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DEPARTMENT OF THE ARMY FIELD MANUAL
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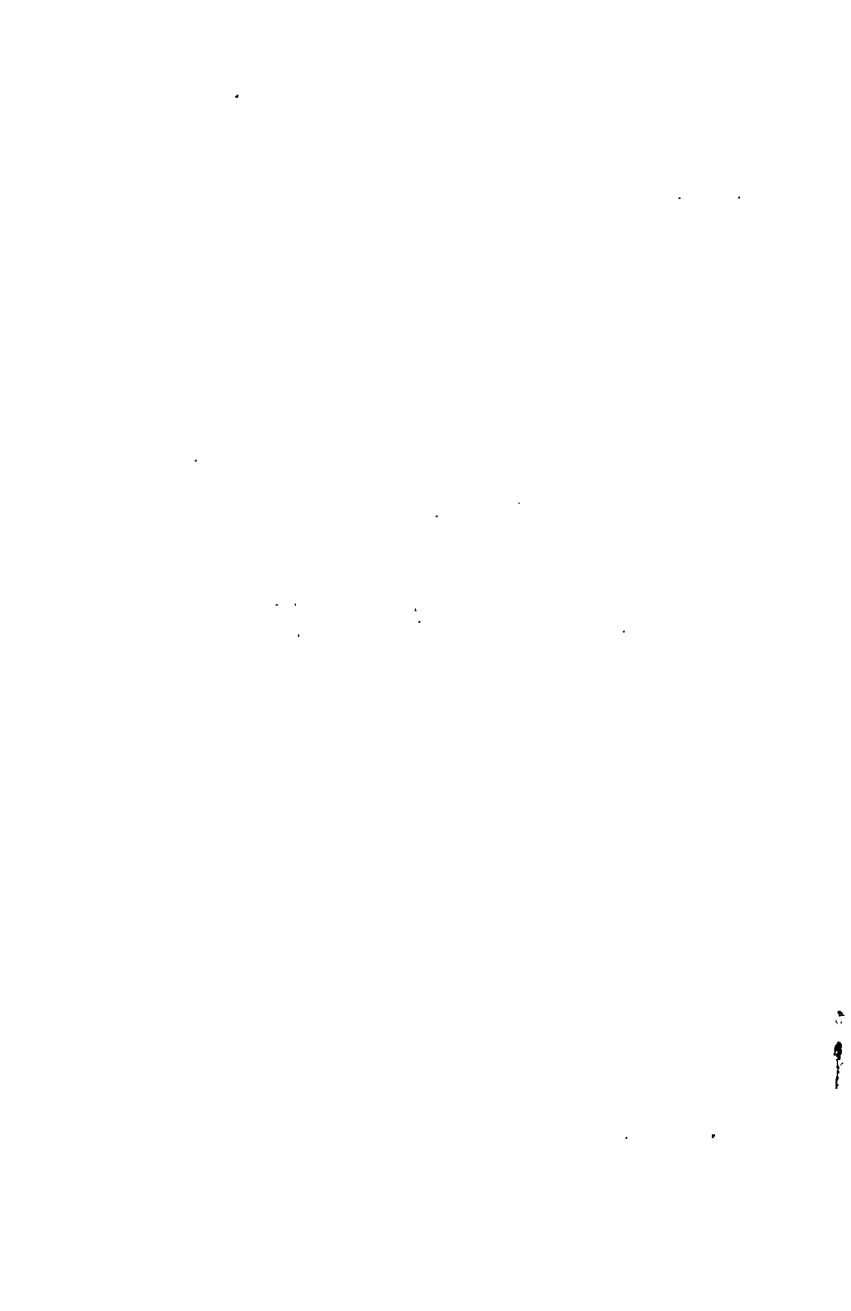
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155-MM HOWITZER M44 SELF-PROPELLED



**HEADQUARTERS, DEPARTMENT OF THE ARMY
APRIL 1962**

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FIELD MANUAL }
 No. 6-92

HEADQUARTERS,
 DEPARTMENT OF THE ARMY
 WASHINGTON 25, D.C., 4 April 1962

155-MM HOWITZER M44, SELF-PROPELLED

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CHAPTER 1

GENERAL

1. Purpose and Scope

a. This manual is a guide to assist commanders in developing the sections of 155-mm howitzer, motor carriage M44, firing batteries into efficient smooth-working teams with a sense of discipline that will impel them to operate effectively under the stress of battle. This manual prescribes individual duties, section drills, inspection and maintenance drills and tests and adjustments for sighting and fire control equipment, and provides instructions for the decontamination and destruction of equipment.

b. Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of the text in which change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be forwarded direct to Commandant, U.S. Army Artillery and Missile School, Fort Sill, Okla.

2. Definitions and Terms

a. *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 used to designate *only the personnel* required to serve one howitzer and its equipment.

b. *Front.* The front of a section is the direction in which the muzzle of the howitzer is pointed.



Figure 1. Self-propelled 155-mm howitzer and section personnel.

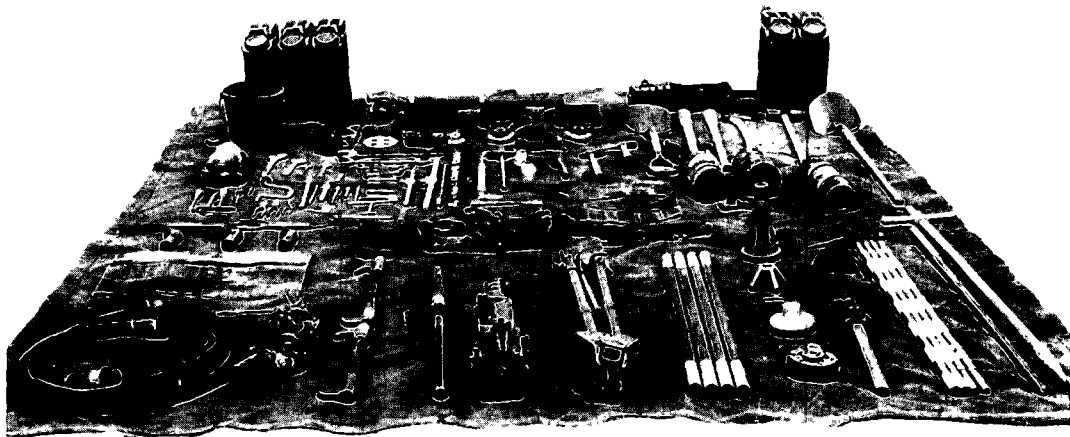


Figure 2. A method of displaying items of section equipment of the self-propelled 155-mm howitzer.

c. *Right (Left)*. The direction right (left) is the right (left) of one facing the front.

d. *In Battery*. A howitzer is said to be in battery when it is in its normal position ready to be fired.

3. Description of Equipment

To insure proper use of the motor carriage and to avoid accidents caused by exceeding its capabilities and limitations, all members of the section should be familiar with the characteristics shown in figure 3. For further details pertaining to full-track vehicle capabilities and combat driving, see TM 21-306.

4. References

Publications covering matters related to the self-propelled 155-mm howitzer and auxiliary equipment which are not discussed in detail in this manual, are listed in the appendix.

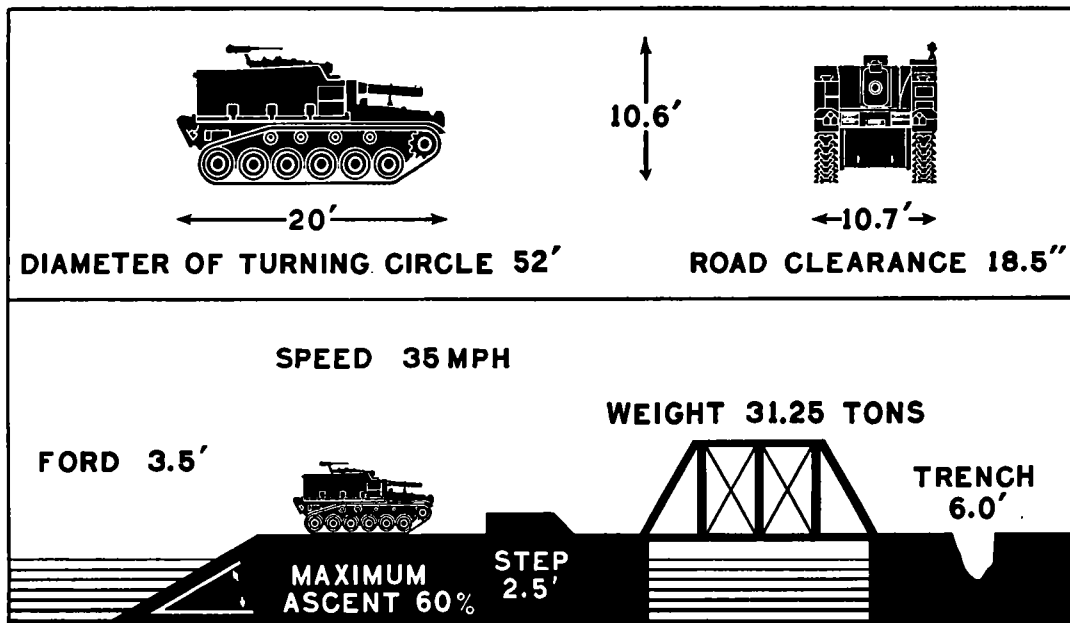


Figure 3. Characteristics of the 155-mm howitzer motor carriage M44.

CHAPTER 2

ORGANIZATION

5. Composition of Howitzer Section

a. The howitzer section consists of section personnel, a 155-mm howitzer mounted on motor carriage M44, and auxiliary equipment (figs. 1 and 2).

b. In howitzer batteries organic to armored or mechanized divisions, the howitzer section consists of the following personnel:

- (1) A chief of section (CS)
- (2) A gunner (G).
- (3) An assistant gunner (AG).
- (4) Six cannoneers, numbered 1 through 6.
- (5) A driver (D) of the howitzer motor carriage.

c. In howitzer batteries organic to separate battalions, seven cannoneers are authorized in the howitzer section and are numbered 1 through 7. In this type battery, number 7 cannoneer is utilized as an ammunition handler.

d. Section equipment is listed in the table of organization and equipment (TOE) and standard nomenclature lists (SNL's) appropriate to the weapon and unit.

6. General Duties of Personnel

a. *Chief of Section.* The chief of section is the non-commissioned officer in command of the entire section and, as such, is responsible to the battery executive for the—

- (1) Training and efficiency of personnel.
- (2) Performance of duties listed under section

drill, duties in firing, tests and adjustment of sighting and fire control equipment, and inspection and maintenance of all section equipment.

- (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 weapons record book.
- (7) Maintenance of all section equipment.
- (8) Police of the section area.

b. Gunner. The gunner assists 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. Assistant Gunner. The assistant gunner assists the gunner and in an emergency acts as the gunner. The assistant gunner's specific duties are prescribed in the appropriate chapters of this manual.

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

e. Driver. The primary duty of the driver is to drive and perform preventive maintenance on his vehicle. The driver performs other duties as prescribed in this manual and in TM 9-7004, or as assigned by the chief of section.

CHAPTER 3

SECTION DRILL

Section I. GENERAL

7. Objectives

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

8. Instructions

a. To develop maximum efficiency and to prevent injuries to personnel and damage to 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 before or after the command to fire has been given. The chief of section reports 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 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 in order that they will be capable of functioning as members of a howitzer section if required.

Section II. PRELIMINARY COMMANDS AND FORMATIONS

9. To Form the Section

a. *To Fall In.*

- (1) 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. 4). Higher numbered cannoneers, if present, form in order between No. 6 and the driver. The chief of section may indicate in his preparatory command the place and direction the section is to form. At the first formation for a drill or exercise, the caution, "As howitzer section," precedes the command. The commands are FALL IN, or 1. IN FRONT (REAR) OF YOUR PIECE, 2. FALL IN; or 1. ON THE ROAD FACING THE PARK, 2. FALL IN. Execution is as follows: The howitzer section moves at double time and forms at close interval, at attention, guiding on the gunner. The driver of the motor carriage is the last in line (fig. 4).
- (2) To execute 1. IN FRONT OF YOUR PIECE. 2. FALL IN, the section falls in as shown in figure 1.

b. *To Call Off.* The section being in formation, the command is CALL OFF. At the command, all personnel in rank, except the gunner, execute eyes right. The section then calls off in sequence, "Gunner, Assistant gunner, 1, 2, 3, 4, 5, 6, Driver." As each man calls out his designation he turns his head smartly to the front.

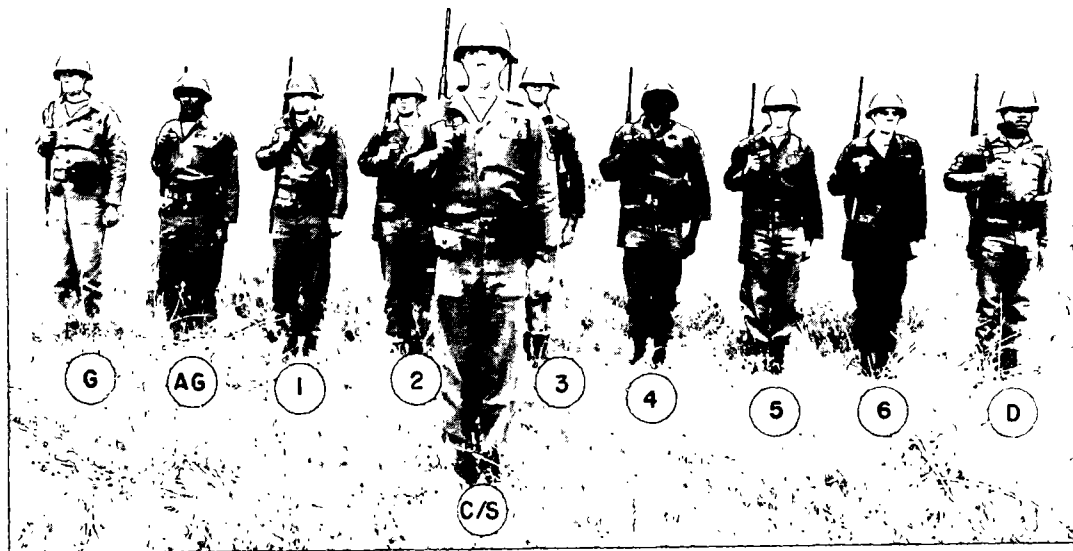


Figure 4. Formation of the howitzer section.

10. 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, 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. Dismounted. The section moves to posts as shown in figure 5.

b. Prepared for Action. The howitzer having been prepared for action, posts are taken as shown in figure 6.

c. Mounted. Posts of members of the section who mount the motor carriage are shown in figure 7. Other members of the section mount in other vehicles as directed by the chief of section or battery executive (par. 12).

11. To Change Posts

To acquaint the members of the section with all duties and 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 the command 1. CHANGE POSTS, 2. MARCH, all cannoneers except the gunner and the driver (or the highest numbered cannoneer) take two left steps, thus placing them at the post of the next higher numbered cannoneer. At the preparatory command CHANGE POSTS, the driver (or the highest numbered cannoneer) takes 1 step to the rear, executes a right face, and at the command MARCH, moves at double time to the post of the assistant gunner. The gunner of the section stands fast.

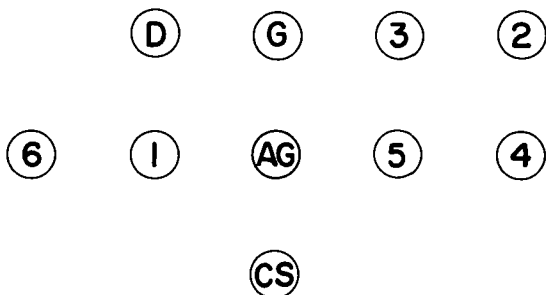
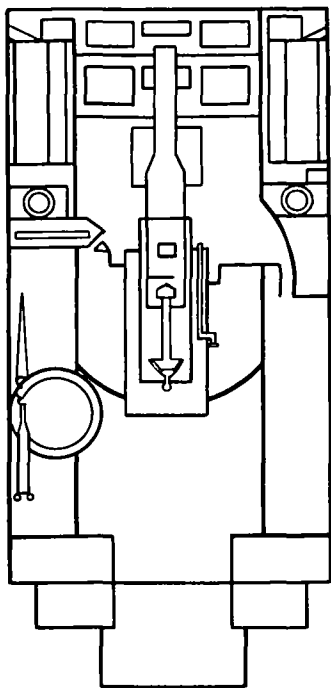


Figure 5. Posts of section, dismounted.

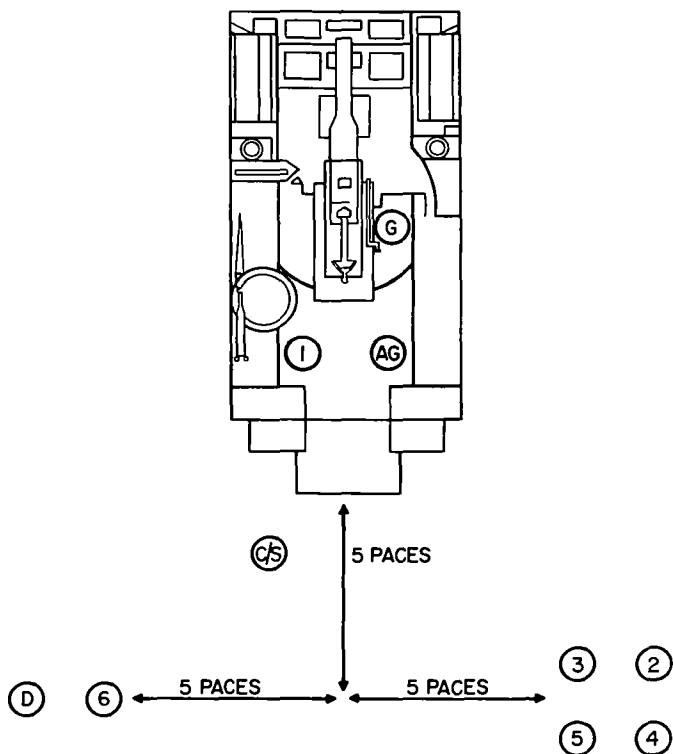


Figure 6. Posts of section, prepared for action.

b. At the command 1. SECTION CHANGE POSTS, 2. MARCH, all members of the section except the left most member take two left steps. The left most member moves at double time in rear of the section to the post of the gunner.

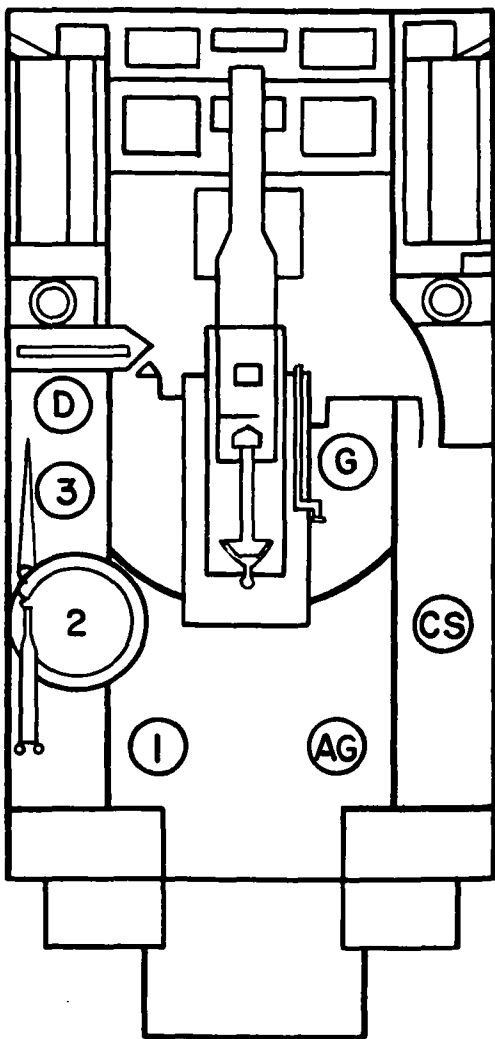


Figure 7. Section mounted.

12. To Mount

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

a. At the preparatory command, the section moves at double time to positions shown in figure 5. At the command of execution, the chief of section, gunner, assistant gunner, and Nos. 1, 2, and 3 mount take positions as shown in figure 7. The driver and gunner mount into the motor carriage at the same time. The driver takes his position and is followed by Nos. 3 and 2 in that order. The assistant gunner and No. 1 mount after No. 2. The chief of section is the last person in the section to mount. At the command of execution, MOUNT, cannoneers Nos. 4, 5, and 6 move to and mount other battery vehicles as directed by the chief of section or battery executive. If any member of the section who normally mounts into the motor carriage is not to follow the command, his designation is announced with the caution, "Stand fast" given between the preparatory command and the command of execution. For example: 1. PREPARE TO MOUNT, "driver stand fast," 2. MOUNT.

b. If the command MOUNT, is given without a preparatory command the section mounts in the manner and order prescribed in *a* above. Dismounted posts are not taken.

13. To Dismount

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

a. At the preparatory command, the personnel mounted in closed compartments unlatch their doors and open them; the members of the section assume positions from which they can dismount promptly. At

the command of execution, members of the section dismount in inverse order of mounting and quickly take posts as shown in figure 5.

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

14. To Fall Out

a. *At Drill.* When it is desired to give the personnel 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 implies 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 howitzer, the command FALL OUT is given. Men stand clear of the howitzer to insure that settings and laying remain undisturbed. During these periods, the chief of section may direct the men to improve the position, to replenish ammunition, or to do other necessary work.

CHAPTER 4

PREPARING HOWITZER FOR FIRING AND TRAVELING

Section I. PREPARATIONS FOR FIRING

15. General

The howitzers of a battery will ordinarily be put into position individually under the direction of the executive and chiefs of sections. A stake should be driven into the ground at a point where the center of each carriage is to be placed. Another stake should be placed in the direction of fire 50 to 100 yards from the first stake, so that the driver of the motor carriage can point the tube at the far stake as he drives the vehicle into position over the first stake. Each vehicle is halted at its proper place by the chief of section. Hand signals for guiding the driver are found in FM 21-60.

16. To Prepare for Action

a. The howitzer being in position or approaching the position, the command is **PREPARE FOR ACTION**. Duties of individuals are given in table I. Each man takes his post (fig. 6) upon completion of his duties.

Table I. Duties in Preparation for Firing
(Located in back of manual)

b. The howitzer normally will be partially prepared for action before reaching the firing position. The duties of the cannoneers in preparing for action are the same whether moving or halted, but only such operations as are practicable are carried out while moving. Immediately after the howitzer is established in posi-

tion, preparation for action is completed without further command.

c. If PREPARE FOR ACTION has not been ordered before the howitzer arrives at the position, the command is habitually given by the chief of section as soon as the vehicle is halted in position. If preparation for action is not desired, the caution "Do not prepare for action" must be given.

Section II. PREPARATIONS FOR TRAVELING

17. March Order

To prepare to resume travel, the command is MARCH ORDER. Duties of individuals are given in table II. Each man takes his post (fig. 5) upon completion of his duties.

Table II. Duties in Preparation for Traveling
(Located in back of manual)

18. To Resume Firing in Another Position

a. If firing is to be resumed shortly in another position in which the howitzer must be immediately ready to fire, the command MARCH ORDER is not given. When a displacement is ordered, only those operations necessary for the movement of the howitzer and the security of equipment are performed. The chief of section will instruct the section concerning the operations to be performed.

b. If the command MARCH ORDER is given while the howitzer is prepared for travel as described in *a* above, the operations pertaining to march order (table II) are completed.

CHAPTER 5

FIRING BY INDIRECT LAYING

Section I. GENERAL

19. Duties in Loading and Firing

The general instructions in paragraphs 7 and 8 on the conduct of section drill apply equally to section drill in duties in loading and firing. For duties of the battery executive, see FM 6-40. For the sequence of duties in loading and firing, see table III.

20. Duties of Individuals

In general, the duties of individuals in the section in indirect fire 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 and elevation, centers the cross-level and longitudinal-level bubbles, lays for direction and elevation, and refers the howitzer.

c. The assistant gunner operates the breech and assists No. 1 in loading and ramming the projectile, primes the howitzer, and fires the piece.

Table III. Duties in Firing
(Located in back of manual)

d. No. 1 swabs the powder chamber; assisted by the assistant gunner, loads and rams the projectile; and places the powder charge in the chamber.

e. No. 2 fuzes the projectile assisted by No. 4, operates the fuze setter, and sets fuzes.

f. No. 3 assisted by No. 5, carries the projectile to the hull door.

g. No. 4 assists No. 2 in fuzing the projectile.

h. No. 5 assists No. 3 in carrying projectiles to the hull door. Returns loading tray to ammunition point.

i. No. 6 prepares powder charges, assisted by the driver, and hands the prepared charge to No. 1.

j. The driver shifts the howitzer motor carriage and assists in the preparation of powder charges.

Section II. DUTIES OF CHIEF OF SECTION

21. List of Duties (Detailed Description of Duties)

(Pars. 23-35)

a. Lays for quadrant, assisted by the gunner, when the gunner's quadrant is used.

b. Measures the quadrant.

c. Measures the site to the mask.

d. Indicates the aiming point to the gunner.

e. Follows fire commands.

f. Indicates when the howitzer is ready to fire.

g. Gives his section the command to fire.

h. Reports mistakes and other unusual incidents of fire to the executive.

i. Conducts prearranged fires.

j. Records basic data.

k. Observes and checks frequently the functioning of the materiel.

l. Assigns duties when firing with reduced personnel.

m. Verifies the adjustment of the sighting and fire control equipment.

n. Controls the movement of the motor carriage.

