WAR DEPARTMENT

COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY FORMATIONS, INSPECTIONS, SERVICE, AND CARE OF MATÉRIEL

FM 4-20

COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY

FORMATIONS, INSPECTIONS, SERVICE, AND CARE OF MATÉRIEL

Prepared under direction of the
Chief of Coast Artillery

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON: 1940

For sale by the Superintendent of Documents, Washington, D. C. - Price 15 cents

WAR DEPARTMENT,
WASHINGTON, *April 10, 1940.*

FM 4–20, Coast Artillery Field Manual, Seacoast Artillery—Formations, Inspections, Service, and Care of Matériel, is published for the information and guidance of all concerned.

[A. G. 062.11 (2–21–40).]

BY ORDER OF THE SECRETARY OF WAR:

G. C. MARSHALL,
Chief of Staff.

OFFICIAL:
E. S. ADAMS,
Major General,
The Adjutant General.

TABLE OF CONTENTS

COAST ARTILLERY FIELD MANUAL

SEACOAST ARTILLERY

FORMATIONS, INSPECTIONS, SERVICE, AND CARE OF MATÉRIEL

(The matter contained herein supersedes chapters 3, 4, and 5, part two, Coast Artillery Field Manual, volume I, February 1, 1933.)

CHAPTER 1

FORMATIONS AND INSPECTIONS

SECTION I

FORMATIONS

■ 1. INFANTRY FORMATIONS.—For infantry formations, drills, ceremonies, and inspections, all seacoast artillery units conform to the provisions of FM 22–5. Batteries are organized into squads and platoons for this purpose.

■ 2. ARTILLERY FORMATIONS.—The battery is the only seacoast artillery unit that engages in prescribed artillery formations and inspections.

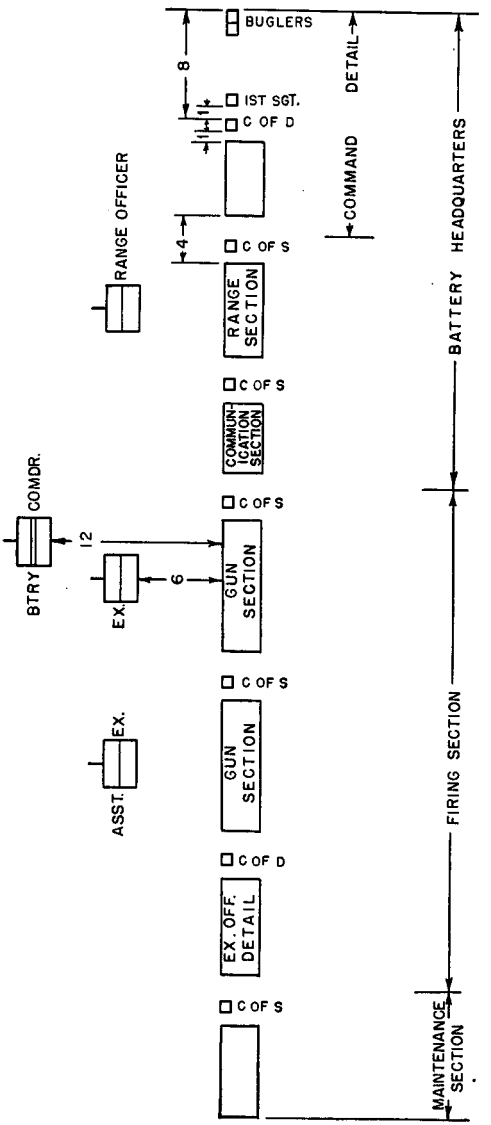
■ 3. FORMING THE BATTERY.—For purposes of artillery training, inspections, and maneuvers the battery is formed as indicated in figure 1. The first sergeant takes post nine paces in front of where the center of the battery is to rest and, facing that point, commands: FALL IN. Each chief of section and separate detail takes post three paces in front of and facing where the center of his section or detail is to rest and superintends its formation. Each section and separate detail assembles in two ranks, with 4 inches between files and 40 inches between ranks. Chiefs of squads form in the front rank on the right of their respective squads. After the sections and separate details are formed, they are verified by their respective chiefs, who then face to the front.

The first sergeant commands: REPORT. Each chief of section or separate detail, successively from the right, salutes and reports, "_____ section (detail) present," or "_____ absent" (giving names of unauthorized absentees), and takes post in the front rank one pace to the right of his section or detail. The first sergeant faces about, salutes, and reports to the battery commander, who has taken post 12 paces in front of the center of the battery, "Sir, all present or accounted for," or "_____ noncommissioned officers and privates absent." When the battery commander has acknowledged the report, the first sergeant takes his post in the front rank one pace to the right of the chief of the command detail. The battery officers form as shown in figure 1, facing to the front.

■ 4. MARCHING THE BATTERY.—The battery is formed in column for marching by the command RIGHT (LEFT), FACE. At the second command all face to the right (left), the battery officers taking post opposite and one pace to the left (right) of the leading file of their respective sections. The bugler, who is in rear, after facing, steps up to the left (right) of the bugler in front of him. The battery in column is marched, halted, and changed in direction as prescribed in FM 22–5. In marching, the column extends to easy marching distance; in halting, all close up to facing distance without command. The battery commander marches in such position as will enable him to direct the movement of the column most advantageously.

■ 5. POSTING THE SECTIONS AND DETAILS.—At the command SECTIONS, POSTS, given either while marching or from a halt, the chiefs of sections or separate details fall out of ranks and assume command of and march their respective sections or details to the immediate vicinity of their emplacement or station. To post the details, the chiefs of sections and separate details command: 1. DETAILS, 2. POSTS. At the second command the details fall out of ranks, procure equipment, and take their posts as specified in the field manuals pertaining to the service of the piece.

■ 6. DISMISSING THE BATTERY.—*a. In ranks.*—The battery in artillery formation in ranks is dismissed as prescribed for



ALL DISTANCES AND INTERVALS IN PACES
FIGURE 1.—Battery artillery formation.

infantry units in FM 22–5, omitting that part pertaining to the inspection of arms when the battery is unarmed.

b. At artillery drill.—The battery commander commands: DISMISSED. The range officer commands: CLOSE STATION. The battery executive commands: REPLACE EQUIPMENT. After complying with instructions, chiefs of sections and separate details command: FORM SECTION. The battery is then formed and marched to its quarters and dismissed. Subdivisions from remote stations are marched to their quarters and dismissed by their chiefs.

SECTION II

ARTILLERY INSPECTIONS

■ 7. PURPOSE.—Artillery inspections are made with all individuals at their battle stations to—

a. Ascertain the condition, mechanical functioning, state of preservation, and appearance of all matériel and equipment issued the units inspected.

b. Determine the efficiency of the personnel in the performance of their duties, individually and as a team.

c. Detect faults or deficiencies for the purpose of correcting them.

■ 8. INSPECTING OFFICERS.—Artillery inspections are made by harbor defense, fort, groupment, group, and battery commanders. They are the normal and routine inspections of a command. Each commander inspects his own command as he may desire or as may be required by the next higher commander. Normally, batteries are inspected weekly or oftener by the battery commander, twice a month by group or groupment commanders, and monthly by fort and harbor defense commanders. No formal reports of artillery inspections are made, but deficiencies noted are referred to the proper agencies for correction. Such phases of training and such training inspections as are desired may be taken up at the same time and in connection with the inspection.

■ 9. PROCEDURE.—*a.* The armament, fire-control apparatus, and all accessory equipment at the emplacements and stations having been carefully cleaned and arranged as for service conditions, the various sections, details, and individuals take

posts as prescribed in appropriate field manuals. The inspector inspects the emplacements, magazines, and stations in the most convenient order. If the inspector is other than the battery commander, he is accompanied by the latter. As the inspector approaches, the chief of section or detail commands: ATTENTION, faces the inspector, salutes, and reports, "Sir, Corporal Smith, Battery A, Observer B'','' or "Sir, Sergeant Jones, Battery A, gun commander." Chiefs of sections or details give necessary commands to display the mechanical functioning of various equipment.

b. An artillery inspection will be conducted so as to include the following:

(1) Examination of the equipment, the implements, and all parts of the gun, carriages, and emplacements, special attention being given to—

Breech mechanisms.
Vents, to determine condition as to rust or pitting.
Obturators, to see that they are adjusted properly and the gas check pads are in serviceable condition.
Elevating and traversing mechanisms.
Devices for running guns to and from battery.
Recoil cylinders.
Throttling valves.
Oil holes and grease cups.
Adjustment of sights and means of giving quadrant elevation.
Adjustment of subscales of azimuth circles.
Firing mechanisms and safety devices.
Firing circuits.
Motors and controllers.
Sponges.
Rammers.
Condition of doors.
Condition of drains, diagrams of which should be posted.
Condition of hoists.
Condition of electric and other lights.
Condition of electric installations and power plants.
Condition of galleries, magazines, and ammunition.
Condition of emplacements and grounds.

(2) Examination of fire-control stations and apparatus, special attention being given to the condition and adjustment of all instruments and appliances, tables and charts, and to the knowledge observers and operators have of adjustments and operation of instruments, charts, and tables.

(3) Examination of the communication system.

(4) Examination of the mine casemate, storeroom, loading room, wharves, boathouses, cable tanks, and mine-planting boats, special attention being given to—

Operating boards.
Engines, motors, generators, and storage batteries.
General condition of buildings.
Painting and piling of mine cases.
Condition of anchors, distribution boxes, mooring ropes, and raising ropes.
Condition of small tools, supplies, cranes, tramcars, and trucks.
Storage of cable.
Boats:
General condition.
Condition of engines.
Condition of hoisting apparatus.
Condition of davits and blocks.
Condition of cable-laying apparatus.
Knowledge and expertness of personnel.

(5) Examination of mobile armament, special attention being given to the condition of guns and carriages as outlined for the fixed armament and including as well the condition of railway equipment, motor transportation, and parks.

(6) Examination of the uniform of the personnel.

(7) Examination of emplacement and fort record books, log books, and work charts.

SECTION III

OTHER INSPECTIONS

■ 10. INSPECTION IN RANKS.—The battery, being formed, opens ranks as prescribed in FM 22–5. The battery commander inspects the lieutenants and, accompanied by the latter, inspects the ranks, passing in front of each rank from right

to left and in rear of each rank from left to right. Upon completion of the inspection, all officers resume their posts as shown in figure 1. The battery closes ranks as prescribed in FM 22–5. Should the inspector be other than the battery commander, the latter, after commanding FRONT, adds REST, and faces to the front. As the inspecting officer approaches, the battery commander faces toward the battery and commands: 1. BATTERY, 2. ATTENTION, faces to the front, and salutes. As soon as he has been inspected, the battery commander accompanies the inspecting officer. The inspection proceeds as prescribed above for inspection by the battery commander, except that lieutenants, after being inspected, remain at their posts at ease, unless otherwise directed.

■ 11. TECHNICAL INSPECTIONS.—Technical inspections of the condition and the functioning of the parts of the battery pertaining to the Ordnance Department, the Signal Corps, and the Corps of Engineers are made periodically by designated representatives. The battery commander should follow the progress of the inspection closely and should bring to the attention of the inspector deficiencies which cannot be corrected locally.

■ 12. TACTICAL AND TRAINING INSPECTIONS.—Tactical and training inspections are a function of command and are utilized to produce battle efficiency, which involves efficient training supervision, adequate training plans, and a correct application of approved doctrines. Additional purposes are to ascertain the state of instruction and readiness for field service of the organization and to remove obstacles to training. Tactical inspections will comprise the actual solution by commands and individuals of tactical, field firing, supply, and communication exercises. Training inspections will comprise within their scope an examination of the program for the current school and training year, and observation of the scheduled drills, exercises, assemblies, and conferences. Tactical inspections may be formal or informal. Training inspections are essentially informal. Detailed information is included in AR 265–10.

CHAPTER 2

SERVICE AT THE EMPLACEMENTS

SECTION I

GENERAL DUTIES OF BATTERY OFFICERS

■ 13. BATTERY COMMANDER.—*a.* The battery commander orders all fire, specifying the ammunition to be used, coordinates the action of the various sections, and keeps his battery in hand at all times.

b. He assures himself that firing data are received at the guns in such a way and at such times that the gun sections will never be confused as to the instant at which such data are good for firing.

c. He assures himself that all commands received at the guns from the battery command post are correctly interpreted.

d. He is responsible for the observance of all safety regulations at the battery. Attention is directed to the pertinent provisions of AR 750–10 for firing in time of peace.

e. Before target practice he should personally test all safety devices and assure himself that all safety precautions are understood by the battery personnel.

