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STUDENT HANDOUT

M-60 MACHINE GUN



TAC COMBAT ARMS SCHOOL

NELLIS AIR FORCE BASE, NEVADA

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MACHINEGUN

7.62mm, M60

INTRODUCTION

1. ROLES OF THE MACHINEGUN:

The machinegun supports the rifleman in both the attack and defense. It is capable of engaging distant targets with a heavy volume of controlled and accurate fire that is beyond the capability of individual weapons. It provides the rifleman with the heavy volume of close continuous fire necessary to accomplish his mission in the attack. The long range, close defensive, and final protective fires delivered by this weapon form an integral part of the unit's defensive fires.

2. DESCRIPTION:

The M60 machinegun is an air cooled, belt fed, gas operated, automatic weapon fired from the open bolt position (figure 1). Two barrels are issued with each weapon, and the weapon features fixed headspace which permits rapid changing of the barrels.

3. SAFETY:

A safety lever is located on the left side of the trigger housing. It has an S (Safe) and an F (Fire) position. When on the SAFE position the bolt cannot be pulled to the rear or released to go forward.

4. FLASH SUPPRESSOR:

A flash suppressor is affixed to the muzzle of the barrel and the ribs of this suppressor vibrate during firing and dissipate flash and smoke.

5. BIPOD MOUNT:

The M60 can be effectively fired from the integral bipod mount. The hinged shoulder rest provides support for the rear of the gun, and the movable carrying handle provides a method for carrying the gun short distances and can be positioned out of the gunner's line of sight.

6. TRIPOD MOUNT:

The M122 tripod mount provides a stable and durable mount for the M60 machinegun, and firing of the gun from the tripod permits a high degree of accuracy and control.

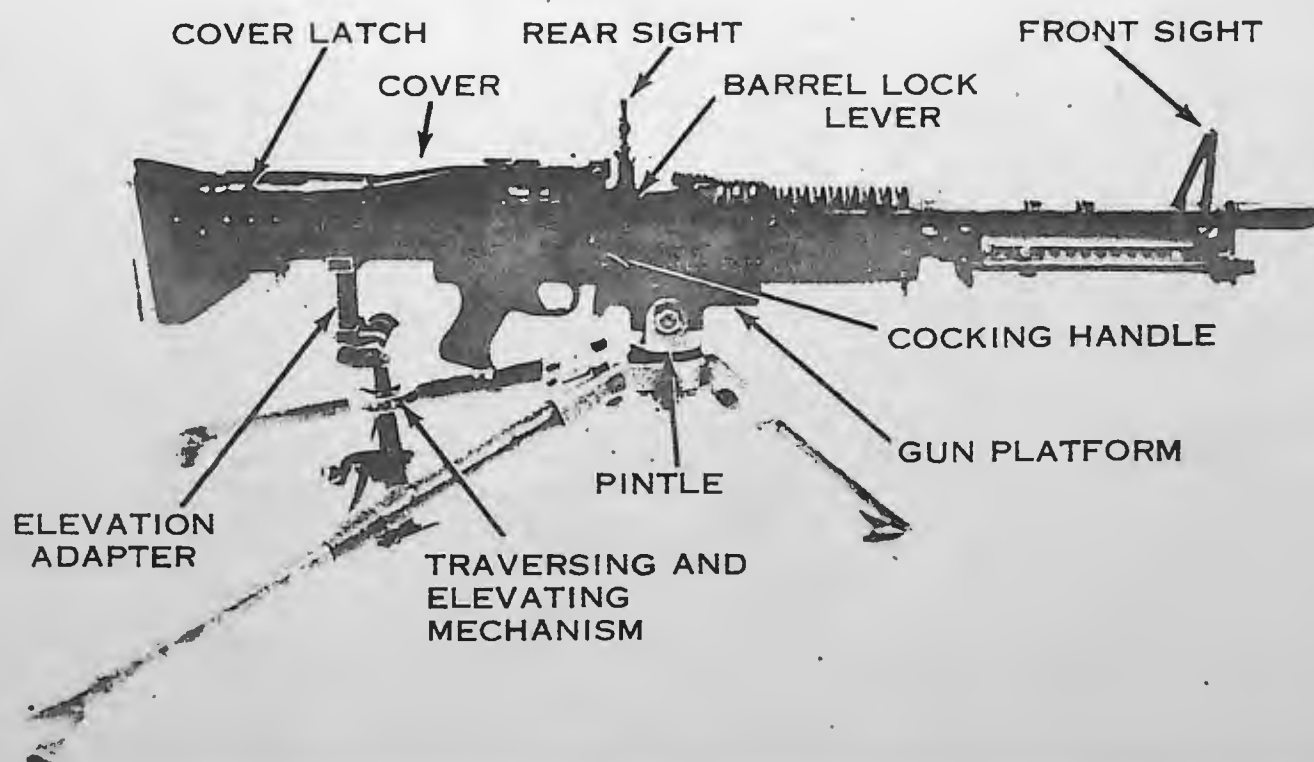


FIGURE 1 M60 MACHINEGUN

7. SIGHTS:

a. The M60 has a front sight permanently affixed to the barrel.

b. The M60 has a leaf type rear sight which is mounted on a spring type, dove-tail base. The range plate on the sight leaf is marked for each 100 meters; from 300 meters to the maximum effective range of 1100 meters. Range changes may be made by using either the slide release or the elevating knob. The elevating knob is used for fine adjustments, such as during zero. Four clicks on the elevating knob equals a 1-mil change of elevation. The windage knob is located on the left side of the sight. One click on the windage knob is equal to a 1-mil change of deflection (figure 2).

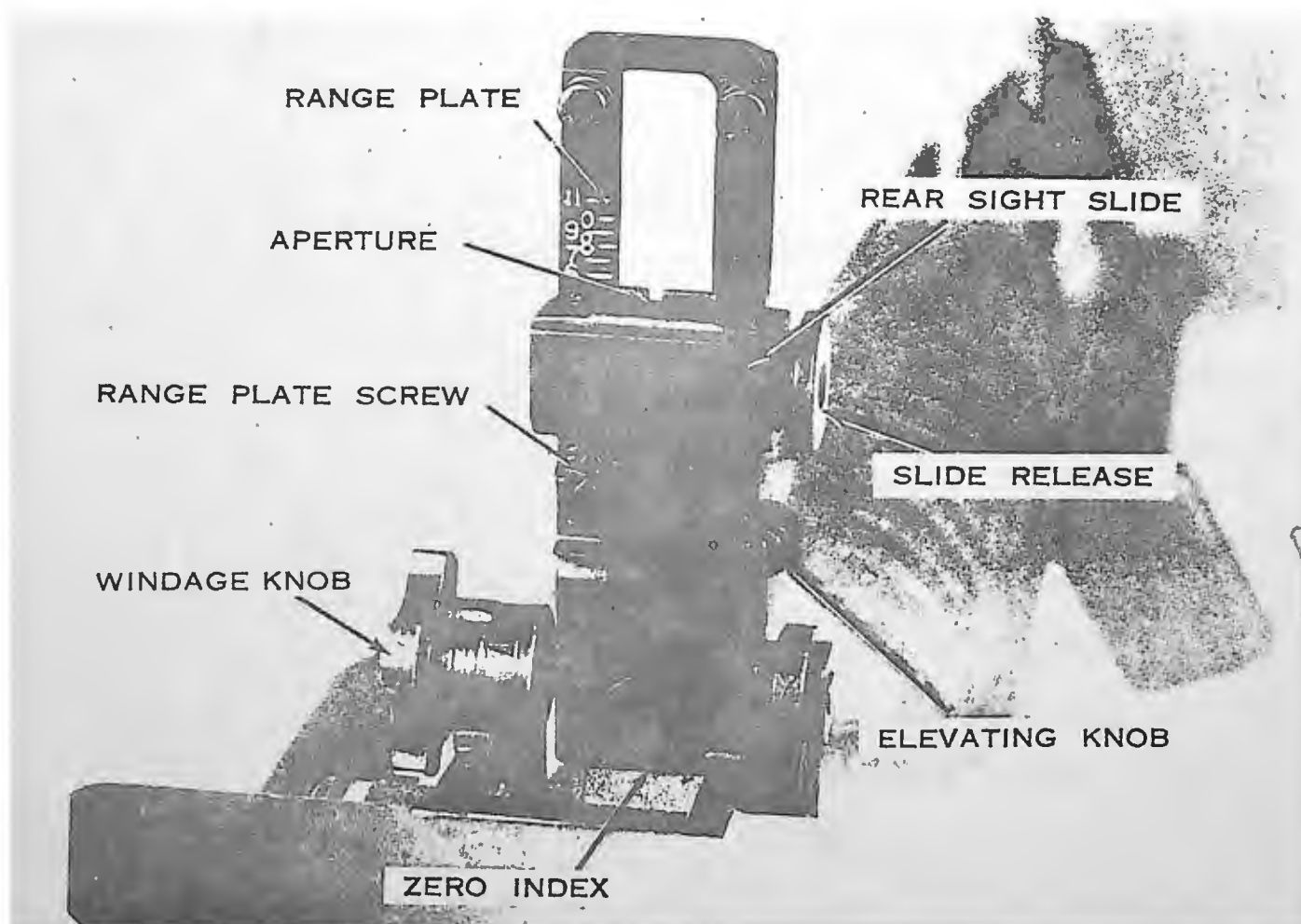


FIGURE 2 REAR SIGHT

8. GENERAL DATA:

LENGTH OF GUN -----43 $\frac{1}{2}$ inches
WEIGHT OF GUN -----23 lbs
WEIGHT OF MOUNT WITH T&E AND PINTLE/PLATFORM GROUP-----19.5 lbs

MAXIMUM EFFECTIVE RANGE ----- 1100 meters
MAXIMUM RANGE ----- 3725 meters
RATES OF FIRE

- a. SUSTAINED ----- 100 rpm; change barrel every 10 minutes.
- b. RAPID ----- 200 rpm; change barrel every 2 minutes.
- c. CYCLIC ----- 550 rpm; change barrel every 1 minute.

BASIC LOAD OF AMMO (3 man crew) ----- 600 - 900 rounds
MAXIMUM EXTENT OF GRAZING FIRE ----- 600 meters
NORMAL SECTOR OF FIRE ----- 875-mils (with tripod)
TRACER BURN OUT ----- Approximately 900 meters

REVIEW QUESTIONS

1. The weight of the M60 machinegun bipod mounted is _____.
2. The M60 machinegun is an _____, _____, _____
_____, _____ weapon.
3. The front sight of the M-60 machinegun is _____ affixed
to the barrel.
4. The rear sight is graduated from _____ meters to _____ meters.
5. The cyclic rate of fire for the M60 is _____ rounds per minute, and
change the barrel every _____ minutes.
6. The maximum effective range of the M60 is _____ meters.
7. The maximum range of the M60 is _____ meters.
8. The M60 is an _____ weapon fired from the _____
position.
9. The weight of the M60, tripod mounted, is _____ lbs.
10. The length of the M60 is _____.

NOTES

CHAPTER 1

DISASSEMBLY AND ASSEMBLY

Section I. INTRODUCTION

9. GENERAL:

a. The M60 machinegun can be disassembled and assembled without the use of force. With the exception of the barrel group, all disassembly can be accomplished with a cartridge or other pointed object.

b. As the weapon is disassembled, the parts are placed in the order in which they are removed on a clean, flat surface such as a table, shelter half, or nomenclature mat (figure 3). This reduces the possibility of loss of parts and aids in assembling the gun. The parts are replaced in reverse order. The nomenclature of each part is learned by naming it as it is removed and replaced.

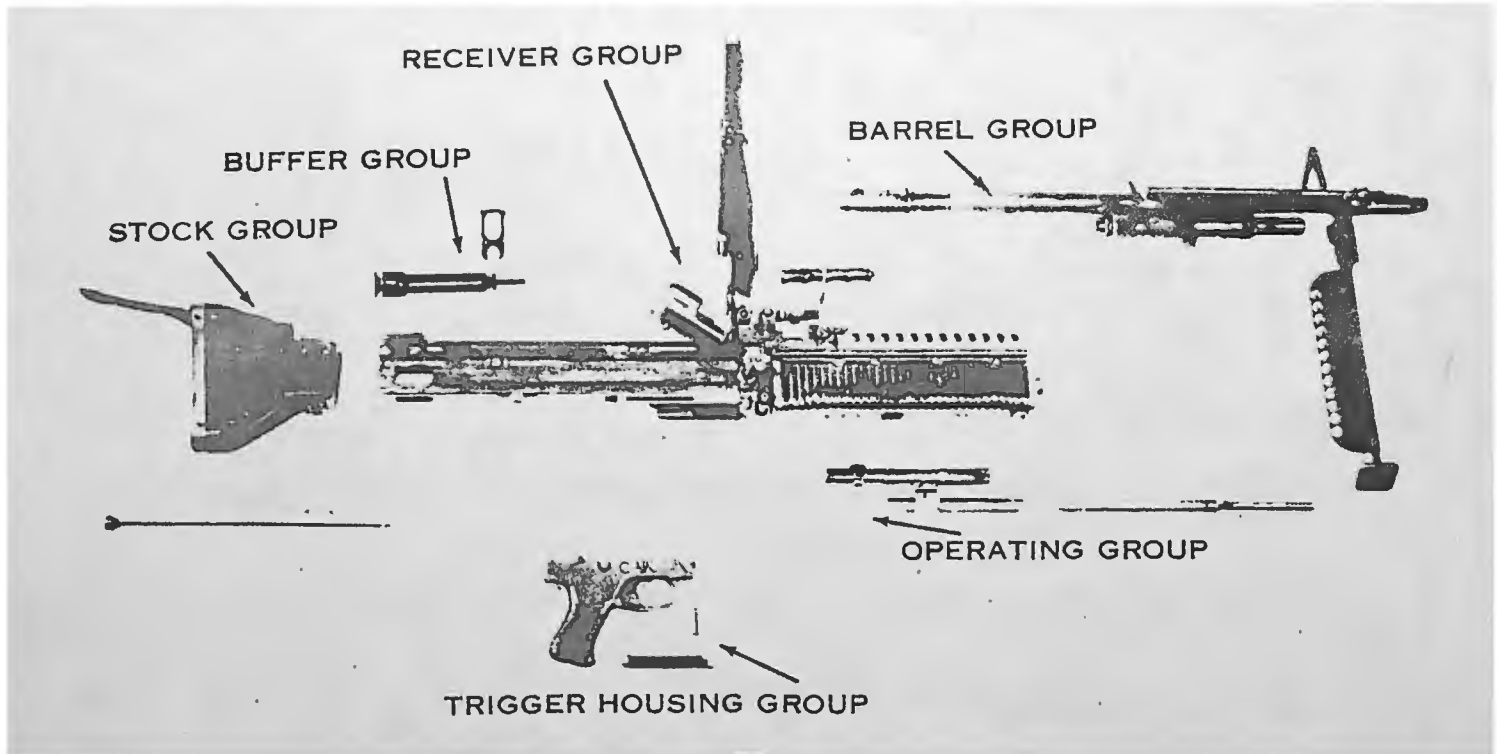


FIGURE 3 MACHINEGUN DISASSEMBLED INTO SIX MAJOR GROUPS

c. Disassembly and assembly of the gas system and adjustment of the range plate must be kept to a minimum to avoid undue wear of these parts.

d. Disassembly of the weapon beyond that described in this handout is not authorized except by orance-trained personnel.

10. TYPES OF DISASSEMBLY AND ASSEMBLY:

The two types of disassembly and assembly are general and detailed.

a. General disassembly and assembly involves removing and replacing the six major groups (figure 3).

b. Detailed disassembly and assembly involves removing and replacing the component parts of the major groups.

Section II. GENERAL DISASSEMBLY

11. GENERAL:

a. The six major groups are the stock group, buffer group, operating group, trigger housing group, barrel group, and receiver group (figure 3).

b. General disassembly begins with the bolt forward, the cover closed, and the safety on SAFE. Before the weapon is disassembled it must be cleared as outlined in Chapter 3, paragraph 40 c.

12. REMOVING THE STOCK GROUP:

a. Raise the hinged shoulder rest and insert the nose of a cartridge into the latch hole (figure 4).

b. With the latch depressed, remove the stock by pulling it directly to the rear.

13. REMOVING THE BUFFER GROUP:

The buffer group consists of the buffer yoke and the buffer. Hold the palm of the hand against the exposed buffer and press lightly. Remove the buffer yoke from the top of the receiver (figure 5). Withdraw the buffer slowly allowing the drive spring to expand until the end of the drive spring guide is exposed at the rear of the receiver. Pull the buffer plunger from the drive spring guide (figure 6).

14. REMOVING THE OPERATING GROUP:

The operating group consists of the operating rod, bolt, drive spring, and drive spring guide.

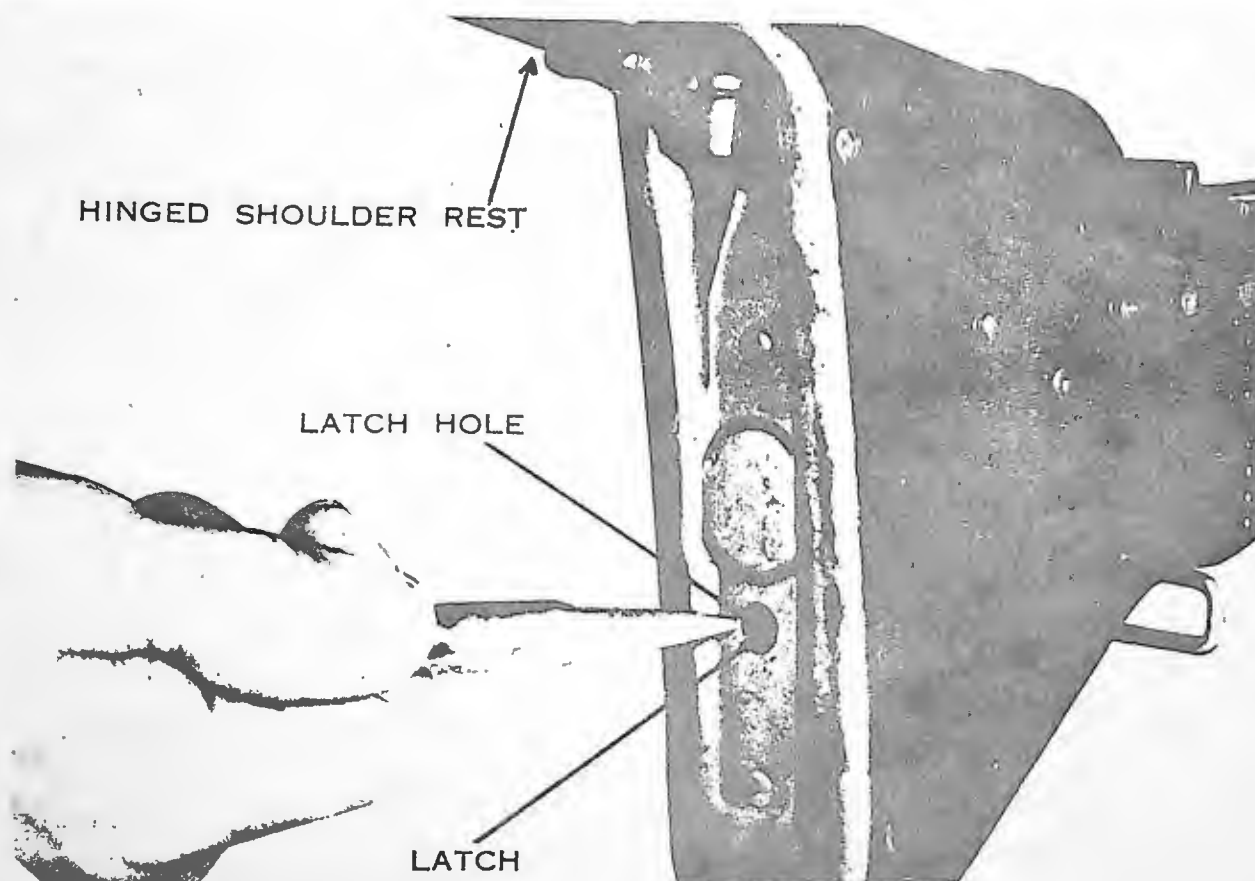


FIGURE 4 RELEASING THE STOCK LATCH

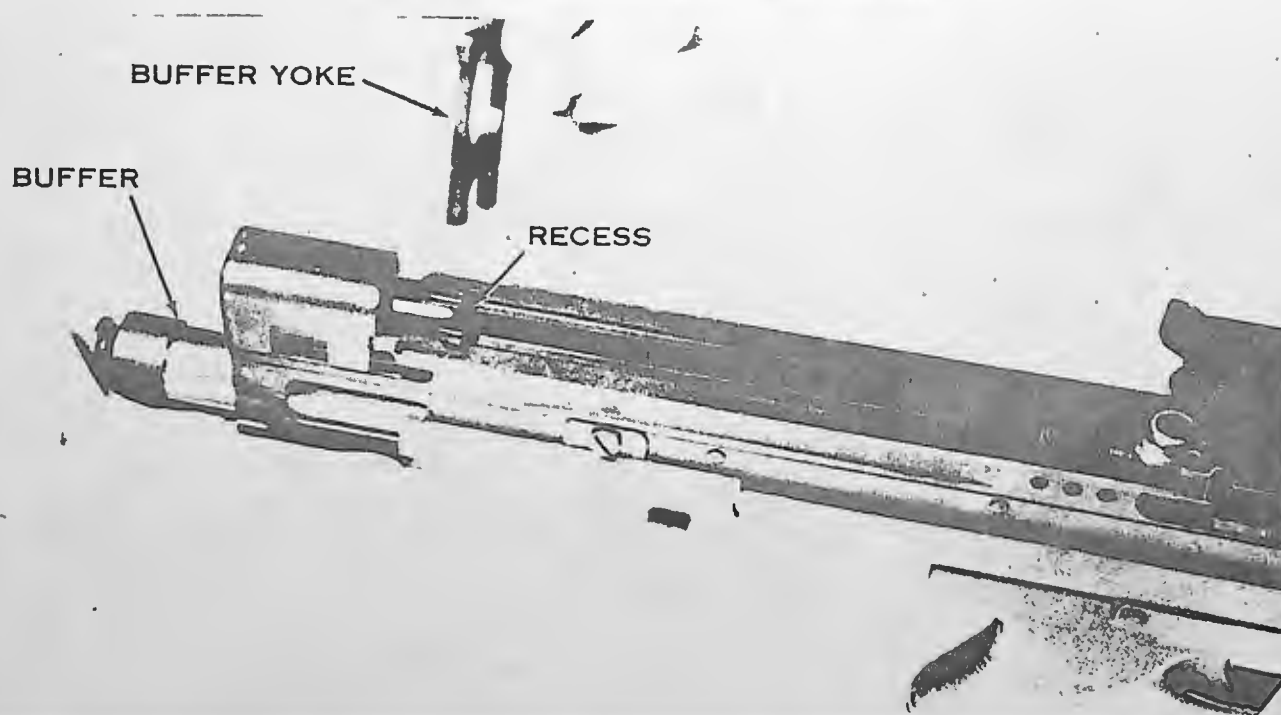


FIGURE 5 REMOVING THE BUFFER GROUP

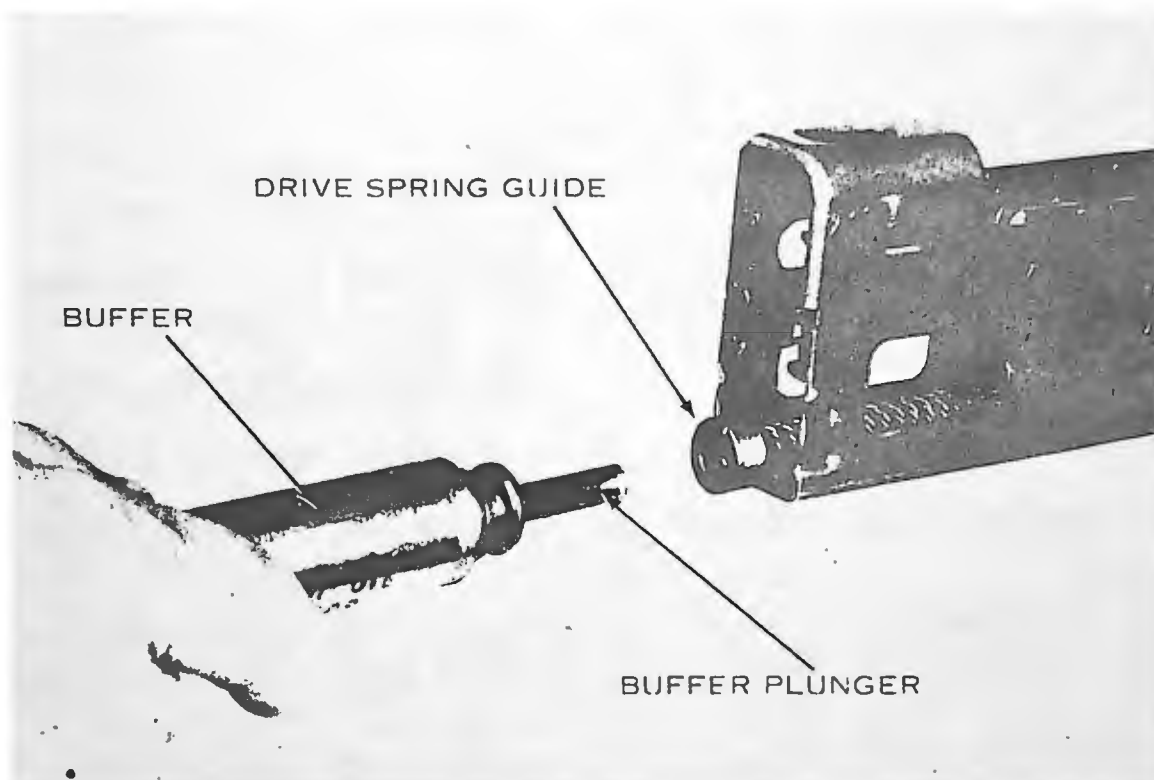


FIGURE 6 SEPARATING THE BUFFER GROUP (BUFFER PLUNGER FROM THE OPERATING GROUP DRIVE SPRING GUIDE)

a. Pull the drive spring guide and spring from the receiver and separate them.

b. With the left hand, grasp the pistol grip and pull the cocking handle to the rear until the bolt is separated from the barrel socket. Continue to pull the operating rod and bolt to the rear by pulling on the cam roller (figure 7).

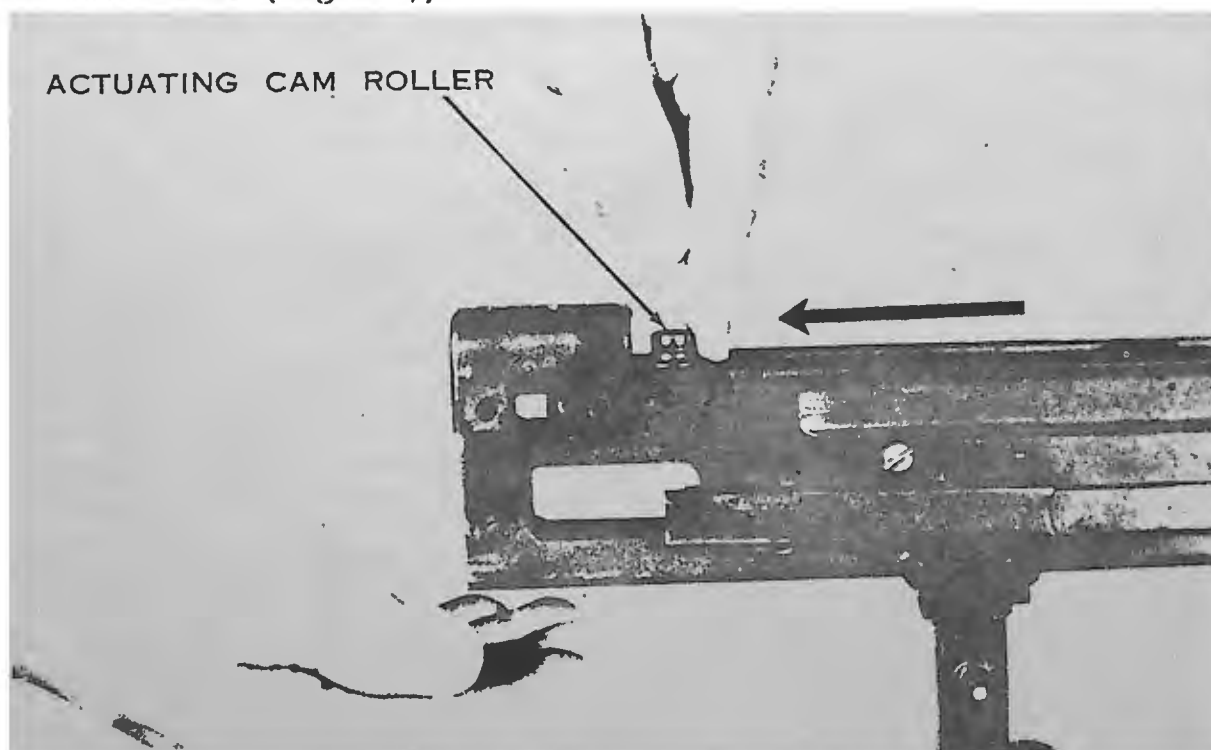


FIGURE 7 MOVING THE OPERATING GROUP TO THE REAR OF THE RECEIVER

c. When the operating rod and bolt are exposed approximately four inches to the rear of the receiver, grasp them securely to prevent the bolt from rotating, and remove them from the receiver (figure 8). Relax the grip and allow the bolt to rotate slowly. Do not separate the bolt from the operating rod.

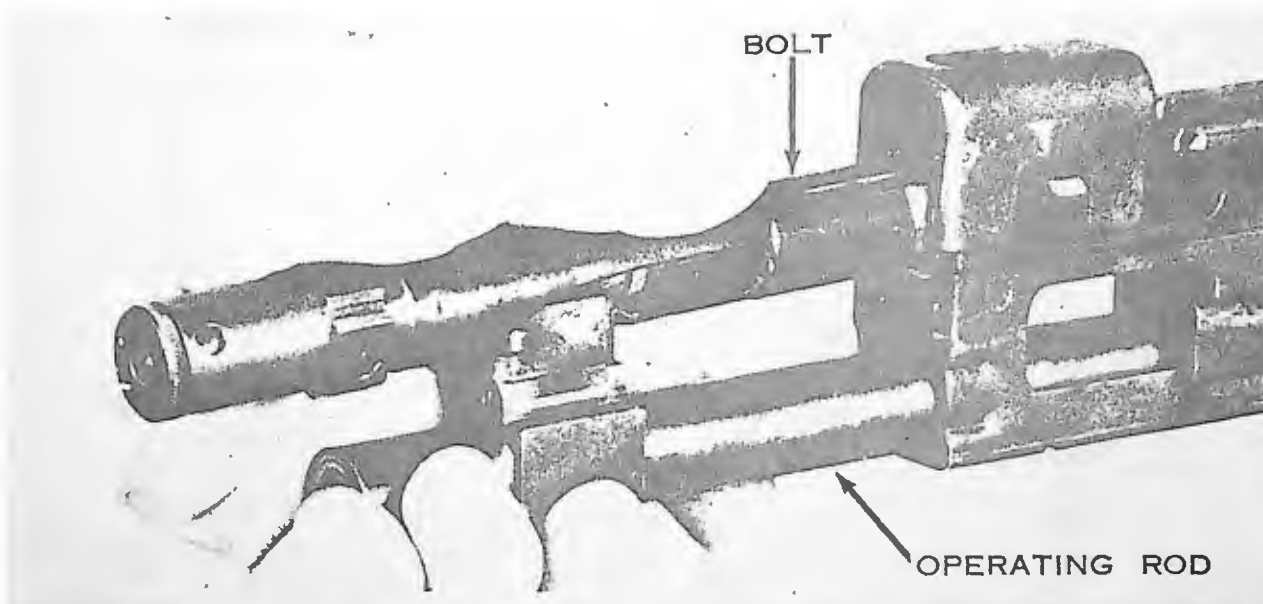


FIGURE 8 WITHDRAWING THE OPERATING GROUP FROM THE RECEIVER

15. REMOVING THE TRIGGER HOUSING GROUP:

The trigger housing group consists of the trigger housing assembly (trigger housing, sear, sear plunger, sear plunger spring, trigger pin and trigger), trigger housing pin (interchangeable with the sear pin) and leaf spring (figure 9).

a. Press in on the front of the leaf spring and rotate the front end down to clear it from the trigger housing pin (figure 9). Pull forward to disengage the rear notch from the sear pin.

b. Remove the trigger housing pin by pushing it to the left.

c. Slide the trigger housing slightly forward, rotate the front of the housing down, and remove it (figure 10).

16. REMOVING THE BARREL GROUP:

The barrel group consists of the barrel, flash suppressor, front sight bipod assembly, and gas cylinder. Raise the barrel lock lever to the vertical position and remove the barrel group by pulling it to the front (figure 11).

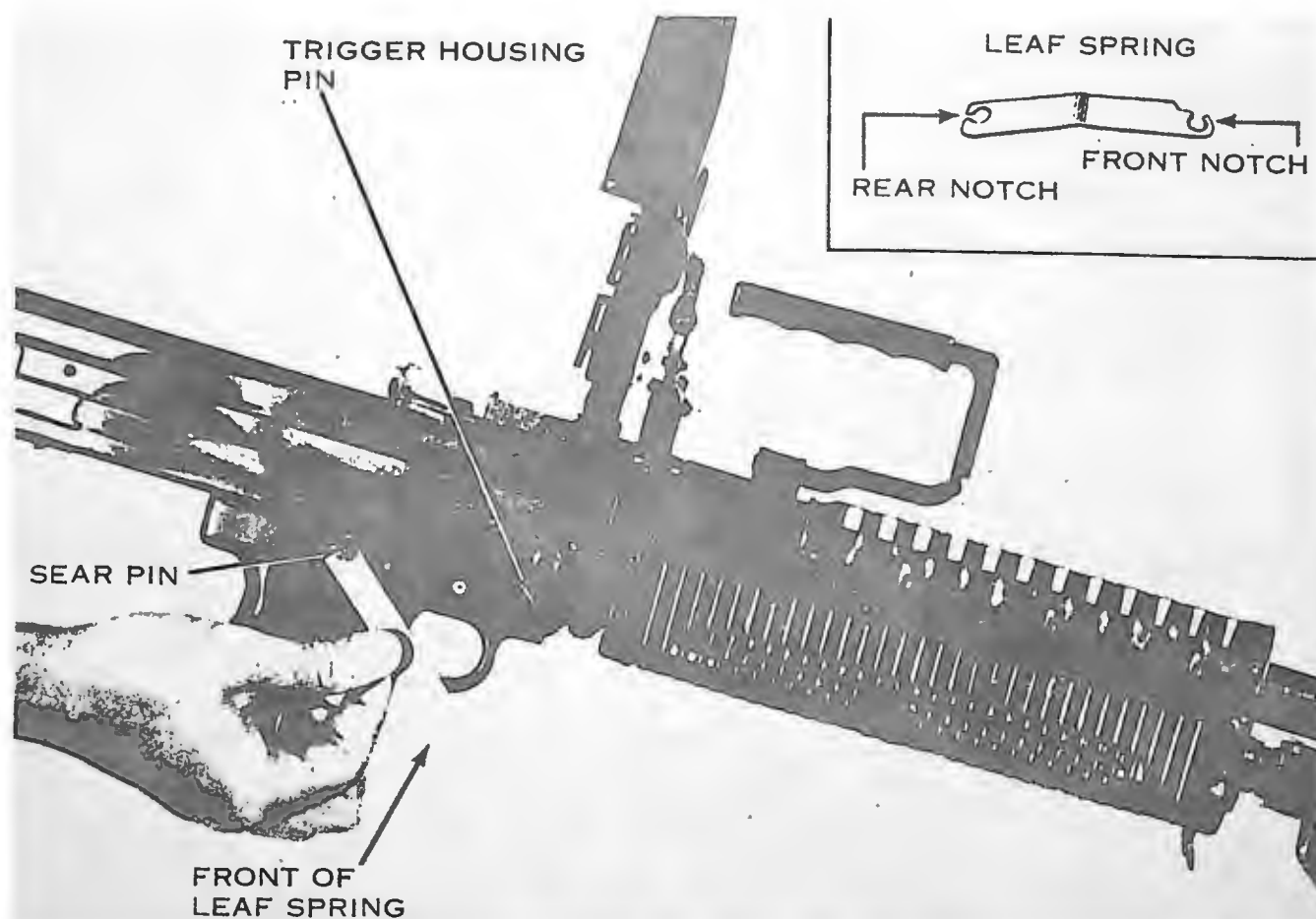


FIGURE 9 REMOVING THE LEAF SPRING

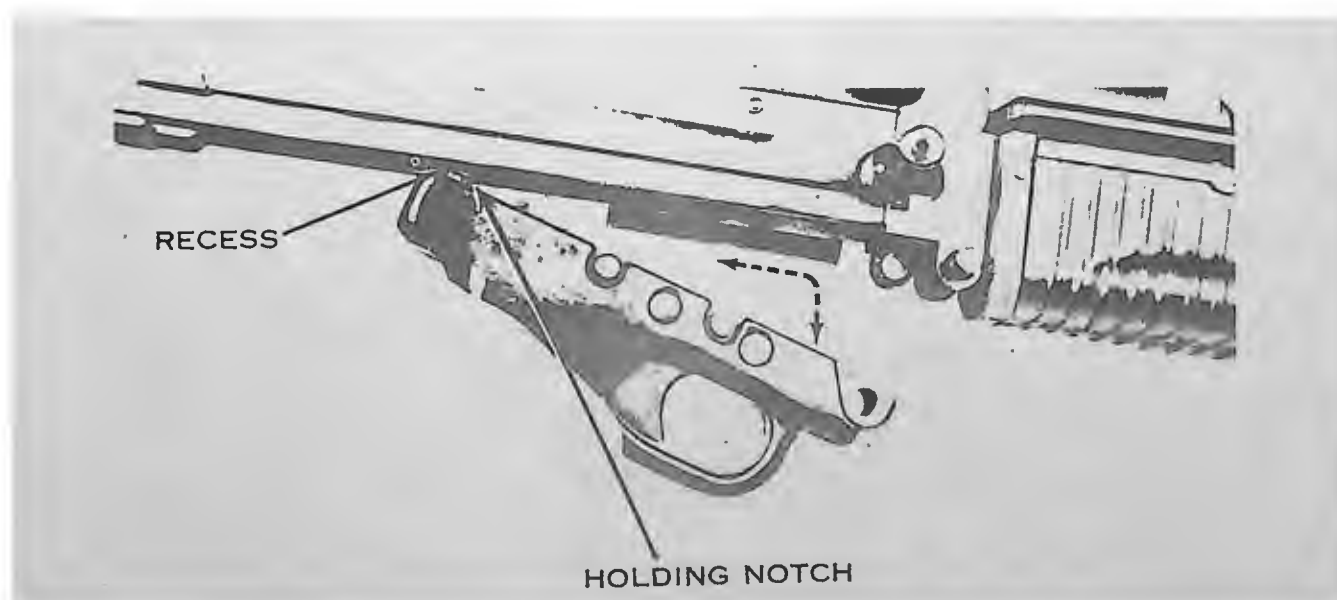


FIGURE 10 REMOVING THE TRIGGER HOUSING GROUP

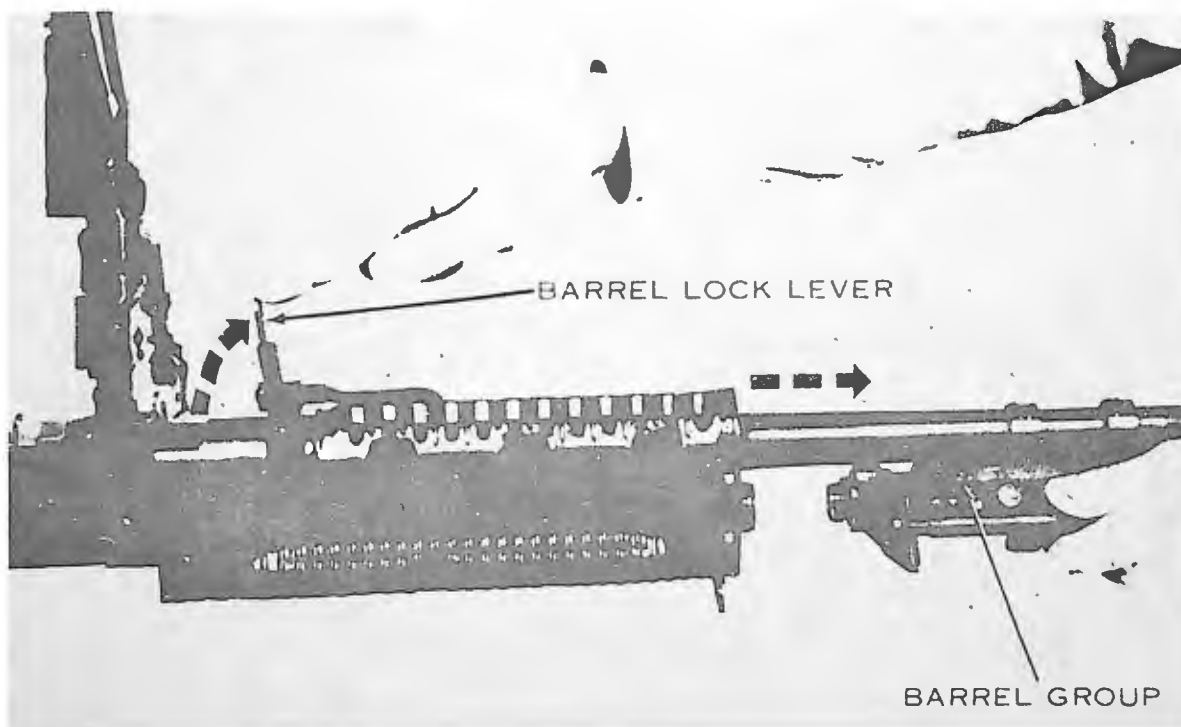


FIGURE 11 REMOVING THE BARREL GROUP

17. THE RECEIVER GROUP:

The receiver group consists of the receiver, forearm assembly, rear sight, cover, feedtray, and carrying handle. General disassembly of the gun is completed after the removal of the other five groups from the receiver group.

Section III. GENERAL ASSEMBLY

18. REPLACING THE BARREL GROUP:

Insure that the barrel lock lever is in the vertical position (figure 11). Insert the rear of the barrel under the forearm shell and aline the gas cylinder nut with its recess in the forearm assembly. Lower the barrel lock lever.

19. REPLACING THE OPERATING GROUP:

a. Insert the end of the operating rod into the receiver. Hold the rod with one hand. With the other hand, push forward on the rear of the bolt, causing the bolt to rotate until the locking lugs are in a vertical position (figure 12).

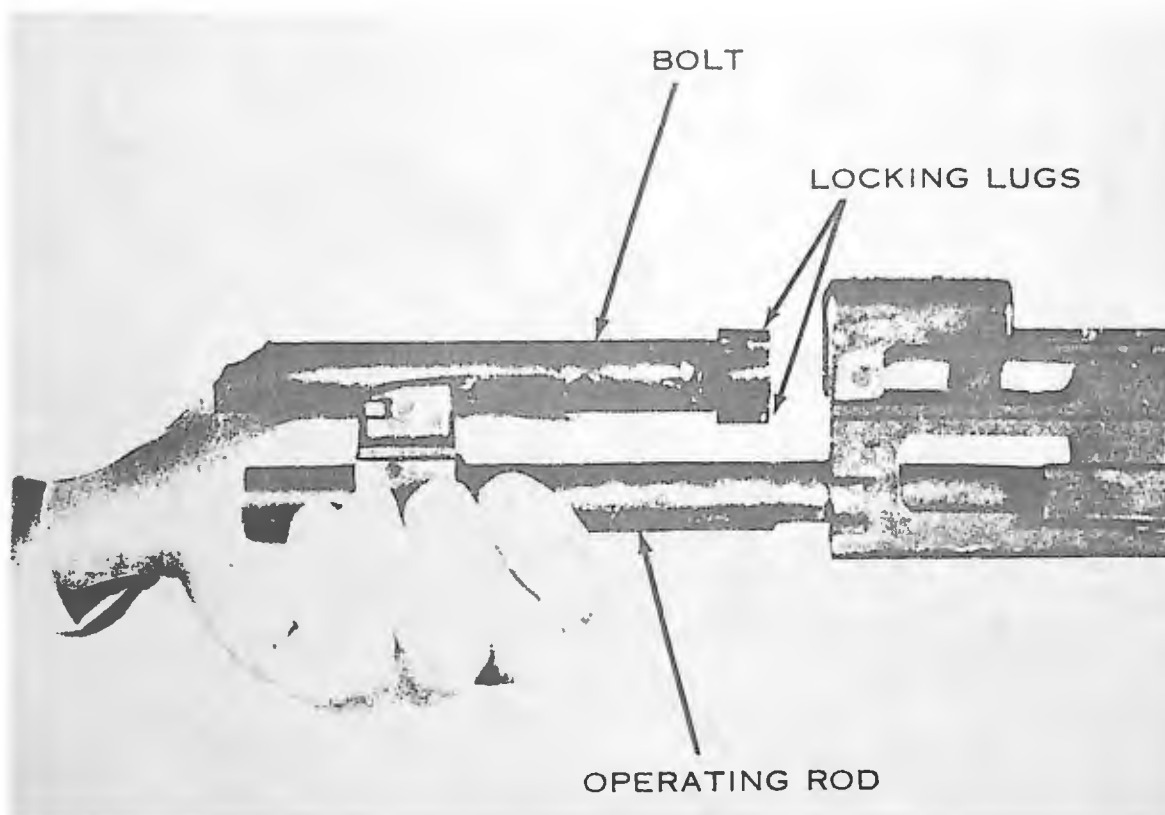


FIGURE 12 INSERTING THE OPERATING GROUP IN THE RECEIVER

b. With the cam roller up, push the operating rod and bolt into the receiver until the end of the operating rod is even with the rear of the receiver (figure 13).

c. Insert the drive spring guide into the drive spring, then insert the opposite end of the drive spring in the recess of the operating rod (figure 13). Pull the trigger, and push in the drive spring until the head of the guide is approximately an inch from the receiver (figure 6).

20. REPLACING THE BUFFER GROUP:

a. Insert the buffer plunger into the drive spring guide (figure 6). Push forward on the buffer until the operating rod and bolt go fully forward.

b. Push in on the buffer until the recesses on the buffer are aligned with the recesses in the receiver. Replace the buffer yoke from the top of the receiver (figure 5).

21. REPLACING THE STOCK GROUP:

Align the guide rails of the stock with the guide rails on the receiver. Push forward until the stock is fully seated. A distinct click will be heard when the latch engages.

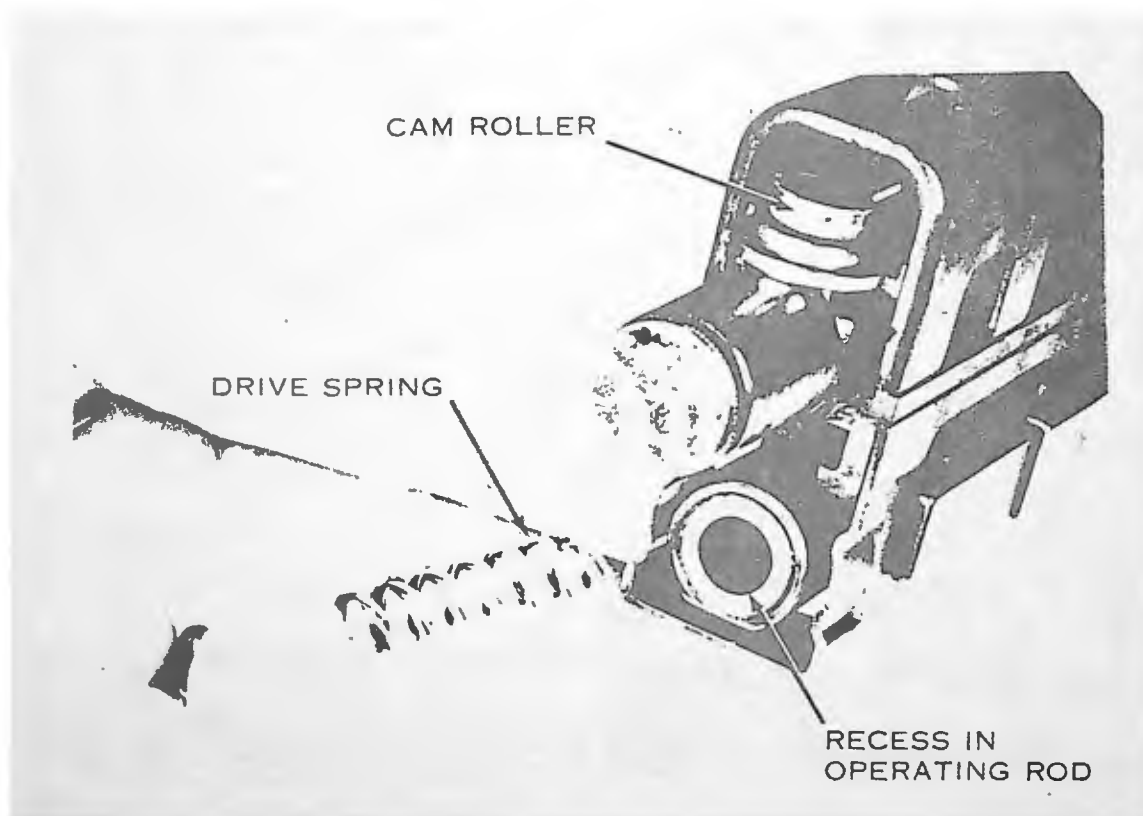


FIGURE 13 ALINING THE OPERATING GROUP
AND INSERTING THE DRIVE SPRING

22. REPLACING THE TRIGGER HOUSING GROUP:

a. Engage the holding notch of the trigger housing in its recess in the bottom of the receiver (figure 10). Rotate the front of the trigger housing up and aline the holes of the trigger housing with the mounting bracket on the receiver. Insert the trigger housing pin from the left.

b. Engage the rear of the leaf spring with the sear pin (figure 9). Insure that the leaf spring is positioned so that the bent portion is pressed against the side of the trigger housing. Rotate the front of the leaf spring up and engage it with the trigger housing pin.

23. CORRECT ASSEMBLY:

To check for correct assembly, pull the cocking handle to the rear and return it to its forward position. Close the cover and pull the trigger. The bolt should go forward.

Section IV. DETAILED DISASSEMBLY AND ASSEMBLY

24. GENERAL:

Detailed disassembly of the operating group, trigger housing group, barrel group, and receiver group is authorized at the unit level. Detailed disassembly of the stock group and the buffer group is not authorized.

25. DISASSEMBLY OF THE OPERATING GROUP:

a. Grasp the bolt in one hand with the bolt faced toward the body, operating rod on top, grasp the operating rod securely in the other hand. Push forward on the operating rod, pivot the front of the operating rod up, and disengage it from the bolt (figure 14).

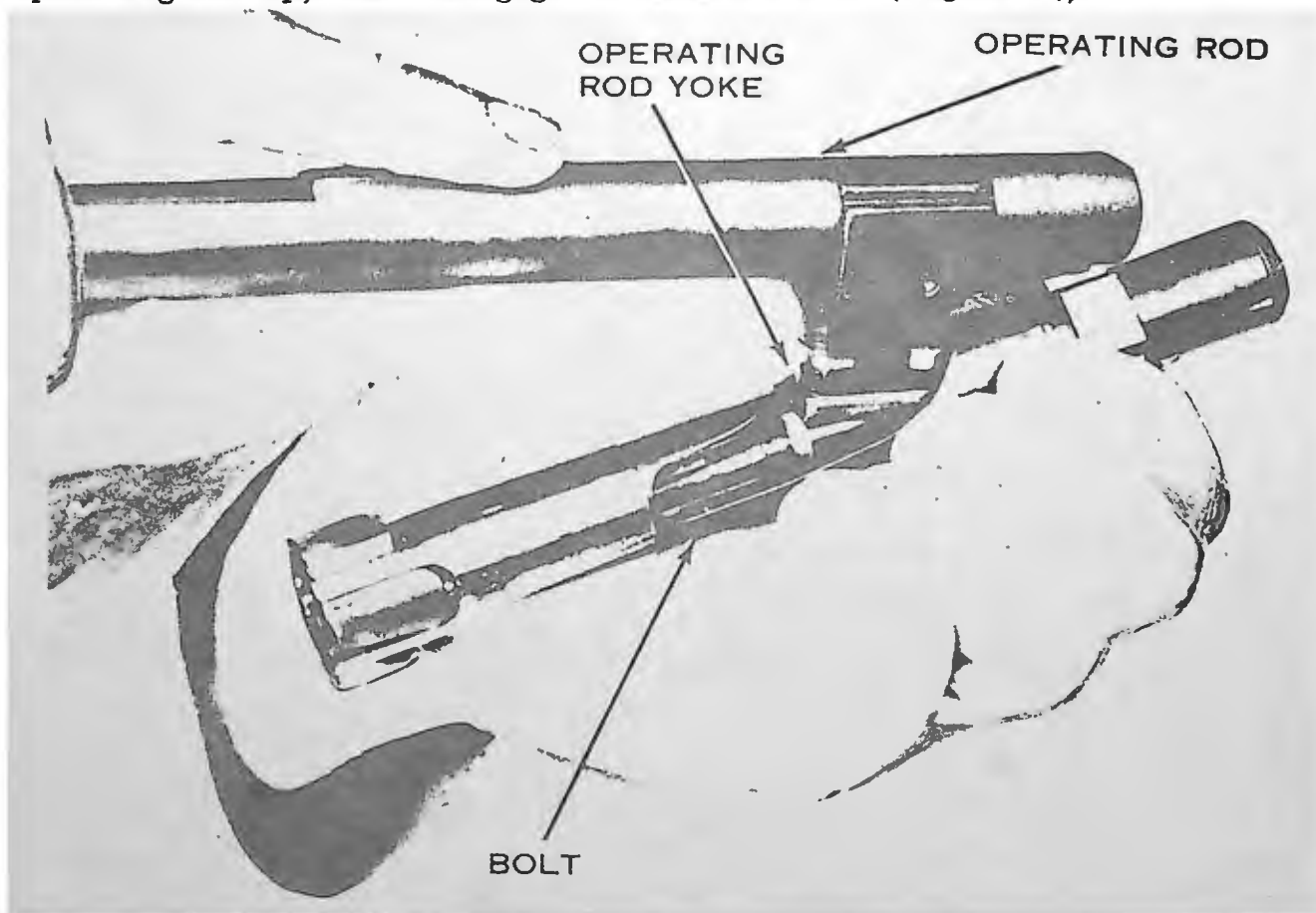


FIGURE 14 REMOVING THE BOLT

b. Rotate the cam roller assembly on the bolt until the holes are aligned with the bolt plug pin. Use the pointed end of the drive spring guide to remove the bolt plug pin (figure 15). Unscrew and remove the bolt plug.

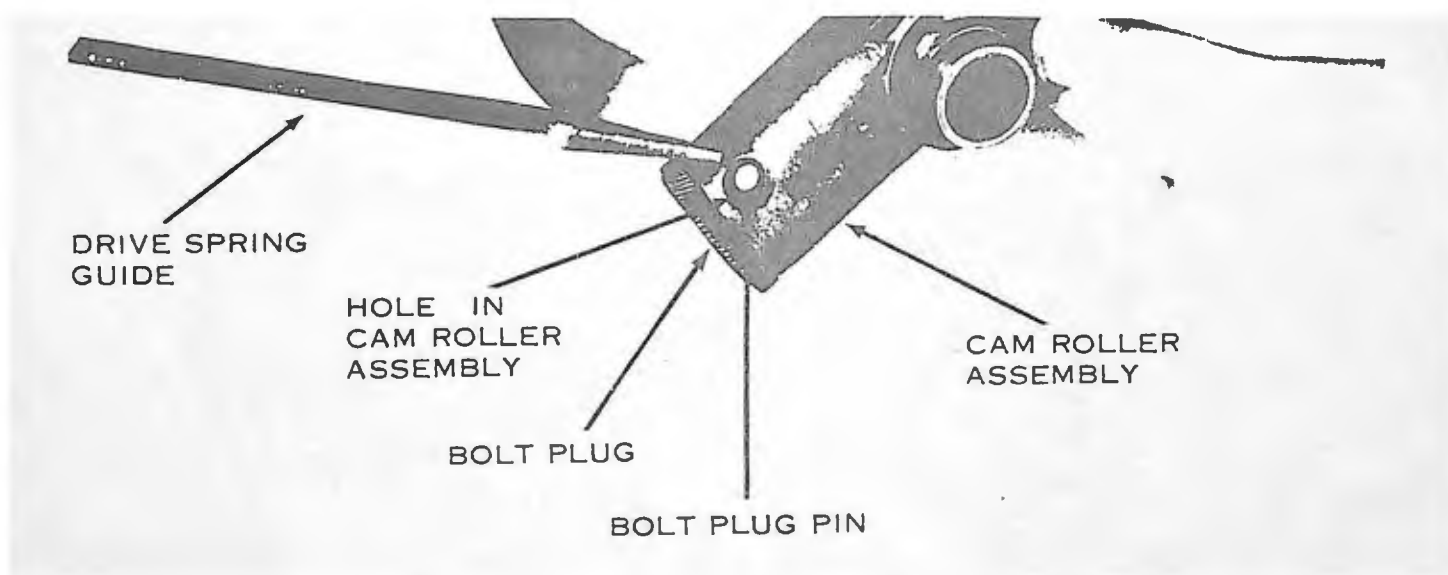


FIGURE 15 REMOVING THE BOLT PLUG PIN

c. Remove the cam roller assembly by pulling it from the rear of the bolt (figure 16).

d. Remove the firing pin spring, firing pin bearing and firing pin from the bolt body (figure 16).

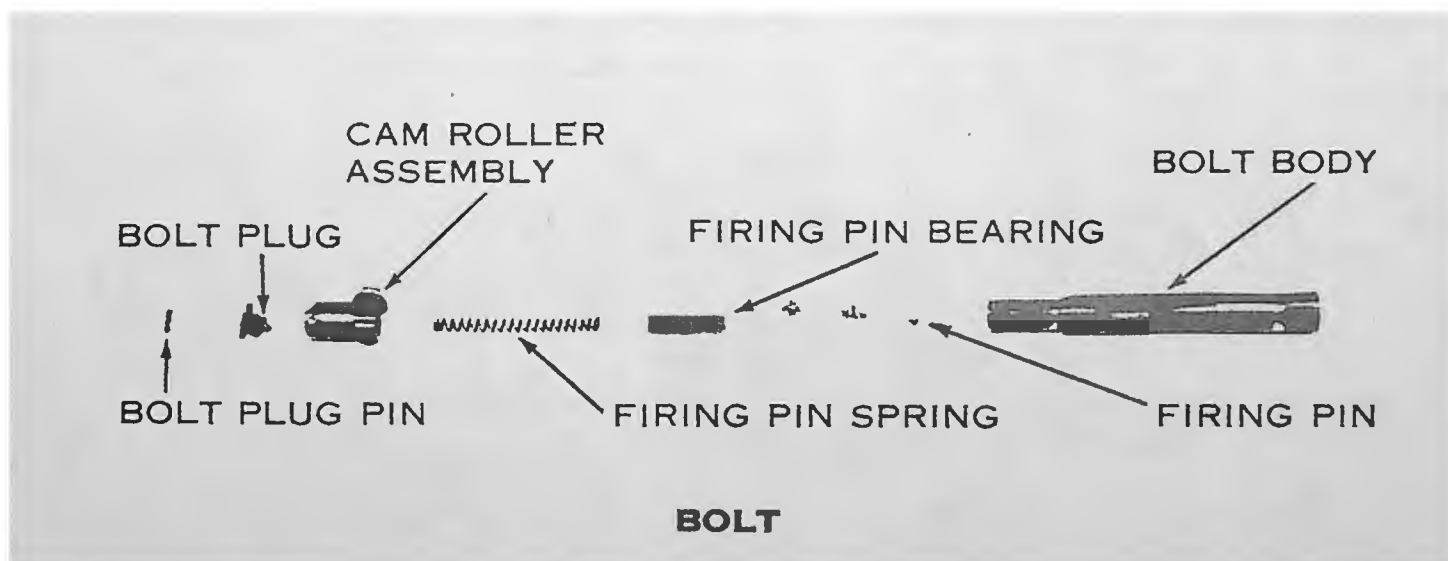


FIGURE 16 DISASSEMBLED BOLT

e. The extractor and ejector on the face of the bolt are removed by an ordnance qualified armorer only (figure 17).