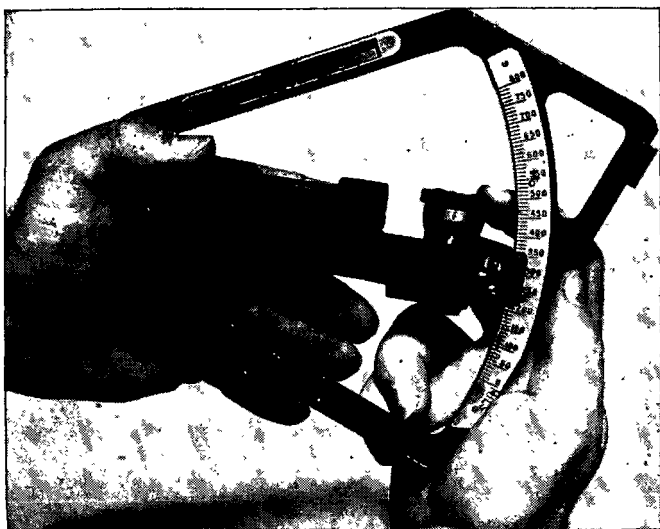


Figure 8. Setting the gunner's quadrant.

22. Lays for Elevation, Assisted by Gunner, When Gunner's Quadrant is Used

a. The command **USE GUNNER'S QUADRANT** indicates that the gunner's quadrant is to be used.

b. Quadrant 361.8, for example, is set on the gunner's quadrant, (fig. 8) as follows: The upper edge of the plunger plate is set opposite the 360 mark of the scale on the quadrant frame and the micrometer on the arm is turned to read 1.8. Care must be taken to use the same side of the quadrant in setting both the plunger plate and the micrometer.

c. The announced quadrant having been set on the gunner's quadrant, the howitzer loaded, and the breechblock closed, the gunner's quadrant is set on the quadrant seat of the telescope mount. The words *line*

of fire must be at the bottom of the quadrant, and the line-of-fire arrow must be 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 the gunner to elevate or depress the tube 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 the gunner 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 fire direction center. The quadrant then would be announced as No. (SO-AND-SO), QUADRANT (SO MUCH).

23. Measuring the Quadrant

At the command MEASURE THE QUADRANT, the howitzer having been laid, the chief of section directs the gunner to center the cross-level bubble and then to center the longitudinal-level bubble on the panoramic telescope mount with the elevating knob. The chief of section then reads the quadrant set on the elevation scale and micrometer and announces the quadrant thus set as "Sir, No. (so-and-so), quadrant (so much)." If use of the elevation scale on the telescope mount is impractical, due to inaccuracies, the quadrant 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 as above.

24. Measures Site to Mask

a. The command is MEASURE THE SITE TO THE MASK. The chief of section has the gunner center the cross-level bubble on the panoramic telescope mount. Then, sighting along the lowest element of the bore, he directs the gunner to traverse and elevate the tube until the line of sight just clears the crest at its highest point in the probable field of fire. He then directs the gunner to center the longitudinal-level bubble by turning the elevation knob. The chief of section reads the elevation set on the elevation scale and micrometer and reports to the executive, "Sir, No. (so-and-so) site (so much)."

b. If use of the elevation scale on the panoramic telescope mount is impractical, the chief of section may use the gunner's quadrant in measuring the site to the mask.

c. When the executive announces the minimum quadrant and charge or the minimum quadrant for each charge, the chief of section records it in a notebook and directs the gunner to chalk on a convenient place on the turret in front of the gunner's seat, the minimum quadrant for each charge to be used.

25. Indicates Aiming Point to Gunner

When an aiming point has been designated by the executive (FM 6-40), the chief of section makes sure

that he has properly identified the point designated. He then identifies it to the gunner. If there is any possibility of misunderstanding, the chief of section adjusts the panoramic telescope until the horizontal and vertical crosshairs are on the aiming point and identifies the point to the gunner in this manner.

26. Follows Fire Commands

The chief of section follows fire commands and repeats the commands as required.

27. Indicates When Howitzer is Ready to Fire

When the executive can see arm signals made by the chief of section, the chief of section raises his right arm upward as a signal that the howitzer is ready to fire (fig. 9). 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, "Sir, No. (so-and-so), ready."

28. Gives Command to Fire

When the assistant gunner can see arm signals made by the chief of section, the chief of section gives 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.

29. Reports Mistakes and Other Unusual Incidents of Fire to Executive

If for any reason the howitzer cannot be fired, the chief of section promptly reports that fact, and the reasons therefor to the executive; for example, "Sir, No.

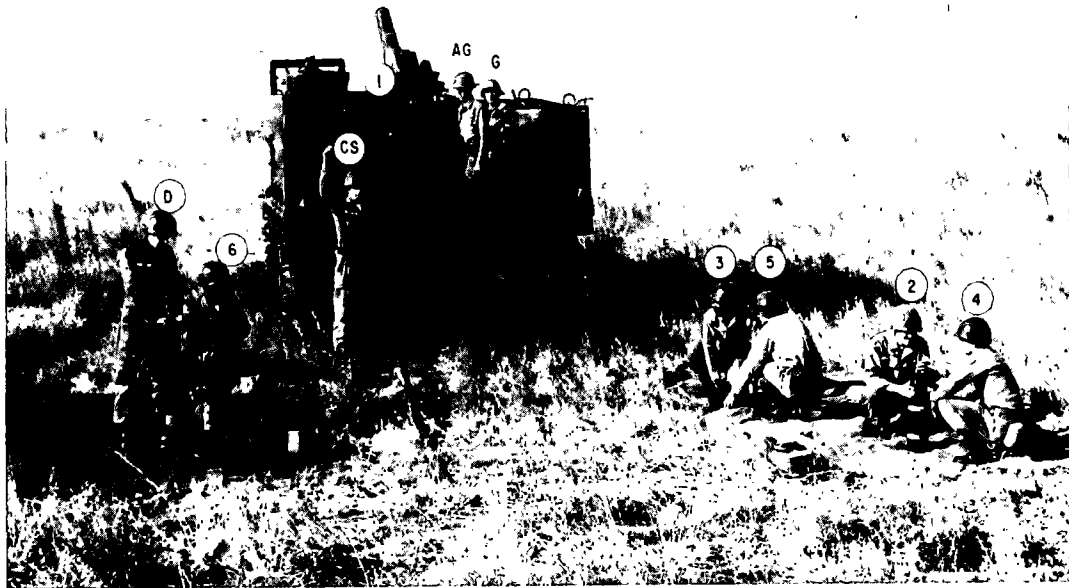


Figure 9. Howitzer loaded and ready to fire.

(so-and-so) out, misfire." Whenever it is discovered that the howitzer has been fired with a mistake in laying, the chief of section reports that fact at once; for example, "Sir, No. (so-and-so) fired 40 mils right." Whenever the gunner reports that the aiming posts are out of alinement, the chief of section reports that fact and, during the next lull in firing, requests permission to realine them. Likewise, he promptly reports other unusual incidents that affect the service of the howitzer.

30. Conducts Prearranged Fires

Whenever the execution of prearranged fires is ordered, the chief of section conducts the fire of his section in conformity with the prescribed data.

31. Records Basic Data

The chief of section records data of a semipermanent nature in a notebook. This data includes such information as minimum quadrants; aiming points used and their deflections; prearranged fires when section data sheets are not furnished; safety limits in quadrant and deflection; number or rounds fired, with the date and hour; and calibration and special corrections when appropriate.

32. Observes and Frequently Checks Functioning of Materiel

The chief of section closely observes the functioning of all parts of the materiel during firing. Before the howitzer 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. See TM 9-7004.

33. Assigns Duties When Firing With Reduced Personnel

Whenever the number of personnel serving the howitzer is temporarily reduced below that indicated in this manual, the chief of section makes such redistribution of duties as will best facilitate the service of the howitzer. Loss of cadremen, various details, and casualties will necessitate operation of the howitzer section with a reduced number of personnel to the extent that it is almost normal for section members to double up on duties. Around-the-clock firing will require the chief of section to divide the section into shifts to provide for relief. Two possible sets of duty combinations are—

a. Section of Eight Men.

Chief of section, gunner, assistant gunner, Nos. 1, 2, and 6, no change.

Nos. 3 and 4.

No. 5 and driver.

b. Section of Six Men.

Chief of section and gunner.

Assistant gunner and No. 1, no change.

Nos. 2 and 3.

Nos. 4 and 5.

No. 6 and driver.

34. Verifies Adjustment of Sighting and Fire Control Equipment

See chapters 8 and 9 and TM 9-7004 for detailed instructions on boresighting, testing, and adjusting sighting and fire control equipment.

35. Controls Movement of Motor Carriage

When it is necessary to move the motor carriage, the

chief of section instructs the driver to start the engines. He then controls the displacement of the motor carriage by hand signals or by oral instructions.

Section III. DUTIES OF GUNNER

36. List of Duties (Detailed Description of Duties)

(Pars. 37-47)

- a.* Centers the cross-level bubble on the panoramic telescope mount.
- b.* Zeroes the sight.
- c.* Lays the howitzer for direction.
- d.* Directs alinement of the aiming posts.
- e.* Sets a common deflection to a common aiming point.
- f.* Sets or changes the deflection.
- g.* Sets quadrant.
- h.* Lays for quadrant.
- i.* Calls "Ready."
- j.* Refers the howitzer.
- k.* Corrects for aiming post displacement.

37. Centers Cross-Level Bubble on Panoramic Telescope Mount

The gunner centers the cross-level bubble on the telescope mount by operating the cross-leveling knob as part of all operations that involve the use of the panoramic telescope except as described in paragraphs 110 through 116, for direct fire. This bubble is centered prior to using the telescope, and the level of the mount is verified before firing (par. 45).

38. Zeroes Sight

The howitzer being in position but not laid for direction, the gunner zeroes the telescope as follows:

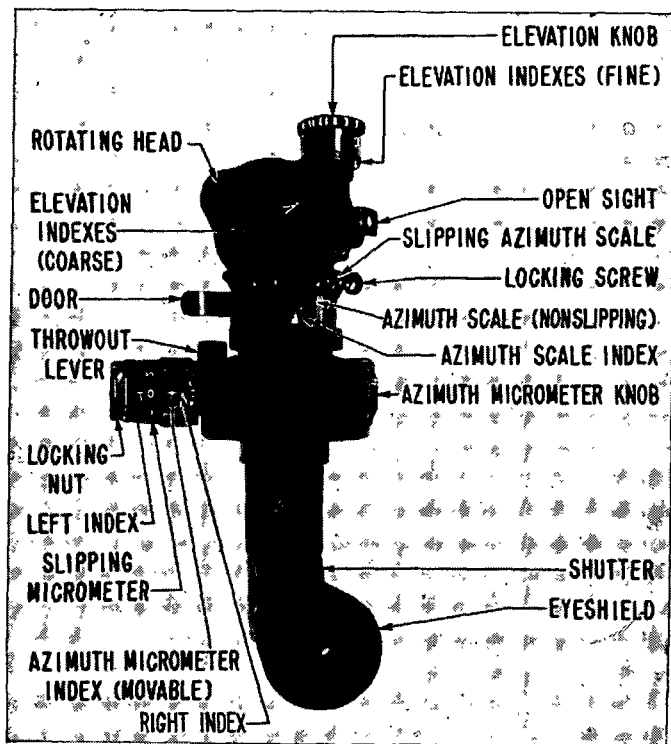


Figure 10. Panoramic telescope M12A7-series.

a. Aligns the azimuth micrometer index (gunner's aid) with the zero of the right (fixed) index (fig. 10).

b. Loosens the slipping micrometer locking nut by turning it counterclockwise while firmly holding the azimuth micrometer knob with his right hand (fig. 11).

c. Slips the slipping micrometer until its zero is in coincidence with the left index (fig. 12); tightens the locking nut.

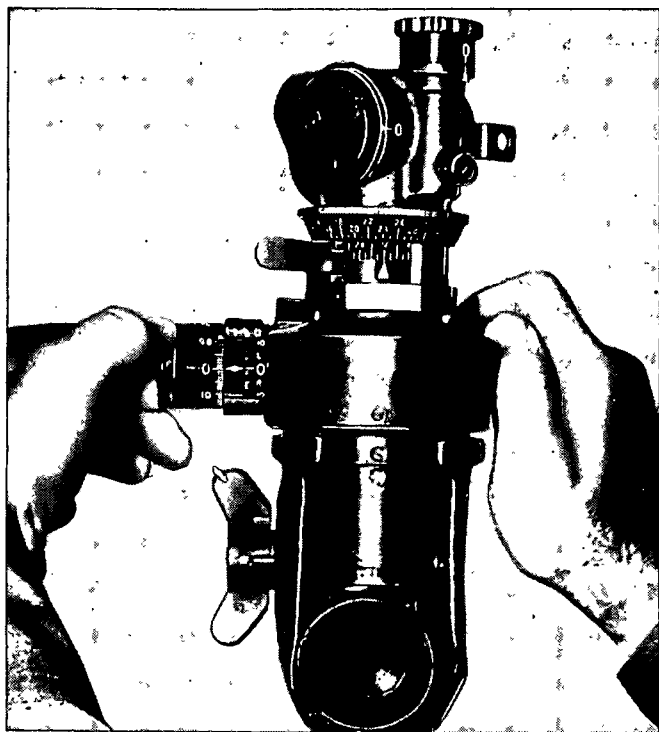


Figure 11. Loosening the slipping micrometer locking nut.

d. Turns the azimuth micrometer knob so that the left index and zero of the slipping micrometer are aligned with the zero of the right index (fig. 10).

e. Opens the door and, with the azimuth micrometer knob or rotating head, sets the nonslipping azimuth scale at zero (fig. 13) and closes the door.

f. Loosens the slipping azimuth scale locking screw; moves the slipping azimuth scale until its zero coincides with the index on the outside of the door (fig. 14).

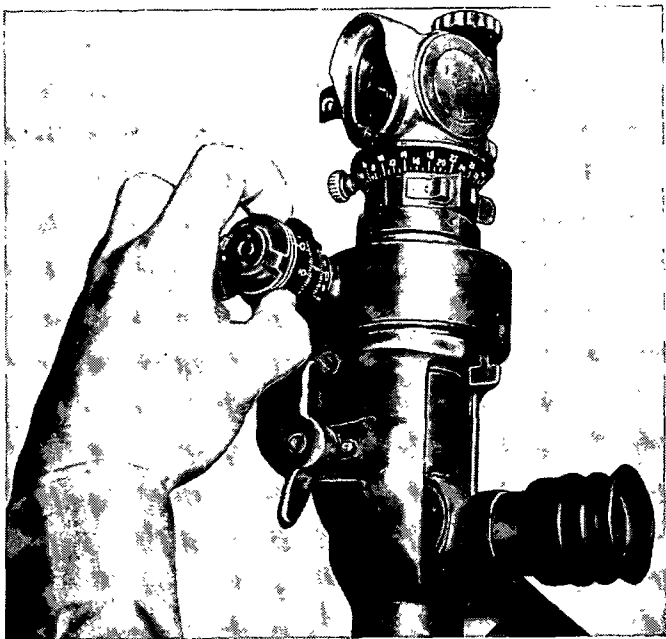


Figure 12. Alining the zero of the slipping micrometer with the left index.

g. Tightens the locking screw and verifies the reading. With the sight thus zeroed, the gunner opens the door and, for indirect fire, sets and reads deflection on the nonslipping azimuth scale, employing the azimuth micrometer for the last two digits of the deflection.

39. Lays Howitzer for Direction

The executive commands AIMING POINT THIS INSTRUMENT, No. (so-and-so) DEFLECTION (so much). The gunner, having zeroed the sight (par. 38), sets the deflection for his howitzer on the panoramic

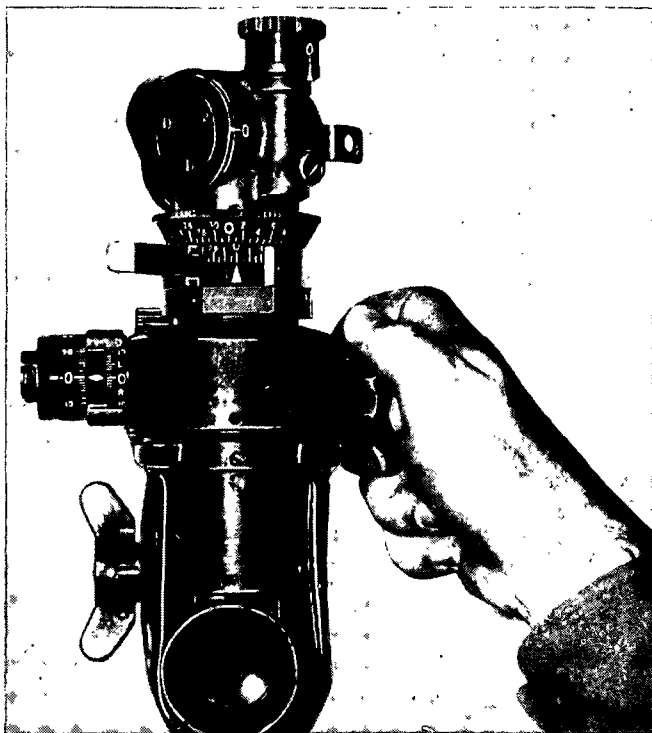


Figure 13. Turning the nonslipping azimuth scale to zero.

telescope by disengaging the throwout lever and turning the rotating head to the announced 100-mil graduation. He releases the throwout lever and, using the azimuth micrometer knob, turns off the last two digits of the deflection on the azimuth micrometer scale. He then traverses the tube until his line of sight through the telescope is on the objective lens of the executive's aiming circle. He checks to insure that the bubbles are

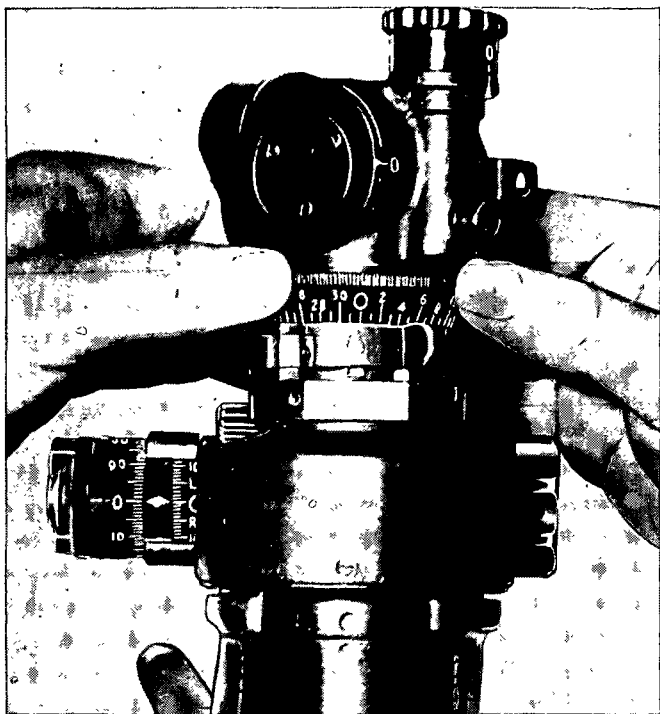


Figure 14. Slipping the zero of the slipping azimuth scale to the index on the door.

level and reports, "Sir, No. (so-and-so) ready for recheck." As additional deflections are announced by the executive (FM 6-40), he sets them on the sight and traverses the tube so that the vertical crosshair of the 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. For further details on laying the howitzer, see FM 6-40.

40. Directs Alinement of Aiming Posts

The howitzer having been laid as in paragraph 39, the executive may command, AIMING POINT, AIMING POSTS, DEFLECTION 600, REFER. At this command, the gunner sets the panoramic telescope at deflection 600 and, with hand signals, directs No. 5 in the alinement of the aiming posts with the vertical crosshair of the sight (fig. 15). If, because of the nature of the terrain, the aiming posts cannot be set out at deflection 600, the gunner turns the azimuth micrometer knob until the slipping azimuth scale is on another even 100-mil graduation. He alines the aiming posts at this new deflection. The chief of section reports the altered deflection to the executive "Sir, No. (so-and-so) aiming posts at (so many hundred), 600 in lake (or other reason)," The executive will then command "No. (so-and-so), DEFLECTION 600, REFER." At this command the gunner loosens the slipping azimuth scale to deflection 600 (fig. 16). He then tightens the locking screw and verifies the adjustment.

41. Sets a Common Deflection to a Common Aiming Point

The battery having been laid, the executive may command AIMING POINT, CHURCH STEEPLE, REFER. At this command, without moving the tubes, the gunner of all howitzers turns his sight to the aiming point designated and reports the deflection to the executive. The executive then commands, COMMON DEFLECTION 600. At this command each gunner loosens the locking screw of the slipping azimuth scale of the panoramic telescope and moves the scale until 600 is in coincidence with the index on the door. The

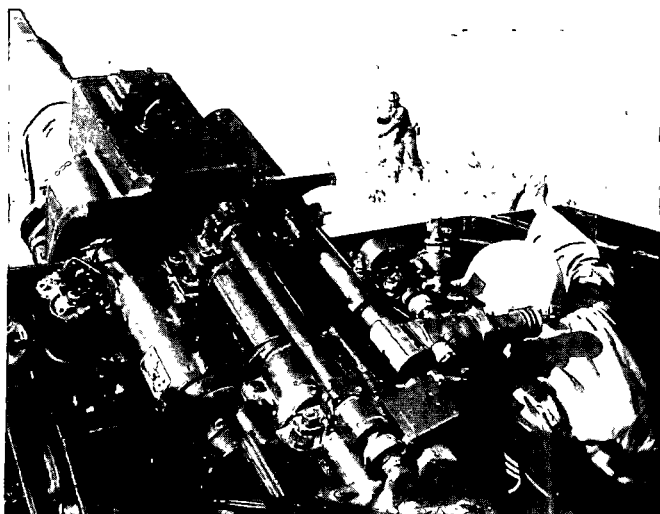


Figure 15. Gunner and No. 5 alining aiming posts.

gunners then unlock the slipping azimuth micrometer scale locking nut and move the slipping azimuth micrometer scale to zero, tightens the locking nut, and verifies that the zero is in coincidence with the index and that the line of sight is still on the aiming point.

42. Sets or Changes Deflection

The command is DEFLECTION (so much). If, for example, the command is DEFLECTION 2483, the gunner disengages the throwout lever with his left thumb and turns the rotating head of the panoramic telescope to 2400. He releases the throwout lever and, with his right hand, turns off the remaining 83 mils on the micrometer scale (fig. 17). He then traverses the tube until the vertical crosshair of the reticle is on the aiming post, being careful that the last motion will

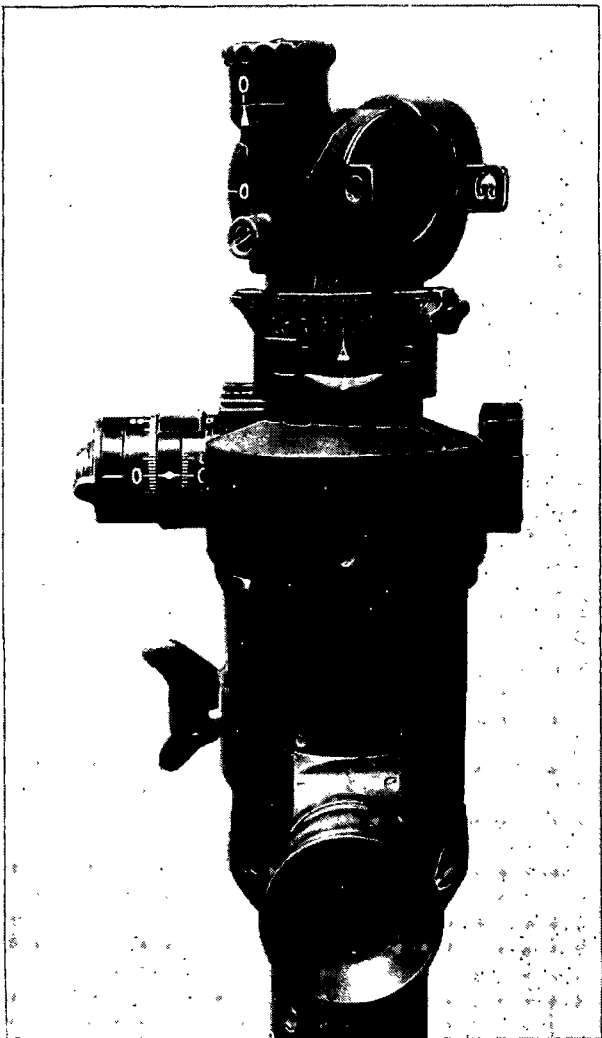


Figure 16. Common deflection 600.

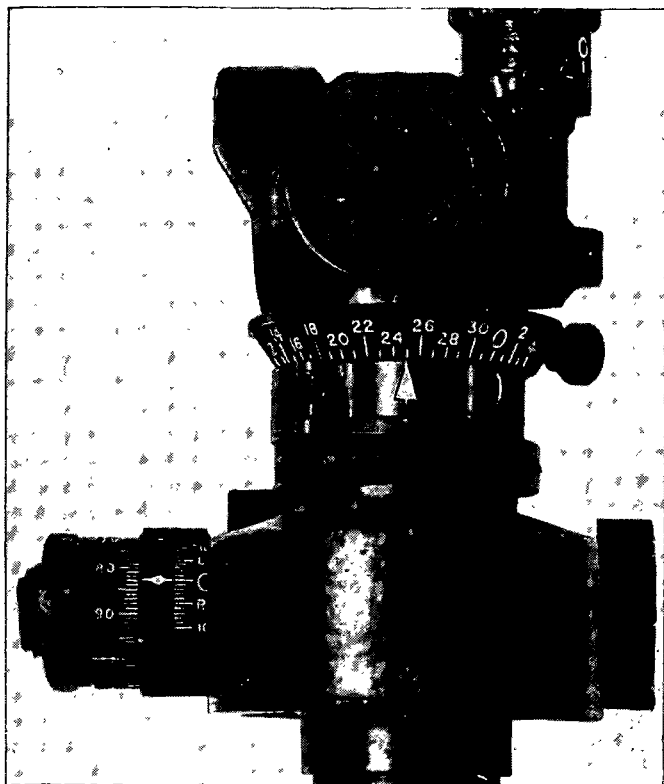


Figure 17. Deflection 2483.

cause the vertical crosshair of the telescope to approach the aiming point from the left to take up any lost motion in the mechanism.