■ 14. BATTERY EXECUTIVE.—*a.* The battery executive commands the firing section of the battery and is in charge of the gun emplacements and accessories. He is responsible to the battery commander for the—

(1) Training and efficiency of the personnel of the firing section.

(2) Condition of the matériel and ammunition under his charge.

(3) Observance of all safety precautions pertaining to the service of the piece.

(4) Police of all emplacements.

b. In batteries assigned to mobile armament, he is responsible to the battery commander for the emplacement and removal from position of the guns.

c. He inspects all matériel and ammunition under his charge and personally verifies the adjustment of all pointing devices as frequently as is necessary to insure accuracy. He or an assistant executive tests all circuits and firing devices before each drill or firing, paying special attention to the safety features.

d. He verifies the filling of recoil cylinders and adjustment of recuperator systems, sees that there is no obstruction to the operation of the carriage in recoil or counterrecoil, and, so far as possible, verifies the adjustment of all parts that move in recoil or are affected by it.

e. He receives the reports of the assistant battery executives or chiefs of sections and reports to the battery commander, "Sir, firing section in order," or reports any defects which he is unable to remedy without delay.

f. Should circumstances arise after the firing battery has been reported ready which in his opinion would make it unsafe to fire, he causes the firing circuit to be broken, the lanyard to be dropped, or other effective steps taken to prevent the firing of any piece affected by the unsafe condition. He then reports his action to the battery commander.

g. The battery executive may act as the officer in charge of one of the gun emplacements during drill and firing, and in such cases performs the additional duties for that emplacement as prescribed for an assistant battery executive.

h. At the conclusion of drill or firing the battery executive commands: REPLACE EQUIPMENT, inspects the emplacements, and reports to the battery commander.

■ 15. ASSISTANT BATTERY EXECUTIVE.—*a.* Each assistant battery executive (emplacement officer), in addition to the duties described below, will perform the duties of the battery executive insofar as they apply to the emplacement or emplacements to which he is assigned.

b. He receives reports of the chief of section and reports to the battery executive, "Sir, No. _____ in order," or reports any defects he is unable to remedy without delay.

c. Should it become apparent that a piece will not be laid in time, he commands: RE-LAY, and reports his action to the battery executive. When the piece is laid and the personnel is clear, he reports or signals to the battery executive, "No. _____ ready."

d. Should he desire to halt all movements of matériel and personnel, he commands: STAND FAST.

e. When the piece is fired by Case III, he is responsible that the piece is fired immediately upon receipt of the proper firing signal, safety precautions permitting.

f. At the conclusion of the drill or practice, he repeats the command REPLACE EQUIPMENT given by the battery executive, inspects the emplacement, and reports to the battery executive.

SECTION II

ORGANIZATION OF THE GUN SECTIONS

■ 16. COMPOSITION.—Each gun and each mortar pit is manned by a gun section of strength and composition prescribed in field manuals pertaining to the service of the piece. Each gun section consists of a gun squad (or squads), an ammunition squad, and such special squads as may be required. Mechanics, additional noncommissioned officers, and other individuals are included in the gun section when required.

■ 17. FORMATION.—Each section assembles in two ranks with 4 inches between files and 40 inches between ranks. The post of the chief of section is in the front rank, one pace to the right of his section. Unnumbered men form on the right of their squads, in both front and rear rank. Numbered cannoneers form in the order of their numbers from the right, even numbers in the front rank and odd numbers in the rear. There is no interval between squads. Chiefs of squads are in the front rank on the right of their respective squads and are not covered in file. Mechanics take post in the front rank on the left of their respective sections.

SECTION III

DUTIES OF CERTAIN ENLISTED MEN

■ 18. CHIEF OF SECTION.—*a*. The chief of section (or pit commander), a noncommissioned officer, is in command of a gun section. He is responsible to the officer in charge of the emplacement for the—

(1) Training and efficiency of the personnel of his section.

(2) Condition of the matériel and ammunition under his charge.

(3) Camouflage discipline and gas discipline at the emplacement and magazines, when necessary.

(4) Observance of all safety precautions pertaining to the service of the piece.

(5) Police of the emplacements and magazines under his charge.

b. He supervises the service of the piece and the service of ammunition at his emplacement. He personally directs the work of care and preservation of his matériel.

c. After the gun is emplaced or when the section arrives at the emplacement he commands: 1, DETAILS, 2. POSTS, and supervises the procurement of equipment. After all details have reached their posts he commands: EXAMINE GUN. He then personally makes an inspection of the gun (or mortar) carriage(s) and other matériel.

d. He receives the reports of the gun commander(s) and the chief of ammunition and reports to the battery executive or assistant, "Sir, No. _____ in order," or "Sir, _____ pit in order," or any defects he is unable to remedy without delay.

e. When necessary to verify the section, he commands: CALL OFF. The cannoneers of the section call off their titles or numbers in succession, beginning with the unnumbered members of the section, followed by the numbered members in order.

f. He indicates to the chief of ammunition the projectile, fuze, and powder to be served.

g. At the command LOAD, he repeats the command and supervises the loading. He also commands: LOAD, before each shot of a series. The piece (or pit) is not fired, however, until

the command COMMENCE FIRING is given and the proper firing signal received.

h. At the command COMMENCE FIRING, if the piece(s) is unloaded, he commands: LOAD, and supervises the work of his section.

i. After the piece (or pit) is ready to fire he reports or signals, "Ready," to the officer in charge of the emplacement and waits for the command or signal to fire if that system is prescribed for his particular battery.

j. Should he desire to halt all movements of matériel and personnel, he commands: STAND FAST. He reports his action to the officer in charge of the emplacement.

k. He commands: CEASE FIRING, when the number of shots specified has been fired. When the number of shots has not been specified, the chief of section repeats the command CEASE FIRING when it is given by the battery commander.

l. In case of a *misfire,* he reports to the battery executive, "No. _____ misfire," and sees that the precautions described in paragraphs 72 or 79 are observed.

m. At the command REPLACE EQUIPMENT, the chief of section supervises the replacing of all equipment, sees that all matériel is properly secured and the emplacement policed, and then, unless otherwise directed, forms his section.

n. He keeps a record of the number of rounds fired by his gun (or pit) during a practice or action, showing the date and approximate time, in order to keep the gun or emplacement book accurate and up-to-date.

■ 19. GUN COMMANDER.—*a.* The gun commander (noncommissioned officer) is in command of a gun squad. If no chief of section has been designated, the gun commander will, in addition to his other duties, perform the duties prescribed in paragraph 18 for the chief of section. He is responsible to the chief of section for the—

(1) Efficiency of the personnel of his squad.

(2) Condition of the matériel under his charge.

(3) Observance of all safety precautions pertaining to the service of the piece.

(4) Police of the emplacement to which assigned.

b. In batteries assigned to mobile armament, he supervises the preparation of the firing position, the emplacement of the mount, its removal from firing position, and the loading of the equipment.

c. At the command EXAMINE GUN, given by the chief of section, he personally makes an inspection of the gun, carriage, and other matériel, paying special attention to the recoil cylinders, firing mechanism, safety devices, and the oiling of all movable parts. He also gives special attention to those parts peculiar to the armament he is serving which are most likely to cause trouble and to which special attention is required by the pertinent field manuals and technical regulations.

d. He receives the reports of the chiefs of the various details of the gun squad and reports to the chief of section, "No. _____ in order," or any defects he is unable to remedy without delay.

e. At the command LOAD, he supervises the work of his squad.

f. After the piece is loaded and laid the gun commander verifies the laying as far as practicable, considering the mount or emplacement, the time allowed before firing, and the method of pointing being used. He receives the reports, "Set," or a signal from the elevation setter and the gun pointer.

g. The gun commander next sees that all personnel are clear of the piece to be fired and have taken cover posts or firing posts. Thereafter he either reports his piece ready and waits for the command or signal to fire or himself commands: FIRE, according to the system prescribed for his particular battery.

h. When firing by Case II, and when the gun is ready to be fired, the gun commander calls or signals, "No. _____ ready." The gun is then fired by the gun pointer or at the command of the latter.

i. When firing by Case III he is responsible that the piece is fired immediately upon receipt of the proper signal, safety precautions permitting.

j. Should he desire to halt all movements of matériel and personnel, he commands: STAND FAST. He reports his action to the chief of section.

k. During firing he will station himself in such position as best to observe the functioning of the gun squad and the gun itself. He will pay particular attention to the action of the gun in recoil and counterrecoil, in order that a loss of recoil oil by leakage may be corrected.

l. With disappearing carriages, at the command TRIP he sees that the gun goes fully into battery.

m. At the command CEASE FIRING, when dummy ammunition is being used, he commands: UNLOAD, and supervises the unloading.

n. In case of a *misfire,* he reports to the chief of section, "No. _____ misfire," and sees that the precautions described in paragraph 72 or 79 are observed.

o. At the command REPLACE EQUIPMENT, the gun commander supervises the replacing of his equipment, sees that all matériel is properly secured, and then, unless otherwise directed, forms his squad and reports to the chief of section.

p. Additional duties and details of drill peculiar to certain types of armament are prescribed in field manuals pertaining to the service of the piece.

■ 20. CHIEF OF AMMUNITION.—*a.* The chief of ammunition (noncommissioned officer) is responsible to the chief of section for the—

(1) Efficiency of the personnel of his squad.

(2) Care of the ammunition.

(3) Camouflage discipline and gas discipline at the magazines or ammunition shelters pertaining to his section.

(4) Correct recording of the projectile and powder data.

(5) Proper fuzing of projectiles.

(6) Police of all ammunition cars, magazines, galleries, or dugouts under his charge.

(7) Uninterrupted service of ammunition during action.

b. In batteries assigned to railway artillery matériel, the chief of ammunition is responsible to the chief of section for the ammunition cars, their equipment, care, and preservation. In batteries assigned to fixed armament he is responsible for all ammunition-handling apparatus, including trolleys,

cranes, blocks and chains, shot hoists, receiving and delivery tables, trucks, and powder-serving trays.

c. He is responsible for the observance of all safety precautions in the care and service of ammunition.

d. He supervises the inspection and cleaning of all projectiles and the smoothing of rotating bands.

e. Before the beginning of an action he causes all shot trucks to be loaded and adjusted and delivery tables to be filled with projectiles.

f. He is prepared to furnish information as to powder temperature when called upon by the battery officers to do so.

g. At the command DETAILS, POSTS, he opens the ammunition car or galleries and magazines, if necessary, and posts the members of his squad.

h. At the command EXAMINE GUN, he inspects the matériel under his charge, gives the necessary instructions for preparing ammunition and equipment for firing or drill, and reports to the chief of section, "Ammunition service in order," or reports defects that he is unable to remedy without delay.

i. At the command LOAD, he directs and supervises the service of ammunition.

j. At the command REPLACE EQUIPMENT, he supervises the replacement of equipment, sees that all ammunition and matériel are properly secured, and then, unless otherwise directed, forms his squad and reports to the chief of section.

■ 21. ARTILLERY MECHANICS.—The artillery mechanics, assisted by members of the gun sections, make such minor repairs and adjustments as can be made with the means available. The chief artillery mechanic is the custodian of the supplies pertaining to the gun emplacements to which his battery is assigned. He is responsible for the condition of the supply cars or storerooms pertaining to the gun emplacements and the supplies contained therein. The chief mechanic or his assistant issues such equipment, tools, oils, paints, and cleaning materials to the members of the gun sections as may be necessary for the service and care of the guns and accessories.

SECTION IV

INFORMATION ON THE SERVICE OF THE PIECE

■ 22. GENERAL.—*a.* Guns, carriages, and batteries differ in type, arrangement, and design, and for this reason the service of the piece is intended only as a guide for the battery commander in the assignment of individuals and duties. Changes in the details of the service of the piece to meet local conditions may be made.

b. The service of the piece should be conducted with dispatch and precision and with as few orders as possible. Except for the necessary orders, reports, and instructions, no talking should be permitted. Cannoneers change positions at a run.

c. Loading with dummy ammunition and pointing the piece as for service firing is the normal practice at drill.

d. Commands should be given in the prescribed forms. (See FM 4–5.) Signals may be substituted for commands whenever desirable.

e. In time of peace when firing high explosive ammunition and cover is prescribed, each member of the gun section will be required to take shelter each time the piece is fired. (See par. 65.)

f. When there is a lull in the firing or drill, each member of the gun section will inspect, clean, and place in the best condition possible the matériel and tools under his charge.