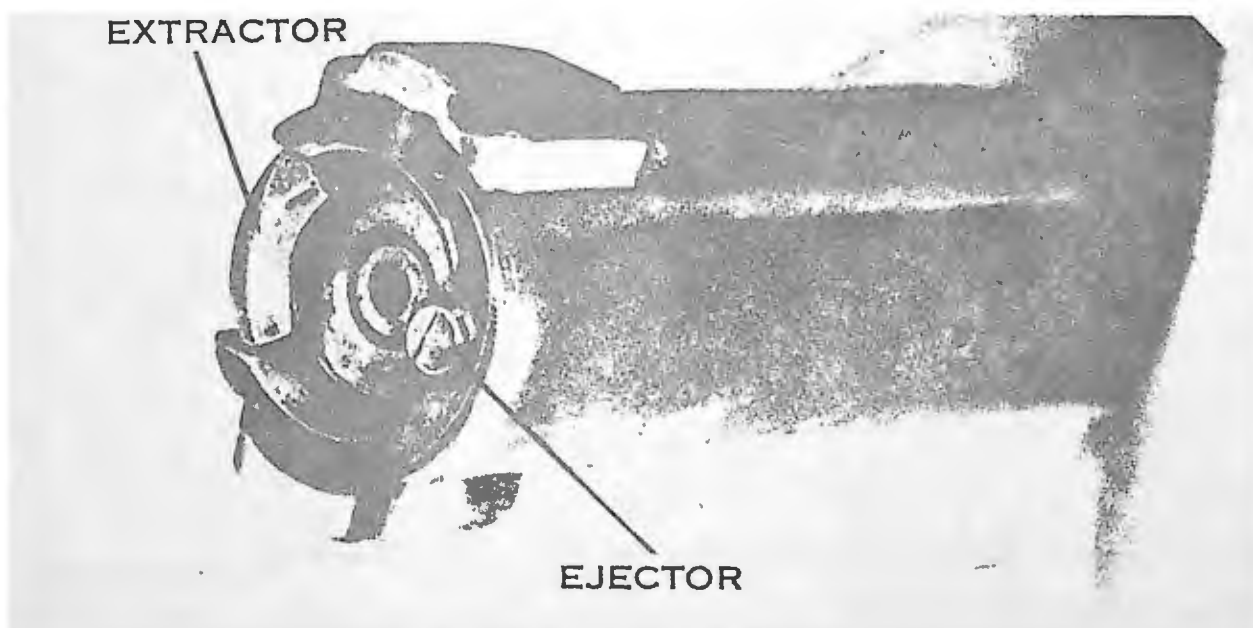


FIGURE 17 THE FACE OF THE BOLT

26. ASSEMBLY OF THE OPERATING GROUP:

a. Hold the bolt body in the palm of the hand, bolt face down, and insert the striker end of the firing pin into the rear of the bolt body. Prevent the firing pin from moving fully forward by holding the rear pin spool in the bolt camming slot with the thumb (figure 18).

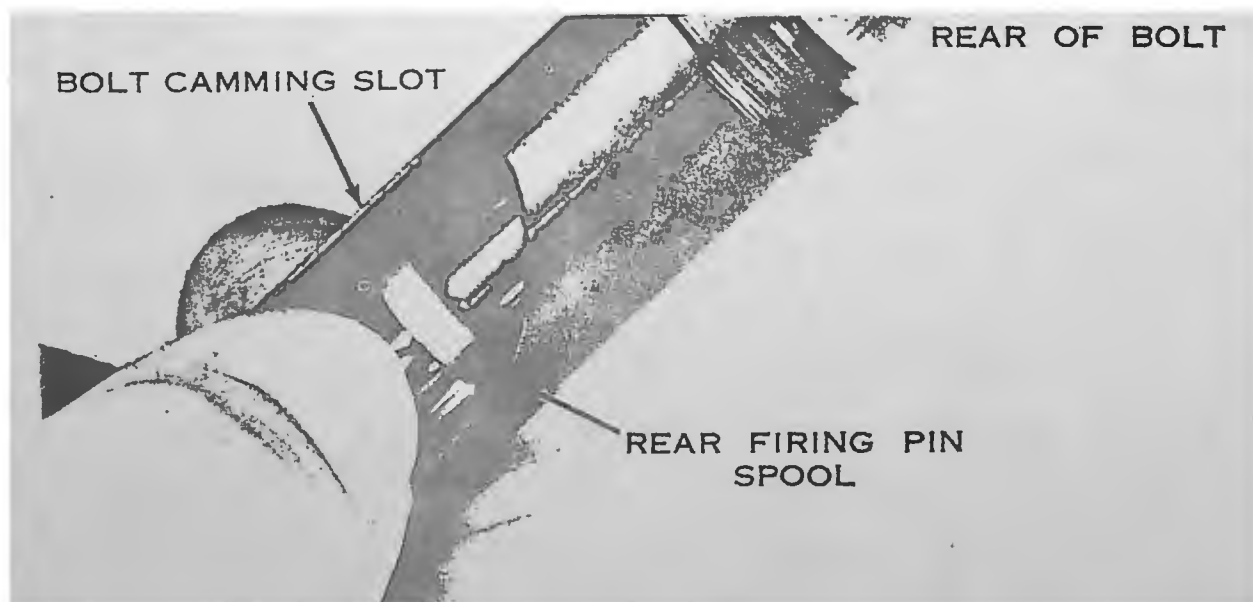


FIGURE 18 ASSEMBLY OF THE BOLT

b. Insert the firing pin bearing into the bolt body, with the partially closed end first.

c. Position the firing pin spring within the firing pin bearing. Remove the thumb from the bolt camming slot and allow the parts to fully enter the bolt body.

d. Place the cam roller assembly over the rear of the bolt with the cam roller toward the front of the bolt.

e. Screw the bolt plug finger tight into the bolt body. Rotate the cam roller assembly until the holes are aligned with the holes in the bolt body. Unscrew the bolt plug until the holes align with the holes in the cam roller assembly and the bolt body. Insert the bolt plug pin so that it is within the cam roller assembly (figure 15). The assembly should rotate freely around the bolt.

f. With the camming slot up, hold the bolt securely in one hand with the face of the bolt toward the body. With the other hand position the rear of the operating rod yoke against the rear firing pin spool (figure 19). Push on the operating rod, compressing the firing pin spring, and position the operating rod yoke between the firing pin spools.

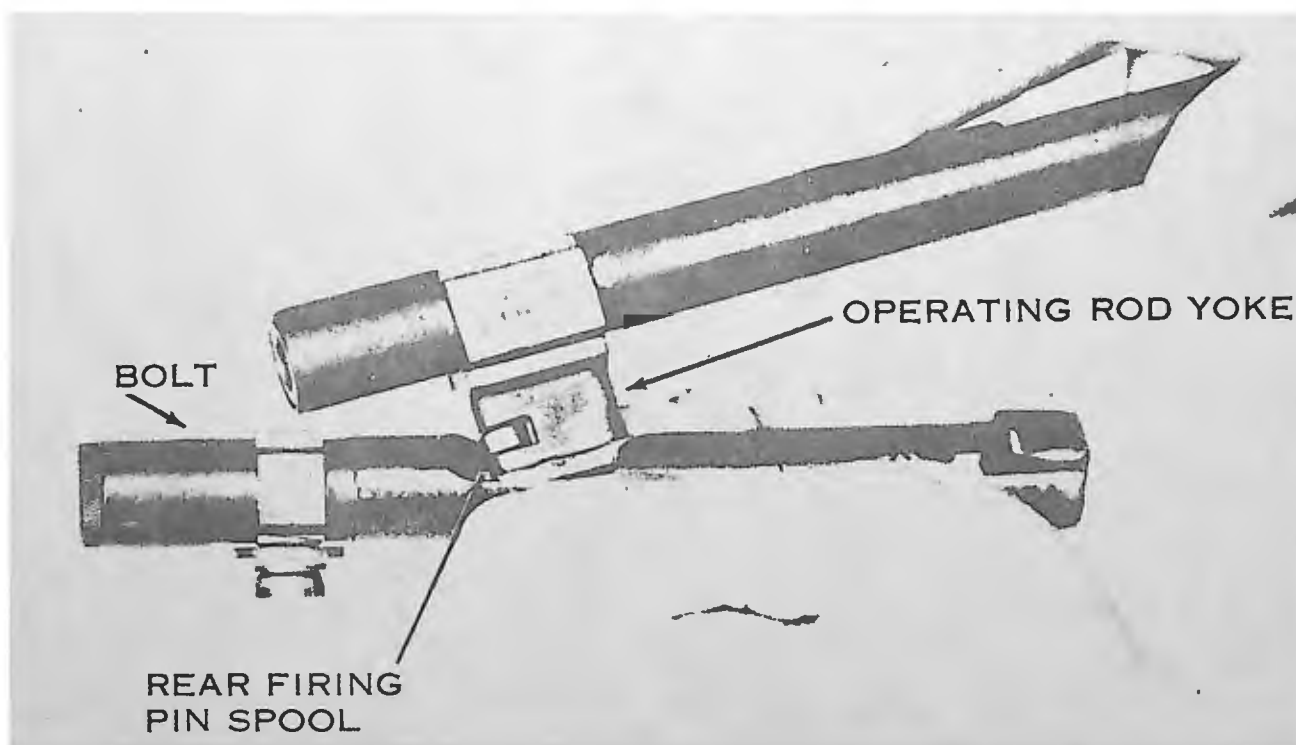


FIGURE 19 ASSEMBLY OF THE BOLT TO THE OPERATING ROD

27. DISASSEMBLY OF THE TRIGGER HOUSING ASSEMBLY:

- a. Depress the sear and remove the sear pin by pushing the pin to the left (figure 20).
- b. Remove the sear from the top of the trigger housing.

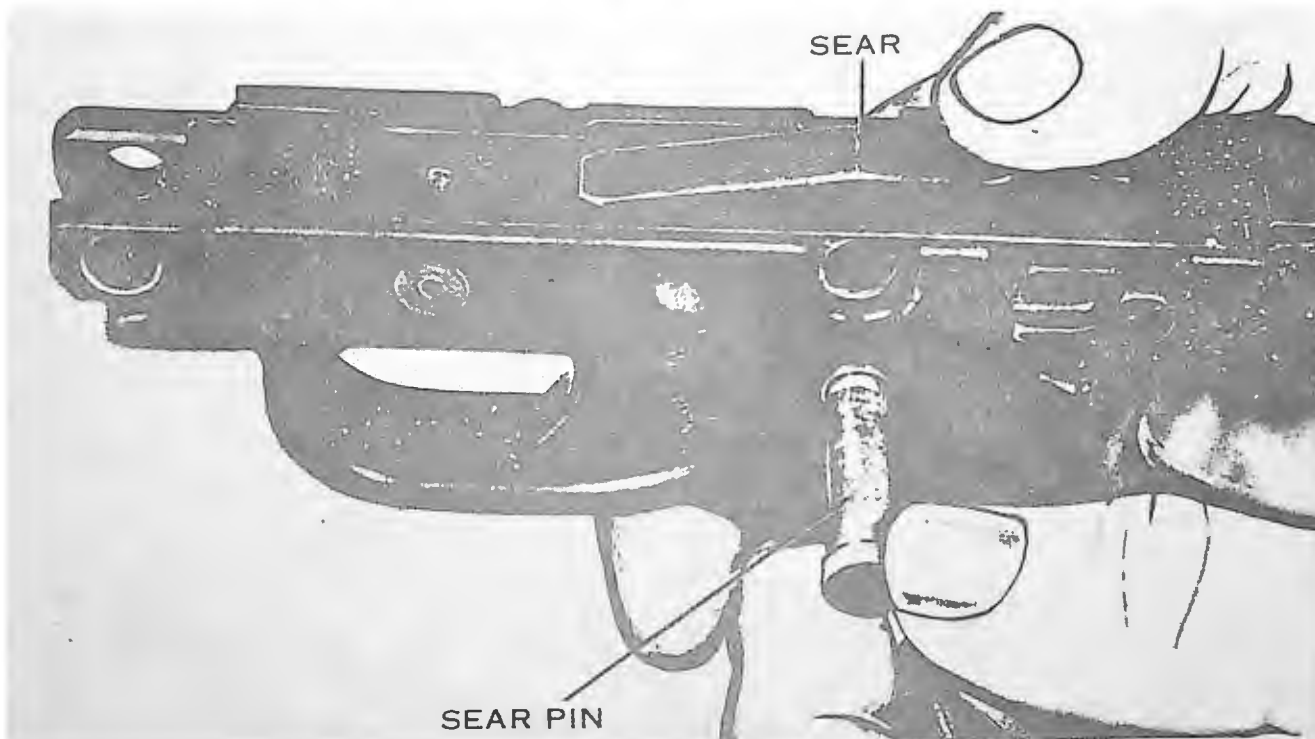


FIGURE 20 REMOVING THE SEAR PIN

- c. Remove the sear plunger and sear plunger spring (figure 21).

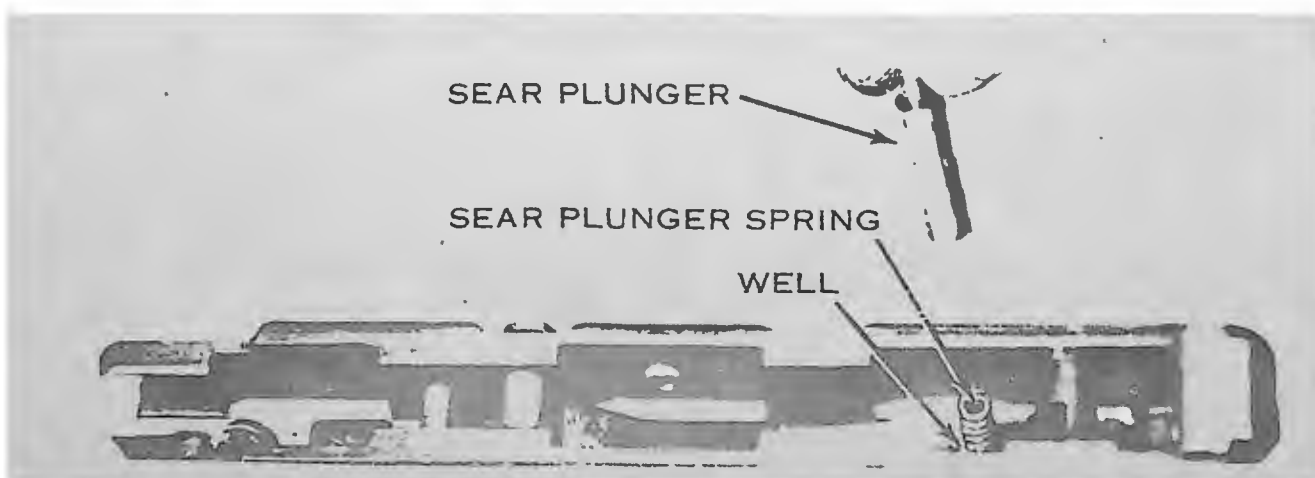


FIGURE 21 REMOVING THE SEAR PLUNGER AND SPRING

- d. Remove the trigger pin by pulling it to the right (figure 22).

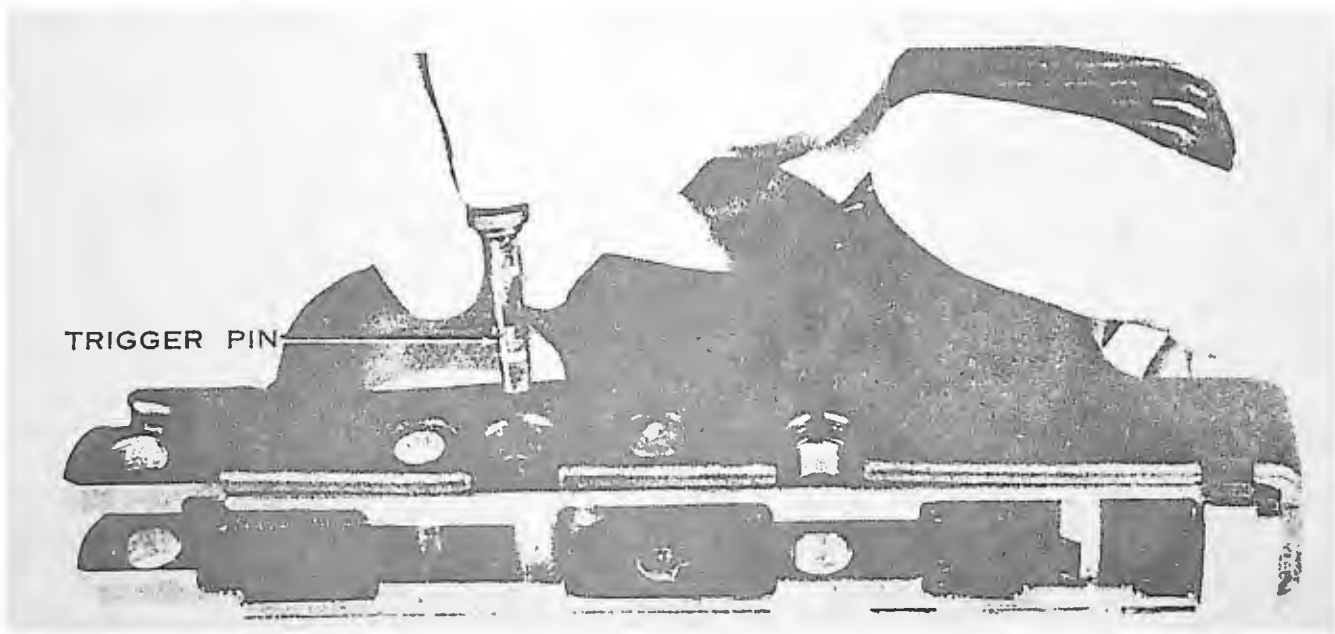


FIGURE 22 REMOVING THE TRIGGER PIN

- e. Remove the trigger through the top of the trigger housing (figure 23).

28. ASSEMBLY OF THE TRIGGER HOUSING ASSEMBLY:

a. Position the trigger, with the trigger spring to the rear, through the top of the trigger housing so the spring is under the channel surface (figure 24). Align the hole in the trigger with the holes in the housing and replace the trigger pin from the right (figure 22). Replace the sear plunger spring and sear plunger in their well in the trigger housing (figure 21).

b. Position the sear with the shoulder up and to the rear (figure 20). Press down on the sear and replace the sear pin from the left (figure 20).

29. DISASSEMBLY OF THE BARREL GROUP:

To disassemble the barrel group, place the bipod legs in the down position (figure 25). Use the combination wrench to unscrew and remove the cylinder nut (figure 25). Allow the gas piston to slide out the rear of the cylinder. Unscrew and remove the gas port plug. Unscrew and remove the gas cylinder extension. This completes the disassembly of the barrel group.

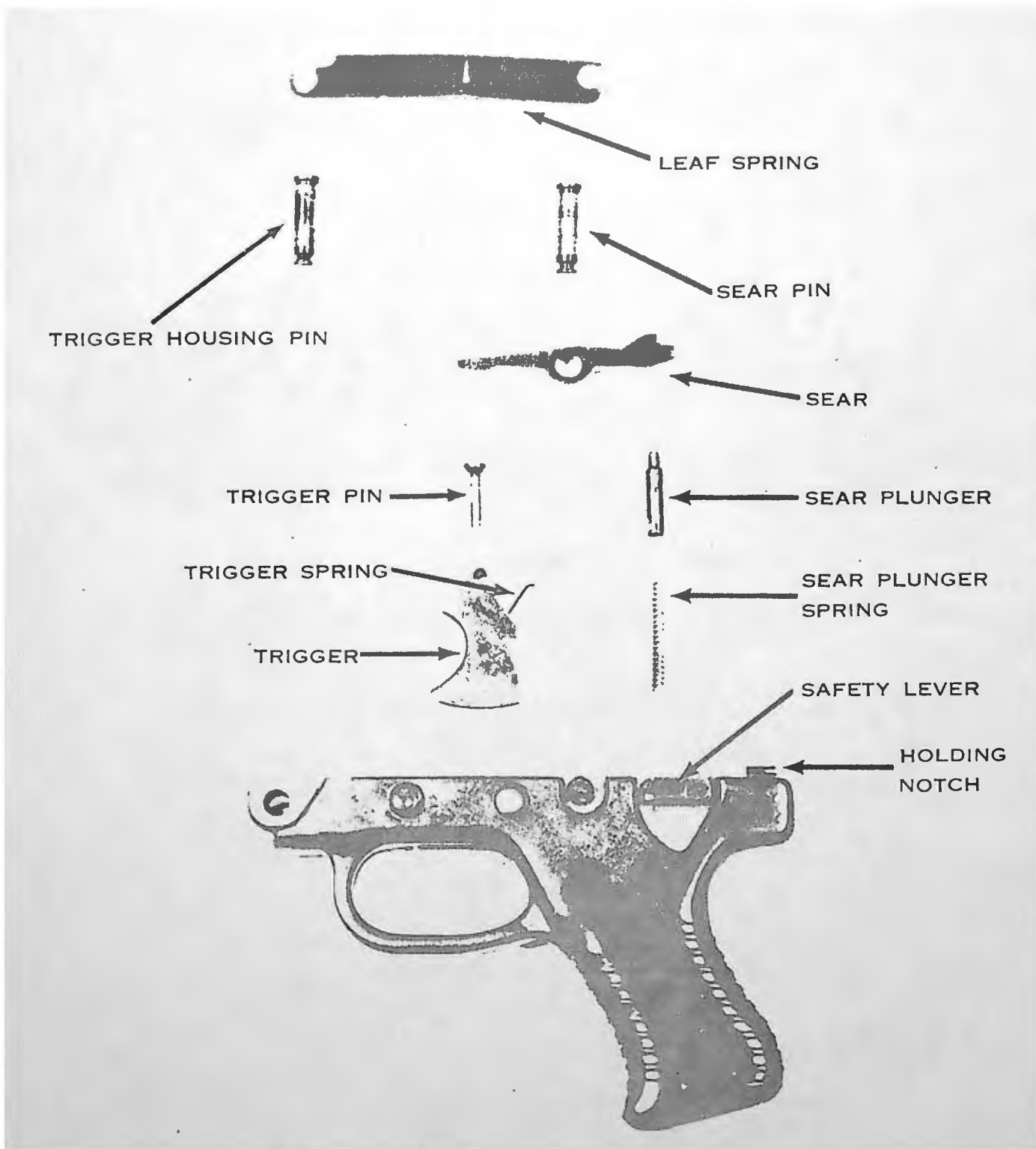


FIGURE 23 TRIGGER HOUSING GROUP DISASSEMBLED

30. ASSEMBLY OF THE BARREL GROUP:

Assemble the barrel group in reverse order of disassembly. Insure that the gas piston is inserted into the gas cylinder with the gas escape holes and the closed end to the rear. If the gas cylinder plug was removed, rewire it with safety wire.

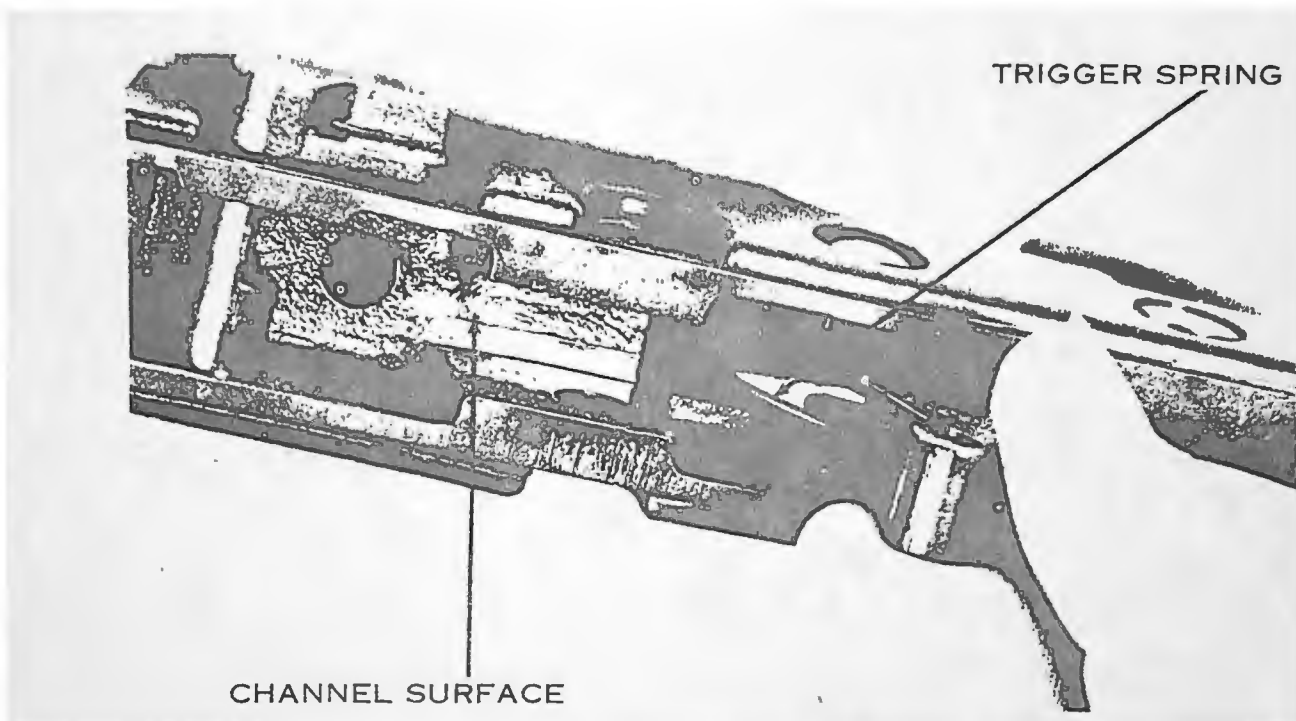


FIGURE 24 INSERTING THE TRIGGER

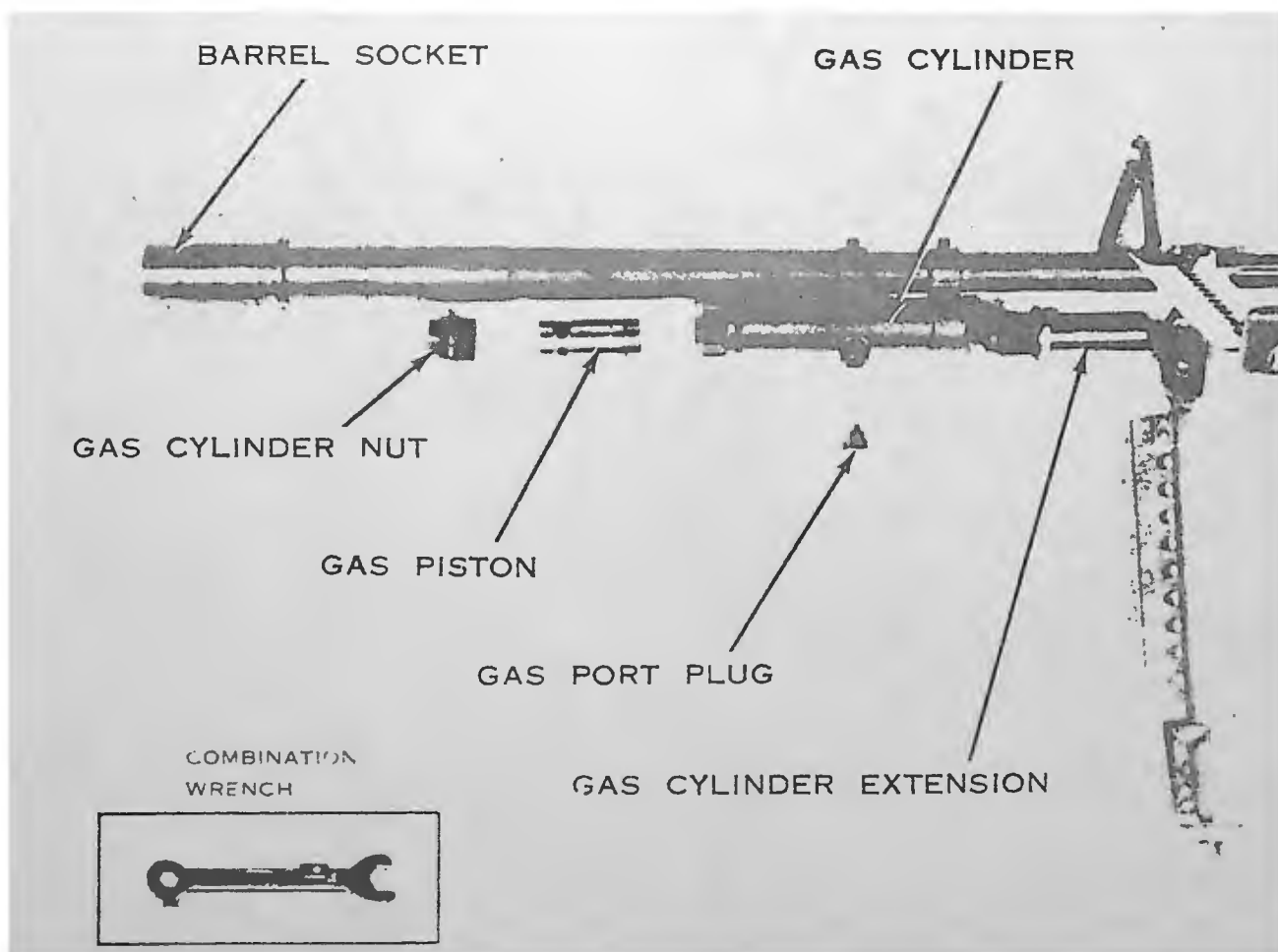


FIGURE 25 DISASSEMBLED BARREL GROUP

31. DISASSEMBLY OF THE RECEIVER GROUP:

a. To remove the cocking handle --

(1) Unscrew and remove the cocking handle guide screw and lock washer (figure 26).

(2) Remove the cocking handle guide by rotating it downward and away from the receiver.

(3) Pull the cocking handle to the rear and remove it from the guide slot.

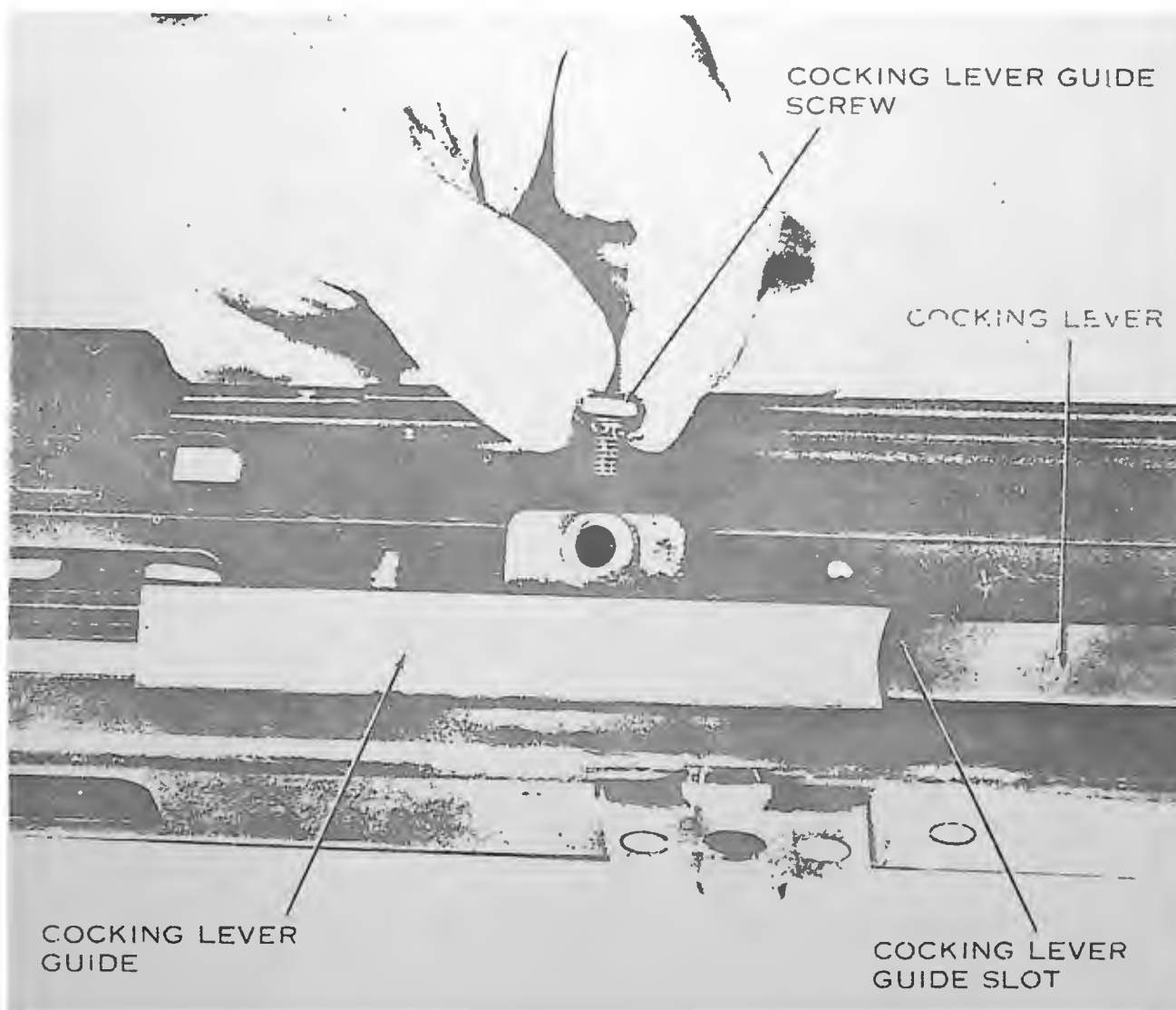


FIGURE 26 REMOVING THE COCKING HANDLE

b. To remove the forearm assembly, close the cover and turn the receiver group so the cover is down. Insert the nose of a cartridge into the latch hole at the bottom rear of the forearm assembly (figure 27). Press down on the cartridge, releasing the forearm latch, raise the rear of the forearm assembly slightly, and remove it to the front.

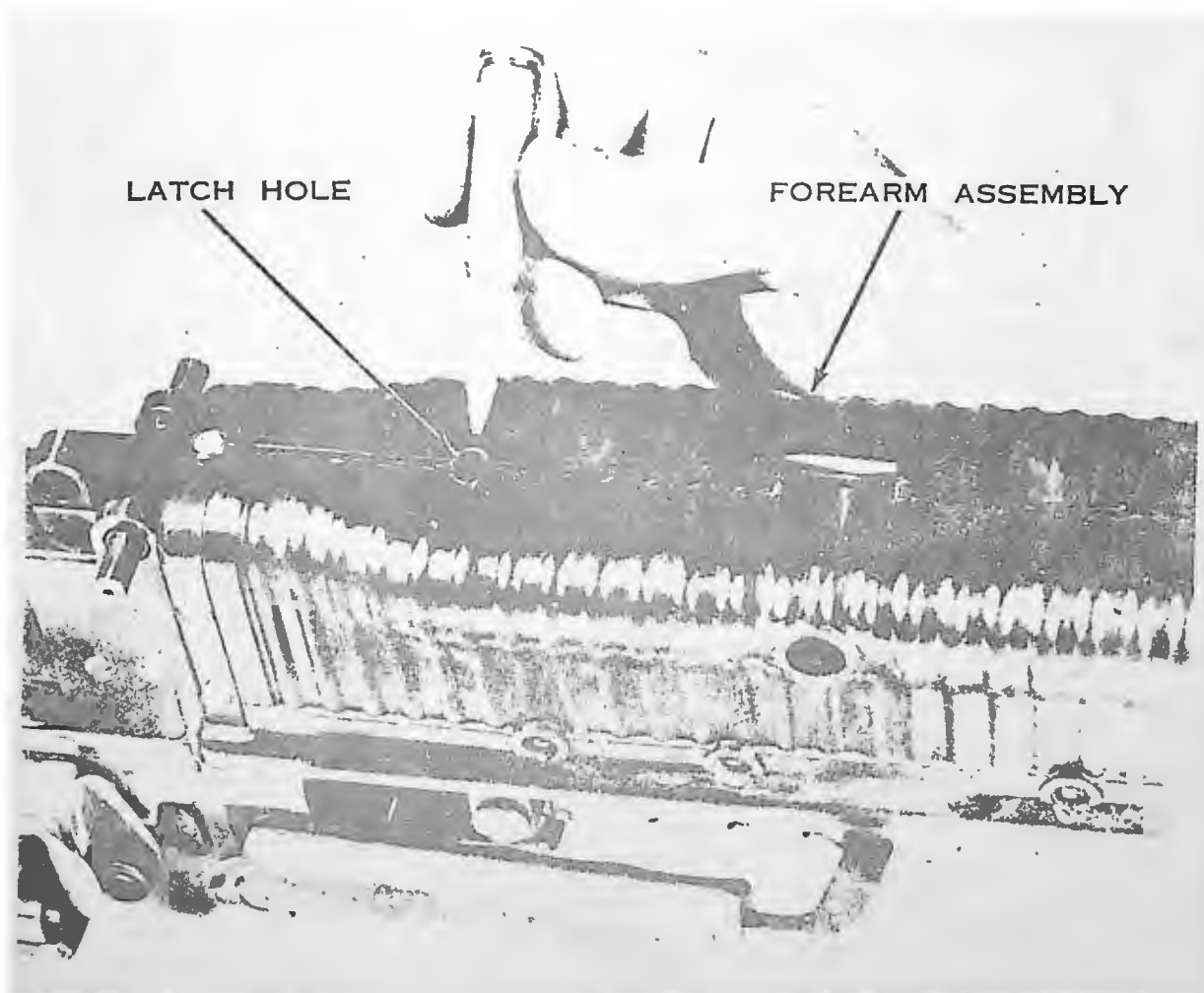


FIGURE 27 REMOVING THE FOREARM ASSEMBLY

c. To remove the cover assembly —

(1) Take a cartridge and push the hinge pin latch out of its recess (figure 28).

(2) Remove the hinge pin by pulling it from the opposite side of the recess (figure 28).

(3) Lift the cover from the receiver.

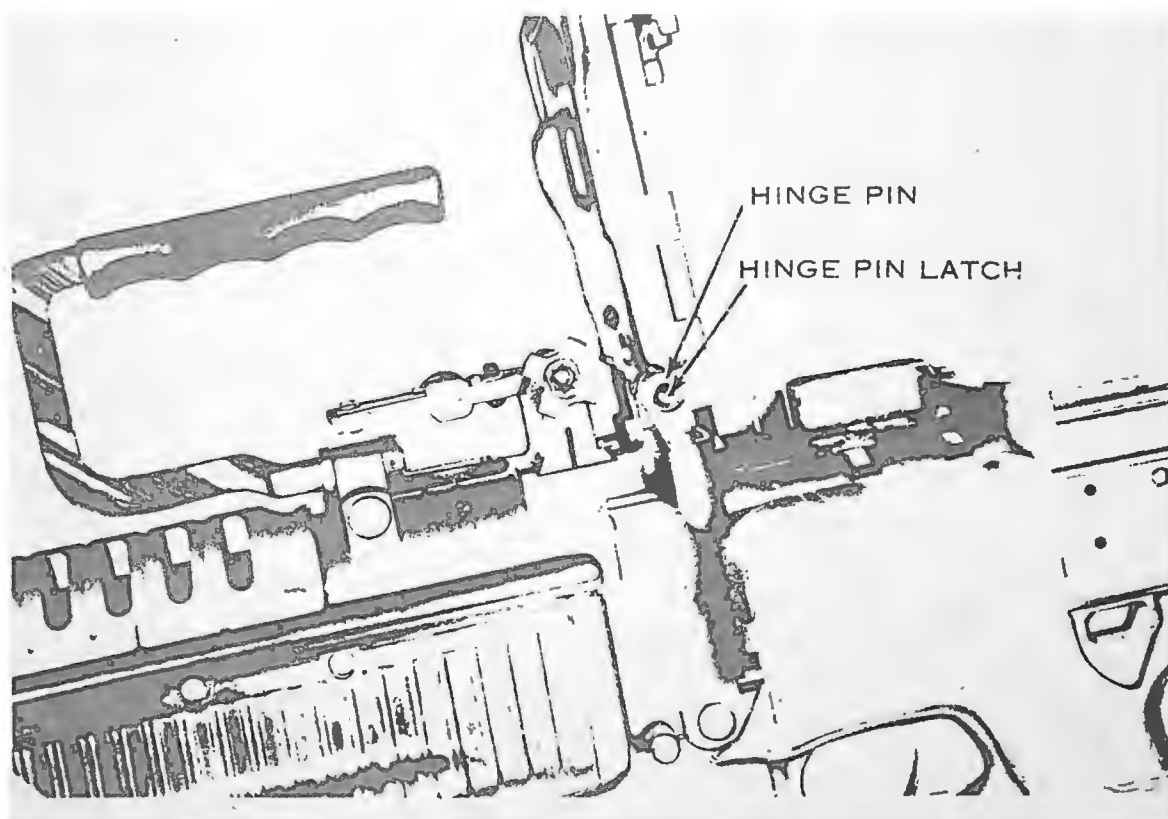


FIGURE 28 HINGE PIN AND LATCH

d. When the cover has been removed, raise the feedtray from the receiver and remove it (figure 29).



FIGURE 29 REMOVING THE FEEDTRAY

32. ASSEMBLY OF THE RECEIVER GROUP:

a. To replace the feedtray, aline the feedtray guides to the left of the receiver mounting brackets and replace it (figure 29).

b. To replace the cover —

(1) Insert the cover spring in the well in the receiver and aline the cover in the mounting bracket (figure 29).

(2) Insert the hinge pin from one side and the hinge pin latch from the opposite side (figure 28).

c. To replace the forearm assembly —

(1) Guide the forearm assembly over the operating rod tube, insuring that the operating rod tube does not strike the baffles inside the assembly. Aline the recess in the forearm assembly with the end of the operating rod tube.

(2) Tap on the bottom rear of the forearm assembly firmly with the palm of the hand to lock it into position.

d. To replace the cocking handle —

(1) Position the cocking handle in the square opening at the rear of the cocking handle guide slot and push it forward (figure 26).

(2) Position the cocking handle guide over the cocking handle by inserting the bottom tabs in the slots in the receiver. Then properly aline the screw holes and rotate it upward into position (figure 26).

(3) Replace the lockwasher and screw.

e. The disassembled receiver group is shown in figure 30.

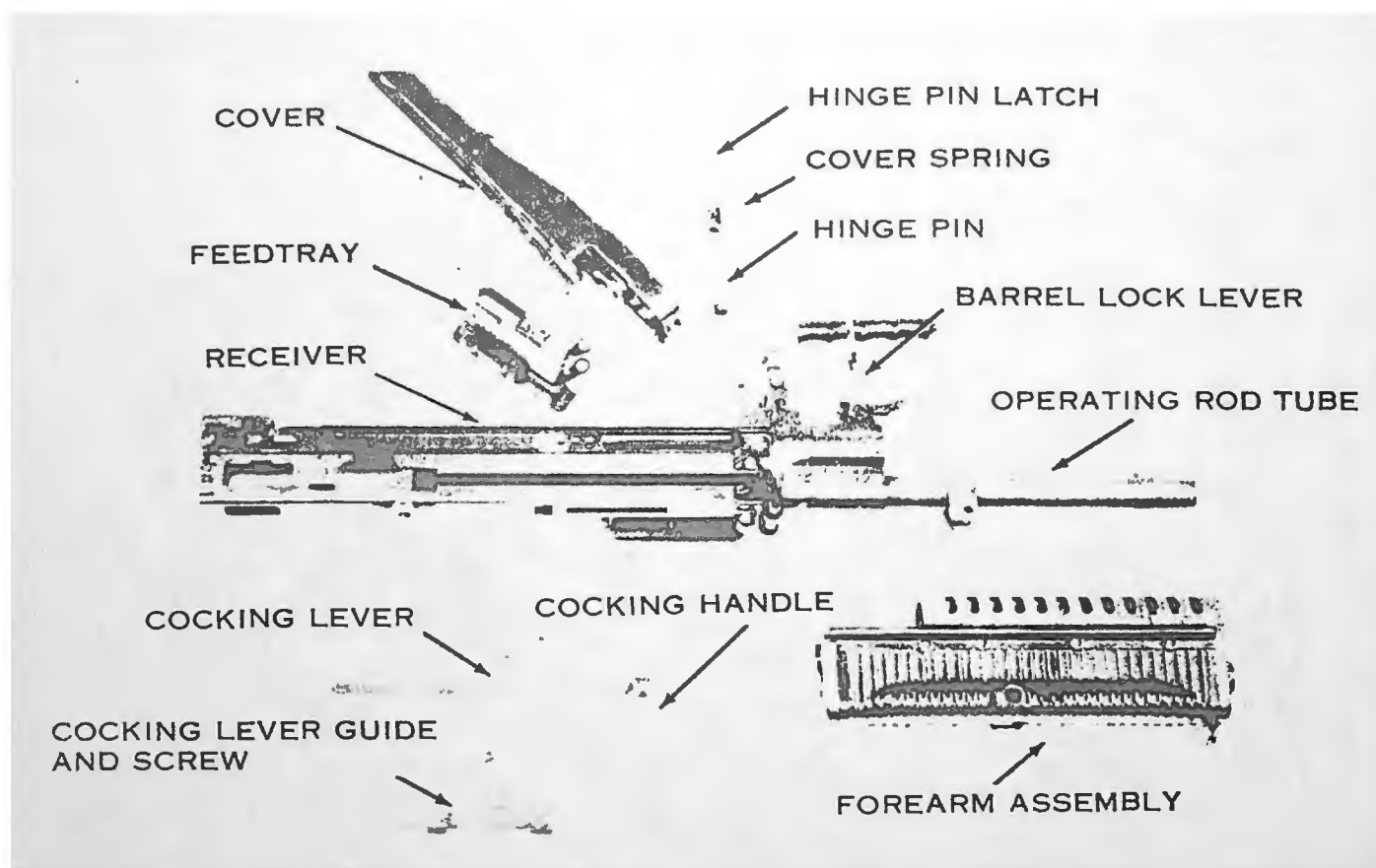


FIGURE 30 DISASSEMBLED RECEIVER GROUP

REVIEW QUESTIONS

1. Before the weapon is disassembled, it must be _____.
2. How many types of assembly or disassembly are there? _____.
3. General disassembly and assembly involves removing and replacing the _____ major groups.
4. The buffer group consists of the _____ and the _____.
5. In disassembly, the first thing to be removed is the _____.

6. The six major groups are the -
1. _____ 2. _____
3. _____ 4. _____
5. _____ 6. _____
7. The operating group consists of the _____,
_____, _____, and _____.
8. The M-60 machinegun can be disassembled and assembled without the
use of _____.
9. Detailed disassembly and assembly involves removing and replacing
the _____ of the major groups.
10. The trigger housing pin is interchangeable with the _____.
11. The barrel group is removed by raising the _____
_____ to the _____ position and pulling the barrel
group to the _____.
12. The barrel group consists of the _____,
_____, _____, and _____.
13. The trigger housing group consists of the _____
_____, _____, and _____.
14. The trigger housing assembly consists of the _____
_____, _____,
_____, _____,
and _____.
15. The receiver group consists of the _____,
_____, _____,
_____, and _____.

16. Before the bolt of the M-60 can be pulled to the rear, the safety must be on the _____ position.
17. The bolt of the M-60 is mounted on the _____
_____.
18. When reassembling the bolt, insert the _____ first, the _____ second, the _____ third, the _____ fourth, the _____ fifth, and the _____ last.
19. The M-60 has a fixed _____ on the barrel.
20. The leaf spring is locked into position by the _____ and the _____.
21. The rear of the barrel is called the _____.
22. To replace the feedtray, align the feedtray guides to the _____ of the _____.
23. In assembling the barrel group the _____ is inserted into the gas cylinder with the _____ and the _____ to the rear.
24. The trigger spring is to the rear and under the _____.
25. The extractor and ejector on the face of the bolt are removed by an _____ only.
26. Detailed disassembly of the _____, _____, _____, and _____ is authorized at the unit level.
27. To check the M-60 for correct assembly pull the _____ to the rear and _____ to its _____ position, close the _____ and pull the _____. The _____ should go forward.

NOTES

CHAPTER 2

MOUNTS

Section I. BIPOD MOUNT

33. The bipod mount is an integral part of the barrel group. It is not removed at the unit level. The bipod yoke fits around the barrel and is held in position by the flash suppressor (figure 31).

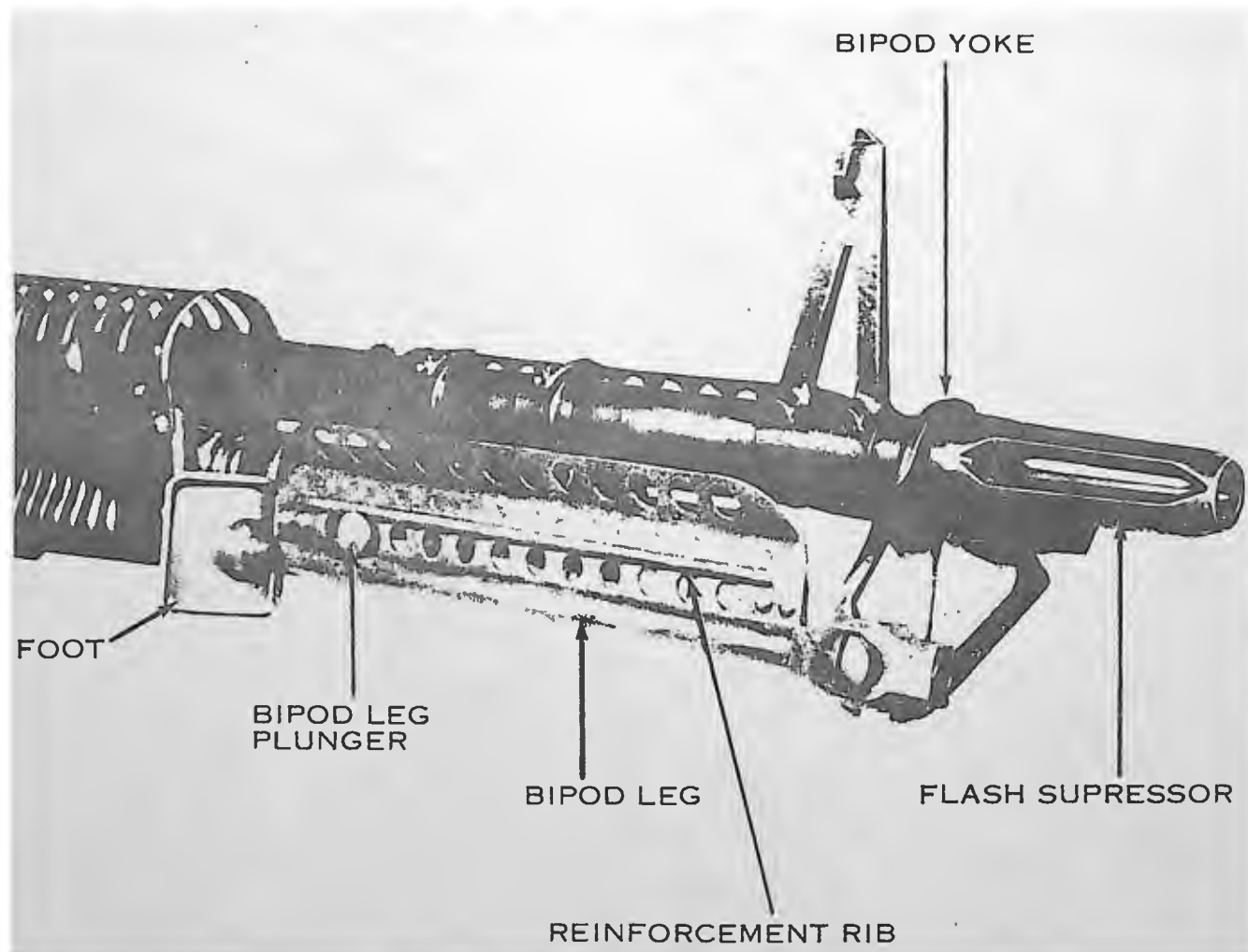


FIGURE 31 BIPOD ASSEMBLY

34. LOWERING, ADJUSTING, AND RAISING THE BIPOD LEGS:

a. Lowering: To lower a bipod leg, pull it to the rear compressing the lock spring, and push it downward (figure 32). The leg automatically locks when in the down position.

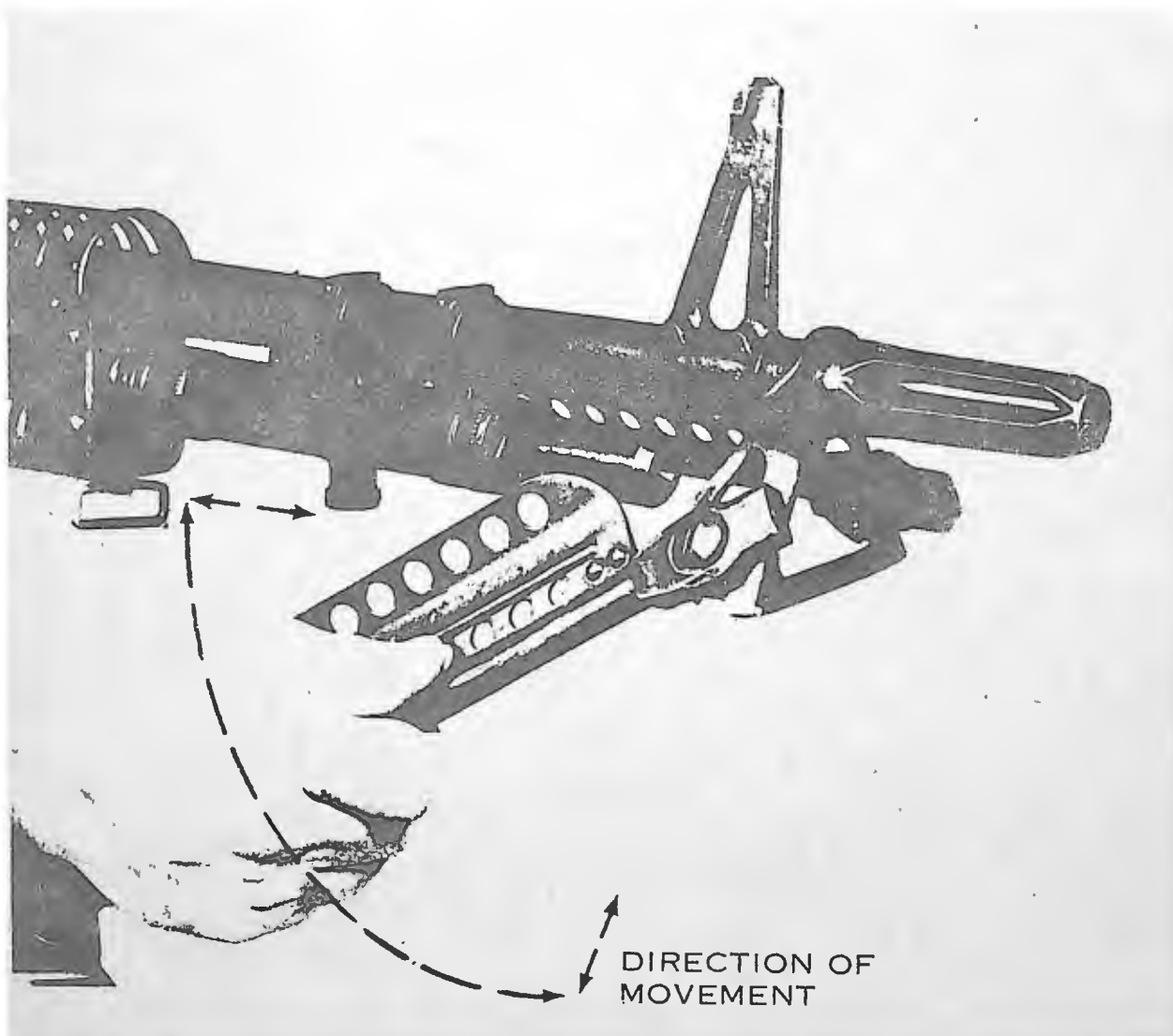


FIGURE 32 LOWERING AND RAISING THE BIPOD LEG

b. Adjusting: To lengthen a bipod leg, pull down on the foot (figure 33). The bipod leg plunger engages a notch in the bipod leg extension and holds it in the desired position. To shorten the bipod leg, depress the bipod leg plunger and push up on the bipod foot (figure 33).

c. Raising: To position the bipod leg in the up position, pull down on the bipod leg compressing the lock spring, and raise it until it locks into position along-side the barrel.

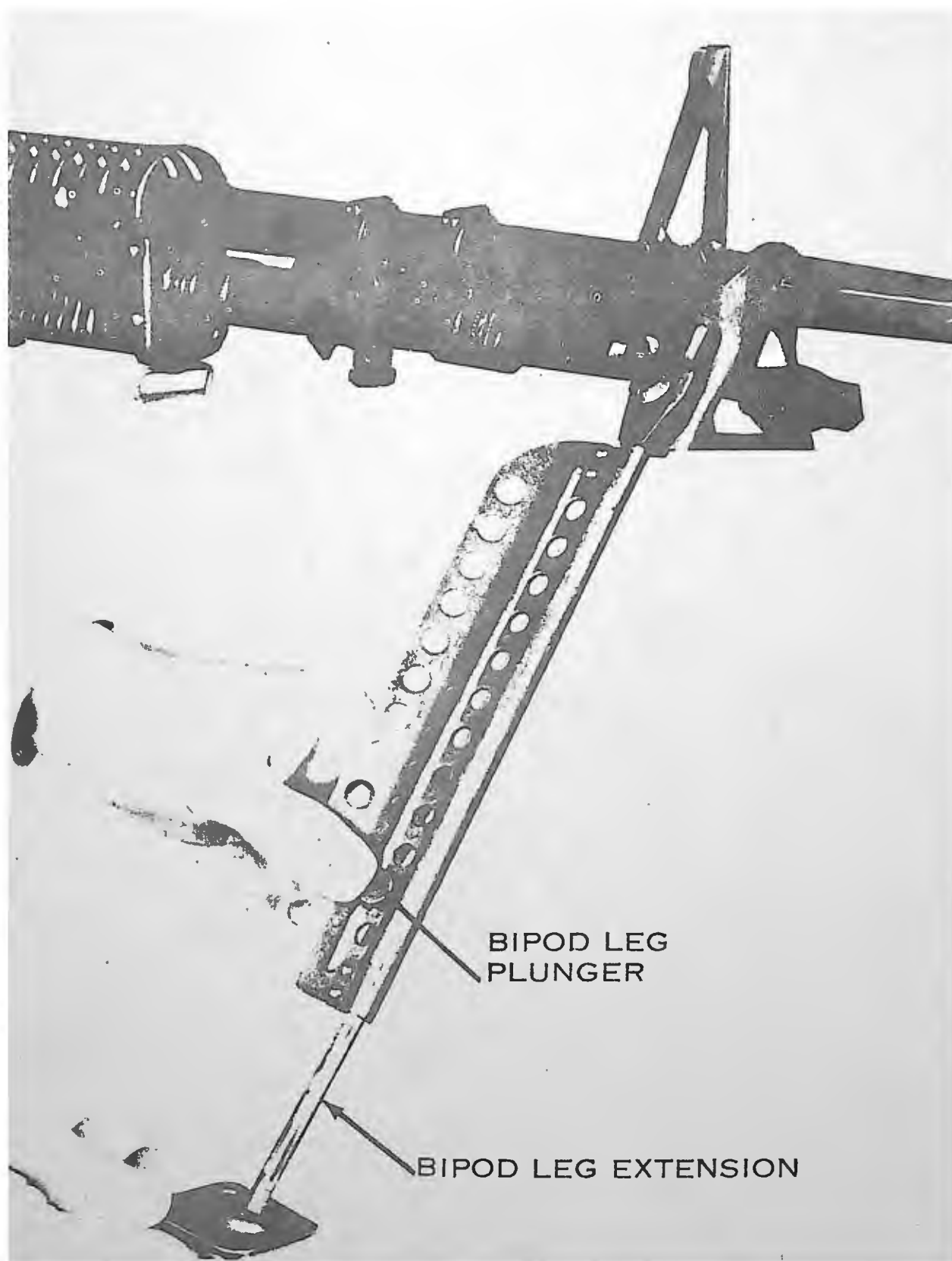


FIGURE 33 ADJUSTING BIPOD LEG EXTENSION

Section II. TRIPOD MOUNT M122

35. The M122 tripod mount consists of the tripod assembly, the traversing and elevating mechanism, and the pintle and platform group.

a. Tripod assembly: consists of the tripod head with the pintle bushing and pintle lock, one front leg, two rear legs, and a traversing bar (figure 34). The traversing bar connects the two rear legs, and supports the traversing and elevating mechanism. Engraved on the bar is a scale which is divided into 100-mil major divisions and 5-mil subdivisions, 450-mils to the left and 425- to 430-mils to the right of center. A sliding sleeve connects the traversing bar and a rear leg to permit folding the legs. Position stops are provided to stop the traversing bar in the open or closed position. The sleeve latch on the right rear leg secures the traversing bar when in the open position (figure 34).