43. Setting the Quadrant

The telescope mount is provided with an elevation scale graduated in hundreds of mils from 0 to 1,100

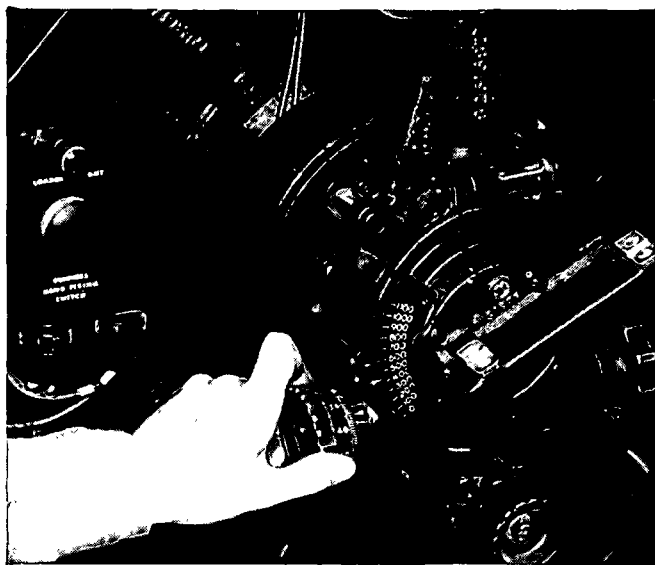


Figure 18. Setting quadrant.

mils and a micrometer graduated in mils from 0 to 100. The scale is read opposite the micrometer index. To set a quadrant of 435, for example, the gunner rotates the elevation knob in the proper direction until the space between 400 and 500 on the scale is opposite the index. He refines the setting by turning the elevation knob until 35 is opposite its index (fig. 18). The last motion should always be in the direction of increasing elevation.

Note. The gunner is first taught to read quadrants set and then to set announced quadrants.

44. Lays for Quadrant

a. Manual Operation. When use of the electrical elevating mechanism (*b* below) is not practical, the

elevating handwheel may be used by setting the elevating hand-to-power shifting handle (fig. 19) for manual operation. The quadrant having been set at 435, for example, the gunner moves the tube in the appropriate direction by turning the elevating manual control handwheel until the longitudinal-level bubble on the telescope mount is centered. To insure accuracy, the last motion must be in the direction in which it is more difficult to turn the handwheel. When the howitzer is being fired at elevations higher than loading elevation, the gunner must depress the tube after each round until the loading position indicator is within the prescribed limits.

b. Electrical Elevation. When the electrical elevating mechanism is to be used, the elevating hand-to-power shifting handle (fig. 19) is set for electrical operation. Before the elevating mechanism will function electrically, both the master relay switch and the power pack electric motor switch must be in the ON position. The quadrant having been at 435, for example, the gunner moves the elevating power control handwheel in the appropriate direction until the longitudinal-level bubble on the telescope mount is approximately centered. He then sets the elevating hand-to-power shifting handle to the hand drive position and centers the bubble as in *a* above.

c. With Gunner's Quadrant. For information concerning laying for quadrant using the gunner's quadrant, see paragraph 22.

45. Calls "Ready"

The howitzer having been laid for direction and quadrant and the assistant gunner having called "Set" (par. 54), the gunner verifies the laying, moves his head clear

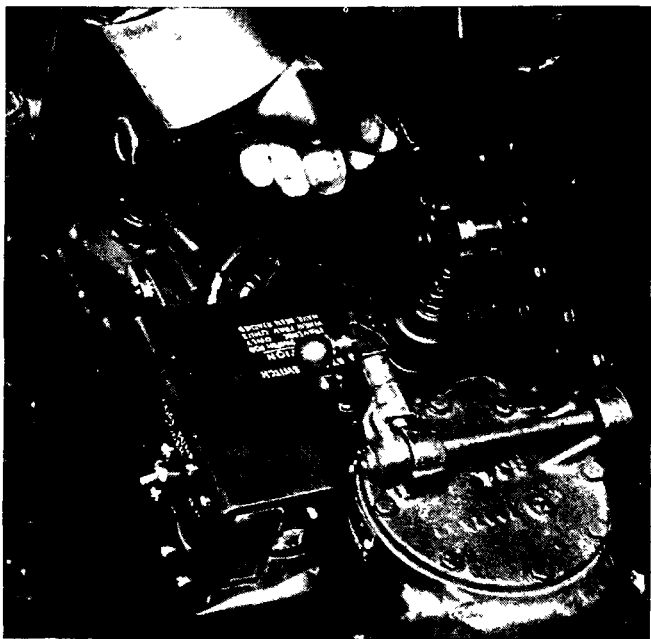


Figure 19. Elevating hand-to-power shifting handle.

of the telescope, and calls "Ready" to indicate to the chief of section that the howitzer is ready to be fired.

46. Refers Howitzer

The command from the executive is AIMING POINT THIS INSTRUMENT (or other point), REFER. Without disturbing the laying of the howitzer, the gunner turns only the rotating head of the panoramic telescope until, with the bubbles level, the vertical crosshair of the reticle is on the point designated. He then reports the deflection to the executive, "Sir, No. (so-and-so), deflection (so much)."

47. Corrects for Aiming Post Displacement

For details of correcting for aiming post displacement, see paragraph 122.

Section IV. DUTIES OF ASSISTANT GUNNER, CANNONEERS, AND DRIVER

48. Assistant Gunner, List of Duties (Detailed Description of Duties)

(Pars. 49-55)

- a. Opens and closes the breech.
- b. Assists No. 1 in loading the projectile.
- c. Places rammer hydraulic pump starting switch in ON position and extends rammer head.
- d. Primes the howitzer and announces "Set."
- e. Fires the piece.
- f. Cleans and oils the breechblock, breech recess, and primer vent.

49. Opens and Closes Breech

For a detailed description of the procedure used to open and close the breech, see TM 9-7004.

50. Assists No. 1 in Loading Projectile

The assistant gunner assists No. 1 in loading the projectile in the sequence given in table III. See TM 9-7004 for complete details of loading.

51. Places Rammer Hydraulic Pump Starting Switch in ON Position and Extends Rammer Head

The assistant gunner places the rammer hydraulic pump starting switch in the ON position and then depresses and holds the button (on the right side of the

tube) of the rammer hydraulic pump solenoid valve switch until the rammer head is fully extended.

52. Primes the Piece

After the breech is closed, the assistant gunner inserts a new primer into the holder, being careful to keep the right hand clear of the front of the primer, and insures that the flange head of the primer seats against the extractor. He grasps the firing mechanism operating handle with the left hand and closes the firing assembly by rotating the operating handle to the upward position.

53. Announces "Set"

The assistant gunner calls "Set" when the howitzer has been loaded, the breech has been closed, and the primer has been inserted.

54. Fires the Piece

After the gunner announces ready, the assistant gunner attaches the firing lanyard and, on command of of the chief of section, fires the piece.

55. Cleans and Oils Breechblock, Breech Recess, and Primer Vent

Whenever possible and during lulls in firing, the assistant gunner washes the powder residue from the mushroom head, the gas check seat, and the threaded sections of the breech recess and breechblock with a water-saturated cloth. In addition, he passes the vent cleaning bit through the obturator spindle vent several times. From time to time and as necessary, the assistant gunner wipes the threaded sectors of the breech recess and breechblock with a cloth *slightly dampened* with oil, lubricating preservative, medium (for temperature of 32°F and above) or oil, lubricating, preserva-

tive, special (for temperatures below 32° F.). When necessary, he oils the operating parts of the breech mechanism with the same type of oil specified for the breech recess and breechblock.

56. No. 1, List of Duties (Detailed Description of Duties)

(Pars. 57-62)

a. Loads the projectile, assisted by the assistant gunner and operates the rammer release handle bar to ram the projectile.

b. Places the powder charge in the chamber.

c. Calls "Close."

d. Swabs and inspects the powder chamber after each round fired.

e. Swabs the bore.

f. Calls out the number of the round and the announced quadrant in volley fire.

57. Loads Projectile, Assisted by the Assistant Gunner, and Operates Rammer Release Bar to Ram Projectile

No. 1, assisted by the assistant gunner, loads the projectile, places the rammer head in position to ram the projectile by depressing the projectile throwing-arm catch, and operates the rammer release handle bar to ram the projectile.

58. Places Powder Charge in Chamber

After releasing the loading tray, No. 1 turns and receives the powder charge from No. 6. He places the charge in the chamber, lashed end to the front (fig. 20), and pushes it in until the base of the charge is approximately 3 inches inside the chamber (fig. 21). By



Figure 20. Placing the powder charge in the chamber.

placing it in this position, unduly large gaps between the obturator spindle and the powder bag caused by shoving when the breech is closed are avoided. No. 1 must be sure that the red igniter pad is to the rear and that the igniter protector cap has been removed.

59. Calls "Close"

After placing the powder charge in the chamber and removing his hand from the breech recess, No. 1 calls "Close" to notify the assistant gunner that it is safe to close the breech.

60. Swabs and Inspects Powder Chamber After Each Round Fired

After each round fired, No. 1 sponges out the powder chamber immediately after the assistant gunner opens

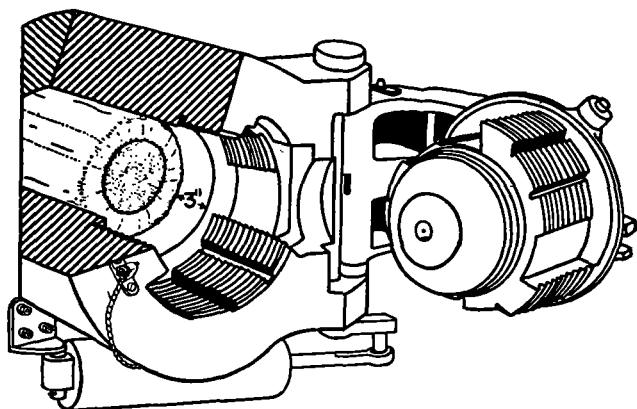


Figure 21. Position of powder charge in the chamber.

the breech. The rear of the bore, including the forcing cone, is swabbed with a water-soaked sponge. After swabbing between rounds, No. 1 inspects the bore for injuries to the tube, for burning fragments of powder bags, and for other objects. Any burning fragments or other objects in the bore must be removed before reloading. He calls out "Bore clear," if it is clear. Any damage to the howitzer is reported to the chief of section.

61. Swabs Bore, Assisted by No. 3

The chief of section directs swabbing of the bore during lulls in firing or at other times. The tube is brought to the horizontal position by the gunner. No. 1, assisted by No. 3, swabs the bore as prescribed in TM 9-7004.

62. Calls out Number of Round and Announced Quadrant in Volley Fire

To insure firing the correct number of rounds in volley fire, No. 1 calls out the number of the round and the quadrant as he finishes ramming the projectile. As he finishes ramming the last round, he adds, "Last round." For example, when two rounds are to be fired at quadrant 373, he calls out, "Second and last round, 373." He should speak no louder than is necessary to be heard by the members of his own section.

63. No. 2, List of Duties (Detailed Description of Duties)

(Pars. 64-67)

- a. Fuzes projectiles.
- b. Sets the fuze setter.
- c. Sets fuzes.
- d. Removes fuzes from projectiles.

64. Fuzes Projectiles

No. 2 unscrews the eyebolt lifting plug from the fuze socket of the projectile; inspects the socket for rust and dirt; removes (or replaces) the supplemental charge, if necessary; and screws in the designated fuze. In tightening or loosening the fuze of a projectile, only the authorized fuze wrench should be used. Variable time (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. 2 removes the safety pull wire from the fuze and, if a booster is present, the safety pin from the booster. Boosters without safety pins will not be used. Fuzes and boosters will not be used if they

are not in their original condition. For detailed description of safety precautions, see TM 9-7004.

65. Sets Fuze Setter

Fuze setters M14, M22, M23, M26, M27, and M28 are authorized for use with this weapon. For detailed description and operation of these fuze setters, see TM 9-7004. Although the description and operation of the fuze setter M28 is not discussed in TM 9-7004, its operation is the same as that for the fuze setter M26. The only difference between the two fuze setters is in the time scales. The two scales of the fuze setter M26 range from 0 to 25 seconds and from 0 to 75 seconds, respectively (fig. 22), whereas the 2 scales of the fuze setter M28 range from 0 to 45 seconds and from 0 to 100 seconds, respectively.

66. Sets Fuzes

a. Selective Superquick and Delay Fuzes. When FUZE QUICK is announced, No. 2 verifies that the setting sleeve is alined with the letters SQ. When FUZE DELAY is announced, he turns the setting sleeve with a fuze wrench, screwdriver, or similar instrument until the slot is alined with the word DELAY.

b. Combination Time and Superquick Fuzes. The combination time and superquick fuze can be set to function on time (in the air) or impact action. After fuzing the projectile, No. 2 removes the safety pull wire from the fuze. For percussion (impact) action, the command is FUZE M520 QUICK (or other designation). No. 2 then verifies that the **S** (safe) on the setting ring is alined with the index on the fixed ring; if not, he sets it at **S**.

c. VT Fuzes. The VT fuze can be set for either time

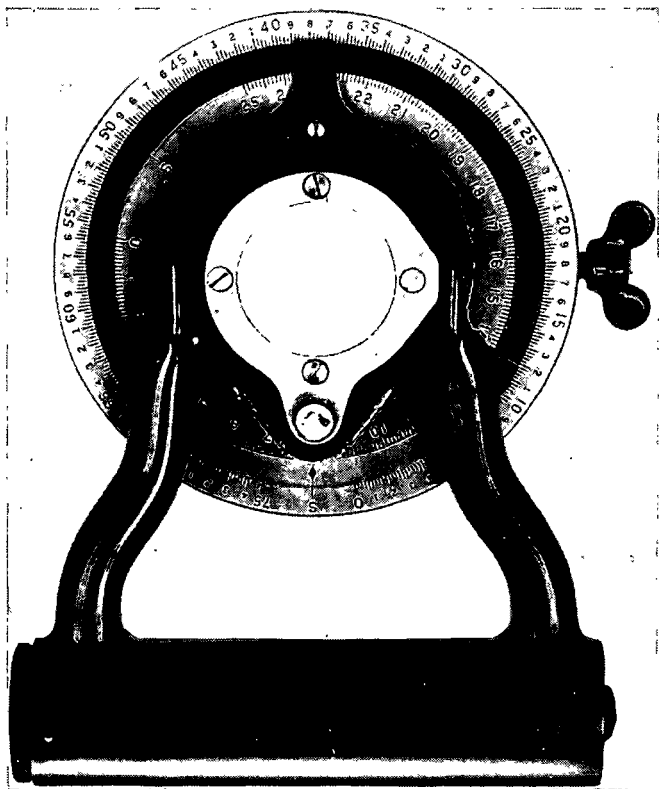


Figure 22. Fuze setter M26.

or superquick. Time settings of 0 to 100 seconds can be set on this fuze by using the M28 fuze setter.

d. Setting Time Fuzes. To set the time on time fuzes, No. 2 must use the fuze setters authorized for this weapon. For the detailed description and operation of authorized fuze setters, see TM 9-7004.

67. Removes Fuzes From Projectiles

If for any reason a projectile that has been fuzed is not to be fired, the fuze must be removed. The operation of inserting a fuze is reversed. Supplemental charges must be replaced, provided the projectile was issued with the charge. The booster safety pin of the fuze is replaced, if provided with the fuze. Combination superquick and delay fuzes are reset to superquick. Time and VT fuzes are reset to **S**, and the safety pull wire on time fuzes are replaced. All fuzes are returned to their containers. The eyebolt lifting plugs are replaced in the fuze sockets of the projectiles.

68. No. 3, List of Duties (Detailed Description of Duties)

(Pars. 69 and 70)

a. Carries the projectile to the howitzer, assisted by No. 5.

b. Assists No. 1 in swabbing the bore.

69. Carries Projectile to Howitzer, Assisted by No. 5

No. 3 places the fuzed projectile on the loading tray. He grasps the handles on the left side of the tray. No. 5 grasps the handles on the right, and together they carry the tray to the hull door. They lift the tray in such a manner that the assistant gunner and No. 1 can receive it with ease. No. 3 returns to his position while No. 5 stands fast to receive the empty tray from No. 1.

70. Assists No. 1 in Swabbing Bore

For detailed description of this duty, see paragraph 61 and TM 9-7004.

71. No. 4, List of Duties (Detailed Description of Duties)

(Pars. 72-74)

- a. Inspects and cleans projectiles.
- b. Assists No. 2 in fuzing the projectile.
- c. Repairs section communication wire.

72. Inspects and Cleans Projectiles

No. 4 verifies the type, weight, and lot number (when appropriate) of each projectile, removes the grommet, and examines the projectile, carefully for defects. He inspects each round to see that it is free from sand and dirt and that the rotating band is not burred. The projectile is then placed upright on its base and the entire surface cleaned. Projectiles with burred rotating bands are put aside until No. 4 can remove the burrs with a file. If any appreciable length of time intervenes between the cleaning of the projectile and its insertion into the howitzer, the projectile must be reinspected. Any sand, dirt, oil, or grease on the projectile will cause undue wear, scratches, or gouges in the bore of the weapon.

73. Assists No. 2 in Fuzing the Projectile

After the command designating the projectile to be used is given, for example, SHELL HE, No. 4 procures the projectile and holds it upright while No. 2 fuzes it and sets the fuze. When directed by the chief of section, No. 4 reads and announces the time as set.

74. Repairs Section Communication Wire

No. 4, when directed by the chief of section, makes repairs to the wire line to the executive's post.

75. No. 5, List of Duties (Detailed Description of Duties)

(Pars. 76–79)

a. Assists No. 3 in carrying the projectile to the howitzer.

b. Returns the loading tray.

c. Sets out aiming posts.

d. Performs other duties as directed by the chief of section.

76. Assists No. 3 in Carrying Projectile to Howitzer

For a detailed description of this duty, see paragraph 69.

77. Returns Loading Tray

When the projectile has been rammed into the breech, No. 1 hands the tray to No. 5, who returns the tray to the place where the ammunition is being prepared.

78. Sets out Aiming Posts

Unless otherwise directed, No. 5 sets out aiming posts as described in paragraphs 40, 121, and 122.

79. Performs Other Duties as Directed by Chief of Section

No. 5, when not otherwise occupied, may assist in the preparation and cleaning of projectiles, the preparation of powder charges, or as otherwise directed by the chief of section.

80. No. 6, List of Duties (Detailed Description of Duties)

(Pars. 81–84)

a. Prepares powder charges.

b. Passes powder charge to No. 1.

- c. Calls out the number of the charge.
- d. Determines and announces powder temperature.

81. Prepares Powder Charges

a. *Type M3 (Green Bag).* The type M3 (green bag) propelling charge consists of a base charge and four smaller increments corresponding to five zones of fire. The base charge is marked "Charge 1" and the other bags are numbered from 2 to 5, inclusive. When the command designating the charge to be used is given, for example, CHARGE 3, No. 6, assisted by the driver, when available, takes a complete charge from one of the containers and places it in front of him, base charge on the bottom. No. 6 unties the lashings which hold the bags together. Without disturbing the order in which they are arranged, he checks the increments and removes the bags marked "4" and "5" from the top, leaving the bag marked "3" at the top of the pile. He then ties the remaining bags together and removes the igniter protector cap on the base of the charge. The discarded bags, that is, the bags marked "4" and "5", are placed in the containers provided for that purpose. They are later disposed of as the executive may direct. No flash reducer is necessary for use with this charge.

b. *Type M4 (White Bag) and M4A1 (White Bag).* The type M4 (white bag) powder charge consists of a base charge (charge 5) and two increments corresponding to charges 6 and 7, respectively. The M4A1 consists of a base charge, with igniter, and four increments corresponding to charges 3, 4, 5, 6, and 7. Preparation of these charges is accomplished as in *a* above, except that no charge lower than charge 5 can be prepared with the M4 type and no charge lower than charge 3 with the M4A1 type. *Green and white bag increments must*

not be mixed in the same charge. In night firing, when the flash reducer M2 (T2) is used, No. 6 assembles the propelling charge and flash reducer by tying one flash reducer at the forward end of the base charge and one at the forward end of each increment used.

82. Passes Powder Charge to No. 1

As the projectile is being seated in the breech ring and after the powder charge has been prepared as in paragraph 81, No. 6 passes the charge to No. 1 in such a manner that No. 6 can grasp the base in his right hand.

83. Calls out Number of Charge

After passing the powder charge to No. 1, No. 6 calls out the number of the charge he has prepared, for example, "Charge 3." This informs the chief of section that the proper charge has been prepared.

84. Determines and Announces Powder Temperature

No. 6 sets aside one charge for use in taking powder temperature. This charge must be clearly marked to prevent its use in the howitzer. Powder temperature is announced when requested by the chief of section. For further details on powder temperature, see FM 6-40.

85. Driver, Howitzer Motor Carriage, List of Duties (Detailed Description of Duties)

(Pars. 86-88)

- a. Shifts the motor carriage.
- b. Assists No. 6 in preparing powder charges.
- c. Performs first echelon maintenance on the motor carriage.

86. Shifts Motor Carriage

When the chief of section points out a new direction of fire, the driver shifts the motor carriage so that, when the howitzer is pointed in the new direction and the spade is seated, the panoramic telescope will be as nearly as possible over its original location.

87. Assists No. 6 in Preparing Powder Charges

As soon as his other duties permit or when directed by the chief of section, the howitzer carriage driver assists No. 6 in preparing powder charges (par. 81). He holds the complete charge while No. 6 unties the lashings, withdraws unnecessary bags, and reties the lashings. The driver then places the discarded bags in the containers provided for that purpose.

88. Performs Maintenance in Stabilized Situations

When firing is stabilized and the engines are not running, the driver performs such maintenance as may be accomplished without interfering with the firing of the howitzer. Any disassemblies or maintenance operations that will render the vehicle immobile for any period of time must be ordered by the chief of section.

CHAPTER 6

FIRING BY DIRECT LAYING

Section I. GENERAL

89. Technique

a. Firing by direct laying is a technique that demands special training. The section must operate as an independent unit. Training in direct laying is based on the technique employed in indirect laying. Targets taken under fire by laying are usually targets capable of returning direct fire on the howitzer section; therefore, the speed and accuracy required in indirect laying becomes even more important for direct laying missions.

b. For additional information on firing by direct laying, see FM 6-40.

90. Preparation of a Range Card

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

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. For quick reference, he prepares a range card (fig. 23) upon which he records these ranges and their corresponding elevations (EL). These elevations are for use when it is not possible to use telescope M93 for direct laying.

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 is improved

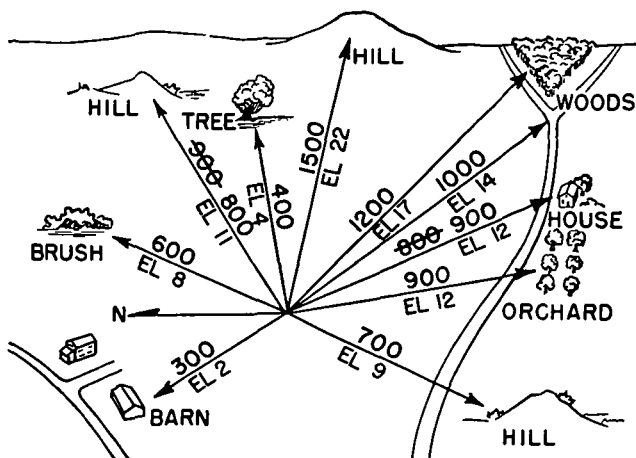


Figure 23. Range card for direct laying.

by replacing estimated ranges with more accurate data obtained by firing, pacing, taping, vehicle speedometer reading, map measurements, or survey.

91. Field of Fire

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

Section II. CONDUCT OF FIRE

92. General

Targets for firing by direct laying usually consist of hostile vehicles, tanks, and personnel threatening the battery. Enemy personnel, whether alone or accom-

panying tanks, will seldom present themselves as a clearly defined target. Normally, attacking troops use all available cover and reveal themselves only fleetingly. Accordingly, fire is conducted on the area containing the attackers rather than on the individuals. Tanks usually attack in groups and may be accompanied by infantry.

93. Priority for Selection of Targets

Normally, first priority is given to attack of those targets within the assigned sector of the weapon and second priority to targets in other sectors. Priority within the assigned zone is given to—

- a.* Tanks at short ranges, threatening to overrun the position.
- b.* Hull-down stationary tanks covering the advance of other tanks.
- c.* The commander's tank, if identified.
- d.* Tank nearest to cover.
- e.* The rear tank of a column moving across the front of the position (to avoid disclosing the howitzer position to leading tanks).

Section III. AMMUNITION AND FUZES

94. General

For close-in fires, a variety of fuzes and shells is 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 howitzers, may make extremely close-in fire impossible due to projectiles skipping without detonating on impact. At ranges of 200 to 400

yards (approximately 200 to 400 meters), 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 howitzer's sector of responsibility so that projectiles may be fired on the points to cause detonation. When direct fire is placed on these or other previously selected points as they are approached by an attacking force, the necessity for adjustment fire is reduced.

95. Ammunition

Ammunition for direct fire may be high explosive shell (HE) or white phosphorus shell (WP). Shell 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 of the resulting smoke screen on friendly elements.

96. Fuzes

WP ammunition is fused with a superquick-delay fuze; HE may be used with fuze quick, fuze delay, or fuze time.

a. Fuze quick is the best selection for use with HE shell for close-in fires. It is highly effective and, since no fuze setting is required, firing is more rapid.

