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TM 9-223

WAR DEPARTMENT TECHNICAL MANUAL

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

RESTRICTED DISSEMINATION OF RESTRICTED MATTER—

The information contained in restricted documents and the essential characteristics of restricted material may be given to any person known to be in the service of the United States and to persons of undoubted loyalty and discretion who are cooperating in Government work, but will not be communicated to the public or to the press except by authorized military public relations agencies. (See also paragraph 23b, AR 380-5, 15 March 1944.)

This Technical Manual supersedes TM 9-223, dated 30 October 1942; TM 9-222, dated 8 June 1943; TB 223-1, dated 20 August 1943; and TB 223-2, dated 22 November 1943.

TWIN CAL. .50 MACHINE
GUN MOUNT M33 AND
MULTIPLE CAL. .50
MACHINE GUN
MOUNT M45



WAR DEPARTMENT

27 JULY 1944

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WAR DEPARTMENT
Washington 25, D. C., 27 July 1944

TM 9-223, Twin Cal. .50 Machine Gun Mount M33 and Multiple Cal. .50 Machine Gun Mount M45, is published for the information and guidance of all concerned.

[A.G. 300.7 (27 Jan 44)
O.O. 300.7/1054]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:

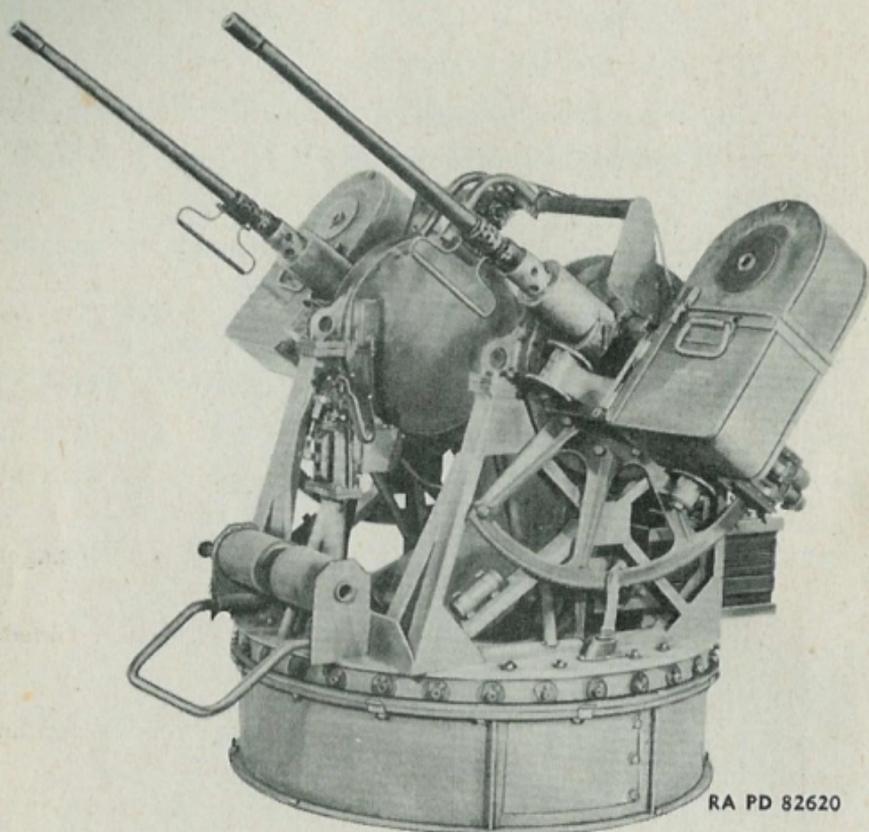
J. A. ULIO,
Major General,
The Adjutant General.

DISTRIBUTION: C and H 9 (3); IBn 44 (3); IC 44 (3).

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

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RA PD 82620

Figure 1—Twin Cal. .50 Machine Gun Mount M33 (Without Armor)

RESTRICTED

This Technical Manual supersedes TM 9-223, dated 30 October 1942; TM 9-222, dated 8 June 1943; TB 223-1, dated 20 August 1943; and TB 223-2, dated 22 November 1943.

Section I
INTRODUCTION**1. SCOPE.**

a. This Technical Manual is published for the information and guidance of all concerned. It contains information required by the using arms to identify, use, maintain, and preserve the following materiel:

- (1) Twin cal. .50 Machine Gun Mount M33.
- (2) Multiple cal. .50 Machine Gun Mount M45.

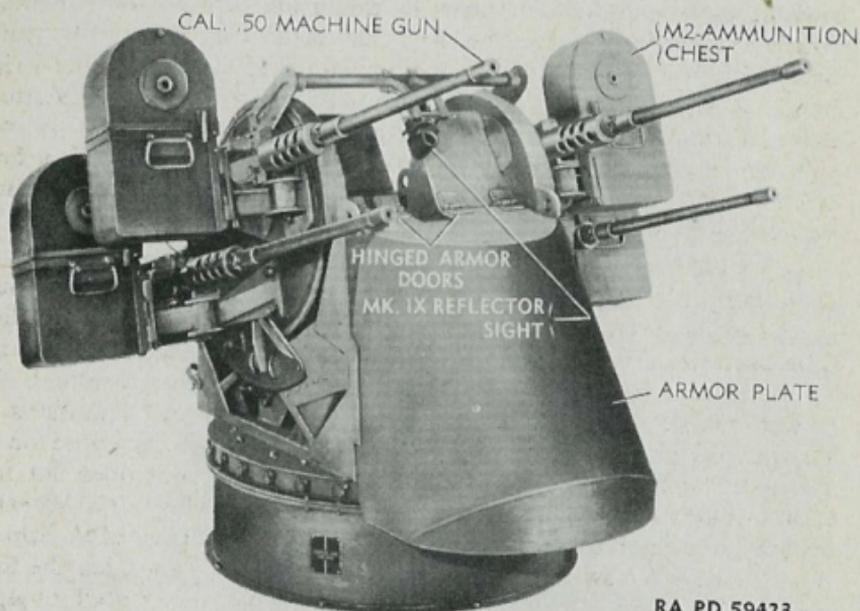
b. This manual differs from TM 9-223 of 30 October 1942 and TM 9-222 of 8 June 1943 in the following respects:

- (1) The material of both manuals has been rearranged and combined into one.
- (2) Illustrations have been added showing power drive unit, sub-assemblies, and associated gun carriages.
- (3) Full explanations have been included of the functioning of all assemblies such as differentials, gears, pulleys, and controls.
- (4) A section on malfunctions and corrections has been added.
- (5) A section on disassembly and assembly has been added.
- (6) The material on care and preservation has been revised and brought up to date and lubrication guides have been added.
- (7) Information has been added on care and maintenance of the power charger, including gasoline engine and generator.

2. CHARACTERISTICS.

a. The twin and multiple machine gun mounts (figs. 1 and 2) are power-driven, semi-armored gun mounts with self-contained power units. They can be mounted on a vehicle, trailer, or any suitable fixed base or on the ground. The mounts can be traversed through 360 degrees and elevated through an arc of -10 degrees to +90 degrees from the horizontal. The mount movement and machine gun fire are controlled from a pair of control handles which are placed directly in front of the centrally located seat within the mount.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 59423

Figure 2—Multiple Cal. .50 Machine Gun Mount M45 (With Armor)

3. DIFFERENCES BETWEEN MODELS.

a. The major difference between M33 and M45 Mounts is that the M33 carries *two* cal. .50 machine guns and the M45 carries *four* cal. .50 machine guns. Operation, controls, and component parts are similar on both mounts, with necessary structural and electrical changes made on the M45 Mounts to accommodate two machine guns on each trunnion. Specific differences between the two models are listed below:

(1) GUNS. On the M33 Mount, the two guns are mounted through the agency of ring spring adapters. Two studs projecting from the adapter casing are latched in the forward mounting yoke. The four guns for the M45 Mount use heavy barrel supports in place of the ring spring adapters and are mounted by gun securing pins which pass through the forward gun receiver hole.

NOTE: M33 Guns with ring spring adapters can be assembled on M45 Mounts. Guns with heavy barrel supports *cannot* be assembled on M33 Mounts.

(2) ELECTRIC CIRCUITS.

(a) *M45 Mount.* The two 6-volt storage batteries are connected in series to supply power for the turret drive motor, firing circuit

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relay, and for the four solenoids in the firing circuit. They also supply current for the indicator lamps in the firing circuit and the motor overheat circuit and for the Mk. IX Reflector Sight. The turret drive switch is located on the mount frame below the gunner's right hand. A sight interlock switch mounted on the side of the turret drive switch box permits illumination of the Mk. IX Sight for bore sighting adjustments without operating the power drive. The firing circuit switch may be operated independently, so that the guns may be fired without the turret drive operating.

(b) *M33 Mount.* The two storage batteries supply power for the turret drive motor, the two firing solenoids, and for the light bulbs in the firing circuit indicator lamp and the Mk. IX Reflector Sight. The batteries are connected in series with the negative side grounded to the mount frame. Power is taken off the positive terminal. The power charger is connected across the batteries, and maintains the charge. All circuits stem from a large junction box mounted on the frame in back of the gunner's seat. The M33 Mount does not have motor thermostat, overheat lamp, firing circuit relay, sight interlock switch, or circuit breaker reset button as provided on M45 Mounts. The turret drive switch must be closed in order to energize the firing circuit. The Mk. IX Reflector Sight may be illuminated independently of the turret drive circuit.

b. Differences Between Early and Late M45 Mounts.

(1) The following additions or modifications have been made on the late model M45 Mounts:

- (a) The voltmeter has been removed and a hydrometer installed.
- (b) The combination turret drive switch and circuit breaker has been replaced with a turret drive switch and separate circuit breaker equipped with reset button.
- (c) Batteries of the same capacity, but with larger physical dimensions have been installed.
- (d) Foot platforms for the right and left cannoneers have been installed at the rear of the mount.
- (e) Safety belts for the gunner have been added.

c. Capacitors.

(1) The capacitors for the reduction of interference on radio sets have been installed on a great number of Multiple cal. .50 Machine Gun Mounts M45 and M33, and at the present time, the rest of the mounts are being modified by a traveling field crew. However, due to the limited supply of the capacitors, they are not being installed in any of the Briggs-Stratton power charger units which are stored as spare parts.

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
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(2) One of the capacitors is located in the generator control box. On replacing Briggs-Stratton power charger unit with one from spare parts, the capacitor should be removed from the old generator control box and installed in the generator control box of the new unit.

4. DATA.

a. General.

Weight of M33 Mount fully equipped (approx).....	1500 lb
Weight of M45 Mount fully equipped (approx).....	2400 lb
Over-all width of M33 Mount.....	72 in.
Over-all width of M45 Mount.....	81½ in.
Over-all height of M33 Mount (guns level).....	72 in.
Over-all height of M33 Mount (guns fully elevated).....	78½ in.
Over-all height of M45 Mount (guns level).....	55 in.
Over-all height of M45 Mount (guns fully elevated).....	75 in.

b. Power Drive.

Power—Maxson variable speed drive, Model 120A with electric motor—style 441Q417, Emerson Corporation, or Air Associates 1-hp, compound wound, 12-volt, 90-amp or equivalent.

Output torque—13 in-lb at 2,800 rpm approximately at either shaft, zero output at the other.

Dimension—11 in. high x 18½ in. wide x 25½ in. long.

Weight 139 lb

c. Power Charger.

Briggs and Stratton, Model 300, PC-1 for M33 Mount.

Briggs and Stratton, Model 304, type 25592 for M45 Mount.

Output 300 watts

Output 12 volts

Gasoline Engine (4-cycle)..... 1 cylinder

Weight (with fuel and oil)..... 75 lb

d. Armament.

Gun, machine, cal. .50, Browning, M2, heavy barrel, turret type.

2 mounted outside the right and left trunnions of M33 Mount

4 mounted outside the right and left trunnions of M45 Mount

e. Ammunition.

200 cal. .50 rounds carried in each ammunition chest.

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f. Fuel and Oil.

Power charger:

Fuel capacity 2 qt

Oil capacity 1½ pt

Variable speed drive:

Oil capacity (per differential) 22 cu cm ($\frac{1}{25}$ pt)

g. Performance.

Duty cycle (5 min off, 5 min on) 5 hr

Tests have indicated that when using a cycle of 5 minutes off and 5 minutes on, turret operation can reasonably be expected for 5 hours, starting with fully charged batteries and running power charger continuously.

Azimuth speed 0 deg to 60 deg per sec

Elevation speed 0 deg to 60 deg per sec

Power charger speed 2,600 to 2,900 rpm

Batteries—2—storage, lead acid, (4H), 3-cell, 23 plates per cell.

Minimum capacity at 20-hour rate—150 ampere-hours.

NOTE: Batteries of larger outside dimensions are installed on late M45 Mounts; specifications remain the same as listed above.

h. Areas of Interrupted Fire of M33 Mounts.

M33 Mount elevation interrupter switches:

Left and right guns from lowest limit of depression to 10-deg \pm 1-deg elevation

M33 Mount azimuth interrupter switches:

Left gun from 21½-deg \pm 1-deg traverse left to 52-deg \pm 1-deg traverse right

Right gun from 25½-deg \pm 1-deg traverse right to 52-deg \pm 1-deg traverse left

i. Areas of Interrupted Fire of M45 Mounts.

M45 Mount elevation interrupter switches:

Lower guns from lowest limit of depression to 4-deg \pm 1-deg elevation

Upper guns from lowest limit of depression to -1½-deg \pm 1-deg depression

M45 Mount azimuth interrupter switches:

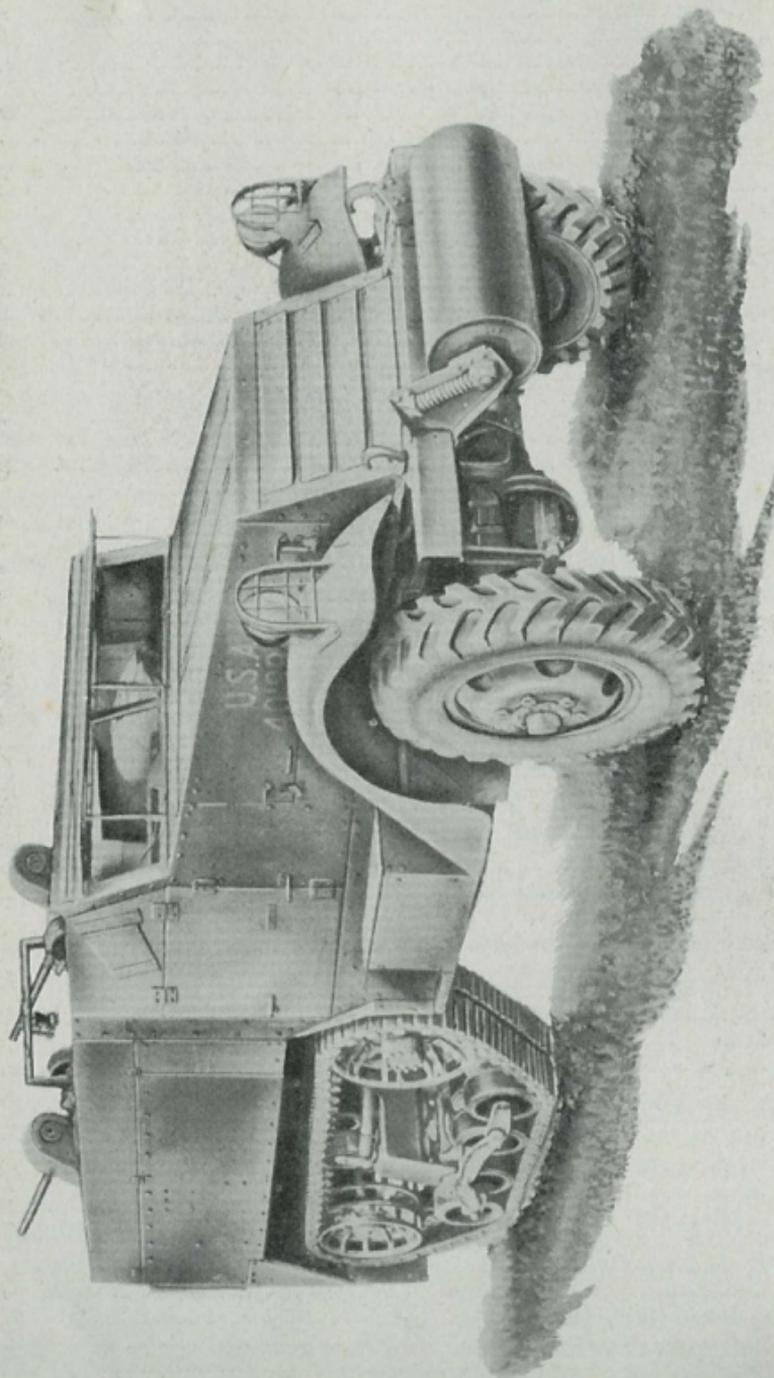
Lower right gun from 56½-deg \pm to 1-deg azimuth left to 29½-deg \pm 1-deg azimuth right

Upper right gun from 53-deg \pm 1-deg azimuth left to 33-deg \pm 1-deg azimuth right

Upper left gun from 26-deg \pm 1-deg azimuth left to 60-deg \pm 1-deg azimuth right

Lower left gun from 22½-deg \pm 1-deg azimuth left to 63½-deg \pm 1-deg azimuth right

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 26707

Figure 2A—Multiple Gun Motor Carriage M13 With Twin Cal. .50 Machine Gun Mount M33

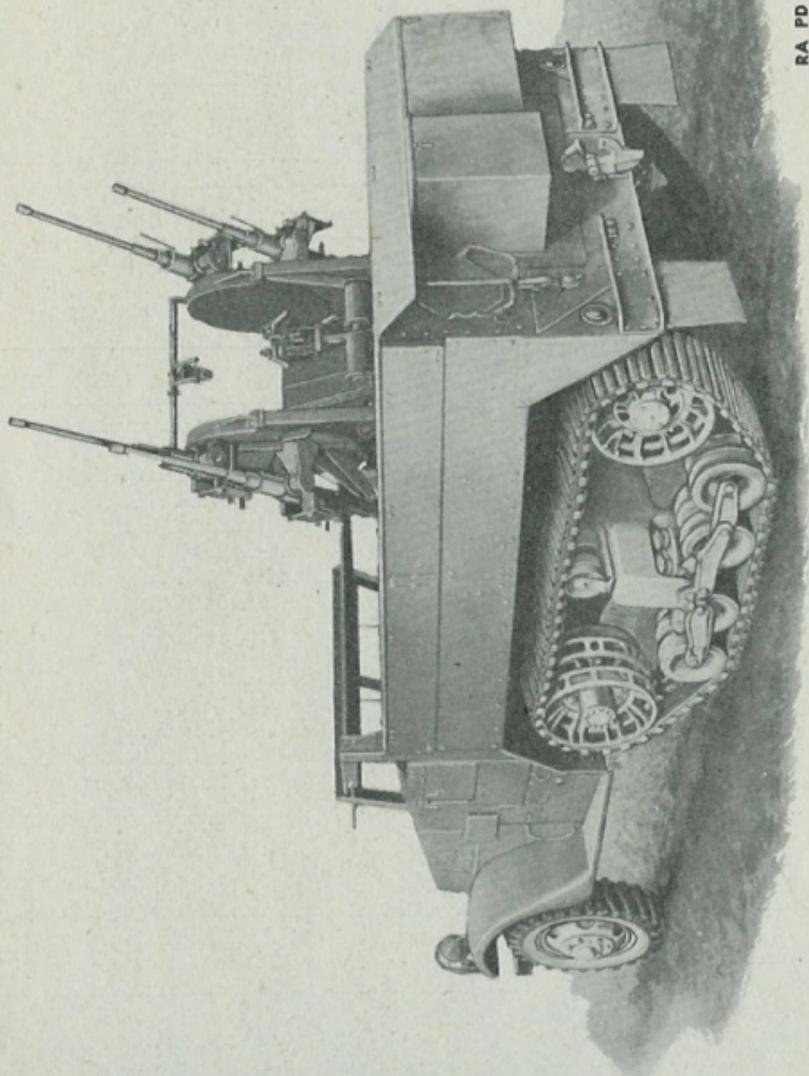
INTRODUCTION



RA PD 66387

Figure 2B—Multiple Gun Motor Carriage M14 With Twin Cal. .50 Machine Gun Mount M33

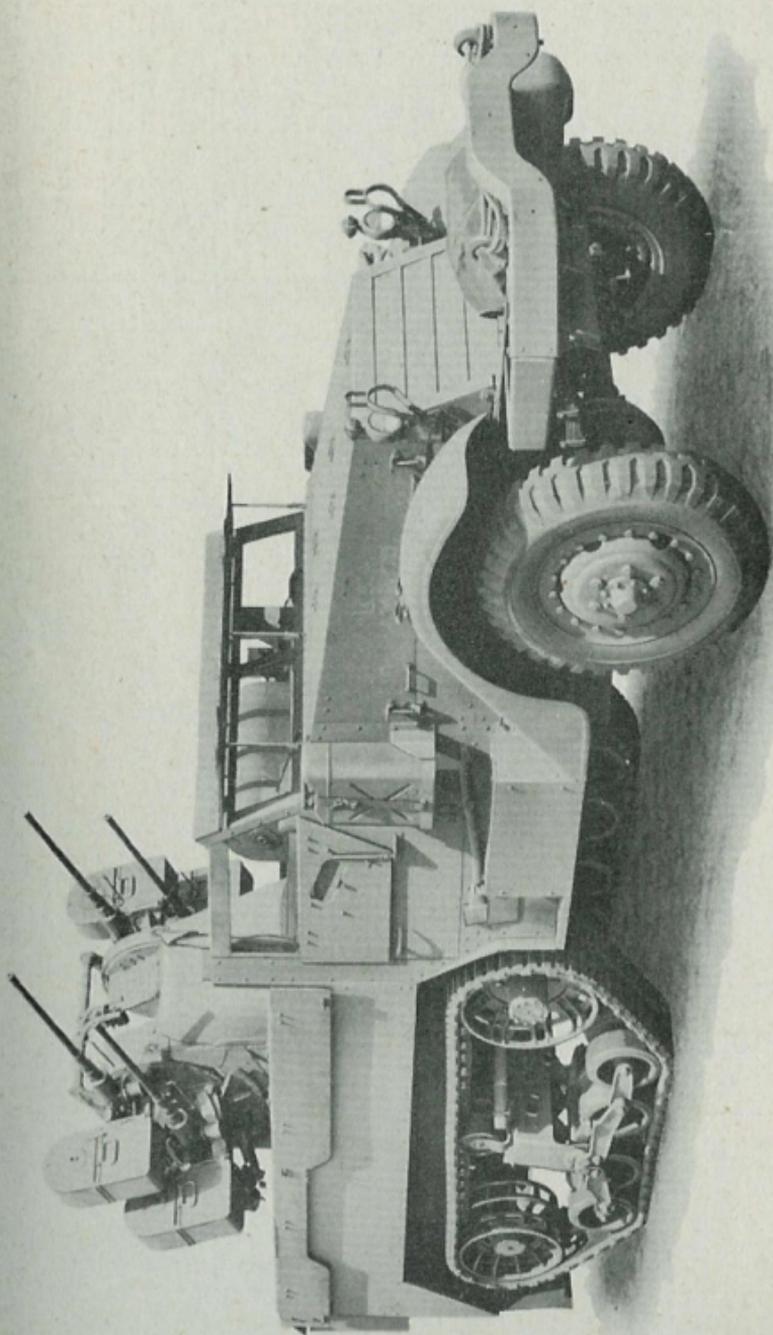
TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 26710

Figure 2C—Multiple Gun Motor Carriage M16 With Multiple Cal. .50 Machine Gun Mount M45

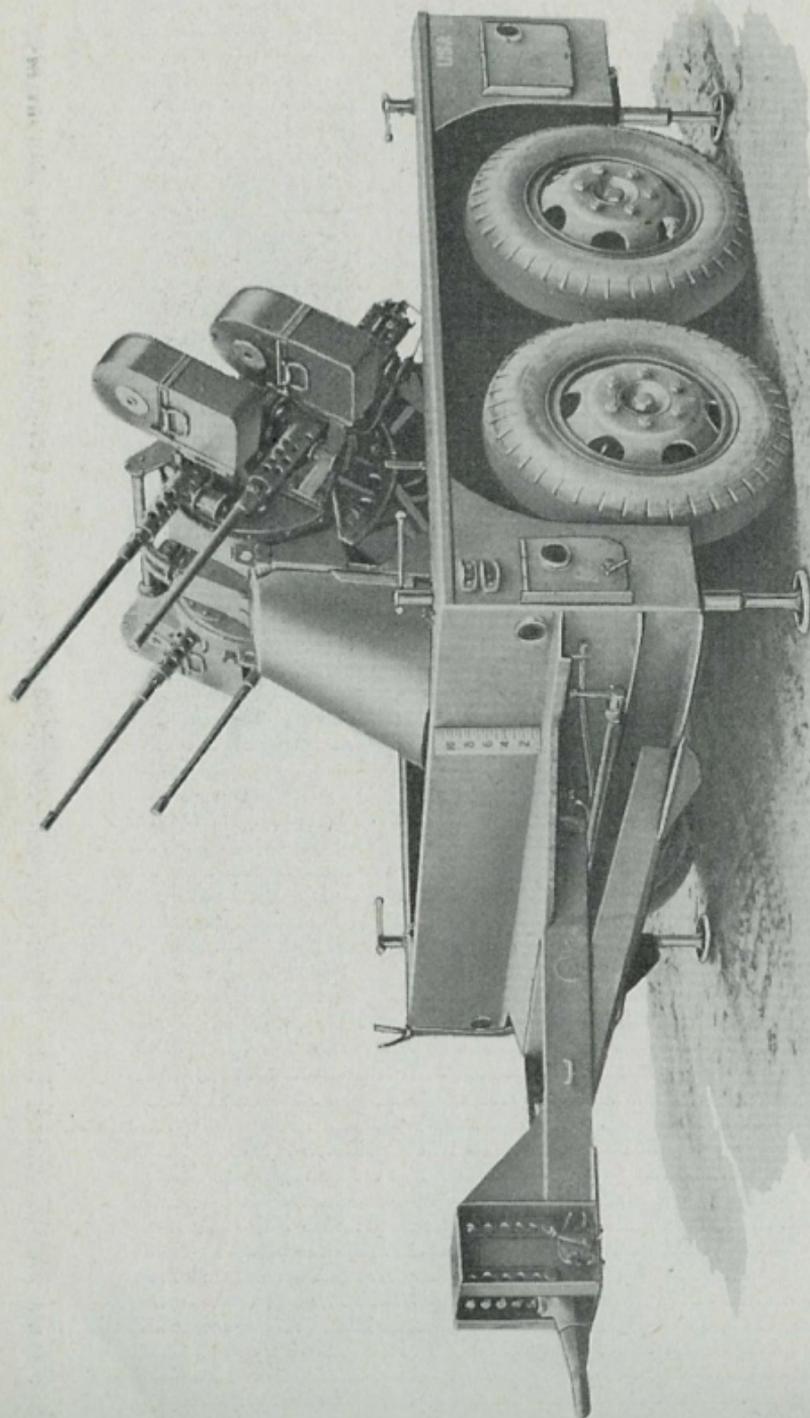
INTRODUCTION



RA PD 308921

Figure 2D—Multiple Gun Motor Carriage M17 With Multiple Cal. .50 Machine Gun Mount M45

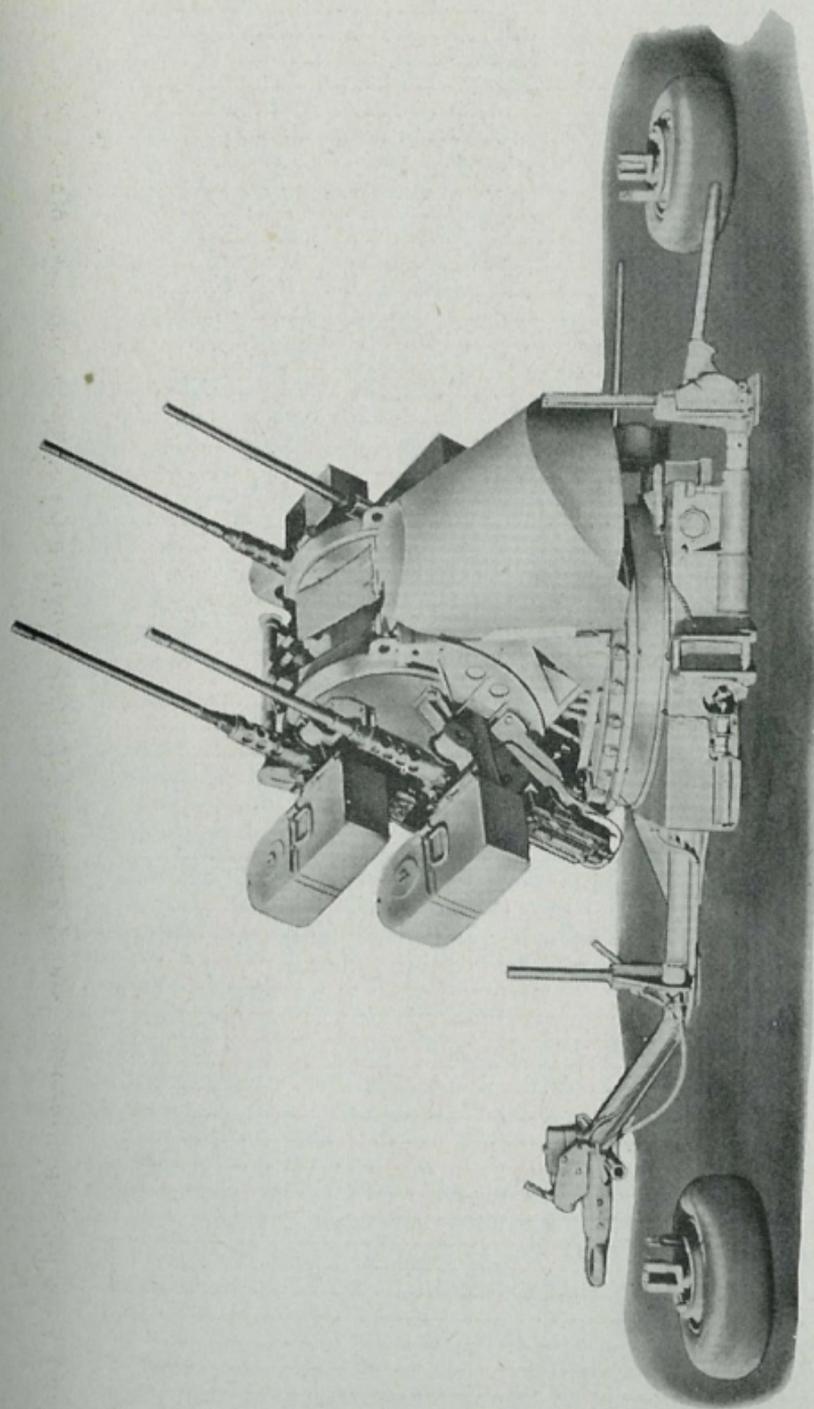
TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 26708

Figure 2E—Multiple Machine Gun Carriage M51 With Multiple Cal. .50 Machine Gun Mount M45

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Figure 2F—Multiple Machine Gun Trailer Mount M55 With Multiple Cal. .50 Machine Gun Mount M45C

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MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**

j. Associated Carriages.

Mount	Vehicle	Designation
M33	M3, Half-track	Multiple Gun Motor Carriage M13 (fig. 2A)
M33	M5, Half-track	Multiple Gun Motor Carriage M14 (fig. 2B)
M45	M3, Half-track	Multiple Gun Motor Carriage M16 (fig. 2C)
M45	M5, Half-track	Multiple Gun Motor Carriage M17 (fig. 2D)
M45	M7, Generator Trailer	Multiple Machine Gun Carriage M51 (fig. 2E)
M45c	M20, Trailer mount	Multiple Machine Gun Trailer Mount M55 (fig. 2F)

5. PRECAUTIONS.

a. Never operate the mount without starting the power charger, unless in extreme emergency. The storage batteries will be drained below an operating charge in less than 1 hour if this precaution is not observed.

b. The mount must not be held at a sustained tilt beyond a maximum angle of 10 degrees from horizontal. Momentary tipping will have no adverse effect on the power drive, but a sustained tilt will allow oil to run out of the drive differentials, thereby ruining the gearing and pulley belts. Therefore, if the tactical situation demands that the mount vehicle be located on a slope, the vehicle should be turned so the guns point along the contour lines of the slope. This positions the differentials so no oil will drain from them.

c. Except during action or drill, the firing circuit switch must be kept on "SAFE" position. On the M45 Mount, the red plastic guard should be closed over the switch. This is an important precaution due to the fact that the guns on the M45 Mount may be fired without operating the power drive.

d. The operator must take care not to have his head out over the control handles, or between the sight and armor, when operating the mount. If the operator is in this position and depresses the guns, the sight bracket will strike the back of his head. Keep head at all times behind the sight.

e. The operator must check the position of the elevation stop lever before firing guns. If the armored sides of the vehicle are raised, the elevation stop lever on the M45 Mount must engage the

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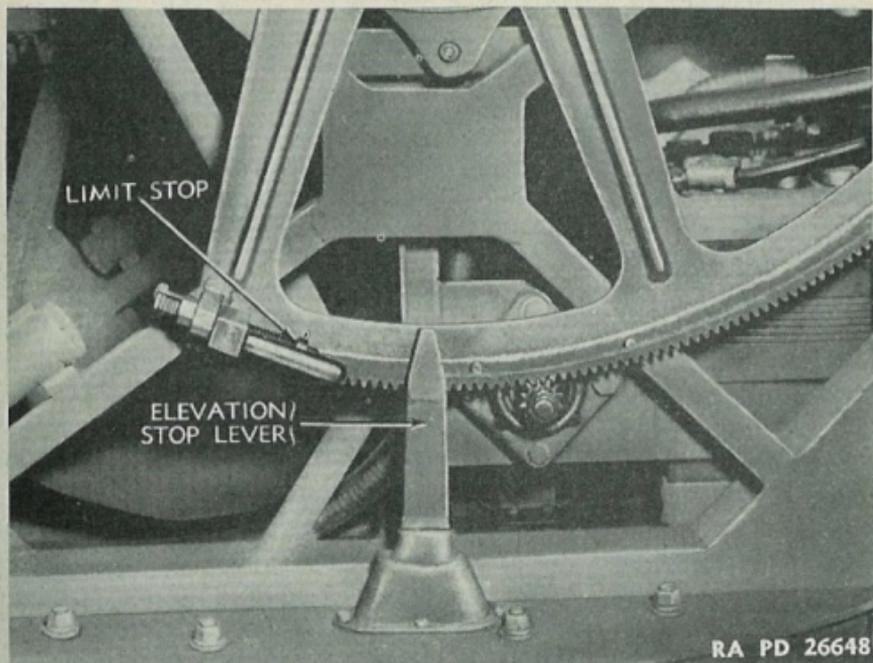


Figure 3—Limit Stop on M33 Mount—Disengaged

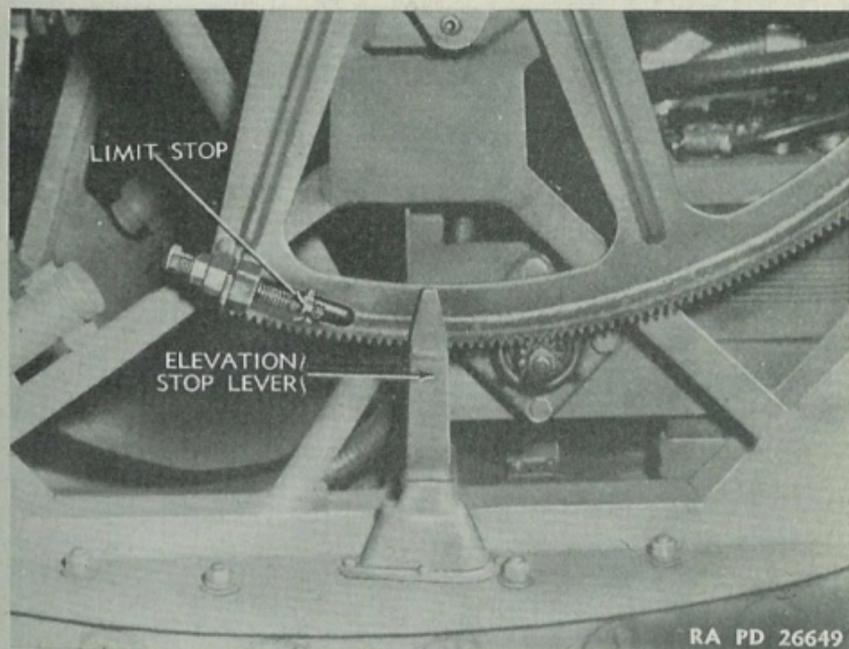


Figure 4—Limit Stop on M33 Mount—Engaged

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

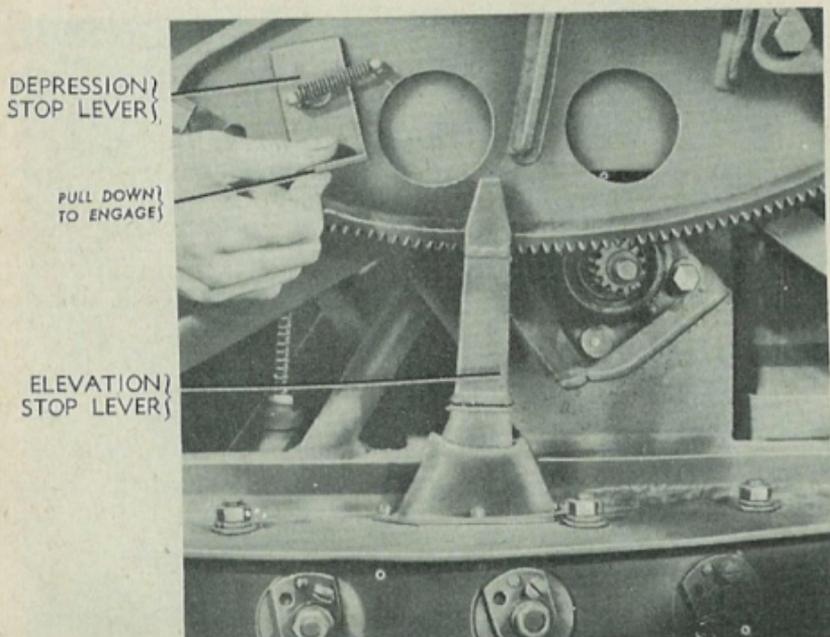
depression stop lever which is pulled down into position (figs. 3 and 4). On the M33 Mount, the elevation stop lever must engage the limit stop lever (figs. 3 and 4).

f. Under conditions of training, when these mounts are used for more than 4 hours daily, the charging rate should be set for not over 20 amperes by setting the charger control switch on high position and adjusting throttle or governor so that engine does not run at a speed higher than 2,600 revolutions per minute. This will materially increase the generator life. Furthermore, every effort should be made to use supplemental means of charging the mount storage batteries. Portable chargers may be utilized, or the batteries may be removed and charged separately if equipment is available. Under conditions other than training, the mount generator should be allowed to charge at a maximum rate.

g. The solenoid trigger (issued only with M45 Mounts) should always be in the safety position until ready to use.

h. When shutting off power charger, always move generator switch to "N" position before pushing stop button on blower housing to avoid burning cut-out points together.

i. During operation, avoid excessive rapid changes of speed and direction, as this has a tendency to bend the pulleys.



