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FM 6-75

DEPARTMENT OF THE ARMY FIELD MANUAL

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105 – mm HOWITZER M2 – SERIES TOWED

DEPARTMENT OF THE ARMY • AUGUST 1952

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This manual supersedes FM 6–75, 5 October 1945, including C1, 24 January 1947

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FM 6–75 is published for the information and guidance of all concerned.

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5 October 1945, including C1, 24 January 1947

CHAPTER 1
GENERAL

1. PURPOSE AND SCOPE

This manual is a guide to assist commanders in developing the sections of towed 105-mm howitzer firing batteries into efficient teams that have a sense of discipline that will impel them to operate effectively under the stress of battle. This manual prescribes individual duties and section drills, inspection and maintenance drills, tests and adjustments for sighting and fire control equipment, and methods for the destruction and decontamination of equipment.

2. DEFINITIONS AND TERMS

a. Gun. Throughout this manual the term *gun* is used generally to include howitzer.

b. Section. Tables of organization and equipment prescribe the *personnel* and *equipment* comprising each section of a battery (figs. 1 and 2). In this manual the term *section* is often used to designate *only the personnel* required to serve the gun and equipment of one section.

Figure 1. 105-mm howitzer section; towed.

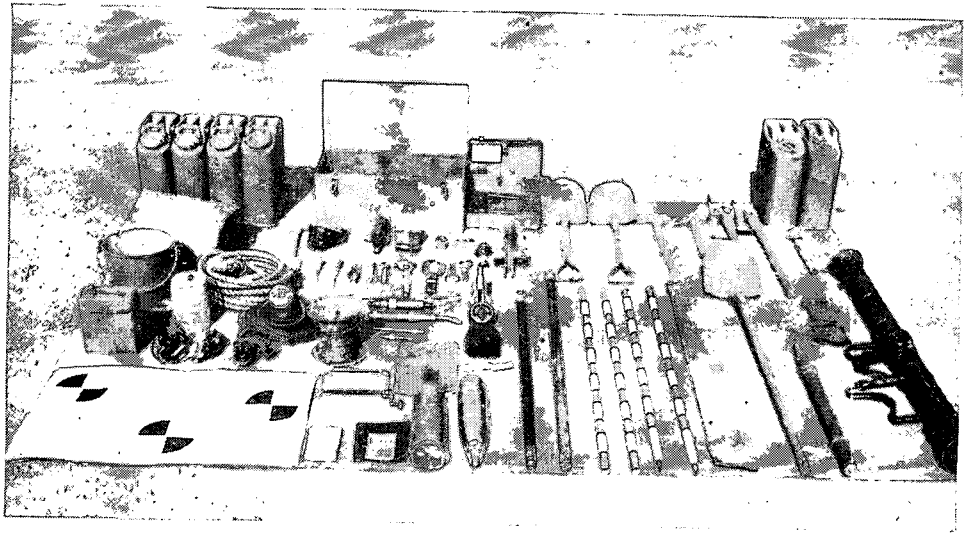

Figure 2. A method of displaying section equipment of 105-mm howitzer, towed (T/O&E 6-27N).

c. Coupled. A gun is coupled when it is attached to its prime mover and all braking and lighting connections are in place.

d. Uncoupled. A gun is uncoupled when it is detached from its prime mover.

e. Front. The front of a section, gun coupled, is the direction in which the prime mover is headed; with the gun uncoupled, front is the direction in which the muzzle points.

f. Right (left). The direction right (left) is the right (left) when facing to the front.

g. In Battery. A gun is said to be *in battery* when its tube is in normal firing position.

3. REFERENCES

Publications pertaining to the 105-mm howitzer, towed, and auxiliary equipment, covering related matters not discussed in detail in this manual, are listed in appendix I.

CHAPTER 2
ORGANIZATION

4. COMPOSITION OF THE GUN SECTION

a. The gun section consists of section personnel, gun, prime mover, and auxiliary equipment.

b. The personnel of the gun section consists of:

(1) A chief of section (CS).

(2) A gunner (G).

(3) Seven cannoneers, numbered from 1 to 7. Number 1 cannoneer is the assistant gunner.

(4) A driver (D).

c. Section equipment is listed in T/O&E's and SNL's appropriate to the weapon and unit (app. I).

5. GENERAL DUTIES OF PERSONNEL

a. Chief of Section. The chief of section is the noncommissioned officer in command of the section. As such he is responsible to the battery executive for—

(1) Training and efficiency of personnel.

(2) Performance of duties listed under section drill; duties in firing, testing and

adjustment of sighting and fire control equipment; and inspection and maintenance of all section equipment, including the prime mover.

(3) Observance of safety precautions.

(4) Preparation of field fortifications for protection of equipment, ammunition, and personnel.

(5) Camouflage discipline; local security; and radiological, biological, and chemical security discipline.

(6) Maintenance of the gun book.

(7) Police of the section area.

b. Gunner. The gunner is the assistant to the section chief in carrying out the duties specified in *a* above. The gunner's specific duties are prescribed in the appropriate chapters of this manual.

c. Cannoneers. Cannoneers perform duties as listed in this manual, and any other duties that the chief of section prescribes.

d. Driver. The driver's primary duties are driving and maintenance of the prime mover. He remains with the prime mover unless other duties are designated.

CHAPTER 3
SECTION DRILL

Section I. GENERAL

6. OBJECTIVE

The objective of section drill is the attainment of efficiency: Maximum precision coupled with high speed.

7. INSTRUCTIONS

a. To develop maximum efficiency and to prevent injuries to personnel and equipment, the drills prescribed in this manual must be observed. Section drill should be conducted in silence except for commands and reports. The section must be drilled until reactions to commands are automatic, rapid, and efficient.

b. Mistakes are corrected immediately. Each member of the section must be impressed with the importance of reporting promptly to the chief of section any mistakes discovered after the command to fire has been given. The chief of section will report mistakes immediately to the executive.

c. Battery officers supervise the drill to insure that instructions are carried out and that maximum efficiency is obtained.

d. Duties should be rotated during training so that each member of the gun section can perform all the duties within the section. In addition, battery overhead personnel not assigned specific duties during drill periods should be trained in the fundamentals of section drill so that they will be capable of functioning efficiently with a gun section if required.

Figure 3. Section in formation.

Section II. PRELIMINARY COMMANDS AND FORMATIONS

8. TO FORM THE SECTION

a. To Fall In. The chief of section takes his post. On the command of execution the section forms in a single rank at close interval centered on and facing the chief of section at a distance of 3 paces (fig. 3). Higher numbered cannoneers,

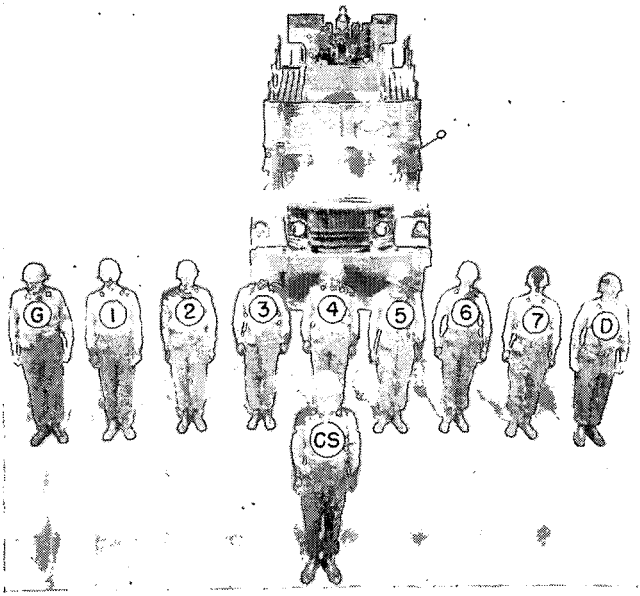

Figure 4. Section formed in front of the gun, gun coupled.

if present, form in order between No. 7 and the driver. The chief of section may indicate in his preparatory command the place and direction most suitable to form the section for a particular situation. At the first formation for a drill or exercise the caution, "As gun section(s)," precedes the command. The commands are: 1. FALL IN; (or 1. IN FRONT (REAR) OF YOUR GUN(S), 2. FALL IN; or 1. ON THE ROAD FACING THE PARK,) 2. FALL IN. The gun section moves at double time and forms at close interval, at attention, guiding on the gunner (figs. 3, 4, and 5).

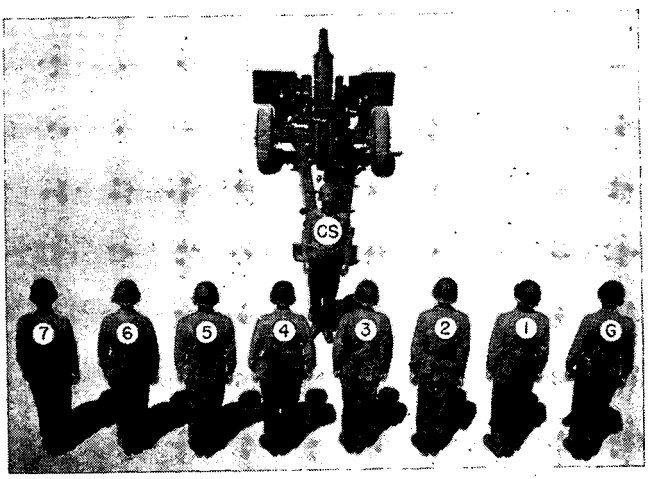

Figure 5. Section formed in rear of the gun, gun uncoupled.

b. To Call Off. The section being in formation, the command is: CALL OFF. Execution is as follows:

(1) At the command all personnel in rank, except the gunner, execute eyes right.

(2) The section then calls off in sequence: "Gunner," "1," "2," "3," "4," "5," "6," "7," "Driver." As each man calls out his designation he turns his head and eyes smartly to the front.

9. POSTS OF SECTION

The command is: 1. CANNONEERS, 2. POSTS. The command is general and is applicable whether the section is in or out of ranks and at a halt or marching. All movements are executed at double time and are terminated at the position of attention. Higher numbered cannoneers, if present, take posts as prescribed by the chief of section.

a. Gun Coupled. The section moves to posts as shown in figure 6. All personnel face to the front and are alined 2 feet outside the prime mover.

b. Gun Uncoupled, Not Prepared for Action. The section moves to posts as shown in figure 7. All personnel face to the front and are aligned 2 feet outside the wheels.

c. Gun Prepared for Action. The section moves to posts as shown in figure 8. All personnel face to the front except the chief of section who faces the executive unless otherwise indicated.

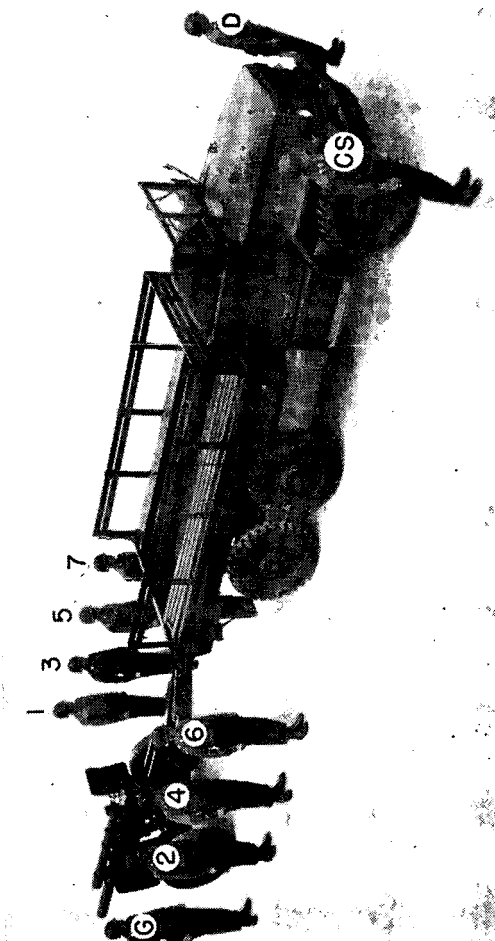

Figure 6. Posts, gun coupled.

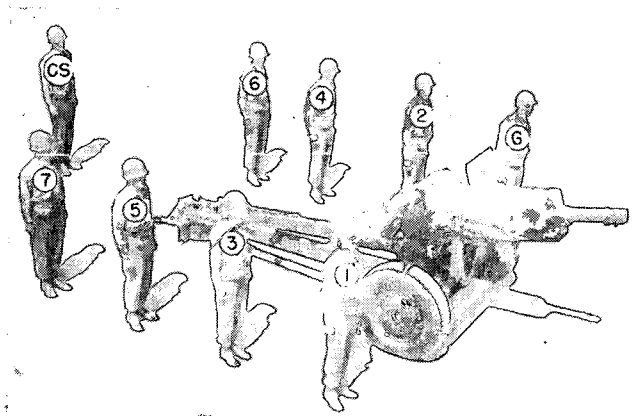

Figure 7. Posts, gun uncoupled, not prepared for action.

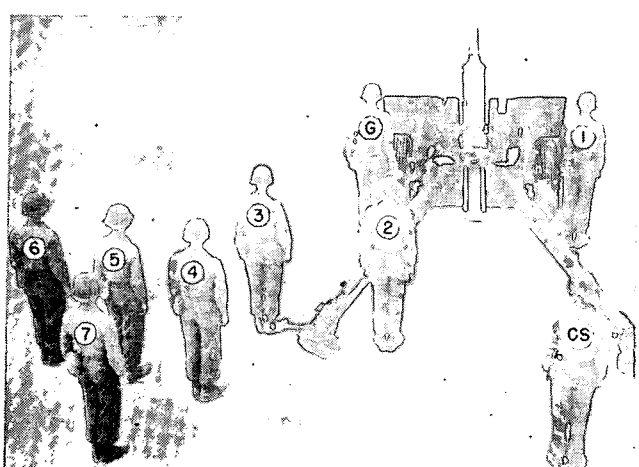

Figure 8. Posts, gun prepared for action.

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10. TO CHANGE POSTS

To acquaint the members of the section with all duties and to lend variety to drill, posts should be changed frequently. The section being *in formation,* the commands are: 1. CHANGE POSTS, 2. MARCH, or 1. SECTION, CHANGE POSTS, 2. MARCH.

a. At 1. CHANGE POSTS, 2. MARCH, only the numbered cannoneers change posts. No. 7 (or the highest numbered cannoneer) moves at double time in rear of the section to the post of No. 1. All numbered cannoneers take 2 left steps thus placing them at the post of the next higher numbered cannoneer.

b. At 1. SECTION, CHANGE POSTS, 2. MARCH, the driver (or the leftmost man) moves at double time in rear of the section to the post of the gunner. The gunner and all other men in line take 2 left steps as in *a* above.

11. TO MOUNT

The commands are: 1. PREPARE TO MOUNT, 2. MOUNT, or 1. MOUNT.

a. At the command 1. PREPARE TO MOUNT, the section moves at double time to positions shown in figure 6. At MOUNT, all members of the section mount and take seats as shown in figure 9. Each cannoneer is assisted by the one directly behind (or in front in the case of the last can-

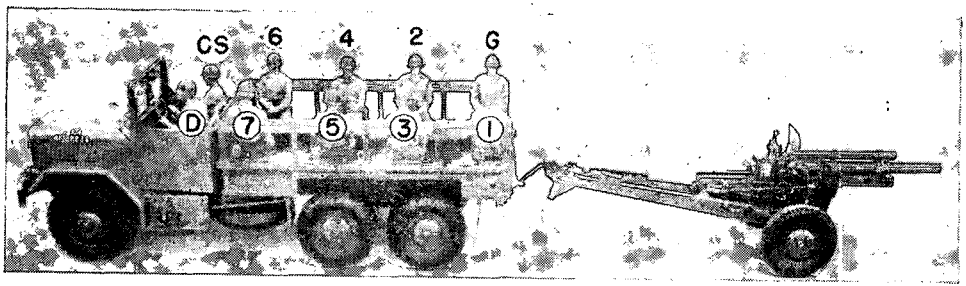

Figure 9. Posts of section, mounted in prime mover.

noneer in column) to insure rapid mounting and to prevent injuries. Before the commander of the vehicle and the driver mount, they verify that the load is properly coupled, that personnel and equipment are aboard, and that the tail gate and safety strap are secure. If any members of the section are to remain dismounted, their designation is announced with the caution "stand fast" between the preparatory command and the command of execution. For example: 1. PREPARE TO MOUNT, "driver stand fast," 2. MOUNT.

b. If the command is: 1. MOUNT, the section executes without pausing all that has been prescribed for the command 1. PREPARE TO MOUNT, 2. MOUNT.

12. TO DISMOUNT

The commands are: 1. PREPARE TO DISMOUNT, 2. DISMOUNT, or 1. DISMOUNT.

a. At the preparatory command the members of the section stand, if appropriate, and make preparations to dismount quickly. At the command of execution members of the section jump to the ground and take posts as shown in figure 6.

b. If the command is: 1. DISMOUNT, the section executes without pausing all that has been prescribed for the command 1. PREPARE TO DISMOUNT, 2. DISMOUNT.

13. TO FALL OUT

a. At Drill. When it is desired to give the section a rest from drill or relieve them temporarily from a *formation* or *post,* the command FALL OUT is given. The command may be given at any time, and infers that the section is to remain in the vicinity of the drill area.

b. When Firing. When firing has been suspended temporarily, but it is desired to have the section remain in the vicinity of the gun, the command FALL OUT is given. Men stand clear of the gun to insure that settings and laying remain undisturbed. During these periods the chief of section may direct his men to improve the position, to replenish ammunition, or to do other necessary work.

CHAPTER 4

PREPARING THE GUN FOR FIRING AND TRAVELING

Section I. PREPARATIONS FOR FIRING

14. TO UNCOUPLE

The command is: UNCOUPLE. At the command, members of the section take positions as shown in figure 10 and execute the following:

a. The gunner disconnects the blackout light-system from the prime mover. No. 1 removes the blackout light-system from the gun and places it in the section chest. The gunner and No. 1 then hasten to the wheels nearest their respective posts.

b. Nos. 2, 3, 6, and 7 hasten to the trail handrails, even-numbered cannoneers on the left, odd-numbered cannoners on the right with respect to the tube.

c. Nos. 4 and 5 go to the muzzle of the gun and assist by placing their weight on the tube.

d. No. 2 unlatches the pintle and, assisted by Nos. 3, 6, and 7, lifts the lunette from the pintle.

e. Nos. 2, 3, 4, 5, 6, and 7 move the gun to the desired location.

f. Nos. 2, 3, 6, and 7 then lower the trails to the

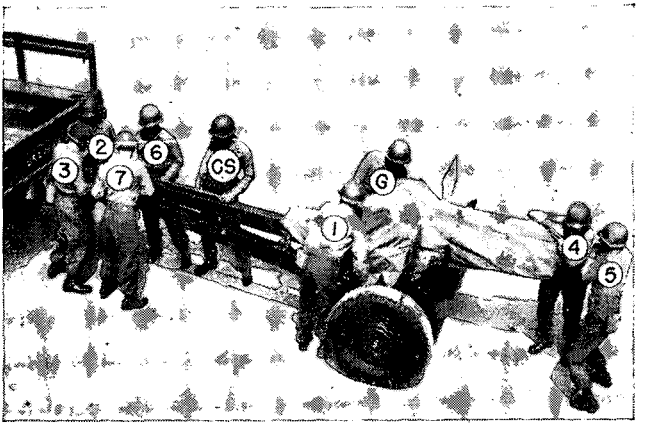

Figure 10. Section uncoupling (coupling) the gun.

ground. Nos. 4 and 5 set the left and right handbrake respectively.

15. DIRECTION

a. Action Front. If the command: ACTION FRONT is given, No. 4 sets the left handbrake and the gun is turned 180° in a clockwise direction (par. 2*e*).

b. Action Right (Left). The command is: ACTION RIGHT (LEFT). The movement is executed as in ACTION FRONT, except that after the gun is uncoupled, the trail is turned 90° in the appropriate direction, and the gun is moved forward to clear the track of the prime mover (par. 2*f*).

16. MOVEMENT OF GUN BY HAND

The commands are: 1 GUN(S) FORWARD (BACKWARD) 2. MARCH. Execution is as follows:

a. At command GUN(S) FORWARD (BACKWARD) the following actions are taken:

(1) The gunner and No. 1 remove the left and right trail lock pins respectively, and place the pins in traveling position. They then move to the wheels of the gun and assist in moving the gun.

(2) Nos. 2 and 6 on the left trail and Nos. 3 and 7 on the right trail manipulate the trails as directed by No 4, so that the axle locks may be locked by Nos. 4 and 5, working on the left and right respectively.

(3) Nos. 2, 3, 6, and 7 close the trails; No. 6, assisted by No. 7, fastens the trail lock.

(4) Nos. 4 and 5 release the handbrakes.

(5) Nos. 2 and 6 grasp the trail handrails on the left and Nos. 3 and 7 grasp the trail handrails on the right.

(6) No. 4 and No. 5 ride the muzzle in order to balance the gun.

(7) Higher-numbered cannoneers, if present, are employed as directed by the chief of section. If the situation requires additional manpower, Nos. 4 and 5, under the direction of the chief of section, will

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obtain prolonges and attach them to the hooks on the left and right axles, respectively. Personnel designated by the battery executive to assist in movement of the gun will take position and pull on the prolonges as directed by the chief of section.

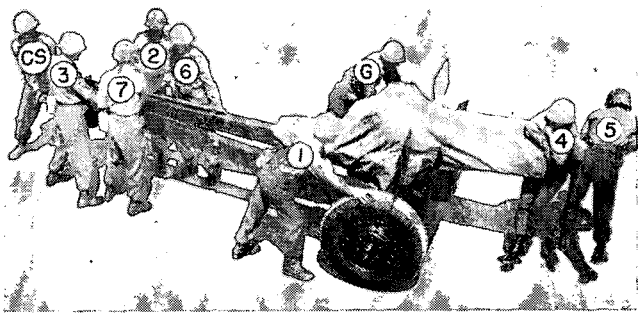

Figure 11. Section moving gun forward.

b. At the command MARCH, all move the gun forward (backward) under the direction of the chief of section (fig. 11). When the gun is being moved up or down steep slopes, Nos. 4 and 5 assist by alternatingly setting and releasing the left and right brakes, permitting the gun to be pivoted about the alternately braked wheels, thus the gun is moved in a zigzag manner. Otherwise Nos. 4 and 5 ride the tube for balance.

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c. At the command HALT, the gun is stopped and reestablished in the firing position and all personnel resume their posts (par. 9*c* and fig. 8).

17. TO PREPARE FOR ACTION

a. The gun being in position uncoupled, the command is: PREPARE FOR ACTION (figs. 12 and 13). If PREPARE FOR ACTION has not been ordered by the executive before the gun is established in the firing position, the command is habitually given by the chief of section as soon as the gun has been uncoupled. After completion of designated duties personnel take posts (fig. 8). If PREPARE FOR ACTION is not desired, the caution DO NOT PREPARE FOR ACTION must be given.

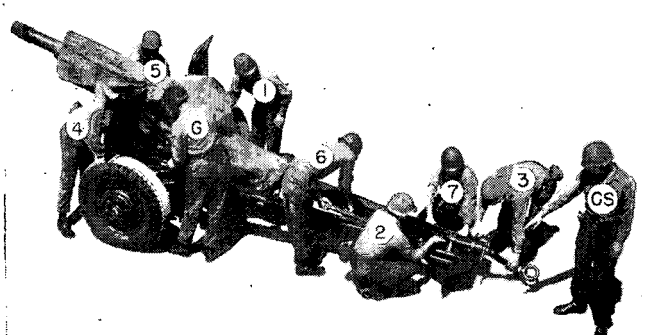

Figure 12. Preparing for action prior to spreading trails.

Table I. Duties in Preparing for Action

Sequence	Chief of Section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
1	Supervises the work of all cannoneers throughout all sequences.			Assists No. 3 in rotating the drawbar 180° to the upward position.	Disengages the drawbar locking shaft and rotates the drawbar 180° to the upward position, assisted by No. 2; re-engages the drawbar locking shaft.	Unlocks and lowers the bottom flap of the shield.		Unlocks the trail locking latch, removes the trail handspike from the traveling position and places it in its socket at the rear of the left trail.	
2		Removes left trail locking pin from the traveling position.	Removes the right trail locking pin from the traveling position.			Unlocks the left axle lock from the traveling position and locks it in the firing position.	Unlocks the right axle lock from the traveling position and locks it in the firing position.		
3				Using the handspike for leverage, assisted by No. 6, lifts and spreads the left trail when No. 4 calls "spread."	Using the drawbar for leverage, assisted by No. 7, lifts and spreads the right trail when No. 4 calls "spread."	When he sees that No. 5 has the right axle lock unlocked, he calls "spread," informing Nos. 2, 3, 6, and 7 that the trails may be spread Releases left handbrake momentarily while the trails are being spread.	Releases right handbrake momentarily while trails are being spread.	Assists No. 2 in lifting and spreading the left trail when No. 4 calls "spread."	Assists No. 3 in lifting and spreading the right trail when No. 4 calls "spread."
4		When the left trail is fully spread, locks it in position by inserting the trail locking pin into the forward hole (firing position).	When the right trail is fully spread, locks it in position by inserting the trail locking pin into the forward hole (firing position).	Removes the rammer staff from its traveling position, assembles it to the rammer head (bore brush), and places it to the right of the gun.	Obtains the fuze setter from the section chest and places it conveniently in relation to the ammunition.	Unfasten the front of the overall cover and fold the front flaps back to the gunner and No. 1.		Place the section chest to the left of the gun.	
5		Gunner and No. 1 together receive the front portion of the overall cover from Nos. 4 and 5 and remove the cover to the rear. No. 1 throws cover to right of the right wheel.			Arranges ammunition and equipment assisted by Nos. 4, 5, 6, and 7 as available.		Removes muzzle cover and places it to the right of the right wheel.	Distributes waste to the cannoneers.	
6		Removes the panoramic telescope from its case and seats it in the telescope mount.	Operates the elevating handwheel to assist No. 4 in unlocking the cradle lock.	Folds the overall cover and places it on the ground to the right of the right wheel.		Unlocks the cradle lock strut, assisted by No. 1 operating the elevating handwheel, and latches it in the firing position.	Removes the aiming posts from the traveling position, assembles them and sets them out or places them to the left of the gun, as directed by the chief of section.	Assists No. 3 in arranging the ammunition and equipment.	Lays telephone wire from his gun to executive's control station and other lines as directed.
7	Verifies that the recoil mechanism contains the proper amount of oil.	Uncovers the telescope mount bubbles; matches elevation indexes (fine and coarse) on telescope mount; sets index of rotating head at zero; sets deflection at zero; levels mount by centering both bubbles.	Uncovers the range quadrant bubbles; sets site at 300 and centers bubbles; operates the breech mechanism and examines the breechblock, chamber, and bore, cleaning any parts requiring it (assisted by No. 2 when so directed); leaves breech open.	When so directed, assists No. 1 in cleaning the breech mechanism, chamber and bore.		Assists No. 3 in arranging the ammunition and equipment.			Assists No. 3 in arranging the ammunition and equipment.
8	Verifies that the gun is prepared for action. Reports to executive, "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.	Lowers and fastens top left shield flap if the aiming point is obstructed by the flap.	Removes the elbow telescope from its case and seats it in its mount when so directed.				Assists No. 3 in arranging ammunition and equipment.		

