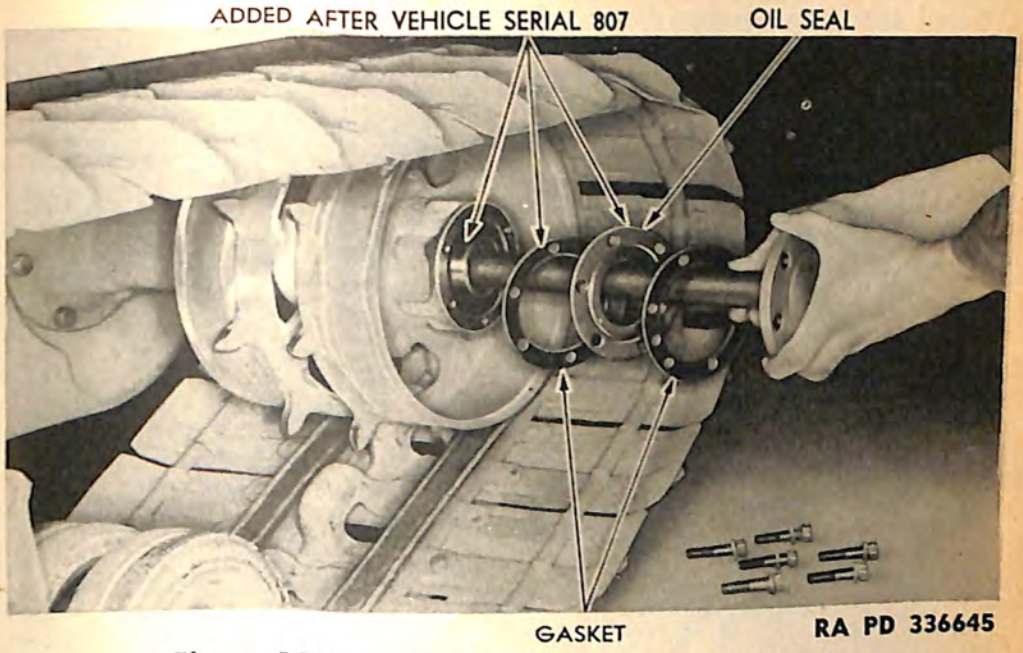


Figure 129 — Removing Final Drive (Axle) Shaft

out of carrier (fig. 129). Place a new gasket, grease seal, and another new gasket in position on wheel hub. Insert replacement axle shaft into carrier and turn until splines enter differential side bevel gear. Install cap screws with lock washers and tighten securely.

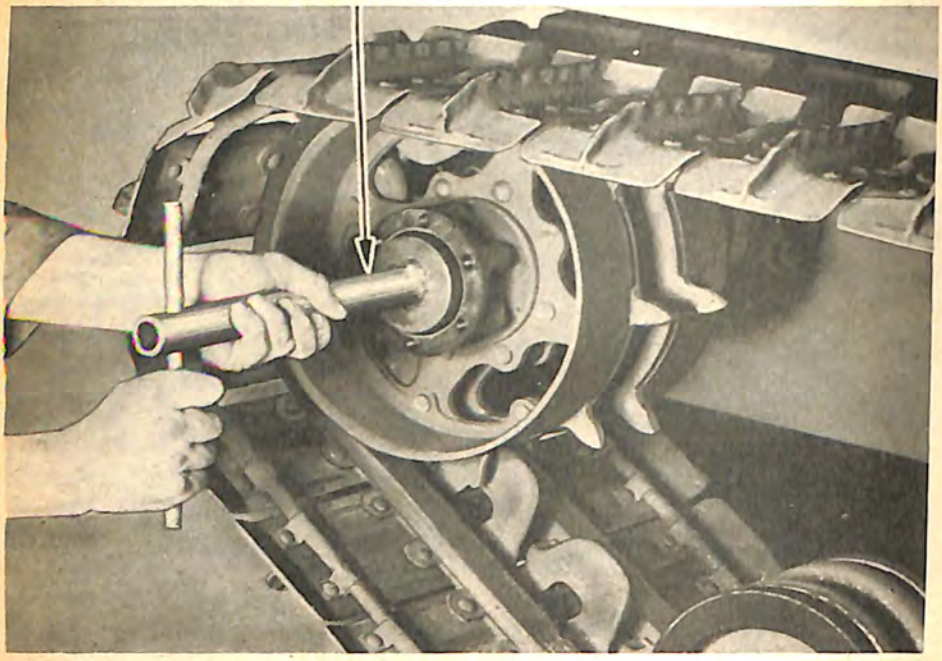
c. Drive Wheels.

(1) DESCRIPTION. The sprocket-type drive wheels are mounted on the carrier with two tapered roller bearings. An adjusting nut is provided to adjust the bearings, and grease seals and gaskets are used to prevent leakage. Vehicles after serial 15,562 (approx.) are equipped with a weed cutter (fig. 128) mounted by a U-bolt clip at each carrier arm and extending around the inner sprocket of the drive wheel. The purpose of the weed cutter is to minimize the accumulation of vegetation and debris at the drive wheel and track.

(2) BEARING ADJUSTMENT (fig. 130). Remove axle shaft (subpar. **b** above). Unlock and remove bearing lock nut, remove lock, and adjust bearing with adjusting nut wrench. Tighten nut until it is snug; then loosen it one-sixth turn. Install lock and lock nut, tighten securely, and bend lock over flat on nut. Install axle shaft (subpar. **b** above).

(3) REMOVAL. Remove track (par. 135 **e**) and axle shaft (subpar. **b** above). Unlock and remove bearing lock nut and remove lock and adjusting nut. After vehicle serial 15,562 (approx.), remove nuts

DRIVE AND IDLER WHEELS BEARING NUT WRENCH



RA PD 336497

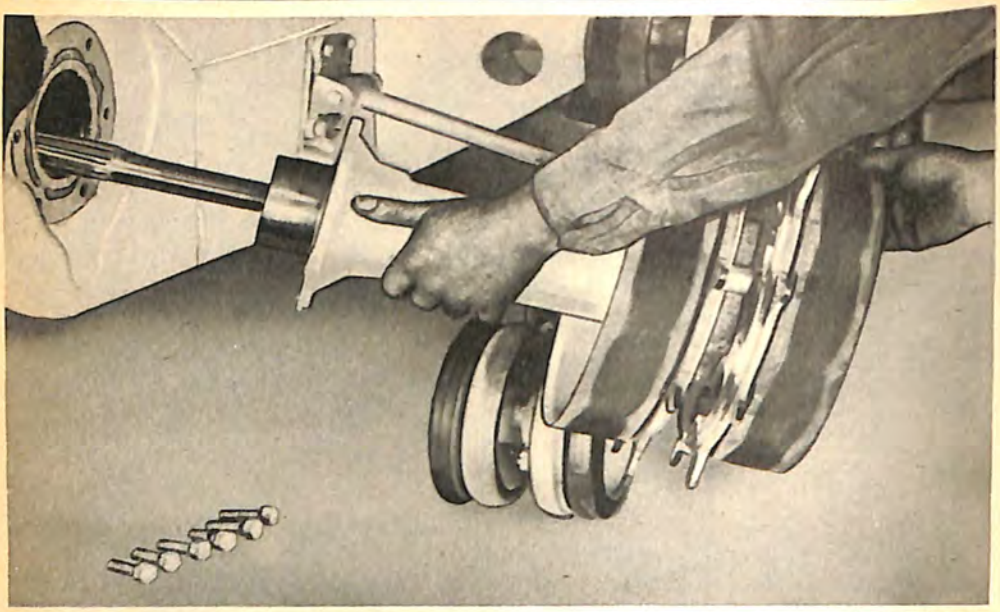
Figure 130 — Adjusting Drive Wheel Bearings With Wrench (41-W-2940-55)

and lock washers from U-bolt clip holding weed cutter to carrier, and slip weed cutter down onto the carrier brace rod. NOTE: *If at any time it becomes necessary to remove weed cutter from vehicle, loosen clamp on carrier brace rod by removing clamp screw, lock washer, and nut; then turn rod down on bracket until weed cutter can be removed between upper end of carrier brace rod and socket boss on carrier.* Pull wheel and outer bearing cone off carrier (fig. 131), and remove the inner bearing cone and seal.

(4) BEARING CUP REPLACEMENT. If bearings are to be replaced, drive bearing cups out of wheel hub (fig. 159). Install new cups.

(5) INSTALLATION. Install new oil seal and inner bearing cone on carrier; then install drive wheel. Install outer bearing cone and bearing nut; then adjust bearings (subpar. (2) above). After vehicle serial 15,562 (approx.), position weed cutter on carrier and install U-bolt clip. Install lock washers and nuts on U-bolt clip, and tighten. Install track (par. 135 **b**) and axle shaft (subpar. **b** above).

d. Removal of Final Drive Assembly. Remove track (par. 135 **e**) from side where final drive assembly is to be removed. Relieve track

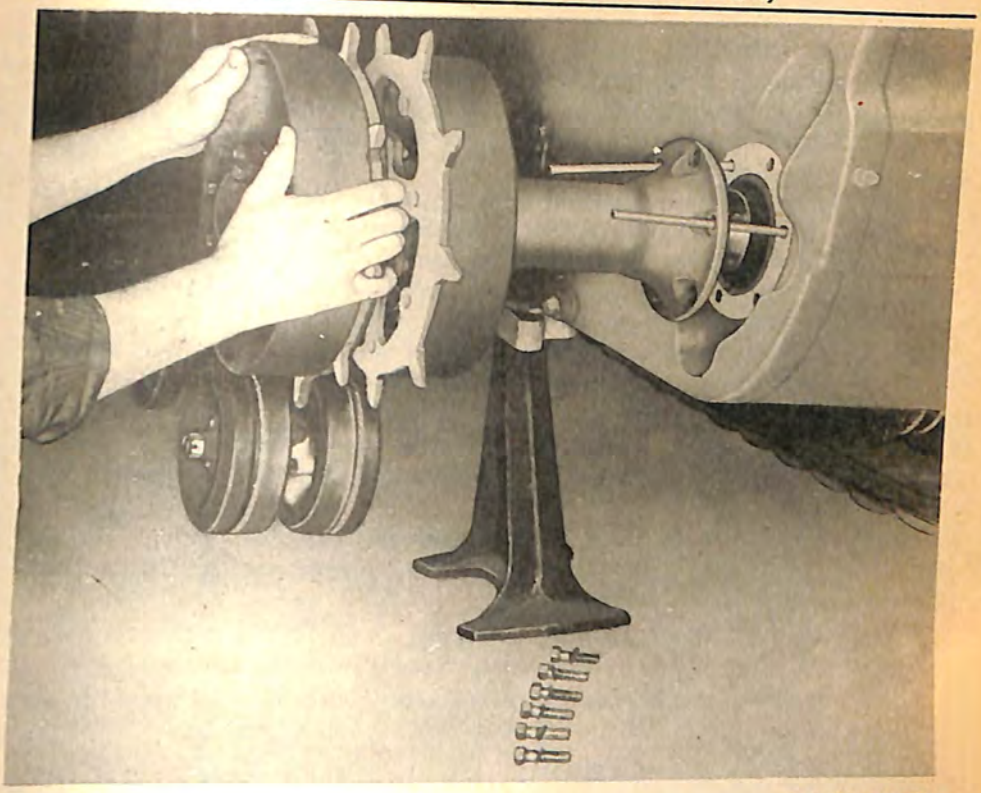


RA PD 67079

Figure 132 — Removing Final Drive Assembly

tension on opposite track. After vehicle serial 13,560, loosen clamp on carrier brace rod by removing clamp screw, lock washer, and nut; then turn rod down on bracket as far as possible. NOTE: *If at any time it becomes necessary to remove carrier brace rod and bracket from vehicle, remove screws and lock washers that hold carrier brace rod bracket to bogie spring bumper bracket and hull, and remove carrier brace rod assembly.* Remove the nuts, lock washers, copper washers, and bolts that hold the final drive assembly to the axle housing and hull. Pull the assembly out of the axle housing (fig. 132).

e. Installation of Final Drive Assembly. Place guide pins through holes in hull and into flange on axle housing, being sure that the shim between the housing and hull is in place. Install a new gasket coated with joint sealing compound against hull. Place final drive assembly in position (fig. 133) on the guide pins, so the drain hole in carrier points downward; then push shaft and carrier into the axle housing. Install bolts, copper washers, lock washers, and nuts, and tighten securely. On vehicles after serial 13,560, turn carrier brace rod to position upper end into socket boss on carrier. After carrier brace rod is in position and all rod end play is eliminated, tighten rod one additional turn. Position clamp at lower end of carrier brace rod. Install clamp screw, lock washer and nut, and tighten. Install track (par. 135 f) and adjust tension on both tracks (pars. 135 c (1) and (2)).



RA PD 336496

Figure 133 — Installing Final Drive Assembly Using Guide (Pins) (41-G-1259-400) (Third Echelon Tool)

131. AXLE TRANSMISSION AND DIFFERENTIAL ASSEMBLY.

a. Description (fig. 127). This assembly contains the transmission with mechanism for shifting the unit into high or low range. The differential assembly, steering brake drums, and bands with linings are also contained in this unit. After vehicle serial 12,324, the axle unit transmission and differential drain plugs are magnetized for the purpose of collecting and holding any metal particles in the lubricant.

b. Coordination with Higher Echelon. Replacement of the axle transmission and differential assembly with a new or rebuilt assembly is normally a third echelon operation. However, it may be performed in an emergency by second echelon, provided authority for performing this replacement is obtained from the appropriate commander. Tools needed for the operation, which are not carried in second echelon, may be obtained from a higher echelon of maintenance.

c. Removal.

(1) REMOVE TOP AND BOWS. Remove vehicle top and bows as outlined in paragraphs 143 b (1) and c (1).

(2) REMOVE PROPELLER SHAFT. Remove propeller shaft as outlined in paragraph 121.

(3) REMOVE PARKING BRAKE MECHANISM AND SUPPORTS (AFTER VEHICLE SERIAL 15,681, APPROX.). Remove adjusting link and springs from parking brake mechanism and remove brake band. Turn brake drum 90 degrees and slip it over axle unit driving flange. Remove cotter pin and pin fastening the link to the support bracket; then move cam lever and link out of the way. Remove cap screws and lock washers holding support bracket and anchor bracket to axle unit, and remove brackets.

(4) REMOVE AXLE UNIT COVER. Remove axle unit cover by taking out cap screws that hold plate to hull directly over axle unit (fig. 134).

(5) DISCONNECT AXLE TRANSMISSION CONTROL ROD. Disconnect axle transmission remote control rod by removing cotter pin and clevis pin from lever on axle unit.

(6) DISCONNECT STEERING CONTROL RODS. Disconnect steering remote control rods from operating levers on axle unit.

(7) DISCONNECT SPEEDOMETER CABLE. Disconnect speedometer cable from axle unit.

(8) REMOVE REAR EXHAUST PIPE. See paragraph 93 b (1).

(9) REMOVE FINAL DRIVE ASSEMBLIES. See paragraph 130 d.

(10) REMOVE AXLE UNIT. With both carriers removed, attach a lifting chain around axle unit and lift unit forward and upward from hull with a suitable hoist (fig. 135). Take particular note of any shims used on each side between the housing flange and the hull, and make certain that the same number of shims are installed when axle is again placed in vehicle. Remove drain plugs and allow lubricant to drain out of housings.

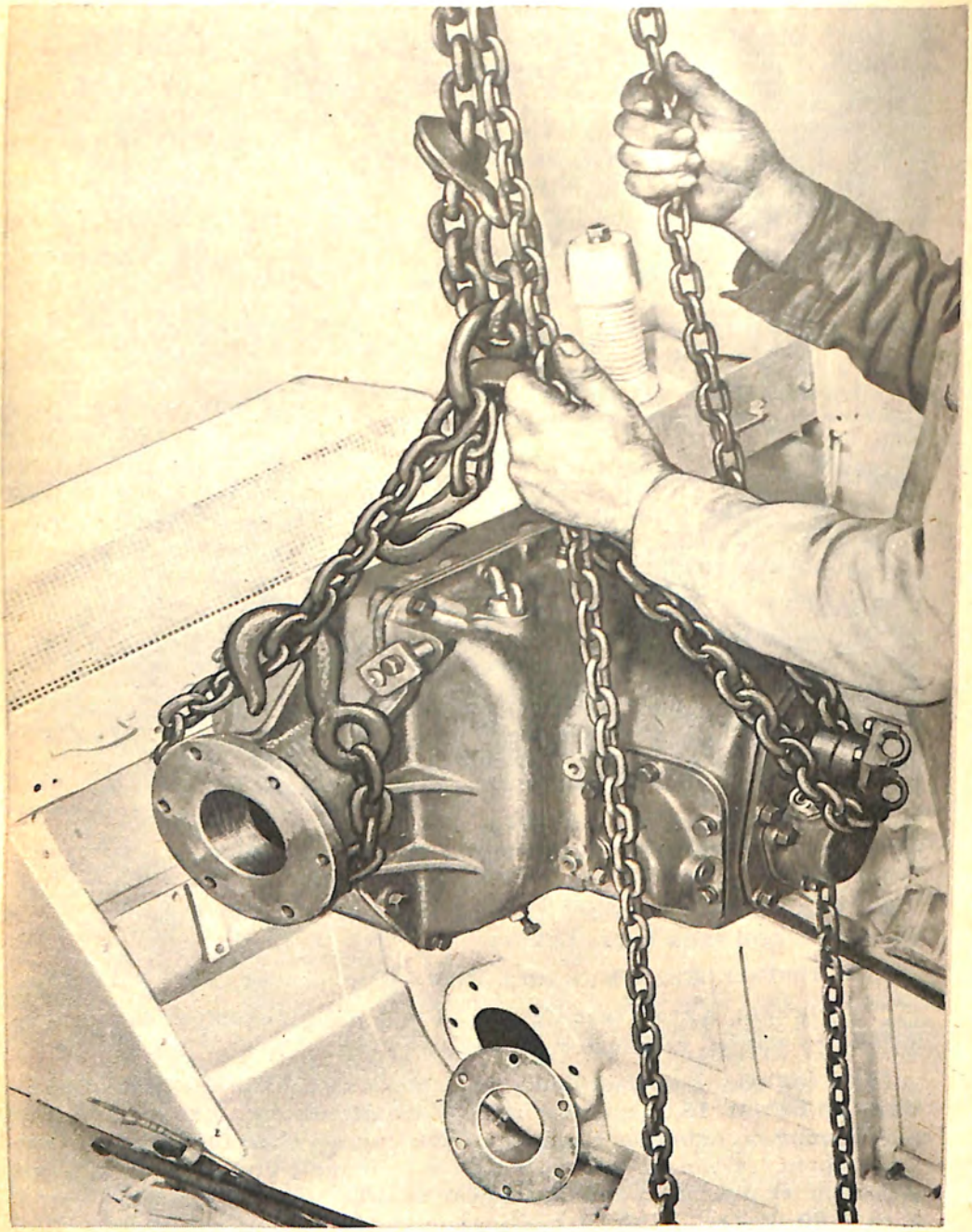
d. Installation.

(1) PLACE AXLE UNIT IN VEHICLE. Lower axle unit into position in hull. Place same number of shims as were used previously between hull and housing flanges. Aline both holes in hull with holes in shims and axle housing flanges, and install guide pins in opposite holes.

(2) INSTALL FINAL DRIVE ASSEMBLIES. See paragraph 130 e.

(3) CONNECT SPEEDOMETER CABLE. Connect speedometer cable to axle unit.

(4) CONNECT AXLE TRANSMISSION CONTROL ROD. Connect and adjust axle transmission control rod (par. 132 b).



RA PD 336647

Figure 135 — Removing Axle Unit

lever and install upper part of adjusting link through band lower bracket, lower spring, support, upper spring, and band upper bracket.

(9) INSTALL PROPELLER SHAFT. Install propeller shaft as outlined in paragraph 122.

(10) INSTALL BOWS AND TOP. Install bows and top (pars. 143 **b** (1) and **c** (1)).

132. AXLE TRANSMISSION CONTROL AND LINKAGE.

a. Description (fig. 136). The axle transmission is shifted by remote control from the driver's compartment. When the axle transmission shifting lever is in the rear position, the low-speed gear is engaged. The forward position of the lever engages the high-speed gear.

b. Adjustment. Take out screws and remove hull floor pan. Remove cotter pin and clevis pin that holds shift rod clevis to shift lever at axle transmission. Move shift lever at axle transmission forward to shift the sliding gear into the low range. Have an assistant hold the hand control gearshift lever slightly forward from vertical; loosen clevis lock nut and adjust length of rod until holes in clevis are alined with hole at axle transmission shift lever. Connect shift rod clevis to shift lever at axle transmission with clevis pin and new cotter pin. Tighten clevis lock nut, place hull floor pan in position, install screws, and tighten securely.

c. Removal.

(1) CONTROL. Remove control bracket from floor of hull (par. 133 **c** (1)). Remove cotter pin and washer from left end of shift lever shaft. Remove nut and bolt from lever, and slide shaft out of control bracket and lever.

(2) LINKAGE. Loosen wing nuts and remove engine compartment cover. Remove engine compartment side panel (par. 75 **m**). Take out cap screws and remove hull floor pan. Remove cotter pin, washer, and clevis pin from each end of forward control rod, and remove rod. Remove cotter pin, washer, and clevis pin from each end of rearward control rod, and remove rod.

d. Installation.

(1) CONTROL. Insert left end of shaft through hole in right side on control bracket, place shift lever into position in bracket, and slide shaft through lever and hole in left side of bracket. Install clamp bolt and nut in shift lever and tighten to clamp lever on shaft. Place washer over left end of shaft and install a new cotter pin. Install control bracket on floor of hull (par. 133 **d**).

(2) LINKAGE. Install rearward control rod and install clevis pin, washer, and new cotter pin in each end. Install forward control shift rod and install clevis pin, washer, and new cotter pin in each end.

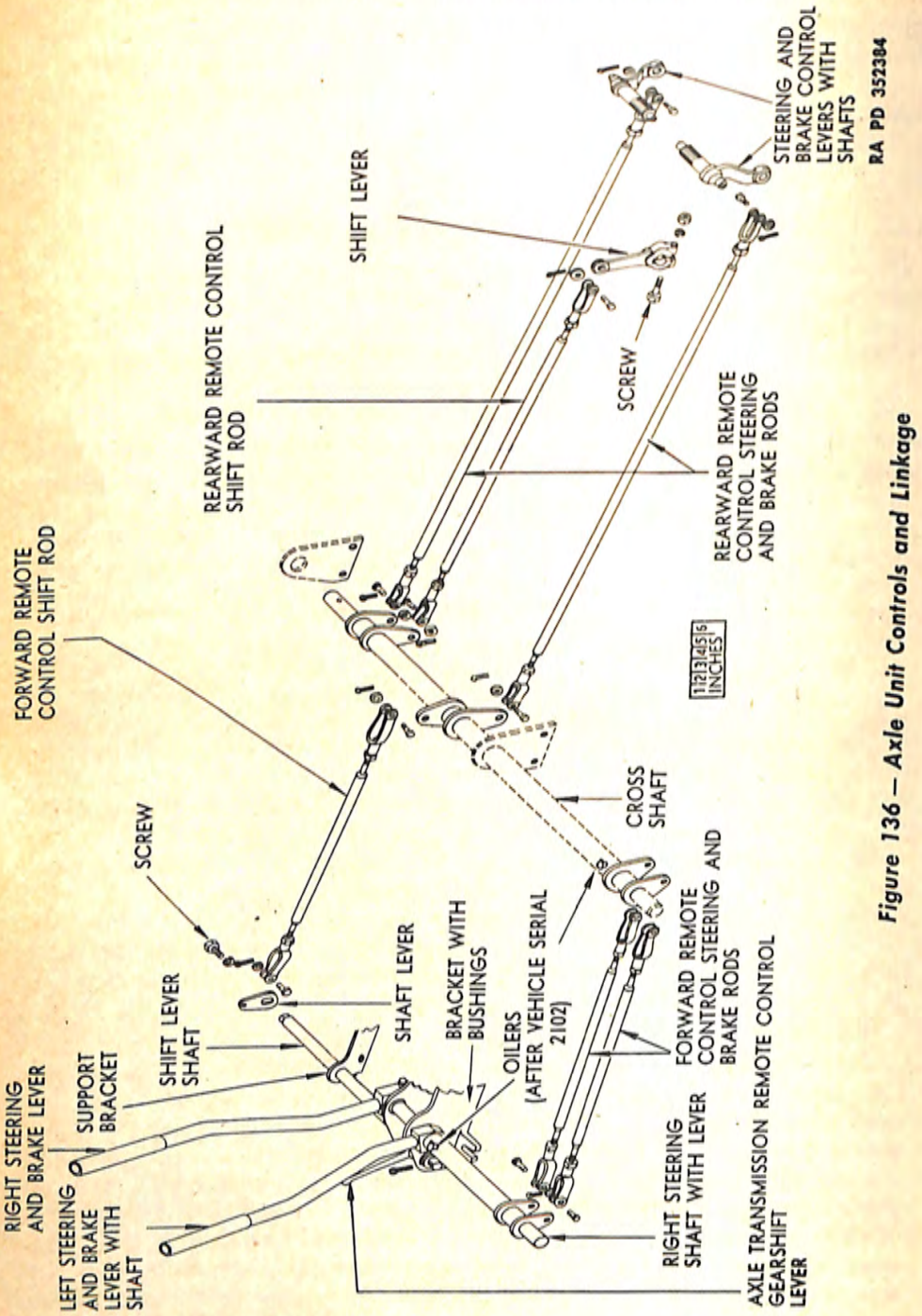
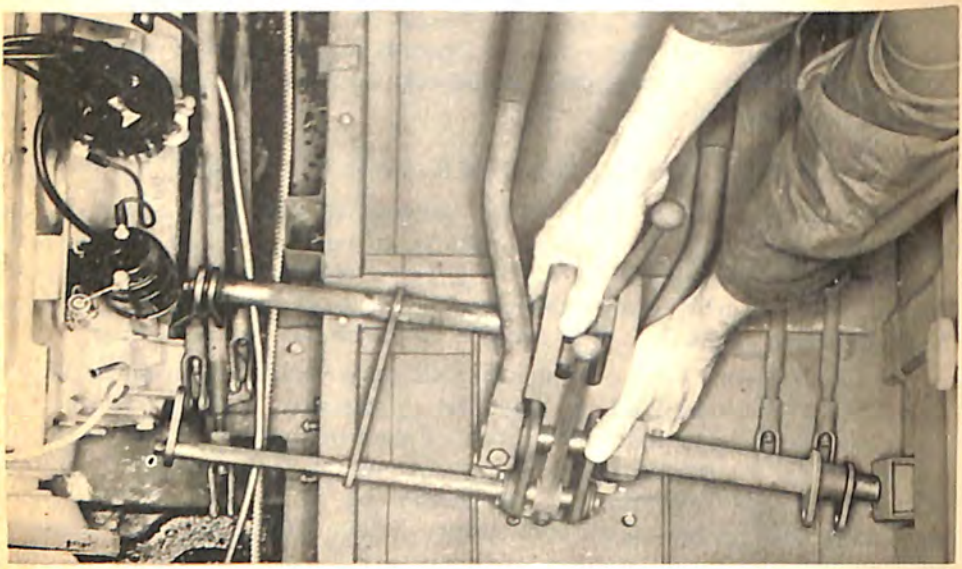


Figure 136 — Axle Unit Controls and Linkage



RA PD 336528

Figure 137 — Removing Steering Levers, Shift Levers, and Bracket Assembly

Remove seat and cushion from driver's compartment (pars. 144 b and c). Remove cap screws, lock washers, and plain washers holding heater outlet panel to bulkhead and engine side panel, and remove heater outlet panel. Remove cap screws, lock washers, and plain washers holding bulkhead cross shaft cover to hull side inner reinforcement and to bulkhead, and remove bulkhead cross shaft cover. Disconnect all rods from cross shaft by removing cotter pins and clevis pins. Remove cap screws and lock washers holding cross shaft brackets to hull. Remove cotter pin from right end of cross shaft and slide cross shaft assembly toward right side of vehicle until left end of cross shaft is free from socket in hull. Lift cross shaft assembly forward and up out of vehicle through driver's compartment.

d. Installation.

(1) CONTROLS. Reassemble inner shaft through left end of tubular shaft, and install right end of inner shaft through control bracket from left side. Install spacer, key, and right steering lever on right end of inner shaft and tighten clamp bolt securely. Place assembly on hull floor and fasten bracket to hull floor securely with cap screws. Place transmission shift lever and axle transmission shift lever shaft supporting bracket in position and tighten securely with cap screws. Connect rods to steering lever shafts, transmission shift lever shafts, and axle transmission shift lever shaft by installing the clevis pins

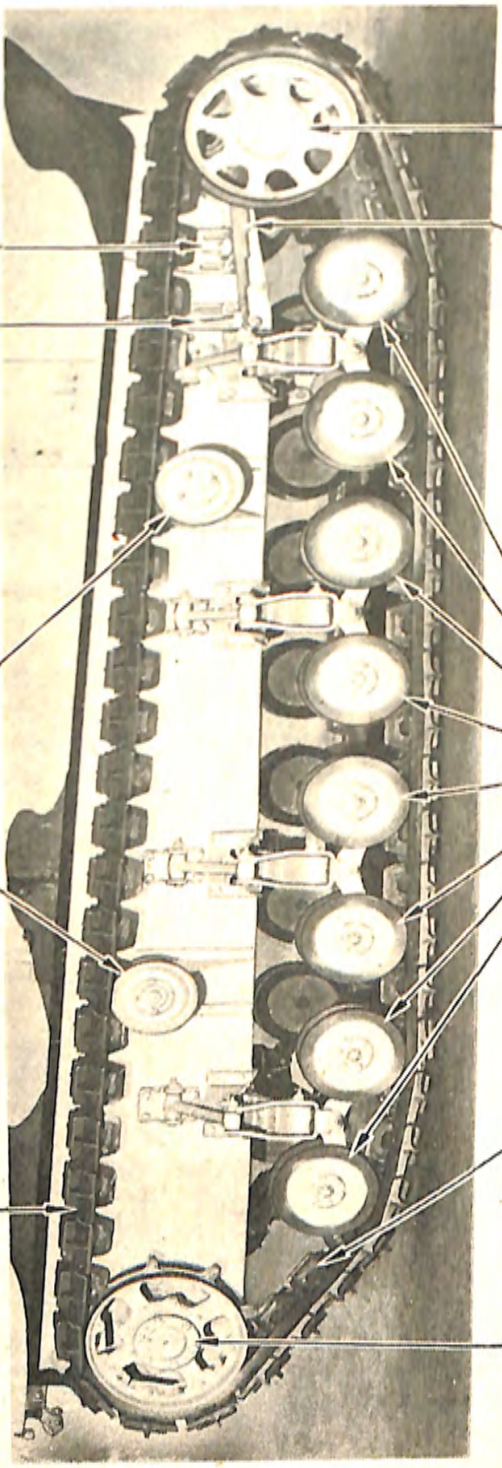


Figure 138 — Track and Suspension System — Right Side (Before Vehicle Serial 2103)

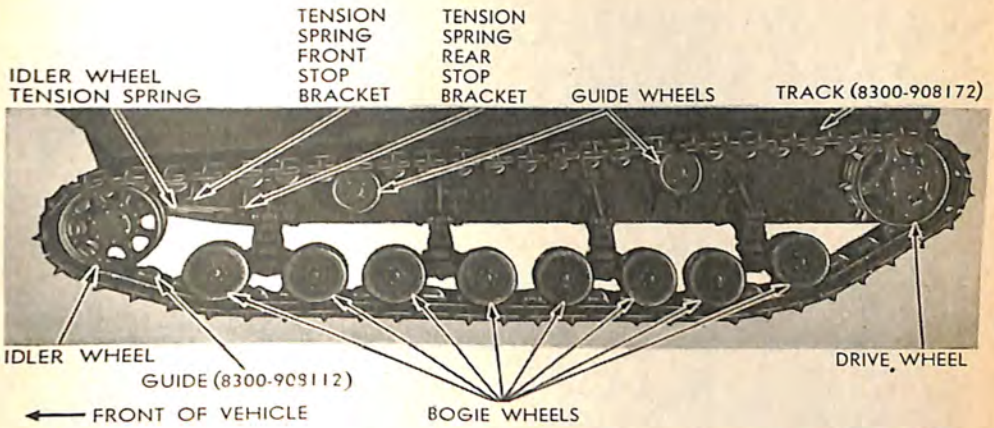


Figure 139 — Track and Suspension System — Left Side (From Vehicle Serial 2103 Through 14,999, Approx.)

135. TRACKS.

a. Description. Two rubber belts, into which are embedded four continuous steel cables with metal lugs attached at 2¼-inch intervals, act as the backbones of the track. Ribbed steel plates and guide members are riveted to the driving lugs.

b. Checking Tension.

(1) USE OF GAGE (41-G-434-500) (SUPPLIED WITH VEHICLES BEFORE SERIAL 9503). Back up vehicle on level ground for a distance equivalent to its length; then drive straight ahead to original position and stop without applying brakes. Clean any mud or debris from machined edge of the front wheel spring seat. With pointer end of track spring tension gage (41-G-434-500) toward rear, engage locating ears at the front of gage between spring U-bolts with upper edge of gage flat against machined surface of spring seat (fig. 141). Draw gage hook and spring up around carrier arm, and engage hook in hole near front of gage (fig. 142). Note position of gage with relation to top leaf of spring (fig. 143). If pointer is below top of upper spring leaf, the track tension is too loose. If pointer of gage is above upper leaf of spring, the track is too tight. In either case, track tension must be adjusted (subpar. c (1) below).