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Figure 5—Engaging Depression Stop Lever on M45 Mount

DESCRIPTION AND FUNCTIONING

j. When performing repair work or adjustments on the mount, particularly when working inside the base, always disconnect the battery ground cable on the left rear post of the frame. This precaution will prevent the mount from being started accidentally while work is being performed and subsequent injury to mount or to personnel.

k. In the interest of safety, exercise interrupter switches daily when in use and weekly when in storage. If the interrupter switch rests on the interrupter area for an excessive period of time, the switch spring takes on a permanent set. Therefore, when the mount is put in use on a half-track there is danger of firing into the half-track cab.

Section II

DESCRIPTION AND FUNCTIONING

6. GENERAL.

a. For purposes of explanation, the description of the materiel is divided into the paragraphs given below. The descriptions are applicable to both mounts unless noted otherwise.

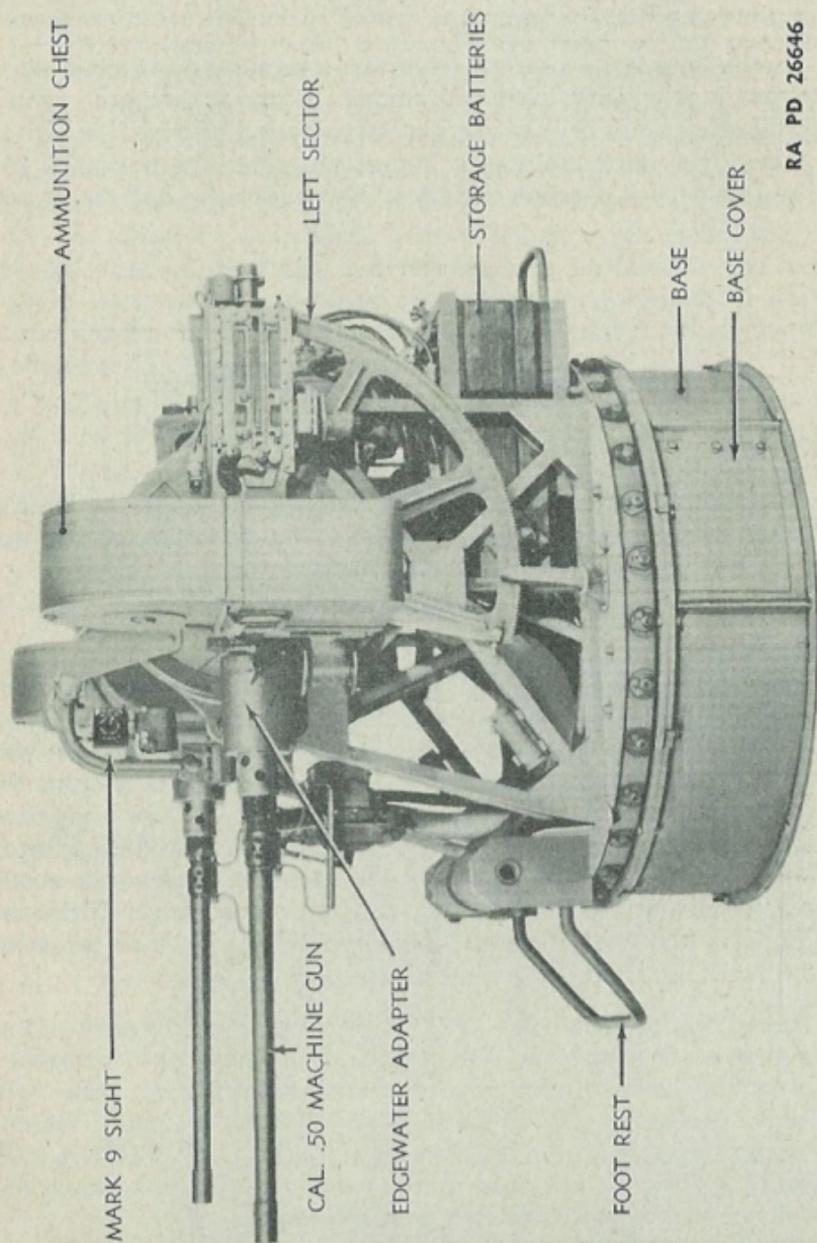
7. MOUNT STRUCTURE.

a. **Turret Structure** (figs. 6 and 7). The turret structure contains all of the rotatable supporting elements of the mount. The trunnions which carry the guns, ammunition chests, and sight are mounted to elevate through an arc of minus 10 degrees to plus 90 degrees from horizontal. The turntable, upon which the trunnions are mounted, rotates through 360 degrees. The seat for the operator is centralized in the mount structure and is tilted backwards about 45 degrees to permit coverage of the full elevation range. The seat is adjustable so that the operator may regulate his position so as to follow the sight with minimum head movement.

b. **Base** (figs. 6, 7 and 8). A base of welded steel construction supports the turret structure. Two removable base covers on opposite sides of the base provide access to the power drive. Nine bolt holes around the upper rim of the base provide the means of fastening the turret structure to the base. A plate marked "CENTER LINE CAB END" is fixed to the side of the base (fig. 8) indicating the proper placement of the mount in the half-track.

c. **Interrupter Switches** (figs. 8A, 8B, and 8C). The mount is provided with azimuth and elevation interrupter switches to break the gun fire circuits when the guns reach predetermined positions in

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
 MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



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Figure 6—Twin Cal. .50 Machine Gun Mount M33—Side View

DESCRIPTION AND FUNCTIONING

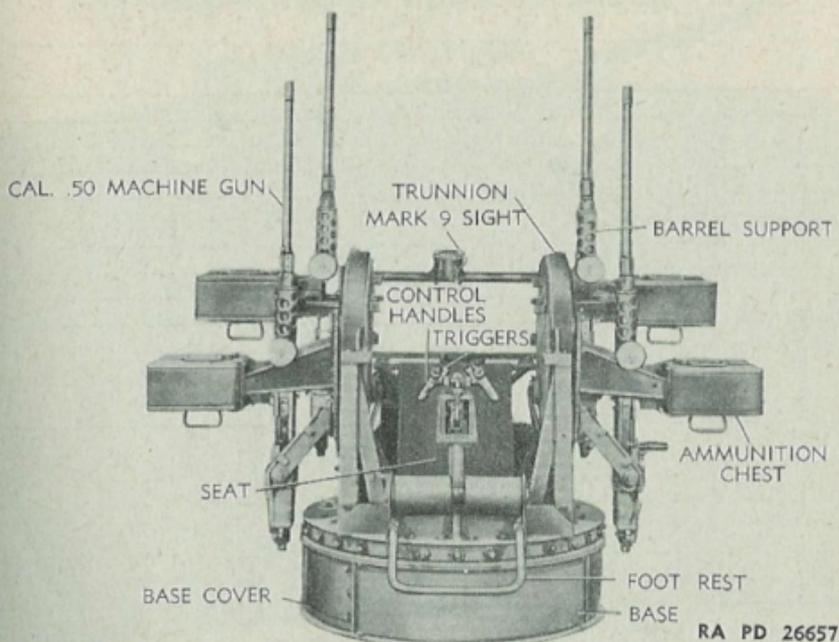


Figure 7—Multiple Cal. .50 Machine Gun Mount M45—Guns at 90-degree Elevation—Front View

elevation and traverse. When the mount is properly mounted on vehicles having cabs, the gun fire will be interrupted when the guns approach the cab area of the vehicle (par. 4 h). There is an interrupter switch provided for each gun in both elevation and azimuth. When the guns approach an area of fire interruption, a cam engages a roller arm of the interrupter switch. The action displaces the roller arm so that it depresses a plunger in the switch to break the circuit between the trigger switches and the firing solenoid. This action is repeated for each gun so that it automatically ceases fire as it enters the interruption area.

d. The interrupter switches on the Multiple cal. .50 Machine Gun Mount M45 have been failing as a result of their being held in the interrupted position for an excessively long period of time. This causes the switch springs to take a permanent set and renders them inoperative. **CAUTION:** *In the interest of safety, check these interrupters daily when in use and weekly when in storage. In training, the limit depression stop should be engaged at all times to prevent depression of the guns below zero elevation and consequent firing into the cab if the interrupters fail to function.*

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
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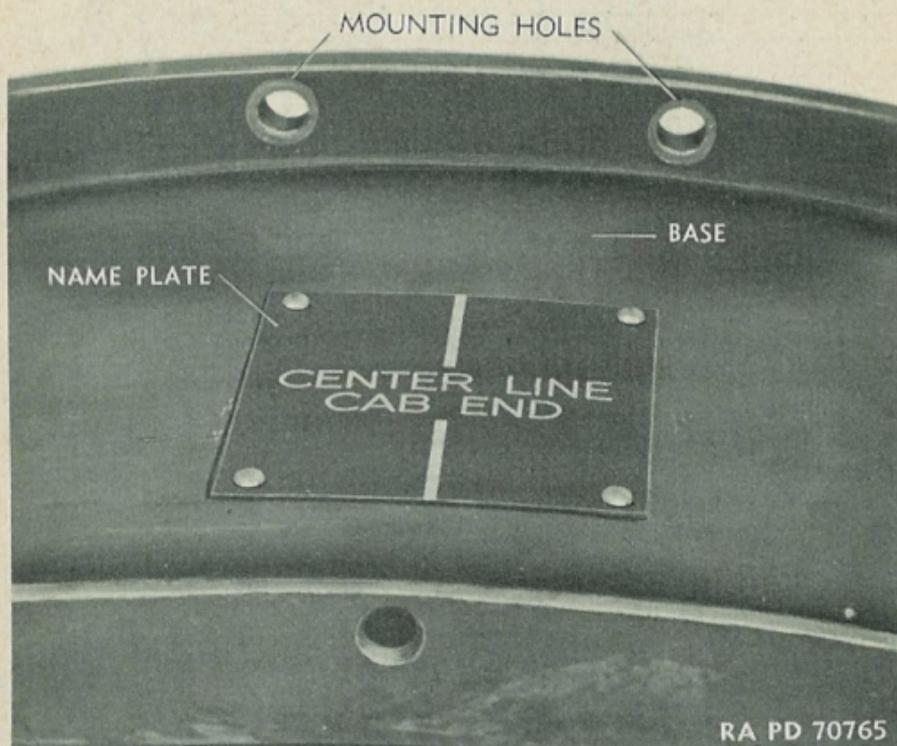
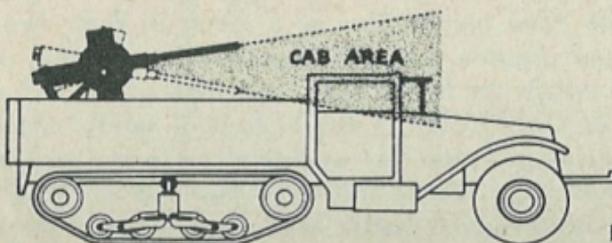
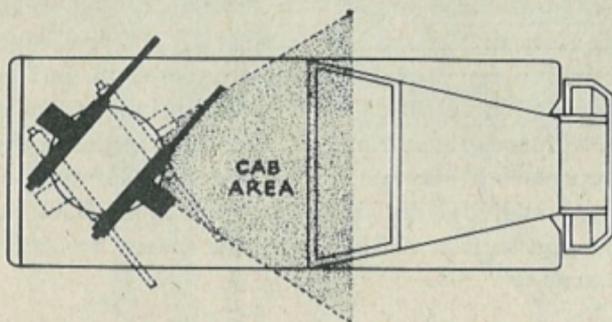


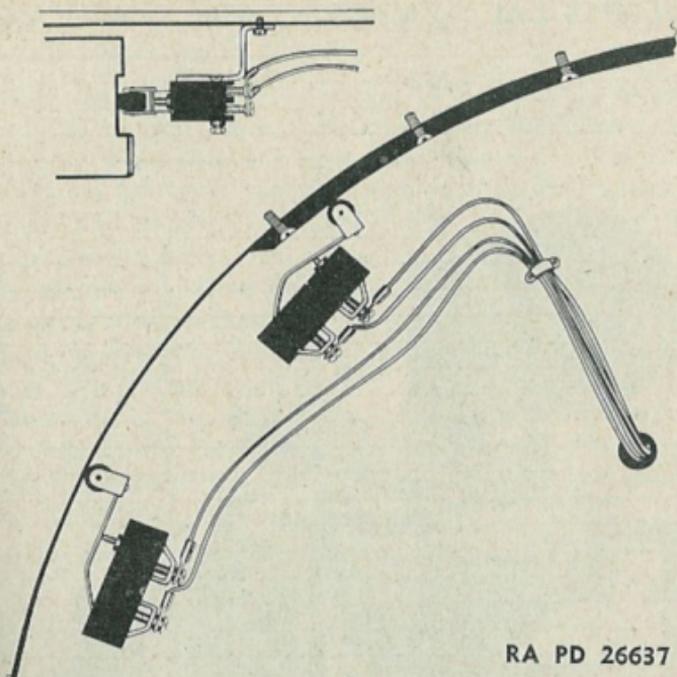
Figure 8—Main Base Name Plate—Looking Upward From Bottom



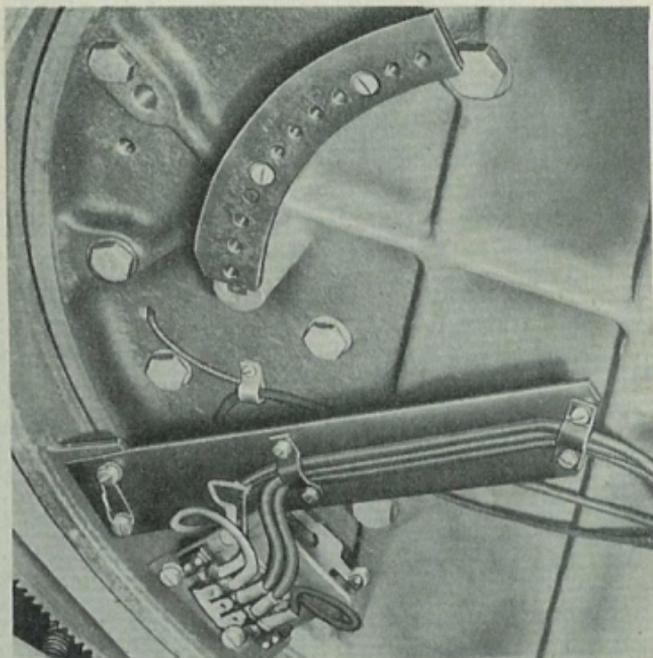
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Figure 8A—Extent of Cab Area

DESCRIPTION AND FUNCTIONING



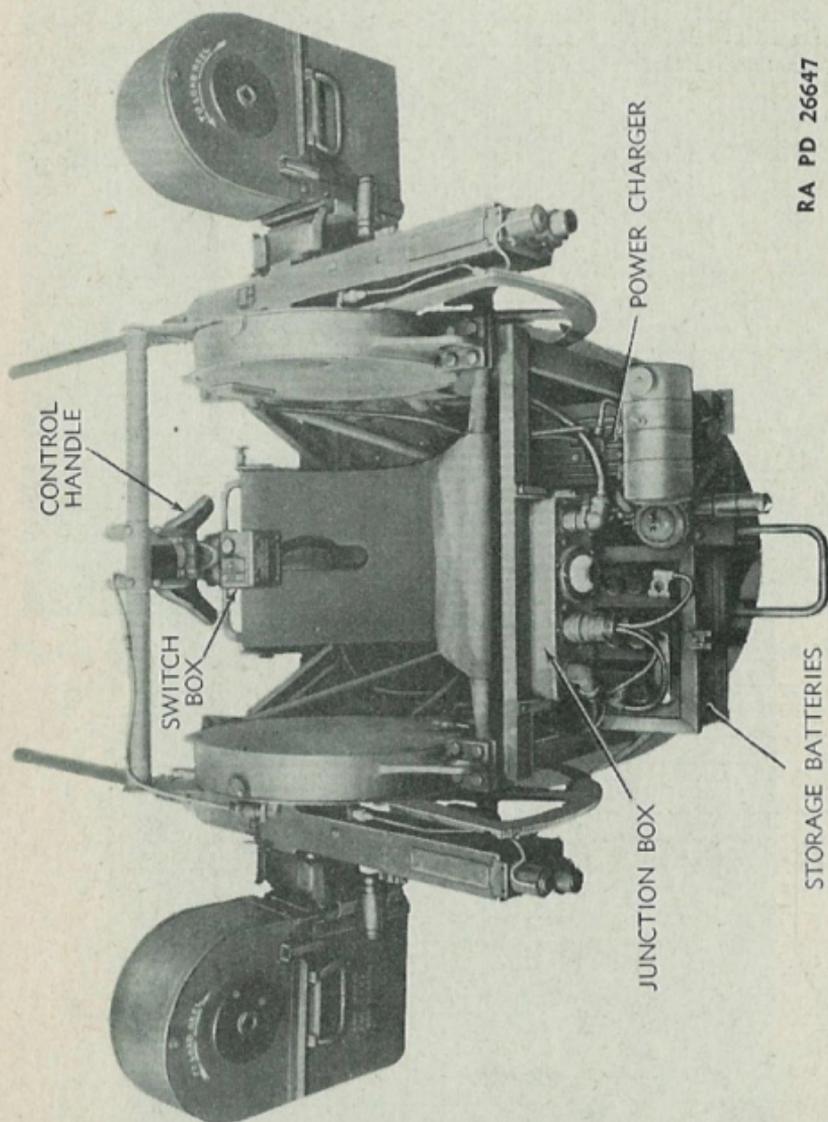
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Figure 8B—Azimuth Interrupter Switches

RA PD 26638

Figure 8C—Elevation Interrupter Switches—Cam Repositioned To Eliminate Interrupted Area of Fire

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
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RA PD 26647

Figure 9—Twin Cal. .50 Machine Gun Mount M33—From Above

DESCRIPTION AND FUNCTIONING

e. Switch Box (figs. 9, 10, 11, and 12).

(1) The turret drive switch on the M45 Mount is located on the top side of the switch box mounted between the mount cross-brace members below the operator's right hand (fig. 12). The turret drive switch or toggle switch is used to start or stop the power drive. A circuit breaker is mounted in the turret drive switch box on the line between the switch and drive motor to protect the motor, batteries, and wires against excessive overloads. The circuit breaker will trip (open the circuit) when the current exceeds 172 amperes. The circuit breaker can be reset by pushing a button mounted on top of the switch box. The turret drive switch of the M33 Mount is located on the underside of the pilot light box on the control column. The pilot light box of the M45 Mount is located in the same relative position to the control handles that the M33 Mount switch box is to its control handles.

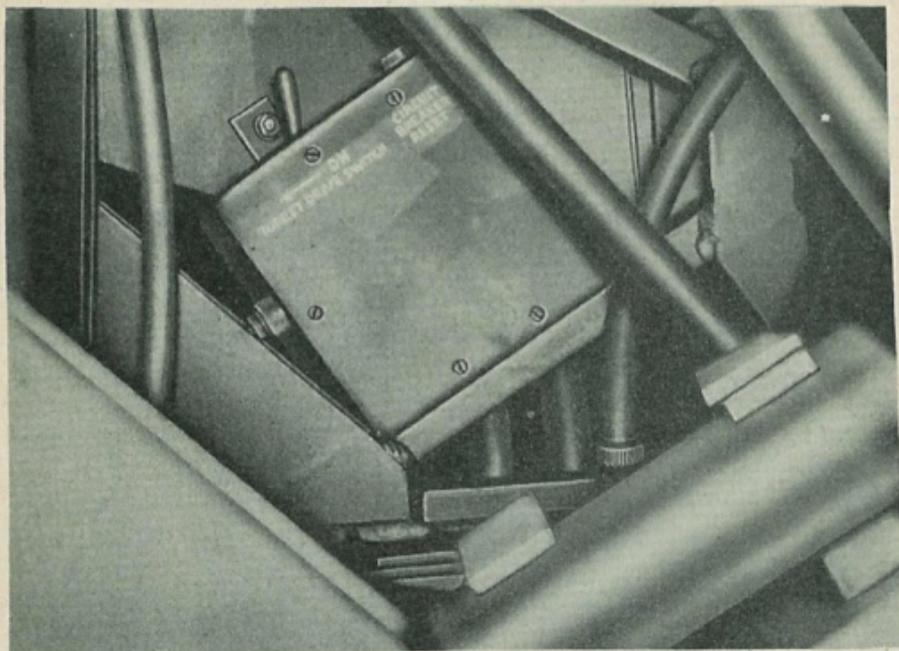
NOTE: In earlier M45 Mounts, the turret drive switch and circuit breaker are combined as one unit having the same function as described above.

(2) A sight interlock switch is located on the side of the switch box on M45 Mounts only. This switch (fig. 12) will light the Mk. IX Reflector Sight when it is held in the "ON" position. As soon as the



Figure 10—Heinemann Switch Box (Used on Early M45 Mounts)—Side View

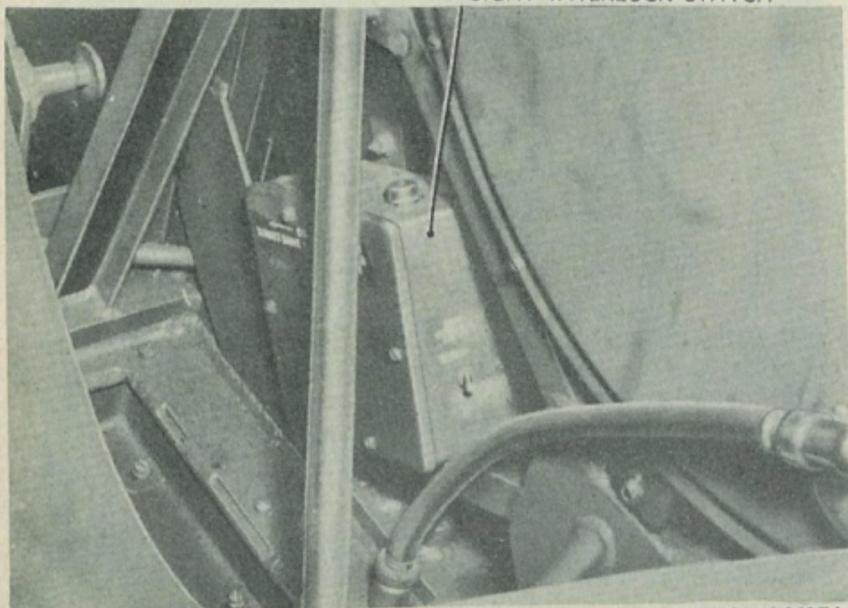
**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
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RA PD 26626

Figure 11—Cutler Hammer Switch Box—Side View

SIGHT INTERLOCK SWITCH



RA PD 26627A

Figure 12—Cutler Hammer Switch Box—Rear View

DESCRIPTION AND FUNCTIONING

- A — RETRACTING SLIDE HANDLE
- B — LEFT SECTOR
- C — TRUNNION ASSEMBLY
- D — ARMOR DOOR HOLDER
- E — SIGHT BRACE
- F — CONTROL HANDLES
- G — PILOT LIGHT BOX
- H — SEAT
- J — SOLENOID
- K — POWER CHARGER
- L — STORAGE BATTERIES

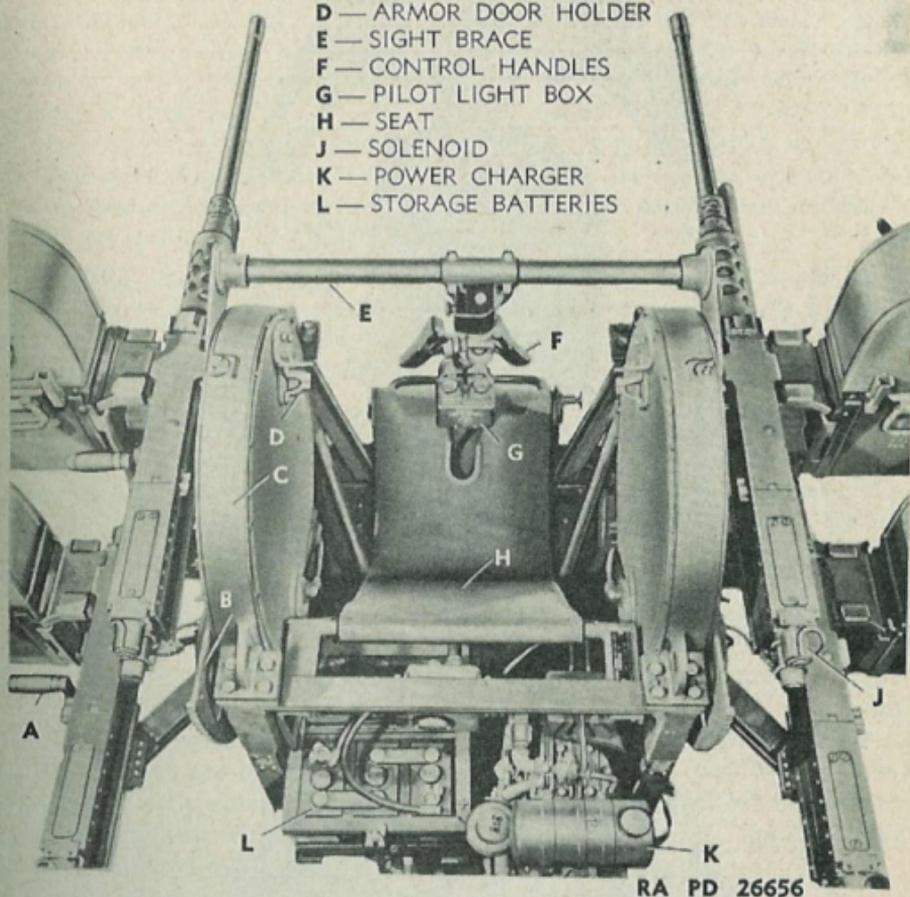
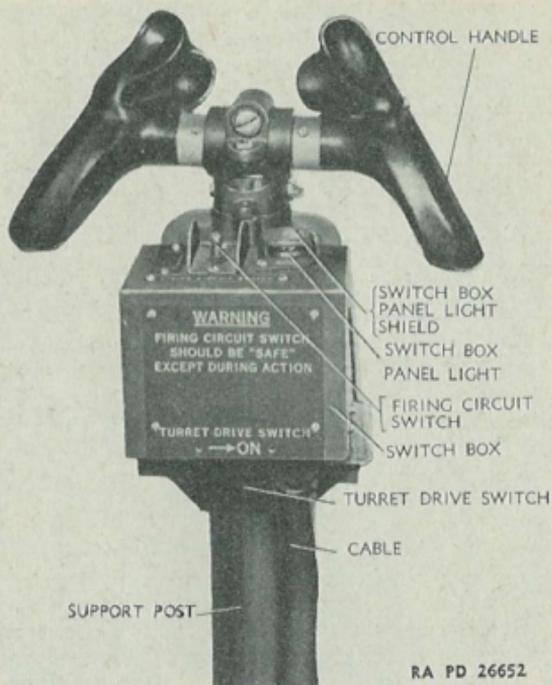


Figure 13—Multiple Cal. .50 Machine Gun Mount M45—From Above

pressure on the switch is released, it will return to its original position. This switch is used for bore sighting the guns and has no other function in the operation of the mount. It may be operated without the power drive running.

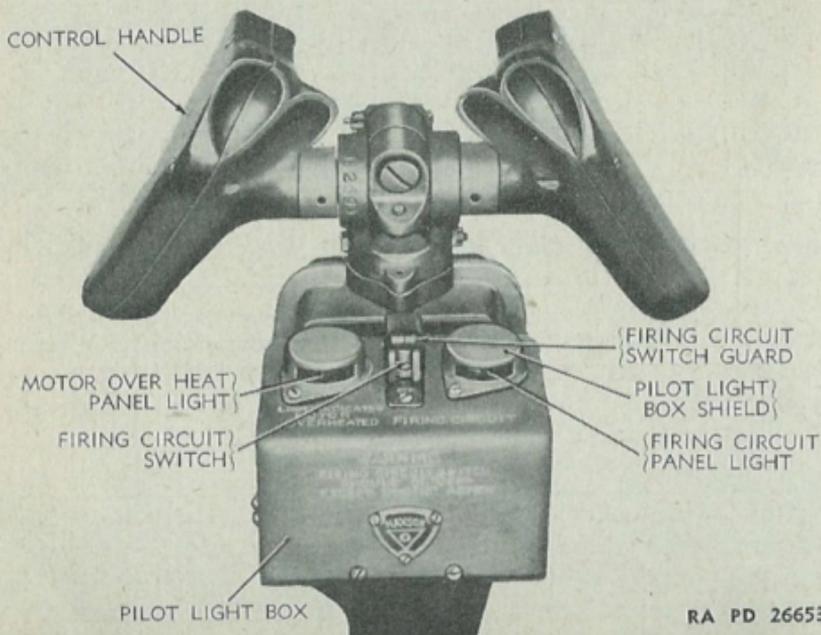
(3) The firing circuit switch is located on the switch box of the M33 Mount, and on the pilot light box of the M45 Mount, which are located directly below the control handles in both mounts. The firing circuit switch in the M45 Mount is covered by a firing circuit switch guard which prevents it from being accidentally engaged. To the right of the firing circuit switch in the M33 Mount is a shielded switch box panel light, and in the M45 Mount is a

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**



RA PD 26652

Figure 14—Turret Drive Switch Box and Control Handles of M33 Mount



RA PD 26653

Figure 15—Pilot Light Box and Control Handles of M45 Mount

DESCRIPTION AND FUNCTIONING

shielded firing circuit panel light which indicates, in both types of mounts, when the firing circuit is "alive." In the case of the M45 Mount, there is another shielded panel light to the left of the firing circuit switch; this light indicates overheating of the power drive motor (figs. 14 and 15). A thermostat is mounted on the case of the power drive motor. Overheating of the motor between 190° F and 210° F causes the thermostat contacts to close and complete a circuit to light a warning lamp located on the left side of the pilot light box. Except in emergency situations, the drive should be stopped when the light shows because sustained high temperature will deteriorate insulation in the motor.

NOTE: On some early M45 Mounts the turret drive switch must be in the "ON" position before the firing circuit switch will function. Except for a few early models, circuits are dependent in the M33 Mounts and independent in the M45 Mounts.

f. **Seat** (fig. 13). The seat is mounted between the gun trunnions in a central position. The controls are mounted on a column which is straddled by the operator and within easy reach of his hands. The height of the seat is adjustable, as well as a projecting rest for the operator's feet (par. 30).

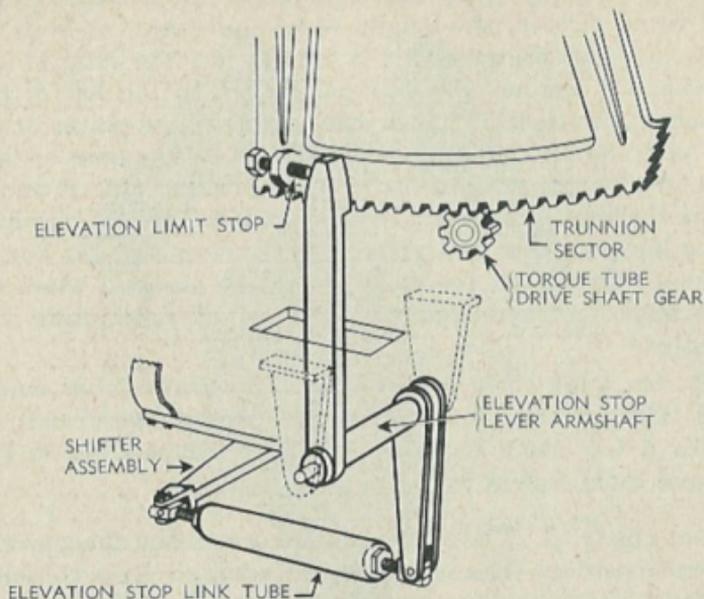
g. **Elevation Stop Lever** (figs. 3, 4, 5, and 15A). Studs are mounted on both ends of the left trunnion segment, so that they engage an elevation stop lever to limit the elevation and depression of the guns between 90 degrees and -10 degrees from horizontal. When either stud engages the elevation stop lever it forces the lever in the direction of travel and operates linkage (fig. 15A) which neutralizes the elevation differential output. This action checks trunnion movement so long as the control handles remain displaced, and prevents damage to the power drive.

(1) **LIMIT STOP (ZERO DEPRESSION)—M33 MOUNTS.** To engage the limit stop so that the trunnions do not go below 0 degree in depression it is necessary to move the limit stop on the forward end of the left trunnion segment so that it engages the elevation stop lever (figs. 3 and 4).

(2) **DEPRESSION STOP LEVER—M45 MOUNTS.** To prevent the trunnions from going below 0 degree in depression it is necessary to pull down the lever, which is held in place by a spring, so that it engages the elevation stop lever.

h. **Controls** (figs. 14 and 15). The control handles consist of a pair of moulded hand grips mounted directly in front of the seat. The control handles may be moved in a vertical or horizontal arc or in a combination of both. The degree of movement and position of the handles control the speed and direction of the mount. Trigger

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 26619

Figure 15A—Elevation Limit Linkage

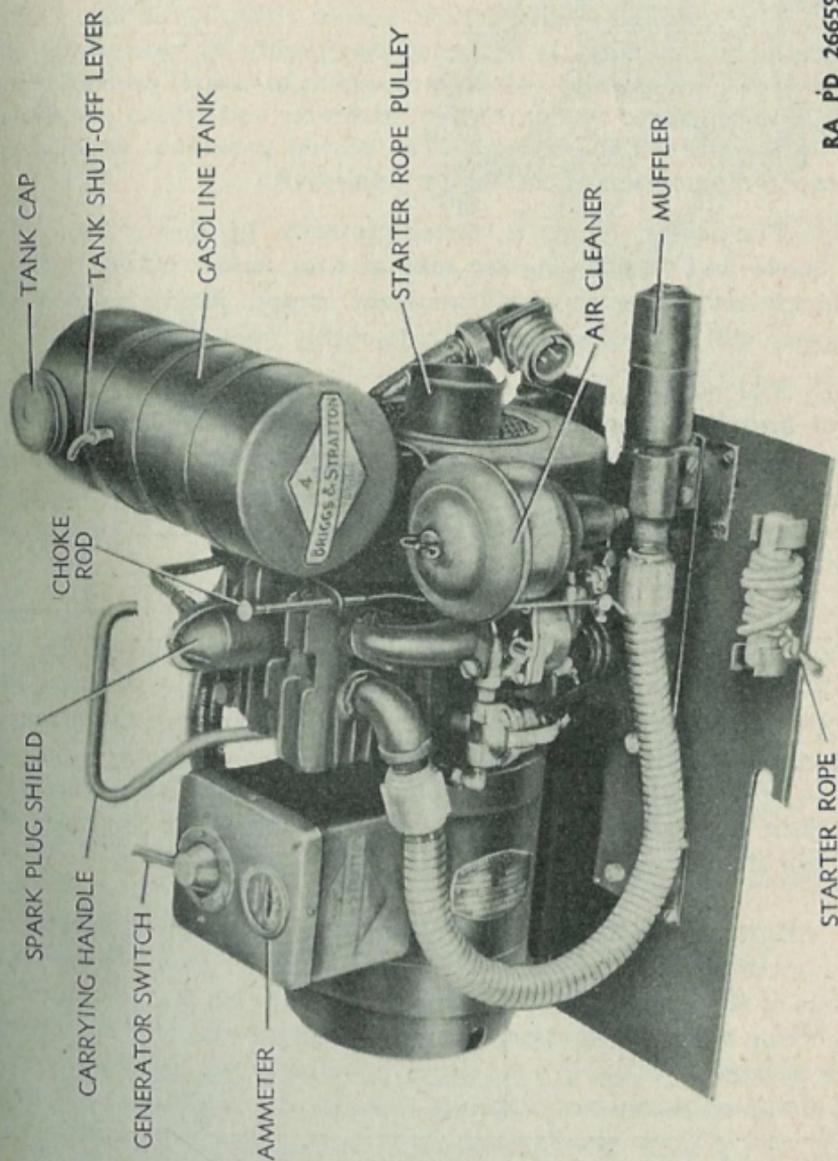
switches are mounted in the control handles so that the forefinger pressure against the trigger will actuate the trigger switch, which in turn energizes the firing circuit relay. The firing circuit relay is mounted in the base of the M45 Mount only. The relay acts as an electrically operated switch to boost current to the firing solenoids when the triggers are pressed. The firing circuit relay is necessary because the trigger switches are not heavy enough to carry the current for all four firing solenoids. Only one-half ampere is required to operate the relay, whereas the firing solenoids draw 8 amperes each. The electric current transmitted to the solenoids actuates the solenoids to fire the guns.

8. POWER CHARGER, BATTERIES, AND HYDROMETER (figs. 13 and 16).

a. Power Charger.

(1) A 300-watt, 12-volt, 4-cycle gasoline engine-driven power charger is placed in the rear of the mount. This is used to charge two 6-volt storage batteries of the lead acid type. The carburetor on the power charger is of the gravity type and the gasoline supply is regulated by a needle valve. The throttle is automatically controlled by a

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RA PD 26659

Figure 16—Power Charger for M33 Mount

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

governor. The ignition is produced by a spark from the magneto and is sent into the motor cylinder through the ignition cable and spark plug.