■ 23. SIGNALS.—*a.* The commands or signals ELEVATE, DEPRESS, RIGHT, or LEFT given in pointing refer to the direction of motion of the muzzle.

b. Signals with whistles or bugles are authorized. It is desired to limit verbal commands to the minimum. During continuous firing, none should be necessary except in the case of accident or unforeseen occurrences.

c. Visual signals are not prescribed, but if used, the following are suggested:

(1) ELEVATE.—Raise either hand to the height of the head, fingers pointing upward. Move the hand in short upward movements by flexing the hand at the wrist.

(2) DEPRESS.—Raise either hand to the height of the head, fingers pointing downward. Move the hand in short downward movements by flexing the hand at the wrist.

(3) RIGHT OR LEFT.—Motion with either hand, palm turned and fingers pointing in the desired direction.

(4) READY.—Raise and fully extend either arm vertically, hand and fingers open and in prolongation of the arm.

(5) CEASE FIRING.—Raise the forearm in front of the forehead, palm to the front, and swing it up and down several times in front of the face.

■ 24. TO LOAD AND FIRE.—The battery commander designates the target and the type of ammunition to be used. After tracking has begun and the battery is ready to fire, he gives one of the following commands:

COMMENCE FIRING.
HALF RATE—COMMENCE FIRING.
NO(S). ———, ——— ROUND(S)—COMMENCE FIRING.

The chief of section commands: LOAD when the battery commander commands: COMMENCE FIRING, and before each shot of a series. The battery commander may command: LOAD, in which case the chief of section repeats the command. The piece is loaded but is not fired until the battery commander commands: COMMENCE FIRING. When the specified number of rounds has been fired, the chief of section commands: CEASE FIRING, at which command all cannoneers resume their posts. When the number of rounds is not specified, the battery commander commands: CEASE FIRING, and the chief of section repeats the command. When dummy ammunition is used, the piece is unloaded at the command CEASE FIRING, unless otherwise directed.

■ 25. SERVICE OF AMMUNITION.—*a.* For *drill* or *firing*, ammunition will be delivered as directed by the battery executive or assistant battery executive.

b. Preparatory to and during action the service of ammunition becomes all important. Since the method of serving ammunition is entirely dependent on the layout and matériel of the individual battery, no detailed procedure is prescribed.

During the training period, however, a complete plan will be worked out for each battery. Such a plan will include the necessary provisions to insure that ammunition in sufficient quantity for any expected action will be available at the emplacement. Ample safety precautions will be inaugurated should it become necessary at any time to store ammunition in the vicinity of the emplacement.

CHAPTER 3

PREPARATIONS FOR FIRING

■ 26. CLASSES.—Preparations for firing may be divided broadly into four general classes—

a. Training of personnel.

b. Test, adjustment, and check of matériel.

c. Test, adjustment, and check of the fire control system.

d. Determination of ballistic and meteorological data.

This section is intended as a guide and reminder list for battery commanders in their preparations for firing.

■ 27. PERSONNEL.—*a.* The accuracy of the work of the personnel in key positions should be checked with care.

b. No man should be detailed to a position in the duties of which he has not been instructed.

c. Personnel should be trained to ram the projectile properly and uniformly.

d. In order to insure the most uniform results from observing, plotting, and pointing instruments, and other similar equipment, operators should be trained to operate them so that the backlash of the gears or play in the brackets and supports will affect the readings or settings in the same manner each time. This will cause the existing play to have a uniform effect on the pointing of the gun.

e. Elevation setters should be trained to lay the gun in elevation in the same manner each time by always depressing to the proper setting rather than by setting sometimes by elevating and sometimes by depressing. This should be done even though there is no backlash to affect the relation between the actual elevation of the gun and the reading of the elevation scale or quadrant. Improvement in uniformity of results is obtained by having the balance of the gun and carriage and the weight of the gears against the jump of the gun as nearly the same for each shot as is possible.

f. Where displacement corrections are necessary, personnel should be trained in their application.

■ 28. ADJUSTING FIRE.—*a.* Select the method of adjustment to be used in the firing, both range and direction, and thor-

oughly drill all personnel who will participate in this phase of the firing.

b. Install the fire adjustment board or bracketing adjustment chart and drill personnel in the use thereof for adjustment of fire. This may be accomplished independently of regular drill by the use of the dispersion tape and scale.

c. Decide upon a method for use of aerial spots.

■ 29. MALFUNCTIONINGS.—Special attention should be given to the malfunctionings which have occurred in the past in order that they may be provided against. Repeated misfires and hangfires are generally attributable to some fault of the matériel other than the primers themselves. Any malfunctioning during firing should be noted in the emplacement book.

■ 30. INSPECTION AND ADJUSTMENT OF GUN AND CARRIAGE.—*a. General.*—(1) Have all guns or mortars prepared for action regardless of the number to be fired.

(2) Test the level of the base rings, record the variations for each 10° of azimuth, and prepare corrections if required.

(3) Dismantle the breechblock, clean the parts, adjust the pad, lubricate, and assemble.

(4) Adjust the recoil and counterrecoil systems.

(5) Examine and test the safety features of the firing mechanism, making whatever adjustments may be necessary.

(6) Test the firing mechanism, using primers.

(7) Test the long and short lanyards and have spares available.

(8) Clean the bore and powder chamber thoroughly.

(9) Be certain that the recoil cylinders are full.

(10) Test the traversing mechanisms for freedom of operation, by hand and by power, and correct any defects.

(11) Test and adjust the elevating mechanisms for freedom of movement in both directions, by hand and by power.

(12) Test and adjust all slip friction devices.

(13) See that no oil holes have been overlooked in oiling and that all grease cups have been filled and adjusted.

(14) Give special attention to all probable causes of previous malfunctionings.

b. The following tests and adjustments apply especially to gun batteries:

(1) Examine the sights to see that they are in good condition.

(2) Bore sight the guns and verify the adjustment of the sight standards and of the azimuth subscales. Careful orientation is necessary for firing by Case III.

(3) Test and adjust the levels on telescope mounts.

(4) Test and adjust the range drums, using a clinometer.

(5) In the case of disappearing carriages, see that the gun goes completely into battery without shock.

(6) Set the throttling valves according to the experience of previous firings, and give instructions to the executive officer for changes of setting to correct for differences in recoil from that expected.

(7) Test and adjust the retracting mechanism of disappearing carriages.

c. The following tests and adjustments apply especially to mortar batteries:

(1) Test and adjust the elevating quadrants, hand quadrants, and the auxiliary scale on the elevating rack, using a clinometer. See that the seats for the hand quadrants are cleaned on each mortar and kept oiled.

(2) Verify the orientation of the mortars. Adjust the azimuth subscales, if necessary.

(3) Adjust the elevation clamps.

(4) Adjust the slip friction device.

(5) Adjust the counterrecoil springs so as to give even pressure against the webs and retract the mortars several times with a tackle, allowing them to return freely to battery under the action of the springs.

■ 31. RECOIL AND COUNTERRECOIL MECHANISMS.—*a.* Prior to a firing, the throttling and buffer valves should be set as determined by an examination of records of previous firings. After a firing, care should be taken that all the data on this subject are entered in the emplacement book in order that they may be available for future use.

b. Some of the later types of hydropneumatic recuperator systems are equipped with gages which register the gas and liquid pressures in the cylinders. These pressures must be checked carefully before firing.

■ 32. PREPARATION OF PROPELLING CHARGES.—*a.* Propelling charges for separate loading ammunition will habitually be fired as received.

b. Powder containers will as a rule be opened only as charges are required. Markings on the containers should permit assurance that proper charges are ready for use. After opening containers and in handling charges, care will be exercised that igniters are correctly and securely attached to the proper sections (sewed at three places 120° apart, *not pinned*) and that sections are securely wrapped so as to preserve their shape. The cloth or paper cap covering the igniter pad must be removed before firing.

c. Sections of the powder charge will be arranged on the serving trays in the same order that they will have in the powder chamber.

d. At least two powder-serving trays per gun should be provided.

e. Where powder has been stored for at least 2 weeks in service magazines, the temperature of the magazine may be taken as the powder temperature. This temperature should be taken immediately upon opening the magazine. Where these conditions cannot be fulfilled, place a thermometer in a powder-storage case and determine the temperature of that charge, this being taken as the temperature of all charges.

■ 33. PREPARATION OF PROJECTILES.—*a.* All projectiles should be weighed and, so far as practicable, those of approximately the same weight selected for firing. Uniformity in this respect is especially desirable in adjustment. The mean projectile weight will be applied to the range correction board. Target practice projectiles will be brought to uniform weight by sand loading. In case the projectile is brought to standard weight before the cavity is completely filled with sand, the sand may shift within the projectile during flight and cause erratic behavior. This difficulty may be avoided by completely filling the cavity with a mixture of sawdust and sand and bringing to standard weight by adding water.

b. All projectiles should thoroughly be cleaned and the paint removed from the bourrelets.

c. Grease and oil should be removed from the projectile before it is fired.

d. Projectiles should be arranged in the most convenient manner. All live ammunition at the firing point must so be placed that it will be impossible to ignite, explode, or detonate it in case of an accident at the gun position. It should be in a dry place and protected from the direct rays of the sun.

■ 34. PREPARATION OF PRIMERS AND FUZES.—*a.* Previous to firing, each of the primers to be used will be inserted in the obturator spindle in order to test the proper fit of each primer. On guns equipped with the firing mechanism M1903, the firing leaf and slide will be lowered to their firing position in order to demonstrate that these parts will properly function with each primer.

b. If electric primers are to be used, test all of them for continuity of circuit.

c. Test the length of the button wire by inserting the primer in the primer seat and lowering the firing leaf.

d. Test the firing circuit.

e. Have friction primers and lanyards available for prompt transfer to friction primers in case of failure of the electric firing mechanism.

f. All handling of fuzes will be governed strictly by current technical publications.

■ 35. MISCELLANEOUS PREPARATIONS.—*a.* Examine the powder-serving trays to determine their serviceability and suitability.

b. Examine the ammunition trucks so as to be assured that the tires are secure, that the buffer is adjusted and functions properly, that all moving parts run smoothly, and that the loading trays enter the breech recess freely. In the case of disappearing-gun batteries, it is useful to construct and attach a scale in notches of recoil of the gun to each shot truck so that it may be adjusted quickly when the recoil is known. Prior to practice or action, adjust shot trucks to the highest point to which it is anticipated that the gun will recoil, since a downward adjustment may be made much more easily and rapidly than an upward one.

c. Test the operation of shot hoists and check the operation of their safety features.

d. Examine all blocks, trolleys, rails, and shot tongs to see that they function properly.

e. See that tubs of liquid are provided for sponging the powder chamber.

f. Have a megaphone at the battery.

g. Issue cotton, waste, or other form of ear protection to the gun sections.

h. Have all doors of the battery and all doors and windows of nearby stations and buildings opened.

i. Water or oil down the parapet.

■ 36. CHECK OF THE ORIENTATION.—*a.* The coordinates of all the stations to be manned and all the datum points to be used should be verified prior to firing. The location of the directing point and the locations of the individual pieces for the calculation of gun displacement corrections should likewise be verified.

b. Prior to firing mobile artillery, check will be made of the locations of the aiming points and the orientation of all aiming rules and other auxiliary aiming devices.

c. All depression position finders, azimuth instruments, and other observing instruments will be adjusted and tested. The instruments will then be oriented on the data which have previously been verified.

■ 37. PLOTTING-ROOM DEVICES.—Plotting-room devices are designed to make all the necessary calculations in a minimum of time and with an accuracy nearly equal to that given by pencil and paper computations. To insure that this is accomplished—

a. All plotting boards, spotting boards, elevation boards, and other mechanical and graphical computing devices will be adjusted and verified.

b. All scales where readings are made or set will be cleaned and made readable.

c. All scales will be verified to assure the reading is in the correct direction.

d. All instruments will be adjusted to eliminate lost motion and backlash.

e. All scales, curves, and similar devices will be examined to assure that they correctly represent the firing table and that

important local corrections, such as height of site, are incorporated in them.

■ 38. METEOROLOGICAL MESSAGE.—*a.* Steps will be taken to insure that the meteorological and tide messages are correct, complete, and furnished at regular intervals.

b. Every effort will be made to obtain the ballistic data to the maximum ordinate of the trajectory.

c. Personnel will be trained to apply meteorological data in the correct manner. This is especially true in applying the azimuth of the ballistic wind.