(2) USE OF TOOL (41-T-3079-525) (SUPPLIED WITH VEHICLES FROM SERIAL 9503 THROUGH 14,999, APPROX.) Back up vehicle on level ground for a distance equivalent to its length; then drive straight ahead to original position and stop without applying brakes. Assemble calibrating tool (41-T-3079-525) to end of torque wrench (41-W-3630) at the ½-inch square hole near one end of calibrating tool so

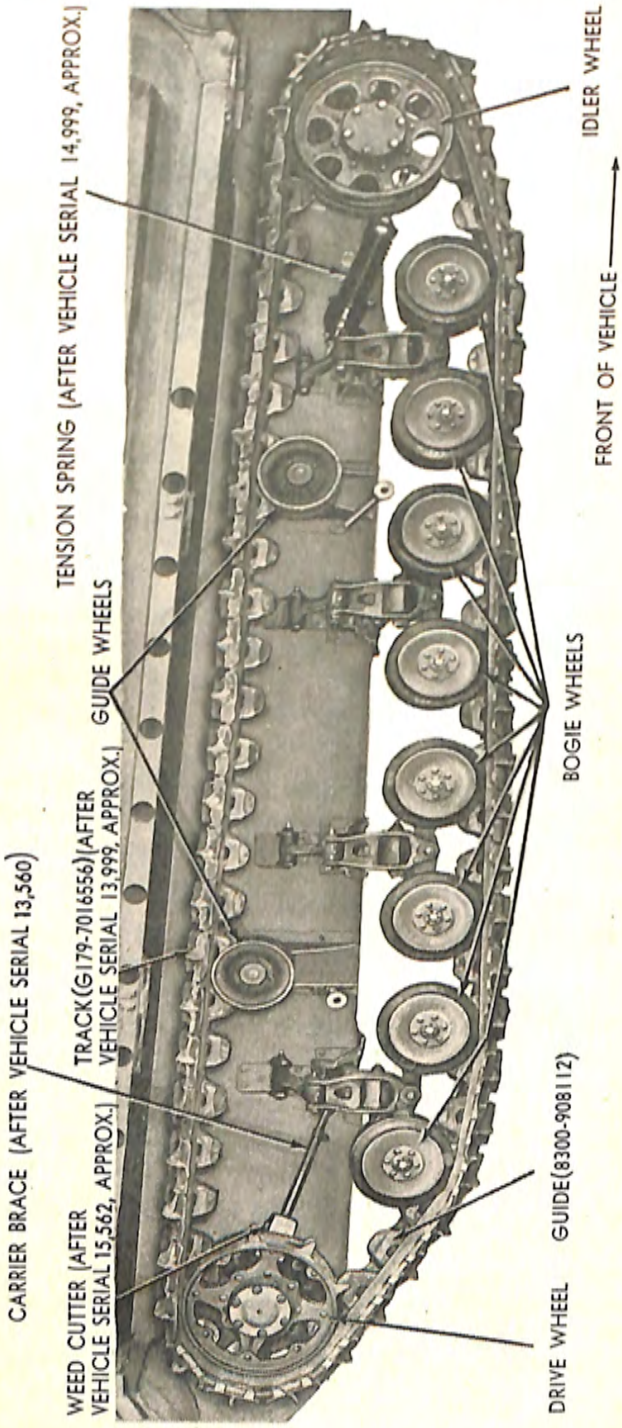
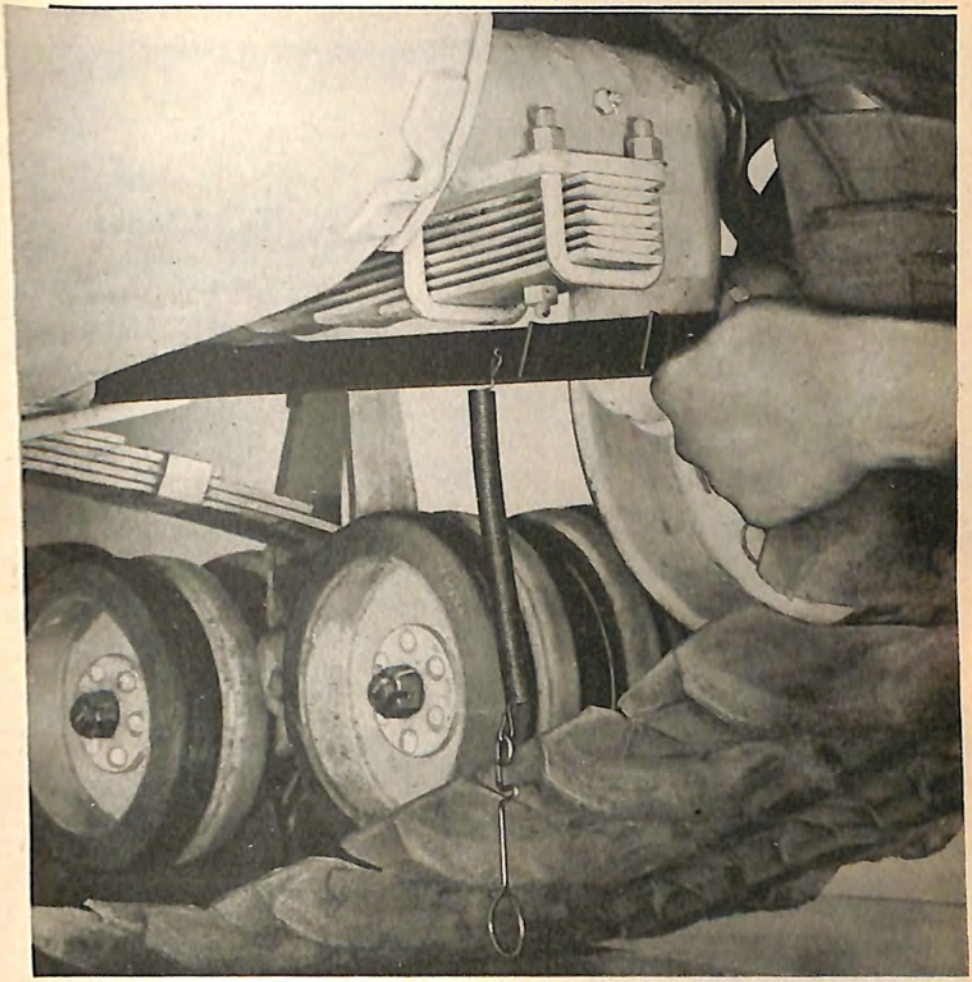


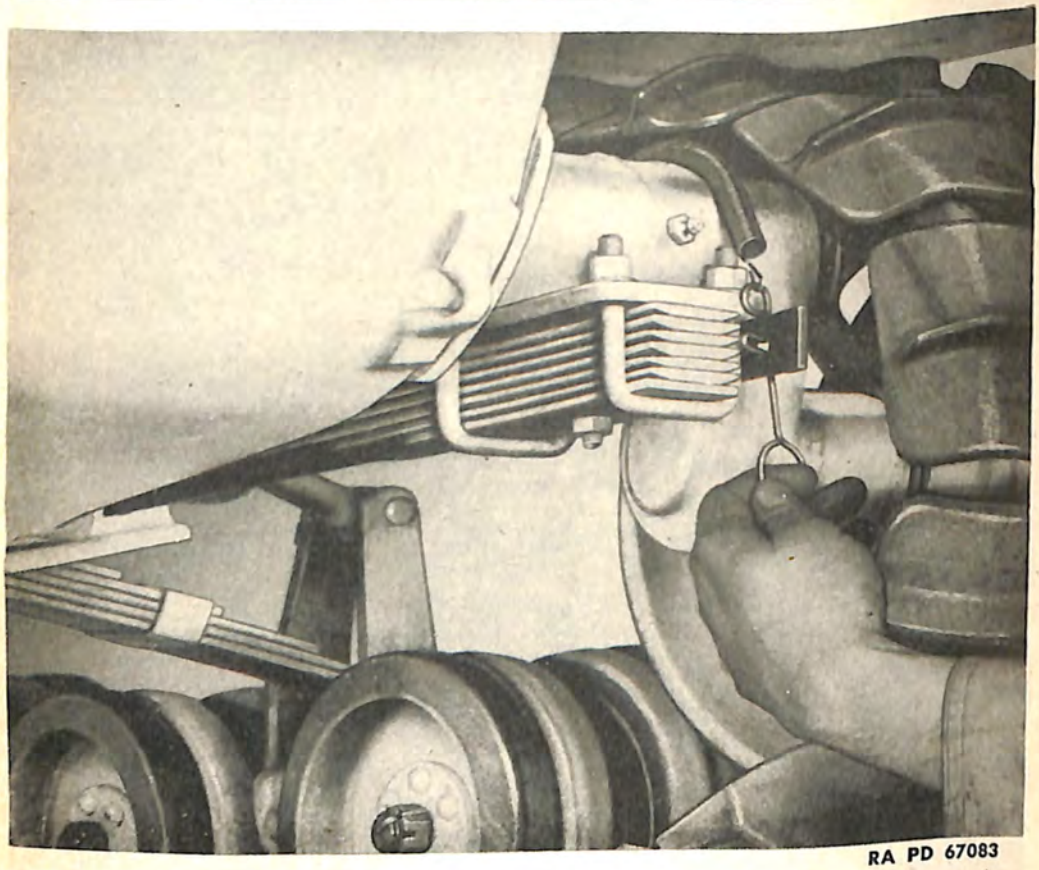
Figure 140 — Track and Suspension System — Right Side (Late Production)



RA PD 67081

Figure 141 — Positioning Track Tension Gage (41-G-434-500) (Before Vehicle Serial 9503)

that ball at other end points downward. Position checking tool assembly so that ball end of calibrating tool enters track tension spring eye. With tool directly in line with tension spring rearward stop bracket, pull upward on torque wrench handle so that upper boss on calibrating tool works against under face of stop bracket to pull tension spring out of contact with bracket (fig. 144). Observe torque wrench reading when tension spring has been pulled a maximum of 1/8-inch downward and away from stop bracket. Track tension adjustment is correct when torque wrench registers 42 to 47 foot-pounds. If necessary, alter track tension adjustment (subpar. c (1) below).



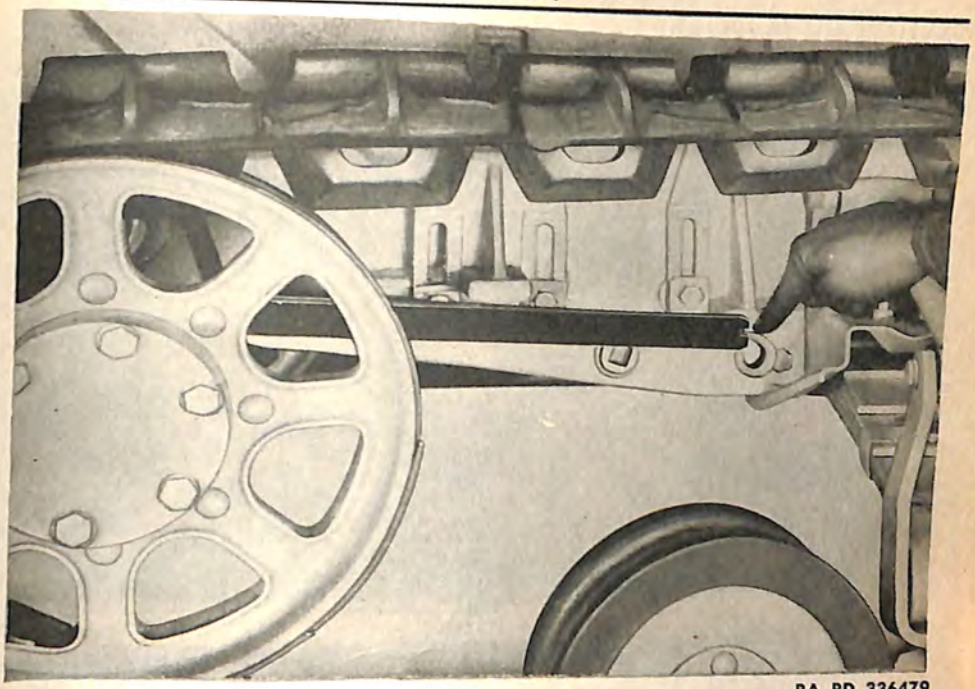
RA PD 67083

Figure 142 — Hooking Track Tension Gage in Place (Before Vehicle Serial 9503)

(3) COIL SPRING TENSION CHECK (AFTER VEHICLE SERIAL 14,999, APPROX.). Back up vehicle on level ground for a distance equivalent to its length; then drive straight ahead to original position and stop without applying brakes. Check the length of the exposed portion of coil spring by measuring with a scale (ruler) between outer edge of anchor bracket and outer lip on guide at other end of spring (fig. 145). Track tension adjustment is correct when exposed spring length measures 6¾-inches. If necessary, alter tension adjustment as directed in subpar. c (2) below.

c. Tension Adjustment.

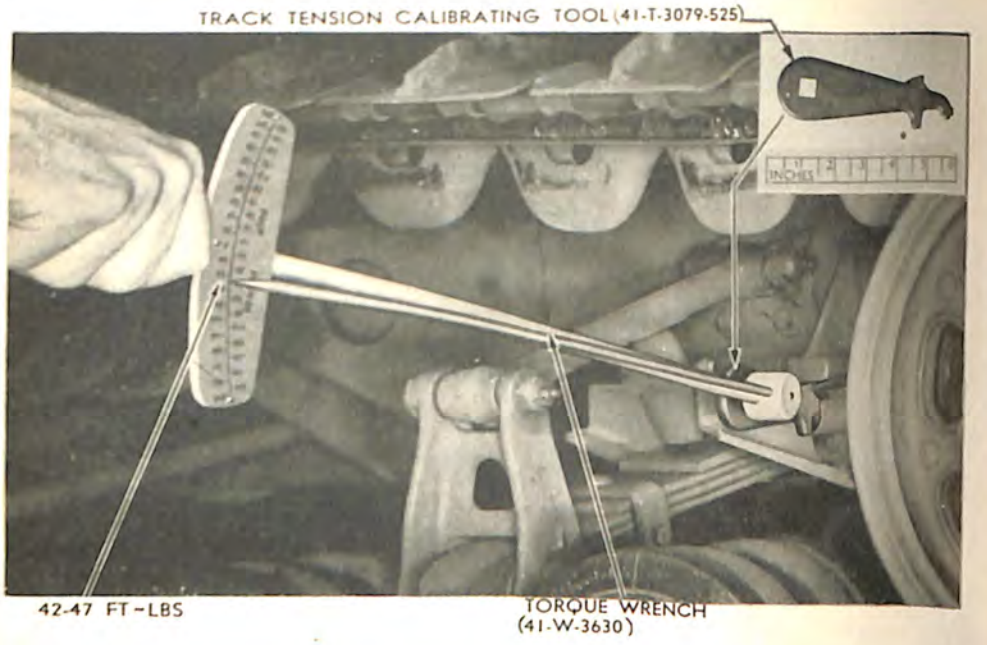
(1) LEAF SPRING TYPE (BEFORE VEHICLE SERIAL 15,000, APPROX.). Place vehicle so entire weight is on suspension system, with tracks on ground. Hook tension spring release bracket under the hull front spring bracket, and place vehicle jackscrew through the slot in the



RA PD 336479

Figure 143 — Checking Track Tension (Before Vehicle Serial 9503)

spring release bracket. Place yoke on top of jackscrew over the tension spring eye and insert pin through yoke and eye. Operate jack to pull spring downward (fig. 146). After upper leaf of spring has been pulled out of contact with rear adjustable stop bracket, use jack handle to loosen bracket screws and locks and raise or lower bracket as required. After repositioning rear stop bracket, tighten the fastening screws. Make sure that serrations on bracket engage with those on bracket lock. Remove jack and spring release bracket. Check adjustment, using gage (41-G-434-500) or calibrating tool (41-T-3079-525) (subpar. b above). A clearance adjustment is required at the front stop or safety bracket whenever the rear stop bracket adjustment is changed. When gage (41-G-434-500) is used, insert front end of gage between front stop bracket and spring top leaf (fig. 147) to check for correct clearance ($\frac{5}{16}$ inch). As necessary, reposition front stop bracket by loosening bracket screws and moving bracket up or down to obtain proper clearance. Make sure that bracket and lock serrations engage and tighten screws. When calibrating tool (41-T-3079-525) is used, insert edge of tool between front stop bracket and spring top leaf (fig. 148) to check for correct clearance ($\frac{3}{8}$ inch). As necessary, reposition front stop bracket to obtain proper clearance.

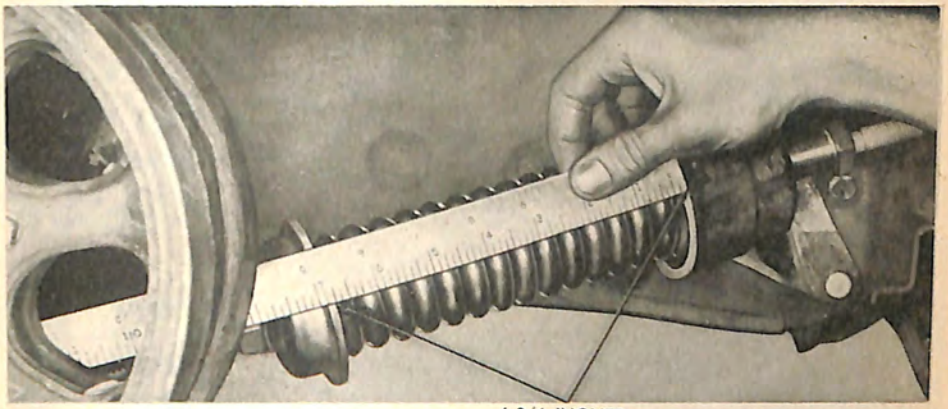


RA PD 352387

Figure 144 — Checking Track Tension (From Vehicle Serial 9503 Through 14,999 Approx.)

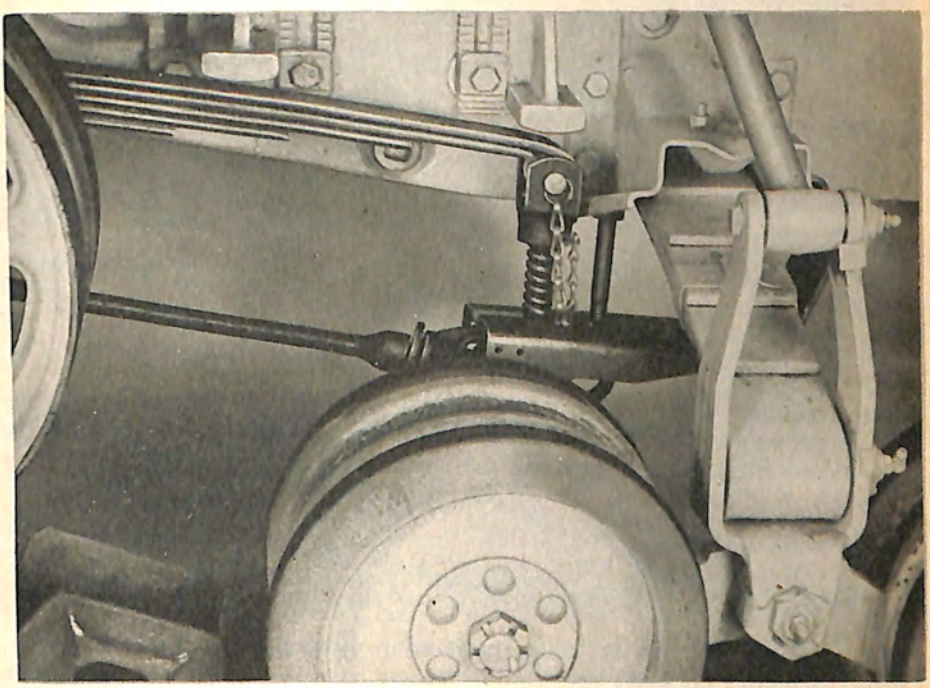
(2) COIL SPRING TYPE (AFTER VEHICLE SERIAL 14,999, APPROX.). Clean any mud and debris from coil spring parts. Remove friction tape from around threads on spring guide stud and at ball stud near pivot bracket. Loosen sleeve lock nut and ball stud lock nut. To increase track tension, turn ball stud (fig. 149) counterclockwise "out of coil spring," or clockwise to reduce tension, until exposed portion of spring length measures approximately 6¾ inches (fig. 145). Using single-head, 1⅛-inch open-end wrench (vehicle tool), turn sleeve (fig. 150) as necessary so that exposed portion of sleeve under hex-head measures 1¼ inches to anchor bracket. Tighten lock nut on ball stud against spring guide, and tighten lock nut on guide stud to maintain sleeve adjustment. Coat exposed threads on guide stud and ball stud with rust preventive compound (thin film). Wrap friction tape around threads to protect them further from direct exposure to dirt, sand, and water.

d. Repair. If only rivets are loose or broken, they can be repaired or replaced without removing track from vehicle. Use anvil (41-A-281-50) and rivet set (41-S-2198) for all rivet repairs. Replace any broken or damaged track parts by removing rivets and installing replacement parts and new rivets, using anvil and rivet set



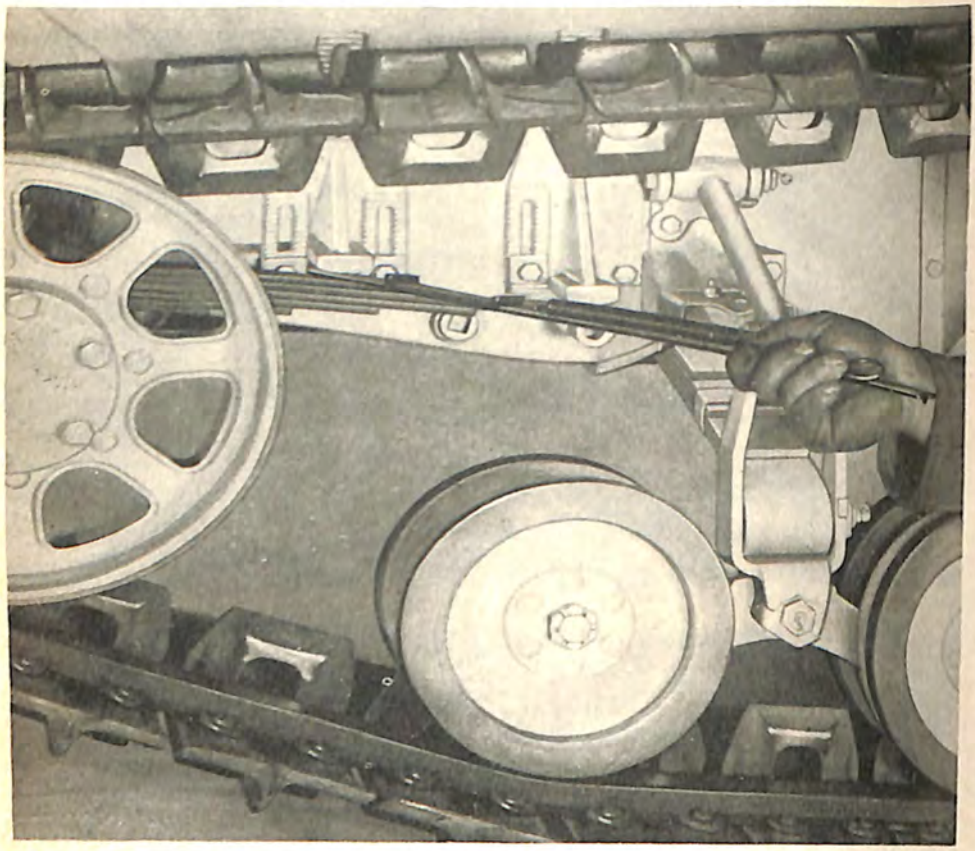
RA PD 352282

Figure 145 — Checking Track Tension at Coil Spring (After Vehicle Serial 14,999, Approx.)



RA PD 336478

Figure 146 — Pulling Track Tension Spring Out of Contact With Stop Bracket (Before Vehicle Serial 15,000 Approx.)



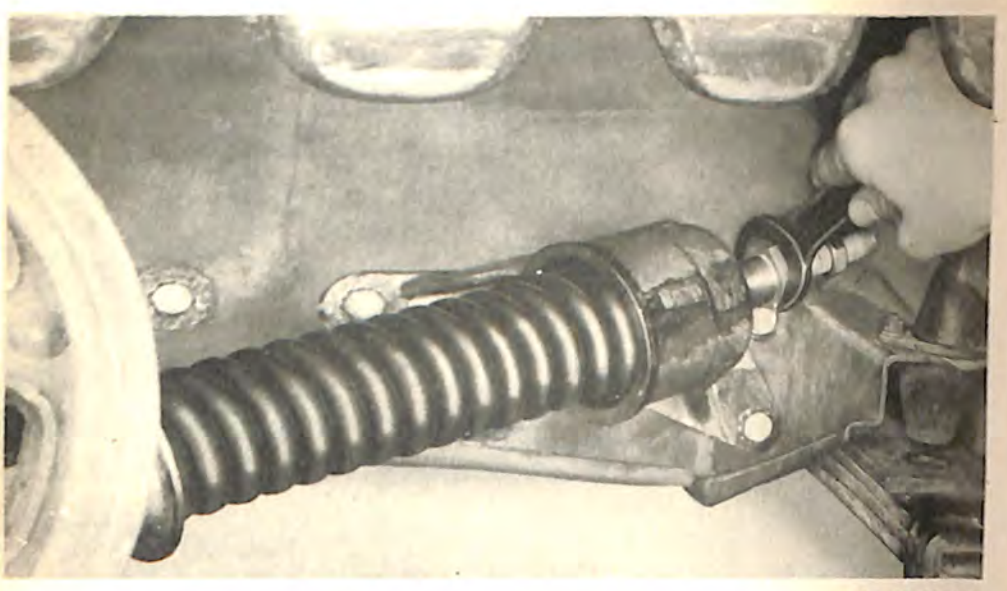
RA PD 336477

Figure 147 — Checking Clearance at Front Stop Bracket (Before Vehicle Serial 9503)

(fig. 151). If necessary, straighten track guides. Tracks serviceable for overseas use must have a grouser height of more than $\frac{7}{16}$ inch. Tracks serviceable for domestic use must have a grouser height of more than ¼ inch.

e. Removal.

(1) ONE-PIECE IDLER WHEEL AND 15-INCH TRACK (BEFORE VEHICLE SERIAL 2103). Raise vehicle so track will clear ground. With the aid of pry bars or by using suspension spring lifter (41-L-1392), insert blocking between each bogie spring support arm and bumper bracket to raise bogie wheels above track guides. Relieve track tension with jack and bracket, and remove adjustable stop brackets after spring is pulled down (fig. 152). Operate jack so it will allow tension spring to raise as far as possible, and remove the jack and bracket.



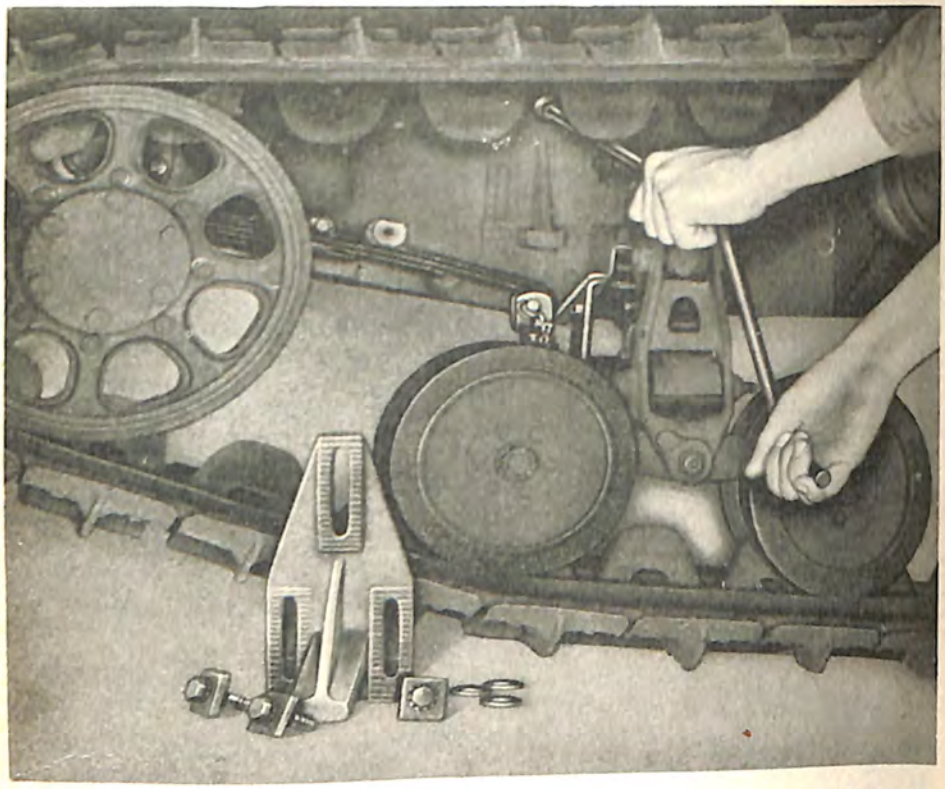
RA PD 336669

Figure 150 — Adjusting Sleeve at Coil-type Track Tension Spring (After Vehicle Serial 14,999, Approx.)

Lift track guides out of guide wheels; rotate upper portion of track toward front (fig. 153) while pulling outward and away from vehicle and idler wheel; then remove track from drive wheels.

(2) SPLIT IDLER WHEEL AND 20-INCH TRACK (FROM VEHICLE SERIAL 2103 THROUGH 14,999, APPROX.). Raise vehicle so track will clear ground. With the aid of pry bars or by using suspension spring lifter (41-L-1392), insert blocking between each bogie spring support arm and bumper bracket to raise bogie wheels above track guides. Pull spring down with jack and bracket, and remove adjustable stop brackets (fig. 152). Operate jack so it will allow spring to raise as far as possible, and remove the jack and bracket. Remove nuts and lock washers from idler wheel bolts and remove outer half of idler wheel. Lift track up and away from idler wheel (fig. 154); raise track guides out of guide wheels; then remove track from drive wheel.

(3) COIL-TYPE TENSION SPRING (AFTER VEHICLE SERIAL 14,999, APPROX.). Raise vehicle so track will clear ground. With the aid of pry bars or by using suspension spring lifter (41-L-1392), insert blocking between each bogie spring support arm and bumper bracket to raise bogie wheels above track guides. Remove friction tape from around coil spring guide stud threads and threads on ball stud. Use single-head, 1 1/8-inch, open-end wrench (vehicle tool) to turn sleeve on spring guide stud until coil spring is compressed to its shortest

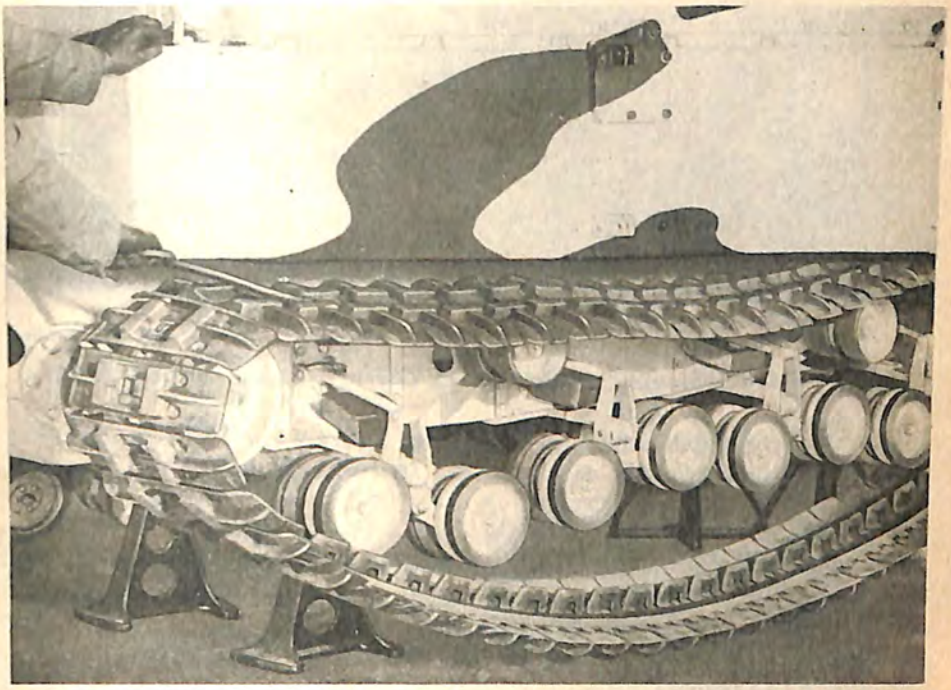


RA PD 336521

Figure 152 — Removing Spring Stop Brackets (Before Vehicle Serial 15,000, Approx.)

(2) SPLIT IDLER WHEEL AND 20-INCH TRACK (FROM VEHICLE SERIAL 2103 THROUGH 14,999, APPROX.). Place track in position on drive wheel and start track on guide wheels and inner half of idler wheel. Rotate upper portion of track toward rear while applying pressure on outer edge of track lower section until track is in position on inner half of idler wheel. Install outer half of idler wheel and tighten nuts securely. Lower vehicle and remove blocking from between bogie spring support arms and bumper brackets. Pull tension spring down with jack and bracket and install adjustable stop brackets. Adjust track tension as instructed in subparagraph c (1) above.

(3) COIL-TYPE TENSION SPRING (AFTER VEHICLE SERIAL 14,999, APPROX.). Position end of track over drive wheel to engage sprockets and start track on guide wheels and inner half of idler wheel. Rotate upper section of track toward rear while applying pressure on outer



RA PD 67056

Figure 153 — Removing Vehicle Track (Before Vehicle Serial 2103)

edge of lower portion of track until it is in position on inner half of idler wheel. Install outer half of idler wheel and tighten nuts securely. Turn ball stud counterclockwise "out of coil spring" until approximately 2 inches of threading is exposed. Using single-head, 1⅛-inch open-end wrench (vehicle tool), turn adjusting sleeve on spring guide stud until hex-head on sleeve is out of contact with anchor bracket. Lower vehicle and remove blocking from between bogie spring support arms and bumper brackets. Adjust track tension as directed in subparagraph **c** (2) above.