(2) The gasoline engine-driven power charger can be started electrically or manually. It is started electrically by closing the carburetor choke and turning the control switch to "start" position (par. 17 a). The generator acts as an electric starter and cranks the motor. The 4-pole, 4-brush, shunt-wound, air-cooled generator is mounted on a tapered extension of the motor crankshaft.

(3) The power charger is started manually by closing the carburetor choke and winding starter rope around starter pulley. Pulling up quickly on starter rope will start the motor. Adjustment of the carburetor will make the motor run smoothly (par. 17 b).

(4) The control box of the power charger houses the multiple control switch, ammeter, automatic breaker, and all wiring. The circuit breaker protects the battery against discharge back through the generator. The motor on the M45 is stopped by holding down button directly below the gas tank. The motor on the M33 is stopped by holding down switch on spark plug terminal.

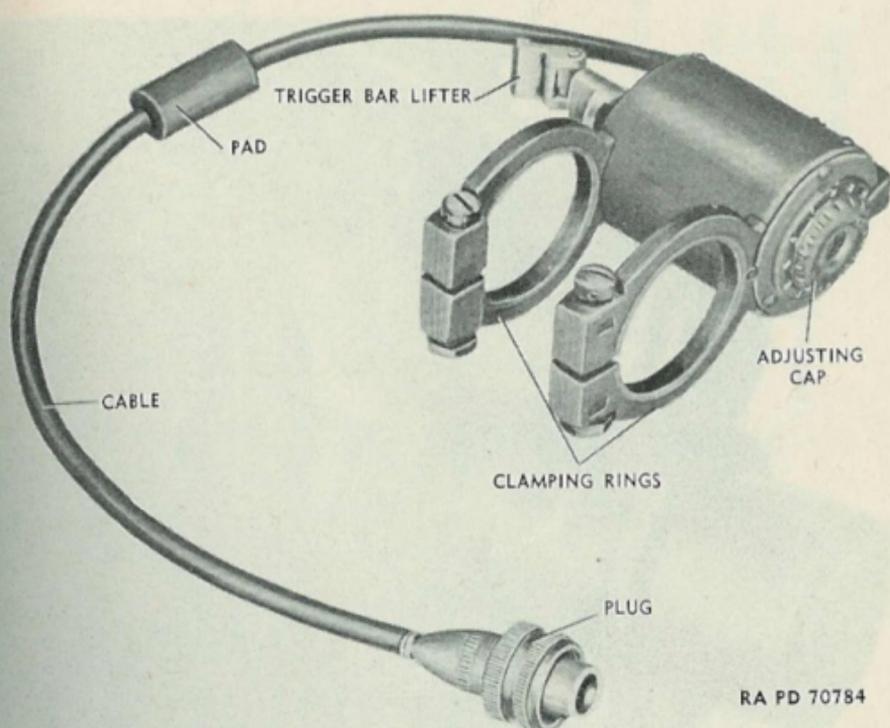
(5) Under conditions of training, when the M33 Mount is used for more than 4 hours daily, the charging rate should be set for not over 20 amperes. This will materially increase the generator life. Furthermore, every effort should be made to use supplemental means of charging the mount storage batteries. Portable chargers may be utilized, or the batteries may be removed and charged separately, if equipment is available. Under conditions other than training, the generator should be allowed to charge at a maximum rate.

b. Batteries. Each 3-cell, 23 plates per cell battery is rated at 150 ampere-hours at a 20-hour rate. The batteries are located in the rear of the mount. Even though the reading on the voltmeter in the junction box, located above the batteries, indicates that the charge of the batteries is "good," the batteries should be checked with a hydrometer to insure an accurate estimate of condition (par. 49).

NOTE: On later M45 Mounts the voltmeter has been removed.

c. Hydrometer. A hydrometer for determining the true specific gravity of the electrolyte in the batteries has been installed on later mounts. It is mounted to the rear and left side of the mount in a hydrometer case.

DESCRIPTION AND FUNCTIONING



RA PD 70784

Figure 17—Firing Solenoid

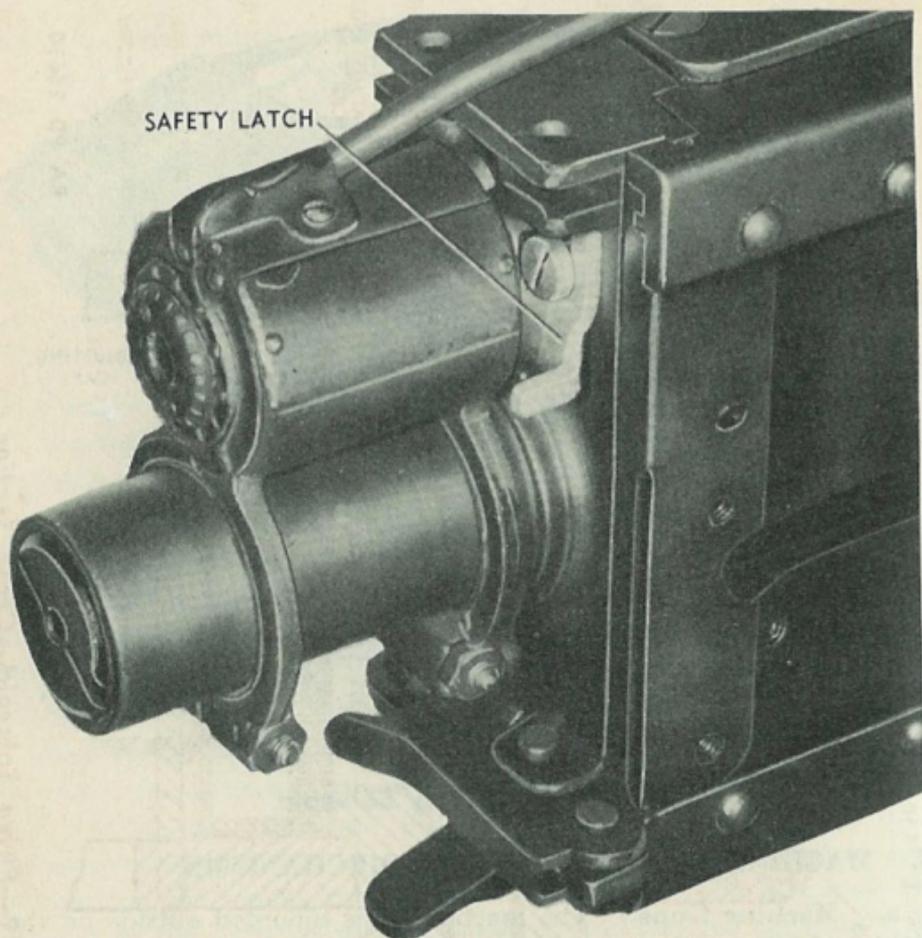
9. MACHINE GUNS AND FIRING MECHANISMS.

a. **Machine Guns.** The machine guns mounted outside on the right and left trunnions of the mount are of the heavy barrel, turret type (TT).

These guns are the M2 aircraft, with the following modifications:

- (1) The barrel jacket has been removed.
- (2) The barrel has been replaced with a heavy barrel.
- (3) The gun is cocked by means of a retracting slide.
- (4) The oil has been removed from the oil buffer.
- (5) The guns on the M45 Mounts are provided with barrel supports; those on M33 Mounts are provided with Edgewater adapters. The Edgewater adapter is a ring spring recoil absorber. It consists of an inner shell which is threaded onto the trunnion block and an outer shell containing a series of overlapping spring rings. The springs consist of an overlapping inner and outer set with beveled and engaging surfaces. When the gun recoils, the springs act together to compress the inner rings and expand the outer rings. The recoil is neutralized by the frictional engagement of the rings.

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**



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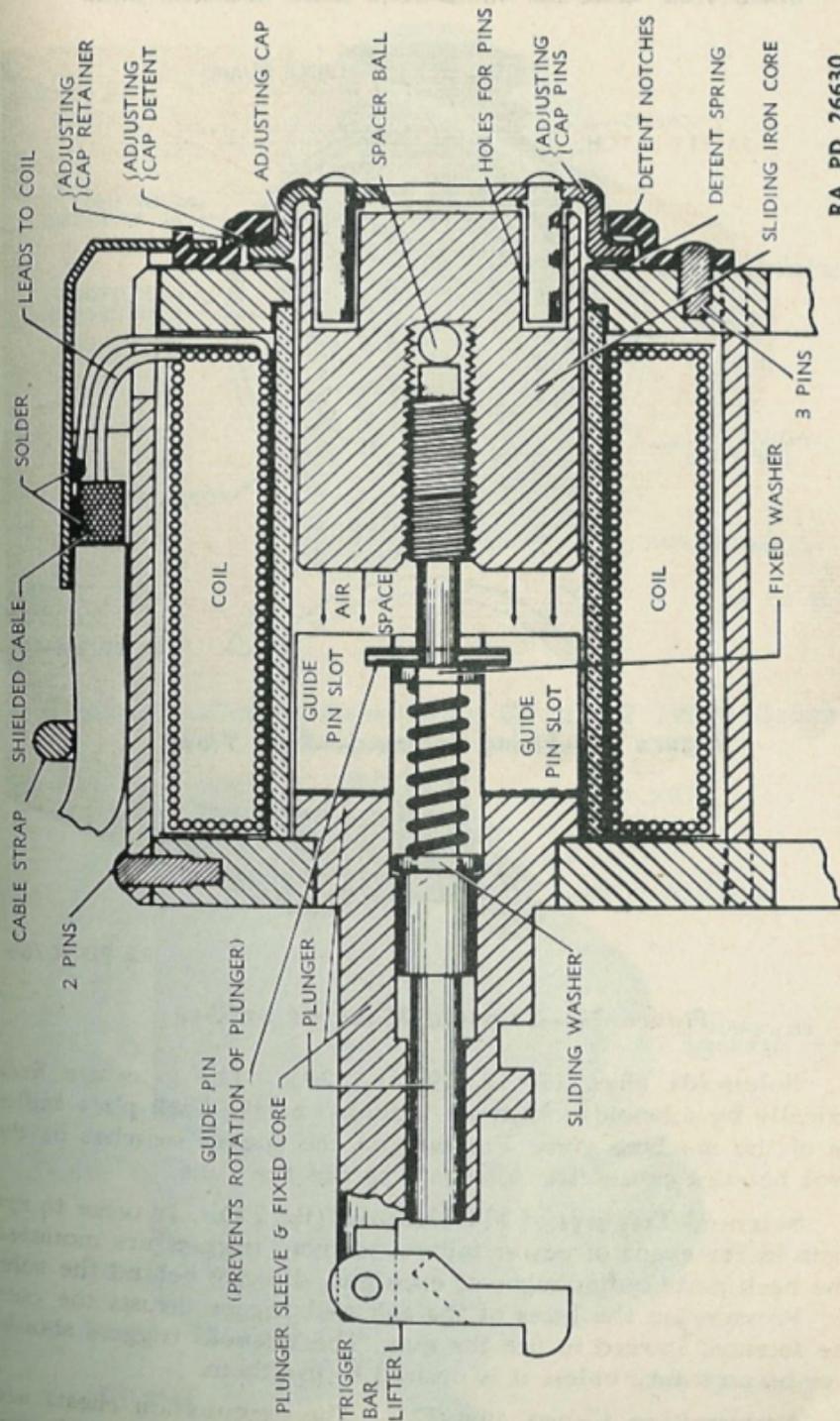
Figure 18—Solenoid Mounted on Gun

b. Solenoids (figs. 17, 18, 19, and 20). The guns are fired electrically by solenoids which are mounted on the back plate buffer tubes of the machine guns. Pressure on the trigger switches in the control handles causes the solenoids to fire the guns.

c. Solenoid Triggers of M45 Mounts (fig. 21). In order to fire the gun in the event of power failure, solenoid triggers are mounted on the back plate buffer tubes of each gun, directly behind the solenoids. Pressure on the lever of the solenoid trigger thrusts the core of the solenoid inward to fire the gun. The solenoid triggers should always be on safety unless it is desired to use them.

d. Ammunition Chests (fig. 22). The ammunition chests are standard cal. .50, M2 Chests with a capacity of 200 rounds each. On

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RA PD 26630

Figure 19—Firing Solenoid—Cross Section

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**

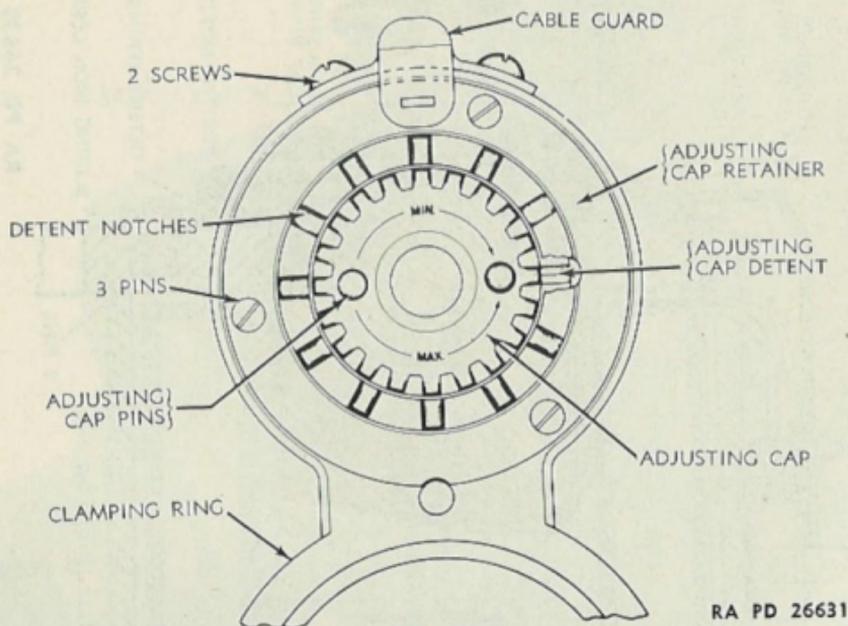


Figure 20—Firing Solenoid—Rear View

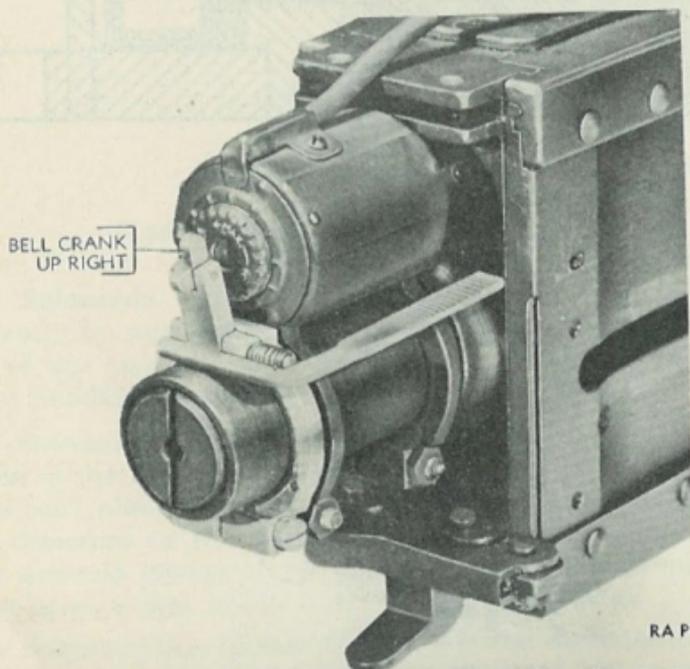
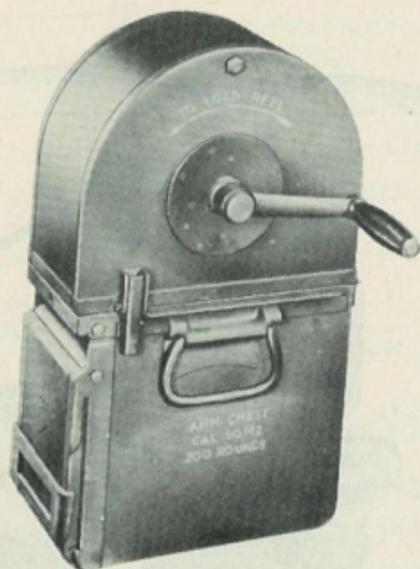


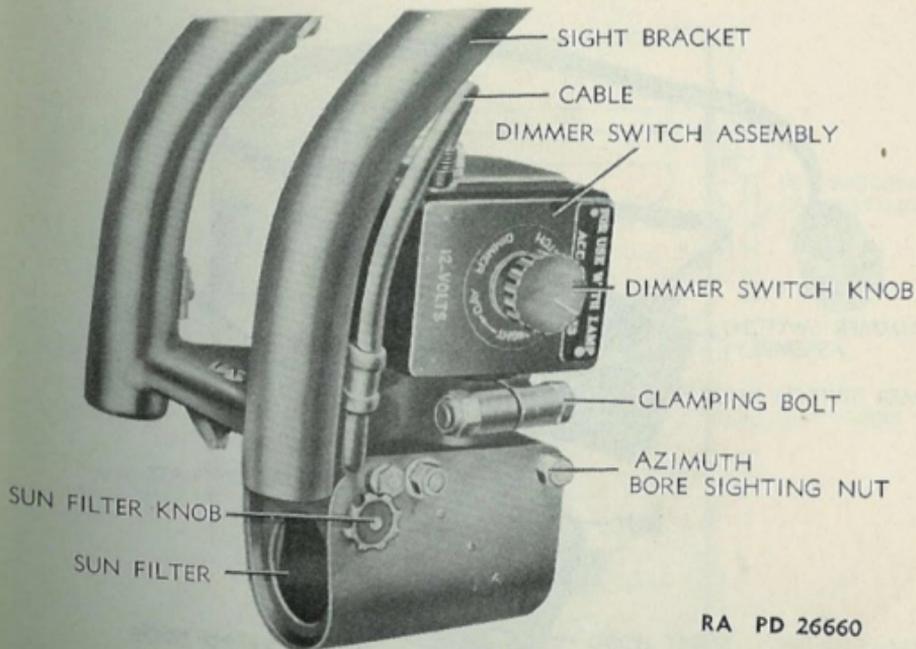
Figure 21—Solenoid Trigger (M45 Mount)—In Safety Position

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RA PD 86100

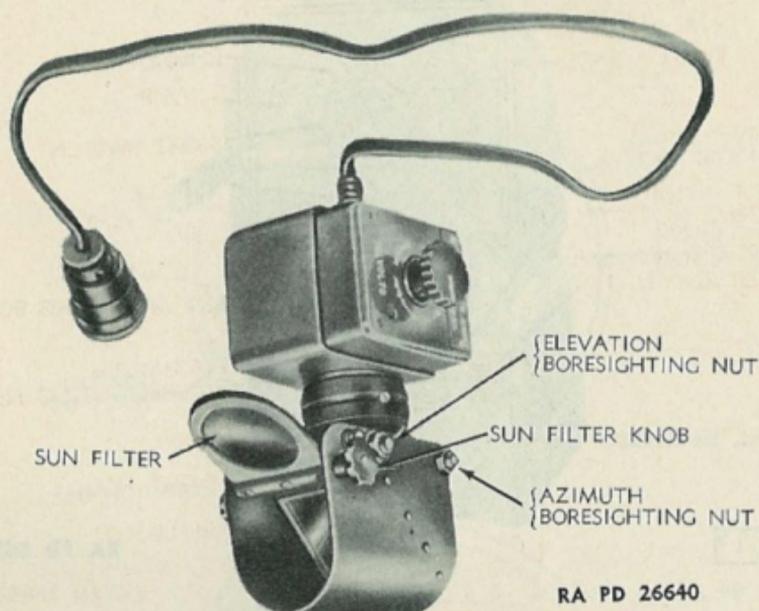
Figure 22—Cal..50 Ammunition Chest M2 (With Crank)



RA PD 26660

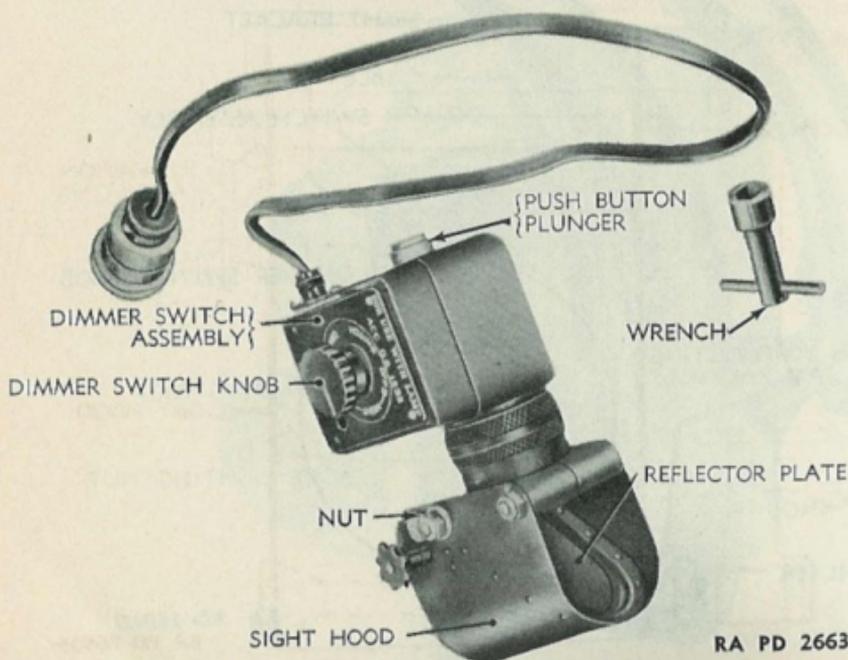
Figure 23—Mk. IX Reflector Sight—Mounted

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
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RA PD 26640

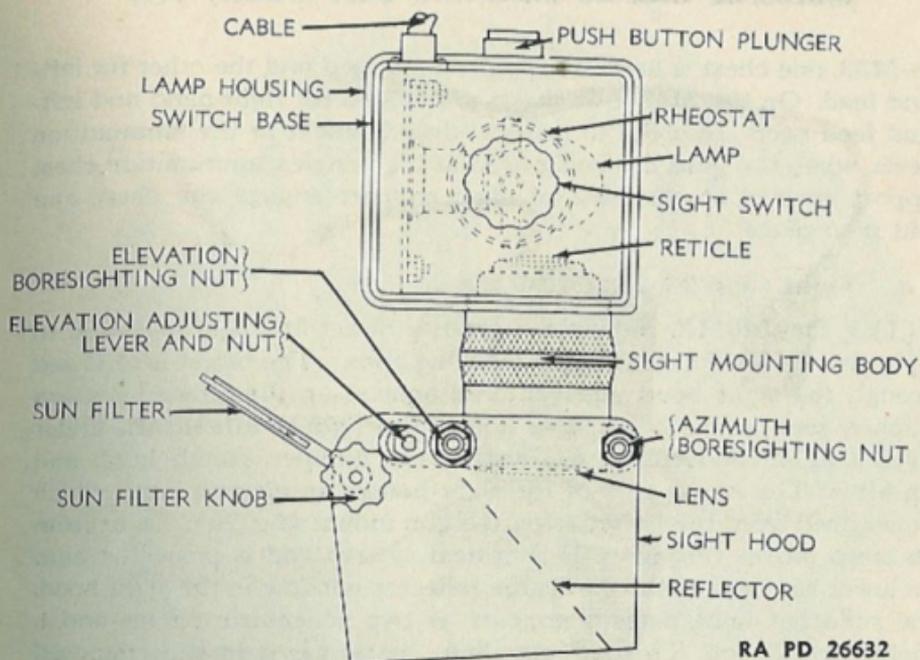
Figure 24—Mk. IX Reflector Sight Showing Sun Filter Open



RA PD 26639

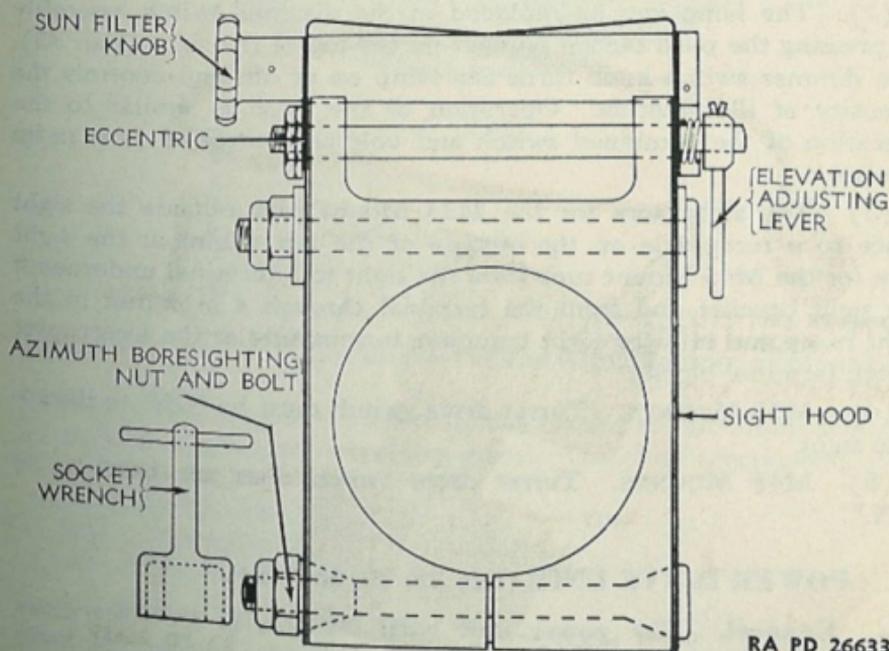
Figure 25—Mk. IX Reflector Sight Showing Reflector Plate

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RA PD 26632

Figure 26—Mk. IX Reflector Sight—Left Side View



RA PD 26633

Figure 27—Mk. IX Reflector Sight—Reflector Housing Plan View

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

the M33, one chest is loaded for right-hand feed and the other for left-hand feed. On the M45, two chests are loaded for right-hand and left-hand feed each. In order to prevent dislodgement of the ammunition chests, when the guns are being fired at high angles, ammunition chest support springs at the base of each support engage the chest and hold it in place.

e. Sight (figs. 23, 24, 25, 26, and 27).

(1) The Mk. IX Reflector Sight is a direct fire sight and used to apply travel lead for aiming the machine guns. The target is followed through the sight hood and centered against an illuminated pattern which is seen in the hood. The line of the sight is established under varying light conditions by adjusting the dimmer switch knob and sun filter. The upper part of the sight houses an electric lamp which is energized from the batteries on the gun mount (fig. 26). Light from the lamp passes through a lens optical system and is projected onto the lower surfaces of the 45-degree reflector window in the sight hood. The reflected light pattern appears as two concentric circles and a bright central dot. This reflector light pattern is seen superimposed in the window area. The sun filter located at the front of the hood can be lifted out of the line of sight for night operation by pressing and rotating the sun filter knob.

(2) The lamp can be replaced in the dimmer switch assembly by pressing the push button plunger on the top of the sight (par. 33). The dimmer switch knob turns the lamp on or off, and controls the intensity of illumination. Operation of the knob is similar to the operation of the combined switch and volume control of most radio receivers.

(3) The sight wire for the M33 Mount runs outside the sight brace to a receptacle on the outside of the left trunnion; the sight wire for the M45 Mount runs from the sight to a terminal underneath the sight bracket and from the terminal through a grommet in the sight brace and into the right trunnion, terminating at the interrupter switch terminal block.

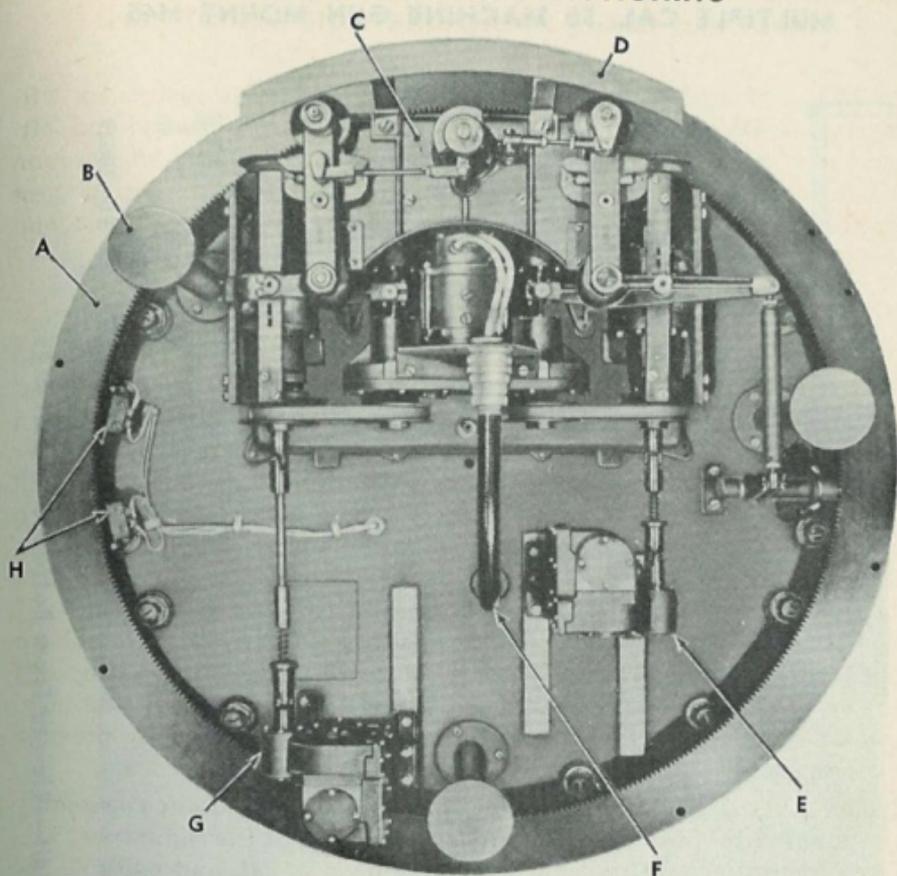
(4) M33 MOUNTS. Turret drive switch must be "ON" to illuminate sight.

(5) M45 MOUNTS. Turret drive switch does not have to be "ON."

10. POWER DRIVE UNIT (figs. 28, 29, and 30).

a. General. The power unit with controls is an electrically operated, variable speed drive which is housed beneath the main frame of the mount. It is equipped with two independent output

DESCRIPTION AND FUNCTIONING



- A — TURRET RING GEAR
 B — FOOT
 C — POWER DRIVE
 D — GUARD
 E — ELEVATION GEAR BOX
 F — POWER CONDUIT
 G — AZIMUTH GEARS
 H — AZIMUTH INTERRUPTER SWITCHES

RA PD 26645

Figure 28—Power Drive Unit—Viewed From Bottom of Mount M33

shafts for elevating and traversing the mount at maximum speeds of at least 60 degrees per second or more. The chief components of the unit are:

- (1) Power drive.
- (2) Differentials.
- (3) Controls.

b. Power Drive (fig. 30).

(1) For the sake of clarity, only the azimuth side of the motor shown in figure 30 will be considered in the following explanation.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
 MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

- A — FOOT
- B — GUARD
- C — POWER DRIVE
- D — THERMOSTAT
- E — BLOCK
- F — RELAY
- G — ELEVATION GEAR BOX
- H — TURRET RING GEAR
- I — AZIMUTH GEAR BOX
- J — AZIMUTH INTERRUPTER SWITCHES

RA PD 26629

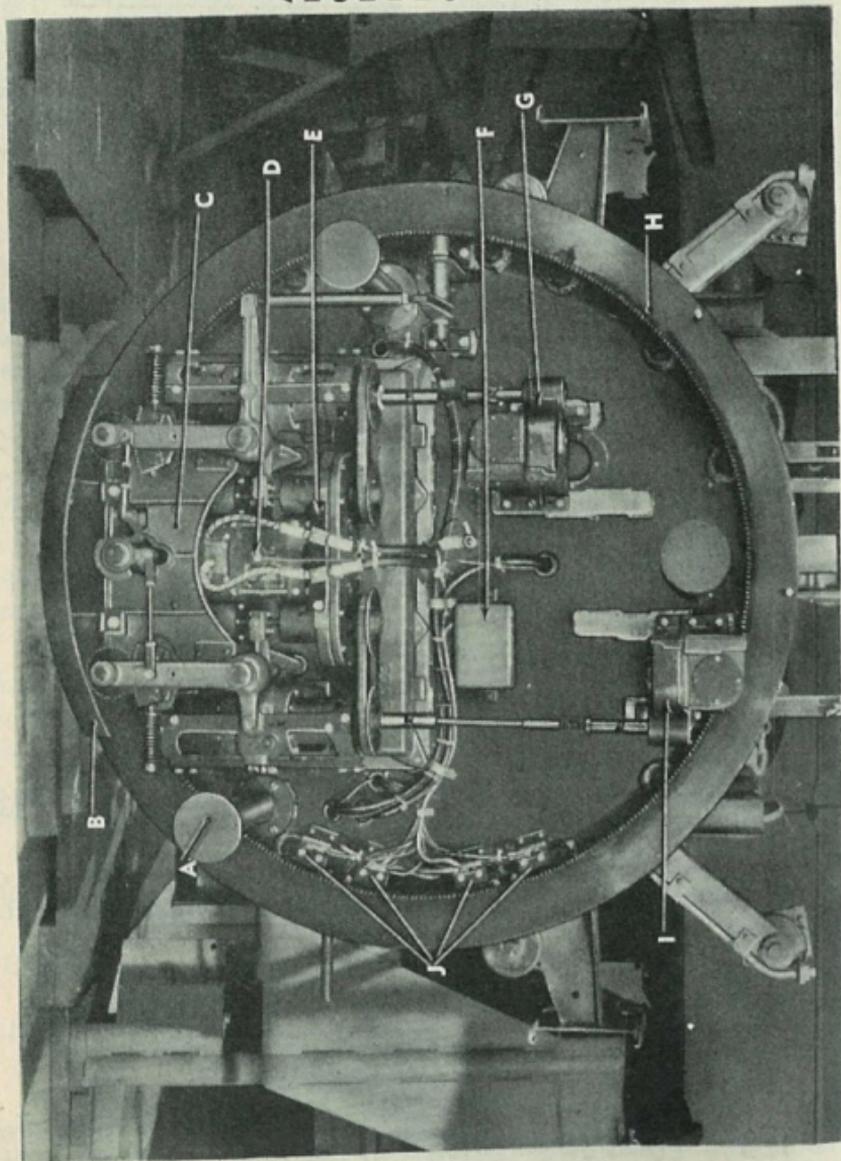
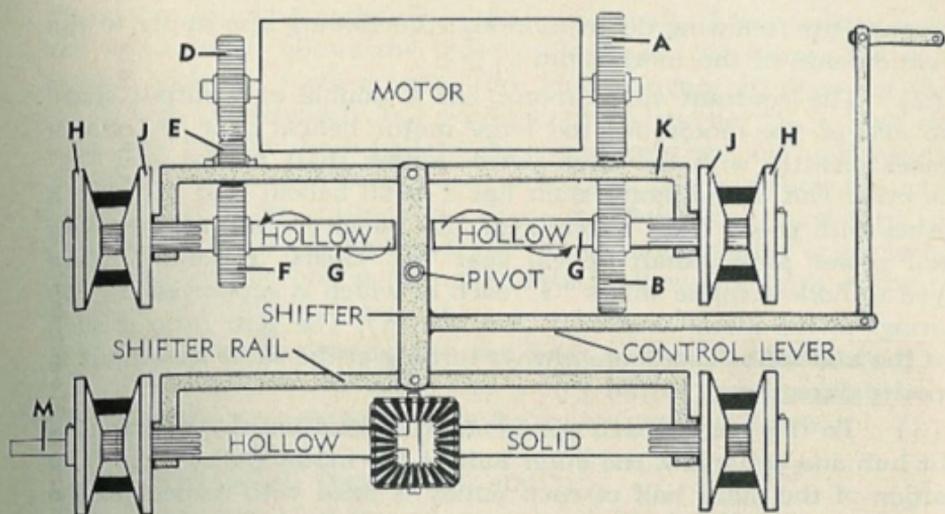
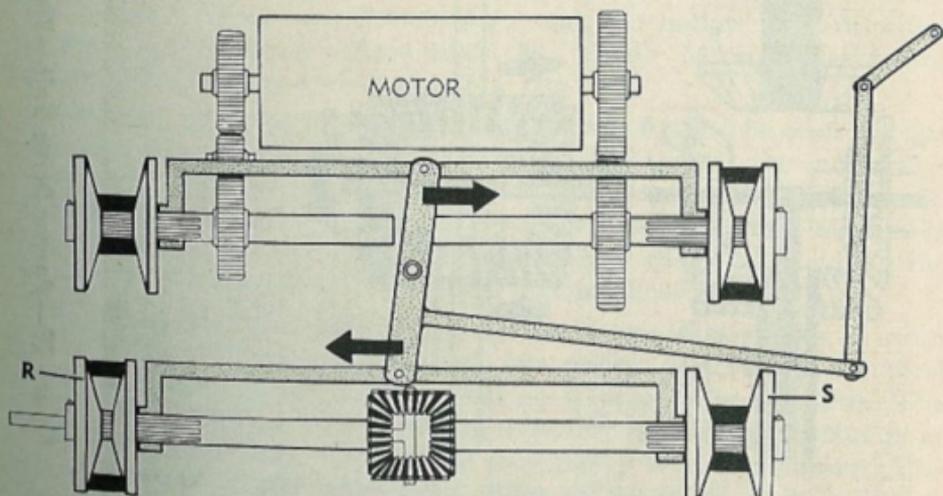


Figure 29—Power Drive Unit—Viewed From Bottom of Mount M45

DESCRIPTION AND FUNCTIONING



POSITION 1



POSITION 2

RA PD 26628

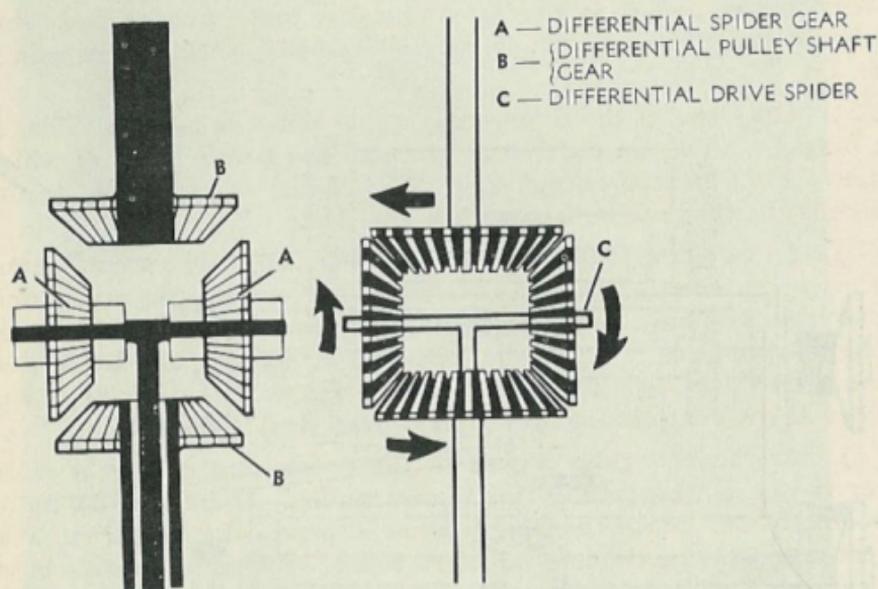
Figure 30—Power Drive Unit—Azimuth Side

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

However, the following description and functioning also apply to the elevation side of the motor unit.

