

RESTRICTED

Not to be published

The information given in this document is not to be communicated, either directly or indirectly, to the Press or to any person not holding an official position in His Majesty's Service.

**IM 6-A
USAFBI**

Copy No. 6

**TENTATIVE
FIELD ARTILLERY
INSTRUCTION MANUAL**

SERVICE OF THE PIECE

**25-PDR. GUN, MARK II, ON 25-PDR. CARRIAGE, MARK I
(BRITISH) MODIFIED, TRUCK-DRAWN**

LIBRARY

Field Artillery School,
Fort Sill, Oklahoma

828663
HEADQUARTERS

**UNITED STATES ARMY FORCES IN THE
BRITISH ISLES**

LONDON, ENGLAND

January, 1942

RESTRICTED

Not to be published

The information given in this document is not to be communicated, either directly or indirectly, to the Press or to any person not holding an official position in His Majesty's Service.

**IM 6-A
USAFBI**

*Deleted per letter to Cof FA
from Hq USAFBI 10 Feb 42*

TENTATIVE

**FIELD ARTILLERY
INSTRUCTION MANUAL**

SERVICE OF THE PIECE

**25-PDR. GUN, MARK II, ON 25-PDR. CARRIAGE, MARK I
(BRITISH) MODIFIED, TRUCK-DRAWN**

**HEADQUARTERS
UNITED STATES ARMY FORCES IN THE
BRITISH ISLES**

LONDON, ENGLAND

January, 1942

HEADQUARTERS
UNITED STATES ARMY FORCES IN THE
BRITISH ISLES,
LONDON, ENGLAND.

January, 1942.

Tentative Field Artillery Instruction Manual, IM 6-A, Service of the Piece, 25-pdr. gun, Mark II, on 25-pdr. Carriage, Mark I, truck-drawn, is published for the information and guidance of all concerned.

By command of Major General CHANEY.

CHARLES L. BOLTE,
Brigadier General, G.S.C.
Chief of Staff.

OFFICIAL :

I. B. SUMMERS,
Colonel, A.G.D.,
Adjutant General.

American.—RESTRICTED.

British.—*Not to be published.*

The information given in this document is not to be communicated, either directly or indirectly, to the Press or to any person not holding an official position in His Majesty's Service.

TABLE OF CONTENTS

	<i>Para.</i>	<i>Page</i>
Section I.—General.		
Purpose and scope	1	1
References	2	1
Definitions and terms	3	1
.. II.—Organisation.		
Composition	4	2
Formation	5	2
.. III.—Posts ; mounting and dismounting.		
Posts of the gun squad	6	3
To post the gun squads	7	4
Posts of the cannoneers	8	4
To post the cannoneers	9	4
To mount the cannoneers	10	4
To dismount the cannoneers	11	4
.. IV.—Movements of the carriages by hand.		
Limbered (uncoupled)	12	5
Unlimbered	13	6
.. V.—Uncoupling and unlimbering ; limbering and coupling.		
Uncoupling and unlimbering	14	6
Limbering	15	8
Coupling	16	8
.. VI.—Preparation for action and march order.		
To prepare for action	17	9
Posts of the cannoneers, carriages unlimbered	18	12
March order	19	13
.. VII.—Duties in firing.		
General	20	16
Chief of Section	21	17
Gunner	22	21
No. 1	23	28
No. 2	24	30
No. 3	25	31
No. 4	26	32
No. 5	27	32

Section VIII.—Additional information on the service of the piece.

Accuracy in laying	28	33
Fire at will	29	33
Aiming stakes	30	34
Correction for lateral displacement	31	35
Reporting errors	32	35
Cease firing	33	35
Suspend firing	34	35
Changes in data during firing	35	36
To unload the piece	36	36
Misfires	37	36
Ammunition	38	36
The section data board	39	39
To disable gun before capture	40	39

IX.—Care and maintenance of materiel.

General	41	40
Cleaning	42	40
Lubrication	43	41
Protection against chemicals	44	42
Gun, breech mechanism and firing mechanism	45	43
Recoil mechanism	46	48
Removal and assembly of barrel	47	50
Retraction of gun and cleaning slides	48	52
Wheels and wheel bearings	49	54
Gun brake mechanism	50	54
Caisson	51	54
Sighting and fire control equipment	52	55

Appendix A.—List of Gun Lubricating Fittings and Holes. 60

Appendix B.—List of Caisson Lubricating Fittings and Holes. 61

Appendix C.—Conversion Table, Mills to Degrees and Minutes. 62

TENTATIVE SERVICE OF THE PIECE

25-PDR., MARK I (BRITISH) MODIFIED

(This is the British 25-pdr., Mark II barrel assembly on the 25-pdr. carriage, Mark I, modified to permit the use of the American panoramic telescope.)

SECTION I

GENERAL

1. **Purpose and Scope.**—This manual prescribes the duties to be performed in the service of the piece by the personnel normally assigned to one-gun section of the firing battery.

2. **References.**—*a. Description, operation, functioning and care of materiel.*—Handbook for the Ordnance, Q.F. 25-pdr., Mark II, on Carriage 25-pdr., Mark I, Land Service, 1940; Identification List for Q.F. 25-pdr., Mark II Gun on 25-pdr., Mark I Carriage, 1941.

b. Description and operation of fire control and sighting equipment.—TM 6-220; British handbook as in *a* above.

c. Ammunition.—British handbook as in *a* above; British range tables; British Gun Drill; Notes on Care and Preservation of Ammunition and Explosives in the Field (British).

d. Cleaning and preserving materials.—TR 1395-A; SNL K-1.

e. The Field Artillery Driver.—Part two, FM 6-5.

f. Manœuvres of the Battery.—Part two, FM 6-5.

g. Safety Precautions in firing.—AR 750-10; chapter 4, FM 6-40.

h. The Firing Battery.—Chapter I, FM 6-40.

i. Reconnaissance, occupation and organization of position.—Part one, FM 6-20.

3. **Definitions and Terms.**—*a. Section.*—Tables of organization prescribe the personnel and materiel comprising a section of a battery. In this manual the term is frequently used to designate a section of the firing battery. In this restricted sense, a gun section is composed of one piece, its caisson, and the additional materiel and personnel required to serve the piece.

b. Limbered.—A piece (caisson) is said to be limbered when its lunette is attached to the pintle of its caisson.

c. Unlimbered.—A piece (caisson) is said to be unlimbered when its lunette has been detached from the pintle of the caisson and the trail (drawbar) rests on the ground.

d. Coupled.—Carriages are said to be coupled when limbered and the lunette of the caisson is attached to the pintle of a truck or other prime mover.

e. Uncoupled.—Carriages are said to be uncoupled when the lunette of the caisson is detached from the pintle of a truck or other prime mover and the caisson drawbar rests on the ground.

f. Front.—The front in a section, carriages limbered or coupled, is in the direction in which the trail points; carriages unlimbered, the direction in which the muzzle of the piece points.

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

h. In Battery.—The term "in battery" is used to designate the position of the gun when it is in its normal firing position.

SECTION II ORGANIZATION

4. *Composition.*—*a. Gun Squad.*—A gun squad consists of the gunner and five cannoneers numbered from 1 to 5. The remaining cannoneers of the gun section act as reliefs or are assigned such other duties as the chief of section may direct. When the battery unlimbers for drill or for firing, the chief of section remains at the firing position and commands the gun squad.

b. Ammunition Squad.—(1) An ammunition squad consists of an ammunition corporal and cannoneers as prescribed in Tables of Organization. These cannoneers are numbered consecutively, beginning with No. 1, and are assigned to the ammunition vehicles of the ammunition (fifth) section.

(2) Posts and movements prescribed hereinafter for the gun squad apply, with obvious modifications, to the ammunition squad.

5. *Formation.*—*a. Order of Formation.*—A gun squad is formed as shown in fig. 1. Higher-numbered cannoneers, if present, form in order on the left of No. 5.

b. To form.—(1) The place of formation is indicated and the command given thus, for example: 1. **IN FRONT (REAR) OF YOUR PIECES (CAISSONS)**, or 1. **ON THE ROAD FACING THE PARK**, 2. **FALL IN**. Each gunner repeats the command **FALL IN** and hastens to place himself, faced in the proper direction, at the point where the right of his squad is to rest. The cannoneers move at the double time and assemble at attention at their proper places. For the first formation of the gun squads for any drill or exercise, the caution "As gun squads" precedes the command. The chief of section, if present, supervises the formation.

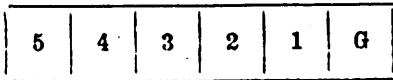


FIG. 1. FORMATION OF THE GUN SQUAD.

(2) In case the front or rear of the carriages is designated, each squad falls in at its post (par. 6).

c. To call off.—(1) The command is: **CALL OFF**. The cannoneer on the left of the gunner calls off "One"; the cannoneer on the left of No. 1, "Two"; and so on.

(2) After having called off, if a subsequent formation is ordered, the cannoneers fall in at once in their proper order.

d. Chief of section.—While instructing his section alone, the chief of section goes wherever necessary to accomplish his purpose; his normal post is two paces in front of the centre of his section.

SECTION III

POSTS; MOUNTING AND DISMOUNTING

6. Posts of the Gun Squad.—*a. Carriages limbered or coupled.*—(1) *In front of the piece or caisson.*—The squad is in line facing to the front, its center two paces from the end of the caisson drawbar or from the front of the truck if coupled.

(2) *In rear of the piece or caisson.*—The squad is in line facing to the front, its center two paces from the muzzle of the piece or from the rear of the caisson.

b. Carriages unlimbered.—The squad is in rear of the piece, in line facing to the front, its center two paces from the end of the trail of the piece.

7. **To Post the Gun Squads.**—The squads having been marched to the vicinity of the carriages are posted at the command **SQUADS IN FRONT (REAR) OF YOUR PIECES (CAISSONS)**. Each gunner marches his squad to its carriages and posts it in the position indicated.

8. **Posts of the Cannoneers.**—*a. Carriages limbered or coupled.*—The cannoneers of the gun squad are posted as shown in figs. 2 and 3. All are 2 feet outside the line of wheels and are facing to the front. Higher-numbered cannoneers, if present, are posted as prescribed by the chief of section.

b. Carriages unlimbered.—See par. 18.

9. **To Post the Cannoneers.**—*a.* The command is: 1. **CANNONEERS**, 2. **POSTS**. Each gunner repeats the command **POSTS**. The cannoneers leave the ranks, if formed, and move at the double time to their posts.

b. For preliminary instruction, the squads on entering the park are first posted with their carriages, and the cannoneers are then sent to their posts by the foregoing command. The command is general, however, and is applicable when the cannoneers are in or out of ranks, at a halt or marching, and when the carriages are limbered, coupled, unlimbered or uncoupled.

10. **To Mount the Cannoneers.**—*a.* In each squad the personnel is seated in the body of the truck in the order prescribed by the battery commander. The chief of section is seated beside the driver.

b. The command is: 1. **CANNONEERS**, **PREPARE TO MOUNT**, 2. **MOUNT**. At the first command the cannoneers move at the double time to positions on the ground convenient for mounting the truck. At the second command, all mount as prescribed by the battery commander.

c. If the command is: 1. **CANNONEERS**, 2. **MOUNT**, the cannoneers execute, at the command **MOUNT**, all that has been prescribed for the commands **CANNONEERS**, **PREPARE TO MOUNT** and **MOUNT**.

11. **To Dismount the Cannoneers.**—*a.* The command is: 1. **CANNONEERS**, **PREPARE TO DISMOUNT**, 2. **DISMOUNT**. At the first command, the cannoneers assume positions from which they can dismount promptly; at the second command, they jump to the ground and take their posts at the double time.

b. If the command is: 1. **CANNONEERS**, 2. **DISMOUNT**, the cannoneers execute, at the command **DISMOUNT**, all that has been prescribed for the commands **CANNONEERS**, **PREPARE TO DISMOUNT** and **DISMOUNT**.

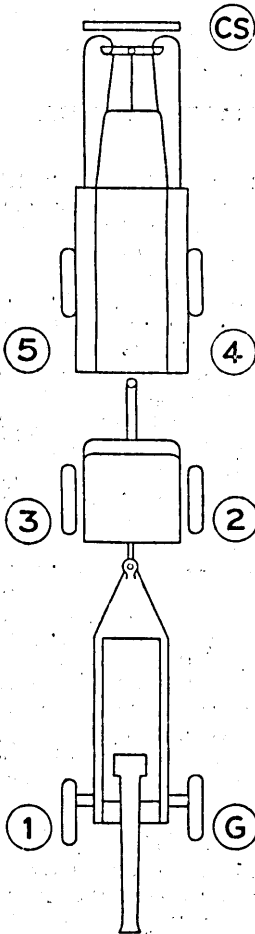


FIG. 2.

POSTS OF THE CANNONEERS,
CARRIAGES COUPLED.

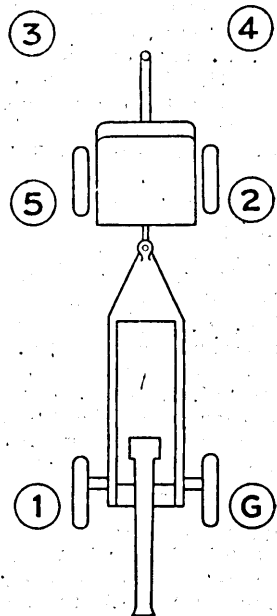


FIG. 3.

POSTS OF THE CANNONEERS,
CARRIAGES UNCOUPLED
(LIMBERED).

SECTION IV

MOVEMENTS OF THE CARRIAGES BY HAND

12. **Limbered (Uncoupled).**—*a. To the front.*—(1) *Without drag ropes.*—The command is: 1. **PIECES FORWARD**, 2. **MARCH**, 3. **HALT**. In each squad at the first command the gunner and No. 1 hasten to the piece wheels; Nos. 2 and 5 to the rear of the gun shield; and Nos. 3 and 4 to the caisson drawbar and swing the lifting handles outward; higher-numbered cannoneers, if present, to posts as directed by the chief of section; the gunner and the even numbers working on the right side of the carriage, odd numbers on the left. Nos. 1 and 5 operate the hand brakes. At the command **MARCH**, all assist in moving the carriage to the front. At the command **HALT**, the carriage is stopped, brakes are set and the drawbar lifting handles are swung to their closed position. All cannoneers resume their posts.

(2) *With drag ropes.*—The command is: 1. **WITH DRAG ROPES, PIECES FORWARD**, 2. **MARCH**, 3. **HALT**. In each squad at the first command the gunner and No. 1 procure the drag ropes and hook them to the piece drag washers, the backs of the hooks downwards; Nos. 3 and 4 hasten to the caisson drawbar, swing the lifting handles outwards, and raise the drawbar; the remaining cannoneers man the ropes; the gunner and the even numbers working on the right side of the carriage, odd numbers on the left. Nos. 1 and 5 operate the hand brakes. At the command **MARCH** all assist in moving the carriage to the front. At the command **HALT**, the carriage is stopped, brakes are set, the drawbar lifting handles are swung to their closed position, and drag ropes are replaced on the shield. All cannoneers resume their posts.

b. To the rear.—(1) *Without drag ropes.*—The command is: 1. **PIECES BACKWARD**, 2. **MARCH**, 3. **HALT**. Executed as prescribed in sub-paragraph 12*a* (1), except that at the command **MARCH** the cannoneers move the carriage to the rear. No. 3 insures that the overrun brake of the caisson is released.

(2) *With drag ropes.*—The command is: 1. **WITH DRAG ROPES, PIECES BACKWARD**, 2. **MARCH**, 3. **HALT**. Executed as prescribed in sub-paragraph 12*a* (2), except that at the command **MARCH** the cannoneers move the carriage to the rear. No. 3 insures that the overrun brake of the caisson is released.

13. **Unlimbered.**—The command is: 1. **PIECES (CAISSONS) FORWARD (BACKWARD)**, 2. **MARCH**, 3. **HALT**.

a. Piece.—(1) *First Command.*—At the first command the firing platform is raised to its travelling position (par. 19*b*). Nos. 3 and 4 insert and grasp the trail handspikes, No. 3 on the right and No. 4 on the left; No. 2 grasps the left wheel and No. 5 the right wheel; the gunner and No. 1 place themselves advantageously in rear of the axle in moving forward, in front of the axle in moving backward; higher-numbered cannoneers, if present, are employed as directed by the chief of section. If the situation requires the use of drag ropes, under direction of the chief of section the drag ropes are secured by the gunner and No. 1 and attached to the left and right drag washers respectively. Personnel designated by the battery executive to assist in the movement of the piece will take position and pull on the drag ropes as directed by the chief of section.

(2) *Second Command.*—At the command **MARCH** all working together move the piece forward (backward) under the direction of the chief of section. At the command **HALT**, they stop the piece, re-establish it in the firing position, and all resume their posts.

b. Caisson.—Executed as explained for the piece except that the gunner and No. 1 are at the drawbar side of the caisson when moving forward and at the pintle side when moving backward, the gunner on the left.

SECTION V

UNCOUPLING AND UNLIMBERING; LIMBERING AND COUPLING

14. **Uncoupling and Unlimbering.**—*a. General.*—At drills, trucks are posted as directed by the battery commander. In active service and in instruction simulating it, the trucks are conducted by the first sergeant to a place previously designated by the battery commander, where they are disposed so as to take the best advantage of cover and concealment. If no cover and concealment are available, they are located in rear of either flank, faced to the front, with wide intervals between them. It may not always be advisable to leave the caisson at the gun position, in this case the caissons are not uncoupled at the battery position. When it is desired to uncouple without unlimbering, the commands **UNCOUPLE** or **ON FIRING PLATFORM, UNCOUPLE** are used.

b. *To fire to the right (left).*—The easiest method of coming into action is to the right, as this involves the minimum of man-handling of the caisson with a consequent saving in time. The command is: **ACTION RIGHT (LEFT)**. If marching, the trucks halt at the command or signal. The cannoneers, if mounted, dismount after the trucks have halted.