136. IDLER WHEELS AND CARRIER ARMS.

a. Description. The idler wheels are mounted near the front on either side of the hull, and by means of a carrier arm and spring arrangement, provide for track tension adjustment.

b. Adjustment.

(1) IDLER WHEEL. Remove the cap screws which hold hub cover to the wheel. Bend ear of lock inward to free lock nut. Remove lock nut and lock, and tighten adjusting nut with bearing adjusting nut wrench (41-W-2940-55) until it is snug. Loosen the nut

RA PD 336668

Figure 154 — Removing Vehicle Track (After Vehicle Serial 2102)

one-sixth turn, install lock and lock nut, tighten securely, and bend a portion of lock over flat of lock nut. Install hub cover with a new gasket, and tighten cap screws.

(2) CARRIER ARM. Remove the idler wheel (subpar. c (1) below). Remove carrier arm adjusting nut lock nut and lock. Tighten the adjusting nut until crank arm turns hard on support tube, loosen nut one-sixth turn, and install lock and lock nut. Tighten lock nut securely and bend ear of lock over flat on lock nut. Install idler wheel (subpar. c (3) below).

c. Idler Wheel.

(1) REMOVAL. Remove track (par. 135 e). Take out the cap screws which hold hub cover to wheel. Unlock and remove bearing lock nut, lock, and adjusting nut. Pull wheel and outer bearing cone off spindle (figs. 156 and 157), remove inner bearing cone (fig. 158), and seal.

(2) BEARING CUP REPLACEMENT. Drive bearing cups out of wheel hub (fig. 159), and install new bearing cups.

(3) INSTALLATION. Pack inner bearing cone with lubricant and install new seal with cone on spindle. Pack wheel hub with lubricant, slip wheel on spindle, pack outer bearing cone with lubricant, and install on spindle. Install bearing adjusting nut, and adjust (subpar. b (1) above). Place a new gasket and hub cover on wheel, install screws, and tighten securely. Install track (par. 135 f).

d. Carrier Arm (fig. 160).

(1) REMOVAL.

(a) With Leaf-type Tension Spring (Before Vehicle Serial 15,000, Approx.). Remove idler wheel (subpar. c (1) above). Unlock and remove carrier arm adjusting nut lock nut, remove the lock and adjusting nut, and pull the carrier arm with spring attached off the support tube (fig. 161).

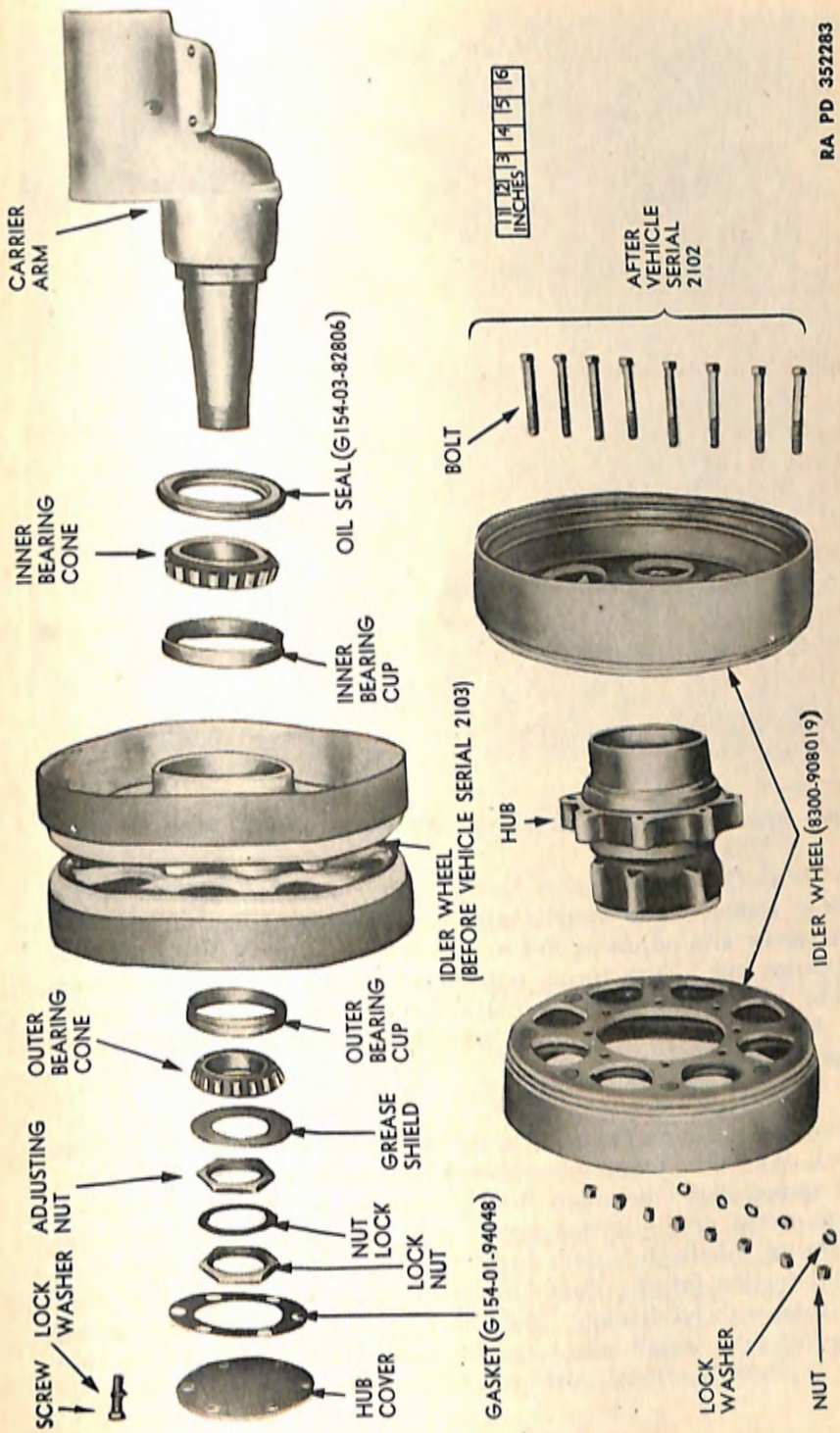
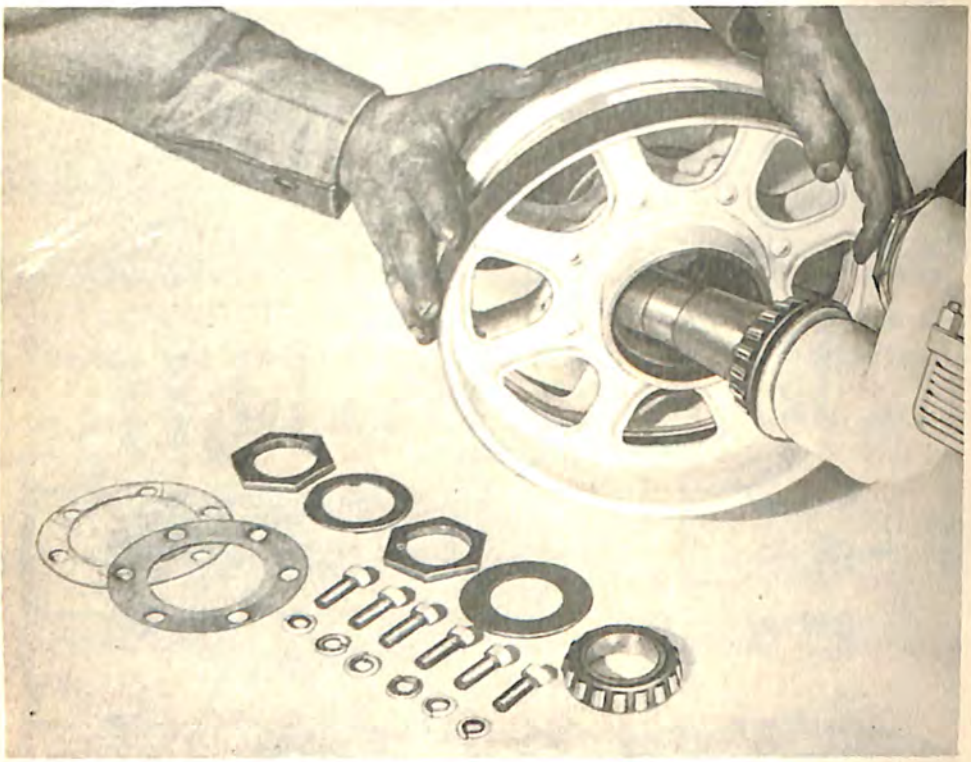


Figure 155 — Idler Wheel — Disassembled



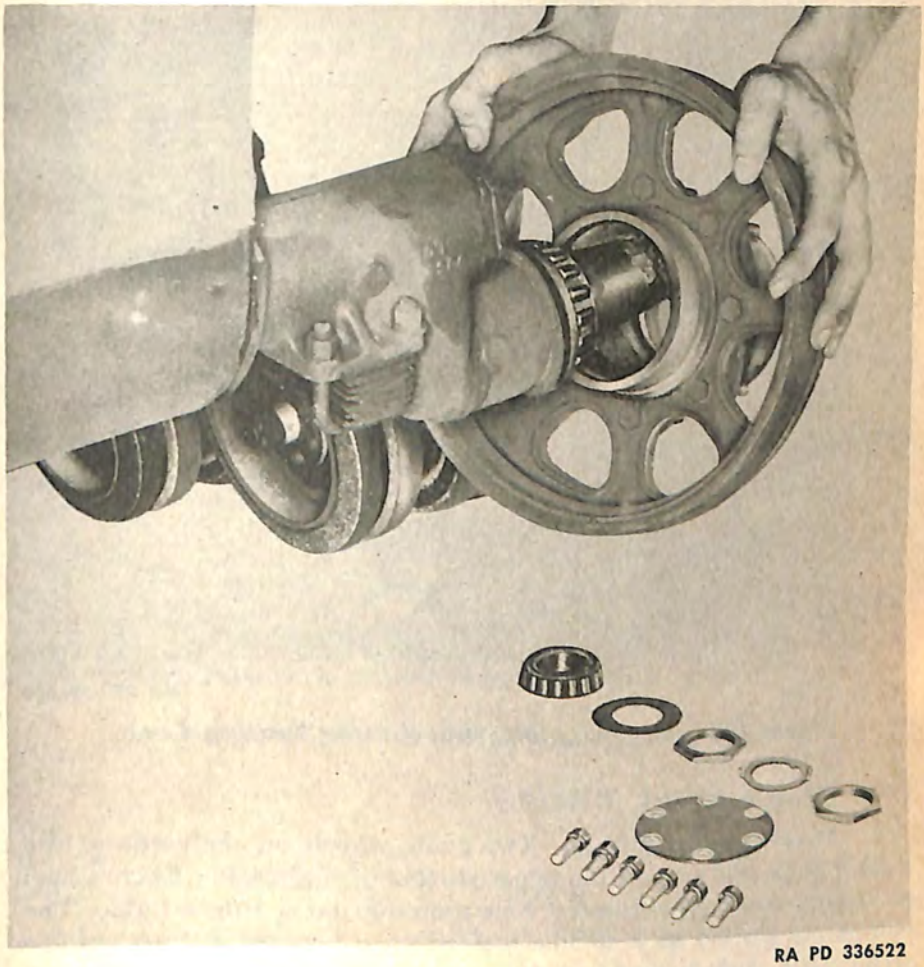
RA PD 67071

Figure 156 — Removing Idler Wheel (Before Vehicle Serial 2103)

(b) With Coil-type Tension Spring (After Vehicle Serial 14,999, Approx.). Remove idler wheel (subpar. c (1) above). Unlock and remove carrier arm adjusting nut lock nut, and remove the lock and the adjusting nut. Turn spring tension adjusting ball stud counterclockwise "out of coil spring" to disconnect ball stud from spring guide. Pull carrier arm with pivot bracket and ball stud attached off the support tube (fig. 162).

(2) INSTALLATION.

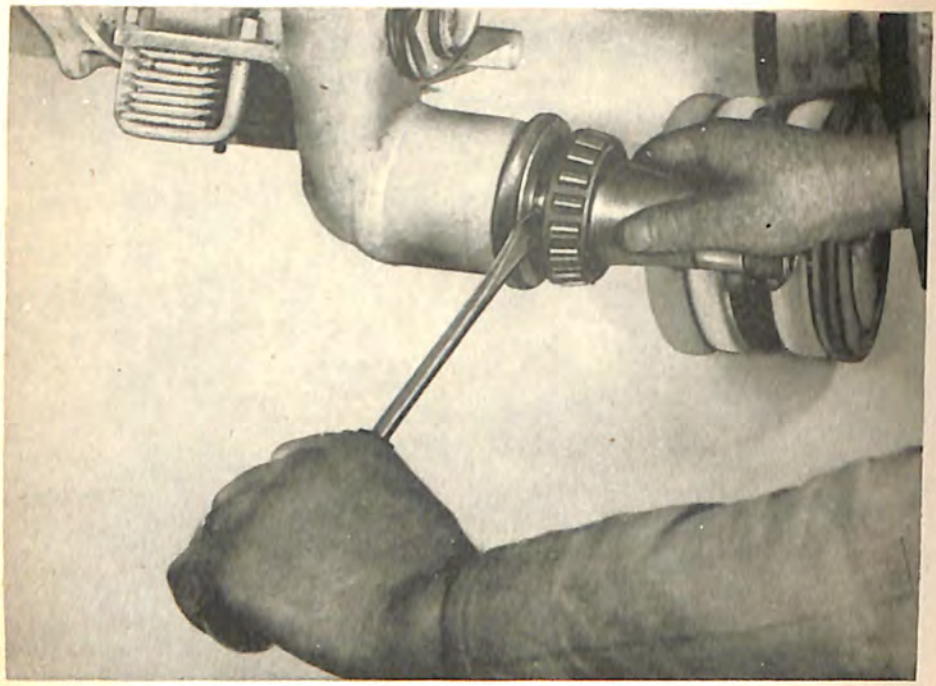
(a) With Leaf-type Tension Spring (Before Vehicle Serial 15,000, Approx.). If carrier arm is to be replaced, remove spring U-bolt clips, tension spring, and lubrication fitting from arm. Position tension spring on carrier arm with new grease seal over head of center bolt, install spring U-bolt clips with lock washers and special nuts, and install lubrication fitting. Coat bronze bushings in carrier arm and support tube with lubrication. Slide carrier arm with tension spring onto support tube, install adjusting nut, and adjust carrier arm (subpar. b (2) above). Install idler wheel (subpar. c (3) above).



RA PD 336522

Figure 157 — Removing Idler Wheel (After Vehicle Serial 2102)

(b) With Coil-type Tension Spring (After Vehicle Serial 14,999, Approx.). If carrier arm is to be replaced, remove nut, lock washer, and screw to pull pivot bracket with ball stud off arm. Remove lubrication fitting from arm and install on replacement. Install pivot bracket with ball stud on replacement arm so that screw hole in bracket alines with locking slot in carrier arm. Install pivot bracket screw and lock washer. Coat bronze bushings in carrier arm and support tube with lubricant. Slide carrier arm with pivot bracket and ball stud onto support tube, install adjusting nut, and adjust carrier arm (subpar. **b** (2) above). Thread end of ball stud into spring guide and continue to turn ball stud clockwise "into the spring" as far as possible. Install idler wheel (subpar. **c** (3) above).



RA PD 336536

Figure 158 — Removing Idler Wheel Inner Bearing Cone

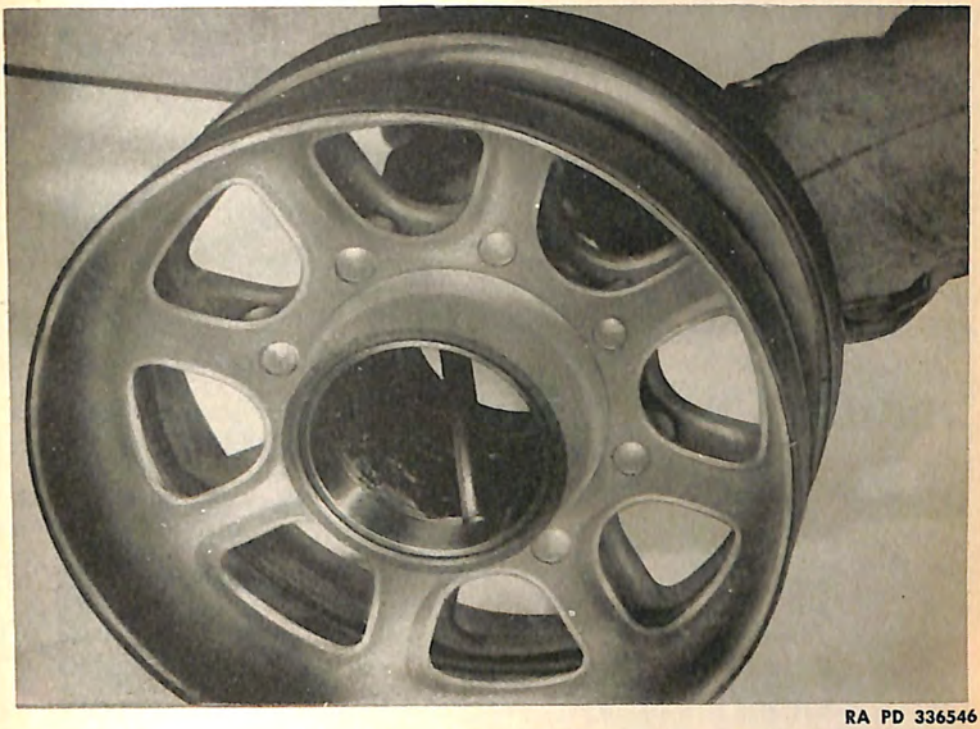
137. TRACK GUIDE WHEELS.

a. Description (fig. 163). Two guide wheels on each side of the vehicle guide and support the upper portion of the track. Each wheel consists of two rubber-covered rims mounted on a single hub. The wheels are carried on a spindle welded to a bracket before vehicle serial 4103, and mounted in rubber insulators in the bracket on vehicles after serial 4102. The wheels turn on two needle bearings.

b. Removal. Relieve track tension and block up the track so track guides clear the guide wheels. Remove hub cap screws, cap, and gasket. Remove the wheel retaining screw and washers, and pull wheel off the spindle (fig. 164).

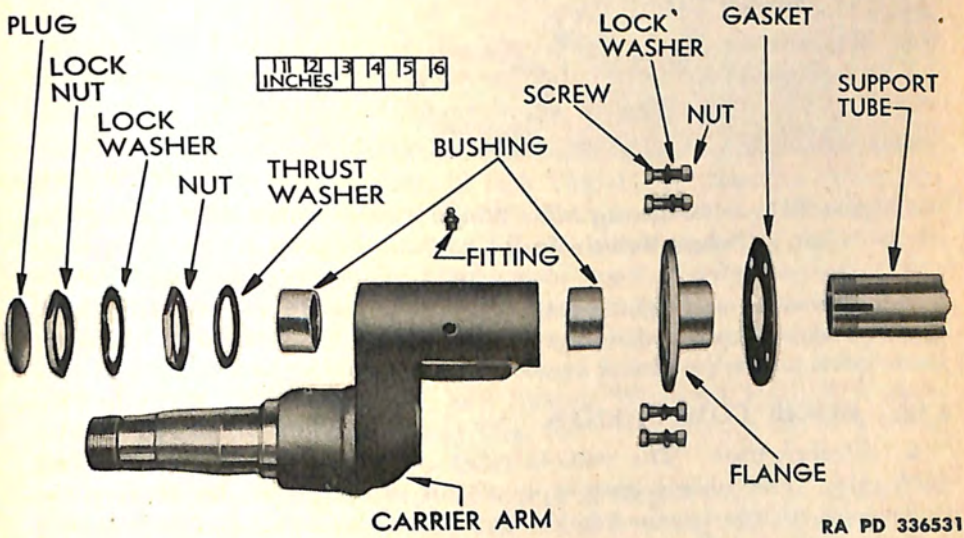
c. Bearing Replacement. Take out the screws that hold oil seal to inner side of hub, and remove oil seal and gasket. Remove bearings with drift (fig. 165) and carefully install replacement bearings. Install new oil seal and gasket to inner side of hub and tighten screws securely.

d. Installation. Pack the wheel bearings with proper lubricant. Slip wheel onto spindle and install thrust washer, flat washer,



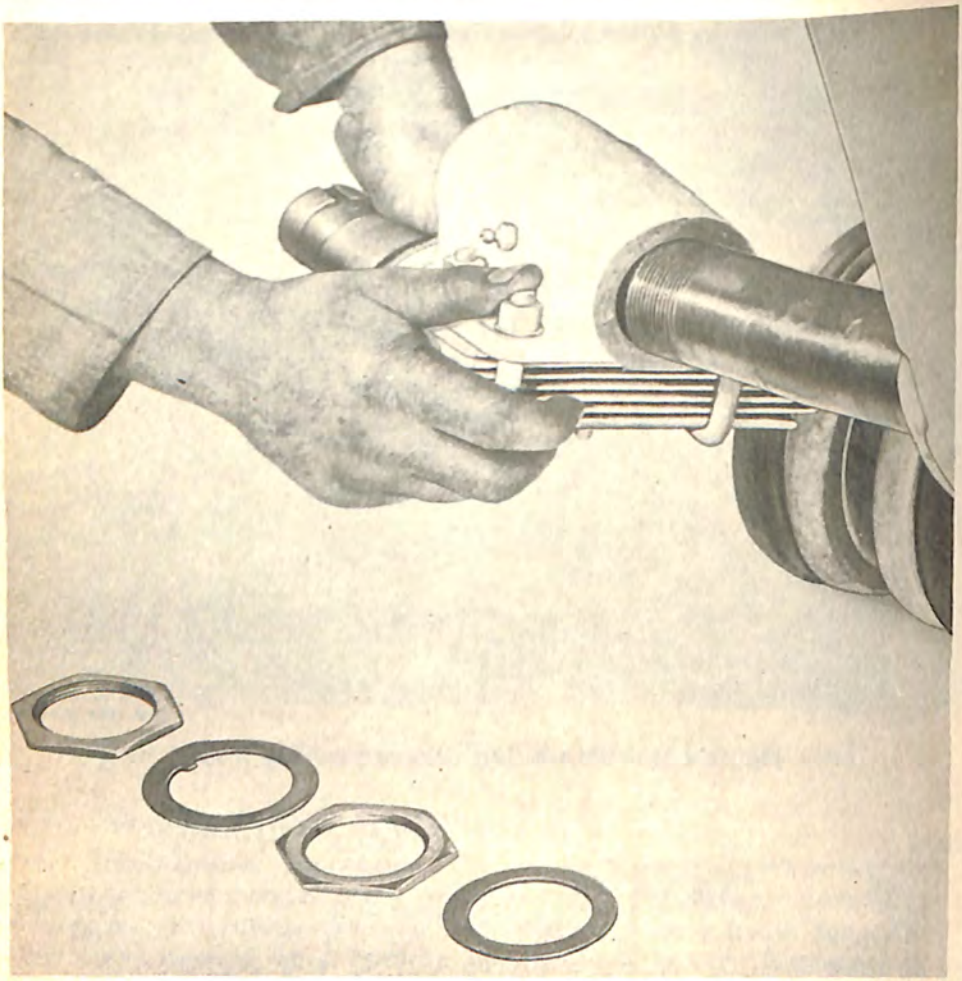
RA PD 336546

Figure 159 — Removing Wheel Bearing Cup



RA PD 336531

Figure 160 — Idler Wheel Carrier Arm — Disassembled



RA PD 67063

Figure 161 — Removing Idler Wheel Carrier Arm and Spring (Before Vehicle Serial 15,000, Approx.)

and lock washer, and tighten retaining screw securely. Install a new gasket and hub cap, and tighten screws securely. Remove blocking from track and adjust track tension (par. 135 c).

138. BOGIE COMPONENTS.

a. Description. The vehicle rides on 32 bogie wheels—16 on each side. The wheels are supported, in sets of four, by transverse suspension springs fastened to the bottom of the hull. A bogie spring support yoke is fastened to each end of the springs. The bottom of the yoke supports a bogie wheel support arm to each end of which

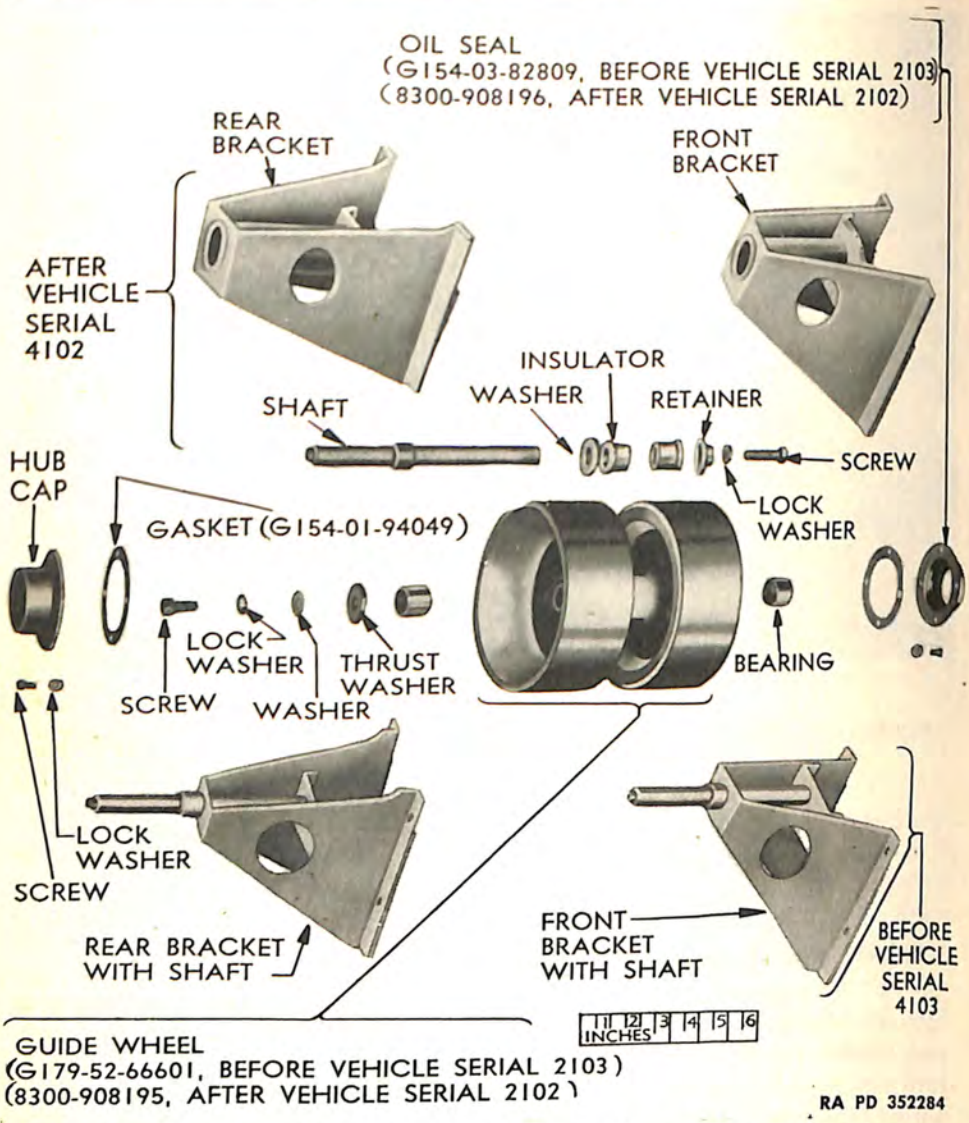
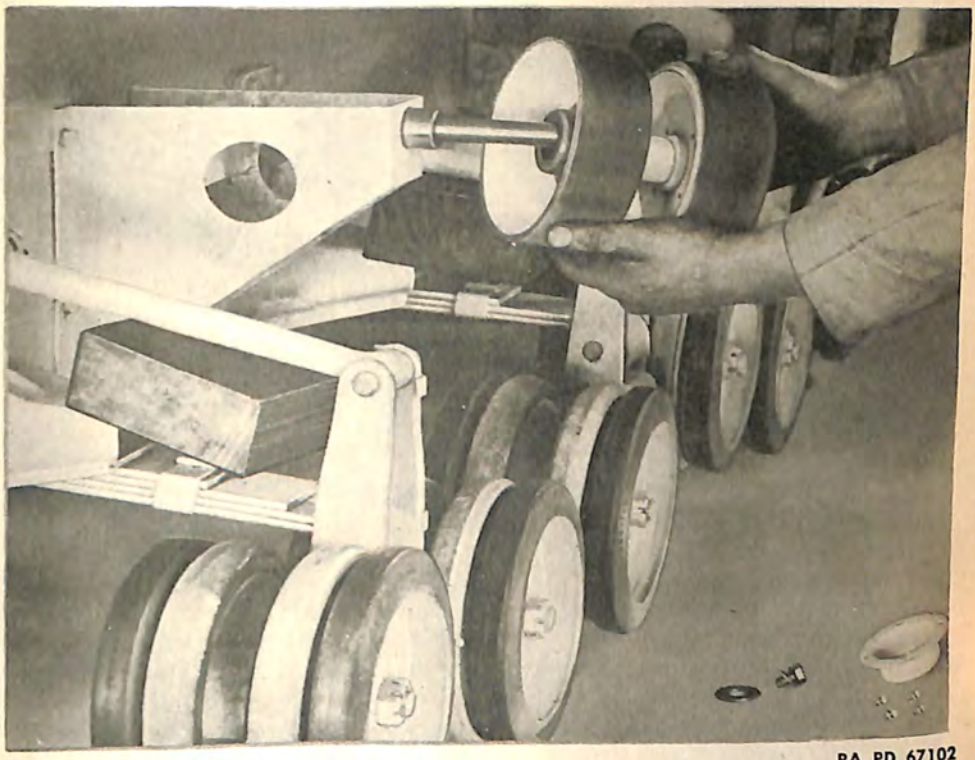


Figure 163 — Guide Wheel and Brackets — Disassembled

c. Wheels (After Vehicle Serial 1002).

(1) REMOVAL. See subparagraph **b** (2) above.

(2) ADJUSTMENT. Remove outer grease seal and bearing cone from wheel support. Insert shaft (with one wheel in place) through support; install spacer, shims, and outer bearing cone on shaft; and install wheel and nut. Tighten nut securely, and test for end play in shaft. Add or remove shims until from 0.001 to 0.004 inch end play is obtained when the nut is tightened securely.



RA PD 67102

Figure 164 — Removing Guide Wheel

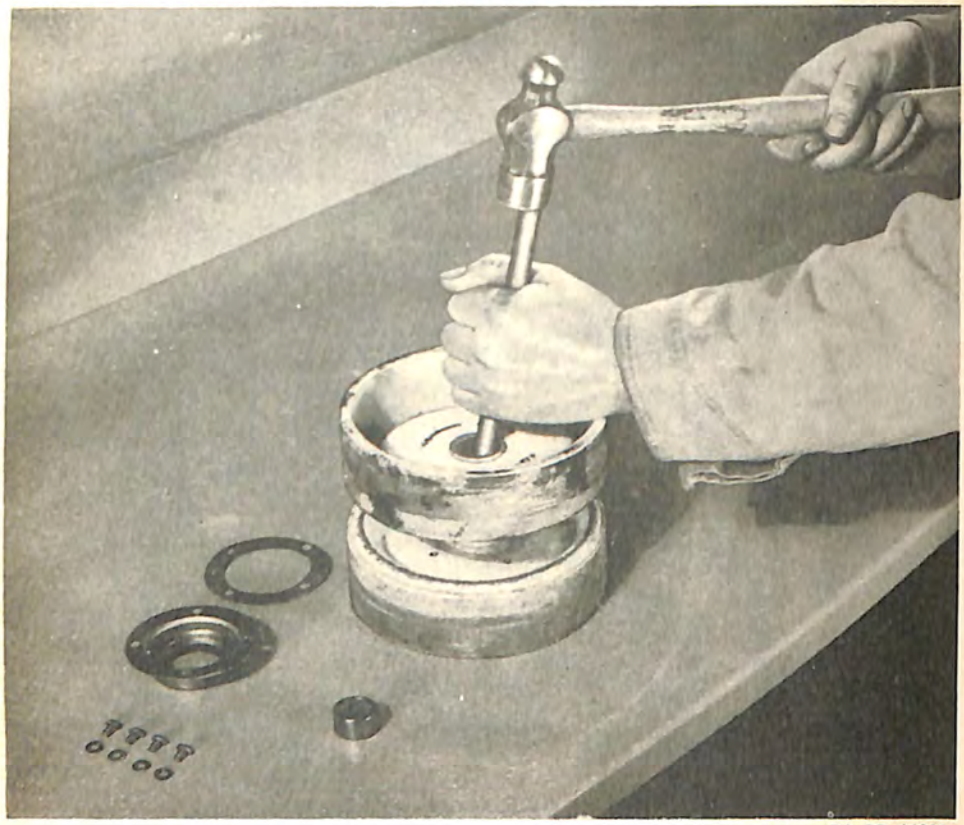
(3) INSTALLATION. Insert shaft (with one wheel in place) through wheel support, and install spacer, shims (the correct amount of shims as determined under adjustment), and outer bearing cone on shaft. Install new grease seal in support, insert Woodruff key into keyway, and place the wheel on shaft. Tighten the wheel nut securely, test for correct end play (0.001 to 0.004 in.), and install a new cotter pin. Lower wheel to track and remove tools.

d. Wheel Support.

(1) REMOVAL. Remove bogie wheels (subpar. b (2) above). Remove cotter pin, nut, and plain washer from end of support arm. Pull wheel support off support arm and remove the Woodruff key.

