FM 23-70

WAR DEPARTMENT

BASIC FIELD MANUAL

37-MM GUN, ANTITANK M3

November 28, 1942

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FM 23–70, 37-mm Gun, Antitank, M3, is published for the information and guidance of all concerned.

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(For explanation of symbols see FM 21–6.)

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rifled bore threaded to screw into the breech ring. There are two bearings, one near the breech end and one at mid-length, that support the barrel and aline it in the yokes of the sleigh. The front bearing has a flange at the rear and is threaded for a lock nut to secure the position. Keyways in

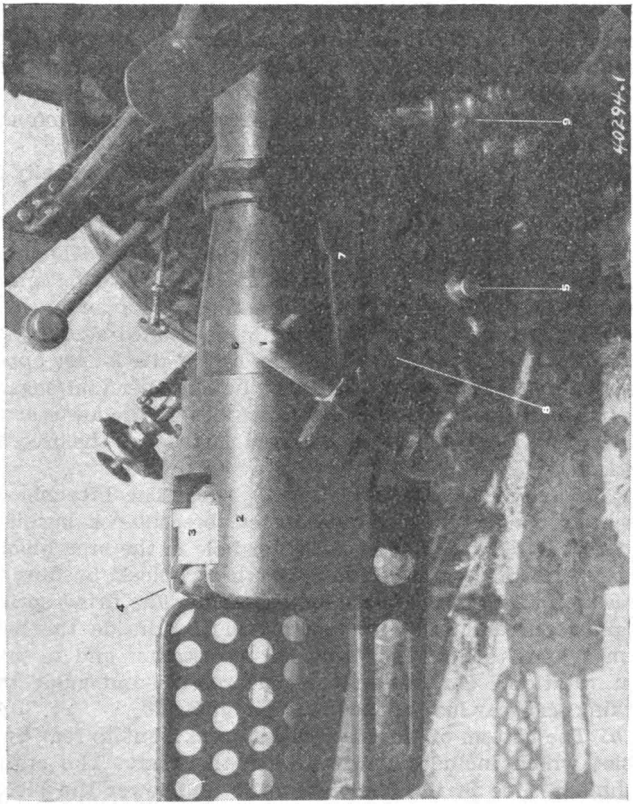


FIGURE 2.—37-mm antitank gun M3—right rear view.

1. Operating handle.
2. Breech ring.
3. Breechblock.
4. Cocking lever.
5. Traveling lock hook.
6. Barrel.
7. Sleigh.
8. Recoil cylinder.
9. Elevating mechanism.

the right and left rim of the flange engage keys in the yoke to prevent rotation of the barrel.

(*b*) The breech face of the barrel is recessed on each side of the bore to form extractor pockets.

(2) *Breech ring* (fig. 2).—(*a*) The breech ring is bored and threaded in front to receive the barrel. A locking key secures the breech ring to the barrel; lugs on the bottom of the breech ring are bored to provide a hole for attaching the breech ring to the recoil mechanism and the operating shaft. The rear hole is for the operating shaft.

(*b*) The operating handle latch catch is attached on the right side of the ring.

(*c*) The rear half of the breech ring is slotted vertically to receive the breechblock. The rear of the breech ring is formed to a U-shape to facilitate loading. The cylindrical studs inside the ring serve as extractor pivots. The hold through the lower left wall forms the trigger bearing and a counterbore inside provides a pocket for the tripper.

(3) *Extractors.*—The extractors are positioned against the side walls of the breech recess. The lips of the longer upper arms lie in pockets on each side of the chamber and engage the flange of the cartridge. Camming lugs on the lower arms project inward to engage the cammed surfaces of the breechblock.

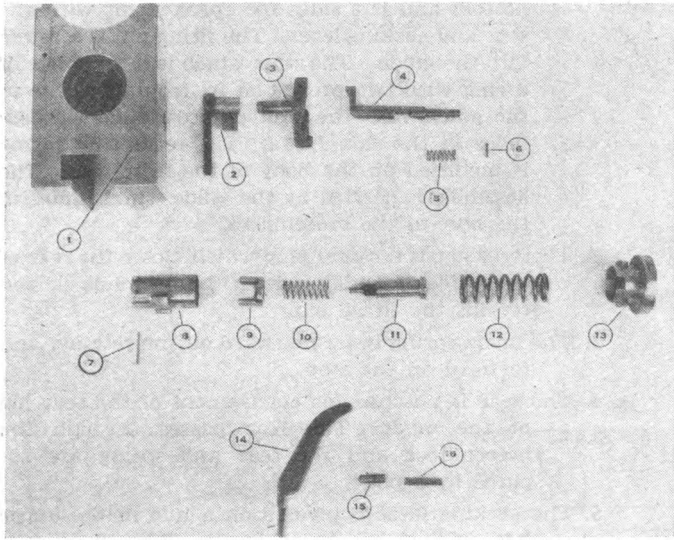
(4) *Breechblock assembly* (fig. 3).—(*a*) The breechblock assembly consists of the breechblock, breechblock bushing, and a straight pin. The large center hole in the breechblock houses the firing pin guide. The breechblock bushing is screwed into the forward end of the hole. The firing spring retainer pin and the interrupted shoulder inside the hole form a joint to hold the firing spring retainer and to prevent rotation. Grooves in the hole receive and guide the cocking and sear lugs of the firing pin guide.

(*b*) The bottom of the block is cut from front to rear by a T-slot which includes downward to the rear. The crank trunnions slide in the T-slot to raise and lower the block. The top of the block is U-shaped to guide the cartridge into the chamber. A hole with a slot for the sear arm is on the left side of the block; it houses and guides the sear and sear spring. The upper left side of the block is recessed to re-

ceive the cocking lever. A hole in the rear face of the recess houses the cocking lever plunger and spring.

(5) *Crank.*—The crank with splined hub is mounted on the shaft of the operating handle. Extending upward and rearward, it terminates in a pair of trunnions which project right and left. These trunnions engage and slide in the T-slot in the breechblock to raise and lower the block as the operating handle is rotated. Stop surfaces are provided to limit the throw of the upward and downward movement of the crank.

(6) *Operating handle assembly* (fig. 2).—The operating



1. Breechblock.
2. Trigger.
3. Tripper.
4. Sear.
5. Sear spring.
6. Sear pin.
7. Guide pin.
8. Guide.
9. Stop.
10. Retracting spring.
11. Firing pin.
12. Firing spring.
13. Retainer.
14. Cocking lever.
15. Cocking lever plunger.
16. Cocking lever plunger spring.

FIGURE 3.—Parts of breech mechanism.

handle assembly consists of the operating handle, latch, spring, and pin.

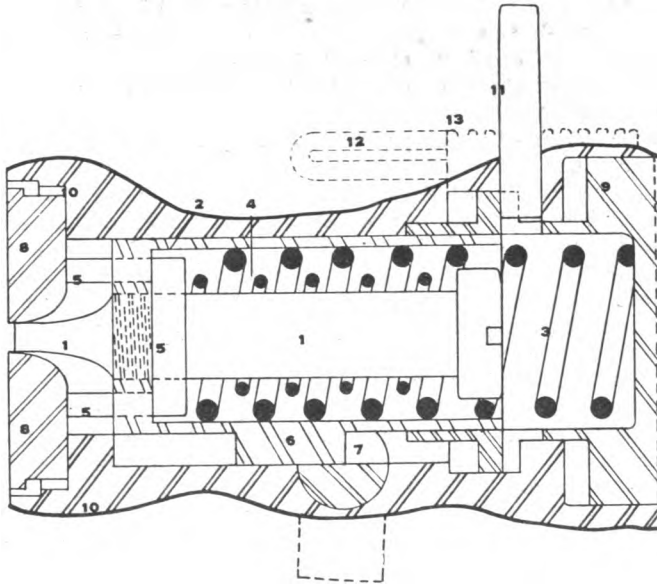
(7) *Firing mechanism* (fig. 4).—The firing mechanism consists of two groups of components which are assembled in the breechblock and the breech ring.

(*a*) The firing pin and guide assembly, retainer, firing spring, sear, sear spring and pin, and the cocking lever and cocking lever plunger and spring are supported in the breechblock.

1. The firing pin and guide assembly consists of firing pin, guide, stop, retracting spring, and guide pin. The guide is a cylindrical tube with lugs on the bottom and left sides for engagement with the sear and cocking lever. The firing pin is screwed into the guide. The stop, which is in the form of a ring with two prongs on its front face, fits in the guide with the prongs, protruding through holes in the closed end. The retracting spring is mounted on the body of the firing pin. The assembly is carried by the guide which slides in the bore of the breechblock.
2. The retainer is a round plug which closes the rear of the guide assembly hole in the breechblock and retains the firing pin.
3. The firing spring bears rearward on the retainer and forward on the stop.
4. The sear is notched for engagement of the sear lug of the guide. The sear passes through the breechblock and the sear and spring are secured by a pin.
5. The cocking lever is pivoted on a hub in the upper left side of the breechblock. The upper arm projects upward and rearward from the block and terminates above the rear wall of the breech ring. The lower arm extends forward and downward, terminating in a lug which engages and forces the guide rearward to cock the mechanism. A plunger and spring return the lever to position as the upper end is released.

(*b*) The tripper, trigger, trigger plunger, and spring are supported in the breech ring.

1. The tripper is within the breech ring. The operating arm of the tripper extends upward and carries a cam surface for actuating the sear. The lower arm of the tripper carries a horizontal safety button, which in the idle position of the trigger and tripper extends inward, below, and forward of the left lower edge of the breechblock. Lowering the block places this shoulder behind the button of the tripper and prevents actuation when the breech is open.



1. Firing pin.
2. Guide.
3. Firing spring.
4. Retracting spring.
5. Stop.
6. Sear lug.
7. Sear.
8. Breechblock bushing.
9. Retainer.
10. Breechblock.
11. Retainer pin.
12. Cocking lever plunger.
13. Cocking lever plunger spring.

FIGURE 4.—Firing mechanism.

2. The trigger consists of a tapered arm with a hollow cylindrical hub; the hub enters a hole in the breech ring. The trigger plunger and spring which are seated in the cheek of the breech ring retain the trigger in position and return it to a forward position after firing.

b. Recoil mechanism and sleigh (fig. 5).—(1) *Recoil mechanism.*—The recoil mechanism, which is of the hydrospring type, controls the recoil, counterrecoil, and buffer action of the gun. This mechanism is housed in the recoil cylinder. The cylinder is secured to the trunnions and the entire assembly is supported in the trunnion bearings of the top carriage. The recoil cylinder is provided with rails which guide the sleigh during the recoil and counterrecoil motion of the gun. The gun and piston rod of the recoil mechanism are connected by a coupler. The shoulder guard is bolted to the recoil cylinder.

(2) *Sleigh.*—The sleigh is a built-up steel construction and mounts the gun in yokes.

(3) *Trunnions.*—The trunnions are made in two halves, doweled to each side of the recoil cylinder and locked by a screw.

c. Top carriage, pintle pin, axle, wheels and segments, and trails (figs. 1 and 6).—(1) *Top carriage.*—(*a*) The top carriage forms the connection between the axle and recoil cylinder. The recoil cylinder and attached barrel pivot on the trunnion bearings which form the fulcrum for the movement of the gun in elevation. The top carriage in turn rotates horizontally on the pintle pin which permits movement of the gun in traverse. The pintle pin is housed in the support which is assembled to the axle.

(*b*) The traversing arc is secured to the support and meshes with the pinion of the traversing mechanism which is assembled to the top carriage. The support swivels on a pin within the range of equalizing movement provided for the axle.

(2) *Axle.*—(*a*) Each end of the axle is reinforced to mount the wheel spindles and wheel segments. The axle is assembled to the support by a pin seated in a bearing and is guided in movement by bearings.

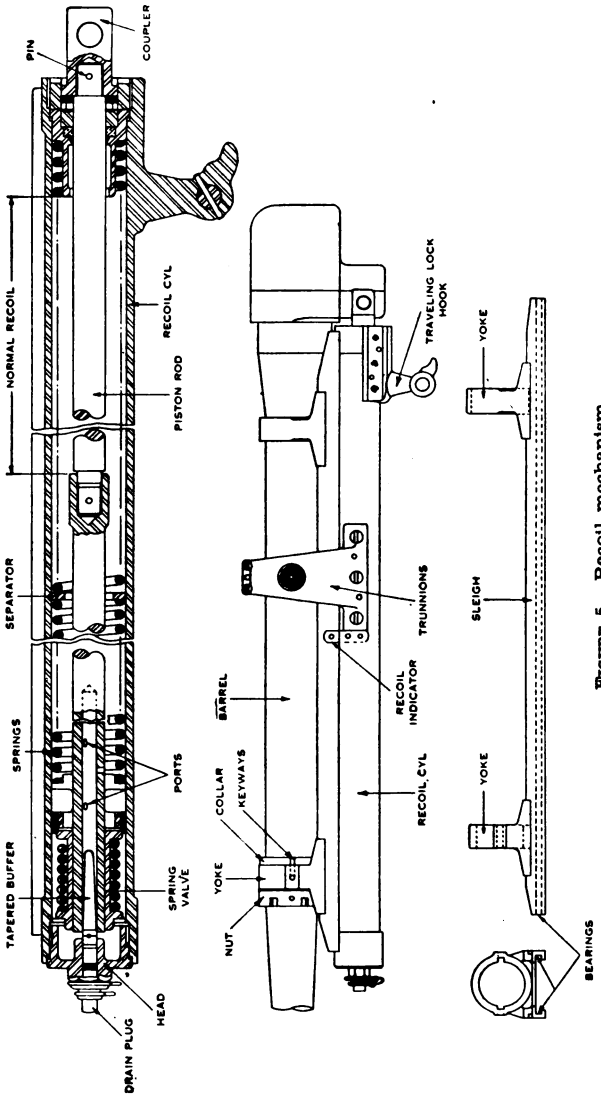
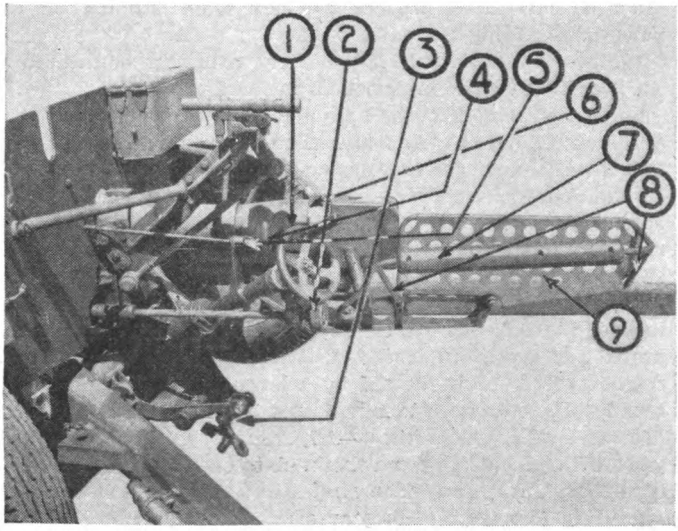


FIGURE 5.—Recoil mechanism.



1. Elevating handwheel.
2. Traversing knob.
3. Traveling lock.
4. Traversing release handle.
5. Traversing release lock.
6. Breech ring.
7. Shoulder traversing bar.
8. Shoulder traversing brackets.
9. Shoulder guard.

② 37-mm antitank gun M3 (carriage M4A1)—left rear view.

FIGURE 6.—Continued.

commercial disk wheel mounted on wheel spindles. The disk and rim are secured to the hub by studs. The wheels are interchangeable. The wheel segments are provided to raise the tires off the ground and thereby increase the stability of the carriage for firing. The segments swing on the axle and are locked in both travel and firing positions by a plunger. The plunger is actuated by a handle. 6.00 by 16 six-ply balloon tires with 6.00 by 16 inner tubes are mounted on the wheels. These tires have a load rating of 990 pounds at 32 pounds per square inch air pressure. As the weight carried by each tire is approximately 420 pounds, the optimum air pressure for these tires is established at 15 pounds per square inch. A relatively low pressure will prevent bouncing during towing and when firing from the wheels, but enough pressure

must be carried to prevent the tire from slipping on the wheel and pulling the valve stem.