(1) *The piece.*—Unless the caution **WITHOUT FIRING PLATFORM** has been given, the gunner and Nos. **1, 2** and **5** go to the platform; the gunner and No. **1** nearest the breech, the gunner and even number on the right, odd numbers on the left. The gunner and No. **1** release the lever clamps and assisted by Nos. **2** and **5** lift the platform clear of the hooks and lower it to the ground. The chief of section commands or signals **SLOW** and the truck is driven forward very slowly to place the gun on the platform, and halts. The gunner and No. **1** clamp the lever link locking pawls of the platform linkage. The gunner and No. **1** take positions at the lunette. The gunner releases the pintle latch and assisted by No. **1** lifts the trail clear. The gunner raises his hand and the chief of section commands or signals **FORWARD**. The gunner assisted by No. **1** carries the trail through a quarter circle to the left (right) and the trail is lowered to the ground. No. **1** sets the brakes for the first round.

(2) *The caisson.*—Nos. **2, 3, 4** and **5** go to the caisson, Nos. **3** and **4** at the drawbar and Nos. **2** and **5** in rear, all on their respective sides. Nos. **3** and **4** release the lifting handles, No. **3** releases the pintle latch and assisted by No. **4** lifts the lunette clear of the pintle. The chief of section commands or signals **FORWARD**. No. **3** insures that the overrun caisson brake is released. Nos. **2, 3, 4** and **5** move the caisson into position on the left (or for the left gun the right) of the gun with the hub cap of the caisson one foot in front and two feet clear of the piece hub cap and with the drawbar 30° away from the gun. No. **5** sets the caisson handbrake. All cannoneers assist in unloading the truck and, when completed, the chief of section commands or signals **DRIVE ON**. The gunner and all cannoneers take their posts (par. 18).

(3) *The trucks.*—At the command **SLOW** the driver moves his vehicle to the front 1 yard, very slowly, to avoid damaging the platform linkage. At the first command **FORWARD** he moves his vehicle 2 yards; at the second command **FORWARD**, 1 yard. At the command **DRIVE ON** the trucks move out and are conducted by the first sergeant to their, previously designated position.

c. To fire to the front.—The command is: ACTION FRONT. The movement is executed according to the principles of ACTION RIGHT except that the trail is carried in a half circle to the right, or on a side slope carried in a half circle in the downhill direction.

d. To fire to the rear.—The command is: ACTION REAR. The movement is executed according to the principles of ACTION RIGHT, except that the trail is at once lowered to the ground.

15. **Limbering.**—*a. To limber to the rear.*—The pieces being in march order, the command is: LIMBER REAR. Nos. 3 and 4 swing the caisson drawbar handles to their outward position and assisted by Nos. 2 and 5 pushing the caisson body, the odd numbers on the right, move the caisson to the rear of the trail lunette. No. 5 operates the caisson handbrake; No. 1 the gun handbrake. The gunner and No. 1 lift the trail and upon signal from the chief of section the caisson is pushed towards the trail until the piece lunette engages the pintle of the caisson. The gunner latches the pintle. Nos. 3 and 4 swing the drawbar away from the direction of approach of the prime mover and lower it to the ground.

b. To limber to the front.—The command is: LIMBER FRONT. The movement is executed according to the principles of LIMBER REAR with the following modifications: Nos. 2, 3, 4 and 5 move the caisson far enough to the front to enable the gun to be turned through a half circle. The gunner and No. 1 go to the piece lunette, Nos. 3 and 4 go to the muzzle and the gunner orders LIFT. The trail is raised and with Nos. 3 and 4 pushing at the muzzle the trail is carried through a semicircle to the right. The trail is lowered to the ground and the procedure as described for LIMBER REAR is carried out.

c. To limber to the right (left).—The command is: LIMBER RIGHT (LEFT). The movement is executed according to the principles of LIMBER FRONT except that the trail is carried through a quarter circle to the right (left).

16. **Coupling.**—*a.* The pieces being limbered and in march order, the command is: COUPLE. The trucks, under the command of the first sergeant, approach the position by the most direct route. As each truck approaches its piece, it turns so as to halt in prolongation of the trail of the piece and about 3 yards in front of the caisson body.

b. All cannoneers working together under the direction of the chief of section load the tools, accessories and unexpended ammunition other than the caisson load. Then Nos. 3 and 4 hasten to the drawbar handles. Nos. 1 and 5 operate the brakes on the piece and caisson respectively. The truck, upon signal from the chief of section, is manœuvred backward until the pintle is the correct distance from the caisson body. Nos. 3 and 4 raise the trail and place the lunette in the travelling position over the pintle. No. 3 latches the pintle and insures that the backing stop is in the "up" position. Nos. 1 and 5 release the brakes of the gun and caisson respectively. All cannoneers take their posts (par. 8). (*Note.*—When the carriages are coupled, No. 3 insures that the backing stop is in the "up" position (wing parallel to drawbar) unless it is desired to reverse the prime mover, in which case he places the backing stop in the "down" position (wing perpendicular to drawbar) until immediately after the reverse movement is completed.)

SECTION VI

PREPARATION FOR ACTION AND MARCH ORDER

17. To Prepare for Action.—*a.* The carriages being in position unlimbered (and on the firing platform, if it is to be used), the command is: **PREPARE FOR ACTION.** Duties of individuals are as follows:—

(1) *Chief of section.*—(*a.*) Supervises the work of the cannoneers.

(*b.*) Inspects the materiel, verifies the fact that the recoil mechanism contains the proper amount of liquid and air, the running-back stop is removed, the piston rod nuts are tight and the muzzle velocity correctors of the range mechanism are correctly set for the muzzle velocity of his gun; and, when the operations have been completed, reports to the executive, "Sir, No. (so and so) in order", or reports any defects which the section cannot remedy without delay.

(2) *Gunner.*—(*a.*) Assisted by Nos. 1, 2 and 5 removes the overall cover, when used.

(*b.*) Removes the sight cover and places it on top of the caisson.

(*c.*) Assists No. 1 to raise and latch the top shield.

(d) Removes the sight clinometer from its case, installs it upon its seat and sets site 0 (our 300).

(e) Receives the panoramic telescope from No. 1 and seats it in the sight bracket, sets the tilting head at zero, the deflection at zero, the drift correction for charge 2, and centers the cross level bubble.

(f) Opens the sight port in the shield.

(g) Pushes the recoil indicator as far forward as it will go.

(h) Assists No. 1 to release the cradle travelling lock (cradle clamping gear) by securing the locking bar in the housing bracket.

(i) Sets the range scale at 4000, charge 2, and centers the sight clinometer bubble by means of the elevating handwheel.

(j) Installs the antitank telescope and sets range 500 thereon.

(3) No. 1.—(a) Assists the gunner and Nos. 2 and 5 to remove the overall cover, when used.

(b) Removes the breech cover and passes it to No. 5.

(c) Assists the gunner to raise and latch the top shield.

(d) Removes the panoramic telescope from its case and passes it to the gunner.

(e) Removes the gunner's quadrant from its case, inspects it for cleanliness, and passes it to the chief of section.

(f) Assisted by the gunner, releases the cradle travelling lock (cradle clamping gear) by sharply pulling the release lever of the locking plunger to the left and swinging the locking bar towards the housing bracket.

(g) Operates the breech mechanism; sets the safety catch in the FIRE position.

(h) Examines the breechblock, chamber and bore, cleaning any parts requiring it; leaves the breech open.

(i) Notes that the cocking lanyard is in a position convenient for use.

(j) Takes his post.

(4) No. 2.—(a) Assists the gunner and Nos. 1 and 5 to remove the overall covers, when used.

(b) Assists No. 5 to install the spade box, if not previously installed.

(c) Removes the fuze wrenches from their case and passes them to No. 3.

(d) Removes the aiming stakes and places them alongside the left of the platform, or sets out the aiming stakes when so directed by the chief of section.

(e) Distributes waste to the cannoneers.

(f) Assists Nos. 3 and 4 to sort and arrange the ammunition in an orderly and convenient manner.

(g) Takes his post.

(5) No. 3.—(a) When directed by the chief of section, assists No. 4 to secure the camouflage net and remove tools from the stores tray of the caisson.

(b) Opens the right caisson door.

(c) Receives the fuze wrenches from No. 2.

(d) Assisted by No. 4, sorts the ammunition and prepares it for use. His duties are primarily with projectiles and fuzes.

(e) Takes his post.

(6) No. 4.—(a) When directed by the chief of section, assists No. 3 to secure the camouflage net and remove tools from the stores tray of the caisson.

(b) Opens the left caisson door.

(c) Assists No. 3 to sort and prepare the ammunition. His duties are primarily with the preparation of charges.

(d) Takes his post.

(7) No. 5.—(a) Assists the gunner and Nos. 1 and 2 to remove the overall cover, when used. No. 5 neatly folds the cover and places it on the caisson.

(b) Removes the muzzle cover and places it neatly folded on top of the caisson.

(c) Receives the breech cover from No. 1 and places it neatly folded on top of the caisson.

(d) Removes a handspike from the trail and inserts it in the rear handspike socket.

(e) Assists No. 2 to install the spade box, if not previously installed.

(f) Removes the loading rammer from its travelling position on the trail.

(g) Takes his post.

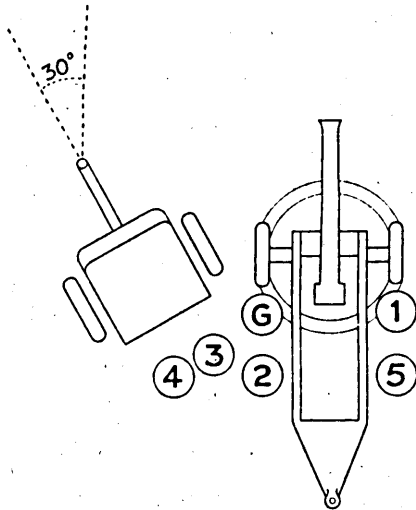


FIG. 4.

POSTS OF THE CANNONEERS,
CARRIAGES UNLIMBERED.

b. The limbered carriages may be partially prepared for action before reaching the firing position. The duties of the cannoneers are the same as when the carriages are unlimbered, but only such operations as are practicable are carried out before the carriages are unlimbered. Immediately after establishing the carriages in position, preparation for action is completed without command, and the cannoneers take their posts for firing the piece.

c. If PREPARE FOR ACTION has not been ordered before the carriages are established in the firing position, the command habitually is given by the chief of section as soon as the carriages have been unlimbered. In case this is not desired, the caution "do not prepare for action" must be given.

18. Posts of the Cannoneers, Carriages unlimbered.—

a. The carriages having been unlimbered, posts are taken as follows:—

(1) *Chief of section.*—The chief of section goes where he can control the service of the piece, hear commands, and perform his duties effectively. A convenient post is near the end of the trail on the side opposite the executive.

(2) *Gunner.*—To the left of the gunner's seat.

(3) *No. 1.*—Opposite the gunner, clear of the firing platform.

(4) *No. 2.*—Two feet in rear of the gunner, clear of the firing platform.

(5) *No. 3.*—Two feet in the rear of the caisson chest, on the right of the caisson pintle.

(6) *No. 4.*—Two feet in rear of the caisson chest, on the left of the caisson pintle.

(7) *No. 5.*—Two feet in rear of No. 1, clear of the firing platform.

b. At drill all stand at attention at their posts (fig. 4) facing the front. In firing and in combat, minor modifications of these posts are required for the more efficient performance of the duties in the service of the piece and to secure the protection afforded by the materiel. One variation in the posts of cannoneers is encouraged when the caisson is to the right of the piece. In this case, No. 2 takes position on the right and No. 5 rams from a position on the left. Higher-numbered cannoneers, if present, take posts as prescribed by the chief of section.

c. In order to exercise the cannoneers in all of the duties connected with the service of the piece and to lend variety to the drill, the posts of individual cannoneers should be changed frequently.

19. March Order.—a. Duties of individuals.—The carriages being unlimbered and prepared for action, to resume the order for marching, the command is: MARCH ORDER. Duties of individuals are as follows:—

(1) *Chief of section.*—(a) Supervises the work of the cannoneers.

(b) Passes the gunner's quadrant to No. 1.

(c) Inspects the materiel; *makes sure that the piece is not loaded* and that the cradle travelling lock is set for travelling; and, when the operations have been completed, reports to the executive, "Sir, No. (so and so) in order," or reports any defects which the section cannot remedy without delay.

(2) *Gunner.*—(a) Assisted by Nos. 1 to 5, inclusive, removes the gun from the platform (par. 19b).

(b) Releases the firing pin by pulling the firing lever while No. 1 eases forward the striker.

(c) Closes the sight port cover.

(d) Assisted by No. 1, lowers and latches the top shield.

(e) Sets the tilting head and deflection zero, drift correction for charge 2, removes the panoramic telescope from the mount and passes it to No. 1.

(f) Removes the antitank telescope and replaces it in its case.

(g) Sets site 0 (our 300) on the sight clinometer, removes it from the sight bracket and replaces it in its case.

(h) Sets the range scale at zero.

(i) Locks the cradle travelling lock (cradle clamping gear) by traversing the gun to approximately 3° (53 mils) right traverse and elevating until the U-shaped piece of the bracket on the underside of the cradle bears on the clamp. The gun is then traversed to zero, when the retaining pawl automatically locks the cradle in its travelling position.

(j) Replaces the sight cover.

(k) Assisted by Nos. 1, 2 and 5 replaces the overall cover, when used.

(l) Takes his post.

(3) No. 1.—(a) Assists in moving the piece from the firing platform (par. 19b).

(b) Closes the breech and assists the gunner to release the firing pin by easing forward the striker when the gunner pulls the firing lever.

(c) Assists the gunner to lower and latch the top shield.

(d) Swings the cradle lock until its plunger is engaged in the bracket on the inside of the right trail.

(e) Receives the panoramic telescope from the gunner and replaces it in its case.

(f) If they have been removed, he receives the can of lubricating oil, tool roll and spare parts roll from No. 5 and replaces them in their travelling position on the carriage.

(g) Receives the gunner's quadrant from the chief of section, sets it at zero and replaces it in its carrying case.

(h) Releases the brake, if set.

(i) Replaces the breech cover.

(j) Assists the gunner and Nos. 2 and 5 to replace the overall cover, when used.

(k) Takes his post.

(4) No. 2.—(a) Assists in moving the piece from the firing platform (par. 19b).

(b) Procures and replaces the aiming stakes in their traveling position on the shield.

(c) Receives the fuze wrenches from No. 3 and replaces them in their case.

(d) When so instructed by the chief of section, assisted by No. 5, removes the spade box and places it in its traveling position on the top of the trail.

(e) Assists the gunner and Nos. 1 and 5 to replace the overall cover, when used.

(f) Assists Nos. 3 and 4 to prepare ammunition for travel.

(g) Takes his post.

(5) No. 3.—(a) Assists in moving the piece from the firing platform (par. 19b).

(b) Assisted by No. 4 insures that any time fuzes which have been set are set back at safe and caps are replaced on all fuzes from which they have been removed.

(c) Assisted by No. 4 replaces unused ammunition in trays and secures all clamps.

(d) Passes the fuze wrenches to No. 2.

(e) Closes and secures the right caisson door.

(f) Assisted by No. 4 replaces the camouflage net and equipment from the caisson stores tray.

(g) Takes his post.

(6) No. 4.—(a) Assists in moving the piece from the firing platform (par. 19b).

(b) Assists No. 3 in setting time fuzes back to safe and replacing fuze caps.

(c) Assists No. 3 to replace unused ammunition in trays and secure the clamps.

(d) Closes and secures the left caisson door.

(e) Assists No. 3 to replace the camouflage net and equipment from the caisson stores tray.

(f) Takes his post.

(7) No. 5.—*a.* Assists in moving the piece from the firing platform (par. 19*b*).

(*b*) Replaces the muzzle cover, and passes the breech cover to No. 1.

(*c*) If they have been removed, he replaces the drag ropes in their travelling position on the shield.

(*d*) When so instructed by the chief of section, assists No. 2 to remove the spade box and place it in its travelling position on the top of the trail.

(*e*) Secures the loading rammer and trail handspikes in their travelling position on the trail.

(*f*) Procures the overall gun cover and assists the gunner and Nos. 1 and 2 to replace it, if used.

(*g*) If tools or spare parts have been removed from the gun, he places them in their roll and passes the tool and spare parts rolls to No. 1.

(*h*) Takes his post.

b. To remove the gun from the firing platform.—(1) To release the platform.—At the command MARCH ORDER or OFF PLATFORM, the latter used when it is desired to continue fire from the wheels, No. 1 releases the brake, and the gunner and No. 1 unclamp the lever-link locking pawls and lift the platform stays to break the joint on the side nearest their position. The gunner and No. 1 take position in rear of the shield; No. 2 and No. 5 at the wheels; No. 3 and No. 4 at the handspike; the gunner and even numbers on the left, odd numbers on the right. The chief of section commands HEAVE and the gun is run forward, off the platform. The gunner and even numbers then take position around the platform on the left; odd numbers around the platform on the right.

(2) To secure the platform under the trail.—The chief of section orders LIFT and the detachment lifts and hooks the platform under the trail, No. 1 and No. 2 reporting HOOKED as soon as their respective side is hooked. The chief of section then orders CLAMP, and No. 1 and No. 2, in unison, clamp the platform to the trail. All cannoners continue their duties in MARCH ORDER or take their posts.

