

FM 23-9

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FIELD MANUAL

**M16A1 RIFLE  
AND  
RIFLE  
MARKSMANSHIP**

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HEADQUARTERS, DEPARTMENT OF THE ARMY

JUNE 1974

## WARNING

There are certain safety procedures relative to the handling and firing of M16A1 rifles and ammunition which every soldier should follow to avoid possible injury or death.

### DANGEROUS PROCEDURES

Never interchange bolts and / or bolt carrier groups between two weapons. Bolts may appear the same, however, interchanging them may result in incorrect head-space, which in turn may cause the weapon to blow up.

When assembling the bolt carrier group, insure that the *Bolt Cam Pin* is installed. The weapon may fire without it, but will blow up.

Failure to remove water from the barrel may result in the weapon blowing up. If the weapon has been submerged in water, exposed to heavy rain and / or dew, or there is any reason to believe there is excess moisture in the barrel, point the muzzle of the weapon toward the ground and pull the charging handle 2 to 3 inches to the rear, breaking the seal formed by a chambered round and allowing the water to drain out of the barrel. Release the charging handle and strike the forward assist to make sure the round is reseated in the chamber and the bolt is locked.

*Note.* When using the M16 rifle and this condition results, point the muzzle down, pull the charging handle completely to the rear, allow water to drain, and release charging handle.

When using the blank firing attachment (BFA) use only the M200 blank round with the *Violet Tip*. Initial issue of the M200 had a white tip; these cartridges should not be used because of excessive fouling.

Never fire ammunition that is suspected of or has evidence of being tampered with.

If a noticeable difference in sound or recoil is experienced, further firing should be suspended. Either of these conditions could indicate an incomplete propellant combustion and present the possibility that the projectile has not been propelled with sufficient force to clear the bore. In such instances, the bolt should be retracted slowly to remove and identify the fired cartridge case. The weapon should be cleared and examined for the presence of unburned propellant grains in the receiver, or possible presence of a bullet remaining in the bore. Any unburned propellant or obstruction in the bore should be removed before further firing.

*Note.* If bullet is lodged in bore, turn in rifle to direct support maintenance.

FIELD MANUAL

NO. 23-9

HEADQUARTERS  
DEPARTMENT OF THE ARMY  
WASHINGTON, D.C., 14 June 1974

## M16A1 RIFLE AND RIFLE MARKSMANSHIP

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\* This manual supersedes FM 23-9, 27 March 1970; TC 23-12, 16 June 1966; TC 23-20, 31 August 1967; FM 23-71, 18 December 1966; and FM 23-16, 23 June 1965, including all changes.

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This manual supersedes FM 21-21, 1970, and FM 21-21, 1971, which are hereby canceled. This manual is effective 15 June 1972. It contains all changes to the 1970 and 1971 editions.

# CHAPTER 1

## INTRODUCTION

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### 1-1. Purpose and Scope

This manual is designed to provide instructor guidance for presenting instruction, as required, on the 5.56-mm M16A1 rifle to include the necessary guidance for conducting basic rifle marksmanship and automatic rifle marksmanship training. (Guidance provided herein is also applicable to the 5.56-mm M16 rifle.)

### 1-2. Objectives

This manual provides the instructor with the knowledge and expertise necessary for development of training programs, plans, and lessons which will meet the following objectives of the United States Army rifle marksmanship program:

*a.* Develop in every soldier during training—

(1) The confidence, will, knowledge, and skills required to fire a rifle and hit the enemy in combat.

(2) The ability to apply correct techniques of rifle marksmanship when functioning as an individual in a unit engaged in combat.

*b.* Insure that every soldier maintains a continuing degree of proficiency in combat rifle firing consistent with the mission of the unit to which he is assigned.

*c.* Provide in time of peace a large number of shooters from which potential precision marksmen can be selected and further trained to successfully compete in interservice, civilian, and international competition.

*d.* Provide in time of war an instructor base or cadre for sniper training (TC 23-14), if it is required.

*e.* Insure that every soldier can properly maintain his weapon.

### 1-3. Training Conditions

*a.* The procedures and techniques used in the United States Army rifle marksmanship training program are based on the concept that riflemen must be proficient marksmen, capable of effectively applying their shooting skills in combat. The degree of proficiency attained by a rifleman is largely dependent upon the correct teaching and application of marksmanship fundamentals. Consequently, the sequence of instruction outlined in Army Subject Schedules 23-71 and 23-72 should be followed. Initially, during marksmanship training, emphasis is placed on learning or reviewing shooting fundamentals. These fundamentals are taught in an environment designed to prepare

soldiers for later combat-type exercises. Later in the course emphasis is gradually placed on the combat applications of marksmanship in addition to the fundamentals. These applications are based on the following, more common, conditions affecting marksmanship on the battlefield:

(1) Enemy personnel are seldom visible except in the assault.

(2) Most combat targets are linear in nature and will consist of a number of men or objects irregularly spaced along covered or concealed areas such as ground folds, hedges, and borders of woods.

(3) Most combat targets can be detected by smoke, flash, dust, noise, or movement and will only be visible for a brief moment.

(4) Combat targets can be engaged by using nearby objects as reference points.

(5) The range at which individual personnel targets can be detected and effectively engaged will rarely exceed 300 meters.

(6) The nature of the target, irregularities of terrain, and vegetation will generally require a rifleman to use a position other than the prone position to fire effectively on the target. In a defensive situation the rifleman will usually be firing from a foxhole position.

(7) Selecting an aiming point in elevation is difficult because of the low outline and obscurity of most combat targets.

(8) Time-pressure fire in combat can be categorized into three types:

*(a)* A single fleeting target that must be engaged within a minimum time period.

*(b)* A number of distributed targets engaged within the time they remain available. In the latter case the firer, at times, may select the time spent in engaging individual targets.

*(c)* A surprise target which must be engaged immediately with accurate, instinctive fire; e.g., a target in a bunker which is being cleared or a target that presents itself in a building that is being cleared.

*b.* Competition between individuals and units is an effective means of motivating the individual and engendering unit pride, *but it should never be fostered at the expense of the ultimate objective of the marksmanship program: to produce well-trained combat riflemen.* Should this objective become secondary to obtaining high scores on the range or qualifying the maximum number of soldiers, then it becomes a matter of time before the

more difficult aspects of the marksmanship courses are either eliminated or simplified to the point of being useless. None of the marksmanship courses, techniques, requirements, or objectives outlined in this manual are beyond the capability of any individual who has been found physically qualified for military service *provided he is given good instruction and proper supervision.*

#### 1-4 User Comments

Users of this manual are encouraged to submit

recommended changes and comments to improve the publication. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be prepared using DA Form 2028 (Recommended Changes to Publications and Blank Forms) and forwarded direct to the Commandant, US Army Infantry School, Fort Benning, Georgia 31905.

# CHAPTER 2

## MECHANICAL TRAINING

### Section I. CHARACTERISTICS

#### 2-1. Description of the Rifle

a. The M16A1 rifle (fig 2-1) is a 5.56-mm, magazine-fed, gas-operated, shoulder weapon. It is designed for either semiautomatic or automatic fire through the use of a selector lever.

b. The rifle is equipped with a flash suppressor.

c. The barrel is surrounded by two aluminum-lined fiberglass handguards which are notched to permit air to circulate around the barrel and further serve to protect the gas tube.

d. A hard pad is attached to the butt of the stock to partially reduce the effects of recoil.

e. A forward assist assembly located on the right rear of the upper receiver permits the closing of the bolt when this is not done by the force of the action spring.

*Note.* Provided on M16A1 only. M16 version does not have a forward assist assembly.

f. A "clothespin" bipod is issued to and used by the automatic rifleman. The bipod is attached to the barrel directly beneath the front sight between the bayonet lug and the front sling swivel (fig 2-2).

g. The trigger guard is easily adaptable to winter operations. A spring-loaded retaining pin is depressed with the nose of a cartridge, and the trigger guard is swung down along the pistol grip, allowing ready access to the trigger when wearing arctic mittens.

h. An ejection port cover is provided to prevent dirt or sand from getting into the ejection port. The cover should be closed during periods when firing is not anticipated. It will open by the forward or rearward movement of the bolt carrier.

i. A compartment to store cleaning equipment is provided in the stock (fig 2-35).

*Note.* Early production rifles do not have this compartment.

#### 2-2. General Data

##### a. Weights in Kilograms (Pounds):

	Kilograms	(Pounds)
(1) Rifle without magazine and sling ..	2.95	(6.50)
(2) Empty magazine (aluminum)		
(20 rounds) .....	.09	(.20)
(30 rounds) .....	.11	(.25)
(3) Full magazine (20 rounds) .....	.32	(.70)
(30 rounds) .....	.46	(1.01)
(4) *Sling, M1 .....	.18	(.40)

Kilograms (Pounds)

(5) Firing Weight (w / sling and loaded magazine)		
(20 rounds) .....	3.45	(7.60)
(30 rounds) .....	3.60	(7.91)
(6) Bipod, M3 .....	.27	(.60)
(7) Bipod case .....	.09	(.20)
(8) Bayonet-knife, M7 .....	.27	(.60)
(9) Scabbard, M8A1 .....	.14	(.30)

\* Sling, small arms, FSN 1005-714-9749, is an authorized substitute for sling M1. This sling is extra long and will enable a firer to carry the weapon slung across the front of his body in a position allowing him to remove both hands from the weapon, yet keep it available for use. It is especially useful for personnel designated as automatic riflemen or for personnel who must carry equipment such as radios and binoculars.

##### b. Lengths in Centimeters (Inches):

	Centimeters	(Inches)
(1) Rifle with bayonet-knife, M7 .....	112.40	(44.25)
(2) Rifle overall with flash suppressor ..	99.06	(39.00)
(3) Barrel (with flash suppressor) .....	53.34	(21.00)
(4) Barrel (without flash suppressor) ..	41.80	(20.00)

##### c. Sights.

- (1) Front ..... Adjustable click-type post. Each click equals 2.8 centimeters (1.1 inches) per every 100 meters of range.
- (2) Rear ..... Adjustable, flip type. Normal range setting is from 0 to 300 meters; long-range setting (L), 300 to 460 meters. Each notch of the windage drum equals 2.8 centimeters (1.1 inches) per every 100 meters of range. On a weapon set for battlesight zero of 250 meters flip to long range aperture; weapon is then zeroed for 290 to 375 meters.
- (3) Sight radius—50.17 centimeters (19.75 inches).

##### d. Ammunition.

- (1) Caliber 5.56-mm, M193 (complete round) .....
- (2) Projectile .....
- (3) Types .....
- (4) Recommended minimum basic load (30-round magazine) .....

##### e. Operational Characteristics.

- (1) Muzzle velocity in meters per second (feet per second) .....

- (2) Muzzle energy (at the muzzle) ..... 1,300 foot pounds (approximately).
- (3) Cyclic rate of fire ..... (700 to 800 rounds per minute (approximately)).
- (4) Maximum effective rate of fire:
  - (a) Semiautomatic ..... 45 to 65 rounds per minute.
  - (b) Automatic ..... 150 to 200 rounds per minute.
  - (c) Sustained rate of fire ..12 to 15 rounds per minute.
- (5) Maximum range ..... 2,653 meters.
- (6) Maximum effective range ..... 460 meters.

*f. Terms.*

- (1) Cyclic rate of fire ..... The rate at which a weapon fires automatically.
- (2) Sustained rate of fire .. Actual rate of fire that a weapon can continue to

deliver for an indefinite length of time without seriously overheating.

- (3) Maximum effective rate of fire ..... The rate of fire that can be maintained without danger to the firer or the weapon.
- (4) Maximum range ..... The greatest distance that a weapon can fire.
- (5) Maximum effective range ..... The greatest distance at which a weapon may be expected to fire accurately to inflict casualties or damage.

*g. M203 Grenade Launcher.* The M203 grenade launcher can be attached to the M16A1 rifle. The procedure for operating the M203 grenade launcher is explained in FM 23-31.

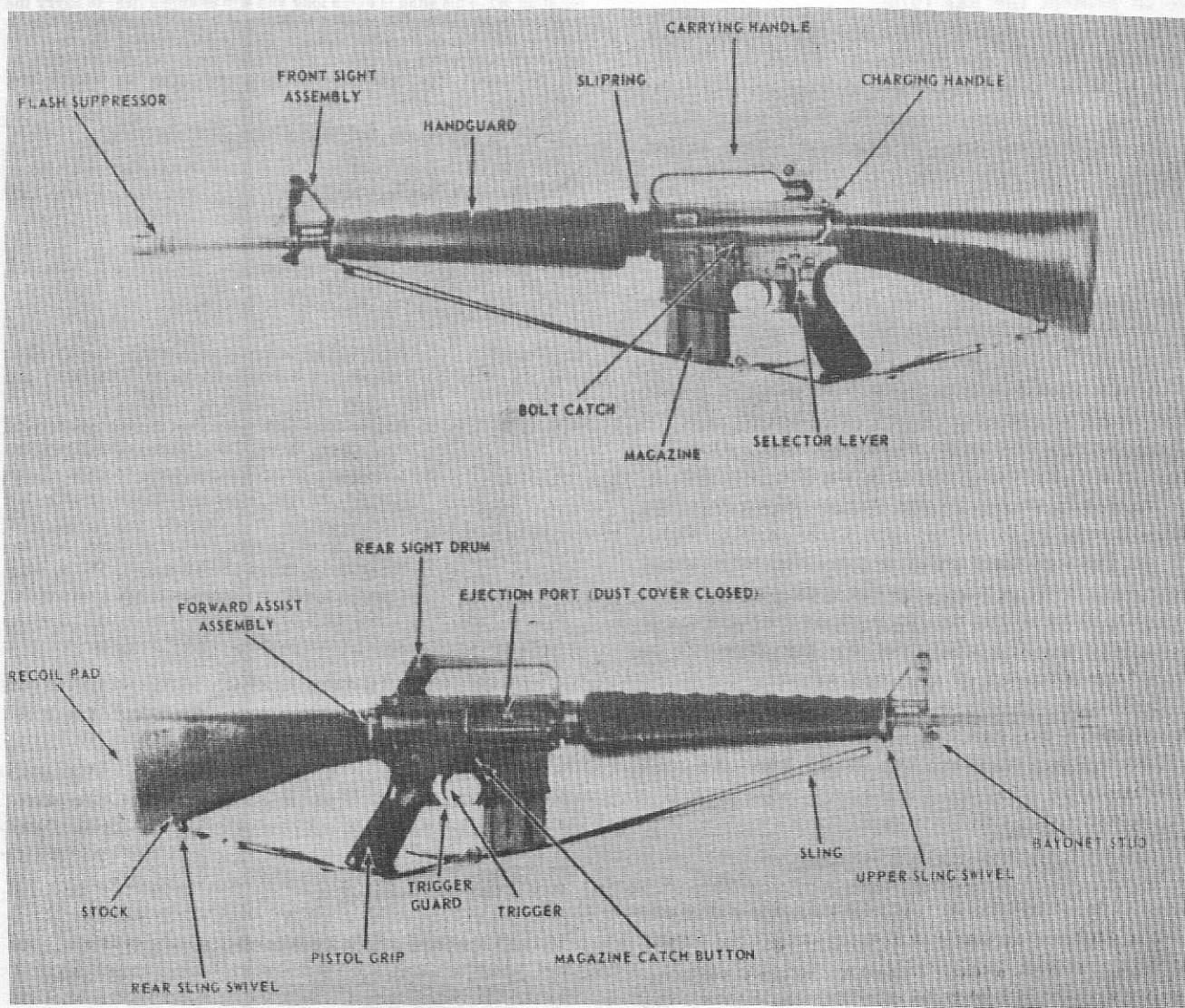


Figure 2-1. Rifle, 5.56-mm, M16A1, right and left side views.

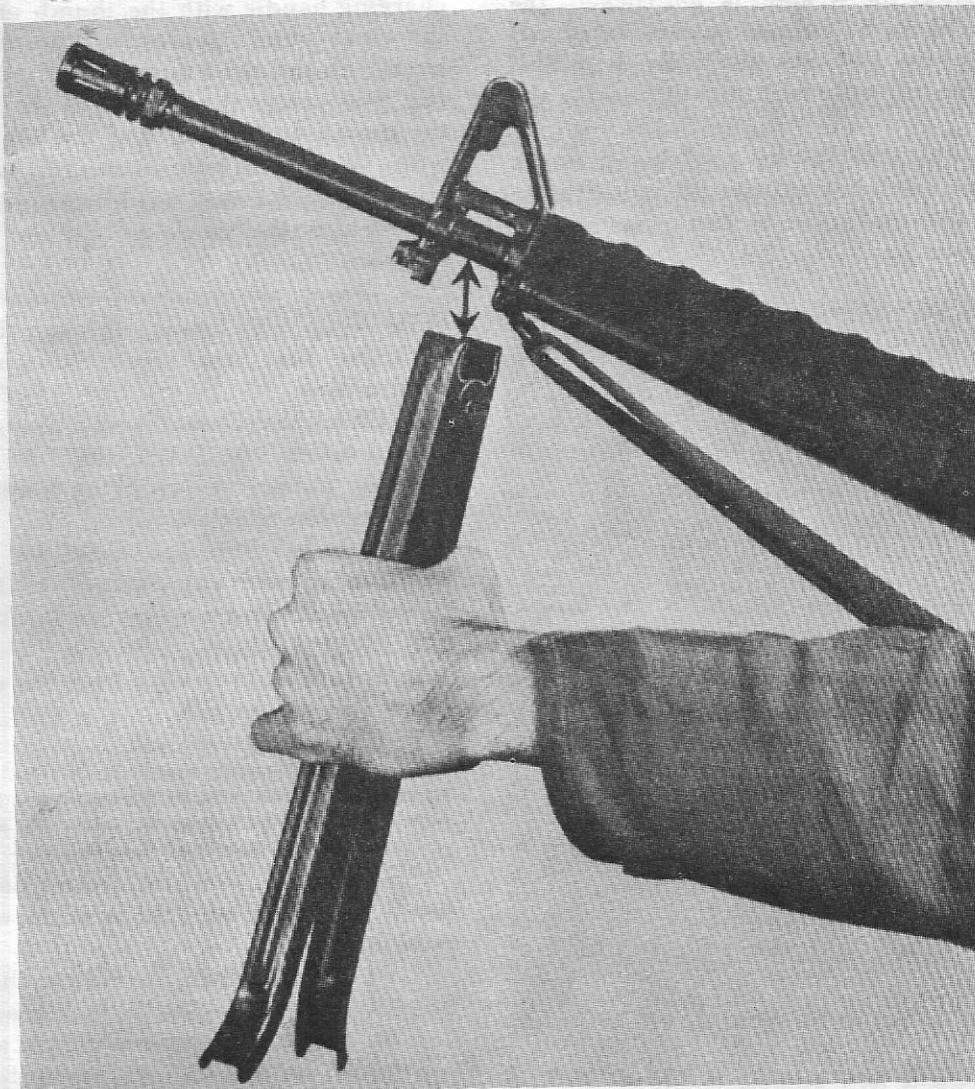


Figure 2-2. Attaching the bipod.

## Section II. DISASSEMBLY, ASSEMBLY, AND FUNCTION CHECK

### 2-3. General

a. The purpose of mechanical training is to give the soldier a knowledge of the working parts of the M16A1 rifle so that he will understand its operation, be able to locate and reduce stoppages, and properly maintain the weapon.

b. The soldier is authorized to disassemble the M16A1 rifle to the extent called *field stripping*. This can be accomplished without supervision and is adequate for normal maintenance.

*Note.* Do not attempt to remove / replace handguards when the upper and lower receivers are separated.

c. The frequency of disassembly and assembly should be kept to the minimum consistent with proper maintenance and instructional requirements.

d. The M16A1 rifle is easily disassembled and assembled. No force is required to accomplish this function.

e. As the weapon is disassembled, the parts should be laid out from left to right in the order of removal on a table or other clean surface. This makes assembly easier because the parts are assembled in the reverse order of disassembly. Nomenclature (the names of the parts) should be taught as the weapon is disassembled and assembled to make further instruction on the rifle easier to understand.

### 2-4. Clearing the M16A1 Rifle

The first consideration in handling any weapon is to make it safe by clearing it. To clear the rifle—

a. Attempt to point the selector lever toward SAFE (fig 2-3). If the weapon is *not* cocked, the selector lever *cannot* be pointed toward SAFE. If this is the case, do *not* cock the weapon at this time; instead, go on to the next step in clearing the weapon.

b. Remove the magazine by applying pressure on the magazine catch button with the index finger and allowing the magazine to fall clear of the weapon into your hand (fig 2-4).



Figure 2-3. Selector lever pointing to SAFE.



Figure 2-4. Removing the magazine.

c. Lock the bolt to the rear by grasping the charging handle with the thumb and forefinger of the right hand, depressing the charging handle latch with the right thumb, and pulling to the rear (fig 2-5); press the bottom of the bolt catch with the thumb or forefinger of the left hand (fig 2-6) when the bolt is fully rearward. Allow the bolt to move slowly forward until it engages the bolt catch and return the charging handle to its forward position.

d. Inspect the upper receiver and chamber area of the weapon by looking through the ejection port to insure that these areas contain no brass or ammunition.

e. Check the selector lever to insure that it points toward SAFE (fig 2-3). Allow the bolt to go forward by pulling the charging handle fully to the rear and releasing it.

**Caution:** Selector must be in the SAFE position to prevent damage to the automatic sear during disassembly and assembly.

## 2-5. Field Stripping

a. Disconnect the sling from the sling swivels at either end of the rifle.

b. Handguard removal.

*Note.* Handguards should be removed only when visual inspection (looking through the ventilation holes of the handguards) reveals rust, corrosion, or foreign matter around the gas tube and / or barrel of the rifle.

(1) Step 1. Place the recoil pad of the stock firmly on the ground or a table with the barrel pointing up.

(2) Step 2. Pivot the rifle so that the carrying handle (upper receiver) is facing away from you.

(3) Step 3. Place the fingers of one hand in the ventilation holes in the top of the handguard near the receiver and, simultaneously, place the thumb on the bottom of the handguard.

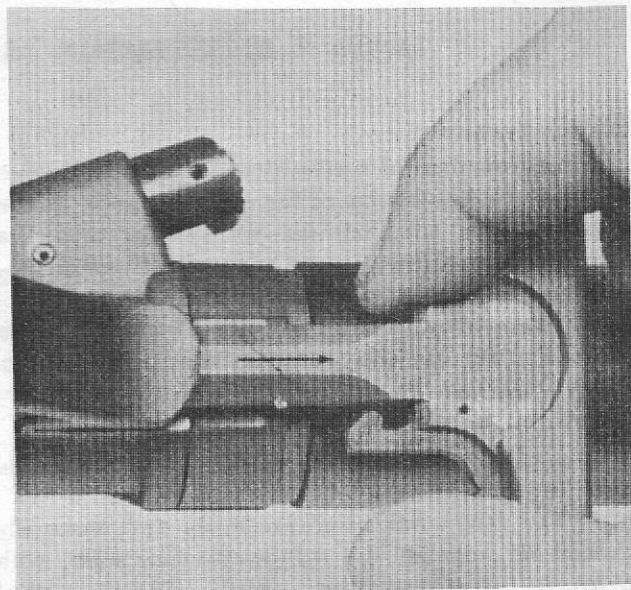


Figure 2-5. Pulling the charging handle rearward.



Figure 2-6. Locking the bolt open.

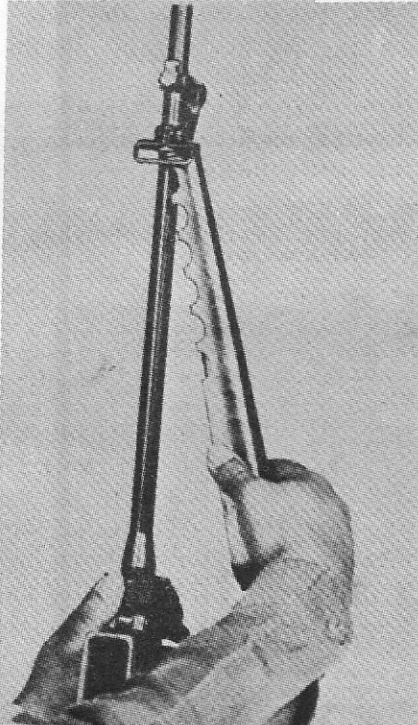


Figure 2-7. Removing the handguards.

(4) Step 4. Grip the slivering with the thumb and forefinger of the other hand. While pushing the slivering down on the side from which the handguard is to be removed, lift up and out on the handguard (1, fig 2-7).

(5) Step 5. Once one handguard is removed, the other can be removed by repeating this procedure with the opposite hand (2, fig 2-7).

*Note.* Handguards should not be removed/replaced when the upper and lower receiver groups are separated because of potential damage to the forward assist assembly. Care must be taken to prevent damage to the gas tube while the handguards are removed.

c. Using the nose of a cartridge or a similar pointed object, press out (unseat) the takedown pin (1, fig 2-8) until the upper receiver can swing free of the lower receiver.

*Note.* The takedown pin does not come completely out of the receiver.

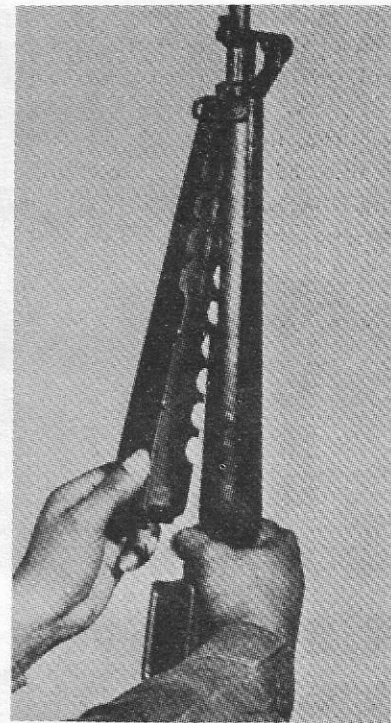


Figure 2-7—Continued.

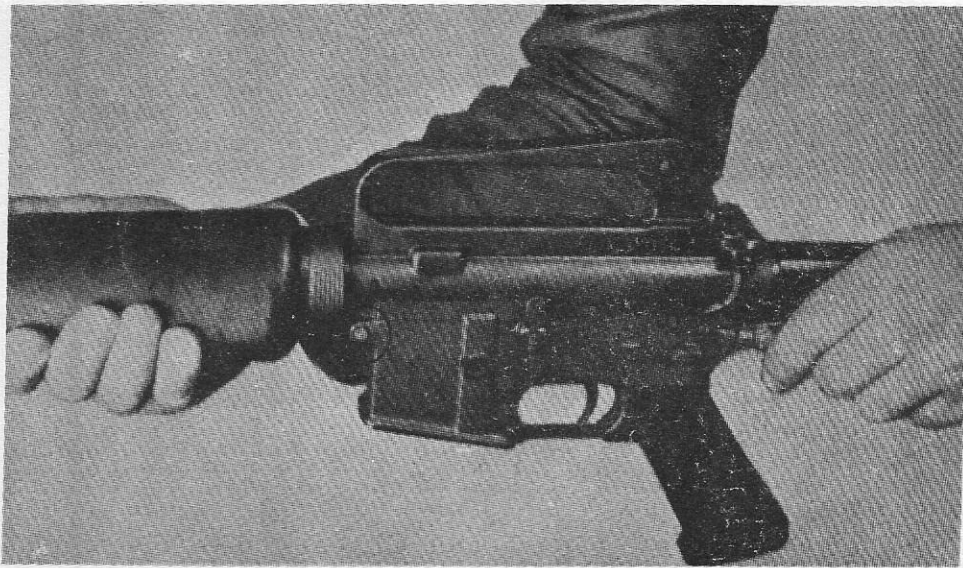
d. Again using the nose of a cartridge, press out (unseat) the receiver pivot pin (2, fig 2-8). Separate the upper and lower receiver groups (fig 2-9) and place the lower receiver group aside for the time being.

*Note.* The receiver pivot pin does not come out of the receiver.

e. Pick up the upper receiver group; keep the muzzle pointed to the left. Grasp the charging handle, pressing in on the charging handle latch, and pull to the rear 5 to 7 centimeters (2 to 3 inches) (1, fig 2-10). Grasp the bolt carrier and pull it from the receiver (2, fig 2-10). After the bolt carrier is removed, the charging handle will fall free of its groove in the receiver when pulled to the rear (fig 2-11). Place the upper receiver on a clean surface.

f. To disassemble the bolt carrier group, press out the firing pin retaining pin by using the nose of a cartridge or some similar object (fig 2-12). Elevate the front of the bolt carrier and allow the firing pin to drop from its well in the bolt (fig 2-13). Rotate the bolt until the cam pin is clear of the bolt carrier key and remove the cam pin by rotating it 90 degrees ( $\frac{1}{4}$ -turn) and lifting it out of the well in the bolt and bolt carrier (fig 2-14).

After the cam pin is removed, the bolt can be removed easily from its recess in the bolt carrier (1, fig 2-15). To remove the extractor, apply pressure on the extractor body just to the rear of the extractor pin (this compresses the extractor spring and reduces the pressure on the extractor pin).



- 1 Takedown pin
- 2 Receiver pivot pin

Figure 2-8. Unseating the takedown pin and receiver pivot pin.

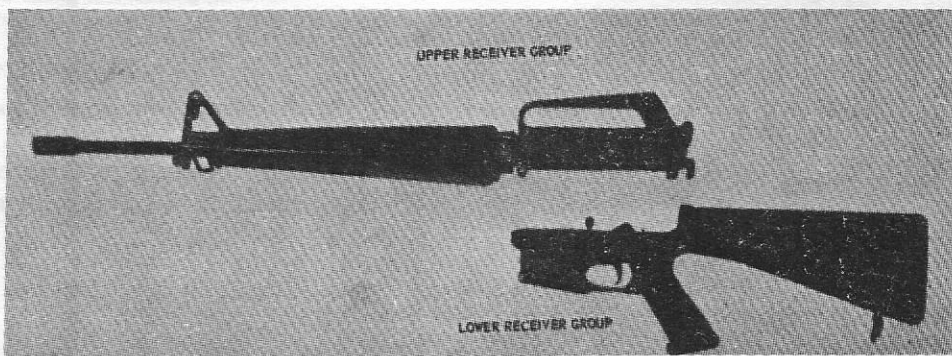


Figure 2-9. Upper and lower receiver groups.

With the tip of the firing pin (or some similar pointed object) push the extractor pin from the bolt body (2, fig 2-15). Release the pressure exerted on the extractor body and remove the extractor. The extractor spring should not be separated from the extractor. If it should become separated and is not damaged, it may be replaced by the user. When the spring is replaced, insure that the wide end of the spring is positioned in the recess of the extractor.

*Note.* The extractor should be removed only when necessary for cleaning.

g. The final step in disassembly is removal of the buffer assembly and action spring.

*Note.* The action spring is compressed and care must be taken when removing it.

Using the index finger of the left hand, push in on the buffer assembly. With the nose of a cartridge or some similar object push down on the buffer

retainer (1, fig 2-16). To remove the buffer assembly the hammer must be pressed downward past the cocked position. After the body of the buffer assembly has cleared the hammer the action spring can be withdrawn from the lower receiver (2, fig 2-16).

*Note.* While withdrawing the action spring, it may hang up on the buffer retainer. If this occurs, wiggling the action spring while withdrawing it will eliminate the resistance. Under no circumstance should the action spring be pulled if resistance is encountered.

h. This completes field stripping (fig 2-17).

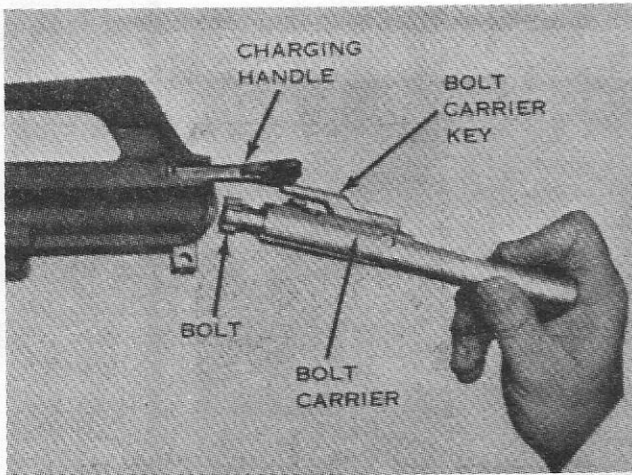
*Note.* Detailed disassembly consists of removing the remaining operating parts from the lower receiver (fig 2-18) and is NOT authorized at user level. The soldier has no need to disassemble the weapon beyond field stripping. Only qualified maintenance personnel are authorized to remove any other parts from the weapon.

**Caution:** Steps b and g above should be performed only when absolutely necessary for care and cleaning.



1 Pulling the charging handle rearward

Figure 2-10. Removing charging handle and bolt carrier from upper receiver.



2 Removing bolt carrier

Figure 2-10—Continued.

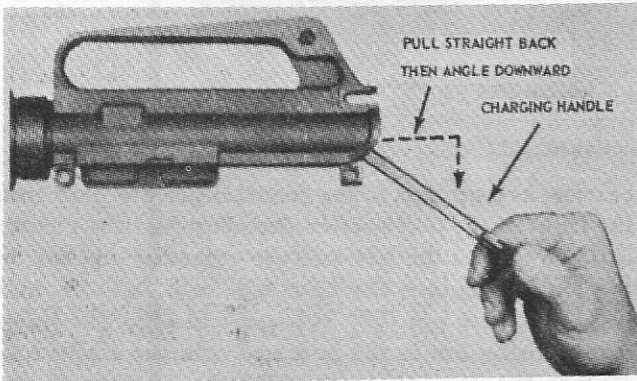


Figure 2-11. Removing the charging handle.

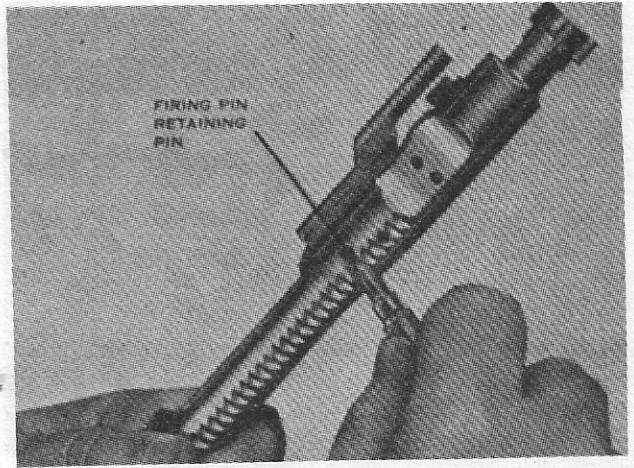


Figure 2-12. Pressing out firing pin retaining pin.



Figure 2-13. Removing the firing pin.

## 2-6. Assembly

To assemble the rifle, reverse the procedures of disassembly.

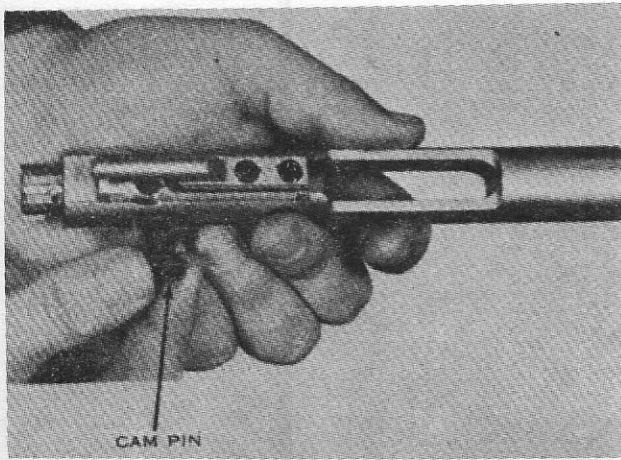
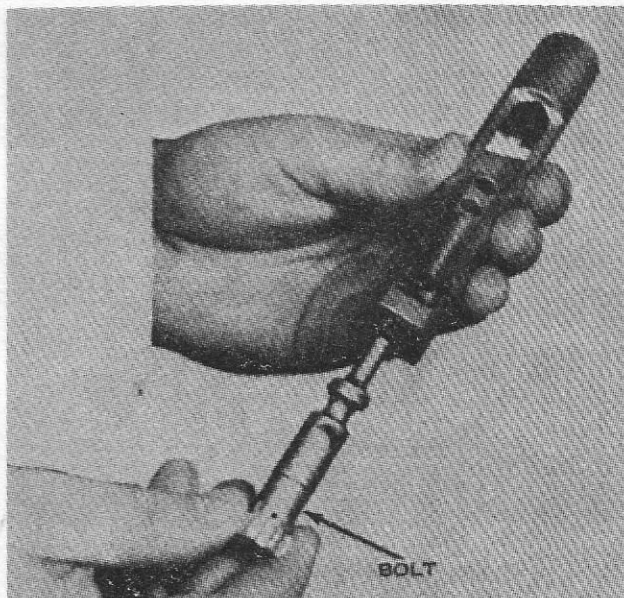


Figure 2-14. Removing the cam pin.

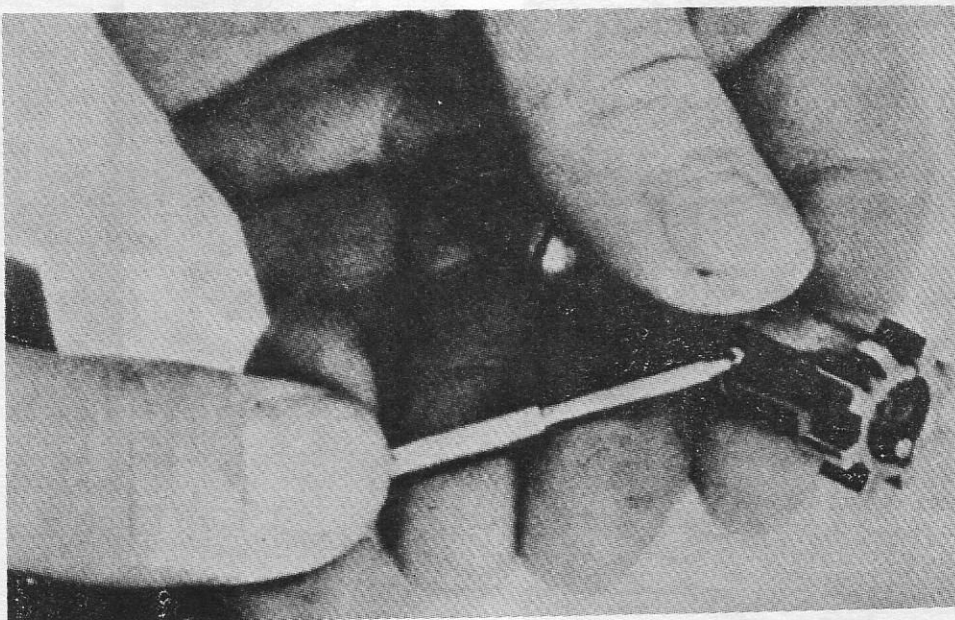
*Note.* The hammer must be in the cocked position to allow the buffer assembly and action spring to be inserted into the lower receiver extension.

a. Insure that the action spring is fully seated on the buffer assembly. Insert the loose end of the action spring into the lower receiver extension; press the hammer downward, past the cocked



1 Removing the bolt

Figure 2-15. Removing bolt and extractor.



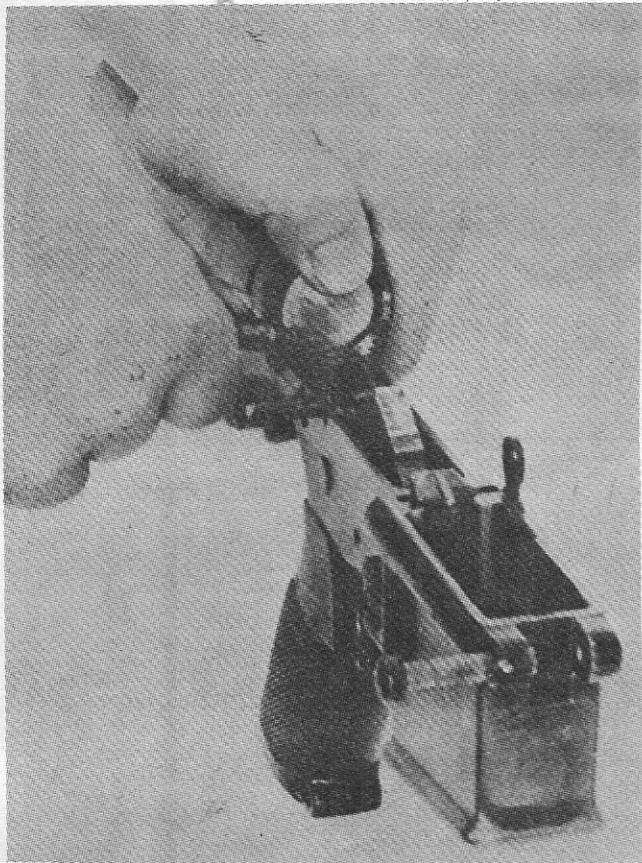
2 Removing the extractor

Figure 2-15—Continued.

position, to allow passage of the buffer assembly; depress the buffer retainer with the nose of a cartridge or some similar object; seat the buffer assembly and release the buffer retainer.

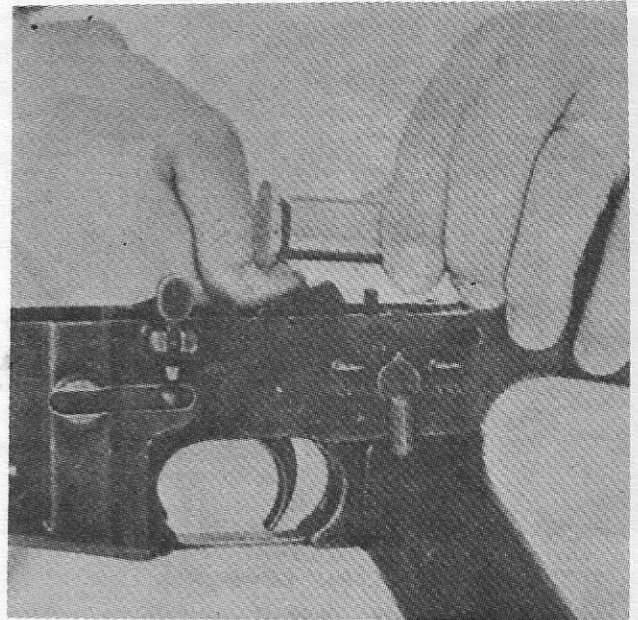
b. To assemble the bolt carrier group, grasp the bolt and the extractor with spring. Seat the extractor in the extractor recess, apply pressure on the extractor to align the pinhole and insert the extractor pin. Check the bolt rings to insure that the slots in the three rings are offset. Pick up the bolt

carrier, key up and to the front, insert the bolt into the front of the bolt carrier, insuring that the ejector is down and to the left and the extractor up and to the right. Replace the cam pin into its well and rotate the cam pin 90° (1/4-turn) to align the holes for the firing pin in the bolt and cam pin (failure to replace the cam pin can cause the weapon to explode). Grasp the lugged rim of the bolt and turn until the cam pin is directly under the bolt carrier key. Insert the firing pin through the open end of



1 Depressing the buffer retainer

Figure 2-16. Removing the buffer assembly and action spring.



2 Removing assembly and spring

Figure 2-16—Continued.

the bolt carrier and seat fully. Insert the firing pin retaining pin (if resistance is encountered, rotate pin clockwise while inserting).

**Caution:** Do not attempt to spread the slotted end of the firing pin retaining pin.

**Note.** Check for proper assembly by elevating the front of the bolt. If the firing pin drops out, the firing pin retaining pin was not seated between the front and rear spool at the base of the firing pin and the bolt carrier group is improperly assembled.

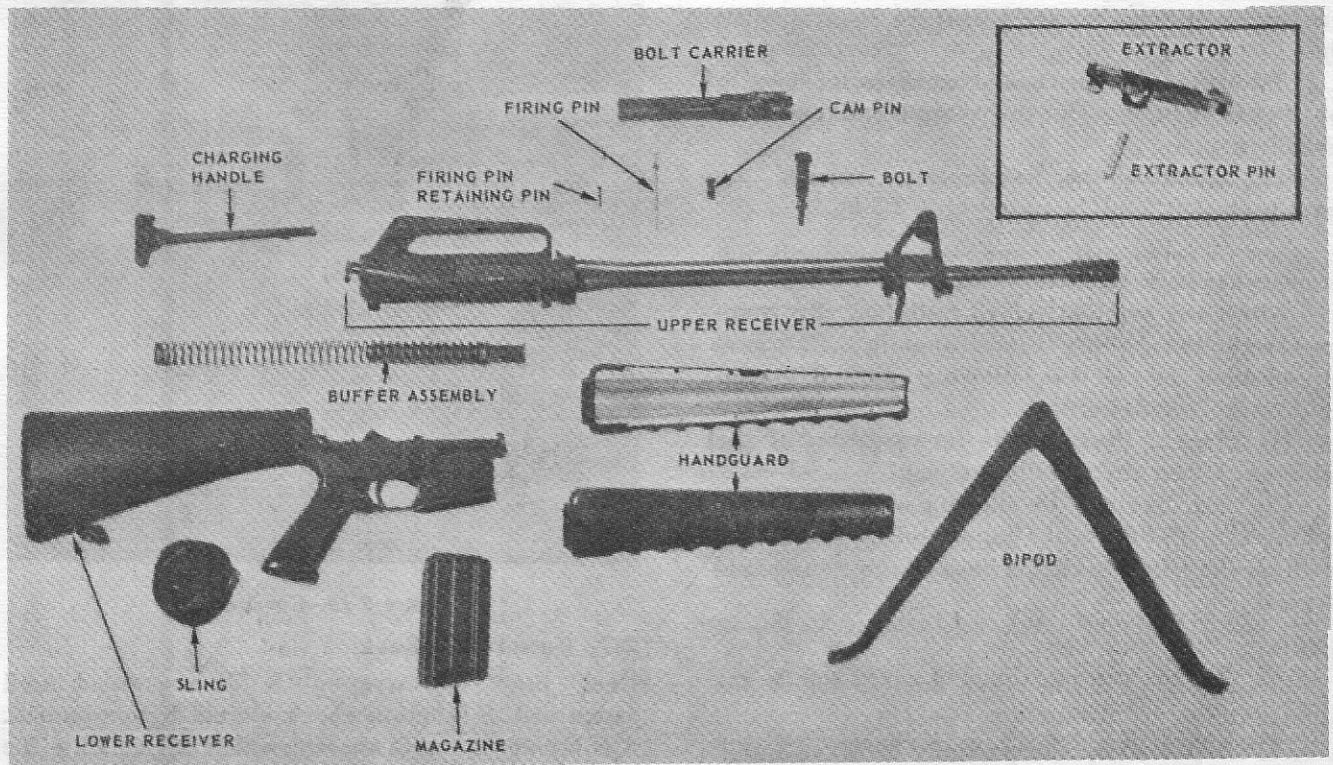


Figure 2-17. The M16A1 rifle field stripped.

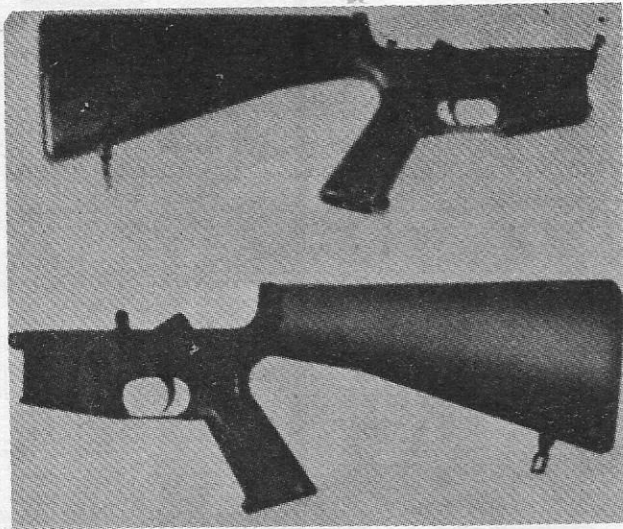


Figure 2-18. Lower receiver group.

c. Grasp the upper receiver with the carrying handle up. Place the charging handle into the groove in the top of the upper receiver. The lugs on the charging handle must be seated in their grooves in the receiver. Place the bolt carrier group into the open end of the receiver, insuring that the bolt carrier end key is in the slot on the underside of the charging handle and the bolt is fully forward. Push forward on the bolt carrier group and charging handle until fully seated.

*Note.* If the bolt carrier group fails to seat properly, insure that the carrier key and the gas tube are properly aligned.

d. Place the upper receiver group and lower receiver group together and reseal the receiver pivot pin.

e. With the hammer cocked and selector lever in the *SAFE* position, close the weapon and reseal the takedown pin.

f. To assemble the handguards, reverse the procedures outlined in paragraph 2-5 b.

*Note.* Do not attempt to assemble the handguards with the upper and lower receivers separated.

g. Alternate method of installation. In some cases, when the sliping is exceptionally stiff, it may be necessary to use the following method for installing the handguards:

(1) Step 1. Position the forward end of the handguard into the handguard cap.

(2) Step 2. Grip the sliping with the thumb and forefinger of the other hand, and while pushing down on the sliping, fit the base of the handguard in place.

*Note.* Do not fully seat the handguard at this time (1, fig 2-19).

(3) Step 3. Fit the other handguard in the same manner.

(4) Step 4. Grip the partially installed hand-

guards tightly at the base to fully seat the handguards (2, fig 2-19).

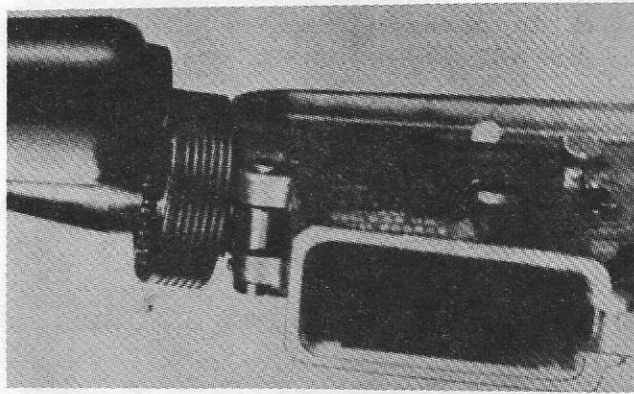


Figure 2-19. Assembly of handguards.