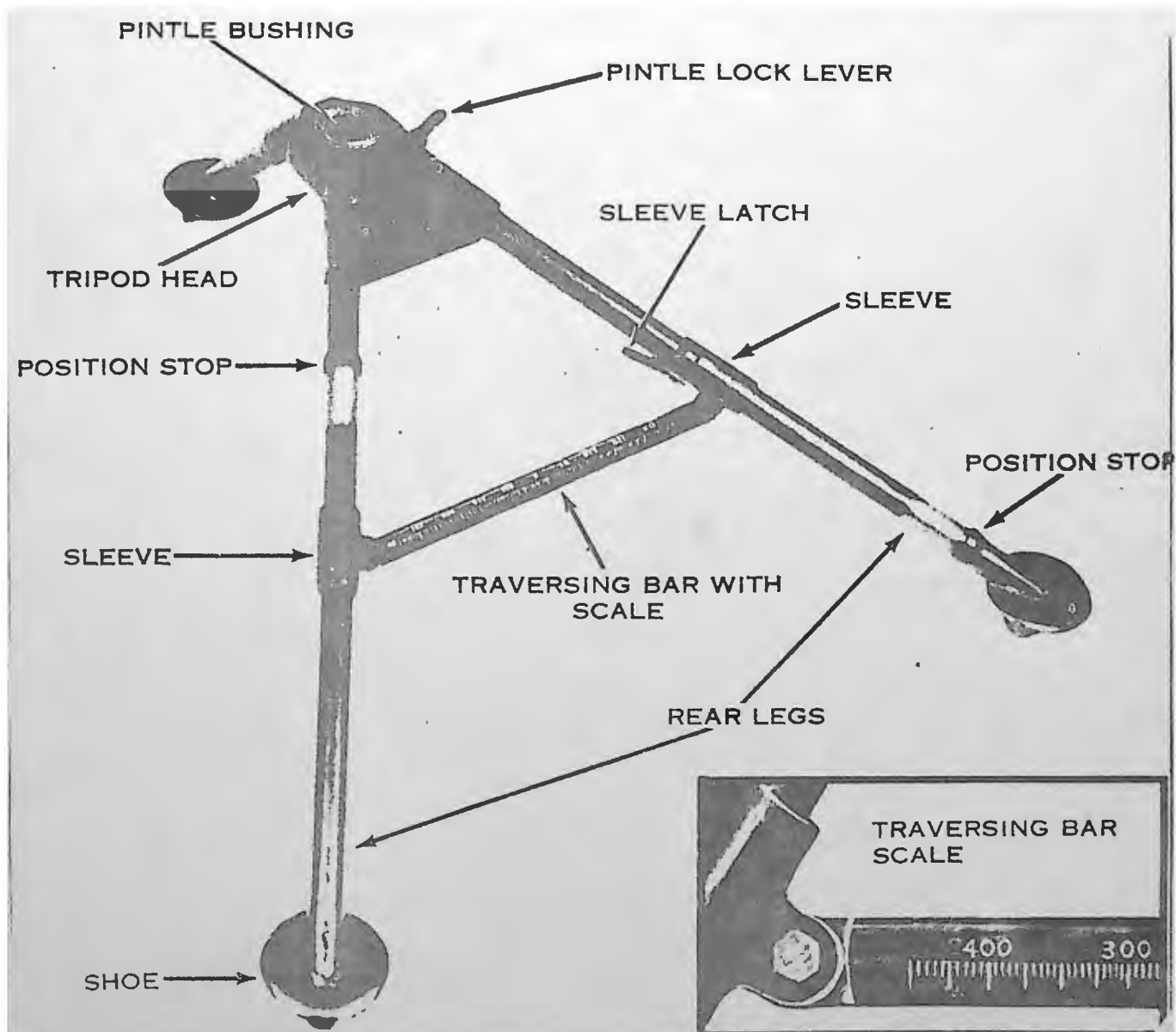


FIGURE 34 M122 TRIPOD ASSEMBLY

b. Traversing and elevating mechanism: (figure 35) consists of -

(1) The elevation adapter - which connects the mounting plate on the bottom of the receiver.

(2) The traversing handwheel - which has a mil click device built into it. One click equals a 1-mil change. Engraved on the traversing handwheel is a scale which is divided into 5-mil major divisions and 1-mil subdivisions. One complete revolution of the traversing handwheel is 25 mils of adjustment. By using the traversing mechanism the gun can be traversed 50 mils right and left of center for a total of approximately 100-mils of traverse.

(3) The elevating handwheel, and the upper and lower elevating screw.

(a) The elevating handwheel - has a mil click device built into it. One click equals a 1-mil change. Engraved on the handwheel is a scale which is divided into 5-mil major divisions. The scale is read directly from the indicator (figures 35 and 111).

(b) The upper elevating screw - has the elevating screw plate which is graduated into 50-mil increments. There are 200-mils above and 200-mils below the zero index line for a total of 400-mils in elevation change.

(4) The traversing slide with the traversing slide lock lever - allows rapid lateral adjustments along the traversing bar. Readings are taken from the left side of the slide.

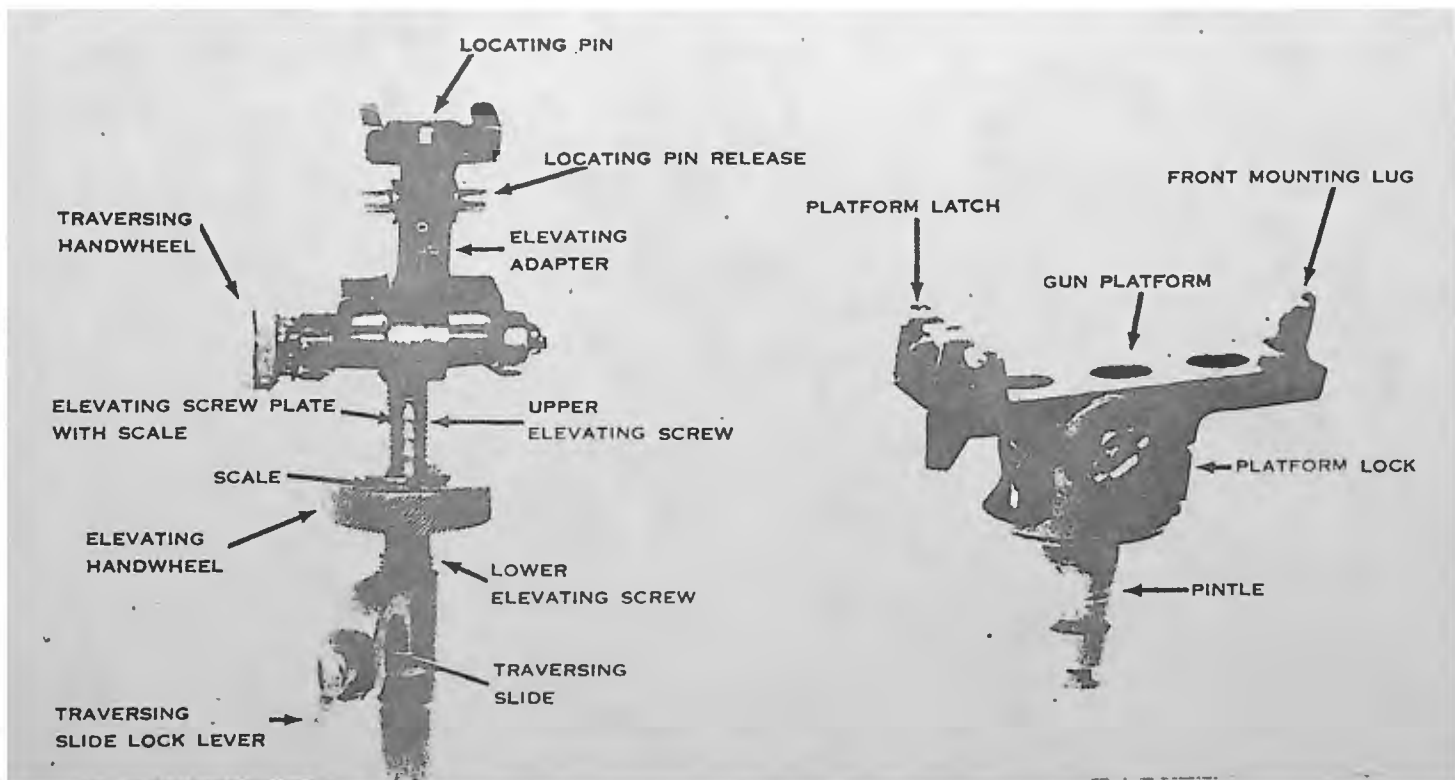


FIGURE 35 TRAVERSING AND ELEVATING MECHANISM, PINTLE AND PLATFORM GROUP

c. Pintle and platform group: (figure 35) consists of the gun platform to which the gun is attached and the pintle which is secured to the tripod assembly.

36. MOUNTING THE GUN ON THE M122 TRIPOD MOUNT:

a. Lock the pintle and platform group into the pintle bushing (figure 36).

b. Position the front locating pin (in the forearm assembly) in the front mounting lug (if pintle and platform group is so equipped).

c. Lower the receiver so the rear locating pin snaps under the platform latch.

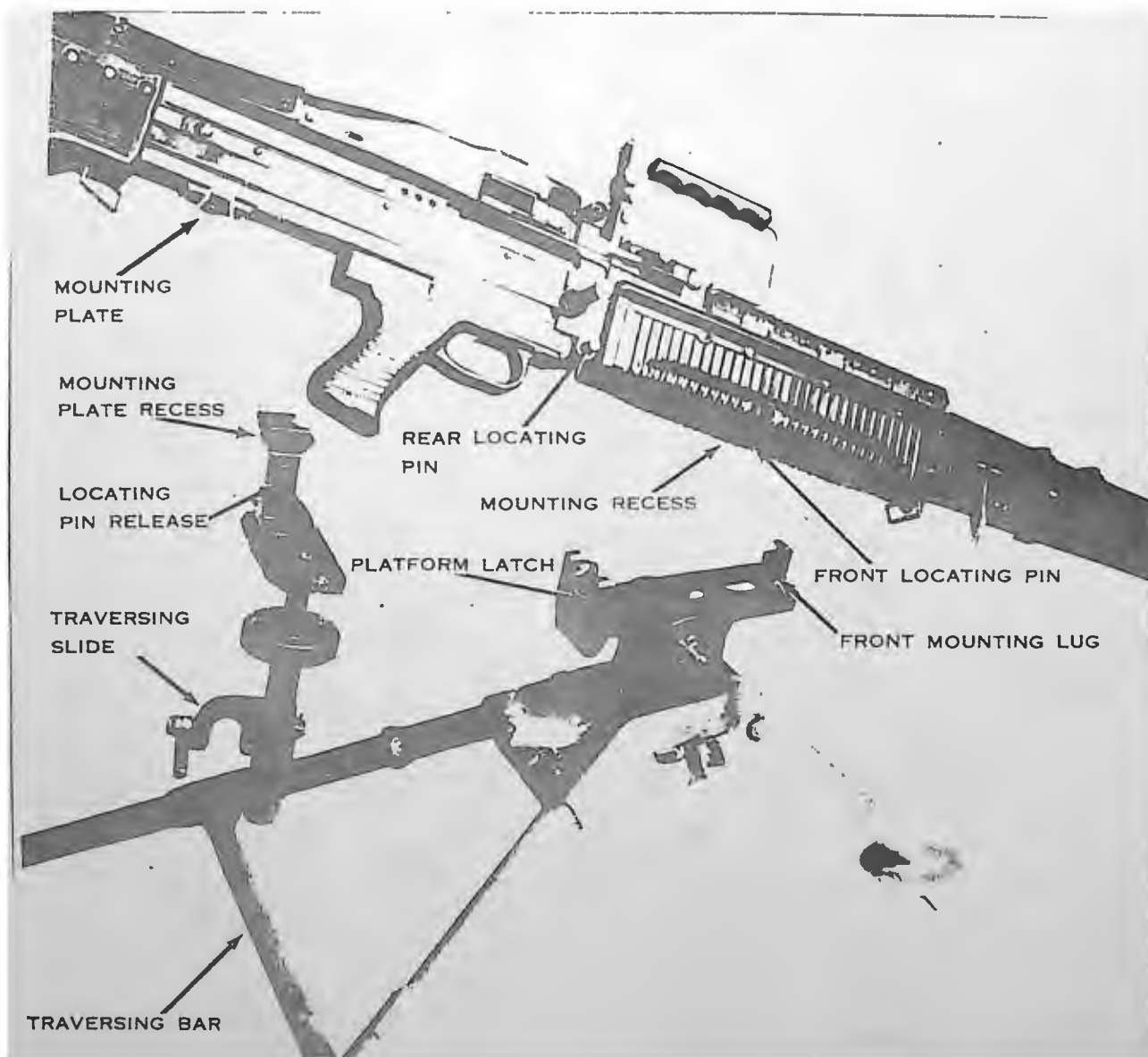


FIGURE 36 GUN IN RELATION TO TRIPOD

d. With the gun mounted on the tripod, release the platform lock (figure 37) and raise the rear of the gun.

e. Place the mounting plate recess of the elevation adapter on the rear of the mounting plate and push it forward (figure 37). The adapter pin automatically locks into position in the bottom of the mounting plate

f. Lower the rear of the gun, place the traversing slide (with the traversing slide lock lever to the rear) on the traversing bar and lock it into position.

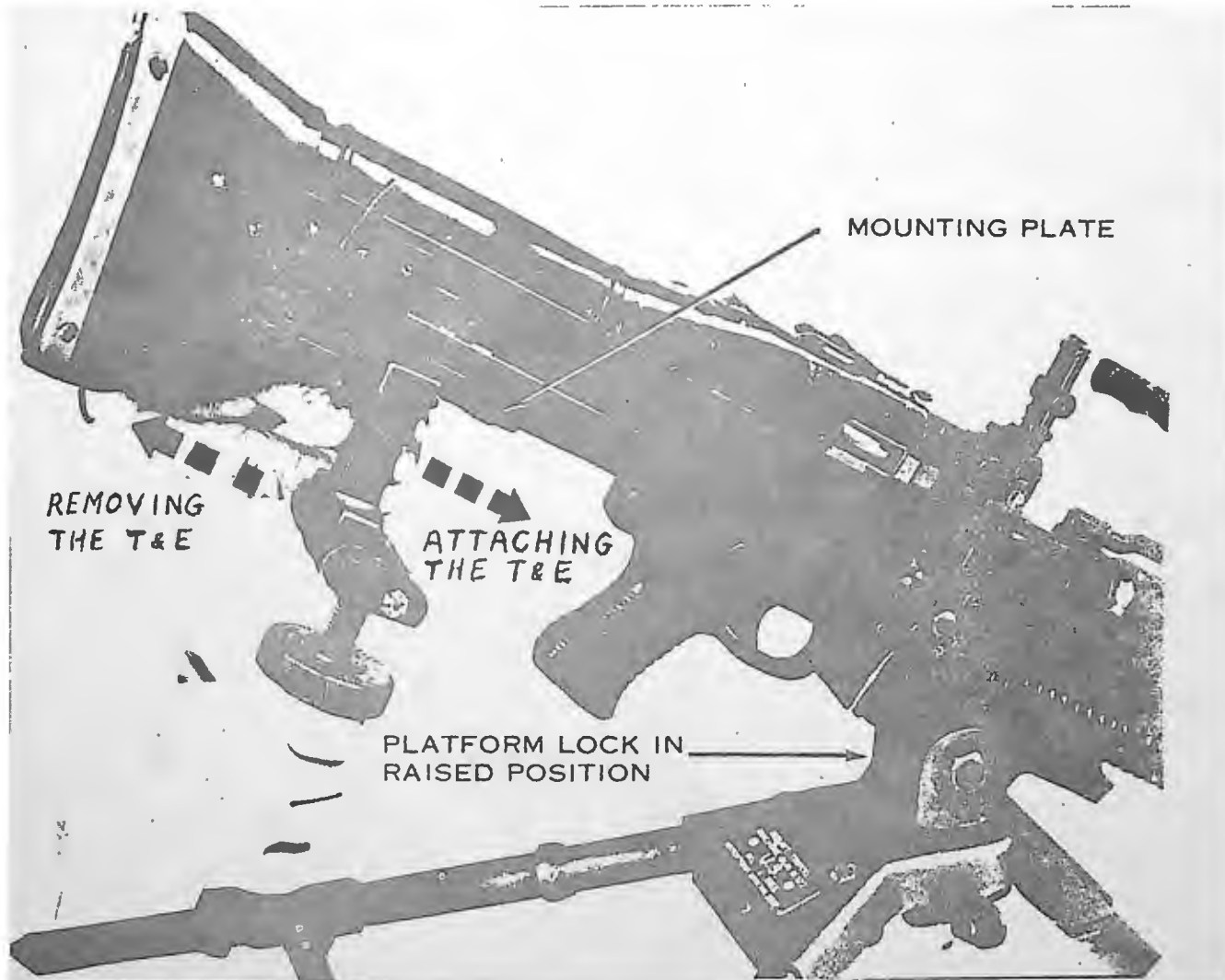


FIGURE 37 ATTACHING AND REMOVING THE TRAVERSING AND ELEVATING MECHANISM

37. REMOVING THE GUN FROM THE M122 TRIPOD MOUNT:

a. Remove the traversing and elevating mechanism by releasing the slide lock lever and raising the rear of the gun.

b. Pull down on the adapter locating pin release and pull the T&E mechanism straight back, off the mounting plate (figure 37).

c. Return the platform lock to the down position.

d. Stand to the left of the gun and grasp the carrying handle with the left hand.

e. With the right hand depress the platform latch and raise the rear of the gun slightly, thus removing the rear locating pin from under the platform latch.

f. Place the right hand on the top of the stock, pull the gun slightly to the rear, push down on the stock, and lift the gun from the mount.

Section III. VEHICULAR MOUNTS

38. GENERAL:

The standard vehicular mount for firing the M-60 machinegun is the M4 pedestal mount for the M151 1/4-ton truck (figure 38). One component of this mount, the M142 gun mount which serves as a cradle for the M60 machinegun, is adaptable to use in other vehicles which will mount this weapon (figure 39). The M142 gun mount has a travel lock which permits locking the gun in a horizontal position. The gun platform in this mount is identical to that used in the M122 tripod mount.

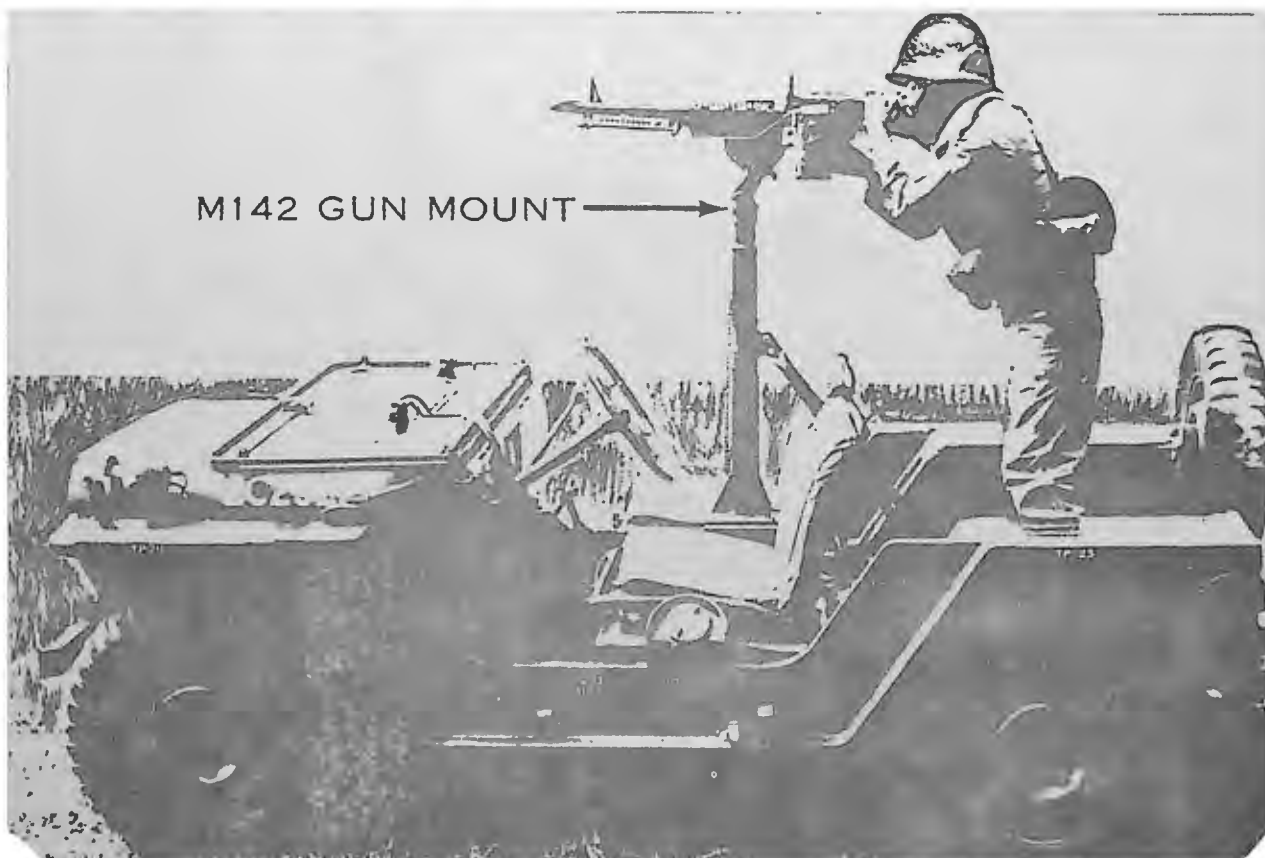


FIGURE 38 M4 PEDESTAL MOUNT

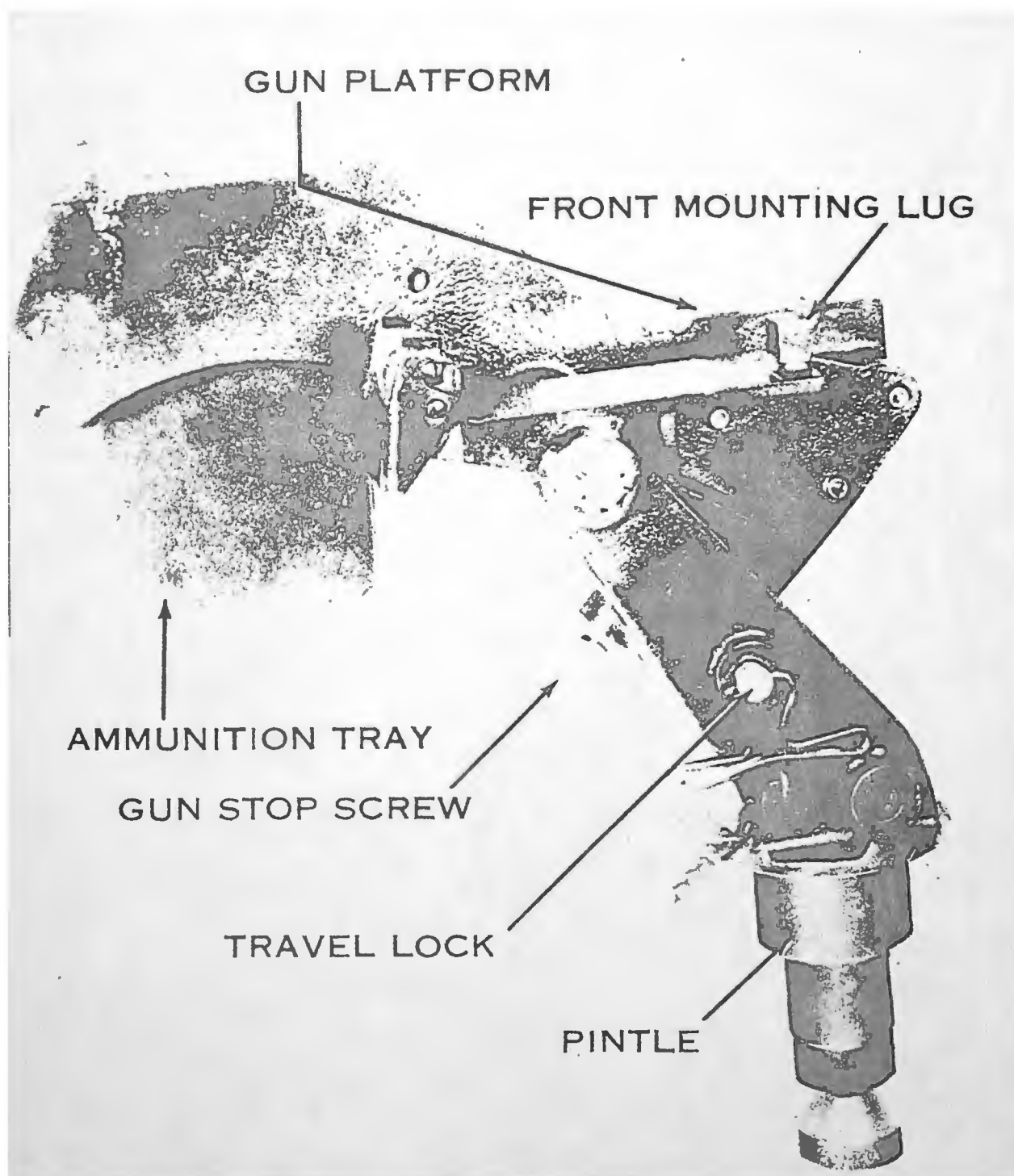


FIGURE 39 M142 GUN MOUNT

39. MOUNTING AND DISMOUNTING THE GUN (VEHICULAR MOUNT):

a. Mounting:

(1) Lock the gun platform in the horizontal position by inserting the pin into the travel lock.

(2) Position the front locating pin (in the forearm assembly) in the front mounting lug.

(3) Lower the receiver so the rear locating pin snaps under the platform latch.

b. Dismounting:

(1) Insure that the travel lock is engaged (holding the gun platform in a horizontal position).

(2) Grasp the carrying handle with one hand and depress the platform latch with the other. Raise the rear of the gun slightly and lift the gun from the mount.

REVIEW QUESTIONS

1. To lower a bipod leg, _____ it to the _____ compressing the lock spring, and _____ it downward.
2. To lengthen a bipod leg, _____ on the foot.
3. To shorten the bipod leg, depress the _____ and _____ on the bipod foot.
4. The M122 tripod mount consists of the _____, the _____ and _____, and the _____ and _____.
5. The tripod assembly consists of the _____ with the _____ and _____, one _____, two _____, and a _____.
6. The traversing bar scale is divided into _____-mil major divisions and _____-mil subdivisions.
7. There are _____-mils left and _____ to _____-mils right engraved on the traversing bar.

8. Engraved on the traversing handwheel is a scale which is divided into ____-mil major divisions and ____-mil subdivisions.
9. One click of adjustment on the elevating handwheel equals ____-mil of change.
10. The elevating screw plate is graduated into ____-mil increments and there are 200-mils above and ____-mils below the zero index line for a total of ____-mils in elevation change.
11. Readings are taken from the traversing bar from the ____ side of the traversing slide.
12. There are ____ steps in mounting the gun on the M122 tripod, and ____ steps in removing it from the tripod.
13. In mounting or dismounting the M60 from the M142 vehicular mount, the first step is to ____ the gun platform in the ____ position by inserting the ____ into the ____.

NOTES

CHAPTER 3

OPERATION AND FUNCTIONING

Section I. OPERATION

40. GENERAL:

The M60 machinegun is loaded, fired, unloaded, and cleared in the open bolt position. The safety must be placed in the FIRE position before the bolt can be pulled to the rear.

41. LOADING:

- a. Place the safety on the fire position.
- b. Pull the bolt to the rear, using the cocking handle.
- c. When the bolt is held to the rear by the sear, return the cocking handle to the forward position, and place the safety on the SAFE position.
- d. Raise the cover and insure that the feedtray, receiver, and chamber are clear (figure 40).
- e. Place the first round of the belt in the feedtray groove and close the cover, INSURING THAT THE ROUND REMAINS IN THE FEEDTRAY GROOVE (figure 40).

42. UNLOADING:

Pull the bolt to the rear, place the safety on the SAFE position, and return the cocking handle to the forward position. Raise the cover and remove any ammunition or links from the feedtray.

43. CLEARING THE GUN:

- a. The gun is clear after live firing when --
 - (1) The cover, feedtray, receiver, and chamber are checked to insure they are clear of ammunition.
 - (2) The safety is placed on the FIRE position, the trigger is pulled and the safety is placed on the SAFE position.
- b. The gun is clear during mechanical training WITH THE BOLT FORWARD, SAFETY ON THE SAFE POSITION, AND THE COVER RAISED. During live fire exercises a cleaning rod is run through the bore until the end is visible in the receiver and is then removed.

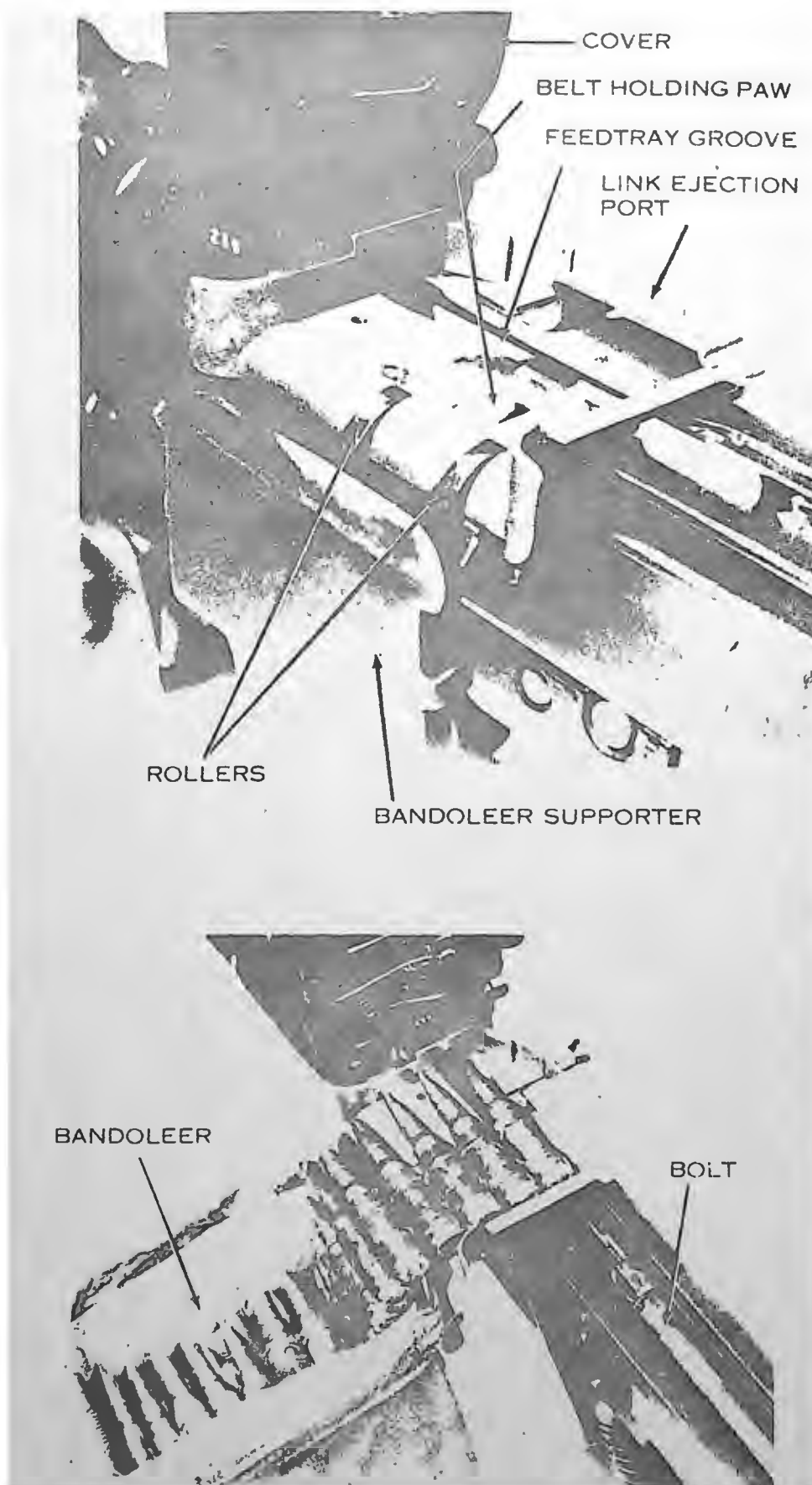


FIGURE 40 FEEDTRAY - UNLOADED AND LOADED

Section II. FUNCTIONING

44. GENERAL:

a. By having a basic knowledge of how the M60 machinegun functions the crew members are better able to recognize and correct stoppages which occur during firing.

b. The machinegun is designed to function automatically as long as ammunition is fed into the gun and the trigger is held to the rear. Each time a round is fired, the parts of the machinegun function in a certain sequence. Many of these actions occur simultaneously and are only separated for teaching purposes. The sequence of operation is known as the cycle of functioning.

c. For ease of understanding, the complete cycle of functioning is taught in eight separate steps.

- (1) FEEDING - A round is positioned in the feedtray groove.
- (2) CHAMBERING - A round is stripped from the belt and placed in the chamber.
- (3) LOCKING - The bolt is locked inside the barrel socket.
- (4) FIRING - The firing pin strikes and detonates the primer of the cartridge.
- (5) UNLOCKING - The bolt is unlocked from the barrel socket.
- (6) EXTRACTING - The empty case is pulled from the chamber.
- (7) EJECTING - The empty case is thrown from the receiver.
- (8) COCKING - The sear engages the sear notch.

45. CYCLE OF FUNCTIONING:

The cycle starts by putting a round in the feedtray groove and pulling the trigger, releasing the sear from the sear notch (figure 41). It stops when the trigger is released and the sear again engages the sear notch in the operating rod. When the trigger is held to the rear, the rear of the sear is lowered and disengaged from the sear notch. This allows the operating rod and bolt to be driven forward by the expansion of the operating rod drive spring. Now that the gun is functioning, the steps of the cycle can be traced.

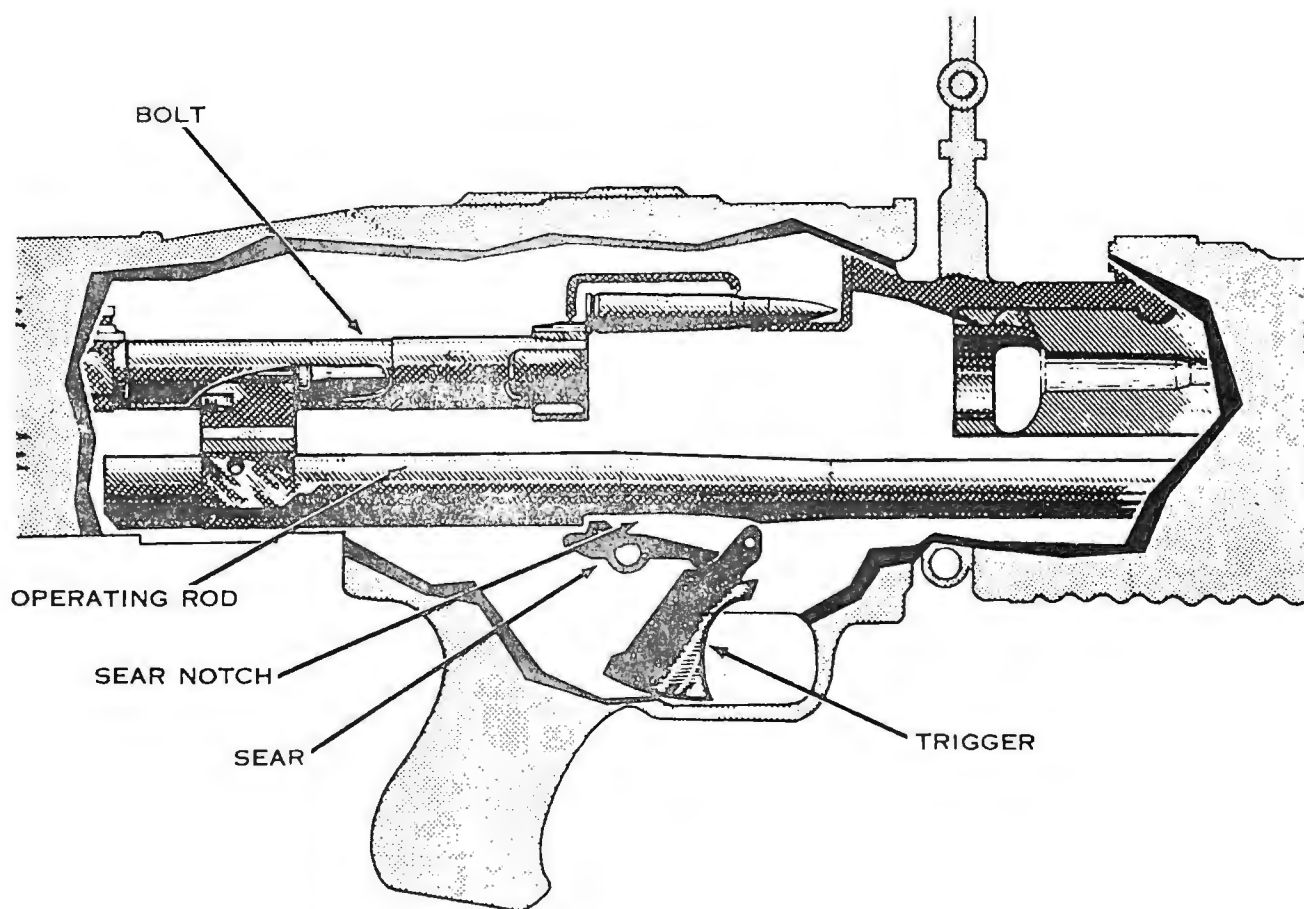


FIGURE 41 SEAR DISENGAGING FROM SEAR NOTCH

a. FEEDING

(1) As the bolt begins its forward movement, the feed cam is forced to the right, causing the feed cam lever to pivot in the opposite direction and forcing the feed pawl over the next round in the belt, ready to place it in the feedtray groove when the rearward action occurs again (figure 42).

(2) As the bolt moves to the rear after firing the cam roller on the top of the bolt forces the feed cam to the left. The feed cam lever is forced to pivot, moving the feed pawl to the right, placing a round in the feedtray groove (figure 43).

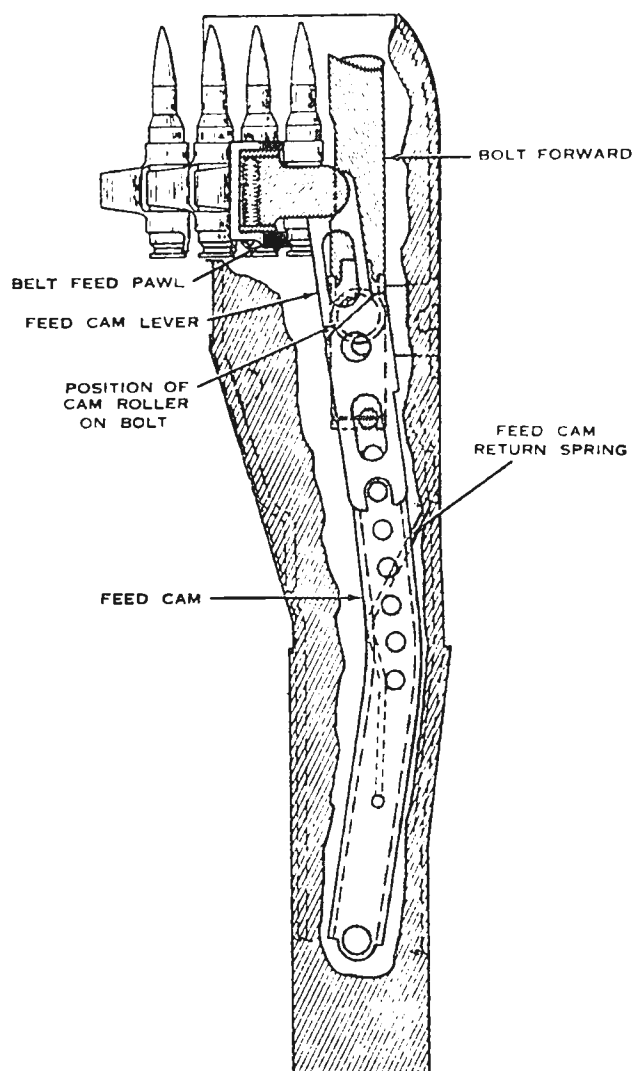


FIGURE 42 BOLT FORWARD

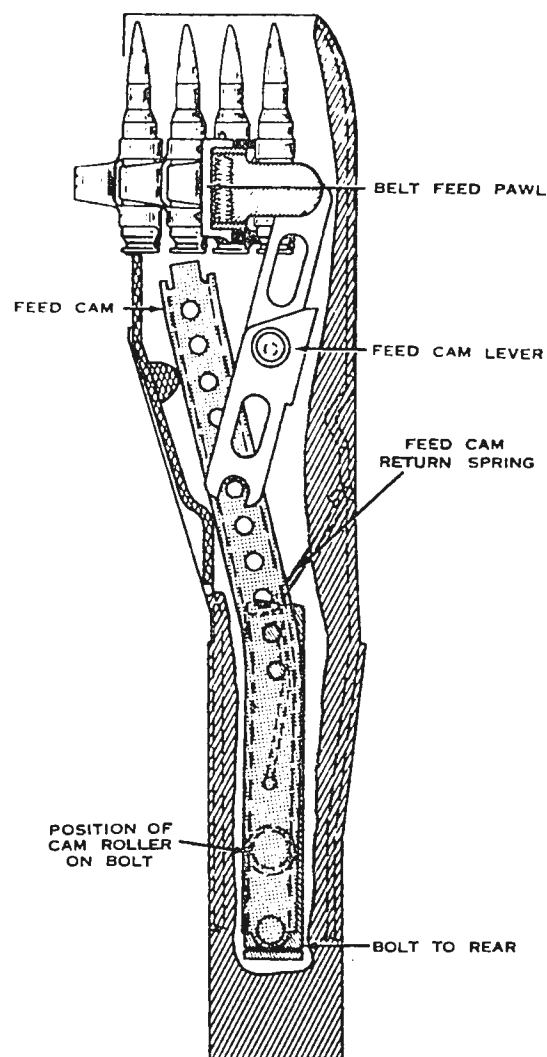


FIGURE 43 BOLT TO REAR

b. CHAMBERING

(1) As the bolt travels forward, the upper locking lug engages the rim of the cartridge (figure 44). The pressure of the front and rear cartridge guides hold the round so that positive contact is made with the upper locking lug of the bolt. The front cartridge guide prevents the link's forward motion as the round is stripped from the belt.

(2) The upper locking lug carries the round forward; the chambering ramp causes the nose of the cartridge to be cammed downward into the chamber (figure 45).

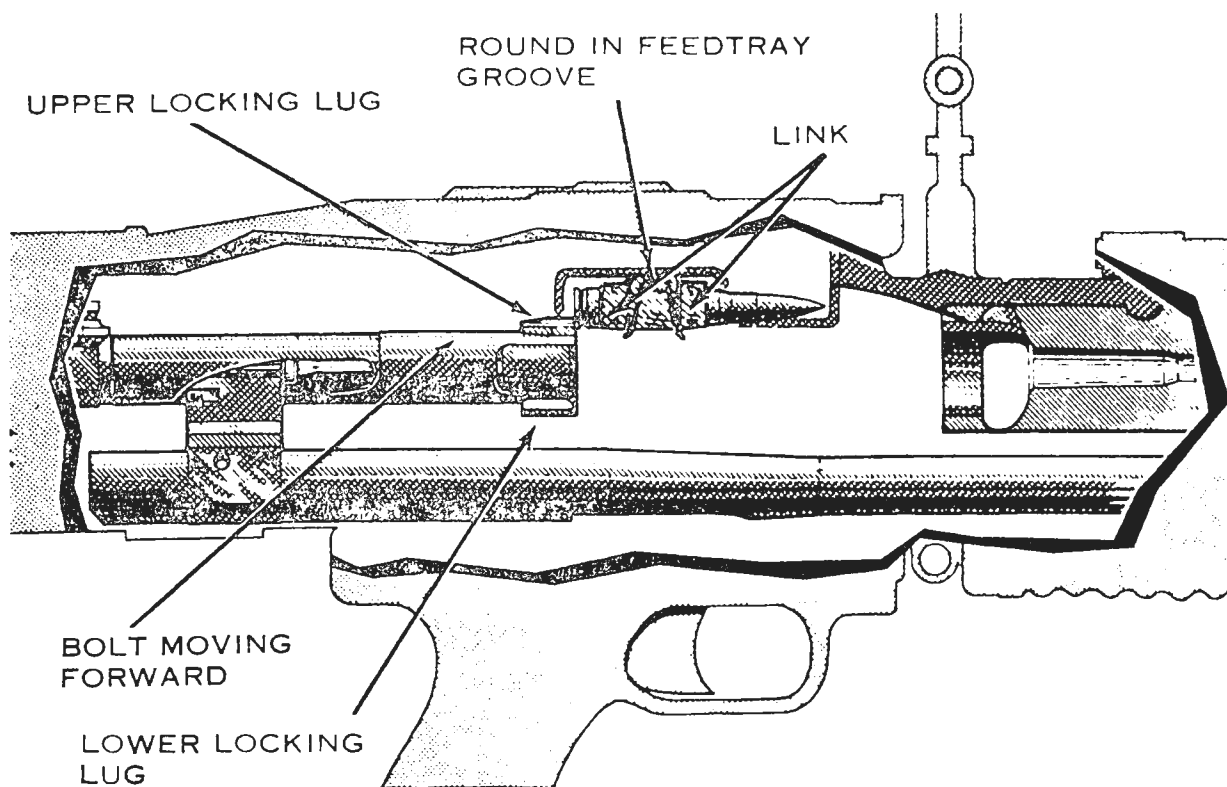


FIGURE 44 BOLT CONTACTING CARTRIDGE

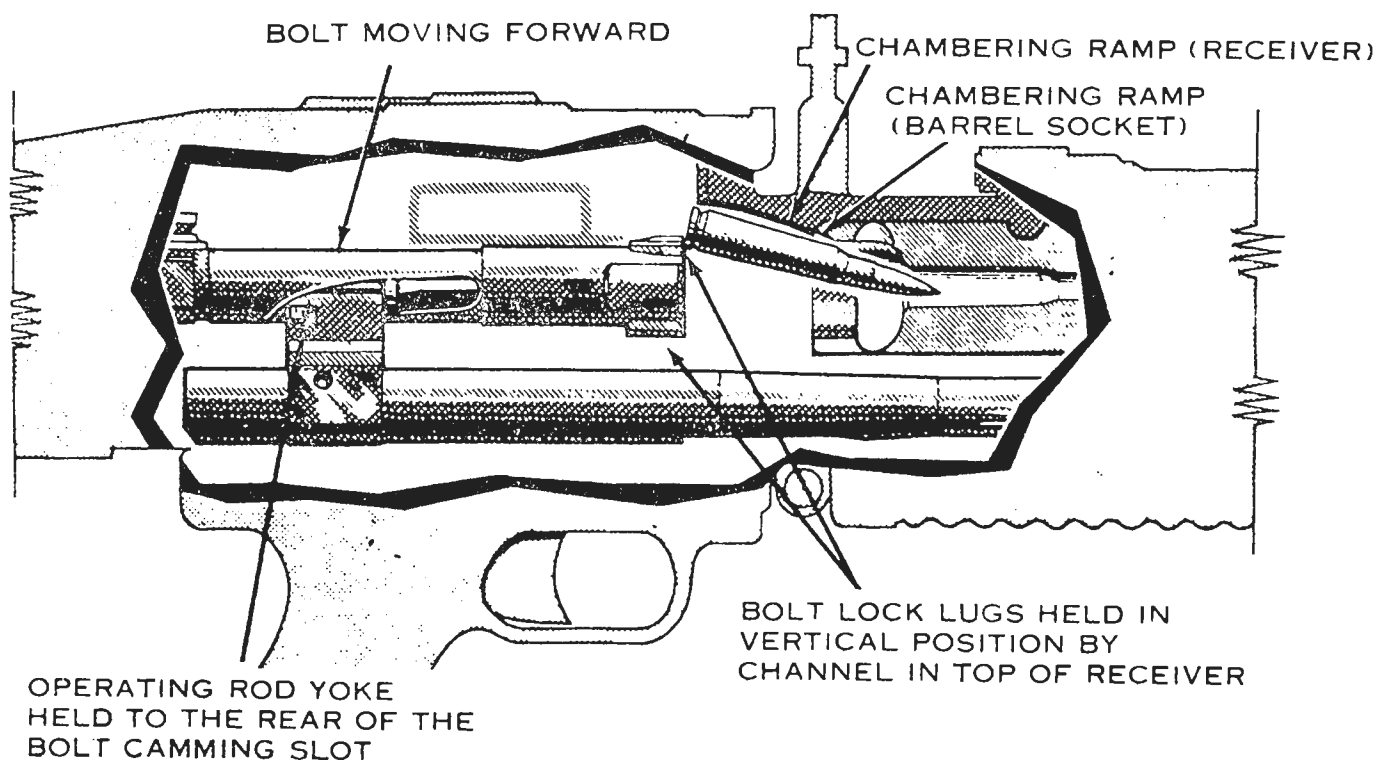


FIGURE 45 CARTRIDGE BEING DEFLECTED INTO CHAMBER

(3) When the round is fully seated in the chamber, the extractor snaps over the extractor rim of the cartridge, and the ejector on the face of the bolt is depressed.

c. LOCKING

As the round is chambered, the bolt enters the barrel socket. The upper and lower locking lugs contact the bolt camming surfaces inside the barrel socket and start the rotation of the bolt clockwise. The action of the operating rod yoke against the bolt camming slot, as the operating rod continues forward, causes the bolt to complete its one-quarter turn clockwise rotation (figure 46). Locking is then completed.

d. FIRING

After the bolt reaches its fully forward and locked position, the operating rod continues to go forward, independently of the bolt, for a short distance. The yoke, engaged between the firing pin spools, carries the firing pin forward. The striker of the firing pin protrudes through the aperture in the face of the bolt, striking the primer of the cartridge and detonating it (figure 47).

e. UNLOCKING

(1) After the cartridge is ignited and the projectile passes the gas port, part of the expanding gases enter the gas cylinder through the gas port. The rapidly expanding gases enter the hollow gas piston and force it to the rear. The operating rod, being in contact with the piston, is pushed to the rear (figure 48).

(2) As the operating rod continues to the rear, the operating rod yoke acts against the bolt camming slot; this causes the bolt to begin its counterclockwise rotation. The upper and lower locking lugs of the bolt, contacting the bolt camming surfaces inside the barrel socket, cause the bolt to complete its one-quarter turn rotation (counterclockwise) and unlocks the bolt from the barrel socket. Unlocking begins as the yoke of the operating rod contacts the curve of the bolt camming slot, and ends as the bolt clears the end of the barrel socket.

f. EXTRACTING

While unlocking is going on, extraction is beginning. The rotation of the bolt (in unlocking) loosens the cartridge case in the chamber. As the operating rod and bolt continues to the rear, the extractor (gripping the rim of the cartridge) pulls the cartridge case from the chamber (figure 49).

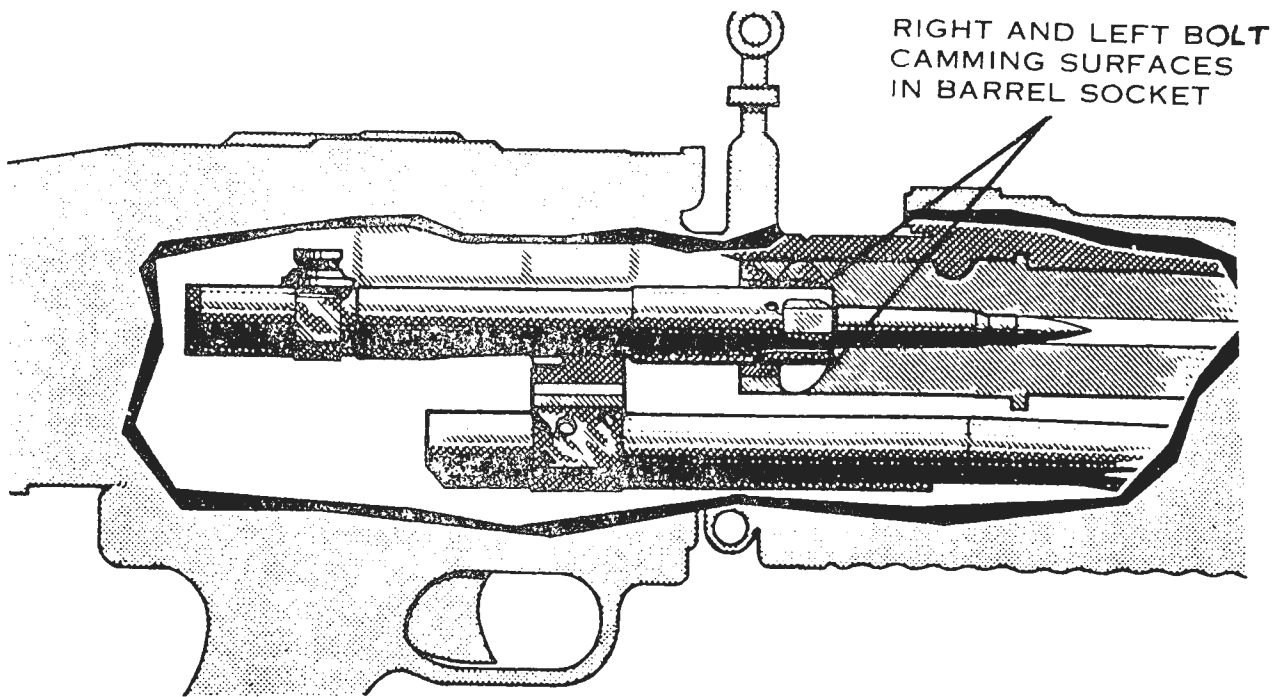


FIGURE 46 WEAPON LOCKED, READY TO FIRE

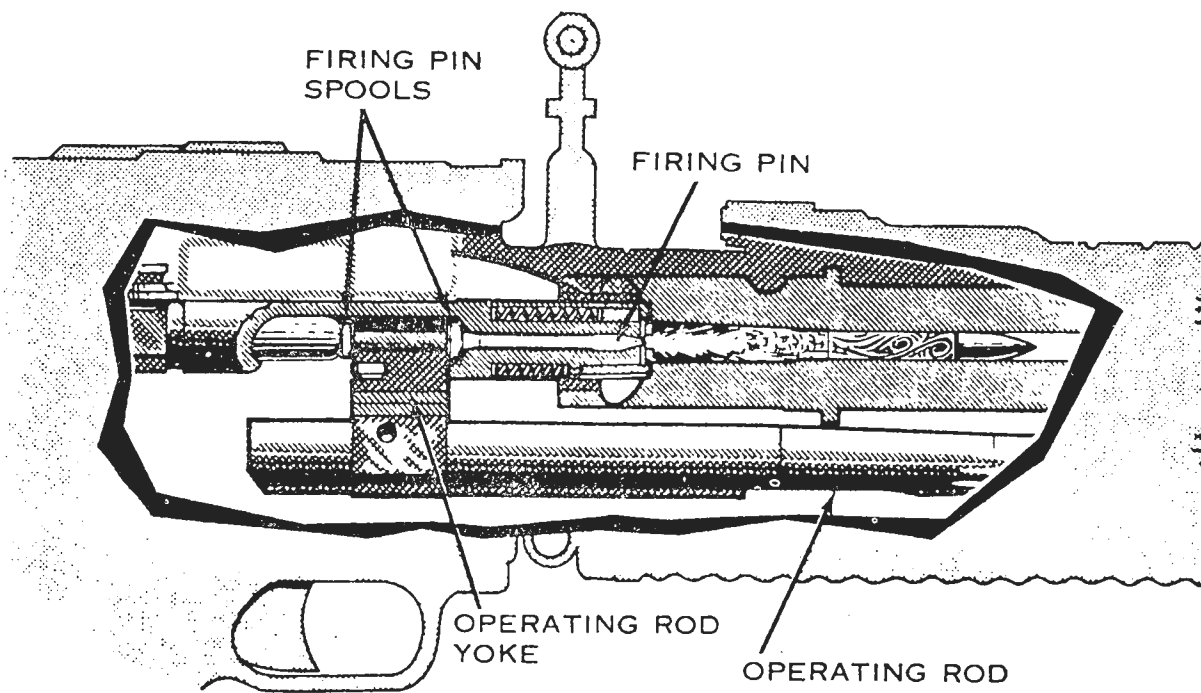


FIGURE 47 FIRING

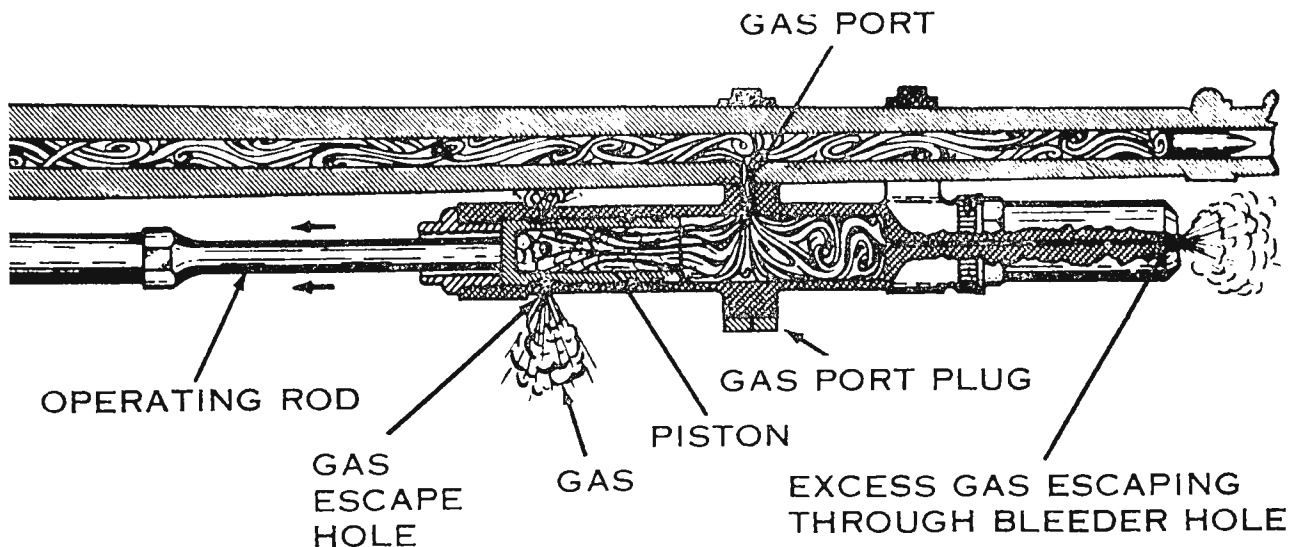


FIGURE 48 UNLOCKING ACTION OF GASES

g. EJECTING

As the case is withdrawn from the chamber, the ejector spring expands. The ejector presses on the base of the cartridge case, forcing the front of the spent case against the right side of the receiver. As the bolt continues to the rear, the action of the ejector pushing against the base of the cartridge and the extractor gripping the right side of the case causes the cartridge case to spin from the gun as the case reaches the ejection port (figure 49). The empty link is forced out of the link ejection port as the rearward movement of the bolt causes the next round to be positioned in the feedtray groove.

h. COCKING

(1) As the expanding gases force the gas piston to the rear, the operating rod is initially moved independently of the bolt. The yoke of the operating rod acts against the rear firing pin spool, withdrawing the firing pin from the primer of the spent cartridge case. The action of the operating rod yoke continuing to the rear against the rear firing pin spool, fully compresses the firing pin spring (figure 47).

(2) As long as the trigger is held to the rear, the weapon will continue to complete the first seven steps of functioning automatically. When the trigger is released and the sear again engages the sear notch, the cycle of functioning is stopped and the weapon is cocked (figure 42).