Table II. Duties in Preparing for Travel (March Order)

Sequence	Chief of Section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7
1	Inspects the gun to insure that it is not loaded. Supervises the work of all members of the section throughout all sequences.	Assists No. 4 in locking the cradle locking strut by placing the gun in the center of traverse. Withdraws the left trail locking pin from the forward hole (firing position) and inserts it in the rear hole (traveling position.)	Inspects the chamber to see that the gun is unloaded; closes the breech after inspection by the chief of section. Closes cover on range quadrant bubbles. Assists No. 4 in locking cradle locking strut by operating the elevating handwheel. Withdraws the right trail locking pin from the forward hole (firing position) and inserts it in the rear hole (traveling position). Picks up gun cover from the right of the gun and places it over the cradle.	Moves to his position at the left trail prepared to assist in closing it.	Moves to his position at the right trail prepared to assist in closing it.	Locks the cradle locking strut in traveling position assisted by the gunner operating the traversing handwheel and No. 1 operating the elevating handwheel. Releases the left handbrake.	Releases the right handbrake.	If removed, inserts the trail handspike in its socket in the rear of the left trail. Moves to his position at the left trail prepared to assist in closing it.	Moves to his position at the right trail prepared to assist in closing it.
2		Fit the overall cover over the breech end of the gun, fitting the holes of the cover over the traveling lock shaft; leave the cover draped over the cradle.	Removes the elbow telescope and places it in its case. When trails are closed, verifies that the traveling lock shafts fit into the traveling lock brackets.	Using the handspike for leverage, assisted by No. 6, lifts and closes the left trail when No. 4 calls "close."	Using the drawbar for leverage, assisted by No. 7, lifts and closes the right trail when No. 4 calls "close."	When he sees that gunner and No. 1 have finished fitting the holes of the gun cover over the traveling lock shaft, calls "close" to Nos. 2, 3, 6, and 7 indicating that the trails may be closed.	Picks up the muzzle cover, and after the tube has been inspected by the chief of section and found cleared, fastens the cover on the muzzle of the gun.	Using the handrail for leverage assists No. 2 in closing the left trail when No. 4 calls "close." Locks the trail locking latch, assisted by No. 7, after the trails are completely closed.	Using the handrail for leverage assists No. 3 in closing the right trail when No. 4 calls "close." Assists No. 2 in locking the trail locking latch.
3		Sets the rotating head and deflection of the panoramic telescope at zero. Closes the covers on the telescope mount level bubbles. Removes telescope from its mount and places it in its case; locks the case.	Removes the elbow telescope, if mounted, and places it in its case.	Assists No. 3 in placing the drawbar in the traveling position.	Disengages the drawbar locking shaft and rotates the drawbar 180° to the downward position, and reengages the drawbar locking shaft.	Locks left axle lock in traveling position by rotating the crank of the axle lock crank assembly 180° out toward the wheels and engages the lock in the outer hole.	Locks the right axle lock in traveling position by rotating the crank of the axle lock crank assembly 180° out toward the wheels and engages the lock in the outer holes.	Removes the handspike, places it in its carrying socket on the left trail and fastens it.	Picks up wire from the executive's control station and other wire as directed.
4	Inspects to insure that the trail lock, cradle traveling locks, and cradle locking strut are locked in traveling position.	Fit and fasten the breech end of the overall cover. Raises and fastens the left top shield flap if lowered.	Raises and fastens the right top shield flap if lowered.	Disassembles the rammer staff; removes the rammer (bore brush) and places it in the section chest; fastens the sections of the rammer staff in their brackets onto the left trail.	Places the fuze setter in the section chest; prepares ammunition and equipment for loading in the prime mover, assisted by other members of the section.	Raise and latch the bottom shield flap; secure the overall cover over the forward part of the gun.		Prepare the section chest for loading in the prime mover.	
5	When operations have been completed reports to the executive "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.	Assists the chief of section in supervising the preparation for travel.		Assists No. 3 in preparing ammunition and equipment for loading in the prime mover.		Assists No. 3 in preparing ammunition and equipment for loading in the prime mover.	Retrieves and disassembles the aiming posts, places them in their covers, and fastens them in their brackets on the right trail. Assists No. 3.	Assist No. 3 in preparing ammunition and equipment for loading in the prime mover.	

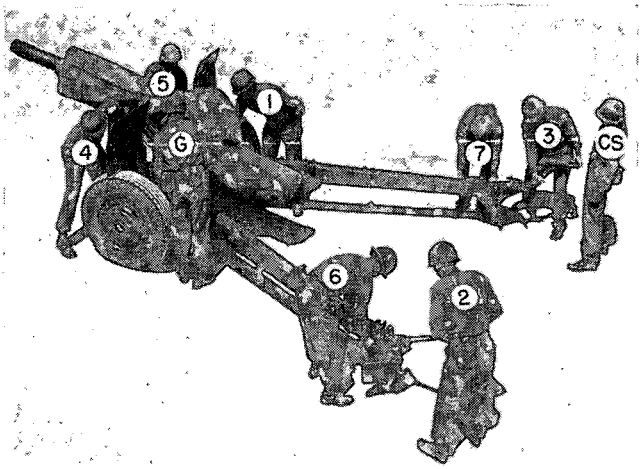

Figure 13. Preparing for action after spreading trails.

b. Individual duties in the execution of the command PREPARE FOR ACTION are as shown in table I.

Section II. PREPARATIONS FOR TRAVELING

18. TO PREPARE FOR TRAVEL (MARCH ORDER)

a. To prepare to resume travel, the gun being uncoupled and prepared for action, the command is: MARCH ORDER. After completion of designated duties personnel take posts as in figure 7.

b. Individual duties in the execution of the command MARCH ORDER are as shown in table II.

c. Exceptions modifying MARCH ORDER duties are:

(1) If firing is to be resumed shortly in another position to which the gun must be towed by its prime mover, the command MARCH ORDER is not given. In this case, at the command for coupling, only such of the operations incident to march order are performed as are necessary for the movement of the gun and for the care and security of the equipment.

(2) If the command MARCH ORDER is given while the gun is coupled, the operations pertaining to march order are completed.

19. TO COUPLE

The gun(s) being in position and in march order, the command is: COUPLE. The prime mover(s), usually under the command of the first sergeant, approaches the gun and halts in prolongation of its trails. The procedure for coupling is as follows:

a. The gunner and cannoneers under the direction of the chief of section lower the tail gate; load the tools, ammunition, and equipment; raise and fasten the tail gate.

b. Nos. 2, 3, 6, and 7 hasten to the trail handrails, even-numbered on the left, odd-numbered on the right with respect to the tube (fig. 10).

c. Nos. 4 and 5 hasten to the front of the gun. No. 4 releases the left handbrake; No. 5, the right.

d. The chief of section directs the maneuvering of the prime mover until the pintle is almost over the lunette.

e. After No. 3 has placed the drawbar in traveling position, Nos. 2, 3, 6, and 7 raise the trails and place the lunette in the pintle. No. 2 latches and locks the pintle.

f. Nos. 4 and 5 assist by placing their weight on the tube.

g. The gunner and No. 1 install the blackout light-system. No. 1 secures the blackout light to the muzzle; the gunner connects the system to the prime mover.

h. The chief of section verifies that the section is in order; checking that the handbrakes are released, the blackout light-system connected, and the pintle latched and locked.

i. As each individual completes his duties, he hastens to his post (fig. 6).

CHAPTER 5
DUTIES IN FIRING

Section I. INDIRECT LAYING

20. DUTIES OF INDIVIDUALS

The general instructions given in paragraphs 6 and 7 on the conduct of section drill apply equally to section drill in duties in firing. For duties of the battery executive see FM 6–140. In general, the duties of individuals in the section in firing are as follows:

a. The chief of section supervises and commands his section and is responsible that all duties of the section are performed properly, all commands executed, and all safety precautions observed.

b. The gunner sets the announced deflection, lays for direction, and refers the gun.

c. No. 1 sets the announced site and elevation, operates the breech, and fires the gun.

d. No. 2 loads the gun.

e. No. 3 operates the fuze setter and sets the fuzes.

f. No. 4 assists No. 3 in setting fuzes, and passes the rounds to No. 2 for loading.

g. No. 5, assisted by Nos. 6 and 7, prepares charges, assembles rounds, and passes the assembled rounds to No. 4.

h. Nos. 6 and 7 remove ammunition from the containers and assist No. 5 in preparing charges and assembling rounds. No. 7 keeps empty cartridge cases out of way of the cannoneers.

i. The driver, after his vehicle is unloaded, is normally directed to the truck park, designated by the battery commander, where he remains with his vehicle and performs maintenance operations unless assigned other duties by the chief of section.

21. CHIEF OF SECTION

a. List of Duties.

(1) To lay for elevation, assisted by No. 1, when the gunner's quadrant is used.
(2) To measure the elevation.
(3) To measure the site to the mask.
(4) To indicate to the gunner the aiming point.
(5) To follow fire commands.
(6) To indicate when the gun is ready to fire.
(7) To give the command to fire.
(8) To report mistakes and other unusual incidents of fire to the executive.
(9) To conduct prearranged fires.
(10) To record basic data.

(11) To observe and check frequently the functioning of the matériel.

(12) To assign duties when firing with reduced personnel.

(13) To verify the adjustment of the sighting and fire control equipment.

(14) To check, before they are replaced in their containers, all rounds not fired which have been prepared for firing.

b. Detailed Description of Duties.

(1) *To lay for elevation when gunner's quadrant is used.*

(*a*) The command QUADRANT (SO MUCH) indicates that the gunner's quadrant is to be used. In laying for elevation it is employed only when the range (elevation) quadrant is inoperative or known to be inaccurate.

(*b*) An elevation of QUADRANT 361.8, for example, is set on the gunner's quadrant (fig. 14) as follows: The upper edge of the index plate is set opposite the 360 mark of the graduated arc on the quadrant frame and the micrometer on the index arm is turned to read 1.8. Care must be taken to use the same side of the quadrant in setting both the index plate and the micrometer knob.

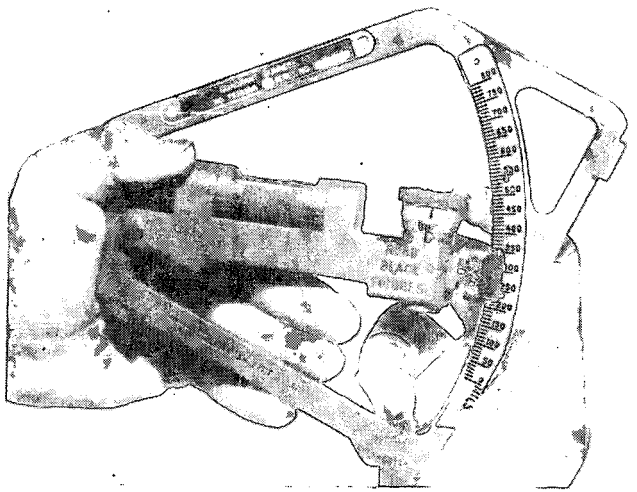

Figure 14. Setting the gunner's quadrant.

(*c*) The announced elevation having been set on the gunner's quadrant, the gun loaded, and the breechblock closed, the gunner's quadrant is set on the quadrant seat on top of the breech. The words *line of fire* must be at the bottom of the quadrant and the arrow pointing toward the muzzle. The chief of section must be sure to use the arrow which appears on the same side of the quadrant as the scale which he is

using. He stands squarely opposite the side of the quadrant and holds it firmly on the quadrant seat, parallel to the axis of the bore. *It is important that he take the same position and hold the quadrant in the same manner for each subsequent setting,* so that in each case he will view the quadrant bubble from the same angle.

(*d*) The chief of section then directs No. 1 to elevate or depress the gun until the bubble is centered, being careful that the last motion is in the direction in which it is more difficult to turn the handwheel. The chief of section cautions No. 1 when the bubble is approaching the center, in order that the final centering may be performed accurately.

(*e*) Normally, special and calibration corrections will be added algebraically at the battery fire direction center and simply announced as: NO. (SO-AND-SO), QUADRANT (SO MUCH).

(2) *To measure the elevation.* At the command MEASURE THE ELEVATION, the gun having been laid, the chief of section directs No. 1 to center the cross-

level bubble, to set the angle of site at scale 300, and with the elevation knob, to center the range quadrant longitudinal-level bubble. The chief of section then reads the elevation set on the elevation scale and micrometer and announces the elevation thus set as, "No. (so-and-so), elevation (so much)." If the range quadrant is inoperative or known to be inaccurate, the elevation is measured by placing the gunner's quadrant on the quadrant seats of the breech ring where the chief of section, by raising and lowering the index arm and turning the micrometer knob, centers the bubble. He then reports the reading on the gunner's quadrant to the executive.

(3) *To measure site to the mask.*

(*a*) The command is: MEASURE THE MASK. The chief of section has No. 1 set site 300 on the angle of site scale and center the cross-level bubble. Then, sighting along the lowest element of the bore, he directs the gunner and No. 1 to operate the traversing and elevating mechanism until the line of sight just clears the crest at its highest point in the probable field of fire. He then directs No. 1 to center the longitudinal-level

bubble by turning the elevation knob. The chief of section reads the site to the mask from the elevation scale and micrometer and reports to the executive, "No. (so-and-so), site (so much)."

(*b*) When the executive announces the minimum quadrant elevation or the minimum elevation and site for each charge, the chief of section records it in a notebook and directs No. 1 to chalk the minimum elevation for each charge to be used on a convenient place on the shield.

(4) *To indicate to gunner the aiming point.* When an aiming point has been designated by the executive (FM 6–140), the chief of section will make sure that he has properly identified the point in question. He will then indicate it to the gunner. If there is any possibility of misunderstanding, the chief of section will turn the panoramic telescope until the horizontal and vertical hairs are on the point designated.

(5) *To follow fire commands.* The chief of section will follow fire commands. He will repeat the commands as required.

(6) *To indicate when the gun is ready to fire.* When the executive can see arm signals

of the chief of section, the chief of section will extend his right arm vertically upward as a signal that the gun is ready to fire (fig. 15). He gives the signal as soon as the gunner calls "Ready." When arm signals cannot be seen, the chief of section reports orally to the executive, "No. (so-and-so) ready."

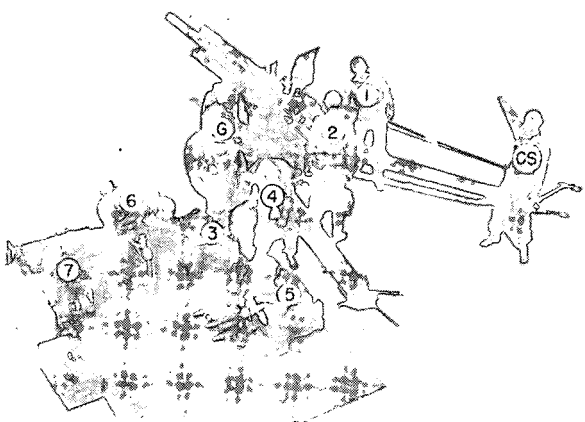

Figure 15. Gun loaded and ready to fire.

(7) *To give the command to fire.* When No. 1 can see arm signals made by the chief of section, the chief of section will give the command to fire by dropping his right arm sharply to his side. When his

arm signals cannot be seen he commands orally: NO. (SO-AND-SO) FIRE. The chief of section will not give the signal or command to fire until all cannoneers are in their proper places. He will require the cannoneers to stand clear of the gun until it has been firmly seated.

(8) *To report mistakes and other unusual incidents of fire to the executive.* If for any reason the gun cannot be fired, the chief of section will promptly report that fact to the executive, and the reasons therefor; for example, "No. (so-and-so) out, misfire." Whenever it is discovered that the gun has been fired with a mistake in laying, the chief of section will report that fact at once; for example, "No. (so-and-so) fired 40 mils right." Whenever the gunner reports that the aiming posts are out of alinement with the sight, the chief of section will report that fact and request permission to realine the aiming posts. Likewise, he promptly reports other unusual incidents that affect the service of the gun.

(9) *To conduct prearranged fires.* Whenever the execution of prearranged fires is ordered, the chief of section will conduct the fire of his section in conformity with the prescribed data.

(10) *To record basic data.* The chief of section will record data of a semipermanent nature in a notebook. These include such data as minimum elevations; aiming points used and their deflections; prearranged fires when section data sheets are not furnished; safety limits in elevation and deflection; number of rounds fired, with the date and hour; and calibration and special corrections when appropriate.

(11) *To observe and check functioning of the matériel.* The chief of section closely observes the functioning of all parts of the matériel during firing. Before the gun is fired, he makes sure that the recoil mechanism contains the proper amount of oil; thereafter he carefully observes the functioning of the recoil system. He promptly reports to the executive any evidence of malfunctioning (TM 9-325). Correct recoil oil pressure exists when the end of the oil index indicator rod is flush with the front face of the recuperator cylinder front head. Whenever the amount of reserve oil is less than that prescribed, the index indicator rod recedes into the oil index recess. If the oil reserve pressure is excessive, the oil index is mechanically unable to indicate

this excess condition due to the construction of the mechanism indicator. This condition necessitates extreme care in establishing the correct oil reserve.

(12) *To assign duties when firing with reduced personnel.* Whenever the personnel of the section serving the gun is reduced in numbers below that indicated in this manual, the chief of section will make such redistribution of duties as will best facilitate the service of the gun. Understrength units, loss of cadremen, casualties, and various details will necessitate gun section operation with a reduced number of personnel to the extent that it is almost normal for cannoneers to double-up on duties. When round-the-clock firing is to be rendered, cannoneers must split up and work in shifts so that provision can be made for relief. Two possible sets of duty combinations are:

Section of 5 men.	Duties which may be combined
	Chief of section and gunner
	No. 1 (no other duty)
	No. 2 and No. 3
	No. 4 and No. 5
	No. 6 and No. 7.

Section of 4 men. Chief of section and gunner
No. 1 (no other duty)
No. 2 and No. 7
No. 3, No. 4, No. 5 and No. 6.

(13) *To verify the adjustment of the sighting and fire control equipment.* See paragraphs 52–64 and TM 9–325 for detailed instructions on testing and adjusting sighting and fire control equipment.

(14) *To check, before they are replaced in their containers, all rounds not fired which have been prepared for firing.* The chief of section personally checks, before they are replaced in their containers, all rounds not fired which have been prepared for firing, to see that all seven powder increments are present in proper condition, that they are assembled in the proper numerical order, and that they are of the proper lot number. He also checks to see that the lot number on the ammunition corresponds to the lot number on the container.

22. GUNNER

a. List of Duties.

(1) To center the bubbles on the telescope mount.

(2) To lay the gun for direction.
(3) To aline the aiming posts with the help of No. 5.
(4) To set a common deflection on a common aiming point after the gun has been laid.
(5) To set or change the deflection.
(6) To apply special corrections for deflection.
(7) To refer the gun.
(8) To make corrections for aiming post displacement.
(9) To call "Ready."

b. Detailed Description of Duties.

(1) *To center the level bubbles on the panoramic telescope mount.* The gunner centers the level bubbles on the telescope mount as part of all operations that involve the use of the panoramic telescope except as described below for direct fire. These bubbles are centered prior to using the telescope and the level of the mount is verified before firing ((9) below). For direct fire, using the two-man, two-sight system (pars. 34–38) the gunner centers the cross-level bubble only.

(2) *To lay the gun for direction.* The gun being in position but not laid for direction, the gunner alines the movable azimuth micrometer (gunner's aid) index

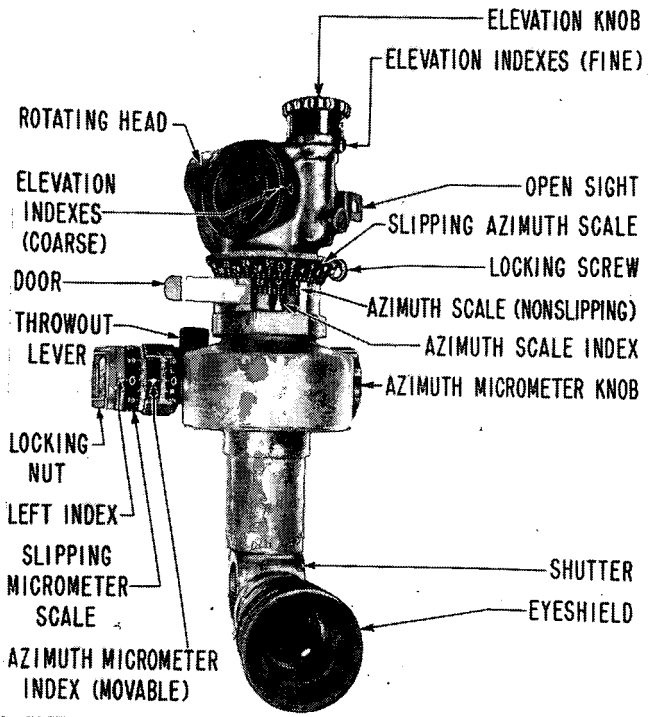

Figure 16. Panoramic telescope M12A7-series.

of the sight (fig. 16) with the right (fixed) index. He then loosens the slipping azimuth micrometer scale locking nut (fig. 17) and slips the slipping azimuth micrometer scale until its zero is

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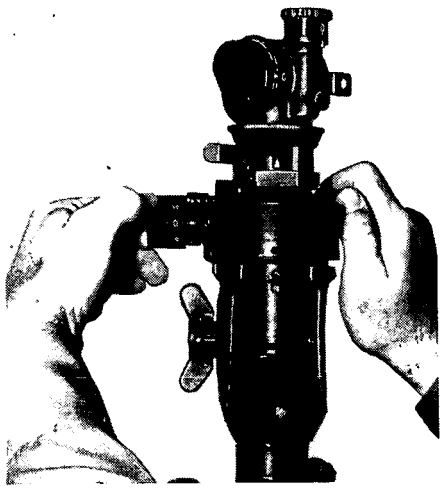

Figure 17. Loosening azimuth micrometer scale locking nut

alined with the left index (fig. 18). He tightens the locking nut (fig. 19) and verifies the alinement of zero of the scale with the left index. He then turns the azimuth micrometer knob to aline zero of the micrometer scale (and the left index) with the right index. He then opens the door and with the azimuth micrometer knob or rotating head sets the nonslipping azimuth scale at zero (fig. 20). He closes the door over the nonslipping azimuth scale. He then

[redacted]

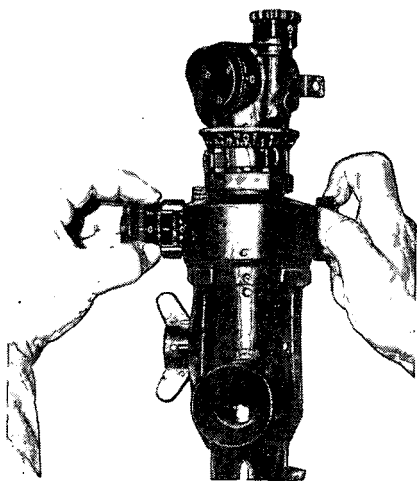

Figure 18. Alining the zero of the slipping micrometer with the left index.

loosens the slipping azimuth scale locking screw and moves the slipping azimuth scale until its zero coincides with the index on the outside of the door (fig. 21). He tightens the locking screw and verifies the reading. The executive commands AIMING POINT THIS INSTRUMENT, DEFLECTION NO. (SO-AND-SO) (SO MUCH). The gunner sets the deflection for his gun on the panoramic telescope by disengaging the throwout lever and turning the rotating

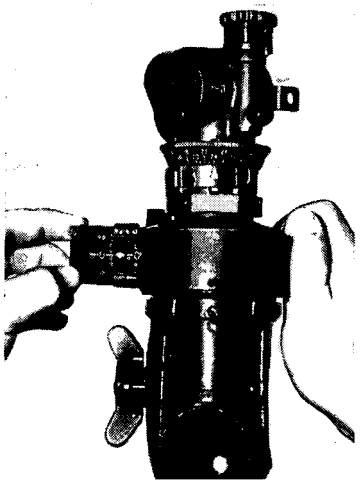

Figure 19. Tightening the locking nut with slipping azimuth micrometer scale set at zero.

head to the announced hundred mil graduation. He releases the throwout lever and turns off the last two digits of the deflection on the azimuth micrometer scale, using the azimuth micrometer knob. He then traverses the gun until his line of sight through the telescope is on the executive's aiming circle. He checks to insure that his bubbles are level and announces, "No. (so-and-so) ready for recheck." As additional deflections are announced by the executive he

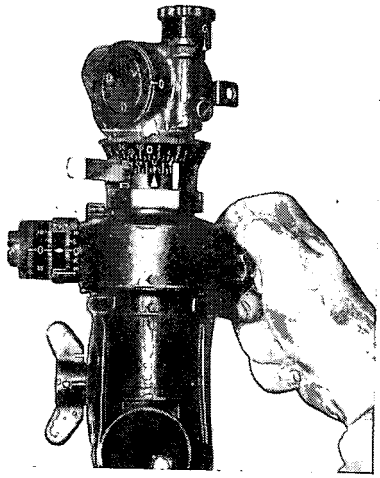

Figure 20. Turning the nonslipping azimuth scale to zero.

sets them on the sight and traverses the gun so that his vertical reticle is on the aiming circle. When the executive announces "No. (so-and-so) is laid" the tube is oriented and should not be traversed except on order of the executive.

(3) *To aline aiming posts.* The gun having been laid, as in (2) above, the executive may command, AIMING POINT, AIMING POSTS, DEFLECTION 2800, REFER. At this command the gunner sets the panoramic telescope at deflection

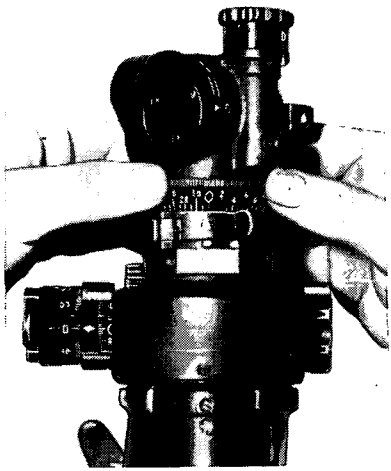

Figure 21. Slipping zero of the slipping azimuth scale to index on door.

2800 and, with hand signals, directs No. 5 in the alinement of the posts with the vertical reticle of the sight (fig. 22). If because of the nature of the terrain the posts cannot be set out at deflection 2800, the gunner turns the azimuth micrometer knob until the slipping azimuth scale is on another even hundred mil graduation. He alines the posts at this new deflection. The chief of section reports the altered deflection to the executive: "No. (so-and-so) aiming posts at

(so many hundred), deflection 2800 in lake (or other reason)." The executive will then command NO. (SO-AND-SO), DEFLECTION 2800, REFER. At this command the gunner loosens the slipping azimuth scale locking screw and moves the slipping azimuth scale to deflection 2800 (fig. 23). He then tightens the locking screw and verifies the adjustment.

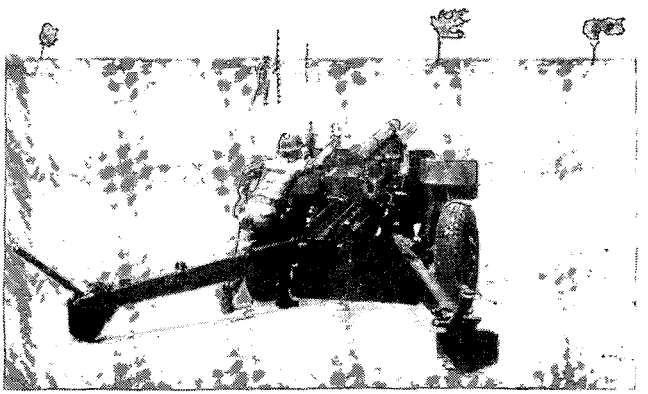

Figure 22. Gunner and No. 5 alining aiming posts.

(4) *To set a common deflection on a common aiming point after the gun has been laid.* The battery having been laid, the ex-

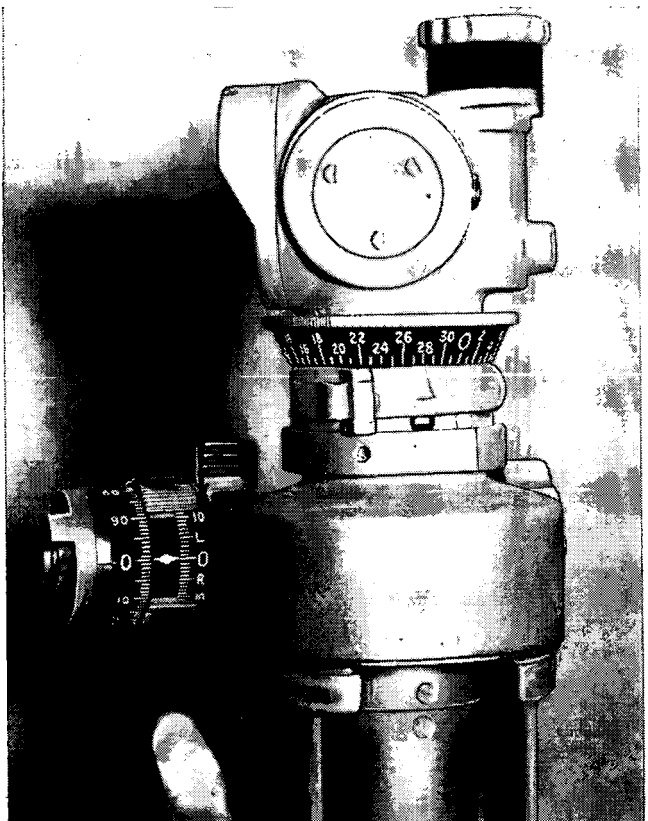

Figure 23. Common deflection 2800.

ecutive may command, AIMING POINT, CHURCH STEEPLE, REFER. At this command without moving the tubes, the

[redacted]

gunners of all guns turn their sights to the aiming point designated and report the deflections to the executive. The executive then commands, COMMON DEFLECTION 2800. At this command each gunner loosens the locking screw of the slipping azimuth scale and moves the scale until 2800 is in coincidence with the index on the door. The gunners then unlock the slipping azimuth micrometer scale locking nut and move the slipping azimuth micrometer scale to zero; tighten the locking nut and verify that zero is in coincidence with the index and that line of sight is still on the aiming point.