(4) *Trails and trail lock.*—(*a*) The trails are connected to the support by a pin mounted on needle bearings.

(*b*) Lugs welded to the axle are engaged by the trail end and lock the axle to the trails when the latter are secured in travel position by means of the trail lock. With the trails spread, bumpers contact brackets on the support and the assembly is secured by pins. A section of the rammer is carried on each trail. The trail spades are at the rear end of each trail.

(*c*) The trail lock secures the trails for travel. When locked, the ball bracket on the left trail is secured in a cup bracket on the right trail and the assembly is secured by a toggle type clamp actuated by a lever. The lever is locked by a latch. The lunette is mounted on the right trail.

d. Elevating mechanism.—Adjustment of the gun in elevation is transmitted from the knob to the barrel by a system of shafts and gears. The shafts are all mounted on antifriction bearings and the gear case assembly is sealed by oil retainers.

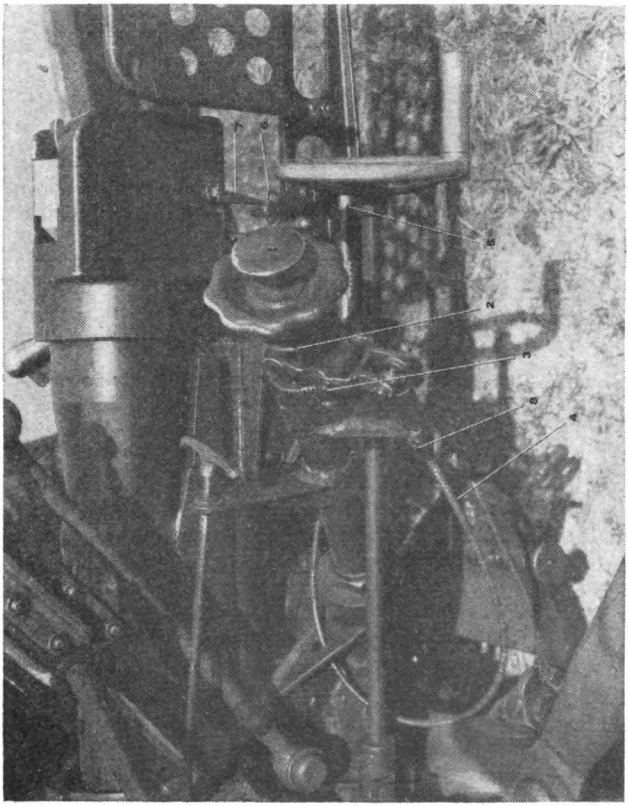
e. Traversing mechanism.—(1) Adjustment of the gun in traverse is normally made by pressure of the right shoulder and arm on the shoulder traversing bar. In order to traverse the gun by this method, the traversing release handle must be locked to the rear so that the handle is vertical. (See fig. 6②.)

(2) The gun is also equipped with a traversing knob which adjusts the gun in traverse by transmitting motions of the knob through the flexible joint shaft and the gears housed just in front of the shield to the traversing arc. In order to traverse the gun by this method, the traversing release handle must be in its forward position so that the handle is horizontal.

NOTE.—Gun carriage M4 is not equipped with the shoulder traversing bar, and adjustments in traverse on this carriage are normally made by the use of the traversing handwheel. A traversing release handle is provided which permits free movement of the gun in traverse, so that rapid changes in traverse may be made. However, no lock is provided to hold this release to the rear, and on release of the handle the action of a spring automatically reengages the gears and locks the gun to the traversing mechanism. (See fig. 6 ①.)

f. Firing lever.—A firing lever on the gun carriage M4A1 is attached to the shoulder guard bracket to permit actuation of the trigger by the right hand. (See fig. 7②.)

NOTE.—Gun carriage M4 is equipped with a trigger actuator mechanism assembled on a bracket on the elevating mechanism. This mechanism consists of a plunger, link, spring, cable, trigger lever plunger, and trigger lever. A handle on the trigger lever is provided for hand operation of the trigger. (See fig. 7①.)



① Trigger actuator.
FIGURE 7.

1. Plunger.
2. Disk.
3. Link.
4. Cable.
5. Trigger lever plunger.
6. Trigger lever.
7. Trigger.
8. Set screw.

is traversed. A parallelogram linkage between the gun trunnion and the telescope mount transmits the elevating motion to the telescope as the gun is elevated or depressed. Further description of parts and adjustment of the mount is given in paragraph 27.

SECTION II

DISASSEMBLING, ASSEMBLING, AND OPERATION OF THE PIECE

■ 4. GENERAL.—*a.* Disassembling may be considered under two general heads: removal of groups to the extent required for ordinary cleaning and minor repairs, and detailed disassembling involving removal of all components from each group.

b. The procedure given in paragraph 5 includes that part of the complete disassembly and assembly of the gun and the groups essential for normal care, cleaning, adjustment, and repair to be accomplished by the using services.

■ 5. DISASSEMBLING AND ASSEMBLING.—*a. To remove firing pin and guide assembly from breechblock (assembled in gun).*—Close breech and actuate trigger. Press in on retainer and rotate it one-quarter turn. Release pressure. The retainer may now be removed from its seat. The firing spring and firing pin and guide assembly may now be ejected by throwing cocking lever forward.

b. To replace firing pin and guide assembly in breechblock.—Insert firing pin and guide assembly into firing pin guide assembly opening in rear of breechblock with firing pin inserted point first and lugs on guide assembly in alinement with grooves in the firing pin hole of the breechblock. Pull and hold trigger to the rear, push firing pin and guide assembly forward until it contacts the bushing, then release trigger. Place firing spring into guide. Place cupped end of retainer over rear end of spring and insert retainer into guide assembly hole of breechblock with groove horizontal. Press retainer forward about ⅛ inch below surface of block and rotate it until the groove is in a vertical position, then release the pressure.

f. To move gun in elevation.—To depress barrel, turn elevating knob (handwheel) to the right. To elevate barrel, turn elevating knob (handwheel) to the left.

g. To adjust gun in traverse.—Move body or turn traversing handwheel in direction desired to move barrel.

SECTION III

CARE AND CLEANING

■ 7. GENERAL.—*a.* This section contains information and instructions pertaining to the care and maintenance of the 37-mm antitank gun, M3. Laxity in proper care and maintenance results in deterioration and reduction of accuracy and dependability of the gun. Detailed information pertaining to cleaning, preserving, and lubricating materials and their authorized use will be found in TM 9–850. The use of materials other than those authorized for the purposes mentioned is strictly forbidden.

b. Operations not covered herein are the functions of the ordnance maintenance company. Certain classes of repairs, adjustments, and replacements of parts may be made under the direction of an officer or trained armorer. Parts which may be drawn for replacement purposes are indicated in SNL A–44 by the symbol %. Unless specifically prohibited, such parts may be installed under the direction of an officer or by a trained armorer.

c. In general, the using unit is charged with preventive maintenance; that is, with routine cleaning, lubricating, and preserving. Specific duties are assigned to individuals and a strict accountability for the proper performance of such duties is enforced. Even under the most adverse conditions, the gun squad is required to keep the matériel clean and well lubricated.

d. A complete record of lubrication servicing will be kept for the matériel. If lubrication instructions are closely followed, proper lubricants used, and satisfactory results are not obtained, a report will be made to the ordnance officer responsible for the maintenance of the matériel.

e. Assignment of specific duties to the members of the

(7) *Oilcan points.*—Lubricate traversing mechanism universal joints, trail lock mechanism, clevises, hinges, and trigger mechanism with OE daily.

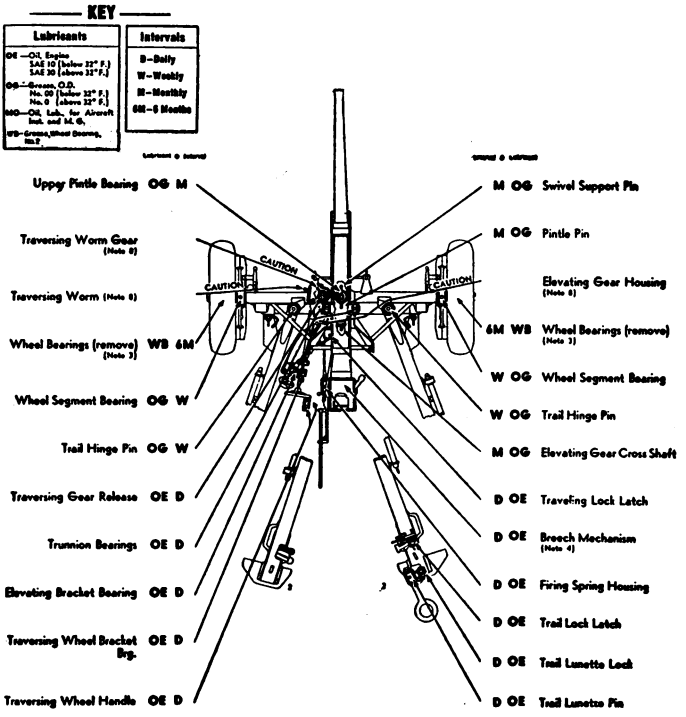


FIGURE 8.—Lubrication chart, carriage and 37-mm antitank guns, M3 and M4.

(8) *Points to be lubricated by ordnance maintenance personnel at time of ordnance inspection.*—Elevating and traversing gear mechanism.

e. Wheel bearings.—To clean and pack wheel bearings properly, they must be removed from the hub. Follow the procedure below:

(1) Remove the bearings from the hub and wash them in dry-cleaning solvent until all the old grease is removed.

SECTION IV

MECHANICAL FUNCTIONING

■ 17. OPENING THE BREECH.—Movement of the operating handle to the rear is transmitted through the operating shaft to the crank. The trunnions on the crank move downward to the rear in the inclined T-slot in the breechblock and slide the block downward in the breech recess. The motion is stopped by impact of the stop surface of the crank hub on the shoulders of the breech ring lugs.

■ 18. EXTRACTION.—As the breechblock nears its lowermost position, the cam surfaces on its forward shoulders contact the round cams on the lower ends of the two extractors. This imparts a sharp rearward throw to the extractor lips on the upper arms of the extractors. Since the extractor lips are behind the cartridge rim, the case is extracted from the chamber and ejected clear of the breech end of the gun. The breech is then open and ready for loading.

■ 19. COCKING.—As the cocking lever is carried down with the breechblock, the projecting upper arm of the cocking lever is cammed forward into the breech recess by the cam surface inside the upper rear wall of the recess. The lower arm is thus rotated rearward to engage the cocking lug on the firing pin guide and to move the guide toward the rear. This movement of the firing pin guide compresses the firing spring sufficiently to permit engagement of the sear. As the sear lug on the firing pin guide moves to the rear, the tapered rear end of the lug cams the sear to the right so that the lug may pass the sear. The sear is then moved to the left by the sear spring to engage the sear lug and hold the guide and firing pin cocked.

■ 20. CLOSING THE BREECH.—A round is inserted into the gun chamber through the breech opening. The cartridge is positioned by the engagement of its rim with the lips of the extractors. The breech is then closed by rotating the handle forward into the latched position. The forward movement of the operating handle, through the action of the crank, raises the breechblock to the closed position. The upward

(*b*) Dirty chamber.

(*c*) Dirty ammunition.

(*d*) Sluggish movement of operating handle to the rear.

(2) *Action to remedy.*—(a) Close the breech and open smartly.

(*b*) If this is not effective, pry the cartridge case from the chamber by means of a screw driver or similar tool. If the case cannot be extracted by this means, remove it with the rammer staff by inserting the staff through the bore from the muzzle.

(*c*) Replace extractors if necessary.

(*d*) Clean the chamber thoroughly.

d. Failure to feed.—(1) *Causes.*

(*a*) Defective ammunition (bulged round).

(*b*) Obstruction or dirt in the chamber.

(2) *Action to remedy.*—(*a*) Inspect ammunition.

(*b*) If ammunition is not defective, clean the chamber thoroughly.

e. When the stoppage cannot be corrected by the application of "immediate action" and other remedial action described above, or when no simple remedy can be applied, the gun should be turned over to competent ordnance personnel for examination and repair.

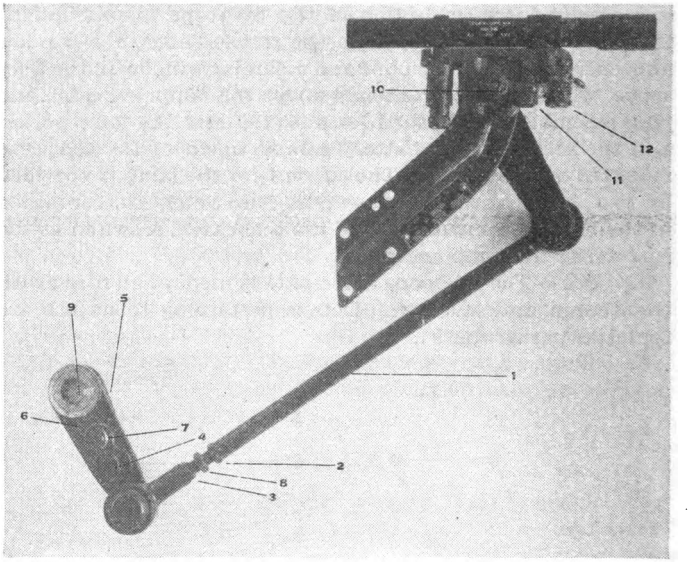
SECTION VI

SIGHTING AND FIRE-CONTROL EQUIPMENT

■ 27. SIGHTING EQUIPMENT.—The sighting equipment consists of the telescope M6, the telescope mount M19, and for training purposes, the aiming device (device, aim checking, M1), the details of which are as follows:

a. Telescope M6.—(1) *Description.*—(*a*) The telescope M6 is a straight tube telescope with no magnification. It has an illuminated reticle which is graduated for various ranges and leads as shown in figure 9. The geometric and optical axis of the reticle, corresponding to the zero range, is marked by the upper dot just inside the 5-mil circle. The dot at the center of this circle indicates a range of 600 yards; two dots, representing 10-mil and 20-mil leads, are placed on each side of the center and are connected by short lines. The 1,200-

(2) *Use.*—The mount is rigidly fastened to the left side of the top carriage of the gun carriage, and traversing the gun will therefore move the telescope in the same plane and direction. A parallelogram linkage between the gun carriage trunnion and the telescope holder transmits the elevating motion to the telescope as the gun is elevated or depressed.



1. Link tube.
2. Locking nut.
3. Locking nut.
4. Clamping bolt.
5. Gun trunnion arm.
6. Lower link tube arm.
7. Eccentric.
8. Differential screw.
9. Trunnion.
10. Shaft.
11. Clamping bolt.
12. Eccentric.

FIGURE 10.—Telescope M6 and telescope mount M19.

c. *Aiming device (device, aim checking, M1).*—The aiming device (device, aim checking, M1) is adapted to fit over the rear end of the telescope tube. It reflects images in the field of the telescope at an angle so that the correctness of the gunner's aim may be checked by a coach without interfering with the line of sight.

■ 28. LINKAGE ADJUSTMENT.—*a. General.*—When the linkage system is correctly adjusted, the gun barrel and the sight holder move through the same vertical angle.

b. Test of linkage adjustment.—To test for correctness of linkage adjustment proceed as follows:

(1) Place a gunner's quadrant (or similar leveling device) on left upper surface of breech ring and level gun barrel.

(2) Place quadrant on sight holder, being careful not to move the position of the gun barrel, and read elevation of sight holder.