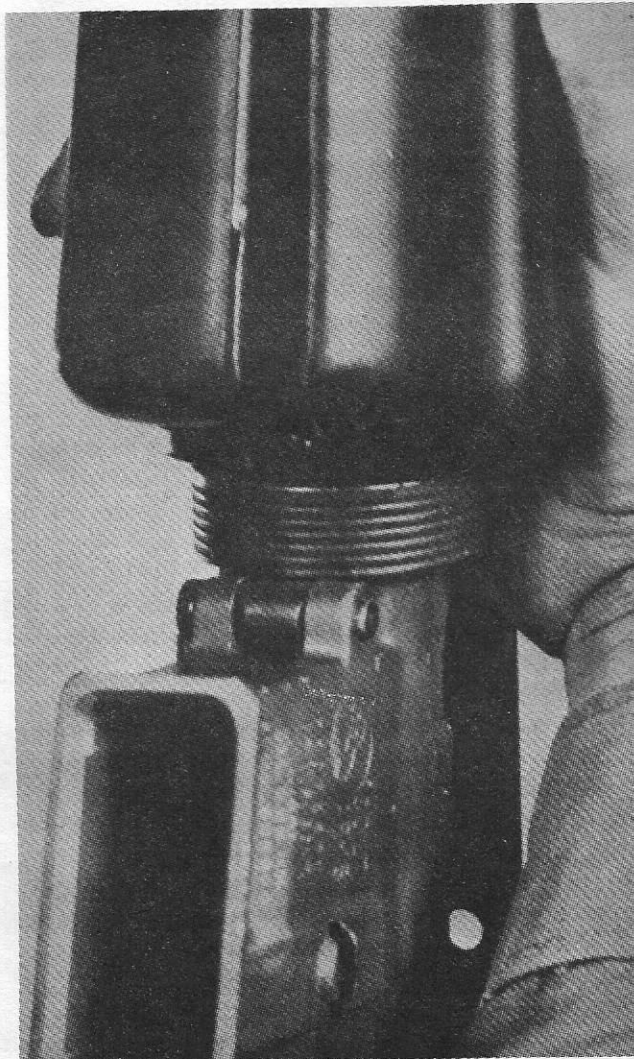


Figure 2-19—Continued.

## 2-7. Function Check

Each time the weapon is disassembled and assembled, a function check should be conducted. A complete function check consists of checking the

operation of the weapon while the selector lever is in the SAFE, SEMI, and AUTO position. The following sequence is used for a rapid, complete check. Any portion of the check may be used alone to determine the operational condition of any specific fire selection.

a. *SAFE Position.* Cock the weapon, pull trigger, hammer should not fall.

*Note.* To cock the weapon, pull the charging handle to the rear and release it.

b. *SEMI Position.* Pull trigger, hammer should fall. Hold trigger to rear, recock the weapon, and release trigger. Again pull the trigger, hammer should fall.

c. *AUTO Position.* Cock the weapon. Pull trigger, hammer should fall. Hold trigger to the rear and cock the weapon. Release the pressure on the trigger and pull it to the rear again. The hammer should not fall because it should have fallen when the bolt was allowed to move forward during the cocking sequence.

### Section III. MAGAZINE—DISASSEMBLY, CLEANING, AND ASSEMBLY

#### 2-8. General

There are two magazines available for use with the M16A1 rifle (a 20-round and a 30-round, fig 2-20). Both magazines will function properly if maintenance is performed when needed. To properly perform maintenance on either magazine they must be disassembled.

#### 2-9. Disassembly

a. The 20-round magazine is disassembled in the following manner:

(1) Hold the magazine in the left hand, open end to the left, short edge near the body (1, fig 2-21).

(2) Insert the nose of a cartridge into the hole in the base of the magazine, depress the spring steel lock band and at the same time exert a slight pressure on the base, pushing it away from the body or toward the long edge of the magazine (1, fig 2-21).

(3) Slide the base forward until it is free of the tabs (2, fig 2-21).

*Note.* Keep the left thumb over the magazine spring to prevent it from jumping out of the magazine.

(4) To remove the magazine spring, disengage it from the tabs on the magazine, first from one side and then the other until it is free of the magazine (3, fig 2-21).

(5) The follower, attached to the end of the magazine spring, must be canted in order to clear the tabs (4, fig 2-21).

b. The 30-round magazine is disassembled in the same manner as the 20-round magazine except for the removal of the magazine base. The base of the 30-round magazine is removed in the following manner:

(1) Hold the magazine in the left hand, open end to the left, short edge near the body (1, fig 2-22).

(2) Insert the nose of a cartridge (2, fig 2-22) into the hole in the base of the magazine and raise the rear of the magazine base until the indentation on the base is clear of the magazine.

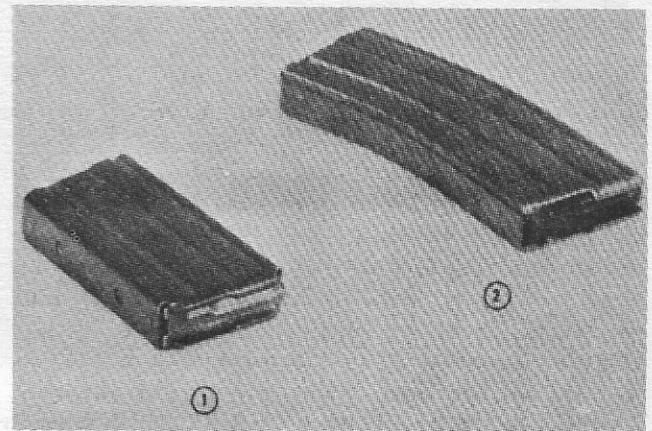


Figure 2-20. Magazines: 20-round (1) and 30-round (2).

(3) Slide the base forward until it is free of the tabs (3, fig 2-22).

#### 2-10. Cleaning

The interior and exterior of the magazine body (20-round or 30-round), the magazine spring, and magazine follower should be wiped clean with a dry patch or cloth. After cleaning apply a light coat of LSA to the magazine spring. *DO NOT* apply lubricant to the body of the magazine or the magazine follower.

#### 2-11. Assembly

To assemble either magazine, the parts are replaced in the reverse order of removal.

a. Place the small end of the follower in the magazine; slip it under the spring steel lock band and cant the follower to clear the magazine tabs; insure that the follower is seated properly before feeding the spring into the magazine.

b. Feed the spring into the magazine by pushing down and from side to side until the last coil is under the tabs.

c. Hold the spring down with the thumb and insert the base under the first set of tabs

d. On the 20-round magazine, depress the spring steel lock band; seat the base of the magazine

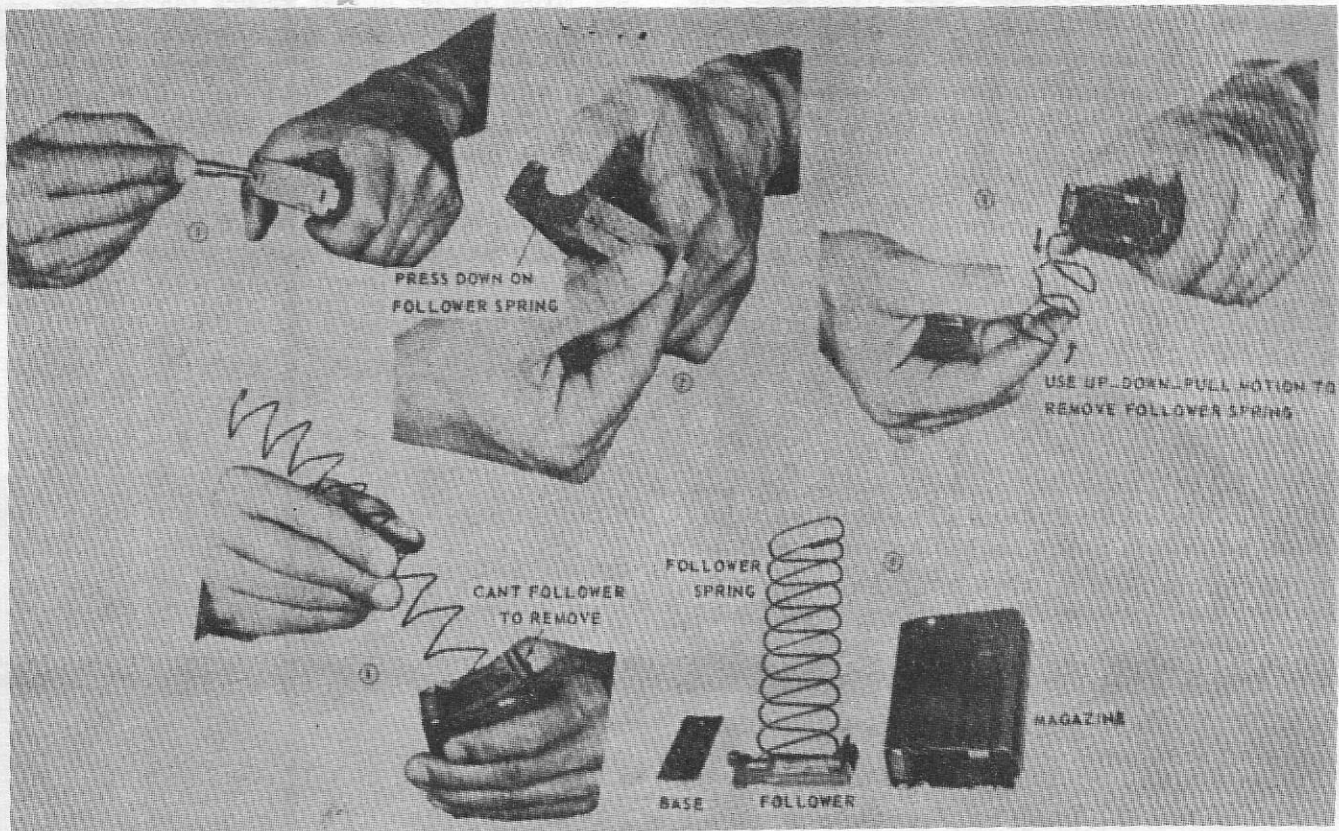
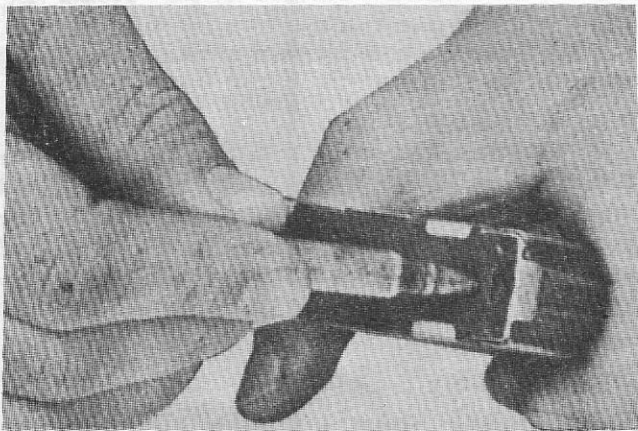


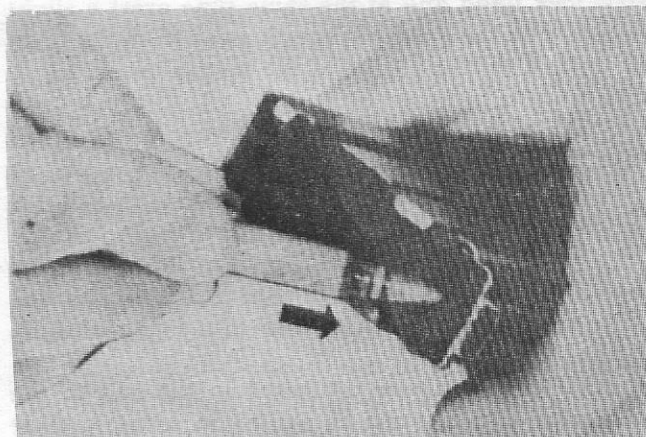
Figure 2-21. Disassembly of the 20-round magazine.



1 Disassembly

Figure 2-22. Disassembly of the 30-round magazine.

insuring that the lock band is fully engaged. On the 30-round magazine slide the base under the tabs until the indentation on the base catches the

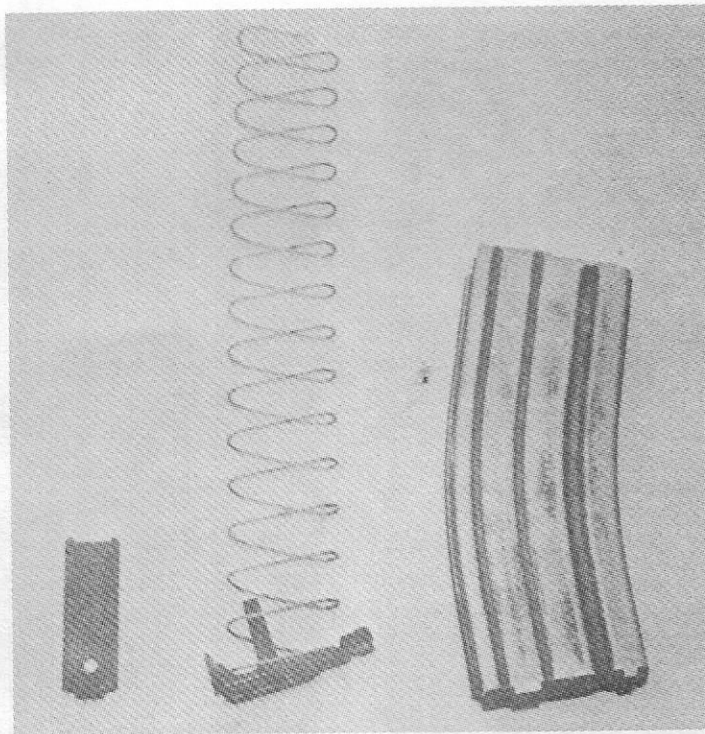


2 Removing magazine base

Figure 2-22—Continued.

magazine.

e. Depress the follower several times to insure that it moves freely.



3 Disassembled 30-round magazine

Figure 2-22—Continued.

## Section IV. OPERATION AND FUNCTIONING

### 2-12. Operation

a. *Types of Magazines.* Either a 20-round or a 30-round magazine may be used with the M16A1 rifle (fig 2-20).

(1) Either type magazine may be loaded with any amount of rounds up to its capacity. The magazine follower of each has a raised portion generally resembling the outline of a cartridge.

(2) Cartridges are loaded into either magazine so that the projectile or the rounds point in the same direction as the raised portion of the follower (1, fig 2-23).

*Note.* Rounds in the magazine should be removed and checked daily for corrosion and dents and wiped with a dry cloth.

(3) A magazine charger and magazine charger strip are provided for faster loading of the magazine. Connect the magazine charger to the magazine until it is fully seated (2a, 2b, fig 2-23). Insert magazine charger strip into the magazine charger until the charger strip stops are in contact with the magazine charger. Push down on top cartridge, forcing cartridges into magazine (2c, fig 2-23).

**Caution:** Do not load or attempt to load either magazine with more rounds than

authorized. Overloading will deform the lips of the magazine and cause malfunctions.

c. *Unloading Either Magazine.* To prevent damage to the lips of the magazine, removal of ammunition is accomplished in the following manner:

(1) Hold the magazine in the left hand with the open end away from the body, nose of the cartridge down (1, fig 2-24).

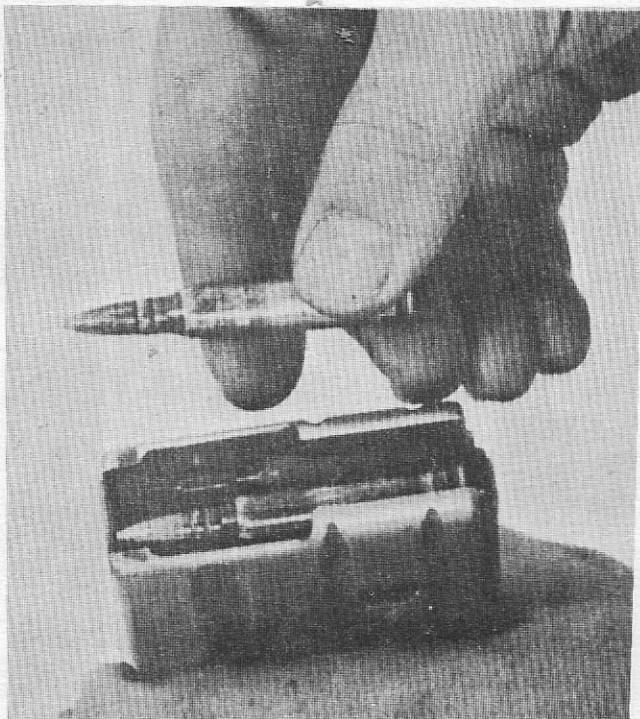
(2) Using the nose of a cartridge, depress the center of the second round in the magazine allowing the first round to drop out of the magazine (2, fig 2-24). This process is repeated until all rounds have been removed from the magazine except the last.

(3) To remove the last round, use the nose of a cartridge and depress the follower allowing the last round to drop out of the magazine (3, fig 2-24).

#### d. *Loading the Rifle.*

(1) With the hammer cocked, place the selector lever on SAFE (fig 2-3). The magazine may be inserted with the bolt opened or closed. However, the soldier should be taught to load the weapon with the bolt open. This will reduce the possibility of a first round stoppage.

(2) Point the muzzle in a safe direction. Insert a loaded magazine into the magazine housing. Push



1 Loading cartridges individually

Figure 2-23. Loading the magazine.

upward until the magazine catch engages and holds the magazine. Strike the base of the magazine with the heel of the hand to insure positive engagement. Pull the charging handle fully to the rear and release it. Strike the forward assist assembly to insure that the bolt is fully forward and locked.

(3) The bolt catch is to be used only on those occasions when it is desired to manually lock the bolt to the rear.

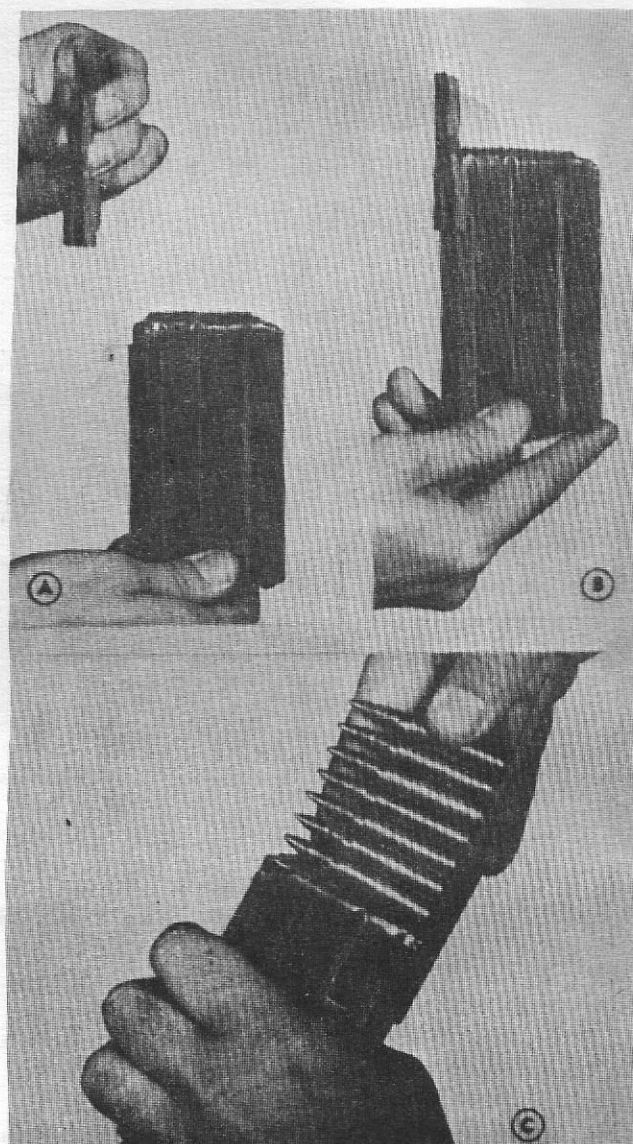
*Note.* Do not ride the charging handle forward. If the charging handle is eased forward from the open position, the bolt may fail to lock.

*c. Unloading.* To unload the rifle and make it safe, the firer first places the selector lever on safe, presses in on the magazine catch button to remove the magazine, pulls the charging handle to the rear, inspects the chamber and receiver to insure they are clear, locks the bolt carrier to the rear by depressing the lower portion of the bolt catch, and returns the charging handle forward. The rifle is clear only when no brass or rounds are in the chamber or the receiver, the magazine has been removed, the bolt carrier is to the rear, and the selector lever is on the SAFE setting.

*Note.* The weapon should not be stored for long periods with the bolt locked to the rear (i.e., storage in an arms room).

### 2-13. Functioning

*a.* Functioning consists of eight basic steps. Keep in mind that some of the steps take place simultaneously. The eight steps are —



2 Loading with strip and charger.

Figure 2-23—Continued.

- (1) Firing.
- (2) Unlocking.
- (3) Extracting.
- (4) Ejecting.
- (5) Cocking.
- (6) Feeding.
- (7) Chambering.
- (8) Locking.

*b.* Functioning in the rifle may be either automatic or semiautomatic through the use of the selector lever. Certain differences in the operation of parts take place when the selection is made.

#### (1) Semiautomatic fire.

*(a) Firing* (fig 2-25). With a round in the chamber, the hammer cocked, and the selector on the SEMI setting (fig 2-34), the firer pulls the trigger. The trigger rotates on the trigger pin

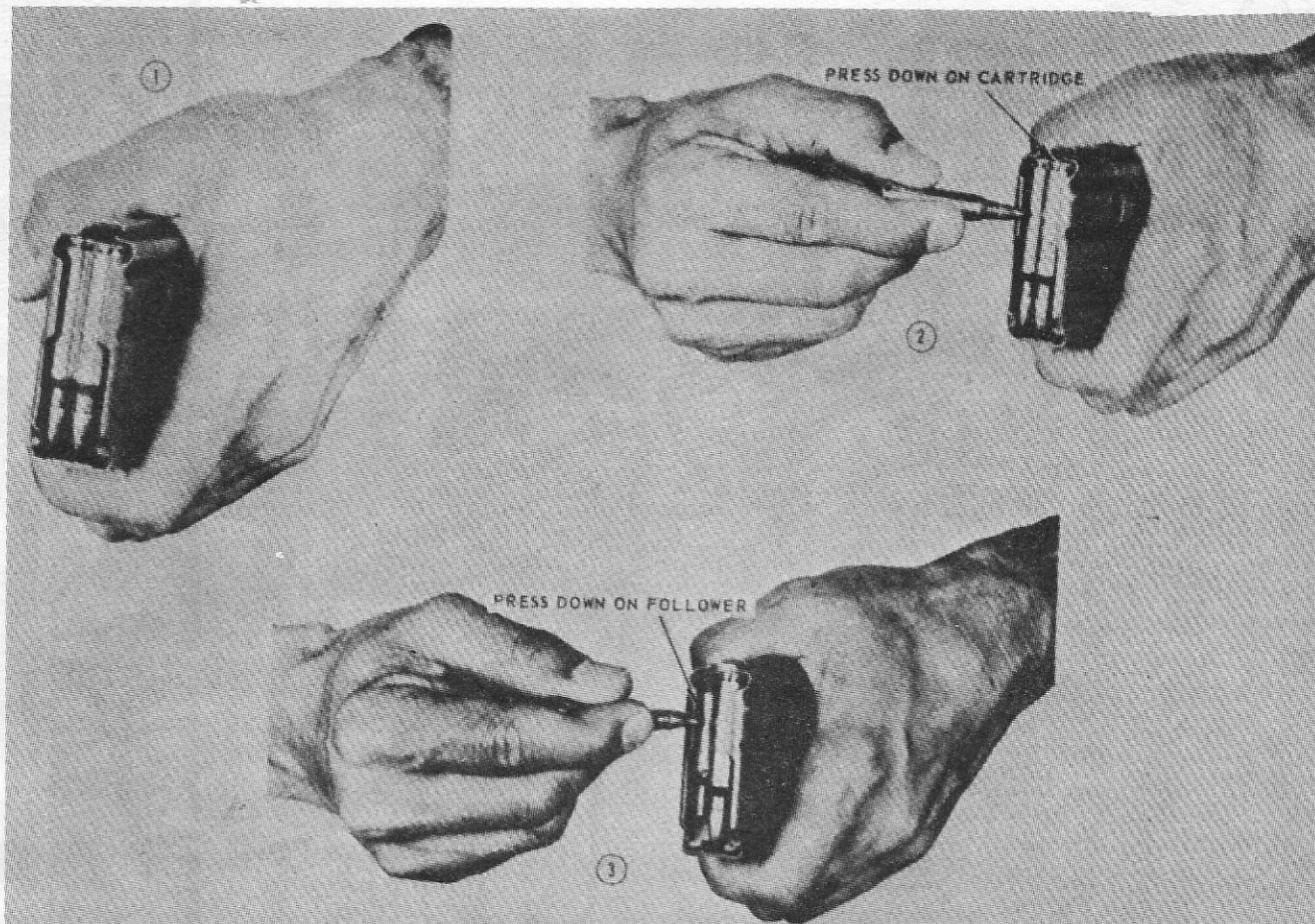


Figure 2-24. Unloading the magazine.

depressing the nose of the trigger and disengaging the notch on the bottom of the hammer. The hammer is thrown forward by action of the hammer spring. The hammer strikes the head of the firing pin, driving the firing pin through the bolt into the primer of the round. When the primer is struck by the firing pin, it ignites and causes the powder in the cartridge to ignite. The gas generated by the rapid burning of the powder forces the projectile from the cartridge and propels it through the barrel. After the projectile has passed the gas port (located on the upper surface of the barrel under the front sight) (fig 2-25) and before it leaves the barrel, a portion of gas enters the gas port and moves into the gas tube. The gas tube directs the gas into the bolt carrier key (fig 2-26) and subsequently into the cylinder between the bolt and bolt carrier, causing the carrier to move rearward.

(b) *Unlocking* (fig 2-27). As the bolt carrier moves to the rear, the bolt cam pin follows the path of the cam track (located in the bolt carrier). This action causes the cam pin and bolt assembly to simultaneously rotate until the locking lugs of the bolt are no longer in line behind the locking lugs of the barrel extension.

(c) *Extracting*. As the bolt carrier group continues to move to the rear, the extractor (which is attached to the bolt) (fig 2-28) grips the rim of the cartridge case, holds it firmly against the face of the bolt, and withdraws the cartridge case from the chamber.

(d) *Ejecting*. (fig 2-29). With the base of a cartridge case firmly against the face of the bolt, the ejector and ejector spring are compressed into the bolt body. As the rearward movement of the bolt carrier group allows the nose of the cartridge case to clear the front of the ejection port, the cartridge is pushed out by the action of the ejector and spring.

(e) *Cocking*. (fig 2-30). The rearward movement of the bolt carrier overrides the hammer, forcing it down into the receiver, compressing the hammer spring. The action of the rifle is so much faster than human reaction that it is impossible for the firer to release the trigger rapidly enough to prevent multiple firing. Therefore, it is necessary for a mechanism to be installed in the weapon to enable the firer to fire single rounds. In the M16A1 the disconnector is used for this purpose. The disconnector is attached to the trigger and is rotated forward by action of the disconnector

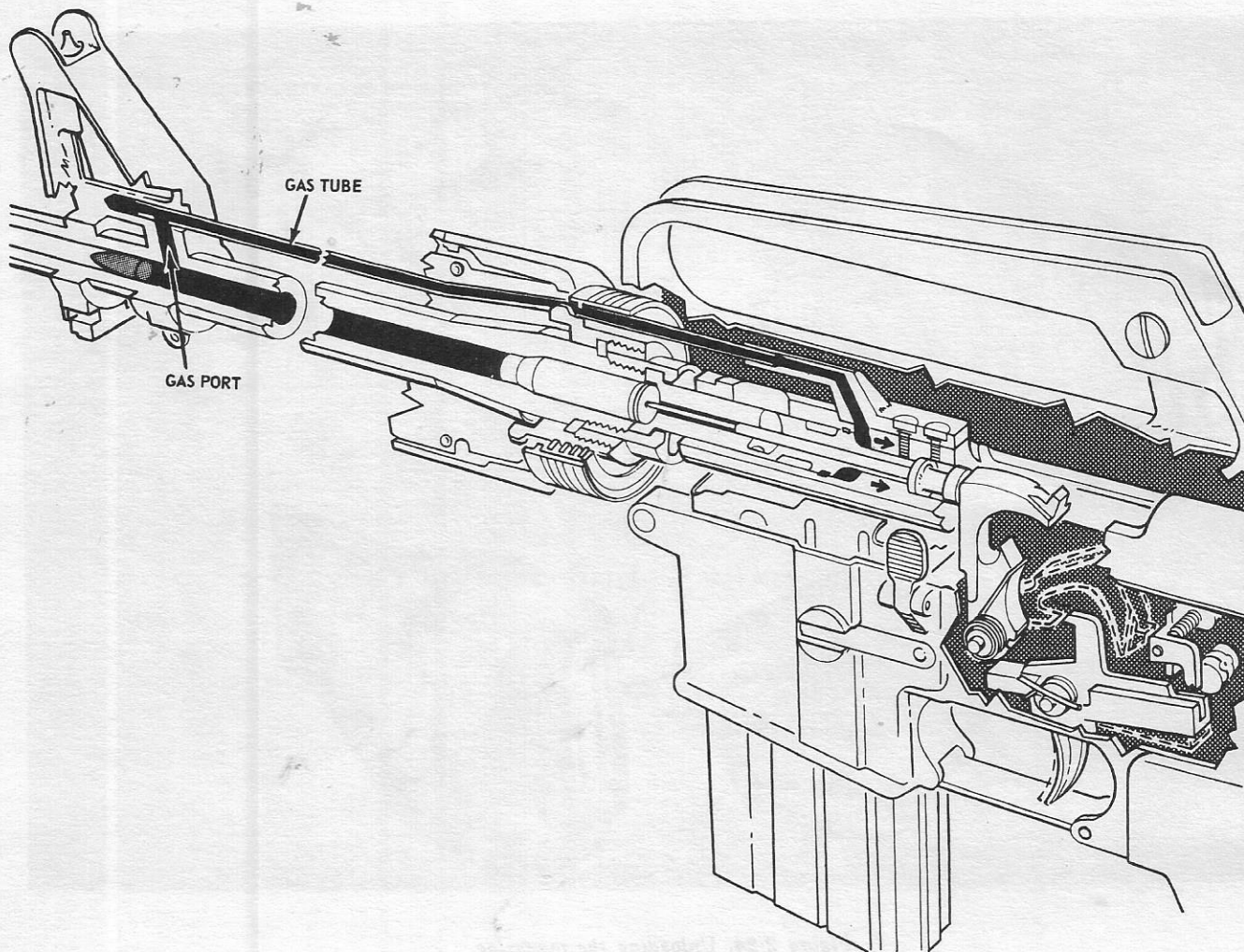


Figure 2-25. Firing (and action of the gases).

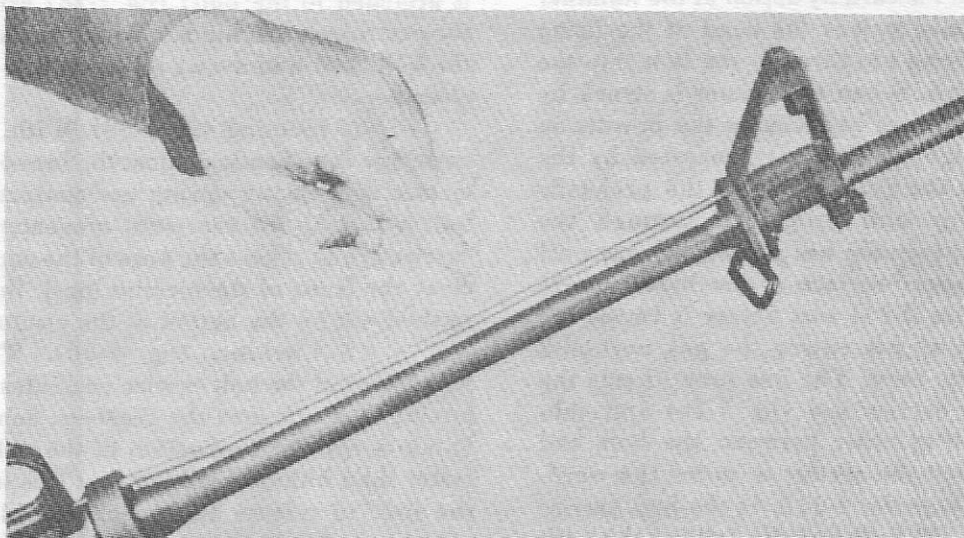


Figure 2-26. The gas tube.

spring. When the hammer is cocked by the recoil of the bolt carrier, the disconnector engages the lower hook of the hammer and holds it until the trigger is

released. When the trigger is released, the disconnector rotates to the rear and down, disengaging the hammer and allowing it to rotate

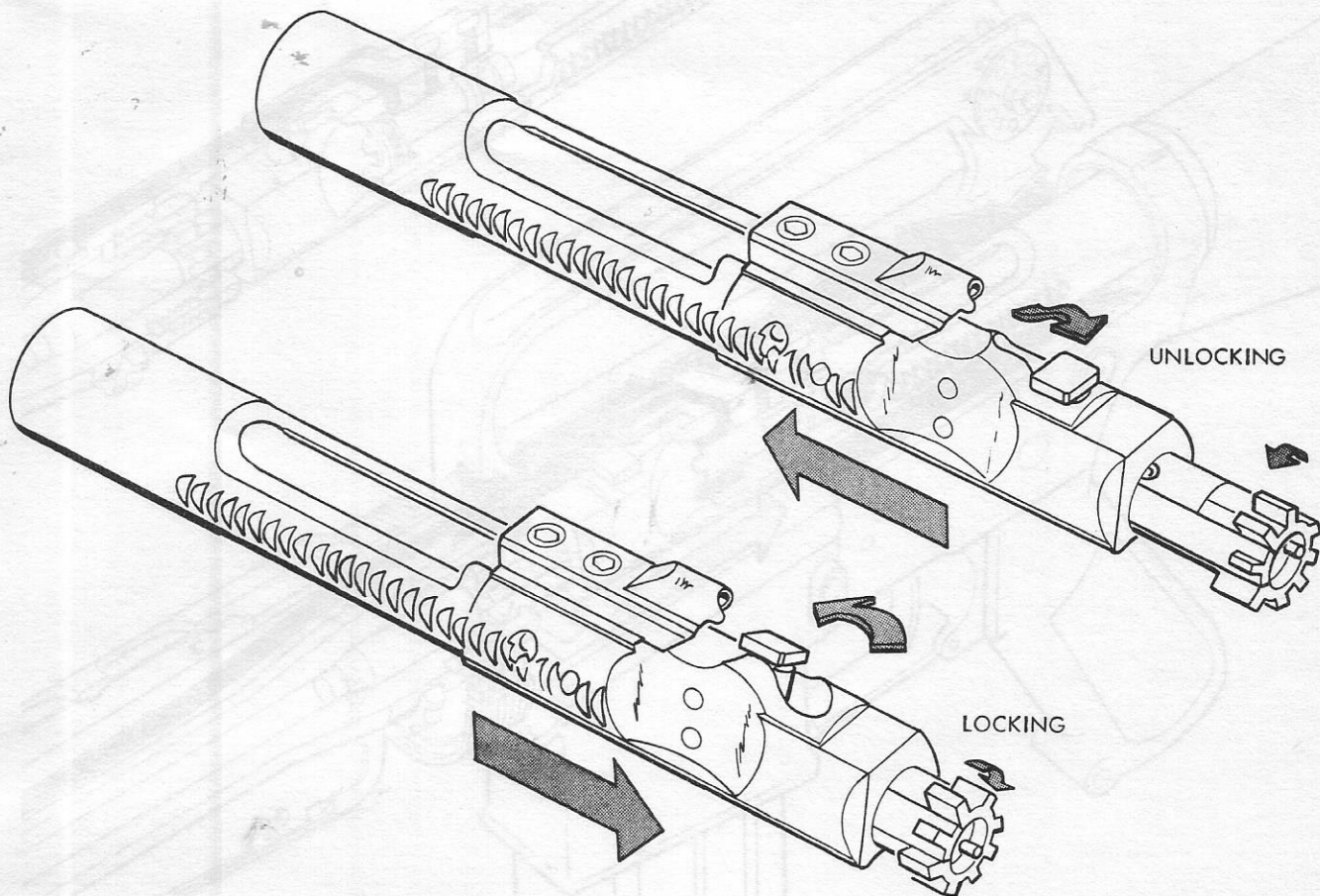


Figure 2-27. Locking and unlocking.

forward until caught by the nose of the trigger. This prevents the hammer from following the bolt carrier forward and causing automatic fire (fig 2-30). The trigger must be pulled again before the next round will fire.

(f) *Feeding* (fig 2-31). As the bolt carrier group moves rearward, it engages the buffer assembly and compresses the action spring into the lower receiver extension. At the moment the bolt carrier group clears the top of the magazine, the expansion of the magazine spring forces the follower and a new round up into the path of the forward movement of the bolt. The expansion of the action spring sends the buffer assembly and bolt carrier group forward with sufficient force to strip a new round from the magazine.

*Note.* The buffer assembly also absorbs the force of the recoil.

(g) *Chambering* (fig 2-32). As the bolt carrier group continues to move forward, the face of the bolt thrusts the new round into the chamber. At the same time the extractor claw grips the rim of the cartridge and the ejector is compressed.

(h) *Locking.* As the bolt carrier group moves forward, the bolt is kept in its most forward position by the bolt cam pin riding in the guide

channel in the upper receiver. Just prior to the bolt locking lugs making contact with the barrel extension the bolt cam pin emerges from the guide channel. The pressure exerted by the contact of the bolt locking lugs and the barrel extension causes the bolt cam pin to move along the cam track (located in the bolt carrier) in a counterclockwise direction, rotating the bolt locking lugs in line behind the barrel extension locking lugs. The weapon is then ready to fire and the cycle is repeated.

(2) *Automatic fire.*

(a) When the selector lever (fig 2-33) is set on the AUTO position, the rifle will continue to fire as long as the trigger is held back and ammunition is in the magazine. The functioning of certain parts of the weapon changes when firing automatically.

(b) As the rifleman pulls the trigger, the cycle of operation begins. As the bolt carrier group moves to the rear, the hammer is cocked, but the center cam of the selector depresses the rear of the disconnecter and prevents the nose of the disconnecter from engaging the lower hammer hook.

(c) The bottom portion of the automatic sear catches the upper hammer hook and holds it until the bolt carrier group moves forward, striking the top of the sear, releasing the hammer, and causing the rifle to fire automatically (fig 2-34).

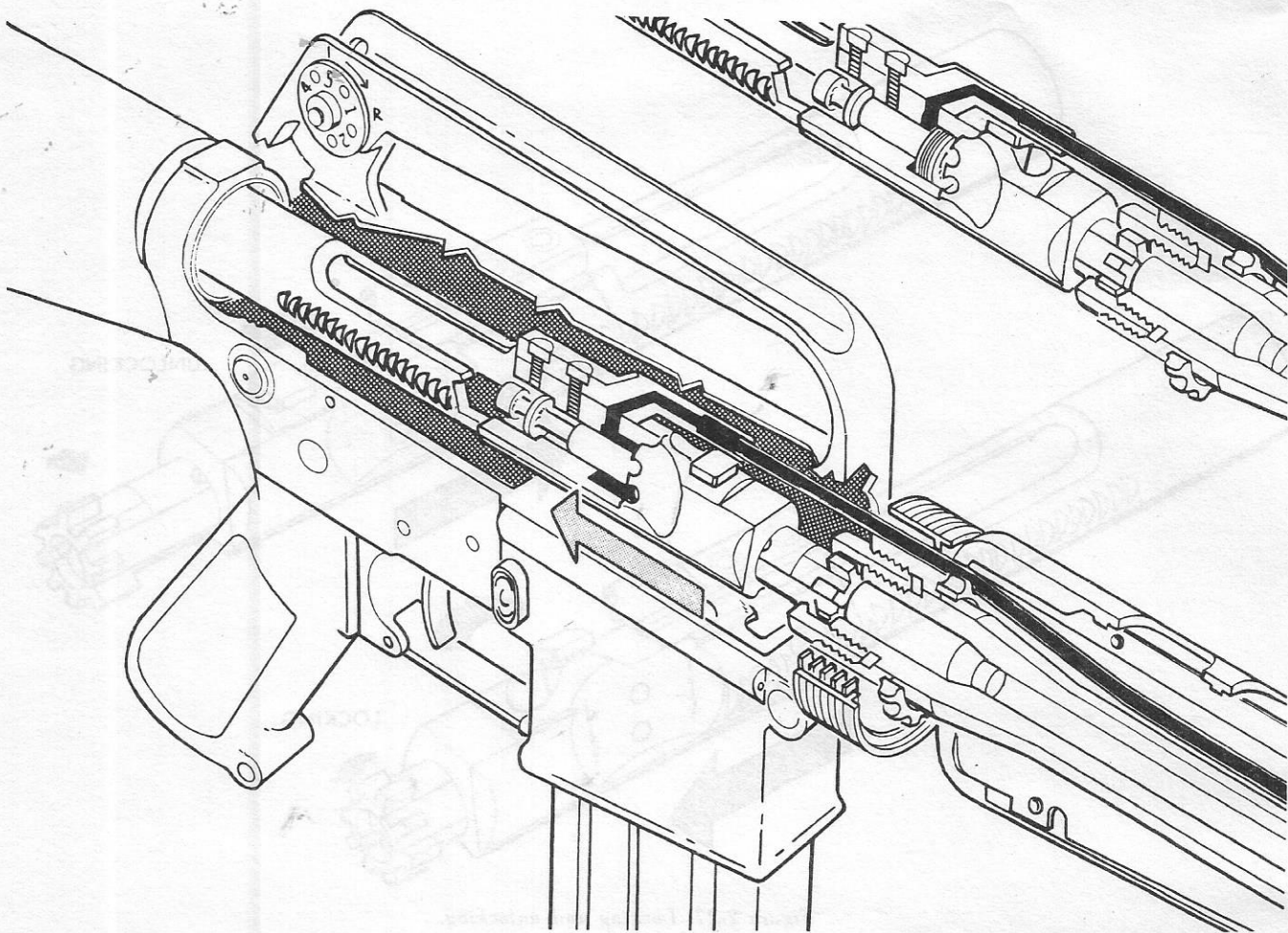


Figure 2-28. Extracting.

(d) If the trigger is released, the hammer moves forward and is caught by the nose of the trigger. This ends the automatic cycle of fire until the trigger is pulled again.

(c) All other portions of the cycle of operation remain the same as in semiautomatic fire.

c. The functioning of the rifle through the cycle of operation stops when the trigger is released or when the magazine is empty. In the latter case certain actions take place within the weapon to indicate to the firer that he must change magazines.

(1) When the last round of a magazine has been chambered, the magazine follower rises to the top of the magazine and contacts the bolt catch. As

the bolt carrier group recoils, the bolt catch is forced into the path of the bolt face by action of the magazine spring. This holds the bolt carrier group to the rear.

(2) Removal of the magazine does not release the bolt carrier group due to the force of the action spring holding the face of the bolt tightly against the bolt catch. To release the bolt carrier group, the firer must pull the charging handle to the rear and release it.

**Caution:** If a new magazine has been inserted and the bolt carrier group goes forward, the weapon is charged and ready to fire.

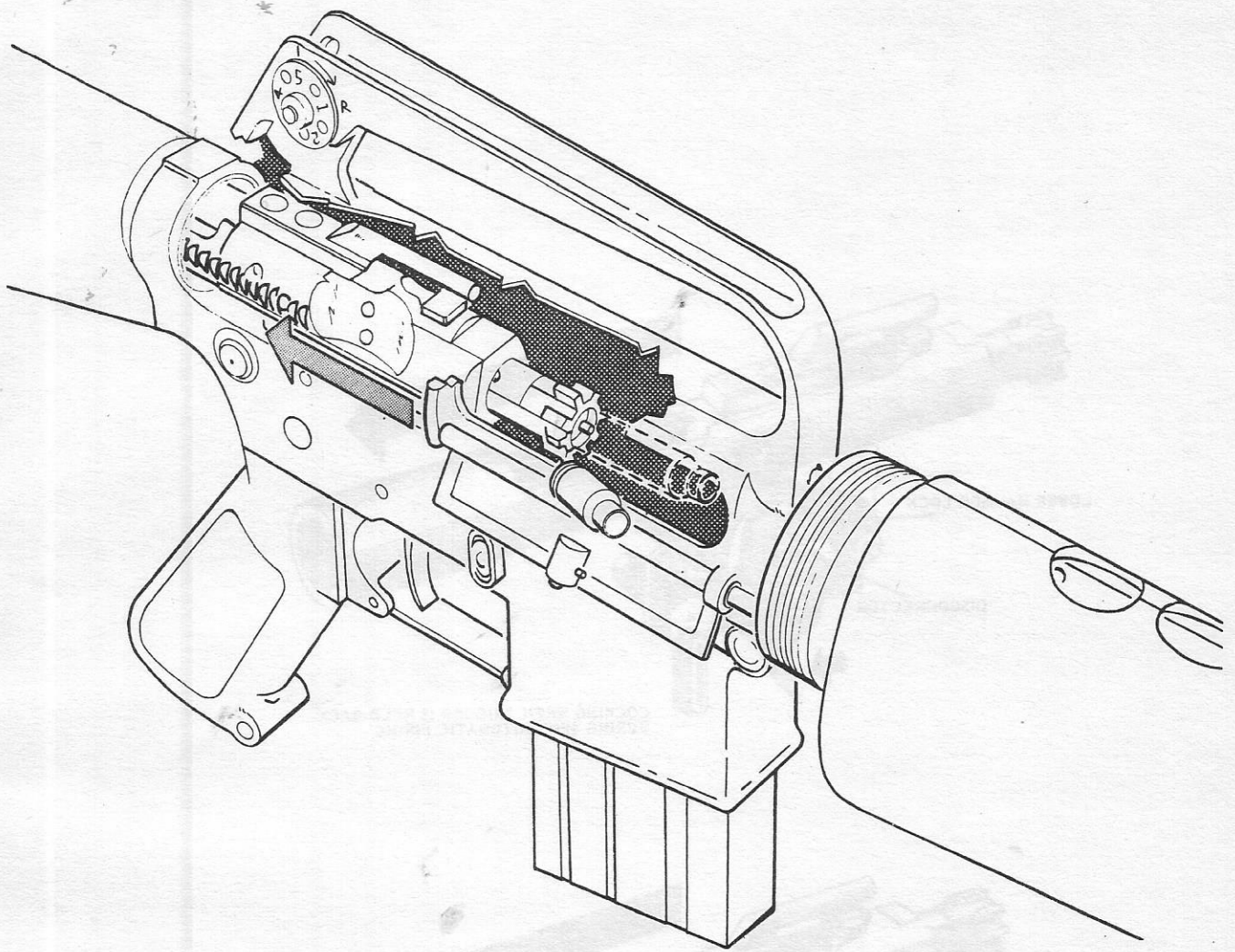


Figure 2-29. Ejecting.

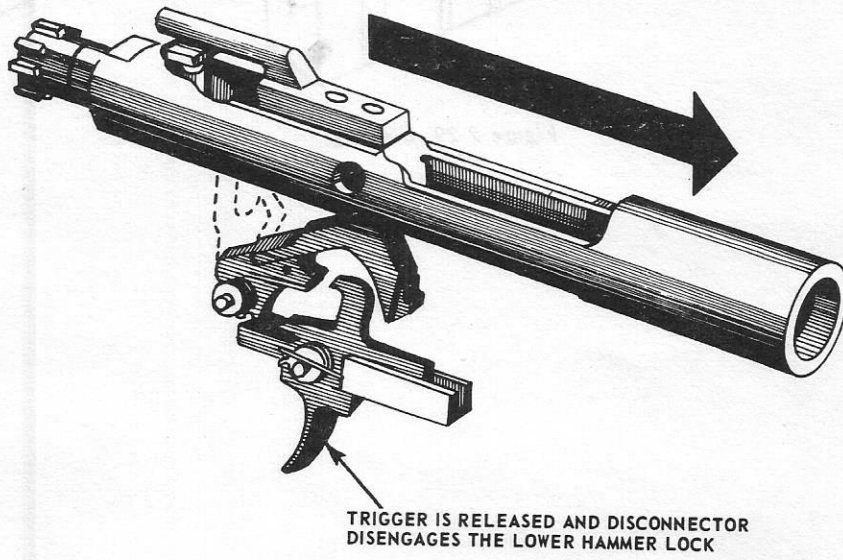
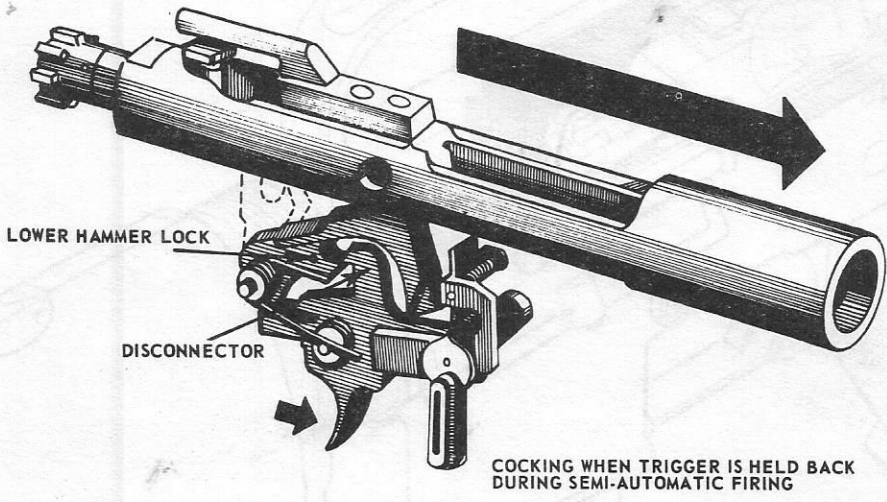


Figure 2-30. Cocking.