(5) *To set or change a deflection.* The command is: DEFLECTION (SO MUCH). If, for example, the command is DEFLECTION 483, the gunner disengages the throwout lever with his left thumb and turns the rotating head of the sight to 4 (400). He releases the throwout lever, and with his right hand turns off the remaining 83 mils on the micrometer scale (fig. 24). He then traverses the gun until the vertical reticle is on the aiming post, being careful that the last motion is such as to cause the vertical hair of the telescope to approach the

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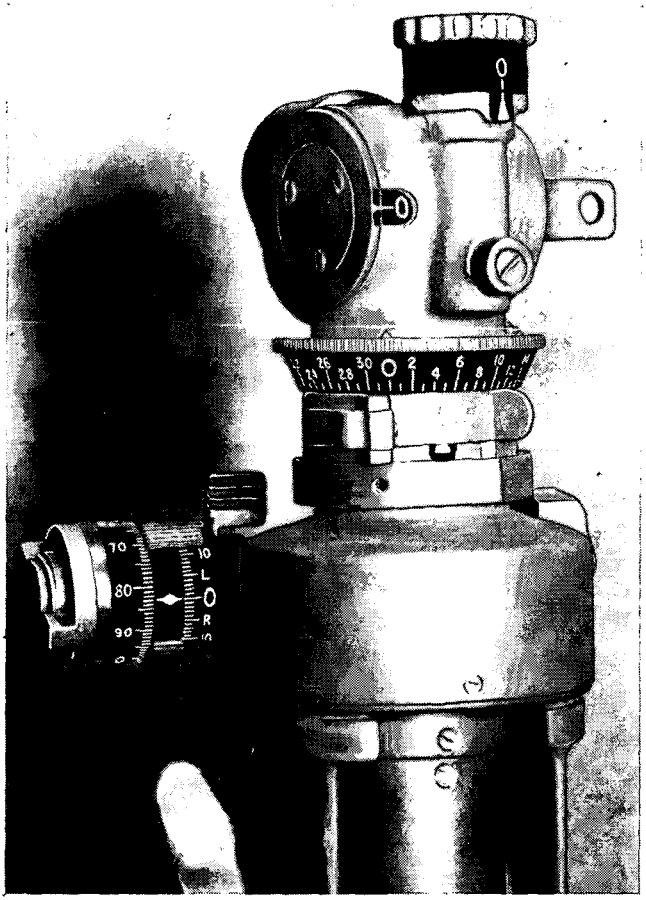

Figure 24. Deflection 483.

aiming point from the left to take up any lost motion in the mechanism.

(6) *To apply special corrections for deflection.* The gunner applies special corrections to the announced deflection for his gun by moving the movable azimuth micrometer index the proper amount of direction. For example, the executive announces SPECIAL CORRECTIONS, DEFLECTION 2665, NO. 1 LEFT 10. The gunner on No. 1 gun first sets off the announced deflection, then moves the azimuth micrometer index (gunner's aid) upward 10 mils. He then resets the announced deflection at the index in its new position. Subsequent deflections, which are set on the azimuth micrometer scale, will be increased 10 mils automatically. The *special correction* is left on the gunner's aid until completion of the mission or until a new special correction is announced. The new special correction is set off as commanded and is *not* applied algebraically by the gunner.

(7) *To refer the gun.* The command from the executive is: AIMING POINT THIS INSTRUMENT (OR OTHER POINT), REFER. Without disturbing the laying of the gun the gunner turns only the sight until, with the bubbles level, the

vertical reticle is on the point designated. He then reports the deflection to the executive: "No. (so-and-so), deflection (so much)."

(8) *To make correction for aiming post displacement.* For details of correcting for aiming post displacement see paragraph 44.

(9) *To call "Ready."* The gun having been laid for direction and No. 1 having called "Set," the gunner verifies the laying, moves his head clear of the telescope, and calls "Ready" to indicate that the gun is ready to be fired.

23. NO. 1

The No. 1 cannoneer is the assistant gunner (par. 4*b*).

a. List of Duties.

(1) To set the site.
(2) To apply special corrections for site.
(3) To set the elevation.
(4) To lay for elevation.
(5) To open and close the breech.
(6) To call "Set."
(7) To fire the gun.
(8) To use the rammer.

b. Detailed Description of Duties.

(1) *To set the site.*

(*a*) When site is to be used, the initial

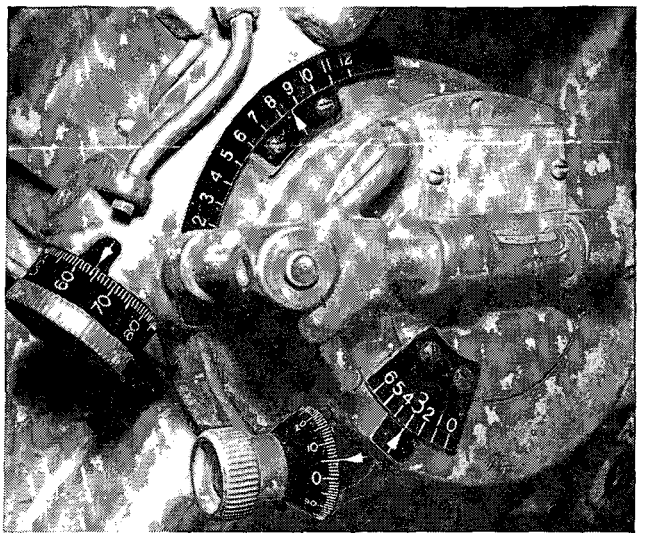

Figure 25. Site 305, elevation 864.

series of fire commands for opening fire will contain the command for site. The command is, for example, SITE 305 (fig. 25). The site setting is changed only by a new command SITE (SO MUCH).

(*b*) To set the site, No. 1 turns the angle of site micrometer knob until the announced site is shown. The site is indicated by a scale graduated in hundreds of mils from 0 to 6

and a micrometer scale graduated from zero to 100 mils. A site of 300 is horizontal. No. 1 first sets the index in the proper section of the scale in hundreds of mils and then sets the units on the micrometer scale. The last motion in setting the site should be in the direction of increasing site.

(2) *To apply special corrections for site.* During any mission when special corrections for site are announced, the No. 1 adds algebraically the site correction announced for his gun to each site commanded. For example, the executive announces SPECIAL CORRECTIONS, SITE 310, NO. 1 DOWN 2, NO. 2 DOWN 3, etc.; 308 is set on the site scale of No. 1 gun; 307 is set on the site scale of No. 2 gun, etc. Special site corrections should be marked in chalk on the right shield.

(3) *To set the elevation.* To set an elevation, No. 1 sets the site and then sets the announced elevation on the elevation scale. The elevation is indicated by an elevation scale graduated in hundreds of mils from minus 100 to plus 1200 and an elevation micrometer graduated from zero to 100 mils. No. 1 grasps the ele-

vating knob and turns it until the announced elevation is shown, making sure that the last movement is in the direction of increasing elevation.

(4) *To lay for elevation.* No. 1 turns the cross-leveling worm knob and centers the cross-level bubble. Having performed the duties described in (1), (2), and (3) above, he turns the elevating handwheel and elevates or depresses the tube until the longitudinal-level bubble is centered making sure that his eye is directly opposite the bubble and that the last movement is in the direction in which it is most difficult to turn the handwheel.

(5) *To open and close the breech.*

(*a*) *To open breech.* No. 1 grasps the breech operating lever handle with his left hand, depresses the handle to release the catch, and draws it toward him and to the rear, opening the breech.

(*b*) *To close the breech.* No. 1 grasps the breech operating handle with his left hand and pushes it forward and away from him until the breech is closed and the latch is engaged. When the breech is fully closed the latch is automatically engaged.

(6) *To call "set."* No. 1 calls "Set" when the

gun has been loaded, the breech closed, and the gun laid for elevation.

(7) *To fire the gun.* At the chief of section's signal or command, NO. (SO-AND-SO) FIRE (par. 21*b*(7)) No. 1 grasps the handle of the lanyard with his right hand and pulls (fig. 26). After firing, release the lanyard. In case of a misfire, the instructions contained in paragraph 85 will be followed.

(8) *To use the rammer.* Normally the rammer components will be handled by No.

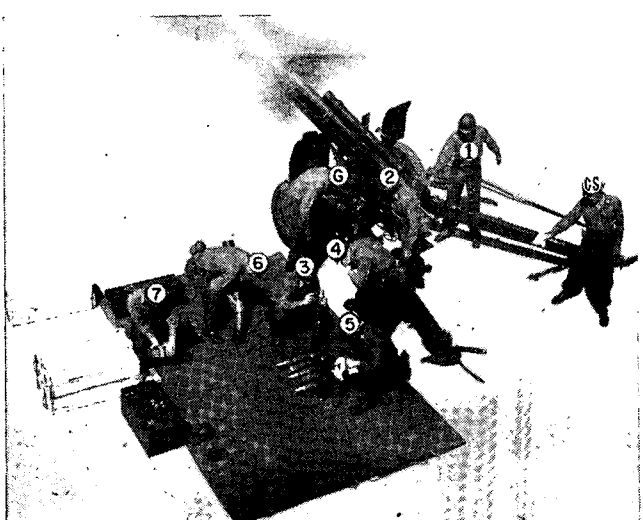

Figure 26. No. 1 firing gun.

[redacted]

1. The rammer staff is used to extract cartridge cases which cannot be ejected by the extractor. To extract a cartridge case, No. 1 inserts the rammer staff in the bore, and lightly taps the bottom of the inside of the case until it is loosened and can be pushed out of the chamber (fig. 27). No. 2, standing at the breech, receives the cartridge case in both

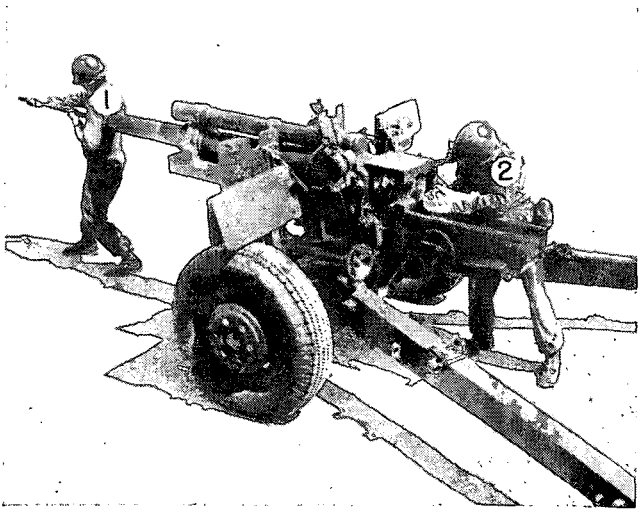

Figure 27. Using rammer to remove stuck cartridge case.

hands. To extract an unfired round, the procedure described in paragraph 49 will be followed.

[redacted]

24. NO. 2

a. List of Duties.

(1) To load the gun.

(2) In volley fire, to call out the number of the round and the announced elevation.

(3) To assist No. 6 in shifting the left trail when necessary.

(4) When the breech is opened, to inspect the chamber and bore to insure that they are clear.

Figure 28. No. 2 receiving round from No. 4.

b. Detailed Description of Duties.

(1) *To load the gun.* To receive the round, No. 2 steps with his left foot toward No. 4 and grasps the round with his right hand at the base of the cartridge case and his left hand in front of the rotating band (fig. 28). After resuming his position facing the gunner, and after an elevation or quadrant has been announced, he inserts the round in the breech and *pushes it home* with his right fist (fig. 29). It is extremely important that he use his fist to guard against getting his fingers crushed by the closing breechblock. No. 2 will be particularly careful to avoid striking the fuze against any portion of the gun. A round to be loaded will be held well out of the path of recoil until the gun is again in battery.

(2) *To call out the number of the round and the announced elevation in volley fire.* In volley fire, to insure firing the correct number of rounds, No. 2 calls out the number of the round and the elevation as he finishes loading the projectile. As he finishes loading the last round, he adds, "Last round." For example, when two rounds are to be fired at elevation 480, he calls out, "Second and last round,

Figure 29. Loading the gun.

480." He should not speak louder than is necessary to insure his being heard by the members of his own section.

(3) *To assist No. 6 in shifting the left trail when necessary.* No. 2 assists No. 6 in shifting the left trail as directed by

the gunner. The command is: MUZZLE RIGHT (LEFT), and the trail is shifted in the opposite direction so that the muzzle is swung in the direction commanded. At the gunner's command or signal to stop shifting, Nos. 2 and 6 lower the trail to the ground.

(4) *When the breech is opened, to inspect the chamber and bore to insure that they are clear.* No. 2 will inspect the chamber and bore after each round is fired to make certain that the chamber is clear and that the bore is free of any residue from the charge. He calls out "bore clear" if it is clear.

25. NO. 3

a. List of Duties

(1) To fuze or change fuzes of projectiles.
(2) To set the fuze setter.
(3) To set fuzes.
(4) To apply special corrections for his gun to fuze settings.
(5) To assist No. 5 in assembling rounds when necessary.
(6) To assist No. 7 in shifting the right trail when necessary.

b. Detailed Description of Duties.

(1) *To fuze or change fuzes of projectiles.* No. 3 removes the fuze or closing plug

from the projectile; removes (or replaces) the supplemental charge, if necessary; and screws in the designated fuze. In assembling fuzes to or disassembling fuzes from shell, only the authorized fuze wrench should be used. VT fuzes should be screwed in by hand and tightened with fuze wrench M18 using only manual force. Do not hammer on the wrench or use an extension handle. If a time fuze is used No. 3 removes the safety pull wire from the fuze and, if a booster is present, the safety pin from

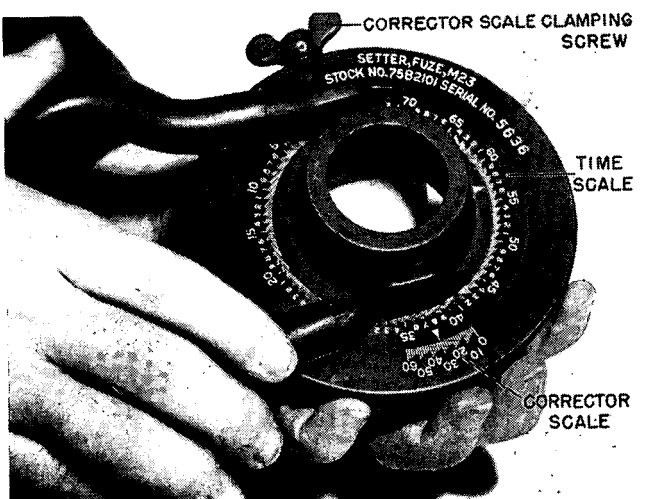

Figure 30. Setting the fuze setter.

the booster. Boosters without safety pins will not be used.

(2) *To set the fuze setter M22 or M23.* The corrector scale is not used. No. 3 makes certain that the corrector scale is locked at corrector setting 30. He releases the time scale clamping screw marked "T" and grasping the handle, turns the body until the index on the body is opposite the announced time on the time scale (fig. 30). He then locks the time scale clamping screw, being careful not to disturb the setting. For accuracy, No. 3 looks squarely at the scales and indexes in the same manner each time.

(3) *To set fuzes.*

(*a*) *Selective superquick and delay fuzes.* When FUZE QUICK is announced, No. 3 will verify the superquick setting. (The slot on the setting sleeve should be alined with the letters SQ.) When FUZE DELAY is announced, he will turn the setting sleeve until the slot is alined with the word *delay.*

(*b*) *Combination time and superquick fuzes.* These fuzes may be set for time action. However, the percussion element will detonate the round upon impact if the time element

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fails. After fuzing the projectile, No. 3 removes the safety pull wire from the fuze. For percussion action the command is FUZE QUICK M500 (or other designation). For time fuzes No. 3 verifies that the *S* on the setting ring is alined with the index on the fixed ring. If not, he sets it at *S*.

(*c*) *VT fuzes.* These fuzes operate and function in such a manner as to require no setting on the part of any personnel.

(*d*) *Setting time fuzes.*

1. Using fuze setter M22 or M23. After making the announced settings on the fuze setter M22 or M23, No. 3 carefully places it over the fuze and turns the setter clockwise until the notch on the time ring of the fuze engages the stop on the setting ring of the fuze setter. He places the handle in the most convenient position, pushes down on the fuze setter until the notch fully engages the stop, and continues to turn it clockwise until the pawl in the adjusting ring assembly drops into the notch of the fixed fuze ring

(fig. 31). This prevents further turning and indicates that the fuze is set. He then lifts the fuze setter from the fuze and makes a visual check of the fuze setting to insure that the fuze ring notch was actually engaged and that the fuze is properly set. If the desired time setting is passed, the time ring on the fuze should be turned back several seconds and then continued in the original direc-

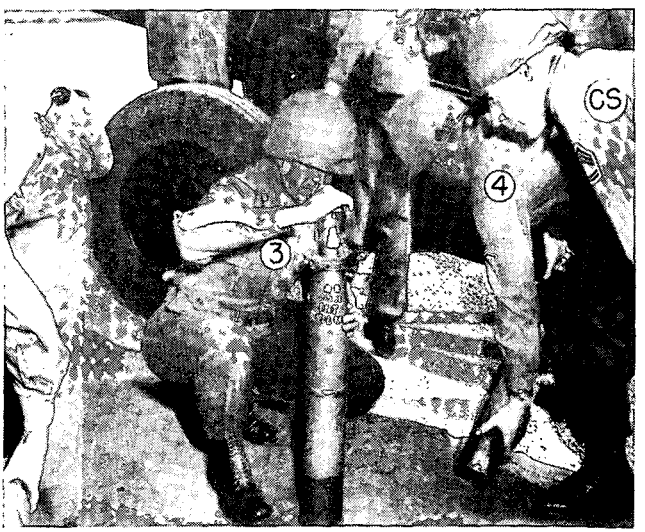

Figure 31. Setting time fuze.

tion until the desired time is again opposite the index.

2. *Using fuze setter M14.* This is a wrench-type fuze setter in which the fuze time scale is used in setting the fuze. With M500 fuzes No. 3 engages the key of this wrench-type fuze setter in the notch on the setting ring of the fuze and rotates the setting ring clockwise (increasing direction) until the announced time setting of the fuze time scale is opposite the index mark on the fuze. With M54 and M55 fuzes, the setting ring is rotated in a counterclockwise direction.

(4) *To apply special corrections for his gun to fuze settings.* When special corrections are announced for his gun, No. 3 will apply the special fuze setting correction; for example, the command is TIME 18.2, NO. 1 PLUS .7, the No. 3 cannoneer on No. 1 gun must add .7 of a second to 18.2 and to all subsequent commands received for fuze time in that mission or until a new special correction is received for his gun.

(5) *To assist No. 5 in assembling rounds, when necessary.* When directed by the

chief of section, No. 3 assists No. 5 in fitting the projectile to the cartridge case after the charge has been prepared.

(6) *When necessary, to assist No. 7 in shifting right trail.* No. 3 assists No. 7 in shifting the right trail as directed by the gunner. The command is: MUZZLE RIGHT (LEFT), and the trail is shifted in the opposite direction so that the muzzle is swung in the direction commanded. At the gunner's command or signal to stop shifting, Nos. 3 and 7 lower the trail to the ground.

26. NO. 4

a. List of Duties.

(1) To assist No. 3 in setting time fuzes.

(2) To pass the round to No. 2.

b. Detailed Description of Duties.

(1) *To assist No. 3 in setting time fuzes.* See paragraph 25*b*(3) for details of setting time fuzes.

(2) *To pass the round to No. 2.* No. 4, with his left hand under the cartridge case, his right hand under the projectile, taking care that the projectile and cartridge case do not separate, passes the round to No. 2 in a manner that enables No. 2 to grasp the base of the cartridge case in his right hand (fig. 28).

27. NO. 5

a. List of Duties.

(1) To set out and to assist the gunner in alining the aiming posts.

(2) To prepare charges.

(3) To replace increments in the cartridge case before rounds are replaced in their containers.

b. Detailed Description of Duties.

(1) *To set out aiming posts.* When so directed by the chief of section, No. 5 sets out the aiming posts under the guidance of the gunner (par. 22*b*(3)).

(2) *To prepare charges.* The fire commands for opening fire will include the designation of the charge. No. 5 verifies the number of increments and removes those increments numbered higher than the charge designated (fig. 32). He then replaces the remaining increments in the cartridge case in their original numerical order. After No. 5 has prepared the charge he fits the projectile to the cartridge case assisted by No. 3, when necessary. Care is taken to prevent damage to the lip of the cartridge case. When so directed, Nos. 6 and 7 assist No. 5.

(3) *To replace increments in cartridge case before rounds are replaced in their con-*

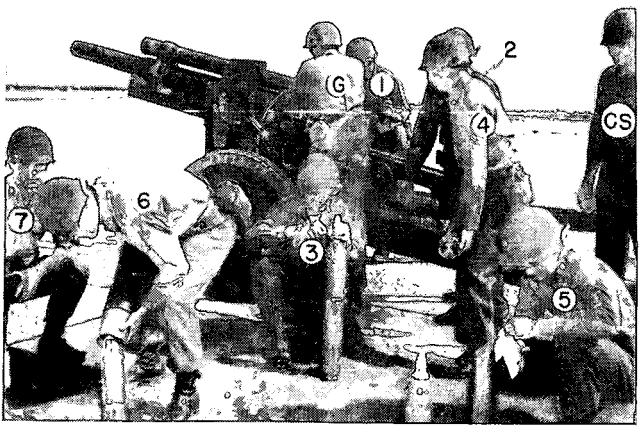

Figure 32. Preparing ammunition.

tainers. Under the personal supervision of the chief of section, No. 5, assisted by Nos. 6 and 7, replaces increments in cartridge cases for all ammunition prepared for firing but not fired. He carefully checks to see that all seven increments are present, in the proper condition, assembled in the proper numerical order, and that they are of the proper lot number.

28. NO. 6

a. List of Duties.

(1) To remove ammunition from containers.

(2) To assist No. 5 in preparing charges.
(3) When necessary, assisted by No. 2, to shift the left trail.
(4) To replace unused ammunition in containers.

b. Detailed Description of Duties.

(1) *To remove ammunition from containers.* Assisted by No. 7, No. 6 removes rounds from their containers and arranges them so that they are within easy reach of No. 5. He inspects each round to see that it is free from sand and dirt and that the rotating band is not burred. With a cloth, he wipes off any foreign matter. Projectiles with burred rotating bands are put aside until he can remove the burrs with a file.

(2) *To assist No. 5 in preparing charges.* When so directed, Nos. 6 and 7 assist No. 5 in preparing charges as described in paragraph 27*b*(2).

(3) *When necessary, assisted by No. 2, to shift the left trail.* When so directed by the gunner, No. 6, assisted by No. 2, shifts the left trail (par. 24*b*(3)).

(4) *To replace unused ammunition in containers.* Under the personal supervision of the chief of section and assisted by No. 7, No. 6 replaces unused ammunition in containers, being careful that the lot

number on the ammunition corresponds to the lot number on the container.

29. NO. 7

a. List of Duties.

(1) To assist No. 6 in removing ammunition from containers.
(2) To assist No. 5 in preparing charges.
(3) To keep empty cartridge cases out of the way of the cannoneers.
(4) When necessary, assisted by No. 3, to shift the right trail.
(5) To assist No. 6 in replacing ammunition in containers (par. 28*b*(4)).
(6) Lays or picks up telephone wire to executive's control station as directed.

b. Detailed Description of Duties.

(1) *To assist No. 6 in removing ammunition from containers.* No. 7 assists No. 6 in removing rounds from their containers as described in paragraph 28*b*(1).
(2) *To assist No. 5 in preparing charges.* When so directed Nos. 7 and 6 assist No. 5 in preparing charges as described in paragraph 27*b*(2).
(3) *To keep empty cartridge cases out of way of cannoneers.* No. 7 places the empty cartridge cases in rear of the right trail where they will be out of the way of the cannoneers.

(4) *When necessary, assisted by No. 3, to shift the right trail.* When so directed by the gunner, No. 7, assisted by No. 3, shifts the right trail (par. 25*b*(6)).

(5) *To assist No. 6 in replacing ammunition in containers.* No. 7 assists No. 6 in replacing rounds in containers in the manner described in paragraph 28*b*(4).

(6) Lays or picks up telephone wire to executive's control station as directed.

Section II. DIRECT LAYING, GENERAL

30. GENERAL

a. Firing by direct laying is a special technique that demands a high standard of training. The section must operate as an independent unit. Training in direct laying is based on the technique employed in indirect laying. Enemy targets taken under fire by the section in direct laying are usually those capable of returning fire on the gun section at point-blank range, therefore, the speed and accuracy required in indirect laying becomes even more important for direct laying missions.

b. There are two basic systems of direct laying for use with the 105-mm howitzer: The *two-man, two-sight system* (pars. 34 to 38, incl.) where the gunner, using the panoramic telescope, lays for

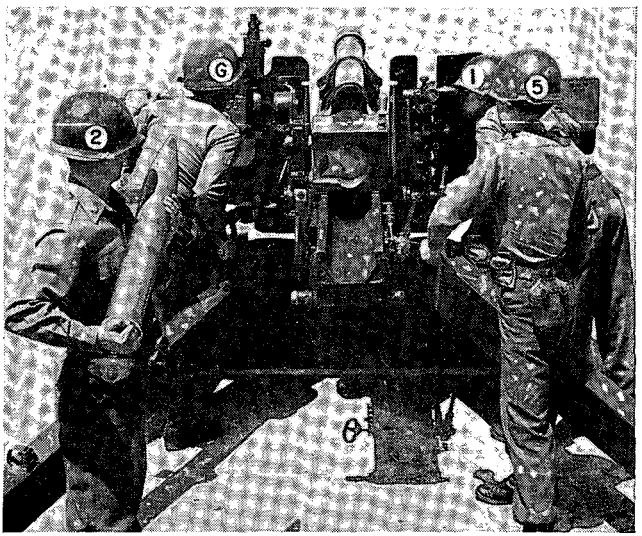

Figure 33. Serving the gun, direct laying, two-man, two-sight system.

direction, and No. 1, using the elbow telescope, lays for range (fig. 33) ; and the *one-man, one-sight system* (pars. 39 to 42) where the gunner lays for both direction and range using the panoramic telescope.

c. The chief of section will designate the system of laying to be used when firing by direct fire methods. Selection of the system is dependent upon the type which can more effectively engage the target. Training must include both systems of direct laying.

d. For additional information on direct laying see FM 6–140.

31. PREPARATION OF A RANGE CARD

a. The chief of section is responsible for defense in his assigned sector, but he should be prepared to fire on targets in other sectors.

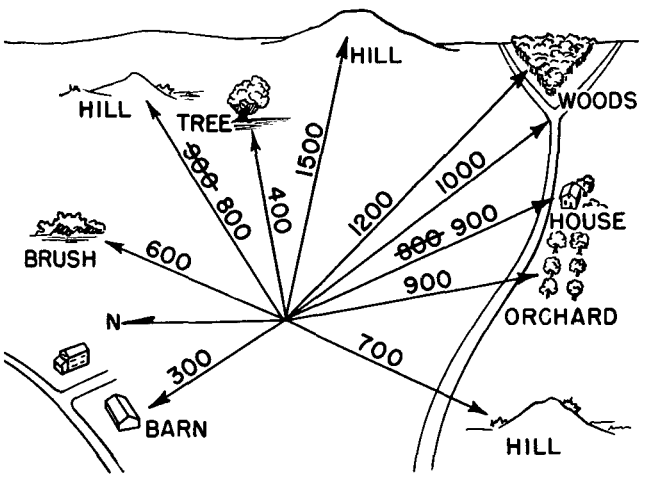

Figure 34. Range card for direct laying.

b. As soon as possible after occupation of position, the chief of section measures or estimates the ranges to critical points in likely avenues of approach for enemy tanks and vehicles, and pre-

pares a range card (fig. 34) upon which he notes the ranges for quick reference.

c. If there are no prominent terrain features, stakes may be driven into the ground at critical points for reference. As time permits, the range card will be improved by replacing estimated ranges with more accurate ranges obtained by firing, pacing, taping, vehicle speedometer reading, map measurement, or survey.

32. FIELD OF FIRE

The sector of fire for the gun should, if possible, be cleared of all obstructions that might endanger battery personnel when the gun is fired, or that might hinder observation. Care should be taken not to give away the location of the position.