(3) Fully elevate gun barrel and read elevation of both sight holder and gun barrel.

(4) When the linkage system is correctly adjusted, the vertical angle through which the barrel moves will equal the vertical angle through which the sight holder moves. The tolerance permitted is a deviation of 1 mil.

c. Indications of maladjustment.—(1) The linkage system when properly adjusted forms a parallelogram. The parallelogram is formed by adjusting the length of the link tube. The remaining three sides of the linkage system are fixed. If the linkage system is out of adjustment the link tube may be either too short or too long.

(2) If, when testing the correctness of the linkage adjustment as in *b* above, the sight holder moves through a greater angle than the gun barrel, between the horizontal and the fully elevated position, it is an indication that the link tube is too short. Conversely, if the sight holder moves through a smaller vertical angle than the gun barrel, between the horizontal and the fully elevated position, it is an indication that the link tube is too long.

d. Examples.—The following examples illustrate the foregoing statements:

	Gun level (mils)	Maximum elevation (mils)	Total angle (mils)	Error
Gun	0	178	178	
Sightholder	−4	174	178	None.
Gun	0	178	178	Link tube too short.
Sightholder	−4	180	184	
Gun	0	178	178	Link tube too long.
Sightholder	−4	170	174	

link tube arm and turn eccentric (7) until center of dot is alined with horizontal line of upper left figure on testing target, then tighten bolt (4). Looking through telescope again, ascertain whether or not upper dot (0-range) on the reticle is in line with vertical *C'–D'* (fig. 12) line of upper left figure on testing target. If it is not, loosen clamping bolt (11) (fig. 10) and turn eccentric (12) until center of dot is alined with vertical line of upper left figure on the target, then tighten clamping bolt (11).

(*i*) Recheck alinement of testing target and bore by again bore sighting. This is done to make sure that gun and target have not been thrown out of alinement during process of alining telescope. If out of alinement, reset testing target as described in (*f*) and (*g*) above. Then make a final check on alinement of sight and testing target, adjusting telescope as described in (*h*) above, if necessary.

NOTE.—Telescopes and telescope mounts are not interchangeable without adjustment. Each different telescope and telescope mount used with the same gun must be adjusted by bore sighting with that particular gun and mount.

b. Infinity method (or alternate method).—Since neither gunner's quadrant nor clinometer will be issued with the sighting equipment for this gun, occasions may arise, especially in the field, whereby neither of these instruments will be available. The following simplified method may be used where no special equipment is available. The use of testing target, target frame, plumb bob, and gunner's quadrant or clinometer is eliminated, and the use of bore sights is optional.

(1) *Purpose.*—The purpose of the bore sight adjustment is to collimate (parallel) the line of sight (0-range) passing through the telescope with the axis of the bore of the gun. The linkage adjustment must not be disturbed while making this adjustment.

(2) *Procedure.*

(*a*) Place telescope sight M6 on telescope mount M19.

(*b*) Select any well-defined object at a range of 1,500 yards or at a greater range from the gun. Aline the axis of the bore accurately on the selected object by bore sighting. The bore sights, as issued, may be used if available, or bore-

sighting may be done without the aid of bore sights. In the latter case, remove the firing pin and guide assembly, sight through the firing pin hole in the breechblock bushing, and place strings across the bore sighting marks on the muzzle to center accurately the object sighted in the bore.

(*c*) When the tube is accurately alined on the distant object, ascertain whether or not the upper dot (0-range) on the telescope sight reticle is in line with the object selected. If so, the sight is collimated. If not, the position of the telescope must be adjusted by means of the two eccentrics (cams) specifically provided for this purpose.

(*d*) To adjust the position of the telescope for elevation, loosen clamping bolt (4) (fig. 10) on link tube arm (6), being careful not to change the laying of the gun, and by means of the eccentric (7) on link tube arm (6), raise or lower the line of sight until the upper dot (0-range) coincides with the distant object or with a horizontal line through the distant object. Tighten clamping bolt.

(*e*) To adjust the position of the telescope for deflection, loosen clamping bolt (11), and by means of the eccentric (12) under the telescope bracket adapter, rotate telescope and holder to the right or left until the upper dot (0-range) is accurately alined on the selected object. Tighten clamping bolt.

(*f*) Recheck all adjustments to insure accuracy. The axis of the bore and the zero line of sight through the telescope are now parallel. The amount that the telescope is offset from the axis of the bore (approximately 9 by 11 inches) has no appreciable effect upon the parallelism if the distant object selected for the adjustment is at a range greater than the maximum usable range of the gun.

■ 30. FIRE CONTROL EQUIPMENT.—*a. Binocular M3* (fig. 13).—(1) This is the standard binocular field glass used for observation and approximate measurement of small angles. It has six-power magnification and an objective pupil diameter of 30 mm. The field glass type EE is a field glass with characteristics basically the same as those of the binocular M3. (For reticle pattern, type EE, see fig. 15.)

(2) Binocular M3 consists of two compact prismatic telescopes pivoted about a hinge which provides adjustment for interpupillary distances varying between 56 and 74 mm. The left telescope contains the reticle.

(3) The reticle (fig. 14) has a horizontal mil scale, graduated at 10-mil intervals and numbered from 50 mils right to 50 mils left of the center of the field of view. Above the horizontal line are two series of reference marks; these marks are spaced 5 mils apart for convenience in observing fire. The vertical scale, graduated in hundreds of yards, with the 1,800-yard indication in line with the horizontal mil scale, is used by infantry organizations in indirect firing at long ranges and at indistinct field targets.

(4) The neck strap, secured to the strap loops of the instrument, protects the instrument from accidental falls and keeps it within easy reach. A russet leather carrying case, with loop and shoulder strap, protects the instrument when it is not in use. The instrument is carried in the case with the objective end up. When replacing the binocular in the case the diopter scale setting need not be disturbed, but the hinge may need adjusting.

b. Operation.—(1) *Setting interpupillary distances.*—To set the binocular so that the eyepieces are the same distance apart as the observer's eyes, first look through the glass at some fairly distant object, then open or close the glasses at the hinge until the field of view ceases to be separate or overlapping circles and appears to be one sharply defined circle.

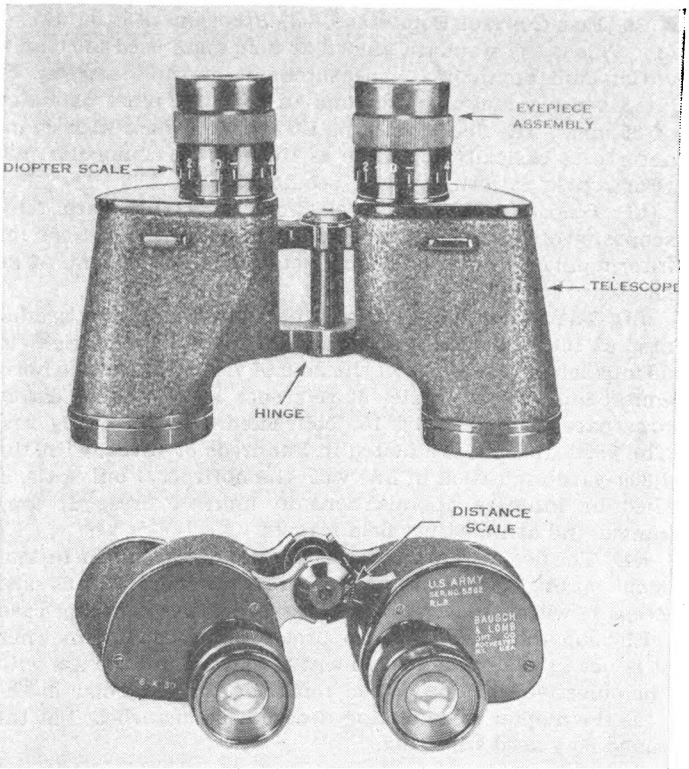


FIGURE 13.—Binocular M3.

(2) *Focusing.*—Look through the eyepieces, both eyes open, at a fairly distant object. Place a hand over the front of one telescope and screw the focusing nut of the other in or out until the object is sharply defined. Repeat for the other eye. Then note the diopter scale reading on each eyepiece; a similar setting of the eyepieces of any other field glass will accommodate the observer's eyes. Avoid touching the objective lens.

(*b*) *To measure an azimuth.*

1. Raise eyepiece and cover vertically and lower needle dial.
2. Grasp ring between thumb and forefinger, allowing base of compass to rest on the back of the fingers.
3. Hold compass horizontally in front of the face, hand against the chin, and aperture of eyepiece immediately in front of one eye with the other eye closed.
4. Turn about carefully until the object whose azimuth is desired is bisected by etched line on cover as viewed through slit of eyepiece standard. Allow needle to come to rest then read azimuth from outer circle as viewed through the aperture. If greater stability of the needle is desired, the compass should be supported on a solid platform or used in a prone position on the ground.

(*c*) *To measure an azimuth at night.*

1. Use radiolite marker on movable index ring to lay off azimuth on circle about the outside of compass case. The clamp controls the movable ring.
2. Hold compass horizontally and carefully turn about until needle points to market on movable ring. The azimuth is now indicated by radiolite marker along line of sight of the instrument.

(*d*) *To determine azimuth of position of observer from a given point (target).*—Read azimuth of given point as described in (3)(*b*) above. Since position of observer with respect to given point is on back azimuth, determine back azimuth, that is, if the reading is less than 3,200 mils, add 3,200 to it; if over 3,200 mils, subtract 3,200 mils from it.

(*e*) *To lay off a line of a given azimuth from position of observer.*—Turn compass until dial index indicates given azimuth. Direct placing of an aiming stake on line of sighting.

(*f*) *Given an azimuth to a point, to find a position from which the point is on that azimuth.*—The observer places

ity of the company commander. It must also contain date of issuance of the matériel, by whom issued, and place where issued. If a new gun is installed on the carriage, all data recorded in the old book with reference to sights, carriage, etc., must be copied into the new gun book before the old book is relinquished.

NOTE.—Record of assignment data must be removed and destroyed prior to entering combat.

c. Brush, bore, 37-mm M8.—The bore brush is used for cleaning and also for applying grease in the bore of the gun. The brush assembly consists of a "Steelgript" coiled brush fitted on a male coupler and held securely by a nut. When needed, the brush is affixed to the cleaning staff.

d. Cable and plug.—The cable and plug consists of a 2-foot cable with a socket plug at each end. One plug is attached to the socket of the tool case in which batteries are carried, while the other is slipped into a socket which is part of the telescope mount. This socket holds a small lamp which illuminates the sights of the telescope.

e. Case, telescope.—The case is of leather construction and fitted with straps and buckles for fastening to the upper left-hand corner of the carriage shield. The case protects the telescope when not in use or when traveling.

f. Cover, gun, M87.—The gun cover, M87, is an overall cover for the 37-mm gun M3 and gun carriage M4. It is used for the protection of the matériel when it is being transported.

g. Gage, tire pressure.—This is a commercial type of tire-pressure gage, calibrated from 10 to 50 pounds in 1-pound units. It is used to check tire pressure.

h. Staff, cleaning, M2A1.—The cleaning staff consists of two staff sections coupled together. The front section is used as a rammer and also is threaded to receive the bore brush. The middle of the rear section is reinforced by a brass sleeve so that it may be used in conjunction with the shoulder harness for manual draft of the matériel.

i. Towing harness.—The towing harness consists of a canvas shoulder strap and a towrope. The rope is attached to the shoulder strap. An iron hook is attached to the free end of the rope. For towing purposes, the hooks are engaged as prescribed in paragraph 64.

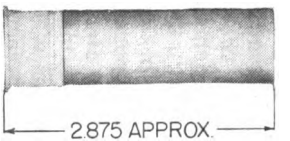


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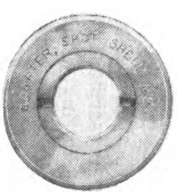
FIGURE 21.—Shell, shotgun, 10-gage, blank (8 grains black powder with dry felt wads).



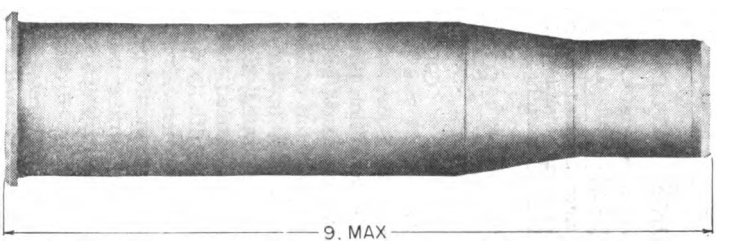


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FIGURE 22.—Adapter, shot shell (10-gage) M2.

duties of Nos. 1 and 2. This is accomplished by rotating the members during drill.

■ 53. GENERAL RULES.—*a.* In general, drill will be executed and commands and signals given as described in FM 22–5. Particular attention should be given to drill for motor units, extended order, and signals. In executing the drills described herein, the individual soldier will conduct himself in accordance with those provisions of FM 22–5 pertaining to the soldier without arms and the soldier with arms so far as reasonably applicable.

b. Except when forming the squad at the command FALL IN, all training is executed at ease.

c. All movement in assuming positions other than the movement of the gun by hand will be executed at a run. Speed of execution should be gradually developed as individual and squad proficiency is attained. During the early stages of instruction, movements are carefully explained and demonstrated. The individuals will then be required to execute the movements slowly and carefully. The tempo of the drill is gradually increased until all positions can be assumed at a run and all movements executed rapidly without confusion or lost motion.

d. When not specifically prescribed, the position of the squad leader will be that from which he can best supervise and direct training.

e. In all training involving movement of the gun by hand, the ammunition bags will be hung over the top of the shield so as to relieve Nos. 3 and 4 of the weight and facilitate their pulling the gun with the towing harness.

f. For all training, except when actually used for towing the gun, the towing harness will be worn in the slung position. In the slung position, Nos. 1 and 3 will adjust the breast strap over the right shoulder and across the chest to the left hip; Nos. 2 and 4 over the left shoulder and across the chest to the right hip. The towing rope will be passed completely around the back of the body and the hook engaged in front of the body in ring of shoulder strap. (See fig. 23.)

g. Whenever the gun is being moved by hand and the command HALT is given, the trail of the gun carriage will be lowered to the ground.

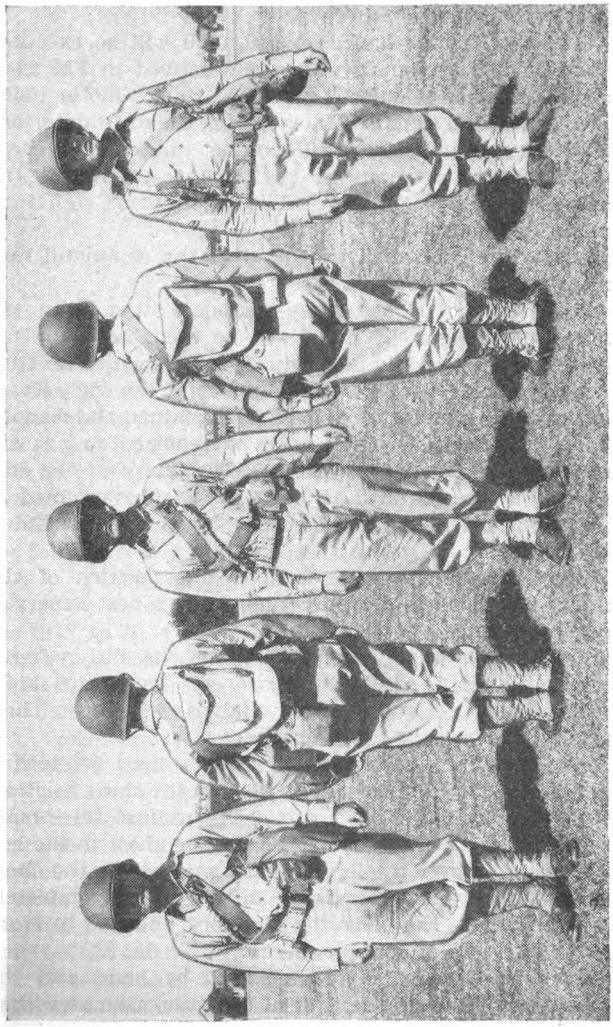


FIGURE 23.—Squad wearing towing harness. Right to left: corporal (squad leader), No. 1, No. 2, No. 3, No. 4.