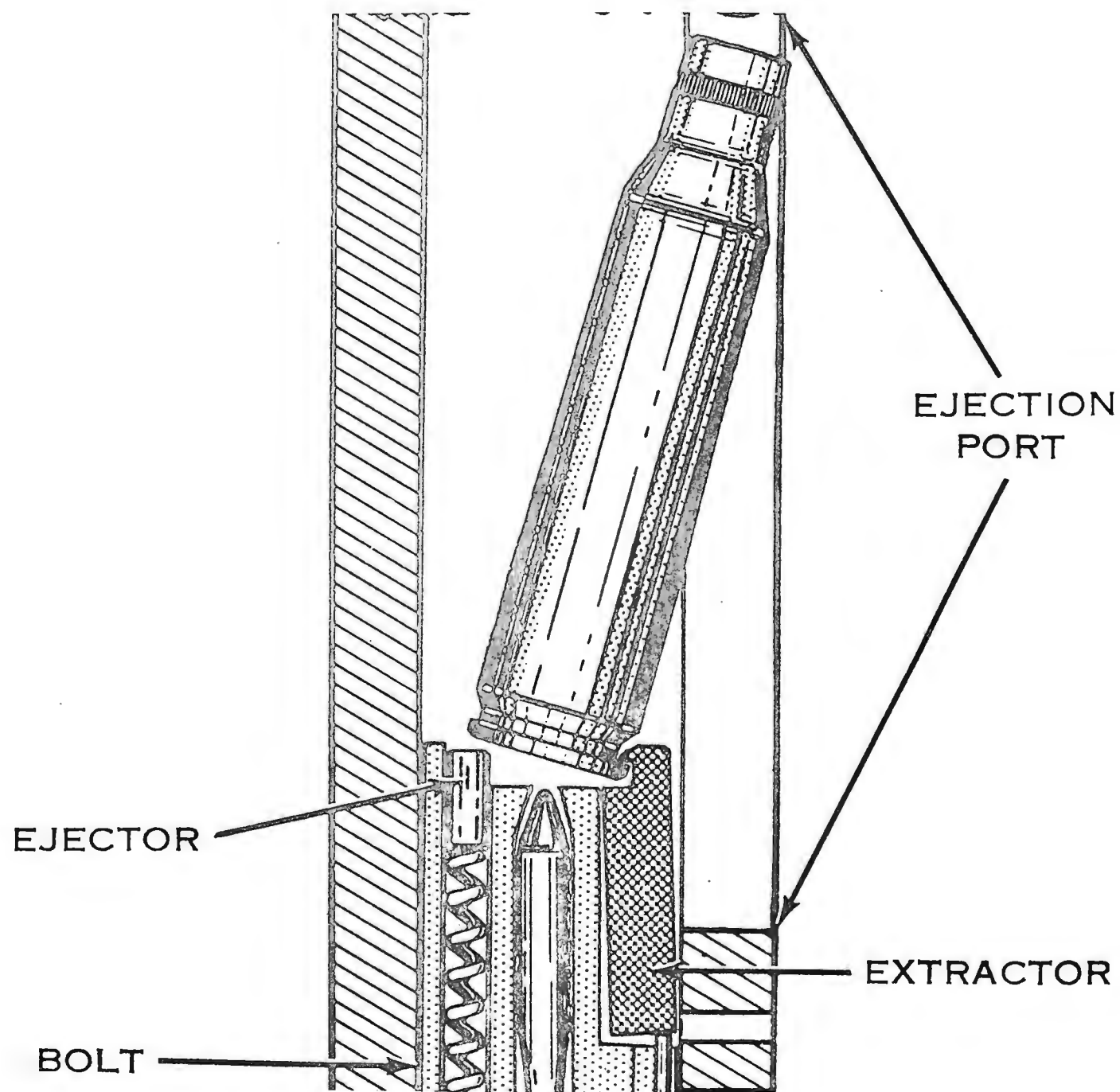


FIGURE 49 EXTRACTION AND EJECTION

1. The M60 machinegun is _____, _____, _____, and _____ in the open bolt position.
2. When unloading the M60, the cover will be raised and any _____ or _____ will be removed from the _____.
3. After firing, the machinegun is clear when the _____, _____, _____, and _____ are checked to insure they are clear of _____; and the _____ is placed on the _____ position, the _____ is _____ and the _____ is placed on the _____ position.
4. The machinegun is clear during mechanical training with the _____, _____ on the _____ and the _____.
5. The eight steps in functioning are -
 1. _____ 2. _____ 3. _____
 4. _____ 5. _____ 6. _____
 7. _____ 8. _____
6. When the trigger is held to the rear, the rear of the sear is _____ and _____ from the sear notch.
7. The operating rod and bolt are driven forward by the expansion of the _____.
8. As the bolt begins its forward movement the _____ is forced to the right.
9. The feed pawl moves to the _____, placing a round in the _____.

10. The upper _____ engages the rim of the cartridge during chambering.
11. The _____ causes the nose of the cartridge to be cammed downward into the chamber.
12. The bolt turns one-quarter turn _____ in locking and locks into the _____.
13. The _____ protrudes through the aperture in the face of the bolt during firing.
14. Unlocking ends as the bolt clears the end of the _____.
15. The rapidly expanding gases enter the hollow _____ and force it to the rear.
16. The _____ pulls the cartridge case from the chamber.
17. The action of the operating rod yoke against the _____ fully compresses the firing pin spring.
18. _____ is the final stage of functioning.

NOTES

CHAPTER 4

MALFUNCTIONS, STOPPAGES, IMMEDIATE ACTION, MAINTENANCE, AND DESTRUCTION

Section I. MALFUNCTIONS, STOPPAGES AND IMMEDIATE ACTION

46. MALFUNCTIONS:

A malfunction is a failure of the gun to function satisfactorily. Defective ammunition or improper operation of the gun by a crew member is not considered a malfunction of the gun. Two of the most common malfunctions of the M60 machinegun are sluggish operation and runaway gun.

a. Sluggish operation and corrective action - Sluggish operation of the gun usually is due to excessive friction caused by dirt or carbon, lack of proper lubrication, burred parts, or excessive loss of gas. Clean and lubricate the gun, inspect it thoroughly for burred parts and replace parts as necessary. Excessive loss of gas usually is due to a loose or missing gas port plug.

b. Runaway gun and corrective action - A runaway gun is a gun that continues to fire after the trigger is released. It may be caused by a worn sear, worn sear notch, or short recoil (the operating group recoils sufficiently to feed and fire but not sufficiently for the sear to engage the sear notch) caused by loss of gas or excessive carbon build-up in the operating rod tube.

(1) HOLD THE FIRE ON THE TARGET UNTIL FEEDING IS STOPPED OR THE AMMUNITION IS EXPENDED. The best method of stopping the gun depends on many factors such as the amount of ammunition remaining in the belt, how the gun is mounted, and whether an assistant gunner is present. For example: In assault firing with the bandoleer attached to the gun, the gunner continues to move forward keeping the gun on the target until the ammunition is expended. In other types of firing the primary consideration is keeping the gun on target; however, the gunner may be able to stop the gun by -

- (a) Raising the cover, thus stopping the feeding action.
- (b) Twisting or breaking the belt to stop the feeding.
- (c) Grasping the cocking handle firmly and pulling it to the rear to stop the bolt from going forward.

(2) When the gun has ceased firing, disassemble it and check the sear and sear notch for excessive wear. Check the gas system to insure that the gas port plug, gas cylinder extension, and gas cylinder nut are tight. Clean the operating rod tube, and replace parts as necessary.

47. STOPPAGES:

A stoppage is any interruption in the cycle of functioning caused by faulty action of the gun or faulty ammunition. Stoppages are classified by their relationship to the cycle of functioning.

48. IMMEDIATE ACTION:

Immediate action is the action taken to reduce the stoppage without investigating the cause. This action must be accomplished within 10 seconds (to include waiting time) when the barrel is hot enough to cause a cookoff. One hundred and fifty rounds fired in a 2-minute period may heat the barrel sufficiently to cause a cookoff.

a. If a stoppage occurs, WAIT FIVE SECONDS. The bolt must remain forward for the five seconds due to the possibility of a hangfire.

b. After the five-second wait, raise the cover and remove the ammunition belt and links from the feedtray.

c. Pull the cocking handle to the rear, making sure that the sear engages the sear notch in the operating rod; close the cover immediately (do not check the chamber) and return the cocking handle to its forward position.

d. During the retraction of the bolt, observe if the round is extracted and ejected.

(1) If the round is NOT extracted - Pull the trigger, attempting to fire the round. If the round does not fire and the barrel is hot, wait at least five minutes with the bolt in the forward position to preclude damage or injury in the event of a cookoff. After the five minute wait, remove the round by using a cleaning rod inserted from the muzzle of the weapon.

(2) If a round IS extracted - or when a round is removed from the chamber - Inspect the weapon and the ammunition to determine the cause of the stoppage.

e. After clearing the weapon, reload, relay on the target, and attempt to fire.

Section II MAINTENANCE AND DESTRUCTION

49. GENERAL:

Maintenance of the M60 machinegun includes inspection, cleaning and replacement of parts. A complete operator's and organizational maintenance guide is found in TM 9-1005-224-12, TM 9-1005-224-20P, and TO 9-1005-224-10.

50. INSPECTION:

Inspection begins with the weapon disassembled into its six major groups.

a. Stock:

- (1) Must not be cracked and it should fit securely on the receiver.
- (2) Guide rails should not be cracked, bent, or burred.
- (3) The hinged shoulder rest and stock latch should function correctly.
- (4) The rubber covering on the stock and all other parts of the gun should be checked for signs of cleaning with unauthorized solvents. If these parts are cleaned with unauthorized solvents, the rubber will soften and become unserviceable.

b. Buffer group:

- (1) The buffer yoke and yoke recess should not be burred, cracked or bent.
- (2) The buffer plunger must fit easily into the recess in the drive spring guide.
- (3) Check the buffer for evidence of leaking hydraulic fluid.

c. Operating group:

- (1) The sear notch should not show signs of excessive wear.
- (2) The yoke roller, bolt plug, bolt plug pin, firing pin, and cam roller assembly should be checked for serviceability.
- (3) The firing pin should be checked for wear on the tip (should be well rounded).
- (4) The operating rod, drive spring, and the firing pin spring must not be bent, broken, or have any sharp edges.

(5) The ejector and extractor should be checked to see that they are under spring pressure and not chipped or worn.

d. Trigger housing group:

(1) The sear should not show signs of excessive wear.

(2) A check should be made for cracks near the trigger housing pin.

(3) Insure that the leaf spring is properly bent.

(4) The safety should function properly.

(a) The sear should not move when the trigger is pulled with the safety on SAFE position.

(b) The sear should move when the trigger is pulled with the safety on the FIRE position.

e. Barrel group:

(1) The flash suppressor should be tight and the front sight, and the barrel locking cams should not be bent, cracked, or burred.

(2) The bipod assembly should be checked visually to insure that it functions properly.

(3) The gas cylinder bleed hole should be clear of obstructions.

(4) The gas cylinder assembly will be disassembled only when the gas piston will not move back and forth under its own weight, and the gas cylinder interior should be free of lubricant and not burred or shows signs of the use of abrasives when inspected.

f. Receiver group:

(1) The forearm assembly, cover, feedtray, cocking handle, and receiver housing should not be cracked or bent.

(2) The feed cam and lever, feedtray rollers, belt holding pawl, and barrel lock lever should all function smoothly.

(3) The range plate must be legible. The range plate screw should not be worn or burred to the extent that it cannot be readily loosened and tightened.

g. Mount:

(1) The traversing and elevating mechanism handwheels should not bind and an audible click should be heard for each mil of adjustment made. The numbers on the scales should be legible and easily read.

(2) The pintle should fit snugly, and the pintle lock should hold the pintle securely in the pintle bushing.

(3) The sleeve latch should function properly, and the traversing bar should be tight.

h. Spare barrel case: (figure 50)

(1) The maintenance equipment should be checked for completeness and serviceability (to include bottle of LSA).

(2) The case should not show signs of excessive washing. Frequent washing of the case destroys its waterproofing and causes the canvas to deteriorate.

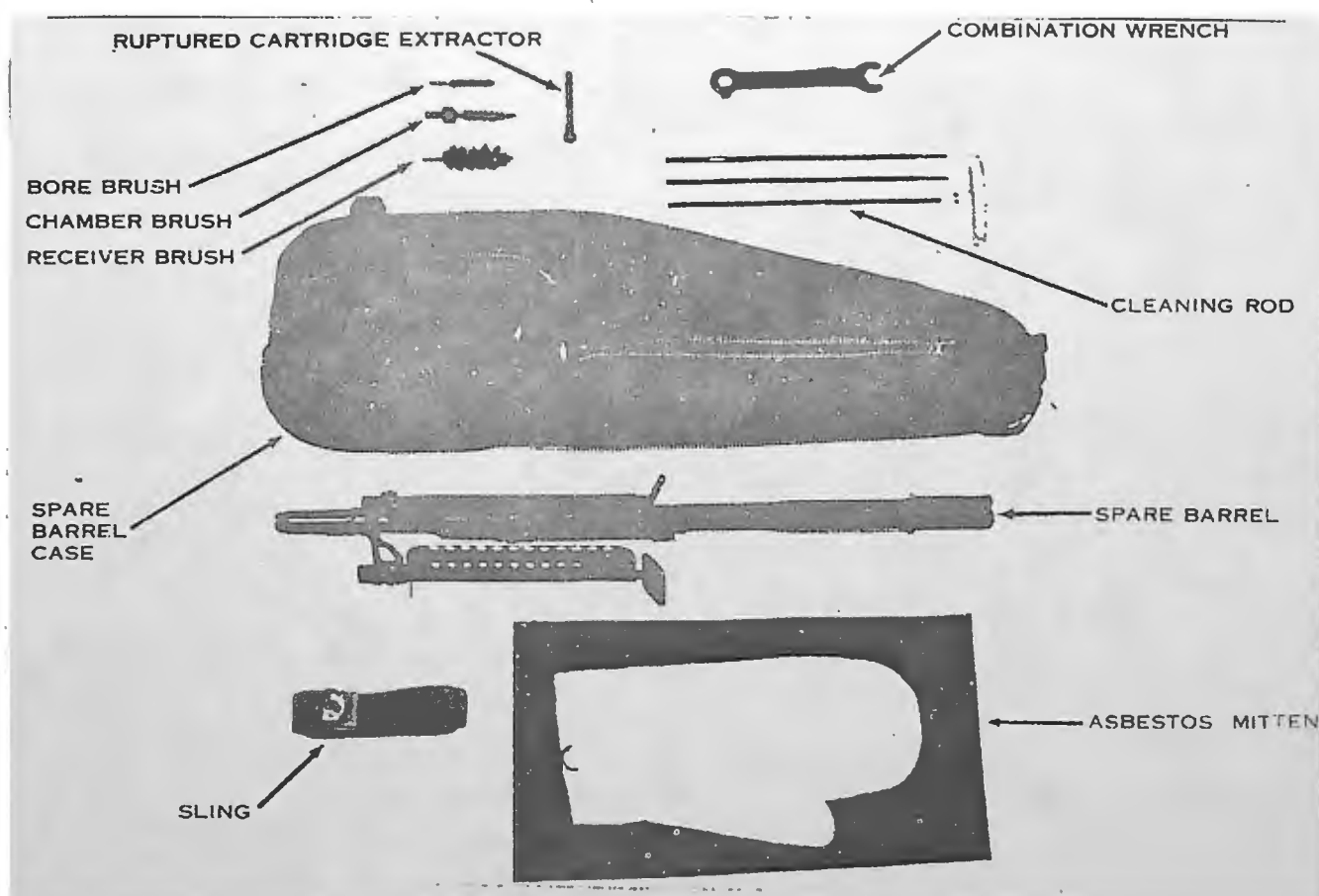


FIGURE 50 SPARE BARREL CASE

51. CLEANING AND LUBRICATING:

a. Cleaning:

(1) Immediately after firing and on two consecutive days thereafter, thoroughly clean the bore, and the parts that become powder fouled with bore cleaner (cleaning compound, solvent; CR), and do not wipe dry. On the third day after firing, clean with bore cleaner, wipe dry, and lightly coat with oil.

(2) Weekly thereafter when the gun is not being fired, clean the bore and chamber with bore cleaner, wipe dry, and oil.

(3) The rest of the gun should be cleaned with dry cleaning solvent immediately after firing and weekly thereafter. Wipe dry and oil.

(4) Do not clean the inside of the gas system unless blank ammunition has been used, the piston will not move back and forth under its own weight, or the gun fires sluggishly after all other reasons for sluggishness have been checked.

(5) The buffer is never submerged in cleaning compounds or solvents. WIPE WITH AN OILY RAG ONLY TO CLEAN.

b. Lubricating:

(1) LSA (weapons oil medium) on all the below critical areas regardless of climatic conditions.

(a) Bolt locking lug camming surface in the barrel socket.

(b) Operating rod assembly roller and surfaces immediately below the yoke which ride within the receiver rails.

(c) Feed cam assembly groove (where the bolt cam roller rides).

(d) Where the feed pawl carrier assembly mates with the frame.

(e) On the bolt locking lugs, bolt cam roller, and in the camming recess of the bolt for the operating rod.

(f) On the receiver rails.

(2) General purpose lubricating oil - On all non-critical surfaces under the below climatic conditions.

(a) Usual conditions

(b) Hot, humid, and salty climates.

(3) Weapons lubricating oil (LAW) - On all non-critical surfaces when the temperature is consistently below 0 degrees F.

(4) No lubrication - On non-critical surfaces in sandy or dusty climates to prevent sand adhering to and damaging the gun; and no lubricant will be used on the gas piston or the gas cylinder interior except for long term storage.

NOTE: LSA will always be used on critical areas regardless of the climatic conditions.

52. ACTIONS BEFORE AND DURING FIRING:

a. Before firing:

- (1) Wipe the bore and chamber dry.
- (2) Lubricate the critical areas with LSA.
- (3) Inspect the weapon.
- (4) Follow same procedures with the spare barrel.
- (5) Insure the weapon is lubricated IAW climatic conditions.

b. During firing:

- (1) Change the barrel as prescribed in GENERAL DATA "Rates of Fire". Barrel changing will prolong the barrel life and equalize barrel wear.
- (2) Periodically inspect the weapon to insure it is properly lubricated.
- (3) When malfunctions and stoppages occur, follow procedures as outlined in paragraphs 46 thru 48.

53. DESTRUCTION OF MATERIAL:

a. Destruction of the machinegun and mount will be undertaken only when subject to capture or abandonment.

b. Methods of destruction are --

(1) Mechanical means - Disassemble as completely as time permits; and using the barrel or some other heavy equipment, smash the cover, feedtray, receiver group, operating group, buffer, stock, and gas cylinder.

(2) Burning - To destroy the weapon by burning, use a thermite grenade placed on the receiver over the bolt (cover resting on the grenade) and fire the grenade.

(3) Disposal - Bury the disassembled weapon in suitable holes or dump parts into streams, mud, snow, sumps or latrines.

(4) Destruction of mount - Smash the traversing and elevating mechanism, and the platform group. Bend the tripod legs.

REVIEW QUESTIONS

1. Two of the most common malfunctions of the M60 are _____
_____ and _____.
2. A runaway gun may be caused by a _____,
_____, or _____.
3. A stoppage is caused by _____ action of the _____ or
_____.
4. Inspection begins with the weapon _____ into its _____
_____.
5. The gas piston and interior of the gas cylinder should be free of
_____ and not show signs of the use of _____.
6. Clean the M60 immediately after firing and _____ consecutive
days thereafter.
7. Never submerge the _____ in cleaning compounds or solvents.
8. The critical areas of the M60 will be lubricated with _____
regardless of _____.
9. Destruction of the machinegun and mount will be undertaken only
when subject to _____ or _____.
10. There are _____ methods of destruction for the M60 and mount.

NOTES

CHAPTER 5

CREW TRAINING

Section I. INTRODUCTION

54. GENERAL:

a. Crew training not only gives crew members training in the rudiments of machinegun operation, but gives them confidence in their ability to put the machinegun into action with precision and speed. Rotation of duties during training insures that every member becomes well trained in the duties of each crew position. Precision is obtained by strict adherence to the specific procedures such as inspection before firing, the manner of handling the gun during training, and following the prescribed safety procedures. Speed is integrated into the training after precision has been developed. Precision is never sacrificed for speed.

b. It should be emphasized that the organization for crew training as discussed in this chapter is designed as a means of training the crew members in the rudiments of machinegun operation and not as the organization that must be employed in every situation.

c. Crew training as discussed here involves the weapons crew leader and the crew of one machinegun: gunner, assistant gunner and ammunition bearer. The crew may consist of only a gunner and assistant gunner; in which case the assistant gunner carries both the spare barrel case and the tripod and performs the duties listed for the ammunition bearer in addition to his own.

d. All commands are given by the crew leader. The gunner and the assistant gunner repeat all commands. After the gun is mounted, the assistant gunner transmits all signals from the crew leader to the gunner and from the gunner to the crew leader.

55. CREW EQUIPMENT:

In addition to individual arms and equipment, crew members carry equipment for both bipod and tripod training. The following is a suggested division of the equipment among the crew members and may be changed as the situation dictates.

Crew Leader - - - - - Binoculars and compass

Gunner - - - - - Machinegun, three bandoleers (dummy ammunition)

Assistant gunner - - - - Spare barrel case with components and three bandoleers (dummy ammunition)

Ammunition bearer - - - - M122 tripod mount, three bandoleers (dummy ammunition)

56. FORMING FOR CREW TRAINING (BIPOD OR TRIPOD MOUNTED):

The crew leader commands FORM FOR CREW TRAINING. The crew forms in column, with five steps between men in the following order: gunner, assistant gunner, and ammunition bearer; the gunner is five steps from and facing the crew leader. When the crew members reach their correct position, they assume the prone position and are ready for crew training.



FIGURE 51 CREW IN PRONE POSITION FORMED FOR CREW DRILL

57. ROTATION OF DUTIES DURING CREW TRAINING:

a.. Duties are rotated during crew training to insure that each member learns all duties within the crew.

b. The command to rotate all personnel is FALL OUT LEADER, or FALL OUT GUNNER.

(1) Fall out leader:

Each member of the crew rises, moves forward, and assumes a new duty. The crew leader becomes the ammunition bearer. The gunner moves forward and becomes the crew leader, the assistant gunner becomes the gunner, and the ammunition bearer becomes the assistant gunner.

(2) Fall out gunner:

If it is not desired to change the crew leader, the command fall out gunner is given. At this command, crew members rise, the gunner becomes the ammunition bearer, the assistant gunner becomes the gunner, and the ammunition bearer becomes the assistant gunner.

c. When the crew members have assumed their new positions, they call out their new duties in order, AMMUNITION BEARER, ASSISTANT GUNNER, GUNNER.

Section II CREW TRAINING - BIPOD MOUNTED GUN

58. INSPECTION OF EQUIPMENT BEFORE FIRING:

A thorough inspection of equipment is made at the beginning of each exercise. After the crew is formed for crew training, the leader commands INSPECT EQUIPMENT BEFORE FIRING, BIPOD. At this command, each crew member inspects his equipment as explained in paragraphs 59 thru 61.

59. INSPECTION BY GUNNER:

a. The gunner inspects his ammunition first. He insures that the ammunition is properly linked, free of dirt and corrosion, and the double link is up, ready for loading. After he inspects the ammunition he inserts the cardboard flaps in the bandoleer and places the cloth slings over his shoulder (except the last bandoleer which he prepares for loading).

b. He then inspects the gun. To do this he -

(1) Grasps the forearm with the left hand, reaches over with the right hand, pulls to the rear on the right bipod leg, and lowers it. He then reaches under the right leg, lowers the left bipod leg (figure 52), and rests the gun on the bipod.

(2) Attaches the bandoleer to the gun.

(3) Places the safety on FIRE, pulls the cocking handle to the rearward position, raises the cover and feedtray, and checks the chamber to insure it is clear (figure 53).

(4) Calls for the cleaning rod and combination wrench and receives them from the assistant gunner.

(5) Crawls forward and runs the cleaning rod through the bore of the barrel to insure it is clear. While in this position, he visually checks the bleeder hole of the gas cylinder to insure it is clear (figure 54).



FIGURE 52 GUNNER LOWERING BIPOD LEGS

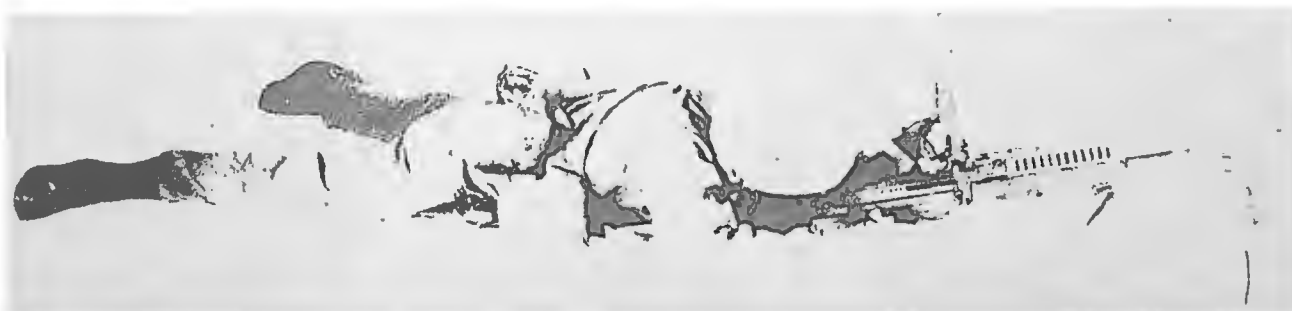


FIGURE 53 GUNNER CHECKING CHAMBER



FIGURE 54 GUNNER INSPECTING BARREL AND BLEEDER HOLE

- (6) Checks the flash suppressor for cracks.
 - (7) Checks the front sight for tightness and for damage to the blade.
 - (8) Checks the gas cylinder extension, gas port plug, and gas cylinder nut for tightness with the combination wrench.
 - (9) Checks the carrying handle to insure it can be positioned so it will not interfere during aiming and firing.
 - (10) Insures the barrel lock lever is down and the barrel is securely locked to the receiver.
 - (11) Returns the cleaning rod and combination wrench to the assistant gunner.
 - (12) Moves to the rear of the gun and checks the moving parts in the cover. To do this he -
 - (a) Insures that the feed cam is clean and properly lubricated.
 - (b) Pushes back and forth on the feed cam to check for free functioning.
 - (c) Pushes on the feed pawl to insure it has spring tension.
 - (d) Pushes on the cartridge guides to insure they have spring tension.
 - (13) Checks the feedtray to insure that the bandoleer is fully seated. He pushes the belt holding pawl to insure it has spring tension.
 - (14) Lowers and latches the cover (without inserting the belt).
 - (15) Pulls the trigger to check the functioning of the safety.
 - (16) Places the safety on FIRE and pulls the trigger to allow the bolt to go forward.
 - (17) Checks the rear sight, sets it at 500 meters and zero windage, and lowers it.
 - (18) Checks the hinged shoulder rest for proper operation and leaves it in the down position.
- c. This completes the gunner's inspection of equipment; he resumes his position parallel to the gun, head on line with the feedtray.

60. INSPECTION BY ASSISTANT GUNNER:

a. Remaining in the prone position, the assistant gunner begins by inspecting the ammunition as explained in paragraph 59a.

b. He takes the cleaning rod, magazine, and combination wrench from the spare barrel case and assembles the cleaning rod.

c. He then removes the traversing and elevating mechanism from the spare barrel case, and —

(1) Rotates the elevating handwheel to the zero reading on the upper screw plate and the handwheel indicator.

(2) Rotates the elevating mechanism sleeve, exposing approximately $1\frac{1}{2}$ inches of threads below the handwheel.

(3) Rotates the traversing handwheel until an equal number of threads are exposed on each side of the traversing mechanism

(4) Checks the adapter pin of the adapter assembly to insure it functions and that it has spring tension.

(5) Replaces the traversing and elevating mechanism and removes the spare barrel from the spare barrel case.

d. To inspect the spare barrel, he —

(1) Checks the barrel and the bleeder hole of the gas cylinder extension to insure they are clear.

(2) Checks the flash suppressor for cracks and any vertical or horizontal movement.

(3) Checks the front sight for tightness and for damage to the blade.

(4) Checks the bipod assembly for proper operation.

(5) Checks the gas cylinder extension, gas port plug, and gas cylinder nut for tightness using the combination wrench.

(6) Insures the barrel socket is clean.

e. The assistant gunner's inspection is completed when he returns the spare barrel to its case, closes the case, disassembles the cleaning rod and returns it and the combination wrench to the accessory pocket, and checks the ruptured cartridge extractor, bore brush, chamber brush, receiver brush, and asbestos mitten for serviceability (figure 50).

61. INSPECTION BY AMMUNITION BEARER:

a. Remaining in the prone position, the ammunition bearer inspects his ammunition as explained in paragraph 56a.

b. He then inspects the tripod by --

(1) Insuring the legs are folded closely together.

(2) Checking the sleeve latch to insure it has spring tension and will function.

(3) Checking the pintle lock lever to insure it is locking in the pintle bushing and the pintle rotates freely in the bushing.

(4) Checking the front mounting lug to insure it is free of dirt and is pointing forward.

(5) Lowering the platform lock.

(6) Depressing the platform latch, insuring that it is free of dirt and has spring tension.

c. This completes the ammunition bearer's inspection of equipment.

62. REPORTING COMPLETION OF INSPECTION OF EQUIPMENT:

On completion of the inspection of equipment, each member will report as follows.

a. Ammunition bearer: Reports AMMUNITION BEARER CORRECT, or he will report deficiencies.

b. Assistant gunner: Reports AMMUNITION BEARER AND ASSISTANT GUNNER CORRECT, or he will report deficiencies.

c. Gunner: Reports ALL CORRECT, or he will report deficiencies.

d. Discrepancies that cannot be corrected during the inspection are reported.

63. PLACING THE GUN IN ACTION:

To place the gun in action, the leader commands and signals GUN TO BE MOUNTED HERE (pointing to the position where the gun is to be mounted), FRONT (pointing in the direction of fire), ACTION (vigorously pumping fist in the direction of the designated gun position).

a. At the command ACTION, the gunner rises to his feet, grasps the carrying handle with his left hand, the top of the stock with his right hand, raises the gun to the carrying position, muzzle to the front, and moves to the gun position (figure 55).

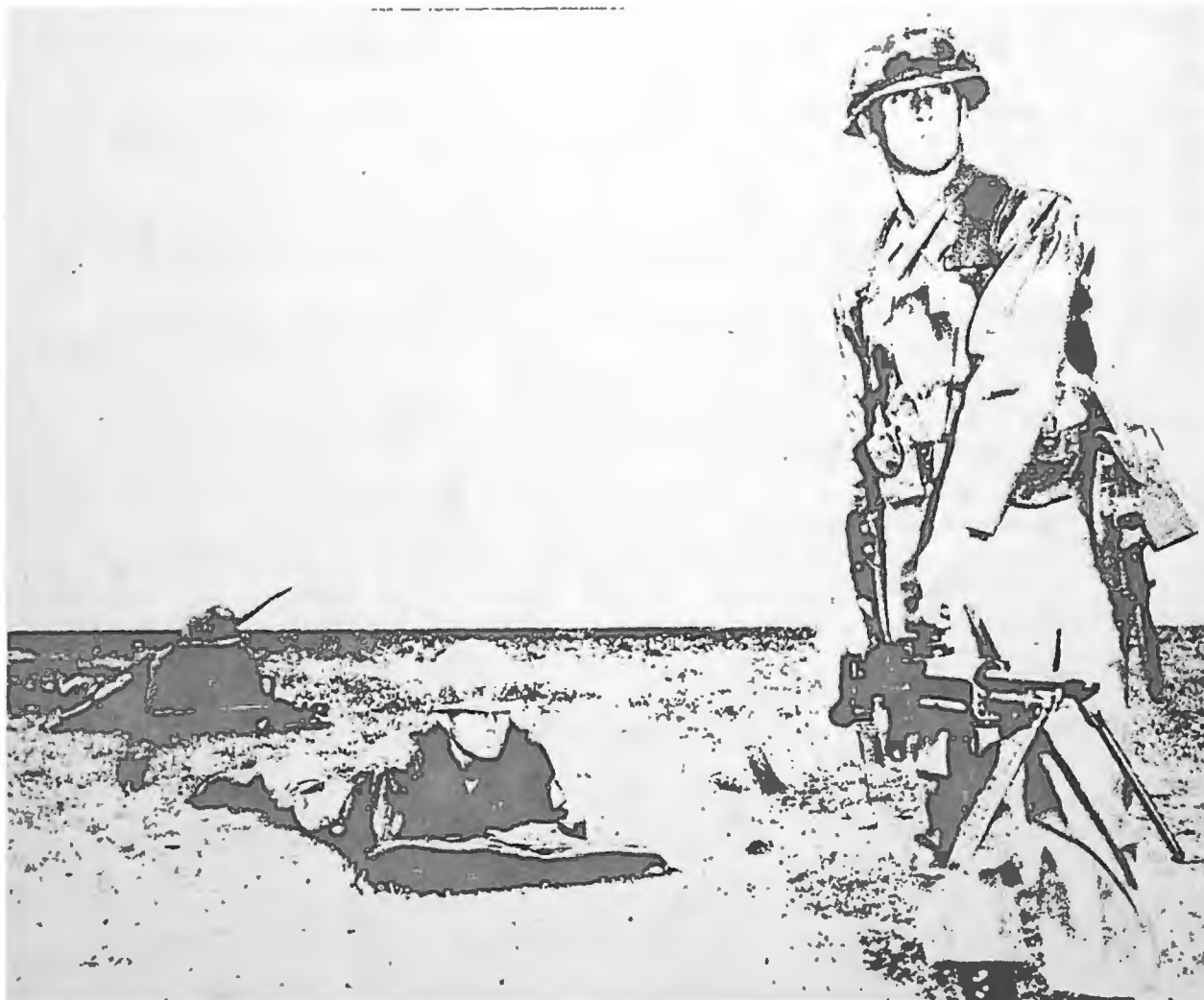


FIGURE 55 GUNNER MOVES TO THE GUN POSITION

b. On arrival at the gun position, the gunner places the gun on the ground. He then assumes a prone position to the rear of the gun. He positions the carrying handle so it will not interfere during aiming and firing. He aligns the gun in the direction of fire and raises the rear sight (figure 56). He raises the cover, places the first round of ammunition in the feedtray groove, and lowers the cover (insuring that the round does not slide out of the feedtray groove). He raises the hinged shoulder rest and places it on his shoulder, assuming a proper firing position (figure 57).

c. The assistant gunner times himself to arrive at the gun position as the gunner is assuming the prone position. He assumes a prone position on his left hip, feet to the rear, on the left side of the gun.

d. The assistant gunner places the spare barrel case parallel to the gun with the zippered side toward the gun. He opens the spare barrel case and removes the spare barrel. He extends the bipod legs and places the spare barrel on the case, muzzle to the front and even with the muzzle of the gun.



FIGURE 56 GUNNER PREPARES GUN FOR FIRING

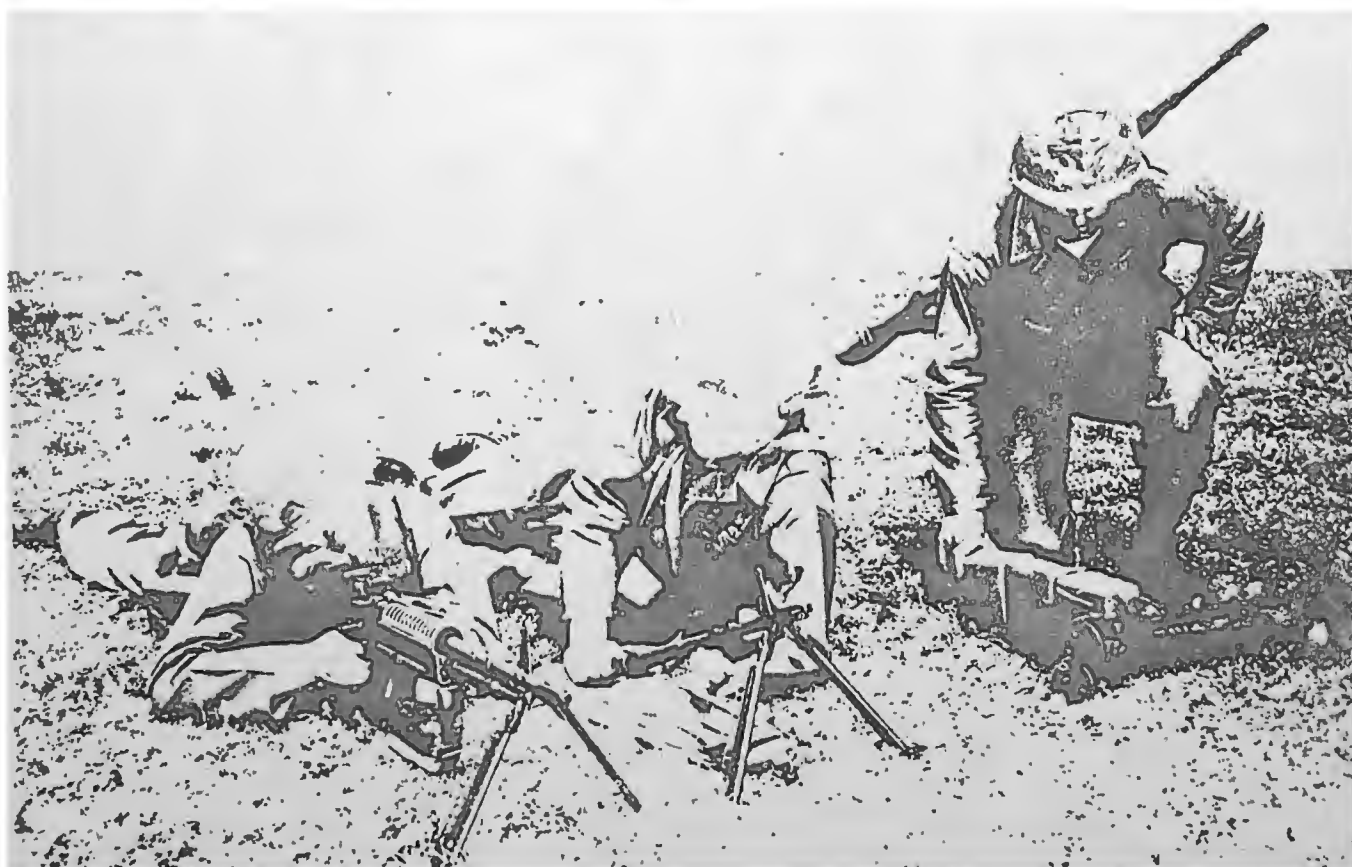


FIGURE 57 GUNNER ASSUMES FIRING POSITION

e. The ammunition bearer times himself to arrive at the gun position as the assistant gunner is assuming the prone position. He places the tripod one step to the left of the muzzle of the gun and on line with it, the head of the tripod away from the gun. He unslings his bandoleers and places them next to the tripod legs. He then assumes a prone position approximately ten meters to the left and on line with the gun position and prepares to deliver fire into the target area with his individual weapon (figure 58).



FIGURE 58 AMMUNITION BEARER IN POSITION

f. If the bipod legs must be adjusted, the assistant gunner crawls forward and supports the muzzle of the gun by grasping the bipod yoke with the asbestos mitten protected left hand. He then adjusts the height of the bipod legs with his right hand.

g. When ready to fire, the gunner places the safety on FIRE, reports UP, and the assistant gunner reports or signals READY to the leader (figure 59).



FIGURE 59 READY TO FIRE

64. CHANGING THE BARRREL:

To insure proficiency and speed in changing barrels, this is included in crew training using the following procedures.

a. When the gunner has reported UP and the assistant gunner has signaled READY, the leader commands CHANGE BARRELS.

b. The gunner places the stock on the ground and the safety on SAFE. He then raises the barrel lock lever with his right hand. He moves his right hand to the rear and places it on the top of the stock. He places his left hand under the rear of the forearm assembly and raises the muzzle of the gun by applying pressure down on the stock with his right hand and raising the muzzle with his left hand (figure 60).

c. The assistant gunner (wearing the asbestos mitten) grasps the barrel by the gas system, removes it from the gun, and places it down with the barrel socket on the spare barrel case. He grasps the replacement barrel by the gas system and inserts the barrel into the forearm assembly (figure 60).



FIGURE 60 CORRECT POSITION FOR BARREL CHANGE

d. The gunner lowers the barrel lock lever, moves the safety to the fire position, assumes his correct firing position, and reports UP. The assistant gunner signals READY to the leader (figure 59).

65. TAKING THE GUN OUT OF ACTION:

To take the gun out of action the leader commands and signals OUT OF ACTION. The gunner and assistant gunner repeat the command.

a. At the command OUT OF ACTION, the ammunition bearer (slinging his individual weapon on the move) moves to the gun position, picks up and slings the bandoleers that he previously left there, secures the tripod and returns to his original position approximately 15 steps to the rear of the gun position. He then assumes the prone position with the tripod in front of him, tripod head to the left.

b. The assistant gunner raises the bipod legs of the spare barrel and replaces it in the case. Before rising, he insures that the spare barrel case is closed sufficiently to retain the spare barrel and the traversing and elevating mechanism. He then returns to his original position approximately 10 steps to the rear of the gun position and assumes the prone position. At this time he fully closes the spare barrel case if he was unable to do so previously at the gun position.

c. The gunner places the stock on the ground, insures the bolt is to the rear, places the safety on SAFE, raises the cover, removes the ammunition from the feedtray, replaces it in the bandoleer, examines the chamber to insure it is clear, closes the cover, places the safety on FIRE, pulls the trigger and places the safety on SAFE. He then lowers the shoulder rest with his right hand and the rear sight with his left hand, grasps the carrying handle with his left hand and the stock with his right hand, rises, pivots to his right leg (keeping the gun pointing toward the target), raises the gun to his left hip and moves to his original position. On reaching his original position, he visually checks to insure the ammunition bearer and the assistant gunner are in their original positions, assumes the prone position with the gun on his right, folds the bipod legs alongside the barrel, and reports UP to the leader.

Section III CREW TRAINING - TRIPOD MOUNTED

66. INSPECTION OF EQUIPMENT BEFORE FIRING:

The inspection of equipment for tripod mounted training is the same as for bipod, with the following exceptions.

a. The leaders command to initiate inspection of equipment is INSPECT EQUIPMENT BEFORE FIRING, TRIPOD.

b. The gunner returns the bipod legs to their position alongside the barrel after inspecting them.

67. PLACING THE GUN INTO ACTION:

The leader commands and signals GUN TO BE MOUNTED HERE, FRONT, ACTION in the same manner as for the bipod training (paragraph 63).

a. At the command ACTION -

(1) The ammunition bearer - rises to his feet, grasps the tripod in his right hand, and moves forward to the gun position, moving to the left of the gunner. On arrival at the gun position, he kneels on his right knee and rests the shoes of the rear tripod legs on the ground with the mount in a vertical position. Steadying the mount with the right hand near the tripod head, he raises the front leg with the left hand. He grasps the right shoe with his right hand, the left shoe with his left hand, and raises the tripod chest high. He separates the tripod legs with a quick jerk (fig 61). Insuring that the sleeve latch engages the sleeve, he places the tripod on the ground with the front leg pointing in the direction of fire. He rises to his feet and stamps the rear shoes into the ground. He then unslings his bandoleers and places them on line with the front leg of the tripod, one step to the left of the tripod. He moves approximately 10 meters to the left of the gun position, unslings his individual weapon, assumes a prone position, and prepares to deliver fire into the target area.



FIGURE 61 OPENING THE TRIPOD

(2) The assistant gunner times himself to arrive at the gun position as the ammunition bearer clears it. He places the spare barrel case (zippered side toward the gun) so it will be parallel to and on line with the muzzle of the gun when the gun is mounted. He assumes the prone position on his left hip, with his hip at the left tripod shoe. He unzips the spare barrel case and takes out

the spare barrel and the traversing and elevating mechanism. He places the spare barrel on the case with the sight toward the gun.

(3) The gunner - times himself to arrive at the gun position as the assistant gunner assumes the prone position. He rises to his feet, grasps the carrying handle in his left hand, the stock in his right hand, raises the gun to the carrying position (muzzle to the front), and moves forward to the gun position. Upon arrival at the gun position, he engages the front locating pin (in the forearm assembly) with the front mounting lug of the gun platform. He lowers the rear of the gun until the rear locating pin engages the platform latch (figure 62). Then he positions the carrying handle so it will not interfere during aiming and firing, raises the rear sight, and assumes the prone position.

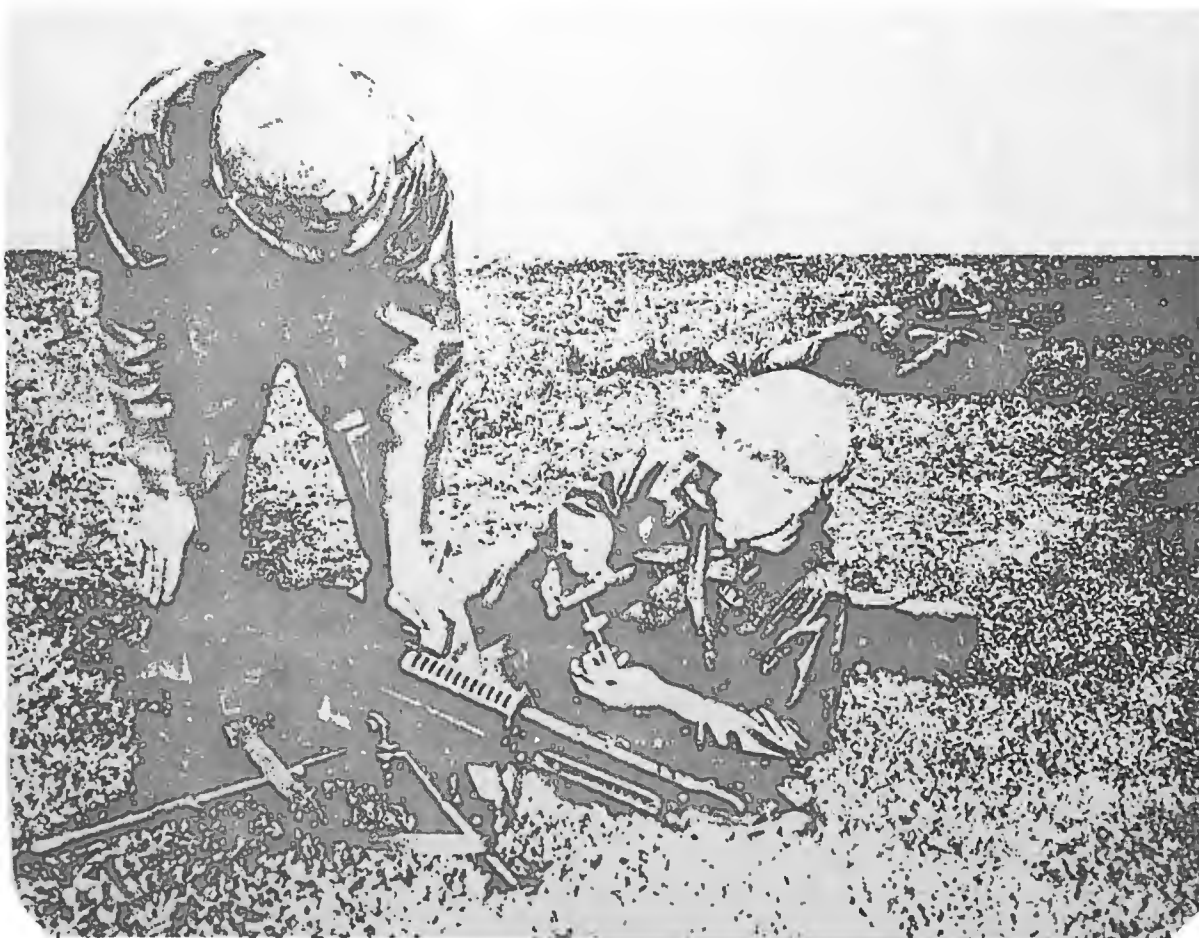


FIGURE 62 MOUNTING THE GUN

(4) The gunner - moves his head to the right, raises the platform lock, and swings the rear of the gun up and to his left.

(5) The assistant gunner - hands the gunner the traversing and elevating mechanism and steadies the rear of the gun .

(6) The gunner - then positions and locks the traversing and elevating mechanism on the gun, the slide on the traversing bar (figure 63), and raises the cover.

(7) The assistant gunner - places the first round of ammunition in the feedtray groove and supports the belt while the gunner closes the cover.

(8) The gunner - assumes the correct firing position and grip, places the safety on FIRE, and reports UP.

(9) The assistant gunner - then signals or reports READY to the leader (figure 64).



FIGURE 63 ATTACHING THE TRAVERSING AND ELEVATING MECHANISM



FIGURE 64 READY TO FIRE

68. CHANGING THE BARREL:

The procedure for changing the barrel is as follows.

a. When the gunner has reported UP and the assistant gunner has signaled READY, the leader commands CHANGE BARRELS.

b. The gunner - puts the safety on SAFE and places his left hand on top of the cover. He raises the barrel lock lever with his right hand and keeps his hand at this position (figure 65).

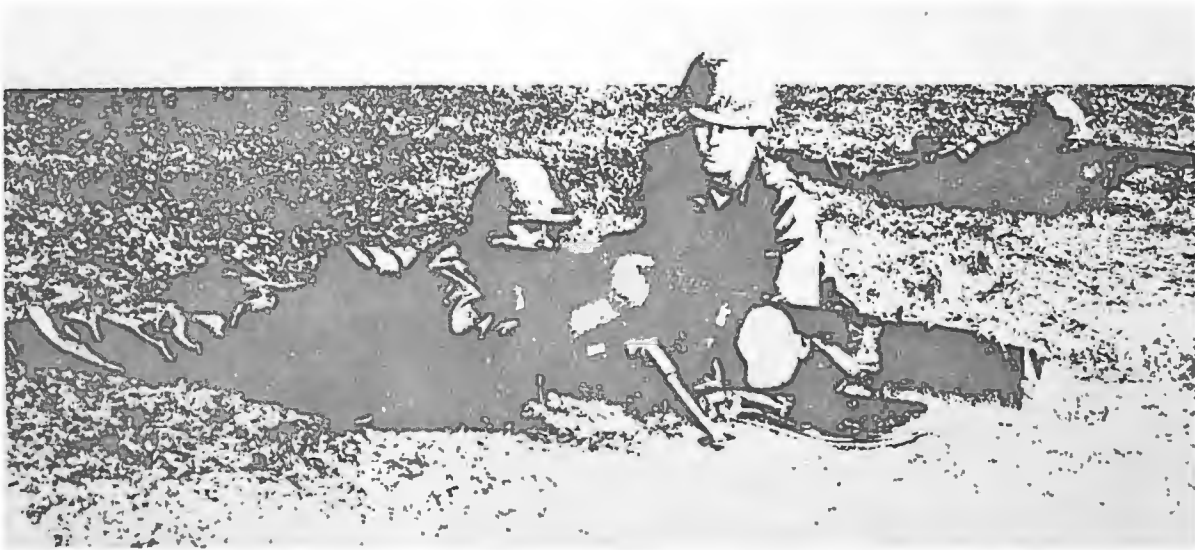


FIGURE 65 CORRECT PROCEDURE FOR BARREL CHANGE

c. The assistant gunner - grasps the bipod legs, removes the barrel from the gun, and places it on the spare barrel case. He then grasps the replacement barrel by the bipod legs and inserts it in the forearm assembly.

d. The gunner - lowers the barrel lock lever, moves the safety to FIRE, assumes the correct firing position, and reports UP. The assistant gunner signals READY to the leader.

69. TAKING THE GUN OUT OF ACTION:

At the command OUT OF ACTION -

a. The gunner - insures that the bolt is to the rear, places the safety on SAFE, and raises the cover.

b. The assistant gunner - removes the ammunition from the feedtray, returns it to the bandoleer, and closes the bandoleer.

c. The gunner - inspects the chamber to insure it is clear, closes the cover, places the safety on FIRE, pulls the trigger, and places the safety on SAFE. He raises the slide from the traversing bar, supports the gun with his left hand, moves his head to the right, and elevates the rear of the gun.

d. The assistant gunner - removes the traversing and elevating mechanism and places it in the spare barrel case. He places the spare barrel in the case and closes it sufficiently to retain the spare barrel and the traversing and elevating mechanism. He rises, moves 10 steps to the rear of the gun position and assumes the prone position, facing to the front. At this time he fully closes the spare barrel case if he was unable to do so at the gun position.

e. When the assistant gunner has removed the traversing and elevating mechanism, the gunner - moves the rear of the gun back to its normal position and places the platform lock in the down position. He rises to his feet, lowers the rear sight, and secures the carrying handle with his left hand. With his right hand, he reaches down and depresses the platform latch, raises the rear of the gun, and removes it from the tripod. Grasping the stock with his right hand, he pivots to his right as he raises the gun to the carrying position and returns to his original position (figure 66).



FIGURE 66 GUN CREW MOVING BACK TO ORIGINAL POSITIONS

f. The ammunition bearer - rises, slings his individual weapon, and approaches the gun position, timing his arrival so that when he has slung his bandoleers, the gunner and assistant gunner will be clear of the tripod. He grasps the tripod in his left hand and returns to his original position. On reaching his position, he kneels on his right knee. He places the tripod in a vertical position with the rear shoes on the ground and supports the tripod with the right hand near the head of the tripod. He reaches up with his left hand and lowers the front leg, slides his right hand down the right leg, and releases the sleeve latch. He grasps the left leg near the shoe with the left hand and closes the left leg to the right (figure 67). He lowers the tripod to the ground, head to the left, and assumes a prone position behind it. Upon completion of this action, he reports UP.



FIGURE 67 CLOSING THE TRIPOD LEGS

REVIEW QUESTIONS

1. In crew training, _____ is never sacrificed for speed.
2. There are _____ members in a crew in a normal situation.
3. The _____ and the _____ will repeat all commands.
4. In addition to individual arms and equipment, crew members will carry equipment for _____ and _____ training.
5. The distance between each member of the crew is _____ steps when forming for crew drill.
6. The assistant gunner's position is on the _____ of the gunner when placing the gun in action.
7. The spare barrel case is placed parallel to the gun with the _____ side toward the gun.
8. The _____ adjusts the bipod legs with his _____ hand.
9. The _____ places the tripod _____ step (s) to the left of the _____ of the gun.
10. The ammunition bearer is located approximately _____ to the left of the gun position when the gun is placed in action.
11. The assistant gunner wears an _____ when changing barrels, and it is always worn on the _____ hand.
12. During bipod crew drill the assistant gunner changes barrels by grasping the _____ with his _____ hand.
13. During tripod crew drill the assistant gunner changes barrels by grasping the _____ with his _____ hand.

14. On the command OUT OF ACTION (bipod crew drill), the _____
_____ is the first to move back to his original position.
15. On the command OUT OF ACTION (tripod crew drill), the _____
is the first to move back to his original position.

NOTES

CHAPTER 6

TECHNIQUE OF FIRE DURING PERIODS OF GOOD VISIBILITY

Section I. INTRODUCTION

70. GENERAL:

a. Each member of the machinegun crew must be trained in standard methods of applying fire, either as a crew or an individual, and must perform his assigned task automatically and effectively.

b. The easiest, quickest, and most effective means of delivering fire with the gun mounted on its bipod, tripod, or vehicular mount is by alining the sights of the weapon on the target and properly applying fire. This technique of fire is called **direct laying**.

c. At times, the techniques of fire other than direct laying are more appropriate and effective. When delivering fire in the assault, overhead fire, and fire from position defilade, the gunner must use the appropriate techniques described in paragraphs 93 through 105.

71. FUNDAMENTALS AND FIRING TECHNIQUES:

Before the machinegun can be employed to the best advantage using any firing technique, certain fundamentals must be understood and applied. These include characteristics of fire, classes of fire, range determination, and lateral distance measurements.

Section II. FUNDAMENTALS

72. CHARACTERISTICS OF FIRE:

a. Trajectory —

This is the path of the projectile in its flight. It is almost flat at ranges of 300 meters or less. At ranges beyond 300 meters the trajectory is curved and the curve becomes greater as the range increases (figure 68).

b. Maximum Ordinate —

This is the highest point which the trajectory reaches above an imaginary line from the muzzle of the gun to the base of the target. It always occurs at a point approximately two-thirds of the distance from the gun to the target. The maximum ordinate increases as the range increases (figure 68).

(H = MAXIMUM ORDINATE—HIGHEST POINT OF TRAJECTORY)

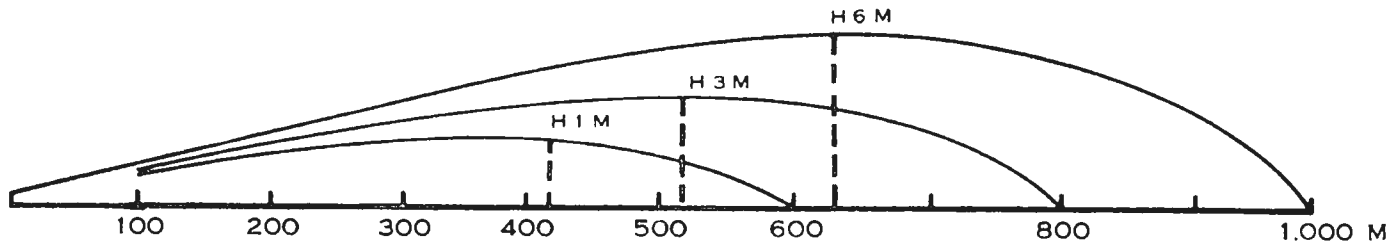


FIGURE 68 TRAJECTORY AND MAXIMUM ORDINATE

c. Cone of Fire —

When several rounds are fired in a burst from a machinegun, each projectile takes a slightly different trajectory. This is caused by vibrations of the gun and variations in ammunition and atmospheric conditions. The pattern formed by the multiple trajectories of each burst of fire is called the cone of fire (figure 69).

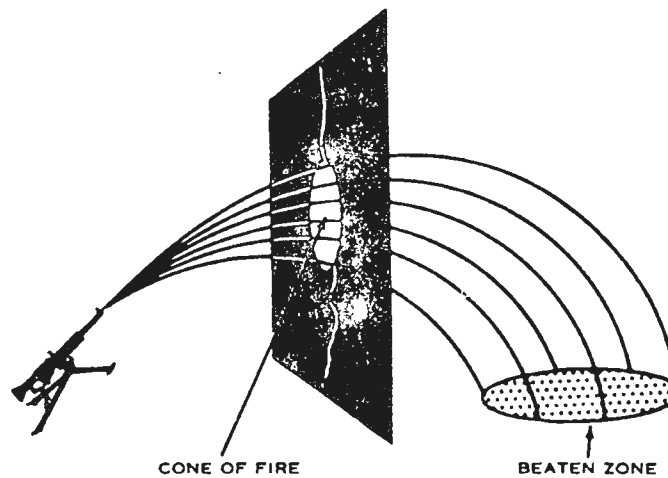


FIGURE 69 CONE OF FIRE AND BEATEN ZONE

d. Beaten Zone and Center of Impact —

The area where the cone of fire strikes the ground or the target is called the beaten zone (figures 69 and 70).

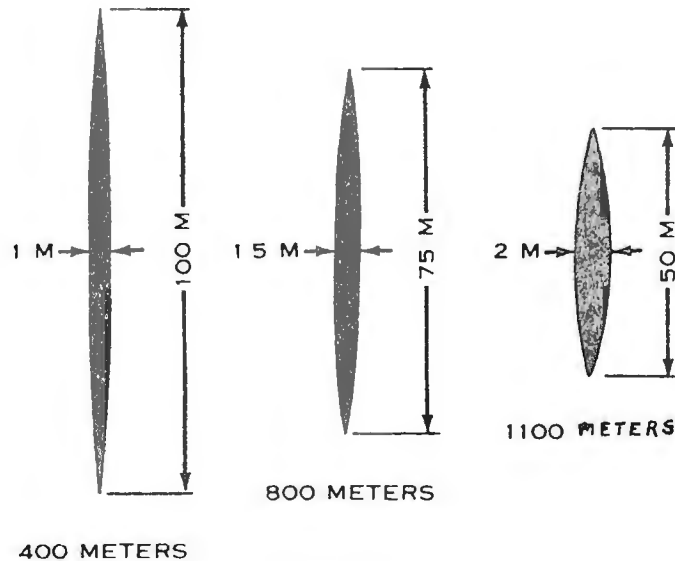


FIGURE 70 SIZE AND SHAPE OF BEATEN ZONES

(1) The size and shape of the beaten zone changes when the range to the target changes and when the gun is fired into different types of terrain. On uniformly sloping or level terrain, the beaten zone is elliptical (long and narrow) in shape (figure 70). As the range to the target increases beyond 500 meters, the beaten zone will become shorter and wider. When fires are delivered into falling ground, the beaten zone will become longer. When fires are delivered into rising ground, the beaten zone will become shorter. The terrain has no appreciable effect on the width of the beaten zone.

(2) The center of the beaten zone is called the **center of impact**. The center of impact will coincide with the line of aim if the weapon is properly zeroed.

e. Danger Space -

This is the space between the gun and the target where the trajectory does not rise above the average height of a standing soldier (1.8 meters). This includes the area encompassed by the beaten zone.

(1) When a machinegun (on its bipod or tripod mount) is fired over level or uniformly sloping terrain at a target less than 700 meters away, the trajectory will not rise above the average height of a standing soldier (figure 71).

(2) When firing at targets at ranges greater than 700 meters, the trajectory will rise above the height of an average standing soldier; therefore, not all the distance between the gun and the target is danger space (figure 71).