(2) The constant speed motor has a double end output shaft. One end of the motor has the large motor helical gear "A" which meshes directly with the large power pulley shaft helical gear "B." The other end of the motor shaft has a small helical gear "D" which meshes with power idler helical gear "E," which in turn meshes with small power pulley shaft helical gear "F." Gears "B" and "F" are keyed to hollow spline shafts "G," each of which is supported by two bearings in the motor unit case (not shown). The gear ratio is such that the two spline shafts are always turning at the same speed but in opposite directions.

(3) To the end of each spline shaft is attached, by means of a split hub and set screw, the outer half of the motor pulley "H." The position of the outer half of each pulley is fixed with respect to the motor unit case. Each outer pulley turns with the spline shaft.



RA PD 26643

Figure 31—Schematic Diagram of Differential Gearing

(4) The inner half "J" of each motor pulley is splined and can slide on the shaft between the outer half of the pulley and the motor unit case, but must turn with the spline shaft. The two opposite inner motor pulleys are joined together by means of a shifter rod, which passes through the hollow spline shafts. The shifter rod is pinned to

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each of the two inner pulleys by means of a straight pin, which goes through a slot cut lengthwise in the spline shaft. The presence of this slot in the shaft allows the inner pulleys and the shifter rod to be moved back and forth at will. For clarity, figure 30 does not show the shifter rod assembly, but represents it by the bar "K." This indicates how the two inner pulleys are joined together and how they can be moved back and forth as a unit, although it does not show the actual construction of the shifter rod. Since the shifter rod must turn with the pulley to which it is pinned, the shifter rod assembly is cut in half and has a bearing box in its center, which allows the ends of the rod to rotate in opposite directions.

(5) By moving the shifter rod back and forth, the pitch of the two pulleys can be changed. The pulley halves are so adjusted that when one is at its maximum pitch the other is at its minimum.

c. Differentials (figs. 30, 31, and 32).

(1) The differential pulleys are operated in the same way except that an external cross bar guide shifter rail, attached to the differential pulley bearing yokes, is used to move the inner pulleys back and forth instead of the internal shifter rod assembly used on the power unit.

(2) Only one of the differential spline shafts is hollow. That is the output side of the differential through the hollow shaft of which passes the differential output shaft "M." Shaft "M" is pinned to the differential spider and rotates with it (fig. 31).

(3) By referring to figure 30, position No. 2, it will be seen that the shifter, when actuated by the control linkage, causes the motor unit shifter rod assembly to move in one direction and the differential shifter assembly to move in the opposite direction. The blacked-in sections on the pulleys in figure 30 show how the V-belts ride in the pulleys as the controls are moved in a given direction.

(4) As the belt rides higher in the power unit pulley, it rides lower in the corresponding differential pulley. Therefore, the total belt length and hence the belt tension is practically constant. The lowest speed of the differential drive pulley is when its radius is at a maximum and that of the power unit pulley is at a minimum. The greatest speed of the differential drive pulley is when its radius is smallest and that of the power unit pulley is largest.

(5) In figure 30, position No. 2, it will be seen that differential pulley "S" rotates faster than differential pulley "R." In order to compensate for this difference in speed of the differential spline shafts, the differential spider gears must "walk" around the differential pulley shaft gears, thus rotating the output shaft. When both differential spline shafts are rotating at the same speed, i.e., when the pitch of

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
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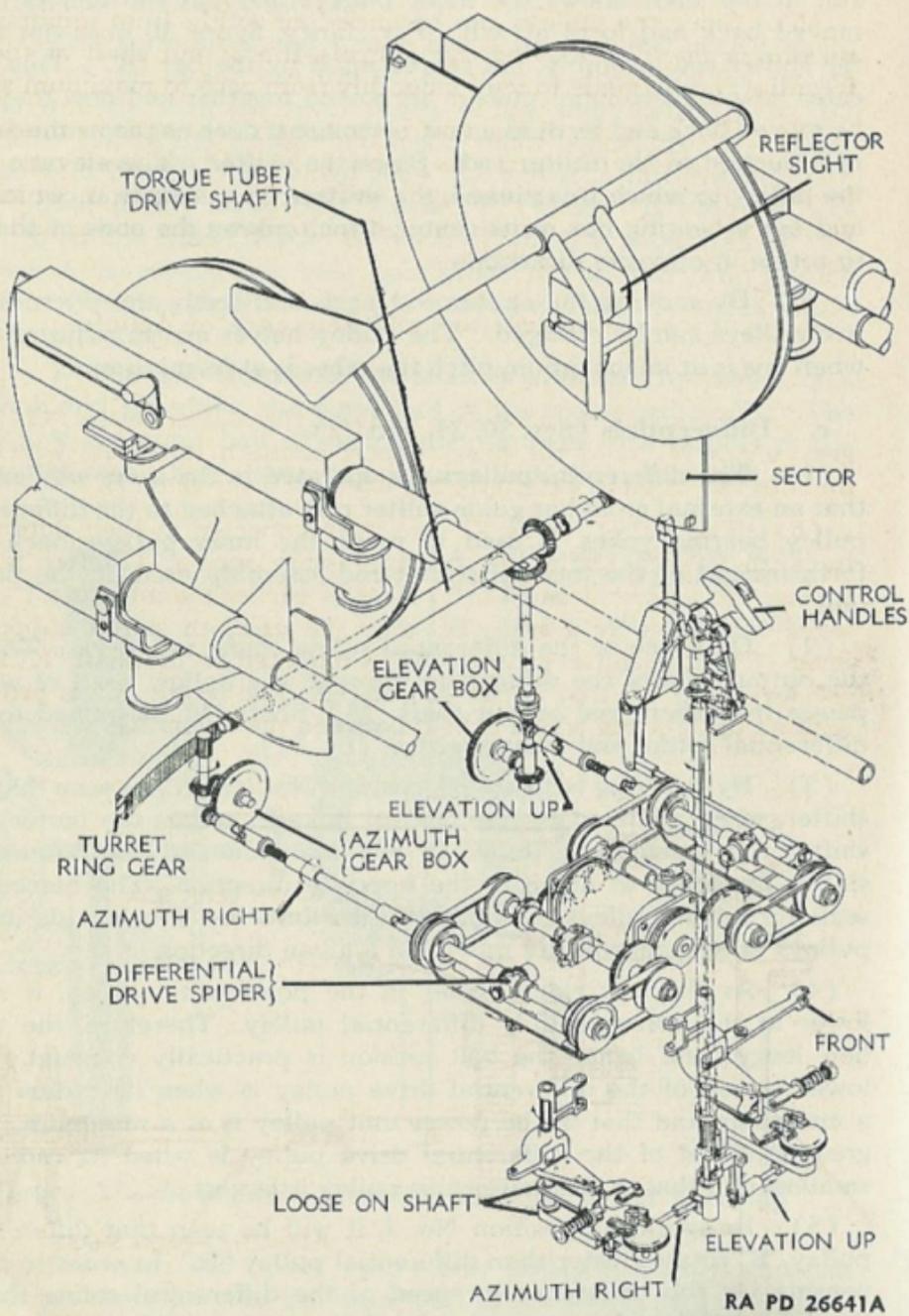


Figure 32—Schematic Diagram of Power Drive Unit

DESCRIPTION AND FUNCTIONING

all four pulleys is the same (fig. 30, position No. 1) the spider remains stationary and only its gears revolve.

(6) Since the pulleys can be varied smoothly from minimum to maximum pitch by moving the controls, the output shaft of the differential can be made to vary smoothly from zero to maximum speed.

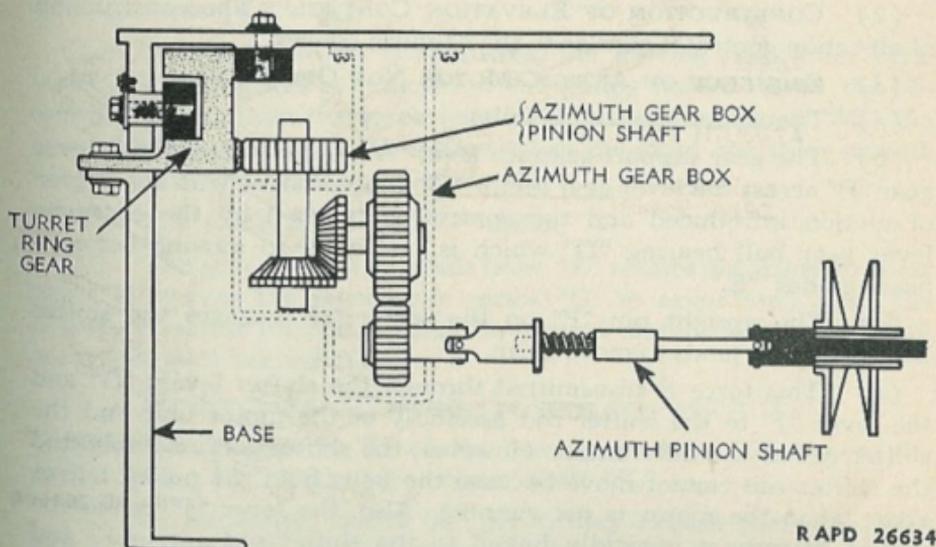
(7) The azimuth differential output shaft drives the azimuth gear box, which drives the turret ring gear (fig. 32A). The elevation differential output shaft drives the elevation gear box from which the gearing action is transmitted through the torque tube power and drive shafts to the sectors (fig. 32B).

d. Controls: Construction and Sequence of Action.

(1) CONSTRUCTION OF AZIMUTH CONTROL (fig. 33).

(a) The azimuth control consists of the shifter levers "G," lever gear sector "C," and the gear support azimuth lever "A" which has mounted at its outer extremity the azimuth lever gear "B."

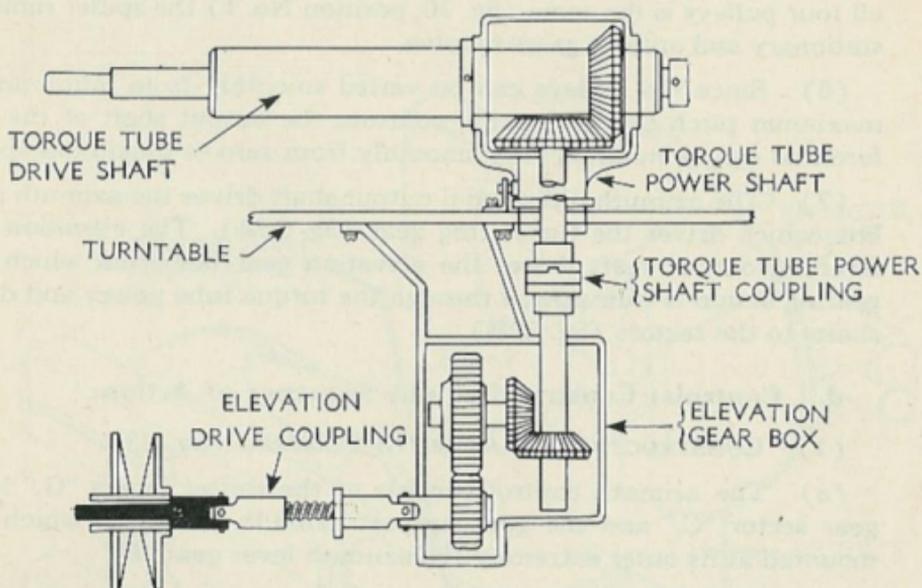
(b) The shifter levers "G" are interconnected at their outer ends by a shaft with shifter lever compression spring. (Shifter tension springs are provided on M33 Mounts of earlier manufacture.) Each lever is pivoted by a stud "H" onto the azimuth shifter supporting lever "J." The gear lever sector "C" is mounted on the shaft "K" below the levers "G" so that it can be rotated. The sector "C" is provided with an upright pin which is held between the levers "G."



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Figure 32A—Azimuth Power Train

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Figure 32B—Elevation Power Train

(c) The gear support azimuth lever "A" is mounted on the shifter supporting lever shaft "K" below the sector "C" so that it can be rotated. Lever "A" is so mounted that the azimuth lever gear "B" meshes the lever gear sector "C."

(2) CONSTRUCTION OF ELEVATION CONTROL. The construction of elevation control is similar to the azimuth control.

(3) SEQUENCE OF ACTION, MOTOR NOT OPERATING.

(a) The azimuth tie rod L shifts.

(b) The gear support azimuth lever "A" rotates the azimuth lever gear "B" across the lever gear sector "C" in accordance with the degree of motion introduced and the control established by the eccentric lever gear ball bearing "D" which is restricted to moving between fixed guides "E."

(c) The upright pin "F" on the sector "C" engages the shifter levers "G" and tends to move them.

(d) This force is transmitted through the shifter levers "G" and the lever "J" to the shifter rod assembly of the motor unit and the shifter rail of the differential. However, the shifter rod assembly and the shifter rail cannot move because the belts hold the pulley halves apart when the motor is not running. Also, the lever "J" cannot be moved because it is rigidly linked to the shifter rod assembly and shifter rail.

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(e) Therefore, when the upright pin "F" on the sector "C" engages the lever "G" and shifts, the levers "G" expand compressing the spring "M," and the lever "J" remains stationary.

(f) When the pressure on the control handles is released, the force of the shifter lever spring returns the sector "C," the lever "A," and the input control to zero speed position.

(4) ELEVATION CONTROL (figs. 33 and 33A). The sequence of action for elevation control is the same as for azimuth control.

11. CONTROL OPERATION—MOTOR OPERATING.

a. Azimuth (fig. 33).

(1) As the azimuth input control is moved from neutral position, the azimuth tie rod "L" shifts the gear support azimuth lever "A." The azimuth lever gear "B" pivots the gear lever sector "C" in the opposite direction. However, the rotation of the gear "B" is limited by the small lever gear ball bearing "D" confined between the lever gear ball bearing guides "E" which are fixed to the control column mounting plate (not shown). Therefore, the changing relation of the rotation axis of the bearing "D" to the rotation axis of the gear "B" determines the extent of the rotation of the gear "B" and, hence, the displacement of sector "C." The action of the bearing "D" is such as to cause the gear "B" to rotate at an ever increasing rate as the sector "C" moves from zero speed position. The net result is a progressively increased rate of azimuth rotation relative to control handle movement for higher speeds (slewing) and a greatly decreased rate for slower speeds (tracking).

(2) When the motor is operating, the moving belts offer little resistance to changes in position of the pulley halves. Since this resistance is less than the force required to compress spring "M," the levers "G" do not spread. Therefore, when the input control is moved, the following sequence of action occurs:

(a) The azimuth tie rod "L" shifts.

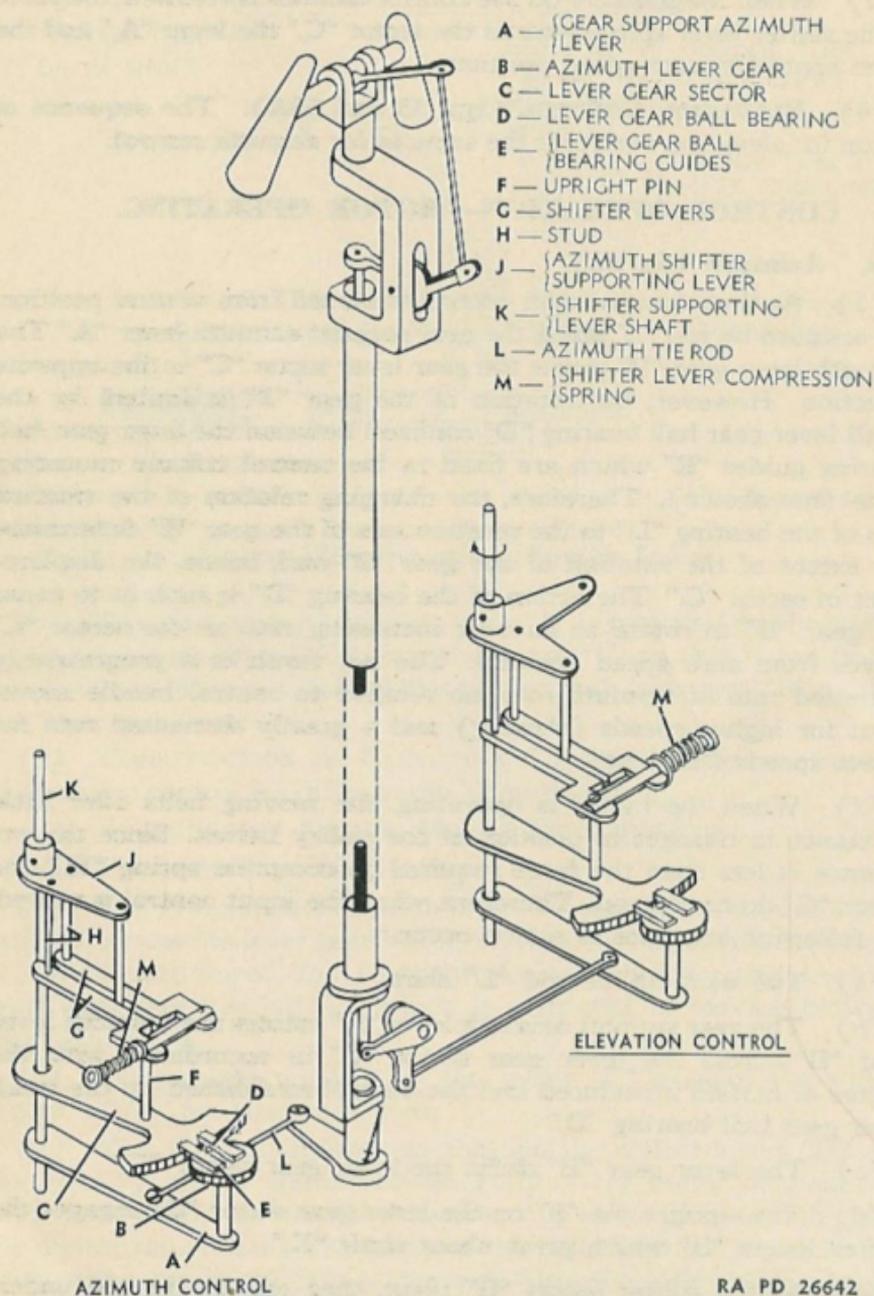
(b) The gear support azimuth lever "A" rotates the azimuth lever gear "B" across the lever gear sector "C" in accordance with the degree of motion introduced and the control established by the small lever gear ball bearing "D."

(c) The lever gear "B" shifts the lever gear sector "C."

(d) The upright pin "F" on the lever gear sector "C" engages the shifter levers "G" which pivot about shaft "K."

(e) As the shifter levers "G" pivot, they engage the pin underneath the azimuth shifter supporting lever "J" and thereby pivot the lever "J."

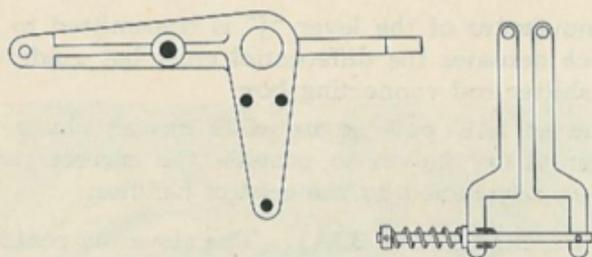
**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**



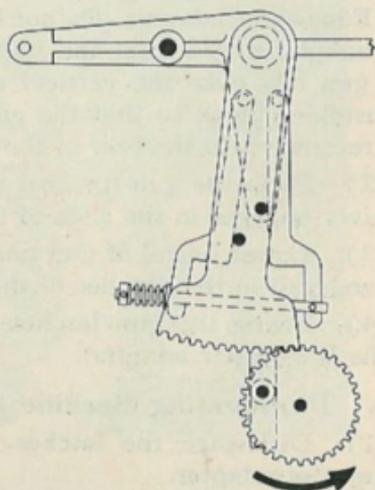
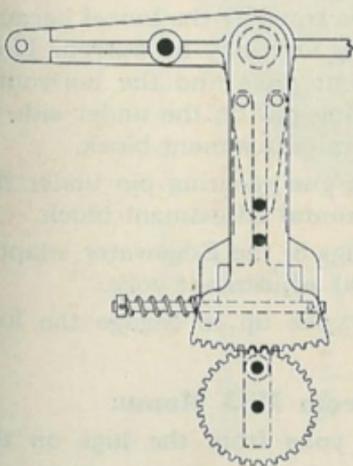
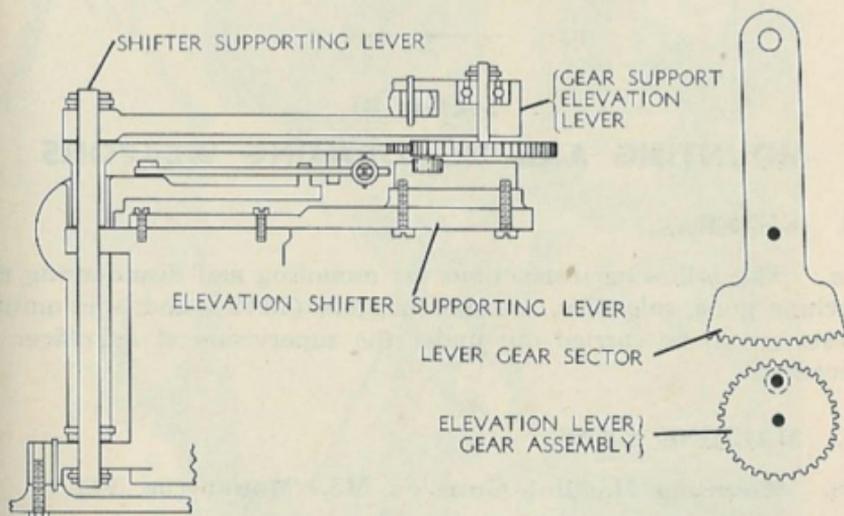
RA PD 26642

Figure 33—Schematic Diagram of Controls

DESCRIPTION AND FUNCTIONING



SHIFTER ELEVATION ASSEMBLY



RA PD 26620

Figure 33A—Elevation Controls

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**

(f) The movement of the lever "J" is transmitted to the shifter assembly which actuates the differential cross bar guide shifter rail and also the shifter rod connecting box.

(g) The inner half pulleys are thus moved closer or farther from the outer pulley halves to provide the correct radii for the output speed as determined by the control handles.

b. **Elevation** (figs. 33 and 33A). The elevation control with the motor operating is the same as the azimuth control.

Section III**MOUNTING AND DISMOUNTING WEAPONS****12. GENERAL.**

a. The following instructions for mounting and dismounting the machine guns, solenoids, solenoid triggers (M45), and ammunition chests are to be carried out under the supervision of an officer or mechanic.

13. MACHINE GUNS.**a. Mounting Machine Guns on M33 Mount (fig. 34).**

(1) Lift the gun at the rear by the receiver and at the front by the Edgewater adapter. Do not lift at the front by the barrel because the adapter may rotate and its mounting lugs may be burred. Hold the gun low over the vertical adjustment yoke and the horizontal adjustment block so that the gun securing pin on the under side of the receiver is to the rear of the horizontal adjustment block.

(2) Slide the gun forward until the gun securing pin under the receiver engages in the slots of the horizontal adjustment block.

(3) Lower barrel of gun until the lugs of the Edgewater adapter are engaged in the notches of the vertical adjustment yoke.

(4) Swing the gun latches on the yoke up to engage the lugs of the Edgewater adapter.

b. Dismounting Machine Guns From M33 Mount.

(1) Disengage the latches on the yoke from the lugs on the Edgewater adapter.

(2) Lift the gun by the Edgewater adapter (do not lift by the barrel) until the lugs on adapter clear the notches in the vertical adjustment yoke.

MOUNTING AND DISMOUNTING WEAPONS

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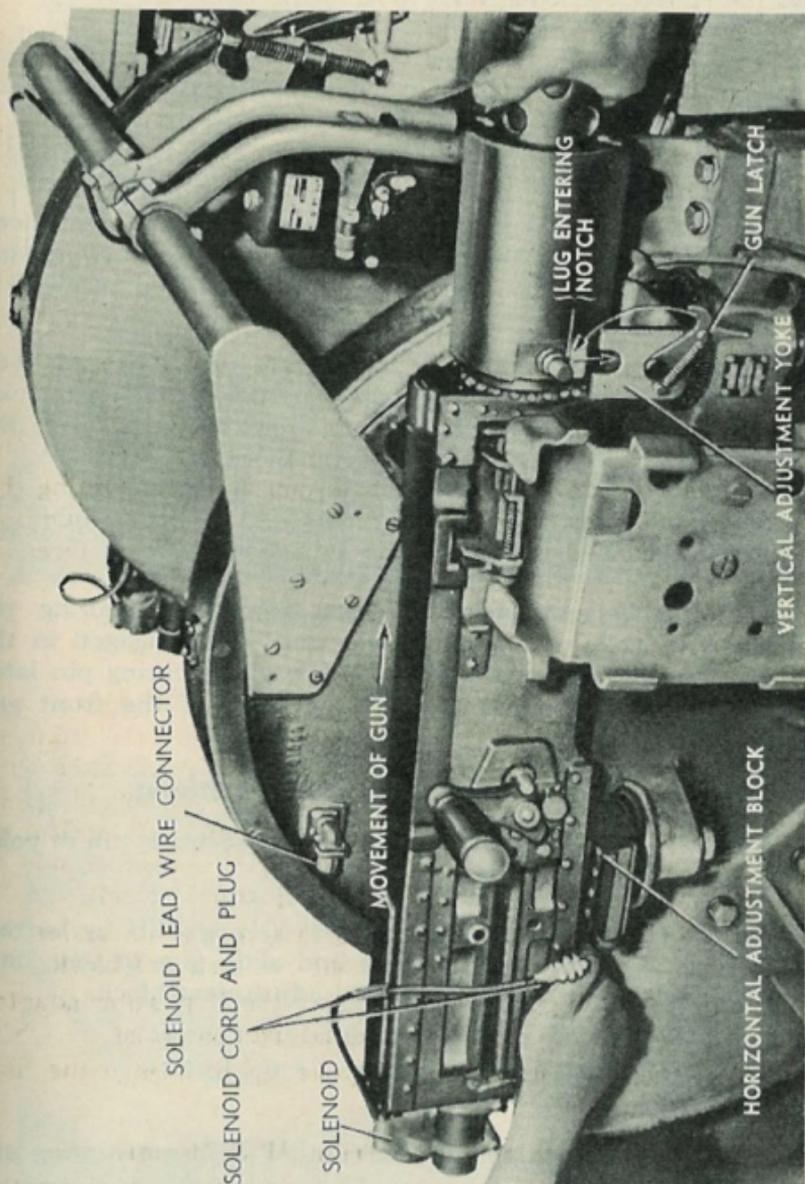


Figure 34—Mounting Machine Gun on M33 Mount

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**

(3) Slide the gun to the rear so that the gun securing pin clears the slots of the horizontal adjustment block.

(4) Lift the gun from the mount.

NOTE: If the M33 Mount has been modified to carry machine guns provided with barrel supports instead of Edgewater adapters, the procedure in subparagraphs c and d, below, should be followed.

c. Mounting Machine Guns on M45 Mount (figs. 35 and 36).

(1) Lift the gun and place over the horizontal adjustment block and vertical adjustment yoke with the retracting slide outward and the rear gun securing pin on the under side of the gun receiver in front of the horizontal adjustment block.

(2) With one man holding the barrel support of the gun (do not hold by barrel) above and clear of the vertical adjustment yoke, ease the gun back until the rear gun pin drops to the level of the horizontal slot in the horizontal adjustment block.

(3) With the rear gun securing pin engaged in the slot, move the gun forward and down until the hole in the forward end of the receiver lines up with the holes in the yoke.

(4) Using a twisting motion, insert front gun securing pin through holes in yoke and gun receiver until it is engaged in the hole in the opposite side of the yoke. Allow gun securing pin latch to enter the slot just behind the knurled head of the front gun securing pin.

d. Dismounting Machine Guns From M45 Mount.

(1) Disengage the latch from the front gun securing pin in yoke.

(2) Remove front gun securing pin.

(3) Lift front of gun by barrel support (do not lift by barrel) until the receiver just clears the yoke and slide gun to rear until the rear securing pin clears the horizontal adjustment block.

(4) Lift the gun from the mount.

14. SOLENOIDS.

CAUTION: Make sure guns are not loaded before mounting and adjusting solenoids.

a. Mounting the Solenoids (fig. 37).

(1) Remove pin and back plate filler piece from window at top of back plate.

MOUNTING AND DISMOUNTING WEAPONS

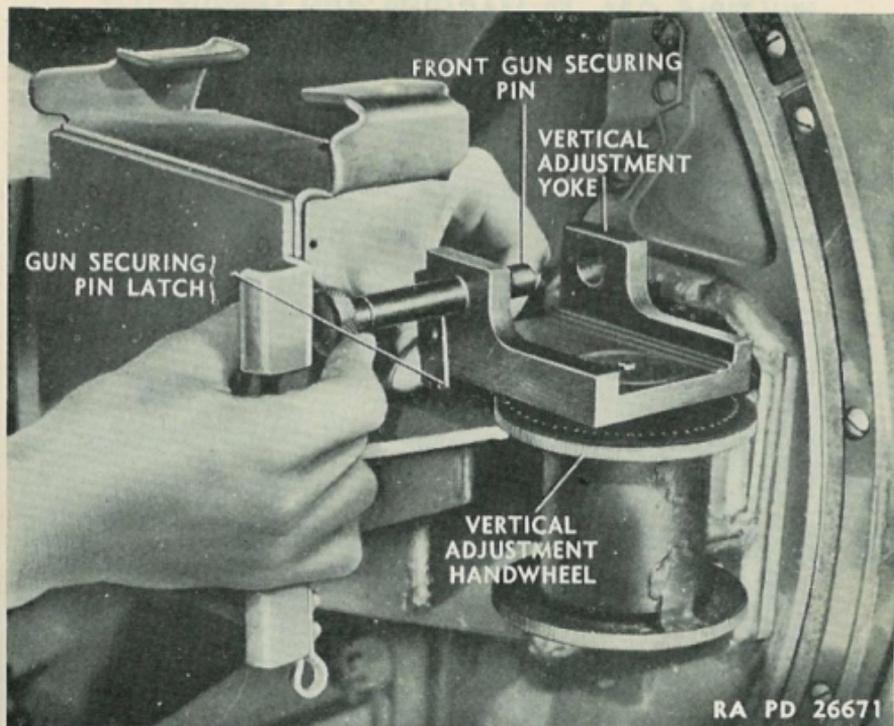


Figure 35—Front Gun Securing Pin on M45 Mount

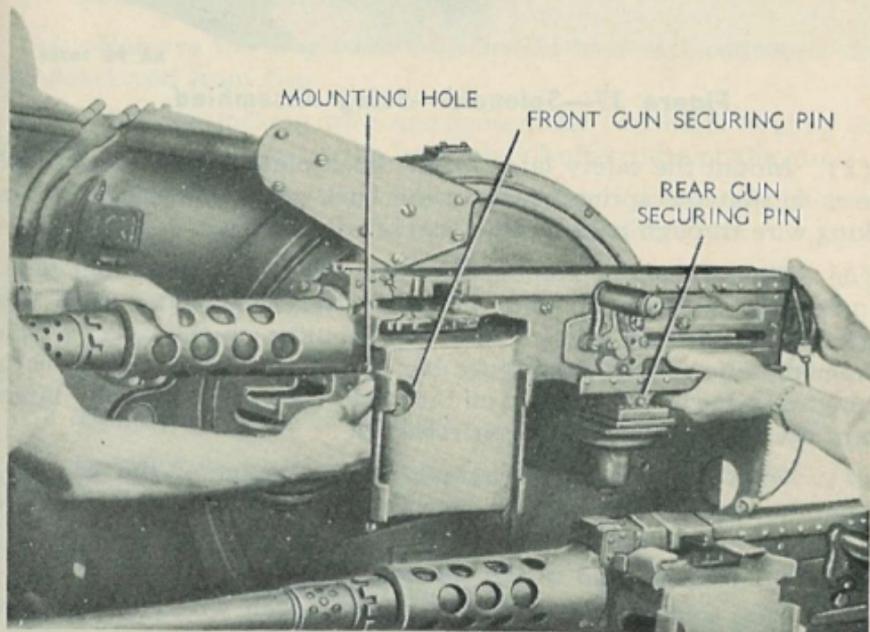
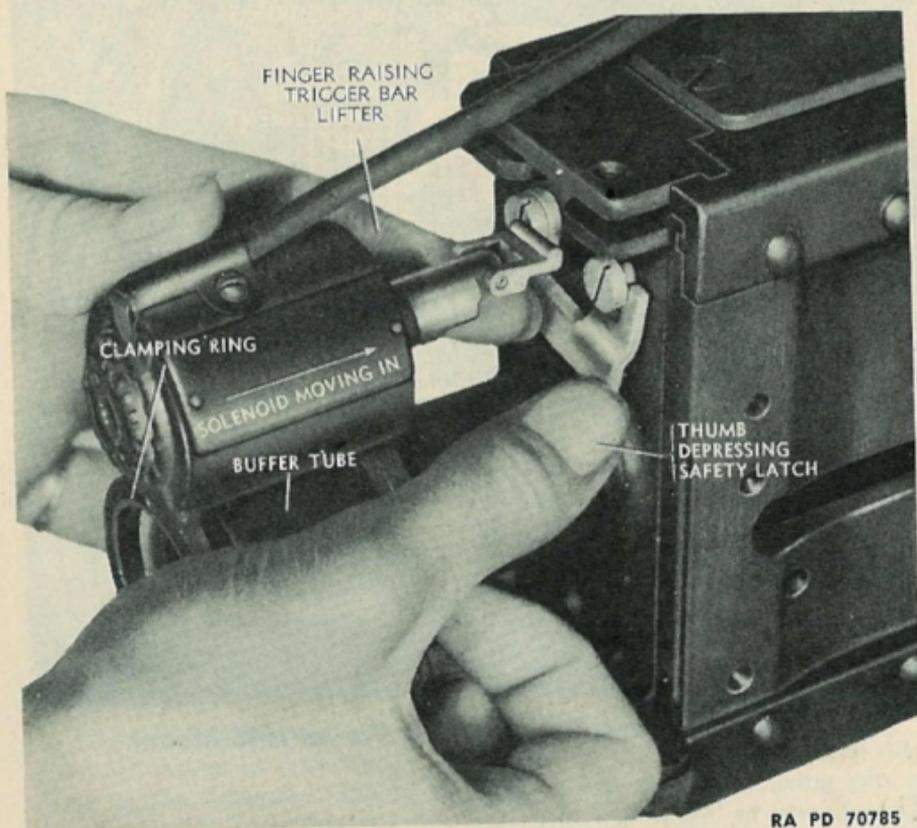


Figure 36—Machine Gun on M45 Mount

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 70785

Figure 37—Solenoid—Being Assembled

(2) Mount the safety latch on the back plate with special 10-32 screws so that the spring bears on the back plate buffer tube. Pass locking wire through holes in the head of each screw.

(3) Slide solenoid clamping rings over the back plate buffer tube. Depress the safety latch and raise the trigger bar lifter with the finger. Slide solenoid forward until the shoulder on the case (which is immediately behind the trigger bar lifter) comes in contact with the bottom edge of the window on the back plate, and the safety latch enters the slot in the case when released.

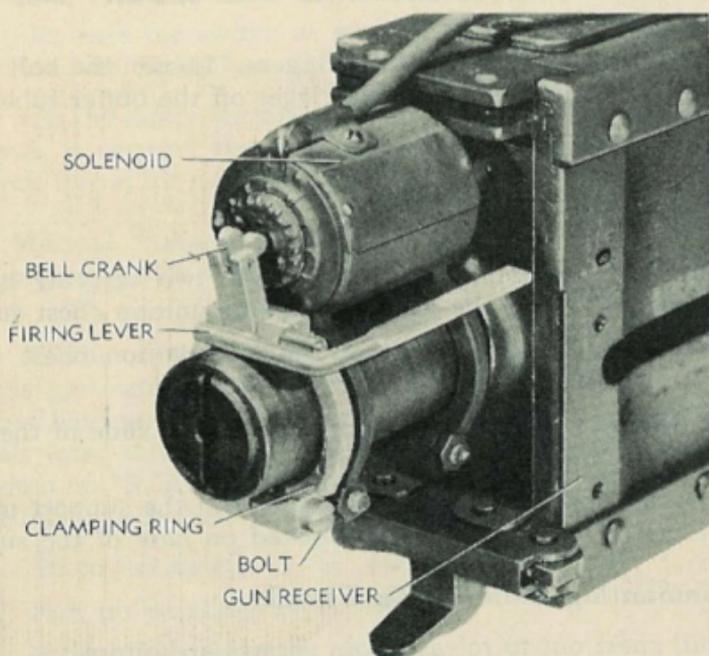
(4) With the case approximately in the center of the window, tighten the two bolts on the clamping rings. Pass locking wire through the hole in the head of each bolt.

(5) Insert cable pad in the solenoid clip.