■ 54. DEFINITIONS AND TERMS.—*a. Coupled.*—A gun is said to be coupled when its lunette is attached to the pintle of the prime mover.

b. Uncoupled.—A gun is said to be uncoupled when its lunette is detached from the pintle of the prime mover.

c. Front.—The front in a gun squad, with the gun coupled, is the direction in which the prime mover is headed; with the gun uncoupled, it is the direction in which the muzzle of the gun points.

d. Right (left).—The direction right (left) is the right (left) of one facing to the front.

e. Readiness for action.—Being uncoupled, the gun may be held in one of two stages of readiness for action:

(1) *In firing position.*—The gun is prepared to fire instantly.

(2) *In cover position.*—The gun is near a reconnoitered and prepared firing position. The gun is prepared for firing as far as practicable in the tactical situation and held under cover.

■ 55. ORGANIZATION AND EQUIPMENT.—*a.* The 37-mm gun squad is organized as follows:

(1) Squad leader.
(2) Gunner, No. 1.
(3) Assistant Gunner (loader), No. 2.
(4) Ammunition bearer, No. 3.
(5) Ammunition bearer, No. 4.
(6) Chauffeur, No. 5.

b. Each member of the squad is given a permanent number as indicated above. If the chauffeur is present for training without his vehicle, he is designated as No. 5 and functions as an additional ammunition bearer.

c. For equipment of the gun squad see Table of Basic Allowances.

■ 56. DUTIES.—*a. Squad leader.*—The squad leader is in direct command of the gun squad and all matériel pertaining thereto, including the prime mover when present. He conducts the squad in accordance with the orders or instructions of his section leader or of the commander of the unit to which he is attached. He is responsible for the care and maintenance of the gun and its equipment, and in com-

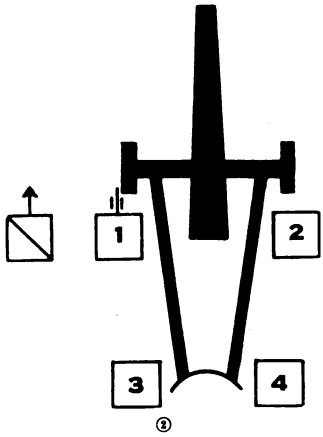


FIGURE 25.—Posts of gun squad, gun uncoupled—Continued.

the gunner is directed to fall out, he takes the position of the last number of the squad. The numbers following the designated number call out their new number and move to their new positions. The men preceding the designated number do not change their position.

b. During preliminary training the command for rotating the members within the squad should be given only after a movement or command has been completely executed. After each member of the squad is familiar with the duties of each other member, the command may be given before the completion of a movement. In such cases each man at once stays the execution of his duties and takes up the duties of his new number.

■ 64. TO MOVE GUN BY HAND.—The squad having taken posts, the squad leader commands: BY HAND. At this command, No. 2 releases the clamp which holds the reinforced section of the rammer to the right trail. Nos. 1 and 2 engaged the hooks of their tow ropes in the trail locking pin holes on the support. Nos. 3 and 4 engage the hooks of their tow ropes in the towing rings on the trails. No. 4 secures the released section of the rammer and inserts it through the rammer

(1) The squad leader indicates the general direction for firing.

(2) Nos. 3 and 4 raise trails and turn gun so that the muzzle points in the direction indicated by the squad leader; they then lower the trails to the ground. Nos. 1 and 2 assist in turning the gun by pushing on the wheels and shield.

(3) Nos. 1 and 2 then move to positions in front of the left and right sides of the shield, respectively, and No. 1 releases the apron from its traveling position by raising the apron latch. Both then release the wheel segments by pulling the locking plungers inward and rotating the wheel segments to the rear. Nos. 3 and 4 raise the spades slightly and, on word from No. 1, pull to the rear until the wheels are off the ground and the segments are in the vertical position. Nos. 1 and 2 release the wheel segment locking plungers, locking the wheel segments in position.

(4) Nos. 1 and 2 move to positions beside the left and right wheels, remove the ammunition bags from the shield, and hold them in their right and left hands, respectively. Nos. 1 and 2 then remove the trail locking pins from the carrying holes with their left and right hands, respectively, hold them until the trails are extended, then insert them in their locking holes, locking the trails to the support.

(5) As soon as the gun is mounted on the wheel segments, No. 4, at the right spade, pushes the trail lock latch down and No. 3, at the left spade, raises the trail lock lever with his right hand and raises and disengages the trail lock loop and hook with his left hand. Nos. 3 and 4 then, with their right and left hands, respectively, grasp the lifting handles of the trails and extend the trails fully. No. 4 presses down on the lunette latch and turns the lunette up to its firing position.

(6) No. 1 steps over the left trail, places the ammunition bag on the ground at a convenient distance in rear of the breech of the gun, turns toward the front, removes the sight from its carrying case on the shield, and installs it on the sight holder. No. 1 then takes up his firing position, depresses the muzzle until the traveling lock falls free, tests the traversing mechanism and trigger actuator mechanism, and if found to be in working order calls, "Up." (See fig. 27 ① and ②.)

②

FIGURE 27.—No. 1 in firing position—Continued.

(9) When No. 4 finishes assisting No. 3 in handling ammunition, he takes his firing position.

(10) Any deficiencies noted in the matériel or ammunition by any members of the squad while preparing the gun for action will be immediately reported to the squad leader.

(11) For the firing positions of the members of the gun squad during firing, see paragraph 67*b*.

c. Action on wheels.—The 37-mm gun fires satisfactorily from the wheels; however, the gun will habitually be prepared for firing resting on the wheel segments as described in *b* above. When the situation requires additional speed in placing the gun in action, mounting it on wheel segments may be omitted. To place the gun in action on wheels, the command is: 1. ON WHEELS, 2. ACTION. The procedure is the same as in *b* above except that—

(1) After the gun is turned in the desired direction, Nos. 1 and 2 reach over the top of the shield and No. 1 releases the

apron from its traveling position. Both then release the wheel segments by pulling the locking plungers inward and rotating the wheel segments to the front.

(2) Nos. 3 and 4 unlock and spread the trails as soon as the gun has been turned in the desired direction.

d. Action while moving by hand.—At any time during movement by hand, the squad leader may indicate the point at which he wishes the gun to go into action and command: ACTION. At this command, the squad moves the gun to the designated point and upon arrival thereat turns the gun smartly and points the barrel in the direction indicated by the squad leader. The trails are then dropped to the ground and towing hooks detached. No. 4 removes the reinforced section of the rammer staff from the rammer rings, and action proceeds as described in *b* above.

e. Action from a cover position.—The degree of readiness of the gun for firing while in a cover position depends upon several factors (par. 83); for preliminary training, however, it

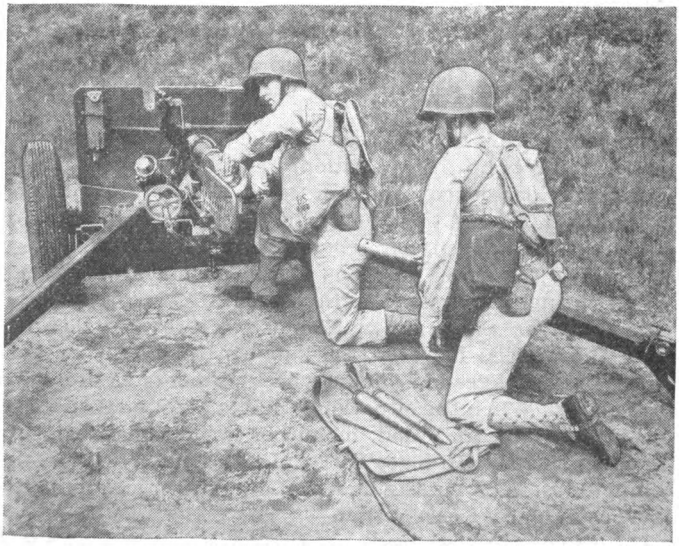


FIGURE 28.—Nos. 2 and 3 in firing position; No. 2 loading.

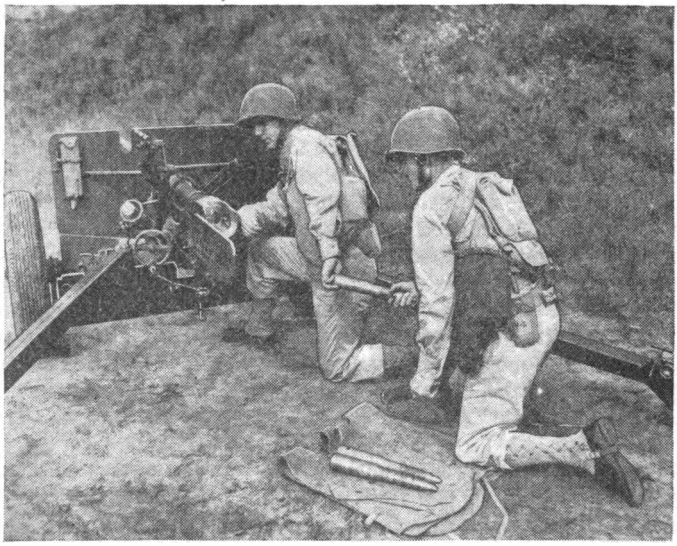


FIGURE 29.—Nos. 2 and 3 in firing position; No. 2 receiving another round.

b. To go out of action.—The command is: OUT OF ACTION.

(1) No. 1 approximately centers the gun in traverse, and removes the sight and places it in the carrying case.

(2) No. 2 unloads the gun if loaded, closes the breech, and reports "Clear." He then raises the traveling lock into position with his right hand, and with his left hand accurately centers the gun so that the traveling lock pin on the recoil cylinder can be seated in the circular bearing of the traveling lock.

(3) As soon as the sight has been replaced, and upon the report "Clear" from No. 2, No. 1 releases the trigger and turns the elevating knob (handwheel) to depress the breech of the gun into the traveling lock.

(4) When the traveling lock pin is seated in the circular bearing of the traveling lock, No. 2 places the loop of the traveling lock over the traveling lock hook, and forces the

lever forward into its seat until the traveling lock latch snaps into position.

(5) Nos. 1 and 2 remove the trail locking pins from their locking holes and, as Nos. 3 and 4 close the trails, replace the pins in their traveling holes. Nos. 1 and 2 move to positions in front of the shield on the left and right respectively; they then withdraw the wheel segment plungers from their positions and hold them out.

(6) Upon the command OUT OF ACTION, No. 3 moves the ammunition clear of the trails and replaces it in the ammunition bags. No. 4 assists No. 3 if there is considerable ammunition at the gun. As Nos. 1 and 2 remove the trail locking pins, Nos. 3 and 4 spring to positions by the left and right spades respectively: No. 4 lowers the lunette and Nos. 3 and 4 close and lock the trails. In locking the trails, No. 3 handles the trail lock lever, loop, and hook, while No. 4 is responsible for the operation of the latch.

(7) As soon as the trails are locked, Nos. 3 and 4 raise the

FIGURE 30.—Moving the gun by pushing.

right arm clear of the shoulder guard. Because of the recoil of the gun, he avoids extending his right arm over the shoulder guard. He operates the elevating mechanism with his left hand and the traversing mechanism with his right hand. He is trained to elevate, traverse, and fire the gun simultaneously, accurately, and rapidly. No. 1 aims and lays the gun as described in paragraphs 97 and 98.

(3) For the gun carriage M4A1, No. 1 takes the same relative position, with the shoulder traversing bar under his right arm, and with the bar held to his body in such manner that by moving his body he can point the gun in traverse. His right hand grasps the trigger lever for firing. His left hand is on the elevating handwheel. (See fig. 27②.)

(4) No. 2 assumes a position at the gun that will avoid injury by the recoil. He kneels on his left knee or sits on or straddles the right trail so that he loads with his left hand and opens the breech with his right hand.

(5) No. 3 kneels on either or both knees between the trails, near the right spade, so that he can pass ammunition to No. 2. His position clears the path of the ejected cartridge cases.

(6) No. 4 insures that sufficient ammunition is kept immediately behind and within convenient reach of No. 3. Otherwise, he is about 1 or 2 paces to the right of the right spade in a prone position.

c. To load.—(1) Unless specifically ordered otherwise, the gun is loaded the instant the squad leader announces the first element of a fire order. Exceptions to this procedure occur during marksmanship instruction where, as a safety precaution or for control purposes, it is necessary to announce the number of rounds to be fired in an exercise and to specify when the gun is to be loaded. (See pars. 98*e*(2) and 110*d*.)

(2) To load the gun, No. 3 grasps a round by the nose of the projectile with his right hand and passes it to No. 2, placing the base of the cartridge case in No. 2's open left hand. No. 2 grasps the base of the cartridge with his left hand, turns the projectile to the front as he swings his arm toward the breech, and carefully inserts the round in the breech opening, pushing it into the gun chamber with the fingers until the rim of the cartridge contacts the extract or lips, and continuing

32), to assist in reducing the recoil of the gun and to cause it to seat itself quickly in a stable position. No. 1 under such circumstances must *hold his eye 15 to 20 inches from the eyepiece of the sight.* During this procedure, ammunition must be placed within reach of No. 2.

j. Removal of rammer staff.—If, after the gun has been put into action, it appears expedient to have the rammer staff ready for use, No. 4 removes the sections from the trails and assembles them, at the corporal's direction. When going out of action, if the rammer staffs have been removed, they should be placed back on the trails by Nos. 3 and 4 just before the trails are closed.

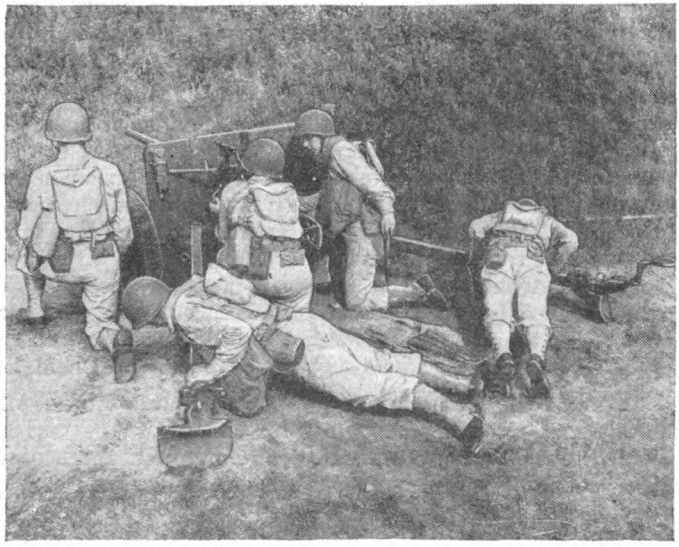


FIGURE 32.—Sinking trails on first round.

on the prime mover, he then stows the ammunition and equipment as it is passed to him by No. 4.

d. Nos. 1 and 2 replace the gun cover and assist in loading the truck if this task has not been completed by the time they have replaced the gun cover.

e. When all the ammunition and equipment have been loaded, the gun is coupled to the prime mover. No. 3 at the right spade and No. 4 at the left spade of the trail, raise it and insert the lunette over the towing pintle hook and secure the latch. Nos. 1 and 2 assist by pushing the gun forward from positions at the right and left wheels, respectively.

f. The men then mount the prime mover and take seats. The squad leader takes the seat beside the chauffeur; Nos. 1 and 3 sit on the right side of the prime mover, No. 3 forward; Nos. 2 and 4 on the left side, No. 4 forward. When the pedestal-mounted antiaircraft machine gun is carried, No. 4 acts as gunner.

g. If operating with other prime movers the squad leader signals READY TO START; otherwise the truck moves in accordance with the squad leader's instructions.

h. The chauffeur should be trained to assist in loading the prime mover, particularly when speed is essential and there is a considerable amount of ammunition to be loaded.