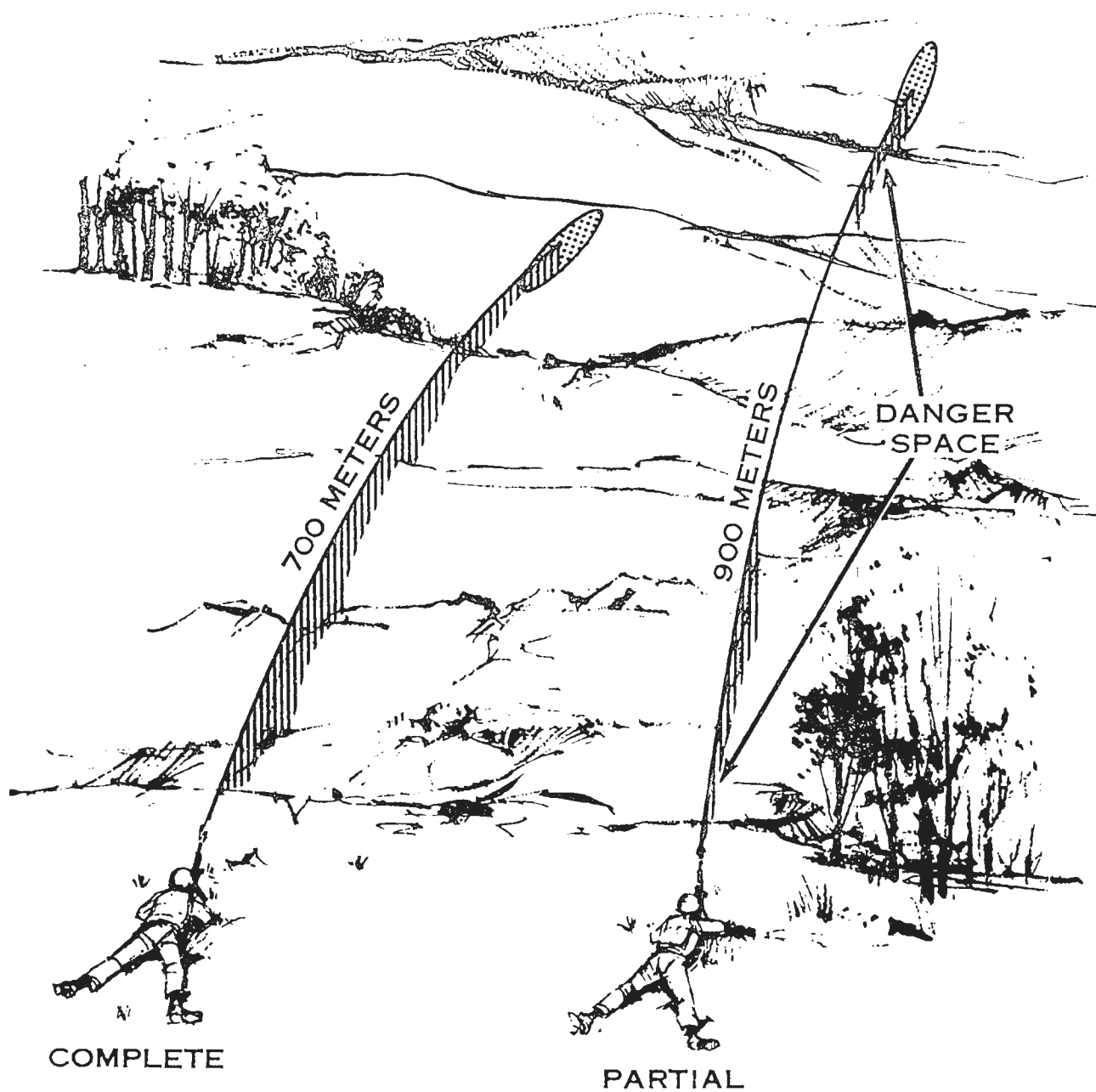


FIGURE 71 DANGER SPACE

73. CLASSES OF FIRE:

Machinegun fire is classified with respect to the ground, target, and gun.

a. Fire with respect to the ground (figure 72) is -

(1) Grazing fire - when the center of the cone of fire does not rise above one meter above the ground. When firing over level or uniformly sloping terrain, a maximum of 600 meters of grazing fire can be obtained.

(2) Plunging fire - when the danger space is practically confined to the beaten zone. Plunging fire occurs when firing at long ranges, when firing from high ground to low ground, and when firing into abruptly rising ground.

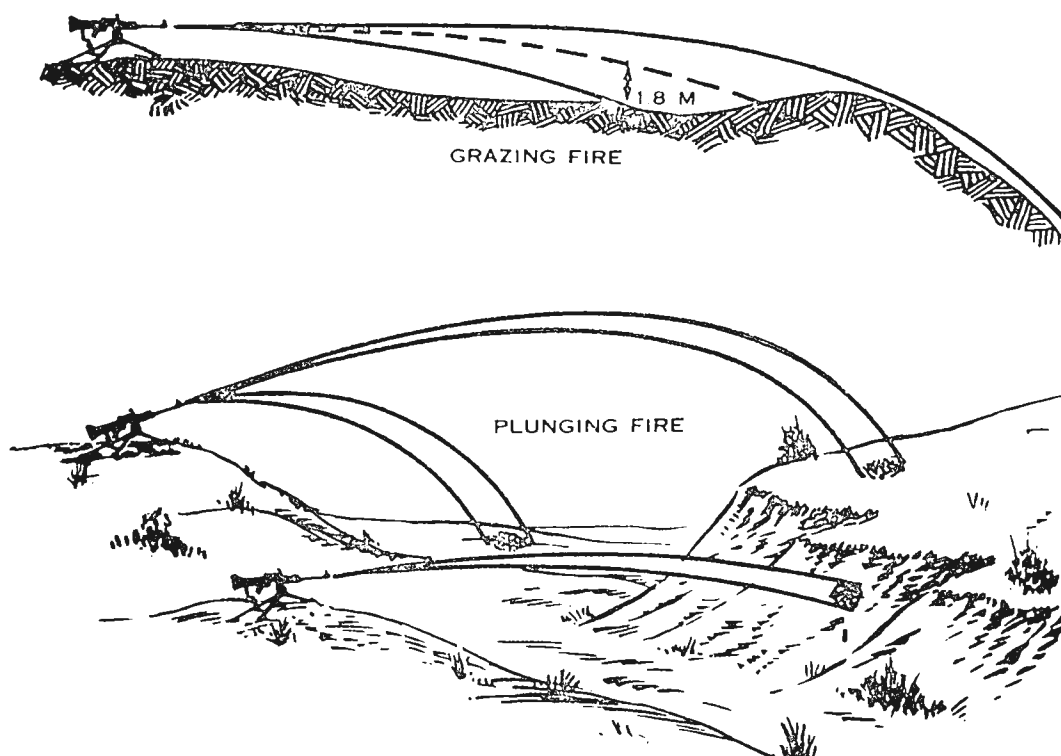


FIGURE 72 PLUNGING AND GRAZING FIRE

b. Fire with respect to the target (figure 73) is -

(1) Frontal fire - when the long axis of the beaten zone is at a right angle to the front of the target.

(2) Flanking fire - when delivered against the flank of a target.

(3) Oblique fire - when the long axis of the beaten zone is at an angle other than a right angle to the target.

(4) Enfilade fire - when the long axis of the beaten zone coincides or nearly coincides with the long axis of the target. This type of fire is either frontal or flanking and is the most desirable type of fire with respect to the target because it makes maximum use of the beaten zone.

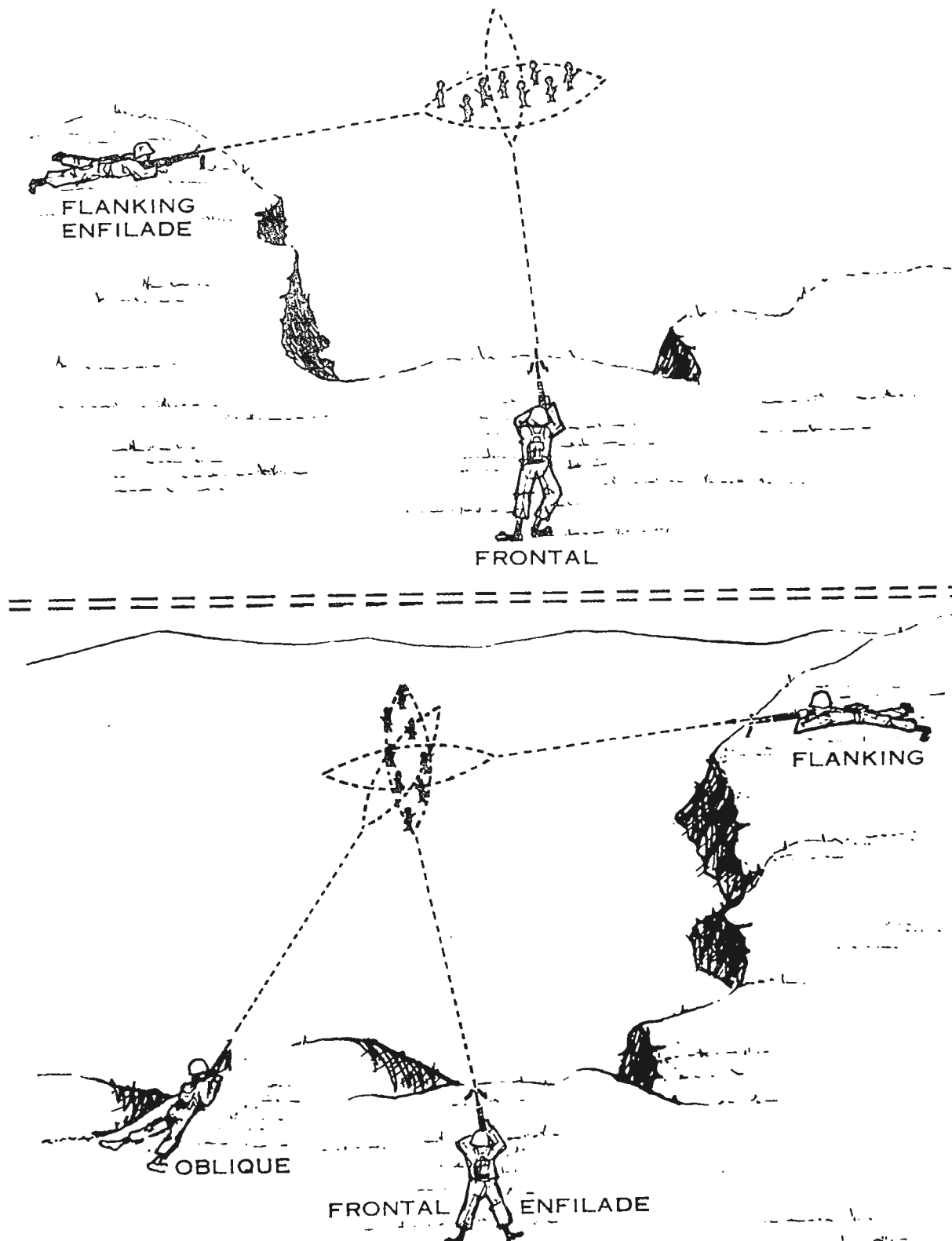


FIGURE 73 CLASSES OF FIRE WITH RESPECT TO THE TARGET

c. There are six types of fire classified with respect to the gun: fixed, traversing, searching, traversing and searching, swinging traverse, and free gun (figure 74). Swinging traverse and free gun fire cannot be delivered with the bipod mounted gun. With the vehicular mounted gun, swinging traverse fire cannot be delivered. The other types of fire can be delivered with either the bipod, tripod, or vehicular mounted gun.

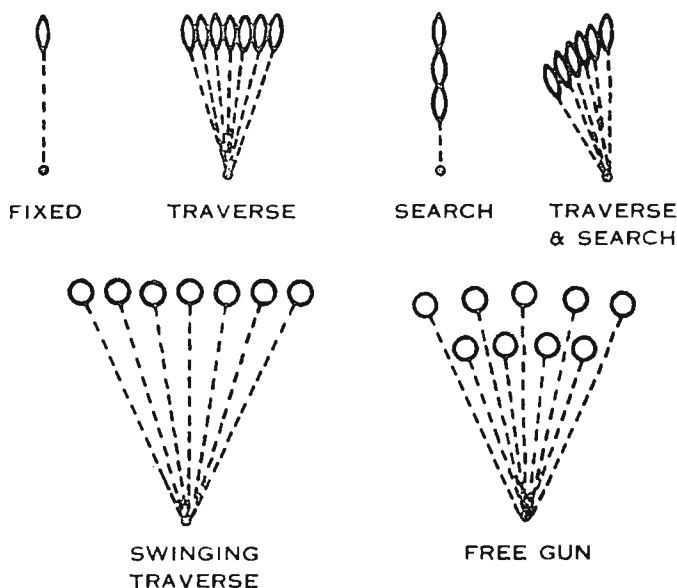


FIGURE 74 CLASSES OF FIRE WITH RESPECT TO THE GUN

(1) Fire with respect to the gun is —

(a) Fixed - when delivered against targets which require a single aiming point.

(b) Traversing - when distributed in width by successive changes in direction. With the tripod mounted gun, the changes are made in 4- to 6-mil increments on the traversing handwheel. To insure adequate target coverage, a burst is fired after each direction change.

(c) Searching - when distributed in depth by successive changes in elevation. When firing the tripod mounted gun over level or uniformly sloping ground, the changes are made on the elevating handwheel in 2-mil increments. When fires are delivered into rising ground, more than two mils of change are required. When fires are delivered into falling ground, less than two mils of change are required. Gunners learn the amount of change to apply through experience. To insure adequate target coverage, a burst is fired after each elevation change.

(d) Traversing and searching - when distributed in width and depth by successive changes in direction and elevation. With the tripod mounted gun, the changes in direction are made in 4- to 6-mil increments on the traversing handwheel. The amount of elevation change is determined by the slope of the terrain and the angle of the target. To insure adequate target coverage, a burst is fired after each combined change in direction and elevation.

(e) Swinging traverse - when delivered against targets too wide to cover with the traversing handwheel and targets moving so rapidly across the gunner's front, that he cannot maintain effective fire while using the traversing handwheel. To deliver this type of fire, the gunner loosens the traversing slide lock lever to allow the traversing and elevating mechanism to slide freely on the traversing bar. Changes in direction are made by applying pressure to the rear of the gun. Minor changes in elevation are made by manipulating the elevating handwheel.

(f) Free gun - when delivered from the tripod mount against targets requiring rapid, major changes in direction and elevation which cannot be applied with the traversing and elevating mechanism, and when delivered from the vehicular mount against targets which cannot be adequately covered by selecting a series of aiming points. To deliver this type of fire from the tripod mount, the gunner loosens the traversing slide lock lever and lifts the traversing and elevating mechanism from the traversing bar to allow the gun to be moved freely in any direction. To deliver this type of fire from the vehicular mount, the gunner allows the weapon to rest freely on the mount. Changes in direction or elevation are made by applying pressure to the rear of the gun.

(2) With the bipod or vehicular mounted gun, fixed fire is delivered by firing a series of bursts at a single aiming point. To deliver traversing, searching, or traversing and searching fire with the bipod or vehicular mounted gun, the gunner selects a series of successive aiming points on the target and fires a succession of aimed bursts. To insure adequate target coverage, he observes the width and length of the beaten zone of the initial burst and selects each succeeding aiming point a sufficient distance from the previous burst to allow an overlap of the beaten zone.

74. RANGE DETERMINATION AND LATERAL DISTANCE MEASUREMENT:

a. Range Determination -

This is the process of determining the distance between the gunner's position and his target. The gunner's ability to engage a target depends on his ability to accurately determine the range to the target. There are many methods for determining range. Some of these are estimating by eye, firing the gun, measuring range from a map or aerial photograph, stepping off the distance, and securing the data from other units. Ranges are determined to the nearest 100 meters for

machinegun firing. In combat the most commonly used methods are --

(1) Estimating by eye - This is the method most often used in the field. There are two methods of estimating by eye, the 100-meter unit of measure method and the appearance of objects method.

(a) 100-meter unit of measure method.

To use this method the gunner must be able to visualize a 100-meter distance on the ground. With this unit in mind, he can mentally determine how many of these 100-meter units there are between his position and the target. In training his estimates should be checked by pacing off the distance (the average airman takes about 130 steps per 100 meters). Constant practice in applying the 100-meter unit of measure is essential. This method is used for ranges up to 500-meters (figure 75).



FIGURE 75 APPLYING THE 100-METER UNIT OF MEASURE METHOD FOR RANGES UP TO 500 METERS

1. For ranges from 500 to 1,000 meters, the airman selects a point halfway to the target, determines the range to the halfway point by applying the 100-meter unit of measure, then doubles the estimate (figure 76). This method of determining range is not accurate beyond 1,000 meters.

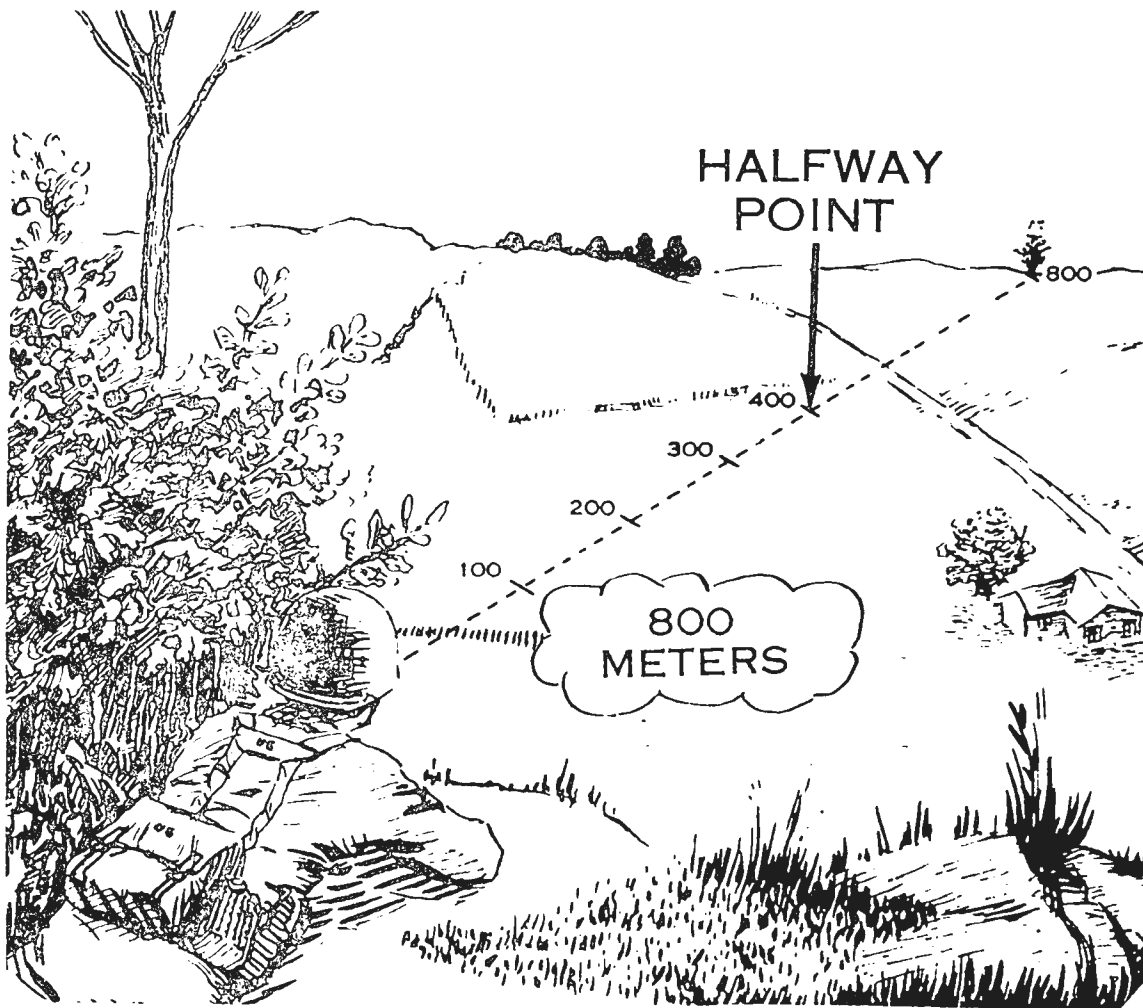


FIGURE 76 APPLYING THE 100-METER UNIT OF MEASURE METHOD FOR RANGES GREATER THAN 500 METERS

2. Certain types of terrain will affect the appearance of 100-meter units of measure. On terrain that slopes upward toward the target, 100 meters appears longer than on level terrain; on ground that slopes downward toward the target, 100 meters appears shorter than on level terrain.

(b) The appearance-of-objects method.

Many times it is impossible to observe all of the terrain to the target. In this case, it is impractical to apply the 100-meter unit of measure and ranges must be determined by the appearance-of-objects method. To use this method, the airman must learn

through practice how familiar objects look at various known ranges. For example, he studies the appearance of a man when he is standing 100 meters away. He fixes his appearance firmly in mind—his size and the details of his uniform and equipment. Next he studies the man in the kneeling position, then in the prone position. This same procedure is followed at various known ranges out to 500 meters. By comparing the appearance of the man in these positions at known ranges he can establish a series of mental images which will help him to determine range on unfamiliar terrain out to 500 meters.

1. Training should be conducted to familiarize the airman with the appearance of other familiar objects such as weapons and vehicles.

2. Certain factors affect the appearance of objects, and an understanding of them will help to make estimates more accurate (table I).

(2) Firing the gun - To determine range by firing either the tripod, bipod or vehicular mounted gun, it must have been previously zeroed (paragraph 143). Open fire on the target with the sight set at the estimated range. If the center of impact is at the base of the target, the actual range is the range setting on the rear sight.

(a) With the tripod mounted gun.

If the center of impact is not placed on the base of the target, move it onto the base by means of the traversing and elevating mechanism. Cease fire and reset the rear sight slide so the new line of aim is on the target. The rear sight will then be set at the actual range to the target.

(b) With the bipod or vehicular mounted gun.

If the center of impact falls short of the target, raise the rear sight slide after each burst; or if it goes over the target, lower the rear sight slide after each burst until the line of aim coincides with the strike of the projectile on the target. The rear sight will then be set at the actual range to the target.

(c) When the ground in the vicinity of the target does not permit observation of the beaten zone.

The gunner must select an alternate point on the ground that will permit him to see the strike of the projectiles. The selected point must be at the same range as the target. The gunner then determines the actual range to the alternate point on the ground by firing the weapon. This is also a method of determining range to a target upon which surprise fire is to be delivered.

TABLE I. FACTORS AFFECTING RANGE DETERMINATION

Factors to be considered in estimating range by eye	Objects <i>appear</i> nearer than they really are and ranges are underestimated	Objects <i>appear</i> more distant than they really are and ranges are overestimated
The target: its clearness of outline and details.	When most of the target is visible and offers a clear outline.	When only a small part of the target may be seen or is small in relation to its surroundings.
Nature of terrain or position of the observer.	When looking across a depression, most of which is hidden from view.	When looking across a depression, all of which is visible.
	When looking downward from high ground.	When looking from low ground toward high ground.
	When looking down a straight open road or along a railroad track.	When vision is narrowly confined as in streets, draws, or forest trails.
	When looking over uniform surfaces like water, snow, desert, or grain fields.	
Light and atmosphere.	In bright light or when the sun is shining from behind the observer.	In poor light such as dawn and dusk, in rain, snow, fog, or when the sun is in the observer's eyes.
	When the target is in sharp contrast with the background or is silhouetted, by reason of size, shape, or color.	When the target blends into the background or terrain.
	When seen in the clear atmosphere of high altitudes.	

b. Lateral Distance Measurement —

In addition to being able to determine range accurately, the gunner needs a quick method of measuring lateral distance right or left from a reference point to a target.

(1) When the gun is mounted on the tripod - width can be measured by aiming on a point and manipulating the traversing hand-wheel and counting the clicks from one point of aim to another point of aim. Each click equals one meter at 1,000 meters, or half a meter at 500 meters. This method is accurate but time consuming.

(2) The finger measurement method - is not a method of range determination, but only a method of measuring the lateral distance (in fingers) between two points. To measure the distance in fingers between a reference point and a target, extend the arm with the palm outward, the fingers cupped, and the elbow locked. Close one eye, raise the index finger, and sight along its edge, placing the edge of the finger along the flank of the target or reference point. Note the space remaining between the two points, and then fill this space by raising fingers until the space is covered (figure 77). The measurement from the reference point to the target is then stated as being one or more fingers, depending on how many fingers are raised to cover this distance. It should be emphasized that fingers cannot be calibrated to any unit of measure.



FIGURE 77 THE FINGER MEASUREMENT METHOD

Section III. FIRE CONTROL

75. GENERAL:

a. Fire control includes all actions of the leader and crew(s) that are connected with the preparation for and application of effective fire on a target. It is the ability to select and designate targets for the appropriate gun(s), open fire at the instant desired, adjust the fire of the gun(s), regulate the rate of fire, shift from one target to another, and cease fire.

b. Ability to exercise fire control depends primarily on the ability of the leader and the discipline and training of the crew. Failure to exercise fire control results in ineffective employment of the machinegun and can result in danger to friendly troops, loss of surprise effect, premature disclosure of positions, fire on unimportant targets, loss of time in adjusting fire, and a waste of ammunition.

76. METHODS OF FIRE CONTROL:

There are several methods of controlling machinegun fire. The noise and confusion of battle will limit the use of some of these methods; therefore, the leader must select the best method or combination of methods which will best accomplish his purpose.

a. Oral —

This is an effective method of control; but at times, the leader will be too far away from the gun crew(s) or the noise of battle will make it impossible for the gun crew(s) to hear him.

b. Arm-and-Hand Signals —

This is an effective method when the gun crew(s) can see the leader. All crew members must understand the standard arm-and-hand signals discussed in paragraph 82.

c. Prearranged Signals —

These are either visual or sound signals such as pyrotechnics or blasts on a whistle. These signals should be included in appropriate SOP's and must be clearly understood by all crew members.

d. Personal Contact —

In many situations, the leader must move to individual crew members to issue orders. This method of control is used more than any other by small unit leaders. The leader must use maximum cover and concealment to keep from disclosing the gun crew's position.

e. Standing Operating Procedures —

Are actions the gun crews perform automatically without command. SOP's such as those described in paragraph 81e are developed during the training of the gun crews, and their application eliminates many commands and simplifies the leaders job of fire control.

77. FIRE COMMANDS:

a. When the leader decides to deliver fire on a target which is not obvious to the gunners, he must give them the information they will need to place effective fire on the target. He must get their attention, tell them what the target is, where it is located, which rate of fire to use, and give the command to open fire.

b. A fire command is given in order to accomplish this quickly and without confusion. Fire commands are either initial or subsequent. Initial fire commands are issued to begin firing at a target, and subsequent fire commands are issued to adjust fire, change the rate of fire, interrupt fire, shift fire to a new target, or to terminate the alert.

c. The noise and confusion of combat, and the separation of the guns make the use of complete fire commands, particularly oral commands, difficult and impractical. Therefore, abbreviated, informal fire commands (initial and subsequent) are more appropriate. However, before the crew members can react properly when they receive informal or abbreviated fire commands, they must have a complete understanding of the standardized fire command.

78. ELEMENTS OF THE FIRE COMMAND:

Fire commands for all direct fire weapons follow a pattern that includes similar elements. There are six essential elements for the machinegun that are either given or implied by using one or more of the methods of control. During training the gun crew repeats each element of the fire command as it is given. This is done to avoid confusion and to train the crew to think and act in the proper sequence. The six elements of the fire command as they apply to the machinegun are alert, direction, description, range, method of fire, and command to open fire.

a. Alert —

This element brings the crew(s) to a state of readiness to receive further instruction. The leader may alert both gun crews or only one, depending on the situation. Once alerted the assistant gunners frequently check with the leader in order to pass on to the gunners any instructions from the leader. The oral alert consists of FIRE MISSION, which is announced to alert the gunner(s) that a target

has been detected and will receive fire. If both guns are to fire, the fire unit leader announces FIRE MISSION; if only one gun is to fire, he will announce NUMBER ONE (TWO) FIRE MISSION. If he desires to alert both guns but fire only one, he will announce FIRE MISSION NUMBER ONE (TWO).

b. Direction —

This element indicates the general direction to the target and may be given in one or a combination of the following ways.

(1) Orally - The leader gives the direction to the target in relation to the position of the gun(s) as shown in figure 78.

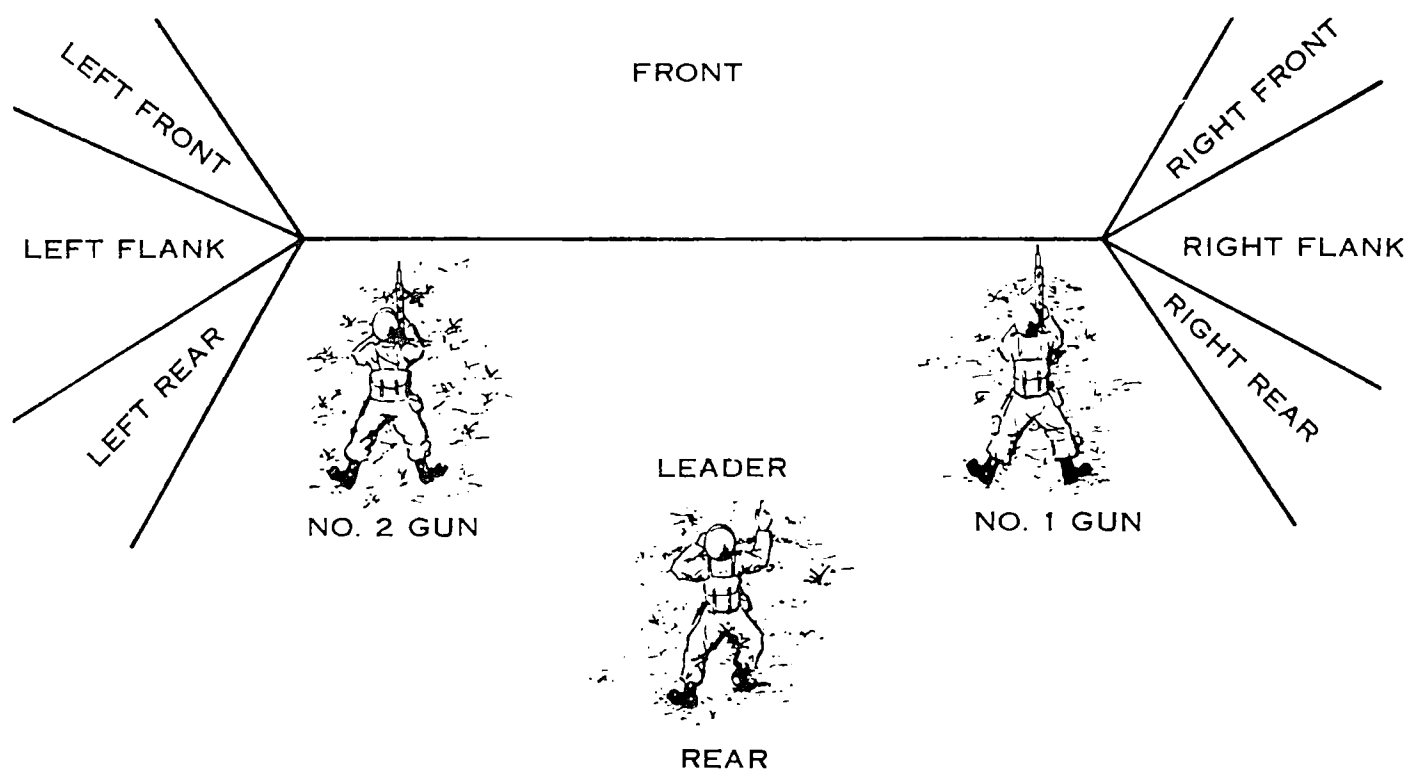


FIGURE 78 GENERAL DIRECTION

(2) Pointing - The leader can designate a small or obscure target by pointing with his arm or aiming the machinegun(s). When pointing with his arm, a man standing behind him should be able to look over his shoulder and sight along his arm and index finger to locate the target. When a gun has been aimed at a target, an airman looking through the sights should be able to see the target.

(3) Use of tracer ammunition - Tracer ammunition is a quick and sure method of designating a target which is not clearly visible. When using this method, the leader should first give the general direction to direct the gun crew's attention to the desired area. To minimize the loss of surprise when using tracer ammunition, the leader does not fire until he has given all of the elements of the fire command except the command to fire. When using this method of designating a target, the leader may use his individual weapon or fire one or more bursts from a machinegun. The firing of the tracer(s) then becomes the last element of the fire command and is the signal to open fire. For example:

FIRE MISSION
FRONT
BUNKER
WATCH MY TRACER(S)
(BURST)

The leader fires his individual weapon or a machinegun at the enemy bunker, then his gun crew(s) open fire.

(4) Reference points - Another method of designating obscure targets is by using easily recognizable reference points. Prominent terrain features and manmade objects make good reference points. All leaders and members of the gun crew(s) must be familiar with the terrain features and the terminology used to describe them. When using a reference point, the word "reference" precedes the target description. This is done to avoid confusion. The general direction of the reference point should be given. Here are some examples of the use of reference points.

FIRE MISSION, NUMBER ONE
FRONT
REFERENCE: LONE PINE TREE
TARGET: TRUCK

Sometimes a target must be designated by using successive reference points. For example:

NUMBER ONE, FIRE MISSION
RIGHT FRONT
REFERENCE: RED ROOFED HOUSE, LEFT TO HAYSTACK, LEFT
TO BARN
TARGET: MACHINEGUN

Finger measurements (paragraph 74 b (2)) can be used to direct the gun crews' attention to the right or left of reference points. For example:

FIRE MISSION
LEFT FRONT
REFERENCE: CROSS ROADS, RIGHT FOUR FINGERS
TARGET: LINE OF TROOPS

When the guns are mounted on tripod, lateral distance from reference points can be accurately announced. When gunners are firing the tripod mounted gun, lateral distance is assumed to be in mils unless otherwise indicated, so the word "mils" is not necessary. For example:

FIRE MISSION
FRONT
REFERENCE: KNOCKED OUT TANK
LEFT FOUR ZERO
TARGET: COLUMN OF TROOPS

c. Description —

The target description is used to create a picture of the target in the minds of the gun crew. The gun crew(s) must know the type of target they are to engage to properly apply their fire. The leader should describe it briefly, but accurately. For example:

Dismounted enemy personnel	LINE OF TROOPS COLUMN OF TROOPS
Automatic weapon	MACHINEGUN
Armored vehicle	TANK
Unarmored vehicle	TRUCK
Artillery or antitank weapon	ANTITANK
Airplanes or helicopter	AIRCRAFT

If the target is obvious, no description is necessary. Finger measurements or mil measurements can be used to designate the width of a linear target when the flanks cannot be pinpointed.

d. Range —

The range to the target is given so the gun crew(s) knows how far to look for the target and knows immediately what range setting to place on the rear sight. Range is determined and announced in meters. Since the meter is the standard unit of range measurement, the word "meters" is not used. With machineguns the range is determined and announced in even hundreds or thousands, for example: THREE HUNDRED,

ONE THOUSAND, ONE ONE HUNDRED. This element may be omitted when the gunners can obviously determine the range for themselves; however it is desirable in some situations to announce the range.

e. Method of Fire —

This element includes manipulation and rate of fire.

(1) Manipulation - is used to prescribe the class of fire with respect to the gun (paragraph 73c). It is announced as FIXED, TRAVERSE, SEARCH, TRAVERSE AND SEARCH, SWINGING TRAVERSE, or FREE GUN.

(2) Rate - is used to control the rate of fire. There are three rates of fire which may be announced for the gun(s), sustained, rapid, and cyclic (paragraph 85b).

f. Command to Open Fire —

If surprise fire is required, the command FIRE is given without pause. It is often of great importance that machinegun fire be withheld for maximum effect and that both guns of a pair open fire at the same time. To insure this, the leader may preface the command to commence firing with the words AT MY COMMAND. When the gunners are ready to engage the target, they report UP to the assistant gunners who signal READY (paragraph 82a) to the leader. The leader will then give the command FIRE at the specific time desired. For example:

FIRE MISSION
FRONT
COLUMN OF TROOPS
AT MY COMMAND (Pause until crew members are ready to fire)
FIRE

79. SUBSEQUENT FIRE COMMANDS:

If the gunner fails to adjust his fire on the target, the leader must promptly correct him by announcing or signaling the desired change(s). When these changes are given, the gunner makes the required corrections and continues to engage the target without further command. When firing under the control of a leader, the assistant gunner checks with the leader for instructions which he passes on to the gunner.

a. Adjustment for Direction —

Is always given first, such as RIGHT ONE ZERO or LEFT FIVE.

b. Adjustment for Elevation —

Is given next (second), such as ADD FIVE or DROP ONE FIVE. These may be given orally or with arm-and-hand signals (paragraph 82c, d).

c. Adjustments in Direction and Elevation --

(1) For guns on the tripod are always implied as mils.

(2) For guns on bipod or vehicular mount, direction and elevation adjustments are made by announcing or signaling SHIFT LEFT (RIGHT) or DROP (ADD). The word mils is not used in subsequent fire commands.

d. Changes in the Rate of Fire --

Are given orally or by arm-and- hand signals (paragraph 82b).

e. To Interrupt Firing --

The leader announces CEASE FIRE or gives a signal to cease fire (paragraph 82e). The gun crew(s) remains on the alert and firing can be resumed on the same target by announcing FIRE.

f. To Terminate the Alert --

The leader announces CEASE FIRE, END OF MISSION.

80. DOUBTFUL ELEMENTS AND CORRECTIONS:

a. Doubtful Elements --

When the gunner is in doubt about any element of the fire command, he repeats the element in question with a rising inflection in his voice to denote a question. The leader then announces THE COMMAND WAS, repeats the element in question, and continues with the fire command.

b. Corrections --

(1) Initial fire commands - When the leader makes a mistake in the initial fire command, he corrects it by announcing CORRECTION, and then gives the corrected element(s). For example:

FIRE MISSION
FRONT
LINE OF TROOPS
FIVE HUNDRED
CORRECTION
SIX HUNDRED
TRAVERSE
AT MY COMMAND

(2) Subsequent fire commands - When the leader makes an error in the subsequent fire command he may correct it by announcing CORRECTION, and then repeating the entire subsequent fire command. For example:

LEFT FIVE, DROP ONE
CORRECTION
LEFT FIVE, DROP ONE ZERO

81. ABBREVIATED, INFORMAL FIRE COMMANDS:

Fire commands need not be complete or formal to be effective. In combat the leader's fire command will seldom include all of the elements. He will use only the elements necessary to place fire on a target quickly and without confusion. However, initially during training he should use all of the elements to instill in the crew members the habit of thinking and reacting in the proper manner when a target is to be engaged. After the crew members' initial training in fire commands, they should be taught to react to abbreviated, informal fire commands, using the various methods of control. Here are some examples of abbreviated, informal fire commands using the various methods of control.

a. Oral --

The leader desires to place the fire of one gun on an automatic weapon that he has located. He gives the following fire command:

FIRE MISSION, NUMBER ONE
REFERENCE: TOP OF SILO
LEFT THREE ZERO (Gun is on tripod mount.)
TARGET: MACHINEGUN
FIRE

When a range card has been prepared (paragraph 116 and 117) the leader can place fire on targets, which the gunner cannot see, by using only the alert, description, and the command to fire. The leader describes the target by its number, prefacing the number of the target with the word target. For example:

FIRE MISSION, NUMBER ONE
TARGET NUMBER THREE
AT MY COMMAND
FIRE

b. Arm-and-Hand Signals --

The leader desires to have one gun engage a halted truck about 400 meters away. The leader throws a pebble at the gun that will fire. The gunner or assistant gunner turns to look at the leader.

The leader points to the target. The assistant gunner signals the leader when they are ready to fire. The leader then signals FIRE.

c. Prearranged Signals —

Assume that a pair of machineguns is placing supporting fire on an objective. The leader desires to shift the fire at a specific time. When the time arrives, he fires a smoke streamer and the gunners, upon seeing the signal, shift their fire to a prearranged point.

d. Personal Contact —

Assume that both guns are engaging the same target and the leader wishes to shift the fire of one gun to a new target. The leader moves to the gun that he desires to have shift fire, obtains the gunner's attention, points out the new target, and commands FIRE.

e. SOP's That Can Be Developed —

(1) The search-fire-check SOP —

(a) Search — The crew members search their sector.

(b) Fire — Gunners open fire automatically on appropriate targets that appear in their sector.

(c) Check — While the gunner is firing, the assistant gunner must check the leader for instructions.

(2) The return fire SOP — The gun crews are trained to return enemy fire without order, concentrating on enemy automatic weapons.

(3) The shifting fires SOP — The gunners should be trained to engage all appropriate machinegun targets in their sector and shift their fire automatically when more dangerous targets appear.

(4) The rate of fire SOP — When gunners engage a target, they fire at the rate necessary to gain fire superiority, then they decrease the rate of fire to a point that is sufficient to maintain fire superiority.

(5) Mutual support SOP —

(a) When both machineguns are engaging the same target and one of the guns stops firing, the other gunner increases his rate of fire and covers the entire target.

(b) When only one gun is required to engage a target and the leader has alerted both guns, the gun not firing must lay on the target and follow the movements of the target so that he can fire instantly should the other gun malfunction or cease fire before the target has been eliminated.

82. ARM-AND-HAND SIGNALS:

Due to battlefield noises and the possibility of guns being located considerable distances from the leader, it will often be necessary to use arm-and-hand signals to control the machinegun fire. When an action or movement is to be executed by only one of the gun crews, a preliminary signal is given by pointing toward the crew to execute the action. When necessary all signals are relayed to the gunner by the assistant gunner. The following are the most commonly used signals for machinegun fire control.

a. The assistant gunner signals that the gunner is ready to fire by raising his right hand and arm above his head toward the leader (figure 79).

b. To commence firing, the leader brings his hand, palm down, to the front of his body about waist level and moves it horizontally in front of his body (figure 80). To fire faster, increase the speed of the hand movement; to fire slower, decrease the speed of the hand movement.

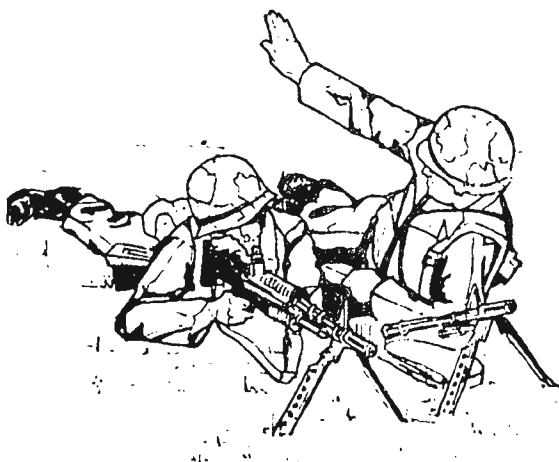


FIGURE 79 THE READY SIGNAL

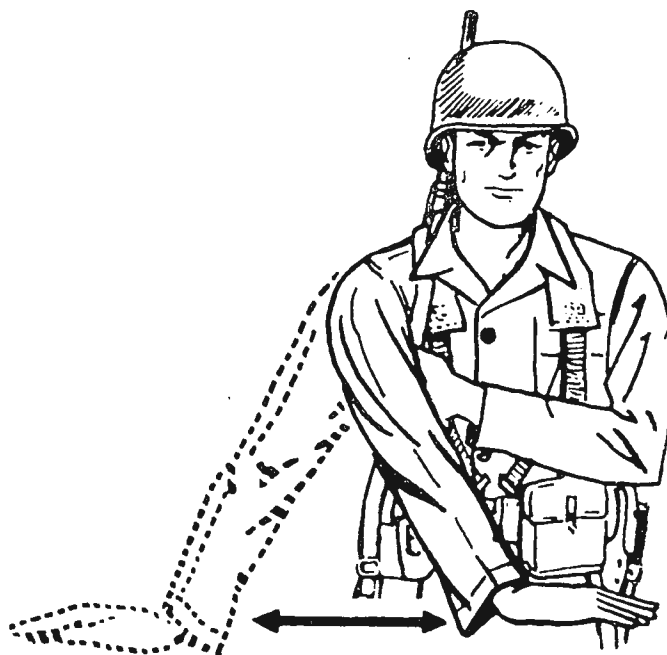
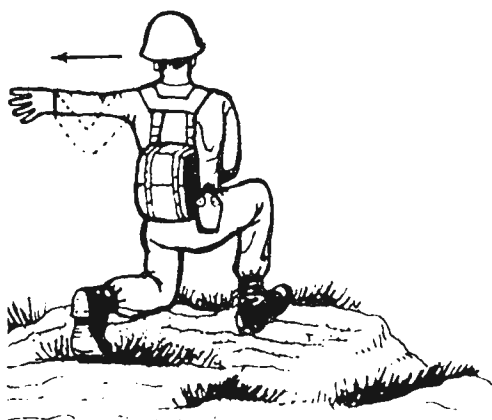


FIGURE 80 COMMENCE FIRING

c. To signal changes in direction and elevation, with the tripod mounted gun, extend the arm and hand in the direction of the desired change and indicate, by the number of fingers extended, the amount of change necessary. The fingers must be spread so the assistant gunner can easily see the number of fingers extended. Each finger indicates one mil of change (figure 81). If the desired change is more than five mils, the leader extends the hand the number of times necessary

to indicate the total amount of change. For example, RIGHT NINE would be indicated by extending the hand once with five fingers showing and a second time with four fingers showing for a total of nine fingers.



LEFT 4



ADD 4

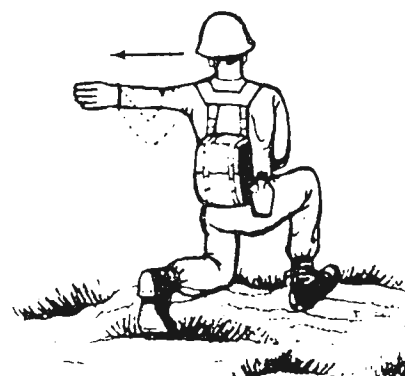
FIGURE 81 ADJUSTING FIRE WITH THE TRIPOD MOUNTED GUN

d. To signal changes in direction and elevation with the bipod or vehicular mounted gun, extend the arm and hand in the direction of the desired change with the fingers extended and joined (figure 82). If the gunner makes too bold or too slight a change, issue subsequent signals until the fire is placed in the desired area.

e. To interrupt firing, the leader raises his arm and hand in front of his forehead, palm outward, and cuts it downward sharply. The assistant gunner then slaps the gunner on his back to indicate CEASE FIRING (figure 83).



ELEVATE FIRE



SHIFT FIRE LEFT

FIGURE 82 ADJUSTING FIRE WITH THE BIPOD MOUNTED GUN



FIGURE 83 CEASE FIRE

f. The leader can devise other signals to control his guns; for example, signals to change barrels, remove the gun from the tripod, or emplace the gun in a certain position.

Section IV. PRINCIPLES OF APPLICATION OF FIRE

83. GENERAL:

a. Application of fire consists of the methods the gun crews use to insure complete and effective coverage of a designated target to include suspected areas in which the enemy might be located.

b. Training in the methods of applying machinegun fires can be accomplished only after the crew members have learned to recognize the various types of targets they might encounter in combat, how to properly distribute and concentrate their fire, and how to maintain the proper rate of fire.

84. TYPES OF TARGETS:

Targets presented to the machinegunners during combat will in most cases consist of enemy personnel in various formations which require distribution and concentration of fire. These targets have width and depth, and the application of machinegun fire is designed to thoroughly cover the area in which the enemy is known or suspected to be. These targets may be easily distinguishable or may be indistinct and difficult to locate.

a. Point Targets —

Are targets which require the use of a single aiming point. Enemy bunkers, weapons emplacements, vehicles, small groups of personnel, and aerial targets such as helicopters or descending paratroopers are examples of point targets.

b. Linear Targets —

Have sufficient width to require traversing fire and no more depth than can be effectively covered by the beaten zone (figure 84).

c. Linear Targets With Depth —

Are targets which have sufficient width to require traversing fire and depth which cannot be covered by the beaten zone. They require a combined change in direction and elevation (traversing and searching fire) to maintain effective fire on them (figure 85).

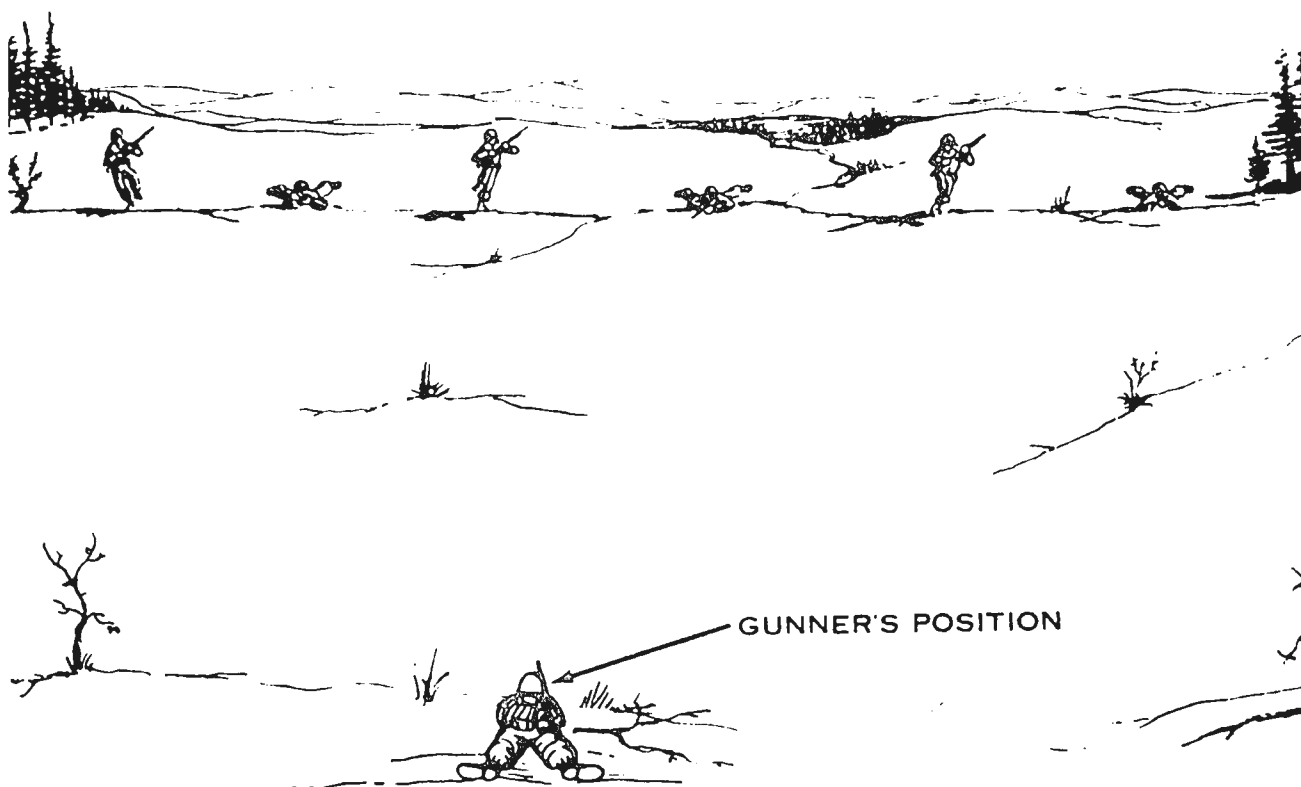


FIGURE 84 LINEAR TARGET

d. Deep Targets —

Have depth but very little width and can be effectively covered by searching fire (figure 86).

e. Area Targets —

Have considerable width and depth and require extensive traversing and searching fire. This type target exists when the enemy is in a certain area but his exact location is not known. An objective such as a hilltop is a typical area target.

85. DISTRIBUTION, CONCENTRATION, AND RATE OF FIRE:

In combat the size and nature of a target may call for the fire-power of one or both guns. The method of applying fire to a target is generally the same for either a single gun or a pair of guns.

a. Distribution and Concentration of Fire —

(1) Distributed fire is delivered in width, depth, or in a combination of these two. To distribute fire properly, gunners must know where to aim and adjust their fire and which direction to manipulate the gun.

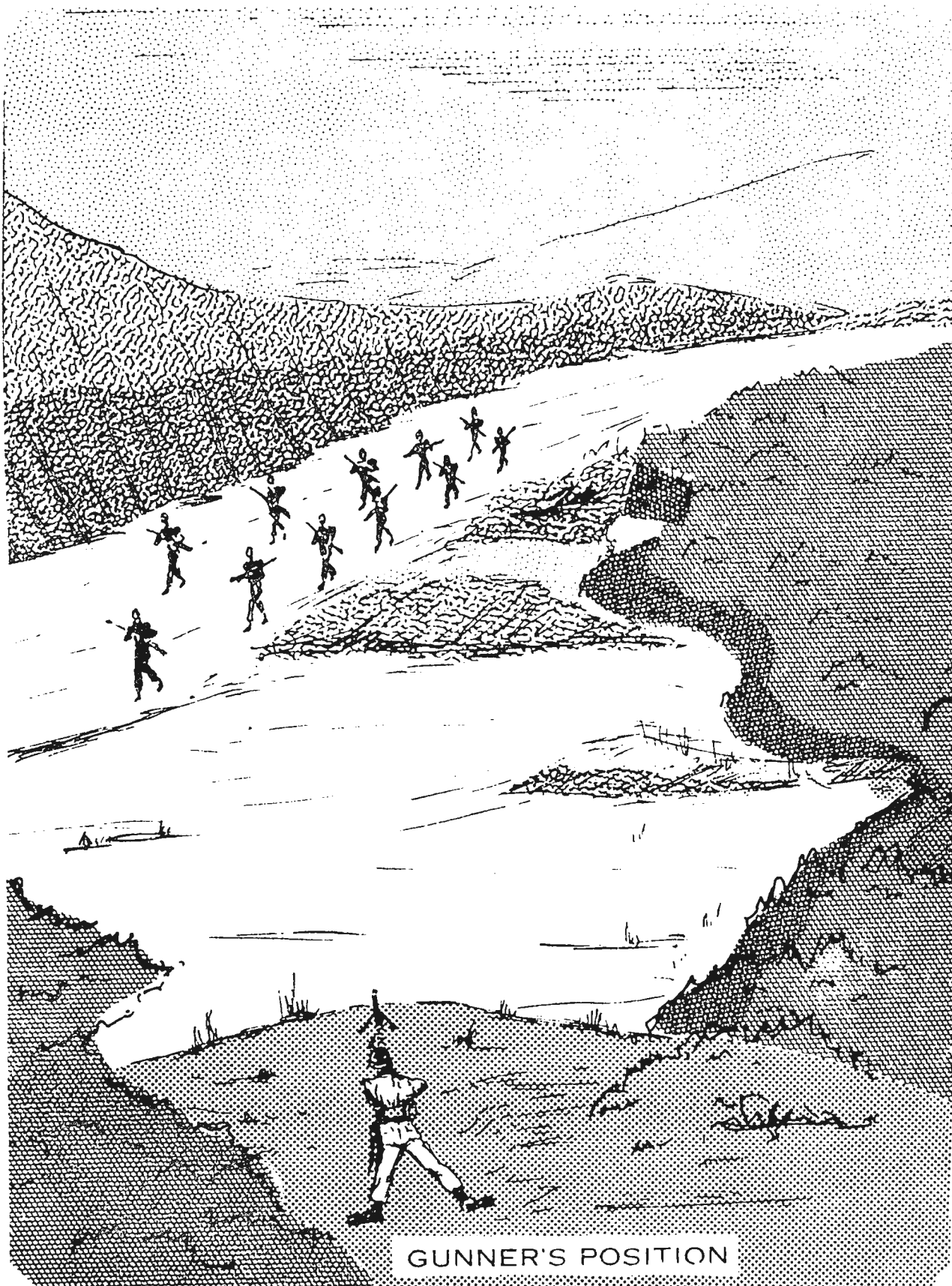


FIGURE 85 LINEAR TARGET WITH DEPTH

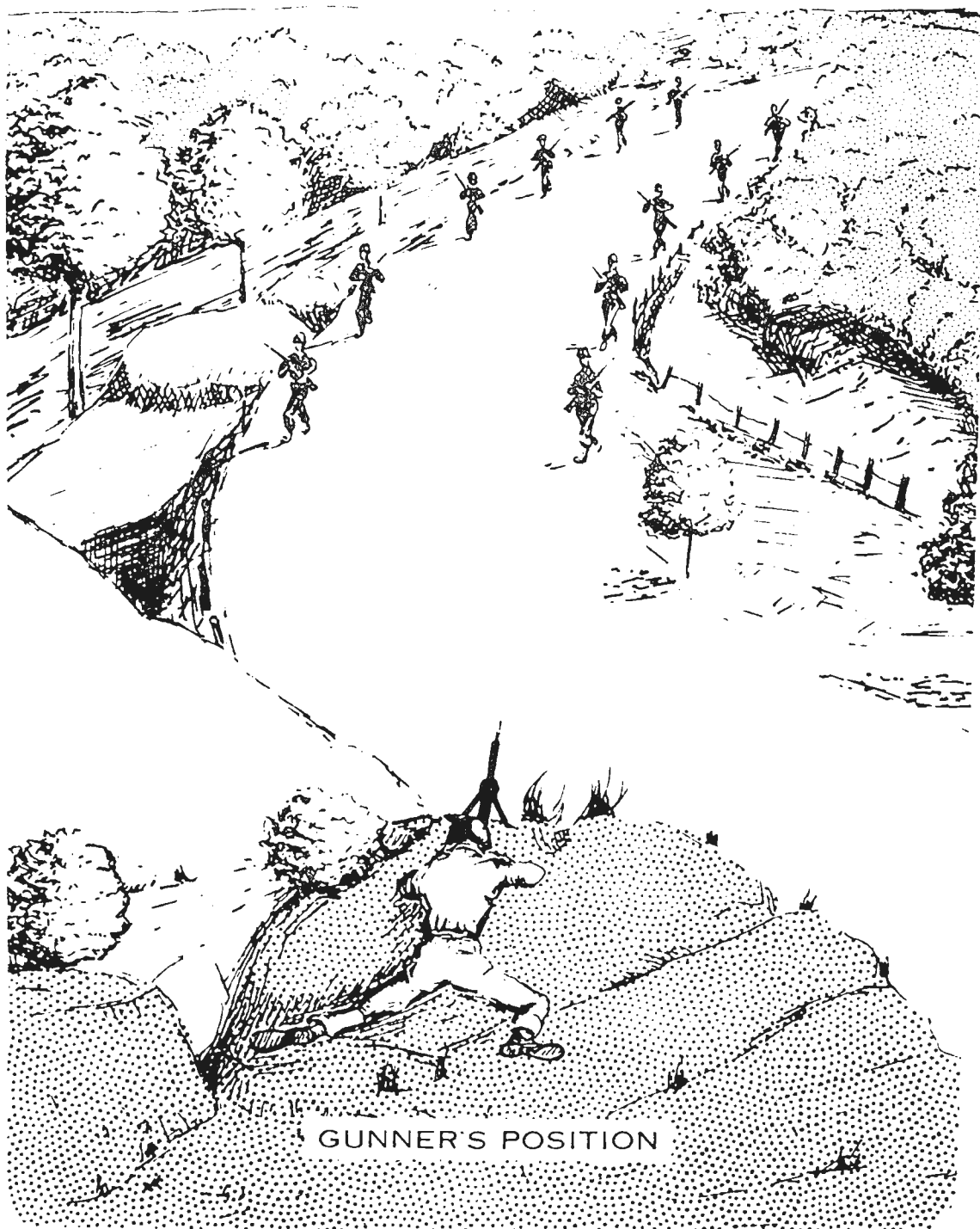


FIGURE 86 DEEP TARGET

(a) Point of initial lay and adjustment - The gunner must aim, fire, and adjust on a certain point of the target. It is extremely important that fire be adjusted boldly, rapidly, and continuously. Binoculars can be used by the leader to facilitate fire adjustment. The gunner insures throughout his firing that the center of impact is maintained at the base of the target for maximum effect from each burst of fire. When this is done, projectiles in the upper half of the cone of fire will hit the target, and projectiles in the lower half of the beaten zone may ricochet into the target (figure 87).

(b) Direction of manipulation of the gun after adjusting fire onto the point of initial aim - The gunner must move his beaten zones in a certain direction over the target. The direction depends on the type of target and whether the target is engaged with a pair of guns or a single gun. When engaging targets other than point targets with a pair of guns, the targets are divided so that fire is evenly distributed throughout the target area.

(2) Fire delivered on point targets or a specific area of other target configurations is called concentrated fire.

b. Rates of Fire --

(1) There are three rates of fire with the machinegun: sustained, rapid, and cyclic - These rates are established primarily as a guide for training and to indicate when a barrel change is desirable. In many instances firing will be in excess of the rapid and sustained rate or below the sustained rate. In training, the rate of fire should be announced to facilitate learning and to provide the gunners with a basis for judging the number of rounds being expended in subsequent training or in combat.

(a) Sustained fire - is 100 rounds per minute in bursts of six to nine rounds at 4- to 5-second intervals. It is directed by announcing SUSTAINED. (A barrel change is recommended after firing the sustained rate for 10 minutes).

(b) Rapid fire - is 200 rounds per minute in bursts of six to nine rounds at 2- to 3-second intervals. It is directed by announcing RAPID. (A barrel change is recommended after firing two minutes.)

(c) Cyclic rate of fire - represents the maximum amount of ammunition which can be expended by a weapon in one minute. The cyclic rate of fire with the M60 machinegun is approximately 550 rounds per minute. This rate is in effect when the trigger is held to the rear and ammunition is continuously fed into the weapon for any given period of time. (A barrel change is recommended after firing at any rate in excess of the rapid rate for one minute.)