(2) DISASSEMBLY. Remove the grease seal at each end of support, take out bearing cones, and drive out the bearing cups with a drift.

(3) ASSEMBLY. Drive the replacement bearing cups into the support, being careful to avoid damaging the cups. Pack bearing cones with lubricant. Install bearing cone and new grease seal on inner side of support.



RA PD 66916

Figure 165 — Removing Guide Wheel Bearings

(4) INSTALLATION. Install Woodruff key in support arm and place support in position on arm. Install flat washer and nut, tighten securely, and install a new cotter pin. Adjust the bearings (subpars. **b** (1) and **c** (2) above) and install the wheels (subpars. **b** (3) and **c** (3) above).

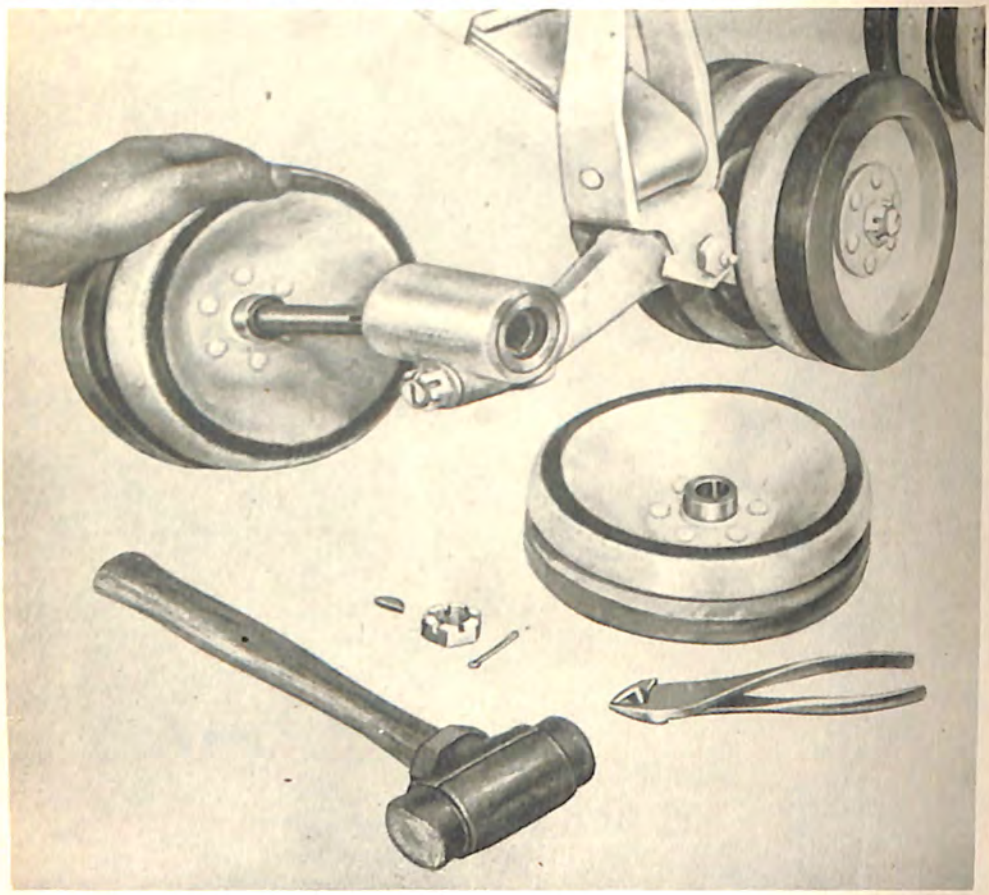
e. Wheel Support Arm.

(1) REMOVAL. Remove bogie wheel supports (subpar. **d** (1) above). Remove the nut, lock, and pivot bolt that hold bogie wheel support arm to spring support yoke, and remove arm. NOTE: *The bogie wheels and support arm may be removed as an assembly.*

(2) INSTALLATION. Place support arm into position in spring support yoke; install pivot bolt, lock, and nut. Tighten nut securely and install wheel support (subpar. **d** (4) above).

f. Spring Yoke.

(1) REMOVAL. Remove bogie wheel and support arm assembly (subpar. **e** (1) above). Remove nut and lock, and take out shackle



RA PD 67080

Figure 167 — Removing Bogie Wheel

(2) INSTALLATION. Place spring yoke support arm into position at hull bracket and spring yoke, and install shackle bolts, locks, and nuts. Tighten nuts securely, lower bogie wheels to track, and remove tools.

h. Spring.

(1) REMOVAL. Place vehicle on supports high enough so bottom of hull can be reached easily. Relieve track tension on both sides so bogie wheels are clear of track guides. Alternately install suspension spring lifter (41-L-1392) on each end of spring to be removed, and remove the nuts, locks, and shackle bolts that hold spring to yokes on each end. Remove tools and pull bogie wheel assembly and yoke away from spring eye on each side. Remove cap screws, toothed lock washers, and plain washers from spring cover plate and remove plate.

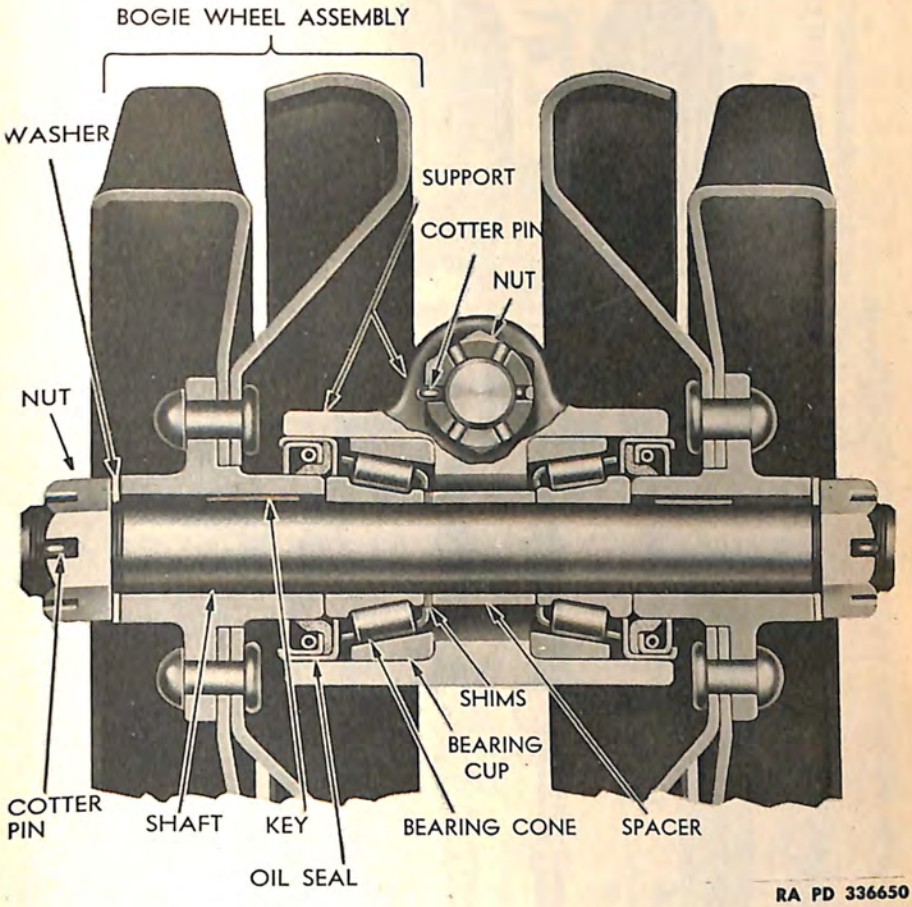


Figure 168 — Bogie Wheel Support and Parts — Cross Section

Support spring assembly, remove cap screws and toothed washers from spring support plate, and remove spring assembly.

(2) INSTALLATION. If spring is to be replaced, remove support plate and U-bolt clips from old spring, and install on replacement. Lift spring assembly into place under vehicle. Apply joint sealing compound to all joints and fastening parts; install support plate cap screws and toothed washers; and install the cover plate with plain washers, toothed washers, and cap screws. Raise spring eye at each end with suspension spring lifter (41-L-1392) and insert shackle bolts through yoke and spring eye. Install locks and nuts on bolts, and tighten nuts securely. Remove tools, lower vehicle to floor, and adjust track tension (par. 135 c).

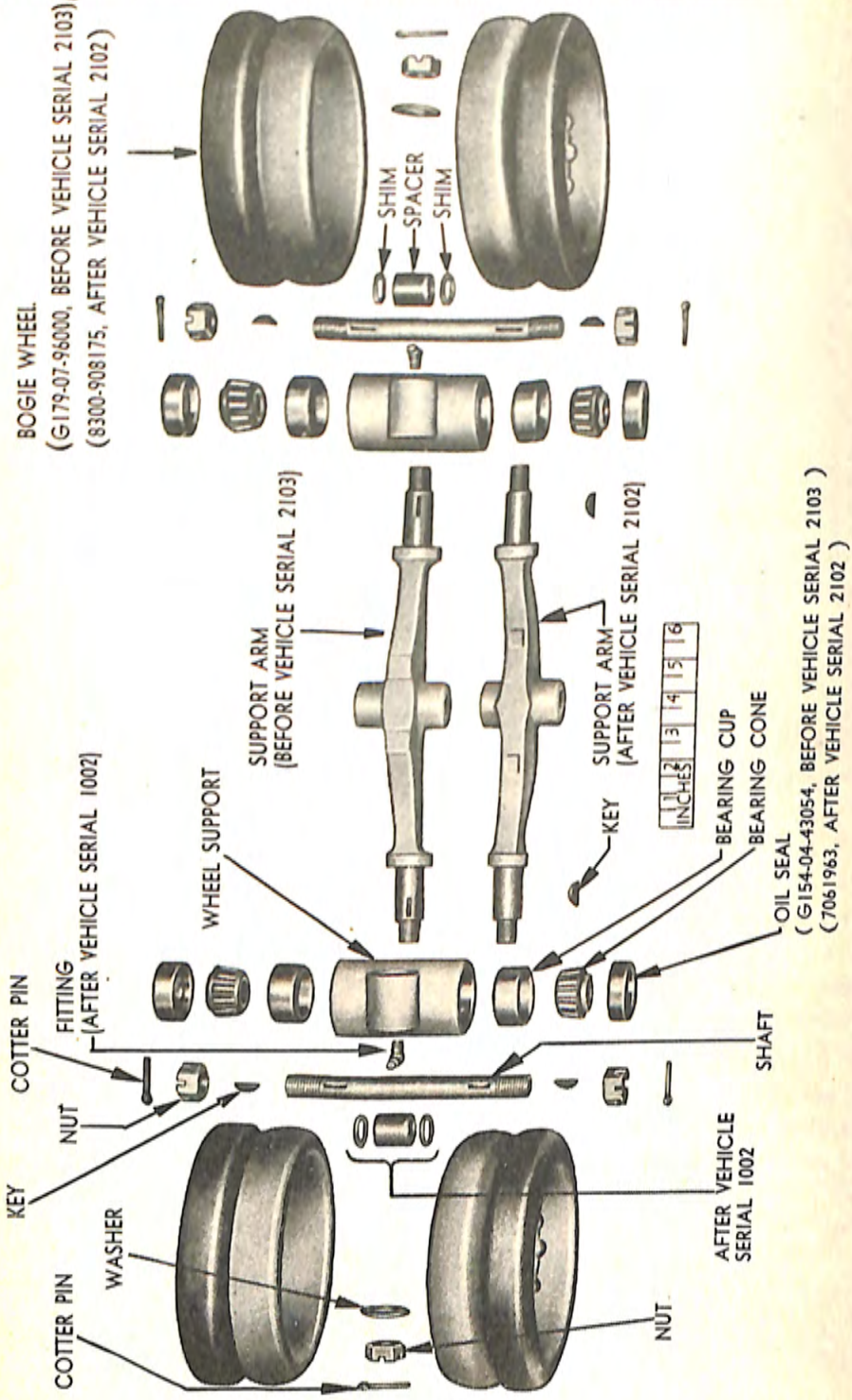


Figure 169 — Bogie Set — Disassembled

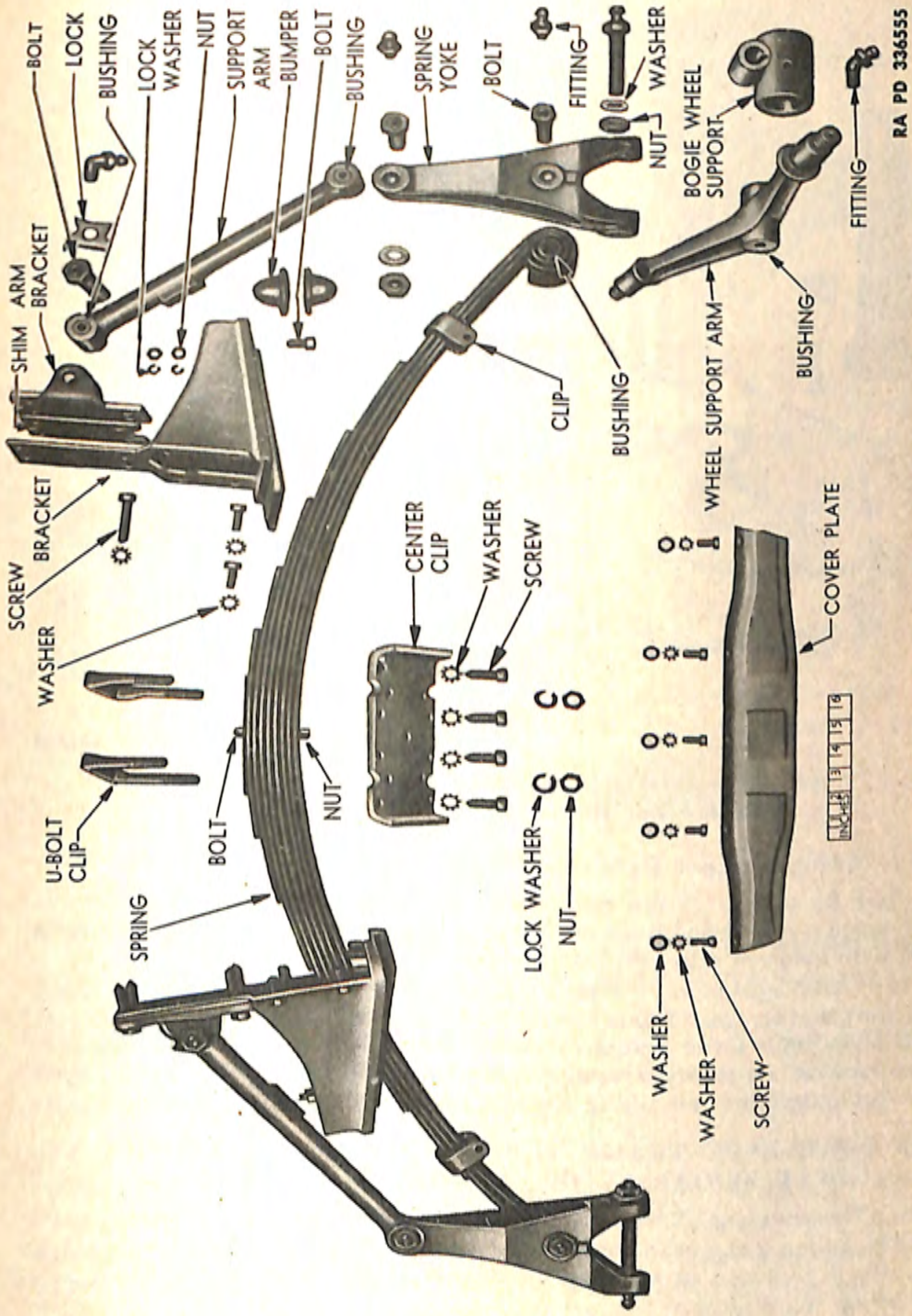


Figure 170 — Bogie Suspension — Partially Disassembled

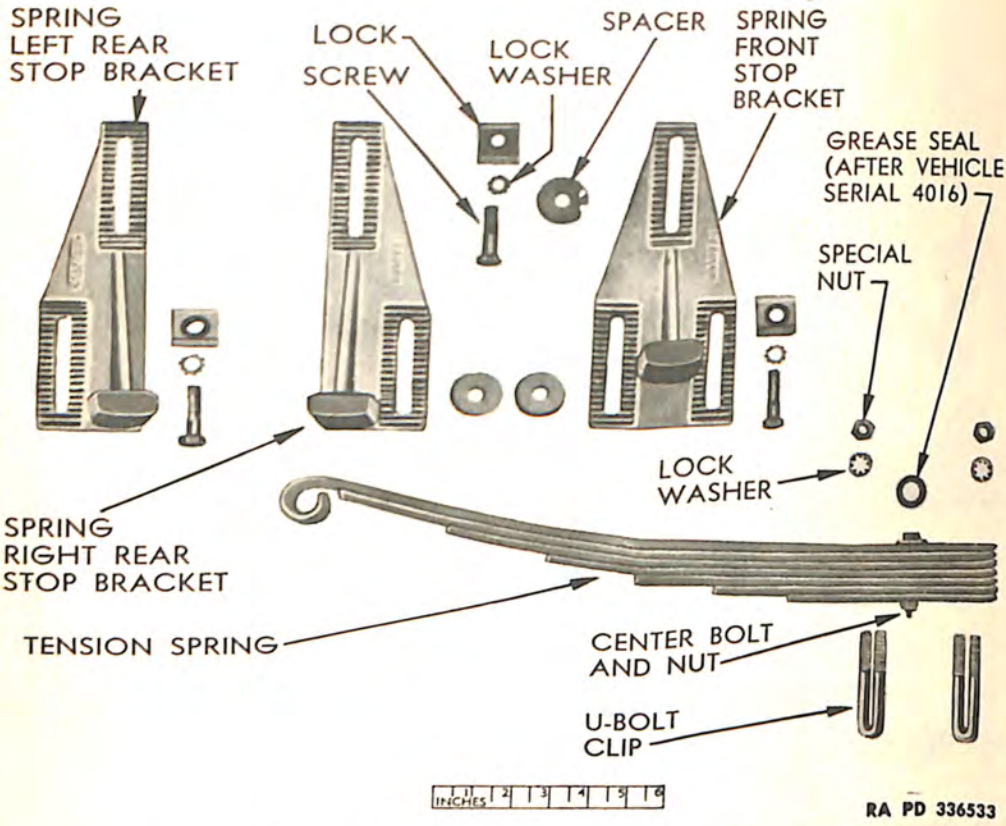


Figure 171 — Idler Wheel Tension Spring and Brackets (Before Vehicle Serial 15,000, Approx.)

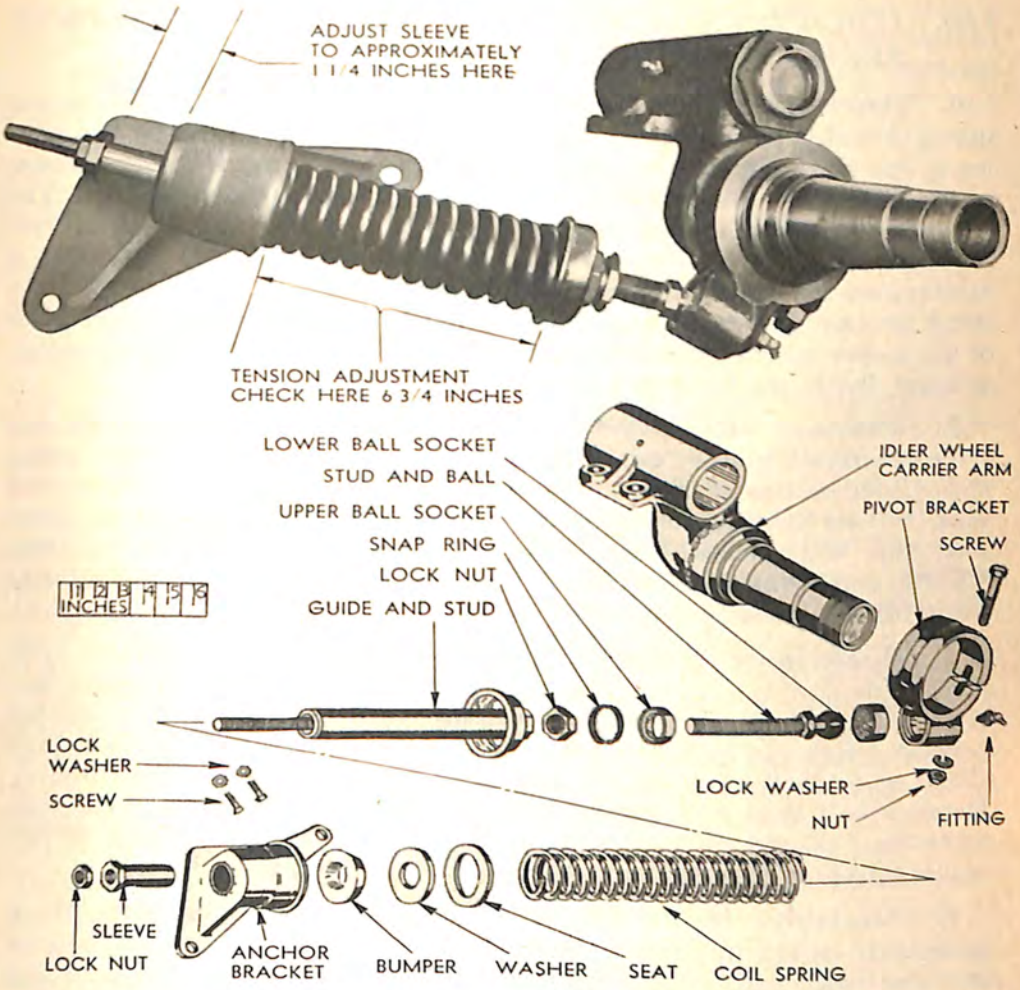
i. Spring Bumper Bracket.

(1) REMOVAL. Take out screws that hold spring yoke support arm bracket and spring bumper bracket to the hull. Remove brackets and shim between arm and bumper brackets.

(2) INSTALLATION. Apply joint sealing compound to hull, brackets, and screws. Place spring bumper bracket in position against hull and install lower screws. Hold shim and spring yoke support arm bracket in position against upper portion of spring bumper bracket, install the remaining screws, and tighten all screws securely.

139. LEAF-TYPE TRACK TENSION SPRING (BEFORE VEHICLE SERIAL 15,000, APPROX.).

a. Description. The cantilever-type track tension spring is attached at one end to the idler wheel carrier arm by two U-bolt clips. An eye is provided at the rearward end of the spring for use when adjusting track tension.



RA PD 352286

Figure 172 — Idler Wheel Track Tension Spring — Assembled and Disassembled Views (After Vehicle Serial 14,999, Approx.)

b. Removal. Place a block between the idler wheel and front bogie wheel. Relieve tension on spring, remove nuts and lock washers from U-bolt clips, and remove spring.

c. Installation. Install a new grease seal between spring and carrier arm (around spring bolt head). Place spring in position against carrier arm; install U-bolt clips, lock washers, and nuts; and tighten securely. Remove block from between idler wheel and bogie wheel. Adjust track tension (par. 135 c).

140. COIL-TYPE TRACK TENSION SPRING (AFTER VEHICLE SERIAL 14,999, APPROX.).

a. Description (fig. 172). Track tension is maintained by the use of a coil-type spring at each idler wheel carrier arm. The rearward end of the spring is carried in an anchor bracket which mounts to the hull, just ahead of the front bogie spring bumper bracket. The forward end of the spring acts through a ball stud and a pivot bracket mounted on the idler wheel carrier arm. Correct track tension is maintained by the adjustment of the spring ball stud connecting the pivot bracket to the spring guide, ahead of the spring. Adjustment of the sleeve on the rearward end of the guide stud, behind the anchor bracket, limits the rebound movement of the spring.

b. Removal. Remove the track (par. 135 e (3)). Turn ball stud counterclockwise "out of spring" to disconnect stud from guide, spring, and anchor bracket assembly. Remove screws and toothed lock washers holding anchor bracket to hull and remove spring, guide and stud, and anchor bracket as an assembly. Remove nut, lock washer, and pivot bracket screw and lift pivot bracket and ball stud assembly off carrier arm.

c. Disassembly. Turn lock nut and sleeve off spring guide stud. Pull guide stud out of anchor bracket and lift spring off guide and stud. Remove spring seat, washer, and rubber bumper from anchor bracket. Remove lock nut from ball stud. Use a narrow-blade cold chisel to cut ball-joint snap ring out of ring groove in pivot bracket. Remove ball stud and upper ball socket, and lift socket over stud adjusting hex and off ball stud. Unscrew lubrication fitting at ball socket on pivot bracket and remove lower ball socket.

d. Assembly. Install lubrication fitting on pivot bracket. Place lower ball socket into joint opening on bracket. Lubricate ball on stud and insert ball end in joint. Install upper ball socket over end of stud and adjusting hex and into position in joint. Install new snap ring over end of ball stud and into ring groove in pivot bracket. Tap around edge of snap ring as necessary to make sure it seats evenly around ring groove. Turn ball stud lock nut onto stud. Install rubber bumper in anchor bracket so that larger diameter edge is to the rear. Install washer against bumper and position spring seat within anchor bracket. Install coil spring over stud and guide and insert stud end through anchor bracket. Screw sleeve onto guide stud portion extending through anchor bracket, and tighten sleeve until spring is compressed to its shortest length. Start lock nut onto guide stud.

e. Installation. Position pivot bracket and ball stud assembly onto carrier arm so that screw-way in bracket alines with lock groove in carrier arm. Install bracket screw, lock washer, and nut, and tighten securely. Place anchor bracket, spring, and guide and stud

opposite side. The plugs are located in such a manner that each plug drains sections of the hull that are separated by the crossmembers.

(2) BOW AND STERN CELLS (M29C). The bow and stern cells are equipped with drain plugs on the left side. Remove plugs to drain cells when on land. During operation in water, excessive bilge water may be removed with the hand bilge pump.

b. Shields, Covers, and Lids. Shields, covers, and lids are provided where necessary and their removal and installation are covered in the various sections to which they apply. A sliding door in the engine compartment side panel allows engine compartment heat to enter the driver's compartment when the door is open. Simply pull the control handle backward to open or push it forward to close (figs. 18 and 19).

c. Vehicle Identification Plate. Change the oil specifications caption "SUMMER OIL SAE" on all vehicles having a serial number lower than 1003. Remove the "No. 10" by grinding the metal smooth. Use a $^{3}/_{16}$-inch stencil and stamp "No. 30" opposite the caption where No. 10 was removed (figs. 10 and 11).

143. TOP AND BOWS.

a. Description. The top, side curtains, and the rear curtain are constructed of duck material. All curtains are provided with windows. A flexible cable is used to lash the top, side curtains, and rear curtain to hull coaming. The bows are constructed of tubing, divided into sections of the proper shape, and held in sockets on the coaming with cotter pins.

b. Top.

(1) REMOVAL. Remove all lashings from attaching buttons on hull and coaming. Unhook the top from bows and remove top with side curtains and the rear curtain. (Rear curtain can be removed separately on vehicles after serial 1002.)

(2) INSTALLATION. Place the top with side curtains and the rear curtain in position over bows; hook the top to bows and lash it securely to the hull and coaming with a flexible cable.

c. Bows.

(1) REMOVAL. Remove the top (subpar. **b** (1) above). Take out cotter pins from all bows and sockets, loosen wing nuts at windshield upper bar, and lift bows from vehicle.

(2) INSTALLATION. Place bows into position in sockets on hull coaming and install all cotter pins. Tighten front section of bows to windshield top bar with wing nuts. Install top (subpar. **b** (2) above).

144. SEATS.

a. Description. The seat bottoms are an integral part of the hull and are furnished with removable cushions and backs. The

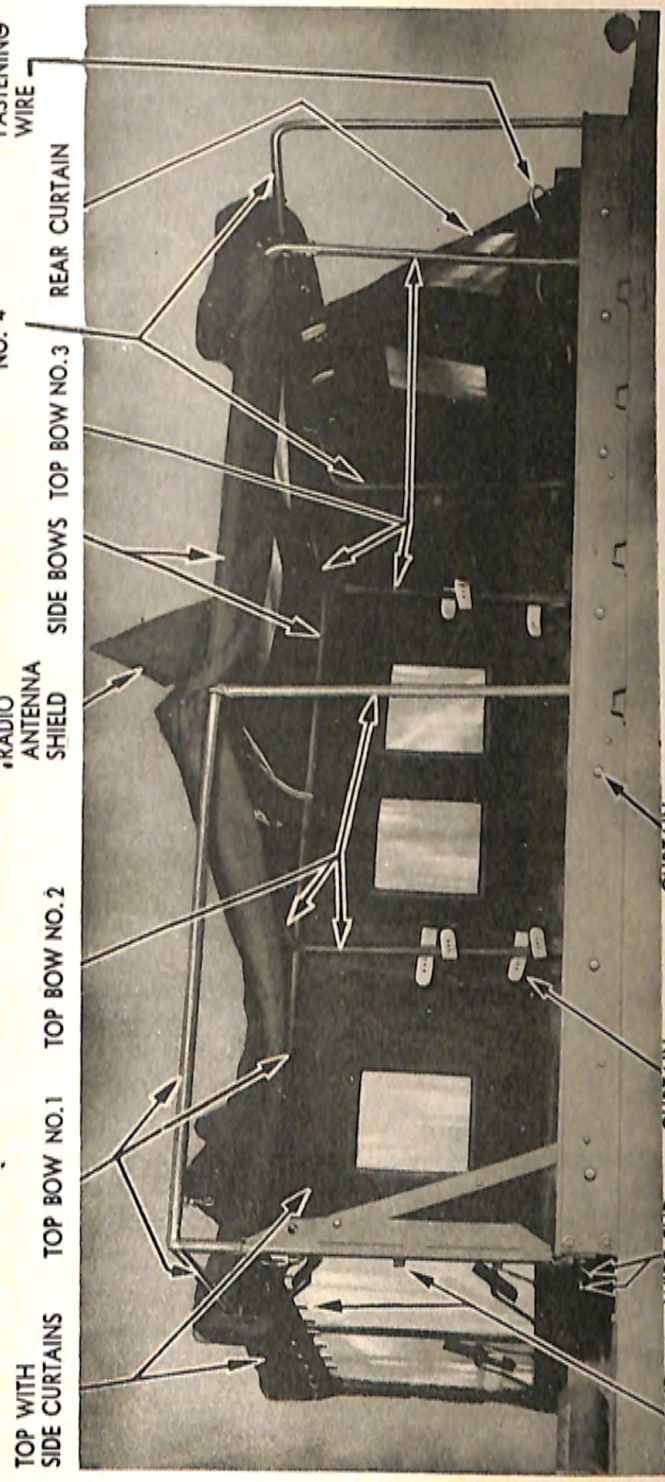
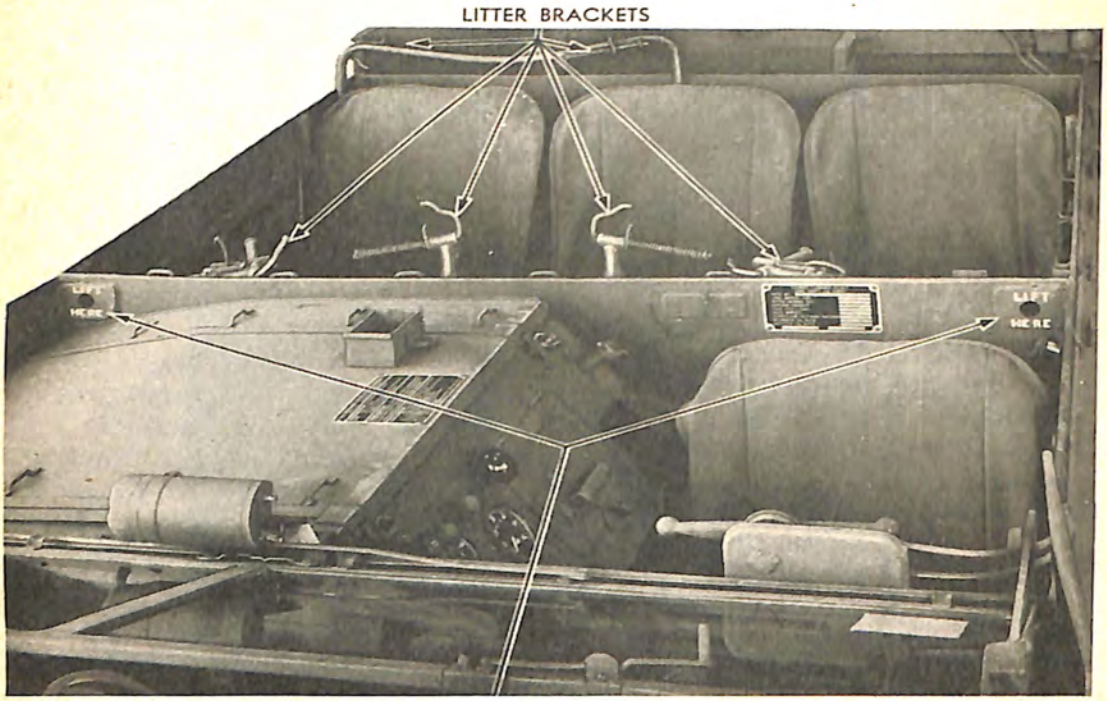


Figure 173 — Top and Bows (After Vehicle Serial 1002)



RA PD 336574

Figure 174 — Vehicle Lifting Marks and Litter Brackets

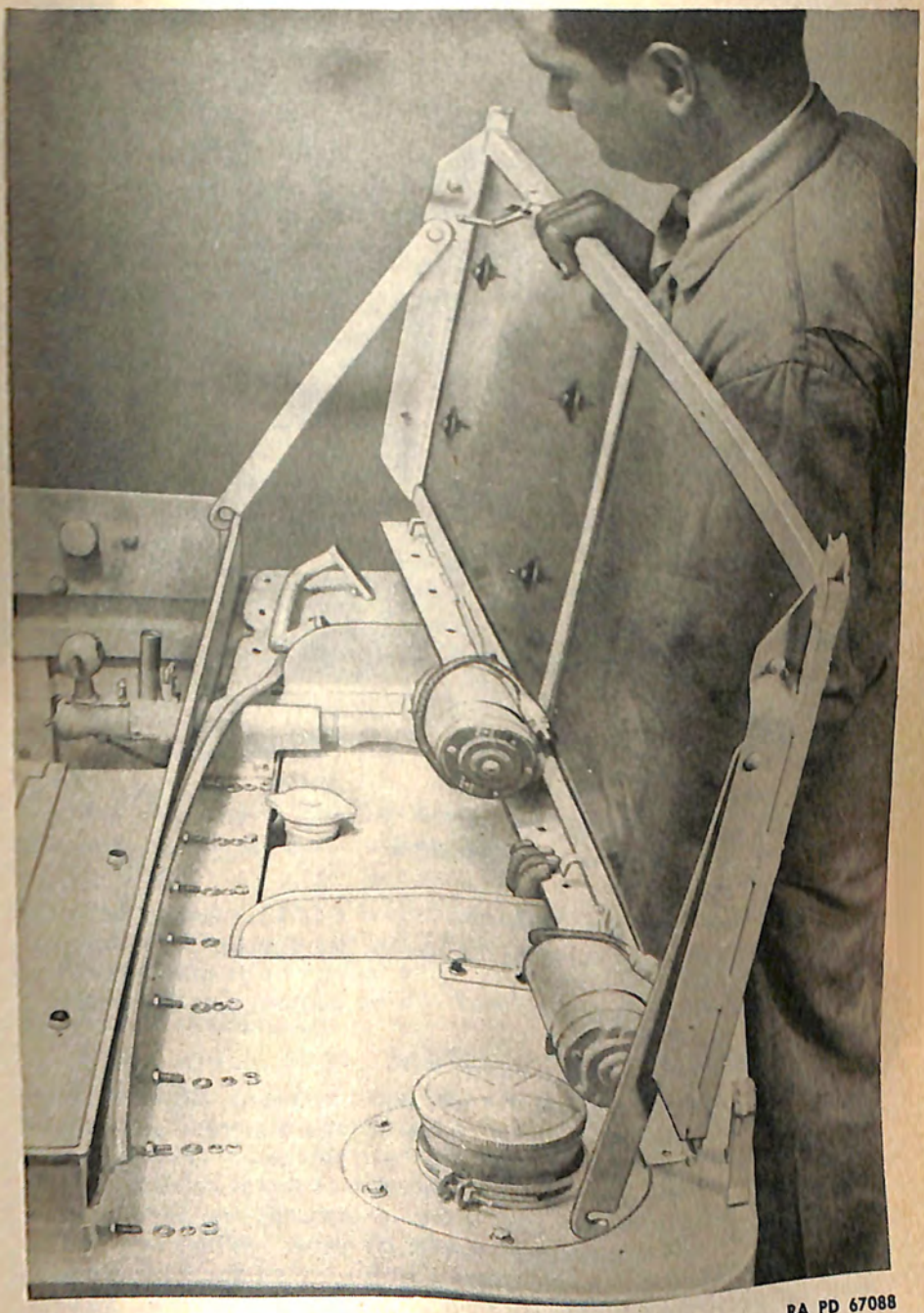
driver's seat is located to the left of the engine, and the seats in the rear compartment of the hull may be removed for carrying cargo.

b. Seat Backs. To remove the seat backs: Unhook seat back hook located on floor at rear of seat, tip the seat back forward, pull ears out of slots in hull floor, and remove from vehicle. To install seat backs: Place seat back ears into slots in hull floor, tip assembly rearward, and securely fasten into position by attaching seat back hook.

c. Seat Cushions. To remove seat cushions, unhook hold-down strap at front and back of cushion from pegs on floor, pull straps out of loops, and lift cushions out of seat bottom. To install cushions, place in bottom, slide straps through loops, and hook over pegs.