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 from 10 to 30 yards (approximately 10 to 30 meters) in front of the target. If less than 50 percent

of the bursts are ricochet, the fuze action should be changed to quick.

c. Fuze time is the least desirable fuze for close-in fires. At short fuze settings, variations in time of burning give wide range dispersion. Fuze time should be used only for ranges of more than 1,000 yards (approximately 900 meters). The areas covered effectively by airbursts and ricochet bursts are similar.

Section IV. TRAJECTORIES

97. General

Trajectory characteristics change with the type of ammunition and the charge fired. The trajectory characteristics given in paragraphs 98 through 102 govern the conduct of fire when using shell HE or WP with charge 7.

98. Ranges From 0 to 400 Yards (Approximately 0-400 Meters)

Within range limits of 0 to 400 yards, the trajectory will be extremely flat. If fields of fire and terrain allow, 400 yards is the ideal range 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.

99. Ranges From 400 to 1,500 Yards (Approximately 400 to 1,400 Meters)

Range limits of 400 to 1,500 yards include the zone in which the trajectory is sufficiently flat to permit direct estimation of range without actually bracketing the target. Assuming little dispersion and firing at the

upper range limit, if a hit is obtained at the bottom of an 8-foot high tank, a 100-yard range increase will result in a round that 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 limit, 1,500 yards, is the greatest range at which direct fire should be opened on a tank unless tactical conditions require otherwise. A trained howitzer crew should obtain hits by the second shot.

100. Ranges From 1,500 to 2,500 Yards (Approximately 1,400 to 2,300 Meters)

At ranges of 1,500 to 2,500 yards, there is only a reasonable probability of hits. Bracket methods are normally used to obtain adjustments in this zone. Fire should not be opened at these ranges if surprise is important.

101. Ranges Over 2,500 Yards (Approximately 2,300 Meters)

At ranges over 2,500 yards, using charge 7, firing by direct laying is not advisable against moving targets. 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 difficult to obtain.

102. 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. Table IV shows the vertical displacement for a 100-yard range change at various ranges, firing shell HE, charge 7.

Table IV. Vertical Displacement (Feet) per 100-Yard Range Change

Range		Displacement feet, shell HE, charge 7	Remarks	Range	
(Meters)	(Yards)			(Yards)	(Meters)
100	100	0.5	Start firing, using 400 yard range setting.	100	100
200	200	1.0		200	200
300	300	1.0		300	300
400	400	1.5	Start firing with estimated range. Increase or decrease by 50-or 100- yard changes. Bracketing not necessary.	400	400
500	500	2.0		500	500
500	600	2.5		600	500
600	700	3.0		700	600
700	800	3.5		800	700
800	900	4.0		900	800
900	1,000	4.5		1,000	900
1,000	1,100	5.0		1,100	1,000
1,100	1,200	5.5		1,200	1,100
1,200	1,300	6.0		1,300	1,200
1,300	1,400	6.5	Bracket target (get bursts over and short) to obtain hit.	1,400	1,300
1,400	1,500	7.0		1,500	1,400
1,500	1,600	8.0		1,600	1,500
1,600	1,700	8.5		1,700	1,600
1,600	1,800	9.0		1,800	1,600

1,700	1,900	9.5		1,900	1,700
1,800	2,000	10.5		2,000	1,800
1,900	2,100	11.0		2,100	1,900
2,000	2,200	12.0		2,200	2,000
2,100	2,300	12.5		2,300	2,100
2,200	2,400	13.0		2,400	2,200
2,300	2,500	13.5		2,500	2,300
Over	Over	-----	At ranges over 2,500 yards, direct firing is too inaccurate to be used against moving targets.	Over	Over
2,300	2,500	-----		2,500	2,300

Section V. DUTIES OF CHIEF OF SECTION

103. List of Duties (Detailed Description of Duties)

(Pars. 104-109)

- a.* Conducts the fire of his howitzer.
- b.* Identifies or selects the target.
- c.* Estimates the range to the target.
- d.* Determines the lead.
- e.* Gives initial commands.
- f.* Observes effect of fire and gives subsequent commands.

104. Conducts Fire of his Howitzer

The chief of section conducts the fire of his howitzer when the executive commands TARGET (so-and-so), FIRE AT WILL, or simply FIRE AT WILL.

105. Identifies or Selects Target

If the executive designates an object or one of a group of objects as the target, the chief of section must identify this target correctly. If the target is, for example, a group of tanks, the chief of section selects the one which, in his estimation, is the greatest threat to his own position or the position of the supported troops. He repeats the identification to his section, employing the minimum number of words, such as LEAD TANK or MOVING TANK.

106. Estimates Range to Target

Range cards (fig. 23) with accurately measured ranges to key points provide the best means for determining the initial range. If a range card has not been prepared, the chief of section estimates the range.

107. Determines Lead

The appropriate lead in mils is determined by the speed of the target, the range, course at which it is moving, and the charge being fired. With shell HE, charge 7, approximate initial leads are slow (0-5 mph), 5 mils; medium (5-10 mph), 10 mils; and fast (10-15 mph), 15 mils. Based on the observed effect, the lead is changed as necessary.

108. Gives Initial Commands

The chief of section announces fire commands in the following sequence:

a. Designation of Target. The command is TARGET (so-and-so).

b. Projectile, Charge, and Fuze. The chief of section commands the appropriate items in sequence, such as SHELL HE, CHARGE 7, FUZE QUICK. He selects the charge, fuze, and projectile in accordance with considerations contained in paragraphs 94 through 96. The M78A1 concrete-piercing fuze should be used against concrete pillboxes or fortifications.

c. Lead. The command is LEAD (so much). See paragraph 107 for method of determining the lead.

d. Method of Fire. Fire is continuous unless otherwise commanded. In continuous fire, the howitzer is loaded and laid as rapidly as possible and fired by the gunner as soon as the assistant gunner announces "Set."

e. Range. The command is RANGE (so much). The range commanded by the chief of section is the range to be set on the sight reticle. For the method of determining range, see paragraphs 90 and 106.

109. Observes Effect of Fire and Gives Subsequent Commands

a. Change in Lead. During adjustment the lead is changed by the command RIGHT (LEFT) (so much).

b. Change in Range. During adjustment the range is increased by the command ADD (so much) and decreased by the command DROP (so much). See paragraphs 97 through 102 for the method of determining changes in range during adjustment of fire.

Section VI. DUTIES OF GUNNER

110. Gunner, List of Duties (Detailed Description of Duties)

(Pars. 111-116)

- a.* Adjusts the telescope M93 for cant.
- b.* Takes the proper lead.
- c.* Lays the howitzer for range.
- d.* Fires the howitzer.
- e.* Continues tracking the target.
- f.* Applies corrections for lead and range.

111. Adjusts Telescope M93 for Cant

The gunner adjusts the reticle of the telescope M93 for cant by rotating the cant corrector adjustment knob (fig. 24) until the bubble in the level vial of the cant corrector is centered.

112. Takes Proper Lead

When the chief of section commands LEAD (so much), the gunner, sighting through the telescope M93, traverses the tube so that the target appears in the reticle traveling toward the vertical center line (fig. 25). The lead expressed in mils determines the distance



Figure 24. Gunner adjusting cant corrector knob.

between the target and the vertical center line. The gunner maintains this lead continuously until the target is immobilized or the chief of section announces a change.

113. Lays Howitzer for Range

The gunner, sighting through the telescope M93, operates the elevating handwheel and brings range line of the sight reticle to the target at the setting commanded by the chief of section.

114. Fires Howitzer

After the assistant gunner has called "Set" and the correct sight picture is obtained, the gunner fires the howitzer.

155-HE M107
CHARGE 7

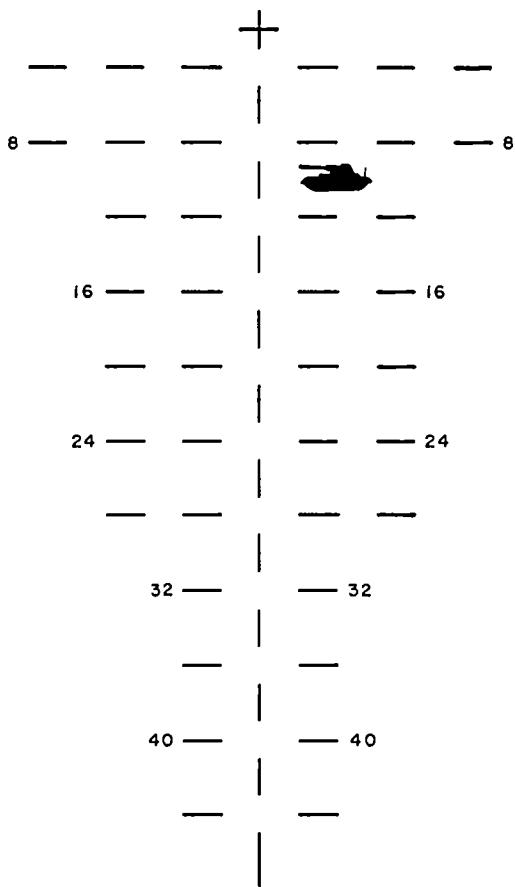


Figure 25. Gunner's sight picture (lead 10 mils, range 1,000 yards).

115. Continues Tracking Target

The gunner continues to track the target until CEASE FIRING is given or until the target is immobilized.

116. Applies Corrections for Lead and Range

The gunner applies corrections for lead and range as commanded by the chief of section (par. 109).

Section VII. DUTIES OF REMAINDER OF SECTION

117. Motor Carriage Driver

The motor carriage driver takes his post in the driver's compartment, starts the engines, and prepares to shift the vehicle as directed by the chief of section.

118. Assistant Gunner and Cannoneers

The assistant gunner and numbered cannoneers perform the same duties in the same sequence in direct laying that they perform in indirect laying.

CHAPTER 7

TECHNIQUES AND SITUATIONS THAT REQUIRE SPECIAL ATTENTION

119. 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. For uniformity and accuracy, the last motion in setting instruments and in laying should be in the direction prescribed in this manual. To insure accurate laying, personnel who lay the howitzer must be required to verify the laying after the breech has been closed.

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

c. For uniformity and accuracy in laying on aiming posts, the vertical crosshair in the reticle of the panoramic telescope should be aligned with the left edges of the aiming posts.

120. Aiming Points

a. *General.* After the howitzer has been laid initially for direction, it is referred to the aiming posts and usually to one or more distant aiming points. An aiming point must have a sharply defined point or vertical line which is clearly visible from the howitzer so that the vertical crosshair of the panoramic telescope can be aligned on exactly the same place each time the howitzer is relaid.

b. *Distant Aiming Point.* A distant aiming point is

one at sufficient distance (at least 2,500 meters) so that normal displacements of the howitzer in firing or traverse will not cause a horizontal angular change in direction (with the same settings on the azimuth scales) of more than $\frac{1}{2}$ mil. The executive officer usually designates the distant aiming point or points to be used.

121. Aiming Posts

a. Two aiming posts are used for each howitzer. Each aiming post is equipped with a light for use at night. The most desirable distance from the howitzer to the far aiming post is 100 meters, considering accuracy of laying, visibility, and ability to control the aiming post lights. First, the far aiming post is set up and alined. The near aiming post is then set up and alined halfway between the far aiming post and the howitzer (par. 40). The vertical crosshair of the panoramic telescope must be on *the left edge* of the aiming posts for proper alinement. To insure equal spacing of aiming posts, the distance to both the near and the far aiming post should be paced by the same man. Where ground conditions make pacing inaccurate, the distance from the howitzer to the aiming posts may be measured by using the panoramic telescope and the aiming post as measuring devices (*d* below).

b. For night use, the aiming post lights should be adjusted so that the far light will appear several feet above the near light. On flat terrain this may be accomplished by using only the lower half of the near aiming post. The two lights placed in this way will establish a vertical line for laying the howitzer.

c. Since the panoramic telescope is mounted at considerable distance from the center of rotation of the top carriage, large changes in deflection will cause misa-

linement of the aiming posts. Placing the aiming posts to the right front at a deflection of approximately 600 when the tube is in the center of traverse will keep this misalignment to a minimum and will still allow for maximum visibility.

d. To measure the distance from the howitzer to the aiming posts, the stadia method may be employed by using the panoramic telescope 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 horizontal crosshair of the panoramic telescope. Since the upper section of the aiming post is $4\frac{1}{2}$ feet long, it measures 14 mils on the horizontal crosshair when it is 100 meters from the howitzer. The proper location for the near aiming post, in this case, would be at the point at which the $4\frac{1}{2}$ -foot section measures 28 mils on the horizontal crosshair. In many cases, the ideal spacing of 50 and 100 meters cannot be obtained but the aiming posts will be properly spaced when the near aiming post is set at a point where one section of the aiming post ($4\frac{1}{2}$ ft.) held horizontally measures twice the number of mils on the horizontal crosshair that it measured at the far aiming post location. This measurement may be performed at night by attaching the night lighting devices on the ends of one section of an aiming post and holding it horizontally.

122. Correction for Displacement of Aiming Posts

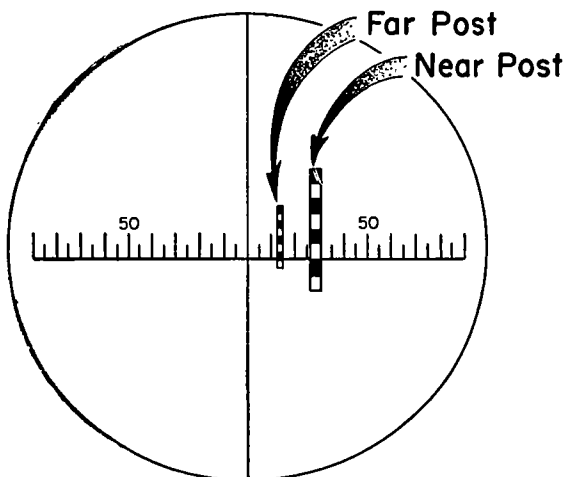
When the gunner notes that the vertical crosshair of the panoramic telescope is displaced from the line formed by the two aiming posts (or aiming post lights), he lays the howitzer so that the far aiming post (light)

appears exactly midway between the near aiming post (light) and the vertical crosshair (fig. 26). If the displacement is due to traversing the tube, 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 notifies the chief of section, who, at the first lull in firing, notifies the executive and requests permission to realine the aiming posts. To realine, the howitzer is laid with the far aiming post midway between the near aiming post and the vertical crosshair (fig. 26). The far aiming post is moved into alinement with the vertical crosshair of the telescope and then the near aiming post is alined. If terrain conditions make it impracticable to move one of the two aiming posts, the howitzer is laid for direction and referred to the aiming post that cannot be moved. This deflection is reported to the executive. The other aiming post is alined, using the method described in paragraph 40, and the azimuth micrometer scale is slipped to retain the same deflection that was used prior to realinement of the aiming posts.

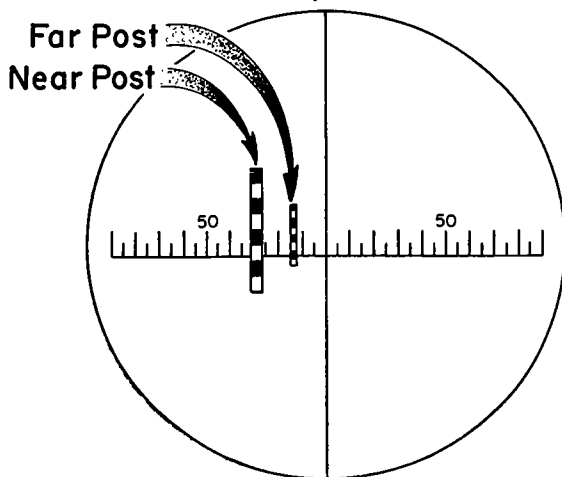
123. Testing Targets

Testing targets will be most useful if they include the following features:

- 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, the target should be fastened to a stand in a manner similar to that shown in figure 27.
- c. For use in either leveling or canting the test target, a mil scale may be inscribed at the bottom of the target. A small nail at the top marks the center from which the



Left Displacement



Right Displacement

Figure 26. Gunner's sight picture of aiming posts in proper relationship when correcting for displacement.

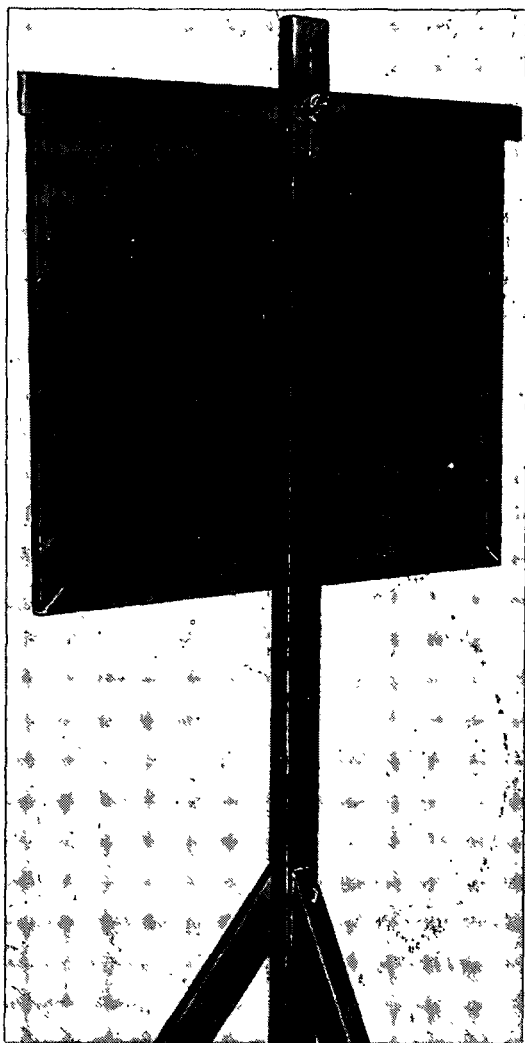
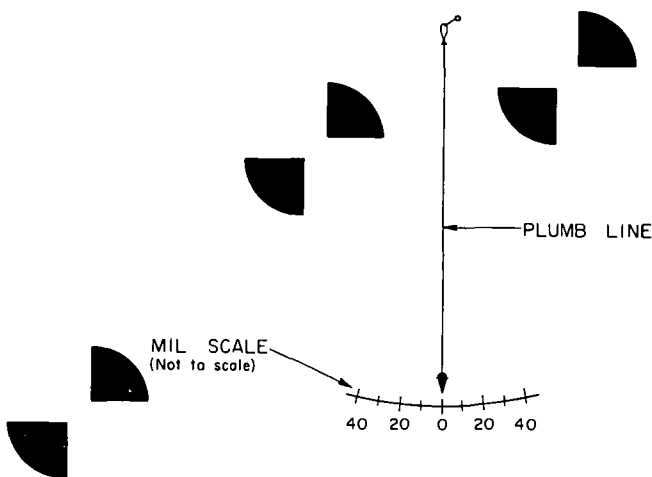


Figure 27. Rear view of boresighting target stand.



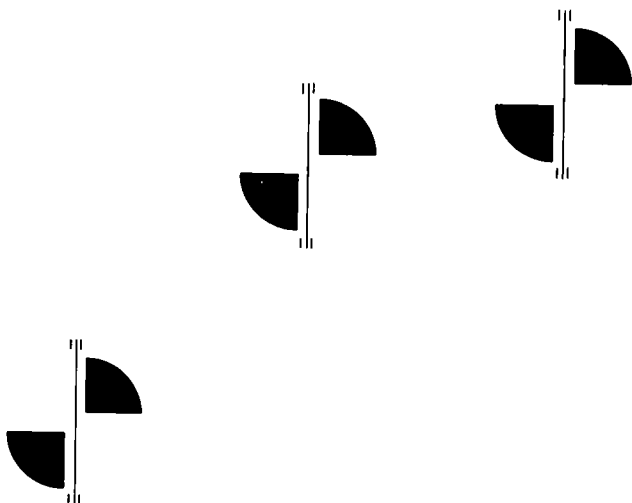
155 -mm Howitzer Carriage M44

Figure 28. Mil scale inscribed on testing target.

arc was drawn and provides a hook from which to suspend a plumb line (fig. 28).

d. Vertical reference lines for use when the trunnions cannot be leveled may be drawn through the centers of each of the diagrams (fig. 29). These lines may be used by setting the test target at an angle to correspond with the cant angle of the howitzer. The target is rotated until the line of sight through the tube tracks the reference line when the tube is elevated or depressed. Similarly, the panoramic telescope should be adjusted so that its reticle tracks the appropriate reference line when the tube is elevated or depressed.

e. To facilitate boresighting in darkness, a $\frac{1}{16}$ -inch hole is bored through the mounted testing target at the



155 — mm Howitzer Carriage M44

Figure 29. Vertical reference lines drawn on testing target.

center of each aiming diagram. A flashlight is held against the target behind the appropriate hole to provide an aiming point for use during blackout conditions. Patches of felt padding are placed on the back of the target covering the regions of each hole so that light from the flashlight will not 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.

124. Cease Firing

The command **CEASE FIRING** is normally given to the howitzer section by the chief of section but, in emergencies anyone present may give the command.

At the command cease firing, regardless of its source, firing will cease immediately. If the howitzer is loaded, the chief of section reports that fact to the executive. The executive acknowledges this report by saying "No. (so-and-so) loaded." If CEASE FIRING came from the fire direction center, firing is resumed at the announcement of the quadrant. If CEASE FIRING came from within the firing battery, the executive will investigate the condition that caused the command to be given. When corrected, firing is resumed at the executive's announcement of the quadrant.

125. Changes in Data During Firing

a. Before Howitzer is Loaded. If it is necessary to correct any element of firing data before the howitzer is loaded, the corrected data is announced. The new data is then set off and firing resumed at the announcement of quadrant.

b. After Howitzer is Loaded. If it is necessary to correct any element of firing data after the howitzer is loaded, the command CEASE FIRE is given. If no change in the fuze setting is required, or if the howitzer is loaded with percussion-fuzed shell, the new data is set off and firing is resumed at the announcement of quadrant. If the howitzer is loaded with time-fuzed shell and the data requires a change in fuze setting, the chief of section suspends firing and reports that fact to the executive, for example, "No. 2 loaded, time (so much)." The howitzer is not unloaded unless unloading is directed by the executive. In continuous fire, changes in data are applied in a manner which permits continued fire without breaking continuity.

126. To Unload Howitzer

A loaded howitzer should always be fired in preference

to being unloaded. When unloading by firing is not feasible, the procedures listed in *a* through *f* below will be followed except in the case of a misfire. Instructions contained in paragraph 187 and TM 9-7004 will be followed in unloading misfires. Additional information on unloading is contained in TM 9-7004. Unloading is supervised by an officer who will inspect the rammer head prior to the operation to insure that it is free of obstructions.

a. At the command UNLOAD, the gunner depresses the tube to zero elevation.

b. The assistant gunner disconnects the firing cable, removes the primer, opens the breech, removes the powder charge, and passes it to No. 6. No. 6 receives the powder charge, then passes waste to the assistant gunner. The assistant gunner fills the chamber with waste and closes the breech.

c. No. 1, assisted by No. 4 if necessary, inserts the rammer head into the muzzle of the howitzer until the head incloses the fuze and comes in contact with the projectile. He pushes firmly, tapping lightly on the end of the rammer staff if necessary, until the projectile is loosened.

d. The assistant gunner opens the breech and removes the waste.

e. Nos. 3 and 5 place the loading tray in the breech recess and receive the projectile as it is slowly pushed out by Nos. 1 and 4, as shown in figure 30.

f. Nos. 3 and 5 then return the projectile to No. 2, who resets the fuze.

127. Care of Ammunition

a. To insure uniform results in firing, to prolong the life of the tube, and to avoid accidents great care must

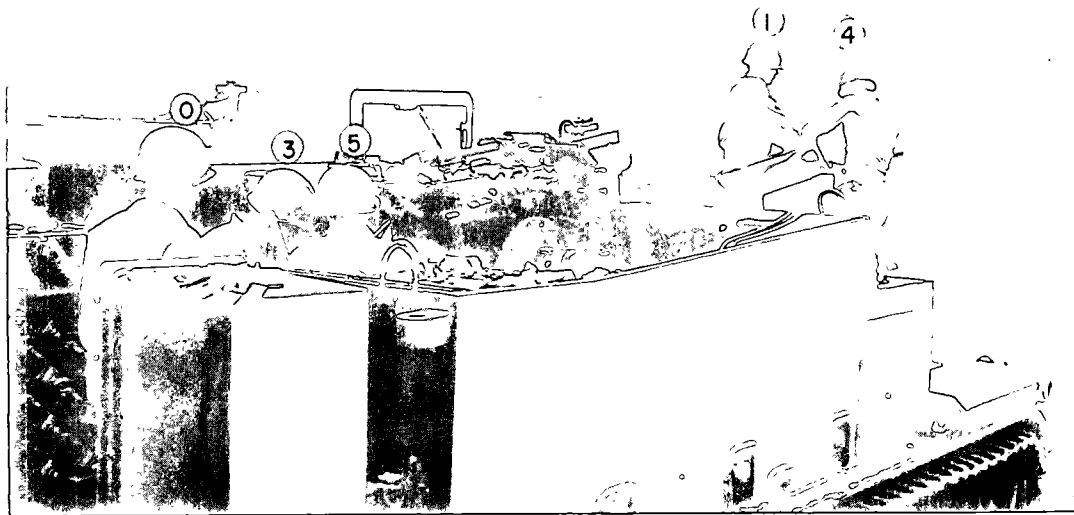


Figure 30. Unloading the howitzer.