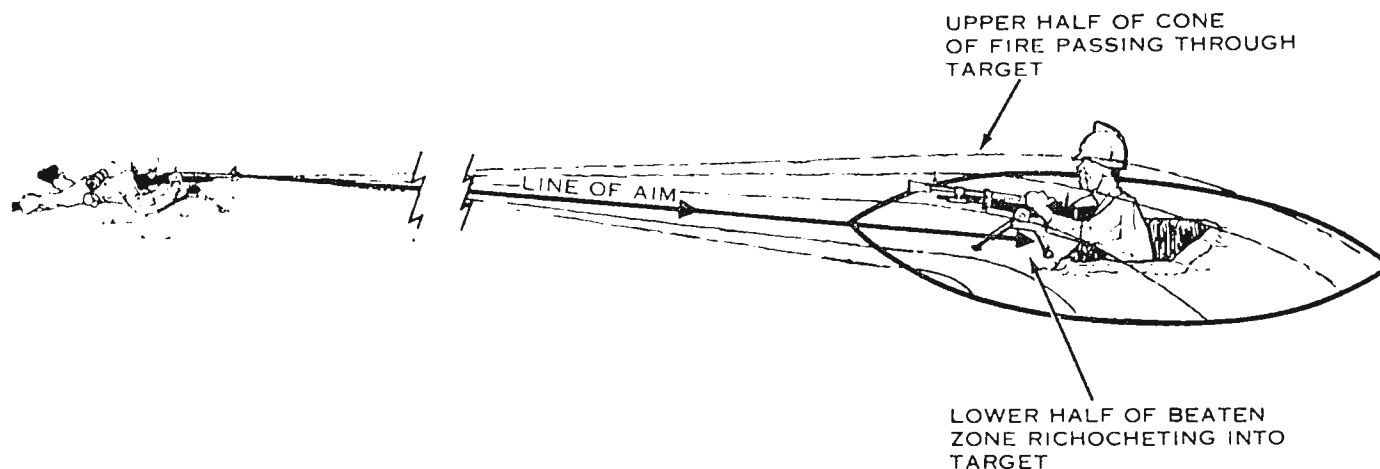


FIGURE 87 PLACEMENT OF CENTER OF IMPACT ON TARGET

(2) The following techniques concerning the rate of fire should be followed for maximum effect.

(a) Ground targets are initially engaged using the rapid or higher rate (200 or more rounds per minute) in order to gain fire superiority. After fire superiority has been gained, the rate of fire is reduced to a point that is sufficient to maintain fire superiority. This reduction in rate of fire is necessary to keep the barrel from overheating and to conserve ammunition.

(b) Aerial targets are engaged using the cyclic rate.

Section V. APPLICATION OF FIRE (TARGET ENGAGEMENT—DIRECT LAY)

86. GENERAL:

a. When machinegun fire is under direct control of a leader, he designates the midpoint and flanks or ends of a target unless these are obvious to the gun crew(s).

b. When a target other than a point target is engaged by two gunners, it is always divided. Each gunner applies his fire to that portion of the target corresponding to his position with relation to the other gun. Normally each gunner engages one half of the target; however, gunners must be prepared to engage the entire target if this becomes necessary. Gunners continue to fire on the target until it is neutralized or until receiving another signal from the leader.

c. In order that the weapons machinegunners remain constantly aware of the portion of a given target that they would engage, their positions are numbered. The gun position on the right is the number one position, and the gun position on the left is the number two

position (figure 78). It should be emphasized that the positions are numbered, not the guns or gunners.

d. To insure that gunners react quickly and properly when they detect a target or when a target is designated by the leader, standard methods of applying fire to the various types of targets are taught. These methods of applying fire are the same for bipod, tripod, and vehicular mounted guns.

87. POINT TARGET:

A point target is engaged with fixed fire. If it moves after the initial burst, the gun crew(s) keeps fire on the target by following its movement with the gun(s).

88. LINEAR TARGETS:

Linear targets are engaged with traversing fire.

a. Two Guns —

(1) Normal division - The target is divided at the midpoint; gun No. 1 firing on the right half, and gun No. 2 firing on the left half. The point of initial lay and adjustment for both guns is on the midpoint of the target. After adjusting on the midpoint, gun No. 1 traverses right, firing a burst after each change in direction until reaching the right flank. Gun No. 2 traverses to the left flank in the same manner. Both gunners then reverse their direction of traverse and return to the midpoint (figure 88).

(2) Special division - If one portion of the target presents a greater threat than another portion, fire can be concentrated on that portion by dividing the target unevenly. This special division of the target is accomplished with subsequent fire commands after firing begins. The gunners initially lay on the midpoint regardless of the special division to be made, thus precluding confusion (figure 89).

b. One Gun —

A single gunner must engage the entire width of a linear target. The point of initial lay is on the midpoint or that portion of the target presenting the greatest threat. The gunner then manipulates in either direction to a flank and reverses his direction of manipulation to cover the rest of the target (figure 88).

c. Indistinct Linear Targets —

If a linear target is not easily identifiable by the gunners, the leader may designate the target by using a reference point. When the reference point method of designating an indistinct target is used, the leader determines the center mass of the target and announces the number of mils or fingers from the reference point that will cause each

gunner to lay on the center mass. The reference point may be within or adjacent to the target; however, it should be on line with the target for maximum effect. After the command to fire has been given, the leader maintains and controls the fire on the target by using subsequent fire commands. Here is an example of a fire command with the reference point outside the target area (figure 90).

FIRE MISSION
FRONT
REFERENCE: BUNKER, RIGHT FIVE, CENTER MASS
TARGET: LINE OF TROOPS IN PRONE
SIX HUNDRED
TRAVERSE
AT MY COMMAND
FIRE

Here is an example of a fire command with the reference point within the target area (figure 91).

FIRE MISSION
LEFT FRONT
REFERENCE: BURNED OUT TANK, CENTER MASS
TARGET: LINE OF TROOPS IN PRONE EXTENDING LEFT FIVE ZERO,
RIGHT FIVE ZERO
SEVEN HUNDRED
TRAVERSE
AT MY COMMAND
FIRE

89. DEEP TARGETS:

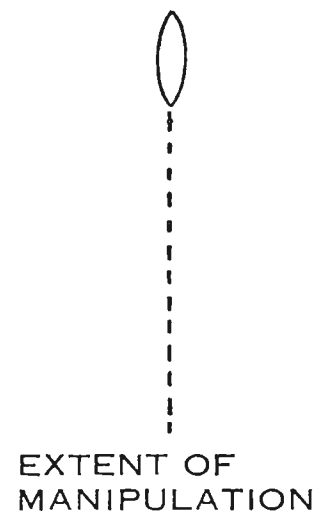
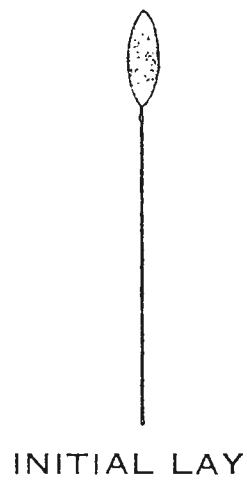
Deep targets are engaged with searching fire. When range is announced, it is given to the midpoint of the target.

a. Two Guns —

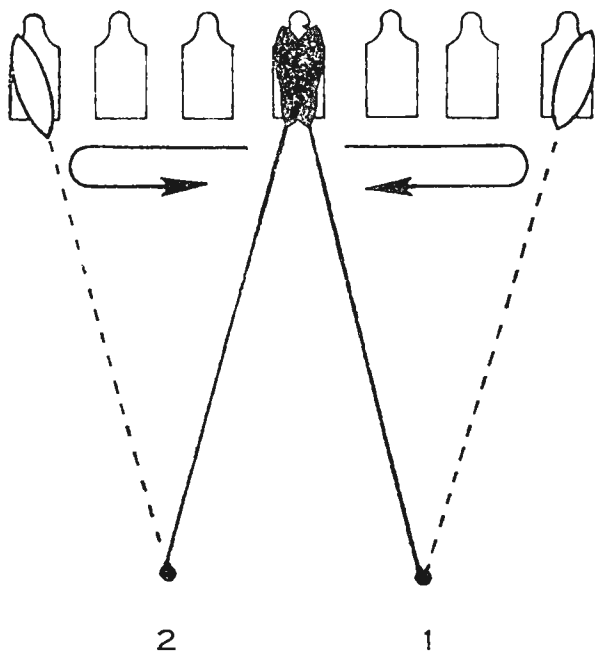
The point of initial lay for both guns is on the midpoint which is also the point of division. Since enfilade fire (paragraph 73b(4)) is being delivered, it is not necessary to adjust on the midpoint of the target because the long beaten zone will compensate for any range errors. After the initial burst, gun No. 1 searches down to the near end of the target and gun No. 2 searches up to the far end. Both gunners then reverse their direction of search and return to the midpoint (figure 92).

b. One Gun —

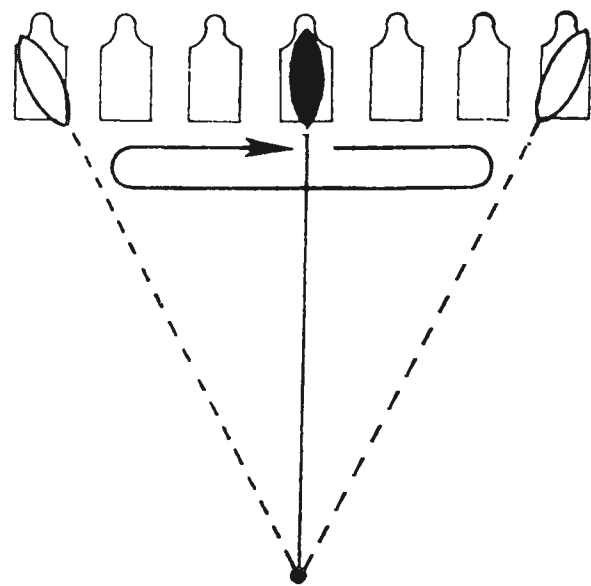
A single gunner initially lays on the midpoint of a deep target unless another portion of the target is more critical. The gunner then searches down to the near end and back up to the far end (figure 92).



SYMBOLS

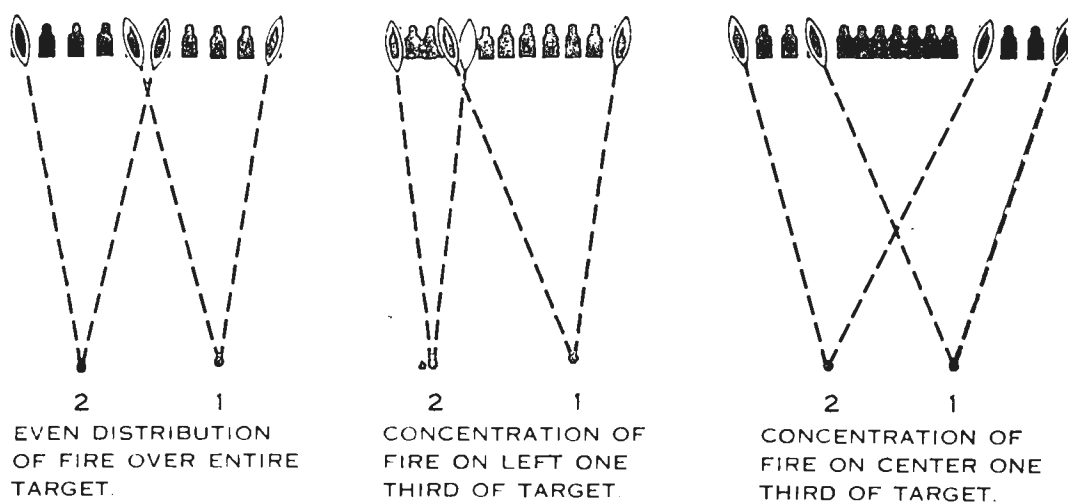


PAIR



SINGLE

FIGURE 88 ENGAGEMENT OF LINEAR TARGETS (DISTINCT)



- NOTE 1-INITIAL LAY AND ADJUSTMENT FOR BOTH GUNS OF A PAIR IS ALWAYS ON THE MIDPOINT OF THE TARGET.
- 2-NORMAL DIVISION IS ALWAYS NO. 1 RIGHT HALF AND NO. 2 LEFT HALF FOR LINEAR TARGETS AND LINEAR TARGETS WITH DEPTH (NO. 1 NEAR HALF AND NO. 2 FAR HALF FOR DEEP TARGETS)
- 3-IF OTHER THAN NORMAL DIVISION IS REQUIRED, THE LEADER MUST USE SUBSEQUENT FIRE COMMANDS.

FIGURE 89 SPECIAL DIVISION OF TARGETS

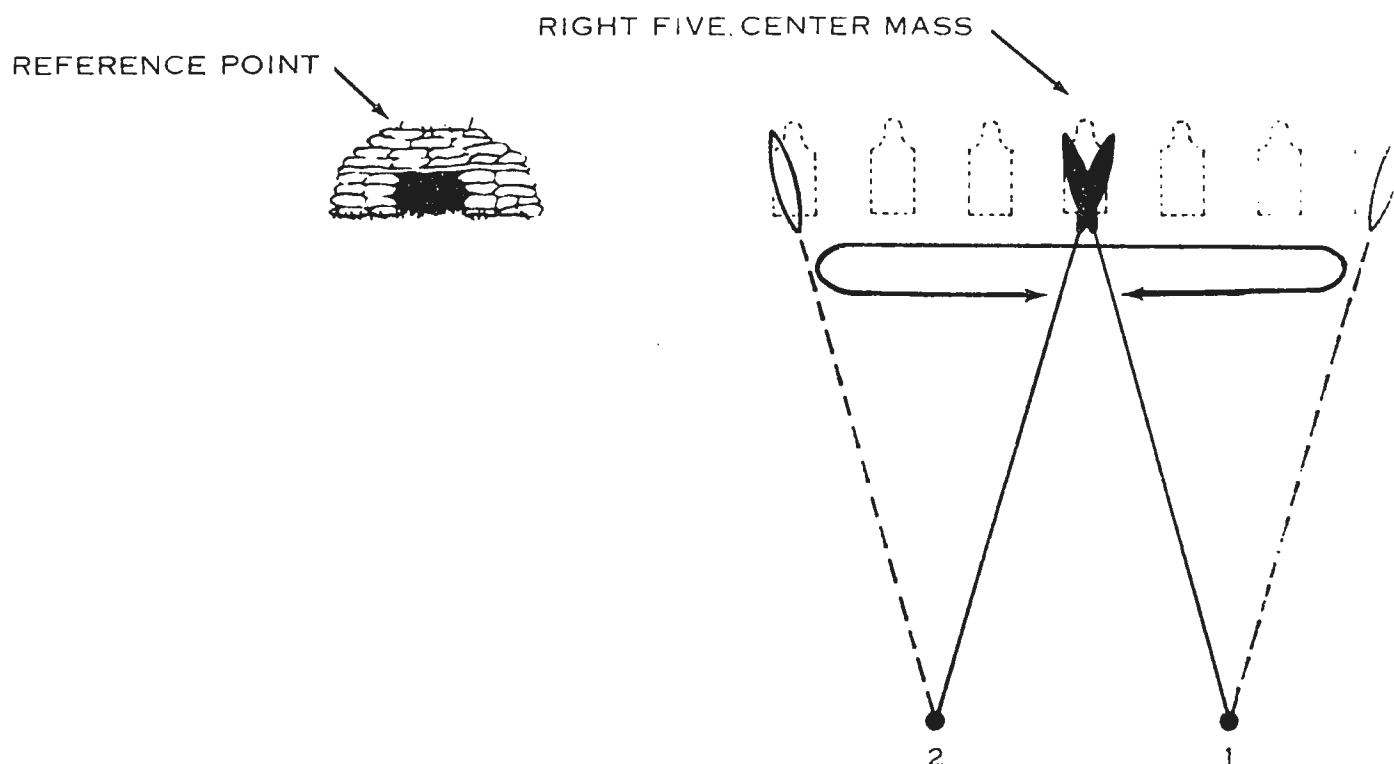


FIGURE 90 ENGAGING INDISTINCT LINEAR TARGETS WITH A REFERENCE POINT OUTSIDE THE TARGET AREA

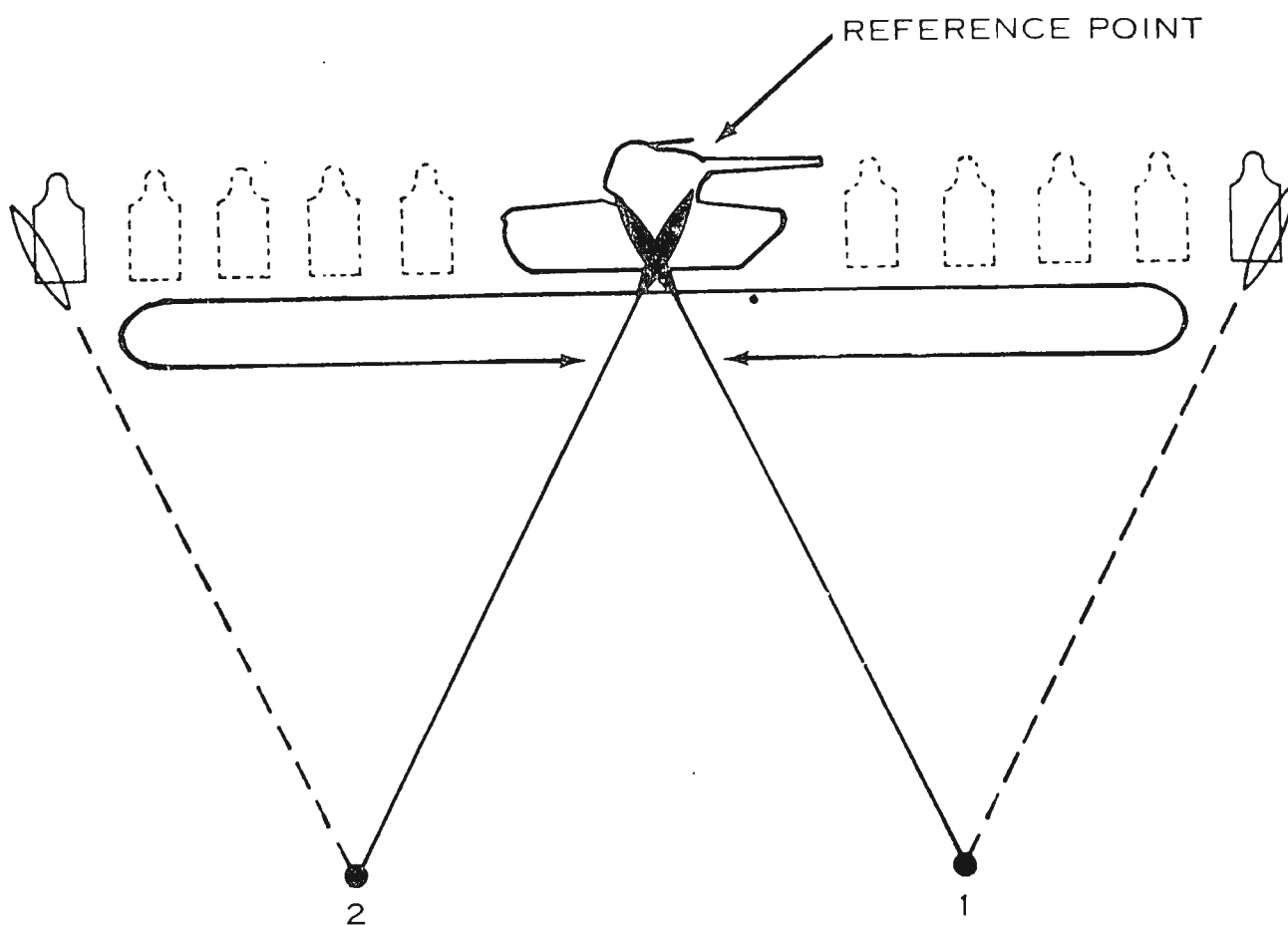


FIGURE 91 ENGAGING INDISTINCT LINEAR TARGETS WITH A
REFERENCE POINT WITHIN THE TARGET AREA

c. Indistinct Deep Targets —

The center of mass of indistinct deep targets may be designated by using reference points in the same manner as for linear targets, except that the extent (depth) of the target is always given in meters. Here is an example of a fire command with the reference point within the target area.

FIRE MISSION

FRONT

REFERENCE: BUNKER, CENTER MASS

TARGET: COLUMN OF TROOPS EXTENDING 100 (METERS) SHORT,
OVER 100 (METERS)

FIRE

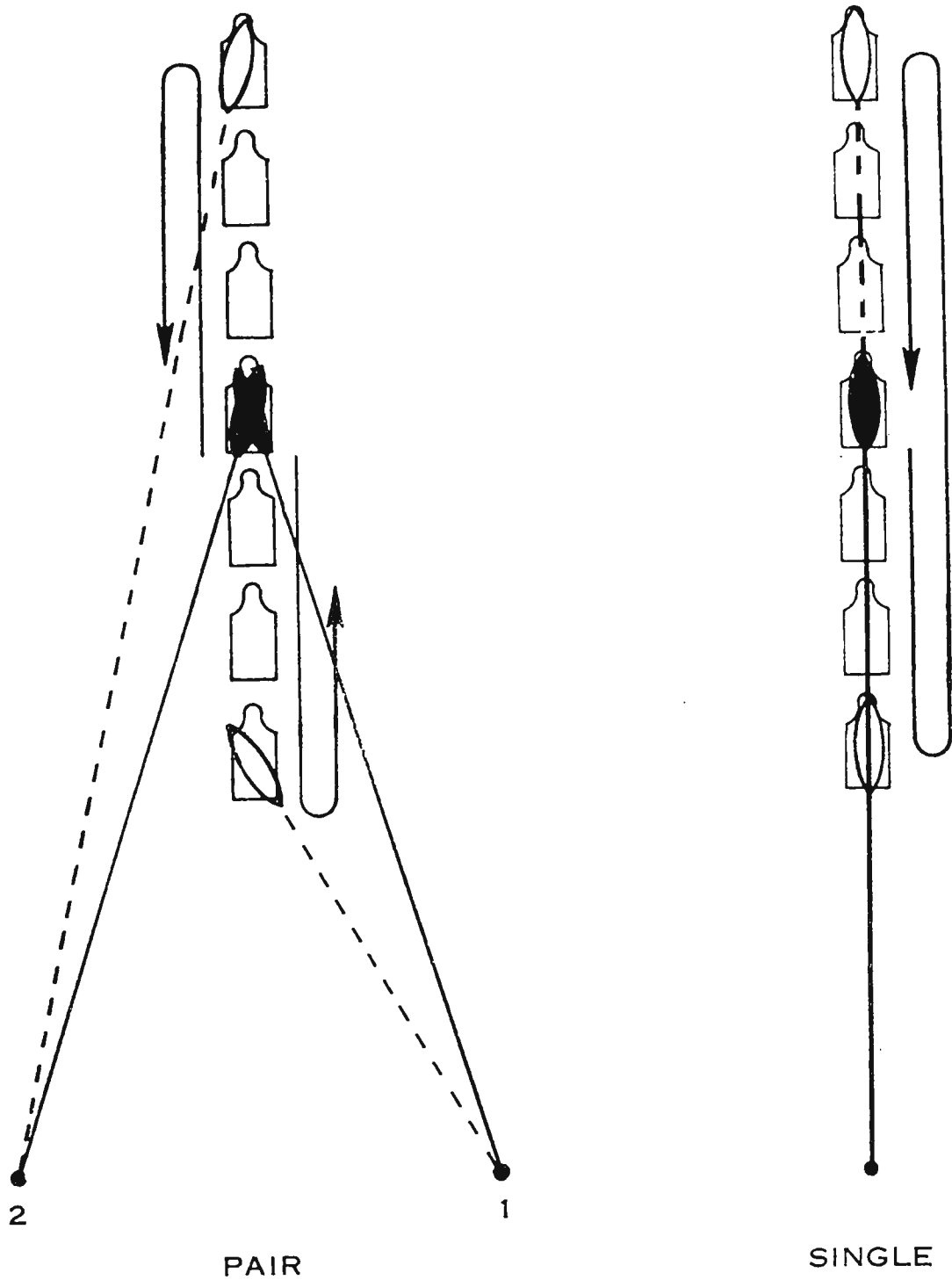


FIGURE 92 ENGAGEMENT OF DEEP TARGETS

Here is an example of a fire command with the reference point outside the target area (indistinct deep target).

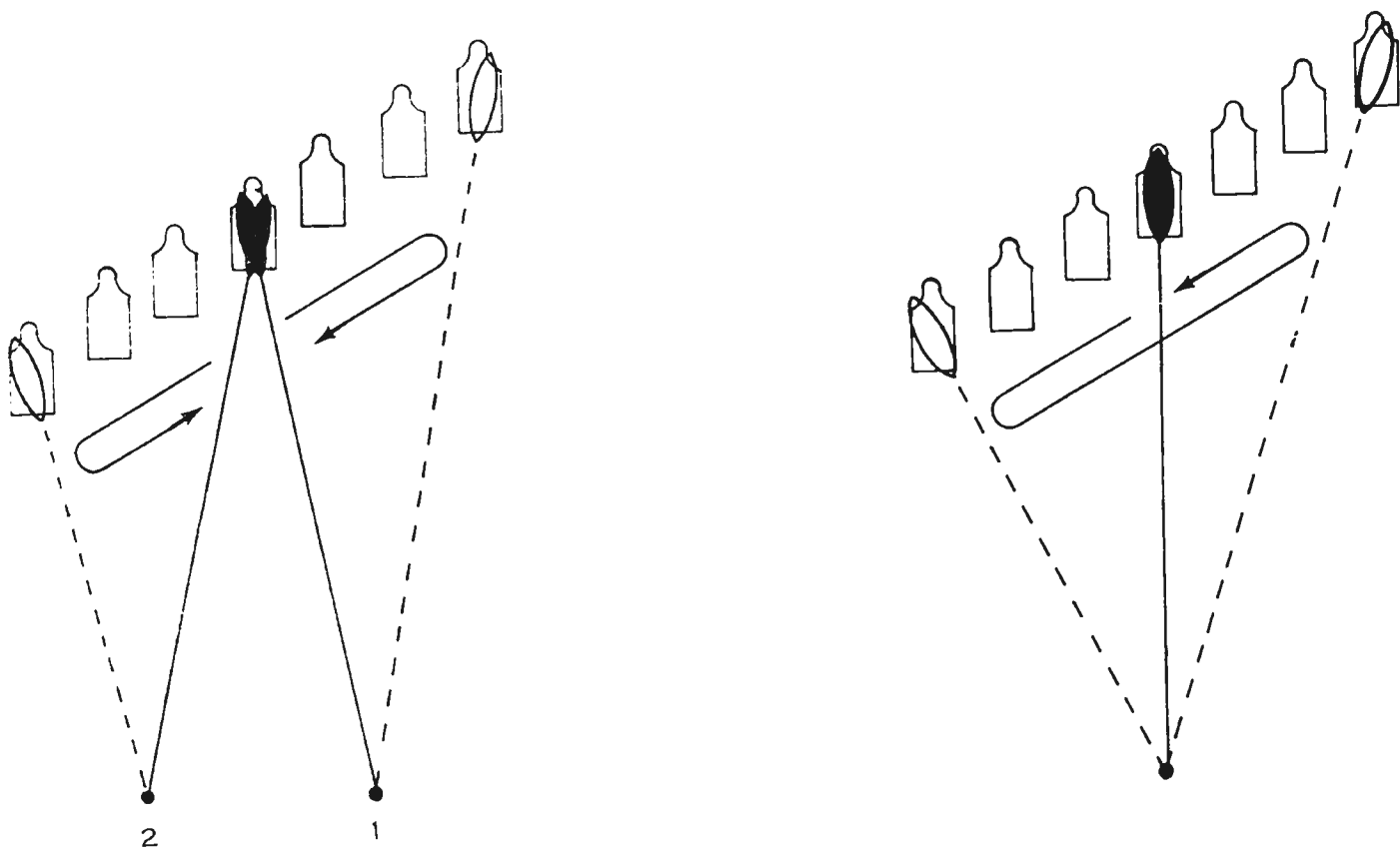
FIRE MISSION
 FRONT
 REFERENCE: BUNKER, RIGHT FOUR, CENTER MASS
 TARGET: COLUMN OF TROOPS EXTENDING SHORT 100, OVER 100
 NINE HUNDRED
 SEARCH
 AT MY COMMAND
 FIRE

90. LINEAR TARGETS WITH DEPTH:

Linear targets with depth are engaged with traversing and searching fire. When range is announced, it is given to the midpoint.

a. Two Guns —

The method of division, the point of initial lay and adjustment, and the extent of manipulation for both guns is the same as that prescribed for linear targets. The gunners employ enough search between each burst to keep the center of impact on the base of the target (figure 93).



PAIR

SINGLE

FIGURE 93 ENGAGEMENT OF LINEAR TARGETS WITH DEPTH

b. One Gun —

A single gunner initially lays and adjusts on the midpoint of a linear target with depth unless some other portion of the target presents a greater threat. The gunner then traverses and searches to the near flank, then back to the far flank (figure 93).

c. Indistinct Linear Targets with Depth —

The flanks and midpoint of an indistinct linear target with depth should be designated with machinegun or rifle fire. The reference point method should not be used because a minimum of two reference points are required to show the angle of the target.

91. AREA TARGETS:

The leader designates an area target by indicating to the gun crew(s) the width and depth of the target. Area targets are engaged with traversing and searching fire.

a. Two Guns —

(1) The target is divided at the center of mass; gun No. 1 fires on the right half and gun No. 2 fires on the left half. The point of initial lay and adjustment for both guns is on the center of mass.

(2) After adjusting fire on the center of mass of the area, fire is distributed by determining the size of the beaten zones and applying direction and elevation changes that cause the most effective coverage of the target area. Gun No. 1 traverses to the right, searches the necessary amount, and fires a burst. He continues traversing and searching up and down until the right flank of the area target has been reached. Gun No. 2 traverses and searches to the left flank in the same manner. Both gunners then reverse the direction of manipulation and return to the center of mass, firing a burst after each combined direction and elevation change (figure 94). Here is an example of a fire command to engage an area target.

FIRE MISSION
FRONT
REFERENCE: LONE PINE TREE, CENTER MASS
TARGET: AREA, LEFT FIVE ZERO, RIGHT FIVE ZERO
SUSTAINED
AT MY COMMAND
FIRE

b. One Gun —

A single gunner engages an area target by laying and adjusting on the center mass, then traversing and searching to either flank. Upon reaching the flank, direction is reversed and the gun is traversed and searched in the opposite direction (figure 94).

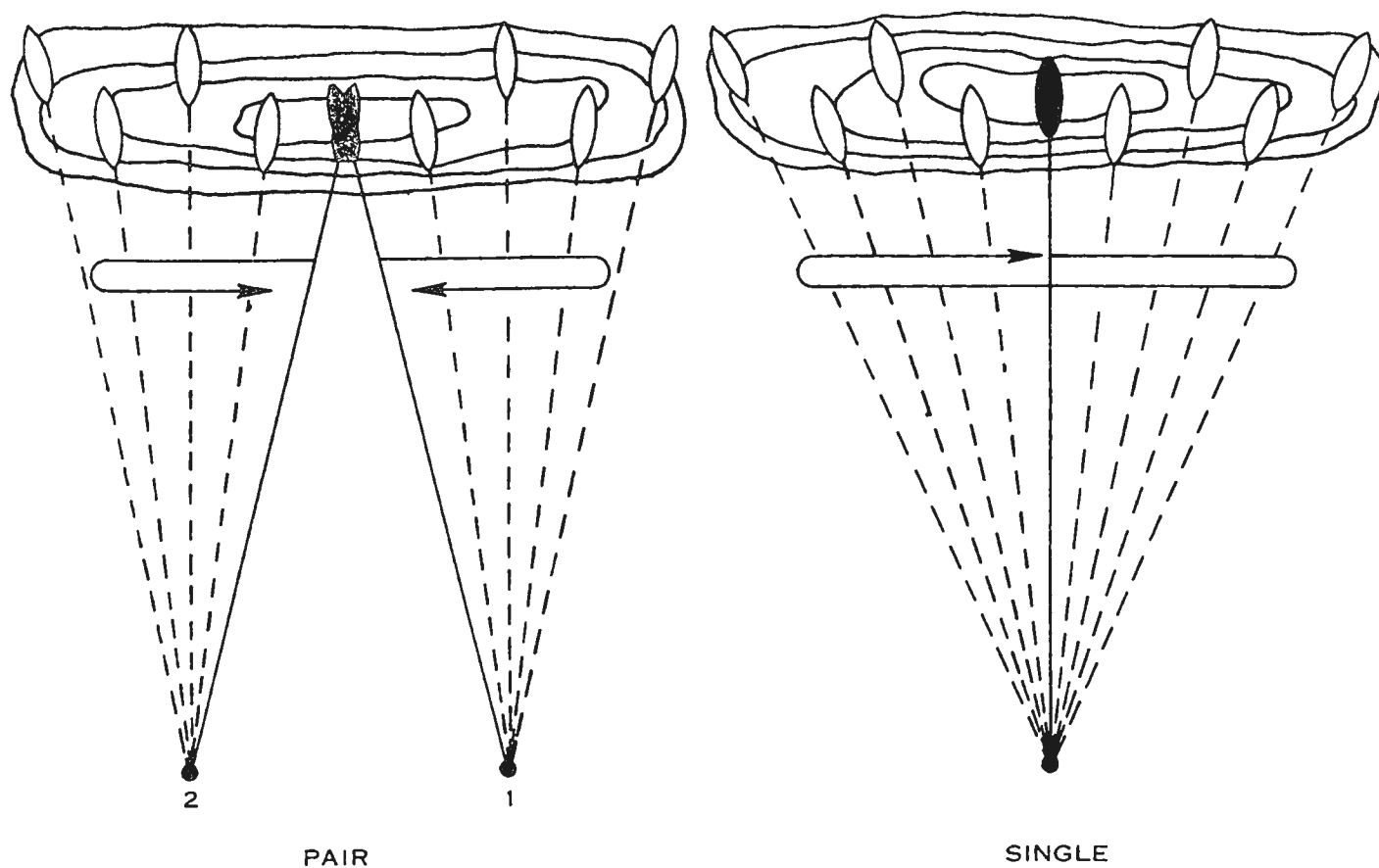


FIGURE 94 ENGAGEMENT OF AREA TARGETS (OBJECTIVE)

92. AERIAL TARGETS:

Aerial targets are engaged using the hip firing position, or free gun from the tripod and vehicular mounts. Solid tracer ammunition should be used whenever possible for ease of observation and adjustment of fire. To obtain hits on an aerial target, the gunner must aim in front of the target at a point that will cause the target and the projectiles from the weapon to arrive at the point simultaneously (figure 95). The gunner must observe the tracer stream and adjust fire as necessary.

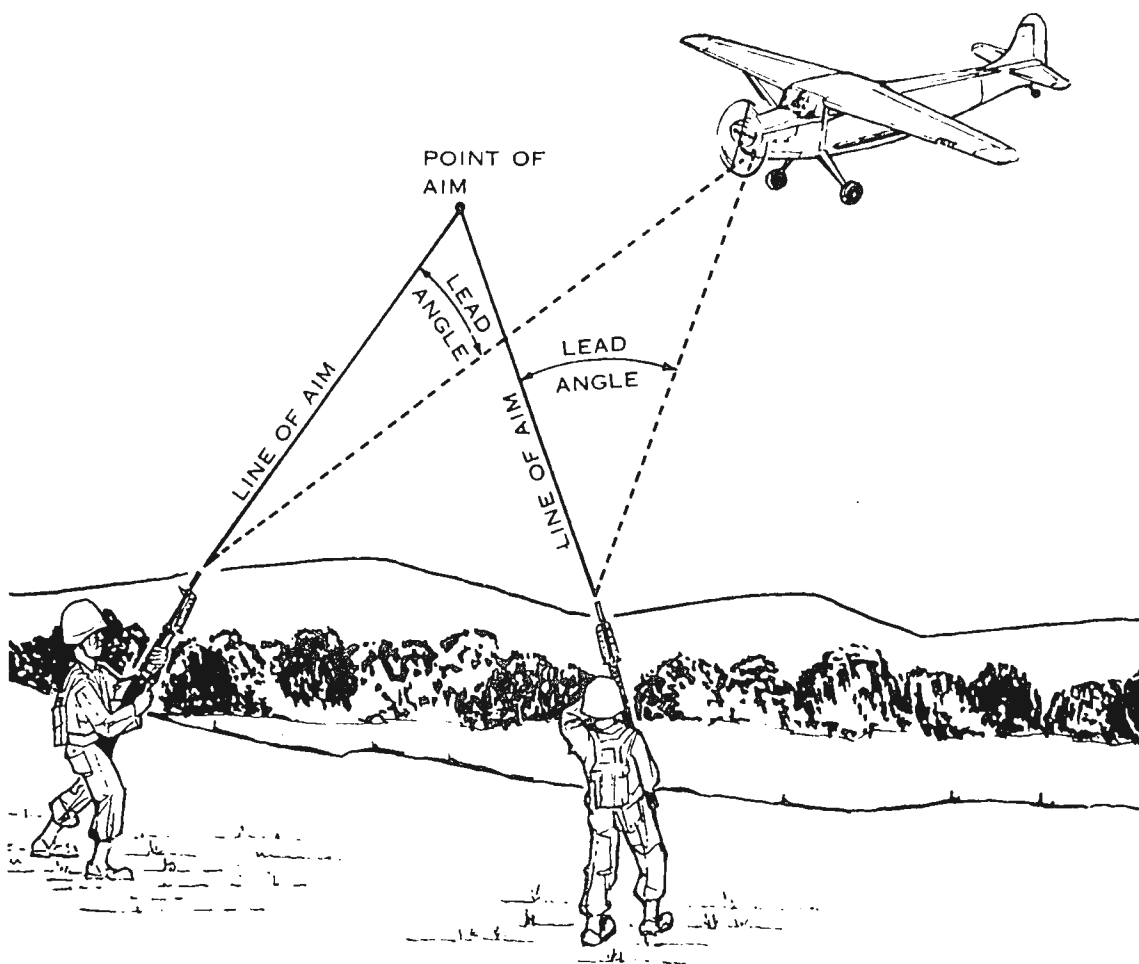


FIGURE 95 ENGAGEMENT OF AERIAL TARGETS

Section VI. ASSAULT FIRE

93. GENERAL:

a. Machineguns need not always be limited to supporting fire roles in the attack. In many situations the leader can obtain maximum effect from the machineguns by placing them on line in the assault. The procedures described in this section are used when assaulting in a line such as during a night attack or during the final stages of a day assault when fire superiority has been gained.

b. To assault successfully, crew members must learn to —

- (1) Deliver fire effectively without alining the sights.
- (2) Move rapidly and maintain alinement in order to arrive on the objective in the shortest possible time.

- (3) Reload rapidly to prevent lulls in the firing.
- (4) Keep the fire down in the objective area.
- (5) Distribute fire properly.

94. FIRING POSITIONS:

There are three firing positions which may be used when firing the gun in the assault. Use of each of the positions at the proper time will enable gunners to place accurate fire on the enemy without alining the sights. With all assault firing positions the gunner adjusts his fire by observing the tracers and the impact of the projectiles in the target area. To provide support for the gun in the assault, a sling is attached to the weapon and placed over the gunner's shoulder. It is primarily used to support the weapon when carried or fired in the underarm and hip positions.

a. Hip Position —

The hip firing position (figure 96) is used when a heavy volume of fire is desired in the target area and rapid movement is not essential. The hip firing position provides good stability but is awkward to use while moving. Not less than nine rounds are fired in each burst. When firing from this position—

- (1) The bipod legs are down for instant use if needed.
- (2) The rear sight is down.
- (3) The left hand grasps the handguard of the forearm assembly.
- (4) The right hand is on the pistol grip.
- (5) The rear of the stock is held firmly against the forward portion of the right thigh.
- (6) The left foot is pointed in the direction of the target during firing.
- (7) The right foot is positioned to the rear to provide stability.
- (8) The gunner leans toward the target before and during firing.

b. Shoulder Position —

The shoulder firing position (figure 97) is used when the gunner desires to hit specific points in the target area and rapid movement is not essential. He pauses momentarily and fires a burst after every two or three steps as the left foot strikes the ground

(right handed firer). A maximum of six rounds is fired in each burst. This position provides the greatest accuracy. When firing from this position-

(1) The rear sight and bipod legs are down. To aim, the gunner places the top of the front sight blade at the center base of the target.

(2) The gunner's hands and feet are placed the same as when firing from the hip position.

(3) The stock of the weapon is held firmly into the shoulder, and the gunner leans toward the target before and during firing.

c. Underarm Position -

The underarm firing position (figure 98) is used when closing with the enemy and a heavy volume of fire and rapid movement are required. During periods of limited visibility this position is used during the entire assault. The gunner's movement is continuous and he fires a short burst each time his left foot strikes the ground. A maximum of six rounds is fired in each burst. When firing from this position-

(1) The rear sight and bipod legs are down.

(2) The gunner's hands and feet are placed the same as when firing from the hip position.

(3) The weapon is held firmly between the right arm and the right side of the chest. The gunner leans forward while firing.

95. SPEED OF MOVEMENT AND MAINTAINING ALINEMENT:

The gun crews must move rapidly and maintain alinement with the other members of the assaulting element in order to reach the objective in mass. To accomplish this the following techniques are used.

a. The gunners move as rapidly as possible, consistent with their ability to fire accurately and maintain alinement.

b. The gun crew(s) maintains alinement by guiding on the designated base man, maintaining visual contact, and sensing the muzzle flashes and blasts to the flanks.

c. The gun crew(s) must not stop during the assault. Stopping disrupts alinement and slows movement.

96. RELOADING:

Gunners and assistant gunners must learn to reload rapidly to avoid lulls in the firing. This can be achieved by practice and by applying the following techniques.



FIGURE 96 HIP FIRING POSITION



FIGURE 97 SHOULDER FIRING POSITION



FIGURE 98 UNDERARM POSITION

a. Reloading Prior to the Assault —

(1) The gunner inspects the extended bandoleer supporter for damage.

(2) The assistant gunner removes the cardboard covers from the tops of the bandoleers, checks the ammunition to insure it is clean and serviceable, and checks the bandoleer loop for serviceability.

b. Reloading During the Assault —

(1) Gunners use their assistant gunners to assist in reloading the weapon; however, if the assistant gunner is hit, the gunner must continue moving forward and reload as rapidly as possible. The sling will allow the gunner to use both hands to reload.

(2) The assistant gunner moves to the left of the gunner carrying a belt of 100 rounds of ammunition, which is attached to the end of the belt in the weapon before it is expended. If the gunner becomes a casualty, the assistant gunner must secure the gun and continue in the assault or move to the objective for the consolidation and reorganization.

97. KEEPING THE FIRE DOWN:

a. Gunners have a tendency to fire high in the assault. To overcome this they must be trained to make a bold depression of the muzzle when firing, and then adjust upward. It is easier to adjust upward than downward, and by firing low, maximum effect is obtained from ricochets.

b. The use of tracer ammunition provides a means of adjusting fire. At night, solid tracer ammunition should be used. In addition to providing a means of adjusting fire, it aids in illuminating the objective area and has a demoralizing effect on the enemy.

98. DISTRIBUTING FIRE:

To insure that fire is properly distributed over the objective area, gunners fire and adjust rapidly and continuously on as much of the objective area as possible without endangering friendly troops, giving priority to enemy automatic weapons.

Section VII. OVERHEAD FIRE

99. GENERAL:

a. Overhead fire is delivered over the heads of friendly troops. During training it is used only when troop safety has been proven. The terrain and visibility dictate when overhead fire can be used safely.

b. Overhead fire cannot be safely delivered on a target at a range greater than 850 meters from the gun, and it is not delivered over level or uniformly sloping terrain.

100. DELIVERY OF OVERHEAD FIRE:

a. Overhead fire is delivered with guns on tripod because of the greater degree of stability and accuracy and the capability of measuring precise vertical mil angles by using the elevating mechanism.

b. Ideally, overhead fire is delivered when a depression in the terrain exists between the gun position and the target. The depression should be such that the gunner's line of aim is well above the heads of friendly troops (figure 99).

c. Control is normally accomplished by the weapons leader. He lifts or shifts the fire when the feet of the troops in the element being supported reach an imaginary line drawn parallel to the target where further fire would cause casualties to friendly troops. This imaginary line is called the safety limit (figure 99). In some instances the leader of the element being supported will direct lifting of fire at the proper time by prearranged signals which can be transmitted by radio, wire, or visual means.

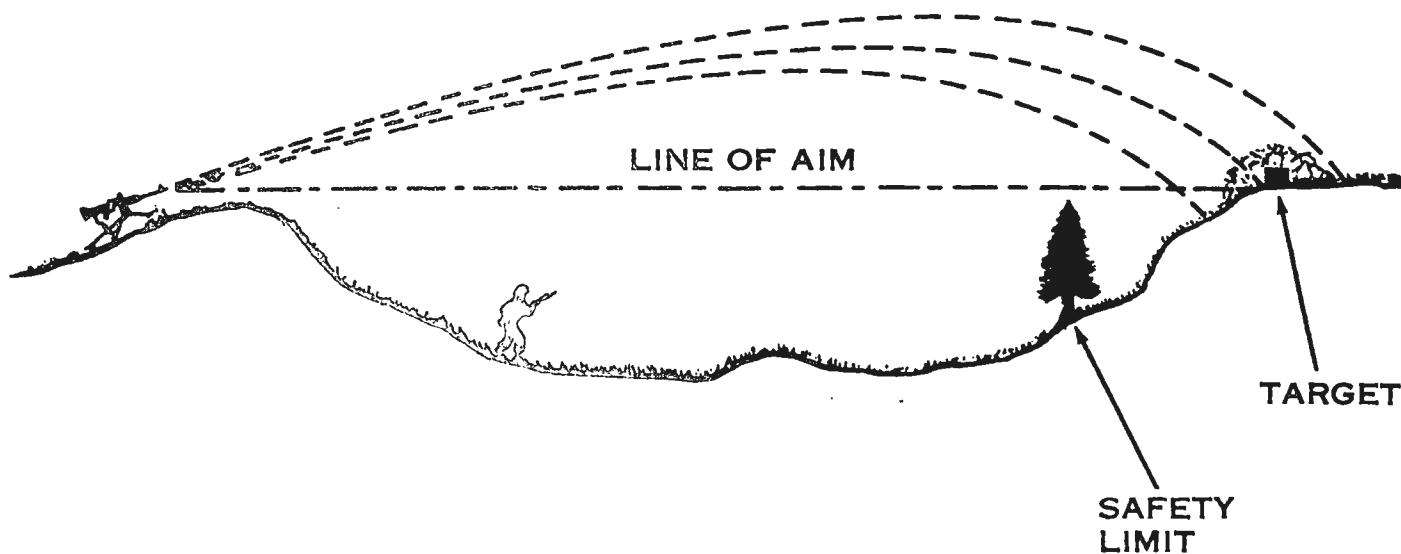


FIGURE 99 DELIVERING OVERHEAD FIRE

101. DETERMINING THE SAFETY LIMIT:

The safety limit can be determined by observation of the fire or by using the gunner's rule (paragraph 101b).

a. To determine the safety limit by observation the leader uses binoculars to observe the fire with relation to advancing friendly troops.

b. A safety limit can be selected prior to firing the gun by using the gunner's rule. The accuracy and safety of this method depends on the weapon being accurately zeroed and the range to the target being correctly determined (paragraph 74). The gunner's rule is used only when the target is between 350 and 850 meters from the gun. To use the gunner's rule

(1) Determine the range to the target and set the range on the rear sight.

(2) Lay the gun to hit the target.

(3) Raise the rear sight slide to 1,100 meters..

(4) Depress the muzzle of the weapon 10 mils by using the elevating handwheel (one click equals one mil).

(5) Look through the rear sight and note the point where the new line of aim strikes the ground. An imaginary line drawn through this point and parallel to the target is the safety limit.

(6) Reset the range to the target on the rear sight, relay on the target, and prepare to fire.

102. PRECAUTIONS FOR OVERHEAD FIRE:

The following safety measures must be considered in delivering overhead fire.

a. Firmly emplace the tripod mount.

b. Use depression stops to prevent the muzzle of the gun from accidentally being lowered below the safety limit.

c. Do not deliver overhead fire through trees.

d. Inform commanders of friendly troops when fire is to be delivered over their heads.

e. Insure that all members of the gun crew are aware of the safety limit.

f. Do not deliver overhead fire if the range from the gun to the target is less than 350 meters or exceeds 850 meters

g. Do not use a barrel which has excessive muzzle blast or is otherwise determined to be badly worn.

h. During training exercises —

(1) Do not lay machineguns so their fire will cross at any point over the heads of friendly troops.

(2) Consult local safety regulations concerning overhead fire.

Section VIII. POSITION DEFILADE

103. GENERAL:

In order to achieve maximum effectiveness, the machinegun(s) must be employed using the technique of direct lay; however, at times it may be desirable to employ guns from position defilade. A machinegun is in position defilade when the gun and its crew are hidden from enemy ground observation by a land mass such as the crest of a hill. The position may be on the reverse side of the mask or the forward slope of the next high ground in the rear of the mask or in a small fold in the ground (figure 100). The machinegun on bipod mount is not fired from position defilade due to the difficulties encountered in adjusting fire when the gunner cannot see the target.

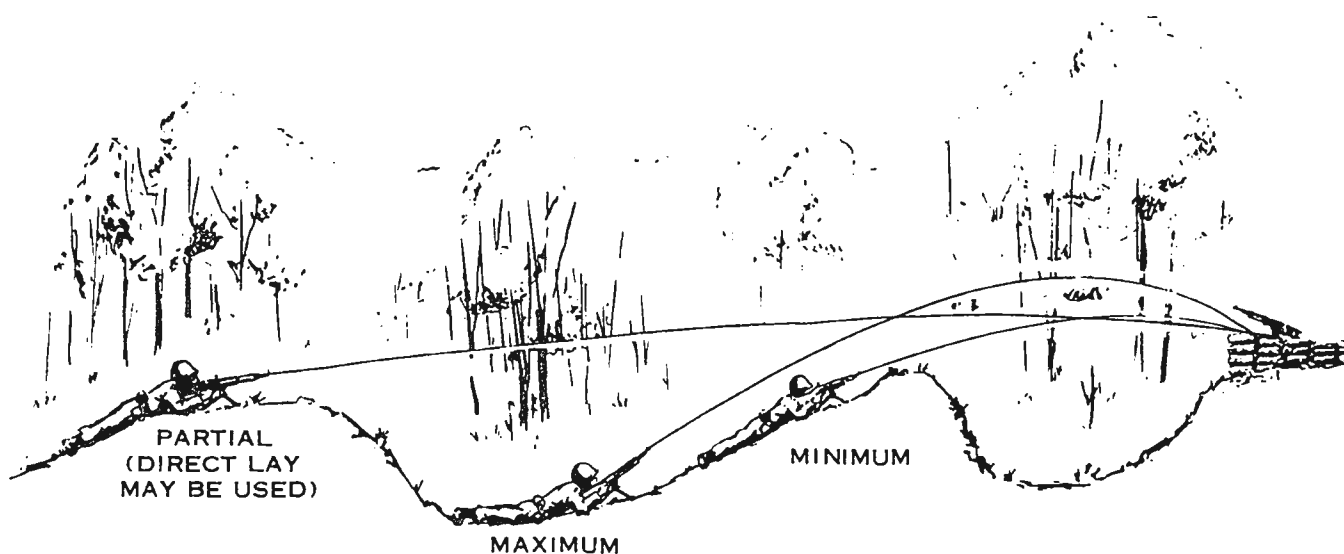


FIGURE 100 TYPES OF POSITION DEFILADE

a. Advantages —

(1) The gun crew(s) have cover and concealment from aimed small arms fire.

(2) The crew has some freedom of movement in the vicinity of the gun position.

(3) Control and supply are facilitate.

(4) The characteristic smoke and flash of the gun is less easily observed by the enemy.

b. Disadvantages —

(1) Rapidly moving ground targets are not easily engaged because adjustment of fire must be made through an observer.

(2) Targets close to the mask usually cannot be engaged.

(3) It is difficult to obtain a final protective line.

104. TYPES OF POSITION DEFILADE:

a. Maximum Position Defilade —

A gun is in maximum position defilade when it is at the lowest point on a slope from which it can engage the target (figure 100). It has relatively good cover but lacks flexibility in engaging new targets.

b. Minimum Position Defilade —

A gun is in minimum position defilade when it is at the highest point on a slope at which position defilade can be obtained (figure 100).

c. Partial Defilade —

A gun is in partial defilade when a mask provides the gun and crew with some protection from enemy direct fire, and the gunner is still able to engage the target by direct laying techniques (figure 100).

105. TARGET ENGAGEMENT:

The essential elements in the engagement of a target from position defilade are mask clearance, direction, elevation, and adjustment of fire. If possible, a minimum mask clearance (minimum elevation) will be determined for the entire sector of fire. However, it may be necessary (due to the slope of the mask) to establish clearance for each individual target.

a. Establishing Mask Clearance —

(1) If the mask is 300 meters or less from the gun position, place a 300-meter range setting on the rear sight, lay on the top of

the mask, and add three mils (clicks) of elevation with the elevating handwheel.

(2) If the mask is over 300 meters from the gun position, place the range setting to the mask on the rear sight, lay on top of the mask, and add three mils (clicks) of elevation.

(3) The elevation reading(s) obtained using the methods outlined in (1) and (2) above, give the minimum elevation for the sector or targets. The minimum elevation should be recorded.

b. Laying the Gun for Direction —

The observer places himself to the rear of the gun on the gun-to-target line and in a position where he can see the gun and the target (figure 101). He alines the gun for general direction by directing the gunner to shift the mount and/or gun until it is alined on the target. A prominent terrain feature or landmark visible to the gunner through his sights is selected as an aiming point. This aiming point should be at a greater range than the target and at a higher elevation. When laying the gun on the aiming point, the range setting on the rear sight must correspond to the range to the target.

(1) If the aiming point is on the gun to target line, the gun is laid on the aiming point and is thereby alined for direction.

(2) If the aiming point is not on the gun to target line, the horizontal distance in mils is determined using the best means available (binoculars) and announced to the gunner. This measured distance is then laid off with the traversing handwheel.

c. Laying the Gun for Elevation —

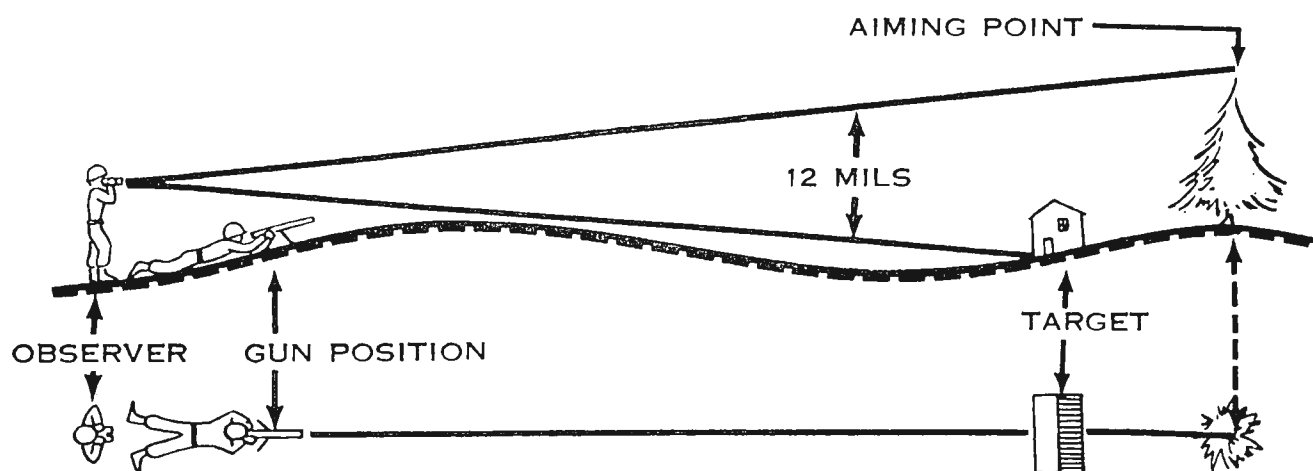
The observer measures the vertical distance from the aiming point to the base of the target using the best means available and directs the gunner to depress the muzzle of the gun the number of mils measured. The gun should now be laid to hit the target (figure 101).

d. Control —

Control of fire from position defilade is accomplished by an observer (who can see the target) standing at or near the gun (figure 101). An example of a fire command used to engage a target from position defilade is—

AS LAID (The gun has already been laid for direction and
elevation)
AT MY COMMAND
FIRE

Adjustment of fire is accomplished by the leader or a member of the machinegun crew acting as the observer.



1-AIMING POINT ON GUN TO TARGET LINE.

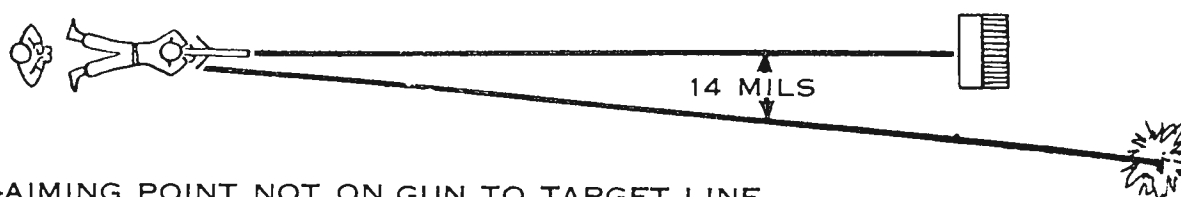
RANGE GUN-TARGET IS 1000 METERS

DIRECTION:

WITH REAR SIGHT SET AT 1000 METERS. LAY GUN ON AIMING POINT.

ELEVATION:

DEPRESS GUN 12 MILS.



2-AIMING POINT NOT ON GUN TO TARGET LINE.

RANGE GUN-TARGET IS 1000 METERS.

TARGET IS 14 MILS LEFT OF AIMING POINT.

DIRECTION:

WITH REAR SIGHT SET AT 1000 METERS. LAY GUN ON AIMING POINT.

TRAVERSE GUN LEFT 14 MILS.

ELEVATION:

DEPRESS GUN 12 MILS.

FIGURE 101 FIRING FROM POSITION DEFILADE

REVIEW QUESTIONS

1. Fundamentals of machinegun firing include _____
_____, _____, _____,
_____, and _____.
2. The path of the projectile in its flight is called _____.
3. The highest point which the projectile reaches above an imaginary line from the muzzle of the gun to the base of the target is called _____.
4. The pattern formed by the multiple trajectories of each burst of fire is called the _____.
5. The area where the projectiles strike the ground or the target is called the _____.
6. The space between the gun and the target where the trajectory does not rise above 1.8 meters is _____.
7. Machinegun fire is classified with respect to the _____,
_____, and _____.
8. Fire with respect to the ground are _____ and _____.
9. Fire with respect to the target are _____,
_____, and _____.
10. Fire with respect to the gun are _____,
_____, _____,
_____, and _____.
11. In combat the most commonly used methods of range determination are _____ and _____.

12. The two methods of estimating range by the eye are _____
_____ and the _____
_____.
13. The two methods of measuring lateral distance are from the
_____ mounted gun and the _____
method.
14. Fire commands are either _____, or _____.
15. The six elements of the fire command are _____,
_____, _____, _____, and the
_____.
16. To interrupt firing the leader announces _____.
17. To terminate the alert, the leader announces _____,
_____.
18. The five types of targets as discussed in this handout consist of
_____ targets, _____ targets, _____
_____, _____ targets, and _____ targets.
19. The three rates of fire for the machinegun are _____,
_____, and _____.
20. Ground targets are initially engaged using the _____ or _____
rate of fire to _____.
21. A line of troops abreast would be engaged with _____ fire.
22. A column of troops would be engaged with _____ fire.
23. Aerial targets are engaged using the _____ firing position, or
_____ from the tripod or vehicular mounts.

24. The assault firing positions are _____, _____, and _____°.
25. During periods of limited visibility the _____ position is used during the assault.
26. Overhead fire cannot be delivered on a target at a range greater than _____ meters from the gun.
27. The safety limit for delivery of overhead fire can be determined by _____ of the _____ or by using the _____°.
28. A machinegun is in _____ when the gun and its crew are hidden from enemy ground observation..

NOTES

CHAPTER 7

TECHNIQUES OF FIRE DURING PERIODS OF LIMITED VISIBILITY

Section I. GENERAL

106. GENERAL:

a. This chapter provides guidance in machinegun firing techniques during periods of limited visibility. Periods of limited visibility refer not only to periods of darkness, but also to periods during day-time operations when visibility is impaired by conditions such as smoke, fog, rain, or snow. This chapter also discusses terms frequently used in techniques of fire during periods of limited visibility.

b. Machinegunners encounter several difficulties while defending during periods of limited visibility. These difficulties preclude the use of many of the daylight techniques of engaging targets.

(1) During periods of limited visibility the machinegun sector cannot be observed in depth as during normal daylight periods. Most targets are difficult to detect, and in some instances it is difficult to detect targets at all.

(2) In some instances visibility will be so limited that the leader cannot control the fires of his guns by selecting and directing fire on targets as he would do during periods of good visibility. Oral commands are not dependable, arm-and-hand signals cannot be seen, and personal contact with the gunners is difficult.

(3) At night there is a tendency for the machinegunners to fire indiscriminately at noises and suspected enemy locations other than preplanned target areas.

c. In order to overcome the difficulties encountered during periods of limited visibility, special techniques must be developed for engagement of visible targets and in delivering preplanned fires by the use of range cards.