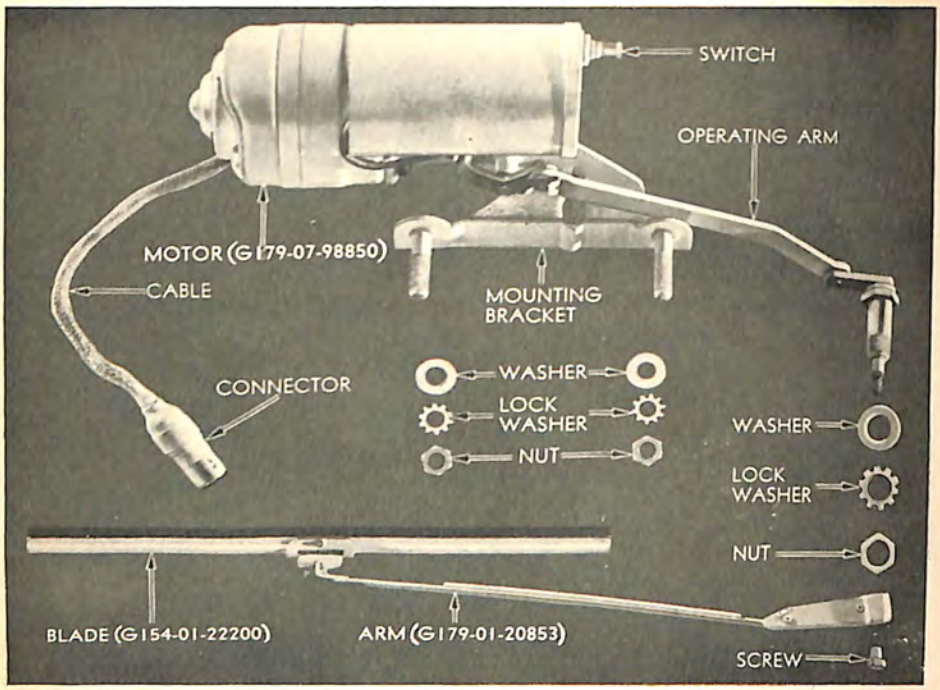
145. COVERS, CARGO STRAPS, AND SAFETY BELTS.

a. Covers. A canvas cover is provided for the rear compartment cargo. The seat backs, seat cushions, and spotlight (before vehicle serial 3103) are provided with canvas covers, and there is a camouflage cover for the windshield.



RA PD 67088

Figure 175 — Removing Windshield



RA PD 352287

Figure 176 — Electric Windshield Wiper and Mounting Parts

b. Cargo Straps. Cargo straps are located in the rear compartment and are used to secure cargo and equipment when operating over rough terrain.

c. Safety Belts (Before Vehicle Serial 8141). Safety belts are provided on vehicles before serial 8141 for the comfort and safety of the driver and crew, or passengers. The safety belts are fastened to the hull with triangular brackets and can be adjusted as necessary.

146. LITTER BRACKETS (fig. 174).

a. All vehicles after serial 4103 are equipped with litter brackets. The four forward brackets fit into holes on the top rear side of the bulkhead and are fastened in place by spring clips. The two rear brackets are integral with a bow tube located at the rear right section of the cargo compartment. The tube is secured at each end in sockets on the deck coaming and locked by pins. When not in use, the front litter brackets may be placed in an out-of-the-way position by simply installing them upside down in their socket holes. The lip fastening arrangement makes it necessary to interchange the position of the brackets when locating them in this manner.

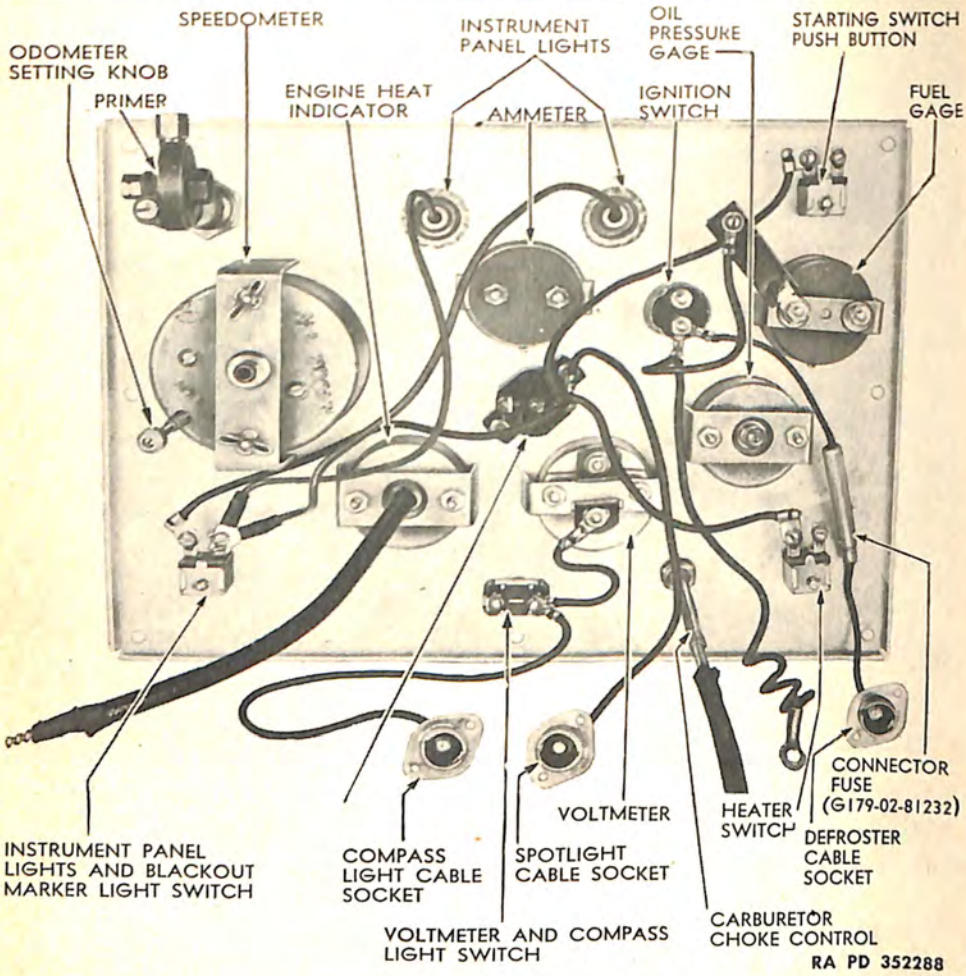


Figure 178 — Instrument Panel — Rear (Before Vehicle Serial 1003)

toothed washers, and bolts that hold windshield hinge to coaming and lift windshield assembly from the vehicle (fig. 175).

c. Installation. Place windshield in position and install hinge bolts, flat washers, and toothed lock washers. Install nuts on bolts and tighten securely. Position brackets over knob studs and tighten knobs. Install windshield wiper cable plugs in sockets of engine compartment front panel. Place top front bow in position on windshield frame and tighten wing nuts.

148. WINDSHIELD WIPERS (ELECTRIC).

a. Description (fig. 176). The electric windshield wiper system consists of two single-speed motor and arm assemblies mounted inside the hull, with connecting arms, blades, linkage, and cables.

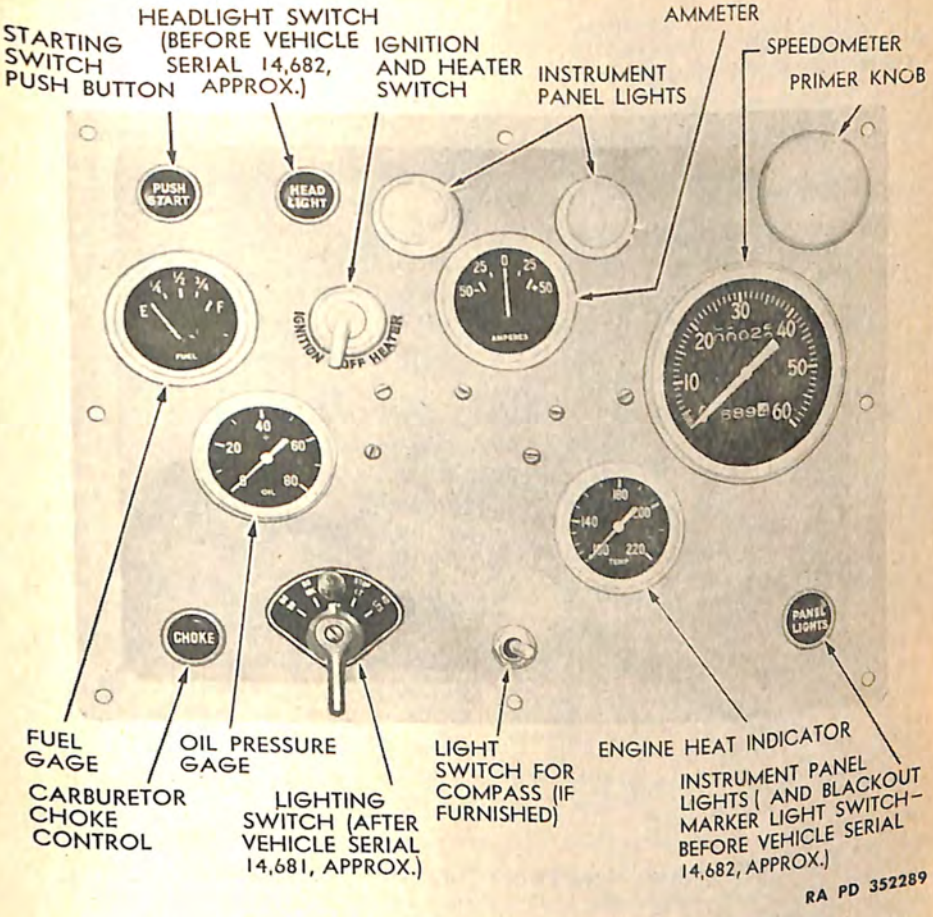


Figure 179 — Instrument Panel — Front (Late Production)

b. Removal. Remove the wiper cable plug from connector socket on engine compartment front panel. Loosen wiper blade arm fastening nut from end of wiper arm operating shaft, remove nuts that hold wiper to coaming, and remove wiper body and linkage.

c. Installation. Place toothed washers over studs, position wiper motor on coaming, install washers and nuts, and tighten securely. Install lock ring on operating shaft and push cable plug into socket on engine compartment front panel. Place wiper blade arm and blade on operating shaft and install nut. Upon completing installation, operate wipers to check blade travel and position wiper arms on operating shafts as required to give equal blade travel on windshield surface.

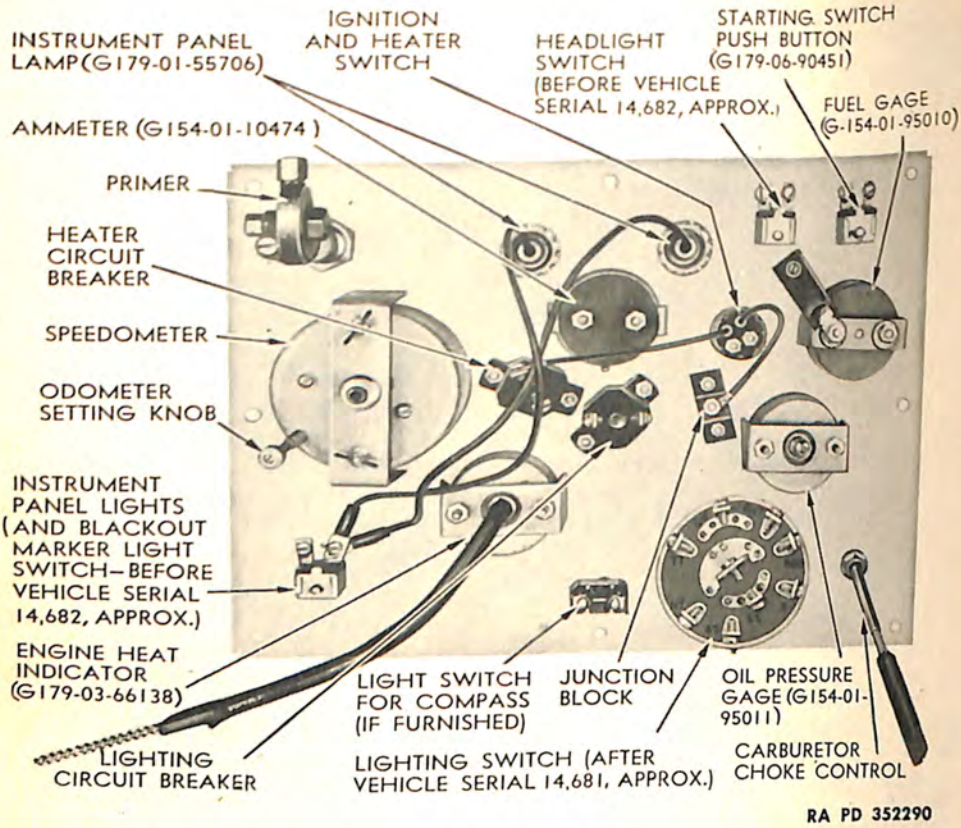


Figure 180 — Instrument Panel — Rear (Late Production)

149. WINDSHIELD WIPER (MANUAL).

a. Description. The manually operated wiper is located directly in front of driver on the upper part of windshield frame. A clip on the windshield frame holds the wiper handle securely when the wiper is not in use, and keeps the handle and blade out of driver's vision.

b. Removal. Remove cap nut from end of wiper shaft and pull off wiper arm and blade. Remove hex nut and washers from wiper shaft. Remove wiper handle and shaft assembly from windshield frame.

c. Installation. Install wiper handle and shaft assembly on windshield frame; place washers on wiper shaft and tighten hex nut against them. Position wiper arm and blade assembly on splined end of wiper shaft, and check for correct blade travel. Install cap nut on end of shaft and tighten.

150. INSTRUMENT PANEL (figs. 177, 178, 179, and 180).

a. Description. The gages, switches, choke control, primer, speedometer and two panel lights are located on the instrument panel. The panel is located at the right of driver and is mounted on the engine compartment side panel.

b. Removal. Loosen wing nuts and remove engine compartment cover. Remove and tag all wires from instruments and switches on panel. Drain engine cooling system and remove heat indicator element from fitting in left rear side of cylinder head. Disconnect oil pressure gage pipe from flexible connection at oil gage. Disconnect primer inlet and outlet pipe connections from fittings at primer. Loosen choke tube clip at fastening bracket screw, loosen swivel clamp screw on choke wire; then pull choke cable away from carburetor. Unscrew knurled nut that holds cable to speedometer and place out of the way along right side of hull tunnel. Remove panel fastening screws, lock washers, clips, and nuts, and carefully lift instrument panel assembly through engine compartment and out of vehicle.

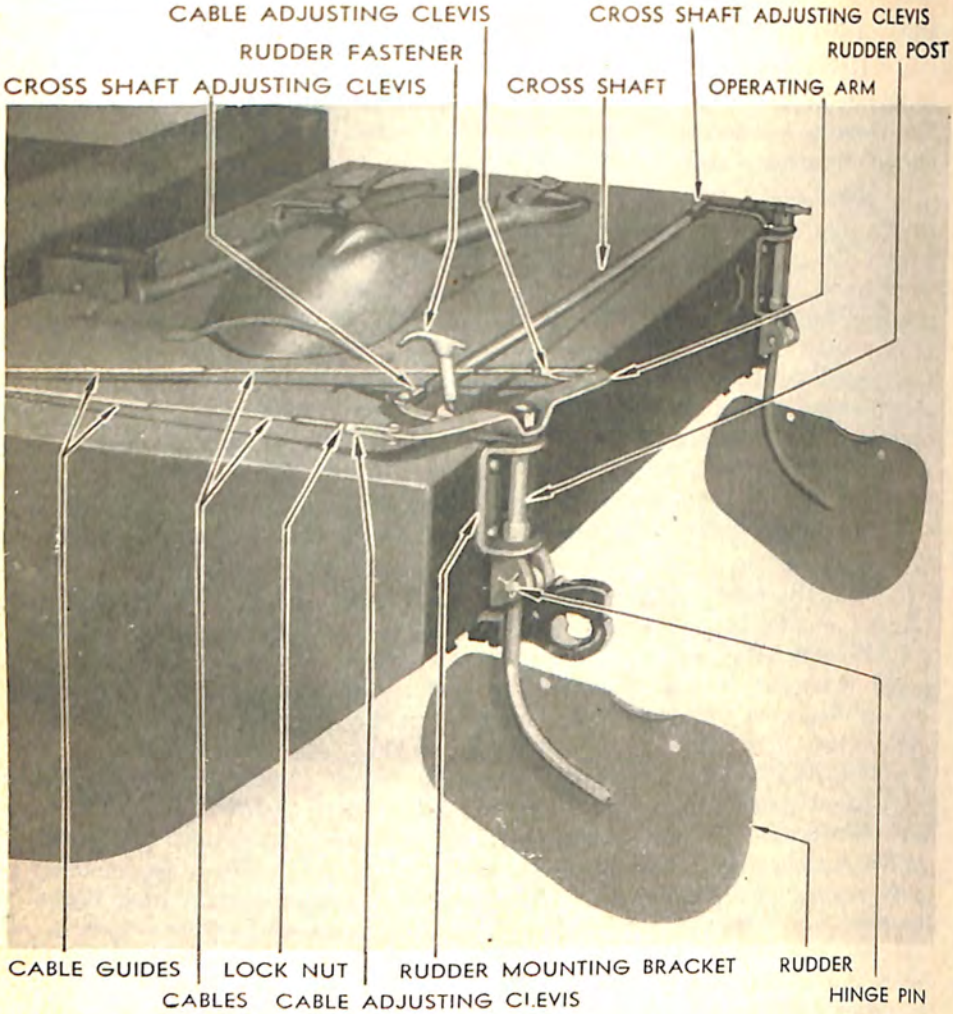
c. Installation. Place instrument panel assembly in vehicle through engine compartment and install screws, lock washers, clips (where required), and nuts. Connect all wires to proper terminals on panel as tagged during removal. If difficulty is experienced, refer to wiring diagrams. Place choke control in position through clamp at carburetor, with wire going through swivel on choke valve lever. Tighten the bracket clip screw securely, push choke control against instrument panel, open choke valve fully, and tighten swivel screw onto choke wire. Place primer inlet and outlet pipes into position at primer fittings and tighten nuts securely. Place speedometer cable up over engine, insert drive end of cable into speedometer, and tighten knurled nut. Be sure that there are no kinks or sharp bends in speedometer cable to impede operation. Insert heat indicator element into fitting in left side of cylinder head and tighten nut securely. Connect oil pressure pipe to flexible connection at gage and tighten securely. Refill engine cooling system. Install engine compartment cover and fasten it in position with clamps and wing nuts.

151. PINTLE HOOK.

a. Description. A pintle hook is provided at the rear of the vehicle for towing purposes. Before vehicle serial 2103 the hook is a swivel type; after vehicle serial 2102 it is stationary.

b. Removal. Remove the cap screws and lock washers which hold the pintle hook to hull, and remove the pintle hook.

c. Installation. Coat the hull, base of pintle hook, and cap screws with joint sealing compound. Place pintle hook in position against hull, install cap screws and lock washers, and tighten screws securely.

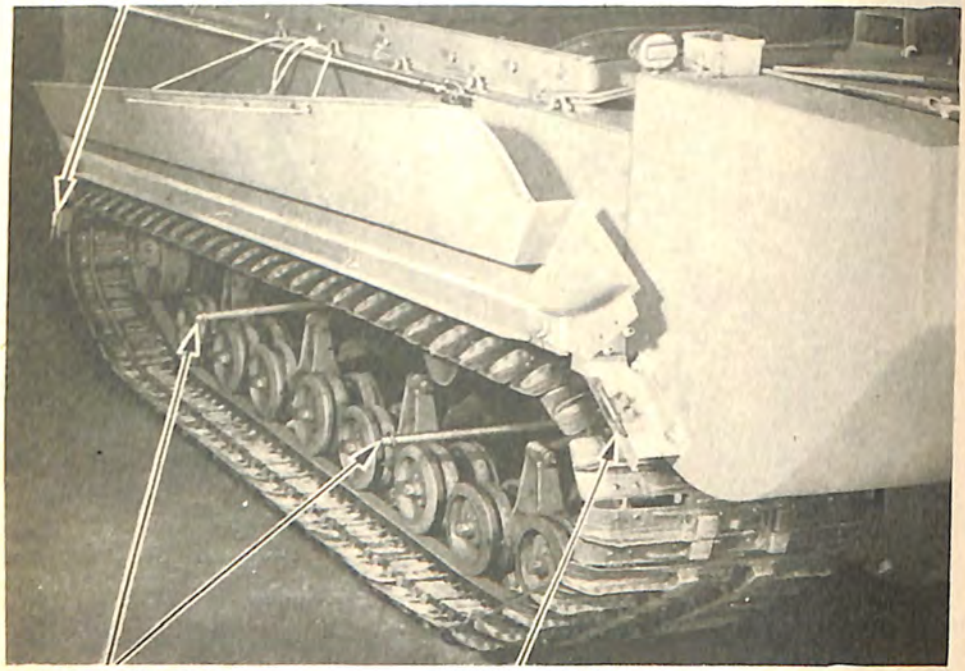


RA PD 336485

Figure 181 — Rudders and Control Parts — Cargo Carrier M29C

152. RUDDERS AND CONTROL (M29C) (fig. 181).

a. Description. Twin rudders, located on the rear of the stern cell, are used to control the course of the vehicle while operating in water. The left rudder is connected by cables (encased in guides) to the tiller, which is mounted on the front coaming below the windshield, directly in front of driver (fig. 22). The rudder posts are connected by an adjustable cross shaft. The rudders are pivoted to permit raising them for land operation (fig. 6).



RA PD 337136

Figure 184 — Track Apron in Raised Position — Cargo Carrier M29C

washers and nuts. Fasten conduits to left coaming with clamp. Connect cable clevises to rudder arm with clevis pins and new cotter pins, and adjust (subpar. b above) if necessary.

153. CELL LIDS (M29C).

a. Bow Cell Stowage Compartment.

(1) DESCRIPTION. The deck for the bow cell is equipped with a hinged lid to permit using the cell for a stowage compartment (fig. 7). A floor is provided in the cell to give level stowage space. An inspection hole, with a spring-hinged lid, is located in the floor and provides access to bilge under the floor for pumping out bilge water (fig. 182).

(2) CELL LID REMOVAL. Remove screws from hinges that fasten lid to hull and lift off lid.

(3) CELL LID INSTALLATION. Place lid in position over cell opening, install the cap screws through hinges, and tighten securely.

b. Stern Cell Top Panel Lid.

(1) DESCRIPTION. The stern cell top panel lid is fastened to the cell with cap screws, and joint sealing compound is used at the joint and on the screws. An inspection hole, with a spring-hinged cover, is provided in the panel lid (fig. 7).

(2) REMOVAL. Take out cap screws with lockwashers and remove the lid (fig. 183). Remove all old joint sealing compound from lid, cell opening, and mounting screws.

(3) INSTALLATION. Apply new joint sealing compound around cell opening and to mounting screws. Place lid in position, install screws with lock washers, and tighten securely.

154. SURF GUARD (M29C).

a. Description and Operation. A surf guard is located on top of the bow cell to prevent shipping excessive amounts of water. The guard is pivoted at each side so it can be swung back over hull in front of windshield for better visibility during land operation. Latches on the guard permit securing it in either its "ahead" or "folded-back" position. It is curved to fit the bow cell of the vehicle and contoured outward at the top to deflect water away from the vehicle.

b. Removal. Remove cotter pin, nut, and pivot bolt from each side at the hinge point. Lift surf guard off vehicle.

c. Installation. Place surf guard in position at front of bow cell. Insert pivot bolts through brackets and install washers, nuts, and new cotter pins.

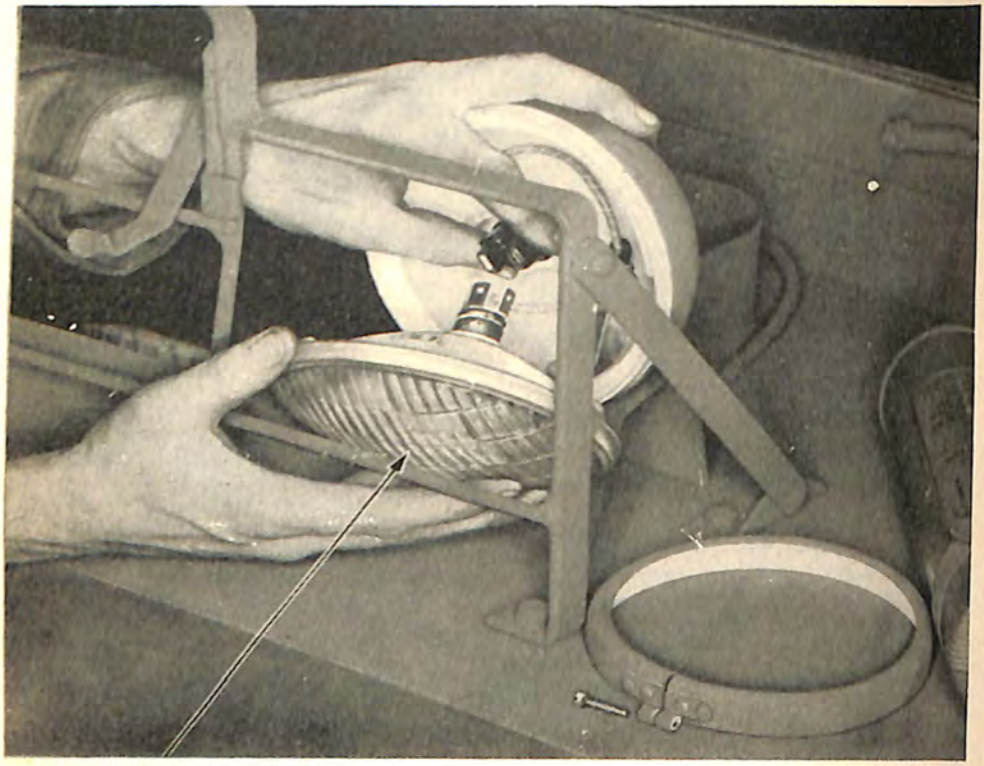
155. TRACK APRON (M29C).

a. Description. A track apron is mounted along each side of hull with hinges. Two braces are provided to give further support to each apron.

b. Raising Apron for Suspension System Maintenance. Unhook the fasteners from the apron braces. Remove cotter pins from hinges at the front and rear of apron, lift apron outward and up, and fasten to hull (fig. 184).

c. Removal. Unhook the apron brace fasteners, remove cotter pins from all hinges, and remove apron.

d. Installation. Place apron in position on hinges and apron braces. Insert cotter pins in all hinges, and hook apron brace fasteners.



LAMP-UNIT (7007619) RA PD 352293

Figure 188 — Replacing Sealed Beam Lamp-unit in Headlight (After Vehicle Serial 3102)

(2) SEALED BEAM LAMP-UNIT REPLACEMENT. Remove screw from bottom of light rim. Remove rim, lift out sealed beam lamp-unit, and pull the unit off the plug connection socket. Connect replacement lamp-unit to plug socket (fig. 188), place unit in light body, position rim on body, install the screw, and tighten securely.

(3) REMOVAL. Loosen wing nuts, remove the engine compartment cover, and disconnect the wire from connector at front of engine compartment. Remove the nut and washers which hold light to mounting bracket, lift off light assembly, and pull wire out of conduit (fig. 189).

(4) INSTALLATION. Push wire into conduit, position light assembly on the mounting bracket, install nut and washers, and adjust (subpar. **b** (1) above). Connect wire to connector at front of engine compartment, install engine compartment cover, and fasten in position with clamps and wing nuts.

approx.). On vehicles after serial 14,681 (approx.), the rear marker light switch is combined in rotary switch at lower left corner of instrument panel.

b. Instrument Panel Lights.

(1) REMOVAL. Pull downward on panel light shield with the hand to spring the assembly out of panel. To remove lamp, spring the lamp socket out of shield by pulling sidewise on wire. Push in on lamp, turn counterclockwise, and pull out of socket. If it is necessary to replace entire light assembly or wire, disconnect wire from terminal of light switch before removing the light assembly from the panel.

(2) INSTALLATION. Push lamp into socket and turn it clockwise. Insert lamp and socket into shield and push on socket until it snaps into place. Push shield into position in panel and operate switch button to check lamp position.

c. Rear Marker Light (fig. 191).

(1) LAMP REPLACEMENT. Take screw out of light door and remove the door. Push lamp in, turn counterclockwise, and remove from socket. Place replacement lamp into socket, push lamp in, and turn clockwise to lock in place. Install light door, insert screw, and tighten securely.

(2) REMOVAL. Pull marker light wire from connector inside of rear deck. Remove the nut which holds marker light to rear deck and lift light assembly from vehicle.

(3) INSTALLATION. Insert marker light wire through hole in rear deck and install nut on light stud inside rear deck. Plug the light wire into connector.

d. Switch (Before Vehicle Serial 14,682, Approx.).