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 projectiles are received, they should be sorted into lots and placed in the best available storage. Ammunition data cards should be kept until all ammunition for that lot is expended. The eyebolt lifting plug should not be removed from unfuzed projectiles until the fuze is to be inserted. Protection should be provided against moisture, dirt, direct rays of sun, and, as far as practicable, artillery fire and bombing. Protection against weather, dirt, and sun may be obtained by the use of tarpaulins and dunnage. Projectiles stacked in the open should be raised at least 6 inches off the ground. If drainage is not good, ditches should be dug around stacks. A liberal use of dunnage should be made between layers and covering tarpaulins should be raised at least 6 inches from the stack to insure adequate ventilation. Each stack should contain not more than 50 rounds and should be not more than 3 layers high. Stacks should be at least 10 meters apart.

c. Powder charges should be sorted into lots and protected from sources of high temperatures, including direct rays of the sun. More uniform firing is obtained if the charges are of the same temperature. Powder

charges should not be removed from containers until just before firing.

d. Explosive elements in primers and fuzes are particularly sensitive to shock high temperature; therefore, strict attention should be given to their care and handling. Protection and safety devices should not be removed from fuzes until just before use. No attempt should ever be made to disassemble a fuze into its components.

e. For further information on care of ammunition, see FM 6-140, TM 9-1900, and TM 9-7004.

128. 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 corrections, when appropriate; minimum quadrants; data for barrages and counterpreparations; and other data which may be needed quickly. If such information assumes a standard pattern, the section may paint a form on the turret or on the inside of the hull and chalk in the various items of information in the appropriate spaces.

CHAPTER 8

BORESIGHTING

Section I. GENERAL

129. Description

Boresighting is the process of verifying that the optical axis of the on-carriage fire control equipment is parallel to the axis of the tube of the weapon, both for deflection and, except for the aiming circle method of boresighting, for elevation. Any misalignment discovered through boresighting is corrected as described in paragraphs 134 and 135. The tube should be placed near its center of traverse prior to boresighting. All instruments and mounts must be positioned securely; there must be no free play. Boresighting is conducted before firing and, when necessary, during lulls in firing.

130. Equipment

The following equipment is needed for boresighting:

a. Boresights. Front and rear boresights or improvised substitutes are necessary for all but the standard angle method. If boresights are not available, crosshairs may be fastened on the muzzle, and the obturator spindle vent in the breechblock bushing may be used as a rear sighting guide.

b. Testing Target. A testing target or suitable substitute is needed for certain methods of boresighting. If a testing target is not available, a clearly defined aiming point at least 2,500 meters from the howitzer may be used to accomplish approximately the same purpose as the testing target.

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

131. Conditions

The on-carriage sighting equipment of the weapon is in correct alinement when the following conditions exist:

a. Mounts and instruments are securely attached, and there is no binding or excessive backlash between gears.

b. The line of sight of the panoramic telescope is parallel to the axis of the bore throughout the limits of elevation.

c. All scales and indexes read zero.

d. All bubbles are leveled.

e. The line of sight through the telescope M93 is parallel to the axis of the bore.

f. The bubble in the level vial of the cant corrector is centered.

132. Leveling

a. Although it is not absolutely necessary to level the trunnions for boresighting, it is advisable to do so whenever possible. Accurate results can be obtained more readily if the trunnions are level, because a tilt corresponding to the cant does not have to be introduced in the telescope mount and the testing target when used. To level the howitzer, the tube is first leveled longitudinally and then cross-leveled. In the field, the trunnions can be leveled best by moving the

carriage to level ground or by building up the standing for one of the motor carriage tracks.

b. The best method to check leveling is by means of the plumb line. (It is essential that a plumb line or an improvised substitute be used in the basic periodic test (ch. 9).) 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 minimum elevations and the limits described by the line. The plumb line should be as long as possible and the higher the tube elevations, the more complete the test. When the trunnions are level, the line of sight tracks the plumb line exactly through all elevations. To keep a long plumb line taut, it may be necessary to add weight to the line. 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 31. Additional height may be gained by placing a pole atop a vehicle or other object. A plumb line strung from a building or tree is desirable to gain the height that is needed for the line. Units in garrison may find it convenient to rig a plumb line on a tall building. The line may then be nailed in place for permanent use.

133. Methods of Boresighting

There are four methods for boresighting the howitzer.

- a. Testing target method (pars. 134-138).
- b. Distant aiming point method (pars. 139 and 140).
- c. Aiming circle method (pars. 141-145).
- d. Standard angle method (pars. 146-149).

2"X4" ON EDGE DRILLED TO FIT OVER SPIKE
AND SHAPED TO LIGHTEN FREE END.

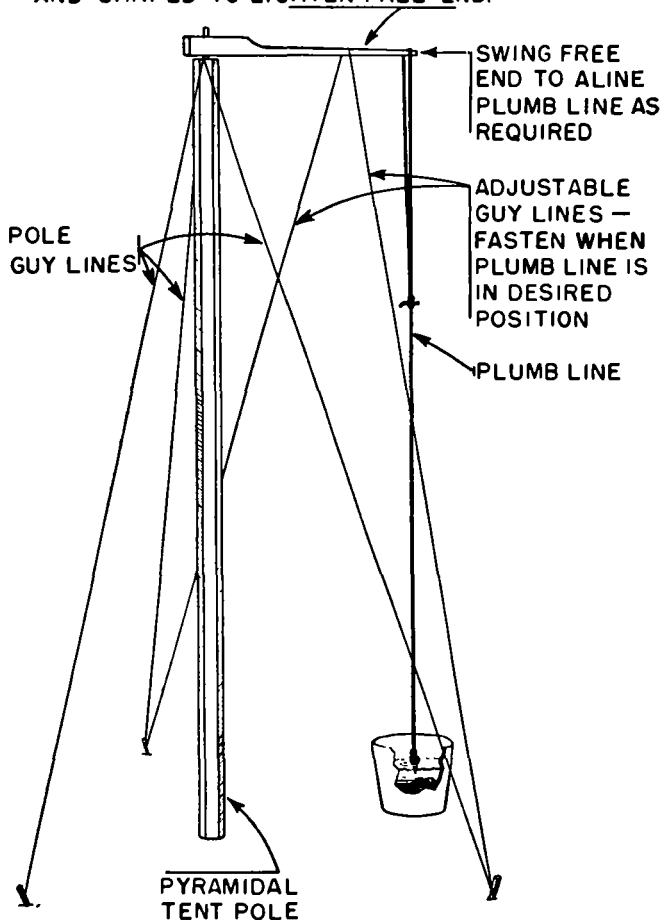


Figure 31. *Improvised plumbline.*

Section II. TESTING TARGET METHOD

134. General

The testing target method of boresighting consists of using the aiming diagrams of the testing target as aiming points. It is essential that the proper testing target be used. The steps to be followed are—

a. Level Trunnions. Level the trunnions as exactly as possible, as described in paragraph 132.

b. Level Tube. Place the gunner's quadrant on the leveling plates of the breech ring and level the tube. Make certain that the shoes of the gunner's quadrant are positioned between the engraved lines on the leveling plates.

c. Boresight. Place the boresight crosshairs on the muzzle and either insert the breech boresight or use the obturator spindle vent.

d. Level Telescope Mount M95. Level the telescope mount M95 in both directions by centering the level bubbles. Mount should be checked with the gunner's quadrant.

e. Testing Target Alinement. Without moving the tube, aline the lower left testing target with the line of sight through the tube (fig. 32). (When testing target reference lines are used, the tube may be elevated and depressed slightly to insure that the testing target is properly alined. If necessary to move the tube to verify the alinement, relevel the tube.) The target should be located at least 50 meters in front of the muzzle. If uneven ground makes it necessary to elevate or depress the tube slightly to make the alinement, position the testing target as described in *f* below.

f. Cant Compensation. If the tube and trunnions are



Figure 32. Alining the testing target.

level, the face of the target must be vertical and the horizontal center lines of the aiming diagrams must be level. This may be ascertained by means of a plumb line attached to the testing target (fig. 28). If the trunnions are slightly canted, the target must be canted an equal amount in the same direction. If the tube is not level longitudinally, the face of the target must be tilted forward or backward accordingly. In all cases, the face of the target must be positioned so that it is at right angles to the line of sight through the tube and the horizontal center lines of the aiming diagrams are parallel to the axis of the trunnions.

135. Panoramic Telescope Lateral Alinement

Set the panoramic telescope scales at zero (par. 38). If the vertical crosshair is not in alinement with its aiming diagram, loosen the tangent locking screws and adjust the tangent screws until the vertical crosshair is properly alined. Tighten the locking screws and verify the adjustment.

136. Panoramic Telescope Horizontal Alinement

If the horizontal crosshair of the panoramic telescope is out of alinement, turn the elevation knob of the telescope until the crosshair is alined properly. Loosen the clamping screws and rotate the scale (zero) into coincidence with the fine elevation indexes. Tighten the clamping screws and verify the adjustment.

137. Elevation Scale, Panoramic Telescope Mount

a. Center the longitudinal-level vial on the panoramic telescope mount by turning the elevation knob. The elevation scale should read zero. If the scale does not read zero, adjust the elevation scale to zero by

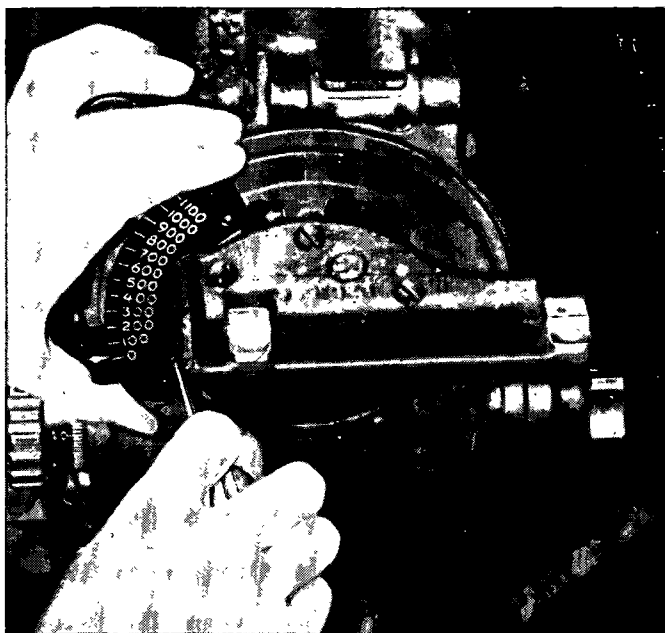


Figure 33. Shifting elevation scale index to zero.

loosening the clamping screws and shifting the scale plate until the zero on the elevation scale is directly opposite the index (fig. 33). Tighten the clamping screws and check the level.

b. If the elevation micrometer does not now read zero, loosen the three small setscrews on the elevation knob and slide the micrometer to aline the zero with its index (fig. 34). Tighten the setscrews, check the reading to see that the scale did not slip, and check the level.

138. Telescope M93 Alinement

The telescope M93 must be adjusted vertically and

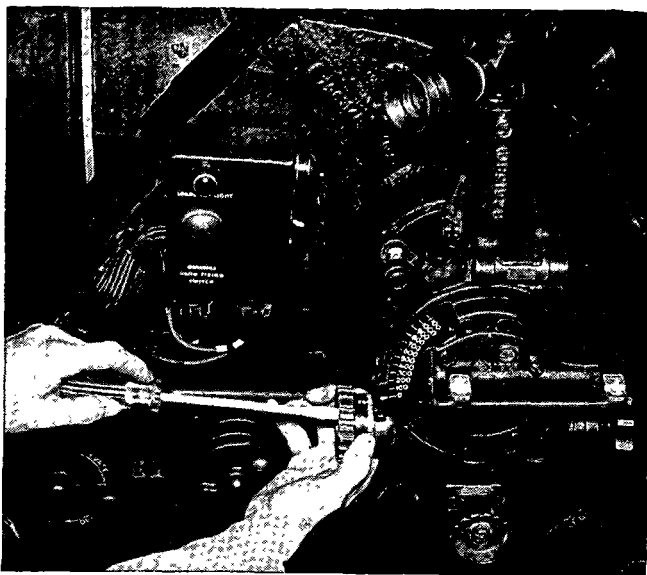


Figure 34. Shifting zero of the elevation micrometer to its index.

horizontally so that the boresight cross, representing zero range and zero deflection on the reticle pattern, is alined with its diagram on the testing target. Adjustment is made as follows:

a. Rotate the cant corrector adjustment knob on the telescope mount M96 until the bubble in the level vial of the cant corrector is centered (fig. 35).

b. To adjust vertically, loosen the locking knob on the boresight elevation adjustment knob (fig. 35). Rotate the adjustment knob until coincidence is obtained. Tighten the locking knob and verify the adjustment.

c. To adjust horizontally, loosen the locking knob on the boresight azimuth adjustment knob (fig. 35).

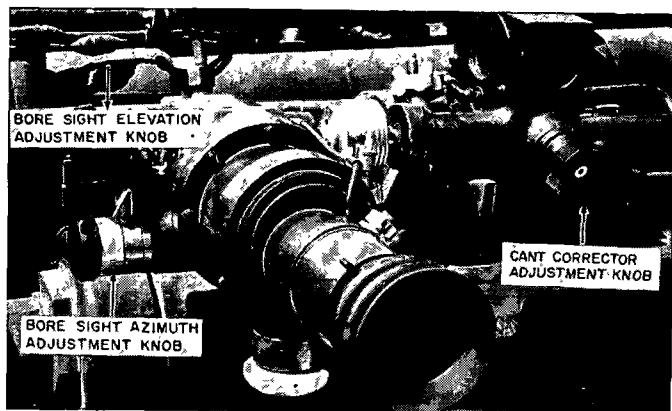


Figure 35. Telescope M93.

Rotate the adjustment knob until coincidence is obtained. Tighten the locking knob and verify the adjustment.

Section III. DISTANT AIMING POINT METHOD

139. General

The distant aiming point method of boresighting consists of aligning the optical axis of the on-carriage fire control equipment and the line of sight through the tube on a common point at least 2,500 meters from the weapon. If the moon or a star is used as an aiming point, care must be taken that the lines of sight through the tube and through the panoramic telescope are on the same point at the same time. Accurate cross-leveling of the trunnions is unnecessary when boresighting on a distant aiming point, because the lines of sight converge on a single point.

140. Procedure, Distant Aiming Point Method

The steps prescribed for the testing target method (pars. 134-138) apply except that the telescopic sights and the line of sight through the tube are aligned on a common distant aiming point instead of on their respective aiming diagrams.

Section IV. AIMING CIRCLE METHOD

141. Preliminary Operations, Aiming Circle Method

Before boresighting with the aiming circle, certain preliminary operations and preparatory steps must be performed, preferably after a basic periodic test (pars. 150-168) when the panoramic telescope mount is in correct adjustment. The greatest care must be exercised in all phases of these steps. All final movements of the instruments must be made so that the crosshair of the reticle approaches the final position from left to right, in order to eliminate the effects of lost motion in the gears.

142. Parallax

Parallax in the aiming circle and the panoramic telescope must be eliminated. Parallax is eliminated from the aiming circle by placing a parallax shield made of dark-colored cardboard or metal in front of the eyepiece lens. This parallax shield should be of the same diameter as the eyepiece lens housing. The shield should have a vertical slot one-sixteenth of an inch wide and one-fourth of an inch long in the exact center. It is held in place with a piece of adhesive tape around the edge of the focusing sleeve (fig. 36). To eliminate parallax from the panoramic telescope, a shield of the same diameter as the eyepiece lens housing

and having an exactly centered hole one-sixteenth of an inch in diameter is mounted in front of the eyepiece lens (fig. 37). A more permanent parallax shield may be constructed of brass or bronze shim stock. When the shield is constructed of metal, a series of fingers approximately three-sixteenths of an inch wide and one-fourth of an inch long separated by $\frac{1}{4}$ -inch spaces should extend beyond the perimeter of the shield. These fingers, which should be bent along the circumference of the circle until they form an angle of 90° with the surface of the shield, serve as a means of clipping the shield in place quickly and permit easy removal. If the eyepiece has a rubber eyeguard, the fingers permit alinement within the guard without its removal.

143. Boresight Marks

The aiming circle method of boresighting requires that boresight marks be located on the top surface of the tube at the muzzle end and on the rear of the breech ring (fig. 38.) The position of these boresight marks must be accurately defined by painting a white stripe about 1 inch wide and several inches long on the tube and from the top of the breech ring to the breech-block carrier. The left edge of the stripe lies in the same vertical plane as the exact center of the bore when the trunnions are level. The location of boresight marks is determined as follows:

- a. Level the trunnions.
- b. Set up an aiming circle equipped with a parallax shield 30 to 50 meters directly in rear of the howitzer.
- c. Fasten crosshairs in the muzzle witness marks.
- d. With adhesive tape, fasten a bright common pin in the top witness mark so that it projects above the muzzle.



Figure 36. Parallax shield on eyepiece of aiming circle.

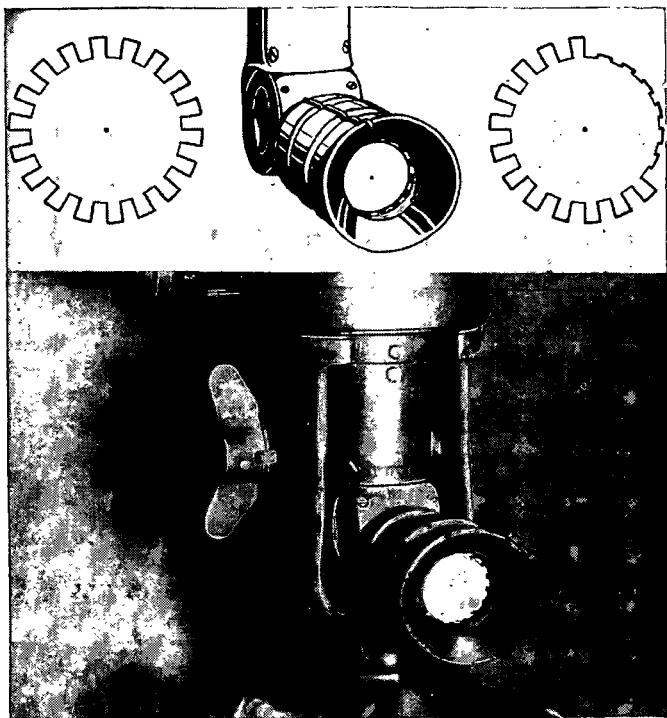


Figure 37. Parallax shield on eyepiece of panoramic telescope.

e. Place the breech boresight in place with two finger holes vertical.

f. Place a straightedge in a vertical position on the rear face of the breech ring and aline the right side of the straightedge with the center hole of the breech boresight and the vertical crosshair on the muzzle.

g. Sight through the aiming circle and, if necessary, traverse the tube until the pin mounted on the muzzle and the right side of the straightedge are alined with

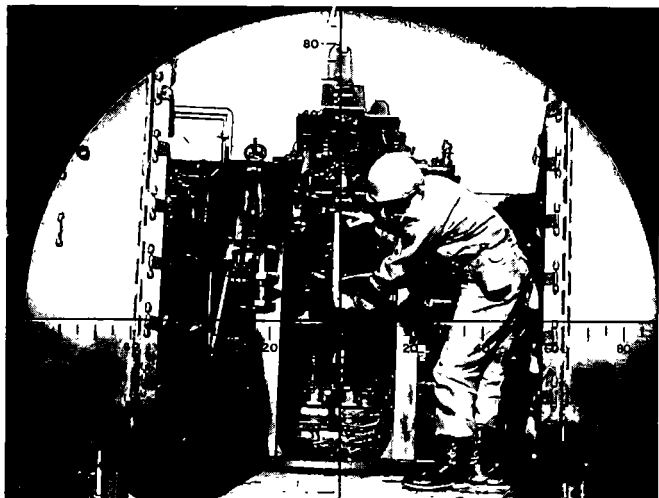


Figure 38. Boresight marks.

the right edge of the vertical crosshair of the aiming circle. Recheck the alinement of the straightedge with the boresight. Draw a pencil line along the right side of the straightedge on the upper rear portion of the breech ring.

h. Lay the straightedge atop the tube at the muzzle along the same line of sight and draw a pencil line. Paint the white stripe on the tube, its left edge exactly on the pencil line.

i. Remove the breech boresight and close the breech. By using the straightedge and the same line of sight, extend the breech pencil line (*g* above) to the breech-block carrier. Paint the white stripe on the breech, its left edge exactly on the pencil line.

j. Open the breech. Depress the tube until the cross-

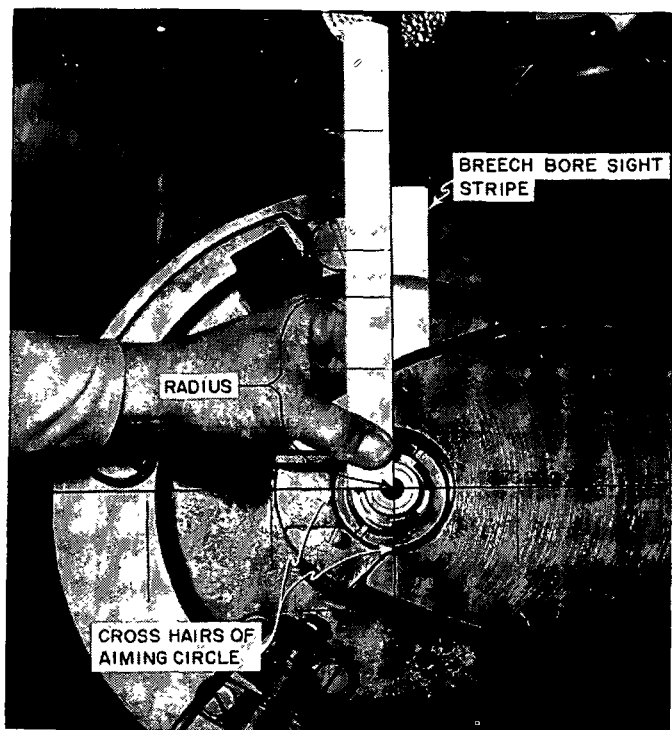


Figure 39. Aligning the base of the radius with the horizontal hair of the aiming circle.

hairs of the aiming circle reticle are directly centered on the muzzle boresight. Close the breech.

k. Measure the *outside* diameter of the muzzle. Divide this measurement by 2, thereby obtaining the radius, and lay off this distance on the straightedge.

l. Place the right edge of the straightedge (*k* above) along the left edge of the breech boresight stripe, with the base of the straightedge (radius) resting on a line

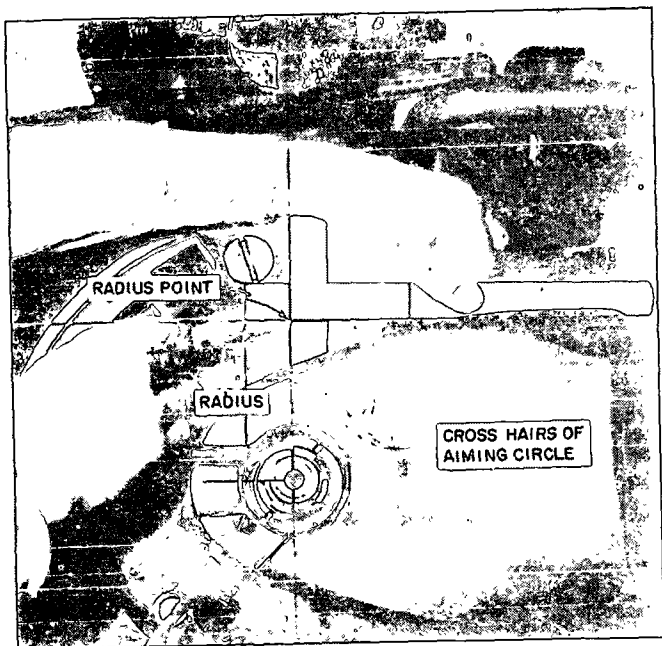


Figure 40. Marking the radius point.

where the aiming circle horizontal crosshair falls across the breech (fig. 39). Keeping the straightedge in place, move the horizontal crosshair upward until it falls across the top of the radius mark on the straightedge by turning the elevating knob of the aiming circle. Then turn the straightedge horizontally against the breechblock driver, alining its lower edge along the horizontal crosshair of the aiming circle (fig. 40). Mark the point where the lower edge crosses the left edge of the breech boresight stripe (fig. 40). This point is the radius point.

m. To make the point easy to identify, paint a short

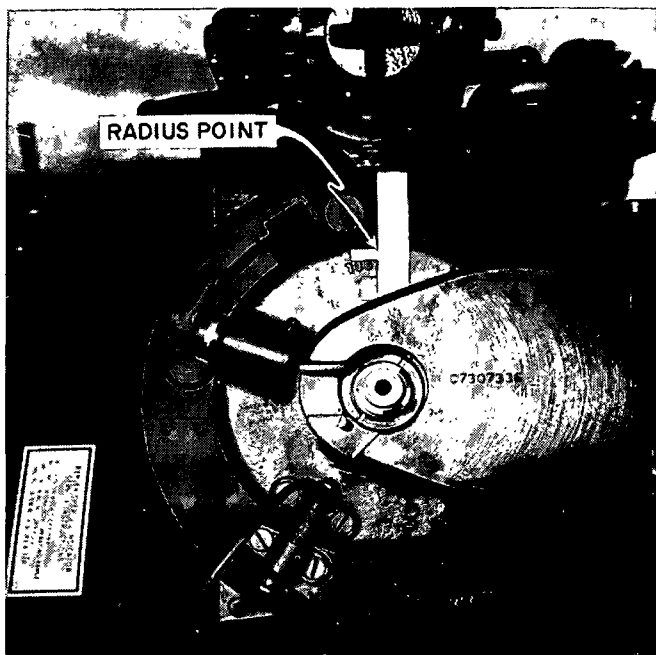


Figure 41. Radius point on the breechblock stripe.

white line to the left, the top of the line being an extension of the point (fig. 41).