107. TERMS:

This paragraph defines and discusses terms frequently used in technique of fire during periods of limited visibility.

a. Sector of Fire —

An area (to be covered by fire) assigned to an individual or unit. Machineguns are normally assigned two sectors of fire, a primary and a secondary.

b. Final Protective Line —

A predetermined line along which grazing fire is placed to stop an enemy assault. This line is fixed as to direction; however, a few mils of search are employed while firing to compensate for irregularities in the terrain. The final protective line can be delivered regardless of conditions of visibility. The final protective line always corresponds to the inner limit of the primary sector which ideally is assigned close to the forward edge of the battle area (FEBA). When terrain permits, final protective lines are assigned machineguns along the FEBA as a part of the final protective fires of the defending unit.

c. Sector of Graze —

A wedge shaped area of terrain, formed by assigned sector limits, which affords continuous knee high grazing fire (one meter high maximum) from the muzzle of the weapon out to the first major break in the terrain (figure 109). The sector of graze is fired using swinging traverse with the tripod mounted gun in the primary sector. It can be fired in the secondary sector in conjunction with field expedients by freeing the traversing and elevating mechanism, using the tripod mount as a pivot, or by using the bipod mounted gun (paragraph 11³d). A sector of graze can be delivered regardless of the condition of visibility.

d. Principal Direction of Fire —

A priority direction of fire which marks the center of a specific principal area assigned to a weapon. This area may extend from the gun position to the maximum effective range of the weapon and is, therefore, not fixed for elevation. Visible targets appearing in the principal direction of fire take priority over targets which may appear elsewhere in the sector. A principal direction of fire may be assigned to cover an area which provides good fields of fire, a likely avenue of foot approach, or to mutually support an adjacent unit.

(1) Principal direction of fire day — A primary direction of fire which marks the center of a specific principal area assigned to a weapon to be covered during periods of good visibility.

(2) Principal direction of fire night — A priority direction of fire which marks the center of a specific principal area assigned to a weapon to be covered during periods of limited visibility.

e. Area of Graze —

An area, other than the sector of graze, within a sector of fire which is covered by grazing fire. Grazing fire need not be continuous from the muzzle of the weapon to the area over which grazing fire is desired (figure 110). Areas of graze are normally areas of tactical significance such as likely routes or avenues of approach. A gunner uses traversing fire to cover areas of graze and employs a few mils of searching fire to compensate for irregularities in the terrain.

Section II. TECHNIQUES OF ENGAGING VISIBLE TARGETS DURING PERIODS OF LIMITED VISIBILITY

108. GENERAL:

A gunner's ability to detect and identify targets during periods of limited visibility will vary depending upon the amount of natural and artificial illumination. Complete definition of these targets as to the exact size and flanks will in many cases be questionable.

109. TYPES OF TARGETS:

Normally two types of targets will appear in the machinegunner's sector of fire during periods of limited visibility:

a. Enemy personnel in platoon or squad size formations which will be linear, linear targets with depth, or deep targets.

b. Supporting automatic weapons and assaulting enemy personnel which will be point targets.

110. FIRE CONTROL:

Since the leader cannot effectively direct the fires of his guns during periods of limited visibility as he does during good visibility, initiative is required of the gunners. When targets within their sectors become visible to gunners, they must engage these targets without command and continue to fire until these targets have been neutralized. Gun crews engage targets only when they can identify them unless ordered to do otherwise. As an example, if one gunner detects a target and engages it, the other gunner(s) will observe the area in which fire is being placed and will add his fire only if he can identify the target or if he is ordered to place fire in the area.

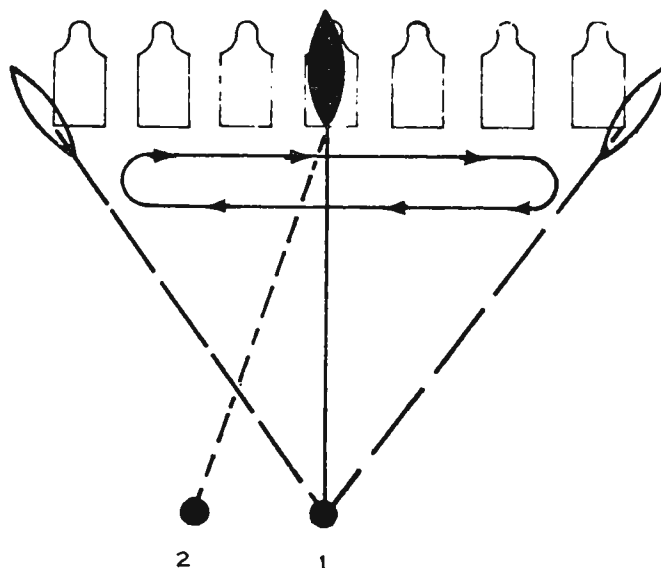
111. TARGET ENGAGEMENT:

a. Solid tracer ammunition will enable a gunner to more effectively engage visible targets during periods of limited visibility and should be used when possible. Gunners must be trained to fire low initially,

and adjust up when engaging targets during periods of limited visibility. This aids in overcoming the tendency to fire high during these conditions.

b. When engaging linear, linear targets with depth, and deep targets, no attempt is made to divide these targets (when two or more guns are engaging the same target) as is done during periods of good visibility. During periods of limited visibility, the center and flanks of these targets will not be clearly defined; therefore, each gunner observes his tracers and covers what he believes to be the entire target. To effectively engage -

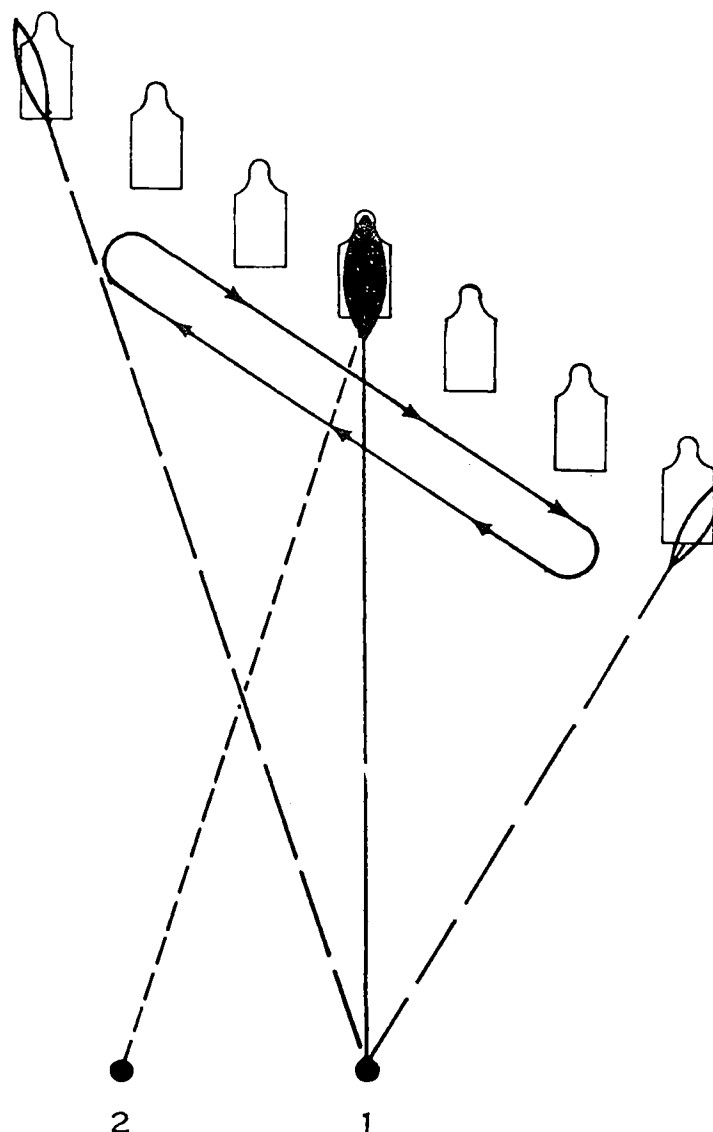
(1) Linear targets - the gunner(s) lays on what he considers to be the center of mass of the target. With the tripod mounted gun, he uses swinging traverse fire and maintains his beaten zone on the base of the target (figure 102). With the bipod mounted gun, the gunner traverses rapidly back and forth across the target by selecting successive aiming points.



ONE OR BOTH GUNS INITIALLY LAY ON CENTER OF MASS.
THEN TRAVERSE WHAT IS CONSIDERED TO
BE THE ENTIRE TARGET. GUNNER(S) MAY
TRAVERSE IN "EITHER" DIRECTION.

FIGURE 102 ENGAGEMENT OF A LINEAR TARGET DURING
PERIODS OF LIMITED VISIBILITY

(2) Linear targets with depth - the gunner(s) lays on what he considers to be the center of mass of the target, then traverses and searches it first, covering the side which is closest to his position. With the tripod mounted gun, swinging traverse fire combined with searching fire is used to cover the target (figure 103). With the biped mounted gun, the gunner selects successive aiming points, covering what is considered to be the entire target by observing his tracers.



ONE OR BOTH GUNS INITIALLY LAY ON THE CENTER OF MASS. TRAVERSE AND SEARCH DOWN AND THEN UP. COVERING WHAT IS CONSIDERED TO BE THE ENTIRE TARGET.

FIGURE 103 ENGAGEMENT OF LINEAR TARGET WITH DEPTH DURING PERIODS OF LIMITED VISIBILITY

(3) Deep targets - the gunner(s) lays on what he considers to be the center of mass of the target, then searches it. The direction of search is down to what is considered the near end, then up to what is considered the far end. With the tripod mounted gun, the target is searched by using the elevating handwheel. To facilitate rapid lateral adjustments, the traversing slide is left loose. While searching the target, the gunner traverses a few mils to either side of his line of search by applying shoulder pressure to the stock of the weapon (figure 104). With the bipod mounted gun, the gunner covers the entire target by selecting successive aiming points and observing his tracers.

c. The types of point targets with which machinegunners will be concerned during periods of limited visibility, particularly at night, are enemy automatic weapons and assaulting enemy personnel.

(1) Enemy automatic weapons - Point targets such as automatic weapons may be identified during conditions of limited visibility by their muzzle flashes. To effectively engage these targets, field expedients are used to aid in alining the weapon sights on these targets (figure 105). Fire should be delivered in a heavy volume and adjusted on these targets by observing the tracer stream.

(2) Assaulting enemy personnel - During the final stages of an enemy assault, machineguns normally fire final protective fires; however, it may be necessary to engage individual enemy soldiers if they are observed in the proximity of the gun position. When engaging these types of targets with the tripod mounted gun, the type of fire employed is normally free gun, which allows rapid shifting of fire from one point to another.

Section III. TECHNIQUES OF DELIVERING PREPLANNED FIRES

112. GENERAL:

In addition to engaging appropriate visible targets, the machinegunner must be able to deliver preplanned fires during periods of limited visibility. These fires are used to cover target areas of tactical significance such as routes, avenues of approach, anticipated enemy supporting weapons positions, probable enemy assault positions, and to establish sectors of graze and final protective lines.

113. OBTAINING GRAZING FIRE:

For maximum effect in all preplanned target areas, grazing fire should be obtained when possible. Grazing fire must be obtained for final protective lines, sectors of graze, and areas of graze. Grazing fire may be obtained within a sector of fire over various types of terrain.

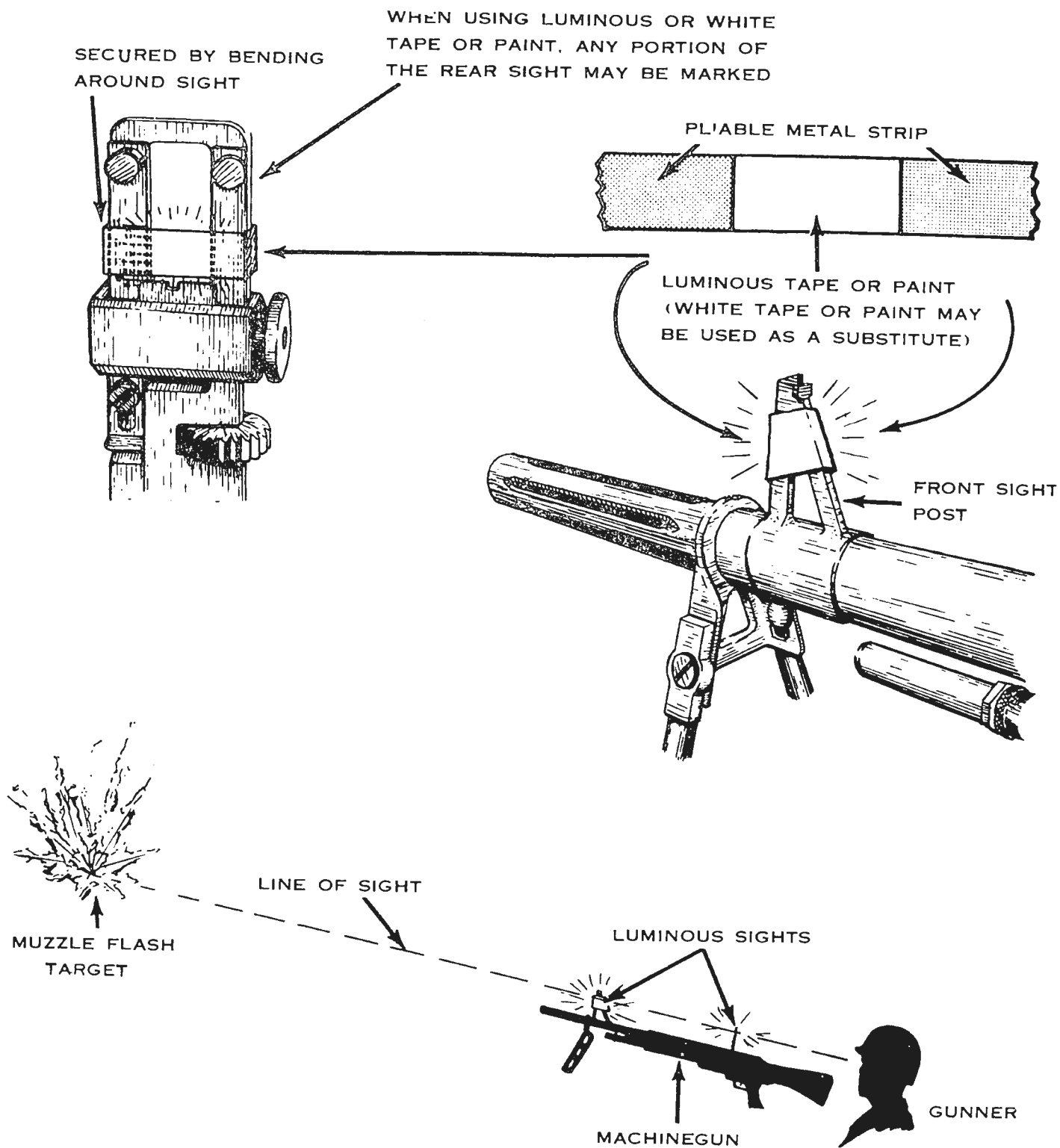


FIGURE 105 FIELD EXPEDIENT NIGHT SIGHT AND SIGHT PICTURE FOR THE M60 MACHINEGUN

a. Obtaining the Maximum Extent of Grazing Fire Over Level or Uniformly Sloping Terrain (figure 106) —

To obtain the maximum extent of grazing fire with the M60 machinegun, the gunner sets the rear sight at 600 meters, selects a point on the ground which he determines to be at a range of 600 meters, lays, fires, and adjusts on this point. At no time will the center of the cone of fire rise above more than one meter from the ground.

SET SIGHTS AT 600 METERS
LAY ON POINT 600 METERS
FROM GUN.

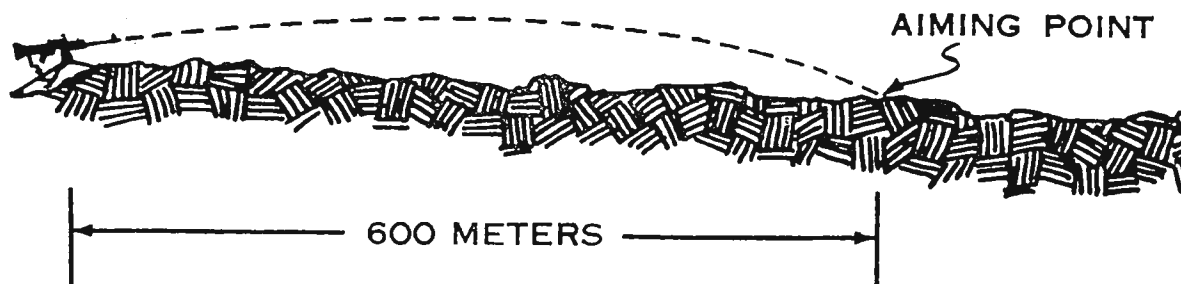


FIGURE 106 OBTAINING THE MAXIMUM EXTENT OF GRAZING FIRE
OVER LEVEL OR UNIFORMLY SLOPING TERRAIN

b. Obtaining the Maximum Extent of Grazing Fire Over Irregular Terrain (figure 107) —

If the gunner concludes that he cannot obtain 600 meters of grazing fire because of a major break in the ground at a range of less than 600 meters, he places the range to the break on his rear sight and lays, fires, and adjusts on the break. At no time will the center of the cone of fire rise more than one meter between the gun and point of lay of the weapon.

c. Determining the Extent of Grazing Fire on a Final Protective Line —

The extent of grazing fire on the final protective line is determined using the techniques described in a and b above. Any intermediate breaks in the terrain along this line which cannot be covered by grazing fire from a gun firing along the line is considered as deadspace (figure 108). Deadspace includes streams, ravines, and shell craters. The location and extent of deadspace may be determined in two ways.

SET SIGHTS AT RANGE TO BREAK.
LAY ON BREAK.

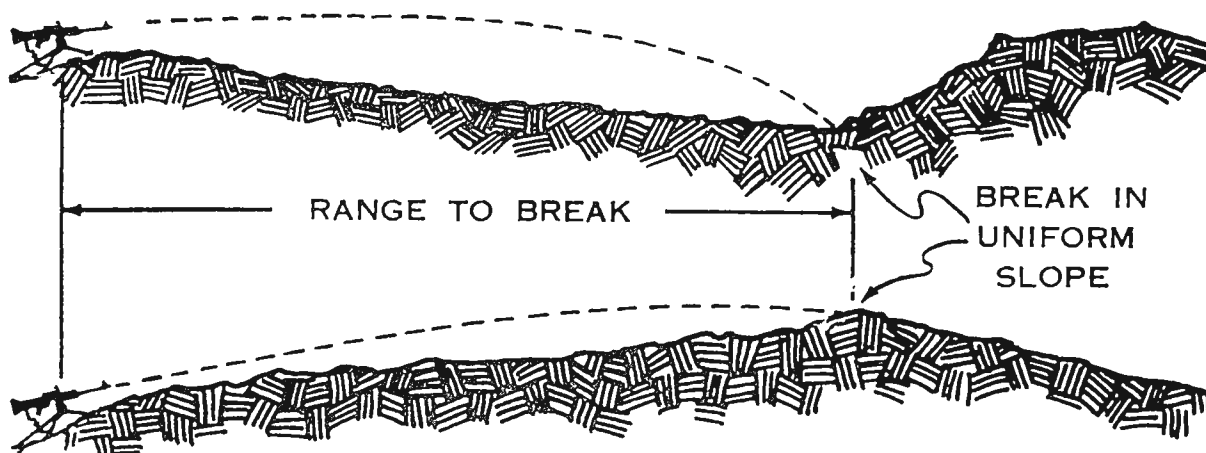


FIGURE 107 OBTAINING THE MAXIMUM EXTENT OF GRAZING FIRE
OVER IRREGULAR TERRAIN

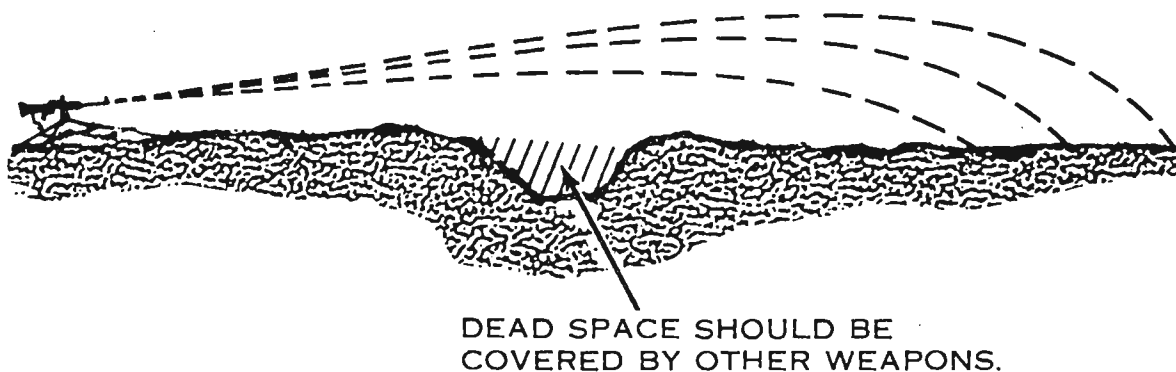


FIGURE 108 DEADSPACE

(1) Walking the final protective line - After the gun is laid for direction and elevation, a member of the gun crew walks the final protective line while the gunner looks through his sights. Anytime the individual's waist falls below the gunner's line of aim, deadspace exists.

(2) Observing fire - By observing the flight of tracer ammunition from behind or from the flank of the gun position deadspace may be determined.

d. Determining the Amount of Grazing Fire in a Sector of Graze -

A sector of graze exists over uniformly sloping or level terrain anytime the machinegun is fired at a target which can be engaged with a sight setting of 600 meters or less. The ranges to the extent of grazing fire in a sector of graze are determined by observation of the terrain and by observation of the tracer stream from behind the gun or from a flank of the gun. Normally the extent of grazing fire within this area will be much less than on a final protective line and will form an irregular pattern as shown in figure 109.

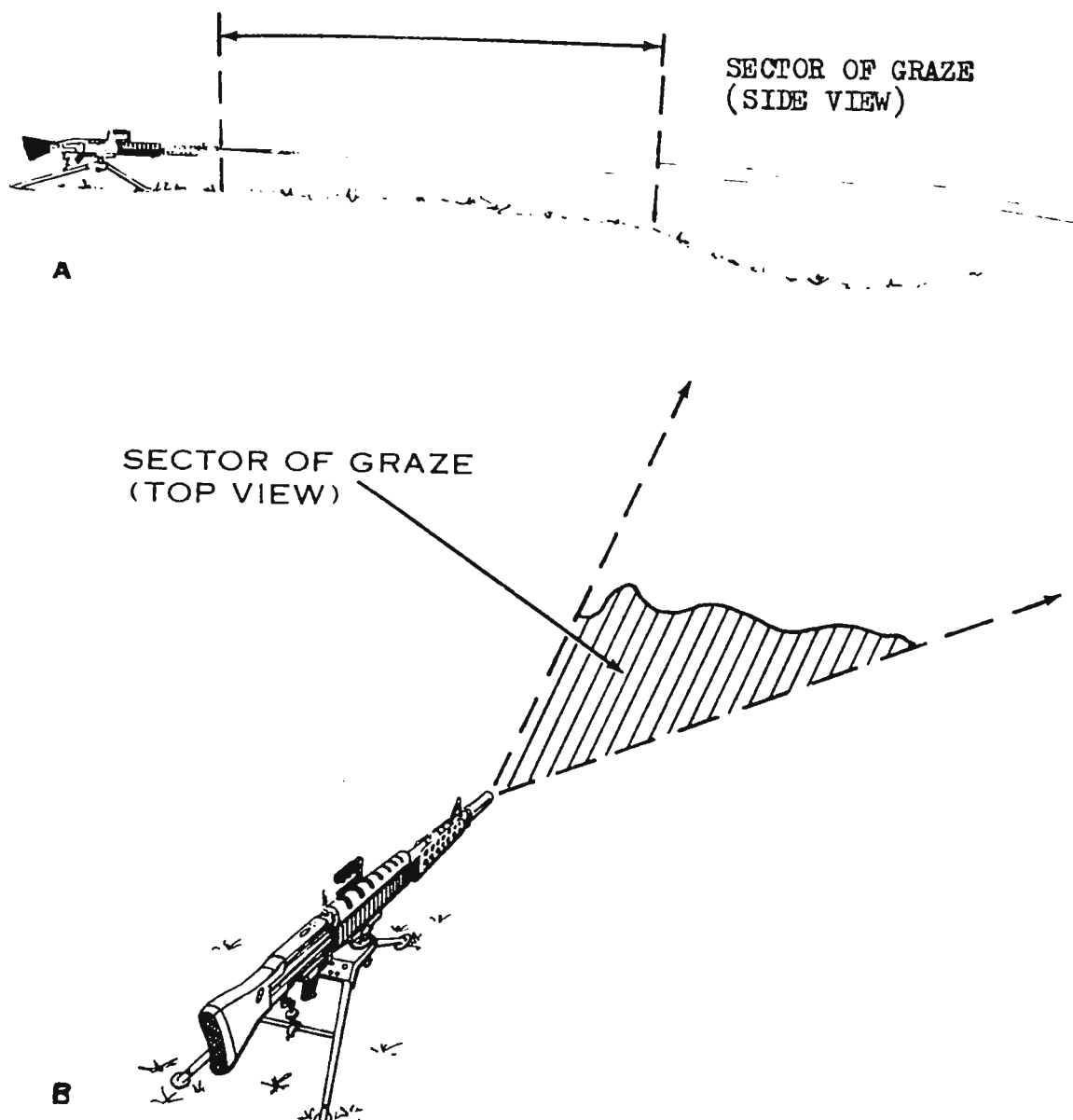


FIGURE 109 DETERMINING A SECTOR OF GRAZE

e. Determining the Amount of Grazing Fire in an Area of Graze -

The same procedures used in a and b above are used in determining the extent of grazing fire in an area of graze. The ranges to areas of grazing fire are determined by observing the flight of tracer ammunition from behind or from the flank of the gun position. The gunner determines the lateral extent of areas of graze by selecting and engaging successive aiming points in the area believed to afford grazing fire, using the same range setting as when determining the range to the extent of grazing fire (figure 110).

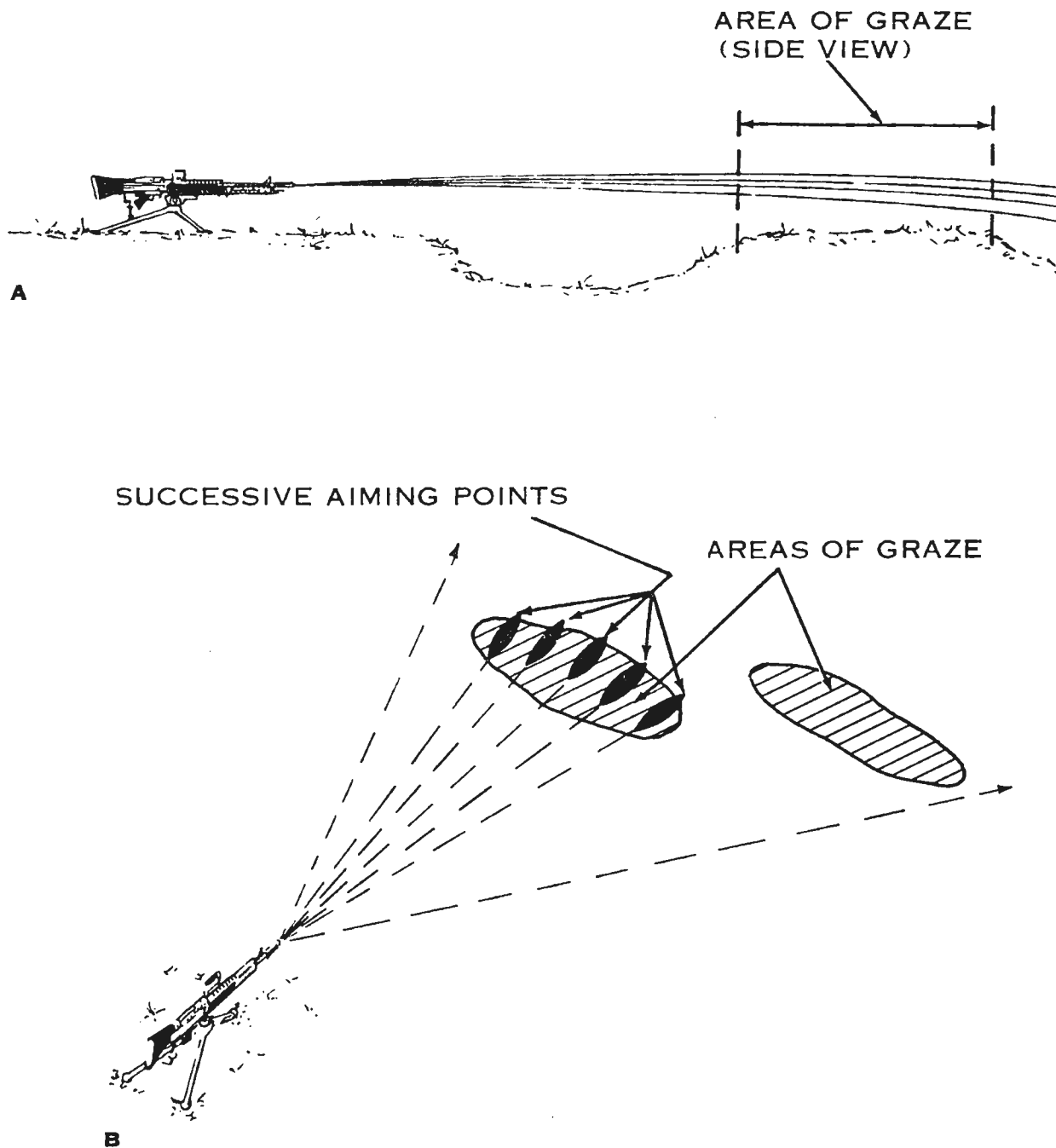


FIGURE 110 DETERMINING THE AREAS OF GRAZE

114. FIRE CONTROL:

Predetermined target areas are engaged on order from the leader or by SOP.

a. Final Protective Fires —

The signal used in calling for final protective fires is normally prescribed in the defense operation order. Final protective fires are ceased on order or signal.

(1) Signals - Arm-and-hand signals, voice commands, or pyrotechnic devices may be used in calling for these fires.

(2) Rates of fire - When firing final protective fires, the rapid rate of fire is used unless it is obvious that a higher rate is necessary to accomplish the mission.

b. Engaging other Preselected Target Areas —

When engaging other preselected target areas, the rapid rate of fire is used until a command to cease fire is given.

115. METHODS OF LAYING THE GUN:

The technique of laying the gun to engage preselected target areas during periods of limited visibility is effective only if the data are correct. These data are determined from the lay of the gun on targets. If possible, the lay is verified by firing and adjusting on these selected targets. There are two methods of determining data necessary to engage selected targets during periods of limited visibility: readings taken from the traversing bar and traversing and elevating mechanism, and by the use of field expedients.

a. Traversing Bar and Traversing and Elevating Mechanism Method —

Direction and elevation readings constitute the data necessary to engage preselected target areas during periods of limited visibility. These readings are measured by and recorded from the traversing bar and traversing and elevating mechanism. All measurements are recorded in mils.

(1) Preliminary steps before direction and elevation readings are obtained —

(a) Positioning the traversing mechanism: Turn the traversing handwheel toward your body as far as it will go, then turn it away two complete revolutions. Check the traversing handwheel scale to insure the same reading is lined up with the "0" index line before and after the two revolutions. The traversing mechanism can be positioned at night by turning the traversing handwheel toward the body as far as it will go, and then turning it away 50 clicks (two revolutions).

(b) Laying the gun for direction: To lay the gun for direction when a final protective line has been assigned, lock the traversing slide on either the extreme left or right side of the traversing bar, depending on the side of the sector on which the final protective line has been assigned. Pick up the rear legs of the tripod and shift the tripod until the muzzle of the gun points along the final protective line. If a final protective line has not been assigned, the gun will be laid for direction on the center of the primary sector. In this case, lock the left edge of the traversing slide on the "0" graduation on the traversing bar. The left edge of the traversing bar slide is always used as the index. Pick up the rear legs of the tripod and shift the tripod until the muzzle of the gun is laid on the center of sector.

(c) Once the gun is laid for direction: Emplace the tripod firmly by digging the tripod shoes in or by placing sand bags on the tripod legs. This is done to insure greater stability and to prevent accidental movement of the tripod.

(2) Direction readings - Direction readings are obtained and recorded to all targets within the primary sector of fire with the exception of the final protective line. The final protective line needs no direction reading since the traversing slide is positioned to the extreme right or left of the traversing bar. To obtain direction readings to targets other than the final protective line-

(a) Loosen the traversing slide lock lever and slide the traversing bar slide along the traversing bar until the gun is laid on the center of a point target and on either flank of a linear target.

(b) Lock the traversing slide to the traversing bar and read the direction reading from the scale on the traversing bar (figure 111). If the left edge of the traversing slide does not fall exactly on a 5-mil graduation (tickmark), use the nearest 5-mil graduation as the direction reading.

(c) When the left edge of the traversing slide is on a graduation to the left of the "0" graduation on the traversing bar, the direction reading is recorded as RIGHT that number of mils. (The muzzle of the weapon moves to the right) When the left side of the slide is to the right of the "0" graduation, the direction reading is recorded as LEFT that number of mils. (The muzzle of the weapon moves to the left.)

(d) After having taken a direction reading of a linear target, the width of the target is measured in mils by traversing across the target using the traversing handwheel. The traversing mechanism must be repositioned before moving to another target.

(3) Elevation readings -

(a) After obtaining the direction reading to a target, an elevation reading is obtained before moving to another target. To obtain the reading the gun is laid on the base of the target.

(b) The elevation reading is obtained from two scales. The first portion of the reading is taken from the engraved scale on the upper elevating screw plate. The second portion is taken from the engraved scale on the top of the elevating handwheel, using the indicator as the index (figure 111). The two portions of the elevation reading are separated by a slash (/) when they are recorded.

(c) The engraved scale on the upper elevating screw plate is graduated in 50-mil increments from MINUS 200 mils to PLUS 200 mils. There is an index line below each number and a PLUS or MINUS sign above each number, with the exception of the "0" (figure 111). The zero reading has no sign. In obtaining the elevation reading, the gunner should lower his head until his eyes are on line with the top of the elevating handwheel. The first portion of the reading is the number and plus or minus sign above the first visible index line. As in figure 111, this would be a minus 50 reading.

(d) The scale on the elevating handwheel is graduated in 1-mil increments for a total of 50 mils. Locate the graduation on line with the indicator (figure 111). The entire reading is recorded as minus 50/3.

(e) An elevation reading is valid on only one mechanism. If data are placed on another mechanism using the same mount and gun, the data could be inaccurate. The number of threads exposed on the lower elevating screw (figure 111) must remain the same both when obtaining and using data. If the number of threads is increased or decreased after the data are recorded, accurate fire cannot be placed on the target. For example, when a gun is freed to engage a secondary sector, should the base of the traversing and elevating mechanism rotate, the data are only correct if the gunner insures that the same number of exposed threads is replaced on the mechanism.

(f) To replace the elevation reading of minus 50/3 on the traversing and elevating mechanism, manipulate the elevating handwheel until the horizontal line below -50 is visible at eye level, with the handwheel indicator on 3.

(4) To insure a correct elevation reading to a target, the gunner should fire and adjust on this target.

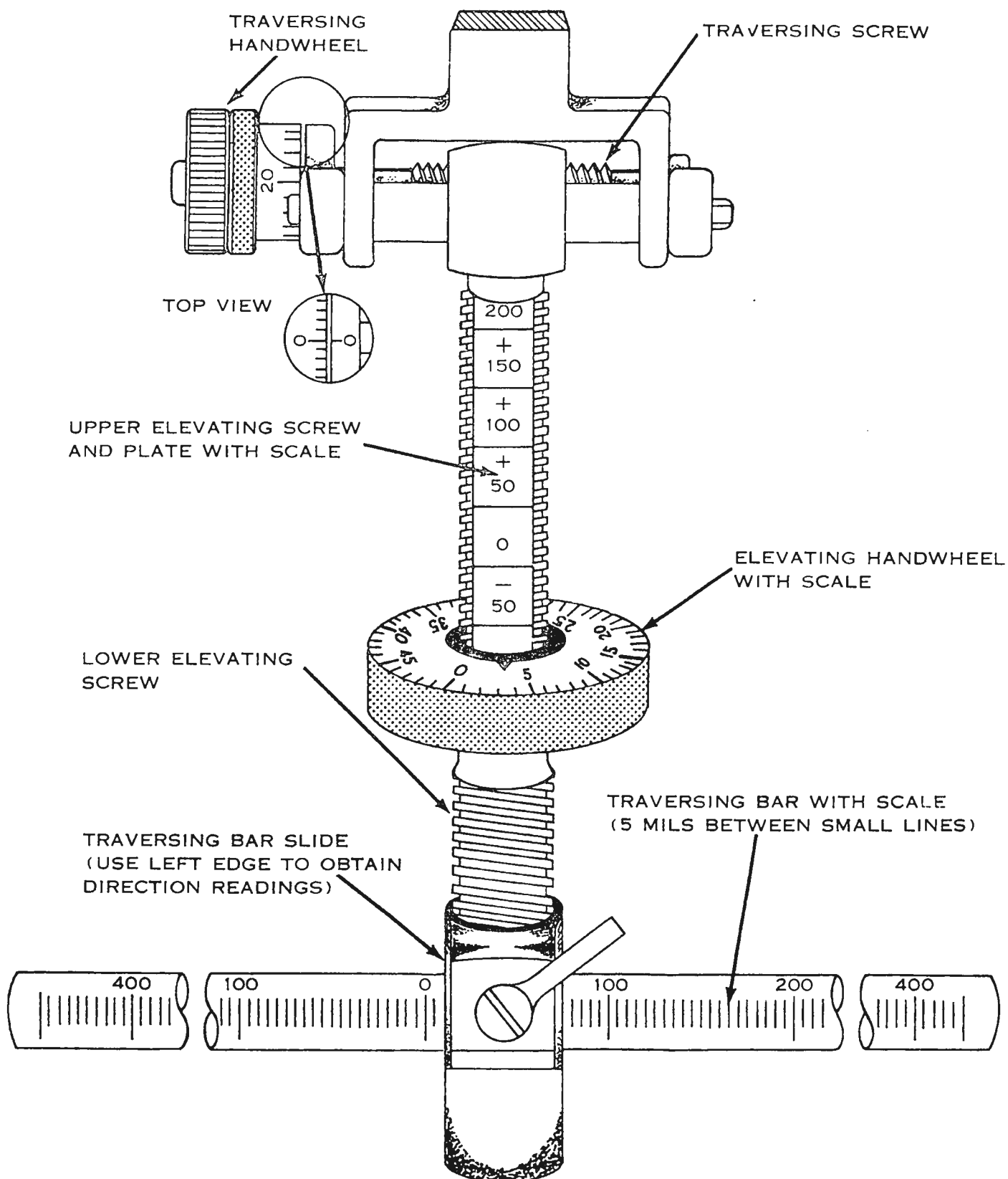


FIGURE 111 TRAVERSING BAR AND TRAVERSING AND ELEVATING MECHANISM

(5) Data may be obtained to targets without firing and adjusting as mentioned in the preceding paragraph. This is accomplished using the dry-fire method of laying the gun. In using this method, the range to the target is determined by eye; this range is placed on the rear sight and the gun is laid on the center base of the target. The direction and elevation readings are then taken. Range determination is critical because any discrepancy will cause an error in the elevation when the target is engaged. The dry-fire method of obtaining data is used only when firing is not possible or when the situation is such that firing would disclose the position of the gun.

b. Laying the Machinegun by the Use of Field Expedients -

Field expedients include the use of stakes and other devices to engage preselected target areas. Proper use of one or a combination of the field expedient techniques described in this paragraph will aid the gunner considerably in employing the machinegun in its predetermined fire role. These techniques may be used in conjunction with the traversing bar and traversing and elevating mechanism method. The field expedient method serves to supplement and enhance the employment of the gun in engaging preselected target areas. This method is not as effective as the traversing bar and traversing and elevating mechanism method and requires additional material. Field expedients serve as a primary means of engaging preselected target areas in a secondary sector during periods of limited visibility, and they may be used as a primary means in the primary sector until time or conditions of visibility permit recording data from the traversing bar and traversing and elevating mechanism. If a gun crew is replaced for any reason, field expedients being employed must be explained to the relieving crew.

(1) The aiming stake method - The principal advantage of this technique is that no light is required at the gun position at night. This technique is not effective when visibility is so limited that aiming stakes cannot be observed. To employ this technique the gun is laid to hit a target area and the following procedure is used.

(a) The rear sight slide is raised to its uppermost position in the rear sight leaf.

(b) A strip of luminous tape or luminous paint is placed at least halfway up the rear of the front sight post.

(c) An aiming stake, marked with a strip of luminous tape or paint, is taken one or two meters forward of the gun position.

(d) The gunner moves his head slightly to the right causing the front sight post to appear in the left corner of the rectangle formed by the rear sight slide and rear sight leaf. Under the gunner's direction the stake is alined and driven into the ground in such a way that the two pieces of luminous material are adjacent (alined for direction) and the top edges of both pieces of material are level (alined for elevation), presenting a sight picture such as the one

depicted in figure 112. The gunner must maintain the correct position and grip throughout the procedure and, when engaging targets, must cause the front sight post to appear in the left of the rear sight by again moving his head slightly to the right.

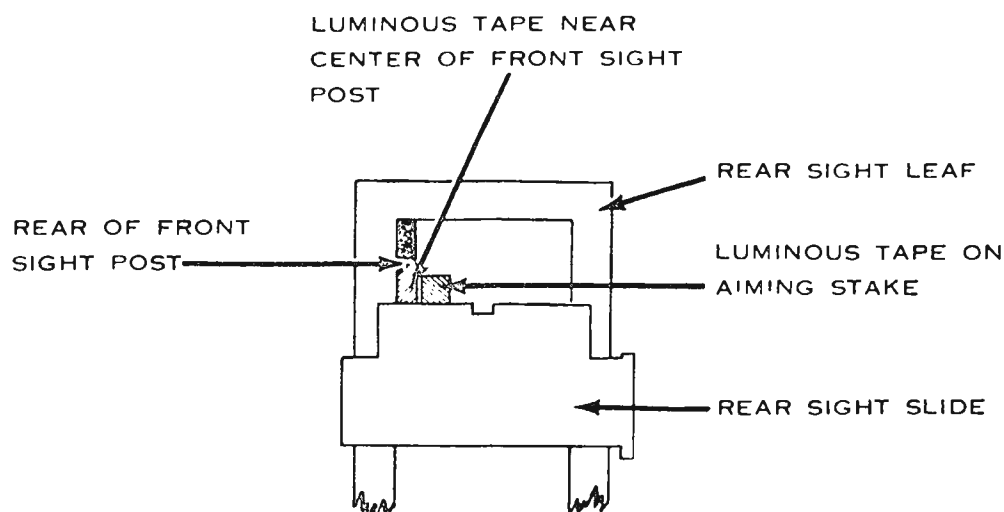


FIGURE 112 AIMING STAKE TECHNIQUE OF ENGAGING TARGETS DURING PERIODS OF LIMITED VISIBILITY

(2) The base stake technique - This technique is used to define sector limits and may provide the lay for the final protective line or other preselected target areas which exist along a primary or secondary sector limit. The base stake method is effective in all conditions of visibility and requires a minimum of additional material. The following procedure is used to-

(a) Define a limit of sector: Lay the gun for direction along one sector limit and emplace a stake along the outer edge of the folded bipod legs, taking up the "play", since the legs rotate slightly on the barrel. The same procedure is used for placing a stake along the opposite sector limit (Figure 113).

(b) Lay the gun to engage a final protective line: Move the muzzle of the weapon to a limit of sector. Adjust for elevation by driving a stake into the ground so the top of the stake is under the gas cylinder extension, allowing a few mils of depression to facilitate covering irregularities in the terrain (figure 113).

(c) Lay the gun to engage other target areas on a sector limit: In a primary sector this is accomplished by using the procedure in (b) above, the only difference is that no depression is allowed for irregularities in the terrain. In a secondary sector when the gun is mounted on tripod, and the traversing and elevating mechanism is removed the procedure described in (a) above is used in addition

to driving in an additional stake under the gas cylinder extension to fix the elevation (figure 114).

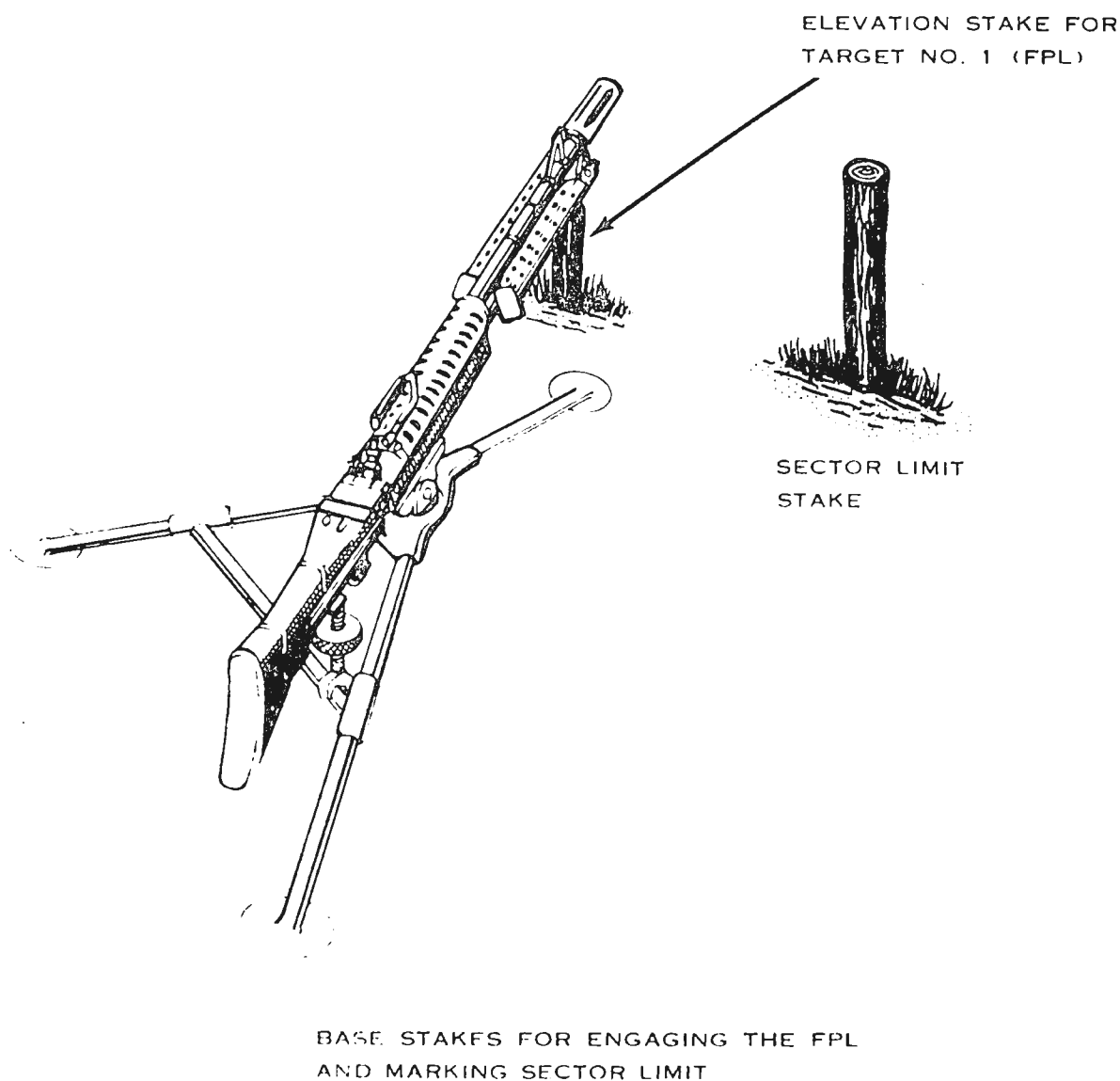


FIGURE 113 BASE STAKE TECHNIQUES OF ENGAGING PRESELECTED TARGET AREAS

(3) The notched stake or tree crotch technique (figure 115) - The notched stake or tree crotch technique is used with the bipod mounted gun to engage preselected target areas within a sector or to define sector limits. This method is effective in all conditions of visibility and requires a minimum of additional material. To employ the method the following procedure is used.

(a) The stock of the weapon is placed in the rests of notched stakes or tree crotches and adjusted to hit desired targets or to define sector limits.

(b) Shallow trenches or grooves are dug for the bipod feet. These trenches or grooves act as a pivot point for the weapon, permitting rotation of the bipod feet as the stock is moved from one crotch or stake to another.

(c) The weapon is held and fired using the position and grip employed in bipod firing.

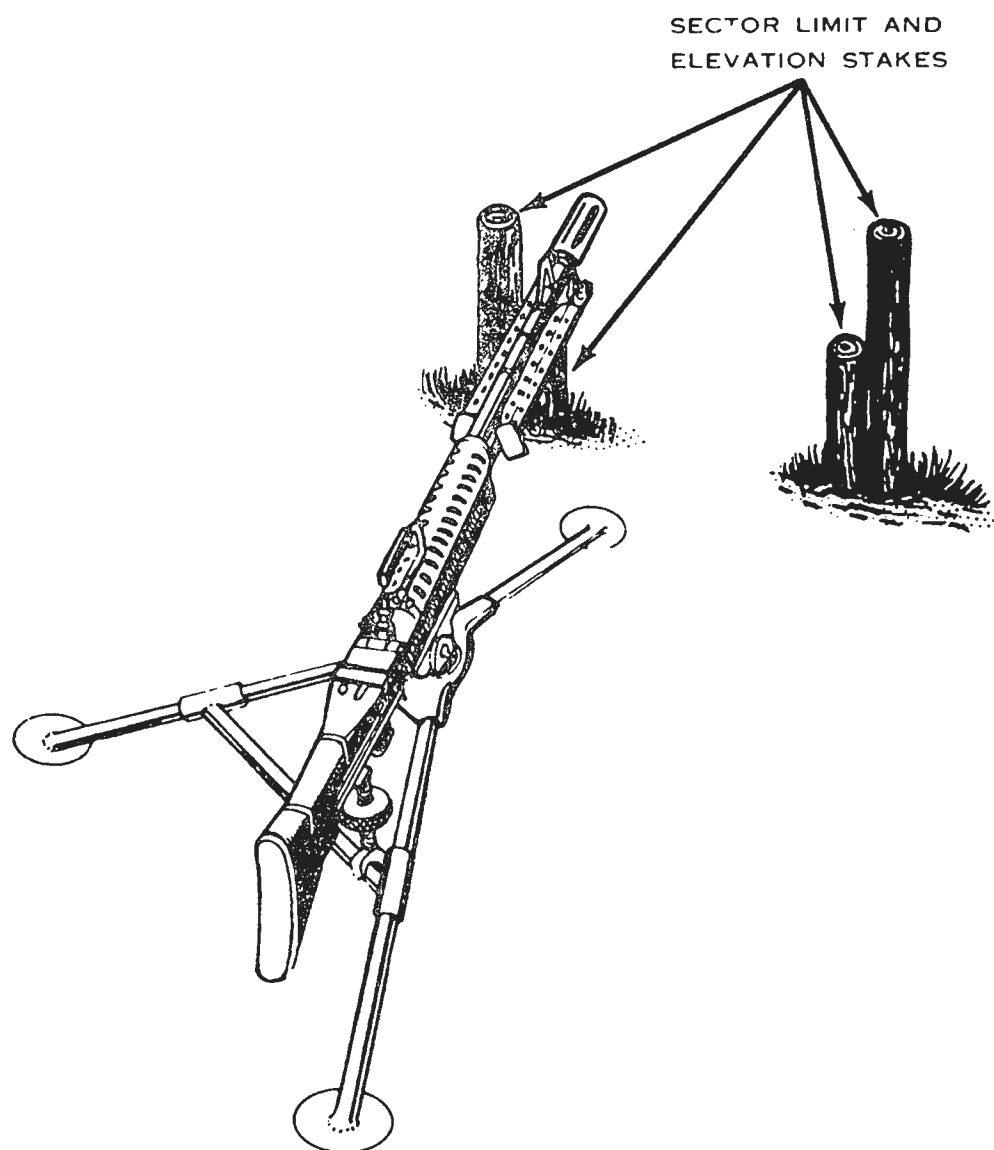


FIGURE 114 BASE STAKE TECHNIQUE OF ENGAGING PRESELECTED
TARGET AREAS (FIXED ELEVATION)

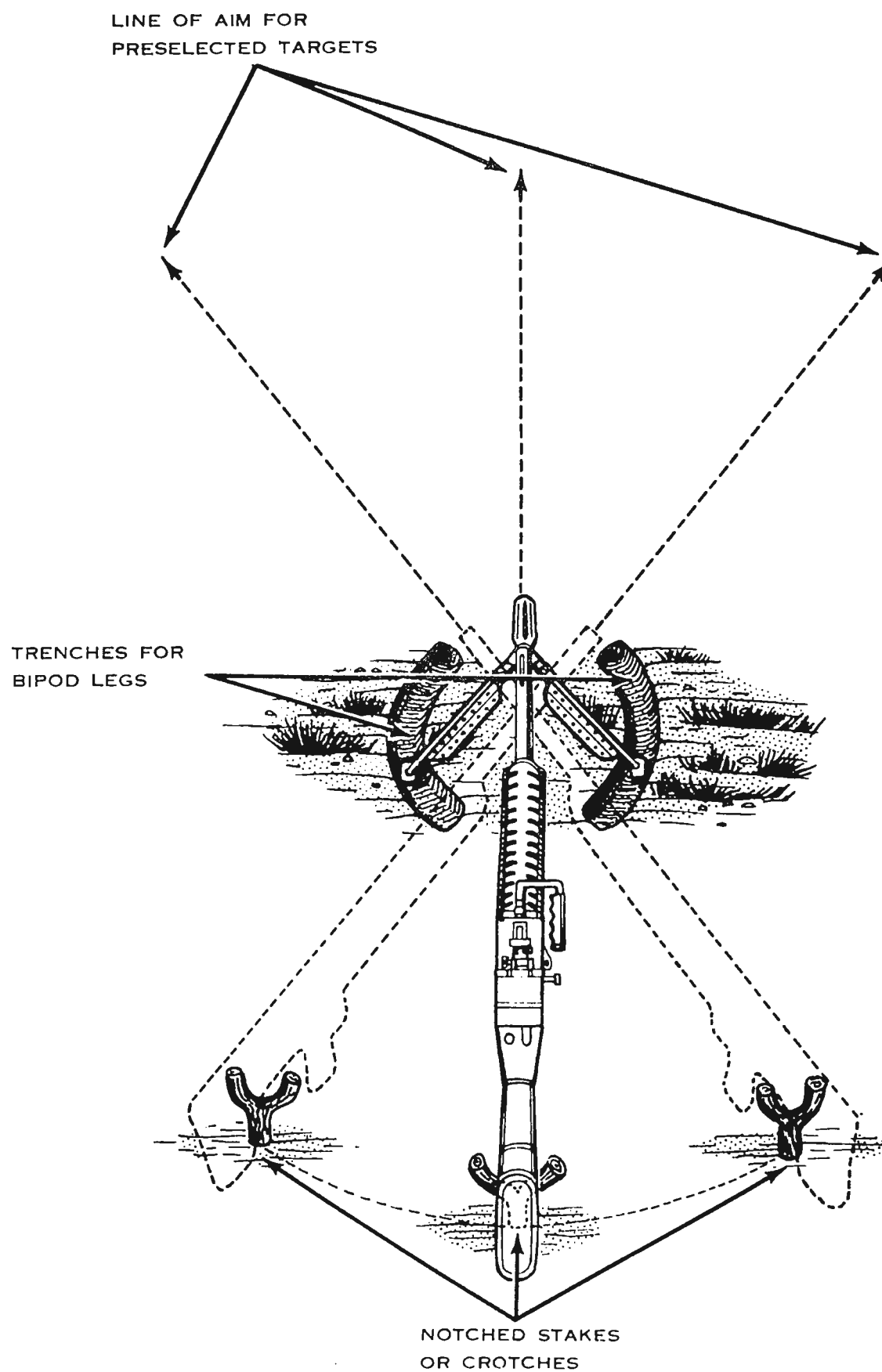


FIGURE 115 NOTCHED STAKE OR TREE CROTCH TECHNIQUE
OF ENGAGING PRESELECTED TARGETS

SECTOR LIMITS AND
SECTOR OF GRAZE

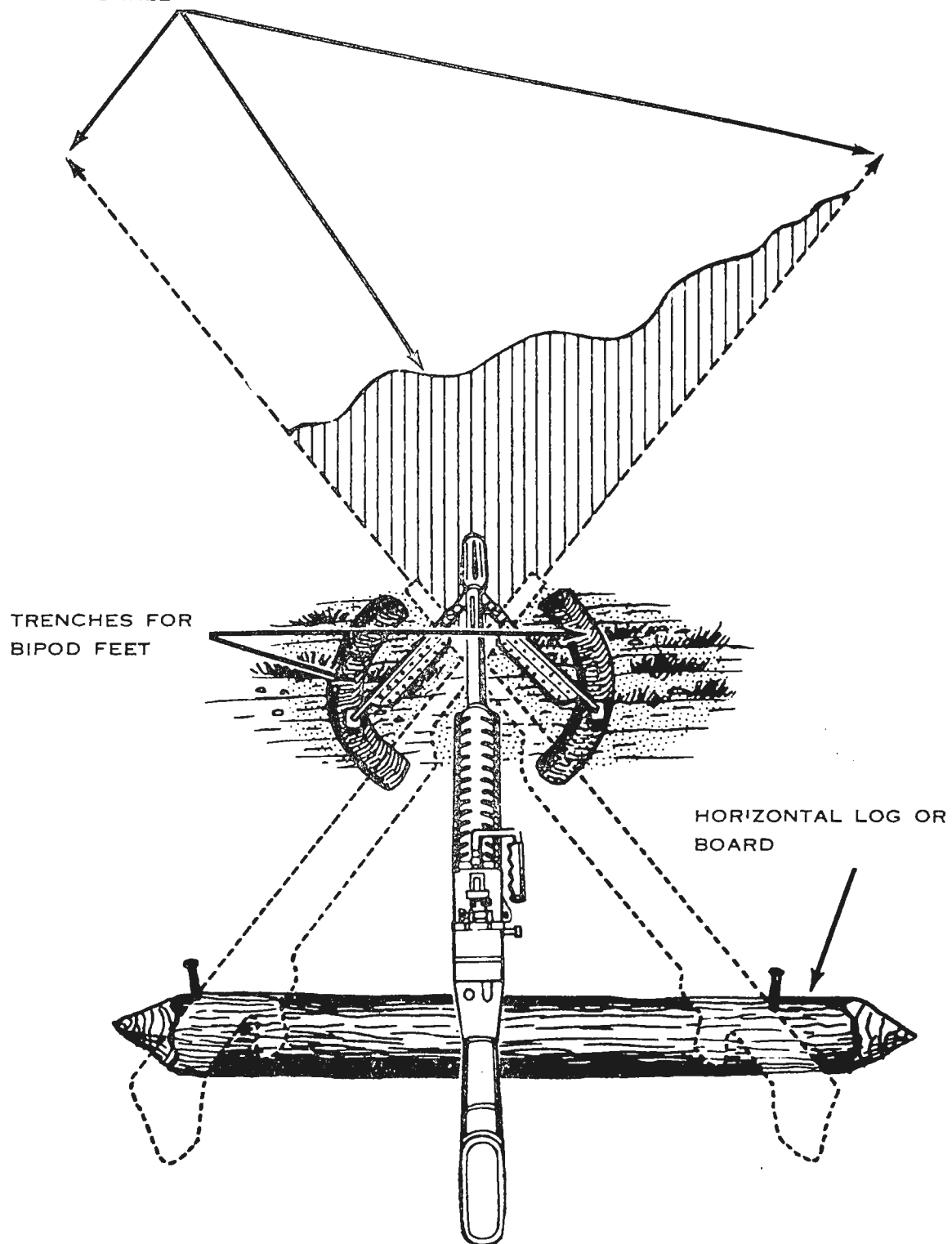


FIGURE 116 HORIZONTAL LOG OR BOARD TECHNIQUE
OF ENGAGING PRESELECTED AREAS

(4) The horizontal log or board technique (figure 116) - This technique is used with the bipod or tripod mounted machinegun to mark sector limits and provide sector of graze fire. The horizontal log or board technique is effective in all conditions of visibility. The following procedures are used with-

(a) The bipod mounted gun: Place a log or board beneath the stock of the weapon in such a way that the stock can slide across it freely. Dig shallow trenches or grooves for the bipod feet to allow rotation of the feet as the stock is moved along the horizontal log or board. Adjust the bipod legs to the desired elevation. The sector limits may be marked by notching or placing stops on the horizontal log or board. Bipod firing position and grip are used.

(b) The tripod mounted gun: Place a log or board beneath the barrel of the weapon. The log or board should be positioned in such a way that the barrel, when resting on the log, will be at the proper elevation to obtain sector of graze fire. The limits of sector are marked, when appropriate, as discussed in (a) above.