(3) To carry the platform on the caisson.—The chief of section orders REMOVE PLATFORM, and the gunner and No. 1 release the platform stays from the trail. The chief of section next gives the command: 1. READY, 2. HEAVE.

At the command **READY** the cannoneers grasp the platform and at the command **HEAVE** they lift and push or pull the platform clear of the trail and in the direction of the caisson. The gunner and No. 1 fold over and secure the stays and all cannoneers working together lift and place the platform on the caisson. Cannoneers then resume their duties in march order or, if the command **MARCH ORDER** has not been given, take their posts.

c. To resume fire in another position.—(1) If it is intended to resume firing shortly, but in another position, so that the limbering, or limbering and coupling, of the pieces is necessitated, the command **MARCH ORDER** is not given. In this case, at the command for limbering, or limbering and coupling, only such of the operations incident to march order are performed as are necessary for the movement of the piece (and caisson) and for the care and security of the equipment.

(2) If the command **MARCH ORDER** is given while the pieces are limbered, or limbered and coupled, the operations pertaining to march order are completed as described above.

SECTION VII

DUTIES IN FIRING

20. **General.**—*a.* In general, the duties in firing are as follows:—

(1) The chief of section is responsible that all duties are properly performed, all commands executed, and all safety precautions observed.

(2) The gunner sets the announced deflection, site and range, lays for direction and elevation, refers the piece, and fires the piece.

(3) No. 1 opens and closes the breech.

(4) No. 2 loads the piece.

(5) No. 3 prepares projectiles and fuzes, and passes ammunition to No. 2.

(6) No. 4 prepares charges, assists No. 3 in setting time fuzes, passes the prepared charge to No. 3; and, in direct laying at moving targets, shifts the trail.

(7) No. 5 rams the projectile and shifts the trail.

(8) Higher-numbered cannoneers, if present, assist with the preparation of ammunition unless assigned other duties by the chief of section.

b. The duties of the gunner and Nos. 1, 2 and 5 are mutually dependent. The same is true of Nos. 3 and 4.

21. **Chief of Section.**—*a. Enumeration of duties.*—(1) Assisted by the gunner, to lay for elevation when the gunner's quadrant is used.

(2) To measure the elevation.

(3) (a) To measure the minimum quadrant elevation.

(b) To measure the minimum range.

(4) To indicate to the gunner the aiming point, the referring point, or the target.

(5) To follow fire commands.

(6) To indicate when the piece is ready to fire.

(7) To give the command to fire, except when firing at moving targets with direct laying.

(8) To report errors and other unusual incidents of fire to the executive.

(9) To conduct prearranged fire schedules.

(10) To record basic data.

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

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

(13) To conduct the fire of his piece on a moving target, when so ordered by the executive.

b. Detailed description of certain duties.—(1) *To lay for elevation when the gunner's quadrant is used.*—(a) The chief of section must first know how to read settings on the gunner's quadrant, and then how to set the elevations announced. To set an elevation on the gunner's quadrant, for example, 361.8 mils, the chief of section sets the upper edge of the head of the index arm opposite the 360 mark of the graduated arc on the quadrant frame and slides the slide level along the index arm (for the M1, rotates the micrometer) until its index is opposite the 1.8 mark of the scale on the index arm. Care must be taken in setting the slide to use the scale on the index arm which is on the same side of the quadrant as the graduated arc on the frame which was used in setting the index arm at 360 mils. After the slide has been set, the clamp is tightened just sufficiently to hold the slide in place.

(b) The command QUADRANT (SO MUCH) indicates that the gunner's quadrant is to be used.

(c) The announced elevation having been set on the gunner's quadrant, the piece loaded, and the breechblock closed, the chief of section places the quadrant on the levelling plate of the breech hoop, with the words "line of fire" at the bottom and the arrow pointing toward the muzzle. The chief of section must be sure to use the arrow which appears on the same side of quadrant as the scale which he is using. He stands squarely opposite the side of the quadrant and holds it firmly on the levelling plate, parallel to the axis of the bore. It is important that he take the same position and hold the quadrant in the same manner and on the same portion of the leveling plate for each subsequent setting, so that the quadrant bubble will in each case be viewed from the same angle and cant errors will be eliminated.

(d) The gunner operates the elevating handwheel until the quadrant bubble is centered, making sure that his last movement is breech upward. The chief of section warns the gunner when the bubble is approaching the center, in order that the final centering may be performed accurately.

(2) *To measure the elevation.*—At the command MEASURE THE ELEVATION, the piece having been laid, the chief of section sets the slide level of the index arm of the gunner's quadrant at zero and places the quadrant on the quadrant seat as in laying for elevation ((1) above). He then moves the index arm until the bubble passes to the end of the vial away from the hinge of the index arm. He then slowly lowers the index arm until the bubble just passes to the end of the vial toward the hinge. He then allows the index arm to engage the arc, and slides the level along the index arm until the bubble is accurately centered. He then removes the quadrant and reads and announces the elevation thus set, for example, "Elevation, No. (so and so), (so much)."

(3) *To measure the minimum elevation or minimum range.*—
 (a) 1. *Elevation.*—The command is MEASURE THE MINIMUM ELEVATION. The chief of section, sighting along the lowest element of the bore, causes the gunner to operate the elevating mechanism until the line of sight just clears the crest. He then measures the quadrant elevation as described in (2) above and reports the angle read from the gunner's quadrant to the executive, thus, "Minimum elevation, No. (so and so), (so much)."

2. *Range.*—The command is MEASURE THE MINIMUM RANGE, SITE (SO MUCH), CHARGE (SO MANY). The chief of section causes the gunner to set the site announced on the sight clinometer. Sighting along the lowest element of the bore, he then causes the gunner to operate the elevating handwheel until the line of sight just clears the crest. The gunner then operates the range scale mechanism handwheel to centre the bubble of the sight clinometer and reads the range setting. The chief of section reports this range to the executive, thus, "Minimum range, No. (so and so), (so much), site (so much), charge (so many)."

(b) When the executive announces the corrected minimum elevation, or the corrected minimum range and site, the chief of section records it in a notebook and causes the gunner to mark it on a convenient place on the carriage.

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

(5) *To follow fire commands.*—The chief of section will follow the fire commands mentally. He will not repeat the commands but will be prepared to give any element of the last command to any cannoneer who has failed to hear it.

(6) *To indicate when the piece is ready to fire.*—When arm signals between the chief of section and the executive can be observed, the chief of section will extend his right arm vertically as soon as the gunner has called "Ready," as a signal to indicate that the piece is ready to fire. When arm signals cannot be observed, the chief of section reports orally to the executive "No. (so and so) ready."

(7) *To give the command to fire.*—When the gunner can see arm signals made by the chief of section, the chief of section will give the command to fire by dropping his right arm sharply to his side. When arm signals cannot be used, the command NO. (SO AND SO) FIRE will be given orally. *The chief of section will not give the signal or command to fire until all the cannoneers are in their proper places.*

(8) *To report errors and other unusual incidents of fire to the executive.*—If for any reason the piece cannot be fired, the chief of section will report promptly to the executive that fact and

the reason therefor; for example "No. (so and so) out, misfire." Whenever it is discovered that the piece has been fired with an error in laying, the chief of section will report that fact at once; for example, "No. (so and so) fired with incorrect deflection." Whenever the gunner reports that the aiming stakes are out of alinement with the panoramic telescope, the chief of section will report that fact and ask for instructions (par. 31). Likewise, other unusual incidents that affect the service of the piece are reported by the chief of section.

(9) *To conduct prearranged fire schedules.*—Whenever the execution of prearranged fires is ordered, the chief of section will conduct the fire of his section in strict conformity to the schedule prescribed.

(10) *To record basic data.*—Data of a semipermanent nature will be recorded in a notebook by the chief of section. This includes such data as minimum elevations; base deflections, including aiming points used; prearranged fires when prepared schedules are not furnished; safety limits in elevation and deflection; number of rounds fired in each charge, with the date and hour; and calibration corrections. The number of rounds fired in each charge may be obtained by counting the unused charges.

(11) *To observe and check the functioning of the materiel.*—The functioning of all parts of the materiel will be observed closely during firing. Before the piece is fired, the chief of section verifies the fact that the recoil mechanism contains the proper amount of liquid and air and thereafter carefully observes the functioning of the recoil system. Occasionally he causes the gun to be elevated, releases Plug M and operates the *snifting valve* of the recoil (buffer) cylinder to remove any accumulation of air. If after the gun is warmed up the counterrecoil is either sluggish or violent during the last few inches, the chief of section adjusts the *counterrecoil buffer (run-out) adjusting valve*. At frequent intervals the chief of section compares the length of recoil indicated by the *recoil indicator* with that indicated on the scale on the *front cap*. Any evidence of trouble (par. 46) is reported promptly to the executive.

(12) *To assign duties when firing with reduced personnel.*—Whenever the personnel of the section serving the piece is temporarily reduced in numbers below that indicated in this manual, the chief of section will make such redistribution of

duties as will best facilitate the service of the piece. In case of casualties, the chief of section should instruct personnel to assume duties as follows:

(a) *Chief of section.*—Duties assumed by gunner in addition to normal duties.

(b) *Gunner.*—Duties assumed by chief of section, No. 4, No. 5 or No. 3 in the order named.

(c) *With gunner and 4 cannoneers.*—No. 3 performs duties of Nos. 3 and 4.

(d) *With gunner and 3 cannoneers.*—No. 1 performs the duties of Nos. 1 and 5. No. 3 performs the duties of Nos. 3 and 4.

(e) *With gunner and 2 cannoneers.*—No. 1 performs the duties of Nos. 1 and 5. No. 2 performs the duties of Nos. 2, 3 and 4.

(13) *During direct laying on a moving target, to conduct the fire of his piece when so ordered by the executive.*—(a) *To announce an initial lead.*—The chief of section observes the target, estimates its lateral speed, and, based thereon, the lead in tank lengths, and announces the lead to the gunner; for example, LEAD RIGHT (LEFT) (ZERO) (SO MANY). If the lead is observed to be in error, or if the speed or direction of movement changes, during firing, a new lead is announced. After the first command, new leads are given without repeating the word LEAD, for example, RIGHT (LEFT) (SO MUCH) or ZERO. In each case the last lead given is understood to include the initial command plus all subsequent changes.

(b) *To announce an initial range.*—The chief of section estimates the initial range to the target and announces it to the gunner. During the firing he announces range changes as appropriate, except no range changes are announced for shorter ranges once the target reaches 500 yards.

22. *Gunner.*—a. *Enumeration of duties.*—(1) (a) To set the drift scale for the correct charge.

(b) To set the sliding range indicator for the correct charge.

(c) To set or change the deflection.

(d) To apply the deflection difference.

(e) To set the angle of site.

(f) To center the cross level bubble.

(g) To lay for direction.

(h) To set the range.

B28663

- (i) To lay for range or elevation.
- (j) To call "Ready".
- (k) To fire the piece.
- (l) To refer the piece.
- (m) To record base deflection.
- (n) To measure a deflection.
- (o) To report the reading of the recoil indicator.
- (p) For direct laying on a moving target, to take and maintain an announced lead and range.

(2) For indirect laying, the gunner performs the duties prescribed in (1) (a), (b), (c), (d), (e), (f), (g), (h), (i), (j) and (k) above.

(3) For direct laying at a stationary target, the gunner performs the duties prescribed in (1) (a), (b), (c), (f), (g), (h), (i), (j) and (k) above.

(4) For direct laying at a moving target, the gunner performs the duties prescribed in (1) (f), (g), (i), (j), (k) and (p) above.

(5) When directed, the gunner performs the duties prescribed in (1) (l), (m), (n) and (o) above.

b. Detailed description of certain duties.—(1) *To set the drift scale for the correct charge.*—Upon receiving the charge, the gunner loosens the wing nut and rotates the drift scale until the correct charge is opposite the index.

(2) *To set the sliding range indicator for the correct charge.*—After setting the drift scale, the gunner moves the sliding range indicator until it is in agreement with the index of the fixed reader for the announced charge and tightens the thumb screw.

(3) *To set or change the deflection.*—(a) *To set the deflection.*—The gunner is first taught to read deflections set on the sight and then to set the deflections announced. At the command, for example, DEFLECTION 1,885, the gunner first sets the zero of the azimuth micrometer opposite the fixed azimuth index, if it is not already so set. He then pushes the throw-out lever with his left hand and with his right hand turns the rotating head until the hundreds' graduation (18 in this case) is opposite the azimuth-circle index. He then releases the throw-out lever and grasping the azimuth-worm knob with his left hand with the thumb on top, turns the azimuth-worm knob to the left until the micrometer index is opposite the graduation 85 of the counterclockwise graduations on the azimuth micrometer. The line of sight will then make a horizontal angle of

1,885 mils with the axis of the bore. The azimuth micrometer is then turned until its zero graduation is opposite the micrometer index. Any movement of the azimuth micrometer does not change a deflection previously set.

(b) *To change the deflection.*—The gunner should be trained always to grasp the azimuth-worm knob with his left thumb on top, as the command for changing the deflection then will indicate the direction in which he should move his thumb in turning the azimuth-worm knob. He also should be taught that turning the azimuth-worm knob to the right decreases the deflection set on the sight and results in moving the muzzle to the right when the piece is laid with the new deflection. Similarly, turning the azimuth-worm knob to the left increases the deflection and results in moving the muzzle to the left when the piece is laid. The deflection having been set at 1,885 mils, if a subsequent command be, for example, RIGHT 65, the gunner turns the azimuth-worm knob by moving his thumb to the right until the micrometer index has moved from zero to 65 on the clockwise graduations of the azimuth micrometer. As turning the azimuth-worm knob to the right decreases the deflection, the resulting deflection will be 1,820 mils. The azimuth micrometer is then reset with its zero opposite the micrometer index. Should the command be LEFT (SO MUCH), the deflection setting is changed in a similar manner, except that the gunner moves his thumb to the left and follows the counterclockwise graduations of the azimuth micrometer.

(4) *To apply the deflection difference.*—(a) The command is: ON NO. (SO AND SO) OPEN (CLOSE) (SO MUCH). The gunner of the piece indicated in the command does not change the deflection set on his sight. Each of the other gunners changes his sight setting by the number of mils specified in the command if his piece is next in line to the piece indicated; by twice this number of mils if his piece is second in line from the piece indicated; by three times this number of mils if his piece is third in line from the piece indicated.

(b) If the command is, for example, ON NO. 1 OPEN 5, the gunner on No. 1 makes no change; the gunner on No. 2 turns the azimuth-worm knob by moving his thumb to the left, *away from the piece indicated in the command*, and sets off 5 mils once; the gunner on No. 3 turns the azimuth-worm knob in a similar manner, except that he sets off 5 mils twice, a total of 10 mils; the gunner on No. 4 also turns his azimuth-worm knob in a similar manner, except that he sets off 5 mils three times, a total of 15 mils.

(c) Should the command be, for example, ON NO. 3 CLOSE 10, the gunner on No. 1 turns the azimuth-worm knob by moving his thumb to the left, *toward the piece indicated in the command*, and sets off 10 mils twice, or a total of 20 mils; the gunner on No. 2 turns his azimuth-worm knob in a similar manner, except that he sets off 10 mils once; the gunner on No. 3 makes no change; the gunner on No. 4 turns his azimuth-worm knob by moving his thumb to the right and sets off 10 mils once.

(d) It should be noted that, in making the deflection changes involved in applying the deflection difference, each gunner turns the azimuth-worm knob by moving his thumb away from the piece indicated if the command is OPEN, and toward the piece indicated if the command is CLOSE; also that the muzzles of the pieces will be moved in similar directions when the pieces are laid after the deflection difference has been set.

(e) In training gunners to apply the deflection difference, it will be found advantageous to teach them to use the sight as a mechanical adding machine. For example, if the command is ON NO. 1 OPEN 8, the gunner on No. 4 first sets off 8 mils, then after an imperceptible pause another 8 mils, and so on until he has set off 8 mils three times. This method requires no mental arithmetic.

(f) When a deflection change and a deflection difference are announced at the same time, for example, RIGHT 30, ON NO. 1 CLOSE 5, both of which affect the gunner's piece, he will first set off the deflection change and then apply the deflection difference.

(g) In the methods described above, it is implied that the gunner resets the azimuth micrometer with its zero opposite the micrometer index each time the azimuth-worm knob has been turned. By so doing, each change in the deflection setting is made by starting with the micrometer index at zero. This facilitates setting off the tens and units on the azimuth-micrometer scales. It is important that the gunner before turning the azimuth-worm knob verify the setting of the azimuth micrometer to make sure that its zero coincides with the micrometer index.

(h) Another method is authorized as follows: The zero of the azimuth micrometer is left opposite the fixed azimuth index at all times. Deflection changes are made in the proper direction by turning the micrometer index through the required number of graduations, the only difference being that the movement of the index does not always start at zero.

(i) Irrespective of which method is used, all gunners in a battery should be required to use the same method.

(5) *To set the angle of site.*—Pending the manufacture and issue of an angle of site level (sight clinometer) graduated in mils, it is necessary to use the British sight clinometer which is graduated in degrees and minutes. For this instrument the angle of site is converted from mils and given in degrees and minutes, for example, POINT 36 if in minutes, or ONE POINT 36 if in degrees and minutes. The word "point" is understood to give the division between degrees and minutes; it is not a decimal. The gunner is first taught to read angles of site on the sight clinometer scale. To set an angle of site, the gunner grasps the worm knob and turns it until the announced reading is shown. The angle of site is indicated by a course scale graduated in single degrees from zero to plus 20 (20° elevation) and from zero to minus 20 (20° depression), and two micrometer scales graduated in 5-minute divisions, one which turns clockwise with increasing readings to indicate a plus (elevation) angle of site, and the other which turns counter-clockwise for increasing readings to indicate a minus (depression) angle of site. One complete turn of the micrometer knob equals one degree. For a plus setting the gunner turns the micrometer knob clockwise to obtain the desired reading of degrees on the near portion of the course scale and minutes on the micrometer scale nearest the knob. For a minus setting the gunner turns the micrometer knob in a counter-clockwise direction to obtain the desired reading of degrees on the far portion of the course scale and minutes on the micrometer scale farthest from the knob. The last motion in setting the angle of site should be to turn the top of the micrometer worm knob to the left (counter-clockwise).