33. CONDUCT OF FIRE

a. Trajectories. Trajectory characteristics change with the type of ammunition and the charge fired. The following trajectory characteristics govern the conduct of fire:

(1) *Ranges from 0 to 400 yards using HEAT or ranges from 0 to 600 yards using HE charge 7.* Within these range limits, the trajectory will be flat enough to prevent an 8-foot tank from passing safely under it. Fields of fire and terrain allowing, the upper range limits for the ammuni-

tion and charge used are the ideal at which to open fire. Fire can then be conducted over the maximum time without misses if deflection is correct. Also there is less risk of obscuring the target with the smoke from a short burst.

(2) *Ranges from 400 to 700 yards using HEAT or 600 to 1000 yards using HE charge 7.* These range limits include the zone in which the trajectory is sufficiently flat to permit direct estimation of range without actually bracketing the target. Assuming little dispersion, if a hit is obtained at the bottom of an 8-foot tank firing at the upper range limit, 700 yards for example, with HEAT, the adding of a 100-yard range change will result in a round which will just brush the top of the tank. During adjustment within this zone, range changes should seldom be more than 100 yards, and frequently range changes of 50 yards will be sufficient. The upper limits mentioned herein are the greatest ranges at which fire should be opened unless tactical conditions require otherwise. A trained gun crew should obtain hits by the second shot.

(3) *Ranges from 700 to 1300 yards using HEAT or 1000 to 1800 yards using HE*

charge 7. This zone includes the ranges at which hits are only reasonably possible. Bracket methods are normally used to obtain adjustment in this zone. There is more dispersion in this zone; fire should not be opened at these ranges unless surprise is not important.

(4) *Ranges over 1300 yards using HEAT or over 1800 yards using HE charge 7.* At ranges over 1300 yards using HEAT or over 1800 yards using HE charge 7, direct laying is not advisable against moving targets. Dispersion is the controlling factor. Ranges must be known accurately or determined by bracketing. At these ranges the slope of fall of the projectile becomes so great that a hit on a moving target is very difficult to obtain.

b. Vertical Displacement Table. Vertical displacement is the change in the point of burst (up or down) between two rounds fired at an upright target at different range settings. The following table shows the vertical displacement for a 100-yard range change at various ranges, firing shell HEAT and shell HE charge 7. The use of vertical displacement in direct firing is explained in FM 6–140.

Table III

Vertical Displacement (feet) per 100 Yd. Range Change

Range (yards)	Displacement, feet, Shell HEAT	Remarks	Displacement, feet, Shell HE, Charge 7	Range (yards)
100	1	Start firing using 400 yard range setting.	.5	100
200	2		1.5	200
300	3		2	300
			2.5	400
			3.5	500
400	4	Start firing with estimated range. Increase or decrease by multiple of 50 or 100 yards. Bracketing not necessary.	4	600
500	5.5		5	700
600	6		5.5	800
700	8		6	900
			7	1,000
800	9	Bracket target (get bursts over and short) to obtain hit.	8	1,100
900	10.5		9	1,200
1,000	11.5		10	1,300
1,100	13		10.5	1,400
1,200	14.5		11.5	1,500
1,300	16		13	1,600
			14	1,700
			14.5	1,800
Over 1,300	----------	At ranges over 1300 yards using HEAT or over 1800 yards using HE charge 7, direct firing is too inaccurate to be used against moving targets (*a*(4) above).	----------	Over 1,800

Note.—Information computed from data obtained from FT 105-H-4.

c. Types and Selection of Targets for Direct Laying. Targets for direct laying usually consist of hostile vehicles, tanks, and personnel threatening the battery. Enemy personnel, whether alone or accompanying tanks, will seldom present themselves as a clearly defined target. Normally, attacking infantry, using all available cover, reveal themselves only fleetingly. Accordingly fire is conducted on the area containing the attackers rather than upon the individuals. Tanks usually attack in groups and may be accompanied by infantry. Normally, first priority is given to attack of those targets within the assigned sector of the weapon and second to targets in other sectors. Priority within the assigned zone is given to:

(1) Tanks at short ranges, threatening to overrun the position.

(2) Hull down stationary tanks, covering the advance of other tanks.

d. Ammunition and Fuzes.

(1) *General.* For close-in fires a variety of fuzes and shells are available. When using high explosive shell, charge 7 is used habitually for speed, ease in adjustment, imparting forward motion to fragments, and more effective fuze action. The flat trajectory resulting from use of charge 7 coupled with dug-in guns may make extremely close-in fire impossible

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due to projectiles skipping without detonating on impact. At ranges of 200 to 400 yards fuzes may fail to function on hard, flat ground; however, preparation of sectors of fire will remedy this situation. The terrain may be prepared for direct fire by placing mounds of sandbags, dirt, or logs in the gun's sector of responsibility. When direct fire is placed on these or other previously selected points, as they are approached by an attacking force, the necessity for adjusting fire is reduced.

(2) *Ammunition.* Ammunition may be HE, HEAT, or white phosphorus (WP). HEAT is designed for, and is highly effective in, antitank and antivehicle fires. HE is ideally suited for antipersonnel fire and is effective against vehicles and tanks. WP may be used to set immobile tanks and vehicles on fire, to further restrict defiles, and to produce casualties. However, consideration must be given to the effect on the defense of the resulting smoke screen.

(3) *Fuzes.* Base detonating fuzes are contained in HEAT projectiles. WP ammunition is fuzed with a superquick-delay fuze while HE may be used with fuzes quick, delay, or time.

(*a*) Fuze quick is the most desirable fuze to use with HE shell on close-in fires. It is highly effective and, since no fuze setting is required, is much faster to use.

(*b*) The time required to set the fuze and to adjust the point of impact for maximum ricochet effect makes fuze delay less desirable than fuze quick. When using fuze delay to gain ricochet effect, the point of impact is adjusted 10-30 yards in front of the target. If less than 50 per cent of the bursts are ricochet, the fuze should be changed to quick.

(*c*) Fuze time is the least desirable type fuze for close-in fires. Due to the wide range dispersion resulting from variations in time of burning with short fuze settings, this fuze should be used only for ranges of more than 1,000 yards. The areas covered effectively by air and ricochet bursts are similar.

Section III. DIRECT LAYING, TWO-MAN, TWO-SIGHT SYSTEM

34. CHIEF OF SECTION

a. List of Duties.

(1) To conduct the fire of his gun.
(2) To identify or select the target.
(3) To estimate the range to the target.
(4) To determine the lead in mils.
(5) To give initial commands.
(6) To give subsequent commands, based upon observed effect.

b. Detailed Description of Duties.

(1) *To conduct the fire of his gun.* The chief of section conducts the fire of his gun when the executive commands: TARGET (IDENTIFICATION), FIRE AT WILL, or simply FIRE AT WILL.

(2) *To identify or select the target.* If the executive designates an object or one of a group of objects as the target, the chief of section must correctly identify this target. If the target is a group of tanks or other objects, the chief of section selects the target that, in his estimation, is the greatest threat to his own position or the position of the supported troops.

(3) *To estimate the range to the target.* A range card (fig. 34) with ranges to key

points provides the best means for determining the initial range. If a range card has not been prepared the range is estimated.

(4) *To determine the lead in mils.* The amount of lead in mils is determined by the speed of the target, range, course at which it is moving, and charge being fired. Approximate initial leads are: With shell HEAT—slow (0–5 mph), 5 mils; medium (5–10 mph), 10 mils; fast (10–15 mph), 15 mils. Based upon the observed effect, the lead is changed as necessary.

(5) *To give initial command.* The chief of section will give fire commands containing the following elements in sequences:

(*a*) *Designation of target.* The command is: TARGET (SO-AND-SO).

(*b*) *Projectile, charge and fuze.* The commands specify the appropriate items in sequence, such as: SHELL HE, CHARGE 7; or SHELL ANTI-TANK. With shell HEAT, no command for charge or fuze is necessary because these are not variable but are fixed.

(*c*) *Lead.* The command is: LEAD (SO MUCH). See (4) above for estimating initial leads.

(*d*) *Method of fire.* Fire is continuous unless otherwise commanded. In continuous fire the gun is loaded and laid as rapidly as possible and fired at the command of the gunner.

(*e*) *Range.* The command is: RANGE (SO MUCH). The range commanded by the chief of section is that range to be set on the elbow telescope sight reticle. When firing charges other than those for which the reticle of the sight is graduated, the chief of section converts his estimated range to an appropriate range command for the charge and telescope being used. For example when firing shell HE, charge 7, using the elbow telescope graduated for shell HEAT, for a range estimated as 800 yards the command is RANGE 500. A conversion table for various charges may be prepared using data obtained from the firing tables for the weapon.

(6) *To give subsequent commands, based on observed effect.*

(*a*) *Change in lead.* During adjustment the lead is changed by the command RIGHT (LEFT) (SO MUCH).

(*b*) *Change in range.* During adjust-

ment the range is increased by the command ADD (SO MUCH) and decreased by the command DROP (SO MUCH). See paragraph 33 for determining range changes during adjustment of fire.

35. GUNNER

a. List of Duties.

(1) To center the cross-level bubble on the panoramic telescope mount.

(2) To set the elevation indexes and the azimuth scales of the panoramic telescope at zero.

(3) To lay on the target with the announced lead.

(4) To track the target.

(5) To command FIRE.

(6) To follow subsequent commands.

b. Detailed Description of Certain Duties.

(1) *To lay on the target with the announced lead and track the target.*

(*a*) Prior to any direct fire mission the gunner verifies that the movable azimuth micrometer (gunner's aid) index is set at zero.

(*b*) If the slipping azimuth and slipping micrometer scales have not been slipped, the gunner zeros these two scales.

(*c*) If only the slipping azimuth scale has been slipped, the gunner disregards this scale. He opens the door over the nonslipping azimuth scale and sets that scale at zero. The micrometer scale is brought to zero.

(*d*) If both the slipping micrometer scale and the slipping azimuth scale have been slipped, the gunner opens the azimuth scale door and turns the nonslipping azimuth scale to zero. He then turns the azimuth micrometer knob until the left index of the micrometer matches the right index.

(*e*) The operations described in (*a*), (*b*), (*c*), and (*d*) above make the line of sight of the telescope parallel to the axis of the bore. The gunner then tracks the target using the traversing handwheel to keep the appropriate vertical grid line in the reticle of the telescope ahead of the target. The announced lead is measured on the horizontal reticle scale (fig. 35). In the two-man, two-sight system the vertical location (range) of the target is controlled by No. 1. If time does not permit the chief of section to announce the lead, it is estimated by the gunner.

[redacted]

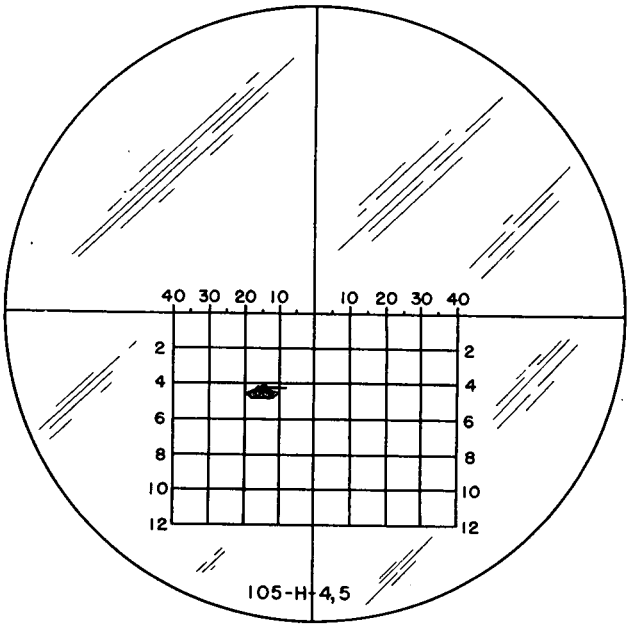

Figure 35. Gunner's sight picture, two-man, two-sight system (lead 15 mils).

(2) *To command FIRE.* After No. 1 has called "Set" and when ready, the gunner commands FIRE.

36. NO. 1

a. List of Duties.

(1) To lay for range, using the elbow telescope.

[redacted]

(2) To track the target.
(3) To call "Set" when the gun is loaded and the correct range line is on the center of the visible mass of the target.
(4) To follow subsequent commands.

b. Detailed Description of Certain Duties. In direct laying, using the elbow telescope, the No. 1 sets off the range commanded by the chief of

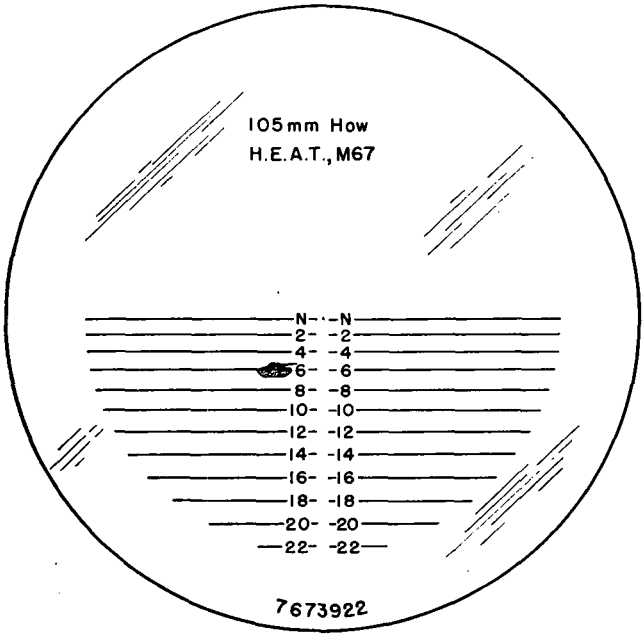

Figure 36. No. 1's sight picture, elbow telescope M16A1D, two-man, two-sight system (range 600 yards HEAT).

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section by placing the appropriate range line in the reticle of the elbow telescope on the center of the visible mass of the target; he tracks the target with the elevating handwheel maintaining the proper range line on the center of the target (fig. 36).

37. NO. 5

a. List of Duties.

(1) To open and close the breech.

(2) To indicate that the gun is loaded by tapping No. 1 on the shoulder.

(3) To fire the gun at the gunner's command.

b. Detailed Description of Certain Duties. No. 5 will take position in rear of No. 1 and will open and close the breech and fire the gun. He taps No. 1 with his right hand; pulls the lanyard with his left hand.

38. REMAINDER OF SECTION

The remaining cannoneers perform their duties as prescribed for indirect laying.

Section IV. DIRECT LAYING, ONE-MAN, ONE-SIGHT SYSTEM

39. CHIEF OF SECTION

The duties of the chief of section are the same as in the two-man, two-sight system (par. 34).

[redacted]

[redacted] Information

40. GUNNER

a. List of Duties.

(1) To match the elevation indexes of the panoramic telescope mount and set the azimuth scales of the sight at zero (par. 35*a* and *b*(1)).

(2) To center the cross-level bubbles on the panoramic telescope mount.

(3) To lay on the target with the announced lead and range.

(4) To track the target.

(5) To command FIRE.

(6) To follow subsequent commands.

b. Detailed Description of Certain Duties.

(1) The gunner matches the sight mount elevation indexes on the actuating arm and rocker and those on the elevation knob and shaft. He then sets the elevation indexes and azimuth scales of the panoramic telescope at zero. Action in regard to slipping scales is as described in paragraph 35*b*(1). After laying approximately on the target, he centers the telescope mount cross-level bubble. He then lays on the target with the announced lead and range measured on the scales of the reticle (fig. 37). Other duties are performed as in the two-man, two-sight system (par. 35).

[redacted]

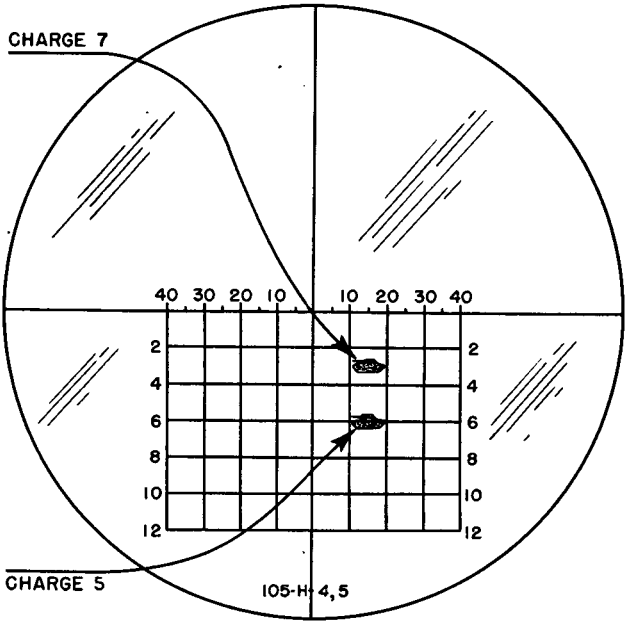

Figure 37. Gunner's sight picture, one-man, one-sight system (lead 15 mils; range 600 yards).

(2) The reticle of the panoramic telescope is graduated for ranges corresponding to shell HE charge 5, and is so marked. At short ranges (under 2400 yards) the elevations for charge 7, are almost exactly half those of charge 5. Hence the reticle can be used for charge 7 by

laying with half the true range. When firing shell HEAT, the correct range setting is determined and announced by the chief of section (par. 34*b*(5) (*e*)).

41. NO. 1

The duties of No. 1 when using the one-man, one-sight system are to open and close the breech, to call "Set" when the gun is loaded, and to fire the gun at the gunner's command FIRE.

42. REMAINDER OF THE SECTION

The remaining cannoneers perform their duties as prescribed for indirect laying.

CHAPTER 6

TECHNIQUES AND SITUATIONS THAT REQUIRE SPECIAL ATTENTION

43. PRECISION IN LAYING

a. Sighting and laying instruments, fuze setters, and elevating and traversing mechanisms must be properly operated to reduce the effects of lost motion. This requires that the last motion in setting instruments and in laying be in the direction prescribed in this manual. To insure accurate laying, personnel who have duties in connection with laying the gun must be required to verify the laying after the breech has been closed.

b. The line of sight when setting and reading a scale or centering a bubble should be at a right angle to the scale or level vial to prevent parallax errors. Bubbles should be centered exactly.

c. For uniformity and accuracy in laying on aiming posts, the vertical hair in the reticle of the panoramic telescope should be alined with the left edge of the aiming posts.

[redacted]

44. AIMING POINTS AND DISPLACEMENT CORRECTIONS

a. General. After the gun has been laid initially for direction it is referred to the aiming posts and usually to one or more distant aiming points as described in paragraph 22*b*(2) and (3). An aiming point must have a sharply defined point or vertical line clearly visible from the gun so that the vertical hair of the panoramic telescope can be alined on exactly the same place each time the gun is re-laid.

b. Distant Aiming Point. A distant aiming point is one at sufficient distance so that normal displacements of the gun in firing or traverse will not cause a horizontal angular change in direction (with the same settings on the azimuth scales) of more than one-half mil. The executive officer usually designates any distant aiming point or points to be used.

c. Aiming Posts.

(1) Two aiming posts are used for each gun. Each post is equipped with a light for use at night. The most desirable distance from the gun to the far aiming post, considering accuracy of laying, visibility, and ability to control the aiming post lights, is 100 yards. The near post is set up at the mid-point between the far post and the gun and is lined in by the

[redacted]

gunner so that the vertical hair of the telescope and the two aiming posts are in alinement. To insure equal spacing of aiming posts, the distance to both the near and the far post should be paced by the same man. Where ground conditions make pacing inaccurate, the distance from the gun to the posts may be measured using the panoramic telescope, with the aiming post as a stadia rod ((4) below).

(2) For night use, the aiming post lights should be adjusted so that the far one will appear several feet above the near one. The two lights placed in this way will establish a vertical line for laying the gun.

(3) Since the panoramic telescope is mounted at considerable distance from the center of rotation of the top carriage, large changes in deflection will cause misalinement of the aiming posts. Placing the aiming posts to the left front at a deflection of approximately 2800 when the gun is in center of traverse will keep this misalinement to a minimum and still allow for maximum visibility (*d* below).

(4) To measure the distance from gun to aiming posts the stadia method may be employed, using the panoramic telescope

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and the aiming post as measuring devices. No. 5 cannoneer, when setting out the aiming posts, holds the upper section of one of the aiming posts in a horizontal position, perpendicular to the line of sighting. The gunner measures the length of this section in mils on the reticle of the panoramic telescope. For example, the upper section of the aiming post is 4½ feet long, so that it measures 15 mils when it is 100 yards from the gun. The proper location for the near post, in this case, would be at the point at which the 4½-foot section measures 30 mils. In many cases, the ideal spacing of 50 and 100 yards cannot be obtained but the posts will be properly spaced when the near post is set at a point where the 4½-foot section measures twice the number of mils it measured at the far post location. This measurement may be performed at night by attaching the night lighting devices at the 4½-foot marks on the aiming posts.

d. Correction for Displacement of Aiming Posts. When the gunner notes that the vertical hair of the telescope is displaced from the line formed by the two aiming posts (or aiming post lights), he lays the gun in such a manner that the far aiming post (light) appears exactly mid-

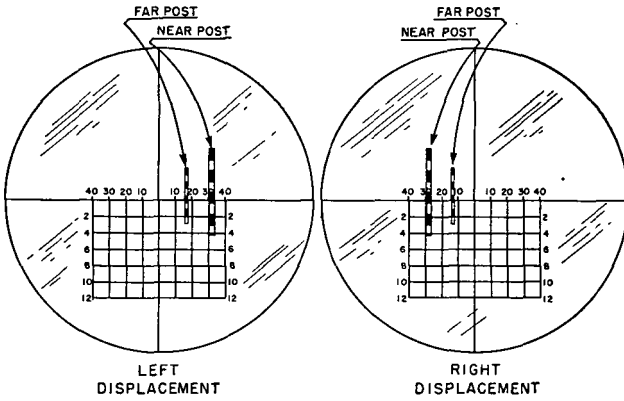
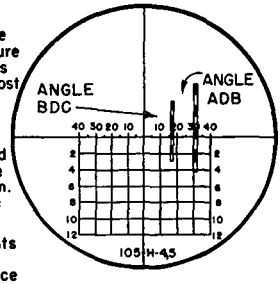


Figure 38. Gunner's sight picture of aiming posts in proper relationship when correcting for displacement.

way between the near aiming post (light) and the vertical hair (fig. 38). If the displacement is due to traversing the gun, the gunner continues to lay as described above. If the displacement is due to progressive shifting of the carriage from shock of firing or other cause, the gunner will notify the chief of section, who, at the first lull in firing, will notify the executive and request permission to realine the aiming posts. To realine, the gun is laid with the far post midway between the near post and the vertical hair (fig. 38). The far aiming post is moved into alinement with the vertical hair of the telescope and then the near aiming post is alined. If terrain conditions make

PROPOSITION:

The new line of sight, $\overline{DC}$, is parallel to the line of aiming posts, $\overline{PB}$, when the sight picture is such that the far aiming post (B) appears exactly midway between the near aiming post (A) and the vertical hair ($\overline{DC}$).



GIVEN:

1. The aiming posts are initially positioned and aligned correctly. (The near post at the mid-point between the far post and the gun. The vertical hair of the telescope and the two aiming posts in alignment.)

2. The gun (and sight) is displaced from its initial position. This displacement, $\overline{DP}$, is assumed as small compared to the distance from the gun to the near aiming post ($\overline{PA}$). Therefore, the distance $\overline{PA}$ is assumed to be equal to the distance $\overline{DA}$.

3. The sight is positioned so that $\measuredangle BDC\textcircled{D} = \measuredangle ADB\textcircled{D}$

TO PROVE:

That line $\overline{CD}$ is parallel to line $\overline{PB}$.

PROOF:

$\overline{PA} = \overline{AB}$	By initial placement of aiming posts.
$\overline{PA} = \overline{DA}$	By initial assumption.
$\therefore \overline{DA} = \overline{AB}$	Things equal to the same thing are equal to each other.
$\triangle ADB$ is an isosceles triangle.	An isosceles triangle is a triangle two of whose sides are equal.
$\measuredangle ADB\textcircled{D} = \measuredangle ABD\textcircled{D}$	The base angles of an isosceles triangle are equal.
$\measuredangle ADB\textcircled{D} = \measuredangle BDC\textcircled{D}$	By measurement in the sight.
$\therefore \measuredangle ABD\textcircled{D} = \measuredangle BDC\textcircled{D}$	Things equal to the same thing are equal to each other.
$\therefore \overline{PB} \parallel \overline{DC}$	If two straight lines are cut by a third straight line, and the alternate-interior angles so formed are equal, then the two straight lines are parallel.

Q.E.D.

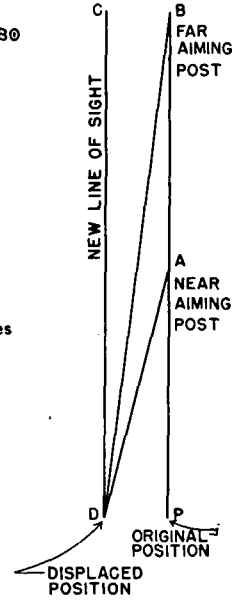


Figure 39. Mathematical explanation of aiming post displacement correction.

it impracticable to move one of the two aiming posts, the gun is laid for direction and referred to the aiming post which cannot be moved. This deflection is reported to the executive. The other post is alined using the method described in paragraph 22*b*(3) and the azimuth micrometer scale is slipped to retain the same deflection that was used prior to realinement of the aiming posts. The explanation of aiming post displacement correction is shown in figure 39.

45. PREPARATION OF POSITION FOR EMPLACEMENT OF GUN

a. General. For detailed information on the preparation of the gun position see FM 5–15 and and FM 6–140. The gun should be emplaced on level ground to insure stability in firing and to reduce the time needed for leveling the telescopes and range quadrant.

b. Spade Pits. Unless lack of time prevents, pits should be dug for the spades. On soft ground the spades can be seated by firing, but the displacement of the carriage will be greater than if the spades had been dug-in initially.

c. Recoil Pits. A recoil pit with a full 50-inch clearance between the breech and the ground must be dug for high-angle fire. After the gun has been emplaced and, if possible, seated, the gun will be elevated to maximum elevation, and a recoil pit dug that will insure proper clearance throughout

the limits of traverse. When not firing high-angle fire the recoil pit should have an improvised cover to facilitate service of the gun.

46. TESTING TARGETS

Testing targets will be more useful if the following improvements are made.

a. The target should be mounted on a flat piece of masonite, wallboard, or similar material.

b. To insure stability of the testing target throughout bore sighting, it should be fastened

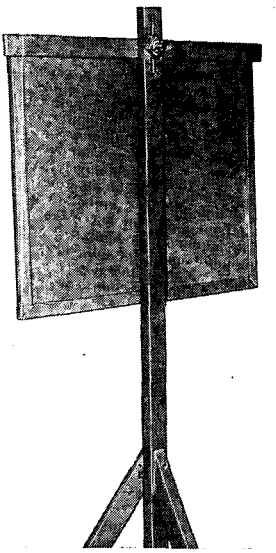


Figure 40. Rear view of bore sighting target stand.

to a stand in a manner similar to that shown in figure 40.

c. For use in either leveling or canting the test target (par. 54*b*) a mil scale may be inscribed at the bottom of the target. A small nail at the top marks the center from which the arc was drawn and provides a hook from which to suspend the plumb line (fig. 41).

d. Vertical reference lines may be drawn through the centers of each of the diagrams (fig.

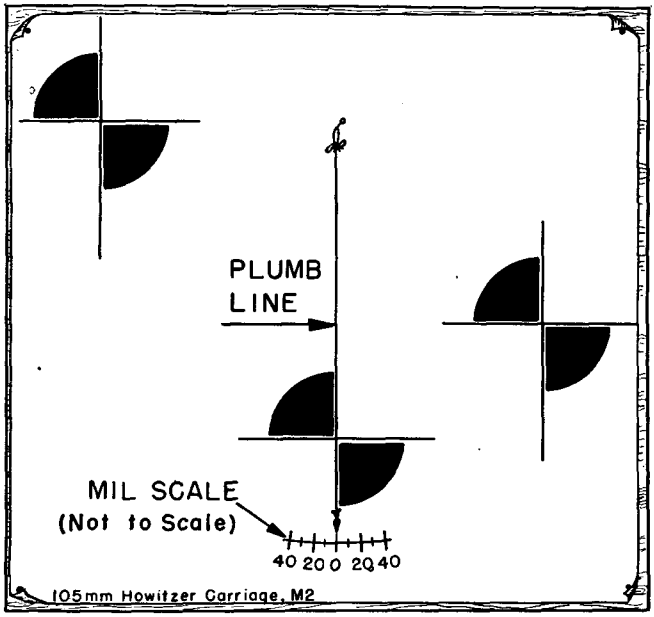


Figure 41. Mil scale inscribed on testing target.

42). These lines may be used when the trunnions can not be leveled, by setting the test target with the cant angle of the gun. The target is rotated until the line of sight through the tube tracks the reference line when the tube is elevated and depressed. Similarly, the panoramic telescope should be adjusted so that its reticle tracks the appropriate reference line when the tube is elevated and depressed.