(1) REMOVAL. Loosen wing nuts and lift engine compartment cover out of vehicle. Disconnect battery ground strap by loosening clamp bolt and remove clamp from post. Loosen two terminal post screws on back of switch body and remove and tag wires from terminals. Loosen the switch button set screw and turn the button counterclockwise off the switch operating shaft. Remove the lock nut which holds switch body to instrument panel and remove switch from panel. A toothed lock washer is used between switch body and rear side of panel. NOTE: *After vehicle serial 14,681 (approx.), the rear marker light is contacted by the rotary switch. For removal and installation of the rotary switch see paragraph 159 c.*

(2) INSTALLATION. Position switch in panel, place toothed lock washer between switch body and rear side of the panel, install nut, and tighten. Connect wires to the terminals on switch. Install switch button by turning clockwise on the operating shaft until tight,

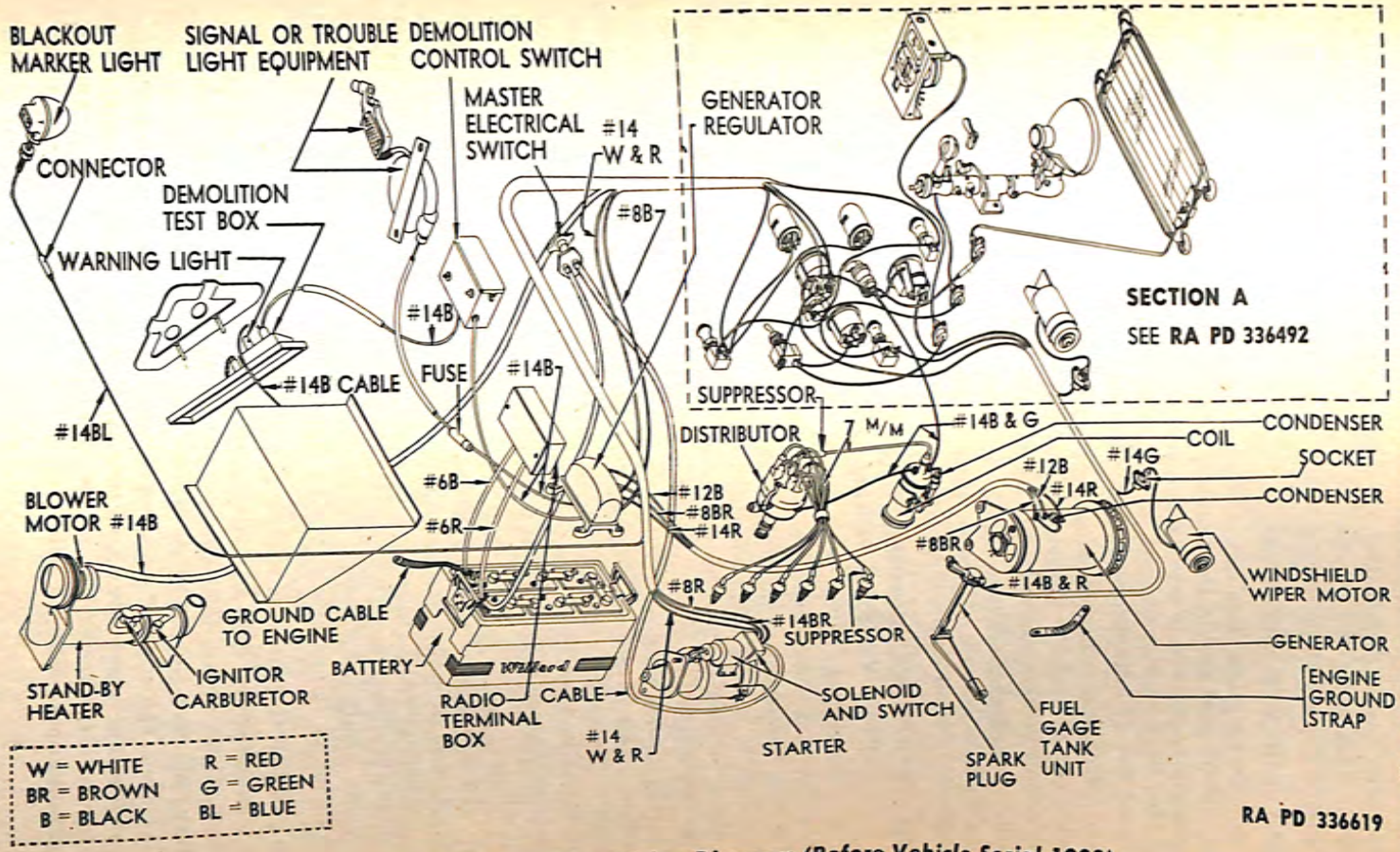


Figure 192 — Complete Wiring Diagram (Before Vehicle Serial 1003)

then turn until identification name is horizontal, and tighten set screw. Connect battery ground strap clamp to battery post; install engine compartment cover and fasten with clamps and wing nuts.

162. CIRCUIT BREAKERS.

a. Description. Two circuit breakers, one connected in the lighting circuit and one in the stand-by heater circuit (in vehicles so equipped), are used to prevent damage to the wiring in the event of an electrical short or overload. The circuit breakers are mounted on engine side of instrument panel near the center (fig. 178 or 180).

b. Removal. Loosen wing nuts and lift engine compartment cover out of vehicle. Disconnect and tag the wires from terminals on circuit breaker. Remove fastening nuts and circuit breaker.

c. Installation. Place circuit breaker in position, install nuts, and tighten securely. Connect wires to terminals as tagged during removal. Install engine compartment cover and tighten wing nuts.

163. BLACKOUT DRIVING LIGHT RESISTOR ASSEMBLY (AFTER VEHICLE SERIAL 14,681, APPROX.).

a. Description. The blackout driving light resistor assembly consists of a 2.4-ohm, 40-watt resistor with mounting support bracket and shield, mounted on the front engine compartment division panel. The resistor is used to provide a voltage drop allowing the 6-volt blackout driving light to be used with the 12-volt source supplied with the vehicle.

b. Removal. Remove the screws, washers, and nuts which hold resistor shield to engine compartment division panel and remove shield. Disconnect wires from resistor terminals. Remove the screws, washers, and nuts which hold resistor bracket to engine compartment division panel and lift off resistor and bracket, brass ferrule, and nut.

c. Installation. Position resistor bracket with resistor brass ferrule and nut, on engine compartment division panel and fasten with two mounting bolts, washers, and nuts. Push wires from blackout driving light circuit through brass ferrule and connect them to resistor terminals. Install shield over resistor and fasten to division panel with mounting screws, washers, and nuts.

164. WIRING.

a. Description. The vehicle electrical wiring is contained in one main harness and one auxiliary wiring harness. The main harness connects the controls and gages on the instrument panel with the related units in the engine compartment and is fastened to the engine side of the instrument panel, engine compartment side panel, and bulkhead. The auxiliary wiring harness connects the generator to the generator regulator.

b. Removal. No special instructions are required for removal of either the main or auxiliary harness other than to note the location of all fastening clips and to be sure that the clips and all attaching bolts, nuts, and washers are available for installation.

c. Installation. When the wiring is installed, make sure that all wires are in good condition, all holding clips are properly positioned and tightened, and that all connections are securely tightened. Check connections with wiring diagram (figs. 185, 192, 193, and 194).

Section XXXI
INSTRUMENTS AND GAGES

165. AMMETER.

a. Description. The ammeter is located in the instrument panel to the right of the ignition switch. It registers the rate of electrical charge to, or discharge from, the batteries. The gage has a 50-ampere range, both for charge and discharge. With all electrical switches in their "OFF" positions, the ammeter hand should stand at zero. If a reading appears under these conditions, report the matter to Ordnance personnel so the electrical short or difficulty can be traced and eliminated.

b. Removal. Loosen wing nuts and lift engine compartment cover out of vehicle. Disconnect battery ground strap by loosening clamp bolt and remove clamp from post. Remove two terminal post nuts and locks from back of gage, tag wires for installation, and remove wires from terminal. Remove two nuts and flat washers which hold clamp bracket to ammeter. Remove clamp with fiber disk and insulators from two terminal posts. Slip ammeter out of instrument panel face.

c. Installation. Place the ammeter in panel, noting that locating boss on the bottom of gage fits into a recess in panel hole. Install clamp, fiber disk, insulators, flat washers and nuts, and tighten securely. Connect wires as tagged during removal. Connect battery ground strap clamp to battery post. Install engine compartment cover and fasten with clamps and wing nuts.

166. COMPASS.

a. Description. The compass is the sealed liquid type. It is suspended by four rubber mountings in a bracket which is attached to underside of hull coaming directly in front of the driver (fig. 18). A small light illuminates the compass from within and is wired to voltmeter switch so that light burns only when switch is operated to close the circuit. On vehicles after serial 2102, the compass is omitted.

b. Removal. Remove the screws from each side which hold the left and right side plates to the compass case. Disconnect the compass light by removing the plug from the lower socket on the engine compartment side panel. Remove the compass mounting bracket to hull brace bolt, nut, and spacer from the compass bracket. Remove the two rear nuts with locks and loosen the forward two nuts and locks that secure the compass mounting bracket to hull coaming support bracket. The forward nuts should then be removed with the fingers while the entire assembly is held with the other hand.

c. Installation. Install the compass mounting bracket to hull brace with bolt, nut, and spacer. Install the two front nuts with locks that secure compass mounting bracket to hull coaming support bracket. Connect the compass light by installing the plug in the lower socket on the engine side panel. Install screws on each side which hold plates to compass case and tighten securely.

167. FUEL GAGE (DASH UNIT).

a. Description. The fuel gage is located in the instrument panel to the left of the ignition switch. It registers the approximate amount of fuel in the tank by means of the float and electrical impulse furnished by the tank unit. The ignition switch must be turned on before the gage will register.

b. Removal. Remove engine compartment cover. Take off the terminal nuts and lock washers from the back of the gage. Remove the wire and resistor, and tag them for installation. Remove the nuts that hold gage to instrument panel; remove the U-clamp on gage terminal posts and pull gage from panel face.

c. Installation. Place gage in position in the instrument panel, install U-clamp over terminal posts, and install the two nuts holding gage to panel. Install the wire and resistor, as tagged during removal, and install the lock washers and nuts on the terminal posts. Install engine compartment cover and tighten wing nuts.

168. ENGINE HEAT INDICATOR.

a. Description. The heat indicator (engine cooling system temperature gage) is located just below and to the left of the speedometer. The gage range is from 100° to 220° F. The gage heat element is located in left side of engine cylinder head near the rear.

b. Removal. Loosen the wing nuts and remove engine compartment cover. Turn the sealing radiator cap to its half-open position and drain cooling system (par. 96 b (1)). Remove the heat indicator element of the gage from the engine cylinder head (fig. 51). Unfasten the clip that holds the flexible tube. Remove the nuts and

right side of hull, and attach front connector nut to speedometer head. Install hull floor pan with cap screws. Place engine compartment cover in position and tighten wing nuts.

171. VOLTMETER AND SWITCH.

a. Description. The voltmeter is located in the lower left center of the instrument panel and registers the voltage present in the electrical system. This instrument has an 8- to 16-volt range. It is necessary to snap on the voltmeter switch, located below the voltmeter, in order to take a voltage reading (or to light the lamp in the compass). Voltmeters are not installed in production after vehicle serial 2102. NOTE: *Inoperative voltmeters will not be replaced.*

b. Voltmeter.

(1) DISCONNECTION. Loosen wing nuts and lift engine compartment cover out of vehicle. Remove the nut and lock and disconnect the wire from the terminal post on the back of the voltmeter. Tape the unprotected ends of the disconnected wires, and leave the voltmeter mounted on the instrument panel.

c. Switch.

(1) REMOVAL. Loosen wing nuts and lift engine compartment cover out of vehicle. Disconnect the battery ground strap by loosening clamp bolt and remove clamp from post. Loosen the terminal screws, remove wires, and tag them for identification. Remove the escutcheon nut and ring from front of switch. Push switch body out of panel opening.

(2) INSTALLATION. If a new switch is to be installed, transfer the jam nut onto the new switch body and adjust the nut so the switch body will be flush with the escutcheon nut when tight. Position switch in panel, install escutcheon nut and ring, and tighten. Connect tagged wires to terminal post, and connect battery ground strap clamp to battery. Install engine compartment cover and fasten with clamps and wing nuts.

Section XXXII
EQUIPMENT

172. CAPSTAN AND DRIVE (M29C).

a. Description and Data.

(1) DESCRIPTION (fig. 195). The capstan is located in the center of the front (bow) cell deck (fig. 5). A split, V-type pulley is mounted on rear end of the upper drive shaft. A universal joint connects the front end of drive shaft to capstan worm shaft. The

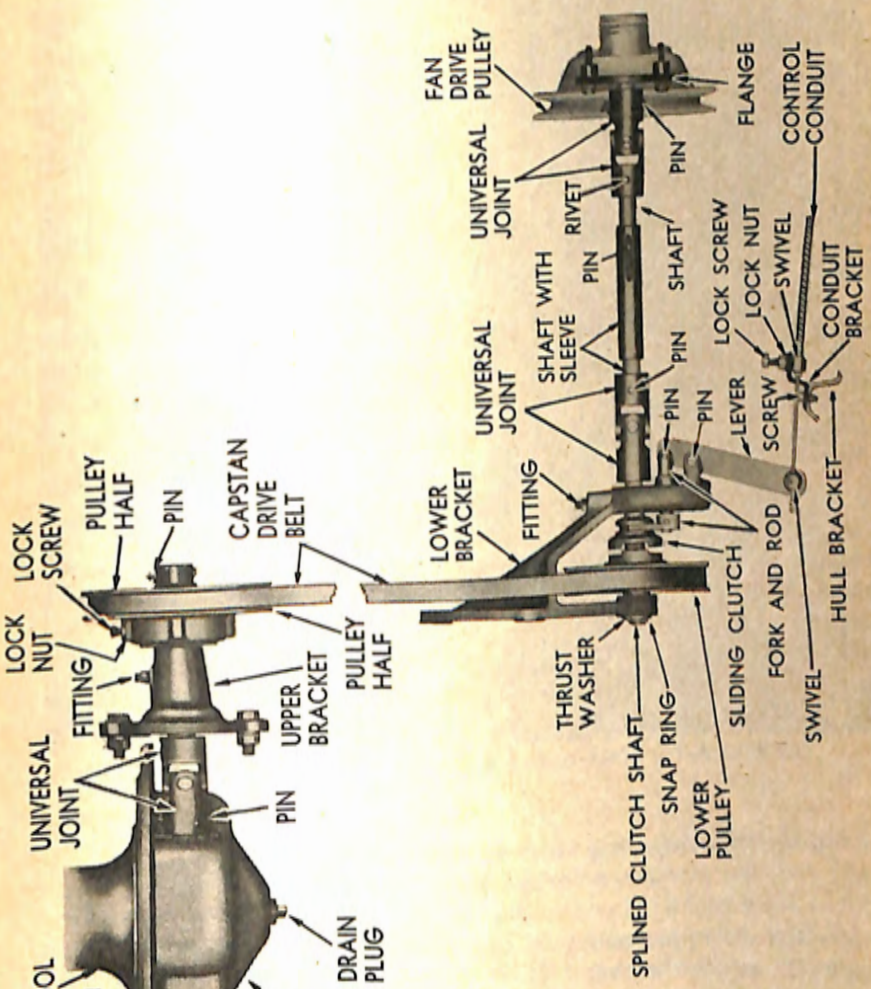
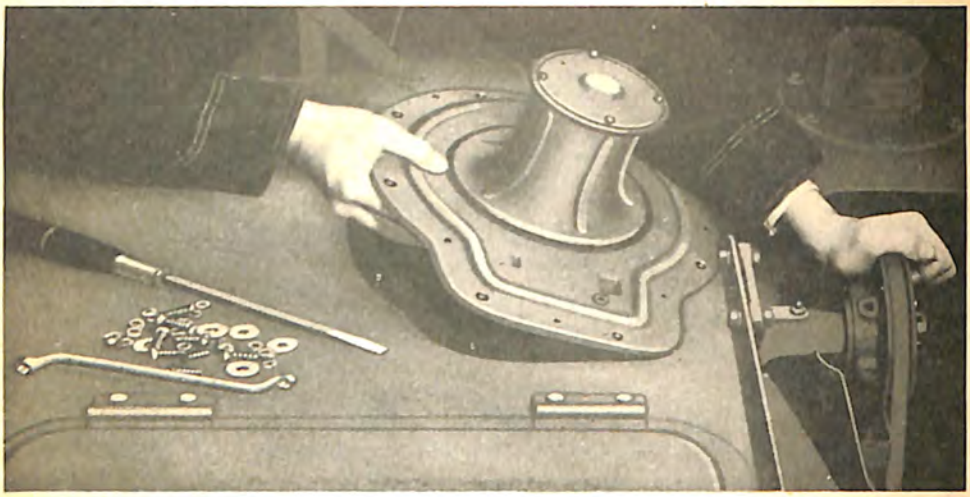


Figure 195 — Capstan Drive and Control — Cargo Carrier M29C



RA PD 319374

Figure 198 — Removing Capstan

of drive belt. Take the cotter pin out of pulley hub to drive shaft pin, and drive out pin (fig. 199). Slide pulley rearward off the shaft.

(2) INSTALLATION. Place pulley in position on shaft, aline pulley to drive shaft pin hole, install pin and a new cotter pin. Install drive belt on pulley, and adjust tension (subpar. **b** above).

e. Upper Drive Shaft.

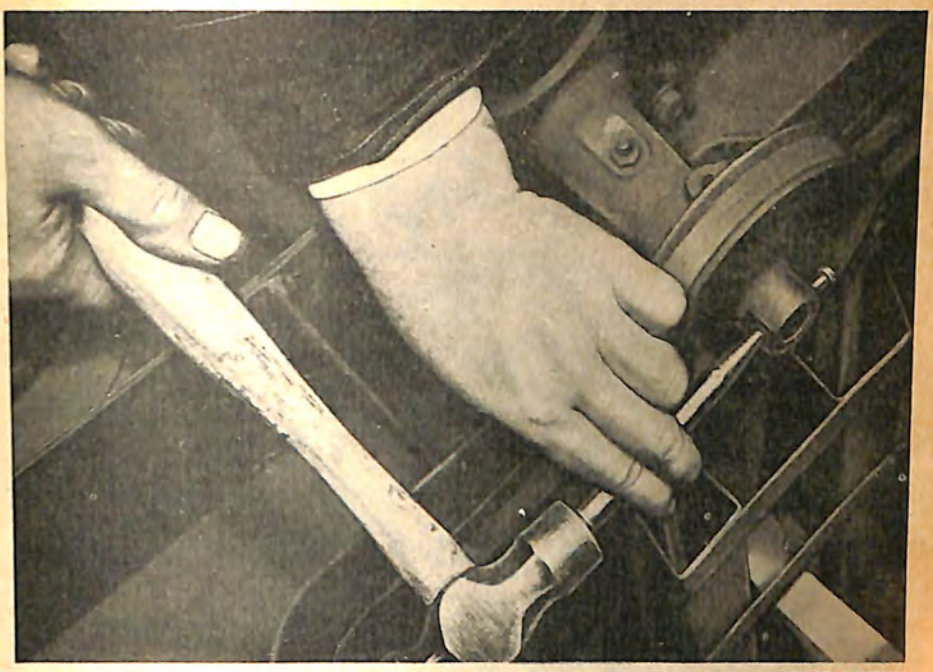
(1) REMOVAL. Remove capstan (subpar. **c** (1) above) and upper drive pulley (subpar. **d** (1) above). Pull drive shaft and universal joint forward out of bearing support bracket.

(2) INSTALLATION. Lubricate shaft with proper lubricant (par. 38) and insert into bearing support bracket from the front. Install capstan (subpar. **c** (2) above) and upper drive pulley (subpar. **d** (2) above).

f. Drive Belt.

(1) REMOVAL. Loosen lock nut and lock screw in upper pulley hub. Turn rear flange of pulley counterclockwise to relieve tension of drive belt. Take the cap screws out of the lower drive shaft bracket (fig. 200), move bracket to one side, disengage belt from pulleys, and remove.

(2) INSTALLATION. Place belt in position over upper and lower drive pulleys. Move lower drive shaft bracket into place and install cap screws with lock washers. Tighten cap screws securely and adjust belt tension (subpar. **b** above).



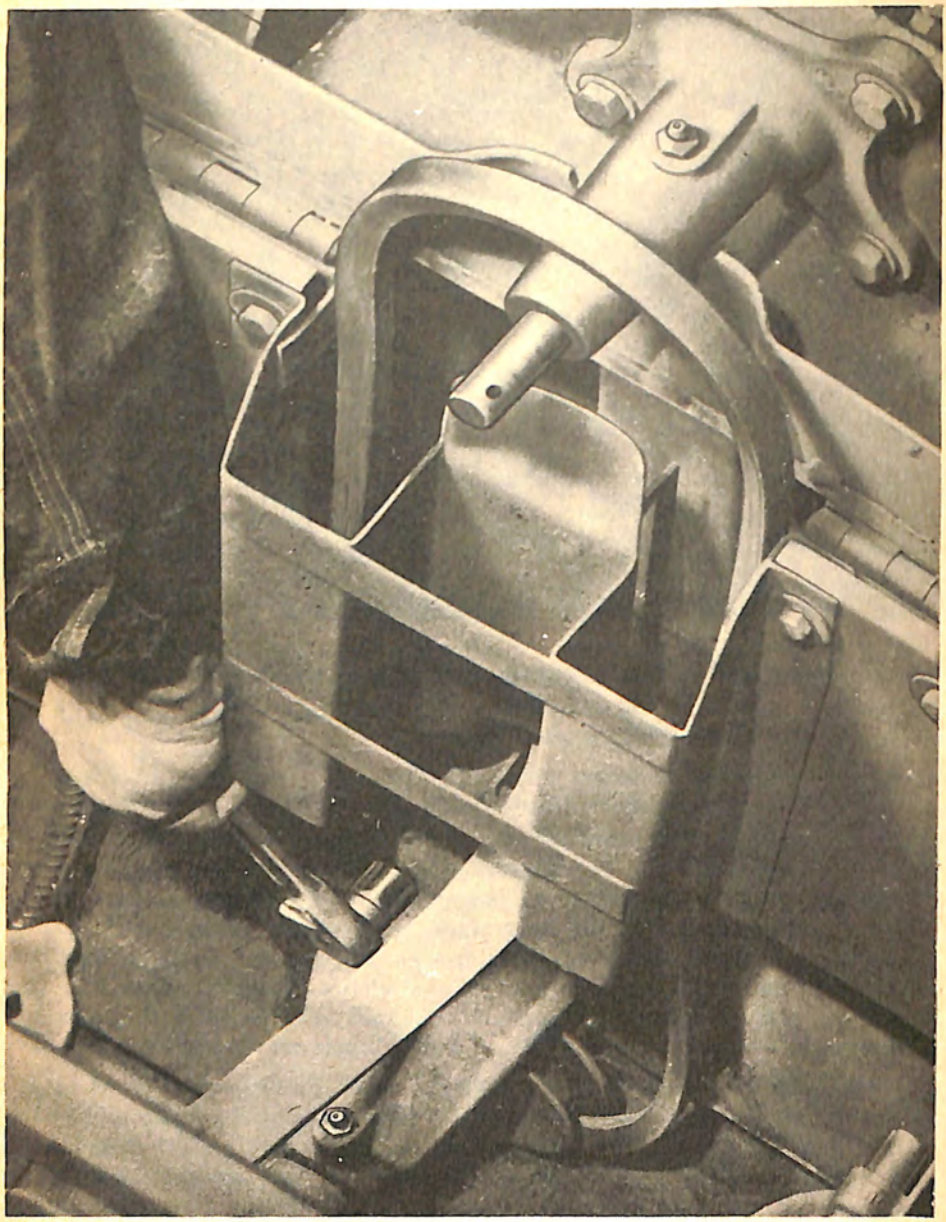
RA PD 319382

Figure 199 — Removing Capstan Upper Drive Pulley Pin

g. Lower Drive Pulley and Shaft.

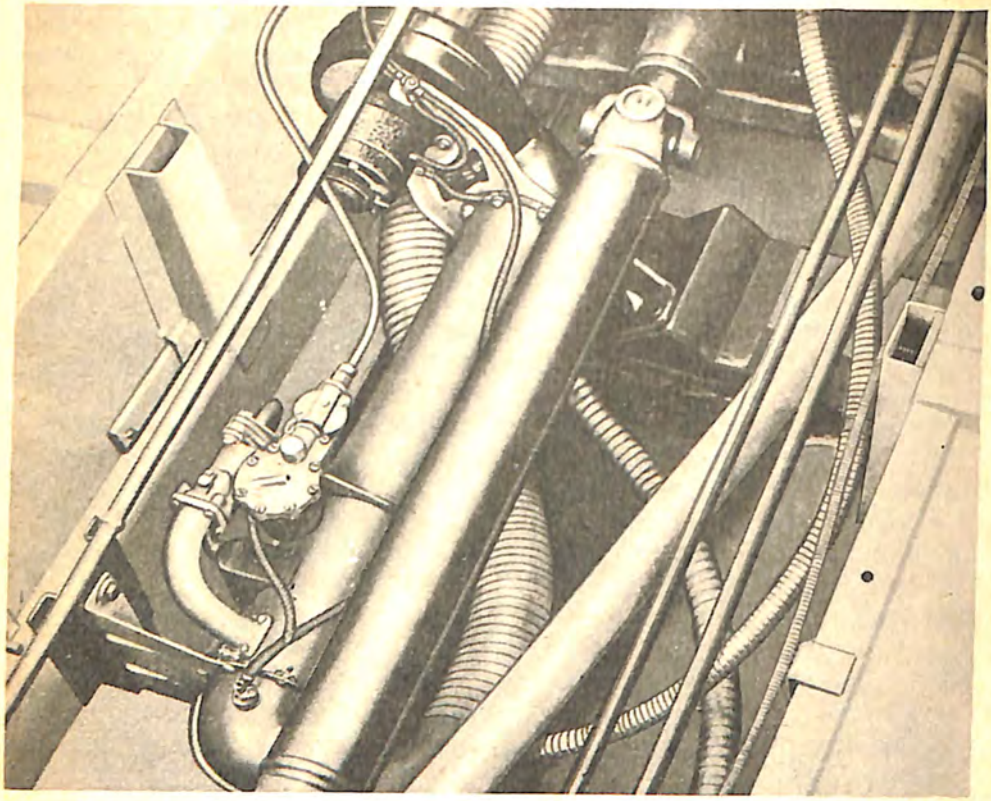
(1) REMOVAL. Loosen lock nut and set screw in upper pulley hub. Turn rear flange of pulley counterclockwise to relieve tension of drive belt. Loosen clamp bolt at swivel that holds clutch control wire to clutch operating lever, and pull wire out of swivel. Remove cotter pin and flange pin from rear flange of capstan lower drive shaft front universal joint, and slide connecting shaft and sleeve rearward. Remove cap screws at lower drive shaft bracket and lift out the bracket with clutch and lower drive pulley. Remove the snap ring and spacer from front end of shaft and pull shaft rearward out of bracket, pulley, and clutch. Lift clutch off the shift fork.

(2) INSTALLATION. Place clutch into position in shift fork, insert shaft through rear bore of bracket, and into clutch. Hold lower drive pulley so the bore is alined with shaft, and slide shaft through pulley and front bore of bracket. Place spacer over front end of shaft and install a new snap ring. Lower bracket with clutch and drive pulley into air duct, place rear flange of front universal joint over front end of connecting shaft, and place drive belt in lower pulley. Hold bracket in position, install cap screws, and tighten securely. Aline holes in front universal joint rear flange and con-



RA PD 319384

Figure 200 — Removing Capstan Drive Shaft Mounting Bracket Screws



RA PD 336649

Figure 201 — Stand-by Heater

(2) Every 4 months, discharge a small quantity of extinguisher fluid into a glass container. If the fluid is clean, pour it back and add fluid to the extinguisher through the filler hole in the cap. If the sample fluid is excessively dirty, drain and refill with fresh fluid. This test procedure determines the amount and condition of the fluid in the extinguisher.

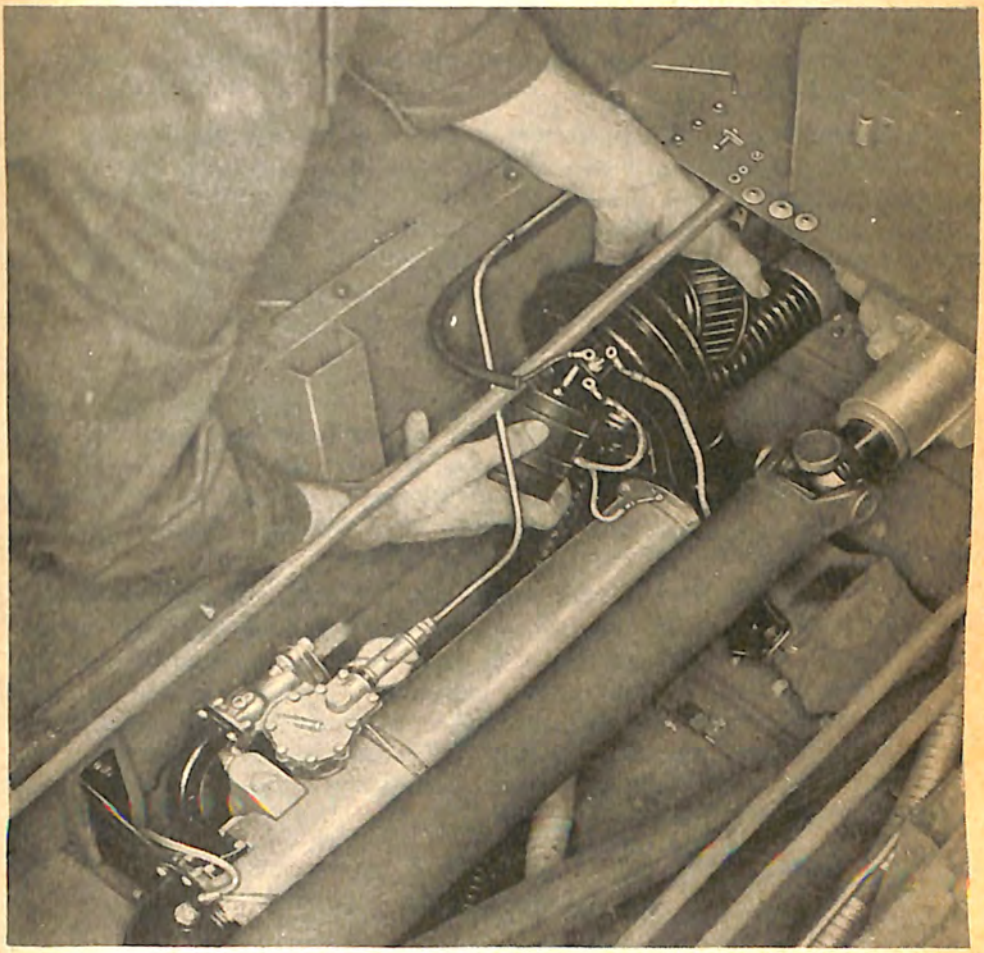
(3) Under no circumstances must water be added with the fluid in the extinguisher. The slightest amount of moisture in the fluid reacts to produce hydrochloric fumes which are highly corrosive and damaging to the internal parts of the extinguisher.

c. Filling.

(1) Remove gasket and plug on top of extinguisher.

(2) Place a funnel in the hole and fill extinguisher with fire extinguisher fluid.

(3) Install gasket and plug securely in top of extinguisher.



RA PD 336519

Figure 202 — Removing Stand-by Heater Blower Motor

174. STAND-BY HEATER.

a. Description (fig. 201). The stand-by heater (on vehicles so equipped) is mounted in the hull tunnel to the left of the propeller shaft. By burning a mixture of gasoline and air in the combustion chamber, heat is obtained and is distributed to the engine and battery compartments by means of a motor-driven blower and flexible tubes.

b. Removal. Take out screws and remove hull floor pan. Disconnect the fuel pipe from the heater carburetor and the wire from the blower terminal. Remove the cotter pin and clevis pin from the steering control rod clevis and lever at the left side of the axle

differential. Remove the cap screws and lock washers from the heater front and rear mounting brackets and lift the heater assembly out of the hull.

c. Installation. Position the heater on the mounting brackets in the hull tunnel, install cap screws with lock washers, and tighten securely. Connect the fuel pipe to the heater carburetor and the wire to the blower terminal. Insert the clevis pin in the steering control rod clevis and lever at the left side of the axle differential, and install a new cotter pin. Install hull floor pan and fasten securely with screw.

d. Blower Motor Replacement.

(1) REMOVAL. Take out screws and remove hull floor pan. Disconnect the wires from the blower motor terminal and the wire from the motor to the case. Loosen the set screw in the blower hub, using a ⅛-inch socket head set screw wrench, and pull blower off the motor shaft. Remove the nuts and washers from mounting studs and lift motor off the studs (fig. 202).

(2) INSTALLATION. Place motor on the mounting studs, install washers and nuts, and tighten securely. Install blower on motor shaft, make sure that set screw in hub coincides with flat on the shaft, and tighten the set screw securely. Fasten motor ground wire to case, connect wires to the blower motor terminal, install nuts with washers, and tighten securely. Test motor to make sure the blower turns freely in the housing. Install hull floor pan and fasten securely with screws.

Section XXXIII

RADIO INTERFERENCE SUPPRESSION

175. PURPOSE.

a. Radio interference suppression is the elimination or minimizing of the electrical disturbances which interfere with radio reception, or disclose the location of the vehicle to sensitive electrical detectors. Therefore, it is important that vehicles with, as well as vehicles without, radios be suppressed properly to prevent interference with radio reception of neighboring vehicles.

b. Suppression is accomplished by the use of a filter, resistor suppressors, and condensers (capacitors). In addition, metal parts in the vicinity of the engine are formed into shield by the use of toothed lock washers, confining electrical disturbances so they cannot act on the antenna of receiving equipment. Wiring, which may carry interfering surges to a point where interference will affect radio reception, is shielded.