(6) *To center the cross-level bubble.*—The gunner centers the cross-level bubble by rotating the outer screw knob which is located at the lower left of the sight mount.

(7) *To lay for direction.*—(a) *Indirect laying.*—The deflection having been set, the gunner brings the vertical hair of the panoramic telescope on the aiming point by traversing the piece with his left hand on the traversing handwheel. If the amount of movement necessary is greater than can be obtained by traversing, the trail must be shifted. To shift the trail, the gunner commands or signals MUZZLE RIGHT (LEFT). No. 5 (or, for direct laying at a moving target, No. 4) hastens to the handspike and shifts the trail so that the muzzle moves in the indicated direction until commanded or signalled to stop by the gunner. The gunner then completes the laying by bringing the vertical hair of the panoramic telescope on the aiming point. If the first round has not been fired and the spade is not embedded, the traversing mechanism

should be within 30 minutes of its center, or zero mark when the laying is completed. In general, whenever a new target is designated the gunner should insure that the fire starts with the gun in approximately center traverse.

(b) *Direct laying on a stationary target.*—The deflection having been set, the gunner traverses the piece by means of the traversing handwheel until the vertical hair of the panoramic telescope is on his part of the target. If the amount of movement necessary to lay on the target is greater than can be obtained by traversing, the trails must be shifted ((a) above).

(c) *Direct fire on a moving target.*—See (16) below.

(d) *Procedure to insure accuracy.*—To take up lost motion, the final movement of the traversing handwheel should be in a counter-clockwise direction. The gunner should habitually lay with the vertical hair of the panoramic telescope on exactly the same portion of the aiming point or target for each round.

(8) *To set the range.*—To set a range, the gunner grasps the range-scale mechanism handwheel with his right hand and turns it until the announced range is below the index of the sliding range indicator (fig. 5), making sure that the last motion is such as to depress the sight, that is, in the direction of increasing range.

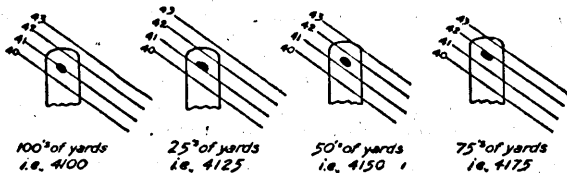


FIG. 5. RANGE SCALE SETTINGS.

(9) *To lay for range or elevation.*—The gunner having performed the duties described above, grasps and turns the elevating handwheel with his right hand until the bubble of the sight clinometer or gunner's quadrant is centered. At least the last two turns of the handwheel must be made in the direction "breach up" in order to minimize the effects of lost motion. If, in depressing the piece, the bubble overruns the center, the gunner turns the elevating handwheel at least two complete turns of elevation and he then depresses until the bubble is centered.

(10) *To call "Ready."*—The piece having been laid for direction, angle of site, and range or elevation, and the No. 1 having called "Set," the gunner verifies the laying, grasps the firing lever with his right hand and calls "Ready." to indicate that the piece is ready to be fired.

(11) *To fire the piece.*—Upon command or signal from the chief of section to fire, the gunner pulls the firing lever smartly, releases it at once and replaces his hand on the elevating handwheel. In direct laying, having heard No. 1 announce "Set" and having the announced lead maintained on the target, the gunner fires. For fire against tanks, the gun is fired by means of an elbow strap attached to the firing lever. When ready to fire, the gunner pulls his elbow to the rear and into his side. At drill, the striker should be removed to prevent breakage of the firing pin.

(12) *To refer the piece.*—The piece having been laid for direction, to refer the piece, the command is: 1. AIMING POINT (SO AND SO), 2. REFER. Without disturbing the laying of the piece, the gunner brings the vertical hair of the panoramic telescope on the new aiming point (referring point). He then reads and announces the deflection thus set, and records the deflection and referring point upon a convenient part of the carriage. Two referring points usually are used, one for day and another for night. A referring point should be at least 50 yards from the panoramic telescope, preferably to the rear. Frequently it will be necessary to use the aiming stakes as referring points, particularly for night use.

(13) *To record base deflection.*—At the command RECORD BASE DEFLECTION, the gunner records the deflection set on his panoramic telescope upon the data block of the shield or some other convenient part of the carriage, or upon the section data board (paragraph 39).

(14) *To measure a deflection.*—The command is: 1. AIMING POINT (SO AND SO), 2. MEASURE THE DEFLECTION. The piece having been established in direction, the gunner turns the panoramic telescope until the vertical hair is on the aiming point. He then reads and announces the deflection.

(15) *To report the reading of the recoil indicator.*—The command is: CHECK RECOIL INDICATOR. The gunner reads the position of the indicator slider on the top left of the cradle, reports the reading and pushes the slider as far forward as it will go.

(16) *For direct laying on a moving target, to take and maintain an announced lead and range.*—The command is: LEAD RIGHT. (LEFT) (SO MUCH). (RANGE). For this fire the point of aim should be the center of the visible mass of the target and the cross level bubble is centered for the first round only.

(a) *With the antitank telescope.*—The gunner tracks the target with his right hand on the elevating handwheel and his left hand on the traversing handwheel, keeping the vertical hair of the telescope ahead of the center of the visible part of the target by the announced lead, measured on the reticule scale, and the horizontal cross-hair at the center of the visible part of the target. He applies the initial range and subsequent range changes by means of the knob on the top of the antitank telescope. Each click indicates a range change of 100 yards. For any range below 500 yards, a setting of 500 yards is retained. After No. 1 calls "Set," the gunner fires as soon as he is satisfied with his laying.

(b) *With the panoramic telescope.*—The gunner sets both the deflection and tilting head at zero and tracks the target with his right hand on the elevating handwheel and his left hand on the traversing handwheel, keeping the vertical hair of the panoramic telescope ahead of the center of the visible part of the target by the announced lead, and the horizontal hair of the panoramic telescope on the center of the visible part of the target, both as determined by the reticule scale of the panoramic telescope. The gunner sets the initial range, if over 500 yards, or range 500 yards and applies range corrections as given. This he applies to the range cone with the range-scale mechanism handwheel. After the No. 1 calls "Set," the gunner fires as soon as he is satisfied with his laying.

23. No. 1.—a. *Enumeration of duties*—(1) To open and close the breech.

(2) To call "Set."

(3) To operate the piece brake.

(4) To recock the firing mechanism in case of a misfire.

b. *Detailed description of certain duties.*—(1) *To open and close the breech.*—(a) *To open the breech.*—No. 1 grasps the breech-operating lever (lever breech mechanism) with his right hand, compresses the latch (catch-retaining), and pushes the lever to the rear and downwards, thus opening the breech and ejecting the cartridge case. The breech is held in the open

position by means of the extractors (extractor levers), the lugs of which engage recesses in the breechblock. As soon as the breech is open, No. 1 looks through the bore to see that it is clear. In firing, he opens the breech as the gun returns to battery.

(b) *To close the breech when loading.*—The first movement of closing the breech is brought about by the rim of the cartridge case forcing the extractors forward, and allowing the buffer spring to raise the block partially. While this movement is taking place, No. 1 holds the operating lever lightly with his right hand. He then completes the closing of the breech by pulling the lever upward and forward. If there is difficulty in closing the breech, No. 1 first insures that the primer is screwed fully home and is flush with the face of the cartridge case. He then endeavors to press the round home by grasping the operating lever with both hands and exerting the whole weight of his body upon it. If necessary other cannoneers should assist No. 1 in forcing the breech to its closed position. *The rammer or other implement must never be used to drive the primed cartridge case home.*

(c) *To close the breech without loading.*—No. 1 first takes the weight of the buffer spring by pressing down the operating lever, he then pushes forward the extractors with the thumb and forefinger of the left hand; at the same time pulling the operating lever upwards with the right hand, thus freeing the block. He then completes the closing of the breech.

(2) *To call "Set."*—When the piece has been loaded, the breech closed and all cannoneers are clear of the path of recoil and a possible rearward movement of the platform and carriage, No. 1 calls "Set."

(3) *To operate the piece brake.*—Unless otherwise ordered by the chief of section, No. 1 releases the brake after the first round has been fired or when the spade is embedded. If the brakes are used and the trail is to be shifted, No. 1 releases the brakes during the period of trail shifting, and then resets the brake lever.

(4) *To recock the firing mechanism in case of a misfire.*—No. 1 procures the cocking lanyard, attaches it to the cocking handle of the firing mechanism, and pulls the lanyard to the rear. He drops the cocking lanyard before calling "Set," which indicates to the gunner that the piece is once again ready to fire.

24. **No. 2.**—*a. Enumeration of duties.*—(1) To load the piece.
- (2) In volley fire, to call out the number of the round.
- (3) When necessary, to assist **No. 5** in shifting the trail.

b. Detailed description of certain duties.—(1) *To load the piece.*—(a) *General.*—To prevent injury to his right hand in loading the cartridge case, **No. 1** should protect his knuckles with a spare cardboard cup or a glove. **No. 2** will be particularly careful to avoid striking the fuze against any portion of the materiel. *To prevent premature bursts caused by projectiles being struck on the fuze by the piece in recoil, a round to be loaded will be held well out of the path of recoil of the gun until the latter is again in battery.* (AR 750-10.)

(b) *To load a fused projectile.*—**No. 2** receives the fused shell from **No. 3** on his right-hand side, fuze leading. He visually checks to insure that the proper fuze or fuze setting is being used. He then places the shell in the breech and retains it there with his left hand under the shell and in rear of the rotating band until **No. 5** rams it home.

(c) *To load the charge.*—After the shell is rammed, **No. 2** turns to the rear, and in his left hand receives the loaded cartridge case from **No. 3**, holding it at the point of balance. He then centers the case in the breech with his left hand, supporting it at the base with his clenched right hand, pushes the cartridge case home with his clenched right hand, and calls "IN."

(2) *To call out the number of the round.*—To insure that the correct number of rounds are fired in volley fire, **No. 2** calls out the range and the number of the round as he loads the cartridge case in the piece; and, as he loads the last round, adds "Last round." For example, when two rounds are to be fired at 2,800, he calls out "2,800 one; 2,800 two, last round." He should not speak louder than necessary to insure his being heard by the members of his own gun squad.

(3) *When necessary, to assist No. 5 in shifting the trail.*—Whenever, due to the slope of the ground or to the imbedding of the spade, two men are required to shift the trail, **No. 2** hastens to the handspike and assists **No. 5** in shifting the trail.

25. No. 3.—*a. Enumeration of duties.*—(1) To remove ammunition from the caisson or other container and to clean and prepare it for firing.

(2) To set fuzes.

(3) To pass ammunition to No. 2.

b. Detailed description of certain duties.—(1) To remove ammunition from the caisson or other container and to clean and prepare it for firing.—No. 3 assisted by No. 4 arranges the ammunition so it will be convenient for use and sorted into groups according to type, lot number, fuze and charge. No. 3 then inspects the projectiles and fuzes to see that they are free from sand and dirt and that the rotating band is not burred. Any foreign matter will be removed by wiping with an oily cloth. Projectiles having burred rotating bands or which are otherwise defective are placed to one side and the chief of section is informed as to details. No. 3 must be fully conversant with the matter contained in paragraph 38. No. 3 should always have ready for instant use against moving targets several projectiles and cartridge cases prepared with charge 3. If available, the projectiles should be armour-piercing shot, otherwise they should be plugged high explosive, or 117 fuzed high explosive with the cap on, in the priority given.

(2) To set fuzes.—(a) *Impact fuzes.*—When preparing 117 fuzes, the No. 3 removes the steel safety cap and insures that the brass striker cover is in position and intact. When preparing 119 fuzes he removes the steel safety cap, unless the order has been received FUZE 119 DELAY. If the cap is removed he insures that the brass striker cover is in position and intact. If, after preparing a round, it is not used, No. 3 replaces the steel safety cap.

(b) *Time fuzes.*—No. 3, assisted by No. 4, sets time fuzes at the given time-setting. For this purpose they use the fuze wrenches. Fuzes should be prepared in advance so that there are never less than two rounds ready to be fired; at least six rounds should be set as early as possible. In making the setting of a 220 or 221 fuze, the ring should be turned only in a clockwise direction. When setting the 210 fuze, it must not be turned counter-clockwise from zero, but it may be turned in either direction between zero and 60. For any time fuze, if a change in time is given, No. 3 immediately replaces any round in the hands of No. 2, with a fuzed round of the corrected setting. All time fuzes must be reset to safe before being returned to the caisson or other vehicle, and waterproof covers should be replaced on the 220 or 221 fuzes.

(3) *To pass ammunition to No. 2.*—After inspecting and properly fuzeing the projectile, No. 3 passes it to No. 2, fuze foremost. He then obtains the cartridge case from No. 4, the case vertically in his left hand near the neck, and passes it to No. 2.

26. No. 4.—*a. Enumeration of duties.*—(1) To remove ammunition from the caisson or other container and to clean and prepare it for firing.

(2) To assist No. 3 to set fuzes.

(3) For direct laying at a moving target, to shift the trail.

b. Detailed description of certain duties.—(1) *To remove ammunition from the caisson or other container and to clean and prepare it for firing.*—No. 4 assists No. 3 in arranging the ammunition so it will be convenient for use and sorted into groups according to type, lot number, fuze and charge. No. 4 then inspects the cartridge cases to see that they are free from sand and dirt, that the cases are not dented, and that the primers are correctly screwed home. Any foreign matter is removed from the cases by wiping with an oily cloth. Cases which are damaged, or charges which are defective, are placed to one side and the chief of section is informed as to the details. When it is known that a number of rounds of a particular charge will be required, they may be prepared in advance; in such a case No. 4 marks each case with the number of the charge and replaces one cardboard cup. For a change of position or after a lapse of several hours, the markings on prepared charges are erased and the charges are re-established at charge 3. No. 4 must be fully conversant with the matter contained in paragraph 38.

(2) *To assist No. 3 to set fuzes.*—No. 4 takes advantage of any available opportunity to assist No. 3 in preparing or setting fuzes as indicated in paragraph 25 (b) (2).

27. No. 5.—*a. Enumeration of duties.*—(1) To ram projectiles.

(2) To shift the trail.

(3) To keep empty cartridge cases out of the way.

b. Detailed description of certain duties.—(1) *To ram projectiles.*—As soon as No. 2 has placed the fuzeed projectile in the breech and has his hand clear of the base, No. 5 places the rammer against the base of the projectile and, with his

left hand at the rear of the rammer, rams the projectile. The sound of the rotating band engaging the rifling should be clearly heard. If the No. 5 is on the left of the trail, he grasps the rammer with his right hand. Practice projectiles are understood to be properly rammed when they are forced through the bore and to the ground in front of the muzzle. To decrease friction the use of talc (French chalk) on the drill projectiles is recommended.

(2) *To shift the trail.*—No. 5 goes to the trail handspike and gives direction to the piece by shifting the trail as directed by the gunner. The command is: MUZZLE RIGHT (LEFT), and the trail is shifted in the opposite direction, so that the muzzle is swung in the direction indicated. At the gunner's signal, No. 5 lowers the trail to the ground. No. 5 should mentally note a command for a deflection shift and practice to become proficient in shifting the trail the desired amount within a few mils tolerance. For fire against a moving target No. 4 normally shifts the trail and No. 5 continues to ram projectiles.

(3) *To keep empty cartridge cases out of the way.*—No. 5 throws the fired cases well to the left of the piece during any lulls in his other duties.

SECTION VIII

ADDITIONAL INFORMATION ON THE SERVICE OF THE PIECE

28. **Accuracy in laying.**—Sighting and laying instruments and elevating and traversing mechanisms will be manipulated so as to minimize the effects of lost motion. This requires that the last motions in setting instruments and in laying be always in the direction prescribed. To insure accurate laying the gunner and any other personnel who have duties in connection with laying the piece invariably will be required to verify the laying after the breech has been closed. Periodic and accurate testing and adjusting of the instruments is required.

29. **Fire at will.**—*a.* The piece being unlimbered and prepared for action, in case of sudden attack; when the target appears at a range of less than 500 yards, the executive may command: 1. TARGET (SO AND SO), 2. FIRE AT WILL. The chief of section repeats this command.

(1) The gunner insures that the range micrometer of the antitank telescope is set at 500 yards, and, using the anti-tank telescope, lays the piece directly on his part of the target. In order to obtain ricochet action H.E. shell with the 119 fuze, if available, set at delay (cap on) and charge 3 is used for fire against personnel or light *matériel* targets. Anti-tank shot should be used against armoured targets. Based on his observation of his shots throughout the firing, the gunner corrects the laying for direction and range as may be necessary.

(2) Firing is commenced at the command of the chief of section: NO. (SO AND SO) FIRE. The piece is loaded and fired as rapidly as possible until the command CEASE FIRING, or until the enemy disappears from view, or actually reaches the piece.

b. In fire at will, except at armored vehicles, refinements of laying are not attempted, rapidity of fire being of primary importance. Shell, preferably with delay fuze, will be used. In general, the procedure in firing is that the gunner lays so that the shell will strike at or just short of the base of the target for personnel targets, or will strike the target preferably at the center if it is an armored vehicle.

c. In case of an attack from all sides or from more than one direction, in the absence of other instructions from the executive, the right section is responsible for the first quadrant, the area between 12:00 and 3:00 o'clock; the next section, the second quadrant; the third section from the right, the third quadrant; and the left section, the fourth quadrant.