■ 39. COMMUNICATION.—*a.* All signal communication used within the battery should be tested daily, and all defects developed will be corrected immediately. These tests will apply to mechanical data transmission, posting of data, and all similar devices, as well as to telephones.

b. Range and azimuth data should be displayed in the pit or emplacement in full view of the pit or gun commanders, emplacement officers, and data setters.

■ 40. DISPERSION.—The firing table probable error is usually an inaccurate guide as to the dispersion to be expected, even from a new gun firing new ammunition. The erosion of the gun and the deterioration of the powder may be expected to cause progressive but sometimes irregular increase in dispersion. The most dependable information is to be had from the history of previous firings.

■ 41. MUZZLE VELOCITY.—*a.* Every effort should be made, prior to firing, to determine the most probable value of the muzzle velocity to be expected.

b. The best determination is that resulting from chronograph firings, but the availability of a chronograph in the field is most unlikely and this method of determination will be possible only in very exceptional instances.

c. The best sources for determining expected muzzle velocity in the field are listed below in order of preference:

(1) Calibration firings.

(2) Records of previous firings.

(3) Data obtained locally from average muzzle velocity attained in firing similar guns.

(4) If none of the above are available, the standard muzzle velocity as listed on the powder tag.

■ 42. CALIBRATION CORRECTIONS.—In determining the calibration corrections which should be applied to the pieces of a battery, all available records of firings with that battery should be studied. Firings which have been conducted for the express purpose of determining calibration corrections should be considered in connection with any other firings in which the shots from the individual guns can be identified. Such corrections are generally applied at the guns by adjustment of the range drums or elevation scales. Calibration corrections applied and the data from which they were obtained will be entered in the gun or emplacement book. They should be expressed in feet per second muzzle velocity so that the corresponding correction in yards at any range may readily be determined.

■ 43. WARMING-UP EFFECT.—The records of previous firings should be studied to determine whether or not a "warming-up effect" has been shown by the battery. In most cases it will be found that no "warming-up effect" is apparent; but where it has usually made an appearance in the past, the adjustment of fire should be planned in such a way as to take account of it in the future.

■ 44. PIECES TO FIRE.—When there are more pieces in a battery than are to be fired, those pieces which have been fired the least should be selected for firing.

■ 45. SPECIAL PREPARATIONS FOR TARGET PRACTICE.—*a.* Provide a proper system for recording all data and occurrences during target practice necessary for the subsequent analysis of the practice and for a complete history of the battery performance. (See TM 4–235 (now published as TM2160–35).)

b. All data recorders should be detailed in ample time, instructed, and drilled.

c. Designate a suitable position for the officials who are to observe lateral deviations and the azimuth of the target at the instant of impact. Arrange to notify these officials when fire is to commence, which target is to be fired upon, and when the target is changed.

d. Provide a means for orienting the instruments to be used by the officials.

e. Procure forms for reports and have them ready for distribution to the various officials and recorders.

f. Drill the range section in measuring the length of the towline by plotting.

g. Have the plotter prepare to check the angle between the path of the target and the line joining the target and battery (40° angle), when directed by the safety officer. If equipment and personnel are available, this should be done by a separate plotting section.

h. Decide upon the conditions under which a seemingly abnormal shot is to be rejected.

i. Prior to target practice, conduct at least one subcaliber practice as a rehearsal of target practice, firing the same number of shots. Keep all records and perform all operations in the identical manner prescribed for target practice. Analyze the practice or practices, and correct any deficiencies noted.

j. Prior to target practice, conduct at least one rehearsal of the target practice simulating the firing of the same number of rounds. Keep all records, analyze the drill, and perform all operations in the identical manner prescribed for target practice.

k. Have a red streamer at the battery and detail a man to hoist and lower it at command.

CHAPTER 4

SAFETY PRECAUTIONS

SECTION I

GENERAL

■ 46. GENERAL.—*a.* Safety regulations are prescribed in AR 750–10. Those regulations pertaining to seacoast artillery are included in this chapter.

b. The safety precautions described are for peacetime conditions. They indicate as well the principles to be followed under war service conditions, but should be interpreted by personnel concerned according to the circumstances existing at the time of any particular emergency. Safety precautions applicable solely to a particular weapon are prescribed in the field manual covering service of the piece for that weapon.

c. Any individual in the military service who observes a condition which makes firing dangerous will immediately command: CEASE FIRING, and if at a distance from the unit firing will make the prescribed signal therefor.

■ 47. DRILL.—The personnel of the battery command must be drilled to take proper action to avoid accident and to respond as readily to commands given for insuring safety as to commands applying to regular routine drills.

■ 48. COMMANDING OFFICERS.—*a.* It is the responsibility of the harbor defense or regimental commander that the safety

requirements are strictly enforced. He will make the decision as to whether or not the target may be towed from left to right for seacoast gun batteries. For mortar batteries the target may be towed in either direction. He will detail a safety officer and such assistants (see sec. III) as may be required.

b. Commanding officers will insure the fact that individuals detailed as safety pointing observers have such knowledge of the ballistic and other conditions connected with the firings as to render them fully capable of judging when the field of fire is safe.

c. Commanding officers will designate an officer in charge of firing (normally the group or battalion commander) at each firing point.

SECTION II

SAFEGUARDING PROPERTY

■ 49. BATTERY PROPERTY.—All doors of the battery and doors and windows of nearby buildings and stations will be opened before firing is commenced.

■ 50. WARNING ORDER.—In all cases where firing except with blank ammunition is to be conducted, a warning order will be published to the entire garrison at least 24 hours prior to the time of firing, showing—

a. Nature of the firing.
b. Place where the firing is to be conducted.
c. Hour firing is to begin and cease each day.
d. Number of days firing will continue.
e. Boundaries of the danger area.
f. Officer in charge of the firing.

■ 51. PUBLIC NOTICES.—*a.* Prior to firing over water areas which are used by shipping of any kind, the officer in charge of the firing will inform the public of the contemplated firings through one or more of the following agencies: Public press, Coast Guard, or other interested public officials.

b. When public or private property is likely to be damaged by concussion or other causes resulting from firing, notice will be given to owners, supervisors, or others concerned sufficiently in advance of firing so that the necessary pre-

cautions may be taken by those responsible for such property. Also general notice will be given by publication in local newspapers.

SECTION III

THE SAFETY OFFICER

■ 52. GENERAL.—The safety officer will be responsible for the safety of the field of fire and of the towing vessel. He will command or signal CEASE FIRING, when a splash occurs ahead of the towing vessel, or between the towing vessel and the target closer to the towing vessel than one-half the length of the towline.

■ 53. ASSISTANTS.—*a.* The safety officer will be provided with an assistant safety officer (noncommissioned officer for subcaliber and machine guns) as safety pointing observer for each gun or mortar to be fired and as many other assistants as may be necessary for him to accomplish his mission. He will assure himself that the safety pointing observers and other assistants are thoroughly informed as to their duties and that they are capable of performing them without unduly interfering with the firing battery.

b. The tug officer is an assistant safety officer in addition to his other duties.

■ 54. SAFETY OF FIELD OF FIRE.—The safety officer will confer with the officer in charge of firing with a view to preventing the starting of the tug on a course that will be unsafe, due to approaching vessels, before all rounds can be fired. He indicates to the officer in charge of firing when the field of fire is safe, and, if at any time thereafter it becomes unsafe to fire, he will give the command CEASE FIRING.

■ 55. DANGER FLAGS AND LIGHTS.—*a.* The safety officer will not permit firing at a towed seacoast target unless a red streamer is displayed both at the firing point and on the towing vessel to indicate a safe field of fire. No firing will be permitted when either of the red streamers is down and all firing will cease at once in case either streamer is lowered during firing.

b. Red danger flags and, when deemed necessary, warning signals or notices will be displayed or sentinels will be posted at appropriate points to warn persons approaching a firing

area which is being used. At night red lights may be used in lieu of danger flags, and to supplement the red streamer.

■ 56. BARRIER LIGHTS.—The safety officer is responsible that, for firing at night, searchlights are employed as barrier lights to enable safety observers to detect shipping which may attempt to enter the danger zone.

■ 57. COMMUNICATION.—The safety officer will arrange for effective means of communication between his station, all safety observers, the tug officer, and the firing point, so as to insure prompt notification to all concerned when firing is to commence, and to the firing point when the field of fire is unsafe.

SECTION IV

SAFETY POINTING OBSERVERS

■ 58. GENERAL.—*a.* Safety pointing (line of metal) observers will be used during all coast artillery firings in time of peace.

b. Officers will be utilized as safety pointing observers for all firings except subcaliber and machine-gun practices. For the excepted firings, qualified noncommissioned officers may be used as safety pointing observers.

c. The duties of the safety pointing observers are to assist the safety officer in safeguarding the towing vessel and nearby shipping by detecting abnormal errors in the pointing of the piece in direction. When such errors are noted, the safety pointing observer will stop the firing of that gun and report the reason to the safety officer.

■ 59. EMPLOYMENT.—Safety pointing observers will be employed in one of the two following ways:

a. As line of metal observers in all cases where such procedure is practicable.

b. If the gun being fired is equipped with an oriented azimuth circle or if a suitably accurate temporary azimuth circle may be arranged for, the following procedure may be used: The safety pointing observer will be stationed so that he may read the actual azimuth at which the gun is laid for firing. He will be connected directly by telephone (field telephone is suggested) with an assistant who is provided with an oriented azimuth instrument so located that the towing vessel may be tracked. The assistant will observe and telephone the azimuth of the tug continuously to the safety pointing ob-

server. The safety pointing observer will obtain, before the practice, such data as to the effect of wind, drift, and travel for the probable course of the target as will enable him to determine the safety of the pointing of the gun. When the azimuth of the gun is such as to endanger the tug, he will not permit the gun to be fired. This method, if properly employed, should not interfere with the firing battery. In this connection, the azimuth of the gun as indicated by a panoramic sight *will not* be used for the check prescribed above.

SECTION V

SAFETY OF TOWING VESSEL

■ 60. TUG OFFICER.—For seacoast firing, the tug officer will act as an assistant to the safety officer for the observation of that part of the field of fire in the vicinity and to the seaward of the target, and will cause a red flag to be displayed on the tug when that portion of the field of fire is safe.

■ 61. TOWING VESSEL.—*a.* In target practice, firing must be stopped at once if the visibility becomes so poor as to endanger the tug or shipping in the field of fire.

b. Firing will be prohibited when the angle between the path of the target and the line joining the target and battery is less than 40° or more than 140°.

c. In firing upon targets towed on the surface of the water, the direction of ricochet is in general dependent upon the direction of the rotation of the projectile, the magnitude of the wave masses, and the actual angle of impact. In smooth water with moderate angles of impact, the direction of ricochet will be the same as the direction of rotation of the projectile, but in rough water, particularly when firing small caliber guns, the deflecting effect of the waves may cause the ricochet to be in the opposite sense from the direction of rotation. In general, when the water is smooth, and the angle of fall is not great enough to preclude the danger of ricochet, targets should be towed from right to left, as seen from the firing point, when firing from guns having a right-handed twist to the rifling. Under similar conditions, targets should be towed from left to right, as seen from the firing point, when firing from guns having a left-handed twist to the rifling. These factors will be given serious consideration

by local commanders who will be responsible for determining the manner and direction in which targets are to be towed.

d. When direction is given the piece by aiming the sight at the target (Case I or Case II), the length of towline will be at least 3 percent of the range to the target and in no case less than 300 yards in length.

e. When direction is given to the piece by use of an azimuth circle or by directing the sight at an aiming point other than the target (Case III), the length of towline will be at least 3 percent of the range to the target and in no case less than 500 yards in length.

f. Firing will cease if the towing vessel develops engine trouble, or if the towing vessel gives a prearranged signal to cease firing.

g. For firing at night the towing vessel will carry such lights as will indicate its position to safety observers. Firing on the target will be permitted only when the latter is effectively illuminated and when both the target and the towing vessel are visible from the battery.

h. For night firings, the safety officer will see that the illuminating searchlights are trained on the target only and not on the towing vessel.

SECTION VI

SAFETY PRECAUTIONS APPLICABLE TO ALL TYPES OF SEACOAST ARMAMENT

■ 62. GENERAL.—*a.* Matches and unauthorized lights must not be permitted in any magazine, ammunition car, or ammunition shelter.

b. Smoking will not be permitted in the vicinity of the guns or near the ammunition.

c. All safety devices installed on guns by the Ordnance Department will, when applicable to the method of fire being employed, be used during the firing.

d. To insure accurate laying and safety in firing, cannoneers who have duties in connection with laying will be required invariably to verify the laying after the breech has been closed.

e. At the command SUSPEND FIRING or CEASE FIRING, lanyards will be detached or firing circuits opened.