144. Procedure (Trunnions Level), Aiming Circle Method

The howitzer having been prepared as in paragraph 143 it may be boresighted at any later time by the aiming circle method as follows:

- a. Set up the aiming circle from 30 to 50 meters in rear of the howitzer.
- b. Zero the scales of the aiming circle and level the instrument.

c. Elevate the tube until the two boresighting 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 boresight marks.

d. By traversing the tube and turning the lower motion of the aiming circle, place the right edge of the vertical crosshair exactly in the line with the left edge of the two boresight stripes.

e. Check that the trunnions are level by elevating and depressing the tube and noting if the two boresight stripes remain parallel to the right edge of the vertical crosshair of the aiming circle. If the trunnions are not level, proceed as in paragraph 145. If the trunnions are level, the radius point is not used. Proceed with *f* through *j* below.

f. Verify that the azimuth scales of the telescope are set at zero, the indexes in coincidence, and the telescope mount bubbles leveled.

g. 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 crosshair.

h. Read the angle on the azimuth scales of the aiming circle (fig. 42).

i. Set the angle from the aiming circle (*h* above) on the azimuth micrometer scale of the panoramic telescope.

j. Adjust the tangent screws on the panoramic telescope until the vertical crosshair 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 crosshairs.

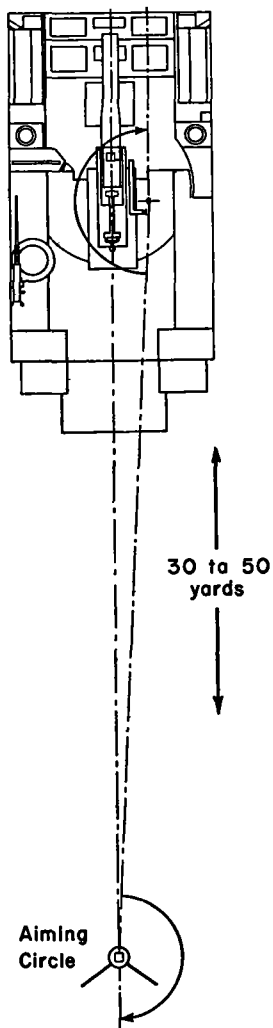


Figure 42. Measuring the boresighting angle with the aiming circle and panoramic telescope.

145. Procedure (Trunnions Not Level), Aiming Circle Method

a. Follow the procedure set forth in paragraph 144a through d. Sighting on the boresight stripes must be made at prescribed points on the stripes when the trunnions are not level. The right edge of the vertical crosshair of the aiming circle must be alined with the top left edge of the muzzle boresight stripe and with the radius point on the left edge of the breech boresight stripe. These two points are of equal distance from the axis of the bore. If this alinement is not accomplished, the line of sight through the aiming circle will not be parallel to a vertical plane through the axis of the bore and error in alinement will result.

b. Proceed with procedures in paragraph 146f through j.

Section V. STANDARD ANGLE METHOD

146. General

When conditions exist to make other methods of boresighting impracticable, the standard angle method may be used. In this method, the alinement of the optical axis of the panoramic telescope parallel to the axis of the bore is tested and adjusted by referring to a selected point on the muzzle. The deflection and elevation angles necessary to refer the line of sight of the telescope to the selected point on the muzzle are referred to as the standard angles (figs. 43 and 44). Once standard angles have been determined, they may be used for a quick test of the alinement of the panoramic telescope when more precise methods cannot be used. Misalinement discovered and corrected as a result of this test should be verified by a more accurate

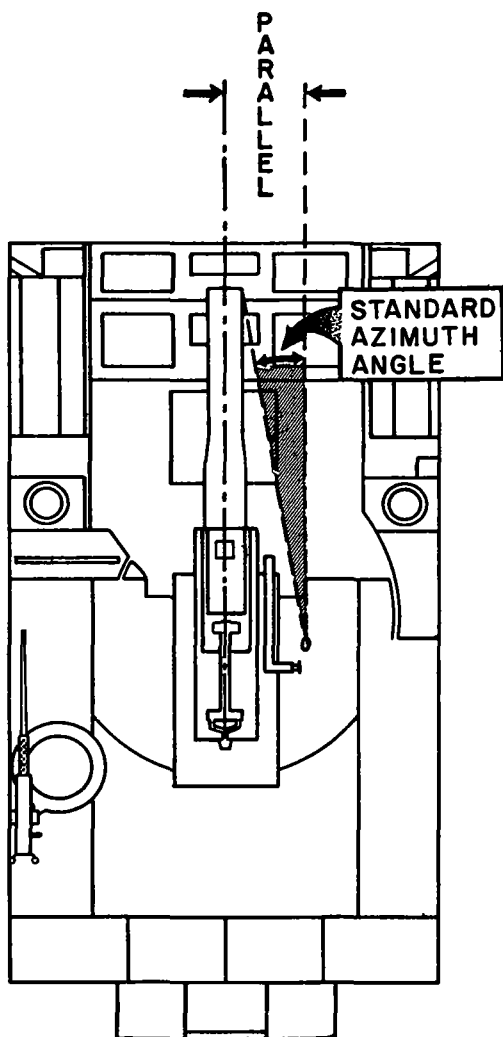


Figure 43. Standard angle (azimuth).

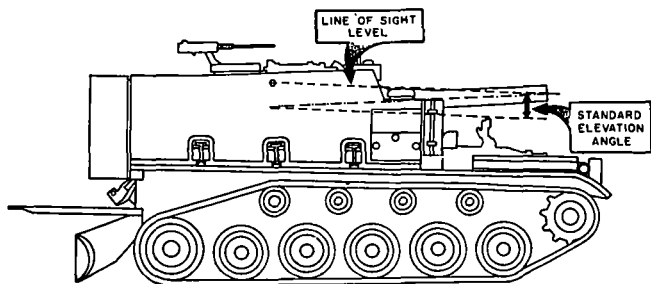


Figure 44. Standard angle (elevation).

method at the earliest opportunity. When the standard angle method of boresighting is used, the position of the recoiling parts with respect to the nonrecoiling parts must be the same as when the standard angles were determined. Standard angles are usable only as long as the same tube-carriage combination is intact. If interchange of tubes or carriages is made, standard angles must be reestablished.

147. Preliminary Operations, Standard Angle Method

The ideal time to determine standard angles for later use is after performing basic periodic tests, when the trunnions are level and the panoramic telescope mount has been found to be in correct alinement. The procedure for determining standard angles is as follows:

a. Verify that the parts that move in recoil are in the correct position with respect to the nonrecoiling parts. To readily establish the above relationship, check that the recoil cylinder shock washer is held firmly against the rear cover of the recoil cylinder by the piston nut.

b. Verify that the trunnions are level.

c. With friction tape, fasten a bright common pin

in the right horizontal witness mark. Allow the pin to project to the right of the muzzle.

d. Fasten the parallax shield over the eyepiece of the panoramic telescope (fig. 37).

e. Verify that the coarse and fine elevation knob indexes on the panoramic telescope mount are at zero.

f. Elevate the tube until the metal pin in the right horizontal witness mark is approximately level with the top of the panoramic telescope.

g. Level the bubbles of the panoramic telescope mount and refer the telescope to the junction of the pin with the muzzle. Adjust the tube elevation and the telescope angle until, with the bubbles level, the horizontal and vertical cross hairs of the telescope are exactly on the junction of the pin with the muzzle (fig. 45).

h. Read the deflection from the azimuth scales of the panoramic telescope to the nearest $\frac{1}{4}$ mil and record it. (Since the graduations are to the nearest mil, it is necessary to interpolate to the nearest $\frac{1}{4}$ mil.) This reading is the standard azimuth (horizontal) angle for the howitzer tested.

i. With the gunner's quadrant or elevation scales, measure the elevation of the tube to the nearest $\frac{1}{4}$ mil. This reading is the standard elevation (vertical) angle for the howitzer tested.

j. With the panoramic telescope mount set as in *g* above, scribe lines with a knife blade or other sharp metal point in the paint on the parts of the telescope mount as shown in figure 44. Care should be taken that the lines are scribed in the paint only and are not cut into the metal. To establish scribed line 1, figure 46, scribe the line straight across the junction of the cross-leveling worm knob shaft and the cross-

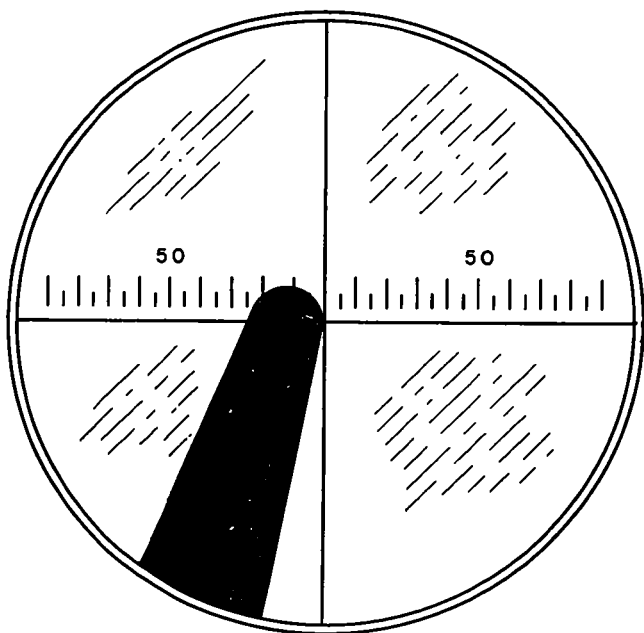


Figure 45. Sight picture of projecting pin.

leveling worm housing. This scribed line is the fine cross-level index. The indexes on the cross-leveling segment and the cross-leveling worm housing (2, fig. 46) are brought into coincidence for coarse cross-leveling. Establish scribed line 3, figure 46. Fill the scribed lines with *red* paint and wipe off the excess. These lines establish control for the telescope mount for use in boresighting with the standard angle method. The positions of the scribed lines are verified at subsequent periodic tests and adjusted if necessary.

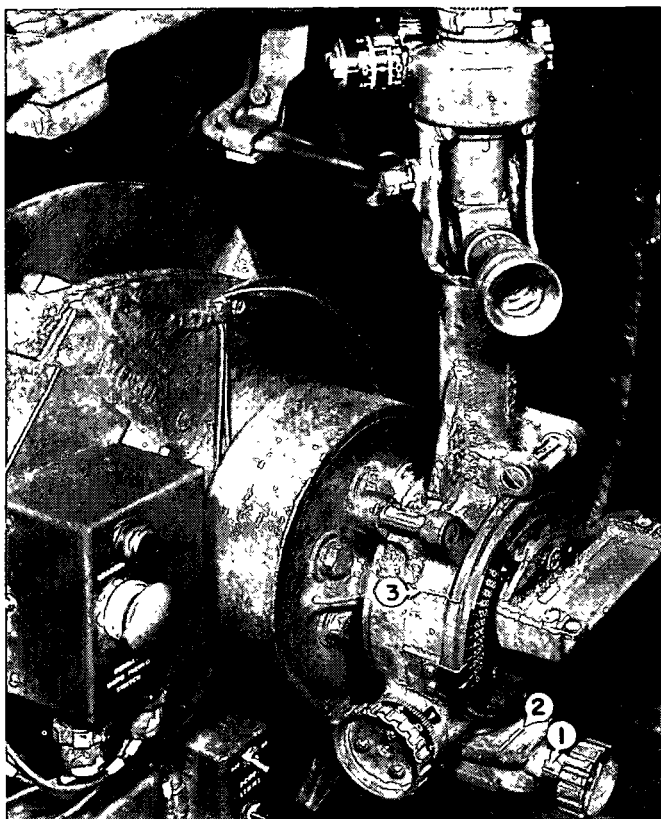


Figure 46. Scribed lines.

148. Procedure Standard Angle Method

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

a. 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. If they are not in the same position, the amount of recoil oil in the recoil mechanism must be checked.

b. With friction tape, fasten a pin in the right horizontal witness mark so that the pin projects out to the right of the muzzle.

c. Place the parallax shield on the eyepiece of the panoramic telescope.

d. Insure that the *red scribed lines* (par. 147j) are alined. Set the standard azimuth angle on the panoramic telescope.

e. If the vertical crosshair of the reticle of the panoramic telescope is not exactly on the junction of the pin and the muzzle, adjust the tangent screws until the vertical crosshair of the reticle is properly alined.

f. If the horizontal crosshair of the 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. If the indexes are not in coincidence, loosen the clamping screws (fig. 47) and adjust the zero of the elevation knob scale so that it is in alinement with the index (fig. 48).

149. Elevation Scales, Panoramic Telescope Mount

To adjust the elevation scales of the panoramic telescope mount, follow the procedure outlined in paragraph 137.

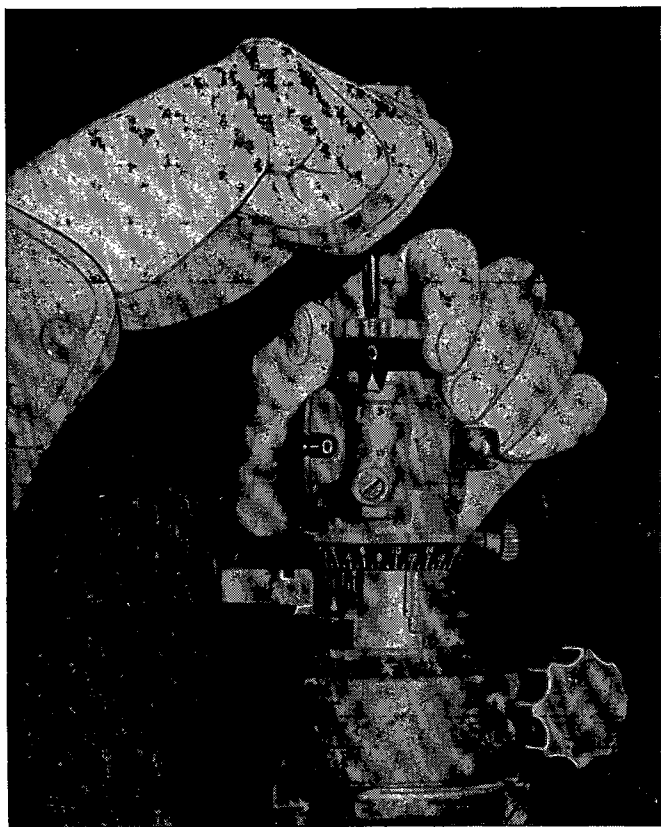


Figure 47. Loosening clamping screws.

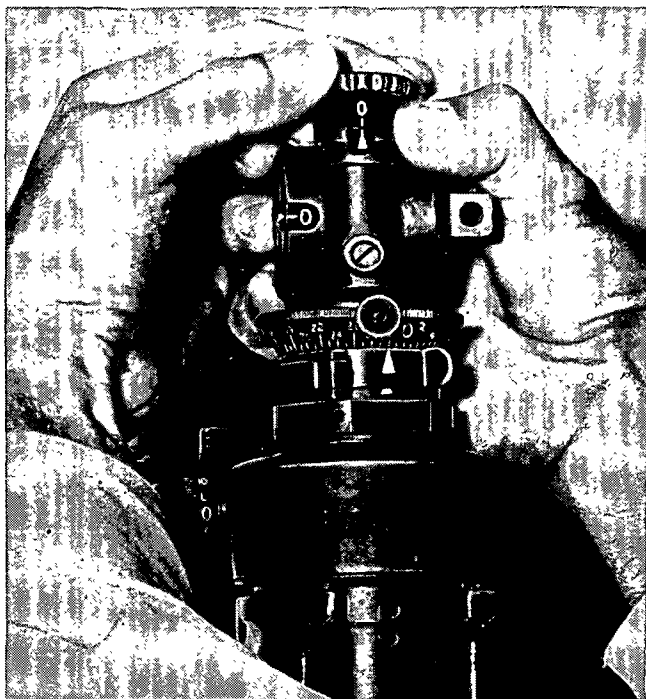


Figure 48. Shifting zero of the elevation knob to its index.

CHAPTER 9

BASIC PERIODIC TESTS

Section I. GENERAL

150. Purpose and Scope

a. The purpose of this chapter is to outline the procedures for making basic periodic tests of on-carriage fire control equipment. The procedures covered include only those that may be accomplished at battery level. It is not contemplated that using units will have the necessary facilities, tools, or skilled personnel to perform the more precise tests and adjustments of sighting and fire control equipment. If the range quadrant, telescope mount M95, or panoramic telescope exceed the tolerance authorized on any of the tests outlined, the howitzer and/or panoramic telescope should be sent to ordnance for adjustment.

b. Basic periodic tests are performed by the section under the supervision of the executive officer 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 howitzer is used for nonfiring training; once every three months if the howitzer is fired; as soon as possible after extensive use, accidents, interchange of tube or carriage, or traveling over extremely rough terrain; and whenever the howitzer fires inaccurately for no readily apparent reason. The tests reveal whether the on-carriage sighting equipment, the gunner's quadrant, and the fuze setter are in correct adjustment.

151. Preliminary Conditions

a. For the on-carriage equipment to be in correct adjustment, the following conditions must exist:

- (1) The line of sight of the panoramic telescope remains in a plane parallel to the vertical plane passing through the axis of the bore as the tube is elevated through its limits of elevation.
- (2) All indexes and scales read zero.
- (3) The panoramic telescope mount M95 longitudinal-level bubble remains centered when the movable cross-level segment is operated throughout its limits.
- (4) The sighting equipment is accurately bore-sighted as described in paragraphs 150 through 165.

b. Prior to all tests of on-carriage fire control equipment, it is essential that the trunnions be level. Leveling the trunnions is most easily accomplished and checked as prescribed in paragraph 132.

152. Preparations

a. Place the motor carriage on a site that is as near level as possible.

b. Boresight the howitzer as prescribed in paragraphs 134 through 138.

c. Suspend a plumb line (par. 132) approximately 5 feet in front of the muzzle or, if a fixed plumb line is used, position the vehicle so that the muzzle is 5 feet from the plumb line.

d. Prepare a parallax shield for the panoramic telescope (par. 142) to eliminate parallax in viewing the plumb line at close range.

Section II. TESTS OF GUNNER'S QUADRANT

153. 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 burs. Similarly, inspect the leveling plates on the upper surface of the breech ring and the gunner's quadrant seat of the telescope mount. Dirt, nicks, or burs on these surfaces will cause the instrument to give inaccurate readings.

154. End-for-End Test, Gunner's Quadrant

a. Set both the radial arm and the micrometer scale of the gunner's quadrant at zero, making sure that the auxiliary indexes match.

b. Place the gunner's quadrant on the longitudinal-leveling plates on the breech ring, with the line-of-fire arrow pointing to the front, and center the quadrant bubble with the elevating mechanism.

c. Reverse the position of the quadrant (turn it end-for-end). If the bubble recenters, the quadrant is in adjustment, and the test is completed.

d. If the bubble does not recentre, try to center it by turning the micrometer knob of the gunner's quadrant. If the bubble centers, read the black figures and divide by 2. This quotient is the correction. Place the correction on the micrometer and again place the quadrant on the longitudinal-leveling plates. Relevel the bubble with the elevating mechanism. Check again by reversing the quadrant. The bubble should center.

e. If the bubble does not center by turning the

micrometer knob as in *d* above, move the radial arm down one graduation (-10 mils). Turn the micrometer until the bubble centers. Add 10 to the reading on the micrometer and divide sum by 2. Place this quotient on micrometer, leaving the arm at minus 10; level the bubble with the elevating mechanism and check by reversing the quadrant. The bubble should now center. Subtract the reading on the micrometer from 10 to obtain the error.

f. Send the quadrant to an ordnance unit if correction of error amounts to more than plus or minus 0.4 mil.

155. Micrometer Test, Gunner's Quadrant

a. Set the radial arm to read 10 mils on the elevation scale, and set the micrometer scale at zero.

b. Place the quadrant on the longitudinal-leveling plates on the breech ring, with the line-of-fire arrow pointing to the front, and center the quadrant bubble with the elevating mechanism.

c. Set the radial arm at zero on the elevation scale and turn the micrometer one revolution to read 10 mils.

d. Reseat the quadrant on the leveling surface. The bubble should center. If the bubble does not center, the micrometer is in error and must be adjusted by ordnance personnel.

Caution: Do not move the tube after the step in *c* above.

156. Comparison Test, Gunner's Quadrant

Compare readings taken at low, medium, and high elevations with all of the gunner's quadrants of a battery on the quadrant seats of a *single* howitzer. The trunnions of the howitzer should be level. Any quadrant differing from the average by more than 0.4

mil at any elevation should be sent to an ordnance unit for adjustment.

157. Correction, Gunner's Quadrant

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 recorded and applied only when making sight tests and adjustments.

Section III. TESTS FOR TELESCOPE MOUNT M95 AND PANORAMIC TELESCOPE

158. Purpose

The purpose of these tests is to determine whether the azimuth compensating mechanism of the telescope mount M95 actually establishes the tube in the correct vertical plane at all elevations (regardless of cant). These tests check the adjustment and mounting of the telescope mount, the setting of the cross-level and longitudinal-level vials, and the alinement of the telescope socket. The test of the telescope mount described in paragraph 159 may be performed with the trunnions either level or canted. It reflects total errors of the entire mechanism. Since compensating errors of various parts of the mount may result in the weapon's testing out properly with this test, the other tests specified in paragraphs 160 through 163 must be performed regardless of the result of the test in paragraph 159. Total errors found in this test may then be reduced to errors in specific components.

159. Telescope Mount M95 Test

a. With the boresights in place and the tube near zero elevation, traverse the howitzer so that the line

of sight through the tube is on the plumb line. Level the telescope mount M95 by centering both the cross-level and longitudinal-level bubbles.

b. Place the intersection of the crosshairs of the panoramic telescope reticle on any sharply defined aiming point and note the deflection.

c. Elevate the tube from zero to maximum elevation (or limit of the plumb line) in 100-mil steps. At each step, traverse the tube (if necessary) to bring the line of sight through the tube back on the plumb line. Relevel the telescope mount M95 in both directions and check for deviation of the line of sight from the aiming point. If the vertical crosshair of the panoramic telescope is off the aiming point, it is returned to the aiming point with the azimuth micrometer knob, and the deviation is measured on the azimuth micrometer. If the horizontal crosshair is off, it is brought to the aiming point with the leveling knobs, and the bubble displacement is noted.

d. If the vertical crosshair of the panoramic telescope deviates from the aiming point by more than $\frac{1}{2}$ mil from the original deflection at any elevation tested, or if the correction for the deviation of the horizontal crosshair causes either of the bubbles to travel in excess of one-half of a vial graduation, the telescope mount M95 is out of adjustment or improperly mounted. The weapon must be referred to authorized ordnance maintenance personnel for adjustment or correction.

160. Telescope Mount M95 Cross-Level Test

a. If the trunnions are not level, as noted in paragraph 167c, level them (par. 132) so that the line of

sight through the tube tracks the plumb line at all elevations.

b. Level the tube longitudinally with the gunner's quadrant.

c. Center the cross-level bubble on the telescope mount M95.

d. Elevate the tube to maximum elevation keeping the telescope mount M95 longitudinal-level bubble level, noting the cross-level bubble.

e. If the cross-level bubble does not remain centered within one-half of a vial graduation, either the telescope mount M95 is misaligned or the cross-level vial is incorrectly set. Refer the mount to authorized ordnance personnel for adjustment.

161. Telescope Mount M95 and Howitzer Alinement Test

a. With the tube placed at any elevation, but preferably not zero, and by turning the elevating manual control handwheel, the elevation is measured with the gunner's quadrant seated on the leveling plates on the breech ring.

b. Place the gunner's quadrant on the quadrant seat which is attached to the telescope mount M95. The level vial bubble will center if the eccentric adjusting pin on the actuating arm is in adjustment.

c. If the quadrant level vial bubble does not center, the bubble is centered by turning the eccentric adjusting pin. The bubble in the longitudinal-level vial is centered by means of the elevation knob on the telescope M95. The elevation scale and the longitudinal-leveling micrometer should read zero. If the elevation scale and the longitudinal-leveling micrometer do not read zero, they must be brought into adjustment.

162. Telescope Mount M95 Socket Alinement Test

- a. Center the cross-level bubble.
- b. With the panoramic telescope scales set at zero, traverse the tube until the vertical crosshair of the telescope reticle is on the plumb line, with both the cross-level and longitudinal-level bubbles on the telescope mount M95 centered.
- c. Sight through the panoramic telescope and rotate the elevation knob throughout its limits of motion. The vertical crosshair should remain on the plumb line within 1 mil.
- d. Set the panoramic telescope scales at 1600 and shift the carriage until the vertical crosshair is on the plumb line, with both the cross-level and longitudinal-level bubbles centered.
- e. Rotate the panoramic telescope elevation micrometer knob throughout its limits of motion. If the intersection point on the reticle deviates from the plumb line by more than $\frac{1}{2}$ mil, refer the mount to authorized ordnance personnel for correction.

163. Telescope Mount M95 Longitudinal-Level Test

- a. Level the telescope mount M95 in both directions.
- b. With the panoramic telescope azimuth scale and micrometer set at 1600, aline the intersection of the telescope reticle crosshairs with the plumb line.
- c. Sight through the telescope and rotate the panoramic telescope elevation knob through the extent of travel.
- d. If the vertical crosshair deviates from the plumb line by more than one-half vertical crosshair deviates from the plumb line by more than $\frac{1}{2}$ mil the longitudinal-level vial is incorrectly set. The mount must be

referred to authorized ordnance personnel for adjustment.

Section IV. TEST OF TELESCOPE MOUNT M96 AND TELESCOPE M93

164. Purpose

The purpose of this test is to determine whether the vertical plane through the axis of the telescope M93 is parallel to the vertical plane through the axis of the bore.

165. Test

a. Rotate the cant corrector adjustment knob on the telescope mount M96 and aline the vertical crosshair of the telescope M93 reticle with the plumb line.

b. Elevate the tube from zero to maximum elevation and check for deviation of the boresighting cross from the plumb line.

c. If the boresighting cross on the reticle deviates from the plumb line by more than $\frac{1}{2}$ mil, misalignment is indicated. Refer the weapon to authorized ordnance maintenance personnel.