30. **Aiming Stakes.**—*a. General.*—When a suitable natural aiming point is not visible, the piece, after it has been laid initially for direction, is referred to the aiming stakes as described in paragraph 22 *b* (13). Two aiming stakes are used for each piece. One stake is set up in a convenient location at least 100 yards from the piece. The other stake is set up at the mid-point between the first stake and the piece, and is lined in by the gunner so that the vertical hair of his panoramic telescope and the two aiming stakes are all in the same vertical plane. Any lateral displacement of the piece during firing can then be detected easily and corrected for as indicated in paragraph 31.

b. American type.—Each stake is equipped with a light for use in firing at night. The lights should be adjusted so that the far one will appear several feet higher than the near one. The two lights thus will clearly establish a vertical line on which the vertical hair of the panoramic telescope can be laid.

(c) *British type*.—This type is a solid iron bar with a cross-head on which are painted the numbers 1 to 6 inclusive, and it is shorter than the American type. After planting the far stake, the crosshead is turned to the horizontal and clamped in a position close to the ground. Then after planting the near stake, the crosshead of this stake is moved up or down until the bottom of the far crosshead is just visible over the top of the near crosshead. Only the near stake is lighted at night.

31. Correction for lateral displacement.—*a. For American stakes*.—When the gunner notes that the piece is out of line with reference to the aiming stakes, he reports that fact to the chief of section. The gunner continues to lay the piece, using the far stake, until correction is authorized by the executive. The piece is then moved back into its original position, or a correction is made as follows:—the gunner lays the piece by using the far stake, then refers to the near stake, and finally lays on the far stake with the new reading. The stakes are then re-aligned by moving the near stake. This correction is effective only when the stakes have been equally spaced as indicated in paragraph 30.

b. For British stakes.—When the gunner notes that the piece is out of line with reference to the stem of the aiming stakes, he continues to lay by alining the vertical hair of the telescope on the same number on both crossheads. This automatically compensates for a lateral displacement of the piece.

32. Reporting Errors.—Each member of the gun squad should be constantly impressed with the importance of reporting promptly to the chief of section any errors made by members of the gun squad. The chief of section will report errors immediately to the executive as prescribed in paragraph 21 b (8).

33. Cease Firing.—The command CEASE FIRING normally is given to the gun squad by the chief of section, but in emergencies anyone present may give the command. At this command, regardless of its source, firing will cease immediately. If the piece is loaded, the chief of section will report that fact to the executive. Firing is resumed at the announcement of the range or elevation.

34. Suspend Firing.—The command SUSPEND FIRING is given only when the battery is firing on a prearranged schedule and a temporary halt in the firing is desired. At this command firing is stopped, but settings continue to be altered in

conformity with the schedule. If the piece is loaded, the chief of section will report that fact to the executive. Firing will be resumed at the command RESUME FIRING.

35. Changes in Data during Firing.—The announcement to the gun squad of any new element of firing data serves as a signal to stop all firing *previously ordered but not yet executed*. If the piece is not loaded at the announcement of a new element of firing data, the new data will be set off and firing resumed at the announcement of the range or elevation. If the piece is loaded with time shell, smoke or gas, and the new data require a change in the fuze setting, the chief of section will report that fact to the executive; for example: NO. (SO AND SO) LOADED, FUZE SIX POINT SIX. If no change in the fuze setting is required or if the piece is loaded with impact fuze shell, the new data are set off and the firing is resumed.

36. To unload the piece.—Whenever possible, it is desirable that rounds be fired out. Data is determined which is surely safe and the round is fired from the gun. If desirable, the cartridge case may be removed in order to change the charge. When necessary, and always under the direct supervision of the executive, the projectile may be removed by the use of the "projectile ejector."

37. Misfires.—In the event of a misfire, the chief of section insures that the gun is fully in battery, and then No. 1 attaches the cocking lanyard to the cocking handle of the firing mechanism, recocks it and reports "Set." The gunner gives the firing lever a second pull. If the gun again fails to fire, the chief of section reports to the executive, NO. (SO AND SO) MISFIRE. The breechblock will not be opened until at least two minutes have elapsed after the last attempt to fire. (AR 750-10.) Upon removing the cartridge case the primer should be examined. If it has not been struck, the striker will be changed. If the primer has been struck, a fresh cartridge case will be loaded, and the defective cartridge case will be disposed of as directed by the executive. If a misfire occurs when firing blank ammunition, a pause of 30 minutes must elapse before the breech is opened, and no personnel may be in rear of the breech when it is opened.

38. Ammunition.—*a. General.*—Ammunition must be protected from damage, especially to rotating bands and cartridge cases. When it is received, it should be sorted into lots and placed in the best available storage. Ammunition data cards should be retained until after all ammunition pertaining

thereto is expended. Fuzes must not be stored with other components, unless shipped assembled to the projectile, and all components should be kept in their waterproof containers or the caissons until their early use is expected. Protection should be provided against moisture, dirt, the direct rays of the sun and so far as practicable, against hostile artillery fire and airplane bombs. Protection against weather, dirt and sun may be obtained by the use of the caissons or by paulins below and above the ammunition, with suitable dunnage below and between the layers. Protection against hostile fire may be obtained by the use of the caissons, small dispersed stacks, trenches or dugouts.

b. Fuzes.—In general, fuzes are issued assembled to the projectile. Fuzes 117, 119 and 210 are the most common used with HE shell. Fuzes 220 and 221 are the most common used with base ejection gas or smoke shell.

(1) *Fuzes 117 and 119.*—(a) *General Instructions.*—Fuzes 117 and 119 are similar in contour but the latter is distinguished from the 117 by a milled band around the fuze body above which is painted a black band half an inch wide. The 117 fuze is a single purpose superquick fuze, the 119 is a selective superquick or delay fuze. If the black steel safety cap of the 119 fuze is removed, it is superquick in action; if fired with the safety cap on, a small delay action (1/10 second) results. For the 117 fuze the black steel safety cap *must* be removed for positive functioning of the fuze. All fuzes which are uncapped *must* be recapped before they are replaced in the vehicles. *Provided the brass striker cover is present and intact*, 117 and 119 fuzes which have been uncapped or which become uncapped in transit may be safely recapped and replaced in the vehicle.

(b) *Safety Precautions.*—The main function of the brass striker cover is to prevent air pressure overcoming the spring which supports the striker during flight. Without this cover a fuze is very likely to function prematurely as soon as the shutter (centrifugal safety device) has opened. Therefore, cannoners assigned to ammunition handling must insure that the brass striker cover is in position and undamaged. If it is missing or damaged, the safety cap should be replaced and the round disposed of as directed by the executive.

(2) *Fuze 210.*—(a) *General Instructions.*—This is an extremely accurate mechanical time-fuze designed to function high explosive shell for air-burst ranging at any interval of time up to 60 seconds. The setting for safety is *zero*. This fuze will not function at a setting of less than approximately 1½ seconds, thus there is no danger of its bursting immediately in

front of the muzzle. The lower edge of the scale is numbered in *seconds* from 0-9, each second being further subdivided into *tenths*. Above the zero mark is cut a vertical slot in which slides a brass index peg which indicates the *tens* of seconds up to 60. The tens are painted *red* and the units and tenths *black*. Settings between zero and 60 on this fuze may be increased or decreased as desired, using the fuze wrench. No fuze covers are provided.

(b) *Safety Precautions*.—This fuze must not be turned counterclockwise beyond its zero setting, *i.e.*, it must not be turned below zero.

(3) *Fuzes 220 and 221*.—(a) *General Instructions*.—These fuzes are provided with metal covers which must be removed before the fuzes can be set. To set the fuze, remove the cover, place the wrench over the movable (lower) ring and turn in a clockwise direction to the desired setting read opposite the index line. If it is later desired to reset the fuze at either a higher or a lower setting, the ring is again turned clockwise to the desired setting. Where rubber replaceable covers are provided, all fuzes which have been prepared but not fired are covered as soon as they have been reset to "Safe." When replaceable covers are not available, every effort should be made to keep the fuze dry until it can be coated with a moisture sealing compound.

(b) *Safety Precautions*.—The screws which secure the false ogive (nose cap) must not be tampered with. Time-fuzes must be accurately reset at "Safety" before replacing in an ammunition box or vehicle. A setting of zero will burst the shell immediately in front of the muzzle. To set the fuzes at "Safe" the index of the movable (lower) time ring is placed opposite the word "Safe" on the fuze body.

c. *Charges*.—(1) *General*.—Two separate-loading types of charges are furnished. One charge consists of a primed cartridge case with zones 1, 2 and 3, the second consists of a primed cartridge case with zone 4, the supercharge.

(2) *Charges 1, 2 and 3*.—Charges 1, 2 and 3 are packed in red, white and blue bags in the primed cartridge case and are held in place for transit by one or two cardboard cups. After establishing a charge, one cardboard cup only is replaced before firing, this to insure that the red portion of the charge remains in contact with the primer. Charges are identified as follows:—

Charge 1.—Red portion only.

Charge 2.—Red and white portions.

Charge 3.—Red, white and blue portions.

(3) *Supercharge*.—Supercharge is a unit charge consisting of a primed cartridge case, charge, and a cardboard cup which is shellaced in position. The cartridge case and packages have the word SUPER stencilled on them in one inch black letters.

39. **The Section Data Board**.—When positions are occupied for more than a few hours, a data board may be used by each section for recording such items as base deflection, calibration corrections when appropriate, minimum range or elevation, data for primary defensive fire missions, and other data the need for which may be urgent. Such of this data as is shown on the shield data block need not be repeated on the data board. Calibration corrections for this weapon are automatically applied by the sighting mechanism when range changes are used.

40. **To Disable Gun before Capture**.—*a. General*.—The extent to which the gun is disabled will depend upon the time and the probability of recapture. *Guns will not be disabled except upon the orders or instructions of the executive*. In disabling guns all batteries should, as far as possible, follow the same procedure, so that if a number of guns are captured they will all be deficient of the same essential parts. The panoramic telescope, anti-tank telescope, gunner's quadrant, and sight clinometer should *always* be removed and taken away when a gun is abandoned. Spares of any part removed from the gun must also be taken away.

b. To disable a gun so that it may be brought into action immediately after recapture.—Remove the breech mechanism; remove plugs N and H; open valve K.

c. To disable the gun so that it can be brought into action after repair.—Remove the breech mechanism. Place the gun horizontal. Remove plugs M, N, and H; valve K; and snifting valve. Remove the recoil and counter-recoil piston rod nuts and elevate until the gun and recoil mechanism slide to the rear.

d. To destroy the gun.—Place a high explosive shell in the muzzle; load with high explosive shell; and fire the gun by means of a long lanyard from under cover. A length of telephone wire attached to the firing lever is suitable as a long lanyard. In addition the on carriage fire control equipment mentioned in paragraph 40 (a) above should be removed and carried away. If in danger of capture they should be destroyed.

SECTION IX

CARE AND MAINTENANCE OF MATERIEL

41. **General.**—*a.* This section covers such operations in the care and maintenance of the materiel as may be performed by a battery in the field.

b. In general, the battery is charged with *preventive* maintenance, that is, with routine cleaning, lubricating and preserving. Certain classes of repairs, adjustments and replacement of parts may also be made under the direction of an officer or the chief mechanic. In general, any spares carried by the battery may be replaced by battery personnel; and those operations which can be performed in a reasonable time with the equipment furnished the battery may be performed by battery personnel. For routine care and maintenance, specific duties are assigned to individuals, squads or sections, and a strict accountability for the proper performance of such duties is enforced.

c. In general, the following operations should be performed within the battery:—

- (1) Removal, disassembly and replacement of parts of the breech, operating and firing mechanisms.
- (2) Removal and replacement of the barrel and breech ring.
- (3) Draining and replenishing recoil liquid and air.
- (4) Minor adjustments of variable recoil mechanism (cut-off gear) or recoil mechanism packing in an emergency.
- (5) Retraction of gun and recoil mechanism, and when necessary for cleaning the slides the removal of the barrel assembly and recoil mechanism.
- (6) Removal, care and adjustment of wheels and wheel bearings, including tires.
- (7) Maintenance and adjustment of brake mechanisms on the gun and on the caisson.
- (8) Replacement of minor parts or assemblies as carried by the battery in the spare parts or stores kits.

42. **Cleaning.**—*a.* Dirt and grit accumulated in traveling or from the blast of the piece in firing settle on the bearing surfaces, and in combination with the lubricant form a cutting compound. Powder fouling attracts moisture and hastens the formation of rust. At lulls during firing and immediately after

firing, the piece must be thoroughly cleaned. At other times it should be cleaned at intervals not exceeding two weeks, depending upon the use and condition. Dirt on non-bearing surfaces can usually be removed by water; lubricated or other greasy parts must be cleaned with dry cleaning solvent (or kerosene) applied with a cloth. The procedure in cleaning the bore and breech mechanism is described in paragraph 45 (b). The following cleaning materials, with the English equivalents in parentheses, are issued by the Ordnance Department for use in the field:—

- (1) *Soda ash or sal soda* (not used by English).—Used for cleaning the bore, breech mechanism and firing mechanism after firing.
- (2) *Dry-cleaning solvent* (kerosene).—For removing grease. It is preferred to kerosene because it does not leave a corrosive film, and to gasoline because it is less inflammable.
- (3) *Crocus cloth* (none).—This is the coarsest abrasive permitted for cleaning rust and stains from bearing surfaces.
- (4) *Emery cloth* (emery cloth).—Issued for cleaning unfinished or *non-bearing* steel surfaces only. Issued in five degrees of coarseness, of which 00 is the finest.
- (5) *Burlap, jute* (tow).—Issued for cleaning the bore.
- (6) *Cotton waste, clean rags, and sponges* (waste and rags, and interwoven sponge cloth).—For general cleaning purposes.

b. A division of duties for members of the gun squad in routine cleaning and maintenance is as follows:—

- (1) *The gunner*.—Panoramic telescope, antitank telescope, sight mount, sight clinometer, and the elevating and traversing mechanisms.
- (2) *No. 1*.—The breechblock, firing mechanism, gunner's quadrant, tools and spare parts.
- (3) *Nos. 2 and 5*.—The bore, recoil slides and gun carriage.
- (4) *Nos. 3 and 4*.—The caisson.
- (6) Higher-numbered cannoneers assist in the operations as directed by the chief of section.

43. Lubrication.—**a.** To facilitate identification, all oil holes and grease fittings should be made conspicuous by circling with bright red enamel.

b. Lubrication instructions for the gun and carriage are given in Appendix A.

c. Lubrication instructions for the caisson are given in Appendix B.

d. Prescribed British lubricants, with our Ordnance Department equivalent or suitable substitute, and their use are shown below :—

British.	American.	Used for
Grease, G.S. (General Service)	Grease, chassis, medium, or Grease, medium mineral lubricating.	Lunettes and pintles, open gears.
Grease, G.S.	Grease, wheel-bearing, fibrous.	Wheel bearings.
Grease, graphite	Grease, lubricating, graphite, medium.	Exterior threads of gun barrel.
Oil, C.600	Grease, chassis, medium	Force feed lubrication.
Oil, C.70	SAE 10W (British M120x) or SAE 30 (British M160) depending upon temperature.	Breech mechanism, trunnion bearings and working parts generally.
Oil, graphited, concentrate . .	SAE 10W or SAE 30 depending upon temperature.	Slides of gun and cradle guideways.
Oil for Instruments	Neutral oil	Delicate parts of sights and fire control instruments.
Mineral jelly	Petrolatum	Gears of sights and fire control instruments.

44. Protection against Chemicals.—Whenever chemical attacks are anticipated, all bright parts should be covered with oil. After a gas attack, the oil is wiped off and fresh oil applied. If mustard or other persistent gas is used, absorbent objects may be deeply contaminated, and even hard surfaces may be dangerous for six to eight days if the chemical is not neutralized. Surfaces should be sprinkled with calcium hypochlorite or chloride of lime, or painted with a whitewash made from either. After two to six hours the lime is washed off and the materiel rinsed thoroughly with water. When large quantities of water are available, warm (but not boiling) water should be used instead of whitewash. In all cleaning operations, the gas mask and special gas-proof gloves must be worn. All cleaning rags, sticks, etc., are disposed of by burning.

45. **Gun, Breech Mechanism and Firing Mechanism.**—
a. Operations during firing.—(1) During firing, all exposed bearing surfaces must be kept clean and covered with a thin film of lubricating oil.

(2) Whenever the rate of firing permits, the bore should be swabbed with clean water; or cooled by loading an empty cartridge case, elevating the gun and pouring in cold water from the muzzle.

(3) The causes and corrections of malfunctioning of the breech and firing mechanism are given in the following table:—

Malfunction.	Cause.	Correction.
Fails to fire, no percussion on primer.	(1) Broken firing spring (main-spring), broken or deformed firing pin. (2) Piece not in battery. (3) Safety catch at "safe." (4) Insufficient firing pin protrusion.	(1) Replace complete striker case. (2) Push piece into battery; fire. (3) Set safety catch to "fire." (4) Replace complete striker case.
Fails to fire until primer is struck several times.	(1) Weak firing spring (main-spring); (2) Firing mechanism parts not working freely.	(1) Replace complete striker case. (2) Disassemble firing mechanism and examine for burrs and rough spots. If found, remove with crocus cloth or an oilstone. Wash parts with dry-cleaning solvent, dry and lubricate before assembly.
Fails to fire when proper percussion on primer is obtained (misfire).	Defective primer	Make two attempts to fire the primer, then wait 2 minutes before opening breech and replacing charge (<i>see</i> par. 37).
Fails to extract empty case.	Broken extractor or broken cartridge case rim.	Gently ram out the case. Examine the edge of the chamber for burrs. Remove burrs, if any, with crocus cloth or an oilstone. Replace extractor if broken.
Breechblock fails to close.	(1) Primer not flush with head of cartridge case. (2) Deformed case.	(1) Screw primer fully home. (2) Replace with new round if it cannot be forced in by application of power on operating lever. If difficult to extract, remove primer, drive in, reseal primer, close breech and fire.

b. Operations after firing.—(1) As soon as possible after firing, the breechblock and firing mechanism should be removed from the gun, disassembled and all parts cleaned and lightly

oiled. The procedure for disassembly and assembly of the breech and firing mechanism is given in sub-pars. (c) to (f) below.