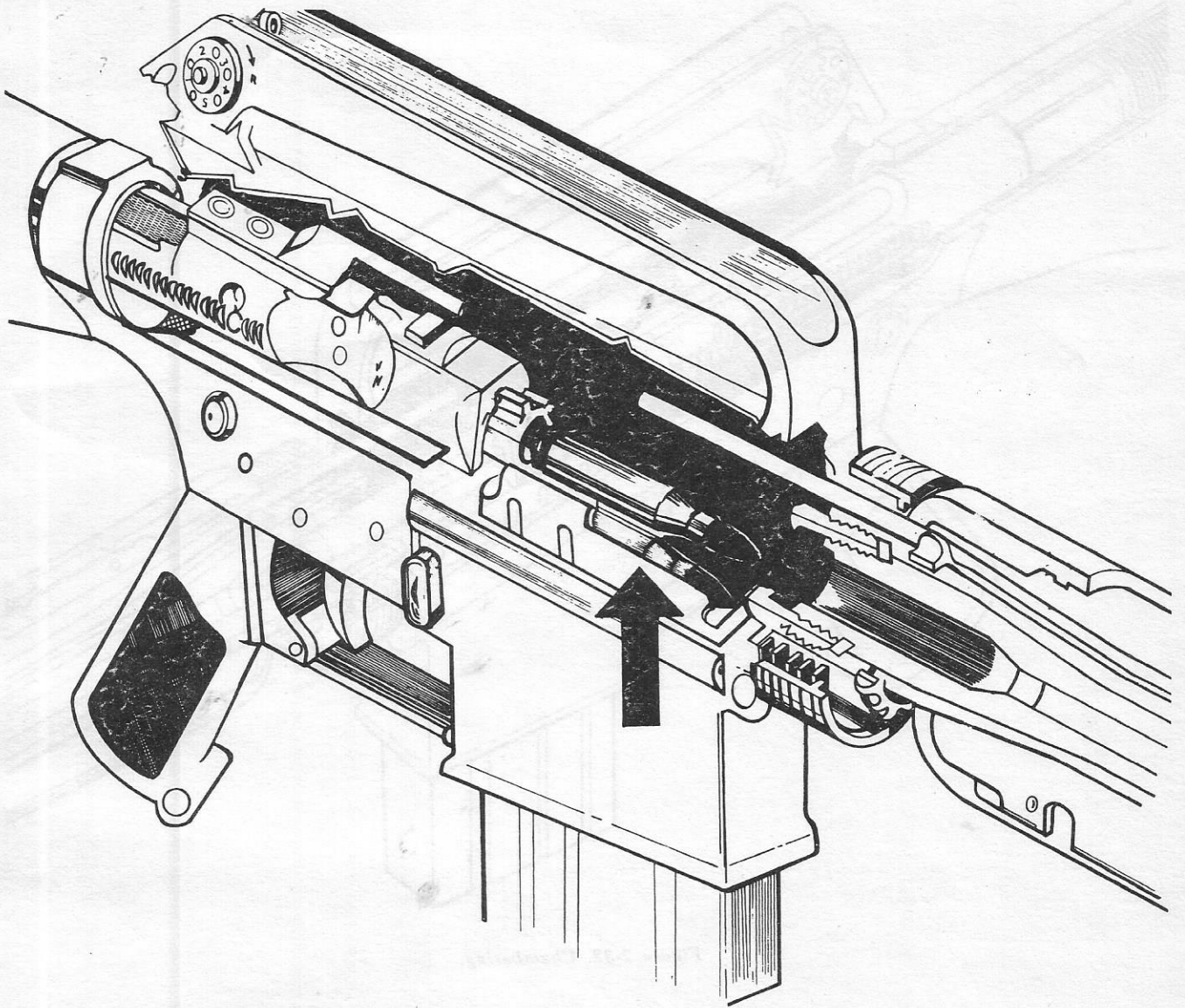
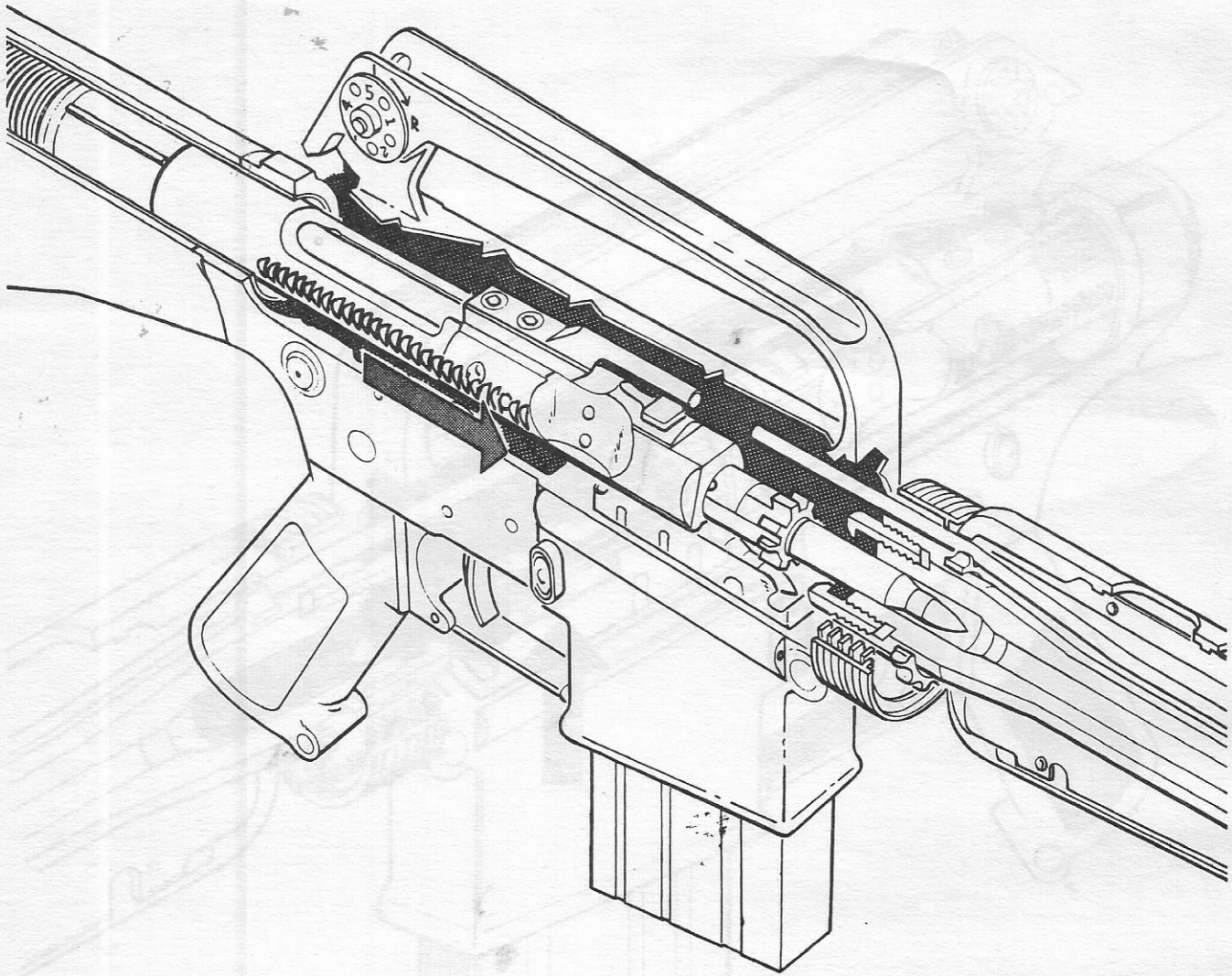


Figure 2-31. Feeding.



*Figure 2-32. Chambering.*

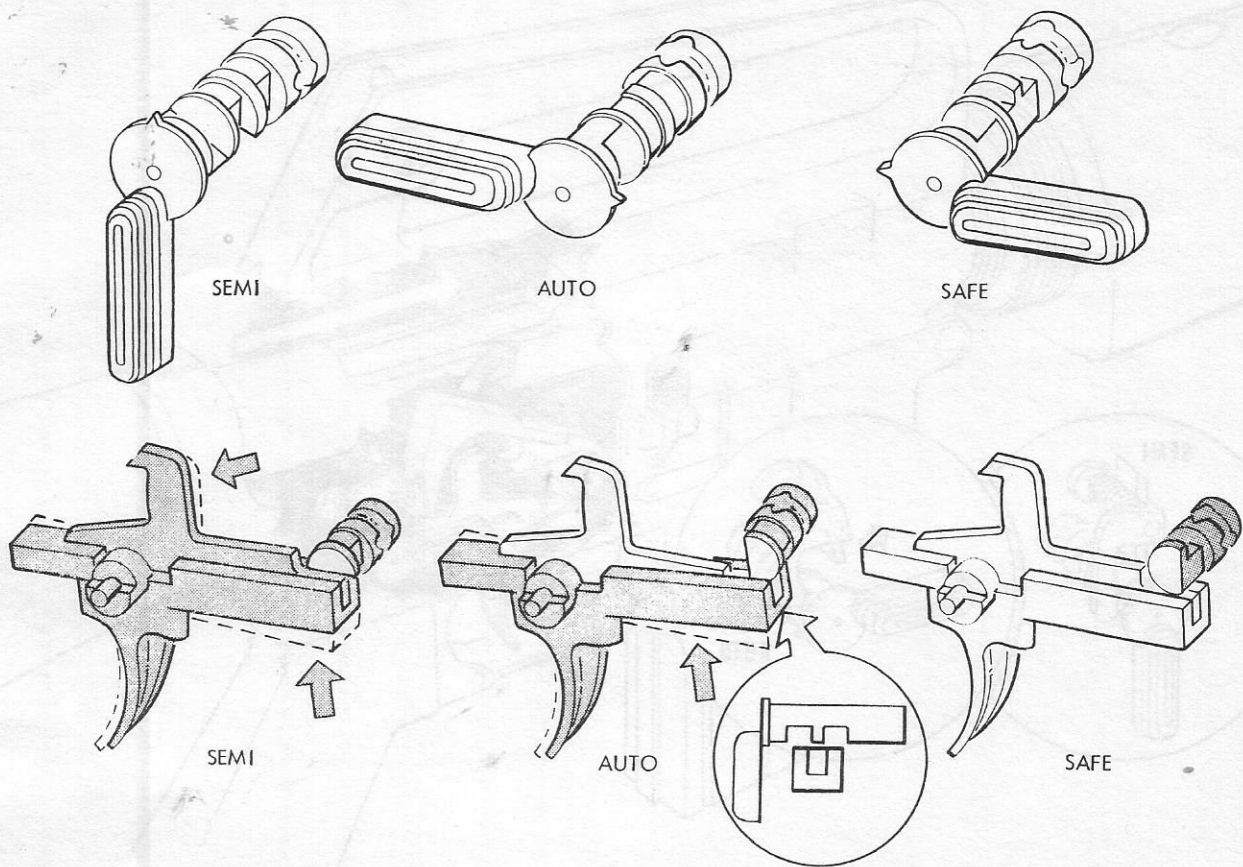


Figure 2-33. Selector lever.

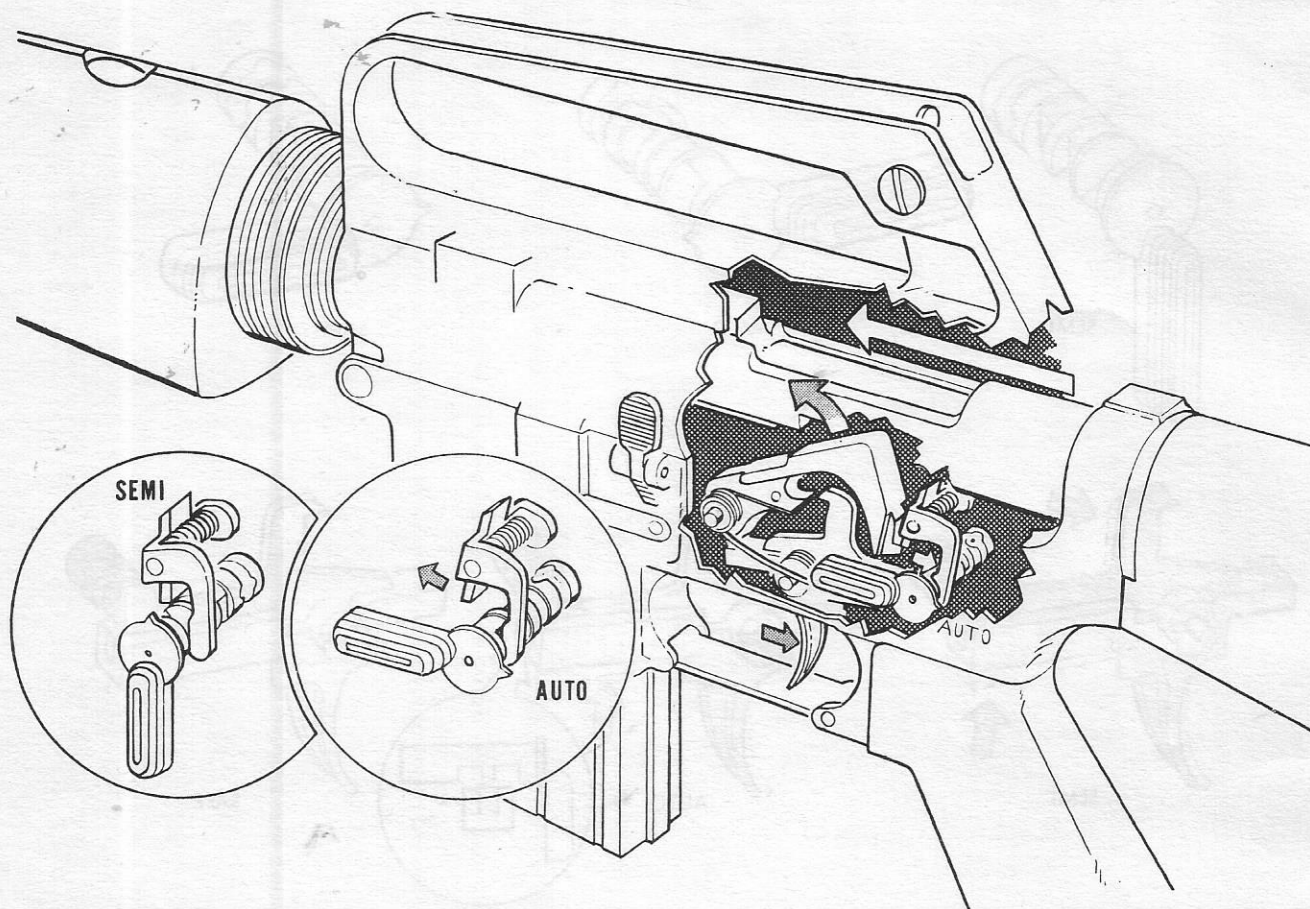


Figure 2-34. Automatic sear.

## Section V. CARE AND CLEANING

### 2-14. Maintenance

a. *General.* A clean, properly lubricated and maintained rifle loaded with clean ammunition will fire when needed. In order to keep the M16A1 rifle and ammunition in good operating condition they must have periodic care and cleaning. During inclement weather conditions certain key parts of the rifle and ammunition may need care and cleaning as often as several times a day. To insure proper maintenance of the M16A1 rifle, it is imperative that certain procedures be followed.

b. *Cleaning and Lubrication.* Refer to table 2-1.

c. *Definition for the Application of LSA (Oil).* Definitions for the amount of LSA specified in table 2-1 are listed below.

(1) *One drop.* Dip the end of the swab holder section into lubricant and allow one drop to fall from the tip.

(2) *Light coat.* Apply lubricant to a cloth until it becomes just damp enough so the oil cannot be squeezed from the cloth. When applied, the part will have a film of lubricant which is barely visible.

(3) *Generous coat.* Apply lubricant to a cloth

until it becomes saturated and the oil can be squeezed from the cloth. When applied, the part will have a film of lubricant heavy enough so that it can be spread with the finger.

d. *Maintenance.* Maintenance equipment can be stored in the stock of the M16A1 rifle (fig 2-35).

### 2-15. Preventive Maintenance

a. *General.* Preventive maintenance is the systematic care, inspection, and servicing of equipment to keep it in serviceable condition to prevent breakdowns and assure maximum operational readiness. The operator's role in the performance of preventive maintenance service is—

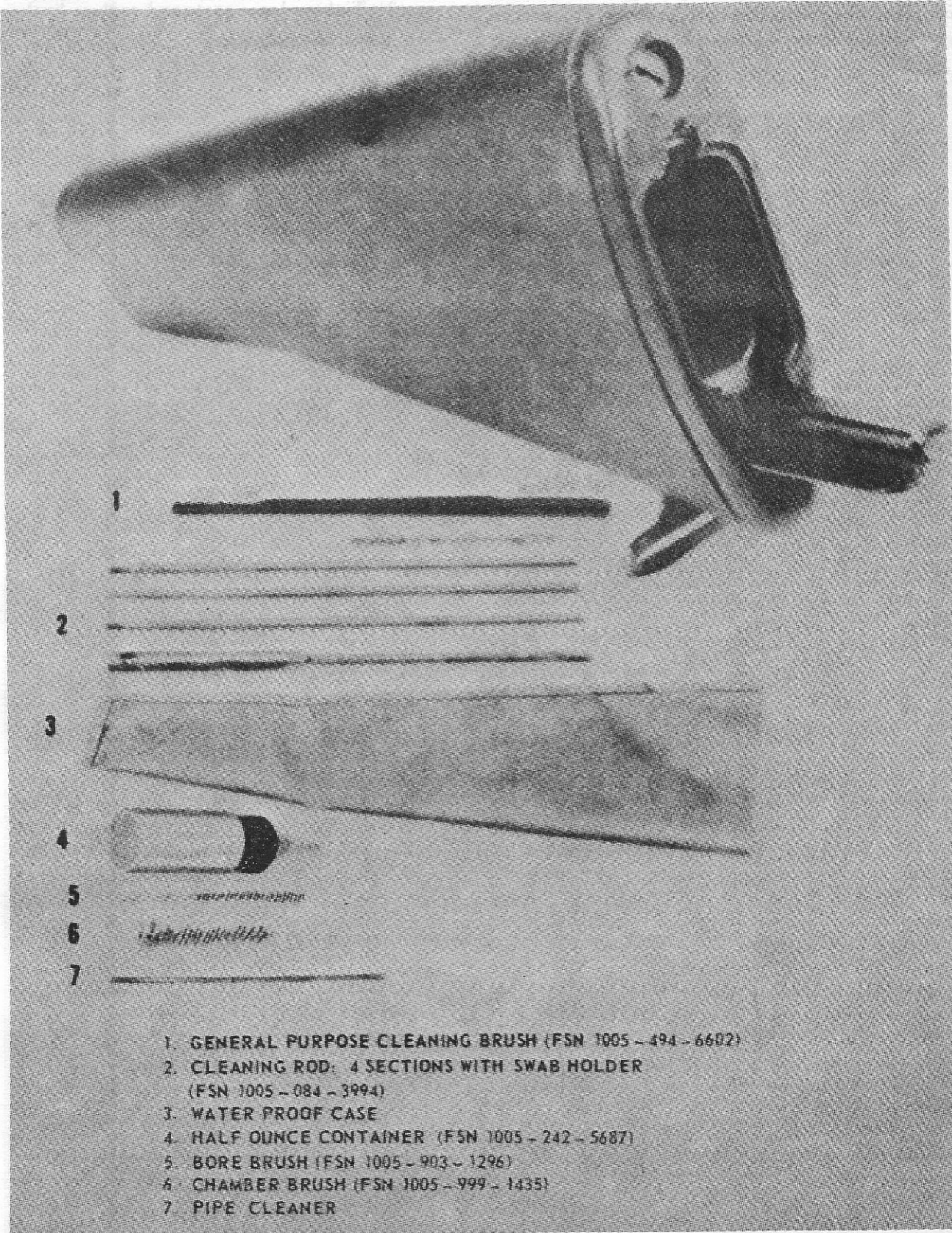
(1) To perform preventive maintenance each day the rifle is operated.

(2) To help the organizational unit armorer perform any scheduled periodic services which are authorized.

b. *Specific Procedures.*

(1) Table 2-2 gives the specific procedures to be performed by the operator.

(2) In addition to procedures outlined in table



1. GENERAL PURPOSE CLEANING BRUSH (FSN 1005 - 494 - 6602)
2. CLEANING ROD: 4 SECTIONS WITH SWAB HOLDER (FSN 1005 - 084 - 3994)
3. WATER PROOF CASE
4. HALF OUNCE CONTAINER (FSN 1005 - 242 - 5687)
5. BORE BRUSH (FSN 1005 - 903 - 1296)
6. CHAMBER BRUSH (FSN 1005 - 999 - 1435)
7. PIPE CLEANER

Figure 2-35. Maintenance equipment.

2-2. perform the following: remove dirt, rust, grit, gummed oil, and water, as these will cause rapid deterioration of the inner mechanism and the outer surfaces. Take particular care to keep all surfaces clean and lubricated. Do not clean or polish outer

surfaces of the weapon with a treated cloth or other commercial compounds.

(3) Tighten loose parts and replace broken or worn parts, as authorized.

Table 2-1. Cleaning and Lubricating Instructions

Item	After firing	As required	Maintenance level	Action required
Rifle			C*	<p>Note. Lubricants listed below and specified within this table will be utilized. Do not use any commercial products for cleaning and lubricating purposes. Use semifluid lubricating oil (LSA) for temperature ranges of minus 35° and above. Use weapons lubricating oil (LAW) for temperature ranges below zero degrees.</p> <p>Note. Either lubricant can be used at temperatures ranging from zero to minus 35°.</p> <p>Before operation.</p> <ol style="list-style-type: none"> <li>1. Prior to firing, visually inspect the bore and chamber for condition and obstruction. Clean by pushing swabs through the bore (from chamber to muzzle) until the swabs protrude through the flash suppressor.</li> <li>2. After cleaning, apply a light coat of LSA / LAW to the bore and chamber with a swab to prevent corrosion and pitting.</li> <li>3. The bolt carrier group may be removed and dirt and oil cleaned off the firing pin, outer and inner surfaces of the bolt, and bolt carrier with clean, dry swabs or rags. Also, clean firing pin hole using a pipe cleaner. Lubricate the bolt and bolt rings. Make certain bolt rings are well lubricated. Apply a coating of LSA / LAW to the inner surfaces of the bolt carrier. Give special attention to the slide and cam pin area.</li> </ol> <p><b>Warning:</b> Most cleaning solutions are toxic, and inhaling their vapors for extended periods could be harmful. These materials should be used sparingly and in a well ventilated location.</p> <p>Note. Use of the rifle cover does not take the place of normal cleaning and lubrication.</p> <p>Disassemble and wipe dirt from the magazine tube, spring, and follower. Apply a light coat of lubricant to the magazine spring.</p> <p>Note. Because moisture will collect in the plastic magazine bag from condensation, the magazine must be removed, unloaded, and dried every 24 hours to prevent corrosion. After the cartridges and magazines have been dried, apply a light coat of LSA / LAW to the magazine spring.</p> <ol style="list-style-type: none"> <li>1. Disassemble the bolt carrier group and clean all components and outet surfaces with a swab saturated in rifle bore cleaner.</li> <li>2. Clean bolt carrier key with a bore brush dipped in rifle bore cleaner (fig 2-36).</li> <li>3. Dry bolt carrier key using pipe cleaners (fig 2-37).</li> <li>4. Using a small brush dipped in rifle bore cleaner, scrub carbon deposits and dirt from the locking lugs of the bolt.</li> </ol>
Magazine assembly	X	X	C	
Bolt carrier group	X	X	C	
	X	X	C	
	X	X	C	

\* The letters in the maintenance level column indicate the lowest level of maintenance at which corrective action can be performed. The letter "C" indicates operator maintenance.

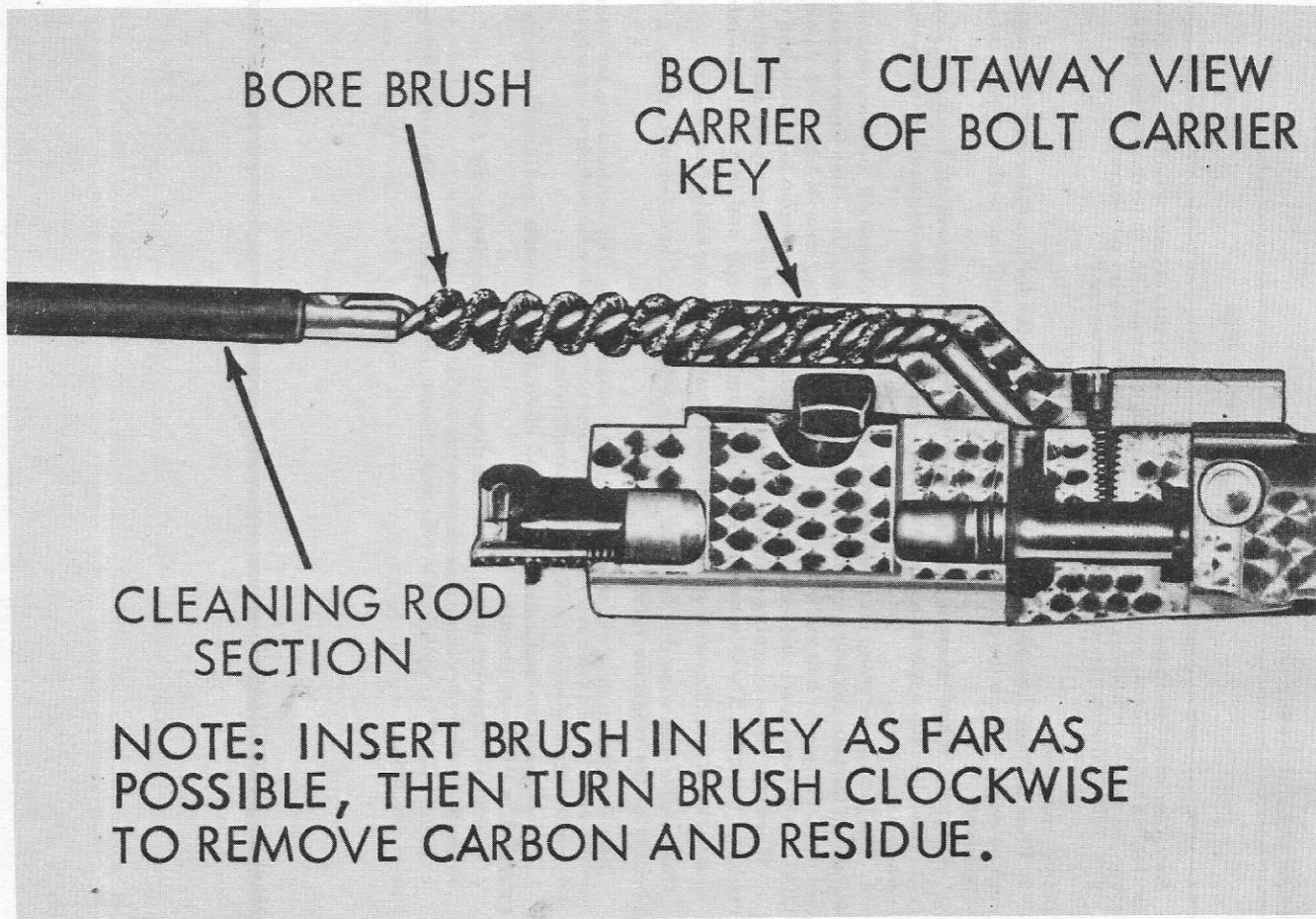
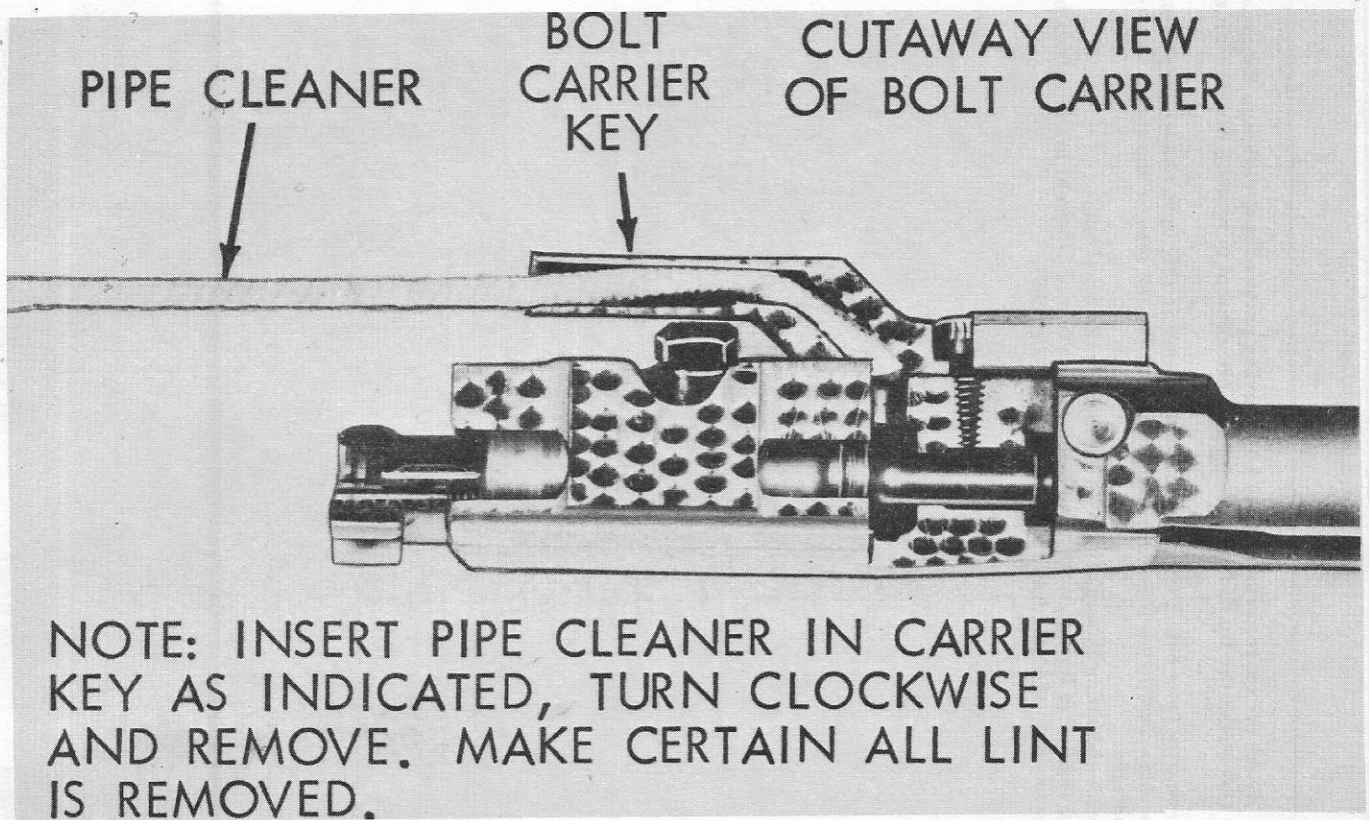


Figure 2-36. Cleaning carrier key.



*Figure 2-37. Drying carrier key.*

Item	After firing	As required	Maintenance level	Action required
		X	C	<p><b>Caution:</b> Brush the outer surface of the bolt, paying particular attention to the area behind the bolt rings and under the lip of the extractor. Do not attempt to remove discoloration caused by heat.</p> <p>5. Remove extractor from bolt. Using a small brush, dipped in rifle bore cleaner, scrub extractor to remove carbon. Also clean firing pin recess and firing pin. Do not remove the spring from extractor unless it is damaged.</p> <p>6. Clean ejector and spring by scrubbing with brush using rifle bore cleaner.</p> <p>7. When dry and before final assembly, apply a generous coat of lubricant to the outside bolt body and rings. Place one drop of LSA / LAW in bolt carrier key (fig 2-38).</p>
	X	O**		
	X	C		

\*\*The letter "O" indicates organizational maintenance.

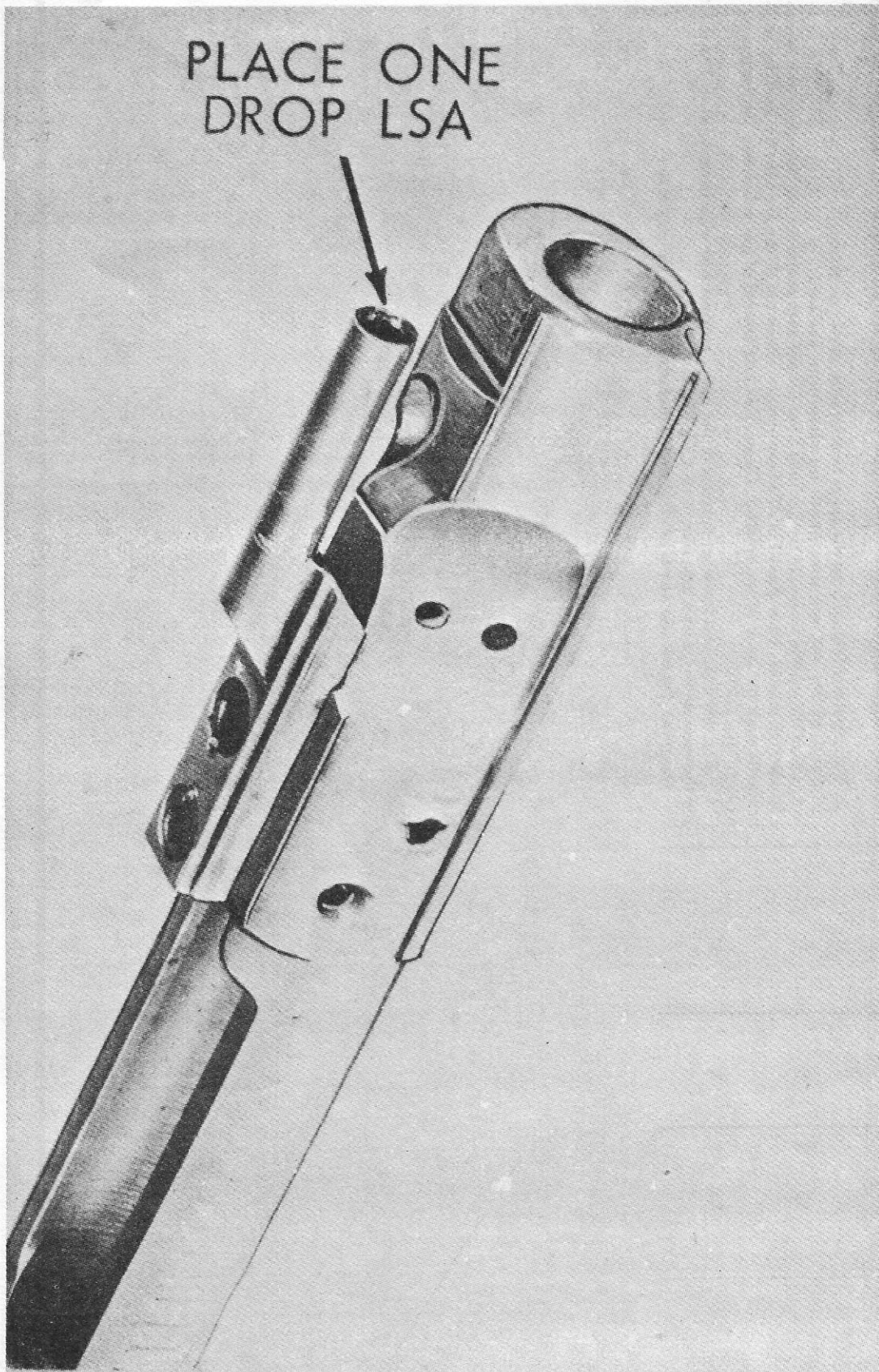


Figure 2-38. Oiling carrier key.

Item	After firing	As required	Maintenance level	Action Required
Upper receiver . . . . .	X	X	C	<p>8. During cleaning and lubricating, inspect the bolt for cracks, especially in the bolt cam pin hole area.</p> <p>1. Clean powder fouling from the upper receiver with rifle bore cleaner.  <i>Caution: Do not use wire brush on aluminum surface.</i></p> <p>2. Clean the outside surface of the gas tube (that portion that protrudes into the upper receiver) with a bore brush that has been dipped in rifle bore cleaner. Clean top of the gas tube by inserting rod and brush through the back of the receiver. Clean sides and bottom of gas tube from the bottom of the receiver (fig 2-39).</p> <p>3. After cleaning, coat the inner surfaces of the upper receiver with a generous coat of LSA / LAW and the outer surface with a light coat of LSA / LAW.  <i>Caution: Do not use any type of abrasive material to clean the gas tube.</i></p>

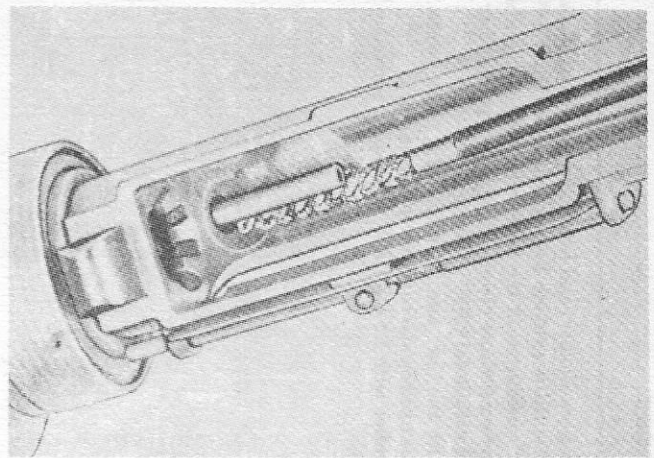
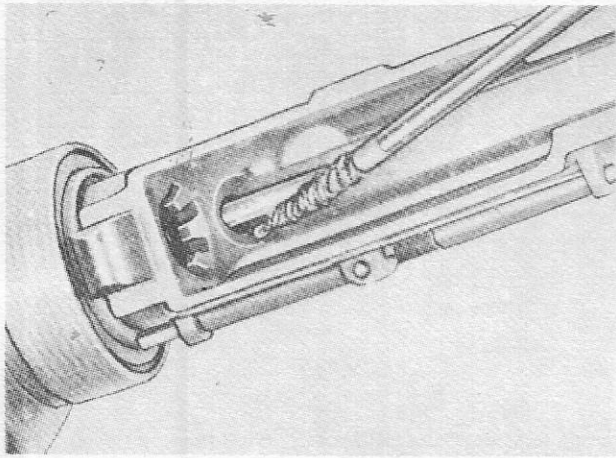


Figure 2-39. Cleaning outside surface of gas tube in receiver.

Item	After firing	As required	Maintenance level	Action Required
Barrel .....	X	X	C	<ol style="list-style-type: none"> <li>1. Attach the bore brush to a cleaning rod, dip in rifle bore cleaner, and brush the bore from chamber to muzzle (fig 2-40). Push the brush through the bore until it extends beyond the muzzle. DO NOT reverse direction of brush while in the bore. Continue brushing until the bore is thoroughly scrubbed.</li> <li>2. Attach the chamber brush to the cleaning rod, dip in rifle bore cleaner, and insert in chamber (fig 2-41). Use a minimum of five plunging strokes and three rotational (360° ) motions.</li> <li>3. Remove brush from chamber and cleaning rod. Dry the bore and chamber with clean swabs. Do not reverse direction of swabs while in the bore. Continue until swabs come out clean and dry.</li> <li>4. After cleaning, lightly lubricate the bore and chamber with LSA / LAW to prevent corrosion and pitting. Lightly lubricate the lugs in the barrel extension.</li> </ol>

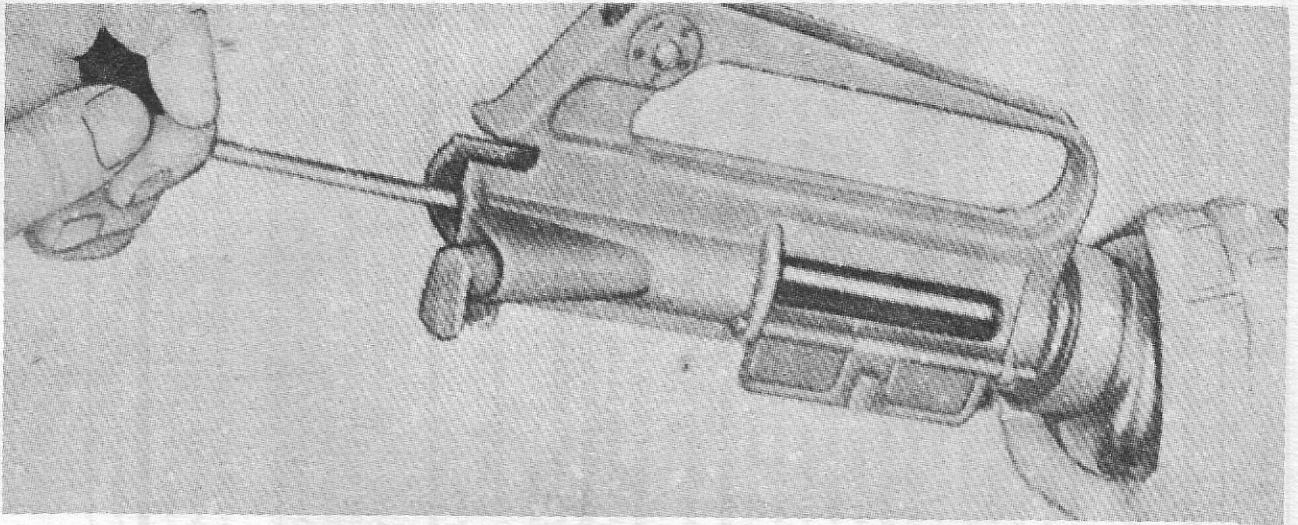


Figure 2-40. Cleaning the bore.

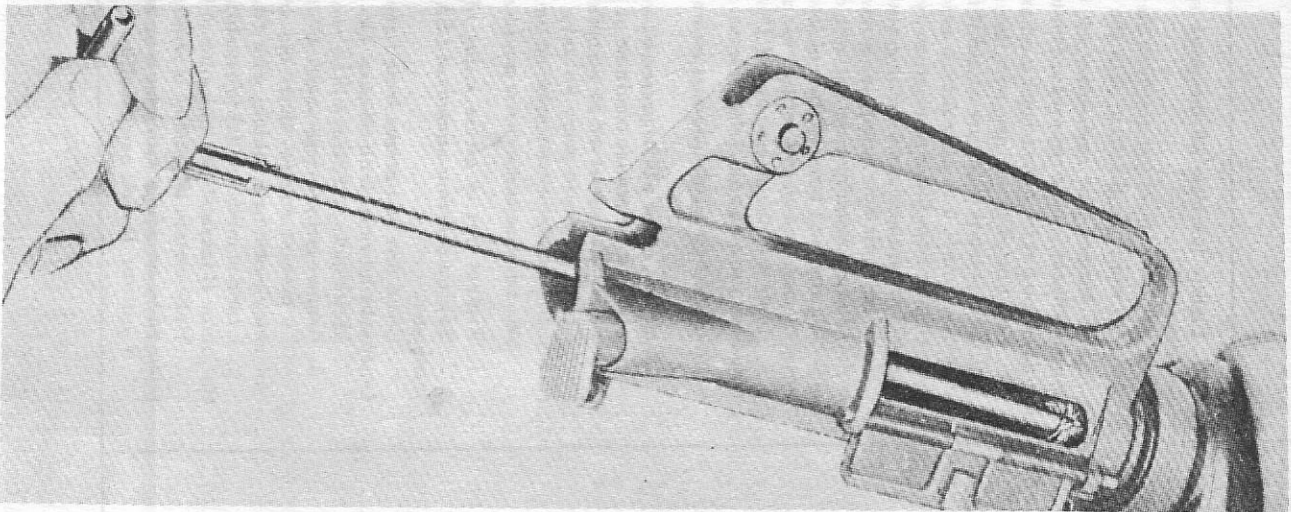


Figure 2-41. Cleaning the chamber.

Item	After firing	As required	Maintenance level	Action required
Lower receiver	X X X X	X X X X	C C C C	5. Lightly lubricate all the outer surfaces of the barrel and sight (including surfaces under the handguard). 6. Apply lubricant generously to the front sight post screw, detent, and spring. Depress detent several times to work the lubricant into the spring. Note. Moisture from condensation will collect in the bore of the rifle when the protective cap is used on the muzzle. The cap must be removed and the bore cleaned and lubricated every 24 hours. 1. Wipe dirt from the trigger mechanism with a clean swab or brush. Caution: Do not use wire brush on aluminum surface. 2. Components which are coated with carbon will be cleaned with rifle bore cleaner and a toothbrush or similar brush. Use a scrubbing action to remove all carbon and foreign material. Drain excess rifle bore cleaner from lower receiver cavity and wipe dry. Use the opposite end of the brush with a piece of rag or cloth wrapped around it to get into the hard-to-get-at places. 3. Clean drain hole in butt cap screw using a pipe cleaner. 4. After the lower receiver has been cleaned and dried, apply a light coat of LSA / LAW to the buffer, action spring, and inner surface of lower receiver extension. Also apply a generous coating inside the lower receiver and all components including the takedown and pivot pins. 5. Apply a generous amount of LSA / LAW in the detent well, to the detents and springs for the takedown pin, pivot pin, selector lever, and outer surfaces of lower receiver extension. Note. If the detents and springs are frozen, the weapon should be turned in to the unit armorer for repair.
Inactive weapons	.....	X	C	Inactive weapons will be preserved with a generous coat of (LSA / LAW). Inspect these weapons on a weekly basis to determine condition of preservation. Weapons having corrosion or rust will be cleaned immediately and preserved in accordance with instructions. All inactive weapons will be thoroughly cleaned and preserved every 90 days. Weapons in storage should have the bolt forward in the non-cocked position to relieve tension on the firing mechanism. Note. Do not use the rifle cover or protective cap on rifles which are to be stored over 24 hours.
Bipod, rifle	.....	X X	C C	1. Remove dirt or grease, using rifle bore cleaner. 2. Apply a generous amount of LSA / LAW to all surfaces, making certain the tension spring is well lubricated.
Bayonet-knife M7	.....	X	C	1. Clean dirt and grease from bayonet-knife. Apply a light coat of LSA / LAW to the blade and generously lubricate both releases. The releases should work freely and return to the locked position. 2. Minor nicks and dents will be removed with file or whetstone.
Scabbard M8A1 and sling	.....	X X X	O O C	3. Remove grips to clean shank of blade assembly and apply a light coat of LSA / LAW. 1. To prevent mildew, shake out and air the scabbard and sling at frequent intervals. Mildewed canvas is cleaned by scrubbing with a dry brush. 2. Examine mildewed fabric carefully for evidence of rotting or weakening by stretching and pulling the fabric. If fabric shows indication of loss of tensile strength, turn in for replacement. 3. Make certain all mildew is removed before water is used to remove dirt. Oil and grease may be removed by scrubbing with issue soap and water. Rinse well with water and dry thoroughly. Caution: Do not use gasoline or solvent to remove oil or grease from canvas.

Table 2-2. Preventive Maintenance Checks and Services

Item No.	*Operator		Item to be inspected	Procedure
	B	A		
1			Rifle	Wipe excessive oil from bore and chamber. Retract bolt to insure free movement between bolt carrier and gas tube. Hand function to insure proper operation. Check magazine for positive retention and functioning of bolt catch. Clean and lubricate. Be sure to clean bolt carrier key. Clean and lubricate. Check bipod legs. Make certain they move freely from closed to open position under spring tension, and that tension is of sufficient strength to hold the bipod to the rifle.
**2	X		Rifle	
**3	X		Rifle	
**4	X		Rifle	
**5		X	Rifle	
**6	X		Bipod	

\* B—before, D—during, A—after operation.

\*\*—Will be performed weekly unless daily schedule is performed as a result of firing.

## Section VI. STOPPAGE, IMMEDIATE ACTION, REMEDIAL ACTION, AND MALFUNCTIONS

### 2-16. Stoppage

A stoppage is failure of an automatic or semiautomatic firearm to extract or eject a spent case or to load or fire a new round. Immediate or remedial action must be taken to clear the stoppage.

### 2-17. Immediate Action

Immediate action is the unhesitating application of a probable remedy to reduce a stoppage without investigating the cause. Immediate action to clear a stoppage with the M16A1 rifle is as follows:

*a.* Tap upward on the bottom of the magazine to insure it is fully seated. Pull the charging handle fully to the rear (observe for the ejection of a live or expended cartridge) and release it (do not ride the charging handle forward). Strike the forward assist assembly to insure bolt closure (M16A1 rifle only). Attempt to fire the weapon.

*Note.* Immediate action is to be applied only one time for a given stoppage.

*b.* If the weapon still fails to fire, it must be inspected to determine the cause of the stoppage, and appropriate action must be taken.

*Note.* When using the M16 rifle, the statement, "Strike the forward assist assembly to insure bolt closure" (*a* above) should be ignored. The M16 rifle does not have a forward assist assembly.

*c.* Application of immediate action, a second time for the same malfunction, prior to determining the cause of the stoppage could result in compounding the stoppage or result in the weapon blowing up.

**Caution:** If an audible "Pop" or reduced "Recoil" is experienced during firing, immediately cease fire, remove the magazine, lock the bolt to the rear, and place the selector lever on the safe position. Visually inspect and/or insert a cleaning rod into the bore to insure there is not a projectile lodged in the bore. **DO NOT APPLY IMMEDIATE ACTION.**

*Note.* If a projectile is lodged in the barrel of a weapon, DO NOT attempt to remove it. Turn the weapon in to the armorer for turn-in to direct support.

### 2-18. Remedial Action

When the application of immediate action fails to reduce a stoppage, remedial action must be applied. Remedial action is the continuing effort to determine the cause for a stoppage, apply a remedy to clear the stoppage once it has been identified, and return the weapon to operation.

### 2-19. Malfunction

*a.* A malfunction is an unplanned cessation of fire due to a stoppage caused by a mechanical failure of

the weapon, magazine, or ammunition.

*b.* Six major categories of malfunctions and related subtypes common to the M16A1 rifle are discussed in detail and illustrated below.

(1) *Designation.* Failure to feed, chamber, and lock a round from the magazine.

*(a) Description.* This malfunction may occur when initially loading the weapon or during the cycle of operation. When initially loading the weapon, the forward movement of the bolt carrier group lacks sufficient force (generated by the expansion of the action spring) to feed, chamber, and lock the first round of a magazine. While firing, the cycle of function is interrupted by a failure to strip a round from the magazine, chamber, and lock it.