■ 72. To UNLOAD PRIME MOVER.—*a.* The squad being in the prime mover, the command is: UNLOAD TRUCK (or other vehicle). At this command, all members of the squad, except the chauffeur, will dismount in an orderly manner and move to the rear of the prime mover. The gun is uncoupled and the prime mover unloaded as follows:

(1) Nos. 1 and 2 remove the gun cover and place it either in the prime mover or on the gun carriage (par. 70), as directed by the squad leader.

(2) Nos. 3 and 4 working on the right and left sides of the trails, respectively, uncouple the gun, No. 3 calling out "Forward" to the chauffeur as the lunette is pulled clear of the pintle.

(3) The prime mover moves forward about 3 paces and Nos. 3 and 4 turn the gun so that the muzzle or trail points in the direction ordered by the squad leader.

(4) No. 3 then takes position in the prime mover and

shown in FM 7–35, should be used. But, regardless of the type of firing position used, proper concealment is essential, and the squad must be trained to camouflage the firing position expertly. The squad should be trained to take full advantage of all natural vegetation afforded by the terrain and to use such available camouflage materials as the camouflage net, canvas, old tents, covers from trucks, etc. (See fig. 33 and FM 5–20.)

b. It is desirable to place the gun immediately in rear of cover so that it just clears it in firing. A check should be made by a quick glance through the gun barrel (not through the telescope) to insure that the gun will clear the cover in firing. Measures should be taken to prevent dust from flying up before the muzzle when the gun is fired. Spreading the gun cover or dampened burlap bags under the muzzle tends to keep down dust.

c. The gun should have an excellent field of fire to include the maximum effective range and traverse to the flanks. It may be necessary to clear partially a field of fire.

d. A level base for the trail spades at the firing position facilitates rapid shifting of the gun in traverse.

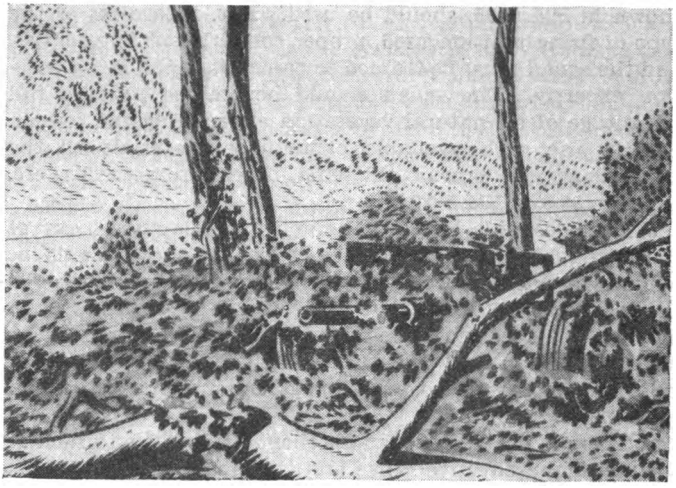
e. Provision should be made for seating the trail spades, regardless of the direction in which the gun is to be fired.

f. Cover and concealment for the gun crew in the immediate vicinity of the firing position or in a cover position are provided. If cover or concealment are not afforded by the terrain they should be constructed. Care must be exercised in digging individual pits or making any other excavations near the gun so as not to interfere with the movement of the gun into or out of the firing position, or with the free movement of the trails when they are shifted laterally.

g. Ammunition is placed below ground when practicable so that it is readily accessible to the gun crew. Its location should not interfere with the occupation of the firing position or the quick shifting of the gun in traverse. If time is available, covering should be placed over the ammunition.

h. Local protection in the form of wire, or natural or artificial obstacles, etc., is desirable.

i. Covered approaches between the firing position and the location of the prime mover should be reconnoitered.



① WRONG.—This camouflage doesn't break the straight lines.

② RIGHT—Camouflage which breaks the straight lines affords concealment even in barren ground.

FIGURE 33.

■ 83. COVER POSITION.—*a.* The firing position, being located in the open, is usually subject to hostile fire and observation. It is therefore essential that the gun and equipment be kept under cover in close proximity to the firing position and so concealed that the enemy cannot recognize or discover the firing position prior to opening fire. This nearby position is known as the "cover position." The squad is trained in selecting and preparing cover positions and should practice repeatedly going into and evacuating the firing position. Care must be exercised in such training to insure that the gun or crew is not silhouetted against the skyline or bright background.

b. Suitable cover positions may be found in draws, reverse slopes, wooded areas, behind cliffs, cut banks, hedges, or stone fences. Equipment and personnel should be so situated that they are well concealed and covered.

c. In open terrain, nearby cover and concealment may be scarce, and a suitable cover position may be lacking. The unit is trained to resort to artificial means for cover and concealment. Use of camouflage for this purpose is emphasized. Similarly, in a surprise meeting with enemy tanks or mechanized forces, speed in delivering effective fire upon the enemy will be a more important consideration than cover and concealment. Consequently, the squad should be trained to move rapidly into a firing position directly from the prime mover.

d. While in a cover position the gun, equipment, and ammunition are prepared for firing as far as practicable. The degree of preparedness depends upon the distance between the cover position and the firing position, and the character of the intervening terrain. When the command ACTION is given, the gun is quickly moved into the firing position to engage the enemy.

e. If the gun is in a cover position and the squad leader wishes to quickly occupy the firing position and engage a target, he may employ one of the following methods:

(1) *If target is visible from cover position.*—The squad leader commands: LEFT FRONT, EDGE OF WOODS, TANK FOURTH FROM LEFT, 800. The gunner confirms that he recognizes the target. The squad leader then commands:

ACTION. Upon the command ACTION, the gun is moved quickly into its firing position, prepared for action, laid on the target, and firing begins at the command COMMENCE FIRING.

(2) *If target is not visible from cover position.*—Upon the command ACTION, the gun will be moved quickly into the firing position and prepared for action; the fire order follows: FRONT, TANK THIRD FROM RIGHT, 800, ONE LEAD—COMMENCE FIRING. Fire is opened when the gun is laid on the target.

■ 84. ALTERNATE AND SUPPLEMENTARY FIRING POSITIONS.—An alternate position may be selected for each primary firing position. The squad is trained to move rapidly from a firing position or cover position into an alternate position and open fire on the enemy. Similar training is conducted in connection with the occupation of supplementary positions. Care must be exercised by the squad, while changing position, to take full advantage of available cover and concealment to avoid enemy observation.

■ 85. TO TAKE GUN OUT OF ACTION.—*a.* Different methods of taking the gun out of action should be explained in detail and practiced. The following methods are given as a general guide:

(1) The gun being in a defiladed or partially defiladed position, the squad leader commands: OUT OF ACTION, BY HAND, or OUT OF ACTION, LOAD TRUCK (or other vehicle), etc. At these commands the gun, if only partially defiladed, is pulled back to full defilade and there prepared for movement by hand, or for movement to the prime mover or designated point for coupling.

(2) The gun being in action at a position where the operation of going out of action would expose the squad to observation and there is cover close at hand, preferably in the immediate rear, the squad leader commands: OUT OF ACTION, COVER CLOSE BEHIND (or otherwise). The gun is unloaded and pulled to the cover position and there prepared for movement as directed by the squad leader.

(3) The gun being in a firing position where there is scant cover and it is desired to conceal from the enemy the action

■ 88. AMMUNITION SUPPLY.—The squad is trained in moving ammunition from the prime mover to the firing position and to effect this supply during action. The squad leader keeps informed at all times as to amount of ammunition at hand, and where and how he can replenish it. Sufficient ammunition must be available at the gun position to insure successful completion of the fire missions. Upon occupation of a firing position, the squad leader indicates the amount of ammunition to be placed in the close proximity of the gun. Arrangements are made for rapid replenishment of ammunition under all circumstances from the prime mover or the section ammunition truck. In addition to the ammunition carriers, the chauffeur is available to transfer ammunition by hand. After accomplishing a fire mission, ammunition at the gun and on the prime mover must be replenished. The amount of ammunition used should be reported to the section leader who will arrange for its replenishment.

firing. (See pars. 106 and 110.) By so doing, the group undergoing instruction will receive early training in a systematic and orderly range procedure which is considered necessary for efficient conduct of firing exercises.

b. Equipment.—The standard range equipment described in paragraphs 116 and 117 is necessary. Either targets similar to those used for the aiming exercises or the standard 1,000-inch range targets may be used (pars. 115 and 118). All targets should have the silhouette aiming tanks on both sides.

c. Organization.—When conducting the tracking exercises (*e*, *f*, and *g*, below), an organization of the platoon similar to that shown in figures 34 and 38 will prove highly satisfactory.

(1) *Platoon leader* (*A*).—Conducts instruction and supervises generally the work of the entire platoon.

(2) *Platoon sergeant* (*B*).—Issues the orders for conducting the exercises and controls, by signal, operation of the target.

(3) *Section leaders* (*C*) *and* (*D*).—Supervise the work in each group of three guns. Relay orders from the platoon sergeant to the squads. Signal the platoon sergeant "Ready" when all guns in their groups are ready to engage the target.

(4) *Agent corporal* (*E*).—Is time keeper. Starts target on signal from platoon sergeant and regulates time of exposure in accordance with his orders. Specifies to men operating drum the time of exposure of the target for each run. At intervals, as an aid to regulating the target speed, calls out the time consumed as the target travels across the course.

(5) *Two drum operators* (*F*).—Operate the drum so that the target will be exposed as nearly as possible for the time specified by the agent corporal (*E*). Regulate the speed at which they turn the drum so as to obtain a uniform rate of travel for the target throughout its entire course.

(6) *Squad leaders.*—Stationed at guns. Conduct individual instruction and check execution of the exercises by the gunners. Use aiming device to check accuracy of tracking.

(7) *Gunners.*—Execute the exercises at the guns. The loaders, who operate the breech when firing is simulated, assist in coaching as directed by the squad instructor.

(8) *Remainder of platoon* (not shown in fig. 38).—Held

ing directly across the front of the gun and over comparatively level ground. Throughout the exercise, emphasis should be placed on the importance of smooth manipulation of the gun and keeping the gun moving through the same angular speed as the target while simulating fire.

(2) *Procedure.*—(*a*) The exercise is conducted on the level course of the 1,000-inch moving target range (par. 117). The squad instructor, gunner executing the exercise, and a loader who acts as No. 2 when firing is simulated or as coach when so directed, take position at each gun. When all are ready the target is operated, the sequence of commands and procedure being similar to that described in paragraph 110. No commands for loading are given. An example of the sequence of command is: ALL GUNS ON AIMING STAKE; when all guns have been laid on the aiming stake and are ready, LEFT FRONT, TANK, 600, ZERO LEAD, TRACK

(*b*) At the command LEFT FRONT, the gunner traverses to the left, and as the target comes into view he aims the gun, using the announced range and lead on the center of the aiming silhouette as previously instructed (par. 97), and tracks the target. As soon as the target is obscured from view by the screen, and without further command, it is immediately set in motion in the opposite direction. As the target reappears, the gunner relays on the aiming silhouette and tracks, using the same range and lead, but conforming to the new direction of travel of the target.

(*c*) The passage of the target across the course once is known as a "run." A "double run" is a passage of the target over the course once in each direction. The exercise is continued until two double runs are completed and then the next relay takes position. Frequent changes of gunners and coaches are advisable to avoid monotony.

(*d*) While the gunner is executing the exercise, the squad instructor or the loader will observe through the aiming device. A check is made on the correctness of the point of aim, whether or not the correct range and lead are used, and on the accuracy and smoothness of tracking. Errors detected should be called immediately to the gunner's attention. Thoughout the travel of the target, the gunner should remain correctly and continuously laid on the aiming silhouette.

■ 103. COURSE B.—Range: 1,000 inches. Targets: *A* and *B*.

a. Instruction practice.—Fire tables IV, V, and VI three times.

TABLE IV.—*Level course—Target A*

Number of rounds	Speed, inches per second	Seconds to traverse course	Lead	Direction of movement of target
5	12	41	0	L to R.
5	12	41	0	R to L.
5	16	31	1	L to R.
5	16	31	1	R to L.

TABLE V.—*Hilly course—Target A*

Number of rounds	Speed, inches per second	Seconds to traverse course	Lead	Direction of movement of target
5	12	41	0	L to R.
5	12	41	0	R to L.
5	16	31	1	L to R.
5	16	31	1	R to L.

TABLE VI.—*Level course—Target B*

Number of rounds	Speed, inches per second	Seconds to traverse course	Lead	Direction of movement of target
5	12	41	0	L to R.
5	12	41	0	R to L.
5	16	31	1	L to R.
5	16	31	1	R to L.

b. Record practice.—Fire tables IV, V, and VI of course B, once, under prescribed record firing conditions.

ready to begin the exercise, signal "Ready" to the officer conducting firing.

3. Repeat all orders to unload, cease and suspend firing, and clear gun, and see that the orders are complied with as described in paragraph 67.

4. Announce for the gunner's benefit when the prescribed number of rounds for each run of the target have been fired, thus, "Five rounds complete."

(*c*) Report all misfires and malfunctions or stoppages to the squad instructor (scoring officer during record firing practice). During instruction firing, in case of a misfire, immediately recock the rifle without command by raising the bolt handle, and endeavor to render the gun ready for firing as quickly as practicable. In case of a minor malfunction or stoppage, such as failure to feed another round into the chamber when the bolt is operated or failure to extract, etc., remedy the condition without command as quickly as practicable. In case of a misfire, stoppage, or minor malfunction during record firing practice, proceed as described in paragraph 111*n*.

(*d*) Without command, reload the gun upon the completion of a run of the target as prescribed in paragraph 110*d*(7).

(*e*) Exchange targets on the sled as directed. (To expedite operations, he may be assisted in this duty by another member of the squad.) At the command MARK TARGET, secure the target that has been fired on from the sled and return it to the squad instructor (scoring officer in case of record firing practice).

■ 107. GUNS, MOUNTS, AND TELESCOPES.—*a*. The gun, mount, telescope, and .22 subcaliber rifle will be used as issued by the Ordnance Department without addition or modification, except as specifically authorized hereafter. A shade may be used to protect the front lens of the telescope from sun glare.

b. (1) Before marksmanship firing is begun, each gun, mount, telescope, and accessories to be used will be thoroughly examined and repaired or adjusted to insure their efficient functioning. Excessive play will be removed from the guns and mounts, and adjustments made to permit smooth manipulation.

(3) A run of the target across the course once in each direction at the same speed will constitute a single score and is known as a "double run." A double run constitutes an exercise.

(4) Scores are fired in the order in which exercises are listed in the tables.

(5) Each table can be completed on one target.

(6) During instruction firing only, when time is available, the firing of each table may be preceded by one or more dry runs.

b. Organization.—For functional purposes, an organization similar to that described in preparatory marksmanship training (paragraph 98*c*) is suggested. The organization must be modified to meet the requirements of firing live ammunition. During instruction firing only one group of two guns can fire on each range unit.

c. Duties.—All personnel will perform the duties prescribed in paragraph 106. During instruction firing, a squad instructor, gunner (No. 1), and a loader (No. 2) will be at each gun. A third man from each squad may be assigned the duty of loading magazines and furnishing them to the loader. A line of small loading benches placed a short distance (about 5 yards) in rear of the guns will facilitate loading and assure a prompt supply of ammunition to the guns. Other members of the squads may be employed in operating the range and preparing targets for firing.

d. Instruction firing.—Before firing on the 1,000-inch range, the officer conducting firing will give a general description of the range and announce specific instructions pertaining to firing procedure.