(2) The bore, breech mechanism and firing mechanism are washed in a solution of $\frac{1}{2}$ pound of soda ash or 1 pound of sal soda in 1 gallon of water. Cleaning the bore is accomplished by means of the bore brush or by burlap tied to the center of a rope. The bore brush may be covered with a piece of canvas or burlap. No attempt should be made to remove copper fouling. When all powder fouling has been removed, the bore should be swabbed with clear water and then wiped dry. Finally, after the bore has cooled, it should be lightly coated with lubricating oil to prevent corrosion. The process may have to be repeated on successive days if there is any evidence of sweating. If the piece is not to be kept in constant service, the bore should be slushed with rust-preventive compound instead of oil.

c. To disassemble the breech mechanism.—A procedure to be followed in dismounting and disassembling the breech mechanism is as follows:—

- (1) Place breechblock in closed position.
- (2) Cock firing mechanism by grasping cocking handle and pulling to the rear. Rotate safety catch to the SAFE position. Pull back the retaining-catch plunger, revolve striker case in a clockwise direction for one-sixth of a turn, and withdraw striker case with striker.
- (3) Remove the firing bracket from the breech ring by releasing the four fixing screws. Withdraw the firing bracket bar from its recess, drive out the firing-bracket-lever-pivot pin and remove the lever with its rollers from the bracket.
- (4) Remove the two firing-rod-bracket screws and withdraw the firing rod.
- (5) Withdraw the cotter pin from the control lever pivot and release the nut of the control lever. Remove the lever from the stud, drive out the plunger retaining pin and withdraw the plunger and spring.
- (6) Rotate the locking screw of the breechblock buffer to the right to screw into the breech ring until the head is below the surface of the ring; press the buffer case down approximately one inch and lift the buffer from its recess. Remove the cotter pin from the plunger nut, remove the nut and withdraw the plunger and spring.
- (7) Supporting the breechblock with the left hand and knee, release the operating lever catch and pull the lever towards

the rear until the block is half-way out, then support the weight with both hands until the block is clear of the breech ring.

(8) Remove the cotter pin from the intermediate cocking-lever pivot pin and withdraw the pin. Remove the intermediate cocking lever from its recess in the breechblock.

(9) Remove the cotter pin from the operating-handle shaft (actuating shaft) nut, remove the nut and withdraw the operating lever from the shaft. Withdraw the cotter pin from the retaining-catch collar and remove the catch and actuating lever. Release the plunger retaining screw and remove the plunger.

(10) Drive the operating-handle shaft to the left, at the same time supporting and removing the extractor levers and crank. Withdraw the operating-handle shaft sleeve from the right-hand bearing in the breech ring. Dismantle the crank rollers by removing the retaining-collar pins.

d. To disassemble the striker.—The striker is disassembled in the following manner:—

(1) Unscrew the pivot pin retaining screw of the cocking lever, in the rear face of the striker case, and remove the pivot pin and cocking lever.

(2) Rotate the safety catch to the FIRE position. Grasp the cocking handle in one hand and the case in the other, and press the toe of the trigger sear to uncock. Remove the cotter pin from the cocking handle and unscrew. Care should be taken to take the tension off the spring while unscrewing, or the striker spindle and spring will fly forward when released. Withdraw the cocking sleeve from the rear and the spindle and firing spring (main spring) from the front of the case.

(3) Remove the cotter pins from the head of the retaining pin of the safety catch and withdraw the pin. Pull the safety catch to the rear to remove. To dismantle the plunger, withdraw the cotter pin from the spindle portion and remove the plunger and spring.

(4) Remove the trigger sear and spring by withdrawing the toe end to the left, remove the cotter pin securing the trigger-sear spring seat and withdraw the seat to the right. Withdraw the cotter pin from the head of the roller-pivot pins and insert a screwdriver in the slots in the bosses to ease the pins. The pivot pins can then be withdrawn and the rollers taken from the recesses in which they are housed.

(5) Remove the firing-pin-retaining staple from the head of the striker spindle, and, with the aid of a No. 18 drift inserted in the transverse hole behind the head, withdraw the firing pin.

(6) Remove the cotter pin and the head of the striker-case-retaining-catch plunger and withdraw the plunger and spring from the front of the case.

e. To assemble the striker.—After thoroughly cleaning and lightly oiling the individual parts of the firing mechanism, assembly is performed in the following manner :

(1) Insert the striker-case-retaining-catch plunger and spring in the hole in the front face of the striker case and secure by its head and cotter pin.

(2) Insert the trigger-sear rollers in their recesses, drive home their pivot pins and secure them with cotter pins. Place the spring seat in the right-hand end of the trigger-sear recess and secure it with a cotter pin. Insert the trigger-sear spring and trigger sear from the left.

(3) Insert the safety-catch plunger and spring and secure by its cotter pin. Place the catch in the hole bored in the rear face of the striker case, insert the retaining pin in its boss and secure with its cotter pin.

(4) Place the firing pin in position and secure by inserting the retaining staple in the holes provided in the flats on the head, insuring that the closed end of the staple is at the top, that is, opposite the gas-escape recess in the head.

(5) Place the firing spring (main spring) in position over the spindle and insert in the front of the case. Holding the head of the spindle against the spring, insert the arm of the cocking sleeve in its recess to engage the slot in the trigger sear, first turning the safety catch to the FIRE position, and press the left-hand end of the trigger sear, while pushing the sleeve home to engage the flats on the striker spindle.

(6) Screw on the cocking handle and secure with its cotter pin. Cock the striker and place the safety catch at the SAFE position.

(7) Insert the boss of the cocking lever between the lugs at the bottom of the striker case, allowing the thinner arm to engage the recess in the striker spindle, the boss on the thinner end facing rear. Drive home the pivot pin and secure by inserting the retaining screw in the rear face of the striker case.

f. To assemble the breech mechanism.—Prior to replacing the breechblock in its recess, the protrusion of the firing pin should be gauged. This is accomplished by measuring to the point of the firing pin with the No. 16 protrusion gauge with the striker in its released position. If the measurement is not

within the maximum-minimum tolerance shown by the gauge, the firing pin should be replaced. The following procedure is used to assemble the breech mechanism :

(1) Insert the operating-lever shaft (actuating-shaft) into the left-hand bearing of the breech ring, assembling in order, the left extractor, crank and right extractor on the shaft.

(2) Press the operating-handle-shaft sleeve (actuating-shaft sleeve) into the right-hand bearing until the face of the sleeve flange is flush with the face of the bearing.

(3) Insert the retaining-catch spring and plunger, and screw home the plunger-retaining screw.

(4) Place the operating lever (actuating lever) catch in its recess and assemble the catch from the left side of the lever with the arm towards the rear.

(5) Place the collar on the end of the spindle portion of the catch and secure with its cotter pin. Place the operating lever in position, tighten up the nut and secure with its cotter pin.

(6) Place the intermediate cocking lever with its roller arm in the recess in the rear face of the breechblock, drive the pivot pin through the bracket and boss, and secure with its cotter pin.

(7) Pull the operating lever to the rear past the full open position. Lift the block so that it will just enter the guides in the breech ring, insert the crank in its recess in the breechblock, and place the extractor levers in the vertical position. Close the breech by rotating the operating lever in a clockwise direction. The roller of the intermediate cocking lever will drop into position in the crank as the breechblock is closed.

(8) Place the plunger and spring into the bracket of the breechblock buffer, screw down the plunger nut and secure with a cotter pin. Screw the bracket-locking screw into the breech ring until the head is flush with the face of the ring, insert the bracket in its recess, press the bracket up until the locking screw is visible and unscrew the locking screw until its head is firmly fixed in the tapered hole of the lug.

(9) Insert the plunger and spring in position in the control lever with the flat towards the bottom and drive home the retaining pin. Place the lever over its pivot with the stop portion in the recess in the breech ring and secure with its nut and cotter pin.

(10) Secure the firing rod bracket to the left side of the breech ring by its two screws. Insert the firing rod in the firing bracket with the shortest end from the collar towards the front.

(11) Insert the firing-bracket lever with its rollers into the bracket and drive home the pivot pin. Slide the bar into position, place the bracket on the breech ring, and secure by its four screws. The control lever should be in its correct position to the right of the projection on the bar.

(12) Insert the striker case into the breechblock, with the retaining catch on the right and opposite its groove in the breechblock. Revolve the case in a counter-clockwise direction for one-sixth of a turn, when the retaining-catch plunger secures it against rotation.

(13) Turn the safety catch to the FIRE position and release the striker by pressing the firing lever on the carriage. The firing lever should not be operated except when a cartridge is in the chamber or when a cannoneer eases the cocking lever forward.

46. Recoil Mechanism.—a. General.—Battery maintenance of the recoil mechanism is limited to exterior cleaning and lubricating, draining and filling with recoil liquid and air, minor adjustments of packing in an emergency, and locking or in an emergency setting of the variable recoil mechanism (cut-off gear). Operations which include the removal of glands, packings and stuffing boxes are performed by Ordnance personnel under conditions which will prevent the entrance of foreign matter into the system. Artillery personnel should take every precaution to prevent the entrance of grit or foreign matter into the system while under their care. The authorized liquid to be used in this mechanism is "Oil, mineral, hydraulic, buffer," and so long as this liquid is available no other liquid will be used. In an active combat emergency, should the supply of correct liquid fail, any lubricating or recoil oil may be used, and in extreme cases even water may be employed. These alternative liquids may cause damage to the recoil mechanism if they are retained in the cylinder for any length of time. Hence, at the first opportunity, the mechanism should be turned in to Ordnance personnel for disassembly, cleaning, and the supply of the correct liquid. Liquids such as kerosene or gasoline must never be used in the recoil system. Except in an emergency, liquid emptied from the mechanism must not be used again. The air used for charging the counter-recoil mechanism must be as moist free as it is possible to make it, and, except in an emergency, only that air issued by the Ordnance Department may be used. During severe weather, the mechanism should be protected as much as possible from the cold, in order to prevent the liquid becoming frozen. The standard type of buffer oil should remain unfrozen down to a

temperature of 20° F. Should the liquid become frozen, firing must not take place. To ascertain that the liquid is not frozen, the snifting valve is opened and oil should flow. A small amount of liquid leakage at the glands is to be expected; any effort to prevent all leakage may result in undue tightness of the packings, with a resulting decreased efficiency of operation and excessive wear of the working parts. The best time to tighten a gland, though by the battery only in an emergency, is during pauses in action when the packings are hot. Before attempting any operation on the recoil mechanism, personnel must be thoroughly familiar with the provisions and procedure given on pages 242-260 of "Handbook for the Ordnance Q.F. 25-pdr., Mark II on Carriage, 25-pdr., Mark I".

b. Operations prior to firing.—Prior to firing, the recoil system should be thoroughly examined and tested to insure that the liquid levels and air pressure are correct. There should be no undue leakage at the glands, and the piston rods must be connected with their cotter pins in position. The counterrecoil buffer regulating mechanism should be in correct adjustment and the recoil slides should be lubricated.

c. Operations during firing.—(1) During firing, the chief of section verifies that the system is working correctly, and that there is no undue leakage at the glands. He constantly verifies the complete return of the piece to battery and frequently observes the length of recoil. From time to time, he operates the snifting valve and checks the liquid level in the reservoir. The position of the floating piston is carefully watched and, when necessary, the liquid in the counterrecoil cylinder is replenished. The slides are kept clean and properly lubricated.

(2) Faults, which frequently affect both recoil and counter-recoil, are invariably caused through one or more of the following:—

(a) Too much friction, for example, damaged slides, dirt, lack of lubrication, and overtight packings.

(b) Incorrect adjustment, for example, adjustment of the variable recoil mechanism (cut-off gear), or the counterrecoil buffer adjusting valve (run-out adjusting valve).

(c) Incorrect filling and charging of the recoil and counter-recoil systems.

(3) The chief of section takes such action in the case of malfunction as is indicated in the following table. (*Note.*—If the variable recoil mechanism (cut-off gear) is damaged, the chief of section or chief mechanic will disconnect and lock the segment on the buffer rod at 20 inches recoil):

Malfunction.	Cause.	Correction.
Violent or excessive recoil.	(1) Air in recoil cylinder. (2) Insufficient liquid in recoil cylinder. (3) Insufficient air pressure in counterrecoil system.	(1) Operate snifting valve. (2) Fill recoil cylinder and reservoir. (3) Test and recharge. It may be due to air alone, or it may be caused by leakage of liquid by the floating piston; the precise cause should be ascertained.
Insufficient recoil.	(1) Damaged slides. (2) Improperly set variable recoil mechanism. (3) Excessive air pressure. (4) Excessive liquid in counterrecoil system. (5) Packings too tight.	(1) Examine slides; if burred remove burrs with fine file; if deformed, refer to ordnance personnel. (2) Test variable recoil mechanism; in an emergency it may be adjusted; otherwise, refer to ordnance personnel. (3) Test; release surplus. (4) Test and recharge counterrecoil system. (5) Refer to ordnance personnel.
Return of gun to battery with a shock (violent counterrecoil).	(1) Counterrecoil buffer (run-out) adjusting valve incorrect. (2) Excessive air pressure. (3) Retarding valve stuck in open position.	(1) Valve provided with a scale marked 0-7, so setting can be readily checked and adjusted. Close valve partially. (2) Test; release surplus. (3) If suspected, and few rounds fail to move it, refer to ordnance personnel.
Failure of gun to return to battery (incomplete counterrecoil) or slow counterrecoil.	(1) Reduced air pressure in counterrecoil system. (2) Too much liquid in recoil system. (3) Air in recoil system. (4) Counterrecoil buffer adjusting valve closed. (5) Burrs or obstruction on slides. (6) Packings too tight.	(1) Test; adjust pressure. (2) Operate snifting valve. (3) Operate snifting valve. (4) Open valve. (5) Examine slides; if burred, remove burrs with fine file. If obstruction, remove. If deformed, refer to ordnance personnel. (6) Refer to ordnance personnel.

47. **Removal and Assembly of Barrel.**—*a. General.*—Every three months the breech ring and the barrel should be removed from the jacket. After removal, the bores, surfaces and threads are cleaned, particular attention being paid to the removal of rust or grit in keyways, on keys and faces of shoulders. Before assembly, the exterior of the barrel is cleaned with an oily cloth. The threads on the breech end of the jacket, the inside of the breech ring, the front end of the jacket, and its sealing collar are coated with graphite grease. After reassembly, a coating of graphite grease is applied to the front end of the

breech ring to assist in excluding moisture. *The clearance between the barrel and the jacket must not be filled with oil or grease.* When removing or replacing the barrel, the following tools are used :—

Artillery tool No. 85.—For the insertion of the barrel.

It also fits into the chamber end of the barrel.

Artillery tool No. 86.—For the removal of the barrel. It also fits into the muzzle end of the barrel.

Artillery tool No. 93.—For the removal and replacement of the breech ring.

Sealing collar wrench.—For the removal and replacement of the sealing collar.

b. To remove the barrel.—(1) Place the gun at approximately zero degrees elevation and lash the hand wheel.

(2) Set the brakes and block the wheels.

(3) Remove the breech mechanism.

(4) Assemble the No. 93 tool in the breech ring as follows :—

(a) Insert the block upwards into the breech ring.

(b) Assemble the clamping plate to the block and secure with the clamping-plate nut tightened by means of a pry bar.

(c) Insert the handles into the block.

(d) Insert the centering mandrel, with its pry bar holes outwards, into the chamber until it is firmly in position.

(5) Loosen the breech-ring securing screw until it is free of the jacket.

(6) With one man on each handle of the No. 93 tool, rotate the breech ring in a counterclockwise direction until the arrow on the breech ring is opposite the arrow on the jacket marked DISMANTLE. A hammer blow on the No. 93 tool may be necessary to start the unscrewing.

(7) The breech ring is next removed by sliding its threaded portion through the blank segments of the jacket. Care should be taken not to allow the weight of the breech ring to rest on the centering mandrel as it is designed solely to guide the breech ring and so to prevent it tilting and jamming on the jacket.

(8) Remove the mandrel from the chamber with the centering-mandrel pry bar, by turning and pulling at the same time.

(9) Remove the sealing collar with the sealing collar wrench.

(10) Insert the No. 86 tool in the muzzle and with a timber, tap the tool until the barrel is loosened. At the same time a handspike should be inserted in the chamber to assist in the removal.

(11) Remove the No. 86 tool and draw the barrel to the rear until the center of gravity (C of G) is clear.

(12) Place a rope sling around the barrel at the center of gravity and pass a handspike through the loops. Two men, one at each end of the handspike, remove the barrel. A third man steadies the barrel with the handspike in the breech end to prevent it fouling the jacket.

c. To assemble the barrel.—(1) See that the word TOP, engraved near the breech end, is uppermost.

(2) Place a handspike in the chamber, a rope sling around the center of gravity of the barrel, and pass a handspike through the two loops of the sling. Three men on the handspikes insert the barrel into the jacket as far as the center of gravity of the former. The man at the chamber handspike should be careful to guide the barrel through the jacket without fouling it.