(6) Plug solenoid lead into the solenoid lead wire connector in outer trunnion face.

NOTE: For adjustment of solenoids, see paragraph 23.

MOUNTING AND DISMOUNTING WEAPONS



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Figure 38—Solenoid Trigger in Firing Position on M45 Mount

b. Dismounting the Solenoid.

- (1) Remove the plug from the solenoid lead wire connector and disconnect pad from clip.
- (2) Remove locking wire and loosen the two bolts holding the solenoid clamping rings on the back plate buffer tube of the gun.
- (3) Remove locking wire from safety latch screws. Hold down the safety latch and slide the solenoid off the buffer tube.
- (4) If necessary, remove the safety latch and replace the back plate filler piece on gun.

15. SOLENOID TRIGGERS (M45 MOUNTS).

a. Mounting Solenoid Triggers.

- (1) Loosen the bolt on clamping ring of solenoid trigger.
- (2) With the firing lever pointing toward receiver, slide the trigger onto the buffer tube.
- (3) Tighten the clamping ring.

CAUTION: Do not aline bell crank on trigger with center of solenoid until ready to fire (fig. 38).

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
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b. **Dismounting the Solenoid Triggers.** Loosen the bolt on the clamping ring and slide the solenoid trigger off the buffer tube.

16. AMMUNITION CHESTS.**a. Mounting Ammunition Chests.**

(1) Grasp the ammunition chest by the two carrying handles and lift to slightly above the level of the ammunition chest support.

(2) Insert the tapered slides of the ammunition chest in the flanges of the ammunition chest support.

(3) Slide chest downward in support until the slide of the chest engages the ammunition chest support springs.

(4) Depress spring and seat chest firmly in the support making certain the end of the chest slide is hooked on base of the support.

b. Dismounting Ammunition Chests.

(1) Pull chest out to release from springs at bottom.

(2) Lift the chest straight up and out of the ammunition chest support.

Section IV**OPERATION AND ADJUSTMENTS****17. STARTING AND WARM-UP OF BATTERY CHARGER.****a. Electrical Starting.**

(1) Make sure that the generator switch on the control box cover is placed at "N" (neutral position).

(2) Pull up choke rod at least halfway. (This prestarting adjustment of the choke will vary according to weather conditions, or if the motor is still warm from previous use. Generally the motor should be choked full if in cold condition and very little if warm.)

(3) Make sure tank shut-off lever on top of gas tank is open. Four complete turns to left (counterclockwise) will open the lever.

(4) Turn the generator switch to "START" position (counterclockwise) until motor starts. This should be only a few seconds after the switch is turned to "START" position.

OPERATION AND ADJUSTMENTS

(5) Release the switch as soon as the motor starts. The switch will return automatically to "N" (neutral position).

(6) As the motor warms up, gradually adjust the choke rod until the motor is running smoothly. If starting in cold conditions, allow the motor to run for a few minutes before attempting to adjust choke.

b. Manual Starting. Manual starting is necessary when the motor will not crank electrically. Take the following steps for manual starting:

(1) If the motor will not crank electrically, make a final test with the generator switch after the motor fails to start when the switch is held on "START" position. Release switch and after one minute's wait, throw switch back to "START" again. Do not hold the switch on "START" position more than a few seconds at a time. If this final check fails to start the motor, follow the steps below:

(a) Place the switch in "N" (neutral position).

(b) Pull up on choke rod.

(c) Remove starter rope.

(d) Place knot at end of starter rope on inside of one of the two slots in the starter rope pulley. Wind rope around the pulley in a clockwise direction.

(e) If the power charger is not bolted down, steady the unit by holding the carrying handle.

(f) Holding the handle of the starter rope, pull up quickly on the rope (fig. 39).

(g) As soon as the motor starts, adjust the choke rod so that the motor runs smoothly.

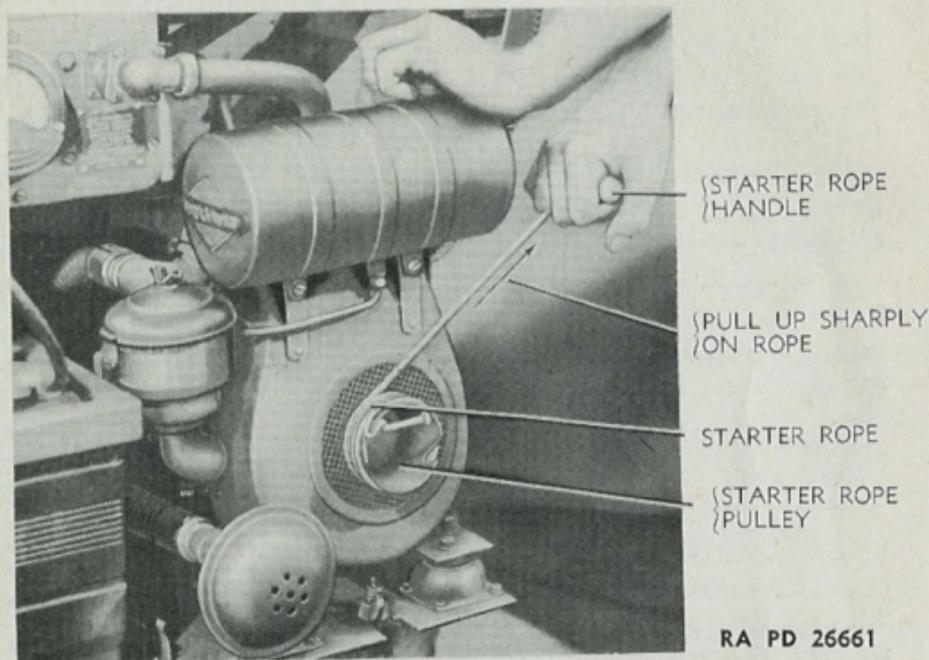
c. Generator Switch Adjustment. When the motor warms up and is running smoothly, without further adjustments needed on the choke rod, place generator switch in position marked "HIGH." In periods of training the generator switch is in the "HIGH" position, for though the batteries are charging, the operation of the mount neutralizes the charging rate. When the turret drive is inoperative the generator switch should be returned to "N" or neutral position.

18. OPERATION OF CONTROLS.

a. Elevation and Azimuth Controls.

(1) Turn the turret drive switch to the "ON" position. This action starts the drive and makes the controls operative.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 26661

Figure 39—Power Charger—Manual Starting

(2) Using both hands, grasp the control handles in a natural grip.

(3) To move the mount to any desired position in azimuth, rotate the handles in a horizontal arc. To swing mount to the left, turn handles in that direction. Reverse action will swing mount to the right.

(4) To elevate or depress the guns, rotate the handles in a vertical arc, that is, up and down. To elevate the guns, push the handles outward with the heel of the hand. Reverse to depress the guns.

(5) The two actions described in steps (3) and (4), above, are then combined for a simultaneous movement of the guns in two planes.

(6) To move the mount at rapid (slewing) speeds, swing the handles in the direction desired. A slight displacement in any direction will result in slow tracking speeds. Any variation of speed, in any direction within the limits of the mount, is obtained by the correct amount of movement of the handle controls.

OPERATION AND ADJUSTMENTS**19. STOPPING DRIVE AND POWER CHARGER.****a. Stopping Drive.**

(1) Bring guns to a horizontal position and release the control handles when they are in a neutral position. If the mount is on a half-track the guns should point away from the cab.

(2) Turn the turret drive switch to the "OFF" position. This action will stop the power drive and makes the controls inoperative. On the late M45 Mounts the firing circuit switch operates independently of the turret drive switch, and the guns may be fired without power drive operating.

(3) If the firing circuit switch is on "FIRE" position, throw to "SAFE" position.

b. Stopping Power Charger. After the turret drive has been made inoperative, the power charger may be stopped, provided investigation shows that the batteries are not below normal charge. If charger is shielded against radio interference, the stop switch will be located on the blower housing just below the gas tank (fig. 40). Turn generator switch to "N" (neutral position) to stop the motor, press the stop switch, and hold in until motor stops.

(1) Return the generator switch to "N" (neutral position).

(2) Push down on the stop switch on the cylinder head until it makes contact with the spark plug terminal.

(3) Hold the stop switch on the spark plug terminal until the motor stops.

c. Test batteries with a hydrometer to make certain they are not below normal charge.

d. In the event that the batteries are below normal charge, do not stop the power charger. Set the generator switch on "LOW" position and allow charger to operate until battery charge is brought up to normal.

20. ADJUSTMENT OF SEAT AND FOOT REST (fig. 41).

a. For efficient operation of the mount, it will be necessary to make adjustments on both the seat and foot rest to suit the operator. It is necessary to adjust the seat to bring the operator's right eye level with sight hood of the Mk. IX Sight, with the guns level or in horizontal position. The operator must be able to look straight into the sight without bending or stretching. Adjustments are made as follows:

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
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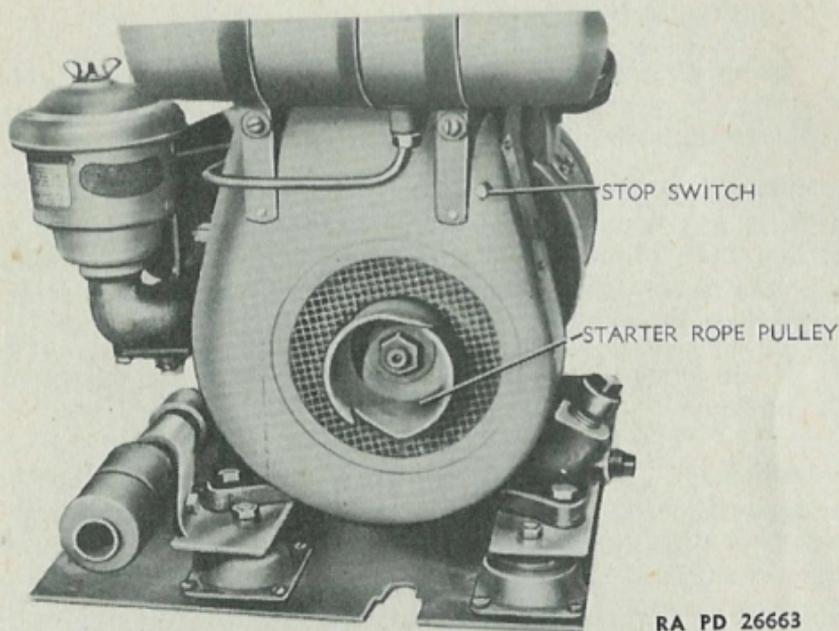


Figure 40—Power Charger Stop Switch—M45 Mount

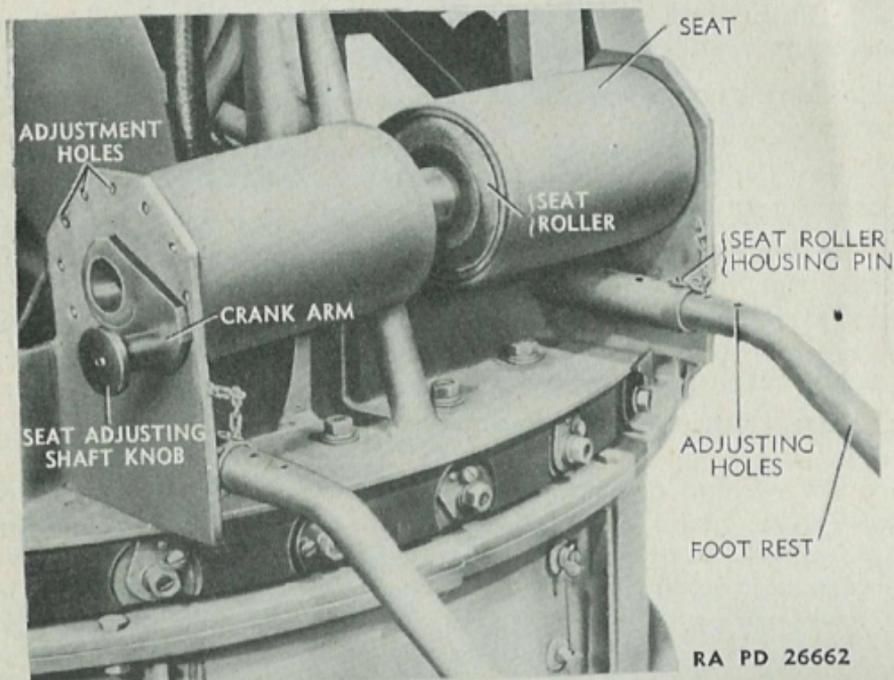


Figure 41—Seat and Foot Rest Adjustments

OPERATION AND ADJUSTMENTS

(1) Pull out the seat adjusting shaft knob which is on the seat roller crank arm.

(2) To raise the seat to the proper level, rotate the crank arm in a clockwise direction. Reverse motion to lower the seat.

(3) Lock the seat roller by allowing the seat adjusting shaft knob to engage one of the 12 holes on the face of the seat roller housing.

(4) Before the final seat adjustment is made, it is advisable for the operator to test the adjustment, because weight of his body will make some difference in the sag of the canvas seat.

(5) After the seat is in correct position, the foot rest must be adjusted to afford the proper brace for the operator's feet.

(6) Remove the two seat roller housing pins (chained) which secure the foot rest and move the foot rest in or out as required.

(7) Lock foot rest in place by dropping seat roller housing pins in holes provided.

21. ADJUSTMENT OF SIGHT ILLUMINATION (figs. 23, 24, 25, 26, and 27).

a. To adjust illumination of sight, proceed as follows:

(1) Turn the dimmer switch knob on the left of the lamp housing to the right (clockwise).

(2) Adjust the intensity of illumination by the switch dimmer knob through "NIGHT" (dim illumination) to "DAY" (bright illumination).

(3) To lift sun filter out of way, push in sun filter knob located on upper left side of sight hood and turn to right (clockwise).

NOTE: The Mk. IX Reflector Sight has been preset in position. Do not make any attempt to turn the sight in the bracket or to move the position of the bracket on the sight brace.

b. **Mechanical Bore Sighting Adjustments.** The bore sighting adjustments are built in the sight and are very easily operated. The only tool required to bore sight the instrument is a $\frac{3}{8}$ -inch hexagonal socket wrench, which is supplied with the sight.

(1) Bore sighting in azimuth is done by loosening the azimuth bore sighting nut on the after end of the hood on the right-hand side (fig. 27). Rotate hood to any position desired. When the setting has been carefully made, tighten the azimuth bore sighting nut and then check the line of sight to insure that it has not been moved.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

(2) Bore sighting in elevation is done by loosening the elevation nut on the right-hand side and to the front of the hood. When it has been loosened sufficiently, grasp the elevation adjusting lever located on the left side of the hood (fig. 27), with the left hand. While looking through the sight, turn elevation adjusting lever to bring the line of sight to the desired position. After setting has been made, tighten the forward nut and check the sight again to insure accurate completion of the bore sighting operation.

CAUTION: Be sure both nuts are tightened securely.

22. ADJUSTMENT OF ANGLE OF FIRE.

a. **Disengagement of Interrupter Switches of M33 Mounts.**
In the event that the M33 Mount is removed from the half-track and it is necessary to fire the guns at any angle including the arc normally interrupted on the half-track, the following steps must be followed to disengage the interrupter switches after drive and power charger have been stopped:

(1) Locate the junction box mounted on the frame cross member at the rear of the mount. Remove the two battery cable leads from their junction box receptacles and bend out of the way.

(2) Remove the eight screws holding the junction box cover. Remove cover and bend out of the way.

(3) Locate the terminal block mounted on the rear wall of the junction box and make wiring changes indicated in figure 42.

(4) Tighten all connections and replace junction box cover.

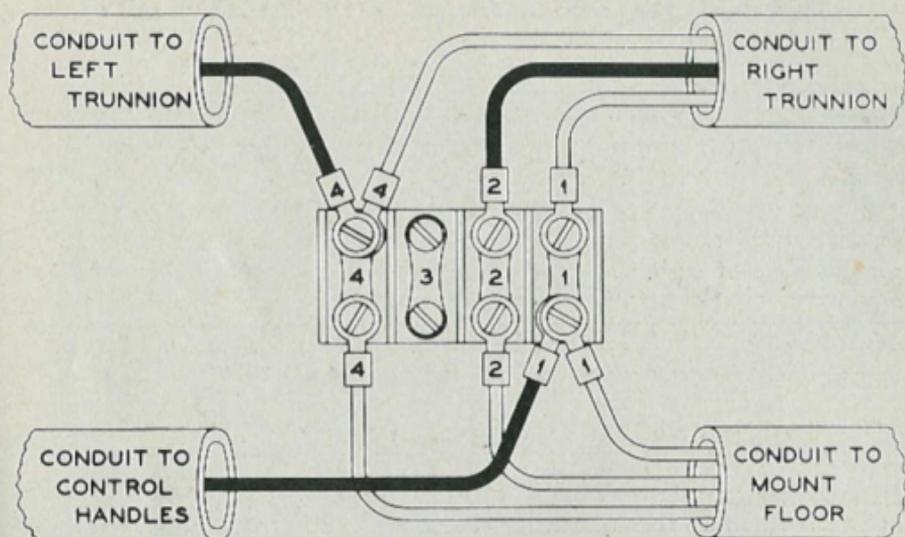
(5) Make sure guns are *not loaded*; then close turret drive switch and firing circuit switch. Rotate mount so that guns point into the interrupter area indicated by the plate on the base marked "CENTER LINE—CAB SIDE." Press control handle triggers and move guns in azimuth and elevation through this area. If the solenoids continue to function a "clicking sound" will be heard, indicating that the circuit has been changed correctly.

(6) Tag mount in a conspicuous place, such as the control handles, noting the wiring change.

b. **Disengagement of Interrupter Switches of M45 Mounts.**

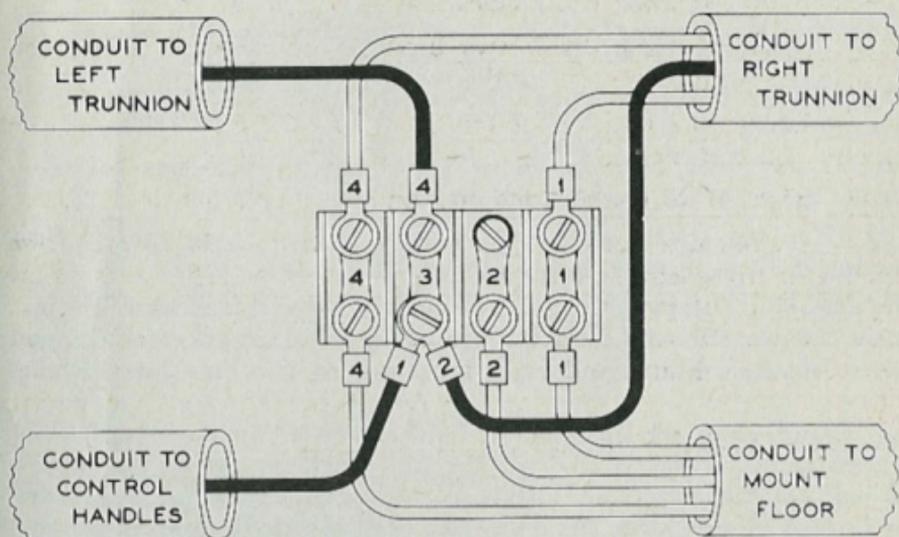
(1) In the event that the M45 Mount is removed from the half-track and it is necessary to fire the guns at any angle including the arc normally interrupted on the half-track, and if a jumper is not available the following steps must be taken to disengage the interrupter switches:

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JUNCTION BOX TERMINAL BLOCK - BEFORE CHANGE

WIRES INDICATED IN SOLID BLACK ARE LEADS TO BE CHANGED

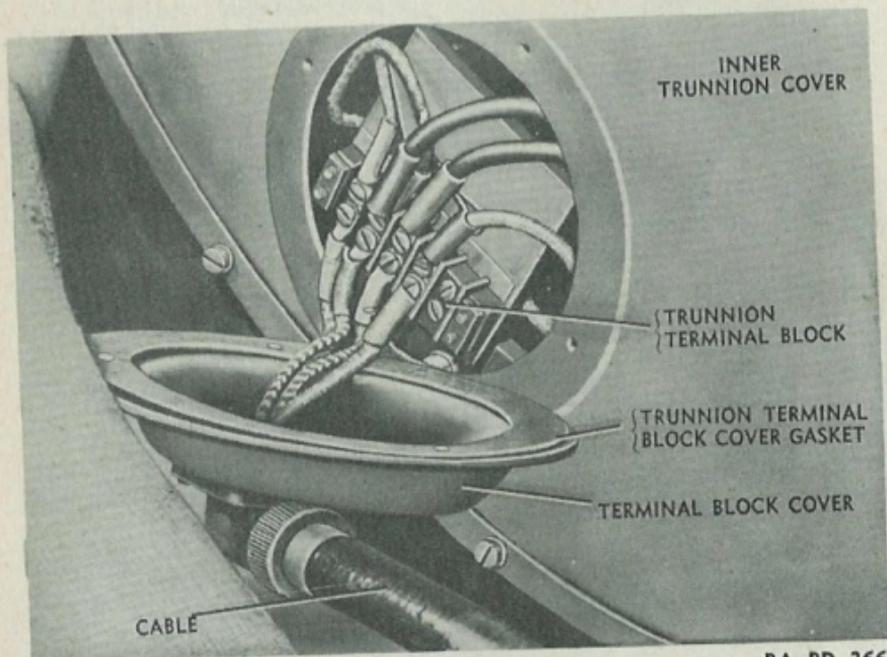


JUNCTION BOX TERMINAL BLOCK - AFTER CHANGE

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Figure 42—Wiring Change—Disengaging Interrupter Switches of M33 Mount

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RA PD 26672

Figure 43—Terminal Block—Left Trunnion of M45 Mount

(a) Remove the terminal block covers on right and left trunnions (fig. 43).

(b) Locate the terminal block and make the changes as indicated in figure 44 on both trunnions.

(c) Replace covers and with a bright yellow paint stencil the following in large block letters on the right trunnion cover.

WARNING: Traverse and elevation firing interrupter switches on this mount are adjusted for Multiple cal. .50 Machine Gun Carriage M51 or Multiple Machine Gun Trailer Mount M55 (no dead area).

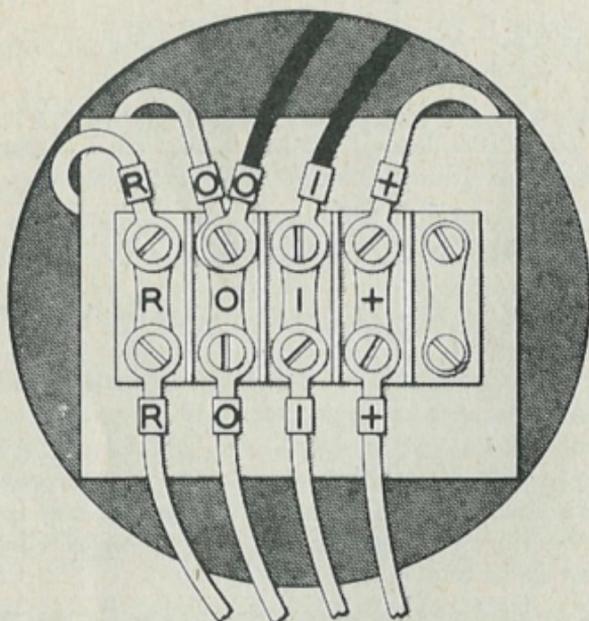
c. Installation of Jumper on M45 Mounts. In the event that the M45 Mount is removed from the half-track for use on the Multiple cal. .50 Machine Gun Carriage M51 or the Multiple Machine Gun Trailer Mount M55, the area of interrupted fire is eliminated by installing the jumper as follows:

(1) Remove the terminal block covers on left and right trunnions.

(2) Fasten the jumper to the "+" terminal, "0" terminal, and "I" terminal on both interrupter switch terminal blocks.

(3) Replace the terminal block covers.

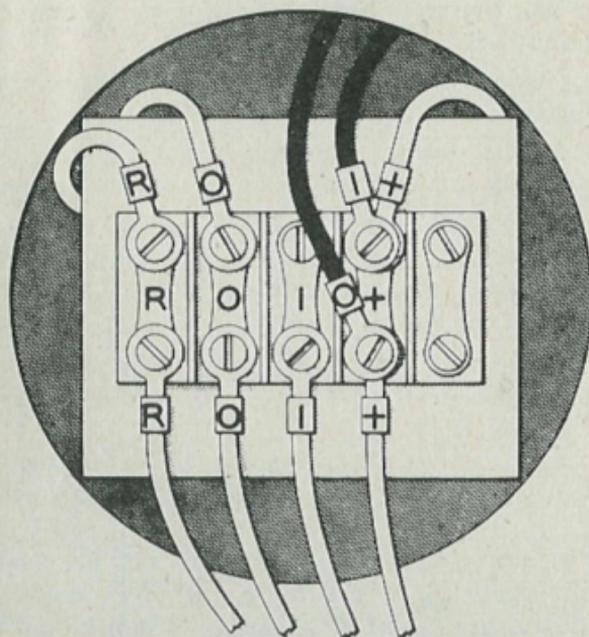
OPERATION AND ADJUSTMENTS



LEFT TRUNNION
TERMINAL BLOCK

BEFORE
CHANGE

WIRES INDICATED IN
SOLID BLACK ARE LEADS
TO BE CHANGED



LEFT TRUNNION
TERMINAL BLOCK

AFTER
CHANGE

RA PD 70808

Figure 44—Wiring Change—Disengaging Interrupter Switches of M45 Mount

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

(4) With a bright yellow paint, stencil the following in large block letters on the right trunnion cover:

WARNING: Traverse and elevation firing interrupter switches on this mount are adjusted for Multiple cal. .50 Machine Gun Carriage M51 or Multiple Machine Gun Trailer Mount M55 (no dead area).

23. ADJUSTMENT OF SOLENOIDS (figs. 19 and 20).

a. **General.** Head space adjustment must be checked before firing and with the gun fully assembled.

(1) **ADJUSTMENT FOR CAL. .50 HEAVY BARREL MACHINE GUNS.** Head space adjustment is made without removing working parts from the casing. To head space the cal. .50 heavy barrel, M2 Gun, screw barrel by hand into barrel extension until it comes into contact with bolt. Check to make sure end of barrel extends through barrel extension. Then unscrew barrel two notches. If gun operates sluggishly, unscrew barrel one additional notch.

CAUTION: Care must be exercised to avoid roughening the barrel notches during adjustment.

b. Before the solenoids are adjusted, it is necessary to test the machine guns for early or late timing. Cock the firing pin, disconnect the solenoid cable, and remove the back plate.

(1) For early timing, insert a 0.116 timing gage between the trunnion block and the forward end of the barrel extension.

(2) Lift up strongly on the rear of the trigger bar. The firing pin should not be released. Do not perform tests by pushing down on front of trigger bar.

(3) If the firing pin is released here, the gun will fire early, and the extractor may fail to engage the succeeding round. This will cause a stoppage due to failure to feed. If the timing is early, replace the trigger bar. Trigger bars must not be bent to change timing.

(4) To test for late timing follow procedure in subparagraph b, above, using the 0.020 timing gage.

(5) Lift up strongly on the rear of the trigger bar. The firing pin should be released. Do not perform test by pushing down on front of trigger bar.

(6) If the firing pin is not released here the gun will fire late and produce counterrecoil pounding or the firing pin may not be released at all, and then fail to fire the gun. If timing is late, replace the trigger bar (making certain to repeat the test for early timing).

NOTE: Guns of recent manufacture are equipped with an adjustable trigger bar stop which aids in timing adjustment. If after

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changing trigger bars (and sears also if necessary) the correct timing still cannot be obtained, choose a trigger bar that passes the early timing test and file or stone down the trigger bar stop gradually until the trigger bar will just release the firing pin.

(7) Replace backplate and reconnect solenoid cable.

c. The solenoids are adjusted without any timing gage in place. The solenoid will usually release the firing pin at any one of a series of settings. It is necessary to determine the number of notches in the series of settings which permits release of the firing pin; then the central notch of this series of settings will be the correct setting. There are 12 notches for the adjusting cap, and it is convenient to use these as clock hour settings for one of the two adjusting cap pins in making the adjustment. The procedure is as follows:

(1) Turn the adjusting cap clockwise toward minimum as far as it will go. Then turn it $1\frac{1}{2}$ turns in the other direction toward maximum, to the starting position for the test.

(2) Turn on the firing circuit switch.

(3) Charge the gun and press a trigger switch. See if the firing pin is released by looking down the T-slot. (When familiar with the adjustment it is possible to determine if the firing pin is released by the characteristic sound produced.)

(4) If the firing pin is not released, turn the adjusting cap one notch counterclockwise toward maximum, charge the gun, and attempt to release firing pin again. Continue to check operation at each successive setting (toward maximum) until you determine the first setting at which the solenoid will release the firing pin. Using the head of one of the adjusting cap pins as an index, note its clock hour setting.

(5) Continue testing the setting at each notch toward maximum, and determine the series of settings at which the solenoid will release the firing pin. Usually the test indicates six or seven settings beyond which the solenoid again fails to release the firing pin.

(6) Set the adjusting cap midway between the minimum and maximum settings of this range. This is the correct setting.

NOTE: During adjustment it is essential to retract the retracting slide handle before each attempt to release the firing pin.

(7) Check the adjustment by charging the gun and inserting the 0.020-inch gage between the trunnion block and the barrel extension. Operate the solenoid once. The firing pin must be released.

(8) Again charge the gun and insert the 0.116-inch gage between the trunnion block and the barrel extension. Operate the solenoid once. The firing pin must not be released.

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24. TRIGGER MANIPULATION.

- a. Make the trigger switches in the control handles of the M45 Mount operative by closing the firing circuit switch located on top of the switch box directly below the control handles. The control handles in the M33 Mount are made operative by closing the turret drive switch and the firing circuit switch. To close the firing circuit switch place it in the "FIRE" position. Apply same procedure to the turret drive switch and place it in the "ON" position. The shielded light to the right of the firing circuit switch will be illuminated, indicating a closed circuit. The finger triggers on the outer upper surfaces of the control handles are now "alive." When the control handles are grasped, the gunner's forefingers will curve naturally around the control handles to engage the trigger switches.
- b. Fire guns by gently squeezing on the triggers. *One or both* triggers will fire all guns.

Section V

DISASSEMBLY AND ASSEMBLY

25. BATTERIES (figs. 45, 46, and 47).

a. Removal.

- (1) Remove battery cable leads from the junction box.
- (2) Remove cables from batteries.
- (3) Loosen the wing nuts on the battery securing latches which hold the battery frame in place, lift up on the battery frame, swing the front battery securing latch down, and remove the battery frame.
- (4) Slide the batteries out one at a time and remove.

b. **Replacement.** To replace the batteries, proceed in reverse order of removal.

26. POWER CHARGER (figs. 46 and 47).

a. Removal.

- (1) Remove cable from connection on junction box.

NOTE: Only the M33 has receptacle on junction box. On the M45, power charger lead is held by wing nut to junction box.

- (2) Loosen the wing nuts at front and rear of charger.
- (3) Swing front latch down and out of way.

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(4) Loosen wing nut on frame and remove metal web grounding strip, if in use.

(5) Slide power charger out of the channels, grasp the carrying handle, and remove the charger.

(6) To remove the spark plug, use spark plug socket wrench (fig. 48) if plug is set in the shielding cup or an open-end wrench if plug is not shielded.

b. Replacement. To replace the power charger, proceed in reverse order of removal.

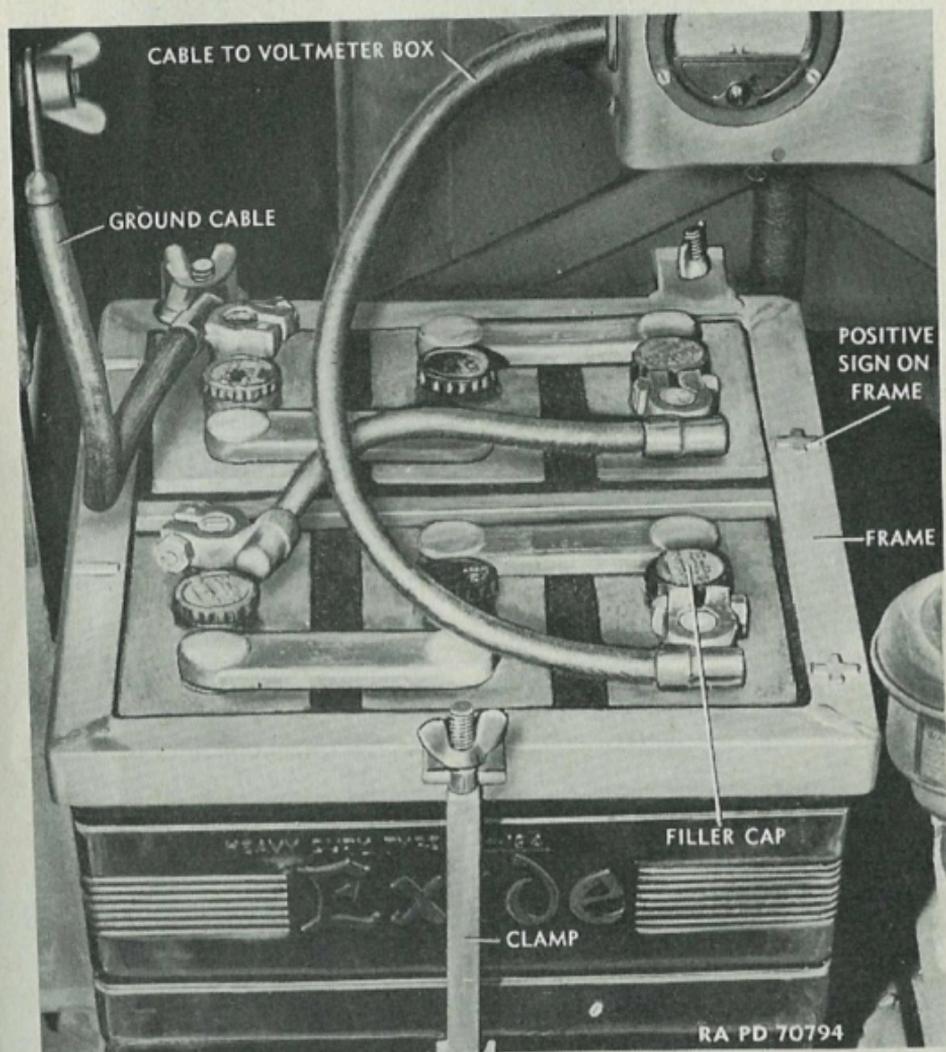
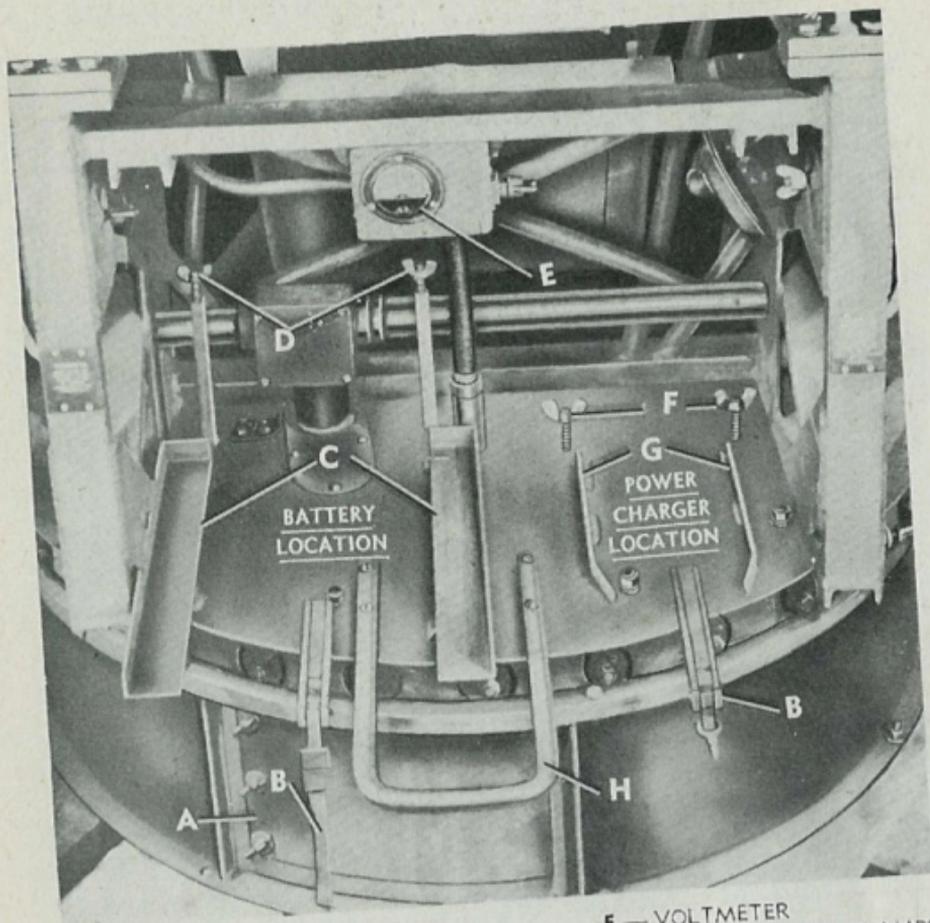


Figure 45—Battery and Cable Arrangement

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

- A — BASE COVER
 B — FRONT BATTERY SECURING LATCH
 C — BATTERY CHANNELS
 D — REAR BATTERY SECURING LATCHES
 E — VOLTMETER
 F — REAR CHARGER CLAMPS
 G — POWER CHARGER MOUNT
 H — STEP

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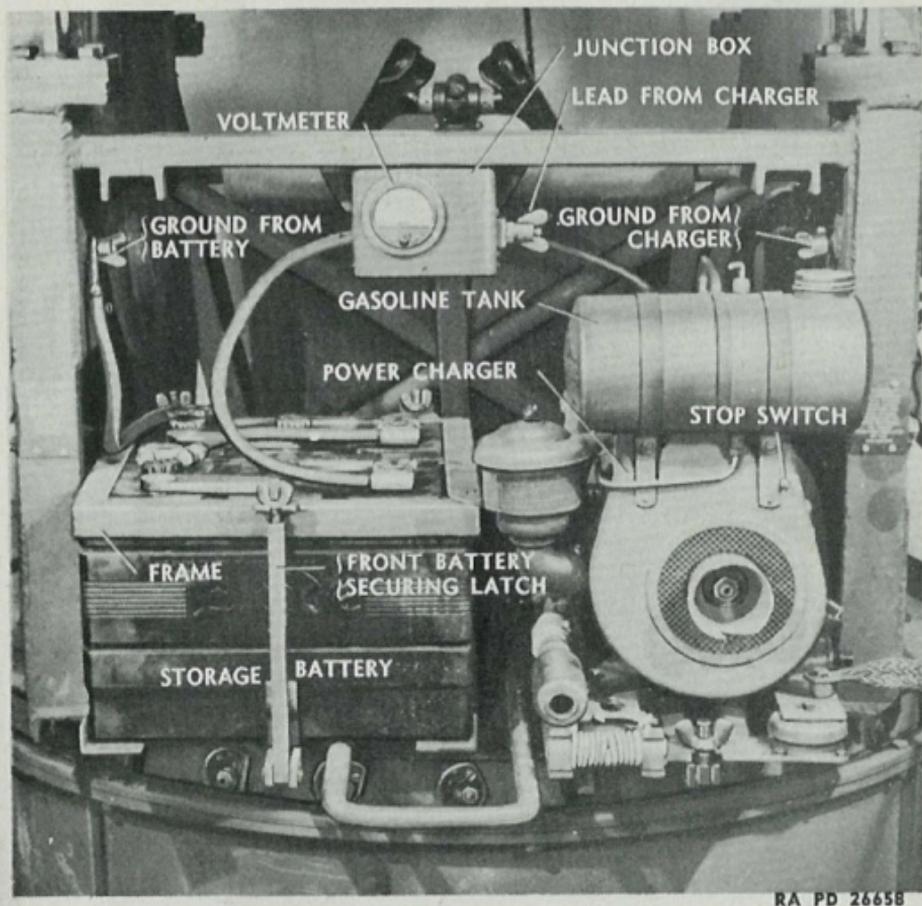
Figure 46—Battery and Power Charger Locations

27. POWER UNIT PULLEY BELTS.

a. Removal.