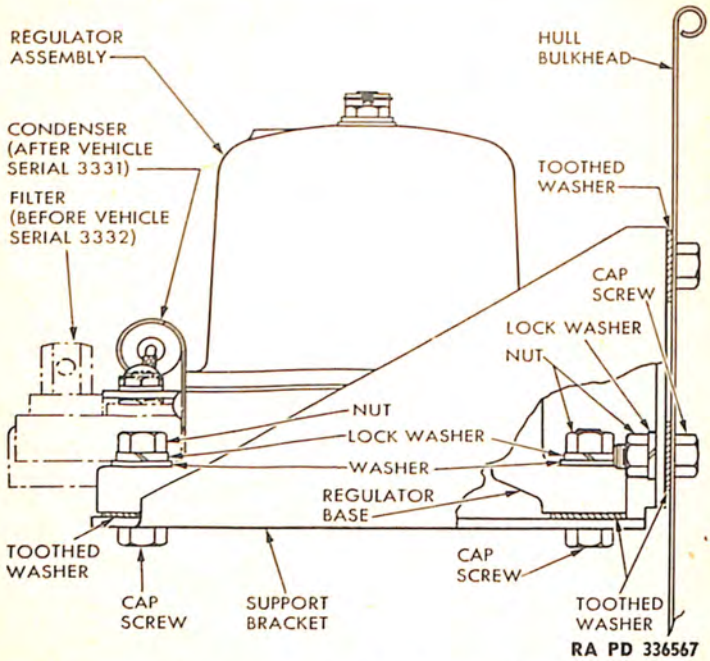
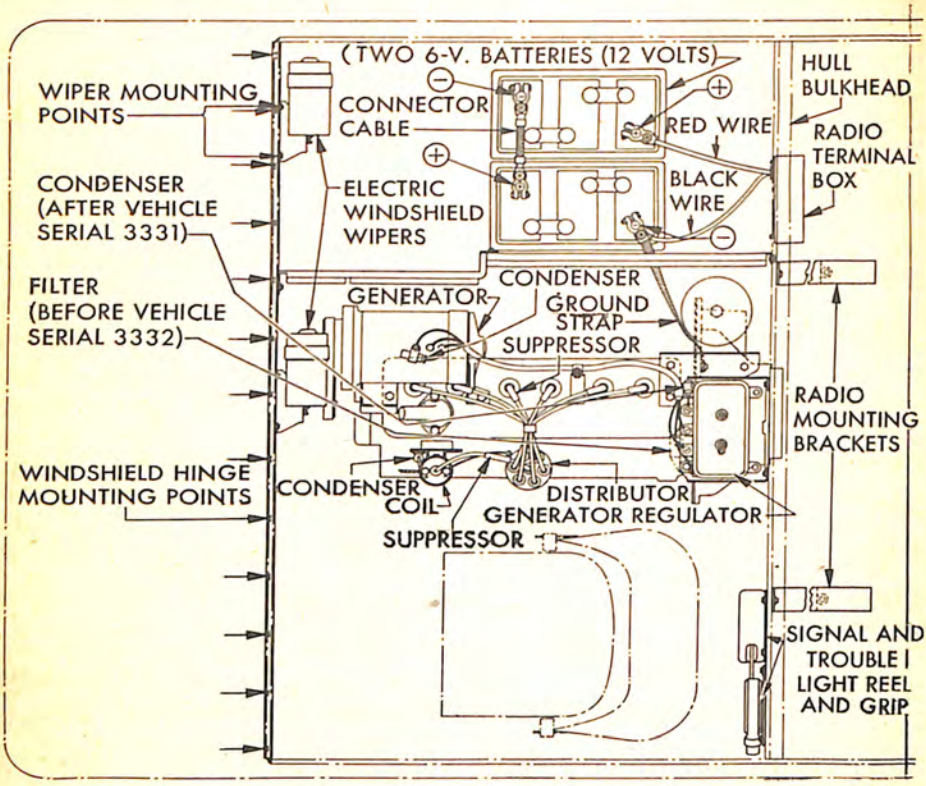


Figure 204 — Generator Regulator Mounting

c. The ignition and generating systems, signal and trouble light control, radio terminal box, and windshield wiper motors are treated to accomplish suppression of radio interference. The ignition system is equipped as follows: resistor-suppressors at each spark plug and at the center tower of the distributor cap, and a condenser connected to the coil. The generating system is equipped as follows: a condenser on generator; a condenser is applied to generator regulator (a filter is applied to generator regulator on vehicles prior to serial 3332) (fig. 204); generator to regulator wiring is shielded. The radio terminal box has a 0.1-Mfd capacitor mounted between the positive and negative posts (fig. 205). The signal and trouble light control reel to generator regulator cable is shielded. A 0.1-microfarad capacitor is mounted inside each windshield wiper motor cover and connected to the positive battery terminal. The leads from the windshield wiper motors are shielded.

176. IGNITION SYSTEM.

a. Description. The L-type (10,000-ohm), resistor-suppressors are used on each of the spark plugs and one is mounted in coil-to-distributor high-tension lead at distributor cap. A 0.1-microfarad capacitor is mounted on the primary terminal of the ignition coil.



RA PD 352383

Figure 206 — Engine and Hull Front Section — Top View

b. Maintenance.

(1) CONDENSER. See paragraph 176 b (2) for condenser replacement.

(2) FILTER. Disconnect wire from filter terminal, remove nut from filter stud through generator regulator field terminal, remove nut and washer from generator mounting bolt, and remove filter. Insert replacement filter stud through generator field terminal, install generator regulator mounting bolt nut and washer, tighten nut on filter stud, and connect wire to filter terminal.

(3) RADIO TERMINAL CONDENSER. Take out screws and remove cover from terminal box. Remove condenser lead from positive terminal, remove nut from negative post, and remove condenser. Position replacement condenser in box, with condenser base on negative post, and install nut; connect lead from condenser to positive terminal, install nut, and tighten both nuts securely. Place cover on box, install screws, and tighten securely.

178. LIGHTING SYSTEM.

a. Description. The wire from the signal and trouble light control reel to the generator regulator is shielded and the shield is grounded to engine compartment side panel.

b. Maintenance.

(1) SIGNAL AND TROUBLE LIGHT CONTROL REEL SHIELDED WIRE. Loosen wing nuts and remove engine compartment cover. Disconnect fuse container, and remove grommet screws and grommet from engine compartment side panel. Remove the nut and toothed lock washer which hold the cable cover to reel housing. Carefully remove cover, disconnect wire and shield, and remove from terminals. Place cable and shield replacement in position on terminals, install screws, cable cover, toothed lock washer, and nut. Insert cable through hole in engine compartment side panel; then install grommet with screws, placing shield terminal under one of the screws. Place fuse in container, and connect the halves of container together. Install engine compartment cover and fasten with clamps and wing nuts.

179. BONDS (figs. 203, 204, 205, and 206).

a. The toothed lock washers located throughout vehicle tend to bind the entire unit together into a solid shield. Toothed lock washers are located at the following points around the various electrical units:

(1) Between regulator and mounting bracket.

(2) Between regulator bracket and bulkhead.

(3) Between radio terminal box and bulkhead.

(4) Between cap screw head and oil filter brace.

(5) Between battery ground strap and clutch housing.

(6) Between coil condenser and coil clamp.

(7) Between coil clamp and coil mounting bracket.

(8) Between windshield wiper mounting and coaming.

(9) Between signal and trouble light reel and control brackets and the bulkhead.

(10) Under windshield hinge bolt heads and nuts.

(11) Under radio support bracket screw heads, bolt heads, and nuts.

(12) Under all engine compartment division panel screw heads, bolt heads, and nuts.

PART FOUR — AUXILIARY EQUIPMENT

Section XXXIV
GENERAL

180. SCOPE.

a. Part four contains information for guidance of personnel responsible for operation of this equipment. It contains only the information necessary to using personnel to properly identify, connect, and protect such auxiliary equipment while being used or transported with the main equipment. Detailed instructions on this equipment are contained in separate technical manuals.

Section XXXV
COMMUNICATIONS EQUIPMENT

181. RADIO SETS.

a. **General.** The cargo carriers M29 and M29C are equipped with radio installation provisions to mount any of the required radio equipment. All sets obtain power from the vehicle 12-volt electrical system, and the connections are made in the radio terminal box located on the right rear side of the engine bulkhead. The radio sets SCR-508, 510, 528, 608, 610, and 628 are all frequency-modulated, and operated by voice only. Radio Sets SCR-506, 694-AW, 714-AW, and 694-C, are amplitude-modulated, and operate either by voice or key. Any one of the frequency-modulated sets may be mounted in the vehicle alone, or in combination with one of the amplitude-modulated radio sets. Radio Sets SCR-694-AW, 714-AW, or 694-C may be mounted alone. Provisions are incorporated in the vehicles for the installation of the British Radio Set No. 19. Signal Corps drawings and installation instructions have been prepared for the radio installations referred to above. If needed, copies can be obtained through the organization signal officer.

(1) RADIO SET SCR-508 (figs. 207, 210, and 211). The major components of this set consist of a transmitter BC-604 ( ), and two receivers BC-603 ( ), mounted on mounting base FT-237 ( ).

(2) RADIO SET SCR-510 (figs. 208, 214, and 215). The major components of this set consist of a radio receiver and transmitter BC-620 ( ), and plate supply unit PE-97 ( ) or PE-120, mounted directly on mounting base FT-250.

(3) RADIO SET SCR-528. The major components of this set consist of transmitter BC-604 ( ), and one receiver BC-603 ( ), mounted on mounting base FT-237 ( ).

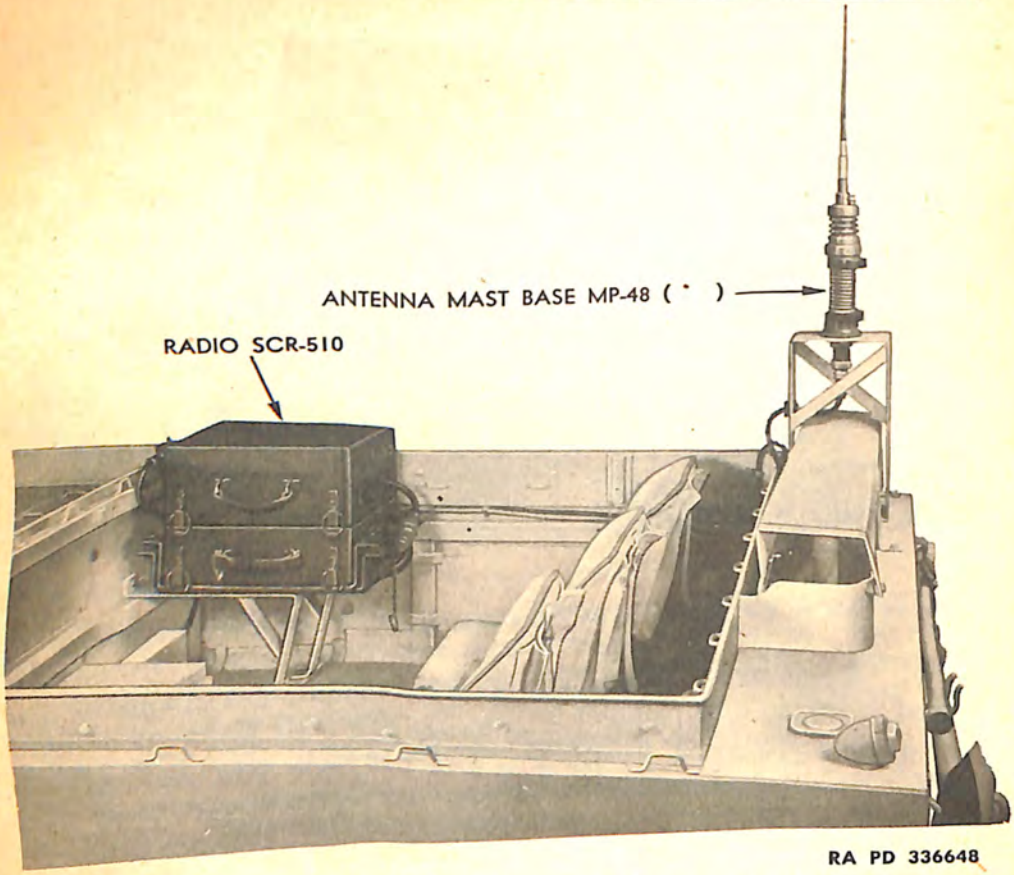


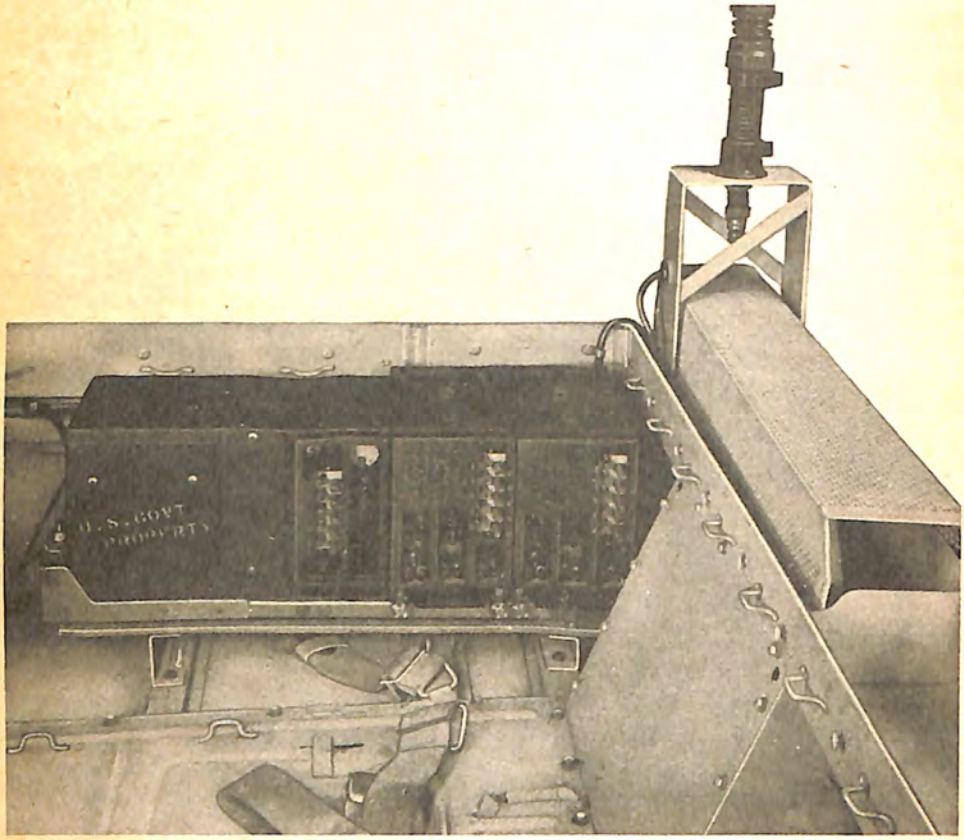
Figure 208 — Radio Set SCR-510 and Antenna Mast Base MP-48 ( ) — Installed

(10) British Radio No. 19 (figs. 221 and 222). The major components of this set consist of a sender-receiver and a power supply unit mounted on a mounting base.

(11) Radio Set SCR-694-C (fig. 220). The major components of this set consist of Transmitter and Receiver BC-1306, on Mounting FT-482, and Vibrator Power Unit PE-235, with integral mounting provisions.

182. MOUNTINGS.

a. Mounting Base FT-237 ( ). This mounting base, which is used with each of the radio sets described in paragraphs 181 a (1), (3), (4), and (6), is wired through a multiple connector receptacle into which the units of the set can be plugged. Two bed plates are attached to the mounting base through rubber shock



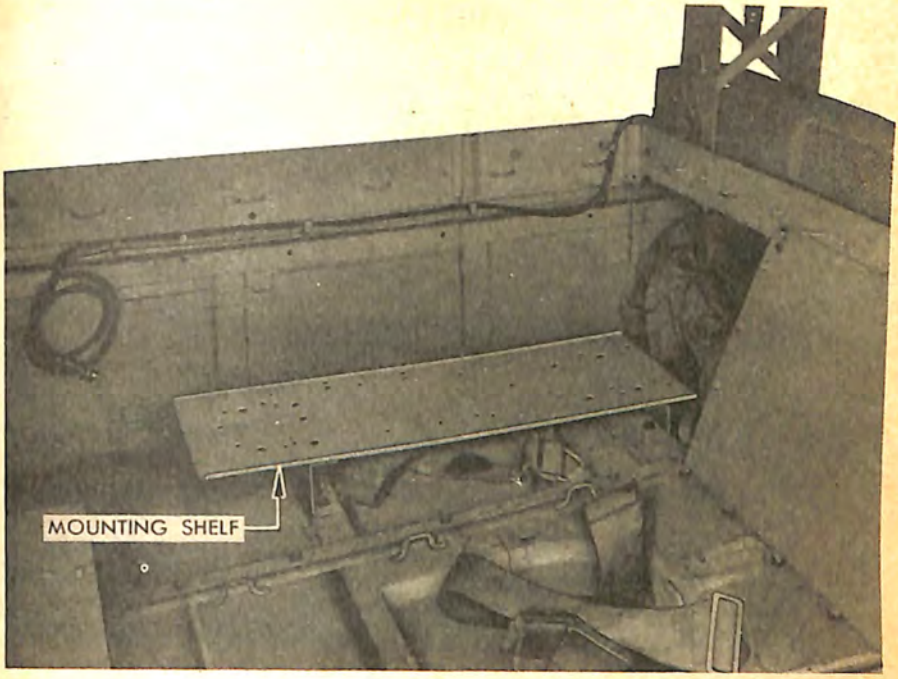
RA PD 339823

Figure 211 — Radio Set SCR-508 — Location When Installed With Radio Set SCR-506

mounts to support the radio sets. The bed plates are screwed to the radio shelf with four cap screws through each plate. The units of the set are fastened to the mounting base with thumbscrews.

b. Mounting Base FT-250 ( ). This mounting base is used with each of the radio sets described in paragraphs 181 a (2) and (5). The base is made up of two sections which are connected through four rubber grommets. The lower section is fastened to the vehicle brackets with four cap screws. The plate supply unit fastens to the top portion of the mounting base by the use of four snap fasteners. The transmitter-receiver is located on top of the plate supply unit, and is fastened on it by the use of snap fasteners.

c. Mounting Base FT-253 ( ). This mounting, which is used with each of the radio sets described in paragraph 181 a (7),



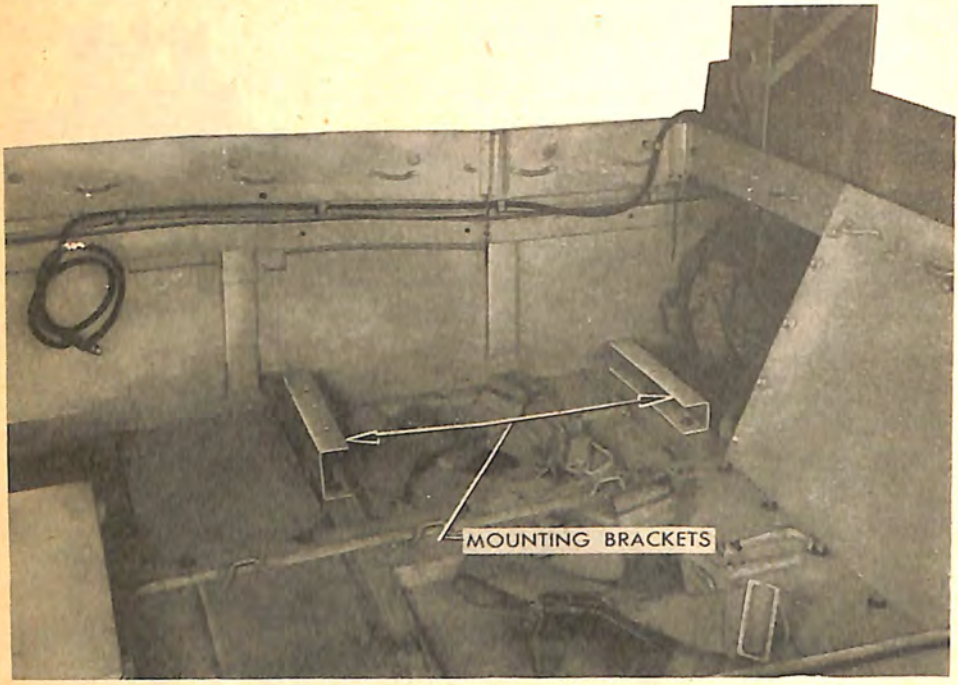
RA PD 339810

Figure 212 — Mounting Shelf Installed — Used for Mounting Radio Set SCR-508, in Combination With Radio Set SCR-506

is wired through a multiple connector receptacle into which the units of the set can be plugged. Six bed plates are attached to the mounting base through rubber shock mounts to support the radio set. The bed plates are secured to the radio shelf with two cap screws through each plate. Spacer plates are used between the bed plates and the radio shelf to provide adequate clearance. The units of the set are fastened to the mounting base with wing nuts and clamps.

d. Mounting Base FT-382 ( ). This mounting base is used with each of the radio sets described in paragraphs 181 a (8) and (9). It consists of a flat plate secured to the vehicle through four shock mounts. Each shock mount is fastened to the vehicle with four screws. The unit of the set is fastened to the mounting base with snap slide fasteners and a strap.

e. Mounting Base FT-185 ( ). This mounting base is used with the radio set described in paragraph 181 a (8). It consists of a plate secured to the vehicle with four screws. The unit is fastened to the mounting base with snap slide fasteners.



RA PD 339811

Figure 213 — Mounting Brackets Installed — for Supporting Shelf in Mounting Radio Set SCR-508, When Used in Combination With Radio Set SCR-506

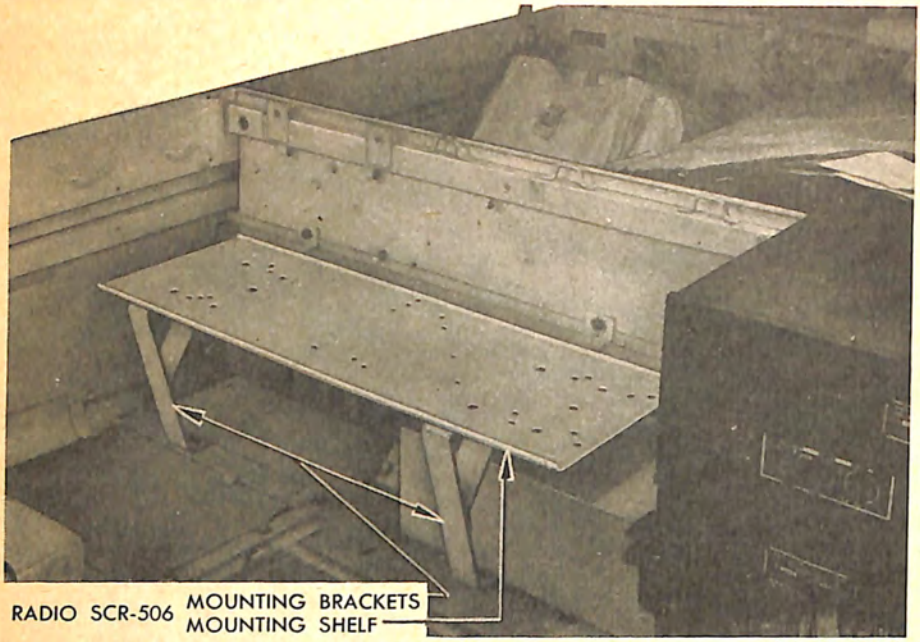
f. Mounting Base, British. This mounting base is used with the British Radio Set No. 19 described in paragraph 181 a (10). Eight feet are attached to the mounting base through rubber shock mounts to support the radio set. The feet are secured to the vehicle with one cap screw through each foot. The units of the set are fastened to the mounting base with a canvas strap and thumbscrews.

g. Mounting FT-482. This mounting is used with Radio Set SCR-694-C. It consists of a tray-shaped base with 13 small rubber disks for shock-mounting, six straps for securing the transmitter-receiver BC-1306, and eight holes for securing in the vehicle.

183. ANTENNA.

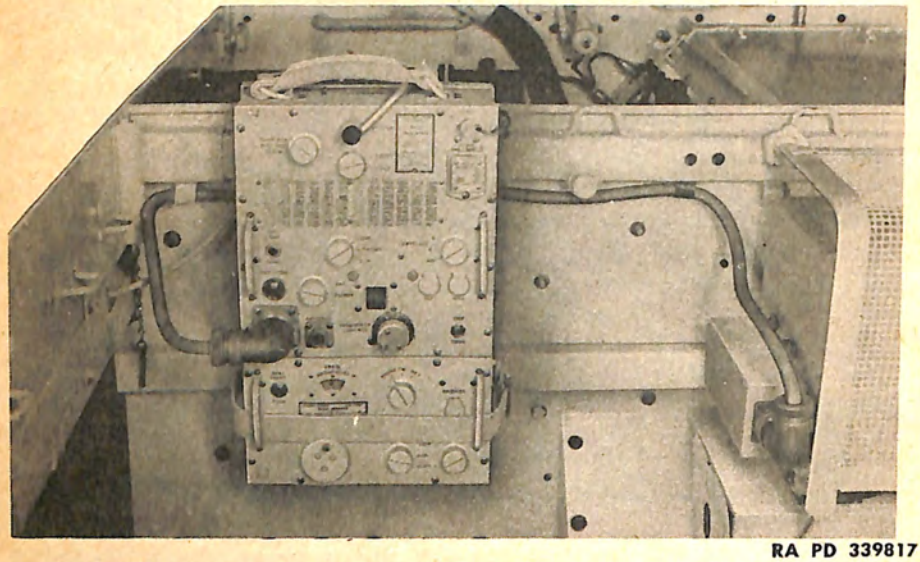
a. Mast Bases.

(1) MAST BASE MP-48 ( ). This base is equipped with large helical springs for flexing, and a small porcelain insulator incorporated above the spring. The base is secured to its mounting bracket (or surface) by clamping action with the use of a large



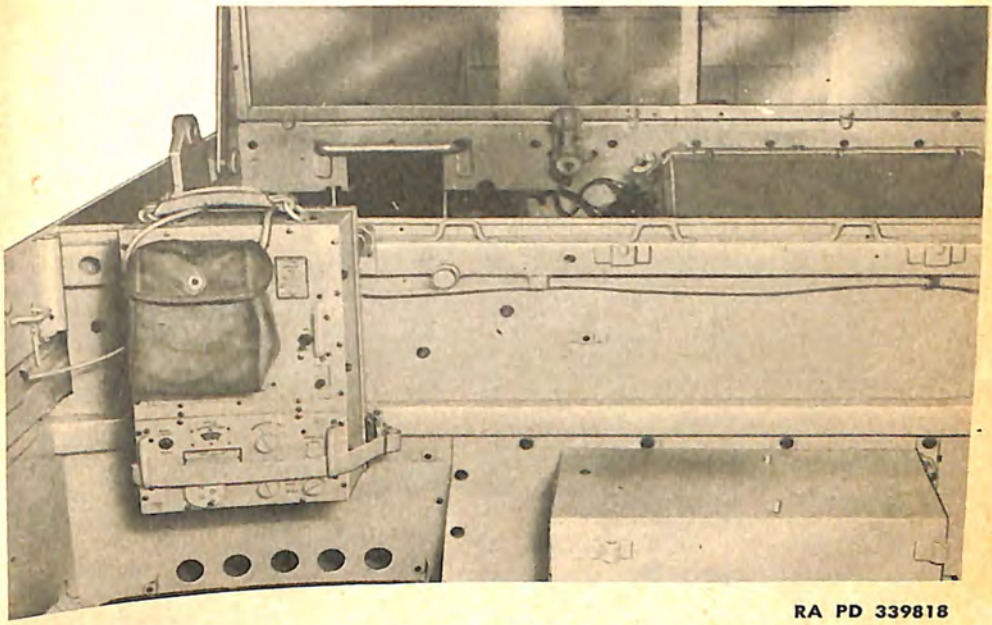
RA PD 339816

Figure 216 — Mounting Shelf and Brackets for Radio Set SCR-506 When Used in Combination With Other Radios



RA PD 339817

Figure 217 — Radio Set SCR-694-AW — Installed



RA PD 339818

Figure 218 — Radio Set SCR-714-AW — Installed

hexagonal nut on the lower end of the base. The base is used with the radio sets described in paragraphs 181 a (1) through (6) inclusive. Mast Base MP-65, a new lightweight, waterproof mast base with improved mechanical and electrical characteristics is now available as a replacement for Mast Base MP-48.

(2) MAST BASE MP-37 ( ) or MP-57 ( ). This base is equipped with large helical springs for flexing with a large porcelain insulator incorporated below the spring. This base is secured to its mounting bracket (or surface) by clamping action with the use of a large hexagonal nut on the lower end of the base. The base is used with the radio sets described in paragraphs 181 a (7) through (11) inclusive. Mast Base MP-65, a new lightweight, waterproof mast base with improved mechanical and electrical characteristics is now available as a replacement for Mast Bases MP-37 and MP-57.

(3) AERIAL BASE NO. 8. This base is used with the British low frequency antenna and is fastened to its mounting bracket either by the use of six mounting bolts or by clamping action with the variometer which fastens on the bottom side of the bracket. The base is used with the radio sets described in paragraph 181 a (10) and in conjunction with the aerial base described in the following subparagraph.

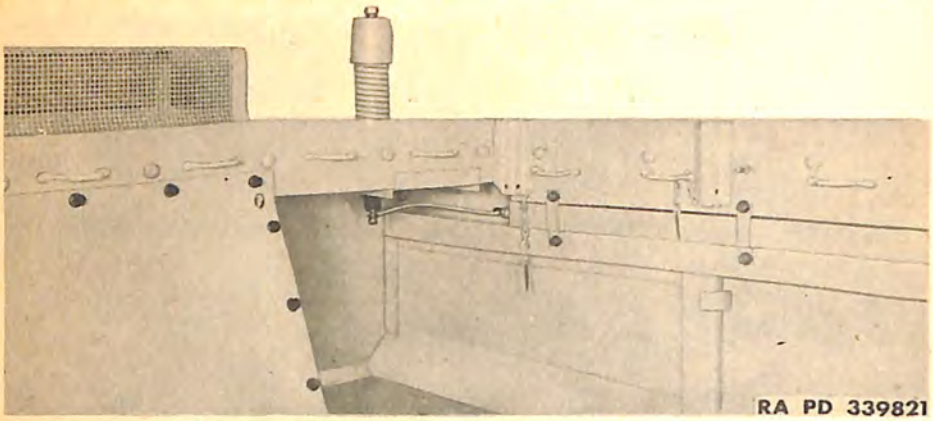


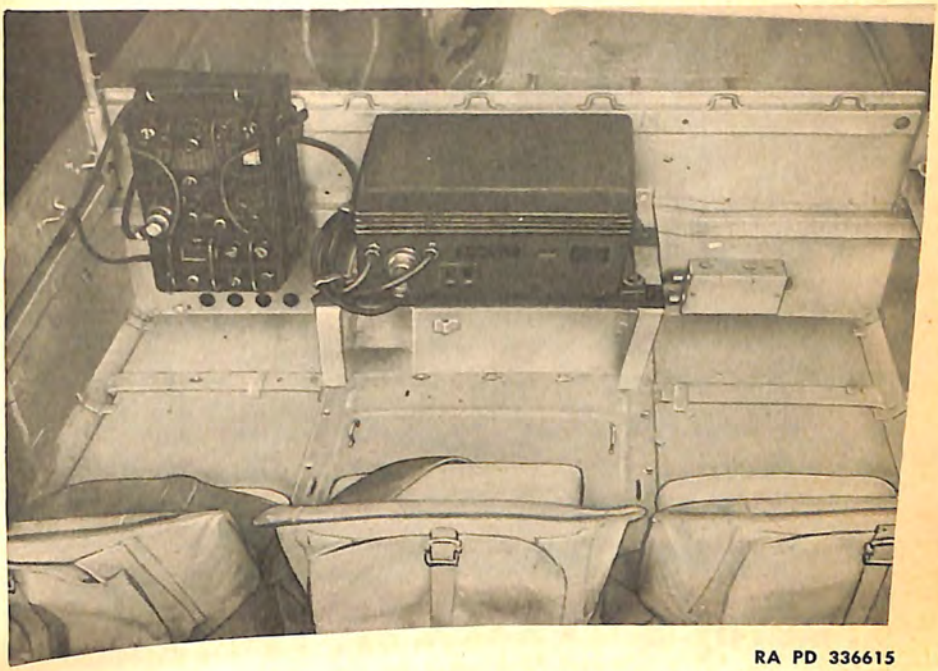
Figure 219 — Antenna Used With Radio Sets SCR-694-AW and SCR-714-AW

(4) AERIAL BASE NO. 9. This base is used with the British high frequency antenna and is fastened to its mounting base with four mounting bolts. The base is used with the radio set described in paragraph 181 a (10) and in conjunction with the aerial base described in the preceding step.

b. Mast Sections.

(1) AMPLITUDE-MODULATED SETS. Amplitude-modulated sets SCR-506, SCR-694-AW, and SCR-714-AW each use five mast sections, Numbers MS-49, 50, 51, 52, and 53. The sections are of high-tensile steel and are secured together so that the ends with like-color enamel are joining. The body of the mast bears the type number. Clamps are provided to keep the mast sections from loosening while in use. These sections and spare sections are stored in Roll BG-56 when not in use. Radio Set SCR-694-C uses four sections (Section MS-53 is omitted). When the new lightweight Mast Base MP-65 is used instead of Mast Base MP-37 or MP-57, three each Mast Section MS-116, and one each MS-117 and MS-118 are used instead of Mast Sections MS-49 to MS-53. One Mast Section MS-116 is omitted in the case of Radio Set SCR-694-C.

(2) FREQUENCY-MODULATED SETS. Frequency-modulated sets (SCR-508, 510, 528, 608, 610, and 628) each use three mast sections, numbers MS-51, 52, and 53. The sections are made of high-tensile steel and are secured together so that the ends with like-color enamel are joining. The body of the mast bears the type number. Clamps are provided to keep the mast sections from loosening while in use. These sections and the spare sections are stored in Roll Bag BG-56 ( ) when not in use. When the new lightweight Mast Base



RA PD 336615

Figure 220 — Radio Set SCR-694-C — Installed

AG-15/GR is used instead of Mast Base MP-48, one each Mast Section MS-116, MS-117, and MS-118 are used instead of Mast Sections MS-51, MS-52, and MS-53.