(3) Remove the handspike and sling and push the barrel gently into the jacket, being careful that the grooves in the shoulder of the barrel are correctly alined to receive the securing screws.

(4) Insert the No. 85 tool in the chamber and with a timber tap the barrel gently home.

(5) Remove the No. 85 tool and replace the sealing collar, being careful to ascertain that the joints of the packing rings are diametrically opposite.

(6) Insert the mandrel of the No. 93 tool into the chamber and with the block of the No. 93 tool secured in the breech ring and using the mandrel as a guide, slide the breech ring on to the jacket, keeping the arrow on the breech ring in line with the arrow on the jacket marked ENGAGE. Rotate the breech ring in a clockwise direction until the arrow on the ring coincides with the arrow on the jacket marked LOCKED.

(7) Tighten the breech-ring securing screw and remove the No. 93 tool.

(8) Unlash the elevating handwheel, release the brakes and remove the wheel blocks.

48. Retraction of Gun and Cleaning Slides.—*a. General.*—At periods of not exceeding one month the assembly of gun and sleigh (recoil mechanism) must be retracted in order to stir up the liquid and permit lubrication of the positions where the packings rest. This is accomplished by actual firing or by the use of the retraction device known as the "apparatus, pulling-back gun." When manually retracting the gun and before the assembly is released to return to battery, the visible portion of the recoil slides and cradle guideways should be thoroughly

cleaned and lubricated. Under conditions of extreme dust, mud or sand it may be necessary periodically to remove the barrel assembly and sleigh (recoil mechanism) in order to completely clean the recoil slides and cradle guideways. Due to the considerable weight involved, this operation may best be performed by ordnance personnel. However, each battery must be prepared to clean its guns as part of its routine maintenance schedule. After removing the sleigh (recoil mechanism), burrs or rough spots on the sliding surfaces are removed with a fine file. The slides are cleaned with dry-cleaning solvent, wiped dry and coated with a light film of the British colloided graphite lubricant; or, if it is not available, a good grade of lubricating oil, either SAE 10W or SAE 30 depending upon the temperature.

b. To retract the gun.—The gun is retracted by means of the "apparatus pulling-back gun" in combination with the "attachment, quick release" in the following manner:—

- (1) Assemble the two devices and secure the assembly to the gun by means of the wire rope through the bore and the chain through the lunette.
- (2) Retract the assembled gun and sleigh (recoil mechanism) about one foot to the rear.
- (3) Clean the visible portion of the sliding surfaces.
- (4) Permit the gun to return to battery by releasing the quick-release attachment.

c. Removal of gun and sleigh.—The procedure for removing the gun and sleigh (recoil mechanism) to clean the slides is as follows:—

- (1) Place the gun on a horizontal platform and lay it horizontally.
- (2) Remove the shield.
- (3) Remove the keys (cotters) from the rear projection of the sleigh.
- (4) Remove the gun securing strap and lift the gun from the sleigh.
- (5) Remove the piston rod nuts, disconnect the variable recoil mechanism and remove the cradle cap.
(*Note.*—See that the cotter pin is correctly assembled in the variable recoil mechanism before disconnecting.)
- (6) Withdraw the sleigh to the rear, care being taken to avoid damage to liners.

d. To replace the gun and sleigh the procedure in c above is reversed.

49. **Wheels and Wheel Bearings.**—*a.* The care and maintenance of the wheel mechanism including tires is a function of the battery. Tire pressure should be maintained at 40 pounds. Tires are removed at least once a year and the disc and rim cleaned and painted. Every six months, or oftener if necessary, the wheel hubs should be removed, the old grease flushed out, new grease pressed into the space between the cleaned and dried rollers and race by hand, and the wheels reassembled.

b. To disassemble the wheel hub from the spindle the procedure is as follows:—

- (1) Remove the hub cap.
- (2) Remove the cotter pin, slotted nut, and washer from the spindle.
- (3) Pull the hub from the spindle, being careful to prevent the roller bearings and spacer from falling to the ground.

c. To assemble the wheel hub on the spindle the procedure is as follows:—

- (1) Clean and dry the bearings and pack with G.S. grease or fibre wheel-bearing grease.
- (2) Place the bearings and spacer in the hub.
- (3) Holding the outer bearing, carefully guide the wheel hub over the spindle, and the brake drum over the shoes.
- (4) Install the washer and nut, tightening the latter sufficiently to allow the wheel to revolve freely and without end play.
- (5) Insert the cotter pin and attach the hub cap.

50. **Gun Brake Mechanism.**—The brake operating mechanism should be inspected periodically and adjusted to take up wear. Means for adjusting are provided through rods with hexagonal ends which connect with the lever operating the brake cam. Rotating the hexagonal ends in a clockwise direction will take up any looseness due to wear.

51. **Caisson.**—*a. General.*—In normal service the caisson should require no special maintenance precautions. Parts must be kept clean and free from corrosion and moving parts must be lubricated. The wheels require exactly the same

maintenance as those of the gun. The handbrake is independent in its action from that of the overrun brake. However, it is important that the handbrake mechanism be free in action and that the ratchet be positive, as otherwise the vibration when travelling may cause the brakes to be applied.

b. Overrun brake.—The lunette is permitted to move in an asbestos lining through approximately $1\frac{1}{2}$ inches of travel for application of the brake. The linings must not be lubricated, lubricant should be applied only at the fittings provided.

52. Sighting and Fire Control Equipment.—*a. General.*—Especial care is needed to assure the positive and accurate functioning of the sighting and fire-control mechanism. Care must be exercised to prevent denting the soft metal surfaces or scratching the glasses. Dirt should be removed from optical surfaces by brushing lightly with a camel's hair brush. Oil or grease should be removed from glass by applying alcohol, or, if alcohol is not available, by breathing on the glass and then wiping lightly with lens paper or a clean, soft cloth. The steel surfaces should be kept covered with a light film of high grade lubricant to prevent corrosion. In general, the sights are correct :

(1) in *direction*, if the deflection scales read zero when the line of sighting is in a plane parallel to the vertical plane passing through the axis of the bore.

(2) In *elevation*, if the algebraic sum of the range and site settings indicate the same angle above the horizontal that is measured with an accurate gunner's quadrant on the tube.

(3) If there is no excessive lost motion between the sights and the tube.

b. Testing equipment.—Equipment used in testing sights consists of bore sights, a testing plane, and gunner's quadrant. The target for bore sighting may be a distant terrain object, more than 1,000 yards away, or a test target for use in close proximity. In the latter case the displacement of the axis of sighting from the axis of the bore must be correctly shown. For this gun the panoramic telescope displacement is 15.28 inches to the left of and 13.632 inches higher than the axis of the bore ; that for the anti-tank telescope is 19.179 inches to the left of and 6.507 inches above the axis of the bore. Aiming stakes with wooden blocks or markers attached make a suitable test target. In direction tests these may be canted as the carriage is canted, making leveling of the trunnions unnecessary. Tests are made without manufactured bore sights by sighting through the striker recess, using improvised cross hairs at the muzzle. The tests of sub-pars. *e*, *f* and *h* should be

carried out occasionally, especially at periods when ordnance personnel are available for early adjustment. The remaining tests and adjustments should be made daily. The sequence of operations should be as given in the succeeding paragraphs.

c. Gunner's quadrant.—(1) *End-for-end test.*—To test the accuracy of a gunner's quadrant at zero elevation and obtain the index error, if any, set the scales at zero, place it on the leveling plates of the piece, and level the quadrant bubble. Then reverse the quadrant on its seat. The bubble should recenter itself. If it does not, it should be adjusted at the earliest opportunity by ordnance personnel. If it must be used, apply a correction in the appropriate sense equal to one-half of the measured error determined in the end-for-end test.

(2) *To test the accuracy of the index arm.*—Set any elevation on the arc, for example, 80 mils, set the sliding level at zero, place the quadrant on the leveling plates, and center the bubble with the elevating handwheel. Now move one notch down on the arc scale, move the sliding level to ten and retest. The bubble should again be centered.

d. Sight clinometer.—(1) Place the sight clinometer, set at zero, in its bracket and center the bubble by means of the elevating handwheel. Reverse the sight clinometer end for end; the bubble should remain in the center.

(2) If the bubble is not centered, bring it to the center by turning the micrometer head of the instrument. Note the reading, and set the micrometer scales to half this reading. Repeat the end-for-end test with this reading on the sight clinometer and the bubble should remain centered. If it is not centered, repeat the foregoing operation until the bubble does remain centered when the instrument is reversed end for end. Then, slacken the nuts securing the micrometer scales and the screws securing the index of the degree scale; and shift all scales to zero without turning the worm. Clamp and recheck.

e. Sight clinometer for backlash error.—The sight clinometer should be tested for backlash in the following manner:

(1) Set the scales at zero, place the sight clinometer in its bracket, and center the bubble by means of the elevating handwheel.

(2) Turn the micrometer head clockwise two or three turns, then carefully turn it back counterclockwise until the bubble is centered, and note the reading. If the bubble goes beyond the center, the complete operation must be repeated.

(3) Next, turn the micrometer head counterclockwise for two or three turns, carefully turn it back in a clockwise direction until the bubble is centered, and note the reading.

(4) Any difference between the two readings (2) and (3) above is error due to :

- (a) Insensitiveness of the bubble, or
- (b) Backlash, or
- (c) a combination of both.

(5) Repeat the same tests at angles other than zero.

(6) If, in the foregoing tests, any error is greater than 2 minutes, the sight clinometer should be turned in to ordnance personnel.

f. Cross-leveling mechanism.—With piece laid at zero elevation with the aid of the sight clinometer, the cross-leveling mechanism is tested as follows :

(1) Secure the testing plane in the panoramic telescope holder.

(2) Place the gunner's quadrant, set at zero, along the transverse positioning marks of the testing plane, and center the bubble by means of the cross-leveling knob.

(3) Check the cross-level bubble. It should be centered ; if it is not, it should be referred to ordnance personnel for adjustment.

g. Range scale mechanism.—(1) Bring the sighting mechanism to the minimum elevation stops by turning the range-scale mechanism handwheel in a counterclockwise direction.

(2) Set the movable range index at the extreme right of the index arm.

(3) The red setting line on the cone and the dots of the range index should be in line ; if not, bring them into line by loosening the securing screw at the apex of the cone and revolving the cone. Tighten the securing screw and recheck the setting.

(4) The tangent-elevation index should now be in line with the zero degree graduation of the tangent-elevation scale. If not, loosen the screws of the index plate and move the index to the zero reading. Tighten and recheck.

(5) Set the sight clinometer to zero, and the movable range indicator to charge 3.

(6) Set the cone by means of the range-scale mechanism handwheel to 20 degrees tangent elevation. (Read opposite tangent-elevation index.)

(7) Lay the gun at 20 degrees elevation, using the gunner's quadrant on the muzzle leveling plate. (*Note.*—If no muzzle leveling plate is provided, place the gunner's quadrant on the

breech leveling plate and make the allowance for droop, if known. "Down" droop should be added to, and "Up" droop subtracted from, the angle set on the gunner's quadrant.)

(8) Cross level the sight mount. The bubble of the sight clinometer should now be centered. If not, bring it to the central position by loosening the grub screws and lock nuts and altering the position of the adjusting block at the end of the arm extending upward and to the front from the left gun trunnion. Care should be taken that the cone remains set at 20 degrees during the adjustment. When the bubble is centered, tighten the lock nut and grub screws and retest. (Note.—Adjustments to the linkage, other than that for the block at the upper end of the trunnion arm, must be made by ordnance personnel.)

h. Accuracy of tangent-elevation scale.—Periodically the sighting mechanism should be tested to insure that the tangent-elevation scale records accurately any tangent elevation at which the gun is laid. Having first tested and adjusted the range scale mechanism as described in sub-paragraph *g* above, the procedure is as follows:—

- (1) Cross level the sight mount and set the sight clinometer at zero.
- (2) Lay the gun at 10 degrees elevation, using the gunner's quadrant on the muzzle leveling plate.
- (3) Center the bubble of the sight clinometer, using the range-scale mechanism handwheel.
- (4) Note the reading on the tangent-elevation scale of the cone.
- (5) Repeat the same procedure at elevations of 30 degrees and 40 degrees.
- (6) The angles read on the tangent-elevation scale should be 10, 30 and 40 degrees respectively; if errors exceed 5, 10 or 15 minutes respectively, the sight mount should be referred to ordnance personnel for adjustment.

i. Panoramic telescope.—Before testing and adjusting the panoramic telescope by the following procedure, insure that: The telescope is firmly clamped in place; the piece trunnions are leveled; the range (elevation) scale is set at zero and the sight clinometer and cross level bubbles are centered; and, if a testing target is used, the drift angle is set at 1 degree 5 minutes.

(1) *Test for direction* (vertical cross hair).—(a) Boresight on the target.

(b) Turn the vertical hair of the telescope to the target, using the azimuth micrometer of the telescope. Take the reading.

(c) The reading should be zero on both the azimuth (window) scale and micrometer scale. If not, loosen the micrometer set screw, turn the micrometer to zero without disturbing the vertical hair, and then tighten and recheck. If the azimuth-window index is not exactly at zero, loosen the set screws and move the index. Tighten and recheck.

(2) *Test for elevation* (horizontal cross hair).—(a) With the elevation scale and sight clinometer set at zero, boresight on the target.

(b) Put the horizontal hair of the telescope on the target, using the elevation micrometer on the head of the telescope. Take the reading.

(c) The reading should be zero (or 300) on the elevation scale on the head of the telescope and zero on the elevation micrometer. If the micrometer does not read zero, loosen the micrometer set screw, and without disturbing the horizontal hair turn the micrometer to zero. Tighten and recheck. In making this adjustment do not remove the micrometer knob.

j. Antitank telescope.—The antitank telescope is tested in the same manner and should be tested at the same time as the panoramic telescope (*see* sub-par. (i) above), except that the range scale should be set at 325 yards, the range equivalent to the jump with HE shell at charge 3; or to the jump mark, if provided, on the outer scale of the telescope.

(1) *Adjustment for direction.*—If the vertical hair is not on the proper portion of the test target, or on the boresighted distant object, and it is correctly positioned in its carrier, it should be adjusted as follows:—

(a) Remove the erector lens cover. The screws must not be removed—six half-turns are sufficient to free the cover.

(b) Move the erector lens until the intersection of the cross-hairs is on the distant object or proper portion of the test target.

(c) Replace the erector lens cover and recheck.

(2) *Adjustment for elevation.*—If the horizontal hair is not on the proper portion of the test target, or on the boresighted distant terrain object, it should be adjusted as follows:—

(a) Loosen the screw which secures the locking plate of the elevation-adjusting pin and disengage the plate.

(b) By means of a screwdriver, revolve the elevation-adjusting pin until the horizontal hair is on the correct portion of the target, or on the distant terrain object.

(c) Replace the locking plate and fixing screw. Recheck.

APPENDIX A
LIST OF GUN LUBRICATING FITTINGS
AND HOLES
(See following plate)

Position	No. of Fittings	Reference No. on Chart
Gun :—		
Operating handle shaft	2	1, 2
Carriage :—		
Hubs—		
Brake operating cam	2	3, 4
Hub oil plugs	2	5, 6
Trail—		
Lunette bearings	2	7, 8
Handspike locking catch	3	9, 10, 11
Stay catch lever hinge pin	2	12, 13
Cradle clamp hinge pin	1	14
Traversing mechanism—		
Traversing handwheel shaft bearing ..	1	15
Shield—		
Sight port cover hinge pin	1	16
Cradle clamp—		
Plunger retaining catch	1	17
Retaining catch pawl pin	1	18
Locking plunger	1	19
Brake operating mechanism—		
Brake shaft bracket	2	20, 21
Top carriage—		
Sight supporting bracket	1	22
Trunnion caps (cap squares)	2	23, 24
Traversing mechanism connecting pin	1	25
Traversing pinion	1	26
Pintle	1	27
Elevating worm shafts	3	28, 29, 30
Sight mount—		
Sight operating arm	1	31
Driving worm spindle bearing	1	32
Sight supporting bracket	1	33
Adjusting block	1	34
Quadrant link	2	35, 36
Cross-leveling hinge pin	1	37
Cradle—		
Guides—		
Upper	6	38-43
Lower	6	44-49
Segment—		
Bevel pinion	1	50
Bevel wheel	1	51
Firing mechanism—		
Firing lever hinge pin	1	52
Firing plunger	1	53

APPENDIX B

LIST OF CAISSON LUBRICATING FITTINGS AND HOLES

(See following Plate)

Position	No. of Fittings	Reference No. on Chart
Brake operating mechanism—		
Brake shaft brackets	3	1, 2, 3
Lubricating tubes securing bracket ..	1	4
Hand lever	1	5
Drawbar—		
Grease tube securing bracket	2	6, 7
Drawbar plunger sleeve	1	8
Buffer spring pin	1	9
Pintle lock	1	10
Wheel hub—		
Brake operating cams	2	11, 12
Hub oil plugs	2	13, 14