- (1) Loosen the differential mounting screws; they are located under the seat (figs. 49 and 50).
- (2) Working through the base doors, loosen lock nut on differential drive adjusting screw. Turn adjusting screw to the left (counter-clockwise) until it no longer moves differential inwards.

DISASSEMBLY AND ASSEMBLY



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Figure 47—Battery and Power Charger Locations

(3) Lift belt over the outer half of one pulley and work down until it falls free; then lift it off the other pulley (fig. 51).

(4) On each of the inner belts, it will be necessary to disengage the azimuth pinion shaft assembly and elevation drive coupling in order to remove the belts. Both the azimuth and elevation couplings may be disengaged by positioning each in closest position to base cover openings and grasping coupling splined shaft collar, pulling it back against spring around spline shaft until shaft is disengaged (fig. 52).

NOTE: The azimuth pinion shaft should always be disengaged first, since it is then possible to rotate the mount by hand if necessary in order to position it for disengagement of elevation drive coupling. The belts should be marked so that they will be replaced on the same pulleys from which they came.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

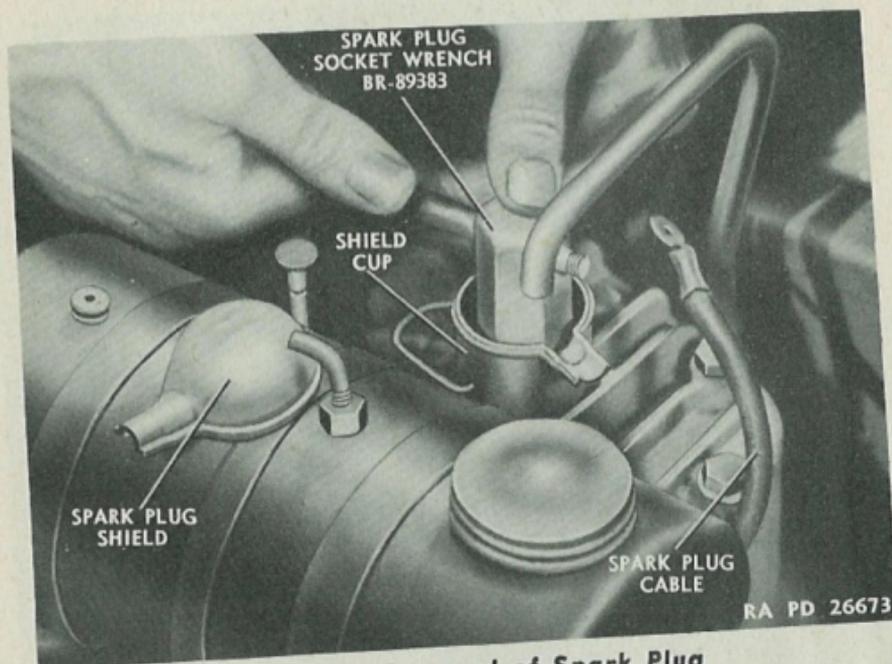


Figure 48—Removal of Spark Plug

b. Replacement. To replace the belts, proceed in reverse order of removal. Always replace the inner belt on the elevation side (short shaft) first, and reengage the shaft before proceeding to assemble another belt.

IMPORTANT: Always replace belts in matched pairs as issued. Never replace only a single belt even if just one belt is unserviceable.

28. DIFFERENTIALS.

a. Removal.

- (1) Remove the belts as described in paragraph 27 a.
- (2) Remove differential mounting screws.
- (3) Remove the differentials.

b. Replacement.

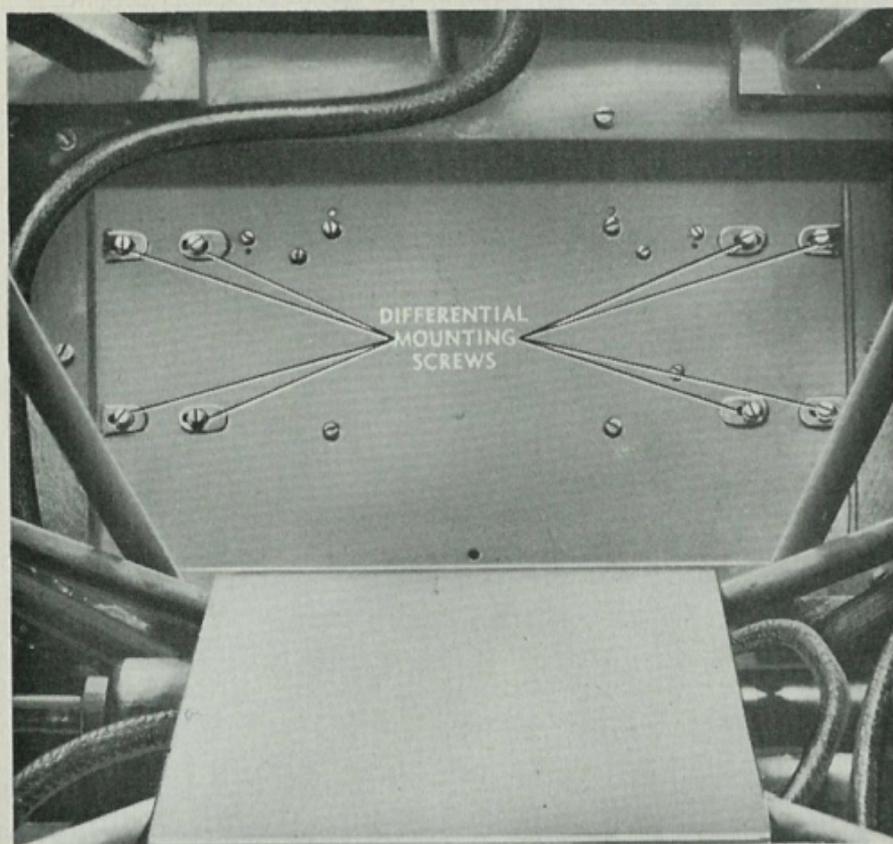
- (1) To replace the differentials, proceed in reverse order of removal.
- (2) Adjust belt tension (par. 49 c (2)).

29. FIRING CIRCUIT PANEL LIGHT.

a. Removal.

- (1) Remove the pilot light box shield (M45 Mount) or switch box panel light shield (M33 Mount) to the right of the firing circuit

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Figure 49—Differential Mounting Screws

switch by removing the two screws which secure the shield to the top of the box (figs. 14 and 15).

- (2) Unscrew and remove the light jewel.
- (3) Remove the bulb by pushing down and turning the bulb.

b. Replacement. To replace the light bulb, proceed in reverse order of removal. A spare bulb is carried in the spare bulb can which is clipped to the frame on the left side of the mount.

30. SEAT.

a. Removal (fig. 53).

- (1) Revolve the seat adjusting shaft knob counterclockwise until the end of the seat appears.
- (2) Remove the two seat roller strips and the seat securing strip.

b. Replacement. To replace the seat, proceed in reverse order of removal.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

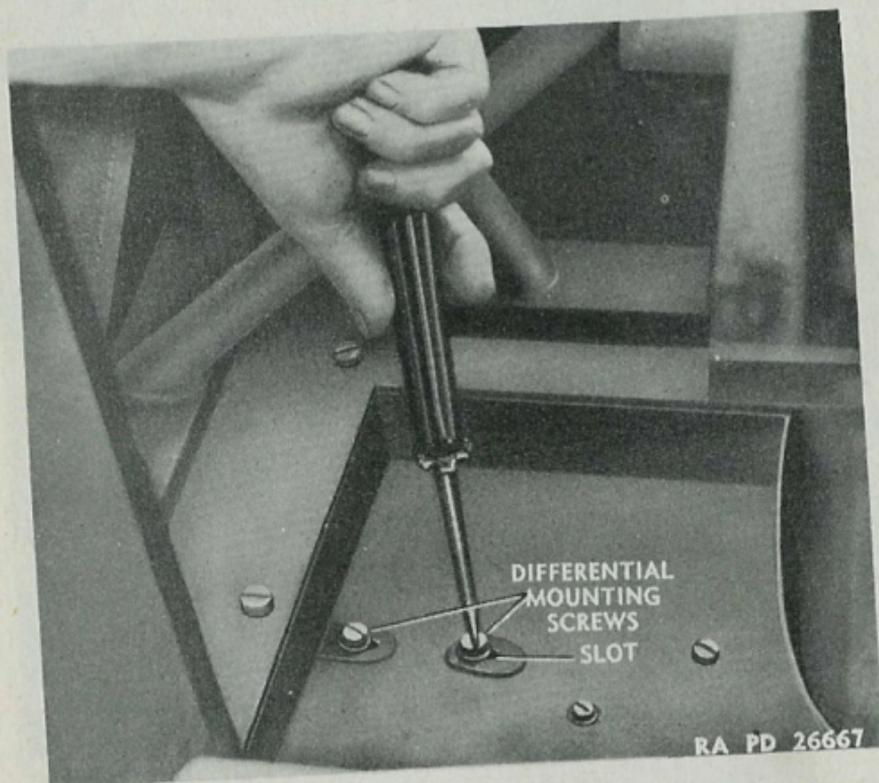


Figure 50—Loosening Differential Mounting Screws

31. CARBURETOR.

a. To remove the carburetor, proceed as follows (fig. 54):

- (1) Close the tank shut-off lever on top of the gasoline tank. Disconnect gasoline line at gasoline filter elbow.
- (2) Disconnect choke rod at choke lever.
- (3) Disconnect carburetor at carburetor intake elbow by removing two screws and lock washers (fig. 55).
- (4) Disconnect throttle spring and throttle link from throttle lever.
- (5) Disconnect the gas filter assembly from the carburetor.
- (6) Remove screw and washer that fastens carburetor brace to air cleaner.

DISASSEMBLY AND ASSEMBLY

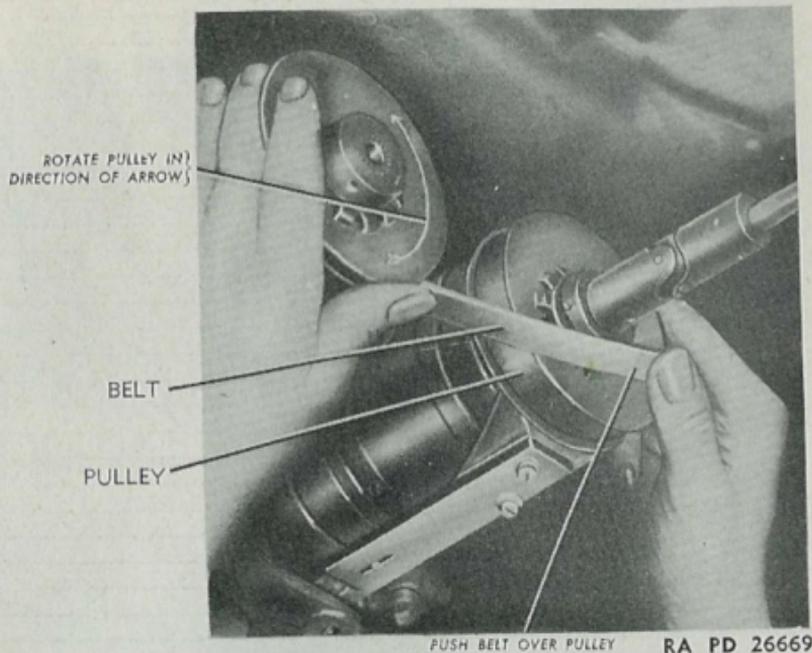


Figure 51—Removing V-belt

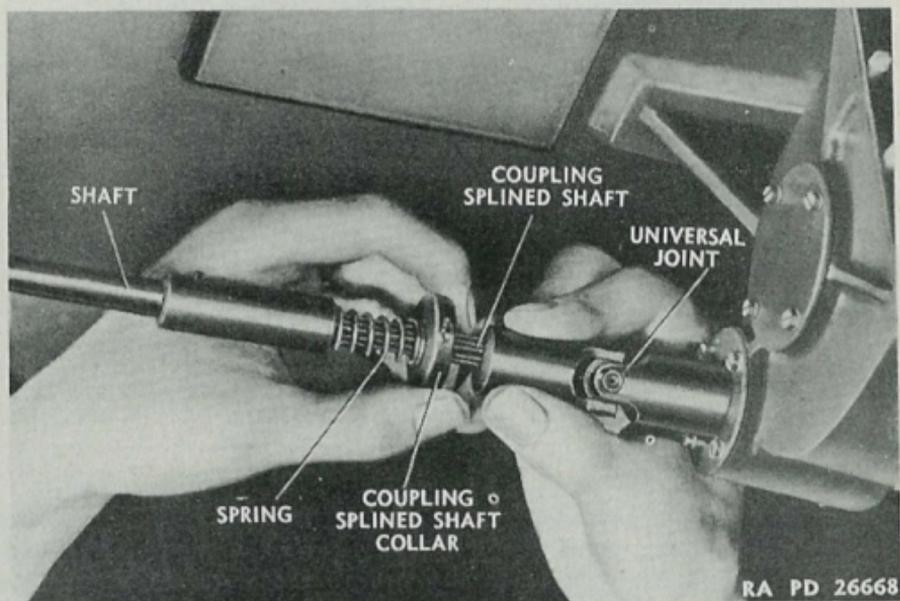
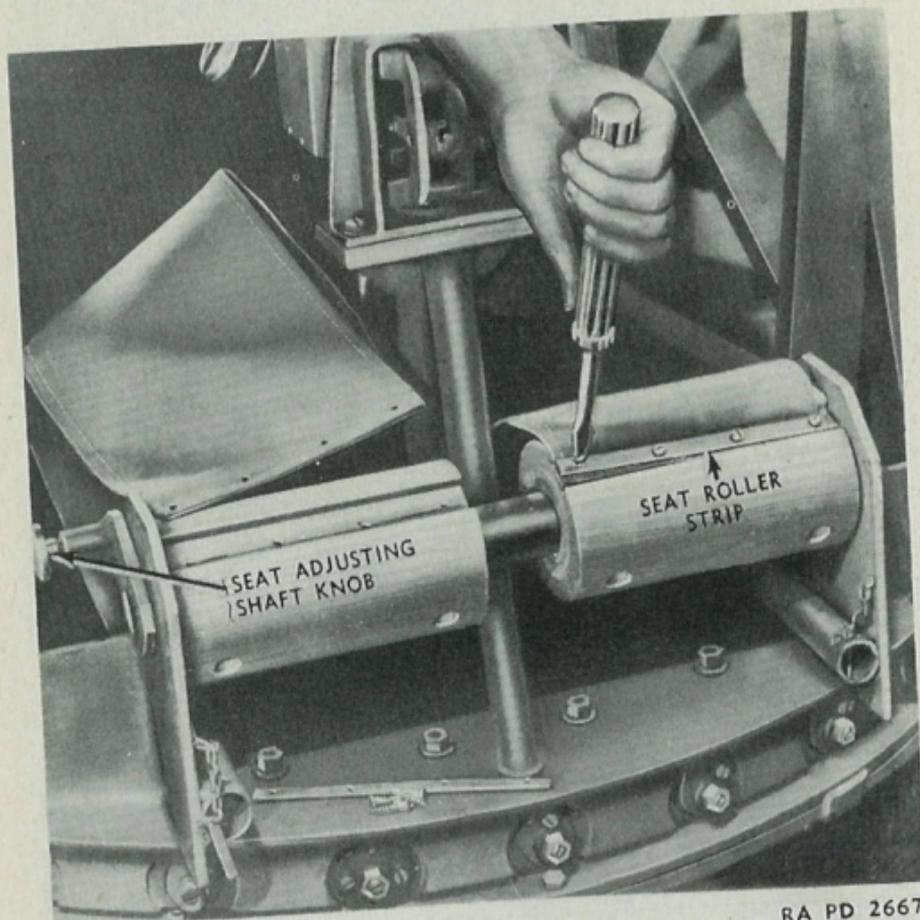


Figure 52—Disengaging Coupling Splined Shaft

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



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Figure 53—Removal of Seat

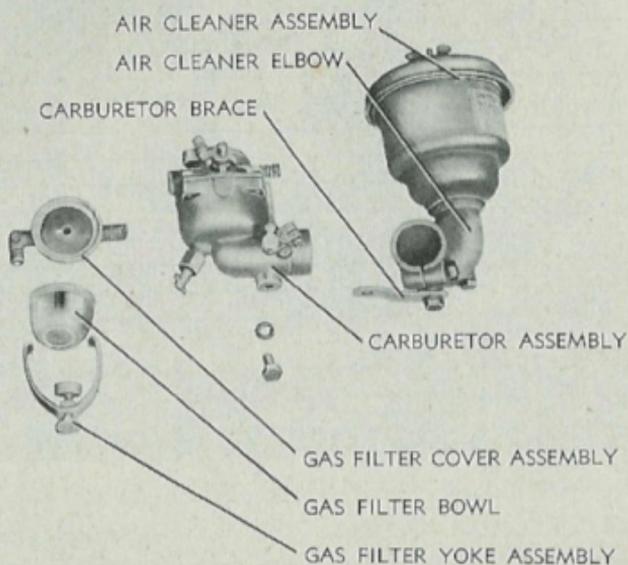
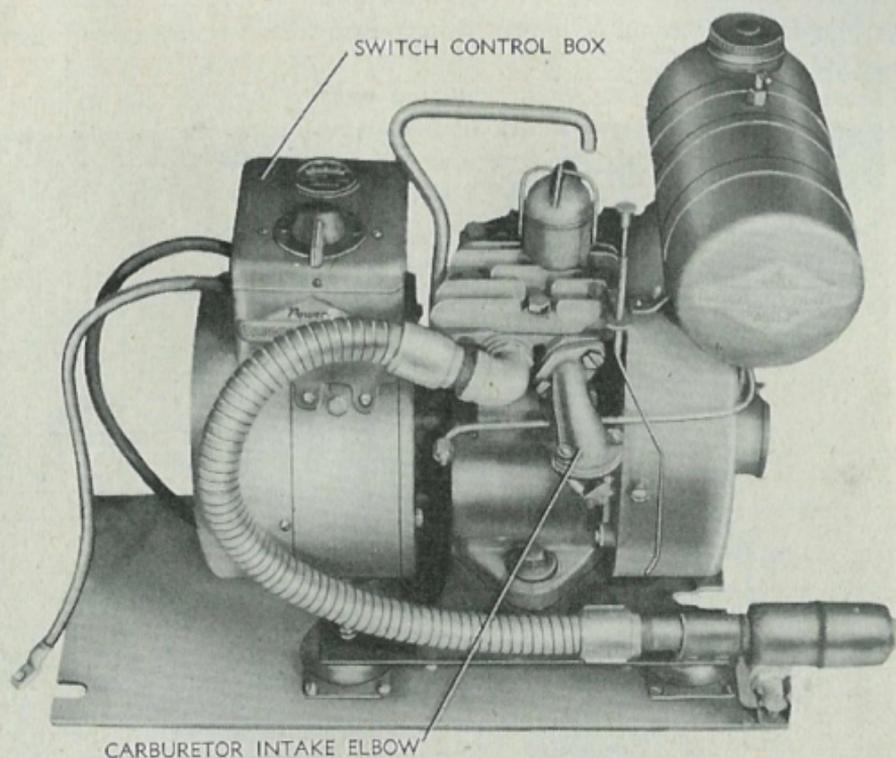
- (7) Loosen screw that connects air cleaner and carburetor.
 - (8) Remove carburetor.
- b. Follow the reverse procedure for assembly.

32. ARMOR.

a. **Assembly.** Lift armor plate onto frame of the M45 Mount and secure on each side of the frame and from inside the mount with a bolt. The hinged armor plate is engaged by clips on the inner trunnion faces.

- b. **Disassembly.** Follow the reverse procedure for disassembly.

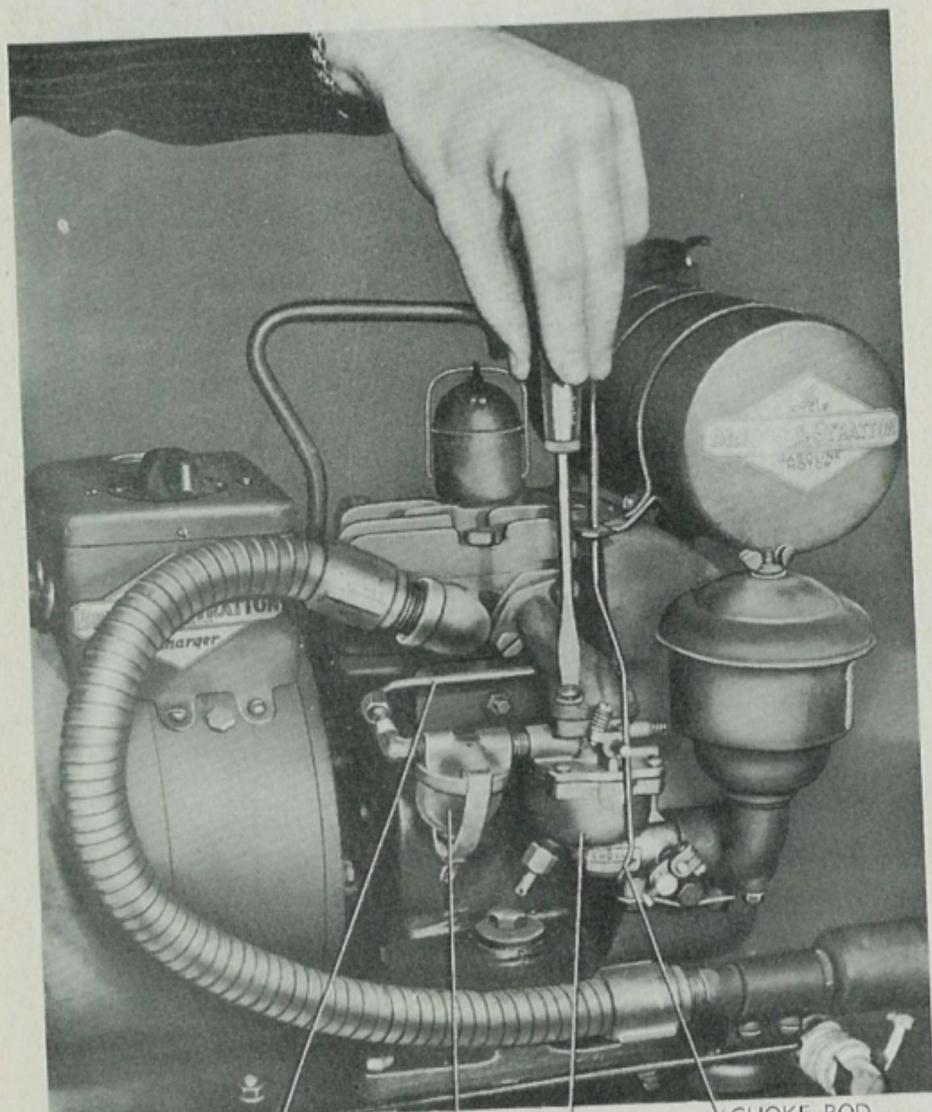
DISASSEMBLY AND ASSEMBLY



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Figure 54—Power Charger—Carburetor, Gas Filter, and Air Cleaner (Removed)

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
 MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



GASOLINE LINE
 (DISCONNECTED)

GASOLINE FILTER ASSEMBLY

CHOKE ROD
 (DISCONNECTED)

CARBURETOR ASSEMBLY

RA PD 26621

Figure 55—Power Charger—Disconnecting Carburetor

DISASSEMBLY AND ASSEMBLY**33. SIGHT BULB.**

a. **Assembly.** Depress the push button plunger located on the top of the case of the Mk. IX Sight. This procedure separates the case from the dimmer switch assembly and makes the bulb socket accessible. The bulb is inserted into the socket with the reference mark corresponding to the white line on the socket. Press gently on the bulb so that it may be turned in the socket and securely fastened in the socket by the bayonet lock.

CAUTION: Insert bulb as directed; due to improper installation there is danger of burning out a resistance in the circuit. If bulb fails to light, reverse position in socket.

b. **Disassembly.** Follow the reverse procedure for disassembly.

34. ELEVATION STOP LEVER BOOT.

a. **Disassembly.** To replace the boot on either the M33 or M45 Mounts, remove the screws and washers that fasten the elevation stop lever boot clamp to the mount. Remove the clamp by slipping up over elevation stop lever. Grasp the bottom edge of the elevation stop lever boot and pull up over the stop lever.

b. **Assembly.** Reverse the procedure to assemble.

35. GAS FILTER BOWL.

a. **Disassembly.**

(1) To replace the gas filter bowl on the power charger, loosen the wing nut that is part of the yoke (fig. 54).

(2) Remove yoke that is held in place on the cover by two bosses.

(3) Remove the gas filter bowl from the cover.

b. **Assembly.** Reverse the procedure to assemble.

36. ADJUSTMENT BLOCK AND YOKE.

a. **Disassembly of Horizontal Adjustment Block.**

(1) To disassemble the horizontal adjustment block group (fig. 56), proceed as follows:

(a) Remove the cotter pins from the horizontal adjustment handwheel and from the nut on the horizontal adjustment block.

(b) Unscrew the nut and remove the horizontal adjustment block, handwheel, and washer.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

b. Disassembly of Vertical Adjustment Yoke.

(1) To disassemble the vertical adjustment yoke group (figs. 57 and 58), proceed as follows:

(a) Remove cotter pins from the upper vertical adjustment handwheel and yoke.

(b) Unscrew the lower vertical adjustment handwheel and remove yoke, upper handwheel, and washers.

c. Assembly (figs. 57 and 58). Assemble the horizontal adjustment block and vertical adjustment block groups in the reverse of disassembly.

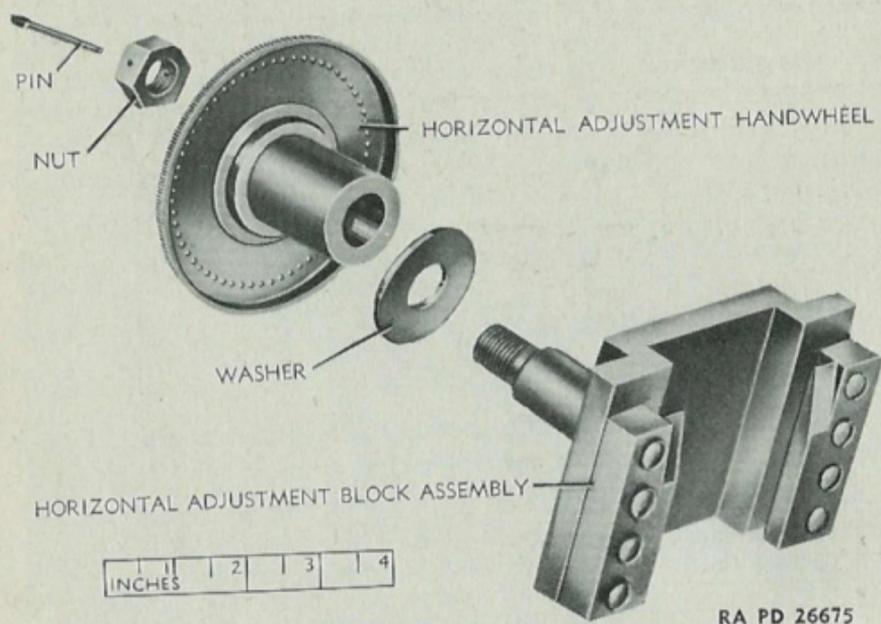


Figure 56—Horizontal Adjustment Block Group Parts for M33 and M45 Mounts

37. CIRCUIT BREAKER.

a. Disassembly. To remove circuit breaker, proceed as follows:

(1) Remove the four screws from the control box cover that fastens it to the control box.

(2) Lift control box cover up so that the circuit breaker is accessible.

DISASSEMBLY AND ASSEMBLY

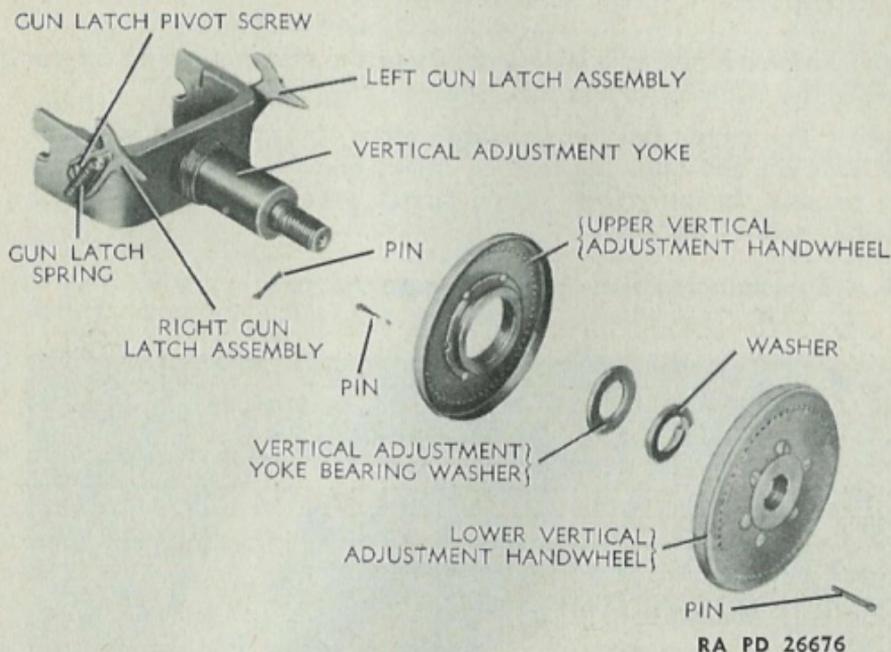


Figure 57—Vertical Adjustment Yoke Group Parts for M33 Mount

- A — FRONT GUN SECURING PIN
- B — GUN SECURING PIN LATCH PIVOT STUD
- C — GUN SECURING PIN LATCH
- D — GUN SECURING PIN LATCH SPRING
- E — LEFT VERTICAL ADJUSTMENT YOKE
- F — PIN
- G — UPPER VERTICAL ADJUSTMENT HANDWHEEL
- H — VERTICAL ADJUSTMENT BEARING WASHER
- J — WASHER
- K — LOWER VERTICAL ADJUSTMENT HANDWHEEL
- L — PIN

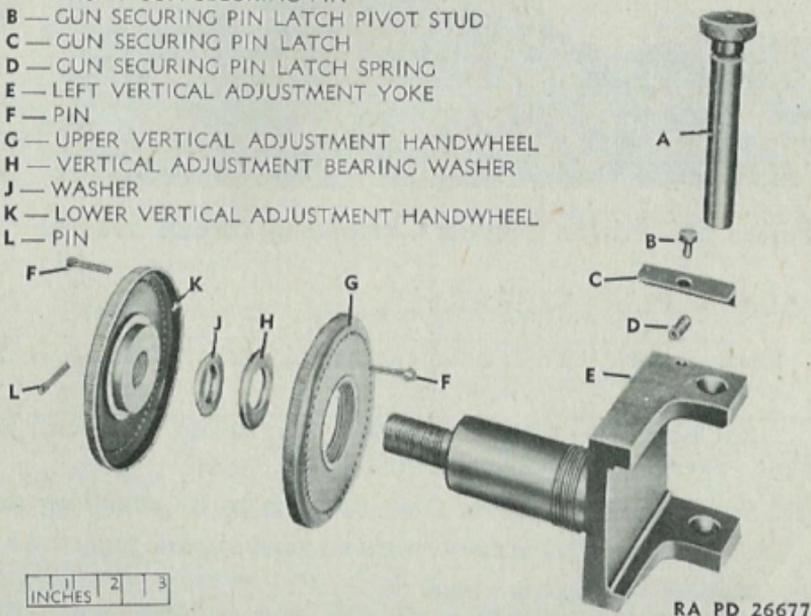


Figure 58—Vertical Adjustment Yoke Group Parts for M45 Mount

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

(3) Remove the two wire leads from the circuit breaker by removing the two screws and lock washers (fig. 59).

(4) The circuit breaker is held in place by two screws, washers, lock washers, and nuts. To remove circuit breaker, loosen one screw and remove the other one. Slide circuit breaker from under the loosened screw (fig. 59).

b. To assemble, follow the reverse procedure.

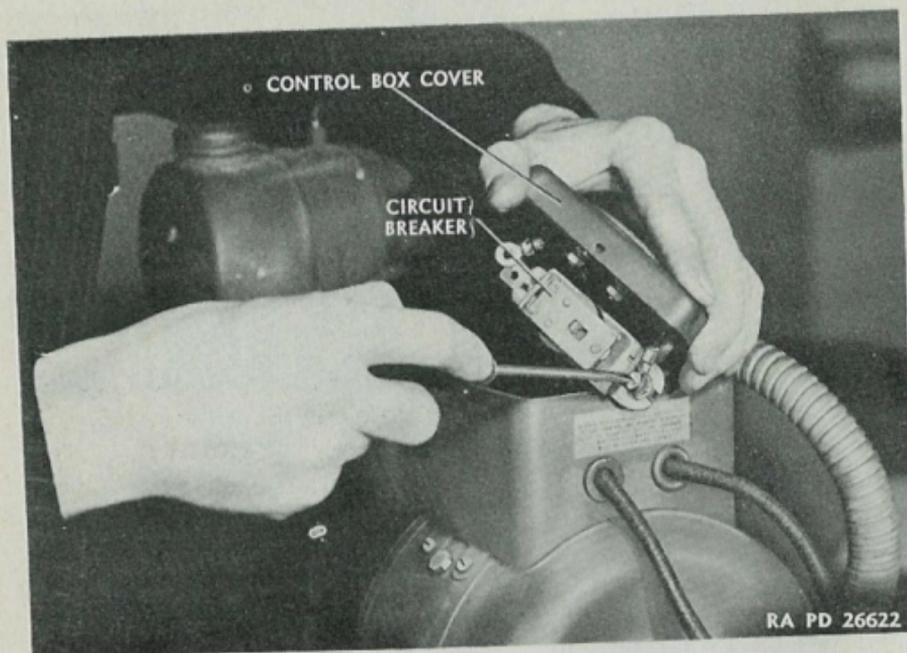


Figure 59—Power Charger—Removing Circuit Breaker

38. SPARK PLUG GASKET.

a. **Disassembly.** To remove spark plug gasket, proceed as follows:

(1) Lift up on the arm of the spark plug shield that holds the spark plug cover in place. Remove spark plug cover.

(2) Remove ignition cable from spark plug by removing nut.

(3) Using spark plug socket wrench, remove spark plug.

(4) Remove spark plug gasket.

b. To assemble, follow the reverse procedure.

DISASSEMBLY AND ASSEMBLY**39. GOVERNOR SPRING (fig. 60).**

a. **Disassembly.** To remove the governor spring, proceed as follows:

- (1) Shut off gas flow and disconnect gas line from elbow at gas filter.
- (2) Remove screw and lock washer that fastens the choke rod to the power charger.
- (3) Remove the two nuts and lock washers that fasten the carburetor intake elbow and the carburetor together.
- (4) The gas filter, carburetor, and air cleaner may be moved aside so that the governor spring is accessible.
- (5) Remove one end of the governor spring from the throttle lever and the remaining end from the stud.
- (6) Remove governor spring.

b. **Assembly.** Follow the reverse procedure for assembly.

40. NEEDLE ADJUSTING VALVE.

a. **Disassembly.**

- (1) Remove needle valve packing nut from the carburetor. In removing this nut, the needle adjusting valve is disassembled with it.
- (2) Remove needle adjusting valve from needle valve packing nut.

b. **Assembly.** Follow the reverse procedure for assembly.

CAUTION: Do not screw up too tight or use force when closing needle valve, or needle valve may be damaged.