*(b) Probable cause.* In the above mentioned malfunction the cause may be the result of one or more of the following:

1. Excess accumulation of dirt or fouling in and around the bolt and bolt carrier.

2. Defective magazine (dented or bulged) (defective magazines are discussed in paragraph 2-19 *b* (6) *(g)*).

3. Magazine improperly loaded.

4. Magazine improperly inserted into the weapon.

5. Defective round (projectile forced back into the cartridge case which could result in a "stuffed round").

6. Damaged or broken action spring.

7. Excess accumulation of dirt in the lower receiver extension.

8. Fouled gas tube resulting in short recoil.

*(c) Corrective action.* Immediate action should be taken; however, to avoid the risk of further jamming the firer should watch for ejection of a cartridge and insure that the upper receiver is free of any loose rounds. The application of immediate action will usually overcome the malfunction. The carrier should not be forced; if resistance is encountered, as may occur with a "stuffed round," the bolt should be locked to the rear, the magazine removed, and the malfunction cleared. If the application of immediate action fails to clear the malfunction, remedial action must be taken (i.e., locate the cause for the malfunction and correct it).

*Note:* While repetitive occurrences of this malfunction may be temporarily overcome by lubricating the bolt carrier without disassembly, the weapon should be field stripped, inspected for a defective part, cleared, and lubricated at the earliest opportunity.

*(d) Malfunction subtypes.* Various feeding failure subtypes are shown in figures 2-42, 2-43- 2-

44. and 2-45. Due to the relative frequency of a failure to feed, the subtypes are often identified as indicated in the figures.

(2) *Designation.* Failure of a cartridge to fire despite the fact that a round has been chambered and the trigger or the automatic sear has released the hammer.

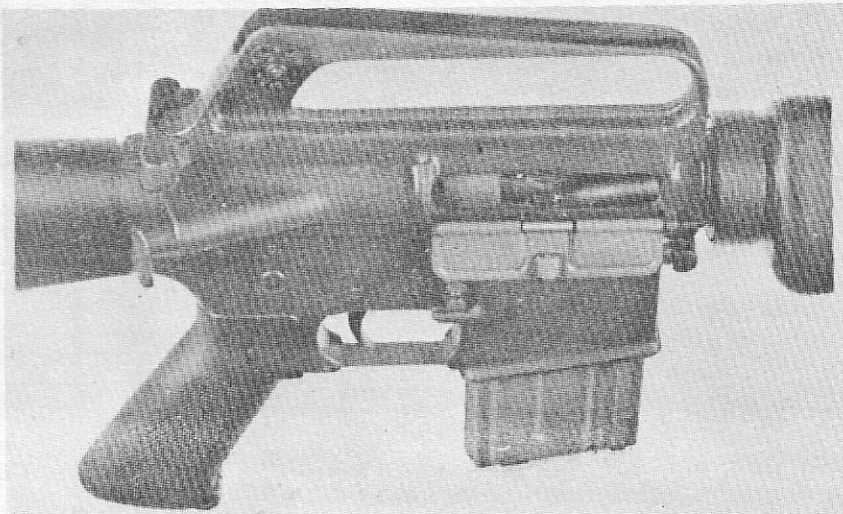


Figure 2-42. Failure to feed the first round from the magazine.

(b) *Probable cause.* Carbon or fouling accumulation on the firing pin, as shown in figure 2-46, is often the cause of this malfunction, since the full forward travel of the firing pin is restricted. However, a defective or broken firing pin may have the same results. This malfunction also occurs when the bolt carrier fails to fully close and the hammer strikes the carrier rather than the firing pin. However, the hammer striking the carrier may cause the carrier to move fully forward and, on inspection, the cause of the malfunction is not then apparent.

(c) *Corrective action.* Apply immediate action. If the malfunction continues, the firing pin, bolt, bolt carrier, and locking lug recesses of the barrel extension should be inspected, and any accumulation of carbon or fouling should be removed. The firing pin tip, although extremely durable in normal service, should also be inspected for damage.

*Note.* This malfunction is often erroneously attributed to faulty ammunition. If this cause is suspected and remedial action fails to eliminate the malfunction, rounds which fail to fire and exhibit a normal firing pin indent should be identified, stored, and the responsible ammunition agency notified.

(d) *Malfunction subtypes.*

1. Two subtypes are illustrated in figure 2-47. The third subtype, carrier not fully closed, on initial visual inspection will appear to be the same as shown in figure 2-43.

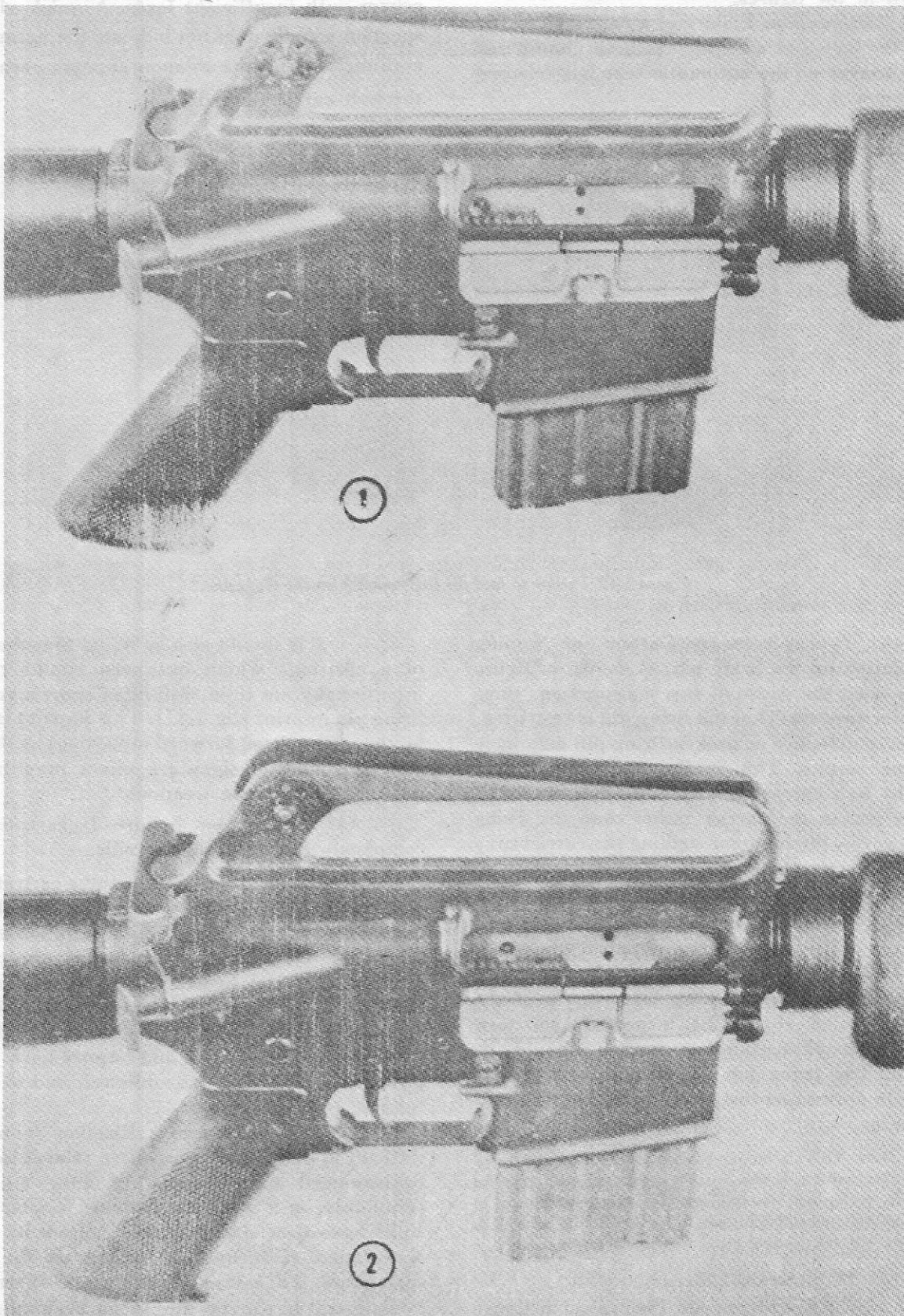
(a) *Description.* This failure occurs when the firing pin either fails to strike or strikes the primer with insufficient force. A quick visual inspection usually does not indicate the nature of the malfunction and the weapon appears normal with the bolt carrier closed.

2. It should also be noted that the primer of a cartridge which has been chambered, but intentionally not fired, will often show a very light firing pin imprint (fig 2-47). This imprint is caused by the unrestricted forward movement of the firing pin; this normal signature effect may be quite indistinct with some weapons.

(3) *Designation.* Failure of a cartridge to be completely ejected from the rifle.

(a) *Description.* Ejection of a cartridge is an element of the cycle of function of the rifle regardless of the mode of fire. A malfunction occurs when the cartridge is not ejected through the ejection port and becomes jammed in the upper receiver as the bolt closes. On some occasions the cartridge, while initially clearing the rifle, may strike an outside surface and bounce back into the path of the bolt. This is usually referred to as spin-back.

(b) *Probable cause.* Ejection failures are difficult to diagnose but are often related to a weak or damaged extractor spring and, much less commonly, to a weak or damaged ejector spring. Failures-to-eject can also be caused by an accumulation of carbon or fouling on the ejector spring, on the extractor, and from short recoil. Short recoil is usually due to an accumulation of fouling in the mechanism which may result in any of a number of failures including a failure-to-eject. Resistance caused by an extremely carboned or



*Figure 2-43. Top view—a failure to feed the first round from the magazine with the bolt carrier not fully closed; bottom view—bolt carrier in a normal, fully closed position.*

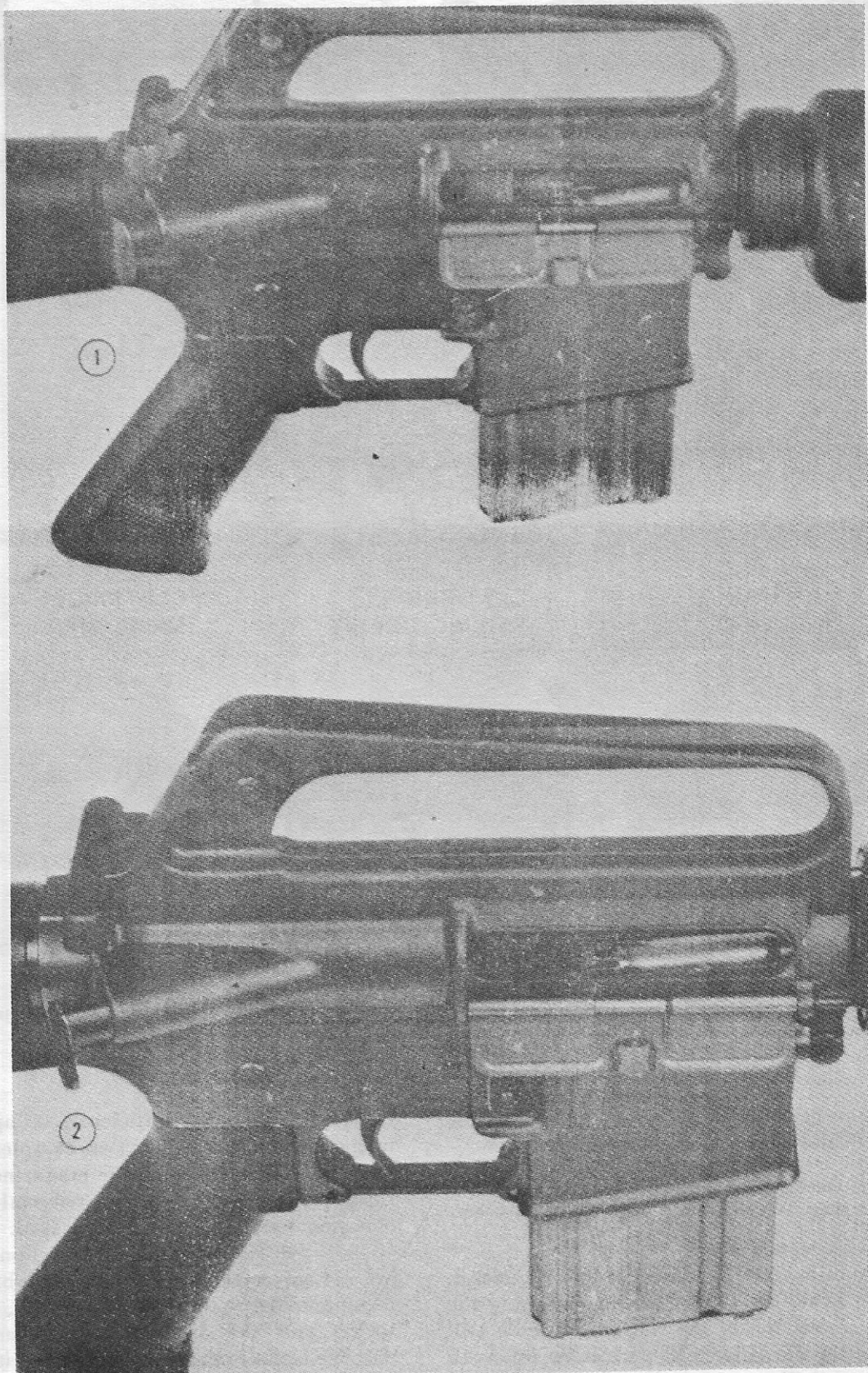


Figure 2-44. Two subtypes of a failure to feed.

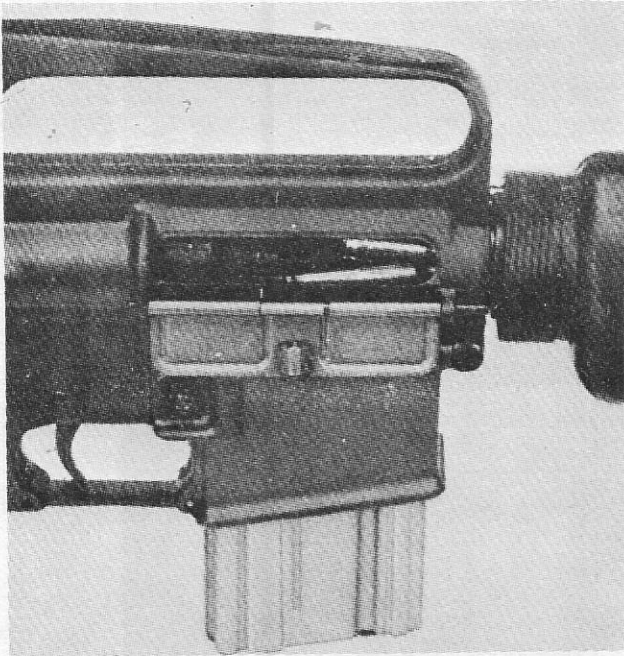


Figure 2-45. A double feed of two live rounds.

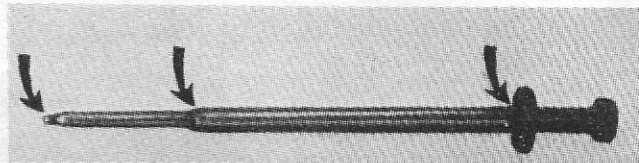
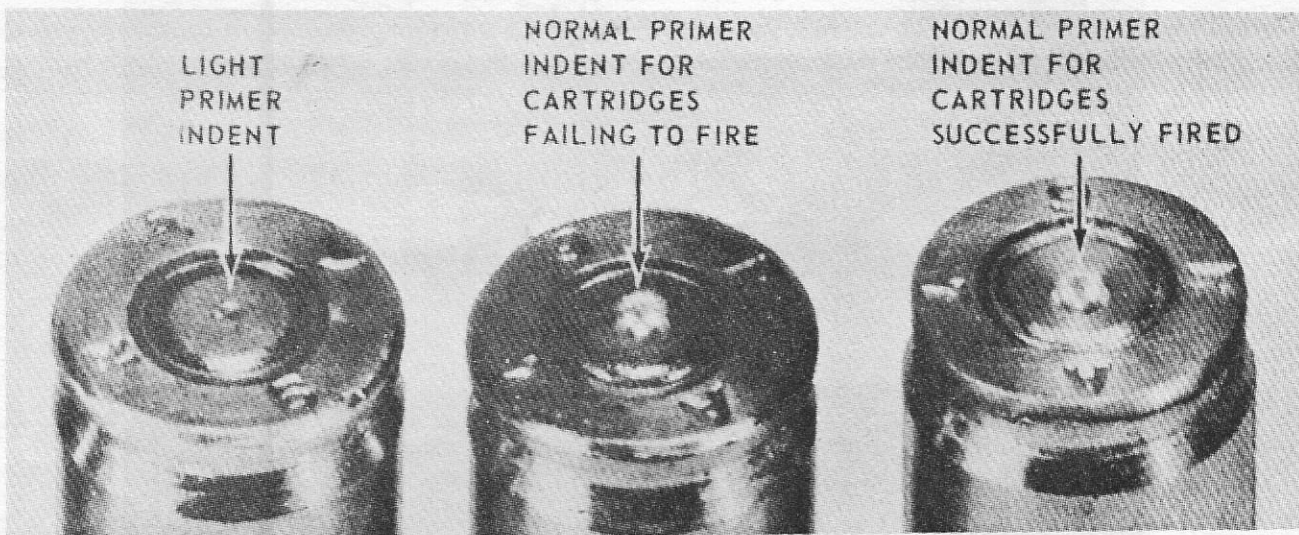


Figure 2-46. Arrows indicate critical areas where fouling accumulation may cause failures to fire.



Note that for cartridges successfully fired, the primer, and particularly the circumference of the primer indent, show a distinct flattening of the surface as a result of normal propellant pressure.

Figure 2-47. Various degrees of primer indent on 5.56-mm cartridges.

corroded chamber may impede the extraction and subsequently the ejection of a cartridge.

*Note.* Short recoil may also be caused by a fouled or obstructed gas tube. This problem is discussed in (6) below.

(c) *Corrective action.*

1. Immediate action should be taken, carefully, to avoid the risk of further jamming the rifle. While retraction of the charging handle will usually free the cartridge and permit its removal, the charging handle must not be released until the position of the next live round is determined. If a

live round has been sufficiently stripped from the magazine, or in some cases completely stripped from the magazine, then the magazine and all live rounds may also require removal before the charging handle should be released.

2. If repetitive malfunctions occur and are not corrected by cleaning and lubricating, it is recommended that the ejector spring, the extractor spring and the extractor be replaced, even if damage is not apparent. The ejector itself does not often require replacement. Note that the extractor spring cannot be easily removed from the extractor



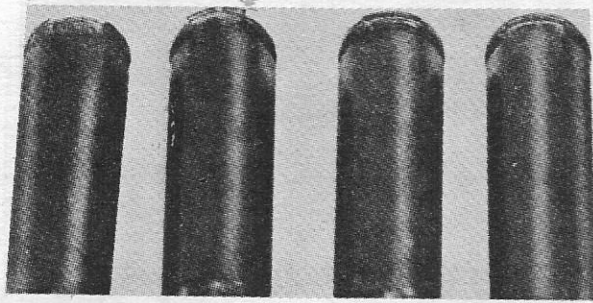
Top View—Failure-to-eject the cartridge case, base exposed.  
Bottom View—fired case, mouth exposed.

*Figure 2-48. Two subtypes of failure-to-eject.*



Top view—Failure-to-eject with no portion of the cartridge case outside the ejection port.  
Bottom view—Failure-to-eject with a live round jammed.

Figure 2-49. Two subtypes of failure-to-eject.



Left to right—rim is completely sheared; partial rim shears illustrated on next two cartridges; hard rim extraction.

Figure 2-50. Various degrees of rim damage which may occur as a result of a failure-to-extract.

without damaging the spring; however, a new extractor spring can be properly installed if care is exercised.

(d) *Malfunction subtypes.* The four subtypes of failure-to-eject are shown in figures 2-48 and 2-49. On rare occasions a fifth subtype may be encountered where the cartridge which has not been successfully ejected is found to be completely rechambered and the bolt is fully closed and locked. This should not be confused with failure-to-extract (4) below. The determining factor in deciding whether a failure-to-eject or a failure-to-extract has occurred is the nature of the clearing action required to overcome the malfunction. If the cartridge case can be cleared by simply retracting the charging handle, a failure-to-eject has occurred; if difficulty is encountered to the extent that repeated charging handle cycles are required, or if tools (cleaning rod, bayonet) are required to clear the malfunction, then a failure-to-extract has occurred.

(4) *Designation.* Failure of a cartridge to be successfully extracted from the rifle chamber.

(a) *Description.* A failure-to-extract results when the cartridge case remains in the rifle chamber. While the bolt and bolt carrier may move rearward only a very short distance, more commonly the bolt and carrier recoil fully to the rear, leaving the cartridge case in the chamber. A live round is then forced into the base of the cartridge case as the bolt returns in counterrecoil. This malfunction is considered to be one of the most difficult to clear.

*Note.* The distinction between certain failures-to-eject and a failure-to-extract is determined by the nature of the clearing action required to overcome the malfunction. As the latter malfunction is considered to be an extremely serious one that requires the use of tools to clear, it is essential that it be properly identified and reported. Relatively easy to clear failures-to-eject must not be incorrectly reported as extraction failures.

(b) *Probable cause.* Short recoil cycles or

fouled or corroded rifle chambers are the most common causes of failures-to-extract. A damaged extractor or a weak or broken extractor spring can also cause this malfunction.

(c) *Corrective action.*

1. The severity of a failure-to-extract determines the corrective action procedures which will be successful. If the bolt has moved rearward far enough so that it strips a live round from the magazine in its forward motion, the magazine and all loose rounds must be removed prior to attempting to clear the stoppage. Next, lock the bolt and carrier to the rear. A cleaning rod then may be inserted in the bore from the muzzle end; the cartridge case can be forced from the chamber by tapping the cleaning rod against the inside base of the fired cartridge.

2. When cleaning and inspection of the mechanism and the chamber reveal no deficiencies in these areas, and failures-to-extract persist, the extractor and extractor spring should be replaced. If the chamber surface is damaged, the entire barrel must be replaced.

(d) *Malfunction subtypes.* Various degrees of cartridge case rim damage are shown in figure 2-50 and illustrate, together with 2-51, types of failure-to-extract.

(5) *Designation.* Failure of the bolt to remain in a rearward position, engaged by the bolt catch, after the last round has been fired.

(a) *Description.* When this failure occurs, the soldier has no immediate visual check to determine if a malfunction has interrupted firing or whether the last round has been fired. The weapon appears to be in a normal, bolt-closed position.

(b) *Probable causes.* This malfunction may be caused by any one or a combination of the following.

1. Short recoil, where the bolt recoils far enough to complete all other firing operations but not far enough to be engaged by the bolt catch.

2. Excess fouling or dirt, which restricts or prohibits the bolt catch from moving freely into the path of the bolt after the last round has been fired.

3. Dented or dirty magazine which restricts or prohibits the follower of the magazine to force the bolt catch up into the path of the bolt as it moves forward after the last round has been fired.

*Note.* This cause may also create feeding problems.

4. Weak or broken magazine spring, which restricts or prohibits the full upward movement of the follower, resulting in (3) above.

5. Defective action spring, normally caused by stretching the action spring which causes the bolt and carrier to move forward faster than normal, not allowing sufficient time for the bolt to



Figure 2-51. Failure-to-extract resulting in a live round being jammed against the base of the fired case.

catch to move into position to arrest the bolt after the last round has been fired.

*(c) Corrective action.*

1. Immediate corrective action is accomplished by using the charging handle to fully retract the bolt and bolt carrier. The bolt catch will then usually engage and hold the bolt rearward and the empty magazine can be removed and a loaded magazine inserted. A fully loaded magazine should not be inserted with the bolt in a closed position; if the bolt is in a closed position after an empty magazine is removed from the weapon, the bolt

catch will not automatically engage the bolt when the bolt is retracted. Under these conditions the bolt catch must be manually positioned to hold the bolt to the rear.

2. Inspection, cleaning, lubrication, and / or replacement of the defective part(s) should be accomplished when repetitive failures occur.

*(6) Designation and description.* Any malfunction which cannot be defined under the previous categories are included here.

*(a) Firing two rounds on a single trigger pull in the semi-automatic mode.* The firing of two

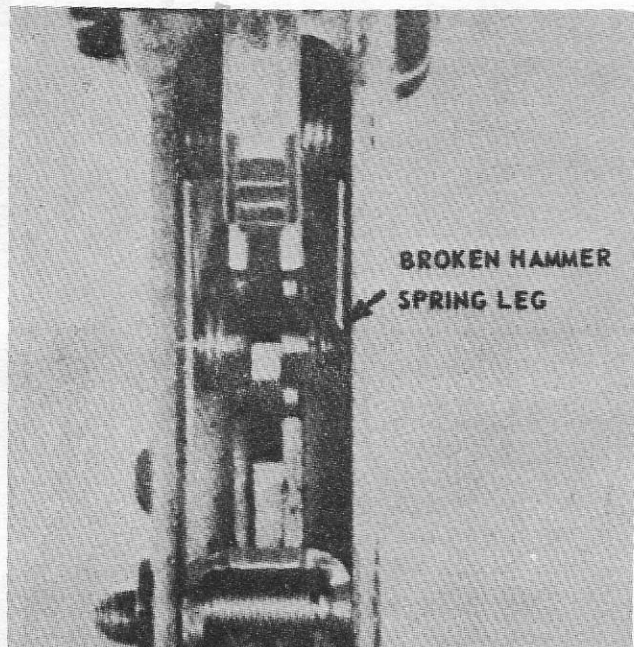
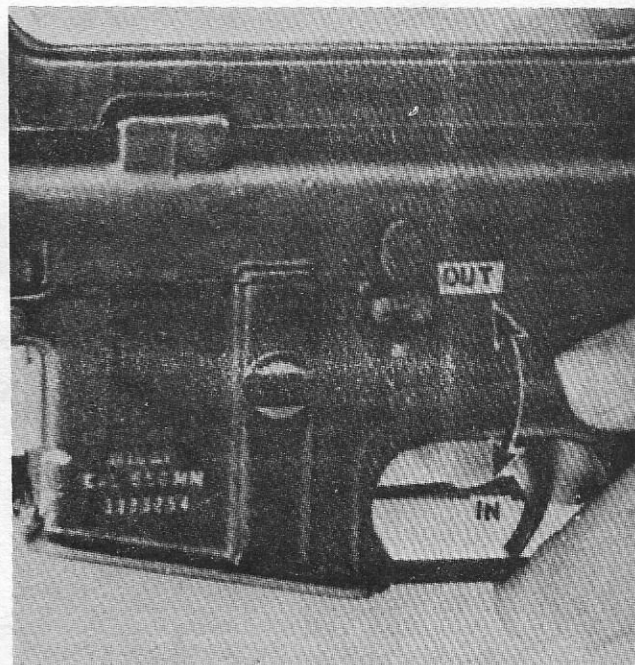
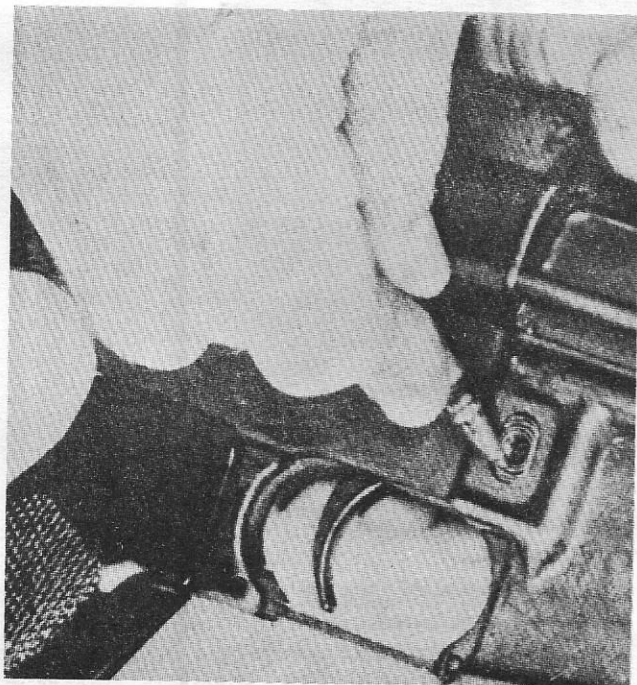


Figure 2-52. Interior view of the lower receiver. Arrow indicates that one leg of the hammer spring is broken.



2 Adjusting magazine catch



1 Pressing magazine catch button

Figure 2-53. Adjusting magazine catch.

rounds on a single trigger pull in the semiautomatic mode is often due to the trigger pin backing out from engagement on one side or the other of the receiver. Loosening of the trigger pin in turn is due usually to a broken or incorrectly assembled hammer spring (fig 2-52). Immediate corrective action can be taken without disassembly of the rifle

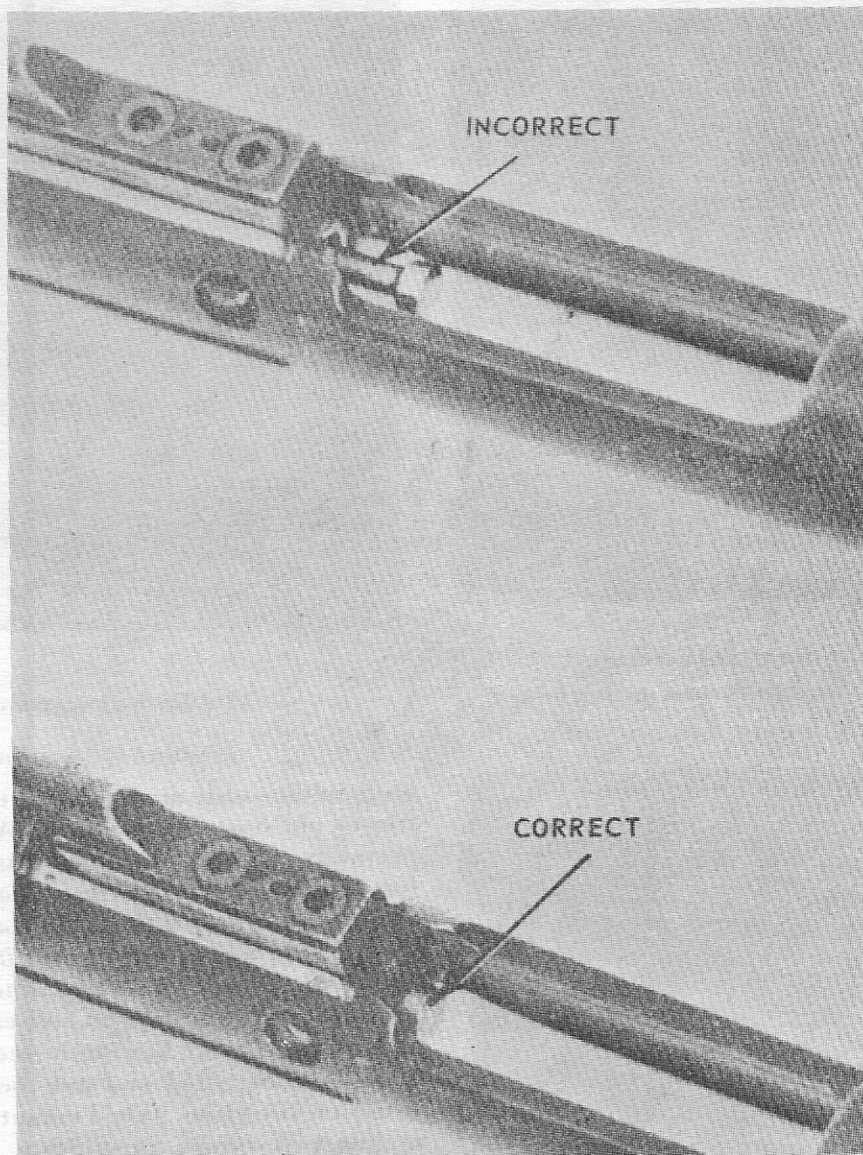
Figure 2-53-Continued:

by simultaneously manipulating the trigger and the trigger pin back into position. At the earliest opportunity the hammer spring should be inspected for damage or for incorrect assembly.

(b) Bolt catch engages and stops the bolt or the bolt carrier during firing instead of after the last round in the magazine is fired. The engagement of the bolt or bolt carrier by the bolt catch during burst fire rarely occurs if the rifle is being shoulder fired and only occasionally occurs when it is fired from a rigid mount. However, if the malfunction occurs repetitively during shoulder-fired operations, the bolt catch and spring should be replaced.

(c) Failure of the trigger to return to a forward position after trigger release. A failure of the trigger to return to the forward position after trigger release is usually due to dirt or an accumulation of fouling in the mechanism, or to a lack of lubricant. While immediate corrective action can be taken by manually repositioning the trigger, permanent corrective action usually requires disassembly, cleaning, and lubrication; in some instances, due to improper engagement surfaces, the hammer and disconnecter may require replacement.

(d) Failure of the magazine to lock in the weapon. Repetitive failures of a magazine(s) to lock or stay locked in the weapon are most often due to an accumulation of fouling or dirt in the area of the magazine release lock mechanism. While a magazine can usually be forcibly locked into



Top view—retaining pin has been incorrectly assembled ahead of the firing pin shoulder. Bottom view—correct assembly.

Figure 2-54. Arrows indicate location of pin which retains firing pin in the bolt carrier.

position. cleaning and lubrication of the magazine release lock mechanism are required. On occasion, a particular magazine will be found with dimensional irregularities which restrict or prohibit proper locking; such magazines are not repairable.

*Note.* Adjusting the magazine catch: The magazine catch should hold the magazine firmly but should not interfere with magazine removal when the catch button is depressed. To adjust (1, fig 2-53) press in on the magazine catch button (use the tip of a cartridge or cleaning rod) until the left side of the magazine catch protrudes beyond the left side of the receiver. To tighten, turn the magazine catch clockwise; to loosen turn it counterclockwise (2, fig 2-53).

(c) *Broken or damaged parts.* While broken parts are usually apparent when the rifle is

disassembled and inspected, damaged parts are not as readily detected.

(f) *Incorrectly assembled or loose parts.* Figures 2-54 and 2-55 illustrate incorrectly assembled and loose parts.

(g) *Damaged magazine.* Figure 2-56 illustrates damaged magazines. It should be noted that the illustrations are those of grossly damaged magazines and the degree of misalignment or damage is often much less apparent; however, such apparently minor damage can cause repetitive feeding failures. Damaged magazines or those suspected of damage should not be used, and no attempt should be made to repair them.

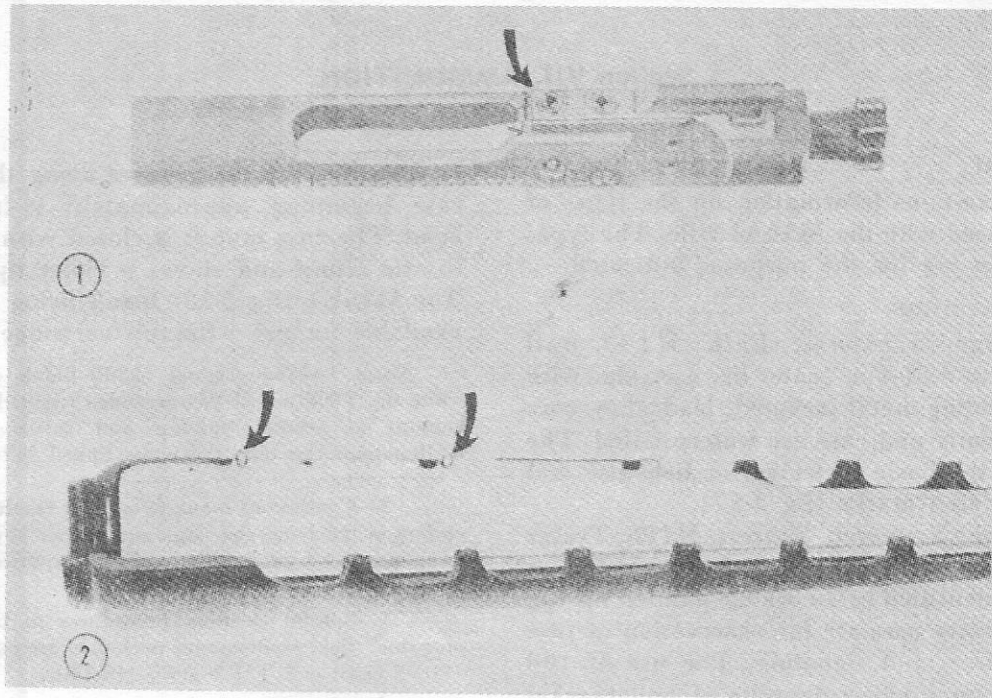


Figure 2-55. Top view—rear bolt carrier key screw has become unstaked and loosened approximately  $\frac{1}{2}$  turn. Bottom view—loose rivets on handguard shield.

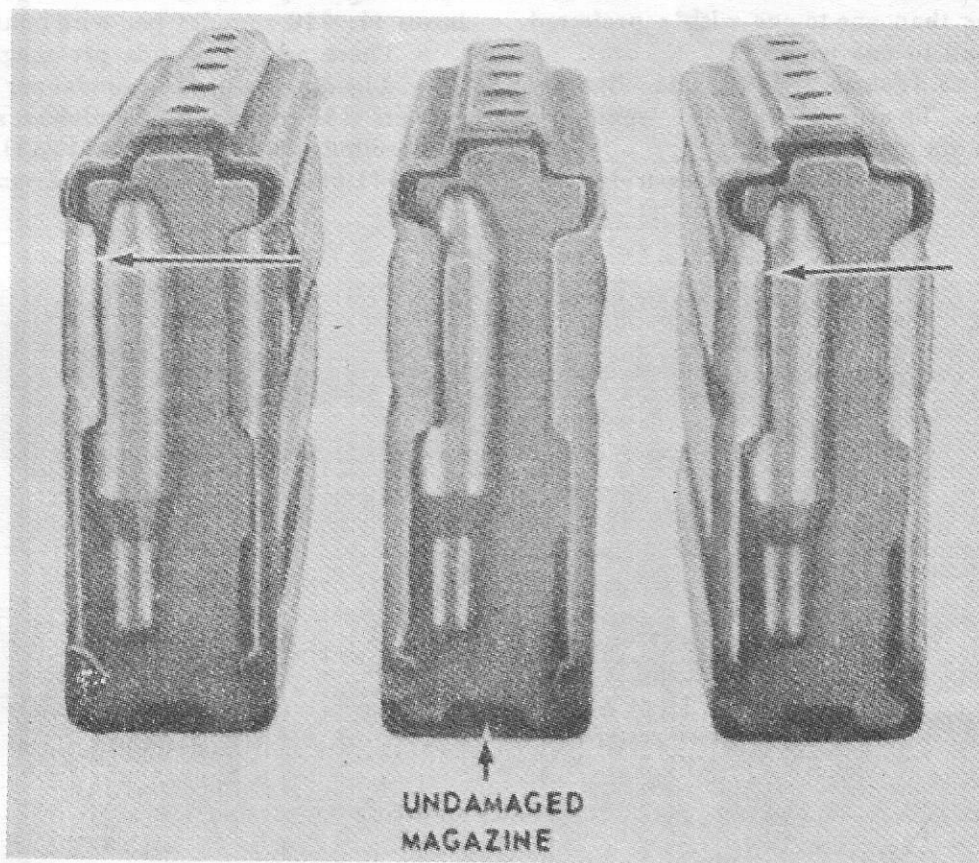


Figure 2-56. Arrows indicate bent and spread magazine lips.

(h) *Fouled gas tube.* One cause of short recoil may be due to a fouled or obstructed gas tube. If short recoil-type malfunctions continue to

occur after a thorough disassembly, inspection, cleaning, and lubrication of the mechanism, the weapon should be turned in to the unit armorer.

## Section VII. AMMUNITION

### 2-20. General

This section contains information on the types of ammunition used with the M16A1 rifle. The types of ammunition are for the purposes indicated.

### 2-21. Classification

a. *Cartridge, 5.56-mm, Ball, M193.* Ball ammunition is a 5.56-mm center fire cartridge with a 55-grain, gilding-metal jacketed, lead alloy core bullet. The primer and case are waterproofed. The ball round is the basic cartridge for field use and has no identifying marks (fig 2-57).

b. *Cartridge, 5.56-mm, Tracer, M196.* Tracer ammunition has the same basic characteristics as the ball. It is identified by an orange painted tip (fig 2-57). Its primary uses are for observation of fire, incendiary effect, and signaling. The use of 100 percent tracer may cause deposits of bullet-jacket material (metal fouling) to form in the bore and rifling grooves of the barrel. Metal fouling is extremely difficult to remove and constitutes a potential safety hazard. Therefore, when tracer is fired it will be intermixed with ball ammunition in a ratio no greater than one-to-one with a preferred ratio of four ball to one tracer.

c. *Dummy, 5.56-mm, M199.* The dummy round can be identified by six lengthwise corrugations in the case (fig 2-57).

d. *Cartridge, M200, Blank.* This cartridge can

be identified by the grooves along the side of the case beginning approximately 1/2-inch from its head. The case mouth is closed with a seven-petal rosette crimp and shows a violet tip (fig 2-57)\*. The M15E1 (fig 2-58) blank firing attachment is available for use with this cartridge.

*Notes.* 1—The original M200 blank cartridge had a white tip. Field use of this cartridge resulted in an excessive amount of residue buildup and subsequently excessive malfunction. Use only the violet tipped M200 cartridge.

2—Continuous blank firing will result in a buildup of carbon in the bore, gas tube, and carrier key. To restore the weapon to good serviceable condition requires special cleaning procedures.

3—Special cleaning procedures to be taken by the operator/field maintenance personnel are outlined in TM 9-1005-219-10 and TM 9-1005-219-34.

### 2-22. Packing

Ammunition for the M16A1 rifle is packed in two ways.

a. There are 20 rounds per carton, 36 cartons (720 rounds) per metal box (M2A1), and 2 metal boxes (1, 440 rounds) per wire-bound box.

b. There are 10 rounds per magazine loading strip, 2 loading strips (20 rounds) per pocket, seven pockets (140 rounds) per bandoleer, six bandoleers (840 rounds) per metal box (M2A1), and 2 metal boxes (1,680 rounds) per wire-bound box. Each

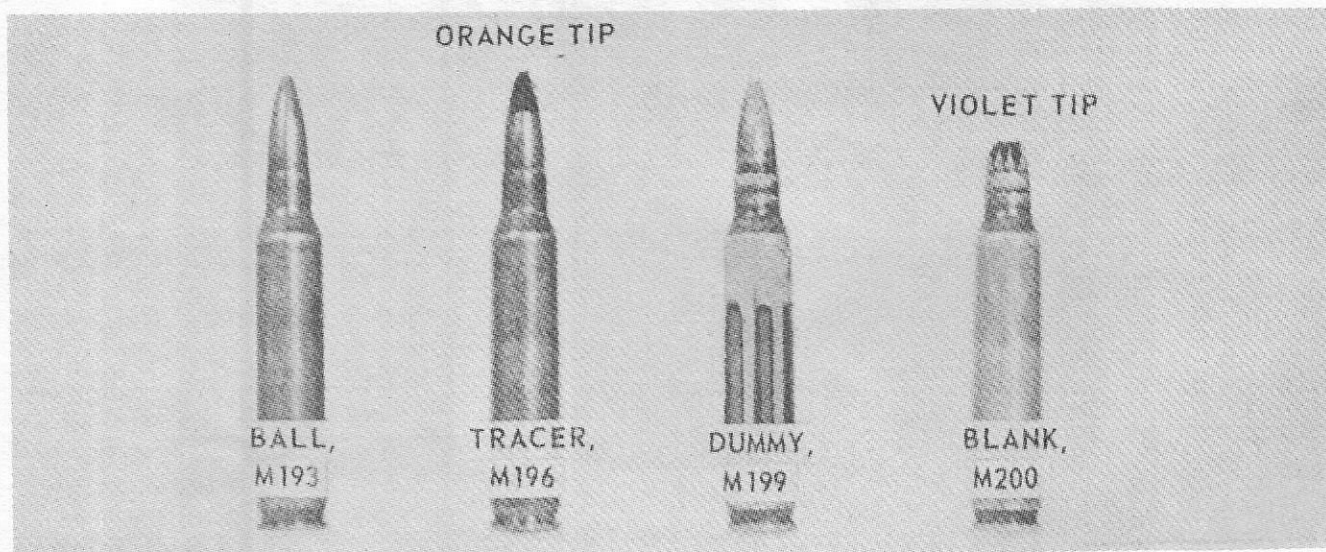


Figure 2-57. Ammunition 5.56-mm.

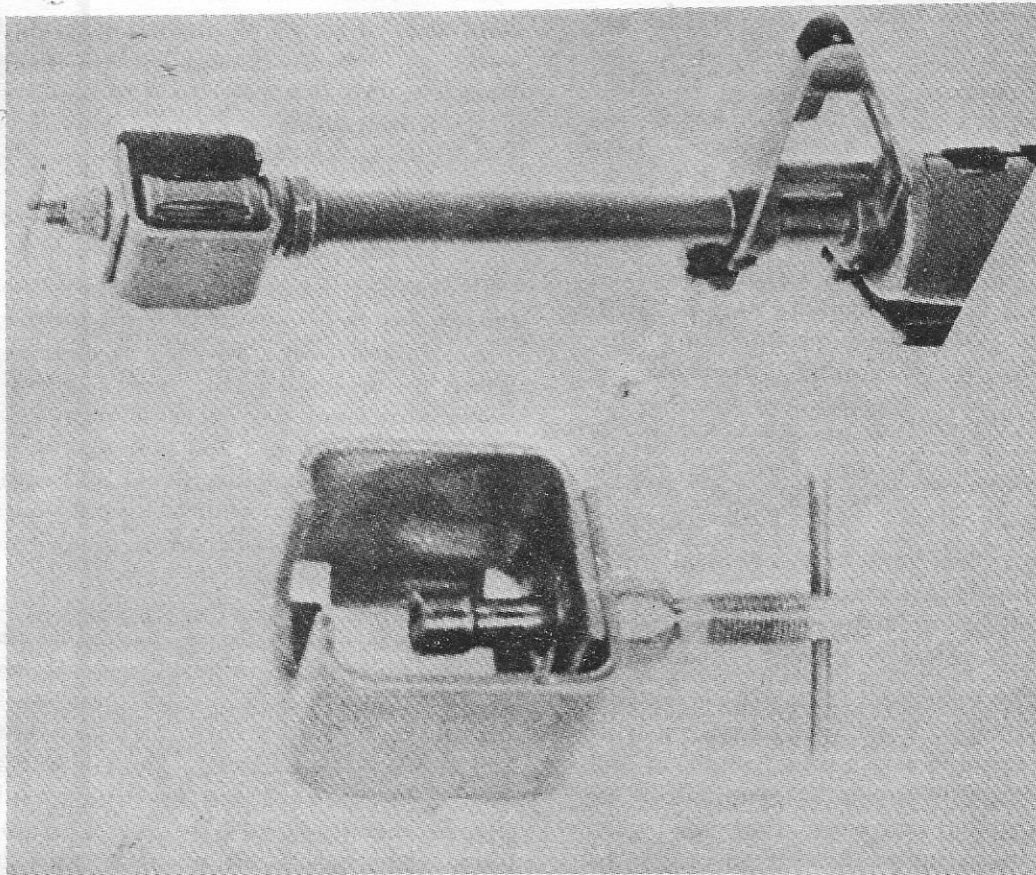


Figure 2-58. M15E1 blank firing attachment.

bandoleer of ammunition has one charger provided which is found in one of the end pockets.

### 2-23. Care and Cleaning

a. When necessary to store ammunition in the open, raise it on dunnage at least 6 inches from the ground and protect it with a cover, leaving enough space for circulation of air.

b. Since ammunition and explosives are adversely affected by moisture and high temperature, due consideration should be given to the following:

(1) Do not open boxes until ammunition is to

be used. Ammunition removed from airtight containers, particularly in damp climates, is likely to corrode.

(2) Protect ammunition from high temperatures and the direct rays of the sun. More uniform firing is obtained if rounds are kept at an even temperature.

c. Do not attempt to disassemble the cartridge or any of its components.

d. The use of lubricant or grease on cartridges is prohibited.

## Section VIII. DESTRUCTION OF MATERIEL TO PREVENT ENEMY USE

### 2-24. General

a. Rifles, subject to capture or abandonment in the combat zone, will be destroyed only by the authority of the unit commander, in accordance with orders of, or policy established by, the army commander. The destruction of equipment is to be reported through regular command channels.

b. The information which follows is for guidance only. Certain of the procedures outlined require use of explosives and incendiary grenades, normally not authorized items of issue to the using organization. Issue of these and related items, and conditions under which destruction will be effected, are

command decisions based on the tactical situation. Of the several means of destruction, the following generally apply:

Mechanical . . . . . Requires axe, pick mattock, sledge, crowbar, or other heavy implement.

Burning . . . . . Requires gasoline, oil, incendiary grenades, and other flammables or welding or cutting torch.

Demolition .....	Requires suitable explosives or ammunition.
Gunfire .....	Includes artillery, machinegun, rifle grenades, and launchers using antitank rockets. Under some circumstances, hand grenades may be used.
Disposal .....	Requires burying in the ground, dumping in streams or marshes, or scattering so widely as to preclude recovery of essential parts.

Destruction of essential parts by mechanical means will render the rifle useless; however, selection depends upon utilizing facilities on hand under existing conditions. Time is usually critical.

c. If destruction to prevent enemy use is resorted to, the rifle and bipod must be damaged so that they cannot be restored to a usable condition in a combat zone either by repair or cannibalization. Adequate destruction requires that all parts essential to the operation of the rifle and bipod be destroyed or damaged beyond repair. However, when lack of time and personnel prevent destruction of all parts, priority is given to destruction of parts in the following order:

- (1) Bolt carrier group.
- (2) Upper receiver group.
- (3) Lower receiver group.

It is equally important that the same essential parts

be destroyed on all like materiel, including spare parts, so that the enemy cannot construct one complete unit from several damaged units.

d. If destruction is directed, due consideration should be given observance of appropriate safety precautions.