■ 63. FIRING MECHANISMS.—Firing mechanisms will be inspected and tested frequently and immediately before target practice to insure the proper operation and functioning of the safety features. For guns that can be fired either electrically or by friction primers, a test of the safety features of both methods of firing will be made. (See par. 70.)

■ 64. AMMUNITION.—If questionable condition of ammunition is a possible cause of an accident, the particular lot involved will be withdrawn from the service until the War Department authorizes its reissue.

■ 65. COVER.—*a.* When high explosive ammunition is fired with fuzes in which the explosive train is *not* interrupted between the detonator and the explosive charge of the projectile until the projectile has cleared the muzzle of the gun, *cover* sufficient to provide positive protection against premature bursts in or out of the bore will be afforded all persons within the following distance from the cannon firing:

(1) 200 yards for all calibers up to and including the 3-inch.

(2) 300 yards for all calibers from 3-inch, exclusive, to 105-mm, inclusive.

(3) 400 yards for all other calibers.

b. When shrapnel is fired no cover is necessary.

c. The following list of fuzes, which may be issued to seacoast artillery, shows whether or not cover is required:

Fuze	Type	Cover required	Action
M46	P. D	Yes	Superquick.
M35	P. D	Yes	Superquick.
Mk. III Am	P. D	Yes	Superquick.
Mk. IIIA Am	P. D	Yes	Superquick.
Mk. III Fr	P. D	Yes	Superquick.
Mk. IIIA Fr	P. D	Yes	Superquick.
M47	P. D	Yes	Delay.
Mk. IV	P. D	Yes	Delay.
Mk. IV*	P. D	Yes	Delay.
Mk. V	P. D	Yes	Delay.
Mk. V	B. D	No	Delay.
Mk. X	B. D	No	Delay.

NOTE.—The Mk. III and Mk. IIIA American fuzes contain an interrupter between the upper and lower detonators. The Mk. III and Mk. IIIA French fuzes do not have an interrupter.

d. Technical manuals describing the ammunition for various types of armament should be studied carefully before any high explosive ammunition is fired.

66. FUZES.—*a.* The alteration of fuzes is forbidden except when specifically authorized by the Chief of Ordnance.

b. Fixed ammunition and projectiles fuzed with base detonating fuzes are normally shipped fuzed. Projectiles which use a point detonating fuze are shipped unfuzed, a fuze plug being used instead of a fuze. These latter projectiles will not be fuzed until immediately before they are to be fired. The tarred tape and waterproof cap will not be removed until the fuze is screwed in the projectile and the projectile about to be loaded.

c. The Mk. III and Mk. IIIA fuzes must be handled with the greatest care. A fuze will not be screwed into a shell if the tarred tape and lead foil cap are not in their proper places. After the fuze is screwed into the shell, the tape and waterproof cap will be removed by pulling on the loose end of the tape which is exposed. The spiral (brass ribbon) and the safety pin will be examined to see that they are in their proper places. If the spiral is not in place, there will be danger of a premature explosion in the cannon and the fuze must be removed and destroyed. These fuzes are now in reserve and will not be used in target practice in time of peace. The brass spiral is frequently referred to as the tape, resulting in confusion as to the proper part to be removed. Enlisted men will carefully be instructed to remove only the waterproof cover with the friction tape and not the brass spiral.

67. PRESSURE PLUGS.—*a.* For cannon equipped with fixed pressure gages, pressure measurements will be made in all practices with service or target practice ammunition. Copper cylinders may be changed either after each shot of trial fire or after completion of trial fire. Copper cylinders will not be changed between shots of record fire.

b. For cannon using loose gages, pressure measurements will be limited to shots of trial fire. Extreme care will be taken after each round to insure that no gage remains in the bore.

c. Should there be evidence that excessive pressures are being developed, *the firing will be stopped* and an investigation made to determine the cause.

SECTION VII

SAFETY PRECAUTIONS APPLICABLE TO ARMAMENT USING SEPARATE LOADING AMMUNITION

■ 68. GENERAL.—The powder chamber will be sponged after each shot with the liquid provided, unless the gun is equipped with gas ejectors, and the inner face of the breechblock will be wiped with a wiper of oily waste.

■ 69. PRIMERS.—Primers must not be inserted until after the breechblock is closed, rotated, and locked. In no case will primers be inserted or removed by means of the button or wire. Precautions must be taken to prevent any attempt to use a primer that has failed. Care must be taken not to drop primers. The greatest care will be exercised in lowering the leaf of the firing mechanism M1903. Any primer removed after an attempt to fire should be handled with great care due to the possibility of a primer hangfire.

■ 70. FIRING MECHANISMS.—*a.* The tests of the electric safety devices should demonstrate that the primer cannot be fired until the breechblock has been closed and locked. In addition, in the case of mortar batteries, the primer should not fire until the mortar has been elevated to or beyond 45°, and in the case of guns mounted on disappearing carriages, the primer should not fire until the gun is "in battery." Failure to fire electrically may be caused by the presence of oil on the electric contacts; a test immediately before firing should establish the proper functioning in this respect.

b. The tests of the safety features of the friction firing device serve the same purposes as stated in *a* above, for the electric firing device.

■ 71. LANYARDS.—When the lanyard is used, except in the case of disappearing guns, the lanyard will not be attached until the piece has been given sufficient elevation to clear any mask in front of it. Lanyards should be pulled with a quick, strong pull (not a jerk) from a position as near the rear of the piece as is convenient.

■ 72. MISFIRES.—*a.* A misfire is said to occur when the piece fails to discharge when desired.

b. A misfire has a strong tendency to produce confusion and excitement in the gun squad. Great care should therefore be taken to prepare for this contingency by drill in the action to be taken and by explanation of the reasons for these precautions.

c. With cannon using separate loading ammunition the following procedure will be observed:

(1) *In case the discharge of the primer is heard but the powder charge has failed to ignite,* at least 10 minutes must elapse after the firing of the primer before the old primer is removed or the breechblock is opened. During this period all persons will stand clear of the breech. The piece will be kept directed on the target or on a safe place in the field of fire.

(2) *In case the discharge of the primer is not heard—*

(*a*) If a special device is available which permits removal of the primer by a person entirely clear of the path of recoil, the primer may be removed after 2 minutes have elapsed since the last attempt to fire. If, after removal, it is found that the primer actually failed to fire, no further wait is necessary before inserting a new primer or opening the breech. If, on the other hand, examination shows that the primer has fired, the precautions prescribed in (1) above will be observed.

(*b*) If no special device can be employed for removal of the primer the precautions prescribed in (1) above will be observed.

d. Figure 2 indicates the action to be taken in case of misfires.

e. Probably the most frequent cause of misfires is inserting a primer which has previously been fired. Therefore used primers should never be kept in the same pouch with live ones.

■ 73. FLAREBACKS.—Flarebacks are caused by hot gases coming in contact with the air, which affords sufficient oxygen to permit combustion. When the breechblock is withdrawn, the gases remaining in the bore sometimes pass to the rear and ignite upon striking the air, regardless of the direction of the wind. Flames of varying length and intensity may

result. Precautions must be taken to prevent the flame from reaching a new propelling charge, as well as to prevent serious burns to the breech detail.

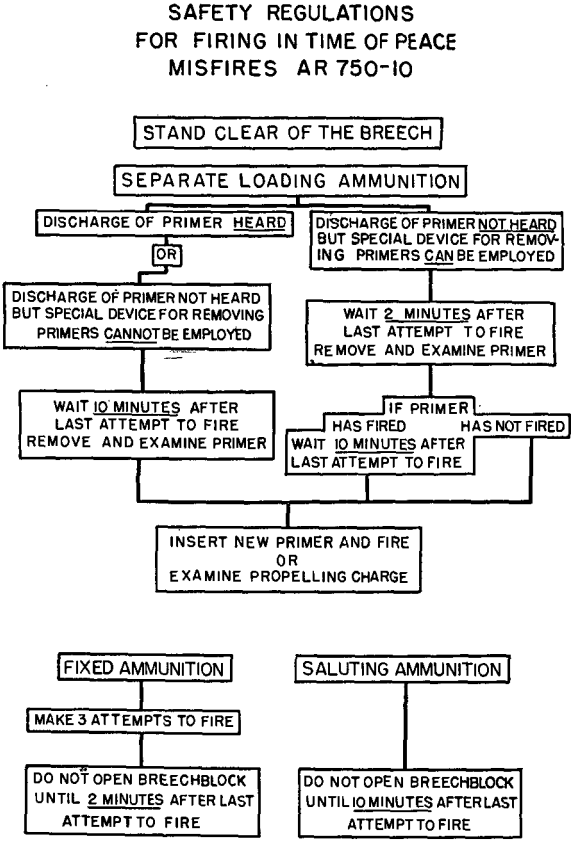


FIGURE 2.—Action to be taken in case of a misfire.

■ **74. HANDLING POWDER CHARGES.**—*a.* In the magazines or ammunition cars, all powder charges will be kept in their containers except the charge which is to be served to the piece for the next succeeding round. The powder charge for

any given round will not be brought near the breech until the preceding round has been fired and—

(1) On cannon not equipped with gas ejectors, until the wet chamber sponge has been withdrawn from the breech and the face of the mushroom head wiped.

(2) On cannon equipped with gas ejectors, until the bore has been announced clear and the face of the mushroom head wiped.

b. Each section of the charge, of the base igniter type, will be examined to insure that there is only one igniter and that this igniter is sewed to the base section and *not pinned* to the base section.

■ 75. EXCESSIVE PRESSURES.—*a.* The attention of all concerned is directed to the fact that, in firing seacoast cannon, excessive pressures, which may be dangerous, are likely to develop if the diameter of the propelling charge or any section thereof is so large as seriously to interfere with the projection of the flame from the igniter to the front of the powder chamber by restricting or eliminating the space between the top surface of the charge and the top of the chamber wall. Such a condition can occur if—

(1) The diameter of the charge as made up is too great.

(2) The sections of the charge are not laced or wrapped tightly enough to prevent bulging of the sections when rammed.

(3) Excessive force is used in ramming, especially when the bag material has been weakened due to age.

b. In addition to the present requirement that the total length of the charge, when firing maximum service charge, will be at least nine-tenths of the distance from the mushroom head to the base of the projectile, the following precautions will be observed in firing seacoast cannon of 6-inch or larger caliber:

(1) Each section of the charge will be examined to insure that it is tightly wrapped or laced.

(2) The powder charge will be inserted in the powder chamber so that it will be pushed into place by the mushroom head when the breech is closed.

(3) No charge, or section thereof, of the base igniter type will be fired which exceeds the maximum allowable diameter

as determined by gages furnished by the Ordnance Department for this purpose.

(4) In the core igniter type of charge the flame is projected through the center of the charge. With this method of ignition the space between the surface of the charge and the chamber is not of such great importance as with the base igniter type. Core igniter charges need not, therefore, be gaged. All other precautions as listed above must, however, be taken.

c. Reduced charges will be of the same diameter as the full charge, but will not be remade to comply with requirement as to length referred to above.

d. The attention of all concerned is directed to the following possible causes of excess pressures in firing seacoast artillery:

(1) Dimensions of charges not complying with *b* and *c* above.

(2) One or more sections cocking in powder chamber in ramming.

(3) Damp igniter.

(4) Hangfire due to wet igniter or charge.

(5) Improper placing of igniter or use of two or more igniters where one is prescribed.

(6) Omission of igniter where required.

(7) Loss of volatiles by powder, usually due to high storage temperatures and leaky cartridge-storage cases.

(8) Projectile slipping back on powder charge due to faulty ramming.

(9) Wrong type of projectile where increased density of loading results.

(10) Projectile overweight. See range tables for limiting percentages and corrections therefor.

(11) Charge overweight.

Every effort will be made to insure that none of these causes exist. Should excess pressures occur, firing will be stopped and full report will be made by the battery commander concerned as to all details of the firing which might assist in determining the cause.

SECTION VIII

SAFETY PRECAUTIONS APPLICABLE TO ARMAMENT USING FIXED AMMUNITION

■ 76. GENERAL.—Each time the breech is opened, if its construction or design permits, the breech operator will pass his hand over the inner face of the block and feel for the firing pin. Should the firing pin protrude through the face of the breechblock, firing from that gun will be suspended until the matter is investigated and corrected.