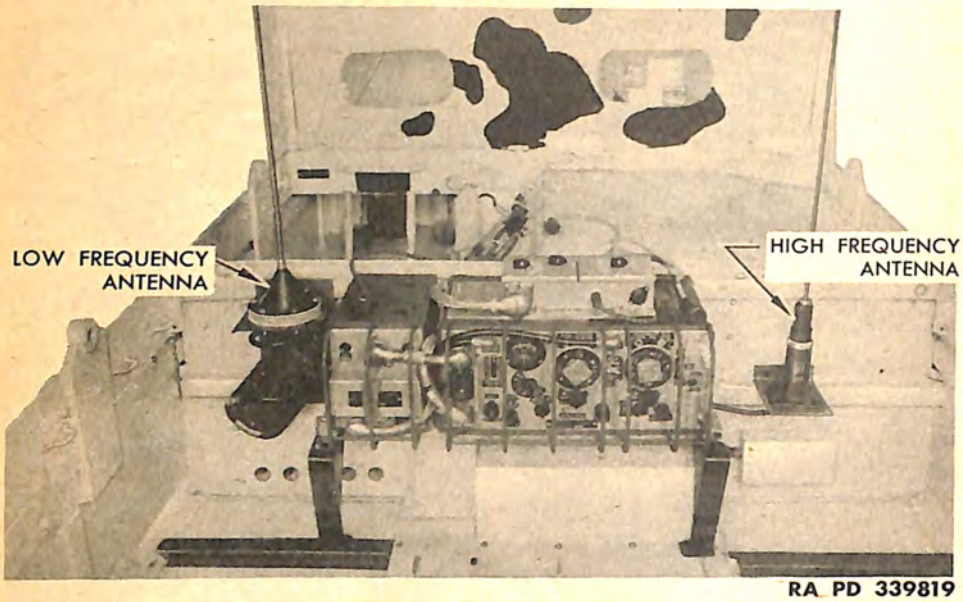
c. **Phantom Antennas.** Antenna A-62 (phantom), for Radio Sets SCR-508 and SCR-528, and Antenna A-83 (phantom), for Radio Sets SCR-608 and SCR-628, are mounted on the left end of Mounting Base FT-237. Antenna A-27 (phantom) for Radio Set SCR-506 is stowed underneath the radio set. These antennas are used when setting up the channels on the transmitter so that no signal will be transmitted over the air.

184. INSPECTIONS.

a. **Antenna.**

(1) MAST SECTIONS. Inspect the antenna mast sections to be sure that they are securely screwed and clamped together, and are not damaged.

(2) HELICAL SPRING. Inspect the helical spring on the base; be sure that it maintains a vertical position and is not damaged so as to prevent flexibility.



RA PD 339819

Figure 221 — British Radio Set No. 19 Installed With High and Low Frequency Antennas

(3) MAST BASE. See that the mast base is secure to its bracket or mounting surfaces and that the insulator is not cracked or chipped.

(4) LEADS TO SET. Check the leads to the set and be sure that there is no interference that may damage the cords and that any stand-off insulators are not cracked or chipped.

(5) PHANTOM ANTENNA. Be sure that the phantom antenna is in place and secure.

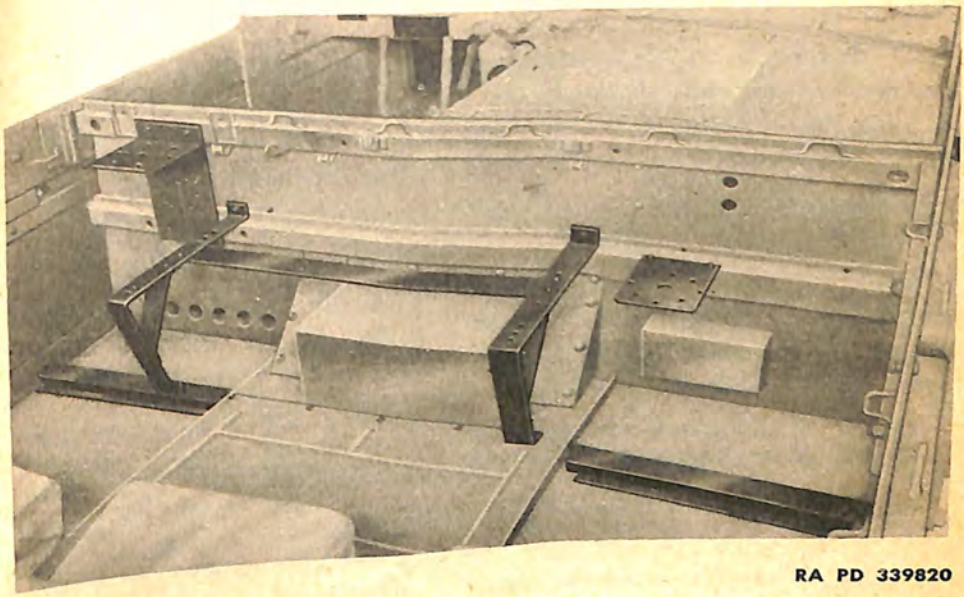
b. Mountings.

(1) CLAMPS, THUMBSCREWS, OR WING NUTS. Be sure that the radio components are securely fastened into the mounting base.

(2) LOCK WASHERS. When reinstalling radio equipment, make sure that all toothed lock washers are replaced in the locations where they were originally used.

(3) SHOCK MOUNTS. Inspect the mounting screws to see that they are tight, and that the shock mountings are in good condition. Rock the set to determine if it is bumping any other equipment, and observe whether the shock absorbers are deteriorated and prevent excessive movement.

c. Cords and Connections. Inspect all cords which connect the radio to see that they are not damaged; make sure they are properly secured in the clips. Report any damage to the proper authority.



RA PD 339820

Figure 222 — Mounting Brackets for British Radio Set No. 19 — Installed

d. Microphones and Headsets. Handle the microphones and headsets with care to see that they are hung on the hooks provided for this purpose when not in use. Be sure that the cords are not twisted or knotted to prevent movement of the wearer. Inspect the jack plugs on the microphones and headsets to see that they are not damaged.

e. Radio Terminal Box (fig. 205). Remove the cover and check the tightness of all terminal nuts. Tighten the nuts, if necessary, to prevent any movement of the wire terminal stud, thereby eliminating the possibility of radio interference from this source. At this time, also check the presence and security of the condenser in the terminal box.

f. Covers. Be sure that all covers for the protection of the radio set are available in the vehicle, and that these covers are installed when the equipment is not in use. See that all fasteners and zippers are in good condition. The following designations are used for the radio and antenna protective covers:

Radio Set	Cover
SCR-506	BG-103 ( )
SCR-508, 528, 608, and 628	BG-96 ( )
SCR-510 and 610	BG-153 ( )

185. PRECAUTIONS.

a. Antenna. Tie the antenna down securely when the vehicle is in motion and radio is not in use, to prevent damage to the antenna. Be sure the antenna is vertical and not touching anything when the radio is in use.

b. Radio.

(1) Keep the radio covered when the vehicle is not in use to prevent dust and moisture from entering the set. Keep all cover plates closed and securely fastened.

(2) Turn off all radio switches when not in use. Do not turn off the master electrical switch with the radio on.

(3) Do not store equipment behind the radio where it can prevent motion of the mountings or damage to the connections.

c. Batteries and Generating System (fig. 206).

(1) Be sure the batteries are charged at all times to ensure satisfactory operation of the set. Low batteries will cause the set to be weak and unstable, resulting in poor reception.

(2) See that all battery cables and terminals are in good condition and tight.

(3) Test the operation of the generator and regulator (par. 53 c). Excessive charging rate may cause damage to the radio.

(4) When radio set SCR-506, 508, 528, 608, 628, or a combination of these sets is installed in the vehicle, the 55-ampere generator kit (G-179-5700564) should replace the standard 40-ampere generator. MWO ORD G179-W3 gives instructions for installing the 55-ampere generator. If this kit is not already installed, it should be requisitioned.

VEHICLE	CARRIER, CARGO M29
OVERALL LENGTH	125-3/4
OVERALL WIDTH	66
OVERALL HEIGHT	70-13/16
LOWEST OPERABLE HEIGHT	54
SHIPPING CUBIC	340
SHIPPING TONNAGE	8.5
FIGHTING WEIGHT (LESS CREW)	4940

RA PD 336484

Figure 223 — Shipping Plate — Cargo Carrier M29

(5) FUEL IN TANK. It is not necessary to remove the fuel from the tank during temporary storage or shipment within the United States, nor to label the tank under Interstate Commerce Commission Regulations. Leave fuel in the tank except when storing in locations where fire ordinances or other local regulations require removal of all gasoline before storage. If vehicle is to be maintained ready for operation on call in excess of 30 days, the following precautions against gum formation must be taken:

(a) The fuel system must be free from accumulated gum. Unless the vehicle is entering its first storage and has never been issued for use, inspect and clean the fuel pump value before vehicle serial 9503; inspect and clean carburetor accelerator pump plunger, venturi tube, choke and throttle valves, float mechanism, fuel lines, fuel tank, fuel filter, fuel shut-off valve, and screens.

(b) If gum is present in the above parts, it can best be removed by benzol, acetone, alcohol, or a mixture of these solvents. Deposited gum is not readily soluble in fresh gasoline. When gum has dried, it may be necessary to resort to mechanical means to remove it.

(c) Parts which cannot be thoroughly cleaned and freed from the gum deposit without damage should be replaced.

(d) After cleaning and reassembly, fill the fuel tank half full of fresh gasoline which has not been long in storage.

(e) Add two containers (8 oz) of gum-preventive compound to the fuel tank.

(f) Fill the fuel tank to capacity and operate the vehicle for at least 5 minutes.

(6) EXTERIOR OF VEHICLE. If practical, remove rust appearing on any part of the vehicle exterior by using flint paper or any suit-

VEHICLE	CARRIER, CARGO M29C
OVERALL LENGTH	188-11/16
OVERALL WIDTH	67-1/4
OVERALL HEIGHT	70-13/16
LOWEST OPERABLE HEIGHT	55-5/8
SHIPPING CUBIC	519
SHIPPING TONNAGE	12.9
FIGHTING WEIGHT (LESS CREW)	5640

RA PD 336483

Figure 224 — Shipping Plate — Cargo Carrier M29C

able abrasive which is available. Repaint painted surfaces whenever necessary to protect metal. Coat exposed metal surfaces susceptible to rust with preservative, lubricating oil (medium). If top and bows are installed, see that they are securely fastened. Make sure tarpaulins are in place and firmly secured. Equipment such as pioneer tools, boat hook (M29C), and fire extinguisher can remain in place on the vehicle.

(7) ENGINE.

(a) Remove spark plugs and spray into tops of cylinders with preservative engine oil, SAE 30 (Grade II), while slowly rotating engine. Replace spark plugs.

(b) If spark plugs cannot be removed, spray preservative oil into air intake with engine running at a fast idle until smoke comes from exhaust pipe. CAUTION: *Preservative oil should never be poured through carburetor.* After spraying preservative oil into air intake, shut off engine and allow to cool for about 15 minutes. Start engine and again spray preservative oil into air intake for several minutes only. The second spraying is necessary in order to coat exhaust valves. Do not run engine for more than several minutes as exhaust valves will become so hot that preservative oil will not adhere properly. Perform this treatment when further running of the engine is not necessary.

(c) If it becomes necessary to run the engine after treatment, it should not be operated at over 1,600 revolutions per minute. Hold operation to a minimum, and spray cylinders again after operation.

(8) INSPECTION. Make a systematic inspection just before shipment or limited storage to insure that all the above steps have been

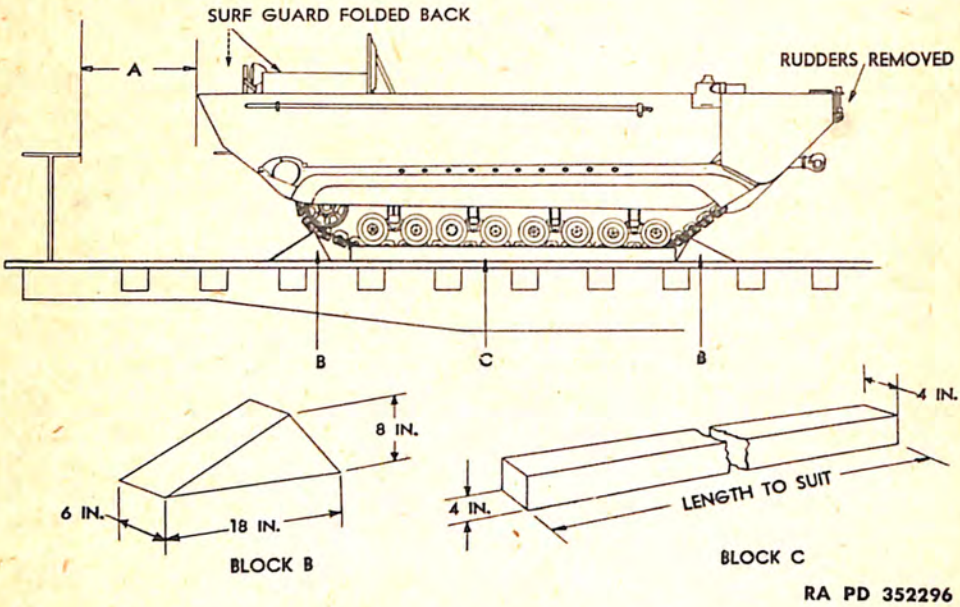


Figure 225 — Blocking Requirements for Rail Shipment

covered, and that the vehicle is ready for operation on call. Make a list of all missing or damaged items and attach it to the steering brake levers. Refer to Before-operation Service (par. 41).

(9) SECURING VEHICLE. Chock tracks.

c. Inspection in Limited Storage. A vehicle in limited storage will be inspected weekly for condition of battery. If water is added to battery when freezing weather is anticipated, recharge the battery with a portable charger or remove the battery for charging. Do not attempt to charge the battery by running the engine. If freezing temperature is expected, add the proper quantity of antifreeze compound (par. 25 (4)) to cooling system to afford protection from freezing. Remove any rust from vehicle with flint paper.

188. LOADING AND BLOCKING FOR RAIL SHIPMENT.

a. Preparation. In addition to the preparation described in paragraph 187, when ordnance vehicles are prepared for domestic shipment, take the following steps:

(1) EXTERIOR. Cover the cargo compartment of the vehicle with the canvas cover supplied.

(2) BATTERIES. Disconnect the batteries to prevent their discharge by vandalism or accident. This may be accomplished by

d. **Shipping Data.**

	M29	M29C
Length, over-all	125¾ in.	188 11/16 in.
Length — M29C (Rudders removed — surf guard back)		176 3/16 in.
Width	66 in.	67¼ in.
Height (with top and bows)	70 13/16 in.	70 13/16 in.
Height (without top and bows)	64 11/16 in.	64 11/16 in.
Area of car floor occupied per vehicle	58 sq ft	88 sq ft
Volume occupied per vehicle	340 cu ft	519 cu ft
Shipping weight per vehicle	4,940 lb	5,640 lb
Bearing pressure (lb per sq ft of area occupied per vehicle)	85	64

Section XXXVII

REFERENCES

189. PUBLICATIONS INDEXES.

a. The following publications indexes should be consulted frequently for latest changes to or revisions of the publications given in this list of references and for new publications relating to material covered in this manual:

Introduction to Ordnance Supply Catalog (explains SNL system)	ASF Cat. ORD 1
Ordnance publications for supply index (index to SNL's)	ASF Cat. ORD 2 OPS1
Ordnance Major Items and Combinations and Pertinent publications (alphabetical listing of Ordnance major items with available publications pertaining thereto, including TM's, WDTB's, OFSTB's, FSMWO's, MWO's, and ASF catalogs)	SB 9-1

191. EXPLANATORY PUBLICATIONS.

a. Fundamental Principles.

Automotive brakes	TM 10-565
Automotive electricity	TM 10-580
Automotive power transmission units	TM 10-585
Basic maintenance manual	TM 37-250
Chassis, body, and trailer units	TM 10-560
Driver's manual	TM 21-305
Driver selection and training	TM 21-300
Electrical fundamentals	TM 1-455
Fuels and carburetion	TM 10-550
Fuels, lubricants, cleaners, and preservatives	TM 9-2835
Instruction guide: Cooling systems: Vehicles and powered ground equipment systems	TM 9-2858
Instruction guide: Ordnance packaging and shipping (posts, camps, and stations)	TM 9-2854
Military motor vehicles	AR 850-15
Motor vehicle inspections and preventive maintenance service	TM 37-2810
Precautions in handling gasoline	AR 850-20
Preliminary instructions for Radio set SCR-506-A	TM 11-630
Radio fundamentals	TM 11-455
Radio sets SCR-509 and SCR-510	TM 11-605
Radio sets SCR-609 and SCR-610	TM 11-615
Radio sets SCR-508, SCR-528 and SCR-538	TM 11-600
Radio sets SCR-608A and SCR-628A	TM 11-620
Radio set SCR-694-C	TM 11-230C
Sheet metal work, body, fender, and radiator repairs	TM 10-450
Standard military motor vehicles	TM 9-2800
Storage batteries, lead-acid type	TM 9-2857
Suppression of radio noises	TM 11-483

b. Maintenance and Repair.

Care and maintenance of ball and roller bearings	TM 37-265
Cleaning, preserving, lubricating and welding materials and similar items issued by the Ordnance Department	TM 9-850
Maintenance and care of pneumatic tires and rubber treads	TM 31-200
Ordnance maintenance: Carburetors (Carter)	TM 9-1826A
Ordnance maintenance: Electrical equipment (Auto-Lite)	TM 9-1825A
Ordnance maintenance: Engine, engine accessories, and clutch for light cargo carrier M29	TM 9-1772A
Ordnance maintenance: Fuel pumps	TM 9-1828A
Ordnance maintenance: Power train, suspension system, hull, and hull electrical system for light cargo carrier T24 (Standardized M29)	TM 9-1772B
Ordnance maintenance: Speedometers, tachometers, and recorders	TM 9-1829A

c. Protection of Materiel.

Camouflage	FM 5-20
Decontamination	TM 3-220
Decontamination of armored force vehicles	FM 17-59
Defense against chemical attack	FM 21-40
Explosives and demolitions	FM 5-25

d. Storage and Shipment.

Ordnance company, depot	FM 9-25
Ordnance storage and shipment chart, Group G —major items	SB 9-OSSC-G
Protection of Ordnance materiel in open storage	SB 9-47
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, an open top equipment published by Operations and Maintenance Department of Association of American Railroads.	
Storage of motor vehicle equipment	AR 850-18

INDEX

A

Page

Accelerator
- adjust linkage 185
- operation 28

Accelerator control
- connect 150
- disconnect 147

Accelerator linkage 99

Accessories
- after-operation service 84
- at-halt service 81
- before-operation service 76
- list of 15
- preliminary service 22

Accessory drives, road test 97

Accident-Report, Form No. 26 79

Aerial bases 343

Air cleaners
- after-operation service 84
- at-halt service 82
- description and servicing 181
- installation 184
- maintenance in cold weather 55
- preliminary service 22
- removal 183
- road test 96

Air intake system
- description 161
- trouble shooting 109

Ammeter
- before-operation service 77
- description, removal, and installation 314
- operation 34
- preliminary service 24
- road test 89
- trouble shooting 121

Amphibian cargo carrier M29C (*See* Cargo carriers)

Amphibian services
- after-operation service 86
- at-halt service 82
- before-operation service 79
- during-operation 80
- preliminary 25
- run-in test 26

Amphibious operation 40

Anchor, deadman 48

Page

Antenna
- general 340
- inspection 345
- precautions 348

Antifreeze compound charts 51

Antifreeze record 98

Antifreeze solution, testing 52

Auxiliary equipment 44

Axle, preliminary service 23

Axle shaft replacement 237

Axle steering controls and linkage
- description, adjustment, and removal 249
- installation 250

Axle transmission
- adjustment of steering brake bands 236
- description 236, 243
- removal and installation 244
- trouble shooting 115

Axle transmission control and linkage 247

Axle transmission shift lever 32

Axle vent
- after-operation service 85
- at-halt service 81

B

Bases (*See* Mast bases, Mounting bases *and* Aerial bases)

Batteries
- after-operation service 83
- charge very low 105
- description 205
- maintenance in cold weather and in torrid zones 55
- precautions 348
- removal and installation 207
- road test 98
- servicing 206
- specific gravity of 56
- trouble shooting 113

Battery cable replacement 206

Belts
- after-operation service 84
- at-halt service 81
- (*See also* Drive belts)

C — Contd. Page

Clutch assembly, road test 97
Clutch control 325
Clutch control linkage
  connect 149
  description and adjustment 216
  disconnect 144
  installation 220
  removal 217, 220
Clutch driven plate 213
Clutch housing, installation 215
Clutch pedal
  operation 28
  road test 100
Clutch pilot bushing 216
Clutch release bearing
  description 215
  installation and removal 216
Coil, maintenance in cold weather .. 54
Communications equipment 15, 19, 334
Compass
  description 314
  operation 35
  removal and installation 315
  road test 90, 101
Compression test 95
Condenser
  defective 109
  maintenance in cold weather 54
  removal and installation 156
Conduits, road test 96
Control arms, preliminary service .. 25
Cooling system
  description and cleaning 193
  flushing and coolant service 195
  leaks 112
  neutralizing 194
  protecting at low temperature 51
  trouble shooting 111
Covers (hull) 288
Crankcase, oil level too high 104
Crankshaft will not turn 105
Cylinder head, road test 96
Cylinder head gasket
  installation 136
  replacement 135

D Page

Dash instruments, run-in test 25
Deadman anchor 48
Decontaminator
  after-operation service 83
  before-operation service 78
  road test 103
Demolition to prevent enemy use .. 59
Differential
  description 263, 243
  road test 91, 92, 100
  trouble shooting 115
Distributor
  description and removal 152
  installation 153, 156
  maintenance in cold weather 54
  removal 155
  road test 95
Distributor points
  adjustment 153
  gap incorrectly adjusted 109
  pitted and stuck 108
Drive assemby 317
Drive belts
  adjustment 141, 321
  preliminary service 25
  removal and installation
    capstan 322
    fan and water pump 142
    generator 143
  replacement 141
Drive shaft 25
Drive wheels
  description and removal 239
  installation 240
  road test 94
  trouble shooting 116
Driver's Permit and Form No. 26 .. 79
Driver's Trip Ticket and Preventive Maintenance Service Record, W.D., Form No. 48 75
Drives
  before-operation service 76
  during-operation service 80
  preliminary service 22
  (*See also* Final drive assembly)

F — Contd.

Page

Fuel supply
- after-operation service 83
- at-halt service 81
- check 76
- data 13
- preliminary service 22
- use in cold weather..... 49

Fuel system
- description 161
- maintenance in cold weather..... 55
- road test 97
- trouble shooting 109

Fuel tank
- description, draining, and cleaning 161
- installation 163
- removal 162

G

Gasoline, cold-weather operation.... 49

Gear oil levels..... 85

Generator
- description, cleaning, removal, and installation 210
- maintenance in cold weather..... 54
- road test 95

Generator regulator
- description 211
- installation 150, 212
- removal 144, 212

Generator regulator filter..... 212

Generating system
- description 331, 205
- maintenance 332
- precautions 348
- trouble shooting 113

Ground strap
- installation 150
- removal 148

Guide wheel
- improper operation 119
- road test 93

H

Headlight
- description and adjustment..... 305
- removal and installation..... 306

Headsets, inspection 347

Page

Heat indicator
- connect 151
- description and removal..... 315
- installation 316
- operation 35
- preliminary service 24
- road test 89
- trouble shooting 121

Heater, stand-by (See Stand-by heater)

Heating controls, operation..... 34

High-tension wiring 161

Hubs, road test 94

Hulls
- after-operation service 85
- at-halt service 82
- before-operation service 78, 79
- description and drainage 285
- during-operation service 80
- improper operation 119
- preliminary service 23
- road test 94, 102

I

Idler, road test 93

Idler wheels
- description and adjustment..... 265
- improper operation 118
- installation 263, 264, 266

Ignition, timing 109, 157

Ignition coil
- connect 151
- defective 109
- description, removal, and installation 158

Ignition switch
- description 159
- installation 161
- removal 160

Ignition system
- description 152, 330
- maintenance 331
- road test 96
- trouble shooting 108

I — Contd.

Page

Instrument panel
- connect wires 151
- description 295
- installation
  - engine compartment 150
  - hull 295
- removal
  - engine compartment 146
  - hull 295

Instrument panel lights 309

Instruments
- after-operation service 83
- before-operation service 77
- during-operation service 80
- observation of 39
- preliminary service 24
- road test 89
- trouble shooting 121

Intake manifold (*See* Manifold (intake and exhaust))

L

Lamps (lights)
- after-operation service 83
- before-operation service 77

Leaks (general)
- after-operation service 85
- at-halt service 81
- before-operation service 77
- preliminary service 24
- road test 91, 99
- run-in test 26

Lifting eye bolts 148

Lighting system 120, 302, 333

Lights
- inoperative 120
- road test 101
- (*See also* Headlights, Blackout driving light, *and* Marker light, rear)

Litter brackets 290

Loading for rail shipment 352

Lubrication
- cold-weather 50
- detailed instructions 73
- preliminary service 23

Lubrication Order 63

M

Page

Maintenance
- coordination with higher echelon 213, 221, 243
- first echelon 75
- second echelon 87

Manifold (intake and exhaust)
- adjustment of valves 131
- assembly 128
- description and removal 124
- disassembly 127
- installation 130, 134
- road test 96

Marker light, rear 309

Mast bases
- MP-48 340
- MP-37 or MP-57 343

Microphones, inspection 347

Mounting bases
- FT-237 336
- FT-250 and FT-253 338
- FT-382 and FT-185 339
- FT-482 and British 340

Mounting bracket
- installation
  - generator regulator 150
  - rudder 298
- removal
  - generator regulator 150
  - rudder 298

Muffler
- removal and installation 192
- road test 97

MWO and Major Unit Assembly Replacement Report, W.D., A.G.O. Form No. 478 ..... 79, 103

O

Oil filler cap
- after-operation service 84
- road test 96

Oil filter
- description, removal, and installation 139
- road test 91

Oil pan, replacement of gasket 143

Oil pipes (external)
- description 140
- repair, removal, and installation 141

O — Contd.

Page

Oil pressure gage
- before-operation service 77
- connect 151
- description 316
- operation 35
- preliminary service 24
- removal and installation..... 317
- road test 89
- trouble shooting 121

Oil pressure relief valve..... 105

Oil supply
- after-operation service 83
- at-halt service 81
- before-operation service 76
- draining 148
- improper viscosity 104, 105
- leaks 116
- low pressure 105
- preliminary service 22

Oil system (*See* Engine oil system)

Operation under:
- ordinary conditions 36
- unusual conditions 49

P

Parking brake handle..... 32

Parking brake support and mechanism 245

Parking brakes
- description, adjustment, and linkage 229
- road test 90
- trouble shooting 115

Phantom antennas 345

Pintle hook..... 295

Pressure gage (*See* Oil pressure gage)

Primer
- before-operation service 77
- description 179
- installation 181
- operation of knob 28
- preliminary service 24
- removal 180
- road test 96

Primer pipes
- connect 151
- disconnect 145

Page

Propeller shaft
- after-operation service 85
- at-halt service 81
- description 226
- installation 228
- preliminary service 23
- removal 144, 227
- road test 91, 101
- trouble shooting 115

Proper main metering (discharge) jet 187

Publications and Form No. 26..... 103

Pulley, removal and installation
- lower drive 323
- upper drive 321

R

Radiator
- description 195
- installation 151, 198
- removal 196
- road test 98

Radiator core, clogged..... 111

Radio, precautions 348

Radio bonding, road test..... 101

Radio interference suppression
- purpose 328
- trouble shooting 122

Radio sets 334

Radio terminal box..... 347

Regulator unit, road test..... 99

Reports and records..... 1

Road test 89

Rotor, removal and installation..... 156

Rudder-mountings 25

Rudders
- adjustment 297
- before-operation service 79
- description 296
- hard to operate..... 120
- removal and installation..... 298
- road test 102

Running gear, during-operation service 80

S

Safety belts 288

Seats, description 286

Shields (hull) 286

Shipment and storage..... 349

S — Contd.

Page

Shipping data 354
Signal light
  description, and removal of control and reel..... 304
  installation of control and reel.... 305
Spare parts 15, 20, 103
Spark control, operation..... 27
Spark plugs
  description 158
  dirty or broken..... 105, 109
  maintenance in cold weather..... 54
  removal, adjustment of gap, and installation 159
  road test 95
  wires loose 109
Special services 88
Speedometer
  description, removal, and installation 317
  operation 36
Speedometer cable
  connect 151
  disconnect 146
Spotlight 302
Spring bumper bracket..... 282
Spring yoke
  installation
    support arm 278
    yoke 277
  removal
    support arm 277
    yoke 276
Springs
  after-operation service 85
  at-halt service 81
  before-operation service..... 78
  preliminary service 23
Sprockets, road test..... 91, 94
Standby-heater
  description 44, 327
  installation 328
  operation 45
  removal 327
Starter
  description and removal..... 201
  installation 203
  maintenance in cold weather..... 54
  road test 95, 99

Page

Starter solenoid switch
  description and removal..... 204
  installation 205
Starting system
  description 201
  trouble shooting 112
Steering brake levers..... 32
Steering brake linkage
  after-operation service 85
  at-halt service 81
  before-operation service 78
  preliminary service 23
Steering brakes
  during-operation service 80
  road test 90, 100
  run-in test 25
Surf guard (M29C) 301
Suspensions
  after-operation service 85
  at-halt service 81
  before-operation service 78
  description 251
  preliminary service 23
  trouble shooting 117
Switches
  connect cables to master..... 151
  description
    ignition 159
    instrument panel and rear marker lights 309
    master 209
    starter
      manual 205
      solenoid 204
  installation
    headlight 308
    ignition 161
    instrument panel and rear marker lights 310
    master 209
    spotlight 302
    starter 205
    voltmeter 318
  operation
    lights 33
    master, ignition, heater, and starter 27
    windshield wiper 34

S — Contd.

Page

Switches — Contd.
removal
headlight 307
ignition 160
instrument panel and rear marker lights 310
master 209
spotlight 302
starter 204, 205
voltmeter 318
road test 101

T

Tampering and damage 76
Temperatures
at-halt service 81
road test 91
run-in test 26
Thermostat
description and removal 200
inoperative 111
installation 201
Throttle
operation 27
road test 96
Tiller (M29C), operation 33
Tires, road test 94
Tools
after-operation service 86
before-operation service 78
on-vehicle 16
preliminary service 25
road test 103
special 62
Top (hull) 286
Towing connections
after-operation service 85
at-halt service 82
before-operation service 78
preliminary service 23
Track aprons
after-operation service 84
at-halt service 82
before-operation service 78
description, installation, and removal (carrier M29C) 301
Track guide wheels 270
Track tension
adjustment 256
checking 253
final road test 91
road test 94
run-in test 26
Track tension springs
assembly (coil type) 284
description
coil-type 284
leaf-type 282
installation
coil-type 264, 269, 284
leaf-type 268, 283
removal
coil-type 284
leaf-type 283
Track throwing, prevention 38
Tracks
after-operation service 84
at-halt service 81
before-operation service 78
description 251, 253
installation 263
preliminary service 22
removal 260
repair 258
road test 91, 92
trouble shooting 117
Transmission
description and coordination with higher echelon 221
disconnect 144
during-operation service 80
installation 225
removal 223
road test (control and linkage) .. 100
run-in test 26
shifting 37
trouble shooting 114
(*See also* Axle transmission)
Transmission control shift rods
connect 225
disconnect 223
installation 149
removal 147
Transmission shift lever, operation
axle 32
engine 29
Transmission shift mechanism and linkage 225
Transmission vents 23

U

Page

U-joints
- preliminary service 25
- road test 91
- trouble shooting 115

Unusual noises
- road test 91
- run-in test 26

V

Vacuum test 99

Valve mechanism 94

Valve spring chamber breather 139

Vehicle pubications and reports 27

Vehicle specifications 7

Vehicles
- after-operation service 86
- deep-water operation 39
- effect of low temperature 49
- identification plate 286
- landing 41
- maintenance in cold-weather 54
- parking 54
- performance and capacities data 15
- preparation for amphibious operation 40
- pulls
  - rearward 48
  - to one side 117
- securing for rail shipment 353
- speeds 13
- steering 38, 41
- stopping 42
- towing 43
- weight specifications 8
- (*See also* Hulls)

Vehicular operating controls 27

Ventilators (crankcase)
- description and removal 138
- installation 139
- operation 34
- preliminary service 22
- road test 96

Voltmeter
- before-operation service 77
- description and disconnection 318
- operation 36
- preliminary service 24
- road test 90

W

Page

W.D., A.G.O. Form No. 462 88

Water pump
- description, removal, and installation 200
- inoperative 111
- road test 97

Water supply
- after-operation service 83
- at-halt service 81
- before-operation service 76
- preliminary service 22

Wheels
- at-halt service 81
- before-operation service 77
- preliminary service 23
- road test 91
- (*See also* Guide wheels, Bogie wheels, *and* Drive wheels)

Windshield
- installation 292
- noisy 120
- removal 291
- road test 90

Windshield wiper
- after-operation service 83
- before-operation service 77
- description
  - electric 292
  - manual 294
- preliminary service 24
- removal and installation
  - electric 293
  - manual 294
- road test 90

Wiring, electrical
- after-operation service 84
- description 312
- disconnect instrument panel wires 145
- high-tension 161
- maintenance in cold weather 54
- preliminary service 22
- removal and installation 314
- road test 96, 101

Wiring harness (generator to regulator) 211

NOTES