Section V. TEST OF FUZE SETTERS

166. General

a. 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.

b. 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.

167. Scale Test

Set the corrector, *if applicable*, to 30 and set any convenient time on the time scale. Test the time scale of the fuze setter by setting several fuzes.

168. Precautions

When live fuzes are used for performing the tests outlined in paragraphs 166 and 167, the following precautions must be taken:

a. Before setting a fuze, make sure 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 time ring. The tolerance amounts to 0.05 second for fuzes having 0.2-second graduations and 0.125 second for fuzes having 0.5-second graduations. If the time setting on the fuze do not agree with the time set on the fuze setter, repeat the test as a check with a different setting. If the time setting on the set still do not agree with the fuze setter, refer the instrument to an ordnance unit for adjustment.

b. Do not set any one live fuze more than twice. Reset all fuzes to SAFE and replace the safety wire or cotter pin.

Warning: The fuze from a dud must never be used.

CHAPTER 10

MAINTENANCE AND INSPECTIONS

169. General

Maintenance and inspections are essential to insure that the 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.

170. Disassembly, Adjustment, and Assembly

Disassemblies and adjustments of the weapon authorized to be performed by battery personnel are prescribed in TM 9-7004, supplemented by instructions contained in the appropriate Department of the Army supply manuals. No deviation from these procedures is permitted unless authorized by the responsible ordnance officer.

171. Records

The principal records pertaining to the weapon is the weapon record book (AR 750-1000-8), formerly artillery gun book. Information on the purpose and use of this record may be found in the record itself. Additional records pertaining to the motor carriage are described in TM 9-2810.

172. Maintenance

For detailed instructions concerning maintenance of the 155-mm howitzer and motor carriage M44, see TM 9-7004 and LO 9-7004.

173. Inspections

Regular inspections are required to insure that materiel 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 informal inspection. Each day he inspects different parts of the weapons to insure complete coverage every few days. At least once a month, the executive makes a thorough mechanical inspection of 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 appearance, condition, and completeness.

d. For details on inspecting the howitzer and motor carriage, see TM 9-7004. Deficiencies found during inspections should be corrected promptly.

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

174. Duties in Inspection Before Operation (March)

The inspection performed before operation is a final check on materiel prior to leaving the motor park for

training in the field, or the bivouac area for combat, or before displacement. Boresighting is accomplished during this inspection if time permits. After inspection and after all deficiencies have been corrected, the motor carriage, howitzer, and auxiliary armament are ready to go into action. For detailed duties of section personnel, see table V.

175. Duties in Inspection During Operation (March)

The inspections performed during operation are constant checks on the functioning of the vehicle and the security of all stowed equipment. The responsibilities and duties of section personnel are as follows:

a. The chief of section insures that march discipline is complied with and assists the driver in detecting obstacles that might cause injury to personnel or damage to the vehicle.

b. The gunner, assistant gunner and numbered cannoneers inspect security of stowed equipment and act as air sentinels as directed by the chief of section.

c. The driver who operates the vehicle inspects all instruments and controls.

176. Duties in Inspection and Maintenance After Operation

Immediately after operation, the motor carriage is given whatever servicing and maintenance is required to prepare for further sustained action or to determine the need for maintenance by higher echelons. Boresighting is accomplished, if time permits. These operations may be performed in the motor park, bivouac area, or combat position. Individual duties of howitzer section personnel are listed in table V.

177. Duties in Weekly Inspection and Maintenance

In garrison, inspection and maintenance duties are performed as directed by the local commander.

a. Chief of Section. The chief of section supervises the section in inspection and maintenance of howitzer motor carriage, tools, accessories, and equipment, (TM 9-7004 and LO 9-7004). He is assisted by the artillery mechanic in performing those operations requiring skills and tools beyond the capabilities of the section.

b. Gunner, Assistant Gunner, and Cannoneers. The gunner, assistant gunner, and cannoneers perform normal maintenance as directed by the chief of section.

c. Driver. The driver performs maintenance on the motor carriage as indicated in TM 9-7004 and LO 9-7004. TM 9-7004 lists the first echelon maintenance services required.

Table V. Maintenance and Inspection Duties
(Located in back of manual)

CHAPTER 11

DECONTAMINATION OF EQUIPMENT

178. General

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

179. Decontamination for Chemical Agents

a. *Ammunition.* Using rags, wipe visible contamination from projectiles. Apply DANC (decontamination agent, noncorrosive, M4), wipe with gasoline-soaked rag, and 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 into 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 from weapons. Do not apply wet mix but allow surfaces to air after oil 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 necessary (FM 21-40), extreme care must be taken to insure that the gasoline does not spread the contaminant and that no gasoline in liquid or vapor form remains. This excess gas would be ignited when the weapon is fired. After decontamination, weapons are dried and oiled.

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

180. 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 the 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 consideration. 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, is carried out in rear areas and repair bases and includes procedures of surface decontamination, aging, sealing, and disposal.

181. References

For further information on decontamination, see FM 21-40 and TM 3-220.

CHAPTER 12

DESTRUCTION OF EQUIPMENT

182. General

a. Tactical situations may arise in which it is 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 a division or higher commander.*

183. Plans for Destruction of Equipment

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

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

b. Destruction must be as complete as the available time, equipment, and personnel will permit. Since complete destruction requires considerable time, priorities must be established so that the more essential parts are destroyed first.

c. The same essential parts must be destroyed on all like units to prevent the enemy from constructing a complete unit from undamaged parts.

d. Spare parts and accessories must be given the same priorities for destruction as the parts installed on the equipment.

e. 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.

184. References

For detailed information on destruction of the 155-mm howitzer, fire control equipment, and motor carriage, see TM 9-7004.

CHAPTER 13

SAFETY PRECAUTIONS

185. General

Safety precautions to be observed in training are prescribed in AR 385-63. Additional information is found in FM 6-40, TM 9-7004, and TM 9-1900. The more important safety precautions are summarized in paragraphs 186 through 188.

186. Ammunition

a. All ammunition at the firing position must be so placed that it is protected against explosion in case of accident at the position. Fire and explosive or flammable materials must be kept away from 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.

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

d. All rounds which have been prepared for firing but not fired must be checked by the chief of section to insure that all powder increments are present in proper order and condition, that the powder increments are of the proper lot number, and that the time fuzes are set on SAFE and the safety wire is present. The chief of section also verifies that the lot number on the powder increments corresponds to the lot number on the container. For ammunition that is to be re-

turned to ordnance, a battery officer must certify that it has been properly reassembled.

187. Misfires

A misfire is a complete *failure* to fire, whereas a hangfire is a *delay* in the functioning of the propelling charges explosive train. These facts have the following significances: Since a misfire could possibly be a hangfire, it is extremely dangerous to open the breech until 10 minutes after all attempts to fire have been made. After this time lapse, spin the firing lock and remove the primer. For detailed procedure in the event of misfire, refer to TM 9-7004.

188. Drill and Firing

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

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

c. Personnel should stay a safe distance from the breech to prevent injury when the howitzer recoils.

d. During firing, personnel should use cotton 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.

CHAPTER 14

TRAINING

Section I. GENERAL

189. Purpose and Scope

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

190. Objective

The objective of a minimum training program is to train each cannoneer in essential knowledges and skills that will enable him to operate effectively as a member of a howitzer section in combat. During training, supervisors should keep in mind the proficiency sought by Army Training Test, ATT 6-117. Maximum efficiency is attained through continuous drills.

191. Conduct of Training

a. Training will be conducted in accordance with the principles set forth in FM 21-5. The goal of training should be the standards set forth in FM 6-125 and AR 611-201.

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 on a progress card which may be maintained by each chief of section 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 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.

192. Standard To Be Attained

A satisfactorily trained howitzer section must be capable of performing the following functions in the times indicated:

a. Firing 10 rounds (drill ammunition) at different deflections, elevations, and time fuze settings, using the same charge, in 5.5 minutes by day and 6 minutes by night. Changes in data should be typical for an area time mission; data is announced from prepared cards.

b. Performing after-firing care and maintenance of armament. The howitzer being in position, clean and lubricate, disassemble and assemble the breech and firing mechanism, and inspect the weapon in 35 minutes by day and 45 minutes by night. All materials and tools required should be available at the position.

c. Performing 6-month inspection and maintenance of armament. After the howitzer has been prepared for action in the gun park, clean and lubricate all parts

and assemblies as authorized, and prepare for ordnance inspection, in $2\frac{1}{2}$ hours. All materials and tools required should be available in the gun park.

d. Each member of the howitzer section should know the duties of all other members of the section and be able to perform efficiently in all positions. See chapter 15 for tests to be given for the qualification of gunners.

Section II. MINIMUM TRAINING SCHEDULE

193. General

The training schedule outlined in paragraph 195 is a guide to meet the minimum training requirements in subjects covered in this manual for personnel of a howitzer section.

194. Individual Periods

a. Individual periods of training in service of the howitzer 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. Periods of howitzer drill should be for only $\frac{1}{2}$ hour and should be conducted in a vigorous manner.

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

d. TM 9-7004 provides information on which to base periods of instruction on description, characteristics, and functioning of the howitzer; familiarization with the howitzer, including breech and firing mechanism, barrel assembly and slides, recoil mechanism, elevating mechanism, sighting and fire control equipment; and field assembly and malfunctions. These periods of instruction should be included in the battery training schedule, closely allied with the training in service of the howitzer outlined in paragraph 195. Approximately 8 hours should be devoted to this instruction.

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

195. Schedule

C—conference; D—demonstration; PW—practical work.

Total hours 78

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW	1	Organization and composition of howitzer section, general duties of individuals, and formation of howitzer section.	Pars. 2-9.	Howitzer and motor carriage.
C, D, PW	1	Posts and posting, changing posts, and mounting and dismounting.	Pars. 10-14.	Do.
C, D, PW	2 (1-hour periods)	Prepare for action and march order.....	Pars. 15-18.	Do.
C, D, PW	24 (½-hour periods)	Howitzer drill, duties in firing by indirect laying.	Pars. 19-88, 119, 124, 128.	TOE equipment.
C, D, PW	9 (½-hour periods)	Howitzer drill, duties in firing by direct laying.	Pars. 89-118.	Do.
C, D, PW	6 (1-hour and ½-hour periods)	Test and adjustment of sighting and fire control equipment.	Pars. 129-168.	TOE equipment.

Method	Hours	Subject	Text references	Training aids and equipment
C, D, PW	2 (½-hour periods)	Aiming post displacement correction.....	Pars. 120.	TOE equipment and blackboard and chalk.
C, D, PW	4 (1-hour periods)	Inspections and maintenance drills.....	Pars. 169-177.	TOE equipment.
C, D, PW	1	Decontamination of materiel.....	Pars. 178-181.	Decontamination and TOE equipment.
C, D, PW	1	Destruction of materiel to prevent use by the enemy.	Pars. 182-184.	Demolition and TOE equipment.
C, D	1	Safety precautions.....	Pars. 185-188.	TOE equipment.
PW	16 (4-hour periods)	Service practice, firing by indirect laying.	Pars. 19-89, 119-128.	Do.
PW	4	Service practice, firing by direct laying...	Pars. 89-118.	Do.
C, PW	6 (1-hour periods)	Review and tests of subjects previously covered.	All previous references.	Do.

CHAPTER 15

TESTS FOR QUALIFICATION OF GUNNERS

Section I. GENERAL

196. Purpose and Scope

This chapter prescribes the tests to be given in the qualification of gunners. The purposes of the tests are—

a. To provide a means of determining the relative proficiency of the individual artillery soldier in the performance of the duties of the gunner, 155-mm howitzer M44 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.

197. General Instructions, Standards of Precision

The candidate will be required to perform the tests in accordance with the standards listed in *a* through *d* below.

a. Scale settings must be exact, and matching indexes must be brought into coincidence.

b. Level bubbles must be exactly centered.

c. The vertical crosshair 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 howitzer is laid.

d. Final motions of azimuth and elevation setting knobs, as well as traversing and elevating handwheels, must be made in the appropriate direction. Final motion for setting scales is from lower to higher num-

bers. For elevation, the final motion of the hand-wheel should be in the direction of the more difficult movement. Final motion for traversing is from left to right. Final movement of the vertical crosshair of the telescope is from left to right.

198. 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.

199. 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.

200. Scoring

Scoring will be conducted in accordance with the two paragraphs entitled PENALTIES and CREDIT under each subject. If a test is performed correctly, credit will be given in accordance with the paragraphs entitled CREDIT under each subject. No credit will be allowed if conditions exist as specified in the paragraphs entitled PENALTIES. No penalty will be assessed in excess of the maximum credit for each test.

201. Preparation for Tests

The howitzer will be prepared for action and the candidate posted at the proper position corresponding to the test being conducted or as indicated in the

paragraphs 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.

202. Qualification Scores

Minimum scores required for qualification in the courses are as follows:

<i>Individual Classification</i>	<i>Points</i>
Expert gunner	90
First-class gunner	80
Second-class gunner . . .	70

203. Outline of Tests

Section	Subject	Number of tests	Points each	Maximum credit
II	Direct laying, panoramic telescope.....	4	2	8
III	Indirect laying, deflection only.....	18	2	36
IV	Laying for quadrant with elevation scale.....	3	2	6
V	Laying for quadrant with gunner's quadrant.....	3	2	6
VI	Displacement correction.....	1		6
	Part I.....		5	(5)
	Part II.....		1	(1)
VII	Measuring site to the mask.....	1	4	4
VIII	Measuring quadrant.....	1	4	4
IX	Referring the howitzer.....	1	5	5
X	Test and adjustment of sighting and fire control equipment.....	6		10
	Test 1.....	(1)	2	(2)
	Tests 2, 3, 4, and 5.....	(4)	1	(4)
	Test 6.....	(1)	4	(4)
XI	Material.....	3	5	15
Total credit.....				100

Section II. DIRECT LAYING, PANORAMIC TELESCOPE

204. Score of Tests

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 paragraph 206. Tests 1 and 2 (3 and 4) will be executed as one series of commands.

205. Special Instructions

a. A stationary target will be placed approximately 600 yards from the howitzer.

b. The candidate will be posted as gunner.

c. The howitzer will be pointed so that a shift of approximately 100 mils is required for tests 1 and 3 and the motor carriage need not be moved for any of the 4 tests.

d. Laying at the termination of tests 1 and 3 will not be disturbed at the beginning of tests 2 and 4.

e. The examiner will announce the assumed direction of movement of the target before tests 1 and 3. The assumed direction of movement of the target in test 3 will be opposite to that in test 1.

206. Outline of Tests

Test number	Examiner commands	Action of candidate
1 and 3	THAT TANK, SHELL HE, CHARGE 7, FUZE QUICK, LEAD 10, RANGE 800.	Performs appropriate duties as described in paragraphs 110-116, traversing tube until proper lead has been set. Places proper range line of reticle on the center of the visible mass of the target. Calls "Ready" when the operations are complete and steps clear.
2 and 4	RIGHT (LEFT) 3, DROP 200.	Do.

207. Penalties

No credit will be allowed if, after each test—

- a. The lead in mils is not indicated properly.
- b. The proper range line of the reticle is not on the center of the visible mass of the target.
- c. The bubble in the level vial of the cant corrector was not centered prior to movement of the tube.

208. Credit

Time in seconds, exactly or less than	6	7	8
Credit-----	2.0	1.5	1.0

Section III. INDIRECT LAYING, DEFLECTION ONLY

209. Scope of Tests

Eighteen tests (two groups of nine tests each) will be conducted in which the candidate will be required to execute commands similar to those given in paragraph 211. Tests 1 through 9 (10 through 18) will be executed as one series of commands.

210. Special Instructions

- a. Commands will not necessitate movement of motor carriage.
- b. The examiner will select a suitable aiming point and identify it to the candidate.
- c. Commands for special corrections will be given *only* in the tests indicated in the examples in *d* below.
- d. 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
6 and 15.....	260	210
7 and 16.....	100	60
8 and 17.....	50	30
9 and 18.....	20	10

e. The howitzer will be laid with the correct settings at the conclusion of each test before proceeding with the next test.

f. For these tests aiming posts will be set out at deflection 600 with the far aiming post 100 meters from the sight.

g. The examiner will designate the section number of the howitzer to be used and will announce, when applicable, special corrections in deflection to be applied by the candidate.

h. The candidate will be posted as gunner.

211. Outline of Tests

Test number	Examiner commands	Action of candidate
1 and 10	SPECIAL CORRECTIONS, DEFLECTION 600, NO. 1, LEFT 7.	Sets deflection and applies special correction. Centers cross-level and longitudinal-level bubbles. Traverses tube until vertical crosshair is on left edge of aiming posts. Checks centering on bubbles. Re-lays if necessary.
2 and 11	DEFLECTION 600.	Calls "Ready" and steps clear. Sets deflection. Leaves correction on gunner's aid. Lays on aiming posts. Checks centering on bubbles. Re-lays if necessary.
3 and 12	DEFLECTION 600.	Calls "Ready" and steps clear.
4 and 13	DEFLECTION 600 NO. 1, RIGHT 4.	Same as test 2 above. Same as test 2 above but changes gunner's aid to right 4, and sets deflection 600 opposite index.

Test number	Examiner commands	Action of candidate
	At conclusion of test 4 (13) give END OF MISSION. (No time considered for this operation.)	Gunner moves gunner's aid to zero.
5 and 14	AIMING POINT, CHURCH STEEPLE (or such-and-such), REFER.	Refers panoramic telescope to church steeple.
6 and 15	DEFLECTION 600, REFER.	Reads deflection and calls "No. 1, deflection (so much)." Slips the slipping azimuth micrometer to zero. Slips the slipping azimuth scale to 600. Verifies that vertical crosshair of the reticle is on church steeple. Calls "No. 1, deflection 600." Steps clear.
7 and 16	SPECIAL CORRECTIONS, DEFLECTION 600, NO. 1, LEFT 7.	Same as test 1 above.
8 and 17	DEFLECTION 600.	Same as test 2 above.
9 and 18	DEFLECTION 600.	Same as test 2 above.

212. Penalties

- a. No credit will be allowed if, after each test—
- (1) Deflection is set incorrectly.
 - (2) Cross-level or longitudinal-level bubble is not centered.
 - (3) Vertical crosshair of the telescope is not on the aiming point or left edge of aiming posts, as the case may be.
- b. No credit will be allowed if the last motion of the traverse was not from left to right.

213. Credit

Time in seconds, exactly or less than—

Tests 1, 10, 6 and 15, each.....	13	14	15
Other tests, each.....	8	9	10
Credit.....	2.0	1.5	1.0

Section IV. LAYING FOR QUADRANT WITH ELEVATION SCALE

214. Scope of Tests

Three tests will be conducted in which the candidate will be required to execute commands similar to those given in paragraph 216.

215. Special Instructions

- a. Each test will require a change of settings and the accompanying laying of the tube in quadrant within the limits of 20 to 40 mils.
- b. Commands for quadrant elevation for tests 2 and 3 will not be made in multiples of 5 mils.
- c. Candidate will be posted as the gunner.
- d. Quadrant setting on the elevation scale prior to test 1 will be within 40 mils of the initial quadrant for the test.

216. Outline of Tests

Test number	Examiner commands	Action of candidate
1	QUADRANT 280.	Sets announced quadrant. Centers cross-level and longitudinal-level bubbles. Calls "Ready" and steps clear.
2	QUADRANT 316.	Same as test 1 above.
3	QUADRANT 351.	Same as test 1 above.

217. Penalties

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

- (1) Quadrant is set incorrectly.
- (2) Cross-level and longitudinal-level bubbles are not centered.

b. 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.

218. Credit

Time in seconds, exactly or less

than	4	5 $\frac{2}{5}$	6 $\frac{4}{5}$
Credit	2.0	1.5	1.0

Section V. LAYING FOR QUADRANT WITH GUNNER'S QUADRANT

219. Scope of Test

Three tests will be conducted in which the candidate will be required to execute commands similar to those given in paragraph 221.

220. Special Instructions

a. Gunner's quadrant will be set at zero for the first test.

b. Each succeeding test will require a change of quadrant setting within the limits of 30 to 60 mils.

c. Candidate will be posted facing the breech with the gunner's quadrant in his hand.

d. An assistant, selected by the candidate, will be posted to the left of the telescope mount M95 to operate the elevating handwheel.

221. Outline of Tests

Test number	Examiner commands	Action of candidate
1	QUADRANT 180.	Sets quadrant elevation on gunner's quadrant. Seats quadrant on telescope mount seat. Has assistant elevate or depress the tube until the quadrant bubble is centered. Calls "Ready" and waits for examiner to verify laying.
2	QUADRANT 237.	Same as test 1 above.
3	QUADRANT 205.	Same as test 1 above.

222. Penalties

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

- (1) Quadrant elevation is set incorrectly.
- (2) Quadrant is not properly seated.
- (3) Quadrant bubble is not properly centered.

b. 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.

223. Credit

Time in seconds, exactly or less than 8	8 $\frac{3}{5}$	9
Credit-----	2.0	1.0

Section VI. DISPLACEMENT CORRECTION

224. Scope of Test

One test, consisting of two parts, will be conducted in which the candidate will be required to execute the commands given in paragraph 226.

225. Special Instructions

a. Aiming posts will be set out at the prescribed distances.

b. An assistant, selected by the candidate, will be stationed near the far aiming post.

c. Examiner will require the candidate to lay the howitzer on an announced deflection and report "I am ready."

d. Motor carriage will then be moved so that an aiming post displacement of 5 to 10 mils occurs.

e. Laying on the howitzer at the termination of part I will not be disturbed for part II.

226. Outline of Test

a. Part I.

Examiner commands	Action of candidate
CORRECT FOR DIS- PLACEMENT.	Lays the howitzer so that the far aiming post appears midway between the near aiming post and the vertical crosshair of the panoramic telescope. Checks centering of bubbles. Re-lays if necessary. Calls "Ready" and steps clear.

b. Part II.

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

227. Penalties

No credit will be allowed if during—

a. Part I.

- (1) Far aiming post does not appear midway between the near aiming post and the vertical crosshair of the telescope.
- (2) Cross-level and longitudinal-level bubbles are not centered.
- (3) Final motion of traverse was not from left to right.

b. Part II.

- (1) Deflection is other than the announced deflection.
- (2) Aiming posts are not properly alined.
- (3) Vertical crosshair of the telescope is not on the left edge of the aiming posts.

228. Credit

Part I, time in seconds, exactly

or less than.....	6	7	8	9
Credit.....	5.0	4.0	3.0	2.0

Part II, no time limit

Credit..... 1.0

Section VII. MEASURING SITE TO MASK

229. Scope of Test

One test will be conducted in which the candidate will be required to execute the command given in paragraph 231.

230. Special Instructions

a. The howitzer, prepared for action, will be placed 200 to 400 meters from a mark of reasonable height.

b. 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.

c. The candidate will take post at the rear of the breech.

d. An assistant, selected by the candidate, will be stationed at the post of the gunner to operate the elevating and traversing mechanism.

231. Outline of Test

Examiner commands	Action of candidate
MEASURE SITE TO MASK.	Sights along lowest element of bore and directs the elevating and traversing of the tube until line of sight just clears the highest point of the crest. Centers cross-level bubble; centers longitudinal-level bubble by turning elevation knob. Reads elevation from elevation scale and micrometer. Reports "No. (so-and-so), site to the mask (so much)."

232. Penalties

No credit will be allowed if—

- Line of sight along the lowest element of the bore does not just clear the highest point of the crest.
- Cross-level and longitudinal-level bubbles are not properly centered.
- Site is announced incorrectly.
- Last movement of the tube was not in the direction in which it is most difficult to turn the elevating handwheel.

233. Credit

Time in seconds, exactly or less

than.....	14	15	16	17
Credit.....	4.0	3.0	2.0	1.5

Section VIII. MEASURING QUADRANT

234. Scope of Test

One test will be conducted in which the candidate will be required to measure the quadrant.

235. Special Instructions

Prior to the test, the examiner will lay the tube at a selected quadrant, measure the quadrant with the elevation scales, and then turn the elevation and cross-leveling knobs so that the scales and level bubbles have to be brought to their correct positions by the candidate.

236. Outline of Test

Examiner commands	Action of candidate
MEASURE THE QUADRANT	Centers cross-level bubble; centers longitudinal-level bubble by turning elevation knob. Reads quadrant from elevation scale and micrometer. Reports "No. (so-and-so), quadrant (so much)."

237. Penalties

No credit will be allowed if—

- Cross-level and longitudinal-level bubbles are not centered properly.
- Quadrant was announced incorrectly.

238. Credit

Time in seconds, exactly or less

than -----	8	9 $\frac{2}{5}$	10 $\frac{3}{5}$
Credit -----	4.0	3.0	2.0

Section IX. REFERRING HOWITZER

239. Scope of Test

One test will be conducted in which the candidate will be required to refer (measure and report a deflection) in accordance with the command given in paragraph 241.

240. Special Instructions

a. The howitzer will be laid with aiming posts to the right front.

b. A well-defined 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.

241. 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 bubbles. Refers to aiming point. Reads deflection and reports, "No. (so-and-so), deflection (so much)" and steps clear.

242. Penalties

No credit will be allowed if—

a. Cross-level and longitudinal-level bubbles are not centered properly.

b. Vertical crosshair of the panoramic telescope is not on the aiming point.

c. Deflection is announced incorrectly.

d. Traversing handwheel is turned.

243. Credit

Time in seconds, exactly

or less than.....	5	5 $\frac{3}{5}$	6	6 $\frac{3}{5}$
Credit.....	5.0	4.0	3.0	2.5

Section X. TEST AND ADJUSTMENT OF SIGHTING AND FIRE CONTROL EQUIPMENT

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

245. Special Instructions

a. The howitzer will be prepared for the test as indicated in paragraph 151.

b. The equipment that will be needed for the tests includes boresights, testing target, gunner's quadrant, and plumb line.

c. The candidate will select an assistant(s) 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 6.

d. The tests will be conducted in the sequence indicated in paragraph 246. After completion of test 2, the gunner's quadrant used in tests 1 and 2 will be used for tests 3 and 4, with the proper correction, as determined in test 1, carried on the quadrant, provided the correction does not exceed 0.4 mil.

e. Adjustments that the candidate may be required to accomplish will fall within the following limits:

(1) *Elevation scale.*

(a) Elevation scale telescope mount M95, not to exceed one 100-mil graduation.