■ 77. FIRING MECHANISMS.—Firing mechanisms should be inspected and tested frequently to insure proper functioning and the operation of the safety features. This test should include a strong pull exerted on the lanyard or firing lever while the breechblock is being closed to ascertain if it is possible for the firing mechanism to function before the breech is fully closed.

■ 78. LANYARDS.—Lanyards or firing handles should be pulled with a quick, strong pull (not a jerk).

■ 79. MISFIRES.—In case of a misfire with cannon firing fixed service or target practice ammunition, at least three attempts to fire the primer will be made and the breechblock will not be opened until 2 minutes have elapsed after the last attempt to fire the piece. All individuals remain clear of the path of recoil and the piece is kept pointed at the target or at a safe place in the field of fire. Figure 2 indicates the action to be taken in case of a misfire. The procedure to be followed in case of a misfire when firing blank or saluting ammunition is described in paragraph 82.

CHAPTER 5

SALUTES

■ 80. GENERAL.—*a.* Salutes with cannon are fired for the purpose of rendering honors to certain officials and other persons, to return the salutes of foreign men-of-war in the ports and territorial waters of the United States and on certain holidays. Harbor defense and fort commanders should familiarize themselves with the provisions of AR 600–25 and AR 600–30, which list the occasions on which salutes are required, the number of rounds to fire, and other details. A list of posts designated by the War Department as saluting stations to return the salutes of foreign vessels of war will be found in AR 600–25.

b. A salute with cannon is always fired under the personal supervision of a commissioned officer, who directs the firing. The interval between rounds when one gun is used is 10 seconds; when two or more guns are used, the interval is 5 seconds. Salutes are ordinarily fired from saluting guns issued for that purpose. However, certain specified service guns may be used. Those guns authorized for use as saluting guns, and for which saluting ammunition is issued, as well as the precautions to be observed in firing, are listed in TM 9–905 (now published as TR 1370–B).

■ 81. SALUTING AMMUNITION.—*a.* A complete round of saluting or blank ammunition consists of a black powder charge contained in a cloth bag which is placed in a primed cartridge case of drawn brass, and of a felt wad and a chipboard closing cup inserted in the mouth of the case and sealed to hold the charge in place and to prevent any powder from leaking out. For identification purposes, data as to the type, weight of charge, ammunition lot number, initials of the assembly depot, and caliber and model of the gun for which the charge is intended are stenciled on the side of the case. Each round is issued in a fiber container on the end of which appears the same data.

b. The assembly of blank ammunition in the field, or at any post or station other than the designated ordnance assembly depots, is prohibited.

■ 82. PROCEDURE.—*a.* Firings with blank ammunition and of particularly long salutes will be greatly facilitated by a careful observance of the following:

(1) After the arrival of the saluting detail and immediately before firing the salute, try the loaded rounds in the chamber of the gun in two positions about 90° apart. Replace any rounds that do not fit.

(2) Wipe off the exterior of the cartridge cases with an oily rag.

(3) See that one or more extra rounds are provided for emergency use in case of misfires.

(4) Detail two assistants to the officer in charge; one, an officer or noncommissioned officer to see that all safety requirements are observed; the other, a capable enlisted man to assist the officer in charge by counting the number of rounds fired and to notify that officer when the proper number has been discharged.

b. In firing long salutes, as many guns as are available (not to exceed four) should be used, so as to increase the time between rounds from the same gun and avoid any necessity for haste on the part of the cannoneers. The pieces are numbered from right to left. At the proper moment, the officer in charge commands: NO. 1, FIRE, and on observing the proper interval, NO. 2, FIRE, and so on to the last piece when he returns to No. 1 and repeats the same commands until the prescribed number of rounds has been fired. In giving the command FIRE, he looks toward the piece to be fired and gives the command in such a pronounced manner, accompanied by a signal with the saber or arm, as to be unmistakable.

c. Should a piece misfire, the officer immediately commands the next piece to fire. He allows the piece that has misfired to remain undischarged until its proper turn comes again when a second attempt may be made to fire, but the breechblock will not be opened on an unfired charge until at least 10 minutes have elapsed.

■ 83. PRECAUTIONS.—The greatest care should be used to avoid accident. It should be borne in mind that the black powder

with which each round is loaded constitutes one of the worst-known explosive hazards when loose or in bulk. In addition to the general restrictions, the following precautions should be observed:

a. Under no circumstances will rounds of blank ammunition issued by the Ordnance Department be tampered with in the field. Rounds that have loose-fitting closing cups or protruding primers, or that have misfired or failed to seat properly in the gun, or that are found to be defective in any way, will be reported to the local ordnance officer for destruction and replacement.

b. Blank ammunition should not be removed from the fiber containers sooner than is necessary before firing. While firing, keep the remaining rounds well away from the gun. A box with a lid that closes automatically under its own weight is preferable.

c. If, for any reason, a live round sticks in the chamber of a gun, never attempt to remove it by ramming from the muzzle. If it cannot be removed by ordinary means of extraction, the gun should be turned over to the local ordnance officer for removal of the round.

d. Use great care in sponging. Use a wet sponge and take plenty of time between rounds to examine the bore for sparks.

e. Handle ammunition with care at all times. Rough or careless handling may result in—

(1) A damaged cartridge case which cannot be loaded into the gun.

(2) The primer's receiving a blow sufficiently severe to explode the charge.

(3) Breaking the closing cup seal, making the round unsafe to fire.

f. Blank ammunition should not be exposed to high storage temperatures as this tends to cause the chipboard closing cup to shrink and break the seal.

g. Precautions should be taken to insure that the bore of the gun is unobstructed and that no foreign material is placed therein.

h. Smoking in the vicinity of guns or ammunition should not be permitted.

CHAPTER 6

CARE OF MATÉRIEL

SECTION I

GENERAL

■ 84. GENERAL INSTRUCTIONS.—*a.* The information and instructions contained in this chapter are brief and are intended as a general guide only.

b. Officers will be held strictly responsible for the proper care and preservation of all artillery matériel in their charge. Any damage to or defect in property will be reported to the proper representative of the supply department concerned.

c. The methods prescribed for the operation, care, and preservation of matériel are those described herein and in other publications issued by the War Department, a thorough understanding of which is required on the part of all officers and others having matériel in charge.

d. Battery commanders are charged with the maintenance of all matériel issued to the battery. This includes periodic painting and such constant attention as is necessary to maintain the equipment in serviceable and attractive condition. Major repairs are made by the services concerned, only adjustments and minor repairs being made by the troops.

e. Group or battalion commanders are directly responsible to the groupment, harbor defense, or regimental commander for the serviceability of the armament and all other matériel under their respective commands. Frequent inspections must be made to determine the condition of this matériel and a thorough knowledge of the regulations governing its care and maintenance is therefore essential to officers of all grades.

f. The employment of labor-saving devices such as paint-spraying equipment, blowtorches, and scaling hammers for

cleaning metal and similar equipment is strongly recommended. Where such facilities do not exist, they should be obtained by transfer from surplus stocks, or purchased if available maintenance funds will permit.

g. (1) Classification of matériel for care and preservation is as follows:

(*a*) *Class A.*—Matériel assigned to an organization in a primary capacity for purposes of regular and frequent training, together with all installations required to make that matériel effective, is considered as in class A.

(*b*) *Class B.*—Matériel which is not assigned to an organization for regular and frequent training, but which is important to the performance of the mission of a harbor defense, is considered as in class B.

(*c*) *Class C.*—Matériel which is not considered vital to the performance of the mission of a harbor defense, but which is capable of furnishing some fire support, is regarded as in class C.

(2) This chapter deals primarily with the care and preservation of matériel in class A. The care and preservation of matériel in class B or class C is fully covered in TM 4–245 (now published as TR 1160–20), which should be studied carefully by all personnel responsible for the care and preservation of matériel.

h. Detailed information describing the care and maintenance of matériel will be found in the following publications:

(1) Preservation and care of seacoast defense matériel, TM 4–245 (now published as TR 1160–20).

(2) Cleaning and preserving materials, TM 9–850 (now published as TR 1395–A).

(3) Technical regulations pertaining to the particular type of armament.

(4) Signal Corps manuals and instruction books pertaining to Signal Corps matériel issued to Coast Artillery troops.

(5) Further detailed instructions will be found in Ordnance Field Service Bulletins in the files of the local ordnance officer.

■ 85. SUPPLY SERVICES.—*a. Corps of Engineers.*—(1) The Corps of Engineers erects, alters, and maintains other than routine care, all emplacements and all fire-control, search-

light, and submarine mine structures and fortification power plants.

(2) It supplies, installs, and maintains other than routine care, ammunition hoists, trolley systems, mechanical range indicators, searchlights, and fortification light and power equipment, except the following: Signal Corps storage batteries and mechanisms for operating fire-control apparatus, mine casemate equipment for operating the mine system, and ordnance motors for operating guns.

(3) It installs all electric circuits and apparatus on major caliber fixed seacoast gun batteries, including terminal boxes, magneto firing systems, motors, and switchboards when furnished by the Ordnance Department, and dry cells or storage batteries used for illumination or firing circuits. It installs fixed armament of caliber greater than 6-inch; fixed armament of 6-inch caliber and below is mounted by the Coast Artillery Corps on foundations prepared by the Corps of Engineers.

(4) It supplies drawing boards and drawing instruments; draftsmen's supplies; circular benches for observing and spotting stations and plotting rooms; rubber matting or other approved floor covering for the floors of fire-control stations and fortification power rooms; lumber, hardware, and other materials and supplies for the preservation and upkeep of batteries and structures (fire-control, searchlight, fortification power plants, submarine mine, and others); electrical and other supplies for the maintenance, repair, and operation of searchlight and fortification light and power equipment; spare parts for ammunition hoists, trolley systems, and searchlight and fortification light and power equipment; special tools for use with equipment furnished by the Corps of Engineers.

b. Signal Corps.—The Signal Corps furnishes cameras and camera supplies, time-interval systems, signal and meteorological apparatus, portable ammeters, and voltmeters; it is charged with the supply, installation, and maintenance, other than routine, of all cable for signal communication and of fire-control apparatus pertaining to signal communication.

c. Ordnance Department.—(1) The Ordnance Department supplies and maintains other than routine care, guns

and mortars, their carriages and accessories, and tools and implements for the service thereof; ammunition; targets; fire control apparatus (except that pertaining to signal communication, time-interval systems, signaling, and meteorological data); and, in addition, observation telescopes, stop watches, thermometers, magnetos for firing, firing batteries, bench and hand tools (not furnished with machines), appliances for fortification power plants and ordnance repair shops, and recoil and cutting oil.

(2) It supplies paints, oils, cleaning and preserving materials and tools and accessories required therewith in the cleaning and preservation of ordnance property, targets and target accessories including towlines (except air-towed targets and towlines), powder and projectile scales and scale test sets, and equipment for tests and surveillance of ammunition.

(3) It supplies and maintains other than routine care, motors and their circuits on the gun carriages, wiring for firing circuits and illuminating circuits on carriages and position-finding instruments. It furnishes field glasses; paulins for gun covers; rope, blocks, and gins for mechanical maneuvers; oil storage tanks (30- and 60-gal.), funnels and measures for the storage of oil at batteries; plumbers' force pumps and hose for cleaning recoil cylinders; and testing sets for testing cartridge storage cases and metallic boxes.

d. Quartermaster Corps.—(1) The Quartermaster Corps supplies furniture (except floor covering or circular benches for fire-control stations), stoves, scythes, sickles, shovels, rakes, fuel-handling apparatus, fire tools, wheelbarrows, emplacement and fort record books, and other similar supplies.

(2) It supplies fuel, kerosene, oil storage tanks, supplies and spare parts for power and electrical plants maintained by the Quartermaster Corps, brooms, sapolio, brushes, soap, mops, sal soda, and waste. For police of fire-control stations: brooms, sapolio, brushes, soap, mops, sal soda, and waste.

e. Chemical Warfare Service.—The Chemical Warfare Service supplies all chemical warfare weapons and ammunition, all smoke and incendiary materials, all toxic gases, and all gas defense appliances and equipment for either individual or collective protection.