41. ELEVATION INTERRUPTER SWITCHES (M33 MOUNT).

a. **Disassembly.**

- (1) Remove the six screws and lock washers that fasten the right trunnion switch cover to the right trunnion cover plate.
- (2) Remove the right trunnion switch cover and gasket.
- (3) The two elevation interrupter switches are mounted on individual brackets, a rear and front elevation interrupter switch bracket, by two screws (fig. 61). The brackets are mounted on the inside of the trunnion cover plate.
- (4) Remove the four screws and lock washers that fasten the brackets to the trunnion cover plate.
- (5) Remove the rear and front elevation interrupter switch brackets.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

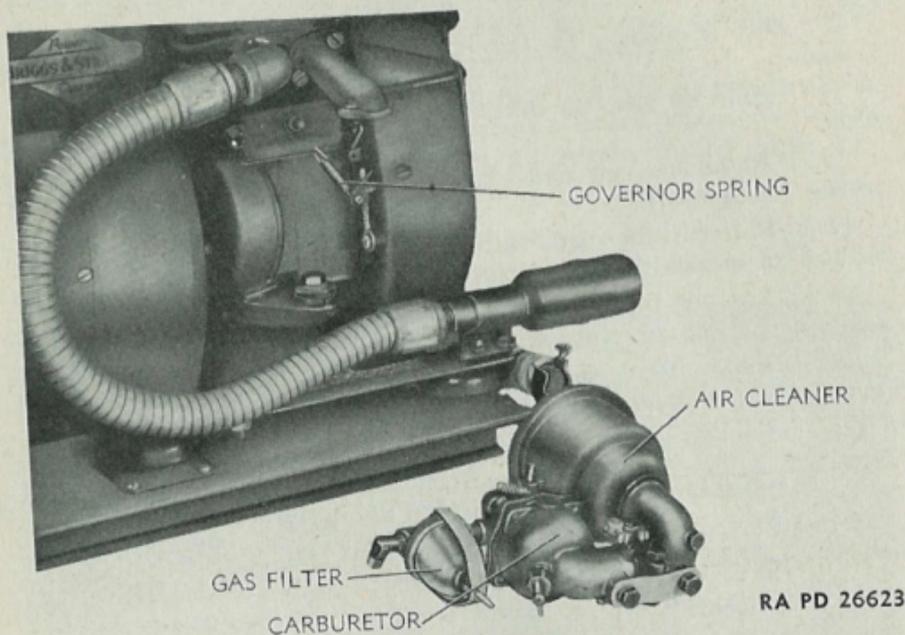


Figure 60—Power Charger—Governor Spring (Gas Filter, Carburetor, and Air Cleaner Removed)

(6) Remove the four screws, lock washers, and washers that secure the elevation interrupter switches to the brackets. Remove switches.

b. Assembly. Follow the reverse procedure for assembly.

42. ELEVATION INTERRUPTER SWITCHES (M45 MOUNT).

a. Disassembly (fig. 43).

NOTE: Disassembly procedure is same for both trunnions.

(1) Elevate the guns to approximately 70 degrees and remove the four screws and lock washers in the interrupter switch cover located on the trunnion cover plate.

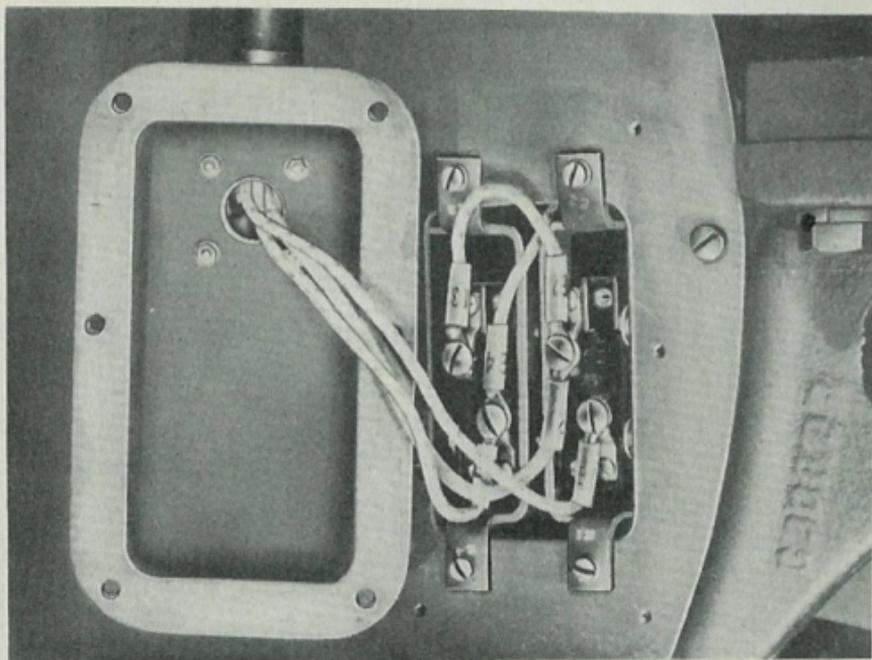
(2) Disconnect the trunnion wire assembly leads from the terminal block.

(3) Remove 16 screws and lock washers from the trunnion cover plate and remove cover.

(4) Bend down the lugs on the terminal block to gain access to the two screws holding elevation interrupter switch to switch bracket.

(5) Cut and remove lockwire in the two screws.

DISASSEMBLY AND ASSEMBLY



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Figure 61—Elevation Interrupter Switches

(6) Remove the two screws and the screw plate on the back of the switch, and slide switch over top of mounting bracket.

(7) Remove wires and bus bar from the switch.

b. Assembly.

(1) Replace wires and bus bar on new switch. Be sure that markers on wires correspond to the same markings on the switch.

(2) Replace switch with screws and screw plate with the switch roller pointing toward the rear of the mount.

(3) Check new switch installation for proper operation:

(a) Remove the opposite trunnion cover plate.

(b) Depress guns so that the switch rollers engage cams. Switches should operate simultaneously when roller passes over scribed line on the elevation cam. Small adjustments can be made by loosening the holding screws and shifting the switch.

(c) Orient the guns to the dead area (pointing at cab) and depress guns to below horizontal.

1. With guns unloaded, press trigger switch.

2. If switch is set correctly, solenoid should *not* click.

(4) Replace wires on terminal block and replace trunnion cover plate and interrupter switch cover.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

Section VI

MALFUNCTIONS AND CORRECTIONS

43. MALFUNCTIONS AND CORRECTIONS.

a. Failure of Power Drive Motor To Start.

Cause	Correction
Batteries not connected to circuit.	Check junction box to battery cable connection and, if necessary, connect wires to proper terminals (M45). Plug cables in receptacles on junction box (M33). Tighten lugs on battery posts.
Battery weak.	Throw turret drive switch off. Recharge batteries with power charger generator switch "HIGH."
Cable to motor disconnected from power drive.	Remove base covers. Reach in; tighten any loose connection on motor terminal block (M45). Reengage motor wiring conduit plug in receptacle on power drive (M33).
Short in motor.	Report malfunction to Ordnance maintenance personnel.
Bearing on pulley sheave frozen, causing turret drive circuit breaker switch to open.	Report malfunction to Ordnance maintenance personnel.

b. Failure of Mount To Elevate.

Break in linkage from control handles to power drive.	Report malfunction to Ordnance maintenance personnel.
Obstruction between the trunnion sector and torque tube drive shaft gear.	Remove obstruction without damaging gear teeth if possible. If obstruction cannot be removed, report malfunction to Ordnance maintenance personnel.
Pinion gear on torque tube drive shaft gear damaged or bent out of line.	Report malfunction to Ordnance maintenance personnel.
Control handles loose on horizontal shaft.	Set handles in neutral position. Tighten set screws on each handle.

MALFUNCTIONS AND CORRECTIONS

c. Failure of Mount To Traverse.

Cause	Correction
Obstruction in turret ring gear or azimuth pinion.	If possible, disengage the azimuth pinion shaft splined coupling and work obstruction free.
Azimuth pinion gear broken or out of alinement.	Report malfunction to Ordnance maintenance personnel.
Linkage from the handle controls to drive disengaged or broken.	Reengage linkage if possible. If condition cannot be remedied, report malfunction to Ordnance maintenance personnel.
Drive motor belt broken.	Replace matched pair of belts on the pulleys of the left differential drive assembly (par. 27 b).

d. High Speeds Not Obtainable in Traverse or Elevation.

Batteries not supplying full power to motor.	Tighten all battery connections. Stop turret drive and recharge batteries.
Power unit pulley belts loose.	Open both base covers. Traverse mount so that belts are accessible through base doors. Loosen differential mounting screws under seat. Loosen differential drive adjusting screw lock nut at top center of differential housing. Turn differential drive adjusting screw clockwise. If belt flex is more than one-half inch, adjust belts as in paragraph 49 c (2). Center differential by means of differential drive adjusting screw. With the motor running, the output shaft should not turn if the differential is accurately centered. Shift differential slightly by means of adjusting screw until output shaft ceases to turn. Tighten differential mounting screws and replace base covers.
Oil on motor pulleys or belts causing belts to slip.	Remove belts from motor. Wipe pulley surfaces clean and dry. Wipe belts with cloth soaked in dry-cleaning solvent and wipe dry. If belts are badly oil-soaked replace them with another pair (par. 27 b).
Trunnion binding, ring clamp too tight.	Loosen screws of trunnion clamp holding felt seal to trunnion face.

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**

Cause	Correction
Trunnion binding, dent in trunnion casting.	Report malfunction to Ordnance maintenance personnel.
Tie rod from control handles to linkage bent. Slow speed in one direction.	Report malfunction to Ordnance maintenance personnel.

e. Failure of Power Charger To Start

- | | |
|--|--|
| Cable to junction box from power charger not properly seated. | Unscrew locking ring on plug, reseal plug firmly in receptacle on junction box, and tighten locking ring (M33). See that terminal of cable from power charger is held securely by junction box block wing nut (M45). |
| Batteries unable to start charger when the generator switch is placed on "START" position. | Start charger manually, using rope on starter pulley. Set generator switch on neutral or "N" position. Pull up on choke rod. Insert knot of starter rope in slot of pulley, and wind rope in clockwise direction. Grasp handle and pull up sharply on rope. After motor starts, adjust choke so that motor runs smoothly. Set switch on "HIGH" position (par. 17 b).
NOTE: Do not operate mount until batteries have been brought up to correct charge (par. 49 a). |
| Gasoline not feeding into motor. | Remove gasoline tank cap; check fuel level. If not filled to capacity, add fuel. Open tank shut-off lever (4 complete turns to the left counterclockwise). Check for breaks or leaks in the fuel line to gas filter and carburetor (see below). Check needle adjusting valve for damage. Replace if necessary. Check governor spring for looseness. Replace if necessary. |
| Fuel lines clogged. | Close shut-off lever on top of gasoline tank by turning all the way to the right (clockwise). Disconnect gas line at tank and gas filter. Blow through line to clear it. Remove |

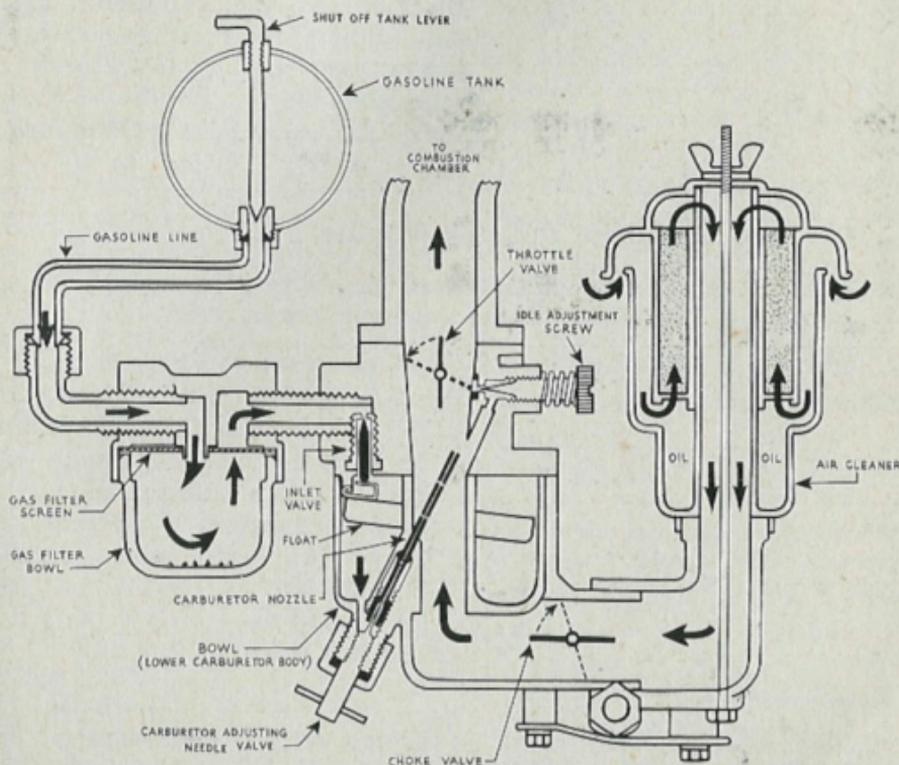
MALFUNCTIONS AND CORRECTIONS

Cause

Ignition cable, broken or grounded.

Correction

cover from carburetor bowl, loosen thumb screw below gas filter bowl and remove and clean gas filter bowl and filter screen. Blow through gas passage in cover between carburetor and gas filter bowl. Acetone, grade B can be used to dissolve gum deposits in fuel line when necessary (fig. 62). Remove blower housing and inspect the full length of magneto ignition cable from spark plug to the ignition coil. If insulation of cable is broken or oil-soaked inform Ordnance maintenance personnel. Dry cable thoroughly if wet. Cable should be securely fastened to ignition coil.



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Figure 62—Fuel System and Air Cleaner

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**

Cause

Spark plug does not fire.

Correction

Remove shield from plug. Remove magneto ignition cable from spark plug terminal. Remove plug. If dirty or covered with carbon, scrape plug clean. Check spark plug gap and reset points to 0.025 inch if necessary. Replace plug if porcelain is cracked or broken. Make sure plug is clean and free from moisture. Adjust points. Replace plug after 100 hours operation.

Ignition coil burnt out.

Inform Ordnance maintenance personnel.

NOTE: If motor misfires after checking gas line, carburetor, spark plug, cable and contact points, install a new condenser. A leaky or weak condenser may cause the motor to start hard, sputter, or misfire under load.

f. Failure of Sight Bulb To Operate.

Plug not seated in receptacle on left trunnion face (M33).

Seat plug firmly in receptacle and tighten locking ring.

Bulb burned out.

Depress push button plunger (fig. 25) on top of sight. Unscrew bulb from holder and replace bulb with spare in spare bulb can clipped to left side of mount. Make sure bulb burns brightest when dimmer switch knob is turned to "day" (par. 33).

g. Creepage of Mount.

Mount "creeps" when controls are neutral.

Test belt tension and adjust if flex is more than one-half inch (par. 49 c (2)). If creepage still exists, report to Ordnance maintenance personnel.

MALFUNCTIONS AND CORRECTIONS

h. Failure of Guns To Fire When Triggers Are Pressed.

Cause	Correction
Solenoid lead not plugged into receptacle on outer trunnion face.	Plug lead into receptacle and tighten locking ring.
Solenoid not properly seated on buffer tube of machine gun.	Loosen the two bolts on solenoid clamping rings. Depress safety latch, and push solenoid forward until the shoulder on the core comes in contact with the bottom of the back plate window. Release safety latch and allow it to enter slot in core. Center core in back plate window; tighten bolts on clamping ring. Install locking wire.
Firing circuit switch off; indicator light out.	Throw firing circuit switch on.
Trigger switches not functioning. <i>CAUTION: Make sure guns are not loaded.</i>	Turn on firing circuit switch (M45) and check each trigger separately. Listen for click of switch when trigger is depressed; at same time have someone check operation of solenoid. If trigger switches do not function inform Ordnance maintenance personnel. On the M33, turn on turret drive switch before proceeding as above.

i. Failure of Interrupter Switches To Operate.

Connections in junction box loose or incorrectly assembled (M33).	Remove cover of junction box; bend down out of way. Locate terminal block on rear wall of junction box. Compare numbered markers on wires with corresponding numbers on terminal block. Assemble leads correctly and tighten all connections.
Elevation interrupter switches in trunnions not breaking contact.	Remove trunnion cover plate. Make a slight bend in the roller springs on switches outwards from switch blocks and test. If switches still do not function, replace (pars. 41 and 42).

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

Cause	Correction
Elevation interrupter cam in trunnion loose or missing.	On the M33, elevation interrupter switches are in right trunnion only. On the M45, remove trunnion covers. Check presence of cam. Tighten the two mounting screws, if cam is loose. If cam is missing, inform Ordnance maintenance personnel.
Azimuth interrupter switches under mount floor not breaking contact.	Remove base doors and traverse mount until interrupter switches are accessible. Increase tension on roller springs as for elevation switches. Test and if switches do not function, report malfunction to Ordnance maintenance personnel.
Azimuth interrupter cam missing.	Check presence of cam. If missing, report to Ordnance maintenance personnel.

Section VII

INSPECTION

44. GENERAL.

a. Inspection of your materiel is vital. Thorough, systematic inspection at regular intervals is the best insurance against an unexpected breakdown at the critical moment when maximum performance is absolutely necessary. Never let your materiel run down; keep it in first class fighting condition by vigilant inspection and prompt maintenance.

b. Inspection is for the purpose of determining the condition of the materiel and the repairs or adjustments necessary to insure serviceability and proper functioning. Its immediate aim is trouble prevention, which includes:

- (1) Detecting faulty or careless operation and care.
- (2) Determining when replacement of parts is necessary because of ordinary wear, breakage, or defective parts.
- (3) Discovering evidence of improper treatment received by materiel before delivery to using arms.

INSPECTION

45. INSPECTION INSTRUCTIONS.

a. To insure mechanical efficiency, it is necessary that the mount be inspected before and after every session of firing. Parts to be inspected and points to be observed are given in the following subparagraphs. It will not be necessary to check all the following points every day. They are offered as suggestions to aid in making up daily inspection check lists and 25-hour inspection check lists, which in the judgment of the unit commander will best insure continued and reliable mount operation.

b. Mount Structure as a Unit.

- (1) Condition of all welds, rivets, bolts, and screws.
- (2) Operation of seat adjustments.
- (3) Condition of seat fastenings.
- (4) Condition of foot rest.
- (5) Tightness of bolts holding rotatable mount frame to base.
- (6) Tightness of wing nuts holding base covers to base.
- (7) Spare bulb cans filled and in place.

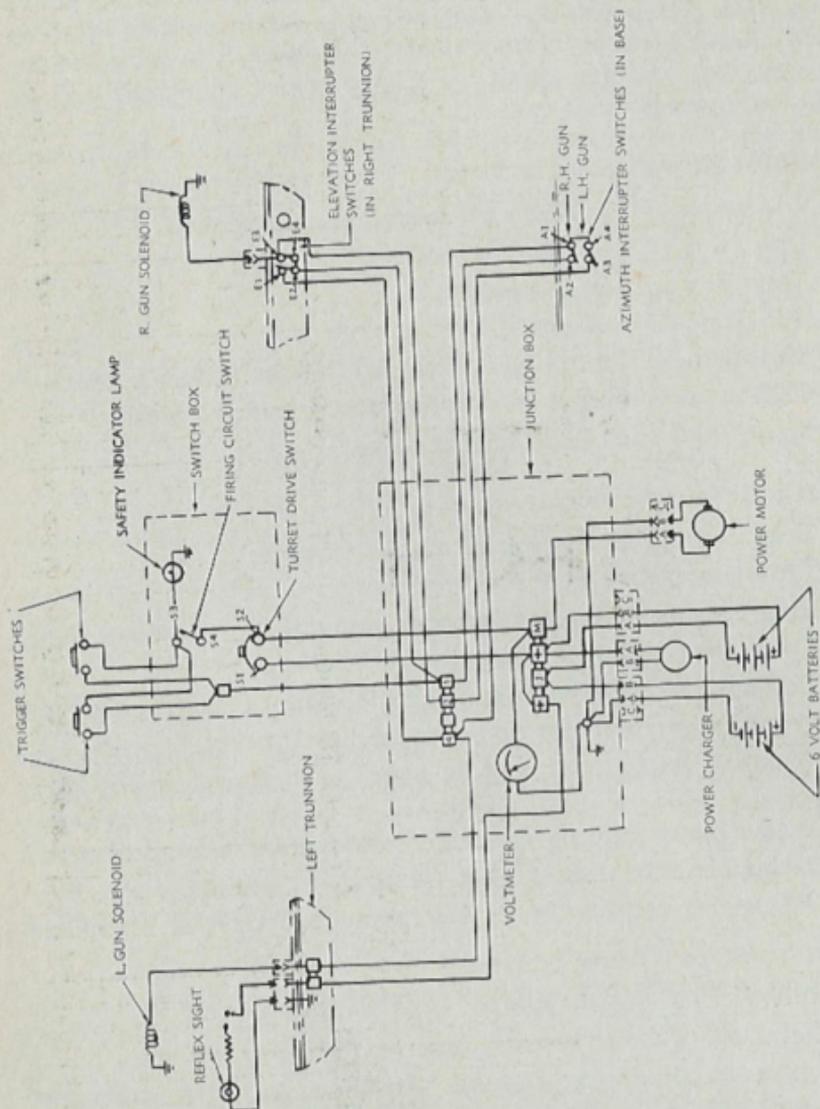
c. Trunnions and Sectors.

- (1) Trunnions properly bolted to main frame.
- (2) Trunnions lubricated.
- (3) Ring clamp of trunnions securely mounted with screws tight.
- (4) Trunnions moving freely without binding.
- (5) Tightness of bolts holding rotatable mount frame to base.
- (6) Trunnion sector teeth not scratched or broken.
- (7) Trunnion sector properly engaged with torque tube drive shaft.
- (8) Welded limit stop in alinement with elevation stop lever.
- (9) Depression stop lever (M45 Mount) in working order.
- (10) All wiring receptacles in both trunnions tight and undamaged.

d. Junction Box and Conduits (figs. 63, 64, 65, and 66).

- (1) Tightness of bolts holding junction box.
- (2) Voltmeter operating and all wiring to voltmeter correctly connected and tight.
- (3) Voltmeter cover glass intact.
- (4) All conduits for wear and proper seating.
- (5) Cables to batteries properly connected. Lugs clean and free from corrosion.

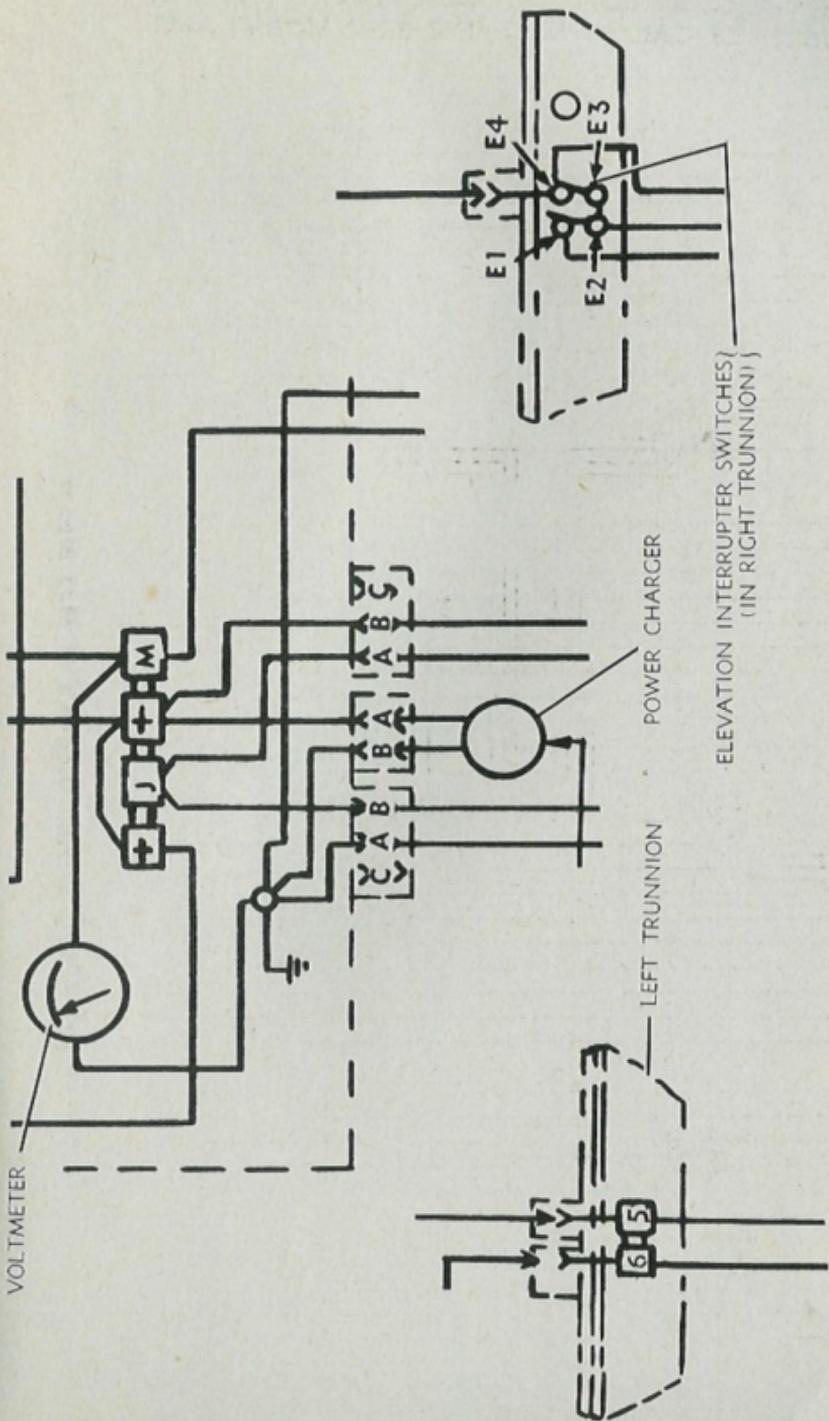
TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
 MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 51347

Figure 63—Wiring Diagram of M33 Mount

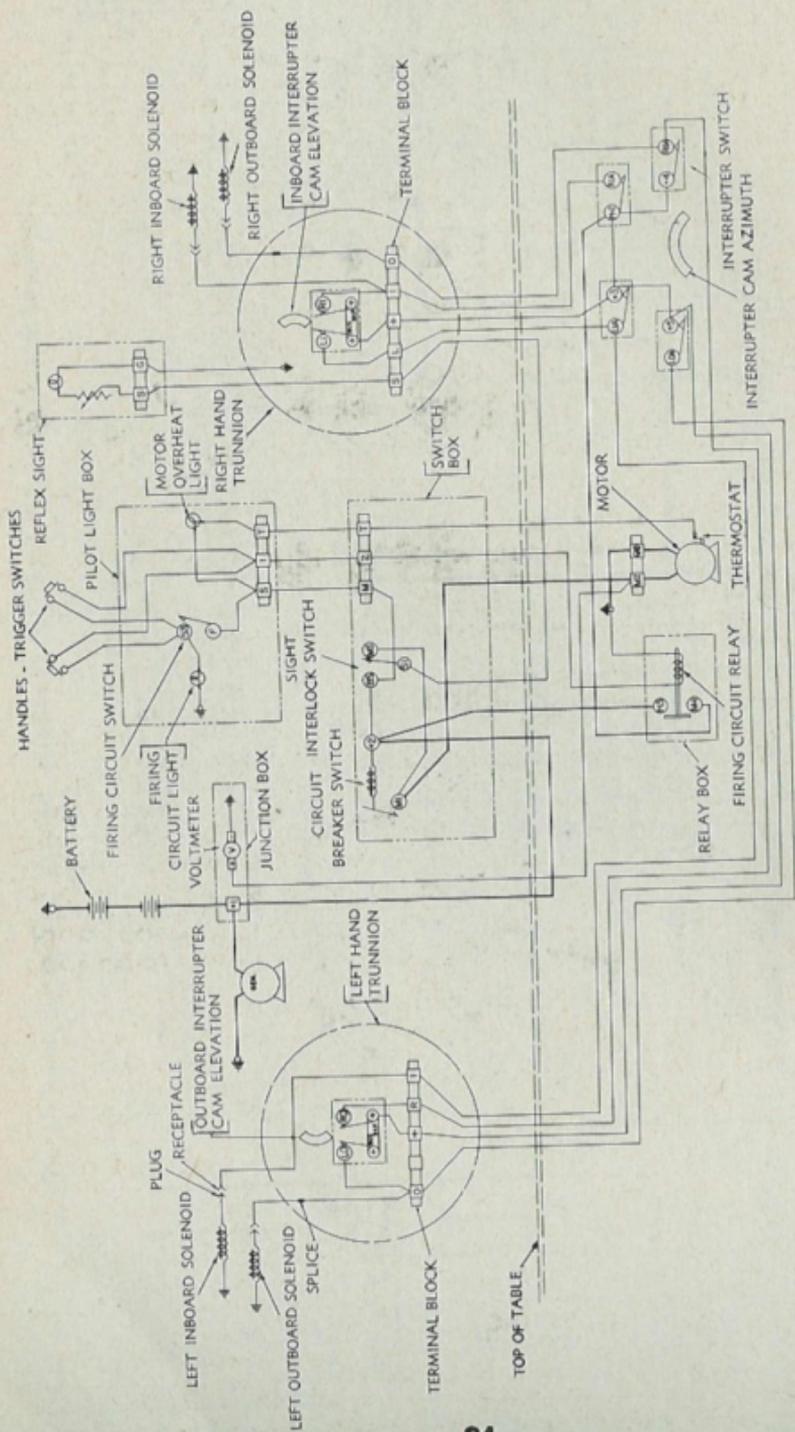
INSPECTION



RA PD 51347A

Figure 64—Schematic Wiring Diagram of M33 Mount (Enlargements)

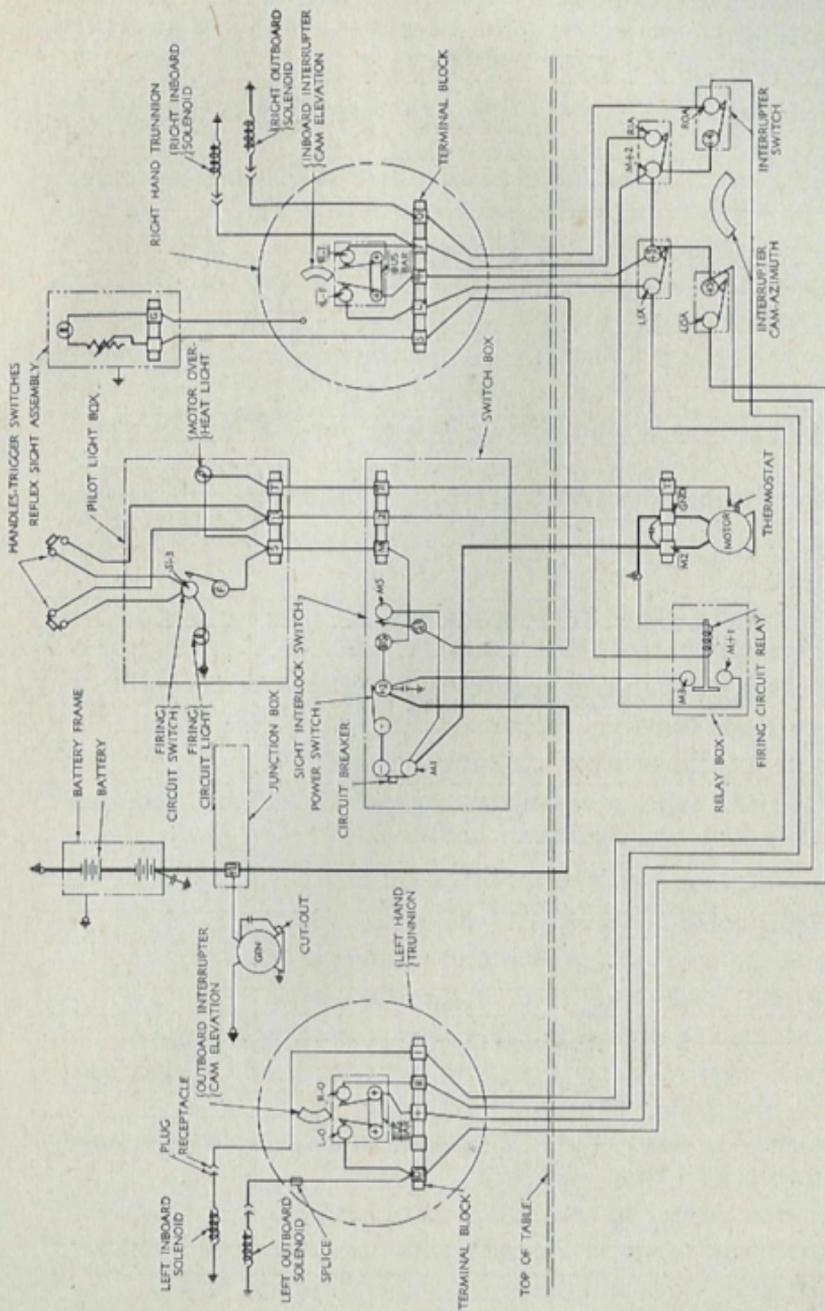
TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
 MULTIPLE CAL. .50 MACHINE GUN MOUNT M45



RA PD 70805

Figure 65—Wiring Diagram of M45 Mount—Early Manufacture

INSPECTION



RA PD 60260

Figure 66—Wiring Diagram of M45 Mount—Present Manufacture

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

(6) Conduit through floor of mount to power drive in good condition. Plug properly seated in motor receptacle (M33). Connections on motor terminal block secure (M45).

e. Switch Box (M33) and Pilot Light Box (M45) (figs. 63, 64, 65, and 66).

(1) Firing circuit panel light (M45) and switch box panel light (M33) go on when firing circuit switch is thrown.

(2) Firing circuit switch in working order.

CAUTION: Guns should not be loaded.

(3) Turret drive switch functioning properly (M33). Check the turret drive switch of the M45 located in switch box on right side of mount.

(4) Wires to trigger switches in control handles in good condition.

(5) Conduit from junction box properly coupled to junction box (M33).

f. Batteries.

(1) If charge is below 1240 by hydrometer reading, it should be brought up to full charge (1225 to 1280) (par. 49).

(2) At least three-eighths inch of fluid above cell plates.

(3) Free from corrosion and cracks in rubber casing.

(4) Cable lugs to be tight on battery posts.

(5) Batteries properly seated on channel slides, and frame and battery latches in proper working condition.

g. Power Charger (figs. 67 and 68).

(1) Proper cable connection to junction box.

(2) Capacity level of gasoline and crankcase oil.

(3) Air filter clean and filled to the bead level.

(4) Venthole in gasoline tank cap clear of obstructions.

(5) Spark plug properly seated in cylinder head. If necessary, scrape spark plug free from dirt or carbon.

(6) Spark plug points set at .025, and points cleaned after every 25 hours of operation (par. 49 b (2)).

(7) Ignition system and magneto functioning properly (par. 43 f).

(8) Carburetor adjusted for proper fuel feed (par. 49 b (3)).

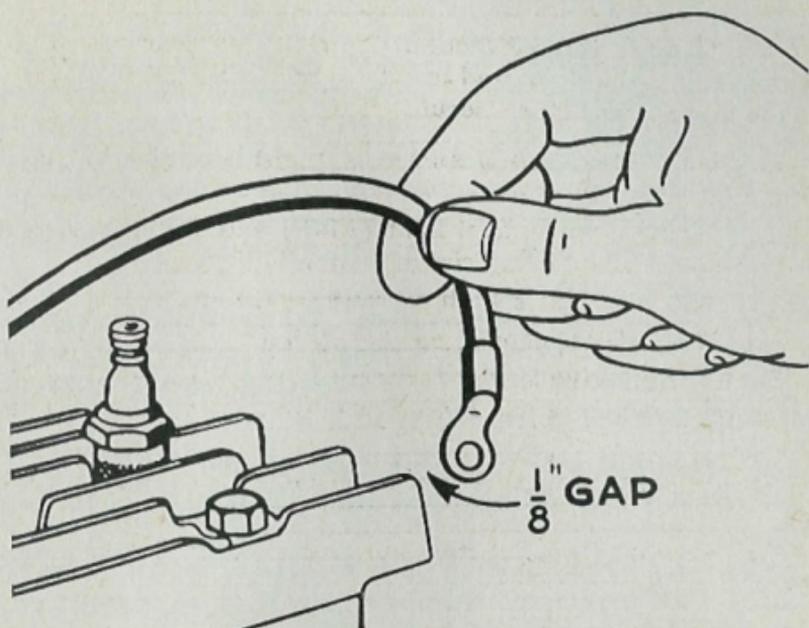
(9) Fuel lines clear and properly connected (par. 43 e).

(10) Controls for proper connections. Check wiring for defects.

(11) Generator brushes for wear.

(12) Field coil for grounds.

INSPECTION



CHECKING SPARK

RA PD 26678

Figure 67—Checking Spark



SPARK PLUG

RA PD 26617

Figure 68—Checking Ignition System

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45****h. Power Drive.**

- (1) Power unit pulley belts for tension. Belts with more than one-half-inch flex must be tightened (par. 49 c (2)).
- (2) Differentials filled to oil plug with lubricant.
- (3) Differential assemblies for oil or grease leakage.
- (4) Pulley belts for traces of wear or grease.
- (5) Splined shafts for scratches or burs.
- (6) Short circuit in motor.
- (7) Pulleys for axial slippage. Set screws to be tight.
- (8) Units to be securely fastened to power unit bed plate.
- (9) Differential adjustment screws tightened to prevent slippage of units, and loss of belt traction.

i. Azimuth and Elevation Gear Boxes.

- (1) Shafting and coupling from power drive to be properly engaged.
- (2) All screws holding units to base of mount to be tight.
- (3) All covers and bearing retainers to be screwed on tight.
- (4) Units to operate freely without binding or drag.

j. Turret Ring Gear.

- (1) Ring gear to be free from broken teeth.
- (2) Gear to be lubricated.
- (3) All roller bearings to move freely, and to be in proper alignment.

k. Interrupter Switches.

- (1) Wiring circuits to switches to be correct and all connections tight.
- (2) Switches to break contact properly at correct arc, in both traverse and elevation.
- (3) Cams to be properly positioned and firmly in place.
- (4) When mount is used on trailer see that the jumper is connected as in paragraph 22 c.

Section VIII**CARE AND MAINTENANCE****46. IMPORTANCE OF LUBRICATION.**

- a. One of the best ways of getting the utmost in performance and operating life from the mount is to see that every moving part is provided at all times with the correct lubricants in the right quantity. When this is done, all parts of the mount operate with the least

CARE AND MAINTENANCE

amount of effort, require less work by the power drive, and deliver far more operating hours without the need of adjustment or replacement due to wear. The likelihood of failures or breakdowns will be greatly reduced. Lack of lubrication, on the other hand, may be the biggest factor in putting the mount out of commission.