Section IV. RANGE CARDS

116. GENERAL:

a. A range card is a record of firing data necessary to engage preselected target areas within a sector(s) of fire during periods of limited visibility. Such areas are suspected of being tactically significant during these periods. These areas include likely routes or avenues of approach, anticipated enemy supporting weapons positions, probable enemy assault positions, final protective lines, and sectors of graze. The range card may also be used as a reference to engage targets during periods of good visibility, and it also aids the leader in preparing his fire plan.

b. Data to areas within the primary sector are of primary concern. The tripod mounted gun is habitually employed covering the primary sector of fire. Preselected targets in the secondary sector are engaged during periods of limited visibility by the use of field expedients (paragraph 115).

c. A range card consists of two parts (figures 118 and 119): a sketch of the sectors of fire containing drawings of targets, and a data section which lists data necessary to engage these targets during periods of limited visibility. The sketch is not drawn to scale, but the data referring to the areas must be accurate.

117. PREPARATION OF A RANGE CARD:

a. Range cards are prepared in duplicate; one copy stays at the gun position, and the other copy is sent to the officer in charge of the gun. Complete range cards are prepared for primary gun positions, and partially completed range cards are prepared for alternate and supplementary gun positions. The gunner, assisted as necessary by the assistant gunner and leader, is responsible for the preparation of the range card. Range cards are prepared immediately upon arrival in a position regardless of the anticipated length of stay. The range cards should be constantly revised during occupation of a position. Military symbols in figure 117 are used in preparing a range card.

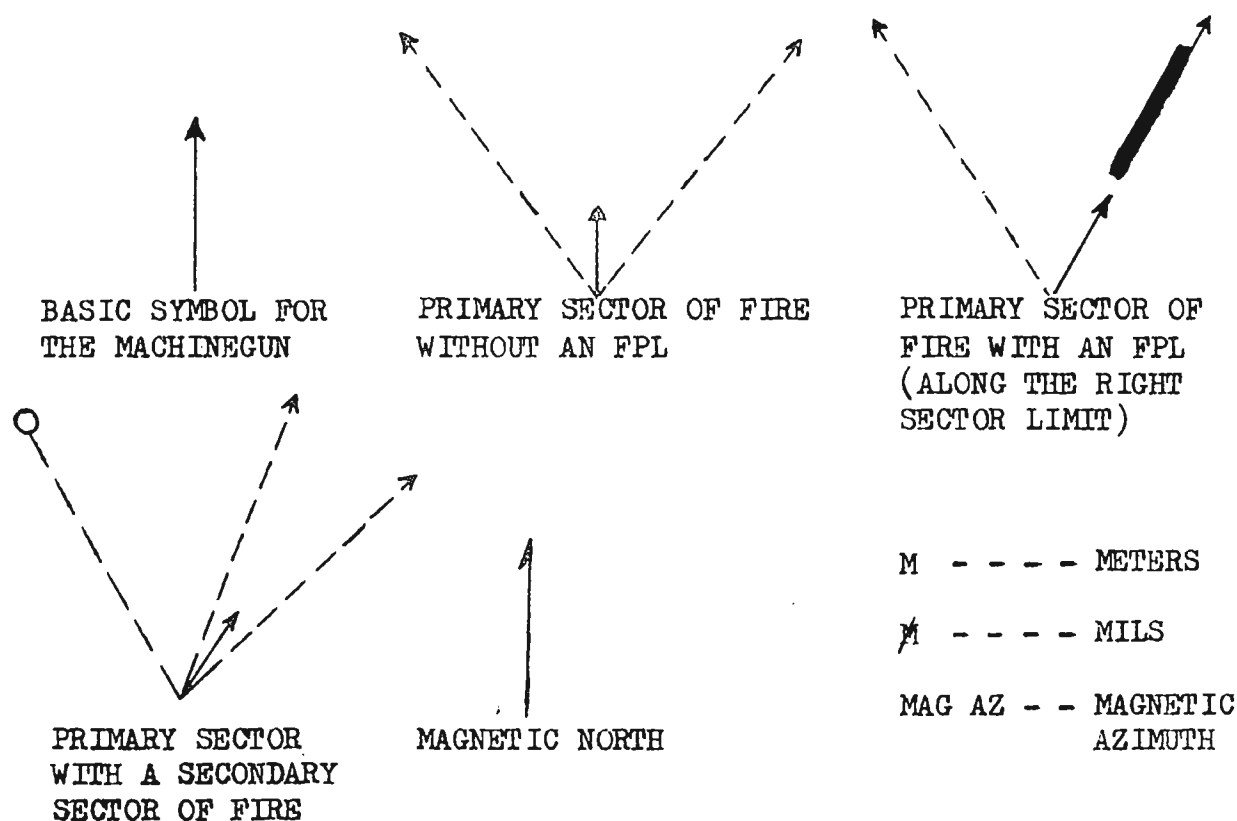


FIGURE 117 MILITARY SIGNS AND SYMBOLS APPLICABLE TO THE M60 MACHINEGUN

b. The following steps are accomplished in preparing a range card, but need not be accomplished in the order outlined.

- (1) Position the traversing mechanism (paragraph 115)..

(2) Position the weapon with the muzzle oriented on the final protective line. If a final protective line is not assigned, the muzzle should be oriented on the center of sector. Emplace the tripod as explained in paragraph 115.

(3) Sketch in the basic symbol for the machinegun in the lower center portion of the card, oriented in the direction of the final protective line or center of sector, as appropriate (figure 118).

(4) If a final protective line is assigned, draw in the final protective line using the procedure outlined in (9) below.

(5) Draw in the limit(s) of the primary sector which does not contain a final protective line on the sketch. No data are recorded for this limit(s) of sector in the data section unless a target is located along this line (figure 118).

(6) Draw in the limit of the secondary sector which does not border the primary sector on the range card sketch.

(7) Draw in and label friendly positions which are located forward of the forward edge of the battle area (FEBA) and in the vicinity of machinegun's sector of fire (figure 118).

(8) Draw a magnetic north arrow from the base of the machinegun symbol pointing in the direction of magnetic north.

(9) Orient the gun position with a prominent terrain feature recognizable on a map by obtaining the magnetic azimuth from the terrain feature to the gun position. Determine the distance in meters between these two points (figure 118). Place arrow barbs along this line to indicate the direction in which the magnetic azimuth was taken. If a prominent terrain feature is not available, the gun position may be oriented by using an 8-digit grid coordinate.

(10) As marginal data, record the gun number, unit designation, and date in one of the corners of the sketch. No higher unit designation than squadron is recorded on the sketch because of security reasons (figure 118).

(11) Obtain data to target areas -

(a) When a final protective line is assigned, determine the maximum extent of grazing fire on this line, then draw a solid line in extension to the basic symbol for the machinegun. This line ends in an arrowhead. Sketch in a shaded blade on the inside of the final protective line to represent the extent of grazing fire. If deadspace exists on the final protective line, breaks are left in the shaded blade to represent it. Record the ranges to the near and far edges of the deadspace and to the maximum extent of graze along the final protective line.

Determine the magnetic azimuth of the final protective line and record this azimuth along the final protective line. Record the elevation reading and other pertinent data under appropriate columns in the data section (figure 118). The final protective line is referred to in the data section as "FPL".

(b) Select the principal direction of fire day and principal direction of fire night and mark the center of these areas on the sketch with a number as discussed in (f) below. Obtain direction readings to this marked area and enter the data in appropriate columns of the data section.

(c) If a sector of graze is obtainable, determine the elevation setting which gives the maximum extent of grazing fire between the muzzle of the weapon and the first major break in the terrain between the primary sector limits. Record this elevation reading in the data section (figure 118). The sector of graze is referred to in the data section as "SG".

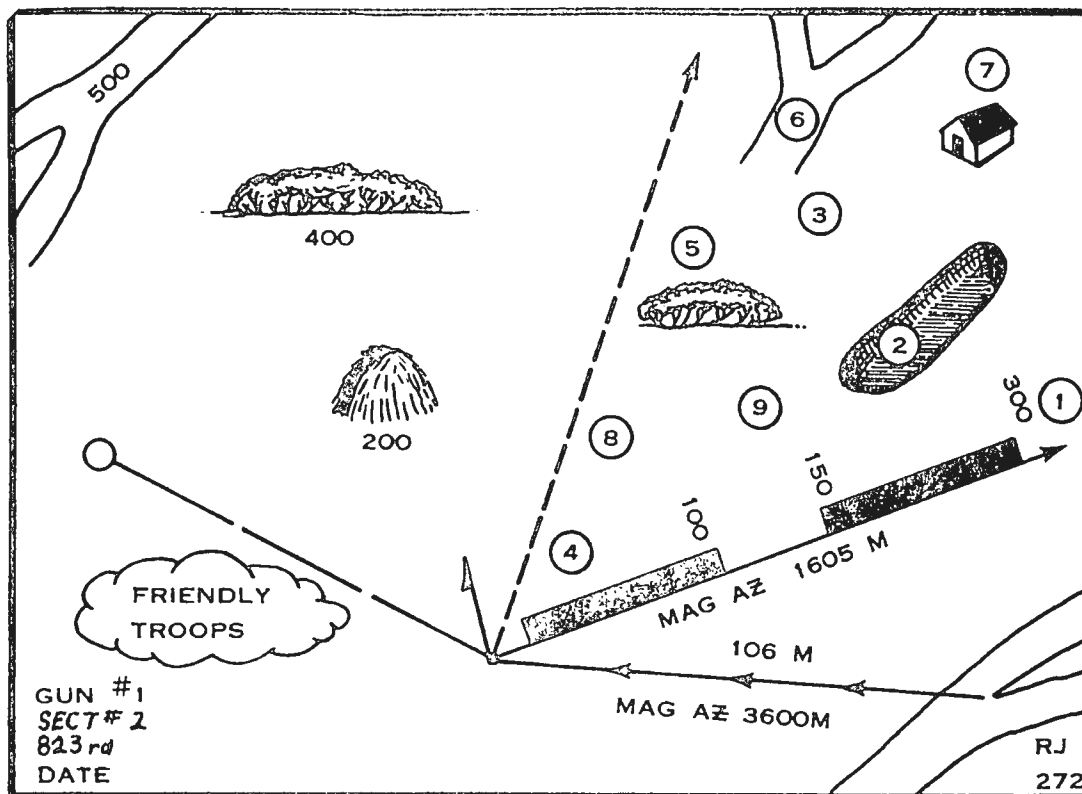
(d) After having laid the gun on other target areas in the primary sector, obtain direction and elevation readings for these areas and record the data in the data section (figure 118).

(e) An area of graze is treated as a target area, and is referred to in the data section as "AG".

(f) Target areas in the primary sector are marked on the range card sketch by numbers enclosed in circles. The final protective line, when assigned, is labelled target number 1; the principal direction of fire day, target area number 2; and the principal direction of fire night, target area number 3. In the absence of a final protective line, principal direction of fire day becomes target number 1 and principal direction of fire night becomes number 2. The remaining targets are assigned subsequent numbers in order of their priority. The principal direction of fire night and the principal direction of fire day are referred to in the data section as "PDFD" and "PDFN" respectively.

(g) When field expedients are used to engage targets, replicas of the field expedients are sketched above the drawing of the targets and the word "stake", with its number, is written in the data section (figure 119).

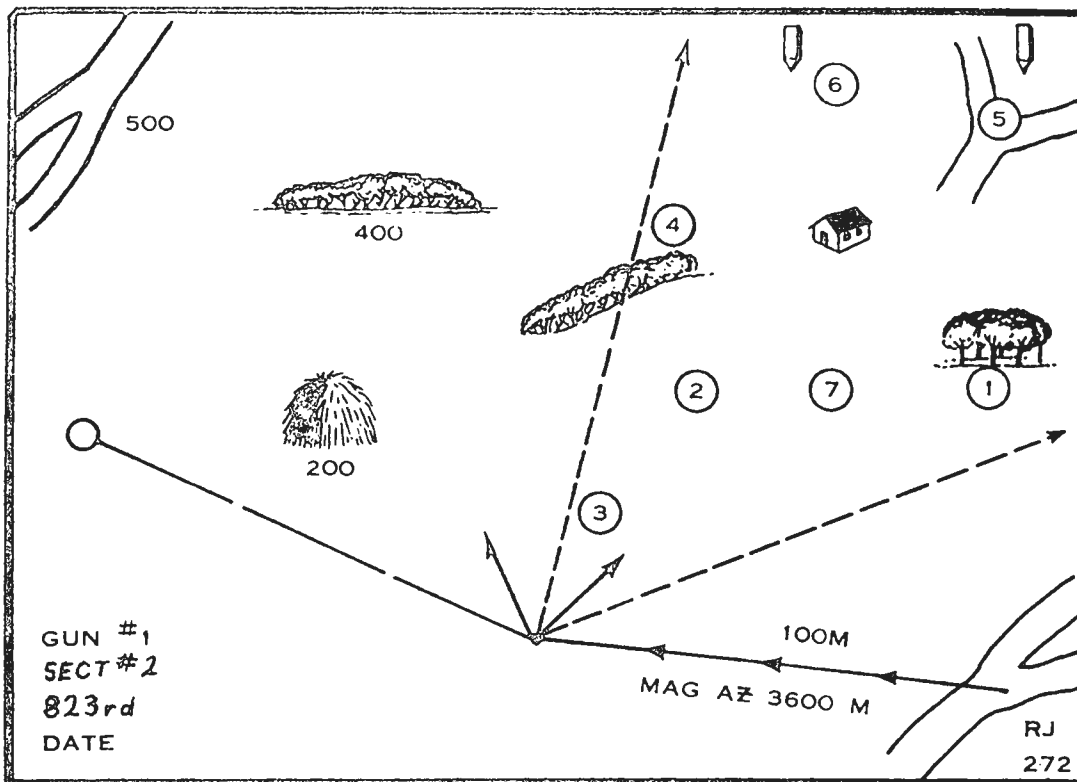
(h) Preselected targets in the secondary sector are sketched in on the range card, and ranges to these targets are recorded below the sketches. Data to these targets are not recorded in the data section (figure 119).



DATA SECTION

NO.	DIRECTION	ELEVATION	RANGE	DESCRIPTION	REMARKS
1		+50 / 15	300	FPL	
2	R200			PDFD	
3	L100			PDFN	
4		-50 / 10		SG	
5	L305	+50 / 41	300	HEDGEROW	R25
6	L270	+100 / 10	600	RJ	+5
7	R165	+100 / 15	500	HOUSE	R3+2
8	L400	+50 / 8	200	AG	R100
9	R25	+50 / 43	200	AG	R50

FIGURE 118 RANGE CARD WITH A FINAL PROTECTIVE LINE



DATA SECTION

NO.	DIRECTION	ELEVATION	RANGE	DESCRIPTION	REMARKS
1	R20			PDFD	
2	L150			PDFN	
3		-100 / 25		SG	
4		+50 / 47	300	HEDGEROW	R30
5			600	RJ	AIMING STAKE
6			500	HOUSE	AIMING STAKE
7	R75	0 / 26	300	AG	R50

FIGURE 119 RANGE CARD WITHOUT A FINAL PROTECTIVE LINE

REVIEW QUESTIONS

1. Periods of limited visibility refer not only to periods of darkness but also periods during _____ operations when _____.
2. In order to overcome difficulties encountered during periods of limited visibility, _____ must be developed for engagement of _____ targets, and in delivering _____ fires by use of _____.
3. An area (to be covered by fire) assigned to an individual or unit is a _____.
4. Machineguns are normally assigned two sectors of fire; a _____ and a _____.
5. A predetermined line along which grazing fire is placed to stop an enemy assault is the _____.
6. The _____ can be delivered regardless of visibility.
7. The final protective line always corresponds to the inner limit of the _____.
8. A wedge shaped area of terrain, formed by assigned sector limits, which affords continuous knee high grazing fire from the weapon out to the first major break in the terrain is _____.
9. A priority direction of fire which marks the center of a specific principal area assigned to a weapon is called the _____.

10. Visible targets appearing in the _____
_____ take priority over targets which may appear elsewhere in the sector.
11. A primary direction of fire which marks the center of a specific principal area assigned to a weapon to be covered during periods of good visibility is the _____
_____.
12. A priority direction of fire which marks the center of a specific principal area assigned to a weapon during periods of limited visibility is the _____
_____.
13. An area, other than the sector of graze, within a sector of fire which is covered by grazing fire is an _____.
14. When engaging linear, linear targets with depth, and deep targets during periods of limited visibility _____ is made to _____ these targets as is done during periods of good visibility.
15. During periods of limited visibility each gunner will observe his tracers and _____ to be the entire target.
16. Grazing fires must be obtained for _____,
_____, and _____.
17. In obtaining the maximum extent of grazing fire over level or uniformly sloping terrain at no time will the center of the cone of fire rise more than _____ from the ground out to a range of _____ meters..

18. In obtaining the maximum extent of grazing fire over irregular terrain at no time will the center of the cone of fire rise more than _____ above the ground between the _____ and _____ of the weapon.
19. Any intermediate breaks in the terrain which cannot be covered by grazing fire from a gun is considered as _____.
20. In determining the amount of grazing fire in an area of graze the gunner uses the same range setting as when determining the range to the _____ over level or irregular terrain.
21. The techniques of laying the gun to engage preselected target areas during periods of limited visibility is effective only if _____.
22. The traversing mechanism can be positioned at night by turning the traversing handwheel _____ as far as it will go, and then turning it _____.
23. The _____ of the _____ is always used as the index for direction readings obtained from the traversing bar.
24. Direction readings are obtained and recorded to all targets within the primary sector of fire with the exception of the _____.
25. When the traversing bar slide is locked on a graduation to the left of the "0" graduation on the traversing bar, the direction is recorded as _____ that number of mils.

26. After obtaining the direction reading to a target an _____
_____ before moving to another
target.
27. The elevation reading is obtained from two scales; the _____
_____ scale and the
_____ scale.
28. The reading on the upper elevating screw plate scale is the number
_____ the first visible _____.
29. In obtaining the elevation reading the gunner should _____
his head until the eyes are _____ with the _____ of
the elevating handwheel.
30. An elevation reading is valid only on _____.
31. The number of threads exposed on the _____
_____ must remain the same both when obtaining and using
data.
32. To place the elevation reading of minus 50/3 on the T&E mechanism
manipulate the elevating handwheel until the horizontal line _____
_____ is visible at eye level, with the handwheel
indicator on _____.
33. Range cards are prepared in _____.
34. Complete range cards are prepared for _____ gun positions
and partially completed range cards are prepared for _____
and _____ gun positions.
35. The range card should be _____ during occu-
pation of a position.

NOTES

CHAPTER 8

MACHINEGUN MARKSMANSHIP TRAINING

Section I. INTRODUCTION

118. GENERAL:

Machinegun marksmanship training includes training on both the basic (10 meter) and transition ranges. During this training a gunner is taught the fundamentals of machinegun marksmanship with the bipod and tripod mounted machinegun. This training is conducted in three phases: bipod instructional firing on the basic (10-meter) range, tripod instructional and record firing on the basic (10-meter) range, and instructional and record firing on the transition range.

Section II. BASIC MARKSMANSHIP TRAINING, BIPOD MOUNTED GUN, BASIC (10-METER) RANGE

119. GENERAL:

During basic marksmanship training with the bipod mounted gun, the objectives and fundamentals of machinegun marksmanship are taught and applied during live fire exercises. This instruction is also designed to familiarize the gunner with the characteristics, noise, and recoil of the weapon during firing.

a. The objectives of machinegun marksmanship are —

- (1) OBTAINING AN ACCURATE INITIAL BURST
- (2) TRAVERSING AND SEARCHING THE GUN
- (3) OBSERVATION AND ADJUSTMENT OF FIRE
- (4) OPERATING WITH SPEED

b. In addition to the objectives and fundamentals, the following subjects are covered in this section.

- (1) Fire commands used on the basic range.
- (2) Basic marksmanship target.
- (3) Analyzing and scoring the target.
- (4) Range facilities.

(5) Organization for firing and conduct of firing exercises.

120. OBTAINING AN ACCURATE INITIAL BURST:

Optimum effectiveness of machinegun fire is obtained with an accurate initial burst. To obtain an accurate initial burst, the fundamentals of position and grip, sight alinement and sight picture, trigger manipulation, and zeroing must be properly applied.

a. Position and Grip (figure 120) —

(1) The gunner assumes a prone position behind the gun and raises the rear sight.

(2) He places the hinged shoulder rest on his right shoulder, and an imaginary line drawn through the gun should bisect his right shoulder and his right buttock (figure 121).

(3) His legs are spread a comfortable distance apart and his heels are down, if possible.

(4) His right hand grasps the pistol grip, index finger resting lightly on the trigger.

(5) His left hand is placed on the cover.

(6) With both hands, he exerts a firm, steady pressure down and to the rear while both aiming and firing the gun.

(7) His cheek rests lightly against the cover or against his left hand.

(8) His shoulders are level and his elbows are an equal distance from the receiver of the gun.

(9) Left handed firing with the M60 machinegun is discouraged because the ejection pattern of some weapons is almost directly to the rear. In addition, a gunner firing the tripod mounted gun makes all manipulations with the left hand (paragraph 132).



FIGURE 120 PRONE POSITION

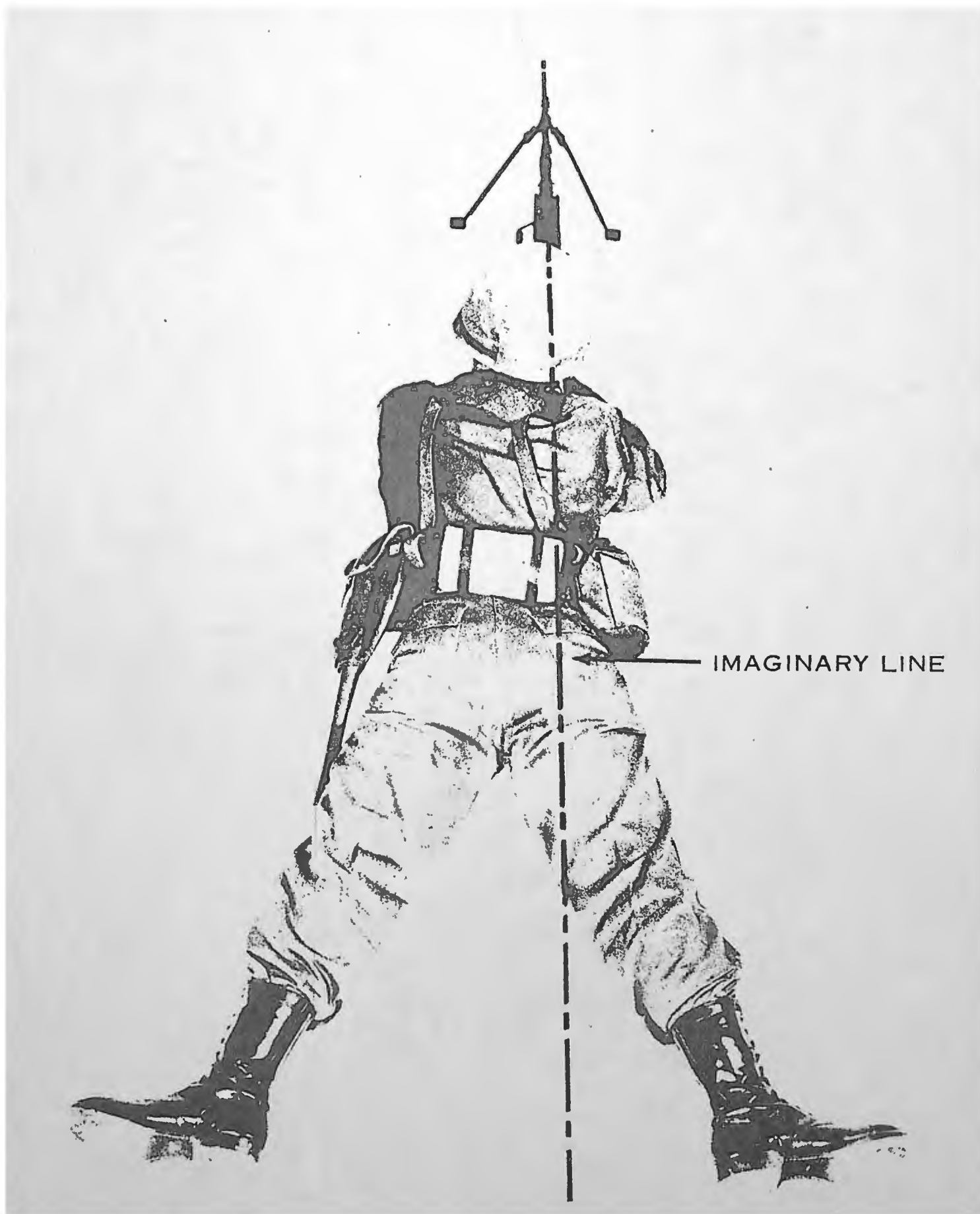


FIGURE 121 PRONE POSITION

b. Sight Alinement and Sight Picture —

(1) Sight alinement - To obtain correct sight alinement, the gunner centers the front sight blade in the aperture of the rear sight slide with the top of the front sight blade even with the top of the sight slide (figure 122).

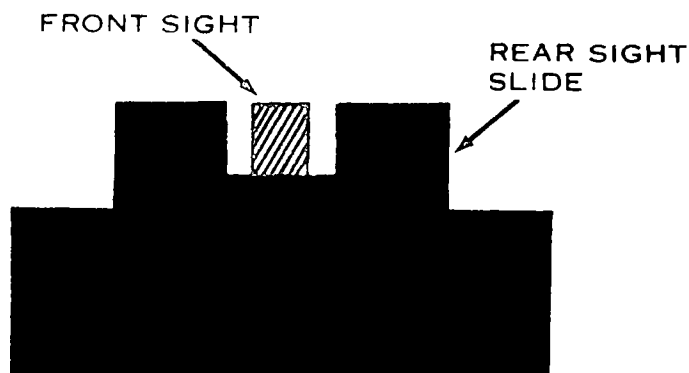


FIGURE 122 SIGHT ALINEMENT

(2) Sight picture - To obtain correct sight picture, the gunner centers the target over the front sight blade so that it appears to rest on top of the front sight blade and on top of the rear sight slide (figure 123).

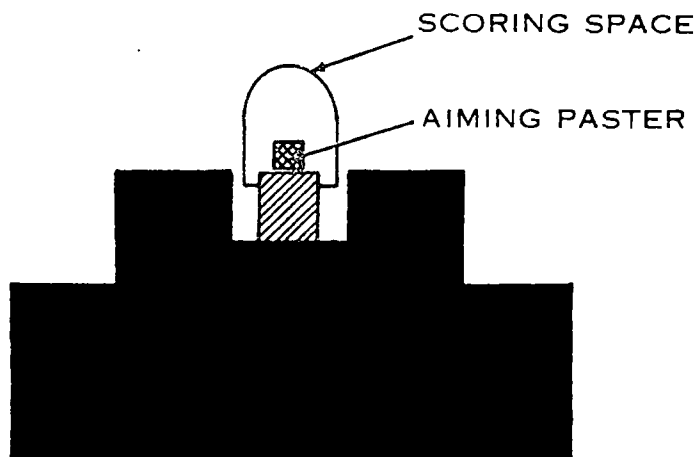


FIGURE 123 CORRECT SIGHT ALINEMENT AND CORRECT SIGHT PICTURE

c. Trigger Manipulation —

When firing the M60 machinegun, the trigger is not squeezed as with other small arms. It is pulled straight to the rear and then released.

This aids the gunner in controlling the number of rounds in each burst and prevents excessive wear to the sear and sear notch. To time himself in firing a 6-round burst, the gunner pulls the trigger straight to the rear and says, "Fire a burst of six," and then releases the trigger.

d. Zeroing —

This is adjusting the rear sight until the strike of the projectiles coincide with the point of aim at a given range, and then adjusting the range plate to reflect that range. Zeroing the machinegun on the basic range is accomplished through the following step-by-step procedure.

(1) Step 1 - set sights - To establish a common starting point when zeroing on the basic range, a range setting of 500 meters should always be used. The gunner sets this range and aligns the windage index by placing zero windage on the rear sight.

(2) Step 2 - fire three rounds - Upon receiving the command to fire, the gunner fires three rounds (one round at a time) to establish a shot group. He takes the same sight alignment and sight picture each time he fires. No adjustments on the rear sight are made until he has fired three rounds. The shot group should be small enough to determine exactly where the center of the group is in relation to the aiming paster.

(3) Step 3 - correct for deflection - If the center of the shot group is to the left or right of the point of aim, the gunner must correct for deflection. To correct for deflection the gunner turns the windage knob, causing the rear sight to move in the direction of the desired change. Since the distance to the target is 1000 centimeters (10 meters), a 1-click or 1-mil adjustment moves the point of aim one centimeter. For example: if the gunner notes that the center of the shot group is two centimeters (two aiming pasters) to the right of the aiming point, he turns the windage knob two clicks, moving the rear sight in the direction of the aiming paster (to the left).

(4) Step 4 - correct for elevation - If the center of the shot group is above or below the black aiming paster, the gunner must correct for elevation. To correct for elevation, the gunner turns the elevation knob, causing the rear sight slide to move in the direction of the desired change. A 1-click adjustment on the elevation knob equals a $\frac{1}{4}$ -mil change, or four clicks equal a 1-mil change. Since the distance to the target is 1000 centimeters (10 meters), a 4-click (1-mil) adjustment moves the point of aim one centimeter.

(5) Step 5 - confirm - After making corrections for deflection and elevation, the gunner fires a confirming round. If he misses his point of aim, he treats this hit as the center of a three round shot group, makes further adjustments as necessary, and fires

another round. He continues this procedure until he hits the point of aim.

(6) Step 6 - adjust the range plate and record deflection - The gunner loosens the range plate screw and moves the adjustable range plate up or down until the 500-meter graduation coincides with the top left edge of the rear sight slide. He then tightens the range plate screw and records the deflection for future reference.

121. TRAVERSING AND SEARCHING THE GUN:

Machinegun targets may have width and depth which requires the gunner to move the gun in order to distribute fire throughout the target area.

a. Traversing —

This is moving the muzzle of the weapon to the left or right to distribute fire laterally. With the bipod mounted gun, this is accomplished by selecting successive aiming points in the target area. The gunner makes minor changes in direction by shifting his shoulders slightly to the right or left. To make major changes in direction, the gunner moves his elbows and realines his body to remain directly behind the gun.

b. Searching —

This is moving the muzzle of the weapon up or down to distribute fire in depth and is accomplished by selecting successive aiming points in the target area. To make changes in elevation, the gunner moves his elbows closer together or farther apart.

122. OBSERVATION AND ADJUSTMENT OF FIRE:

Gunners must be taught to observe and rapidly adjust their fire.

a. Observation of Fire —

Machinegun fire is observed by noting the strike of the projectiles in the target area, by observing tracers in their flight, or, in the case of the 10-meter range, by noting the holes made in the target.

b. Adjustment of Fire —

When firing the bipod mounted gun, fire is adjusted by changing the gunner's body position as outlined in paragraph 121.

123. OPERATING WITH SPEED:

Gunners must be capable of delivering effective fire onto a given target with speed. Initially, however, emphasis must be placed upon

attaining proficiency in the first three objectives. Speed will come as a byproduct while becoming skilled in the first three objectives (paragraph 119a).

124. FIRE COMMANDS: (Chapter 6)

The standardized fire command is used as a means of control during marksmanship training. The fire command as it applies to the basic range must be understood by the gunner. The elements are given (as appropriate) before each firing exercise. The gunner takes the appropriate action as indicated and repeats each element as it is announced.

a. Alert —

The alert is given as FIRE MISSION. Upon receipt of the alert, the gunner loads his weapon and places the safety on FIRE.

b. Direction —

Since all targets appear to the gunner's front, the direction is given as FRONT.

c. Description —

Since the gunner aims at black aiming pasters, description is announced as PASTER NUMBER _____ (pasters 1-8 as appropriate), at which time the gunner lays on the announced paster.

d. Range —

A range setting of 500 meters on the rear sight is always used on the basic range. This is announced as FIVE HUNDRED, at which time the gunner must insure that his rear sight reflects the correct range setting.

e. Method of Fire —

Manipulation is announced as FIXED, TRAVERSE, SEARCH, and TRAVERSE AND SEARCH. All firing on the basic range with the bipod mounted gun is at point targets, so the method of fire is announced as FIXED. The gunner fires either single rounds or bursts of six at a rate slower than the sustained rate; therefore, the rate of fire element is omitted.

f. Rate of Fire —

The rate of fire is always slower than the sustained rate; therefore, the rate of fire element is omitted.

g. Command to Open Fire —

To facilitate control, this is announced as AT MY COMMAND. When the gunner is ready, he announces UP to the assistant gunner who extends his right arm and hand in the READY signal. When all gunners are ready to fire, the command FIRE is given.

125. BASIC MACHINEGUN MARKSMANSHIP TARGET:

The basic machinegun marksmanship target (figure 124) is used for all firing on the basic range. An explanation of the target, to include size of the aiming pasters and scoring spaces, will aid the gunners in zeroing their weapons and facilitate control during the firing exercises.

a. The target consists of four sections lettered A, B, C, and D respectively, each of which consists of scoring spaces for eight fixed fire exercises (scoring spaces 1, 2, 3, 4, 5, 6, 7, and 8).

b. Each scoring space is four centimeters wide and five centimeters high.

c. The black aiming paster within each numbered scoring space is one centimeter wide by one centimeter high.

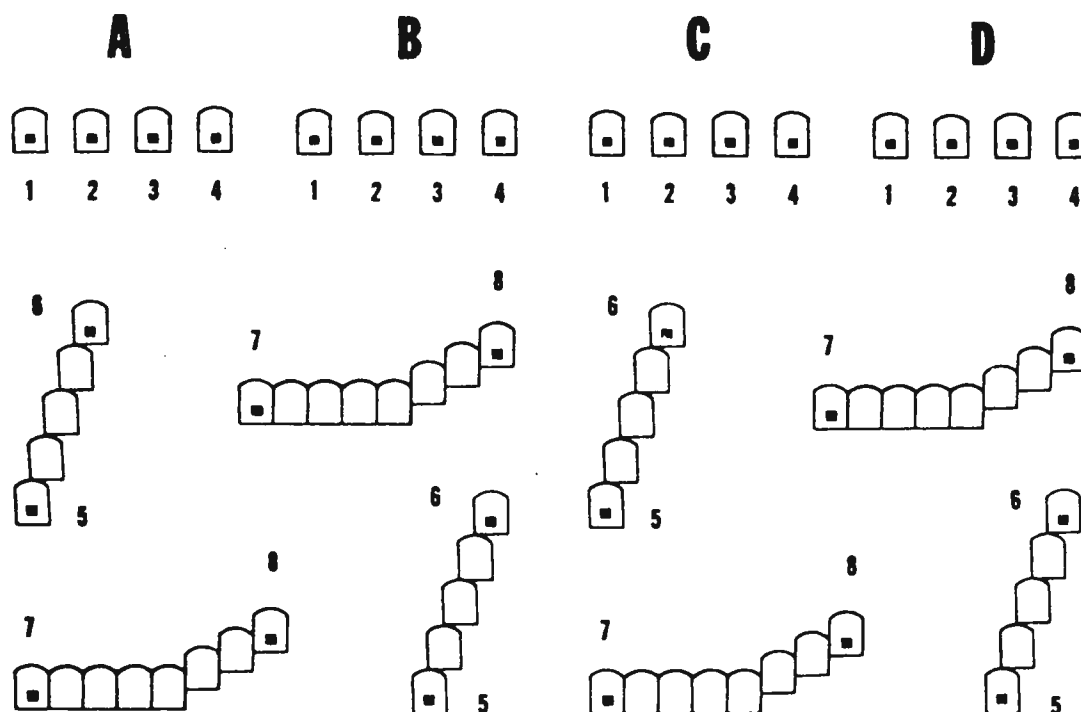


FIGURE 124 BASIC MACHINEGUN MARKSMANSHIP TARGET

126. ANALYZING AND SCORING THE TARGET:

Targets are analyzed and scored to determine the fundamentals in which gunners need more training and to determine their degree of proficiency.

a. Analyzing —

During bipod firing, a target is best analyzed by considering the fundamentals of position and grip and sight alinement and sight picture.

(1) Large shot groups are usually due to incorrect position and grip.

(2) Tight (small) shot groups, which are outside of the scoring space, are usually due to incorrect sight alinement or sight picture.

b. Scoring —

Bipod firing on the basic range is scored for instructional purposes only and may be scored by the gunner. Pastors 1 and 2 are used for zeroing and not scored.

(1) One point is given for each hit (not to exceed six) in each scoring space. Holes touching the boundary of a scoring space are considered hits.

(2) A bonus of two points is given for each scoring space hit, regardless of the number of rounds within the space.

(3) Since six scoring spaces are engaged with 36 rounds, the total possible score for table I is 48 points. A score of 26 is satisfactory.

127. RANGE FACILITY:

A standard basic range should consist of the following.

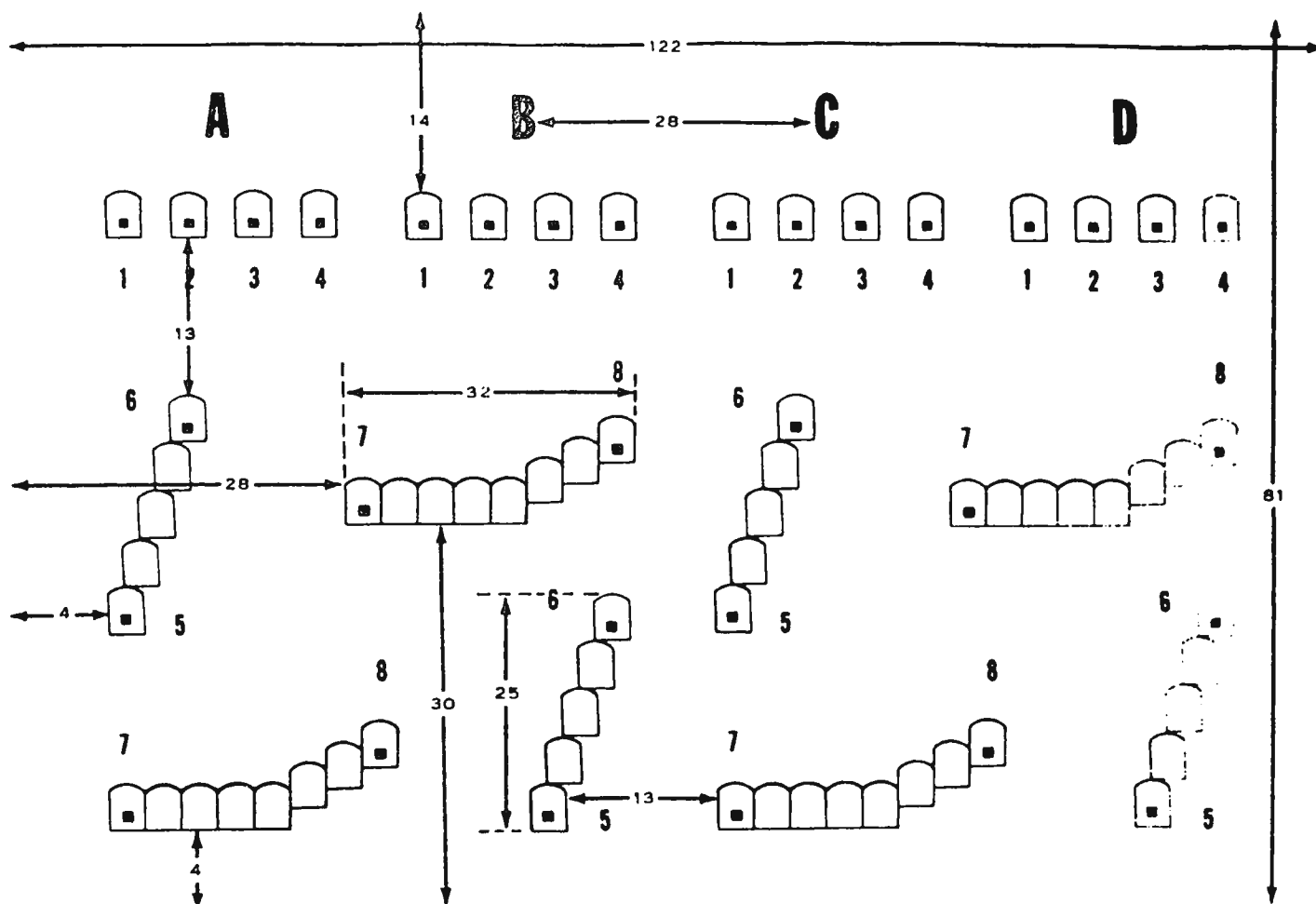
a. Firing line —

The firing line is of sufficient length to properly emplace the number of guns being fired allowing a minimum of three meters between guns.

b. Targets —

The target line is ten meters in front of the firing line. The machinegun marksmanship target is a paper target (figure 124) pasted onto target cloth which is stretched over a wooden frame.

One target is set up for each gun position. The dimensions of the target are shown in figure 125.



ALL MEASUREMENTS IN CENTIMETERS

FIGURE 125 BASIC MACHINEGUN MARKSMANSHIP TARGETS

c. Instructional Site —

A bleacher with the required seating capacity located to the immediate rear of the firing line is desirable.

d. Control Tower —

To control the firing line, a control tower is centrally located to the immediate rear of the firing line.

128. ORGANIZATION FOR FIRING AND CONDUCT OF FIRING EXERCISES:

a. Organization —

To conduct firing, the unit is organized into equal groups. Each group is divided into two firing orders. One order becomes gunners, and the other order becomes assistant gunners.

b. Conduct of Firing —

(1) The gunners and assistant gunners at each gun position set up their guns and perform prefiring check.

(2) The gunner is required to assume the correct gunner's position and to aim at paster 1. The assistant gunner checks his position and has him explain what sight alinement and sight picture he has taken.

(3) The gunner is then given fire commands to require him to place range settings on the rear sight. This is done to insure proficiency in moving the rear sight slide and obtaining accurate sight settings. The assistant gunner checks the manner in which the gunner sets his sight, checks the range settings for correctness, and points out any errors.

(4) A fire command is then issued requiring the first order to zero their guns..

(5) At the completion of zeroing, individual fire commands are issued to require the gunners to engage each of the six remaining numbered scoring spaces. Sufficient time is allowed between bursts to permit gunners to observe their firing from the firing line.

(6) After the first order has fired table I, the second order fires the course in the same manner.

(7) After both orders have fired, the weapons are cleared.

(8) After the weapons have been cleared, both orders move to the target line where they analyze and score their targets as outlined in paragraph 126.

(9) Following this, the targets are analyzed, and the firing is critiqued by qualified personnel.

Section III. BASIC MARKSMANSHIP TRAINING, TRIPOD MOUNTED GUN.
BASIC (10-METER) RANGE

129. GENERAL:

Basic marksmanship training with the tripod mounted gun is a continuation of basic marksmanship training with bipod mounted gun.

The same four objective which applied to the bipod mounted gun also apply here; however, the techniques used in attaining these objectives differ in some instances. Therefore, the gunner is taught these techniques as they apply to the tripod mounted gun. He then applies these techniques during manipulation and practice and record firing on the basic (10-meter) range.

130. MOUNTING AND EMLACING THE GUN:

To assist in delivering accurate fire, the gun must be properly mounted and emplaced.

a. Mounting the gun —

(1) Place the mount on the ground with the pintle lock lever ten meters from the target and the front leg pointing toward the center of the target.

(2) Place the gun on the mount (paragraph 36a).

(3) Center the traversing mechanism, "0" the elevating hand-wheel and upper screw plate scale and expose one and a half inches of threads on the lower elevating screw.

(4) Attach the traversing and elevating mechanism to the gun and clamp the left edge of the traversing slide on the zero graduation on the traversing bar.

b. Emplacing the Gun —

(1) The gunner alines the gun and the mount for direction by shifting the rear legs of the tripod until the gun is pointing to the approximate center of the target.

(2) The gunner then loosens the dirt around and under the tripod feet and firmly emplaces the tripod shoes in the ground.

(3) If the traversing bar is not level, he removes the dirt from under one or both of the rear shoes to level it. He also insures that only the tripod feet, and not the legs, are in contact with the ground, and that dirt is removed from under the traversing bar to insure that the slide can be moved freely across the bar.

131. OBTAINING AN ACCURATE INITIAL BURST:

To obtain an accurate initial burst with the tripod mounted gun, the fundamentals of position and grip, sight alinement and sight picture, trigger manipulation, and zeroing must be properly applied.

a. Position and grip (figure 126)



FIGURE 126 PRONE POSITION

(1) The gunner assumes the prone position behind the gun so that a straight line drawn through the weapon would bisect his right shoulder and his right buttock (figure 121).

(2) His legs are spread a comfortable distance apart, and his heels are down, if possible.

(3) He grasps the pistol grip with his right hand, index finger resting lightly on the trigger.

(4) With his left hand, palm down, he grasps the elevating handwheel and exerts a firm downward pressure with both hands, both while aiming and firing the gun.

(5) His cheek rests lightly (if at all) against the cover.

(6) His elbows are inside the tripod legs, but not touching the tripod.

(7) The gunner has his shoulder lightly against the stock of the gun. He does not apply any pressure, because this could push the gun out of alinement while firing.

b.. Sight Alinement, Sight Picture, Trigger Manipulation, and Zeroing —

Are the same as outlined for the bipod mounted gun in paragraphs 119 through 120.

132. TRAVERSING AND SEARCHING THE GUN:

Machinegun targets may have width and depth which requires the gunner to move the gun by manipulating the handwheels in order to distribute fire throughout the target area.

a. Changes —

All manipulations are made with the left hand. Changes in direction are made first and then changes in elevation. The three manipulations are traverse, search, and traverse and search.

b. Traversing —

To make changes in direction, the following fundamentals are applied.

(1) To move the muzzle of the gun to the right, the gunner puts his left hand on the traversing handwheel, thumb up, and pushes his thumb away from himself (PUSH RIGHT).

(2) To move the muzzle of the gun to the left, the gunner pulls his thumb toward himself (PULL LEFT).

c. Searching —

To make changes in elevation, the following fundamentals are applied.

(1) To move the muzzle of the gun up (search up), the gunner grasps the elevating handwheel with his left hand and pushes his thumb away from himself (PUSH ADD).

(2) To move the muzzle of the gun down (search down), he pulls his thumb toward himself (PULL DROP).

133. OBSERVATION AND ADJUSTMENT OF FIRE:

Gunners must be taught to observe and rapidly adjust their fire.

a. Observation of fire is the same as outlined in paragraph 122.

b. To adjust fire when firing the tripod mounted gun, the gunner makes adjustments by manipulating the traversing and elevating handwheels. A 1-click adjustment on either wheel equals a 1-mil change, and will move the strike of the projectile 1 centimeter (the width or height of the black aiming paster) on the 10-meter range.

134. OPERATING WITH SPEED:

Gunners must be capable of delivering effective fire onto a given target with speed. During the initial training of a gunner, however, emphasis must be placed on the first three objectives before he is required to operate with speed. Speed will come as a byproduct while attaining skill in the first three objectives. The only timed exercises are record practice firing and record firing.

135. ANALYZING AND SCORING THE TARGET AND MAINTAINING THE SCORECARD:

Targets are analyzed to determine the objectives and fundamentals in which the gunner needs more training. The targets are scored to determine the degree of proficiency of the gunner, and a score card is maintained as a record of his performance.

a. Analyzing the Target —

- (1) Large shot groups - This is usually due to-
 - (a) Incorrect position and grip.
 - (b) Improper emplacement of the gun.
- (2) A tight (small) initial shot group outside the first scoring space - is usually due to incorrect sight alinement or sight picture.
- (3) Second or subsequent bursts outside the scoring spaces - is caused by a failure to properly traverse or search the gun.
- (4) Tight shot groups fired continuously either high, low, right, or left of each scoring space - indicates a failure to properly observe and adjust fire.
- (5) Failure to complete a firing exercise in the time prescribed - indicates a need for more training in the first three objectives.

b. Scoring the Target —

During all firing except record firing, the gunner may score his target. Only exercise 7-8 and 6-5 are scored.

- (1) One point is given for each hit, not to exceed six in each scoring space. Holes touching the boundary of a scoring space are considered hits but can be counted in only one scoring space.
- (2) A bonus of two points is given for each scoring space engaged, regardless of the number of hits within the space.
- (3) When firing exercise 7-8, eight scoring spaces are engaged with 48 rounds. The possible score is 64 points. When firing exercise 6-5, five scoring spaces are engaged with 30 rounds. The possible score is 40 points.
- (4) The total possible score for exercise 7-8 and 6-5 is 104 points. A minimum score of 65 points is required for the gunner to qualify on the basic range (paragraph 143).

c. Maintaining the Scorecard —

(1) All scores are entered by authorized personnel and are made in ink or indelible pencil. No erasures are allowed.

(2) Alterations may be made only by the unit commander or an officer acting as scorer, and they must be authenticated.

(3) All scorecards are checked and signed by the authorized SALTU NCO.

136. RECORD FIRING PROCEDURES:

Before record firing is conducted, all personnel (gunners and instructors) must be familiar with the time and ammunition allowances, procedures followed in the event of a stoppage, and penalties imposed. It will be necessary for gunners to emplace and zero their guns prior to firing.

a. Time and Ammunition Allowances (table IV) —

(1) The gunner is allotted six rounds to zero.

(2) He is then given individual fire commands and fires four spacings of six rounds at pasters 1, 2, 3, and 4 for practice in firing 6-round bursts.

(3) He is then allotted 50 seconds to fire 48 rounds at exercise 7-8 on command, and 40 seconds and 30 rounds to fire exercise 6-5 on command.

b. Stoppages —

(1) If a stoppage occurs, the gunner must apply immediate action. If the stoppage is reduced, he continues to fire the course. To complete firing of the exercise the gunner is allotted 15 seconds for each application of immediate action.

(2) If a stoppage occurs which cannot be reduced by applying immediate action, the gunner raises his hand and announces TIME.

(3) Upon hearing a gunner announce TIME, the assistant instructor notes the time, insures that a legitimate stoppage exists, and assists the gunner in reducing it. He then instructs the gunner to complete firing, allowing him additional 15 seconds for each application of immediate action.

(4) If the cause of a stoppage is due to an error on the part of the gunner, additional time is not permitted. The gunner then receives the score he obtained before the stoppage occurred.

(5) If it should be necessary to replace the entire weapon, the gunner is given six rounds to zero the new weapon and he may then refire the exercise.

(6) Gunners who could not complete firing in the time allotted due to malfunctions and applying immediate action, finish the exercise in an alibi run after all other gunners complete firing.

c. Penalties —

(1) A penalty of five points is deducted from the score of any gunner who fails to stop firing at the command or signal to cease fire.

(2) One additional point is deducted for each round in excess of three fired after the command CEASE FIRE was given.

(3) If a gunner fires at the wrong target or exercise, he loses the points for those rounds. The gunner whose target was fired upon by another gunner, is permitted to refire the exercise.

137. MANIPULATION EXERCISES:

a. Upon command the gunner assumes the correct position behind the gun. The assistant gunner moves to a position approximately ten steps to the gunner's front and slowly moves his hand right, left, up, and down requiring the gunner to follow these movements with the gun by manipulating the traversing and elevating handwheels.

b. After the gunner reaches the degree of proficiency required, the assistant gunner becomes the gunner and the exercises are repeated in the same manner.

138. PRACTICE FIRING (TABLE II):

Each gunner is issued six single rounds, four spacings of six rounds, one belt of 48 rounds, and one belt of 30 rounds.

a. The gunner and assistant gunner at each gun position set up their guns and perform prefiring checks (paragraphs 58 - 61).

b. The gunner zeroes as outlined in paragraph 120d.

c. Fire commands are given, requiring the gunners to fire four spacings of six rounds each at pasters 1, 2, 3, and 4 to give him additional practice in firing 6-round bursts.

d. The gunner is then given a command to fire the 18-round belt at exercises 7-8, attempting to place a 6-round burst in each of the eight scoring spaces.

e. The gunner is then given a command to fire the 30-round belt at exercise 6-5, attempting to place a 6-round burst in each of the five scoring spaces.

f. The gun is cleared (paragraph 43), and the gunner moves to the target line to score and analyze his target. While the gunners are scoring and analyzing their targets, assistant instructors critique each gunner individually.

g. After the scoring, analysis, and critique of the first order, the gunner and assistant gunner change over and the second order fires the exercises in the same manner.

139. RECORD PRACTICE FIRING (TABLE III):

This is a timed exercise designed to emphasize the necessity for operating with speed and to familiarize the gunner with record firing procedures.

- a. This firing immediately follows practice firing.
- b. Exercises 7-8 and 6-5 are fired. The gunner is allotted 50 seconds to fire exercise 7-8 and 40 seconds to fire exercise 6-5.
- c. During this firing the assistant gunner performs no checks.
- d. Before each exercise is fired, instructor personnel lay the guns off for direction to require the gunner to readjust and lay on his target.
- e. The assistant gunner must be directed to observe the control tower in order to have the gunner cease fire on command.
- f. Upon completion of firing both exercises, the targets are analyzed and scored.

140. RECORD FIRING (TABLE IV):

- a. The gunners and assistant gunners emplace their guns and perform the prefiring checks.
- b. After zeroing is completed, record fire is conducted.
- c. After the first order has fired, the gunners and assistant gunners change over and the second order fires for record.
- d. Upon completion of all firing, weapons are cleared, instructor personnel score the targets, record the scores (paragraph 135b), and conduct a final critique.

Section IV. TRANSITION FIRING

141. GENERAL:

a. Bipod firing on the basic (10-meter) marksmanship range teaches the gunner the basic fundamentals of firing the bipod mounted gun. Later, when the gunner moves to the transition range, he is taught to engage targets at long ranges with the bipod mounted gun.

b. Transition firing provides the gunner the necessary experience to progress from basic (10-meter) range firing to field firing. It is also the final phase of a gunners qualification.

c. Prior to transition firing the individual receives training in the fundamentals of long-range target engagement to include field zeroing, range determination, and the alternate aiming point method of fire adjustment.

142. TRANSITION RANGE:

Either eight single "E" silhouette targets or eight double "E" silhouette targets must be used in each lane (double "E" silhouettes if possible). The target closest to the firing line is target number 1 and is located at a range of 400 meters. The target farthest from the firing line is target number 8 and is located at a range of 800 meters. The remaining six targets are located at various ranges between targets number 1 and 8. Any two of these targets, as they appear to a gunner from the firing line, must be at least five mils apart in width or 150 meters apart in depth. This spacing of the targets will require the gunner to make a major change in either direction or elevation when engaging any two successive targets.

143. FIELD ZEROING:

Gunners must be taught how to zero the weapon at long ranges.

a. During field zeroing, a target between 300 and 700 meters should be selected. The reasons for this are that range graduations on the rear sight of the M60 machinegun begin at 300 meters, making it impossible to place a lesser range setting on the sight, and at ranges greater than 700 meters the gunner will experience great difficulty in determining the center of the beaten zone in relation to the target.

b. After determining the range to the target on which he is going to zero, the gunner places this range on the rear sight and aligns the windage index (zero windage). A 500-meter target is recommended because of the ease of determining deflection adjustments at that range.

c. The gunner fires a 6- to 9-round burst at the target and notes where the burst hits.

d. The gunner then makes any necessary corrections for deflection. One click or one mil on the windage knob moves the line of aim one meter at a thousand meters ($\frac{1}{2}$ meter at 500 meters). He applies the necessary corrections for deflection by moving the rear sight the necessary number of clicks in the direction of the target. For example, if the gunner is two meters to the right of the target at a distance of 500 meters, he will move the rear sight four clicks (mils) in the opposite direction (left).

e. The gunner estimates how high or low he thinks the center of the beaten zone is hitting in relation to the target and makes elevation changes accordingly. It is extremely difficult to determine how high or low the beaten zone is in relation to the target, especially over uneven terrain or at greater ranges. New gunners will have to rely on trial and error until they gain sufficient experience to make accurate estimates.

f. After correcting for deflection and elevation, the gunner fires a confirming burst, and if his adjustments were correct, the gunner then adjusts the range plate (paragraph 120a(6)).

g. If the gunner does not hit the target with the confirming burst, he repeats the same procedures treating each subsequent burst as if it were the initial burst.

144. ADJUSTED AIMING POINT METHOD OF FIRE ADJUSTMENT:

a. All machinegunners strive for an accurate initial burst. However, an accurate initial burst may not always be obtained. Therefore, gunners must have a means of rapidly and accurately adjusting their fire onto the target without going through the time consuming process of making sight adjustments. This is known as the adjusted aiming point method of fire adjustment.

b. If the gunner misses the target with his initial burst, he must select a new aiming point on the ground the same distance from the target as the center of impact of the initial burst but in the opposite direction and fire a second burst (figure 127).

145. TRANSITION COURSE (TABLE V):

a. Rules —

These rules are predicated upon a transition course utilizing double "E" silhouette targets. If single "E" silhouette targets are used, gunners should be allotted 180 rounds and a maximum of three burst per target to compensate for the greater difficulty they will experience in engaging them. Also, when using single "E" silhouettes, no minimum score is required in order to qualify in this phase of a gunner's qualification.

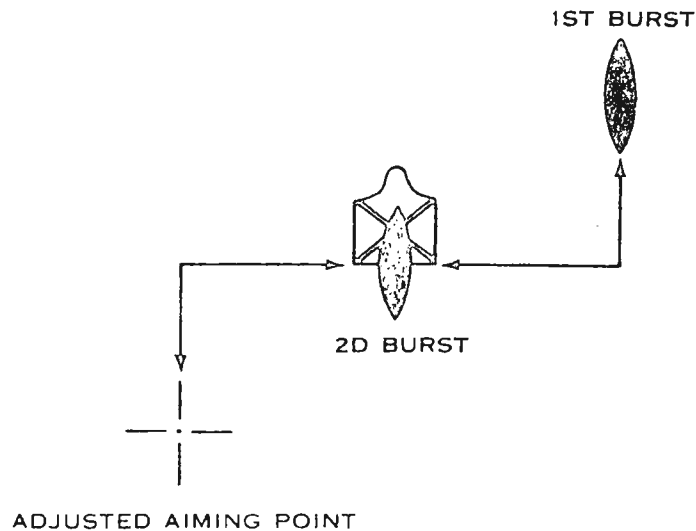


FIGURE 127 ADJUSTED AIMING POINT

(1) Each gunner is allotted 120 rounds and four minutes to engage the eight targets in his lane. He may fire a maximum of two bursts (any number of rounds is considered a burst) at each target, but he fires the second burst only if he fails to hit the target with his first burst.

(2) The assistant gunner may assist the gunner in locating targets but may not assist the gunner in determining the range to them or in adjusting his fire.

(3) Target number 1 (400 meters) is always the first target engaged.

(4) If a stoppage occurs, the gunner must apply immediate action; and if the stoppage is reduced, continue to fire the course. The gunner may be allotted an additional 15 seconds for each application of immediate action. If a stoppage occurs which cannot be reduced by immediate action the gunner announces TIME and with the assistance of the lane NCO reduces the stoppage. When the gunner announces time, the lane NCO notes how many targets the gunner has not engaged, and after the stoppage has been reduced, insures that the gunner is allotted 30 seconds to engage each of the remaining targets.

(5) In order to qualify, the gunner must engage all eight targets within the prescribed time limit.

(6) A minimum score of 50 points is required (five hits) in order to receive a qualification.

b. Recommended Method of Firing the Course —

(1) Each gunner zeroes his weapon prior to firing the course.

(2) Within each lane one gunner fires, determines the range to each target, places this setting on the rear sight, assumes proper position and grip, obtains correct sight alinement and sight picture, and fires 6- to 9-round bursts.

(3) If the gunner fails to hit the target with his initial burst, he must utilize the adjusted aiming point method of fire adjustment to attempt to hit the target with his next burst.

c. Scoring Procedures —

(1) A gunner is credited with ten points for each target he hits and no credit for unexpended ammunition.

(2) The score is recorded in the place provided on the same scorecard which was used to record the gunner's score on the basic (10-meter) range.

(3) All entries on the scorecard are made by authorized personnel only.

REVIEW QUESTIONS

1. Machinegun marksmanship training includes training on both the

_____ and _____.

2. The objectives of machinegun marksmanship are

a. _____

b. _____

c. _____

d. _____

3. To obtain an accurate initial burst, the fundamentals of _____

and _____, _____ and _____,

_____ and _____ must be properly applied.

4. Adjusting the rear sight until the strike of the bullet coincides with the point of aim at a given range, and then adjusting the range plate to reflect this range is _____.
5. To move the muzzle of the gun to the right, the gunner puts his _____ thumb on the traversing handwheel, thumb _____, and _____ his thumb _____ himself.
6. To move the muzzle of the gun up, the gunner grasps the elevating handwheel with his _____ hand and _____ his thumb _____ himself.
7. If a stoppage occurs, the gunner must _____.
8. If the cause of a stoppage is due to an error on the part of the gunner _____ is not permitted.
9. A penalty of _____ points is deducted from the score of any gunner who fails to stop firing on the command or signal to cease fire..
10. On the transition range, the target closest to the firing line is located at a range of _____ meters.
11. On the transition range, the target farthest from the firing line is located at a range of _____ meters.
12. During field zeroing (long-range), a target between _____ and _____ meters should be selected.

NOTES