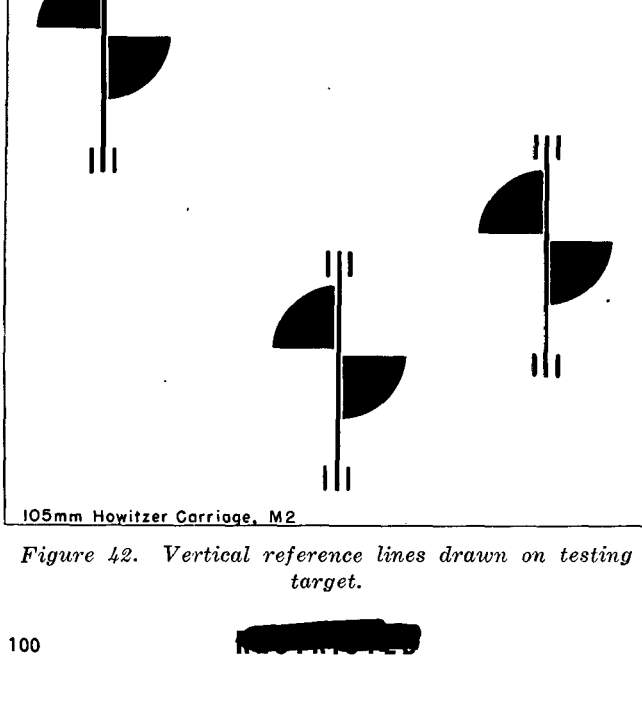


Figure 42. Vertical reference lines drawn on testing target.

e. To facilitate bore sighting in darkness bore a one-sixteenth inch hole through the mounted testing target at the center of each aiming diagram. A flashlight held against the target behind the appropriate hole provides an aiming point for use in blackout conditions. Fasten patches of felt padding on the back of the target covering the regions of each hole so that light from the flashlight won't escape. The flashlight must be lighted only after it is placed firmly in position. Care must be taken to prevent disturbing the position of the testing target.

47. CEASE FIRING

The command CEASE FIRING normally is given to the gun section by the chief of section, but in emergencies anyone present may give the command. At this command, regardless of its source, firing will cease immediately. If the gun is loaded, the chief of section will report that fact to the executive. The executive acknowledges this report by repeating it, "No. (so-and-so) loaded." If CEASE FIRING came from the fire direction center, firing is resumed at the announcement of the elevation. If CEASE FIRING came from within the firing battery the executive will investigate the condition which caused the command to be given. When the condition has been corrected, firing is resumed by the executive's announcement of the elevation.

48. CHANGES IN DATA DURING FIRING

If it is necessary to correct any element of firing data, all firing previously ordered, but not yet executed is stopped by the command CEASE FIRING. Corrected data is then announced. If the gun is not already loaded, the new data will be set off and firing resumed at the announcement of the elevation. If the gun is loaded at the announcement of a new element of firing data, the new data will be set off. If no change in fuze setting is required, or if the gun is loaded with percussion-fuzed shell, firing is resumed at the announcement of elevation. If the gun is loaded with time-fuzed shell, and the data requires a change in fuze setting, the chief of section will suspend firing and that fact will be reported to the executive; for example: "No. 2 loaded, time (so much)." In continuous fire, changes in data are so applied as not to stop the fire or break its continuity.

49. TO UNLOAD THE GUN

a. A complete round, once loaded, should always be fired in preference to being unloaded, unless military necessity dictates otherwise.

b. When the command UNLOAD is given, No. 1 opens the breech slowly; No. 2 standing at the breech, receives the ejected round or cartridge case.

[redacted]

c. Should the extractor fail to extract the complete round, the staff and unloading rammer (head) is used. This will be done only under the immediate supervision of an officer. He inspects the recess in the head of the rammer to assure that it is free from obstructions. No. 1 then inserts the rammer in the bore until the head incloses the fuze and comes into contact with the projectile. He pushes and, if necessary, taps the rammer staff lightly, or operates the spring-operated rammer, until the round is dislodged (fig. 43). He then pushes it out of the breech and No. 2 receives it.

Figure 43. Nos. 1 and 2 unloading the gun.

[redacted]

d. If the cartridge case is extracted but not the projectile, No. 1 fills the chamber with waste and closes the breechblock. He dislodges the projectile as in *c* above. No. 2 then opens the breech, removes the waste, and receives the projectile as No. 1 pushes it to the rear.

e. For further information on unloading see FM 6–140 and TM 9–325.

f. In case of a misfire, the instructions contained in paragraph 85 will be followed.

50. CARE OF AMMUNITION

a. To insure uniform results in firing, to prolong the life of the tube, and to avoid accident, great care must be exercised in the storage and handling of ammunition at the battery. Provisions of TM 9–1900 applicable to field service should be followed carefully. In the field, conditions existing in each position will determine the amount of time, labor, and materials required to store and preserve the ammunition adequately. If the position is to be occupied for only a few hours, a tarpaulin spread on the ground may be sufficient; for longer periods of time more elaborate facilities should be provided.

b. Ammunition must be protected from damage. When ammunition is received, it should be sorted into lots and placed in the best available storage. Powder temperature should be kept as uniform as possible. Ammunition data cards

should be kept until after all ammunition for that lot is expended. Ammunition should be left in containers until its early use is expected. Protection should be provided against moisture, dirt, direct rays of sun, and, as far as practicable, hostile artillery fire and bombing. Protection against weather, dirt, and sun may be obtained by the use of tarpaulins below and above the ammunition, and suitable dunnage between the layers. Protection against hostile fire may be obtained by the use of small dispersed stacks, trenches, or dugouts. Each stack should contain not more than 75 rounds and should be not more than four layers high. Stacks should be at least 10 yards apart.

c. For further information on care of ammunition see FM 6–140, TM 9–325, TM 9–1900, and TM 9–1901.

51. SECTION DATA BOARD

When positions are occupied for more than a few hours, data boards may be used by each section for recording such items as deflections to aiming points, calibration correction when appropriate, minimum elevations, data for barrage and counter preparations, and other data which may be needed quickly. If such information assumes a standard pattern, the section may paint a form on the back of the shield and chalk in the various items of information in the appropriate spaces.

CHAPTER 7
BORE SIGHTING AND BASIC PERIODIC TESTS

Section I. GENERAL

52. PURPOSE AND SCOPE

The purpose of this chapter is to outline the procedures for bore sighting and making basic periodic tests of on-carriage fire control equipment. The procedures covered will include only those that may be accomplished at battery level.

53. EQUIPMENT

The following equipment is needed for bore sighting and periodic tests:

a. Bore Sights. Front and rear bore sights or improvised substitutes are necessary for both bore sighting and testing. If bore sights are not available, cross hairs may be fastened on the muzzle, and the firing pin hole in the breechblock bushing may be used as a rear sighting guide by removing the firing lock from the closed breechblock.

b. Testing Target. A testing target or suitable substitute is needed for both bore sighting and testing. If a testing target is not available, a

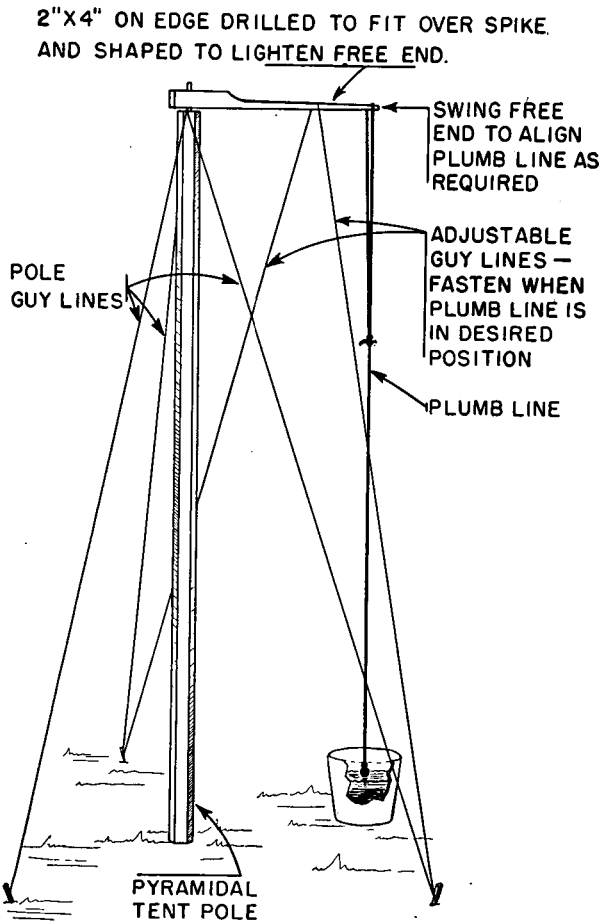


Figure 44. Improvised plumb line.

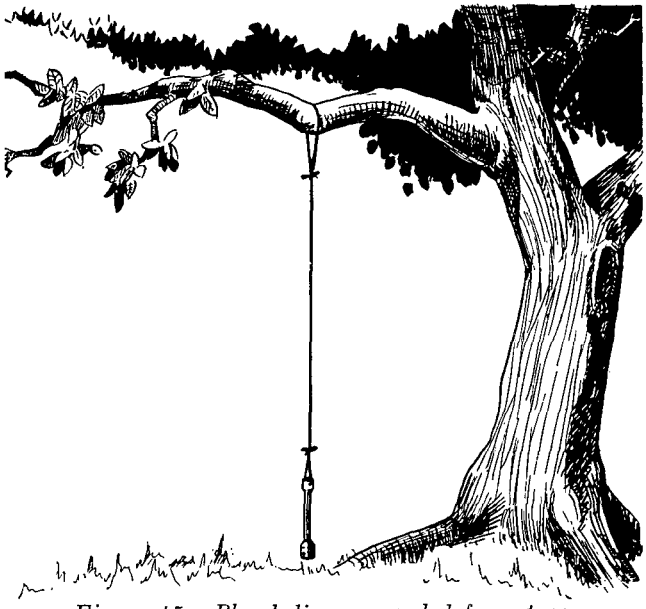


Figure 45. Plumb line suspended from tree.

clearly defined aiming point 2000 or more yards from the gun may be used to accomplish approximately the same purpose as the testing target.

c. Tools. The section equipment includes all the necessary tools for bore sighting and testing. Care must be taken in using the screw drivers and wrenches to insure that damage does not result through carelessness or the use of inappropriate tools.

d. Plumb Line. Although not essential for bore sighting, it is highly desirable that a plumb line be used in the basic periodic test for maximum accuracy. The farther from the gun that the plumb line is placed, the longer the line must be. For example, to be effective at 6 feet in front of the gun tube, the line must be at least 30 feet long. To keep such a long plumb line taut it may be necessary to add weight to it. Wrenches or rocks may be used. The tendency of the weight to swing may be decreased by placing a bucket containing water or other liquid under the plumb line so that the plumb bob or other weight is partially immersed in the liquid. If a convenient means of suspension is not readily available, a pole may be employed as in figure 44. Additional height may be gained by placing the pole atop a vehicle or other object. A plumb line strung from a building or tree as in figure 45 is more desirable and should be used if possible. Units in garrison may find it convenient to rig a plumb line on a building. The line may then be nailed in place so that it can be used permanently.

Section II. BORE SIGHTING

54. GENERAL

a. Description. Bore sighting is the process of alining the on-carriage fire control equipment so

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that its optical axes are parallel to the axis of the bore. It consists of those tests and adjustments which are performed by section personnel to insure accuracy in laying for elevation and direction. The gun should be placed near its center of traverse prior to bore sighting. All instruments and mounts must be positioned securely; there must be no free play. Bore sighting is conducted before firing and when necessary during lulls in firing.

b. Leveling. Although it is not absolutely necessary to level the trunnions for bore sighting, it is advisable to do so whenever possible. Accurate results can be obtained more readily if the trunnions are level, because then a corresponding tilt does not have to be introduced in the mounts and testing target. The trunnions should be leveled by leveling the ground under the trails or by blocking up one trail (fig. 46). Approximate leveling may be accomplished by use of the gunner's quadrant placed on the breech ring parallel to the trunnions.

(1) *Plumb line.* The best method to check leveling is by means of the plumb line. The line is suspended directly in front of the axis of the bore. The line of sight should track the plumb line as the tube is depressed and elevated between maximum depression and at least 1000 mils of elevation. When the trunnions are

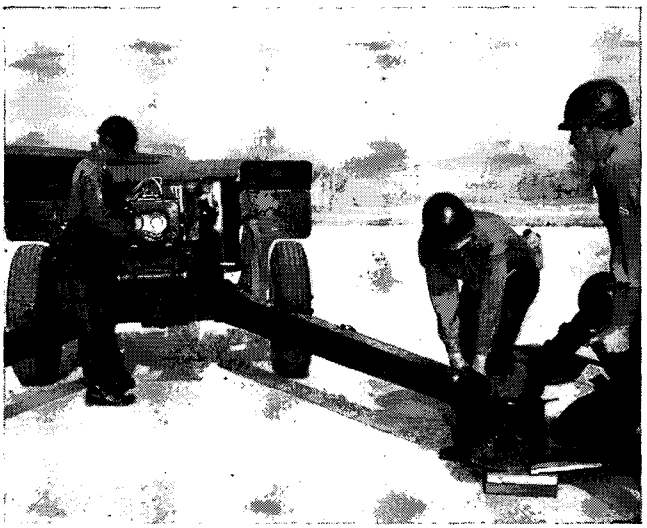

Figure 46. Blocking trail to level trunnions for bore sighting with gunner's quadrant atop breech ring.

level, the line of sight tracks the plumb line exactly through all elevations. If the trunnions are not exactly level and the cant is only slight, to bring the trunnions into level, the following technique may be used. Traverse the tube from center and shift the trails to bring the line of sight back on the plumb line. Elevate the tube to determine whether it more nearly tracks the plumb line. Repeat this

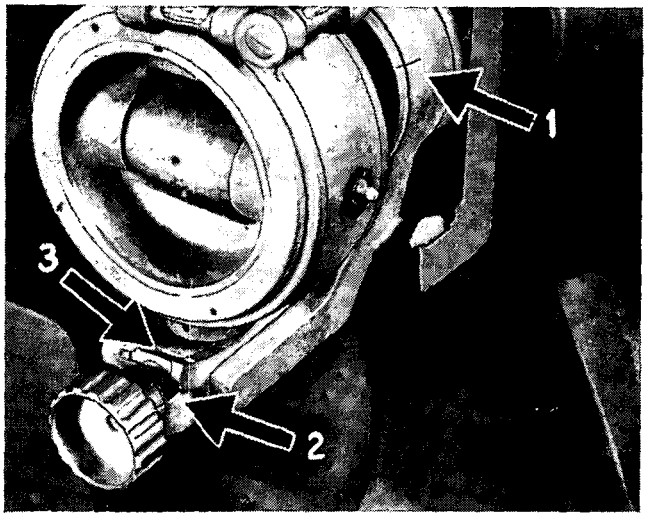

Figure 47. Scribed lines for positioning mount both laterally and longitudinally.

experimentation until the line of sight tracks the plumb line exactly.

(2) *Gunner's quadrant.* In leveling operations using the gunner's quadrant, a quadrant that has been tested (par. 60) and found to be accurate is required.

(3) *Gun not level.* When it is impossible to level the trunnions the cross-level bubbles cannot be used. If the tube cannot be leveled the longitudinal-level bubbles cannot be used. To permit bore sighting

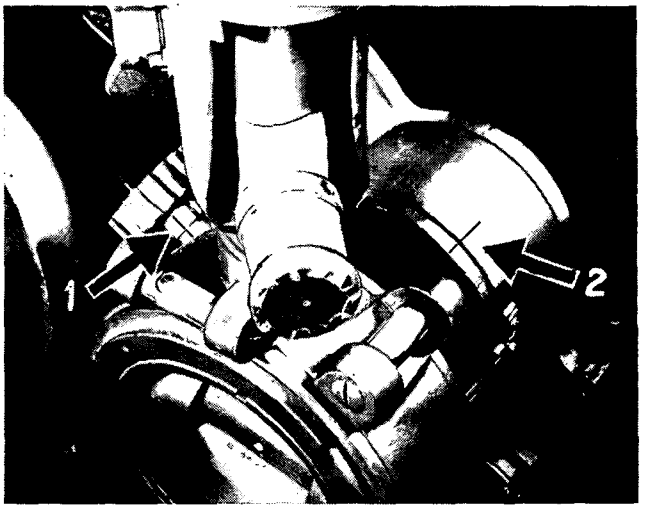

Figure 48. Scribed lines for positioning mount longitudinally.

when either of these conditions exist, lines should be scribed on the mounts after a basic periodic test (pars. 59–64) when the mounts are in correct adjustment. These scribed lines can be matched later, when leveling is impossible, to retain the same relationship between the axis of the bore and moving parts of the on-carriage sighting equipment. After a basic periodic test with the tube and sighting equipment in perfect alinement,

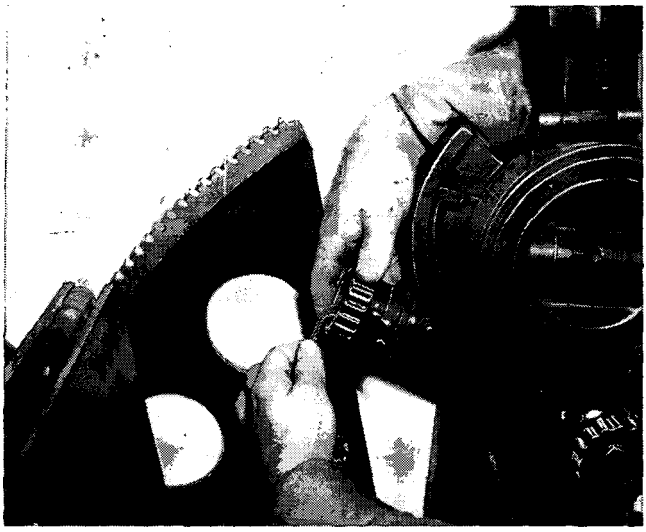

Figure 49. Slipping the longitudinal knob index into coincidence with the bracket index.

use a knife blade or other sharp metal point to scribe the following lines: (1) Straight across the junction of the cross-leveling segment and the cross-leveling worm housing of the panoramic telescope mount (fig. 47(3)). (2) Straight across the junction of the cross-leveling worm knob shaft and the cross-leveling worm housing (fig. 47(2)). (3) Straight across the junction of the rocker and the

actuating arm (figs. 47(1) and 48(2)). (4) Straight across the junction of the longitudinal-leveling (elevation) knob shaft and the bracket (fig. 48(1)). On models having indexes on the elevation knob shaft and on the bracket, the elevating knob locking nut is loosened and the indexes slipped into coincidence (fig. 49). Care should be taken that the lines are scribed in the paint only and are not cut into the metal. Fill the scribed lines with white paint and wipe off the excess. If conditions prevent bore sighting with the tube level, longitudinal compensation for an unlevel (elevated or depressed) tube is measured with the gunner's quadrant and this angle is set on the elevation micrometer instead of zero when adjustment is being checked (par. 55*i*).

c. Methods. The four methods of bore sighting are—

(1) Testing target.
(2) Distant aiming point.
(3) Aiming circle.
(4) Standard angle.

55. TESTING TARGET METHOD

This method consists of bringing the line of sight, and indexes of on-carriage fire control

equipment into parallel alinement with the tube, using the aiming diagrams of the testing target as aiming points.

Caution: For weapons modified per MWO ORD C21–W19, 2 Nov 51, i.e., a bracket added to raise the sight 8″, test target 1–T–283–42 is not correct and must have an additional diagram improvised above the sight diagram.

The steps to be followed are listed below:

a. Trunnions. Level the trunnions if possible (par. 54*b*).

b. Tube. Using the gunner's quadrant, level the tube.

Figure 50. Emplacing breech bore sight.

c. Bore Sights. Place the breech and muzzle bore sights in their proper positions (fig. 50).

d. Testing Target Alinement. Without moving the gun (except for elevating and depressing slightly when using testing target reference lines) aline the center testing diagram with the line of sight through the tube (fig. 51). The target normally should be located at least 50 yards in front of the muzzle.

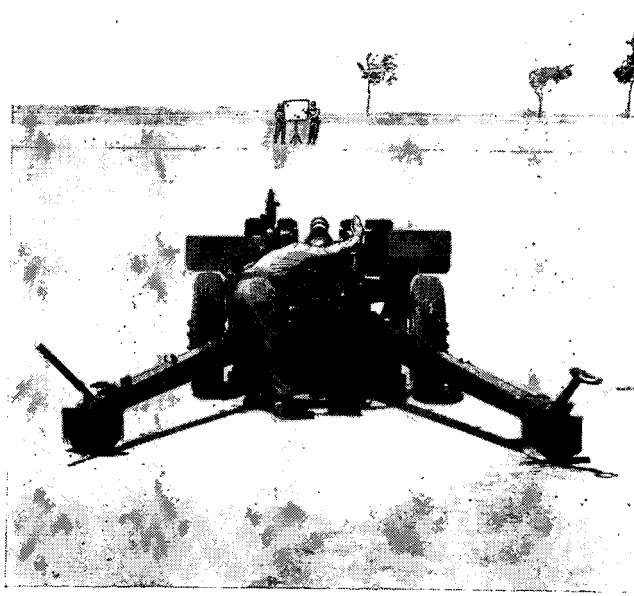

Figure 51. Alining the testing target.

Security Information

e. Cant Compensation. If the trunnions are level, level the target by means of a plumb line (fig. 41). If the trunnions are not level, cant the

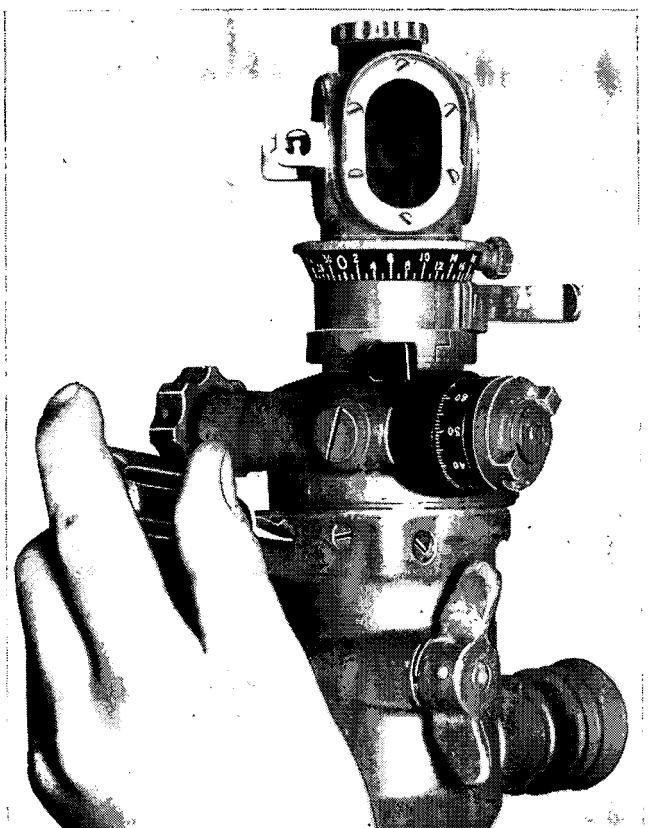

Figure 52. Loosening a tangent locking screw.

target to correspond to the cant of the trunnions. In either case the face of the target is alined so that it is at right angles to the line of sight through the bore.

f. Panoramic Telescope Lateral Alinement. If the trunnions are level, level the cross-level and longitudinal-level bubbles. If the trunnions are not level, match the white scribed lines. Zero the sight as in paragraph 22*b*. If the vertical reticle is not in alinement with its aiming diagram, loosen the tangent locking screws (fig. 52) and

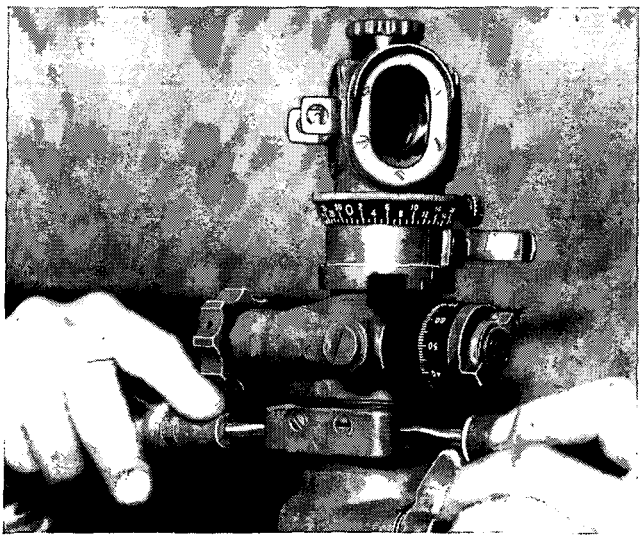

Figure 53. Adjusting the vertical reticle with tangent screws.

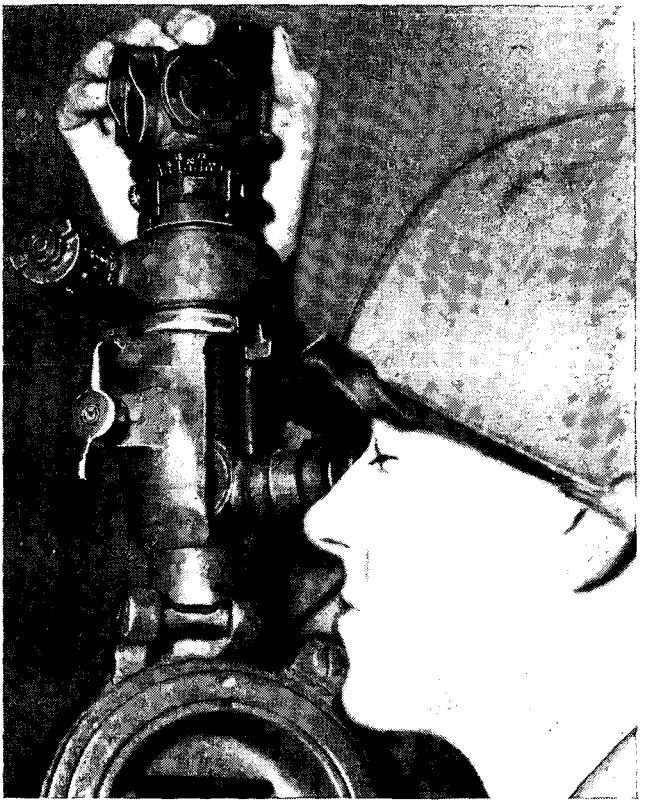

Figure 54. Alining horizontal recticle by turning elevation knob.

adjust the tangent screws (fig. 53) until the vertical hair is properly alined. Tighten the locking screws and verify the adjustment.

g. Panoramic Telescope Horizontal Alinement. If the horizontal reticle is out of alinement, turn the elevation knob of the telescope (fig. 54) until it is alined properly. Loosen the clamping screws

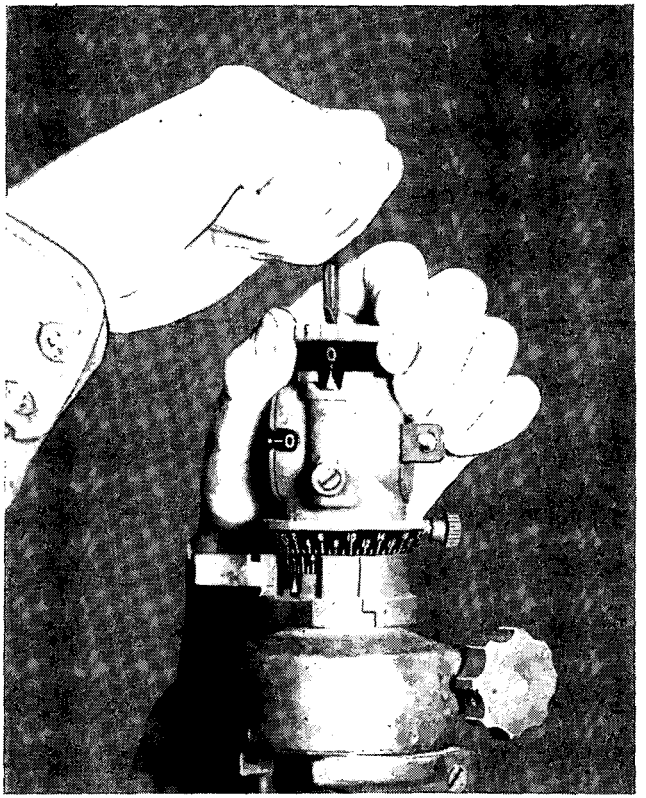

Figure 55. Loosening clamping screws.