■ 86. MOTOR TRANSPORTATION.—*a.* Tracklaying motor vehicles are designed, developed, procured, stored, and issued by the Ordnance Department; wheeled motor vehicles used for transportation of personnel or cargo, by the Quartermaster Corps. Both the Ordnance Department and the Quartermaster Corps are concerned in the development of combat and technical motor vehicles. Combat motor vehicles are stored and issued by the Ordnance Department; technical motor vehicles, by the service furnishing the technical equipment. The latest approved Tables of Organization show the services charged with the issue of motor vehicles pertaining to an organization.

b. Motor vehicles must be kept clean and lubricated as indicated by instruction charts of the vehicle. Bolts and screws must be kept tightened, bright parts cleaned and polished, and the vehicle kept in perfect mechanical condition. In short, vehicles must be given that daily attention that keeps them in perfect mechanical order and appearance and up to military standards of well-kept equipment.

c. Motor vehicles will be painted and marked as prescribed in current regulations.

d. In time of peace the regimental commander may direct that the repair of all motor vehicles of the regiment be pooled under the supply officer. Major repairs and replacements should be handled by repair establishments of the supply service of issue.

e. In time of war, regimental repair pools are not contemplated. Each unit will be responsible for the upkeep of its own vehicles to include minor repairs. Where vehicles cannot be repaired within the unit, they will be turned over to the regimental supply officer, who will turn them in to the nearest ordnance repair detachment or to the nearest quartermaster motor-repair section and make requisition for replacements at once.

SECTION II

ENGINEER PROPERTY AND INSTALLATIONS

■ 87. DRAINS AND WELLS.—*a.* All open drains and gutters should be swept at least once a week, and sweepings disposed of so they cannot be blown or washed back.

b. Under no circumstances should drains, gutters, sumps, and counterweight wells be used as places of deposit for sweepings, waste, rags, and other rubbish. Drains and sumps should be inspected weekly and kept in good order.

c. Water fixtures should be inspected weekly and leaky fixtures promptly repaired. In freezing weather, water should be shut off and pipes and fixtures drained.

■ 88. EARTH SLOPES AND PARAPETS.—*a.* After rains, earth slopes and parapets should be inspected and any tendency to gully and wash corrected at once or reported immediately.

b. Walking on earth slopes should be prohibited except as may be necessary for their inspection and repair.

c. Dry grass and weeds that are fire hazards should be cut and removed from the vicinity of structures. In this connection, however, the effectiveness of natural vegetation as a camouflage material should be kept in mind.

■ 89. MACHINERY.—All machinery, such as 25-kilowatt sets, generators, motors, disappearing searchlight towers, and pumps should be kept in good working order at all times. Electric light and power equipment should be put in operation under normal load at least 1 hour per month, and where machinery is not connected with its source of power it should be turned over by hand. In exceptionally damp climates power plants and electric motors require more frequent periods of operation to prevent deterioration due to moisture.

■ 90. AMMUNITION SERVICE APPARATUS.—*a.* The ammunition service apparatus (trolleys, motors, and hoists) should be operated under normal load at least 1 hour per month and the different working parts, such as pulleys and journals, kept clean and lubricated.

b. Special care should be exercised in operating the motor starter and in preventing the jamming of any part of the hoist, also in handling the projectiles at the receiving and delivery tables.

c. The Hodges ammunition hoist is not designed for lowering projectiles and must not be so used either by motor or by hand power.

d. The Taylor-Raymond ammunition hoist may be used with safety to lower projectiles by hand power, provided care

is exercised and the hoist operated slowly; but the hoist must not be used to lower projectiles by motor power. Where emplacements are provided with cranes, these should be used in preference to the Taylor-Raymond hoist for lowering projectiles.

■ 91. SEARCHLIGHTS.—*a.* An inspection of all parts of searchlights will be made once each month, and the lamp will be cleaned and carbon particles removed after each period of operation. The motors and bearing surfaces require frequent oiling. Commutators will be smoothed with sandpaper (not emery). The mirror will be dusted with a soft cloth and then polished with chamois. Grease will be removed with a solution of chalk, water, and alcohol, the preparation first being allowed to dry on the surface. The light should never be operated with the arc between the focus and the mirror. Except in the case of antiaircraft searchlights, the beam should never be elevated above 30°, as hot carbon particles are liable to fall on the mirror and damage it. Moisture will never be allowed to remain in or near the light, and the light will be covered when not in use.

b. Searchlights will be operated during the time power plants are running for a sufficient period to insure that they are in satisfactory operating condition.

c. All searchlight power plants will be operated under normal load at least 1 hour per month. Generating sets will be kept clean, properly painted, and in such condition as to permit operation with minimum delay. For detailed instructions on the preservation and care of local power plants, see books of instruction which accompany the sets. The cautions and directions contained in these books will carefully be observed. An instruction book will be kept with each set in a readily accessible place. Generating sets should be overhauled thoroughly every 3 years.

d. In exceptionally damp climates searchlights and their power plants will require more frequent inspections and longer periods of operation to prevent deterioration due to moisture.

SECTION III

SIGNAL CORPS PROPERTY AND INSTALLATIONS

■ 92. GENERAL.—Practically all harbor defense fire control systems are in the immediate vicinity of large bodies of salt water, which tend to make the atmosphere more or less moist and salty. Fire control stations are usually of such substantial construction that, under certain atmospheric conditions, condensation takes place within them. These conditions make such installations considerably more difficult to maintain than ordinary commercial plants. The urgent necessity that all parts of the installation be ready at all times makes the problem of maintenance an unusually important one.

■ 93. INSPECTIONS.—A monthly inspection of each fire-control system should be made under the supervision of the harbor defense artillery engineer. This monthly inspection consists of an examination of all apparatus of the fire-control system. Contacts should be examined and made positive, defective telephone mouthpieces replaced, and inefficient instrument circuits repaired before trouble actually occurs. All external connections to apparatus should be examined for possible corrosion. A strip of paper should be drawn between platinum contacts for the purpose of cleaning them and to make sure that the contact is properly made. Only hard-surfaced paper should be used; otherwise paper lint may collect and cause poor or open contact.

■ 94. TESTS.—A monthly maintenance test should be made by the harbor defense artillery engineer covering all lines of the fire control system under his supervision. This is distinct from the monthly inspection made by his personnel. The lines are first tested by operating the apparatus connected thereto, defects being noted and the trouble located by technical tests prescribed in Signal Corps regulations.

■ 95. TELEPHONES.—*a.* Each operator should be required to keep his telephone in good condition. At the completion of drill the talking set should be in its appointed place, the hook switch held down by the means provided, and cords free from twists or kinks. The nickel plating should be kept polished and the external connections tight and free from corrosion.

Cords should be examined for wear just behind the tips. Operators should not be permitted to attempt any repairs.

b. Ordinarily, telephone transmitter shells should not be opened. If trouble arises due to defective buttons, the transmitters so affected should be returned to the Signal Corps supply depot for repair. A small reserve of transmitters should be kept on hand.

■ 96. POWER SWITCHBOARDS.—*a.* All switch parts should be kept bright and clean and care should be taken to see that all nuts are tight and that no corrosion exists at the contacts.

b. On a switchboard having a marble finish, no oil or grease should be allowed to touch the marble.

c. The voltmeter switch should be inspected frequently to see that all contacts are positive. Particular attention is invited to the necessity for regular inspections of all connections in the rear of these switchboards in order that trouble which might arise from loosening of parts or similar causes may be anticipated. While particular care is taken by the Signal Corps to avoid the possibility of the corrosion of terminals due to the use of soldering salts and other causes, it is well to examine the lugs frequently during the first year of operation, since trouble from this cause may occur. It is pointed out that a high resistance, such as might be caused by a defective lug in the circuit of a telephone storage battery, may be the cause of cross talk.

d. Separate fuses for all circuits should be kept in ample quantity in the supply cabinet. If through a series of accidents a number of fuses have been blown out and the reserve supply becomes low, special requisition should be submitted without delay, since only under conditions of grave emergency should fuse terminals be bridged by an open wire link. If this must be done, connection should be made in the rear of the board. When such a fuse is blown, the switchboard is likely to be defaced in a manner which is beyond remedy, aside from the possible damage to the terminals. There should be a sufficient supply of fuses on hand to meet all reasonable demands.

■ 97. MOBILE ARTILLERY WIRE SYSTEMS.—*a.* Mobile artillery, when serving within a harbor defense, may be assigned part of the fixed fire control system for its communication net.

However, mobile artillery will normally be required to install and maintain its own signal equipment. As this installation is usually temporary, field wire, monocord switchboards, and local battery field telephones are standard equipment. Maintenance is difficult and wire chiefs and trouble shooters must be constantly on the alert to diagnose, locate, and repair troubles.

b. Troubles may be classified generally as short circuits, grounded circuits, crossed circuits, and open circuits.

■ 98. BATTERIES.—*a. Storage batteries* will be cared for strictly in accordance with the instructions issued for each particular type of battery. Battery rooms will be well ventilated and clean. Jars, sand trays, and tables will be clean. The electrolyte should be from one-half to three-fourths of an inch above the plates. No foreign substance will be permitted to lodge between the plates, and sediment in the bottoms of the jars must not be allowed to reach the plates. Connections must be bright and clean.

b. Dry batteries will be removed from all equipment which is to be stored for a longer period than 24 hours in the tropics, or 1 week in other climates.

SECTION IV

ORDNANCE PROPERTY AND INSTALLATIONS

■ 99. GENERAL.—*a.* All rust must be removed completely before the application of paint or rust preventive. Its presence will prevent the adhesion of grease, paint, or rust preventive to the surface of the metal, thus preventing the protection of the metal surface.

b. Polishing is prohibited on instruments, sights, scales, and surfaces which are painted, varnished, lacquered, or given such special finish as browning or parkerizing, except as required in refinishing in ordnance shops.

c. The paint on fire-control instruments, panoramic sights, telescopic sights, quadrants, and fuze setters is baked on at the time of manufacture, and these instruments do not require any additional paint in service. If the paint on an instrument becomes marred so that the finish should be renewed, it will be painted by ordnance personnel.

d. All metal surfaces which require painting for proper preservation will first be cleaned thoroughly to remove all old paint which has scaled or rubbed off, and rust, and the cleaned surfaces then painted with one coat of red lead. Ordnance matériel such as guns, carriages, shot trucks, and subcaliber equipment will be given a final finish of two coats of olive-drab paint. Emplacement accessories, such as doors, handrails, ceiling beams, trolley rails, power and light cable, and ammunition-handling devices will be given a final finish of two coats of good quality black bituminous paint. The use of paint on concrete surfaces is considered unnecessary.

e. All means of lubrication, including grease cups, handy oilers, oil cups, oil holes, and passages will be cleaned thoroughly and kept filled with prescribed lubricant, which will be forced into all bearings. To secure best results, mechanisms will, if possible, be operated while lubricants are being applied. Missing grease cups, oilers, or plugs will be replaced promptly. When necessary, temporary means will be devised to keep water and dirt out of the oil or grease passages.

f. Oil cups, grease cups, and oil-hole plugs will be painted red. Handy oilers and oil holes not provided with oil plugs will have a red ring painted around them. In cases where this is prevented by inaccessibility, red arrows pointing to such handy oilers or oil holes will be painted upon the nearest convenient surface. After matériel has been painted, responsible officers will personally verify that all such oil cups, grease cups, and oil holes have been indicated in the prescribed manner.

■ 100. GUNS AND MORTARS.—*a. Painting.*—(1) Cannon should be painted as frequently as required for their proper preservation and appearance. When cannon are initially installed, the finishing coat of paint should be applied at once and all grease cups, oil holes, and grease or oil fittings painted or outlined with red paint.

(2) When the coats of old paint begin to scale off, all paint should be removed and a priming coat of red lead applied to the cleaned metallic surface.

(3) Paint should be kept from all bearing surfaces, oil holes, electrical contacts, breech mechanism, and cross lines

on breech or muzzle. Ammunition trays, except upper and front surfaces and guide rails, should be painted.

b. Care.—(1) Breech mechanism should be kept accurately adjusted and well polished. Heavy oil or rust preventive is used on exposed parts between drill periods. Lubricating oil of proper body is used on all parts during use. Canvas covers are issued for the protection of these parts when not in use. Breechblocks are dismantled for cleaning and lubrication both before and after firing. Avoid the use of grease where oil is intended, as the pressure transmitted by the grease may blow out a handy oiler and jam the breech.

(2) Careful attention is given to the cleaning and prevention of rust in the primer seat, especially after firing, as enlarged primer seats are an important cause of primer failures and sticking.

(3) Utmost care is exercised to prevent rust or corrosion from getting a start in the bore. To prevent corrosion it is essential that all powder residue be removed and that the bore be cleaned and dried thoroughly, protected with rust preventive compound, and inspected frequently, as indicated below.

(*a*) Sponge thoroughly with soda ash solution.

(*b*) Where soda ash does not remove the powder residue, the wire brush should be used. Several hours are often required for this work.