(1) Two guns are placed on the firing line with the pintles 1,000 inches from the level course. The guns are placed to the right and left of the center stake (par. 117*g*) and as close together as the spread of the trails will permit. Another gun may be added for dry shooting if desired. They are numbered from left to right.

(2) No. 1 gun is assigned the aiming silhouette targets on the left, marked with the number 1. No. 2 is assigned the aiming silhouette targets on the right, marked with the number 2.

(3) The squad instructor, gunner, and loader take position at the gun. The gunner tests the firing, elevating, and traversing mechanisms. The loader secures the necessary ammunition.

(4) When all guns are prepared for firing, all safety precautions having been previously taken, the individual conducting firing gives the fire order.

(5) An example of the sequence of a fire order is as follows:

(*a*) GUNS ON AIMING STAKE, TWO MAGAZINES, FIVE ROUNDS EACH, LOAD. At these commands, the gunner aims at the aiming stake and the loader reports "Up" when loaded and ready to fire. When the gunner is ready to begin the exercise, he so indicates to the loader who signals READY.

(*b*) In the meantime the individual conducting firing will have specified to the timekeeper at the drum the course to be traveled by the target and the time of exposure for the run (firing tables, pars. 102, 103, and 104).

(*c*) When all guns have signaled READY, the individual conducting firing will give a signal to start the target and simultaneously order: LEFT (RIGHT) FRONT, TOP (CENTER, LOWER) TANK, 600, ZERO (ONE, TWO) LEAD(S), COMMENCE FIRING.

(6) As the phrase, LEFT (RIGHT) FRONT of the fire order is given, the gunner will start traversing toward the left (right) of the range. Upon its appearance from behind the screen, he will engage the target, using the announced range and lead, aiming on the announced black silhouette, and firing the number of rounds contained in the magazine. The loader will announce "Five rounds complete" (or appropriate number) when the magazine is empty. For training purposes, the gunners will be required to track the target during its entire time of exposure, even though they have fired the required number of rounds for the run.

(7) When the target is obscured behind the screen, prior to its return run, the loader will, without command, rapidly remove the used magazine and all unfired rounds remaining in the rifle and reload with the second magazine provided for the return run of the exercise. As soon as this operation

in the appropriate scoring space for the designated aiming silhouette.

(3) A hit will be scored for each bullet hole found in the correct scoring space, except that no more hits will be counted in any scoring space(s) than the number of rounds authorized to be fired at that space. The maximum number of hits to be counted in each of the scoring spaces is:

Target A—Zero lead—ten hits each scoring space.
One lead and two leads—five hits each scoring space.
Target B—Zero lead—two hits each scoring space.
One lead—one hit each scoring space.

(4) The shot holes in the target will be counted after the completion of a table. If the number of holes exceeds the number of rounds authorized for the table, the gunner will be penalized five points for each round in excess of the allowance.

(5) During record firing, the name of the individual will be placed above the vertical row of silhouettes he is to use for a table before he fires on it. No person will handle the target until after it is scored except under the direct supervision of the scoring officer or his assistant.

(6) A bullet hole which touches the line of a scoring space will be counted as a hit.

(7) Ammunition not fired during the time of exposure of the target for each run of an exercise will be forfeited.

(8) Holes made by ricocheting bullets, rocks, or other foreign matter will not be counted.

b. Computation of scores.—(1) Subject to the conditions specified in *a* above, a total of five points will be counted for each hit in a correct scoring space.

(2) The following indicates the total possible score for the three authorized courses:

	Table I	Table II	Table III	Total possible
Course A	150	150	100	400

target described above except that three rows of three aiming silhouettes each or nine silhouettes are equally spaced on the blank white paper on each face of the target frame.

■ 116. TARGET SLED.—The details of the sled on which the 1,000-inch targets are mounted are shown in figures 39 and 40. The sideboards which form the body of the sled are 2- by 4-inch lumber. The weight of the heavy lumber in the body provides a low center of gravity which is necessary for smooth operation of the sled. The target holder is made of ¾-inch material. The bottom surface of the sled is covered with tin so that it will slide easily in the runways of the 1,000-inch range. The standard which is attached to the top of the sled to receive the target frame consists of two upright slots. The slots should be made to hold the target firmly and still allow it to be withdrawn easily. A piece of twisted wire cable is fastened loosely across each open end of the sled to provide a means for attaching the snaps of the towing cable. The snaps of the towing cable should be attached so that they are positioned in the center of the cable on the sled.

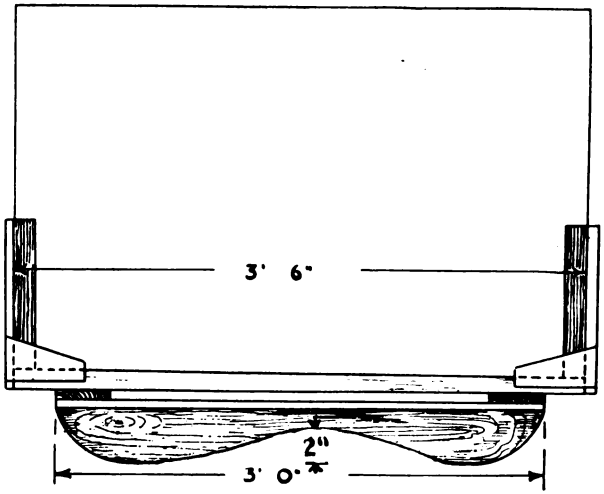


FIGURE 40.—Target sled—side view.

■ 117. CONSTRUCTION OF 1,000-INCH RANGE.—AR 750–10 prescribes the danger areas for target ranges. Due to the small size of the 1,000-inch range, a location can usually be found without difficulty. A level open space about 70 yards long (in the direction of fire) and about 20 yards wide is required for each range unit. Approximately 20 yards between range units are required. A single unit is necessary for each four-gun platoon. It will greatly facilitate the conduct of 1,000-inch firing to have two of these range units per platoon. A range unit consists of two runways in which a sled target moves to simulate the various directions of movement and speeds of probable combat targets. Movement of the sled is actuated by a wire cable which runs from a hand-operated drum through a system of pulleys and is fastened to both ends of the sled.

a. The dimensions and plans of construction of the two runways, that is the level and the hilly, are given in figure 41.

b. Figure 42 is a sketch of the arrangement of the whole unit showing the positions of the pulleys and the hand-operated drum (reel). Pulleys numbered 1 to 7 are fastened to the tops of 4- by 4-inch posts. These are standard 2½-inch side pulleys. Pulleys 2, 3, 4, 5, and 7 are adapted for "snatching" by cutting an opening in one side just large enough to allow the wire cable to pass through the side so that it may be removed or replaced on the pulley wheel.

c. Figure 43 shows the hand-operated drum. A commercial wooden cable drum was used to make this reel. The weight and relatively large diameter of the drum tends to resist sudden changes in speed, thus insuring smooth operation of the sled. Two 2½-inch swivel eye pulleys (one shown in fig. 43) are attached to the base of the drum mount to bring the running cable close to the ground.

d. A twisted steel wire between No. 9 and No. 12 gage will make the most satisfactory cable. Two swivel rope snaps are fastened to the ends of the cable for attachment to the sled. The operating length of the cable is fixed as follows: Place the sled on the hilly course; place the spool or coil of twisted wire on the ground at the same point, and run off the correct length of wire by passing the free end through pulleys P4,

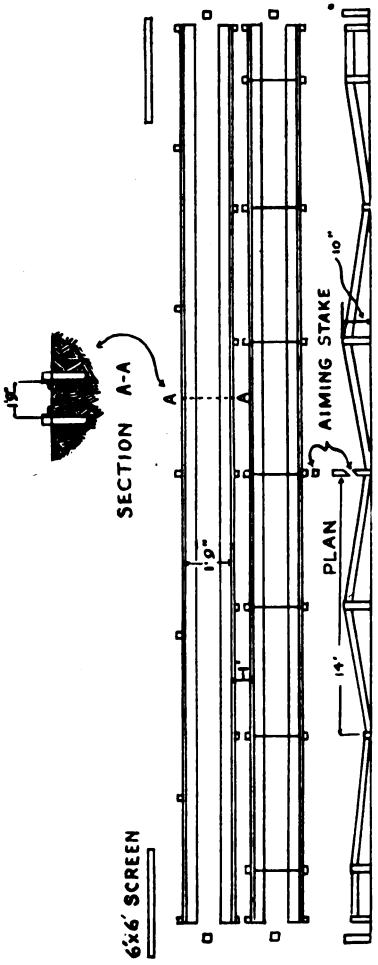


FIGURE 41.—Dimensions and plan of construction, 1,000-inch range.

NOTE.—All side boards and tracks are of 1-inch by 4-inch lumber.

to the swivel eyes of the rope snaps making the wire taut. Further adjustment in the length of the cable may need to be made to obtain smooth operation of the sled.

e. The offset pulley P7 is a snatch pulley so placed that, when the sled is used on the level course, the wire may be run around it as shown by the dotted lines in figure 42 to take up the slack due to the difference in the length of the wire required for the two courses.

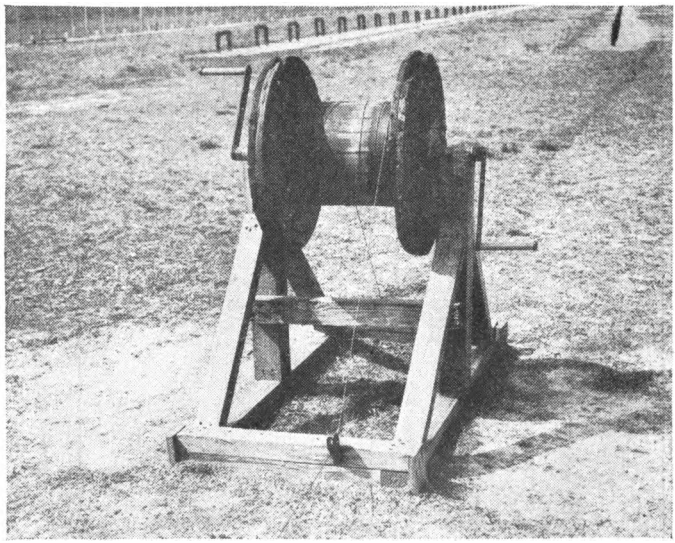
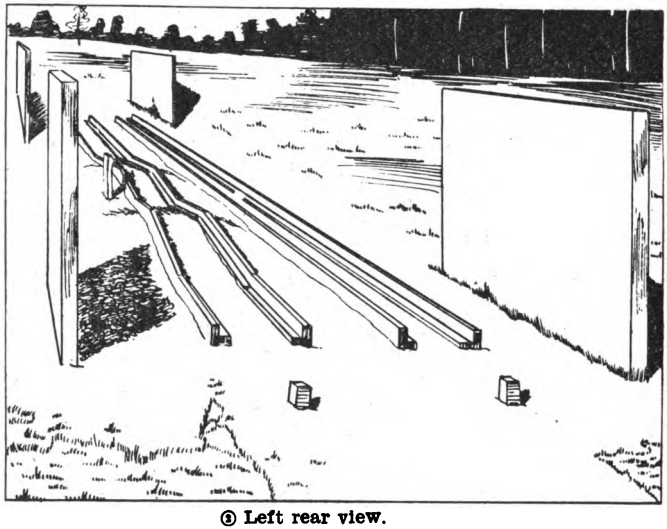


FIGURE 43.—Hand-operated drum (reel), 1,000-inch range.

f. For the level course, the wire runs from the reel through P1, P7, P2, to the sled and from the opposite end of the sled through P5, P6, to the reel. For the hilly course, the circuit is reel, P1, P2, P3, sled, P4, P5, P6, and reel.

g. The position of the gun (pintle) for record firing is marked by a stake in the center of the range and 1,000 inches from the rear of the level runway.

h. An aiming stake bearing a small round white spot is



③ Left rear view.

FIGURE 44.—1,000-inch range—Continued.

placed in the center of the range just in rear of the hilly course.

i. Figure 44 shows two views of the completed range.

■ 118. 1,000-INCH 37-MM GUN TARGET.—*a. Frame.*—The target frame for all 1,000-inch firing is 3 feet 6 inches by 2 feet 6 inches. It is made of ¾- by 1½-inch lumber, halved and joined squarely at the corners. The frame is covered with target cloth to provide a bearing surface for the paper target.

b. Targets.—The types of targets for 1,000-inch firing are shown in figure 45① and ②. The target labeled *A* is used in Tables I, II, IV, V, VII, and VIII. The target labeled *B* is used in Tables III, VI, and IX. Both types of targets have aiming silhouettes and scoring spaces for two individual scores.

(1) Target *A* is printed with six solid black silhouettes (tanks) or aiming targets, each for a separate exercise (double run). The numeral printed under each silhouette indicates the gun to be assigned to that target. In each

on estimating ranges between 200 and 1,500 yards. The estimation by eye of untrained men is little better than a guess and the average error of such men will be at least 15 percent of the range. A definite system of range estimation, frequently practiced, is the only way to make estimation by eye sufficiently reliable.

(*b*) *Application.*—Estimation by eye consists of measuring the range by applying to it a unit of measure 100 yards long. This is accomplished by the use of an accurate mental picture of one 100-yard length which the man applies the proper number of times to the distance. Application of the unit of measure beyond 500 yards is difficult. For this reason, in ranges over 500 yards, it is better to select a point halfway to the target, apply the 100-yard unit up to this halfway point, and multiply the estimated distance by two. An understanding of the size of tanks and other ordinary objects at the most used ranges will be of assistance. All antitank gun personnel will be trained in estimating ranges by eye. The average of a number of estimates by different men will generally be more accurate than a single estimate. This variation of the suggested method is used when time permits by taking the average of the estimates of members of the squad or of specially qualified men.

b. Range cards.—(1) When time and circumstances permit, every gun commander should prepare a range card of his assigned sector of responsibility (par. 131), and of other sectors, including the rear, that the gun can cover from the vicinity of its position. The range card is maintained to facilitate rapid determination of ranges to targets.

(2) A simple range card of the type shown in figure 46 should prove adequate for the needs of a gun commander. It should show the gun position, direction of magnetic north, field of fire in the sector, prominent features of terrain, and ranges thereto.

(3) Range cards will be made for alternate and supplementary positions.

c. Application of the range table.—When the range to a target is announced by the gun commander, all the gunner need do, as far as the range is concerned, is apply the range table (par. 97*b*(2)) and aim the appropriate range marking in

(5) It is contemplated that the lead table will furnish the amount of lead to be used for the first round; necessary corrections thereafter should be based upon observation of strike or tracer. *Too much lead is better than too little because the target runs into the fire and the observation of the strike is easier.*

SECTION III

FIRE ORDERS

■ 126. GENERAL.—*a* There are two general classes of fire orders:

(1) Those employed when engaging moving targets.

(2) Those employed when engaging stationary or small fixed targets.

b. The elements that make up each class of order are generally the same; however, in the second class the elements pertaining to the description of the target and direction thereto are usually more detailed.

c. Three types of ammunition (AP, TP, and HE) may be employed. *No mention of the type of ammunition to be employed will be included in any fire order unless the high-explosive shell is to be used, in which case the command* HIGH EXPLOSIVE *will constitute the first element of the order.*

■ 127. INITIAL AND SUBSEQUENT FIRE ORDERS.—*a. Initial order.*—The initial fire order (which contains the data for firing the first round) will contain the information shown below and will be given in the following sequence:

(1) Type of shell (only when HE is used).

(2) Direction.

(3) Description.

(4) Range.

(5) Lead (moving targets only).

(6) Fire control, which includes—

(*a*) Number of rounds to be fired (only when restriction on number of rounds is necessary).