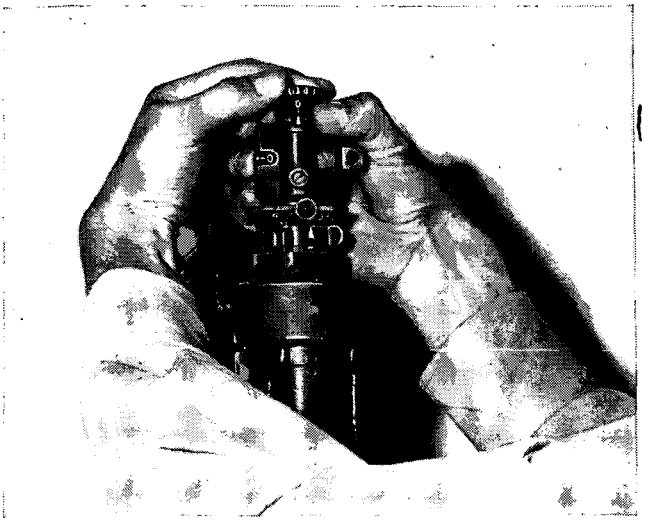

Figure 56. Shifting zero of the elevation knob to its index.

(fig. 55) and shift the scale into coincidence with the fixed index (fig. 56). Tighten the locking screws and verify the adjustment.

h. Elevation Index. Loosen the elevation index locking screws. Slip the movable index until it coincides with the fixed index (fig. 57). Tighten the screws and verify the adjustment.

i. Range Quadrant. The elevation mechanism is tested next. Verify that the locking screws of the elevation micrometer scale are tight. With the line of sight through the tube still on the appro-

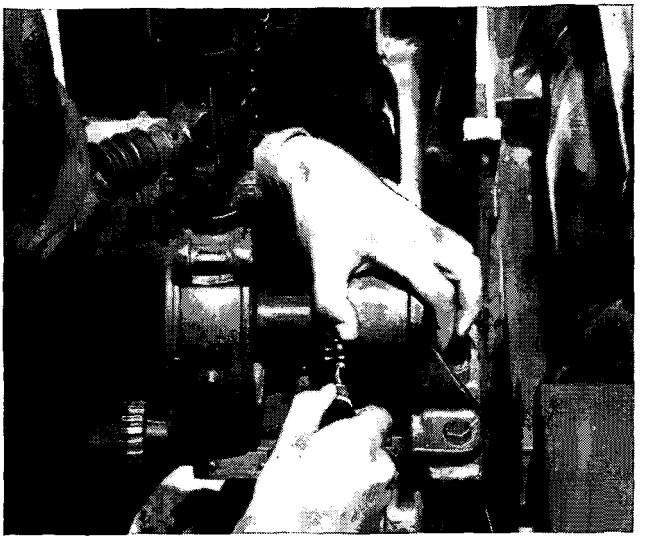

Figure 57. Shifting elevation index into coincidence.

priate aiming diagram and with the elevation scale near or on zero set the elevation micrometer scale at zero. Level the longitudinal- and cross-level bubbles of the range quadrant with the angle of site micrometer and the cross-leveling worm knob.

j. Elevation Scale Index. If the elevation scale index does not coincide exactly with zero, loosen the screws holding the index plate and slide the plate to zero (fig. 58). Tighten the screws and verify the adjustment.

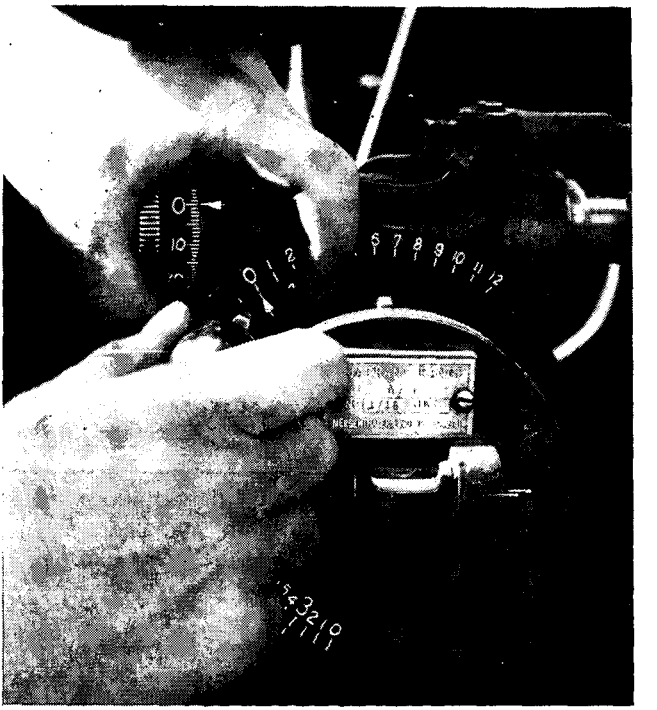

Figure 58. Shifting elevation scale index to zero.

k. Angle of Site Scale. If the angle of site scale does not read 3(300) loosen the two locking screws of the scale and slip the scale until the numeral 3 is in coincidence with the index (fig. 59). Tighten the screws and verify the adjustment.

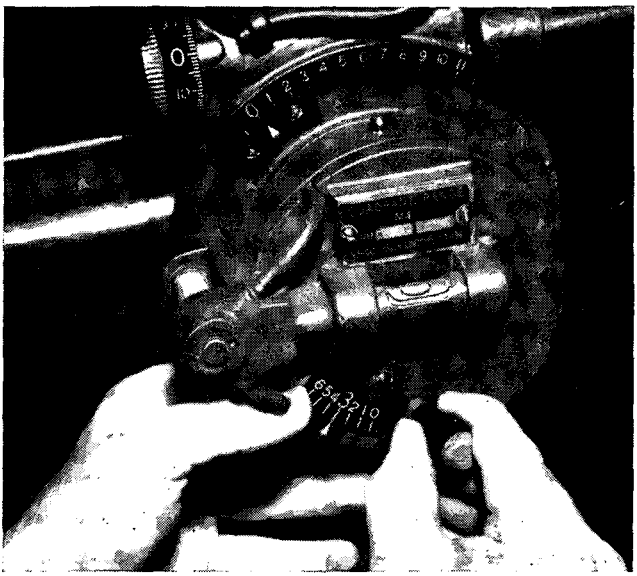

Figure 59. Shifting site scale to 3(300).

l. Angle of Site Micrometer. If the angle of site micrometer does not read zero, loosen the clamping screw in the micrometer knob and slip the scale to zero (fig. 60). Be sure that the knob does not turn and thus throw the longitudinal-level bubble off center. Tighten the locking screw and verify the adjustment.

m. Elbow Telescope.

(1) *M23 mount.* No deflection adjustment can be made. If the zero range line of the elbow telescope does not match the

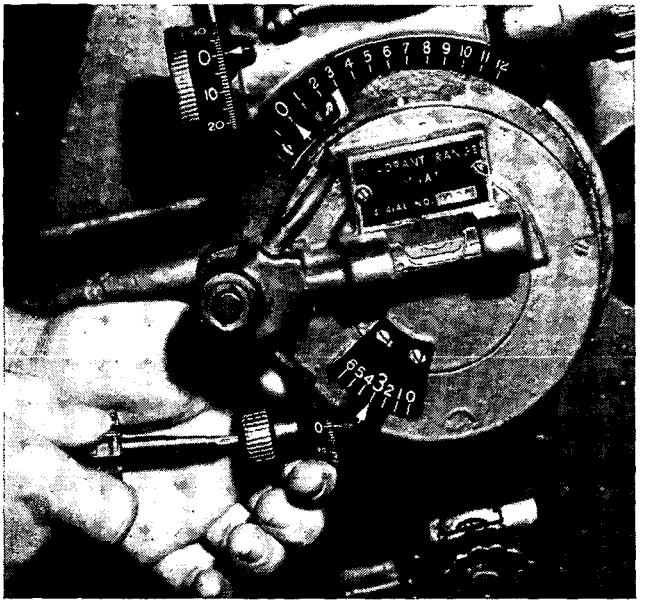

Figure 60. Adjusting angle of site micrometer scale to zero.

horizontal line of its aiming diagram, loosen the worm clamping bolt (fig. 61). With a screw driver bring the zero line into alinement with the horizontal line on the aiming diagram. Tighten the worm clamping bolt and verify the adjustment. If the horizontal reticle is not parallel to the horizontal line of its diagram, bring it into alinement by turning the bracket rotating knob.

Figure 61. Loosening worm clamping bolt of elbow telescope.

(2) *M42 mount.* There is no provision for leveling the reticle lines. If the vertical reticle is not in alinement loosen the jam nut on the lateral adjusting screw, and with a screw driver, turn the lateral adjusting screw to aline the reticle. Tighten the jam nut and verify the adjustment. If the horizontal reticle is not in alinement loosen the jam nut on the elevation adjusting screw, and with a screw driver turn the elevation adjusting screw to aline the reticle. Tighten the jam nut and verify the adjustment.

56. DISTANT AIMING POINT METHOD

This method consists of alining the on-carriage fire control equipment and the line of sight through the tube on a common point at least 2000 yards from the gun. A distant aiming point may be used instead of the testing target if the testing target is not available or if the tactical situation makes its use impracticable. The steps prescribed for the testing target method (par. 55*a*, *c* and *f* through *m*) apply except that the bore sights and optical sights are alined on the same point instead of on the three diagrams of the testing target. Accurate cross leveling of the trunnions is unnecessary when bore sighting on a distant aiming point because the lines of sight converge on a single point. It is improbable that

the tube will be level, so the white scribed lines will be used normally.

57. AIMING CIRCLE METHOD

a. General. The aiming circle method may be used when weather or terrain conditions prohibit the use of the test target method or the distant aiming point method. The aiming circle method does not include a test for determining horizontal errors. For this method the trunnions must be level. If, by the aiming circle method, misalinement is discovered and corrected it should be verified at the earliest opportunity, by bore sighting with the test target or distant aiming point. To facilitate bore sighting with the aiming circle certain preparatory steps must be performed. These operations, described in *b* below, should be performed after a basic periodic test (Sec. III) when the panoramic telescope mount is in correct adjustment.

b. Preliminary Operations.

(1) To insure accuracy the greatest care must be exercised in all phases of these operations. All final movements of the instruments must be made so that the reticles approach the final position from left to right in order to eliminate the effects of lost motion in the gears.

(2) *Parallax.* Parallax in the aiming circle and the panoramic telescope must be

eliminated. This is done with the aiming circle after focusing by placing in front of the eyepiece lens a dark colored cardboard or metal parallax shield of the same diameter as the eyepiece lens focusing sleeve. The shield should have

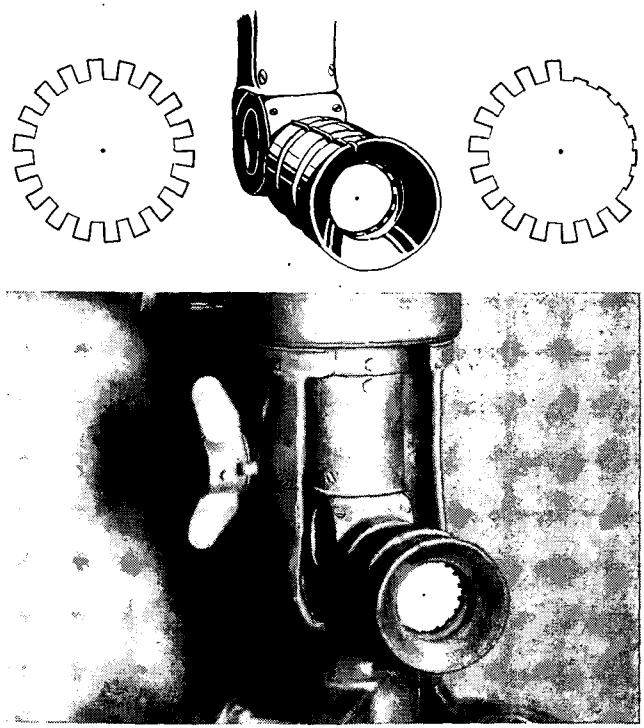

Figure 62. Parallax shield.

a vertically and horizontally leveled slot 1/16 inch wide and 1/4 inch long. It may be held in place with a piece of adhesive tape around the edge of the focusing sleeve. To eliminate parallax in the panoramic telescope, a shield of the same diameter as the eyepiece lens housing and having an exactly centered hole 1/16 inch in diameter is mounted in front of the eyepiece lens (fig. 62). A more permanent parallax shield may be constructed of brass or bronze shim stock. When constructed of metal a series of fingers approximately 3/16 inch wide and 1/4 inch long separated by 1/4 inch spaces should extend beyond the perimeter of the shield. These fingers should be bent along the circumference of the circle until they form an angle of 90° with the surface of the shield. They serve as a means of clipping the shield in place quickly and permit easy removal. Where the eyepiece has a rubber eyeguard, the fingers permit alinement within the guard without its removal.

(3) *Bore sight marks.* The aiming circle method requires that bore sight marks be located on the top surface of the tube at the muzzle end and on the rear of the breech ring (fig. 63). The position of

side of the straight edge is still in alinement with the bore sights and parallel to the vertical hair of the aiming circle. Draw a pencil line along the side of the straight edge on the upper rear portion of the breech ring.

(*h*) Lay the straight edge on the tube at the muzzle along the same line of sight and draw a pencil line.

(*i*) Paint the white stripes on the tube and breech ring so that the left edge of the stripes are exactly on the pencil lines.

c. Procedure. The gun having been prepared as in *b* above, steps in performing the aiming circle method of bore sighting are as follows:

(1) Set up the aiming circle 30 to 50 yards in rear of the gun.

(2) Zero the aiming circle's scales and level the instrument.

(3) Elevate the gun until the two bore sighting marks are plainly visible from the aiming circle. Do not elevate the tube any more than is necessary for clear definition of the edges of the white bore sight marks.

(4) By traversing the gun and turning the lower motion of the aiming circle, place the right edge of the vertical hair exactly

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in line with the left edge of the two bore sight stripes.

(5) Check that the trunnions are level by elevating and depressing the tube and noting if the two bore sight stripes remain parallel to the edge of the vertical hair of the aiming circle. If the trunnions are not level, they must be leveled.

(6) With the upper motion of the aiming circle turn to the objective lens of the panoramic telescope. Make certain that equal amounts of the housing appear on each side of the vertical hair.

(7) Read the angle on the azimuth scales of the aiming circle.

(8) Insure that the azimuth scales of the telescope are set at zero and that the indexes are in coincidence.

(9) Set the angle from the aiming circle ((7) above) on the azimuth micrometer scale of the panoramic telescope.

(10) Adjust the tangent screws until the vertical hair of the telescope is exactly on the center of the objective lens of the aiming circle. Recheck the angle settings and the alinement of the vertical hairs.

58. STANDARD ANGLE METHOD

a. General. When positions are occupied in combat, the necessity for speed in opening fire or the

[redacted]

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termined, they may be
the alinement of the
more precise methods
ent discovered and cor-
test should be verified
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standard angle method
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en the standard angles
of this, the recoil sys-
see that it contains the
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ons. The procedure for
gles is as follows:
battery, scribe lines in
k the position of parts
recoil with respect to
not move in recoil

he trunnions.
n using a testing target.
pe fasten a bright com-
left horizontal witness
pin to project to the
e (fig. 65).

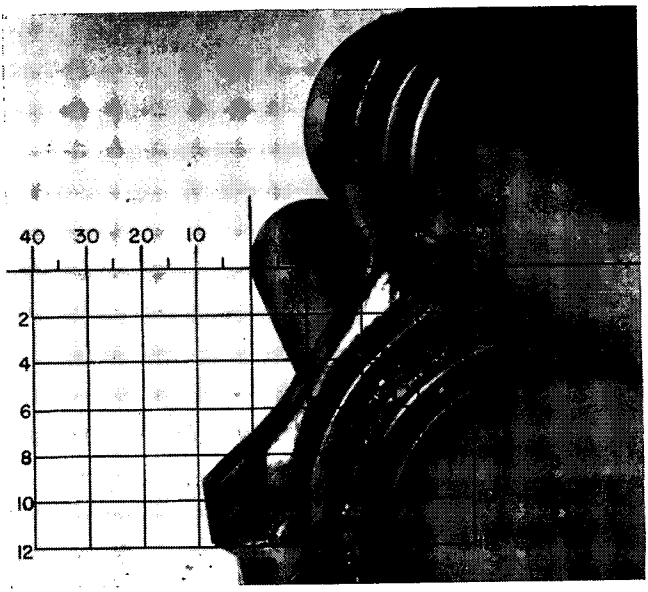

Figure 65. Sight picture of projecting pin.

(5) Fasten the telescope parallax shield in place over the eyepiece (fig. 62).
(6) Verify that the elevation index and micrometer on the telescope are at zero.
(7) Elevate the tube until it is approximately level with the top of the panoramic telescope.
(8) Level the bubbles of the telescope mount and refer the telescope to the junction of the pin with the muzzle. Adjust the tube

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elevation and turn the azimuth micrometer knob until, with the bubbles level, the horizontal and vertical hairs of the telescope are exactly on the junction of the pin with the muzzle (fig. 65).

(9) Read the angle from the panoramic telescope to the nearest one-fourth mil. Since the graduations are to the nearest mil it is necessary to interpolate to the nearest one-fourth mil. This is the standard azimuth (horizontal) angle for the gun tested.

(10) With either the range quadrant or gunner's quadrant measure the elevation of the tube to the nearest one-fourth mil. This is the standard elevation (vertical) angle for the gun tested.

(11) With a knife blade or other sharp metal point scribe lines in the paint on the following parts:

(*a*) Straight across the junction of the cross-leveling segment and the cross-leveling worm housing (fig. 47(3)).

(*b*) Straight across the junction of the cross-leveling worm housing and the cross-leveling worm knob shaft (fig. 47(2)).

(*c*) Straight across the junction of the rocker and the actuating arm (figs. 47(1) and 48(2)).

(*d*) Straight across the junction of the elevation knob shaft and the bracket (fig. 48(1)).

(12) Fill the scribed lines with red paint and wipe off the excess.

c. Procedure. Once the standard angles have been determined, steps in performing the standards angle method of bore sighting are as follows:

(1) Verify that the parts that move in recoil are in the same position with respect to the nonrecoiling parts as they were when the standard angles were determined.

(2) Verify that the trunnions are canted not more than 10 mils; if convenient, level the trunnions.

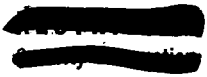
(3) With adhesive tape fasten a pin in the left horizontal witness mark so that the pin projects out to the left of the muzzle.

(4) Using the range quadrant or gunner's quadrant elevate the tube to the standard elevation angle.

(5) Place the parallax shield on the eyepiece of the telescope.

(6) Set the standard azimuth angle on the panoramic telescope. Make sure that the red scribe lines are in coincidence and set off the standard azimuth angle on the panoramic telescope.

(7) If the vertical reticle is not exactly on the junction of the pin and the muzzle,



adjust the tangent screws until the vertical reticle is properly alined.

(8) If the horizontal reticle is not exactly on the junction of the pin and the muzzle, turn the elevating knob of the panoramic telescope until it is properly alined. Adjust the zero of the elevation knob scale so that it is in alinement with the index.

Section III. BASIC PERIODIC TESTS

59. GENERAL

Basic periodic tests are performed by the section under the supervision of the battery executive and the artillery mechanic. These tests are performed at the discretion of the unit commander. Suggested times for performance are: once each year if the gun is used only for nonfiring training; once every 3 months if the gun is fired, as soon as possible after extensive use, accidents, or traversing extremely rough terrain; and whenever the gun fires inaccurately for no readily apparent reason. The tests reveal whether or not the on-carriage sighting equipment and certain off-carriage equipment are in correct adjustment. For the on-carriage equipment to be in correct adjustment, the following conditions must be met:

a. The line of sight of the panoramic telescope and of the elbow telescope must be parallel to the axis of the bore.

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b. All indexes and scales, except the angle of site scale, must read zero. The angle of site scale must read 3(300).

c. All bubbles must be in adjustment and level.

d. The sighting equipment must satisfactorily meet all tests described in paragraphs 54–58.

e. Prior to all tests of on-carriage fire control equipment it is desirable that the trunnions be as level as possible. Leveling the trunnions is most easily accomplished by raising or lowering one trail (fig. 46). The best check that the trunnions are level is accomplished by seeing that the axis of the bore tracks a plumb line as described in paragraph 54*b*.

60. TEST OF GUNNER'S QUADRANT

a. General. The gunner's quadrant must be in proper adjustment before conducting tests and adjustments of other sighting and fire control equipment. Inspect the shoes of the gunner's quadrant for dirt, nicks, or burrs. Similarly, inspect the leveling plates on the upper surface of the breech ring. Dirt, nicks, or burrs on these surfaces will cause the instrument to give inaccurate readings.

b. End-for-End Test.

(1) Set both the index arm and micrometer scale of the gunner's quadrant at zero, making sure the auxiliary indexes match.

(2) Place the quadrant on the leveling plates of the breech ring, the line-of-fire arrow pointing toward the muzzle, and center the quadrant bubble by turning the elevating handwheel (fig. 66).

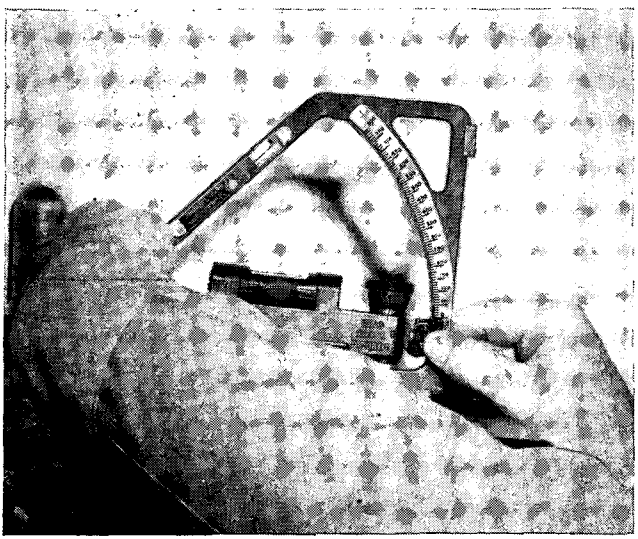

Figure 66. Leveling bubble of gunner's quadrant, normal position, end-for-end test.

(3) Reverse the quadrant on the leveling plates (turn it end-for-end) (fig. 67). If the bubble recenters, the quadrant is in adjustment and the test is completed.

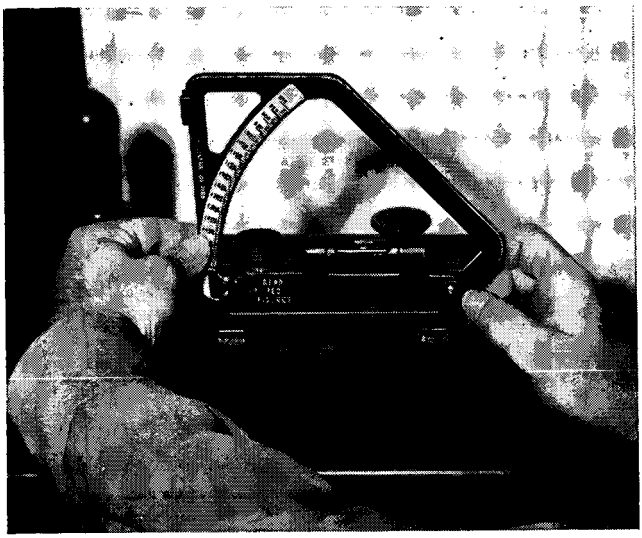

Figure 67. Centering bubble of gunner's quadrant, quadrant reversed.

(4) If the bubble does not recenter, try to center it by turning the micrometer knob.
   (*a*) If bubble centers, read black figures and divide by two. This is the correction.
   (*b*) Place correction on micrometer; level tube using elevation handwheel.
   (*c*) Check by again reversing the quadrant. Bubble should center.

(5) If bubble doesn't center as in (4) above,

move the arm down one graduation (10 mils).

(*a*) Turn micrometer until bubble centers.

(*b*) Take reading on micrometer add ten to it and divide sum by two. This is the correction.

(*c*) Place this reading on micrometer leaving the arm at minus 10; level tube with elevation handwheel.

(*d*) Check by reversing quadrant on seats. Bubble should center.

(*e*) Quadrant should be sent to Ordnance if correction of error amounts to more than plus or minus 0.4 mils.

c. Micrometer Test.

(1) Set the index arm to read 10 mils on the graduated arc and set the micrometer scale at zero.

(2) Place the quadrant on the leveling plates on the breech ring, the line-of-fire arrow pointing toward the muzzle, and center the quadrant bubble by elevating the tube.

(3) Set the index arm at zero on the graduated arc and turn the micrometer one revolution to read 10 mils.

(4) Reseat the quadrant on the leveling plates. The bubble should center.

Caution: Do not disturb the laying of the tube.

(5) If the bubble does not center, the micrometer is in error and must be adjusted by ordnance personnel.

d. Comparison Test. Compare readings taken at low, medium, and high elevations with all of the gunner's quadrants of a battery on a *single* gun whose quadrant seats have been accurately cross leveled. Any quadrant differing from the average by more than .4 mil at any elevation should be sent to ordnance for adjustment.

e. Correction. When a gunner's quadrant requires a correction as determined by the end-for-end test, this correction is not carried during firing but is applied only when making sight tests and adjustments.

61. TEST OF RANGE QUADRANT

a. Cross-level Tests.

(1) The gun and carriage being level (axis of bore and axis of trunnions), center the cross-level bubble.

(2) Turn the elevation knob throughout its limits of motion.

(3) The cross-level bubble should remain centered to within one-half vial graduation; if it does not, the level vial is incorrectly alined and the weapon should be sent to an ordnance unit for adjustment.

b. Pivot Azimuth Alinement Test.

(1) Place the breech and muzzle bore sights in their proper positions in the tube.

(2) Center the previously tested cross-level bubble.

(3) Elevate and depress the tube, checking to see that the bore sights track a plumb line placed in front of the tube; at the same time watch the cross-level bubble.

(4) The bubble should remain centered to within one-half vial graduation.

(5) If the bubble moves off center in excess of this amount, the pivot is not alined in azimuth with the tube; send the weapon to an ordnance unit for adjustment.

c. Pivot Vertical Alinement Test.

(1) Level the tube using the previously tested gunner's quadrant.

(2) Center the longitudinal-level bubble by turning the angle of site micrometer knob.

(3) Operate the cross-leveling knob throughout the limits of the motion; the longitudinal-level bubble should remain centered.

(4) If the bubble moves off center in excess of one-half vial graduation, either the pivot is not alined vertically with the

tube or the level vial is not correctly alined; send the weapon to an ordnance unit for adjustment.

d. Comparison Test.

(1) Compare the readings indicated by the gunner's quadrant with those on the elevation quadrant at low, medium, and high elevations of the tube.

(2) If the two instruments do not agree at all elevations, send the weapon to an ordnance unit for adjustment.

e. Angle of Site Scale Test. Level the tube with the gunner's quadrant, cross level the range quadrant, and set the scales at zero. Center the longitudinal-level bubble by turning the angle of site micrometer knob. The angle of site scale should read 3 (300) and the angle of site micrometer should read zero; if they do not, adjust the scales.

62. TEST OF AZIMUTH COMPENSATING MECHANISM OF PANORAMIC TELESCOPE MOUNT

a. General. The purpose of this test is to determine whether the azimuth compensating mechanism of the telescope mount actually keeps the tube in the correct vertical plane at all elevations. One of the tests listed below, in order of preference, should be performed.

b. Test Wherein Trunnions Need Not Be Level (Plumb Line Required). By using a plumb line

as a vertical reference plane this test reveals the total amount of error that exists between the center of the reticle pattern and the direction in which the tube points. Steps are as follows:

(1) With bore sights in place and tube near zero elevation, traverse so line of sight through the tube is on the plumb line.

(2) With the sight mount leveled, move only the sight to refer to a distant sharply defined aiming point (in any direction). Use the elevation knob of the sight to bring the horizontal reticle to the aiming point.

(3) Elevate the tube to maximum elevation or to the top of the plumb line. Traverse if necessary to bring line of sight through tube back to plumb line.

(4) Level the panoramic telescope mount both laterally and longitudinally.

(5) Sight through the telescope to determine whether or not it is still on the aiming point.