#### 2-25. Destruction of The Rifles, 5.56-MM, M16, M16A1, and Bipod, Rifle, M3

**Warning:** Do not use any type of mechanical means for destruction of ammunition.

a. *Method No. 1—By Mechanical Means.* Using an axe, pick mattock, sledge, or other heavy implement, destroy the rifles by smashing the receiver groups, front and rear sights, trigger and trigger guard, magazine, stock, and controls. Also bend the barrel and cut the sling into several pieces. Destroy the bipod using same items listed above. Elapsed time: about 3 minutes.

b. *Method No. 2—By Burning.*

(1) Place the rifle on a suitable pile of combustible material. Pour gasoline or oil over the rifle and bipod and the combustible material. Ignite and take cover. A hot fire is required to render the rifle and bipod useless. Elapsed time: about 3 minutes.

**Warning:** When igniting gasoline, due consideration should be given to the highly flammable nature of gasoline and its vapor. Carelessness in its use may result in painful burns.

(2) If a welding or cutting torch is available, burn through the barrel and receiver groups. Destroy the stock and sling as described in a above.

c. *Method No. 3—By Disposal.* Bury the rifle in a suitable hole or dump it into a stream. Elapsed time: about 3 minutes.

## CHAPTER 3

# RIFLE MARKSMANSHIP FUNDAMENTALS

### Section I. GENERAL

#### 3-1. Purpose and Scope

To be proficient, a combat rifleman must be able to detect targets, determine the ranges to targets, and hit the targets when he fires at them. There are many variables affecting an individual's ability to detect and determine the ranges to combat targets (chap. 6). However, the factors affecting a rifleman's ability to fire and hit the target are relatively constant. Essentially, the rifleman must be able to assume a firing position which enables him to hold the rifle in such a manner that he and his rifle form a single, steady unit. He must know how to correctly align his rifle on the target and he must be able to fire his rifle without disturbing this alinement. The skills needed to accomplish these requirements are known collectively as rifle marksmanship fundamentals.

#### 3-2. Early Firing Exercise and Recoil Demonstration

A recoil demonstration and a firing exercise should be conducted for soldiers who have little or no previous marksmanship experience. The recoil demonstration will clearly show soldiers that they have nothing to fear from recoil if they handle the

weapon properly. The firing exercise is designed to motivate soldiers toward marksmanship training. The degree of involvement of firing exercises will be directly related to the marksmanship level of experience of the soldier, i.e., basic combat training (BCT)—three, three-round shot groups to acquaint the trainee with the weapon, and after BCT three rounds for familiarization firing. A recoil demonstration should be conducted before the soldier fires the service rifle for the first time. The demonstration is fired by a well-trained rifleman. He fires the first round while holding the rifle to his side, in one hand. Next, he fires a round while holding the butt of the weapon tightly against his thigh. The third round is fired with the rifle butt pressed firmly against the demonstrator's groin. A fourth round is fired with the butt of the rifle placed firmly against the pit of the stomach. The final round will usually convince even the most skeptical, since it is fired with the rifle butt pressed firmly against the demonstrator's chin. As long as the demonstrator keeps the rifle butt pressed firmly against his body, he will have no difficulty in performing the demonstration. The soldiers should be instructed in the principle of pressing the butt firmly against the body to avoid the effects of recoil.

### Section II. MARKSMANSHIP FUNDAMENTALS

#### 3-3. The Integrated Act of Shooting

The integrated act of shooting is the application of the skills necessary to fire a rifle accurately. The components of the integrated act of shooting are aiming and steady hold.

##### a. Aiming.

(1) *Sight picture.* In aiming, the firer is concerned with correctly pointing his rifle so the projectile will hit the target when he fires. To do this, he must have the rear sight, the front sight post, and the target, or aiming point, in their proper relationship—known as sight picture. A correct sight picture is obtained when the sights are perfectly aligned and the aiming point (target) is in the correct relationship to the front sight post (fig 3-1). Sight picture includes two basic elements: sight alinement, and placement of the aiming point.

(a) *Sight alinement.* To obtain correct sight alinement, the sights are alined as shown in figure

3-2. Notice that the *top center of the front sight post* is exactly in the *center of the rear sight aperture*. If an imaginary horizontal line were drawn through the center of the rear sight aperture, the top of the front sight post would touch this line. If an imaginary vertical line were drawn through the center of the rear sight aperture, the line would bisect the front sight post. The firer insures that he has perfect sight alinement by concentrating his attention and focusing his eye on the front sight post through the indistinct or fuzzy appearing rear sight aperture. By doing this any errors in sight alinement can be easily detected and corrected.

(b) *Placement of the aiming point.* The aiming point (target on which the firer has alined his rifle sights) is correctly placed when it is centered on and appears to touch the top of the front sight post. If the aiming point is correctly positioned, an imaginary vertical line drawn

through the center of the front sight post will appear to cut it in half (fig 3-3).

(2) *Importance of sight alinement.*

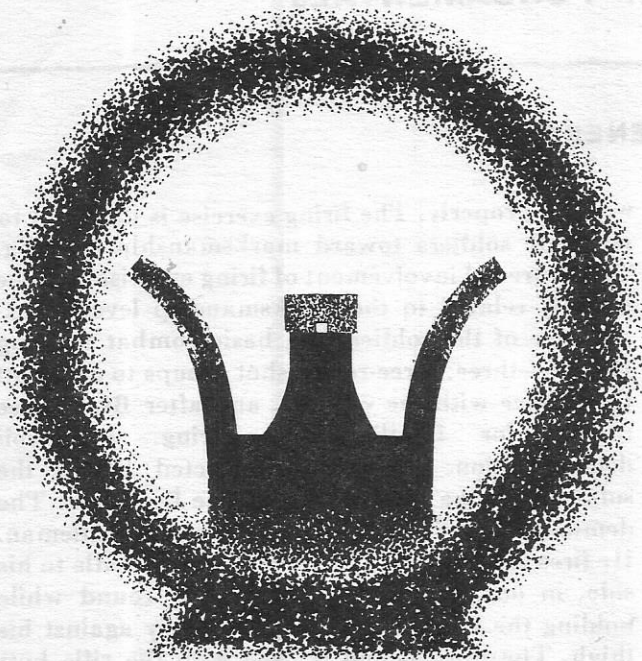


Figure 3-1. Correct sight picture.

reason for this lies in the firer's inability to focus his eye on two objects at different distances at the same time. If the firer focuses his eye on the aiming point, the rifle sights will appear hazy and indistinct; therefore, the problem is whether sight alinement or placement of the aiming point is of the greater importance to the firer. An error in either can cause the projectile to miss the aiming point (fig 3-4). Sight alinement is the relationship between the front and rear sight with respect to the firer's eye. An error in sight alinement will result in an error that increases proportionately as the range to the target increases. On the battlefield a slight error in placement of the aiming point can be as effective as a point-of-aim hit. For example, a man-size target is approximately 20 inches wide. Consequently, a rifleman could be several inches off his desired aiming point (center of visible mass) and still hit an enemy soldier. However, if the error was due to sight alinement, the bullet would miss a man-size target by as much as several feet, depending on the range. The correct relationship between the front sight post and the rear sight aperture (sight alinement) is much more important than the placement of the aiming point. Figure 3-5 depicts some common errors in aiming and the resulting impact of the projectile.

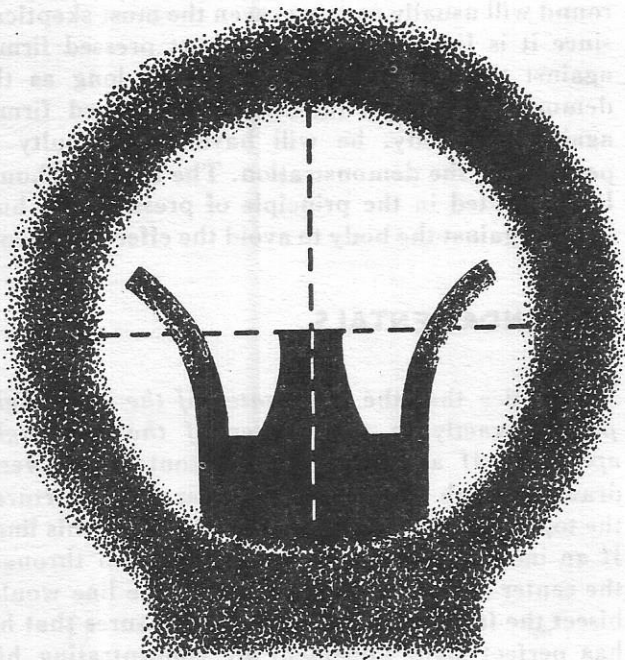


Figure 3-2. Correct sight alinement.

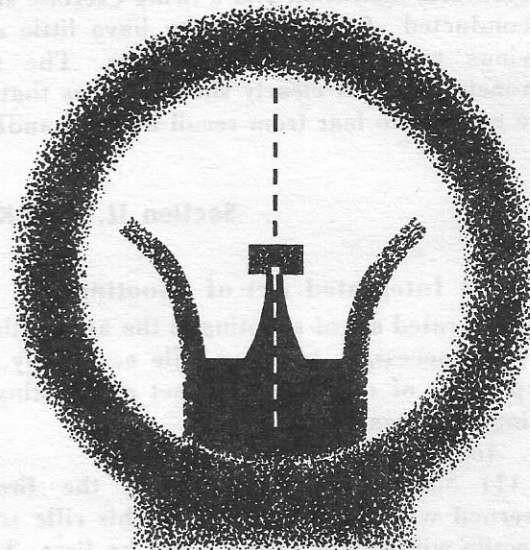


Figure 3-3. Correct placement of the aiming point.

(a) At some point in his marksmanship training, a soldier may experience difficulty in hitting the target because of errors in aiming. The trouble may be either incorrect sight alinement or improper placement of the aiming point. If the firer understands the principles of aiming, he will rarely commit both errors simultaneously. The

(b) Since it is so important to obtain and hold correct sight alinement when shooting, the rifleman must concentrate on it as the first and last steps in aiming. That is, he first concentrates on getting perfect sight alinement, then establishes the proper placement of the aiming point to complete

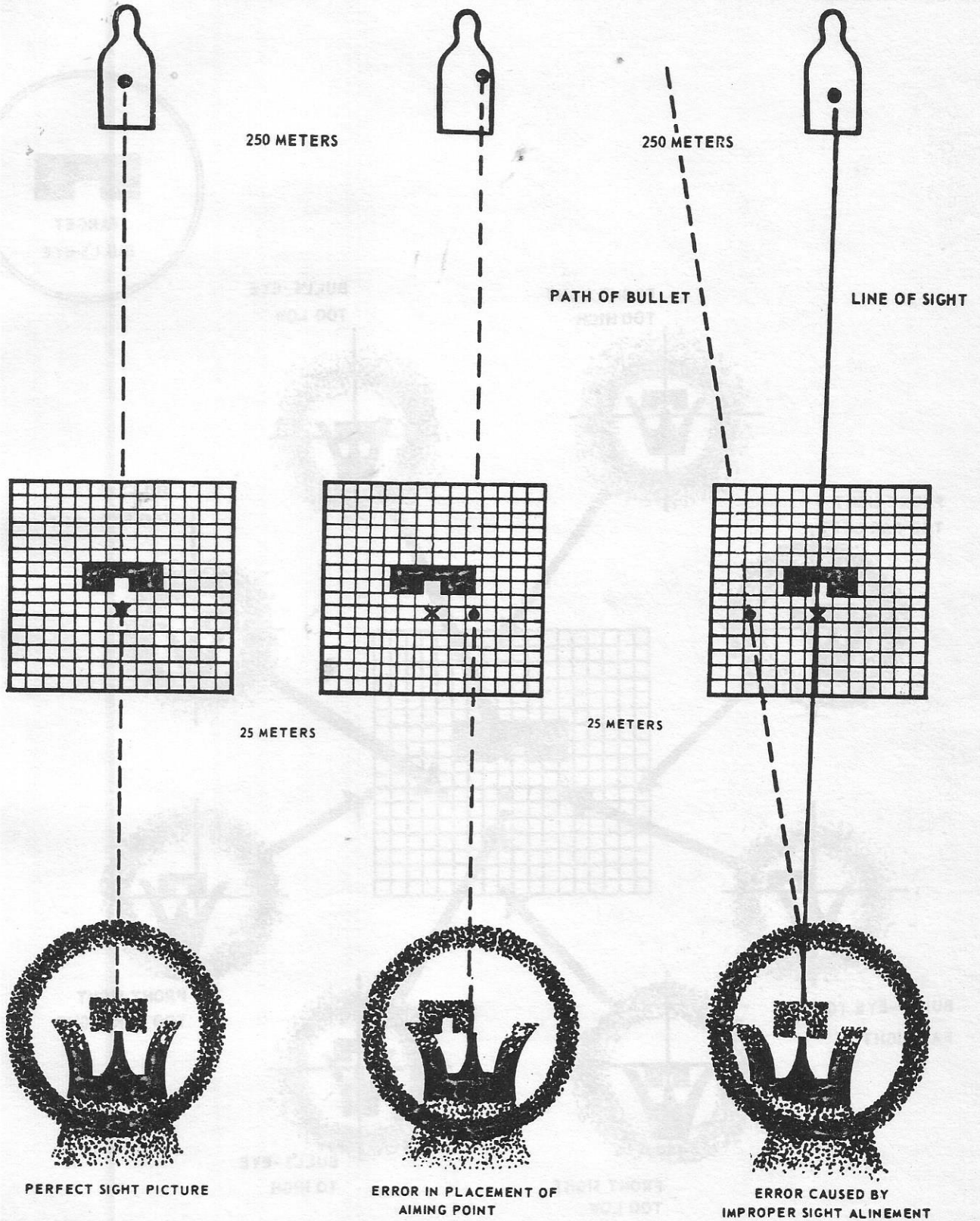


Figure 3-4. Importance of correct sight alignment.

the sight picture and finally, as he starts to squeeze the trigger, he again concentrates on maintaining correct sight alignment. At no time during the trigger squeeze should the firer divert his concentration from the front sight post and maintaining correct sight alignment. With practice, these

three steps will become an almost continuous, automatic process. No matter how quickly they are done, the three steps are always distinct for the simple reason that the human eye can focus at *only one distance* and on only one point at a time. Therefore, the firer focuses first on the front sight

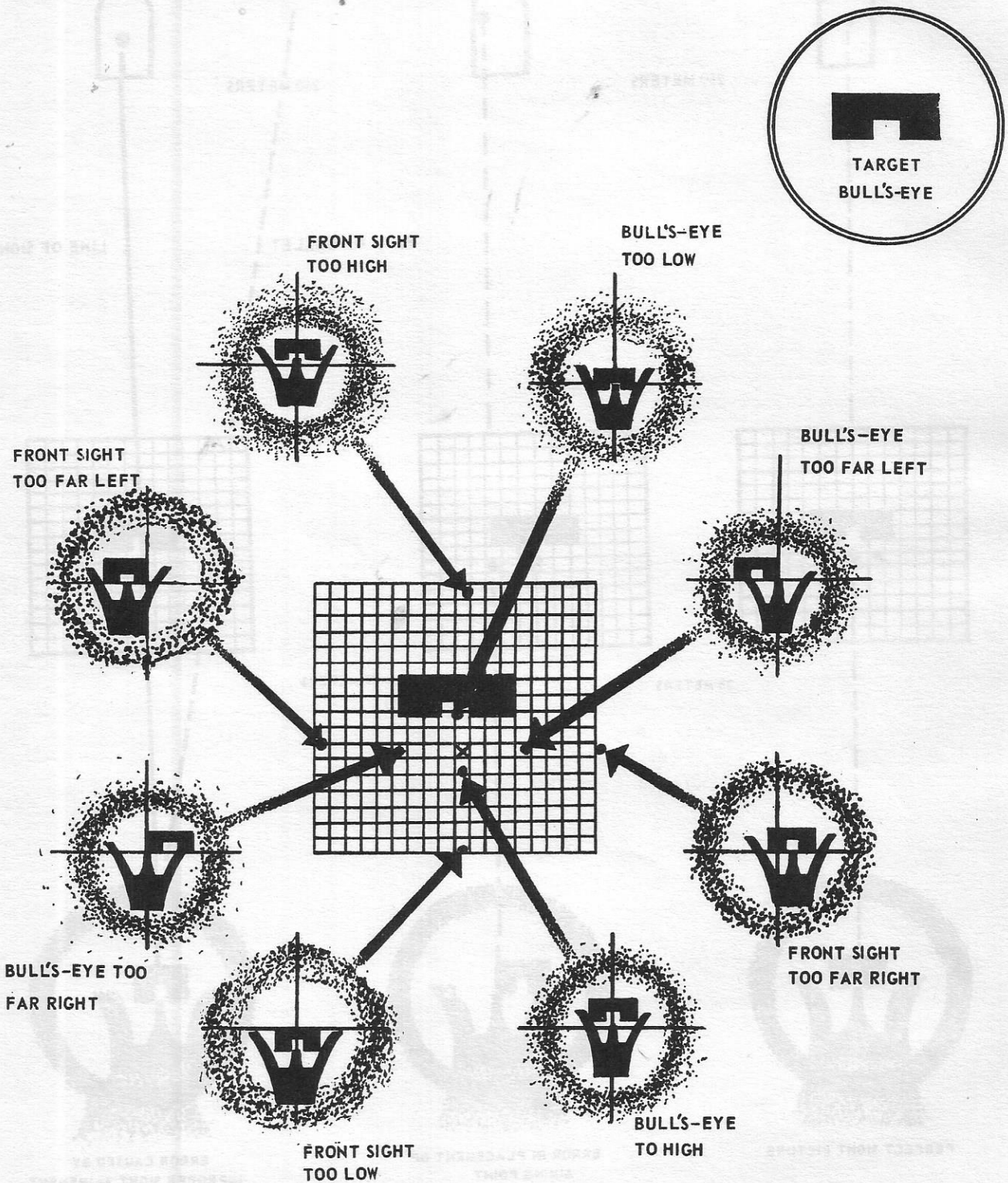


Figure 3-5. Errors in aiming with zeroed weapon on a 25-meter target.

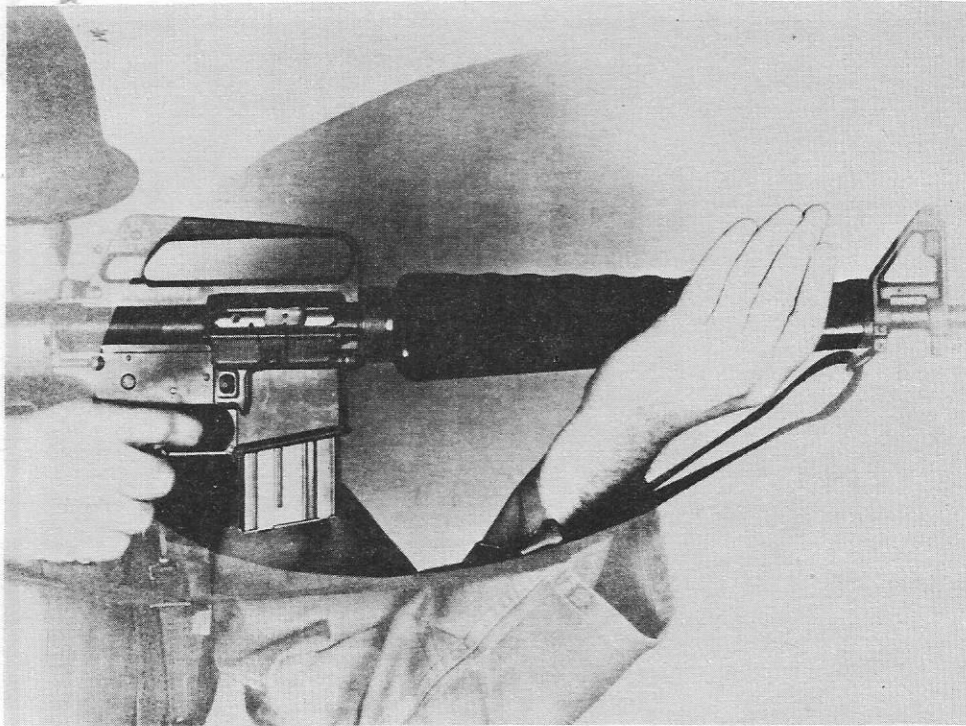


Figure 3-6. Grip of the left hand (semiautomatic fire).

post to obtain correct sight alinement, then focuses on the placement of the aiming point to complete the sight picture by shifting or adjusting the position of the weapon as necessary, and finally as he starts to squeeze the trigger he devotes total concentration back to the front sight post and maintaining sight alinement. At this point the firer should see a picture similar to the one shown in figure 3-1. Notice that the front sight post stands out clear and distinct while the aiming point and rear sight aperture are slightly fuzzy or blurred.

*b. Steady Hold Factors.* As the name implies, steady hold is the technique of holding the rifle as steady as possible while alining the sights and firing the weapon. There are *eight factors* which affect holding a rifle steady. These factors are the same for all firing positions; however, the precise manner in which they are applied differs slightly with the various positions. This discussion of the steady hold factors will apply to the *semiautomatic firing positions*.

*(1) Grip of the left hand (fig 3-6).* The rifle should rest in the "V" formed by the thumb and forefinger of the left hand, and lie across the heel of the hand. The grip on the handguard should be relaxed but, at the same time, a slight rearward pressure exerted. The handguards are gripped at a point which suits both the conformation of the firer's body and the location of the target. If the

target is high, the left hand is moved closer to the body thereby raising the muzzle of the rifle. Conversely, if the target is low, the left hand is moved forward causing a corresponding drop in the muzzle of the rifle. The left hand and wrist should be relaxed with the fingers curled naturally around the upper handguard, and the left elbow should be directly under the receiver of the weapon or as close to this position as the conformation of the firer's body will permit.

*(2) Rifle butt in the pocket of the shoulder (fig 3-7).* The firer must place the butt of the stock firmly into the pocket formed in his right shoulder. The proper placement of the butt of the stock lessens the effect of recoil, helps steady the weapon, and prevents the butt of the stock from riding up on the shoulder.

*(3) Grip of the right hand (fig 3-8).* The right hand grasps the pistol grip so that the pistol grip rests in the "V" formed by the thumb and forefinger. The forefinger (trigger finger) is placed on the trigger so that the finger does not touch the side of the receiver. The remaining fingers are wrapped firmly around the pistol grip. A firm rearward pressure must be exerted by the right hand to keep the butt of the stock in its proper position in the pocket of the shoulder, thus minimizing the effects of recoil which in turn allows the firer to rapidly re-aim and fire again.

\* Procedures described in this text apply to "right-handed" firers; "left-handed" firers must reverse these procedures.

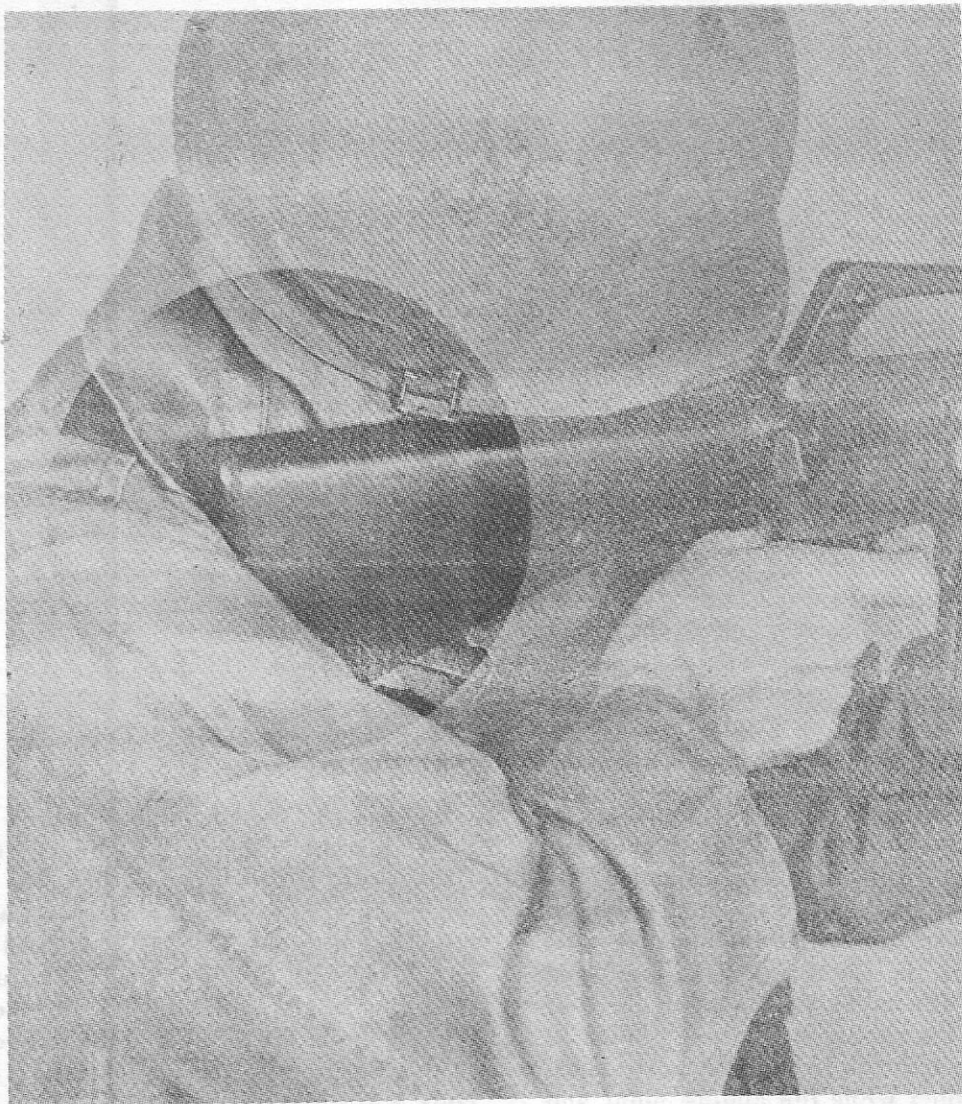


Figure 3-7. Rifle butt in the pocket of the shoulder.

(4) *Right elbow* (fig 3-9). The location of the right elbow is important because it provides balance to the firer's position. Correct positioning of the right elbow helps form a pocket in the shoulder for the butt of the stock. The exact location of the right elbow varies in each firing position and is described in the explanation of the firing positions (para 3-4).

(5) *Stock weld* (fig 3-10). The stock weld has two functions. First, the firer, by placing his cheek against the same place on the stock each time he fires, keeps his eye in the same relationship with the sights, thus helping to maintain a consistent sight picture and accuracy. Second, when the firer's cheek is placed firmly against the stock, the rifle and the firer's head recoil together. This reduces the amount of time required between shots to recover and aim again.

(6) *Breathing*. If the rifleman breathes while trying to aim and fire his weapon, the rise and fall

of his chest will cause a corresponding rise and fall in the muzzle of the rifle. If the firer employs *improper breathing techniques*, holding a sight picture long enough to shoot accurately will be difficult for him. Sight alinement is accomplished during breathing; but to complete the process of aiming, the firer must be able to hold his breath. To properly hold his breath, the firer inhales, then exhales normally and stops at the moment of natural respirator pause. A respiratory cycle lasts 4 to 5 seconds. Inhalation and exhalation require only about 2 seconds. Thus, between each respiratory cycle there is a pause of 2 to 3 seconds. This pause can be extended to 12 to 15 seconds without any special effort or unpleasant sensations. It is during an extended pause between breaths that the firer should fire the shot. The reason: during the respiratory pause, the breathing muscles are relaxed and the firer thus avoids strain upon the diaphragm. A firer should assume his position and

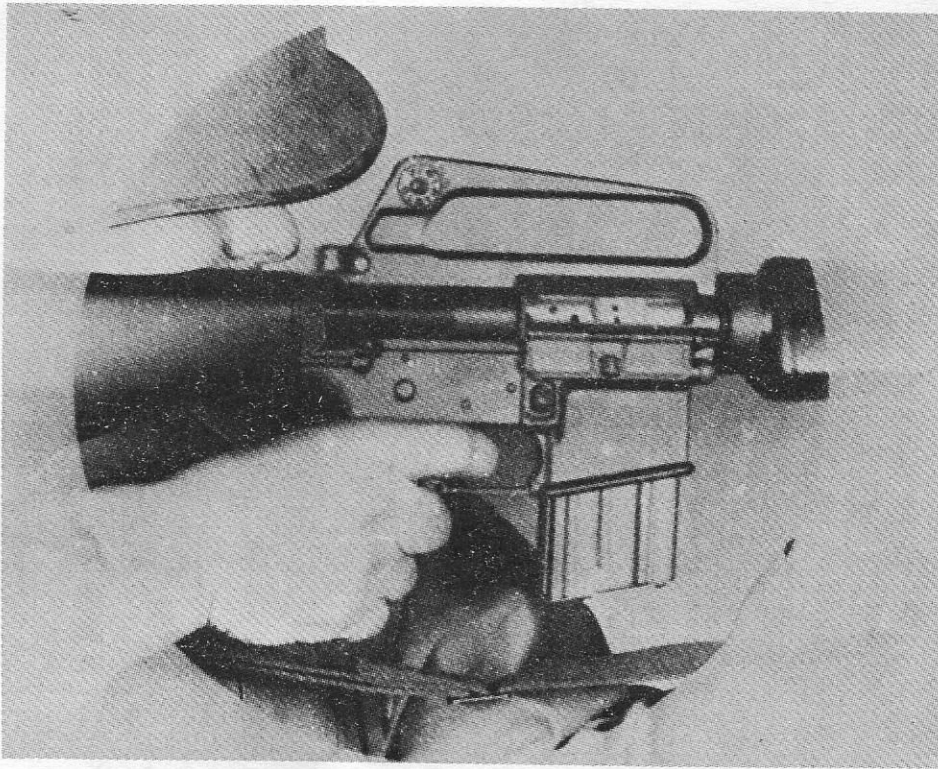


Figure 3-8. Grip of the right hand.



Figure 3-9. Right elbow.

breathe naturally until his *hold* begins to settle. Many firers then take a slightly deeper breath, exhale and pause, expecting to fire the shot during

the pause. If the *hold* does not settle sufficiently to allow the shot to be fired, the firer resumes normal breathing and repeats the process. The respiratory



Figure 3-10. Stock weld.

pause should never feel unnatural. If the pause is extended for too long a period, the body suffers from oxygen deficiency and sends out signals to resume breathing. These signals produce slight involuntary movements in the diaphragm and interfere with the firer's ability to concentrate. Generally speaking, 8 to 10 seconds is the maximum effective period for the respiratory pause.

(7) *Relaxation.* The soldier must learn to relax as much as possible in the various firing positions. Undue muscle strain or tension causes trembling which is transmitted to the rifle. If he finds that a particular position causes excessive strain, he should vary the position slightly until the cause of the strain has been eliminated. The firer must relax to determine a natural position. This is accomplished by relaxing when in position and checking to see if the sight picture is correct. If the sight picture is not correct, the firer should move his body until a relaxed position and the desired sight picture are achieved. Muscle tension should be eased or eliminated when firing from semiautomatic positions.

(8) *Trigger control.* Trigger control is the independent action of the forefinger on the trigger with a uniformly increasing pressure straight to the rear until the rifle fires. The forefinger should contact the trigger at some point between the fingertip and the second joint of the finger. Since the trigger must be brought straight to the rear, the finger must not touch the side of the receiver as this will cause pressure to be applied at a slight angle rather than straight to the rear (fig 3-11). Side pressure on the rifle, no matter how slight, will tend to pull the sights off the aiming point. Correctly applied pressure on the trigger causes no movement of the rifle barrel.

### 3-4. Firing Positions

a. The six *standard* semiautomatic firing positions taught in the rifle marksmanship program are the *prone*, *prone supported*, *kneeling*, *kneeling supported*, *standing*, and the *foxhole*. On the battlefield, a rifleman must assume the steadiest possible position which can provide observation of the target area and some cover and/or concealment. Considering the many variables of

terrain, vegetation, and tactical situations, there are innumerable possible positions that might be used. However, in most instances they will be variations of those listed above.

b. Some soldiers will have more difficulty in assuming a particular position than will others. In training, so long as the firer applies the fundamentals of maximum support for his rifle, relaxation, and trigger control, he is permitted to adjust a position to fit his body conformation as long as it is advantageous to his marksmanship proficiency. In combat firing from any of the positions, the firer should attempt to position himself in such a manner as to expose as little of his body to hostile fire as possible.

c. During initial training in fundamentals,

positions are taught as a step-by-step process. That is, the soldier is guided through a series of precise movements until he is in the correct position. The purpose of this is to insure that he correctly applies all of the steady hold factors. Through practice, the soldier will gradually become accustomed to the feel of the positions, and eventually he will know instinctively whether or not his position is correct. This is particularly important in combat since the soldier must be able to assume positions rapidly. There are any number of intermediate positions a combat rifleman might use before assuming his final firing position. Consequently, he must know instinctively whether or not his position is correct rather than follow a set sequence of movements to insure correctness.

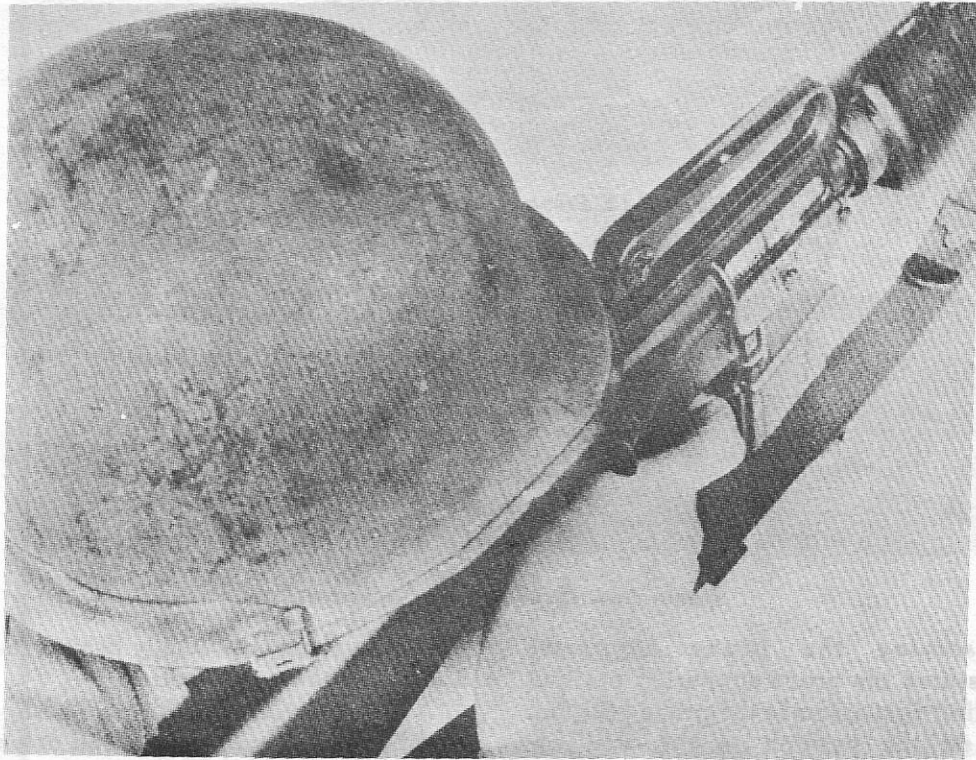


Figure 3-11. Position of the trigger finger.

d. Throughout position training the soldier should be continuously checked on the proper application of the eight steady hold factors, particularly trigger control. It is necessary to adjust each position until the rifle points naturally at the target. When the firer assumes a position he should close his eyes for a second, relax, and then open his eyes. With proper sight alinement, the position of the front sight indicates the natural point of aim. A slight shift of the position can bring the point of aim naturally to desired point.

e. The methods of assuming the positions and the conditions governing their use follow:

(1) *Prone positions.* The prone positions (figs 3-12 and 3-13) are relatively steady positions, which are easy to assume. The positions present a low silhouette and are easily adapted to the use of cover and support. However, their effectiveness as battlefield firing positions is frequently limited since vegetation and irregularities of terrain may limit the soldier's field of vision.

(a) *Assuming the prone position.* To assume the prone position, the firer stands facing his target, spreads his feet a comfortable distance apart, and drops to his knees. With his left hand positioned under the handguards and his right hand at the heel

of the stock, he places the butt of the rifle well out to his front on an imaginary line drawn between the target and his right knee. Using the butt of the rifle as a pivot, the firer rolls down on his left side, placing the left elbow as far under the rifle as the conformation of his body will allow. He places the rifle butt into the pocket formed in his right shoulder, grasps the pistol grip with the right hand, and lowers the right elbow to the ground. The rifle rests in the "V" formed by thumb and forefinger of the left hand. He adjusts the position of his right elbow until his shoulders are approximately level and exerts a firm rearward pressure with both

hands. To complete the position, the firer obtains a stock weld and relaxes. His spine is straight and his legs are spread a comfortable distance apart with the right knee brought slightly forward to reduce tension and add stability to the firing position (fig 3-12 and 3-13). The firer's body should be directly behind the weapon or as close as the conformation of the body will allow. Normally the angle formed by the firer's body and the weapon should be no greater than 30 degrees. This places enough of the firer's weight behind the rifle to absorb recoil without disturbing his position.

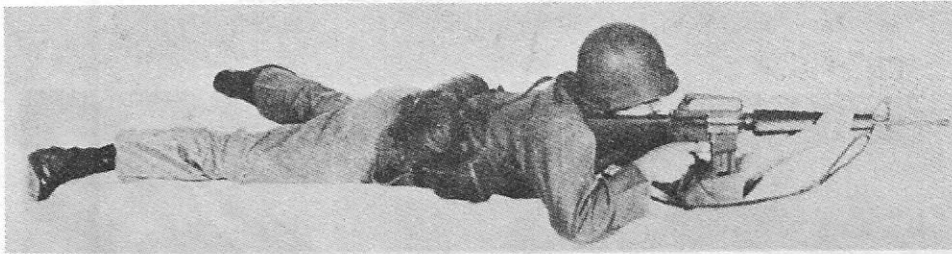


Figure 3-12. Prone position (unsupported).



Figure 3-13. Prone position (supported).

(b) *Assuming the prone supported position.* To assume the prone supported position (fig 3-13), the firer first assumes the prone position. He then adjusts the position to the available support, placing his left hand and forearm against the support. Whether his left elbow is directly under the rifle is of less importance in this position because the support, rather than the arm, sustains the weight of the rifle. No part of the rifle should be touching the support as this reduces the firer's control of his rifle and hinders rapid recovery between shots.

(c) *Alternate prone position.* The alternate prone position is an alternate to both of the above positions allowing the firer to cock his right leg (fig 3-14) to assume a comfortable position while maintaining the same relationship between his body and the axis of the rifle. This position relaxes the stomach muscles and allows a heavy firer to breathe easier. In addition, it shifts some of the

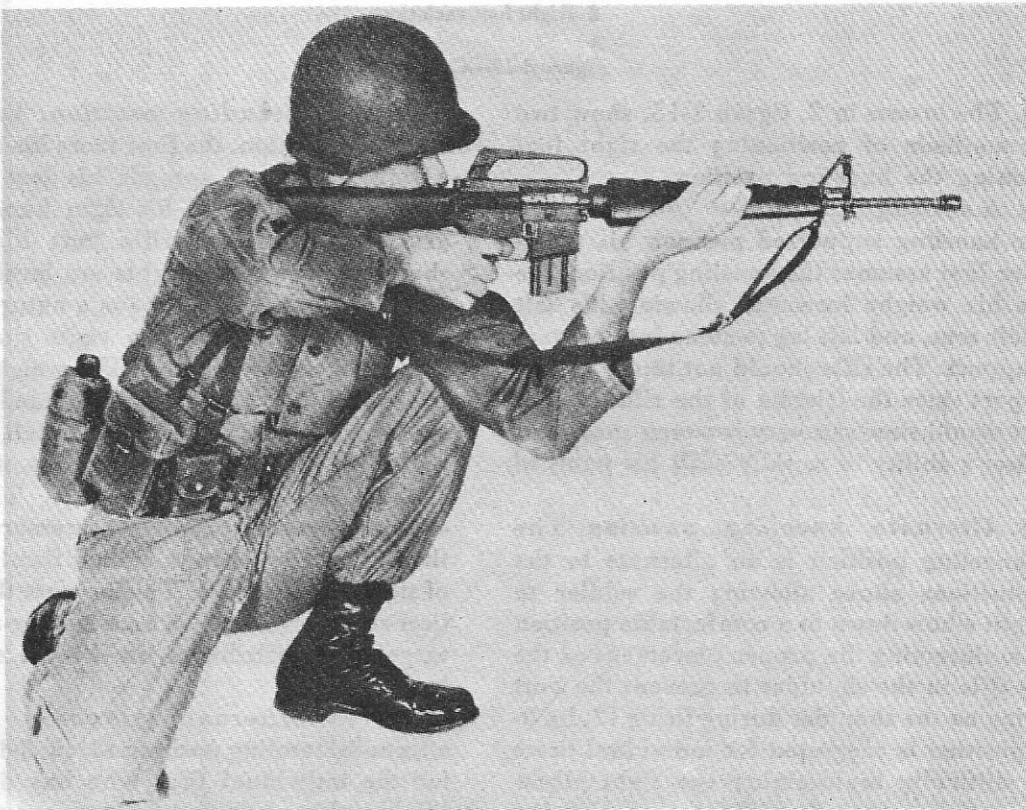
firer's weight more directly behind the weapon this absorbing the recoil better.

(2) *Kneeling positions.* These positions are suitable for use on level ground or on ground that slopes gently upward. They can be adjusted in height, and may be used when firing from behind trees, the corners of buildings, vehicles, and the like which give added support to kneeling positions.

(a) *Kneeling unsupported position.* To assume the kneeling unsupported position (1, fig 3-15), the firer faces his target and executes a right face. He places his left foot to his left front, pointing toward the target. He kneels on his right knee, sitting on his right heel as he does so. He places his left upper arm on the flat portion of his left knee. With his right hand, he places the rifle butt into the pocket formed in the right shoulder. His right elbow should be in a natural position that forms the pocket in the right shoulder. To complete the position, he shifts his weight forward and obtains a

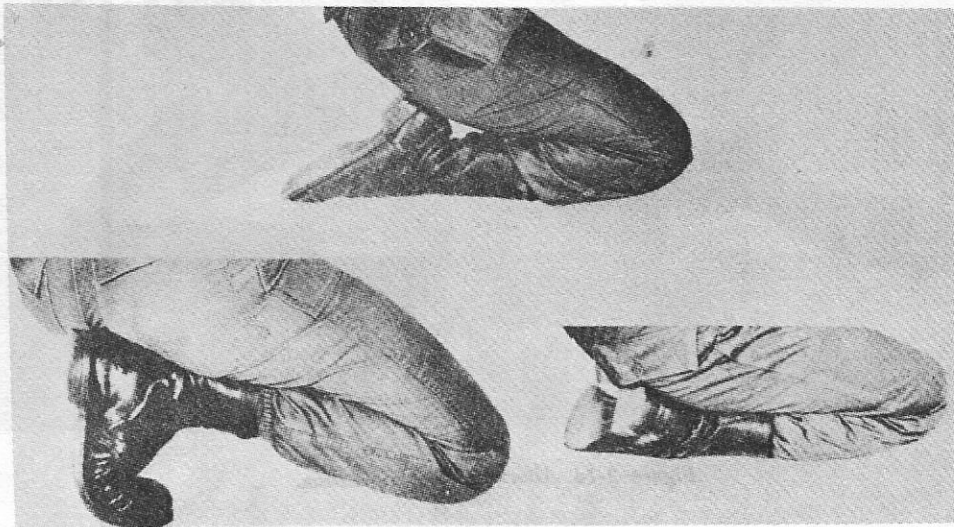


Figure 3-14. Alternate prone position.



1 Standard

Figure 3-15. Kneeling unsupported positions.



## 2 Right foot variations

Figure 3-15—Continued.

stock weld. The inserts in 2, figure 3-15, show two additional methods of positioning the right foot when assuming the kneeling position.

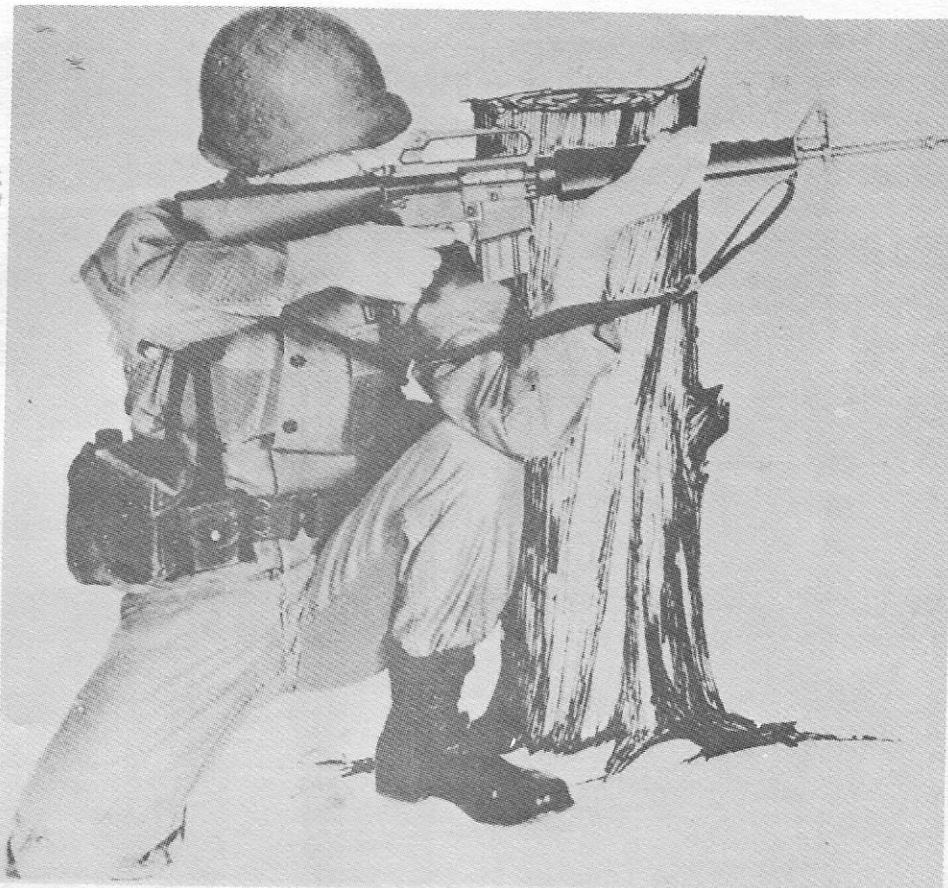
(b) *Kneeling supported position.* To assume the kneeling supported position (1, fig 3-16), the firer first assumes the kneeling position. He then shifts his weight forward, allowing his left shoulder, left arm, and left leg to come into contact with the support. The rifle should not touch or rest on the support since the friction of the rifle against the support would slow recovery between shots and limit the firer's ability to rapidly shift his point of aim.

(c) *Alternate kneeling position.* The alternate kneeling position is an alternate to the kneeling positions above allowing the soldier to drop his right elbow down to a comfortable position while still maintaining the proper placement of the butt of the rifle in the shoulder to prevent the butt from slipping on the shoulder during firing (2, fig 3-16). This position is suggested for individual firers who have difficulty maintaining the right elbow horizontal to the ground without experiencing muscle strain and excessive movement of the rifle.

(3) *Standing positions.* The standing position (1, fig 3-17) is used in the assault, to engage surprise targets, or when no other position can be used.

(a) *Standing position.* To assume the standing position, the firer faces his target, executes a right face, and spreads his feet a comfortable distance apart. With his right hand on the pistol grip, he places the rifle butt high against his shoulder so that the sights are level with his eyes. The right elbow should be in a natural position that forms the pocket of his right shoulder without causing stress or tension. The weight of the rifle is supported by the pocket formed in the right shoulder and the left hand. The left hand is placed under the weapon at a point that offers maximum support in steadying the rifle. The right hand should exert slight rearward pressure to insure that the butt of the weapon is held firmly in the pocket of the right shoulder. To complete the position, the firer shifts his feet until he is aiming naturally at the target and distributes his weight evenly on both legs.

(b) *Alternate standing position.* The alternate standing position (2, fig 3-17) is suggested for the individual firer who has difficulty maintaining the position above without experiencing muscle strain and excessive "wobble." To assume the alternate standing position, the firer faces the target, executes a right face, and places his feet a comfortable distance apart. The right hand and



1 Supported

*Figure 3-16. Kneeling positions.*



2 Alternate kneeling

*Figure 3-16—Continued.*



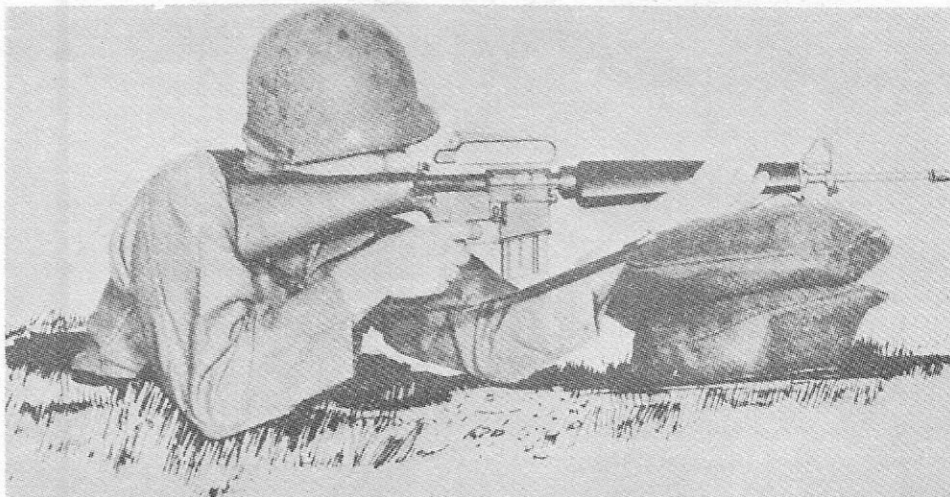
1 Standard

*Figure 3-17. Standing positions.*



2 Alternate standing

*Figure 3-17—Continued.*



*Figure 3-18. Foxhole position (without bipod).*

arm are placed the same as the position above except that the right elbow may be dropped below the horizontal to a comfortable position. The left elbow is held tight against the firer's left side and the left hand grasps the bottom of the magazine, palm up, with the base of the magazine resting in the "V" formed by the thumb and four fingers. The weight of the rifle should be supported by the firer's left forearm such that the elbow is resting on the firer's left side and the bone of the forearm is supporting the rifle weight rather than the muscles of the left arm. The firer must arch his back slightly and obtain a good stock weld. To complete the position, the firer shifts his feet until he is aiming naturally at the target, and distributes his weight evenly on both feet.