APPENDIX C
CONVERSION TABLE
Mils to Degrees and Minutes.
 1 Mil = 3.375 minutes

Mils.	Degrees	Mils.	Degrees	Mils.	Degrees
1	0 3	46	2 35	91	5 7
2	0 7	47	2 39	92	5 11
3	0 10	48	2 42	93	5 14
4	0 14	49	2 45	94	5 17
5	0 17	50	2 49	95	5 21
6	0 20	51	2 52	96	5 24
7	0 24	52	2 55	97	5 27
8	0 27	53	2 58	98	5 31
9	0 30	54	3 2	99	5 34
10	0 34	55	3 6	100	5 38
11	0 37	56	3 9	101	5 41
12	0 41	57	3 12	102	5 44
13	0 44	58	3 16	103	5 48
14	0 47	59	3 19	104	5 51
15	0 51	60	3 23	105	5 54
16	0 54	61	3 26	106	5 58
17	0 57	62	3 29	107	6 1
18	1 1	63	3 33	108	6 5
19	1 4	64	3 36	109	6 8
20	1 8	65	3 39	110	6 11
21	1 11	66	3 43	111	6 15
22	1 14	67	3 46	112	6 18
23	1 18	68	3 50	113	6 21
24	1 21	69	3 53	114	6 25
25	1 24	70	3 56	115	6 28
26	1 28	71	4 0	116	6 32
27	1 31	72	4 3	117	6 35
28	1 35	73	4 6	118	6 38
29	1 38	74	4 10	119	6 42
30	1 41	75	4 13	120	6 45
31	1 45	76	4 17	121	6 48
32	1 48	77	4 20	122	6 52
33	1 51	78	4 23	123	6 55
34	1 55	79	4 27	124	6 59
35	1 58	80	4 30	125	7 2
36	2 2	81	4 33	126	7 5
37	2 5	82	4 37	127	7 9
38	2 8	83	4 40	128	7 12
39	2 12	84	4 44	129	7 15
40	2 15	85	4 47	130	7 19
41	2 18	86	4 50	131	7 22
42	2 22	87	4 54	132	7 26
43	2 26	88	4 57	133	7 29
44	2 29	89	5 0	134	7 32
45	2 32	90	5 4	135	7 36

Mils.	Degrees	Mils.	Degrees	Mils.	Degrees
136	7 39	186	10 28	236	13 17
137	7 42	187	10 31	237	13 20
138	7 46	188	10 35	238	13 23
139	7 49	189	10 38	239	13 27
140	7 53	190	10 41	240	13 30
141	7 56	191	10 45	241	13 33
142	7 59	192	10 48	242	13 37
143	8 3	193	10 51	243	13 40
144	8 6	194	10 55	244	13 44
145	8 9	195	10 58	245	13 47
146	8 13	196	11 2	246	13 50
147	8 16	197	11 5	247	13 54
148	8 20	198	11 8	248	13 57
149	8 23	199	11 12	249	14 0
150	8 26	200	11 15	250	14 4
151	8 30	201	11 18	251	14 7
152	8 33	202	11 22	252	14 11
153	8 36	203	11 26	253	14 14
154	8 40	204	11 29	254	14 17
155	8 43	205	11 32	255	14 21
156	8 47	206	11 35	256	14 24
157	8 50	207	11 39	257	14 27
158	8 53	208	11 42	258	14 31
159	8 57	209	11 45	259	14 34
160	9 0	210	11 49	260	14 38
161	9 3	211	11 52	261	14 41
162	9 7	212	11 55	262	14 44
163	9 10	213	11 58	263	14 48
164	9 14	214	12 2	264	14 51
165	9 17	215	12 6	265	14 54
166	9 20	216	12 9	266	14 58
167	9 24	217	12 12	267	15 1
168	9 27	218	12 16	268	15 5
169	9 30	219	12 19	269	15 8
170	9 34	220	12 23	270	15 11
171	9 37	221	12 26	271	15 15
172	9 41	222	12 29	272	15 18
173	9 44	223	12 33	273	15 21
174	9 47	224	12 36	274	15 25
175	9 51	225	12 39	275	15 28
176	9 54	226	12 43	276	15 32
177	9 57	227	12 46	277	15 35
178	10 1	228	12 50	278	15 38
179	10 4	229	12 53	279	15 42
180	10 8	230	12 56	280	15 45
181	10 11	231	13 0	281	15 48
182	10 14	232	13 3	282	15 52
183	10 18	233	13 6	283	15 55
184	10 21	234	13 10	284	15 59
185	10 24	235	13 13	285	16 2

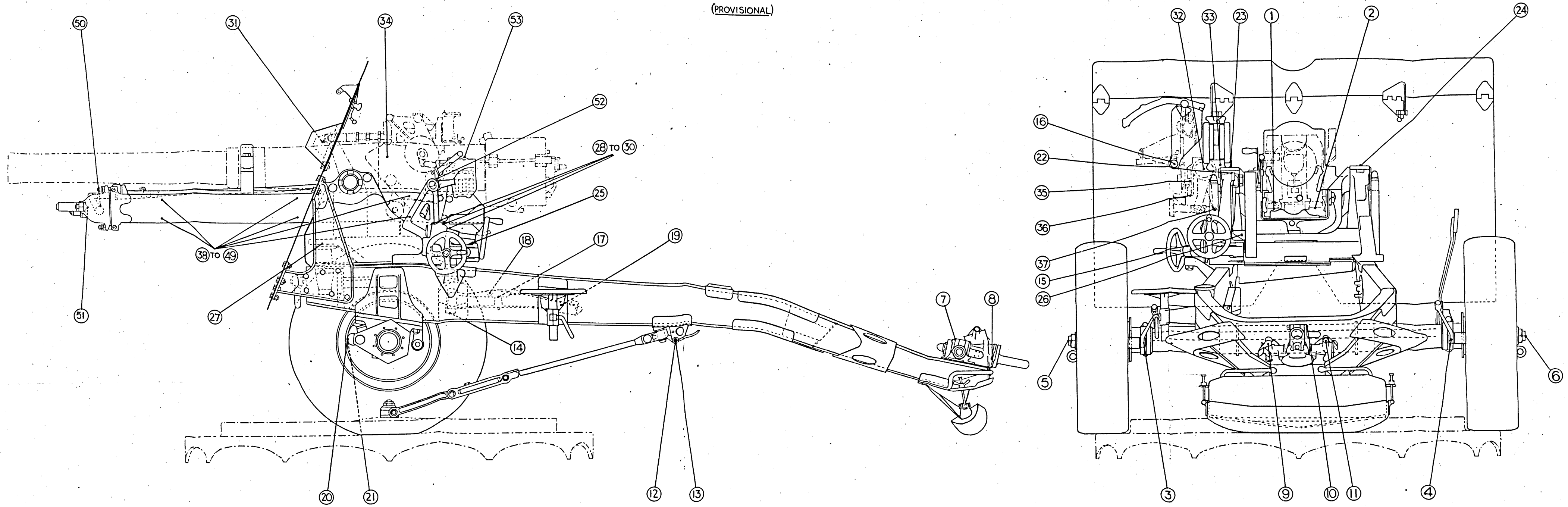
Mils.	Degrees	Mils.	Degrees	Mils.	Degrees
286	16 5	336	18 54	386	21 43
287	16 9	337	18 57	387	21 46
288	16 12	338	19 1	388	21 50
289	16 15	339	19 4	389	21 53
290	16 19	340	19 8	390	21 56
291	16 22	341	19 11	391	22 0
292	16 26	342	19 14	392	22 3
293	16 29	343	19 18	393	22 6
294	16 32	344	19 21	394	22 10
295	16 36	345	19 24	395	22 13
296	16 39	346	19 28	396	22 17
297	16 42	347	19 31	397	22 20
298	16 46	348	19 35	398	22 23
299	16 49	349	19 38	399	22 27
300	16 53	350	19 41	400	22 30
301	16 56	351	19 45	401	22 33
302	16 59	352	19 48	402	22 37
303	17 3	353	19 51	403	22 40
304	17 6	354	19 55	404	22 44
305	17 9	355	19 58	405	22 47
306	17 13	356	20 2	406	22 50
307	17 16	357	20 5	407	22 54
308	17 20	358	20 8	408	22 57
309	17 23	359	20 12	409	23 0
310	17 26	360	20 15	410	23 4
311	17 30	361	20 18	411	23 7
312	17 33	362	20 22	412	23 11
313	17 36	363	20 26	413	23 14
314	17 40	364	20 29	414	23 17
315	17 43	365	20 32	415	23 21
316	17 47	366	20 35	416	23 24
317	17 50	367	20 39	417	23 27
318	17 53	368	20 42	418	23 31
319	17 57	369	20 45	419	23 34
320	18 0	370	20 49	420	23 38
321	18 3	371	20 52	421	23 41
322	18 7	372	20 55	422	23 44
323	18 10	373	20 58	423	23 48
324	18 14	374	21 2	424	23 51
325	18 17	375	21 6	425	23 54
326	18 20	376	21 9	426	23 58
327	18 24	377	21 12	427	24 1
328	18 27	378	21 16	428	24 5
329	18 30	379	21 19	429	24 8
330	18 34	380	21 23	430	24 11
331	18 37	381	21 26	431	24 15
332	18 41	382	21 29	432	24 18
333	18 44	383	21 33	433	24 21
334	18 47	384	21 36	434	24 25
335	18 51	385	21 39	435	24 28

Mils.	Degrees	Mils.	Degrees	Mils.	Degrees
436	24 32	486	27 20	536	30 9
437	24 35	487	27 24	537	30 12
438	24 38	488	27 27	538	30 16
439	24 42	489	27 30	539	30 19
440	24 45	490	27 34	540	30 23
441	24 48	491	27 37	541	30 26
442	24 52	492	27 41	542	30 29
443	24 55	493	27 44	543	30 33
444	24 59	494	27 47	544	30 36
445	25 2	495	27 51	545	30 39
446	25 5	496	27 54	546	30 43
447	25 9	497	27 57	547	30 46
448	25 12	498	28 1	548	30 50
449	25 15	499	28 4	549	30 53
450	25 19	500	28 8	550	30 56
451	25 22	501	28 11	551	31 0
452	25 26	502	28 14	552	31 3
453	25 29	503	28 18	553	31 6
454	25 32	504	28 21	554	31 10
455	25 36	505	28 24	555	31 13
456	25 39	506	28 28	556	31 17
457	25 42	507	28 31	557	31 20
458	25 46	508	28 35	558	31 23
459	25 49	509	28 38	559	31 27
460	25 53	510	28 41	560	31 30
461	25 56	511	28 45	561	31 33
462	25 59	512	28 48	562	31 37
463	26 3	513	28 51	563	31 40
464	26 6	514	28 55	564	31 44
465	26 9	515	28 58	565	31 47
466	26 13	516	29 2	566	31 50
467	26 16	517	29 5	567	31 54
468	26 20	518	29 8	568	31 57
469	26 23	519	29 12	569	32 0
470	26 26	520	29 15	570	32 4
471	26 30	521	29 18	571	32 7
472	26 33	522	29 22	572	32 11
473	26 36	523	29 26	573	32 14
474	26 40	524	29 29	574	32 17
475	26 43	525	29 32	575	32 21
476	26 47	526	29 35	576	32 24
477	26 50	527	29 39	577	32 27
478	26 53	528	29 42	578	32 31
479	26 57	529	29 45	579	32 34
480	27 0	530	29 49	580	32 38
481	27 3	531	29 52	581	32 41
482	27 7	532	29 55	582	32 44
483	27 10	533	29 58	583	32 48
484	27 14	534	30 2	584	32 51
485	27 17	535	30 6	585	32 54

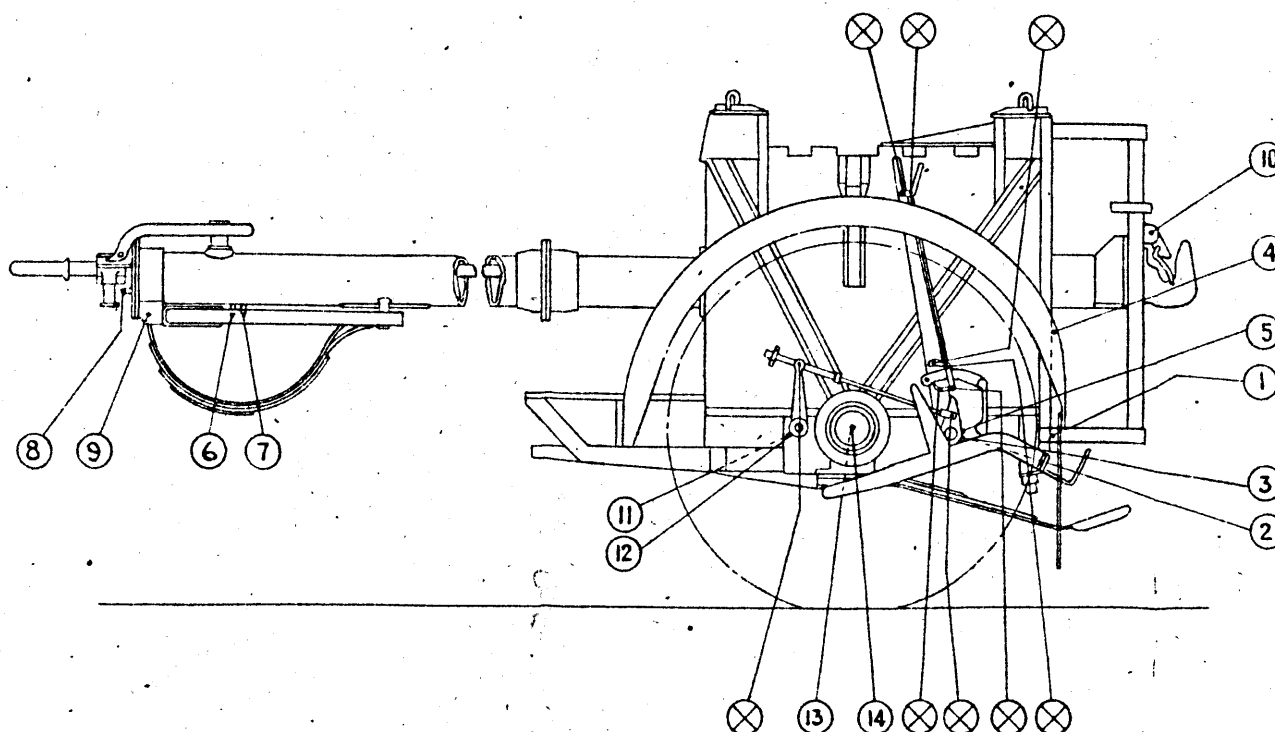
Mils.	Degrees	Mils.	Degrees	Mils.	Degrees
586	32 58	636	35 47	686	38 35
587	33 1	637	35 50	687	38 39
588	33 5	638	35 53	688	38 42
589	33 8	639	35 57	689	38 45
590	33 11	640	36 0	690	38 49
591	33 15	641	36 3	691	38 52
592	33 18	642	36 7	692	38 55
593	33 21	643	36 10	693	38 58
594	33 25	644	36 14	694	39 2
595	33 28	645	36 17	695	39 6
596	33 32	646	36 20	696	39 9
597	33 35	647	36 24	697	39 12
598	33 38	648	36 27	698	39 16
599	33 42	649	36 30	699	39 19
600	33 45	650	36 34	700	39 23
601	33 48	651	36 37	701	39 26
602	33 52	652	36 41	702	39 29
603	33 55	653	36 44	703	39 33
604	33 59	654	36 47	704	39 36
605	34 2	655	36 51	705	39 39
606	34 5	656	36 54	706	39 43
607	34 9	657	36 57	707	39 46
608	34 12	658	37 1	708	39 50
609	34 15	659	37 4	709	39 53
610	34 19	660	37 8	710	39 56
611	34 22	661	37 11	711	40 0
612	34 26	662	37 14	712	40 3
613	34 29	663	37 18	713	40 6
614	34 32	664	37 21	714	40 10
615	34 36	665	37 24	715	40 13
616	34 39	666	37 28	716	40 17
617	34 42	667	37 31	717	40 20
618	34 46	668	37 35	718	40 23
619	34 49	669	37 38	719	40 27
620	34 53	670	37 41	720	40 30
621	34 56	671	37 45	721	40 33
622	34 59	672	37 48	722	40 37
623	35 3	673	37 51	723	40 40
624	35 6	674	37 55	724	40 44
625	35 9	675	37 58	725	40 47
626	35 13	676	38 2	726	40 50
627	35 16	677	38 5	727	40 54
628	35 30	678	38 8	728	40 57
629	35 23	679	38 12	729	41 0
630	35 26	680	38 15	730	41 4
631	35 30	681	38 18	731	41 7
632	35 33	682	38 22	732	41 11
633	35 36	683	38 26	733	41 14
634	35 40	684	38 29	734	41 17
635	35 43	685	38 32	735	41 21

Mils.	Degrees.	Mils.	Degrees.	Mils.	Degrees.
736	41 24	761	42 48	786	44 13
737	41 27	762	42 52	787	44 16
738	41 31	763	42 55	788	44 20
739	41 34	764	42 59	789	44 23
740	41 38	765	43 2	790	44 26
741	41 41	766	43 5	791	44 30
742	41 44	767	43 9	792	44 33
743	41 48	768	43 12	793	44 36
744	41 51	769	43 15	794	44 40
745	41 54	770	43 19	795	44 43
746	41 58	771	43 22	796	44 47
747	42 1	772	43 26	797	44 50
748	42 5	773	43 29	798	44 53
749	42 8	774	43 32	799	44 57
750	42 11	775	43 36	800	45 0
751	42 15	776	43 39		
752	42 18	777	43 42		
753	42 21	778	43 46		
754	42 25	779	43 49		
755	42 28	780	43 53		
756	42 32	781	43 56		
757	42 35	782	43 59		
758	42 38	783	44 3		
759	42 42	784	44 6		
760	42 45	785	44 9		

CARRIAGE, 25-PR., MARK I
LUBRICATION CHART
(PROVISIONAL)



TRAILER, ARTILLERY, N° 27, MARK I



POINTS INDICATED THUS ⊗ ARE TO BE LUBRICATED WITH OIL, LUBRICATING, BY CAN, LUBRICATING, N° 11.
 PLUGS N° 13 & 14 ARE TO BE PERIODICALLY REMOVED AND FILLED WITH GREASE.
 POINTS N° 1 TO N° 12 ARE TO BE LUBRICATED WITH OIL, C. 600 BY INJECTOR, LUBRICATING, TECALEMIT, N° T. 26.