(6) If the sight is off the aiming point in excess of 1 mil in deflection and/or one-half vial graduation in elevation send the weapon to an ordnance unit for adjustment.

c. Test With Trunnions Level. Using the leveled trunnions and tube for control this test deter-

mines whether errors exist in the actuating arm pivot and/or level vials. Leveling may be accomplished by a plumb line check (par. 53*d*) or by cross leveling with the gunner's quadrant on the breech ring. If cross leveling is accomplished with the gunner's quadrant on the breech ring, results of the test are no more accurate than the parallel relationship of the trunnions to the top surface of the breech ring. Steps are as follows:

(1) *Cross level test of telescope mount.* The telescope mount cross-level bubble must be in proper adjustment before conducting the remainder of this test of the azimuth compensating mechanism.

(*a*) Center the cross-level bubble and place the line of sight of the panoramic telescope on a sharply defined aiming point.

(*b*) Elevate the tube to maximum elevation while keeping the telescope mount level longitudinally.

Note. Do not readjust the cross-level bubble after the initial setting.

(*c*) The line of sight must not deviate from the target by more than 1 mil at any elevation checked nor may the cross-level bubble travel more than one-half vial graduation. If deviation in excess of the tolerance occurs, the level vial or pivot is

incorrectly alined. Send the weapon to an ordnance unit for adjustment.

(2) *Vertical alinement test of telescope mount.*

(*a*) Level the tube longitudinally with the gunner's quadrant.

(*b*) Center the longitudinal-level bubble.

(*c*) Operate the cross-leveling knob throughout the limits of motion; the longitudinal level bubble should remain centered within one-half vial graduation. If the bubble moves in excess of the tolerance, either the level vial or the actuating arm pivot is not alined correctly and the weapon should be sent to an ordnance unit for adjustment.

d. Test with Gunner's Quadrant on Socket. Using the top surface of the socket for control this test determines the relationship of the level bubbles to the top surface of socket. If the socket is bent or if the top surface is unlevel, results of the test will be inaccurate. With the tube and trunnions approximately level, place a steel or glass plate having parallel sides on top of the telescope mount. Level the telescope mount both crosswise and longitudinally by turning the cross leveling and elevation knobs, using the tested gunner's quadrant as a level. If the elevation indexes on the rocker and the actuating arm and those

on the elevation knob and the shaft do not match, adjust them by moving the adjustable index on the rocker or by adjusting the elevation knob index as needed. If the cross- and longitudinal-level bubbles are not centetred within one-half vial graduation, adjustment must be made by ordnance personnel.

63. ORDNANCE CHECK

It is not contemplated that using units will have the necessary facilities, tools, or skilled mechanics to perform the more precise tests and adjustments of sighting and fire control equipment. When deficiencies recur or when defects cannot be corrected in the field, ordnance checks should be scheduled.

64. FUZE SETTERS

a. General. Examine the stop which fits into the slot in the movable time ring and the adjusting pawl which engages the notch in the fixed fuze ring to see that their edges are not burred or bent. Depress the adjustable pawl against its spring to see that the movement of the pawl is free. In the following test be sure to test the fuze setter with the fuze for which it is designed; the time scale on the fuze setter must have the same graduations as the time ring on the fuze.

b. Time Scale Test. Set the corrector to 30 and set any convenient time on the time scale. Test

the time scale of the fuze setter by setting several fuzes.

Caution: Before setting a fuze, make sure that the "T" and "C" screws (of the fuze setter) are tight to prevent any slipping of the scale indexes when the handle of the fuze setter is rotated. The time set on the fuze should agree with the time setting on the fuze setter within one-fourth of the smallest graduation on the fuze time ring. The tolerance amounts to 0.05 seconds for fuzes having 0.2 second graduations, and 0.125 seconds for fuzes having 0.5 second graduations. If the fuzes set do not agree with the time set on the fuze setter, repeat the test as a check with a different setting. If the fuzes set still do not agree with the fuze setter, refer the instrument to ordnance for adjustment.

Caution: Do not set any one live fuze more than twice. The fuze from a dud must never be used. Reset all fuzes to SAFE and replace the safety wire or cotter pin.

CHAPTER 8
MAINTENANCE AND INSPECTIONS

65. GENERAL

Maintenance and inspection is essential to insure that the gun section is prepared to carry out its mission immediately. Systematic maintenance and inspection drills provide the best insurance against unexpected breakdown at the critical moment when maximum performance is essential.

66. DISASSEMBLY, ADJUSTMENT, AND ASSEMBLY

Disassemblies and adjustments of the weapon authorized to be performed by battery personnel are prescribed in TM 9–325, supplemented by instructions contained in Department of the Army Supply Catalogs, ORD 7 SNL C 21, ORD 8 SNL C 21, and ORD 9 SNL C 21. No deviation from these procedures is permitted except when authorized by the responsible ordnance officer.

67. RECORDS

a. The principal records pertaining to the weapon are the Artillery Gun Book (OO Form 5825), a field report of accidents (SR 385–310–1),

and the unsatisfactory equipment report (DA Form 468). Information on the purpose and use of these records may be found in the forms themselves.

b. The chiefs of sections, battery executive, and battery commander also should keep semipermanent records on their weapons for information and guidance.

68. MAINTENANCE

For detailed instructions concerning maintenance of the 105-mm howitzer see TM 9–325 and LO 9–325. For detailed instructions concerning maintenance of the vehicle being used as a prime mover, see the technical manuals and lubrication orders pertaining to that vehicle.

69. INSPECTIONS

Regular inspections are required to insure that matériel is maintained in serviceable condition.

a. The chief of section is responsible for the equipment within his section. He should inspect it thoroughly each day. If he sees the need for repair or adjustment, he notifies the battery executive immediately so that the necessary action may be taken.

b. The executive, accompanied by the artillery mechanic, should make a daily spot-check inspection. Each day he inspects different parts of the weapons thereby insuring complete coverage every

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few days. At least once a month, the executive makes a thorough mechanical inspection of the weapons, auxiliary equipment, tools, and spare parts.

c. Battery, battalion, and higher commanders should make frequent command inspections to assure themselves that the equipment in their commands is being maintained at prescribed standards of condition, appearance, and completeness.

d. For details on inspecting the 105-mm howitzer see TM 9–325. For details on inspecting the vehicle being used as prime mover see the appropriate technical manual for that vehicle. Deficiencies found during inspections should be remedied promptly.

e. Duties of individuals in performing the necessary inspections and maintenance of the gun are outlined in the tables IV and V. Work will be made routine, thorough, and rapid by following the drill outlined in these tables. When the section is reduced in strength the chief of section must reassign duties to insure that all maintenance steps are completed.

70. INSPECTION DUTIES BEFORE OPERATION (MARCH)

The inspection performed before operation is a final check on matériel prior to leaving the motor park for training in the field, the bivouac

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Table IV. Inspection Duties Before Operation (March)

Sequence	Chief of Section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	Driver
1	Supervises inspections by members of the gun section in all sequences.	Inspects condition, completeness, contents, and security of section chest.						Assist the prime mover driver in inspection and maintenance of his vehicle when directed to do so by the chief of section. Load ammunition in prime mover and trailer as directed.		Performs "before operation" duties as prescribed in TM 21-305, assisted by cannoneers Nos. 6 and 7 when so directed by chief of section.
2	Verifies that gun is properly coupled.	Releases left wheel handbrake.	Releases right wheel handbrake before coupling.	Inspects condition and security of rammer staff.						
3	Verifies that handbrakes are released.			Disconnects and removes light system from gun.	Inspects gun cover for torn or worn places and for broken or missing fastenings.					
4	Inspects recoil system for signs of oil leakage.	Remove breech end of overall gun cover.		Inspects condition and security of trail handspike.		Remove muzzle end of overall gun cover.	Removes muzzle cover.			
5	Supervises the gunner in making tests and adjustments of sighting and fire control equipment.	Inspects condition and security of sighting and fire control equipment, except elbow telescope.	Inspects elbow telescope for condition and security. Inspects breech-block, firing mechanism, chamber, and bore for cleanliness, freedom from foreign matter, and lubrication.	Inspects tires for wear, bruises, cuts, stones in treads, and for low air pressure. Inspects wheels for loose or missing nuts, hubcap screws, and valve caps.	Inspects drawbar to see that it is in proper position and securely locked.	Inspects left axle lock for proper fastening in traveling position.	Inspects right axle lock for proper fastening in traveling position.			
6	Inspects oil index to insure that proper reserve of oil is present in the recoil system (TM 9-325).					Inspects cradle lock strut for adjustment and fastening.	Inspects condition and security of aiming posts on trails.			
7	Inspects ammunition for lot number, condition, and stowage.			Determines presence of ample supply of cleaning and preserving material.	Inspects carriage for loose parts, condition of tube fittings, and for cracked or broken welds.	Assures that left latch is holding bottom shield flap in traveling position.	Assures that right latch is holding bottom shield flap in traveling position.			
8	Verifies presence of proper supply of gasoline, oil, water, and emergency rations.					Inspects cradle traveling locks for adjustment.	Inspects barrel locking ring and locking nuts for security.			
9	Inspects loading of section equipment for completeness and security.	Inspects position and fastening of shield.			Inspects for grease and oil leakage on or under carriage.	Cleans and oils elevating rack and pinions.	Cleans and greases recoil slides.			
10	Verifies presence of technical manuals and lubrication orders for prime mover and gun, trip ticket, driver's accident report form, vehicle identification card, and gun book.	Replace breech end of overall gun cover.				Replace muzzle end of gun cover.	Replaces muzzle cover.			
11			Inspects condition and fastening of trail traveling lock and latch.	Replaces and connects light system on gun.	Loads ammunition in prime mover and trailer.	Load ammunition in prime mover and trailer.				
12	Receives reports of personnel of his section upon completion of their duties in inspection.	Reports, "Gunner ready."	Reports, "No. 1 ready."	Reports, "No. 2 ready."	Reports, "No. 3 ready."	Reports, "No. 4 ready."	Reports, "No. 5 ready."	Reports, "No. 6 ready."	Reports, "No. 7 ready."	Reports, "Driver ready."
13	Reports to battery executive when section personnel have completed their duties, "Sir, No. (so-and-so) in order," or reports any defects which the section cannot remedy without delay or assistance.									

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area for combat, or before displacement. After inspection, and when all deficiencies have been corrected, the section is ready to go into action.

71. INSPECTION DUTIES DURING THE MARCH

The inspection performed during operation is a constant check on the operation of the matériel and the security of equipment to insure that all matériel goes into combat in the best possible condition. There is no command for this inspection as it is carried on constantly. The responsibilities and duties are as shown below:

a. Chief of Section.

(1) Rides in cab with driver and supervises march discipline.

(2) Assigns duties for antiaircraft and antimechanized security.

(3) Observes prime mover instruments and controls for proper functioning, and listens for unusual noises indicating malfunctioning of the vehicle or gun.

b. Gunner.

(1) Listens for abnormal or unusual noises and observes towed load for security.

(2) Signals chief of section in case of malfunction.

c. Nos. 1–7 inclusive.

(1) Perform duties as antiaircraft and antimechanized security sentries as assigned by chief of section.

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(2) Listens for abnormal or unusual noises indicating malfunction of vehicle or gun.

d. Driver. Performs *during operation* duties as prescribed in TM 21–305.

72. INSPECTION DUTIES DURING HALT

The inspection at the halt is made to insure that the gun and prime mover are in good condition. This inspection checks items which cannot be checked during the march and is performed as soon as a halt is made. The chief of section, on being told length of halt, will divide halt time between relief and maintenance. Duties are as shown in table V.

73. INSPECTION DUTIES PRIOR TO AND DURING FIRING

Inspection before and during firing is a continuing inspection to insure proper functioning of matériel. No command is necessary; each member of the section performs appropriate inspections throughout pre-firing and firing periods as shown below:

a. Chief of Section.

(1) Supervises and commands section as prescribed in chapters 4 and 5.

(2) Supervises servicing of recoil system and testing and adjustment of sighting and fire control equipment prior to firing.

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Table V. Inspection Duties During Halt

Sequence	Chief of Section	Gunner	No. 1	No. 2	Nos. 3–7 inclusive	Driver
1	Commands PERFORM HALT INSPECTION. Supervises inspection and maintenance at halt. Insures that personnel remain to right of left wheel line except to inspect left wheels.	Inspects for presence, condition, and security of sighting equipment, gun covers, staff sections, aiming posts, trail handspikes, and section chest.	Inspects coupling of gun to prime mover.	Inspects tires and wheels. (Inspects tires for wear, bruises, cuts, stones in treads, and for correct air pressure.) Inspects wheels for loose or missing nuts, hubcap screws, valve caps, and overheated wheel bearings.	Perform duties as prescribed by chief of section.	Performs *at halt* duties as prescribed for his vehicle.
2			Inspects trail traveling lock and latch for condition and fastening.			
3			Inspects connection, functioning, and mounting of light system and inspects fastenings of gun cover.			
4	Receives reports of personnel upon completion of their duties.	Reports, "Gunner ready."	Reports, "No. 1 ready."	Reports, "No. 2 ready."	Reports, "No. (so-and-so) ready."	Reports, "Driver ready."
5	Reports to battery executive when inspection is completed, "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.					

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b. Gunner.

(1) Tests and adjusts sighting and fire control equipment prior to firing, provided sufficient time is available.

(2) Performs inspection duties in firing as prescribed in chapters 4 and 5.

c. No. 1.

(1) Tests and adjusts elbow telescope prior to firing.

(2) Performs inspection duties in firing as prescribed in chapters 4 and 5.

d. Nos. 2–7. Perform appropriate inspection as prescribed in chapters 4 and 5, and any other duties as directed by chief of section.

e. Driver. The driver moves his vehicle to the motor park, usually under the direction of the first sergeant, and performs *after operation* duties as prescribed in TM 21–305.

74. INSPECTION DUTIES AND MAINTENANCE AFTER OPERATION

After operation, the gun is immediately given whatever servicing and maintenance is needed to prepare it in every way for further sustained action or to determine the need for maintenance by higher echelons. These operations may be performed in the motor park, bivouac area, or combat position. Inspections are as shown in table VI.

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75. DUTIES IN WEEKLY INSPECTION AND MAINTENANCE

In garrison these duties are performed weekly. On maneuver or in combat they are performed after each field operation.

a. Chief of Section.

(1) Supervises section in weekly inspection and maintenance of gun, tools, accessories, and equipment. (See TM 9–325 and Lubrication Order 9–325 for further details.)

(2) Obtains assistance of the artillery mechanic for operations requiring skill and tools beyond the capabilities of the section.

b. Gunner and Cannoneers Nos. 1–5 Inclusive. Perform normal maintenance as directed by the chief of section.

c. Driver and Cannoneers Nos. 6 and 7. When directed to do so by the chief of section, assist the motor mechanic in the performance of the prescribed vehicle weekly inspection and maintenance.

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Table VI. Inspection Duties and Maintenance After Operation

Sequence	Chief of Section	Gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	Driver
1	Commands INSPECT EQUIPMENT. Supervises detailed inspection and maintenance of gun in all sequences.	Inspects for presence of all sighting and fire control equipment, cleans, secures and, to the extent that he is authorized, lubricates them.	Inspects, cleans, and secures elbow telescope.	Removes, cleans, and replaces rammer staff and trail handspike.				As directed by the chief of section. May assist prime mover driver in inspection and maintenance or perform other duties as directed by the chief of section.		Performs after operation duties as prescribed for his vehicle, assisted by cannoneers Nos. 6 and 7 when so directed by chief of section.
2	Inspects tools, accessories, and equipment for completeness and condition.			Inspects tires and wheels for damage and loose or missing parts; tests air pressure of tires and corrects if it is necessary.						
3	Inspects ammunition for lot number, complete rounds, and general condition.			Removes and cleans light system equipment and stores it in section chest.	Inspects fastenings and general condition of cover.					
4		Remove breech portion of overall gun cover.				Remove muzzle portion of overall gun cover.	Removes muzzle cover.			
5	Inspects recoil system for signs of leakage and supervises filling to correct oil reserve when necessary (TM 9-325).	Inspects shield fastenings.	Removes, cleans, oils, and replaces breech mechanism, assisted by section personnel as directed by chief of section.	Clean gun and carriage.		Clean gun and carriage.				
6	Verifies the presence of and makes current entries in gun book, trip ticket, and other required documents.	Inspects bore and breech mechanism after cleaning.			Lubricates gun and carriage.	Lubricates gun and carriage.	Removes, cleans, lubricates, and returns aiming posts.			
7	Verifies that there is an ample supply of emergency rations, oil, water, and gasoline.	Checks the contents of the section chest, and inspects for condition of chest and contents.			Inspects carriage for loose or missing nuts, bolts, rivets, and broken welds; looks for excess grease or oil under carriage.					
8		Replace breech portion of overall gun cover.			Cleans, lubricates, and returns fuze setter to section chest.	Replace muzzle portion of overall gun cover.	Replaces muzzle cover.			
9							Properly stores unused cleaning and preserving materials.			
10	Receives reports from members of the section as they complete inspection and maintenance operations.	Reports, "Gunner ready."	Reports, "No. 1 ready."	Reports, "No. 2 ready."	Reports, "No. 3 ready."	Reports, "No. 4 ready."	Reports, "No. 5 ready."	Reports, "No. 6 ready."	Reports, "No. 7 ready."	Reports, "Driver ready."
11	Reports to battery executive, "Sir, No. (so-and-so) in order."									

CHAPTER 9
DECONTAMINATION OF EQUIPMENT

76. GENERAL

Equipment which has been contaminated by chemical, biological, or radiological agents constitutes a danger to personnel. *Contamination* means the spreading of an injurious agent in any form and by any means. Persons, objects, or terrain may be contaminated. *Decontamination* is the process of making any contaminated place or object safe for unprotected personnel. This can be done by covering, removing, destroying, or changing into harmless substances the contaminating agent or agents. Generally, only equipment contaminated by persistent agents need be decontaminated.

77. DECONTAMINATION FOR CHEMICAL AGENTS

a. Ammunition. With rags, wipe off visible contamination from projectiles. Apply DANC (decontamination agent, noncorrosive, M4), wipe with gasoline-soaked rag, then dry. If DANC is not available, scrub with soap and cool water. Slurry (equal weights of water and chloride of lime) can be used on contaminated ammunition

containers, but it must not be allowed to penetrate to the ammunition itself.

b. Instruments. If exposed to corrosive gases, clean instruments as soon as possible with alcohol (or gasoline, if no alcohol is available), and apply a thin coat of light machine oil. A rag dampened with DANC may be used, followed by drying with a clean rag and then applying a coat of machine oil. DANC injures plastic or hard rubber surfaces.

c. Weapons. Remove dirt, dust, grease, and oil. Do not apply wet mix but allow surfaces to air after soil and dirt have been removed. DANC can be used on all metal surfaces except the bore. Also effective on metal are hot water, cleaning solvent, or repeated applications of gasoline on swabs. If the emergency use of gasoline-soaked swabs is made (FM 21–40), extreme care must be taken to insure that the gasoline does not spread the contamination and that no gasoline in liquid or vapor form remains. This excess would be ignited when the gun is fired. After decontamination, weapons are dried and oiled.

d. Automotive Equipment. Light contamination from spray can be decontaminated by aeration alone. For heavier contamination use DANC on interior or exterior surfaces which personnel are likely to touch. For larger area decontamination, wash vehicle with water and scrub painted surfaces with soap and water.

78. DECONTAMINATION FOR BIOLOGICAL AND RADIOLOGICAL AGENTS

a. General. After a contaminating attack, recovery of equipment may be achieved either by waiting, to permit the decay of contamination, or by active decontamination, to reduce danger to a level where it is no longer a significant hazard to operating personnel. Decontamination may be either rough or detailed, depending on the urgency of the military situation. The procedure adopted will be a command decision.

b. Rough Decontamination. Rough decontamination is performed when urgency is the main factor. Its purpose is to reduce contamination sufficiently to permit personnel to work with, or close to, equipment for limited periods. Rough decontamination may be achieved by means of water or steam if available. Soap or other detergent used in conjunction with water or steam aids in decontamination.

c. Detailed Decontamination. Detailed decontamination, in which the emphasis is on thoroughness, will be carried out in rear areas and repair bases and includes procedures of surface decontamination, aging and sealing, and disposal.

79. REFERENCES

For further information on decontamination see FM's 17–59 and 21–40, TM 3–220, and TF 3–1407.

CHAPTER 10
DESTRUCTION OF EQUIPMENT

80. GENERAL

a. Tactical situations may arise when it becomes necessary to abandon equipment in the combat zone. In such a situation all abandoned equipment must be destroyed to prevent its use by the enemy.

b. The destruction of equipment subject to capture or abandonment in the combat zone will be undertaken only upon authority delegated by division or higher commanders.

c. All batteries must prepare plans for destroying their equipment in order to reduce the time required should destruction become necessary. The principles to be followed are:

(1) Plans for destruction of equipment must be adequate, uniform, and easily carried out in the field.

(2) Destruction must be as complete as the available time, equipment, and personnel will permit. Since complete destruction requires considerable time, the more essential parts are destroyed first.

(3) The same essential parts must be destroyed on all like units to prevent the enemy from constructing complete units from damaged ones.
(4) Spare parts and accessories must be given the same priorities as the parts installed on the equipment.

81. METHODS

To destroy equipment adequately and uniformly, all personnel of the unit must know the plan and priority of destruction and be trained in the methods of destruction.

82. REFERENCES

For detailed information on destruction of barrel assembly and recoil mechanism, carriage or mount, tires, and fire control equipment, see TM 9-325; for ammunition, see TM 9-1901. For destruction of vehicle, see the TM appropriate to the vehicle being used as prime mover.

CHAPTER 11
SAFETY PRECAUTIONS

83. GENERAL

Safety precautions to be observed in training are prescribed in SR 385–310–1. Additional information is found in FM 6–140, TM 9–325, and TM 9–1900. The more important safety precautions are summarized in the following paragraphs.

84. AMMUNITION

a. All ammunition at the firing position must be so placed that it is protected against explosion in case of accident at the gun position. Flames and explosive materials such as gasoline must be kept away from the ammunition. Ammunition should be protected from direct rays of the sun by use of a tarpaulin or other suitable covering.

b. Battery personnel must not attempt to disassemble fuzes or remove primers from rounds.

c. If for any reason a round is not fired after the time fuze has been set, the fuze must be reset to SAFE before it is restowed.

d. All rounds not fired which have been prepared for firing must be checked by the chief of section, to insure that all seven powder increments

are present in proper order and condition, and that they are of the proper lot number. He also verifies that the lot number on the ammunition corresponds to the lot number on the container. A battery officer must certify that ammunition has been properly reassembled. (For further details, see FM 6–140.)

85. MISFIRES

a. In the event of a misfire two more attempts are made to fire the gun. If it does not fire, wait two minutes from the time of the last attempt before the executive commands UNLOAD.

b. Upon the command to unload, the breech is opened to extract the cartridge case. Should the complete round be extracted, the projectile is separated from the cartridge case. Immediately inspect the primer in the base of the cartridge case to determine whether the indent is normal. The cartridge case is thrown clear of all personnel to prevent injury in case of a hang-fire. The projectile is reloaded with another cartridge case and firing is resumed.

c. See TM 9–325 for action to be taken in case the indent on the primer is light or if there is no indent, indicating that the firing lock is not functioning properly.

86. DRILL AND FIRING

a. The gun is kept unloaded except when firing is imminent.

b. Members of the gun section pass in rear of the gun when going from one side to another.

c. Personnel must stay a safe distance from the breech to prevent injury when the gun recoils.

d. During firing personnel should use waste in their ears to protect eardrums against injury.

e. In training there must always be a safety officer for each artillery unit firing. For duties of the safety officer see **FM 6–40.**

APPENDIX I

REFERENCES

AR 600–70	Badges.
AR 750–5	Maintenance Responsibilities and Shop Operation.
ATT 6–1	Training Test for Field Artillery Battery.
ATT 6–2	Training Tests for Field Artillery Battalion Firing.
ATT 6–5	Training Tests for Light and Medium Field Artillery Battalion, Involving Displacement and Continuous Fire Support.
SR 110–1–1	Index of Army Motion Pictures, Kinescope Recordings and Film Strips.
SR 310–20–series	Military Publications.
SR 320–5–1	Dictionary of United States Army Terms.
SR 385–310–1	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
SR 615–25–15	Military Occupational Specialties.
SR 615–25–20	Career Fields.
FM 5–15	Field Fortifications.
FM 5–20	Camouflage, Basic Principles.
FM 5–20B	Camouflage of Vehicles.
FM 5–20D	Camouflage for Field Artillery.
FM 5–25	Explosives and Demolitions.
FM 6–40	Field Artillery Gunnery.

FM 6-101	Tactics and Technique Battalion and Battery Motorized.
FM 6-125	Qualification Tests for Specialists, Field Artillery.
FM 6-140	The Field Artillery Battery.
FM 21-5	Military Training.
FM 21-8	Military Training Aids
FM 21-40	Defense Against Chemical Attack.
FM 25-10	Motor Transport.
TM 3-220	Decontamination.
TM 5-267	Camouflage.
TM 6-605	Field Artillery Individual and Unit Training Standards.
TM 9-325	105-mm Howitzer M2A1; Carriages M2A1 and M2A2; and Combat Vehicle Mounts M4 and M4A1.
TM 9-575	Auxiliary Sighting and Fire Control Equipment.
TM 9-850	Cleaning and Preserving, Sealing, and Related Materials Issued for Ordnance Matériel.
TM 9-1325	105-mm Howitzer, M2 and M2A1; Carriages M2A1 and M2A2; and Combat Vehicle Mounts M3 and M4.
TM 9-1527	Gunner's Quadrants M1 and M1918, and Machine Gun Clinometer M1917.
TM 9-1545	Telescope Mounts, and Range and Elevation Quadrants for Motor Carriages, Field Artillery and Anti-aircraft Artillery.
TM 9-1582	Panoramic Telescopes, All Types.
TM 9-1590	Fuze Setters for Field Artillery.
TM 9-1900	Ammunition, General.
TM 9-1901	Artillery Ammunition.
TM 9-2300	Artillery Matériel and Associated Equipment.

TM 21-300	Driver Selection Training and Supervision, Wheeled Vehicles.
TM 21-305	Driver's Manual.
TM 37-2810	Motor Vehicle Inspection and Preventive Maintenance Services.
DA ORD Supply Catologs:	
SNL C-21	Howitzer, 105, M2A1; Carriage Howitzer, 105-mm, M2A1 and M2A2.
SNL K-1	Cleaning and Preserving Materials.
SNL R-1	Ammunition for Light Artillery.
SNL R-3	Fuzes and Primers.
SNL R-7	Demolition Matériel, Land Mines, and Fuzes.

APPENDIX II
TRAINING

Section I. GENERAL

1. PURPOSE AND SCOPE

The purpose of this appendix is to present the absolute minimum requirements for training the personnel of a gun section in the performance of their duties in service of the gun. It includes general information on the conduct of training, a minimum training schedule, and tests to be given for the qualification of gunners.

2. OBJECTIVES

The objectives are speed in training cannoneers in their individual duties; and, through drill, to weld them into an effective, coordinated team able to function efficiently in combat. During training, supervisors may well keep in mind the proficiency sought by Army Training Tests (ATT) 6–1, 6–2, and 6–5. Maximum efficiency is attained through continuous drills.

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3. CONDUCT OF TRAINING

a. Training will be conducted in accordance with the principles laid down in FM 21–5. Its goal should be the standards set forth in FM 6–125, TM 6–605, SR 615–25–15, and SR 615–25–20.

b. In general, individual training is conducted by noncommissioned officers as far as practicable. Officers are responsible for training plans, for conducting unit training, and for supervising and testing individual training.

c. Throughout training, the application of prior instruction to current training must be emphasized.

d. A record of the training received by each individual should be kept. This may be done by each chief of section keeping a progress card for each man in his section. This card should show each period of instruction attended, tests taken, and remarks pertaining to progress. Progress cards should be inspected frequently by the battery executive to make sure that they are being kept properly and to determine the state of training. *Requiring the chief of section to keep these records emphasizes his responsibility toward his section.*

e. The necessity for developing leadership and initiative in noncommissioned officers must be emphasized constantly throughout training.

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4. STANDARDS TO BE ATTAINED

A satisfactorily trained gun section must be capable of performing the following functions in the times indicated (TM 6–605) :

a. Firing 10 rounds (drill ammunition) at different deflections, elevations, and time fuze settings, using the same charge, in 3 minutes by day and 4 minutes by night. Changes in data should be typical for a time bracket adjustment; data is announced from prepared cards.

b. Performing after-firing care and maintenance of gun and carriage. The gun being in position, clean and lubricate, disassemble and assemble the breech and firing mechanism, and inspect the weapon, in 30 minutes by day and 40 minutes by night. All materials and tools required should be available at the position.

c. Performing 6-months inspection and maintenance of the gun and carriage. The gun prepared for action in the gun park, clean and lubricate, as authorized, all parts and assemblies, and prepare for ordnance inspection in 2 hours. All materials and tools required should be available in the gun park.

d. Each member of the gun section should know the duties of all other members of the section and be able to perform efficiently in all positions. See paragraphs 8 through 21 in app. II for tests to be given for the qualification of gunners.