(4) *Foxhole position.* The foxhole position (fig 3-18) is used whenever such prepared positions are available. The soldier enters the foxhole, adds or removes dirt, sandbags, or other supports to best fit his height, and then assumes a comfortable firing position. He assumes this firing position by placing his feet as in the standing position and then leans forward until his chest is against the right forward corner of the foxhole. He extends his left arm and elbow over the side of the foxhole, allowing the parapet or sandbags to support the left forearm. The firer places the rifle butt into the pocket formed in the right shoulder and grasps the pistol grip with his right hand. He places the right elbow outside of the foxhole, blocking it against solid support. As in the other supported positions, the rifle (held in the left hand) must not rest on or touch the support.

### 3-5. Wobble Area

"Wobble" is the movement of the rifle that occurs during aiming. "Wobble area" is the extent of this movement in all directions. From the firer's viewpoint, the wobble area is indicated by the movement of the front sight post on and around the aiming point (target). This movement is a natural occurrence and can never be completely eliminated. The size of the wobble area depends upon the stability of the firing position and the firer's mental determination to control it.

a. *Firing Positions.* The more stable a firer's position, the smaller his wobble area will be. Therefore, if a firer has a choice of positions, he should select the most stable position that affords observation of the target area.

b. *Trigger Control.* Wobble is a relative matter; e.g., the prone position affords more stability than standing. Since the body, and thus the weapon, will tend to move back and forth and / or up and down, the inexperienced firer must be taught to maintain sight alignment while simultaneously applying pressure to the trigger during his wobble and not attempt to jerk the trigger when the sight picture

"looks perfect." The application of constant pressure on the trigger while maintaining sight alignment during the wobble will greatly reduce the tendency of the firer to jerk or snap the shot, which may result in a miss.

### 3-6. Followthrough

Followthrough is the continued application of the integrated act of shooting after each round has been fired. That is, the firer maintains his position and sight alignment, holds his breath, and continues to press the trigger to the rear even though the rifle has fired.

### 3-7. Calling the Shot

a. When a soldier "calls his shot" he is indicating the place on the target at which he thinks his rifle was aimed the instant it fired. In the case of 25-meter range targets, a shot is "called" by indicating the relationship between where the rifle was pointing at the instant of firing and the aiming point on the target. If his sights were aligned anywhere on the aiming point, the firer would call "Good." If over or under the aiming point, the call would be either "High" or "Low" and if to the sides, "Right" or "Left." As the firer becomes more experienced he can become even more precise in his "calls." For example, "Good, high-right" would mean the firer hit the upper right portion of the aiming point. "Low, slightly left" would mean the firer was well beneath the aiming point but just barely off its left edge. During 25-meter firing, the soldier must immediately record his call of the shot on his DA Form 3016 (firing data) (fig 3-19). DA Form 3016 is available through normal AG Publications supply channels.

b. Initially, soldiers may have difficulty in calling their shots. The primary reason for this is that many soldiers will not properly followthrough and thus have no idea of their sight picture at the instant of firing. Such firers must receive close supervision if they are to correct this fault. The ability to call his shot will greatly assist the firer in zeroing his weapon (para 4-8).

### 3-8. Shot Group Analysis

a. A perfect shot group is one in which all rounds hit the target at exactly the same point. However, factors such as wind, the ability of the firer, and the slight manufacturing differences between rounds make such a shot group virtually impossible. Shot groups are analyzed by studying the arrangement of the bullet holes in the target. The distance between these holes and the overall pattern made by the shot group are considered in determining the proficiency of the firer. The smaller the pattern, the better the shot group.

b. Most unsatisfactory shot groups are usually elongated, either vertically or horizontally, and are the direct result of incorrect sight pictures. That is,

### FIRING DATA

For use of this form, see FM 23-9; the proponent agency is US Army Training and Doctrine Command.

<p>1 CALL TARGET</p> <p>POSITION <i>Prone</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone</i></p>	<p>7 CALL TARGET</p> <p>POSITION <i>Prone supported</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone supported</i></p>	<p>13 CALL TARGET</p> <p>POSITION <i>Kneeling supported</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Kneeling supported</i></p>
<p>2 CALL TARGET</p> <p>POSITION <i>Prone</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone</i></p>	<p>8 CALL TARGET</p> <p>POSITION <i>Prone supported</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone supported</i></p>	<p>14 CALL TARGET</p> <p>POSITION <i>Kneeling supported</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Kneeling supported</i></p>
<p>3 CALL TARGET</p> <p>POSITION <i>Prone</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone</i></p>	<p>9 CALL TARGET</p> <p>POSITION <i>Prone supported</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone supported</i></p>	<p>15 CALL TARGET</p> <p>POSITION <i>Kneeling supported</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Kneeling supported</i></p>
<p>4 CALL TARGET</p> <p>POSITION <i>Prone</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone</i></p>	<p>10 CALL TARGET</p> <p>POSITION <i>Kneeling</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Kneeling</i></p>	<p>16 CALL TARGET</p> <p>POSITION <i>Standing</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Standing</i></p>
<p>5 CALL TARGET</p> <p>POSITION <i>Prone</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone</i></p>	<p>11 CALL TARGET</p> <p>POSITION <i>Kneeling</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Kneeling</i></p>	<p>17 CALL TARGET</p> <p>POSITION <i>Standing</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Standing</i></p>
<p>6 CALL TARGET</p> <p>POSITION <i>Prone</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Prone</i></p>	<p>12 CALL TARGET</p> <p>POSITION <i>Kneeling</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Kneeling</i></p>	<p>18 CALL TARGET</p> <p>POSITION <i>Standing</i></p>	<p>HIT TARGET</p> <p>POSITION <i>Standing</i></p>

DA FORM 3016  
1 JAN 74

REPLACES DA FORM 3016, 1 JUN 65, WHICH IS OBSOLETE.

Front

Figure 3-19. Firing data card (M16A1 rifle) (DA Form 3016).

19	CALL TARGET 	HIT TARGET 	24	CALL TARGET 	HIT TARGET 	29	CALL TARGET 	HIT TARGET 
POSITION <i>foxhole</i>		POSITION <i>prone supported</i>		POSITION <i>standing</i>				
20	CALL TARGET 	HIT TARGET 	25	CALL TARGET 	HIT TARGET 	30	CALL TARGET 	HIT TARGET 
POSITION <i>foxhole</i>		POSITION <i>prone supported</i>		POSITION <i>standing</i>				
21	CALL TARGET 	HIT TARGET 	26	CALL TARGET 	HIT TARGET 	31	CALL TARGET 	HIT TARGET 
POSITION <i>foxhole</i>		POSITION <i>prone supported</i>		POSITION <i>kneeling</i>				
22	CALL TARGET 	HIT TARGET 	27	CALL TARGET 	HIT TARGET 	BATTLESIGHT ZEROING 1ST GROUP 2D GROUP 		
POSITION <i>prone supported</i>		POSITION <i>prone supported</i>						
23	CALL TARGET 	HIT TARGET 	28	CALL TARGET 	HIT TARGET 	3D GROUP 	4TH GROUP 	
POSITION <i>Prone supported</i>		POSITION <i>standing</i>						
NAME <u>John Doe</u>				SSAN <u>600-48-9342</u>				
UNIT <u>C-1-3</u>				RIFLE NO. <u>6879105</u>				

Back

Figure 3-19—Continued.

at the instant of firing the soldier has an error in sight alinement or in the placement of the aiming point, or he may have had a combination of the two errors. However, the fact that an obviously in-

correct sight picture occurred at the instant of firing does not necessarily mean that the only mistake was aiming. For example, incorrect application of pressure on the trigger will almost always pull the

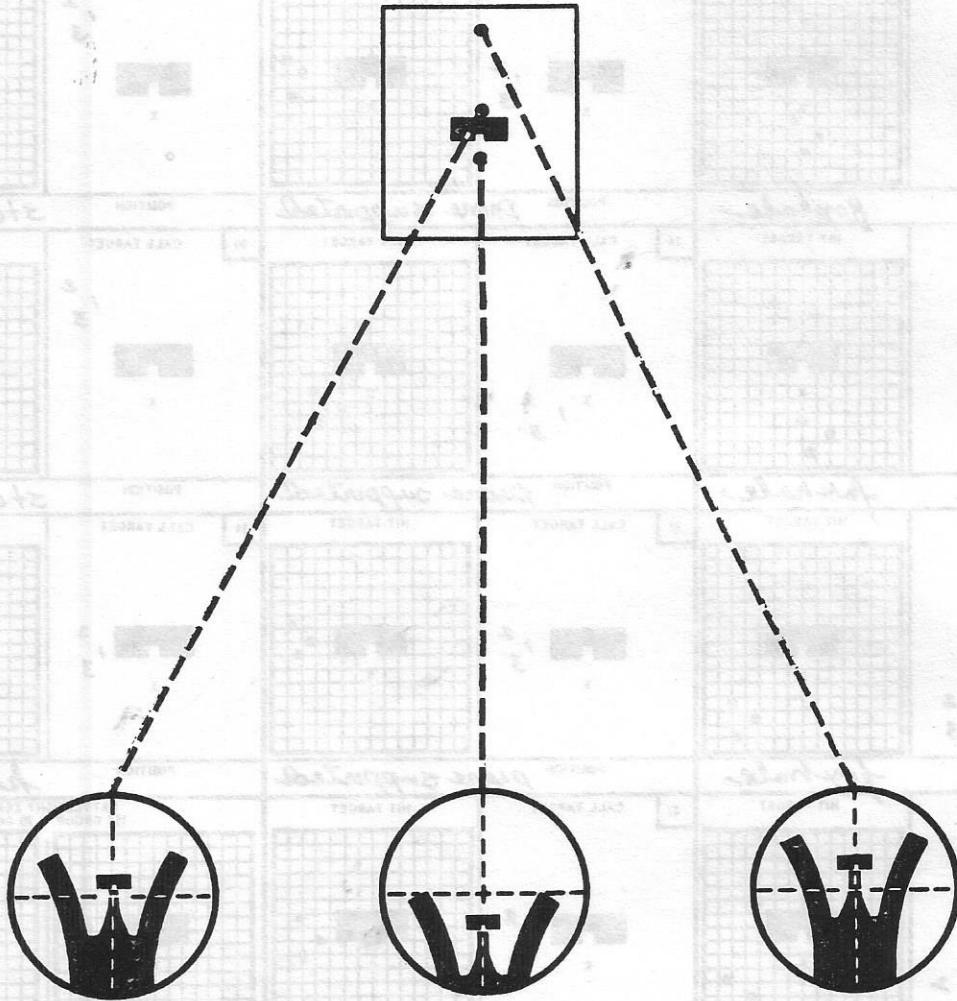


Figure 3-20. Long vertical shot group.

sights out of alignment and/or off the aiming point. Improper breathing or undue muscular strain can also cause aiming errors, although these are less common mistakes than improper trigger control.

*Note.* Instructors must keep in mind that any of several improperly applied fundamentals can disarrange the sight picture and cause unsatisfactory shot groups. Consequently, they should carefully observe a firer's application of all fundamentals to insure that the actual mistake is identified.

c. Assuming that all fundamentals except aiming have been eliminated as the cause of a firer's unsatisfactory shot groups, the instructor can then use the size and configuration of the shot group patterns to determine the specific type of aiming error. The relationship of these patterns to the type of aiming errors is as follows:

(1) Long vertical shot groups (fig 3-20) are

the result of improper vertical sight alignment. That is, on successive shots the firer has positioned the top of the front sight post above and below center in the rear sight aperture.

(2) Long horizontal shot groups (fig 3-21) are the result of improper horizontal sight alignment. That is, on successive shots the firer has positioned the front sight post too far right or left of center in the rear sight aperture.

(3) A small or "tight" shot group indicates proper application of the eight steady hold factors and correct sight picture (fig. 3-22).

*Note.* See figure 3-5 for additional errors and the resulting impact of the projectile on the target.

d. During fundamentals training, each soldier should receive a rifle shot group analysis card, GTA 21-1-4 (fig 3-23), to assist him in determining and

correcting his own mistakes. This card depicts several different types of unsatisfactory shot

groups, the probable errors that caused them, and the necessary corrective action.

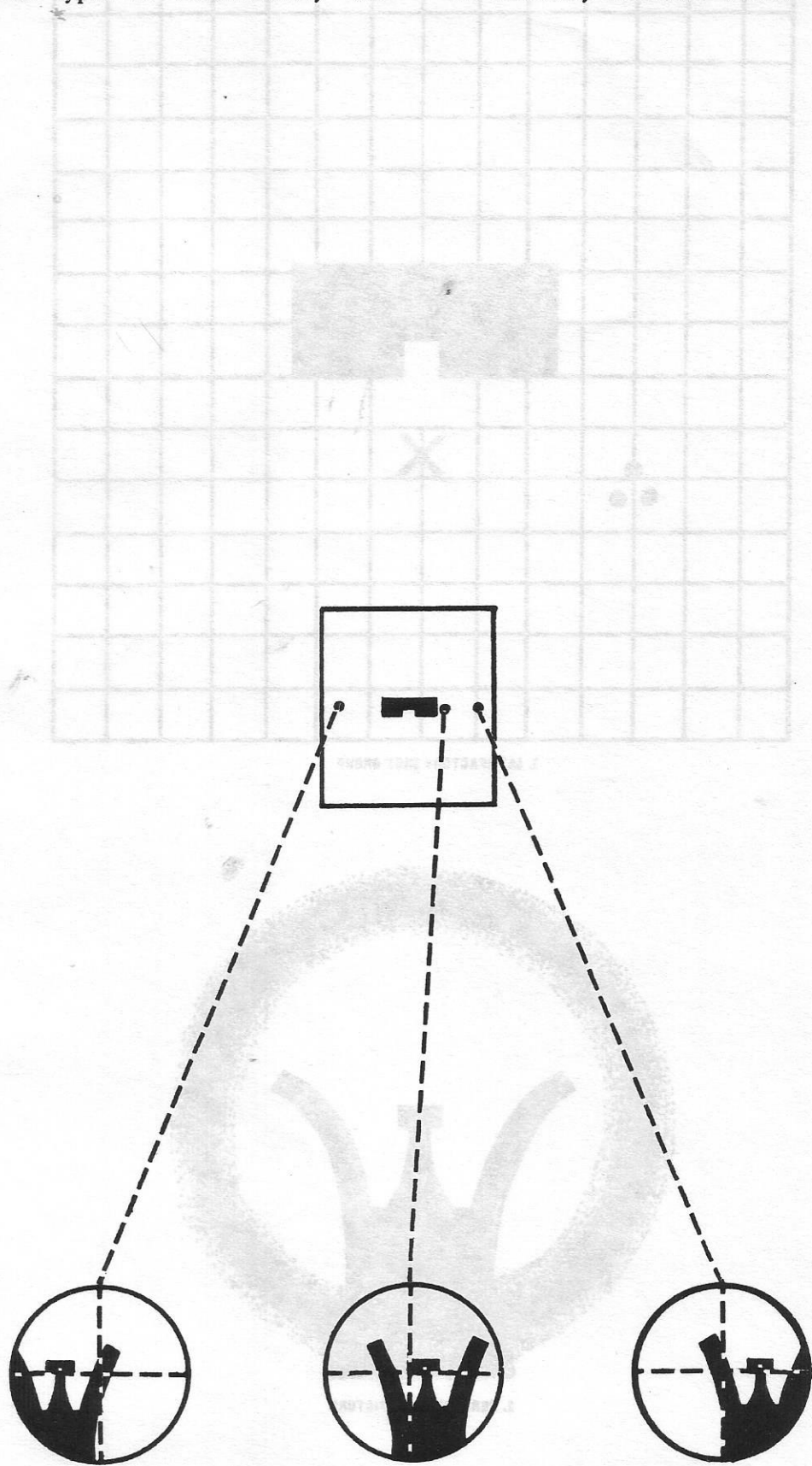
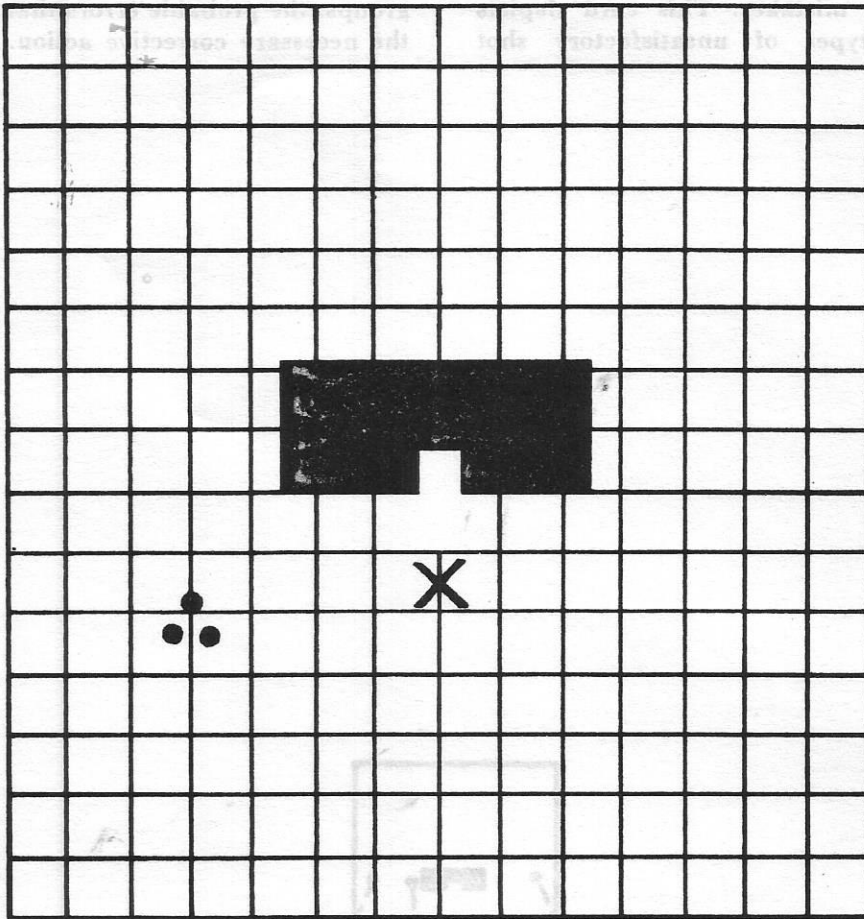
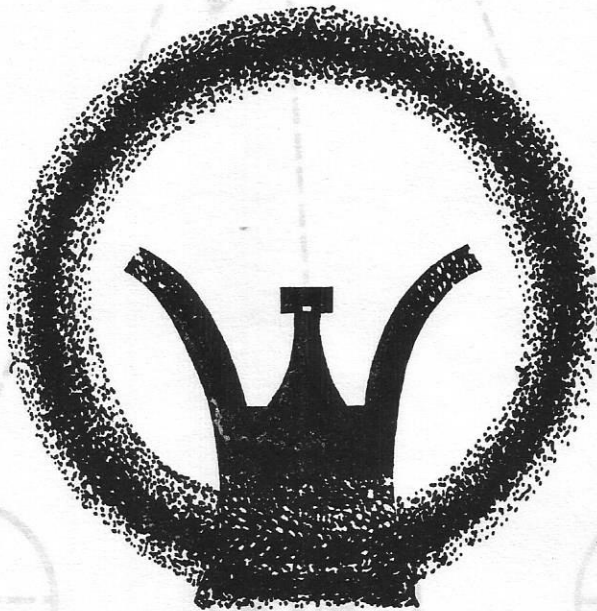


Figure 3-21. Long horizontal shot group.



1. SATISFACTORY SHOT GROUP



2. PERFECT SIGHT PICTURE

Figure 3-22. Correct sight picture—satisfactory shot group (rifle not zeroed).

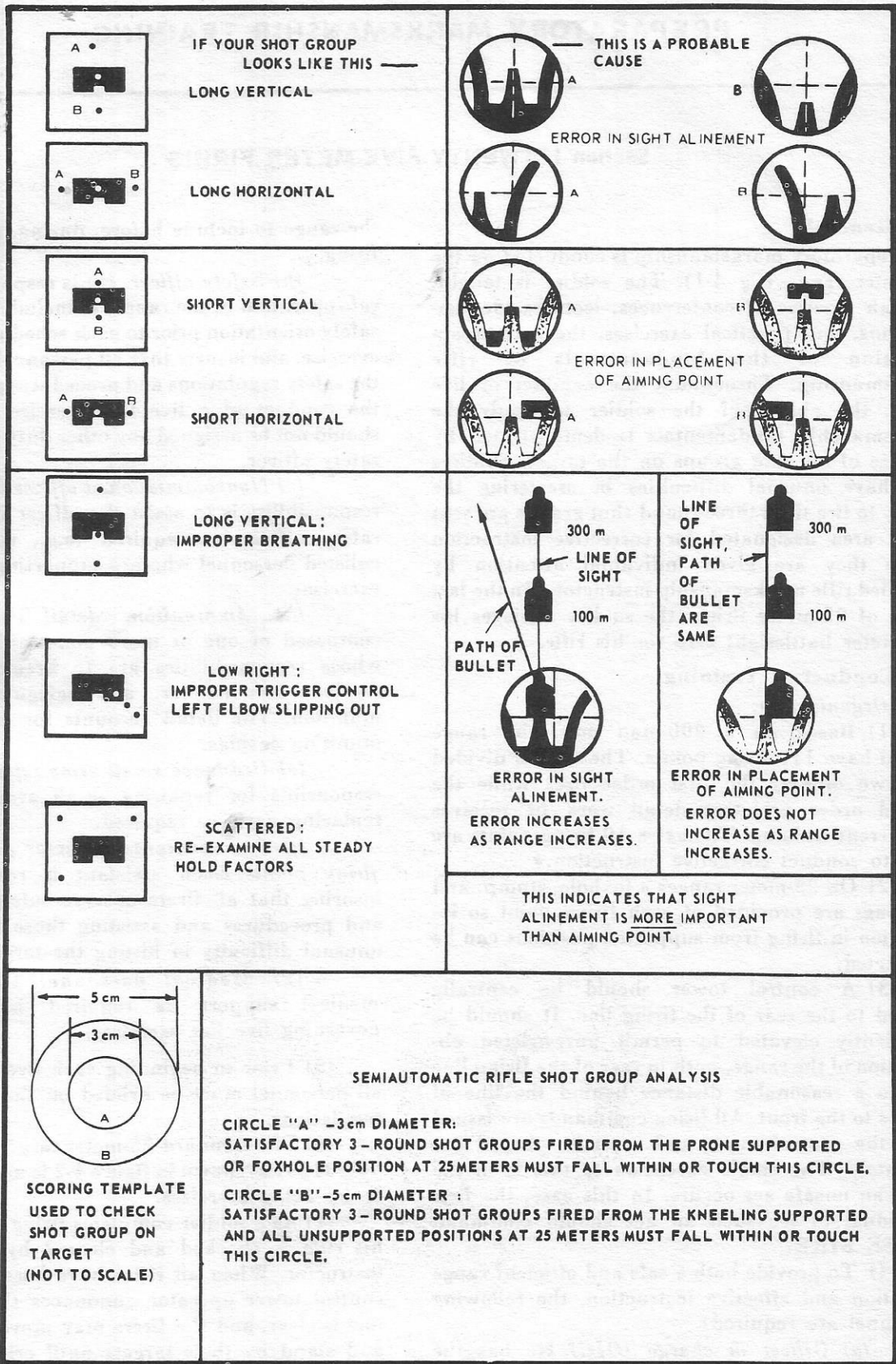


Figure 3-23. Rifle shot group analysis card (GTA 21-1-4):  
Semiautomatic fire with M16A1 rifle.

## CHAPTER 4

# PREPARATORY MARKSMANSHIP TRAINING

### Section I. TWENTY-FIVE-METER FIRING

#### 4-1. General

All preparatory marksmanship is conducted on the 25-meter range (fig 4-1). The soldier is taught, through a series of conferences, lectures, demonstrations, and practical exercises, the correct application of the fundamentals of rifle marksmanship. Throughout the conduct of live firing, the ability of the soldier to apply the marksmanship fundamentals is demonstrated by the size of his shot groups on the target. Soldiers who have unusual difficulties in mastering the ability to fire tight three-round shot groups are sent to an area designated for corrective instruction where they are given individual attention by qualified rifle marksmanship instructors. In the last phase of 25-meter firing, the soldier achieves his 250-meter battlesight zero for his rifle.

#### 4-2. Conduct of Training

##### a. Organization.

(1) Based on a 200-man unit, the range should have 110 firing points. The unit is divided into two orders: the first order fires while the second order performs detail work or receives concurrent training. The extra 10 firing points are used to conduct corrective instruction.\*

(2) On 25-meter ranges a foxhole, stump, and sandbags are provided at each firing point so instruction in firing from supported positions can be conducted.

(3) A control tower should be centrally located to the rear of the firing line. It should be sufficiently elevated to permit unrestricted observation of the range, both in rear of the firing line and to a reasonable distance behind the line of targets to the front. All firing commands are issued from the control tower and must be obeyed immediately. The single exception to this is in the event an unsafe act occurs. In this case, the first individual to see such an act should command **CEASE FIRE**.

(4) To provide both a safe and efficient range operation and effective instruction, the following personnel are required:

(a) *Officer in charge (OIC)*. He has the ultimate responsibility for the overall operation of

the range to include before, during, and after live firing.

(b) *Safety officer*. He is responsible for the safe operation of the range, to include conducting a safety orientation prior to each scheduled live firing exercise, and insures that all personnel comply with the safety regulations and procedures prescribed for the conduct of a live fire exercise. This officer should not be assigned any other duty except that of safety officer.

(c) *Noncommissioned officer in charge*. His responsibility is to assist the officer in charge and safety officer as required (e.g., supervision of enlisted personnel who are supporting the live fire exercise).

(d) *Ammunition detail*. This detail is composed of one or more ammunition handlers, whose responsibilities are to breakdown, issue, receive, account for, and safeguard live ammunition. The detail accounts for expended ammunition casings.

(e) *Ordnance small arms repairman*. He is responsible for repairing small arms to include replacing parts as required.

(f) *One assistant instructor per five to ten firing points*. Each assistant is responsible for insuring that all firers observe safety regulations and procedures and assisting those firers having unusual difficulty in hitting the target.

(g) *Medical personnel*. They provide medical support as required by regulations governing live fire exercises.

(5) Prior to beginning each live fire exercise, all personnel must be briefed on the range safety regulations.

(6) The standard 25-meter target (FSN 6920-906-0169) as shown in figure 4-2 is used during 25-meter firing exercises.

(7) As a soldier completes firing a shot group, his rifle is checked and cleared by an assistant instructor. When all rifles have been cleared, the control-tower operator announces that the firing line is clear, and the firers may move down range and stand by their targets until critiqued by an assistant instructor.

\* The organization described here refers to Army Training Center facilities. Army unit training facilities may not accommodate 200-man groups at one time; therefore, appropriate multiples may be used.

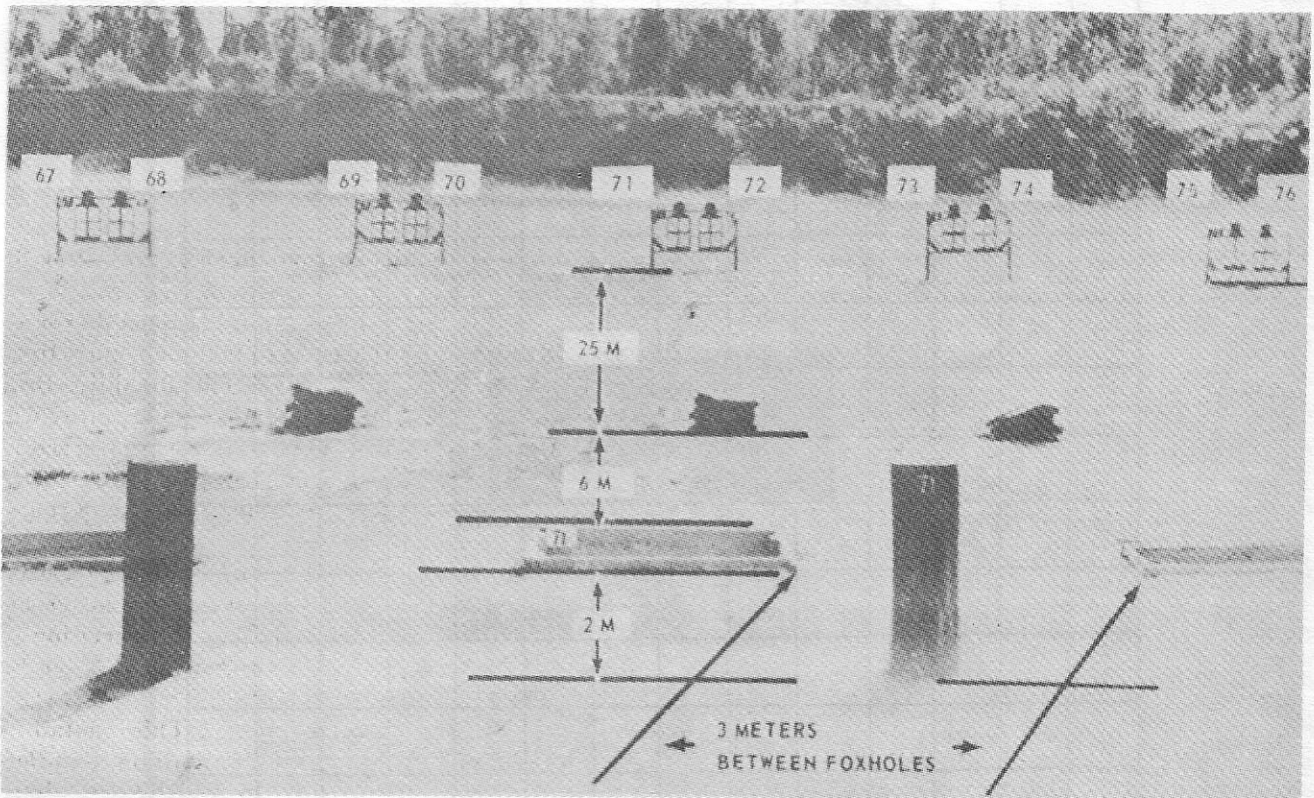


Figure 4-1. The 25-meter range.

*b. Exercises.*

(1) *Firing data card* (fig 3-19).

(a) The firing data card is used during marksmanship fundamentals training. This card provides a record of the "calls," "hits," and positions used in firing.

(b) Properly used, the firing data card is a valuable aid to the firer and the instructor, since it provides an excellent means of analyzing each soldier's progress and marksmanship proficiency.

(c) The "call" is plotted on the call target of the firing data card immediately after each shot is fired. "Calls" are plotted in numerical order (i.e., 1, 2, 3) until all rounds of the shot group exercise have been fired. After the firing line has been cleared, firers will go forward, check their targets, and record the exact location of each hit as a penciled dot on the hit target.

(2) *Progress booklet.* Each soldier should be required to maintain a locally prepared progress booklet throughout his initial marksmanship training during BCT. With this booklet instructors can review a soldier's performance and accurately identify those areas that are causing difficulty.

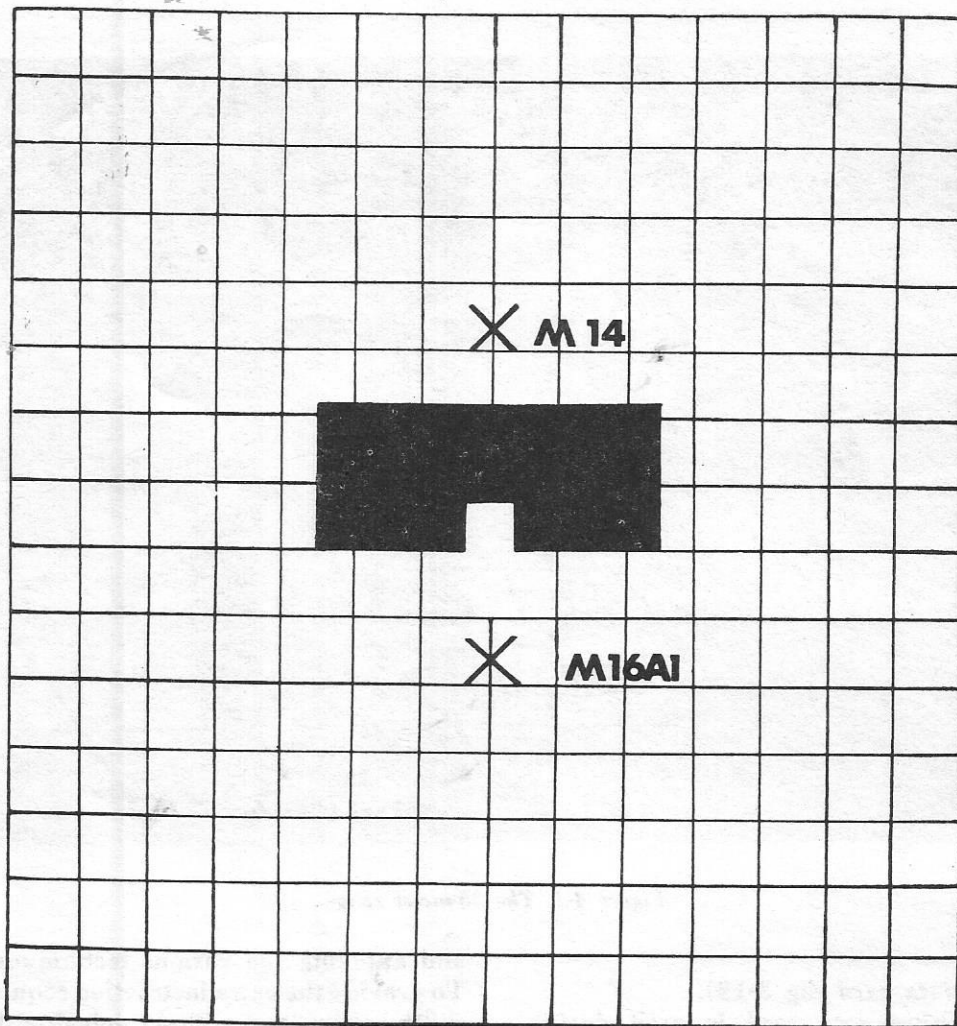
*c. Corrective Instruction.*

(1) *Purpose.* During some phases of marksmanship fundamentals training, a few soldiers will have more difficulty understanding

and applying the various techniques than others. To provide the extra instruction required by the less skillful firers, and without delaying the progress of the entire unit, a concurrent corrective training area should be used. If a separate range is not available for this concurrent training, a number of firing points should be set aside on the 25-meter range for this purpose.

(2) *Conduct.*

(a) In practically every instance, the size and configuration of shot groups will identify those firers who have difficulty. Once they have been identified, assistant instructors should be assigned to provide individual corrective instruction. Only the best qualified instructors should be designated to conduct corrective instruction. They must be thoroughly knowledgeable in marksmanship fundamentals, alert to common shooting errors, and have a thorough understanding of how to quickly correct these errors. In some cases, the instructor can determine the cause of the firer's deficiencies simply by discussing the problem with him and examining his shot groups and other data contained in the progress booklet. However, in the majority of cases, the instructor must closely observe the soldier firing several rounds before the cause of his errors can be determined. The reason for this is that the instructor might hastily conclude



NOTE: TWO CLICKS OF ELEVATION OR WINDAGE WILL MOVE THE STRIKE OF THE BULLET ONE SQUARE ON THIS TARGET.

Figure 4-2. The 25-meter target (FSN 6920-906-0169).

that the firer's poor shot groups are the result of an incorrect sight picture when, in fact, the error in sight picture (like the poor shot groups) is a result of improper trigger control.

(b) Time is a definite factor in corrective instruction. While a firer is receiving corrective instruction, he will, of necessity, miss the regularly scheduled training of his unit. In view of this, the instructor should provide intensified training on those subjects the firer has missed before the soldier rejoins his unit.

(c) If the instructor determines improper trigger control to be the source of the firer's difficulty, he may be able to correct this simply by telling the firer his specific error and reemphasizing the proper application of trigger control.

(d) When necessary, the ball and dummy exercise can be used during corrective instruction. Initially some types of exercises, such as positions

and aiming, are better conducted without live ammunition. Instructors must closely supervise the corrective firing exercises to insure that the soldier has overcome his difficulties before he is returned to his regular class. The ball and dummy exercise is conducted as follows:

1. The assistant instructor secures dummy rounds and live rounds. The firer is directed to look away while the instructor loads a dummy or a live round into the magazine.

2. The instructor allows the bolt to go forward.

3. The firer is told to aim, apply the steady hold factors correctly, and fire.

4. The instructor observes the firer's eyes and face for evidence of flinching, the trigger finger for improper trigger control, and the back and chest for improper breathing techniques. When a soldier

attempts to fire a dummy round, any of these errors will become apparent to an observant instructor.

(c) There are two exercises which may be used to effectively teach aiming. The first exercise is conducted using an aiming bar, and the second a rifle rest, target box, and disk. The soldiers should be paired into groups of two, firer and assistant, for the following aiming exercises.

1. *First aiming exercise (aiming bar).* The aiming bar (fig 4-3) is designed to teach sight alinement and placement of the aiming point. Continuous visual checks are made by the assistant instructors to insure that firers apply the correct principles of sight alinement and placement of the aiming point. This exercise is conducted as follows:

(a) The firer moves the rear sight on the aiming bar until he considers the sight alinement to be correct. The assistant checks the result. If the alinement is incorrect, the assistant determines the error and makes the necessary corrections. If the alinement is correct, the assistant moves the sight to cause a misalinement and returns the aiming bar to the firer. The firer must then correct the misalinement. Assistant instructors should continuously check the performance of assistants and firers. This exercise is continued until the principles of correct sight alinement are clearly understood.

(b) In the second step of the exercise a

small metal target is placed on the aiming bar, and the soldier is required to complete the sight picture by placing the aiming point in correct relation to the front and the rear sight alinement. As in the first part of the exercise, the firer's completed work is checked by the assistant, and both individuals are continuously checked by the assistant instructors. The assistant again corrects the errors of the firer. If the sight picture is correct, the assistant moves the target and sight to cause improper sight alinement and placement of the aiming point. The firer must then repeat the exercise.

2. *Second aiming exercise (target box).* Those soldiers who participate in this aiming exercise are paired into teams. Each team consists of a firer and an assistant. To conduct this exercise a rifle, a rifle rest, a target box, and a target disk must be provided each team. A piece of blank paper is attached to the target box end and is used to record sight pictures. A black miniature rectangle, identical in shape to that on a 25-meter target, is painted on the disk. A small hole is made in the disk at the center base of the cutaway portion of the black rectangle. This small hole allows the assistant to insert the point of a pencil and mark the firer's point of aim (fig 4-4). The exercise is conducted in the following manner:

(a) The rifle is braced in the rifle rest.\*

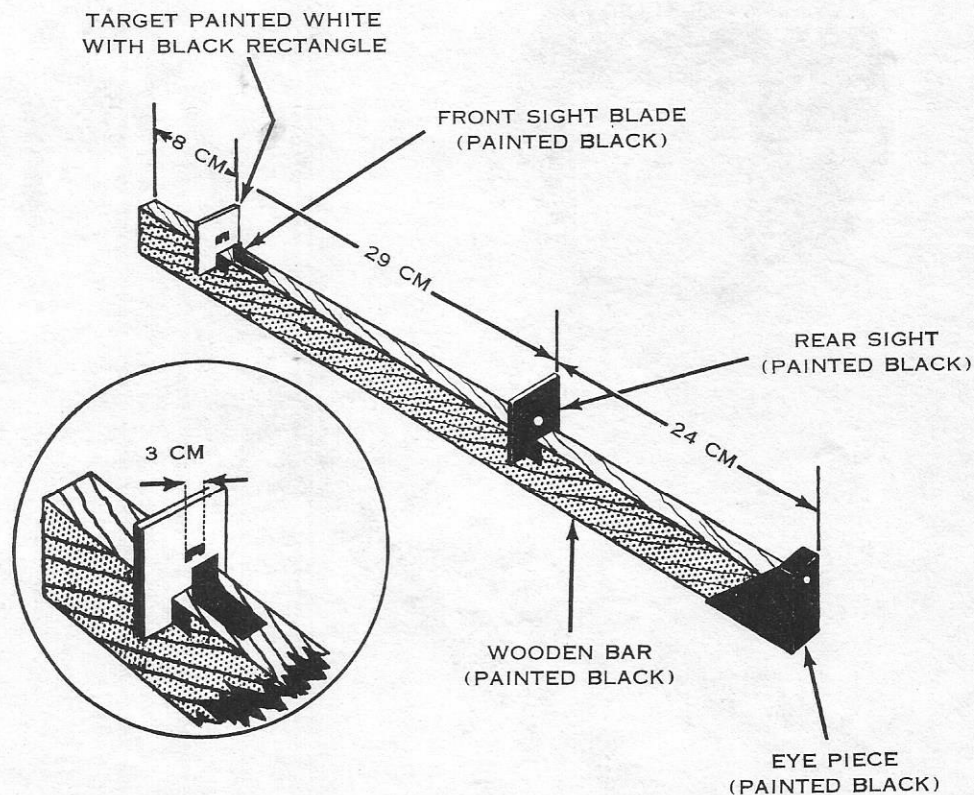


Figure 4-3. Aiming bar.

\* M14 rifle rests may be used by modifying them to accommodate the M16A1 rifle.

The firer assumes a position beside the rifle so that his eye is as close as possible to the rear sight without disturbing the lay of the weapon. He places both elbows on the ground and rests his chin in the palm of his left hand. The assistant sits on the target box located 15 meters from the firer. The assistant holds the target disk against the paper on the target box. The firer alines the weapon so it is pointed at the approximate center of the blank piece of paper. He then signals the assistant with his right hand to move the disk in the desired direction until a correct sight picture is obtained. He then clenches his fist and gives the command MARK. The assistant records the sight picture by marking the paper with his pencil through the hole in the disk. This procedure is repeated until three sight pictures, called a shot group, have been recorded. The firer must keep his eye in the same position with relation to the rear sight aperture each time he obtains a sight picture.

**Caution:** To obtain valid results, there must be no movement of the rifle, the rifle rest, or the target box until all three sight pictures have been recorded. If any of these items are ac-

cidental moved before three sight pictures have been recorded, the firer must repeat the entire exercise.

(b) An assistant instructor critiques the shot group, using the shot group analysis card (fig 3-23) as a guide. A satisfactory shot group can be covered by the unsharpened end of a pencil.

*d. Conduct of Firing.*

(1) *Clean and blackened sights.* A firer can experience difficulty in obtaining a proper sight picture because of shiny or dirty sights. A shiny front or rear sight will cause glare and partially blind the firer. Dirt or shine can change the distinctive sight outline and cause errors in alinement. Thus, it is important in training and in combat to continually inspect rifle sights, cleaning and blackening them as necessary.

*Note.* Extreme caution must be taken when blackening the front sight of rifles equipped with the promethium sight. A direct exposure to flame or intense heat will cause the plastic vial containing the luminous substance to melt.

During marksmanship training, materials for this purpose should be available on the range. In combat the soldier can use a cleaning patch or

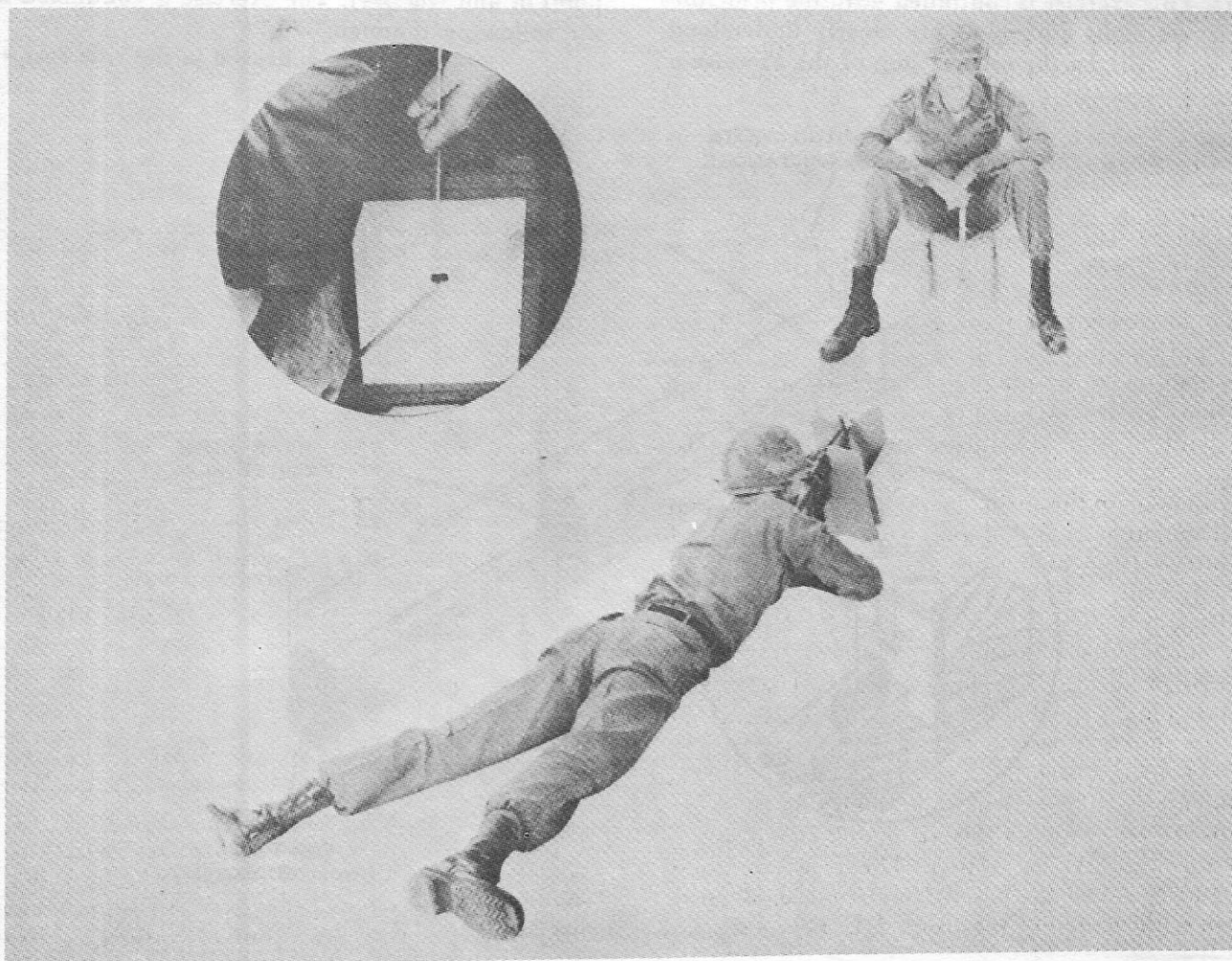


Figure 4-4. Target box exercise.

handkerchief to clean the sights, and he can blacken them with an ordinary match flame.

(2) *Fire commands.* In order to simplify firing procedures, fire commands should be brief and standardized as much as possible from one exercise to the next. A sample fire command follows: FIRERS ASSUME A GOOD \_\_\_\_\_ POSITION. THE FIRING LINE IS NO LONGER CLEAR. LOCK, ONE MAGAZINE OF THREE ROUNDS, LOAD. PLACE THE

SELECTOR LEVER IN THE SEMI-AUTOMATIC (AUTOMATIC) POSITION. YOU WILL FIRE AT THE (NUMBER OR LOCATION) TARGET. COMMENCE FIRING WHEN READY. CEASE FIRING, LOCK AND CLEAR ALL WEAPONS. CLEAR ON THE RIGHT? CLEAR ON THE LEFT? THE FIRING LINE IS CLEAR. ASSISTANT INSTRUCTORS AND FIRERS MOVE DOWN RANGE AND CHECK YOUR TARGETS.

## Section II. M16A1 SIGHTS

### 4-3 General

Following fundamentals training, the soldier must zero his weapon. In order to accomplish this, the soldier must first learn the operation of the sights, the use of the elevation and windage rule, and how to compute sight changes.

### 4-4. The Sights

The sights of the M16A1 rifle are adjustable for both elevation and windage. Windage adjustments are made on the rear sight; elevation adjustments on the front sight.

a. The rear sight consists of two apertures (fig 4-5) and a windage drum with a spring loaded detent (fig 4-6). The aperture marked "L" is used for ranges beyond 300 meters, and the unmarked aperture for ranges from 0 to 300 meters.

*Note.* See Appendix C (para C-5) for the correct procedure to obtain battlesight zero with the M16A1 rifle equipped with the promethium sight (Low Light Level Sight System).

The unmarked aperture is used when establishing the battlesight zero. Once the battlesight zero has been obtained, flipping to the aperture marked "L" automatically extends the zero out to 375 meters without additional adjustments to the front sight post. Adjustments for windage are made by pressing in on the spring loaded detent with a sharp instrument or the tip of a cartridge and rotating the windage drum in the desired direction of change.

b. The front sight consists of a rotating sight post with a spring loaded detent (fig 4-7). Adjustments are made by using a sharp instrument or a tip of a cartridge. To raise or lower the front sight post, depress the spring loaded detent and rotate the post in the desired direction of change.

c. During training in marksmanship fundamentals, all firing exercises should be conducted with the rear sight of the weapon centered and set on the unmarked aperture. The front sight post should be set so the base of the front sight post is flush with the top of the front sight post well. This setting should not be changed until the firer is able

to fire tight shot groups. The reason for this is twofold: first, untrained firers will tend to focus their attention on manipulating the sights rather than learning to properly apply marksmanship fundamentals; second, during fundamentals training, the precise location of a shot group on the target is unimportant since it is the size of the shot group, not the location, that governs the proficiency of the firer.