(*c*) Washing with water should follow the use of soda ash solution. Water dissolves salts that collect atmospheric moisture and cause corrosion, and should therefore be used freely after firing.

(*d*) Compound, rust preventive, medium (Grade B), is used for the protection of the bore between inspections. It must not be applied until the bore is thoroughly dry.

(*e*) The bore should be clean and dry for inspection. A light coat of oil makes the appearance more attractive, but may conceal the true condition of the bore.

(*f*) When cleaning the bore, care must be exercised to prevent the staves of the sponges, or the staves of the slush or cleaning brushes, from rubbing against the lower portion of the bore, as excessive wear of the lands will result from such practice.

■ 101. CARRIAGES.—*a. Painting.*—(1) The painting requirements for carriages are the same as for cannon.

(2) The painting of bearing surfaces, oil holes, handles of handwheels and cranks, gear teeth, guides, rollers and surfaces on which they travel, racks and pawl teeth, direction plates, sight holders, scales and pointers, and stuffing box followers will be avoided.

(3) Large unfinished bronze pieces will be painted.

b. Care.—(1) *Disappearing carriages.*—Disappearing carriages will be tripped and retracted at least once a month and elevated, depressed, and traversed twice a month.

(2) *Barbette carriages and railway mounts.*—(*a*) Guns mounted on barbette carriages will be elevated, depressed, and traversed twice a month and when not in use will be set at an elevation of 5°.

(*b*) Guns mounted on barbette carriages and on the later model railway mounts can be retracted without firing. This will be done at intervals of approximately every 6 months. While these guns are retracted, the sliding portion, together with the interior of the cradle, will be cleaned thoroughly and lubricated with the prescribed lubricant.

(3) All traversing rollers and paths and all other exposed machined surfaces will be kept cleaned and oiled with appropriate lubricants.

(4) Railway trucks will be given a run once each 2 weeks, the air brake equipment used, and necessary lubrication attended to. Journal box packing will be kept pushed down below the center line of the journal. Dust guards must be in good condition to exclude grit and retain oil. Paint on air hose destroys the rubber and renders them unserviceable.

(5) Compression grease cups will be filled with appropriate lubricant.

(6) Motors installed on gun carriages will be operated at least once each month for sufficient time to dry out any moisture that may have collected in them.

(7) (*a*) For information concerning the fluid to be used in recoil cylinders, tests to be applied to it, and instructions governing its storage, see TM 9–850 (now published as TR 1395–A).

(*b*) Care will be taken that no water is allowed to enter the recoil cylinders at any time. Water will cause corrosion

and, if present in sufficient quantity, presents the danger of freezing in cold weather.

(*c*) Care will be exercised to insure that bolts passing into hydraulic cylinders are kept tight.

(*d*) All recoil and recuperator systems, except hydropneumatic systems, will be kept as full as possible of the prescribed liquid at all times. Hydropneumatic recoil mechanisms will be filled according to respective instructions. At least once every 3 years all recoil and recuperator systems permitted to be disassembled in the field will be disassembled completely and inspected carefully for rust and corrosion. Hydropneumatic recoil mechanisms that are permitted to be disassembled in the field will be disassembled only under the supervision of the local ordnance officer. Systems will be cleaned and dried thoroughly and placed in first-class condition throughout before being reassembled. Under no circumstances will emery cloth or other abrasives be used for removing discolorations. Dry cleaning solvent, not kerosene, will be used for cleaning. For comprehensive instructions governing each type of seacoast artillery carriage, see the appropriate Ordnance Field Service Bulletin.

■ 102. OBTURATORS.—*a*. Gas check pads are issued in individual zinc containers and will not be removed until required, as the purpose of the container is primarily to protect the pad from expansion through the absorption of moisture.

b. Prior to use they will be treated with graphite lubricating grease, medium, liberally applied, and carefully worked in with the fingers.

c. Gas check pads will be inspected, cleaned, and reslushed at intervals of 6 months in the continental United States and 4 months at stations outside the continental limits of the United States.

d. When gas check pads are removed from cannon and are placed in permanent storage, they will be inclosed in suitable containers which will preserve them from deformation and from contact with moisture. Whenever possible such containers will be sealed by soldering to prevent the entrance of moisture. Ammunition containers, metal cans, metal boxes, and pie plates make suitable temporary containers.

e. Gas check pads which have been in service, or exposed to the air in storage for a considerable period of time, and have become deformed or softened will not be resealed in containers without re-pressing because damage might result through the use of such pads. All pads in such condition will be turned in to the local ordnance officer.

f. Containers will be opened by means of the container opener, a special tool designed for opening gas check pad containers without damaging the pad.

g. Field manuals and technical manuals covering a particular type of armament will be consulted for detailed instructions on the adjustment of the obturator.

■ 103. CARE OF FIRE CONTROL APPARATUS.—Exposed steel parts of fire control apparatus will be protected against rusting by a thin film of petrolatum. Parts subject to friction will be oiled regularly with petrolatum or neutral oil.

a. Telescopes.—(1) The prisms and lenses in the telescopes of position finders, azimuth instruments, and sights are not arranged for adjustment by those using them. The taking apart of telescopes for any purpose and the making of adjustments other than those provided for in their construction and described in ordnance publications are prohibited.

(2) All repairs will be made by the Ordnance Department.

(3) Under no circumstances will lenses be removed from their cells. Cleaning of the exposed surfaces of lenses is required, but the only material authorized for this cleaning is optical paper issued for that purpose.

(4) If water is permitted to remain on the surfaces of optical elements, a portion of the glass may become etched, leaving pocks or holes in the glass surface. In the presence of grease, dirt, and dust, which ordinarily contain acids, glass is likely to be corroded.

(5) The cross wires are unprotected when the eyepiece is removed; therefore care will be exercised to prevent their being broken. No attempt will be made to clean the cross wires except by blowing on them.

(6) Covers will be kept over these instruments when not in use. Optical instruments should never be subjected to jars or rough usage.

b. Telescopic sights.—The sight bracket and cradle will never be removed from the carriage unless the carriage is to be dismounted. When not in use, these parts will be kept protected by the covers provided for that purpose. The covers will be removed and the sight bracket examined at least once each month; the cradle will be moved in elevation and direction. Special care will be exercised in handling or using the small electric lamps, as they are fragile.

c. Plotting-room instruments.—(1) Rough handling of any plotting-room device will be avoided. Bending or warping of any scale alters the distance between graduations and causes that scale to give incorrect readings. This is especially true of the arms of plotting boards.

(2) Plotting-room instruments will be kept clean by wiping with a soft, dry cloth. Inspections will cover the lubrication and adjustment of these instruments.

d. Leather instrument cases will be kept in repair and the leather will be kept properly dressed.

SECTION V

CARE AND HANDLING OF AMMUNITION

■ 104. GENERAL.—*a.* TM 9–905 (now published as TR 1370–A) gives detailed instructions for the storage, handling, identification, maintenance, surveillance, and shipment of ammunition. Many of the provisions contained therein are mandatory, and all persons who handle ammunition are required to be thoroughly familiar with them.

b. This section is intended to serve as a guide to the reading of those regulations.

c. The enemies of ammunition are moisture, shock, fire, deformations which prevent normal functioning, deterioration due to chemical changes, contamination by foreign materials, and tampering by unauthorized persons. At times one danger is greater than another, and the instructions are drawn up accordingly.

■ 105. STORAGE.—*a.* Storage spaces should be clean, dry, and well ventilated; in buildings used for no other purposes; free from fire hazards; and locked and secure against intruders. If the temperature of a magazine in which smokeless powder is stored exceeds 80° F. continuously for more than

72 hours, consideration should be given to removing the contents of the magazine or to cooling the magazine by wetting down its exterior with water.

b. (1) Store each of the following classes of ammunition in a separate magazine:

(*a*) Black powder.

(*b*) Fuzes, primers, detonators, boosters, and adapters.

(*c*) Propelling charges.

(*d*) Separate loaded shell.

(2) Observe quantity-distance tables.

c. Store ammunition so that lots can be identified; use skids or dunnage to prevent damage and provide ventilation; keep all containers closed to exclude foreign substances; keep cases sealed against moisture; and keep fuze cavities of projectiles closed. (See TM 9–905 (now published as TR 1370–A).)

■ 106. FIRE HAZARDS.—The common causes of fire are dry grass, leaves, and underbrush; deteriorated ammunition; handling operations not properly supervised; smoking, open lights, or fires; striking matches; failure to observe safety precautions; sparks caused by tools or by nails in shoes; heating appliances; lightning; electrical transmission lines; also spontaneous combustion of greasy rags or waste, or direct rays of sun on smokeless powder.

■ 107. FIRE PREVENTION.—Avoid fire hazards; have fire extinguishers handy; have supply of gunny sacks and tools for use against grass and brush fires; keep grass and brush cut back.

■ 108. FIRE FIGHTING.—Upon discovery of fire, give the alarm; fight grass fires vigorously even when close to a magazine; if fire is in ammunition, use all available cover.

■ 109. FUZES.—Fuzes are delicate mechanisms and must be treated as such. Tampering with fuzes is very dangerous. If fuzes are assembled into shell by battery personnel, only the wrench provided will be used, and they will be seated securely. Point fuzes assembled by using service will be removed before transporting. Fuzes assembled into shell before issue will be removed only with special authority.

■ 110. POWDER CHARGES.—Powder charges are fired as issued. Their dimensions must conform to certain rules. Containers must be kept air-tight. This necessitates care in inspection and handling. Remove protective cap and tag before using. If black powder leaks from igniter, it is collected and destroyed in water. Smokeless powder becomes dangerous if exposed to high temperatures.

■ 111. PROJECTILES.—Store on skids or dunnage; protect the rotating band; inspect for exudation; never unload explosive charge; keep cavity closed; paint as required.

■ 112. HANDLING.—Ammunition should be handled under the direct supervision of an officer or competent person who understands the risks involved. Bale hooks will not be used and containers will not be tumbled, dragged, thrown, or dropped. No tools or equipment so designed that steel or other spark-producing metal comes in contact with packages will be used in handling explosives. Do not permit trash to accumulate in magazines, or floors to become littered. If a container leaks, work will be stopped until the floor is cleaned and watered. Repairs to damaged containers will be made at least 100 feet from magazine. Containers that will be exposed to sun for some time will be covered with paulins.

■ 113. TRANSPORTATION BY MOTOR TRUCK.—*a.* In passing through cities, obtain routes from city government. Take every precaution against fire, inspecting electrical wiring, lights, brakes, and gasoline tanks and lines daily. Clean grease from around engine, universal joints, transmission, and other moving parts. Keep lighted matches or open lights away from gasoline tank or explosives. Permit no smoking or carrying of matches. Have on each truck at least one fire extinguisher, at least 3 cubic feet of sand, and a shovel. Instruct personnel in methods of fighting gasoline fire and impress upon them that in nearly all cases there is time to extinguish fire.

b. If trucks are in convoy, keep safe distances. Inspect once each hour. Do not stop in towns. Avoid congested traffic. Drive at moderate speed. Come to full stop at railroad crossings. Permit no unauthorized passengers. If a

truck catches fire, separate it from the rest of the convoy and post guards to stop all traffic at a safe distance.

c. Do not transport fuzes or detonators with explosives. Cover the iron strips of the truck body with wood or its equivalent. See that the load is well braced and stayed, and covered with paulins to protect from weather and possible sparks. Do not unload or pile ammunition back of exhaust.

■ 114. MARKING.—See TM 9–905 (now published as TR 1370–A) and other Technical Manuals concerning the particular units considered.

■ 115. SHELL STUCK IN BORE.—No attempt will be made to remove a loaded shell stuck in the bore before reading TM 9–905 (now published as TR 1370–A). If a projectile cannot readily be extracted from the gun or a projectile become separated from the cartridge case when the breech is opened, it will be fired out, if this is possible; if not, it will be removed under the direct supervision of an officer, a rammer being used which bears only on the projectile and provides for clearance around the fuze. *Never use for this purpose a rammer which touches the fuze.*

■ 116. AMMUNITION IN THE FIELD.—It is desirable that ammunition parks and dumps be located in woods in order to prevent aerial observations. The interval between piles of ammunition should be ample to prevent mass detonation in case one pile should be exploded, and every practicable available means should be used to obscure the ammunition piles from view; camouflage, paulins, and branches of trees are suggested. The reverse slope of hills and cuts with steep banks make good dump sites, especially if time permits the excavating of shelter in the slope. If practicable, each type of ammunition should be divided into two or more piles, so that in the event of the destruction of one pile the complete loss of the type will not occur.

INDEX