(*b*) Time of opening fire.

(*c*) Time to cease or suspend firing.

b. Subsequent orders.—Initial fire orders will usually be in complete form. Subsequent orders, issued during the fire

fight to switch to a new moving target, etc., will be abbreviated to include only the data which are to be changed.

■ 128. MOVING TARGETS.—Most of the firing with the 37-mm antitank gun will be against fast-moving vehicular targets appearing unexpectedly and in large numbers. The fire order, therefore, must be given in the briefest and most concise form possible. When the target appears, the squad leader quickly designates the target to the gunner by as simple a description as possible, quickly estimates and announces the range and lead, and adds necessary instructions to open fire. Calling out the order in a loud voice should be avoided; calmness on the part of the leader and crew is essential.

a. Initial order.—Since examples to fit all situations are impracticable, the following instructions are given and should be considered as a guide to be adapted to the actual needs of service conditions:

(1) *Type of shell.*—No mention of the type of shell is made unless an open or unarmored vehicle is engaged upon which it is desired to use the high-explosive shell.

(2) *Direction.*—(*a*) Direction is usually indicated by the terms, "Front; right (left) front; right (left) flank; right (left) rear; rear."

(*b*) The use of previously established terrain points (par. 124*b*) will greatly facilitate the speed in directing the gunner on the target. An example of such a fire order would be: RED BARN; TANK; 700; 0-LEAD; COMMENCE FIRING.

(3) *Description.*—The description should be very brief and informal. Examples: tank (combat, armored, scout car); tank approaching from clump of bushes; tanks emerging from woods, third from right; leading tank, etc.

(4) *Range.*—The range is announced as estimated (par. 124), "600," "800," etc., given always in full hundreds of yards. The gunner applies the range table.

(5) *Lead.*—Always announced thus, "Zero lead, one lead," etc.; using the lead table (par. 125*b*) as the basis for estimation.

(6) *Fire control.*—(*a*) *Number of rounds.*—To restrict the number of rounds fired, this fact is announced in the fire order as: FRONT; LEADING TANK; 800; ONE LEAD; FIVE ROUNDS;

targets such as stationary tanks or other vehicles. The second is small fixed tactical targets such as a machine gun, an antitank gun, an open emplacement, personnel, etc. Such targets are assigned the gun by the squad leader only in an emergency where to ignore them will interfere with the mission; or upon specific orders from platoon or section leaders; or upon the orders of the commander of the unit to which the gun is attached. Where the gun is in action against attacking hostile tanks, all other targets will be ignored.

a. Stationary tanks or other vehicles.—(1) When engaging stationary tanks or other vehicles, no change in the sequence or contents of the fire order described in paragraphs 127 and 128 is necessary, except that the fifth elements (leads) is omitted.

(2) If difficulty is encountered in pointing out or describing the target to the gunner, which may be the case at long ranges, one of the methods described in *b* below may be used.

b. Small fixed targets.—(1) Fire orders to engage small fixed targets are similar to those described for moving or stationary vehicular targets; however, the necessity for designating the type of shell, HIGH EXPLOSIVE, will be more frequent.

(2) Small tactical targets, if effectively concealed by camouflage or other means, are often hard to find and difficult to designate. Consequently, the squad leader may find it necessary to add more detailed description or resort to some physical means to designate the location and describe the character of a target.

(3) Two general methods may be used to designate small fixed targets: Laying the gun and oral designation. The method used will be the one which will bring fire to bear on the target in the shortest possible time.

(*a*) *Laying the gun.*—The quickest, surest, and simplest method of designating an obscure target is for the squad leader to lay the gun on the target. When using this method, the squad leader aims the appropriate range dot in the telescope on the target. He then completes the fire order orally thus: MACHINE GUN IN SHELL HOLE, 800, COMMENCE FIRING.

(*b*) *Oral designation.*—The situation may require the use of an oral method of describing the location of the target.

platoon) leader also assigns a principal direction of fire for each gun within its sector; the squad leader is responsible for placing the gun in firing positions (primarily or alternate) so that it can fire in the assigned principal direction without shifting the trials, although it may be necessary to shift the trails to engage targets appearing elsewhere in the sector of responsibility.

b. When sectors are so assigned, any control of the conduct of fire to be exercised by the platoon or section leaders must be carefully arranged for in advance of the fire fight. During the fire fight, platoon and section leaders will, as a rule, convey orders to the guns by signal; it is therefore essential that any signals to be employed are thoroughly understood by all concerned.

■ 132. OBSERVATION.—Before and during firing, each squad leader is responsible for continuous observation of the battlefield. A system of observation within each gun squad must be established as early as possible and carefully maintained during combat with every available means. The squad leader may assign various members of his squad to observe for targets. After fire has opened, these duties must be continued to permit early detection of new targets. In addition to their regular duties, No. 3 may be detailed to observe to the left and left rear and No. 4 to the right and right rear. Individuals in observation must know the mission of the most advanced friendly troops, where they are located, and whether friendly tanks have been or will be employed.

■ 133. MOVING TARGETS.—*a. Initial fire order.*—(1) After the gun is placed in the firing position, the squad leader takes his place near the gunner to obtain a similar view of the battlefield and to control and assist in the conduct of fire. The squad leader issues the initial fire order and the gunner engages the designated target with the prescribed data.

(2) Within his assigned sector each squad leader is permitted to determine which targets he will fire upon. Fire control of each gun by platoon or section leaders will be exceptional.

b. Time of opening fire.—The correct time of opening fire is very important and exceedingly difficult to determine. At

leader calls out, "HIT". The gunner continues to fire at the tank until directed by the squad leader to change target, cease or suspend firing. When tanks are in an attack formation the leading enemy vehicle within the assigned sector should be first engaged; however, command vehicles, recognized as such, should receive priority if the combat situation permits. Engaging the leading vehicle of an enemy column passing along a road in order to block the road by disabling the leading vehicle is usually effective.

(2) If the situation so requires (for example, when a command vehicle or tank is recognized or a particular tank is approaching dangerously near), the squad leader may order an immediate change of target by calling, for example, "Third from the right."

(3) If, during the fire fight, tanks suddenly appear from a new direction and threaten to overrun the firing position, it may be necessary to shift the trails to meet this threat. The command NEW DIRECTION LEFT (RIGHT); WHITE HOUSE; TANK; 300, is given. The gun is swung in the new direction and firing continues.

(4) To stop tanks most quickly, every effort should be made to engage them so that vulnerable points are brought under fire. The most vulnerable areas are the sides, tracks, track suspension mechanisms, and bellies. The turrets and front are the most heavily armored. Therefore, flanking fire should be preferred to frontal; plunging fire should be avoided; and, when necessary, fire should be adjusted so that hits are obtained on the most vulnerable points.

(5) When a tank has been stopped, one more round should be fired into it before another target is engaged. However, no effort should be made to completely disable partially disabled tanks as long as a mobile tank is within range, unless the disabled tank is firing upon friendly troops.

e. Rate of fire.—The rate of fire will be determined by the number, range, and visibility of the hostile tanks. At more distant ranges, the fire will necessarily be slow due to the difficulty in accurately tracking the target. At close range, tanks must be fired on with great rapidity to prevent a break-through. The ammunition supply may prove the determining factor in deciding upon the rate of fire.

f. Interruption of fire.—To interrupt fire, the command or signal CEASE or SUSPEND FIRING is given. The gun squad proceeds as prescribed in paragraph 67*f*. Observation of the battlefield must be continued during these interruptions.

g. Serious malfunction.—In case of a serious mechanical malfunctioning of the gun during the fire fight, it should be returned to the cover position for repair.

h. Action when fire mission is completed.—If operating independently, the gun is immediately withdrawn to the cover position after accomplishing its fire mission. If the situation requires or permits, a change of position is made. If operating under fire control of the section or platoon leader, these moves are made only upon their orders.

■ 134. STATIONARY TANKS OR OTHER VEHICLES.—*a.* An opportunity to fire on a stationary tank or other vehicle will often occur in combat. The method of conducting fire against this type of target, with obvious exceptions, is the same as that described in paragraph 122.

b. For the initial round, the gunner aims at the target with the prescribed data as described in paragraph 97*b*(1)(*b*). Thereafter, adjustment is made by changing the location of the selected range marking (in the sight) on the target, or by selecting a different marking more nearly conforming to the apparent range of the target. At long ranges, considerable difficulty may be encountered in securing a hit because of the following factors:

(1) The relatively large size of the range markings in the sight as compared to the apparent small size of the target when looking through the sight at long ranges precludes aiming at exact points on the target as the dot covers such a large area of the target.

(2) A relatively small movement of the elevating knob (handwheel) results in an abrupt change in the point of strike of the projectile. It requires only 1 mil, and sometimes less, to increase the range 100 yards.

c. When firing at unarmored vehicles, the high-explosive shell will prove more effective than the armor-piercing shell.

■ 135. SMALL FIXED TARGETS.—*a.* The conduct of fire when engaging small fixed targets will, whenever practicable, re-

should be short of the target. By gradually raising the dot up for successive shots, the bursts may be rolled into the target. A similar method may be used when engaging guns firing from behind bushes, trees, folds in the ground, or embrasures. If the terrain makes it impracticable to observe the strike of the bursts in front of the target, a reverse of the process just described may be employed. The bursts are rolled into the target from its rear. For the initial round, a range marking is used that will insure a burst beyond the target; the bottom of the range marking is aimed so that it touches the highest visible point on the target, or if it has no apparent height, is aimed slightly above the target. The first burst should be over the target; for successive rounds, the point of aim is gradually lowered to bring the bursts into the target from the rear.

(3) In some types of terrain, the armor-piercing shot may prove more satisfactory than the high-explosive shell when adjusting fire by these methods, because of its tracer characteristic. The high-explosive shell should be substituted when firing for effect.

the ranges and speeds of vehicles and to determine the correct lead.

b. The size of a combat target (armored car or tank) will have a definite influence upon the estimation of its range and speed. Before beginning the exercises described below, the men should be given an opportunity to note the appearance of available types of armored vehicles at ranges between 200 and 1,200 yards. They should be placed so that they may be seen at different angles, front, side, etc.

c. Figure 48 illustrates the appearance of combat vehicles as seen by the gunner under varying conditions of movement. It is highly desirable as a preliminary step in this phase of training to use a real tank to demonstrate where the gunner should aim in each different situation. The vehicle should be placed so that the group will obtain the same point of view the gunner would have when looking through the telescope at targets moving at various angles to his line of sight. In each case, the instructor should point out on the vehicle, by means of a marker or pointer, the correct point of aim.

d. Figure 49 illustrates the use of various types of combat vehicles operating at constant speeds through known distances. It lends reality to the instruction to use different types of armored vehicles, when available, for this training. This or a similar set-up should be used in conducting exercises Nos. 1 to 4, paragraph 141.

e. Application of sight reticle in field firing.—The following points will add materially to the accuracy of initial fire and should be brought out in field firing after gunners have learned the essentials of aiming and tracking.

(1) *Interpolation for range.*—Interpolation between range brackets, while not essential for the initial round due to the flat trajectory of the 37-mm projectile, may well be used by experienced gunners for the initial shot. For example, at ranges of from 200 to 400 yards, if the zero dot in the reticle is placed slightly above the center of the target, the chance of obtaining a hit with the first round will be increased. After the first round is fired, adjustment is made by observing the strike or trace of the projectile and raising or lowering the range marking in the telescope.

(2) *Adjustment when taking leads on a target moving up or down hill.*—(*a*) Due to the fact that the M6 sight reticle is constructed so that the lead lines are in a horizontal position, it is necessary to make an adjustment in the point of aim when the target is not moving on the horizontal, that is, moving up or down hill. Since the sole reason for leading a moving target is to cause the projectile and the target to arrive simultaneously at the same point, it is necessary to take into account, as far as possible, all the movement, both forward and up or down, that the target will make during the time of flight of the projectile.

(*b*) *When the target is moving up hill, it is necessary to aim higher than when it is moving on the level, and, when the target is moving down hill, it is necessary to aim lower than when it is moving on the level.* The movement of the target brings it up or down to the appropriate aiming point for range. The amount of adjustment necessary can be determined by placing the appropriate range dot along the slope on which the target is moving and, at the same time, placing the appropriate lead dot vertically in line with the target. (See fig. 47.)

■ 141. EXERCISES.—*a. No. 1.*—(1) A vehicle moves parallel to the front of the group at a range of 200 to 300 yards. The men are required to estimate range and speed of the target and announce the corresponding lead listed in the lead table (par. 125*b*). It is advisable to start off with a speed of 5 miles per hour and gradually increase the speed as the men become proficient in their estimations.

(2) Successively, similar courses are taken by the vehicle at ranges up to 1,200 yards.

b. No. 2.—In this exercise, the vehicles are made to approach or recede at different angles and speeds as shown in figure 50. The men are required to estimate the range and speed of the target and to announce the changes in range and leads as the target traverses its course.

c. No. 3.—In this exercise, the gun is placed in position and the vehicles are run successively over the courses described in exercises Nos. 1 and 2. The squad leader estimates the range and speed and announces a fire order to engage the target. The gunner aims accordingly and tracks the

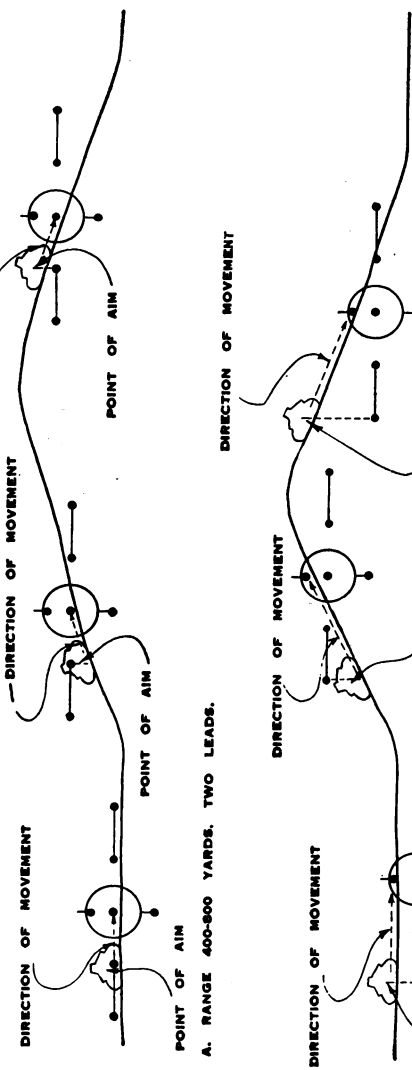


FIGURE 47.—Changes in aiming. Target moving up and down hill.

target. The squad leader announces necessary corrections in range and lead as the target moves through the "range zones" and changes its speed and direction of movement.

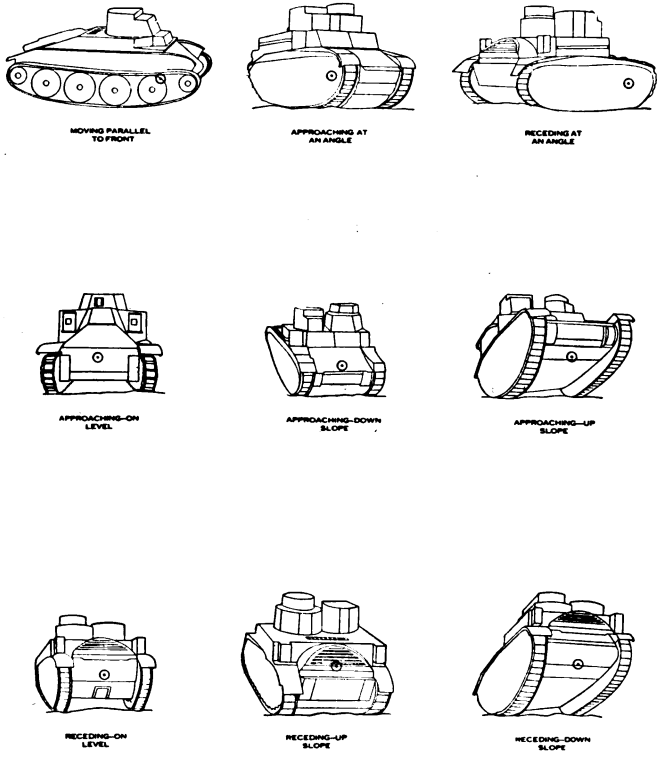


FIGURE 48.—Points of aim when engaging a moving tank. (Circle with dot in center indicates correct aiming point.)

d. No. 4.—In this exercise, more than one vehicle is used. They should be made to appear unexpectedly from various directions. The squad leader will frequently order the gunner to shift to other targets.

e. No. 5.—The men are required to prepare range cards

should start at 5 miles per hour and gradually increase to 15 miles per hour or greater depending on the efficiency of the equipment.