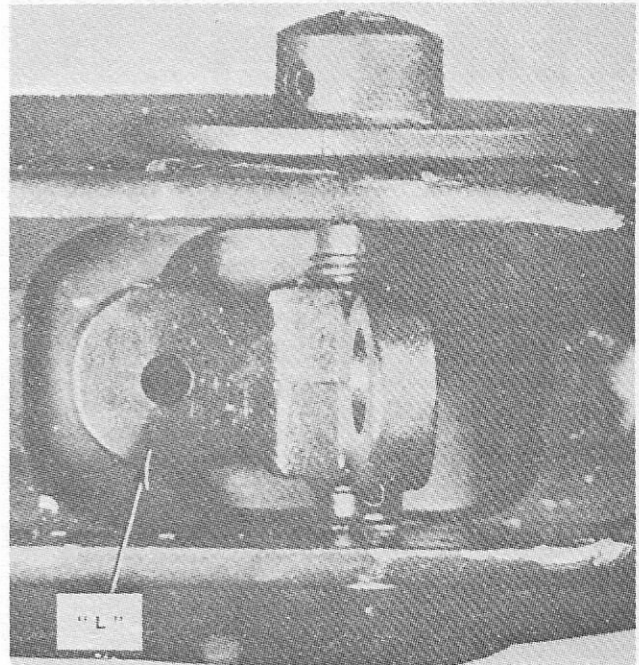


Figure 4-5. Rear sight aperture.

### 4-5. Elevation and Windage Rule

The elevation and windage rule states that one click of elevation or windage will move the strike of a projectile a specific distance at a specific range. At a range of 25 meters one click of either elevation or windage on the sights of the M16A1 rifle will move the strike of the projectile approximately .7 centimeter. To compute the distance that one click of

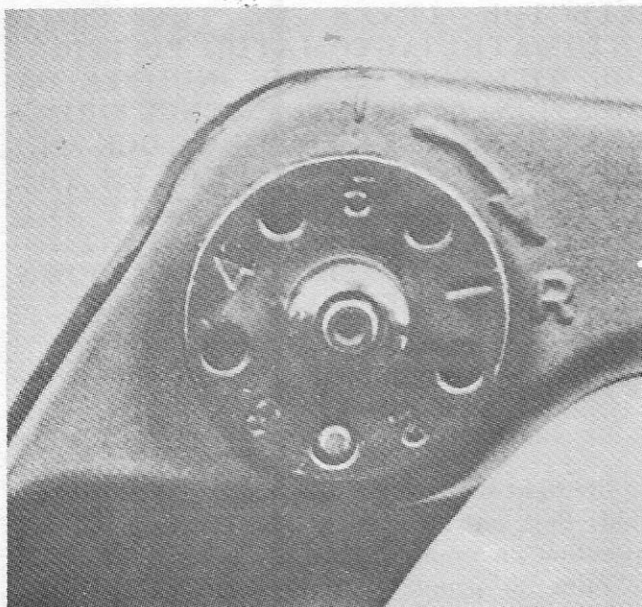


Figure 4-6. Windage drum.

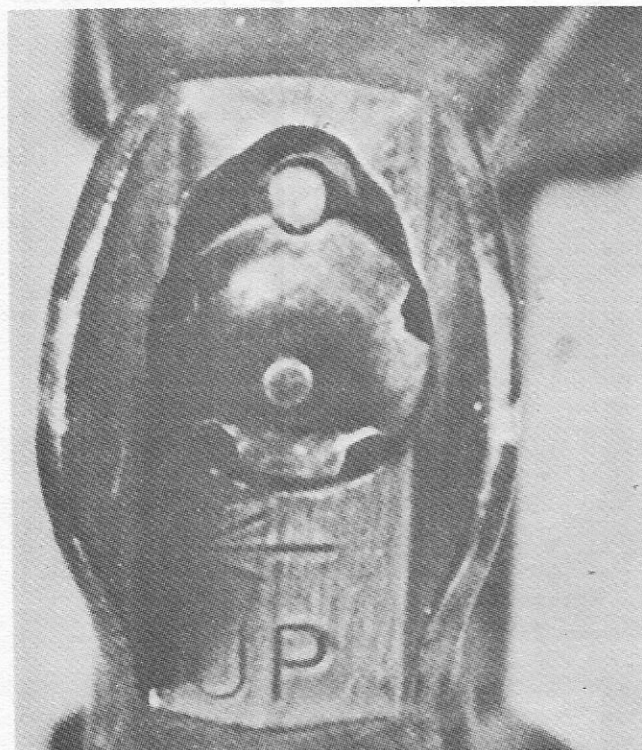


Figure 4-7. Front sight.

elevation or windage will move the strike of a projectile at a given range, divide the range (expressed in meters) by 25 meters and multiply by .7 centimeter.

$$D \equiv \frac{R \times .7}{25m} \quad \begin{array}{l} D = \text{Distance in centimeters} \\ R = \text{Range in meters} \end{array}$$

Example: To compute the distance that one click of elevation or windage will move the strike of

the bullet at a range of 250 meters, simply divide 250 meters (m) by 25 meters (m) and multiply by .7 centimeter (cm).

$$D = \frac{250m \times .7}{25m} = 10 \times .7 = 7 \text{ cm}$$

Therefore, one click of elevation or windage will move the strike of the bullet 7 centimeters at a range of 250 meters.

#### 4-6. Sight Changes

a. To make sight changes, the firer first locates the center of his three-round shot group and then determines the distance between it and the desired location. An error in elevation is measured *vertically*, while a windage error is measured *horizontally*. These distances are converted to clicks by using the elevation and windage rule. As a general rule, bold adjustments will prove more advantageous to the firer. For example, if there is a question whether to move two or three clicks, the firer normally should make the adjustment requiring the greater number of clicks.

b. To raise the strike of the projectile, the firer must rotate the front sight post in the direction of the arrow marked *UP* (stamped on the front sight base) (fig 4-7); thus, the strike of the projectile is raised but the post is lowered. Reverse the direction of rotation to move the strike of the projectile down. To move the strike of the projectile to the right, rotate the windage drum the desired number of clicks clockwise (in the direction of the arrow marked "R," right) (fig 4-6). Reverse the direction of rotation to move the strike of the projectile to the left.

*Note.* Prior to making any sight changes the firer must be able to fire shot groups consistently within a 5-centimeter radius.

#### 4-7. Progress Check

a. *Purpose.* Prior to obtaining his battlesight zero, each soldier should fire an exercise to measure his fundamental shooting skill. This exercise is called a progress check. The results of the progress check will enable instructors to identify specific deficiencies and to take advantage of scheduling procedures in the subsequent battlesight zero period.

b. *Conduct of Exercise.* To conduct a progress check, each soldier is required to fire a three-round shot group from one or more of the six standard firing positions.

*Note.* The number of positions to be used will vary depending on the marksmanship training the firer has received

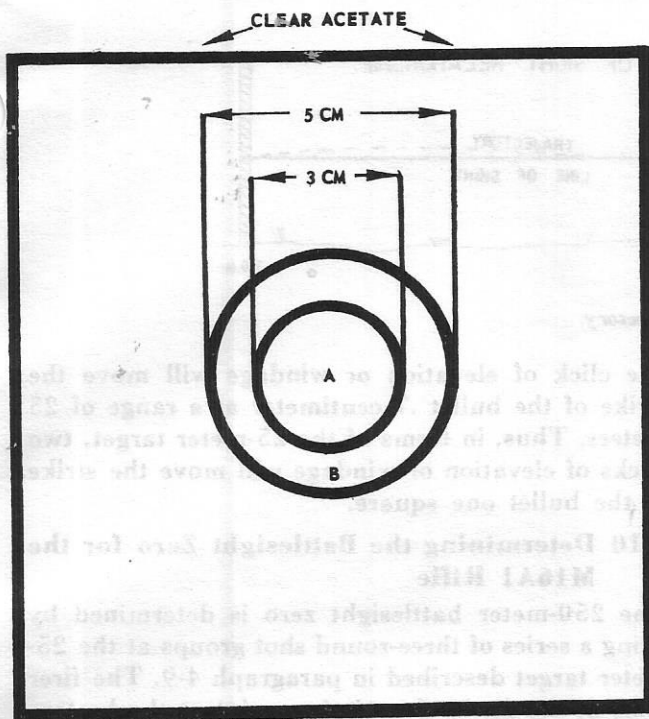


Figure 4-8. Shot group template.

### Section III. BATTLESIGHT ZERO

#### 4-8. Principles of Zeroing

a. In order to understand the principles of zeroing, the soldier should have a basic knowledge of ballistics; specifically, the relationship between the path of the projectile in flight and the line of sight. In flight, a projectile will follow a relatively straight line until loss of velocity and gravity combine to cause it to fall to earth, forming an arc as it does so. It will appear to have a curved trajectory (fig 4-9). If the muzzle of a rifle is elevated at the time of firing, the trajectory of the projectile will form an even greater arc. The greater the distance a projectile travels before impact, the higher its trajectory will be. On the other hand, the line of sight is a straight line through the rear sight aperture and across the front sight post to the aiming point on the target.

b. When the projectile leaves the muzzle of the M16A1 rifle it is initially below the line of sight, because of the physical distance between the axis of the bore and the line of sight. This distance varies from one weapon type to another. The sight setting in elevation required to engage a target at a specific range produces an angle between the line of sight and axis of the bore (fig 4-9). At long ranges this angle causes the projectile to intersect the line of sight twice during its flight. First as the projectile

(e.g., a basic trainee may be required to fire from all six positions where as a member of a TOE unit may be required to fire only from the unsupported positions).

Assistant instructors check the results after each shot group is fired, using a shot group template (fig 4-8). This template is made of transparent plastic with two circles imprinted on it. One circle is 3 centimeters in diameter ("A" ring) and the other 5 centimeters ("B" ring). In checking shot groups fired from the three most stable positions, (prone, prone supported, and foxhole supported) the shot groups must lie on or within the 3-centimeter circle to be considered satisfactory. The 5-centimeter circle is used to check shot groups fired from the least stable positions (kneeling, kneeling supported, and standing). Again, the three rounds must lie on or within the 5-centimeter circle to be considered satisfactory. Soldiers should be given an opportunity to refire from those positions found to be unsatisfactory if there is sufficient time and ammunition available. New recruits must receive a formal progress check as an integral part of their marksmanship training. The shot group template should be continually used to check and critique shot groups during all 25-meter firing.

travels toward its maximum height and second when it loses its velocity and gravity pulls it back to earth. The point where the projectile and line of sight intersect the second time is known as rifle zero.

c. The zero of a weapon is that sight setting in elevation and windage that will cause a hit at the point of aim for a given range.

d. Current doctrine of the United States Army prescribes a battlesight zero for 250 meters. That is, the sights of a weapon should be adjusted so that the trajectory of the projectile and the line of sight intersect at a range of 250 meters. To phrase it another way, a soldier firing a weapon properly zeroed for a range of 250 meters should hit his aiming point at that range.

e. One method of determining the 250-meter battlesight zero would be to fire at a range of 250 meters, making the necessary sight adjustments to place the center of the shot group on the aiming point. However, such a method requires extensive terrain and training time for firers to move between the firing line and the targets to check the location of their shot groups.

f. A more suitable method of determining the 250-meter battlesight zero can be accomplished on a 25-meter range (fig 4-1 and 4-10). This method is

TRAJECTORY-LINE OF SIGHT RELATIONSHIP

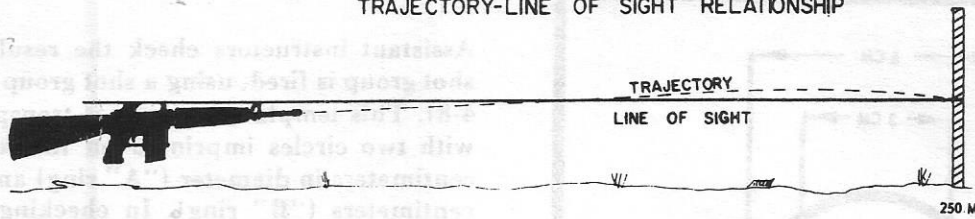


Figure 4-9. Trajectory.

based on the principle that projectiles of the same type and caliber, fired at the same range, have the same trajectory. That is, if several projectiles were fired from the same weapon and all hit the same 250-meter aiming point, the trajectories of all these projectiles are the same. Therefore, when each of these projectiles reaches a distance of 25 meters from the muzzle of the weapon, they are all the same distance below the firer's line of sight. Thus, by placing an aiming point at a range of 25 meters, the firer has only to adjust the weapon sights until the projectiles (shot group) impact at the prescribed distance below the 25-meter aiming point to obtain a zero for 250 meters.

4-9. Battlesight Zero Target

The standard 25-meter target (fig 4-2) previously used during fundamental training is used when determining the battlesight zero for the M16A1 rifle. In order to use the elevation and windage rule effectively, the firer must know the dimensions of the squares on the target. Vertical and horizontal lines are printed on the target, forming 1.4-centimeter squares. As indicated in paragraph 4-5,

one click of elevation or windage will move the strike of the bullet .7 centimeter at a range of 25 meters. Thus, in terms of the 25-meter target, two clicks of elevation or windage will move the strike of the bullet one square.

4-10 Determining the Battlesight Zero for the M16A1 Rifle

The 250-meter battlesight zero is determined by firing a series of three-round shot groups at the 25-meter target described in paragraph 4-9. The firer aims at the distinctive aiming point at the bottom center of the black rectangle (base of the white cutaway portion) and adjusts his sights until the center of his acceptable shot group is located 2.4 centimeters directly below the aiming point (fig 4-10) on or around the X.

*Note.* The sights (front and rear) of the M16A1 rifle *should not* be changed after the firer has determined the sight setting in elevation and windage that produces a good 25-meter battlesight zero. If a firer experiences difficulty in hitting field fire targets he should return to the 25-meter range where an assistant instructor can observe his application of the integrated act of shooting and the firer can confirm his battlesight zero.

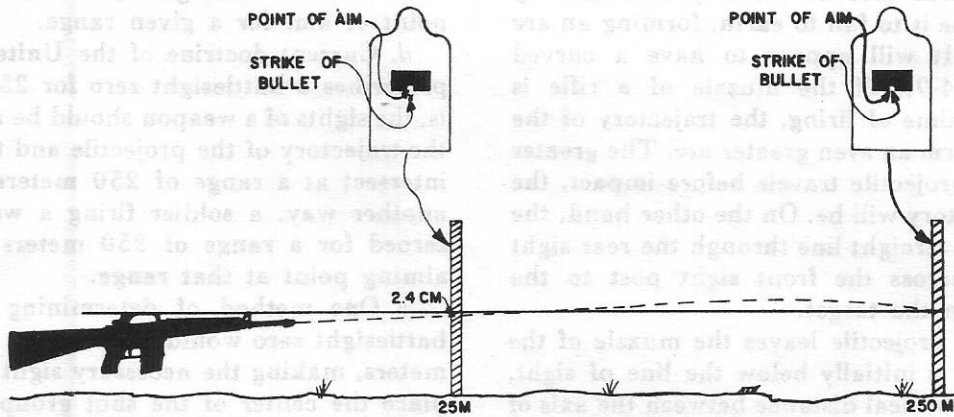


Figure 4-10. Principles of battlesight zeroing.

## CHAPTER 5

# FIELD FIRING

### Section I. CONDUCT OF TRAINING

#### 5-1. Purpose and Scope

Field firing provides the soldier with practical experience in firing at realistic targets located at ranges comparable to those on the battlefield. Field firing begins with simple exercises designed to familiarize the soldier with the range, the targets, and the scoring system. During the first field firing exercises the soldier should be allowed sufficient time to check his position and sight picture, and fire at the target. However, in subsequent exercises, speed becomes an increasingly important factor since a time limit is imposed on the firer. In later exercises there are added requirements such as rapid reloading, reducing stoppages, and engaging multiple targets. Initially, the soldier fires from the more stable positions and gradually progresses to the less stable positions. Toward the end of his field firing training, he is required to physically advance toward the targets, quickly move into position, and fire when the targets appear.

#### 5-2. Center of Target Method of Engagement

*a. General.* A projectile fired from an M16A1 rifle (that has been battlesight zeroed for 250m) at a target 250 meters away will have a maximum ordinate above the line of sight approximately 7.9 centimeters (3.5 inches). Because of this relatively flat trajectory the rifleman is able to engage targets using the center-of-target method of engagement (i.e., aim for the center of visible target).

*b. Effects of Weather.* A rifleman who has a well-zeroed weapon and who has properly applied the integrated act of shooting may still experience misses on target. Contributing to these misses are such factors as wind, mirage, light, temperature, and humidity. The factor which presents the greatest problem for the firer is the effect of wind. The remaining factors, although important, are generally associated with long range sniping (TC 23-14) and therefore are not mentioned in this manual.

##### *c. Wind*

(1) The effects of wind on a projectile depend on the velocity of the wind and the direction it is blowing. Wind also has an effect on the firer. The stronger the wind, the more difficulty the firer may have holding the rifle steady. The effect on the firer can be partially offset with good training and conditioning.

(2) Since the firer must know how much effect the wind will have on the projectile, he must be able to determine its direction and velocity, then classify it as having a full value effect, half value, or no effect.

(3) Determining the direction of the wind can be accomplished by observing certain indicators (e.g., range flags, smoke, trees, grass, rain, or the sense of touch). Once the direction of wind has been determined the firer must then estimate the velocity. The following information may be used as a guide in estimating wind velocity:

3 to 5 mph—wind can be felt on the face.

5 to 8 mph—leaves in trees are in constant motion.

12 to 15 mph—small trees begin to sway.

(4) After the direction and velocity of the wind are determined, the firer must decide whether it has a full value effect, half value effect, or no effect. The universally accepted method of classifying the wind is by use of the clock method (fig 5-1). A half value wind will affect the projectile  $\frac{1}{2}$  as much as a full value wind of the same velocity.

*Note.* With the M16A1 rifle a full value wind of 10 mph or less will have negligible effect on a projectile's accuracy out to a range of 300 meters. At ranges beyond 300 meters or when the velocity of a full value wind exceeds 10 mph the firer should apply hold-off to compensate for the wind effect (e.g., if the wind is blowing from left to right—hold to the left side of the target (fig 5-1)).

#### 5-3. Rapid Reloading

Concurrent with 25-meter range firing, the soldier receives his initial training and practical exercises in the techniques of rapid reloading. The continuation of training in this skill is conducted during the field fire exercises. To conduct these exercises, the ammunition is issued in two magazines. The rifle is loaded with one of the magazines and the firer carries the other in his ammunition pouch or belt. As soon as he has expended all of the ammunition in the first magazine, he must rapidly reload and be ready to engage the next target when it appears. (It is possible the firer will run out of ammunition and not realize until he attempts to fire. In such cases he should still attempt to reload and engage the target within the prescribed time limit. However, there is *no time added* to the exercises for the purpose of reloading.)

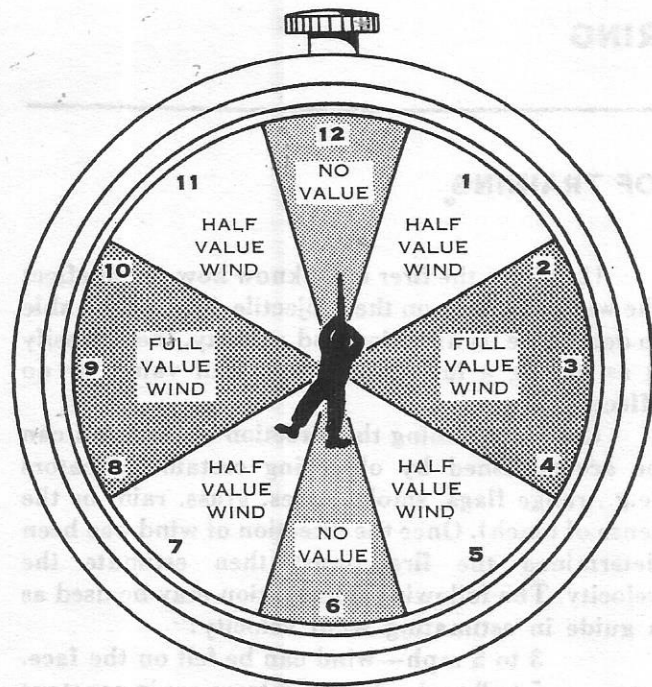


Figure 5-1. Hold-off to compensate for wind.

#### 5-4. Reduction of Stoppages

During the later field firing exercises, one dummy round should be placed among the live rounds in the firer's magazine. When this round fails to fire, the soldier must rapidly apply *immediate action* to eject the dummy round, and reload a new round. Unless the soldier learns to perform this action rapidly and almost instinctively, the target will disappear before he can fire. In combat, a slight hesitation in performing immediate action might give an enemy soldier just enough time to fire a killing round. Since speed is important, the firer *must not be given additional time* during the exercise to perform the immediate action required.

#### 5-5. Positions and Engaging Single Targets

a. Field firing continues the soldier's training in firing from both supported and unsupported positions. However, greater emphasis is placed on the combat application of these firing positions. Since the combat rifleman may be moving or in a stationary position when he encounters the enemy, he must be proficient in rapidly assuming a firing position and engaging targets in either situation. Field firing exercises provide practical training in both techniques. In some exercises the firer engages targets from stationary positions (phase 1, fig 5-2). In others he is required to walk forward and, when targets appear, rapidly assume a position and fire (phase 2, fig 5-2). (See ASubjSecd 23-72 for additional details on field fire.) Speed is emphasized by limiting target exposure times. As he progresses through field firing, each soldier should eventually

be able to effectively engage single targets at ranges out to 175 meters within 5 seconds, and single targets beyond 175 meters within 10 seconds.

b. The purpose of imposing different time limits for targets at different ranges is to emphasize the fleeting nature of combat targets and the definite correlation which exists between the range to the target and the time required to hit it. Through practical experience, the probability of a firer hitting a 75-meter target in the same allotted time (5 seconds). Hence, as a general rule, more time is required to fire an effective round at longer ranges since the firer must take extra care in his application of fundamentals. From the combat rifleman's viewpoint, this relationship between range and time must also take into consideration the degree of personal danger posed by enemy targets. Normally, the closest enemy targets are the most dangerous, and the speed with which they are engaged becomes increasingly important as the range decreases. Considering all of the above factors, the combat rifleman must possess both speed and accuracy in firing on enemy targets. At shorter ranges (200 meters and less) speed and accuracy must be emphasized and at longer ranges (over 200 meters) accuracy must be emphasized with speed becoming secondary. For soldiers moving in the open, these factors have an added application in determining the best firing position from which to engage surprise enemy targets. In such situations, the standing position is obviously the quickest and easiest firing position to assume, however, it is also the least stable. Experience has shown that in the standing position the chances of hitting targets beyond 100 meters within 5 to 10 seconds are slight. The prone position, on the other hand, is the most stable of all the unsupported positions; however, it too has limited application on the battlefield. The reason is that once in the prone position, the firer will usually discover that terrain and / or vegetation has masked the target. Thus, firers moving in the open who detect targets beyond a range of 100 meters should normally assume a kneeling position to engage them. The kneeling position affords the best combination of speed and accuracy.

#### 5-6. Engaging Multiple Targets

If a combat rifleman observes three enemy soldiers, he fires at the one presenting the greatest danger to him; normally the nearest. When he fires, he can expect the other two to quickly seek cover. Consequently, the rifleman must be able to rapidly shift his point of aim and fire at a second and even a third enemy soldier before they have the opportunity to reach a protected position. The last exercises conducted during field firing training are designed to present such multiple target situations to the firer. As in the single target exposure exer-

**PERIOD TEN  
FIELD FIRING SCORECARD  
RIFLE MARKSMANSHIP COURSE**

For use of this form, see ASubjSed 23-72; the proponent agency is TRADOC.

FIRER'S NAME DOE JOHN E. PLATOON 1 FIRING POINT 6  
 (LAST) (FIRST) (MIDDLE)

DATE 23 JULY 73 SCORER'S NAME BROWN JOE L  
 (LAST) (FIRST) (MIDDLE)

**PHASE I FOXHOLE POSITION**

RANGE (M)	TIME (SEC)	HIT	MISS
75	10	✓	
175		✓	
175		✓	
300	25		✓
300		✓	
175	25	✓	
300			✓
300			✓

Ammunition 8 rds    TOTAL    5    3

RANGE (M)	TIME (SEC)	HIT	MISS
75	10	✓	
175			✓
175	25	✓	
300		✓	
300		✓	
300	15		✓
300		✓	

Ammunition 7 rds    TOTAL    5    2

**PHASE 2**

PLACE	POSITION	RANGE (M)	TIME (SEC)	HIT	MISS
By rear stake	Kneeling	75	10	✓	
		175		✓	
By stump	Kneeling Supported	175	15	✓	
		300		✓	
By foxhole	Standing	75	5	✓	
By front stake	Kneeling	175	25		✓
		300		✓	
		300			
Forward of stake	Kneeling	175	5	✓	
By rear stake	Standing	75	5	✓	
		175			
By stump	Kneeling Supported	300	25		✓
		300			✓
		300			✓
By foxhole	Kneeling	75	5	✓	
By front stake	Standing	175	10	✓	
		75		✓	
Forward of stake	Kneeling	175	15	✓	
		300		✓	
By stump	Kneeling Supported	75	15		✓
		300		✓	

Ammunition 20 rds    TOTAL FOR PERIOD 10    TOTAL    15    5

	HIT	MISS
PHASE 1	10	5
PHASE 2	15	5
TOTAL	25	10

DA FORM 3601-R, 1 Nov 73. REPLACES DA FORM 3601-R, 1 APR 70, WHICH IS OBSOLETE.

Figure 5-2. Field firing scorecard (DA Form 3601-R) with sample entries.

cises, the firer must engage the targets within prescribed time limits and from various firing positions.

### 5-7. Application of Marksmanship Fundamentals and Corrective Instruction

a. Although field firing exercises are primarily designed to develop skills which cannot be logically developed on 25-meter ranges, the fundamentals learned during this earlier training phase must continue to be emphasized. Instructors should check firers particularly for indications of *improper trigger control*. Many soldiers firing under pressure of a time limit will develop a tendency to jerk the trigger. This error must be corrected before it becomes a habit.

b. A second fundamental frequently slighted on the field firing range is that of position. Continued

emphasis must be placed on the importance of correct body position. Since time is a factor in field firing exercises, emphasis should be placed on the fact that no more time is required to assume a correct position than an incorrect one, and that firing results are considerably better from a correct position. Firers committing major errors should be returned to the 25-meter range for corrective instruction.

c. The initial field fire exercises will generally reveal firers who do not have a satisfactory battlesight zero (i.e., the firer appears to be applying all the fundamentals correctly but is still missing the long range targets). These firers should be returned to the 25-meter range for zero confirmation firing and the necessary corrections made before continuing their field fire training.

## Section II. RANGE OPERATION

### 5-8 Range Facilities

When possible, field firing exercises should be conducted on *standard field firing ranges* constructed for this specific purpose. If such ranges are not available, field firing can be conducted on a *known distance range*. However, both the known distance range and course of fire must be modified to accomplish this. Even with modifications, the firing conducted on the known distance range is, at best, expedient training and cannot be considered comparable to the benefits gained from training on standard field firing ranges.

### 5-9. Operation of Standard Field Firing Ranges

The standard field firing range is constructed on open, flat terrain having a minimum depth of 300 meters (fig 5-3). The vegetation is removed so that targets will be clearly visible to the firer. The *standard range* consists of 35 lanes and will accommodate a maximum of 105 soldiers in three 35-man firing orders. Each firing lane must have a foxhole, stump, and two sandbags in order to continue training in firing from supported positions. Control points are also required to

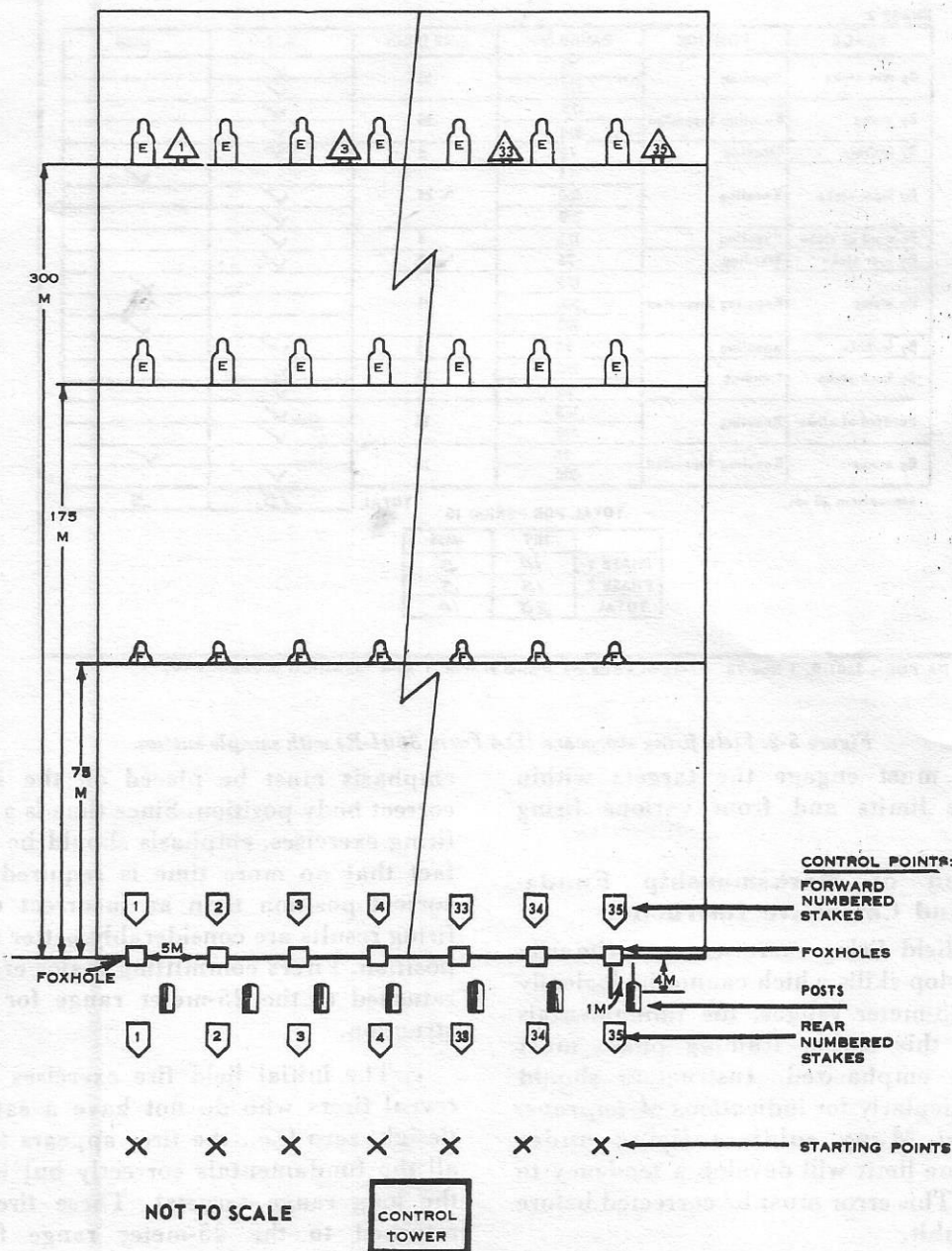


Figure 5-3. Standard (rifle marksmanship) field firing range.

regulate the forward progress of firers during movement-type exercises. The stumps and foxholes are used as two of these control points. Numbered stakes are placed forward of the foxholes and other stakes are placed in rear of the stumps to provide additional control points. The starting points are located behind the rear numbered stakes and can be designated by stakes, a line placed on the ground, or a line of ready chairs.

a. *Targets.* There are three rows or banks of targets on the standard field firing range. One bank is located at a range of 75 meters, the second at 175 meters, and the third at 300 meters. The targets are silhouettes shaped in the general outline of a man. At the 75-meter range, the F-type silhouette target is used. This depicts the head and shoulders of an average size man. The E-type silhouette is used at ranges of 175 and 300 meters. This depicts an average size man from the hips to the top of his head.

b. *Target Devices.* Each target is affixed to a target holding mechanism (M31A1) (fig 5-4) which is electrically operated and can be centrally or individually controlled. The most satisfactory control method is to connect all of the targets in one bank into one switch. This switch will then raise or lower the entire target bank at one time. Except for the initial field firing exercise, targets are exposed for a prescribed period of time and then lowered. Since it requires 1 to 2 seconds for the mechanism to physically raise the targets, timing should begin when the targets are fully exposed rather than the moment the switch activates the mechanism. Time limits and sequence of target exposures are prescribed on the scorecard (fig. 5-2) for the exercise being conducted.

c. *Scoring.* When a target is hit by a projectile, the vibration activates a mechanism in the device which causes the target to fall, simulating a "kill." Each kill is scored as a hit for the firer. If the target does not fall, the firer receives a miss. During timed exercises, and audible signal such as a buzzer, whistle, or bell should be used to designate the expiration of the time limit. Rounds fired after the signal has sounded are scored as misses.

d. *Range Organization.* The organization of firers and range personnel to conduct field firing is as follows:

(1) *Firers.* Normally, the training schedule requires half of a 200-man unit to receive training on the field firing range while the remainder of the unit either fires on the 25-meter range, receives instruction on target detection, or participates in other training deemed appropriate by the commander. Those on the field firing range are divided into three orders. Initially, the first order is designated as firers, the second as scorers, and the third as the ammunition detail. These duties are then rotated.

(2) *Range personnel.* The following personnel are required to conduct field firing:

(a) *Officer in charge.* He has the ultimate responsibility for the overall operation.

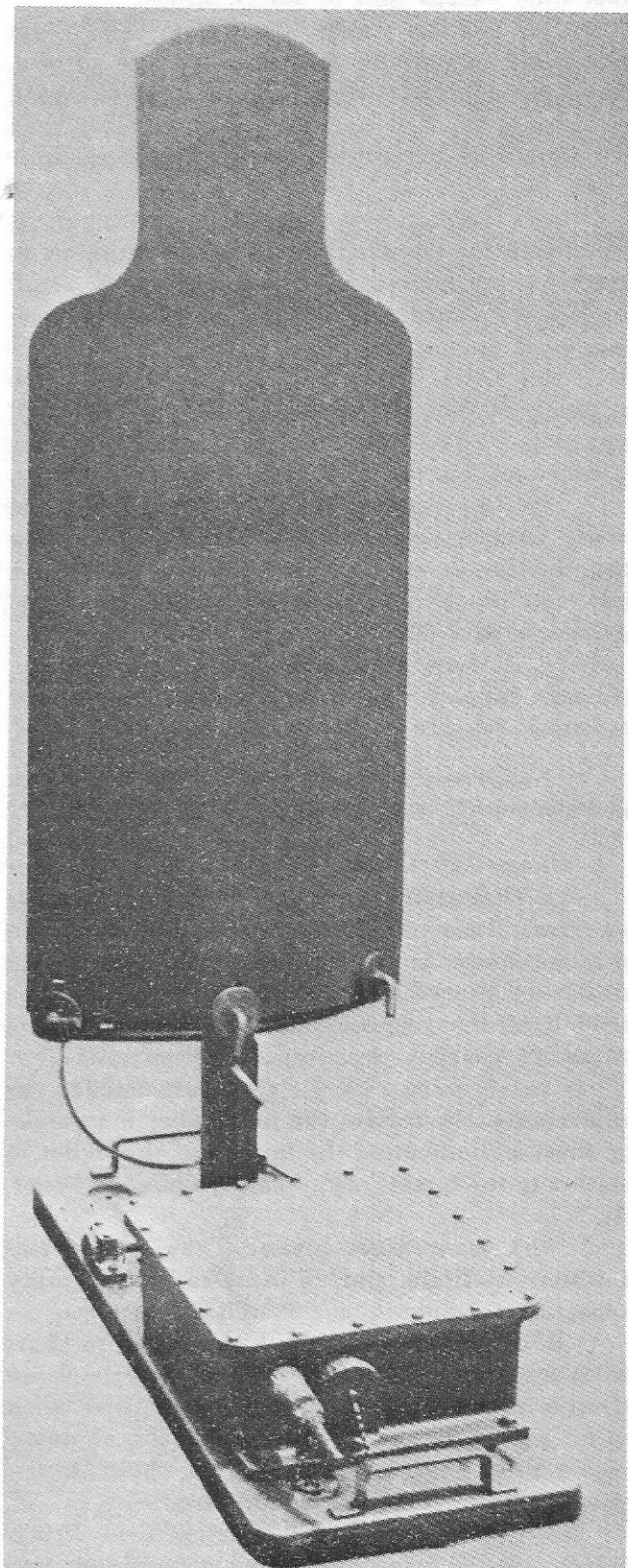


Figure 5-4. Target holding mechanism (M31A1) with E-type silhouette.

(b) *Range safety officer.* He is responsible for the safe operation of the range to include conducting a safety orientation prior to each scheduled period of instruction. He insures that all personnel comply with safety regulations and procedures. This officer should not be assigned any other duty except that of safety officer.

(c) *Control tower operators.* They are responsible for raising and lowering the targets, timing the exposures, sounding the audible signal, and giving the fire commands. If possible, two men should be designated to perform these functions.

(d) *Ammunition detail.* This detail is responsible for the distribution of ammunition to central points behind the firing line. This detail should not be confused with the ammunition men designated among the firing orders.

(e) *Ordnance detail.* This detail should be composed of two segments, one to conduct small arms repair and the other to perform minor maintenance on the target holding mechanisms.

(f) *One assistant instructor per five to ten points.* Each assistant is responsible for insuring that all firing personnel observe safety procedures and regulations, and for assisting those firers having unusual difficulty in hitting the targets.

(g) *Medical personnel.* They provide medical support as required by regulations governing live fire exercises.

*Note.* Personnel requirements to conduct 25-meter zero confirmation firing are the same as outlined in chapter 4.

### *c. Range Procedures.*

(1) *Orientation.* Prior to beginning live fire exercises, all personnel must receive an orientation on range safety. In addition, the orientation should outline the procedures for conducting the exercise to include the responsibilities of the nonfiring orders. In general, these responsibilities are:

(a) *Scorers.* They are responsible for maintaining the score of the firer. They may assist the firers by indicating the impact of the bullet in relation to the target; e.g., "short, right" or "over, left."

(b) *Ammunition men.* They issue ammunition to firers and, if necessary, fill empty magazines for subsequent exercises.

(2) *Master score chart.* A master score chart indicating individual scores for each exercise is an effective method of maintaining a competitive spirit within a unit. It also provides a means of determining those individuals in need of closer supervision and/or corrective instruction.

(3) *Conduct of firing.* During field firing, soldiers will fire from both stationary positions and positions which they assume rapidly while moving forward. In either of these two types of exercises,

targets may be exposed singly or in multiples of two or three. The firing positions to be used and the sequence, type, and time of target exposures are prescribed on the scorecard (fig 5-2) for each exercise. For training purposes, only one round should be fired at each target within an exposure.

(a) *Stationary position exercises.* On command, firers assume the designated firing position and lock and load their rifles. The exercise begins on the command, WATCH YOUR LANES. At this time, firers move the rifle selector lever to *semi* and engage targets as they appear in their lanes. Firers remain in the same position unless told otherwise.

(b) *Movement-type exercises.* In order to conduct movement-type exercises, firers must be thoroughly familiar with the control points used to regulate forward progress: the starting points, rear numbered stakes, stumps, foxholes, and the front numbered stakes (fig 5-3). To begin the exercises, firers move to the starting points and, on command, lock and load their rifles. Subsequent fire commands may or may not prescribe the firing position; however, the control point from which firing will be conducted must always be included in the command; e.g., THE KNEELING POSITION BY THE REAR NUMBERED STAKE, MOVE OUT, or, BY THE FOXHOLE, MOVE OUT (the firer begins walking slowly forward).

**Caution:** Firers must maintain *alinement* as they advance. Assistant instructors must closely supervise this movement to insure individual firers do not get ahead of or behind the other firers. All firers must lock their weapons before they make the next movement. As the line of firers nears the designated control points, targets are exposed and each firer rapidly assumes the designated position and engages the exposed target(s) in his lane. Firers remain in this position and continue to observe their lanes for other targets to appear. If the firing position is not designated, firers may select their own position.

(c) *Single and multiple target exercises.* For the first several exercises, targets are exposed singly in each lane, and all 35 firers engage the targets in their respective lanes. Later in the training multiple target exercises are conducted. During the multiple target exercises, the firer may be presented any combination of a 75-meter target, a 175-meter target and/or a 300-meter target.

(d) *Fire commands.* Simple standardized fire commands are essential to avoid confusion during field firing exercises.

1. Fire commands for exercises fired from stationary positions.

(a) **FIRERS, ASSUME A GOOD POSITION.**

(b) **LOCK, ONE MAGAZINE OF \_\_\_\_\_ ROUNDS, LOAD.**

(c) **READY ON THE RIGHT?**

(d) **READY ON THE LEFT?**

(e) **THE FIRING LINE IS READY.**

(f) **WATCH YOUR LANES.**

(g) **CEASE FIRE, LOCK YOUR WEAPON (PLACE THE SELECTOR LEVER IN THE SAFE POSITION).**

(h) Repeat (a) through (e) above or give (i) through (k) below.

(i) **CEASE FIRING, CLEAR ALL WEAPONS.**

(j) **CLEAR ON THE RIGHT?**

(k) **CLEAR ON THE LEFT?**

(l) **THE FIRING LINE IS CLEAR.**

2. Fire commands for movement-type exercises. Before an initial exercise of this type, explain the use of control points and the need for maintaining alinement while advancing.

(a) **FIRERS. MOVE TO YOUR STARTING POINT.**

(b) **LOCK, ONE MAGAZINE OF \_\_\_\_\_ ROUNDS, LOAD.**

(c) **READY ON THE RIGHT?**

(d) **READY ON THE LEFT?**

(e) **THE FIRING LINE IS READY.**

(f) **BY THE (control point), THE (position). MOVE OUT or, BY THE (control point), MOVE OUT.\* (The position is optional.)**

\*This command is repeated for each control point as prescribed on the scorecard.

## Section II. RANGE ORGANIZATION AND MANAGEMENT

### 0-3. Location

Since target detection training is usually conducted concurrently with other firing exercises, the target detection ranges should be located nearby (within 10 minutes movement time) of the firing ranges. It is also essential that target detection ranges be located in areas having good natural vegetation (fig 0-1). The observation lines of target detection ranges must be placed on terrain which will approximate good defensive locations for units occupying that particular area.

### 0-4. Construction

The observation line should be among the furthest of the target detection range to be constructed. The reason for this is that the location of all down range panels, sound systems, and any necessary trimming of foliage depends on the degree of visibility from the observation line. The observation line should be wide enough to accommodate 50 points. The distance between observation points should be no closer than 2 meters. An observation line of this size is sufficient to ac-

## CHAPTER 6

# TARGET DETECTION

### Section I. GENERAL

#### 6-1. Purpose

Even the most skilled marksman is useless if he cannot find the target. For the combat rifleman, finding the target can be even more of a problem than hitting it. Except during the assault, a soldier rarely fails to use some cover and / or concealment when he is in the vicinity of enemy units. Consequently, considerable emphasis must be placed on teaching soldiers the techniques of detecting targets as they will appear on the battlefield. As used in this manual, the term "target detection" means the process of locating, marking, and determining the range to combat targets. These targets may be either single or multiple, stationary or moving. They can also be completely hidden. The purpose of this chapter is to outline procedures for teaching soldiers how to detect enemy personnel on the battlefield under varying degrees of mobility, concealment, and visibility.

#### 6-2. Training Concepts

Target detection training is based on concepts governing the usual behavior and employment of infantry units, and the individuals within those units, on the battlefield. These concepts include:

- a. Enemy personnel are seldom seen except in the assault.
- b. The range at which individual enemy soldiers can be detected rarely exceeds 300 meters.
- c. Many indications can reveal the location of the enemy. Among the more common are movement, sounds of movement, sound and / or muzzle flash of a firing weapon, and the reflection of light from shiny objects. However, any of these indications will usually be sensed for only a brief time.
- d. A combat target does not have to be visible in order to be hit by rifle fire. An enemy soldier who has been observed moving into a concealed position can be effectively engaged by using a nearby feature as a reference point.

### Section II. RANGE ORGANIZATION AND MANAGEMENT

#### 6-3. Location

Since target detection training is usually conducted concurrently with other firing exercises, the *target detection range(s)* should be located nearby (within 10 minutes movement time of) the firing ranges. It is also essential that target detection ranges be located in areas having good natural vegetation (fig 6-1). The observation lines of target detection ranges must be placed on terrain which will approximate good defensive locations for units occupying that particular area.

#### 6-4. Construction

a. The observation line should be among the first areas of the target detection range to be constructed. The reason for this is that the location of all down range panels, sound systems, and any necessary trimming of foliage depends on the degree of visibility from the observation line. The observation line should be wide enough to accommodate 50 points. The distance between observation points should be no closer than 2 meters. An observation line of this size is sufficient to ac-

commodate half of a 200-man unit (50 two-man teams).

b. The fan of observation should cover an area between 30° left of the left flank point of the observation line to 30° right of the right flank point. Ideally, to provide maximum flexibility in conducting exercises in range determination, the target detection range should have a depth in excess of 500 meters. Installations having limited training space can conduct satisfactory training on ranges having a depth of at least 300 meters.

c. Both lettered and numbered panels are placed throughout the observation area. The lettered panels serve two purposes: first, they divide the range into sectors defining a rifleman's area of responsibility; and second, they serve as reference points for marking targets. The numbered panels are used during exercises to locate sound targets only. Consequently, these panels should be constructed so they can be easily raised or lowered as required.

d. The number of panels needed depends upon the size of the range. For a range having a 50-point

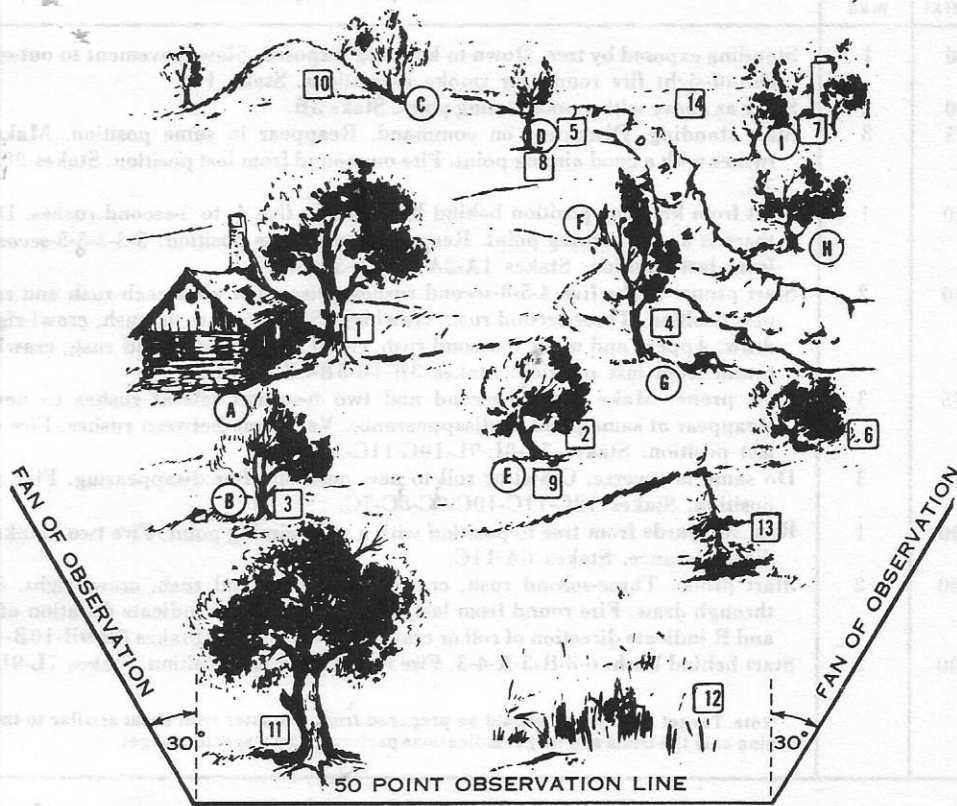


Figure 6-1. Target detection range.

observation line and a depth of 300 meters. approximately seven lettered panels and 14 numbered panels will be required.

e. In addition to the panels, numbered stakes are also placed down range. These stakes should not be visible from the observation line since they are for use only by instructors and target men in presenting various target situations. As in the case of the panels, the number of stakes required will depend upon the depth of the range. As a guide, a range having a depth of 300 meters should have approximately 150 stakes. In placing numbered stakes a method should be used to provide easy reference to stake locations. One such method is to divide the range into three sectors, "A," "B," AND "C." Stakes are then numbered beginning at the maximum depth of the range and proceeding forward to the observation line. All stakes in one sector would have the sector letter following the number. For example, if the right sector is designated "A," all numbers on stakes in that sector will be followed by the letter "A." Stakes in the center and left sectors will have the letter "B" and "C," respectively, after the number.

f. The location of all panels and stakes must be recorded on the *master trial sheets* (fig 6-2).

g. For proper control of target men, it is necessary to use sound equipment throughout the

observation area. Since problems of adequate sound vary according to location, it is best that a sound survey be conducted of each target detection range before the equipment is installed.

h. The exact positioning of panels, stakes, and sound equipment should be checked from the observation line. It is desirable that sound equipment be concealed from the observation line; however, this is not an absolute necessity.

#### 6-5. Use of Field Expedient Area for Target Detection Training

If standard target detection ranges are not available, the principles can be applied to parks, open fields, or other sparsely vegetated areas. The following considerations provide a checklist when adapting such areas for target detection training:

a. There should be more depth to the range than for a standard target detection range. In addition, the fan of observation should be increased depending on the degree of camouflage in the area.

b. Target men should be spaced wider apart in areas having little natural vegetation. In this regard, it may even be necessary to bring in piles of brush, logs, and manmade objects to add to the number of concealed positions.