Section II. MINIMUM TRAINING SCHEDULE

5. GENERAL

The training schedule outlined in paragraph 7 of this appendix is a guide to meet the minimum training requirements for personnel of a gun section in subjects covered in this manual.

6. INDIVIDUAL PERIODS

a. Individual periods of training in service of the gun should be arranged, along with other battery training, into a balanced training program taking into consideration the basic principles of training.

b. In general, except for service practice, periods on any subject should not be longer than 1 hour. Gun drill periods should be for only one-half hour and should be conducted in a vigorous manner.

c. Gun drill periods should be preceded and followed by periods on subjects that will be logically related to the drill. For example, precede a period of gun drill with a period of testing and adjustment of sighting and fire control equipment, and follow it with a period on inspection and maintenance drills. A period on aiming post displacement correction may come between two periods of gun drill.

d. TM 9-325 provides information on which to base periods of instruction on description, characteristics, and functioning of the gun; familiarization with the gun, including breech and firing mechanism, barrel assembly and slides, recoil mechanism, equilibrator, elevating mechanism, sighting and fire control equipment; and field assembly and malfunction. These should be included in the battery training schedule, closely allied with the training in service of the gun outlined in paragraph 7 of this appendix. Approximately 8 hours should be devoted to this instruction.

e. Additional service of the gun training may be performed during battery training exercises.

7. SCHEDULE

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW	1	Organization and composition of gun section; general duties of individuals; formation of gun section.	Pars. 4–8, incl.	Gun and prime mover.
C, D, PW	1	Posts and posting of cannoneers; changing posts; mounting and dismounting.	Pars. 9–13, incl.	Do.
C, D, PW	2 (1 hour periods)	Coupling and uncoupling; prepare for action, and march order; movement of gun by hand.	Pars. 14–19, incl.	Do.
C, D, PW	24 (½ hour periods)	Gun drill, duties in firing, indirect laying.	Pars. 20–29, incl; 43; 46–51 incl.	T/O&E equipment.
C, D, PW	9 (½ hour periods)	Gun drill duties in firing, direct laying.	Pars. 30–42, incl.	Do.

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW	6 (1 hour and ½ hour periods)	Testing and adjustment of sighting and fire control equipment.	Pars. 52–64, incl.	T/O&E equipment.
C, D, PW	2 (½ hour periods)	Aiming post displacement correction.	Par. 44.	T/O&E equipment, blackboard and chalk.
C, D, PW	4 (1 hour periods)	Inspections and maintenance drills.	Pars. 65–75, incl.	T/O&E equipment.
C, D, PW	1.	Decontamination of matériel.	Pars. 76–79, incl.	Decontamination equipment; T/O&E equipment.

C, D, PW	1	Destruction of matériel to prevent use by the enemy.	Pars. 80–82, incl.	Demolition and T/O&E equipment.
C, D	1	Safety precautions.	Pars. 83–86, incl.	T/O&E equipment.
PW	16 (4 hour periods)	Service, practice, indirect laying.	Pars. 20–29, incl; 43; 45, 46–51.	T/O&E equipment.
PW	4	Service, practice, direct laying.	Pars. 30–42, incl.	Do.
C, PW	6 (1 hour periods)	Review and tests of subjects previously covered.	All previous references.	Do.

C—conference; D—demonstration; PW—practical work (78 hrs.).

Section III. TESTS FOR QUALIFICATION OF GUNNERS

8. PURPOSE AND SCOPE

This section prescribes the tests to be given in the qualification of gunners. The purposes of the tests are twofold:

a. To provide a means of determining the relative proficiency of the individual artillery soldier in the performance of the duties of the gunner, 105-mm howitzer M2 and modifications. *The tests will not be a basis for determining the relative proficiency of batteries or higher units.*

b. To serve as an adjunct to training.

9. GENERAL INSTRUCTIONS

a. Standards of Precision. The candidate will be required to perform the tests in accordance with the standards listed below:

(1) Scale settings must be exact and matching indexes must be brought into coincidence.

(2) Level bubbles must be exactly centered.

(3) The vertical hair in the reticle of the panoramic telescope must be alined on the left edge of the aiming post or on exactly the same part of the aiming point or target each time the gun is laid.

(4) Final motions of azimuth and elevation setting knobs, as well as traversing and elevating handwheels, must be made in

the appropriate direction. For elevating, the final motion of the handwheel should be in the direction of the more difficult movement. Final motion for traversing is from left to right. Final movement of the vertical hair of the telescope is from left to right.

b. Assistance. The candidate will receive no unauthorized assistance. Each candidate may select authorized assistants as indicated in the tests. In the event a candidate fails any test because of the fault of the examiner or any assistant, the test will be disregarded, and the candidate will be given another test of the same nature.

c. Time. The time for any test will be the time from the last word of the command to the last word of the candidate's report. The candidate may begin any test after the first word of the first command.

d. Scoring. Scoring will be conducted in accordance with the two subparagraphs *Penalties* and *Credit* under each subject. If a test is performed correctly, credit will be given in accordance with the subparagraph *Credit* under each subject. No credit will be allowed if conditions exist as specified in the subparagraphs headed *Penalties.*

e. Preparation for Tests. The gun will be prepared for action and the candidate posted at the proper position corresponding to the test being

conducted or as indicated in the subparagraphs entitled "Special instructions." The examiner will insure that the candidate understands the requirements of each test and will require the candidate to report "I am ready," before each test.

f. Qualification Scores. Minimum scores required for qualification in the courses are as follows:

Individual Classification	*Points*
Expert gunner	90
First-class gunner	80
Second-class gunner	70

10. OUTLINE OF TESTS

Paragraph number	Subject	Number of tests	Points each	Maximum credit
11	Direct laying, panoramic telescope.	4	2	8
12	Direct laying, elbow telescope.	4	2	8
13	Indirect laying, deflection only.	18	2	36
14	Laying for elevation with range quadrant.	3	2	6
15	Laying for elevation with gunner's quadrant.	3	2	6
16	Displacement correction.	2	–	4
	Part I	(1)	3	(3)
	Part II	(1)	1	(1)

[redacted]

Paragraph number	Subject	Number of tests	Points each	Maximum credit
17	Measuring site to the mask.	1	4	4
18	Measuring elevation	1	4	4
19	Measuring deflection	1	4	4
20	Tests and adjustment of sighting and fire control equipment.	6	–	10
	Tests 1, 3, 4, and 5.	(4)	2	(8)
	Tests 2 and 6	(2)	1	(2)
21	Matériel	3	–	10
	Tests 1 and 2	(2)	3	(6)
	Test 3	(1)	4	(4)
	Total credit			100

11. DIRECT LAYING, PANORAMIC TELESCOPE

a. Scope of Tests.

(1) Four tests (two groups of two tests each) will be conducted in which the condidate will be required to execute commands similar to those given in *c* below.

(2) Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

(3) The candidate will be tested in the duties of the gunner, using the one-man, one-sight system.

[redacted]

b. Special Instructions.

(1) A stationary target will be placed approximately 600 yards from the gun.

(2) The fixed azimuth scale and micrometer scale will be set at zero, and indexes on telescope mount will be matched.

(3) The candidate will be posted as the gunner.

(4) The gun will be pointed so that—

(*a*) A shift of approximately 100 mils will be required for tests 1 and 3.

(*b*) It will not be necessary to shift the trails for any of the four tests.

(5) Laying at the termination of tests 1 and 3 will not be disturbed prior to beginning tests 2 and 4.

(6) The examiner will announce the assumed direction of the movement of the target at the beginning of tests 1 and 3. The assumed direction of the movement of the target in test 3 will be opposite to that in test 1.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 and 3.	TARGET, THAT TANK; LEAD 5, RANGE 600.	Traverses gun until proper lead has been set.

Test number	Examiner commands (for example)	Action of candidate
		Places proper range line of reticle on the center of the visible mass of the target. Centers cross-level bubble. Gives the command, FIRE, when ready and steps clear.
2 and 4.	RIGHT (LEFT) 10, ADD (DROP) 200.	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test—

(1) The azimuth scale has been moved from zero.

(2) The indexes on the azimuth micrometer have been moved from zero.

(3) The indexes on the telescope mount are not in coincidence.

(4) The lead in mils is not set properly.

(5) The proper range line of the reticle is not on the center of the visible mass of the target.

e. Credit.

Time in seconds, exactly or less than	4	4⅘	5⁻
Credit	2.0	1.5	1.0

12. DIRECT LAYING, ELBOW TELESCOPE

a. Scope of Tests.

(1) Four tests (two groups of two tests each) will be conducted in which the candidate will be required to execute commands similar to those given in *c* below.

(2) Tests 1 and 2 (and tests 3 and 4) will be executed as one series of commands.

(3) The candidate will be tested in the duties of No. 1 cannoneer, using the two-man, two-sight system.

b. Special Instructions.

(1) A stationary target will be placed approximately 600 yards from the gun.

(2) For tests 1 and 3 the field of view of the telescope will be placed on the target, with the correct range line more than 100 yards off the target.

(3) The laying of the gun will not be disturbed after tests 1 and 3.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 and 3.	TARGET, THAT TANK; RANGE 500.	Places proper reticle line for announced range of the center of the visible mass of the target. Calls "Set" and steps clear.

Test number	Examiner commands (for example)	Action of candidate
2 and 4.	ADD (DROP) 400.	Same as test 1 above.

d. Penalties. No credit will be allowed if, after each test—

(1) The correct range line is not on the center of the visible mass of the target.

(2) The range lines of the reticle are not approximately horizontal.

Time in seconds, exactly or less than..	1⅘	1⅘	2
Credit	2.0	1.5	1.0

13. INDIRECT LAYING, DEFLECTION ONLY

a. Scope of Tests. Eighteen tests will be conducted in which the candidate will be required to execute commands similar to those given below. Tests 1 through 4 (and tests 5 through 9, 10 through 13, and 14 through 18) will be executed as one series of commands.

b. Special Instructions.

(1) Commands will not necessitate shifting trails.

(2) The examiner will select a suitable aiming point and identify it to the candidate.

(3) Commands for special corrections will be given *only* in the tests indicated in the examples below.

(4) The command for new deflections for each test will be within the following prescribed limits:

Test number	Maximum change (mils)	Minimum change (mils)
2 and 11	180	140
3 and 12	90	70
4 and 13	40	20
7 and 16	100	60
8 and 17	50	30
9 and 18	20	10

(5) The gun will be laid with correct settings at the conclusion of each test before proceeding with the next test.

(6) Aiming posts will be set out at prescribed deflection and distances for these tests.

(7) The examiner will designate the section number of the gun to be used. The examiner will announce special corrections in deflection to be applied by the candidate.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 and 10.	SPECIAL CORRECTIONS, DEFLECTION 2890, NO. 1 LEFT 7.	Sets deflection and applies special correction.

Test number	Examiner commands (for example)	Action of candidate
		Centers cross- and longitudinal-level bubbles.
		Traverses gun until vertical hair is on left edge of aiming posts.
		Checks centering of bubbles.
		Re-lays if necessary.
		Calls "Ready" and steps clear.
2 and 11.	DEFLECTION 2760	Sets deflection change.
		Leaves correction on gunner's aid.
		Lays on aiming posts.
		Checks centering of bubbles.
		Re-lays if necessary.
		Calls "Ready" and steps clear.
3 and 12.	DEFLECTION 2835	Same as test 2 above.
4 and 13.	NO. 1, RIGHT 4	Same as test 2 above, but changes gunner's aid to right 4 and resets deflection 2835 opposite index.

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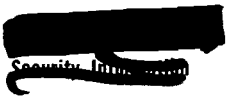
Test number	Examiner commands (for example)	Action of candidate
	At conclusion of test 4 (13) give CEASE FIRE, END OF MISSION. (No time considered for this operation).	Gunner moves gunner's aid to zero.
5 and 14.	AIMING POINT, CHURCH STEEPLE, REFER.	Refers telescope to church steeple. Reads deflection and calls "No. 1, Deflection (so much)."
6 and 15.	DEFLECTION 2800, REFER.	Slips the slipping azimuth micrometer scale to zero. Slips the slipping azimuth scale to 2800. Verifies that vertical reticle is on church steeple. Calls "No. 1, Deflection 2800." Steps clear.
7 and 16.	SPECIAL CORRECTIONS DEFLECTION 2920 NO. 1, LEFT 7.	Same as test 1 above.
8 and 17.	DEFLECTION 3040.	Same as test 2 above.
9 and 18.	DEFLECTION 3080.	Same as test 2 above.



d. Penalties.

(1) No credit will be allowed if, after each test—

(*a*) The deflection is set incorrectly.

(*b*) The cross-level or longitudinal-level bubble is not centered.

(*c*) The vertical hair of the telescope is not on the aiming point or left edge of aiming posts, as the case may be.

(2) No credit will be allowed if the last motion of the traverse was not made to the right.

e. Credit.

Time in seconds, exactly or less than—			
Tests 1, 10, 6, and 15 each	12	13	14
Other tests, each	8	9	10
Credit	2.0	1.5	1.0

14. LAYING FOR ELEVATION WITH RANGE QUADRANT

a. Scope of Tests. Three tests will be conducted in which the candidate will be required to execute commands similar to those given below.

b. Special Instructions.

(1) Each test will require a change of settings and the accompanying laying of the tube in elevation within the following limits: Site, 15 to 25 mils; elevation, 20 to 40 mils.

(2) Commands for elevation for tests 2 and 3 will not be made in multiples of 5 mils.

(3) Special corrections for site will be applied by the candidate.

(4) The candidate will be posted as No. 1 cannoneer.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1 ...	SITE 295, ELEVATION 280.	Sets announced site and elevation. Centers cross-level and longitudinal-level bubbles. Calls "Set" and steps clear.
2 ..	SITE 320, ELEVATION 316.	Same as test 1 above.
3 ...	SPECIAL CORRECTIONS, SITE 310, NO. 1 UP 2, ELEVATION 323.	Same as test 1 above.

d. Penalties.

(1) No credit will be allowed if, after each test—

(*a*) The site or elevation is not set accurately.

(*b*) The cross-level or longitudinal-level bubble is not centered.

(2) No credit will be allowed if the last movement of the tube was not in the direction in which it is most difficult to turn the elevating handwheel.

e. Credit.

Time in seconds, exactly or less than	6⅗	7⅗	8⅗
Credit	2.0	1.5	1.0

15. LAYING FOR ELEVATION WITH GUNNER'S QUADRANT

a. Scope of Tests. Three tests will be conducted in which the candidate will be required to execute commands similar to those given below.

b. Special Instructions.

(1) The gunner's quadrant will be set at zero for the first test.

(2) Each succeeding test will require a change of quadrant elevation setting within the limits of 30 to 60 mils.

(3) The candidate will be posted to the left of and facing the breech, with the gunner's quadrant in his hand.

(4) An assistant, selected by the candidate, will be posted to the right of the breech to operate the elevating handwheel.

c. Outline of Tests.

Test number	Examiner commands (for example)	Action of candidate
1	QUADRANT 180	Sets quadrant elevation on gunner's quadrant. Seats quadrant. Has assistant elevate or depress the tube until the quadrant bubble is centered.

Test number	Examiner commands (for example)	Action of candidate
		Calls "Ready" and waits for examiner to verify laying.
2	QUADRANT 240	Same as test 1 above.
3	QUADRANT 205	Same as test 1 above.

d. Penalties.

(1) No credit will be allowed if, after each test—

(a) The quadrant elevation is set incorrectly.

(*b*) The quadrant is not properly seated.

(*c*) The quadrant bubble is not properly centered.

(2) No credit will be allowed if the last movement of the tube was not in the direction in which it is most difficult to turn the elevating handwheel.

e. Credit.

Time in seconds, exactly or less than	6	6⅔	7
Credit	2.0	1.5	1.0

16. DISPLACEMENT CORRECTION

a. Scope of Test. One test, consisting of two parts, will be conducted in which the candidate will be required to execute the commands given below.

b. Special Instructions.

(1) Aiming posts will be set out at the prescribed distances.

(2) An assistant, selected by the candidate, will be stationed close to the far aiming post.

(3) The examiner will require the candidate to lay the gun on an announced deflection and report "I am ready."

(4) The far post or the gun will then be moved so that a displacement of 5 to 10 mils occurs.

(5) The laying of the gun at the termination of part I will not be disturbed for part II.

c. Outline of Test.

(1) Part I.

Examiner commands	Action of candidate
CORRECT FOR DISPLACEMENT.	Lays the gun so that the far post appears midway between the near post and the vertical cross hair of the telescope. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.

(2) Part II.

Examiner commands	Action of candidate
ALINE AIMING POSTS.	Records deflection on shield and announces "Deflection (so much) recorded." Directs assistant in alining aiming posts. Calls "Ready" and steps clear.

d. Penalties. No credit will be allowed if—

(1) Part I.

(*a*) The far aiming post does not appear midway between th near post and the vertical cross hair of the telescope.

(*b*) The cross-level or longitudinal-level bubble is not centered.

(*c*) The last motion of traverse was not made to the right.

(2) Part II.

(*a*) The deflection is other than the announced deflection.

(*b*) The aiming posts are not properly alined.

(*c*) The vertical hair of the telescope is not on the aiming posts.

e. Credit.

Part I, time in seconds, exactly or less than	3	3⅓	3⅔	4
Credit	3.0	2.0	1.5	1.0

Part II, no time limit
Credit ..... 1.0 — — —

17. MEASURING SITE TO MASK

a. Scope of Test. One test will be conducted in which the candidate will be required to execute the command given below.

b. Special Instructions.

(1) The gun, prepared for action, will be placed 200 to 400 yards from a mask of reasonable height.

(2) The tube will be pointed so that it is 100 to 150 mils above the crest and 100 to 150 mils right or left of the highest point of the crest.

(3) The candidate will take post at the right rear of the breech.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE SITE TO MASK.	Sights along lowest element of bore and operates elevating and traversing mechanism until line of sight just clears crest.
	Sets angle of site scale at 300, centers longitudinal-level bubble by turning elevating knob, and centers cross-level bubble.

Examiner commands	Action of candidate
	Reads elevation from elevation scale and micrometer.
	Reports "No. (so-and-so), Site to mask (so much)."

d. Penalties. No credit will be allowed if—

(1) The line of sight along the lowest element of the bore does not just clear crest.
(2) The cross-level or longitudinal-level bubble is not properly centered.
(3) The angle of site scale does not read 300.
(4) The site is announced incorrectly.
(5) The last movement of the tube was not in the direction in which it is most difficult to turn the elevating handwheel.

e. Credit.

Time in seconds, exactly or less than	11	12	13	14
Credit	4.0	3.0	2.0	1.5

18. MEASURING ELEVATION

a. Scope of Test. One test will be conducted in which the candidate will be required to measure the elevation by means of the gunner's quadrant.

b. Special Instructions. Prior to the test the examiner will lay the tube at a selected elevation, measure the elevation, and then set the gunner's quadrant at zero.

c. Outline of Test.

Examiner commands	Action of candidate
MEASURE THE ELEVATION.	Places gunner's quadrant on quadrant seats of the breech ring. Levels bubble by raising or lowering the index arm and turning the micrometer knob. Announces "No. (so-and-so), Elevation (so much)," and hands quadrant to examiner.

d. Penalties. No credit will be allowed if—

(1) The quadrant bubble is not centered when the quadrant is seated properly.

(2) The elevation is announced incorrectly.

e. Credit.

Time in seconds, exactly or less than..	8	9⅘	10⅗
Credit	4.0	3.0	2.0

19. MEASURING DEFLECTION

a. Scope of Test. One test will be conducted in which the candidate will be required to measure and report a deflection in accordance with the command given below.

b. Special Instructions.

(1) The gun will be laid on aiming posts to the left front.

(2) An aiming point within 200 mils to the left or right of the aiming posts will be

designated by the examiner and identified by the candidate.

c. Outline of Test.

Examiner commands	Action of candidate
NUMBER (SO-AND-SO), AIMING POINT, THAT (SO-AND-SO), REFER.	Centers cross-level and longitudinal-level bubble. Refers to aiming point. Checks centering of bubbles and re-lays telescope if necessary. Reads deflection and reports, "No. (so-and-so) deflection (so much)" and steps clear.

d. Penalties. No credit will be allowed if—

(1) The cross-level or longitudinal-level bubble is not centered properly.

(2) The vertical hair of the telescope is not on the aiming point.

(3) The deflection is announced incorrectly.

(4) The traversing handwheel is turned.

e. Credit.

Time in seconds, exactly or less than	5	5⅗	6	6⅗
Credit	4.0	3.0	2.0	1.5

20. TEST AND ADJUSTMENT OF SIGHTING AND FIRE CONTROL EQUIPMENT

a. Scope of Tests. Six tests will be conducted in which the candidate will be required to demonstrate the methods employed in making the

prescribed tests and authorized adjustments, or describe the action taken (i.e., send to the ordnance maintenance company) if adjustment is not authorized to be made by using personnel.

b. Special Instructions.

(1) The gun will be prepared for the tests as indicated in paragraphs 54 and 55 of this manual.

(2) The equipment which will be needed for the tests is listed in paragraph 53 of this manual.

(3) The candidate will select an assistant who will operate the elevating handwheel at the direction of the candidate during tests 1 and 2 and adjust and aline the testing target at the direction of the candidate prior to test 5.

(4) The tests will be conducted in the chronological sequence indicated in *c* below. After completion of test 2, the gunner's quadrant used in tests 1 and 2 will be used for test 3, with the proper correction, as determined in test 1, carried on the quadrant, provided the correction does not exceed 0.4 mil.

(5) Adjustments which the candidate may be required to accomplish will fall within the following limits:

(*a*) Elevation and angle of site scales, not to exceed one 100-mil graduation.

(*b*) Elevation and angle of site micrometer scales, not to exceed ten 1-mil graduations.

(*c*) Rotating head and telescope mount elevation indexes, none.

(*d*) Rotating head and telescope mount elevation micrometer indexes, not to exceed one-fourth turn.

(*e*) Panoramic telescope azimuth scale, not to exceed one 100-mil graduation.

(*f*) Panoramic telescope slipping azimuth micrometer scale, not to exceed ten 1-mil graduations.

(6) The tube will be leveled at the conclusion of test 2 and will not be disturbed thereafter.

c. Outline of Tests.

Test number	Examiner commands	Action of candidate
1 . . .	PERFORM END-FOR-END TEST	Performs test as prescribed in paragraph 60 of this manual.
	ON GUNNER'S QUADRANT.	Calls "Error (so many) mils, quadrant serviceable (unserviceable)" and hands quadrant to examiner for verification.

Test number	Examiner commands	Action of candidate
2 ...	PERFORM MICROMETER TEST ON GUNNER'S QUADRANT.	Performs test as prescribed in paragraph 60 of this manual. Calls "Quadrant micrometer is (is not) in error."
3 ...	TEST TELESCOPE MOUNT.	Performs tests and makes adjustments, if necessary, as prescribed in paragraph 55 of this manual. Calls "Cross- (longitudinal-) level bubble(s) within (without) allowable limit."

Caution.—Do not turn cross-leveling or elevation knobs of the telescope mount after this test.

4 ...	TEST RANGE QUADRANT.	Performs tests and makes adjustments, if necessary, as prescribed in paragraph 55 of this manual. Calls "Ready" and steps clear.

Note.—Prior to test 5, the cross and longitudinal leveling of the tube and the panoramic telescope mount will be verified by the examiner, and the testing target will be alined by the candidate with the help of his selected assistant as described in paragraph 55 of this manual.

[redacted]

Test number	Examiner commands	Action of candidate
5 ...	TEST ADJUSTMENT OF PANORAMIC TELESCOPE.	Performs tests and makes adjustments, as prescribed in paragraph 55 of this manual.
		Calls "Ready" and steps clear.
6 ...	TEST ADJUSTMENT OF ELBOW TELESCOPE.	Performs test and makes adjustments, as described in paragraph 55 of this manual.
		Calls "Ready" and steps clear.

d. Penalties.

(1) *General.* The tests are not essentially speed tests. The purpose of the prescribed time limits is to insure that the candidate can perform the operation without wasted effort.

(2) *Test 1.* No credit will be allowed if—

(*a*) The bubble of the gunner's quadrant does not center when verified by the examiner.

(*b*) The error (one-half of the amount of the angle which was indicated when the quadrant was first reversed and the bubble centered by

[redacted]

moving the index arm and micrometer) is announced incorrectly by the candidate.

(*c*) The candidate fails to declare the quadrant unserviceable if the error (necessary correction) exceeds 0.4 mil, or fails to declare the quadrant serviceable if the error (necessary correction) is 0.4 mil or less.

(*d*) The time to complete the test exceeds 2 minutes.

(3) *Test 2.* No credit will be allowed if—

(*a*) The procedure is not followed correctly.

(*b*) The time to complete the test exceeds 1 minute.

(4) *Test 3.* No credit will be allowed if—

(*a*) The bubble of the gunner's quadrant is not centered in either direction.

(*b*) The candidate does not announce correctly in regard to the status of either the cross-level or the longitudinal-level bubble.

(*c*) The matching indexes on the rocker and actuating arm or those on the elevation knob and shaft are not in coincidence when the adjustments are complete.

(*d*) The time to complete the test and adjustments exceed 4 minutes.

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(5) *Test 4.* No credit will be allowed if—

(*a*) The elevation micrometer does not read zero when the elevation scale reads zero.

(*b*) The angle of site does not read 300 when the cross-level and longitudinal-level bubbles are centered.

(*c*) The cross-level or longitudinal-level bubble is not proprly centered.

(*d*) The time to complete the tests and adjustments exceeds 2 minutes.

(6) *Test 5.* No credit will be allowed if—

(*a*) The candidate fails to make any adjustment when such adjustment is indicated.

(*b*) The rotating head elevation micrometer indexes are not in coincidence.

(*c*) The zero line of either the azimuth scale or azimuth scale micrometer is not in coincidence with its respective index.

(*d*) The center line of the bore, as viewed through the bore sights, or the line of sight of the telescope do not fall on their respective sighting points on the testing target when all scales are set at zero.

(*e*) The time to complete the tests and adjustments exceeds 4 minutes and 30 seconds.

(7) *Test 6.* No credit will be allowed if—

(*a*) The reticle is not horizontal.

(*b*) The "N" range line is not in coincidence with the proper sighting line of the testing target.

(*c*) The time to complete the test and adjustment exceeds 1 minute.

e. Credit.

(1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.

(2) If the tests and adjustments are performed correctly within the prescribed time limit, maximum credit will be given as follows:

Test 1	2
Test 2	1
Test 3	2
Test 4	2
Test 5	2
Test 6	1
Total	10

21. MATÉRIEL

a. Scope of Tests. The candidate will be required to perform three tests as outlined below.

b. Special Instructions.

(1) *Tests 1 and 2.* For tests 1 and 2, a paulin will be placed on the ground for the convenience of the candidate in laying

out the disassembled parts. The candidate will be allowed to select the tools and accessories necessary for the performance of the tests prior to the start of the tests.

(2) *Test 3.*

(*a*) A complete set of lubrication equipment authorized for use of battery personnel will be made conveniently available on a paulin adjacent to the gun.

(*b*) Every type of lubricant, in plainly labeled containers, used on the gun will be placed conveniently on the paulin.

c. Outline of Tests.

Test number	Examiner commands	Action of candidate
1 . . .	DISASSEMBLE BREECH MECHANISM AND FIRING LOCK.	Performs the operation as described in TM 9-325, laying the parts on the paulin. After disassembly, identifies all parts to examiner.
2 . . .	ASSEMBLE BREECH MECHANISM AND FIRING LOCK.	Performs the operation as described in TM 9-325.

Test number	Examiner commands	Action of candidate
3 ...	DAILY, WEEKLY, AND MONTHLY LUBRICATION TEST.	Selects proper lubricating equipment and lubricant and shows *how* and with *which lubricant* each lubrication point is serviced. (Actual lubrication is not performed.)

d. Penalties.

(1) The tests are not essentially speed tests. The purpose of the maximum time limits is to insure that the candidate can perform the operations without wasted effort.

(2) No credit will be given if the following time limits are exceeded:

Test 1	1½ minutes
Test 2	3 minutes
Test 3	2 minutes

(3) A penalty of one-half point will be assessed for each component part not correctly identified or omitted in test 1. There is no time limit imposed on the identification of component parts. However, the examiner may reduce the grade if it becomes obvious that the candidate is not familiar with the nomenclature.

e. Credit

(1) The candidate will be scored on the general merit of his work in addition to the specific requirements above.

(2) If each test is performed correctly within the prescribed time limit, maximum credit will be given as follows:

Test 1	3
Test 2	3
Test 3	4
Total	10

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Security Information

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[redacted] Security Information

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