(2) Initially, the ring exercises should be directed toward the training of efficient gun crews. The squad leader, gunner (No. 1), loader (No. 2), and No. 3 are at the gun. Upon the appearance of the target or start of a run, the squad leader is required to issue a fire order and engage the target with a specified amount of ammunition. During this firing, emphasis is placed on correct technique of fire and service of the piece.

(3) Subsequent exercises combining simple tactical situations and firing should be conducted with a view to training the squad as a combat team. These exercises may be conducted on the range described in paragraph 147. However, it is highly desirable when possible, to use terrain that is not familiar to the men in order to avoid the artificiality which results from using a permanent familiar set-up. A flexible arrangement which can be readily installed on any terrain is to use one pulley, emplaced as shown in figure 52, to obtain one change of direction. The target is concealed at its starting point. The unit required to perform the exercise is brought to the area and given a simple situation requiring the application of the various elements of advanced training in going into action and engaging a target from various states of readiness. Set-ups should be varied as much as possible for each exercise in order to keep up interest. Sample exercises of this type are shown in paragraph 145. In these exercises, the instructor acts as umpire, presenting the situation and requirements, and holding a critique at the end of each exercise.

■ 145. EXERCISES.—*a. No. 1.*—(1) The squad is brought up to the position area on its prime mover. The instructor indicates the general direction of a possible approaching tank attack and the position area for the gun.

(2) The squad is required to detruck and go into action immediately.

(3) When the gun is prepared for firing, the instructor causes the target to appear.

(4) After the firing is completed, a critique is held to discuss the execution of the exercise by the squad. Service of the piece and conduct of fire are stressed as well as the necessity for speed and teamwork in preparing the gun for action.

b. No. 2.—(1) The gun is placed in its firing position with the carriage and bore pointing in a direction which will require the trails to be shifted after the first round in order to continue tracking the target.

(2) With the squad in firing position, the target is released, No. 1 calls out when the limit of traverse is reached, at the squad leader's command trails are shifted (par. 67*h*), and the firing continues.

(3) A critique is held as before, covering the performance of each member of the crew. The importance of suspending fire as short a time as possible is emphasized.

c. No. 3.—(1) A situation is presented which requires the squad to move by hand for a distance of 25 to 50 yards to an indicated firing position and engage a target.

(2) The target is released when the gun is prepared for firing.

(3) A critique is held for this and the exercises which follow as described in exercises Nos. 1 and 2. Speed of going into action is emphasized.

d. No. 4.—The squad (with prime mover and gun) is halted in a defiladed area, about 100 yards in rear of the position area. The squad leader is brought forward to the position area where he is instructed to put his gun in action to meet an impending attack; the direction of the attack is indicated by the instructor. The necessity for immediate reconnaissance of the position area by the squad leader while the gun crew unloads and moves the gun forward by hand is emphasized in the critique.

e. No. 5.—The squad leader is presented a situation which requires the squad to prepare a firing position and a position of readiness nearby. A time limit for preparing the positions is given. The gun is placed in the position of readiness fully prepared for action. While work is progressing on the position of readiness, an indication of a tank attack requires the crew to push the gun into the firing position and engage the

target. The target appears when the firing position is occupied and the gun is ready for firing. Continuous observation of the sector during preparation of the positions and the necessity for camouflage, cover, and concealment in both positions is emphasized.

f. No. 6.—Same requirement as in exercise No. 5 except that the position area affords "scant cover" and the gun must be moved by hand (trails closed) a considerable distance.

g. No. 7.—The section leader is brought forward and assigned a position area and a sector of fire for the section. He is told that there is a threat of a tank attack from a specified direction which may come in the next 10 or 15 minutes. This situation requires the selection of positions by the section leader, preparation and occupation of a firing position by squads, and orders of the squad leader to engage a target. The time allowed before the target appears is about 15 minutes. While work is progressing, the target appears, moving very slowly initially. The importance of advance reconnaissance by leaders of position areas and gun positions, necessity for continuous battlefield observation, and readiness to immediately engage a target are discussed in the critique.

SECTION IV

CONSTRUCTION OF TARGETS, RANGES, AND EQUIPMENT

■ 146. RANGE FOR CALIBER .30 FIELD FIRING.—*a.* An approximately level or gently rising piece of ground should be selected for this range. It should be at least 500 yards in depth and of sufficient length to permit convenient operation of the moving target. Figure 50 shows a moving target range including two methods of towing the target. The construction of pits for the scoring and target details will facilitate scoring and changing targets. It is desirable also to have telephone communication between the pits and the firing line.

b. The set-up shown in figure 50 is flexible; that is, the length of the target run and the distance between firing line and target can be varied as desired. By placing the gun in successive firing positions, ranges between 200 and 500 yards

(2) Figure 52 shows the pulley lay-out to creat changes in direction of the target. In the absence of pulleys, a piece of 4-inch pipe, driven into the ground until 5 or 6 inches protrude, will serve. With the pulley arrangement, the tow-rope is attached to the top edge of the target sled and a large knot about 8 inches in diameter, or preferably a wooden ball, is placed in the rope approximately 15 feet ahead of the target to cause the rope to jump the pulley. If the pipe is used, the towrope is attached to the target on a special bracket about 18 inches from the ground.

(3) A drum similar to the one shown in figure 53 is installed at each curve in the road traveled by the towing vehicle.

(4) Details of construction of the sled target are shown in figure 54. A larger target, more nearly corresponding to the size of a tank, may be used; however, its increased weight will reduce smoothness of operation.

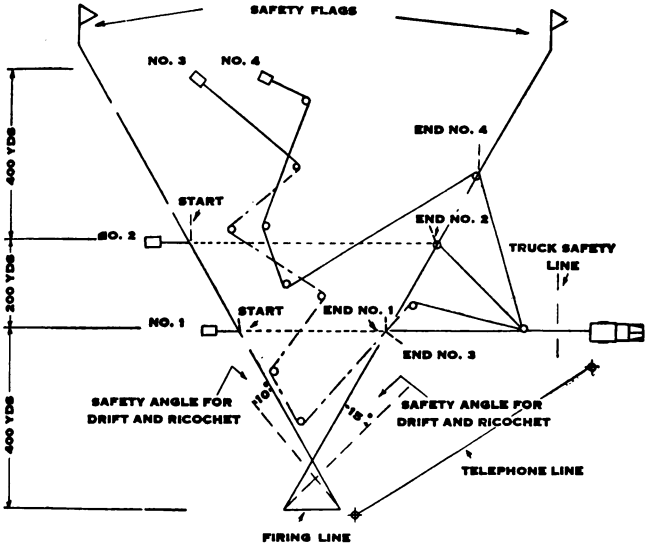


FIGURE 51.—Range for firing 37-mm ammunition at stationary or towed targets.

d. Operation.—(1) After training the operating personnel, an exercise may be fired every 6 or 8 minutes, provided two towing vehicles are used.

(2) The second vehicle, as soon as safety permits after each run, moves to the old target. The towrope is unhooked from

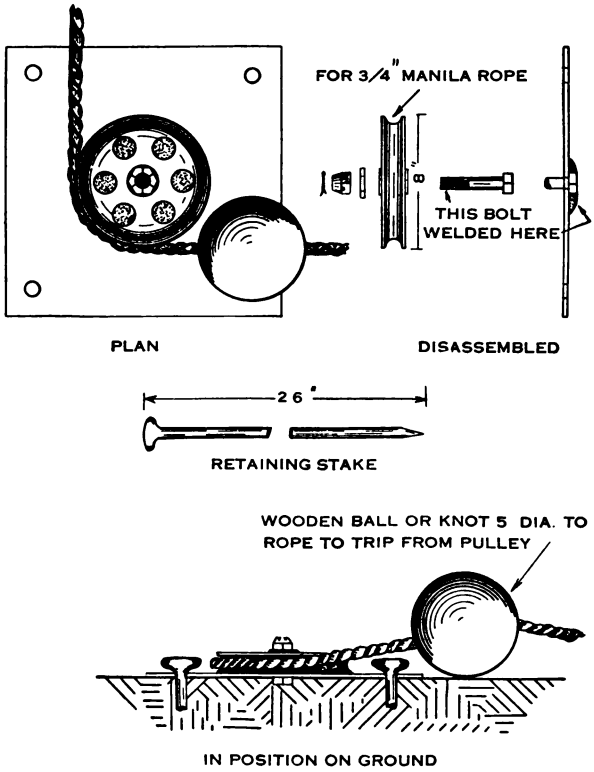


FIGURE 52.—Pulley lay-out for towed target range shown in figure 51.

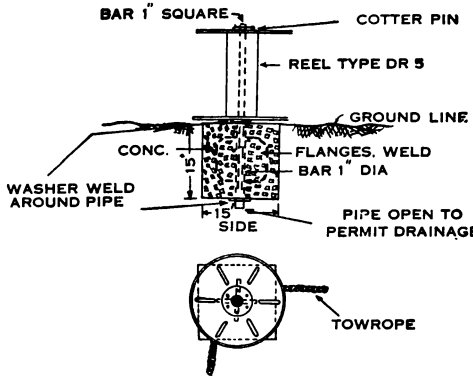


FIGURE 53.—Roadway drum for towed target range shown in figure 52.

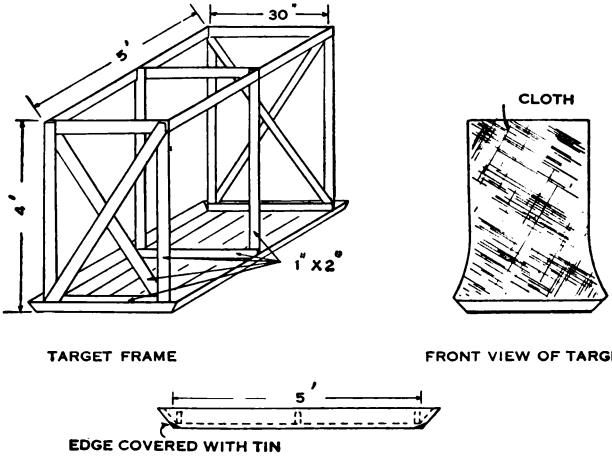


FIGURE 54.—Target frame and sled for towed target range shown in figure 52.

in this schedule to meet the different conditions under which the equipment is being used should be discussed.

d. The method of filling the recoil cylinder as described in paragraph 16 is demonstrated by the instructor.

■ 157. FUNCTIONING.—The use of charts or models to illustrate the functioning of the various groups will facilitate instruction in this subject. The men should be taught to visualize the functioning of the parts rather than to memorize it. To accomplish this, the instructor describes the action of one part upon another in its proper sequence as a chain of events proceeding logically from the cause to effect.

■ 158. STOPPAGES AND IMMEDIATE ACTION.—It is not practicable to prepare actual stoppages without damage to the gun. The instructor should, however, thoroughly explain the causes of different stoppages and how to detect them. The action to be taken for each type of stoppage is explained and the men are required by their group instructor to give similar explanation in their own words calling upon other members of the group for corrections until each has a practical working knowledge of the subject.

■ 159. SIGHT ADJUSTMENTS.—*a. Linkage adjustment.*—All men should be taught the method of checking the linkage system. The borrowing of clinometers or other angle measuring instruments should be arranged before scheduling this instruction. The actual adjustment of the linkage system will seldom be necessary and requires such care that it should be made only by noncommissioned personnel, preferably supervised by an officer. For this reason, instruction in this adjustment may be limited to selected personnel, such as noncommissioned officers. Adjustment of the system for training purposes should be avoided as loosening and tightening the locking nuts will introduce play into the moveable parts of the system. Covering the differential screw and locking nuts is an expedient which will prevent tampering with the linkage adjustment.

b. Bore sighting.—The simplicity of the infinity (alternate) method (par. 29*c*) is emphasized. Instruction in the testing target method (par. 29*b*) is included when time permits. Repeated adjustment of the eccentrics on the trunnion arm

dirt similar to those found on the 1,000-inch range may be easily improvised.

■ 164. ORGANIZATION OF WORK.—*a.* Careful thought must be given to allotment of personnel and use of time during marksmanship training.

b. A schedule should be prepared making a specific allotment of time for each step in the training. The progress of the individual man should be watched carefully and made a matter of record to insure that the instruction is progressing satisfactorily and that all men understand the instruction being given. Frequent rotation of duties within each group, with each man performing each phase of an exercise several times, is preferable to keeping one man at one position a long time.

c. When firing on the 1,000-inch range is contemplated, a sufficient number of targets should be prepared well in advance and the necessity for other equipment and spare parts foreseen so that firing need not be stopped because of failure to anticipate needs.

(1) The following is a check list of equipment necessary for training on the 1,000-inch range:

Target frames and different type targets.
Target paste and paste brush.
Pasters (black and white).
Ammunition, caliber .22.
Magazines, caliber .22.
Stop watch.
Aiming devices.
Pencils.
Record of progress.
Repair tools for guns and range.

(2) Prior to day of firing—

(*a*) Repair and have in working order all range equipment and apparatus.

(*b*) Check linkage adjustment of each gun to be fired.

(*c*) Have orders ready for firing.

(*d*) Have a chart for recording all scores fired.

(*e*) Check with range officer on availability of range and mark range with safety flags.

d. The prompt publication on a bulletin board of the

scores made during instruction and record practice will be of great value in stimulating interest and arousing a spirit of competition.

SECTION V

FIRING AT FIELD TARGETS

■ 165. FIELD FIRING.—Marksmanship on the 1,000-inch range should have taught the mechanical principles of aiming and manipulation. Field firing should teach the accurate estimation of range and lead, the changing of range dots as the range varies, interpolation between range and lead markings, and the adjustment of fire. Although the majority of time allotted for field firing should be spent in firing on moving targets, firing at small fixed targets should not be neglected. Experience in field firing should enable the gunner to obtain a hit on the first round and maintain 80 to 100 percent hits.

■ 166. CONDUCT OF FIRING EXERCISES.—Field firing exercises combine speed in placing the gun in action, skill in marksmanship and field firing, and technique of fire. These exercises are a culmination of all previous training with this gun and should be conducted as far as possible under simulated battlefield conditions rather than a target range set-up.

a. The instructor acts as umpire in all exercises, combining the various elements of advanced training to place the gun in action and firing at a towed target (par. 144). He presents the situations, observes execution of the exercise, and conducts the critique.

b. In the early stages of training, value of the instruction may be increased by suspending the exercise and commenting upon errors at the time they are made. As training progresses, an exercise should be permitted to continue regardless of errors. As a general rule, the instructor should interfere as little as possible during the progress of an exercise and allow the unit leader to solve the requirements in his own way.

c. In all exercises, the time of starting the target on its course is artificial insofar as simulating actual combat conditions are concerned. However, this feature cannot be avoided due mainly to the fact that on most ranges the time required for the target to traverse its course is so short that, if it is released at the start of an exercise, it will have com-