#### 6-6. Range Personnel and Equipment

a. The following personnel are required to

Trial No.	Range (meters)	Target man	Description of requirements
1	200	1	Standing exposed by tree. Down to kneeling, exposed. Slow movement to out-of-sight position. Out-of-sight fire round for smoke indications. Stake 1A.
2	150	2	Same as above with a poor aiming point. Stake 3B.
3	175	3	Start standing. Disappear on command. Reappear in same position. Make five 4-second rushes with a good aiming point. Fire one round from last position. Stakes 2C-3C-4C-5C-6C-7C.
4	300	1	Start from kneeling position behind bush. Make five 4- to 5-second rushes. Disappear where there is a poor aiming point. Reappear from same position. 5-3-3-5-seconds. Fire round from last position. Stakes 1A-2A-3A-4A-5A-6A.
5	300	2	Start prone. Make five 4-5-8-second rushes. Disappear after each rush and roll or crouch to new position. Three-second rush, crawl left. Six-second rush, rush, crawl right. Cross small draw. Appear and make 8-second rush, crawl left. Three-second rush, crawl right. Fire one round from last position. Stakes 3B-4B-5B-6B-7B-8B.
6	175	3	Start prone. Make three 4-second and two 6-second lateral rushes to new concealment. Reappear at same point of disappearance. Vary time between rushes. Fire one round from last position. Stakes 7L-8L-9L-10C-11C-12C.
7	175	3	Do same in reverse. Crawl or roll to new position after disappearing. Fire round from last position. Stakes 12C-11C-10C-9C-8C-7C.
8	200	1	Run 200 yards from tree to position with a poor aiming point. Fire two blanks 1 minute after disappearance. Stakes 6A-11C.
9	300	2	Start prone. Three-second rush, crawl left. Five-second rush, crawl right. 5-L-3-3-6-R-4-5, through draw. Fire round from last position. (Numbers indicate duration of rush; letters L and R indicate direction of roll or crawl after each rush.) Stakes 8B-9B-10B-11B.
10	300	3	Start behind bush. 6-8-R-3-R-4-3. Fire round from last position. Stakes 7L-9L-10L-11L-12C.

Note. Target trial sheets should be prepared from a master trial sheet similar to the one above containing only the trials and target indications performed by a specific target.

Figure 6-2. Sample master trial sheet.

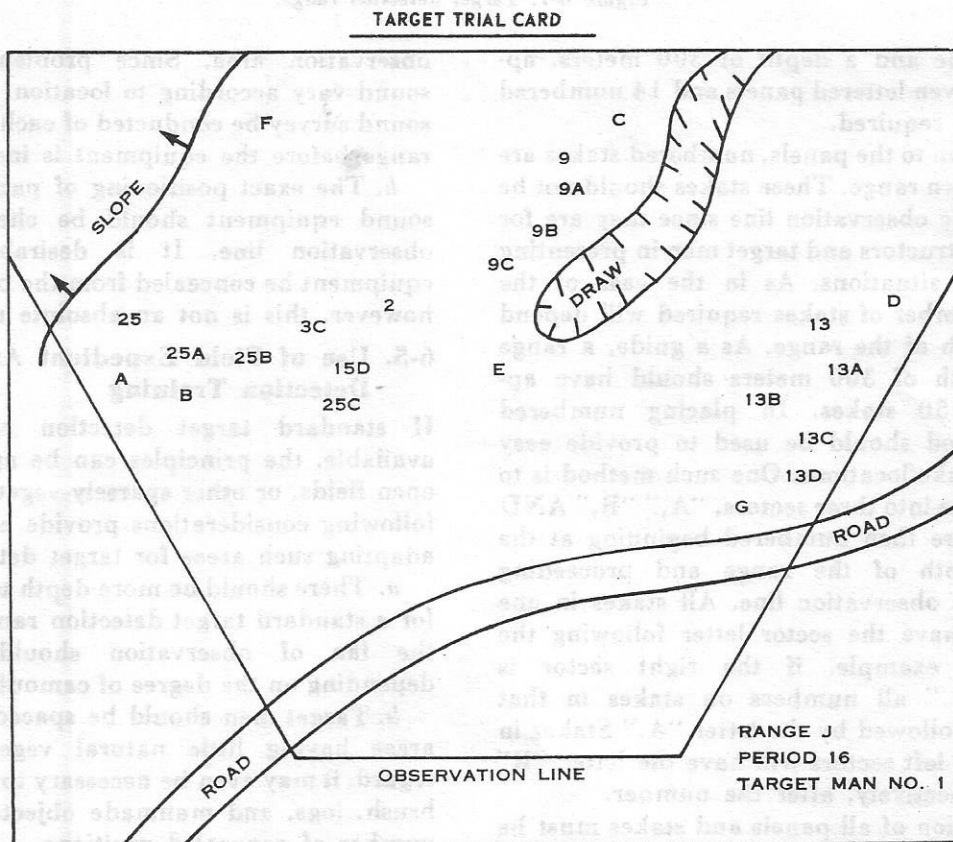


Figure 6-3. Target trial card (locally fabricated).

TARGET MAN NO. 1

<u>TRIAL NO.</u>	<u>STAKE LOCATION</u>
1	2
5	25-25A-25B-3C-15D-25C
6	13-13A-13B-13C-13D
8	9-9A-9B-9C

<u>TRIAL</u>	<u>(PHASE)</u>	<u>ACTIONS</u>
1-	1-	MOTIONLESS IN PRONE POSITION
	2-	SLOWLY RAISE AND LOWER HEAD AND SHOULDERS
	3-	SLOWLY RAISE HEAD AND SHOULDERS, DROP ABRUPTLY
	4-	FIRE TWO BLANKS

5-RUSH TO EACH POSITION. AWAIT COMMANDS TO STAND, DISAPPEAR, AND MAKE NEXT MOVEMENT.

6-CRAWL TO EACH POSITION. AWAIT COMMANDS TO STAND, DISAPPEAR, AND MAKE NEXT MOVEMENT.

8-RUSH TO EACH POSITION, STOPPING TWO SECONDS AT EACH.

RANGE J

PERIOD 16

BACK SIDE

2 Back

*Figure 6-3—Continued.*

conduct and supervise target detection training:

- (1) Officer in charge and/or principal instructor.
- (2) Four assistant instructors (based on a 50-point observation line).
- (3) Target men as required for the period of instruction.
- (4) Medical personnel.

b. The following equipment is required to conduct target detection training:

- (1) One master trial/answer (fig 6-2) sheet per instructor and assistant instructor.

- (2) One *target trial card* per target man (fig 6-3).

- (3) One answer sheet per observer.

- (4) One *aiming device* per observation point as required for the period of instruction (fig 6-4).

- (5) Camouflage paint tubes as required.

- (6) For exercises in which observers simulate firing on target men, there should be one rifle (which has had the firing pin removed) per observation point.

- (7) Target men should have their normal combat field equipment including steel helmet and rifle.

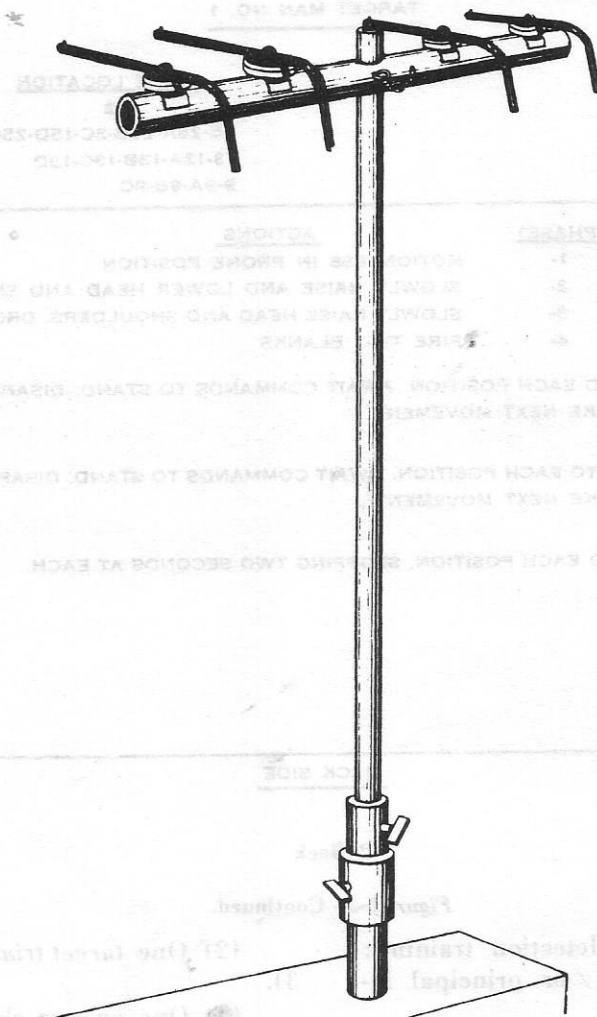


Figure 6-4. Aiming device.

### Section III. CONDUCT OF TRAINING

#### 6-7. Training Conditions

Demonstrators for target detection training wear combat field equipment to increase their value as "target men" simulating the movements and appearance of enemy soldiers.

#### 6-8. Fundamentals of Target Detection

Initially, target detection is taught in three distinct phases: first, how to locate a target; second, how to mark the location of the target; and third, how to determine the range to the target. Later, these phases are combined into practical exercises which test the overall target detection ability of the soldier.

*a. Locating Targets.* The ability to locate a combat target depends upon the observer's position, his skill in search and/or maintaining

observation over the area, and the type of indications made by the "target."

#### (1) Selection of a position.

(a) Depending upon the situation, the individual rifleman may or may not select his own position. In most defensive situations, the rifleman is told where to prepare his position. However, there are situations such as the attack and reorganization on the objective which require the individual to select his own position. Although target detection training courses prescribe conference and demonstrations on selection of positions, the instruction does not normally include practical application of this skill. Consequently, instructors must continuously refer to and emphasize the importance of the observer's position

when conducting practical exercises in other target detection techniques.

(b) A good position is one that offers maximum visibility of the area while affording cover and / or concealment. As used in this case, "position" is both the observer's location on the ground and the position of his body at that location.

(2) *Searching and maintaining observation of an area.*

(a) When a soldier moves into a new area, he must quickly check for enemy activity which may be of immediate danger to him. This is a very rapid search, lasting approximately 30 seconds and known as the self-preservation method of search. The search should be conducted by making quick glances at specific points throughout the area rather than just sweeping the eyes across the terrain in one continuous panoramic view. The reason for this is that the eyes are sensitive to slight movements occurring within the arc on which they are focused. This is commonly called "seeing out of the corner of the eye." However, **THE EYES MUST BE FOCUSED ON A SPECIFIC POINT IN ORDER TO HAVE THIS SENSITIVITY.**

(b) If the soldier fails to locate the enemy

during the initial search, he must then begin a systematic examination known as the 50-meter overlapping strip method of search (fig 6-5). Normally, the area nearest the soldier offers the greatest potential danger to him. Therefore, the search should begin with the terrain nearest the observer's position. Beginning at either flank, the soldier should systematically search the terrain to his front in a 180-degree arc, 50 meters in depth. After reaching the opposite flank, the soldier should search over a second 50-meter strip farther out but overlapping the first strip by approximately 10 meters. The soldier continues in this manner until the entire area has been searched.

(c) To again take advantage of his side vision, the soldier should focus his eyes on specific points as he searches from one flank to the other. He should make mental notes of prominent terrain features and areas that may offer cover and / or concealment to the enemy. In this way, he becomes familiar with the terrain as he searches it.

(d) After completing his detailed search, the soldier may be required to maintain observation of the area. To do this, he should use a method similar to his initial quick search of the area. That is, he

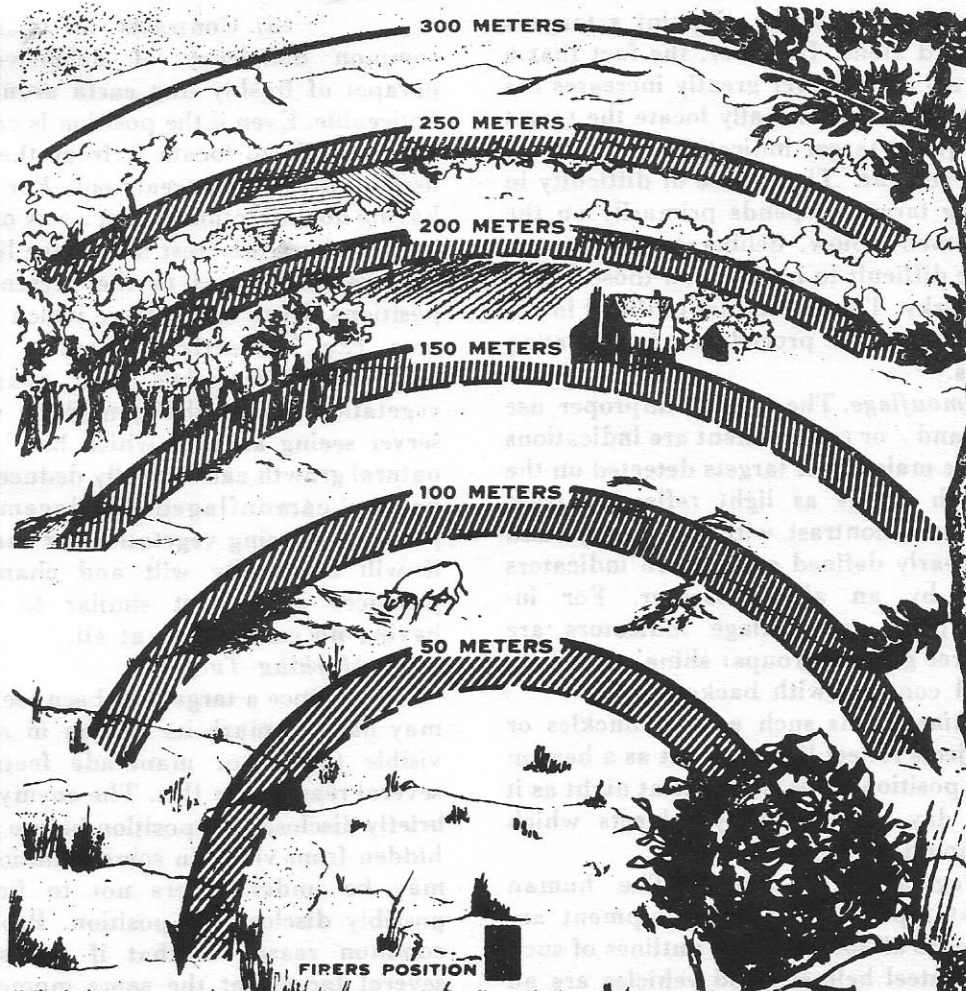


Figure 6-5. Searching the terrain in overlapping strips.

uses quick glances at various points throughout the entire area, focusing his eyes on specific features as he conducts this search. He should devise a set sequence of searching the area to insure complete coverage of all terrain. Since it is entirely possible that this quick search may fail to detect the initial movement of an enemy, the observer should periodically repeat a systematic search of the area as described in (b) above. This systematic search should also be conducted anytime the attention of the observer has been distracted from his area of responsibility.

(3) *Target indications.* A target indication is anything a soldier (friendly or enemy) does or fails to do that will reveal his position. Since these indications apply equally to both sides of the battlefield, a soldier must learn target indications from the standpoint of locating the enemy but, at the same time, preventing the enemy from using the same indications to locate him. These indications can be grouped into three general areas for instructional purposes: sound, movement, and improper camouflage.

(a) *Sound.* Targets indicated by sounds such as footsteps, coughing, or equipment noises provide only a direction and general location. Consequently, it is difficult to pinpoint a target's location by sound alone. However, the fact that a sound has alerted an observer greatly increases the possibility that he will eventually locate the target through subsequent target indications.

(b) *Movement.* The degree of difficulty in locating moving targets depends primarily on the speed of movement. Slow, deliberate movements are much more difficult to notice than those which are quick and jerky. The techniques outlined in (2) (a) above are the best procedures for locating moving targets.

(c) *Camouflage.* The lack or improper use of camouflage and / or concealment are indications which reveal the majority of targets detected on the battlefield. Such things as light reflecting from shiny surfaces or a contrast with the background presenting a clearly defined outline are indicators easily noticed by an alert observer. For instructional purposes, camouflage indicators are divided into three general groups: shine, regularity of outline, and contrast with background.

1. *Shine.* Items such as belt buckles or other metal objects reflect light and act as a beacon to the wearer's position. This is as true at night as it is during the day. Consequently, objects which reflect light should be camouflaged.

2. *Regularity of outline.* The human body and most types of military equipment are familiar outlines to all soldiers. The outlines of such things as rifles, steel helmets, and vehicles are all easily identified. The reliability of this indicator

depends upon the visibility and the experience of the observer. On a clear day most soldiers can easily identify enemy riflemen or equipment if a distinctive outline is presented. At night or during other periods of poor visibility, it is not only more difficult to see outlines, but inexperienced troops will frequently mistake stumps and rocks for enemy soldiers. This is an added reason for soldiers to become completely familiar with the terrain during periods of good visibility.

### 3. *Contrast with the background.*

(a) Suppose a soldier wearing a dark uniform moved into a position in front of a snowbank. The contrast between the white snow and the dark uniform would make him clearly visible. However, if he were wearing a white (or light colored) uniform, he would be more difficult to see. *Contrast with the background is among the most difficult of the target indicators for a soldier to avoid.* The reason for this is that during operations in which the soldier is moving, he is usually exposed to numerous types of colors of backgrounds. Since there is no one kind of personal camouflage which blends in all areas, a moving soldier must be continually aware of the surrounding terrain and vegetation.

(b) Contrasts in background are a common deficiency of defensive positions. A parapet of freshly dug earth around a foxhole is noticeable. Even if the position is camouflaged, it is still possible to locate it from the very materials used to provide concealment. For example, a hill having no vegetation except a row of equally spaced bushes along the crest may leave little doubt in an observer's mind as to the presence of defensive positions. Even camouflage which blends with the area can indirectly disclose a position. Since camouflage materials are usually cut from vegetation within the immediate vicinity, an observer seeing an area which has been stripped of natural growth can logically deduce the presence of nearby camouflaged emplacements. Another problem of using vegetation for camouflage is that it will eventually wilt and change color. This produces a contrast similar to those positions having no camouflage at all.

### b. *Marking Targets.*

(1) Once a target has been located, the soldier may have to mark its location in relation to some visible terrain or manmade feature. There are several reasons for this. The enemy may have only briefly disclosed his position before again becoming hidden from view. In some situations the rifleman may be under orders not to fire and thereby possibly disclose his position. Probably the most common reason is that if the soldier observes several targets at the same moment, he can obviously fire on only one of them at a time. Con-

sequently, he must mark the location of the others until he is ready to engage them.

(2) To mark the location of a target, the soldier uses an aiming point or a reference point. An aiming point is a feature directly on line between the soldier and the target. For example, suppose a soldier observes an enemy rifleman moving into a completely concealed position behind a bush. By selecting a point of aim on the bush, the soldier should hit the enemy rifleman even though he can't see him. However, suppose the enemy rifleman moves into a concealed position which has no distinguishable feature in front of it. The soldier must then select a nearby feature as a reference point and determine its distance and general direction from the target. Of the two, an aiming point is usually the more effective means of delivering accurate fire.

(3) The difficulty in using reference points or aiming points to mark targets moving from one location to another depends on the factors listed below.

(a) *Number of targets.* If several targets appear and disappear at approximately the same time, it is very difficult to note the point of disappearance of each.

(b) *Exposure time of target.* Usually, moving targets are exposed for only a short period of time. Thus, the observer must be alert to note the point of disappearance for all of the targets. In such situations the soldier should mark the location of as many targets as possible before engaging any of them. By so doing, he will know the location of several targets and can engage each of them in rapid succession.

(c) *Spacing of targets.* The greater the interval between targets, the more difficult it is to note the movements of each. When there is considerable distance between targets, the observer should accurately locate and mark the one nearest his position and note the general area of the others.

(d) *Good and poor aiming points.* Good aiming points are easily distinguishable in the surrounding terrain. Targets disappearing behind good aiming points such as manmade objects, large terrain features, and the like can be easily marked for future reference. Poor aiming points are not easily distinguishable within the surrounding terrain. Targets disappearing behind poor aiming points are difficult to mark accurately and are easily lost. If two targets offer about the same degree of danger to the soldier, but one disappears behind a good aiming point and the other behind a poor aiming point, the soldier should mark the location of the target behind the good aiming point and engage the other target first.

#### c. *Determining Range.*

(1) Simply stated, range determination is the process of finding the distance between two points. In most situations one of these points will be the observer's own position. The other point may be a target or prominent feature. **THE ABILITY TO ACCURATELY DETERMINE RANGE IS AN IMPORTANT SKILL NEEDED BY THE COMBAT RIFLEMAN TO ACCOMPLISH HIS MISSION.** Not only does the *accurate determination of range affect his combat marksmanship proficiency*, but it is also required in the reporting of information and the adjustment of artillery and mortar fire.

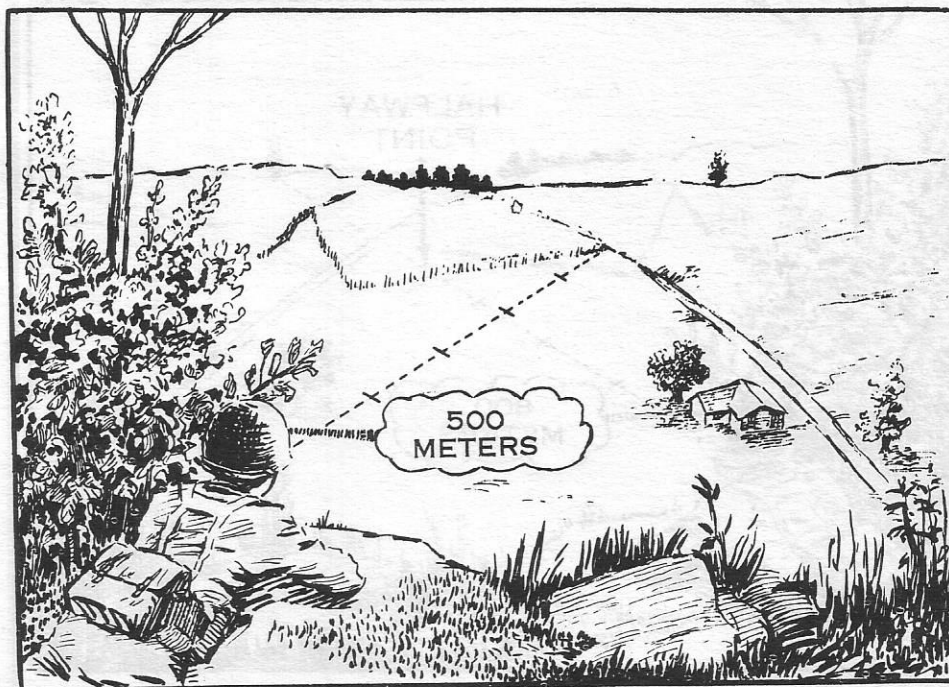


Figure 6-6. The 100-meter-unit-of-measure method; ranges up to 500 meters.

(2) There are a number of methods for determining range: measuring distances on maps, pacing the distance between two points, using an optical range finder, and firing a round at the point in question. However, the combat rifleman does not usually have a map, and he rarely has access to an optical range finder. Pacing the distance between two points is one method a soldier can use, provided the enemy is not in the vicinity. Firing a round to determine the range is usually not desirable since it immediately reveals the firer's presence and possibly his position. There are two methods of determining range which do not have the above disadvantages: the 100-meter-unit-of-measure method and the appearance-of-objects method.

(a) *100-meter-unit-of-measure method.*

1. To use this method, the soldier must be able to visualize a distance of 100 meters on the ground. For ranges up to 500 meters he determines the number of 100-meter increments between the two points (fig 6-6). Beyond 500 meters the soldier must select a point halfway to the target, determine the number of 100-meter increments to the halfway point, and then double it to find the range to the target (fig 6-7).

2. During training exercises the soldier must become familiar with the effect that sloping ground has on the appearance of a 100-meter increment. Ground which slopes upward gives the illusion of greater distance and observers have a tendency to underestimate a 100-meter increment. Conversely, ground which slopes downward gives the illusion of shorter distance. In this case, the observer's tendency is to overestimate.

3. Proficiency in the 100-meter-unit-of-

measure method requires constant practice. Throughout the training in this technique, comparisons should be made continually between the range as determined by the soldier and the actual range as determined by pacing or other more accurate means of measurement. The best training technique is to require the soldier to pace the range after he has visually determined it. In this way he discovers the actual range for himself, which makes a much greater impression than if he is simply told the correct range.

1. The greatest limitation of the 100-meter-unit-of-measure method is that its accuracy is directly related to the amount of terrain visible to the observer. This is particularly true at longer ranges. If a target appears at a range of 500 meters or more and the observer can see only a portion of the ground between himself and the target, it becomes very difficult to use the 100-meter-unit-of-measure method of range determination with any degree of accuracy.

(b) *Appearance-of-objects method.*

1. The appearance-of-objects method is a means of determining range by the size and other characteristic details of the object observed. This is a common method of determining distances and is used by most people in their everyday living. For example, a motorist attempting to pass another car must judge the distance of oncoming vehicles based on his knowledge of how vehicles appear at various distances. Of course, in this example, the motorist is not interested in precise distances, but only that he has sufficient road space to safely pass the car in front of him. Suppose, however, the motorist knows that at a distance of 1 mile an oncoming vehicle

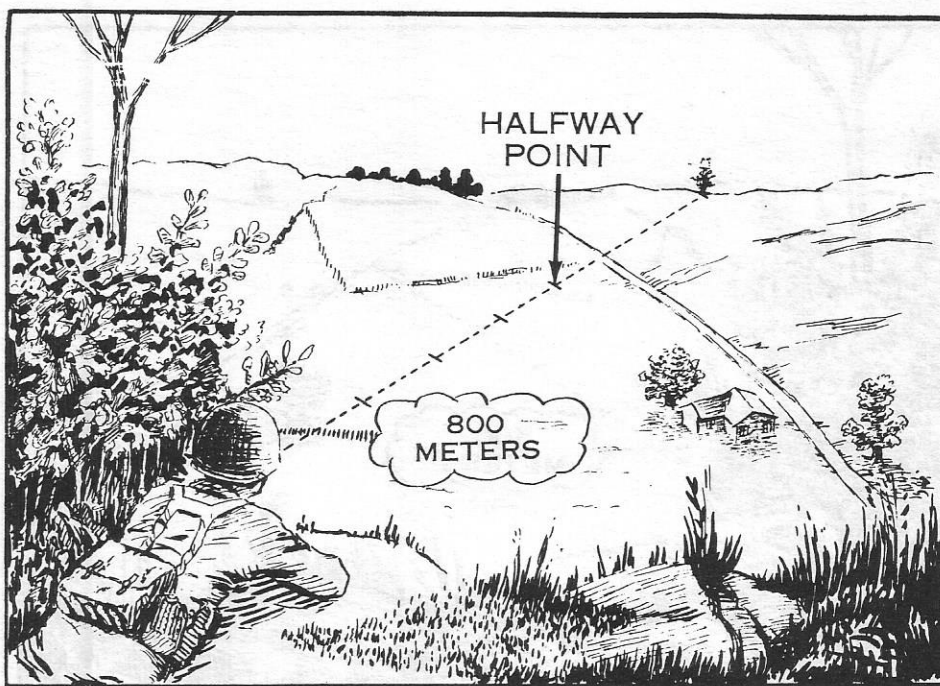


Figure 6-7. The 100-meter-unit-of-measure method; ranges over 500 meters.

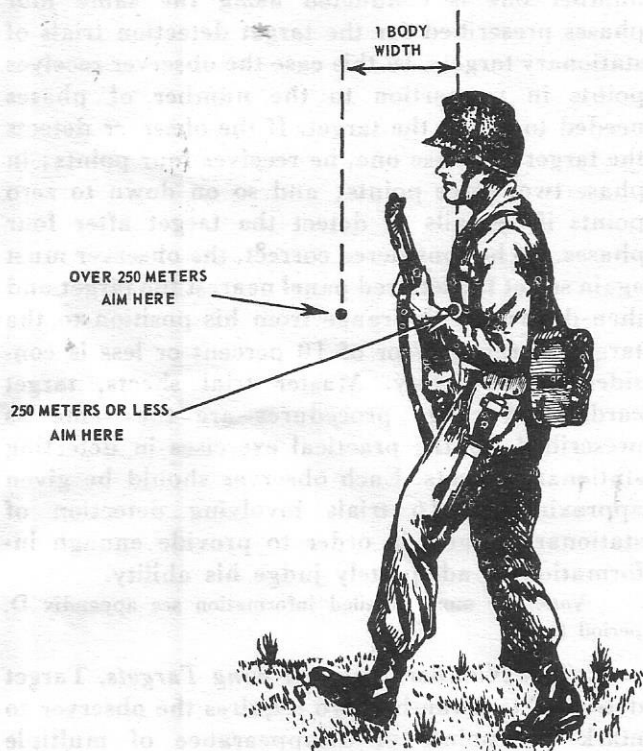


Figure 6-10. Target leads.

### 6-11. Conduct of Trials

Before a trial is conducted, observers should face away from the range area so target men can assume their positions unobserved. When the target men are in position, the observers are told to again face down range. There are four types of trials conducted during target detection training. These are stationary trials, moving trials, stationary sound trials, and multiple moving and sound trials.

*a. Stationary Target Trials.* Normally, there are four phases in each stationary trial. The first three phases last 30 seconds each. In *phase one* the target man remains motionless in a slightly exposed position that will enable him to observe the heads and chests of soldiers along the observation line. In the *second phase* the same target man slowly raises his head and shoulders until he can observe the soldiers on the observation line from the ground up. In *phase three* the same target man makes rapid, jerky movements continuously for 30 seconds. Finally, in *phase four*, the same target man fires one or two blank rounds toward the observation line (safety permitting). The command to begin a stationary target trial is **TRIAL ONE, PHASE ONE, OBSERVE**. If, during the first phase, the observer thinks he has located the target, he notes the letter of the panel nearest the target and determines the range from his position to the target. He enters this information on his answer sheet and an assistant instructor checks his solution. A range error of not more than 10 percent

is considered satisfactory. If the observer has selected the wrong panel or the error in range exceeds 10 percent, he should be told his answer is incorrect and to continue his observation. If the answer is correct, the observer should continue his observation of the area, recording the required information on his scoresheet for the subsequent phases. This procedure is followed throughout the four phases of stationary trials.

*Note.* For more detailed information see appendix D, periods 1 and 2.

#### *b. Moving Target Trials.*

(1) The target trial cards for moving trials must indicate the specific trials in which the target man will participate, the stake location at which he begins the trial, the stake location to which he must move, and finally, the type of movement and / or other specific actions to be performed by the target man. For example, the target trial card for target man No. 1 might indicate that he would participate in trials 1, 5, 6, and 8. In trial one the instructions state that he will perform four phases of a stationary target exercise. In trial 5 he is told to make five short rushes from stake 25 to stake 25C.

(2) In order to check the accuracy of observers, aiming devices should be used to mark the points of disappearance of multiple moving targets (fig 6-4). The observer simply alines the two sight knobs on the aiming device where he thinks the targets are located. Normally, two soldiers are assigned to an aiming device, one to act as the observer and the other to check the observer's work.

(3) To begin a moving trial, the command is **MOVING TARGET(S) STAND UP; AND DISAPPEAR, AND BEGIN YOUR MOVEMENTS**. On these commands the applicable target men reveal themselves to the observers, move back into their concealed positions, and begin the movements as directed on their target trial cards. During some exercises the target men may fire blank rounds after reaching a new location. Observers are allowed 30 seconds to mark the point(s) of disappearance with the aiming device. The instructor then commands, **TARGETS STAND UP, ALTERNATE OBSERVERS CHECK ALINEMENT**. The observer then checks the accuracy of his work. This procedure is continued until all of the trials have been conducted.

*Note.* For more detailed information see appendix D, periods 3, 4, and 6.

*c. Sound Target Trials.* Before the trials begin, the observers should draw a sector sketch of the area. All of the numbered panels should then be raised for sound target trials. Each target man occupies a concealed position in the vicinity of one of the numbered panels. The instructor then in-

forms the observer that a shot will be fired from one of the numbered panels. The observers must determine the panel location nearest the sound and record the information on their answer sheets. The commands to conduct the exercise are: TRIAL NUMBER (ONE): READY, AIM, FIRE. OBSERVERS RECORD YOUR ANSWERS. Should it be necessary to reposition target men for subsequent trials, the observers should face away from the range while the movement is taking place. In some trials two target men should fire simultaneously in order to demonstrate the difficulty in locating similar sounds coming from two directions at the same time.

*Note.* For more detailed information see appendix D, period 5.

*d. Multiple Moving and Sound Targets.* To conduct multiple moving and sound target exercises, eight target men are required (two four-man teams). Observers are divided into two groups with each pair having one aiming device. The command to begin the exercise is MOVING TARGETS STAND UP; DISAPPEAR AND BEGIN YOUR MOVEMENT. The moving target men expose themselves, resume their concealed positions, and begin their rushes forward. After making their move, some of the target men should fire one or more blank rounds. The observer uses the aiming device to mark the point of disappearance of as many moving targets as possible. Upon completing a trial, the instructor commands, TARGETS STAND UP, CHECK ALINEMENT. At this time the target men stand up and the alternate observer checks the accuracy of the observer's work. In the next trial the alternate observer becomes the observer and the observer becomes the alternate observer.

*Note.* For more detailed information see appendix D, period 7.

#### 6-12. Target Detection Tests

As the final stage of this target detection training, soldiers should be tested on their ability to detect and determine ranges to single stationary targets, marking the points of disappearance of single and multiple moving targets, and locating targets by sound.

### Section IV. CRACK AND THUMP TECHNIQUE

#### 6-13. Definitions

*a.* The term "crack" as used in this section refers to the sound of a projectile (exceeding the speed of sound) as it passes near the individual.

*b.* The term "thump" as used in this section refers to the sound caused by the expanding gases escaping into the atmosphere when a weapon is fired.

*a. Test Number One—Stationary Targets.* Test number one is conducted using the same four phases prescribed for the target detection trials of stationary targets. In this case the observer receives points in proportion to the number of phases needed to detect the target. If the observer detects the target in phase one, he receives four points; in phase two, three points; and so on down to zero points if he fails to detect the target after four phases. To be considered correct, the observer must again select the lettered panel nearest the target and then determine the range from his position to the target. A range error of 10 percent or less is considered satisfactory. Master trial sheets, target cards, and range procedures are the same as prescribed for the practical exercises in detecting stationary targets. Each observer should be given approximately 16 trials involving detection of stationary targets in order to provide enough information to adequately judge his ability.

*Note.* For more detailed information see appendix D, period 8.

*b. Test Number Two—Moving Targets.* Target detection test number two requires the observer to mark the points of disappearance of multiple moving targets. These tests are conducted in the same manner as the practical exercises for moving targets (para 6-11 *b*). After the target men have completed their movements, observers are allowed 30 seconds to mark the points of disappearance, using the aiming device. Assistant instructors check the results and award one point for each correctly marked target location.

*Note.* For more detailed information see appendix D, period 9.

*c. Test Number Three—Sound Targets.* Test number three involves sound targets only. The test is conducted in the same manner as practical exercises for locating sound targets (para 6-11 *c*). On command, one or two target men fire their rifles, and the observer attempts to locate the sound, using the numbered panels as reference points. One point is awarded for each correct answer.

*Note.* For more detailed information see appendix D, period 9.

#### 6-14. Objective and Standards

The objective of crack and thump target detection training is to insure that all soldiers can effectively determine the location of and the range to a concealed target engaging them with fire. Units must conduct sufficient training under varying conditions of weather and visibility to insure effective target detection under all climatic conditions.

appears to be 1 inch wide and 2 inches high. Then, any time he sees other oncoming vehicles which fit these dimensions he knows they are about 1 mile away. This same technique can be used by the rifleman to determine ranges on the battlefield. If he knows the characteristic size and detail of personnel and equipment at known ranges, then he can compare these characteristics to similar objects at unknown ranges. When the characteristics match, so then do the ranges.

2. To use the appearance-of-objects method with any degree of accuracy, the soldier must be thoroughly familiar with the characteristic details of objects as they appear at various ranges. For example, the soldier should study the appearance of a man when he is standing at a range of

100 meters. He fixes the man's appearance firmly in his mind, carefully noting details of size and the characteristics of uniform and equipment. Next, he studies the same man in a kneeling position and then in a prone position. By comparing the appearance of soldiers in these positions at known ranges from 100 to 500 meters, the soldier can establish a series of mental images which will help him determine range on unfamiliar terrain. Training should also be conducted in the appearance of other familiar objects such as weapons or vehicles. Because the successful use of this method depends upon visibility, anything which limits the visibility (such as weather, smoke, darkness) will also limit the effectiveness of this method (fig 6-8).

FACTORS TO BE CONSIDERED IN DETERMINING RANGE BY EYE.	OBJECTS APPEAR NEARER THAN THEY REALLY ARE.	OBJECTS APPEAR MORE DISTANT THAN THEY REALLY ARE.
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 THE TERRAIN OR POSITION OF THE OBSERVER.	WHEN LOOKING ACROSS A DEPRESSION, MOST OF WHICH IS HIDDEN FROM VIEW. WHEN LOOKING DOWNWARD FROM HIGH GROUND. WHEN LOOKING DOWN A STRAIGHT, OPEN ROAD OR ALONG A RAILROAD TRACK.	WHEN LOOKING ACROSS A DEPRESSION, ALL OF WHICH IS VISIBLE. WHEN LOOKING FROM LOW GROUND TOWARD HIGH GROUND. WHEN FIELD OF VISION IS NARROWLY CONFINED AS IN TWISTED STREETS, DRAWS, OR FOREST TRAILS.
LIGHT AND ATMOSPHERE.	WHEN LOOKING OVER UNIFORM SURFACES LIKE WATER, SNOW, DESERT, OR GRAIN FIELDS. IN BRIGHT LIGHT OR WHEN THE SUN IS SHINING FROM BEHIND THE OBSERVER. WHEN THE TARGET IS IN SHARP CONTRAST WITH THE BACKGROUND OR IS SILHOUETTED BY REASON OF SIZE, SHAPE, OR COLOR. WHEN SEEN IN THE CLEAR ATMOSPHERE OF HIGH ALTITUDES.	IN POOR LIGHT SUCH AS DAWN AND DUSK, IN RAIN, SNOW, OR FOG, OR WHEN THE SUN IS IN THE OBSERVER'S EYES. WHEN THE TARGET BLENDS INTO THE BACKGROUND OR TERRAIN.

Figure 6-8. Factors affecting the appearance of objects.

(c) *Proper conditions.* Under proper conditions, either the 100-meter-unit-of-measure or the appearance-of-objects method is an effective way of determining range. However, proper conditions do not always exist on the battlefield. Consequently, the soldier will be required to use a combination of methods. The terrain might limit the use of the 100-meter-unit-of-measure method and the visibility might limit the use of the appearance-of-objects method. For example, an observer may not be able to see all of the terrain out to the target; however, he may see enough to get a general idea of the distance, say, within 100 meters. A slight haze may obscure many of the target details; however, the observer should still be able to judge its size. Thus, by carefully considering the approximate ranges as determined by both methods, an experienced observer should arrive at a figure close to the true range.

(d) *Sector sketch.* A sector sketch is a rough schematic map of an observer's area of responsibility (fig 6-9). It shows the range and direction from the observer's position to easily

recognizable objects, terrain features, avenues of approach, and possible enemy positions. If practicable, the observer should pace the distance between his position and reference points in order to minimize range errors. By referring to this sketch, the observer can quickly find the range to a target appearing in the vicinity of a reference point.

### 6-9. Engaging Targets

Unless a rifleman has specific orders to the contrary, targets are engaged as soon as they are detected. In the case of enemy personnel, there are essentially three types of target situations which confront the rifleman: a stationary target, a slowly moving target, or a rapidly moving target.

a. A stationary target can be engaged using reference or aiming points. Since a stationary target normally is in a concealed position, engaging it is usually as much a problem of target detection as it is of marksmanship.

b. Although there are less detection problems involved in locating moving targets, the movement itself complicates the selection of an accurate

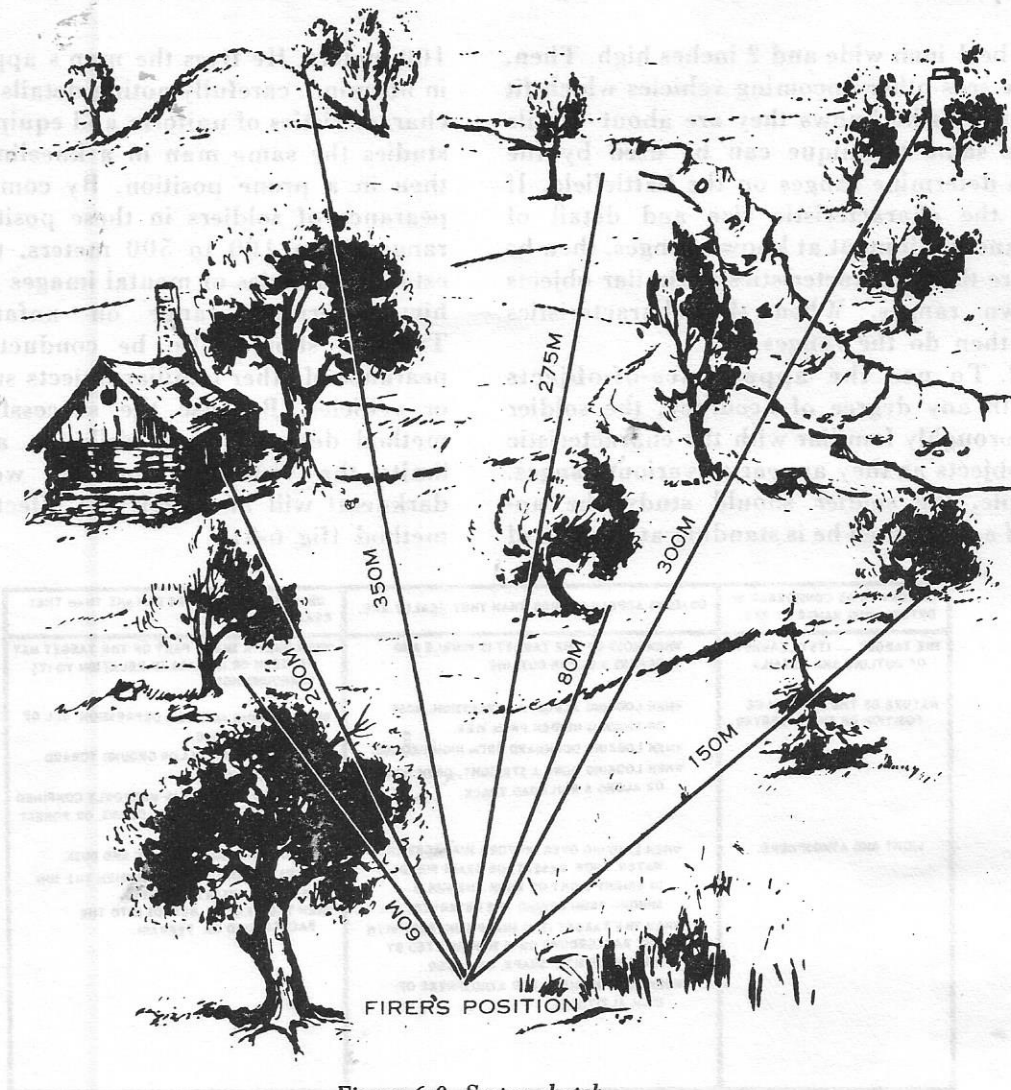


Figure 6-9. Sector sketch.

aiming point. Unless the enemy is completely unaware of the rifleman's presence, he normally will move by rushes from one covered or concealed position to another. While making the rush, the enemy soldier presents a rapidly moving target. However, for a brief moment as he begins and ends the rush, the movement is usually slow. The reason for this is that a few steps are needed to gather momentum to begin the rush; and, by the same token, a few steps are required to slow down to avoid overrunning the new position. It is at either of these two moments that a moving target is most vulnerable to aimed rifle fire.

c. A target moving directly toward the rifleman can be engaged in the same manner as a stationary target. However, to hit a target moving laterally across his front, the rifleman must aim far enough in advance of the target so the bullet will meet the target (fig 6-10). To hit a man walking laterally at ranges of 200 meters and less, the rifleman should aim at the forward edge of the body. For ranges beyond 200 meters the rifleman should select an aiming point approximating one body width in front of the target. If the target is running, these

target leads are doubled. That is, at ranges of less than 200 meters the rifleman aims approximately one body width in front of the target, and beyond 200 meters he aims approximately two body widths in front of the target.

*Note.* For targets moving either away from or toward the firer at an oblique angle the firer would take  $\frac{1}{2}$  the number of leads normally taken for the same target moving laterally.

#### 6-10. Trial Sheets

a. *Master Trial Sheets.* The master trial sheet (fig 6-2) shows the number of target men required for an exercise, the actions to be performed by the target men, the duration of the actions, and the panel or stake locations where the actions will occur. A master trial sheet should be made for each period of instruction.

b. *Target Trial Cards.* A target trial card (fig 6-3) is issued to each man who will act as an enemy "target" in the area of observation. These men, called "target men," use the target trial cards as a basis for their location and actions throughout an exercise. All actions performed by a target man, which lead to his eventual disclosure, are termed a "trial."

During training the soldier should be able to determine the location of the target within 10 meters, 60 percent of the time.

### 6-15. Training Facilities

*a. Range Terrain.* A crack and thump target detection range is a live firing range and should be constructed on terrain that slopes downward for approximately 500 meters and then slopes upward for an additional 200 meters. The natural vegetation should be removed only if it creates a safety hazard. A range layout is shown in figure 6-11.

### *b. Range Facilities.*

(1) *Communications.* A central switchboard should be located at the instructor/student location. The principal instructor must have a primary and secondary means of communicating with each rifle position, the safety officer, and the medical aid personnel.

(2) *Rifle cradles.* Each weapon must be placed in a secure weapons cradle, and when locked into position the weapon must have no horizontal or vertical movement.

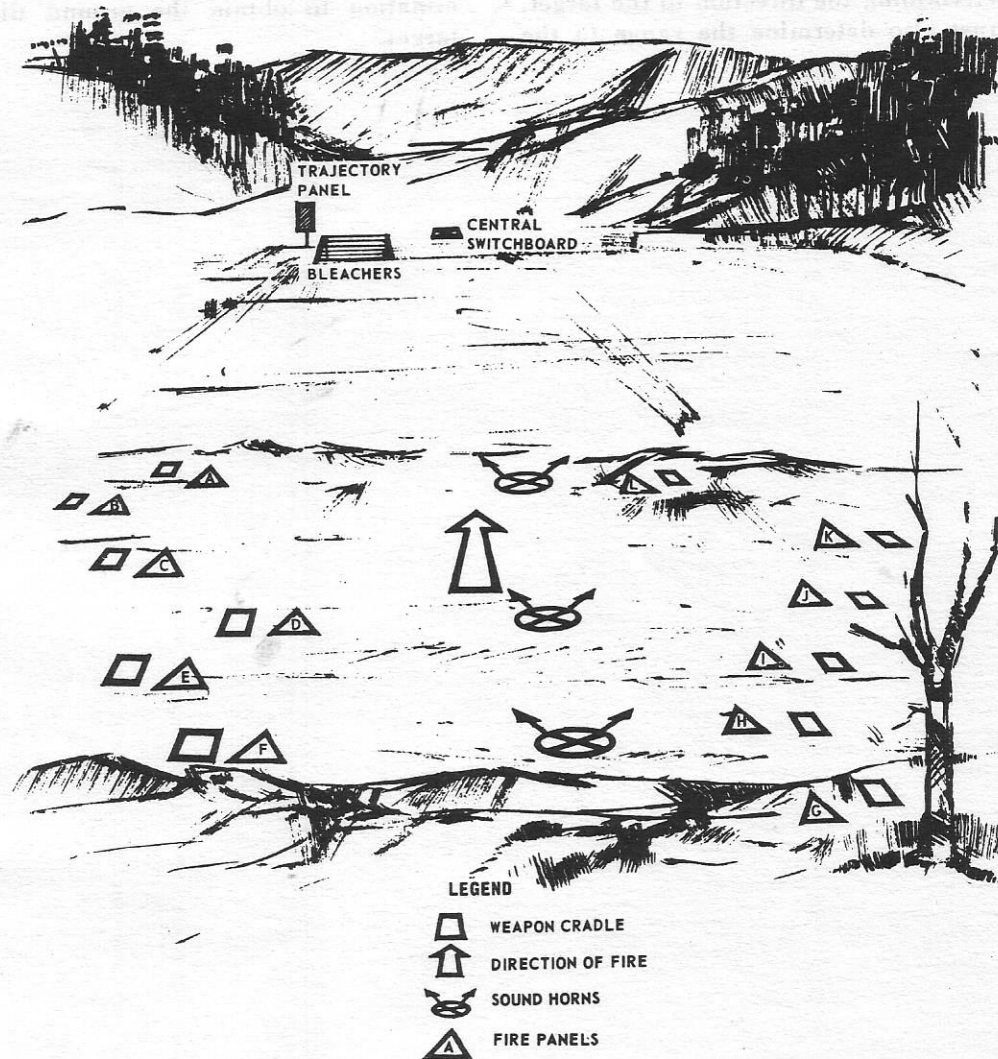


Figure 6-11. Crack and thump target detection range.

*c. Weapons Requirements.* A minimum of 12 rifle positions (cradles) should be prepared. When the weapon is secured in the cradle, the trajectory must not be less than 20 feet above the highest position at which a student will be located. Every weapon used for this instruction should be inspected by local ordnance to insure it does not exceed the authorized bore tolerance.

*d. Ammunition.* Only ammunition that has been

certified by the local ordnance technicians as being approved for overhead fire may be used.

### 6-16. Training Policies

*a. General.* The first series of trials conducted should be critiqued by the instructor to insure that each soldier thoroughly understands the principles of applying the crack and thump technique of locating a concealed target. Then as many trials as

time permits may be conducted to test the soldier's proficiency.

*b. Technique of Crack and Thump.* The soldier must understand that when an enemy soldier engages him with semiautomatic or automatic fire, the first sound that he will hear is the crack of the projectile as it passes nearby. The next sound that he will hear is the thump, or the compressed gasses escaping from the muzzle of the weapon into the atmosphere. Therefore, by mentally alining the crack with the thump, the soldier can determine the direction of his target (location of enemy firer).

*c. Crack and Thump Range Determination.* In addition to determining the direction to the target, the soldier must also determine the range to the

target. This is accomplished by using the rapid count method. The rapid count method is conducted by the soldier starting his count when he hears the crack and continues until he hears the thump. This count is conducted at a fast rate of five counts per second. If the soldier is engaged by automatic fire, he starts his count on the last crack and ends it on the last thump. The count obtained is multiplied by 100 and this gives him the range to the target in hundreds of meters. This method of range determination may be used in conjunction with the 100-meter-unit-of-measure method or the appearance-of-objects method of range determination to obtain the ground distance to the target.