47. LUBRICATION ORDER.

a. War Department Lubrication Orders Nos. 130 and 133 (figs. 68A and 68B) prescribes first and second echelon lubrication maintenance. Lubrication to be performed by Ordnance maintenance personnel is covered in TM 9-1223.

b. A Lubrication Order is placed on or 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 an order, a replacement should be immediately requisitioned (FM 21-6).

c. Service intervals specified on the Lubrication Orders are for normal operating conditions and continuous use of the materiel. These intervals will be reduced under extreme conditions such as excessively high or low temperatures, prolonged periods of high-speed operation, continued operation in sand or dust, immersion in water or exposure to moisture, any one of which may quickly destroy the protective qualities of the lubricant, and require servicing in order to prevent malfunctioning or damage to the materiel.

d. Lubricants are prescribed in the "Key" in accordance with three temperature ranges, "above $+32^{\circ}\text{F}$," " $+32^{\circ}\text{F}$ to 0°F ," and "below 0°F ." The time to change to lubricants prescribed for a different range is determined by maintaining a close check on operation of the materiel during the approach to prolonged periods when temperatures will be consistently higher or lower. Because of the time element involved in preparing for operation at lower prevailing temperatures, a change to lubricants prescribed for the next lower range will be undertaken the moment operation becomes sluggish. Ordinarily, it will be necessary to change lubricants only when expected air temperatures will be consistently in the higher or lower range.

e. Lubrication Equipment.

(1) Each piece of materiel is supplied with lubrication equipment adequate to maintain the materiel. This equipment will be cleaned both before and after use.

(2) Lubrication guns will be operated carefully and in such manner as to insure a proper distribution of the lubricant.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

No. 130

WAR DEPARTMENT LUBRICATION ORDER

ORDNANCE DEPARTMENT

CARRIAGE, MOTOR, MULTIPLE GUN, M14

SNL G-147

Clean all parts with SOLVENT, dry-cleaning or OIL, fuel, Diesel.
Lubricate dotted arrow points on both sides.

Requisition replacement Lubrication Orders from the Commanding Officer, Fort Wayne Ordnance Depot, Detroit 32, Michigan.

Clean fittings before lubricating. Lubricate after washing.
Reduce intervals under severe operating conditions.

For detailed instructions, refer to TM 9-207 (General), TM 9-223 (Mount).

NOTE— See Reversal Side for Lubrication of CHASSIS

Lubricant • Original
Dive Sprocket Bearings WB 6
Remove, clean and re-pack

Oil • Lubricant
1/4 CG Track Support Roller



Bogie Wheels CG 1/4

HALF TRACK SUSPENSION SYSTEM

1/4 CG Track Rear Idler
D PS Gun Bores
(See Note)

M CG Seat Roller

M PS Trunnion Bearing

D PS Breech and Firing

D OE Crankcase Fill and Level

25 Crankcase Drain and refill

D CG Trunnion Sector Rack

PS M

PS D

OE D

CG D

Trunnion Bearing

Elevate while lubricating

1 to 2 drops

Breech and Firing

Mechanism

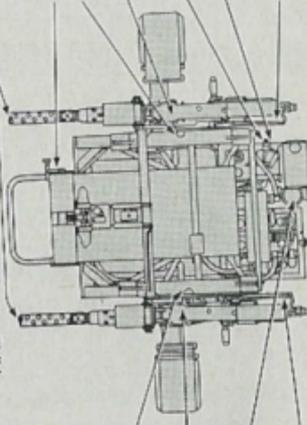
Daily and after firing, clean and oil

Air Cleaner

Check level (See Note)

Trunnion Sector Rack

Clean and coat



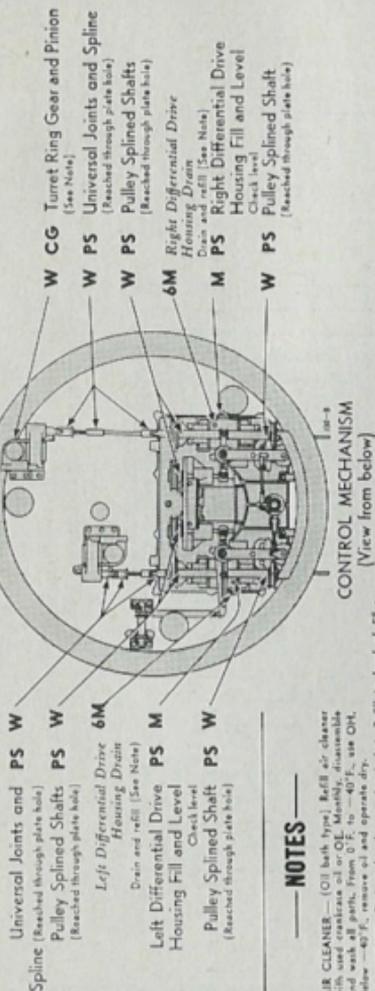
MOUNT, MACHINE GUN, TWIN, CAL. 50, M33 (Plan View)

Clean and coat

Figure 68A—Lubrication

CARE AND MAINTENANCE

RA PD 60245



- PS W Universal Joints and Spline (Reached through plate hole)
- PS W Pulley Splined Shafts (Reached through plate hole)
- 6M Left Differential Drive Housing Drain (Drain and level) (See Note)
- PS M Left Differential Drive Housing Fill and Level (Check level)
- PS W Pulley Splined Shaft (Reached through plate hole)

NOTES

AIR CLEANER—(Oil bath type) Refill air cleaner with used crankcase oil or OIL Monthly, disassemble and wash with parts, fresh oil if needed. See OIL.

CRANKCASE—Drain only when engine is hot. Refill to level of filler plug opening.

GUN BORE—After firing, and for 3 consecutive days thereafter, clean with CLEANER, rifle bore, dry and cool. When moisture is not being driven, grease oil film daily. Every 5 days, clean with SOLVENT, dry thoroughly.

LEFT AND RIGHT DIFFERENTIAL DRIVE HOUSINGS—(Some models) Monthly, check oil level by removing plate on side of case. Add PS to level of plate opening. Every 6 months, drain and refill with OIL. The only fill plug to level plug opening. Drain through drain plug located at bottom of case.

TURRET RING GEAR AND PINION—Apply through backhole plate opening in side of base ring to pinion and at each of the 4 holes at bottom of turret ring to gear with GREASE, general purpose.

OIL CAN POINTS—Daily, lubricate Recoil Indicator, Latches and Hinges with PS.

DISASSEMBLE PERIODICALLY BY ORDINANCE PERSONNEL—Torque Table Gear Box, Motor Unit Case, Ammunition and Elevation Gear Box, Case. (Refer to TM 9-1222.)

Copy of Lubrication Order will be carried with the manual of maintenance. From lubrication instructions are binding on all sections of maintenance.

By Order of the Secretary of War:
G. C. Marshall, Chief of Staff.

No. 130 (NOT TO BE REPRODUCED without the authority of the Chief of the Staff, G-1, War Department.)

KEY

This Side Only

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE
OE—OIL, engine	above +32° F. +32° F. to 0° F.
CG—GREASE, general purpose	SAE 30 SAE 10 No. 0 No. 0
WB—GREASE, general purpose, No. 2—All temperatures	See OFSB 6-11 No. 0
PS—OIL, lubricating, preservative, special—All temperatures	INTERVALS
OH—OIL, hydraulic	14—250 miles 15—500 miles 25—2500 miles D—Daily W—Weekly M—Monthly M—at intervals

COLD WEATHER: For Lubrication and Service below 0° F., refer to OFSB 6-11 and OFSB 6-5.

4 Apr 44
Supersede all previous issues.

TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45

No. 133

WAR DEPARTMENT LUBRICATION ORDER DEPARTMENT

ORDNANCE



CARRIAGE, MOTOR, MULTIPLE GUN, M17

SNL G-147

For detailed instructions, refer to TM 9-223 (Mount).

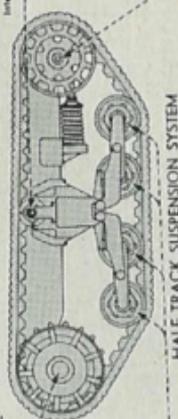
Clean all parts with SOLVENT, dry-cleaning or OIL, fuel, Diesel.
Lubricate dotted arrow points on both sides.

Requisition replacement Lubrication Orders from the Commanding Officer, Fort Wayne Ordnance Depot, Detroit 32, Michigan.

Clean fittings before lubricating. Lubricate after washing.
Reduce intervals under severe operating conditions.

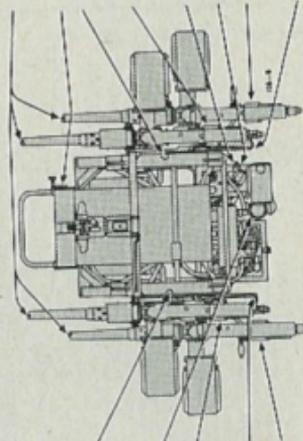
Internal • Interval
Lubricant • Interval
WB 6
Remove, clean and repack

Internal • Lubricant
CG Track Support Roller



Bogie Wheels **CG** 1/4

1/4 **CG** Track Rear Idler



Trunnion Bearing **PS M**
Elevate while lubricating

Air Cleaner **OE D**
Check level (See Note)

Breach and Firing Mechanism **PS D**
Duty and after firing, clean and oil

Trunnion Sector Rack **CG D**
Clean and coat

Breach and Firing Mechanism **PS D**
Duty and after firing, clean and oil

D PS Gun Bores
(See Note)

M CG Seat Roller
M PS Trunnion Bearing
Elevate while lubricating

D PS Breach and Firing Mechanism
Duty and after firing, clean and oil

D OE Crankcase Fill and Level
Check level

25 Crankcase Drain
Clean and oil Cap, 1/2 qt. (See Note)

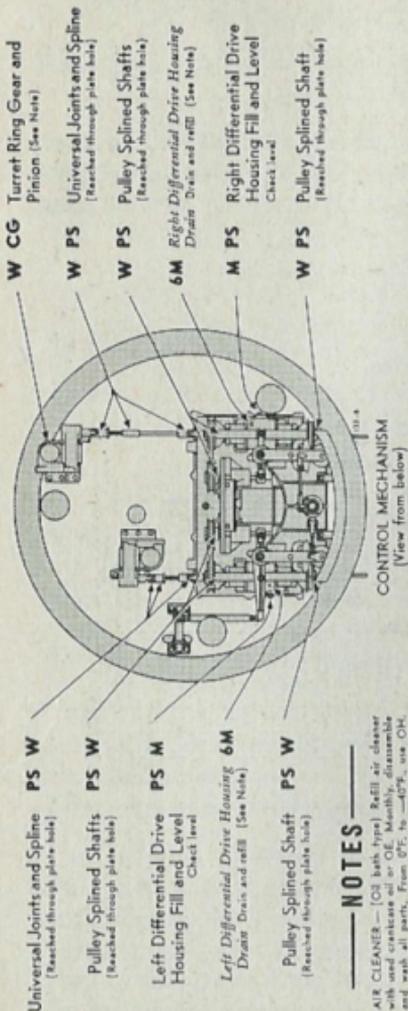
D PS Breach and Firing Mechanism
Duty and after firing, clean and oil

D CG Trunnion Sector Rack
Clean and coat

Figure 68B—Lubrication

CARE AND MAINTENANCE

RA PD 60246



NOTES

- AIR CLEANER—(Oil bath type) Refill oil cleaner with used crankcase oil or OE. Monthly, drainable and wash all parts. From 0°F. to -40°F., use OH. Below -40°F., remove oil and operate dry.
- CRANKCASE—Drain only when engine is hot. Refill to level of filler plug opening.
- FLUIDS—Check ring and fan 2 connecting deep throttle, clean with CLEANER, rifle bore, dry and reoil. When machine gun is not being fired, reoil oil film daily. Every 5 days, clean with SOLVENT, dry-cleaning, dry and reoil.
- LEFT AND RIGHT DIFFERENTIAL DRIVE HOUSINGS—(Some models have differential housings on the right side of the vehicle) Add PS to level of plate opening. Every 6 months, drain and refill with PS. Drain only after operation. Fill to level of plate opening. (Some models) Fill through OE plug to level plug opening. Drain through drain plug located in bottom of case.
- JURIDIC RING—Clean and reoil. Apply grease to the bottom of the ring gear as it can be reached. Monthly, clean ring gear and pinion and lubricate.
- OIL CAN POINTS—Daily, lubricate Recoil Indicator, Leclerch DISASSEMBLED PERIODICALLY BY ORDINANCE PERSONNEL—Torque Tube Gear Box, Motor Unit Case, Aimath and Elevation Gear Box Cases. (Refer to TM 9-1221.)
- Copy of this Lubrication Order will be carried on the material of all items. These Lubrication Instructions are binding on all activities of maintenance.

By Order of the Secretary of War:
G. C. Marshall, Chief of Staff.

No. 133 (NOT TO BE REPRODUCED IN ANY MANNER WITHOUT PERMISSION OF THE CHIEF OF ORDNANCE) CHECK CHART

KEY THIS SIDE ONLY

NOTE—See Reverse Side for Lubrication of CHASSIS (View from below)

LUBRICANTS	LOWEST ANTICIPATED AIR TEMPERATURE	INTERVALS
OE—OIL, engine	above +32°F. to 0°F.	1/2—250 miles W—Weekly 4—4,000 miles M—Monthly 25—25 hours 6M—6 months D—Daily
Crankcase	SAE 30	
CG—GREASE, general purpose	No. 1	No. 0
WB—GREASE, general purpose, No. 2—All temperatures		
PS—OIL, lubricating, preservative, special—All temperatures		
OH—OIL, hydraulic		

COLD WEATHER: For Lubrication and Service below 0°F., refer to OFSB 6-11 and OFSB 4-5.

4 Apr 44
Supersedes all previous issues.

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45****f. Points of Application.**

(1) Lubrication fittings, grease cups, oilers, and oilholes are readily identifiable on the materiel. Lubricators and the surrounding surface will be wiped clean before lubricant is applied.

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

g. 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.

h. Air Cleaners.

(1) **OIL BATH TYPE.** Daily, check level and refill engine air cleaners to bead level with used crankcase oil or engine oil SAE 30 above $+32^{\circ}\text{F}$ and SAE 10 from $+32^{\circ}\text{F}$ to 0°F . From 0°F to -40°F , use hydraulic oil. Below -40°F , remove oil and operate dry. Monthly remove cleaners and wash all parts.

i. Crankcases. Daily, check level and refill to "FULL" mark with engine oil SAE 30 above $+32^{\circ}\text{F}$ or SAE 10 from $+32^{\circ}\text{F}$ to 0°F . Every 25 hours, remove drain plug from bottom of crankcase and completely drain case. Drain only when engine is hot. After thoroughly draining, replace drain plug and refill crankcase to plug level with correct lubricant to meet temperature requirements. Run engine a few minutes and recheck oil level.

j. Gun Bore. After firing, and for 3 consecutive days thereafter, clean with rifle bore cleaner, dry and oil. When machine gun is not being fired, renew oil film daily. Every 5 days, clean with dry cleaning solvent, dry, and oil.

k. Right and Left Differential Drive Housing (Some Models). Monthly, check oil level by removing plate on side of case. Add special preservative lubricating oil to level of plate opening. Every 6 months, drain and refill with special preservative lubricating oil. Drain only after operation. Fill to level plug hole (some models). Fill through fill plug to level plug opening. Drain through drain plug located in bottom of case.

l. Turret Ring Gear and Pinion. Weekly, apply general purpose grease No. 1 above $+32^{\circ}\text{F}$ and No. 0 below $+^{\circ}\text{F}$ through hand-hole plate opening in side of base ring to pinion and as much of the ring gear as can be reached. Traverse mount through 360 degrees to distribute grease. Repeat application to pinion and traverse through 360 degrees. Monthly, clean ring gear and pinion and lubricate.

CARE AND MAINTENANCE

m. Oil Can Points. Daily, lubricate recoil indicator, latches and hinges with special preservative lubricating oil.

n. Disassembled Periodically by Ordnance Personnel.

- (1) Elevation and azimuth gear box cases.
- (2) Torque tube gear box.
- (3) Motor unit cases.

o. Reports and Records.

(1) **REPORTS.** Unsatisfactory performance of materiel will be reported to the Ordnance officer responsible for maintenance.

48. SCOPE OF MAINTENANCE.

a. The maintenance duties for which tools and parts have been provided the using arm personnel are described below. Other replacements and repairs are the responsibility of the other maintenance personnel, but may be performed by the using arm personnel, when circumstances permit, within the discretion of the pertinent Ordnance officer.

b. Maintenance and repair on the mount groups above the base may be handled without removing the mount from the base. The drive gearing may be disengaged by working through the base cover openings and disengaging the elevation drive coupling and the azimuth pinion shaft splined coupling between the power drive and the gear boxes. This will facilitate operations involving traverse and elevation action without using power drive, batteries, and power charger. The mount may be positioned by hand in both traverse and elevation. *CAUTION: When operating mount with elevation and azimuth drive uncoupled, operate very slowly because the universal joint will hit the under side of the base and cause damage.*

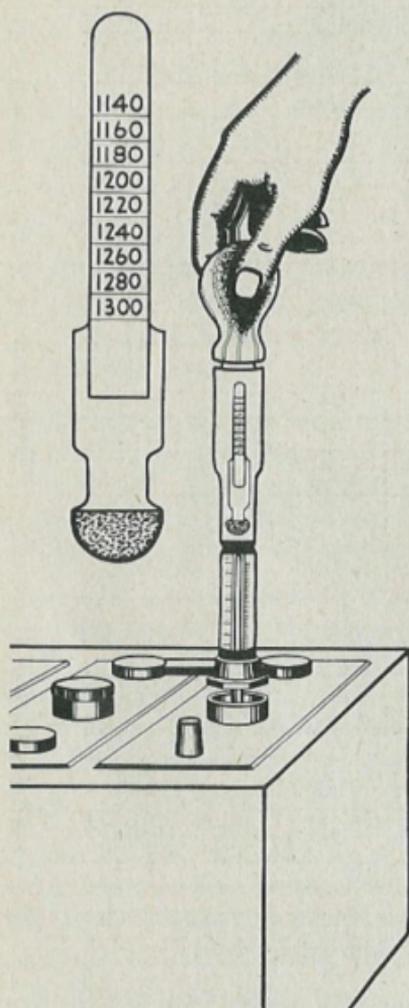
c. When parts or assemblies, or parts of assemblies, are broken or worn so as to render them unserviceable, they must be replaced from stock. Often only parts of assemblies or groups will be worn or broken; however, when it takes more time to remove serviceable parts from assemblies than the parts are worth, the entire assembly should be replaced.

49. MAINTENANCE INSTRUCTIONS.

a. Batteries.

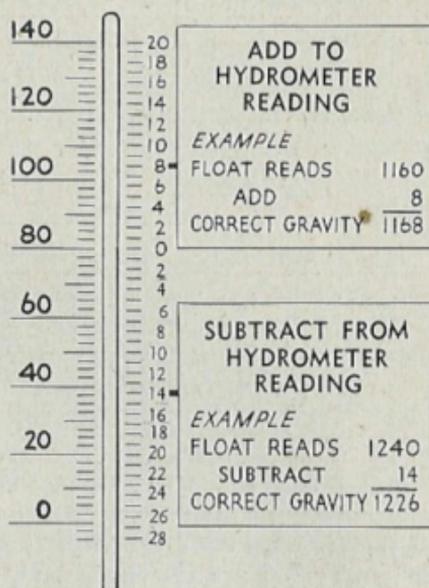
(1) Before and after each operation of the mount, the batteries should be serviced. Using the hydrometer, make a careful test on each cell. When the batteries are fully charged, the hydrometer reading should be between 1240 and 1280. (For unusual conditions, see

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**



TEMPERATURE CORRECTION

ONE POINT IS ADDED TO THE HYDROMETER READING FOR EACH THREE DEGREES INCREASE IN TEMPERATURE OVER 80° F., AND ONE POINT IS SUBTRACTED FOR EACH 3 DEGREES IN TEMPERATURE BELOW 80° F.



RA PD 26618

Figure 69—Using the Battery Hydrometer

sec. IX). If the hydrometer reading is lower than 1240 the batteries are undercharged and should be brought up to full charge before the mount is operated. Set generator switch to "LOW" until battery is fully charged. Determine by another hydrometer reading whether the battery is fully charged (fig. 69).

NOTE: Even though the mount has a voltmeter on the junction box, use hydrometer to get accurate check of battery charge. This hydrometer test must be made before and after each operation of

CARE AND MAINTENANCE

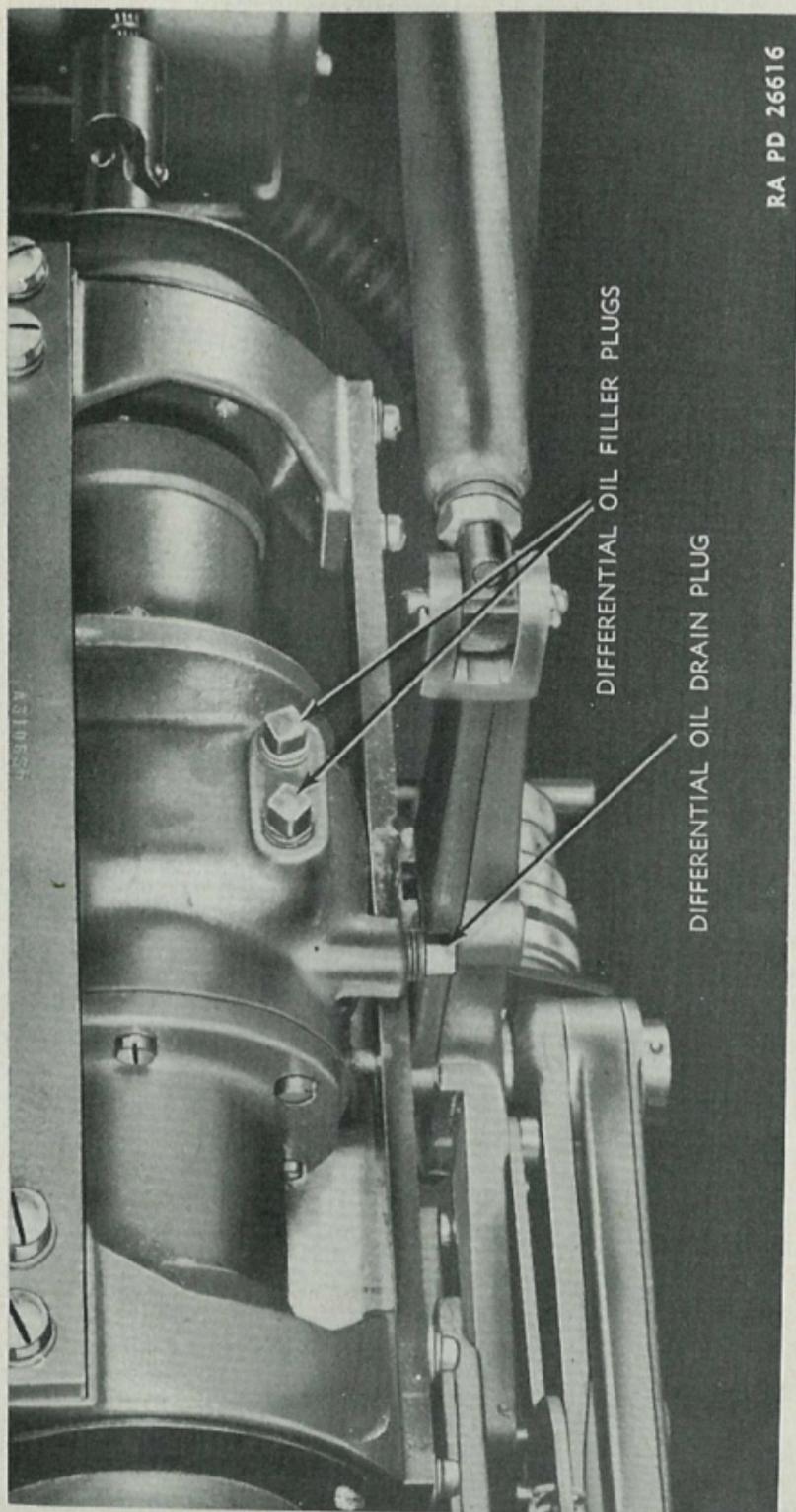


Figure 70—Differential Oil Filler and Drain Plugs (as Seen Through Opening in Base)

**TWIN CAL. .50 MACHINE GUN MOUNT M33 AND
MULTIPLE CAL. .50 MACHINE GUN MOUNT M45**

the mount. Do not make test immediately after water has been added. Tests made after water has been added will not register correctly. Make test before water is added or after the battery has been on charge or in use for a few hours.

(2) A fluid level of at least three-eighths inch above the cell plates must be maintained in the batteries at all times. Since the water component of the electrolyte tends to evaporate, replace it when necessary with distilled water added by means of a hydrometer. Do not overfill cells or solution may bubble over.

(3) The batteries must be kept clean and dry at all times and the vent plugs tightened, although the breather holes in the latter must be kept open. If electrolyte (battery fluid) is spilled or any parts are damp with acid, a solution of ordinary baking soda (1 pound of soda to 1 gallon of water), should be applied to the surfaces then rinsed with fresh water and dried. No cleaning solution should be allowed to enter a cell. Cleaning cloths contaminated with acid should be discarded.

(4) Cable terminals should be kept tight or the proper connections cannot be maintained. Scrape clean with coarse wire brush and then wash surfaces with hot water and soap. Coat terminals with general purpose grease No. 1 or No. 0, to prevent formation of corrosion.

(5) In the event of battery damage or if the batteries fail to take charge, notify Ordnance maintenance personnel.

b. Power Charger.

(1) For efficient operation of the mount, the power charger should be serviced before and after each operation of the mount. Check level of fuel in gasoline tank; fill tank up to capacity. Check level of crankcase oil every 5 hours of motor operation. If necessary add until oil is up to plug level. Drain by removing oil drain plug in cylinder base, while engine is still hot. Refill crankcase with fresh oil after every 25 hours of operation through oil filler cap located in cylinder base. Do not flush the crankcase. Check, clean, and refill air cleaner at least once a week or if mount is operating under extreme dirt and dust conditions, clean once a day (par. 53). The level of oil in air cleaner must be checked daily.

(2) The spark plug of the power charger should be cleaned, checked, and points reset to 0.025-inch gap every 25 hours of motor operation. Examine the porcelain for cracks or breaks, as these faults will prevent the plug from firing. Water on the outside of the plug may permit the current to leak over the surface of the porcelain. Dirt or carbon on the surface of the porcelain will act in the same manner

CARE AND MAINTENANCE

as water on the surface. The points should be scraped clean. Replace the plug, regardless of condition, after every 100 hours of operation.

(3) To adjust the carburetor, completely close the needle valve by turning it to the right (clockwise) as far as possible. Do not use force in this action as the needle valve may be damaged by forcing. From the closed position, open the needle valve one-half to three-quarters of a turn. After the engine has been started and warmed up, with the choke wide open make the final adjustment on the valve by turning it to a point where the engine operates most smoothly with a full load. This setting will also take care of starting with the use of the choke. If, when starting a cold engine, it is necessary to keep the choke partly closed several minutes before the engine runs smoothly, the carburetor setting is too lean, and the needle valve should be opened slightly to the left.

(4) To operate properly, the gasoline engine must have all parts in correct adjustment to provide good ignition, carburetion, compression, and cooling. It is equally important that the gasoline and oil be *clean* and of the proper grades. Keep the engine clean both inside and outside. Make sure that no dirt or water enters engine when filling with gasoline or oil. Always wipe off the gasoline tank cap and the oil filler plug, as well as around them before refilling.

c. Power Drive.

(1) To service the differentials, remove both base covers in the base of the mount. Drain completely through lowest plug, first. Then locate the two oil plugs on the side of the differentials and remove both plugs. Locate drain plug in bottom of differential, remove, and drain out old oil. Replace drain plug. Use a pressure oil can to apply oil to the differentials. Pump oil in one of the two holes until oil starts to flow out of the other hole. Replace plugs and repeat operation at opposite differential.

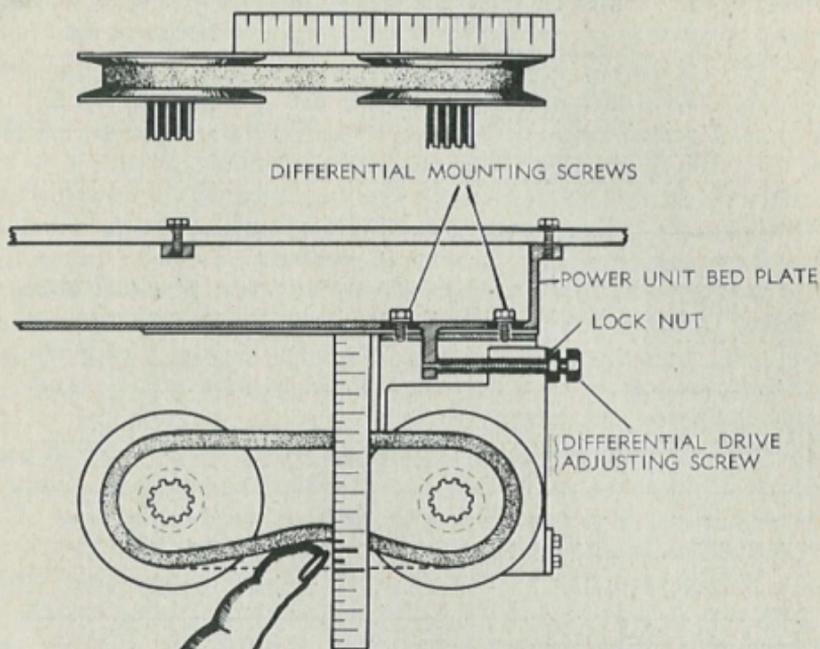
(2) A common cause of lack of proper speed from the power drive is incorrect belt adjustment. To check and tension belts proceed as follows (fig. 71):

(a) Remove base covers and traverse mount so that belts may be observed, watch for apparent looseness in any of the four belts.

(b) Turn off drive and test belts for proper tension by displacing belt with finger. If one side of belt can be displaced more than one-half inch, it should be tightened as follows:

1. Locate differential mounting screws (fig. 49), under the seat.
2. Loosen mounting screws of differential involved (fig. 50).
3. Through base cover openings in base, loosen lock nut on differential housing and turn the differential drive adjusting screw clockwise.

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Figure 71—Testing Pulley Belt Tension

4. Test tension of belts again.
5. Tighten lock nut of differential drive adjusting screw.
6. Tighten differential mounting screws under seat.
7. Replace base covers.

(3) If the belts are worn, stretched beyond tightening, or damaged in any way, they should be replaced as in paragraph 27. Always replace *both* belts on the differential even though only one needs replacement.

Section IX

OPERATION UNDER UNUSUAL CONDITIONS

50. GENERAL.

a. When operating under unusual conditions such as tropical or arctic climates, severe dust or sand conditions, and near salt water, the precautions listed below should be scrupulously observed:

OPERATION UNDER UNUSUAL CONDITIONS**51. TROPICAL CLIMATES.**

a. When operating in tropical climates, the following precautions should be carefully observed:

(1) **STORAGE BATTERIES.** Watch battery for overheating. The temperature of the electrolyte should not be allowed to exceed 110°F. In tropical climates, the danger of overheating is much greater than in cooler climates. Under such conditions the batteries when fully charged will probably have a hydrometer reading of about 1260. Maintain a constant check on the level of the battery fluid, and keep plates covered by at least three-eighths inch of fluid or more at all times.

(2) **POWER CHARGER.** Maintain bead level of oil in the filter reservoir. Keep the venthole in the gasoline tank cap clear of obstructions.

52. ARCTIC CLIMATES.

a. When operating in arctic climates, the following precautions should be observed:

(1) **STORAGE BATTERIES.**

(a) Keep the storage batteries fully charged at all times. The ability of a battery to develop its capacity is materially reduced if it is not fully charged. Unless fully charged with a reading between 1275 and 1300, the solution may freeze and create sufficient damage to the plates and containers to destroy the battery for future use. A completely discharged battery may freeze and rupture at temperatures near 0°F.

(2) **POWER CHARGER.**

(a) At low temperatures the gasoline engine requires careful attention to lubrication to assure quick, positive starting and trouble-free operation. Engine lubricating oil will be engine oil, SAE 10, diluted with gasoline or dry-cleaning solvent. Since the diluent will tend to evaporate when the oil becomes warm, the oil level may go down rapidly and must be maintained by adding make-up oil and diluent.

(b) The procedure below should be followed to provide the engine with properly diluted engine oil for cold starting:

1. With the oil level at "FULL" mark and the engine warm, add a quantity of gasoline or dry-cleaning solvent equal to 20 percent ($\frac{1}{5}$) of the normal crankcase capacity, for operation between 0°F and -30°F, and 30 percent for temperatures below -30°F. Example: With a 5-quart capacity crankcase, add 1 quart of diluent for temperatures between 0°F and -30°F or $1\frac{1}{2}$ quarts of diluent for temperatures below -30°F.

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2. Run engine 5 to 10 minutes to mix oil and diluent thoroughly and then stop engine.

3. After stopping, note level of crankcase oil on oil level gage stick. Level will be above normal "FULL" mark. It is advisable to mark this increased level on the gage for future reference.

CAUTION: Do not add diluent while engine is running. If any diluent is spilled on the engine, it must be wiped dry before starting.

(c) The following procedure should be used when operating the generator unit at sub-zero temperatures.

1. At end of each operating period, check oil level.

2. If oil level is below normal "FULL" mark, add necessary quantity of undiluted engine oil SAE 10, to bring level to "FULL" mark. Then add the necessary quantity of gasoline or dry-cleaning solvent, to raise level to the mark recorded in step (b) 3, above. If oil level on stopping is at or above "FULL" mark, add enough gasoline or dry-cleaning solvent to bring level to mark recorded in step (b) 3, above.

3. Start engine again and run 5 to 10 minutes to mix oil and diluent thoroughly; then stop engine. Crankcase oil is then properly diluted to provide the necessary oil fluidity for the next cold start.

(d) In addition to proper dilution of crankcase oil, it is often necessary to prime the engine cylinders with gasoline for starting at sub-zero temperatures. This can be done by spraying gasoline into the carburetor throat (after removing air filter) as the engine is being cranked with the electric starter.

(e) Oil pressure should be noted immediately after each start. If none is indicated, engine must be shut down immediately to determine the cause.

(f) For temperatures from 0°F to -40°F the air cleaner should be disassembled, all parts washed in dry-cleaning solvent or Diesel fuel oil, dried thoroughly, and reassembled. The air cleaner will then be refilled to bead level with hydraulic oil or light shock-absorber fluid. The above servicing procedure should be repeated every hundred hours or more frequently if required. Below -40°F, the air cleaner should be disassembled, washed, and replaced without oil in the reservoir.

(g) An attempt must be made at all times to keep the mount in a warm sheltered place. If this is not possible, cover the mount with the tarpaulin cover.

(h) If conditions permit, operate the mount for at least 5 minutes every hour at slow speed in both azimuth and elevation.

OPERATION UNDER UNUSUAL CONDITIONS**53. SEVERE DUST OR SAND CONDITIONS.**

a. When operating under severe dust or sand conditions the following precautions should be observed:

- (1) Check, at least once a day, must be made on the condition of the air filter of the power charger. Wash filter and reservoir bowl as in paragraph 52 a (2) (f) and refill bowl up to bead level.
- (2) As soon as possible after operating the mount, put the canvas cover over the power charger.
- (3) Check breather holes in battery caps and venthole in power charger gasoline tank cap; clear holes of obstructions.
- (4) Place tarpaulin over mount as soon as possible after operation.
- (5) Keep inspection doors assembled on base.

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**Section X
REFERENCES**

54. PUBLICATIONS INDEXES.

The following publications indexes should be consulted frequently for latest changes or revisions of references given in this section and for new publications relating to materiel covered in this manual:

- a. Introduction to Ordnance Catalog (explaining SNL system) ASF Cat.
ORD 1 IOC
- b. Ordnance Publications for Supply Index (index to SNL's) ASF Cat.
ORD 2 OPSI
- c. Index to Ordnance Publications (listing FM's, TM's, TC's, and TB's of interest to Ordnance personnel, OPSR, FS, MWO's, BSD, S of SR's, OSSC's, and OFSB's, and including alphabetical listing of Ordnance major items with publications pertaining thereto) OFSB 1-1
- d. List of Publications for Training (listing MR's, MTP's, FM's, TM's, TR's, TB's, MWO's, SB's, WDLO's, and FT's) FM 21-6
- e. List of Training Films, Film Strips, and Film Bulletins (listing TF's, FS's, and FB's by serial number and subject) FM 21-7
- f. Military Training Aids (listing graphic training aids, models, devices, and displays) FM 21-8

55. STANDARD NOMENCLATURE LISTS.

- a. **Gun Materiel.**
 - Gun, machine, cal. .50, Browning, M2, heavy barrel, turret type SNL A-59
 - Mount, machine gun, multiple, cal. .50, M45 ... SNL A-61
 - Mount, machine gun, twin, cal. .50, M33 SNL A-54
- b. **Maintenance.**
 - Cleaning, preserving and lubricating materials; recoil fluids; special oils, and miscellaneous related items SNL K-1

REFERENCES

Soldering, brazing and welding material, gases and related items	SNL K-2
Truck, 2½ ton, 6 x 6, small arms repair, M7 and M7A1	SNL G-138

56. EXPLANATORY PUBLICATIONS.

a. Ammunition.

Ammunition, general	TM 9-1900
Small arms, light field mortars and 20-mm aircraft guns	TM 9-2200
Small arms ammunition	TM 9-1990
Small arms ammunition	OFSB 3-5

b. Maintenance.

Basic Maintenance Manual	TM 38-250
Cleaning, preserving, lubricating, and welding materials and similar items issued by the Ordnance Department	TM 9-850
Decontamination	TM 3-220
Defense against chemical attack	FM 21-40
Ordnance maintenance: Twin cal. .50 machine gun mount M33 and multiple cal. .50 machine gun mount M45	TM 9-1223
Preparation of Ordnance materiel for deep water fording	TM 9-2853

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