(b) Elevation micrometer not to exceed ten 1-mil graduations.

(2) *Panoramic telescope.*

(a) Rotating head elevation indexes (coarse), none.

(b) Rotating head elevation indexes (fine), not to exceed $\frac{1}{4}$ turn.

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

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

(3) *Panoramic telescope mount.* Actuating arm, not to exceed 10 mils out of alinement with base.

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

246. Outline of Tests

Test number	Examiner commands	Action of candidate
1	PERFORM END-FOR-END TEST ON GUNNER'S QUADRANT.	Perform test as prescribed in paragraph 154.
2	PERFORM MICROMETER TEST ON GUNNER'S QUADRANT.	Calls "Correction (so many) mils, quadrant serviceable (unserviceable)" and hands quadrant to examiner for verification.
3	TEST ACTUATING ARM. <i>Note.</i> Level tube at the conclusion of test 2. <i>Caution:</i> Do not turn cross-leveling or elevation knob of the telescope mount after this test.	Performs test as prescribed in paragraph 155.
4	TEST LEVELS ON TELESCOPE MOUNT M95. <i>Caution:</i> Do not turn cross-leveling or elevation knobs of the telescope mount after this test.	Calls "Quadrant micrometer is (is not) in error." Performs tests and makes adjustments, if necessary, as prescribed in paragraph 161. Calls "Ready" when adjustment is complete.
		Performs tests as prescribed in paragraphs 160 and 163. Calls "Cross- (longitudinal-) level bubble (s) within (without) allowable limit.

Test number	Examiner commands	Action of candidate
5	<p>TEST THE ELEVATION SCALES.</p> <p><i>Note.</i> Prior to test 6, 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(s), as described in paragraph 134.</p>	<p>Performs tests and makes adjustments, if necessary, as prescribed in paragraph 137<i>a</i> and <i>b</i>. Calls "Ready" and steps clear.</p>
6	<p>BORESIGHT THE HOWITZER.</p>	<p>Performs tests and makes adjustments as prescribed in paragraphs 134 through 138. Calls "Ready" and steps clear.</p>

247. Penalties

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. No credit will be allowed if during—

a. Test 1.

- (1) Bubble of the gunner's quadrant does not center when verified by the examiner.
- (2) Error (one-half of the angle that was indicated when the quadrant was first reversed and the bubble centered by moving the index arm and micrometer) is announced incorrectly by the candidate.
- (3) 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.
- (4) Time to complete the test exceeds 2 minutes.

b. Test 2.

- (1) Procedure is not followed correctly.
- (2) Time to complete the test exceeds 1 minute.

c. Test 3.

- (1) Procedure was not followed correctly.
- (2) Time to complete the tests and adjustments exceeds 3 minutes.

d. Test 4.

- (1) Bubble of the gunner's quadrant is not centered in either direction.
- (2) Candidate does not announce correctly in regard to the status of either the cross-level or the longitudinal-level bubble.
- (3) Time to complete the test and adjustments exceeds 6 minutes.

e. Test 5.

- (1) Elevation micrometer does not read 0 when the elevation scale reads zero.
- (2) Cross-level and longitudinal-level bubbles are not properly centered.
- (3) Time to complete the tests and adjustments exceeds 3 minutes.

f. Test 6.

- (1) Candidate fails to make any adjustment when such adjustment is indicated.
- (2) Elevation indexes (coarse and fine) on the rotating head are not in coincidence.
- (3) Zero line of either the azimuth scale or azimuth micrometer is not in coincidence with its respective index.
- (4) Center line of the bore, as viewed through the bore sights or the line of sight of the panoramic telescope do not fall on their respective sighting points on the testing target when all the scales are set at zero.
- (5) Time to complete the tests and adjustments exceeds 4 minutes 30 seconds.

248. Credit

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.....	1
Test 4.....	1
Test 5.....	1
Test 6.....	4
<hr/>	
Total.....	10

Section XI. MATERIEL

249. Scope of Tests

The candidate will be required to perform three tests as outlined in paragraph 251.

250. Special Instructions

a. Tests 1 and 2. For tests 1 and 2 a paulin will be placed on the hull door 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. The candidate may have an assistant to aid him in lowering and lifting the breechblock.

b. Test 3. For test 3—

- (1) A complete set of lubrication equipment authorized for the use of battery personnel, including lubrication order will be made available on a nearby paulin.
- (2) Every type of lubricant, in plainly labeled containers, used on the howitzer will be placed on the paulin.

251. Outline of Tests

Test number	Examiner commands	Action of candidate
1	DISASSEMBLE BREECH AND FIRING LOCK.	Performs the operation as described in TM 9-7004, laying the parts on the paulin.
2	ASSEMBLE BREECH AND FIRING LOCK.	After disassembly, identifies all parts to examiner. Performs the operation as described in TM 9-7004.
3	DAILY, WEEKLY, AND MONTHLY LUBRICATION TEST.	Selects proper lubricating equipment and lubricant and shows <i>how</i> , <i>when</i> , and with <i>which lubricant</i> each lubrication point on the howitzer is serviced. (Actual lubrication is not performed.)

252. Penalties

a. 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.

b. No credit will be given if the following time limits are exceeded:

Test 1.....	8 minutes
Test 2.....	12 minutes
Test 3.....	5 minutes

c. A penalty of one-half point will be assessed for each component part that is incorrectly 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 correct nomenclature.

d. A penalty of one-half point will be assessed for each lubrication point that is missed or lubricated improperly and for each time that the proper lubricating device or proper lubricant is not selected.

253. Credit

If each test is performed correctly within the prescribed time limit, maximum credit of five points will be given for that test.

APPENDIX

REFERENCES

AR 320-5	Dictionary of United States Army Terms.
AR 385-63	Regulations for Firing Ammunition for Training, Target Practice, and Combat.
AR 611-201	Manual of Enlisted Military Occupational Specialties.
AR 672-5-1	Awards.
AR 750-5	Organization, Policies and, Responsibilities for Maintenance Operation.
AR 750-1000-8	Weapon Record Book for Other Than Small Arms.
ATP 6-100	Army Training Program for Field Artillery Unit.
ATT 6-117	Training Test for Field Artillery Howitzer Battery 105-mm or 155-mm.
FT155-Q-3	Firing Tables for Howitzer, 155-mm, M1, M1A1, and M45.
DA Pam 108-1	Index of Army Motion Pictures, Filmstrips, Slides, and Phono-Recordings.
DA Pam 310-series	Indexes of Military Publications.
AR 320-50	Authorized Abbreviations and Brevity Codes.
FM 5-15	Field Fortifications.
FM 5-20	Camouflage, Basic Principles and Field Camouflage.
FM 5-25	Explosives and Demolitions.
FM 6-40	Field Artillery Cannon Gunnery.
FM 6-125	Qualification Tests for Specialists, Field Artillery.
FM 6-140	The Field Artillery Battery.
FM 17-50	Armor Logistics.
FM 21-5	Military Training.
FM 21-30	Military Symbols.
FM 21-40	Small Unit Procedures in Nuclear, Biological, and Chemical Warfare.
FM 21-60	Visual Signals.

FM 22-5	Drill and Ceremonies.
FM 23-65	Browning Machine Gun, Caliber .50, HB, M2.
FM 25-10	Motor Transportation, Operations.
TM 3-220	Decontamination.
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 Carriage, Field Artillery and Antiaircraft Artillery.
TM 9-6111	Panoramic Telescopes, M1, M2, M12A2, M12A5, and M12A6.
TM 9-1590	Fuze Setters, M14, M22, M23, M25, and M27.
TM 9-1730A	Continental 6-Cylinder Engine, Model AOS-895-3.
TM 9-1730B	Cross-Drive Transmission, Models CD-500-3 and -4 (Allison-GM).
TM 9-1828A	Fuel Pumps.
TM 9-1829A	Speedometers, Tachometers, and Recorders.
TM 9-1900	Ammunition, General.
TM 9-2300	Artillery Materiel and Associated Equipment.
TM 9-2810	Preventive Maintenance Supply, Inspection and Training, Tactical Motor Vehicles.
TM 9-238	Deep Water Fording of Ordnance Materiel.
TM 9-7004	Self-Propelled 155-mm Howitzer M44.
TM 9-8625	Carburetors (Stromberg).
TM 9-8627	Electrical Equipment (Delco-Remy).
TM 9-8631	Electrical Equipment, Eclipse-Pioneer.
TM 9-8637	Electrical Equipment (Jack and Heintz).
TM 21-301	Driver Selection, Training and Supervision: Tracked Vehicles.
TM 21-305	Driver's Manual.
TM 21-306	Manual for the Tracked Vehicle Driver.
LO 9-7004	Howitzer, 155-mm, Self-Propelled, M44.
DA Form 468	Unsatisfactory Equipment Report.
DD Form 110	Vehicle and Equipment Operational Record.

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BY ORDER OF THE SECRETARY OF THE ARMY:

G. H. DECKER,
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Chief of Staff.

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6-426, 6-427, 6-429 (1); 6-501 (2).

USAR: Same as Active Army except allowance is one copy
to each unit.

For explanation of abbreviations used, see AR 320-50.

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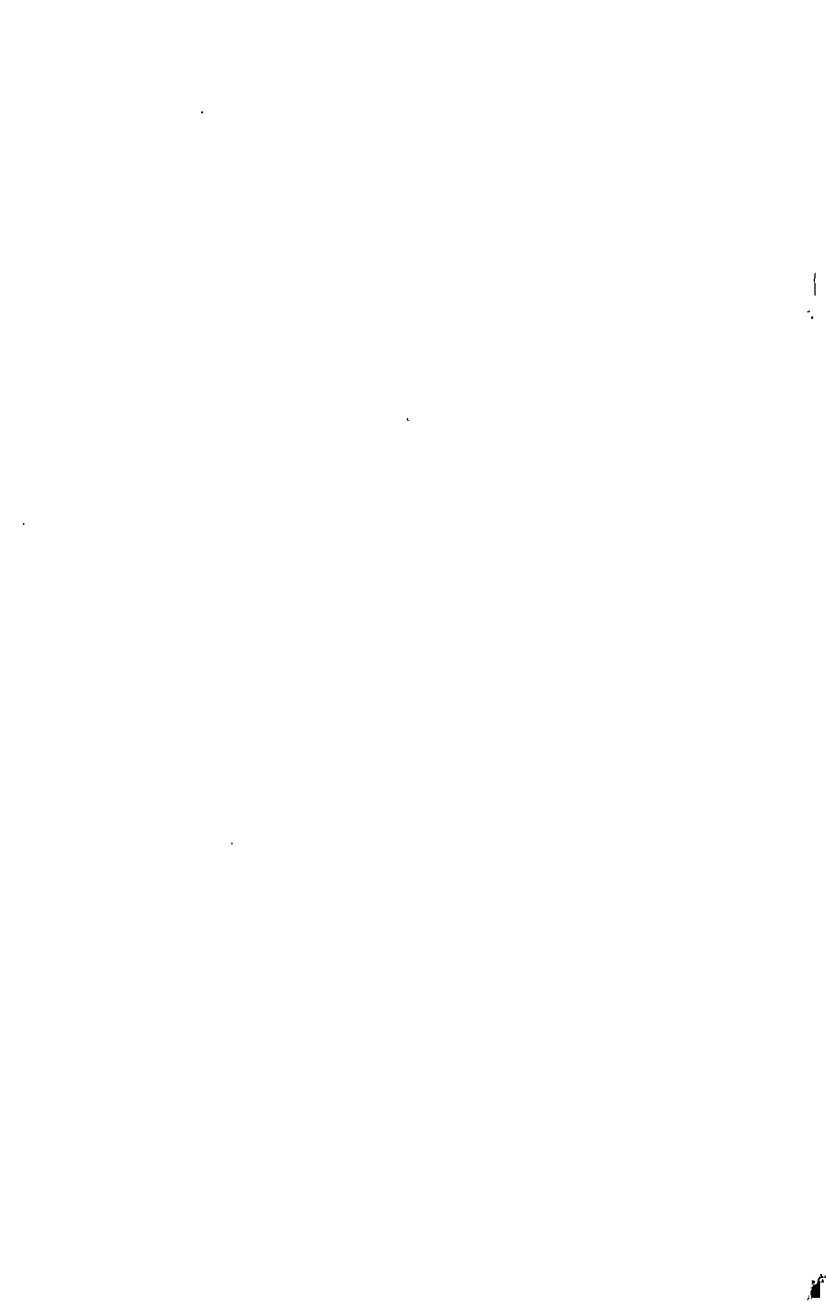


Table 1. Duties in Preparation for Firing

Sequence	Chief of section	Gunner	Assistant gunner	No 1	No. 2	No 3	No. 4	No. 5	No. 6	Driver
1	Releases howitzer traveling lock. Supervises work of all members of the section throughout remaining sequences.	Removes breech and telescope mount covers, and throws them to right of howitzer. Elevates tube to allow howitzer traveling lock to be folded to the lowered position.	Pulls out right retaining latch retainer. Simultaneously release right and left recoil spade release levers.	Pulls out left retaining latch retainer.	Procures fuse wrench and fuze setter and places them on the right paulin.	Procures paulin from right stowage box on shield and, assisted by No. 5, spreads it on ground to the right rear of the howitzer.	Assists No. 6 in spreading paulin. At double time, lays wire to executive's post and prepares telephone for use.	Procures aiming posts from the hull door assemblies and places them to the right of the howitzer and assists No. 3. in spreading paulin.	Procures paulin from left stowage box on shield and assisted by No. 4, spreads it to the left rear of the howitzer.	Assists gunner in removing breech cover.
2	Directs the backing of the vehicle against spade, and then commands driver to cut engine and lock vehicle brakes.		Releases right hull door outside locking handle and retains door in raised position. Simultaneously lower the door.	Releases left hull door outside locking handle and retains door in raised position.	Unloads box of fuzes from howitzer compartment and places it near the fuze setter and wrench.					
3	Checks position of replenisher indicator. Adds or drains recoil oil as reading indicates, as prescribed in TM 9-7004. Checks recoil cylinders for oil leakage.	Depresses tube until loading position indicator is between white lines on loading position indicator scale.	Remove stowage rack retaining pin from retaining bracket. Swings out powder case stowage racks. Secures right stowage case hold-open pin.	Secures left stowage case hold-open pin.	Cleans and oils fuze setter.	Procures the lanyard, vent cleaning bit, waste, and oiler from section chest and places them in a convenient location. Procures chamber sponge, burlap, and bucket of water and places them to left rear of howitzer.		Collects and folds all covers and places them to the left of howitzer.	Assisted by No. 4, unloads powder charges from the howitzer compartment and arranges them on left paulin.	When so directed by chief of section, backs vehicle onto spade, locks brakes, and idles, stops, or continues running engine as directed by chief of section.
4		Removes panoramic telescope from its case and seats it in its mount, sets rotating head and all scales at zero; uncovers longitudinal and cross-level bubbles.	Checks functioning of power rammer. Cleans and oils the breechblock and breech recess and cleans the primer vent.	Removes staff sections from hull door; places them conveniently for assembling.	Assists in unloading and arranging ammunition.	Obtains loading tray and places it on right paulin.	Assists No. 6 in unloading and arranging powder charges.	Assists in unloading and arranging ammunition		Removes muzzle cover and tosses it to right of howitzer. Secures howitzer traveling lock and places in lowered position.
5		Checks functioning of elevating and traversing mechanisms for smooth operation. Assisted by No. 2, checks functioning of equilibrator. Sets tube at loading elevation.		Assists gunner in checking functioning of equilibrator.						
6	Verifies that the howitzer 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.	Operates the manual and electrical firing mechanism several times to determine proper functioning.	Checks functioning of breech mechanism by opening and closing breech several times.	Cleans powder chamber and, assisted by No. 3, cleans bore if necessary.		Assists No. 1 in cleaning bore if bore needs cleaning.				Services vehicle.

Table 1

Table II. Duties in Preparation for Traveling

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Inspects chamber to see that howitzer is not loaded. Supervises work of all members of the section throughout all sequences.	Sets all scales of panoramic telescope at zero, and covers telescope mount bubbles.	Opens breech and closes it after chamber is inspected by chief of section.	Replaces unused primers in traveling compartments; verifies that there are at least 25 primers or replenishes the supply of primers if necessary.	Replaces fuzes in box and returns box to howitzer compartment.	Places loading tray in traveling position.	Assists No. 6 in replacing powder charges in howitzer compartment.	Recovers and disassembles aiming posts.	Assisted by No. 4, replaces powder charges in howitzer compartment.	Procures breech and sight mount, covers and places them over hull near the gunner.
2		Removes telescope from mount and replaces it in its case.	Disassembles chamber sponge and rammer head from staff section.	Receives aiming posts from No. 5 and returns them to hull door.	Returns fuze wrench and fuze setter to their traveling chest.	Checks to see that projectiles are ready for loading, all fuzes removed, and lifting plugs replaced.	Assists No. 6 in folding left paulin.	Hands aiming posts to No. 1 at rear of howitzer.	Assisted by No. 4, folds left paulin and replaces it in stowage box on left shield.	Obtains muzzle cover and replaces it.
3		Assists driver in locking tube in traveling lock by operating the traversing and elevating handwheels.	Disassembles rammer staff, and secures staff sections.	Replaces vent and primer seat cleaning tools and oiler.	Assists in reloading ammunition.	Assists in reloading ammunition.	At double time, rewinds telephone wire; replaces telephone and head and chest set.	Assists in reloading ammunition.	Assists No. 3 in folding right paulin.	Assists in reloading ammunition.
4	Directs driver to move carriage forward to unseat spades.	Replaces covers on sight mount and breech.	Returns bucket to traveling position, and chamber sponge rammer head, and burlap to section chest.			Assisted by No. 5, folds right paulin, replaces it in stowage box on right shield.		Assists No. 6 in replacing powder charges in howitzer compartment.		
5		Dismounts from howitzer.	Closes right stowage rack and secures stowage racks.			Closes left stowage rack.				
6	Verifies that the howitzer is prepared for traveling. Reports to the executive "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.	Releases hull door stop hook.	Swing hull door up into traveling position and secure respective hull doors outside locking handles.		Takes post.	Takes post.	Takes post.	Takes post.	Takes post.	Takes post.
		Assistant gunner, gunner, and No. 1, positioned from left to right respectively, simultaneously raise the recoil spade until the recoil spade right and left retaining latches engage.								
		Takes post.	Inserts right retaining latch retainer and takes post.	Inserts left retaining latch retainer and takes post.						

Table II

Table III. Duties in Firing

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Directs work of section personnel throughout all sequences.	Brings tube to loading elevation.	Receive loading tray from No. 3 and place in breech recess.		Assisted by No. 4 fuzes the projectile. Sets time fuze if necessary.	Carries loading tray to hull door assisted by No. 5.	Assists No. 2 in fuzing the projectile.	Assists No. 3 in carrying loading tray to hull door.	Prepares powder charge assisted by driver.	Assists No. 6 in preparing powder charge.
2			Places rammer hydraulic pump starting switch in ON position. Extends rammer head.			Returns to ammunition point.				
3				Rams projectile. Removes loading tray and hands to No. 5.						
4			Closes breech.	Receives powder charge from No. 6 and places in chamber. Calls "Close."						
5			Primes the howitzer after the breech is closed. Announces "Set."							
6	If gunner's quadrant is used, lays for elevation, assisted by the gunner.	Lays howitzer for deflection and elevation and announces "Ready." If gunner's quadrant is used, assists chief of section to lay for elevation.	After the gunner announces ready, connects the firing lanyard.					Receives loading tray from No. 1 and returns to ammunition point.	Hands powder charge to No. 1.	Shifts carriage when directed by the chief of section.
7	Insures personnel are clear of path of recoil of tube.									
8	Raises hand to indicate howitzer is ready to fire. On command of executive, drops arm.									
9	Checks aiming post displacement. Brings tube to loading position.									
10		Opens breech. Removes the lanyard and spent primer. Cleans primer vent.	Inspects bore, swabs powder chamber, and announces "Bore clear."							

By Order of the Secretary of the Army:

Official:

J. C. LAMBERT,
*Major General, United States Army,
The Adjutant General.*

EARLE G. WHEELER,
*General, United States Army,
Chief of Staff.*

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For explanation of abbreviations used, see AR 320-50.

FIELD MANUAL
155-MM HOWITZER M44
SELF-PROPELLED

I 6-92
ANGES No. 2

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., 19 July 1963

FM 6-92, 4 April 1962, is changed as follows:

Prepares Powder Charges

a. Type M3 (Green Bag). The type M3 * * * with this charge. When firing charges 3 and 4, the M3 (green bag) propelling charge is preferred over the use of the M4A1 (white bag) propelling charge.

b. Type M4A1 (White Bag) (Superseded). The M4A1 (white bag) powder charge consists of a base charge, with igniter, and four increments corresponding to charges 3, 4, 5, 6, and 7. Preparation of these charges is accomplished as in *a* above, except that no charge lower than charge 3 can be prepared. *Green and white bag increments must be mixed in the same charge.* In night firing, when the flash reducer is used, No. 6 assembles the propelling charge and flash reducer by tying one flash reducer to the forward end of the base charge and at the forward end of each increment used.

is change supersedes C 1, 18 December 1962.

FIELD MANUAL

155-MM HOWITZER M44
SELF-PROPELLED

FM 6-92

CHANGE No. 1

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON 25, D.C., 18 Dec. 1962

FM 6-92, 4 April 1962, is changed as follows:

81. Prepares Powder Charges.

a. Type M3 (Green Bag). The type M3 * * * with this charge. Only M3 charges should be used when precision or calibration data is required. The M3 charges closely approximate the velocities prescribed in the firing table and produce less dispersion than the M4A1 charges.

b. (Superseded) Type M4A1 (White Bag). The type M4A1 white bag consists of a base charge, with igniter, and four increments corresponding to charges 3, 4, 5, 6, and 7. Preparation of these charges is accomplished as in *a* above, except that no charge lower than charge 3 can be prepared. Type M4A1 charges, except charge 6, should not be used when precision fire is desired. Charges 3 and 4 fire approximately 20 f/s higher than the same M3 charges and 10 f/s higher for charge 5. All charges, except charge 6, produce greater dispersion than the M3 charges.

By Order of the Secretary of the Army:

EARLE G. WHEELER,
General, United States Army,
Chief of Staff.

Official:

J. C. LAMBERT,
Major General, United States Army,
The Adjutant General.

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USAR: Units — same as active Army except allowance is one copy to each unit.

For explanation of abbreviations used, see AR 320-50.

Table V. Maintenance and Inspection Duties

Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3 on left side and No. 4 on right side of section vehicle		No. 5	No. 6	Driver
Before Operation (March) (B) and During Halt (D)										
1	Supervises inspection of members of howitzer section in all sequences.	(B)(D) inspects condition and security of sighting and fire control equipment.	(B)(D) Inspects and verifies security of spade, hull door locks, and loading tray.	(B) Visually inspects fire extinguishers.	(B) Load ammunition.				(B)(D) Performs inspection and maintenance duties as prescribed in TM 9-7004.	
2	(B)(D) Verifies that the tube is secured in traveling position.				(B)(D) Checks machinegun and mount for cleanliness, functioning, and security. Checks storage of machinegun ammunition.	(B) Inspect tracks visually. (D) Inspect tracks for proper tension. (B)(D) Look under vehicle for leaks.	(B) Checks presence, condition, and operation of lights (if tactical situation permits). Driver operates switches.	(B)(D) Checks presence, condition and storing of tools and equipment.		
3	(B) Verifies presence of technical manuals, gun book, lubrication order, trip ticket, driver's license, and standard form No. 91.									
4	(B) Checks section equipment for loading and completeness.									
5	Reports to battery executive "Sir, No. (so-and-so) in order," or reports any defects which the section cannot remedy without delay.	Reports "Gunner ready."	Reports "Assistant Gunner ready."	Reports "No. 1 ready."	Reports "No. 2 ready."	Reports "No. 3 ready," "No. 4 ready," respectively.		Reports "No. 5 ready."	Reports "No. 6 ready."	Reports "Driver ready."
After operation										
Sequence	Chief of section	Gunner	Assistant gunner	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	Driver
1	Supervises maintenance and inspection by all members of the howitzer section in all sequences.	Inspects for presence of all sighting and fire control equipment, and cleans and lubricates to extent authorized.	Remove breech cover and disassemble breech group to extent authorized.	Clean and lubricate tube as directed by the chief of section.	Remove muzzle cover, assemble rammer staff, and obtain bore brush.		Obtains sponge, bucket, and cleaning and preserving materials.	Inspects ammunition components and checks storage of ammunition.	Assists driver in performing maintenance on motor carriage.	Assisted by No. 6 performs maintenance duties on motor carriage as prescribed in TM 9-7004.
2	Checks recoil mechanism for oil leakage and position of replenisher indicator. Replenishes oil reserve when necessary.									
3		Inspects section equipment for completeness and cleans where necessary.	Clean and lubricate breech group and reassemble and check for proper functioning.	Clean machine gun and mount and check for proper functioning. Verify presence, condition, and proper supply of machine gun ammunition.	Cleans breech, muzzle, and bore covers.					
4	Performs general inspection of the tube as described in TM 9-7004.									
5	Reports to battery executive "Sir, No. (so-and-so) in order" or reports any defects which the section cannot remedy without delay.	Clean and lubricate the carriage as directed by the chief of section.				Properly store sponge, bucket, and cleaning and preserving materials.				

Table V.

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